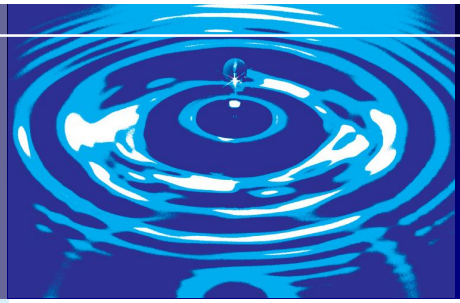

CEQA Drainage Study

Peaceful Valley Ranch Fire Station
San Diego, California
Log # 04-19-007A

August 2006

Prepared for:

Peaceful Valley Ranch LLC
14131 Hillside Drive
Jamul, CA 91935

Prepared by:

RBF CONSULTING
9755 Clairemont Mesa Blvd. Suite 100
San Diego, California 92124-1324
858.614.5000 telephone
858.614.5001 fax

RBF Contact Person:

Rich Lucera, RCE 58089
Steve Wragg

RBF JN 25-101357

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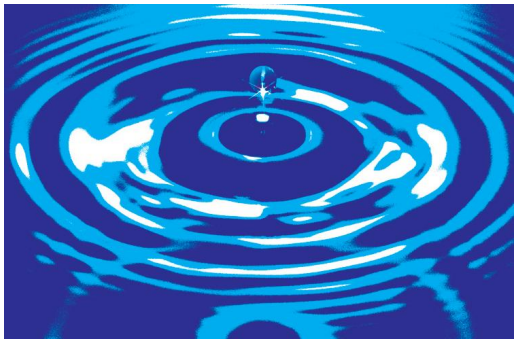

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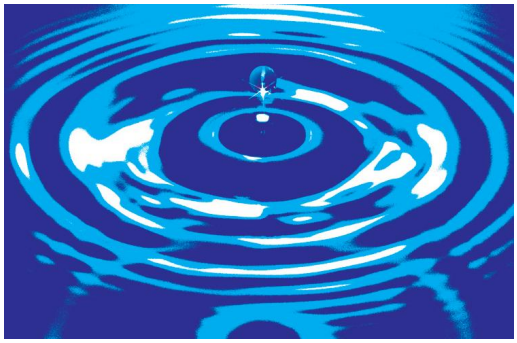


Introduction

This drainage report presents an analysis of the effects the proposed Peaceful Valley Ranch Fire Station on the *quantity* and *pattern* of the storm water runoff from the local watershed. The purpose of this report is to help fulfill requirements of the California Environmental Quality Act (CEQA). Storm water *quality* is addressed in the Storm Water Management Plan (SWMP) for the project, which is under separate cover from this document.

This report examines the existing and proposed hydrology of the site and nearby vicinity and presents preliminary design of drainage facilities. This report is for planning purposes and does not present final design engineering recommendations for the project.

Section 1. Project Information

This section describes the location, activities, and hydrologic setting (watershed, topography, land use, soils and vegetation, drainage patterns, and impervious cover) of the project site.

1.1. Project Description

1.1.1 Project Location

The project site is located in the community of Jamul in San Diego, California. The project is located just east of SR-94/Campo Road (reference Thomas Bros. 1291-J3) provides a location map for the site.

1.1.2 Project Activities Description

The Peaceful Valley Ranch Fire Station project construction of administration buildings for both the Rural Fire Protection District and US Fish and Wildlife Service (totaling approximately 14,100 sf.), related parking, access drives, a fuel storage tank, and utility services. Sewage service for the site will be provided by means of an on-site septic system. The project site is approximately 3.7 acres. Future improvements that impact site drainage consist of construction of an equestrian path as well as an 8’ wide shoulder along the Campo Road frontage.

1.1.3 Topography and Watershed Patterns

The topography of the site creates two basic watersheds. Watershed "A" drains to an existing 12" storm drain in Campo Road, immediately adjacent to the existing access drive. Watershed "B" drains towards an existing swale off the southeast property corner. This swale ultimately discharges to Jamul Creek. A natural ridge divides the two watersheds and there is approximately 50' of elevation difference between the ridge high point and the study points for each watershed. Existing and proposed topography, with watershed delineation is shown on the enclosed Pre and Post Development Watershed Maps (**Exhibits C and D**)

1.1.4 Soil and Vegetation Conditions

No soils report has been prepared at this preliminary stage of the project. Therefore, the Soil Survey for the San Diego Area by the Soil Conservation Service (1973) forms the basis of this discussion.

The Soil Survey indicates that Las Ponas Stony Fine Sandy Loam (Type D), Fallbrook Sandy Loam (Type C), and Ramona Sandy Loam (Type C) soils are present. Existing groundcover could best be described as a moderate grassy meadow. Existing delineation of various site soils are shown on the enclosed Pre and Post-Development Hydrology Maps (**Exhibits C and D**)

1.1.5 Floodplain Mapping

The Federal Emergency Management Agency (FEMA) has not mapped any Special Flood Hazard Areas (SFHAs) for Jamul Creek on the project site. The San Diego County Comprehensive Flood Control Plan for Flood Control District Zone 4 (1975) states that the peak 100-year discharge on the local reach of Jamul Creek will be approximately 2671 cfs. The inundation area corresponding to this peak discharge does not encroach into either of the project watersheds. (**See Exhibit 'B'**)

1.1.6 Downstream Conditions

Because Post Development Runoff has been limited to pre-development levels, no adverse impact to receiving structures or watercourses will occur.

1.1.7 Impervious Cover

The only existing impervious cover is from the site access drive as well as the portion of Campo Road that drains to the adjacent 12' pipe. Proposed impervious surfaces are related to the proposed parking and driveway areas, the two administration buildings, the future equestrian paths, and the future 8' wide shoulder along Campo Road. Existing and proposed impervious surfaces are delineated on the enclosed Pre and Post-Development Watershed Maps (**Exhibits C and D**).

1.2. Proposed Runoff Management Facilities

The proposed facilities managing runoff from the site include:

- Appropriate grading of pads to direct runoff away from structures on the site.
- Storm drain systems to direct on-site runoff to appropriate outfalls.
- Vegetated swales that will intercept runoff for treatment before directing the discharge offsite.

Section 2. Methodology and Design Criteria

This section summarizes the design criteria and methodology applied during drainage analysis of the project site. The design criteria and methodology follow the County of San Diego Hydrology Manual, Hydraulic Design and Procedure Manual, and Storm Water Standards as appropriate for the project site.

2.1. Hydrologic Design Methodology

2.1.1 Rational Method: Peak Flow

Runoff calculations for this study were accomplished using the Rational Method. The Rational Method is a physically based numerical method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage. Flows were computed based on the Rational formula:

$$Q = C\,i\,A$$

where ... Q = Peak discharge (cfs);
C = runoff coefficient, based on land use and soil type;
i = rainfall intensity (in/hr);
A = watershed area (acre)

The runoff coefficient represents the ratio of rainfall that runs off the watershed versus the portion that infiltrates to the soil or is held in depression storage. The runoff coefficient is dependent on the land use coverage and soil type (**Table 2-1**).

For a typical drainage study, rainfall intensity varies with the watershed time of concentration. The watershed time of concentration at any given point is defined as the time it would theoretically take runoff to travel from the most upstream point in the watershed to a concentration point, as calculated by equations in the San Diego County Hydrology Manual.

Peak discharges were computed for 100-year, 50-year, and 10-year design storm frequencies. Rainfall intensity was calculated using the method described in Section 3.1.3. of the San Diego County Drainage Manual.

Table 2-1 Basic Rational Method Runoff Coefficients.

LAND USE	**RUNOFF COEFFICIENT**			
SCS Soil Type	**A**	**B**	**C**	**D**
Single-Family Residential	0.40	0.45	0.50	0.55
Multi-Family Residential	0.45	0.50	0.60	0.70
Mobile Homes	0.45	0.50	0.55	0.65
Rural (< 2 d.u./acre)	0.30	0.35	0.40	0.45
Commercial (80% Impervious)	0.70	0.75	0.80	0.85
Industrial (90% Impervious)	0.80	0.85	0.90	0.95

Section 3. Hydrologic Effects of Project

This section characterizes the quantities and location of storm water runoff from the project site. Discussion of the water quality aspects of the project can be found in the Storm Water Management Plan (SWMP), which is under separate cover from this report.

3.1. Drainage Patterns

The proposed project will not significantly alter drainage patterns on the site. Runoff from the project site may be concentrated at storm drain outfalls but is not substantially diverted from its existing outlet locations.

3.2. Impervious Cover

The project will add approximately 65,000 square feet of impervious area (33% percent of the total project site) in the form of rooftops, parking and access drives, etc. Because of the increase in impervious area, resultant increases in runoff have been calculated.

3.3. Peak Runoff

Table 3-1 summarizes the hydrologic effects in terms of calculated peak runoff from the project site. In general, study point "A" will not experience an increase in peak runoff, while study point "B" will be subject to increases of roughly 300%. However, with provision for a detention basin of approximately 19,820 cubic feet, we believe runoff can be detained to predevelopment levels.

Table 3-1 Summary of Hydrology Analysis.

Outlet Location	100-Year (P_6=3.1 in) Existing/Proposed (cfs)/(cfs)		50-Year (P_6=2.7 in) Existing/Proposed (cfs)/(cfs)		10-Year (P_6=2.0 in) Existing/Proposed (cfs)/(cfs)	
Study Point "A"	10.6	10.7	9.2	9.2	6.7	6.9
Study Point "B"	7.4	*23.2	6.4	*20.1	4.8	*15.0
TOTAL	**18.0**	***33.9**	**15.6**	***29.3**	**11.5**	***21.9**

* Increase in runoff to be mitigated by provision of a minimum 19,820 FT^3 detention pond.

Section 4. Summary and Conclusions

This section provides a summary discussion of the potential effects of the proposed project on local water resources in terms of quantity and location.

- The proposed project will not significantly alter drainage patterns on the site. Runoff from the project site may be concentrated at storm drain outfalls but is not diverted in significant quantities from its existing outlet locations.
- The project will add approximately 65,000 square feet of impervious area (33 percent of the project site) in the form of building, parking, driveway access, and other improvements
- Study Point "A" (existing 12" pipe in Campo Road adjacent the access drive) will not experience any increase in runoff. Study point "B" (within the existing swale just off the southeast corner of the site) will experience runoff increases at a magnitude of 300%.
- A detention basin of approximately 19,820 cubic feet can be provided to limit storm water discharge from watershed 'B' to pre-development levels.

Section 5. References

FEMA, 1997. FEMA. (June 17, 1997). Flood Insurance Study, San Diego County.

San Diego County, 2003. San Diego County Flood Control District. (June 2003). Hydrology Manual.

SCS, 1973. Soil Conservation Service. (December, 1973). Soil Survey, San Diego Area, California.

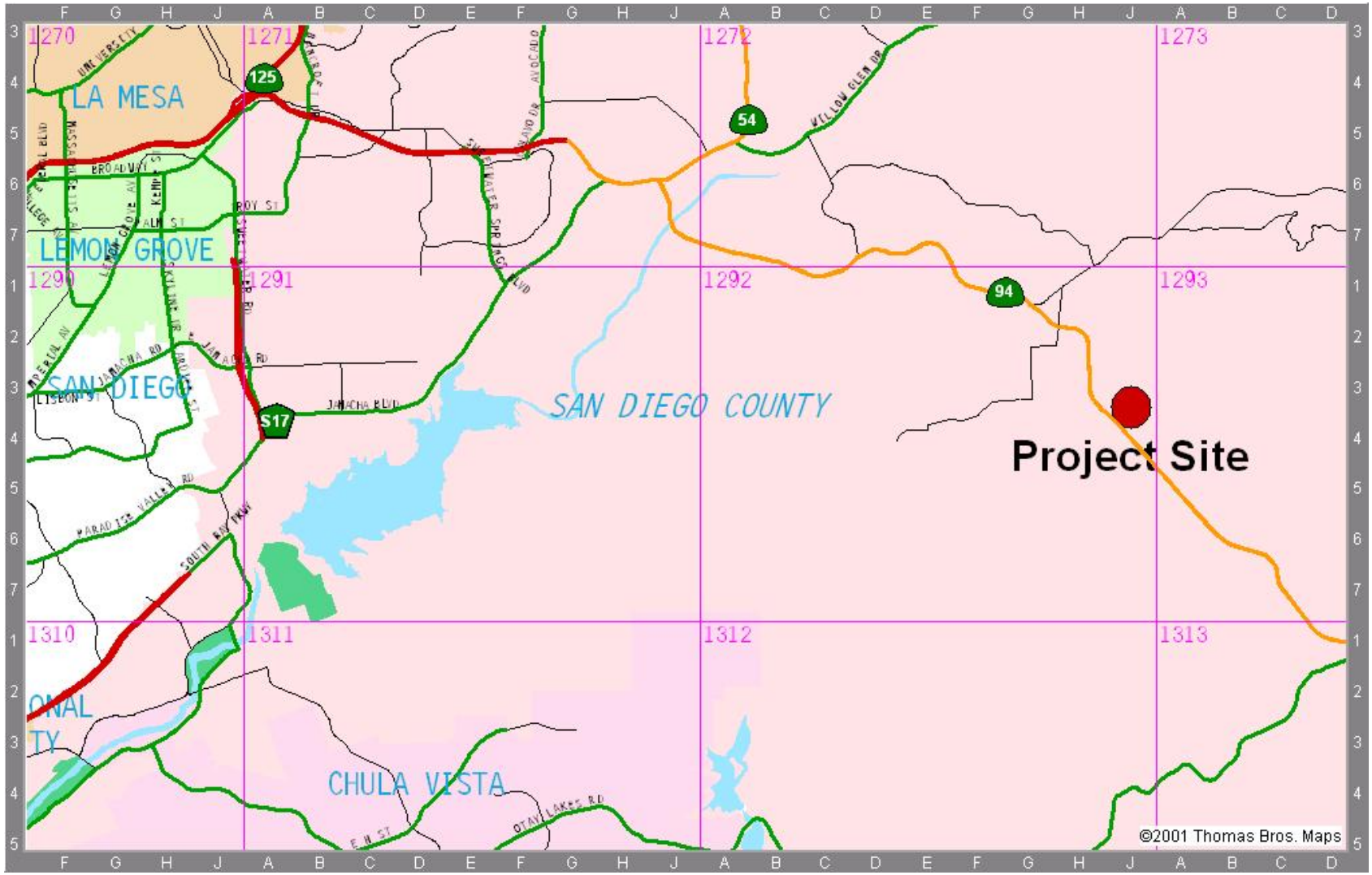
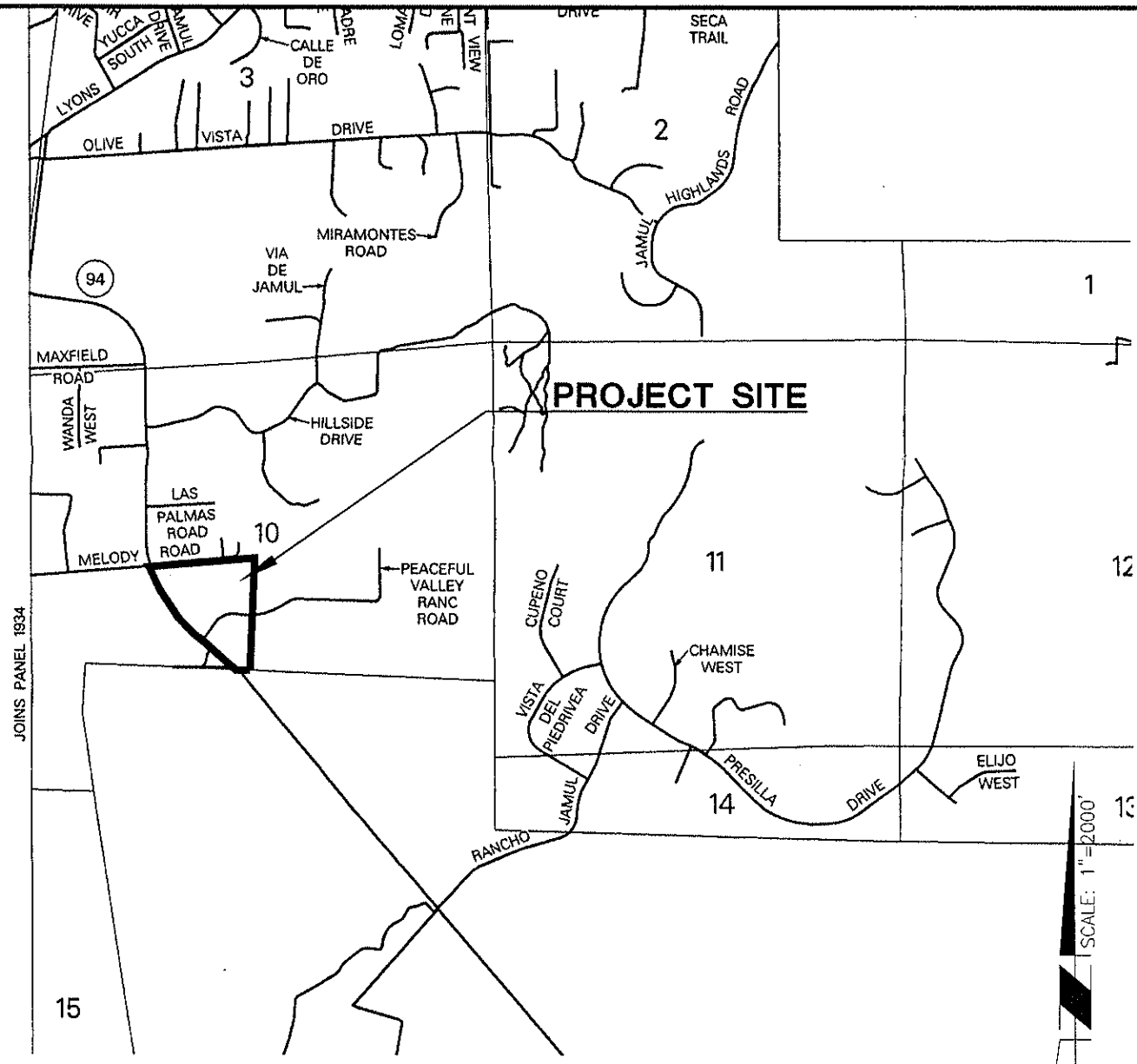


Exhibit A Vicinity Map (Reference Thomas Bros. 1292-J3)



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1975 OF 2375

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY, UNINCORPORATED AREAS	060284	1975	F

MAP NUMBER 06073C1975 F

EFFECTIVE DATE: JUNE 19, 1997

Federal Emergency Management Agency

EXHIBIT B

FLOODPLAIN MAP

PEACEFUL VALLEY RANCH
RBF JN 25-100796.001

2000 0 2000 4000 6000

GRAPHIC SCALE

JN: 25-100483.003
DRAWING: 483EX003.DWG
PLOT: 10/18/02

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SAN DIEGO, CALIFORNIA 92124-1324
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APPENDIX 'A'

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JOB: PERCEPTUL VALLEY RANCH FIRE STATION
SHEET NO. 1 OF 6
CALCULATED BY: RL DATE: 4/23/04
CHECKED BY: DATE:
SCALE:

PRE DEVELOPMENT

WATERSHED 'A' (TOTAL 192,800 SF OR 4.43 AC)

- TYPE 'C' SOILS 99,825 × (.40) = 39,930
- TYPE 'D' SOILS 80,353 × (.45) = 36,159

IMPERVIOUS

- EX DRIVEWAY 5,503 × (.95) = 5,228
- CAMPO ROAD 7,119 × (.95) = 6,763

TOTAL WEIGHTED "C" = $\frac{88,080}{192,800}$

= 0.46

- T_c = 6.9 MIN (AS PER TABLE 3-2 COUNTY DRAINAGE MANUAL FOR FIRST 100' OF NATURAL AREA w/ SLOPE OF 4%)

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

$= \left(\frac{11.9 (0.04)^3}{16}\right)^{0.385}$

= 1.38 MIN

- CHANNEL FLOW PER FIGURE 3-7
  L = 380' $V = \frac{1.489}{.024}(0.26)^{2/3}(0.02)^{1/2} = 3.5$ ft/sec ⇒ T_c = 1.8 MIN

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JOB
SHEET NO. 2 OF 6
CALCULATED BY DATE
CHECKED BY DATE
SCALE

TOTAL TIME OF CONCENTRATION =

$t_c = 6.9 + 1.38 + 1.8$

$= 10.1 \text{ min}$

100 YR	50 YR	10 YR
$P_6 = 3.1$ IN	$P_6 = 2.7$ IN	$P_6 = 2.0$ IN
$I_{100} = 5.2$ IN/HR	$I_{50} = 4.5$ IN/HR	$I_{10} = 3.3$ IN/HR
$Q_{100} = 10.6$ cfs	$Q_{50} = 9.2$ cfs	$Q_{10} = 6.7$ IN/HR

WATERSHED 'B' (TOTAL = 131,981 SF or 3.03 AC)

- TYPE 'C' SOILS 26,968 × (0.40) = 10,787
- TYPE 'D' SOILS 102,405 × (0.45) = 46,082
- IMPERVIOUS
  - EX DRIVEWAY 2,608 × (0.95) = 2,477

TOTAL = 59,346

WEIGHTED "C" = $\frac{59346}{131,981}$ = 0.45

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JOB
SHEET NO. 3 OF 6
CALCULATED BY DATE
CHECKED BY DATE
SCALE

$T_i = 6.9$ MIN (PER TABLE 3-2 COUNTY DRAINAGE MANUAL)

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

$= 0.04$ HOURS $= 2.52$ MIN

T_c (TOTAL) $= 6.9 + 2.5 = 9.4$ MIN

100 YR	50 YR	10 YR
$P_6 = 3.1$ IN	$P_6 = 2.7$ IN	$P_6 = 2.0$ IN
$I_{100} = 5.4$ IN/HR	$I_{50} = 4.7$ IN/HR	$I_{10} = 3.5$ IN/HR
$Q_{100} = 7.4$ CFS	$Q_{50} = 6.4$ CFS	$Q_{10} = 4.8$ CFS

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JOB
SHEET NO. 4 OF 6
CALCULATED BY DATE
CHECKED BY DATE
SCALE

POST DEVELOPMENT

WATERSHED 'A' (TOTAL = 104,980 SF OR 2.41 AC)

- TYPE 'C' SOILS : 55,983 × 0.40 = 22,393
- TYPE 'D' SOILS : 24,589 × 0.45 = 11,065
- IMPERVIOUS
  - CAMPO ROAD (w/8' SHOULDER) 12,988 × 0.95 = 12,339
  - FUTURE DG PATH 7,762 × 0.95 = 7,373
  - MAIN DRIVE 3,658 × 0.95 = 3,475

TOTAL = 56,645

WEIGHTED 'C' = $\frac{56,645}{104,980}$ = 0.54

T_C TOTAL = 5 MIN (ASSUMED)

100 YR	50 YR	10 YR
P_6 = 3.1 IN	P_6 = 2.7 IN	P_6 = 2.0 IN
I_{100} = 8.2 IN/HR	I_{50} = 7.1 IN/HR	I_{10} = 5.3 IN/HR
Q_{100} = 10.7 CFS	Q_{50} = 9.2 CFS	Q_{10} = 6.9 CFS

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JOB
SHEET NO. 5 OF 6
CALCULATED BY DATE
CHECKED BY DATE
SCALE

WATERSHED 'B' (TOTAL 219,978 SF OR 5.05 AC)

TYPE 'C' SOILS : 110,772 x 0.40 = 44,309

TYPE 'D' SOILS : 49,210 x 0.45 = 22,144

IMPERVIOUS :

MAIN DRIVEWAY/PARKING	39,208	x 0.95 =	37,248
BUILDINGS & PORCHES	18,769	x 0.95 =	17,830
FUTURE DG PATH	2,019	x 0.95 =	1,918

TOTAL = 123,449

WEIGHTED 'C' = $\frac{123,449}{219,978}$ = 0.56

T_c (total) = 5 MIN (ASSUMED)

100 YR	50 YR	10 YR
P_6 = 3.1 IN	P_6 = 2.7 IN	P_6 = 2.0 IN
I_{100} = 8.2 IN/HR	I_{50} = 7.1 IN/HR	I_{10} = 5.3 IN/HR
Q_{100} = 23.2 cfs	Q_{50} = 20.1 cfs	Q_{10} = 15.0 cfs

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JOB
SHEET NO. 6 OF 6
CALCULATED BY DATE
CHECKED BY DATE
SCALE

BASIN STORAGE VOLUME ESTIMATE

POST DEVELOPMENT HYDROGRAPH VOLUME = CP_6A

$= 0.56(3.1\,IN)(5.05\,AC)$

$= 8.77$ AC-IN

PRE-DEVELOPMENT HYDROGRAPH VOLUME = $0.45(2.1\,IN)(3.03\,AC)$

$= 4.22$ AC-IN

$= (8.77 - 4.22)\,AC\text{-}IN \times \frac{43{,}560\,FT^2}{AC} \times \frac{FT}{12\,IN}$

$= 16{,}516\,FT^3 \Rightarrow$ w/20% SAFETY FACTOR $19{,}820\,FT^3$ REQ'D

SITE PLAN

	AREA	VOL.	CUMULATIVE VOL. (FT^3)
EL 947°	0		
		1,339	
EL 948°	2,679		1,339
		6,397	
EL 950°	3,718		7,736
		8,691	
EL 952°	4,973		16,427
		11,251	
EL 954°	6,278		27,678

27,678 > 19,820 VOL O.K.

PRE- DEVELOPMENT DRAINAGE CONDITION

PEACEFUL VALLEY RANCH FIRE STATION

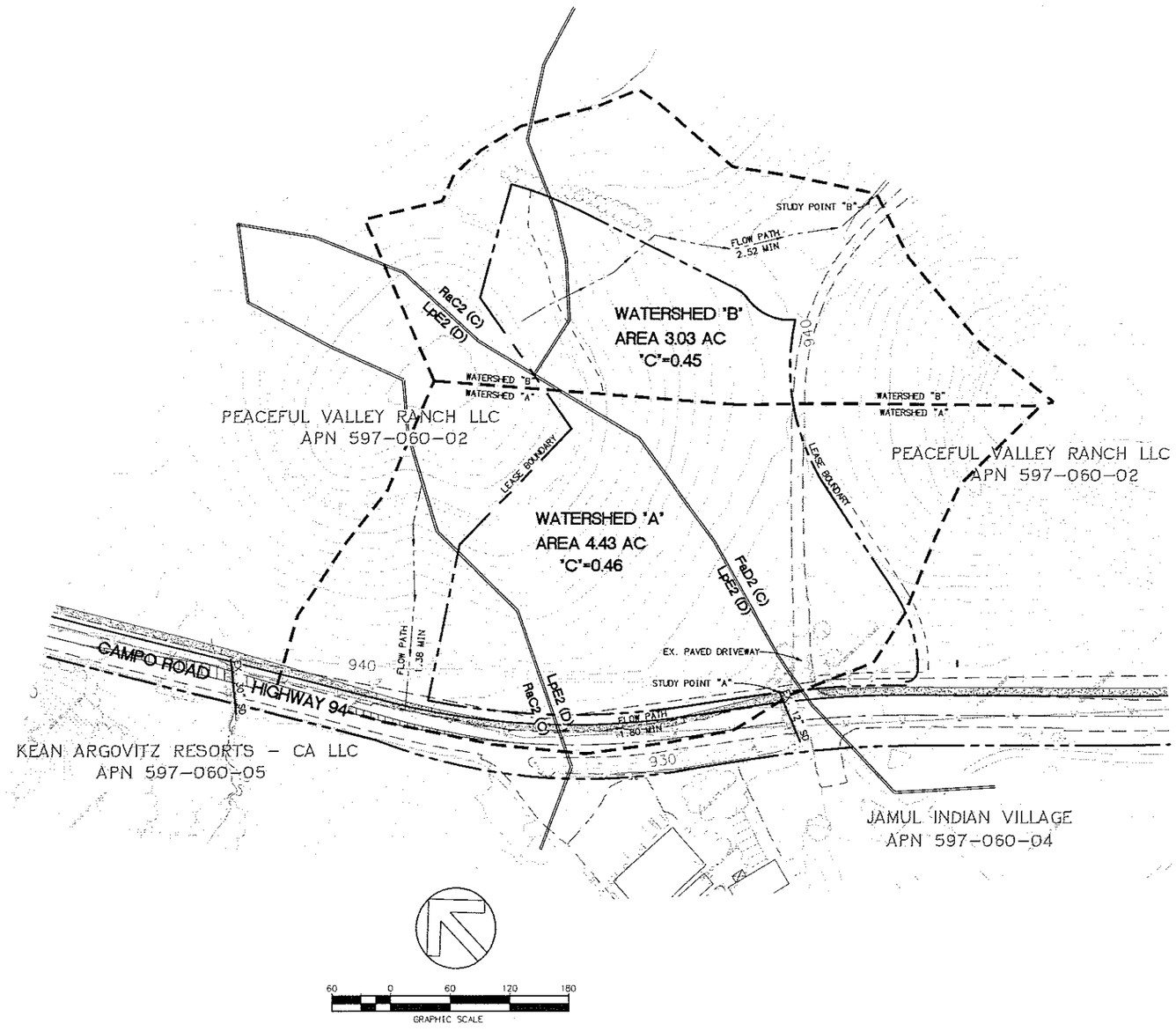

EXHIBIT "C"

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POST DEVELOPMENT DRAINAGE CONDITION

PEACEFUL VALLEY RANCH FIRE STATION

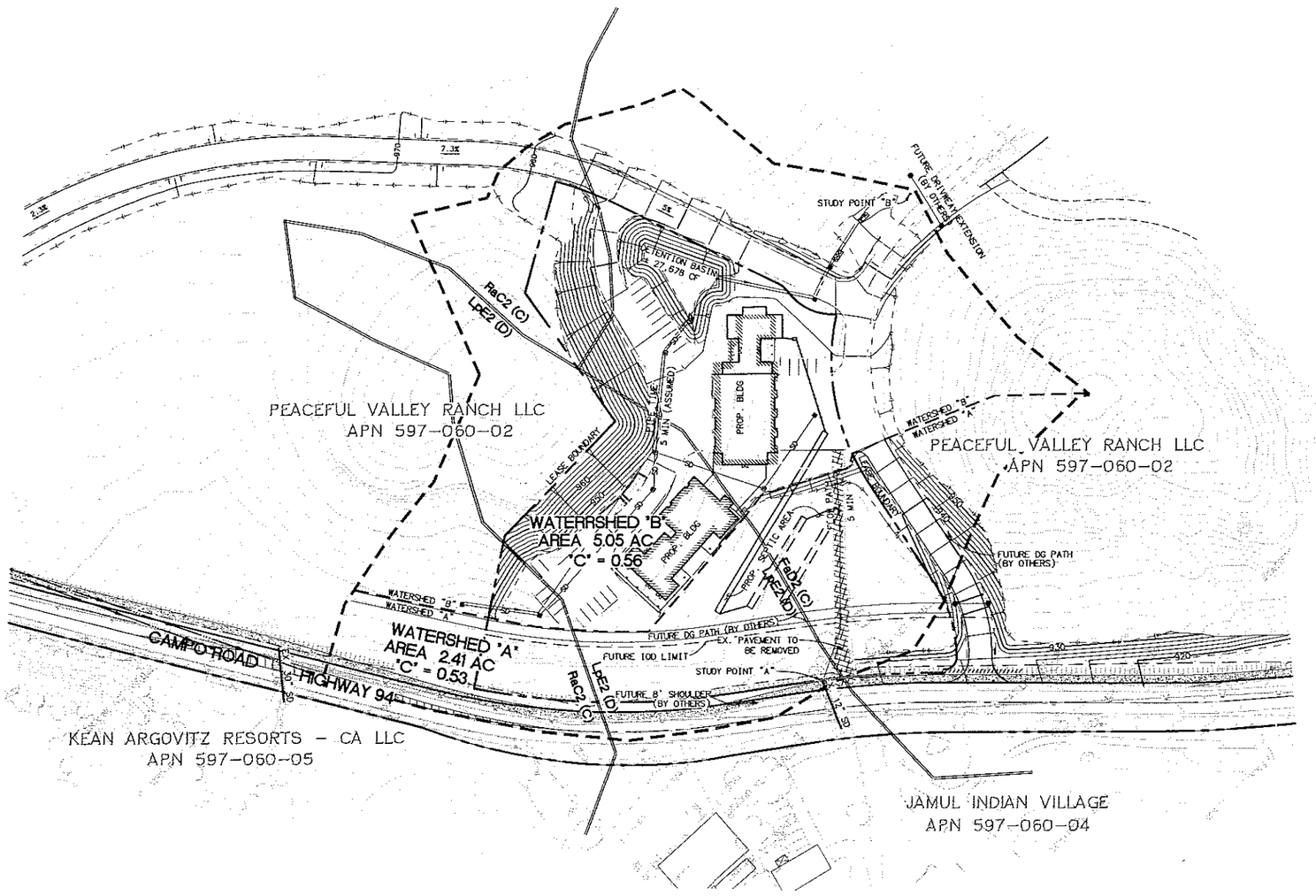

EXHIBIT "D"

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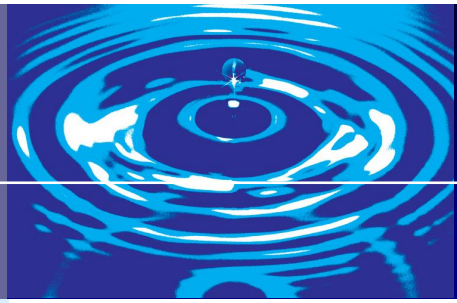

APPENDIX A
Hydrology Calculations

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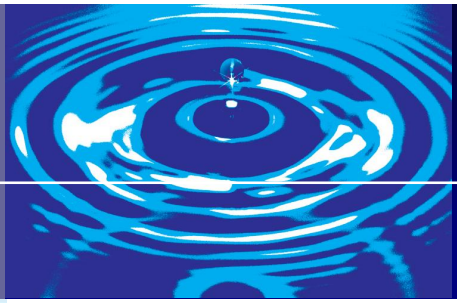

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