APPENDIX G: HYDROLOGY REPORT

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

WATERMAN LOGISTICS CENTER
WATERMAN AVENUE
CITY OF SAN BERNARDINO, CALIFORNIA

PREPARED FOR

HILLWOOD INVESTMENTS
901 VIA PIEMONTE, SUITE 175
ONTARIO, CA 91764
PHONE: (909) 382-0033
FAX: (909) 382-0073

AUGUST 1, 2014

JOB NO. 3288

PREPARED BY

THIENES ENGINEERING
14349 FIRESTONE BLVD.
LA MIRADA, CALIFORNIA 90638
(714) 521-4811

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

WATERMAN LOGISTICS CENTER

PREPARED BY BRIAN WEIL
UNDER THE SUPERVISION OF

REINHARD STENZEL DATE:
R.C.E. 56155
EXP. 12/31/14

INTRODUCTION

A: PROJECT LOCATION

The project site is located on the easterly side of Waterman Avenue between Mill Street and Rialto Avenue. See following page for vicinity map.

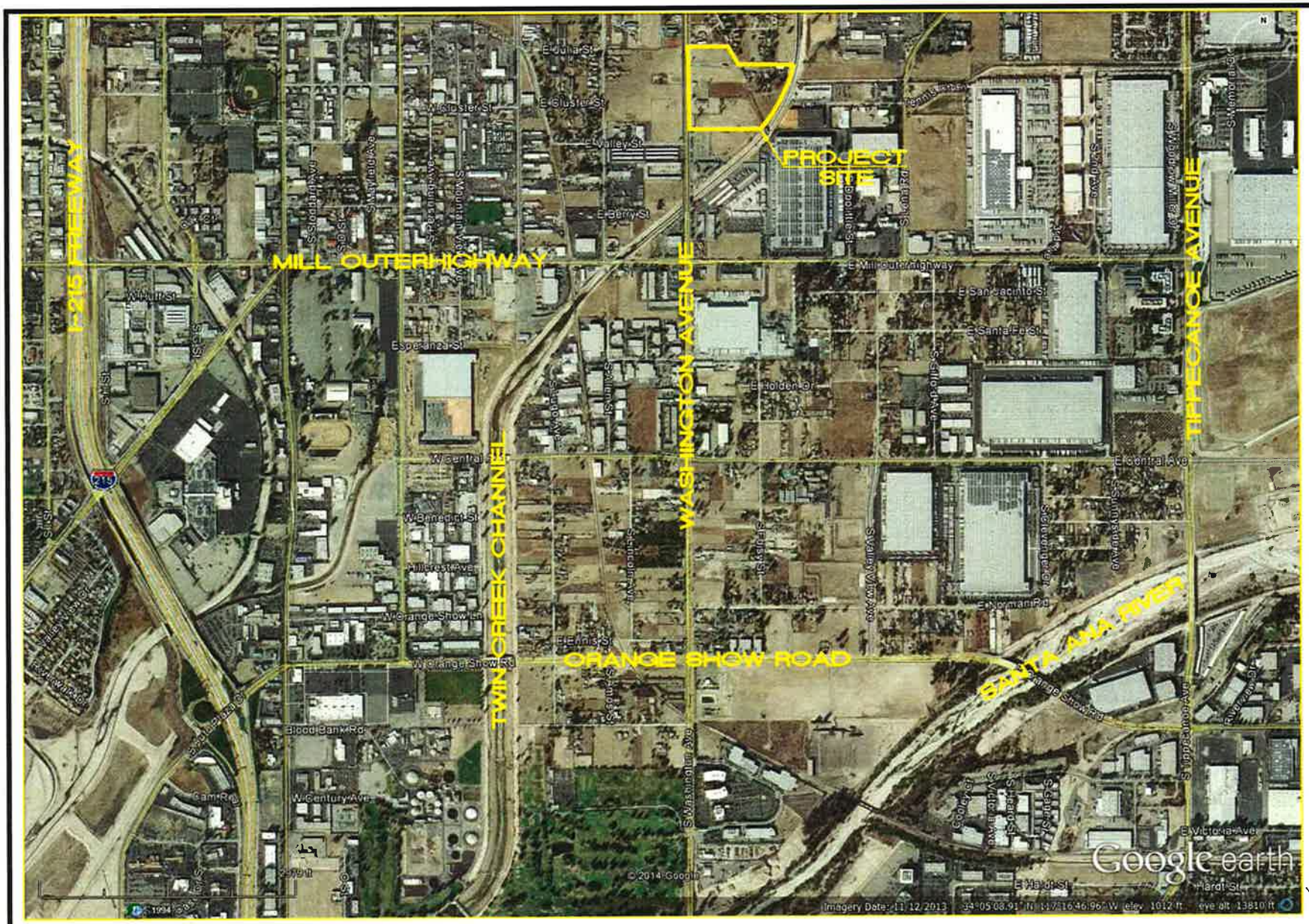
B: STUDY PURPOSE

The purpose of this study is to determine the 100-year existing and proposed condition hydrology for the project site.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel
Brian Weil



Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

VICINITY MAP

FOR

WATERMAN LOGISTICS CENTER

DISCUSSION

Project Description

The project site encompasses approximately 19.7 acres. Proposed improvements to the site consist of the construction of one industrial type building of 426,000 square feet. Truck yards are located on the northerly and southerly sides of the building. Vehicle parking is located on the westerly side of the site. There is a proposed water quality basin at the southwest corner of the site with additional landscaping adjacent to Waterman Avenue.

Master Plan Hydrology

The project site is modeled in the County's Master Plan of Drainage (Comprehensive Storm Drain Plan #7). From the Master Plan, the site has been tabled to an existing storm drain (a portion of areas CET-3) in Waterman Avenue. The existing storm drain traverses southerly and connects to Twin Creek. Master Plan peak flow rates are for the 25-year event. The design frequency for the existing storm drain system in Waterman Avenue is not indicated on the plans. Twin Creek is a fully improved Flood Control channel.

See Appendix "A" for referenced portions of the County's Master Plan of Drainage and plans prepared by CM Engineering Associates and plans for existing storm drain facilities.

Existing Condition Hydrology

While the site is tabled to Waterman Avenue per the County's Master Plan of Drainage, the entire site does not currently drain to Waterman Avenue. The northerly portions of the project site and some offsite areas (nodes 100-102 and 110-112 on existing condition hydrology map) generally drain from east to west to Waterman Avenue. Additional westerly areas (nodes 120-122 and 130-131) also drain to Waterman Avenue. The total 100-year peak flow rate from these areas (direct sum of individual drainage areas) is approximately 30.5 cfs.

The remaining southeasterly portion of the site (nodes 140-141 and 150-151) currently drains to the southerly corner of the site at the former location of the railroad tracks and Twin Creek. The total 100-year peak flow rate for these areas is 25.4 cfs.

Land use types are based on recent aerial topography and images from Google Maps. The site consists of portions of commercial development, open space and large residential lots (1 unit/acre).

Proposed Conditions

Runoff from the proposed site will alter existing drainage patterns. The westerly portion of the site will continue to drain to the existing Waterman Avenue storm drain system. A larger portion of the site will connect directly to Twin Creek. Twin Creek is fully improved and has more capacity for runoff than the Waterman Avenue storm drain system. Since all runoff is ultimately tabled to Twin Creek, the diversion will not significantly impact the existing drainage facilities.

Runoff from the proposed building, the northerly and southerly truck yards and easterly drive aisle (nodes 100-124) will be intercepted in catch basins in the truck yard area and conveyed to the southeast corner of the project site via a proposed storm drain system. The 100-year peak flow rate for this area is approximately 60.0 cfs.

Flow from the northerly parking lot (nodes 200-202) will be intercepted in catch basins and conveyed to the existing storm drain in Waterman Avenue via a proposed onsite storm drain. The 100-year peak flow rate for this area is approximately 3.3 cfs.

Runoff from the westerly parking area and a small portion of the roof (nodes 300-302) drain to the proposed water quality basin at the southwest corner of the site. A proposed storm drain will convey runoff to the existing storm drain in Waterman Avenue. The 100-year peak flow rate for this area is approximately 6.4 cfs.

See Appendix "B" for existing and proposed condition hydrology calculations and Appendix "C" for hydrology maps.

Methodology

San Bernardino County Rational Method program (AES Software) was used for the hydrology calculations. The site is composed of soil type "B" per the San Bernardino County Hydrology.

APPENDIX	DESCRIPTION
A	REFERENCE MATERIALS
B	HYDROLOGY CALCULATIONS
C	HYDROLOGY MAP

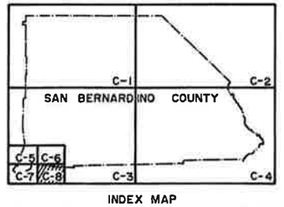
APPENDIX A

REFERENCE MATERIALS

PROJECT SITE

SOURCE: GEOLOGY MAP
SOURCE: 1971 SCS SURVEY

SOURCE: 1971 SCS SURVEY



INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-D AREA

FIGURE C-16

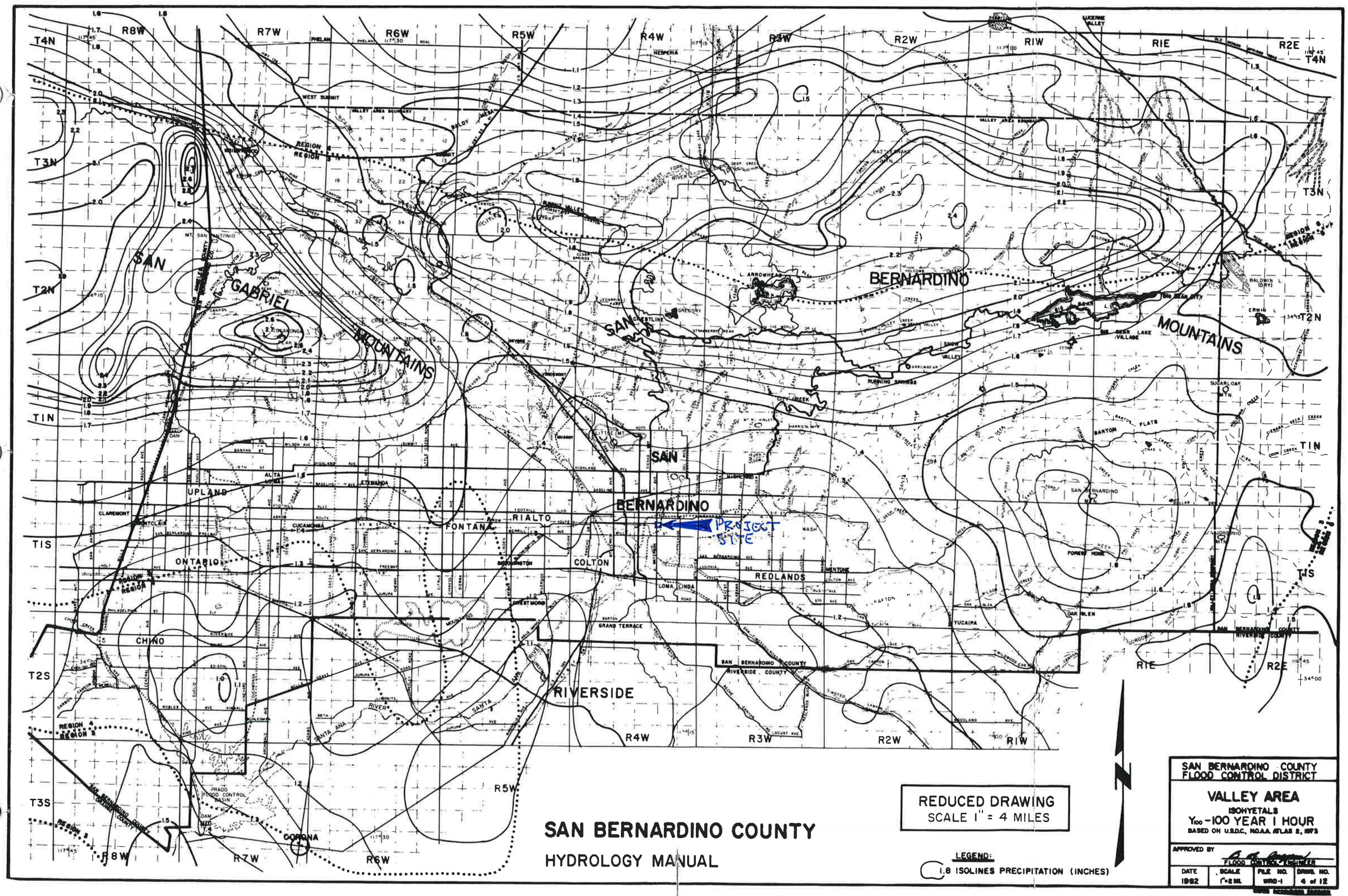

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
1.8 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
Y100 - 100 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
FLOOD CONTROL ENGINEER
DATE
1982
SCALE
1"=2 MI.
FILE NO.
WRD-1
DRWG. NO.
4 of 12
PROJECT SITE
SAN BERNARDINO MOUNTAINS
SAN GABRIEL MOUNTAINS
UPLAND
ONTARIO
CHINO
FONTANA
RIALTO
COLTON
BERNARDINO
REDLANDS
YUCAIPA
RIVERSIDE
CORONA
T4N
T3N
T2N
T1N
T1S
T2S
T3S
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E

FIGURE B-4

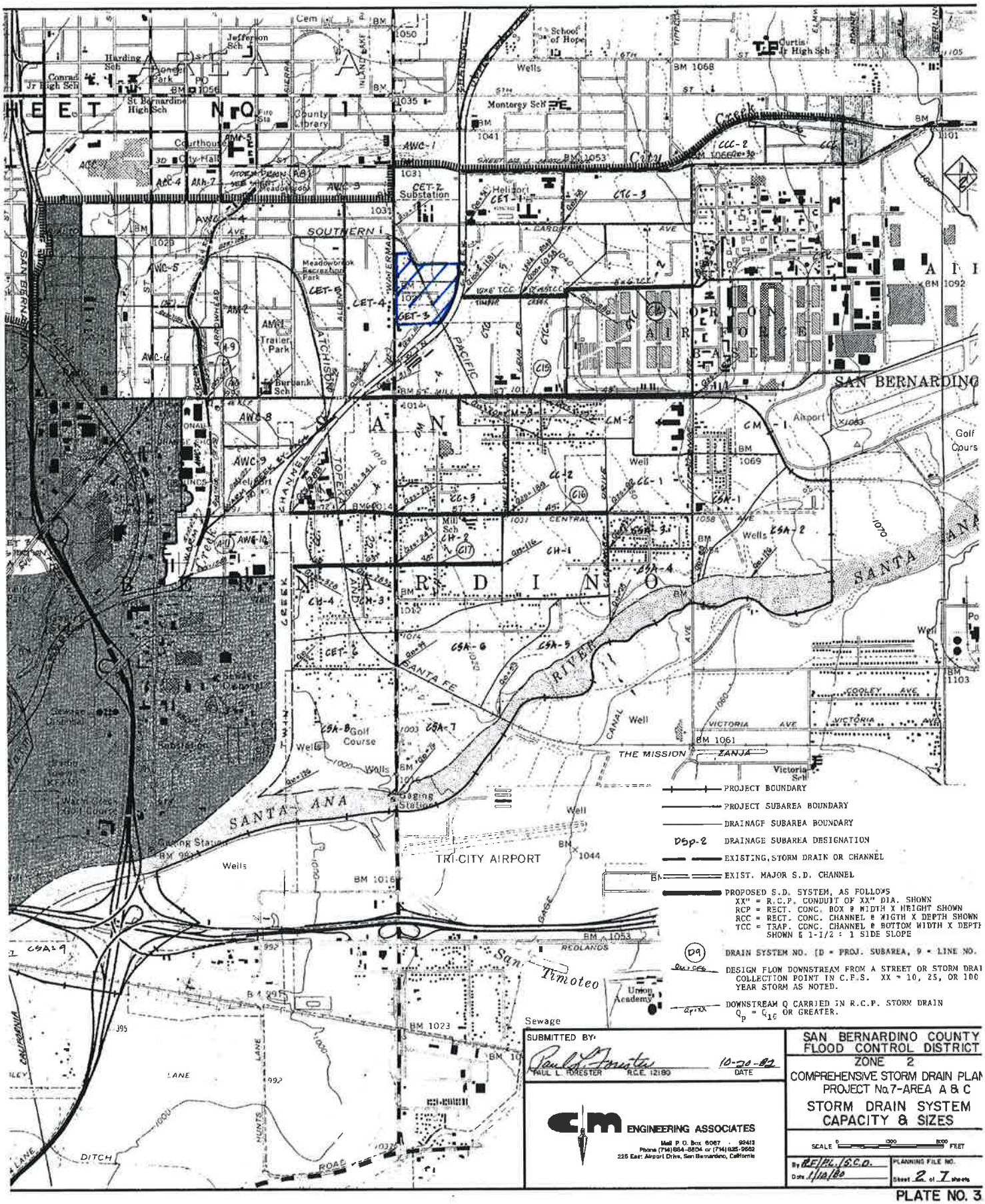

SAN BERNARDINO
NORTON AIR FORCE BASE
TRI-CITY AIRPORT
SANTA ANA RIVER
San Timoteo
Golf Course
Sewage
PROJECT BOUNDARY
PROJECT SUBAREA BOUNDARY
DRAINAGE SUBAREA BOUNDARY
DSp-2 DRAINAGE SUBAREA DESIGNATION
EXISTING, STORM DRAIN OR CHANNEL
EXIST. MAJOR S.D. CHANNEL
PROPOSED S.D. SYSTEM, AS FOLLOWS
XX" = R.C.P. CONDUIT OF XX" DIA. SHOWN
RCP = RECT. CONC. BOX @ WIDTH X HEIGHT SHOWN
RCC = RECT. CONC. CHANNEL @ WIGTH X DEPTH SHOWN
TCC = TRAP. CONC. CHANNEL @ BOTTOM WIDTH X DEPTH SHOWN & 1-1/2 : 1 SIDE SLOPE
D9 DRAIN SYSTEM NO. (D = PROJ. SUBAREA, 9 = LINE NO.
DESIGN FLOW DOWNSTREAM FROM A STREET OR STORM DRAI COLLECTION POINT IN C.F.S. XX = 10, 25, OR 100 YEAR STORM AS NOTED.
DOWNSTREAM Q CARRIED IN R.C.P. STORM DRAIN $Q_p = Q_{10}$ OR GREATER.
SUBMITTED BY:
PAUL L. FORESTER R.C.E. 12180
10-20-82
DATE
CM ENGINEERING ASSOCIATES
Mail P. O. Box 6067 92413
Phone (714) 884-8804 or (714) 825-9662
225 East Airport Drive, San Bernardino, California
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
ZONE 2
COMPREHENSIVE STORM DRAIN PLAN
PROJECT No.7-AREA A & C
STORM DRAIN SYSTEM CAPACITY & SIZES
SCALE 0 1000 2000 FEET
By RF/PL/S.C.D.
Date 1/10/80
PLANNING FILE NO.
Sheet 2 of 7 sheets

PLATE NO. 3

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
RUNOFF TABLING SHEET

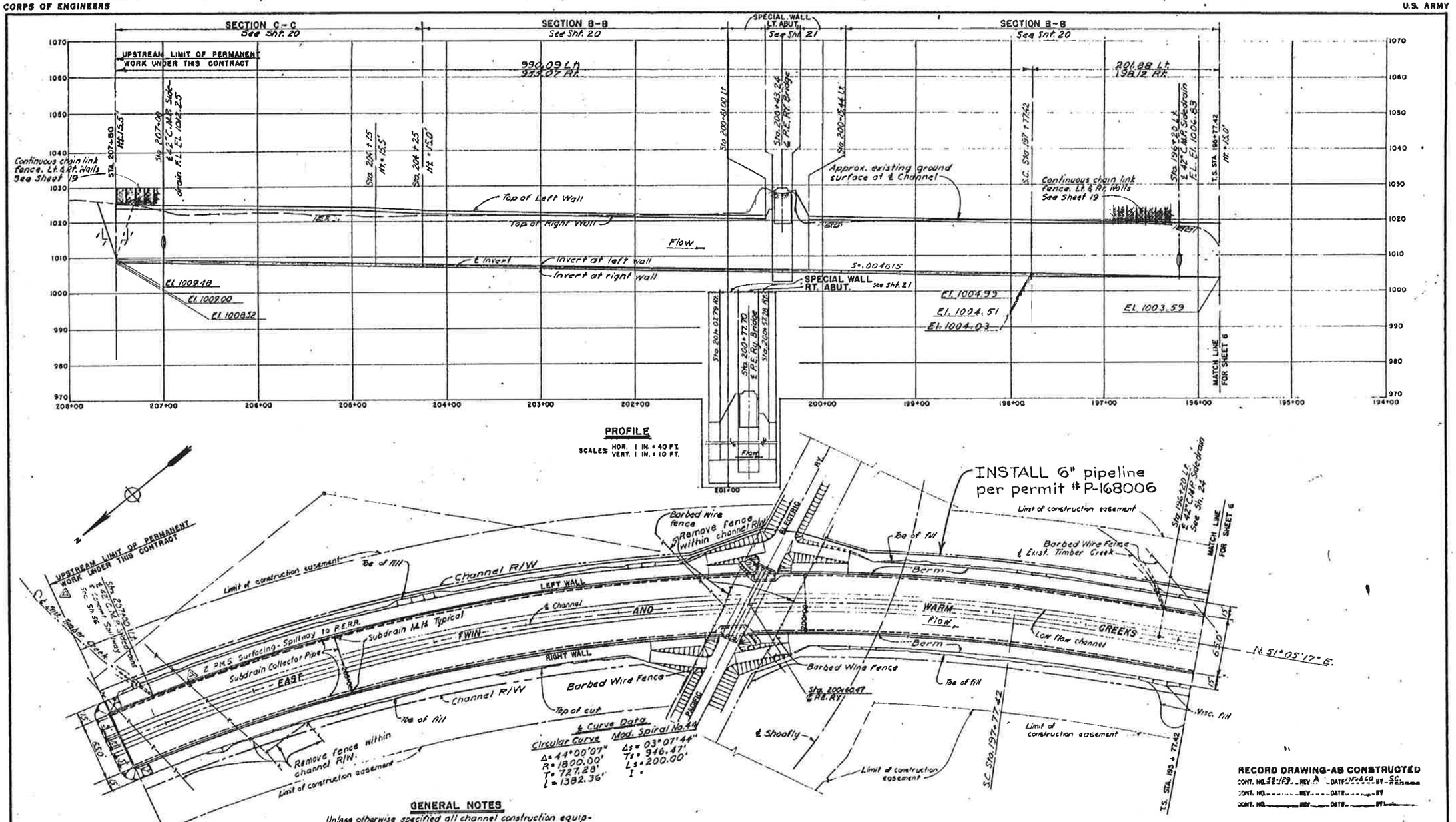
DATE 7-25-79
PAGE 12 OF ___

NOTES: ALL TABLING IS FOR Q_{10} WITH Q_{25} NOTED IN COL. 6 & Q_S IN COL. 7; PIPE FLOW IS FOR Q_{10} UNLESS OTHERWISE NOTED.

AREA C
DRAINAGE SYSTEM ∠18 LINE NO. ___

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
	DRAINAGE SYSTEM NO.	AREA NO.	H Δ ELEV FT.	L LENGTH FT.	S SLOPE FT.	Q_{25} / Q_{10}	FLOW SECTION	V VELOCITY FT/SEC	T_t TRAVEL MIN.	ΣT MIN	$i_{10\,YR}$ IN/HR	$i_{RET\,PER}$ IN/HR	SOIL CLASS	ZONE CLASS I_d	F ÷ 1 HR. RATE	F 12x15	R	A AREA ACRES	Q CFS 16x17x18	ΣQ CFS	ΣA ACRES	ΣA SQUARE MILES	REMARKS
1		CRD-1	25	1800					13.0	13.0	.74	.89	A B	35 35	.35 .55	.31 .49	2.20	50 25	61	61	75		Q_{25}
2		CRD-2	20	2800					22.0	22.0	.74	.89	A B	35 35	.35 .55	.31 .49	1.69	15 37	32	32	51		Q_{25}
3																							
4		CFo-1	20	1700			OVERLAND		13.5	13.5	.75	.92	B	40	.60	.55	2.15	28	33	33	28		Q_{25} FOOTHILL & DALLAS
5		CFo-2	15	1050	.014	33	27" RCP	9.4	3.0	16.0	.75	.92	A B	40	.40 .60	.37 .55	2.00	20 21	38	71	69		Q_{25} Macy & FOOTHILL
6	∠18	CFo-3	15	1200	.013	71	36" R.C.P.	12.4	1.6	17.6	.74	.89	B	35	.55	.49	1.90	27	25	96	96		Q_{25} Replace ex. pipe FOOTHILL
7	∠18						42" R.C.P.																
8																							
9		CCC-1	21	2420	0.009	19.6	overland-street			19.6	0.73	0.73	A	100 70	0.97 0.70	0.71 0.51	1.78	20 12	36	36	32	0.050	Joined City Creek
10																							
11		CCC-2	20	1620	0.012	12.5	overland-flow			12.5	0.73	0.73	A	100 70	0.97 0.70	0.71 0.51	2.25	13 8	208 92	30	21	0.033	Joined City Creek
12																							
13		CET-1	11	2150	0.005	21.9	overland flow			21.9	0.73	0.73	B,A	100	0.97	0.71	1.68	43	51	51	43	0.067	Joined E. Twin-Warm Creek
14		CET-2	5	1600			" "			20.0	0.73	0.73	B	100	0.97	0.71	1.78	57	72	72	57	0.089	
15		CET-3		2700	0.006	20.5	EXIST. 33" & 42" RCP	12.1	3.7	23.7	0.73	0.73	B	100	0.97	0.71	1.62	34	39	111	92	0.142	Joined E. Twin-Warm Creek
16																							
17		CET-4	21	3300	0.006	28.0	overland-street			28.0	0.73	0.73	B	100	0.97	0.71	1.48	61	64	64	61	0.095	Joined E. Twin-Warm Cr.
18																							
19		CET-5	18	3200	0.006	28.7	overland-track			28.7	0.73	0.73	B	100	0.97	0.71	1.46	54	56	56	54	0.084	Joined E. Twin-Warm Creek
20																							
21																							
22																							
23																							

CORPS OF ENGINEERS U.S. ARMY



GENERAL NOTES

Unless otherwise specified all channel construction equipment shall maintain a minimum clearance of 10 ft. from all power lines of 440 volts and over.

Unless otherwise noted existing utilities and structures will remain in place. Any removal or relocation desired by the contractor, other than that noted on the drawings, will be made only with the approval of the owner at the expense of the Contractor.

All stations are normal to the center line of construction.

All dimensions in plan are horizontal unless otherwise noted.

Dimensions shown to existing structures shall be verified in the field.

The Contractor shall take necessary precautions to protect existing structures which are to remain in place.

RECORD DRAWING-AS CONSTRUCTED

CONT. NO. 59-129 REV. A DATE 17 Feb 60 BY SC

CONT. NO. ____ REV. ____ DATE ____ BY ____

CONT. NO. ____ REV. ____ DATE ____ BY ____

REV. NO.	DATE	REVISION	REV	CHK	APR
△	2-17-60	Surfacing 2 PMS Spillway To PERR.	SC	FAR	

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

ENGINEER: A.W.R.
DRAWN BY: J.B.M.
CHECKED BY: [signature]
SUBMITTED BY: [signature]
APPROVAL RECOMMENDED: [signature]

SANTA ANA RIVER BASIN, CALIFORNIA
DEVIL, EAST TWIN, WARM, AND LYTLE CREEKS
EAST TWIN AND WARM CREEKS CHANNEL
P. E. RY. BRIDGE TO CENTRAL AVE.
PLAN AND PROFILE NO. 1.
STA. 207+50 TO STA. 195+77.42

APPROVED: [signature]

SCALE: AS SHOWN
DATE: DECEMBER 1958
TO ACCOMPANY SPECIFICATIONS GIVENS 04-333-59-26
SHEET 5 OF 55
FILE NO. 10. O. SERIES 175/59 REV. "A"

#2-409-17

FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1969-70 SU-SUG 712(5)	3	31

DIST.	COUNTY	ROUTE	SEC.	SHEET NO.	TOTAL SHEETS
08	S.Bd.	712	CR SBd	3	31

M. A. Nicholas
COUNTY ENGINEER — REGISTERED CIVIL ENGINEER NO. 8495

APPROVED August 31, 1970

NOTE DETAILED RIGHT OF WAY MAPS ARE ON FILE IN THE OFFICE OF THE COUNTY ENGINEER 825 EAST THIRD STREET, SAN BERNARDINO, CALIF. SEE FILE NO. 870200 RIGHTS OF ENTRY HAVE BEEN OBTAINED FOR ALL WORK OUTSIDE THE RIGHT OF WAY

DRIVEWAY LEGEND
(C) - Commercial Class B P.C.C.
(R) - Residential Class B P.C.C.
(AC) - Type B Asphalt Concrete

BEGIN PROJECT STA. 164+00

TRANSITION CURB SUMMARY

Sta. 164+51.40	Lt. To	Sta.	164+64.70	Lt.
Sta. 164+88.00	Rt. To	Sta.	165+18.00	Rt.
Sta. 165+54.80	Lt. To	Sta.	165+85.00	Lt.
Sta. 166+07.40	Rt. To	Sta.	166+21.20	Rt.

TYPICAL TRANSITION CURB AT BRIDGE APPROACHES

Bench Mark - Std. Brass Disc So. End of S.E. Curb Ret. @ Mill St. & Waterman Ave. Stamped X524-Reset 1962 Elev. 1013.93

Scale 1" = 50'

Place 2" A.C. 3' Wide at Rear of Driveway at Sta. 172+73 Lt. to Join Exist. Paving

Place 2" A.C. See Note Above

Sta. 172+73 Const. 20' Driveway (C)

Meet Exist. Curb Sta. 172+59.5

Const. Junction Box

Place 596 L.F. of 33" RCP

Place 2" A.C.

Const. Type A2-8 (Mod.) Curb

Cut Exist. 24" CMP & Remove Exist. DI

Construct Type A2-8 (Mod.) Curb

Const. Type D3 (Mod.) Inlet

Extend 24" CMP 14 L.F.

Exist. 24" CMP to Remain in Place

Remove Exist. 24" CMP

Cut existing 24" CMP & Remove Existing DI

Extend 24" CMP 14 L.F.

Const. Type D3 (Mod.) Inlet

Sta. 164+37 Const. 22' Driveway (C)

Sta. 164+97 Const. 15' Driveway (AC)

Sta. 165+73 Const. 15' Driveway (AC)

Sta. 166+32 Const. 15' Driveway (AC)

Sta. 168+64 Const. 30' Driveway (C)

Sta. 171+47 Const. 30' Driveway (C)

Sta. 171+88 Const. 30' Driveway (C)

Sta. 170+60 Const. 30' Driveway (C)

Remove Raised Traffic Bars

Const. Conc. Collar Per Details Sht. No. 8

Const. Curb, Type B A.C. & Class 2 Aggregate Base

Const. Type A2-8 Mod. Curb

Existing Roadway Improvements

N 00° 27' 06" W

Place 176 L.F. of 42" CMP

Place 2" A.C.

Existing P.C.C. Bridge Approach Slab

2" With 8" Curb Face Var. In Transition From 8" Curb Face To 9" Curb Face

EAST TWIN WARM CREEK

Match Line

Service Station

A.C. Paving

Shingle Bldg. w/ Paved Parking Area

Sta. 164+00 to Sta. 173+00
Const. 4 P.C.C. Driveways Lt.
Const. 3 P.C.C. Driveways Rt.
Const. 1 A.C. Driveway Lt.
Const. 2 A.C. Driveways Rt.

& Imp. Sta. 164+00 to Sta. 173+00
See Sheet 21 for Sewer Manhole Work

BEGIN PROJECT STA. 164+00

Top of Curb

Flowline of Gutter Lt.

Existing Profile @ & Survey
Profile Grade @ & Improvement

Sta. 164+00 to Sta. 173+00
Install Following Markers
5 Type G
2 Type L

Existing 24" CMP

Top of Curb Rt.

Flowline of Gutter Rt.

AS BUILT
CORRECTIONS BY
DATE 12-30-7

1. VOSS, W. ESTATE
2. RITTER, H. ET UX
3. COMSTOCK NOVELTY INC.
4. LASSEN FOUNDATION
5. NAPIER, R.W. ET UX
6. MONTES, J. ET UX

Sta.	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	Sheet Totals
Cu. Eis.						41	0	0	222	254	320	266	257	448	445	2263
Yds. Emb.						0		0	44	21	2	8	7	0	4	86

870200-3
88-80

3

DIST	COUNTY	ROUTE	SEC	PROJECT	FISCAL YEAR	SHEET	SHEETS
08	SBd	712	(R SBd	SU-SUG 712 (5)	4	31	

APPROVED August 31, 1970

M A Nicholas
COUNTY ENGINEER REGISTERED CIVIL ENGINEER NO. 6495

Scale: 1"=50'

Place 4" Class "B" PCC 3' Wide at Rear of Driveway at Sta. 173+85 Lt. to Transition To Exist. Conc. Drive

Place 4" Class "B" PCC 5' Wide at rear of Driveway at Sta. 173+65 to Transition to Exist. Conc. Drive

Place 8" A.C. 5' Wide at Rear of Driveway at Sta. 173+30 Lt. to Join Exist. A.C. Paving

Sta. 173+30 Const. 30' Driveway (C)

Sta. 173+85 Const. 12' Driveway (R)

Sta. 177+12 Const. 20' Driveway (C) Place 2" AC

Sta. 178+83 Const. 20' Driveway (C)

Sta. 179+48 Const. 30' Driveway (C)

Const. Type A2-8 (Mod) Curb

Const. 6" Class B PCC 10' Wide at rear Sta 186+25 Lt. To Transition To Exist Conc. Driveway

Const. 4" Class B PCC 10' Wide at rear of Driveway at Sta 186+55 Lt. To meet Exist Conc. Driveway. Const. 4" Class B PCC Sidewalk between Driveways at Sta 186+38 Lt. To Sta 186+47 Lt. 6.33' Wide.

Sta. 186+55 Const. 10' Driveway (R)

Const. 5.33' PCC Sidewalk between driveways at Sta. 175+74 to Sta. 176+90

Const. 4" Class "B" PCC Walk Way

Const. 4" Class "B" PCC Walk Way 2' Wide

Place 348 L.F. 33" RCP

Place 498 L.F. 33" RCP

Place 448 L.F. 33" RCP

Const. Junction Box Place 12 L.F. 24" CMP Const. Type OL Inlet

Const. Junction Box

Const. Type A2-8 (Mod) Curb

Const. 4" Class "B" PCC 4' Wide Walk Way Ramped Upward To Join Exist. Conc. Walk 20' From Curb

Sta. 178+60 Const. 16' Driveway (C)

Sta. 177+98 Const. 8' Driveway (C)

Sta. 179+15 Const. 16' Driveway (C)

Sta. 186+47 Const. 10' Driveway (C)

Sta. 186+75 Const. 10' Driveway (C)

Sta. 173+00 Const. 30' Driveway (C)

Sta. 173+65 Const. 30' Driveway (R)

Sta. 184+81 Const. 10' Driveway (C)

Sta. 186+75 Const. 10' Driveway (C)

Sta. 186+75 Const. 10' Driveway (R)

Match Line Sta. 173+00

Match Line Sta. 187+00

℄ Improvement ℄ of Survey

R/W

N00°27'06"W

Bench Mark - Std. Brass Disk So. End of S.E. Curb Ret. @ Mill St. & Waterman Ave. Stamped K 524 - Reset 1962 Elev. 1013.93

℄ Imp. Sta. 173+00 to Sta. 187+00 Const. 13 P.C.C. Driveways Lt. Const. 6 P.C.C. Driveways Rt.

℄ Imp. Sta. 173+00 To Sta. 187+00 See Sheet No. 21 For Sewer Manhole Work

Top of Curb Lt.

Flowline of Gutter Lt.

Existing Profile @ ℄ of Survey

Profile Grade @ ℄ Improvement

Top of Curb Rt.

Flowline of Gutter Rt.

+0.67%

+0.30%

200' V.C.

Sta.	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	Sheet Totals
Cu. Yds. Esti.		505	456	510	611	399	679	667	683	647	893	968	960	847	753	9578
Cu. Yds. Emb.		0	0	0	0	0	0	0	0	0	0	0	0	0	3	3

AS BUILT
CORRECTIONS BY [illegible]
DATE 12-30-71

AS BUILT
CORRECTIONS BY [illegible]
DATE 12-30-71

870200-4
88-80

4

DIV. NO.	STATE	FEDERAL PROJECT No.	SHEET No.	TOTAL SHEETS
7	CALIF.	SU-SUG 712(5)	24	31

DIST.	COUNTY	ROUTE	SEC.	SHEET No.	TOTAL SHEETS
08	S.Bd.	712	CR SBd	24	31

APPROVED: August 31, 1970 M. A. Nichols
COUNTY ENGINEER REGISTERED CIVIL ENGINEER NO.

EARTHWORK STRUCT. EXC. CU. YDS.	EARTHWORK STRUCT. B.F. CU. YDS.	BAR REINF. STEEL LBS.	CLASS 'A' CONC. STRUCTURE CU. YDS.	CLASS 'A' CONC. MINOR STRUCT. CU. YDS.	JUNCTION BOX	MANHOLE FRAME AND COVER	PRECAST CONC MANHOLE L.F.	INLET	INLET FRAME AND COVER	DROP INLET FRAME AND GRATE	CLASS OR GAGE	CULVERT PIPE, LIN. FT.	4" CAST IRON PIPE L.F.	28"x20" C.M.P.A.	57"x38" C.M.P.A.	24" C.M.P.	42" C.M.P.	30" R.C.P.	33" R.C.P.	54" R.C.P.	STRUCTURES W FT.	STRUCTURES H FT.	STRUCTURES L FT.	STRUCTURES TYPE	INVERT DATA INLET STATION	INLET DISTANCE RT OR LT	INLET ELEVATION	OUTLET STATION	OUTLET DISTANCE RT OR LT	OUTLET ELEVATION	DETAILS ON SHEET NO.	DESCRIPTION	STATION
				*1.29													156								98			+43.5	37.8' RT.	1008.05	16	CONSTRUCT CONCRETE COLLAR 45.67' RT.	166+~~24.03~~ 43.50
*421.9	*362.1										12						~~176~~								167+~~98.50~~	45.67'RT.	1008.66	166+~~24.03~~	MEET EXISTING			PLACE 42" CMP STORM DRAIN RT.	167+12
				*2.43				1	1												3.00	3.32	7.00	OS(MOD)							15	CONSTRUCT INLET 43.00'LT. WITH 8" CURB OPENING & PROTECTION BAR	168+00
*5.3	*3.9										12					14									168+00	43.50'LT.	1015.80	168+00	31'LT.±	MEET EXIST.		EXTEND EXISTING 24" CMP CROSS DRAIN LT.	168+00
*7.6	*6.3										12					~~14~~ 10					3.00	4.00			168+00	~~31.00' RT.~~	~~MEET EXIST~~	168+00	~~43.67' RT.~~	1014.10		EXTEND EXISTING 24" CMP CROSS DRAIN RT.	168+00
				*7.09				1	1										398		~~3.50~~	~~10.15~~	7.00	OS(MOD)		43.50' RT.	1015.10		35.00' RT.		15	CONSTRUCT INLET 43.00'RT. WITH 8" CURB OPENING & PROTECTION BAR	168+00
*797.8	*679.2										III								~~396~~						171+98.50	33.00'RT.	1010.51	168+03.50	45.67'RT.	1008.69		PLACE 33" RCP STORM DRAIN RT. CL III	170+01
				*2.22	1	1	5.97														4.00	4.00	3.00								14	CONSTRUCT JUNCTION BOX 33' RT.	172+00
*1024.7	*875.2										III								498						176+98.50	33.00'RT.	1012.81	172+01.50	33.00'RT.	1010.52		PLACE 33" R.C.P. STORM DRAIN RT. CL III	174+50
				*2.09	1	1	6.65														4.00	4.00	3.00								14	CONSTRUCT JUNCTION BOX 33.00'RT.	177+00
*8.3	*7.5										12					12									177+05.00	43.50'RT.	1016.44	177+00	35.00'RT.	1013.57		PLACE 24" CMP CROSS DRAIN	177+01.50
				*3.69				1	1													7.67	10.00	OL								CONSTRUCT INLET 43.00'RT. WITH 8" CURB OPENING & PROTECTION BAR	177+08.25
*946.8	*812.3										III								448						181+48.50	33.00'RT.	1014.38	177+01.50	33.00'RT.	1012.82		PLACE 33" RCP STORM DRAIN RT. CL III	179+25
				*3.66	1	1	2.93														4.00	7.50	3.00								14	CONSTRUCT JUNCTION BOX 33.00'RT.	181+50
*406.7	*302.6										III								348						184+98.50	33.00'RT.	1019.71	181+51.50	33.00'RT.	1018.50		PLACE 33" RCP STORM DRAIN RT. CL. III	183+25
				*2.01	1	1	2.65														4.00	3.50	3.00								14	CONSTRUCT JUNCTION BOX 33.00'RT.	185+00
*499.7	*357.8										III								474						189+73.50	33.00'RT.	1021.37	185+01.50	33.00'RT.	1019.72		PLACE 33" RCP STORM RT. CL III	187+37.50
				*1.08																											21	CONSTRUCT CONCRETE COLLAR 33' RT.	189+73.50
*30.2	*21.7										V								32						190+05.50	33.00'RT.	1021.48	189+73.50	33.00'RT.	1021.37		PLACE 33" RCP STORM DRAIN RT CL V	189+89.50
				*1.93	1	1	2.86														4.00	3.50	3.00								14	CONSTRUCT JUNCTION BOX 33.00'RT.	190+07
*59.7	*47.9										III							52							0+84.49 Cardiff	34.00'RT.	1021.70	190+07.00	35.00'RT.	1021.48		PLACE 30" RCP CROSS DRAIN	190+07
*57.8	*50.6										12					66									0+88.71	32.50'LT.	1022.02	0+86.07	32.50'RT.	1021.70		PLACE 24" CMP CROSS DRAIN	0+87.25 ℄ CARDIFF
				*6.63				1	1												3.00	6.98	14.00	OS(MOD)							15	CONSTRUCT INLET 32'RT WITH 8" CURB OPENING & PROTECTION BAR	0+90.82 ℄ CARDIFF
				*5.42				1	1													6.69	21.00	OL								CONSTRUCT INLET 32'LT WITH 8" CURB OPENING & PROTECTION BAR	0+98.50 ℄ CARDIFF
*123.9	*108.5										12					138									2+19.17	34.00'RT.	1022.75	0+97.14	34.00'RT.	1022.16		PLACE 24" CMP SIDE DRAIN RT.	1+51.83 ℄ CARDIFF
				*4.05				1	1													6.55	14.00	OL								CONSTRUCT INLET 32'RT WITH 8" CURB OPENING & PROTECTION BAR	2+25.50 ℄ CARDIFF
													14																		15	PLACE CURB DRAIN LT.	5+70 ℄ CARDIFF
*87.0	*75.0										12					108									191+14.16	45.00'RT.	1022.01	190+08.50	33.00'RT.	1021.48		PLACE 24" CMP SIDE DRAIN RT.	190+61
				*3.36				1	1													6.50	10.00	OL								CONSTRUCT INLET 43'RT. WITH 8" CURB OPENING & PROTECTION BAR	191+19
				*0.32						1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	191+~~35~~ 18
				*0.32						1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	201+11
				*0.32						1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	202+83
				*0.32						1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	202+88
				*0.16						**1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	0+86 ℄ THIRD ST. WEST
				*5.50				1	1															SPECIAL			.46				16	CONSTRUCT INLET 53.02 RT. WITH 6" CURB OPENING	203+55.74
*165.6	*150.5										12			360											203+55.47	53.46'RT.	1025.~~86~~	207+10.92	52.46'RT.	1025.25		PLACE 28"x20" CMPA SIDE DRAIN RT.	205+33.00
				*4.56				1	1												3.00	4.52	14.00	OS(MOD)							15	CONSTRUCT INLET 43.00'RT WITH 8" CURB OPENING & PROTECTION BAR	207+11.00
*6.8	*3.4										12				10										207+14.50	43.50'RT.	1023.77	207+14.50	35.00'RT.	MEET EXIST.		PLACE 57"x38" CMPA CROSS DRAIN RT.	207+14.50
*0.5	*0.3										12				6										207+14.50	50.75'RT.	1023.80	207+14.50	46.50'RT.	1023.78		PLACE 57"x38" CMPA CROSS DRAIN RT.	207+14.50
*4.8	*6.3	*226	*3.84																					(MOD)L							19	CONSTRUCT MOD. TYPE "L" HEADWALL RT.	207+18.75
*30.9	*50.1	*1,679	*11.72																												18	CONSTRUCT REINFORCED CONCRETE HEADWALL LT	207+21
*0.7	*0.4										12				2										207+22.00	50.75'RT.	1023.80	207+22.00	48.75'RT.	MEET EXIST		PLACE 57"x38" CMPA CROSS DRAIN RT.	207+22
*7.9	*2.9		*4.53																												17	CONSTRUCT CONCRETE PIPE CRADLE 27'LT.	207+58
				*0.32						1			16																		15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	211+58
*934.6	*410.4	*72,821	*495.85																						217+69.00	14.00'LT.	1026.64	207+29.82	57.75'LT.	1023.05	17-18	CONSTRUCT STANDARD SINGLE BOX CULVERT 6'x4'-A x 1055.27	212+49.41
						1	1.81																								17	PLACE PRECAST CONCRETE CLEANOUT MANHOLE 12.50'LT.	213+36
*44.7	*38.6										12			66											213+65.93	43.50'RT.	1025.66	213+33.00	11.00'LT.	1025.16		PLACE 28"x20" CMPA CROSS DRAIN	213+49.87
				*3.78				1	1													5.60	14.00	OL								CONSTRUCT INLET 43.00'RT. WITH 8" CURB OPENING & PROTECTION BAR	213+71.18
*24.9	*5.7	*1243	*6.33			1	2.00																								17	CONSTRUCT JUNCTION STRUCTURE 14'LT.	217+~~73~~ 74
*64.6	*73.5										12					100									0+73.41 FIFTH	38.00'LT.	1027.56	217+52.00	11.00'LT.	1026.58		PLACE 24" CMP CROSS DRAIN	217+17.15
				*4.12				1	1							90						6.83	14.00	OL	41.21	.00	.53	+74.5				CONSTRUCT INLET 36.00'RT WITH 8" CURB OPENING & PROTECTION BAR	0+80.00 ℄ FIFTH ST. EAST
*62.0	*53.2										12					~~84~~									218+~~30.46~~	43.~~58~~'RT.	1027.~~44~~	217+~~73.00~~	11.00'LT.	1026.66		PLACE 24" CMP CROSS DRAIN	218+01.73
				*0.35						**1			16															77			15	CONSTRUCT DROP INLET AND PLACE DRAINS LT.	218+14
*60.6	*50.3										12					94							7.00		218+64.50	45.00'LT.	1030.92	217+~~76.56~~	18.18'LT.	1027.67		PLACE 24" CMP CROSS DRAIN	218+20.53
				*4.17				~~1~~	~~1~~	1												7.00	~~14.00~~	GOL				78				CONSTRUCT INLET 43.00'RT WITH 8" CURB OPENING & PROTECTION BAR	218+~~35.71~~ 44.71
*297.1	*162.9										III									168					219+45.00	14.00'LT.	1027.59	217+~~77.00~~	14.00'LT.	1026.67		PLACE 54" RCP STORM DRAIN LT.	218+59.50
				*3.27				1	1													3.75	14.00	OL								CONSTRUCT INLET 43.00'LT WITH 8" CURB OPENING & PROTECTION BAR	218+71.50
																									166+43.5	37.8'RT.	1008.05	166+36.5	MEET EXIST.			CONSTRUCT R.C.C. COLLAR, SALVAGE 42" CMP	166+40.00
							1.79														4.00	8.00	3.00									CONSTRUCT JUNCTION BOX 33.00' RT.	168+00.00
7,223.1	4,719.1	75,969	522.27	74.46	5	7	24.81	13	13	5			126	426	18	630	176	52	2196	168													TOTAL

NOTE: 1. ALL C.M.P.'S SHALL BE BITUMINOUS COATED.
2. THE 28"x20" SIDE DRAIN RT. OF STA. 205+33 SHALL BE BITUMINOUS COATED WITH PAVED INVERT.
3. ** SALVAGED DROP INLET FRAME AND GRATE.
4. * DENOTES FINAL PAY QUANTITY
5. USE STANDARD GUTTER DEPRESSION FOR ALL INLETS EXCEPT AT STA. 203+55.74 RT.

AS BUILT
CORRECTIONS BY [signature]
DATE 12-30-71

DRAINAGE SUMMARY

870200-24
88-80

APPENDIX B

HYDROLOGY CALCULATIONS

EXISTING CONDITION

```
****************************************************************************
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                         Analysis prepared by:

                          THIENES ENGINEERING
                        16800 VALLEY VIEW AVENUE
                           LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* EXISTING CONDITION NODES 100-102                                         *
* 100-YEAR                                                                 *
 ***************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXA.DAT
  TIME/DATE OF STUDY: 14:43 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   390.00
  ELEVATION DATA: UPSTREAM(FEET) =   1035.80  DOWNSTREAM(FEET) =   1031.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.758
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.097
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                    B        1.20      0.03       1.00    97   13.76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.03
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =       3.31
  TOTAL AREA(ACRES) =       1.20   PEAK FLOW RATE(CFS) =       3.31

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1031.00  DOWNSTREAM(FEET) =   1025.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   480.00   CHANNEL SLOPE =  0.0115
  CHANNEL FLOW THRU SUBAREA(CFS) =       3.31
  FLOW VELOCITY(FEET/SEC) =   2.05 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.89   Tc(MIN.) =  17.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  17.65
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.667
```

```
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
NATURAL POOR COVER
"BARREN"                    B        1.70       0.03       1.00    97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.03
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =     1.70      SUBAREA RUNOFF(CFS) =     4.03
EFFECTIVE AREA(ACRES) =     2.90    AREA-AVERAGED Fm(INCH/HR) =  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.03   AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =      2.90       PEAK FLOW RATE(CFS) =       6.87
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      2.90  TC(MIN.) =      17.65
EFFECTIVE AREA(ACRES) =       2.90  AREA-AVERAGED Fm(INCH/HR)=  0.03
AREA-AVERAGED Fp(INCH/HR) =  0.03   AREA-AVERAGED Ap =  1.00
PEAK FLOW RATE(CFS)    =      6.87
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

1

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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                 PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* EXISTING CONDITION NODES 110-112                                         *
* 100-YEAR                                                                 *
 ***************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXB.DAT
  TIME/DATE OF STUDY: 14:46 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   475.00
  ELEVATION DATA: UPSTREAM(FEET) =   1037.50  DOWNSTREAM(FEET) =   1029.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.056
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.270
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        1.70      0.45       0.10    76    8.06
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      6.46
  TOTAL AREA(ACRES) =      1.70   PEAK FLOW RATE(CFS) =      6.46

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1029.30  DOWNSTREAM(FEET) =   1025.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00   CHANNEL SLOPE =  0.0062
  CHANNEL FLOW THRU SUBAREA(CFS) =      6.46
  FLOW VELOCITY(FEET/SEC) =   1.77 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.74   Tc(MIN.) =  13.80
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =  1085.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.80
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.092
  SUBAREA LOSS RATE DATA(AMC III):
```

```
 DEVELOPMENT TYPE/       SCS SOIL   AREA       Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)   CN
NATURAL POOR COVER
"BARREN"                    B        3.15       0.03       1.00     97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.03
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =     3.15      SUBAREA RUNOFF(CFS) =     8.67
EFFECTIVE AREA(ACRES) =      4.85   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.05  AREA-AVERAGED Ap =  0.68
TOTAL AREA(ACRES) =      4.85       PEAK FLOW RATE(CFS) =       13.33
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       4.85  TC(MIN.) =      13.80
EFFECTIVE AREA(ACRES) =       4.85  AREA-AVERAGED Fm(INCH/HR)=  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.05  AREA-AVERAGED Ap =  0.68
PEAK FLOW RATE(CFS)    =      13.33
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

1

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                          Analysis prepared by:

                           THIENES ENGINEERING
                         16800 VALLEY VIEW AVENUE
                            LA MIRADA CA 90638
                   PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* EXISTING CONDITION NODES 120-122                                         *
* 100-YEAR                                                                 *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXC.DAT
  TIME/DATE OF STUDY: 14:50 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   440.00
  ELEVATION DATA: UPSTREAM(FEET) =   1030.00  DOWNSTREAM(FEET) =   1027.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.248
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.803
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "OPEN BRUSH"                 B        1.60      0.16      1.00    92   16.25
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.16
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =       3.81
  TOTAL AREA(ACRES) =       1.60   PEAK FLOW RATE(CFS) =       3.81

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =   9
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =   1027.00
  DOWNSTREAM NODE ELEVATION(FEET) =   1023.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   395.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
  PAVEMENT LIP(FEET) =  0.013   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   0.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.563
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                   B        2.30      0.45      0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.41
```

```
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.52
AVERAGE FLOW DEPTH(FEET) =   0.37   FLOOD WIDTH(FEET) =   21.42
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.61   Tc(MIN.) =  18.86
SUBAREA AREA(ACRES) =    2.30       SUBAREA RUNOFF(CFS) =    5.21
EFFECTIVE AREA(ACRES) =    3.90     AREA-AVERAGED Fm(INCH/HR) =   0.09
AREA-AVERAGED Fp(INCH/HR) =   0.20  AREA-AVERAGED Ap =   0.47
TOTAL AREA(ACRES) =    3.90         PEAK FLOW RATE(CFS) =       8.67

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.40   FLOOD WIDTH(FEET) =   24.64
FLOW VELOCITY(FEET/SEC.) =   2.64   DEPTH*VELOCITY(FT*FT/SEC) =   1.05
LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =   835.00 FEET.
****************************************************************************
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      3.90  TC(MIN.) =     18.86
EFFECTIVE AREA(ACRES) =       3.90  AREA-AVERAGED Fm(INCH/HR)=  0.09
AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.47
PEAK FLOW RATE(CFS)    =      8.67
****************************************************************************
****************************************************************************
END OF RATIONAL METHOD ANALYSIS
```

1

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                         Analysis prepared by:

                          THIENES ENGINEERING
                        16800 VALLEY VIEW AVENUE
                           LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* EXISTING CONDITION NODES 130-131                                         *
* 100-YEAR                                                                 *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXD.DAT
  TIME/DATE OF STUDY: 14:51 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   190.00
  ELEVATION DATA: UPSTREAM(FEET) =   1025.00  DOWNSTREAM(FEET) =   1022.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.896
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.150
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.35      0.45       0.10    76    5.90
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      1.61
  TOTAL AREA(ACRES) =      0.35   PEAK FLOW RATE(CFS) =      1.61
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =      0.35  TC(MIN.) =      5.90
  EFFECTIVE AREA(ACRES) =      0.35  AREA-AVERAGED Fm(INCH/HR)=  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)    =      1.61
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
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                          Analysis prepared by:

                           THIENES ENGINEERING
                         16800 VALLEY VIEW AVENUE
                            LA MIRADA CA 90638
                   PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* WATERMAN AVENUE                                                        *
* EXISTING CONDITION NODES 140-141                                       *
* 100-YEAR                                                               *
 ************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXE.DAT
  TIME/DATE OF STUDY: 14:53 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    141.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   720.00
  ELEVATION DATA: UPSTREAM(FEET) =   1028.00  DOWNSTREAM(FEET) =   1019.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.729
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.660
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "OPEN BRUSH"                 B        4.80      0.16       1.00    92   17.73
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.16
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      10.80
  TOTAL AREA(ACRES) =       4.80   PEAK FLOW RATE(CFS) =     10.80
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       4.80  TC(MIN.) =      17.73
  EFFECTIVE AREA(ACRES) =       4.80  AREA-AVERAGED Fm(INCH/HR)=  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.16  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     10.80
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                         Analysis prepared by:

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                           LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATEMAN AVENUE                                                          *
* EXISTING CONDITION NODES 150-151                                        *
* 100-YEAR                                                                *
 **************************************************************************

  FILE NAME: C:\XDRIVE\3288\EXF.DAT
  TIME/DATE OF STUDY: 15:19 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    151.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   690.00
  ELEVATION DATA: UPSTREAM(FEET) =   1038.00  DOWNSTREAM(FEET) =   1021.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.764
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.060
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.75      0.45      0.10    76    8.76
  RESIDENTIAL
  "1 DWELLING/ACRE"           B        0.75      0.45      0.80    76   13.52
  NATURAL POOR COVER
  "BARREN"                    B        2.60      0.03      1.00    97   15.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.12
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.80
  SUBAREA RUNOFF(CFS) =      14.63
  TOTAL AREA(ACRES) =       4.10   PEAK FLOW RATE(CFS) =     14.63
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       4.10  TC(MIN.) =       8.76
  EFFECTIVE AREA(ACRES) =       4.10  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.12  AREA-AVERAGED Ap =  0.80
  PEAK FLOW RATE(CFS)    =     14.63
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

PROPOSED CONDITION

```
****************************************************************************
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                        Analysis prepared by:

                         THIENES ENGINEERING
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                 PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* AREA DRAINING TO CHANNEL                                                 *
* 100-YEAR                                                                 *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3288\3288A.DAT
  TIME/DATE OF STUDY: 16:27 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =   1030.92  DOWNSTREAM(FEET) =   1026.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.823
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.717
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        2.00      0.45       0.10    76    6.82
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      8.41
  TOTAL AREA(ACRES) =      2.00   PEAK FLOW RATE(CFS) =      8.41

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1022.18  DOWNSTREAM(FEET) =  1021.36
  FLOW LENGTH(FEET) =   165.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.32
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.41
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =   7.34
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   465.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.34
```

```
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.515
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.60      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.60      SUBAREA RUNOFF(CFS) =     6.44
EFFECTIVE AREA(ACRES) =      3.60   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      3.60       PEAK FLOW RATE(CFS) =       14.48

****************************************************************************
FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1021.31  DOWNSTREAM(FEET) =  1020.80
FLOW LENGTH(FEET) =   102.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.04
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     14.48
PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   7.62
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =   567.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =   7.62
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.415
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
NATURAL POOR COVER
"BARREN"                    B        1.20      0.03       1.00    97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.03
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
SUBAREA AREA(ACRES) =     1.20      SUBAREA RUNOFF(CFS) =     4.73
EFFECTIVE AREA(ACRES) =      4.80   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.13  AREA-AVERAGED Ap =  0.32
TOTAL AREA(ACRES) =      4.80       PEAK FLOW RATE(CFS) =       18.89

****************************************************************************
FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1020.80  DOWNSTREAM(FEET) =  1020.35
FLOW LENGTH(FEET) =   184.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.92
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     18.89
PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =   8.24
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =   751.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =   8.24
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.211
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B        1.55      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.55      SUBAREA RUNOFF(CFS) =     5.81
EFFECTIVE AREA(ACRES) =      6.35   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.16  AREA-AVERAGED Ap =  0.27
TOTAL AREA(ACRES) =      6.35       PEAK FLOW RATE(CFS) =       23.82

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1020.35  DOWNSTREAM(FEET) =  1019.51
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.90
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     23.82
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   8.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =   919.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.65
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.092
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.30      0.45      0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    4.73
  EFFECTIVE AREA(ACRES) =     7.65   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  0.24
  TOTAL AREA(ACRES) =     7.65       PEAK FLOW RATE(CFS) =      27.87

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1019.51  DOWNSTREAM(FEET) =  1018.67
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.07
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     27.87
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   9.05
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =  1087.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.05
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.983
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.30      0.45      0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    4.61
  EFFECTIVE AREA(ACRES) =     8.95   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.20  AREA-AVERAGED Ap =  0.22
  TOTAL AREA(ACRES) =     8.95       PEAK FLOW RATE(CFS) =      31.73

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1018.67  DOWNSTREAM(FEET) =  1017.59
  FLOW LENGTH(FEET) =   216.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.73
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =   9.53
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =  1303.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.53
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.860
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.10      0.45      0.10    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.10      SUBAREA RUNOFF(CFS) =    3.78
  EFFECTIVE AREA(ACRES) =    10.05   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.21  AREA-AVERAGED Ap =  0.21
  TOTAL AREA(ACRES) =    10.05       PEAK FLOW RATE(CFS) =      34.52

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1017.59  DOWNSTREAM(FEET) =  1013.10
  FLOW LENGTH(FEET) =   576.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.82
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.52
  PIPE TRAVEL TIME(MIN.) =   1.09    Tc(MIN.) =  10.62
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    123.00 =  1879.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   405.00
  ELEVATION DATA: UPSTREAM(FEET) =   1023.88  DOWNSTREAM(FEET) =   1020.87

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.946
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.010
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        3.55      0.45      0.10    76    8.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =     12.67
  TOTAL AREA(ACRES) =      3.55   PEAK FLOW RATE(CFS) =     12.67

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1016.87  DOWNSTREAM(FEET) =  1013.65
  FLOW LENGTH(FEET) =   510.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.29
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     12.67
  PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =  10.30
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    122.00 =   915.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  10.30
RAINFALL INTENSITY(INCH/HR) =   3.69
AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    3.55
TOTAL STREAM AREA(ACRES) =    3.55
PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.67

****************************************************************************
FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
INITIAL SUBAREA FLOW-LENGTH(FEET) =   700.00
ELEVATION DATA: UPSTREAM(FEET) =   1027.56  DOWNSTREAM(FEET) =   1020.87

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.589
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.624
SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
COMMERCIAL                  B        4.05      0.45      0.10    76   10.59
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA RUNOFF(CFS) =     13.04
TOTAL AREA(ACRES) =      4.05   PEAK FLOW RATE(CFS) =     13.04

****************************************************************************
FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1016.87  DOWNSTREAM(FEET) =  1013.65
FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  15.0 INCH PIPE IS  10.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  14.39
ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     13.04
PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =  10.66
LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =   760.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  10.66
RAINFALL INTENSITY(INCH/HR) =   3.61
AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45
AREA-AVERAGED Ap =  0.10
EFFECTIVE STREAM AREA(ACRES) =    4.05
TOTAL STREAM AREA(ACRES) =    4.05
PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.04

** CONFLUENCE DATA **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1     12.67  10.30    3.685  0.45( 0.05) 0.10     3.5     110.00
    2     13.04  10.66    3.610  0.45( 0.05) 0.10     4.1     120.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
 STREAM     Q     Tc   Intensity   Fp(Fm)      Ap   Ae     HEADWATER
 NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
    1     25.54  10.30    3.685  0.45( 0.05) 0.10     7.5     110.00
    2     25.45  10.66    3.610  0.45( 0.05) 0.10     7.6     120.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      25.54    Tc(MIN.) =     10.30
  EFFECTIVE AREA(ACRES) =      7.46   AREA-AVERAGED Fm(INCH/HR) =  0.05
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       7.60
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    122.00 =   915.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1013.65  DOWNSTREAM(FEET) =  1013.10
  FLOW LENGTH(FEET) =   108.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.04
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.54
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =  10.55
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    123.00 =  1023.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     25.54  10.55    3.631  0.45( 0.05) 0.10     7.5     110.00
      2     25.45  10.91    3.559  0.45( 0.05) 0.10     7.6     120.00
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    123.00 =  1023.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     34.52  10.62    3.617  0.21( 0.04) 0.21    10.1     100.00
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    123.00 =     0.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     59.97  10.55    3.631  0.27( 0.04) 0.16    17.4     110.00
      2     59.40  10.91    3.559  0.28( 0.04) 0.16    17.7     120.00
      3     60.04  10.62    3.617  0.27( 0.04) 0.16    17.5     100.00
    TOTAL AREA(ACRES) =      17.65

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       60.04  Tc(MIN.) =   10.621
  EFFECTIVE AREA(ACRES) =     17.54  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.16
  TOTAL AREA(ACRES) =     17.65
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    123.00 =  1023.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1013.10  DOWNSTREAM(FEET) =  1012.00
  FLOW LENGTH(FEET) =    52.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.03
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      60.04
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =  10.68
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    124.00 =  1075.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     17.65  TC(MIN.) =     10.68
  EFFECTIVE AREA(ACRES) =      17.54  AREA-AVERAGED Fm(INCH/HR)=  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.27  AREA-AVERAGED Ap =  0.16
```

PEAK FLOW RATE(CFS) = 60.04

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	59.97	10.62	3.619	0.27(0.04)	0.16	17.4	110.00
2	60.04	10.68	3.605	0.27(0.04)	0.16	17.5	100.00
3	59.40	10.98	3.547	0.28(0.04)	0.16	17.7	120.00

==========

==========

END OF RATIONAL METHOD ANALYSIS

1

```
****************************************************************************
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         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                 PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* NORTHERLY AREA TO EXISTING STORM DRAIN IN WATERMAN AVENUE                *
* 100-YEAR                                                                 *
 ****************************************************************************

  FILE NAME: C:\XDRIVE\3288\3288B.DAT
  TIME/DATE OF STUDY: 17:16 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   220.00
  ELEVATION DATA: UPSTREAM(FEET) =   1028.95  DOWNSTREAM(FEET) =   1026.15

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.294
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.952
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  B        0.60      0.45      0.10    76    6.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      2.65
  TOTAL AREA(ACRES) =      0.60   PEAK FLOW RATE(CFS) =      2.65

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1022.15  DOWNSTREAM(FEET) =  1021.85
  FLOW LENGTH(FEET) =    46.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.35
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      2.65
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   6.47
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =   266.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   6.47
```

```
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.870
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       0.15      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     0.15      SUBAREA RUNOFF(CFS) =     0.65
EFFECTIVE AREA(ACRES) =      0.75   AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      0.75       PEAK FLOW RATE(CFS) =       3.26
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       0.75  TC(MIN.) =       6.47
EFFECTIVE AREA(ACRES) =        0.75  AREA-AVERAGED Fm(INCH/HR)=  0.05
AREA-AVERAGED Fp(INCH/HR) =    0.45  AREA-AVERAGED Ap =  0.10
PEAK FLOW RATE(CFS)    =       3.26
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

1

```
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                         Analysis prepared by:

                          THIENES ENGINEERING
                        16800 VALLEY VIEW AVENUE
                           LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* WATERMAN AVENUE                                                          *
* SOUTHERLY AREA TO EXISTING STORM DRAIN IN WATERMAN                       *
* 100-YEAR                                                                 *
 ***************************************************************************

  FILE NAME: C:\XDRIVE\3288\3288C.DAT
  TIME/DATE OF STUDY: 17:18 06/14/2014
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   585.00
  ELEVATION DATA: UPSTREAM(FEET) =   1026.70  DOWNSTREAM(FEET) =   1023.27

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.867
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.568
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        1.05      0.45      0.10    76   10.87
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      3.33
  TOTAL AREA(ACRES) =      1.05   PEAK FLOW RATE(CFS) =      3.33

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1019.27  DOWNSTREAM(FEET) =  1018.00
  FLOW LENGTH(FEET) =    82.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.47
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      3.33
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  11.08
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =   667.00 FEET.

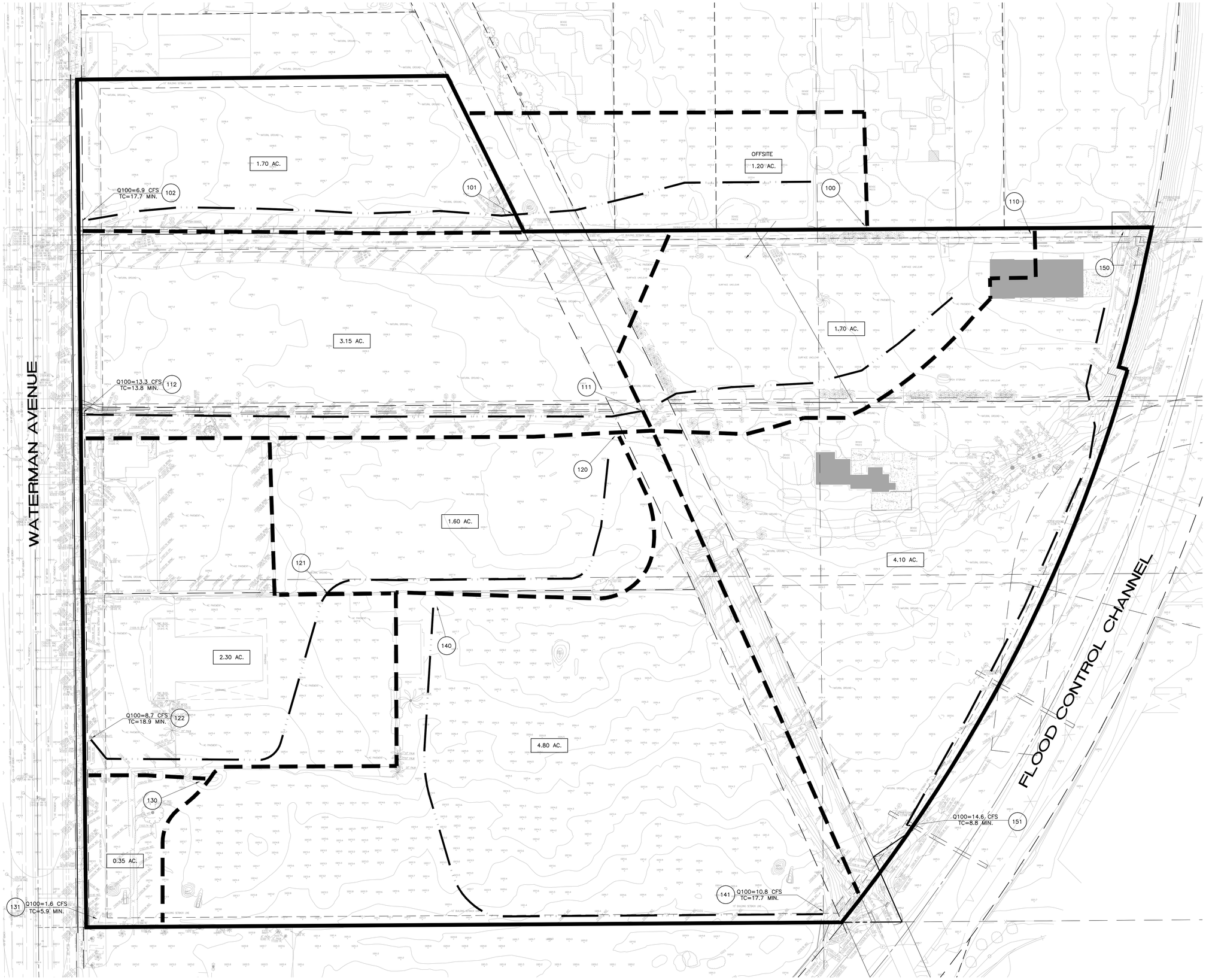
****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.08
```

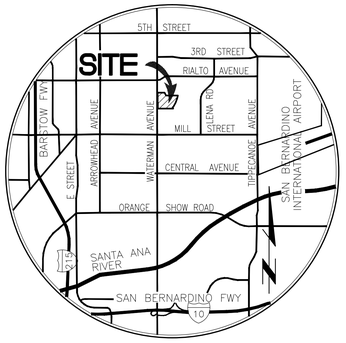
```
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.527
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                  B       1.00      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =     1.00      SUBAREA RUNOFF(CFS) =     3.13
EFFECTIVE AREA(ACRES) =     2.05    AREA-AVERAGED Fm(INCH/HR) =  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45   AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =     2.05        PEAK FLOW RATE(CFS) =       6.42
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      2.05  TC(MIN.) =      11.08
EFFECTIVE AREA(ACRES) =       2.05  AREA-AVERAGED Fm(INCH/HR)=  0.05
AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.10
PEAK FLOW RATE(CFS)    =      6.42
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

1

APPENDIX C

HYDROLOGY MAP





VICINITY MAP

N.T.S.

LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
1.00 AC.	SUBAREA AREA
100	NODE NUMBER

0 20 40 80 120

SCALE:1"=40'

Last Update: 8/1/14
O:\3200-3299\3288\3288HYD-ex.dwg

CITY OF SAN BERNARDINO

PUBLIC WORKS DEPARTMENT

EXISTING CONDITION HYDROLOGY MAP

WATERMAN LOGISTICS CENTER

WATERMAN AVENUE

SHEET 1 OF 1

PREPARED FOR:

HILLWOOD INVESTMENTS
901 VIA PIEMONTE, SUITE 175
ONTARIO, CA 91764
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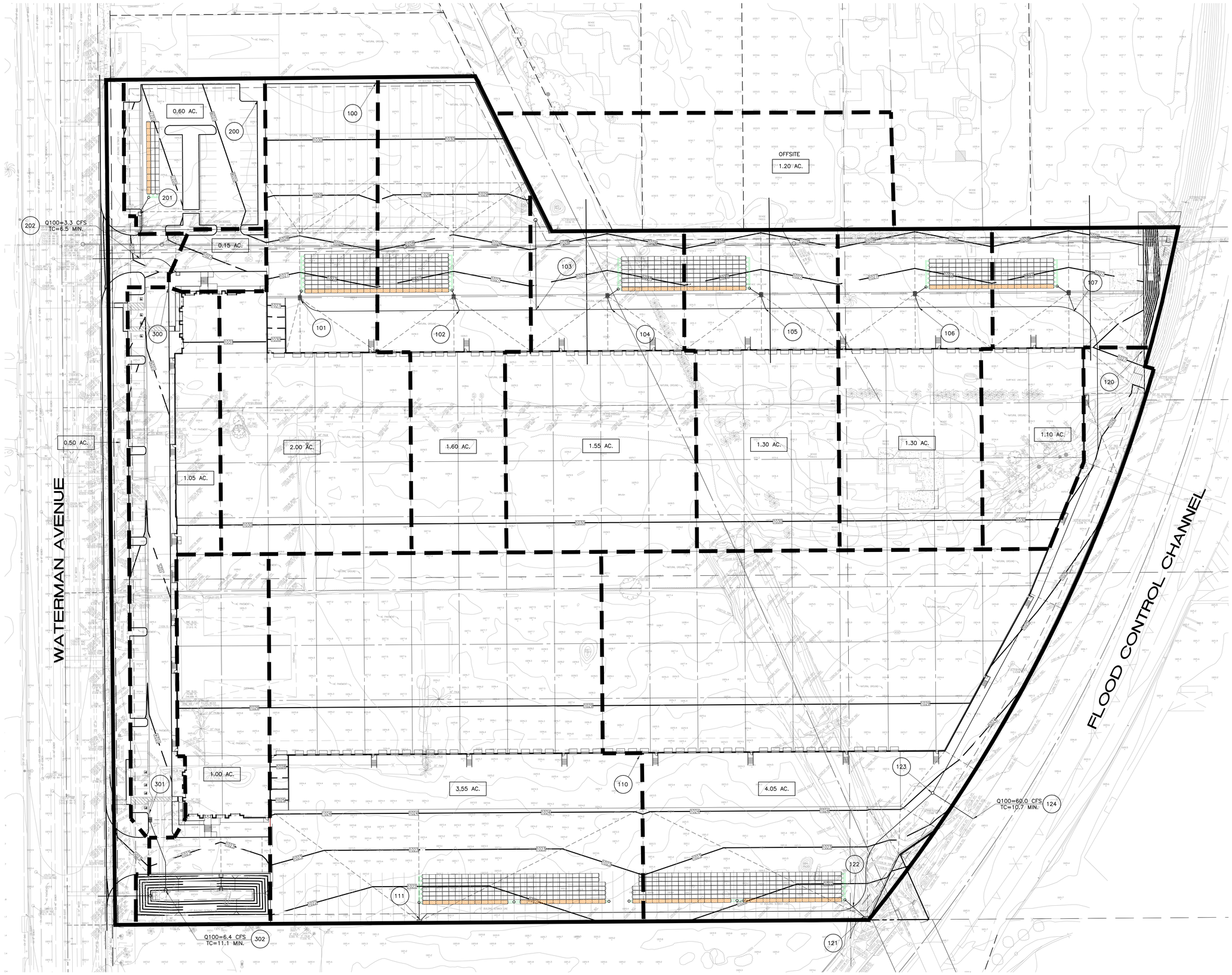
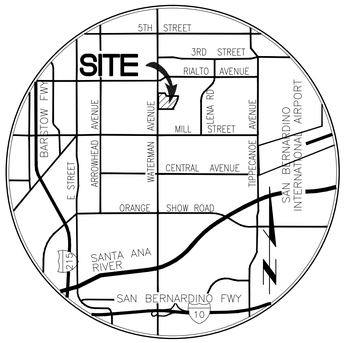
Designed by		Approved by	Date
Date			
Checked by			
Date			
Designed by		Public Works Director	R.C.E. XXXXX
Date			
Checked by			
Date		Sheet 1 of 1 Sheets	





VICINITY MAP

N.T.S.

LEGEND

▬▬	PROJECT BOUNDARY
▬ ▬	SUBAREA BOUNDARY
1.00 AC.	SUBAREA AREA
(100)	NODE NUMBER

0 20 40 80 120

SCALE:1"=40'

Last Update:8/1/14
O:\3200-3299\3288\3288HY0.dwg

CITY OF SAN BERNARDINO

PUBLIC WORKS DEPARTMENT

PROPOSED CONDITION HYDROLOGY MAP

WATERMAN LOGISTICS CENTER

WATERMAN AVENUE

SHEET 1 OF 1 SHEET

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Designed by ____ Date ____	Approved by	Date ____
Checked by ____ Date ____		
Designed by ____ Date ____	Public Works Director	R.C.E. ____ XXXXX
Checked by ____ Date ____	Sheet 1 of 1 Sheets	