Preliminary Hydrology and Drainage Study

Tierra Del Sol Solar Farm

Located in the County of San Diego

August 2012

Written by: Keri Gannon

Reviewed By: Gerard Dalziel

AECOM

7807 Convoy Court, Suite 200

San Diego, CA 9211

858-268-8080

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DECLARATION OF RESPONSIBLE CHARGE

I, hereby declare that I am the Civil Engineer of work for this report, that I have exercised responsible charge over the preparation of this report as defined in section 6703 of the business and professions code, and that the report is consistent with current project concept.

I understand that the check of the project report, by the County of San Diego is confined to a review only and does not relieve me, as the Civil Engineer of work, of my responsibilities for project design.

Keri Gannon

8-7-2012

Keri L. Gannon, P.E.
R.C.E. C68877
EXP. 9-30-13

REGISTERED PROFESSIONAL ENGINEER
KERI H. GANNON
C 68877
EXP. 9-30-13
CIVIL
STATE OF CALIFORNIA

Date

SECTION 1.0 EXECUTIVE SUMMARY

The proposed Tierra Del Sol Solar Energy project (Project) will produce up to 60 megawatts (MW) of solar energy. The Project will cover approximately 420 acres and is located in southeastern San Diego County near the unincorporated community of Boulevard, California.

The objective of this study is to develop and evaluate the existing drainage patterns and flow rates for the project area and ensure that these patterns and flow rates are maintained after the Project's construction. The drainage areas within the project boundary are analyzed using the San Diego County Hydrology Manual's (SDCHM) rational method since they are less than one square mile in size.

The Project does very little to change the characteristics of the existing drainage areas within the Project boundary. Minor amounts of impervious areas will be added during construction, such as transformer pads, sub-station pads, foundation posts for the solar panels, the Operation & Maintenance building and drainage crossings. The exposed ground will be replanted with native plants or minimally compacted to serve as fire access roads. The grading will also retain the existing drainage patterns and flow conveyances in order to maintain the existing hydrologic conditions to the maximum extent practical.

However, several drainage areas will see approximately a 5% increase in the pre-project runoff rate due to the amount of impervious area being constructed within each of these areas. The additional increase in runoff is proposed to be mitigated by the use of infiltration trenches.

This study concludes that the construction of the Project does not adversely affect or substantially alter the existing drainage area, runoff patterns, peak flow rates and the tributaries crossing the project site.

SECTION 2.0 PROJECT DESCRIPTION

2.1 Project Location

The project is located in southeastern San Diego County near the unincorporated community of Boulevard, California and approximately 6 miles south of Interstate 8 (I-8), along Tierra Del Sol Road. Tierra Del Sol Road is the northern and western boundaries of the project site, the International Border is the southern boundary and the western boundary is an International Border access road.

2.2 Project Description

The proposed Tierra Del Sol Solar Farm Project (Project) would produce up to 60 megawatts (MW) of solar energy and would consist of approximately 2,529 concentrating photovoltaic (CPV) trackers on 420 acres in southeastern San Diego County near the unincorporated community of Boulevard, California. As proposed, the project will be developed in two phases. Phase One would include the construction and operation of 45 MWs (1,910 CPV trackers) on approximately 330 acres. Phase Two would consist of the construction and operation of 15 MWs (619 CPV trackers) on approximately 90 acres. The project includes a Major Use Permit (MUP) to authorize a Major Impact Utility Pursuant to Sections 1350, 2705, and 2926 of the Zoning Ordinance. The project may also require a Rezone to remove Special Area Designator “A” and ensure compliance with Section 5100 of the Zoning Ordinance.

Individual tracker dimensions are approximately 48 feet across by 25 feet tall. Each CPV Tracker unit would be mounted on a 28-inch steel mast (steel pole) which would be supported by either (i) extending it into the ground up to 20 feet and encasing it in concrete, or (ii) attaching it to a concrete foundation sized to be suitable to adequately support the CPV tracker based on wind loading and soil conditions at the site. The preferred method would be to set the mast by vibratory pile driving methods depending upon soil conditions.

In its most vertical position and depending on foundation design, the top of each tracker would not exceed 30’ feet above grade, and the lower edge would not be less than 1 foot above ground level. In its horizontal “stow” mode (for high winds), each tracker would have a minimum ground clearance of 13’ feet 6” inches.

Power from the CPV system in each Building Block would be delivered from each tracker to a conversion station through a 1,000 volt DC underground collection system. The underground

1,000 V DC collection system construction footprint would include a trench of one to two feet in width and a depth of up to approximately four feet. It is anticipated that power from the CPV systems on site would be separated into three 34.5 kV underground collection circuits, each delivering approximately 20 MW of power to the Project substation.

Each 34.5 kV underground branch circuit associated with Phase I would connect to a 34.5 kV overhead trunk line on the project site for delivery to the Project substation. These two collection circuits for Phase I would be run overhead on an above ground trunk line adjacent to the south side of the Southwest Power Link right of way. This trunk line would be approximately 1.2 miles long and would have two 34.5 kV circuits and deliver a total of 45 MW. The above ground trunk line would utilize steel poles and would be approximately 50-75 feet high and spaced about 300-500 feet apart. The minimum ground clearance of the 34.5 kV lines would be 30 feet. The maximum hole dimensions for steel pole foundations would be 24 inches in diameter and approximately 20 feet deep. Phase 2 will connect to the Project substation entirely via one 34.5 kV underground branch circuit and the underground 34.5 kV collection system construction footprint would include a trench of three to four feet in width and a depth of up to approximately four feet. Base material would be installed in all trenches to (i) ensure adequate drainage, and (ii) to ensure sufficient thermal conductivity and electrical insulating characteristics below and above collection system cables.

The project will include construction of a 34.5/138 kV step-up substation site (located within the northeast corner of the project site and adjacent to the O&M annex site) would increase the voltage received from the overhead and underground collector system from 34.5 to 138 kV. Switching and transformer equipment as well as a control house and a parking area for utility vehicles would be located within the 3-acre substation site and for security purposes (and to allow for nighttime inspections) lighting would be installed near substation equipment, the control shelter, and on the entrance gates.

A 4-acre operations and maintenance (O&M) annex site would be located adjacent to the substation site and would house operations and maintenance supplies, telecommunications equipment and rest facilities all within a single-story building. It is anticipated that in-place tracker washing would occur every 6 to 8 weeks by mobile crews who will also be available for dispatch whenever on-site repairs or other maintenance are required. Tracker washing will be undertaken using a tanker truck and smaller “satellite” tracker washing trucks. On-site water storage tanks may be installed to facilitate washing.

Note to Reviewer: The Project Applicant is in the process of determining the alignment and right-of-way for the interconnection from the proposed project site to the Boulevard rebuilt substation. The ultimate alignment for the gen-tie will be provided in a subsequent submittal and environmental review completed in a subsequent submittal.

Project construction would consist of several phases including site preparation, development of staging areas and site access roads, solar CPV assembly and installation, and construction of electrical transmission facilities. After site preparation, initial project construction would include the development of the staging and assembly areas, and the grading of site access roads for initial CPV installation The Project would be constructed over a period of up to approximately 12 months, which includes both Phase I and II.

2.3 Study Objective

The objective of this study is to develop and evaluate the existing drainage patterns and flow rates for the runoff within the Project boundary. The hydrology will be the base used to determine the location of the natural watercourses within the project area and the amount of runoff the existing watercourses convey. The proposed design of the Project will take into account the location of the existing drainage courses and the amount of flow. This study will also show the change in runoff rates and characteristics due to the development of the Project.

A Vicinity Map is included in Appendix A.

SECTION 3.0 HYDROLOGY

3.1 Hydrology Design Criteria

The hydrologic design for this project is based on the design criteria outlined in the San Diego County Hydrology Manual, June 2003 (SDCHM), which is based on two methods, the Rational Method and the NRCS Hydrologic Method. The Rational Method is the accepted methodology for watersheds up to 640 acres (1 square mile) in size and the NRCS Hydrologic Method is to be used for watersheds greater than 640 acres.

Since this project is only 420 acres, the Rational Method was used to calculate the pre- and post-project peak runoff rates for the 100-yr storm. Please refer to Chapter 3 of the SDCHM for a more detailed description of the Rational Method.

3.2 Software Used

AES 2008 RATSCx

The AES software is designed with separate modules that are programmed to meet specific SDCHM requirements, which in turn meet all agency requirements. The module used for the calculations in this study will be the Rational Method module programmed to meet the calculation requirements set forth by Chapter 3 of the SDCHM. This program will be used to develop the runoff amounts for the pre- and post-project conditions of the Project site.

3.3 Pre-Project Watershed Characteristics

The Project area is a high point in the existing watershed and therefore, there is no tributary run-on to the site. The high point, which is in the western half of the site, is at an elevation of approximately 3,742 feet. The runoff from the site flows in almost all directions, except directly north, from the high point. From the site reconnaissance and the field survey, there are ten existing watercourses that carry the runoff from the Project area and outlet it across the western, southern and eastern Project boundaries. Ultimately all of the runoff from the Project site flows across the International Border.

The current site is moderately sloped, between 3% and 5% at the high point and gradually flattens out towards the Project boundaries. The existing watercourses are incised around the high point and become shallower and spread out as the runoff flows towards the Project boundaries. The elevations along the Project boundaries range from approximately 3,680 feet to 3,530 feet.

In total, the Project disturbs approximately 420 acres. The longest watercourse length through the watershed is approximately 5,500 feet and elevations of the watershed range from approximately 3,740 feet to 3,530 feet. Accurate topo data was provided for the project area. The USGS 7.5 minute quad sheet and a site visit were used to verify that there was no portion of the watershed outside of the Project boundaries that flowed on to the site.

Refer to Appendix B for the existing hydrology exhibit of the Project Site.

3.3.1 Land Use

The majority of the Project is currently undeveloped and is covered by sparse to moderate growth of native chaparral, shrubs, low-lying grasses, and scattered trees, however, the area appears to be previously inhabited and used for range land. Unpaved roads provide access through the Project, as well as a 200 foot easement for public utilities.

3.3.2 Flow Patterns

The existing flow patterns across the Project are from the high point in the middle of the western half of the Project to the western, southern, and eastern boundaries. Ultimately, all of the runoff from the Project will flow across the International Border.

3.3.3 100-YR Flood Inundation

There are no recorded 100-YR floodplain limits within the proposed Project per FEMA or the County of San Diego.

3.3.4 Rainfall/Soils

Rainfall and soils data are taken from the SDCHM. The Manual gives the following data:

1. 100-year 6-hour rainfall = 2.9 inches.

   100-year 24-hour rainfall = 4.9 inches.

   According to the SDCHM, the P_6 (6 hour rainfall in inches) needs to be within 45% and 65% of the 100-yr 24-hour rain event (P_{24}). The current P_6 for the 100-yr storm falls within the specified range.

(2.9 in ÷ 4.9 in) × 100 = 59%

See Appendix B for the 100-yr 6-hr and 24-hr Isopluvial Charts.

1. Runoff Coefficients: The soil types are A, B, C, & D as shown in Appendix B, Soil Hydrologic Groups Map and the following runoff coefficients are for Undisturbed Natural Terrain in Table 3-1 of SDCHM.

    a. Soil Type A: C=0.20

    b. Soil Type B: C=0.25

    c. Soil Type C: C=0.30

    d. Soil Type D: C=0.35

    Since each sub-area of the watershed area has one or two different types of soils, an average C is calculated for each sub-area.

2. The maximum overland flow length is determined to be 100 feet from Table 3-2 of the SDCHM for each drainage area.

3. The pre-project land cover is assumed to be desert shrub and the post-project land cover is assumed to be perennial grass for the proposed project site.

    The above referenced charts, figures, and calculations are in Appendix B.

3.4 Pre-Project Hydrology

3.4.1 Basin Parameters

In order to analyze the runoff rates from the Project, the 420 acres is split into ten different drainage areas. Each area outlets to a different location along the project boundary and so the limits of the areas are determined by the topography tributary to the different outlet points. Appropriate watershed characteristics are developed for each area, and subsequent sub-areas, using the Rational Method methodologies discussed in the SDCHM. These pre-project characteristics are shown in Appendix B.

3.4.2 Results

The pre-project peak flows for the Project, as determined by the sub-area inputs to AES 2008 RATSCx, are:

Table 1: Pre-Project Peak Flow Rates for the Project's Drainage Areas

Drainage Area No.	Total Area (ac)	Tc (min)	Pre-Project Q_{100} (cfs)
100	34.20	17.78	28.83
200	24.30	17.59	20.64
300	28.60	14.65	27.35
400	24.70	17.28	21.22
500	4.70	13.71	4.70
600	91.80	24.31	58.17
700	6.10	9.52	7.03
800	29.50	20.96	22.38
900	129.70	33.12	73.20
1000	51.30	23.95	35.71

See Appendix C for the Pre-Project AES 2008 RATSCx Output.

3.5 Post-Project Watershed Characteristics

The Project does very little to change the characteristics of the existing drainage areas within the Project boundary. Minor amounts of impervious areas will be added during construction, such as transformer pads, sub-station pads, foundation posts for the solar panels, the Operation & Maintenance building and drainage crossings. The exposed ground will be replanted with native plants and the fire access roads will be minimally compacted. The project proposes very minimal impervious area compared to the total project area and the majority of the project area remains natural terrain.

The Project will be graded in order to smooth out the existing terrain, but the site will retain the same slope characteristics as the existing ground, as well as the same pre-project runoff

patterns. The grading will also take into account the existing watercourses that crisscross the Project site.

The largest change within the Project will be the addition of the CPV trackers. It is anticipated that the effect of the trackers on the drainage characteristics of the project site will be minimal, even though the actual panel of the tracker is impervious. The panel is divided into two smaller panels by a horizontal break along the middle of the panel. This allows the precipitation falling on the top part if the panel to run off at the middle and the precipitation falling on the lower half of the panel to run off at the bottom. Erosion of the ground below will be minimal since only 1.5 tablespoons of water per second will flow off of 1 foot of length of the solar panel during a 2-year storm. The ground cover and soil below the tracker should provide for some infiltration of this runoff. Please refer to Appendix F for the runoff calculations from the tracker and the diagram of the CPV tracker.

Refer to Appendix D for the proposed hydrology exhibit for the Project Site.

3.6 Post-Project Hydrology

3.6.1 Basin Parameters

The analysis of the post-project runoff within the Project is the same as under the pre-project conditions. The only difference in the watershed characteristics is a slight increase in the C value for areas 300, 400, and 600 due to an increase in impervious area after construction of the proposed project, as well as a change in the type of ground cover. Most of the drainage areas will see a slight increase in impervious area after construction, but not enough to change the overall C value for the drainage area. These post-project characteristics are shown in Appendix D.

3.6.2 Results

The post-project peak flows for the Project, as determined by the sub-area inputs to AES 2008 RATSCx, are relatively unchanged from the pre-project peak flows:

Table 3: Post-Project Peak Flow Rates for the Project's Drainage Areas

Drainage Area No.	Total Area (ac)	Tc (min)	Post-Project Q_{100} (cfs)
100	34.20	17.78	28.83
200	24.30	17.59	20.64
300	28.60	14.53	28.60
400	24.70	17.12	22.20
500	4.70	13.71	4.70
600	91.8	24.06	62.23
700	6.10	9.52	7.03
800	29.50	20.96	22.38
900	129.70	33.12	73.20
1000	51.30	23.95	35.71

See Appendix E for the AES 2008 RATSCx Output.

3.7 Pre- and Post-Project Peak Flow Summary

3.7.1 Project Site

Table 6: Summary Table for Pre- and Post- Project Peak Flow Rates for Project Site

Drainage Area No.	H	L	C Pre-Project	C Post - Project	Tc (min)		I (in/hr)		Area
	(ft)	(ft)			Pre-Project	Post-Project	Pre - Project	Post-Project	acres
100	111.0	2215	0.25	0.25	17.78	17.78	3.37	3.37	34.20
200	103.7	2089	0.25	0.25	17.59	17.59	3.39	3.39	24.30
300	**102.0**	**1636**	**0.25**	**0.26**	**14.65**	**14.53**	**3.82**	**3.84**	**28.60**
400	**75.5**	**1714**	**0.25**	**0.26**	**17.28**	**17.12**	**3.43**	**3.45**	**24.70**
500	46.0	959	0.25	0.25	13.71	13.71	3.99	3.99	4.70
600	**167.5**	**4185**	**0.23**	**0.24**	**24.31**	**24.06**	**2.76**	**2.77**	**91.80**
700	32.5	484	0.23	0.23	9.52	9.52	5.04	5.04	6.10
800	61.0	1967	0.25	0.25	20.96	20.96	3.03	3.03	29.50
900	210.5	5493	0.25	0.25	33.12	33.12	2.26	2.26	129.70
1000	131.0	2885	0.25	0.25	23.95	23.95	2.78	2.78	51.30

Drainage Area No.	Q100 (cfs)		Velocity (fps)	
	Pre-Project	Post-Project	Pre - Project	Post-Project
100	28.83	28.83	6.27	6.27
200	20.64	20.64	4.95	4.95
300	**27.35**	**28.60**	**7.76**	**7.85**
400	**21.22**	**22.20**	**5.56**	**5.63**
500	4.70	4.70	2.64	2.64
600	**58.17**	**62.23**	**6.05**	**6.20**
700	7.03	7.03	3.79	3.79
800	22.38	22.38	4.37	4.37
900	73.20	73.20	5.89	5.89
1000	35.71	35.71	5.76	5.67

SECTION 4.0 DRAINAGE DESIGN

4.1 Proposed Drainage Design

The Project proposes to place trackers on approximately 357 acres of the 420 acre project site. The trackers will be constructed in rows with access roads and drainage swales running north – south between them. Since the existing drainage patterns and flows need to be retained to the maximum extent practical, the existing watercourses in each of the drainage areas will be graded into the site and will convey the pre-project flow. If an access road crosses an existing watercourse, the road will be paved and constructed contiguous with the flow line of the channel in order to not impede the flow of the channel and protect the road from erosion during a storm. Due to the steepness of the existing site, the replaced watercourses will remain at a slope between 3% and 5%, which produces an erosive velocity when carrying the 100-year flow. These channels are proposed to be constructed with a turf reinforcement mat and to be re-vegetated in order to avoid erosion.

Within the Project, the proposed design for the site drainage is to provide earthen swales along the service roads in between the trackers. These swales will capture the runoff from the trackers and site and will only convey low flows. The larger flows will over top the channels and flow down the service roads, following the topography of the Project. The earthen ditches will either connect to the existing watercourse within the drainage area, or will carry the runoff to the project boundary where it will be conveyed to its original outlet location.

The swales will be constructed with fiber roll check dams in place to capture the sediment that erodes off the site. Gravel bag check dams will be placed prior to the swales exiting the project site, in order to capture sediment. At the outlet of the swale, outlet protection will be provided to prevent scour and erosion. The velocities in the earthen channels within the tracker areas will be non-erosive, but the perimeter channels will convey flows with erosive velocities and are proposed to be protected by lining them with gravel or cobble.

Areas 300, 400, and 600 will see approximately a 5% increase in the amount of runoff due to the amount of impervious area being constructed within each of these areas. The additional increase in runoff is proposed to be detained within an infiltration trench and allowed to infiltrate into the soil. The approximate volume of additional runoff that needs to be infiltrated is 20,000 cf. The soil is shown on the County Soils Map to be Type B which has the ability to infiltrate surface water. Please see the Proposed Hydrology Map in Appendix D for the location of the infiltration trenches.

SECTION 5.0 SUMMARY

This study concludes that the construction of the Project does not adversely affect or substantially alter the existing drainage area, runoff patterns, peak flow rates and the tributaries crossing the project site.

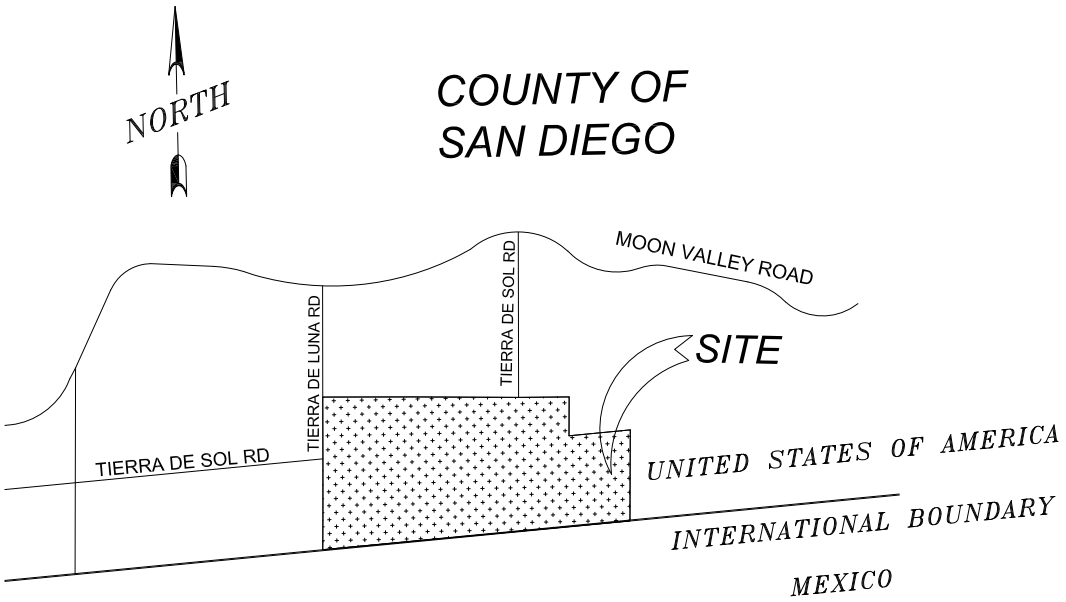
Due to the nature of the Project, the addition of impervious area is very minimal and will only slightly increase the amount of runoff in a few drainage areas. This increase will be mitigated by the use of infiltration trenches. The grading of the site will mimic the existing terrain and the drainage patterns will remain unchanged, also helping to keep the pre-project peak flow rates relatively unchanged.

Most of the proposed site will be planted with native vegetation; however there will be earthen fire access roads that may be susceptible to erosion. Check dams will be provided in the proposed drainage channels along side of the fire access roads in order to capture any sediment that is eroded off of the earthen roads. There will not be any additional sediment transported off the Project since it will be collected on site.

Currently the only drainage conveyance that exists within the Project is the watercourses within the existing drainage areas. The tributary watercourses will remain within the Project in order to maintain the existing drainage patterns and flow capacity. There are no existing drainage facilities that will be adversely affected by the project and the post-project flows will be able to be conveyed within the watercourses crossing the Project, as well as the onsite drainage ditches and perimeter swales.

Appendix A

Vicinity Map



AECOM

AECOM USA, Inc.
7807 CONVOY CT, SUITE 200
SAN DIEG, CA
T 858.286.8080 F 858.292.7432
www.aecom.com

TIERRA DEL SOL	AECOM PROJECT NO.	FIGURE
VICINITY MAP	60212653	1

DWG: P:_MultiOfficeProjects\60212653\000_CAD\006_Civil\Sheets\Site Vicinity Map_Tierra Del Sol.dwg Layout Name: Layout1 – Plotted by: L'Ecluse, Rion Date: 5/17/2012 – 9:44 AM
XREFS: G-BDBx11h IMAGES:

Appendix B

Pre-Project Rational Method Inputs

Existing Hydrology Map

Soil Hydrologic Groups Map

Rainfall Isopluvials

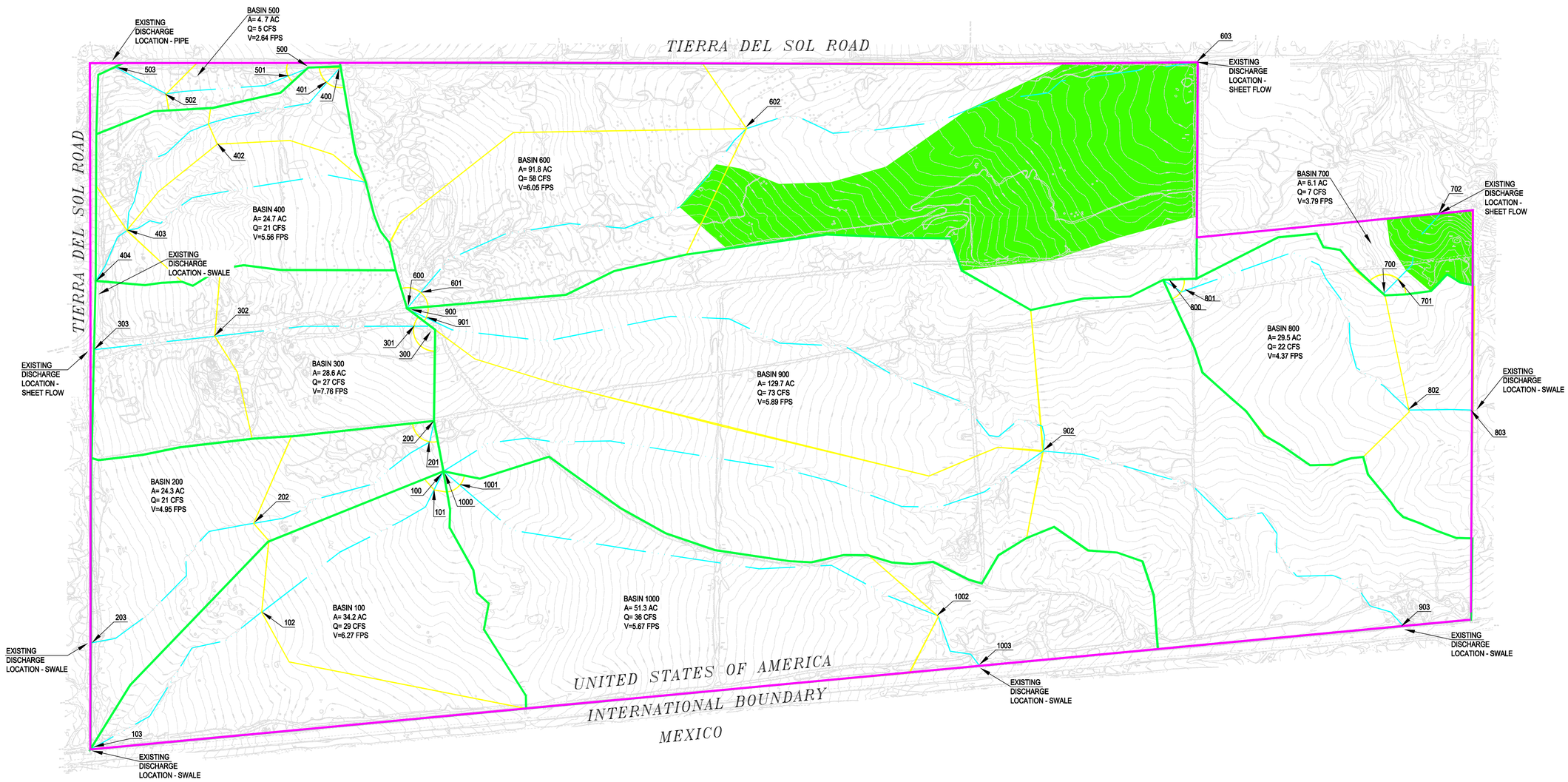
Figure 3-1

Table 3-1

Table 3-2

C Calculations

Watershed Sub-Area Characteristics



LEGEND

- EXISTING DRAINAGE BASIN
- EXISTING DRAINAGE SUBBASIN
- 603 EXISTING DRAINAGE SUBBASIN NUMBER & NODE POINTS
- EXISTING WATER COURSE
- EXISTING CONTOUR
- SOIL A
- SOIL B, ALL OTHER PROJECT AREAS
- PROPOSED PROJECT BOUNDARY

4200 2100 0 4200 8400

SCALE IN FEET

TIERRA DEL SOL
SITE PLAN

EXISTING HYDROLOGY

AECOM
AECOM USA, INC.
401 B STREET, SUITE 200
SAN DIEGO, CA
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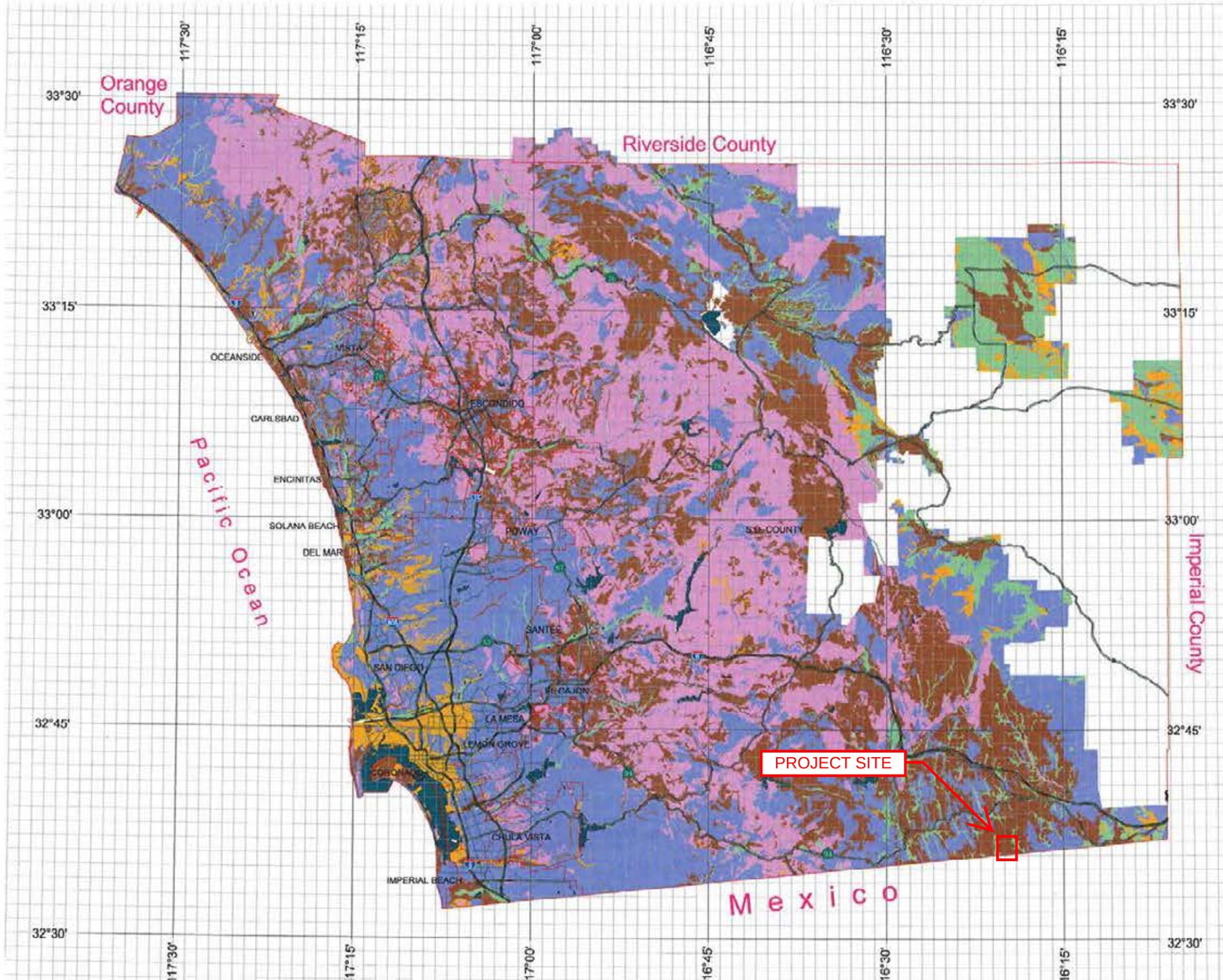
60212653

FIGURE
2

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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N W E S

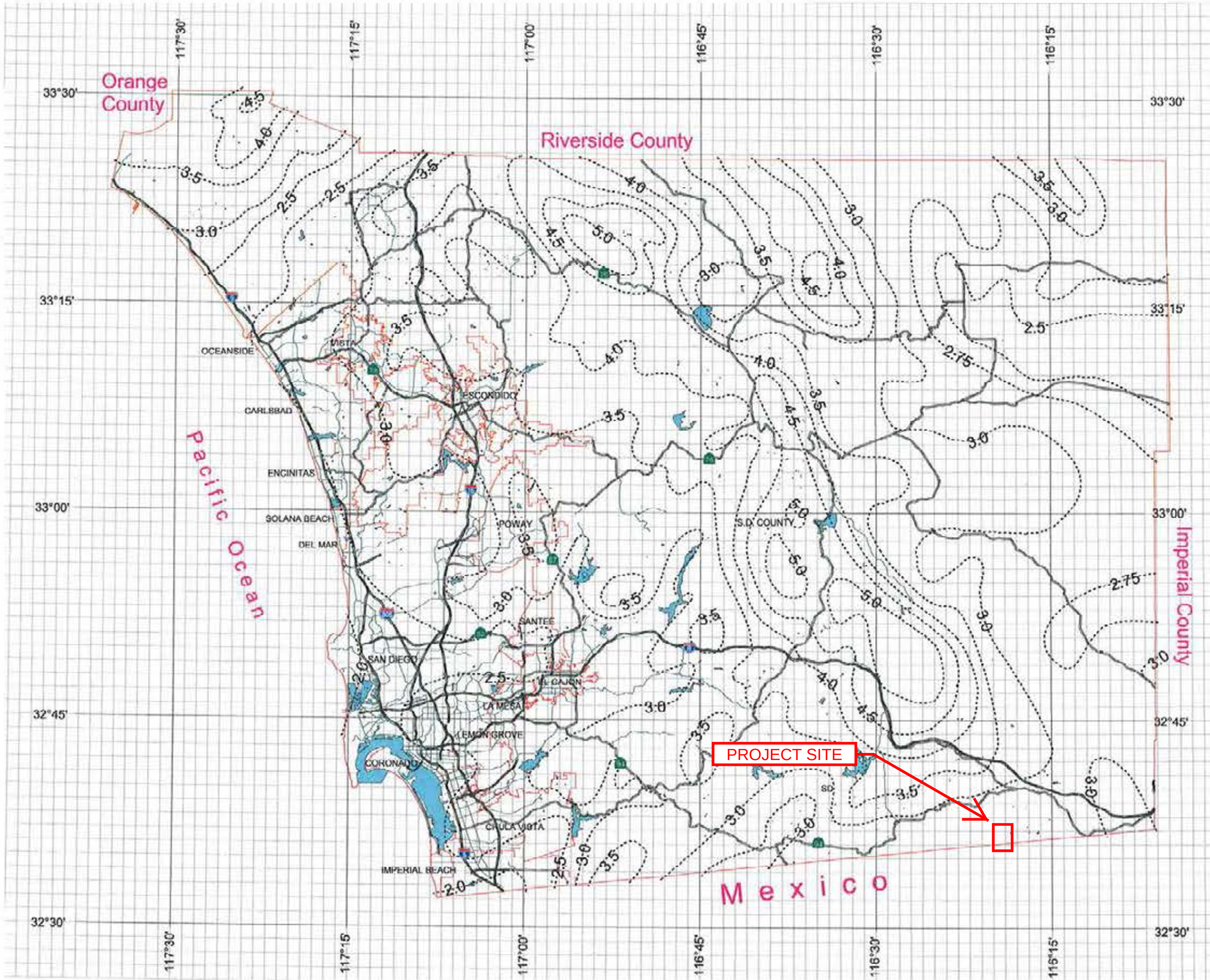
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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N W E S

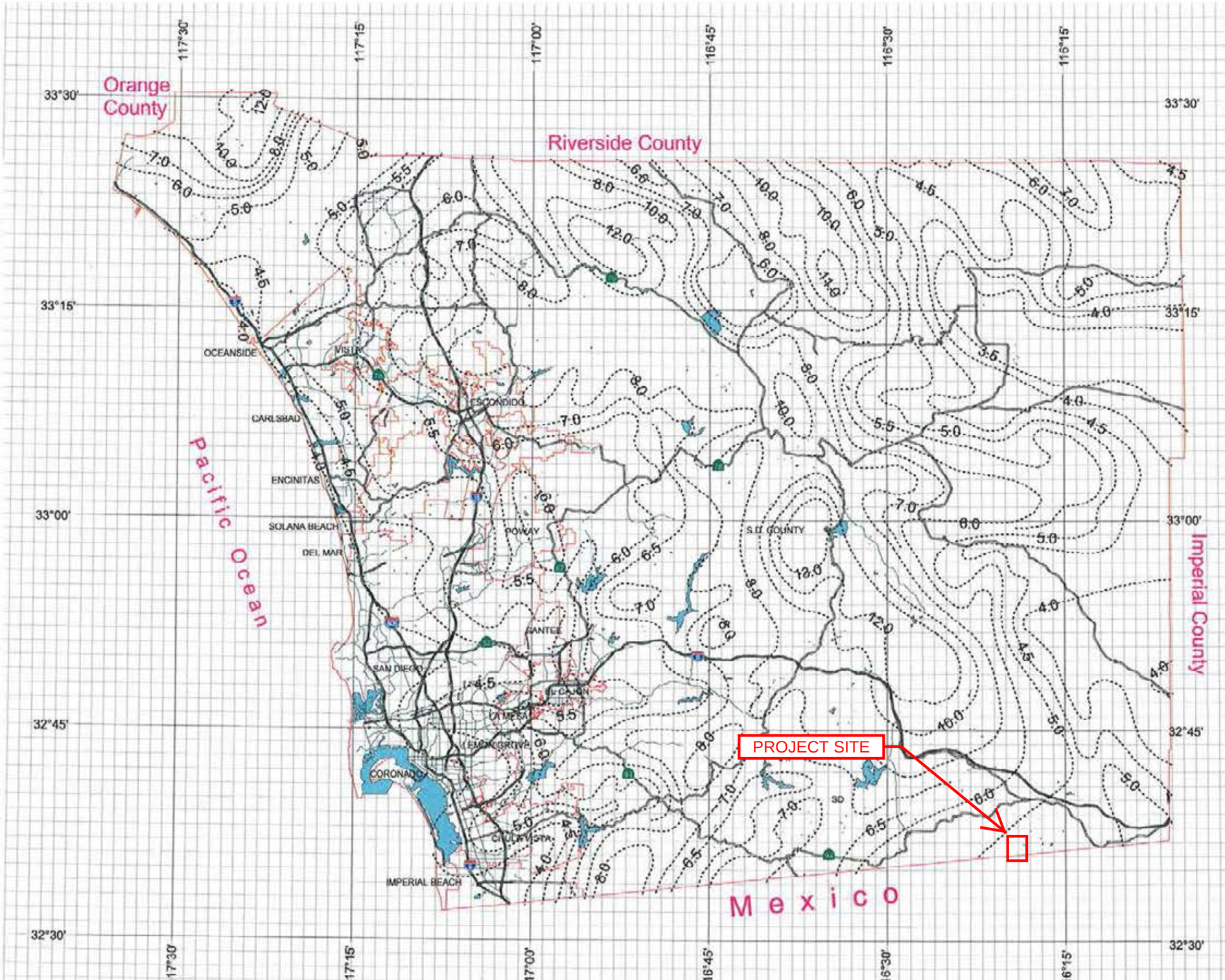
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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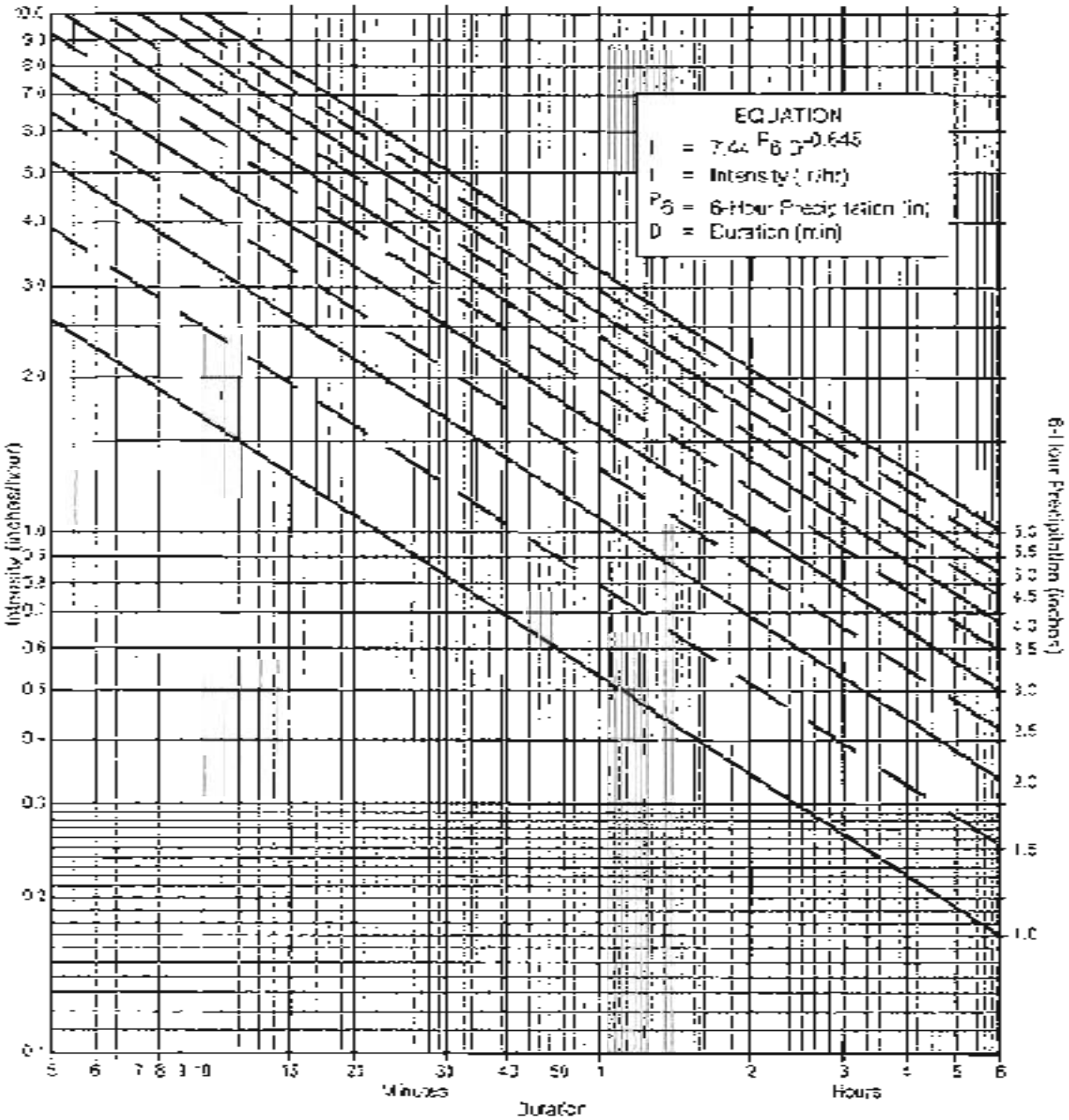
N W E S

3 0 3 Miles



Directions for Application:

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

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

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

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

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

Application Form

(a) Selected frequency 100 year

(b) P_6 = 2.9 in., P_{24} = 4.9 $\frac{P_6}{P_{24}}$ = 59 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.9 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

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

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.99	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.45
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.51
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.62
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.65	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.75	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.75	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

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

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

Table 3-2

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

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

*See Table 3-1 for more detailed description

Pre-Project Soil Type Areas - Site Plan

The C Values of the A - D Soil Types are From Table 3-1 in the SDCHM

Sub Basins Area (ft^2)	Soil Type - Area 100				Soil Type - Area 200				Soil Type - Area 300			
	A	B	C	D	A	B	C	D	A	B	C	D
1												
Sub Basin Total Area		1492786				1059604				1249194		
Total Area (ft^2)	0	1492786	0	0	0	1059604	0	0	0	1249194	0	0
Total Area (acres)	0.00	34.27	0.00	0.00	0.00	24.33	0.00	0.00	0.00	28.68	0.00	0.00
Total Sub Basin Drainage Area (acres)	34.27				24.33				28.68			
Percentage of Total	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
C for Natural Terrain	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35
Watershed Weighted C	0.25				0.25				0.25			

Sub Basins Area (ft^2)	Soil Type - Area 400				Soil Type - Area 500				Soil Type - Area 600			
	A	B	C	D	A	B	C	D	A	B	C	D
1									1378078			
Sub Basin Total Area		1077559				206985				3990831		
Total Area (ft^2)	0	1077559	0	0	0	206985	0	0	1378078	2612753	0	0
Total Area (acres)	0.00	24.74	0.00	0.00	0.00	4.75	0.00	0.00	31.64	59.98	0.00	0.00
Total Drainage Area (acres)	24.74				4.75				91.62			
Percentage of Total	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	34.53%	65.47%	0.00%	0.00%
C for Natural Terrain	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35
Watershed Weighted C	0.25				0.25				0.23			

Sub Basins Area (ft^2)	Soil Type - Area 700				Soil Type - Area 800				Soil Type - Area 900			
	A	B	C	D	A	B	C	D	A	B	C	D
1	118125											
Sub Basin Total Area		265129				1282532				5645351		
Total Area (ft^2)	118125	147004	0	0	0	1282532	0	0	0	5645351	0	0
Total Area (acres)	2.71	3.37	0.00	0.00	0.00	29.44	0.00	0.00	0.00	129.60	0.00	0.00
Total Drainage Area (acres)	6.09				29.44				129.60			
Percentage of Total	44.55%	55.45%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
C for Natural Terrain	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35	0.2	0.25	0.3	0.35
Watershed Weighted C	0.23				0.25				0.25			

Sub Basins Area (ft^2)	Soil Type - Area 1000			
	A	B	C	D
1				
Sub Basin Total Area		2230071		
Total Area (ft^2)	0	2230071	0	0
Total Area (acres)	0.00	51.20	0.00	0.00
Total Drainage Area (acres)	51.20			
Percentage of Total	0.00%	100.00%	0.00%	0.00%
C for Natural Terrain	0.2	0.25	0.3	0.35
Watershed Weighted C	0.25			

PRE-PROJECT AES 2008 RATSCx Inputs - Site Plan

P6 (in)	2.9
P24 (in)	4.9

Subarea		Upstream	Downstream	Flow Length (ft)	Land Cover	% Impervious	C Value	Area (ft^2)	Area (Ac)	Slope
From Node	To node	Elevation (ft)	Elevation (ft)							
100	**101**	3713.5	3710	100	47	0	0.25	6251	0.14	3.5%
101	**102**	3710	3652.5	1024	47	0		839987	19.28	5.6%
102	**103**	3652.5	3602.5	1091	47	0		644422	14.79	4.6%
200	**201**	3718.7	3714.5	100	47	0	0.25	8,649	0.20	4.2%
201	**202**	3714.5	3665	946	47	0		287,241	6.59	5.2%
202	**203**	3665	3615	1043	47	0		764,022	17.54	4.8%
300	**301**	3741.5	3736.5	100	47	0	0.25	11,734	0.27	5.0%
301	**302**	3736.5	3682.5	954	47	0		706,953	16.23	5.7%
302	**303**	3682.5	3639.5	582	47	0		529,245	12.15	7.4%
400	**401**	3720.5	3717.5	100	47	0	0.25	8,373	0.19	3.0%
401	**402**	3717.5	3687.5	621	47	0		181,579	4.17	4.8%
402	**403**	3687.5	3655	701	47	0		198,027	4.55	4.6%
403	**403**	n/a	n/a	n/a	47	0		602,327	13.83	n/a
403	**404**	3655	3645	292	47	0		86,590	1.99	3.4%
500	**501**	3717.5	3713.5	100	47	0	0.25	9,621	0.22	4.0%
501	**502**	3713.5	3682.5	590	47	0		99,270	2.28	5.3%
502	**503**	3682.5	3671.5	269	47	0		96,850	2.22	4.1%
600	**601**	3736.5	3731	100	47	0	0.23	8,922	0.20	5.5%
601	**602**	3731	3640	1852	47	0		992,765	22.79	4.9%
602	**602**	n/a	n/a	n/a	47	0		785,807	18.04	n/a
602	**603**	3640	3569	2233	47	0		2,210,916	50.76	3.2%
700	**701**	3580	3572	100	47	0	0.23	11,963	0.27	8.0%
701	**702**	3572	3547.5	384	47	0		252,087	5.79	6.4%
800	**801**	3608.5	3605	100	47	0	0.25	6,146	0.14	3.5%
801	**802**	3605	3555	1565	47	0		825,623	18.95	3.2%
802	**803**	3555	3547.5	302	47	0		454,447	10.43	2.5%
900	**901**	3743	3740	100	47	0	0.25	3,676	0.08	3.0%
901	**902**	3740	3579.5	3291	47	0		2,130,631	48.91	4.9%
902	**902**	n/a	n/a	n/a	47	0		1,472,598	33.81	n/a
902	**903**	3579.5	3532.5	2102	47	0		2,042,807	46.90	2.2%
1000	**1001**	3714	3711	100	47	0	0.25	6,242	0.14	3.0%
1001	**1002**	3711	3594	2433	47	0		1,654,162	37.97	4.8%
1002	**1003**	3594	3583	352	47	0		576,867	13.24	3.1%

Appendix C

Pre-Project Hydrology AES 2008 RATSCx Output

August 2012

AECOM

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****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2008 Advanced Engineering Software (aes)
            Ver. 15.0 Release Date: 04/01/2008  License ID 1395

                           Analysis prepared by:




----------------------------------------------------------------------------
  FILE NAME: EXSTTDS6.DAT
  TIME/DATE OF STUDY: 14:41 05/18/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 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)
  *PIPE MAY BE SIZED TO HAVE A FLOW CAPACITY LESS THAN
   UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3713.50
  DOWNSTREAM ELEVATION(FEET) =   3710.00
  ELEVATION DIFFERENCE(FEET) =      3.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.078
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3710.00  DOWNSTREAM(FEET) =   3652.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1024.00   CHANNEL SLOPE =  0.0562
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
```

```
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.17
  FLOW VELOCITY(FEET/SEC) =   3.55 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.80   Tc(MIN.) =   14.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1124.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.781
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   19.28   SUBAREA RUNOFF(CFS) =   18.23
  TOTAL AREA(ACRES) =       19.4   TOTAL RUNOFF(CFS) =      18.36
  TC(MIN.) =   14.88

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3652.50  DOWNSTREAM(FEET) =   3602.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1091.00   CHANNEL SLOPE =  0.0458
  CHANNEL FLOW THRU SUBAREA(CFS) =      18.36
  FLOW VELOCITY(FEET/SEC) =   6.27 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.90   Tc(MIN.) =   17.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    2215.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.371
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   14.79   SUBAREA RUNOFF(CFS) =   12.46
  TOTAL AREA(ACRES) =       34.2   TOTAL RUNOFF(CFS) =      28.83
  TC(MIN.) =   17.78

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3718.70
  DOWNSTREAM ELEVATION(FEET) =   3714.50
  ELEVATION DIFFERENCE(FEET) =      4.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.483
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.056
  SUBAREA RUNOFF(CFS) =      0.25
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3714.50  DOWNSTREAM(FEET) =   3665.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   946.00   CHANNEL SLOPE =  0.0523
```

```
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.25
  FLOW VELOCITY(FEET/SEC) =   3.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.60   Tc(MIN.) =   14.08
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1046.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.919
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    6.59   SUBAREA RUNOFF(CFS) =    6.46
  TOTAL AREA(ACRES) =        6.8   TOTAL RUNOFF(CFS) =       6.65
  TC(MIN.) =   14.08

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3665.00  DOWNSTREAM(FEET) =   3615.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1043.00   CHANNEL SLOPE =  0.0479
  CHANNEL FLOW THRU SUBAREA(CFS) =       6.65
  FLOW VELOCITY(FEET/SEC) =   4.95 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.51   Tc(MIN.) =   17.59
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2089.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.394
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   17.54   SUBAREA RUNOFF(CFS) =   14.88
  TOTAL AREA(ACRES) =       24.3   TOTAL RUNOFF(CFS) =      20.64
  TC(MIN.) =   17.59

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3741.50
  DOWNSTREAM ELEVATION(FEET) =   3736.50
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.948
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.249
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3736.50  DOWNSTREAM(FEET) =   3682.50
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   954.00   CHANNEL SLOPE =  0.0566
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.35
  FLOW VELOCITY(FEET/SEC) =   3.57 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.46   Tc(MIN.) =   13.40
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1054.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.045
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   16.23   SUBAREA RUNOFF(CFS) =   16.41
  TOTAL AREA(ACRES) =       16.5   TOTAL RUNOFF(CFS) =      16.69
  TC(MIN.) =   13.40

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3682.50  DOWNSTREAM(FEET) =   3639.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   582.00   CHANNEL SLOPE =  0.0739
  CHANNEL FLOW THRU SUBAREA(CFS) =      16.69
  FLOW VELOCITY(FEET/SEC) =   7.76 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.25   Tc(MIN.) =   14.65
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1636.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.819
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   12.15   SUBAREA RUNOFF(CFS) =   11.60
  TOTAL AREA(ACRES) =       28.6   TOTAL RUNOFF(CFS) =      27.35
  TC(MIN.) =   14.65

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3720.50
  DOWNSTREAM ELEVATION(FEET) =   3717.50
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.609
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.703
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   3717.50  DOWNSTREAM(FEET) =   3687.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   621.00   CHANNEL SLOPE =  0.0483
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.22
  FLOW VELOCITY(FEET/SEC) =   3.30 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.14   Tc(MIN.) =   13.75
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     721.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.979
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    4.17   SUBAREA RUNOFF(CFS) =    4.15
  TOTAL AREA(ACRES) =        4.4   TOTAL RUNOFF(CFS) =       4.34
  TC(MIN.) =   13.75

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3687.50  DOWNSTREAM(FEET) =   3655.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   701.00   CHANNEL SLOPE =  0.0464
  CHANNEL FLOW THRU SUBAREA(CFS) =       4.34
  FLOW VELOCITY(FEET/SEC) =   4.39 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.66   Tc(MIN.) =   16.41
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =    1422.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.550
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   18.37   SUBAREA RUNOFF(CFS) =   16.31
  TOTAL AREA(ACRES) =       22.7   TOTAL RUNOFF(CFS) =      20.18
  TC(MIN.) =   16.41

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3655.00  DOWNSTREAM(FEET) =   3645.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   292.00   CHANNEL SLOPE =  0.0342
  CHANNEL FLOW THRU SUBAREA(CFS) =      20.18
  FLOW VELOCITY(FEET/SEC) =   5.56 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.88   Tc(MIN.) =   17.28
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    1714.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.433
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    1.99   SUBAREA RUNOFF(CFS) =    1.71
  TOTAL AREA(ACRES) =       24.7   TOTAL RUNOFF(CFS) =      21.22
  TC(MIN.) =   17.28

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3717.50
  DOWNSTREAM ELEVATION(FEET) =   3713.50
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.639
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.004
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3713.50  DOWNSTREAM(FEET) =   3682.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   590.00   CHANNEL SLOPE =  0.0525
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.28
  FLOW VELOCITY(FEET/SEC) =   3.44 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.86   Tc(MIN.) =   12.50
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     690.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.231
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    2.28   SUBAREA RUNOFF(CFS) =    2.41
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       2.64
  TC(MIN.) =   12.50

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3682.50  DOWNSTREAM(FEET) =   3671.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   269.00   CHANNEL SLOPE =  0.0409
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.64
  FLOW VELOCITY(FEET/SEC) =   3.69 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.21   Tc(MIN.) =   13.71
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     959.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.986
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    2.22   SUBAREA RUNOFF(CFS) =    2.21
  TOTAL AREA(ACRES) =        4.7   TOTAL RUNOFF(CFS) =       4.70
  TC(MIN.) =   13.71

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3736.50
  DOWNSTREAM ELEVATION(FEET) =   3731.00
  ELEVATION DIFFERENCE(FEET) =      5.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.872
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.278
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3731.00  DOWNSTREAM(FEET) =   3640.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1852.00   CHANNEL SLOPE =  0.0491
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.24
  FLOW VELOCITY(FEET/SEC) =   3.32 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   9.28   Tc(MIN.) =   18.16
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =    1952.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    602.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.326
  *USER SPECIFIED(SUBAREA):
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2300
  SUBAREA AREA(ACRES) =   40.83   SUBAREA RUNOFF(CFS) =   31.23
  TOTAL AREA(ACRES) =       41.0   TOTAL RUNOFF(CFS) =      31.39
  TC(MIN.) =   18.16

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3640.00  DOWNSTREAM(FEET) =   3569.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2233.00   CHANNEL SLOPE =  0.0318
  CHANNEL FLOW THRU SUBAREA(CFS) =      31.39
  FLOW VELOCITY(FEET/SEC) =   6.05 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.15   Tc(MIN.) =   24.31
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =    4185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.755
  *USER SPECIFIED(SUBAREA):
```

```
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2300
  SUBAREA AREA(ACRES) =   50.76   SUBAREA RUNOFF(CFS) =   32.17
  TOTAL AREA(ACRES) =       91.8   TOTAL RUNOFF(CFS) =      58.17
  TC(MIN.) =   24.31

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3580.00
  DOWNSTREAM ELEVATION(FEET) =   3572.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.831
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.721
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    701.00 TO NODE    702.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3572.00  DOWNSTREAM(FEET) =   3547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   384.00   CHANNEL SLOPE =  0.0638
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.36
  FLOW VELOCITY(FEET/SEC) =   3.79 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =    9.52
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    702.00 =     484.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    702.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.044
  *USER SPECIFIED(SUBAREA):
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2300
  SUBAREA AREA(ACRES) =    5.79   SUBAREA RUNOFF(CFS) =    6.72
  TOTAL AREA(ACRES) =        6.1   TOTAL RUNOFF(CFS) =       7.03
  TC(MIN.) =    9.52

****************************************************************************
  FLOW PROCESS FROM NODE    800.00 TO NODE    801.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3608.50
  DOWNSTREAM ELEVATION(FEET) =   3605.00
  ELEVATION DIFFERENCE(FEET) =      3.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.078
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    801.00 TO NODE    802.00 IS CODE =  52
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3605.00  DOWNSTREAM(FEET) =   3555.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1565.00   CHANNEL SLOPE =  0.0319
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.17
  FLOW VELOCITY(FEET/SEC) =   2.68 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   9.73   Tc(MIN.) =   19.81
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    802.00 =    1665.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    802.00 TO NODE    802.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.144
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   18.95   SUBAREA RUNOFF(CFS) =   14.90
  TOTAL AREA(ACRES) =       19.1   TOTAL RUNOFF(CFS) =      15.01
  TC(MIN.) =   19.81

****************************************************************************
  FLOW PROCESS FROM NODE    802.00 TO NODE    803.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3555.00  DOWNSTREAM(FEET) =   3547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   302.00   CHANNEL SLOPE =  0.0248
  CHANNEL FLOW THRU SUBAREA(CFS) =      15.01
  FLOW VELOCITY(FEET/SEC) =   4.37 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.15   Tc(MIN.) =   20.96
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    803.00 =    1967.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    803.00 TO NODE    803.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.032
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   10.43   SUBAREA RUNOFF(CFS) =    7.91
  TOTAL AREA(ACRES) =       29.5   TOTAL RUNOFF(CFS) =      22.38
  TC(MIN.) =   20.96
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       29.5  TC(MIN.) =     20.96
  PEAK FLOW RATE(CFS)   =      22.38
============================================================================
============================================================================
  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 1982-2008 Advanced Engineering Software (aes)
            Ver. 15.0 Release Date: 04/01/2008  License ID 1395

                           Analysis prepared by:




----------------------------------------------------------------------------
  FILE NAME: EXSTTDS5.DAT
  TIME/DATE OF STUDY: 14:39 05/18/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 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)
  *PIPE MAY BE SIZED TO HAVE A FLOW CAPACITY LESS THAN
   UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    900.00 TO NODE    901.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3743.00
  DOWNSTREAM ELEVATION(FEET) =   3740.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.609
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.703
  SUBAREA RUNOFF(CFS) =      0.12
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3740.00  DOWNSTREAM(FEET) =   3579.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  3291.00   CHANNEL SLOPE =  0.0488
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
```

```
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.12
  FLOW VELOCITY(FEET/SEC) =   3.31 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  16.56   Tc(MIN.) =   27.17
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    902.00 =    3391.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    902.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.565
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   82.72   SUBAREA RUNOFF(CFS) =   53.04
  TOTAL AREA(ACRES) =       82.8   TOTAL RUNOFF(CFS) =      53.10
  TC(MIN.) =   27.17

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    903.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3579.50  DOWNSTREAM(FEET) =   3532.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2102.00   CHANNEL SLOPE =  0.0224
  CHANNEL FLOW THRU SUBAREA(CFS) =      53.10
  FLOW VELOCITY(FEET/SEC) =   5.89 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.95   Tc(MIN.) =   33.12
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    903.00 =    5493.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    903.00 TO NODE    903.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.257
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   46.90   SUBAREA RUNOFF(CFS) =   26.46
  TOTAL AREA(ACRES) =      129.7   TOTAL RUNOFF(CFS) =      73.20
  TC(MIN.) =   33.12

****************************************************************************
  FLOW PROCESS FROM NODE   1000.00 TO NODE   1001.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3714.00
  DOWNSTREAM ELEVATION(FEET) =   3711.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.609
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.703
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1002.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3711.00  DOWNSTREAM(FEET) =   3594.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2433.00   CHANNEL SLOPE =  0.0481
```

```
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.16
  FLOW VELOCITY(FEET/SEC) =   3.29 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  12.33   Tc(MIN.) =   22.94
  LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1002.00 =    2533.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1002.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.860
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   37.97   SUBAREA RUNOFF(CFS) =   27.15
  TOTAL AREA(ACRES) =       38.1   TOTAL RUNOFF(CFS) =      27.25
  TC(MIN.) =   22.94

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1003.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3594.00  DOWNSTREAM(FEET) =   3583.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   352.00   CHANNEL SLOPE =  0.0313
  CHANNEL FLOW THRU SUBAREA(CFS) =      27.25
  FLOW VELOCITY(FEET/SEC) =   5.76 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.02   Tc(MIN.) =   23.95
  LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1003.00 =    2885.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1003.00 TO NODE   1003.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.781
  DESERT SHRUB FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  72
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   13.24   SUBAREA RUNOFF(CFS) =    9.21
  TOTAL AREA(ACRES) =       51.3   TOTAL RUNOFF(CFS) =      35.71
  TC(MIN.) =   23.95
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       51.3  TC(MIN.) =     23.95
  PEAK FLOW RATE(CFS)   =      35.71
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix D

Post-Project Rational Method Inputs

Proposed Hydrology Map

C Calculations

Watershed Sub-Area Characteristics

August 2012

AECOM

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AECOM USA, Inc.
3101 POMAS CT, SUITE 200
SAN DIEGO, CA
T 858.586.8080 F 858.292.7432
www.aecom.com

TIERRA DEL SOL SITE PLAN	AECOM PROJECT NO.	FIGURE
PROPOSED HYDROLOGY	60212653	3

Post-Project Soil Type Areas - Site Plan

The C Values of the A - D Soil Types are From Table 3-1 in the SDCHM

Sub Basins Area (ft^2)	Soil Type - Area 100					Soil Type - Area 200					Soil Type - Area 300				
	A	B	C	D	Imp.	A	B	C	D	Imp.	A	B	C	D	Imp.
1					0.18					0.14					0.3
Sub Basin Total Area		1492786					1059604					1249194			
Total Area (ft^2)	0	1484945.2	0	0	7840.8	0	1053505.6	0	0	6098.4	0	1236126	0	0	13068
Total Area (acres)	0.00	34.09	0.00	0.00	0.18	0.00	24.19	0.00	0.00	0.14	0.00	28.38	0.00	0.00	0.30
Total Sub Basin Drainage Area (acres)	34.27					24.33					28.68				
Percentage of Total	0.00%	99.47%	0.00%	0.00%	0.53%	0.00%	99.42%	0.00%	0.00%	0.58%	0.00%	98.95%	0.00%	0.00%	1.05%
C for Natural Terrain	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1
Watershed Weighted C	**0.25**					**0.25**					**0.26**				

Sub Basins Area (ft^2)	Soil Type - Area 400					Soil Type - Area 500					Soil Type - Area 600				
	A	B	C	D	Imp.	A	B	C	D	Imp.	A	B	C	D	Imp.
1					0.26					0.01	1378078				1.01
Sub Basin Total Area		1077559					206985					3990831			
Total Area (ft^2)	0	1066233.4	0	0	11325.6	0	206549.4	0	0	435.6	1378078	2568757.4	0	0	43995.6
Total Area (acres)	0.00	24.48	0.00	0.00	0.26	0.00	4.74	0.00	0.00	0.01	31.64	58.97	0.00	0.00	1.01
Total Drainage Area (acres)	24.74					4.75					91.62				
Percentage of Total	0.00%	98.95%	0.00%	0.00%	1.05%	0.00%	99.79%	0.00%	0.00%	0.21%	34.53%	64.37%	0.00%	0.00%	1.10%
C for Natural Terrain	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1
Watershed Weighted C	**0.26**					**0.25**					**0.24**				

Sub Basins Area (ft^2)	Soil Type - Area 700					Soil Type - Area 800					Soil Type - Area 900				
	A	B	C	D	Imp.	A	B	C	D	Imp.	A	B	C	D	Imp.
1	118125				0					0.08					0.65
Sub Basin Total Area		265129					1282532					5645351			
Total Area (ft^2)	118125	147004	0	0	0	0	1279047.2	0	0	3484.8	0	5617037	0	0	28314
Total Area (acres)	2.71	3.37	0.00	0.00	0.00	0.00	29.36	0.00	0.00	0.08	0.00	128.95	0.00	0.00	0.65
Total Drainage Area (acres)	6.09					29.44					129.60				
Percentage of Total	44.55%	55.45%	0.00%	0.00%	0.00%	0.00%	99.73%	0.00%	0.00%	0.27%	0.00%	99.50%	0.00%	0.00%	0.50%
C for Natural Terrain	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1	0.2	0.25	0.3	0.35	1
Watershed Weighted C	**0.23**					**0.25**					**0.25**				

Sub Basins Area (ft^2)	Soil Type - Area 1000				
	A	B	C	D	Imp.
1					0.31
Sub Basin Total Area		2230071			
Total Area (ft^2)	0	2216567.4	0	0	13503.6
Total Area (acres)	0.00	50.89	0.00	0.00	0.31
Total Drainage Area (acres)	51.20				
Percentage of Total	0.00%	99.39%	0.00%	0.00%	0.61%
C for Natural Terrain	0.2	0.25	0.3	0.35	1
Watershed Weighted C	**0.25**				

POST-PROJECT AES 2008 RATSCx Inputs - Site Plan

P6 (in)	2.9
P24 (in)	4.9

Subarea		Upstream Elevation (ft)	Downstream Elevation (ft)	Flow Length (ft)	Land Cover	% Impervious	C Value	Area (ft^2)	Area (Ac)	Slope
From Node	**To node**									
100	**101**	3713.5	3710	100	38			6251	0.14	3.5%
101	**102**	3710	3652.5	1024	38	0.53%	0.25	839987	19.28	5.6%
102	**103**	3652.5	3602.5	1091	38			644422	14.79	4.6%
200	**201**	3718.7	3714.5	100	38			8,649	0.20	4.2%
201	**202**	3714.5	3665	946	38	0.58%	0.25	287,241	6.59	5.2%
202	**203**	3665	3615	1043	38			764,022	17.54	4.8%
300	**301**	3741.5	3736.5	100	38			11,734	0.27	5.0%
301	**302**	3736.5	3682.5	954	38	1.05%	0.26	706,953	16.23	5.7%
302	**303**	3682.5	3639.5	582	38			529,245	12.15	7.4%
400	**401**	3720.5	3717.5	100	38			8,373	0.19	3.0%
401	**402**	3717.5	3687.5	621	38			181,579	4.17	4.8%
402	**403**	3687.5	3655	701	38	1.05%	0.26	198,027	4.55	4.6%
403	**403**	n/a	n/a	n/a	38			602,327	13.83	n/a
403	**404**	3655	3645	292	38			86,590	1.99	3.4%
500	**501**	3717.5	3713.5	100	38			9,621	0.22	4.0%
501	**502**	3713.5	3682.5	590	38	0.21%	0.25	99,270	2.28	5.3%
502	**503**	3682.5	3671.5	269	38			96,850	2.22	4.1%
600	**601**	3736.5	3731	100	38			8,922	0.20	5.5%
601	**602**	3731	3640	1852	38	0.77%	0.24	992,765	22.79	4.9%
602	**602**	n/a	n/a	n/a	38			785,807	18.04	n/a
602	**603**	3640	3569	2233	38			2,210,916	50.76	3.2%
700	**701**	3580	3572	100	38	0.00%	0.23	11,963	0.27	8.0%
701	**702**	3572	3547.5	384	38			252,087	5.79	6.4%
800	**801**	3608.5	3605	100	38			6,146	0.14	3.5%
801	**802**	3605	3555	1565	38	0.27%	0.25	825,623	18.95	3.2%
802	**803**	3555	3547.5	302	38			454,447	10.43	2.5%
900	**901**	3743	3740	100	38			3,676	0.08	3.0%
901	**902**	3740	3579.5	3291	38	0.50%	0.25	2,130,631	48.91	4.9%
902	**902**	n/a	n/a	n/a	38			1,472,598	33.81	n/a
902	**903**	3579.5	3532.5	2102	38			2,042,807	46.90	2.2%
1000	**1001**	3714	3711	100	38			6,242	0.14	3.0%
1001	**1002**	3711	3594	2433	38	0.60%	0.25	1,654,162	37.97	4.8%
1002	**1003**	3594	3583	352	38			576,867	13.24	3.1%

Appendix E

Post-Project Hydrology AES 2008 RATSCx Output

August 2012

AECOM

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****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2008 Advanced Engineering Software (aes)
            Ver. 15.0 Release Date: 04/01/2008  License ID 1395

                           Analysis prepared by:




----------------------------------------------------------------------------
  FILE NAME: PROPTDS.DAT
  TIME/DATE OF STUDY: 15:32 05/18/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 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    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3713.50
  DOWNSTREAM ELEVATION(FEET) =   3710.00
  ELEVATION DIFFERENCE(FEET) =      3.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.078
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3710.00  DOWNSTREAM(FEET) =   3652.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1024.00   CHANNEL SLOPE =  0.0562
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
```

```
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.17
  FLOW VELOCITY(FEET/SEC) =   3.55 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.80   Tc(MIN.) =   14.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1124.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.781
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   19.28   SUBAREA RUNOFF(CFS) =   18.23
  TOTAL AREA(ACRES) =       19.4   TOTAL RUNOFF(CFS) =      18.36
  TC(MIN.) =   14.88

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3652.50  DOWNSTREAM(FEET) =   3602.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1091.00   CHANNEL SLOPE =  0.0458
  CHANNEL FLOW THRU SUBAREA(CFS) =      18.36
  FLOW VELOCITY(FEET/SEC) =   6.27 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.90   Tc(MIN.) =   17.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    2215.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.371
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   14.79   SUBAREA RUNOFF(CFS) =   12.46
  TOTAL AREA(ACRES) =       34.2   TOTAL RUNOFF(CFS) =      28.83
  TC(MIN.) =   17.78

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3718.70
  DOWNSTREAM ELEVATION(FEET) =   3714.50
  ELEVATION DIFFERENCE(FEET) =      4.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.483
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.056
  SUBAREA RUNOFF(CFS) =      0.25
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3714.50  DOWNSTREAM(FEET) =   3665.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   946.00   CHANNEL SLOPE =  0.0523
```

```
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.25
  FLOW VELOCITY(FEET/SEC) =   3.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.60   Tc(MIN.) =   14.08
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1046.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.919
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    6.59   SUBAREA RUNOFF(CFS) =    6.46
  TOTAL AREA(ACRES) =        6.8   TOTAL RUNOFF(CFS) =       6.65
  TC(MIN.) =   14.08

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3665.00  DOWNSTREAM(FEET) =   3615.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1043.00   CHANNEL SLOPE =  0.0479
  CHANNEL FLOW THRU SUBAREA(CFS) =       6.65
  FLOW VELOCITY(FEET/SEC) =   4.95 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.51   Tc(MIN.) =   17.59
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2089.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.394
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   17.54   SUBAREA RUNOFF(CFS) =   14.88
  TOTAL AREA(ACRES) =       24.3   TOTAL RUNOFF(CFS) =      20.64
  TC(MIN.) =   17.59

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3741.50
  DOWNSTREAM ELEVATION(FEET) =   3736.50
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.843
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.290
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3736.50  DOWNSTREAM(FEET) =   3682.50
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   954.00   CHANNEL SLOPE =  0.0566
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.37
  FLOW VELOCITY(FEET/SEC) =   3.57 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.46   Tc(MIN.) =   13.30
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1054.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.066
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2600
  SUBAREA AREA(ACRES) =   16.23   SUBAREA RUNOFF(CFS) =   17.16
  TOTAL AREA(ACRES) =       16.5   TOTAL RUNOFF(CFS) =      17.44
  TC(MIN.) =   13.30

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3682.50  DOWNSTREAM(FEET) =   3639.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   582.00   CHANNEL SLOPE =  0.0739
  CHANNEL FLOW THRU SUBAREA(CFS) =      17.44
  FLOW VELOCITY(FEET/SEC) =   7.85 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =   14.53
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1636.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.839
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2600
  SUBAREA AREA(ACRES) =   12.15   SUBAREA RUNOFF(CFS) =   12.13
  TOTAL AREA(ACRES) =       28.6   TOTAL RUNOFF(CFS) =      28.60
  TC(MIN.) =   14.53

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3720.50
  DOWNSTREAM ELEVATION(FEET) =   3717.50
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.484
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.739
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   3717.50  DOWNSTREAM(FEET) =   3687.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   621.00   CHANNEL SLOPE =  0.0483
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.23
  FLOW VELOCITY(FEET/SEC) =   3.30 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.14   Tc(MIN.) =   13.62
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     721.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.003
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2600
  SUBAREA AREA(ACRES) =    4.17   SUBAREA RUNOFF(CFS) =    4.34
  TOTAL AREA(ACRES) =        4.4   TOTAL RUNOFF(CFS) =       4.54
  TC(MIN.) =   13.62

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3687.50  DOWNSTREAM(FEET) =   3655.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   701.00   CHANNEL SLOPE =  0.0464
  CHANNEL FLOW THRU SUBAREA(CFS) =       4.54
  FLOW VELOCITY(FEET/SEC) =   4.44 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.63   Tc(MIN.) =   16.25
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =    1422.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.572
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2600
  SUBAREA AREA(ACRES) =   18.37   SUBAREA RUNOFF(CFS) =   17.06
  TOTAL AREA(ACRES) =       22.7   TOTAL RUNOFF(CFS) =      21.11
  TC(MIN.) =   16.25

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3655.00  DOWNSTREAM(FEET) =   3645.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   292.00   CHANNEL SLOPE =  0.0342
  CHANNEL FLOW THRU SUBAREA(CFS) =      21.11
  FLOW VELOCITY(FEET/SEC) =   5.63 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =   17.12
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    1714.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.454
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2600
  S.C.S. CURVE NUMBER (AMC II) =  69
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2600
  SUBAREA AREA(ACRES) =    1.99   SUBAREA RUNOFF(CFS) =    1.79
  TOTAL AREA(ACRES) =       24.7   TOTAL RUNOFF(CFS) =      22.20
  TC(MIN.) =   17.12

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3717.50
  DOWNSTREAM ELEVATION(FEET) =   3713.50
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.639
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.004
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3713.50  DOWNSTREAM(FEET) =   3682.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   590.00   CHANNEL SLOPE =  0.0525
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.28
  FLOW VELOCITY(FEET/SEC) =   3.44 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.86   Tc(MIN.) =   12.50
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     690.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.231
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    2.28   SUBAREA RUNOFF(CFS) =    2.41
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =       2.64
  TC(MIN.) =   12.50

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3682.50  DOWNSTREAM(FEET) =   3671.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   269.00   CHANNEL SLOPE =  0.0409
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.64
  FLOW VELOCITY(FEET/SEC) =   3.69 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.21   Tc(MIN.) =   13.71
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =     959.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.986
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =    2.22   SUBAREA RUNOFF(CFS) =    2.21
  TOTAL AREA(ACRES) =        4.7   TOTAL RUNOFF(CFS) =       4.70
  TC(MIN.) =   13.71

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2400
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3736.50
  DOWNSTREAM ELEVATION(FEET) =   3731.00
  ELEVATION DIFFERENCE(FEET) =      5.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.770
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.318
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3731.00  DOWNSTREAM(FEET) =   3640.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1852.00   CHANNEL SLOPE =  0.0491
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.26
  FLOW VELOCITY(FEET/SEC) =   3.32 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   9.28   Tc(MIN.) =   18.05
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =    1952.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    602.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.338
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   40.83   SUBAREA RUNOFF(CFS) =   34.07
  TOTAL AREA(ACRES) =       41.0   TOTAL RUNOFF(CFS) =      34.23
  TC(MIN.) =   18.05

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3640.00  DOWNSTREAM(FEET) =   3569.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2233.00   CHANNEL SLOPE =  0.0318
  CHANNEL FLOW THRU SUBAREA(CFS) =      34.23
  FLOW VELOCITY(FEET/SEC) =   6.20 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.01   Tc(MIN.) =   24.06
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =    4185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.774
  *USER SPECIFIED(SUBAREA):
```

```
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2400
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2444
  SUBAREA AREA(ACRES) =   50.76   SUBAREA RUNOFF(CFS) =   33.79
  TOTAL AREA(ACRES) =       91.8   TOTAL RUNOFF(CFS) =      62.23
  TC(MIN.) =   24.06

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3580.00
  DOWNSTREAM ELEVATION(FEET) =   3572.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.831
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.721
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    701.00 TO NODE    702.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3572.00  DOWNSTREAM(FEET) =   3547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   384.00   CHANNEL SLOPE =  0.0638
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.36
  FLOW VELOCITY(FEET/SEC) =   3.79 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =    9.52
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    702.00 =     484.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    702.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.044
  *USER SPECIFIED(SUBAREA):
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2300
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2300
  SUBAREA AREA(ACRES) =    5.79   SUBAREA RUNOFF(CFS) =    6.72
  TOTAL AREA(ACRES) =        6.1   TOTAL RUNOFF(CFS) =       7.03
  TC(MIN.) =    9.52

****************************************************************************
  FLOW PROCESS FROM NODE    800.00 TO NODE    801.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3608.50
  DOWNSTREAM ELEVATION(FEET) =   3605.00
  ELEVATION DIFFERENCE(FEET) =      3.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.078
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    801.00 TO NODE    802.00 IS CODE =  52
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3605.00  DOWNSTREAM(FEET) =   3555.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1565.00   CHANNEL SLOPE =  0.0319
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.17
  FLOW VELOCITY(FEET/SEC) =   2.68 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   9.73   Tc(MIN.) =   19.81
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    802.00 =    1665.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    802.00 TO NODE    802.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.144
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   18.95   SUBAREA RUNOFF(CFS) =   14.90
  TOTAL AREA(ACRES) =       19.1   TOTAL RUNOFF(CFS) =      15.01
  TC(MIN.) =   19.81

****************************************************************************
  FLOW PROCESS FROM NODE    802.00 TO NODE    803.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3555.00  DOWNSTREAM(FEET) =   3547.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   302.00   CHANNEL SLOPE =  0.0248
  CHANNEL FLOW THRU SUBAREA(CFS) =      15.01
  FLOW VELOCITY(FEET/SEC) =   4.37 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.15   Tc(MIN.) =   20.96
  LONGEST FLOWPATH FROM NODE    800.00 TO NODE    803.00 =    1967.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    803.00 TO NODE    803.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.032
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   10.43   SUBAREA RUNOFF(CFS) =    7.91
  TOTAL AREA(ACRES) =       29.5   TOTAL RUNOFF(CFS) =      22.38
  TC(MIN.) =   20.96
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       29.5  TC(MIN.) =     20.96
  PEAK FLOW RATE(CFS)   =      22.38
============================================================================
============================================================================
  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 1982-2008 Advanced Engineering Software (aes)
            Ver. 15.0 Release Date: 04/01/2008  License ID 1395

                           Analysis prepared by:




----------------------------------------------------------------------------
  FILE NAME: EXSTTDS4.DAT
  TIME/DATE OF STUDY: 15:20 05/18/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.900
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 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)
  *PIPE MAY BE SIZED TO HAVE A FLOW CAPACITY LESS THAN
   UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    900.00 TO NODE    901.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3743.00
  DOWNSTREAM ELEVATION(FEET) =   3740.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.609
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.703
  SUBAREA RUNOFF(CFS) =      0.12
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.12

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3740.00  DOWNSTREAM(FEET) =   3579.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  3291.00   CHANNEL SLOPE =  0.0488
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
```

```
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.12
  FLOW VELOCITY(FEET/SEC) =   3.31 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  16.56   Tc(MIN.) =   27.17
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    902.00 =    3391.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    902.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.565
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   82.72   SUBAREA RUNOFF(CFS) =   53.04
  TOTAL AREA(ACRES) =       82.8   TOTAL RUNOFF(CFS) =      53.10
  TC(MIN.) =   27.17

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    903.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3579.50  DOWNSTREAM(FEET) =   3532.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2102.00   CHANNEL SLOPE =  0.0224
  CHANNEL FLOW THRU SUBAREA(CFS) =      53.10
  FLOW VELOCITY(FEET/SEC) =   5.89 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.95   Tc(MIN.) =   33.12
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    903.00 =    5493.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    903.00 TO NODE    903.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.257
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   46.90   SUBAREA RUNOFF(CFS) =   26.46
  TOTAL AREA(ACRES) =      129.7   TOTAL RUNOFF(CFS) =      73.20
  TC(MIN.) =   33.12

****************************************************************************
  FLOW PROCESS FROM NODE   1000.00 TO NODE   1001.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   3714.00
  DOWNSTREAM ELEVATION(FEET) =   3711.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.609
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.703
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE   1001.00 TO NODE   1002.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3711.00  DOWNSTREAM(FEET) =   3594.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2433.00   CHANNEL SLOPE =  0.0481
```

```
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.16
  FLOW VELOCITY(FEET/SEC) =   3.29 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  12.33   Tc(MIN.) =   22.94
  LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1002.00 =    2533.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1002.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.860
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   37.97   SUBAREA RUNOFF(CFS) =   27.15
  TOTAL AREA(ACRES) =       38.1   TOTAL RUNOFF(CFS) =      27.25
  TC(MIN.) =   22.94

****************************************************************************
  FLOW PROCESS FROM NODE   1002.00 TO NODE   1003.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3594.00  DOWNSTREAM(FEET) =   3583.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   352.00   CHANNEL SLOPE =  0.0313
  CHANNEL FLOW THRU SUBAREA(CFS) =      27.25
  FLOW VELOCITY(FEET/SEC) =   5.76 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.02   Tc(MIN.) =   23.95
  LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1003.00 =    2885.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1003.00 TO NODE   1003.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.781
  PERENNIAL GRASS FAIR COVER RUNOFF COEFFICIENT = .2500
  SOIL CLASSIFICATION IS "B"
  S.C.S. CURVE NUMBER (AMC II) =  69
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2500
  SUBAREA AREA(ACRES) =   13.24   SUBAREA RUNOFF(CFS) =    9.21
  TOTAL AREA(ACRES) =       51.3   TOTAL RUNOFF(CFS) =      35.71
  TC(MIN.) =   23.95
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       51.3  TC(MIN.) =     23.95
  PEAK FLOW RATE(CFS)   =      35.71
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix F

CPV Tracker Diagram & Runoff Calculations

August 2012

AECOM

6.3.3. The Module DC Cabling (105 m² tracker)

All modules are connected in parallel. The Tracker

The modules are mounted on a precision dual axis tracking system in order to continuously capture the Direct Radiation.

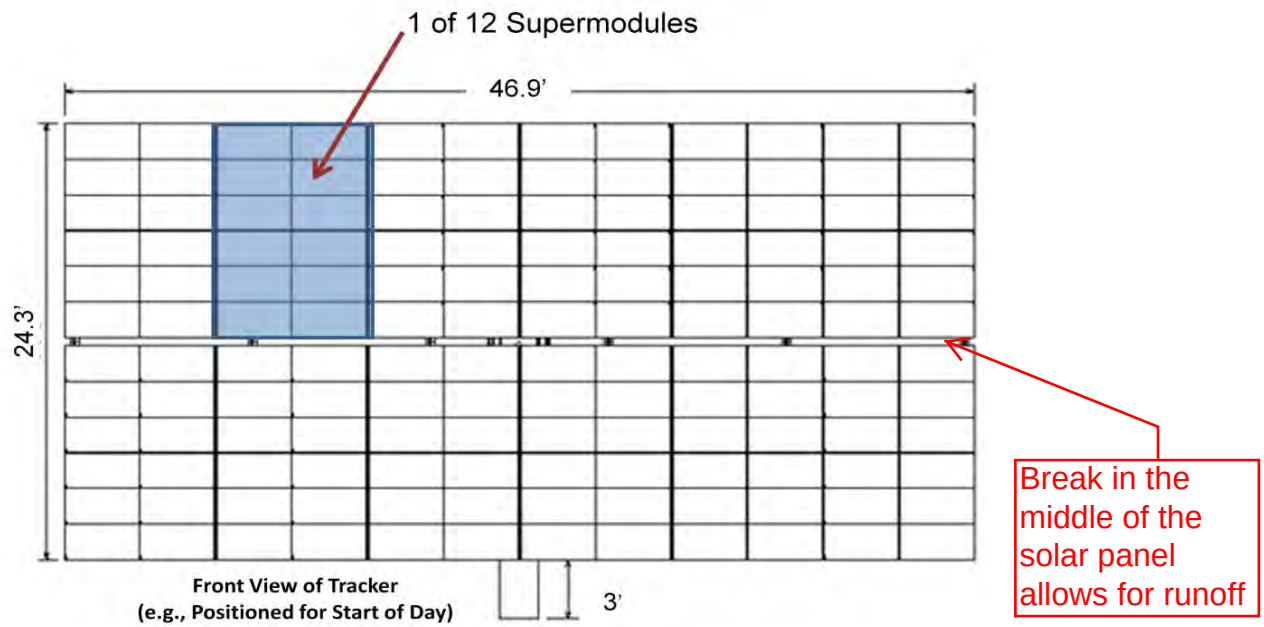

Fig. 6.3: Front Side Drawing of the Concentrix Solar CX-22 CPV System Showing the Tracker Table with the 12 Supermodules, and the Mast.

6.3.4. The Tracker

The FLATCON modules are mounted on a precision dual axis tracking system in order to continuously capture the Direct Radiation.

6.3.4.1. CX-C22, Tracker: Tracking structure and mechanical parts

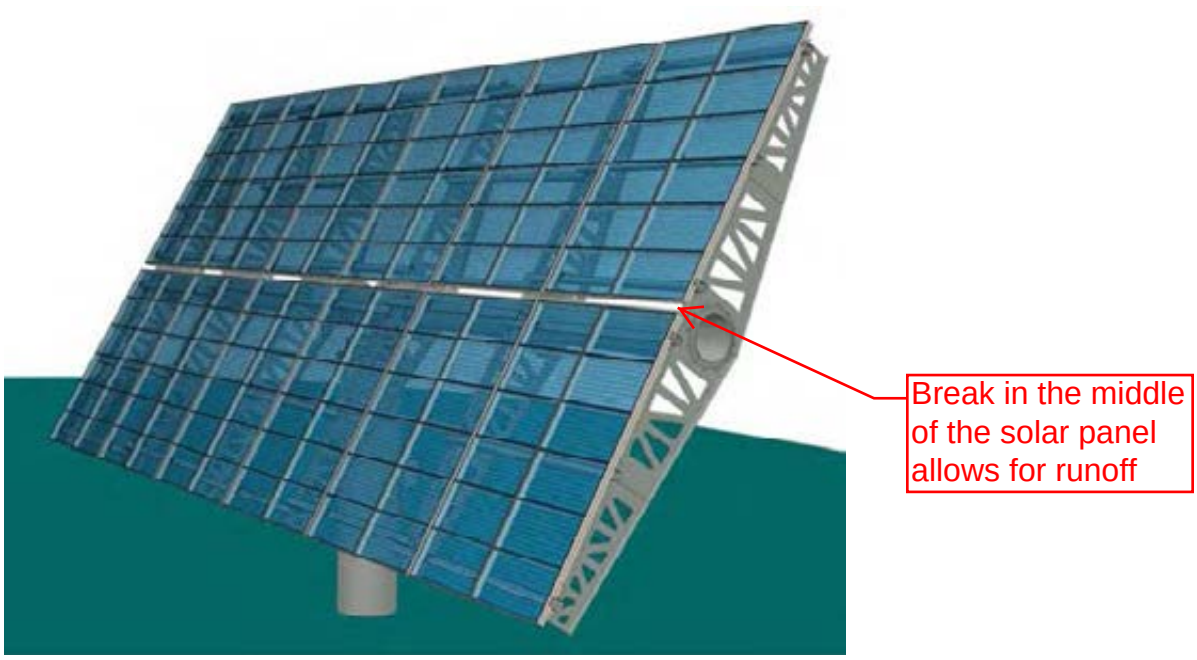

Figure 6.3: Sketch of the Cosma CX-C22 Tracker

Mass of System (kg)	8283
Mass of Steel Structure ONLY (kg)	4725
Total # of Loose Bolts:	552
Total # of Loose Nuts:	300
Total # of Loose Fasteners:	852
Thickness of mast steel (mm)	8.33

Table 6.2: Technical Data of the CX-C22 tracker steel structure

Runoff From CPV Tracker

	Frequency					
	100 Year	**50 year**	**25 Year**	**10 Year**	**5 Year**	**2 year**
Length (ft)	46.90	46.90	46.90	46.90	46.90	46.90
Height (ft)	24.30	24.30	24.30	24.30	24.30	24.30
Area (sf)	1139.67	1139.67	1139.67	1139.67	1139.67	1139.67
Area (ac)	0.03	0.03	0.03	0.03	0.03	0.03
C	1.0	1.0	1.0	1.0	1.0	1.0
t_c (min)	5.0	5.0	5.0	5.0	5.0	5.0
P_6 (in)	2.90	2.75	2.3	1.9	1.5	1.1
I (in/hr)	7.64	7.25	6.06	5.01	3.95	2.90
Total Q (cfs)	0.200	0.190	0.159	0.131	0.103	0.076
*** Q per Panel (cfs)**	0.100	0.095	0.079	0.065	0.052	0.038
**** Q per foot (cfs)**	**0.0021**	**0.0020**	**0.0017**	**0.0014**	**0.0011**	**0.0008**

* The panel is divided into two panels by a horizontal opening in the middle of the panel.
This means half of the Q runs off the panel in the middle and half at the bottom.
** The length is 46.9' and so the runoff can be broken down into the amount that runs off in 1 foot.

1 tablespoon is equal to .00052 cf
The number of tablespoons of runoff that cascade over one foot of the solar panels in a 2 year storm is = .0008cf/.00052cf = 1.54 tablespoons