



PRELIMINARY HYDROLOGY REPORT

TOWN CENTRE

TRACT 17446

Lake Forest, California

Prepared For
Brookfield Residential
3090 Bristol Street, Suite 200
Costa Mesa, CA 92626

Prepared By

Fusco Engineering, Inc.
16795 Von Karman, Suite 100
Irvine, California 92606
949.474.1960
www.fuscoe.com

Project Manager:
Winnie Tham, P.E.

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PRELIMINARY HYDROLOGY REPORT
FOOTHILL RANCH TOWN CENTER

TRACT 17446

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16795 VON KARMAN AVE
IRVINE, CA 92606
949.474.1960

JULY 23, 2012



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Appendix 3	<i>Catch Basin Sizing Analysis</i>
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1.0 INTRODUCTION

1.1 GEOGRAPHIC SETTING

The project area consists of approximately 9.0 acres± and is located in the City of Lake Forest. It is bounded by Portola Parkway to the north, Bake Parkway to the south, and Auto Center Drive to the east.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to accomplish the following objectives:

To evaluate hydromodification impacts (see Appendix 1).

To determine the storm water discharges generated within the project (see Appendix 2).

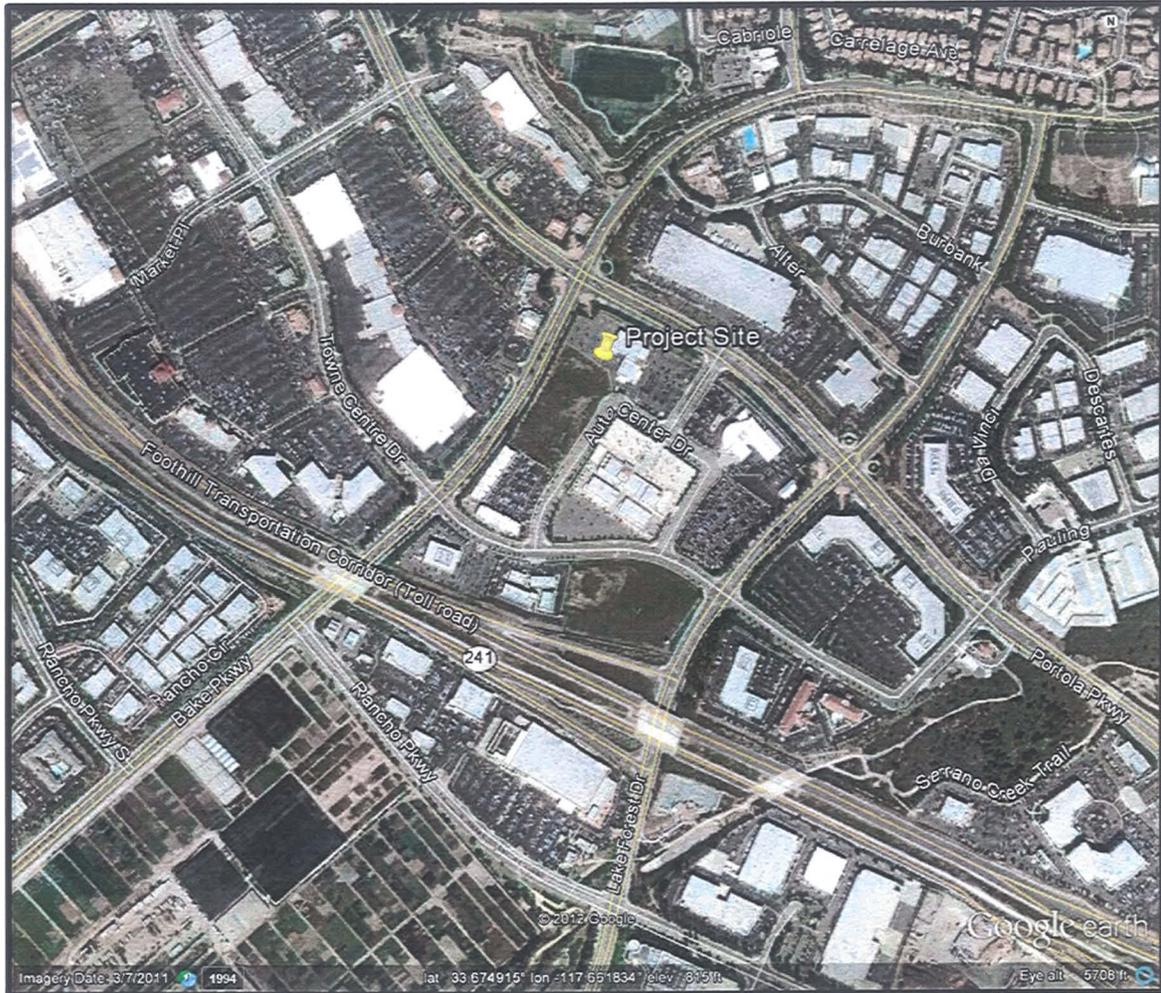
To support the sizing of catch basins and to demonstrate that adequate inlet capacity has been provided to insure that one travel lane will remain clear on local streets during the 25-year storm (see Appendix 3).

To demonstrate that the storm water and flood protection goals as outlined in the Orange County Design Manual have been met. See Section 7.0 for Design Criteria.

1.3 REFERENCES

- Orange County Hydrology Manual
- Orange County Local Drainage Manual

1.4 PROJECT SITE LOCATION MAP



2.0 EXISTING TOPOGRAPHIC & HYDROLOGIC CONDITIONS

2.1 EXISTING TOPOGRAPHY

The project site consists of two parcels. The northern portion of the site is currently developed with a former car dealership while the southern portion is currently vacant land with minor vegetation and a few isolated piles of soil.

2.2 EXISTING DRAINAGE PATTERN

Approximately 80% of runoff from the site drains in southwesterly direction to an existing 30" RCP storm drain pipe that runs west from an existing catch basin at the knuckle on Auto Center Drive to an existing catch basin on Bake Parkway. The remainder of site drains via surface flow in south easterly direction to Auto Center Drive and then to an existing catch basin at the corner of Auto Center Drive and Towne Centre Drive south of the project site.

2.3 EXISTING STORM DRAIN FACILITIES

A series of onsite drainage inlets drain to an existing 30" pipe that originates at the existing 22' catch basin at the knuckle on Auto Center Drive and flows west to an existing catch basin on Bake Parkway. This catch basin drains west to the existing F19 P06 storm drain facility (54" RCP) which drains south along Bake Parkway. Runoffs captured via the existing catch basins at Auto Center Drive and Towne Centre Drive drain to an existing 18" RCP on Towne Centre Drive and flow west until they confluence with the F19 P06 storm drain on Bake Parkway.

3.0 PROPOSED STORM DRAIN FACILITIES

There will be one main storm drain line on site under proposed condition. It will collect runoffs via a series of catch basins on the proposed main driveway and drain west to the existing F19 P06 storm drain facility on Bake Parkway. The proposed system will replace the existing 30" pipe that runs from the existing catch basin at the knuckle on Auto Center Drive to the existing catch basin on Bake Parkway west of the site. The existing catch basin on Auto Center Drive will be also plugged and abandoned allowing the street runoffs to continue to drain south to the existing catch basin at Towne Centre Drive and Auto Center Drive.

4.0 HYDROMODIFICATION

This study is intended to determine if the project has hydrologic conditions of concern (HCOC) on the downstream facilities. The HCOCs are considered to exist if any streams located downstream of the project are determined to be potentially susceptible to hydromodification impacts with either of the following conditions:

Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent

or

Time of concentration (Tc) of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

Table 4.1 summarizes the pre- and post-development condition volumes and times of concentration. See Appendix 1 for calculations.

Table 4.1 SUMMARY OF 2-YR VOLUME AND Tc

	2-yr, 24-hr Runoff Volume	2-yr, 24-hr Tc
Pre-Development	0.90 Ac-ft	8.50 min
Post-Development	1.15 Ac-ft	11.03 min
Increase	0.25 Ac-ft	2.13 min
% Increase	28%	25%

The results indicate that the proposed project is potentially susceptible to hydromodification impacts. According to the Fourth Term MS4 permit, "In cases where the excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow." (Section XII.D.4). Since the project site has very low infiltration rate (0.25 in/hr) and there is no room for detention/reuse facility, analysis of pre- vs. post-development 2-year peak flow rates was performed to evaluate

the above criteria. Table 4.2 summarizes the pre- and post-development condition peak flow rates. See Appendix 1 for calculations.

Table 4.2 SUMMARY OF 2-YEAR FLOW RATES

	2-yr Runoff Flow Rate
Pre-Development	13.75 cfs
Post-Development	11.91 cfs
Decrease	1.84 cfs
% Decrease	13%

The results indicate that the post-development condition flow rate decreases by 13% which satisfies the hydromodification requirements and allowable discharge provisions.

In conformance with the Orange County Hydrology Manual, A.E.S. Computer Software was utilized to compile the hydrologic data and to determine the Tcs, peak discharges, and runoff volumes.

5.0 HYDROLOGY

5.1 STORM FREQUENCY

This study is intended to determine local discharges for use in the design of storm drains and catch basins. Because sumps are created at all catch basins, a 25-year frequency was chosen as the minimum design criteria.

5.2 METHODOLOGY

This study was prepared in conformance with the Orange County Hydrology Manual. A.E.S. Computer Software was utilized to compile the hydrologic data and to determine the peak discharges.

Table 5.1 SUMMARY OF 25-YEAR FLOW RATES

	Area	25-yr Runoff Flow Rate
Pre-Development	A	23.2 cfs
	B	7.9 cfs
	Total	31.1 cfs
Post-Development	A	23.5 cfs
	B	3.2 cfs
	Total	26.7 cfs
Decrease		4.4 cfs
% Decrease		14 %

Table 5.2 SUMMARY OF 25-YR VOLUME AND Tc

	2-yr, 24-hr Runoff Volume	2-yr, 24-hr Tc
Pre-Development	2.63 Ac-ft	7.77 min
Post-Development	2.80 Ac-ft	10.62 min
Increase	0.17 Ac-ft	2.85 min
% Increase	6%	37%

The results of the rational method hydrology indicated that the proposed condition 25 year flow rate (31.1 cfs total) will reduce approximately 14% from the existing condition (26.7 cfs total). As shown in the existing and proposed 25 year hydrology maps included in Appendices 4 and 5 of this report, runoffs that drain to the existing storm drain in Bake Parkway near the southwest corner of the site will increase very slightly from 23.2 cfs in the existing condition to 23.5 cfs in proposed condition. This 1% increase in proposed condition is negligible and will have no negative impact on the existing pipe capacity in Bake Parkway.

6.0 CATCH BASIN SIZING

6.1 STORM FREQUENCY

Consistent with the Design Criteria set forth in Section 5.1 of this report, a storm frequency of 25-year was used.

6.2 METHODOLOGY

Standard curb opening catch basins were analyzed using A.E.S. software Hydraulic Elements program package. Catch basin openings were designed to minimize ponding in the area adjacent to catch basins and protect buildings from flooding. See Appendix 4 for calculations.

7.0 DESIGN CRITERIA

The proposed storm drain systems will be designed to be consistent with the following goals and guidelines:

All buildings shall be protected from flooding during a 100-year frequency storm.

Onsite design storm is based on a 25-year frequency in sump conditions for catch basins and the connecting storm drains also use a 25-year frequency.

Velocity should not exceed 20 FPS in a standard wall R.C.P.

Where velocity exceeds 20 FPS, a special wall R.C.P. with a minimum of 1½-inch steel clearance on the inside surface shall be used.

Maximum velocity in special cover R.C.P. shall be 45 FPS.

On local streets one lane shall be free of storm water in a 25-year storm event.

Maximum W.S. in CB's for design conditions shall be 0.5' below inlet (FL.) elevation.

Once water is picked up in a storm drain, it should remain in the system.

Pipe size may not be decreased downstream without the City's approval.

8.0 RESULTS AND CONCLUSIONS

The results of the existing and proposed hydrology study done in this report indicate that the proposed storm drain systems, designed to a Q_{25} Storm Frequency, will not have an adverse effect on any of the existing or proposed improvements within the project or adjacent public streets. Plugging the existing catch basin at the knuckle on Auto Center Drive will not impact the downstream catch basin or storm drain pipe on Town Centre Drive because the existing on-site runoffs that currently drain to Auto Center Drive will be captured via on-site underground storm drain system in the proposed condition, which will reduce the flow rate entering Auto Center Drive significantly. In addition, all design criteria outlined above have been met.

9.0 APPENDICES

- Appendix 1 *Hydromodification Study*
 - A. *2 Year Hydrology Study*
 - B. *Existing 2 Year Hydrology Map*
 - C. *Proposed 2 Year Hydrology Map*
 - D. *2 Year Unit Hydrograph Study*
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A. 2 YEAR HYDROLOGY STUDY

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2010 Advanced Engineering Software (aes)
Ver. 17.0 Release Date: 07/01/2010 License ID 1355

Analysis prepared by:

Fusco Engineering, Inc.
16795 Von Karman Ave. Ste. 100
Irvine, California 92606
PH: 949-474-1960 Fax: 949-474-5315

***** DESCRIPTION OF STUDY *****
* FOOHILL RANCH TOWN CENTER *
* EX. 2 YR HYDROLOGY *
* 120327-SS *

FILE NAME: 30844X2.DAT
TIME/DATE OF STUDY: 14:04 03/27/2012

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

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

Table with columns: NO., HALF-WIDTH (FT), CROWN CROSSFALL (FT), STREET-CROSSFALL IN-/OUT-SIDE / PARK-SIDE / WAY, CURB HEIGHT (FT), GUTTER WIDTH (FT), GUTTER LIP (FT), GUTTER HIKE (FT), GEOMETRIES: MANNING FACTOR (n). Row 1: 1, 30.0, 20.0, 0.018/0.018/0.020, 0.67, 2.00, 0.0313, 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)
SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH(FEET) = 278.00
ELEVATION DATA: UPSTREAM(FEET) = 797.50 DOWNSTREAM(FEET) = 789.70

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.900
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.058
SUBAREA Tc AND LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 1.25 0.20 0.100 57 5.90
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 2.29
 TOTAL AREA(ACRES) = 1.25 PEAK FLOW RATE(CFS) = 2.29

 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 789.70 DOWNSTREAM(FEET) = 786.20
 CHANNEL LENGTH THRU SUBAREA (FEET) = 266.00 CHANNEL SLOPE = 0.0132
 CHANNEL BASE(FEET) = 1.00 "Z" FACTOR = 10.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.846
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	2.08	0.20	0.100	57
NATURAL POOR COVER "BARREN"	D	0.74	0.20	1.000	83

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.336
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.56
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.59
 AVERAGE FLOW DEPTH(FEET) = 0.31 TRAVEL TIME(MIN.) = 1.24
 Tc(MIN.) = 7.14
 SUBAREA AREA(ACRES) = 2.82 SUBAREA RUNOFF(CFS) = 4.51
 EFFECTIVE AREA(ACRES) = 4.07 AREA-AVERAGED Fm(INCH/HR) = 0.05
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.26
 TOTAL AREA(ACRES) = 4.1 PEAK FLOW RATE(CFS) = 6.57

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.36 FLOW VELOCITY(FEET/SEC.) = 3.90
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 544.00 FEET.

 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 781.80 DOWNSTREAM(FEET) = 779.70
 FLOW LENGTH(FEET) = 143.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.99
 ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 6.57
 PIPE TRAVEL TIME(MIN.) = 0.34 Tc(MIN.) = 7.48
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 687.00 FEET.

 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 7.48
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.797
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	1.67	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 1.67 SUBAREA RUNOFF(CFS) = 2.67

EFFECTIVE AREA (ACRES) = 5.74 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.22
TOTAL AREA (ACRES) = 5.7 PEAK FLOW RATE (CFS) = 9.06

FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 31

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

=====
ELEVATION DATA: UPSTREAM (FEET) = 779.70 DOWNSTREAM (FEET) = 777.00
FLOW LENGTH (FEET) = 273.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.2 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 6.51
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 9.06
PIPE TRAVEL TIME (MIN.) = 0.70 Tc (MIN.) = 8.18
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 960.00 FEET.

FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 81

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

=====
MAINLINE Tc (MIN.) = 8.18
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.707
SUBAREA LOSS RATE DATA (AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL POOR COVER
"BARREN" D 1.24 0.20 1.000 83
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA (ACRES) = 1.24 SUBAREA RUNOFF (CFS) = 1.68
EFFECTIVE AREA (ACRES) = 6.98 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.36
TOTAL AREA (ACRES) = 7.0 PEAK FLOW RATE (CFS) = 10.28

FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 31

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

=====
ELEVATION DATA: UPSTREAM (FEET) = 777.00 DOWNSTREAM (FEET) = 775.80
FLOW LENGTH (FEET) = 129.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.8 INCHES
PIPE-FLOW VELOCITY (FEET/SEC.) = 6.68
ESTIMATED PIPE DIAMETER (INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW (CFS) = 10.28
PIPE TRAVEL TIME (MIN.) = 0.32 Tc (MIN.) = 8.50
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 1089.00 FEET.

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 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) = 788.50 DOWNSTREAM (FEET) = 783.30

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 6.698
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.914

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SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL POOR COVER						
"BARREN"	D	0.71	0.20	1.000	83	11.57
COMMERCIAL	D	0.26	0.20	0.100	57	6.70

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.759
 SUBAREA RUNOFF(CFS) = 1.54
 TOTAL AREA(ACRES) = 0.97 PEAK FLOW RATE(CFS) = 1.54

 FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 783.30 DOWNSTREAM(FEET) = 780.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 194.00 CHANNEL SLOPE = 0.0170
 CHANNEL BASE(FEET) = 1.00 "Z" FACTOR = 10.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.771

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL POOR COVER					
"BARREN"	D	1.23	0.20	1.000	83
COMMERCIAL	D	0.20	0.20	0.100	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.874
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.57
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.34
 AVERAGE FLOW DEPTH(FEET) = 0.23 TRAVEL TIME(MIN.) = 0.97
 Tc(MIN.) = 7.67
 SUBAREA AREA(ACRES) = 1.43 SUBAREA RUNOFF(CFS) = 2.05
 EFFECTIVE AREA(ACRES) = 2.40 AREA-AVERAGED Fm(INCH/HR) = 0.17
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.83
 TOTAL AREA(ACRES) = 2.4 PEAK FLOW RATE(CFS) = 3.47

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.26 FLOW VELOCITY(FEET/SEC.) = 3.65
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 494.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.4 TC(MIN.) = 7.67
 EFFECTIVE AREA(ACRES) = 2.40 AREA-AVERAGED Fm(INCH/HR) = 0.17
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.827
 PEAK FLOW RATE(CFS) = 3.47

=====

END OF RATIONAL METHOD ANALYSIS

♀

PROP. 2 YR HYDROLOGY

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 17.0 Release Date: 07/01/2010 License ID 1355

Analysis prepared by:

Fusco Engineering, Inc.
16795 Von Karman Ave. Ste. 100
Irvine, California 92606
PH: 949-474-1960 Fax: 949-474-5315

***** DESCRIPTION OF STUDY *****
* LAKE FOREST TOWN CENTER *
* PROPOSED 2 YR HYDROLOGY *
* 120328-SS *

FILE NAME: 30844P2.DAT
TIME/DATE OF STUDY: 16:11 03/28/2012

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL
Table with columns: NO., HALF-WIDTH (FT), CROWN CROSSFALL (FT), STREET-CROSSFALL IN-/OUT-SIDE, PARK-/WAY, CURB HEIGHT (FT), GUTTER WIDTH (FT), GEOMETRIES LIP (FT), MANNING HIKE (FT), FACTOR (n)

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)
SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 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) = 794.60 DOWNSTREAM(FEET) = 791.92

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.151
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.710
SUBAREA Tc AND LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
APARTMENTS D 0.83 0.20 0.200 57 8.15
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA RUNOFF(CFS) = 1.25
TOTAL AREA(ACRES) = 0.83 PEAK FLOW RATE(CFS) = 1.25

FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 791.92 DOWNSTREAM(FEET) = 791.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 131.00 CHANNEL SLOPE = 0.0070
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 10.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.604
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	0.76	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.78
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.28
AVERAGE FLOW DEPTH(FEET) = 0.28 TRAVEL TIME(MIN.) = 0.96
Tc(MIN.) = 9.11
SUBAREA AREA(ACRES) = 0.76 SUBAREA RUNOFF(CFS) = 1.07
EFFECTIVE AREA(ACRES) = 1.59 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA(ACRES) = 1.6 PEAK FLOW RATE(CFS) = 2.24

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.31 FLOW VELOCITY(FEET/SEC.) = 2.36
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 431.00 FEET.

FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 784.00 DOWNSTREAM(FEET) = 783.50
FLOW LENGTH(FEET) = 34.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.45
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.24
PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 9.21
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 465.00 FEET.

FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 9.21
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.594
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	1.12	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 1.12 SUBAREA RUNOFF(CFS) = 1.57
EFFECTIVE AREA(ACRES) = 2.71 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20

TOTAL AREA(ACRES) = 2.7 PEAK FLOW RATE(CFS) = 3.79

FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 783.50 DOWNSTREAM(FEET) = 781.00
FLOW LENGTH(FEET) = 193.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 9.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.73
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.79
PIPE TRAVEL TIME(MIN.) = 0.56 Tc(MIN.) = 9.77
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 658.00 FEET.

FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 9.77
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.541
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
APARTMENTS D 1.65 0.20 0.200 57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 1.65 SUBAREA RUNOFF(CFS) = 2.23
EFFECTIVE AREA(ACRES) = 4.36 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA(ACRES) = 4.4 PEAK FLOW RATE(CFS) = 5.89

FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 781.00 DOWNSTREAM(FEET) = 776.90
FLOW LENGTH(FEET) = 321.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.48
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 5.89
PIPE TRAVEL TIME(MIN.) = 0.83 Tc(MIN.) = 10.60
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 979.00 FEET.

FLOW PROCESS FROM NODE 6.00 TO NODE 6.00 IS CODE = 81

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

MAINLINE Tc(MIN.) = 10.60
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.471
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
APARTMENTS D 1.29 0.20 0.200 57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 1.29 SUBAREA RUNOFF(CFS) = 1.66
EFFECTIVE AREA(ACRES) = 5.65 AREA-AVERAGED Fm(INCH/HR) = 0.04

AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA (ACRES) = 5.7 PEAK FLOW RATE (CFS) = 7.28

FLOW PROCESS FROM NODE 6.00 TO NODE 7.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 776.90 DOWNSTREAM(FEET) = 776.70
FLOW LENGTH(FEET) = 18.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.56
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.28
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 10.64
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 7.00 = 997.00 FEET.

FLOW PROCESS FROM NODE 7.00 TO NODE 7.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 10.64
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.467
SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	1.25	0.20	0.200	57
APARTMENTS	D	1.30	0.20	0.200	57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA AREA(ACRES) = 2.55 SUBAREA RUNOFF(CFS) = 3.28
EFFECTIVE AREA(ACRES) = 8.20 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
TOTAL AREA(ACRES) = 8.2 PEAK FLOW RATE(CFS) = 10.53

FLOW PROCESS FROM NODE 7.00 TO NODE 8.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 776.70 DOWNSTREAM(FEET) = 775.00
FLOW LENGTH(FEET) = 164.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.00
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 10.53
PIPE TRAVEL TIME(MIN.) = 0.39 Tc(MIN.) = 11.03
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 8.00 = 1161.00 FEET.

FLOW PROCESS FROM NODE 8.00 TO NODE 9.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 775.00 DOWNSTREAM(FEET) = 766.65
FLOW LENGTH(FEET) = 107.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 8.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 14.98
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 10.53
PIPE TRAVEL TIME(MIN.) = 0.12 Tc(MIN.) = 11.15

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 9.00 = 1268.00 FEET.

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 21

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

=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 277.00
ELEVATION DATA: UPSTREAM(FEET) = 805.50 DOWNSTREAM(FEET) = 796.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.660
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.108

SUBAREA Tc AND LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.25 0.20 0.100 57 5.66
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.47
TOTAL AREA(ACRES) = 0.25 PEAK FLOW RATE(CFS) = 0.47

FLOW PROCESS FROM NODE 22.00 TO NODE 23.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====
ELEVATION DATA: UPSTREAM(FEET) = 796.00 DOWNSTREAM(FEET) = 786.26
CHANNEL LENGTH THRU SUBAREA(FEET) = 512.00 CHANNEL SLOPE = 0.0190
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.492
SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.56 0.20 0.100 57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.85
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.82
AVERAGE FLOW DEPTH(FEET) = 0.10 TRAVEL TIME(MIN.) = 4.68
Tc(MIN.) = 10.34
SUBAREA AREA(ACRES) = 0.56 SUBAREA RUNOFF(CFS) = 0.74
EFFECTIVE AREA(ACRES) = 0.81 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.8 PEAK FLOW RATE(CFS) = 1.07

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.10 FLOW VELOCITY(FEET/SEC.) = 1.99
LONGEST FLOWPATH FROM NODE 21.00 TO NODE 23.00 = 789.00 FEET.

FLOW PROCESS FROM NODE 23.00 TO NODE 24.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====
ELEVATION DATA: UPSTREAM(FEET) = 786.26 DOWNSTREAM(FEET) = 780.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 438.00 CHANNEL SLOPE = 0.0143
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.239
SUBAREA LOSS RATE DATA(AMC I):

30844P2.RES

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.45	0.20	0.100	57
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100					
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.32					
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.85					
AVERAGE FLOW DEPTH(FEET) = 0.12 TRAVEL TIME(MIN.) = 3.94					
Tc(MIN.) = 14.28					
SUBAREA AREA(ACRES) = 0.45		SUBAREA RUNOFF(CFS) = 0.49			
EFFECTIVE AREA(ACRES) = 1.26		AREA-AVERAGED Fm(INCH/HR) = 0.02			
AREA-AVERAGED Fp(INCH/HR) = 0.20		AREA-AVERAGED Ap = 0.10			
TOTAL AREA(ACRES) = 1.3		PEAK FLOW RATE(CFS) = 1.38			

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.12 FLOW VELOCITY(FEET/SEC.) = 1.77
 LONGEST FLOWPATH FROM NODE 21.00 TO NODE 24.00 = 1227.00 FEET.

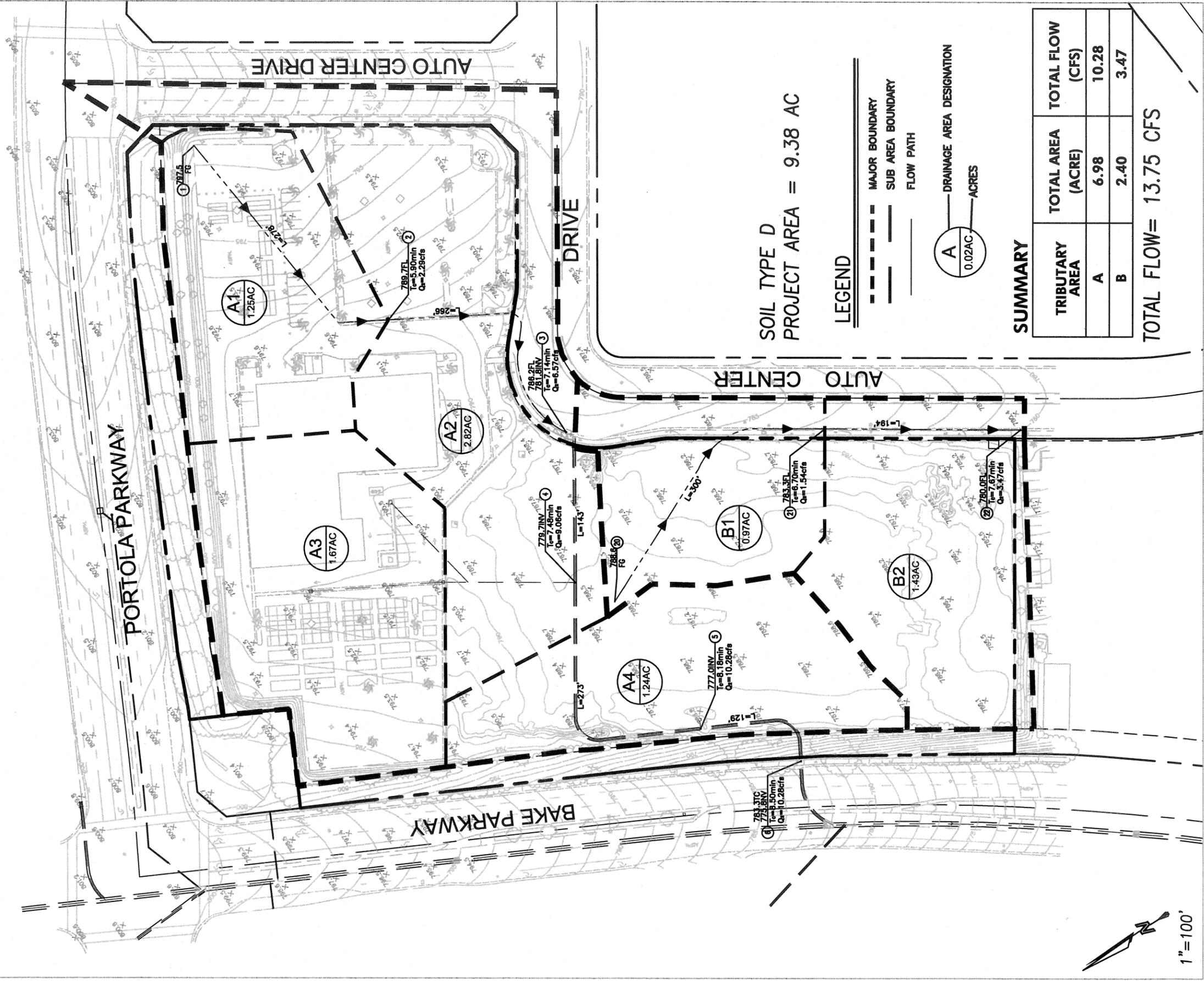
=====
 END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 1.3 TC(MIN.) = 14.28
 EFFECTIVE AREA(ACRES) = 1.26 AREA-AVERAGED Fm(INCH/HR) = 0.02
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS) = 1.38
 =====

=====
 END OF RATIONAL METHOD ANALYSIS

♀

B. EXISTING 2 YEAR HYDROLOGY MAP



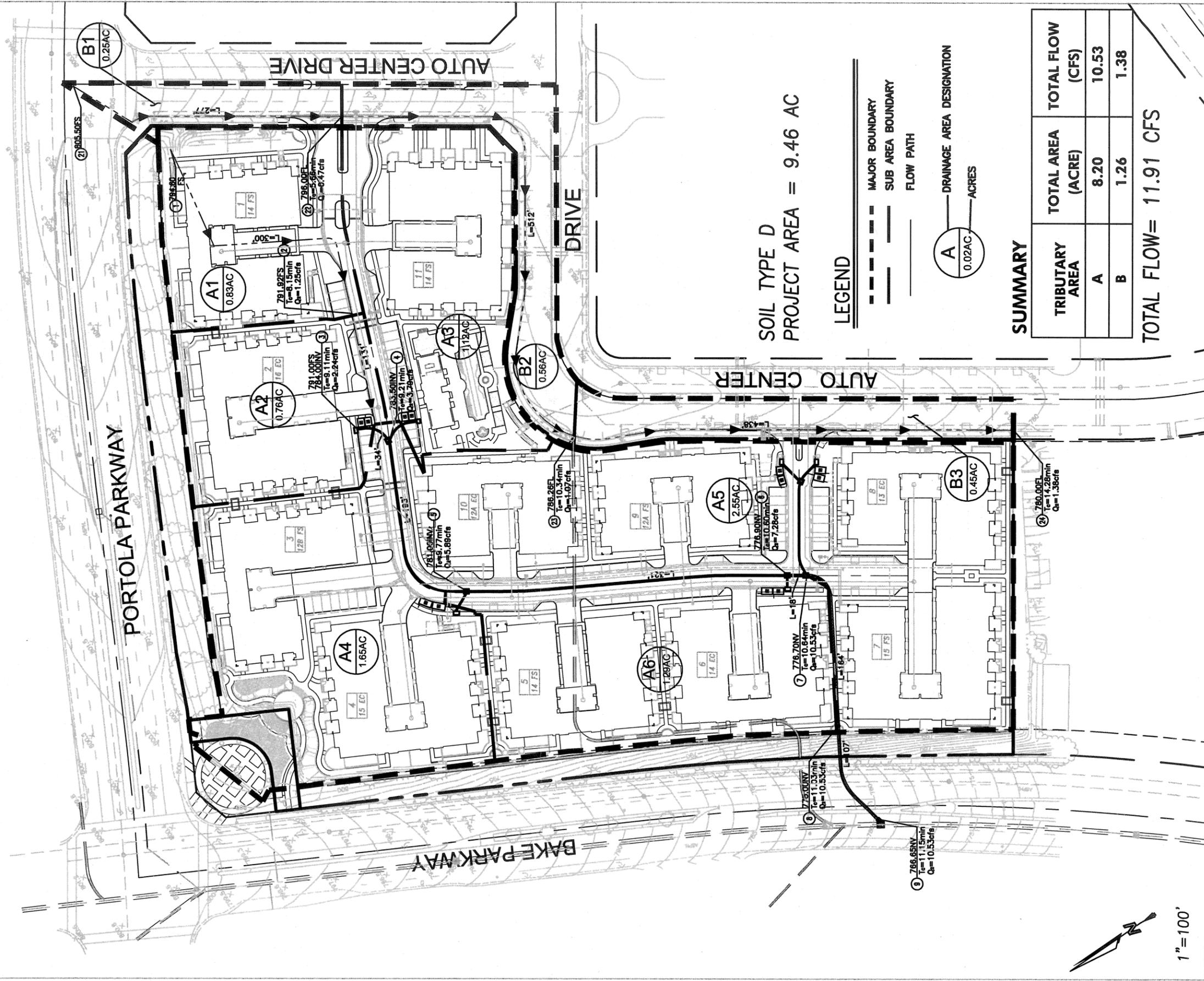
**FOOTHILL RANCH TOWN CENTER
EX 2 YEAR HYDROLOGY MAP
LAKE FOREST, CALIFORNIA**

JULY 23, 2012

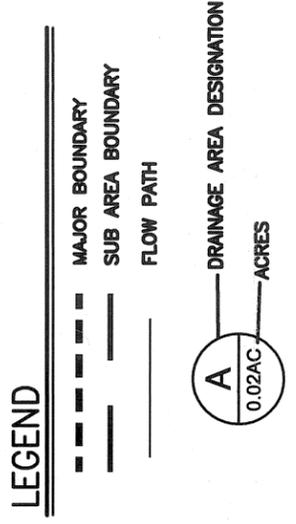


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tel 949.474.1960 • fax 949.474.5315
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C. PROPOSED 2 YEAR HYDROLOGY MAP



SOIL TYPE D
PROJECT AREA = 9.46 AC



SUMMARY

TRIBUTARY AREA	TOTAL AREA (ACRE)	TOTAL FLOW (CFS)
A	8.20	10.53
B	1.26	1.38

TOTAL FLOW = 11.91 CFS



1" = 100'

**FOOTHILL RANCH TOWN CENTER
PR 2 YEAR HYDROLOGY MAP
LAKE FOREST, CALIFORNIA**

JULY 23, 2012



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D. 2 YEAR UNIT HYDROGRAPH STUDY

EX. 2YR VOL.
CALC

VOLUME-2YR-EX.txt
VOLUME CALCULATION - 2 YR EXISTING (120328-SS)

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.93
 TOTAL CATCHMENT AREA (ACRES) = 9.38
 SOIL-LOSS RATE, Fm, (INCH/HR) = 0.095
 LOW LOSS FRACTION = 0.468
 TIME OF CONCENTRATION (MIN.) = 8.50
 SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
 ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
 RETURN FREQUENCY (YEARS) = 2
 5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.19
 30-MINUTE POINT RAINFALL VALUE (INCHES) = 0.40
 1-HOUR POINT RAINFALL VALUE (INCHES) = 0.53
 3-HOUR POINT RAINFALL VALUE (INCHES) = 0.89
 6-HOUR POINT RAINFALL VALUE (INCHES) = 1.22
 24-HOUR POINT RAINFALL VALUE (INCHES) = 2.05

TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 0.90
 TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 0.70

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	5.0	10.0	15.0	20.0
0.13	0.0009	0.15	Q	.	.	.	.
0.28	0.0026	0.15	Q	.	.	.	.
0.42	0.0044	0.15	Q	.	.	.	.
0.56	0.0061	0.15	Q	.	.	.	.
0.70	0.0079	0.15	Q	.	.	.	.
0.84	0.0097	0.15	Q	.	.	.	.
0.98	0.0115	0.15	Q	.	.	.	.
1.12	0.0133	0.15	Q	.	.	.	.
1.27	0.0151	0.16	Q	.	.	.	.
1.41	0.0169	0.16	Q	.	.	.	.
1.55	0.0188	0.16	Q	.	.	.	.
1.69	0.0206	0.16	Q	.	.	.	.
1.83	0.0225	0.16	Q	.	.	.	.
1.98	0.0243	0.16	Q	.	.	.	.
2.12	0.0262	0.16	Q	.	.	.	.
2.26	0.0281	0.16	Q	.	.	.	.
2.40	0.0300	0.16	Q	.	.	.	.
2.54	0.0319	0.16	Q	.	.	.	.
2.68	0.0339	0.17	Q	.	.	.	.
2.83	0.0358	0.17	Q	.	.	.	.
2.97	0.0378	0.17	Q	.	.	.	.
3.11	0.0397	0.17	Q	.	.	.	.
3.25	0.0417	0.17	Q	.	.	.	.
3.39	0.0437	0.17	Q	.	.	.	.
3.53	0.0457	0.17	Q	.	.	.	.
3.67	0.0477	0.17	Q	.	.	.	.
3.82	0.0498	0.17	Q	.	.	.	.
3.96	0.0518	0.18	Q	.	.	.	.
4.10	0.0539	0.18	Q	.	.	.	.
4.24	0.0560	0.18	Q	.	.	.	.
4.38	0.0581	0.18	Q	.	.	.	.
4.53	0.0602	0.18	Q	.	.	.	.
4.67	0.0623	0.18	Q	.	.	.	.
4.81	0.0645	0.18	Q	.	.	.	.
4.95	0.0667	0.19	Q	.	.	.	.
5.09	0.0688	0.19	Q	.	.	.	.

VOLUME-2YR-EX.txt

5.23	0.0710	0.19	Q	.	.	.	.
5.38	0.0733	0.19	Q	.	.	.	.
5.52	0.0755	0.19	Q	.	.	.	.
5.66	0.0778	0.19	Q	.	.	.	.
5.80	0.0800	0.19	Q	.	.	.	.
5.94	0.0823	0.20	Q	.	.	.	.
6.08	0.0846	0.20	Q	.	.	.	.
6.22	0.0870	0.20	Q	.	.	.	.
6.37	0.0893	0.20	Q	.	.	.	.
6.51	0.0917	0.20	Q	.	.	.	.
6.65	0.0941	0.21	Q	.	.	.	.
6.79	0.0965	0.21	Q	.	.	.	.
6.93	0.0990	0.21	Q	.	.	.	.
7.07	0.1014	0.21	Q	.	.	.	.
7.22	0.1039	0.21	Q	.	.	.	.
7.36	0.1065	0.22	Q	.	.	.	.
7.50	0.1090	0.22	Q	.	.	.	.
7.64	0.1116	0.22	Q	.	.	.	.
7.78	0.1142	0.22	Q	.	.	.	.
7.93	0.1168	0.23	Q	.	.	.	.
8.07	0.1195	0.23	Q	.	.	.	.
8.21	0.1221	0.23	Q	.	.	.	.
8.35	0.1249	0.23	Q	.	.	.	.
8.49	0.1276	0.24	Q	.	.	.	.
8.63	0.1304	0.24	Q	.	.	.	.
8.77	0.1332	0.24	Q	.	.	.	.
8.92	0.1360	0.24	Q	.	.	.	.
9.06	0.1389	0.25	Q	.	.	.	.
9.20	0.1418	0.25	Q	.	.	.	.
9.34	0.1448	0.25	Q	.	.	.	.
9.48	0.1478	0.26	Q	.	.	.	.
9.62	0.1508	0.26	Q	.	.	.	.
9.77	0.1539	0.26	Q	.	.	.	.
9.91	0.1570	0.27	Q	.	.	.	.
10.05	0.1602	0.27	Q	.	.	.	.
10.19	0.1634	0.28	Q	.	.	.	.
10.33	0.1666	0.28	Q	.	.	.	.
10.48	0.1699	0.29	Q	.	.	.	.
10.62	0.1733	0.29	Q	.	.	.	.
10.76	0.1767	0.29	Q	.	.	.	.
10.90	0.1802	0.30	Q	.	.	.	.
11.04	0.1837	0.31	Q	.	.	.	.
11.18	0.1873	0.31	Q	.	.	.	.
11.32	0.1910	0.32	Q	.	.	.	.
11.47	0.1947	0.32	Q	.	.	.	.
11.61	0.1985	0.33	Q	.	.	.	.
11.75	0.2024	0.33	Q	.	.	.	.
11.89	0.2063	0.34	Q	.	.	.	.
12.03	0.2103	0.35	Q	.	.	.	.
12.18	0.2149	0.43	Q	.	.	.	.
12.32	0.2200	0.44	Q	.	.	.	.
12.46	0.2253	0.45	Q	.	.	.	.
12.60	0.2306	0.46	Q	.	.	.	.
12.74	0.2360	0.47	Q	.	.	.	.
12.88	0.2416	0.48	Q	.	.	.	.
13.02	0.2473	0.50	Q	.	.	.	.
13.17	0.2532	0.50	.Q	.	.	.	.
13.31	0.2592	0.52	.Q	.	.	.	.
13.45	0.2654	0.53	.Q	.	.	.	.
13.59	0.2717	0.55	.Q	.	.	.	.
13.73	0.2783	0.57	.Q	.	.	.	.
13.88	0.2851	0.59	.Q	.	.	.	.
14.02	0.2921	0.61	.Q	.	.	.	.
14.16	0.2995	0.66	.Q	.	.	.	.
14.30	0.3073	0.68	.Q	.	.	.	.

VOLUME-2YR-EX.txt

14.44	0.3155	0.72	.Q	.	.	.	.
14.58	0.3240	0.74	.Q	.	.	.	.
14.73	0.3330	0.79	.Q	.	.	.	.
14.87	0.3425	0.82	.Q	.	.	.	.
15.01	0.3525	0.90	.Q	.	.	.	.
15.15	0.3633	0.94	.Q	.	.	.	.
15.29	0.3755	1.15	. Q	.	.	.	.
15.43	0.3897	1.27	. Q	.	.	.	.
15.57	0.4050	1.35	. Q	.	.	.	.
15.72	0.4224	1.63	. Q	.	.	.	.
15.86	0.4480	2.74	.	Q	.	.	.
16.00	0.4877	4.04	.	.	Q	.	.
16.14	0.5918	13.75	.	.	.	Q	.
16.28	0.6843	2.06	.	Q	.	.	.
16.42	0.7031	1.14	. Q	.	.	.	.
16.57	0.7159	1.04	. Q	.	.	.	.
16.71	0.7270	0.86	.Q	.	.	.	.
16.85	0.7365	0.77	.Q	.	.	.	.
16.99	0.7450	0.70	.Q	.	.	.	.
17.13	0.7528	0.63	.Q	.	.	.	.
17.27	0.7598	0.58	.Q	.	.	.	.
17.42	0.7664	0.54	.Q	.	.	.	.
17.56	0.7726	0.51	.Q	.	.	.	.
17.70	0.7784	0.49	Q	.	.	.	.
17.84	0.7840	0.47	Q	.	.	.	.
17.98	0.7893	0.45	Q	.	.	.	.
18.12	0.7942	0.38	Q	.	.	.	.
18.27	0.7984	0.34	Q	.	.	.	.
18.41	0.8022	0.32	Q	.	.	.	.
18.55	0.8060	0.31	Q	.	.	.	.
18.69	0.8096	0.30	Q	.	.	.	.
18.83	0.8130	0.29	Q	.	.	.	.
18.98	0.8164	0.28	Q	.	.	.	.
19.12	0.8197	0.27	Q	.	.	.	.
19.26	0.8228	0.27	Q	.	.	.	.
19.40	0.8259	0.26	Q	.	.	.	.
19.54	0.8289	0.25	Q	.	.	.	.
19.68	0.8318	0.25	Q	.	.	.	.
19.83	0.8346	0.24	Q	.	.	.	.
19.97	0.8374	0.23	Q	.	.	.	.
20.11	0.8401	0.23	Q	.	.	.	.
20.25	0.8428	0.22	Q	.	.	.	.
20.39	0.8454	0.22	Q	.	.	.	.
20.53	0.8479	0.22	Q	.	.	.	.
20.67	0.8504	0.21	Q	.	.	.	.
20.82	0.8529	0.21	Q	.	.	.	.
20.96	0.8553	0.20	Q	.	.	.	.
21.10	0.8576	0.20	Q	.	.	.	.
21.24	0.8599	0.20	Q	.	.	.	.
21.38	0.8622	0.19	Q	.	.	.	.
21.52	0.8645	0.19	Q	.	.	.	.
21.67	0.8667	0.19	Q	.	.	.	.
21.81	0.8688	0.18	Q	.	.	.	.
21.95	0.8710	0.18	Q	.	.	.	.
22.09	0.8731	0.18	Q	.	.	.	.
22.23	0.8751	0.18	Q	.	.	.	.
22.38	0.8772	0.17	Q	.	.	.	.
22.52	0.8792	0.17	Q	.	.	.	.
22.66	0.8812	0.17	Q	.	.	.	.
22.80	0.8831	0.17	Q	.	.	.	.
22.94	0.8850	0.16	Q	.	.	.	.
23.08	0.8870	0.16	Q	.	.	.	.
23.23	0.8888	0.16	Q	.	.	.	.
23.37	0.8907	0.16	Q	.	.	.	.
23.51	0.8925	0.16	Q	.	.	.	.

VOLUME-2YR-EX.txt

23.65	0.8943	0.15	Q	.	.	.	.
23.79	0.8961	0.15	Q	.	.	.	.
23.93	0.8979	0.15	Q	.	.	.	.
24.08	0.8997	0.15	Q	.	.	.	.
24.22	0.9005	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%	1445.0
10%	42.5
20%	17.0
30%	8.5
40%	8.5
50%	8.5
60%	8.5
70%	8.5
80%	8.5
90%	8.5

EX. 7 CALC

LOSS-2YR-EX.txt

LOSS CALCULATION - EXISTING 2 YR (120328-SS)

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

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.05 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	5.46	10.00	95.(AMC II)	0.200	0.847
2	3.92	100.00	83.(AMC II)	0.200	0.092

TOTAL AREA (Acres) = 9.38

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.095

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.468
=====

PROP. 2YR VOL.
CALC

VOLUME-2YR-PR.txt

VOLUME CALCULATION - PROPOSED 2 YR (120328-SS)

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
 TOTAL CATCHMENT AREA(ACRES) = 9.46
 SOIL-LOSS RATE, Fm, (INCH/HR) = 0.037
 LOW LOSS FRACTION = 0.270
 TIME OF CONCENTRATION(MIN.) = 11.03
 SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
 ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
 RETURN FREQUENCY(YEARS) = 2
 5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.19
 30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.40
 1-HOUR POINT RAINFALL VALUE(INCHES) = 0.53
 3-HOUR POINT RAINFALL VALUE(INCHES) = 0.89
 6-HOUR POINT RAINFALL VALUE(INCHES) = 1.22
 24-HOUR POINT RAINFALL VALUE(INCHES) = 2.05

TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 1.15
 TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.47

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	5.0	10.0	15.0	20.0
0.01	0.0000	0.00	Q	.	.	.	.
0.19	0.0015	0.20	Q	.	.	.	.
0.37	0.0045	0.20	Q	.	.	.	.
0.56	0.0076	0.20	Q	.	.	.	.
0.74	0.0107	0.20	Q	.	.	.	.
0.93	0.0138	0.20	Q	.	.	.	.
1.11	0.0169	0.21	Q	.	.	.	.
1.29	0.0201	0.21	Q	.	.	.	.
1.48	0.0232	0.21	Q	.	.	.	.
1.66	0.0264	0.21	Q	.	.	.	.
1.84	0.0297	0.21	Q	.	.	.	.
2.03	0.0329	0.21	Q	.	.	.	.
2.21	0.0362	0.22	Q	.	.	.	.
2.40	0.0395	0.22	Q	.	.	.	.
2.58	0.0428	0.22	Q	.	.	.	.
2.76	0.0462	0.22	Q	.	.	.	.
2.95	0.0496	0.22	Q	.	.	.	.
3.13	0.0530	0.23	Q	.	.	.	.
3.32	0.0565	0.23	Q	.	.	.	.
3.50	0.0599	0.23	Q	.	.	.	.
3.68	0.0634	0.23	Q	.	.	.	.
3.87	0.0670	0.23	Q	.	.	.	.
4.05	0.0706	0.24	Q	.	.	.	.
4.23	0.0742	0.24	Q	.	.	.	.
4.42	0.0778	0.24	Q	.	.	.	.
4.60	0.0815	0.24	Q	.	.	.	.
4.79	0.0852	0.25	Q	.	.	.	.
4.97	0.0890	0.25	Q	.	.	.	.
5.15	0.0928	0.25	Q	.	.	.	.
5.34	0.0966	0.25	Q	.	.	.	.
5.52	0.1005	0.26	Q	.	.	.	.
5.71	0.1044	0.26	Q	.	.	.	.
5.89	0.1084	0.26	Q	.	.	.	.
6.07	0.1124	0.26	Q	.	.	.	.
6.26	0.1165	0.27	Q	.	.	.	.
6.44	0.1206	0.27	Q	.	.	.	.

VOLUME-2YR-PR.txt

6.62	0.1247	0.28	Q	.	.	.	.
6.81	0.1289	0.28	Q	.	.	.	.
6.99	0.1332	0.28	Q	.	.	.	.
7.18	0.1375	0.28	Q	.	.	.	.
7.36	0.1418	0.29	Q	.	.	.	.
7.54	0.1463	0.29	Q	.	.	.	.
7.73	0.1507	0.30	Q	.	.	.	.
7.91	0.1553	0.30	Q	.	.	.	.
8.10	0.1599	0.31	Q	.	.	.	.
8.28	0.1646	0.31	Q	.	.	.	.
8.46	0.1693	0.32	Q	.	.	.	.
8.65	0.1741	0.32	Q	.	.	.	.
8.83	0.1790	0.32	Q	.	.	.	.
9.01	0.1840	0.33	Q	.	.	.	.
9.20	0.1890	0.34	Q	.	.	.	.
9.38	0.1941	0.34	Q	.	.	.	.
9.57	0.1993	0.35	Q	.	.	.	.
9.75	0.2047	0.35	Q	.	.	.	.
9.93	0.2101	0.36	Q	.	.	.	.
10.12	0.2156	0.36	Q	.	.	.	.
10.30	0.2212	0.37	Q	.	.	.	.
10.49	0.2269	0.38	Q	.	.	.	.
10.67	0.2327	0.39	Q	.	.	.	.
10.85	0.2387	0.40	Q	.	.	.	.
11.04	0.2448	0.41	Q	.	.	.	.
11.22	0.2510	0.41	Q	.	.	.	.
11.40	0.2574	0.43	Q	.	.	.	.
11.59	0.2639	0.43	Q	.	.	.	.
11.77	0.2707	0.45	Q	.	.	.	.
11.96	0.2775	0.46	Q	.	.	.	.
12.14	0.2851	0.54	.Q	.	.	.	.
12.32	0.2937	0.59	.Q	.	.	.	.
12.51	0.3027	0.61	.Q	.	.	.	.
12.69	0.3120	0.62	.Q	.	.	.	.
12.87	0.3216	0.64	.Q	.	.	.	.
13.06	0.3315	0.66	.Q	.	.	.	.
13.24	0.3418	0.69	.Q	.	.	.	.
13.43	0.3523	0.70	.Q	.	.	.	.
13.61	0.3633	0.74	.Q	.	.	.	.
13.79	0.3747	0.76	.Q	.	.	.	.
13.98	0.3866	0.81	.Q	.	.	.	.
14.16	0.3992	0.84	.Q	.	.	.	.
14.35	0.4128	0.95	.Q	.	.	.	.
14.53	0.4277	1.00	. Q	.	.	.	.
14.71	0.4438	1.12	. Q	.	.	.	.
14.90	0.4614	1.19	. Q	.	.	.	.
15.08	0.4808	1.37	. Q	.	.	.	.
15.26	0.5024	1.48	. Q	.	.	.	.
15.45	0.5264	1.67	. Q	.	.	.	.
15.63	0.5523	1.74	. Q	.	.	.	.
15.82	0.5857	2.66	. Q	.	.	.	.
16.00	0.6345	3.76	. Q	.	.	.	.
16.18	0.7536	11.91	.	.	.	Q	.
16.37	0.8598	2.07	. Q	.	.	.	.
16.55	0.8879	1.62	. Q	.	.	.	.
16.74	0.9099	1.27	. Q	.	.	.	.
16.92	0.9276	1.06	. Q	.	.	.	.
17.10	0.9425	0.91	.Q	.	.	.	.
17.29	0.9554	0.78	.Q	.	.	.	.
17.47	0.9668	0.72	.Q	.	.	.	.
17.65	0.9774	0.67	.Q	.	.	.	.
17.84	0.9873	0.63	.Q	.	.	.	.
18.02	0.9967	0.60	.Q	.	.	.	.
18.21	1.0047	0.47	Q	.	.	.	.
18.39	1.0116	0.44	Q	.	.	.	.

VOLUME-2YR-PR.txt

18.57	1.0182	0.42	Q	.	.	.	.
18.76	1.0244	0.40	Q	.	.	.	.
18.94	1.0304	0.38	Q	.	.	.	.
19.13	1.0361	0.37	Q	.	.	.	.
19.31	1.0416	0.36	Q	.	.	.	.
19.49	1.0469	0.34	Q	.	.	.	.
19.68	1.0520	0.33	Q	.	.	.	.
19.86	1.0570	0.32	Q	.	.	.	.
20.04	1.0618	0.31	Q	.	.	.	.
20.23	1.0665	0.30	Q	.	.	.	.
20.41	1.0710	0.29	Q	.	.	.	.
20.60	1.0754	0.29	Q	.	.	.	.
20.78	1.0798	0.28	Q	.	.	.	.
20.96	1.0840	0.27	Q	.	.	.	.
21.15	1.0881	0.27	Q	.	.	.	.
21.33	1.0921	0.26	Q	.	.	.	.
21.52	1.0960	0.26	Q	.	.	.	.
21.70	1.0998	0.25	Q	.	.	.	.
21.88	1.1036	0.24	Q	.	.	.	.
22.07	1.1073	0.24	Q	.	.	.	.
22.25	1.1109	0.24	Q	.	.	.	.
22.43	1.1144	0.23	Q	.	.	.	.
22.62	1.1179	0.23	Q	.	.	.	.
22.80	1.1213	0.22	Q	.	.	.	.
22.99	1.1247	0.22	Q	.	.	.	.
23.17	1.1280	0.22	Q	.	.	.	.
23.35	1.1313	0.21	Q	.	.	.	.
23.54	1.1345	0.21	Q	.	.	.	.
23.72	1.1376	0.21	Q	.	.	.	.
23.90	1.1407	0.20	Q	.	.	.	.
24.09	1.1438	0.20	Q	.	.	.	.
24.27	1.1453	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%	1444.9
10%	110.3
20%	33.1
30%	22.1
40%	11.0
50%	11.0
60%	11.0
70%	11.0
80%	11.0
90%	11.0

PROP. F CALC.

LOSS-2YR-PR.txt

LOSS CALCULATION - PROPOSED 2 YR (120328-SS)

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

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.05 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	8.20	20.00	57.(AMC II)	0.200	0.712
2	1.26	10.00	95.(AMC II)	0.200	0.847

TOTAL AREA (Acres) = 9.46

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.037

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.270
=====

EX. 25 YR
HYDROLOGY

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2010 Advanced Engineering Software (aes)
Ver. 17.0 Release Date: 07/01/2010 License ID 1355

Analysis prepared by:

Fusco Engineering, Inc.
16795 Von Karman Ave. Ste. 100
Irvine, California 92606
PH: 949-474-1960 Fax: 949-474-5315

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

* FOOTHILL RANCH TOWN CENTER *
* EX. 25 YR HYDROLOGY *
* 120327-SS *

FILE NAME: 30844X25.DAT
TIME/DATE OF STUDY: 14:06 03/27/2012

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 25.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

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

NO.	WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL IN- / OUT- / SIDE / SIDE / WAY	HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	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)

SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 278.00
ELEVATION DATA: UPSTREAM(FEET) = 797.50 DOWNSTREAM(FEET) = 789.70

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.900
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.392
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SC5 SOIL AREA Fp Ap SC5 Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 1.25 0.20 0.100 75 5.90
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 4.92
 TOTAL AREA(ACRES) = 1.25 PEAK FLOW RATE(CFS) = 4.92

 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 789.70 DOWNSTREAM(FEET) = 786.20
 CHANNEL LENGTH THRU SUBAREA(FEET) = 266.00 CHANNEL SLOPE = 0.0132
 CHANNEL BASE(FEET) = 1.00 "Z" FACTOR = 10.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.014
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	2.08	0.20	0.100	75
NATURAL POOR COVER "BARREN"	D	0.74	0.20	1.000	93

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.336
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.93
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.36
 AVERAGE FLOW DEPTH(FEET) = 0.43 TRAVEL TIME(MIN.) = 1.02
 Tc(MIN.) = 6.92
 SUBAREA AREA(ACRES) = 2.82 SUBAREA RUNOFF(CFS) = 10.02
 EFFECTIVE AREA(ACRES) = 4.07 AREA-AVERAGED Fm(INCH/HR) = 0.05
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.26
 TOTAL AREA(ACRES) = 4.1 PEAK FLOW RATE(CFS) = 14.51

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.50 FLOW VELOCITY(FEET/SEC.) = 4.82
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 544.00 FEET.

 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 781.80 DOWNSTREAM(FEET) = 779.70
 FLOW LENGTH(FEET) = 143.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 13.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 8.59
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 14.51
 PIPE TRAVEL TIME(MIN.) = 0.28 Tc(MIN.) = 7.20
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 687.00 FEET.

 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 7.20
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.926
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	1.67	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 1.67 SUBAREA RUNOFF(CFS) = 5.87

30844X25.RES

EFFECTIVE AREA(ACRES) = 5.74 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.22
TOTAL AREA(ACRES) = 5.7 PEAK FLOW RATE(CFS) = 20.06

FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 779.70 DOWNSTREAM(FEET) = 777.00
FLOW LENGTH(FEET) = 273.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.91
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 20.06
PIPE TRAVEL TIME(MIN.) = 0.57 Tc(MIN.) = 7.77
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 960.00 FEET.

FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 81

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

=====

MAINLINE Tc(MIN.) = 7.77
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.758
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL POOR COVER "BARREN"	D	1.24	0.20	1.000	93

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA(ACRES) = 1.24 SUBAREA RUNOFF(CFS) = 3.97
EFFECTIVE AREA(ACRES) = 6.98 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.36
TOTAL AREA(ACRES) = 7.0 PEAK FLOW RATE(CFS) = 23.16

FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 777.00 DOWNSTREAM(FEET) = 775.80
FLOW LENGTH(FEET) = 129.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 27.0 INCH PIPE IS 18.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.13
ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 23.16
PIPE TRAVEL TIME(MIN.) = 0.26 Tc(MIN.) = 8.03
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 1089.00 FEET.

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 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) = 788.50 DOWNSTREAM(FEET) = 783.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.698
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.088

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
NATURAL POOR COVER						
"BARREN"	D	0.71	0.20	1.000	93	11.57
COMMERCIAL	D	0.26	0.20	0.100	75	6.70
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20						
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.759						
SUBAREA RUNOFF(CFS) = 3.44						
TOTAL AREA(ACRES) = 0.97 PEAK FLOW RATE(CFS) = 3.44						

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 783.30 DOWNSTREAM(FEET) = 780.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 194.00 CHANNEL SLOPE = 0.0170
CHANNEL BASE(FEET) = 1.00 "Z" FACTOR = 10.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.843

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL POOR COVER					
"BARREN"	D	1.23	0.20	1.000	93
COMMERCIAL	D	0.20	0.20	0.100	75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.874					
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.80					
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.19					
AVERAGE FLOW DEPTH(FEET) = 0.33 TRAVEL TIME(MIN.) = 0.77					
Tc(MIN.) = 7.47					
SUBAREA AREA(ACRES) = 1.43 SUBAREA RUNOFF(CFS) = 4.72					
EFFECTIVE AREA(ACRES) = 2.40 AREA-AVERAGED Fm(INCH/HR) = 0.17					
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.83					
TOTAL AREA(ACRES) = 2.4 PEAK FLOW RATE(CFS) = 7.94					

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.37 FLOW VELOCITY(FEET/SEC.) = 4.55
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 494.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.4 TC(MIN.) = 7.47
EFFECTIVE AREA(ACRES) = 2.40 AREA-AVERAGED Fm(INCH/HR) = 0.17
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.827
PEAK FLOW RATE(CFS) = 7.94

=====

END OF RATIONAL METHOD ANALYSIS

♀

VOLUME CALCULATION - 25 YR EXISTING (120720-SS)

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.91
 TOTAL CATCHMENT AREA (ACRES) = 9.38
 SOIL-LOSS RATE, Fm, (INCH/HR) = 0.095
 LOW LOSS FRACTION = 0.200
 TIME OF CONCENTRATION (MIN.) = 7.77
 SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
 ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
 RETURN FREQUENCY (YEARS) = 25
 5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.40
 30-MINUTE POINT RAINFALL VALUE (INCHES) = 0.87
 1-HOUR POINT RAINFALL VALUE (INCHES) = 1.15
 3-HOUR POINT RAINFALL VALUE (INCHES) = 1.94
 6-HOUR POINT RAINFALL VALUE (INCHES) = 2.71
 24-HOUR POINT RAINFALL VALUE (INCHES) = 4.49

TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 2.63
 TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 0.88

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	10.0	20.0	30.0	40.0
0.07	0.0014	0.47	Q	.	.	.	.
0.20	0.0064	0.47	Q	.	.	.	.
0.33	0.0114	0.47	Q	.	.	.	.
0.46	0.0164	0.47	Q	.	.	.	.
0.59	0.0215	0.47	Q	.	.	.	.
0.72	0.0266	0.48	Q	.	.	.	.
0.85	0.0317	0.48	Q	.	.	.	.
0.98	0.0368	0.48	Q	.	.	.	.
1.11	0.0420	0.49	Q	.	.	.	.
1.24	0.0472	0.49	Q	.	.	.	.
1.37	0.0524	0.49	Q	.	.	.	.
1.50	0.0577	0.49	Q	.	.	.	.
1.63	0.0630	0.50	Q	.	.	.	.
1.75	0.0683	0.50	Q	.	.	.	.
1.88	0.0737	0.50	Q	.	.	.	.
2.01	0.0790	0.50	Q	.	.	.	.
2.14	0.0845	0.51	Q	.	.	.	.
2.27	0.0899	0.51	Q	.	.	.	.
2.40	0.0954	0.51	Q	.	.	.	.
2.53	0.1009	0.52	Q	.	.	.	.
2.66	0.1064	0.52	Q	.	.	.	.
2.79	0.1120	0.52	Q	.	.	.	.
2.92	0.1176	0.53	Q	.	.	.	.
3.05	0.1233	0.53	Q	.	.	.	.
3.18	0.1290	0.53	Q	.	.	.	.
3.31	0.1347	0.54	Q	.	.	.	.
3.44	0.1404	0.54	Q	.	.	.	.
3.57	0.1462	0.54	Q	.	.	.	.
3.70	0.1521	0.55	Q	.	.	.	.
3.83	0.1579	0.55	Q	.	.	.	.
3.96	0.1639	0.55	Q	.	.	.	.
4.09	0.1698	0.56	Q
4.22	0.1758	0.56	Q
4.35	0.1818	0.57	Q
4.47	0.1879	0.57	Q
4.60	0.1940	0.57	Q

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4.73	0.2002	0.58	Q
4.86	0.2064	0.58	Q
4.99	0.2127	0.59	Q
5.12	0.2190	0.59	Q
5.25	0.2253	0.60	Q
5.38	0.2317	0.60	Q
5.51	0.2382	0.61	Q	.	.	.	.
5.64	0.2447	0.61	Q	.	.	.	.
5.77	0.2512	0.62	Q	.	.	.	.
5.90	0.2578	0.62	Q	.	.	.	.
6.03	0.2645	0.63	Q	.	.	.	.
6.16	0.2712	0.63	Q	.	.	.	.
6.29	0.2779	0.64	Q	.	.	.	.
6.42	0.2847	0.64	Q	.	.	.	.
6.55	0.2916	0.65	Q	.	.	.	.
6.68	0.2986	0.65	Q	.	.	.	.
6.81	0.3056	0.66	Q	.	.	.	.
6.93	0.3126	0.66	Q	.	.	.	.
7.06	0.3197	0.67	Q	.	.	.	.
7.19	0.3269	0.67	Q	.	.	.	.
7.32	0.3342	0.68	Q	.	.	.	.
7.45	0.3415	0.69	Q	.	.	.	.
7.58	0.3489	0.70	Q	.	.	.	.
7.71	0.3564	0.70	Q	.	.	.	.
7.84	0.3639	0.71	Q	.	.	.	.
7.97	0.3715	0.71	Q	.	.	.	.
8.10	0.3792	0.72	Q	.	.	.	.
8.23	0.3870	0.73	Q	.	.	.	.
8.36	0.3949	0.74	Q	.	.	.	.
8.49	0.4028	0.74	Q	.	.	.	.
8.62	0.4108	0.76	Q	.	.	.	.
8.75	0.4189	0.76	Q	.	.	.	.
8.88	0.4271	0.77	Q	.	.	.	.
9.01	0.4354	0.78	Q	.	.	.	.
9.14	0.4438	0.79	Q	.	.	.	.
9.27	0.4523	0.80	Q	.	.	.	.
9.40	0.4609	0.81	Q	.	.	.	.
9.52	0.4696	0.82	Q	.	.	.	.
9.65	0.4785	0.83	Q	.	.	.	.
9.78	0.4874	0.84	Q	.	.	.	.
9.91	0.4964	0.85	Q	.	.	.	.
10.04	0.5056	0.86	Q	.	.	.	.
10.17	0.5149	0.88	Q	.	.	.	.
10.30	0.5243	0.88	Q	.	.	.	.
10.43	0.5339	0.90	Q	.	.	.	.
10.56	0.5436	0.91	Q	.	.	.	.
10.69	0.5534	0.93	Q	.	.	.	.
10.82	0.5634	0.94	Q	.	.	.	.
10.95	0.5735	0.96	Q	.	.	.	.
11.08	0.5838	0.97	Q	.	.	.	.
11.21	0.5943	0.99	Q	.	.	.	.
11.34	0.6050	1.00	.Q	.	.	.	.
11.47	0.6158	1.03	.Q	.	.	.	.
11.60	0.6269	1.04	.Q	.	.	.	.
11.73	0.6381	1.06	.Q	.	.	.	.
11.86	0.6496	1.08	.Q	.	.	.	.
11.99	0.6612	1.11	.Q	.	.	.	.
12.12	0.6738	1.24	.Q	.	.	.	.
12.24	0.6886	1.52	.Q	.	.	.	.
12.37	0.7049	1.54	.Q	.	.	.	.
12.50	0.7216	1.57	.Q
12.63	0.7385	1.59	.Q
12.76	0.7558	1.64	.Q
12.89	0.7735	1.66	.Q
13.02	0.7915	1.71	.Q

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13.15	0.8099	1.73	.Q
13.28	0.8287	1.79	.Q
13.41	0.8480	1.82	.Q
13.54	0.8678	1.88	.Q
13.67	0.8881	1.91	.Q
13.80	0.9089	1.99	.Q	.	.	.	.
13.93	0.9304	2.03	. Q	.	.	.	.
14.06	0.9526	2.11	. Q	.	.	.	.
14.19	0.9753	2.13	. Q	.	.	.	.
14.32	0.9987	2.24	. Q	.	.	.	.
14.45	1.0230	2.30	. Q	.	.	.	.
14.58	1.0483	2.43	. Q	.	.	.	.
14.70	1.0748	2.51	. Q	.	.	.	.
14.83	1.1026	2.69	. Q	.	.	.	.
14.96	1.1319	2.79	. Q	.	.	.	.
15.09	1.1631	3.03	. Q	.	.	.	.
15.22	1.1964	3.18	. Q	.	.	.	.
15.35	1.2328	3.63	. Q	.	.	.	.
15.48	1.2705	3.41	. Q	.	.	.	.
15.61	1.3104	4.04	. Q	.	.	.	.
15.74	1.3569	4.66	. Q	.	.	.	.
15.87	1.4218	7.48	. Q	.	.	.	.
16.00	1.5174	10.38	. Q	.	.	.	.
16.13	1.7394	31.11	.	.	.	.Q	.
16.26	1.9378	5.95	. Q	.	.	.	.
16.39	1.9888	3.57	. Q	.	.	.	.
16.52	2.0260	3.38	. Q	.	.	.	.
16.65	2.0596	2.90	. Q	.	.	.	.
16.78	2.0891	2.59	. Q	.	.	.	.
16.91	2.1156	2.37	. Q	.	.	.	.
17.04	2.1399	2.19	. Q	.	.	.	.
17.17	2.1627	2.07	. Q	.	.	.	.
17.30	2.1842	1.95	.Q	.	.	.	.
17.42	2.2045	1.85	.Q	.	.	.	.
17.55	2.2238	1.76	.Q	.	.	.	.
17.68	2.2422	1.68	.Q	.	.	.	.
17.81	2.2599	1.62	.Q	.	.	.	.
17.94	2.2769	1.56	.Q	.	.	.	.
18.07	2.2932	1.50	.Q	.	.	.	.
18.20	2.3071	1.09	.Q	.	.	.	.
18.33	2.3186	1.05	.Q	.	.	.	.
18.46	2.3296	1.01	.Q	.	.	.	.
18.59	2.3403	0.98	Q	.	.	.	.
18.72	2.3506	0.95	Q	.	.	.	.
18.85	2.3606	0.92	Q	.	.	.	.
18.98	2.3703	0.89	Q	.	.	.	.
19.11	2.3797	0.87	Q	.	.	.	.
19.24	2.3888	0.85	Q	.	.	.	.
19.37	2.3978	0.82	Q	.	.	.	.
19.50	2.4065	0.80	Q	.	.	.	.
19.63	2.4150	0.78	Q	.	.	.	.
19.76	2.4233	0.77	Q	.	.	.	.
19.89	2.4314	0.75	Q	.	.	.	.
20.01	2.4393	0.73	Q	.	.	.	.
20.14	2.4471	0.72	Q	.	.	.	.
20.27	2.4547	0.70	Q	.	.	.	.
20.40	2.4622	0.69	Q	.	.	.	.
20.53	2.4695	0.68	Q	.	.	.	.
20.66	2.4767	0.67	Q	.	.	.	.
20.79	2.4838	0.65	Q	.	.	.	.
20.92	2.4907	0.64	Q
21.05	2.4975	0.63	Q
21.18	2.5042	0.62	Q
21.31	2.5108	0.61	Q
21.44	2.5173	0.60	Q

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21.57	2.5237	0.59	Q
21.70	2.5300	0.58	Q
21.83	2.5362	0.58	Q
21.96	2.5424	0.57	Q
22.09	2.5484	0.56	Q
22.22	2.5544	0.55	Q	.	.	.	.
22.35	2.5602	0.55	Q	.	.	.	.
22.48	2.5660	0.54	Q	.	.	.	.
22.60	2.5717	0.53	Q	.	.	.	.
22.73	2.5774	0.52	Q	.	.	.	.
22.86	2.5830	0.52	Q	.	.	.	.
22.99	2.5885	0.51	Q	.	.	.	.
23.12	2.5939	0.51	Q	.	.	.	.
23.25	2.5993	0.50	Q	.	.	.	.
23.38	2.6046	0.49	Q	.	.	.	.
23.51	2.6099	0.49	Q	.	.	.	.
23.64	2.6151	0.48	Q	.	.	.	.
23.77	2.6202	0.48	Q	.	.	.	.
23.90	2.6253	0.47	Q	.	.	.	.
24.03	2.6304	0.47	Q	.	.	.	.
24.16	2.6329	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%	1445.2
10%	85.5
20%	23.3
30%	15.5
40%	7.8
50%	7.8
60%	7.8
70%	7.8
80%	7.8
90%	7.8

EX. Y CALC.

LOSS-25YR-EX.txt

LOSS CALCULATION - EXISTING 25 YR (120720-SS)

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

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 4.49 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	5.46	10.00	95.	0.200	0.940
2	3.92	100.00	83.	0.200	0.605

TOTAL AREA (Acres) = 9.38

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.095

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.200
=====

PROP. 25 YR
HYDROLOGY

30844P25.RES

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 17.0 Release Date: 07/01/2010 License ID 1355

Analysis prepared by:

Fusco Engineering, Inc.
16795 Von Karman Ave. Ste. 100
Irvine, California 92606
PH: 949-474-1960 Fax: 949-474-5315

***** DESCRIPTION OF STUDY *****
* LAKE FOREST TOWN CENTER *
* PROPOSED 25 YEAR HYDROLOGY *
* 120328-SS *

FILE NAME: 30844P25.DAT
TIME/DATE OF STUDY: 17:40 03/28/2012

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT (YEAR) = 25.00
SPECIFIED MINIMUM PIPE SIZE (INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II 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-GEOMETRIES: WIDTH LIP (FT) (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0313	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)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 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) = 794.60 DOWNSTREAM (FEET) = 791.92

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20

SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.151

* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.658

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
APARTMENTS	D	0.83	0.20	0.200	75	8.15

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, $A_p = 0.200$
 SUBAREA RUNOFF(CFS) = 2.70
 TOTAL AREA(ACRES) = 0.83 PEAK FLOW RATE(CFS) = 2.70

FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 791.92 DOWNSTREAM(FEET) = 791.00
 CHANNEL LENGTH THRU SUBAREA(FEET) = 131.00 CHANNEL SLOPE = 0.0070
 CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 10.000
 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.470

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	0.76	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, $A_p = 0.200$
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.88
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.73
 AVERAGE FLOW DEPTH(FEET) = 0.38 TRAVEL TIME(MIN.) = 0.80
 T_c (MIN.) = 8.95
 SUBAREA AREA(ACRES) = 0.76 SUBAREA RUNOFF(CFS) = 2.35
 EFFECTIVE AREA(ACRES) = 1.59 AREA-AVERAGED F_m (INCH/HR) = 0.04
 AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED $A_p = 0.20$
 TOTAL AREA(ACRES) = 1.6 PEAK FLOW RATE(CFS) = 4.91

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.41 FLOW VELOCITY(FEET/SEC.) = 2.85
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 431.00 FEET.

FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 784.00 DOWNSTREAM(FEET) = 783.50
 FLOW LENGTH(FEET) = 34.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 15.0 INCH PIPE IS 8.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.60
 ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 4.91
 PIPE TRAVEL TIME(MIN.) = 0.09 T_c (MIN.) = 9.04
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 465.00 FEET.

FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81

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

=====

MAINLINE T_c (MIN.) = 9.04
 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.451
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	1.12	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, $A_p = 0.200$
 SUBAREA AREA(ACRES) = 1.12 SUBAREA RUNOFF(CFS) = 3.44
 EFFECTIVE AREA(ACRES) = 2.71 AREA-AVERAGED F_m (INCH/HR) = 0.04
 AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED $A_p = 0.20$

TOTAL AREA (ACRES) = 2.7 PEAK FLOW RATE (CFS) = 8.32

 FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM (FEET) = 783.50 DOWNSTREAM (FEET) = 781.00
 FLOW LENGTH (FEET) = 193.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.2 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 7.16
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 8.32
 PIPE TRAVEL TIME (MIN.) = 0.45 Tc (MIN.) = 9.48
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 658.00 FEET.

 FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 9.48
 * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.357
 SUBAREA LOSS RATE DATA (AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 APARTMENTS D 1.65 0.20 0.200 75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 1.65 SUBAREA RUNOFF (CFS) = 4.93
 EFFECTIVE AREA (ACRES) = 4.36 AREA-AVERAGED Fm (INCH/HR) = 0.04
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
 TOTAL AREA (ACRES) = 4.4 PEAK FLOW RATE (CFS) = 13.02

 FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM (FEET) = 781.00 DOWNSTREAM (FEET) = 776.90
 FLOW LENGTH (FEET) = 321.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 13.5 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 7.96
 ESTIMATED PIPE DIAMETER (INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 13.02
 PIPE TRAVEL TIME (MIN.) = 0.67 Tc (MIN.) = 10.16
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 979.00 FEET.

 FLOW PROCESS FROM NODE 6.00 TO NODE 6.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 10.16
 * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.230
 SUBAREA LOSS RATE DATA (AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 APARTMENTS D 1.29 0.20 0.200 75
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 1.29 SUBAREA RUNOFF (CFS) = 3.70
 EFFECTIVE AREA (ACRES) = 5.65 AREA-AVERAGED Fm (INCH/HR) = 0.04

AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
 TOTAL AREA (ACRES) = 5.7 PEAK FLOW RATE (CFS) = 16.22

 FLOW PROCESS FROM NODE 6.00 TO NODE 7.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM (FEET) = 776.90 DOWNSTREAM (FEET) = 776.70
 FLOW LENGTH (FEET) = 18.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 17.1 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 7.72
 ESTIMATED PIPE DIAMETER (INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 16.22
 PIPE TRAVEL TIME (MIN.) = 0.04 Tc (MIN.) = 10.20
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 7.00 = 997.00 FEET.

 FLOW PROCESS FROM NODE 7.00 TO NODE 7.00 IS CODE = 81

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

=====

MAINLINE Tc (MIN.) = 10.20
 * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.223
 SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
APARTMENTS	D	1.25	0.20	0.200	75
APARTMENTS	D	1.30	0.20	0.200	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
 SUBAREA AREA (ACRES) = 2.55 SUBAREA RUNOFF (CFS) = 7.30
 EFFECTIVE AREA (ACRES) = 8.20 AREA-AVERAGED Fm (INCH/HR) = 0.04
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20
 TOTAL AREA (ACRES) = 8.2 PEAK FLOW RATE (CFS) = 23.49

 FLOW PROCESS FROM NODE 7.00 TO NODE 8.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM (FEET) = 776.70 DOWNSTREAM (FEET) = 775.00
 FLOW LENGTH (FEET) = 164.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.7 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 8.51
 ESTIMATED PIPE DIAMETER (INCH) = 27.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 23.49
 PIPE TRAVEL TIME (MIN.) = 0.32 Tc (MIN.) = 10.52
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 8.00 = 1161.00 FEET.

 FLOW PROCESS FROM NODE 8.00 TO NODE 9.00 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM (FEET) = 775.00 DOWNSTREAM (FEET) = 766.65
 FLOW LENGTH (FEET) = 107.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.4 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 18.06
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 23.49
 PIPE TRAVEL TIME (MIN.) = 0.10 Tc (MIN.) = 10.62

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 9.00 = 1268.00 FEET.

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 21

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

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 277.00
ELEVATION DATA: UPSTREAM(FEET) = 805.50 DOWNSTREAM(FEET) = 796.00

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.660
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.497
SUBAREA T_c AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	D	0.25	0.20	0.100	75	5.66

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 1.01
TOTAL AREA(ACRES) = 0.25 PEAK FLOW RATE(CFS) = 1.01

FLOW PROCESS FROM NODE 22.00 TO NODE 23.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 796.00 DOWNSTREAM(FEET) = 786.26
CHANNEL LENGTH THRU SUBAREA(FEET) = 512.00 CHANNEL SLOPE = 0.0190
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.316
SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	D	0.56	0.20	0.100	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.86
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.12
AVERAGE FLOW DEPTH(FEET) = 0.13 TRAVEL TIME(MIN.) = 4.03
 T_c (MIN.) = 9.69
SUBAREA AREA(ACRES) = 0.56 SUBAREA RUNOFF(CFS) = 1.66
EFFECTIVE AREA(ACRES) = 0.81 AREA-AVERAGED F_m (INCH/HR) = 0.02
AREA-AVERAGED F_p (INCH/HR) = 0.20 AREA-AVERAGED A_p = 0.10
TOTAL AREA(ACRES) = 0.8 PEAK FLOW RATE(CFS) = 2.40

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.14 FLOW VELOCITY(FEET/SEC.) = 2.38
LONGEST FLOWPATH FROM NODE 21.00 TO NODE 23.00 = 789.00 FEET.

FLOW PROCESS FROM NODE 23.00 TO NODE 24.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 786.26 DOWNSTREAM(FEET) = 780.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 438.00 CHANNEL SLOPE = 0.0143
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 50.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 2.813
SUBAREA LOSS RATE DATA(AMC II):

30844P25.RES

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	0.45	0.20	0.100	75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20					
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100					
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 2.97					
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 2.23					
AVERAGE FLOW DEPTH (FEET) = 0.16 TRAVEL TIME (MIN.) = 3.27					
Tc (MIN.) = 12.96					
SUBAREA AREA (ACRES) = 0.45 SUBAREA RUNOFF (CFS) = 1.13					
EFFECTIVE AREA (ACRES) = 1.26 AREA-AVERAGED Fm (INCH/HR) = 0.02					
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10					
TOTAL AREA (ACRES) = 1.3 PEAK FLOW RATE (CFS) = 3.17					

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH (FEET) = 0.16 FLOW VELOCITY (FEET/SEC.) = 2.33
 LONGEST FLOWPATH FROM NODE 21.00 TO NODE 24.00 = 1227.00 FEET.

=====
 END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 1.3 TC (MIN.) = 12.96
 EFFECTIVE AREA (ACRES) = 1.26 AREA-AVERAGED Fm (INCH/HR) = 0.02
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE (CFS) = 3.17
 =====

=====
 END OF RATIONAL METHOD ANALYSIS

‡

PROP. 25 YR VOL.
CALC.

VOLUME-25YR-PR.txt

VOLUME CALCULATION - PROPOSED 25 YR (120720-SS)

RATIONAL METHOD CALIBRATION COEFFICIENT = 0.91
TOTAL CATCHMENT AREA (ACRES) = 9.46
SOIL-LOSS RATE, Fm, (INCH/HR) = 0.037
LOW LOSS FRACTION = 0.185
TIME OF CONCENTRATION (MIN.) = 10.62
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
RETURN FREQUENCY (YEARS) = 25
5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.40
30-MINUTE POINT RAINFALL VALUE (INCHES) = 0.87
1-HOUR POINT RAINFALL VALUE (INCHES) = 1.15
3-HOUR POINT RAINFALL VALUE (INCHES) = 1.94
6-HOUR POINT RAINFALL VALUE (INCHES) = 2.71
24-HOUR POINT RAINFALL VALUE (INCHES) = 4.49

TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 2.80
TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 0.73

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	7.5	15.0	22.5	30.0
0.07	0.0000	0.00	Q	.	.	.	.
0.25	0.0035	0.48	Q	.	.	.	.
0.42	0.0106	0.48	Q	.	.	.	.
0.60	0.0177	0.49	Q	.	.	.	.
0.78	0.0248	0.49	Q	.	.	.	.
0.96	0.0320	0.49	Q	.	.	.	.
1.13	0.0393	0.50	Q	.	.	.	.
1.31	0.0466	0.50	Q	.	.	.	.
1.49	0.0539	0.50	Q	.	.	.	.
1.66	0.0614	0.51	Q	.	.	.	.
1.84	0.0688	0.51	Q	.	.	.	.
2.02	0.0764	0.52	Q	.	.	.	.
2.19	0.0840	0.52	Q	.	.	.	.
2.37	0.0916	0.53	Q	.	.	.	.
2.55	0.0994	0.53	Q	.	.	.	.
2.73	0.1071	0.54	Q	.	.	.	.
2.90	0.1150	0.54	Q	.	.	.	.
3.08	0.1229	0.54	Q	.	.	.	.
3.26	0.1309	0.55	Q	.	.	.	.
3.43	0.1390	0.55	Q	.	.	.	.
3.61	0.1471	0.56	Q	.	.	.	.
3.79	0.1553	0.56	Q	.	.	.	.
3.96	0.1636	0.57	Q	.	.	.	.
4.14	0.1719	0.57	Q	.	.	.	.
4.32	0.1804	0.58	Q	.	.	.	.
4.50	0.1889	0.59	Q	.	.	.	.
4.67	0.1975	0.59	Q	.	.	.	.
4.85	0.2061	0.60	Q	.	.	.	.
5.03	0.2149	0.60	Q	.	.	.	.
5.20	0.2238	0.61	Q	.	.	.	.
5.38	0.2327	0.61	Q	.	.	.	.
5.56	0.2418	0.62	Q	.	.	.	.
5.73	0.2509	0.63	Q	.	.	.	.
5.91	0.2601	0.64	Q	.	.	.	.
6.09	0.2695	0.64	Q	.	.	.	.
6.26	0.2789	0.65	Q	.	.	.	.

VOLUME-25YR-PR.txt

6.44	0.2885	0.66	Q	.	.	.	.
6.62	0.2982	0.67	Q	.	.	.	.
6.80	0.3079	0.67	Q	.	.	.	.
6.97	0.3178	0.68	Q	.	.	.	.
7.15	0.3279	0.69	Q	.	.	.	.
7.33	0.3380	0.70	Q	.	.	.	.
7.50	0.3483	0.71	Q	.	.	.	.
7.68	0.3587	0.72	Q	.	.	.	.
7.86	0.3692	0.72	Q	.	.	.	.
8.03	0.3799	0.74	Q	.	.	.	.
8.21	0.3908	0.74	Q	.	.	.	.
8.39	0.4018	0.76	.Q	.	.	.	.
8.57	0.4130	0.77	.Q	.	.	.	.
8.74	0.4243	0.78	.Q	.	.	.	.
8.92	0.4358	0.79	.Q	.	.	.	.
9.10	0.4475	0.81	.Q	.	.	.	.
9.27	0.4593	0.82	.Q	.	.	.	.
9.45	0.4714	0.83	.Q	.	.	.	.
9.63	0.4837	0.84	.Q	.	.	.	.
9.80	0.4962	0.86	.Q	.	.	.	.
9.98	0.5089	0.87	.Q	.	.	.	.
10.16	0.5218	0.90	.Q	.	.	.	.
10.34	0.5350	0.91	.Q	.	.	.	.
10.51	0.5484	0.93	.Q	.	.	.	.
10.69	0.5622	0.94	.Q	.	.	.	.
10.87	0.5762	0.97	.Q	.	.	.	.
11.04	0.5905	0.98	.Q	.	.	.	.
11.22	0.6051	1.01	.Q	.	.	.	.
11.40	0.6201	1.03	.Q	.	.	.	.
11.57	0.6354	1.06	.Q	.	.	.	.
11.75	0.6511	1.08	.Q	.	.	.	.
11.93	0.6672	1.12	.Q	.	.	.	.
12.11	0.6837	1.14	.Q	.	.	.	.
12.28	0.7038	1.60	. Q	.	.	.	.
12.46	0.7274	1.63	. Q	.	.	.	.
12.64	0.7517	1.70	. Q	.	.	.	.
12.81	0.7768	1.73	. Q	.	.	.	.
12.99	0.8027	1.81	. Q	.	.	.	.
13.17	0.8295	1.85	. Q	.	.	.	.
13.35	0.8573	1.95	. Q	.	.	.	.
13.52	0.8862	2.00	. Q	.	.	.	.
13.70	0.9163	2.11	. Q	.	.	.	.
13.88	0.9477	2.18	. Q	.	.	.	.
14.05	0.9806	2.32	. Q	.	.	.	.
14.23	1.0150	2.37	. Q	.	.	.	.
14.41	1.0510	2.56	. Q	.	.	.	.
14.58	1.0892	2.67	. Q	.	.	.	.
14.76	1.1301	2.93	. Q	.	.	.	.
14.94	1.1742	3.09	. Q	.	.	.	.
15.12	1.2223	3.49	. Q	.	.	.	.
15.29	1.2752	3.75	. Q	.	.	.	.
15.47	1.3317	3.99	. Q	.	.	.	.
15.65	1.3921	4.26	. Q	.	.	.	.
15.82	1.4715	6.60	. Q	.	.	.	.
16.00	1.5866	9.14	.	.	Q	.	.
16.18	1.8484	26.65	.	.	.	Q	.
16.35	2.0799	5.00	.	.	.	.	.
16.53	2.1463	4.06	.	.	.	.	.
16.71	2.1999	3.27	.	.	.	.	.
16.89	2.2442	2.79	.	.	.	.	.
17.06	2.2826	2.46	.	.	.	.	.
17.24	2.3171	2.25	. Q	.	.	.	.
17.42	2.3485	2.06	. Q	.	.	.	.
17.59	2.3775	1.90	. Q	.	.	.	.
17.77	2.4043	1.77	. Q	.	.	.	.

VOLUME-25YR-PR.txt

17.95	2.4294	1.66	. Q	.	.	.	.
18.12	2.4527	1.52	. Q	.	.	.	.
18.30	2.4719	1.10	.Q	.	.	.	.
18.48	2.4876	1.05	.Q	.	.	.	.
18.66	2.5026	1.00	.Q	.	.	.	.
18.83	2.5169	0.96	.Q	.	.	.	.
19.01	2.5306	0.92	.Q	.	.	.	.
19.19	2.5438	0.88	.Q	.	.	.	.
19.36	2.5565	0.85	.Q	.	.	.	.
19.54	2.5688	0.82	.Q	.	.	.	.
19.72	2.5807	0.80	.Q	.	.	.	.
19.89	2.5922	0.77	.Q	.	.	.	.
20.07	2.6033	0.75	.Q	.	.	.	.
20.25	2.6142	0.73	Q	.	.	.	.
20.42	2.6247	0.71	Q	.	.	.	.
20.60	2.6350	0.69	Q	.	.	.	.
20.78	2.6450	0.68	Q	.	.	.	.
20.96	2.6548	0.66	Q	.	.	.	.
21.13	2.6644	0.65	Q	.	.	.	.
21.31	2.6737	0.63	Q	.	.	.	.
21.49	2.6828	0.62	Q	.	.	.	.
21.66	2.6918	0.61	Q	.	.	.	.
21.84	2.7006	0.59	Q	.	.	.	.
22.02	2.7092	0.58	Q	.	.	.	.
22.19	2.7176	0.57	Q	.	.	.	.
22.37	2.7259	0.56	Q	.	.	.	.
22.55	2.7340	0.55	Q	.	.	.	.
22.73	2.7420	0.54	Q	.	.	.	.
22.90	2.7498	0.53	Q	.	.	.	.
23.08	2.7576	0.52	Q	.	.	.	.
23.26	2.7652	0.52	Q	.	.	.	.
23.43	2.7727	0.51	Q	.	.	.	.
23.61	2.7800	0.50	Q	.	.	.	.
23.79	2.7873	0.49	Q	.	.	.	.
23.97	2.7944	0.49	Q	.	.	.	.
24.14	2.8015	0.48	Q	.	.	.	.
24.32	2.8050	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%	1444.3
10%	148.7
20%	31.9
30%	21.2
40%	10.6
50%	10.6
60%	10.6
70%	10.6
80%	10.6
90%	10.6

LOSS-25YR-PR.txt

LOSS CALCULATION - PROPOSED 25 YR (120720-SS)

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

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 4.49 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	8.20	20.00	57.	0.200	0.796
2	1.26	10.00	95.	0.200	0.940

TOTAL AREA (Acres) = 9.46

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.037

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.185
=====

Catch Basin Sizing (120328-ss)

CB #1

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

Curb Inlet Capacities are approximated based on the Bureau of
Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 4.91
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 5.00

=====

CB #2

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

Curb Inlet Capacities are approximated based on the Bureau of
Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 3.44
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 3.50

=====

CB #3

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

Curb Inlet Capacities are approximated based on the Bureau of
Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 4.93
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 5.02

=====

CB #4

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

CB Sizing.txt

Curb Inlet Capacities are approximated based on the Bureau of Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 3.70
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 3.77

=====
CB #5

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

=====
Curb Inlet Capacities are approximated based on the Bureau of Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 3.58
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 3.65

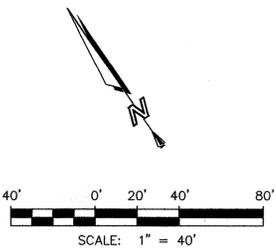
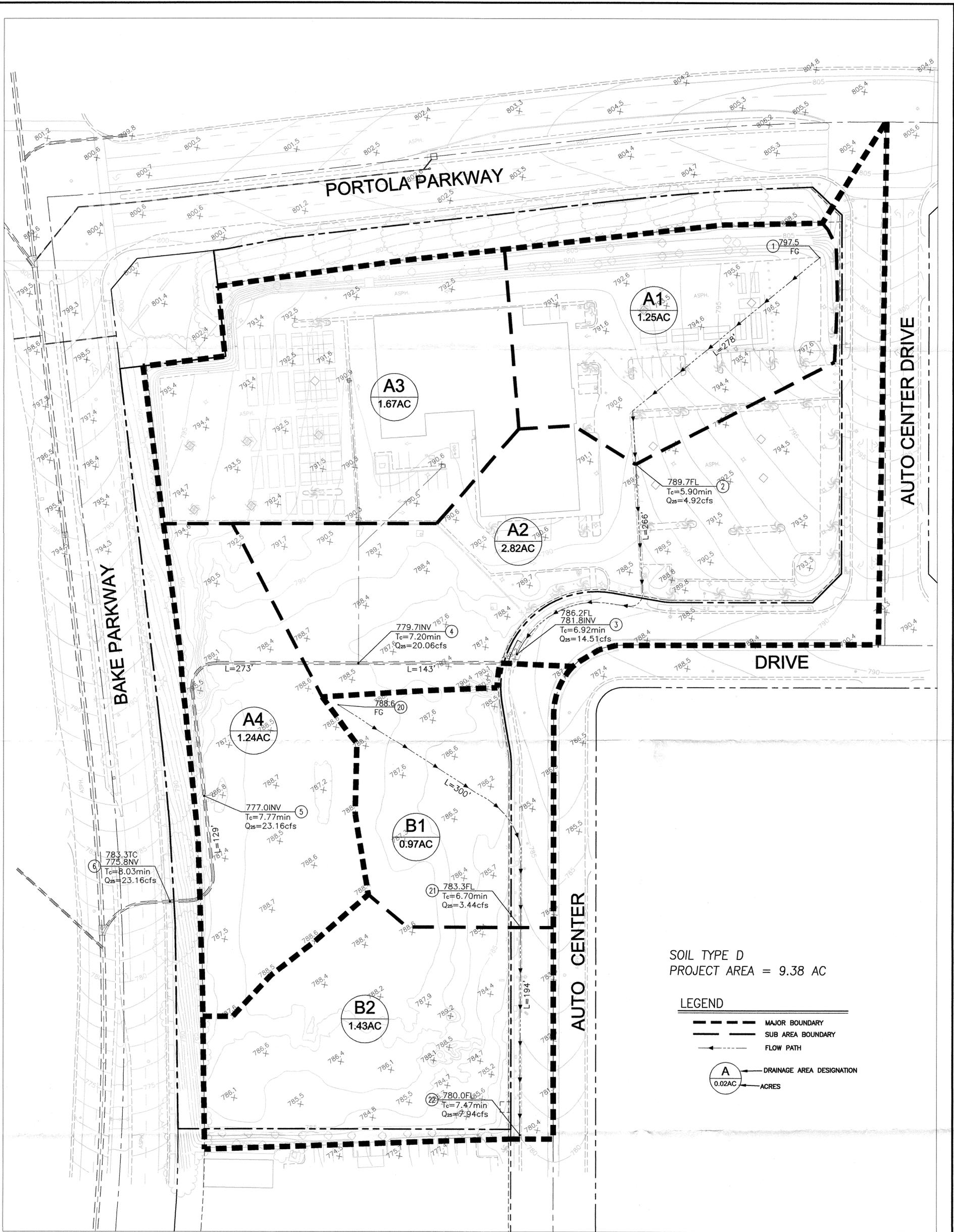
=====
CB #6

>>>>SUMP TYPE BASIN INPUT INFORMATION<<<<

=====
Curb Inlet Capacities are approximated based on the Bureau of Public Roads nomograph plots for flowby basins and sump basins.

BASIN INFLOW(CFS) = 3.72
BASIN OPENING(FEET) = 0.46
DEPTH OF WATER(FEET) = 0.47

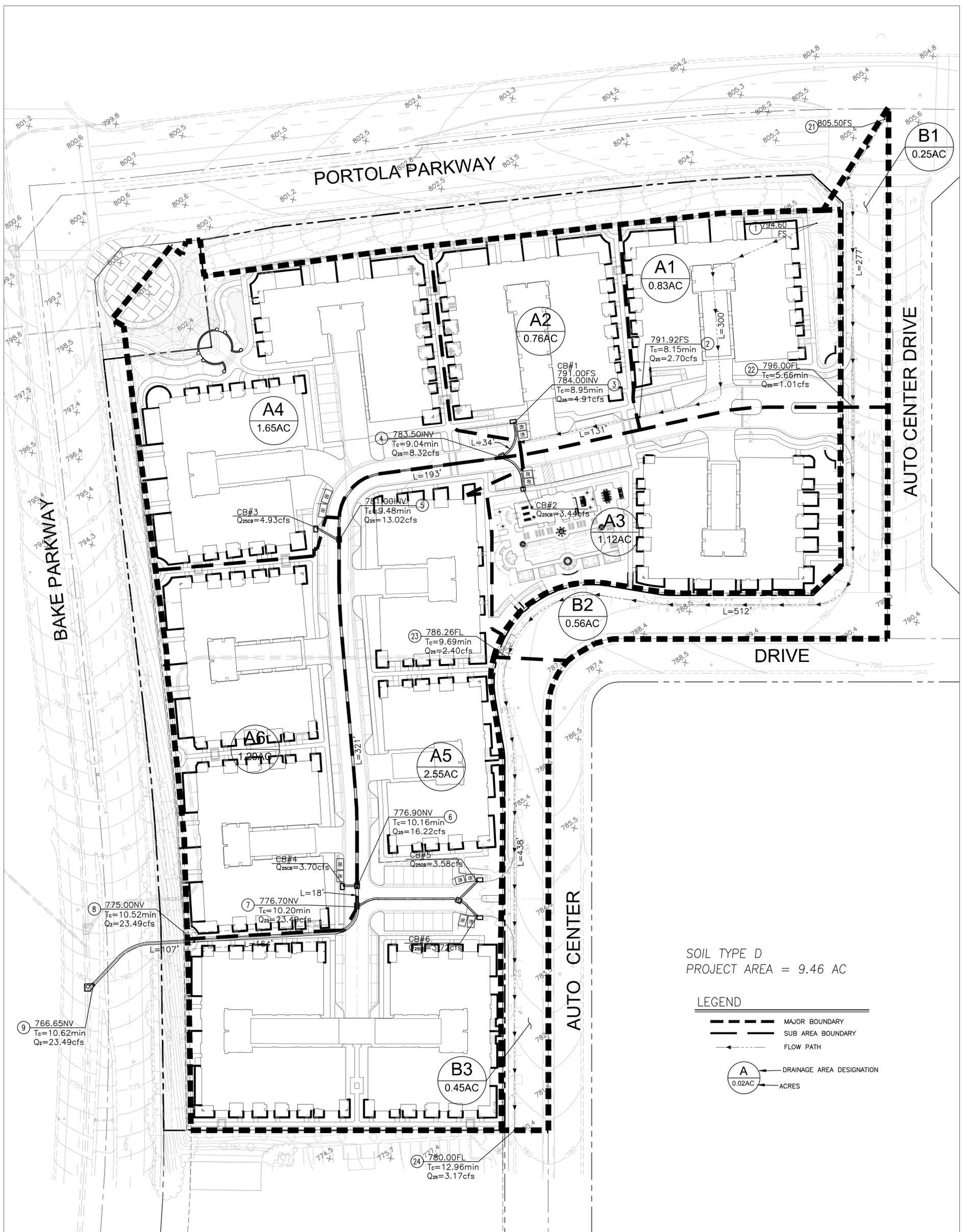
>>>>CALCULATED ESTIMATED SUMP BASIN WIDTH(FEET) = 3.79



FOOTHILL RANCH TOWN CENTER
EX. 25 YEAR HYDROLOGY MAP
LAKE FOREST, CALIFORNIA
 JULY 23, 2012



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FOOTHILL RANCH TOWN CENTER

PR. 25 YEAR HYDROLOGY MAP

LAKE FOREST, CALIFORNIA

JULY 23, 2012



16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com