



**Thienes Engineering, Inc.**  
CIVIL ENGINEERING • LAND SURVEYING

**PRELIMINARY HYDROLOGY  
CALCULATIONS**

FOR

GATEWAY SOUTH  
BUILDING 9  
SAN BERNARDINO

PREPARED FOR

GATEWAY SOUTH 9 DEVELOPMENT, LLC  
36 DISCOVERY, SUITE 130  
IRINVE, CA 92612  
PH. (909) 382-0033

JUNE 22, 2022  
REVISED SEPTEMBER 6, 2022

JOB NO. 4106

PREPARED BY

THIENES ENGINEERING  
14349 FIRESTONE BOULEVARD  
LA MIRADA, CALIFORNIA 90638  
P. (714) 521-4811  
FAX. (714) 521-4173

**PRELIMINARY HYDROLOGY  
CALCULATIONS**

**FOR**

**GATEWAY SOUTH BUILDING 9  
SAN BERNARDINO**

PREPARED BY KRISTIE FERRONATO  
UNDER THE SUPERVISION OF

---

REINHARD STENZEL      DATE:  
R.C.E. 56155  
EXP. 12/31/22

## INTRODUCTION

### A: PROJECT LOCATION

The project site is located on the north side of Orange Show Rd, south of Norman Rd, and north west of the Santa Ana River. This would be in the City of San Bernardino, California. Please see Figure 1 for vicinity map.

### B: STUDY PURPOSE

The purpose of this study is to determine the 100-year peak flow rate from the site that will drain to an existing storm drain 36" Storm drain that connects to the Santa Ana River.

### C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel  
Joshua Jacob  
Kristie Ferronato





Last Update: 8/25/22  
O: \\4100-4199\4106\4106VicMap.dwg

**TEI** Thienes Engineering, Inc.  
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VICINITY MAP  
FOR  
GATEWAY SOUTH BUILDING 9





## DISCUSSION

The proposed project site encompasses approximately 18.39 acres. Proposed improvements to the site consist of the construction of one commercial building of approximately 397,700 square feet. A truck storage yard will be located approximately at the east side of the proposed building. Vehicle parking will be located along the east and west sides of the building. There will be a truck yard along the south side of the building. Landscaping will be throughout site.

### Existing Condition:

The existing site consist of many land uses. The northwestern portion of the stie drains southwesterly and is generally developed as a multi residential lots. The 100-year flow peak flow rate for this area is approximately 6.9 cfs.

The southwestern portion of the site drains generally southerly towards Orange Show Road. The majority of this subarea is vacant undeveloped land with one parcel being developed with concrete paving. The 100-year flow peak flow rate for this area is approximately 10.6 cfs.

The eastern portion of the site consists of several lots, either vacant land or commercial developed used as trailer storage. This area drains southeasterly towards an existing headwall on the property. The 100-year flow peak flow rate for this area is approximately 20.5 cfs.

This existing headwall connects to an existing 36" RCP storm drain which continues southerly across Orange Show Road and ultimately discharges into the Santa Ana River. The plans for this storm drain show a design flow rate of 35 cfs from the headwall.

Please see Appendix "B" for existing condition hydrology calculations and Appendix "D" for existing condition hydrology map.

### Off-Site Run-on:

The property to the east of the project drains southwesterly and appears to drain towards the project site. The 100-year flow peak flow rate for this area is approximately 7.9 cfs.

Please see Appendix "B" for existing condition hydrology calculations and Appendix "D" for existing condition hydrology map.

Proposed Condition:

The project will generally drain south towards the existing headwall in the southeast corner of the site. The northerly landscape area will have a low spot and collected runoff will be conveyed easterly. Runoff from the northwesterly portion of the roof will be added to the storm drain system (Line A) as it is conveyed westerly. The proposed storm drain will continue southerly in the western drive aisle and turn east and where the runoff from the bulk of the building and the southern truck yards will be added by a series of catch basins in the truck yard. Runoff from the adjacent site to the east will be picked via catch basin at the southeasterly landscape area. The proposed storm drain will continue east towards the existing headwall and existing 36" storm drain.

Runoff from the northeasterly portion of the roof will run easterly and turn south at the easterly drive aisle. The proposed storm drain will continue southerly in the eastern drive aisle and turn west where it will confluence with SD Line A in the truck yard.

The 100-year flow peak flow rate for this area is approximately 33.1 cfs.

Runoff from the northerly portion of the west vehicle parking lot will surface drain south to a low spot just north of the west driveway where it will discharge to Lena Road via parkway drain.

The 100-year flow peak flow rate for this area is approximately 1.6 cfs.

Runoff from the southerly portion of the west vehicle parking lot will surface drain north to a low spot just south of the west driveway where it will discharge to Lena Road via parkway drain.

The 100-year flow peak flow rate for this area is approximately 1.4 cfs.

Runoff from the southwesterly portion of the west vehicle parking lot will surface drain south to a low spot at the southwest corner of the parking lot where it will discharge to Orange Show Road via parkway drain.

The 100-year flow peak flow rate for this area is approximately 1.0 cfs.

Runoff from the westerly portion of the building and southwesterly vehicle parking lot will surface drain south to a low spot at the southwest corner of vehicle parking lot where it will discharge to Orange Show Road via parkway drain.

The 100-year flow peak flow rate for this area is approximately 1.0 cfs.

Please see Appendix "B" for proposed condition hydrology calculations and Appendix "D" for proposed condition hydrology map.

Detention:

The existing storm drain in Orange Show Road has a flow rate of 35 cfs (per As-Built Dwg. 9142). This includes runoff from the neighbor to the east. Therefore, the project will limit discharge from the site to less than 27.9 cfs. This will be achieved by ponding runoff in the truck yard. The site discharge can be limited to approximately 22.5 cfs, which will require approximately 0.53 ac-ft of storage which can be achieved at a depth of 0.72 feet. This will limit the peak flow from the site to the design flow rate of the existing storm drain.

Please see Appendix "C" for detention calculations and Appendix "A" for As-Built plan.

Methodology:

Hydrology calculations were computed using the San Bernardino County Rational Method computer program (by AES Software). Detention analysis was calculated using San Bernardino County's small area unit hydrograph program. The site soil type is "A" per the San Bernardino County Hydrology Manual. See Appendix "A" for reference materials.



APPENDIX

DESCRIPTION

A

REFERENCE MATERIALS

B

HYDROLOGY CALCULATIONS

C

DETENTION CALCULATIONS

D

HYDROLOGY MAP

# **APPENDIX A**

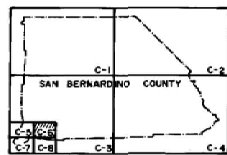
## **REFERENCE MATERIALS**





PROJECT SITE

SAN BERNARDINO COUNTY  
HYDROLOGY MANUAL



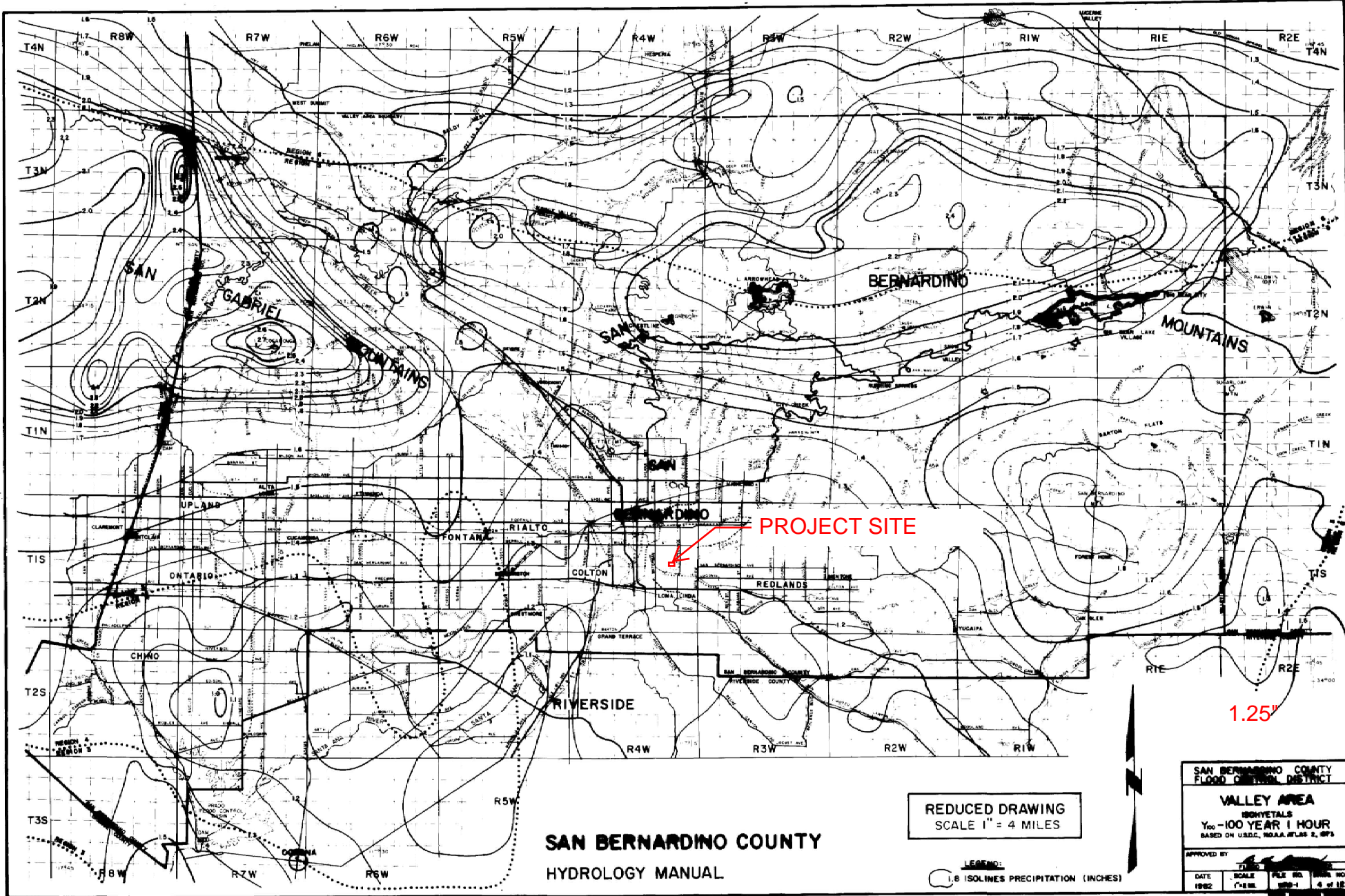
- LEGEND
- SOIL GROUP BOUNDARY
  - A SOIL GROUP DESIGNATION
  - - - BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000  
**SCALE REDUCED BY 1/2**

**SOIL GROUP A**

HYDROLOGIC SOILS GROUP MAP  
FOR  
SOUTHWEST-B AREA





**SAN BERNARDINO COUNTY  
HYDROLOGY MANUAL**

REDUCED DRAWING  
SCALE 1" = 4 MILES

LEGEND:  
1.8 ISOLINES PRECIPITATION (INCHES)

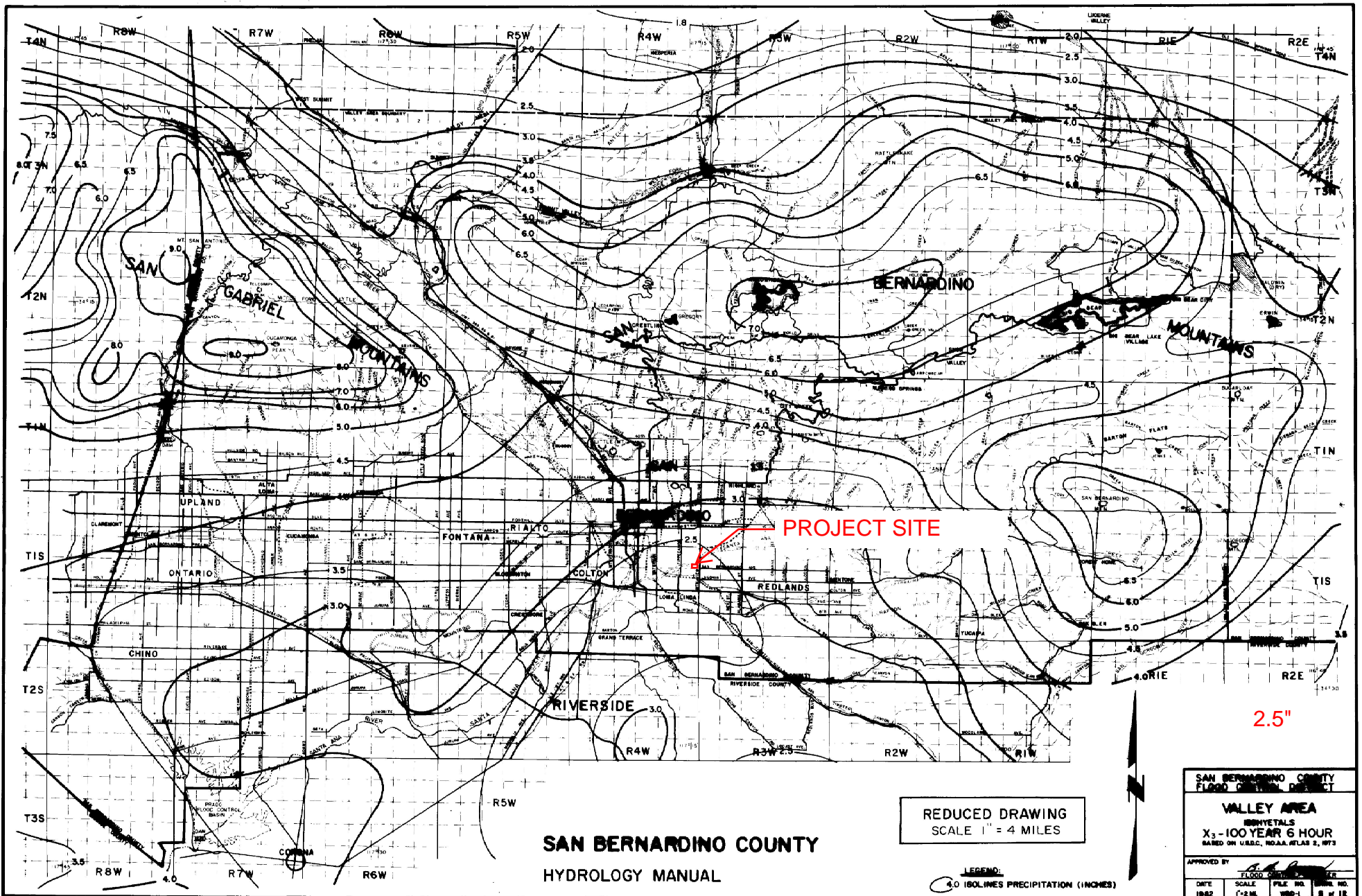
SAN BERNARDINO COUNTY  
FLOOD CONTROL DISTRICT

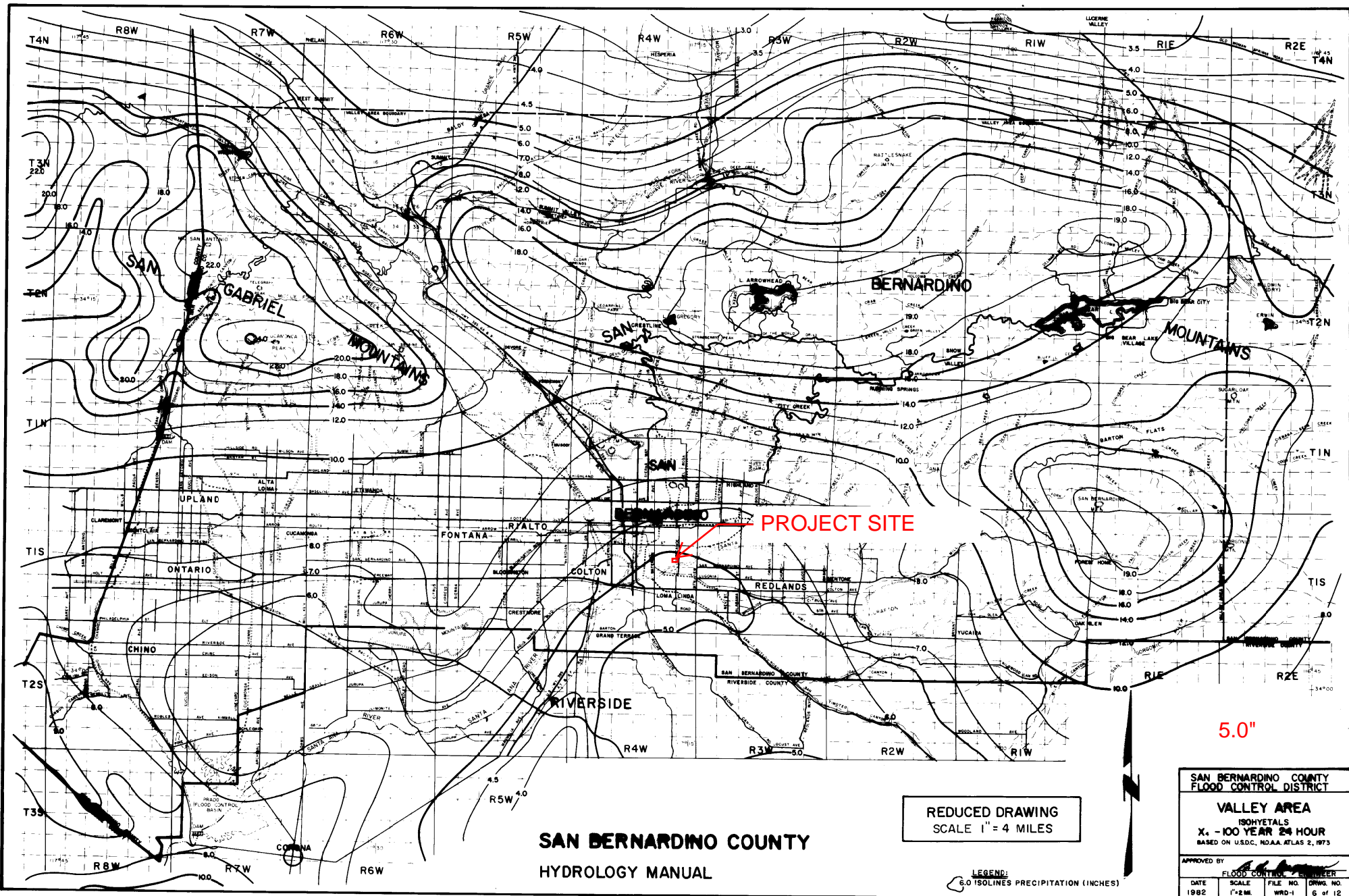
**VALLEY AREA**  
ISOHYETALS  
Y<sub>100</sub> - 100 YEAR 1 HOUR  
BASED ON USDC, NOAA ATLAS 2, 1973

APPROVED BY: \_\_\_\_\_

DATE	SCALE	FILE NO.	DRAW. NO.
1982	1"=4M	579-1	4 of 12







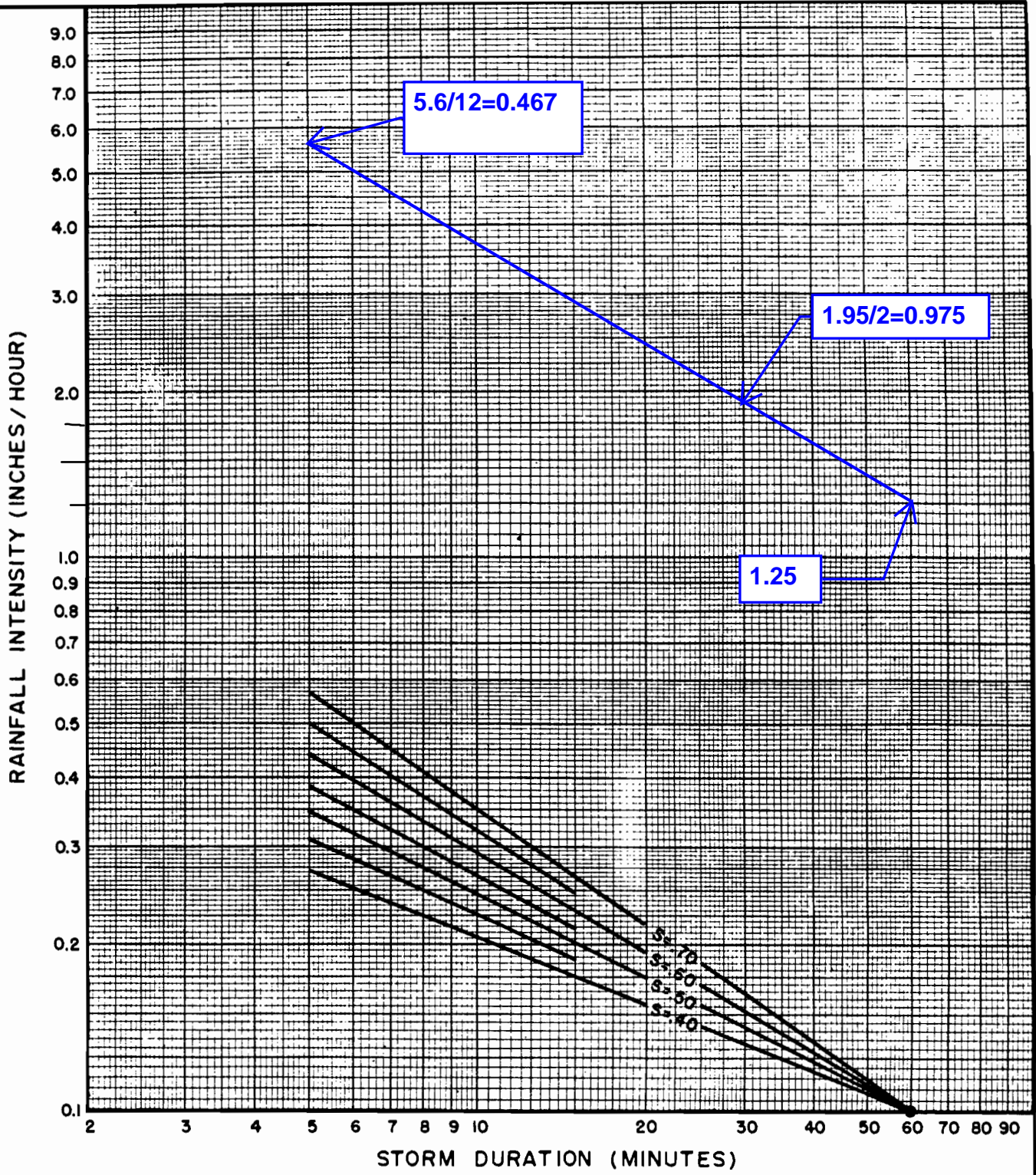
**SAN BERNARDINO COUNTY  
HYDROLOGY MANUAL**

REDUCED DRAWING  
SCALE 1" = 4 MILES

LEGEND:  
☁ 6.0 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
<b>VALLEY AREA</b>			
ISOHYETALS X <sub>1</sub> - 100 YEAR 24 HOUR			
BASED ON U.S.D.C. NDAA ATLAS 2, 1973			
APPROVED BY: <i>[Signature]</i>			
DATE	SCALE	FILE NO.	DRAW. NO.
1982	1" = 2 MI.	WRD-1	6 of 12





DESIGN STORM FREQUENCY = 100 YEARS  
 ONE HOUR POINT RAINFALL = 1.25 INCHES  
 LOG-LOG SLOPE = 0.6  
 PROJECT LOCATION = SAN BERNARDINO

**SAN BERNARDINO COUNTY**  
 HYDROLOGY MANUAL

**INTENSITY - DURATION  
 CURVES  
 CALCULATION SHEET**



POINT RAINFALL - INCHES

50.0  
40.0  
30.0  
20.0  
10.0  
5.0  
4.0  
3.0  
2.0  
1.0  
0.5  
0.4  
0.3  
0.2  
0.1

5 10 20 30 40 50 100 200 300 400 500 1000

STORM DURATION - MINUTES

PROJECT LOCATION Fontana

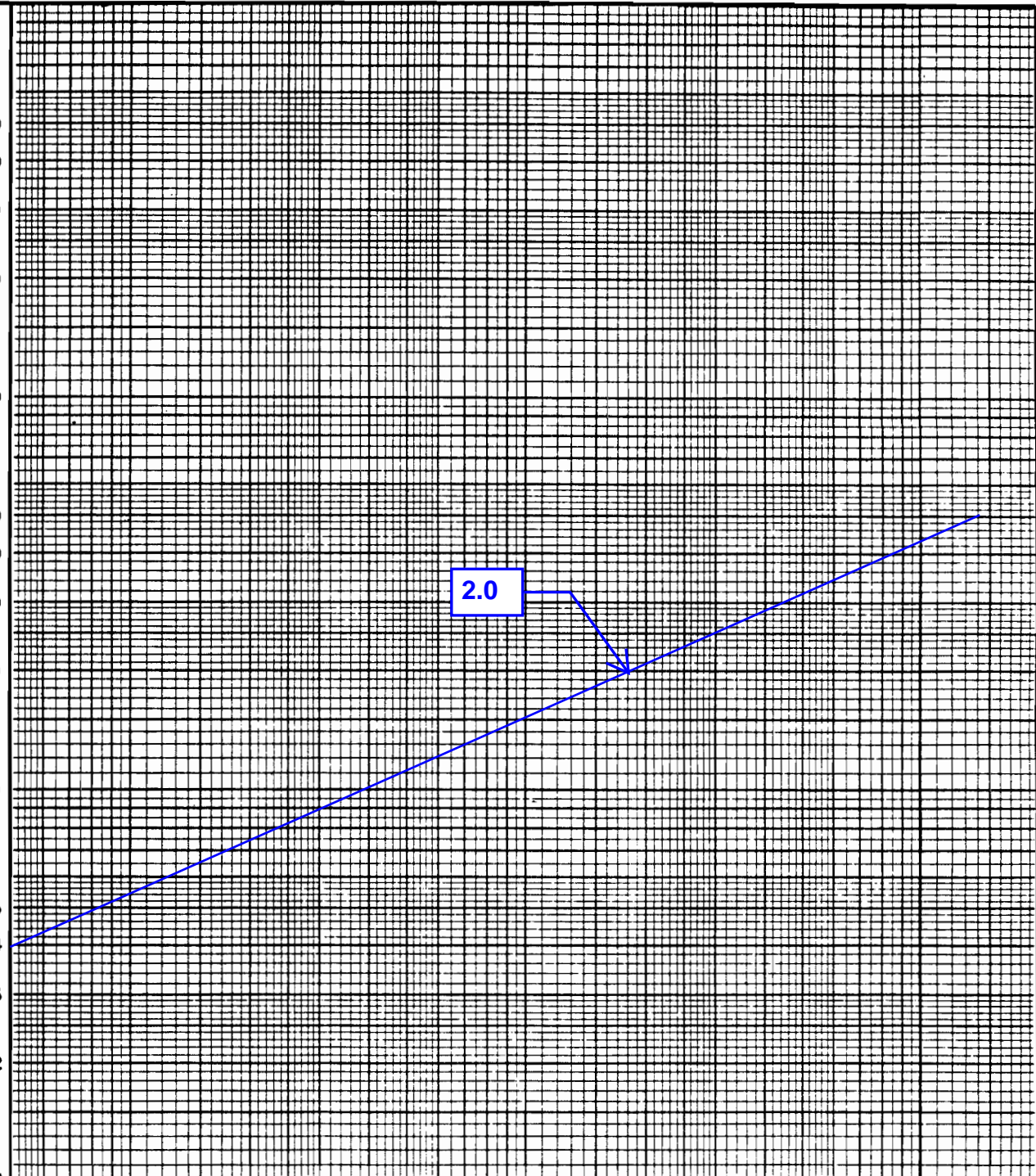
NOTES \_\_\_\_\_

**SAN BERNARDINO COUNTY**  
HYDROLOGY MANUAL

AREA - AVERAGED  
MASS RAINFALL  
PLOTING SHEET

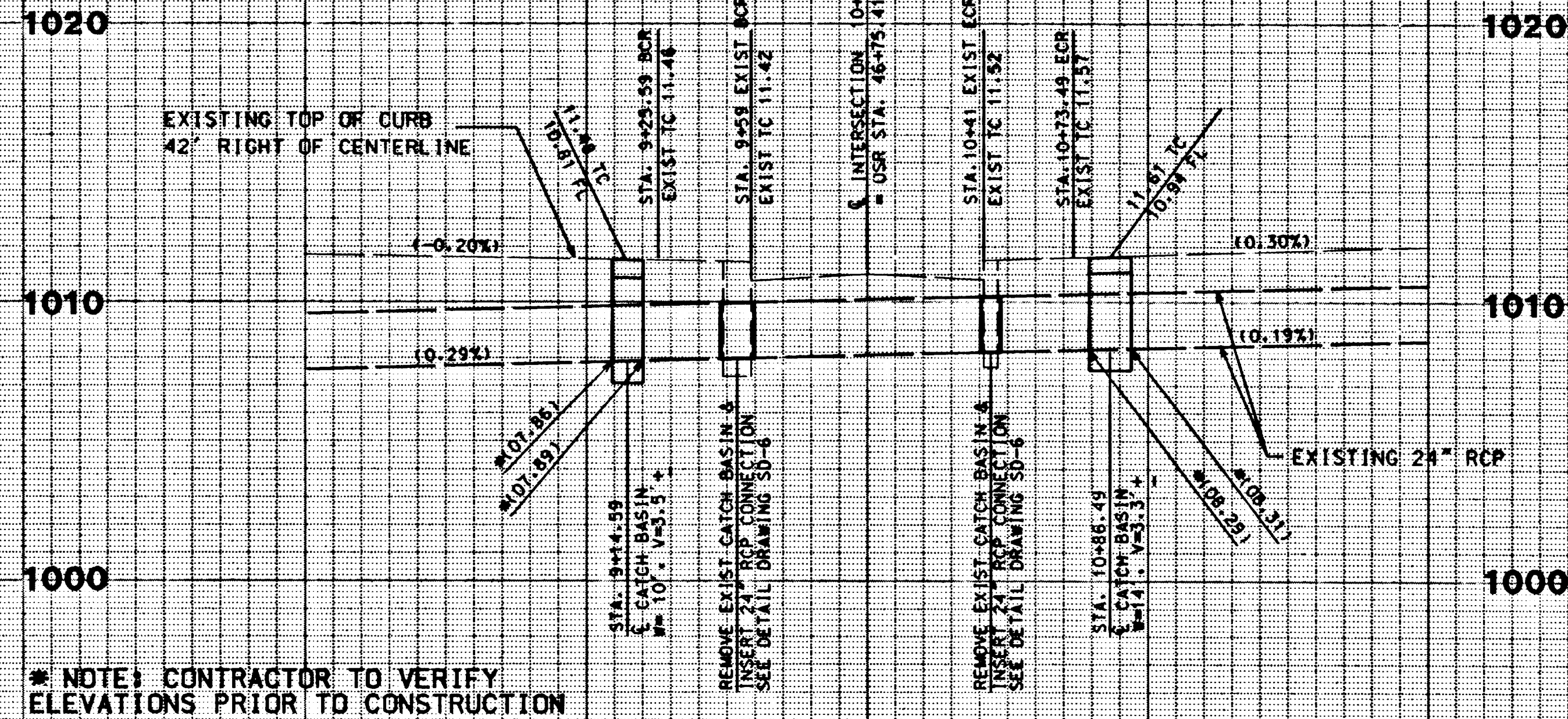
115

2.0



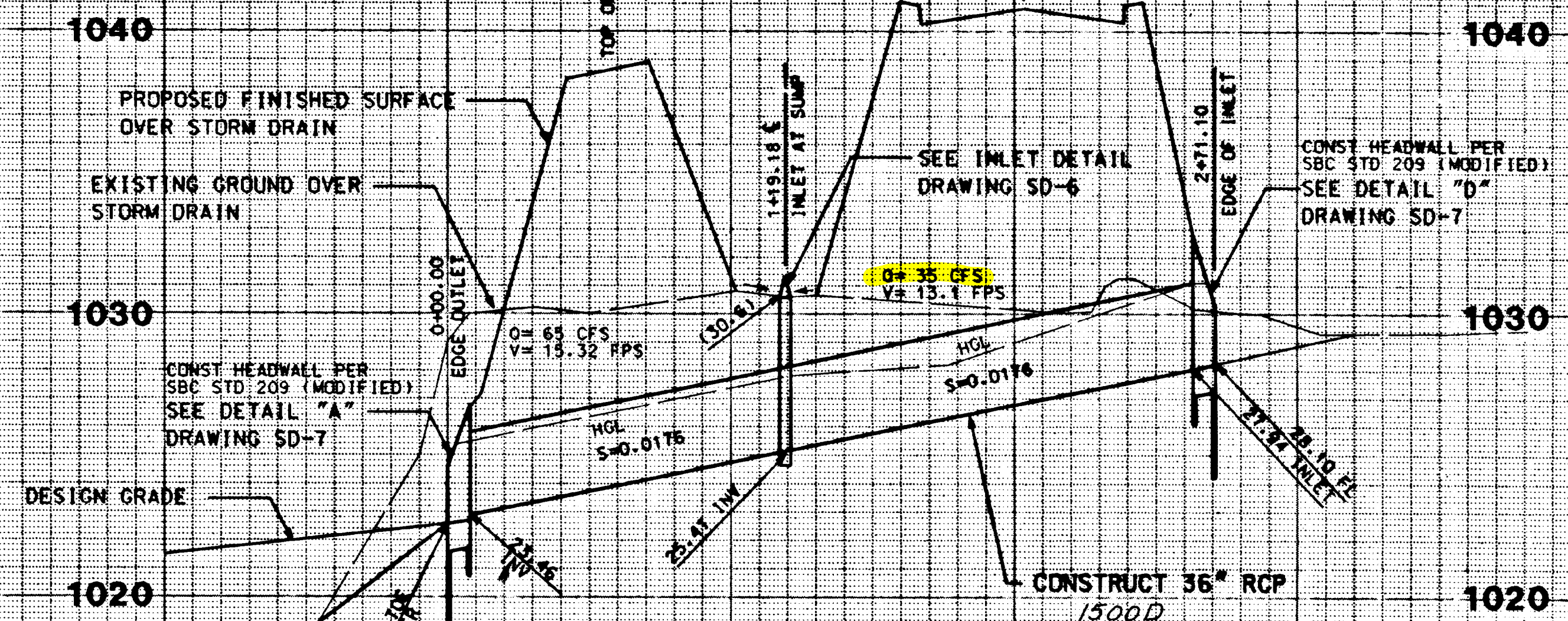


76-83



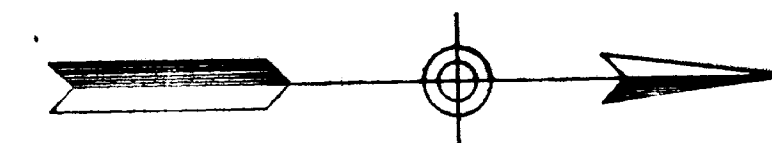
\* NOTE: CONTRACTOR TO VERIFY ELEVATIONS PRIOR TO CONSTRUCTION

PROFILE  
 SCALES: HORIZ: 1" = 40'  
 VERT: 1" = 4'



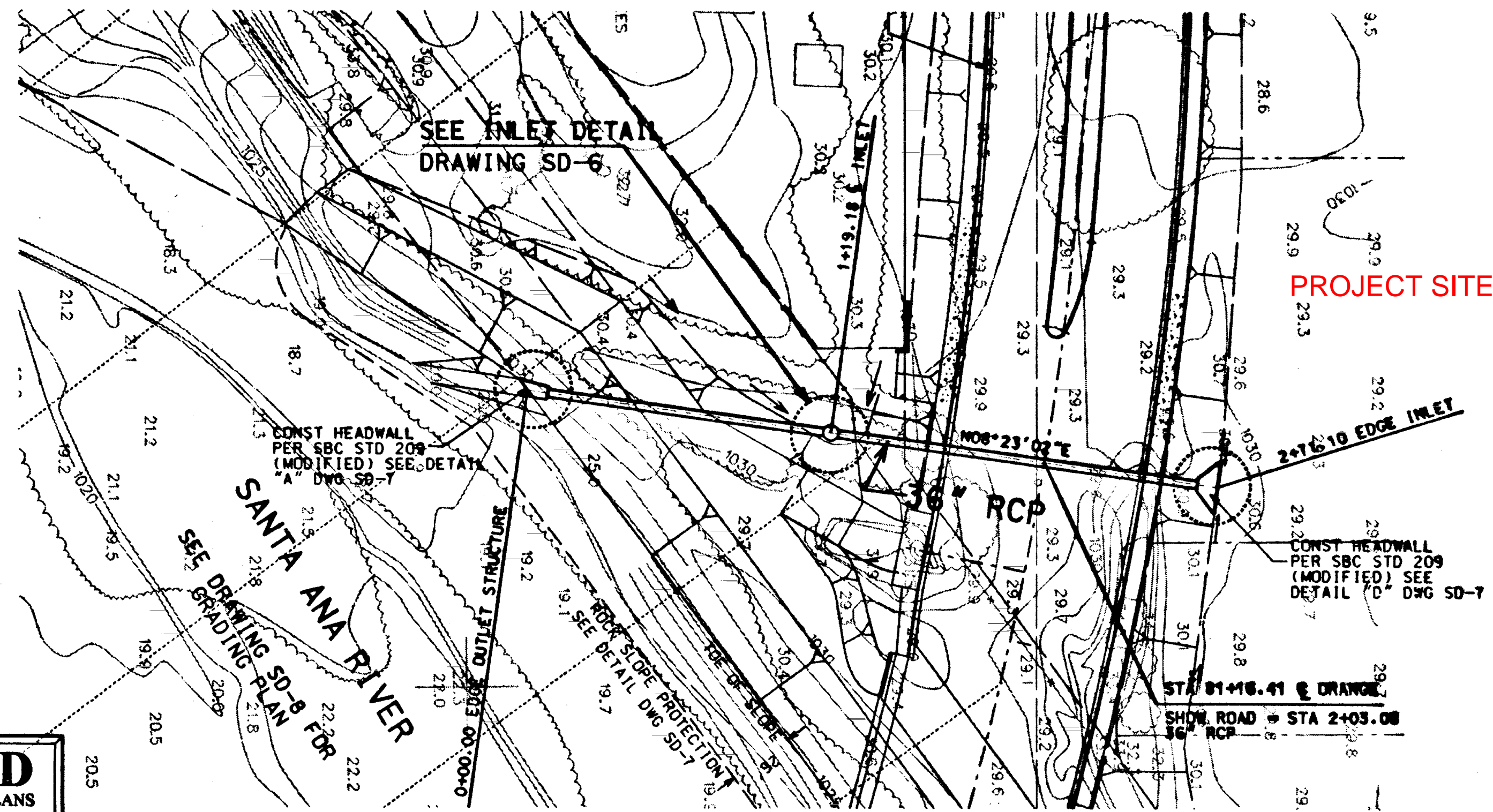
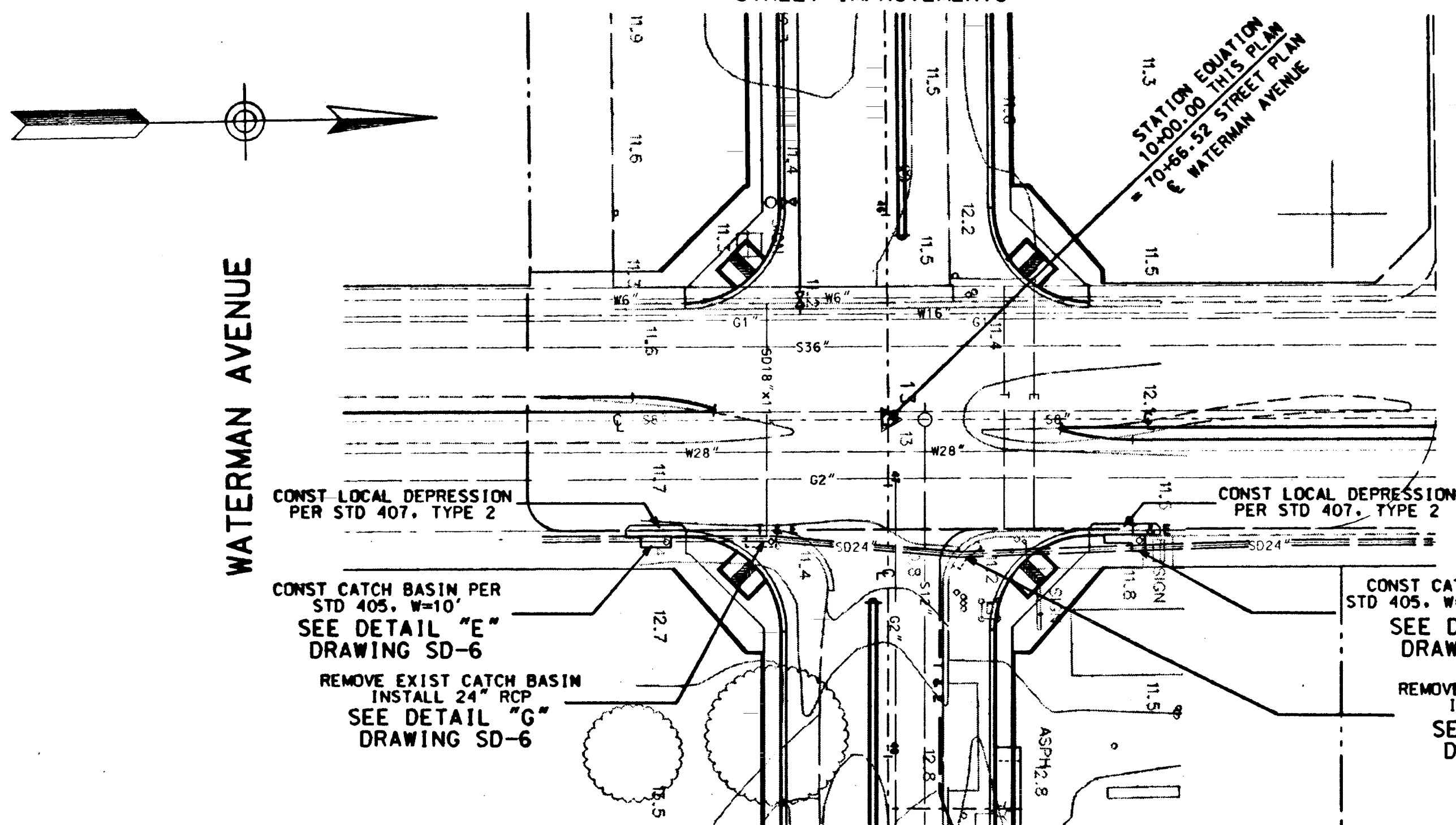
8 9 10 11 12

PLAN  
 SCALE: 1" = 40'



0 1 2 3

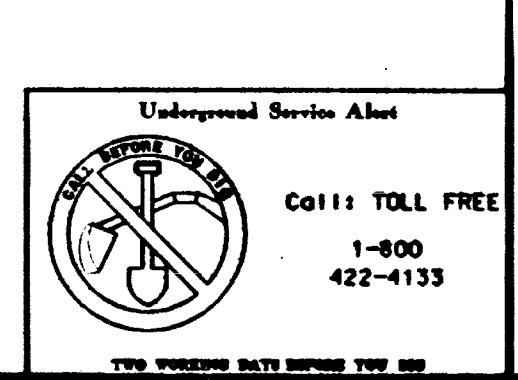
ORANGE SHOW ROAD  
 SEE DRAWING C-5 FOR STREET IMPROVEMENTS



WATERMAN AVENUE RECONSTRUCTION

STORM DRAIN NO. 2

**AS RECORD**  
 NO NOTED DEVIATIONS FROM PLANS  
*Duchak/Miller* 7/19/94  
 APPROVED REC 27006 DATE 6/23-94



PLANS PREPARED BY:  
**DMJM**  
 275 WEST HOSPITALITY LANE, SUITE 314  
 SAN BERNARDINO CA 92408  
 (909) 889-3466  
*T. Lane* 10/5/95  
 DATE

PLANNING ARCHITECTURE ENGINEERING PROGRAM MGMT.	APPROVED 4-23 1996 <i>E. Lewis</i>
REGISTERED CIVIL ENGINEER NO. 23014 BY LICENSE EXPIRES 12-31-97	DIRECTOR OF PUBLIC WORKS
DRAWN BY: E LEWIS	CHECKED BY: D GOODMAN
RECOMMENDED BY: T LANE	NO NOTED DEVIATIONS FROM PLANS <i>Duchak/Miller</i>
MARK	REVISIONS
BY	APPR. DATE

APPROVED 4-23 1996  
 DIRECTOR OF PUBLIC WORKS  
 REGISTERED CIVIL ENGINEER NO. 23014  
 BY LICENSE EXPIRES 12-31-97  
 DRAWN BY: E LEWIS  
 CHECKED BY: D GOODMAN  
 RECOMMENDED BY: T LANE

CITY OF SAN BERNARDINO  
 DEPARTMENT OF PUBLIC WORKS  
**ORANGE SHOW ROAD EXTENSION**  
 STORM DRAIN PLANS  
**STORM DRAIN NO. 2**  
**WATERMAN AVENUE RECONSTRUCTION**

CITY FILE NO  
 9142  
 DRAWING NO  
**SD-3**  
 SHEET 21 OF 29 SHEETS

PLAT TIME 08-07-1995 14:38 0101534501003.dgn

76-83



# **APPENDIX B**

## **HYDROLOGY CALCULATIONS**

\*\*\*\*\*  
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)  
(c) Copyright 1983-2016 Advanced Engineering Software (aes)  
Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* EXISTING CONDITION (NODES 100-101) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\X100.DAT  
TIME/DATE OF STUDY: 13:54 08/08/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)  
=== =====  
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0312 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*  
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) = 932.00  
ELEVATION DATA: UPSTREAM(FEET) = 1036.80 DOWNSTREAM(FEET) = 1027.20

$T_c = K * [(LENGTH * 3.00) / (ELEVATION CHANGE)] * 0.20$   
SUBAREA ANALYSIS USED MINIMUM  $T_c$ (MIN.) = 11.697  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.334

SUBAREA  $T_c$  AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN	$T_c$ (MIN.)
RESIDENTIAL						
".4 DWELLING/ACRE"	A	3.07	0.74	0.900	52	18.74
COMMERCIAL	A	3.07	0.74	0.100	52	11.70
NATURAL POOR COVER						
"BARREN"	A	1.93	0.18	1.000	93	20.20

SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.53  
SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.620  
SUBAREA RUNOFF(CFS) = 21.85  
TOTAL AREA(ACRES) = 8.07 PEAK FLOW RATE(CFS) = 21.85

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 8.1  $T_c$ (MIN.) = 11.70  
EFFECTIVE AREA(ACRES) = 8.07 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.33  
AREA-AVERAGED  $F_p$ (INCH/HR) = 0.53 AREA-AVERAGED  $A_p$  = 0.620

PEAK FLOW RATE(CFS) = 21.85

=====  
=====  
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 \*\*\*\*\*

\* TEI JOB 4106 \*  
\* EXISTING CONDITION \*  
\* X200 \*  
\*\*\*\*\*

FILE NAME: C:\XDRIVE\4106\X200.DAT  
TIME/DATE OF STUDY: 17:38 06/20/2022

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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 = 0.01  
\*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) = 1.2500

\*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) = 503.00  
ELEVATION DATA: UPSTREAM(FEET) = 1037.53 DOWNSTREAM(FEET) = 1032.66

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.254  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.837

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
-------------------------------	-------------------	-----------------	-----------------	-----------------	-----------	--------------

NATURAL POOR COVER

"BARREN"	A	1.69	0.14	1.00	93	15.98
----------	---	------	------	------	----	-------

COMMERCIAL	A	1.47	0.80	0.10	52	9.25
------------	---	------	------	------	----	------

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.19

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.58

SUBAREA RUNOFF(CFS) = 10.59

TOTAL AREA(ACRES) = 3.16 PEAK FLOW RATE(CFS) = 10.59

=====  
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 3.16 TC(MIN.) = 9.25

EFFECTIVE AREA(ACRES) = 3.16 AREA-AVERAGED Fm(INCH/HR)= 0.11

AREA-AVERAGED Fp(INCH/HR) = 0.19 AREA-AVERAGED Ap = 0.58

PEAK FLOW RATE(CFS) = 10.59  
=====

=====  
END OF RATIONAL METHOD ANALYSIS



\*\*\*\*\*

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Ver. 8.0 Release Date: 01/01/99 License ID 1435

Analysis prepared by:

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

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* TEI JOB 4016 \*  
\* EXISTING CONDITION \*  
\* X300 \*  
\*\*\*\*\*

FILE NAME: C:\XDRIVE\4106\X300.DAT  
TIME/DATE OF STUDY: 17:40 06/20/2022

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USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--\*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 = 0.01  
\*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) = 1.2500

\*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) = 709.00  
ELEVATION DATA: UPSTREAM(FEET) = 1037.11 DOWNSTREAM(FEET) = 1027.89

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.007  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.661

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL FAIR COVER						
"GRASS"	A	1.77	0.55	1.00	70	23.24
COMMERCIAL	A	4.81	0.80	0.10	52	10.01

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.60  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.34  
SUBAREA RUNOFF(CFS) = 20.46  
TOTAL AREA(ACRES) = 6.58 PEAK FLOW RATE(CFS) = 20.46

=====  
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 6.58 TC(MIN.) = 10.01  
EFFECTIVE AREA(ACRES) = 6.58 AREA-AVERAGED Fm(INCH/HR)= 0.21  
AREA-AVERAGED Fp(INCH/HR) = 0.60 AREA-AVERAGED Ap = 0.34  
PEAK FLOW RATE(CFS) = 20.46  
=====

=====  
END OF RATIONAL METHOD ANALYSIS

\*\*\*\*\*

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Ver. 8.0 Release Date: 01/01/99 License ID 1435

Analysis prepared by:

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

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* TEI JOB 4106 \*  
\* EXISTING CONDITION \*  
\* X400 OFFSITE (RUN ON CFS) \*  
\*\*\*\*\*

FILE NAME: C:\XDRIVE\4106\X400.DAT  
TIME/DATE OF STUDY: 17:42 06/20/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*\*\*\*\*

FLOW PROCESS FROM NODE 400.00 TO NODE 401.00 IS CODE = 21

-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 575.00  
ELEVATION DATA: UPSTREAM(FEET) = 1040.35 DOWNSTREAM(FEET) = 1034.68

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.727  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.724

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	2.14	0.80	0.10	52	9.73
NATURAL POOR COVER "BARREN"	A	0.26	0.14	1.00	93	16.80

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.44  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.20  
SUBAREA RUNOFF(CFS) = 7.86  
TOTAL AREA(ACRES) = 2.40 PEAK FLOW RATE(CFS) = 7.86

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.40 TC(MIN.) = 9.73  
EFFECTIVE AREA(ACRES) = 2.40 AREA-AVERAGED Fm(INCH/HR)= 0.09  
AREA-AVERAGED Fp(INCH/HR) = 0.44 AREA-AVERAGED Ap = 0.20  
PEAK FLOW RATE(CFS) = 7.86

=====

=====

END OF RATIONAL METHOD ANALYSIS



\*\*\*\*\*  
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)  
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Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* PROPOSED CONDITION (NODES 100-204) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\P100.DAT  
TIME/DATE OF STUDY: 14:53 08/26/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)  
=== =====  
1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0312 0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*  
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) = 707.00  
ELEVATION DATA: UPSTREAM(FEET) = 1033.48 DOWNSTREAM(FEET) = 1027.76

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.991  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.461  
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 A 1.34 0.74 0.100 52 10.99  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA RUNOFF(CFS) = 4.08  
TOTAL AREA(ACRES) = 1.34 PEAK FLOW RATE(CFS) = 4.08

\*\*\*\*\*  
FLOW PROCESS FROM NODE 101.00 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) = 1023.76 DOWNSTREAM(FEET) = 1021.45  
FLOW LENGTH(FEET) = 912.00 MANNING'S N = 0.012

DEPTH OF FLOW IN 36.0 INCH PIPE IS 27.1 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 0.72  
 ESTIMATED PIPE DIAMETER(INCH) = 36.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 4.08  
 PIPE TRAVEL TIME(MIN.) = 21.24 Tc(MIN.) = 32.23  
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 104.00 = 1619.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 104.00 TO NODE 104.00 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.) = 32.23  
 RAINFALL INTENSITY(INCH/HR) = 1.81  
 AREA-AVERAGED Fm(INCH/HR) = 0.07  
 AREA-AVERAGED Fp(INCH/HR) = 0.74  
 AREA-AVERAGED Ap = 0.10  
 EFFECTIVE STREAM AREA(ACRES) = 1.34  
 TOTAL STREAM AREA(ACRES) = 1.34  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.08

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 102.00 TO NODE 103.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
 >>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00  
 ELEVATION DATA: UPSTREAM(FEET) = 1033.22 DOWNSTREAM(FEET) = 1029.52

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.588  
 \* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.194  
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	2.07	0.74	0.100	52	5.59

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA RUNOFF(CFS) = 9.54  
 TOTAL AREA(ACRES) = 2.07 PEAK FLOW RATE(CFS) = 9.54

\*\*\*\*\*  
 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) = 1025.52 DOWNSTREAM(FEET) = 1021.45  
 FLOW LENGTH(FEET) = 32.00 MANNING'S N = 0.012  
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 17.6 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.85  
 ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 9.54  
 PIPE TRAVEL TIME(MIN.) = 0.14 Tc(MIN.) = 5.73  
 LONGEST FLOWPATH FROM NODE 102.00 TO NODE 104.00 = 230.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 104.00 TO NODE 104.00 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.) = 5.73  
 RAINFALL INTENSITY(INCH/HR) = 5.12  
 AREA-AVERAGED Fm(INCH/HR) = 0.07  
 AREA-AVERAGED Fp(INCH/HR) = 0.74  
 AREA-AVERAGED Ap = 0.10  
 EFFECTIVE STREAM AREA(ACRES) = 2.07  
 TOTAL STREAM AREA(ACRES) = 2.07  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.54

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
------------------	------------	--------------	------------------------	---------------------	----	---------------	-------------------

1	4.08	32.23	1.815	0.74( 0.07)	0.10	1.3	100.00
2	9.54	5.73	5.118	0.74( 0.07)	0.10	2.1	102.00

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	11.64	5.73	5.118	0.74( 0.07)	0.10	2.3	102.00
2	7.38	32.23	1.815	0.74( 0.07)	0.10	3.4	100.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 11.64 Tc(MIN.) = 5.73  
EFFECTIVE AREA(ACRES) = 2.31 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 3.4  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 104.00 = 1619.00 FEET.

\*\*\*\*\*

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) = 1021.45 DOWNSTREAM(FEET) = 1021.08  
FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.012  
DEPTH OF FLOW IN 54.0 INCH PIPE IS 40.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 0.92  
ESTIMATED PIPE DIAMETER(INCH) = 54.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 11.64  
PIPE TRAVEL TIME(MIN.) = 2.71 Tc(MIN.) = 8.44  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 105.00 = 1769.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 105.00 TO NODE 105.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<

=====

MAINLINE Tc(MIN.) = 8.44  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.056  
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	A	1.57	0.74	0.100	52

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA AREA(ACRES) = 1.57 SUBAREA RUNOFF(CFS) = 5.63  
EFFECTIVE AREA(ACRES) = 3.88 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 5.0 PEAK FLOW RATE(CFS) = 13.90

\*\*\*\*\*

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) = 1021.08 DOWNSTREAM(FEET) = 1020.70  
FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.012  
DEPTH OF FLOW IN 57.0 INCH PIPE IS 42.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 0.97  
ESTIMATED PIPE DIAMETER(INCH) = 57.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 13.90  
PIPE TRAVEL TIME(MIN.) = 2.57 Tc(MIN.) = 11.01  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 106.00 = 1919.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 106.00 TO NODE 106.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<

=====

MAINLINE Tc(MIN.) = 11.01  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.457  
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	A	1.25	0.74	0.100	52

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA AREA(ACRES) = 1.25 SUBAREA RUNOFF(CFS) = 3.81  
EFFECTIVE AREA(ACRES) = 5.13 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 6.2 PEAK FLOW RATE(CFS) = 15.61

\*\*\*\*\*  
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) = 1020.70 DOWNSTREAM(FEET) = 1020.33  
FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.012  
DEPTH OF FLOW IN 60.0 INCH PIPE IS 44.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 0.99  
ESTIMATED PIPE DIAMETER(INCH) = 60.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 15.61  
PIPE TRAVEL TIME(MIN.) = 2.52 Tc(MIN.) = 13.53  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 107.00 = 2069.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 107.00 TO NODE 107.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
-----  
MAINLINE Tc(MIN.) = 13.53  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.055  
SUBAREA LOSS RATE DATA(AMC III):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
COMMERCIAL A 1.57 0.74 0.100 52  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA AREA(ACRES) = 1.57 SUBAREA RUNOFF(CFS) = 4.21  
EFFECTIVE AREA(ACRES) = 6.70 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 7.8 PEAK FLOW RATE(CFS) = 17.97

\*\*\*\*\*  
FLOW PROCESS FROM NODE 107.00 TO NODE 108.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<  
-----  
ELEVATION DATA: UPSTREAM(FEET) = 1020.33 DOWNSTREAM(FEET) = 1019.95  
FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.012  
DEPTH OF FLOW IN 63.0 INCH PIPE IS 47.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 1.04  
ESTIMATED PIPE DIAMETER(INCH) = 63.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 17.97  
PIPE TRAVEL TIME(MIN.) = 2.41 Tc(MIN.) = 15.94  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 108.00 = 2219.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 108.00 TO NODE 108.00 IS CODE = 81  
-----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<  
-----  
MAINLINE Tc(MIN.) = 15.94  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.768  
SUBAREA LOSS RATE DATA(AMC III):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
COMMERCIAL A 1.55 0.74 0.100 52  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA AREA(ACRES) = 1.55 SUBAREA RUNOFF(CFS) = 3.76  
EFFECTIVE AREA(ACRES) = 8.25 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 9.4 PEAK FLOW RATE(CFS) = 20.00

\*\*\*\*\*  
FLOW PROCESS FROM NODE 108.00 TO NODE 111.00 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<  
-----  
ELEVATION DATA: UPSTREAM(FEET) = 1019.95 DOWNSTREAM(FEET) = 1019.58

FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.012  
 DEPTH OF FLOW IN 66.0 INCH PIPE IS 49.1 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 1.05  
 ESTIMATED PIPE DIAMETER(INCH) = 66.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 20.00  
 PIPE TRAVEL TIME(MIN.) = 2.37 Tc(MIN.) = 18.31  
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 111.00 = 2369.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 111.00 TO NODE 111.00 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.) = 18.31  
 RAINFALL INTENSITY(INCH/HR) = 2.55  
 AREA-AVERAGED Fm(INCH/HR) = 0.07  
 AREA-AVERAGED Fp(INCH/HR) = 0.74  
 AREA-AVERAGED Ap = 0.10  
 EFFECTIVE STREAM AREA(ACRES) = 8.25  
 TOTAL STREAM AREA(ACRES) = 9.35  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 20.00

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 109.00 TO NODE 110.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 357.00  
 ELEVATION DATA: UPSTREAM(FEET) = 1034.82 DOWNSTREAM(FEET) = 1029.52

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.407  
 \* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.386  
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	2.89	0.74	0.100	52	7.41

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA RUNOFF(CFS) = 11.21  
 TOTAL AREA(ACRES) = 2.89 PEAK FLOW RATE(CFS) = 11.21

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 110.00 TO NODE 111.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1023.76 DOWNSTREAM(FEET) = 1019.58  
 FLOW LENGTH(FEET) = 32.00 MANNING'S N = 0.012  
 DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.5 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.11  
 ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 11.21  
 PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 7.54  
 LONGEST FLOWPATH FROM NODE 109.00 TO NODE 111.00 = 389.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 111.00 TO NODE 111.00 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.) = 7.54  
 RAINFALL INTENSITY(INCH/HR) = 4.34  
 AREA-AVERAGED Fm(INCH/HR) = 0.07  
 AREA-AVERAGED Fp(INCH/HR) = 0.74  
 AREA-AVERAGED Ap = 0.10  
 EFFECTIVE STREAM AREA(ACRES) = 2.89  
 TOTAL STREAM AREA(ACRES) = 2.89  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 11.21

\*\* CONFLUENCE DATA \*\*

STREAM	Q	Tc	Intensity	Fp(Fm)	Ap	Ae	HEADWATER
--------	---	----	-----------	--------	----	----	-----------

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)	(ACRES)	NODE
1	20.00	18.31	2.548	0.74( 0.07)	0.10	8.2 102.00
1	12.05	46.69	1.453	0.74( 0.07)	0.10	9.4 100.00
2	11.21	7.54	4.340	0.74( 0.07)	0.10	2.9 109.00

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

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	25.41	7.54	4.340	0.74( 0.07)	0.10	6.3	109.00
2	26.50	18.31	2.548	0.74( 0.07)	0.10	11.1	102.00
3	15.67	46.69	1.453	0.74( 0.07)	0.10	12.2	100.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 26.50 Tc(MIN.) = 18.31  
EFFECTIVE AREA(ACRES) = 11.14 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10  
TOTAL AREA(ACRES) = 12.2  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 111.00 = 2369.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 111.00 TO NODE 203.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1019.58 DOWNSTREAM(FEET) = 1019.50  
FLOW LENGTH(FEET) = 34.00 MANNING'S N = 0.012  
DEPTH OF FLOW IN 72.0 INCH PIPE IS 57.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 1.10  
ESTIMATED PIPE DIAMETER(INCH) = 72.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 26.50  
PIPE TRAVEL TIME(MIN.) = 0.52 Tc(MIN.) = 18.83  
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 203.00 = 2403.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 203.00 TO NODE 203.00 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.) = 18.83  
RAINFALL INTENSITY(INCH/HR) = 2.51  
AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74  
AREA-AVERAGED Ap = 0.10  
EFFECTIVE STREAM AREA(ACRES) = 11.14  
TOTAL STREAM AREA(ACRES) = 12.24  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 26.50

\*\*\*\*\*  
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) = 584.00  
ELEVATION DATA: UPSTREAM(FEET) = 1039.25 DOWNSTREAM(FEET) = 1031.19

$Tc = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.151  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.863

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	2.10	0.74	0.100	52	9.15

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA RUNOFF(CFS) = 7.16  
TOTAL AREA(ACRES) = 2.10 PEAK FLOW RATE(CFS) = 7.16

\*\*\*\*\*  
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) = 1027.19 DOWNSTREAM(FEET) = 1024.44
FLOW LENGTH(FEET) = 18.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 21.0 INCH PIPE IS 15.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 3.85
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.16
PIPE TRAVEL TIME(MIN.) = 0.08 Tc(MIN.) = 9.23
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 202.00 = 602.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 202.00 TO NODE 203.00 IS CODE = 31
-----

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```

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
-----

```

```

ELEVATION DATA: UPSTREAM(FEET) = 1024.44 DOWNSTREAM(FEET) = 1019.50
FLOW LENGTH(FEET) = 288.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 33.0 INCH PIPE IS 21.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 1.71
ESTIMATED PIPE DIAMETER(INCH) = 33.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.16
PIPE TRAVEL TIME(MIN.) = 2.80 Tc(MIN.) = 12.03
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 203.00 = 890.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 203.00 TO NODE 203.00 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.) = 12.03
RAINFALL INTENSITY(INCH/HR) = 3.28
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 2.10
TOTAL STREAM AREA(ACRES) = 2.10
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.16

```

**\*\* CONFLUENCE DATA \*\***

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	25.41	8.05	4.171	0.74( 0.07)	0.10	6.3	109.00
1	26.50	18.83	2.506	0.74( 0.07)	0.10	11.1	102.00
1	15.67	47.27	1.442	0.74( 0.07)	0.10	12.2	100.00
2	7.16	12.03	3.278	0.74( 0.07)	0.10	2.1	200.00

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

**\*\* PEAK FLOW RATE TABLE \*\***

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	31.54	8.05	4.171	0.74( 0.07)	0.10	7.7	109.00
2	32.97	12.03	3.278	0.74( 0.07)	0.10	10.2	200.00
3	31.94	18.83	2.506	0.74( 0.07)	0.10	13.2	102.00
4	18.73	47.27	1.442	0.74( 0.07)	0.10	14.3	100.00

```

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 32.97 Tc(MIN.) = 12.03
EFFECTIVE AREA(ACRES) = 10.18 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 14.3
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 203.00 = 2403.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 203.00 TO NODE 204.00 IS CODE = 31
-----

```

```

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
-----

```

```

ELEVATION DATA: UPSTREAM(FEET) = 1019.50 DOWNSTREAM(FEET) = 1019.12
FLOW LENGTH(FEET) = 160.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 78.0 INCH PIPE IS 62.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 1.16
ESTIMATED PIPE DIAMETER(INCH) = 78.00 NUMBER OF PIPES = 1

```

PIPE-FLOW(CFS) = 32.97  
 PIPE TRAVEL TIME(MIN.) = 2.29 Tc(MIN.) = 14.32  
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 204.00 = 2563.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 204.00 TO NODE 204.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

MAINLINE Tc(MIN.) = 14.32  
 \* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.952  
 SUBAREA LOSS RATE DATA(AMC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 COMMERCIAL A 2.14 0.74 0.100 52  
 NATURAL POOR COVER  
 "BARREN" A 0.26 0.18 1.000 93  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.43  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.197  
 SUBAREA AREA(ACRES) = 2.40 SUBAREA RUNOFF(CFS) = 6.19  
 EFFECTIVE AREA(ACRES) = 12.58 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.64 AREA-AVERAGED Ap = 0.12  
 TOTAL AREA(ACRES) = 16.7 PEAK FLOW RATE(CFS) = 32.97  
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 204.00 TO NODE 204.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

MAINLINE Tc(MIN.) = 14.32  
 \* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.952  
 SUBAREA LOSS RATE DATA(AMC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 COMMERCIAL A 0.21 0.74 0.100 52  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA AREA(ACRES) = 0.21 SUBAREA RUNOFF(CFS) = 0.54  
 EFFECTIVE AREA(ACRES) = 12.79 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.65 AREA-AVERAGED Ap = 0.12  
 TOTAL AREA(ACRES) = 16.9 PEAK FLOW RATE(CFS) = 33.10

=====

END OF STUDY SUMMARY:  
 TOTAL AREA(ACRES) = 16.9 TC(MIN.) = 14.32  
 EFFECTIVE AREA(ACRES) = 12.79 AREA-AVERAGED Fm(INCH/HR) = 0.08  
 AREA-AVERAGED Fp(INCH/HR) = 0.65 AREA-AVERAGED Ap = 0.118  
 PEAK FLOW RATE(CFS) = 33.10

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	32.55	10.35	3.588	0.63( 0.08)	0.12	10.3	109.00
2	33.10	14.32	2.952	0.65( 0.08)	0.12	12.8	200.00
3	32.27	21.12	2.339	0.66( 0.08)	0.11	15.8	102.00
4	20.14	49.91	1.396	0.67( 0.08)	0.11	16.9	100.00

=====

END OF RATIONAL METHOD ANALYSIS

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\*\*\*\*\*  
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Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* EXISTING CONDITION (NODES 500-501) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\X500.DAT  
TIME/DATE OF STUDY: 14:07 08/08/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF-WIDTH (FT)	CROWN CROSSFALL (FT)	STREET-CROSSFALL IN- / SIDE (FT)	STREET-CROSSFALL OUT- / SIDE (FT)	PARK- / WAY (FT)	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018	0.018/0.020		0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.00 TO NODE 501.00 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<  
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 268.00  
ELEVATION DATA: UPSTREAM(FEET) = 1033.73 DOWNSTREAM(FEET) = 1030.71

$T_c = K * [(LENGTH * 3.00) / (ELEVATION CHANGE)]^{0.20}$   
SUBAREA ANALYSIS USED MINIMUM  $T_c(MIN.) = 11.179$   
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.426  
SUBAREA  $T_c$  AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN	$T_c$ (MIN.)
RESIDENTIAL ".4 DWELLING/ACRE"	A	0.58	0.74	0.900	52	11.18

SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p(INCH/HR) = 0.74$   
SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p = 0.900$   
SUBAREA RUNOFF(CFS) = 1.44  
TOTAL AREA(ACRES) = 0.58 PEAK FLOW RATE(CFS) = 1.44

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 0.6 TC(MIN.) = 11.18  
EFFECTIVE AREA(ACRES) = 0.58 AREA-AVERAGED  $F_m(INCH/HR) = 0.67$   
AREA-AVERAGED  $F_p(INCH/HR) = 0.74$  AREA-AVERAGED  $A_p = 0.900$   
PEAK FLOW RATE(CFS) = 1.44

=====

END OF RATIONAL METHOD ANALYSIS



\*\*\*\*\*  
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Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* PROPOSED CONDITION (NODES 400-401) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\P400.DAT  
TIME/DATE OF STUDY: 16:25 08/24/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	WIDTH (FT)	CROSSFALL (FT)	IN- / SIDE	OUT- / SIDE/ WAY	PARK- HEIGHT (FT)	WIP (FT)	HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018	0.020	0.67	2.00	0.0312	0.167

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*

FLOW PROCESS FROM NODE 400.00 TO NODE 401.00 IS CODE = 21

-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 183.00  
ELEVATION DATA: UPSTREAM(FEET) = 1032.42 DOWNSTREAM(FEET) = 1028.05

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.155  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.451

SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.28	0.74	0.100	52	5.16

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

SUBAREA RUNOFF(CFS) = 1.35

TOTAL AREA(ACRES) = 0.28 PEAK FLOW RATE(CFS) = 1.35

-----

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 0.3 TC(MIN.) = 5.16

EFFECTIVE AREA(ACRES) = 0.28 AREA-AVERAGED Fm(INCH/HR) = 0.07

AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.100

PEAK FLOW RATE(CFS) = 1.35

=====

END OF RATIONAL METHOD ANALYSIS



\*\*\*\*\*  
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Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* PROPOSED CONDITION (NODES 500-501) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\P500.DAT  
TIME/DATE OF STUDY: 16:29 08/24/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*  
FLOW PROCESS FROM NODE 500.00 TO NODE 501.00 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<  
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 140.00  
ELEVATION DATA: UPSTREAM(FEET) = 1032.42 DOWNSTREAM(FEET) = 1029.88

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.552  
SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.12	0.74	0.100	52	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
SUBAREA RUNOFF(CFS) = 0.59  
TOTAL AREA(ACRES) = 0.12 PEAK FLOW RATE(CFS) = 0.59

=====

END OF STUDY SUMMARY:  
TOTAL AREA(ACRES) = 0.1 TC(MIN.) = 5.00  
EFFECTIVE AREA(ACRES) = 0.12 AREA-AVERAGED Fm(INCH/HR) = 0.07  
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.100  
PEAK FLOW RATE(CFS) = 0.59

=====

END OF RATIONAL METHOD ANALYSIS





\*\*\*\*\*  
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Analysis prepared by:

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* TEI JOB NO. 4106 \*  
\* PROPOSED CONDITION (NODES 600-601) \*  
\* 100-YEAR STORM EVENT \*  
\*\*\*\*\*

FILE NAME: W:\4106\P600.DAT  
TIME/DATE OF STUDY: 16:32 08/24/2022

=====

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 = 0.01  
\*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) = 1.2500

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

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*

FLOW PROCESS FROM NODE 600.00 TO NODE 601.00 IS CODE = 21

-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 224.00  
ELEVATION DATA: UPSTREAM(FEET) = 1032.42 DOWNSTREAM(FEET) = 1027.76

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$   
SUBAREA ANALYSIS USED MINIMUM  $T_c$ (MIN.) = 5.746  
\* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.107

SUBAREA  $T_c$  AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN	$T_c$ (MIN.)
COMMERCIAL	A	1.81	0.74	0.100	52	5.75

SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.74  
SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100  
SUBAREA RUNOFF(CFS) = 8.20  
TOTAL AREA(ACRES) = 1.81 PEAK FLOW RATE(CFS) = 8.20

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 1.8 TC(MIN.) = 5.75  
EFFECTIVE AREA(ACRES) = 1.81 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.07  
AREA-AVERAGED  $F_p$ (INCH/HR) = 0.74 AREA-AVERAGED  $A_p$  = 0.100  
PEAK FLOW RATE(CFS) = 8.20

=====

END OF RATIONAL METHOD ANALYSIS



# **APPENDIX C**

## **DETENTION CALCULATIONS**

\*\*\*\*\*  
 NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)  
 AND LOW LOSS FRACTION ESTIMATIONS  
 =====

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 Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

\*\*\*\*\*  
 -----

Problem Descriptions:  
 TEI JOB NO. 4106  
 PROPOSED CONDITION  
 LOSS RATES  
 =====

\*\*\* NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)  
 AND LOW LOSS FRACTION ESTIMATIONS FOR AMC III:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 5.00 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp (in./hr.)	YIELD
1	15.14	10.00	32.(AMC II)	0.742	0.873

TOTAL AREA (Acres) = 15.14

AREA-AVERAGED LOSS RATE,  $\bar{F}_m$  (in./hr.) = 0.074

AREA-AVERAGED LOW LOSS FRACTION,  $\bar{Y}$  = 0.127  
 =====



JOB #4106  
TRUCK YARD DETENTION VOLUME

Elevation	Depth (feet)	Area (sq. ft.)	Volume (c.f.)	$\Sigma$ Volume (c.f.)	$\Sigma$ Volume (ac-ft)	Discharge (cfs)
1029.52	0.00	0	10	10	0.00	21.0
1029.60	0.08	1,470	1,859	1,869	0.04	22.0
1029.80	0.28	17,124	6,380	8,249	0.19	23.0
1030.00	0.48	46,674	11,932	20,181	0.46	24.0
1030.20	0.68	72,643	3,067	23,248	0.53	25.2
1030.24	0.72	80,719				

\*\*\*\*\*  
 SMALL AREA UNIT HYDROGRAPH MODEL  
 =====

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Analysis prepared by:

\*\*\*\*\*

-----  
 Problem Descriptions:

TEI JOB NO. 4106  
 PROPOSED CONDITION  
 TRUCK YARD DETENTION HYDROGRAPH  
 -----

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90  
 TOTAL CATCHMENT AREA (ACRES) = 15.14  
 SOIL-LOSS RATE, Fm, (INCH/HR) = 0.074  
 LOW LOSS FRACTION = 0.127  
 TIME OF CONCENTRATION (MIN.) = 17.46  
 SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA  
 USER SPECIFIED RAINFALL VALUES ARE USED  
 RETURN FREQUENCY (YEARS) = 100  
 5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.47  
 30-MINUTE POINT RAINFALL VALUE (INCHES) = 0.98  
 1-HOUR POINT RAINFALL VALUE (INCHES) = 1.25  
 3-HOUR POINT RAINFALL VALUE (INCHES) = 2.00  
 6-HOUR POINT RAINFALL VALUE (INCHES) = 2.50  
 24-HOUR POINT RAINFALL VALUE (INCHES) = 5.00

-----  
 TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 5.03  
 TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 1.28

\*\*\*\*\*

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	10.0	20.0	30.0	40.0
0.29	0.0149	1.24	.Q	.	.	.	.
0.58	0.0449	1.25	.Q	.	.	.	.
0.87	0.0752	1.26	.Q	.	.	.	.
1.16	0.1057	1.28	.Q	.	.	.	.
1.45	0.1366	1.29	.Q	.	.	.	.
1.74	0.1677	1.30	.Q	.	.	.	.
2.03	0.1992	1.31	.Q	.	.	.	.
2.32	0.2310	1.33	.Q	.	.	.	.
2.61	0.2631	1.34	.Q	.	.	.	.
2.91	0.2955	1.36	.Q	.	.	.	.
3.20	0.3284	1.37	.Q	.	.	.	.
3.49	0.3616	1.39	.Q	.	.	.	.
3.78	0.3951	1.40	.Q	.	.	.	.
4.07	0.4291	1.42	.Q	.	.	.	.
4.36	0.4635	1.43	.Q	.	.	.	.
4.65	0.4983	1.46	.Q	.	.	.	.
4.94	0.5335	1.47	.Q	.	.	.	.

5.23	0.5692	1.50	.Q	.	.	.	.
5.52	0.6054	1.51	.Q	.	.	.	.
5.82	0.6420	1.54	.Q	.	.	.	.
6.11	0.6792	1.55	.Q	.	.	.	.
6.40	0.7169	1.58	.Q	.	.	.	.
6.69	0.7552	1.60	.Q	.	.	.	.
6.98	0.7941	1.63	.Q	.	.	.	.
7.27	0.8335	1.65	.Q	.	.	.	.
7.56	0.8737	1.69	.Q	.	.	.	.
7.85	0.9145	1.71	.Q	.	.	.	.
8.14	0.9560	1.75	.Q	.	.	.	.
8.43	0.9983	1.77	.Q	.	.	.	.
8.73	1.0413	1.81	.Q	.	.	.	.
9.02	1.0852	1.84	.Q	.	.	.	.
9.31	1.1300	1.89	.Q	.	.	.	.
9.60	1.1758	1.92	.Q	.	.	.	.
9.89	1.2226	1.97	.Q	.	.	.	.
10.18	1.2704	2.01	. Q	.	.	.	.
10.47	1.3194	2.07	. Q	.	.	.	.
10.76	1.3697	2.11	. Q	.	.	.	.
11.05	1.4213	2.19	. Q	.	.	.	.
11.34	1.4744	2.23	. Q	.	.	.	.
11.64	1.5291	2.32	. Q	.	.	.	.
11.93	1.5856	2.37	. Q	.	.	.	.
12.22	1.6374	1.94	.Q	.	.	.	.
12.51	1.6806	1.66	.Q	.	.	.	.
12.80	1.7220	1.78	.Q	.	.	.	.
13.09	1.7658	1.86	.Q	.	.	.	.
13.38	1.8125	2.03	. Q	.	.	.	.
13.67	1.8624	2.13	. Q	.	.	.	.
13.96	1.9165	2.37	. Q	.	.	.	.
14.25	1.9785	2.78	. Q	.	.	.	.
14.55	2.0575	3.79	. Q	. Q	.	.	.
14.84	2.1521	4.07	. Q	. Q	.	.	.
15.13	2.2596	4.87	. Q	. Q	.	.	.
15.42	2.3838	5.46	. Q	. Q	.	.	.
15.71	2.5286	6.58	. Q	. Q	.	.	.
16.00	2.7359	10.65	.	. Q	.	.	.
16.29	3.2913	35.54	.	.	. Q	.	.
16.58	3.7891	5.86	.	. Q	.	.	.
16.87	3.9127	4.42	. Q	. Q	.	.	.
17.16	4.0087	3.56	. Q	. Q	.	.	.
17.45	4.0784	2.24	. Q	. Q	.	.	.
17.75	4.1286	1.94	.Q	.	.	.	.
18.04	4.1726	1.72	.Q	.	.	.	.
18.33	4.2224	2.43	. Q	.	.	.	.
18.62	4.2789	2.27	. Q	.	.	.	.
18.91	4.3321	2.15	. Q	.	.	.	.
19.20	4.3824	2.04	. Q	.	.	.	.
19.49	4.4303	1.94	.Q	.	.	.	.
19.78	4.4760	1.86	.Q	.	.	.	.
20.07	4.5200	1.79	.Q	.	.	.	.
20.36	4.5623	1.73	.Q	.	.	.	.
20.66	4.6031	1.67	.Q	.	.	.	.
20.95	4.6426	1.62	.Q	.	.	.	.
21.24	4.6809	1.57	.Q	.	.	.	.
21.53	4.7180	1.52	.Q	.	.	.	.
21.82	4.7542	1.48	.Q	.	.	.	.
22.11	4.7895	1.45	.Q	.	.	.	.
22.40	4.8238	1.41	.Q	.	.	.	.
22.69	4.8574	1.38	.Q	.	.	.	.
22.98	4.8902	1.35	.Q	.	.	.	.
23.27	4.9224	1.32	.Q	.	.	.	.
23.57	4.9538	1.30	.Q	.	.	.	.
23.86	4.9847	1.27	.Q	.	.	.	.

24.15	5.0149	1.25	.Q	.	.	.	.
24.44	5.0299	0.00	Q	.	.	.	.

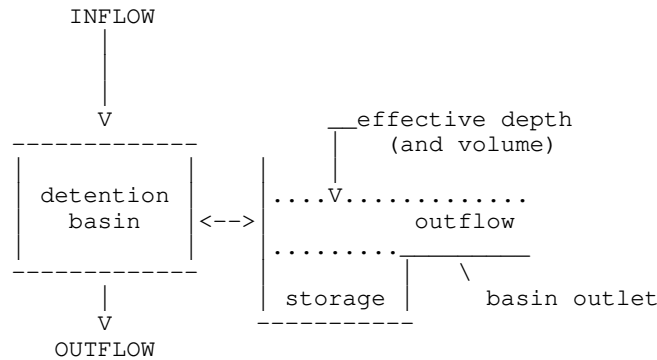
TIME DURATION (minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:  
 (Note: 100% of Peak Flow Rate estimate assumed to have an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1449.2
10%	174.6
20%	34.9
30%	17.5
40%	17.5
50%	17.5
60%	17.5
70%	17.5
80%	17.5
90%	17.5

Problem Descriptions:  
 TEI JOB NO. 4106  
 PROPOSED CONDITION  
 TRUCK YARD DETENTION HYDROGRAPH

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:  
 CONSTANT HYDROGRAPH TIME UNIT (MINUTES) = 17.460  
 DEAD STORAGE (AF) = 0.00  
 SPECIFIED DEAD STORAGE (AF) FILLED = 0.00  
 ASSUMED INITIAL DEPTH (FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:  
 TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 7

*BASIN-DEPTH	STORAGE	OUTFLOW	**BASIN-DEPTH	STORAGE	OUTFLOW
*(FEET)	(ACRE-FEET)	(CFS)	** (FEET)	(ACRE-FEET)	(CFS)
* 0.000	0.000	0.000**	0.080	0.010	23.000*
* 0.280	0.040	24.000**	0.480	0.190	25.000*
* 0.680	0.460	26.000**	0.880	0.820	27.000*
* 1.010	1.060	28.000**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.08	-0.26657	0.28657
3	0.28	-0.24860	0.32860
4	0.48	-0.11062	0.49062
5	0.68	0.14736	0.77264
6	0.88	0.49533	1.14467
7	1.01	0.72331	1.39669

WHERE S=STORAGE (AF);O=OUTFLOW (AF/MIN.);DT=UNIT INTERVAL (MIN.)

-----  
DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES  
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE  
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED (AF)	INFLOW (CFS)	EFFECTIVE DEPTH (FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME (AF)
0.286	0.000	1.24	0.01	1.20	0.001
0.577	0.000	1.25	0.01	2.41	0.001
0.868	0.000	1.26	0.01	2.43	0.001
1.159	0.000	1.28	0.01	2.45	0.001
1.450	0.000	1.29	0.01	2.48	0.001
1.741	0.000	1.30	0.01	2.50	0.001
2.032	0.000	1.31	0.01	2.53	0.001
2.323	0.000	1.33	0.01	2.55	0.001
2.614	0.000	1.34	0.01	2.58	0.001
2.905	0.000	1.36	0.01	2.61	0.001
3.196	0.000	1.37	0.01	2.63	0.001
3.487	0.000	1.39	0.01	2.66	0.001
3.778	0.000	1.40	0.01	2.69	0.001
4.069	0.000	1.42	0.01	2.73	0.001
4.360	0.000	1.43	0.01	2.76	0.001
4.651	0.000	1.46	0.01	2.79	0.001
4.942	0.000	1.47	0.01	2.83	0.001
5.233	0.000	1.50	0.01	2.86	0.001
5.524	0.000	1.51	0.01	2.90	0.001
5.815	0.000	1.54	0.01	2.94	0.001
6.106	0.000	1.55	0.01	2.98	0.001
6.397	0.000	1.58	0.01	3.03	0.001
6.688	0.000	1.60	0.01	3.07	0.001
6.979	0.000	1.63	0.01	3.12	0.001
7.270	0.000	1.65	0.01	3.17	0.001
7.561	0.000	1.69	0.01	3.22	0.001
7.852	0.000	1.71	0.01	3.27	0.001
8.143	0.000	1.75	0.01	3.33	0.001
8.434	0.000	1.77	0.01	3.39	0.001
8.725	0.000	1.81	0.01	3.46	0.002
9.016	0.000	1.84	0.01	3.52	0.002
9.307	0.000	1.89	0.01	3.60	0.002
9.598	0.000	1.92	0.01	3.67	0.002
9.889	0.000	1.97	0.01	3.75	0.002
10.180	0.000	2.01	0.01	3.84	0.002
10.471	0.000	2.07	0.01	3.93	0.002
10.762	0.000	2.11	0.01	4.03	0.002
11.053	0.000	2.19	0.01	4.14	0.002
11.344	0.000	2.23	0.01	4.26	0.002
11.635	0.000	2.32	0.02	4.39	0.002
11.926	0.000	2.37	0.02	4.53	0.002
12.217	0.000	1.94	0.01	4.16	0.002
12.508	0.000	1.66	0.01	3.47	0.001
12.799	0.000	1.78	0.01	3.32	0.001
13.090	0.000	1.86	0.01	3.51	0.002
13.381	0.000	2.03	0.01	3.75	0.002

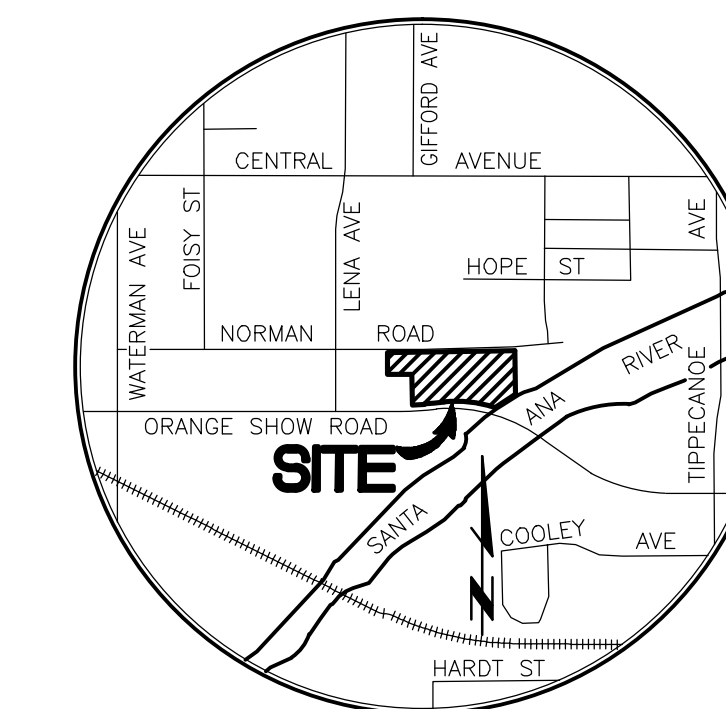
13.672	0.000	2.13	0.01	4.01	0.002
13.963	0.000	2.37	0.02	4.34	0.002
14.254	0.000	2.78	0.02	4.97	0.002
14.545	0.000	3.79	0.03	6.34	0.003
14.836	0.000	4.07	0.03	7.59	0.003
15.127	0.000	4.87	0.03	8.63	0.004
15.418	0.000	5.46	0.04	9.97	0.005
15.709	0.000	6.58	0.04	11.63	0.006
16.000	0.000	10.65	0.07	16.63	0.009
16.291	0.000	35.54	0.72	23.39	0.539
16.582	0.000	5.86	0.33	25.22	0.074
16.873	0.000	4.42	0.03	16.38	0.004
17.164	0.000	3.56	0.02	7.70	0.003
17.455	0.000	2.24	0.02	5.60	0.002
17.746	0.000	1.94	0.01	4.03	0.002
18.037	0.000	1.72	0.01	3.53	0.001
18.328	0.000	2.43	0.02	4.00	0.002
18.619	0.000	2.27	0.02	4.54	0.002
18.910	0.000	2.15	0.01	4.27	0.002
19.201	0.000	2.04	0.01	4.04	0.002
19.492	0.000	1.94	0.01	3.84	0.002
19.783	0.000	1.86	0.01	3.67	0.002
20.074	0.000	1.79	0.01	3.53	0.002
20.365	0.000	1.73	0.01	3.39	0.001
20.656	0.000	1.67	0.01	3.28	0.001
20.947	0.000	1.62	0.01	3.17	0.001
21.238	0.000	1.57	0.01	3.07	0.001
21.529	0.000	1.52	0.01	2.98	0.001
21.820	0.000	1.48	0.01	2.90	0.001
22.111	0.000	1.45	0.01	2.83	0.001
22.402	0.000	1.41	0.01	2.76	0.001
22.693	0.000	1.38	0.01	2.69	0.001
22.984	0.000	1.35	0.01	2.63	0.001
23.275	0.000	1.32	0.01	2.58	0.001
23.566	0.000	1.30	0.01	2.53	0.001
23.857	0.000	1.27	0.01	2.48	0.001
24.148	0.000	1.25	0.01	2.43	0.001
24.439	0.000	0.00	0.00	1.20	0.000
24.730	0.000	0.00	0.00	0.00	0.000

PEAK

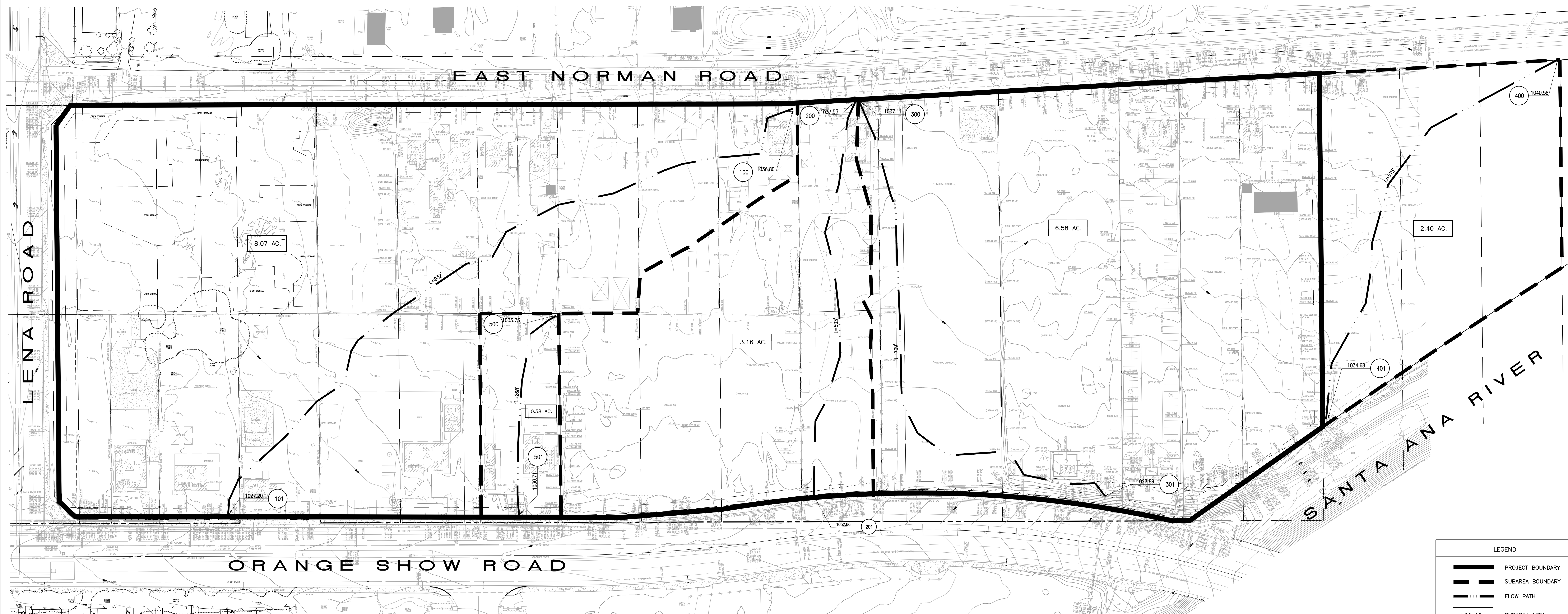


# **APPENDIX D**

## **HYDROLOGY MAP**



VICINITY MAP  
N.T.S.

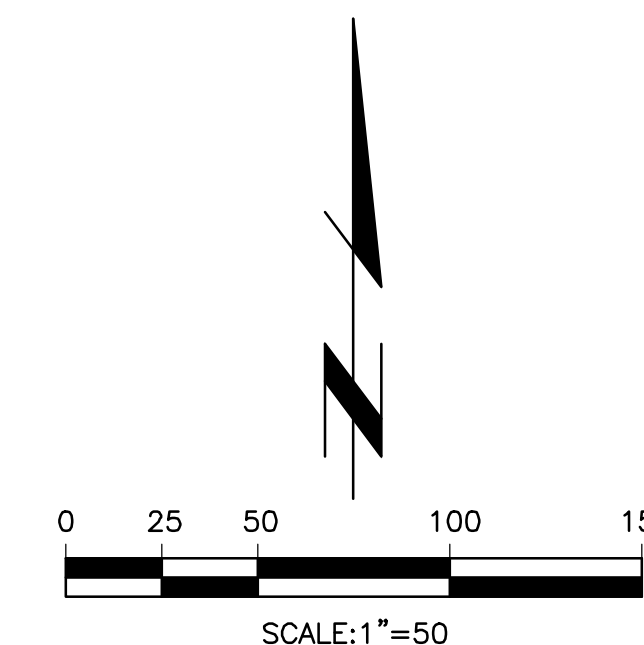


SUBAREA DATA SUMMARY

NODES	AREA (ACRES)	SOIL TYPE	T <sub>c</sub> (MINUTES)	Q <sub>100</sub> (CFS)
100-101	8.07	A	11.70	21.8
200-201	3.16	A	9.25	10.6
300-301	6.58	A	10.01	20.5
400-401	2.40	A	9.73	7.9
500-501	0.58	A	11.18	1.4

LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SUBAREA AREA
	NODE DESCRIPTION

SOIL A  
RAIN FALL 100 YEAR  
1 HOUR = 1.25"  
6 HOUR = 2.5"  
24 HOUR = 5.0"



Last Update: 9/6/22  
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**CITY OF SAN BERNARDINO**  
PUBLIC WORKS DEPARTMENT  
**PRE-DEVELOPED  
HYDROLOGY MAP**  
GATEWAY SOUTH  
BUILDING 9  
SAN BERNARDINO, CA

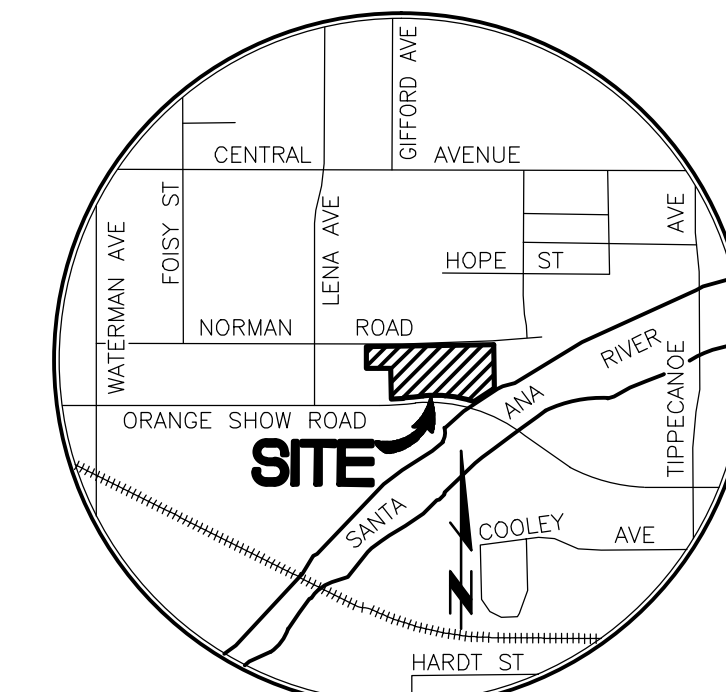
PREPARED FOR:  
GATEWAY SOUTH 9 DEVELOPMENT, LLC  
36 DISCOVERY, SUITE 130  
IRVINE, CA 92618  
(909) 382-0033

PREPARED BY:  
**T&I** Thienes Engineering, Inc.  
CIVIL ENGINEERING • LAND SURVEYING  
14140 FIRESTONE BOULEVARD  
LA MIRADA, CALIFORNIA 90638  
PH: (714) 521-4811 FAX: (714) 521-4173

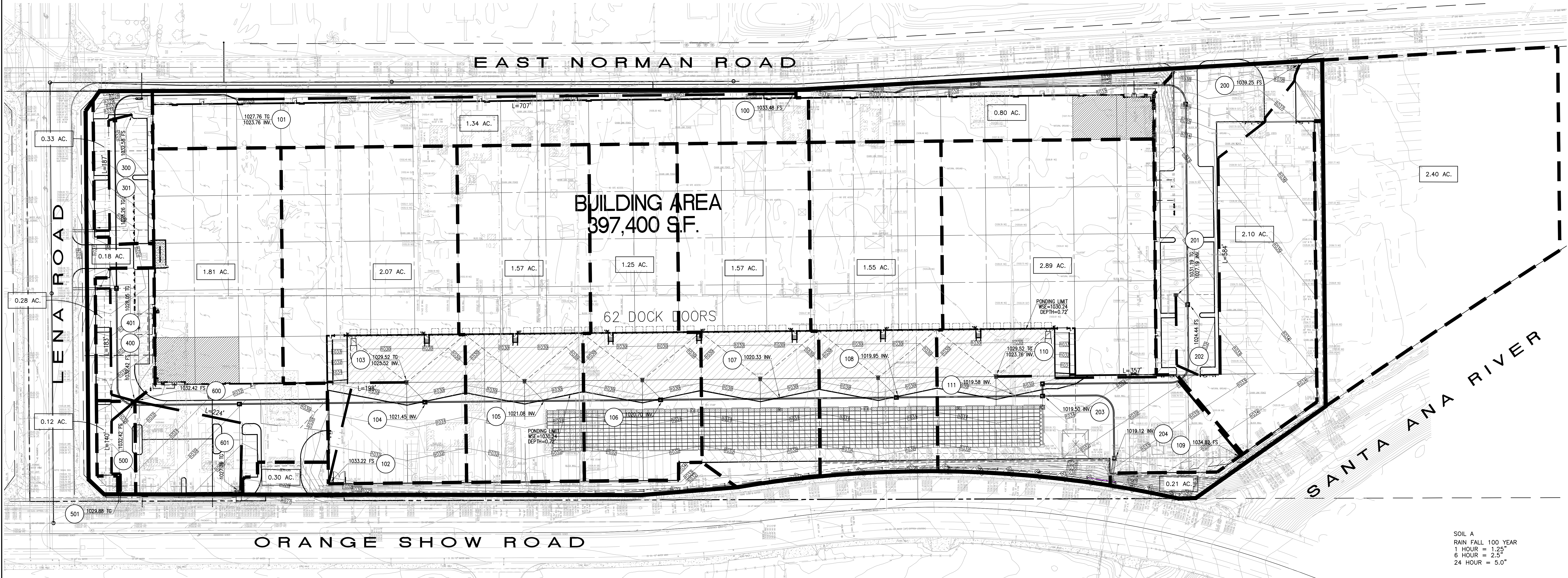
Designed by _____	Approved by _____	Date _____
Checked by _____	Public Works Director _____	R.C.E.
Date _____		
Designed by _____		
Date _____		
Checked by _____		
Date _____		

Sheet **1** of **1** Sheets





VICINITY MAP  
N.T.S.



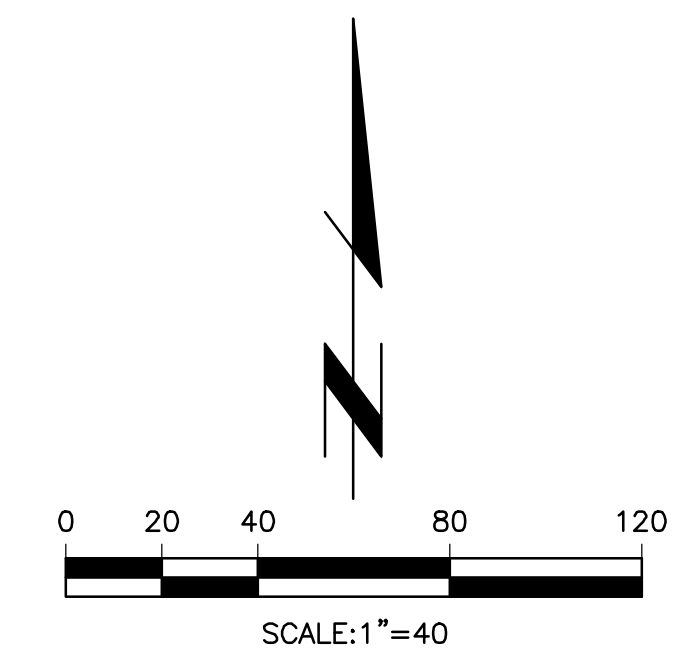
SUBAREA DATA SUMMARY

NODES	AREA (ACRES)	SOIL TYPE	Tc (MINUTES)	Q100 (CFS)
100-204	12.79	A	14.32	33.1
300-301	0.33	A	5.23	1.6
400-401	0.28	A	5.16	1.4
500-501	0.12	A	5.00	1.0
600-601	1.81	A	8.75	8.2

SOIL A  
RAIN FALL 100 YEAR  
1 HOUR = 1.25"  
6 HOUR = 2.5"  
24 HOUR = 5.0"

**LEGEND**

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- SUBAREA AREA
- NODE DESCRIPTION
- PONDING LIMITS



Last Update: 9/6/22  
0:\4100-4198\4105\4106HYD.dwg

**CITY OF SAN BERNARDINO**  
PUBLIC WORKS DEPARTMENT

**PROPOSED HYDROLOGY MAP**  
**GATEWAY SOUTH BUILDING 9**  
**SAN BERNARDINO, CA**

<p>Designed by _____ Date _____</p> <p>Checked by _____ Date _____</p> <p>Designed by _____ Date _____</p> <p>Checked by _____ Date _____</p>	<p>Approved by _____ Date _____</p> <p>Public Works Director _____ R.C.E.</p>
<p>Sheet <b>1</b> of <b>1</b> Sheets</p>	

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