



CEQA DRAINAGE STUDY

PDS2017-TM-5619

El Nopal, Lakeside, CA 92040
(APN 379-023-39)

Prepared for:
SCSS Development, LLC
2608 West Canyon Avenue
San Diego, CA 92123

Prepared by:
Walsh Engineering & Surveying Inc.
607 Aldwych Road
El Cajon, CA 92020

Job No. 13776
Phone (619) 588-6747 * Fax (619) 792-1232
www.walsh-engineering.com

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DECLARATION OF RESPONSIBLE CHARGE

I, HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS DRAINAGE STUDY, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE PREPARATION OF SAID STUDY AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE RECOMMENDATIONS ARE CONSISTENT WITH CURRENT STANDARDS.

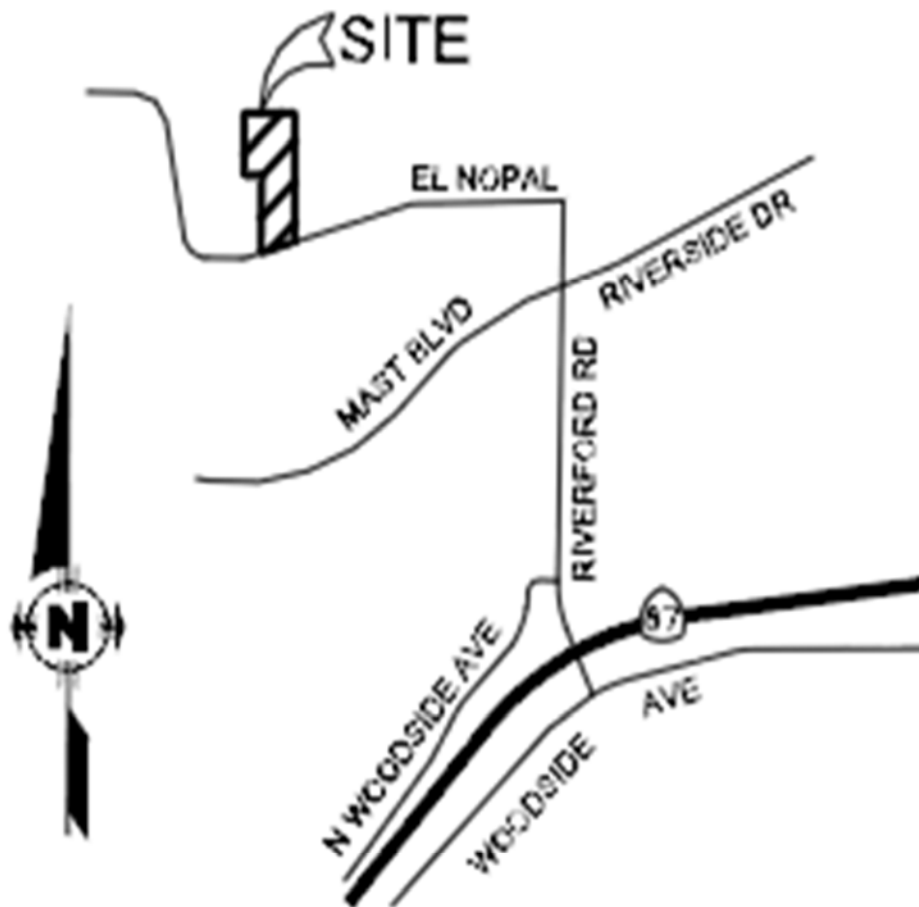
I UNDERSTAND THAT THE CHECK OF THIS DRAINAGE STUDY BY THE COUNTY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES.




Lawrence W. Walsh, RCE 46316

2-6-19
Date

VICINITY MAP



VICINITY MAP

NO SCALE

THOMAS BRO. MAP PG. 1231 G3

PROJECT DESCRIPTION

The proposed project is a 17 lot subdivision off of El Nopal in Lakeside. Currently the land is undeveloped with a private road and three small structures/shed to be removed. The existing 20' private road on site will be widened to the west approximately 20 feet to a 40' private road with 36 feet of drivable width and AC dikes on both sides. The terrain is dry weeds/dirt and the site slopes north to south with a general slope of 5%-15%. There is Type A soil on-site as well as Type D soil making up the majority of the off-site drainage basin.

HYDROLOGICAL DESCRIPTION

The pre-development drainage basins comprise of one large 21.57 acre basin with a sub-basin separated for initial overland flow. There is currently an existing 18" CMP culvert under El Nopal in which this basin flows to and outlets into an eroded skinny ditch 3 feet deep on the neighboring property south of El Nopal. The outlet of this 18" CMP has been selected as the Point of Comparison (POC) for the pre-developed and post-developed conditions.

For the post-developed condition there will be two major basins, one onsite basin of 3.35 acres and one off-site basin with an area of 18.22 acres. The flow coming down the large hill north of the site will be routed around the project site by a proposed concrete brow ditch beginning at the northeast corner of the site. This ditch will capture off-site flows that will bypass the infiltration basin. The site will also include several 12" storm drain pipes that run along the west side of the property with a catch basin connecting the storm drain pipes to pick up drainage on each individual lot not fronting the proposed private road. These storm drain pipes will flow into a proposed infiltration basin in which runoff will be treated and flow increases will be mitigated. Runoff from the proposed private road widening will also be treated and mitigated by the infiltration basin as well as the lots fronting the proposed private road. The previously described concrete brow ditch will be connected to a proposed cleanout near the southwest corner of the site, in which mitigated runoff from the infiltration basin will also converge at this cleanout. From the cleanout there will be a proposed 24" storm drain pipe that connects to another cleanout and takes a 90 degree turn to flow beneath El Nopal and to the POC, in which flows from the site meet up with off-site flows and flow into the off-site 3 foot ditch. Attached are the pre-developed and post-developed hydrology maps that display basin locations as well as flow routing for the project.

HYDROLOGICAL METHODOLOGY

The hydrologic analysis is done to assess the impact of the proposed development on the existing drainage patterns and any increase to runoff that will require mitigation. The projects major drainage basins are divided into minor sub basins based on changes in grade, conveyance geometry and run-off coefficients along the drainage paths. The project's estimated storm runoff for the existing and developed condition is analyzed using a computer application of the County of San Diego Flood Control District's Hydrology Manual. This program also includes the necessary retardation/detention basin routines required to analyze the detention basins and mitigate an increase in runoff. The application is offered by CivilDesign ® Corporation and a complete program description is available upon request.

TABULATED HYDROLOGIC COMPUTATIONAL RESULTS

Numbers in the table are shown to the same decimal place as the computer printout for ease of identification.

Existing 100 year

Nodes	Description	Effective C	Tc (min.)	I (in/hr)	Area (ac) Total	Q _{peak} (cfs) total
1.011 to 1.023	Offsite runoff to POC	0.345	15.10	3.556	21.57	26.461

Developed 100 year

Nodes	Description	Effective C	Tc (min.)	I (in/hr)	Area (ac) Total	Q _{peak} (cfs) total
1.011 to 1.023	Offsite runoff to Confluence at 2.043	0.340	14.20	3.494	10.30	12.531
2.011 to 2.043	On- runoff to confluence at 1.023	0.430	11.92	3.912	3.35	5.727
1.031 to 2.044	Offsite runoff meeting at POC	0.335	14.38	3.466	8.19	9.65
2.044	Runoff at POC	-	14.38	3.466	21.57	27.295

Mitigated 100 year

Nodes	Description	Effective C	Tc (min.)	I (in/hr)	Area (ac) Total	Q _{peak} (cfs) total
1.011 to 2.044	Runoff at POC	0.356	14.38	3.466	21.57	25.674

MITIGATED 100 YEAR

As can be seen in the results above, the post-developed peak flow rates need to be reduced by 0.83 cfs in order to mitigate to pre-development levels. This mitigation was achieved by sizing the infiltration basin receiving runoff from the site for flood control in addition to water quality and hydromodification. An inflow hydrograph was generated for the on-site basin and was inputted into a retardation basin sizing routine within the CivilD program in order to design an outlet, generate an outflow hydrograph and size the infiltration basin to ensure adequate storage capacity. It was determined that a 12" diameter standpipe will reduce the runoff leaving the basin 1.6 cfs. The output of the retardation basin routine can be seen in Exhibit "D".

DETENTION/INFILTRATION BASIN DESIGN

The infiltration basin features a 12" diameter stand pipe with one foot of ponding and two inches of freeboard. Below the ground surface a 1.5 foot thick layer of amended soil and a 2.5 foot thick layer of gravel will be used. Underneath the amended soils and gravel layers is the existing uncompacted soil. An infiltration rate of 1 in/hr at the basin location has been determined by infiltration tests performed by Christian Wheeler Engineering.

HYDROLOGICAL ANALYSIS RESULTS AND CONCLUSION

For the existing condition, the total runoff leaving the project site was calculated to be 26.5 cfs and the post-development runoff was calculated to be 27.3 cfs, requiring a reduction of 0.8 cfs. This small increase in flow from pre to post can likely be attributed to the Type A soil on-site allowing for low C-values. By sizing the infiltration basin receiving runoff from the on-site drainage basin the peak flow rates were reduced by 1.6 cfs, to the mitigated flow rate of 25.7 cfs. This is greater than the 0.8 cfs reduction required to reduce post-developed rates to pre-development levels. This reduction sufficiently demonstrates that the project will not negatively affect 100 year peak flow rates.

For CEQA purposes, the following information is provided in this study for project review and approval of the tentative map.

Q: Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

A: No. The overall existing drainage patterns will be maintained, no alterations to streams or rivers will occur and no increase in off-site erosion or siltation will be caused by this project.

Q: Will the project substantially alter the existing drainage pattern of the site or area including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

A: No. The overall existing drainage patterns will be maintained. No alterations to streams or rivers will occur and the rate or amount of runoff will not significantly increase.

Q: Will the project create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems?

A: No. The project will not create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems.

Q: Will the project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps?

A: No. The project does not propose to place housing within a 100-year flood hazard area.

Q: Will the project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

A: No. The project will not place structures within a 100-year flood hazard area.

Q: Will the project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam on-site or off-site?

A: No. The project will not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of failure of Dam(s) or levee(s). The project is downstream of an existing dam, however, the likelihood for failure of the dam is very low, and therefore, mitigation is not required.

EXHIBIT “A”

Existing Condition
13776ElNopalPre

13776ELNOPALPRE

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/03/17

13776 El Nopal Pre

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

Program License Serial Number 6326

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.200
P6/P24 = 50.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 1.011 to Point/Station 1.021
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 847.000(Ft.)
Lowest elevation = 817.000(Ft.)
Elevation difference = 30.000(Ft.) Slope = 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 6.90 minutes
(for slope value of 10.00 %)
Rainfall intensity (I) = 5.565(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.117(CFS)
Total initial stream area = 0.060(Ac.)

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Page 1

13776ELNOPALPRE

Process from Point/Station 1.021 to Point/Station 1.022
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 13.339(CFS)
 Depth of flow = 0.237(Ft.), Average velocity = 4.740(Ft/s)
 ***** Irregular Channel Data *****

 Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	1.00
2	50.00	0.00
3	100.00	1.00

 Manning's 'N' friction factor = 0.035

Sub-Channel flow = 13.339(CFS)
 ' ' flow top width = 23.724(Ft.)
 ' ' velocity = 4.740(Ft/s)
 ' ' area = 2.814(Sq.Ft)
 ' ' Froude number = 2.425

Upstream point elevation = 817.000(Ft.)
 Downstream point elevation = 396.000(Ft.)
 Flow length = 1968.000(Ft.)
 Travel time = 6.92 min.
 Time of concentration = 13.82 min.
 Depth of flow = 0.237(Ft.)
 Average velocity = 4.740(Ft/s)
 Total irregular channel flow = 13.339(CFS)
 Irregular channel normal depth above invert elev. = 0.237(Ft.)
 Average velocity of channel(s) = 4.740(Ft/s)
 Adding area flow to channel
 Rainfall intensity (I) = 3.556(In/Hr) for a 100.0 year storm
 User specified 'C' value of 0.345 given for subarea
 Rainfall intensity = 3.556(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.345 CA = 7.442
 Subarea runoff = 26.344(CFS) for 21.510(Ac.)
 Total runoff = 26.461(CFS) Total area = 21.570(Ac.)
 Depth of flow = 0.307(Ft.), Average velocity = 5.625(Ft/s)

 Process from Point/Station 1.022 to Point/Station 1.023
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 396.000(Ft.)
 Downstream point elevation = 382.000(Ft.)
 Channel length thru subarea = 405.000(Ft.)
 Channel base width = 16.000(Ft.)
 Slope or 'Z' of left channel bank = 40.000
 Slope or 'Z' of right channel bank = 40.000
 Manning's 'N' = 0.015
 Maximum depth of channel = 0.330(Ft.)
 Flow(q) thru subarea = 26.461(CFS)
 Depth of flow = 0.206(Ft.), Average velocity = 5.289(Ft/s)
 Channel flow top width = 32.503(Ft.)
 Flow Velocity = 5.29(Ft/s)
 Travel time = 1.28 min.
 Time of concentration = 15.10 min.
 Critical depth = 0.332(Ft.)
 End of computations, total study area = 21.570 (Ac.)

EXHIBIT “B”

Developed Condition

13776ElNopalPost

13776ELNOPALPOST

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/03/17

13776 El Nopal Post

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

Program License Serial Number 6326

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.200
P6/P24 = 50.0%
San Diego hydrology manual 'C' values used

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Process from Point/Station 1.011 to Point/Station 1.021
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 847.000(Ft.)
Lowest elevation = 817.000(Ft.)
Elevation difference = 30.000(Ft.) Slope = 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 6.90 minutes
(for slope value of 10.00 %)
Rainfall intensity (I) = 5.565(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.117(CFS)
Total initial stream area = 0.060(Ac.)

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Page 1

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Process from Point/Station 1.021 to Point/Station 1.022
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 6.365(CFS)
 Depth of flow = 0.175(Ft.), Average velocity = 4.145(Ft/s)
 ***** Irregular Channel Data *****

 Information entered for subchannel number 1 :
 Point number 'X' coordinate 'Y' coordinate
 1 0.00 1.00
 2 50.00 0.00
 3 100.00 1.00
 Manning's 'N' friction factor = 0.035

Sub-Channel flow = 6.365(CFS)
 flow top width = 17.524(Ft.)
 velocity = 4.145(Ft/s)
 area = 1.535(Sq.Ft)
 Froude number = 2.468

Upstream point elevation = 817.000(Ft.)
 Downstream point elevation = 437.000(Ft.)
 Flow length = 1551.000(Ft.)
 Travel time = 6.24 min.
 Time of concentration = 13.14 min.
 Depth of flow = 0.175(Ft.)
 Average velocity = 4.145(Ft/s)
 Total irregular channel flow = 6.365(CFS)
 Irregular channel normal depth above invert elev. = 0.175(Ft.)
 Average velocity of channel(s) = 4.145(Ft/s)
 Adding area flow to channel
 Rainfall intensity (I) = 3.674(In/Hr) for a 100.0 year storm
 User specified 'C' value of 0.340 given for subarea
 Rainfall intensity = 3.674(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.340 CA = 3.411
 Subarea runoff = 12.414(CFS) for 9.970(Ac.)
 Total runoff = 12.531(CFS) Total area = 10.030(Ac.)
 Depth of flow = 0.226(Ft.), Average velocity = 4.910(Ft/s)

+++++
 Process from Point/Station 1.022 to Point/Station 1.023
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 437.000(Ft.)
 Downstream point elevation = 382.800(Ft.)
 Channel length thru subarea = 813.000(Ft.)
 Channel base width = 1.500(Ft.)
 Slope or 'Z' of left channel bank = 0.000
 Slope or 'Z' of right channel bank = 0.000
 Manning's 'N' = 0.015
 Maximum depth of channel = 1.000(Ft.)
 Flow(q) thru subarea = 12.531(CFS)
 Depth of flow = 0.657(Ft.), Average velocity = 12.711(Ft/s)
 Channel flow top width = 1.500(Ft.)
 Flow Velocity = 12.71(Ft/s)
 Travel time = 1.07 min.
 Time of concentration = 14.20 min.
 Critical depth = 1.297(Ft.)

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Process from Point/Station 1.023 to Point/Station 2.043
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 10.030(Ac.)
 Runoff from this stream = 12.531(CFS)
 Time of concentration = 14.20 min.
 Rainfall intensity = 3.494(In/Hr)
 Program is now starting with Main Stream No. 2

 Process from Point/Station 2.011 to Point/Station 2.021
 **** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [MEDIUM DENSITY RESIDENTIAL]
 (4.3 DU/A or Less)
 Impervious value, Ai = 0.300
 Sub-Area C Value = 0.410
 Initial subarea total flow distance = 137.000(Ft.)
 Highest elevation = 438.000(Ft.)
 Lowest elevation = 436.000(Ft.)
 Elevation difference = 2.000(Ft.) Slope = 1.460 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 70.00 (Ft)
 for the top area slope value of 1.46 %, in a development type of
 4.3 DU/A or Less
 In Accordance With Table 3-2
 Initial Area Time of Concentration = 9.60 minutes
 (for slope value of 1.00 %)
 Rainfall intensity (I) = 4.498(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
 Subarea runoff = 0.313(CFS)
 Total initial stream area = 0.170(Ac.)

 Process from Point/Station 2.021 to Point/Station 2.031
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 436.000(Ft.)
 Downstream point elevation = 422.000(Ft.)
 Channel length thru subarea = 242.000(Ft.)
 Channel base width = 0.000(Ft.)
 Slope or 'Z' of left channel bank = 0.500
 Slope or 'Z' of right channel bank = 50.000
 Estimated mean flow rate at midpoint of channel = 1.223(CFS)
 Manning's 'N' = 0.015
 Maximum depth of channel = 0.500(Ft.)
 Flow(q) thru subarea = 1.223(CFS)
 Depth of flow = 0.117(Ft.), Average velocity = 3.555(Ft/s)
 Channel flow top width = 5.894(Ft.)
 Flow Velocity = 3.56(Ft/s)
 Travel time = 1.13 min.
 Time of concentration = 10.73 min.
 Critical depth = 0.171(Ft.)
 Adding area flow to channel
 Rainfall intensity (I) = 4.185(In/Hr) for a 100.0 year storm

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Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [MEDIUM DENSITY RESIDENTIAL]
 (7.3 DU/A or Less)
 Impervious value, Ai = 0.400
 Sub-Area C Value = 0.480
 Rainfall intensity = 4.185(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.469 CA = 0.526
 Subarea runoff = 1.887(CFS) for 0.950(Ac.)
 Total runoff = 2.200(CFS) Total area = 1.120(Ac.)
 Depth of flow = 0.145(Ft.), Average velocity = 4.118(Ft/s)
 Critical depth = 0.217(Ft.)

++++
 Process from Point/Station 2.031 to Point/Station 2.031
 **** SUBAREA FLOW ADDITION ****

Rainfall intensity (I) = 4.185(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [MEDIUM DENSITY RESIDENTIAL]
 (4.3 DU/A or Less)
 Impervious value, Ai = 0.300
 Sub-Area C Value = 0.410
 Time of concentration = 10.73 min.
 Rainfall intensity = 4.185(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.442 CA = 0.907
 Subarea runoff = 1.596(CFS) for 0.930(Ac.)
 Total runoff = 3.796(CFS) Total area = 2.050(Ac.)

++++
 Process from Point/Station 2.031 to Point/Station 2.032
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 422.000(Ft.)
 Downstream point/station elevation = 384.000(Ft.)
 Pipe length = 576.00(Ft.) Slope = 0.0660 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 3.796(CFS)
 Nearest computed pipe diameter = 9.00(In.)
 Calculated individual pipe flow = 3.796(CFS)
 Normal flow depth in pipe = 6.63(In.)
 Flow top width inside pipe = 7.92(In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 10.87(Ft/s)
 Travel time through pipe = 0.88 min.
 Time of concentration (TC) = 11.62 min.

++++
 Process from Point/Station 2.032 to Point/Station 2.041
 **** SUBAREA FLOW ADDITION ****

Rainfall intensity (I) = 3.977(In/Hr) for a 100.0 year storm
 Decimal fraction soil group A = 1.000
 Decimal fraction soil group B = 0.000

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 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 [MEDIUM DENSITY RESIDENTIAL]
 (4.3 DU/A or Less)
 Impervious value, Ai = 0.300
 Sub-Area C Value = 0.410
 Time of concentration = 11.62 min.
 Rainfall intensity = 3.977(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.430 CA = 1.440
 Subarea runoff = 1.931(CFS) for 1.300(Ac.)
 Total runoff = 5.727(CFS) Total area = 3.350(Ac.)

++++
 Process from Point/Station 2.041 to Point/Station 2.041
 **** 6 HOUR HYDROGRAPH ****

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 Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003

Time of Concentration = 11.62
 Basin Area = 13.38 Acres
 6 Hour Rainfall = 2.600 Inches
 Runoff Coefficient = 0.108
 Peak Discharge = 5.73 CFS

Time (Min)	Discharge (CFS)
0	0.000
11	0.223
22	0.228
33	0.237
44	0.243
55	0.254
66	0.261
77	0.275
88	0.283
99	0.300
110	0.310
121	0.332
132	0.345
143	0.375
154	0.393
165	0.436
176	0.462
187	0.530
198	0.575
209	0.702
220	0.800
231	1.175
242	1.655
253	5.727
264	0.942
275	0.630
286	0.493
297	0.413
308	0.360
319	0.321
330	0.291
341	0.268
352	0.248
363	0.232

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

Hydrograph in 1 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	1.4	2.9	4.3	5.7
0+ 0	0.0000		0.00	Q				
0+ 1	0.0000		0.02	Q				
0+ 2	0.0001		0.04	Q				
0+ 3	0.0002		0.06	Q				
0+ 4	0.0003		0.08	Q				
0+ 5	0.0004		0.10	Q				
0+ 6	0.0006		0.12	Q				
0+ 7	0.0008		0.14	Q				
0+ 8	0.0010		0.16	VQ				
0+ 9	0.0013		0.18	VQ				
0+10	0.0015		0.20	VQ				
0+11	0.0018		0.22	VQ				
0+12	0.0022		0.22	VQ				
0+13	0.0025		0.22	VQ				
0+14	0.0028		0.22	VQ				
0+15	0.0031		0.22	VQ				
0+16	0.0034		0.23	VQ				
0+17	0.0037		0.23	VQ				
0+18	0.0040		0.23	VQ				
0+19	0.0043		0.23	VQ				
0+20	0.0046		0.23	VQ				
0+21	0.0049		0.23	VQ				
0+22	0.0053		0.23	VQ				
0+23	0.0056		0.23	VQ				
0+24	0.0059		0.23	VQ				
0+25	0.0062		0.23	VQ				
0+26	0.0065		0.23	VQ				
0+27	0.0068		0.23	VQ				
0+28	0.0072		0.23	VQ				
0+29	0.0075		0.23	VQ				
0+30	0.0078		0.23	Q				
0+31	0.0081		0.24	Q				
0+32	0.0085		0.24	Q				
0+33	0.0088		0.24	Q				
0+34	0.0091		0.24	Q				
0+35	0.0094		0.24	Q				
0+36	0.0098		0.24	Q				
0+37	0.0101		0.24	Q				
0+38	0.0104		0.24	Q				
0+39	0.0108		0.24	Q				
0+40	0.0111		0.24	Q				
0+41	0.0114		0.24	Q				
0+42	0.0118		0.24	Q				
0+43	0.0121		0.24	Q				
0+44	0.0124		0.24	Q				
0+45	0.0128		0.24	Q				
0+46	0.0131		0.24	Q				
0+47	0.0134		0.25	Q				
0+48	0.0138		0.25	Q				
0+49	0.0141		0.25	Q				
0+50	0.0145		0.25	Q				
0+51	0.0148		0.25	Q				
0+52	0.0152		0.25	Q				
0+53	0.0155		0.25	QV				
0+54	0.0159		0.25	QV				

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0+55	0.0162	0.25	QV
0+56	0.0166	0.25	QV
0+57	0.0169	0.26	QV
0+58	0.0173	0.26	QV
0+59	0.0176	0.26	QV
1+ 0	0.0180	0.26	QV
1+ 1	0.0183	0.26	QV
1+ 2	0.0187	0.26	QV
1+ 3	0.0190	0.26	QV
1+ 4	0.0194	0.26	QV
1+ 5	0.0198	0.26	QV
1+ 6	0.0201	0.26	QV
1+ 7	0.0205	0.26	QV
1+ 8	0.0208	0.26	QV
1+ 9	0.0212	0.26	QV
1+10	0.0216	0.27	QV
1+11	0.0219	0.27	QV
1+12	0.0223	0.27	QV
1+13	0.0227	0.27	QV
1+14	0.0230	0.27	Q V
1+15	0.0234	0.27	Q V
1+16	0.0238	0.27	Q V
1+17	0.0242	0.27	Q V
1+18	0.0246	0.28	Q V
1+19	0.0249	0.28	Q V
1+20	0.0253	0.28	Q V
1+21	0.0257	0.28	Q V
1+22	0.0261	0.28	Q V
1+23	0.0265	0.28	Q V
1+24	0.0269	0.28	Q V
1+25	0.0272	0.28	Q V
1+26	0.0276	0.28	Q V
1+27	0.0280	0.28	Q V
1+28	0.0284	0.28	Q V
1+29	0.0288	0.28	Q V
1+30	0.0292	0.29	Q V
1+31	0.0296	0.29	QV
1+32	0.0300	0.29	QV
1+33	0.0304	0.29	QV
1+34	0.0308	0.29	Q V
1+35	0.0312	0.29	Q V
1+36	0.0316	0.30	Q V
1+37	0.0320	0.30	Q V
1+38	0.0324	0.30	Q V
1+39	0.0328	0.30	Q V
1+40	0.0332	0.30	Q V
1+41	0.0337	0.30	Q V
1+42	0.0341	0.30	Q V
1+43	0.0345	0.30	Q V
1+44	0.0349	0.30	Q V
1+45	0.0353	0.31	Q V
1+46	0.0358	0.31	Q V
1+47	0.0362	0.31	Q V
1+48	0.0366	0.31	Q V
1+49	0.0370	0.31	Q V
1+50	0.0375	0.31	Q V
1+51	0.0379	0.31	Q V
1+52	0.0383	0.31	Q V
1+53	0.0388	0.32	Q V
1+54	0.0392	0.32	Q V
1+55	0.0396	0.32	Q V
1+56	0.0401	0.32	Q V
1+57	0.0405	0.32	Q V

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1+58	0.0410	0.33	Q	V				
1+59	0.0414	0.33	Q	V				
2+ 0	0.0419	0.33	Q	V				
2+ 1	0.0423	0.33	Q	V				
2+ 2	0.0428	0.33	Q	V				
2+ 3	0.0433	0.33	Q	V				
2+ 4	0.0437	0.34	Q	V				
2+ 5	0.0442	0.34	Q	V				
2+ 6	0.0447	0.34	Q	V				
2+ 7	0.0451	0.34	Q	V				
2+ 8	0.0456	0.34	Q	V				
2+ 9	0.0461	0.34	Q	V				
2+10	0.0465	0.34	Q	V				
2+11	0.0470	0.34	Q	V				
2+12	0.0475	0.35	Q	V				
2+13	0.0480	0.35	Q	V				
2+14	0.0485	0.35	Q	V				
2+15	0.0489	0.35	Q	V				
2+16	0.0494	0.36	Q	V				
2+17	0.0499	0.36	Q	V				
2+18	0.0504	0.36	Q	V				
2+19	0.0509	0.36	Q	V				
2+20	0.0514	0.37	Q	V				
2+21	0.0519	0.37	Q	V				
2+22	0.0525	0.37	Q	V				
2+23	0.0530	0.38	Q	V				
2+24	0.0535	0.38	Q	V				
2+25	0.0540	0.38	Q	V				
2+26	0.0545	0.38	Q	V				
2+27	0.0551	0.38	Q	V				
2+28	0.0556	0.38	Q	V				
2+29	0.0561	0.39	Q	V				
2+30	0.0567	0.39	Q	V				
2+31	0.0572	0.39	Q	V				
2+32	0.0577	0.39	Q	V				
2+33	0.0583	0.39	Q	V				
2+34	0.0588	0.39	Q	V				
2+35	0.0594	0.40	Q	V				
2+36	0.0599	0.40	Q	V				
2+37	0.0605	0.40	Q	V				
2+38	0.0610	0.41	Q	V				
2+39	0.0616	0.41	Q	V				
2+40	0.0622	0.42	Q	V				
2+41	0.0627	0.42	Q	V				
2+42	0.0633	0.42	Q	V				
2+43	0.0639	0.43	Q	V				
2+44	0.0645	0.43	Q	V				
2+45	0.0651	0.44	Q	V				
2+46	0.0657	0.44	Q	V				
2+47	0.0663	0.44	Q	V				
2+48	0.0669	0.44	Q	V				
2+49	0.0675	0.45	Q	V				
2+50	0.0682	0.45	Q	V				
2+51	0.0688	0.45	Q	V				
2+52	0.0694	0.45	Q	V				
2+53	0.0700	0.46	Q	V				
2+54	0.0707	0.46	Q	V				
2+55	0.0713	0.46	Q	V				
2+56	0.0719	0.46	Q	V				
2+57	0.0726	0.47	Q	V				
2+58	0.0732	0.47	Q	V				
2+59	0.0739	0.48	Q	V				
3+ 0	0.0746	0.49	Q	V				

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3+ 1	0.0752	0.49	Q	V			
3+ 2	0.0759	0.50	Q	V			
3+ 3	0.0766	0.51	Q	V			
3+ 4	0.0773	0.51	Q	V			
3+ 5	0.0781	0.52	Q	V			
3+ 6	0.0788	0.52	Q	V			
3+ 7	0.0795	0.53	Q	V			
3+ 8	0.0802	0.53	Q	V			
3+ 9	0.0810	0.54	Q	V			
3+10	0.0817	0.54	Q	V			
3+11	0.0825	0.55	Q	V			
3+12	0.0832	0.55	Q	V			
3+13	0.0840	0.55	Q	V			
3+14	0.0848	0.56	Q	V			
3+15	0.0855	0.56	Q	V			
3+16	0.0863	0.57	Q	V			
3+17	0.0871	0.57	Q	V			
3+18	0.0879	0.57	Q	V			
3+19	0.0887	0.59	Q	V			
3+20	0.0895	0.60	Q	V			
3+21	0.0904	0.61	Q	V			
3+22	0.0912	0.62	Q	V			
3+23	0.0921	0.63	Q	V			
3+24	0.0930	0.64	Q	V			
3+25	0.0939	0.66	Q	V			
3+26	0.0948	0.67	Q	V			
3+27	0.0957	0.68	Q	V			
3+28	0.0967	0.69	Q	V			
3+29	0.0977	0.70	Q	V			
3+30	0.0986	0.71	Q	V			
3+31	0.0996	0.72	Q	V			
3+32	0.1006	0.73	Q	V			
3+33	0.1017	0.74	Q	V			
3+34	0.1027	0.75	Q	V			
3+35	0.1037	0.76	Q	V			
3+36	0.1048	0.76	Q	V			
3+37	0.1058	0.77	Q	V			
3+38	0.1069	0.78	Q	V			
3+39	0.1080	0.79	Q	V			
3+40	0.1091	0.80	Q	V			
3+41	0.1103	0.83	Q	V			
3+42	0.1115	0.87	Q	V			
3+43	0.1127	0.90	Q	V			
3+44	0.1140	0.94	Q	V			
3+45	0.1153	0.97	Q	V			
3+46	0.1167	1.00	Q	V			
3+47	0.1181	1.04	Q	V			
3+48	0.1196	1.07	Q	V			
3+49	0.1211	1.11	Q	V			
3+50	0.1227	1.14	Q	V			
3+51	0.1243	1.17	Q	V			
3+52	0.1260	1.22	Q	V			
3+53	0.1277	1.26	Q	V			
3+54	0.1295	1.31	Q	V			
3+55	0.1314	1.35	Q	V			
3+56	0.1333	1.39	Q	V			
3+57	0.1353	1.44	Q	V			
3+58	0.1373	1.48	Q	V			
3+59	0.1394	1.52	Q	V			
4+ 0	0.1416	1.57	Q	V			
4+ 1	0.1438	1.61	Q	V			
4+ 2	0.1461	1.65	Q	V			
4+ 3	0.1489	2.03	Q	V			

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4+ 4	0.1522	2.40			Q	V			
4+ 5	0.1560	2.77				QV			
4+ 6	0.1603	3.14				VQ			
4+ 7	0.1651	3.51				V	Q		
4+ 8	0.1705	3.88				V		Q	
4+ 9	0.1763	4.25				V		Q	
4+10	0.1827	4.62				V			Q
4+11	0.1896	4.99				V			Q
4+12	0.1969	5.36				V			Q
4+13	0.2048	5.73				V			Q
4+14	0.2121	5.29				V			Q
4+15	0.2188	4.86				V			Q
4+16	0.2249	4.42				VQ			
4+17	0.2304	3.99				V	Q		
4+18	0.2353	3.55					Q		
4+19	0.2396	3.12			Q				
4+20	0.2433	2.68			Q				
4+21	0.2464	2.25		Q					
4+22	0.2489	1.81		Q					
4+23	0.2508	1.38			Q				
4+24	0.2520	0.94							
4+25	0.2533	0.91							
4+26	0.2545	0.89							
4+27	0.2557	0.86							
4+28	0.2568	0.83							
4+29	0.2580	0.80							
4+30	0.2590	0.77							
4+31	0.2600	0.74							
4+32	0.2610	0.72							
4+33	0.2620	0.69							
4+34	0.2629	0.66							
4+35	0.2637	0.63							
4+36	0.2646	0.62							
4+37	0.2654	0.61							
4+38	0.2662	0.59							
4+39	0.2670	0.58							
4+40	0.2678	0.57							
4+41	0.2686	0.56							
4+42	0.2693	0.54							
4+43	0.2701	0.53							
4+44	0.2708	0.52							
4+45	0.2715	0.51							
4+46	0.2722	0.49							
4+47	0.2728	0.49							
4+48	0.2735	0.48							
4+49	0.2741	0.47							
4+50	0.2748	0.46							
4+51	0.2754	0.46							
4+52	0.2760	0.45							
4+53	0.2766	0.44							
4+54	0.2772	0.43							
4+55	0.2778	0.43							
4+56	0.2784	0.42							
4+57	0.2790	0.41							
4+58	0.2795	0.41							
4+59	0.2801	0.40							
5+ 0	0.2806	0.40							
5+ 1	0.2812	0.39							
5+ 2	0.2817	0.39							
5+ 3	0.2822	0.38							
5+ 4	0.2828	0.38							
5+ 5	0.2833	0.37							
5+ 6	0.2838	0.37							

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5+ 7	0.2843	0.36	Q				V
5+ 8	0.2848	0.36	Q				V
5+ 9	0.2853	0.36	Q				V
5+10	0.2858	0.35	Q				V
5+11	0.2862	0.35	Q				V
5+12	0.2867	0.35	Q				V
5+13	0.2872	0.34	Q				V
5+14	0.2877	0.34	Q				V
5+15	0.2881	0.33	Q				V
5+16	0.2886	0.33	Q				V
5+17	0.2890	0.33	Q				V
5+18	0.2895	0.32	Q				V
5+19	0.2899	0.32	Q				V
5+20	0.2904	0.32	Q				V
5+21	0.2908	0.32	Q				V
5+22	0.2912	0.31	Q				V
5+23	0.2916	0.31	Q				V
5+24	0.2921	0.31	Q				V
5+25	0.2925	0.30	Q				V
5+26	0.2929	0.30	Q				V
5+27	0.2933	0.30	Q				V
5+28	0.2937	0.30	Q				V
5+29	0.2941	0.29	Q				V
5+30	0.2945	0.29	Q				V
5+31	0.2949	0.29	Q				V
5+32	0.2953	0.29	Q				V
5+33	0.2957	0.28	Q				V
5+34	0.2961	0.28	Q				V
5+35	0.2965	0.28	Q				V
5+36	0.2969	0.28	Q				V
5+37	0.2973	0.28	Q				V
5+38	0.2976	0.27	Q				V
5+39	0.2980	0.27	Q				V
5+40	0.2984	0.27	Q				V
5+41	0.2987	0.27	Q				V
5+42	0.2991	0.27	Q				V
5+43	0.2995	0.26	Q				V
5+44	0.2998	0.26	Q				V
5+45	0.3002	0.26	Q				V
5+46	0.3006	0.26	Q				V
5+47	0.3009	0.26	Q				V
5+48	0.3013	0.26	Q				V
5+49	0.3016	0.25	Q				V
5+50	0.3020	0.25	Q				V
5+51	0.3023	0.25	Q				V
5+52	0.3026	0.25	Q				V
5+53	0.3030	0.25	Q				V
5+54	0.3033	0.25	Q				V
5+55	0.3037	0.24	Q				V
5+56	0.3040	0.24	Q				V
5+57	0.3043	0.24	Q				V
5+58	0.3047	0.24	Q				V
5+59	0.3050	0.24	Q				V
6+ 0	0.3053	0.24	Q				V
6+ 1	0.3056	0.24	Q				V
6+ 2	0.3060	0.23	Q				V
6+ 3	0.3063	0.23	Q				V

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 Process from Point/Station 2.041 to Point/Station 2.042
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 384.000(Ft.)
 Downstream point/station elevation = 238.800(Ft.)
 Pipe length = 44.00(Ft.) Slope = 3.3000 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 5.727(CFS)
 Nearest computed pipe diameter = 6.00(In.)
 Calculated individual pipe flow = 5.727(CFS)
 Normal flow depth in pipe = 3.22(In.)
 Flow top width inside pipe = 5.98(In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 53.42(Ft/s)
 Travel time through pipe = 0.01 min.
 Time of concentration (TC) = 11.63 min.

 Process from Point/Station 2.042 to Point/Station 2.043
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 383.800(Ft.)
 Downstream point/station elevation = 382.800(Ft.)
 Pipe length = 102.00(Ft.) Slope = 0.0098 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 5.727(CFS)
 Nearest computed pipe diameter = 15.00(In.)
 Calculated individual pipe flow = 5.727(CFS)
 Normal flow depth in pipe = 11.09(In.)
 Flow top width inside pipe = 13.17(In.)
 Critical Depth = 11.63(In.)
 Pipe flow velocity = 5.90(Ft/s)
 Travel time through pipe = 0.29 min.
 Time of concentration (TC) = 11.92 min.

 Process from Point/Station 1.023 to Point/Station 2.043
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 3.350(Ac.)
 Runoff from this stream = 5.727(CFS)
 Time of concentration = 11.92 min.
 Rainfall intensity = 3.912(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	12.531	14.20	3.494
2	5.727	11.92	3.912
Qmax(1) =			
	1.000 *	1.000 *	12.531) +
	0.893 *	1.000 *	5.727) + = 17.646
Qmax(2) =			
	1.000 *	0.839 *	12.531) +
	1.000 *	1.000 *	5.727) + = 16.244

Total of 2 main streams to confluence:

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Flow rates before confluence point:

12.531 5.727

Maximum flow rates at confluence using above data:

17.646 16.244

Area of streams before confluence:

10.030 3.350

Results of confluence:

Total flow rate = 17.646(CFS)

Time of concentration = 14.202 min.

Effective stream area after confluence = 13.380(Ac.)

+++++
Process from Point/Station 2.043 to Point/Station 2.044
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 382.800(Ft.)
Downstream point/station elevation = 382.000(Ft.)
Pipe length = 83.00(Ft.) Slope = 0.0096 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 17.646(CFS)
Nearest computed pipe diameter = 24.00(In.)
Calculated individual pipe flow = 17.646(CFS)
Normal flow depth in pipe = 16.15(In.)
Flow top width inside pipe = 22.52(In.)
Critical Depth = 18.17(In.)
Pipe flow velocity = 7.84(Ft/s)
Travel time through pipe = 0.18 min.
Time of concentration (TC) = 14.38 min.

+++++
Process from Point/Station 2.044 to Point/Station 1.031
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
Stream flow area = 13.380(Ac.)
Runoff from this stream = 17.646(CFS)
Time of concentration = 14.38 min.
Rainfall intensity = 3.466(In/Hr)
Program is now starting with Main Stream No. 2

+++++
Process from Point/Station 1.031 to Point/Station 1.031
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.335 given for subarea
Rainfall intensity (I) = 3.466(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 14.38 min. Rain intensity = 3.47(In/Hr)
Total area = 8.190(Ac.) Total runoff = 9.650(CFS)

+++++
Process from Point/Station 2.044 to Point/Station 1.031
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
Stream flow area = 8.190(Ac.)

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 Runoff from this stream = 9.650(CFS)
 Time of concentration = 14.38 min.
 Rainfall intensity = 3.466(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	17.646	14.38	3.466
2	9.650	14.38	3.466

Qmax(1) =

$$1.000 * 1.000 * 17.646 + 1.000 * 1.000 * 9.650 = 27.295$$

Qmax(2) =

$$1.000 * 1.000 * 17.646 + 1.000 * 1.000 * 9.650 = 27.295$$

Total of 2 main streams to confluence:
 Flow rates before confluence point:
 17.646 9.650
 Maximum flow rates at confluence using above data:
 27.295 27.295
 Area of streams before confluence:
 13.380 8.190

Results of confluence:
 Total flow rate = 27.295(CFS)
 Time of concentration = 14.379 min.
 Effective stream area after confluence = 21.570(Ac.)
 End of computations, total study area = 21.570 (Ac.)

EXHIBIT “C”

Detention/Retarding Basin Hydrograph
13776ElNopalPond

13776ELNOPALPOND

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2012
Study date: 02/02/17

13776 El Nopal Pond

Program License Serial Number 6326

***** HYDROGRAPH INFORMATION *****
From study/file name: 13776ELNOPALPOST.rte
*****HYDROGRAPH DATA*****
Number of intervals = 363
Time interval = 1.0 (Min.)
Maximum/Peak flow rate = 5.727 (CFS)
Total volume = 0.306 (Ac.Ft)
Status of hydrographs being held in storage
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
Peak (CFS) 0.000 0.000 0.000 0.000 0.000
Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000

+++++
Process from Point/Station 2.041 to Point/Station 2.042
**** RETARDING BASIN ROUTING ****

Program computation of outflow v. depth

CALCULATED OUTFLOW DATA AT DEPTH = 1.00(Ft.))
Total outflow at this depth = 0.00(CFS)

CALCULATED OUTFLOW DATA AT DEPTH = 2.00(Ft.))

Free outlet pipe flow: Pipe Diameter = 1.00(Ft.)
Capacity = $8 * \text{Pipe area} * \text{depth}^{0.5}$ (Using feet as units)
Depth above pipe = 1.00(Ft.) Capacity = 6.28(CFS)

Total outflow at this depth = 6.28(CFS)

Total number of inflow hydrograph intervals = 363
Hydrograph time unit = 1.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

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

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
1.000	0.057	0.000	0.057	0.057
2.000	0.129	6.283	0.125	0.133

Hydrograph Detention Basin Routing

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

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	1.4	2.86	4.30	5.73	Depth (Ft.)
0.017	0.02	0.00	0.000	0					0.00
0.033	0.04	0.00	0.000	0					0.00
0.050	0.06	0.00	0.000	0					0.00
0.067	0.08	0.00	0.000	0					0.00
0.083	0.10	0.00	0.000	0					0.01
0.100	0.12	0.00	0.001	0					0.01
0.117	0.14	0.00	0.001	0					0.01
0.133	0.16	0.00	0.001	0					0.02
0.150	0.18	0.00	0.001	OI					0.02
0.167	0.20	0.00	0.001	OI					0.02
0.183	0.22	0.00	0.002	OI					0.03
0.200	0.22	0.00	0.002	OI					0.04
0.217	0.22	0.00	0.002	OI					0.04
0.233	0.22	0.00	0.003	OI					0.05
0.250	0.22	0.00	0.003	OI					0.05
0.267	0.23	0.00	0.003	OI					0.06
0.283	0.23	0.00	0.004	OI					0.06
0.300	0.23	0.00	0.004	OI					0.07
0.317	0.23	0.00	0.004	OI					0.07
0.333	0.23	0.00	0.004	OI					0.08
0.350	0.23	0.00	0.005	OI					0.08
0.367	0.23	0.00	0.005	OI					0.09
0.383	0.23	0.00	0.005	OI					0.10
0.400	0.23	0.00	0.006	OI					0.10
0.417	0.23	0.00	0.006	OI					0.11
0.433	0.23	0.00	0.006	OI					0.11
0.450	0.23	0.00	0.007	OI					0.12
0.467	0.23	0.00	0.007	OI					0.12
0.483	0.23	0.00	0.007	OI					0.13
0.500	0.23	0.00	0.008	OI					0.13
0.517	0.24	0.00	0.008	OI					0.14
0.533	0.24	0.00	0.008	OI					0.15
0.550	0.24	0.00	0.009	OI					0.15
0.567	0.24	0.00	0.009	OI					0.16
0.583	0.24	0.00	0.009	OI					0.16
0.600	0.24	0.00	0.010	OI					0.17
0.617	0.24	0.00	0.010	OI					0.17
0.633	0.24	0.00	0.010	OI					0.18
0.650	0.24	0.00	0.011	OI					0.19
0.667	0.24	0.00	0.011	OI					0.19
0.683	0.24	0.00	0.011	OI					0.20

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0.700	0.24	0.00	0.012	OI					0.20
0.717	0.24	0.00	0.012	OI					0.21
0.733	0.24	0.00	0.012	OI					0.22
0.750	0.24	0.00	0.013	OI					0.22
0.767	0.24	0.00	0.013	OI					0.23
0.783	0.25	0.00	0.013	OI					0.23
0.800	0.25	0.00	0.014	OI					0.24
0.817	0.25	0.00	0.014	OI					0.24
0.833	0.25	0.00	0.014	OI					0.25
0.850	0.25	0.00	0.015	OI					0.26
0.867	0.25	0.00	0.015	OI					0.26
0.883	0.25	0.00	0.015	OI					0.27
0.900	0.25	0.00	0.016	OI					0.28
0.917	0.25	0.00	0.016	OI					0.28
0.933	0.25	0.00	0.016	OI					0.29
0.950	0.26	0.00	0.017	OI					0.29
0.967	0.26	0.00	0.017	OI					0.30
0.983	0.26	0.00	0.017	OI					0.31
1.000	0.26	0.00	0.018	OI					0.31
1.017	0.26	0.00	0.018	OI					0.32
1.033	0.26	0.00	0.018	OI					0.32
1.050	0.26	0.00	0.019	OI					0.33
1.067	0.26	0.00	0.019	OI					0.34
1.083	0.26	0.00	0.020	OI					0.34
1.100	0.26	0.00	0.020	OI					0.35
1.117	0.26	0.00	0.020	OI					0.36
1.133	0.26	0.00	0.021	OI					0.36
1.150	0.26	0.00	0.021	OI					0.37
1.167	0.27	0.00	0.021	OI					0.38
1.183	0.27	0.00	0.022	OI					0.38
1.200	0.27	0.00	0.022	OI					0.39
1.217	0.27	0.00	0.022	OI					0.39
1.233	0.27	0.00	0.023	OI					0.40
1.250	0.27	0.00	0.023	OI					0.41
1.267	0.27	0.00	0.024	OI					0.41
1.283	0.27	0.00	0.024	OI					0.42
1.300	0.28	0.00	0.024	OI					0.43
1.317	0.28	0.00	0.025	OI					0.43
1.333	0.28	0.00	0.025	OI					0.44
1.350	0.28	0.00	0.026	OI					0.45
1.367	0.28	0.00	0.026	OI					0.45
1.383	0.28	0.00	0.026	OI					0.46
1.400	0.28	0.00	0.027	OI					0.47
1.417	0.28	0.00	0.027	OI					0.47
1.433	0.28	0.00	0.027	OI					0.48
1.450	0.28	0.00	0.028	OI					0.49
1.467	0.28	0.00	0.028	OI					0.49
1.483	0.28	0.00	0.029	OI					0.50
1.500	0.29	0.00	0.029	OI					0.51
1.517	0.29	0.00	0.029	OI					0.52
1.533	0.29	0.00	0.030	OI					0.52
1.550	0.29	0.00	0.030	OI					0.53
1.567	0.29	0.00	0.031	OI					0.54
1.583	0.29	0.00	0.031	OI					0.54
1.600	0.30	0.00	0.031	OI					0.55
1.617	0.30	0.00	0.032	OI					0.56
1.633	0.30	0.00	0.032	OI					0.57
1.650	0.30	0.00	0.033	OI					0.57
1.667	0.30	0.00	0.033	OI					0.58
1.683	0.30	0.00	0.033	OI					0.59
1.700	0.30	0.00	0.034	OI					0.59
1.717	0.30	0.00	0.034	OI					0.60
1.733	0.30	0.00	0.035	OI					0.61

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1.750	0.31	0.00	0.035	OI					0.62
1.767	0.31	0.00	0.036	OI					0.62
1.783	0.31	0.00	0.036	OI					0.63
1.800	0.31	0.00	0.036	OI					0.64
1.817	0.31	0.00	0.037	OI					0.65
1.833	0.31	0.00	0.037	OI					0.65
1.850	0.31	0.00	0.038	OI					0.66
1.867	0.31	0.00	0.038	OI					0.67
1.883	0.32	0.00	0.039	OI					0.68
1.900	0.32	0.00	0.039	OI					0.68
1.917	0.32	0.00	0.039	OI					0.69
1.933	0.32	0.00	0.040	OI					0.70
1.950	0.32	0.00	0.040	OI					0.71
1.967	0.33	0.00	0.041	OI					0.72
1.983	0.33	0.00	0.041	OI					0.72
2.000	0.33	0.00	0.042	OI					0.73
2.017	0.33	0.00	0.042	OI					0.74
2.033	0.33	0.00	0.043	OI					0.75
2.050	0.33	0.00	0.043	OI					0.76
2.067	0.34	0.00	0.043	OI					0.76
2.083	0.34	0.00	0.044	OI					0.77
2.100	0.34	0.00	0.044	OI					0.78
2.117	0.34	0.00	0.045	OI					0.79
2.133	0.34	0.00	0.045	OI					0.80
2.150	0.34	0.00	0.046	OI					0.80
2.167	0.34	0.00	0.046	OI					0.81
2.183	0.34	0.00	0.047	OI					0.82
2.200	0.35	0.00	0.047	OI					0.83
2.217	0.35	0.00	0.048	OI					0.84
2.233	0.35	0.00	0.048	OI					0.85
2.250	0.35	0.00	0.049	OI					0.85
2.267	0.36	0.00	0.049	OI					0.86
2.283	0.36	0.00	0.050	O I					0.87
2.300	0.36	0.00	0.050	O I					0.88
2.317	0.36	0.00	0.051	O I					0.89
2.333	0.37	0.00	0.051	O I					0.90
2.350	0.37	0.00	0.052	O I					0.91
2.367	0.37	0.00	0.052	O I					0.92
2.383	0.38	0.00	0.053	O I					0.92
2.400	0.38	0.00	0.053	O I					0.93
2.417	0.38	0.00	0.054	O I					0.94
2.433	0.38	0.00	0.054	O I					0.95
2.450	0.38	0.00	0.055	O I					0.96
2.467	0.38	0.00	0.055	O I					0.97
2.483	0.39	0.00	0.056	O I					0.98
2.500	0.39	0.00	0.056	O I					0.99
2.517	0.39	0.00	0.057	O I					1.00
2.533	0.39	0.04	0.057	O I					1.01
2.550	0.39	0.08	0.058	O I					1.01
2.567	0.39	0.11	0.058	O I					1.02
2.583	0.40	0.15	0.059	O I					1.02
2.600	0.40	0.17	0.059	O I					1.03
2.617	0.40	0.20	0.059	OI					1.03
2.633	0.41	0.22	0.060	OI					1.04
2.650	0.41	0.24	0.060	OI					1.04
2.667	0.42	0.26	0.060	OI					1.04
2.683	0.42	0.28	0.060	OI					1.04
2.700	0.42	0.30	0.060	OI					1.05
2.717	0.43	0.31	0.061	OI					1.05
2.733	0.43	0.33	0.061	OI					1.05
2.750	0.44	0.34	0.061	OI					1.05
2.767	0.44	0.35	0.061	OI					1.06
2.783	0.44	0.36	0.061	O					1.06

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2.800	0.44	0.37	0.061	0					1.06
2.817	0.45	0.38	0.061	0					1.06
2.833	0.45	0.39	0.061	0					1.06
2.850	0.45	0.39	0.061	0					1.06
2.867	0.45	0.40	0.062	0					1.06
2.883	0.46	0.41	0.062	0					1.06
2.900	0.46	0.41	0.062	0					1.07
2.917	0.46	0.42	0.062	0					1.07
2.933	0.46	0.42	0.062	0					1.07
2.950	0.47	0.43	0.062	0					1.07
2.967	0.47	0.43	0.062	0					1.07
2.983	0.48	0.44	0.062	0					1.07
3.000	0.49	0.44	0.062	0					1.07
3.017	0.49	0.45	0.062	0					1.07
3.033	0.50	0.45	0.062	0					1.07
3.050	0.51	0.46	0.062	0					1.07
3.067	0.51	0.46	0.062	0					1.07
3.083	0.52	0.47	0.062	0					1.07
3.100	0.52	0.48	0.062	0					1.08
3.117	0.53	0.48	0.063	0					1.08
3.133	0.53	0.49	0.063	0					1.08
3.150	0.54	0.49	0.063	OI					1.08
3.167	0.54	0.50	0.063	OI					1.08
3.183	0.55	0.50	0.063	OI					1.08
3.200	0.55	0.51	0.063	OI					1.08
3.217	0.55	0.51	0.063	OI					1.08
3.233	0.56	0.52	0.063	OI					1.08
3.250	0.56	0.52	0.063	OI					1.08
3.267	0.57	0.53	0.063	OI					1.08
3.283	0.57	0.53	0.063	OI					1.08
3.300	0.57	0.54	0.063	0					1.09
3.317	0.59	0.54	0.063	0					1.09
3.333	0.60	0.55	0.063	0					1.09
3.350	0.61	0.55	0.063	0					1.09
3.367	0.62	0.56	0.063	0					1.09
3.383	0.63	0.57	0.064	0					1.09
3.400	0.64	0.58	0.064	0					1.09
3.417	0.66	0.58	0.064	0					1.09
3.433	0.67	0.59	0.064	0					1.09
3.450	0.68	0.60	0.064	0					1.10
3.467	0.69	0.61	0.064	0					1.10
3.483	0.70	0.62	0.064	0					1.10
3.500	0.71	0.63	0.064	0					1.10
3.517	0.72	0.64	0.064	OI					1.10
3.533	0.73	0.65	0.064	OI					1.10
3.550	0.74	0.66	0.065	OI					1.10
3.567	0.75	0.67	0.065	OI					1.11
3.583	0.76	0.68	0.065	OI					1.11
3.600	0.76	0.69	0.065	OI					1.11
3.617	0.77	0.70	0.065	OI					1.11
3.633	0.78	0.71	0.065	OI					1.11
3.650	0.79	0.72	0.065	OI					1.11
3.667	0.80	0.72	0.065	0					1.12
3.683	0.83	0.73	0.065	0					1.12
3.700	0.87	0.75	0.066	0					1.12
3.717	0.90	0.76	0.066	OI					1.12
3.733	0.94	0.78	0.066	OI					1.12
3.750	0.97	0.80	0.066	OI					1.13
3.767	1.00	0.82	0.066	OI					1.13
3.783	1.04	0.84	0.067	OI					1.13
3.800	1.07	0.87	0.067	OI					1.14
3.817	1.11	0.89	0.067	0 I					1.14
3.833	1.14	0.92	0.068	OI					1.15

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3.850	1.17	0.95	0.068	O I						1.15
3.867	1.22	0.97	0.068	O I						1.16
3.883	1.26	1.00	0.069	O I						1.16
3.900	1.31	1.04	0.069	O I						1.16
3.917	1.35	1.07	0.069	O I						1.17
3.933	1.39	1.10	0.070	O I						1.18
3.950	1.44	1.14	0.070	O I						1.18
3.967	1.48	1.18	0.070	O I						1.19
3.983	1.52	1.21	0.071	O I						1.19
4.000	1.57	1.25	0.071	O I						1.20
4.017	1.61	1.29	0.072	O I						1.21
4.033	1.65	1.33	0.072	O I						1.21
4.050	2.03	1.39	0.073	O I						1.22
4.067	2.40	1.48	0.074	O I						1.24
4.083	2.77	1.60	0.075	O I						1.26
4.100	3.14	1.76	0.077	O I						1.28
4.117	3.51	1.93	0.079	O I						1.31
4.133	3.88	2.13	0.081	O I						1.34
4.150	4.25	2.35	0.084	O I						1.37
4.167	4.62	2.59	0.087	O I						1.41
4.183	4.99	2.84	0.090	O I						1.45
4.200	5.36	3.10	0.093	O I						1.49
4.217	5.73	3.38	0.096	O I						1.54
4.233	5.29	3.62	0.098	O I						1.58
4.250	4.86	3.79	0.100	O I						1.60
4.267	4.42	3.88	0.101	O I						1.62
4.283	3.99	3.92	0.102	O I						1.62
4.300	3.55	3.90	0.102	O I						1.62
4.317	3.12	3.84	0.101	O I						1.61
4.333	2.68	3.73	0.100	O I						1.59
4.350	2.25	3.59	0.098	O I						1.57
4.367	1.81	3.41	0.096	O I						1.54
4.383	1.38	3.21	0.094	O I						1.51
4.400	0.94	2.97	0.091	O I						1.47
4.417	0.91	2.74	0.088	O I						1.44
4.433	0.89	2.53	0.086	O I						1.40
4.450	0.86	2.34	0.084	O I						1.37
4.467	0.83	2.17	0.082	O I						1.35
4.483	0.80	2.02	0.080	O I						1.32
4.500	0.77	1.88	0.079	O I						1.30
4.517	0.74	1.75	0.077	O I						1.28
4.533	0.72	1.64	0.076	O I						1.26
4.550	0.69	1.53	0.075	O I						1.24
4.567	0.66	1.43	0.073	O I						1.23
4.583	0.63	1.34	0.072	O I						1.21
4.600	0.62	1.26	0.071	O I						1.20
4.617	0.61	1.19	0.071	O I						1.19
4.633	0.59	1.12	0.070	O I						1.18
4.650	0.58	1.06	0.069	O I						1.17
4.667	0.57	1.01	0.069	O I						1.16
4.683	0.56	0.96	0.068	O I						1.15
4.700	0.54	0.91	0.067	O I						1.14
4.717	0.53	0.87	0.067	O I						1.14
4.733	0.52	0.83	0.066	O I						1.13
4.750	0.51	0.79	0.066	O I						1.13
4.767	0.49	0.76	0.066	O I						1.12
4.783	0.49	0.73	0.065	O I						1.12
4.800	0.48	0.70	0.065	O I						1.11
4.817	0.47	0.68	0.065	O I						1.11
4.833	0.46	0.65	0.064	O I						1.10
4.850	0.46	0.63	0.064	O I						1.10
4.867	0.45	0.61	0.064	O I						1.10
4.883	0.44	0.59	0.064	O I						1.09

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4.900	0.43	0.57	0.064	IO				1.09
4.917	0.43	0.56	0.063	IO				1.09
4.933	0.42	0.54	0.063	IO				1.09
4.950	0.41	0.53	0.063	0				1.08
4.967	0.41	0.52	0.063	0				1.08
4.983	0.40	0.50	0.063	0				1.08
5.000	0.40	0.49	0.063	0				1.08
5.017	0.39	0.48	0.063	0				1.08
5.033	0.39	0.47	0.062	0				1.07
5.050	0.38	0.46	0.062	0				1.07
5.067	0.38	0.45	0.062	0				1.07
5.083	0.37	0.44	0.062	0				1.07
5.100	0.37	0.44	0.062	0				1.07
5.117	0.36	0.43	0.062	0				1.07
5.133	0.36	0.42	0.062	0				1.07
5.150	0.36	0.41	0.062	IO				1.07
5.167	0.35	0.41	0.062	IO				1.06
5.183	0.35	0.40	0.062	IO				1.06
5.200	0.35	0.39	0.062	IO				1.06
5.217	0.34	0.39	0.061	IO				1.06
5.233	0.34	0.38	0.061	IO				1.06
5.250	0.33	0.38	0.061	IO				1.06
5.267	0.33	0.37	0.061	IO				1.06
5.283	0.33	0.37	0.061	IO				1.06
5.300	0.32	0.36	0.061	IO				1.06
5.317	0.32	0.36	0.061	IO				1.06
5.333	0.32	0.35	0.061	0				1.06
5.350	0.32	0.35	0.061	0				1.06
5.367	0.31	0.35	0.061	0				1.06
5.383	0.31	0.34	0.061	0				1.05
5.400	0.31	0.34	0.061	0				1.05
5.417	0.30	0.33	0.061	0				1.05
5.433	0.30	0.33	0.061	0				1.05
5.450	0.30	0.33	0.061	0				1.05
5.467	0.30	0.32	0.061	0				1.05
5.483	0.29	0.32	0.061	0				1.05
5.500	0.29	0.32	0.061	0				1.05
5.517	0.29	0.31	0.061	0				1.05
5.533	0.29	0.31	0.061	0				1.05
5.550	0.28	0.31	0.061	0				1.05
5.567	0.28	0.31	0.061	0				1.05
5.583	0.28	0.30	0.060	0				1.05
5.600	0.28	0.30	0.060	0				1.05
5.617	0.28	0.30	0.060	0				1.05
5.633	0.27	0.30	0.060	0				1.05
5.650	0.27	0.29	0.060	0				1.05
5.667	0.27	0.29	0.060	0				1.05
5.683	0.27	0.29	0.060	0				1.05
5.700	0.27	0.29	0.060	0				1.05
5.717	0.26	0.28	0.060	0				1.05
5.733	0.26	0.28	0.060	0				1.04
5.750	0.26	0.28	0.060	0				1.04
5.767	0.26	0.28	0.060	0				1.04
5.783	0.26	0.27	0.060	0				1.04
5.800	0.26	0.27	0.060	0				1.04
5.817	0.25	0.27	0.060	0				1.04
5.833	0.25	0.27	0.060	0				1.04
5.850	0.25	0.27	0.060	0				1.04
5.867	0.25	0.26	0.060	0				1.04
5.883	0.25	0.26	0.060	0				1.04
5.900	0.25	0.26	0.060	0				1.04
5.917	0.24	0.26	0.060	0				1.04
5.933	0.24	0.26	0.060	0				1.04

13776ELNOPALPOND

5.950	0.24	0.26	0.060	0					1.04
5.967	0.24	0.25	0.060	0					1.04
5.983	0.24	0.25	0.060	0					1.04
6.000	0.24	0.25	0.060	0					1.04
6.017	0.24	0.25	0.060	0					1.04
6.033	0.23	0.25	0.060	0					1.04
6.050	0.23	0.25	0.060	0					1.04
6.067	0.00	0.23	0.060	IO					1.04
6.083	0.00	0.20	0.059	IO					1.03
6.100	0.00	0.18	0.059	IO					1.03
6.117	0.00	0.16	0.059	0					1.03
6.133	0.00	0.14	0.059	0					1.02
6.150	0.00	0.13	0.058	0					1.02
6.167	0.00	0.11	0.058	0					1.02
6.183	0.00	0.10	0.058	0					1.02
6.200	0.00	0.09	0.058	0					1.01
6.217	0.00	0.08	0.058	0					1.01
6.233	0.00	0.07	0.058	0					1.01
6.250	0.00	0.06	0.058	0					1.01
6.267	0.00	0.05	0.058	0					1.01
6.283	0.00	0.05	0.058	0					1.01
6.300	0.00	0.04	0.057	0					1.01
6.317	0.00	0.04	0.057	0					1.01
6.333	0.00	0.03	0.057	0					1.01
6.350	0.00	0.03	0.057	0					1.00
6.367	0.00	0.03	0.057	0					1.00
6.383	0.00	0.02	0.057	0					1.00
6.400	0.00	0.02	0.057	0					1.00
6.417	0.00	0.02	0.057	0					1.00
6.433	0.00	0.02	0.057	0					1.00
6.450	0.00	0.01	0.057	0					1.00
6.467	0.00	0.01	0.057	0					1.00
6.483	0.00	0.01	0.057	0					1.00
6.500	0.00	0.01	0.057	0					1.00
6.517	0.00	0.01	0.057	0					1.00
6.533	0.00	0.01	0.057	0					1.00
6.550	0.00	0.01	0.057	0					1.00
6.567	0.00	0.01	0.057	0					1.00
6.583	0.00	0.01	0.057	0					1.00
6.600	0.00	0.00	0.057	0					1.00
6.617	0.00	0.00	0.057	0					1.00
6.633	0.00	0.00	0.057	0					1.00
6.650	0.00	0.00	0.057	0					1.00
6.667	0.00	0.00	0.057	0					1.00
6.683	0.00	0.00	0.057	0					1.00
6.700	0.00	0.00	0.057	0					1.00
6.717	0.00	0.00	0.057	0					1.00
6.733	0.00	0.00	0.057	0					1.00
6.750	0.00	0.00	0.057	0					1.00
6.767	0.00	0.00	0.057	0					1.00
6.783	0.00	0.00	0.057	0					1.00
6.800	0.00	0.00	0.057	0					1.00
6.817	0.00	0.00	0.057	0					1.00
6.833	0.00	0.00	0.057	0					1.00

Remaining water in basin = 0.06 (Ac.Ft)

*****HYDROGRAPH DATA*****

Number of intervals = 410

Time interval = 1.0 (Min.)

Maximum/Peak flow rate = 3.919 (CFS)

```

13776ELNOPALPOND
Total volume = 0.249 (Ac.Ft)
Status of hydrographs being held in storage
Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
Peak (CFS) 0.000 0.000 0.000 0.000 0.000
Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000
*****

```

EXHIBIT “D”

Mitigated Condition

13776EINopalMit

13776ELNOPALmit

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/03/17

13776 El Nopal Post

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

Program License Serial Number 6326

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.200
P6/P24 = 50.0%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 1.011 to Point/Station 1.021
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 847.000(Ft.)
Lowest elevation = 817.000(Ft.)
Elevation difference = 30.000(Ft.) Slope = 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 6.90 minutes
(for slope value of 10.00 %)
Rainfall intensity (I) = 5.565(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.117(CFS)
Total initial stream area = 0.060(Ac.)

+++++
Page 1

13776ELNOPALmit

Process from Point/Station 1.021 to Point/Station 1.022
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 6.365(CFS)
 Depth of flow = 0.175(Ft.), Average velocity = 4.145(Ft/s)
 ***** Irregular Channel Data *****

 Information entered for subchannel number 1 :
 Point number 'X' coordinate 'Y' coordinate
 1 0.00 1.00
 2 50.00 0.00
 3 100.00 1.00
 Manning's 'N' friction factor = 0.035

Sub-Channel flow = 6.365(CFS)
 flow top width = 17.524(Ft.)
 velocity = 4.145(Ft/s)
 area = 1.535(Sq.Ft)
 Froude number = 2.468

Upstream point elevation = 817.000(Ft.)
 Downstream point elevation = 437.000(Ft.)
 Flow length = 1551.000(Ft.)
 Travel time = 6.24 min.
 Time of concentration = 13.14 min.
 Depth of flow = 0.175(Ft.)
 Average velocity = 4.145(Ft/s)
 Total irregular channel flow = 6.365(CFS)
 Irregular channel normal depth above invert elev. = 0.175(Ft.)
 Average velocity of channel(s) = 4.145(Ft/s)
 Adding area flow to channel
 Rainfall intensity (I) = 3.674(In/Hr) for a 100.0 year storm
 User specified 'C' value of 0.340 given for subarea
 Rainfall intensity = 3.674(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.340 CA = 3.411
 Subarea runoff = 12.414(CFS) for 9.970(Ac.)
 Total runoff = 12.531(CFS) Total area = 10.030(Ac.)
 Depth of flow = 0.226(Ft.), Average velocity = 4.910(Ft/s)

+++++
 Process from Point/Station 1.022 to Point/Station 1.023
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 437.000(Ft.)
 Downstream point elevation = 382.800(Ft.)
 Channel length thru subarea = 813.000(Ft.)
 Channel base width = 1.500(Ft.)
 Slope or 'Z' of left channel bank = 0.000
 Slope or 'Z' of right channel bank = 0.000
 Manning's 'N' = 0.015
 Maximum depth of channel = 1.000(Ft.)
 Flow(q) thru subarea = 12.531(CFS)
 Depth of flow = 0.657(Ft.), Average velocity = 12.711(Ft/s)
 Channel flow top width = 1.500(Ft.)
 Flow Velocity = 12.71(Ft/s)
 Travel time = 1.07 min.
 Time of concentration = 14.20 min.
 Critical depth = 1.297(Ft.)

+++++
 Page 2

13776ELNOPALmit

Process from Point/Station 1.023 to Point/Station 2.043
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 1
 Stream flow area = 10.030(Ac.)
 Runoff from this stream = 12.531(CFS)
 Time of concentration = 14.20 min.
 Rainfall intensity = 3.494(In/Hr)
 Program is now starting with Main Stream No. 2

+++++
 Process from Point/Station 2.041 to Point/Station 2.042
 **** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.410 given for subarea
 Rainfall intensity (I) = 3.285(In/Hr) for a 100.0 year storm
 User specified values are as follows:
 TC = 15.62 min. Rain intensity = 3.29(In/Hr)
 Total area = 3.350(Ac.) Total runoff = 3.920(CFS)

+++++
 Process from Point/Station 2.042 to Point/Station 2.043
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 383.800(Ft.)
 Downstream point/station elevation = 382.800(Ft.)
 Pipe length = 102.00(Ft.) Slope = 0.0098 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 3.920(CFS)
 Nearest computed pipe diameter = 15.00(In.)
 Calculated individual pipe flow = 3.920(CFS)
 Normal flow depth in pipe = 8.48(In.)
 Flow top width inside pipe = 14.87(In.)
 Critical Depth = 9.61(In.)
 Pipe flow velocity = 5.47(Ft/s)
 Travel time through pipe = 0.31 min.
 Time of concentration (TC) = 15.93 min.

+++++
 Process from Point/Station 1.023 to Point/Station 2.043
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2
 Stream flow area = 3.350(Ac.)
 Runoff from this stream = 3.920(CFS)
 Time of concentration = 15.93 min.
 Rainfall intensity = 3.244(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	12.531	14.20	3.494
2	3.920	15.93	3.244

Qmax(1) = 1.000 * 1.000 * 12.531) +
 1.000 * 0.891 * 3.920) + = 16.025

Qmax(2) =

13776ELNOPALmit
 0.928 * 1.000 * 12.531) +
 1.000 * 1.000 * 3.920) + = 15.555

Total of 2 main streams to confluence:
 Flow rates before confluence point:
 12.531 3.920
 Maximum flow rates at confluence using above data:
 16.025 15.555
 Area of streams before confluence:
 10.030 3.350

Results of confluence:
 Total flow rate = 16.025(CFS)
 Time of concentration = 14.202 min.
 Effective stream area after confluence = 13.380(Ac.)

+++++
 Process from Point/Station 2.043 to Point/Station 2.044
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 382.800(Ft.)
 Downstream point/station elevation = 382.000(Ft.)
 Pipe length = 83.00(Ft.) Slope = 0.0096 Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 16.025(CFS)
 Nearest computed pipe diameter = 24.00(In.)
 Calculated individual pipe flow = 16.025(CFS)
 Normal flow depth in pipe = 15.09(In.)
 Flow top width inside pipe = 23.19(In.)
 Critical Depth = 17.31(In.)
 Pipe flow velocity = 7.70(Ft/s)
 Travel time through pipe = 0.18 min.
 Time of concentration (TC) = 14.38 min.

+++++
 Process from Point/Station 2.044 to Point/Station 1.031
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
 In Main Stream number: 1
 Stream flow area = 13.380(Ac.)
 Runoff from this stream = 16.025(CFS)
 Time of concentration = 14.38 min.
 Rainfall intensity = 3.465(In/Hr)
 Program is now starting with Main Stream No. 2

+++++
 Process from Point/Station 1.031 to Point/Station 1.031
 **** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.335 given for subarea
 Rainfall intensity (I) = 3.466(In/Hr) for a 100.0 year storm
 User specified values are as follows:
 TC = 14.38 min. Rain intensity = 3.47(In/Hr)
 Total area = 8.190(Ac.) Total runoff = 9.650(CFS)

+++++
 Process from Point/Station 2.044 to Point/Station 1.031
 **** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

In Main Stream number: 2

Stream flow area = 8.190(Ac.)

Runoff from this stream = 9.650(CFS)

Time of concentration = 14.38 min.

Rainfall intensity = 3.466(In/Hr)

Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
------------	-----------------	----------	----------------------------

1	16.025	14.38	3.465
---	--------	-------	-------

2	9.650	14.38	3.466
---	-------	-------	-------

Qmax(1) =

1.000 *	1.000 *	16.025)	+	
1.000 *	1.000 *	9.650)	+	25.674

Qmax(2) =

1.000 *	1.000 *	16.025)	+	
1.000 *	1.000 *	9.650)	+	25.673

Total of 2 main streams to confluence:

Flow rates before confluence point:

16.025	9.650
--------	-------

Maximum flow rates at confluence using above data:

25.674	25.673
--------	--------

Area of streams before confluence:

13.380	8.190
--------	-------

Results of confluence:

Total flow rate = 25.674(CFS)

Time of concentration = 14.382 min.

Effective stream area after confluence = 21.570(Ac.)

End of computations, total study area = 21.570 (Ac.)

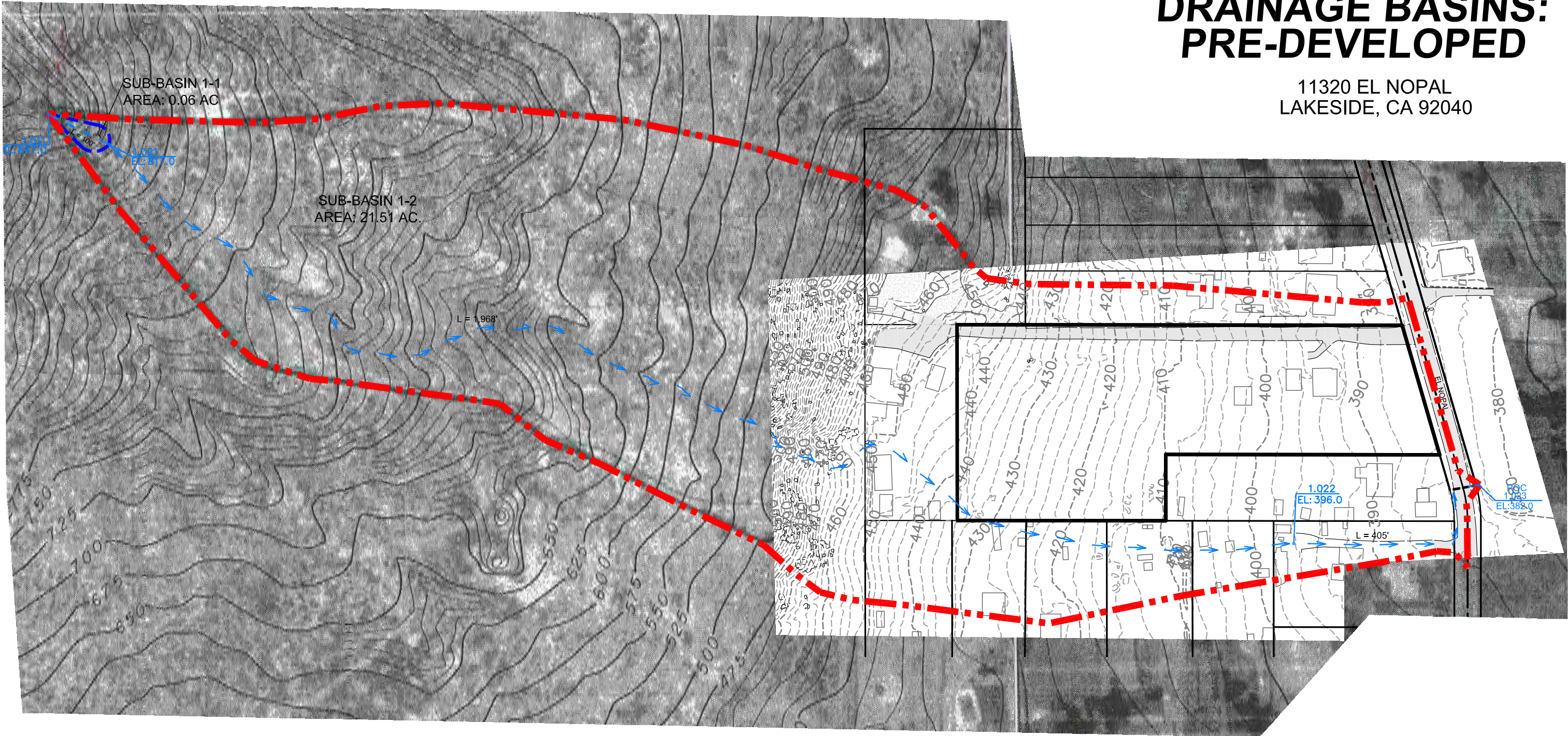
EXHIBIT “E”

Hydrology Maps

Pre-Development Exhibit
Post-Development Exhibit

DRAINAGE BASINS: PRE-DEVELOPED

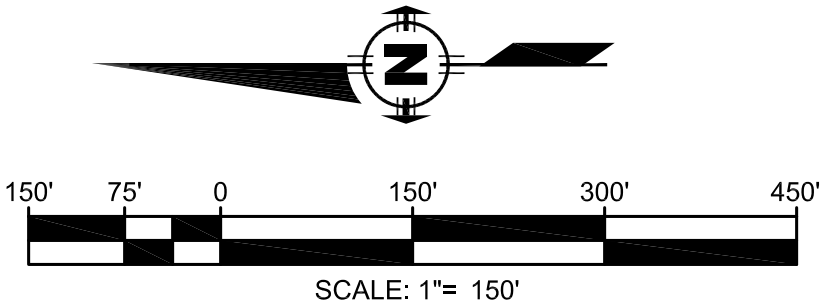
11320 EL NOPAL
LAKESIDE, CA 92040



BASIN
SUB BASIN
NODE
NODE 1.011
EL=390
NODE ELEVATION

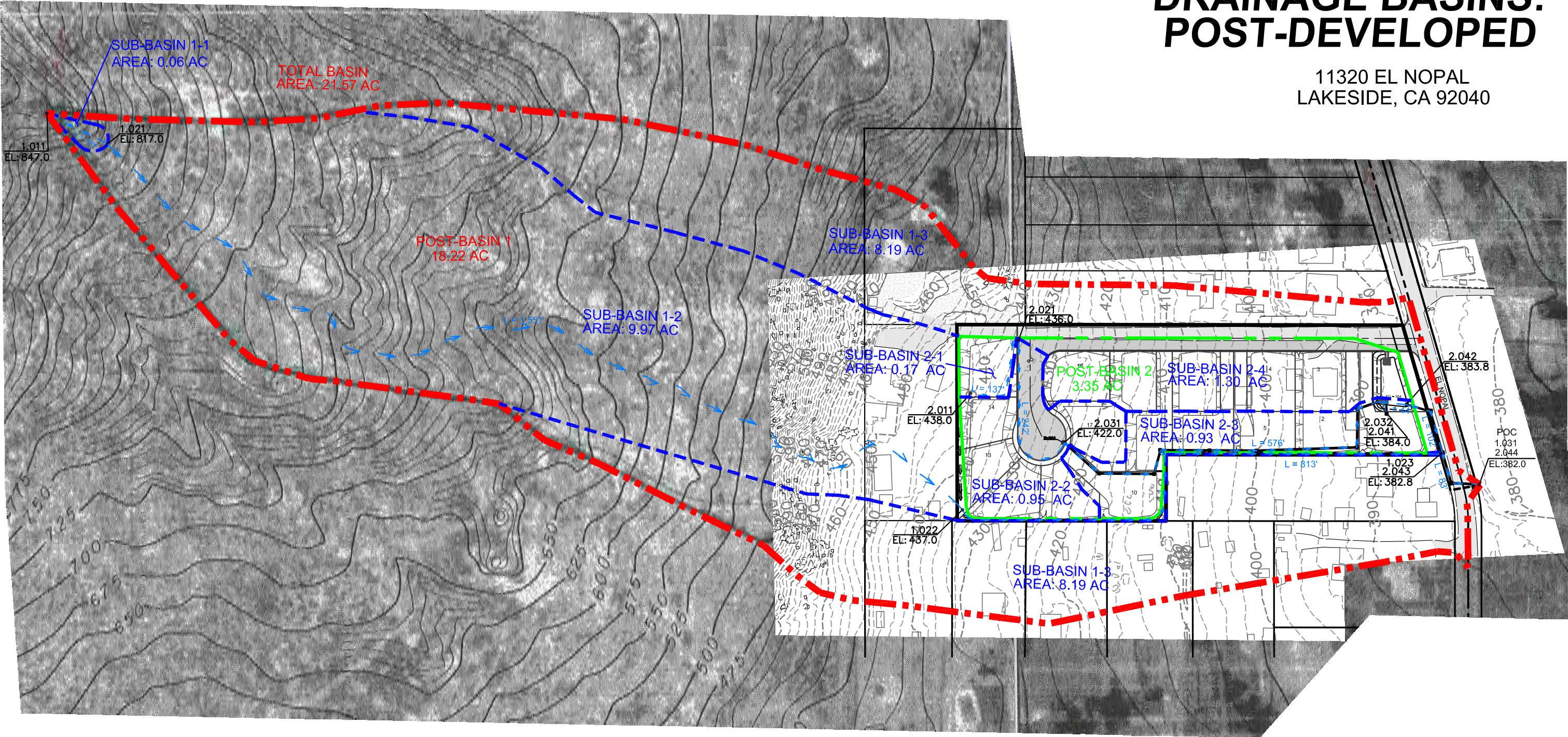
LEGEND:

- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- FLOWPATH



DRAINAGE BASINS: POST-DEVELOPED

11320 EL NOPAL
LAKESIDE, CA 92040



BASIN
SUB BASIN
NODE
NODE 1.011
EL=390
NODE ELEVATION

LEGEND:

- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- FLOWPATH

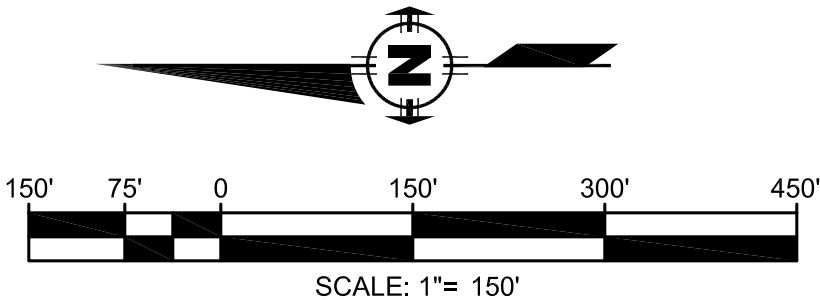
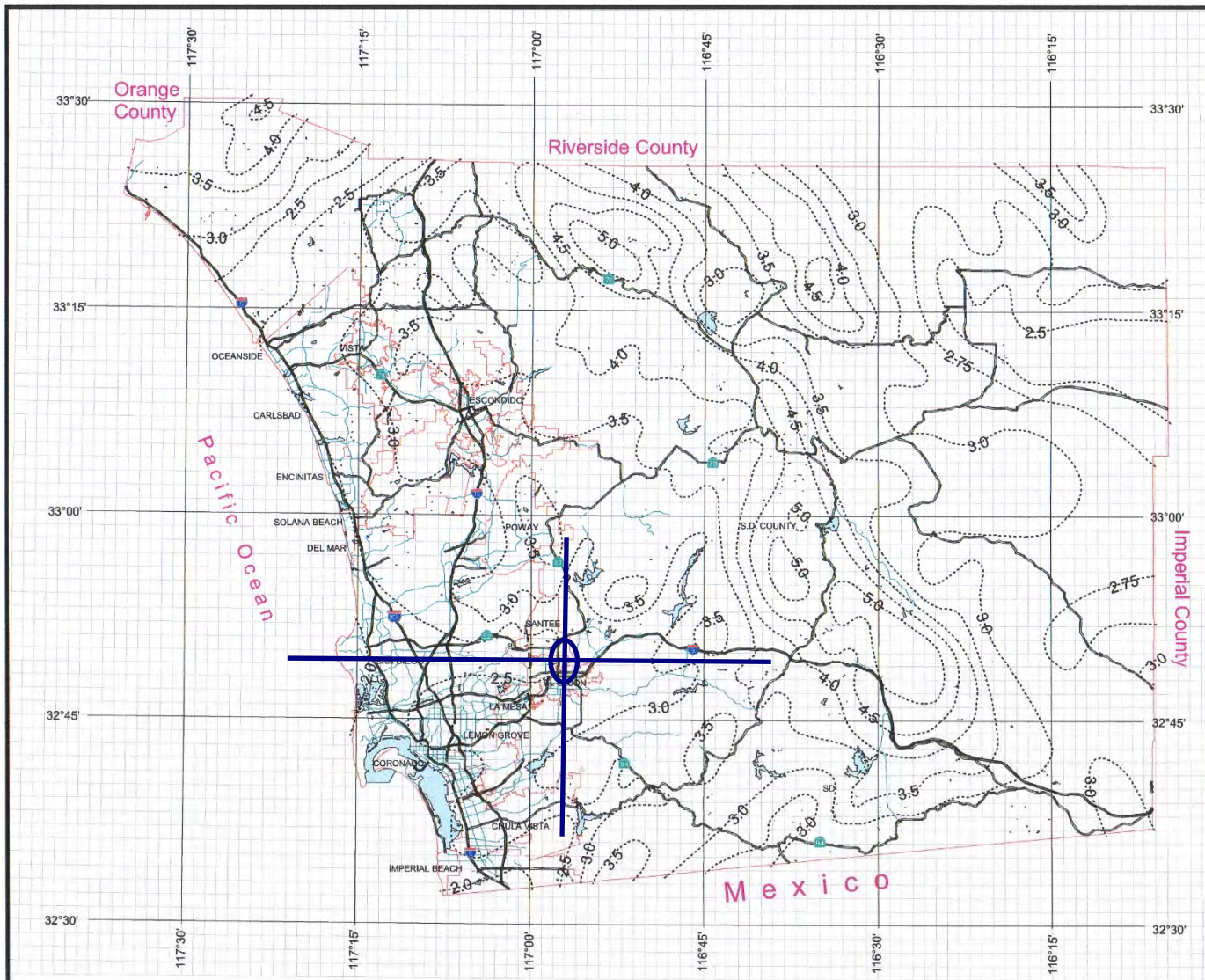


EXHIBIT “F”

Rainfall Isopluvials: 100 Year - 6 Hour and 24 Hour

Hydrologic Soil Map – ArcGIS

County of San Diego Hydrology Tables and Figures



County of San Diego Hydrology Manual



Rainfall Isoplethals

100 Year Rainfall Event - 6 Hours

----- Isopleth (inches)

P6 = 2.6 in



3 0 3 Miles

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County of San Diego Hydrology Manual



Rainfall Isophuvials

100 Year Rainfall Event - 24 Hours

----- Isophuvial (inches)

P24 = 5.2 in

DPW
GIS
Department of Public Works
Geographic Information Systems

SanGIS
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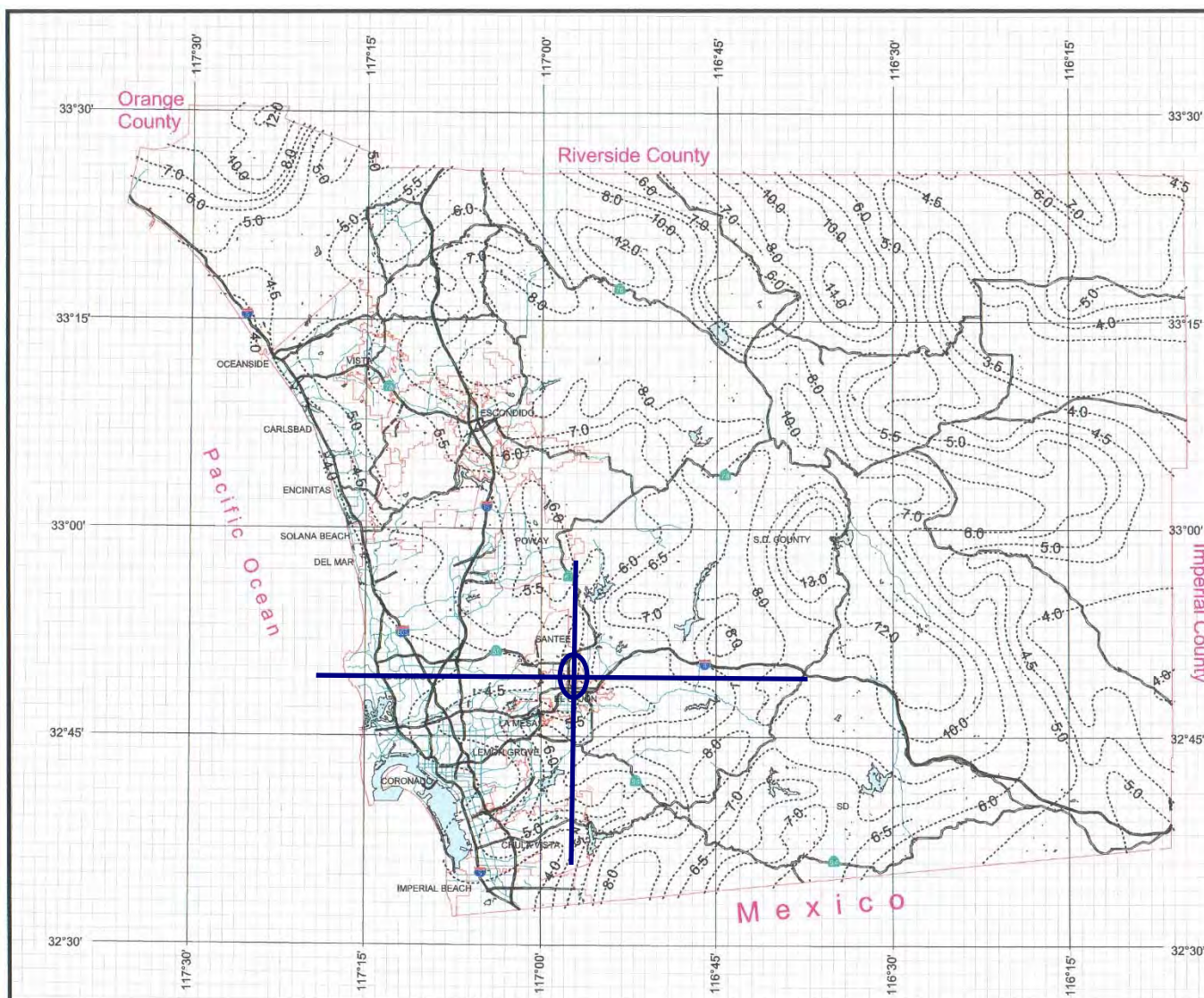


3 0 3 Miles

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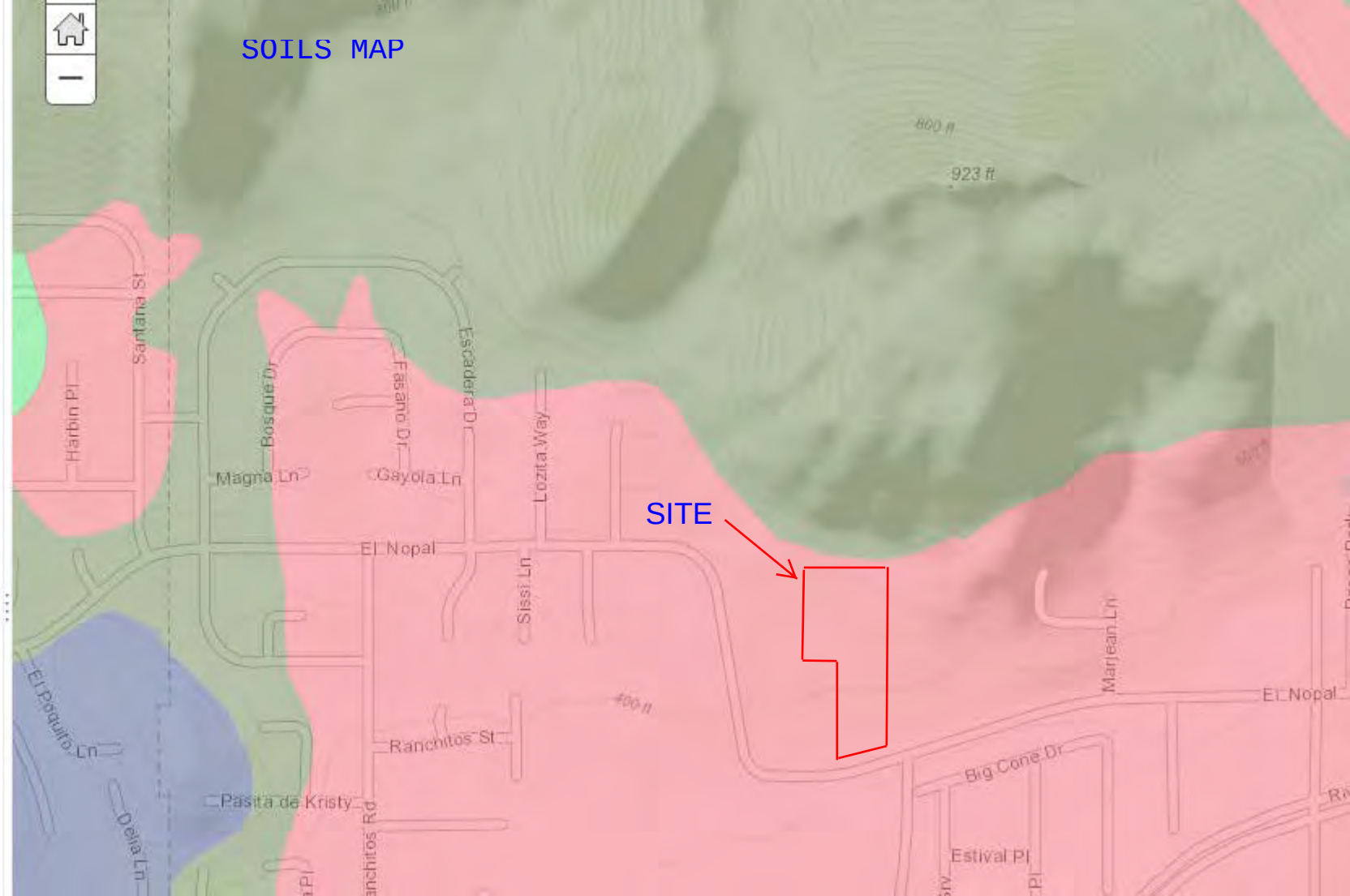
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Legend

BMP Sizing



**Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, C_p , for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

**MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)**

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description