Preliminary Hydrology and Hydraulic Study

St. Gregory of NYSSA Greek Orthodox Church
El Cajon, CA

APN: 498-320-04 and 498-320-05

Prepared For:

St. Gregory of NYSSA Greek Orthodox Church
1454 Jamacha Road
El Cajon, CA 92019

Prepared By:

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CLW No. 1201-D

July 19, 2017

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ATTACHMENTS

INTRODUCTION

The purpose of this study is to determine storm water runoff and site drainage for a 100 year storm event for a proposed multipurpose building, new chapel, parking and roadway development in the City of El Cajon, California. The project site is approximately 1.738 acres located near Jamacha Road and Hidden Mesa Road. The property currently is developed and consists of an existing church building. The adjacent land on the north is developed as a single family residence. The adjacent land to the south is developed as KinderCare.

The existing site topography slopes in a southeasterly direction. The developed site will maintain similar drainage patterns and discharge stormwater into biofiltration basins and tanks that will eventually discharge into an existing culvert located at the south of the property.

The proposed site development consists of preparing the site for construction of a multipurpose building, new chapel, parking and roadway. Incidental underground storm drain utilities, retaining walls, hardscape, and site landscaping are also proposed with this development. The project site is disturbed land with site elevations ranging from 545 to 537 feet above mean sea level (msl). The existing site has stormwater runons from the existing single family residence located north of the property.

DESIGN CRITERIA AND ASSUMPTIONS

1. The site soil classification are hydrologic soil type C & D. See Attachment 2.
2. Per the San Diego County Hydrology Manual (2003) Rainfall Isopluvial Map (See Attachment 2):
   - 100 Year Rainfall Event – 6 hours P_6 = 2.7 inches/hour
   - 100 Year Rainfall Event – 24 hours P_{24} = 5.6 inches/hour
3. Per the San Diego County Hydrology Manual (2003) Table 3.1:
4. Hydrologic calculations were performed using the CIVILCAD/CIVILDESIGN Engineering software version 7.6 per methods as outlined within the San Diego Hydrology Manual (2003). The hydrology calculations for proposed and existing conditions may be found within the hydrology calculations section of this report.

DISCUSSION

EXISTING CONDITIONS

The site is developed and comprises of two hydrologic basin (one for offsite run-on and one for the site). The stormwater sheet flows southeasterly on the site.

Below is a summary of pre-development criteria for the subject property:

TABLE 1: 100 YEAR PRE-DEVELOPMENT CRITERIA

Node	C	Tc (Min.)	Area (acre)	Q100 (cfs)
103	0.33	7.56	1.738	4.905
Total			1.738	4.905

PROPOSED CONDITIONS

The proposed conditions will consists of 2 phases. Phase 1 will propose a concrete driveway approach, DG roadway, DG parking, proposed sidewalk, and retaining wall. Phase 1 will consist 3 total basins, see Attachment 6A for proposed drainage patterns for phase 1. Phase 1 will keep the same drainage pattern as existing and discharge into the existing storm drain system located at the south of the property.

Phase 2 proposes a driveway, new parking, a new multi-purpose building, a new chapel, and 4 biofiltration basins. Basin PR-1A will drain easterly into a biofiltration basin and be discharged into a proposed storm drain system. This proposed storm drain system will also collect the runoff from the northern neighbor. This runoff will then be directed southerly into an existing culvert located south of the property. PR-1B will drain southerly toward a biofiltation basin and be directed into a 24”x24” precast box. PR-1C will consist of the western portion of the property. The drainage will flow southerly into a biofiltration basin and be piped into the same 24”x24” precast box as PR-1B. The runoff from the proposed road will drain westerly into a biofiltration basin and be piped into the same 24”x24” precast box as PR-1B and PR-1C. The precast box will then be directed into the existing culvert located south of the property.

The proposed hydrologic conditions are summarized below:

TABLE 2A: 100 YEAR POST-DEVELOPMENT CRITERIA WITHOUT DETENTION PHASE 1				
Node	**C**	**Tc (Min.)**	**Area (acre)**	**Q100 (cfs)**
103	0.40	9.604	1.718	3.126
Total			1.718	3.126

The proposed post-development without detention will decrease the peak flow by 1.779 cfs.

TABLE 2B: 100 YEAR POST-DEVELOPMENT CRITERIA WITHOUT DETENTION PHASE 2				
Node	**C**	**Tc (Min.)**	**Area (acre)**	**Q100 (cfs)**
106	0.82	5.148	1.981	6.998
Total			1.981	6.998

The proposed post-development without detention will increase the peak flow by 2.093 cfs.

CONCLUSION

Upon performing hydrologic analysis of the project site, for a 100 year storm event, in both the proposed developed condition and existing condition, the following results were produced. In both conditions the hydrologic model included the analysis of the project site at the ultimate points of discharge. The site will employ the use of biofiltration basins to mitigate peak flows.

DECLARATION OF RESPONSIBLE CHARGE

I, hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work of my responsibility for project design.

ENGINEER OF WORK:

Civil Landworks Corporation
110 Copperwood Way Suite P,
Oceanside CA, USA 92058

_____ 7-19-17

David V. Caron
R.C.E. 70066
Exp. 9-30-18

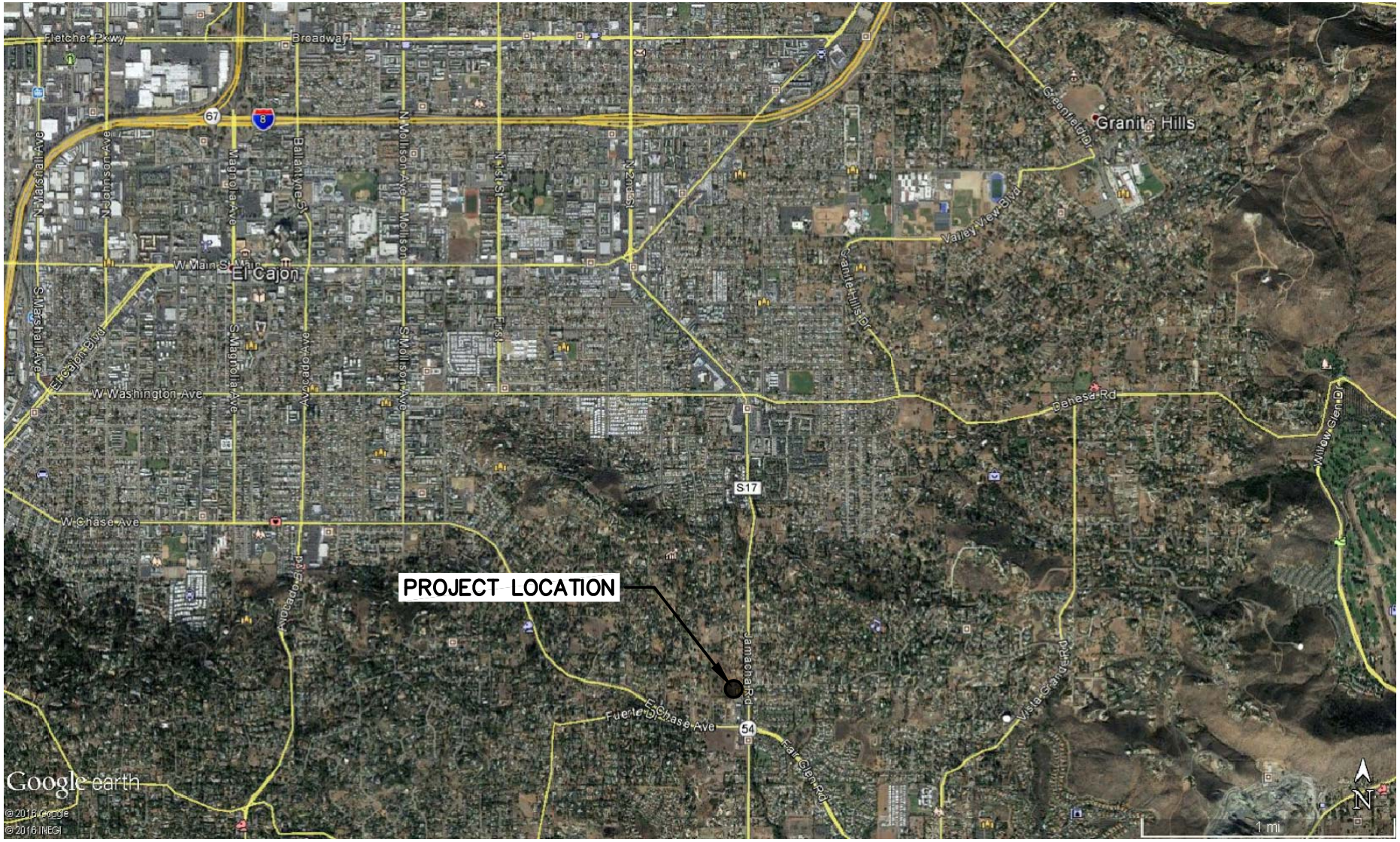
Date

REFERENCES

1. San Diego County Hydrology Manual (June 2003).
2. San Diego County Drainage Design Manual (July 2005).
3. Web Soil Survey, San Diego Area, California. United States Natural Resource Conservation Service.
4. CIVILCADD/CIVILDESIGN Engineering Software, © 1991-2006 Version 7.6. San Diego County Control Division 2003 Manual Rational Hydrology Study.

ATTACHMENT 1

LOCATION MAP



SITE LOCATION MAP

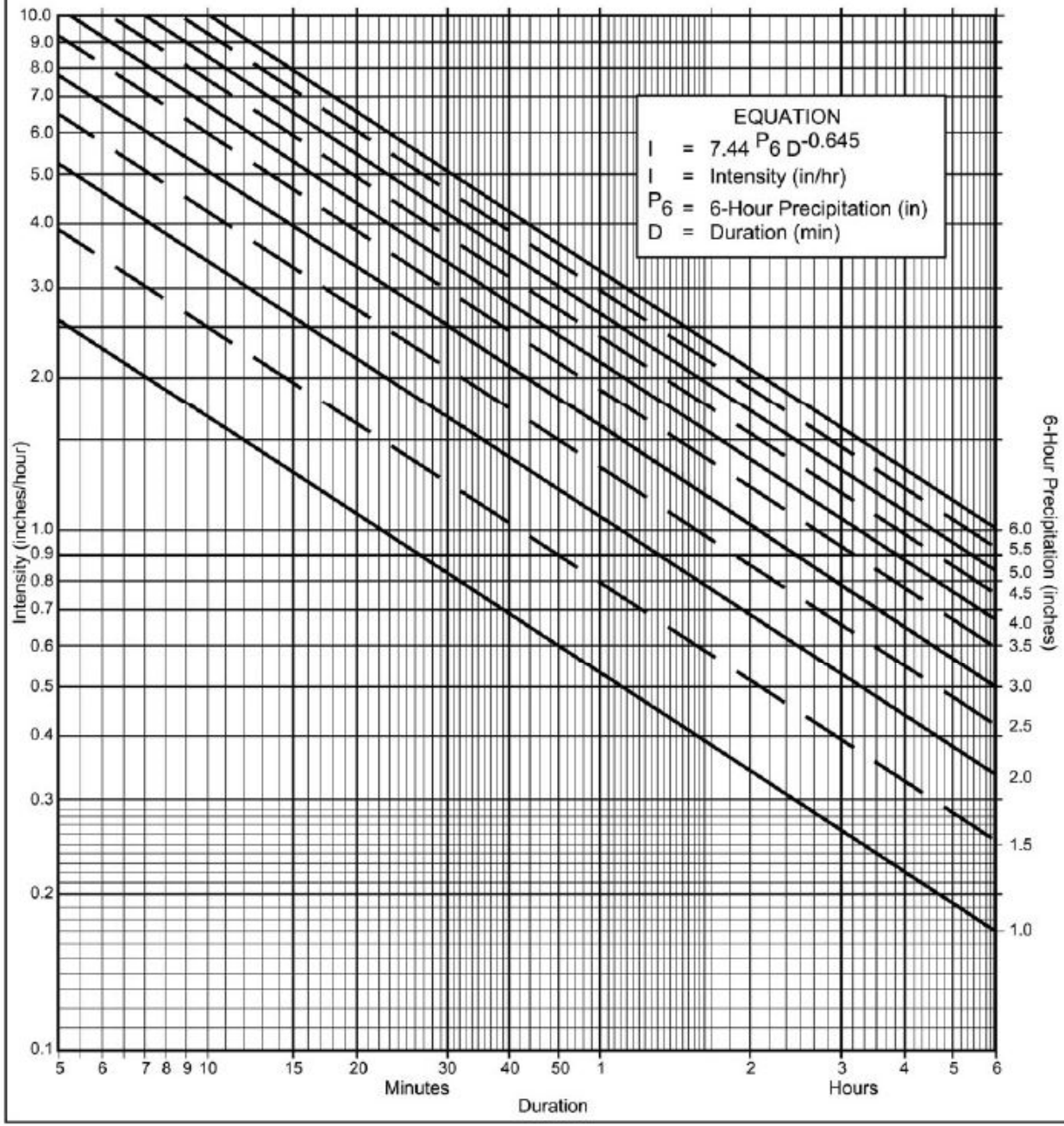
DATE: 3-30-17	SAINT GREGORY	
SCALE: AS SHOWN		DRAWN BY: J. FONG

SITE VICINITY MAP

DATE: 3-30-17	SAINT GREGORY	
SCALE: AS SHOWN		DRAWN BY: J. FONG

ATTACHMENT 2

PRECIPITATION MAPS AND SOIL MAP



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	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, Cp, 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

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

SITE LOCATION
P6=2.7

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

SITE LOCATION
P24=5.6

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

Map Scale: 1:977 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 45 90 180 270

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

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

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	2.8	68.9%
RaB	Ramona sandy loam, 2 to 5 percent slopes	C	1.1	27.7%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	B	0.1	3.4%
Totals for Area of Interest			**4.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT 3

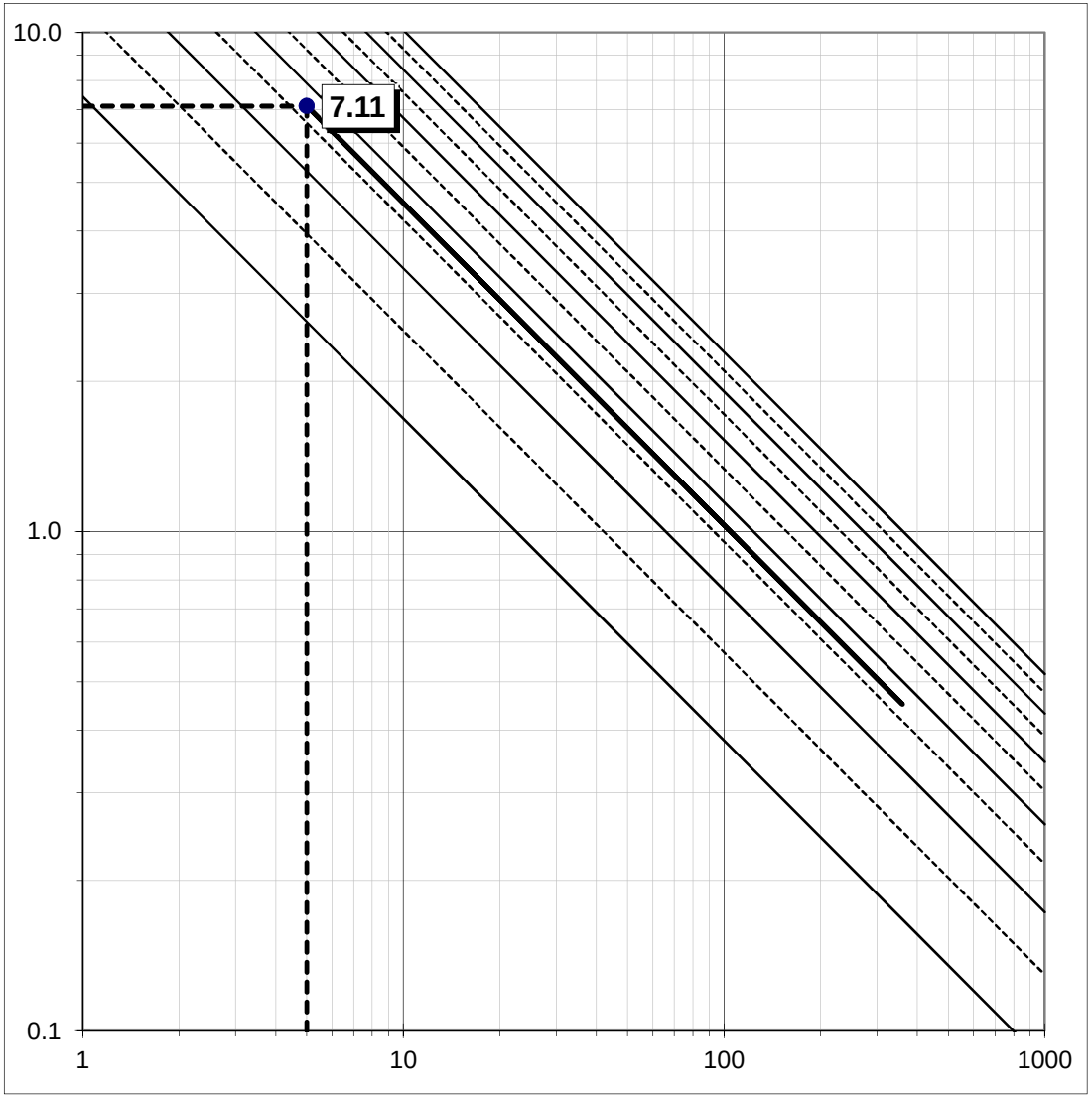
EXISTING HYDROLOGY CALCULATIONS

AREA CALCULATIONS

EXISTING HYDROLOGIC BASINS

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
OFF-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	4,065	0.093	4,065	0	0	0	-	0.30	36%	0.11	-
	D	0.35	7,359	0.169	7,359	0	0	0	-	0.35	64%	0.23	-
	Total	-	11,424	0.262	11,424	0	0	0	0.00%	-	100%	0.33	***0.332***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
EX-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	8,393	0.193	0	0	0	8,393	-	0.30	11%	0.03	-
	D	0.35	67,314	1.545	0	10,433	0	56,881	-	0.35	89%	0.31	-
	Total	-	75,707	1.738	0	10,433	0	65,274	13.78%	-	100%	0.34	***0.468***



EX-OFF1

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.33

Dist. = 51.00 ft.

slope = 9.800 %

***T$_c$** = 5.00 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 5.00 min.

I = 7.11 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q = **0.62** **cfs**

C = 0.33

I = 7.11 in/hr

A = 0.262 ac.

$$Q = C * I * A$$

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: 04/12/17

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

Program License Serial Number 6313

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

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.600
P6/P24 =   48.2%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   101.000 to Point/Station   102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
_____
User specified 'C' value of 0.332 given for subarea
Rainfall intensity (I) =   7.114(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.00 min. Rain intensity =   7.11(In/Hr)
Total area =   0.262(Ac.) Total runoff =   0.620(CFS)

++
Process from Point/Station   102.000 to Point/Station   103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   2.718(CFS)
Depth of flow =   0.167(Ft.), Average velocity =   1.848(Ft/s)
       ******* Irregular Channel Data ***********

Information entered for subchannel number 1 :
Point number   'X' coordinate   'Y' coordinate
        1   0.00   0.40
        2   21.00   0.00
        3   42.00   0.40
Manning's 'N' friction factor =   0.030

Sub-Channel flow =   2.719(CFS)
  '   '   flow top width =   17.576(Ft.)
  '   '   velocity=   1.848(Ft/s)
  '   '   area =   1.471(Sq.Ft)
  '   '   Froude number =   1.126

Upstream point elevation =   545.000(Ft.)
Downstream point elevation =   534.200(Ft.)
Flow length =   284.000(Ft.)
Travel time =   2.56 min.
Time of concentration =   7.56 min.
Depth of flow =   0.167(Ft.)
Average velocity =   1.848(Ft/s)
Total irregular channel flow =   2.718(CFS)
Irregular channel normal depth above invert elev. =   0.167(Ft.)
Average velocity of channel(s) =   1.848(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =   5.448(In/Hr) for a   100.0 year storm
User specified 'C' value of 0.468 given for subarea
Rainfall intensity =   5.448(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450 CA =   0.900
Subarea runoff =   4.285(CFS) for   1.738(Ac.)
Total runoff =   4.905(CFS) Total area =   2.000(Ac.)
Depth of flow =   0.209(Ft.), Average velocity =   2.142(Ft/s)
End of computations, total study area =   2.000 (Ac.)

ATTACHMENT 4

PROPOSED HYDROLOGY CALCULATIONS

PHASE 1

AREA CALCULATIONS

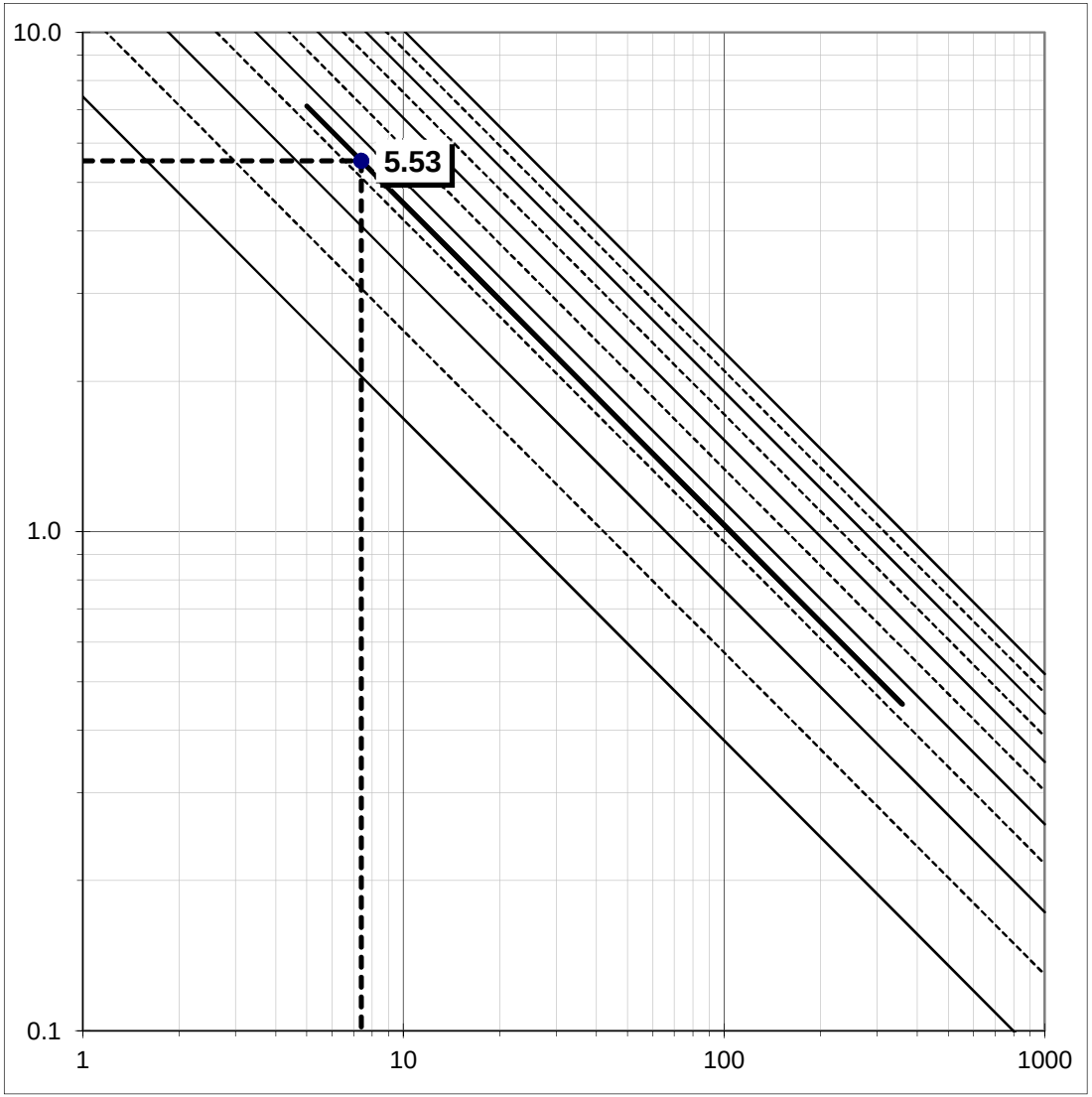
PROPOSED HYDROLOGIC BASINS

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1A	A	0.20	0	0.000	0	0	0	0	-	0.15	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.19	0%	0.00	-
	C	0.30	7,228	0.166	0	0	0	7,228	-	0.23	21%	0.05	-
	D	0.35	26,726	0.614	0	8,361	0	18,365	-	0.26	79%	0.21	-
	Total	-	33,954	0.779	0	8,361	0	25,593	24.62%	-	100%	0.26	***0.477***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1B	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	1,155	0.027	0	0	0	1,155	-	0.30	12%	0.04	-
	D	0.35	8,228	0.189	0	0	0	8,228	-	0.35	88%	0.31	-
	Total	-	9,383	0.215	0	0	0	9,383	0.00%	-	100%	0.34	***0.344***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1C	A	0.20	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	D	0.35	19,703	0.452	0	15,497	4,206	0	-	0.07	100%	0.07	-
	Total	-	19,703	0.452	0	15,497	4,206	0	78.65%	-	100%	0.07	***0.783***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1D	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	39	0.001	0	22	0	17	-	0.30	0%	0.00	-
	D	0.35	10,323	0.237	0	54	4,494	5,775	-	0.35	100%	0.35	-
	Total	-	10,362	0.238	0	76	4,494	5,792	0.73%	-	100%	0.35	***0.354***



PR-1A

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.48

Dist. = 125.00 ft.

slope = 4.880 %

***T$_c$** = 7.39 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 7.39 min.

I = 5.53 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

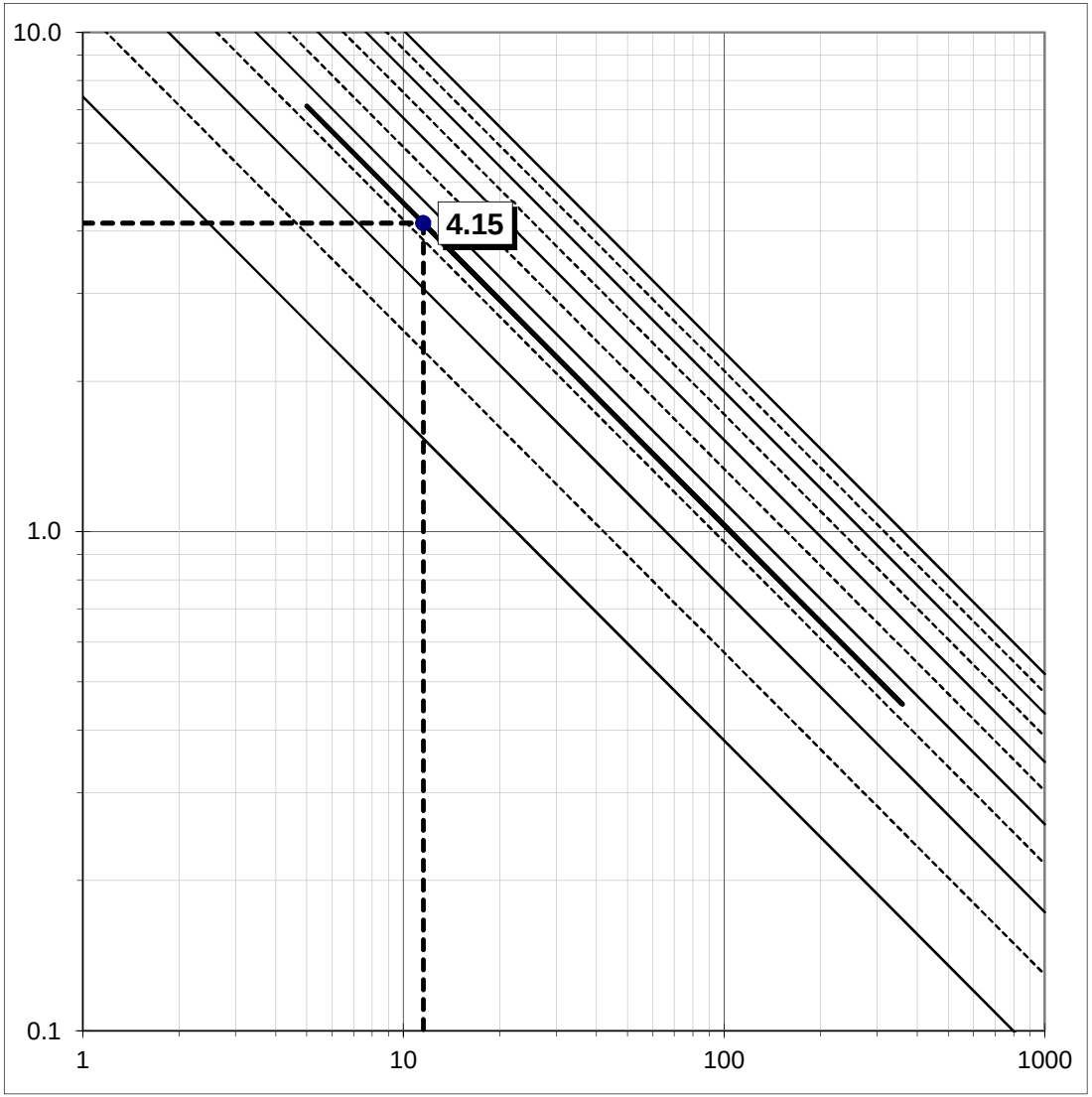
Q = **2.05** **cfs**

C = 0.48

I = 5.53 in/hr

A = 0.779 ac.

$$Q = C * I * A$$



PR-1C

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.39

Dist. = 204.00 ft.

slope = 3.970 %

***T$_c$** = 11.54 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 11.54 min.

I = 4.15 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

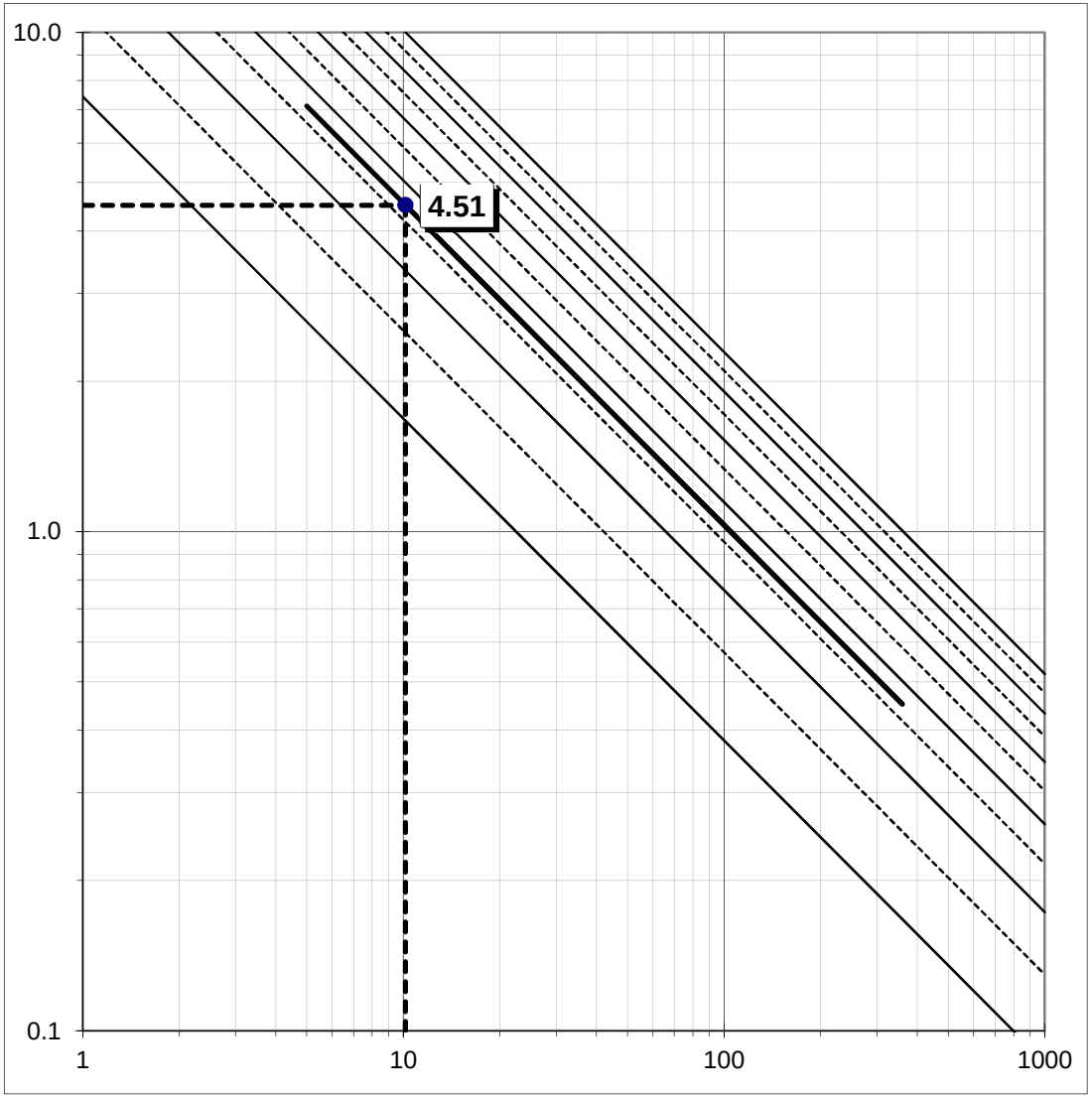
Q = **0.87** **cfs**

C = 0.39

I = 4.15 in/hr

A = 0.537 ac.

$$Q = C * I * A$$



PR-1D

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.40

Dist. = 145.00 ft.

slope = 3.310 %

***T$_c$** = 10.15 min.

$$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 10.15 min.

I = 4.51 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q = **0.34** **cfs**

C = 0.40

I = 4.51 in/hr

A = 0.187 ac.

$$Q = C * I * A$$

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: 03/31/17

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

Program License Serial Number 6313

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

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.600
P6/P24 = 48.2%
San Diego hydrology manual 'C' values used

++

Process from Point/Station 101.000 to Point/Station 102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.477 given for subarea
Rainfall intensity (I) = 5.529(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 7.39 min. Rain intensity = 5.53(In/Hr)
Total area = 0.779(Ac.) Total runoff = 2.050(CFS)

++

Process from Point/Station 102.000 to Point/Station 103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 538.900(Ft.)
End of street segment elevation = 534.200(Ft.)
Length of street segment = 178.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 23.000(Ft.)
Distance from crown to crossfall grade break = 0.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.000
Slope from grade break to crown (v/hz) = 0.000
Street flow is on [1] side(s) of the street
Distance from curb to property line = 0.500(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 0.000(Ft.)
Gutter hike from flowline = 0.000(In.)
Manning's N in gutter = 0.0300
Manning's N from gutter to grade break = 0.0300
Manning's N from grade break to crown = 0.0300
Estimated mean flow rate at midpoint of street = 2.101(CFS)
Depth of flow = 0.068(Ft.), Average velocity = 1.340(Ft/s)
Note: depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 23.000(Ft.)
Flow velocity = 1.34(Ft/s)
Travel time = 2.21 min. TC = 9.60 min.
Adding area flow to street
Rainfall intensity (I) = 4.669(In/Hr) for a 100.0 year storm
User specified 'C' value of 0.344 given for subarea
Rainfall intensity = 4.669(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.448 CA = 0.446
Subarea runoff = 0.030(CFS) for 0.215(Ac.)
Total runoff = 2.080(CFS) Total area = 0.994(Ac.)
Street flow at end of street = 2.080(CFS)
Half street flow at end of street = 2.080(CFS)
Depth of flow = 0.068(Ft.), Average velocity = 1.335(Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown)= 23.000(Ft.)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 0.994(Ac.)
Runoff from this stream = 2.080(CFS)
Time of concentration = 9.60 min.
Rainfall intensity = 4.669(In/Hr)
Program is now starting with Main Stream No. 2

++
Process from Point/Station 104.000 to Point/Station 103.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.389 given for subarea
Rainfall intensity (I) = 4.148(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 11.54 min. Rain intensity = 4.15(In/Hr)
Total area = 0.537(Ac.) Total runoff = 0.870(CFS)

++
Process from Point/Station 105.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 0.537(Ac.)
Runoff from this stream = 0.870(CFS)
Time of concentration = 11.54 min.
Rainfall intensity = 4.148(In/Hr)
Program is now starting with Main Stream No. 3

++
Process from Point/Station 105.000 to Point/Station 103.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.402 given for subarea
Rainfall intensity (I) = 4.506(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 10.15 min. Rain intensity = 4.51(In/Hr)
Total area = 0.187(Ac.) Total runoff = 0.340(CFS)

++
Process from Point/Station 105.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area = 0.187(Ac.)
Runoff from this stream = 0.340(CFS)
Time of concentration = 10.15 min.
Rainfall intensity = 4.506(In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	2.080	9.60	4.669
2	0.870	11.54	4.148
3	0.340	10.15	4.506

Qmax(1) =
1.000 * 1.000 * 2.080) +
1.000 * 0.832 * 0.870) +
1.000 * 0.946 * 0.340) + = 3.126
Qmax(2) =
0.888 * 1.000 * 2.080) +
1.000 * 1.000 * 0.870) +
0.921 * 1.000 * 0.340) + = 3.031
Qmax(3) =
0.965 * 1.000 * 2.080) +
1.000 * 0.880 * 0.870) +

```
                                          PR1PH1
          1.000 *    1.000 *     0.340) + =       3.113

Total of 3 main streams to confluence:
Flow rates before confluence point:
       2.080       0.870       0.340
Maximum flow rates at confluence using above data:
       3.126       3.031       3.113
Area of streams before confluence:
       0.994       0.537       0.187


Results of confluence:
Total flow rate =      3.126(CFS)
Time of concentration =     9.604 min.
Effective stream area after confluence  =      1.718(Ac.)
End of computations, total study area =          1.718 (Ac.)
```

PHASE 2

AREA CALCULATIONS

PROPOSED HYDROLOGIC BASINS

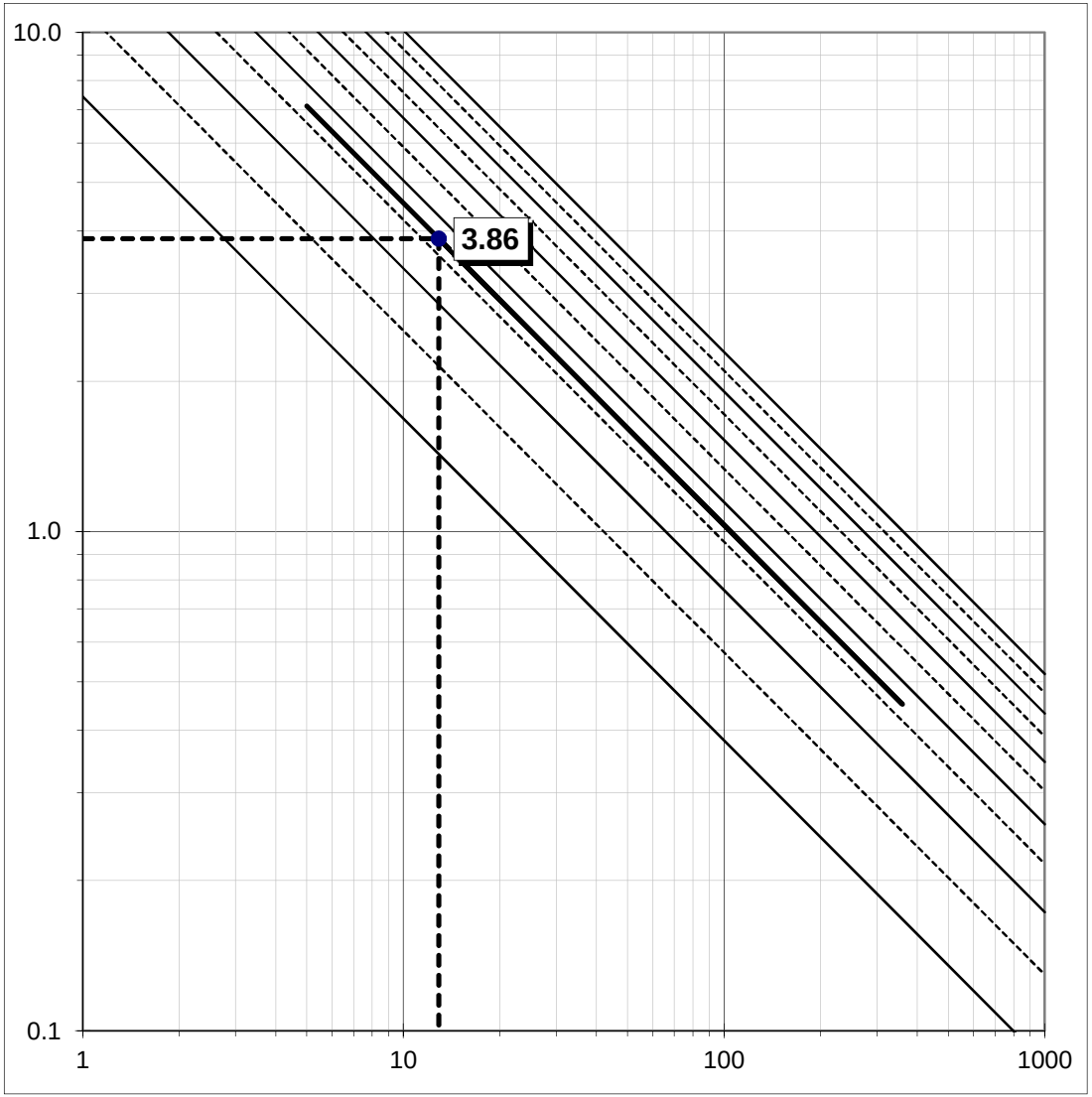
Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
OFF-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	4,065	0.093	4,065	0	0	0	-	0.30	36%	0.11	-
	D	0.35	7,359	0.169	7,359	0	0	0	-	0.35	64%	0.23	-
	Total	-	11,424	0.262	11,424	0	0	0	0.00%	-	100%	0.33	***0.332***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1A	A	0.20	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	C	0.30	4,473	0.103	0	2,079	2,394	0	-	0.07	29%	0.02	-
	D	0.35	10,999	0.253	0	9,857	1,142	0	-	0.08	71%	0.06	-
	Total	-	15,472	0.355	0	11,936	3,536	0	77.15%	-	100%	0.08	***0.771***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1B	A	0.20	0	0.000	0	0	0	0	-	0.03	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	C	0.30	3,875	0.089	0	1,591	2,284	0	-	0.04	13%	0.01	-
	D	0.35	25,479	0.585	0	23,533	1,946	0	-	0.05	87%	0.04	-
	Total	-	29,354	0.674	0	25,124	4,230	0	85.59%	-	100%	0.05	***0.820***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1C	A	0.20	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	D	0.35	19,703	0.452	0	15,497	4,206	0	-	0.07	100%	0.07	-
	Total	-	19,703	0.452	0	15,497	4,206	0	78.65%	-	100%	0.07	***0.783***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1D	A	0.20	0	0.000	0	0	0	0	-	0.09	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.11	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.13	0%	0.00	-
	D	0.35	10,366	0.238	0	5,851	4,515	0	-	0.15	100%	0.15	-
	Total	-	10,366	0.238	0	5,851	4,515	0	56.44%	-	100%	0.15	***0.660***



PR-OFF1

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.33

Dist. = 206.00 ft.

slope = 3.640 %

***T$_c$** = 12.90 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 12.90 min.

I = 3.86 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

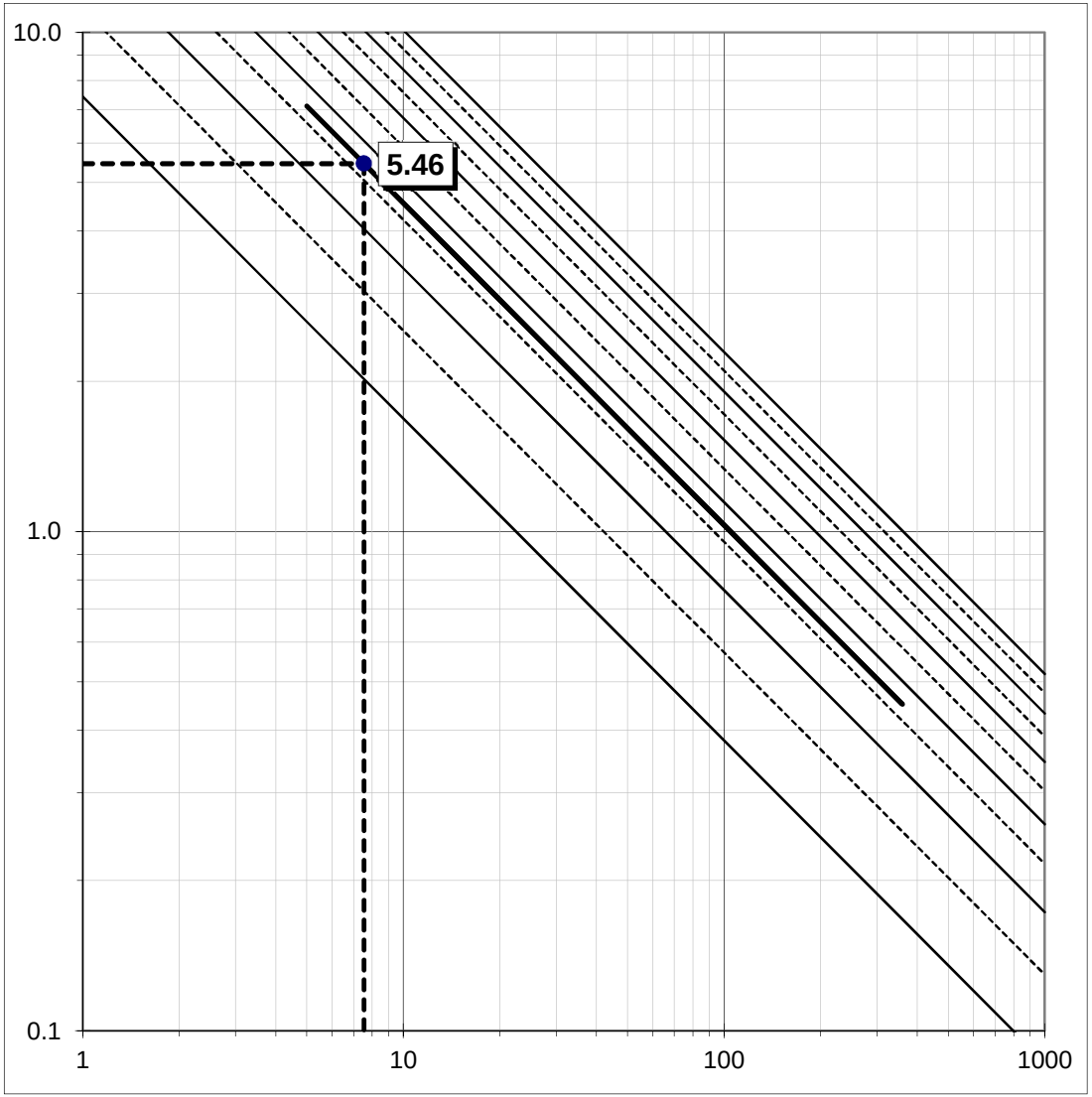
Q = **0.34** **cfs**

C = 0.33

I = 3.86 in/hr

A = 0.262 ac.

$$Q = C * I * A$$



PR-1A

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.77

Dist. = 193.00 ft.

slope = 1.300 %

***T$_c$** = 7.54 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 7.54 min.

I = 5.46 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

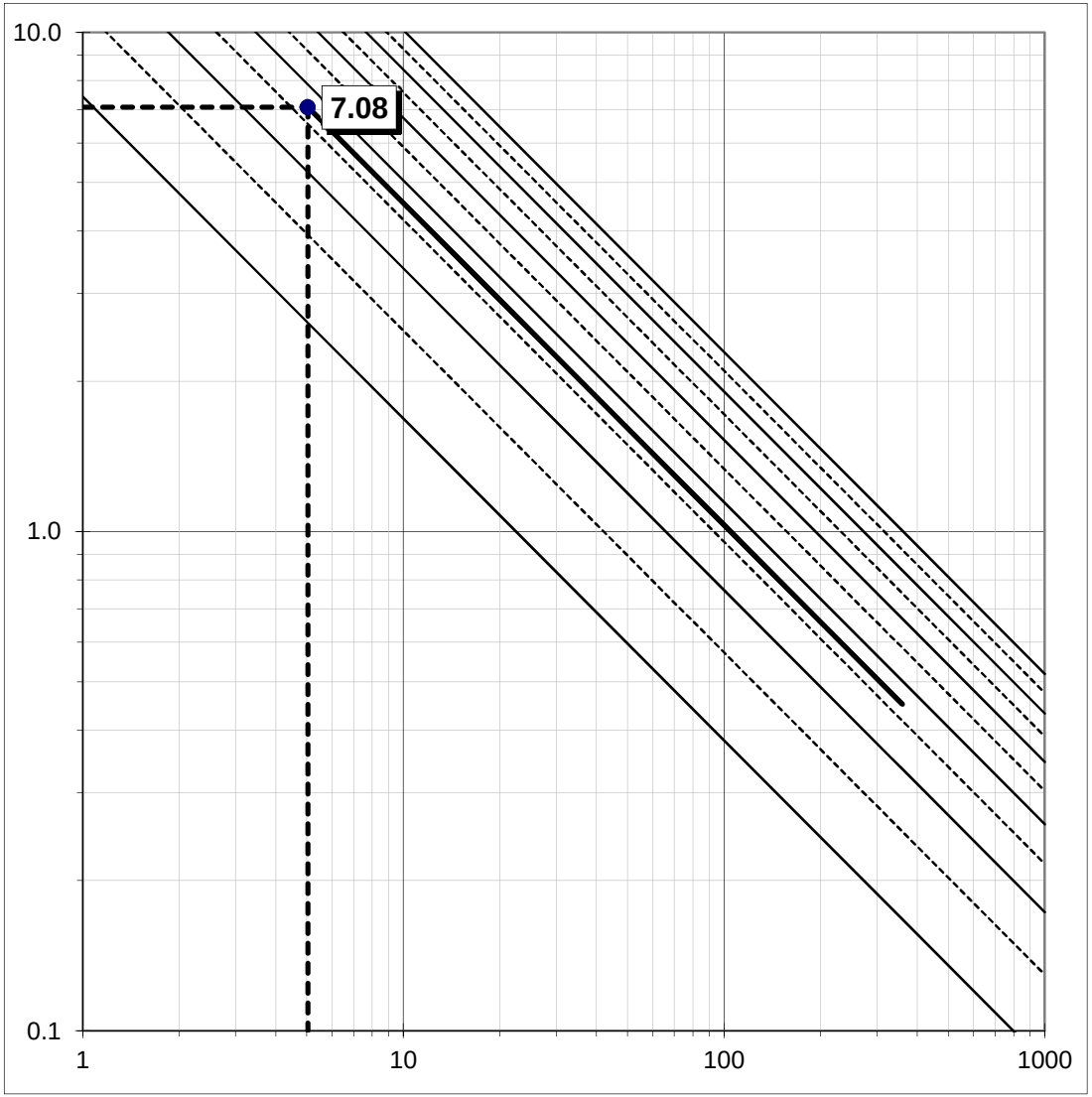
Q = **1.49** **cfs**

C = 0.77

I = 5.46 in/hr

A = 0.355 ac.

$$Q = C * I * A$$



PR-1B

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.82

Dist. = 180.00 ft.

slope = 2.420 %

***T$_c$** = 5.04 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 5.04 min.

I = 7.08 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

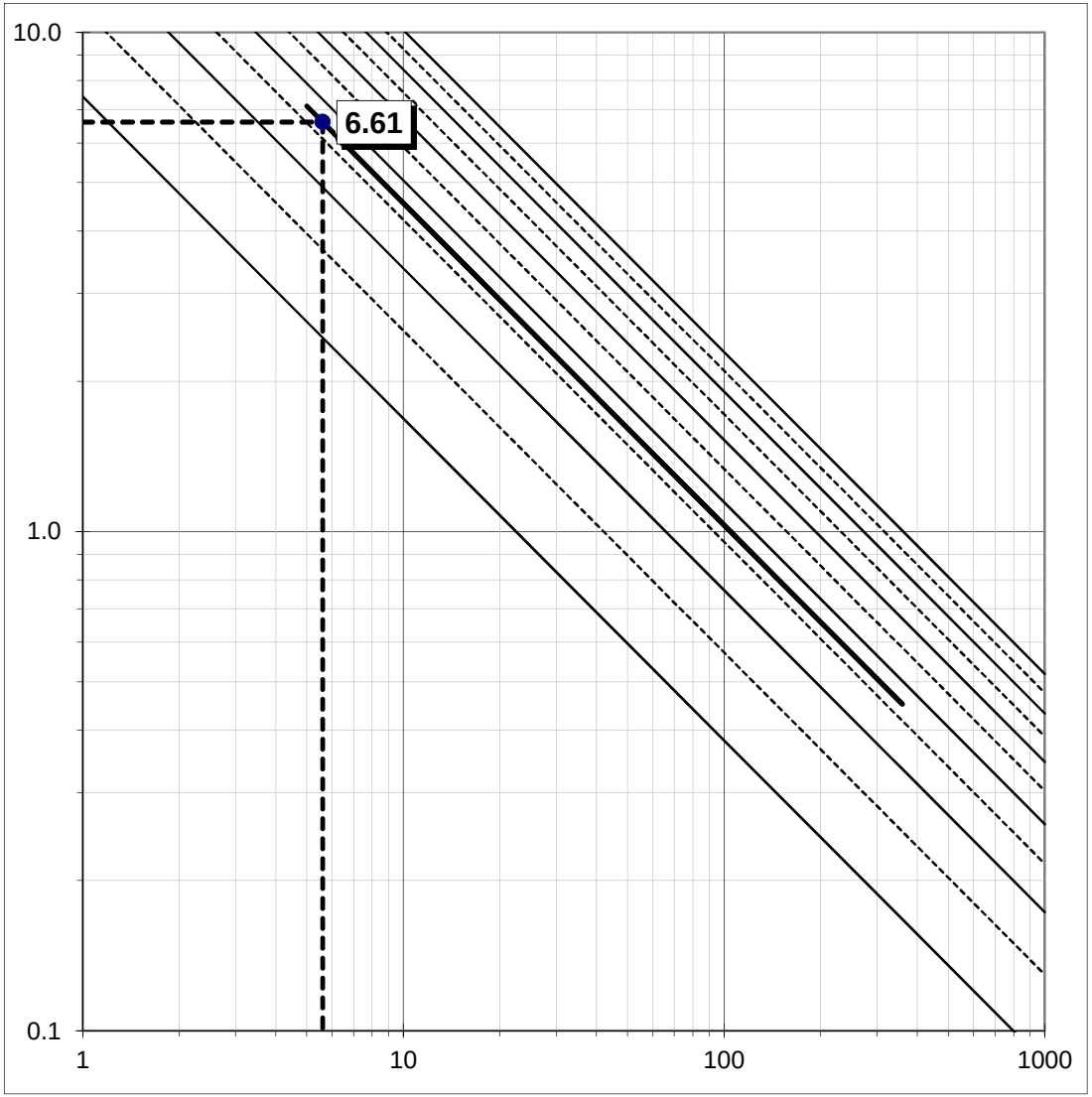
Q = **3.91** **cfs**

C = 0.82

I = 7.08 in/hr

A = 0.674 ac.

$$Q = C * I * A$$



PR-1C

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.78

Dist. = 191.00 ft.

slope = 2.600 %

***T$_c$** = 5.60 min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T$_c$** = #DIV/0! min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in. — P_6 must be within

P_{24} = 5.6 in. — 45% to 65% of P_{24}.

P_6 / P_{24} = 48% — Adjust P_6 as needed.

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 5.60 min.

I = 6.61 in/hr

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

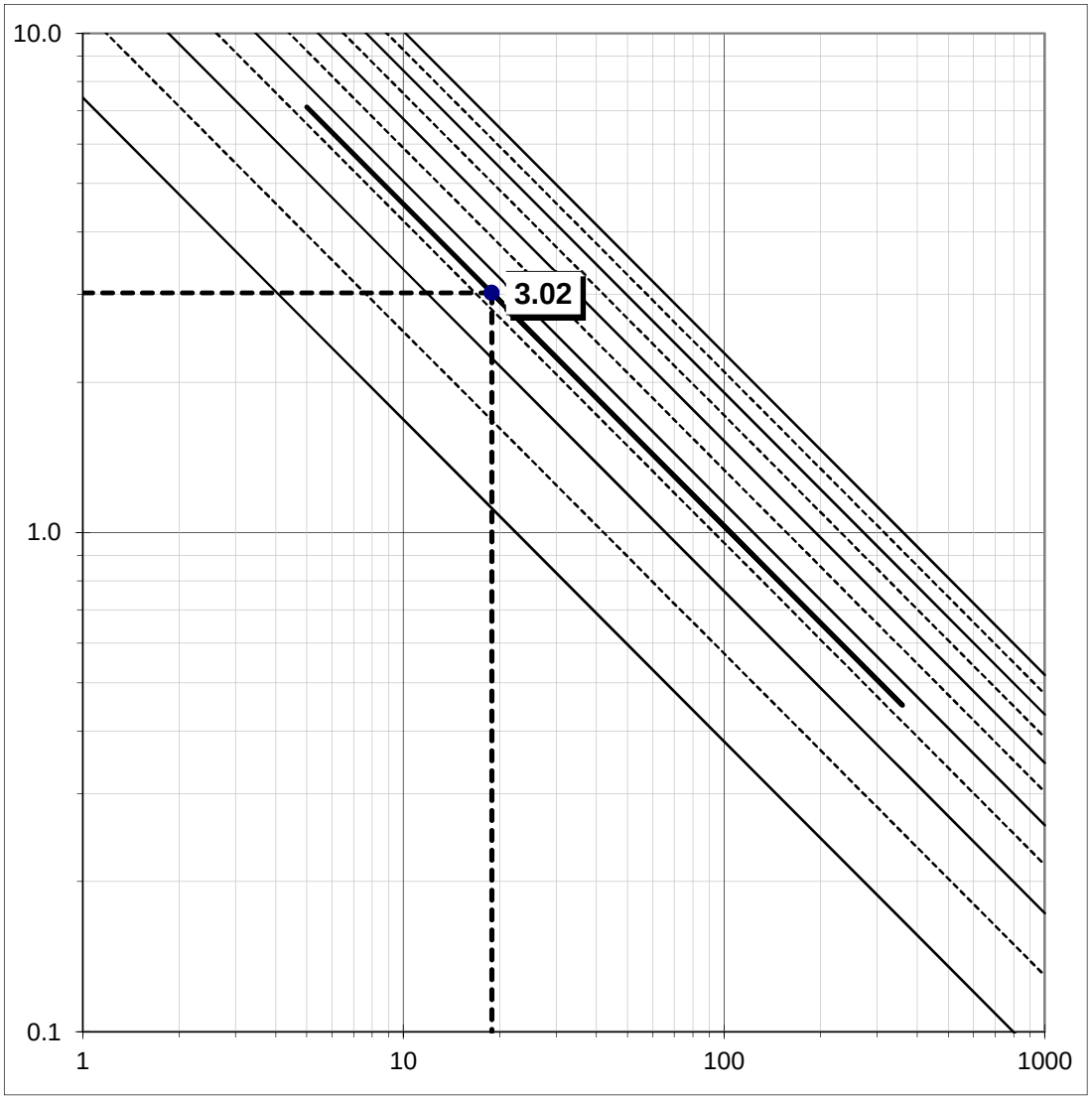
Q = **2.34** **cfs**

C = 0.78

I = 6.61 in/hr

A = 0.452 ac.

$$Q = C * I * A$$



PR-1D

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C =	0.66	
Dist. =	173.00	ft.
slope =	2.100	%
***T_c** =	18.87	min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T_c** =	#DIV/0!	min.

$$T_C = \left(\frac{11 \ .9 \ L^3}{\Delta E} \right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	18.87	min.	
I =	3.02	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**0.28**	**cfs**
C =	0.35	
I =	3.02	in/hr
A =	0.238	ac.

$$Q = C * I * A$$

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: 07/19/17

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

Program License Serial Number 6313

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

Map data precipitation entered:
6 hour, precipitation(inches) = 2.700
24 hour precipitation(inches) = 5.600
P6/P24 = 48.2%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 101.000 to Point/Station 102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.332 given for subarea
Rainfall intensity (I) = 3.860(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 12.90 min. Rain intensity = 3.86(In/Hr)
Total area = 0.262(Ac.) Total runoff = 0.340(CFS)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 537.620(Ft.)
Downstream point/station elevation = 534.290(Ft.)
Pipe length = 66.00(Ft.) Slope = 0.0505 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.340(CFS)
Nearest computed pipe diameter = 6.00(In.)
Calculated individual pipe flow = 0.340(CFS)
Normal flow depth in pipe = 2.13(In.)
Flow top width inside pipe = 5.74(In.)
Critical Depth = 3.55(In.)
Pipe flow velocity = 5.45(Ft/s)
Travel time through pipe = 0.20 min.
Time of concentration (TC) = 13.10 min.

++
Process from Point/Station 102.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 0.262(Ac.)
Runoff from this stream = 0.340(CFS)
Time of concentration = 13.10 min.
Rainfall intensity = 3.822(In/Hr)
Program is now starting with Main Stream No. 2

++
Process from Point/Station 104.000 to Point/Station 105.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.771 given for subarea
Rainfall intensity (I) = 5.458(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 7.54 min. Rain intensity = 5.46(In/Hr)
Total area = 0.355(Ac.) Total runoff = 1.490(CFS)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   534.400(Ft.)
Downstream point/station elevation =   534.290(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0138  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.490(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.490(CFS)
Normal flow depth in pipe =    5.91(In.)
Flow top width inside pipe =    8.55(In.)
Critical Depth =    6.74(In.)
Pipe flow velocity =      4.84(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.57 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
----------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.355(Ac.)
Runoff from this stream =      1.490(CFS)
Time of concentration =    7.57 min.
Rainfall intensity =     5.445(In/Hr)
Summary of stream data:

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


1        0.340     13.10                3.822
2        1.490      7.57                5.445
Qmax(1) =
           1.000 *    1.000 *     0.340) +
           0.702 *    1.000 *     1.490) + =       1.386
Qmax(2) =
           1.000 *    0.578 *     0.340) +
           1.000 *    1.000 *     1.490) + =       1.686

Total of 2 main streams to confluence:
Flow rates before confluence point:
      0.340       1.490
Maximum flow rates at confluence using above data:
       1.386        1.686
Area of streams before confluence:
       0.262        0.355


Results of confluence:
Total flow rate =      1.686(CFS)
Time of concentration =     7.568 min.
Effective stream area after confluence  =      0.617(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   534.290(Ft.)
Downstream point/station elevation =   530.250(Ft.)
Pipe length  =   218.00(Ft.) Slope =   0.0185  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.686(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.686(CFS)
Normal flow depth in pipe =    5.81(In.)
Flow top width inside pipe =    8.61(In.)
Critical Depth =    7.16(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    0.65 min.
Time of concentration (TC) =     8.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
```

**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 0.617(Ac.)
Runoff from this stream = 1.686(CFS)
Time of concentration = 8.22 min.
Rainfall intensity = 5.163(In/Hr)
Program is now starting with Main Stream No. 2

++
Process from Point/Station 107.000 to Point/Station 108.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.783 given for subarea
Rainfall intensity (I) = 6.612(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 5.60 min. Rain intensity = 6.61(In/Hr)
Total area = 0.452(Ac.) Total runoff = 2.340(CFS)

++
Process from Point/Station 108.000 to Point/Station 109.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 534.090(Ft.)
Downstream point/station elevation = 532.080(Ft.)
Pipe length = 140.00(Ft.) Slope = 0.0144 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 2.340(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 2.340(CFS)
Normal flow depth in pipe = 6.34(In.)
Flow top width inside pipe = 11.98(In.)
Critical Depth = 7.86(In.)
Pipe flow velocity = 5.56(Ft/s)
Travel time through pipe = 0.42 min.
Time of concentration (TC) = 6.02 min.

++
Process from Point/Station 108.000 to Point/Station 109.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area = 0.452(Ac.)
Runoff from this stream = 2.340(CFS)
Time of concentration = 6.02 min.
Rainfall intensity = 6.311(In/Hr)

++
Process from Point/Station 110.000 to Point/Station 111.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.660 given for subarea
Rainfall intensity (I) = 3.020(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 18.87 min. Rain intensity = 3.02(In/Hr)
Total area = 0.238(Ac.) Total runoff = 0.280(CFS)

++
Process from Point/Station 111.000 to Point/Station 109.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 532.750(Ft.)
Downstream point/station elevation = 532.080(Ft.)
Pipe length = 6.00(Ft.) Slope = 0.1117 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 0.280(CFS)
Nearest computed pipe diameter = 3.00(In.)
Calculated individual pipe flow = 0.280(CFS)
Normal flow depth in pipe = 2.33(In.)
Flow top width inside pipe = 2.51(In.)
Critical depth could not be calculated.
Pipe flow velocity = 6.84(Ft/s)
Travel time through pipe = 0.01 min.
Time of concentration (TC) = 18.88 min.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.238(Ac.)
Runoff from this stream =      0.280(CFS)
Time of concentration =   18.88 min.
Rainfall intensity =     3.019(In/Hr)
Summary of stream data:

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


1        2.340      6.02                 6.311
2        0.280     18.88                 3.019
Qmax(1) =
           1.000 *    1.000 *     2.340) +
           1.000 *    0.319 *     0.280) + =       2.429
Qmax(2) =
           0.478 *    1.000 *     2.340) +
           1.000 *    1.000 *     0.280) + =       1.399

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.340       0.280
Maximum flow rates at confluence using above data:
       2.429       1.399
Area of streams before confluence:
       0.452       0.238
Results of confluence:
Total flow rate =      2.429(CFS)
Time of concentration =     6.020 min.
Effective stream area after confluence =      0.690(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   532.080(Ft.)
Downstream point/station elevation =   531.430(Ft.)
Pipe length  =    44.00(Ft.) Slope =   0.0148  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.429(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.429(CFS)
Normal flow depth in pipe =    6.43(In.)
Flow top width inside pipe =   11.97(In.)
Critical Depth =    8.02(In.)
Pipe flow velocity =      5.67(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     6.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.690(Ac.)
Runoff from this stream =      2.429(CFS)
Time of concentration =    6.15 min.
Rainfall intensity =     6.225(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
----------------------------------------------------------------------------
User specified 'C' value of 0.820 given for subarea
Rainfall intensity (I) =      7.077(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.04 min.  Rain intensity =       7.08(In/Hr)
Total area =        0.674(Ac.)  Total runoff =     3.910(CFS)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```
Process from Point/Station      114.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   532.040(Ft.)
Downstream point/station elevation =   531.430(Ft.)
Pipe length  =    39.00(Ft.) Slope =   0.0156  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.910(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.910(CFS)
Normal flow depth in pipe =    8.72(In.)
Flow top width inside pipe =   10.70(In.)
Critical Depth =   10.08(In.)
Pipe flow velocity =      6.40(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     5.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.674(Ac.)
Runoff from this stream =      3.910(CFS)
Time of concentration =    5.14 min.
Rainfall intensity =     6.987(In/Hr)
Summary of stream data:

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


1        2.429      6.15                6.225
2        3.910      5.14                6.987
Qmax(1) =
           1.000 *    1.000 *     2.429) +
           0.891 *    1.000 *     3.910) + =       5.913
Qmax(2) =
           1.000 *    0.836 *     2.429) +
           1.000 *    1.000 *     3.910) + =       5.941

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.429       3.910
Maximum flow rates at confluence using above data:
        5.913        5.941
Area of streams before confluence:
        0.690        0.674
Results of confluence:
Total flow rate =      5.941(CFS)
Time of concentration =     5.142 min.
Effective stream area after confluence =      1.364(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   531.430(Ft.)
Downstream point/station elevation =   530.500(Ft.)
Pipe length  =     6.00(Ft.) Slope =   0.1550  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.941(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     5.941(CFS)
Normal flow depth in pipe =    6.75(In.)
Flow top width inside pipe =    7.79(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.71(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     5.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.364(Ac.)
```

```
Runoff from this stream =      5.941(CFS)
Time of concentration =    5.15 min.
Rainfall intensity =     6.982(In/Hr)
Summary of stream data:

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


1        1.686      8.22                5.163
2        5.941      5.15                6.982
Qmax(1) =
           1.000 *    1.000 *     1.686) +
           0.740 *    1.000 *     5.941) + =       6.080
Qmax(2) =
           1.000 *    0.626 *     1.686) +
           1.000 *    1.000 *     5.941) + =       6.998

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.686       5.941
Maximum flow rates at confluence using above data:
        6.080        6.998
Area of streams before confluence:
        0.617        1.364

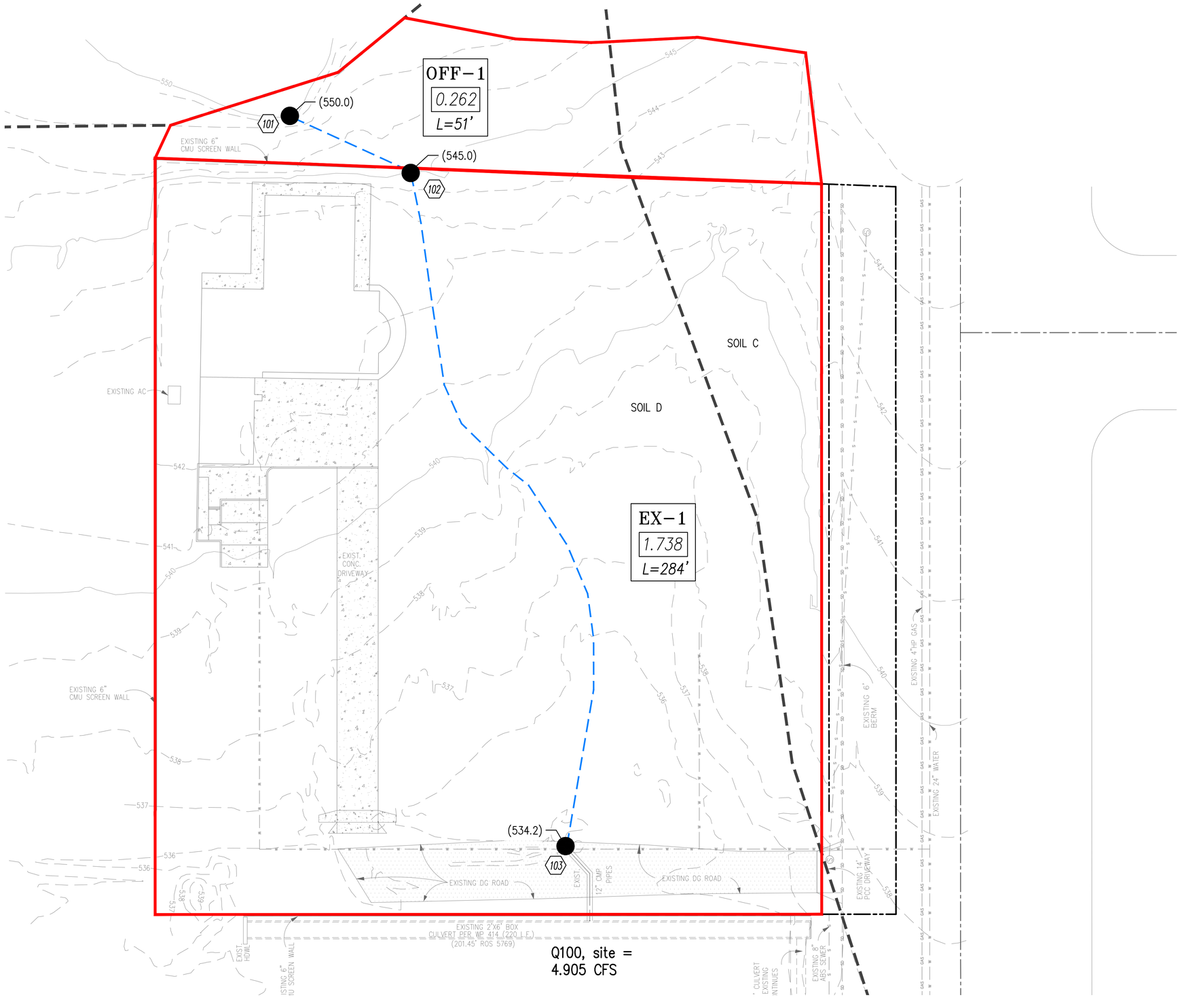

Results of confluence:
Total flow rate =      6.998(CFS)
Time of concentration =     5.148 min.
Effective stream area after confluence  =      1.981(Ac.)
End of computations, total study area =          1.981 (Ac.)
```

ATTACHMENT 5

HYDROLOGY MAP - EXISTING CONDITIONS

ATTACHMENT 5

CONDITIONS



LEGEND

- SUBDIVISION BOUNDARY
- 200 EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- HYDROLOGIC BASIN BOUNDARY
- HYDROLOGIC FLOW PATH
- EX-1 BASIN NUMBER
- 0.20 AREA (ACRES)
- 101 NODE NUMBER
- (200.00) ELEVATION (FEET)

20 0 20 40

GRAPHIC SCALE
SCALE: 1"= 20'

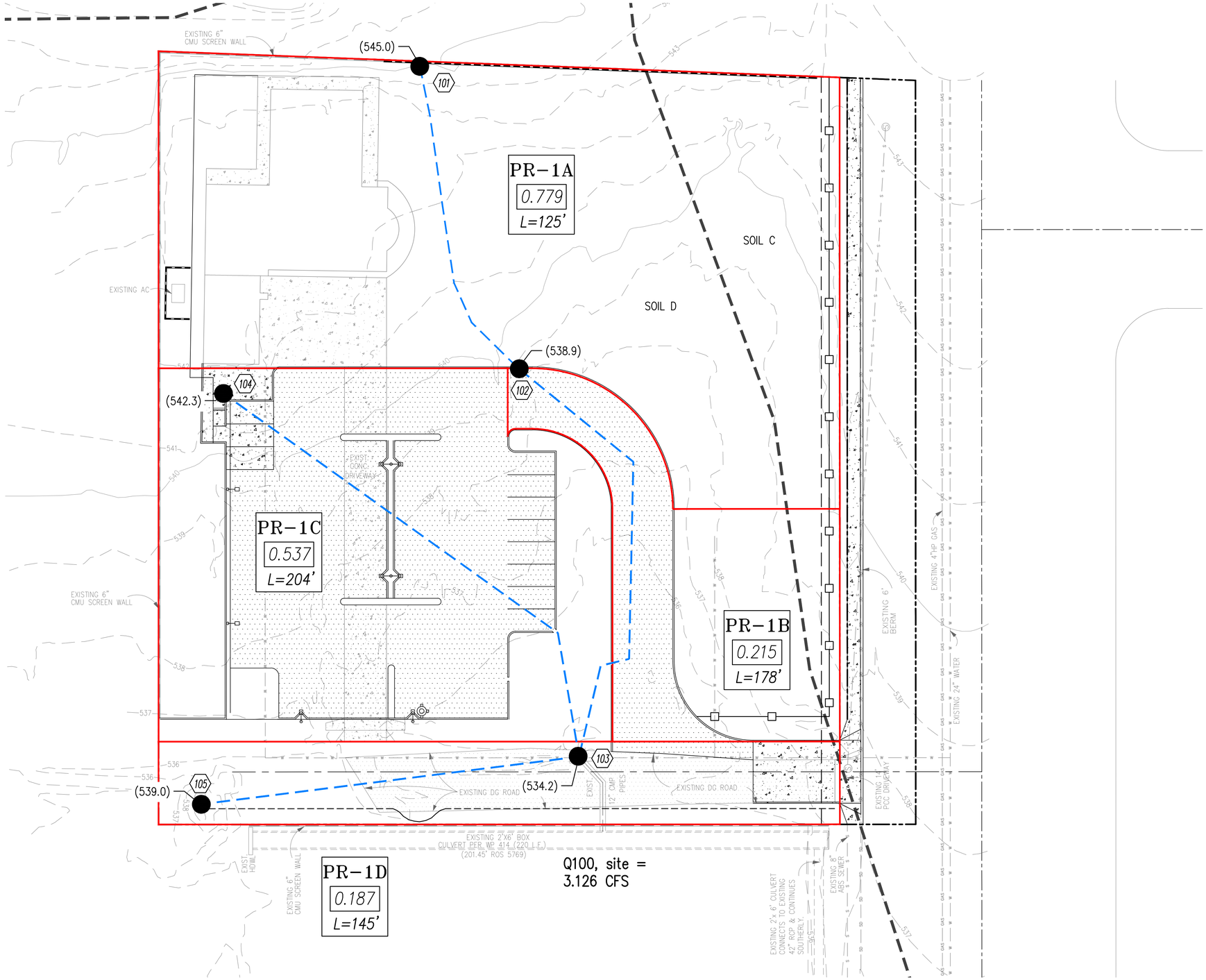
Civil Landworks
110 COPPERWOOD WAY, SUITE P, OCEANSIDE, CA 92058
PH: 760-908-8745 • info@civillandworks.com

ATTACHMENT 6

HYDROLOGY MAP - PROPOSED CONDITIONS

PHASE 1

ATTACHMENT 6A
PROPOSED HYDROLOGIC CONDITIONS



LEGEND

- SUBDIVISION BOUNDARY
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- PROPOSED CONTOUR (MAJOR)
- PROPOSED CONTOUR (MINOR)
- HYDROLOGIC BASIN BOUNDARY
- HYDROLOGIC FLOW PATH
- STORM DRAIN PIPE FLOW PATH
- PR-1 — BASIN NUMBER
- 0.20 — AREA (ACRES)
- 102 — NODE NUMBER
- (200.00) — ELEVATION (FEET)

20 0 20 40

GRAPHIC SCALE
SCALE: 1"= 20'

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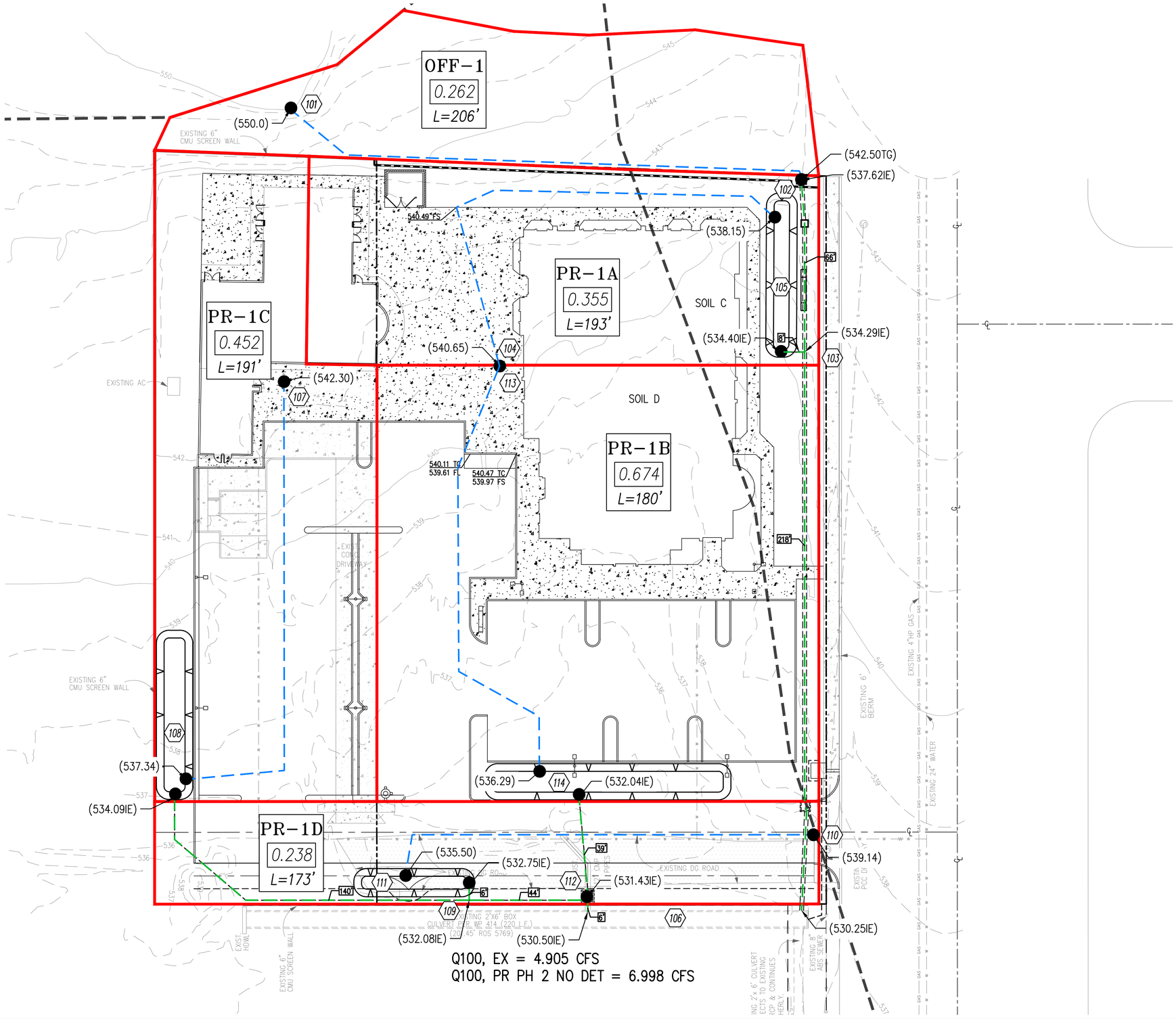
PHASE 2

ATTACHMENT 6B
PROPOSED HYDROLOGIC CONDITIONS



Q100, EX = 4.905 CFS
Q100, PR PH 2 NO DET = 6.998 CFS

LEGEND

- SUBDIVISION BOUNDARY
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- PROPOSED CONTOUR (MAJOR)
- PROPOSED CONTOUR (MINOR)
- HYDROLOGIC BASIN BOUNDARY
- HYDROLOGIC FLOW PATH
- STORM DRAIN PIPE FLOW PATH
- PR-1 — BASIN NUMBER
- 0.20 — AREA (ACRES)
- 102 — NODE NUMBER
- (200.00) — ELEVATION (FEET)

20 0 20 40

GRAPHIC SCALE
SCALE: 1"= 20'

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