APPENDIX P

Preliminary Drainage Study

PRELIMINARY DRAINAGE STUDY

FOR

Warner Ranch
(Tract No. 5508 rpl4)

Prepared By:

S H A P O U R I & A S S O C I A T E S

P R O J E C T M A N A G E M E N T S E R V I C E S

E N G I N E E R I N G • A R C H I T E C T U R E • P L A N N I N G

18029 Calle Ambiente, Suite 502, P.O. Box 676221, Rancho Santa Fe, California 92067
*P H O N E : **(8 5 8) 7 5 6 - 8 3 4 0*** *F A X : (8 5 8) 7 5 6 - 8 3 4 4*

M.H. Shapouri
RCE No. C52794
Expires 12/31/2014

February 28, 2013
July 23, 2013

Table of Contents

List of Text

TITLE	PAGE
Project Description	3
Methodology	5
Pre-Development Conditions	11
Post-Development Conditions	12
Post-Development Runoff Analysis	13
Conclusion	15
Declaration of Responsible Charge	17
Miscellaneous Design Charts	18
San Diego County Isopluvial Maps	22

List of Figures

TITLE **PAGE**

Figure 1: Vicinity Map 10

Figures: Pre Hydrology Maps 11” x 17” Map (Attached)
*Gomez Creek Watershed Geographic Location & Physical Characteristics.
*Gomez Creek Watershed Hydrologic Soils Groups.
*Gomez Creek Watershed Hydrologic Ground Covers.

Figures: Post Hydrology Maps 11” x 17” Map (Attached)
*Gomez Creek Watershed Geographic Location & Physical Characteristics.
*Gomez Creek Watershed Hydrologic Soils Groups.
*Gomez Creek Watershed Hydrologic Ground Covers.

.

Figures: Post Hydrology Maps (3 Sheets) 36” x 45” Map (Attached)
Pre Hydrology Map (1 Sheet) 36” x 45” Map (Attached)

List of Attachments

TITLE	PAGE
100 yr. Pre Hydrology Study	Attached
100 yr. Post Hydrology Study	Attached
Table A: Comparison of Pre & Post Development Conditions	Attached
100 yr. Bio-retention Pond Calculations	Attached
Gomez Creek 100 yr. Hec-Ras Analysis.	Attached
Basin 103 100 yr. Hec-Ras Analysis	Attached

Project Description

This Drainage Study has been prepared pursuant to the San Diego County Grading Ordinance, Grading Plan Manual, Drainage Design Manual and all other applicable County, State and Federal Regulations. This study will discuss the existing, pre-development hydrologic conditions as well as examine the post-development hydrology as proposed on the Warner Ranch Preliminary Grading Plan Site Grading (Tract No. 5508 rpl4).

The proposed Warner Ranch Project is located in the unincorporated area in the northwestern portion of San Diego County, approximately five miles east of Interstate 15 on Pala Road (State Route (SR) 76). It is just west of Pala Temecula Road in the Pala Pauma Subregional Planning Area. It includes Assessor's Parcel Numbers (APNs) 110-021-09 and10; 110-090-01, -17, -18; 110-021-32; and 110-040-22.

The Project is intended to provide a range of workforce housing opportunities consistent with the Job/Housing Balance goals and policies of the San Diego County General Plan. The recently adopted General Plan and associated Pala/Pauma Community Plan provides for the implementation of this project by designating this 513.49-acre property as a Special Study Area (SSA). The SSA requires a focused land use planning analysis "to determine the most compatible and consistent land uses for the property". The designation has required additional planning studies intended to address the unique character of the site and surrounding area as well as address property constraints to allow for the creation of a "cohesive and comprehensive land use plan", the Warner Ranch Project proposes a General Plan Amendment, Specific Plan, Rezone Administrative Permit (for gated access) and Vesting Tentative Map to develop 513.49 acres with 780 residential units and associated public and private facilities and services. The following is a summary of the proposed project:

- The project area consists of 780 residential units (534 single family detached, with a minimum lot size of 3,000 sq ft and 246 multi-family and attached townhomes)

- 7.7 acres of private community parks, including a clubhouse
- 14.54 acres of landscaped areas
- 4.23 acres active public recreational park
- 359.05 acres of preserved open space
- A 10,000 sq ft fire on-site fire station

The project area would be accessed by a central entry road at its current intersection with SR 76, where a signalized intersection is required. The project would also make frontage improvements to the existing 120-foot wide Pala Road/SR 76 easement. These Improvements include widening of the existing 24-foot wide pavement to 52 feet, two 12-foot wide drive lanes, a 12-foot wide painted center median, and 8-foot wide shoulders that also include a painted bike lane in each direction. Additionally, a 350-foot long and 12-foot wide acceleration/deceleration lane is proposed adjacent to the project's main entry.

Earthwork quantities for on-site development are anticipated to consist of 2.3 million cubic yards of cut and 2.3 million cubic yards of fill material. The proposed grading will be balanced with no import or export of materials. .

The project would be implemented in phases major facilities such as the proposed fire station, water storage reservoir, forced sewer line, frontage improvements, drainage improvements, and Public Park, are intended to be constructed as a part of the initial phases of the project.

This Preliminary Drainage Study analyzes the pre and post-development hydrology per the latest project specifications and scope of work. The adequacy of the proposed drainage system will be determined in regards to the 100 year storm event.

Methodology

This study has been prepared consistent with all current County of San Diego's ordinances and procedures. All components of the study are designed to convey storm water based on a 100 year flood event. The anticipated storm runoff has been calculated based on the County of San Diego Rational Method for Computing Water Runoff of Small Watersheds.

The following references have been used in preparation of this report:

- *County of San Diego Hydrology Manual, June 2003.*
- *San Diego County Grading, Clearing and Watercourses Ordinance, dated April 23, 2004*
- San Diego County Drainage Design Manual, dated July 2005.
- San Diego County Hydrology Manual for NRCS (National Resources Conservation Service) Hydrologic Method calculations.
- Water Control Plan for the San Diego Basin (9) from the California Regional Water Quality Control Board San Diego Region, September 1994, (with amendments effective on April 25, 2007).
- *San Diego County Rational Hydrology Program – CIVILCADD/CIVILDESIGN Engineering Software, Version 7.5*
- *The San Diego Unit Hydrograph (SDUH) Peak Discharge Program.*
- *US Army Corps of Engineers, HEC-RAS Program, Version 4.0.0*
- *San Diego County Topographic Survey maps, photographs taken 1960 and 1985*
- *County of San Diego Hydrology Manual, Soils Hydrologic Group Map, 2007.*

Civil Design Hydrology Program

The Civil Design Hydrology Program is a computer-aided design program in which the user develops a node-link model of the watershed. The program has the capability of estimating culvert sizes and using culverts or open channels to convey designed storm discharges. Developing independent node-link models of each interior watershed and linking these sub models together at confluence points create the node-link model.

Rational Method

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures.

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (Tc), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

Q = C I A

Q = peak discharge, in cubic feet per second (cfs)
C = runoff coefficient, proportion of rainfall running off surface (no units)
I = average rainfall intensity for duration equal to the Tc for the area, in inches per hour
A = drainage area contributing to the design location, in acres

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Runoff coefficients (C) based on land use and soil types were obtained from the San Diego County Hydrology Manual, Table 3-1. Soil types were determined from the Hydrology Soils Map provided in Appendix A as well as the US Department of Agriculture (USDA) Soil Survey program. This runoff coefficient was then multiplied by the percentage of total area (A) included in that class.

The rainfall intensity (I) can be determined from the County of San Diego Intensity-Duration Design Chart. The 6-hour storm rainfall amount (P6) and 24-hour storm rainfall amount (P24), were determined from the isopluvial maps provided in Appendix B. Intensity can also be calculated using the following equation:

$$\mathbf{I = 7.44\ (P_6)\ (D^{-.645})}$$

I = Intensity (inches/hour)

P_6 = 6 Hour Precipitation (inches)

D = Duration in minutes (use Tc)

The Time of Concentration (Tc) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The Tc is composed of two components: initial time of concentration (Ti) and travel time (Tt). The Ti is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." The Tt is the time required for the runoff to flow in a watercourse or series of watercourses from the initial subarea to the point of interest. For the RM, the Tc at any point within the drainage area is given by:

$$Tc = Ti + Tt$$

The San Diego Unit Hydrograph (SDUH) Peak Discharge Program

The SDUH Peak Discharge Program may be used only for determination of peak flow rate, and may not be used for detention basin design or other routing purposes for which a hydrograph is required.

NRCS METHOD

The NRCS hydrologic method should be used for study areas approximately 1 square mile and greater in size. The NRCS hydrologic method may be used for the entire study area, or the RM or MRM may be used for approximately 1 square mile of the study area and then transitioned to the NRCS hydrologic method.

The Soil Conservation Service (SCS) (now called the Natural Resources Conservation Service [NRCS]) hydrologic method (NRCS hydrologic method) requires basic data similar to the RM: drainage area, a "runoff curve number" (CN) describing the proportion of rainfall that runs off, time to peak (T_p), the elapsed time from the beginning of unit effective rainfall to the peak flow for the point of concentration, and total rainfall (P).

The NRCS method includes the following basic steps:

1. Delineation of the watershed on a map and determination of watershed physical characteristics including location of centroid, total length and length to centroid, soil type, and land use/land treatment.
2. Determination of time to peak, the elapsed time from the beginning of unit effective rainfall to the peak flow for the point of concentration, and/or lag time, the elapsed time from

the beginning of unit effective rainfall to the instant that the summation hydrograph for the point of concentration reaches 50% of ultimate discharge. Corps lag is an empirical expression of the physical characteristics of a drainage area in terms of time. Corps lag can be expressed by the empirical formula:

Corps Tl (hours) = 24 n ((L x Lc) / s0.5) m (Eq. 4-17)

Where: L = length to longest watercourse (miles)
Lc = length along longest watercourse, measured upstream to a point opposite the watershed centroid (miles)
s = overall slope of drainage area between the headwaters and the collection point (feet per mile)
m = a constant determined by regional flood reconstitution studies (0.38 for San Diego County)
n = the average of the Manning's n values of the watercourse and its tributaries (see Section 4.3.5)

3. Determination of frequency of design storm, and determination of total rainfall amount for the design storm and precipitation zone number (PZN) for the watershed location,
4. Preparation of incremental rainfall distribution,
5. Adjustment of incremental rainfall depths based on watershed area,
6. Determination of composite curve number (CN) for the watershed, which will represent different combinations of land use and soil type within the drainage area and describe the proportion of rainfall that runs off,
6. Adjustment of CN based on the PZN Condition,
7. Determination of excess rainfall amounts using the PZN adjusted composite CN for the watershed and the depth-area adjusted incremental rainfall distribution,
8. Using the dimensionless unit hydrograph approach, development of the hydrograph of direct runoff from the drainage area.

Shapouri & Associates
18029 Calle Ambiente, Suite 502
Rancho Santa Fe, California 92067

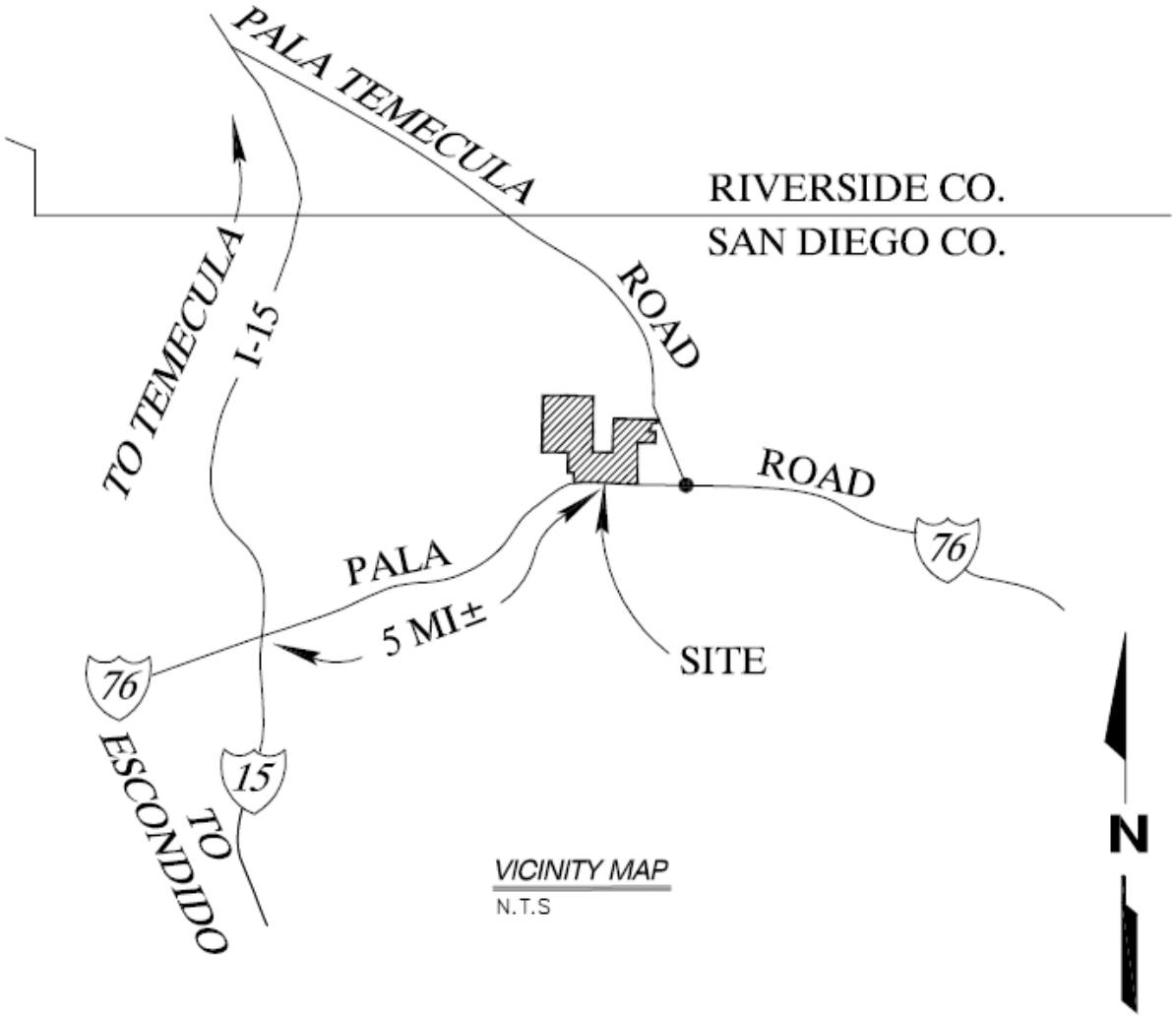


Figure 1 - Vicinity map

Pre-Development Conditions

The Project site is located in the northern portion of San Diego County. The location is approximately five miles east of northbound Interstate 15, approximately 40 miles north of the City of San Diego, in the northwest corner of the intersection of Pala Road (State Route 76) and Pala Temecula Road. The Pala Band of Mission Indians Reservation lies north, south and east of Specific Plan Area (SPA), with the Pala Casino Resort and Spa located directly southeast. Mostly agricultural areas are located along the Northern and Southern boundary of the site. Westerly of the site there is a San Diego gas & Electric power generation complex and existing agricultural industries. In addition there is a substantial acreage on the southwesterly portion of the site that is in process as a potential regional landfill site, i.e., Gregory Canyon Landfill. The project site consists of approximately 513 acres situated between two small bodies of intermittently flowing water on both sides. Gomez Creek runs through the western portion of the Project, and Pala Creek traverses through the eastern side.

The Site is characterized by diverse topography with elevation ranging 350 feet to 1,000 feet above mean sea level; the entire Gomez Creek (Design Point 1) basin study reaches a high elevation of 1,950'. The northern portion of the site within Gomez Creek drainage basin is generally depicted as moderate to steep slopes. The area contains a variety of vegetation types, including Chaparral and Coastal Sage Scrub. The Southern portion of the site is relatively flat and presently contains orchards, as well as a network of unimproved roads for the Gomez Creek basin area.

The total drainage study area for the Gomez creek basin is approximately ± 6.4 square miles, flowing southerly along the western side of the proposed project and eventually converges with the San Luis Rey River further south after crossing the existing Gomez Creek Bridge, serving the State Route 76, Pala Road. The drainage basin is mostly within soil group "C" and "D", there is a small percentage of soil groups "A" and "B" on the Southern part of the property on the proposed development site.

Post-Development Conditions

As specified in the project description the project site is approximately 513 acres in size from which 359 acres are being designated as preserved open space, another large portion is designated as landscape areas and parks. Post development conditions also propose storm drain systems that route through open swales and infiltration/detention basins to clean and contain hydrological flow during storm events. The post-hydrological area consists of one watershed; Gomez Creek Basin designated as: Design Point 1

The Gomez Creek basin was broken down into appropriate sub-basins, labeled 1 thru 113.

The project site within Gomez Creek sub-basins, will be graded for 780 residential units (534 single family detached, and 246 multi-family and attached town homes), including private community parks, landscaped areas, preserved open space, on-site fire station and a public recreational park, as Illustrated on the Post-development hydrology map. Various BMP areas are proposed within this Watershed, after which, all drainage flows are conveyed to the same design point (1). Bioretention/detention facilities areas intended to clean and contain hydrological flows during storm events and are labeled 1 thru 8, vegetated swale areas are labeled 1 thru 3.

Post-Development Runoff Analysis

The project has been designed so all surface runoff within the project site will follow the existing natural landforms, utilize natural drainage structures, and retain the existing flow path. All drainage facilities have been designed using the 100-year flood event. The Runoff coefficient (C) based on Post development conditions (0.30 - 0.90) for this project was derived from a specific coefficient set for different soils group, land use designation and the ultimate improvement of the site. These calculations have been made with aid from the appendices provided in the San Diego County Hydrology Manual. The Soils Group Coefficient (A/B, C/D), according to Table 3-1 of the County of San Diego's Hydrology Manual, has been set between 0.30 and 0.90 and is based on the existing and proposed density land use found within soil groups "(A, B, C, D)". The Intensity (I) has been computed by using the formula on Figure 3-2 and is represented by the following:

$$I := 7.44(P6)\,(D)^{-.645}$$

For sub-basin areas smaller than 1 square mile the Time of Concentration (Tc) is calculated for two cases: 1) Existing Conditions (Natural Undisturbed Watersheds) and 2) Urban Conditions (The Developed Project). The first, for existing (pre-development) condition is calculated using the formula in Figure 3-1 of the County of San Diego Hydrology Manual as follows:

$$Tc := \left[\frac{11.9 \cdot (L)^3}{H}\right]^{.385}$$ where:

L = Length of watershed basin

H = Difference in elevation along effective slope line

The urban condition is calculated using the formula in Section 3.1.4 of the County of San Diego Hydrology Manual. In the developed condition, Time of Concentration is computed from the sum of Inlet Time (Ti) and Travel Time (Tt)

Tc = Ti + Tt

From Figure 3-3 (Urban Areas Overland Time of Flow Nomograph formula from the San Diego County Hydrology Manual.)

$$T := \frac{1.8(1.1 - C)\,D^{.5}}{\sqrt[3]{S}}$$

T = Overland Flow Time (Ti)
C = Runoff Coefficient (C)
D = Watercourse Distance or Length of Flow (L) as in the other formulas here presented.
S = Effective Slope (S)

This formula gives the Initial Time of Concentration (Ti) which together with the Travel Time (Tt) will yield the Duration (D). In other words, Duration and Time of Concentration (Tc) are the same. The (D) factor and the Adjusted (P6) are constants of the Intensity formula on Figure 3-2 of the County of San Diego Hydrology Manual.

This produces the Intensity (I) constant of the formula Q = C I A. The last factor in distinguishing the drainage basin flow is the Area (A) or acreage of the drainage basin.

For sub-basin areas larger than 1 square the NRCS hydrologic method was used, refer to NRCS methodology describe above.

Conclusion

As designed, the development will not alter the natural drainage path or divert any drainage from the existing natural conditions or drainage boundaries. This CEQA Drainage Study has analyzed the hydrological flow and calculations for the proposed improvements and Preliminary Grading Plans (Tract No. 5508rpl4). All drainage facilities are designed using the peak discharge of a 100-year storm event. The runoff coefficient for the project is based on soil groups "A/B, C/D" and the Medium-Density Residential land use designation. This Drainage Study contains 1 Design Point, located at the Existing Gomez Creek Bridge crossing at State Route 76, Pala Road, and labeled as: "Design Point 1". The following discussion is a summary of the Drainage patterns for Design Point 1, as shown on the "Post Hydrology Maps" for Preliminary Grading Plan (Tract No. 5508rpl4) (dated 02/28/2013):

Design Point 1 consists of two drainage basins; Gomez Creek and the Project Development Basin, which have an overall drainage flow of 5,402 cubic feet per second (cfs). (Please refer to Post development study report and Post Hydrology Map attached) Gomez Creek basin, consists of Nodes 113.1 to 113.2, this basin contributes a majority of the drainage flow of approximately 5,066 cfs at the peak of the 100-year storm event. The second basin is the project development area, which contributes approximately, 375 cfs of the total flow, however, when combined with the Gomez Creek basin the flow is approximately 5,402 cfs. The second basin covers the majority of the project development area as well as the undeveloped lands situated to the north and northeast of the project at an elevation of 1,621 feet (Node 103.1). The drainage of this undisturbed area continue it's route through the project's storm drain system and converge into Dry-Detention Ponds 1 and 4, Bio-Retention Ponds 6 and ends at "Swale No.1" located at the south-west of the project boundary, Node 110. Drainage flows from Dry-Detention Pond No. 2 next to Public Park located at the southeast corner of the project boundary, Bio-Retention Ponds 3 and 8 all converge into Swale No. 2, which is located at southeast of the project boundary along SR76 and flows directly to Swale No. 1. Drainage flows from Bio-Retention No. 7 coincide with Swale No.1 as well. Drainage flows from Dry-Detention Pond No. 5 located at the

west corner converges into Swale No.3 and confluence with water from Swale No.1. Swale No.3 it's located near to the Gomez Creek Bridge.
As shown on the Preliminary Grading Plans and Post-Development hydrology map, the private drainage system is proposed to consist of:

- Five (4) Bio-Retention Ponds
- Four (4) Dry-Detention Ponds
- Four (4) Swales
- Drainage System that consist of majority of 24"RCP along with 30", 36", 42" 48" 54", and 66" RCP'S (Please refer to Post Hydrology Map for Pipe Sizing)
- One (1) 20' wide Box culvert, 2' height with 4 spans, each 5' wide, per San Diego Regional Standard Drawing D-77D.

The proposed drainage facilities have been designed to adequately convey the 100-year flood conditions, and are sufficient to protect the proposed site development as shown on the attached "Post Hydrology Map".

Overall, the project results in a minor decrease of drainage flow (See attached Comparison Pre & Post Table A) from pre-development conditions and thus will not contribute to the existing water stream under Gomez Creek Bridge crossing (Design Point 1). All proposed grading and associated drainage/stormwater management for the project has been designed to comply with all County Regulations, including the San Diego County Watershed Protection and Stormwater Management and Discharge Control Ordinance.

Declaration of Responsible Charge

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

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

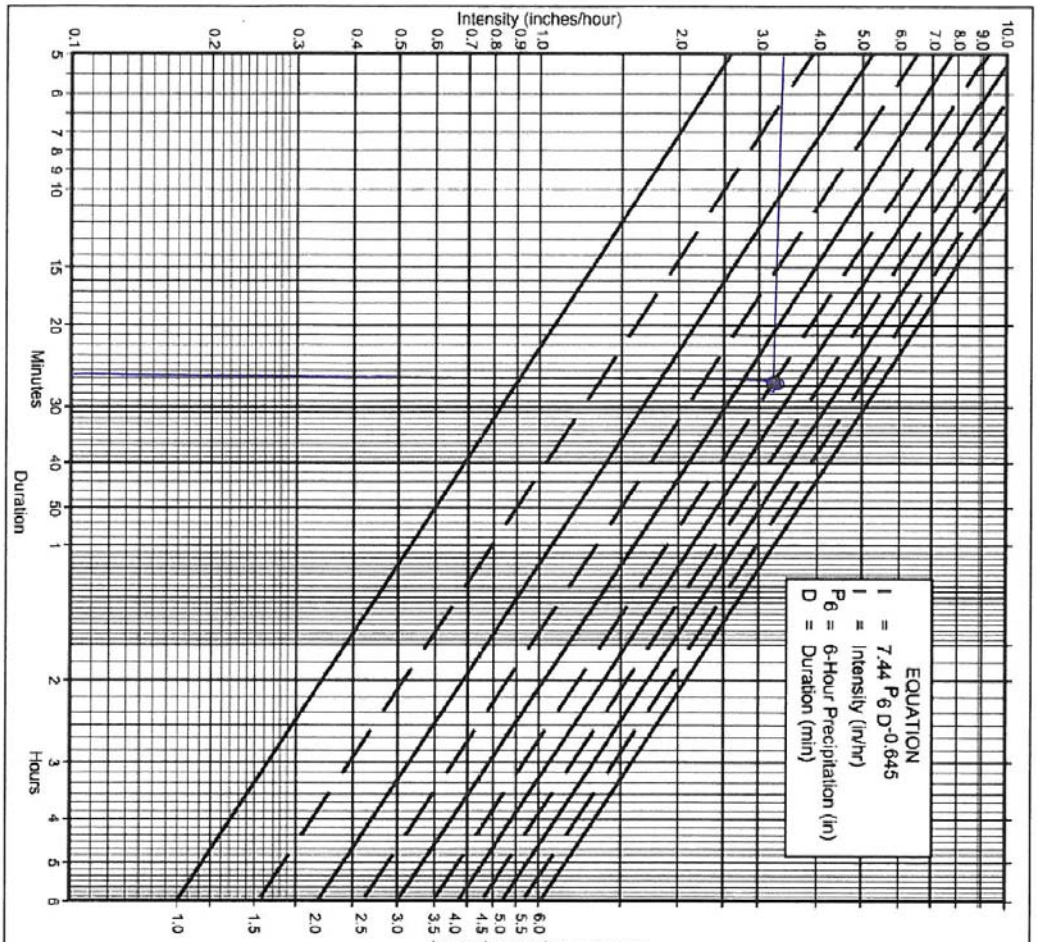
Name: M.H. Shapouri

Address: 18029 Calle Ambiente Suite 502, Rancho Santa Fe, CA 92067

Telephone No: (858) 756-8340

By: _____ Date: ____/____/____
M.H. Shapouri

R.C.E. No: C52794 Expires: 12/31/2014



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 = 3.5 in., P_{24} = 6.0 in., $\frac{P_6}{P_{24}}$ = 58.3 %(2)

(c) Adjusted P_6(2) = 3.52 in.

(d) t_x = 25 min.

(e) I = 3.22 in./hr.

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

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

Intensity-Duration Design Chart - Template

FIGURE **3-1**

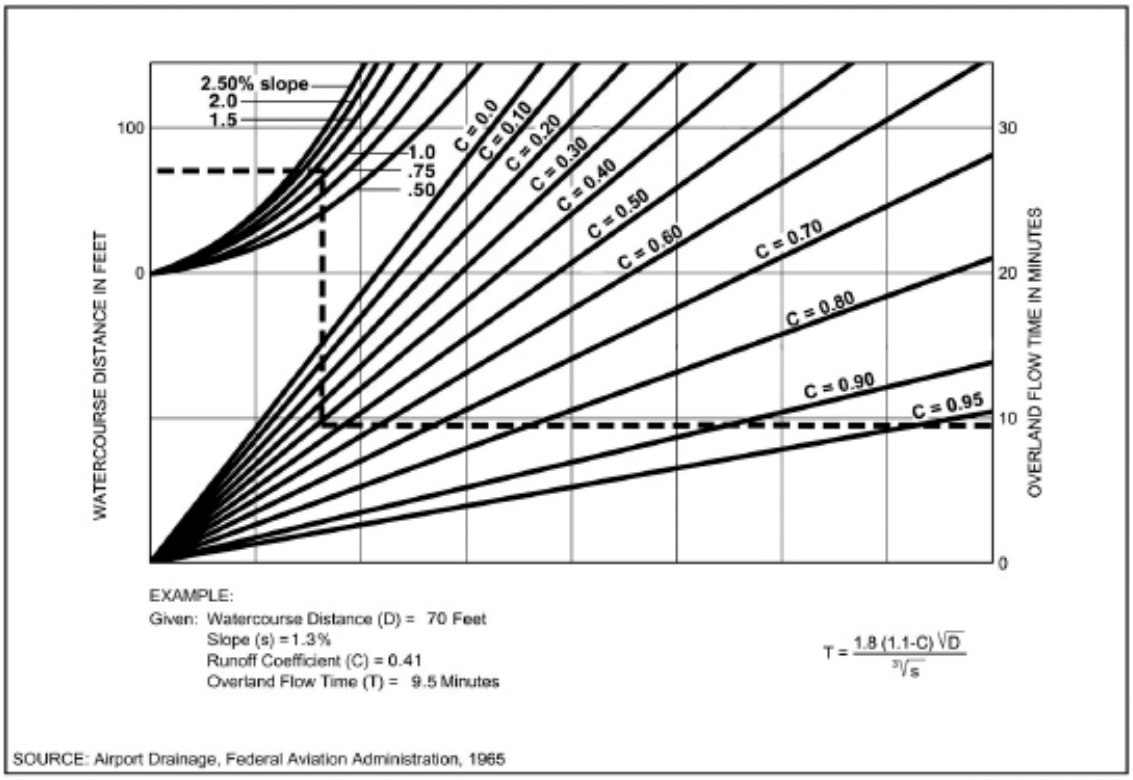
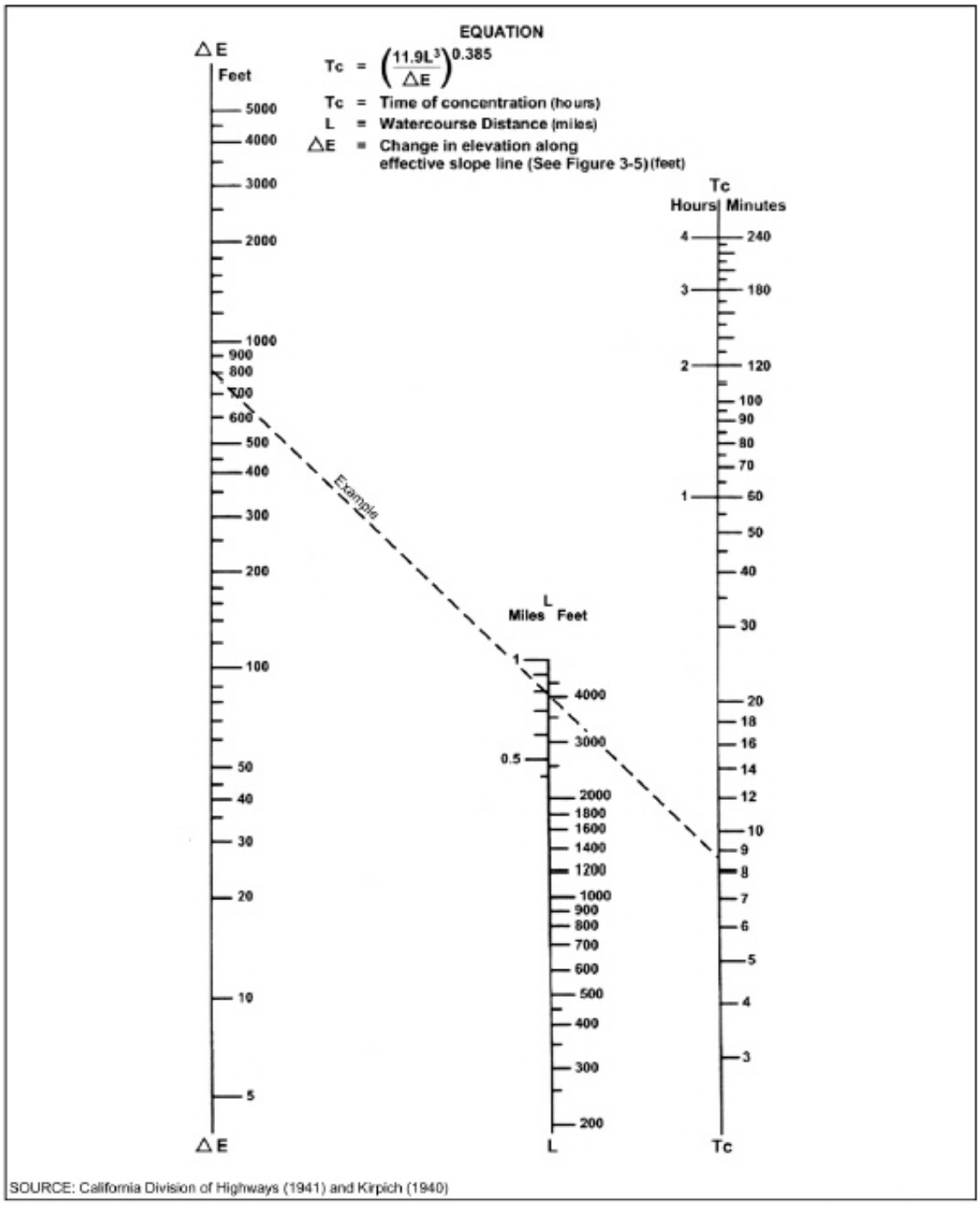


FIGURE 3-3

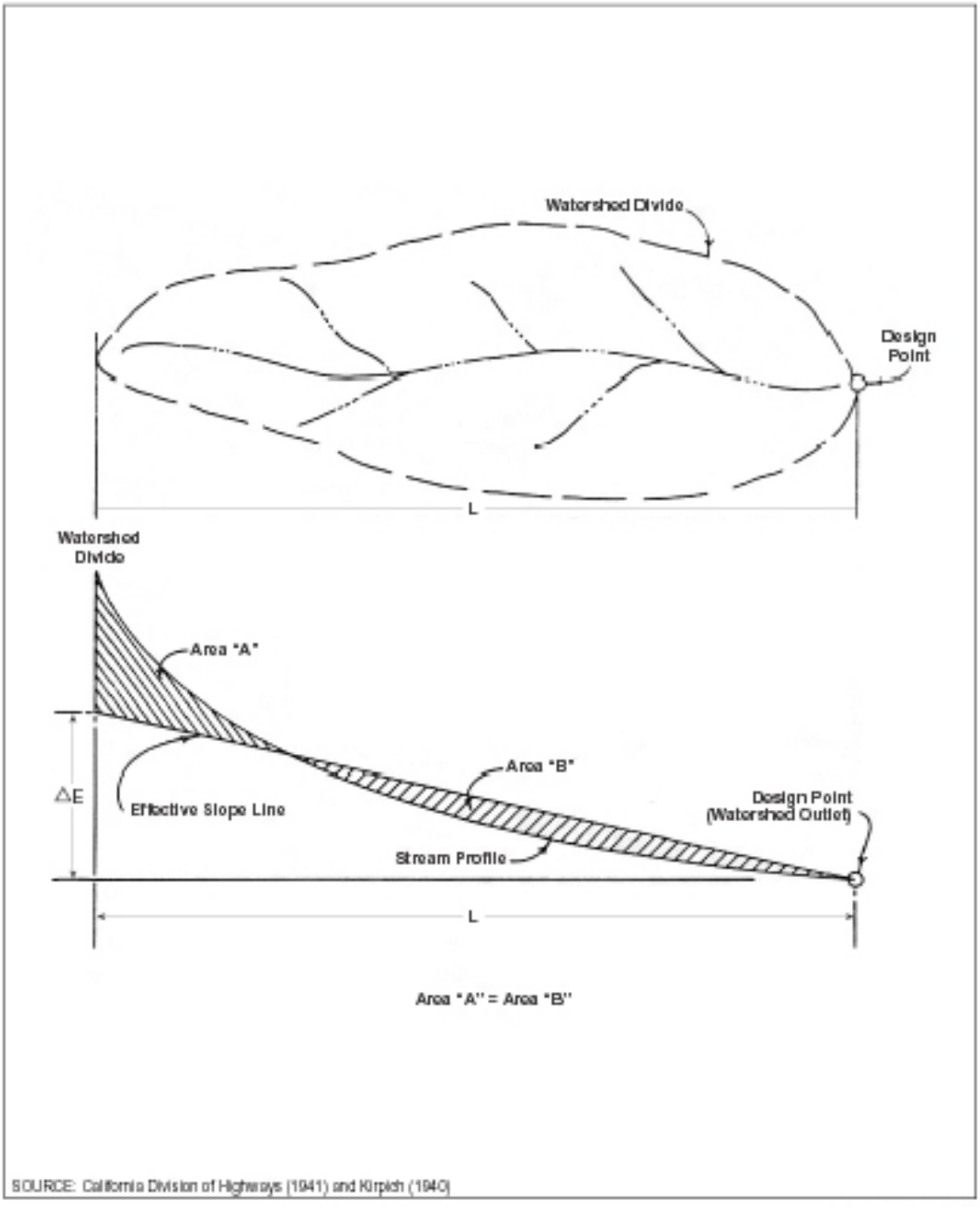
Rational Formula - Overland Time of Flow Nomograph



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



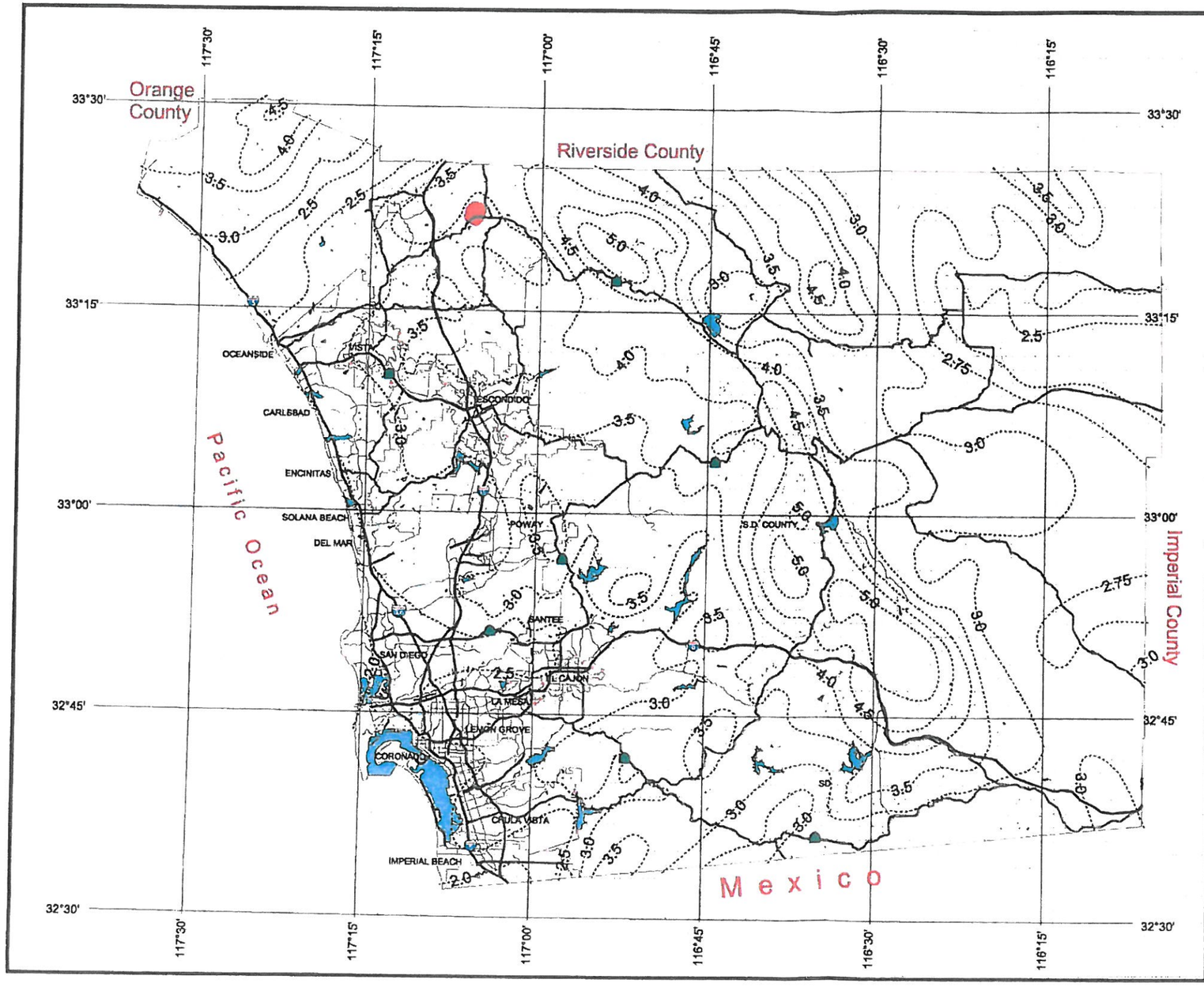
SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-5

Computation of Effective Slope for Natural Watersheds

Rainfall Isopluvial Maps

100 Year Rainfall Event



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (Inches)

● PROJECT LOCATION
LONG: 33° 21' 60"
LAT: 117° 5' 36"

DPW GIS

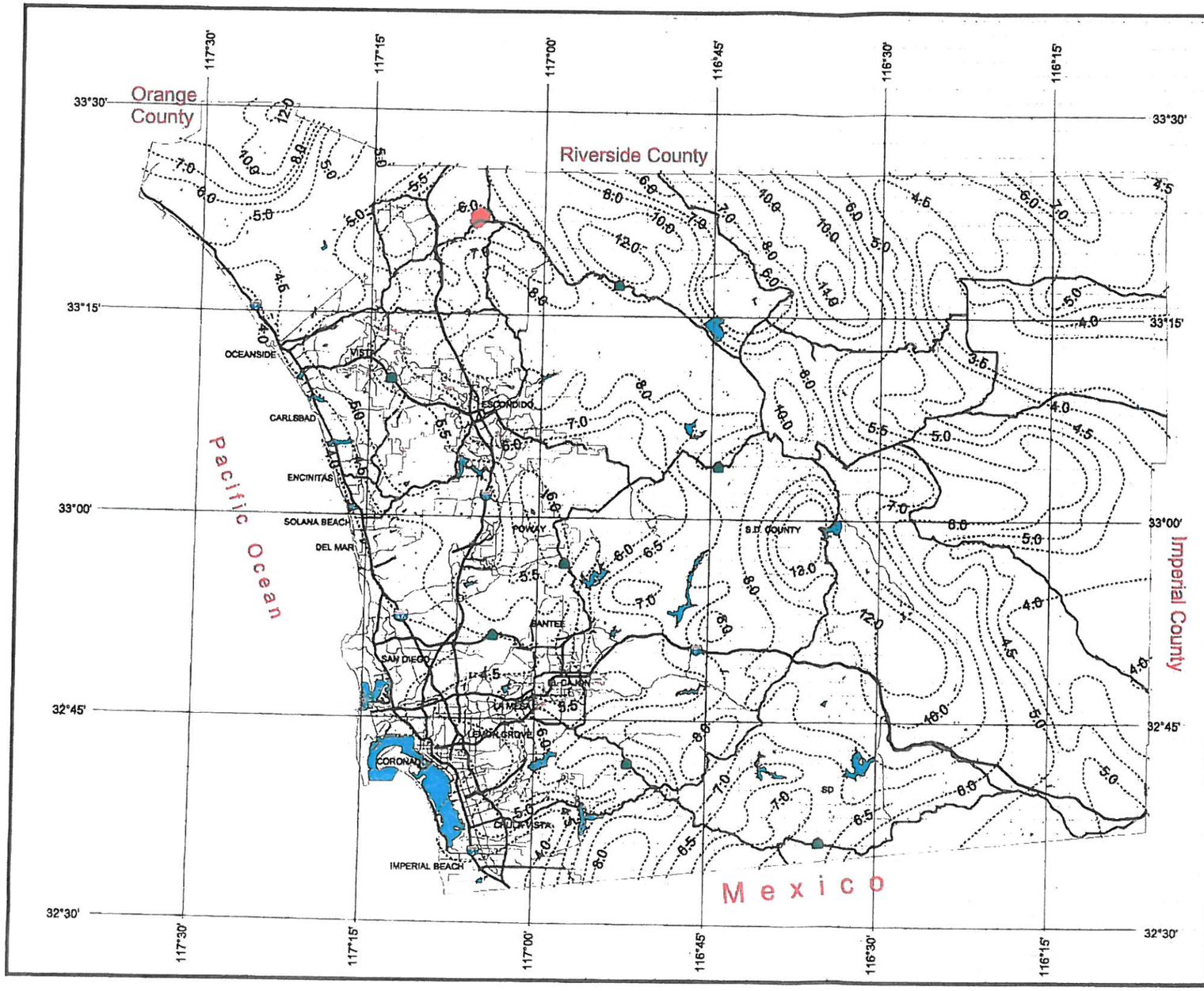
SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

● PROJECT LOCATION
LONG: 33° 21' 60"
LAT: 117° 5' 36"

DPW GIS — Department of Public Works

SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles

Pre Development Condition Hydrology Calculations

Design Point 1

100-year Pre Development Conditions

WARNER RANCH-GOMEZ CREEK BASIN 1

100-YEAR STORM EVENT

PRE DEVELOPMENT HYDROLOGY

NRCS HYDROLOGIC METHOD

WORKSHEET 4-2 WARNER RANCH (name of project) **Curve Number Worksheet**

RUNOFF CURVE NUMBER (for PZN Condition = 2.0) CN_2:

column 1	column 2	column 3	column 4	column 5	column 6
GROUND COVER/ LAND USE	HYDROLOGIC CONDITION (field inspection)	SOIL GROUP	CN_2 From Hydrology Manual, Table 4-2	FRACTION OF AREA A_i/A	PARTIAL CN_2 $CN_2 \times A_i/A$
BC - BROADLEAF CHAPARRAL	GOOD	A	31	0.68	0.21
		B	57	3.61	2.06
BC - BROADLEAF CHAPARRAL	GOOD	C	71	32.49	23.07
		D	78	40.46	31.56
FS - FARMSTEADS	GOOD	A	59	0.37	0.22
		B	74	0.76	0.56
FS - FARMSTEADS	GOOD	C	82	0.26	0.21
		D	88	1.67	1.44
ME - MEADOW	GOOD	A	30	0.01	0.00
		B	58	0.36	0.21
ME - MEADOW	GOOD	C	72	0.33	0.24
		D	78	0.62	0.48
VY - VINEYARDS	GOOD	A	38	0.31	0.12
		B	61	0.81	0.49
		C	74	3.87	2.87
		D	80	9.25	7.40
WO - WOODLAND	GOOD	A	28	0.06	0.02
		B	55	0.06	0.03
WO - WOODLAND	GOOD	C	70	0.93	0.65
		D	77	3.09	2.38
				Sums = 1.000	74.21

For entire basin CN_2 = 74

WORKSHEET 4-3 WARNER RANCH (name of project) **Peak Discharge Computation**

*****For use with NRCS Hydrologic Method Computations*****

Items in boxes are required input parameters for the SDUH Peak Discharge Program.

Computed by: SHAPOURI & ASSOCIATES Date: 11-14-2011

Project Identification (Drainage Area Name): GOMEZ CREEK BASIN 1

Geographic location of center of drainage area: Long: 33° 21' 60" Lat: 117° 5' 36"

Drainage Area: 6.43 – square miles

Storm Frequency (Section 2.3): 100 – year

6-Hour Storm Duration Precipitation (Appendix B): 3.5 – inches

24-Hour Storm Duration Precipitation (Appendix B): 6 – inches

Precipitation Zone Number (PZN): (Section 4.1.2.4 and Appendix C)
PZN = 1.0 ____ 2.0 1.95 3.0 ____ 4.0

PZN Ajustment Factor for 5-year to 35-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6)
1.5 ____ 2.5 ____ 2.0 ____ 1.5

PZN Ajustment Factor for 35-year to 150-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6)
2.0 ____ 3.0 2.95 3.0 ____ 2.0

PZN Adjusted Runoff Curve Number (interpolate between nearest whole number PZN conditions): (Sections 4.1.2.4 and 4.2.4, Tables 4-6 and 4-10)
$CN_{1.0 \text{ or } 2.0}$ 74 CN_X 78 $CN_{2.0 \text{ or } 3.0}$ 88

Watershed Length (L) (Section 4.3.1): 5.26 – miles

Length to Centroid (L_c) (Section 4.3.1): 2.88 – miles

Slope (s) (Section 4.3.1): 305 – feet/mile

Basin $\bar{n}$ Factor (Section 4.3.5): 0.035

Corps lag (T_L) = 24 $\bar{n}$ $((L \times L_c)/s^{0.5})^m$ (Section 4.3.1.1)
OR
Corps lag (T_L) = 0.8 T_c (Section 4.3.1.2)

Lag Time: 0.80 – hours

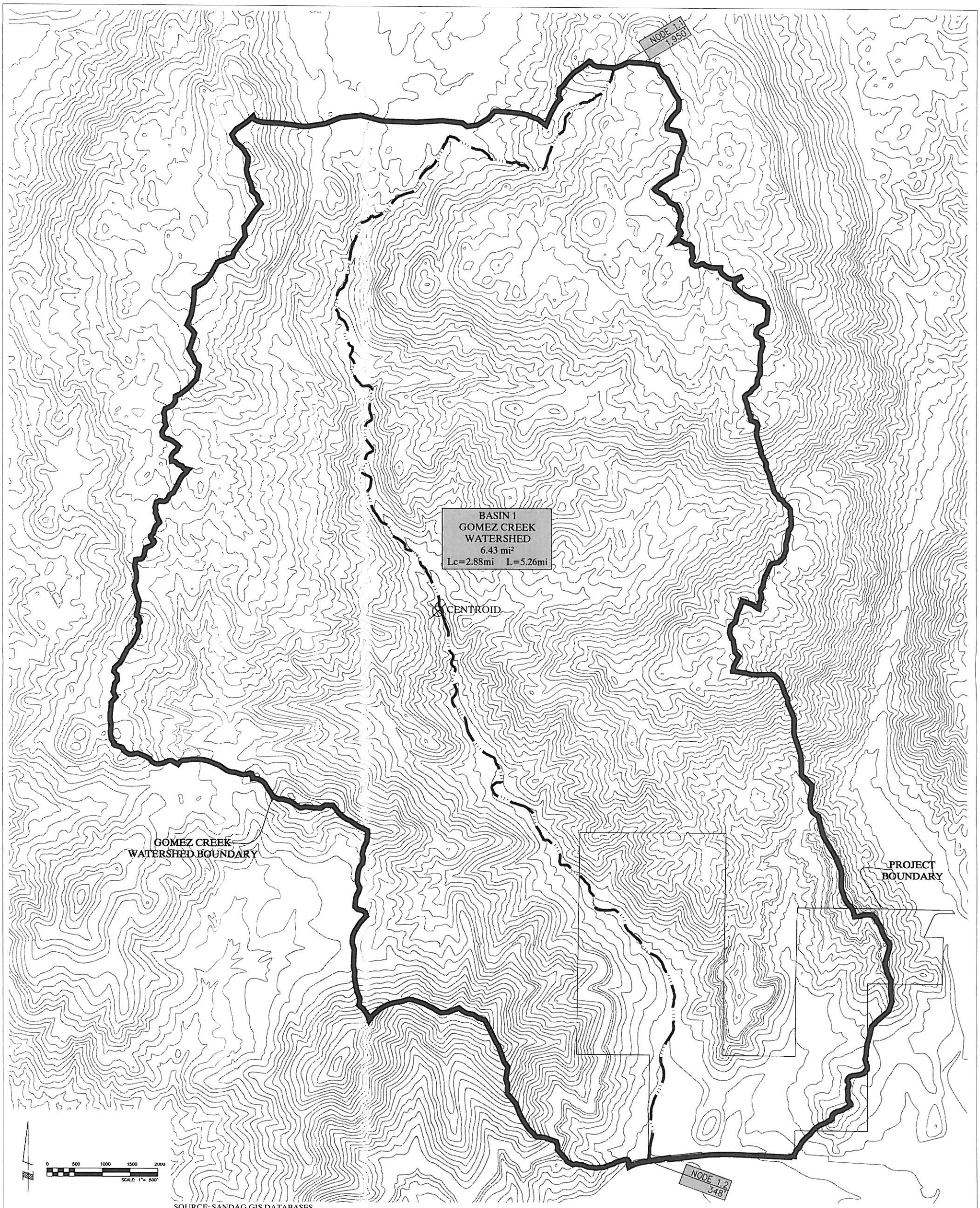
Time to Peak = 0.862 x Corps lag (Section 4.1.5.5):

Time to Peak : 0.69 – hours

```
*************************************************************************
*******
  * The San Diego Unit Hydrograph (SDUH) Peak Discharge Program uses the       *
  * procedures described in Section 4 of the San Diego County Hydrology        *
  * Manual for NRCS Hydrologic Method calculations.  The SDUH Peak Discharge   *
  * Program may be used only for determination of peak flow rate, and may not  *
  * be used for detention basin design or other routing purposes for which a   *
  * hydrograph is required.  To generate a hydrograph, the calculation method  *
  * described in Section 4 of the San Diego County Hydrology Manual may be     *
  * used, or a computer program that includes good documentation of the        *
  * calculations (see Section 1.7 of the San Diego County Hydrology manual).   *
  * Note: the RATHYDRO computer program is not based on the calculation method *
  * described in Section 4 of the San Diego County Hydrology Manual and may    *
  * not be used to generate a hydrograph based on the SDUH Peak Discharge      *
  * Program output.                                                            *

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

   Project Identification: WARNER RANCH, GOMEZ CREEK BASIN 1
   Storm Frequency (years) =  100
   Drainage Area (square miles) =    6.43
   6-Hour Rainfall (inches) =     3.50
   6-Hour Depth-Area Factor =    0.984
   24-Hour Rainfall (inches) =     6.00
   24-Hour Depth-Area Factor =    0.989
   Adjusted Curve Number = 78
   Unit Interval (minutes) =  5
   Watershed Lag Time (hours) =    0.800
   Peak Flow Rate (cfs) =     5,697.9
```



SOURCE: SANDAG GIS DATABASES

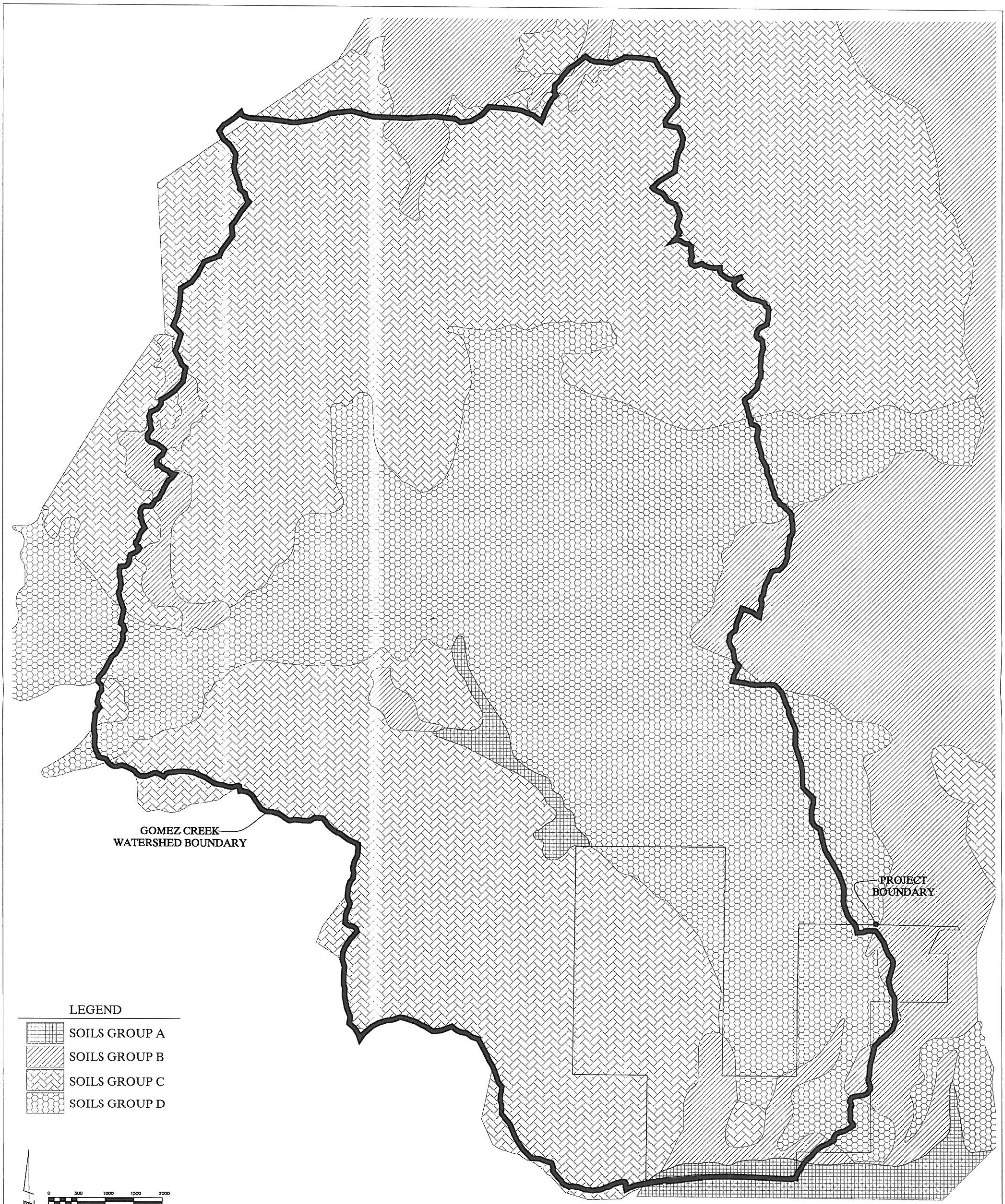
SHEET TITLE
WATERSHED
GEOGRAPHIC
LOCATION AND
PHYSICAL
CHARACTERISTICS

SHAPOURI & ASSOCIATES
PROJECT MANAGEMENT SERVICES
ENGINEERING · ARCHITECTURE · PLANNING
CIELO VILLAGE, 18039 CALLE AMMIENTE, SUITE 202
P. O. BOX 678221, RANCHO SANTA FE, CALIF. 92067
PHONE (858)756-8340 FAX (858)756-8344

WARNER RANCH

Pre-Development Hydrology Map

JOB NO.
DRAWN:
SUBMITTALS:
REVISIONS:
A



SOURCE: GIS ANALYSIS OF SAN DIEGO SOIL SURVEY

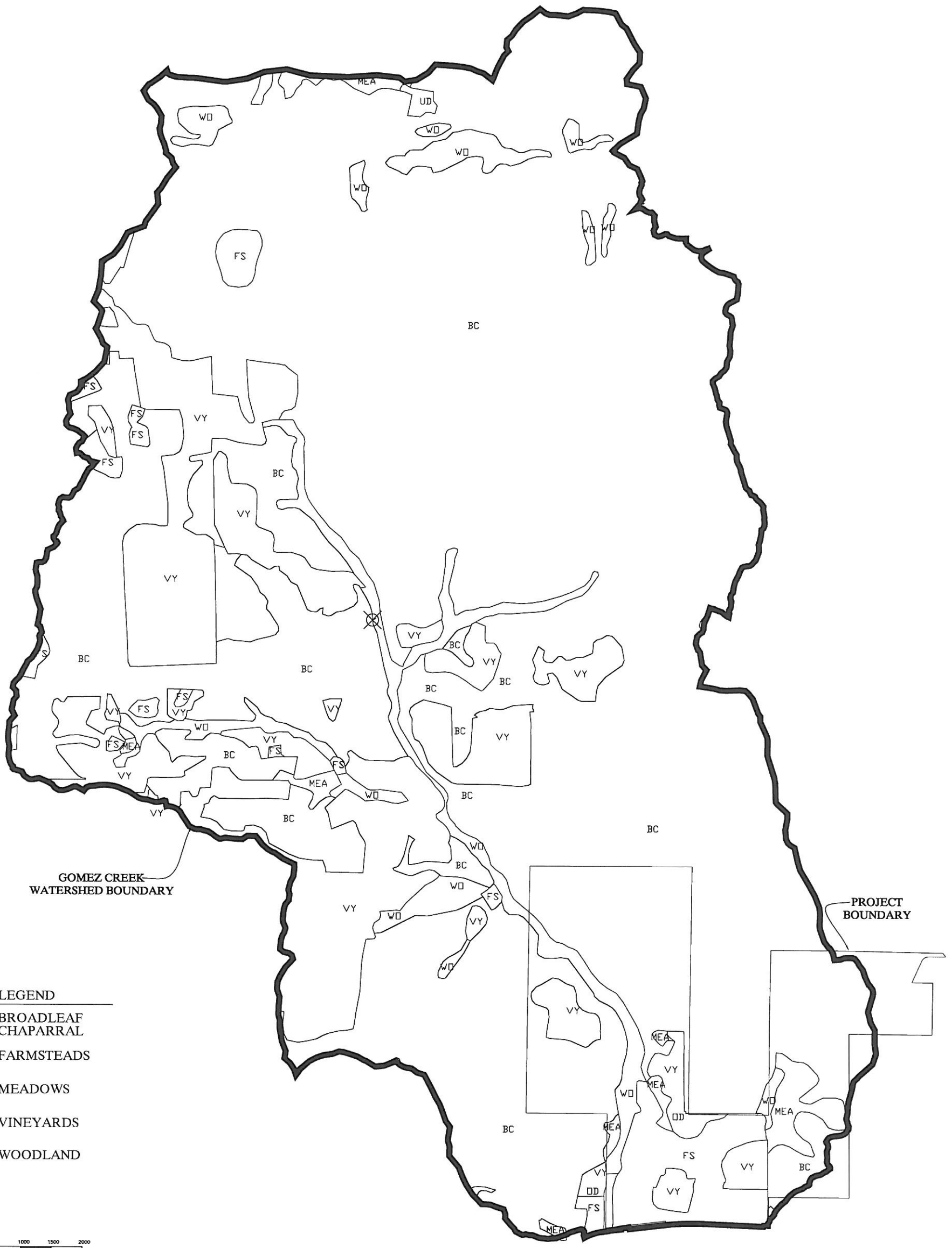
SHEET TITLE:
WATERSHED
HYDROLOGIC
SOILS GROUPS

SHAPOURI & ASSOCIATES
PROJECT MANAGEMENT SERVICES
ENGINEERING • ARCHITECTURE • PLANNING
CIELO VILLAGE, 1809 CALLE AMIENTE, SUITE 50
P.O. BOX 679231, RANCHO SANTA FE, CALIF. 92067
PHONE (858)756-8340 FAX (858)756-8344

WARNER RANCH

Pre-Development Hydrology Map

JOB NO.:
DRAWN:
SUBMITTALS:
BY:DESCRIPTION:



LEGEND

BC	BROADLEAF CHAPARRAL
FS	FARMSTEADS
ME	MEADOWS
VY	VINEYARDS
WO	WOODLAND

0 500 1000 1500 2000
SCALE: 1"= 500'

SOURCE: SANDAG GIS DATABASES

SHEET TITLE:
WATERSHED HYDROLOGIC GROUND COVER

SHAPOURI & ASSOCIATES
PROJECT MANAGEMENT SERVICES
ENGINEERING · ARCHITECTURE · PLANNING
CIVIC VILLAGE, 10620 CALLE AMBIENTE, SUITE 202
P.O. BOX 676221, RANCHO SANTA FE, CALIF. 92067
PHONE (858)756-8341 FAX (858)756-8344

WARNER RANCH

Pre-Development Hydrology Map

JOB NO.:
DRAWN:
SUBMITTALS:
REVISIONS:

Design Point 1

100-year Development Conditions

WARNER RANCH-GOMEZ CREEK BASIN 113

100-YEAR STORM EVENT

POST DEVELOPMENT HYDROLOGY

NRCS HYDROLOGIC METHOD

WORKSHEET 4-2 WARNER RANCH (name of project) **Curve Number Worksheet**

RUNOFF CURVE NUMBER (for PZN Condition = 2.0) CN_2:

column 1	column 2	column 3	column 4	column 5	column 6
GROUND COVER/ LAND USE	HYDROLOGIC CONDITION (field inspection)	SOIL GROUP	CN_2 From Hydrology Manual, Table 4-2	FRACTION OF AREA A_i/A	PARTIAL CN_2 $CN_2 \times A_i/A$
BC- BROADLEAF CHAPARRAL	GOOD	A	31	0.86	0.27
		B	57	3.68	2.10
BC- BROADLEAF CHAPARRAL	GOOD	C	71	26.24	18.63
		D	78	46.52	36.29
FS- FARMSTEADS	GOOD	A	59	0.01	0.00
		B	74	0.08	0.06
FS- FARMSTEADS	GOOD	C	82	0.09	0.07
		D	86	1.46	1.26
ME- MEADOW	GOOD	A	30	0.00	0.00
		B	58	0.11	0.06
		D	78	0.70	0.55
VY- VINEYARDS	GOOD	A	38	0.34	0.13
		B	61	0.30	0.18
VY VINEYARDS	GOOD	C	74	4.35	3.22
		D	80	10.59	8.48
WO- WOODLANDS	GOOD	A	28	0.07	0.02
		B	55	0.04	0.02
WO- WOODLANDS	GOOD	C	70	0.99	0.69
		D	77	3.57	2.75
			Sums =	1.000	74.77

For entire basin CN_2 = 75

WORKSHEET 4-3 WARNER RANCH (name of project) **Peak Discharge Computation**

*****For use with NRCS Hydrologic Method Computations*****

Items in boxes are required input parameters for the SDUH Peak Discharge Program.

Computed by: SHAPOURI & ASSOCIATES Date: 11-28-2012

Project Identification (Drainage Area Name): GOMEZ CREEK BASIN 113

Geographic location of center of drainage area: Long: 33° 21' 60" Lat: 117° 5' 36"

Drainage Area: [5.57] – square miles

Storm Frequency (Section 2.3): [100] – year

6-Hour Storm Duration Precipitation (Appendix B): [3.5] – inches

24-Hour Storm Duration Precipitation (Appendix B): [6] – inches

Precipitation Zone Number (PZN): (Section 4.1.2.4 and Appendix C) PZN = 1.0 ____ 2.0 1.95 3.0 ____ 4.0

PZN Ajustment Factor for 5-year to 35-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 1.5 ____ 2.5 ____ 2.0 ____ 1.5

PZN Ajustment Factor for 35-year to 150-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 2.0 ____ 3.0 2.95 3.0 ____ 2.0

PZN Adjusted Runoff Curve Number (interpolate between nearest whole number PZN conditions): (Sections 4.1.2.4 and 4.2.4, Tables 4-6 and 4-10) $CN_{1.0 \text{ or } 2.0}$ 75 CN_X [79] $CN_{2.0 \text{ or } 3.0}$ 88

Watershed Length (L) (Section 4.3.1): 5.26 – miles

Length to Centroid (L_c) (Section 4.3.1): 2.88 – miles

Slope (s) (Section 4.3.1): 305 – feet/mile Basin $\bar{n}$ Factor (Section 4.3.5): 0.035

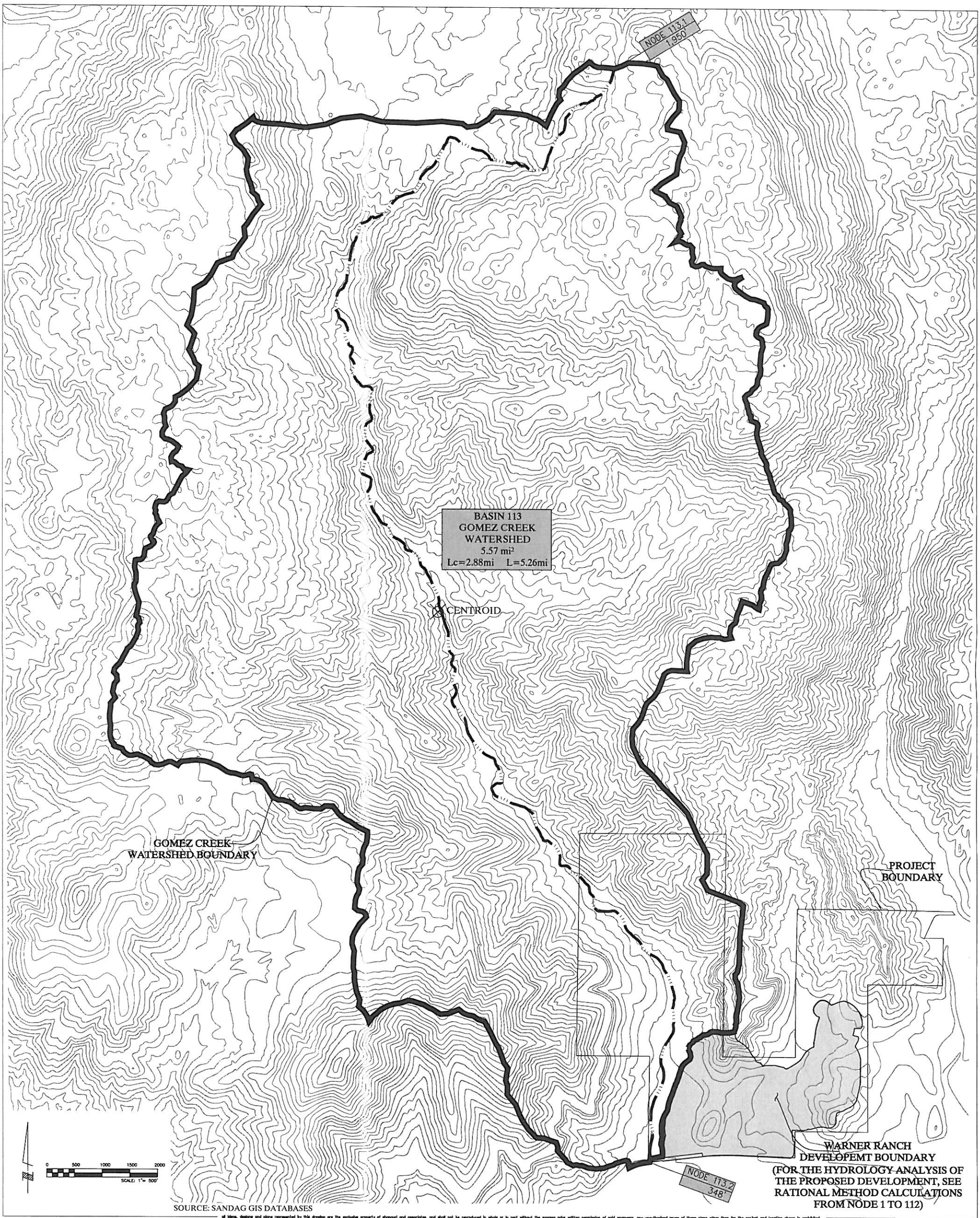
Corps lag (T_L) = 24 $\bar{n}$ $((L \times L_c)/s^{0.5})^m$ (Section 4.3.1.1)
OR
Corps lag (T_L) = 0.8 T_c (Section 4.3.1.2) Lag Time: [0.8] – hours

Time to Peak = 0.862 x Corps lag (Section 4.1.5.5): Time to Peak : 0.69 – hours

```
*************************************************************************
*******
  * The San Diego Unit Hydrograph (SDUH) Peak Discharge Program uses the       *
  * procedures described in Section 4 of the San Diego County Hydrology        *
  * Manual for NRCS Hydrologic Method calculations.  The SDUH Peak Discharge   *
  * Program may be used only for determination of peak flow rate, and may not  *
  * be used for detention basin design or other routing purposes for which a   *
  * hydrograph is required.  To generate a hydrograph, the calculation method  *
  * described in Section 4 of the San Diego County Hydrology Manual may be     *
  * used, or a computer program that includes good documentation of the        *
  * calculations (see Section 1.7 of the San Diego County Hydrology manual).   *
  * Note: the RATHYDRO computer program is not based on the calculation method *
  * described in Section 4 of the San Diego County Hydrology Manual and may    *
  * not be used to generate a hydrograph based on the SDUH Peak Discharge      *
  * Program output.                                                            *

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

   Project Identification: WARNER RANCH, GOMEZ CREEK BASIN 113
   Storm Frequency (years) =  100
   Drainage Area (square miles) =    5.57
   6-Hour Rainfall (inches) =     3.50
   6-Hour Depth-Area Factor =    0.984
   24-Hour Rainfall (inches) =     6.00
   24-Hour Depth-Area Factor =    0.989
   Adjusted Curve Number = 79
   Unit Interval (minutes) =  5
   Watershed Lag Time (hours) =    0.800
   Peak Flow Rate (cfs) =     5,066.7
```



SOURCE: SANDAG GIS DATABASES

SHEET TITLE:
WATERSHED
GEOGRAPHIC
LOCATION AND
PHYSICAL
CHARACTERISTICS

SHAPOURI & ASSOCIATES
PROJECT MANAGEMENT SERVICES
ENGINEERING • ARCHITECTURE • PLANNING
CIELO VILLAGE, 18079 CALLE AMBIENTE, SUITE 301
P. O. BOX 678221, RANCHO SANTA FE, CALIF. 92067
PHONE (858) 756-8140 FAX (858) 756-8144

WARNER RANCH

Post-Development Hydrology Map

REVISIONS
1
2
3
DRAWN:
SUBMITTALS:
JOB NO: