

# **Creekside Assisted Living Technical Appendices**

## **Appendix H2 Hydrology Report**

February 14th, 2020

# PRELIMINARY HYDROLOGY STUDY

For

## CREEKSIDE ASSISTED LIVING

SEC N Twin Oaks Valley Road & Richmar Avenue  
San Marcos, CA 92069

Prepared for:

**Breaker's Real Estate**

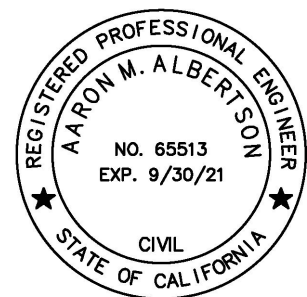
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Prepared by:



Today's Ideas. Tomorrow's Reality.

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Aaron M. Albertson, P.E.  
R.C.E. 65513, Exp. 09/30/21

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## **I. INTRODUCTION**

### **Background/Purpose**

The purpose of this study is to determine storm water runoff and site drainage for a 50 and 100-year storm event for a proposed new residential development in the city of San Marcos, California. The new development is being completed by Breakers RE. The project site is located at the southeast corner of N Twin Oaks Valley Road and Richmar Avenue and consists of 2.33 acres (101,347 ft<sup>2</sup>). The studied area is 3.29 acres (143,441 ft<sup>2</sup>) for the existing condition and 2.73 acres (118,827 ft<sup>2</sup>) for the proposed condition. The project site is bounded by Richmar Avenue to the north, Twin Oaks Valley Creek and a drainage wetland area to the east, Mission Road to the south, and Twin Oaks Valley Road to the west. Twin Oaks Valley Creek is within the project's property limits, but not the project site area.

The existing project site is a vacant lot with natural, seasonal landscaping, a dirt road for access between Richmar Avenue and Mission Road, and an AC pavement road with access from Mission Road. The proposed development consists of removing a portion of the existing natural vegetation and existing onsite utilities as required. The project site does not include the Twin Oaks Valley Creek or area east of the creek. The project proposes construction of a new residential development consisting of 128 residential units with covered trash enclosure. This will also include new onsite AC pavement parking areas, drive aisles, landscaping, and an uncovered interior courtyard. Incidental underground utilities, an underground retention system, concrete swale to divert offsite run-on, and a new storm drain system are part of the proposed development. The project proposes import material up to 8 feet to raise building pad elevations above the flood zone. The area is located within the Heart of the City Specific Plan Area (SPA). Site elevations range from approximately 570 to 590 feet above mean sea level (MSL). A fill slope of approximately 20 feet in height is located along the western property line of the project site. See Vicinity Map in Attachment 1.

The project site is located within the Carlsbad hydrologic unit (904) and San Marcos hydrologic sub-area (904.52) of Carlsbad Watershed Management Area (WMA) of the San Diego Region (9). The City of San Marcos owns the storm drain system that project runoff flows to. Location of existing storm drain lines are per City as-built plans included in Attachment 5. The storm drain system discharges to the drainage wetland area west of the project site (Twin Oaks Valley Creek), which flows to San Marcos Creek, San Marcos Lake, Batiquitos Lagoon, then ultimately the Pacific Ocean.

## II. DESIGN CRITERIA AND ASSUMPTIONS

### **Hydrology Methodology**

Hydrologic calculations were performed to determine the 50 and 100-year discharges at critical locations using the Rational Method. A technical description of the rational method is provided in the San Diego County Hydrology Manual dated June 2003. As recommended in the Manual, the rational method was used to calculate the design discharge for the local drainage areas due to the watershed area to the proposed storm drain system being less than one square mile.

Runoff calculations were performed in conformance with the requirements of the County of San Diego Drainage Design Manual dated July 2005 and the San Diego County Hydrology Manual dated June 2003 by use of Advanced Engineering Software (AES). The design discharges were computed by generating a hydrologic "link-node" model which divides the area into subareas, each tributary to a concentration point or hydrologic "node" point determined by the proposed site layout. The results of the hydrologic calculations are used to design proposed storm drain facilities and will be included in Section 4 of the Final Hydrology Study.

### **Hydrologic Parameters/Assumptions**

- **Soil type:** Hydrologic soil ratings are based on a scale of A through D, where A is the most pervious, providing the least runoff. Per the soil map from NRCS (see Attachment 1), the study area consists of Type C and Type D soils.
- **6-hour rainfall precipitation ( $P_6$ ):** Per San Diego County Hydrology Manual (2003) Rainfall Isopluvial Maps (see Attachment 1), the 6-hour rainfall precipitation for 50-year is 2.90 inches and 100-year event is 3.30 inches. The 24-hour rainfall precipitation for 50-year storm event is 5.30 inches and 100-year event is 5.70 inches. The 6-hour rainfall precipitation is within 46-65% of the 24-hour rainfall values for both the 50 and 100-year storm events, so  $P_6$  does not need to be adjusted for the hydrology calculations.
- **Runoff Coefficient (C):** Runoff coefficients are per Table 3.1 in the San Diego County Hydrology Manual (2003). A composite runoff coefficient has been calculated for each drainage area and are included in the existing and proposed hydrology calculation summaries.

### **III. DISCUSSION**

#### **Existing Condition**

The existing project site is a vacant, undeveloped lot with a dirt path connecting Richmar Avenue to Mission Road. The existing studied area is covered with sparse, natural vegetation and considered 100% pervious. All runoff within the studied area sheet flows to the Twin Oaks Valley Creek along the eastern property line.

The existing project site is comprised of one major drainage area (DA-A) with all runoff sheet flowing east across the project site towards Twin Oaks Valley Creek. The drainage area consists of steep hillside in the western portion outside property limits south of Twin Oaks Valley Road, moderate to flat natural land cover, and a dirt road connecting Twin Oaks Valley Road and Mission Road. Runoff within the creek flows south and enters the City's channel box culvert, which eventually discharges to San Marcos Creek. The project site does not receive run-on from Mission Road. An existing 36" CMP storm drain line collects runoff from Richmar and Twin Oaks Valley Road and discharges to Twin Oaks Valley Creek.

Existing runoff conditions are summarized in Table 1 below. A map of the existing drainage patterns and the runoff calculation results are included in Attachment 2. A separate analysis of onsite, pre-development flows for hydromodification analysis is included in the project's SWQMP.

**Table 1 – Existing Peak Flow Hydrology Summary**

<b>Drainage Area</b>	<b>Area (ac)</b>	<b>Q<sub>50</sub> (cfs)</b>	<b>Q<sub>100</sub> (cfs)</b>
DA-A	3.29	5.86	6.69
<b>Total Studied Area</b>	<b>3.29</b>	<b>5.86</b>	<b>6.69</b>

#### **Proposed Condition**

The proposed condition consists of two drainage area: DA-A flows to onsite BMPs, and DA-B flows directly to the City's storm drain system.. Runoff not retained on site in the proposed condition ultimately flows to the Twin Oaks Valley Creek and into the City's existing storm drain system, same as in the existing condition. The new development will alter existing drainage characteristics and patterns so that onsite runoff will be collected, treated, and detained to fulfill LID and hydromodification control requirements. A concrete swale is proposed along the western property line to convey offsite run-on directly to the City's storm drain system. The proposed condition is

considered high density residential with a ratio of 80% impervious and 20% pervious area unless otherwise noted below. Impervious area includes building rooftop, AC pavement, concrete hardscape, and retaining walls. The studied area for the proposed condition is less than that of the existing condition due to proposed limits of improvement. Runoff within the fire access lane and adjacent parking stalls will be collected, treated, and detained onsite. An AC berm is proposed to convey flows from this area to the new onsite storm drain system, instead of flowing directly to the adjacent Twin Oaks Valley Creek. The proposed studied area does not include runoff within the Twin Oaks Valley Creek.

Drainage sub-area A1 is comprised of existing hillside vegetation and AC pavement parking lot area. Drainage sub-area A2 is comprised of roof runoff and AC pavement parking lot area. Runoff from both sub-areas A1 and A2 surface flow to a biofiltration basin for treatment control and discharge to an underground detention vault for hydromodification flow control management prior to entering the City's storm drain system via the existing inlet structure on Mission Road.

Drainage sub-areas A3-9 and A11-23 are comprised of landscape area, proposed roof area, concrete hardscape, and AC pavement. Runoff in these areas sheetflow to localized inlets and discharge to a proposed underground detention vault for hydromodification flow control management. Controlled runoff flows through a proposed proprietary biofiltration device for treatment control prior to being pumped to the City's existing storm drain system via the existing inlet structure on Mission Road.

Drainage sub-area A10 is comprised of hillside landscaping south of the proposed building along Mission Road. Runoff will surface flow to a new inlet west of the new fire access road and discharge to the proposed detention and treatment control system prior to discharging to the City's storm drain system via the existing inlet structure on Mission Road.

Drainage sub-areas B1 and B2 are comprised of hillside landscaping west of the proposed building and includes runoff from west of the western property line and east of Twin Oaks Valley Road. Runoff will surface flow to an existing inlet at the southwest property corner and discharge directly to the City's storm drain system via the existing inlet structure on Mission Road. These areas are considered natural with good cover.

Unmitigated runoff for the proposed condition increases by approximately 144% for both 50 and 100-year storm events due to the development of a previously 100% pervious site. Proposed unmitigated runoff conditions at onsite inlets/discharge points

are summarized in Table 2 on the next page. A map of the proposed drainage patterns and the runoff calculation results are included in Attachment 3.

**Table 2 – Proposed Condition: Unmitigated Peak Flow Hydrology Summary**

<b>Drainage Area</b>	<b>Area (ac)</b>	<b>Q<sub>50</sub> (cfs)</b>	<b>Q<sub>100</sub> (cfs)</b>
DA-A	2.37	13.6	15.5
DA-B	0.35	0.67	0.77
<b>Total Studied Area</b>	<b>2.73</b>	<b>14.3</b>	<b>16.3</b>
<b>Change in Unmitigated Peak Flow Rate</b> [(Existing-Proposed)/Existing]	<b>- 17%</b>	<b>+ 144%</b>	<b>+ 144%</b>

### **LID/Hydromodification Considerations**

The proposed biofiltration basins and proprietary biofiltration system will provide water quality treatment for project site flows. The biofiltration basins will also assist in hydromodification flow control. Both treatment systems discharge to underground detention vaults to fulfill hydromodification requirements. The new development will alter existing drainage characteristics and patterns so that runoff in the post-developed condition does not exceed that of the pre-developed condition for flows durations between  $0.10Q_2$  and  $Q_{10}$ . The flow control analysis is included in the separate Preliminary SWQMP for this project. Therefore, the change in unmitigated runoff for the proposed condition at onsite inlets/discharge points will not affect the project site's total runoff discharging from the site.



## **IV. CONCLUSION**

The project's storm drain PVC pipe network are sized using flows from the 50-year storm event analysis. Storm drain pipe sizing calculations will be included in Attachment 4 of the Final Hydrology Study. The project's proposed structural BMPs are sized based on results from separate hydromodification management and LID requirements. Project overflow locations will remain unchanged with runoff discharging to the Twin Oaks Valley Creek via the lowest inlet in the fire lane and entering the City's storm drain system.

The mitigated storm runoff flow rates be significantly less than that of the existing condition due to the use of onsite water quality basins and underground detention systems to limit outflow rates. Therefore, downstream channels and conveyance system will not be at risk of increased erosion due to project site developments.

## **V. 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 and City of San Marcos is confined to a review only and does not relieve me, as Engineer of Work of my responsibility for project design.

### **ENGINEER OF WORK:**

**Commercial Development Resources**

4121 Westerly Place, Suite 112  
Newport Beach, CA 91660  
949.610.8997

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Aaron M. Albertson  
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02/14/2020

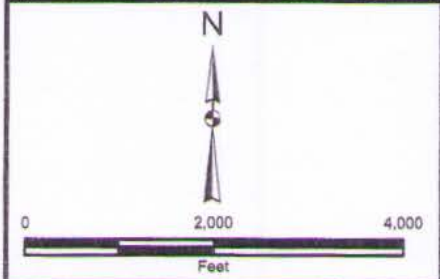
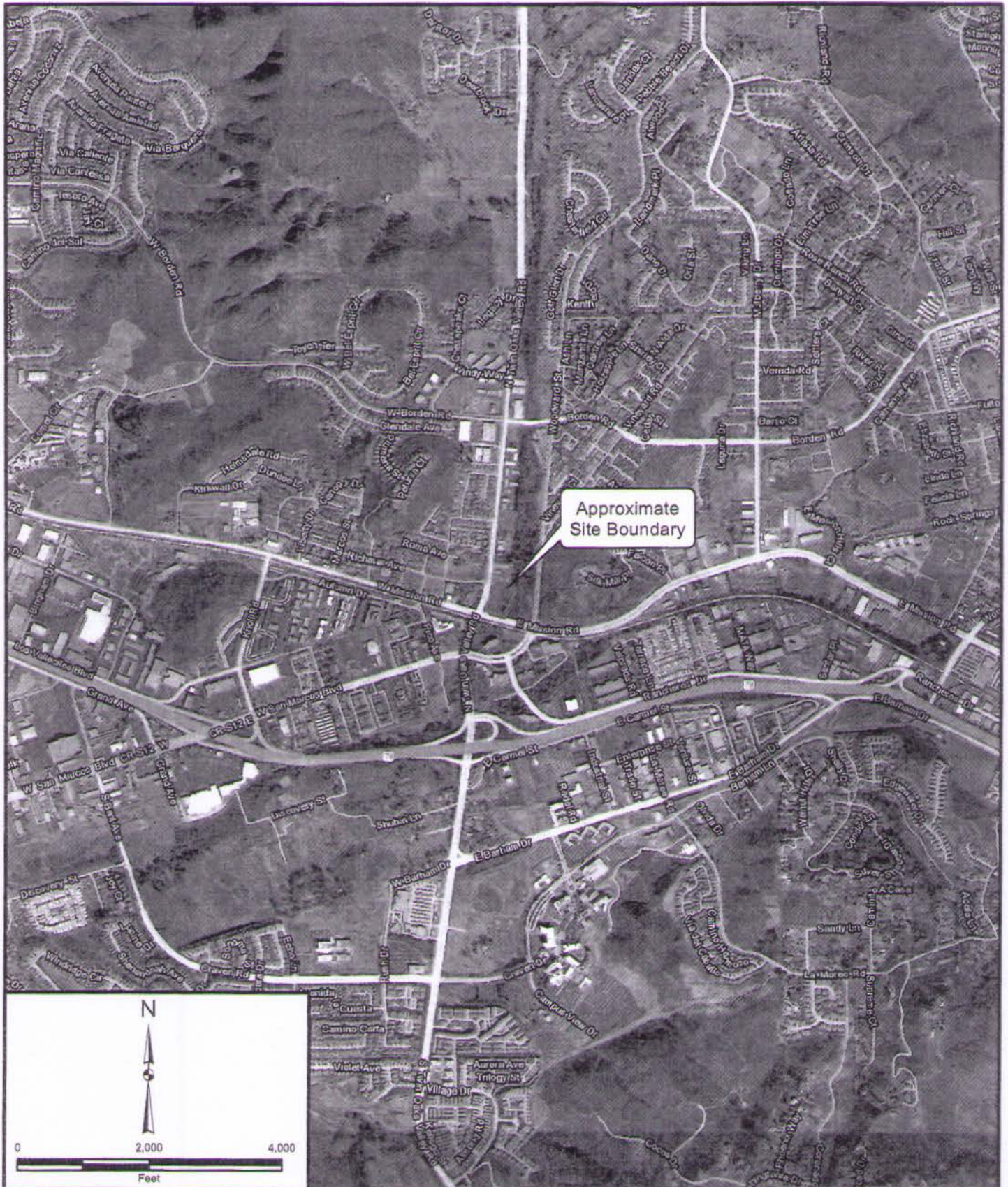
Date

## **VI. 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.** Advanced Engineering Software (AES), © 1982-2016 Version 23.0, San Diego County Control District 2003 Manual Rational Hydrology Study.

**ATTACHMENT 1**  
**Location Map**  
**Precipitation Maps**  
**& Soil Maps**





Project: 11777.001	Eng/Geol: WDO/MDJ
Scale: 1" = 2,000'	Date: October 2017
Base Map: ESRI ArcGIS Online 2017 Thematic Information: Leighton Author: Leighton Geomatics (mmurphy)	

## SITE LOCATION MAP

Warmington Residential  
San Marcos, California

Figure 1



Leighton



# County of San Diego Hydrology Manual



## Rainfall Isoplethals

### 50 Year Rainfall Event - 6 Hours

..... Isopleth (inches)

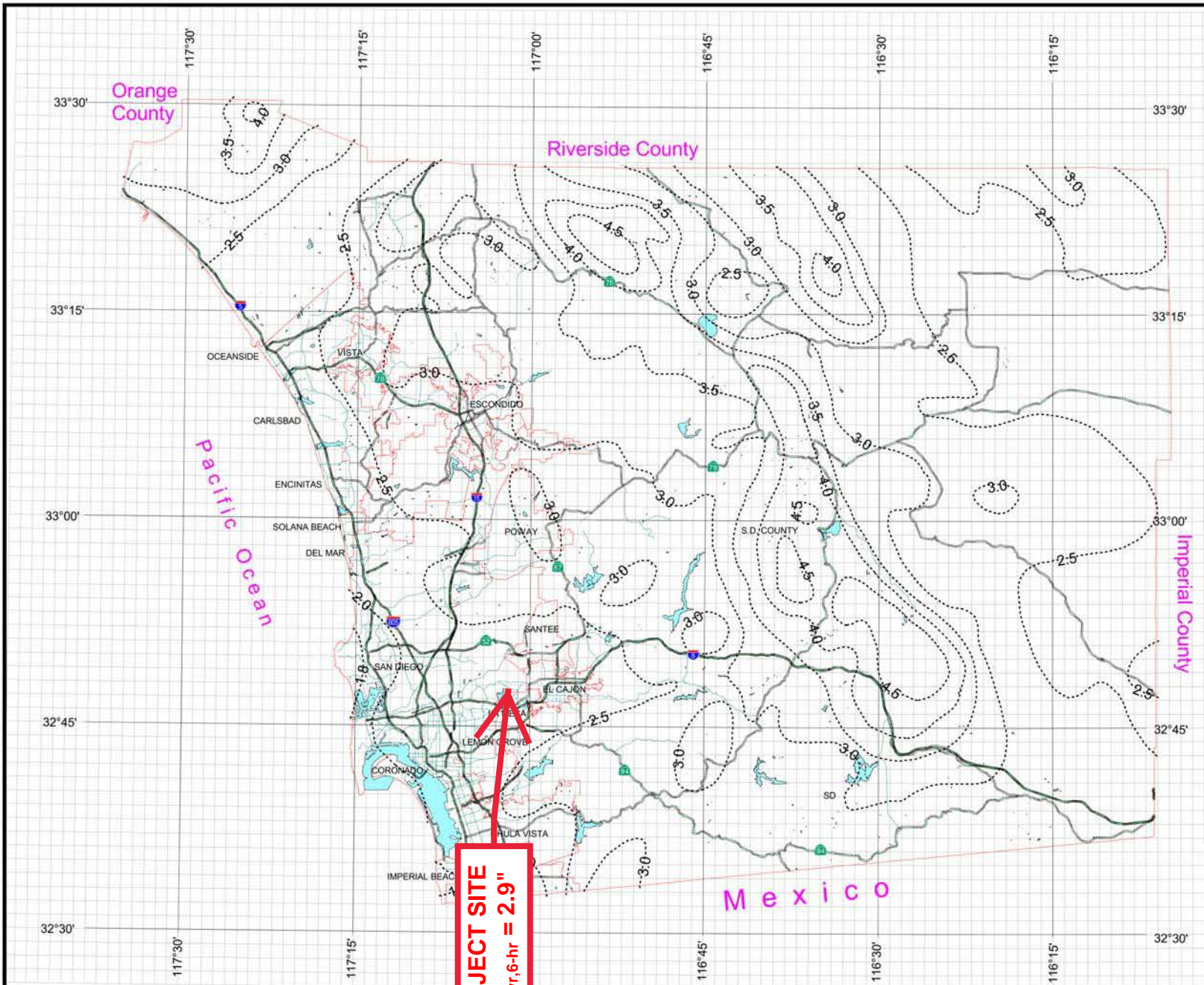


3 0 3 Miles

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# County of San Diego Hydrology Manual



## Rainfall Isoplethals

### 50 Year Rainfall Event - 24 Hours

----- Isopleth (inches)

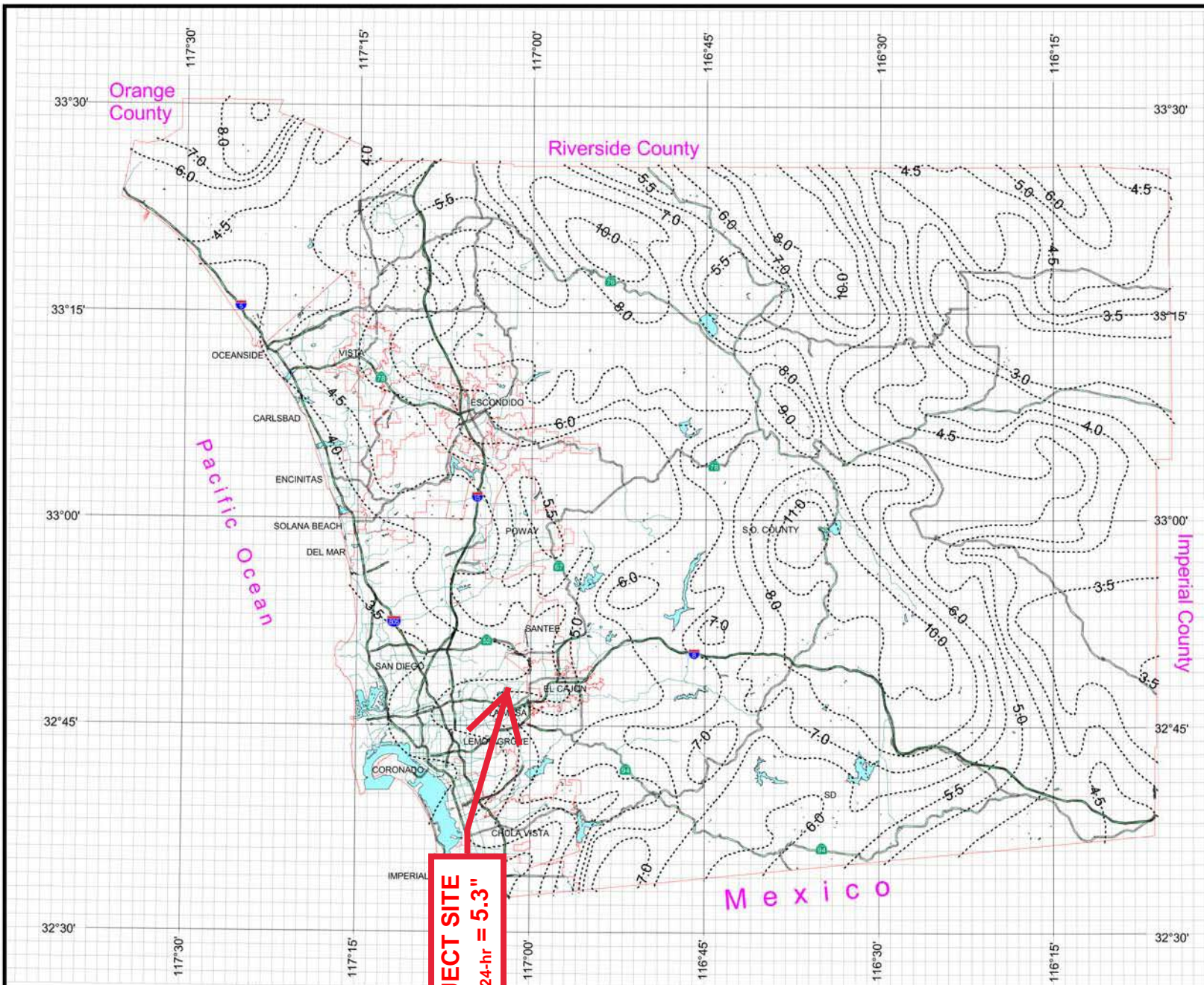


3 0 3 Miles

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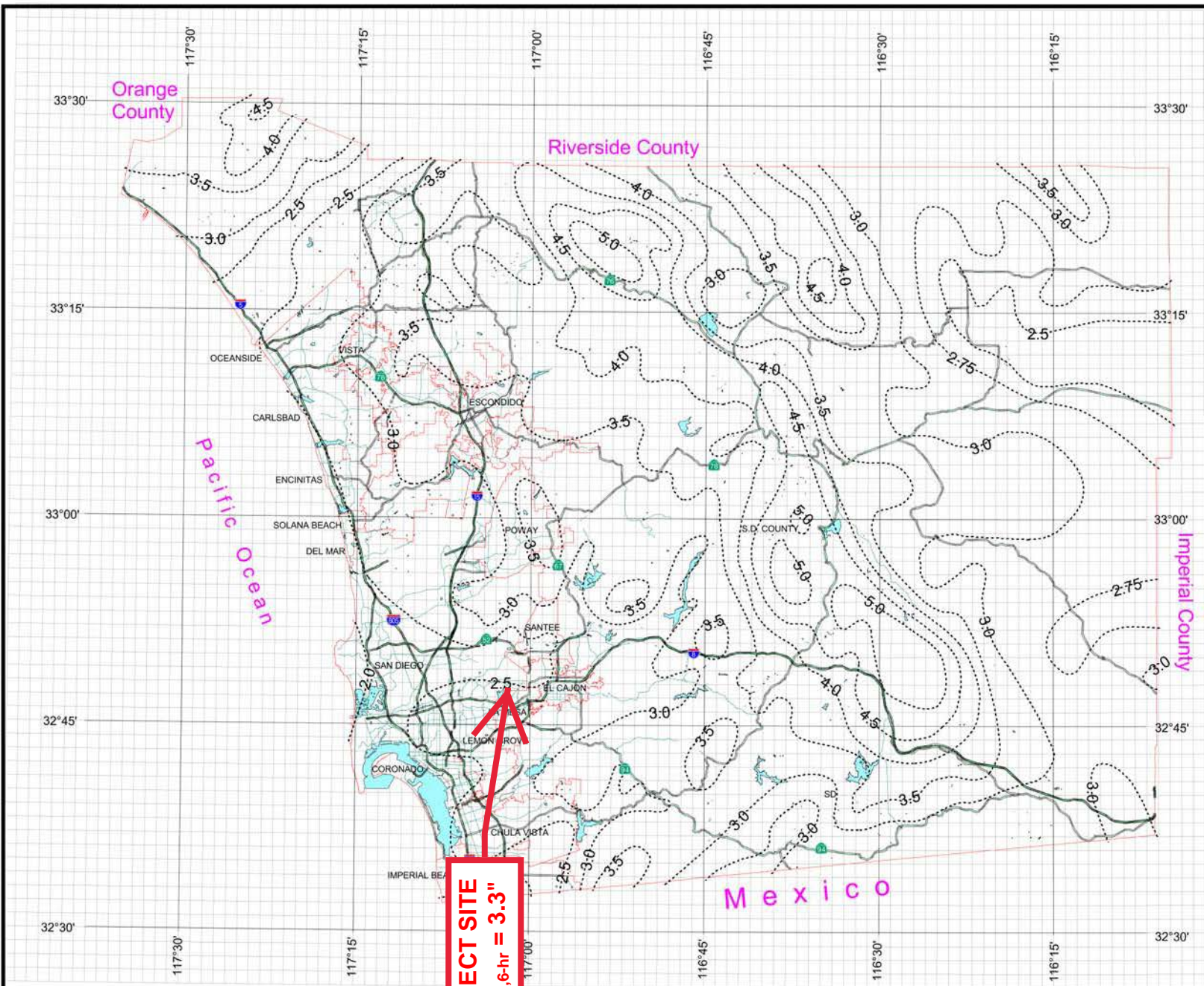
# County of San Diego Hydrology Manual



## Rainfall Isopluvials

### 100 Year Rainfall Event - 6 Hours

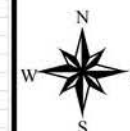
----- Isopluvial (inches)



**PROJECT SITE**  
**P<sub>100-yr.6-hr</sub> = 3.3"**

**DPW**  
**GIS**  
Department of Public Works  
Geographic Information Systems

**SanGIS**  
We Have San Diego Covered!



3 0 3 Miles

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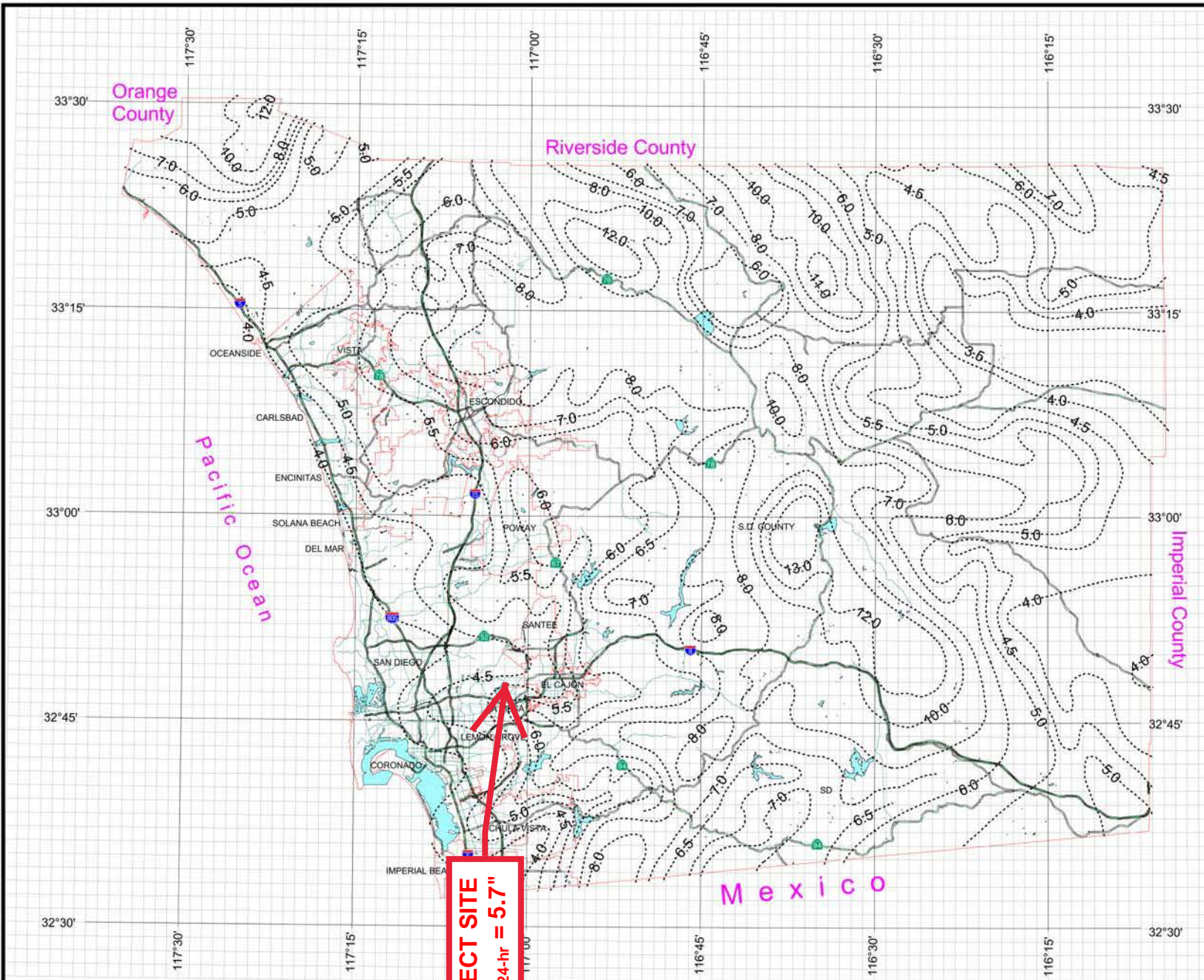
# County of San Diego Hydrology Manual



## Rainfall Isophuvials

### 100 Year Rainfall Event - 24 Hours

----- Isopluvial (inches)



**PROJECT SITE**  
**P<sub>100-yr,24-hr</sub> = 5.7"**

**DPW**  
**GIS**  
Department of Public Works  
Geographic Information Services

**SanGIS**  
We Have San Diego Covered!



3 0 3 Miles

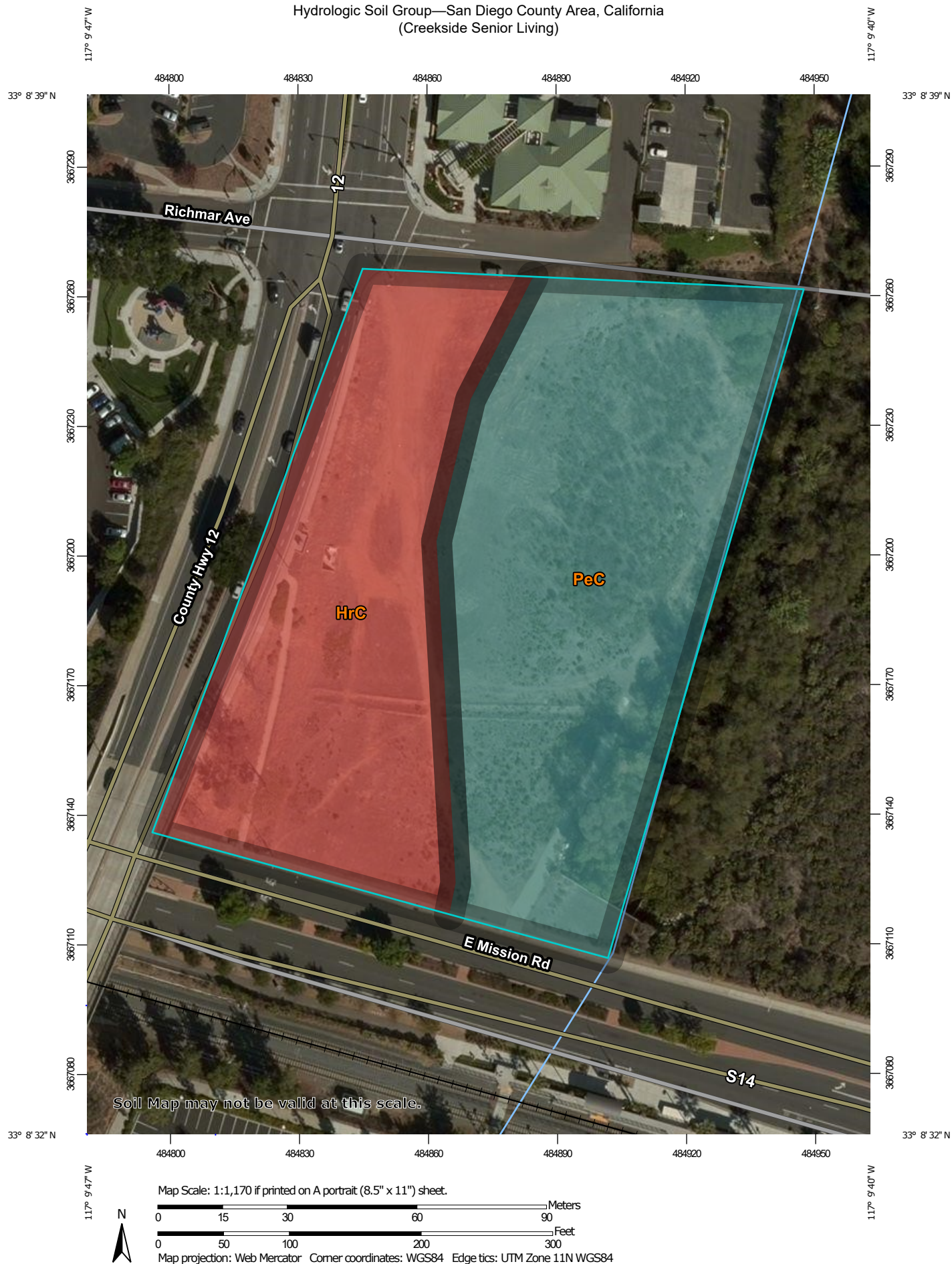
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# Hydrologic Soil Group—San Diego County Area, California (Creskide Senior Living)



Hydrologic Soil Group—San Diego County Area, California  
(Creekside Senior Living)

## 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 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HrC	Huerhuero loam, 2 to 9 percent slopes	D	1.7	43.4%
PeC	Placentia sandy loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	C	2.2	56.6%
<b>Totals for Area of Interest</b>			<b>3.9</b>	<b>100.0%</b>

## 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.

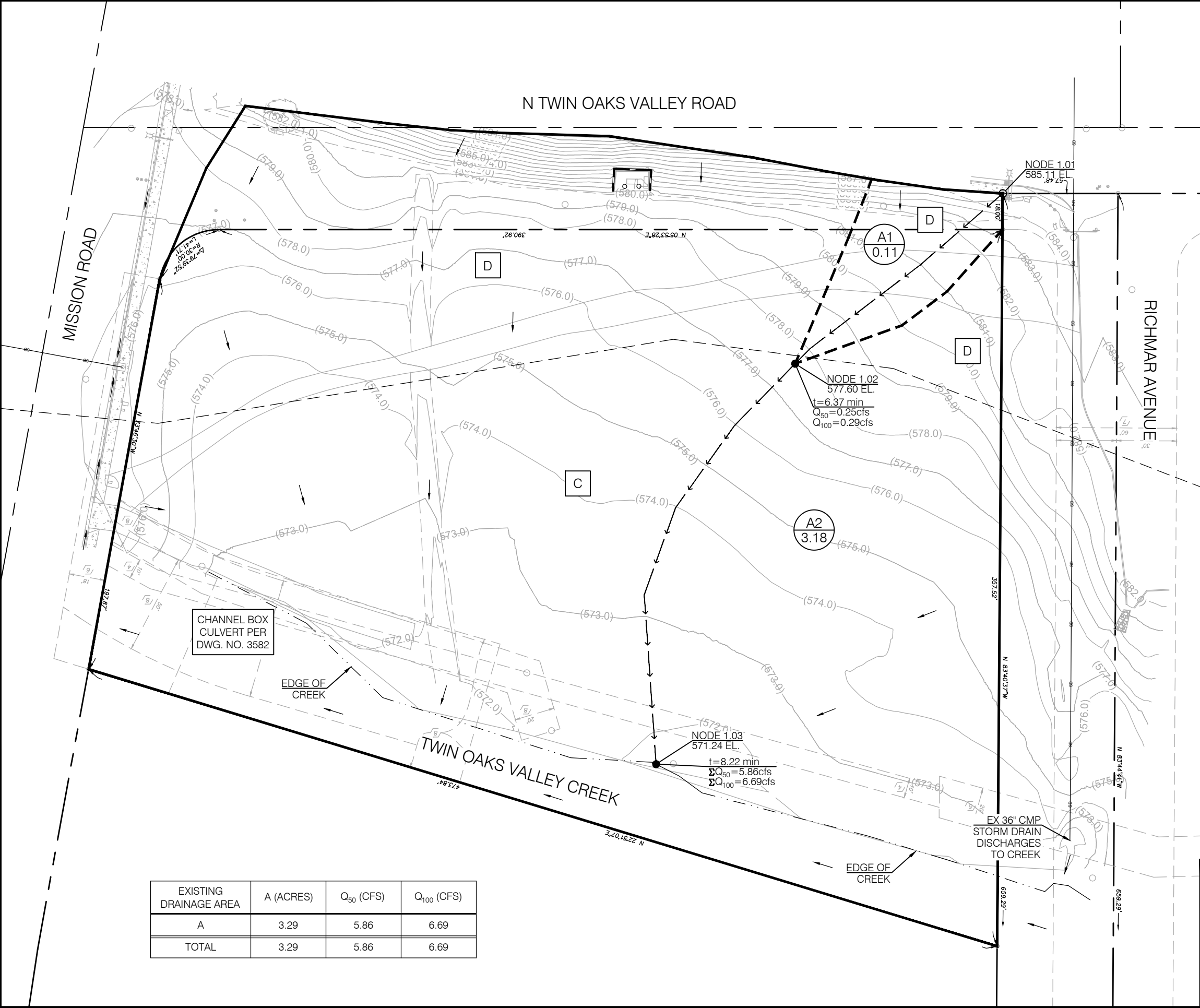
## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

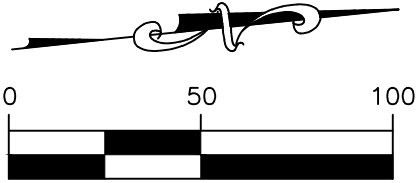
**ATTACHMENT 2**  
**Existing Condition**  
**Map & Hydrology Calculations**



- LEGEND:**
- DRAINAGE AREA (DA) BOUNDARY
  - DRAINAGE SUB-AREA BOUNDARY
  - PROPERTY LINE
  - CENTERLINE
  - DA DESIGNATION  
AREA SIZE (ACRES)
  - FLOW LINE W/ FLOW DIRECTION
  - HYDROLOGIC SOIL GROUP

**PREPARED FOR:**  
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GRAPHIC SCALE  
SCALE: 1" = 50'

EXISTING DRAINAGE AREA	A (ACRES)	Q <sub>50</sub> (CFS)	Q <sub>100</sub> (CFS)
A	3.29	5.86	6.69
TOTAL	3.29	5.86	6.69

HYDROLOGY STUDY EXHIBIT A:  
EXISTING DRAINAGE AREA MAP

CREEKSIDE ASSISTED LIVING  
SEC N TWIN OAKS VALLEY RD & RICHMAR AVE  
SAN MARCOS, CA 92069

## HYDROLOGY CALCULATION SUMMARY

(Using San Diego County Hydrology Manual and AES)

PROJECT: Creekside Assisted Living

LOCATION: San Marcos, CA

DATE: 02/14/2020

Storm Event	50-yr	100-yr
6-hr Precipitation (in)	2.90	3.30
24-hr Precipitation (in)	5.30	5.70
CHECK: $P_6/P_{24} = [46\%-65\%]$	55%	58%
Hydrologic Soil Group	C, D	

Runoff Coefficient "C" per Table 3-1 of Hydrology Manual

Land Use	% Imp.	Soil Type	
		C	D
Natural	0	0.30	0.35
High Density Residential	80	0.78	0.79

### EXISTING CONDITION:

AES Data Input:

Drainage Sub-Area			Hydrologic Soil Type		Weighted Runoff Coefficient "C"	Elevation		Flow Length (ft)	Slope (ft/ft)	AES Nodes	Action	50-yr storm		100-yr storm			
ID	(SF)	(AC)	C	D		Up	Down					Q <sub>sub</sub> (cfs)	Q <sub>peak</sub> (cfs)	Q <sub>sub</sub> (cfs)	Q <sub>peak</sub> (cfs)		
DRAINAGE AREA 1: flows to Twin Oaks Valley Creek																	
A1	4,915	0.11	0	0%	4,915	100%	0.35	585.11	577.60	91	0.083	1.01 → 1.02	initial sub-Area	0.25	0.25	0.29	0.29
A2	138,526	3.18	95,879	69%	42,647	31%	0.32	577.60	571.24	225	0.028	1.02 → 1.03	flow through sub-area	5.64	5.86	6.45	6.69
TOTAL	143,441	3.29		67%		33%								---	5.86	---	6.69



\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
 Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
 2003, 1985, 1981 HYDROLOGY MANUAL

(c) Copyright 1982-2016 Advanced Engineering Software (aes)  
 Ver. 23.0 Release Date: 07/01/2016 License ID 1631

Analysis prepared by:

COMMERCIAL DEVELOPMENT RESOURCES  
 4121 Westerly Place, Suite 112  
 Newport Beach, CA 92660

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

\* Hydrology Study for CREEKSIDE ASSISTED LIVING \*  
 \* In the City of San Marcos \*  
 \* Existing Condition: 50-year Storm Event \*

\*\*\*\*\*

FILE NAME: 19064EX.DAT  
 TIME/DATE OF STUDY: 16:58 12/06/2019

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

## 2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 50.00

6-HOUR DURATION PRECIPITATION (INCHES) = 2.900

SPECIFIED MINIMUM PIPE SIZE(INCH) = 3.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

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

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0313 0.167	0.0150

## GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

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

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

BARREN COVER RUNOFF COEFFICIENT = .3500

SOIL CLASSIFICATION IS "D"

S. C. S. CURVE NUMBER (AMC II) = 93

INITIAL SUBAREA FLOW-LENGTH(Feet) = 91.00

UPSTREAM ELEVATION(Feet) = 585.11

DOWNSTREAM ELEVATION(Feet) = 577.60

ELEVATION DIFFERENCE(Feet) = 7.51

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.373

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.534

2019.12.06\_19064\_EX50.txt  
 SUBAREA RUNOFF(CFS) = 0.25  
 TOTAL AREA(ACRES) = 0.11 TOTAL RUNOFF(CFS) = 0.25

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 1.02 TO NODE 1.03 IS CODE = 51  
 -----

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	577.60	DOWNSTREAM(FEET) =	571.24
CHANNEL LENGTH THRU SUBAREA(FEET) =	225.00	CHANNEL SLOPE =	0.0283
CHANNEL BASE(FEET) =	10.00	"Z" FACTOR =	10.000
MANNING'S FACTOR =	0.030	MAXIMUM DEPTH(FEET) =	0.50
50 YEAR RAINFALL INTENSITY(INCH/HOUR) =	5.545		

\*USER SPECIFIED(SUBAREA):

BARREN COVER RUNOFF COEFFICIENT =	.3200		
S. C. S. CURVE NUMBER (AMC II) =	93		
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =	3.10		
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =	2.03		
AVERAGE FLOW DEPTH(FEET) =	0.13	TRAVEL TIME(MIN.) =	1.85
Tc(MIN.) =	8.22		
SUBAREA AREA(ACRES) =	3.18	SUBAREA RUNOFF(CFS) =	5.64
AREA-AVERAGE RUNOFF COEFFICIENT =	0.321		
TOTAL AREA(ACRES) =	3.3	PEAK FLOW RATE(CFS) =	5.86

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) =	0.19	FLOW VELOCITY(FEET/SEC.) =	2.53
LONGEST FLOWPATH FROM NODE	1.01 TO NODE	1.03 =	316.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES)	=	3.3	Tc(MIN.) =	8.22
PEAK FLOW RATE(CFS)	=	5.86		

=====

END OF RATIONAL METHOD ANALYSIS

♀

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
 Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
 2003, 1985, 1981 HYDROLOGY MANUAL

(c) Copyright 1982-2016 Advanced Engineering Software (aes)  
 Ver. 23.0 Release Date: 07/01/2016 License ID 1631

Analysis prepared by:

COMMERCIAL DEVELOPMENT RESOURCES  
 4121 Westerly Place, Suite 112  
 Newport Beach, CA 92660

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

\* Hydrology Study for CREEKSIDE ASSISTED LIVING \*  
 \* In the City of San Marcos \*  
 \* Existing Condition: 100-year Storm Event \*

\*\*\*\*\*

FILE NAME: 19064EX.DAT  
 TIME/DATE OF STUDY: 16:58 12/06/2019

-----  
 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:-----  
 2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00

6-HOUR DURATION PRECIPITATION (INCHES) = 3.300

SPECIFIED MINIMUM PIPE SIZE(INCH) = 3.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

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

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

## GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

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

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

BARREN COVER RUNOFF COEFFICIENT = .3500

SOIL CLASSIFICATION IS "D"

S. C. S. CURVE NUMBER (AMC II) = 93

INITIAL SUBAREA FLOW-LENGTH(FEET) = 91.00

UPSTREAM ELEVATION(FEET) = 585.11

DOWNSTREAM ELEVATION(FEET) = 577.60

ELEVATION DIFFERENCE(FEET) = 7.51

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 6.373

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.435

2019. 12. 06\_19064\_EX100. txt  
 SUBAREA RUNOFF(CFS) = 0.29  
 TOTAL AREA(ACRES) = 0.11 TOTAL RUNOFF(CFS) = 0.29

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 1.02 TO NODE 1.03 IS CODE = 51  
 -----

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	577.60	DOWNSTREAM(FEET) =	571.24
CHANNEL LENGTH THRU SUBAREA(FEET) =	225.00	CHANNEL SLOPE =	0.0283
CHANNEL BASE(FEET) =	10.00	"Z" FACTOR =	10.000
MANNING'S FACTOR =	0.030	MAXIMUM DEPTH(FEET) =	0.50
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	6.337		

\*USER SPECIFIED(SUBAREA):

BARREN COVER RUNOFF COEFFICIENT =	.3200
S. C. S. CURVE NUMBER (AMC II) =	93
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =	3.55
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =	2.09
AVERAGE FLOW DEPTH(FEET) =	0.15
TRAVEL TIME(MIN.) =	1.79
Tc(MIN.) =	8.16
SUBAREA AREA(ACRES) =	3.18
SUBAREA RUNOFF(CFS) =	6.45
AREA-AVERAGE RUNOFF COEFFICIENT =	0.321
TOTAL AREA(ACRES) =	3.3
PEAK FLOW RATE(CFS) =	6.69

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
 DEPTH(FEET) = 0.21 FLOW VELOCITY(FEET/SEC.) = 2.65  
 LONGEST FLOWPATH FROM NODE 1.01 TO NODE 1.03 = 316.00 FEET.

=====

END OF STUDY SUMMARY:

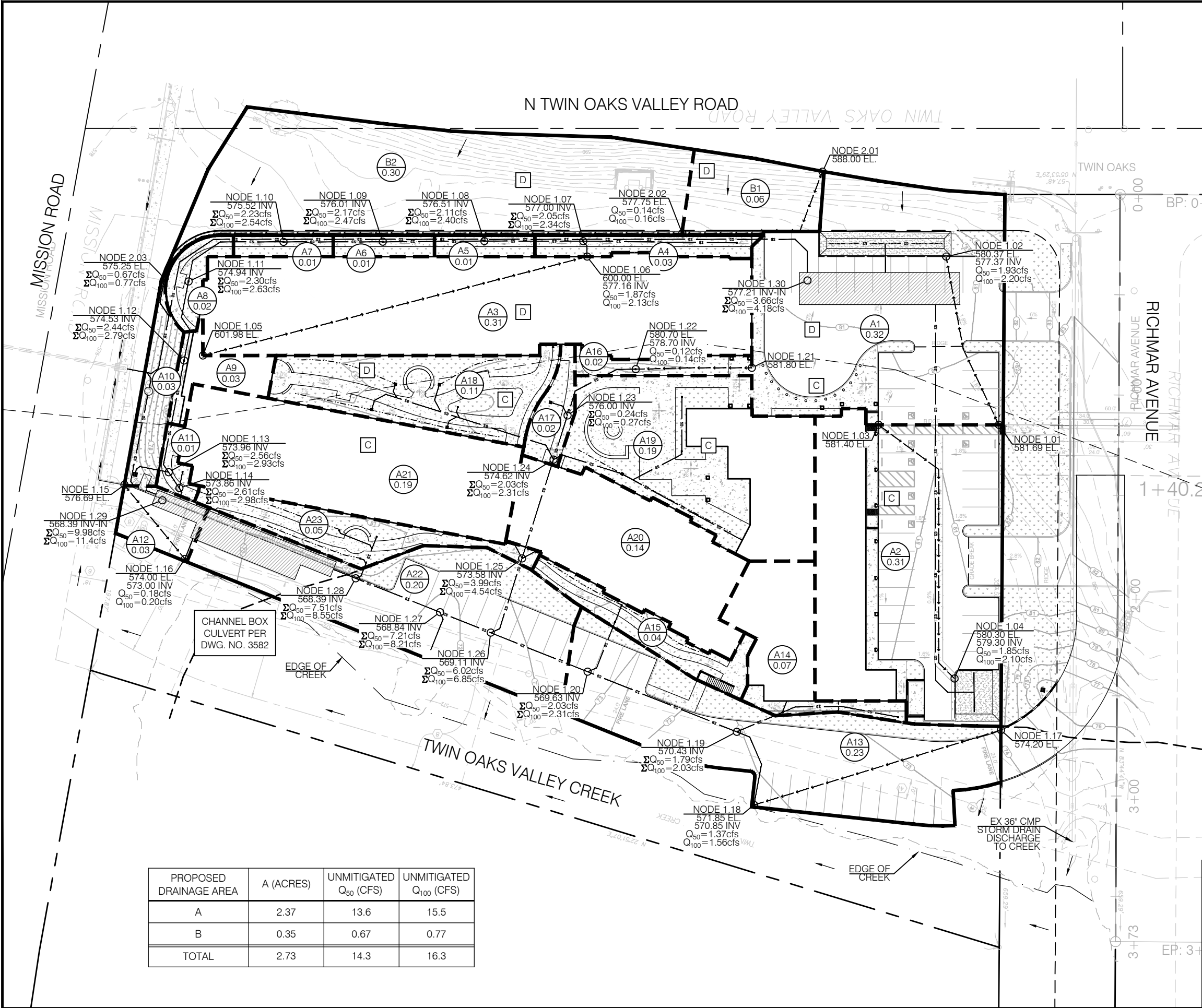
TOTAL AREA(ACRES)	=	3.3	TC(MIN.) =	8.16
PEAK FLOW RATE(CFS)	=	6.69		

=====

END OF RATIONAL METHOD ANALYSIS

♀

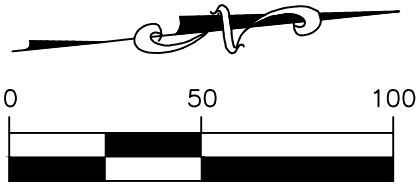
**ATTACHMENT 3**  
**Proposed Condition**  
**Map & Hydrology Calculations**



- LEGEND:**
- AC PAVEMENT
  - CONCRETE
  - LANDSCAPE
  - BIOFILTRATION BASIN
  - DRAINAGE AREA (DA) BOUNDARY
  - DRAINAGE SUB-AREA BOUNDARY
  - PROPERTY LINE
  - CENTERLINE
  - DA DESIGNATION AREA ACREAGE (ACRES)
  - FLOW LINE W/ FLOW DIRECTION
  - SD STORM DRAIN LINE

**PREPARED FOR:**  
BREAKER'S REAL ESTATE  
647 S CEDROS AVENUE  
SOLANA BEACH, CA 92075  
CONTACT: AARON WHITFIELD  
TEL: (858) 663-8215

**PREPARED BY:**  
COMMERCIAL DEVELOPMENT RESOURCES  
4121 WESTERLY PLACE, SUITE 112  
NEWPORT BEACH, CA 92660  
CONTACT: AARON ALBERTSON, PE  
TEL: (949) 610-8997



**GRAPHIC SCALE**  
**SCALE: 1" = 50'**

**HYDROLOGY STUDY EXHIBIT B:  
PROPOSED DRAINAGE AREA MAP**

**CREEKSIDE ASSISTED LIVING  
SEC N TWIN OAKS VALLEY RD & RICHMAR AVE  
SAN MARCOS, CA 92069**

## HYDROLOGY CALCULATION SUMMARY

(Using San Diego County Hydrology Manual and AES)

PROJECT: Creekside Assisted Living

LOCATION: San Marcos, CA

DATE: 02/14/2020

Storm Event	50-yr	100-yr
6-hr Precipitation (in)	2.90	3.30
24-hr Precipitation (in)	5.30	5.70
CHECK: $P_6/P_{24} = [46\%-65\%]$	55%	58%
Hydrologic Soil Group	C, D	

Runoff Coefficient "C" per Table 3-1 of Hydrology Manual

Land Use	% Imp.	Soil Type	
		C	D
Natural	0	0.30	0.35
High Density Residential	80	0.78	0.79

### PROPOSED CONDITION:

AES Data Input:

AES Output:

Drainage Sub-Area			Hydrologic Soil Type				Weighted Runoff Coefficient "C"	Elevation		Flow Length (ft)	Slope (ft/ft)	AES Nodes		Action	50-yr storm		100-yr storm	
ID	(SF)	(AC)	C		D			Up	Down						Q <sub>sub</sub> (cfs)	Q <sub>peak</sub> (cfs)	Q <sub>sub</sub> (cfs)	Q <sub>peak</sub> (cfs)
DRAINAGE AREA A: flows to onsite BMPs [Land Use = High Density Residential]																		
A1	13,926	0.32	2,948	21%	10,978	79%	0.79	581.69	580.37	89	0.015	1.01 → 1.02	initial subarea	1.93	(1.93)	2.20	(2.20)	
---	---	---	---	---	---	---	---	577.37	577.21	15	0.010	1.02 → 1.30	pipe flow, conf. 1/2	---	(1.93)	---	(2.20)	
A2	13,589	0.31	13,589	100%	0	0%	0.78	581.40	580.30	145	0.008	1.03 → 1.04	initial subarea	1.85	(1.85)	2.10	(2.10)	
---	---	---	---	---	---	---	---	579.30	577.21	209	0.010	1.04 → 1.30	pipe flow, conf. 2/2	---	3.66	---	4.18	
A3	13,440	0.31	413	3%	13,027	97%	0.79	601.98	600.00	198	0.010	1.05 → 1.06	initial subarea	1.87	(1.87)	2.13	(2.13)	
---	---	---	---	---	---	---	---	577.16	577.00	8	0.020	1.06 → 1.07	pipe flow	---	(1.87)	---	(2.13)	
A4	1,141	0.03	0	0%	1,141	100%	0.79	---	---	---	---	1.07 → 1.07	add subarea	0.18	(2.05)	0.21	(2.34)	
---	---	---	---	---	---	---	---	577.00	576.51	49	0.010	1.07 → 1.08	pipe flow	---	(2.05)	---	(2.34)	
A5	537	0.01	0	0%	537	100%	0.79	---	---	---	---	1.08 → 1.08	add subarea	0.06	(2.11)	0.07	(2.40)	
---	---	---	---	---	---	---	---	576.51	576.01	50	0.010	1.08 → 1.09	pipe flow	---	(2.11)	---	(2.40)	
A6	541	0.01	0	0%	541	100%	0.79	---	---	---	---	1.09 → 1.09	add subarea	0.06	(2.17)	0.07	(2.47)	
---	---	---	---	---	---	---	---	576.01	575.52	49	0.010	1.09 → 1.10	pipe flow	---	(2.17)	---	(2.47)	
A7	532	0.01	0	0%	532	100%	0.79	---	---	---	---	1.10 → 1.10	add subarea	0.06	(2.23)	0.07	(2.54)	
---	---	---	---	---	---	---	---	575.52	574.94	58	0.010	1.10 → 1.11	pipe flow	---	(2.23)	---	(2.54)	
A8	842	0.02	0	0%	842	100%	0.79	---	---	---	---	1.11 → 1.11	add subarea	0.12	(2.30)	0.13	(2.63)	
---	---	---	---	---	---	---	---	574.94	574.53	41	0.010	1.11 → 1.12	pipe flow	---	(2.30)	---	(2.63)	
A9	1,153	0.03	14	1%	1,139	99%	0.79	---	---	---	---	1.12 → 1.12	add subarea	0.17	(2.44)	0.20	(2.79)	
---	---	---	---	---	---	---	---	574.53	573.96	57	0.010	1.12 → 1.13	pipe flow	---	(2.44)	---	(2.79)	
A10	1,391	0.03	497	36%	894	64%	0.79	---	---	---	---	1.13 → 1.13	add subarea	0.17	(2.56)	0.20	(2.93)	
---	---	---	---	---	---	---	---	573.96	573.86	10	0.010	1.13 → 1.14	pipe flow	---	(2.56)	---	(2.93)	
A11	442	0.01	442	100%	0	0%	0.78	---	---	---	---	1.14 → 1.14	add subarea	0.06	(2.61)	0.06	(2.98)	
---	---	---	---	---	---	---	---	573.86	568.27	6	0.932	1.14 → 1.29	pipe flow, stream 1	---	2.61	---	2.98	
A12	1,167	0.03	1,167	100%	0	0%	0.78	576.69	574.00	48	0.056	1.15 → 1.16	initial subarea	0.18	(0.18)	0.20	(0.20)	
---	---	---	---	---	---	---	---	573.00	568.27	10	0.473	1.16 → 1.29	pipe flow, stream 2	---	0.18	---	0.20	
A13	10,011	0.23	10,011	100%	0	0%	0.78	574.20	571.85	129	0.018	1.17 → 1.18	initial subarea	1.37	(1.37)	1.56	(1.56)	
---	---	---	---	---	---	---	---	570.85	570.43	42	0.010	1.18 → 1.19	pipe flow	---	(1.37)	---	(1.56)	
A14	3,117	0.07	3,117	100%	0	0%	0.78	---	---	---	---	1.19 → 1.19	add subarea	0.42	(1.79)	0.47	(2.03)	
---	---	---	---	---	---	---	---	570.43	569.63	80	0.010	1.19 → 1.20	pipe flow	---	(1.79)	---	(2.03)	
A15	1,773	0.04	1,773	100%	0	0%	0.78	---	---	---	---	1.20 → 1.20	add subarea	0.24	(2.03)	0.27	(2.31)	
---	---	---	---	---	---	---	---	569.63	569.11	52	0.010	1.20 → 1.26	pipe flow, conf. 1/2	---	(2.03)	---	(2.31)	
A16	854	0.02	834	98%	21	2%	0.78	581.80	580.70	58	0.019	1.21 → 1.22	initial subarea	0.12	(0.12)	0.14	(0.14)	
---	---	---	---	---	---	---	---	578.70	576.00	45	0.060	1.22 → 1.23	pipe flow	---	(0.12)	---	(0.14)	
A17	900	0.02	850	94%	50	6%	0.78	---	---	---	---	1.23 → 1.23	add subarea	0.12	(0.24)	0.14	(0.27)	
---	---	---	---	---	---	---	---	576.00	574.62	23	0.060	1.23 → 1.24	pipe flow	---	(0.24)	---	(0.27)	
A18	4,676	0.11	2,693	58%	1,982	42%	0.78	---	---	---	---	1.24 → 1.24	add subarea	0.66	(0.89)	0.75	(1.02)	
A19	8,270	0.19	8,270	100%	0	0%	0.78	---	---	---	---	1.24 → 1.24	add subarea	1.13	(2.03)	1.29	(2.31)	
---	---	---	---	---	---	---	---	574.62	573.58	52	0.020	1.24 → 1.25	pipe flow	---	(2.03)	---	(2.31)	
A20	6,041	0.14	6,041	100%	0	0%	0.78	---	---	---	---	1.25 → 1.25	add subarea	0.83	(2.86)	0.95	(3.26)	
A21	8,215	0.19	7,750	94%	466	6%	0.78	---	---	---	---	1.25 → 1.25	add subarea	1.13	(3.99)	1.29	(4.54)	
---	---	---	---	---	---	---	---	573.58	569.11	42	0.107	1.25 → 1.26	pipe flow, conf. 2/2	---	(6.02)	---	(6.85)	
---	---	---	---	---	---	---	---	569.11	568.84	27	0.010	1.26 → 1.27	pipe flow	---	(6.02)	---	(6.85)	
A22	8,532	0.20	8,532	100%	0	0%	0.78	---	---	---	---	1.27 → 1.27	add subarea	1.19	(7.21)	1.36	(8.21)	
---	---	---	---	---	---	---	---	568.84	568.39	45	0.010	1.27 → 1.28	pipe flow	---	(7.21)	---	(8.21)	
A23	2,338	0.05	2,338	100%	0	0%	0.78	---	---	---	---	1.28 → 1.28	add subarea	0.30	(7.51)	0.34	(8.55)	
---	---	---	---	---	---	---	---	568.39	568.27	12	0.010	1.28 → 1.29	pipe flow, confl.	---	9.98	---	11.36	
ΣA	103,427	2.37		69%		31%									13.6		15.5	
DRAINAGE AREA B: flows directly to City SD System [Land Use = Natural Cover]																		
B1	2,476	0.06	0	0%	2,476	100%	0.35	588.00	577.75	91	0.113	2.01 → 2.02	initial subarea	0.14	(0.14)	0.16	(0.16)	
B2	12,924	0.30	0	0%	12,924	100%	0.35	577.75	575.25	268	0.009	2.02 → 2.03	open channel flow	0.56	0.67	0.64	0.77	
ΣB	15,400	0.35		0%		100%									0.67		0.77	
TOTAL	118,827	2.73													14.3		16.3	

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2016 Advanced Engineering Software (aes)  
Ver. 23.0 Release Date: 07/01/2016 License ID 1631

Analysis prepared by:

COMMERCIAL DEVELOPMENT RESOURCES  
4121 Westerly Place, Suite 112  
Newport Beach, CA 92660

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

\* Hydrology Study for CREEKSIDE ASSISTED LIVING \*  
\* In the City of San Marcos \*  
\* Proposed Condition: 50-year Storm Event \*

\*\*\*\*\*

-----  
FILE NAME: 19064PR.DAT  
TIME/DATE OF STUDY: 18:42 02/14/2020  
-----

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

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 50.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 2.900  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 4.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

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

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

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

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN



OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

-----  
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 89.00

UPSTREAM ELEVATION(FEET) = 581.69

DOWNSTREAM ELEVATION(FEET) = 580.37

ELEVATION DIFFERENCE(FEET) = 1.32

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.089

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 69.83

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN T<sub>c</sub> CALCULATION!

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON T<sub>c</sub> = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 1.93

TOTAL AREA(ACRES) = 0.32 TOTAL RUNOFF(CFS) = 1.93

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.02 TO NODE 1.30 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.37 DOWNSTREAM(FEET) = 577.21

FLOW LENGTH(FEET) = 15.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 7.2 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.08

ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 1.93

PIPE TRAVEL TIME(MIN.) = 0.05 T<sub>c</sub>(MIN.) = 4.14

LONGEST FLOWPATH FROM NODE 1.01 TO NODE 1.30 = 104.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.30 TO NODE 1.30 IS CODE = 1

-----  
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 4.14

RAINFALL INTENSITY(INCH/HR) = 7.64

TOTAL STREAM AREA(ACRES) = 0.32

PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.93

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.03 TO NODE 1.04 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 145.00

UPSTREAM ELEVATION(FEET) = 581.40

DOWNSTREAM ELEVATION(FEET) = 580.30

ELEVATION DIFFERENCE(FEET) = 1.10

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.800

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 57.76

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 1.85

TOTAL AREA(ACRES) = 0.31 TOTAL RUNOFF(CFS) = 1.85

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.04 TO NODE 1.30 IS CODE = 31  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 579.30 DOWNSTREAM(FEET) = 577.21

FLOW LENGTH(FEET) = 209.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 7.1 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 4.93

ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 1.85

PIPE TRAVEL TIME(MIN.) = 0.71 Tc(MIN.) = 5.51

LONGEST FLOWPATH FROM NODE 1.03 TO NODE 1.30 = 354.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.30 TO NODE 1.30 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

TIME OF CONCENTRATION(MIN.) = 5.51

RAINFALL INTENSITY(INCH/HR) = 7.18

TOTAL STREAM AREA(ACRES) = 0.31

PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.85

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	1.93	4.14	7.641	0.32
2	1.85	5.51	7.179	0.31

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

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	3.32	4.14	7.641
2	3.66	5.51	7.179

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 3.66 Tc(MIN.) = 5.51  
TOTAL AREA(ACRES) = 0.6  
LONGEST FLOWPATH FROM NODE 1.03 TO NODE 1.30 = 354.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.05 TO NODE 1.06 IS CODE = 21

-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00

UPSTREAM ELEVATION(FEET) = 601.98

DOWNSTREAM ELEVATION(FEET) = 600.00

ELEVATION DIFFERENCE(FEET) = 1.98

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.499

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 65.00

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 1.87

TOTAL AREA(ACRES) = 0.31 TOTAL RUNOFF(CFS) = 1.87

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.06 TO NODE 1.07 IS CODE = 31

-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.16 DOWNSTREAM(FEET) = 577.00

FLOW LENGTH(FEET) = 8.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.58  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 1.87  
PIPE TRAVEL TIME(MIN.) = 0.02 Tc(MIN.) = 4.52  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.07 = 206.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.07 TO NODE 1.07 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.18  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.05  
TC(MIN.) = 4.52

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.07 TO NODE 1.08 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.00 DOWNSTREAM(FEET) = 576.51  
FLOW LENGTH(FEET) = 49.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.23  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.05  
PIPE TRAVEL TIME(MIN.) = 0.16 Tc(MIN.) = 4.68  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.08 = 255.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.08 TO NODE 1.08 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.06

TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.11  
TC(MIN.) = 4.68

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.08 TO NODE 1.09 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(Feet) = 576.51 DOWNSTREAM(Feet) = 576.01

FLOW LENGTH(Feet) = 50.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.1 INCHES

PIPE-FLOW VELOCITY(Feet/Sec.) = 5.27

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.11

PIPE TRAVEL TIME(MIN.) = 0.16 Tc(MIN.) = 4.83

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.09 = 305.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.09 TO NODE 1.09 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900

SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.06

TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.17

TC(MIN.) = 4.83

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.09 TO NODE 1.10 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(Feet) = 576.01 DOWNSTREAM(Feet) = 575.52

FLOW LENGTH(Feet) = 49.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.2 INCHES

PIPE-FLOW VELOCITY(Feet/Sec.) = 5.30

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.17

PIPE TRAVEL TIME(MIN.) = 0.15 Tc(MIN.) = 4.99

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.10 = 354.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.10 TO NODE 1.10 IS CODE = 81

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-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.06
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.23
TC(MIN.) = 4.99

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*****
FLOW PROCESS FROM NODE 1.10 TO NODE 1.11 IS CODE = 31
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>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 575.52 DOWNSTREAM(FEET) = 574.94
FLOW LENGTH(FEET) = 58.00 MANNING'S N = 0.011
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.33
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.23
PIPE TRAVEL TIME(MIN.) = 0.18 Tc(MIN.) = 5.17
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.11 = 412.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 1.11 TO NODE 1.11 IS CODE = 81
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>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.479
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
SUBAREA AREA(ACRES) = 0.02 SUBAREA RUNOFF(CFS) = 0.12
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.30
TC(MIN.) = 5.17

```

```

*****
FLOW PROCESS FROM NODE 1.11 TO NODE 1.12 IS CODE = 31
-----

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```

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 574.94 DOWNSTREAM(FEET) = 574.53
FLOW LENGTH(FEET) = 41.00 MANNING'S N = 0.011

```

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.4 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.37  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.30  
PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 5.30  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.12 = 453.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.12 TO NODE 1.12 IS CODE = 81

-----

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.363  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.17  
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.44  
TC(MIN.) = 5.30

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.12 TO NODE 1.13 IS CODE = 31

-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 574.53 DOWNSTREAM(FEET) = 573.96  
FLOW LENGTH(FEET) = 57.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.7 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.45  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.44  
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 5.47  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.13 = 510.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.13 TO NODE 1.13 IS CODE = 81

-----

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.210  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.17  
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.56  
TC(MIN.) = 5.47

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.13 TO NODE 1.14 IS CODE = 31

-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 573.96 DOWNSTREAM(FEET) = 573.86

FLOW LENGTH(FEET) = 10.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.9 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.52

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.56

PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 5.50

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.14 = 520.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.14 TO NODE 1.14 IS CODE = 81

-----

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.185

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7898

SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.06

TOTAL AREA(ACRES) = 0.5 TOTAL RUNOFF(CFS) = 2.61

TC(MIN.) = 5.50

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.14 TO NODE 1.29 IS CODE = 31

-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 573.86 DOWNSTREAM(FEET) = 568.27

FLOW LENGTH(FEET) = 6.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 6.0 INCH PIPE IS 2.7 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 30.37

ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.61

PIPE TRAVEL TIME(MIN.) = 0.00 Tc(MIN.) = 5.50

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 10

-----

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<

=====



\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 13

>>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.15 TO NODE 1.16 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 48.00

UPSTREAM ELEVATION(FEET) = 576.69

DOWNSTREAM ELEVATION(FEET) = 574.00

ELEVATION DIFFERENCE(FEET) = 2.69

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 2.247

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 0.18

TOTAL AREA(ACRES) = 0.03 TOTAL RUNOFF(CFS) = 0.18

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.16 TO NODE 1.29 IS CODE = 31

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 573.00 DOWNSTREAM(FEET) = 568.27

FLOW LENGTH(FEET) = 10.00 MANNING'S N = 0.011

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 4.000

DEPTH OF FLOW IN 4.0 INCH PIPE IS 0.9 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 11.55

ESTIMATED PIPE DIAMETER(INCH) = 4.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 0.18

PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 2.26

LONGEST FLOWPATH FROM NODE 1.15 TO NODE 1.29 = 58.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 10

>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 13

>>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<

=====

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.17 TO NODE 1.18 IS CODE = 21

-----

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 129.00

UPSTREAM ELEVATION(FEET) = 574.20

DOWNSTREAM ELEVATION(FEET) = 571.85

ELEVATION DIFFERENCE(FEET) = 2.35

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.036

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 73.22

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN T<sub>c</sub> CALCULATION!

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON T<sub>c</sub> = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 1.37

TOTAL AREA(ACRES) = 0.23 TOTAL RUNOFF(CFS) = 1.37

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.18 TO NODE 1.19 IS CODE = 31

-----

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 570.85 DOWNSTREAM(FEET) = 570.43

FLOW LENGTH(FEET) = 42.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.7 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 4.69

ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 1.37

PIPE TRAVEL TIME(MIN.) = 0.15 T<sub>c</sub>(MIN.) = 4.18

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.19 = 171.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.19 TO NODE 1.19 IS CODE = 81

-----

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON T<sub>c</sub> = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(CFS) = 0.42  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 1.79  
TC(MIN.) = 4.18

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.19 TO NODE 1.20 IS CODE = 31

-----

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 570.43 DOWNSTREAM(FEET) = 569.63

FLOW LENGTH(FEET) = 80.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.9 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 4.90

ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 1.79

PIPE TRAVEL TIME(MIN.) = 0.27 Tc(MIN.) = 4.46

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.20 = 251.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.20 TO NODE 1.20 IS CODE = 81

-----

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.04 SUBAREA RUNOFF(CFS) = 0.24

TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.03

TC(MIN.) = 4.46

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.20 TO NODE 1.26 IS CODE = 31

-----

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 569.63 DOWNSTREAM(FEET) = 569.11

FLOW LENGTH(FEET) = 52.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.21

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.03

PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 4.62

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.26 = 303.00 FEET.

\*\*\*\*\*

```

FLOW PROCESS FROM NODE      1.26 TO NODE      1.26 IS CODE =   1
-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   4.62
RAINFALL INTENSITY(INCH/HR) =   7.64
TOTAL STREAM AREA(ACRES) =    0.34
PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.03

*****
FLOW PROCESS FROM NODE      1.21 TO NODE      1.22 IS CODE =  21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =   58.00
UPSTREAM ELEVATION(FEET) =   581.80
DOWNSTREAM ELEVATION(FEET) =   580.70
ELEVATION DIFFERENCE(FEET) =    1.10
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.544
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.641
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =    0.12
TOTAL AREA(ACRES) =    0.02  TOTAL RUNOFF(CFS) =    0.12

*****
FLOW PROCESS FROM NODE      1.22 TO NODE      1.23 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =   578.70  DOWNSTREAM(FEET) =   576.00
FLOW LENGTH(FEET) =   45.00  MANNING'S N =  0.011
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO  4.000
DEPTH OF FLOW IN  4.0 INCH PIPE IS  1.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.95
ESTIMATED PIPE DIAMETER(INCH) =   4.00  NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    0.12
PIPE TRAVEL TIME(MIN.) =   0.15  Tc(MIN.) =   3.70
LONGEST FLOWPATH FROM NODE      1.21 TO NODE      1.23 =   103.00 FEET.

*****
FLOW PROCESS FROM NODE      1.23 TO NODE      1.23 IS CODE =  81
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====

```

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
 \*USER SPECIFIED(SUBAREA):  
 RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
 S.C.S. CURVE NUMBER (AMC II) = 0  
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
 SUBAREA AREA(ACRES) = 0.02 SUBAREA RUNOFF(CFS) = 0.12  
 TOTAL AREA(ACRES) = 0.0 TOTAL RUNOFF(CFS) = 0.24  
 TC(MIN.) = 3.70

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.23 TO NODE 1.24 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 576.00 DOWNSTREAM(FEET) = 574.62  
 FLOW LENGTH(FEET) = 23.00 MANNING'S N = 0.011  
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 4.000  
 DEPTH OF FLOW IN 4.0 INCH PIPE IS 1.9 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.97  
 ESTIMATED PIPE DIAMETER(INCH) = 4.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 0.24  
 PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 3.76  
 LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.24 = 126.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.24 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
 \*USER SPECIFIED(SUBAREA):  
 RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
 S.C.S. CURVE NUMBER (AMC II) = 0  
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
 SUBAREA AREA(ACRES) = 0.11 SUBAREA RUNOFF(CFS) = 0.66  
 TOTAL AREA(ACRES) = 0.2 TOTAL RUNOFF(CFS) = 0.89  
 TC(MIN.) = 3.76

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.24 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
 \*USER SPECIFIED(SUBAREA):  
 RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 1.13  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.03  
TC(MIN.) = 3.76

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.25 IS CODE = 31

-----  
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 574.62 DOWNSTREAM(FEET) = 573.58  
FLOW LENGTH(FEET) = 52.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.8 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.69  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.03  
PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 3.89  
LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.25 = 178.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.25 TO NODE 1.25 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
SUBAREA AREA(ACRES) = 0.14 SUBAREA RUNOFF(CFS) = 0.83  
TOTAL AREA(ACRES) = 0.5 TOTAL RUNOFF(CFS) = 2.86  
TC(MIN.) = 3.89

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.25 TO NODE 1.25 IS CODE = 81

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

=====

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 1.13  
TOTAL AREA(ACRES) = 0.7 TOTAL RUNOFF(CFS) = 3.99  
TC(MIN.) = 3.89



\*\*\*\*\*

FLOW PROCESS FROM NODE 1.25 TO NODE 1.26 IS CODE = 31

-----  
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 573.58 DOWNSTREAM(FEET) = 569.11  
FLOW LENGTH(FEET) = 42.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.2 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 14.93  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 3.99  
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 3.94  
LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.26 = 220.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.26 TO NODE 1.26 IS CODE = 1

-----  
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 3.94  
RAINFALL INTENSITY(INCH/HR) = 7.64  
TOTAL STREAM AREA(ACRES) = 0.67  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.99

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.03	4.62	7.641	0.34
2	3.99	3.94	7.641	0.67

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

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	5.72	3.94	7.641
2	6.02	4.62	7.641

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 6.02 Tc(MIN.) = 4.62  
TOTAL AREA(ACRES) = 1.0  
LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.26 = 303.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.26 TO NODE 1.27 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 569.11 DOWNSTREAM(FEET) = 568.84  
FLOW LENGTH(FEET) = 27.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.2 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.75  
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 6.02  
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 4.69  
LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.27 = 330.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.27 TO NODE 1.27 IS CODE = 81

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

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 1.19  
TOTAL AREA(ACRES) = 1.2 TOTAL RUNOFF(CFS) = 7.21  
TC(MIN.) = 4.69

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.27 TO NODE 1.28 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 568.84 DOWNSTREAM(FEET) = 568.39  
FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 15.0 INCH PIPE IS 11.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.91  
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 7.21  
PIPE TRAVEL TIME(MIN.) = 0.11 Tc(MIN.) = 4.80  
LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.28 = 375.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.28 TO NODE 1.28 IS CODE = 81

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

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.641

NOTE: RAINFALL INTENSITY IS BASED ON  $T_c = 5$ -MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.05 SUBAREA RUNOFF(CFS) = 0.30

TOTAL AREA(ACRES) = 1.3 TOTAL RUNOFF(CFS) = 7.51

$T_c$ (MIN.) = 4.80

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.28 TO NODE 1.29 IS CODE = 31

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(Feet) = 568.39 DOWNSTREAM(Feet) = 568.27

FLOW LENGTH(Feet) = 12.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.3 INCHES

PIPE-FLOW VELOCITY(Feet/Sec.) = 7.21

ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 7.51

PIPE TRAVEL TIME(MIN.) = 0.03  $T_c$ (MIN.) = 4.83

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.29 = 387.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 11

>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	$T_c$ (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	7.51	4.83	7.641	1.26

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.29 = 387.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	$T_c$ (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.61	5.50	7.182	0.46

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

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

STREAM NUMBER	RUNOFF (CFS)	$T_c$ (MIN.)	INTENSITY (INCH/HOUR)
1	9.80	4.83	7.641
2	9.67	5.50	7.182

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 9.80  $T_c$ (MIN.) = 4.83

TOTAL AREA(ACRES) = 1.7

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 11

-----  
>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<  
=====

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	9.80	4.83	7.641	1.72

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

\*\* MEMORY BANK # 2 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	0.18	2.26	7.641	0.03

LONGEST FLOWPATH FROM NODE 1.15 TO NODE 1.29 = 58.00 FEET.

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	4.77	2.26	7.641
2	9.98	4.83	7.641

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 9.98 Tc(MIN.) = 4.83

TOTAL AREA(ACRES) = 1.8

\*\*\*\*\*

FLOW PROCESS FROM NODE 2.01 TO NODE 2.02 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
=====

\*USER SPECIFIED(SUBAREA):

ANNUAL GRASS (DRYLAND) GOOD COVER RUNOFF COEFFICIENT = .3500

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 91.00

UPSTREAM ELEVATION(FEET) = 588.00

DOWNSTREAM ELEVATION(FEET) = 577.75

ELEVATION DIFFERENCE(FEET) = 10.25

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.978

WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!

50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.809

SUBAREA RUNOFF(CFS) = 0.14

TOTAL AREA(ACRES) = 0.06 TOTAL RUNOFF(CFS) = 0.14

\*\*\*\*\*

FLOW PROCESS FROM NODE 2.02 TO NODE 2.03 IS CODE = 51

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

ELEVATION DATA: UPSTREAM(FEET) = 577.75 DOWNSTREAM(FEET) = 575.25  
CHANNEL LENGTH THRU SUBAREA(FEET) = 268.00 CHANNEL SLOPE = 0.0093  
CHANNEL BASE(FEET) = 2.00 "Z" FACTOR = 12.000  
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.50  
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.290

\*USER SPECIFIED(SUBAREA):

ANNUAL GRASS (DRYLAND) GOOD COVER RUNOFF COEFFICIENT = .3500

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.42

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.56

AVERAGE FLOW DEPTH(FEET) = 0.09 TRAVEL TIME(MIN.) = 2.86

Tc(MIN.) = 8.84

SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 0.56

AREA-AVERAGE RUNOFF COEFFICIENT = 0.350

TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 0.67

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.11 FLOW VELOCITY(FEET/SEC.) = 1.79

LONGEST FLOWPATH FROM NODE 2.01 TO NODE 2.03 = 359.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 0.4 TC(MIN.) = 8.84

PEAK FLOW RATE(CFS) = 0.67

=====

END OF RATIONAL METHOD ANALYSIS



\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003,1985,1981 HYDROLOGY MANUAL  
(c) Copyright 1982-2016 Advanced Engineering Software (aes)  
Ver. 23.0 Release Date: 07/01/2016 License ID 1631

Analysis prepared by:

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Newport Beach, CA 92660

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

\* Hydrology Study for CREEKSIDE ASSISTED LIVING \*  
\* In the City of San Marcos \*  
\* Proposed Condition: 100-year Storm Event \*

\*\*\*\*\*

-----  
FILE NAME: 19064PR.DAT  
TIME/DATE OF STUDY: 18:43 02/14/2020  
-----

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

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
6-HOUR DURATION PRECIPITATION (INCHES) = 3.300  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 4.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD  
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS  
\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

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

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
  2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)
- \*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*



\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

-----  
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 89.00  
UPSTREAM ELEVATION(FEET) = 581.69  
DOWNSTREAM ELEVATION(FEET) = 580.37  
ELEVATION DIFFERENCE(FEET) = 1.32  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.089  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 69.83  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
SUBAREA RUNOFF(CFS) = 2.20  
TOTAL AREA(ACRES) = 0.32 TOTAL RUNOFF(CFS) = 2.20

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.02 TO NODE 1.30 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.37 DOWNSTREAM(FEET) = 577.21  
FLOW LENGTH(FEET) = 15.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.1 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.45  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.20  
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 4.13  
LONGEST FLOWPATH FROM NODE 1.01 TO NODE 1.30 = 104.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.30 TO NODE 1.30 IS CODE = 1

-----  
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION(MIN.) = 4.13  
RAINFALL INTENSITY(INCH/HR) = 8.69  
TOTAL STREAM AREA(ACRES) = 0.32  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.20

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.03 TO NODE 1.04 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 145.00

UPSTREAM ELEVATION(FEET) = 581.40

DOWNSTREAM ELEVATION(FEET) = 580.30

ELEVATION DIFFERENCE(FEET) = 1.10

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.800

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 57.76

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 2.10

TOTAL AREA(ACRES) = 0.31 TOTAL RUNOFF(CFS) = 2.10

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.04 TO NODE 1.30 IS CODE = 31

-----  
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 579.30 DOWNSTREAM(FEET) = 577.21

FLOW LENGTH(FEET) = 209.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.1 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.26

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.10

PIPE TRAVEL TIME(MIN.) = 0.66 Tc(MIN.) = 5.46

LONGEST FLOWPATH FROM NODE 1.03 TO NODE 1.30 = 354.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.30 TO NODE 1.30 IS CODE = 1

-----  
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

TIME OF CONCENTRATION(MIN.) = 5.46

RAINFALL INTENSITY(INCH/HR) = 8.21

TOTAL STREAM AREA(ACRES) = 0.31

PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.10

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	T <sub>c</sub> (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.20	4.13	8.695	0.32
2	2.10	5.46	8.212	0.31

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

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

STREAM NUMBER	RUNOFF (CFS)	T <sub>c</sub> (MIN.)	INTENSITY (INCH/HOUR)
1	3.79	4.13	8.695
2	4.18	5.46	8.212

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 4.18 T<sub>c</sub>(MIN.) = 5.46  
TOTAL AREA(ACRES) = 0.6  
LONGEST FLOWPATH FROM NODE 1.03 TO NODE 1.30 = 354.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.05 TO NODE 1.06 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900

S.C.S. CURVE NUMBER (AMC II) = 0

INITIAL SUBAREA FLOW-LENGTH(FEET) = 198.00

UPSTREAM ELEVATION(FEET) = 601.98

DOWNSTREAM ELEVATION(FEET) = 600.00

ELEVATION DIFFERENCE(FEET) = 1.98

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.499

WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN

THE MAXIMUM OVERLAND FLOW LENGTH = 65.00

(Reference: Table 3-1B of Hydrology Manual)

THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN T<sub>c</sub> CALCULATION!

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON T<sub>c</sub> = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 2.13

TOTAL AREA(ACRES) = 0.31 TOTAL RUNOFF(CFS) = 2.13

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.06 TO NODE 1.07 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 577.16 DOWNSTREAM(FEET) = 577.00

FLOW LENGTH(FEET) = 8.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.76  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.13  
PIPE TRAVEL TIME(MIN.) = 0.02 Tc(MIN.) = 4.52  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.07 = 206.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.07 TO NODE 1.07 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.21  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.34  
TC(MIN.) = 4.52

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.07 TO NODE 1.08 IS CODE = 31

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.00 DOWNSTREAM(FEET) = 576.51  
FLOW LENGTH(FEET) = 49.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.39  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.34  
PIPE TRAVEL TIME(MIN.) = 0.15 Tc(MIN.) = 4.67  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.08 = 255.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.08 TO NODE 1.08 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.07  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.40

TC(MIN.) = 4.67

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.08 TO NODE 1.09 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	576.51	DOWNSTREAM(FEET) =	576.01
FLOW LENGTH(FEET) =	50.00	MANNING'S N =	0.011
DEPTH OF FLOW IN 12.0 INCH PIPE IS	6.6 INCHES		
PIPE-FLOW VELOCITY(FEET/SEC.) =	5.43		
ESTIMATED PIPE DIAMETER(INCH) =	12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	2.40		
PIPE TRAVEL TIME(MIN.) =	0.15	Tc(MIN.) =	4.82
LONGEST FLOWPATH FROM NODE	1.05 TO NODE	1.09 =	305.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.09 TO NODE 1.09 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.	
*USER SPECIFIED(SUBAREA):	
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT =	.7900
S.C.S. CURVE NUMBER (AMC II) =	0
AREA-AVERAGE RUNOFF COEFFICIENT =	0.7900
SUBAREA AREA(ACRES) =	0.01
SUBAREA RUNOFF(CFS) =	0.07
TOTAL AREA(ACRES) =	0.4
TOTAL RUNOFF(CFS) =	2.47
TC(MIN.) =	4.82

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.09 TO NODE 1.10 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	576.01	DOWNSTREAM(FEET) =	575.52
FLOW LENGTH(FEET) =	49.00	MANNING'S N =	0.011
DEPTH OF FLOW IN 12.0 INCH PIPE IS	6.7 INCHES		
PIPE-FLOW VELOCITY(FEET/SEC.) =	5.47		
ESTIMATED PIPE DIAMETER(INCH) =	12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	2.47		
PIPE TRAVEL TIME(MIN.) =	0.15	Tc(MIN.) =	4.97
LONGEST FLOWPATH FROM NODE	1.05 TO NODE	1.10 =	354.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.10 TO NODE 1.10 IS CODE = 81

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

```
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.07
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.54
TC(MIN.) = 4.97
```

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.10 TO NODE 1.11 IS CODE = 31

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

```
ELEVATION DATA: UPSTREAM(FEET) = 575.52 DOWNSTREAM(FEET) = 574.94
FLOW LENGTH(FEET) = 58.00 MANNING'S N = 0.011
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.49
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.54
PIPE TRAVEL TIME(MIN.) = 0.18 Tc(MIN.) = 5.15
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.11 = 412.00 FEET.
```

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.11 TO NODE 1.11 IS CODE = 81

```
-----
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
```

```
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.532
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
SUBAREA AREA(ACRES) = 0.02 SUBAREA RUNOFF(CFS) = 0.13
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.63
TC(MIN.) = 5.15
```

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.11 TO NODE 1.12 IS CODE = 31

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

```
ELEVATION DATA: UPSTREAM(FEET) = 574.94 DOWNSTREAM(FEET) = 574.53
FLOW LENGTH(FEET) = 41.00 MANNING'S N = 0.011
DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.0 INCHES
```



PIPE-FLOW VELOCITY(FEET/SEC.) = 5.54  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.63  
PIPE TRAVEL TIME(MIN.) = 0.12 Tc(MIN.) = 5.27  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.12 = 453.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.12 TO NODE 1.12 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.403  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.20  
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.79  
TC(MIN.) = 5.27

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.12 TO NODE 1.13 IS CODE = 31

-----  
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 574.53 DOWNSTREAM(FEET) = 573.96  
FLOW LENGTH(FEET) = 57.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.61  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.79  
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 5.44  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.13 = 510.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.13 TO NODE 1.13 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.233  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7900  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900  
SUBAREA AREA(ACRES) = 0.03 SUBAREA RUNOFF(CFS) = 0.20  
TOTAL AREA(ACRES) = 0.4 TOTAL RUNOFF(CFS) = 2.93  
TC(MIN.) = 5.44

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.13 TO NODE 1.14 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 573.96 DOWNSTREAM(FEET) = 573.86  
FLOW LENGTH(FEET) = 10.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.67  
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.93  
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 5.47  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.14 = 520.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.14 TO NODE 1.14 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.204  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7898  
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = 0.06  
TOTAL AREA(ACRES) = 0.5 TOTAL RUNOFF(CFS) = 2.98  
TC(MIN.) = 5.47

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.14 TO NODE 1.29 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 573.86 DOWNSTREAM(FEET) = 568.27  
FLOW LENGTH(FEET) = 6.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 6.0 INCH PIPE IS 2.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 31.41  
ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 2.98  
PIPE TRAVEL TIME(MIN.) = 0.00 Tc(MIN.) = 5.47  
LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

\*\*\*\*\*

```

FLOW PROCESS FROM NODE      1.29 TO NODE      1.29 IS CODE =  13
-----
>>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
=====

*****
FLOW PROCESS FROM NODE      1.15 TO NODE      1.16 IS CODE =  21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=====
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =  48.00
UPSTREAM ELEVATION(FEET) =  576.69
DOWNSTREAM ELEVATION(FEET) =  574.00
ELEVATION DIFFERENCE(FEET) =  2.69
SUBAREA OVERLAND TIME OF FLOW(MIN.) =  2.247
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =  0.20
TOTAL AREA(ACRES) =  0.03  TOTAL RUNOFF(CFS) =  0.20

*****
FLOW PROCESS FROM NODE      1.16 TO NODE      1.29 IS CODE =  31
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  573.00  DOWNSTREAM(FEET) =  568.27
FLOW LENGTH(FEET) =  10.00  MANNING'S N =  0.011
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO  4.000
DEPTH OF FLOW IN  4.0 INCH PIPE IS  1.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.03
ESTIMATED PIPE DIAMETER(INCH) =  4.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =  0.20
PIPE TRAVEL TIME(MIN.) =  0.01  Tc(MIN.) =  2.26
LONGEST FLOWPATH FROM NODE      1.15 TO NODE      1.29 =  58.00 FEET.

*****
FLOW PROCESS FROM NODE      1.29 TO NODE      1.29 IS CODE =  10
-----
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
=====

*****
FLOW PROCESS FROM NODE      1.29 TO NODE      1.29 IS CODE =  13
-----
>>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<
=====

```

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.17 TO NODE 1.18 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 129.00  
UPSTREAM ELEVATION(FEET) = 574.20  
DOWNSTREAM ELEVATION(FEET) = 571.85  
ELEVATION DIFFERENCE(FEET) = 2.35  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 4.036  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 73.22  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
SUBAREA RUNOFF(CFS) = 1.56  
TOTAL AREA(ACRES) = 0.23 TOTAL RUNOFF(CFS) = 1.56

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.18 TO NODE 1.19 IS CODE = 31  
-----

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

=====

ELEVATION DATA: UPSTREAM(FEET) = 570.85 DOWNSTREAM(FEET) = 570.43  
FLOW LENGTH(FEET) = 42.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.2 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.82  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 1.56  
PIPE TRAVEL TIME(MIN.) = 0.15 Tc(MIN.) = 4.18  
LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.19 = 171.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.19 TO NODE 1.19 IS CODE = 81  
-----

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
S.C.S. CURVE NUMBER (AMC II) = 0  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(CFS) = 0.47

TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.03  
TC(MIN.) = 4.18

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.19 TO NODE 1.20 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 570.43 DOWNSTREAM(FEET) = 569.63

FLOW LENGTH(FEET) = 80.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.0 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.22

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.03

PIPE TRAVEL TIME(MIN.) = 0.26 Tc(MIN.) = 4.44

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.20 = 251.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.20 TO NODE 1.20 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.04 SUBAREA RUNOFF(CFS) = 0.27

TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.31

TC(MIN.) = 4.44

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.20 TO NODE 1.26 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 569.63 DOWNSTREAM(FEET) = 569.11

FLOW LENGTH(FEET) = 52.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.4 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 5.38

ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.31

PIPE TRAVEL TIME(MIN.) = 0.16 Tc(MIN.) = 4.60

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.26 = 303.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.26 TO NODE 1.26 IS CODE = 1

-----  
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS =	2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:	
TIME OF CONCENTRATION(MIN.) =	4.60
RAINFALL INTENSITY(INCH/HR) =	8.69
TOTAL STREAM AREA(ACRES) =	0.34
PEAK FLOW RATE(CFS) AT CONFLUENCE =	2.31

\*\*\*\*\*

FLOW PROCESS FROM NODE	1.21	TO NODE	1.22	IS CODE =	21
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>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT =	.7800		
S.C.S. CURVE NUMBER (AMC II) =	0		
INITIAL SUBAREA FLOW-LENGTH(FEET) =	58.00		
UPSTREAM ELEVATION(FEET) =	581.80		
DOWNSTREAM ELEVATION(FEET) =	580.70		
ELEVATION DIFFERENCE(FEET) =	1.10		
SUBAREA OVERLAND TIME OF FLOW(MIN.) =	3.544		
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	8.695		
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.			
SUBAREA RUNOFF(CFS) =	0.14		
TOTAL AREA(ACRES) =	0.02	TOTAL RUNOFF(CFS) =	0.14

\*\*\*\*\*

FLOW PROCESS FROM NODE	1.22	TO NODE	1.23	IS CODE =	31
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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	578.70	DOWNSTREAM(FEET) =	576.00		
FLOW LENGTH(FEET) =	45.00	MANNING'S N =	0.011		
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO	4.000				
DEPTH OF FLOW IN 4.0 INCH PIPE IS	1.3	INCHES			
PIPE-FLOW VELOCITY(FEET/SEC.) =	5.25				
ESTIMATED PIPE DIAMETER(INCH) =	4.00	NUMBER OF PIPES =	1		
PIPE-FLOW(CFS) =	0.14				
PIPE TRAVEL TIME(MIN.) =	0.14	Tc(MIN.) =	3.69		
LONGEST FLOWPATH FROM NODE	1.21	TO NODE	1.23 =	103.00	FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE	1.23	TO NODE	1.23	IS CODE =	81
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>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	8.695
--	-------

NOTE: RAINFALL INTENSITY IS BASED ON  $T_c = 5$ -MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.02 SUBAREA RUNOFF(CFS) = 0.14

TOTAL AREA(ACRES) = 0.0 TOTAL RUNOFF(CFS) = 0.27

TC(MIN.) = 3.69

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.23 TO NODE 1.24 IS CODE = 31

-----  
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 576.00 DOWNSTREAM(FEET) = 574.62

FLOW LENGTH(FEET) = 23.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 6.0 INCH PIPE IS 1.7 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 6.04

ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 0.27

PIPE TRAVEL TIME(MIN.) = 0.06  $T_c$ (MIN.) = 3.75

LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.24 = 126.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.24 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON  $T_c = 5$ -MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.11 SUBAREA RUNOFF(CFS) = 0.75

TOTAL AREA(ACRES) = 0.2 TOTAL RUNOFF(CFS) = 1.02

TC(MIN.) = 3.75

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.24 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON  $T_c = 5$ -MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 1.29  
TOTAL AREA(ACRES) = 0.3 TOTAL RUNOFF(CFS) = 2.31  
TC(MIN.) = 3.75

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.24 TO NODE 1.25 IS CODE = 31

-----

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(Feet) = 574.62 DOWNSTREAM(Feet) = 573.58

FLOW LENGTH(Feet) = 52.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 9.0 INCH PIPE IS 6.4 INCHES

PIPE-FLOW VELOCITY(Feet/Sec.) = 6.86

ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.31

PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 3.88

LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.25 = 178.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.25 TO NODE 1.25 IS CODE = 81

-----

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.14 SUBAREA RUNOFF(CFS) = 0.95

TOTAL AREA(ACRES) = 0.5 TOTAL RUNOFF(CFS) = 3.26

TC(MIN.) = 3.88

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.25 TO NODE 1.25 IS CODE = 81

-----

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.695

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800

S.C.S. CURVE NUMBER (AMC II) = 0

AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800

SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = 1.29

TOTAL AREA(ACRES) = 0.7 TOTAL RUNOFF(CFS) = 4.54

TC(MIN.) = 3.88

\*\*\*\*\*



FLOW PROCESS FROM NODE 1.25 TO NODE 1.26 IS CODE = 31

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

ELEVATION DATA: UPSTREAM(FEET) = 573.58 DOWNSTREAM(FEET) = 569.11  
FLOW LENGTH(FEET) = 42.00 MANNING'S N = 0.011  
DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.7 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 15.36  
ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 4.54  
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 3.92  
LONGEST FLOWPATH FROM NODE 1.21 TO NODE 1.26 = 220.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.26 TO NODE 1.26 IS CODE = 1

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<  
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 3.92  
RAINFALL INTENSITY(INCH/HR) = 8.69  
TOTAL STREAM AREA(ACRES) = 0.67  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.54

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.31	4.60	8.695	0.34
2	4.54	3.92	8.695	0.67

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

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	6.51	3.92	8.695
2	6.85	4.60	8.695

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE(CFS) = 6.85 Tc(MIN.) = 4.60  
TOTAL AREA(ACRES) = 1.0  
LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.26 = 303.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.26 TO NODE 1.27 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	569.11	DOWNSTREAM(FEET) =	568.84
FLOW LENGTH(FEET) =	27.00	MANNING'S N =	0.011
DEPTH OF FLOW IN	15.0 INCH PIPE IS	11.3 INCHES	
PIPE-FLOW VELOCITY(FEET/SEC.) =	6.88		
ESTIMATED PIPE DIAMETER(INCH) =	15.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	6.85		
PIPE TRAVEL TIME(MIN.) =	0.07	Tc(MIN.) =	4.66
LONGEST FLOWPATH FROM NODE	1.17 TO NODE	1.27 =	330.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.27 TO NODE 1.27 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.	
*USER SPECIFIED(SUBAREA):	
RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT =	.7800
S.C.S. CURVE NUMBER (AMC II) =	0
AREA-AVERAGE RUNOFF COEFFICIENT =	0.7800
SUBAREA AREA(ACRES) =	0.20
SUBAREA RUNOFF(CFS) =	1.36
TOTAL AREA(ACRES) =	1.2
TOTAL RUNOFF(CFS) =	8.21
TC(MIN.) =	4.66

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.27 TO NODE 1.28 IS CODE = 31

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

=====

ELEVATION DATA: UPSTREAM(FEET) =	568.84	DOWNSTREAM(FEET) =	568.39
FLOW LENGTH(FEET) =	45.00	MANNING'S N =	0.011
DEPTH OF FLOW IN	18.0 INCH PIPE IS	10.9 INCHES	
PIPE-FLOW VELOCITY(FEET/SEC.) =	7.36		
ESTIMATED PIPE DIAMETER(INCH) =	18.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	8.21		
PIPE TRAVEL TIME(MIN.) =	0.10	Tc(MIN.) =	4.77
LONGEST FLOWPATH FROM NODE	1.17 TO NODE	1.28 =	375.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.28 TO NODE 1.28 IS CODE = 81

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

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) =	8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.	
*USER SPECIFIED(SUBAREA):	

RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7800  
 S.C.S. CURVE NUMBER (AMC II) = 0  
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.7800  
 SUBAREA AREA(ACRES) = 0.05 SUBAREA RUNOFF(CFS) = 0.34  
 TOTAL AREA(ACRES) = 1.3 TOTAL RUNOFF(CFS) = 8.55  
 TC(MIN.) = 4.77

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.28 TO NODE 1.29 IS CODE = 31

-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 568.39 DOWNSTREAM(FEET) = 568.27

FLOW LENGTH(FEET) = 12.00 MANNING'S N = 0.011

DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.2 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 7.42

ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 8.55

PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 4.79

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.29 = 387.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 11

-----

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<

=====

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	8.55	4.79	8.695	1.26

LONGEST FLOWPATH FROM NODE 1.17 TO NODE 1.29 = 387.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	2.98	5.47	8.201	0.46

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	11.15	4.79	8.695
2	11.04	5.47	8.201

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 11.15 Tc(MIN.) = 4.79

TOTAL AREA(ACRES) = 1.7

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.29 TO NODE 1.29 IS CODE = 11

-----  
>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<

\*\*\*\*\*  
\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	11.15	4.79	8.695	1.72

LONGEST FLOWPATH FROM NODE 1.05 TO NODE 1.29 = 526.00 FEET.

\*\* MEMORY BANK # 2 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	0.20	2.26	8.695	0.03

LONGEST FLOWPATH FROM NODE 1.15 TO NODE 1.29 = 58.00 FEET.

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

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	5.47	2.26	8.695
2	11.36	4.79	8.695

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 11.36 Tc(MIN.) = 4.79  
TOTAL AREA(ACRES) = 1.8

\*\*\*\*\*

FLOW PROCESS FROM NODE 2.01 TO NODE 2.02 IS CODE = 21

-----  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

\*\*\*\*\*  
\*USER SPECIFIED(SUBAREA):

ANNUAL GRASS (DRYLAND) GOOD COVER RUNOFF COEFFICIENT = .3500  
S.C.S. CURVE NUMBER (AMC II) = 0  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 91.00  
UPSTREAM ELEVATION(FEET) = 588.00  
DOWNSTREAM ELEVATION(FEET) = 577.75  
ELEVATION DIFFERENCE(FEET) = 10.25  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.978  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.748  
SUBAREA RUNOFF(CFS) = 0.16  
TOTAL AREA(ACRES) = 0.06 TOTAL RUNOFF(CFS) = 0.16

\*\*\*\*\*

FLOW PROCESS FROM NODE 2.02 TO NODE 2.03 IS CODE = 51

-----  
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 577.75 DOWNSTREAM(FEET) = 575.25

CHANNEL LENGTH THRU SUBAREA(FEET) = 268.00 CHANNEL SLOPE = 0.0093

CHANNEL BASE(FEET) = 2.00 "Z" FACTOR = 12.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 0.50

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.079

\*USER SPECIFIED(SUBAREA):

ANNUAL GRASS (DRYLAND) GOOD COVER RUNOFF COEFFICIENT = .3500

S.C.S. CURVE NUMBER (AMC II) = 0

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.48

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.64

AVERAGE FLOW DEPTH(FEET) = 0.09 TRAVEL TIME(MIN.) = 2.73

Tc(MIN.) = 8.71

SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 0.64

AREA-AVERAGE RUNOFF COEFFICIENT = 0.350

TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 0.77

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.12 FLOW VELOCITY(FEET/SEC.) = 1.87

LONGEST FLOWPATH FROM NODE 2.01 TO NODE 2.03 = 359.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 0.4 TC(MIN.) = 8.71

PEAK FLOW RATE(CFS) = 0.77

=====

END OF RATIONAL METHOD ANALYSIS



## **ATTACHMENT 4**

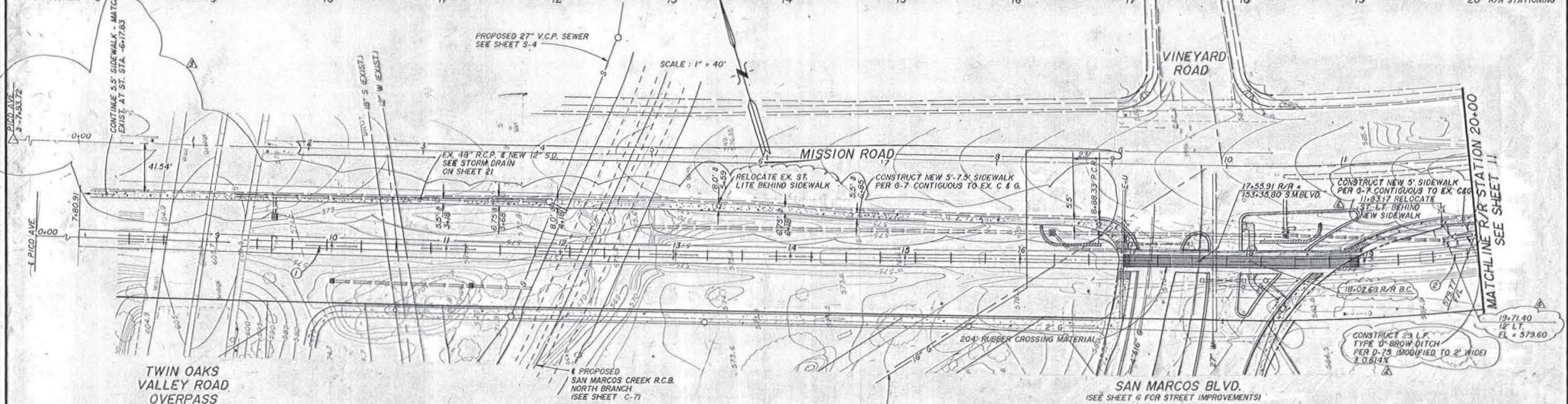
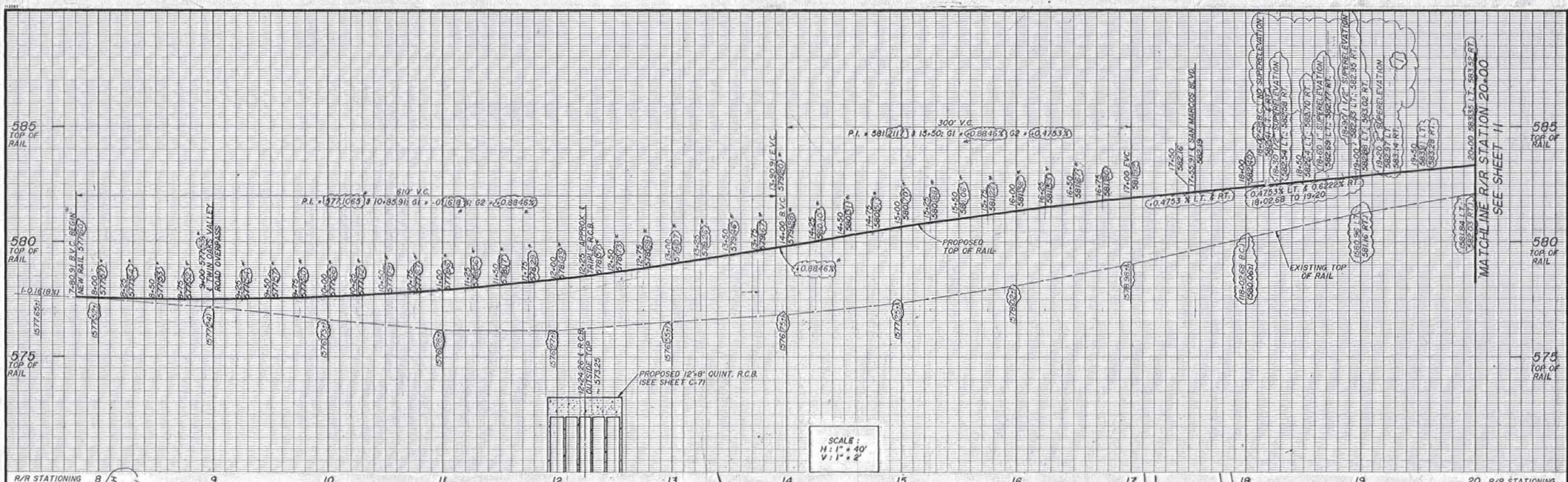
# **Storm Drain Sizing Calculations**

*Will be included in Final Hydrology Study.*

## **ATTACHMENT 5**

# **Referenced Improvement Plans**





TWIN OAKS VALLEY ROAD OVERPASS



RAILROAD & DATA			
NO.	Δ OR BEARING	RADIUS	ARC/LENGTH
(1)	N 73° 15' 59" W	1021.77'	
(2)	Δ = 5° 55' 08"	1910.08'	197.32'

SEE SHEETS 136-143 FOR COMPLETE RAILROAD CONSTRUCTION.

"AS-BUILT"

A.T. & S.F. RAILWAY COMPANY  
FILE #05000427

SAN MARCOS FIRE DEPARTMENT		VALLECITOS WATER DISTRICT		ENGINEER OF WORK		CITY APPROVED CHANGES		APPROVED DATE		Recommended for Approval		Approved for Construction		BENCH MARK		CITY OF SAN MARCOS		Drawing No.	
By: Fire Marshal		By: District Engineer		M.D. YOUNG		Name: TIMOTHY J. REGELLO		Date: 4/14/92		By: JIM R. BROWN		Date: 4/14/92		By: KENNETH H. DAVIS		Date: 4/14/92		3526	
Date:		Date:		Drawn By:		Name: JIM R. BROWN		Date: 4/14/92		By: JIM R. BROWN		Date: 4/14/92		By: KENNETH H. DAVIS		Date: 4/14/92		Sheet 10 of 166	