DRAFT
ENVIRONMENTAL IMPACT REPORT

FOR THE

HARPER CANYON (ENCINA HILLS) SUBDIVISION

SCH# 2003071157
PLN 000696

VOLUME II OF II

PREPARED FOR:

COUNTY OF MONTEREY RESOURCE MANAGEMENT AGENCY
PLANNING DEPARTMENT
168 W. Alisal Street, 2nd Floor
Salinas, CA 93901

PREPARED BY:

PMC®

OCTOBER 2008

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PLANNING DEPARTMENT
168 W. ALISAL STREET, 2ND FLOOR
SALINAS, CA 93901
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585 Cannery Row, Suite 304
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OCTOBER 2008

TECHNICAL APPENDICES

APPENDIX B – AIR QUALITY

Association of Monterey Bay Area Governments (AMBAG). Consistency Letter. December 29, 2005

Ambient Air Quality and Noise Consulting. Carbon Monoxide Modeling.

PMC. Urbemis 2007 Modeling. - Estimated Construction Emissions.

AMBAG
ASSOCIATION OF MONTEREY BAY AREA GOVERNMENTS

December 29, 2005

Pamela Lapham
Assistant Planner
Pacific Municipal Consultants
585 Cannery Row, Suite 304
Monterey, CA 93940

Dear Ms. Lapham:

This letter is in response to your September 22, 2005 request for a determination of consistency of the Harper Canyon Subdivision with the *Air Quality Management Plan for the Monterey Bay Region* (AQMP).

Consistency of housing projects with the AQMP is analyzed by comparing the total potential population growth facilitated by the project with the forecasted growth for Monterey County. The *2004 Population, Housing Unit, and Employment Forecasts* adopted by the AMBAG Board of Directors on April 14, 2004 are the forecasts used for this consistency determination.

AMBAG staff surveyed each jurisdiction in Monterey County to determine the number of housing units that jurisdictions have approved but have not yet received a building permit. The total number of units is 8,395. Building permit data was also collected. A total of 1,067 housing units have received building permits between January and October 2005. The California Department of Finance estimates there are 138,314 dwelling units in Monterey County as of 1/01/05. Combined, there are 147,776 existing, approved, and or permitted housing units in Monterey County.

The Harper Canyon Subdivision consists of a total of 17 residential units. Occupancy of the housing units is estimated to take place by 2010. The *2004 Population, Housing Unit, and Employment Forecast* forecasts there will be 151,844 housing units in Monterey County by the year 2010.

The combination of the existing and approved housing units in Monterey County (147,776) plus the 17 housing units in the Harper Canyon Subdivision is less then the regional forecasts for Monterey County (151,844.) Therefore the Harper Canyon Subdivision is **consistent** with the 2004 regional forecasts and the Air Quality Management Plan.

Please feel free to contact me if you have any questions about this determination.

Sincerely,

Todd Muck

Todd Muck, AICP
Senior Transportation Planner

cc: Jean Getchell, MBUAPCD

Carbon Monoxide Modeling

PREDICTED CO CONCENTRATIONS
INTERSECTION: HWY 68 & CORRAL DE TIERRA RD

BACKGROUND 1-HR:	2.8	(Highest Measured, Salinas Monitoring Station 2003-2005)	
BACKGROUND 8-HR:	1.4	(Highest Measured, Salinas Monitoring Station 2003-2005)	
MOBILE-SOURCE CONC 1-HR:	1.4	(~3m roadway edge, SE/SW Quadrants)	
MOBILE-SOURCE CONC 8-HR:	1.3	(~7m roadway edge, SE/SW Quadrants)	
		CAAQS	EXCEEDS
TOTAL (BACKGROUND+MOBILE) 1-HR:	4.2	20	NO
TOTAL (BACKGROUND+MOBILE) 8-HR:	2.7	9	NO

```
    CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
        JUNE 1989 VERSION
        PAGE  1
      JOB: 168&CorralDeT
      RUN: Hour 1
   POLLUTANT: Carbon Monoxide
 I.  SITE VARIABLES
    U=   .5 M/S        Z0= 100. CM       ALT=    0. (M)
   BRG=   .0 DEGREES      VD=   .0 CM/S
   CLAS=    7 (G)        VS=   .0 CM/S
   MIXH= 1000. M          AMB=   .0 PPM
  SIGTH=  10. DEGREES     TEMP=  4.0 DEGREE (C)
 II.  LINK VARIABLES
   LINK     * LINK COORDINATES (M)  *          EF    H    W
 DESCRIPTION  *  X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
____________*__________________*______________________

A. 168EBAPEX   * ***** ***** ***** ***** *  AG   1487   7.5    .0  22.8
B. 168EBAPIN   * ***** ***** ***** ***** *  AG   1487  12.0    .0  22.8
C. 168EBDPIN   * ***** ***** ***** ***** *  AG   1530   9.9    .0  22.8
D. 168EBDPEX   * ***** ***** ***** ***** *  AG   1530   7.5    .0  22.8
E. 168WBAPEX   * ***** ***** ***** ***** *  AG   1298   7.5    .0  22.8
F. 168WBAPIN   * ***** ***** ***** ***** *  AG   1298  12.0    .0  22.8
G. 168WBDPIN   * ***** ***** ***** ***** *  AG   1220   9.9    .0  22.8
H. 168WBDPEX   * ***** ***** ***** ***** *  AG   1220   7.5    .0  22.8
I. CORNBEXT    * ***** ***** ***** ***** *  AG    244   7.5    .0  22.8
J. CORNBIN     * ***** ***** ***** ***** *  AG    244   8.5    .0  22.8
K. CORSBIN     * ***** ***** ***** ***** *  AG    279   8.5    .0  22.8
L. CORSBEXT    * ***** ***** ***** ***** *  AG    279   7.5    .0  22.8
III.  RECEPTOR LOCATIONS
       *   COORDINATES (M)
 RECEPTOR  *   X     Y     Z
_________*_______________

1. Recpt 1  * 613850 ******   1.8
2. Recpt 2  * 613846 ******   1.8
3. Recpt 3  * 613873 ******   1.8
4. Recpt 4  * 613877 ******   1.8

    CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
        JUNE 1989 VERSION
        PAGE  2
      JOB: 168&CorralDeT
      RUN: Hour 1
   POLLUTANT: Carbon Monoxide
 IV.  MODEL RESULTS (PRED. CONC. INCLUDES AMB.)
        * PRED  *            CONC/LINK
        * CONC  *              (PPM)
 RECEPTOR  * (PPM) *  A   B   C   D   E   F   G   H   I   J
__________*_____*________________________________

1. Recpt 1  *   1.3 *  .0  .0  .6  .0  .0  .0  .6  .0  .0  .0
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Carbon Monoxide
Modeling

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2. Recpt 2  *  1.4 *  .0  .8  .1  .0  .0  .0  .5  .0  .0  .0
3. Recpt 3  *  1.3 *  .0  .0  .7  .0  .0  .0  .6  .0  .0  .0
4. Recpt 4  *  1.3 *  .0  .0  .8  .0  .0  .0  .5  .0  .0  .0
         * CONC/LINK
         *  (PPM)
 RECEPTOR  *  K   L
__________*________
1. Recpt 1  *  .0  .0
2. Recpt 2  *  .0  .0
3. Recpt 3  *  .0  .0
4. Recpt 4  *  .0  .0
```

Carbon Monoxide Modeling

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          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

               JOB: Hwy 68 Roadway Segment
               RUN: Hour 1
        POLLUTANT: Carbon Monoxide


  I.   SITE VARIABLES

        U=     .5 M/S             Z0= 100. CM           ALT=      0. (M)
      BRG=     WORST CASE         VD=    .0 CM/S
     CLAS=      7 (G)             VS=    .0 CM/S
     MIXH= 1000. M               AMB=    .0 PPM
    SIGTH=    10. DEGREES       TEMP= 15.0 DEGREE (C)


 II.   LINK VARIABLES

       LINK         *  LINK COORDINATES (M)     *                EF*      H      W
    DESCRIPTION     *   X1     Y1     X2     Y2  * TYPE  VPH   (G/MI)   (M)    (M)
 -------------------*-------------------------*---------------------------------
 A. Link A          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3
 B. Link B          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3
 C. Link C          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3
 D. Link D          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3
 E. Link E          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3
 F. Link F          * ***** ***** ***** ***** *  AG   1838    6.2      .0   13.3

*DERIVED FROM EMFAC2002,YR2006,WINTER CONDITIONS,50 DEG.CENT,
BASED ON HIGHEST E.F. FOR SPEED RANGE 35-60 MPH.

 III.  RECEPTOR LOCATIONS (AT APPROXIMATELY 50 METERS FROM ROADWAY)

              *    COORDINATES (M)
   RECEPTOR   *    X        Y      Z
 -------------*---------------------
 1. Recpt 1   * 606304 ******    1.8
 2. Recpt 2   * 605375 ******    1.8
 3. Recpt 3   * 605301 ******    1.8
 4. Recpt 4   * 605092 ******    1.8
 5. Recpt 5   * 604997 ******    1.8
 6. Recpt 6   * 606230 ******    1.8


  IV.  MODEL RESULTS (PRED. CONC.)

              * PRED  *           CONC/LINK
              * CONC  *             (PPM)
  RECEPTOR    * (PPM) *   A    B    C    D    E    F
 -------------*-------*------------------------------
  1. Recpt 1  *    .3 *   .0   .0   .0   .0   .0   .3
  2. Recpt 2  *    .0 *   .0   .0   .0   .0   .0   .0
  3. Recpt 3  *    .2 *   .0   .0   .2   .0   .0   .0
  4. Recpt 4  *    .0 *   .0   .0   .0   .0   .0   .0
  5. Recpt 5  *    .3 *   .0   .3   .0   .0   .0   .0
  6. Recpt 6  *    .0 *   .0   .0   .0   .0   .0   .0
```

Carbon Monoxide Modeling

```
MAXIMUM PRED 1-HR ROADWAY CO CONCENTRATION AT RECEPTOR (PPM): 0.3
MAXIMUM AMBIENT 1-HOUR CO CONCENTRATION: 2.8
TOTAL WORST-CASE 1-HR CO CONCENTRATION (PPM): 3.1
CALIFORNIA AMBIENT AIR QUALITY STANDARD (PPM): 20

MAXIMUM PRED 8-HR ROADWAY CO CONCENTRATION AT RECEPTOR (PPM): 0.2
MAXIMUM AMBIENT 8-HOUR CO CONCENTRATION: 1.2
TOTAL WORST-CASE 8-HR CO CONCENTRATION (PPM): 1.4
CALIFORNIA AMBIENT AIR QUALITY STANDARD (PPM): 9.0
```

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

ile Name:

roject Name: Harper Ranch Construction Emissiosn

roject Location: Monterey County

n-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

ff-Road Vehicle Emissions Based on: OFFROAD2007

ONSTRUCTION EMISSION ESTIMATES

	CO2
007 TOTALS (lbs/day unmitigated)	17,457.25
008 TOTALS (lbs/day unmitigated)	20,013.43

REA SOURCE EMISSION ESTIMATES

	CO2
OTALS (lbs/day, unmitigated)	273.15

PERATIONAL (VEHICLE) EMISSION
STIMATES

	CO2
OTALS (lbs/day, unmitigated)	1,677.78

/19/2008 1:32:18 PM

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	CO2
TOTALS (lbs/day, unmitigated)	1,950.93

12/19/2007 2:40:05 PM

Urbemis 2007 Version 9.2.2

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\lmonreal\Application Data\Urbemis\Version9a\Projects\Harper Canyon.urb9

Project Name: Harper Canyon

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.02	0.21	0.09	0.00	0.00	0.00	271.93
Hearth - No Summer Emissions							
Landscape	0.14	0.01	0.79	0.00	0.00	0.00	1.21
Consumer Products	0.83						
Architectural Coatings	0.14						
TOTALS (lbs/day, unmitigated)	1.13	0.22	0.88	0.00	0.00	0.00	273.14

Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.02	0.21	0.09	0.00	0.00	0.00	271.93
Hearth - No Summer Emissions							
Landscape	0.14	0.01	0.79	0.00	0.00	0.00	1.21
Consumer Products	0.83						
Architectural Coatings	0.14						
TOTALS (lbs/day, mitigated)	1.13	0.22	0.88	0.00	0.00	0.00	273.14

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	2.34	3.60	27.06	0.02	3.04	0.61	1,689.13
TOTALS (lbs/day, unmitigated)	2.34	3.60	27.06	0.02	3.04	0.61	1,689.13

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2009 Temperature (F): 70 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

and Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
ingle family housing	164.00	11.55	dwelling units	17.00	196.35	1,740.11
					196.35	1,740.11

Vehicle Fleet Mix

ehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
ight Auto	49.0	2.0	97.6	0.4
ight Truck < 3750 lbs	10.9	3.7	90.8	5.5
ight Truck 3751-5750 lbs	21.7	0.9	98.6	0.5
led Truck 5751-8500 lbs	9.5	1.1	98.9	0.0
ite-Heavy Truck 8501-10,000 lbs	1.6	0.0	75.0	25.0
ite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
led-Heavy Truck 14,001-33,000 lbs	1.0	0.0	20.0	80.0
leavy-Heavy Truck 33,001-60,000 lbs	0.9	0.0	0.0	100.0
ther Bus	0.1	0.0	0.0	100.0
rban Bus	0.1	0.0	0.0	100.0
lotorcycle	3.5	77.1	22.9	0.0
chool Bus	0.1	0.0	0.0	100.0
lotor Home	1.0	10.0	80.0	10.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
rban Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						

Estimated GHG Emissions CH4 N20
GHG Inventory

Year	Vehicle Class	Net VMT (per day)	N2O factor (g/mile)	CH4 factor (g/mile)	N2O (lb/day)	CH4 (lb/day)	N2O (tons/year)	CH4 (tons/year)
2010	Light Duty Auto (Gasoline)	46,519	0.0079	0.0147	**0.81**	**1.51**	0.148	0.275
	Light Duty Auto (Diesel)	93	0.001	0.0005	**0.00**	**0.00**	0.000	0.000
	Light Duty Truck (Gasoline < 3	12,140	0.0101	0.0157	**0.27**	**0.42**	0.049	0.077
	Light Duty Truck (Diesel< 3,75	1,084	0.0015	0.001	**0.00**	**0.00**	0.001	0.000
	Light Duty Truck (Gasoline 3,7	22,434	0.0101	0.0157	**0.50**	**0.78**	0.091	0.142
	Light Duty Truck (Diesel 3,751-	113	0.0015	0.001	**0.00**	**0.00**	0.000	0.000
	Medium Duty Trucks (Gasolin	12,791	0.0177	0.0326	**0.50**	**0.92**	0.091	0.168
	Medium Duty Trucks (Diesel)	-	0.0048	0.0051	**0.00**	**0.00**	0.000	0.000
	Light-Heavy Duty Trucks (Gas	1,951	0.0177	0.0326	**0.08**	**0.14**	0.014	0.026
	Light-Heavy Duty Trucks Diese	759	0.0048	0.0051	**0.01**	**0.01**	0.001	0.002
	Light-Heavy Duty Trucks (Gas	433	0.0177	0.0326	**0.02**	**0.03**	0.003	0.006
	Light-Heavy Duty Trucks Disel:	542	0.0048	0.0051	**0.01**	**0.01**	0.001	0.001
	Medium-Heavy Duty Trucks (	217	0.0177	0.0326	**0.01**	**0.02**	0.002	0.003
	Medium-Heavy Duty Trucks D	1,301	0.0048	0.0051	**0.01**	**0.01**	0.003	0.003
	Heavy-Heavy Duty Trucks (G	-	0.0177	0.0326	**0.00**	**0.00**	0.000	0.000
	Heavy-Heavy Duty Trucks Die	1,843	0.0048	0.0051	**0.02**	**0.02**	0.004	0.004
	Other Bus (Diesel)	108	0.0177	0.0326	**0.00**	**0.01**	0.001	0.001
	Urban Bus	-	0.0177	0.0326	**0.00**	**0.00**	0.000	0.000
	Motorcycle (Gasoline)	4,770	0.0177	0.0326	**0.19**	**0.34**	0.034	0.063
	School Bus (Diesel)	108	0.0048	0.0051	**0.00**	**0.00**	0.000	0.000
	Motor Home (Gasoline)	1,084	0.0177	0.0326	**0.04**	**0.08**	0.008	0.014
	Motor Home (Diesel)	109	0.0048	0.0051	**0.00**	**0.00**	0.000	0.000
	TOTAL	**108,400**			**2.46**	**4.29**	0.450	0.783

Estimated GHG Emissions
Vehicle Fleet Data

Vehicle Class	**Percent of Vehic**	**Percent of Duty**	**Weighted Percer**	**Net Vehicle Trips**	**Net VMT (per da**
Light Duty Auto (Gasoline)	43.0%	99.8%	42.9%	84	747
Light Duty Auto (Diesel)	43.0%	0.2%	0.1%	0	1
Light Duty Truck (Gasoline < 3,750 GVW)	12.2%	91.8%	11.2%	22	195
Light Duty Truck (Diesel< 3,750 GVW)	12.2%	8.2%	1.0%	2	17
Light Duty Truck (Gasoline 3,751=5,750 GV	20.8%	99.5%	20.7%	41	360
Light Duty Truck (Diesel 3,751-5,750 GVW)	20.8%	0.5%	0.1%	0	2
Medium Duty Trucks (Gasoline)	11.8%	100.0%	11.8%	23	205
Medium Duty Trucks (Diesel)	11.8%	0.0%	0.0%	-	-
Light-Heavy Duty Trucks (Gasoline: 8,500-10	2.5%	72.0%	1.8%	4	31
Light-Heavy Duty Trucks Diesel: 8,500-10,00	2.5%	28.0%	0.7%	1	12
Light-Heavy Duty Trucks (Gasoline: 10,001-1	0.9%	44.4%	0.4%	1	7
Light-Heavy Duty Trucks Disel: 10,001-14,00	0.9%	55.6%	0.5%	1	9
Medium-Heavy Duty Trucks (Gasoline: 14,0	1.4%	14.3%	0.2%	0	3
Medium-Heavy Duty Trucks Diesel: 14,001-3	1.4%	85.7%	1.2%	2	21
Heavy-Heavy Duty Trucks (Gasoline: 33,001	1.7%	0.0%	0.0%	-	-
Heavy-Heavy Duty Trucks Diesel: 33,001-60,	1.7%	100.0%	1.7%	3	30
Other Bus (Diesel)	0.1%	100.0%	0.1%	0	2
Urban Bus	0.0%	0.0%	0.0%	-	-
Motorcycle (Gasoline)	4.4%	100.0%	4.4%	9	77
School Bus (Diesel)	0.1%	100.0%	0.1%	0	2
Motor Home (Gasoline)	1.1%	90.9%	1.0%	2	17
Motor Home (Diesel)	1.1%	9.1%	0.1%	0	2
TOTAL	**100.0%**		**100.0%**	**196**	**1,740**

Default CH4 and N2O Emission Factors for Highway Vehicles by Model Year*

Gasoline Passenger Cars

Model Year	N2O (g/mi)	CH4 (g/mi)
1984-1993	0.0647	0.0704
1994	0.0560	0.0531
1995	0.0473	0.0358
1996	0.0426	0.0272
1997	0.0422	0.0268
1998	0.0393	0.0249
1999	0.0337	0.0216
2000	0.0273	0.0178
2001	0.0158	0.0110
2002	0.0153	0.0107
2003	0.0135	0.0114
2004	0.0083	0.0145
2005	0.0079	0.0147

Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)

Model Year	N2O (g/mi)	CH4 (g/mi)
1987-1993	0.1035	0.0813
1994	0.0982	0.0646
1995	0.0908	0.0517
1996	0.0871	0.0452
1997	0.0871	0.0452
1998	0.0728	0.0391
1999	0.0564	0.0321
2000	0.0621	0.0346
2001	0.0164	0.0151
2002	0.0228	0.0178
2003	0.0114	0.0155
2004	0.0132	0.0152
2005	0.0101	0.0157

Esitmated GHG Emissions
GHG Factors

Gasoline Heavy-Duty Vehicles

Model Year	N2O (g/mi)	CH4 (g/mi)
1985-1986	0.0515	0.4090
1987	0.0849	0.3675
1988-1989	0.0933	0.3492
1990-1995	0.1142	0.3246
1996	0.1680	0.1278
1997	0.1726	0.0924
1998	0.1693	0.0641
1999	0.1435	0.0578
2000	0.1092	0.0493
2001	0.1235	0.0528
2002	0.1307	0.0546
2003	0.1240	0.0533
2004	0.0285	0.0341
2005	0.0177	0.0326

Diesel Passenger Cars

Model Year	N2O (g/mi)	CH4 (g/mi)
1960-1982	0.0012	0.0006
1983-2004	0.0010	0.0005

Diesel Light Trucks

Model Year	N2O (g/mi)	CH4 (g/mi)
1960-1982	0.0017	0.0011
1983-1995	0.0014	0.0009
1996-2004	0.0015	0.0010

Diesel Heavy-Duty Vehicles

Model Year	N2O (g/mi)	CH4 (g/mi)
All	0.0048	0.0051

Source: Gasoline vehicle factors from EPA Climate Leaders, Mobile Combustion Guidance, (2007) based on U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 (2007). Diesel vehicle factors based on U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 (2007), Annex 3.2, Table A-98.

* Currently, CCAR's General Reporting Protocol Version 3.0 (April 2008) uses different CH4 and N2O emission factors. CCAR will be replacing the current CH4 and N2O emission factors with these emission factors in the next version of its GRP. CCAR members are encouraged to use these emission factors for consistency with The Climate Registry and this Protocol.

APPENDIX C – BIOLOGICAL RESOURCES

Staub Forestry and Environmental Consultant. Forest Management Plan for Harper Canyon Realty. June 2001.

Staub Forestry and Environmental Consultant. Addendum to Forest Management Plan dated June 2001. April 28, 2008.

Zander Associates. Biological Resources Assessment. July 13, 2001.

Zander Associates. Results of Follow-up Survey. October 3, 2001.

Zander Associates. Biological Resources Assessment. November 11, 2005.

Stephen R. Staub
Forester & Environmental Consultant
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FOREST MANAGEMENT PLAN

for

Harper Canyon Realty

Prepared For

DANJAQ, Inc.

Prepared by

Stephen R. Staub

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License #1911

June, 2001

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FOREST MANAGEMENT PLAN

for

Harper Canyon Realty, L.L.C. Property, Monterey County

APNs 416-611-01 and 416-611-02

Owner: Harper Canyon Realty, L.L.C.
C/o Ms. Elizabeth Farwell
DANJAQ, Inc.
2401 Colorado Avenue, Suite 330
Santa Monica, CA 90404

Introduction

This Forest Management Plan is prepared for Harper Canyon Realty, L.L.C., Jr. by Stephen R. Staub, Registered Professional Forester #1911. It is to be made a part of an application for a 17-lot residential subdivision of this approximately 344 acre property, which is located about ¼ mile east of the junction of Highway 68 and San Benancio Road with most of its eastern boundary adjacent to Toro Regional Park. The Forest Management Plan is subject to the requirements of Zoning Ordinance #21.64.260, which applies restrictions for the preservation of oak and other protected trees as required in the Monterey County General Plan, area plans, and master plans. The scope of this plan covers the trees on the entire property with particular emphasis on trees that will be impacted by construction of road and common driveway infrastructure.

Site Description

Assessor's Parcel Numbers: APNs 416-611-01 and 416-611-02 to be subdivided as delineated on the Vesting Tentative Map dated June 21, 2001 for Harper Canyon Realty Property prepared by Whitson Engineers.

Location: Approximately ¼ mile east of the junction of San Benancio Road and Highway 68. Primary access will be off San Benancio Road over an existing residential access road.

Parcel Size: 344 acres +/-.

Existing Land Use: Principally cattle grazing and undeveloped watershed except where utility line facilities traverse the property.

Slope: Slopes within proposed residential homesite areas are generally less than 25%, although slopes are quite variable and clearly exceed 30% on some sections of residential lots not subject to development. The Remainder parcel (approximately 180 acres) contains both gentle to moderate grassy benchland and ridgetops and steeper sidehills, where slopes may reach 60%.

Soils: Soils on the property are intergrading sandy loams to loamy sands with variable some clay in the subsoil. The Soil Survey of Monterey County, California (USDA, 1978.) maps nearly the entire property as Arnold series loamy sands with a minor incursion mapped as Badlands. The mapped Arnold series is mixed with inclusions of San Andreas and Santa Ynez series fine sandy loams. Top soil layers are generally gray to grayish brown.

Vegetation: Vegetation on the site has been well described and mapped in the Preliminary Biological Resource Assessment of the project prepared by Zander Associates (April 17, 2001). Annual grassland and coast live oak woodland and savanna are the dominant vegetation communities on gentle to moderate slopes with shrub types preponderantly on moderate and steeper slopes. Most of the shrub cover is coastal scrub but there is also a small amount of maritime chaparral. Maritime chaparral occurs only in the Remainder parcel, not the proposed residential parcels. For more detailed descriptions of these vegetation types and characteristic species, see the Zander report.

Vegetation on most of the property has been significantly influenced by past and current grazing activities. Although vegetative cover has not changed dramatically, inspection of 1970 aerial orthophotography and on-site observations suggest that successional patterns of coastal scrub encroaching on annual grassland and oaks becoming established in both coastal scrub and grassland has led to an increase in the amount of oak cover on the property over the last 30 years.

Forest Condition and Health: Tree cover on the property is almost exclusively coast live oak (*Quercus agrifolia*) with perhaps a few buckeyes (*Aesculus californica*) observed from a distance during reconnaissance on the Remainder parcel. The coast live oak occurs both as a denser woodland type and as an open savanna in which individuals and small groups are scattered in grassland. As calculated from Plate 1, Vegetation Types of Zander Associates' Preliminary Biological Resource Assessment, coast live oak woodland occupies 70.2 acres and oak savanna occupies 23.5 acres. Stocking in both oak savanna and oak woodland is quite variable but small trees (less than 12 inches in diameter) are by far the most numerous. Higher percentages of larger trees are restricted to relatively infrequent patches where stand history and soil depth and moisture are favorable. Oak savanna is transitional to grassland with trees widely spaced and tree cover less than 25%. Canopy cover in oak woodland can range from moderately open to closed or nearly closed. Oak woodland here occurs primarily on north facing slopes. It is densest and most continuous below the east/west trending ridgeline through lots 15, 16 and 17. In a number of areas, including some sections of coastal scrub, there are numbers of smaller trees (less than 6 inches in diameter) and seedlings, suggesting a slow trend of increasing oak forest cover. Some of the small trees are heavily browsed. Across the property, tree sizes, densities and ages are quite variable, reflecting differences both in local site conditions and in past land use history.

Health of oaks on the property can be rated as fair to good. In general, foliage color is good but a number of trees have significant internal decay and cavities and some trees have only fair to poor foliage retention. While oak decay and cavities offer useful niche habitat, in combination with other native oak pathogens, some tree mortality has been occurring. However, no symptoms of sudden oak death were observed at this time. The recently reported infection of a tree in Prunedale is the nearest reported case of this new disease in coast live oaks in the general area. The absence of tanoak, which is highly susceptible, and rarity of alternate host species madrone and bay laurel nearby probably have helped to limit the disease's effects in the immediate region.

Project Description

The project proposes a 17-lot residential subdivision with approximately 164 acres contained in residential lots ranging in size from roughly 5 acres to 34 acres. The remaining 180 acres of the property form an undeveloped Remainder parcel. Primary access will be off San Benancio Road over an existing residential access road that will be widened and upgraded. The main access road will more or less follow the alignment of the existing ranch access road. Potential homesites within each lot will be located on gentle to moderate terrain, predominantly in grassland areas as generally indicated on the Plate 1 of Zander Associates' report.

Estimated Native Oak Population and Removals

To characterize stand structure and tree numbers, random tree density measurements, strip diameter class samples, and two plot samples were taken across the range of forest cover types. Total tree numbers were extrapolated from the samples in proportion to woodland and savanna cover types and checked against other data collected from similar stands in the region. Only a small percentage of the total number of trees was actually measured, but the sampling is adequate for purposes of general impact evaluation.

To estimate tree removals, the main access road and the two common access roads, one to lots 8, 9 & 10, the other through lot 6 for lots 1, 2, 3, 4 & 5 were reviewed in the field with engineer Ken Whitson to estimate feasible limits of grading required to install a 20 foot wide main access road, and the less wide access required for small numbers of lots. Trees within the limits of grading or unlikely to maintain reasonable health due to impacts of grading were tallied individually by diameter class and were often marked with a spot of blue paint to avoid double counting. To provide a margin of error due to estimation prior to final staking, the tally of individual removal trees has been increased by 10 % in the table below.

ESTIMATED NUMBER OF OAKS

Diameter Class	Total #	Removal #
6"-11"	8194	68
12"-23"	913	10
24"+	80	1
Total	9187	79 (less than 1% of total)

The estimates of tree numbers above, especially in the 12" to 23" class, are likely to be quite conservative, as they are based on per acre tree estimates that are significantly lower than those reported in extensive sampling of central coast oak stands by Cal Poly researchers. Approximately 20% to 25% of the trees to be removed are suffering from extensive decay, breakage, and/or low vigor. With careful construction methods and permission to construct a few short sections at somewhat less than standard 20 foot width, it is likely that during development of permanent access for the subdivision, no 24"+ dbh oak tree would have to be removed and that a few other trees in the smaller diameter classes could be retained. Final removal tallies are likely to vary slightly from this preliminary estimate, but the evaluation of overall impacts to forest resources will remain valid. Not reflected in the tally above are young oaks in the 1"-5" class, which are sporadically numerous. Utilization of the existing road alignment, appropriate design and construction methods, and of the most open areas for access to currently unroaded areas appears to have minimized tree removals given site conditions.

NOTE: Two existing roads, one that runs south between lots 15 and 16 to the ridge and accesses the remainder parcel, the other that runs east into Toro Regional Park between lots 2 and 11, provide attractive access to these undeveloped areas. However, no improvements are proposed as a part of this development and so no tree removal is anticipated in these areas. Appropriate drainage and surfacing could mitigate some minor erosion that is currently occurring on a couple of these road sections.

Condition of Retained Trees

The health and general condition of the retained trees is good and at least comparable to the trees being removed. As noted above decay and low vigor are apparent in a number of the trees to be removed as well as in the stand as a whole. Such features can be beneficial where improvements and public safety are not at risk. The vast majority of trees on the site and effectively all of the largest trees will be retained. The largest blocks of forest on the property, including extensive oaks stands on the undeveloped remainder parcel, will be effectively retained. Tree mortality will continue to occur as it does in all unmanaged forests. Native diseases and insects are expected to persist at normal background levels unless the new *Phytophthora* disease complex becomes active in the area, in which case native diseases and insects will increase as a part of that complex. Protection measures for trees during construction are included below as in the section Tree Care During Construction.

Tree Replacement: County regulations require replanting on a 1:1 basis for all protected trees removed; except where this would result in an overcrowded or unhealthy environment. Replanting on a 3:1 basis is recommended as a means of promoting 1:1 tree replacement, meaning that 237 oak trees should be planted to replace the 79 oaks being removed. Tree replanting numbers should be 3 times the number of trees actually removed, not the estimated number. Since all trees being removed are coast live oaks, all replacement trees should be as well. Required replacement trees should be planted outside areas subject to development and enjoy protected status after planting. Tree replacement for infrastructure tree removals should be done principally on designated open space parcels or easements. Excess volunteer seedlings already existing on the site may be transplanted to provide suitable replacement planting stock of known local origin. If oak replanting stock is not transplanted from on-site sources, it should be grown from local native seed stock in sizes not greater than 5 gallons, with one gallon or smaller being preferred as the tree is likely to adapt to the site better and grow larger over the long term.

Tree Care During Construction

To protect trees during construction activities, the following general measures shall be adhered to:

1) Around each tree or group of trees to be preserved in a construction area, a boundary of orange snow netting or high visibility plastic fencing supported by wood or metal stakes shall be erected along the approximate driplines of such protected trees to define the construction project boundary. Where guidance of a tree professional is used, encroachment into the dripline of retained trees may occur in order to minimize tree removals. Where construction activities cannot avoid oaks, the following general guidelines should be kept in mind. Oaks will usually survive the loss of up to one-half of their root feeding zone, which is roughly defined as the outer two-thirds of the root radius extending to the dripline. Oaks may even stand the loss of more roots if the tree crown is trimmed to maintain a rough balance between foliage and roots. When cutting roots, especially roots greater than three inches in diameter, it is important to consider the potential loss of security and stability of the tree. Trimming may compensate for imbalance or loss of part of the root system and should be done to maintain tree health if more than 20% of the root zone (roughly the dripline area) is affected.

2) No storage of equipment or construction materials, or parking of vehicles is permitted within the tree rooting zone defined by the fencing of the construction boundary in #1 above.

3) No soil may be removed from within the dripline of any tree and no fill of additional soil should exceed two inches (2") within the driplines of trees, unless it is part of approved construction and is reviewed by a qualified forester, certified arborist, or other tree professional. Oaks are particularly sensitive to increases in soil depth. If part of the feeding zone is buried, it should be considered to be at least partly lost. <u>Under no circumstances should any fill be allowed to rest against the base of any tree.</u> Oaks are especially susceptible because oak root fungus is encouraged. As long as a permanent well is constructed at original grade out from the trunk a minimum distance of one foot, there is not likely to be a problem.

4) Bark injury to any tree from equipment or materials is not acceptable.

5) No native tree may be removed or trimmed unless authorized under this Management Plan or County regulation.

6) Roots exposed by excavation should be pruned promptly to promote callusing, closure and regrowth.

7) All tree work shall be monitored by a qualified forester, certified arborist, or tree professional and work completed by qualified tree service personnel.

8) Project Specific Recommendations: The majority of mitigable tree impacts created by road construction occur on road sections along the boundary of Lot 17. To enhance tree protection, the following measures are recommended.
   a) In specific instances, permit short sections of road to be constructed at less than the standard 20 feet in width. Three examples occur in Lot 17 and one in Lot 12. For example, if the road is routed correctly and narrowed to 12 to 14 feet for a distance of some 130 feet just before the corner of Lot 16, two or three good sized oaks could be retained rather than removed.
   b) Have a qualified tree professional involved in preparation of final road design specifications to enhance tree retention and retained tree health. For example, several attractive trees on the edge of existing cutbanks can be retained by use of keyed fills. In another instance, doing all widening into a shrub-covered cutbank will minimize impacts to a tree on the fill side. In some cases, the road can be aligned to remove unhealthy trees instead of healthy trees, such as at the sharp turn at the NW corner of Lot 17.
   c) Extensive pruning will be necessary to permit road construction in a some places because long limbs extend into the roadway. Before commencement of construction, a qualified arborist or other tree professional should identify trees where significant pruning will be necessary and make recommendations. Coast live oak generally responds well planned pruning even when it is extensive.
   d) The property owner should stay current on developments related to oak mortality from the newly identified *Phytophthora* pathogen. Because this disease complex is so new, current information is likely to be outdated in a short time so the web site of the California Oak Mortality Task Force is recommended as a resource. Proper handling of materials infected with this pathogen is necessary to minimize spread of the disease. Guidelines will be posted on the website.

Project Assessment

Minimum Tree Removal: As noted above in discussion of total oak population and tree removals, use of the existing road alignment, use of appropriate design and construction methods, and use of the most open areas for access to currently unroaded areas has kept tree removals to the minimum (less than 1% of total) given the circumstances of this case and setting.

Potential for adverse environmental impacts due to proposed tree removals in the following subject areas:

Soil Erosion: Potential is low to moderate. Slopes where road construction will occur are usually gentle to moderate, although some steeper slopes are crossed by relatively short road segments in several locations. Most road and building sites are located in relatively treeless areas. Erosion control measures will be required and implemented during active construction on roads and homes. Tree planting and other landscaping mitigations will be implemented upon completion of construction activities.

Water Quality: Tree removals are quite limited (less than 1% of trees on the property) given project size are well removed from significant water resources. The common access road to lots

8, 9 and 10 does parallel a seasonal watercourse at some distance but trees to be removed for its construction are all relatively small, are not located on steep slopes, and their removal is easily mitigatable with proper construction and erosion control methods. Additional discussion of potential impacts to water quality is provided in the Preliminary Biological Resource Assessment prepared by Zander Associates.

Ecological Impacts: Low potential. Less than 1% of the estimated tree population on the property is projected to be removed by the project. The largest blocks of continuous forest cover will be effectively preserved.

Noise Pollution: Not a significant factor after construction activities have been completed. Trees being removed are generally too small and infrequent to provide a significant sound barrier.

Air Movement: The number of trees proposed for removal will have little or no effect on the movement of air in this vicinity.

Wildlife Habitat: Low impact for this property. Continuous upslope and downslope habitat connectivity remains after development as proposed. Large parcel size and high tree retention provide good mitigation.

Forest Management Agreement

The following standard conditions are required by the Monterey County Planning Department in Forest Management Plans:

Definitions

Forest Management Area (FMA). That portion of the subject property which is presently forested and lies beyond the immediate vicinity of the permitted building envelopes within this parcel.
Landmark tree. Any native tree more than 24" in diameter.
Significant tree. Any protected tree more than 6" in diameter.
Retained tree. Any significant tree not shown for removal on an approved final site plan.
Diameter (dbh). Thickness of main trunk of tree as measured 4'6" above the average ground surface at base of tree ("diameter at breast height").
Dripline. The outer edge of the area beneath the crown of a tree.
Greenbelt. An area around the construction zone which, for purposes of fire protection, is kept free of highly flammable vegetation and is stabilized with green, growing plants.

Management Objectives

1) Minimize erosion (in order to prevent soil loss and siltation).

2) Preserve natural habitat (includes native oak forest, understory vegetation, and associated wildlife on site).

3) Prevent forest fire (i.e., uncontrolled fires.)

4) Preserve scenic forest canopy as located within any Critical Viewshed.

5) Preserve landmark trees.

Management Measures

Tree Removal. Tree removal is subject to the requirements of Zoning Ordinance #21.64.260. No protected tree shall be removed without a Tree Removal Use Permit per the ordinance unless diseased or hazardous, as designated by a qualified forester, or exempt from the provisions of the ordinance. Per Section 21.64.260.F.3, "tree removal for construction of structures, roads and other site improvements included in an approved subdivision, Use Permit, or similar discretionary permit" are exempt.

Application Requirements. Where a Tree Removal Permit is required, trees proposed for removal will be conspicuously marked by flagging or paint. A site plan showing the location of each significant tree to be removed will accompany the application. If a substantial number of trees are requested for removal, they will generally be distributed over a wide area so that the overall unbroken appearance of the forest canopy is not altered.

Waiver of Permit Requirements. It is understood that the Director of the Monterey County Planning Department may waive the requirement to obtain a Tree Removal Permit in the following instances:

1) removal of diseased tree(s) which threaten to spread contagion to nearby healthy trees;
2) removal of dangerous tree(s) which present a clear and imminent threat to human life or property;
3) outside the FMA, removal of tree(s) where needed to allow construction of approved structures or roads.

Landmark Trees. All landmark trees will be protected from damage if not required to be removed under the above instances.

Dead Trees. Because of their great value for wildlife habitat (particularly as nesting sites for birds), large dead trees beyond the greenbelt will normally be left in place. Smaller dead trees will normally be removed in order to reduce fire hazard. Dead trees may be removed at the convenience of the owner, provided such removal is otherwise in conformance with this plan and designated by a qualified forester. Large dead trees may be removed from the greenbelt upon a finding of hazard or sufficient presence of this habitat element by a qualified forester. Dead trees, limbs, and other highly flammable material may be removed if required by Agency fire Officials, or as part of an approved Defensible Space Plan.

Thinning. Non-significant trees, where weak, diseased, or overcrowded, may be thinned to promote the growth of neighboring trees. Subject to the above permit requirements, significant trees may be removed for the same purpose. In a number of places, stands of oaks are overcrowded with smaller trees. In such stands, thinning of trees up to 12" in diameter as recommended by a qualified tree professional is encouraged in order to promote growth of larger trees, increase understory diversity, and reduce fire hazard.

Replacement Trees. Where tree replacement is required, the appropriate replacement trees shall be planted in an area where they are free to grow, generally a clearing or gap between trees (preferably 30 feet or more between trunks), except where existing clearings are to be maintained. Exceptions will be made where a suitable seedling already exists, and in unforested garden and lawn areas. Every effort will be made to secure native seedlings rather than nursery stock of unknown origin. Coast live oak replacement trees should generally not be larger than 5 gallon size with one gallon preferred. Occasional use of larger planting stock, however, is acceptable to provide both visual and age diversity.

Protection of Trees. All significant and replacement trees, other than those approved for removal, shall be retained and maintained in good condition. Trimming, when not injurious to the health of the tree(s), may be performed wherever necessary in the judgment of the owner, particularly to reduce personal safety and fire hazards.
Retained trees which are located close to the construction site shall be protected from inadvertent damage by construction equipment through wrapping of trunks with protective materials, bridging or tunneling under major roots where exposed in the foundation or utility trenches, and other measures appropriate and necessary to protect the well-being of the retained trees (See Tree Care During Construction above).

Fire Prevention. In addition to any measures required by local of California Department of forestry fire authorities, owner will:

a. maintain spark arrester screen atop chimney;
b. maintain spark arresters on gasoline-powered equipment;
c. establish "greenbelt" by keeping vegetation around structure to a distance of 50 feet in a green, growing condition, and or controlling fuel accumulation in drought tolerant landscapes.
d. break up and clear away any dense accumulations of dead or dry underbrush or plant litter, especially near landmark trees and within greenbelt.

Use of Fire (for Clearing, Etc.). Open fires will be set or allowed within the FMA only as a forest management tool under the direction of Department of Forestry authorities, pursuant to local fire ordinances and directives.

Clearing Methods. Outside development areas, brush and other undergrowth, if removed, will be cleared through method(s) which will not materially disturb the ground surface. Hand grubbing, crushing, and mowing will normally be the methods of choice. Use of fire and herbicides will be subject to the limitations listed elsewhere in this Plan.

Areas laid bare by clearing, other than firebreaks, will be sown with a suitable erosion mix utilizing native grass and forb seeds as suitable and appropriate (if nothing else is to be planted in the area). Sowing of cleared areas will be completed prior to the onset of the winter rainy season.

Irrigation. In order to avoid further depletion of groundwater resources, prevent root disease, and otherwise maintain favorable conditions for the native oak forest, the FMA will not be irrigated except within the greenbelt area. Caution will be exercised to avoid overwatering around oak trees within the greenbelt.

Exotic Plants. Care will be taken to eradicate, and to avoid introduction of, the following pest species: a) Pampas grass, b) Genista (Scotch broom, French broom), c) Eucalyptus (large types).

Amendments. It is understood that the Director of the Monterey County Planning Department, in consultation with the California Department of Forestry, may approve amendments to this Plan, provided that such amendments are consistent with the provisions of the County Development Permit.

Compliance. It is further understood that failure to comply with this Plan will be considered failure to comply with the conditions of the County Development Permit.

Transfer of Responsibility. This Plan is intended to create a permanent forest management program for the site. It is understood, therefore, that in the event of change in ownership this Plan shall be as binding on the new owner(s) as it is upon the present owner. To this end, this Plan will be conveyed to the future owner upon sale of the property.

Forest Management Plan Prepared by:

Stephen R Staub
Stephen R. Staub

6/26/01
Date

Owner's Agreement to Provisions of the Plan:

Harper Canyon Realty
By, Elizabeth Farwell

Date

Forest Management Plan Approved by:

Director of Planning of County of Monterey

Date

Staub Forestry &
Environmental Consulting STAUB

April 28, 2008

Ms. Laura Lawrence
County of Monterey-Planning Department, Resource Management Agency
168 W. Alisal St., 2nd Floor
Salinas, CA 93901

Addendum to Forest Management Plan dated June 2001

For Monterey County APNs 416-611-01 and 416-611-03 – Encina Hills

This addendum addresses potential tree removal associated with development of proposed building sites. Our review included field assessment of driveways and building sites circled on the VTM at the time of the original FMP recorded as file notes by lot and office evaluation of aerial photography and current maps showing lot lines and building sites. Lot 17 alternatives analyzed show either a residential site on the slope below the ridge in the SE corner of the lot or two on-site inclusionary units at that location with the residential site moved to gentle to moderate terrain near Meyer Road in the NW portion of the lot.

Tree impacts associated with development of proposed building sites shown on the VTM are projected to be minimal as residential sites are proposed in open areas, principally grassland or mixed grass and shrub cover with only occasional oaks. No tree removal per the ordinance would occur on 9 of the 17 lots and little tree removal would occur on the remaining 8 lots. Our evaluation suggests that total tree removal for all direct residential site development will be minimal and less than the limited tree removals estimated for road and infrastructure development in the FMP.

Tree removals would increase markedly under the alternative that would provide two inclusionary units and a residential unit on different parts of Lot 17 because only one feasible site on Lot 17 has both gentle to moderate slope and minimal tree cover. If inclusionary housing occupies that site, the residential site cannot avoid being placed within dense oak cover. Our estimates suggest that tree removals for such a site would exceed tree removals for all other lots combined, more than doubling tree removals associated with residential development.

Please let me know if I can be of further assistance.

Submitted by Stephen R. Staub

Stephen R. Staub, Registered Professional Forester #1911

ZANDER ASSOCIATES

Environmental Consultants

July 13, 2001

Ms. Elizabeth Farwell
Vice President, Finance and Administration
DANJAQ, Inc.
2401 Colorado Avenue, Suite 330
Santa Monica, California 90404

Biological Resources Assessment
Encina Hills Property
Monterey County, California

Dear Ms Farwell:

Zander Associates has completed an assessment of the existing biological resources on the Encina Hills property in Monterey County. The project site consists of approximately 344 acres situated along the southeast side of Highway 68 adjacent to Toro Regional Park. The purpose of our assessment was to describe and map existing vegetation patterns on the site and identify target species and other resources for further survey, as necessary. We consulted the California Natural Diversity Database, and previous environmental documents prepared for properties in the vicinity to compile a list of special status species that are known to occur in the vicinity. Zander Associates conducted a reconnaissance-level survey on March 6, 2001 to characterize and map dominant vegetation types and to evaluate the potential for the property to support a target list of sensitive plant and animal species. On April 25, 2001 a focused survey for sensitive plant species with spring blooming periods was conducted on the entire property. This letter summarizes the results of our background review, reconnaissance survey, and spring plant surveys.

General Site and Project Description

The Encina Hills property consists primarily of pastureland on hilly terrain that ranges in elevation from about 400 to 1,000 feet above sea level. The property is situated south of Highway 68, east of San Benancio Road, north of Harper Canyon Road and west of Toro Regional Park (Figure 1). There are several seasonal drainage courses that originate in the hills on the site and drain downslope to the south, east and west off the property. A sandstone escarpment or badland with severely eroded slopes and minimal vegetation is located at the northern property boundary, in the northern corner of lot 9 (proposed). Several smaller escarpments are found near ridges in the northeastern portion of the property.

There are no homes or other building structures currently on the site. The proposed project is to subdivide the property into 17 lots ranging from approximately 5 acres to 23 acres in extent and retain about 180 acres in a Remainder Parcel. Homesites within each lot are generally sited as indicated on Plate 1 and encompass approximately 1 acre.

Vegetation Communities/Habitat Types

Zander Associates identified elements of four vegetation communities typical of the general area on the site: annual grassland, coast live oak woodland/savanna, coastal scrub and central maritime chaparral. In addition, the upper reaches of several intermittent drainages are found on the site. Classification of the vegetation communities is based generally on Holland (1986) and Sawyer and Keeler-Wolf (1995). Each of these vegetation communities, and the wildlife habitat they provide, is described below. A map indicating the distribution and extent of these communities on the site is attached as Plate 1.

Annual Grassland

The annual grassland community on the property is characterized by a mixture of native perennial and introduced annual species and is heavily grazed by cattle. Common introduced grass species observed included slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), and rattail fescue (*Vulpia myuros*). The primary native perennial species observed scattered throughout the grassland is purple needlegrass (*Nasella pulchra*).

Grasslands often provide habitat for a variety of native wildflowers that typically bloom in the spring. At the time of our site visit, only a few wildflower species were in bloom and identifiable, including: footsteps of spring (*Sanicula arctopoides*), Johnny jump-up (*Viola pedunculata*), and California gilia (*Gilia achilleifolia*). The dominant flowering herb present within the grassland during our survey was the non-native long-beaked filaree (*Erodium botrys*). The dominant presence of this species is indicative of the extensive grazing.

Grasslands provide foraging habitat for small mammals which in turn serve as prey for a variety of other animals, including snakes, raptors ("birds of prey"), and coyotes (*Canis latrans*). Numerous invertebrate species, many of which provide a food source for larger animals such as lizards, birds and some small mammals, can also be found within grassland communities.

Coast Live Oak Woodland and Savanna

Oak woodland communities in Monterey County are dominated by open to nearly closed canopies of coast live oaks (*Quercus agrifolia*) with grass or shrub understories. Savannas are transitional between woodlands and grassland with trees more widely spaced and a grassland-dominated understory. On the Encina Hills property, oak woodlands occupy the more mesic (moist) north-facing slopes and canyon bottoms and the oak savanna is along a drier, east-facing slope, near the ridgetop.

The understory species composition in oak woodlands varies depending upon local conditions such as moisture availability and soil type. The understory in the oak savanna consists of species common to the annual grassland habitat but may include additional wildflower species not found in the open grasslands. Common oak woodland understory species observed on the Encina Hills property include poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), and California coffeeberry (*Rhamnus californica*). The species composition of the understory changes slightly where the oak woodland transitions to coastal scrub higher on the slopes to include some coastal scrub species.

Oak woodland and oak savanna provide habitat for a variety of wildlife. The oak trees provide suitable nesting sites and cover for birds and many mammals. Woody debris and duff in the woodland understory provide foraging areas for small mammals and microclimates suitable for amphibians and reptiles. Acorns are a valuable food source for many animal species, including the California quail (*Lophortyx californicus*), western gray squirrel (*Scirus griseus*), and black-tailed deer (*Odocoileus hemionus*). Other representative animal species of oak dominated woodlands include arboreal salamander (*Aneides lugubris*), western screech owl (*Otus kennicottii*), scrub jay (*Aphelocoma corulescens*), and Virginia opossum (*Didelphis virginianus*).

Coastal Scrub

Coastal scrub communities are characterized by moderate to low-growing evergreen and drought tolerant shrubs adapted to shallow soils. On the Encina Hills property, coastal scrub is typically dominated by soft-leaved shrubs like California sage (*Artemisia californica*), coyote brush (*Baccharis pilularis* var. *consanguinea*), and sticky monkey flower (*Mimulus aurantiacus*). This vegetation community occurs mostly on drier, wind exposed sites near the tops of the ridges or on steep slopes with sandy, mudstone or shale soils.

Coastal scrub provides cover and nesting habitat for a variety of animals. The sandy soils typically associated with this community also provide areas for wildlife denning and nesting. Animal species common to coastal scrub habitat include western fence lizard (*Sceloporus occidentalis*), western rattlesnake (*Crotalus viridis*), California quail (*Callipepla californica*) brush rabbit (*Sylvilagus bachmani*) and gray fox (*Urocyon cinereoargentus*).

Maritime Chaparral

This plant community is similar to coastal scrub in that it is characterized by moderate to low-growing evergreen and drought tolerant shrubs adapted to shallow soils. It varies from coastal scrub in that its dominant species consist of sclerophyllus (hard-leaved) shrubs, such as chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp), and ceanothus (*Ceanothus* spp). Wildlife species using this habitat type are similar to those described for coastal scrub. Maritime chaparral is limited in extent on the property and is found in the upper end (southern) of the canyon that comprises the eastern portion of the Remainder Parcel.

There are several special status plant species associated with this vegetation type in the project vicinity including Toro (or Monterey) manzanita, Monterey ceanothus and Eastwood's ericameria. These are discussed further in the following sections.

Drainages

There are portions of several drainages and tributaries to drainages that originate on the property and carry flows offsite. These drainages appear to be ephemeral, carrying flow only in response to winter storms. In general, the channels are cobble- or soil-lined and are devoid of in-channel vegetation. Some of the channels are deeply incised. Oak woodland vegetation is primarily associated with the drainages; classic riparian (stream-related) vegetation is generally absent from these areas. Most of the drainages on the property are tributary to El Toro Creek, which drains to the Salinas River.

Wildlife habitat in these drainages does not vary substantially from that previously described for oak woodland or grassland habitat. The channels can provide movement corridors for amphibians when water is present and for other animals throughout the year.

Special Status Species

For this assessment, special status species are defined as: those plants and animals listed, proposed for listing, or candidates for listing as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS); those considered "Species of Concern" by the USFWS; those listed or proposed for listing as rare, threatened or endangered by the California Department of Fish and Game (CDFG); plants occurring on lists 1B or 2 of the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (1994); and animals designated as "Species of Special Concern" by CDFG.

Duirng the site visit on March 6, 2001 Zander Associates developed a target list of special status plant and animal species that we evaluated for their potential to occur on the Encina Hills property (Tables 1 and 2, respectively). The list was developed based on our review of the California Natural Database (CNDDB) records and our work on other properties in the vicinity. On April 25, 2001 Zander Associates conducted focused surveys for special status plant species that bloom during the spring. The results of the spring plant survey are discussed below and summarized on Table 1.

Plants

Many of the special status plants that occur in the vicinity of the Encina Hills property are found in specific habitat types such as maritime chaparral, vernal pools, or on serpentine substrate. No vernal pool habitat was observed on the site and there were no obvious areas with serpentine substrates - based on vegetative characteristics. A limited amount of maritime chaparral habitat is present in the Remainder Parcel on the property and was surveyed during the April 25, 2001 site visit. The maritime chaparral habitat was surveyed as completely as possible; however, certain areas were not accessible due to dense brush and steep terrain. A few Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*) shrubs were observed at the northern edge of the maritime chaparral habitat. Other special status plants potentially occuring in the maritime chaparral but not found during the spring plant survey include Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Kellogg's horkelia (*Horkelia cuneata* ssp. *sericea*), and Hooker's manzanita (*Arctostaphylos hookeri* ssp *hookeri*). These species would likely be found in open areas within maritime chaparral habitat; however, the dense structure of this habitat and lack of openings discourage the establishment of these species.

Along the eastern edge of the development area, a few Monterey manzanita (*Arctostaphylos montereyensis*) shrubs were observed during the spring plant surveys. An individual unidentified rein orchid (*Piperia* sp.), most likely *P. elegans* or *P. michaelii* was observed along the northwestern property boundary in lot 3. Focused searches were conducted for other sensitive spring-blooming plants with the potential to occur on the Encina Hills property including Hickman's onion (*Allium hickmanii*), Hutchinson's larkspur (*Delphinium hutchinsoniae*), Carmel Valley cliff-aster (*Malacothamnus parlmeri* var. *incolucratus*), hooked popcorn flower (*Plagiobothrys uncinatus*), Santa Cruz microseris (*Stebbinsoseris decipiens*), Santa Cruz clover (*Trifolium buchwestorium*), and Pacific Grove clover (*Trifolium polyodon*). None of these senstive plant species were observed.

One additional focused plant survey will occur during July to check for sensitive summer-blooming plants with the potential to occur in the proposed development area. These species include Seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*), Congdon's tarplant (*Hemizonia parryi* ssp. *congdonii*), Carmel Valley cliff-aster (*Malacothrix saxatilis* var. *arachnoidea*), and Gairdner's yampah (*Periperidia gairdneri* ssp. *gairdneri*). Focused surveys for these species may be conducted in the development area only since development is not proposed for the Remainder Parcel.

Animals

As a result of our background review and subsequent site survey, we determined that the project site provides limited potential habitat for some special-status animal species. Additionally, raptors and other migratory birds protected under the Migratory Bird Treaty Act could nest on the project site, primarily in the larger coast live oak and Monterey pine trees. Following is a discussion of the special-status species that have the potential to occur on the project site.

California red-legged frog (*Rana aurora draytonii*)

The California red-legged frog (*Rana aurora draytonii*) is a federally listed threatened species and a California Species of Special Concern. The red-legged frog typically inhabits ponds and backwater sections of streams with permanent or near-permanent water, and generally prefers areas with dense emergent or riparian vegetation and deep pools for breeding.

The closest CNDDB occurrences of this species are in the Carmel and Salinas Rivers. The drainages on the site are ephemeral and do not provide suitable breeding habitat for the California red-legged frog because of the lack of permanent water and absence of in-channel vegetation. Nonetheless, there is a limited potential for these drainages to serve as dispersal corridors for red-legged frogs because of their remote linkage to the Salinas River via El Toro Creek. No focused surveys for red-legged frogs are recommended unless the project would affect these drainages.

California tiger salamander (*Ambystoma californiense*)

The California tiger salamander is a federal candidate for listing as threatened or endangered, and is a California Species of Special Concern. This species inhabits annual grassland and open oak woodlands in the vicinity of ephemeral pools or other suitable breeding ponds. CTS use burrows of ground squirrels or other rodents as aestivation sites. With the onset of the rainy season, adults migrate from their burrows to nearby ponds for breeding. Following breeding, the adults disperse to upland areas, and retreat into burrows where they remain for most of the year. CTS have been reported to migrate as far as one mile between their underground retreats and breeding ponds, but aestivation sites are usually located within one quarter mile of breeding ponds.

For the California tiger salamander to complete a breeding cycle, it is generally believed that breeding sites must retain water for a minimum of three consecutive months. Permanent bodies of water, such as freshwater ponds and slow-moving streams, are also used as breeding sites; however, they are often not as desirable for California tiger salamanders because they frequently contain potential predators. Nonetheless, since predators and prey often exist together where equilibrium has been established, the presence of known salamander predators cannot rule out the possibility that salamanders occur at a potential breeding site.

There is no potential breeding habitat for CTS on the project site. The drainages are ephemeral and do not contain pools that remain through the breeding season and there are no other aquatic habitats on or immediately to the project site that provide suitable breeding habitat Therefore, we do not expect this species to be present on the property.

Monterey dusky-footed woodrat (*Neotoma fuscipes luciana*)

The Monterey dusky-footed woodrat is a federal "species of concern" and a California Species of Special Concern. While these designations do not afford the species any legal protection, they do meet the definition of rare and endangered pursuant to §15380 of the CEQA Guidelines. The Monterey dusky-footed woodrat is restricted to western and central Monterey County and northwestern San Luis Obispo County (U.S. Army Corps of Engineers 1993). This subspecies is typically found within dense chaparral or oak woodland habitats with moderately dense understory growth and abundant dead wood for nest construction. It is known from several locations in the project vicinity (e.g., the Hastings Natural History Reservation in Carmel Valley, Fort Ord).

Although we did not conduct species-specific surveys for Monterey dusky-footed woodrat during our site reconnaissance, there is a potential that this animal could occur on the property, especially in the coast live oak woodlands on the site. Since woodrats can live in close proximity to people, development of the site should not affect the species as long as suitable habitat remains.

Coast horned lizard (*Phrynosoma coronatum*)

The coast horned lizard's distribution in the California coastal ranges extends from Sonoma County south to Mexico. Coast horned lizards inhabit open country, especially sandy areas, washes, flood plains, and wind-blown deposits in a wide variety of habitats, including shrublands, woodlands, riparian habitats and annual grassland. Warm, sunny, open areas are a main habitat requirement, along with patches of loose soil where the lizard can bury itself. This species is a federal "species of concern" and a California Species of Special Concern.

Coast horned lizards were seen in the Remainder Parcel during our field reconnaissance, and potentially suitable habitat for this animal exists elsewhere on the site, especially in the coastal scrub-dominated slopes. Although three of the proposed homesites are situated within coastal scrub habitat, it appears that adequate areas of coastal scrub habitat could be set aside as open space for this (and other) species in the Remainder Parcel and outside of the developable area on other lots.

Sensitive bat species

Several species of bats considered sensitive in California could occur in the vicinity of project site. Such species include the pallid bat (*Antrozous pallidus*), California mastiff bat (*Eumops perotis*) and Townsend's big-eared bat (*Plecotus townsendii* ssp. *townsendii*). All of these bat species are considered "species of concern" by the USFWS and/or are listed as California Species of Special Concern by the CDFG. Each could potentially use the site, especially the coast live oak woodlands, as roosting habitat. Day roosts can be found in tree cavities, old buildings, caves, or rocky outcrops. Bats generally leave these day roosts at dusk to forage for invertebrates in a variety of habitats, including annual grasslands and various shrublands and woodlands.

Migratory birds

The Migratory Bird Treaty Act (16 USC 703) prohibits the taking, hunting, killing, selling, purchasing, etc. of migratory birds, parts of migratory birds, and their eggs and nests. As used in the act, the term "take" is defined as meaning, "to pursue, hunt, capture, collect, kill or attempt to pursue, hunt, shoot, capture, collect or kill, unless the context otherwise requires." Most native bird species on the Encina Hills property are covered by this act. The California Fish and Game Code (Section 3511) also provides protection for certain species as listed in the Section. The golden eagle and white-tailed kite are included on that list and have the potential to nest on the project site. Section 3503.5 of the Fish and Game Code specifically protects the nests and eggs of birds-of-prey and essentially overlaps with the Migratory Bird Treaty Act.

Potential nesting sites for birds-of-prey and other migratory birds exist in the coast live oak woodlands as well as in the large individual oak trees that are scattered throughout the property and in the badland escarpments. In practice, abiding by the Migratory Bird Treaty Act usually means to avoid removal of trees with active nests until such time as the young have fledged and the nest is abandoned.

Assessment

The vegetation communities and habitat types that occur on the Encina Hills property are typical of the general area. The grassland areas support a common array of native and introduced grasses and forbs found in grazing land throughout Monterey County. The denser oak woodlands and coastal scrub communities, especially where they line drainage courses are the most biologically diverse areas on the property. The stream channels through the property provide habitat corridors as well as a natural system for carrying seasonal flows during the winter months.. While there is no classic riparian vegetation associated with these drainages, the canopy cover is typically more dense, providing a mesic environment for wildlife.

As we understand the current project proposal, the property would be subdivided into 17 lots ranging from approximately 5 acres to 23 acres in extent and about 180 acres would be retained as open space in the Remainder Parcel. Homesites within each lot are generally sited as indicated on Plate 1 and encompass approximately 1 acre. Access roads will, for the most part, follow existing road alignments. If the area of disturbance is limited to the proposed homesite (about one acre) for each lot, and the remainder of the lot remains natural habitat, then it appears that the effects on biological resources can be minimized. Furthermore, there appears to be ample space available for siting buildings and other facilities so that they would not impact biological resources, if they are found to be present through subsequent site-specific survey work.

The introduction of non-native invasive species as landscape material could threaten to alter the composition of the adjacent native habitats. Also, the increase in human activity in the area will likely displace some of the indigenous wildlife that are less tolerant of disturbance, but these animals may be able to move into the adjacent open space areas. Many of the potential impacts typically associated with increased human activity could be minimized by incorporating features into the project design and by recommending residents follow certain guidelines to reduce disturbance to native species. Some of those features and recommendations are listed in the following section.

Recommendations

As project planning proceeds, we recommend that you consider the following measures to help avoid or minimize impacts on biological resources.

- ✓ Conduct one further focused survey for summer-blooming special status plants in lots 1 through 17 and along proposed road alignments. (This survey is scheduled for July 2001 and results will be submitted as a supplement to this report). Directed surveys in the Remainder Parcel are not necessary unless development is proposed in that parcel. If special status plant species are found in the proposed development areas, consider avoidance alternatives or develop a salvage and relocation plan, as needed.

- Avoid filling or other disturbance of natural drainage courses. Keep homesites, landscaped areas and outbuildings 75 - 100 feet away from the active channel of the drainages. In the event that disturbance of site drainages cannot be avoided (culverts, storm drain outfalls, etc.), authorization from the California Department of Fish and Game through section 1600 (et. seq.) of the Fish and Game Code and/or the U.S. Army Corps of Engineers through Section 404 of the Clean Water Act may be required. Necessary permits and/or authorizations should be obtained from the appropriate regulatory agencies prior to any activity that might encroach on the site's drainages.

- Prior to construction of homesites, roads or other infrastructure, that could result in tree removal during the nesting season (typically the spring and summer months), directed surveys for nesting raptors should be completed. In the event that an occupied nest is observed, the tree should not be removed and adequate buffers should be established around it until the young have fledged.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for day-roosting bats. If day roosts are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for active Monterey dusky-footed woodrat nests. If active nests are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Consider landscape requirements that encourage use of native species and prohibit planting of invasives such as Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*) or eucalyptus (*Eucalyptus* spp.).

- Minimize the area of landscaping around each residence to the extent deemed necessary for fire protection.

- Minimize outdoor lighting features including streetlights and decorative lights away from the homesites.

- Prepare a brochure for homeowners that describes the native flora and fauna and provides guidelines for residents to follow to reduce impacts on the habitat.

Zander Associates can remain available to assist you with follow-up activities, as necessary. Please call us if you have any questions regarding this assessment.

Sincerely,

Leslie Zander
Principal

Attachments

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Encina Hills Project Site
Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Encina Hills Project Site
Figure 1: Site Location
Figure 2: CNDDB Occurrences in the Vicnity of the Encina Hills Property
Plate 1: Vegetation Types

cc: Ken Whitson, Whitson Engineers
Michael Kling
Steve Chidester

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Encina Hills Project Site

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Allium hickmanii (Hickman's onion)	SC/--/1B	Sandy loam soils and vernal swales in a variety of habitats including, closed-cone coniferous forest, chaparral, coastal scrub, valley and foothill grassland, and coastal prairies; blooming period: April – May	Not observed during spring surveys.
Arctostaphylos hookeri ssp. hookeri (Hooker's manzanita)	--/--/1B	Sandy soils, sandstone outcrops in coastal scrub, chaparral, cismontane woodland, and closed-cone coniferous forest habitats in Monterey and Santa Cruz counties; blooms February through May (evergreen)	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Arctostaphylos montereyensis (Monyterey manzanita)	SC/--/1B	Chaparral, cismontane woodland, and coastal scrub habitats in Monterey County, sandy soils often with chaparral associates; blooms February – March (evergreen)	Scattered plants observed within scrub habitat along eastern boundary – found in Toro Park.
Arctostaphylos pajaroensis (Pajaro manzanita)	--/--/1B	Sandy soil chaparral habitats of Monterey County; blooming period: December through March (evergreen)	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Arctostaphylos pumila (Sandmat manzanita)	--/--/1B	Closed-cone coniferous forest, chaparral, coastal dines, and cismontane woodland habitats; sandy soil with other chaparral associates; blooms Feb. – May (evergreen)	Not observed. Not likely to be present – out of range.
Ceanothus cuneatus var. *rigidus* (Monterey ceanothus)	SC/--/4	Chaparral, coastal scrub and closed-cone coniferous forest; evergreen perennial shrub identifiable throughout the year.	Observed at edge of maritime chaparral in Remainder Parcel.
Chorizanthe pungens var. *pungens* (Monterey spineflower)	T/--/1B	Coastal dunes, chaparral, cismontane woodland, and coastal scrub habitats in Monterey and Santa Cruz counties; blooming period: April through June	Not observed during spring surveys. Could occur within maritime chaparral in Remainder Parcel – difficult to access.
Chorizanthe robusta var. *robusta* (Robust spineflower)	E/--/1B	Sandy soils in cismontane woodland openings and coastal dune and scrub habitats; blooms May through September	Not observed in maritime chaparral in Remainder Parcel – difficult to access.
Cordylanthus rigidus ssp. *littoralis* (Seadside bird's-beak)	SC/E/1B	Often found on disturbed closed-cone coniferous, chaparral, cismontane woodland, coastal scrub or dune sites; blooming period: May through September	Summer survey to determine presence/absence.

Table 1 (Continued)

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Delphinium hutchinsoniae (Hutchinson's larkspur)	SC/--/1B	Semi-shaded, slightly moist slopes in broad leaf upland forest, chaparral, coastal prairie or coastal scrub habitats in Monterey County; blooms March through June	Not observed during spring surveys.
Ericameria fasciculata (Eastwood's goldenbush)	SC/--/1B	Sandy openings of closed-cone coniferous forest, maritime chaparral, coastal scrub or coastal dune habitats in Monterey County; blooming period: July through October	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Fritillaria liliacea (Fragrant fritillary)	SC/--/1B	Coastal, scrub, coastal prairie, valley and foothill grasslands, often on serpentine soils; generally blooms from February-April	Not observed during spring surveys. No obvious serpentine habitat observed.
Gilia tenuiflora ssp. *arenaria* (Sand gilia)	E/T/1B	Cismontane woodland, maritime chaparral, coastal scrub and dune habitats in Monterey County, in particular bare, wind-sheltered areas near dune summits or in hind dunes; blooming period: April through May	Not observed during spring surveys. Not expected to occur due to lack of suitable habitat.
Hemizonia parryi ssp. *congdonii* (Congdon's tarplant)	SC/--/1B	Annual herb found on alkaline soils of valley/foothill grasslands, Alameda to San Luis Obispo counties; blooms June – Oct.	Known to occur in the vicinity. Summer survey to determine presence/absence.
Horkelia cuneata ssp. *sericea* (Kellogg's horkelia)	SC/--/1B	Closed-cone coniferous forest, chaparral, and coastal scrub habitats, old dunes and coastal sand hills; blooms April – September	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Malacothamnus palmeri var. *involucratus* (Carmel Valley bush mallow)	SC/--/1B	Burn dependent deciduous shrub found on serpentine soils, talus hilltops, and slopes in cismontane and chaparral habitats in San Luis Obispo and Monterey counties; blooming period: May through August	Not observed during spring surveys.
Malacothrix saxatilis var. *arachnoidea* (Carmel Valley cliff-aster)	SC/--/1B	Rock outcrops and steep rocky road cuts in chaparral communities of Santa Barbara and Monterey counties; blooms June – December.	Summer survey to determine presence/absence. Low potential due to lack of substrate.
Perideridia gairdneri ssp *gairdneri* (Gairdner's yampah)	SC/--/4	Chaparral, broad-leaved upland forests and valley foothills and grasslands under mesic conditions; blooms June – October.	Summer survey to determine presence/absence.

Table 1 (Continued)

Species	Status Fed/CA/CNPS	Habitat and Blooming Period	Findings
Pinus radiata (Monterey pine)	SC/--/1B	Closed-cone coniferous forest, cismontane woodland, dry bluffs and slopes (evergreen)	Not observed.
Piperia yadonii (Yadon's rein orchid)	E/--/1B	Poorly drained sandy soils of closed-cone coniferous forest, chaparral and coastal scrub habitats; blooms May - August	Not observed during surveys. Summer assessment to confirm identify of lone individual *Piperia* sp.
Plagiobothrys uncinatus (Hooked popcorn flower)	SC/--/1B	Various habitats including cismontane woodland, valley and foothill grasslands, canyon sides, and chaparral; blooms in May	Not observed during spring surveys.
Stebbinsoseris decipiens (Santa Cruz microseris)	SC/--/1B	Seaward slopes in broadleaf and closed-cone coniferous forest, chaparral, coastal prairie and scrub communities, loose or disturbed soils derived from sandstone, shale or serpentine; blooms April -- May	Not observed during spring surveys.
Trifolium buckwestorium (Santa Cruz clover)	--/--/1B	Annual herb endemic to Santa Cruz County and found in moist grasslands of coastal prairies, broadleaf upland forests, and cismontane woodlands; biannual blooming period: May and October	Not observed during spring surveys.
Trifolium polyodon (Pacific Grove clover)	SC/R/1B	Annual herb found along small springs and seeps in grassy openings of closed-cone coniferous forests, meadows, and coastal prairies of Monterey County; blooming period: May through June	Not observed during spring surveys.
Trifolium trichocalyx (Monterey clover)	P/E/1B	Closed-cone coniferous forest; generally blooms from April-June	Not observed during surveys. Not expected to occur due to lack of suitable habitat.

1. Status Explanations

Federal (Fed)
E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
SC = "species of concern"
-- = no designation

California State (CA)
R = listed as rare under the California Endangered Species Act
E = listed as endangered under the California Endangered Species Act
T = listed as threatened under the California Endangered Species Act
-- = no designation

California Native Plant Society (CNPS)
1B = plants considered rare, threatened or endangered in California and elsewhere.
4 = plants of limited distribution – a watch list.

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.

Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Encina Hills Project Site

Species	Status Fed/CA	Habitat	Findings
Euphilotes enoptes smithi (Smith's blue butterfly)	E/--	Most commonly associated with coastal dunes and coastal sage scrub plant communities in Monterey and Santa Cruz counties; host plants: *Eriogonum latifolium & E. parvifolium*	No suitable habitat present.
Rana aurora draytonii (California red-legged frog)	T/CSC	Lowlands and foothills in or near permanent sources of deep water within streams, marshes, and occasionally ponds with dense, shrubby, or emergent riparian vegetation.	No aquatic habitat present on site and no documented occurrences in the project vicinity.
Ambystoma californiense (California tiger salamander)	SC/CSC	Grasslands and open oak woodlands with ground squirrel or gopher burrows for underground retreats, and breeding ponds such as seasonal wetlands, vernal pools or slow-moving streams that do not support predatory fish or frog populations	No suitable breeding habitat present on the site
Anniella pulchra nigra (Black legless lizard)	--/CSC	Monterey and Morro Bay areas in moist dunes or sandy soils with mock heather & bush lupine	Not likely to occur; suitable habitat not present.
Phrynosoma coronatum frontale California horned lizard	--/CSC	Found in a wide variety of habitats; however, most common in lowlands along sandy washes with scattered low bushes and areas for sunning	Individual observed in Remainder Parcel. Suitable habitat present.
Clemmys marmorata pallida (Southwestern pond turtle)	--/CSC	Requires aquatic habitats with permanent or persistent water and protected areas for basking such as partially submerged rocks or logs, floating vegetation mats or open mud banks	No suitable habitat present.
Accipiter cooperi (Nesting) (Cooper's hawk)	--/CSC	Nests in riparian forests and dense canopy oak woodlands; forages in open woodlands.	Potential nesting habitat present.
Accipiter striatus (Nesting) (Sharp-shinned hawk)	--/CSC	Nests and forages in dense riparian forests, conifer forests, and dense canopy oak woodlands.	Potential nesting habitat present.

Table 2 (Continued)

Species	Status[1] Fed/CA	Habitat	Findings[2]
Aquila chrysaetos (Nesting) (Golden eagle)	--/CSC	Nests in cliffs and large trees; forages in annual grasslands, chaparral and oak woodlands with abundant medium-sized and large mammals for prey.	Potential nesting habitat present.
Athene cunicularia (Burrowing owl)	--/CSC	Ground nester in open dry annual or perennial grasslands, deserts and scrublands with low-growing vegetation, dependent upon burrowing mammals (i.e. California ground squirrel)	No signs of burrowing owl observed during March surveys. Grasslands could provide habitat for the species.
Falco mexicanus (Nesting) (Prairie falcon)	--/CSC	Level or hilly dry, open terrain with cliffs as breeding sites; foraging ranges may extend to marshlands and ocean shores	Potential nesting habitat present in badland escarpment.
Eumops perotis (California mastiff bat)	SC/CSC	Lowland areas in arid to semi-arid habitats including deciduous woodlands, coastal scrub, and annual grasslands.	Suitable habitat present
Antrozous pallidus (Pallid bat)	SC/CSC	Found in a variety of habitats. Most common in dry, open habitats with rocky areas available for day roosts.	Suitable habitat present.
Plecotus townsendii ssp. townsendii (Townsend's big-eared bat)	SC/CSC	Inhabits oak/bay woodlands and mixed broadleaf conifer woodlands; requires access to caves, building attics or other dark cavities for daytime refuge.	Suitable habitat present.
Neotoma fuscipes luciana (Monterey dusky-footed woodrat)	SC/CSC	Uses habitats with moderate to dense cover and abundant dead wood for nest construction.	Suitable habitat in oak woodlands.

1. Status Explanations

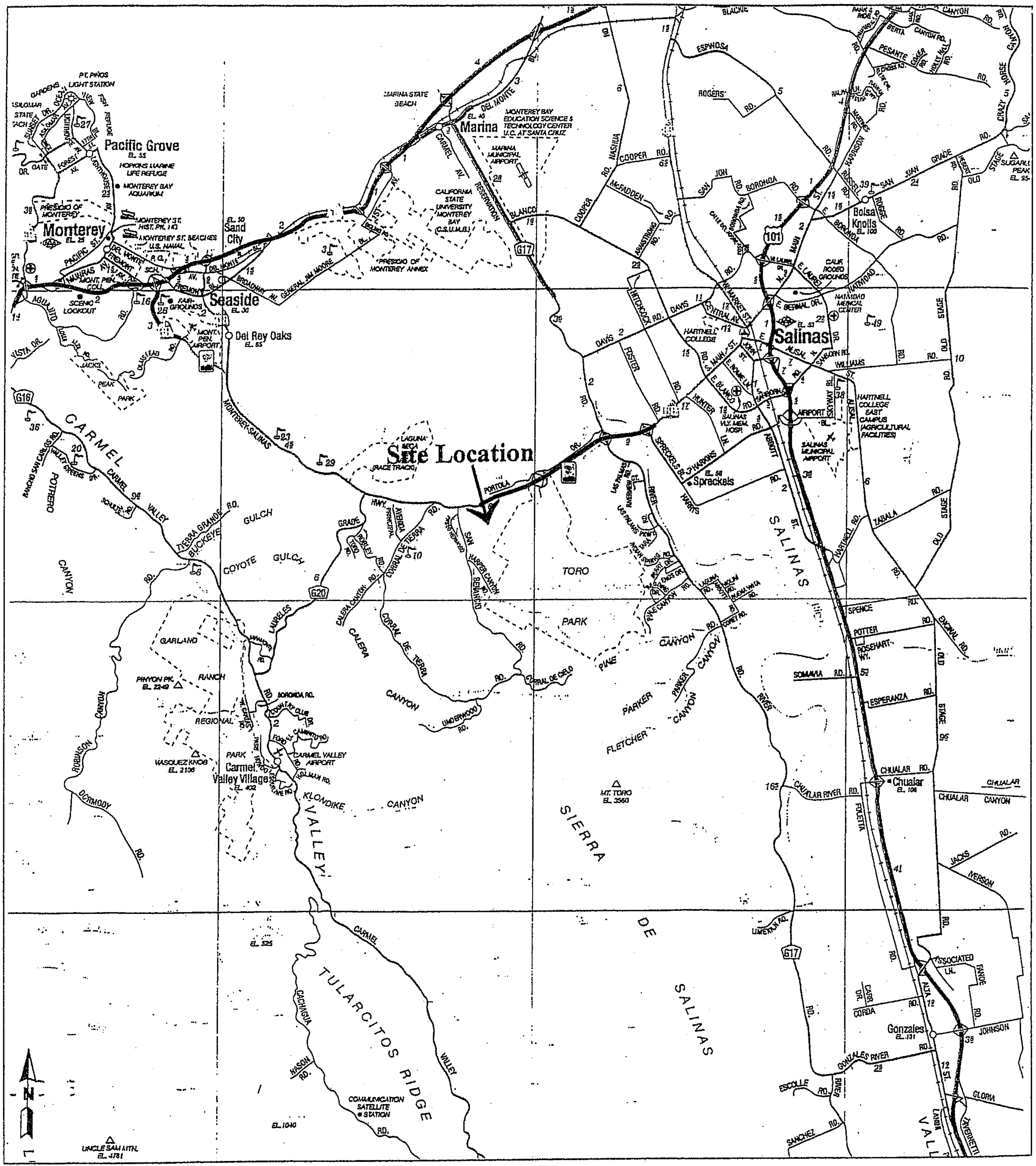
Federal (Fed)

E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
SC = "species of concern"
-- = no designation

California State (CA)

CSC = California Department of Fish and Game Species of Special Concern

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.



ZANDER ASSOCIATES

Environmental Consultants

Site Location

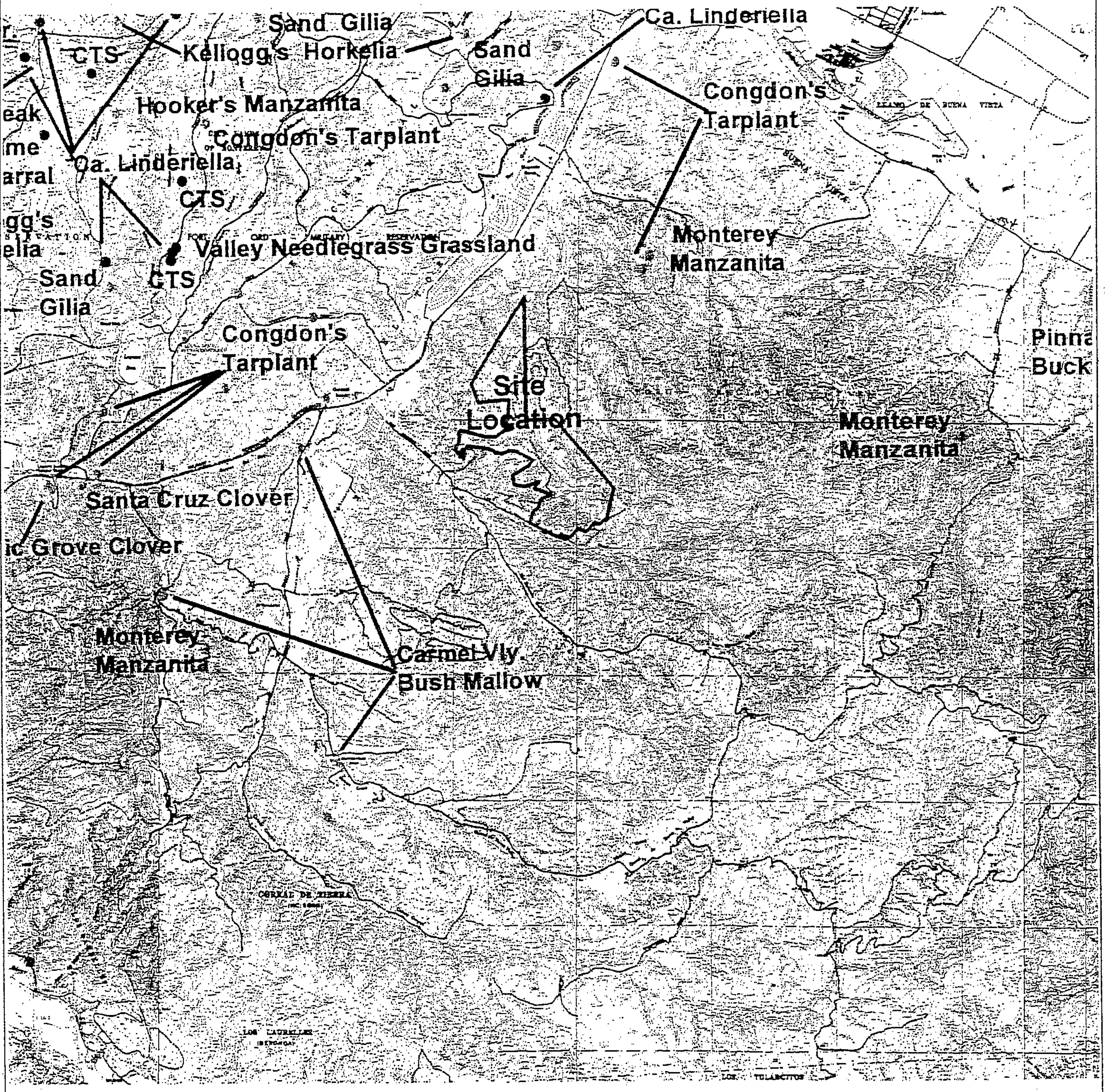
Encina Hills Project

Monterey County, California

Figure

1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
HCR1	**MZ**	**4/01**	**7/01**



ZANDER ASSOCIATES

Environmental Consultants

CNDDB Occurrences in the Vicinity of
Encina Hills Project
Monterey County, California

Figure
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
HCR1	MZ	4/01	7/01

ZANDER ASSOCIATES

Environmental Consultants

October 3, 2001

Ms. Elizabeth Farwell
Vice President, Finance and Administration
DANJAQ, Inc.
2401 Colorado Avenue, Suite 330
Santa Monica, California 90404

RECEIVED
OCT 09 2001
MICHAEL D. CLING
ATTORNEY AT LAW

Results of Follow-up Survey
Encina Hills Property
Monterey County, California

Dear Ms Farwell:

On August 1, 2001, Zander Associates revisited the Encina Hills Property, as recommended in our July 13, 2001 report to specifically survey for sensitive plant species that are identifiable during the summer-blooming season. The species that were the focus of our survey were Seaside bird's beak (*Cordylanthus rigidus* ssp. *littoralis*), Congdon's tarplant (*Hemizonia parryi* ssp. *congdonii*), Carmel Valley cliff-aster (*Malacothrix saxatilis* var. *arachnoidea*), and Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*). Our survey was conducted concurrently with visits to known populations of the target species to confirm that the plants were blooming and identifiable at the time. The survey was conducted by walking the entire property thoroughly, except for the Remainder Parcel, and identifying all plant species observed.

No Seaside bird's beak, Congdon's tarplant, Carmel Valley cliff-aster, or Gairdner's yampah were observed on the site during the survey. There is no appropriate habitat within the development envelopes to support the Carmel Valley cliff-aster (rock outcrops and steep rocky road cuts in chaparral communities) and the Seaside bird's beak (sandy substrate). Though Congdon's tarplant and Gairdner's yampah are typically found in grasslands, much of this habitat on the Encina Hills property is on slopes with porous soils that do not hold adequate moisture for these plants. The few moist flat grassland areas on the property were not found to support Condon's tarplant.

Please call me if you have any questions regarding the results of our follow-up survey.

Sincerely,

Chris Polatin

Chris Polatin
Environmental Scientist

cc: Ken Whitson, Whitson Engineers
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ZANDER ASSOCIATES

Environmental Consultants

July 13, 2001

Ms. Elizabeth Farwell
Vice President, Finance and Administration
DANJAQ, Inc.
2401 Colorado Avenue, Suite 330
Santa Monica, California 90404

Biological Resources Assessment
Encina Hills Property
Monterey County, California

Dear Ms Farwell:

Zander Associates has completed an assessment of the existing biological resources on the Encina Hills property in Monterey County. The project site consists of approximately 344 acres situated along the southeast side of Highway 68 adjacent to Toro Regional Park. The purpose of our assessment was to describe and map existing vegetation patterns on the site and identify target species and other resources for further survey, as necessary. We consulted the California Natural Diversity Database, and previous environmental documents prepared for properties in the vicinity to compile a list of special status species that are known to occur in the vicinity. Zander Associates conducted a reconnaissance-level survey on March 6, 2001 to characterize and map dominant vegetation types and to evaluate the potential for the property to support a target list of sensitive plant and animal species. On April 25, 2001 a focused survey for sensitive plant species with spring blooming periods was conducted on the entire property. This letter summarizes the results of our background review, reconnaissance survey, and spring plant surveys.

General Site and Project Description

The Encina Hills property consists primarily of pastureland on hilly terrain that ranges in elevation from about 400 to 1,000 feet above sea level. The property is situated south of Highway 68, east of San Benancio Road, north of Harper Canyon Road and west of Toro Regional Park (Figure 1). There are several seasonal drainage courses that originate in the hills on the site and drain downslope to the south, east and west off the property. A sandstone escarpment or badland with severely eroded slopes and minimal vegetation is located at the northern property boundary, in the northern corner of lot 9 (proposed). Several smaller escarpments are found near ridges in the northeastern portion of the property.

There are no homes or other building structures currently on the site. The proposed project is to subdivide the property into 17 lots ranging from approximately 5 acres to 23 acres in extent and retain about 180 acres in a Remainder Parcel. Homesites within each lot are generally sited as indicated on Plate 1 and encompass approximately 1 acre.

Vegetation Communities/Habitat Types

Zander Associates identified elements of four vegetation communities typical of the general area on the site: annual grassland, coast live oak woodland/savanna, coastal scrub and central maritime chaparral. In addition, the upper reaches of several intermittent drainages are found on the site. Classification of the vegetation communities is based generally on Holland (1986) and Sawyer and Keeler-Wolf (1995). Each of these vegetation communities, and the wildlife habitat they provide, is described below. A map indicating the distribution and extent of these communities on the site is attached as Plate 1.

Annual Grassland

The annual grassland community on the property is characterized by a mixture of native perennial and introduced annual species and is heavily grazed by cattle. Common introduced grass species observed included slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), and rattail fescue (*Vulpia myuros*). The primary native perennial species observed scattered throughout the grassland is purple needlegrass (*Nasella pulchra*).

Grasslands often provide habitat for a variety of native wildflowers that typically bloom in the spring. At the time of our site visit, only a few wildflower species were in bloom and identifiable, including: footsteps of spring (*Sanicula arctopoides*), Johnny jump-up (*Viola pedunculata*), and California gilia (*Gilia achilleifolia*). The dominant flowering herb present within the grassland during our survey was the non-native long-beaked filaree (*Erodium botrys*). The dominant presence of this species is indicative of the extensive grazing.

Grasslands provide foraging habitat for small mammals which in turn serve as prey for a variety of other animals, including snakes, raptors ("birds of prey"), and coyotes (*Canis latrans*). Numerous invertebrate species, many of which provide a food source for larger animals such as lizards, birds and some small mammals, can also be found within grassland communities.

Coast Live Oak Woodland and Savanna

Oak woodland communities in Monterey County are dominated by open to nearly closed canopies of coast live oaks (*Quercus agrifolia*) with grass or shrub understories. Savannas are transitional between woodlands and grassland with trees more widely spaced and a grassland-dominated understory. On the Encina Hills property, oak woodlands occupy the more mesic (moist) north-facing slopes and canyon bottoms and the oak savanna is along a drier, east-facing slope, near the ridgetop.

The understory species composition in oak woodlands varies depending upon local conditions such as moisture availability and soil type. The understory in the oak savanna consists of species common to the annual grassland habitat but may include additional wildflower species not found in the open grasslands. Common oak woodland understory species observed on the Encina Hills property include poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), and California coffeeberry (*Rhamnus californica*). The species composition of the understory changes slightly where the oak woodland transitions to coastal scrub higher on the slopes to include some coastal scrub species.

Oak woodland and oak savanna provide habitat for a variety of wildlife. The oak trees provide suitable nesting sites and cover for birds and many mammals. Woody debris and duff in the woodland understory provide foraging areas for small mammals and microclimates suitable for amphibians and reptiles. Acorns are a valuable food source for many animal species, including the California quail (*Lophortyx californicus*), western gray squirrel (*Scirus griseus*), and black-tailed deer (*Odocoileus hemionus*). Other representative animal species of oak dominated woodlands include arboreal salamander (*Aneides lugubris*), western screech owl (*Otus kennicottii*), scrub jay (*Aphelocoma corulescens*), and Virginia opossum (*Didelphis virginianus*).

Coastal Scrub

Coastal scrub communities are characterized by moderate to low-growing evergreen and drought tolerant shrubs adapted to shallow soils. On the Encina Hills property, coastal scrub is typically dominated by soft-leaved shrubs like California sage (*Artemisia californica*), coyote brush (*Baccharis pilularis* var. *consanguinea*), and sticky monkey flower (*Mimulus aurantiacus*). This vegetation community occurs mostly on drier, wind exposed sites near the tops of the ridges or on steep slopes with sandy, mudstone or shale soils.

Coastal scrub provides cover and nesting habitat for a variety of animals. The sandy soils typically associated with this community also provide areas for wildlife denning and nesting. Animal species common to coastal scrub habitat include western fence lizard (*Sceloporus occidentalis*), western rattlesnake (*Crotalus viridis*), California quail (*Callipepla californica*) brush rabbit (*Sylvilagus bachmani*) and gray fox (*Urocyon cinereoargentus*).

Maritime Chaparral

This plant community is similar to coastal scrub in that it is characterized by moderate to low-growing evergreen and drought tolerant shrubs adapted to shallow soils. It varies from coastal scrub in that its dominant species consist of sclerophyllus (hard-leaved) shrubs, such as chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp), and ceanothus (*Ceanothus* spp). Wildlife species using this habitat type are similar to those described for coastal scrub. Maritime chaparral is limited in extent on the property and is found in the upper end (southern) of the canyon that comprises the eastern portion of the Remainder Parcel.

There are several special status plant species associated with this vegetation type in the project vicinity including Toro (or Monterey) manzanita, Monterey ceanothus and Eastwood's ericameria. These are discussed further in the following sections.

Drainages

There are portions of several drainages and tributaries to drainages that originate on the property and carry flows offsite. These drainages appear to be ephemeral, carrying flow only in response to winter storms. In general, the channels are cobble- or soil-lined and are devoid of in-channel vegetation. Some of the channels are deeply incised. Oak woodland vegetation is primarily associated with the drainages; classic riparian (stream-related) vegetation is generally absent from these areas. Most of the drainages on the property are tributary to El Toro Creek, which drains to the Salinas River.

Wildlife habitat in these drainages does not vary substantially from that previously described for oak woodland or grassland habitat. The channels can provide movement corridors for amphibians when water is present and for other animals throughout the year.

Special Status Species

For this assessment, special status species are defined as: those plants and animals listed, proposed for listing, or candidates for listing as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS); those considered "Species of Concern" by the USFWS; those listed or proposed for listing as rare, threatened or endangered by the California Department of Fish and Game (CDFG); plants occurring on lists 1B or 2 of the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (1994); and animals designated as "Species of Special Concern" by CDFG.

Duirng the site visit on March 6, 2001 Zander Associates developed a target list of special status plant and animal species that we evaluated for their potential to occur on the Encina Hills property (Tables 1 and 2, respectively). The list was developed based on our review of the California Natural Database (CNDDB) records and our work on other properties in the vicinity. On April 25, 2001 Zander Associates conducted focused surveys for special status plant species that bloom during the spring. The results of the spring plant survey are discussed below and summarized on Table 1.

Plants

Many of the special status plants that occur in the vicinity of the Encina Hills property are found in specific habitat types such as maritime chaparral, vernal pools, or on serpentine substrate. No vernal pool habitat was observed on the site and there were no obvious areas with serpentine substrates - based on vegetative characteristics. A limited amount of maritime chaparral habitat is present in the Remainder Parcel on the property and was surveyed during the April 25, 2001 site visit. The maritime chaparral habitat was surveyed as completely as possible; however, certain areas were not accessible due to dense brush and steep terrain. A few Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*) shrubs were observed at the northern edge of the maritime chaparral habitat. Other special status plants potentially occuring in the maritime chaparral but not found during the spring plant survey include Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Kellogg's horkelia (*Horkelia cuneata* ssp. *sericea*), and Hooker's manzanita (*Arctostaphylos hookeri* ssp *hookeri*). These species would likely be found in open areas within maritime chaparral habitat; however, the dense structure of this habitat and lack of openings discourage the establishment of these species.

Along the eastern edge of the development area, a few Monterey manzanita (*Arctostaphylos montereyensis*) shrubs were observed during the spring plant surveys. An individual unidentified rein orchid (*Piperia* sp.), most likely *P. elegans* or *P. michaelii* was observed along the northwestern property boundary in lot 3. Focused searches were conducted for other sensitive spring-blooming plants with the potential to occur on the Encina Hills property including Hickman's onion (*Allium hickmanii*), Hutchinson's larkspur (*Delphinium hutchinsoniae*), Carmel Valley cliff-aster (*Malacothamnus parlmeri* var. *incolucratus*), hooked popcorn flower (*Plagiobothrys uncinatus*), Santa Cruz microseris (*Stebbinsoseris decipiens*), Santa Cruz clover (*Trifolium buchwestorium*), and Pacific Grove clover (*Trifolium polyodon*). None of these senstive plant species were observed.

One additional focused plant survey will occur during July to check for sensitive summer-blooming plants with the potential to occur in the proposed development area. These species include Seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*), Congdon's tarplant (*Hemizonia parryi* ssp. *congdonii*), Carmel Valley cliff-aster (*Malacothrix saxatilis* var. *arachnoidea*), and Gairdner's yampah (*Periperidia gairdneri* ssp. *gairdneri*). Focused surveys for these species may be conducted in the development area only since development is not proposed for the Remainder Parcel.

Animals

As a result of our background review and subsequent site survey, we determined that the project site provides limited potential habitat for some special-status animal species. Additionally, raptors and other migratory birds protected under the Migratory Bird Treaty Act could nest on the project site, primarily in the larger coast live oak and Monterey pine trees. Following is a discussion of the special-status species that have the potential to occur on the project site.

California red-legged frog (*Rana aurora draytonii*)

The California red-legged frog (*Rana aurora draytonii*) is a federally listed threatened species and a California Species of Special Concern. The red-legged frog typically inhabits ponds and backwater sections of streams with permanent or near-permanent water, and generally prefers areas with dense emergent or riparian vegetation and deep pools for breeding.

The closest CNDDB occurrences of this species are in the Carmel and Salinas Rivers. The drainages on the site are ephemeral and do not provide suitable breeding habitat for the California red-legged frog because of the lack of permanent water and absence of in-channel vegetation. Nonetheless, there is a limited potential for these drainages to serve as dispersal corridors for red-legged frogs because of their remote linkage to the Salinas River via El Toro Creek. No focused surveys for red-legged frogs are recommended unless the project would affect these drainages.

California tiger salamander (*Ambystoma californiense*)

The California tiger salamander is a federal candidate for listing as threatened or endangered, and is a California Species of Special Concern. This species inhabits annual grassland and open oak woodlands in the vicinity of ephemeral pools or other suitable breeding ponds. CTS use burrows of ground squirrels or other rodents as aestivation sites. With the onset of the rainy season, adults migrate from their burrows to nearby ponds for breeding. Following breeding, the adults disperse to upland areas, and retreat into burrows where they remain for most of the year. CTS have been reported to migrate as far as one mile between their underground retreats and breeding ponds, but aestivation sites are usually located within one quarter mile of breeding ponds.

For the California tiger salamander to complete a breeding cycle, it is generally believed that breeding sites must retain water for a minimum of three consecutive months. Permanent bodies of water, such as freshwater ponds and slow-moving streams, are also used as breeding sites; however, they are often not as desirable for California tiger salamanders because they frequently contain potential predators. Nonetheless, since predators and prey often exist together where equilibrium has been established, the presence of known salamander predators cannot rule out the possibility that salamanders occur at a potential breeding site.

There is no potential breeding habitat for CTS on the project site. The drainages are ephemeral and do not contain pools that remain through the breeding season and there are no other aquatic habitats on or immediately to the project site that provide suitable breeding habitat Therefore, we do not expect this species to be present on the property.

Monterey dusky-footed woodrat (*Neotoma fuscipes luciana*)

The Monterey dusky-footed woodrat is a federal "species of concern" and a California Species of Special Concern. While these designations do not afford the species any legal protection, they do meet the definition of rare and endangered pursuant to §15380 of the CEQA Guidelines. The Monterey dusky-footed woodrat is restricted to western and central Monterey County and northwestern San Luis Obispo County (U.S. Army Corps of Engineers 1993). This subspecies is typically found within dense chaparral or oak woodland habitats with moderately dense understory growth and abundant dead wood for nest construction. It is known from several locations in the project vicinity (e.g., the Hastings Natural History Reservation in Carmel Valley, Fort Ord).

Although we did not conduct species-specific surveys for Monterey dusky-footed woodrat during our site reconnaissance, there is a potential that this animal could occur on the property, especially in the coast live oak woodlands on the site. Since woodrats can live in close proximity to people, development of the site should not affect the species as long as suitable habitat remains.

Coast horned lizard (*Phrynosoma coronatum*)

The coast horned lizard's distribution in the California coastal ranges extends from Sonoma County south to Mexico. Coast horned lizards inhabit open country, especially sandy areas, washes, flood plains, and wind-blown deposits in a wide variety of habitats, including shrublands, woodlands, riparian habitats and annual grassland. Warm, sunny, open areas are a main habitat requirement, along with patches of loose soil where the lizard can bury itself. This species is a federal "species of concern" and a California Species of Special Concern.

Coast horned lizards were seen in the Remainder Parcel during our field reconnaissance, and potentially suitable habitat for this animal exists elsewhere on the site, especially in the coastal scrub-dominated slopes. Although three of the proposed homesites are situated within coastal scrub habitat, it appears that adequate areas of coastal scrub habitat could be set aside as open space for this (and other) species in the Remainder Parcel and outside of the developable area on other lots.

Sensitive bat species

Several species of bats considered sensitive in California could occur in the vicinity of project site. Such species include the pallid bat (*Antrozous pallidus*), California mastiff bat (*Eumops perotis*) and Townsend's big-eared bat (*Plecotus townsendii* ssp. *townsendii*). All of these bat species are considered "species of concern" by the USFWS and/or are listed as California Species of Special Concern by the CDFG. Each could potentially use the site, especially the coast live oak woodlands, as roosting habitat. Day roosts can be found in tree cavities, old buildings, caves, or rocky outcrops. Bats generally leave these day roosts at dusk to forage for invertebrates in a variety of habitats, including annual grasslands and various shrublands and woodlands.

Migratory birds

The Migratory Bird Treaty Act (16 USC 703) prohibits the taking, hunting, killing, selling, purchasing, etc. of migratory birds, parts of migratory birds, and their eggs and nests. As used in the act, the term "take" is defined as meaning, "to pursue, hunt, capture, collect, kill or attempt to pursue, hunt, shoot, capture, collect or kill, unless the context otherwise requires." Most native bird species on the Encina Hills property are covered by this act. The California Fish and Game Code (Section 3511) also provides protection for certain species as listed in the Section. The golden eagle and white-tailed kite are included on that list and have the potential to nest on the project site. Section 3503.5 of the Fish and Game Code specifically protects the nests and eggs of birds-of-prey and essentially overlaps with the Migratory Bird Treaty Act.

Potential nesting sites for birds-of-prey and other migratory birds exist in the coast live oak woodlands as well as in the large individual oak trees that are scattered throughout the property and in the badland escarpments. In practice, abiding by the Migratory Bird Treaty Act usually means to avoid removal of trees with active nests until such time as the young have fledged and the nest is abandoned.

Assessment

The vegetation communities and habitat types that occur on the Encina Hills property are typical of the general area. The grassland areas support a common array of native and introduced grasses and forbs found in grazing land throughout Monterey County. The denser oak woodlands and coastal scrub communities, especially where they line drainage courses are the most biologically diverse areas on the property. The stream channels through the property provide habitat corridors as well as a natural system for carrying seasonal flows during the winter months. While there is no classic riparian vegetation associated with these drainages, the canopy cover is typically more dense, providing a mesic environment for wildlife.

As we understand the current project proposal, the property would be subdivided into 17 lots ranging from approximately 5 acres to 23 acres in extent and about 180 acres would be retained as open space in the Remainder Parcel. Homesites within each lot are generally sited as indicated on Plate 1 and encompass approximately 1 acre. Access roads will, for the most part, follow existing road alignments. If the area of disturbance is limited to the proposed homesite (about one acre) for each lot, and the remainder of the lot remains natural habitat, then it appears that the effects on biological resources can be minimized. Furthermore, there appears to be ample space available for siting buildings and other facilities so that they would not impact biological resources, if they are found to be present through subsequent site-specific survey work.

The introduction of non-native invasive species as landscape material could threaten to alter the composition of the adjacent native habitats. Also, the increase in human activity in the area will likely displace some of the indigenous wildlife that are less tolerant of disturbance, but these animals may be able to move into the adjacent open space areas. Many of the potential impacts typically associated with increased human activity could be minimized by incorporating features into the project design and by recommending residents follow certain guidelines to reduce disturbance to native species. Some of those features and recommendations are listed in the following section.

Recommendations

As project planning proceeds, we recommend that you consider the following measures to help avoid or minimize impacts on biological resources.

- Conduct one further focused survey for summer-blooming special status plants in lots 1 through 17 and along proposed road alignments. (This survey is scheduled for July 2001 and results will be submitted as a supplement to this report). Directed surveys in the Remainder Parcel are not necessary unless development is proposed in that parcel. If special status plant species are found in the proposed development areas, consider avoidance alternatives or develop a salvage and relocation plan, as needed.

- Avoid filling or other disturbance of natural drainage courses. Keep homesites, landscaped areas and outbuildings 75 - 100 feet away from the active channel of the drainages. In the event that disturbance of site drainages cannot be avoided (culverts, storm drain outfalls, etc.), authorization from the California Department of Fish and Game through section 1600 (et. seq.) of the Fish and Game Code and/or the U.S. Army Corps of Engineers through Section 404 of the Clean Water Act may be required. Necessary permits and/or authorizations should be obtained from the appropriate regulatory agencies prior to any activity that might encroach on the site's drainages.

- Prior to construction of homesites, roads or other infrastructure, that could result in tree removal during the nesting season (typically the spring and summer months), directed surveys for nesting raptors should be completed. In the event that an occupied nest is observed, the tree should not be removed and adequate buffers should be established around it until the young have fledged.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for day-roosting bats. If day roosts are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for active Monterey dusky-footed woodrat nests. If active nests are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Consider landscape requirements that encourage use of native species and prohibit planting of invasives such as Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*) or eucalyptus (*Eucalyptus* spp.).

- Minimize the area of landscaping around each residence to the extent deemed necessary for fire protection.

- Minimize outdoor lighting features including streetlights and decorative lights away from the homesites.

- Prepare a brochure for homeowners that describes the native flora and fauna and provides guidelines for residents to follow to reduce impacts on the habitat.

Zander Associates can remain available to assist you with follow-up activities, as necessary. Please call us if you have any questions regarding this assessment.

Sincerely,

Leslie Zander
Principal

Attachments

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Encina Hills Project Site
Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Encina Hills Project Site
Figure 1: Site Location
Figure 2: CNDDB Occurrences in the Vicnity of the Encina Hills Property
Plate 1: Vegetation Types

cc: Ken Whitson, Whitson Engineers
Michael Kling
Steve Chidester

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Encina Hills Project Site

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Allium hickmanii (Hickman's onion)	SC/--/1B	Sandy loam soils and vernal swales in a variety of habitats including, closed-cone coniferous forest, chaparral, coastal scrub, valley and foothill grassland, and coastal prairies; blooming period: April – May	Not observed during spring surveys.
Arctostaphylos hookeri ssp. hookeri (Hooker's manzanita)	--/--/1B	Sandy soils, sandstone outcrops in coastal scrub, chaparral, cismontane woodland, and closed-cone coniferous forest habitats in Monterey and Santa Cruz counties; blooms February through May (evergreen)	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Arctostaphylos montereyensis (Monyterey manzanita)	SC/--/1B	Chaparral, cismontane woodland, and coastal scrub habitats in Monterey County, sandy soils often with chaparral associates; blooms February – March (evergreen)	Scattered plants observed within scrub habitat along eastern boundary – found in Toro Park.
Arctostaphylos pajaroensis (Pajaro manzanita)	--/--/1B	Sandy soil chaparral habitats of Monterey County; blooming period: December through March (evergreen)	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Arctostaphylos pumila (Sandmat manzanita)	--/--/1B	Closed-cone coniferous forest, chaparral, coastal dines, and cismontane woodland habitats; sandy soil with other chaparral associates; blooms Feb. – May (evergreen)	Not observed. Not likely to be present – out of range.
Ceanothus cuneatus var. *rigidus* (Monterey ceanothus)	SC/--/4	Chaparral, coastal scrub and closed-cone coniferous forest; evergreen perennial shrub identifiable throughout the year.	Observed at edge of maritime chaparral in Remainder Parcel.
Chorizanthe pungens var. *pungens* (Monterey spineflower)	T/--/1B	Coastal dunes, chaparral, cismontane woodland, and coastal scrub habitats in Monterey and Santa Cruz counties; blooming period: April through June	Not observed during spring surveys. Could occur within maritime chaparral in Remainder Parcel – difficult to access.
Chorizanthe robusta var. *robusta* (Robust spineflower)	E/--/1B	Sandy soils in cismontane woodland openings and coastal dune and scrub habitats; blooms May through September	Not observed in maritime chaparral in Remainder Parcel – difficult to access.
Cordylanthus rigidus ssp. *littoralis* (Seadside bird's-beak)	SC/E/1B	Often found on disturbed closed-cone coniferous, chaparral, cismontane woodland, coastal scrub or dune sites; blooming period: May through September	Summer survey to determine presence/absence.

Table 1 (Continued)

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Delphinium hutchinsoniae (Hutchinson's larkspur)	SC/--/1B	Semi-shaded, slightly moist slopes in broad leaf upland forest, chaparral, coastal prairie or coastal scrub habitats in Monterey County; blooms March through June	Not observed during spring surveys.
Ericameria fasciculata (Eastwood's goldenbush)	SC/--/1B	Sandy openings of closed-cone coniferous forest, maritime chaparral, coastal scrub or coastal dune habitats in Monterey County; blooming period: July through October	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Fritillaria liliacea (Fragrant fritillary)	SC/--/1B	Coastal, scrub, coastal prairie, valley and foothill grasslands, often on serpentine soils; generally blooms from February-April	Not observed during spring surveys. No obvious serpentine habitat observed.
Gilia tenuiflora ssp. *arenaria* (Sand gilia)	E/T/1B	Cismontane woodland, maritime chaparral, coastal scrub and dune habitats in Monterey County, in particular bare, wind-sheltered areas near dune summits or in hind dunes; blooming period: April through May	Not observed during spring surveys. Not expected to occur due to lack of suitable habitat.
Hemizonia parryi ssp. *congdonii* (Congdon's tarplant)	SC/--/1B	Annual herb found on alkaline soils of valley/foothill grasslands, Alameda to San Luis Obispo counties; blooms June – Oct.	Known to occur in the vicinity. Summer survey to determine presence/absence.
Horkelia cuneata ssp. *sericea* (Kellogg's horkelia)	SC/--/1B	Closed-cone coniferous forest, chaparral, and coastal scrub habitats, old dunes and coastal sand hills; blooms April – September	Not observed. Could be within maritime chaparral in Remainder Parcel – difficult to access.
Malacothamnus palmeri var. *involucratus* (Carmel Valley bush mallow)	SC/--/1B	Burn dependent deciduous shrub found on serpentine soils, talus hilltops, and slopes in cismontane and chaparral habitats in San Luis Obispo and Monterey counties; blooming period: May through August	Not observed during spring surveys.
Malacothrix saxatilis var. *arachnoidea* (Carmel Valley cliff-aster)	SC/--/1B	Rock outcrops and steep rocky road cuts in chaparral communities of Santa Barbara and Monterey counties; blooms June – December.	Summer survey to determine presence/absence. Low potential due to lack of substrate.
Perideridia gairdneri ssp *gairdneri* (Gairdner's yampah)	SC/--/4	Chaparral, broad-leaved upland forests and valley foothills and grasslands under mesic conditions; blooms June – October.	Summer survey to determine presence/absence.

Table 1 (Continued)

Species	Status Fed/CA/CNPS	Habitat and Blooming Period	Findings
Pinus radiata (Monterey pine)	SC/--/1B	Closed-cone coniferous forest, cismontane woodland, dry bluffs and slopes (evergreen)	Not observed.
Piperia yadonii (Yadon's rein orchid)	E/--/1B	Poorly drained sandy soils of closed-cone coniferous forest, chaparral and coastal scrub habitats; blooms May - August	Not observed during surveys. Summer assessment to confirm identify of lone individual *Piperia* sp.
Plagiobothrys uncinatus (Hooked popcorn flower)	SC/--/1B	Various habitats including cismontane woodland, valley and foothill grasslands, canyon sides, and chaparral; blooms in May	Not observed during spring surveys.
Stebbinsoseris decipiens (Santa Cruz microseris)	SC/--/1B	Seaward slopes in broadleaf and closed-cone coniferous forest, chaparral, coastal prairie and scrub communities, loose or disturbed soils derived from sandstone, shale or serpentine; blooms April – May	Not observed during spring surveys.
Trifolium buckwestorium (Santa Cruz clover)	--/--/1B	Annual herb endemic to Santa Cruz County and found in moist grasslands of coastal prairies, broadleaf upland forests, and cismontane woodlands; biannual blooming period: May and October	Not observed during spring surveys.
Trifolium polyodon (Pacific Grove clover)	SC/R/1B	Annual herb found along small springs and seeps in grassy openings of closed-cone coniferous forests, meadows, and coastal prairies of Monterey County; blooming period: May through June	Not observed during spring surveys.
Trifolium trichocalyx (Monterey clover)	P/E/1B	Closed-cone coniferous forest; generally blooms from April-June	Not observed during surveys. Not expected to occur due to lack of suitable habitat.

1. Status Explanations

Federal (Fed)

E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
SC = "species of concern"
-- = no designation

California State (CA)

R = listed as rare under the California Endangered Species Act
E = listed as endangered under the California Endangered Species Act
T = listed as threatened under the California Endangered Species Act
-- = no designation

California Native Plant Society (CNPS)

1B = plants considered rare, threatened or endangered in California and elsewhere.
4 = plants of limited distribution – a watch list.

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.

Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Encina Hills Project Site

Species	Status Fed/CA	Habitat	Findings
Euphilotes enoptes smithi (Smith's blue butterfly)	E/--	Most commonly associated with coastal dunes and coastal sage scrub plant communities in Monterey and Santa Cruz counties; host plants: *Eriogonum latifolium & E. parvifolium*	No suitable habitat present.
Rana aurora draytonii (California red-legged frog)	T/CSC	Lowlands and foothills in or near permanent sources of deep water within streams, marshes, and occasionally ponds with dense, shrubby, or emergent riparian vegetation.	No aquatic habitat present on site and no documented occurrences in the project vicinity.
Ambystoma californiense (California tiger salamander)	SC/CSC	Grasslands and open oak woodlands with ground squirrel or gopher burrows for underground retreats, and breeding ponds such as seasonal wetlands, vernal pools or slow-moving streams that do not support predatory fish or frog populations	No suitable breeding habitat present on the site
Anniella pulchra nigra (Black legless lizard)	--/CSC	Monterey and Morro Bay areas in moist dunes or sandy soils with mock heather & bush lupine	Not likely to occur; suitable habitat not present.
Phrynosoma coronatum frontale California horned lizard	--/CSC	Found in a wide variety of habitats; however, most common in lowlands along sandy washes with scattered low bushes and areas for sunning	Individual observed in Remainder Parcel. Suitable habitat present.
Clemmys marmorata pallida (Southwestern pond turtle)	--/CSC	Requires aquatic habitats with permanent or persistent water and protected areas for basking such as partially submerged rocks or logs, floating vegetation mats or open mud banks	No suitable habitat present.
Accipiter cooperi (Nesting) (Cooper's hawk)	--/CSC	Nests in riparian forests and dense canopy oak woodlands; forages in open woodlands.	Potential nesting habitat present.
Accipiter striatus (Nesting) (Sharp-shinned hawk)	--/CSC	Nests and forages in dense riparian forests, conifer forests, and dense canopy oak woodlands.	Potential nesting habitat present.

Table 2 (Continued)

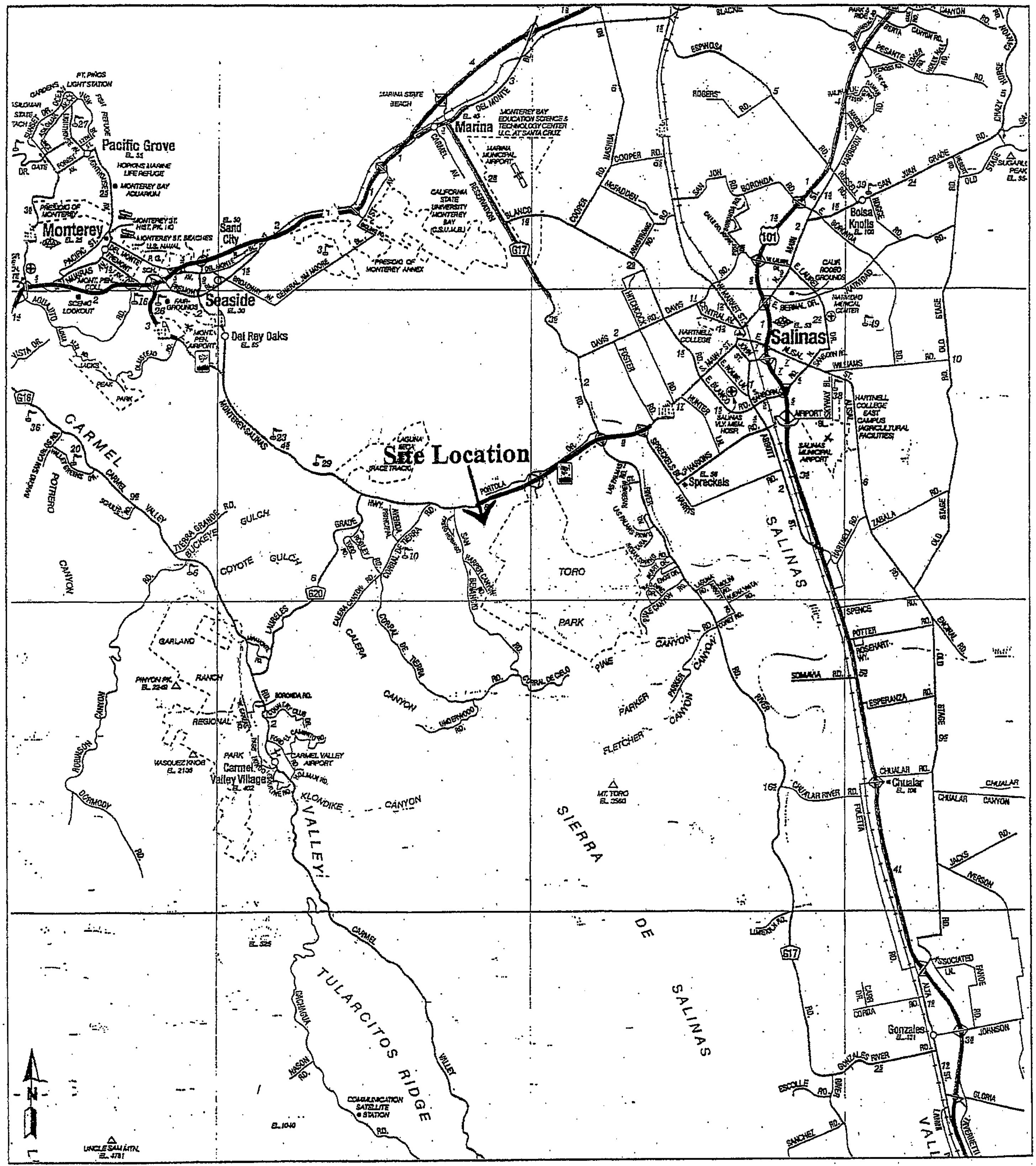
Species	Status[1] Fed/CA	Habitat	Findings[2]
Aquila chrysaetos (Nesting) (Golden eagle)	--/CSC	Nests in cliffs and large trees; forages in annual grasslands, chaparral and oak woodlands with abundant medium-sized and large mammals for prey.	Potential nesting habitat present.
Athene cunicularia (Burrowing owl)	--/CSC	Ground nester in open dry annual or perennial grasslands, deserts and scrublands with low-growing vegetation, dependent upon burrowing mammals (i.e. California ground squirrel)	No signs of burrowing owl observed during March surveys. Grasslands could provide habitat for the species.
Falco mexicanus (Nesting) (Prairie falcon)	--/CSC	Level or hilly dry, open terrain with cliffs as breeding sites; foraging ranges may extend to marshlands and ocean shores	Potential nesting habitat present in badland escarpment.
Eumops perotis (California mastiff bat)	SC/CSC	Lowland areas in arid to semi-arid habitats including deciduous woodlands, coastal scrub, and annual grasslands.	Suitable habitat present
Antrozous pallidus (Pallid bat)	SC/CSC	Found in a variety of habitats. Most common in dry, open habitats with rocky areas available for day roosts.	Suitable habitat present.
Plecotus townsendii ssp. townsendii (Townsend's big-eared bat)	SC/CSC	Inhabits oak/bay woodlands and mixed broadleaf conifer woodlands; requires access to caves, building attics or other dark cavities for daytime refuge.	Suitable habitat present.
Neotoma fuscipes luciana (Monterey dusky-footed woodrat)	SC/CSC	Uses habitats with moderate to dense cover and abundant dead wood for nest construction.	Suitable habitat in oak woodlands.

1. Status Explanations

Federal (Fed)
E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
SC = "species of concern"
-- = no designation

California State (CA)
CSC = California Department of Fish and Game Species of Special Concern

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.



ZANDER ASSOCIATES

Environmental Consultants

Site Location

Encina Hills Project

Monterey County, California

Figure
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
HCR1	MZ	4/01	7/01

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CNDDB Occurrences in the Vicinity of
Encina Hills Project
Monterey County, California

Figure
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
HCR1	MZ	4/01	7/01

ZANDER ASSOCIATES

Environmental Consultants

November 11, 2005

Erika Spencer
Pacific Municipal Consultants
585 Cannery Row, Suite 304
Monterey, CA 93940

Biological Resources Assessment
Harper Canyon/ Encina Hills Subdivision
Monterey County, California

Dear Erika:

In July 2001, with an addendum in October 2001, Zander Associates completed an assessment of the biological resources on the Harper Canyon/Encina Hills property, referred to at that time as the Encina Hills property. The project site consists of approximately 344 acres situated along the southeast side of Highway 68 adjacent to Toro Regional Park. At that time the purpose of the assessment was to describe and map existing vegetation patterns on the site and identify any special status species or other biological resources that occurred on the site. We described the site as containing four habitat types: annual grassland, coast live woodland/savanna, coastal scrub and central maritime chaparral. In addition, the upper reaches of several intermittent drainages were found on the site.

In the 2001 biological assessment several special-status species were evaluated for their potential to use the habitats on the property. After conducting directed plant surveys we determined that special status species occupying the site included Monterey ceanothus (*Ceanothus cuneatus car. rigidus*) and Toro manzanita (*Arctostaphylos montereyensis*). While no directed surveys were conducted for special-status animals, it was determined that there was suitable habitat available for Monterey dusky-footed woodrat (*Neotoma fuscipes luciana*), coast horned lizard (*Phrynosoma coronatum*), sensitive bat species, and limited potential for the occurrence of California red-legged frog (*Rana aurora draytonii*) and California tiger salamander (*Ambystoma californiense*). There was also habitat available for raptors and migratory birds, protected under the Migratory Bird Treaty Act. At that time, we recommended that with directed animal surveys just prior to construction, proper avoidance measures during construction and the setting aside of the Remainder parcel as open space, any impacts to special-status plants, animals, raptors, or migratory birds could be minimized.

On September 28 and 30, 2005 we revisited the site to evaluate current conditions and to report any changes in the conclusions reached during our previous biological assessment. This site assessment included an update of site conditions, habitat types and previously identified sensitive

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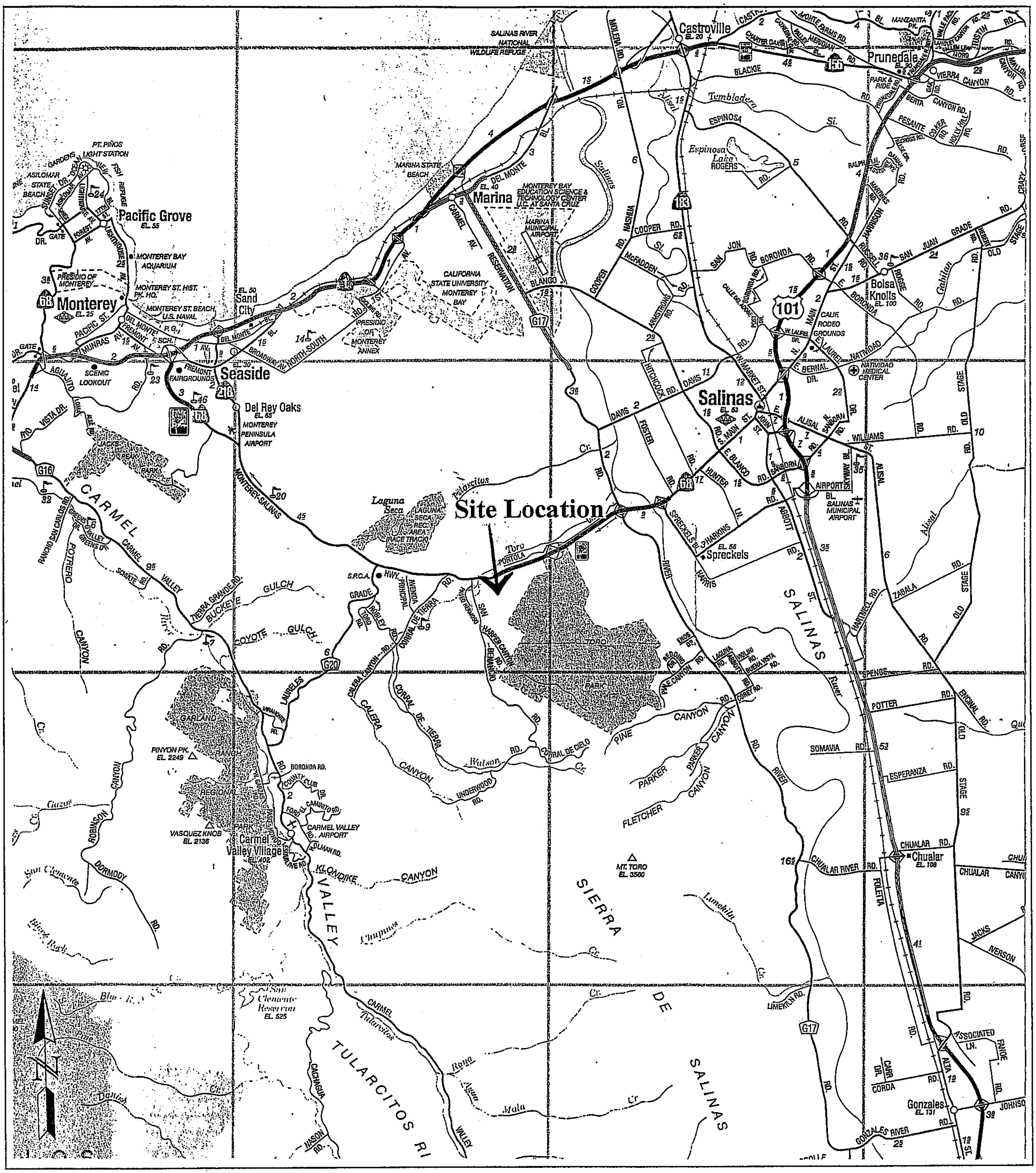

ZANDER ASSOCIATES

Environmental Consultants

Site Location

Encina Hills Project

Monterey County, California

Figure

1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
PMC4	MZ	4/01	7/01	11/05

plant locations. In addition, directed surveys were conducted for sensitive plant species that could be identified in the fall. Prior to our site visit we conducted a search of the biological databases, including the California Natural Diversity Database (CNDDB) and the California Native Plant Society's Electronic Inventory. Our current findings, updated from the 2001 biological assessment, are detailed below.

Vegetation Communities/Habitat Types

The vegetation communities on the Harper Canyon/Encina Hills property have remained relatively unchanged since the 2001 biological assessment. However, following the classification of vegetation communities in Sawyer and Keeler-Wolf (CNPS Manual of California Vegetation Online, 2000), we have elected to combine coastal scrub and central maritime chaparral into one community type, chamise chaparral. All of the other community types remain as described in the 2001 biological assessment. The distribution and extent of the community types on the site have not changed and are delineated on an attached map as Plate 1. Each of these vegetation communities, and the wildlife habitat they provide, is described below.

Annual Grassland

The annual grassland community on the property is characterized by a mixture of native perennial and introduced annual species and is heavily grazed by cattle. Common introduced grass species observed included slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), and rattail fescue (*Vulpia myuros*). The primary native perennial species observed scattered throughout the grassland is purple needlegrass (*Nasella pulchra*).

Grasslands often provide habitat for a variety of native wildflowers that typically bloom in the spring. During the 2001 spring visit, only a few wildflower species were in bloom and identifiable, including: footsteps of spring (*Sanicula arctopoides*), Johnny jump-up (*Viola pedunculata*), and California gilia (*Gilia achilleifolia*). The dominant flowering herb present within the grassland at that time was the non-native long-beaked filaree (*Erodium botrys*). The dominant presence of this species is indicative of the extensive grazing. During our 2005 fall visit the dominant herb present within the grassland was a navarretia species(*Navarretia sp.*). The change in the dominant grassland herb species is likely due to the seasonal timing of the survey, rather than a change in the grassland vegetation community.

Grasslands provide foraging habitat for small mammals which in turn serve as prey for a variety of other animals, including snakes, raptors ("birds of prey"), and coyotes (*Canis latrans*). Numerous invertebrate species, many of which provide a food source for larger animals such as lizards, birds and some small mammals, can also be found within grassland communities.

Coast Live Oak Woodland and Savanna

Oak woodland communities in Monterey County are dominated by open to nearly closed canopies of coast live oaks (*Quercus agrifolia*) with grass or shrub understories. Savannas are transitional between woodlands and grassland with trees more widely spaced and a grassland-dominated understory. On the Harper Canyon/ Encina Hills property, oak woodlands occupy the more mesic (moist) north-facing slopes and canyon bottoms and the oak savanna is along a drier, east-facing slope, near the ridgetop.

The understory species composition in oak woodlands varies depending upon local conditions such as moisture availability and soil type. The understory in the oak savanna consists of species common to the annual grassland habitat but may include additional wildflower species not found in the open grasslands. Common oak woodland understory species observed on the Harper Canyon/ Encina Hills property include: poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), redberry (*Rhamnus crocea*), California wild rose (*Rosa californica*), and cream bush (*Holodiscus discolor*). The species composition of the understory changes slightly where the oak woodland transitions to chamise chaparral higher on the slopes to include some chaparral species.

Oak woodland and oak savanna provide habitat for a variety of wildlife. The oak trees provide suitable nesting sites and cover for birds and many mammals. Woody debris and duff in the woodland understory provide foraging areas for small mammals and microclimates suitable for amphibians and reptiles. Acorns are a valuable food source for many animal species, including the California quail (*Lophortyx californicus*), western gray squirrel (*Scirus griseus*), and black-tailed deer (*Odocoileus hemionus*). Other representative animal species of oak dominated woodlands include arboreal salamander (*Aneides lugubris*), western screech owl (*Otus kennicottii*), scrub jay (*Aphelocoma corulescens*), and Virginia opossum (*Didelphis virginianus*).

Chamise Chaparral

Chamise chaparral communities are characterized by moderate to low-growing evergreen and drought tolerant shrubs adapted to shallow soils. The dominant species is the sclerophyllus (hard-leaved) shrub, chamise (*Adenostoma fasciculatum*). Associated species include toyon (*Heteromeles arbutifolia*), sticky monkey flower (*Mimulus aurantiacus*), manzanita (*Arctostaphylos* spp), ceanothus (*Ceanothus* spp), redberry (*Rhamnus crocea*), California sage brush (*Atemisia californica*), and a few scattered coyote brush (*Baccharis pilularis*). On the Harper Canyon/ Encina Hills property, manzanita species occur clustered in several locations throughout the chamise chaparral. This vegetation community occurs mostly on drier, wind exposed sites near the tops of the ridges or on steep slopes with sandy, mudstone or shale soils.

Chamise chaparral provides cover and nesting habitat for a variety of animals. The sandy soils typically associated with this community also provide areas for wildlife denning and nesting. Animal species common to chamise chaparral habitat include western fence lizard (*Sceloporus occidentalis*), western rattlesnake (*Crotalus viridis*), California quail (*Callipepla californica*) brush rabbit (*Sylvilagus bachmani*) and gray fox (*Urocyon cinereoargentus*).

There are a two special status plant species associated with this vegetation type in the project area; Toro (or Monterey) manzanita and Monterey ceanothus. These are discussed further in the following sections.

Drainages

There are portions of several drainages and tributaries to drainages that originate on the property and carry flows offsite. These drainages appear to be ephemeral, carrying flow only in response to winter storms. In general, the channels are cobble- or soil-lined and are devoid of in-channel vegetation. Some of the channels are deeply incised. Oak woodland vegetation is primarily associated with the drainages; classic riparian (stream-related) vegetation is generally absent from these areas. Most of the drainages on the property are tributary to El Toro Creek, which drains to the Salinas River.

Wildlife habitat in these drainages does not vary substantially from that previously described for oak woodland or grassland habitat. The channels can provide movement corridors for amphibians when water is present and for other animals throughout the year.

Special Status Species

For this assessment, special status species are defined as: those plants and animals listed, proposed for listing, or candidates for listing as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS); those listed or proposed for listing as rare, threatened or endangered by the California Department of Fish and Game (CDFG); plants occurring on lists 1B or 2 of the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California (1994); and animals designated as "Species of Special Concern" by CDFG.

In 2001, Zander Associates developed a target list of special status plant and animal species that we evaluated for their potential to occur on the Harper Canyon/ Encina Hills property. We have updated the target list to include changes in species status and to add species that have been recently classified as having special status (Tables 1 and 2, respectively). The list was developed based on our review of the California Natural Database (CNDDB) records, the California Native Plant Society's Electronic Inventory, and our work on other properties in the vicinity. On September 28 and 30, 2005 Zander Associates conducted focused surveys for special status plant species that bloom in late summer/fall. In addition, we sought to verify the special status plant locations reported during surveys in 2001. General observations were made about potential habitat for target species that were not identifiable at the time of our survey. The results of the fall survey are discussed below and summarized on Tables 1 and 2.

Plants

Many of the special status plants that are known to occur in the vicinity of the Harper Canyon/ Encina Hills property are found in specific habitat types such as chaparral, vernal pools, or on serpentine substrate. No vernal pool habitat was observed on the site and there were no obvious areas with serpentine substrate identified – based on vegetative characteristics. There is a substantial amount of chamise chaparral on the property and it was surveyed during the September site visits. The chaparral habitat was surveyed as completely as possible; however, certain areas, especially within the Remainder parcel, were not accessible due to dense brush and steep terrain.

We were able to verify the 2001 occurrence of Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*) at the southeast portion of the property, in the Remainder parcel. We were also able to verify the occurrence of Monterey manzanita (*Arctostaphylos montereyensis*) along the eastern edge of the development area. We found an additional occurrence of Monterey manzanita on the north end of the Remainder parcel, next to an existing dirt road. The individual unidentified rein orchid (*Piperia sp.*), thought most likely to be *P. elegans* or *P. michaelii*, observed along the northwestern property boundary in 2001 could not be relocated during our fall survey. However, piperia species are generally visible in the early spring and identifiable to species in the summer, and should be surveyed at those times. A second unidentified rein orchid was observed within chaparral habitat on the Remainder parcel. Due to the long spur length on the wilted flower that remained on the plant, it was determined not to be the federally endangered *P. yadonii*. A patch of Gairdner's yampah (*Perideridea gairdneri* ssp. *gairdneri*), a species not previously reported on the site, was identified within the northernmost canyon within oak woodland habitat.

Focused searches were conducted for other late-blooming special status plants with potential to occur on the Harper Canyon/ Encina Hills property, including robust spineflower (*Chorizanthe robusta* var. *robusta*), Seadside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*), Eastwood's goldenbush (*Ericameria fasciculate*), Pinnacles buckwheat (*Eriogonum nortonii*), Kellogg's horkelia (*Horkelia cuneata* ssp. *sericea*), Carmel Valley cliff-aster (*Malacothrix saxatilis* var. *arachnoidea*), Congdon's tarplant (*Hemizonia parryi* ssp. *congdonii*), Monterey pine (*Pinus radiate*), Hooker's manzanita (*Arctostaphylos hookeri ssp. hookeri*), and Pajaro manzanita (*Arctostaphylos pajaroensis*). None of these special status plant species were observed.

While no additional special status plant species were observed during the 2001 biological assessment, additional focused plant surveys should be conducted in April and July to confirm the presence/absence of special-status plants that are identifiable in the spring and summer. These species include Hickman's onion (*Allium hickmanii*), Napa false indigo (*Amorpha californica var. napensis*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Jolon clarkia (*Clarkia jolonensis*), Hutchinson's larkspur (*Delphinium hutchinsoniae*), Pinnacles buckwheat (*Eriogonum nortonii*), Carmel Valley bush mallow (*Malacothamnus palmeri* var. *involucratus*), Santa Lucia bush mallow (*Malacothamnus palmeri* var. *palmeri*), Yadon's piperia (*Piperia yadonii*), hooked popcorn flower (*Plagiobothrys uncinatus*), maple-leaved checkerbloom (*Sidalcea malachroides*), Santa Cruz microseris (*Stebbinsoseris decipiens*), Santa Cruz clover (*Trifolium buckwestorium*), and Pacific Grove clover (*Trifolium polyodon*). Current project plans indicate that no development is proposed in the Remainder Parcel and therefore, additional surveys may not be necessary in this parcel.

To date, all special status plant species located on the Harper Canyon/ Encina Hills property are located outside of areas to be impacted by development and can therefore be avoided.

Animals

Our 2001 assessment of special status animals with potential to occur on the project site remains accurate today, and we therefore refer the reader to that assessment for a discussion of those species; including California red-legged frog, California tiger salamander, Monterey dusky-footed woodrat, coast horned lizard, sensitive bat species, and migratory birds. However, there have been some changes in the listing status of certain species and several additional species have been added to the target list based on the proximity of known occurrences and the potential for the species to occur on the project site. An updated species target list that includes these changes is included as Table 2. Species that have been added to the 2001 target list and have limited potential to occur within the project site are discussed below.

Coast-range newt *(Taricha torosa torosa)*

The coast range newt is a California Species of Special Concern. Coast range newts frequent terrestrial habitats, but breed in ponds, reservoirs, and slow-moving streams from Mendocino County to San Diego County. Lack of data on the movement ecology of this species prevents a complete characterization of the microhabitats used. The coast-range newt is a conspicuous diurnal salamander that, if the behavior of the related red-bellied newt (*T. rivularis*) can be considered an appropriate indicator, probably engages in sometimes long-distance (i.e., > 1 km) migrations to breeding sites. Adult newts eat a wide variety of aquatic and terrestrial invertebrates (earthworms, insects, snails, beetles, butterflies, and stoneflies), as well as egg masses, larvae, and carrion.

The closest CNDDB occurrence of this species is from Hastings Natural Reserve in Monterey County. The drainages on the site are ephemeral and do not provide suitable breeding habitat for the coast-range newt because of the lack of permanent water. Nonetheless, there is limited potential for these drainages to serve as dispersal corridors if there are unknown populations breeding in permanent water bodies within 1 km of the project site. No focused surveys for coast-range newt are recommended unless the project would affect these drainages.

Two-striped garter snake *(Thamnophis hammondii)*

The two-striped garter snake is a California Species of Special Concern. The two-striped garter snake is a highly aquatic snake rarely found far from water, which it freely enters to forage or escape predators. It commonly inhabits perennial and intermittent streams having rocky beds bordered by willow thickets or other dense vegetation. This species also inhabits large sandy riverbeds with riparian vegetation along the stream course, or stock ponds and other artificially-created aquatic habitats if a dense riparian border of emergent vegetation and amphibian and fish prey are present. If flooding, overgrazing, burning, or mechanical alteration removes dense riparian vegetation, two-striped garter snake is infrequently found. Limited data indicate that small mammal burrows are used as overwintering sites.

Adult snakes display use of different areas and habitats in summer versus winter. During summer, snakes utilize streamside sites and have home ranges that vary from approximately 80 m^2 to over 5,000 m^2. During winter, they occupy coastal sage scrub and grassland locations in uplands adjacent to riparian areas, and have home ranges that vary from approximately 50 m^2 to nearly 9,000 m^2.

The closest CNDDB occurrence of this species is from Pine Canyon, 5.5 miles south of Salinas and about 3.5 miles east of the project site. The drainages on the project site are ephemeral and do not provide permanent water bodies or dense riparian vegetation for two-striped garter snakes to forage or escape predators. However, the property site could be within the home range of two-striped garter snake and the drainages could be used as corridors to get to overwintering sites. No focused surveys for two-striped garter snake are recommended unless the project would affect these drainages.

Assessment

With the exception of combining the coastal scrub and maritime chaparral vegetation communities, locating an additional special status plant species, and including additional species to the target list, our assessment of the Harper Canyon/ Encina Hills project has not changed from the 2001 biological assessment.

The vegetation communities and habitat types that occur on the Harper Canyon/ Encina Hills property are typical of the general area. The grassland areas support a common array of native and introduced grasses and forbs found in grazing land throughout Monterey County. The denser oak woodlands and chamise chaparral communities, especially where they line drainage courses are the most biologically diverse areas on the property. The stream channels through the property provide habitat corridors as well as a natural system for carrying seasonal flows during the winter months. While there is no classic riparian vegetation associated with these drainages, the canopy cover is typically more dense, providing a mesic environment for wildlife.

As we understand the current project proposal, the property would be subdivided into 17 lots ranging from approximately 5 acres to 34 acres in extent and about 180 acres would be retained as open space in the Remainder Parcel. Homesites within each lot are generally sited as indicated on Plate 1 and encompass approximately 1 acre. Access roads will, for the most part, follow existing road alignments. If the area of disturbance is limited to the proposed homesite (about one acre) for each lot, and the remainder of the lot remains natural habitat, then it appears that the effects on biological resources can be minimized and that impacts to the identified special status plant species can be avoided. Furthermore, there appears to be ample space available for siting buildings and other facilities so that they would not impact biological resources, if they are found to be present through subsequent site-specific survey work.

The introduction of non-native invasive species as landscape material could threaten to alter the composition of the adjacent native habitats. Also, the increase in human activity in the area will likely displace some of the indigenous wildlife that are less tolerant of disturbance, but these animals may be able to move into the adjacent open space areas. Many of the potential impacts typically associated with increased human activity could be minimized by incorporating features into the project design and by recommending residents follow certain guidelines to reduce disturbance to native species. Some of those features and recommendations are listed in the following section.

Recommendations

As project planning proceeds, we recommend that you consider the following measures to help avoid or minimize impacts on biological resources.

- Conduct seasonally timed focused surveys for special status plants in lots 1 through 17 and along proposed road alignments. The surveys should be conducted in April and July. Directed surveys in the Remainder Parcel are not necessary unless development is proposed in that parcel. If special status plant species are found in the proposed development areas, consider avoidance alternatives or develop a salvage and relocation plan, as needed.

- Avoid filling or other disturbance of natural drainage courses. Keep homesites, landscaped areas and outbuildings 75 - 100 feet away from the active channel of the drainages. In the event that disturbance of site drainages cannot be avoided (culverts, storm drain outfalls, etc.), authorization from the California Department of Fish and Game through section 1600 (et. seq.) of the Fish and Game Code and/or the U.S. Army Corps of Engineers through Section 404 of the Clean Water Act may be required. Necessary permits and/or authorizations should be obtained from the appropriate regulatory agencies prior to any activity that might encroach on the site's drainages.

- If construction of homesites, roads or other infrastructure, that could result in tree removal, are initiated between November and July, then preconstruction surveys for active raptor nests are recommended. If active nests are found and the biologist determines that construction activities would remove the nest or have the potential to cause abandonment, then those activities should be avoided until the young have fledged as determined through monitoring of the nest. Once the young have fledged, construction activities can resume in the vicinity. If activities are initiated after August 1 and before November 1 (outside the typical nesting season for the birds-of-prey and migratory birds that may nest in the study area), then pre-construction surveys for active nests should not be necessary.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for day-roosting bats. If day roosts are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Prior to construction of homesites, roads or other infrastructure, identify the areas of proposed disturbance on the ground and have a qualified biologist survey for active Monterey dusky-footed woodrat nests. If active nests are present in the area of disturbance, work with the biologist to avoid direct impacts to these animals.

- Consider landscape requirements that encourage use of native species and prohibit planting of invasives such as Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*) or eucalyptus (*Eucalyptus* spp.).

- Minimize the area of landscaping around each residence to the extent deemed necessary for fire protection.

- Minimize outdoor lighting features including streetlights and decorative lights away from the homesites.

- Prepare a brochure for homeowners that describes the native flora and fauna and provides guidelines for residents to follow to reduce impacts on the habitat.

Zander Associates can remain available to assist you with follow-up activities, as necessary. Please call us if you have any questions regarding this assessment.

Sincerely,

Leslie Zander for

Erin Avery
Senior Biologist

Attachments

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Harper Canyon Project Site
Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Harper Canyon Project Site
Figure 1: Site Location
Plate 1: Vegetation Types

Table 1: Special Status Plant Species Evaluated for Potential to Occur on the Harper Canyon Project Site

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Allium hickmanii (Hickman's onion)	--/--/1B	Sandy loam soils and vernal swales in a variety of habitats including, closed-cone coniferous forest, chaparral, coastal scrub, valley and foothill grassland, and coastal prairies; blooming period April through May	Spring survey to determine presence/absence.
Amorpha californica var. napensis (Napa false indigo)	--/--/1B	Openings in woodland and chaparral habitat in Monterey County; blooms April through July	Spring survey to determine presence/absence.
Arctostaphylos hookeri ssp. hookeri (Hooker's manzanita)	--/--/1B	Sandy soils, sandstone outcrops in coastal scrub, chaparral, cismontane woodland, and closed-cone coniferous forest habitats in Monterey and Santa Cruz counties; blooms February through May (evergreen)	Not observed during September survey. Could be within chamise chaparral in Remainder Parcel – difficult to access.
Arctostaphylos montereyensis (Monterey manzanita)	--/--/1B	Chaparral, cismontane woodland, and coastal scrub habitats in Monterey County, sandy soils often with chaparral associates; blooms February through March (evergreen)	Observed in chamise chaparral on site as a few isolated patches– also found in Toro Park.
Arctostaphylos pajaroensis (Pajaro manzanita)	--/--/1B	Sandy soil chaparral habitats of Monterey County; blooming period December through March (evergreen)	Not observed during September survey. Could be within chamise chaparral in Remainder Parcel – difficult to access.
Arctostaphylos pumila (Sandmat manzanita)	--/--/1B	Closed-cone coniferous forest, chaparral, coastal dines, and cismontane woodland habitats; sandy soil with other chaparral associates; blooms February through May (evergreen)	Not observed during September survey. Not likely to be present – out of range.
Astragalus tener var. tener (alkali milk-vetch)	--/--/1B	Low ground, alkali flats, and flooded lands in annual grassland or in playas or vernal pools; blooms March through June	Spring survey to determine presence/absence. Not likely to occur; habitat not present.
Ceanothus cuneatus var. *rigidus* (Monterey ceanothus)	--/--/4	Chaparral, coastal scrub and closed-cone coniferous forest; evergreen perennial shrub identifiable throughout the year	Observed in chamise chaparral in Remainder Parcel.

Table 1 (Continued)

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Chorizanthe pungens var. *pungens* (Monterey spineflower)	T/--/1B	Coastal dunes, chaparral, cismontane woodland, and coastal scrub habitats in Monterey and Santa Cruz counties; blooming period April through June	Spring survey to determine presence/absence
Chorizanthe robusta var. *robusta* (Robust spineflower)	E/--/1B	Sandy soils in cismontane woodland openings and coastal dune and scrub habitats; blooms May through September	Not observed during September survey. Could occur within chamise chaparral in Remainder Parcel – difficult to access.
Clarkia jolonensis (Jolon clarkia)	--/--/1B	Dry places in chaparral, cismontane woodland, and coastal scrub. Has been found in degraded sandstone on steep banks; blooms April through June	Spring survey to determine presence/absence
Cordylanthus rigidus ssp. *littoralis* (Seadside bird's-beak)	--/E/1B	Often found on disturbed closed-cone coniferous, chaparral, cismontane woodland, coastal scrub or dune sites; blooming period May through September	Not observed during September survey. Could occur within chamise chaparral in Remainder Parcel – difficult to access.
Delphinium hutchinsoniae (Hutchinson's larkspur)	--/--/1B	Semi-shaded, slightly moist slopes in broad leaf upland forest, chaparral, coastal prairie or coastal scrub habitats in Monterey County; blooms March through June	Spring survey to determine presence/absence
Ericameria fasciculata (Eastwood's goldenbush)	--/--/1B	Sandy openings of closed-cone coniferous forest, maritime chaparral, coastal scrub or coastal dune habitats in Monterey County; blooming period July through October	Not observed during September survey. Could be within chamise chaparral in Remainder Parcel – difficult to access.
Eriogonum nortonii (Pinnacles buckwheat)	--/--/1B	Sandy soils, often on recent burns in chaparral, and valley and foothill grassland; blooms May through August	Not observed during September survey. Spring survey to determine presence/absence.
Fritillaria liliacea (Fragrant fritillary)	--/--/1B	Coastal, scrub, coastal prairie, valley and foothill grasslands, often on serpentine soils; generally blooms from February-April	Spring survey to determine presence/absence. No obvious serpentine habitat observed.

Table 1 (Continued)

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Gilia tenuiflora ssp. *arenaria* (Sand gilia)	E/T/1B	Cismontane woodland, maritime chaparral, coastal scrub and dune habitats in Monterey County, in particular bare, wind-sheltered areas near dune summits or in hind dunes; blooming period April through May	Spring survey to determine presence/absence. Not likely to occur; habitat not present.
Hemizonia parryi ssp. *congdonii* (Congdon's tarplant)	--/--/1B	Annual herb found on alkaline soils of valley/foothill grasslands, Alameda to San Luis Obispo counties; blooms June through October	Not observed during September survey.
Horkelia cuneata ssp. *sericea* (Kellogg's horkelia)	--/--/1B	Closed-cone coniferous forest, chaparral, and coastal scrub habitats, old dunes and coastal sand hills; blooms April through September	Not observed during September survey. Could be within chamise chaparral in Remainder Parcel – difficult to access.
Lasthenia conjugens (Contra Costa goldfields)	E/--/1B	Vernal pools, swales, low depressions in open grassy areas in valley and foothill grassland and cismontane woodlands; blooms March through June	Spring survey to determine presence/absence. Not likely to occur; habitat not present.
Malacothamnus palmeri var. *involucratus* (Carmel Valley bush mallow)	--/--/1B	Burn dependent deciduous shrub found on serpentine soils, talus hilltops, and slopes in cismontane and chaparral habitats in San Luis Obispo and Monterey counties; blooming period May through August	Spring survey to determine presence/absence.
Malacothamnus palmeri var. *palmeri* (Santa Lucia bush mallow)	--/--/1B	Dry rocky slopes in chaparral, mostly near summits, but occasionally extending down canyons; blooms May through July	Spring survey to determine presence/absence.
Malacothrix saxatilis var. *arachnoidea* (Carmel Valley cliff-aster)	--/--/1B	Rock outcrops and steep rocky roadcuts in chaparral communities of Santa Barbara and Monterey counties; blooms June through December.	Not observed during September survey. Could be within chamise chaparral in Remainder Parcel – difficult to access.
Microseris paludosa (Marsh microseris)	--/--/1B	Moist grasslands and open woods in cismontane woodland, coastal scrub, and valley and foothill grassland; blooms April through June	Spring survey to determine presence/absence.

Table 1 (Continued)

Species	Status[1] Fed/CA/CNPS	Habitat and Blooming Period	Findings[2]
Perideridia gairdneri ssp *gairdneri* (Gairdner's yampah)	--/--/4	Chaparral, broad-leaved upland forests and valley foothills and grasslands under mesic conditions; blooms June through October.	Observed in oak woodland within northernmost drainage.
Pinus radiata (Monterey pine)	--/--/1B	Closed-cone coniferous forest, cismontane woodland, dry bluffs and slopes (evergreen)	Not observed.
Piperia yadonii (Yadon's rein orchid)	E/--/1B	Poorly drained sandy soils of closed-cone coniferous forest, chaparral and coastal scrub habitats; blooms May through August	Not observed during September survey. Could occur in inaccessible areas in chaparral. Spring surveys to determine presence/absence.
Plagiobothrys uncinatus (Hooked popcorn flower)	--/--/1B	Various habitats including cismontane woodland, valley and foothill grasslands, canyon sides, and chaparral; blooms in May	Spring surveys to determine presence/absence.
Sidalcea malachroides (Maple-leaved checkerbloom)	--/--/1B	Woodlands and clearings near coast in coastal prairie, coastal scrub and broadleafed upland forests; often in disturbed areas; blooms April through August	Spring surveys to determine presence/absence.
Stebbinsoseris decipiens (Santa Cruz microseris)	--/--/1B	Seaward slopes in broadleaf and closed-cone coniferous forest, chaparral, coastal prairie and scrub communities, loose or disturbed soils derived from sandstone, shale or serpentine; blooms April through May	Spring surveys to determine presence/absence.
Trifolium buckwestorium (Santa Cruz clover)	--/--/1B	Annual herb endemic to Santa Cruz County and found in moist grasslands of coastal prairies, broadleaf upland forests, and cismontane woodlands; biannual blooming period May and October	Not observed during September survey. Spring surveys to determine presence/absence.
Trifolium polyodon (Pacific Grove clover)	--/R/1B	Annual herb found along small springs and seeps in grassy openings of closed-cone coniferous forests, meadows, and coastal prairies of Monterey County; blooming period May through June	Spring surveys to determine presence/absence.
Trifolium trichocalyx (Monterey clover)	E/E/1B	Closed-cone coniferous forest; generally blooms April through June	Spring surveys to determine presence/absence. Not likely to occur; suitable habitat not present.

1. Status Explanations

Federal (Fed)

E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
-- = no designation

California State (CA)

R = listed as rare under the California Endangered Species Act
E = listed as endangered under the California Endangered Species Act
T = listed as threatened under the California Endangered Species Act
-- = no designation

California Native Plant Society (CNPS)

1B = plants considered rare, threatened or endangered in California and elsewhere.
4 = plants of limited distribution – a watch list.

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.

Table 2: Special Status Animal Species Evaluated for Potential to Occur on the Harper Canyon Project Site

Species	Status[1] Fed/CA	Habitat	Findings[2]
Euphilotes enoptes smithi (Smith's blue butterfly)	E/--	Most commonly associated with coastal dunes and coastal sage scrub plant communities in Monterey and Santa Cruz counties; host plants: *Eriogonum latifolium & E. parvifolium*	No suitable habitat present.
Rana aurora draytonii (California red-legged frog)	T/CSC	Lowlands and foothills in or near permanent sources of deep water within streams, marshes, and occasionally ponds with dense, shrubby, or emergent riparian vegetation.	Marginal habitat present but no documented occurrences in the project vicinity.
Ambystoma californiense (California tiger salamander)	T/CSC	Grasslands and open oak woodlands with ground squirrel or gopher burrows for underground retreats, and breeding ponds such as seasonal wetlands, vernal pools or slow-moving streams that do not support predatory fish or frog populations	No suitable breeding habitat present on site. Closest known breeding population over 2 miles north of project site within the former Fort Ord.
Taricha torosa torosa (Coast range newt)	--/CSC	Utilize terrestrial habitats, but breed in ponds, reservoirs, and slow-moving streams	No suitable breeding habitat present on the site
Anniella pulchra nigra (Black legless lizard)	--/CSC	Monterey and Morro Bay areas in moist dunes or sandy soils with mock heather & bush lupine	Not likely to occur; suitable habitat not present.
Clemmys marmorata pallida (Southwestern pond turtle)	--/CSC	Requires aquatic habitats with permanent or persistent water and protected areas for basking such as partially submerged rocks or logs, floating vegetation mats or open mud banks	No suitable habitat present.
Phrynosoma coronatum frontale (California horned lizard)	--/CSC	Found in a wide variety of habitats; however, most common in lowlands along sandy washes with scattered low bushes and areas for sunning	Suitable habitat present.

Table 2 (Continued)

Species	Status[1] Fed/CA	Habitat	Findings[2]
Thamnophis hammondii (Two-striped garter snake)	--/CSC	Inhabits perennial and intermittent streams having rocky beds bordered by willow thickets or other dense vegetation. Also inhabit large sandy riverbeds, such as the Santa,Clara River (Ventura County), if a strip of riparian vegetation is present along the stream course. This taxon also utilizes stock ponds and other artificially-created aquatic habitats if a dense riparian border of emergent vegetation and amphibian and fish prey are present.	Marginal habitat present.
Accipiter cooperi (Nesting) (Cooper's hawk)	--/CSC	Nests in riparian forests and dense canopy oak woodlands; forages in open woodlands.	Potential nesting habitat present.
Accipiter striatus (Nesting) (Sharp-shinned hawk)	--/CSC	Nests and forages in dense riparian forests, conifer forests, and dense canopy oak woodlands.	Potential nesting habitat present.
Agelaius tricolor (Tricolored blackbird)	--/CSC	Breeds near fresh water, preferably in emergent wetland with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats	Not likely to occur; suitable habitat not present.
Aquila chrysaetos (Nesting) (Golden eagle)	--/CSC	Nests in cliffs and large trees; forages in annual grasslands, chaparral and oak woodlands with abundant medium-sized and large mammals for prey.	Potential nesting habitat present.
Athene cunicularia (Burrowing owl)	--/CSC	Ground nester in open dry annual or perennial grasslands, deserts and scrublands with low-growing vegetation, dependent upon burrowing mammals (i.e. California ground squirrel)	No signs of burrowing owl observed during September survey. Grasslands could provide habitat for the species. Closest known occurrence is more than 5 miles at Salinas Airport.

Table 2 (Continued)

Species	Status[1] Fed/CA	Habitat	Findings[2]
Buteo regalis (Ferruginous hawk)	--/CSC	Habitat during both summer and winter includes grasslands, deserts, and other open areas with isolated shrubs or trees where less than 50% of the land is under cultivation. Mostly eat lagomorphs, ground squirrels, and mice.	Suitable habitat present. Closest reported occurrence is 4 wintering adults in Marina.
Eremophila alpestris actia (California horned lark)	--/CSC	Short-grass prairie, "bald hills, mountain meadows, open coastal plains, fallow grain fields, alkali flats. Within coastal regions, from Sonoma Co. to San Diego Co. Also main part of San Joaquin Valley and east to foothills.	Potential nesting habitat present.
Falco mexicanus (Nesting) (Prairie falcon)	--/CSC	Level or hilly dry, open terrain with cliffs as breeding sites; foraging ranges may extend to marshlands and ocean shores	Potential nesting habitat present in badland escarpment.
Eumops perotis (California mastiff bat)	--/CSC	Lowland areas in arid to semi-arid habitats including deciduous woodlands, coastal scrub, and annual grasslands.	Suitable habitat present
Plecotus townsendii ssp. townsendii (Townsend's big-eared bat)	--/CSC	Inhabits oak/bay woodlands and mixed broadleaf conifer woodlands; requires access to caves, building attics or other dark cavities for daytime refuge.	Suitable habitat present.
Antrozous pallidus (Pallid bat)	--/CSC	Found in a variety of habitats. Most common in dry, open habitats with rocky areas available for day roosts.	Suitable habitat present.
Neotoma fuscipes luciana (Monterey dusky-footed woodrat)	--/CSC	Uses habitats with moderate to dense cover and abundant dead wood for nest construction.	Suitable habitat in oak woodlands.

Table 2 (Continued)

Species	Status[1] Fed/CA	Habitat	Findings[2]
Taxidea taxus (American Badger)	--/CSC	Principal habitat requirements include sufficient food, friable soils, and relatively open, uncultivated ground. Grasslands, savannas, and mountain meadows near timberline are preferred. Prey primarily consists of burrowing rodents such as Gophers, Ground Squirrels, Marmots, and Kangaroo Rats.	No signs of badger during September survey. Grasslands could provide habitat for the species. Closest known occurrence is over 2 miles north of project site within the former Fort Ord.

1. Status Explanations

Federal (Fed)
E = listed as endangered under the federal Endangered Species Act
T = listed as threatened under the federal Endangered Species Act
-- = no designation

California State (CA)
CSC = California Department of Fish and Game Species of Special Concern

2. Findings based on literature review, field assessment of habitat types present, and knowledge of species habitat requirements.

APPENDIX D – CULTURAL RESOURCES

Archaeology Consultants. Preliminary Cultural Resources Reconnaissance of Portions of APM 416-211-21 and 415-011-01, San Benancio, Monterey County, California. May 22, 1993

Pacific Municipal Consultants. Written communication to the County of Monterey Planning and Building Inspection Department from Pacific Municipal Consultants regarding the Harper Canyon Subdivision. November 30, 2005.

Pacific Municipal Consultants. Archaeological and Historical Investigations. May 2006.

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PRELIMINARY CULTURAL RESOURCES RECONNAISSANCE OF PORTIONS OF A.P.N. 416-211-21 AND 415-011-01, SAN BENANCIO, MONTEREY COUNTY, CALIFORNIA

by

Anna Runnings, M.A., and Trudy Haversat, *SOPA*

March 22, 1993

Prepared for

Mr. Michael D. Cling

SUMMARY: PROJECT 2097
RESULTS: NEGATIVE
ACRES: ~441
SITES: NONE
UTMG: N 6.1657/40.5010, E 6.1729/40.4785, S 6.1673/40.4725, W 6.1552/40.4834
MAP: USGS 7.5 MINUTE SPRECKELS QUADRANGLE

Note: *SOPA* indicates certification by the Society of Professional Archaeologists.

INTRODUCTION

In January 1993, Archaeological Consulting was authorized by Michael D. Cling to prepare a Preliminary Cultural Resources Reconnaissance report for a lot line adjustment on the property of Albert and Dana Broccoli near Salinas, Monterey County, California.

As part of our methodology in the preparation of this report, we have conducted: 1) a background records search at the Northwest Regional Information Center of the California Archaeological Inventory, located at Sonoma State University, Rohnert Park; and 2) a field reconnaissance of the project area. The following report contains the results of these investigations as well as our conclusions and recommendations.

PROJECT LOCATION AND DESCRIPTION

The project parcel is located off San Benancio Road approximately a mile from it's intersection with Highway 68 near Salinas, Monterey County, California (see Map 1). The Assessor's Parcel Numbers (APNs) are 416-211-21 and 415-011-01, and the Universal Transverse Mercator Grid (UTMG) coordinates for the approximate corners of the project parcel are N 6.1657/40.5010, E 6.1729/40.4785, S 6.1673/40.4725, and W 6.1552/40.4834 on the USGS 7.5 minute Spreckels Quadrangle (1947; photorevised 1984). The two parcels total approximately 441 acres.

At the time of the cultural resources reconnaissance there were no existing structures on the parcel. The area was primarily rangeland, with oak grassland and oak woodland on the moderate slopes and some small areas of dense brush on steeper slopes. Soil visibility was aided by abundant rodent burrowing activity. Overall, ground surface visibility was considered adequate for the purposes of this reconnaissance.

PROJECT METHODOLOGY

The methodology used in the preparation of this report included two primary steps, as follows:

Background Research

The background research for this project included an examination of the archaeological site records, maps, and project files of the Northwest Regional Information Center of the California Archaeological Inventory, located at Sonoma State University, Rohnert Park, California. In addition, our own extensive personal files and maps were examined for supplemental information, such as rumors of historic or prehistoric resources within the general project area.

The Regional Information Centers have been established by the California Office of Historic Preservation as the local repository for all archaeological reports which are prepared under cultural resource management regulations. The background literature search at the appropriate Regional Information Center is required by state guidelines and current professional standards. Following completion of the project, a copy of the report also must be deposited with that organization.

These literature searches are undertaken to determine if there are any previously recorded archaeological resources within the project area, and whether the area has been included within any previous archaeological research or reconnaissance projects.

Field Reconnaissance

The field reconnaissance was conducted by Anna Runnings, M.A., Mary Doane, B.A., Susan Morley, Kathy Owens, and Joanne O'Conner on February 15, 1993, and by Trudy Haversat, M.A., Kathy Owens and Susan Morley on March 8, 1993. The survey consisted of a "general surface reconnaissance" of all areas which could reasonably be expected to contain visible cultural resources, and which could be viewed without major vegetation removal or excavation.

RESULTS OF THE RECONNAISSANCE

Background Research

The record search of the files at the Northwest Regional Information Center showed that there are several archaeological sites recorded within one kilometer of the project parcel, but that none are recorded for the project parcel itself. There was one previous archaeological reconnaissance that covered a portion of one parcel, but the majority of the project area had not been previously studied.

In addition, the California Inventory of Historical Resources (March 1976), California Historical Landmarks, and the National Register of Historic Places were checked for cultural resources which might be present in the project area, but which were not recorded with the Regional Information Center; none were discovered.

The project area lies within the currently recognized ethnographic territory of the Costanoan (often called Ohlone) linguistic group. Discussions of this group and their territorial boundaries can be found in Breschini, Haversat, and Hampson (1983), Kroeber (1925), Levy (1978), Margolin (1978), and other sources. In brief, the group followed a general hunting and gathering subsistence pattern with partial dependence on the natural acorn crop. Habitation is considered to have been semi-sedentary and occupation sites can be expected most often at the confluence of streams, other areas of similar topography along streams, or in the vicinity of springs. These original sources of water may no longer be present or adequate. Also, resource gathering and processing areas, and associated temporary campsites, are frequently found on the coast and in other locations containing resources utilized by the group. Factors which influence the location of these sites include the presence of suitable exposures of rock for bedrock mortars or other milling activities, ecotones, the presence of specific resources (oak groves, marshes, quarries, game trails, trade routes, etc.), proximity to water, and the availability of shelter. Temporary camps or other activity areas can also be found along ridges or other travel corridors.

Field Research

None of the materials frequently associated with prehistoric cultural resources in this area (shell fragments, dark soil, broken or fire-altered rocks, bone or bone fragments, flaked or ground stone, etc.) were noted during the survey.

There was no evidence of significant historical resources.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the background research and the surface reconnaissance, we conclude that the project area does not contain surface evidence of potentially significant cultural resources. Because of this we make the following recommendation:

- The proposed project should not be delayed for archaeological reasons.

Because of the possibility of unidentified (e.g., buried) cultural resources being found during construction, we recommend that the following standard language, or the equivalent, be included in any permits issued within the project area:

- If archaeological resources or human remains are accidentally discovered during construction, work shall be halted within 50 meters (150 feet) of the find until it can be evaluated by a qualified professional archaeologist. If the find is determined to be significant, appropriate mitigation measures shall be formulated and implemented.

REFERENCES

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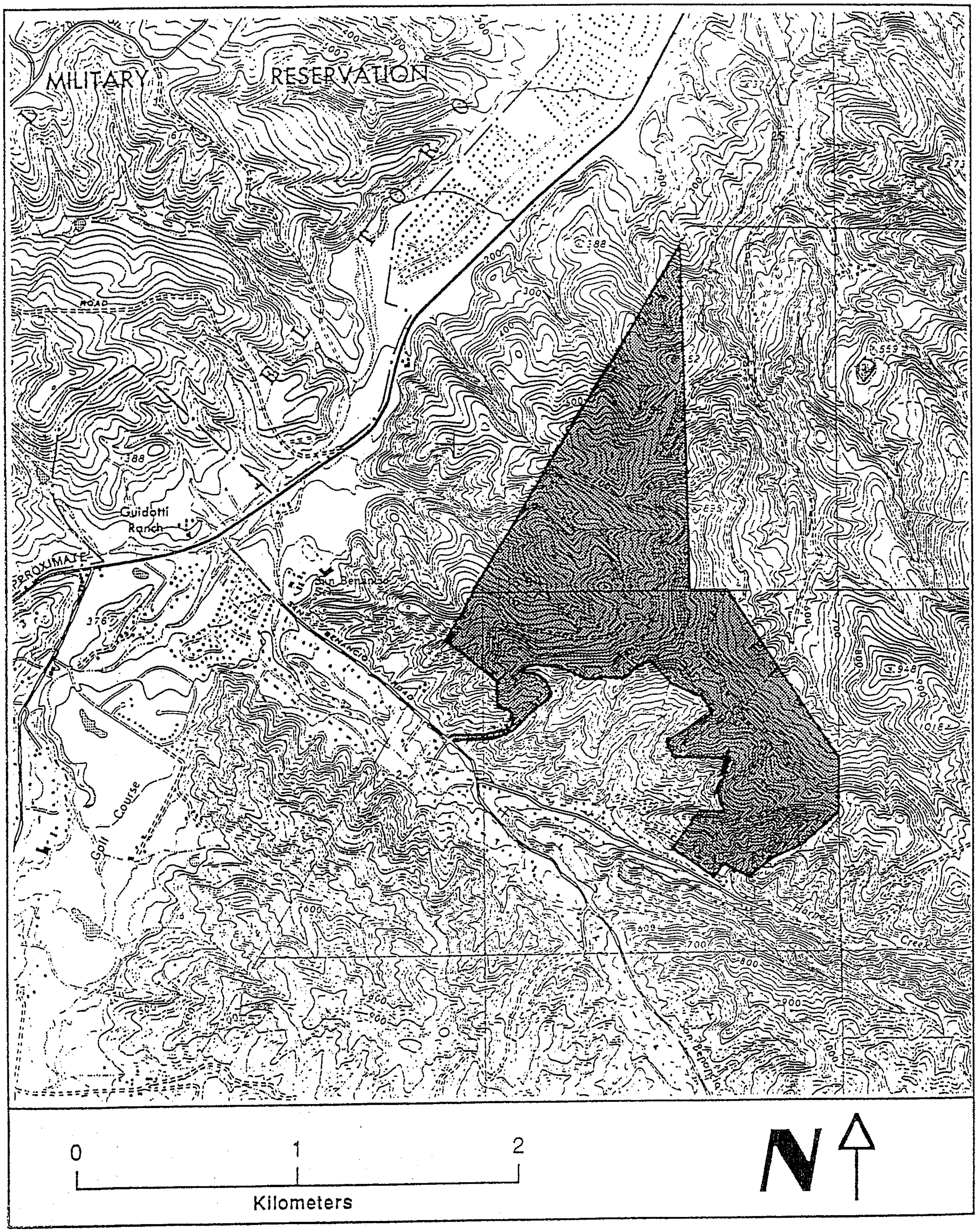

Map 1. Project Location.

PMC

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November 30, 2005

Paul Mugan, Senior Planner
Planning and Building Inspection Department
COUNTY OF MONTEREY
230 Church Street, Building 1
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RE: PEER REVIEW OF CULTURAL RESOURCES INVESTIGATIONS FOR THE ENCINA HILLS SUBDIVISION

Dear Paul:
I have reviewed the cultural resources report titled *Preliminary Cultural Resources Reconnaissance of Portions of APN 416-211-21 and 415-011-01, San Benancio, Monterey County, California* (Archaeological Consulting 1993) that was completed for the area encompassed by the proposed Encina Hills Subdivision. The report is over ten years old and does not appear adequate for project needs. The cultural context of the project area and its archaeological sensitivity are not discussed in sufficient detail, and the description of the surface survey methodology is vague, being described as "general surface reconnaissance."

It is important to address the cultural context and archaeological sensitivity of the project area because: there are archaeological sites near the project area; the report states that ridge tops are archaeologically sensitive; and the cultural context and archaeological sensitivity provide support for the choice of pedestrian surface survey strategy used for the project. For example, the project area appears to be relatively steep with archaeologically sensitive areas along ridge tops, but the description of the survey methodology is unclear (i.e., "general surface reconnaissance" is not described) and does not provide information regarding any differences in survey strategy (e.g., spacing between survey transects) in these areas that vary in archaeological sensitivity. Therefore, I recommend the following:

- A current records search for the project area conducted by the Northwest Information Center, Sonoma State University;

ARCHAEOLOGICAL and HISTORICAL INVESTIGATIONS
for the
HARPER CANYON RESIDENTIAL DEVELOPMENT
in
MONTEREY COUNTY

Report Prepared For:

Monterey County Planning Department

Report Prepared By:

Pacific Municipal Consultants
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Monterey, CA 93940

May 2006

MANAGEMENT SUMMARY

The Monterey County Planning Department is considering approval of the Harper Canyon Residential Development. The approximately 345-acre development is located northeast of the intersection of State Highway 68 and San Benancio Road. Project activities will include: construction of private residences on 17 large lots; construction of roadways; and installation of infrastructure (e.g., utilities and sewage disposal facilities). The project is subject to the legal requirements of the California Environmental Quality Act (CEQA) (Public Resources Code 21000 et seq.) 1970, as amended.

Cultural resources staff of Pacific Municipal Consultants conducted archaeological and historical investigations for the Harper Canyon Residential Development in May 2006. These investigations included: a records search at the Northwest Information Center at Sonoma State University, Rohnert Park; a sacred lands search conducted by the Native American Heritage Commission; consultation with the Native American community; and pedestrian surface survey of the Area of Potential Effects (APE) for the project. The archaeological and historical investigations for the project did not identify any cultural resources (e.g., prehistoric sites, historic sites, historic buildings, or isolated artifacts) either within or immediately adjacent to the project APE. Therefore, it is not anticipated that implementation and completion of the Harper Canyon Residential Development would likely affect any historical resources or unique archaeological resources.

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Monterey County Planning Department is considering approval of the Harper Canyon Residential Development. Project activities will include: construction of private residences on 17 large lots; construction of roadways; and installation of infrastructure (e.g., utilities and sewage disposal facilities). The project is subject to the legal requirements of the California Environmental Quality Act (CEQA) (Public Resources Code 21000 et seq.) 1970, as amended.

1.2 PROJECT LOCATION

The approximately 345-acre Harper Canyon Residential Development is located northeast of the intersection of State Highway 68 and San Benancio Road (Figures 1-2). The project APE is in the Sierra de la Salinas Mountains north of Harper Creek. The area primarily consists of steeply sloped canyons that are separated by ridges, some of which are relatively flat. The residential lots in the project APE are located on relatively flat areas along ridges that vary from moderate to steeply sloped (Figures 3-4).

1.3 SCOPE OF WORK

Monterey County contracted Pacific Municipal Consultants (PMC) to complete the environmental documents necessary for the proposed Harper Canyon Residential Development, including archaeological and historical investigations. Archaeological and historical investigations for the project included: a records search at the Northwest Information Center at Sonoma State University, Rohnert Park in May 2006; a sacred lands search conducted by the Native American Heritage Commission (NAHC) on December 14, 2005; a pedestrian surface survey of the Area of Potential Effects (APE) for the project; and completion of a report documenting the results of archaeological and historical investigations that presents recommendations, as appropriate, for the protection of cultural resources (e.g., prehistoric sites, historic sites, historic buildings, or isolated artifacts) within project boundaries.

1.3.1 Cultural Resources Identification

The record search for the Harper Canyon Residential Development identified that the project APE was previously surveyed (cf., Archaeological Consulting 1993), but did not identify any previously recorded archaeological sites within it. The project APE was previously surveyed in 1993, consequently PMC cultural resources staff conducted a pedestrian surface survey across the project APE to identify any changed conditions in the area and confirm the negative results of the previous survey.

Pedestrian surface survey of the project APE using 10-15 meter parallel transects across open areas and 20-25 meter transects across areas covered with brush did not identify any cultural resources. Vegetation (e.g., grasses and brush) across parts of the project APE affected surface visibility, but surface visibility was generally good in areas that might be sensitive for cultural resources, such as the ridge tops. Surface visibility was generally good across the residential lots along the ridge tops (e.g., there are areas of exposed native soils and rock along the ridge tops) and ranged from good to poor in areas beyond the residential lots on the slopes of the ridges that have a relatively low sensitivity for cultural resources. Consequently, surface visibility across the project APE was adequate to identify the types of cultural resources that would typically

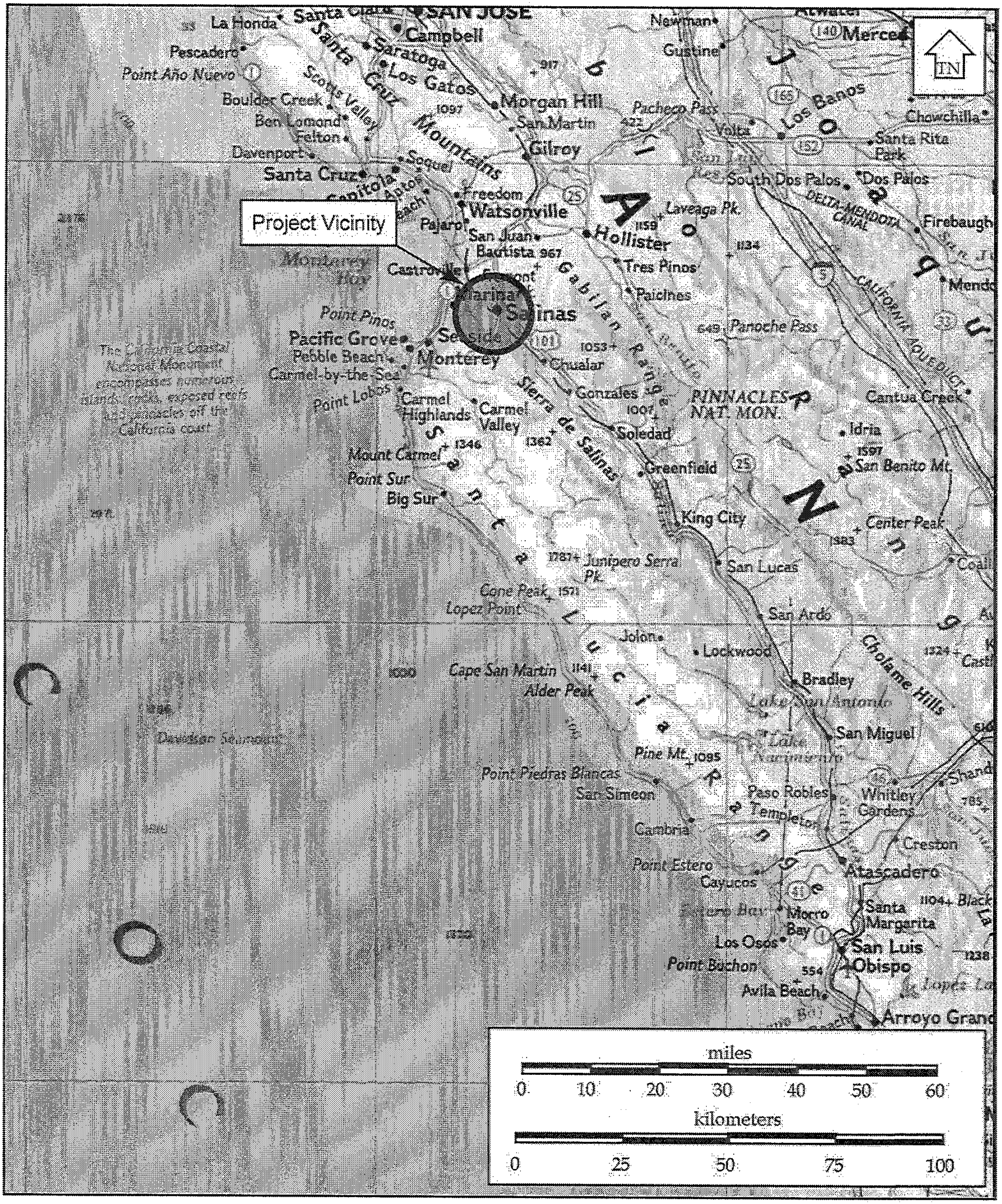


Figure 1. Project Vicinity Map.

SOURCE: National Geographic TOPO!; San Francisco CD; 2004

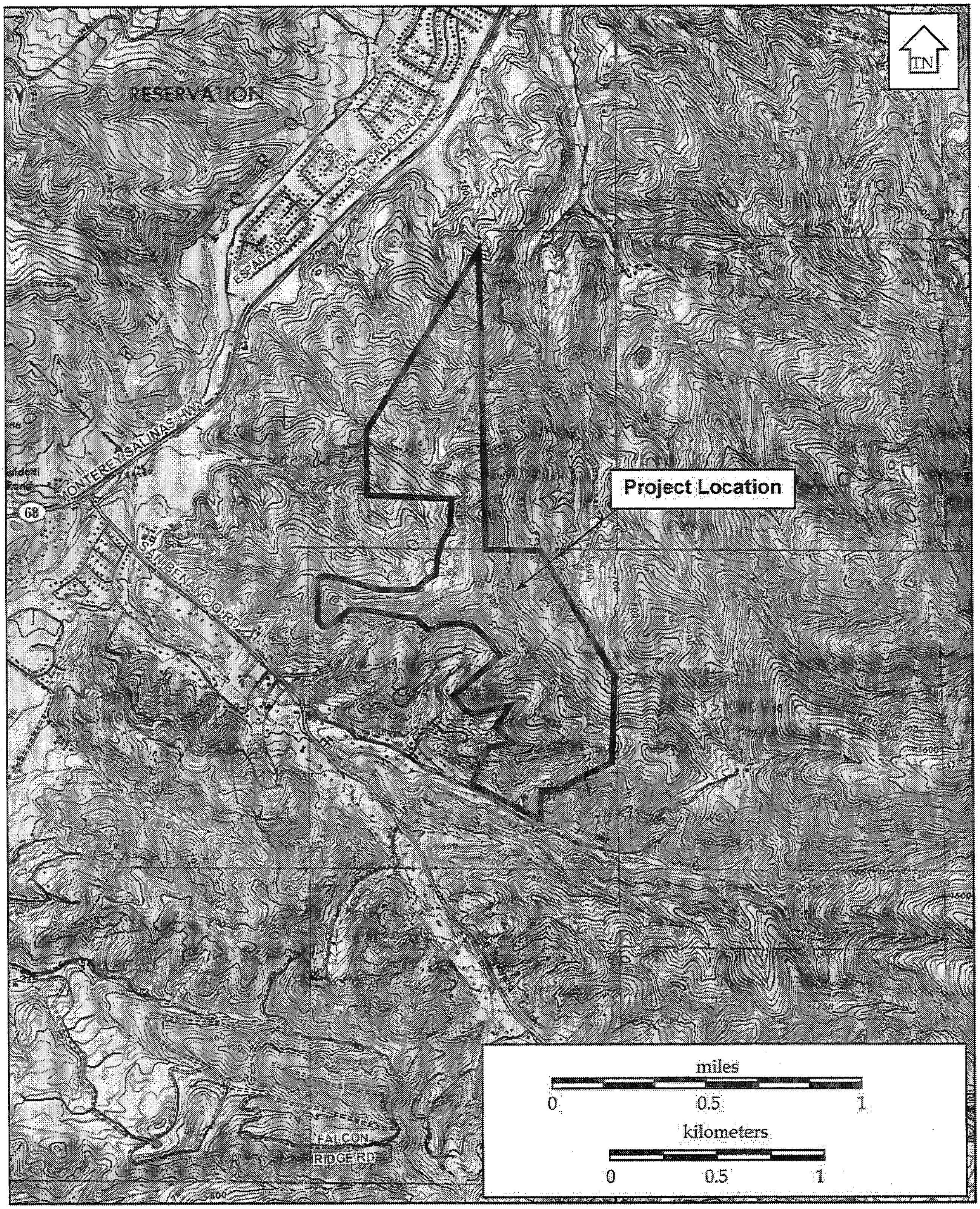


Figure 2. Project Location Map.

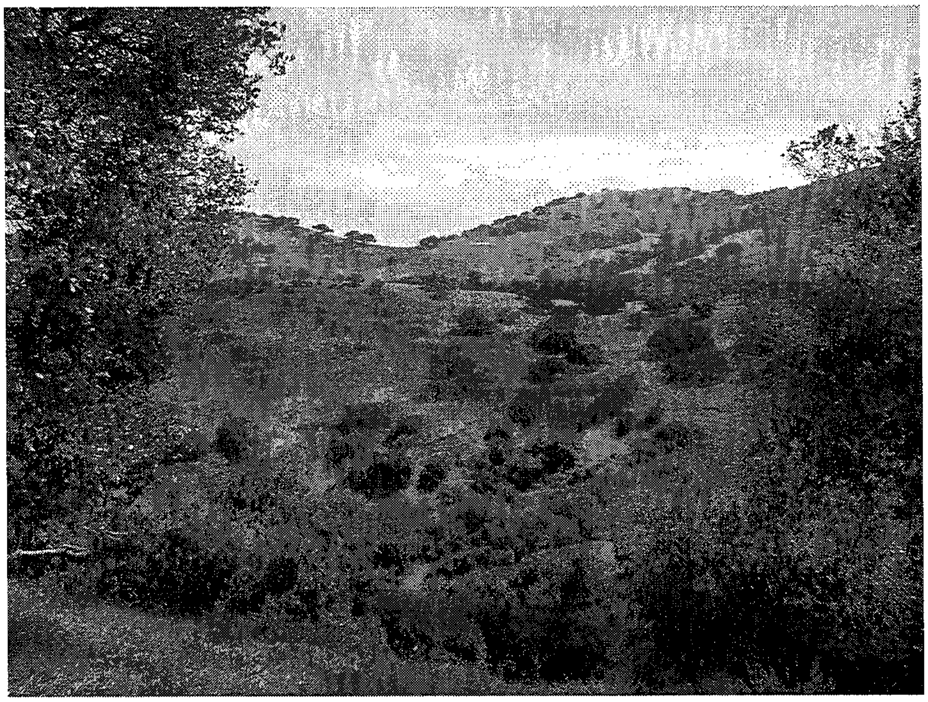
SOURCE: National Geographic TOPO!; San Francisco CD; 2004; showing the Spreckles quadrangle; T15S, R2E and T16S, R2E.

Overview of the central section of the project APE (i.e., Lots 2, 4, 5, 6, 8, 11) facing north

Overview of the northwest boundary of the project APE (i.e., Lot 11) facing southeast

Figure 3. Overview of Project APE

Overview of the eastern section of the project APE (i.e., Lot 16) facing southeast



Overview of the eastern section of the project APE (i.e., Lot 16) facing northwest

Figure 4. Overview of Project APE

occur in the area. Surface survey, however, did identify that there are dirt roads and an overhead utility line across the project APE and also that It is used for grazing.

In summary, archival and field investigations are complete for the Harper Canyon Residential Development. A reasonable effort has been made to identify cultural resources within the APE for the Harper Canyon Residential Development. Archival and field investigations for the project are adequate, and did not identify any cultural resources.

1.3.2 Site Recording

Archaeological and historical investigations did not identify any previous or new prehistoric sites, historic sites, or historic buildings within the APE for the Harper Canyon Residential Development. Consequently, no sites were recorded and no site records were updated as part of the current project.

1.4 NATIVE AMERICAN CONSULTATION

Cultural resources staff of PMC requested a sacred lands search and a list of Native American contacts from the Native American Heritage Commission. The results of sacred lands search were received on December 14, 2005, and did not identify any Native American cultural resources either within or near the project APE. PMC contacted all groups and/or individuals on the list provided by the NAHC regarding the Harper Canyon Residential Development (Appendix A, Native American Consultation). PMC cultural resources staff, to date, has not received any comments regarding the project.

1.5 PERSONNEL CONDUCTING RESEARCH

Professional staff of PMC performed all current archaeological and historical investigations for the Harper Canyon Residential Development. John A. Nadolski, M.A. was responsible for overall project management and implementation, including report writing. Kurt E. Lambert, B.A. assisted Mr. Nadolski in the completion of archaeological and historical investigations. All project personnel meet the Secretary of the Interior's Standards and Guidelines for Professional Qualifications.

2.0 ENVIRONMENTAL CONTEXT

The project is located on California's central coast, which is biologically diverse. The diverse resources and ecosystems in the area attracted prehistoric and historic Native American populations and Euroamericans.

2.1 GEOGRAPHY AND GEOLOGY

The Harper Canyon Residential Development is located in the Sierra de la Salinas Mountains. The Salinas River is located north of the project site and Harper Creek is located to the south. The topography of the project area is primarily composed of relatively well-defined eastward trending drainage channels with steep sloping canyons separated by ridges, some of which are relatively flat.

The climate of the Monterey Bay area is characterized by warm, dry summers and cool, rainy winters. The Pacific Ocean influences the regional climate causing fog and onshore winds that generally maintain mild temperatures in the area.

The Harper Canyon Residential Development is in the Coast Range geomorphic province. This area primarily consists of northwest trending mountain ranges, broad basins, and elongated valleys that generally parallel the coast (Norris and Webb 1990). The principal geologic components in the area include: Mesozoic granite and metamorphic rocks; Miocene marine sedimentary rocks of the Monterey Formation; Upper Miocene to lower Pliocene marine sandstone of the Santa Margarita Formation; Plio-Pleistocene alluvial fan, lake, and fluvial deposits of the Paso Roble Formation; Pleistocene eolian and fluvial sands of Aromas Sand; the Franciscan Formation; and Pleistocene to Holocene valley fill deposits including gravel, silt, sand, clay, and dune sands (Norris and Webb 1990). The Miocene Monterey Formation is generally composed of beds of diatomaceous shales, which are interbedded with siliceous cherts varying in color from black to tan to white (Norris and Webb 1990). The Franciscan Formation is generally composed of graywackes interbedded with lesser amounts of shale, occasional limestone, and bands of black, red, and greenish chert (Norris and Webb 1990).

The Franciscan and Monterey Formations are not only interesting from a geological viewpoint, but also from an archaeological perspective. These formations provided an accessible and plentiful source of chert. Prehistoric and historic Native American populations in the area used Franciscan and Monterey cherts for the production of a variety of tools.

2.2 FLORA AND FAUNA

The Harper Canyon Residential Development is in a biologically diverse area that supports a wide range of plant and animal communities. Regardless, the project area primarily consists of coastal oak woodland (Holland 1988). Coastal oak woodland provides habitat for a variety of animal species including deer, quail, and turkey.

3.0 CULTURAL CONTEXT

The proposed project is located in an area with a long history of use by both Native American and Euroamerican populations. Archaeological evidence suggests that Native American populations occupied the area for 10,000 years, and Spanish exploration/settlement of the area dates to the 1600s.

3.1 REGIONAL PREHISTORY

Archaeological work in vicinity of Monterey Bay dates to 1875, when Saxe tested the Sand Hill Bluff site, CA-SCR-7, just north of Santa Cruz (Saxe 1875). Early research was continued by Kroeber (1915), who recorded nine sites near Monterrey Bay, and by Golomshtok (1921-1922), Hill (1929), and Wood (1930) all of who conducted surveys near Elkhorn Slough. Following this early work, virtually no archaeological research was conducted in the area until the late 1940s and 1950s. Research during this period is highlighted by the work of: Pilling (1948) who identified numerous sites in Monterey County and specifically Elkhorn Slough; Greengo (1951) who sampled shellmounds near Elkhorn Slough; and Broadbent (1951a, 1951b) who tested the Berwick Park site, CA-MNT-107. Most of this work may be classified as exploratory, and tended to be site specific rather than integrative in focus. One of the first major site reports in the Monterey Bay area was completed by Pritchard (1968) for CA-MNT-101. Since the completion of Pritchard's report, archaeological research and interest in the Monterey Bay area has steadily grown. A catalyst to this development is the implementation and completion of numerous cultural resource management projects. These projects have expanded the archaeological database for the area and also have made significant contributions to our understanding of its prehistory.

This recent archaeological work involved the development of regional chronologies and models of culture change for Monterey Bay and its immediate environs (Figure 5). Significant contributions in this regard have been presented by: Breschini (1983); Breschini et al. (1983); Breschini and Haversat (1992); Cartier (1993); Dietz (1985); Dietz et al. (1988); Dietz and Jackson (1981); Hildebrandt and Mikkelsen (1993); Jones and Hylkema (1988); Jones (1993); Jones et al. (1996); Jones and Jones (1992); and Patch and Jones (1984).

Breschini and Haversat proposed two archaeological "patterns" for the Monterey Bay area: the Sur Pattern and the Monterey Pattern (Breschini and Haversat 1980; Breschini 1983). They suggest that the Sur Pattern represents an early "forager" subsistence strategy and a very generalized economy. The Sur Pattern appears by 3000 B.P., and its sites reflect a variety of activities, with both inland and coastal sites exhibiting similar artifact assemblages. Breschini and Haversat associate the Sur Pattern with Hokan speaking ancestors of historic Esselen populations. By contrast, Breschini and Haversat suggest the later Monterey Pattern represents a "collector" subsistence strategy. This pattern appears in the Monterey Bay area after 2450 B.P., and its sites reflect two different strategies of resource exploitation. Coastal sites highlight exploitation of marine resources, while sites located further inland exhibit evidence of more diversified subsistence activities. Breschini and Haversat associate the Monterey Pattern with Penutian speaking ancestors of historic Costanoan populations (1980).

Dietz and Jackson's (1981) archaeological investigations at nineteen sites along the northern shore of Monterey Peninsula confirmed the presence of two archaeological "populations" in the area that are comparable to the Sur and Monterey Patterns. Like Breschini and Haversat, they identified a group of foragers and a group of collectors. The foraging group, which dated to approximately 4,000 B.P., was probably Hokan-speaking ancestors of the Esselen.

Period	Dating	Obsidian Hydration		Bead Types	Projectile Points	Ground-stone	Significant Components			Phase
		Napa	Casa Diablo				Santa Cruz	Elkhorn Slough	Monterey Peninsula	
Historic	Post 1769			Glass; Clam shell disk	Desert Side-notched		Mission Santa Cruz	MNT-229**	MNT-112	
Late***	A.D. 1200-1769	0.9-2.2	1.0-2.2	*Olivella* E; *Olivella* M1*; *Olivella* K; Clam shell disk; Tale schist disk	Desert Side-notched; Canalino	Hopper mortar; Bedrock mortar; Pestle; Handstone; Millingslab	SCR-20	MNT-1765	MNT-1485/H MNT-1486/H	Rancho San Carlos
Middle/ Late	A.D. 1000-1200	1.4-2.4	1.5-2.4	*Olivella* D	Central coast Stemmed Series; Small leaf-shaped	Hopper mortar; Bowl mortar; Pestle; Millingslab; Handstone	SMA-238		MNT-3	
Middle	600 B.C.-A.D. 1000	2.0-4.3	2.0-4.8	*Olivella* G; *Olivella* F;	Central coast Stemmed Series; Ano Nuevo Long-stemmed*; Concave base; Side-notched	Bowl mortar; Pestle; Millingslab; Handstone	SCR-9	MNT-229	MNT-101**	Vierra
Early	3500 B.C.-600 B.C.	3.9-5.9	4.4-6.2	*Olivella* L	Central coast Stemmed Series; Side-notched	Bowl mortar; Millingslab; Handstone	SCR-7**		MNT-391 MNT-387	Saunders
Millingstone and Paleo-Indian	3500 B.C.-8000 B.C.	>5.3	>5.6		Lanceolate Ovate Bi-point; Eccentric crescent	Millingslab; Handstone	SCR-177	MNT-229		Scotts Valley

* Santa Cruz only

** Multi-component

*** The Late Period is generally split into two sub-periods. Jones (1993) defines Late as A.D. 1200-1500, and Protohistoric as A.D. 1500-1769. In the Sacramento Valley, Bennyhoff and Hughes refer to Late Phase I (up to A.D. 1500), and Phase II (A.D. 1500-1769). Bead types from Bennyhoff and Hughes (1987).

Figure 5. Regional Chronologies (after Jones et al. 1996).

The subsequent group of collectors entered the area about 2000 B.P. and either absorbed or replaced the foragers inhabiting the area. These groups of collectors were probably early Costanoan populations. The early Costanoans exploited both the coastal and inland areas, establishing temporary camps along the shore and permanent residential base camps further inland.

Recently, the work of Breschini and Haversat (1980) and Dietz and Jackson (1981) has been thoroughly revised by Dietz et al. (1988), Jones and Hylkema (1988), Hylkema (1991), Hildebrandt and Mikkelsen (1993), and Jones (1993). This recent work proposes a series of seven cultural periods for the Monterey Bay area. These seven periods and their associated dates are: Paleoindian 10,000–8,000 B.C.; Millingstone 8,000–3,500 B.C.; Early 3,500–600 B.C.; Middle 600 B.C.–A.D. 1200; Late A.D. 1200–1769; and Historic. All seven periods are represented in the Monterey Bay area, but are only formally established for the Early, Middle, and Late periods.

The Paleoindian and Millingstone periods are identified as local expressions of the Paleo-Coastal Tradition (Jones et al. 1996). The Early period is best represented at CA-Mnt-391, and is characterized by Class L *Olivella* beads, contracting stem Rossi Square-stemmed projectile points, mortars and pestles, and handstones and milling slabs (Cartier 1993). The Middle period is represented at CA-SCR-9, and is characterized by Class G2 *Olivella* beads, Año Nuevo Long-stemmed and contracting stem Rossi Square-stemmed projectile points, mortars and pestles, and handstones and milling slabs (Hylkema 1991). The Late period has been difficult to define in the Monterey Bay area. Sites CA-MNT-1485/H and -1486/H, however, represent this period and are characterized by Class E, K, and M *Olivella* beads, Desert Side-notched projectile points, bedrock mortars, and pestles (Breschini and Haversat 1992).

3.2 ETHNOGRAPHY

At the time of Euroamerican contact (ca. 1769), Native American groups of the Costanoan language family occupied the area from San Francisco Bay to southern Monterey Bay and the lower Salinas River. The Costanoan language family consists of eight separate and distinct languages, and approximately 50 tribelets (Levy 1978). The Monterey Bay area was primarily occupied by speakers of three different Costanoan languages: Awaswas speakers occupied northern Monterey Bay near Aptos; Mutsun speakers occupied the Pajaro River drainage; and Rumsen speakers occupied the drainages of the lower Salinas, Carmel, and Sur Rivers. The tribelets of Kalendaruc and Guachiron dominated the central Monterey Bay area (Jones et al 1996). Unfortunately, Costanoan culture was dramatically affected by missionization, and information (e.g., mission records and travelers logs) regarding its pre-contact organization is incomplete and inconsistent. Indeed, Costanoan languages were probably extinct by 1935, and in 1971 the remaining Costanoan descendants united as a corporate entity identified as the Ohlone Indian Tribe (Levy 1978).

3.2.1 Settlement, Social Organization, and Subsistence Patterns

Costanoans lived in an area extending from San Francisco Bay to Monterey Bay. This large area was subdivided among several individual tribelets occupying specific territories. Each tribelet consisted of approximately 200 individuals, who were grouped into clans and moieties, usually controlled by a headman (Harrington 1933, 1942; Levy 1978). The position of headman was usually passed from father to son, with succession being subject to approval by the community. If no suitable male heir was available, a woman could also assume the role of headman. Tribelet political organization also included a council of elders, official speakers, and shamans (Levy 1978).

Costanoan tribelets experienced both friendly and hostile relations with each other and with neighboring cultural groups such as the Salinan and Yokuts. Interaction between these groups involved marriage, trade, and warfare. Intermarriage usually occurred between adjacent tribes, and was rare between tribes at greater distances (Milliken et al. 1993). Trade was a regular activity among the tribes of the area, with resources such as shell, piñon, and obsidian moving between coastal and inland groups. Warfare is a common theme in many historical accounts of various groups of Costanoans, and is usually associated with territorial disputes and/or access to and control of particular resources (Broadbent 1972; Langsdorff 1968).

Costanoans usually moved between several semi-permanent camps and villages to take full advantage of seasonally available resources. Dwellings at these camps and villages were dome-shaped, with pole frameworks and thatch for roof and walls. Other structures typically found in a Costanoan village included: acorn granaries; sweathouses; menstrual houses; and dance and/or assembly houses, generally located in the center of a village (Broadbent 1972).

A wide variety of ecological zones, including foothills, valleys, sloughs, and coastal areas, were exploited by Costanoans to obtain subsistence resources. These resources included: various seeds; nuts (e.g., acorn, buckeye, laurel, and hazelnuts); berries; grasses; corms; roots; insects; birds (e.g., geese, mallard, and coot); fish (e.g., steelhead, salmon, and sturgeon); shellfish (e.g., abalone, mussel and clam); and both marine and terrestrial mammals (e.g., sea otter, sea lion, harbor seal, deer, elk, grizzly bear, rabbits, antelope, raccoon, and squirrels) (Levy 1978).

3.2.2 Technology

Costanoan technology highlights exploitation of both marine and terrestrial resources. Tule balsas were used for transportation, fishing, and hunting (Levy 1978). Hunting weaponry and facilities included: sinew-backed and self-bows; wooden arrow shafts; projectile points and other flaked stone tools made from locally available chert or obsidian obtained through trade; and nets (Levy 1978). Costanoans utilitarian tools and facilities included: baskets, primarily twined, for food and water collection, food storage, and food preparation; portable stone mortars and bedrock mortars; pestles; metates; soaproot brushes; stone bowls; and bone awls (Levy 1978). Clothing, robes, and blankets were made of various animal skins (Levy 1978).

Steatite, serpentine, bone, and abalone were used for personal ornaments. In addition, *Olivella* and other shell were cut and ground into beads. Some Costanoans also decorated themselves with pigment and tattoos (Levy 1978).

3.2.3 Euroamerican Contact

Sebastian Vizcaino's landing at present day Monterey in 1602 is the earliest documented contact with Native Americans in the area. Following Vizcaino's landing, other Spanish ships may have stopped at Monterey, but contact was minimal until the initial overland exploration of the area by Gaspar de Portolá in 1769 (Hoover et al. 1990). Portolá's expedition followed the coast, while subsequent exploration of the region by Pedro Fages in 1770 and 1772, Fernando Javier de Rivera in 1774, and Juan Bautista de Anza in 1776 traveled on the east side of the Santa Cruz Mountains, along a route which became known as El Camino Real (Beck and Haase 1974).

Gaspar de Portolá founded Monterey in 1769, and in 1770 Padre Junipero Serra founded Mission San Carlos de Borromeo, which was later relocated to Carmel (Jones et al 1996). Other missions, such as Mission Santa Cruz, founded in 1791, and Mission San Juan Bautista, founded in 1797, are also located in the general area and had a dramatic effect on Native American populations. The Spanish attempted to convert the Native American population to Catholicism and incorporate them into the "mission system." The process of missionization disrupted traditional Costanoan cultural practices, and they were generally slow to adapt to the mission system. The Spanish, however, were intent on implementing it, and by 1810 most Native Americans in the area were either incorporated or relocated into local missions. This factor, coupled with exposure to European diseases, virtually ended the traditional life of Native Americans in and around Monterey Bay.

The Mexican period (ca. 1821-1848) in California is an outgrowth of the Mexican Revolution, and its accompanying social and political views affected the mission system. In 1833 the missions were secularized and their lands divided among the *Californios* as land grants called *Ranchos*. These *ranchos* facilitated the growth of a semi-aristocratic group that controlled the larger *ranchos*. Owners of *ranchos* used local populations, including Native Americans, essentially as forced labor to accomplish work on their large tracts of land. Consequently, Costanoans, and other Native American groups across California, were forced into a marginalized existence as *peons* or *vaqueros* on the large *ranchos*. *Ranchos* in the general project area include: Monterey, City Lands; Monterey County Tracts; Rincon de las Salinas; Las Salinas; and Noche Buena

(Beck and Haase 1974).

The end of the Mexican-American War and the signing of the Treaty of Guadalupe Hidalgo in 1848 marked the beginning of the American period (ca. 1848-Present) in California history. The onset of this period, however, did nothing to change the economic condition of the Native American populations working on the *ranchos*. The *rancho* system generally remained intact until 1862–1864, when a drought forced many landowners to sell off or subdivide their holdings. At this time landowners started to fence ranges and the economy began a shift from cattle ranching to dairy farming and agriculture based on new crops such as wheat and sugar beets. Regardless of a change of economic focus, the plight of Native American populations remained, at best, relatively unchanged (e.g., the U.S. Senate rejected treaties between the government and Native Americans in 1851 and 1852, and military reserves were established to maintain various groups) (Heizer 1974).

The latter half of the nineteenth century witnessed an ongoing and growing immigration of Anglo-Americans into the area, an influx also accompanied by regional cultural and economic changes. Indeed, Anglo-American culture expanded at the expense of Hispanic culture. Dispersed farmsteads slowly replaced the immense Mexican ranchos, and the farming of various crops slowly replaced cattle ranching as the primary economic activity in the region. The advent of the railroad in the area in the mid to late 1800s, and the mechanization of farming with steam-driven machinery, once again altered the economy of the region. For example, larger and larger tracts of land were opened for farming. Some of this land consisted of areas reclaimed from sloughs and lowlands, but corporations specializing in crops grown for export soon purchased many of these farms. These agricultural developments demanded a large labor force and sparked a new wave of immigration into the region. Groups of Chinese were the first new immigrants in the area, and were followed by Japanese, Filipino, and Mexican laborers.

4.0 RESULTS OF RESEARCH

Archaeological and historical investigations for the Harper Canyon Residential Development are complete. These investigations included: a records search at the Northwest Information Center at Sonoma State University, Rohnert Park; a sacred lands search conducted by the Native American Heritage Commission; and a pedestrian surface survey of the project APE. These investigations are adequate to identify the types of cultural resources that would likely be present in the project APE.

The record search identified that the project APE was previously surveyed (cf., Archaeological Consulting 1993), but did not identify any previously recorded archaeological sites within it. The sacred lands search did not identify any sensitive Native American cultural resources within or near the project APE. PMC cultural resources staff conducted a pedestrian surface survey across the project APE to identify any changed conditions in the area and confirm the negative results of the previous survey. Pedestrian surface survey did not identify any cultural resources (e.g., prehistoric sites, historic sites, or isolated artifacts) within the project APE. Archival and field research, however, did identify that the project APE is primarily an area of low sensitivity for cultural resources.

The project APE has a low sensitivity for cultural resources because the area consists of moderate to relatively steep slopes and exposed ridge tops that are not in close proximity to sources of water. Indeed, known archaeological sites in the project area are primarily located in protected valleys either along or near stream courses. The project APE provides plant resources, such as acorns, and habitat for a variety of animals exploited by both Native Americans and Euroamericans. These populations would have used the project APE to acquire food resources, but the exposed ridge tops, slopes, and absence of a water source make the area relatively unattractive for permanent settlements. The types of cultural resources that would likely occur in the project APE would represent transient use of the area, and include either small-scale sites (e.g., sparse lithic scatters or sparse trash scatters) or isolated artifacts.

In summary, archaeological and historical investigations for the Harper Canyon Residential Development did not identify any cultural resources either within or immediately adjacent to the project APE. These investigations are adequate to identify typical cultural resources that would likely be present in the project APE. Therefore, it is not anticipated that implementation and completion of the Harper Canyon Residential Development would likely affect any historical resources or unique archaeological resources.

5.0 MANAGEMENT CONSIDERATIONS

The Monterey County Planning Department is considering approval of the Harper Canyon Residential Development. The approximately 345-acre development is located northeast of the intersection of State Highway 68 and San Benancio Road. Project activities will include: construction of private residences on 17 large lots; construction of roadways; and installation of infrastructure (e.g., utilities and sewage disposal facilities). The project is subject to the legal requirements of the California Environmental Quality Act1970, as amended.

Cultural resources staff of Pacific Municipal Consultants conducted archaeological and historical investigations for the Harper Canyon Residential Development in May 2006. These investigations included: a records search at the Northwest Information Center at Sonoma State University, Rohnert Park; a sacred lands search conducted by the Native American Heritage Commission; consultation with the Native American community; and pedestrian surface survey of the Area of Potential Effects (APE) for the project. The archaeological and historical investigations for the project did not identify any cultural resources (e.g., prehistoric sites, historic sites, historic buildings, or isolated artifacts) either within or immediately adjacent to the project APE. Therefore, it is not anticipated that implementation and completion of the Harper Canyon Residential Development, as currently proposed, would likely affect any historical resources or unique archaeological resources.

Archaeological and historical investigations for the Harper Canyon Residential Development are complete and adequate for project needs. These investigations did not identify any cultural resources within the project APE. Regardless of the findings of the archaeological investigations, it is always possible to inadvertently uncover cultural resources during ground disturbing project activity. Therefore, if any cultural resources are uncovered during ground disturbing project activity it is recommended that all activity cease within 25 feet of the discovery and a qualified archaeologist be retained to determine the significance of the discovery. If human remains are discovered, all work must stop within 25 feet of the discovery, and the County Coroner must be notified, according to Section 7050.5 of California's Health and Safety Code. If the remains are determined to be Native American, the coroner will notify the Native American Heritage Commission, and follow the procedures outlined in the CEQA Guidelines §15064.5(e).

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APPENDIX A
NATIVE AMERICAN AND OTHER CONSULTATION

STATE OF CALIFORNIA Arnold Schwarzenegger, Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-4082
Fax (916) 657-5390
Web Site www.nahc.ca.gov

December 14, 2005

John Nadolski
PMC
10461 Old Placerville Road
Suite 110
Rancho Cordova, CA 95827

Sent by Fax: 916-361-1574
Number of Pages: 6

RE: **Proposed Harper Canyon/Encina Hills Subdivision project, Monterey County; Two Road improvement projects, Sutter County; El Dorado Hills Blvd/Brittany Way Intersection improvement project, El Dorado County**

Dear Mr. Nadolski:

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 653-4038.

Sincerely,

Debbie Pilas-Treadway
Environmental Specialist III

Native American Contacts
Monterey County
December 14, 2005

Linda G. Yamane
1585 Mira Mar Ave.
Seaside , CA 93955-3326
(831) 394-5915
Ohlone/Costanoan

Amah MutsunTribal Band
Edward Ketchum
35867 Yosemite Ave
Davis , CA 95616
aerieways@aol.com
Ohlone/Costanoan
Northern Valley Yokuts

Jakki Kehl
720 North 2nd Street
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jakki@bigvalley.net
(209) 892-2436
(209) 892-2435 - Fax
Ohlone/Costanoan

Amah MutsunTribal Band
Quirina Luna
704 Wes Smith Way
Madera , CA 93638
Ohlone/Costanoan

Ella Rodriguez
PO Box 1411
Salinas , CA 93902
(831) 632-0490 - home
(831) 261-5827 - cell
Ohlone/Costanoan
Esselen

Amah/MutsunTribal Band
Irene Zwierlein, Chairperson
789 Canada Road
Woodside , CA 94062
amah_mutsun@yahoo.com
(650) 851-7747 - Home
(650) 851-7489 - Fax
Ohlone/Costanoan

Amah MutsunTribal Band
Valentin Lopez, Chairperson
3015 Eastern Ave, #40
Sacramento , CA 95821
(916) 481-5785
Ohlone/Costanoan

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
3929 Riverside Drive
Chino , CA 91710
(909) 622-1564
(909) 464-2074
Ohlone/Costanoan

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resource assessment for the proposed Harper Canyon/Encina Hills Subdivision project,Monterey County.

Native American Contacts
Monterey County
December 14, 2005

Indian Canyon Mutsun Band of Costanoan Ann Marie Sayers, Chairperson P.O. Box 28 Hollister , CA 95024	Ohlone/Costanoan
Ohlone/Coastanoan-Esselen Nation Cari Herthel, Chairperson PO Box 1301 Monterey , CA 93942 831-375-8224 831-521-6828 - cell	Esselen Ohlone/Costanoan
Trina Marine Ruano Family Ramona Garibay, Representative 5816 Thornton Ave Newark , CA 94560 510-300-5971 - cell	Ohlone/Costanoan Bay Miwok Plains Miwok Patwin

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resource assessment for the proposed Harper Canyon/Encina Hills Subdivision project,Monterey County.

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December 15, 2005

Ella Rodriguez
P.O. Box 1411
Salinas, CA 93902

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Rodriguez:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Irene Zwierlein, Chairperson
Amah Mutsun Tribal Band
789 Canada Road
Woodside, CA 94062

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Zwierlein:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

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Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Linda G. Yamane
1585 Mira Mar Avenue
Seaside, CA 93955-3326

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Yamane:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

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T Pitsenberger

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December 15, 2005

Ramona Garibay, Representative
Trina Marie Ruano Family
5816 Thronton Avenue
Newark, CA 94560

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Garibay:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

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December 15, 2005

Tony Cerda, Chairperson
Coastanoan Rumsen Carmel Tribe
3929 Riverside Drive
Chino, CA 91710

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Mr. Cerda:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

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T Pitsenberger

Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Quirina Luna
Amah Mutsun Tribal Band
704 Wes Smith Way
Madera, CA 93638

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Luna:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

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T Pitsenberger

Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Ann Marie Sayers, Chairperson
Indian Canyon Mutsun Band of Coastanoan
P.O. Box 28
Hollister, CA 95024

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Sayers:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

TPitsenberger

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December 15, 2005

Jakki Kehl
720 North 2nd Street
Patterson, CA 95363

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Kehl:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

T L Pitsenberger

Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Cari Herthel, Chairperson
Ohlone/Coastanoan-Esselen Nation
P.O. Box 1301
Monterey, CA 93942

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Ms. Herthel:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

Tina Pitsenberger
Cultural Resources Specialist

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December 15, 2005

Edward Ketchum
Amah Mutsun Tribal Band
35867 Yosemite Avenue
Davis, CA 95616

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Mr. Ketchum:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

T. Pitsenberger

Tina Pitsenberger
Cultural Resources Specialist

PMC

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SAN DIEGO
10951 Sorrento Valley Road
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San Diego, CA 92121
Phone (858) 453-3602
Fax (858) 453-3628

December 15, 2005

Valentin Lopez, Chairperson
Amah Mutsun Tribal Band
3015 Eastern Avenue #40
Sacramento, CA 95821

RE: HARPER CANYON/ENCINA HILLS SUBDIVISION PROJECT

Dear Mr. Lopez:

I obtained your name from the Native American Heritage Commission in order to inform you of the Harper Canyon/Encina Hills Subdivision Project in Monterey County. The project area is indicated on the enclosed map.

We are seeking information from Native American representatives in the area regarding the existence of sites within the project area. Thank you for your cooperation in this matter. Please do not hesitate to call me if you have any questions or concerns.

Sincerely,

PACIFIC MUNICIPAL CONSULTANTS

Tina Pitsenberger
Cultural Resources Specialist

APPENDIX E – GEOLOGY AND SOILS

D&M Consulting Engineers, Inc. Geological and Geotechnical Feasibility-Level. August 6, 2001.

GEOLOGICAL AND GEOTECHNICAL FEASIBILITY STUDY
PROPOSED ENCINA HILLS SUBDIVISION
MONTEREY COUNTY, CALIFORNIA

FOR:

Harper Canyon LLC
c/o Whitson Engineers
2600 Garden Road, Suite 230
Monterey, California 93940

Attention: Mr. Ken Whitson

This document was prepared for use only by Harper Canyon LLC (owner/applicant for development) and their Civil Engineering Consultant, Whitson Engineers, only for the purposes stated, and within a reasonable time from its issuance. Please read the "Additional Services" and "Limitations" sections of this report.

August 6, 2001

D&M CONSULTING ENGINEERS, INC.
Geotechnical/Environmental/Materials Testing
A URS CORPORATION COMPANY

August 6, 2001
File: 0001892

Harper Canyon LLC
c/o WHITSON ENGINEERS
2600 Garden Road, Suite 230
Monterey, California 93940

Attention: Mr. Ken Whitson

Subject: **Geological and Geotechnical Feasibility Study for the Proposed Encina Hills Subdivision in Unincorporated Monterey County, California**

Gentlemen:

D&M Consulting Engineers, Inc./Terratech, Inc. (D&M/Terratech) is pleased to submit a draft of our geotechnical and geological feasibility study report for the proposed Encina Hills Subdivision, formerly referred to as the Harper Canyon project, in Monterey County, California. The attached draft report provides a description of the research and site studies performed, and our conclusions and recommendations regarding the site conditions as they related to the proposed project.

In summary, it is our opinion that the site may be developed as presently proposed, provided that the recommendations presented in our report are followed. The majority of the site is covered by a mantle of medium dense to loose colluvial soils generally ranging from about 3 to 5 feet thick. These sandy soils are highly erodible and potentially unstable where they exist on slopes, and should be removed and replaced as engineered fill prior to filling or roadway construction. These soils will also need to be considered in development of the 17 custom home sites. Other issues that need to be addressed as they relate to the development of the project include two mapped landslides, existing erosion gullies, high erosion potential of the soils found on the site once disturbed, and landslide or debris flow potential of the weaker near surface soils. Methods to address and mitigate the issues highlighted herein are presented in our report.

Preliminary geotechnical recommendations are also presented which address development of the custom home sites. These include discussions of surface and subsurface water, weak surficial soils, potential impacts of the geologic and topographic regime and possible methods of mitigation where adverse or unfavorable conditions are present.

12 Thomas Owens Way Monterey, California 93940 831 372 3716 Tel 831 372 7481 Fax
3194 De La Cruz Blvd., Suite 19 Santa Clara, California 95054 408 297 6969 Tel 408 297 7716 Fax
1500 Graham Hill Road, Unit B Santa Cruz, California 95060 831 458 4383 Tel 831 458 4388 Fax

We appreciate the opportunity to provide our services to you on this project. This draft report is provided to you at this time for review, comment and discussion. Upon completion of your review we will be more than happy to discuss your comments and make revisions as appropriate.

Sincerely,

D&M CONSULTING ENGINEERS, INC.,/TERRATECH
A URS CORPORATION COMPANY

Gregory J. Ruf

REGISTERED PROFESSIONAL ENGINEER
GREGORY J. RUF
No. 35389
Exp. ~~9-30-99~~ 03
CIVIL
STATE OF CALIFORNIA

8/8/01

Gregory J Ruf, P.E.
Principal Engineer

Christopher M. Palmer

Christopher M. Palmer, R.G., C.E.G., H.G.
Senior Engineering Geologist

REGISTERED GEOLOGIST
CHRISTOPHER M. PALMER
Nº 1262
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

cc: Addressee (4)
Whitson Engineers (3)
Ms. Liz Farwell (1)

GEOLOGICAL AND GEOTECHNICAL FEASIBILITY STUDY
PROPOSED ENCINA HILLS SUBDIVISION
MONTEREY COUNTY, CALIFORNIA

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GEOLOGICAL AND GEOTECHNICAL FEASIBILITY STUDY
PROPOSED ENCINA HILLS SUBDIVISION
MONTEREY COUNTY, CALIFORNIA

1.0 INTRODUCTION

This report presents the results of our geological and geotechnical feasibility study of the Proposed Encina Hills Development site in unincorporated Monterey County, California. In addition to addressing the feasibility of developing the site, preliminary geotechnical recommendations are presented where mitigation of poor site conditions is needed. The project site is located southeast of Highway 68 and northeast of San Benancio Road. Access to the site is from Meyer Road by way of San Benancio Road as indicated on the Geologic Site Plan, Figure 2.

1.1 PROJECT DESCRIPTION

The proposed development will provide 17 custom home sites within about 164 acres of the 343.92-acre site. Lots will range in size from 5.1 to 34.3 acres. Approximately 180 acres of the parcel will remain as open space. Initial development of the project will include the construction of roadways and underground utilities. After this phase of the project is complete, lots will be sold for individual development as custom home sites. The proposed development is shown on the Geologic Site Map, Figure 2. The basis for the geologic site map is the topographic map of the property prepared by Whitson Engineers.

1.2 PURPOSE AND SCOPE OF WORK

The purpose of this study was to evaluate the geologic and geotechnical feasibility of developing the site, including the 17 single-family residential lots shown on the geologic site map as well as the roadways to allow for site access. This entailed evaluating the potential for regional and site-specific geologic conditions to adversely impact or preclude development of the site or selected areas of the property. In addition to evaluating the geologic conditions, we also considered the geotechnical aspects of the geologic deposits and the soils encountered in our subsurface studies with respect to future development. Our conclusions regarding the geologic and geotechnical aspects of site development and preliminary recommendations for use in future development of the site development planning process have been developed and are presented in this report.

Our investigation was performed in general agreement with the scope of work outlined in our proposal dated February 5, 2001, with direction from the project owner/applicant's agent and the project Civil Engineer, Whitson Engineers, as our study progressed. The California Division of Mines and Geology guidelines for geologic studies was considered in our performance of this study as required by the Monterey County Planning Department.

The scope of services provided during this study included the following:

1. Review of geologic and geotechnical maps, and other information in our files pertinent to the site and vicinity.
2. Review of four stereo sets of aerial photographs of the site area to view the geologic and geomorphic setting, and possible evidences of faulting or landsliding, and to evaluate the geologic units on the site.
3. Geologic reconnaissance and field mapping of the subject property by a Certified Engineering Geologist.
4. Site reconnaissance by Registered Professional Engineers.
5. Excavation of 23 test pits on the site with a backhoe to explore the geologic units and structural conditions on the site. The test pits were excavated to depths of 4 to 12 feet below existing ground surfaces and were logged by a D&M/Terratech geologist. Locations of the test pits are shown on the Geologic Site Plan (Figure 2). Test pit logs are included in the Appendices.
6. Drilling of 12 exploratory borings for geotechnical purposes using truck-mounted drill rigs to investigate subsurface conditions.
7. Soil samples were collected during the drilling of the exploratory borings at minimum depth intervals of 5 feet to allow for examination and logging. A D&M/Terratech geologist logged all of the borings. Locations of the soil borings are shown on the Geologic Site Plan (Figure 2). A Boring Log Legend and the logs of the borings are included in the Appendix.
8. Evaluation of the information collected, identification of any potential geologic constraints to the proposed development, and development of geologic recommendations for addressing any constraints identified.
9. Engineering analysis of the geologic data and subsurface data obtained from the borings and test pits.

10. Evaluation of the research and field data regarding possible geologic and seismic hazards affecting the site and the proposed project.
11. Preparation of this report addressing both the geotechnical and geologic aspects of future site development. The report includes our geologic map, test pit logs, boring logs and geologic cross-sections of the subject property.

Evaluation and recommendations for final design and construction, including mass grading, of subdivision lots and custom homes is beyond the scope of this report and will require further site studies. In addition, this study specifically excluded the assessment of environmental characteristics, particularly those involving hazardous substances at the site.

2.0 GEOLOGY

2.1 REGIONAL GEOLOGY

The Monterey Bay Area occurs along the edge of the Coast Range Geomorphic Province, and is comprised of a discontinuous series of northwest trending mountain ranges, ridges and intervening valleys characterized by intense, complex folding and faulting. The general geologic framework of the Monterey Bay Area is reported in regional studies prepared by the California Division of Mines and Geology (1959, 1977) and Clark and others (2000).

The region lies adjacent to the San Andreas Fault System, which has created predominantly northwest-southeast trending geologic structure and topographic features. The San Andreas Fault System constitutes the boundary between the Pacific and North American tectonic plates, and active faults are abundant in the region.

The property is situated near the northern end of the Sierra de Salinas Mountain Range. The crystalline basement rock, at depths of as much as 3,600 feet, consists of granitic rocks of the Salinian block and the older Sur Series metasedimentary rocks. The oldest on-site geologic unit exposed in the area is Plio-Pleistocene Continental Deposits that have been identified as the Paso Robles Formation (Clark and others, 2000). It is estimated that the maximum thickness of the Paso Robles Formation in the area is approximately 500 feet. The Paso Robles Formation underlies by the Santa Margarita Sandstone, a very fine to coarse-grained arkosic sandstone up to 1,300 feet thick (Clark and others, 2000). The Paso Robles Formation and the underlying Santa Margarita Formation constitute significant regional aquifers. Quaternary alluvium is mapped overlying the Paso Robles Formation in the major regional drainages (Dibblee, 1999).

Regional mapping by Clark and others (2000) shows the bedrock in the region is gently to moderately inclined, and is folded into a series of alternating synclines and anticlines with complex structural trends of both north-south and east-west geomorphic ridge expressions associated with variations of the bedding inclinations across the site.

2.2 SITE GEOLOGY

2.2.1 Bedrock Units

A recent geologic study of the Monterey and Seaside Quadrangles area has been published by Clark and others (2000), which also incorporates the work of several prior studies, including amongst others, Clark and others (1974, 1997), Dupre (1990), Greene and others (1973), and Rosenberg and Clark (1994). Based on the recent study of Clark and others (2000), four geologic units have been mapped at the site area. These include the surficial units which include: Colluvium, Qc; Alluvial Deposits, Qal; and questionable or possible Quaternary Landslide Deposits, Qls; and the underlying bedrock unit, the Paso Robles Formation/Continental Deposits Undivided, QTc. Descriptions of these units at the site area from Clark and others (2000) are presented below.

- Paso Robles Formation/Continental Deposits, QTc – A series of nonmarine, semiconsolidated, oxidized, poorly sorted, fine to coarse grained sand beds with pebble and cobble interbeds. These deposits have been correlated to the Paso Robles Formation in southern Salinas Valley, and stratigraphic relations suggest these deposits are Pleistocene and possibly Pliocene in part and thus younger than the type Paso Robles Formation.
- Colluvium, Qc (Holocene) - Unconsolidated, heterogeneous deposits of moderately to poorly sorted silt, sand, and gravel, which where explored on the subject site consisted mostly of sand and silty sand. These materials on the site have been derived from the Paso Robles Formation and generally ranged from a loose to very loose condition in surface exposures, to compact and medium dense where underlying relatively level valley areas. Where these materials are in a loose to very loose condition along slopes, they are subject to local sand runs and a slow downslope creep.
- Alluvial Deposits, Qal (Holocene) - Unconsolidated, heterogeneous deposits of moderately sorted silt and sand with discontinuous lenses of clay and silty clay, and locally gravel. These materials were generally in a compact, consolidated condition where explored in the generally level valley portions of the site.

- Landslide Deposits, Qls - Based on our aerial photo analysis, field reconnaissance of exposed units, field exploration pits, and a review of data obtained in prior studies at the site, we believe there is sufficient information to conclude that two slides may be present on-site. Also, the slope is mantled by colluvial soils that have been deposited from weathering and erosion of the Paso Robles Formation which underlie the slope.

2.2.2 Surficial Units

Residual soils on-site are derived from complete weathering of the underlying bedrock or other geologic material. Colluvial soils develop by the same processes but migrate downslope by creep, slopewash, and other gravity-induced processes. Our subsurface investigation revealed a soil mantle between 2 and 5 feet thick, derived from the underlying materials, overlying the Paso Robles Formation. The soil consists primarily of medium dense to dense clayey to silty sand. Granitic cobbles were encountered at a depth of about 3 feet in the Lot 1 test pit, and 1- to 2-foot diameter boulders of arkosic sandstone were found at a depth of about 1 to 2 feet in the Lot 11 test pit.

Two relatively recent small landslides with distinct head scarps were observed on lots 14 and 15. Two apparent older large landslides are mapped on lots 11 and 13, adjacent to the eastern property line (see Figure 2, Geologic Site Plan). They were mapped based upon aerial photo interpretation and a surface reconnaissance. Subsurface exploration of these features was not undertaken at this time, as available equipment could not access the two lots due to the saturated condition of the near-surface soils in March 2001 when the initial field study by D&M was performed. In addition, the dense brush and trees also preclude access to these areas. If future subsurface exploration is to be undertaken, a dozer cut road will likely be required to gain site access.

Hummocky topography was observed on Lots 8 and 9, but no scarp was evident in aerial photos. The hummocky topography combined with shallow subsurface water found in the colluvium overlying the Paso Robles Formation in the test pits on Lots 8 and 9 suggest that the slopes prone to creep. The hummocky topography may also be indicative of smaller surficial slides, similar to those observed on Lots 14 and 15, with the effects of erosion now obscuring the scrap and toe areas. Several erosion gullies and scarps were observed within the site boundaries on the aerial photos and during our reconnaissance of the site. These are depicted on Figure 2.

3.0 FAULTING AND SEISMICITY

3.1 REGIONAL AND LOCAL FAULTING

An overview of the fault setting of Central California and the Monterey Bay area is presented in several regional studies including Wallace (1990), Jennings (1994), Rosenberg and Clark (1994), and Clark and others (1997). The regional faults setting is shown on Figure 4, from Jennings (1994), while the local fault setting and Area Geology Figure 4, taken from Clark and others (2000).

This site is located in the seismically active San Francisco-Monterey Bay region but outside the earthquake fault zones established in accordance with the State of California Earthquake Fault Zones (Hart and Bryant, 1997) established by the Alquist-Priolo Earthquake Fault Zoning Act of 1972.

Small areas along the southern end of the site, including portions of Lot 17 and the remainder parcel, are located in County of Monterey Geotechnical Hazard Zone VI, the zone with the greatest prevalence of seismic hazards (Burkland & Associates, 1974). The remainder of the site is located in Hazard Zone IV.

Faults listed on maps produced by California Department of Conservation, Division of Mines and Geology (CDMG, 1998) and published by the International Conference of Building Officials have been classified as Type A and Type B faults for the purpose of evaluating potential seismic impacts associated with these faults. A review of the ICBO published maps indicates that the site is about 33 km southwest of the San Andreas (Pajaro) Fault, the closest Type A fault. The maximum expected magnitude of an earthquake for this segment of the San Andreas Fault is 7.9 (CDMG, 1998). The closest Type B faults are the Rinconada Fault located 4.5 km northeast of the site and the Monterey Bay-Tularcitos Fault located 10.2 km southwest of the site. The maximum expected magnitude (M_W = moment magnitude) of an earthquake generated by the Rinconada Fault is 7.3 (CDMG, 1998).

In addition to the fault zones mapped by CDMG, fault mapping by Dupre (1990) indicates the presence of other local faults. The active fault closest to the site is the Chupines Fault, located about 4 km southwest of the site. Vaughan and others (1991) calculated a "maximum slip rate of about 2 mm per year over the last 12,000 to 13,000 years" based on evidence from a trench about 4 km from the site (Clark and others, 1994). Rosenburg and Clark, (1994) report that epicenter data plotted within 1 km of the mapped fault trace suggests that the western part of the Chupines Fault zone is active. A maximum expected magnitude was not available for the Chupines Fault.

The Harper Fault is mapped trending northwest southeast about 2,000 feet east of the site (Dibblee, 1999; Burkland, 1974). Burkland (1974) also shows the Harper Canyon Fault trending northwest-southeast along San Benancio Canyon Road, about 1,300 feet southwest of the site. Burkland considered both the Harper and Harper Canyon Faults to be potentially active, as they offset Pleistocene strata. However, Clark and others (2000) note that there is no evidence of Holocene activity on the Harper Fault; these authors do not discuss the Harper Canyon Fault activity.

Existing geologic maps of the site and surrounding area do not show any faults on the property. Our review of aerial photographs and our geologic mapping did not reveal any photolineaments or evidence of faulting on the site.

Active and potentially active faults that may result in significant ground shaking at the site are listed on Table 1, which includes regional faults such as the San Andreas, and others, as well as local faults. The locations of the faults and associated parameters presented on Table 1 are based on data presented by Hart and others (1984), Wesnousky (1986), Wong and others (1988), Working Group on California Earthquake Probabilities (1990), Schwartz (1994), Jennings (1994), Mualchin (1995), Frankel and others (1996), Petersen and others (1996), and Clark and others (1997). The information on faults contained in Table 1 are based on the fault's distance from the site, fault length, slip rate, and maximum earthquake moment magnitude determined from the program EQFAULT version 3.0 (Thomas Blake and California Division of Mines and Geology, 1998). This was supplemented with a search with epicenter data from 1994-1999 from the University of California at Berkeley, Northern California Earthquake Data Center. The approximate site center coordinates, taken from the 7.5 minute Spreckels, California Quadrangle Map (USGS, 1947; rev. 1968; 1975), are:

Latitude: 36.5750 North	Longitude: 121.6980 West

Table 1
Significant Faults

Fault Name	Fault Length (km)	Closest Distance to Site (km)	Magnitude of Maximum Earthquake	Slip Rate (mm/yr)
Rinconada	105	4.5	7.3	1.0
Monterey Bay	99	10.4	7.1	0.5
Palo Colorado (Sur)	80	26.5	7.0	3
Zayante-Vergeles	56	27.6	6.8	0.1
San Andreas (creeping)	470	32.3	6.5	24
San Andreas (Pajaro)	470	32.5	6.8	24
San Andreas (1906)	470	32.5	7.9	24
Calaveras (so. of Calaveras Res.)	100	38.6	6.2	15
Sargent	53	13.6	6.5	3
San Andreas (Santa Cruz Mtn.)	470	42.2	7.0	24
Quien Sabe	14	47.0	6.4	1
San Gregorio	129	47.2	7.3	5
Hosgri	172	47.6	7.3	2.5
Monte Vista-Shannon	41	68.1	6.8	0.4
Ortigalita	83	71.3	6.9	1
San Andreas (peninsula)	470	72.3	7.1	24
Great Valley (segment 9)	39	75.5	6.6	1.5
Great Valley (segment 8)	41	76.5	6.6	1.5
Hayward SE Extension	26	77.9	6.4	3
Great Valley 10	22	78.0	6.4	1.5
Great Valley 11	25	86.9	6.4	1.5
Greenville-Marsh Creek	56	95.7	6.9	2
Calaveras (northern)	52	97.3	6.8	6
Hayward South	26	77.9	6.4	3
Hayward (Total Length)	80	23.6	7.1	9
Great Valley (segment 7)	45	53.7	6.7	1.5
Great Valley 12	17	104.9	6.3	1.5
Great Valley 13	30	115.8	6.5	1.5
San Andreas (Parkfield)	470	119.9	6.7	24
San Andreas (1857 Rupture)	470	119.9	7.8	24
Great Valley (segment 6)	45	122.5	6.7	1.5
Hayward (north)	26	134.5	6.4	3
Great Valley 14	24	142.9	6.4	1.5
Concord-Green Valley	26	148.1	6.9	6
San Andreas (Cholame)	470	155.5	7.8	24
San Andreas (north coast)	470	159.4	7.1	24
Los Osos	44	159.8	6.8	0.5
San Juan	68	160	7.0	1

3.2 SEISMICITY

3.2.1 Historical Seismicity

Monterey is in a region of Central California, which is traditionally characterized by high seismic activity. Some of the significant nearby historic earthquakes include the 1906 (M8+) San Francisco earthquake, the 1838 (M7) San Francisco earthquake, the 1989 (M6.9) Loma Prieta earthquake, the 1836 (M6.8) Hayward earthquake, the 1868 (M7) Hayward earthquake, the 1858 (M6.3) San Jose earthquake, the 1864 (M6) South Santa Cruz Mountains earthquake, the 1865 (M6.5) South Santa Cruz Mountains earthquake, the 1870 (M6) Los Gatos earthquake, the 1884 (M6) Santa Cruz Mountains earthquake, the 1897 (M6.3) Gilroy earthquake, the 1911 (M6.5) Calaveras fault earthquake, the two 1926 (M6.1) Monterey Bay earthquakes, and the 1984 (M6.1) Morgan Hill earthquake.

Studies by McCrory and others (1977) indicate that during the 1906 San Francisco Earthquake on the San Andreas Fault that the site occurs in an area that generally experienced Rossi-Forel Intensity values of VII to VIII. They also report that Modified Mercalli Intensity values (MM) of between VI and VIII occurred in the site area over a dozen times during a 159 year period.. Youd and Hoose (1978) indicate a report of 1906 earthquake shaking damage to tracks along the coast the between Seaside and Del Monte, although no damages are described for the immediate site area.

The Loma Prieta Earthquake (October 17, 1989, magnitude 7.1) occurred along the San Andreas Fault with the epicentral area about 40 kilometers north of the site. Plafker and Galloway (1989) and Stover (1990) indicate that the site rests in the general vicinity of Modified Mercalli Scale earthquake shaking intensity distributions of 6. The magnitude of ground motion measured instrumentally shows that the earthquake is reported to have triggered over 130 strong motion instruments operated by the U.S. Geological Survey and the California Division of Mines and Geology (EERI, 1989, Benuska, 1990). An instrumentation station in the Monterey area showed an acceleration value of 0.07 (EERI, 1989, Shakal and others, 1989).

The parameters used to define the limits of the historical earthquake search include geographical limits (within 100 km of the site), dates (1800 through February 2000), and magnitudes (M>4). A summary of the results of the historical search is presented below.

(1) Time Period (1800 to February 2000)	201 years
(2) Maximum Magnitude	M8.3
(3) Approximate distance to nearest historical M>4 earthquake	2.6 km
(4) Number of events exceeding magnitude 4 within search area	763

3.2.2 Design Level Earthquake

We have developed peak ground accelerations for Upper Bound Earthquake (UBE) and the Design Basis Earthquake (DBE). As defined in the 1997 UBC, the UBE is defined as the ground motion that has a 10 percent probability of being exceeded in 100 years (return period of about 950 years). The DBE is defined in the 1997 UBC as the ground motion that has a 10 percent probability of being exceeded in 50 years (return period of about 475 years).

A probabilistic seismic hazard analysis was used to estimate the peak ground accelerations for the UBE and DBE, as discussed above. This analysis involves the selection of an appropriate predictive relationship to estimate the ground motion parameters, and, through probabilistic methods, estimate of peak accelerations. The results of these analyses are presented in Section 4.2.1 of this report.

3.2.3 Attenuation Relationship

The types of faulting, magnitudes of the earthquakes, and the local soil conditions can influence site-specific ground motions. The attenuation relationships used to estimate ground motion from an earthquake source at some distance from the site need to consider these effects.

Many attenuation relationships have been developed to estimate the variation of peak ground surface acceleration with earthquake magnitude and distance from the site to the source of an earthquake. We have used relationships presented by Boore et al. (1993, 1994 and 1997), and Abramson and Silva (1997) because of their wide acceptance by seismologists. These relationships have also been used in developing recent Interim National Seismic Hazard Maps (Frankel et al., 1996) for the State of California. These relationships use an estimate of shear wave velocity of the soil profile in the analysis. An average shear wave velocity of material 280 m/s was selected. The predictive relationships by Boore et al. (1993, 1994, 1997) were developed from statistical analyses of recorded earthquakes from Western North America, including the records from the 1989 Loma Prieta earthquake and 1992 Landers earthquake. The attenuation relationships provide mean values of ground motions associated with one set of parameters: magnitude, distance, site soil conditions, and mechanism of faulting. The uncertainty in the predicted ground motion is taken into consideration by including a magnitude dependent standard error in the probabilistic analysis.

4.0 SITE INVESTIGATION

4.1 SITE DESCRIPTION

The subject property consists of an approximately 343.92-acre parcel located northeast of the terminus of Meyer Road, within the 7.5-minute Spreckels, California Quadrangle. Current and historic site usage is for cattle grazing. Surrounding land uses include public lands (Toro Park) and rural residential.

Past site development appears to have been limited to the grading of several unpaved, narrow roads and trails. Construction of these roadways across the slopes entailed cutting into the sides slopes and placing (likely by side casting) fill on the downslope side of the roadway. Fill slopes were observed to be as steep as 1.5:1. Fills were also noted to be obstructing natural drainages in a few locations.

The property consists of a series of rounded hills and ridges with intervening drainages, with approximately 700 feet of elevation change within the bounds of the site. Elevations on the parcel range from about 1,020 feet near the southeast corner to about 330 feet near the northeast end. The terrain is highly varied with natural slope gradients range from about 6:1 (horizontal:vertical) in the southern portion of the property to about 1.9:1. Steeper slopes are found within eroded drainages in several areas of the site as depicted on Figure 2. Slope inclinations of 1.5:1 to vertical, with some undercutting observed, are common in the erosional features. The Paso Robles Formation bedrock exposed in these scarps commonly exhibits vertical erosion rills.

Two large landslide features are mapped along the west face of the ridge along the eastern boundary of the site at Lots 11 and 13. In addition, two smaller slides are mapped at Lots 14 and 15, with hummocky terrain observed on the slope at Lots 8 and 9.

Although the regional tectonics and geomorphology of the region trend in a northwest-southeasterly direction, ridges on the site vary indirection from the trend. A north-south trending ridge is located above Lots 2, 11 and 13-15. This ridge intersects an east-west trending ridge located to the south of Lots 15-17. Erosion, and possibly regional folding, appears to have resulted in the formation of several smaller ridges on the site that also trend east-west.

Lots 1-6 of the proposed subdivision are located within the northern-most section of the site. The proposed house sites within these lots are within a small valley, with Lots 1 and 3-6 located on the eastern flank of a ridge. Lot 2 is located in the central area of this valley. The building site at Lot 1 is relatively level and is at the base of a narrow ridge with 2.5:1 and 1.5:1 side slopes to the west and east, respectively. These slopes are in excess of 100 feet high. The ridge line to the south of the pad extends up about 170 feet.

The pad site at Lot 2 is in an area above a well–defined active erosion gully and below a slope that extends up behind the lot about 240 feet. The slope has an inclination of about 2.5:1 in the upper 200 feet, flattening to about 3.3:1, with the pad area at about 5:1.

The designated area for the future houses at Lots 3-6 are below a ridge with slopes of about 2.8:1 to 2.5:1 with slope heights ranging from 80 to about 140 feet above the envelopes. The slope flattens to about 5:1 at the building areas.

Lot 7 is at the western side of the property, on the western flank of the ridge at Lots 1 and 3 through 6, and is west northwest of Lot 6. The selected building area has a surface gradient of about 5:1, with a 3.8:1 slope extending about 100 feet up to the east and a descending 150 foot slope at about 5.7:1 to west.

Lots 8-9 are located south of Lots 6 and 7 on a south-facing slope. Lot 10 is south of Lots 8 and 9 in the flatter areas below the slope and above a prominent erosion gully. This area was observed to be saturated in March 2001, indicating the presence of shallow (perched) groundwater. The slope at Lots 8 and 9 has a gradient of about 2.4:1 with a height of about 120 feet. The area was noted to be distinctively hummocky. The designated building areas are below the break in slope and slope at about 5:1. The area below Lot 8 flattens and is the selected location for the building at Lot 10. A vertical-walled erosion gully is present at the southern side of the Lot 10.

Lot 11 is located at the eastern side of the portion of the proposed Encina Hills development, on the western flank of a major ridge. The lot encompasses one of the two larger landslide areas mapped on the site. The proposed home site is just below a break in gradient, with a 2.3:1 to 2.5:1 slope to the east rising above the site 90 and 130 feet. The slope at the home site is about 4:1.

The Lot 12 home site has been placed at the site of a small, more resistant ridge. The area is relatively flat with a gradient of about 6.5:1 or flatter. The slopes that essentially wrap around the site on three sites have a gradient of about 4:1. These slopes appear to be related to erosion of less resistant materials than those at the selected site.

Lot 13 encompasses the second of the two larger landslides, as shown on Figure 2. The general topography at Lot 13 is also found at Lots 14-16, located to the south of Lot 13. The slopes above these four lots extend up from the proposed home sites about 130 feet. The upper 100 feet or so of the slopes have a gradient of about 2:1, flattening slightly to 2.3:1 in some areas. These is an apparent break in slope below this, with slopes at about 3:1 for a vertical height of about 30 feet; additional flattening of the slopes to about 4.5:1 to 5:1 occurs at the home sites.

The majority of Lot 17 lies on the north-facing slope of a west-trending ridge at the southern portion of the proposed development. The balance of the site wraps around the end of the ridge. The proposed home site is located at the western end of the ridge at the ridge top. The north face of the ridge slopes down at about 1.9:1 for a vertical distance of over 100 feet, flattens slightly and continues on down of over 200 feet. The western end of the ridge generally slopes down at about 2.5:1 for about 100 feet. A swale on the eastern flank of the site slopes down at about 4:1 and is representative of the proposed home site.

Surface runoff on the property is by sheet flow to the northwest along erosion gullies toward El Toro Creek. No flowing water was observed in drainages on the property during our surface reconnaissance and subsequent field investigation. Seven minor springs were found, however, two along the unpaved road near the boundary of Lot 17, two on Lot 15, one on Lot 13, and two on Lot 11. These last three springs were located along the existing unpaved road, at the base of apparent landslide deposits. One of the springs on Lot 15 is associated with a small, shallow landslide.

Vegetation observed consisted of grasses, bush and trees. The bushes and trees are often concentrated in the drainages, apparently due to moist conditions from seasonal surface water flow. Dense brush and mature trees are also prevalent on the steeper portions of the slopes above Lots 11 and 13-16.

4.2 FIELD INVESTIGATION

D&M/Terratech performed 23 exploratory test pits across the site. The test pits were excavated to depths ranging from about 3 to 16 feet below existing ground surface using a rubber-tired backhoe. Materials encountered in each boring were visually classified in the field by our representatives and a continuous log of each excavation was made. Visual classifications of soils encountered were made in accordance with the Unified Soil Classification System as shown on the Boring Log Legend presented in Appendices. Classifications of bedrock encountered also included geologic description where applicable. The test pit logs are also presented in the Appendices.

Twelve geotechnical exploratory test borings were also drilled at the site. The test borings were made to depths ranging from about 15 to 50-1/2 feet below existing ground surface using a Mobil B-24 drill rig equipped with 4-inch diameter continuous flight hollow-stem augers and a CME 45 drill rig equipped with 8-inch diameter hollow-stem augers. These borings ranged in depth from about 10 feet to about 50-1/2 feet below the existing ground surfaces. Relatively undisturbed soil samples were obtained at the boring locations by driving a 2-inch inside diameter tube sampler to a depth of 18 inches into the underlying soil using a 140-pound hammer falling 30 inches. Similarly, disturbed soil samples were also obtained with a 2-inch outside diameter Standard Penetration Test (SPT) sampler that was driven into the granular soils with a 140-pound hammer falling 30 inches. The number of blows required to drive the samplers were recorded for each 6-inch penetration interval. The number of blows required to drive the samplers the last 12 inches (unless otherwise noted) are included on the boring logs. Visual classifications of soils encountered and a continuous log of each geotechnical boring were made in accordance with the Unified Soil Classification System as shown on the Boring Log Legend presented in the Appendices.

In addition to drilling borings for geotechnical purposes, two additional borings were excavated at each site where percolation tests were performed. This is discussed in more detail below.

The locations of the points of explorations were estimated in the field based on rough alignment with the existing site features. The locations of the borings and test pits should be considered accurate only to the degree implied by the locating method used.

4.3 SUBSURFACE CONDITIONS

The Paso Robles Formation underlies the property as mapped in road cuts along the access roads, in outcrops across the property, in erosion gullies and scarps, and where encountered in our test pits and exploratory borings. Clark and others (2000) describes the Paso Robles Formation as semiconsolidated, poorly sorted fine- to coarse-grained sands with interbedded pebble and cobble gravels. Dibblee (1999) shows the Paso Robles Formation horizontal or dipping between 3 and 15 degrees to the west in the vicinity of the site. The boring data indicates that the underlying Paso Robles deposits are very dense. Duripan horizons, or cemented soil layers, within these deposits commonly form prominent ledges and may prevent shallow water infiltration, resulting in debris flows. This unit, as observed during this investigation, consists of dense to very dense silty sand, gravelly sand, and clayey sand. Weakly to moderately cemented layers and varies from about 2 inches to about 4 feet thick were encountered locally.

The materials encountered in the test pits and the borings, as well as those mapped during our site reconnaissance support the previous mapping by Clark, Dibblee and others. Data obtained form the test pits reveals the presence of colluvial deposits over the site. These deposits are comprised of loose to medium dense sands, silts and gravels derived form the Paso Robles Formation.

No ponds were visible on the property or in any of the aerial photographs we reviewed. Seasonal perched groundwater conditions can form locally in the colluvium. During the initial stages of our site investigation between March 12 and 22, 2001, perched water was found at depths of about 1 to 2 feet in borings B-2 and B-5, and in test pits on Lots 2, 8, 9, 13 and 16. Areas with seasonal perched groundwater conditions noted in March 2001 are shown on Figure 2.

Groundwater (within a true aquifer) was not encountered in the Paso Robles Formation in any of the relatively shallow test pits or borings, (within a depth of about 50 feet below ground surface) at the time of our subsurface investigation in March and May, 2001. Dibblee (1999) shows a 500-foot-deep water well occurring at an elevation of about 600 feet on a neighboring property.

5.0 CONCLUSIONS - GEOLOGIC HAZARDS

SEISMIC RELATED GEOLOGIC HAZARDS

A discussion of specific seismic related geologic hazards that could impact the site is included below. The hazards considered include: Fault Ground Rupture; Seismic Shaking; Liquefaction, Lateral Spreading and Differential Compaction/Seismic Settlement; Seismically Induced Landslides and Ground Failures.

No seismic hazard zone maps have been published yet for Monterey County under the State's program of mapping areas potentially susceptible to seismically induced landsliding and liquefaction.

5.1 SURFACE FAULT RUPTURE

A compilation of data on historic seismically induced ground failures in northern California (Youd and Hoose, 1978) shows no recorded ground failure in the vicinity of the site, but the area was sparsely populated at the time of the 1906 "San Francisco" earthquake, from which most of the data in the publication were derived.

The site is not located within an Alquist-Priolo Earthquake Fault Zone and no known active faults are believed to traverse the site. Based on our literature review, site reconnaissance and aerial photo-analysis we did not identify any tonal lineations, geomorphic features or other features which could be suggestive of faulting, active or potentially active, crossing the site or the immediately adjacent area. Therefore, it is our opinion that the potential for fault-related surface rupture on the site is very low.

5.2 SEISMIC SHAKING

5.2.1 Estimated Peak Ground Acceleration

The estimated peak horizontal ground acceleration (in units of gravity), calculated using the method discussed above for the UBE and DBE are presented in Table 2. The corresponding return period and annual probability of occurrence are presented in Table 2.

Table 2
Estimated Peak Ground Acceleration

Event	Return Period	Probability of Occurrence	Annual Probability of Exceedance	Peak Horizontal Acceleration (g)
DBE	475	10% in 50 years	0.0022	0.55(1)
UBE	950	10% in 100 years	0.0011	0.68(2)

(1) EQFAULT
(2) U.S. Geological Survey, 2001, Earthquake Hazards Program, Seismic Hazard Mapping Project, Probabilistic Hazard Lookup by Latitude Longitude

Probabilistic modeling procedure was used to estimate the peak ground motion corresponding to the UBE and DBE. The probabilistic analysis approach is based on the characteristics of the earthquake and of the causative fault associated with the earthquake. These characteristics include such items as magnitude of the earthquake, distance from the site to the causative fault, length and activity of the fault. The effects of site soil conditions and mechanism of faulting are accounted for in the attenuation relationships.

5.2.2 Site Soil Profile

The characteristics of the soils and sediments underlying the site are important site-specific seismic design criteria to evaluate the site response. Site soil observations are based upon the geologic exposures in cuts and erosional features on the site, the materials encountered in our test pits. The observations also include materials encountered in our borings, which penetrated the site to a maximum depth of about 50-1/2 feet. A relatively thin mantle of colluvial deposits overlying bedrock of the sedimentary Paso Robles Formation generally underlies the site. The Paso Robles is comprised of semi-consolidated, locally weakly cemented, dense to dense clayey sand, silty sand, sand and gravel.

In our opinion, based on the materials encountered in our subsurface exploration of the site and our knowledge of the subsurface geology in the vicinity, we classify the upper 100 feet of soil profile as type S_C. Soil classified as S_C per Table 16-J of the 1997 UBC, S_C is defined as a soil profile consisting of very dense soil with shear wave velocity between 360 and 760 meters per second (m/s) or SPT-N = >50, or Su = >2000 psf for the upper 100 feet or 30 meters.

5.3 NEAR-FAULT CONSIDERATIONS IN STRUCTURAL DESIGN

Due to potential near-fault motion resulting from activity on local and regional faults, near-source effects should be considered in the structural design of the proposed project. For a code equivalent lateral force design, procedures from the 1997 UBC will need to be considered. The seismic design parameters that follow are as defined by the 1997 UBC and are determined based on the assigned Seismic Hazard Zone, proximity of the site to Type A and Type B faults and the soil profile type. Type A fault zones within 15 kilometers and Type B fault zones within 10 km are to be considered for near-source effects.

For this site, the Rinconada Fault (distance of approximately 4.5 kilometers NE) is defined as the closest significant Type B fault as defined by CDMG. With consideration of the type and proximity of the Rinconada Fault, and the location of the site in Seismic Hazard Zone 4, the Near-Source Factors N_a and N_v can be obtained from Tables 16-S and 16-T, respectively, of 1997 UBC. The Near-Source Factors in the Code are incorporated into the seismic coefficients C_a and C_v which are both used to determine the total design lateral force or shear at the base of the building or structure. Near-Source Factor N_a and N_v are 1.05 and 1.27, respectively, for this governing fault. The seismic coefficients C_a and C_v are equal to $0.4N_a$ and $0.56N_v$, respectively.

5.4 SEISMICALLY INDUCED GROUND FAILURE

5.4.1 Liquefaction and Lateral Spreading

Soil liquefaction is a condition where saturated, granular soils undergo a substantial loss of strength and deformation due to pore pressure increase resulting from cyclic stress application induced by earthquakes. As a result of the loss of strength, the soils gain mobility that can result in significant deformation, including both horizontal and vertical movement where the liquefied soil is not confined. Factors affecting the potential for a soil to liquefy include: 1) intensity and duration of earthquake shaking; 2) soil type and relative density; 3) presence of a confining layer allowing for build-up of excessive pore pressure, 4) overburden pressure; and 5) presence or absence of groundwater. Soils most susceptible to liquefaction are saturated, loose, clean, uniformly graded, Holocene age, fine grained sand deposits. Silts and silty sands have also been proven to be susceptible to liquefaction or partial liquefaction. The occurrence of liquefaction is generally limited to soils located within about 50 feet of the ground surface. Loss of bearing capacity and/or ground settlement can result as a result of liquefaction.

As previously discussed, the near-surface soils blanketing most of the slopes, in the less inclined portions of the site below the slopes and within erosional features, consists of medium dense to loose colluvial deposits of silts, sands and gravel. These deposits are derived from and overly the Paso Robles Formation. Our observation of these deposits indicates that the soils are relatively weak when saturated and that perched groundwater conditions are common on the site. The perched groundwater occurs at the contact between the more permeable colluvium and the dense, often cemented, Paso Robles. Regional mapping by Dupre (1990) shows the site area is classified as very low liquefaction potential.

Based on the observed conditions, it is our opinion that during the time of year when perched groundwater conditions are present, should strong shaking occur, that the potential for liquefaction or at least partial liquefaction to occur is low to moderate. Where the loose sand layer is present at or very near the ground surface and is free-draining, it tends to preclude the development of excess pore pressure, the potential is judge to be low. The dense, weakly indurated Paso Robles Formation that underlies the property is judged not to be susceptible to liquefaction.

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of liquefied subsurface materials beneath a slope, or even beneath level ground if an open topographic face is nearby. With the potential for liquefaction judged to be low to moderate, there is a corresponding low to moderate potential for seismic induced lateral spreading to occur on this site.

5.4.2 Dynamic Compaction and Seismic Settlement

Another type of seismically induced ground failure that can occur as a result of seismic shaking is dynamic compaction or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils. The potential impact of dynamic compaction is settlement of the ground surface. The loose to medium dense colluvial soils have a low to moderate potential to undergo some settlement where building loads are applied or fills are constructed and strong ground shaking occurs.. Mitigation measures are discussed later in this report. Based on the high apparent density of the Paso Robles Formation, it is our opinion that this material has a very low potential to undergo seismic induced settlement

5.4.3 Landslides and Seismically Induced Slope Failures

While there are two large landslides mapped on the site, one of which is queried, the Paso Robles materials when intact are not considered to be landslide prone. These materials are dense to very dense and are often locally cemented. Although we cannot completely rule out past landslide activities at the sites of the two larger mapped slides, there is also a possibility that these features are associated with or are now more pronounced as a result of erosion of site. The "headscarp" areas of the two mapped slides, as well as the slopes above Lots 14-17, are presently at inclinations of about 2:1. Based on the apparent relative density of the granular deposits (bedrock), these soils have a friction angle at peak strength on the order of 40 to 48 degree with a corresponding slope angle of repose of 1.6:1 to 1.4:1 (horizontal:vertical). Based on these values it is our opinion that the slopes are stable under static conditions.

As discussed below, the Paso Robles is highly susceptible to erosion, resulting in relatively loose colluvial deposit below the slopes. These materials, when founded on sloping bedrock surfaces, are prone to surficial sliding where seasonal perched groundwater conditions developed and, where there is a sufficient quantity of fines occur within the soil matrix to preclude rapid drainage. Where these types of slides occur in more granular deposits, the mobilized soils tend to drop out or deposit rather rapidly as the excess pore pressure within the soil mass dissipates. The slides tend to act as a shallow flow as can be seen at the two smaller, relatively recent slides mapped by our geologists at Lots 14 and 15. This process also appears to have occurred which lead-to the long term development of the hummocky terrain present on the slope at Lots 8 and 9, and to a lesser extent at Lot 17. As noted in the geology section of this report, the Paso Robles is mapped to have a west-trending dip-slope bedding that can result in soil creep or surficial landsliding. This is consistent with our observations of the slopes at Lots 11 and 13-16.

Mitigation of the surficial slide potential and for the potential impacts of ongoing sloughage or erosion of the faces of the two larger slides are discussed in subsequent sections of this report.

When considering slope stability with seismic shaking, there is a potential for sloughing of the face of the steeper slopes resulting in deposition of loose materials at the base of the slopes. This would increase the potential for slides to occur below the slopes within the Paso Robles Formation. The potential for randomly oriented ground cracking affecting the site and surrounding areas due to strong seismic shaking cannot be precluded.

5.5 EROSION

With the exception of the local cemented zones in the Paso Robles, the subsurface materials on the site lack cohesion and are very susceptible to erosion. However, where left undisturbed, even where vegetation appears to be relatively sparse, the materials appear to be somewhat resistant to erosion. There is evidence of some downslope creep where the surface is not eroded. However, once the surface is disturbed the potential for, and the rate of erosion, appear to increase significantly. Surface flows cut the materials deeply with incised erosion gullies often having near-vertical sidewalls. Where resistant or cemented layers are present and erosion gullies are being formed, undercutting of the sidewalls occurs thus increasing the lateral extent of the area affected by the erosional process. Erosion in the cemented soils also results in vertical rills ("badlands" topography) as can be seen along the access road south of the property. Mitigation of the effects of on-going and future erosion at the site will need to be addressed through development of controlled surface drainage plans and/or avoidance of erosion affected areas in site planning.

5.6 WEAK OR EXPANSIVE SOILS

Expansive soils were not encountered on the site and are not a consideration in future development of the site. As described throughout this report, the near-surface granular colluvial deposits are generally medium dense to loose. As such, these soils are found to be weak or compressible. This was clearly demonstrated by our inability to access several areas of the site during the month of March 2001 when the soils were wet. Mitigation of this condition will be required for areas to be mass graded and where road and houses are to be constructed.

5.7 TSUNAMI, SEICHE AND FLOODING

The site is located several miles from the shore of Monterey Bay, is a minimum of 330 feet above sea level, and is not located adjacent to or downslope of any lakes, creeks or water storage facilities. Consequently, the potential for Tsunamis, Seiche or seismic induced flooding due to storage facility failure is considered very low.

6.0 PRIMARY CONSIDERATIONS AND MITIGATION RECOMMENDATIONS

6.1 GENERAL

Based upon the data collected during this investigation, and from our geologic and geotechnical engineering analysis, it is our opinion that the site may be developed as discussed in this report provided that the recommendations presented in this report are incorporated into the final design and construction of the project. These opinions, conclusions, and recommendations are based on our field and office studies, and the properties of the materials encountered in our borings and test pits.

The primary geological and geotechnical considerations for design and construction of the project include the following: 1) landslides previously identified at the site; 2) seismic hazards (liquefaction, lateral spreading, lurching; seismic induced settlement), 3) control of surface erosion; 4) weak surface soils; 5) existing uncontrolled fills; and 6) stability of erosion ravine walls. Each of these items is discussed in detail below with recommendations for mitigation presented including grading activities and setbacks.

We note that the current study provides preliminary geotechnical recommendations for earthwork associated with the proposed roadways and infrastructure improvements, as well as future development of the home sites. We anticipate that work beyond the scope of this current study includes geotechnical evaluation and recommendations for overall site mass grading, site features, foundations for individual development sites, and associated elements such as retaining wall, driveways and pools will be required. Additional work that is recommended and is beyond the scope of our current services includes continued consultation with the Civil Engineer as project plans are developed, review of the completed site earthwork and grading plans, and specifications once they become available.

We recommend that D&M/Terratech be retained to provide observation and testing services during site earthwork associated with this report and any subsequent supplemental studies which include mass grading, construction of site infrastructure including but not limited to the on-site roads and utilities. This will allow us the opportunity to compare actual conditions with those encountered in our investigation and, if necessary, to expedite supplemental recommendations if warranted by the exposed surface and subsurface conditions

6.2 LANDSLIDES AND SLOPE STABILITY -

Landslides have been identified at the site as reported above and shown on Figure 2. Although the mass of soil that would be associated with the two larger slides shown on Figure 2 appears to have been eroded out from below the slides, there is some potential that shallow failures will occur on the faces of the slopes at the headscarp areas and on the flatter slopes below. Due to the granular nature of the soils, where sliding does occur, it tends to be surficial and the slide materials tend to deposit out fairly rapidly. Based on the observed conditions below the two larger slides, as well as at Lots 14 through 17, we recommend that appropriate site specific method(s) of mitigation be included in the development of plans for individual homes on these lots. Potential methods of mitigation include but or not necessarily limited to construction of the houses at Lots 11 and 13 through 16 be as far down the slope as possible (at the roadway setback), construction of debris walls or energy dissipation structures just below the mapped slides. Placement of the houses forward on the lots will allow for deposit of materials upslope of the planned development should sliding occur on the steeper slopes above these sites. Debris wall or dissipation structures would cause the materials to be diverted or to lose energy, thus depositing on the site prior to reaching the occupied structures below. Although there are no slides mapped at Lots 5 and 6, a similar siting approach is recommended at these lots as well. This should be considered in future assessment of the lots during the preparation of lot-specific development plans.

The potential for surficial sliding of the colluvial soils at Lots 11 and 13 through 16 can be reduced through the installation of subsurface drains. The drains will alleviate the build-up of a perched groundwater condition, believed to be the triggering mechanism for the shallow slides observed at Lots 14 and 15. Drains should be installed along the contact between the steeper 2:1 slopes above and the flatter slopes trending from 3:1 to 5:1 below. This is generally along the contact between the grass-covered slopes and those vegetated with a dense growth of brush and trees at Lots 13 through 16. The contact is less visible at Lot 11 but can be identified on the topographic map. Additional subdrains should be constructed across the flatter slopes as well.

The specific depths and locations of the subdrains should be established during development of site-specific improvement plans.

Due to the close proximity to the steeper slopes at Lots 8 and 9, and the unstable condition of the slope as demonstrated by the undulating terrain, mitigation will likely require reconstruction of the slope as a fill slope with internal drainage. It may be feasible to leave the slope intact, install subsurface drainage and to protect the planned structures with a debris wall. This will require further evaluation in consultation with the developers of these lots.

Based on the steep to very steep condition of the north facing slope at Lot 17, we recommend against siting of a house at the top of the ridge. Ideally, the house should be sited just south of the break at the south side of the top of the ridge, placing the house on south facing slope. A multi-story house notched into the south slope will still allow for a north view, would place the structure on more stable ground and could aid in allowing for development of the driveway..

6.3 LIQUEFACTION AND LATERAL SPREADING

As discussed above, these are loose sand deposits blanketing the flatter portions of the site. Where there is an absence of cohesive fines and/or significant coarse material (gravel), and a build-up of a perched water condition occurs, there is a potential that liquefaction or partial liquefaction could occur. With the relatively thin section of loose soils, pore pressure would likely dissipate quickly, alleviating the condition. However, where this occurs on a sloping surface, the soils could mobilize and spread downslope before the pore pressure is released.

The installation of subsurface drains, as discussed above under "Landslides" would aid in mitigating the potential for this occurrence. In addition, removal and reconstruction of the loose soils at the locations of the structures, with integral subsurface drainage, will aid in protecting the structures. Lots where this is of greater concern, based on the data available at this time, include Lots 2, 9, 10, and 13-16.

6.4 SURFACE EROSION

As clearly demonstrated on-site with the presence of significant erosion gullies, the soils are highly erodible once the surface soils have been disturbed. Limiting disturbance of the areas outside of the future grading and development areas will be essential in controlling erosion. The site development plans must include extensive erosion protection features to mitigate the increased flows and concentration of surface flows as a result of development. This will include the need to install lined ditches above and below any engineered slopes (cut or fill), and above existing erosion gullies if their continued development is to be slowed. Where surface soils and vegetation are disturbed, development of erosion mitigation plans should include, as a minimum, consideration of the use of vegetative matting where hydroseeding is to be used. The hydroseed mix should be developed as a site-specific mix which will produce a dense growth of grasses.

6.5 WEAK SURFACE SOILS

The surficial colluvial deposits are general comprised of silty and gravel sands and are generally medium dense to loose. These soils generally extended to depths of about 3 to 5 feet below existing grade and were encountered both in hillside and level areas of the site. In their current condition, these soils are not adequate to support embankments, roadways or houses. In addition, where roadways are planned for hillside areas, potentially unstable conditions could exist if these soils are left in place.

To provide support for the proposed embankments and roadways some rework (removal and compaction) of the surface soils will be necessary. The rework will include removal of surface soils followed by replacement and compaction of the excavated material. This will entail the construction of horizontal benches to alleviate potential soil movement associated with adverse dipping (dipslope) contacts between the colluvium and the underlying bedrock. Where roadways are planned for hillside areas, the removal depth and lateral extent will be greater and will include the excavation of keyways and benches into competent soil or bedrock where encountered.

Removal and replacement of these soils as engineered fill will improve their engineering characteristic, lessening their potential to undergo liquefaction where saturated or dynamic compaction where above groundwater. This will also improve bearing capacity, a consideration where retaining walls, house or other earth-supported structures are to be constructed.

6.6 EXISTING UNCONTROLLED FILLS

Construction of the dirt roadways found in several areas of the site required the construction of fills. These fills are often found traversing slopes and are associated with cut/fill roadway construction. In at least one location, the fill for a roadway crosses a drainage ravine. This is at the main road in to the site. In all cases, these fills, and any other fill encountered on the site, are considered to be uncontrolled and will need to be removed prior to further development of these roadways as part of the development of the site. The material may be reused as fill as discussed below in the "Earthwork" section of this report.

Uncontrolled fill also exists at the locations of our exploratory test pits. The backfill materials will need to be re-excavated at these locations during site grading activities. The materials, when properly moisture conditioned may be replaced as compacted (engineered) fill in accordance with the recommendations for fill placement presented below.

6.7 EROSION GULLY WALL STABILITY – DEVELOPMENT SETBACKS

The previously discussed there are a number of erosion gullies at the site with very steep to vertical wall conditions. These walls or slopes are not considered to be stable and thus should be avoided. Where erosion protection and/or slope stability improvements cannot be made due to jurisdictional constraints, the minimum setback for roadways should be equal to 2 times the height of the vertical or near-vertical feature. Where slopes within the erosion feature are 2:1 or steeper, the setback should be based on a plane projecting up from the base of the feature at an inclination of 2:1 to the ground surface behind the gully.

Setbacks for houses should be equal to 4 times the height of the vertical or near vertical feature. Where slopes within the erosion feature are at an inclination of 4:1 or steeper, the setback should be based on a plane projecting up from the base of the feature at 4:1 to the ground surface behind the gully. Where further erosion of the gullies can be controlled or prevented, a reduction in setback may be feasible. This should be evaluated on a case-specific basis.

7.0 PRELIMINARY DESIGN AND CONSTRUCTION RECOMMENDATIONS

7.1 EARTHWORK

7.1.1 General

All site preparation and grading should be performed in accordance with the preliminary recommendations contained in this report, and any subsequent site and project recommendations developed current with development plans. We recommend that all earthwork be observed by the Geotechnical Engineer. Final depths of stripping, rework, benching and keying should be assessed in the field by the Geotechnical Engineer at the time of grading. In addition, the conditions of exposed soils or geologic units at cut slopes should be evaluated by the Geotechnical Engineer and Engineering Geologist. The need for, and the extent of, additional slope stabilization measures should be determined during the grading of the site.

7.1.2 Site Clearing & Stripping

Prior to start of construction, the sites for proposed roadways and infrastructure improvements should be cleared of designated trees. Root balls associated with the existing trees should also be removed. Due to the large size of some of the mature trees at the site, excavations on the order of three to five feet deep may be required at these locations. Excavations resulting from the clearing operations should be backfilled with engineered fill placed and compacted in accordance with "Subgrade Preparation, Fill Placement and Compaction," below.

All surface vegetation should be removed from the areas of proposed construction. Stripping should include both the above grade vegetation as well as any associated dense root zone, such as would be expected where dense brush is present. Where vegetation is limited to grass and weeds in areas of cut, it may be feasible to limit stripping to removal of the surface vegetation by cutting at or just below the ground surface. The actual depth of the required stripping should be determined by the Geotechnical Engineer in the field at the time of grading. The stripping may be stockpiled for possible later use as topsoil fill in landscape areas.

To allow us to substantiate that our recommendations for site clearing and stripping have been adhered to, the site clearing work should be performed under the observation of a representative from D&M/Terratech.

7.1.3 Rework Of Surface Soils

To provide support for future mass fills, embankments and roadways, some rework of the surface soils should be performed. Where mass fills, embankments or roadways are planned in level areas or where slope inclinations are 8 horizontal to 1 vertical (8:1) or flatter, as a minimum, we recommend that the upper three feet of colluvium be removed, that the exposed soils be further evaluated by the Geotechnical Engineer, and that the removed soils be replaced as engineered fill once all loose soils have been removed. This may require excavation of the colluvial surface soils be excavated down to the underlying bedrock. Laterally, the soils should be removed out to a minimum distance of 5 feet from the edges of the proposed roadway section. Exposed subgrade should than be prepared in accordance with our recommendations presented below under "Subgrade Preparation, Fill Placement & Compaction." Following subgrade preparation, the stockpiled soil may be reused as fill provided it meets the requirements for fill presented under "Material For Fill."

Where fills, embankment or roadways are planned for areas of the site with slope inclinations steeper than 8:1, the depth and extent of the excavation will be more extensive. In these areas we recommend that material be entirely removed down to competent medium dense or denser soil, or to bedrock whichever is shallower and the excavated material stockpiled. After removal of the surface material, the exposed competent surface should be keyed and benched. The construction of keyways and benches, and subdrain installation are discussed below. Depths of removal, keying, benching and subdrain installation will all require observation by the Engineering Geologist and Geotechnical Engineer prior to fill placement and rebuilding of these rework areas.

7.1.4 Keyways & Benches

Where fill is to be placed as part of rework of loose soils on hillside slopes steeper than 8:1, keyways and benches should be excavated into the exposed competent medium dense soil or bedrock to provide support for the fill. Typically, keyways should be excavated at least 4 feet below the surface of the competent material and have a minimum width of 10 feet. Horizontal benches should be excavated into competent materials typically at 3-foot vertical intervals as the fill placement progresses up the slope. Benches should be excavated at least 1 foot below the surface of the competent material.

Subsurface drainage should be provided in keyways, on intermediate benches as appropriate, and in natural seepage areas and existing drainage courses to be filled. Recommendations regarding subsurface drainage are presented below.

7.1.5 Subgrade Preparation, Fill Placement & Compaction

After the stripping, clearing and loose soil removal, the exposed ground surface in areas to be filled, with the exception of intact bedrock or excavated benches, should be scarified to a depth of about 8 inches, moisture conditioned and compacted.

All sandy subgrade and fill soils should be moisture conditioned to between 2 percent above or below optimum moisture content and compacted to at least 95 percent relative compaction. Similarly, aggregate base should be compacted to at least 95 percent relative compaction in accordance with and ASTM procedures. Fill materials should be placed in horizontal lifts not exceeding 8 inches in uncompacted thickness. Due to equipment limitations, thinner lifts may be necessary to achieve the recommended levels of compaction.

The poorly graded silty and sandy materials encountered at the site are judged to be relatively sensitive to compaction moisture content. Compaction of these materials can be difficult if the moisture content is not adequately controlled. Grading operations during the wet season or in areas where the soils are saturated may require provisions for drying the soil prior to compaction. If the project necessitates fill placement and compaction in wet conditions, we can provide alternative recommendations for drying the soil. Conversely, additional moisture may be required during the dry months. Water trucks should be available in sufficient number to provide adequate water during compaction.

7.1.6 Material For Fill

In general, the on-site soils without excessive visible organic matter as judged by the Geotechnical Engineer, and free of any deleterious materials or hazardous substances, may be used as engineered fill to achieve project grades.

Rocks or concrete fragments larger than 4 inches in maximum dimension should not be placed in fill areas within five feet of finished rough subgrade. Rocks larger than 12 inches in maximum dimension should not be placed in the upper 12 feet of fill areas. Oversized rocks, larger than 12 inches, may be placed in the deeper fills. Rocks larger than 2 feet in diameter should be removed from fill material and disposed of as directed by the Civil Engineer.

7.1.7 Trenches

Based on our experience in excavating our exploratory test pits, we anticipate that excavations for utility trenches can be readily made with either a conventional backhoe or excavator throughout most of the site. There are demonstrated zones of cemented sols that may impact production or require the use of larger more powerful equipment. The soils found at the site are predominately granular. Where cemented and surface runoff is controlled the bedrock Paso Robles materials will stand vertical. However, the degree of cementing and the gradation of the materials are variable. These soils can be prone to sloughage as they dry when cut at steep inclinations. All trenches should be constructed in accordance with OSHA and Cal-OSHA Safety Standards. Safety in and around utility trenches is the responsibility of the underground contractors.

All underground utility trenches should be backfilled with compacted engineered fill. The silty to sandy site soils or imported sand may be used for backfilling utility trenches. The trench backfill should be compacted to at least 95 percent relative compaction and capped with a minimum 12-inch thick layer of compacted, on-site fill soil similar to that of the adjoining subgrade. The trench backfill material should be placed in lifts not exceeding six inches in uncompacted thickness. Thinner lifts may be necessary to achieve the recommended level of compaction of the backfill due to equipment limitations. Compaction should be performed by mechanical means only. Water jetting to attain compaction should not be permitted.

For purposes of this section of the report, backfill is defined as material placed in a trench starting one foot above the pipe; bedding and shading is all material placed in a trench below the backfill. With the exception of specific requirements of the local utility companies or building department, pipe bedding and shading should consist of clean medium-grained sand. The sand should be placed in a damp state and should be compacted by mechanical means prior to the placement of backfill soils. The sand should be compacted to at least 90 percent relative compaction. Above the pipe zone, underground utility trenches may be backfilled with either free-draining sand, on-site soil or imported soil. The trench backfill should be compacted to at least 90 percent relative compaction. Trench backfill should be capped with at least 12 inches of compacted, on-site soil similar to that of the adjoining subgrade. The upper 12 inches of trench backfill in areas to be paved should be compacted to at least 95 percent relative compaction. The backfill material should be placed in lifts not exceeding 6 inches in uncompacted thickness. Thinner lifts may be necessary to achieve the recommended level of compaction of the backfill due to equipment limitations. Compaction should be performed by mechanical means only. Water-jetting or flooding to attain compaction of backfill should not be permitted.

Where trenches are to be located down the face of a slope, there is a potential for seepage water to collect in the trench and to cause trench failure (blow-out) where water pressure builds-up. The potential for this to occur can be mitigated through the use of subsurface drainage or check dams or trench plugs within the trench. Trench plugs may consist of controlled density fill (2 sack/cubic yard cement/sand slurry), compacted clay soils, cross-trench filter fabric wrapped gravel. This should be considered in civil design.

To maintain the desired support for foundations, such as may be required for retaining walls, utility trenches should be located such that the base of the trench excavation is located above an imaginary plane having an inclination of 1.5 horizontal to 1.0 vertical, extending downward from the bottom edge of the adjacent footing.

7.1.8 Site Slopes

7.1.8.a General

Project planning was at the feasibility stage with development of a site plan but not grading plans at the time this report was prepared. Based on our understanding of the project, we would not anticipate cut or fill slopes constructed as a part of this development to exceed 30 feet in height. Deep-seated slope failures should not occur in cut and fill slopes that are designed and constructed in accordance with the recommendations presented in this report. However, shallow slope failures could still occur as the result of erosion and/or water infiltration. Therefore, it is important that the drainage and erosion control recommendations presented in this report are implemented into the design and construction of the site. Furthermore, it is essential that these measures be maintained on a regular basis after construction. All cut and fill slopes should be constructed with drainage and intermediate benches in accordance with the Uniform Building Code.

7.1.8.b Cut Slopes

We recommend that cut slopes above proposed roadways be designed and constructed no steeper than 2.5 horizontal to 1 vertical (2.5:1) in medium dense to dense sands. Cut slope areas where fragmented bedrock, out of slope bedding, or unstable soils are encountered during construction could require the construction of earth buttresses, stability fills (slope reconstruction) or other remedial measures. Cut slopes below colluvial soil deposits will expose less dense soils and may possibly expose a dipslope condition in some areas. Where colluvial soils are exposed in a cut slope, a flatter gradient or remedial grading above the cut slope will be required. This may entail over-excavation of the cut slope followed by the construction of a slope buttress. This may adversely impact trees or other features that are to be left undisturbed. This must be considered in civil design.

All cut slopes should be observed by our Engineering Geologist and Geotechnical Engineer at the time of grading to assess the applicability of our recommendations and to make supplemental recommendations, if necessary. Supplemental recommendations may include slope-flattening, installation of subsurface drainage, or slope reconstruction in areas where geologic weaknesses or local anomalies are encountered during site earthwork.

7.1.8.c Fill Slopes

We recommend that site fill slopes associated with proposed roadways be designed and constructed no steeper than 2.5:1 (horizontal to vertical). Slopes may be constructed if the fill slopes are internally reinforced during reconstruction. Internal reinforcement generally consists of geogrid. Slopes steeper than 2.5:1 and any slope to be stabilized with geogrid will require site and project specific design recommendations. These can be discussed after site planning has been developed further.

Construction of fill slopes above existing slopes will require a bench at the base of the fill slope. Where there is insufficient room to construct a bench, mechanical stabilization of the natural slope may be required prior to fill construction. Where a bench or mechanical stabilization is not provided, there may not be adequate support for the slope and failure could result in the natural slope below the fill.

Fill material must be compacted to the face of the slopes. To accomplish this, we recommend that slopes be over-built a minimum of four feet horizontally and then trimmed to design grades. The construction of a bench below the fill slope will aid in this process. Other methods may also provide the desired compaction. Proposed alternative methods should be submitted to us for review. Although deep-seated failures should not occur in properly compacted fill slopes, even properly designed and constructed fill slopes have a potential for shallow failures or surficial sloughage, particularly during periods of wet weather.

All fill slopes should be keyed and benched into the foundation and backslope soils. Vertical distance between benches should not exceed 3 feet. The construction of internal drainage is a critical element of the long-term stability of fill slopes. All keyways and intermediate benches on fill slopes should be drained. Additional subsurface drainage will be required in areas where seepage is evident or suspected and in areas where surface drainage exists. Subdrains should be constructed in accordance with the recommendations presented below under "Drainage."

7.2 DRAINAGE

7.2.1 Subsurface Drainage

Where fill slopes are to be constructed at existing slopes, subsurface drainage will be required at the contact between the native soils and the fill. This will require the installation of drains on the benches cut to support the fill as discussed in the preceding section. In general, bench drain spacing should be no more than 10 feet vertically and more than 30 feet horizontally. The drainage systems should consist of a combination of interceptors consisting of perforated pipe surrounded by drain rock (free draining ½- to ¾-inch crushed gravel) wrapped in filter fabric (Mirafi 140 or equivalent, lapped 12" at joints), and drainage blankets. Caltrans Class 2 permeable material (Caltrans Standard Specifications Section 68) may be an acceptable alternative to drain rock wrapped in filter fabric in areas were the volume of seepage is anticipated to be low. Class 2 permeable material may only be used where specifically approved by the Geotechnical Engineer during site grading.

Subdrain pipes should consist of rigid ABS (SDR-23.5) or PVC Schedule 40 minimum for locations where cover is up to 50 feet in height, and ABS (SDR-15.3) or PVC Schedule 80 minimum for fills greater than 50 feet in height. The lateral drains should have a minimum diameter of four inches. Laterals should be connected to a main line with a minimum diameter of six inches. The actual locations, depth and extent of the subsurface drainage systems should be assessed by us in the field at the time of construction.

Keyways and benches cut into the hillside at the back-cut of the slope should have a minimum slope of 1 percent along the length of the slope. A subdrain pipe and drain rock wrapped in a geotextile filter fabric should be installed at the back of the base of the slope excavation. The fabric wrapped gravel section should extend up the back of the cut a minimum of 3 feet (as with a chimney drain). A clean-out should be provided at the high end of the keyway subdrain line.

The drainage systems should consist of lateral drains or interceptors consisting of perforated pipe surrounded by drain rock wrapped in geotextile filter fabric (Mirafi 700X or equivalent, or Mirafi 140N or equivalent, lapped 12" at joints), connected to riser pipes also surrounded by drain rock wrapped in filter fabric.

Subdrains are also recommended in the colluvial deposits at Lots 8-10, 11 and 13-16 to aid in mitigating perched groundwater conditions and slope instability at these locations. Where roads are to be constructed across slopes, subdrains should be constructed at the toe of the slope to aid in protecting the baserock and subgrade soils from saturation and softening.

Subdrains installed to provide drainage of the colluvial soils at Lots 11, 8-10 and 13-16 should extend through the colluvium and in the Paso Robles Formation a minimum of two feet. This will result in a minimum depth of trench of about 6 feet. Subdrains along roadways should extend two feet below finished subgrade. These drains should be a minimum of 12 inches wide. Drains should be sloped at a minimum of 1 percent to a suitable discharge point.

Drain rock should be clean, crushed rock or gravel conforming to the following gradation:

Sieve Size	Percent Passing
1 - 1/2 inch	100
3/4 inch	90 - 100
No. 4	0 – 5

An alternate to the use of fabric wrapped gravel is Caltrans Class 2 permeable backfill (Caltrans Section 68). Where Class 2 permeable backfill is used, the filter fabric may be deleted. Subdrain pipes be bedded on at least 4 inches of drain rock or Class 2 permeable backfill. Pipe should be installed with perforations down and sloped to drain toward an appropriate collection facility. Each subdrain should be provided with at least one near vertical clean out of non-perforated plastic pipe which extends to the surface. Clean-outs should be installed on all main line subsurface drains and lateral lines.

Also, we recommend that subsurface drainage be provided in any natural drainage areas to be filled and in areas of observed or suspected seepage. The need for additional subdrains in other areas of the site should be evaluated by our Engineering Geologist and Geotechnical Engineer during the grading of the roadways and detention basins.

7.2.2 Surface Drainage & Erosion Control

Good surface drainage is essential to intercept and control surface water runoff to reduce slope erosion and subsurface infiltration. Effective erosion-control landscaping is also important. Measures to control surface water and erosion include placement of drains on and above cut and fill slopes, reduction of ponding of water, proper grading to prevent surface water flow over the tops of slopes, construction of berms at the top of slopes, installation of concrete V-ditches, landscaping of slopes, and control of irrigation on slopes. These items are discussed below.

Concentrated water should not be allowed to flow uncontrolled across slope faces. Areas above slopes should be graded to a 2 percent gradient or greater to direct surface water away from the top of the slopes and toward a suitable point of discharge such as erosion controlled ditches or surface drain inlets. Straw bale dikes and/or siltation basins should be constructed to reduce siltation during construction. Erosion control V-ditches, brow ditches, or intermediate benches, should be constructed on slopes where substantial surface water runoff is expected. Lined ditches and temporary silt fences should also be considered at the toe of both cut and fill slopes. Where benches are used for slopes greater than 30 feet in height, V-ditches are recommended to intercept surface water flowing down from above the benches. These types of surface drainage features should also be installed around the perimeter of the erosional ravine to reduce continued erosion. This would likely include either V-ditches combined with construction of a bench at the top of the ravine walls or the installation of a subdrain to capture water flowing along the soil/bedrock interface.

Slopes adjacent to proposed roadways should be protected from erosion by utilizing a system of erosion matting such as Excelsior blanketing or other erosion control matting combined with plantings of appropriate ground cover vegetation to reduce the potential for future erosion and possible slope deterioration. Planting should occur sometime prior to the start of the rainy season. Additional planting may be needed if the initial planting is partially or totally unsuccessful. A professional landscaper should provide specific details regarding erosion matting and planting. Areas of erosion should be anticipated even with erosion planting. If planting is unsuccessful, other mitigating measures such as temporary silt fences might be necessary, depending upon the susceptibility of the exposed materials to erosion.

We recommend that irrigation of all slopes be kept to a minimum. Over-watering of slope surfaces could result in surficial instability and/or downward creep of the near surface soils. For slopes that must be irrigated we recommend the use of a low volume system such as drip irrigation.

7.3 STRUCTURES

7.3.1 Foundations

Foundations will be required for support of retaining walls, houses and other site improvements. With proper site improvement including removal of all loose, weak, compressible or landslide-prone materials, the use of conventional shallow foundations may be feasible. The presence of deep fills or fills with differential thickness of more than 15 feet may adversely impact the performance of a shallow foundation system and will need to be considered in future planning. Where structures are to be constructed on a cut/fill type building pad, or on or immediately above slopes, drilled piers and grade beams may needed. Foundation design parameters will be structure dependent due to the variations in soil types, site preparation alternatives selected, grading activities, proximity to slopes and possibly other factors not evident at this time. Structure specific foundation recommendations should be developed after the structure type and siting, as well as preliminary loading information have been determined.

7.3.2 Earth Retaining Structures.

There are a number of viable alternatives for support of earth fills or where steep cuts are required. These include conventioanl cast-in-place concrete or masonry retaining walls supported by spread footings or drilled cast-in-place piers, soldier piles with lagging, segmental block walls with integral geogrid reinforcment the the retained soil mass (i.e. Keystone, Versa-Lok and others),mechanically stabilized earth (MSE) walls and soil nailed walls among others.

Soil nailing is well-suited to retaining cuts because no excavation is required behind the wall. Soil-nail walls have been used in a variety of civil engineering projects including stabilization of relatively high cut slopes. This technique has been employed to stabilize or support cut slopes on countless private developemnt as well as federal and state highway projects. The system works as a gravity retaining wall and helps restrain the movement of the soil mass behind the wall. Soil-nail walls will serve two purposes in their application on this project. The soil-nail structure will provide temporary shoring during excavations and will remain in place as part of the permanent lateral support system after completion of the construction. A soil-nail wall system involves a number of steel reinforcing bars (soil nails) installed in closely spaced drilled holes and grouted into the soil as the soil face is exposed during excavation. Construction is performed in vertical steps starting at the top of the excavation and proceeding downward in approximate 1.5 to 2-m high lifts. Permanent facings for soil-nail walls often includes reinforced shotcrete and may consist of cast-in-place and precast concrete panels to support the excavation face. A shotcrete facing that is colored and textured to blend in with the surrounding soil and rock can be constructed for aesthetic reasons.

Where large fills are to be constructed with a retained face, gravity walls including segmental block and MSE walls are often found to be very cost effective. Construction of these types of walls entails erection of a rigid facing material (concrete block or concrete panels) with geogrid reinforcement or steel straps mechanically connected to the facing and embedded in the engineered fills as the fill progresses up.

Where site constraints do not allow for placement of geogrid or straps, construction of a soldier pile and lagging wall or concrete/concrete block wall may be required. Selection of the foundations for these types of walls will be influenced by both site lateral constrains and proximity to descending slopes below the wall.

Recommendations for preliminary wall design can be prepared once information regarding wall location, height and anticipated loading with surcharge becomes available. Site-specific subsurface data may be required before formal design level recommendations can be prepared.

7.4 PAVEMENTS

Pavements for this project are expected to consist of private road providing access to the 17 custom lot sites. Traffic will ultimately consist primarily of light passenger vehicles cars, with truck traffic limited to garbage trucks and occasional delivery or moving trucks, or fire trucks. The potential for school bus traffic has not been discussed with us. Based on our experience with similar projects, we suggest using a Traffic Index (TI) of at least 5.5 for minor roadways with a TI of at least 6.0 for the main roadway. The actual traffic indexes to be used in site development should be assigned by the Civil Engineer in accordance with local requirements. For roadways of this type, a minimum asphalt concrete section of 4 inches is recommended over the appropriate aggregate base section for the given TI and subgrade soil.

Laboratory testing of the soils at the site has not been performed as a part of this preliminary study. We recommend that once site grades and roadway locations have been determined that soil sampling be performed. Resistance or R-value testing should then be performed to develop site-specific pavement sections in conjunction with the assignment of the appropriate Traffic Indexes by the Civil Engineer. Asphalt Concrete should meet the requirements for 1/2- or 3/4-inch maximum, medium Type B asphalt concrete. These materials should comply with the specifications presented in Section 39 of the Caltrans Standard Specifications, latest edition. Class 2 aggregate base shall also conform to the materials specifications as presented in the Caltrans Standard Specifications, latest edition. ASTM Test procedures and should be used to assess the percent relative compaction of soils, aggregate base and asphalt concrete. Asphalt concrete should be compacted to a minimum of 96 percent of the maximum laboratory compacted (Hveem) unit weight.

Ideally, pavement areas should be sloped at a minimum of 2 percent and drainage gradients maintained to carry all surface water off the site due to the slightly porous or permeable nature of asphalt concrete. Surface water ponding should not be allowed anywhere on the site during or after construction.

8.0 ADDITIONAL SERVICES & LIMITATIONS

8.1 ADDITIONAL SERVICES

As noted above, we anticipate that work beyond the scope of the current study would include a plan review of the site specific mass grading plan once that plan becomes available, development of site specific grading recommendations based on the plan, supplemental subsurface exploration as required to more fully address future site plans, and ultimately the review of grading plan and specifications. The review of plans and specifications, and the observation and testing by D&M/Terratech of earthwork related construction activities, are an integral part of the conclusions and recommendations made in this report.

The required tests, observations, and consultation during construction include, but are not limited to:

- observation of site clearing and stripping.
- observation of over-excavation and replacement of existing uncontrolled fills and weak surficial soils (colluvial deposits) in fill and roadway areas.
- construction observation and density testing during subgrade preparation, placement and compaction of fill material, backfilling of utility trenches and finished pavement subgrades, and aggregate base.
- observation of subdrain installations.
- observation of site surface drainage improvements.
- construction observation and density testing during backfilling of retaining walls.

Further geotechnical studies and a final geotechnical report will be required to evaluate geotechnical conditions and provide final recommendations with respect to development lots, the design and construction of tract improvements including utilities, sidewalks, and streets, possible subsurface drainage in relation to these improvements, landscaping features that may have a geotechnical effect, finished lot drainage and erosion control, exterior flatwork, lot specific retaining walls, swimming pools and spas, and other items.

8.2 LIMITATIONS

Recommendations contained in this report are for the construction of proposed roadways, infrastructure improvements, and detention basins as described in this report. Our recommendations are based upon field observations, data from our exploratory borings and test pits, laboratory tests, and our present knowledge of the proposed construction. It is possible that subsurface conditions could vary between or beyond the points explored. If soil and groundwater conditions are encountered during construction which differ from those described herein, our firm should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including proposed grades, or roadway locations change from that described in this report, our recommendations should also be reviewed.

Our firm has prepared this report for exclusive use of Michael Wilson and Dana Broccoli Wilson (owner/applicant for development), and their Civil Engineering Consultant, Whitson Engineers, in substantial accordance with the generally accepted geotechnical engineering and engineering geology practices as they exist in the site area at the time of our study. No warranty, expressed or implied, is made. The recommendations provided in this report are based on the assumption that D&M/Terratech will be retained to consult with the Civil Engineer as site improvement plans are further developed and during the construction phase in order to evaluate compliance with our recommendations. It is the client's responsibility to see that all parties to the project including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety including the Additional Services and Limitations section, as well as any subsequent reports or documents providing supplemental recommendations.

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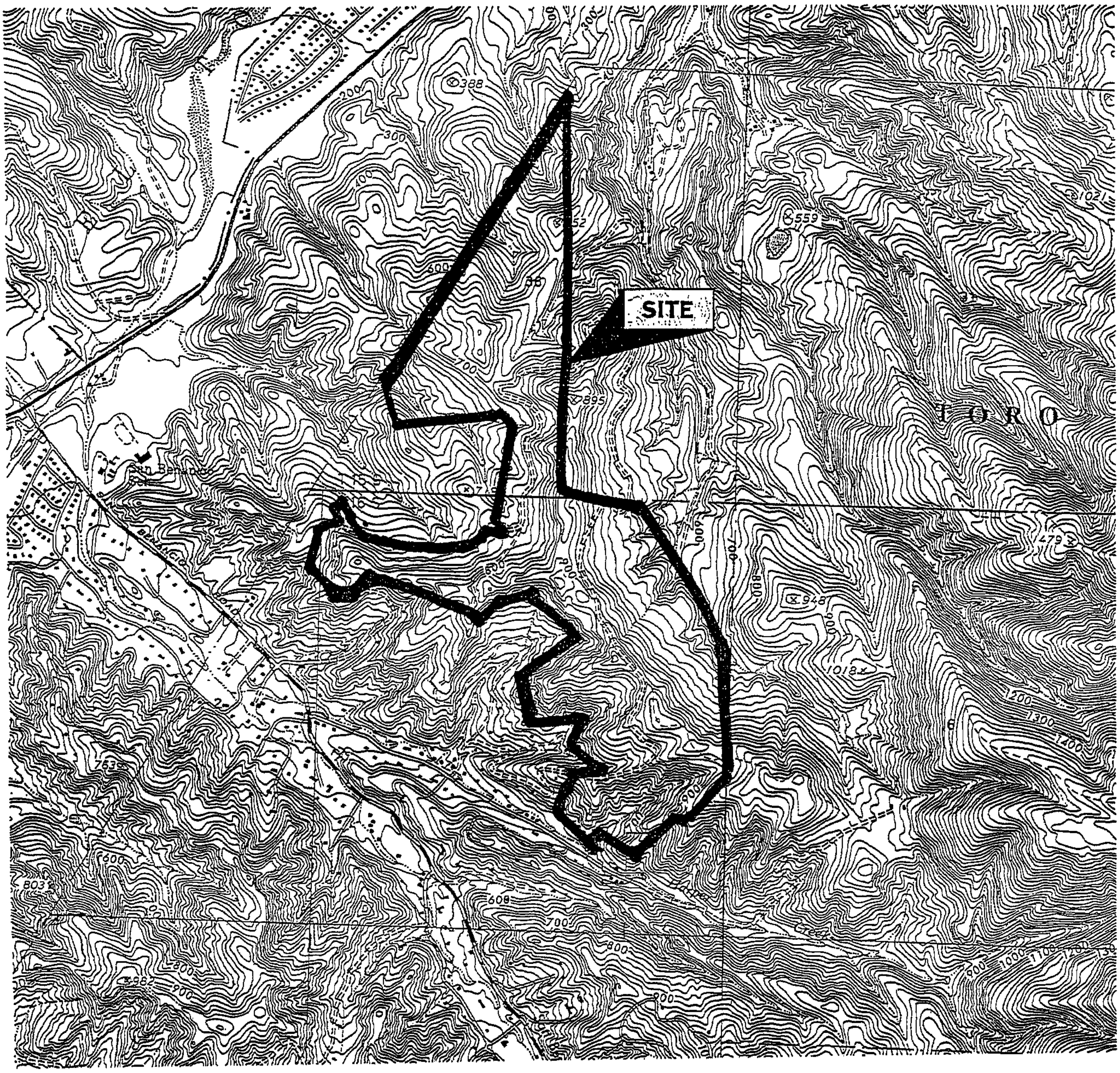
AERIAL PHOTOGRAPHS

Date	Source	Type	Frame	Scale
8/17/49	UCSC	black & white	ABG-17F-15, 16, 17	1:20,000
6/13/68	UCSC	black & white	GS-VBZK 2-138, 139, 140	1:15,000
8/28/81	UCSC	black & white	CDF-ALL-MO 18-11, 12, 13	1:24,000
9/20/97	UCSC	black & white	WAC-97CA 14-9, 10, 11, 65, 66	1:24,000



MAP REFERENCE: USGS 7.5–Minute Topographic Quadrangle, Spreckles, CA, 1947, photorevised 1984.

0 2,000'

SCALE: 1" = 2,000'

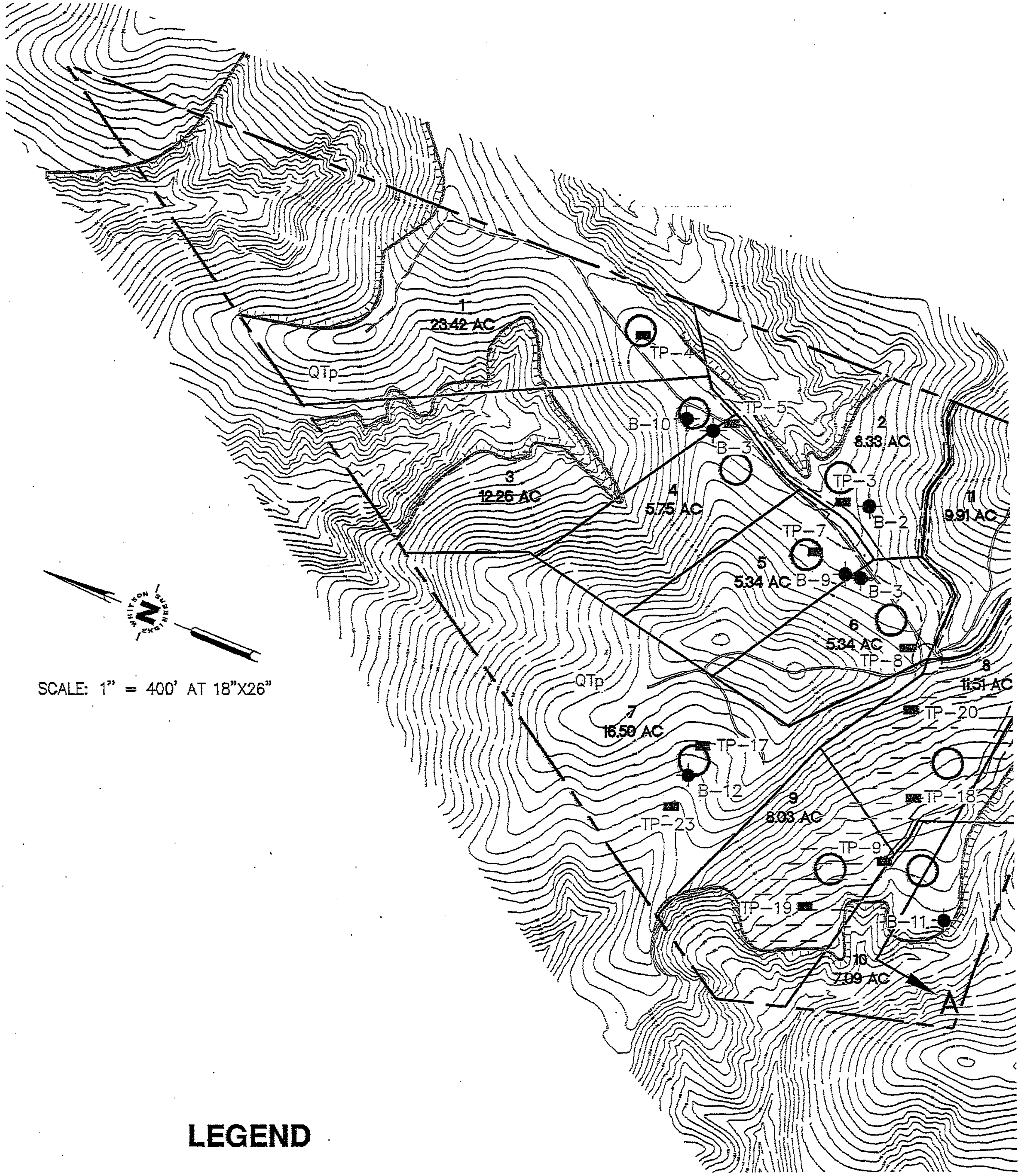
N

JUNE 2001

D&M CONSULTING ENGINEERS, INC.
A URS CORPORATION COMPANY

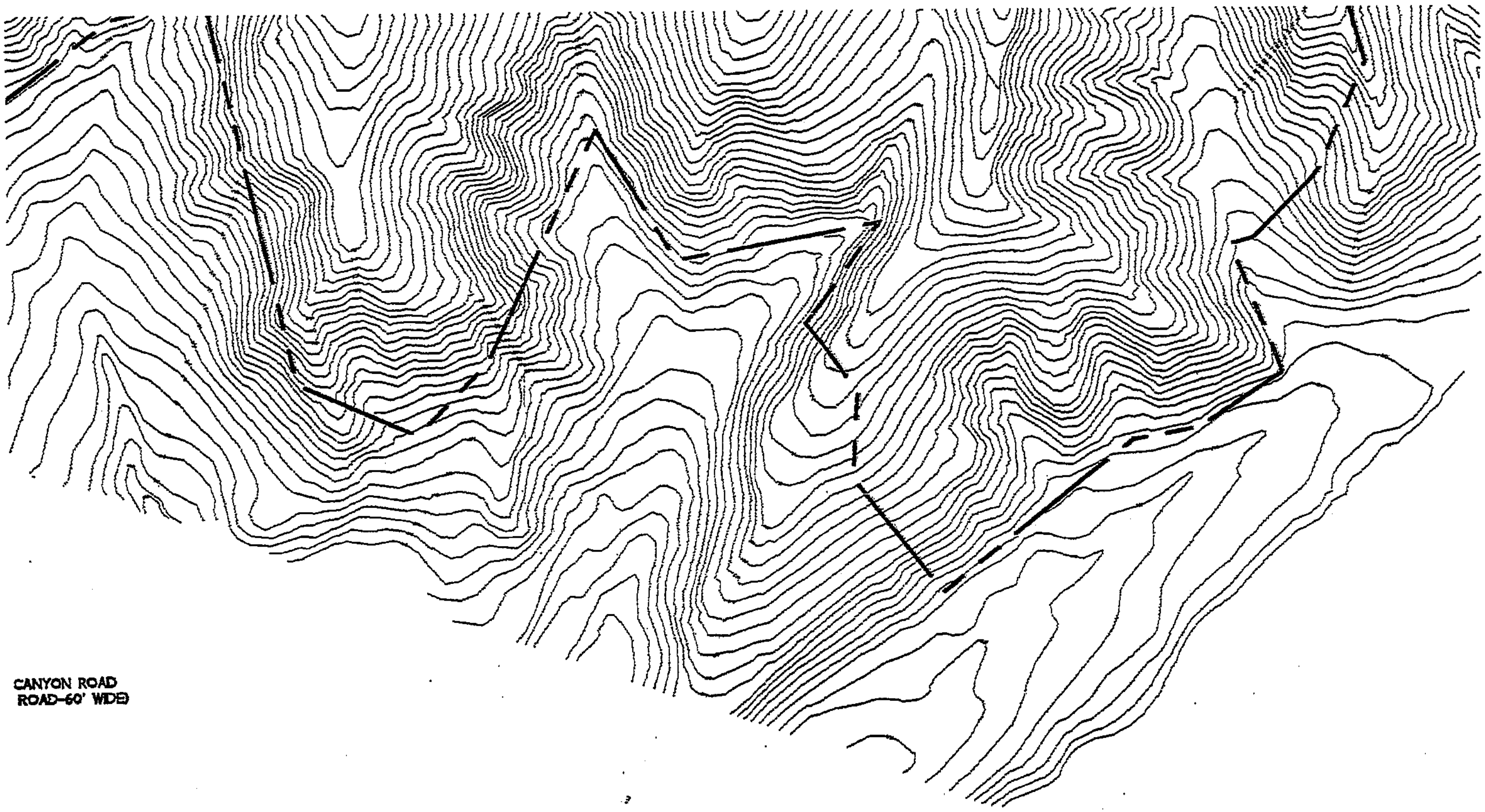
VICINITY MAP
ENCINA HILLS SUBDIVISION
MEYER ROAD
MONTEREY COUNTY, CALIFORNIA

FIGURE
1
PROJECT
1892



SCALE: 1" = 400' AT 18"X26"

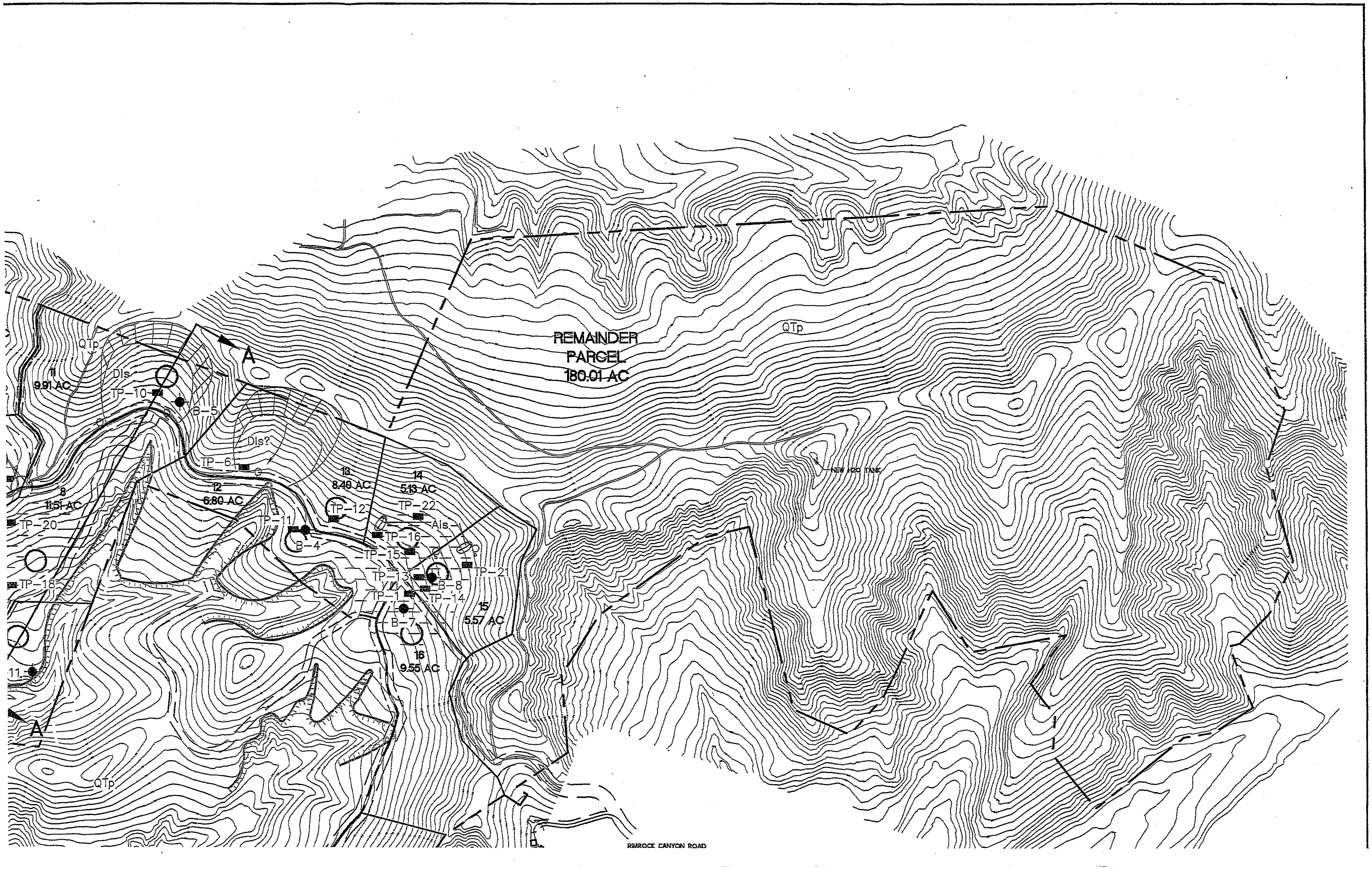
LEGEND

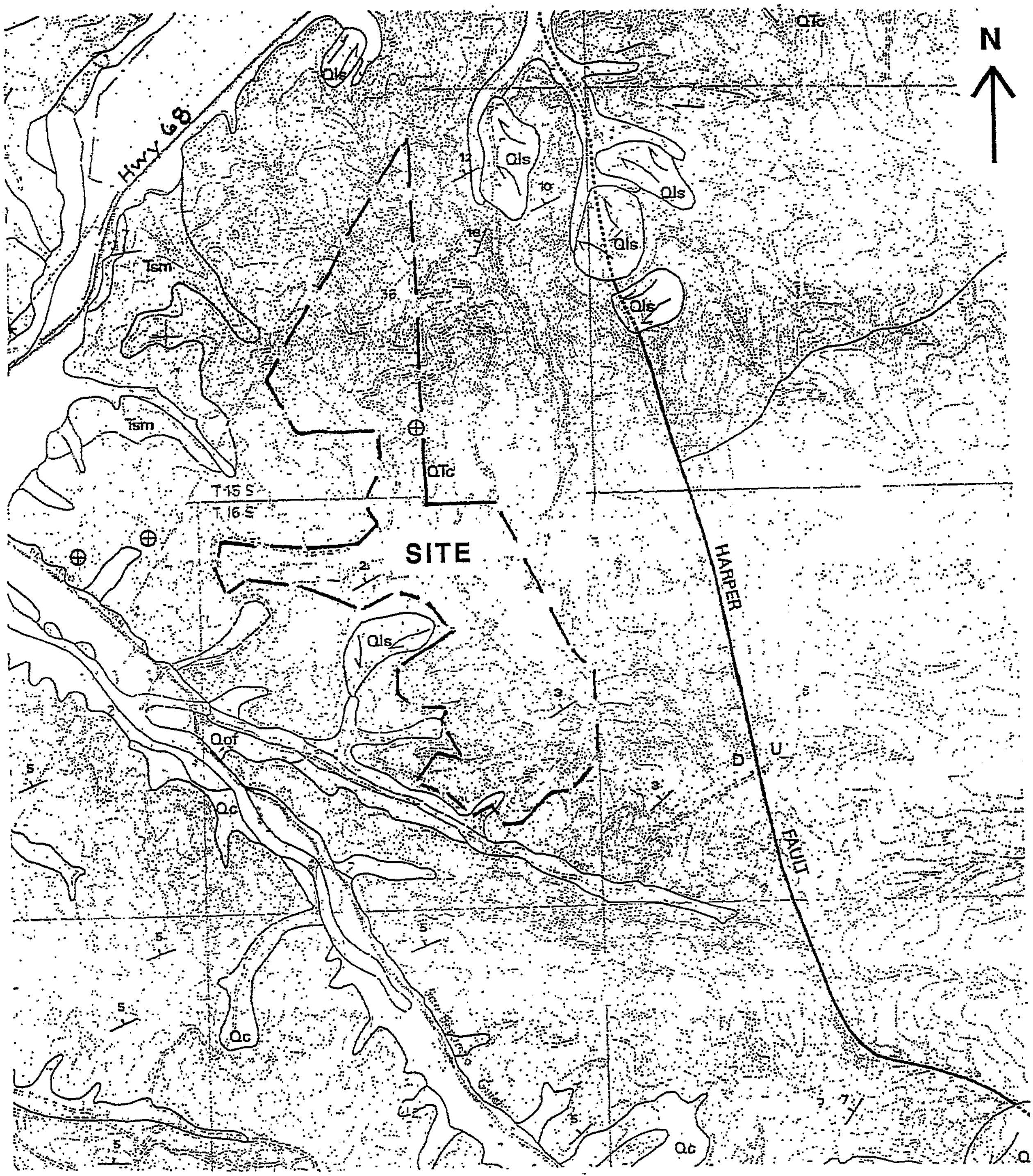


ENCINA HILLS SUBDIVISION
FIGURE 2 - GEOLOGIC SITE MAP
PROJECT 1892
D&M CONSULTING ENGINEERS, INC.
A URS CORPORATION COMPANY
JULY 2001
BASE MAP REFERENCE: WHITSON ENGINEERS (MAY 31, 2000)

LEGEND

A A	LINE OF GEOLOGIC CROSS SECTION (SEE FIGURE 4)
B-12	SOIL BORING/ PERCOLATION TEST LOCATION
▬ TP-22	TEST PIT LOCATION
	LANDSLIDE DEPOSIT AND SCARP, SHOWING DIRECTION OF MOVEMENT
	AREA WITH SEASONAL PERCHED GROUND WATER CONDITIONS
♀	SPRING OR SEEP
QTp	PASO ROBLES FORMATION– SEMICONSOLIDATED, SILTY TO CLAYEY SAND AND SANDY GRAVEL; LOCALLY CEMENTED. GENERALLY OVERLAIN BY 2 TO 5 FEET OF LOOSE, CLAYEY SAND COLLUVIUM (NOT SHOWN)
Als	ACTIVE LANDSLIDE– PRESENTLY, SEASONALLY, OR RECENTLY MOVING
Dls	DORMANT LANDSLIDE– PRESENTLY NOT MOVING LANDSLIDE BUT POSSIBLY SUSCEPTIBLE TO REACTIVATION BY ONGOING GEOLOGIC PROCESSES
○	PROPOSED HOME SITES
	EROSION GULLY


REMAINDER
PARCEL
180.01 AC
QTp
QTp
QTp
A
A'
11
9.91 AC
Dls
Dls?
TP-10
B-5
TP-6
8
11.51 AC
12
6.80 AC
13
8.40 AC
14
5.13 AC
TP-12
TP-22
Als
TP-20
TP-11
B-4
TP-16
TP-15
TP-18
TP-13
TP-21
B-8
TP-1
TP-14
B-7
15
5.57 AC
16
9.55 AC
11
NEW H2O TANK
RIMROCK CANYON ROAD



Qls - Quaternary Landslides
Qc - Quaternary Colluvium
Qof - Quaternary Older Fill
Qtc - Paso Robles Formation
Tsm - Tertiary Santa Margarita Sandstone

SCALE 1" = 2000'

Base: USGS Spreckels 7.5' Quadrangle;
Geology from Clark et. al., 2001.

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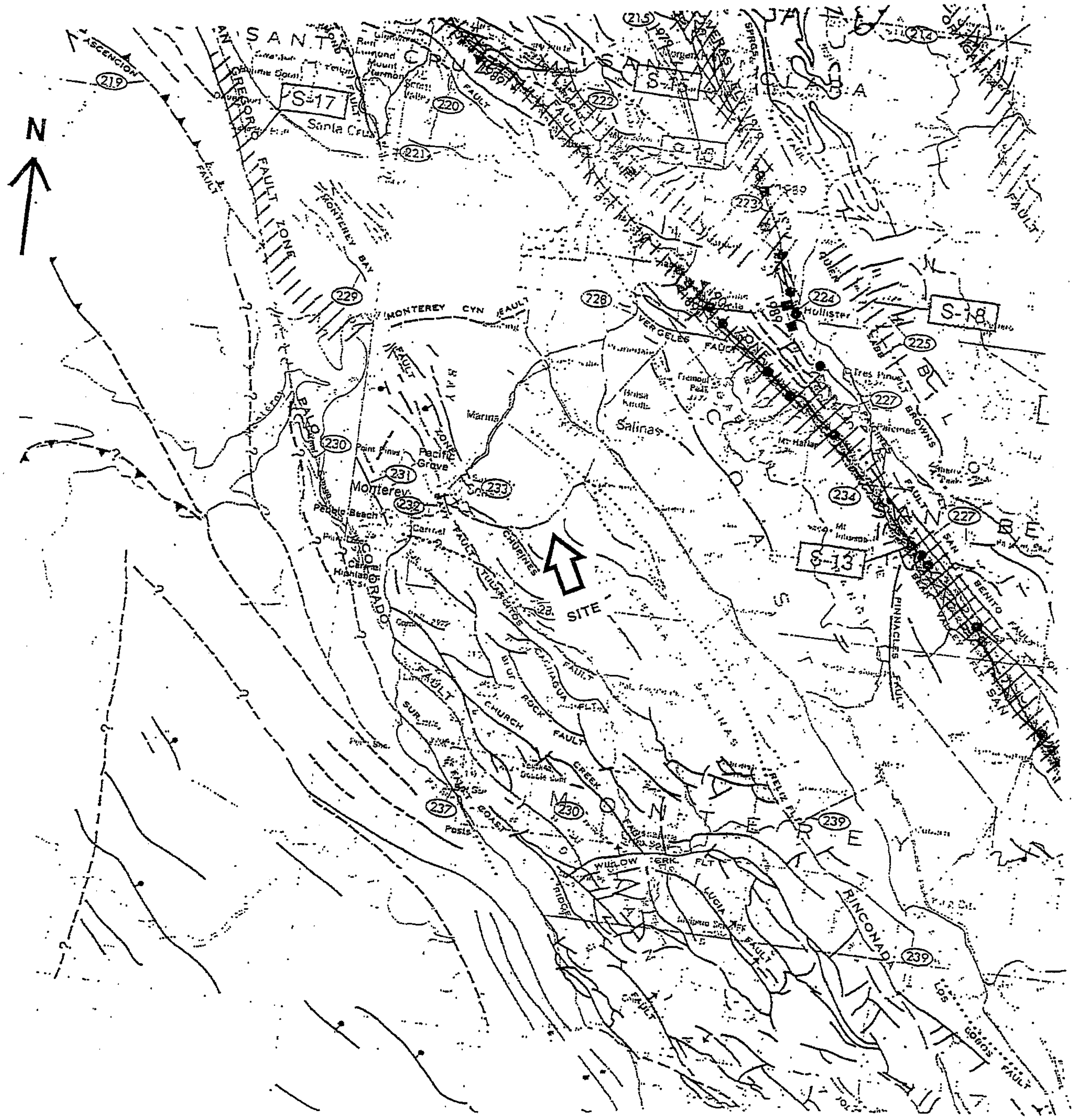
July, 2001

Regional Geologic Map

Proposed Encina Hills Subdivision
Monterey County, California

FIGURE
3
PROJECT
1892



SCALE 1 : 750,000

Source: Fault Activity Map of California and Adj. Areas, DMG, 1994.

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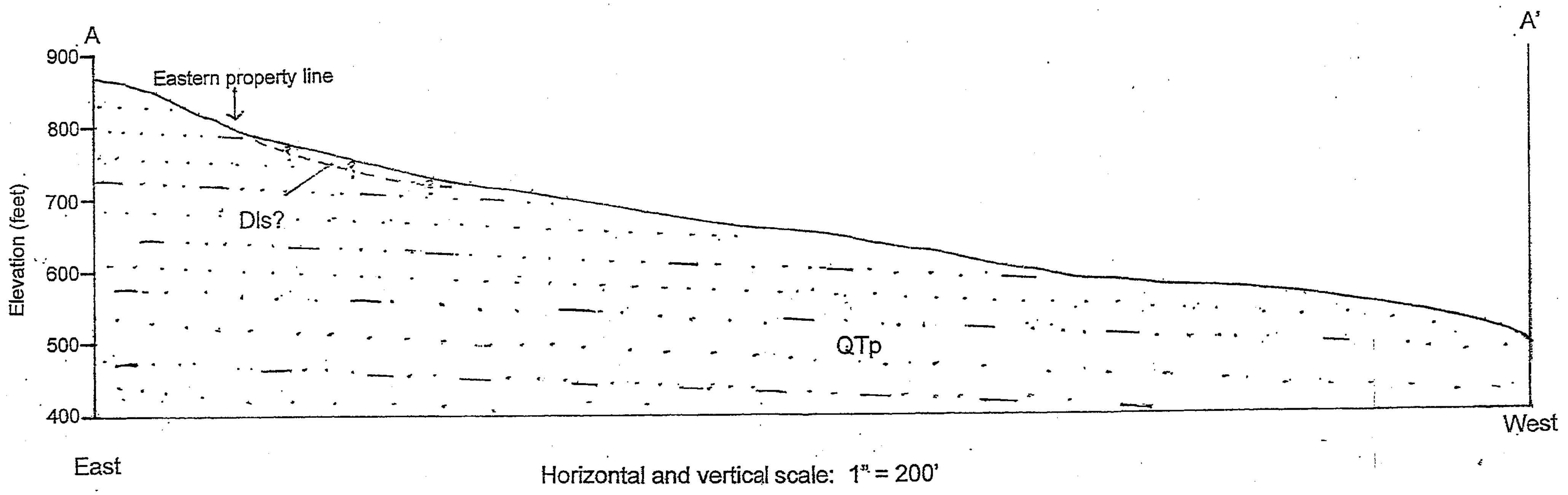
Regional Fault Map

Proposed Encina Hills Subdivision
Monterey County, California

FIGURE
4

PROJECT
1892



Horizontal and vertical scale: 1" = 200'

See Figure 3 for explanation

JUNE 2000

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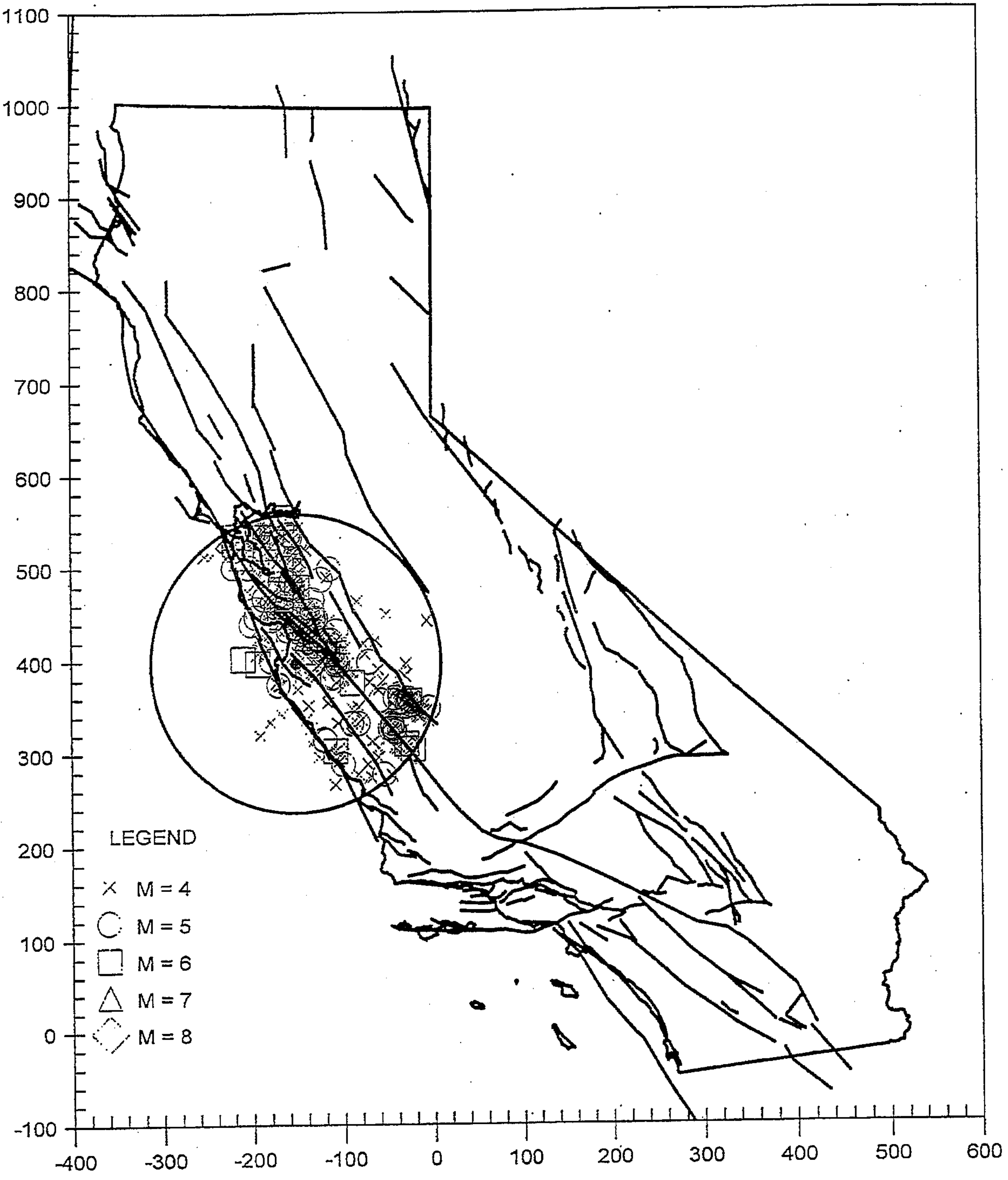
CROSS SECTION A–A'
ENCINA HILLS SUBDIVISION
MEYER ROAD
MONTEREY COUNTY, CALIFORNIA

FIGURE
5
PROJECT
1892

EARTHQUAKE EPICENTER MAP

Harper Canyon



Source: Thomas Blake Computer Services, EQSEARCH, April, 2000.

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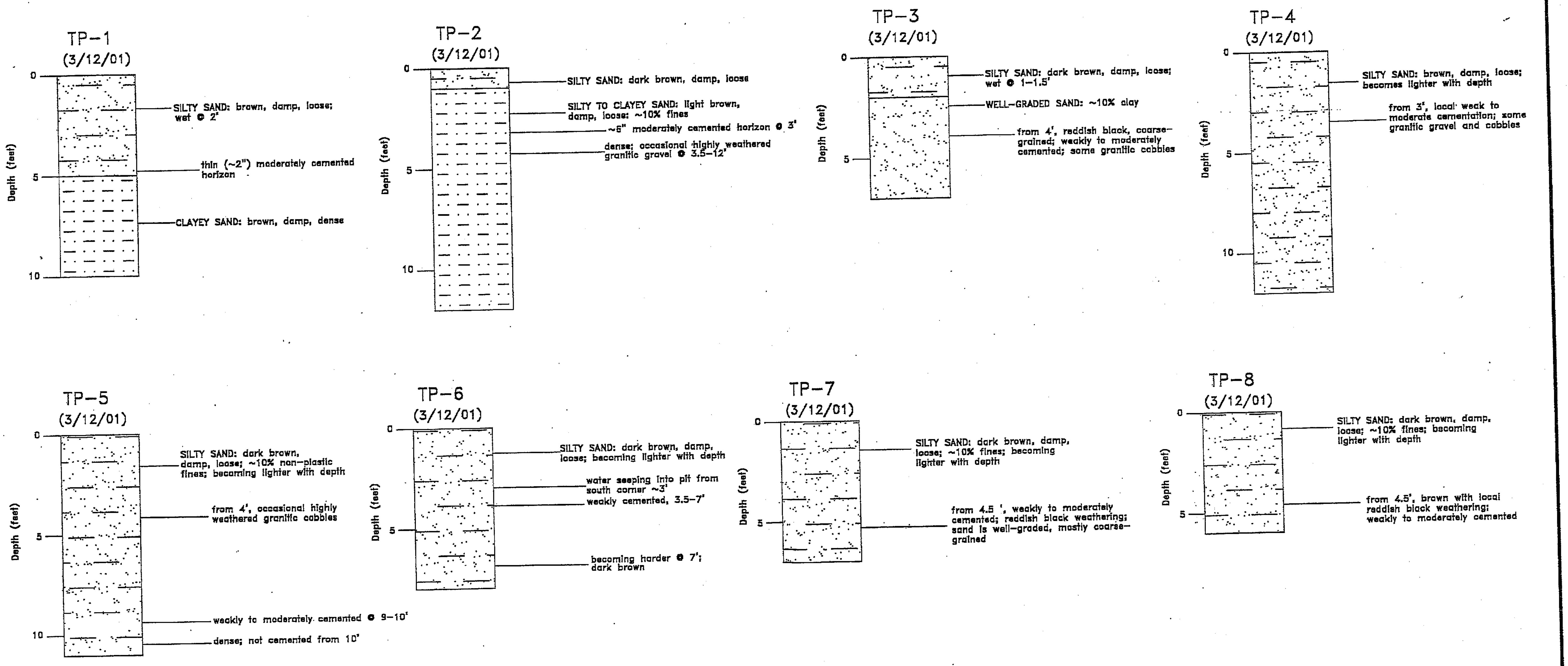
July, 2001

Regional Seismicity Map

Proposed Encina Hills Subdivision
Monterey County, California

FIGURE
6

PROJECT
1892



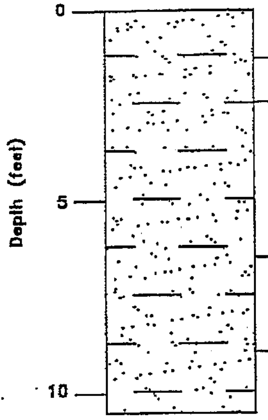
JUNE 2000

D&M CONSULTING ENGINEERS, INC.

EXPLORATORY TEST PITS (TP-1 - TP-8)--GENERALIZED SECTIONS
ENCINA HILLS SUBDIVISION
MEYER ROAD
MONTEREY COUNTY, CALIFORNIA

SHEET
A-1
PROJECT
1892

TP-9
(3/12/01)



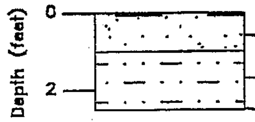
SILTY SAND: brown, damp, loose; lighter with depth; wet ~1.5'

@ 2.5–6', weakly to moderately cemented; damp

@ 6–9', friable; sand is well-graded, minor fine gravel

becoming harder @ 9'

TP-13
(5/14/01)

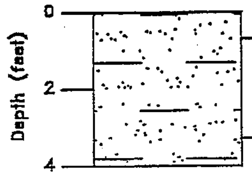


SILTY SAND: light brown, damp, loose

SANDY CLAY: dark brown with orange-brown mottles, damp

very hard @ 2.5'

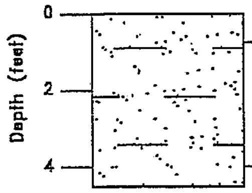
TP-17
(5/14/01)



SILTY SAND: light brown, damp, weakly cemented

moderately to strongly cemented from 2.5'; cementation increases with depth

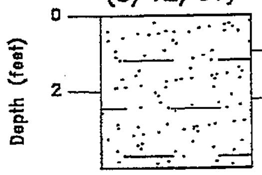
TP-21
(5/14/01)



SILTY SAND: medium brown, damp, loose

@3.5', moderately cemented, becoming strongly cemented with depth

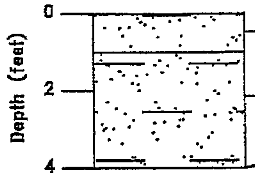
TP-10
(3/12/01)



SILTY SAND: brown, damp, loose

moderately to weakly cemented from 2'

TP-14
(5/14/01)

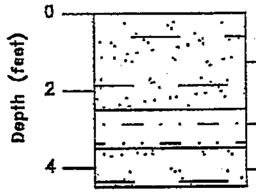


SILTY SAND: light brown, damp loose

SAND WITH CLAY: light brown, ~10% fines

very hard @ 4'

TP-18
(5/14/01)

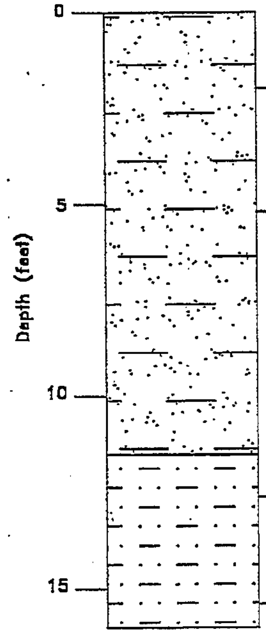


SILTY SAND: light brown, damp, loose

CLAYEY SAND: brown, damp

SILTY SAND: increasing cementation with depth

TP-22
(5/14/01)



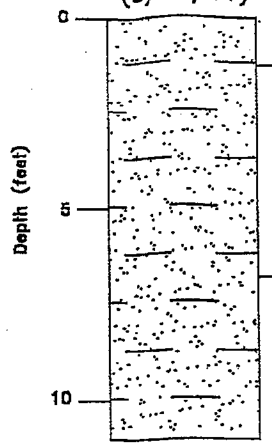
SILTY SAND: light brown, damp, loose to friable; ~10–20% fines, fine to medium grained

from 5', weakly to moderately cemented silty to clayey sand with small gravel

CLAYEY SAND: medium brown, damp, weakly cemented; ~10–20% fines, sand is well-graded, ~5–10% small granitic gravel; % clay increases with depth, grades to SANDY CLAY, medium brown with oxidation mottling, damp

@15', % clay decreases, grades to weakly cemented CLAYEY SAND

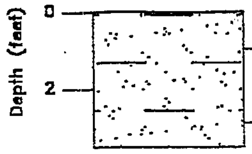
TP-11
(3/12/01)



SILTY SAND: brown, damp, loose; boulders of arkosic sandstone; ~10% fines; weakly cemented from 1.5'

loose from 7'

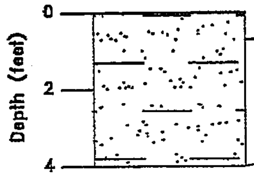
TP-15
(5/14/01)



SILTY SAND: light brown, damp, loose

strongly cemented @ 3'

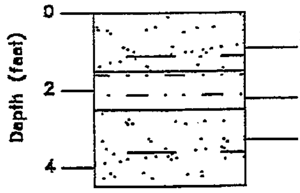
TP-19
(5/14/01)



SILTY SAND: light brown, damp, friable

moderately to strongly cemented @ 4'

TP-23
(5/14/01)

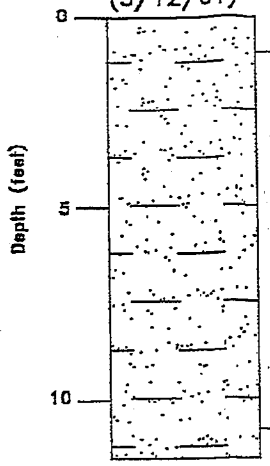


SILTY SAND: light brown, damp, loose

CLAYEY SAND TO SANDY CLAY: dark brown with oxidation mottling, damp

SILTY SAND: strongly cemented @ 3–4.5'

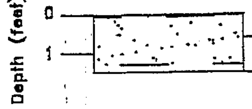
TP-12
(3/12/01)



SILTY SAND: dark brown, damp, loose; ~10% fines, fine to medium grained; becoming tan ~1.5'

weakly cemented from 11'

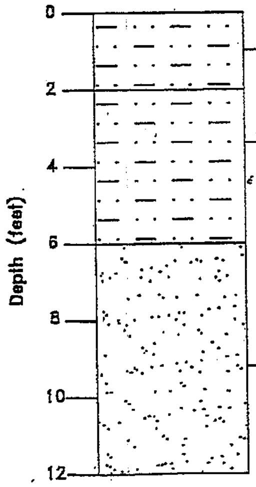
TP-16
(5/14/01)



SILTY SAND: light brown, damp, loose

strongly cemented @ 1.5'

TP-20
(5/14/01)



SILTY TO CLAYEY SAND: brown, damp, friable

CLAYEY SAND with gravel and cobbles

SAND: light yellow, damp, loose to friable becoming weakly cemented @ 6–7', friable @ 7–12'; fine-grained

JUNE 2001

D&M CONSULTING ENGINEERS, INC.

EXPLORATORY TEST PITS (TP-9 – TP-23)--GENERALIZED SECTIONS
ENCINA HILLS SUBDIVISION
MEYER ROAD
MONTEREY COUNTY, CALIFORNIA

SHEET
A-2
PROJECT
1892

e

KEY TO EXPLORATORY BORING LOGS

PRIMARY DIVISIONS			GROUP1 SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size	GRAVELS More than half coarse fraction is larger than No.4 sieve	Clean Gravels (less than5% fines*)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravel with fines*	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS More than half coarse fraction is smaller than No.4 sieve	Clean Sands (less than 5%fines*)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		Sands with fines*	SM	Silty sands, silt-sand mixtures, non-plastic fines
			SC	Clayey sand, sand-clay mixtures, plastic fines
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size	SILTS AND CLAYS Liquid limit is less than 35		ML	Inorganic silts, clayey silts, rock flour, silty very fine sands
			CL	Inorganic clays of low plasticity, gravelly clay of low plasticity
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit is between35 and 50		MI	Inorganic silts, clayey silts and silty fine sand with intermediate plasticity
			CI	Inorganic clays, gravely clays, sandy clays and silty clays of intermediate plasticity
			OI	Inorganic clays and silty clays of intermediate plasticity
	SILTS AND CLAYS Liquid limit is greater than 50		MH	Inorganic silts, clayey silts, elastic silts, micaceous or diatomaceous silty or fine sandy soil
			CH	Inorganic clays of high plasticity
			OH	Organic clays and silts of high plasticity
HIGHLY ORGANIC SOILS			Pt	Peat, meadow mat, highly organic soils

GRAIN SIZES

	U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS		
	200	40	10	4	¾"	3"	12"
Silts and Clays	Fine	Medium	Coarse	Fine	Coarse	Cobbles	Boulders
	SAND			GRAVEL			

RELATIVE DENSITY

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT*
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	30 – 50
VERY DENSE	OVER 50

CONSISTENCY

CLAYS AND PLASTIC SILTS	STRENGTH**	BLOWS/FOOT*
VERY SOFT	0 – ¼	0 – 2
SOFT	¼ – ½	2 – 4
FIRM	½ – 1	4 – 8
STIFF	1 – 2	8 – 16
VERY STIFF	2 – 4	16 – 32
HARD	OVER 4	OVER 32

SYMBOLS

▽	Initial Ground Water Level
▼	Final Ground Water Level
T	Standard Penetration Sampler
M	Modified California Sampler
I	Shelby Pitcher Tube Sampler

NOTES

*BLOWS per FOOT – Resistance to the advancement of the soil sampler-number of blows of a 140-pound hammer falling 30 inches to drive a split spoon sampler.

**Stratification lines on the logs represent the approximate boundary between soil types, and the transition may be gradual.

Modified California Sampler – 2 ½ O.D. (1 7/8 Inch I.D.) sampler

Standard Pennetration Sampler (Teizaghi) – 2 inch O.D. (1 3/8 Inch I.D.) split spoon sampler (ASTM D1586-84).

Shelby/Pitcher Tube Sampler – 3 ½ inch O.D. (3 inch I.D.) CME brand split spoon sampler (5 foot long); advances with augers and provides a 3 foot long continuous core.

BORING LOG

No. B-1

PROJECT ENCINA HILLS SUBDIVISION
DATE 3/21/01
LOGGED BY ACK
DRILL RIG MOBILE B-24
HOLE DIA. 4"
SAMPLER SPT
GROUND WATER DEPTH INITIAL: –
FINAL: –
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAYEY SAND: medium brown, damp, medium dense; ~10-20% fines, predominantly fine to medium grained; COLLUVIUM	SC	1										
		2	T	30								
		3										
SILTY SAND: light gray-brown, damp, very dense; ~20% fines, mostly fine to medium grained; weakly to moderately cemented; PASO ROBLES FORMATION	SM	4	T	50/4-1/2								
		5										
		6										
		7										
		8										
		9										
~20-30% fines, sand is poorly graded, fine grained, ~5% coarse sand and fine, rounded gravel		10	T	71								
		11										
		12										
		13										
		14										
~10% fines, well graded, ~15-20% rounded shale gravel to 1"; moderately cemented		15	T	50/6								
		16										
		17										
		18										
		19										
weakly cemented; minor gravel to ~1/2"		20	T	73								

BORING LOG

No. B-1

PROJECT ENCINA HILLS SUBDIVISION DATE 3/21/01 LOGGED BY ACK

DRILL RIG MOBILE B-24 HOLE DIA. 4" SAMPLER SPT

GROUND WATER DEPTH INITIAL: -- FINAL: -- HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
	SM	21										
		22										
		23										
poorly graded, fine to medium grained, ~5% coarse sand, no gravel		24	T	50/6								
Bottom of boring @ 24.5'. No ground water encountered.		25										
		26										
		27										
		28										
		29										
		30										
		31										
		32										
		33										
		34										
		35										
		36										
		37										
		38										
		39										
		40										

BORING LOG

No. B-2

PROJECT ENCINA HILLS SUBDIVISION

DATE 3/21/01

LOGGED BY ACK

DRILL RIG MOBILE B-24

HOLE DIA. 4"

SAMPLER SPT

GROUND WATER DEPTH INITIAL: –

FINAL: –

HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SILTY SAND: medium brown, damp (wet @ 1-2'); ~20% fines, sand is poorly graded, fine to medium grained, ~5% coarse sand; COLLUVIUM	SM	1										
		2										
SILTY SAND: light brown, damp, dense; ~10-20% fines, minor fine, rounded gravel; weakly cemented; PASO ROBLES FORMATION	SM	3	T	37								
		4	T	50/4								
very dense		5										
		6										
		7										
		8										
		9										
		10	T	50/6								
		11										
		12										
		13										
		14										
		15	T	50/6								
		16										
CLAYEY SAND: light gray-brown, damp, very dense; ~20% fines, poorly graded, medium grained; PASO ROBLES FORMATION	SC	17										
		18										
auger refusal		19										
Bottom of boring @ 19'. No ground water encountered		20										

Project # 1892

D&M CONSULTING ENGINEERS, INC.

Page 1 of 1

BORING LOG

No. B-3

PROJECT ENCINA HILLS SUBDIVISION DATE 3/21/01 LOGGED BY ACK

DRILL RIG MOBILE B-24 HOLE DIA. 4" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)
SILTY SAND: medium brown, damp, dense; ~10-20% fines, well graded; COLLUVIUM	SM	1										
		2										
SILTY SAND: gray-brown, damp, very dense; ~10-20% fines, well graded, moderately cemented; PASO ROBLES FORMATION	SM	3	T	39								
		4	T	50/2								
		5										
		6										
		7										
		8										
predominantly fine to medium grained, ~10-20% coarse sand		9	T	50/3								
		10										
		11										
		12										
		13										
		14										
~10% fines, trace fine, rounded gravel		15	T	77								
Bottom of boring @ 15'. No ground water encountered.		16										
		17										
		18										
		19										
		20										

Project # 1892 D&M CONSULTING ENGINEERS, INC. Page 1 of 1

BORING LOG

No. B-4

PROJECT ENCINA HILLS SUBDIVISION DATE 3/21/01 LOGGED BY ACK

DRILL RIG MOBILE B-24 HOLE DIA. 4" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SILTY SAND: medium brown, damp, medium dense; ~10-20% fines, mostly fine grained, ~5-10% coarse sand; COLLUVIUM	SM	1										
		2										
light yellow brown			T	24								
		3										
mottled brown, yellow-brown, and orange-brown, loose; minor sandstone gravel		4										
		5	T	9								
POORLY GRADED SAND: tan, damp, dense; <5% fines, fine grained; PASO ROBLES FORMATION	SP	6										
		7										
		8										
		9										
		10	T	31								
		11										
		12										
		13										
		14										
tan with pink mottles, very dense; ~5-10% low-plasticity fines		15	T	75								
		16										
		17										
		18										
WELL GRADED SAND WITH CLAY: tan, damp, very dense; ~5-10% fines; PASO ROBLES FORMATION	SW-SC	19										
			T	48/6								
		20										

BORING LOG

No. B-4

PROJECT ENCINA HILLS SUBDIVISION DATE 3/21/01 LOGGED BY ACK

DRILL RIG MOBILE B-24 HOLE DIA. 4" SAMPLER SPT

GROUND WATER DEPTH INITIAL: — FINAL: — HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
	SW-SC	21										
		22										
		23										
weakly cemented		24	T	50/4-1/2								
Bottom of boring @ 24.5'. No ground water encountered		25										
		26										
		27										
		28										
		29										
		30										
		31										
		32										
		33										
		34										
		35										
		36										
		37										
		38										
		39										
		40										

BORING LOG

No. B-5

PROJECT	ENCINA HILLS SUBDIVISION	DATE	3/21/01	LOGGED BY	ACK
DRILL RIG	MOBILE B-24	HOLE DIA. 4"	SAMPLER	SPT	
GROUND WATER DEPTH INITIAL:	–	FINAL:	–	HOLE ELEVATION:	

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
WELL GRADED SAND WITH SILT: brown, wet; ~10% fines, predominantly fine to medium grained; COLLUVIUM	SW-SM	1										
		2										
WELL GRADED SAND WITH SILT: brown, damp, very dense; ~10-20% fines; cemented; PASO ROBLES FORMATION	SW-SM	3	T	60								
		4	T	50/3-1/2								
~10% fine gravel		5										
		6										
		7										
		8										
		9										
dense; ~5% fine gravel		10	T	45								
		11										
		12										
auger refusal @ 13'		13										
dense/very dense		14	T	50								
Bottom of boring @ 14.5'.		15										
No ground water encountered.		16										
		17										
		18										
		19										
		20										

Project # 1892 D&M CONSULTING ENGINEERS, INC. Page 1 of 1

BORING LOG

No. B-6

PROJECT ENCINA HILLS SUBDIVISION
DATE 3/21/01
LOGGED BY ACK
DRILL RIG MOBILE B-24
HOLE DIA. 4"
SAMPLER SPT
GROUND WATER DEPTH INITIAL: –
FINAL: –
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SILTY SAND: medium brown, damp; ~10-20% fines, mostly fine to medium grained, minor fine gravel; COLLUVIUM	SM	1										
		2										
SILTY SAND: light brown, damp, very dense; ~20-30% fines, fine to medium grained, minor coarse sand; PASO ROBLES FORMATION	SM	3	T	67								
		4										
minor fine, granitic gravel		5	T	54								
		6										
		7										
		8										
		9										
no gravel		10	T	92								
Bottom of boring @ 10'. No ground water encountered.		11										
		12										
		13										
		14										
		15										
		16										
		17										
		18										
		19										
		20										

Project # 1892 D&M CONSULTING ENGINEERS, INC. Page 1 of 1

BORING LOG

No. B-7

PROJECT ENCINA HILLS SUBDIVISION
DATE 5/29/01
LOGGED BY CMP

DRILL RIG CME 65
HOLE DIA. 8"
SAMPLER SPT

GROUND WATER DEPTH INITIAL: –
FINAL: –
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SANDY SILT: dark yellowish brown, damp; 55% silt, 45% fine sand	ML	1										
		2										
SANDY CLAY: dark brown, damp, hard; 20-30% fine to medium sand, low plasticity, massive	CL	3										
clay decreases with depth		4	T	40	1.0							
SANDY SILTY TO CLAYEY SAND: brown, damp, stiff/dense; 30-60% fine sand (varies), slightly plastic; sandier with depth to 5'	ML-SC	5										
		6										
		7										
		8										
CLAYEY SAND: very dark gray brown, damp, medium dense; 20-30% clay fines, 60-80% fine to coarse sand; clay content varies in sample, locally very sandy; massive	SC	9										
		10	T	23	3.2	2.5						
		11										
		12										
		13										
CLAYEY SAND TO POORLY GRADED SAND: brownish yellow, damp to slightly moist, medium dense; fine to medium sand mixed with low-plasticity clay and as thin beds; crudely bedded overall	SC-SP	14										
		15	T	18	1.5	1.0						
		16										
		17										
		18										
very thin clayey beds to laminae @ 19', containing disseminated fine sand		19										
POORLY GRADED SAND	SP	20	T	28	2.25	2.3						

BORING LOG

No. B-7

PROJECT	ENCINA HILLS SUBDIVISION	DATE	5/29/01	LOGGED BY	CMP
DRILL RIG	CME 65	HOLE DIA.	8"	SAMPLER	SPT
GROUND WATER DEPTH INITIAL:	–	FINAL:	–	HOLE ELEVATION:	

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
POORLY GRADED SAND: yellowish brown, damp, medium dense: 10-15% non-plastic fines, 85-90% fine to coarse sand; well-bedded; slightly moist 18.5-19.5'	SP	21										
		22										
		23										
		24										
dense; <10% fines, sand locally very poorly sorted and clean		25	T	34	<0.5							
		26										
		27										
		28										
		29										
5-10% fines, rare fine gravel; massive to crudely bedded, local graded sand beds with coarse lag sands		30	T	36	1.0							
		31										
		32										
		33										
WELL GRADED SAND: very pale brown, damp, dense; 5% fines, 95% fine to coarse sand; massive to crudely bedded, local coarse lenses; possible reduced plant matter	SW	34										
		35	T	40	0.5							
		36										
drills as gravel		37										
		38										
very dense, ~10% fines, less coarse sand 39-40'; bedded		39										
		40	T	52	1.5							

BORING LOG

No. B-7

PROJECT ENCINA HILLS SUBDIVISION DATE 5/29/01 LOGGED BY CMP

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
	SW	41										
		42										
		43										
POORLY GRADED TO WELL GRADED SAND: yellow, damp, very dense; 5% non-plastic fines, 95% fine to coarse sand; variably bedded, grades in and out, some iron oxide-defined bedding	SP-SW	44										
		45	T	50	0.5							
		46										
		47										
		48										
POORLY GRADED SAND: yellow, damp, dense; ~10% non-plastic fines, fine to medium sand; crudely bedded, locally fine sand beds	SP	49										
		50	T	44	0.7							
Bottom of boring @ 50'. No ground water encountered.		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

BORING LOG

No. B-8

PROJECT ENCINA HILLS SUBDIVISION DATE 5/30/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: -- FINAL: -- HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SILTY SAND: gray-brown, damp, loose; COLLUVIUM	SM	1										
		2										
		3										
CLAYEY SAND: light brown, damp, very dense; ~15-20% fines, sand is well-graded; minor fine, angular granitic gravel; PASO ROBLES FORMATION	SC	4										
		5	T	50/5								
		6										
		7										
		8										
		9										
		10										
locally, small granitic gravel, subangular to rounded			T	68								
		11										
		12										
		13										
SILTY SAND: light gray-brown, damp, very dense; ~30% low-plasticity fines, poorly graded, fine-grained	SM	14										
		15										
Drilling very slow from 15'			T	9/11								
		16										
		17										
		18										
WELL-GRADED SAND WITH CLAY: light yellow-brown, damp, very dense; ~10% fines, predominantly fine to medium-grained, ~10% coarse sand	SW-SC	19										
		20	T	50/6								

BORING LOG

No. B-8

PROJECT	ENCINA HILLS SUBDIVISION	DATE	5/30/01	LOGGED BY	ACK
DRILL RIG	CME 65	HOLE DIA.	8"	SAMPLER	SPT
GROUND WATER DEPTH INITIAL:	–	FINAL:	–	HOLE ELEVATION:	

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		21										
		22										
		23										
		24										
~20% fines, predominantly medium to coarse sand		25	T	50/5								
		26										
		27										
		28										
		29										
~10-15% fines		30	T	90								
		31										
		32										
		33										
		34										
POORLY GRADED SAND WITH SILT: light yellow-brown, damp, very dense; ~5-10% fines, fine to medium grained	SP-SM	35	T	50/4								
		36										
		37										
		38										
POORLY GRADED SAND: light yellow-brown, damp, very dense; <5% fines, predominantly fine to medium sand, ~10% coarse sand	SP	39										
		40	T	50/4								

BORING LOG

No. B-8

PROJECT ENCINA HILLS SUBDIVISION DATE 5/30/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		41										
		42										
		43										
		44										
		45	T	50/5								
Drilling very slow 45-50'		46										
		47										
CLAYEY SAND: light yellow-brown, damp, very dense: ~15-20% fines, well graded, slightly cemented	SC	48										
		49	T	50/5								
Bottom of boring @ 49'. No ground water encountered.		50										
		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

BORING LOG

No. B-9

PROJECT ENCINA HILLS SUBDIVISION DATE 5/31/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
See log for B-3		1										
		2										
		3										
		4										
		5										
		6										
		7										
		8										
		9										
		10										
		11										
		12										
		13										
		14										
		15										
		16										
		17										
CLAYEY SAND: medium brown, damp, dense; ~20-30% fines, well-graded sand, ~5% small gravel, occasional larger, completely weathered granitic gravel		18										
		19										
		20	☐									

BORING LOG

No. B-9

PROJECT	ENCINA HILLS SUBDIVISION	DATE	5/31/01	LOGGED BY	ACK
DRILL RIG	CME 65	HOLE DIA.	8"	SAMPLER	SPT
GROUND WATER DEPTH INITIAL:	–	FINAL:	–	HOLE ELEVATION:	

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		21	T	46								
		22										
WELL-GRADED SAND WITH CLAY: medium brown, damp, dense; ~10-15% fines, predominantly medium to coarse, trace fine gravel	SW-SC	23										
		24										
		25	T	35								
		26										
		27										
		28										
		29										
locally moist		30	T	27								
		31										
		32										
		33										
		34										
		35										
~15-20% fines, ~5% granitic gravel, some completely weathered clasts >1"		36	T	54								
		37										
		38										
WELL GRADED SAND WITH CLAY AND GRAVEL: light brown, damp, very dense; ~10% fines, mostly medium to coarse sand, ~20% well-graded gravel	SW-SC	39										
		40	T	50/6								

BORING LOG

No. B-9

PROJECT ENCINA HILLS SUBDIVISION DATE 5/31/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		41										
		42										
		43										
SANDY CLAY TO CLAYEY SAND: light gray-brown with local pink mottles, damp, hard/very dense; low-plasticity fines, sand is well-graded Slow drilling 45-50'	SC/ CL	44										
		45										
		46	T	64								
		47										
		48										
CLAYEY SAND: light brown, damp, very dense; ~30-40% fines, well-graded, locally up to ~5% fine, granitic gravel	SC	49										
		50	T	50/5								
Bottom of boring @ 50'. No ground water encountered		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

BORING LOG

No. B-10

PROJECT ENCINA HILLS SUBDIVISION
DATE 6/1-5/2001
LOGGED BY CMP/ACK
DRILL RIG CME 65
HOLE DIA. 8"
SAMPLER SPT
GROUND WATER DEPTH INITIAL: –
FINAL: –
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
See log for B-1		1										
		2										
		3										
		4										
		5										
		6										
		7										
		8										
		9										
		10										
		11										
		12										
		13										
		14										
		15										
		16										
		17										
		18										
		19										
Drills slow/hard to 20'		20										

BORING LOG

No. B-10

PROJECT ENCINA HILLS SUBDIVISION DATE 6/1-5/2001 LOGGED BY CMP/ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		21										
Drills very hard, gravel chatter 22 to 23'		22										
		23										
SANDY SILT: brown, damp, hard; non-plastic to very slightly plastic fines, 30% sand; crudely bedded; appears to grade to more clayey silt @24.5'	ML	24										
		25										
			T	39	4.0							
		26										
		27										
		28										
		29										
SANDY SILT WITH GRAVEL: pale brown, damp, hard; non-plastic fines, 5% coarse gravel; massive, damp	ML	30			3.5							
			T	66								
		31										
becomes sandier, locally 30-40% fine sand with thin coarse sand lenses Hard drilling 31-33'		32										
		33										
WELL-GRADED GRAVELLY SAND TO WELL-GRADED SAND: very pale brown, damp, very dense; 5-10% non-plastic fines, 60-90% fine to coarse sand, up to 20% fine gravel; massive; contains fine to coarse gravel lenses	SW	34										
			T	50/6								
		35										
		36										
		37										
very hard drilling		38										
CLAYEY SAND: medium brown, damp, dense; ~30-40% fines, well-graded	SC	39										
Auger refusal @ 40'		40			>4.5							

BORING LOG

No. B-10

PROJECT ENCINA HILLS SUBDIVISION
DATE 6/1-5/2001
LOGGED BY CMP/ACK
DRILL RIG CME 65
HOLE DIA. 8"
SAMPLER SPT
GROUND WATER DEPTH INITIAL: --
FINAL: --
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
	SC		T	44								
Bottom of boring @ 40.5'. No ground water encountered		41										
		42										
		43										
		44										
		45										
		46										
		47										
		48										
		49										
		50										
		51										
		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

BORING LOG

No. B-11

PROJECT ENCINA HILLS SUBDIVISION DATE 6/5/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 6" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
SILTY SAND: light brown, damp, loose; ~30% fines, predominantly fine to medium grained, some coarse sand; COLLUVIUM	SM	1										
		2										
		3										
		4										
Drilling harder @ 5'		5										
CLAYEY SAND: light brown, damp, very dense; ~20% fines, mostly fine to medium grained, minor fine gravel; PASO ROBLES FORMATION	SC	6										
			T	54	2.0							
		7										
		8										
		9										
		10										
~10-20% fines, sand is well graded		11										
			T	64	3.0							
		12										
SILTY SAND: light yellow-brown, damp, very dense; ~30% fines, mostly fine to medium grained, some coarse sand, ~5% fine gravel	SM	13										
		14										
		15										
		16			2.0							
CLAYEY SAND: light brown, damp, very dense; ~30-40% fines, well-graded	SC		T	80	>4.5							
		17										
Drilling becomes harder		18										
POORLY GRADED SAND: light yellow-brown, damp, very dense; ~5% fines, mostly fine to medium grained, trace coarse sand	SP	19										
		20										

BORING LOG

No. B-11

PROJECT ENCINA HILLS SUBDIVISION DATE 6/5/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 6" SAMPLER SPT

GROUND WATER DEPTH INITIAL: -- FINAL: -- HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		21										
WELL-GRADED SAND WITH CLAY: light brown, damp, very dense; ~10-20% fines	SW-SC	22	T	79	1.0							
		23										
		24										
		25										
very hard drilling		26			3							
CLAYEY SAND TO SANDY CLAY: light brown, damp, dense-very dense/hard;	SC/CL	27	T	55	>4.5							
		28										
		29										
		30										
		31			2.5							
mostly fine to medium grained sand; trace fine gravel		32	M	50	1.5							
		33										
		34										
light brown with darker brown beds, very dense ~20% fines, crudely laminated		35										
		36										
easier drilling		37	T	60	>4.5							
WELL-GRADED SAND WITH CLAY: light brown, damp, very dense; ~10-20% fines, mostly medium to coarse, trace fine gravel	SW-SC	38										
		39										
		40										

BORING LOG

No. B-11

PROJECT ENCINA HILLS SUBDIVISION DATE 6/5/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
		41	T	50/6	2.5							
		42										
CLAYEY SAND: mottled light to medium brown, damp, dense; ~30% fines, well-graded, minor charcoal	SC											
		43										
		44										
		45										
		46										
			T	42	4.5							
		47										
		48										
		49										
		50										
very dense		51										
			T	68	4.5							
Bottom of boring @ 51.5'. No ground water encountered.		52										
		53										
		54										
		55										
		56										
		57										
		58										
		59										
		60										

BORING LOG

No. B-12

PROJECT ENCINA HILLS SUBDIVISION
DATE 6/6/01
LOGGED BY ACK
DRILL RIG CME 65
HOLE DIA. 6"
SAMPLER SPT
GROUND WATER DEPTH INITIAL: --
FINAL: --
HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
CLAYEY SAND: light brown, damp; ~40% fines, well-graded; COLLUVIUM	SC	1										
		2										
		3										
		4										
WELL-GRADED SAND WITH CLAY: mottled light and medium brown, damp, very dense; ~10-15% fines, ~15% small, subangular to rounded granitic gravel; PASO ROBLES FORMATION	SW-SC	5										
		6	T	50/3	2.75							
		7										
		8										
CLAYEY SAND: light gray-brown with local darker brown mottles, damp, very dense; ~20-30% fines, sand is well graded, trace fine gravel	SC	9										
		10										
			T	58	2.5							
		11										
		12										
		13										
		14										
light yellow-brown		15										
			T	54	3.0							
		16										
		17										
		18										
dense; ~10-20% fines, occasional subangular granitic gravel to ~1"		19										
		20										

BORING LOG

No. B-12

PROJECT ENCINA HILLS SUBDIVISION DATE 6/6/01 LOGGED BY ACK

DRILL RIG CME 65 HOLE DIA. 8" SAMPLER SPT

GROUND WATER DEPTH INITIAL: – FINAL: – HOLE ELEVATION:

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT	WATER CONTENT	PLASTIC LIMIT	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
			T	44								
		21										
		22										
		23										
very dense; ~30% fines, charcoal @ 24.5'		24										
WELL-GRADED SAND WITH CLAY: light yellow-brown, damp, very dense; ~10% fines, mostly medium to coarse	SW-SC	25			>4.5							
			T	64	1.25							
Bottom of boring @ 25.5'. No ground water encountered.		26										
		27										
		28										
		29										
		30										
		31										
		32										
		33										
		34										
		35										
		36										
		37										
		38										
		39										
		40										

APPENDIX F - GROUNDWATER RESOURCES

Monterey County Division of Environmental Health. Project Specific Hydrogeologic Report. Prepared by Todd Engineers. September 2002. Updated July 2003.

Monterey County division of Environmental Health. Written Correspondence to Paul Mugan, Associate Planner, Planning and Building Inspection Department from Laura Lawrence, R.E.H.S., EHS IV, Health Department. November 12, 2002.

California-American Water Company. Written Correspondence to Mr. Michael Cling, Attorney at Law from Terry Ryan. April 19, 2001.

Monterey County Health Department
Environmental Health Division
1270 Natividad Road
Salinas, California 93906

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Project Specific Hydrogeologic Report

Harper Canyon Realty, LLC Subdivision

Updated July 2003

Prepared by:

Todd Engineers
Emeryville, California

Project Specific Hydrogeologic Report
Harper Canyon Realty, LLC Subdivision

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Prepared for:

Monterey County Health Department
Environmental Health Division
1270 Natividad Road
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Principal Geologist

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Executive Summary

The Monterey County Health Department, Division of Environmental Health is requiring a Project Specific Hydrogeologic Report for the proposed Harper Canyon Realty LLC (PLN 000696) development prior to deeming the application complete per authority of Title 19 of the Monterey County Code. This report summarizes Todd Engineers' review of available data and reports concerning the hydrogeologic conditions at the proposed site and vicinity. Todd Engineers examined the availability of sustainable long-term water supply for the project, conducted a local water balance, and identified potential effects the project may have on the quantity and quality of groundwater given the data available. The initial Project Specific Hydrogeologic Report was prepared in September 2002. This report updates that draft report with information from a new well.

The Harper Canyon Realty LLC subdivision (site) is approximately 12 miles southeast of Carmel. The 344 acre property will have seventeen homes with the combined lots comprising 164 acres on the northern portion of the property. The remaining property will be open space. Water supply for the development will include an existing well located outside of the subdivision moratorium area in the nearby Oaks subdivision and a new well, also outside of the subdivision moratorium area, east of San Benancio Road approximately 3,100 feet southeast of the Oaks well and approximately 2,600 feet west of the southern portion of the Harper Canyon property. This updated Project Specific Hydrogeologic Report includes installation and testing information from this new well, which had not be installed at the time of the September 2002 report. The Oaks well is currently supplying water at a rate of 4 gallons per minute (gpm) to nine homes in the Oaks subdivision. The Oaks well and new well will be tied together and supply water to the proposed subdivision. This new system will be transferred to the California-American Water Company (Cal Am) and operated as a satellite system.

Todd Engineers' review of available data indicates that pumping 13 acre feet per year (8 gpm) for the proposed Harper Canyon development will not deplete the aquifer on a regional basis. The Oaks well appears to be capable of sustaining a long-term pumping rate of 12 gpm to supply the Oaks subdivision and the Harper Canyon homes and does not appear to result in any appreciable impacts to nearby wells. Available data from the new well indicate that it can also sustain a long-term pumping rate over 12 gpm. Available data also indicate that the project will have a negligible effect on groundwater quantity and quality and that an adequate water supply exists. Neighboring wells should be monitored when the new well is pumped for long periods of time and, if impacts are seen, more production could be shifted to the Oaks well where there are fewer nearby wells.

Mitigation
from

Introduction

Background

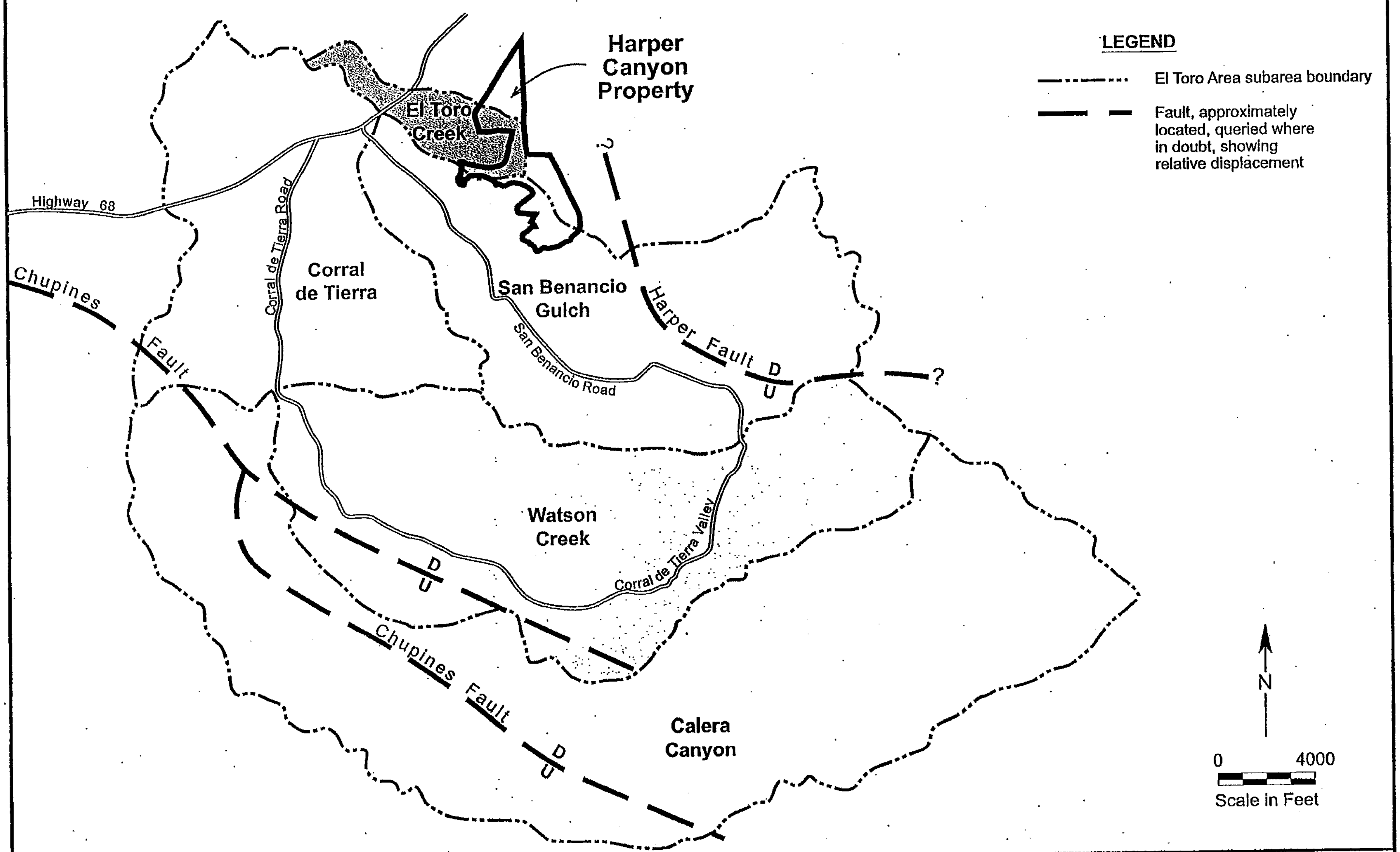
The Monterey County Health Department, Division of Environmental Health is requiring a Project Specific Hydrogeologic Report for the proposed Harper Canyon Realty LLC (PLN 000696) subdivision prior to deeming the application complete per authority of Title 19 of the Monterey County Code.

The Harper Canyon Realty LLC subdivision (site) is approximately 12 miles southeast of Carmel and just south of State Highway 68 and east of San Benancio Road (Figure 1). Seventeen homes are proposed on the northern portion of the property (Figure 2). The Harper Canyon LLC property covers 344 acres with the combined lots comprising 164 acres. The remaining 180 acres will remain as open space (Lawrence, June 4, 2002).

It is proposed that the development will merge with the nearby Oaks subdivision. The California-American Water Company (Cal Am) supplies water to the Oaks subdivision but its main supply wells are located further west in an area currently under a subdivision moratorium (called Zone B-8). One existing well outside the moratorium area (referred to as the Oaks well) supplies 4 gpm of water to nine homes in the Oaks subdivision. This well will be supplemented with a recently installed well east of San Benancio Road approximately 3,100 feet southeast of the Oaks well and approximately 2,600 feet west of the southern portion of the Harper Canyon property. The Oaks well and the new well will be tied together and supply water to the proposed subdivision. This new system will be transferred to Cal Am and operated as a satellite system to keep water from wells outside of the moratorium area separate from the other Cal Am wells. This prevents use in the moratorium area of water from the Salinas Valley Groundwater Basin Assessment Zone (called Zone 2/2A), in which the Oaks well and new well are located. Zone 2/2A is the area east of San Benancio Road (Lawrence, May 31, 2002).

Scope

This report summarizes Todd Engineers' review of available data and reports concerning the hydrogeologic conditions at the proposed site and vicinity. The purpose of the report is to provide an integrated overview of water resource conditions and potential impacts on groundwater and



From: Staal, Gardner and Dunne, August 1991.

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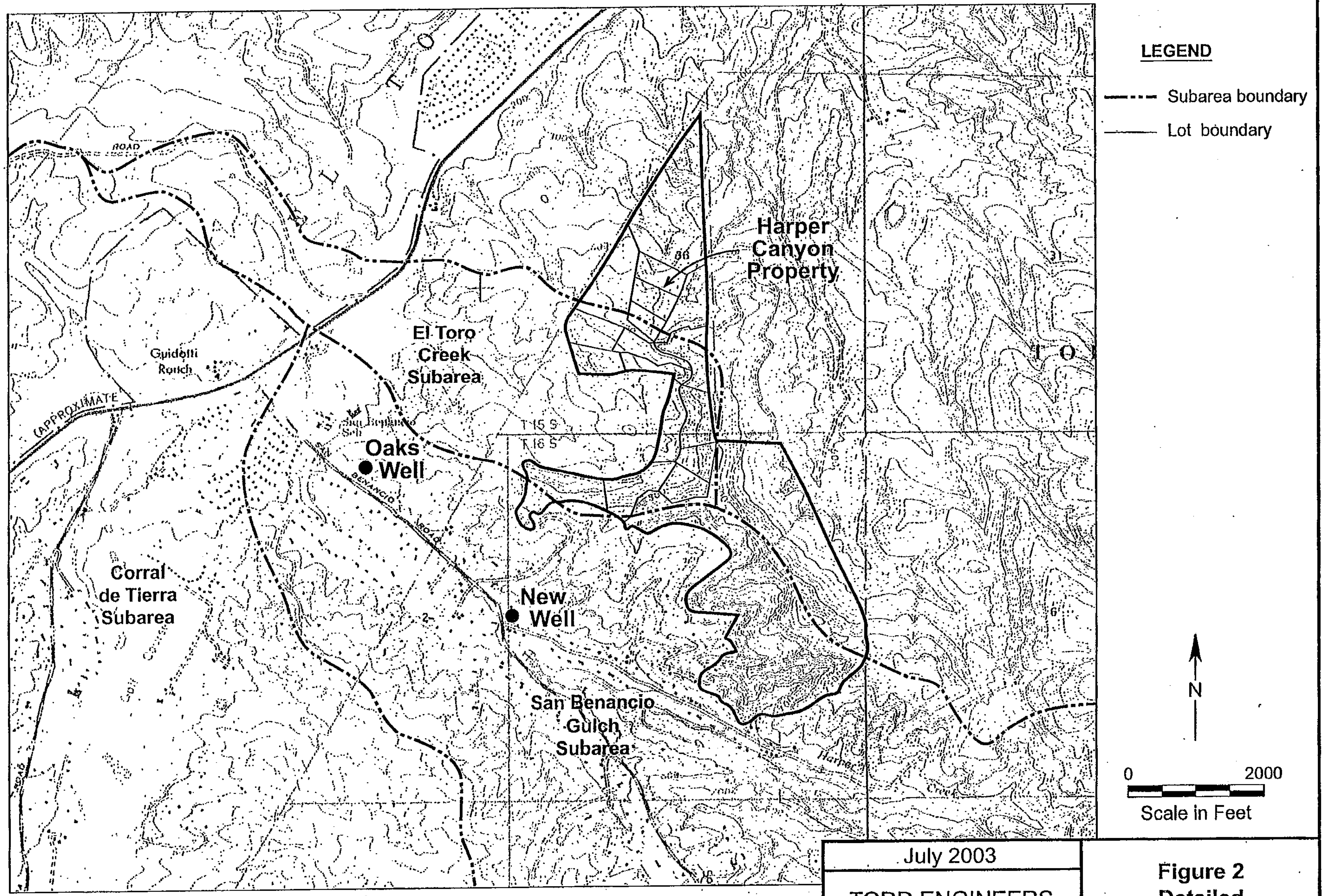
Emeryville, California

Figure 1
Harper Canyon Property Location



Base: USGS Spreckels 7.5 minute topographic map.

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Figure 2
Detailed Location Map

mitigation measures resulting from the proposed development. Specifically, Todd Engineers examined the availability of sustainable long-term water supply for the project, conducted a local water balance, and identified potential effects the project may have on the quantity and quality of groundwater given the data available. This report updates a September 2002 report with installation and testing information from the new well which was installed in April 2003 and tested in June 2003.

Acknowledgements

This report was prepared under the supervision of David Abbott and Phyllis Stanin of Todd Engineers. We appreciate the direction and information from Laura Lawrence of the Monterey County Department of Health and her staff.

Hydrogeology

Geologic and Hydrogeologic Setting

The site is in the northern portion of the Salinas Valley, which is in the central part of the California Coast Ranges. The Salinas Valley is a northwest trending tectonic basin 120 miles long and up to 6 miles wide (EDAW, June 2001). The area is underlain by the Paso Robles Formation, which consists of a thick sequence of continental deposits of interbedded sand, gravel, and clay. This formation, also called the Aromas-Paso Robles Formation, is approximately 400 feet thick just west of the site (Feeney, August 8, 2000). The Santa Margarita Sandstone underlies the Paso Robles Formation and the Monterey Shale is below the Santa Margarita Sandstone.

The site is located in the Pressure subarea of the Salinas Valley Groundwater Basin (EDAW, June 2001). The site is in two subareas of the El Toro planning area of Monterey County (see Figure 2). The El Toro planning area has been divided into five subareas based on surface drainage divides (Figure 1). The southwestern portion of the site is in the San Benancio Gulch subarea and the central portion of the site containing most of the proposed development is in the El Toro Creek subarea. The northern tip and eastern strip of the site are outside of the El Toro planning area in the Greater Salinas planning area. Groundwater in the El Toro subareas north of the Chupines Fault is believed to be interconnected (Staal, Gardner & Dunne, August 1991; Fugro, February 1996; and Fugro, February 4, 1998).

Aquifers and Water Supply Wells

In the vicinity of the site, groundwater is pumped from three water bearing units; the Aromas-Paso Robles Formation, the Santa Margarita Sandstone, and alluvium in local drainages. The Monterey Shale is not considered water bearing since it produces wells with low yields and poor water quality in this area (Schmidt, May 31, 2001). In the vicinity of the Oaks well the Paso Robles Formation is approximately 400 feet thick and the Santa Margarita Sandstone is approximately 250 feet thick (Feeney, February 11, 2000). Typical well yields and specific capacities are listed below for the two principal aquifers in this area (Feeney, February 11, 2000).

Water Bearing Unit	Well Yield (gpm)	Specific Capacity (gpm/ft)
Paso Robles Formation	up to 200	2
Santa Margarita Sandstone	over 500	5

gpm = gallons per minute
gpm/ft = gallons per minute per foot of drawdown

The Oaks well is six inches in diameter, approximately 410 feet deep, and produces from the Paso Robles Formation (Feeney, February 11, 2000 and August 12, 2000). The depth to groundwater in 2000 was 95 feet and the top of the 180-foot screen is at a depth of 220 feet. Feeney (August 12, 2000) reports that the Oaks well can easily produce the design discharge rate of 60 gpm. Assuming a 24-hour specific capacity of 1.1 gpm/ft as calculated from a pumping test, the well is theoretically capable of a discharge rate of 138 gpm without dewatering the screen. Therefore, the practical yield of this well should be about two-thirds of the theoretical capacity, or 92 gpm. This operational practice of using two-thirds of the available drawdown or capacity compensates for seasonal local and regional water level fluctuations, decreasing well and pump efficiencies, and interference from other pumping wells.

The new well was drilled and installed between March 29 and April 10, 2003 by Roy Alsop Pump and Drilling, Inc., Salinas, California. A mud rotary drilling rig was used to drill a 12-inch diameter borehole to 460 feet below ground surface. The well was constructed of 6-inch diameter PVC casing that is perforated from 150 to 450 feet below ground surface. The well is screened at similar depths as the Oaks well and appears to also produce water from the Paso Robles Formation. A copy of the Well Completion Report is in the Appendix.

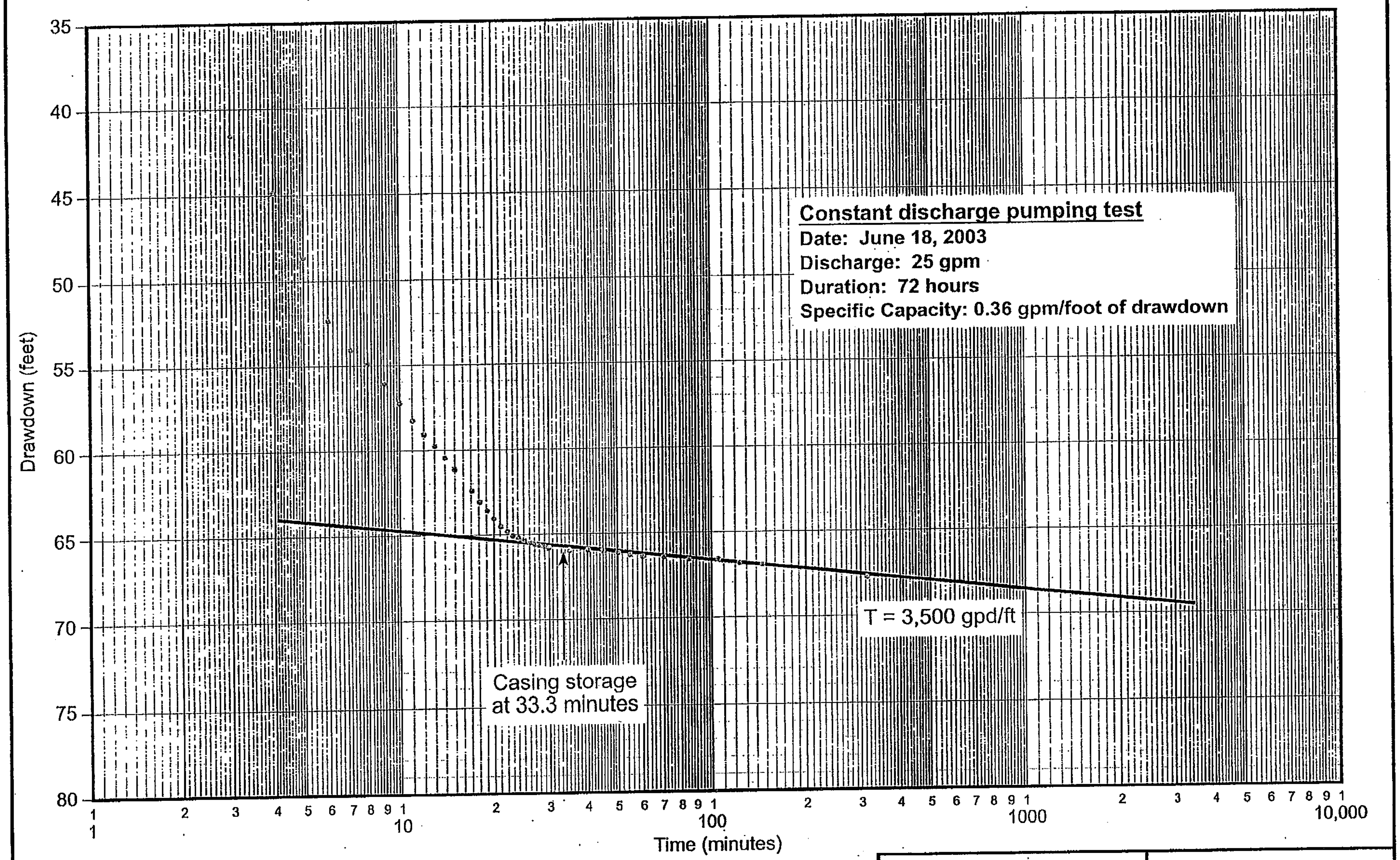
On June 18, 2003, Roy Alsop Pump and Drilling began a 72-hour constant-discharge pumping test on the new well. A 2-horsepower submersible pump was set at a depth of 211 feet. The static water level was measured at a depth of 102 feet providing available drawdown of 109 feet to the top of the pump. Note that this includes dewatering a portion of the 300-foot long screen. The pump was turned on at 10:40 am and the discharge rate and water level declines in the well were measured by Todd Engineers for the first five hours of the pumping test. The average discharge rate during the first five hours was 25 gpm and ranged between 24 gpm (at the five-hour mark) and 26 gpm (at the start of the test). Data were presented to a Monterey County inspector who visited the site at approximately 12:30 pm. Steve Allison of Roy Alsop Drilling measured the discharge rates and water levels in the well for the remainder of the 72-hour pumping test and for 48 hours of recovery. The drawdown at five hours was 67.83 feet (pumping water level was 169.83 feet below ground surface) while the maximum drawdown at 72 hours was 70 feet (172 feet below ground surface). A water quality sample was collected and sent to Monterey Bay Analytical Services in Carmel Valley at the end of the pumping test. The water level in the well recovered to 122.5 feet below ground surface after 48 hours of recovery. This equates to 71 percent recovery to the pre-pumping static water level (102 feet below ground surface). Todd Engineers assumes that the well continued to recover to near the original static water level after approximately 72 hours of non-pumping. Slow to incomplete recovery could indicate a highly inefficient well and/or an aquifer of limited extent. Pumping test, recovery, and water quality data are in the Appendix.

A Cooper-Jacob analysis (Driscoll, 1986) of the pumping test is shown on Figure 3. An analysis of the data indicates an aquifer transmissivity (T) of 3,500 gpd/ft. An evaluation of the specific capacity of the well during the test indicates that well efficiency is low (15 percent). Assuming a 24-hour specific capacity of 0.36 gpm/ft as calculated from the pumping test, the well is theoretically capable of a discharge rate of 17 gpm to the top of the screen. The practical yield is two-thirds of this at 12 gpm.

Groundwater Levels and Flow

Groundwater moves unimpeded across the El Toro subarea boundaries from the southern subareas to the northern subareas. Groundwater flow generally follows the topography and exits the El Toro planning area to the north and to the west. Groundwater elevations are about 320 feet above mean sea level in wells screened in the Paso Robles Formation in the northern San Benancio Gulch subarea (Schmidt, May 31, 2001).

The Monterey County Water Resources Agency has been measuring water levels in about 40 wells in the El Toro area since 1960. Schmidt (May 31, 2001) prepared updated hydrographs for these wells, including six wells in the San Benancio Gulch subarea. No long-term water level decline was apparent on hydrographs for two of these wells, which are screened in the Aromas-Paso Robles Formation and possibly the stream alluvium. The four other hydrographs were from wells screened in the Aromas-Paso Robles Formation and indicated long-term water level declines



Constant discharge pumping test
Date: June 18, 2003
Discharge: 25 gpm
Duration: 72 hours
Specific Capacity: 0.36 gpm/foot of drawdown

T = 3,500 gpd/ft

Casing storage at 33.3 minutes

July 2003 TODD ENGINEERS Emeryville, California	**Figure 3** **Constant Discharge Pumping Test** **Harper Canyon**

between 0.4 and 1.6 feet per year from 1960 to 2000. Apparently no wells are monitored in the El Toro Creek subarea.

Groundwater Quality

Typical water quality for the two principal aquifers in this area is of a calcium-bicarbonate type for the Paso Robles Formation and of the sodium-chloride type for the Santa Margarita Sandstone with total dissolved solids (TDS) of 500 parts per million (ppm) and 1,000 ppm, respectively (Feeney, February 11, 2000).

Water quality data from the Oaks well was collected in July of 2000 and found to be of the sodium-chloride type (Feeney, August 12, 2000). Groundwater meets primary drinking water standards but exceeds secondary esthetic standards for TDS, electrical conductivity, and manganese. Primary maximum contaminant levels (MCLs) are enforceable while secondary standards are guidelines based on such criteria as taste, odor, and laundry staining.

The new well was sampled for water quality June 20, 2003 and found to be of the sodium-chloride type. Although both the Oaks well and the new well appear to be screened in the Paso Robles Formation, their water quality type (sodium-chloride) is more like the Santa Margarita as defined by Feeney (August 12, 2000). Water pumped from the new well may need to be treated since several constituents exceeded secondary MCLs as listed below. Hardness at 224 ppm and sodium at 127 ppm were also elevated, although MCLs have not been set for these two constituents.

Constituent	**Concentration**	**Secondary MCL**
Chloride	263 ppm	250 ppm
Manganese	169 ppb	50 ppb
Electrical conductance	1120 umhos/cm	900 umhos/cm
Total dissolved solids	689 ppm	500 ppm

Water Balance

A simple water balance was conducted to compare inflows (recharge) and outflows (demand) to determine if a surplus or deficit exists between groundwater demand and recharge.

Recharge

Todd Engineers reviewed recharge calculations by Staal, Gardner & Dunne, Inc. (August 1991) and Fugro (February 1996). Their estimates of 2.18 and 1.93 to 3.13 inches/year, respectively, seem reasonable given the annual precipitation and assumptions used in the calculations. Using a value of 2.18 inches for recharge, the total recharge in the El Toro Creek and San Benancio Gulch subareas was calculated by Feeney (April 25, 2000) to be 74 and 486 acre-feet per year (AF/y), respectively. This assumed "retrievable" acreages within each subarea watershed of 408 acres for El Toro Creek and 2,678 acres for San Benancio Gulch subareas.

Project Water Demand

The 17 lots are proposed to use a total of 5.61 AF/y (Harper Canyon Realty, May 30, 2001 and Lawrence, June 4, 2002). This results in a usage of 0.33 AF/y per home (5.61 AF/y/17 homes). Landscape irrigation is expected to be minimal and the development will be sewered. Thus, recharge associated with irrigation or septic system use is assumed to be negligible. Water supply for the development will come from the Oaks well and the new well west of the Harper Canyon property.

This water usage rate estimated by the applicant is on the low end when compared to typical water usage values in the area. Fugro (February 1996) estimated the average interior water usage of an existing home at 0.38 AF/y and exterior usage at 0.28 AF/y in the El Toro area. The Toro Water Company customers in the area used 0.68 AF/y between 1990 and 1993 and Ambler Park Water Company customers used 0.63 AF/y between 1984 and 1990 (Fugro, February 1996). For planning purposes, Monterey County has used a demand of 0.75 AF/y per home in the Rancho San Carlos development (Lawrence, September 6, 2002). After review of these demands and discussions with county staff, it was decided to assume a demand value of 0.75 AF/y per home for a total demand of 12.75 AF/y for the 17 homes.

Comparison of Supply and Demand

Fugro (February 1996) concluded that recharge values in the four El Toro subareas north of the Chupines Fault, which are considered interconnected, exceeded current demand and were sufficient to meet estimated demand at build-out. The table below summarizes 1995 use and build-out projections from the Fugro (February 1996) report and updated in Feeney (April 25, 2000) using a recharge value of 2.18 inches. Build-out conditions were for 175 units in the El Toro Creek subarea and 542 units in the San Benancio Gulch subarea.

Subarea	Recharge @ 2.18 inches	1995 Demand (number of units)	Build-out Demand (number of units)	Build-out Water Surplus
El Toro Creek	74 AF/y	1.1 AF/y (1 unit)	69.3 AF/y (175 units)	4.7 AF/y
San Benancio Gulch	486 AF/y	342.2 AF/y (413 units)	456.1 AF/y (542 units)	29.9 AF/y

These values reflect a 1995 interior use of 0.38 AF/y per unit (57.6 percent) and exterior use of 0.28 AF/y per unit (42.4 percent). Future interior use was estimated to decrease to 0.20 AF/y per unit. The values also assume that 80 percent of the interior usage returns via septic systems and 20 percent of exterior usage is return flow. Additional irrigation needs of larger ranchettes and public areas are also included in these totals. Since the Harper Canyon homes will be sewered, no return flows via septic systems will occur. Assuming that 57.6 percent of water usage is interior the loss of septic return can be estimated to be 5.875 AF/y (12.75 AF/y x 0.576 x 0.80). Since this value is greater than the estimated surplus at projected build-out for the El Toro Creek subarea, the water balance should be recalculated if future developments are planned for this area.

Initial review indicates that recharge is greater than the 1995 water usage plus the proposed project usage in the El Toro Creek and San Benancio Gulch subareas. Based on these data, it appears that a long-term supply exists for this subdivision. It is important to note that this water balance employs regional averages and that local deviations may exist. For example, water levels in some wells in the San Benancio Gulch subarea have experienced long-term declines (Schmidt, May 31, 2001). This indicates that local water level depressions exist and well specific hydrogeologic information is needed to evaluate local water level conditions.

Nitrate Balance

An *Initial Water Use/Nitrate Impact Questionnaire for Development in Monterey County* (Harper Canyon, May 30, 2001) was completed for the proposed development. Responses on this questionnaire suggest that the site would use septic and sewer systems. County of Monterey staff state that the subdivision will be entirely sewered (Lawrence, May 31, 2002). Thus, nitrate loading is not expected to increase since the subdivision will not be on septic systems. Therefore nitrate related impacts associated with the subdivision are negligible.

Potential Effects of Development on Groundwater

Effects on Local Wells

Feeney (July 19, 2000) conducted a 72-hour pumping test on the Oaks well to determine pumping rates and potential impacts on other wells. The well was pumped at 37 gpm resulting in a drawdown of 32.4 feet and a 24-hour specific capacity of 1.1 gpm/ft (Feeney, July 19, 2000). Transmissivity was calculated to be 1,085 gpd/ft. Feeney (July 19, 2000) concluded that pumping of the Oaks well at 4 gpm would not impact adjacent wells. He estimated that after 20 years of pumping, the drawdown 1,000 feet away would be less than 2 feet. Nearby wells included in the evaluation are the San Benancio School well located approximately 1,000 feet north and the Ambler Park wells located approximately 1,500 feet west of the Oaks well (Feeney, July 19, 2000).Pumping the Oaks well at the higher rate required to provide additional supply to the Harper Canyon subdivision would have little impact on the existing wells due to their distance from the pumping well. The cone of depression around the Oaks well would be deeper but the radius of influence would not change.

Similar calculations can be done for the new well. Assuming a T of 3,500 gpd/ft, a pumping rate of 12 gpm, and a storage coefficient of 0.05, drawdown 1,000 feet away at 20 years would be less than 2 feet. Available data indicate that there are at least five wells within 2,000 feet of the new well. It is unknown what volume of water, if any, is pumped from these wells, but they are likely domestic wells with small pumping volumes.

Effects on Aquifer

Regional effects on the aquifer from the pumping increase of 13 AF/y appear to be minimal when compared to recharge estimates. Note that this comparison is regional and on an average basis. Water levels will likely decline in times of extended drought.

Conclusions

Todd Engineers review of available data indicates that pumping 13 AF/y (8 gpm) for the proposed Harper Canyon development will not deplete the aquifer on a regional basis. Pumping the Oaks well or the new well at 12 gpm to supply the Oaks subdivision and the Harper Canyon homes does not appear to result in any appreciable impacts to nearby wells. In conclusion, available data indicate that the project will have a negligible effect on groundwater quantity and quality and that an adequate water supply exists.

Based on our review, we suggest that water levels and water quality be routinely measured and reported for the Oaks well and new well, including monthly water level measurements. These data could assist in determining aquifer(s) sensitivity to droughts and pumping. In addition, pumping volumes should also be recorded and submitted with other monitoring data. If these data are already being generated as part of a California Department of Health Services (DHS) permit, the County could access data from DHS. These data can be used for evaluation of new wells installed in the future.

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  Feeney Draft Technical Memorandum, *Well Location – Hydrogeologic Review, "The Oaks" Subdivision*, February 11, 2000, and
  Feeney Technical Memorandum, *Hydrogeologic Review "The Oaks" Subdivision Well - Well Interference Analysis*, July 19, 2000.

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Maps

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United States Geologic Survey, *Spreckels Quadrangle Topographic Map*, 7.5 Minute Series, Photorevised 1984.

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Appendix

DUPLICATE
Driller's Copy
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. **768957**

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. New 2003
Date Work Began 3/29/03, Ended 4/10/03
Local Permit Agency Monterey Co Health Dept
Permit No. 02-01036 Permit Date 4/2/03

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID Mud

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0 : 20	Top Soil, sand
20 : 85	D.G.
85 : 130	D.G., Sand, Clay
130 : 175	D.G., sand, small streaks of clay
175 : 190	Hard D.G.
190 : 445	D.G., streaks sand & clay
445 : 460	D.G., blue clay, brown shale

TOTAL DEPTH OF BORING 465 (Feet)
TOTAL DEPTH OF COMPLETED WELL 450 (Feet)

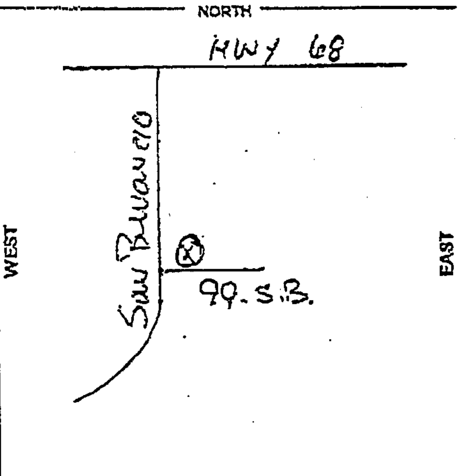
WELL OWNER

Name Harper Cyn Realts
Mailing Address 313 Main St #D
Salinas CA 93901
CITY STATE ZIP

WELL LOCATION

Address San Benancio Cyn Rd
City Salinas CA
County Monterey
APN Book 416 Page 621 Parcel 001
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. ___ DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
— Deepen
— Other (Specify)
— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 60+ (Ft.) BELOW SURFACE 1
DEPTH OF STATIC WATER LEVEL 80 (Ft.) & DATE MEASURED 4/30/03
ESTIMATED YIELD * 50+ (GPM) & TEST TYPE Air Lift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 440 (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 : 150	12.25	✓				PLASTIC	6	sdr21	sdr21
150 : 450	12.25		✓			PLASTIC	6	.032	.032

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 : 110	✓			
110 : 450			✓	8 x 16 sand

ATTACHMENTS (✓)

— Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other ___
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME Roy Alsop Pump and Drilling, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
1508 Abbott St. Salinas CA 93901
ADDRESS CITY STATE ZIP
Signed ___ 04/30/03 C57-569945
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ALSOP PUMP & DRILLING, INC.
WELL DEVELOPMENT LOG

CUSTOMER: TIME START : 10:40
RANCH:
DATE: 6/19/03

ENGINE HRS (start): FLOWMETER : 4315
ENGINE HRS (stop): @ 44 MIN 5474 = 26.34 GPM
SWL @ 90 MIN 6628 = 25.70 GPM
@ 124 MIN 7451 = 25.29 GPM (24.5
@ 148 MIN 8047 = 25.22 GPM INSTAN
@ 310 MIN 11978 = 24.72 GPM 24.

TIME		GPM	PWL	YIELD		DESCRIPTION/COMMENTS DTW	DD	TIME		DD24
SWL	= 102.0'					102.0'		40	167' 11.5"	65.9[illegible]
4" OD	PUMP	[illegible]						45	168' 0.25"	66.02
2 HP	PUMP							50	168' 2.60"	66.15
SET	@ 2.10'							55	168' 3.50"	66.29
TIME .5								60	168' 4.00"	66.33
1	→					124' 2.5"	22.21	70	168' 5.25"	66.44
2	1.5					130' 6.5" 134' 11.5"	28.54 32.56	84	168' 6.68"	66.56
3						143' 6.5"	41.54	105	168' 7.25"	66.60
4						146' 10.0"	44.83	~~100~~		
5						150' 7.5"	48.63	~~110~~		
6						154' 4.5"	52.38	123	168' 10.00"	66.83
7						156' 1.0"	54.08	~~130~~		
8						156' 11.0"	54.92	146	169' 0.00	67.[illegible]
9						158' 2.0"	56.17	~~150~~		
10						159' 3.0"	57.25	~~160~~		
11						160' 3.0"	58.25	~~170~~		
12						161' 1.0"	59.08	~~180~~		
13						161' 9.0"	59.75	~~190~~		
14						162' 5.5"	60.46	~~200~~		
15						163' 1.5"	61.13	~~220~~		
17						164' 5.5"	62.46	~~240~~		
18						165' 0.5"	63.04	~~260~~		
19						165' 7.0"	63.58	~~280~~		
20						166' 0.5"	64.04	~~300~~		
21						166' 6.0"	64.50	312	169' 10"	67.83
22						166' 8.75"	64.91			
23						167' 0.50"	65.04			
24						167' 2.25"	65.19			
25						167' 4.00"	65.33			
26						167' 5.5"	65.46			
27						167" 6.25"	65.52			
28						167" 7.25"	65.60			
29						167" 8.25"	65.69			
30						167" 9.00"	65.75			
35						167" 11.5"	65.96			

ALSOP PUMP & DRILLING, INC.

WELL DEVELOPMENT LOG

CUSTOMER HARPER CANYON REALTY
RANCH. SAN.BENANCIO
DATE 6-18-03

ENGINE HRS (start):
ENGINE HRS (stop):
SWL 102 FT

TIME		GPM	PWL	YIELD		DESCRIPTION/COMMENTS			
1040		30				CLEAR			
1045		27	154			CLEAR			
1050		27	159			CLEAR			
1055		26.5	162			CREAMY			
1100		25.5	166			CREAMY			
1103		25.5	167			CREAMY			
1110		25.5	167			CREAMY			
1115		25.5	168			CREAMY			
1120		25.5	168			CREAMY			
1125		25.5	168			CREAMY			
1130		25.5	168			STILL A LITTLE WHITE			
1140		25.8	168						
1150		25.5	168						
1200		25	168			ALMOST CLEAR			
1620		25	169' 10"						
2015		25	170' 4"						
	6-19-03								
0530		25	170' 6"						
1240		25	178			? BAD PWL READING			
1635		24	171' 8"						
1935		24	171' 3"						
	6-20-03								
0530		24	171' 6"						
0910		24	171' 6"			CLEAR			
0920						TAKE WATER SAMPLE			
0925						STOP TEST			
0930			171			RECOVERY			
0932			158						
0934			149						
0936			145						
0938			144						
0940			142						
0942			141' 6"						
0944			141						
0946			140' 6"						

ALSOP PUMP & DRILLING, INC.

WELL DEVELOPMENT LOG

PAGE 2

CUSTOMER: HARPER CANYON REALTY
RANCH: SAN BENANCIO
DATE: 6-20-03

ENGINE HRS (start):
ENGINE HRS (stop):
SWL

TIME		GPM	PWL	YIELD		DESCRIPTION/COMMENTS			
0948			140			RECOVERY CONTINUED			
0950			139' 6"						
1002			139						
1010			138' 8"						
1110			134' 6"						
1145			134						
1200			133						
1630			130						
	6-21-03								
0640			126' 7"						
1200			126						
1705			125						
	6-22-03								
900			122' 6"						

MONTEREY BAY ANALYTICAL SERVICES
121 Hitchcock Canyon Road
Carmel Valley, CA 93924
831.659.7538 Phone_Fax
ELAP Certification Number: 2385

Alsop Pump & Drilling
Steve Allison
1508 Abbott St.
Salinas, CA 93901

Page 1 of 2

Monday, July 14, 2003

Lab Number: **AA13555**

Collection Date/Time:	6/20/2003	9:10	Sample Collector:	HOLLAND D
Submittal Date/Time:	6/20/2003	9:10	System No.	

Sample Description: 99 San Benancio

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	151		10		6/23/2003
Aluminum	EPA200.8	ug/L	Not detected	E	50	1000	7/11/2003
Antimony	EPA200.8	ug/L	Not detected	E	6.0	6	7/11/2003
Arsenic	EPA200.8	ug/L	28	E	2	50	7/11/2003
Barium	EPA200.8	ug/L	Not detected	E	100	1000	7/11/2003
Berillium	EPA200.8	ug/L	Not detected	E	1	4	7/11/2003
Bicarbonate (as HCO3-)	SM2320B	mg/L	184		10		6/25/2003
Bromide	EPA300.0	mg/L	0.18		0.10		6/21/2003
Cadmium	EPA200.8	ug/L	Not detected	E	1	5	7/11/2003
Calcium	SM3111B	mg/L	55		1		6/26/2003
Carbonate	SM2320B	mg/L	Not detected		10		6/23/2003
Chloride	EPA300.0	mg/L	263		1	250	6/21/2003
Chromium	EPA200.8	ug/L	2	E	1	50	7/11/2003
Color, Apparent (Unfiltered)	SM2120B	Color Units	Not detected		1	15	6/21/2003
Copper	SM 3111B	ug/L	Not detected		50	1000	6/21/2003
Cyanide	EPA 335.2	ug/L	Not detected		20	200	6/20/2003
Fluoride	EPA300.0	mg/L	0.22		0.10	2.0	6/21/2003
Hardness (as CaCO3)	SM2340B	mg/L	224		10		7/5/2003
Hydroxide	SM2320B	mg/L	Not detected		5		6/23/2003
Iron	SM3111B	ug/L	Not detected		100	300	6/21/2003
Langlier Index (60 deg. C)	SM2330B		-0.45				7/5/2003
Lead	SM3113B	ug/L	Not detected		5	15	6/22/2003
Magnesium	SM3111B	mg/L	21		1		6/26/2003
Manganese	SM3111B	ug/L	169		20	50	6/21/2003

mg/L: Milligrams per liter (=ppm)
ug/L : Micrograms per liter (=ppb)
PQL : Practical Quantitation Limit
H: Analyzed outside of hold Time
E: Analyzed by External Laboratory; see External Laboratory Result

MBAS (Surfactants)	SM5540C	mg/L	Not detected		0.05	0.50	6/21/2003
Mercury	EPA200.8	ug/L	Not detected	E	0.2	2	7/11/2003
Nickel	EPA200.8	ug/L	1	E	1	100	7/11/2003
Nitrate as NO3	EPA300.0	mg/L	5		1	45	6/21/2003
Nitrite-N	EPA300.0	mg/L	Not detected		0.10	1.00	6/21/2003
Odor Threshold at 60 C	SM2150B	TON	1		1	3	6/21/2003
o-Phosphate-P	EPA300.0	mg/L	0.11		0.10		6/21/2003
pH (Laboratory)	SM4500-H+B	STD. Units	6.6				6/20/2003
Potassium	SM3111B	mg/L	2.8		0.5		6/26/2003
Selenium	EPA200.8	ug/L	Not detected	E	5.0	50	7/11/2003
Silver	EPA200.8	ug/L	Not detected	E	10	100	7/11/2003
Sodium	SM3111B	mg/L	127		1		6/26/2003
Specific Conductance (E.C)	SM2510B	umhos/cm	1120		1	900	6/20/2003
Sulfate	EPA300.0	mg/L	18		1	250	6/21/2003
Synthetic Organic Compounds		ug/L	attached				6/26/2003
Thallium	EPA200.8	ug/L	Not detected	E	1.0	2	7/11/2003
Total Diss. Solids	SM2540C	mg/L	689		10	500	6/21/2003
Turbidity	EPA180.1	NTU	0.40		0.05	5.0	6/21/2003
Volatile Organic Compounds	EPA 502.2	ug/L	attached				6/26/2003
Zinc	EPA200.8	ug/L	343	E	50	5000	7/11/2003

Sample Comments:

Report Approved by:

Sigrid Weidner-Holland
Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H: Analyzed outside of hold Time E: Analyzed by External Laboratory; see External Laboratory Result

basic
laboratory

www.basiclab.com

voice 530.243.7234 2218 Railroad Avenue
fax 530.243.7494 Redding, California 96001

Report To: MONTEREY BAY ANALYTICAL SERVICES
121 HITCHCOCK CANYON ROAD
CARMEL VALLEY, CA 93924

Lab Number: 3060817
Date: 07/11/03
Phone: (831) 659-7538
P.O.#:

Attention: S. WEIDNER-HOLLAND
Project Name: METALS 200.8

Sample Description: 13555 / 99 SAN BENANCIO
Laboratory ID: 3060817-01

Date Sampled: 06/20/03
Date Received: 06/25/03

	TEST	RESULTS	UNITS	MCL/ACL	DLR
General Mineral	Calcium		mg/l		1
	Magnesium		mg/l		1
	Sodium		mg/l		1
	Potassium		mg/l		1
	Bicarbonate		mg/l		5
	Carbonate		mg/l		5
	Chloride		mg/l	250-500-600	1
	Sulfate		mg/l	250-500-600	0.40
	pH		units		0.01
	Alkalinity-Total @CaCO3		mg/l		5
	Hardness-Total @CaCO3		mg/l		1
	Specific Conductance @25C		umhos/cm	900-1600-2200	10
	Total Dissolved Solids		mg/l	500-1000-1500	5
	MBAS		mg/l	0.5	0.02
	Copper		ug/l	1300	50
	Iron		ug/l	300	100
	Manganese		ug/l	50	30
	Zinc	343	ug/l	5000	50
General Physical	Turbidity		NTU	5	0.01
	Color		units	15	5
	Odor		T.O.N.	3	2
Inorganic Chemical	Aluminum	ND	ug/l	1000	50
	Antimony	ND	ug/l	6	6.0
	Arsenic	28	ug/l	50	2
	Barium	ND	ug/l	1000	100
	Beryllium	ND	ug/l	4	1
	Cadmium	ND	ug/l	5	1.0
	Chromium	2	ug/l	50	1
	Lead		ug/l	15	5.0
	Mercury	ND	ug/l	2	0.2
	Nickel	1	ug/l	100	1
	Selenium	ND	ug/l	50	5.0
	Silver	ND	ug/l	100	10
	Fluoride		mg/l	1.4 -2.4	0.10
	Nitrate as N		mg/l	10	0.45
	Nitrite as N		mg/l	1	0.40
	Thallium	ND	ug/l	2	1.0
Radiological	Gross Alpha		pCi/l	5	1

Approved By
Basic Laboratory, Inc.
California D.O.H.S. Cert #1677

ND - Not Detected at the detection limit
DLR - Reporting limit
MCL/ACL - Maximum contaminant level / action level

BSK ANALYTICAL LABORATORIES

Sigrid Weidner-Holland
Monterey Bay Analytical
121 Hitchcock Canyon Road
Carmel Valley, CA 93924

Certificate of Analysis

ELAP Certificate #1180

Report Issue Date: 07/11/2003

BSK Submission #: 2003061567
BSK Sample ID #: 336114

Project ID:
Project Desc:
Submission Comments:

Sample Type:	Liquid	Date Sampled:	06/20/2003
Sample Description:	99 San Bernancio	Time Sampled:	0910
Sample Comments:	13555	Date Received:	06/24/2003

Organics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
1,1,1,2-Tetrachloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1,1-Trichloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1,2,2-Tetrachloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 502.2	ND	µg/L	10.0	1	10	06/26/03	06/26/03
1,1,2-Trichloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1-Dichloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1-Dichloroethene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,1-Dichloropropene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2,3-Trichlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2,3-Trichloropropane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2,4-Trichlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2,4-Trimethylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2-Dichlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2-Dichloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,2-Dichloropropane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,3,5-Trimethylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,3-Dichlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,3-Dichloropropane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
1,4-Dichlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
2,2-Dichloropropane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
2-Chlorotoluene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
4-Chlorotoluene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Benzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Bromobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Bromochloromethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Bromodichloromethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Bromoform	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Bromomethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Carbon tetrachloride	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Cover Letter for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code: *336114-761.5200*

Sigrid Weidner-Holland
Monterey Bay Analytical
121 Hitchcock Canyon Road
Carmel Valley, CA 93924

Certificate of Analysis

ELAP Certificate #1180

Report Issue Date: 07/11/2003

BSK Submission #: 2003061567

BSK Sample ID #: 336114

Project ID:

Project Desc:

Submission Comments:

Sample Type:	Liquid	Date Sampled:	06/20/2003
Sample Description:	99 San Bernancio	Time Sampled:	0910
Sample Comments:	13555	Date Received:	06/24/2003

Organics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Chlorobenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Chloroethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Chloroform	EPA 502.2	0.76	µg/L	0.5	1	0.5	06/26/03	06/26/03
Chloromethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
cis-1,2-Dichloroethene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
cis-1,3-Dichloropropene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Dibromochloromethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Dibromomethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Dichlorodifluoromethane	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Ethyl t-Butyl Ether	EPA 502.2	ND	µg/L	3.0	1	3	06/26/03	06/26/03
Ethylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Ethylenedibromide	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Hexachlorobutadiene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Isopropylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
m,p-Xylenes	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Methylene chloride	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Methyl-t-Butyl Ether	EPA 502.2	ND	µg/L	3.0	1	3	06/26/03	06/26/03
Naphthalene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
n-Butylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
n-Propylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
o-Xylene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
p-Isopropyltoluene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
sec-Butylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Styrene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
t-Amyl Methyl Ether	EPA 502.2	ND	µg/L	3.0	1	3	06/26/03	06/26/03
tert-Butylbenzene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Tetrachloroethene (PCE)	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Toluene	EPA 502.2	ND	µg/L	0.5	1	0.5	06/26/03	06/26/03
Total 1,3-Dichloropropene	EPA 502.2	ND	µg/L	-	-	N/A		

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Cover Letter for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code: *336114-761.5200*

Sigrid Weidner-Holland
Monterey Bay Analytical
121 Hitchcock Canyon Road
Carmel Valley, CA 93924

Certificate of Analysis

ELAP Certificate #1180

Report Issue Date: 07/11/2003

BSK Submission #: 2003061567

BSK Sample ID #: 336114

Project ID:

Project Desc:

Submission Comments:

Sample Type:	Liquid	Date Sampled:	06/20/2003
Sample Description:	99 San Bernancio	Time Sampled:	0910
Sample Comments:	13555	Date Received:	06/24/2003

Organics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Total Trihalomethanes	EPA 502.2	0.76	μg/L	-	-	N/A		
Total Xylene Isomers	EPA 502.2	ND	μg/L	0.5	1	0.5	06/26/03	06/26/03
trans-1,2-Dichloroethene	EPA 502.2	ND	μg/L	0.5	1	0.5	06/26/03	06/26/03
trans-1,3-Dichloropropene	EPA 502.2	ND	μg/L	0.5	1	0.5	06/26/03	06/26/03
Trichloroethene (TCE)	EPA 502.2	ND	μg/L	0.5	1	0.5	06/26/03	06/26/03
Trichloroflouromethane	EPA 502.2	ND	μg/L	5.0	1	5	06/26/03	06/26/03
Vinyl chloride	EPA 502.2	ND	μg/L	0.5	1	0.5	06/26/03	06/26/03
Dibromochloropropane	EPA 504.1	ND	μg/L	0.01	1	0.01	06/27/03	07/01/03
Ethylenedibromide	EPA 504.1	ND	μg/L	0.02	1	0.02	06/27/03	07/01/03
Aldrin	EPA 505	ND	μg/L	0.075	1	0.075	06/27/03	06/30/03
Chlordane	EPA 505	ND	μg/L	0.1	1	0.1	06/27/03	06/30/03
Chlorothalonil (Daconil,Bravo)	EPA 505	ND	μg/L	5.0	1	5	06/27/03	06/30/03
Dieldrin	EPA 505	ND	μg/L	0.02	1	0.02	06/27/03	06/30/03
Endrin	EPA 505	ND	μg/L	0.1	1	0.1	06/27/03	06/30/03
Heptachlor	EPA 505	ND	μg/L	0.01	1	0.01	06/27/03	06/30/03
Heptachlor epoxide	EPA 505	ND	μg/L	0.01	1	0.01	06/27/03	06/30/03
Hexachlorobenzene	EPA 505	ND	μg/L	0.50	1	0.5	06/27/03	06/30/03
Hexachlorocyclopentadiene	EPA 505	ND	μg/L	1	1	1	06/27/03	06/30/03
Lindane	EPA 505	ND	μg/L	0.2	1	0.2	06/27/03	06/30/03
Methoxychlor	EPA 505	ND	μg/L	10	1	10	06/27/03	06/30/03
PCBs: Arochlor Screen	EPA 505	ND	μg/L	0.2	1	0.2	06/27/03	06/30/03
Toxaphene	EPA 505	ND	μg/L	1.0	1	1	06/27/03	06/30/03
Trifluralin	EPA 505	ND	μg/L	1.0	1	1	06/27/03	06/30/03
2,4,5-T	EPA 515.3	ND	μg/L	1.0	1	1	06/30/03	06/30/03
2,4,5-TP (Silvex)	EPA 515.3	ND	μg/L	1.0	1	1	06/30/03	06/30/03
2,4-D	EPA 515.3	ND	μg/L	10	1	10	06/30/03	06/30/03
Bentazon (Basagran)	EPA 515.3	ND	μg/L	2.0	1	2	06/30/03	06/30/03
Dalapon	EPA 515.3	ND	μg/L	10	1	10	06/30/03	06/30/03
Dicamba (Banvel)	EPA 515.3	ND	μg/L	1.5	1	1.5	06/30/03	06/30/03

mg/L: Milligrams/Liter (ppm)
mg/Kg: Milligrams/Kilogram (ppm)
μg/L: Micrograms/Liter (ppb)
μg/Kg: Micrograms/Kilogram (ppb)
%Rec: Percent Recovered (surrogates)

PQL: Practical Quantitation Limit
DLR: Detection Limit for Reporting
: PQL x Dilution
ND: None Detected at DLR

H: Analyzed outside of hold time
P: Preliminary result
S: Suspect result. See Cover Letter for comments.
E: Analysis performed by External laboratory.
See External Laboratory Report attachments.

Report Authentication Code: *336114-761.5200*

Sigrid Weidner-Holland
Monterey Bay Analytical
121 Hitchcock Canyon Road
Carmel Valley, CA 93924

Certificate of Analysis
ELAP Certificate #1180
Report Issue Date: 07/11/2003

BSK Submission #: 2003061567
BSK Sample ID #: 336114

Project ID: Project Desc:

Submission Comments:

Sample Type: Liquid
Sample Description: 99 San Bernancio
Sample Comments: 13555

Date Sampled: 06/20/2003
Time Sampled: 0910
Date Received: 06/24/2003

Organics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Dinoseb (DNBP)	EPA 515.3	ND	µg/L	2.0	1	2	06/30/03	06/30/03
Pentachlorophenol (PCP)	EPA 515.3	ND	µg/L	0.2	1	0.2	06/30/03	06/30/03
Picloram	EPA 515.3	ND	µg/L	1.0	1	1	06/30/03	06/30/03
Alachlor (Alanex)	EPA 525.2	ND	µg/L	1.0	1	1	06/27/03	06/27/03
Atrazine (AAtrex)	EPA 525.2	ND	µg/L	0.5	1	0.5	06/27/03	06/27/03
Benzo(a)pyrene	EPA 525.2	ND	µg/L	0.1	1	0.1	06/27/03	06/27/03
bis(2-ethylhexyl) adipate	EPA 525.2	ND	µg/L	3.0	1	3	06/27/03	06/27/03
bis(2-ethylhexyl) phthalate	EPA 525.2	ND	µg/L	3.0	1	3	06/27/03	06/27/03
Bromacil (Hyvar)	EPA 525.2	ND	µg/L	10	1	10	06/27/03	06/27/03
Butachlor	EPA 525.2	ND	µg/L	0.38	1	0.38	06/27/03	06/27/03
Diazinon	EPA 525.2	ND	µg/L	0.25	1	0.25	06/27/03	06/27/03
Dimethoate (Cygon)	EPA 525.2	ND	µg/L	10	1	10	06/27/03	06/27/03
Metolachlor	EPA 525.2	ND	µg/L	0.5	1	0.5	06/27/03	06/27/03
Metribuzin	EPA 525.2	ND	µg/L	0.5	1	0.5	06/27/03	06/27/03
Molinate (Ordram)	EPA 525.2	ND	µg/L	2.0	1	2	06/27/03	06/27/03
Prometryn (Caparol)	EPA 525.2	ND	µg/L	2.0	1	2	06/27/03	06/27/03
Propachlor	EPA 525.2	ND	µg/L	0.5	1	0.5	06/27/03	06/27/03
Simazine (Princep)	EPA 525.2	ND	µg/L	1.0	1	1	06/27/03	06/27/03
Thiobencarb (Bolero)	EPA 525.2	ND	µg/L	1.0	1	1	06/27/03	06/27/03
3-Hydroxycarbofuran	EPA 531.1	ND	µg/L	3.0	1	3	06/30/03	06/30/03
Aldicarb	EPA 531.1	ND	µg/L	3.0	1	3	06/30/03	06/30/03
Aldicarb Sulfone	EPA 531.1	ND	µg/L	2.0	1	2	06/30/03	06/30/03
Aldicarb Sulfoxide	EPA 531.1	ND	µg/L	3.0	1	3	06/30/03	06/30/03
Carbaryl	EPA 531.1	ND	µg/L	5.0	1	5	06/30/03	06/30/03
Carbofuran	EPA 531.1	ND	µg/L	5.0	1	5	06/30/03	06/30/03
Methomyl	EPA 531.1	ND	µg/L	2.0	1	2	06/30/03	06/30/03
Oxamyl	EPA 531.1	ND	µg/L	20.0	1	20	06/30/03	06/30/03
Glyphosate	EPA 547	ND	µg/L	25	1	25	07/01/03	07/02/03
Endothall	EPA 548.1	ND	µg/L	45	1	45	06/25/03	06/26/03

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Report Authentication Code: *336114-761.5200*

BSK ANALYTICAL LABORATORIES

Sigrid Weidner-Holland
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Date Sampled: 06/20/2003
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Date Received: 06/24/2003

Organics

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Diquat	EPA 549.1	ND	µg/L	4	1	4	06/26/03	06/27/03
Diuron	EPA 632	ND	µg/L	1.0	1	1	06/27/03	07/07/03
Surrogate								
1-Chloro-2-fluorobenzene	EPA 502.2	96	% Rec		1	N/A	06/26/03	06/26/03
Bromoform	EPA 504.1	94.5	% Rec		1	N/A	06/27/03	07/01/03
Tetrachloro-m-xylene	EPA 505	88	% Rec		1	N/A	06/27/03	06/30/03
DCPAA	EPA 515.3	98	% Rec		1	N/A	06/30/03	06/30/03
1,3-Dimethyl-2-nitrobenzene	EPA 525.2	100	%Rec		1	N/A	06/27/03	06/27/03
BDMC	EPA 531.1	106	% Rec		1	N/A	06/30/03	06/30/03
AMPA	EPA 547	95.5	% Rec		1	N/A	07/01/03	07/02/03
Benthiocarb	EPA 632	82	% Rec		1	N/A	06/27/03	07/07/03

mg/L: Milligrams/Liter (ppm)
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µg/L: Micrograms/Liter (ppb)
µg/Kg: Micrograms/Kilogram (ppb)
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Report Authentication Code: *336114-761.5200*

Monterey Bay Analytical Services
121 Hitchcock Cyn. Rd.
Carmel Valley, CA 93924

SAMPLE ID **AA13555**

CORRECTNESS OF ANALYSIS

CATION	MG/L	FACTOR	MEQ/L
Sodium	127	0.04350	5.52
Potassium	2.8	0.02558	0.07
Calcium	55	0.04990	2.74
Magnesium	21	0.08229	1.73
		SUM	10.07

ANION	MG/L	FACTOR	MEQ/L
Total Alkalinity	151	0.02000	3.02
Sulfate	18	0.02082	0.37
Chloride	263	0.02821	7.42
Nitrate	5	0.01613	0.08
Phosphates	0.1	0.01050	0.00
		SUM	10.90

ANION-CATION BALANCE: -4 (% DIFFERENCE)

Note: Anion-cation sums must balance because all potable waters are electrically neutral. For anion sums below 10.0 meq/L, a 2% difference is acceptable. For anion sums between 10.0 - 800 meq/L, a 5% difference is acceptable. If the difference exceeds the above criteria, the sample should be reanalyzed.

ION SUM AND MEASURED CONDUCTIVITY:

Conductivity	1120	
Cation Sum X 100	1007	**90%**
Anion Sum X 100	1090	**97%**

Note: Ion sum (cation or anion) X 100 should be within 10% of the measured conductivity. If either sum is out of range, recheck analysis.

TDS/SEC Ratio **0.62**

Monterey County Health Department
Environmental Health Division
1270 Natividad Road
Salinas, California 93906

1850

Project Specific Hydrogeologic Report

Harper Canyon Realty, LLC Subdivision

September 2002

Prepared by:

Todd Engineers
Emeryville, California

Project Specific Hydrogeologic Report

Harper Canyon Realty, LLC Subdivision

September 2002

Prepared for:

Monterey County Health Department
Environmental Health Division
1270 Natividad Road
Salinas, California 93906

Prepared by:

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Emeryville, California
Phone: 510 595-2120
Fax: 510 595-2112

Phyllis Stanin
Principal Geologist

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Executive Summary

The Monterey County Health Department, Division of Environmental Health is requiring a Project Specific Hydrogeologic Report for the proposed Harper Canyon Realty LLC (PLN 000696) development prior to deeming the application complete per authority of Title 19 of the Monterey County Code. This report summarizes Todd Engineers' review of available data and reports concerning the hydrogeologic conditions at the proposed site and vicinity. Todd Engineers examined the availability of sustainable long-term water supply for the project, conducted a local water balance, and identified potential effects the project may have on the quantity and quality of groundwater given the data available.

The Harper Canyon Realty LLC subdivision (site) is approximately 12 miles southeast of Carmel. The 343.92 acre property will have seventeen homes with the lots comprising 163.91 acres on the northern portion of the property. The remaining property will be open space.

It is proposed that the water supply for the development will include an existing well located outside of the subdivision moratorium area in the nearby Oaks subdivision. In addition, a new well is to be installed on the Harper Canyon property to supplement the Oaks well. Information regarding this new well will be included as an addendum to this report after installation and testing. The Oaks well is currently supplying water at a rate of 4 gallons per minute (gpm) to nine homes in the Oaks subdivision. The Oaks well and new well will be tied together and supply water to the proposed subdivision. This new system will be transferred to the California-American Water Company (Cal Am) and operated as a satellite system.

Todd Engineers' review of available data indicates that pumping 12.75 acre feet per year (7.9 gpm) for the proposed Harper Canyon development will not deplete the aquifer on a regional basis. Capacity and local impacts associated with the new well cannot be determined at this time because the proposed well location, construction, and pumping test results are unknown. The Oaks well appears to be capable of sustaining a long-term pumping rate of 12 gpm to supply the Oaks subdivision and the Harper Canyon homes and does not appear to result in any appreciable impacts to nearby wells. Available data indicate that the project will have a negligible effect on groundwater quantity and quality and that an adequate water supply exists. These conclusions are pending the results of installation, testing, and water quality sampling of the new well, which will be included as an addendum to this report when available.

Introduction

Background

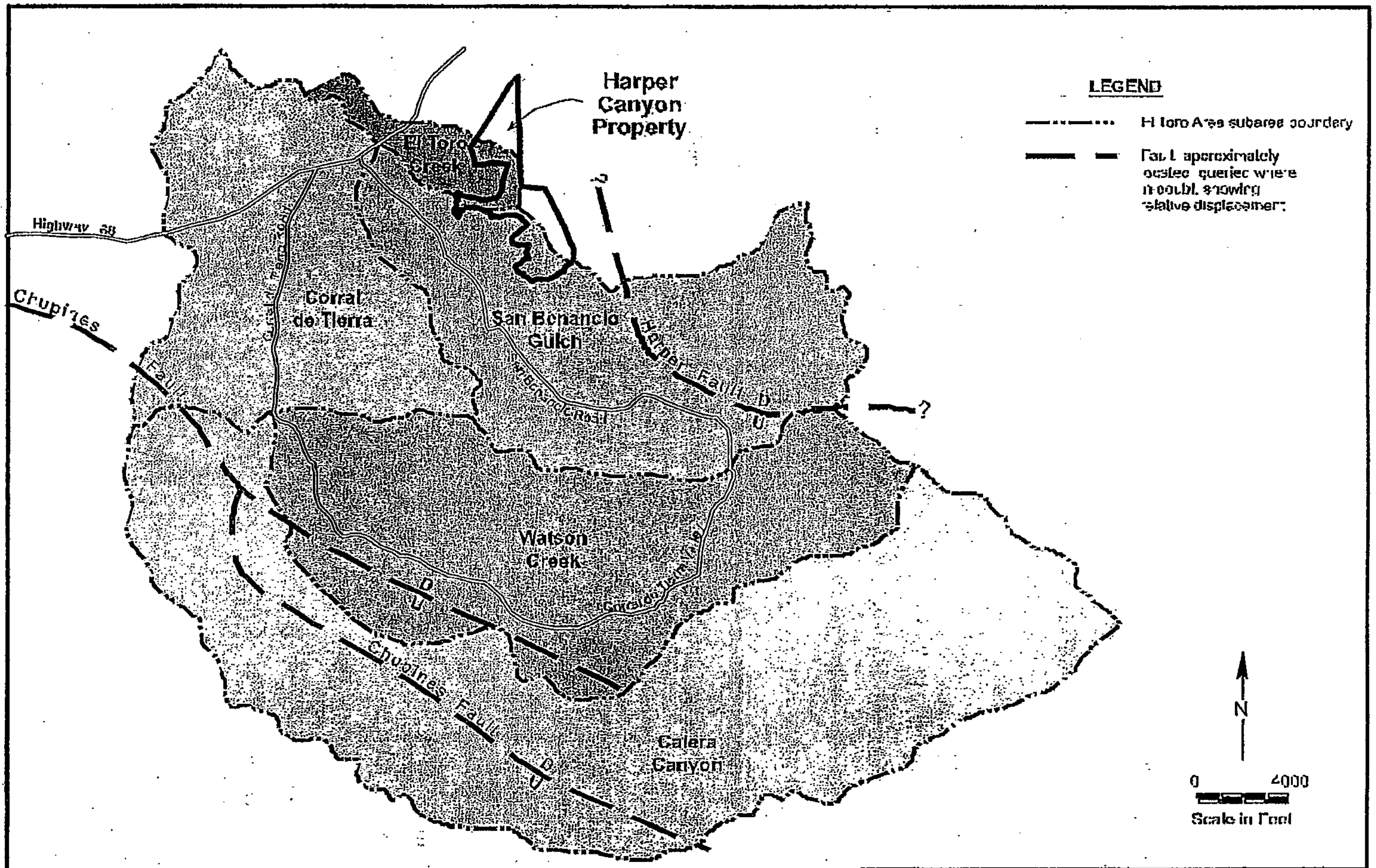
The Monterey County Health Department, Division of Environmental Health is requiring a Project Specific Hydrogeologic Report for the proposed Harper Canyon Realty LLC (PLN 000696) subdivision prior to deeming the application complete per authority of Title 19 of the Monterey County Code.

The Harper Canyon Realty LLC subdivision (site) is approximately 12 miles southeast of Carmel and just south of State Highway 68 and east of San Benancio Road (Figure 1). Seventeen homes are proposed on the northern portion of the property (Figure 2). The Harper Canyon LLC property covers 343.92 acres with the lots comprising 163.91 acres. The remaining 180 acres will remain as open space (Lawrence, June 4, 2002).

It is proposed that the development will consolidate with the nearby Oaks subdivision. The California-American Water Company (Cal Am) supplies water to the Oaks subdivision but its main supply wells are located further west in an area currently under a subdivision moratorium (called Zone B-8). One existing well in the Oaks subdivision (referred to as the Oaks well) is outside the moratorium area. The Oaks well supplies 4 gpm of water to nine homes in the Oaks subdivision. This well will be supplemented with a new well to be installed on the Harper Canyon property. The Oaks well and the new well will be tied together and supply water to the proposed subdivision. This new system will be transferred to Cal Am and operated as a satellite system to keep water from wells outside of the moratorium area separate from the other Cal Am wells. This prevents use in the moratorium area of water from the Salinas Valley Groundwater Basin Assessment Zone (called Zone 2/2A), in which the Oaks well and new well sites are located. Zone 2/2A is the area east of San Benancio Road (Lawrence, May 31, 2002).

Scope

This report summarizes Todd Engineers' review of available data and reports concerning the hydrogeologic conditions at the proposed site and vicinity. The purpose of the report is to provide an integrated overview of water resource conditions and potential impacts on groundwater and mitigation measures resulting from the proposed development. Specifically, Todd Engineers



From: Staal, Gardner and Dunne, August 1991

September 2002

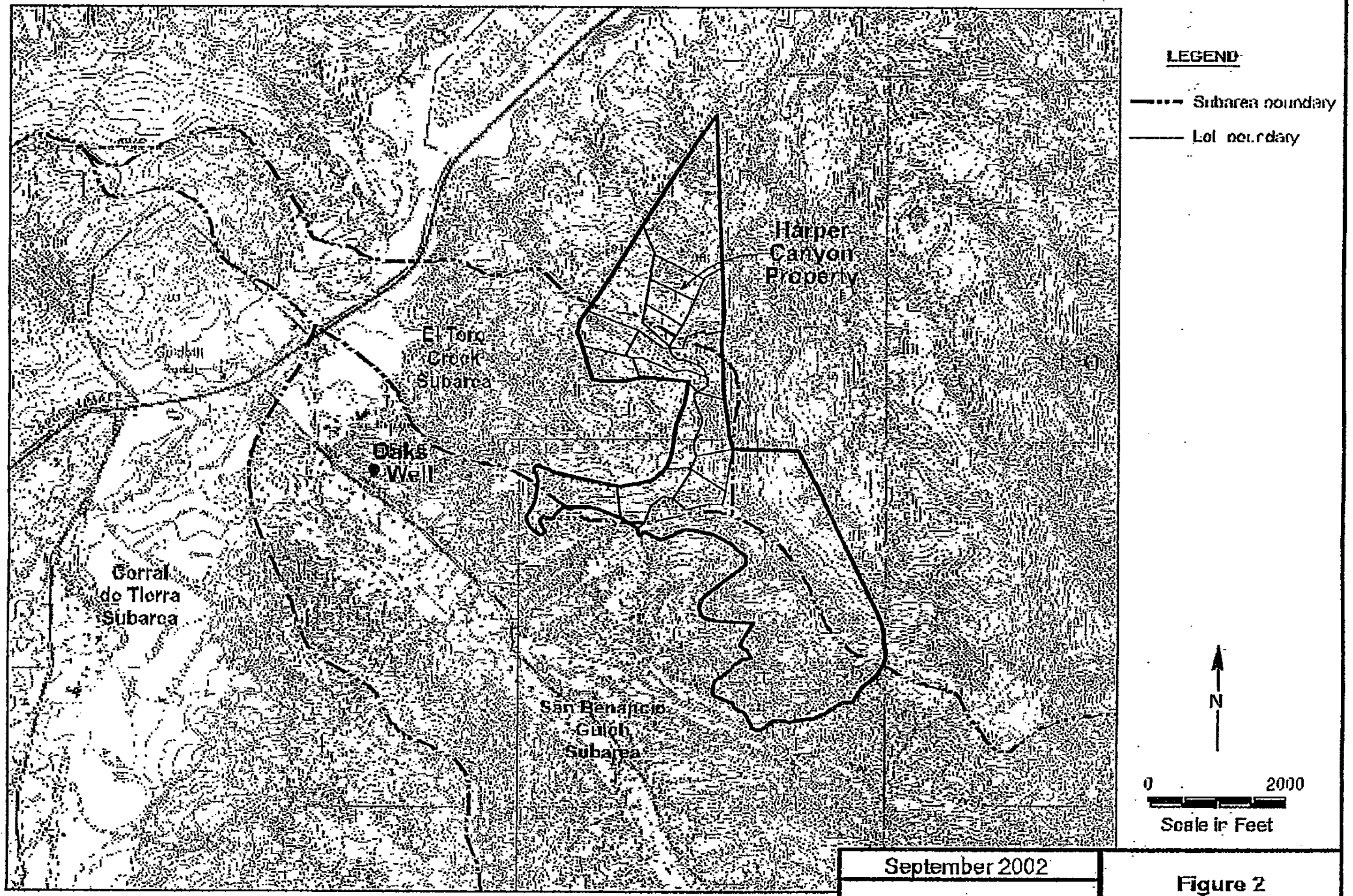
TODD ENGINEERS
Emeryville, California

Figure 1
Harper Canyon
Property Location

examined the availability of sustainable long-term water supply for the project, conducted a local water balance, and identified potential effects the project may have on the quantity and quality of groundwater given the data available. Since this review does not involve the collection of field data, we have relied on the data and reports supplied to us from Monterey County Division of Environmental Health and other data in Todd Engineers' files.

Acknowledgements

This report was prepared under the supervision of David Abbott and Phyllis Stanin of Todd Engineers. We appreciate the direction and information from Laura Lawrence of the Monterey County Department of Health and her staff.



Base. USGS Spreckels 7.5 minute topographic map.

September 2002

TODD ENGINEERS
Emeryville, California

Figure 2
Detailed Location Map

Hydrogeology

Geologic and Hydrogeologic Setting

The site is in the northern portion of the Salinas Valley, which is in the central part of the California Coast Ranges. The Salinas Valley is a northwest trending tectonic basin 120 miles long and up to 6 miles wide (EDAW, June 2001). The area is underlain by the Paso Robles Formation, which consists of a thick sequence of continental deposits of interbedded sand, gravel, and clay. This formation, also called the Aromas-Paso Robles Formation, is approximately 400 feet thick just west of the site (Feeney, August 8, 2000). The Santa Margarita Sandstone underlies the Paso Robles Formation and the Monterey Shale is below the Santa Margarita Sandstone.

The site is located in the Pressure subarea of the Salinas Valley Groundwater Basin (EDAW, June 2001). The site is in two subareas of the El Toro planning area of Monterey County (see Figure 2). The El Toro planning area has been divided into five subareas based on surface drainage divides (Figure 1). The southwestern portion of the site is in the San Benancio Gulch subarea and the central portion of the site containing most of the proposed development is in the El Toro Creek subarea. The northern tip and eastern strip of the site are outside of the El Toro planning area in the Greater Salinas planning area. Groundwater in the El Toro subareas north of the Chupines Fault is believed to be interconnected (Staal, Gardner & Dunne, August 1991; Fugro, February 1996; and Fugro, February 4, 1998.)

Aquifers and Water Quality

In the vicinity of the site, groundwater is pumped from three water bearing units; the Aromas-Paso Robles Formation, the Santa Margarita Sandstone, and alluvium in local drainages. The Monterey Shale is not considered water bearing since it produces wells with low yields and poor water quality in this area (Schmidt, May 31, 2001). In the vicinity of the Oaks well the Paso Robles Formation is approximately 400 feet thick and the Santa Margarita Sandstone is approximately 250 feet thick (Feeney, February 11, 2000). Stream alluvium is reported up to 200 feet thick in the El Toro planning area (Schmidt, May 31, 2001).

Typical well yields, specific capacities, and water quality data are listed below for the two principal aquifers in this area (Feeney, February 11, 2000).

Water Bearing Unit	Well Yield (gpm)	Specific Capacity (gpm/ft)	Water Type	Total Dissolved Solids (mg/l)
Paso Robles Formation	up to 200	2	calcium-bicarbonate	500
Santa Margarita Sandstone	over 500	5	sodium-chloride	1,000

gpm = gallons per minute
gpm/ft = gallons per minute per foot of drawdown
mg/l = milligrams per liter

The Oaks well is six inches in diameter, approximately 410 feet deep, and produces from the Paso Robles Formation. The depth to groundwater in 2000 was 95 feet and the top of the 180-foot screen is at a depth of 220 feet. Feeney (February 11, 2000) reports that the Oaks well can be pumped at a rate of 60 gpm. Assuming a 24-hour specific capacity of 1.1 gpm/ft as calculated from a pumping test, the well is theoretically capable of a discharge rate of 138 gpm. Water quality meets primary drinking water standards but exceeds secondary esthetic standards for total dissolved solids and manganese. The new well should be sampled for water quality to ensure an adequate supply.

Groundwater Levels and Flow

Groundwater moves unimpeded across the El Toro subarea boundaries from the southern subareas to the northern subareas. Groundwater flow generally follows the topography and exits the El Toro planning area to the north and to the west. Groundwater elevations are about 320 feet above mean sea level in wells screened in the Paso Robles Formation in the northern San Benancio Gulch subarea (Schmidt, May 31, 2001).

The Monterey County Water Resources Agency has been measuring water levels in about 40 wells in the El Toro area since 1960. In 2001, Schmidt (May 31, 2001) prepared updated hydrographs for these wells, including six wells in the San Benancio Gulch subarea. No long-term water level decline was apparent on hydrographs for two of these wells, which are screened in the Aromas-Paso Robles Formation and possibly the stream alluvium. The four other hydrographs were from wells screened in the Aromas-Paso Robles Formation and indicated long-term water level declines between 0.4 and 1.6 feet per year from 1960 to 2000. Apparently no wells are monitored in the El Toro Creek subarea.

Water Balance

A simple water balance is conducted here to compare inflows (recharge) and outflows (demand) to determine if a surplus or deficit exists between groundwater demand and recharge.

Recharge

Todd Engineers reviewed recharge calculations by Staal, Gardner & Dunne, Inc. (August 1991) and Fugro (February 1996). Their estimates of 2.18 and 1.93 to 3.13 inches/year, respectively, seem reasonable given the annual precipitation and assumptions used in the calculations. Using a value of 2.18 inches for recharge, the total recharge in the El Toro Creek and San Benancio Gulch subareas was calculated by Feeney (April 25, 2000) to be 74 and 486 acre-feet per year (AF/y), respectively.

Project Water Demand

The 17 lots are proposed to use a total of 5.61 AF/y (Harper Canyon Realty, May 30, 2001 and Lawrence, June 4, 2002). This results in a usage of 0.33 AF/y per home (5.61 AF/y/17 homes). Landscape irrigation is expected to be minimal and the development will be sewered. Thus, recharge associated with irrigation or septic system use is assumed to be negligible. Water supply for the development will come from the Oaks well and a new well on the Harper Canyon property.

This water usage rate estimated by the applicant is on the low end when compared to typical water usage values in the area. Fugro (February 1996) estimated the average interior water usage of an existing home at 0.38 AF/y and exterior usage at 0.28 AF/y in the El Toro area. The Toro Water Company customers in the area used 0.68 AF/y between 1990 and 1993 and Ambler Park Water Company customers used 0.63 AF/y between 1984 and 1990 (Fugro, February 1996). For planning purposes, Monterey County has used a demand of 0.75 AF/y per home in the Rancho San Carlos development (Lawrence, September 6, 2002). After review of these demands and discussions with county staff, it was decided to assume a demand value of 0.75 AF/y per home for a total demand of 12.75 AF/y for the 17 homes.

Comparison of Supply and Demand

Fugro (February 1996) concluded that recharge values in the four El Toro subareas north of the Chupines Fault, which are considered interconnected, exceeded current demand and were sufficient to meet estimated demand at build-out. The table below summarizes 1995 use and build-out projections from the Fugro (February 1996) report and updated in Feeney (April 25, 2000) using a recharge value of 2.18 inches. Build-out conditions were for 175 units in the El Toro Creek subarea and 542 units in the San Benancio Gulch subarea.

Subarea	Recharge @ 2.18 inches	1995 Demand (number of units)	Build-out Demand (number of units)	Build-out Water Surplus
El Toro Creek	74 AF/y	1.1 AF/y (1 unit)	69.3 AF/y (175 units)	4.7 AF/y
San Benancio Gulch	486 AF/y	342.2 AF/y (413 units)	456.1 AF/y (542 units)	29.9 AF/y

These values reflect a 1995 interior use of 0.38 Af/y (57.6 percent) and exterior use of 0.28 AF/y (42.4 percent). Future interior use was estimated to decrease to 0.20 AF/y. The values also assume that 80 percent of the interior usage returns via septic systems and 20 percent of exterior usage is return flow. Since the Harper Canyon homes will be sewered, no return flows via septic systems will occur. Assuming that 57.6 percent of water usage is interior the loss of septic return can be estimated to be 5.875 AF/y (12.75 AF/y x 0.576 x .80 = 5.875 AF/y). Since this value is greater than the estimated surplus at projected build-out for the El Toro Creek subarea, the water balance should be recalculated if future developments are planned for this area.

Initial review indicates that recharge is greater than the 1995 water usage plus the proposed project usage in the El Toro Creek and San Benancio Gulch subareas. It is important to note that this water balance employs regional averages and that local deviations may exist. For example, water levels in some wells in the San Benancio Gulch subarea have experienced long-term declines (Schmidt, May 31, 2001). This indicates that local water level depressions exist and well specific hydrogeologic information is needed to evaluate local recharge. Pumping tests should be conducted on the new well to determine aquifer capacity and at what rate the well could be pumped without impacting other nearby wells. This information will be included as an addendum to this report when available.

Nitrate Balance

An *Initial Water Use/Nitrate Impact Questionnaire for Development in Monterey County* (Harper Canyon, May 30, 2001) was completed for the proposed development. Responses on this questionnaire suggest that the site would use septic and sewer systems. Recent information from the County of Monterey staff state that the subdivision will be entirely sewered (Lawrence, May 31, 2002). Thus, nitrate loading is not expected to increase since the subdivision will not be on septic systems. Therefore nitrate related impacts associated with the subdivision are negligible.

Potential Effects of Development on Groundwater

Effects on Local Wells

It is difficult to determine local impacts associated with the addition of the new well since we do not know the subarea/planning area location, construction, or capacity of the proposed well. If the entire estimated project demand of 12.75 AF/y were to be provided by a new well, the well would have to pump a minimum of about 8 gpm.

Feeney (July 19, 2000) conducted a pumping test on the Oaks well to determine pumping rates and potential impacts on other wells. A 72-hour pumping test was performed on the Oaks well, which is screened in the Paso Robles Formation. The well was pumped at 37 gpm resulting in a drawdown of 32.4 feet and a 24-hour specific capacity of 1.1 gpm/ft (Feeney, July 19, 2000). Transmissivity was calculated to be 1,085 gpd/ft. Feeney (July 19, 2000) concluded that pumping of the Oaks well at 4 gpm would not impact adjacent wells. He estimated that after 20 years of pumping, the drawdown 1,000 feet away would be less than 2.1 feet. Nearby wells included in the evaluation are the San Benancio School well located approximately 1,000 feet north and the Ambler Park wells located approximately 1,500 feet west of the Oaks well (Feeney, July 19, 2000). Additional wells on the Harper Canyon property would be even further away from these wells.

Pumping the Oaks well at a higher rate would have little impact on the existing wells due to their great distance from the pumping well (over 1,000 feet). The cone of depression around the Oaks well would be deeper but the radius of influence would not change. The proposed new well will probably be over 1,000 feet away from the Oaks wells and other existing wells thus reducing the potential for impacts. Nonetheless, pumping tests should be conducted on the new well to assess the local impacts associated with pumping more than one well in the area.

Effects on Aquifer

Regional effects on the aquifer from the pumping increase of 12.75 AF/y appear to be minimal when compared to recharge estimates. Note that this comparison is regional and on an average basis. Local effects are uncertain since location, construction, and pumping capacity of the new well are unknown. Water levels will likely decline in times of extended drought. Hydrogeologic information should be analyzed for any additional wells since recharge, especially on a local level, is limited. This information includes aquifer testing data for the new wells and any existing local wells, pumping rates for the existing and proposed wells, and historic water level and water quality data in nearby wells.

Conclusions

Todd Engineers review of available data indicate that pumping 12.75 AF/y for the proposed Harper Canyon development will not deplete the aquifer on a regional basis. Local impacts associated with the new well cannot be determined at this time since the proposed well location, depth, and pumping capacity are unknown. These data will be summarized in a report addendum after the well has been installed and tested. Pumping the Oaks well and the new well at 12 gpm to supply the Oaks subdivision and the Harper Canyon homes does not appear to result in any appreciable impacts to nearby wells. In conclusion, available data indicate that the project will have a negligible effect on groundwater quantity and quality and that an adequate water supply exists.

Based on our review, we recommend the following:

- Pumping tests should be conducted on any new well(s) installed on the Harper Canyon property to determine aquifer parameters, pumping rates, well interference, and local impacts.
- Water samples from the new well should be analyzed for water quality to ensure an adequate supply.
- Water levels and water quality should be routinely measured and reported for the Oaks well and new well(s), including monthly water level measurements. These data could assist in determining aquifer(s) sensitivity to droughts and pumping. In addition, pumping volumes should also be recorded and submitted with other monitoring data. If these data are already being generated as part of a California Department of Health Services (DHS) permit, the County could access data from DHS. These data can be used for evaluation of new wells installed in the future.
- Additional hydrogeologic understanding of this area on a local level is needed as additional developments are approved. This may involve construction of groundwater elevation maps, hydrographs, and aquifer testing of existing wells.

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Maps

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COUNTY OF MONTEREY
HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

MEMORANDUM

November 12, 2002

TO: Paul Mugan, Associate Planner
Planning and Building Inspection Department

FROM: Laura Lawrence, R.E.H.S., EHS IV
Health Department

SUBJECT: PLN 000696, Harper Canyon Realty LLC, Standard Subdivision

The Division of Environmental Health has reviewed a draft project specific hydrogeological report for the subject project. The report clearly indicates that there is adequate source capacity for the proposed project and that the project in and of itself should have negligible effects on the aquifer in this area and on nearby existing wells. Based upon this information, the Division of Environmental considers the application complete with conditions (see separate memo).

However, the existing water system will require a second well to sustain the additional connections proposed by the development. In agreement with the applicant, the following conditions are to be completed prior to a public hearing:

1. Prior to public hearing, a water supply well for the proposed water system shall be drilled under permit of the Division of Environmental Health. The water system is to be operated by California American Water Company.
2. After drilling the new well and prior to public hearing, provide evidence to the satisfaction of the Director of Environmental Health and California American Water Company that the water source meets applicable State and County standards for water quantity and quality.
3. Water quality and quantity information shall be submitted to the Division of Environmental Health and incorporated into the final Project Specific Hydrogeological Report for the subdivision.

COUNTY OF MONTEREY
HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

MEMORANDUM

November 12, 2002

TO: Paul Mugan, Associate Planner
Planning and Building Inspection Department

FROM: Laura Lawrence, R.E.H.S., EHS IV
Health Department

SUBJECT: PLN 000696, Harper Canyon Realty LLC, Standard Subdivision

The Division of Environmental Health now considers the subject application complete with the following conditions:

1. Design the water system improvements to meet the standards as found in Chapter 15.04 of the Monterey County Code, Titles 17 and 22 of the California Code of Regulations and as found in the Residential Subdivision Water Supply Standards. Submit engineered plans for the water system improvements, including plans for secondary treatment, and any associated fees to the Director of Environmental Health for review and approval prior to installing (or bonding) the improvements.
2. Design the water system improvements to meet fire flow standards as required and approved by the local fire protection agency. Submit evidence to the Division of Environmental Health that the proposed water system improvements have been approved by the local fire protection agency prior to installation or bonding of water system improvements.
3. The developer shall install or bond the water system improvements to and within the subdivision and any appurtenances needed prior to filing the final (parcel) map. The performance bond shall be based on an Engineering Report. Cost Estimate shall be submitted to and approved by the Division of Environmental Health.
4. Submit engineered plans for the sewer system to California Utilities Service for review and approval prior to installing the sewer system improvements. The sewer system improvements shall be installed or bonded for installation to and within the subdivision or prior to filing the final map. Provide evidence to the Director of Environmental Health that the proposed sewer system improvements have been approved by California Utilities Service prior to filing the final map.

COUNTY OF MONTEREY
HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

MEMORANDUM

November 12, 2002

TO: Paul Mugan, Associate Planner
Planning and Building Inspection Department

FROM: Laura Lawrence, R.E.H.S., EHS IV
Health Department

SUBJECT: PLN 000696, Harper Canyon Realty LLC, Standard Subdivision

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1. Prior to public hearing, a water supply well for the proposed water system shall be drilled under permit of the Division of Environmental Health. The water system is to be operated by California American Water Company.
2. After drilling the new well and prior to public hearing, provide evidence to the satisfaction of the Director of Environmental Health and California American Water Company that the water source meets applicable State and County standards for water quantity and quality.
3. Water quality and quantity information shall be submitted to the Division of Environmental Health and incorporated into the final Project Specific Hydrogeological Report for the subdivision.

COUNTY OF MONTEREY
HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH DIVISION

MEMORANDUM

November 12, 2002

TO: Paul Mugan, Associate Planner
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FROM: Laura Lawrence, R.E.H.S., EHS IV
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2. Design the water system improvements to meet fire flow standards as required and approved by the local fire protection agency. Submit evidence to the Division of Environmental Health that the proposed water system improvements have been approved by the local fire protection agency prior to installation or bonding of water system improvements.
3. The developer shall install or bond the water system improvements to and within the subdivision and any appurtenances needed prior to filing the final (parcel) map. The performance bond shall be based on an Engineering Report. Cost Estimate shall be submitted to and approved by the Division of Environmental Health.
4. Submit engineered plans for the sewer system to California Utilities Service for review and approval prior to installing the sewer system improvements. The sewer system improvements shall be installed or bonded for installation to and within the subdivision or prior to filing the final map. Provide evidence to the Director of Environmental Health that the proposed sewer system improvements have been approved by California Utilities Service prior to filing the final map.

California-American Water Company

Monterey Division
50 Ragsdale Dr., Suite 100, P.O. Box 951 • Monterey, CA 93942-0951

Terry Ryan
Vice President & Manager

April 19, 2001

RECEIVED
APR 23 2001
MICHAEL D. CLING
ATTORNEY AT LAW

443-618

Mr. Michael Cling, Attorney at Law
313 So. Main Street, Suite D
Salinas, CA 93901

RE: Harper Canyon Realty, LLC
APN: 416-521-001
416-521-002
416-521-003
416-521-004
416-521-005
416-521-006
416-521-007
416-521-008
416-521-009
416-521-010
416-521-011
416-521-012
416-521-013
416-521-016
416-611-001
416-611-002

This letter is to advise that the referenced property is located within the California-American Water Company (Cal-Am) service area. Cal-Am will serve water to these lots under the provisions of the rules, regulations and tariffs of the California Public Utilities Commission (CPUC) and in accordance with all applicable rules, regulations and ordinances and restrictions of any other regulatory agency with jurisdiction. The applicant for water service must comply with all Cal-Am rules and regulations as are on file with the CPUC and must obtain all required permits and pay all required fees as a condition of service.

Requirements for system improvements that may be necessary have not yet been determined. All costs required to upgrade the system for water service and fire protection to meet all applicable jurisdictional requirements for this project shall be the sole responsibility of the property owner. This may include, but is not limited to, source of supply, treatment, distribution and/or storage. The scope of this proposal to serve water is valid for an indefinite period of time, is subject to water availability to Cal-Am and to changes or modifications as approved, adopted or directed by the CPUC and/or other jurisdictions with authority.

Sincerely,

Terry Ryan

Terry Ryan

APPENDIX G – SURFACE WATER AND WATER QUALITY

Whitson Engineers. Preliminary Drainage Report. March 22, 2007.

PRELIMINARY DRAINAGE REPORT

for

ENCINA HILLS SUBDIVISION

Monterey County, California

REGISTERED PROFESSIONAL ENGINEER
K. M. WHITSON
No. 25766
K.M. Whitson
EXP. 12/31/07
CIVIL
STATE OF CALIFORNIA

Prepared by:

Whitson Engineers
9699 Blue Larkspur Lane, Suite 105
Monterey, California 93940
(831) 649-5225
FAX: (831) 373-5065

March 22, 2007
Project #546.00

PRELIMINARY DRAINAGE REPORT
for
ENCINA HILLS SUBDIVISION

Project Overview

The Encina Hills Subdivision encompasses approximately 164 acres of land lying northwest of San Benancio Road and west of Toro Park. A Vicinity Map showing the project site is included as Attachment 1. This report will estimate the increase in runoff due to the proposed project, and will also estimate the volume of drainage detention that will be required. We will also account for the adjacent undeveloped lots in the calculations, so that the detention facilities can be sized to accommodate both the project and the adjacent lots.

This proposed subdivision consists of 17 residential lots with approximately 9,500 linear feet of paved roads. The 14 adjacent undeveloped properties, not located within the Encina Hills Subdivision, will have an estimated 4,200 linear feet of future paved roads.

Watershed Summary

A Watershed Map showing the proposed development and its relationship to the watersheds is included as Attachment 2. The primary drainage basins involving this project are identified as Watershed A, B, C, D, E, F, G, H, I, J and K on the watershed map. Watersheds A-K are sub-watersheds of El Toro Creek, which is a tributary of the Salinas River. The creek is located approximately 0.7 miles north-west of the project site. The land within these Watersheds is predominantly hilly with slopes varying from 20 to over 50 percent.

There are eleven watersheds, totaling approximately 315 acres, which drain through the Encina Hills project site. Watersheds A, B, C and H are in areas of the subdivision that have no planned development, so no additional runoff will occur in them due to the proposed site improvements. The remaining watersheds D, E, F, G, I, J and K have proposed development in them, including housing and/or paved roads. Their estimated post-development runoff and detention requirements are detailed in Attachment 3.

Hydrology

This drainage report uses the Rational Method for estimating the peak discharge (Q, ft^3/sec) of stormwater from the watersheds (A, acres). This method is a simple technique used for estimating a design discharge for small watersheds up to several hundred acres and assumes that rainfall occurs at a constant rate and is spatially uniform over the drainage area. The Rational method uses the following parameters in the runoff determination:

Drainage Area, (A): The area of the watershed, in acres.

Runoff Coefficient, (C): A value dependent on the land use, cover condition, watershed slope and soil group of the land. The runoff coefficient values of 0.25 (pervious surface) and 0.90 (impervious surface) have been chosen as appropriate for this area.

Time of Concentration, T_c: The time it takes water to flow from the farthest point of the watershed to the point being analyzed. It is determined from travel length and elevation fall of the storm flow, using a standard formula. Time of Concentration calculations was done for each watershed, and all were less than the minimum Time of Concentration of 20 minutes specified by the Water Resources Agency. Therefore, 20 minutes was used in this report.

Rainfall Intensity: This is determined by geographical location, as shown on the Monterey County Rainfall Intensity Chart, attached. This area has a rainfall intensity of approximately 0.5 in/hr.

Storm Frequency: The number of years that would elapse, on average, before a storm of a particular size would occur. (This is a statistical value, and does not imply that a flood of a certain magnitude will not recur sooner that the stated interval.) This study estimates the flows that would result from 10-year and 100-year storms.

Discharge: The discharge is calculated by the formula: $Q = CIA$

Post Development Flows:

Post development runoff was estimated by using a runoff coefficient for impervious area and factoring that into the runoff calculations by the same percentage as the area affected by development. The impervious area for the project was estimated by computing the probable impervious areas to be constructed. We estimate that approximately 8.3 acres of impervious area will result from construction of the project: 190,200 square feet of roads, and 170,000 square feet of impervious area on lots (10,000 square feet per homesite). This represents 2.6% of the project gross area.

We estimate that approximately 5.1 acres of impervious area for the adjacent properties within the watershed will result from future development and include approximately 83,900 square feet of roads and 140,000 square feet of imperious area on lots (10,000 square feet per homesite). Including the adjacent properties increases the impervious area to 13.4 acres and represents 4.3% of the project gross area.

The estimated pre-development and post-development peak runoff flows for Watersheds A, B, C, D, E, F, G, H, I, J and K were computed as follows:

	Estimated Pre-Development Flows (cfs)	**Estimated Post-Development Flows (cfs)**	**Estimated Post-Development Flows Including Adjacent Properties (cfs)**
Watershed A	$Q_{10} = 6.6$ $Q_{100} = 9.9$	No Change	No Change
Watershed B	$Q_{10} = 8.9$ $Q_{100} = 13.3$	No Change	No Change
Watershed C	$Q_{10} = 1.9$ $Q_{100} = 2.8$	No Change	No Change
Watershed D	$Q_{10} = 10.8$ $Q_{100} = 16.2$	$Q_{10} = 12.4$ $Q_{100} = 18.6$	$Q_{10} = 12.4$ $Q_{100} = 18.6$

Watershed E	Q_{10} = 2.5 Q_{100} = 3.8	Q_{100} = 2.7 Q_{100} = 4.1	Q_{100} = 2.7 Q_{100} = 4.1
Watershed F	Q_{10} = 30.4 Q_{100} = 45.5	Q_{10} = 33.4 Q_{100} = 50.1	Q_{10} = 34.8 Q_{100} = 52.1
Watershed G	Q_{10} = 24.2 Q_{100} = 36.4	Q_{10} = 25.5 Q_{100} = 38.3	Q_{10} = 28.0 Q_{100} = 42.1
Watershed H	Q_{10} = 0.3 Q_{100} = 0.4	No Change	No Change
Watershed I	Q_{10} = 2.4 Q_{100} = 3.6	Q_{10} = 2.6 Q_{100} = 3.9	Q_{10} = 2.8 Q_{100} = 4.2
Watershed J	Q_{10} = 1.0 Q_{100} = 1.5	Q_{10} = 1.1 Q_{100} = 1.7	Q_{10} = 1.1 Q_{100} = 1.7
Watershed K	Q_{10} = 12.1 Q_{100} = 18.1	Q_{10} = 12.6 Q_{100} = 18.9	Q_{10} = 12.8 Q_{100} = 19.1

Where Q_{10} = estimated 10 year peak flow
Q_{100} = estimated 100 year peak flow.

See Attachment 3 for runoff calculations.

Drainage Detention Facilities

The basis for calculation of detention volumes within this development is the standard requirement to mitigate the effect of additional runoff created in up to a 100 year storm event. The volume of the required detention is determined by calculating the volume from the 100 year post-development inflow in the subject watershed, and subtracting the10 year pre-development outflow volume (at an assumed uniform rate), and determine the time at which the differential volume is the largest. The volume thus obtained is the total required detention for the watershed. The detention facilities used for each watershed may vary in type, including detention ponds, dispersion facilities, etc. The design and location of these facilities is part of the final subdivision improvement plans, and will be reviewed and approved by the Monterey County Resources Agency. The flows and detention volumes shown in the report are preliminary, subject to final design calculations.

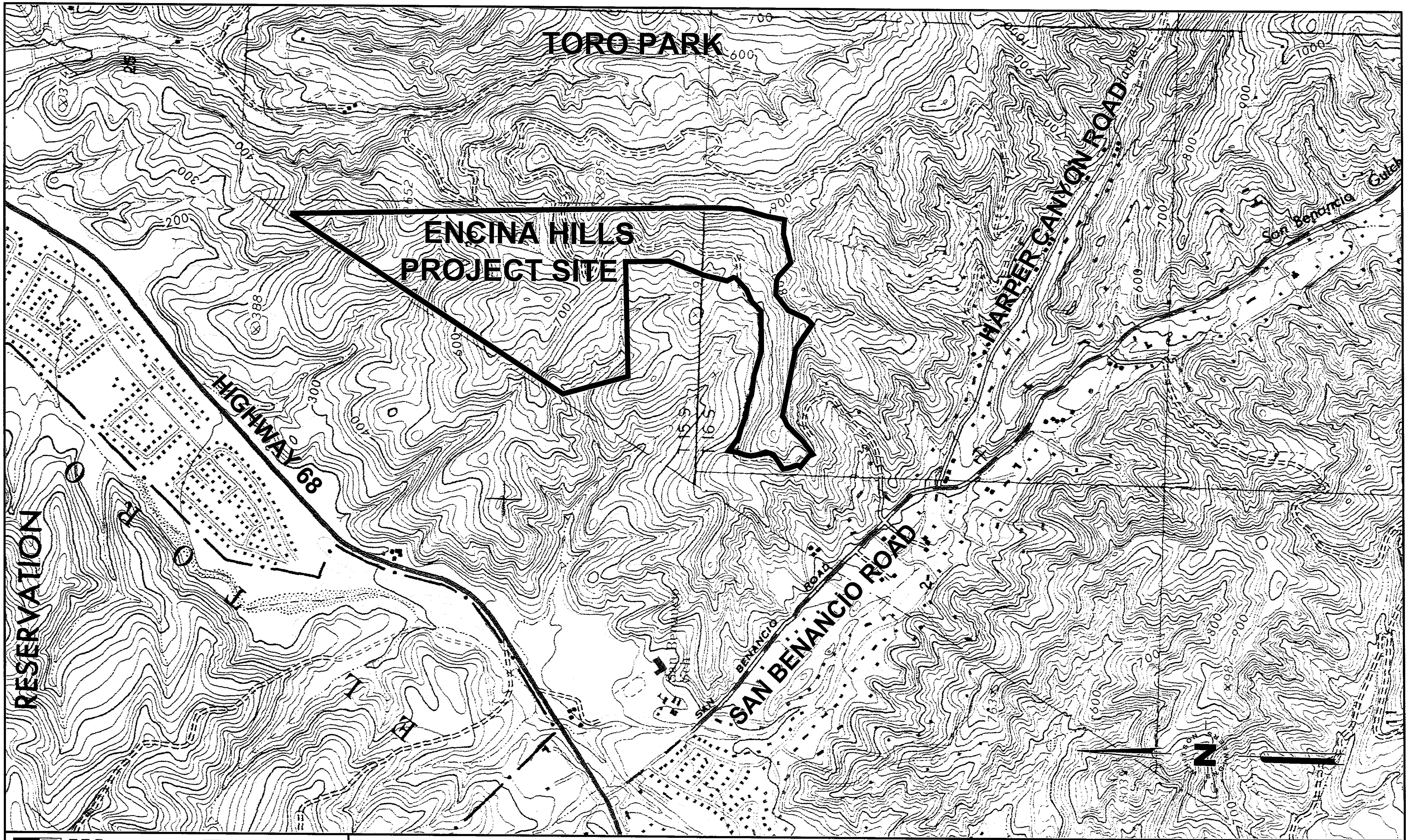
	Approximate Detention Requirements For Subject Property	**Approximate Detention Requirements For Subject Property and Adjacent Parcels**
Watershed A:	0 ft^3	0 ft^3
Watershed B:	0 ft^3	0 ft^3
Watershed C:	0 ft^3	0 ft^3
Watershed D:	9,363 ft^3	9,363 ft^3
Watershed E:	1,865 ft^3	1,865 ft^3
Watershed F:	23,585 ft^3	26,076 ft^3
Watershed G:	16,897 ft^3	21,429 ft^3
Watershed H:	0 ft^3	0 ft^3
Watershed I:	1,807 ft^3	2,152 ft^3
Watershed J:	799 ft^3	799 ft^3
Watershed K:	8,108 ft^3	8,438 ft^3

Storage volume calculations are included in Attachment 3.

Drainage Detention Locations

Several potential locations for drainage detention facilities have been identified, including at least one location in each watershed in which detention may be required. In some cases, more potential basins have been identified than will be actually required. This will provide flexibility in the final design of the basins. The final design will provide at least the minimum required detention volume, and will be sized to allow for drainage from the adjacent undeveloped lots to be accommodated.

The potential drainage basin locations are shown in Attachment 4.



WE WHITSON ENGINEERS
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831 649-5225 ▪ Fax 831 373-5065
CIVIL ENGINEERING ▪ LAND SURVEYING ▪ PROJECT MANAGEMENT

ENCINA HILLS

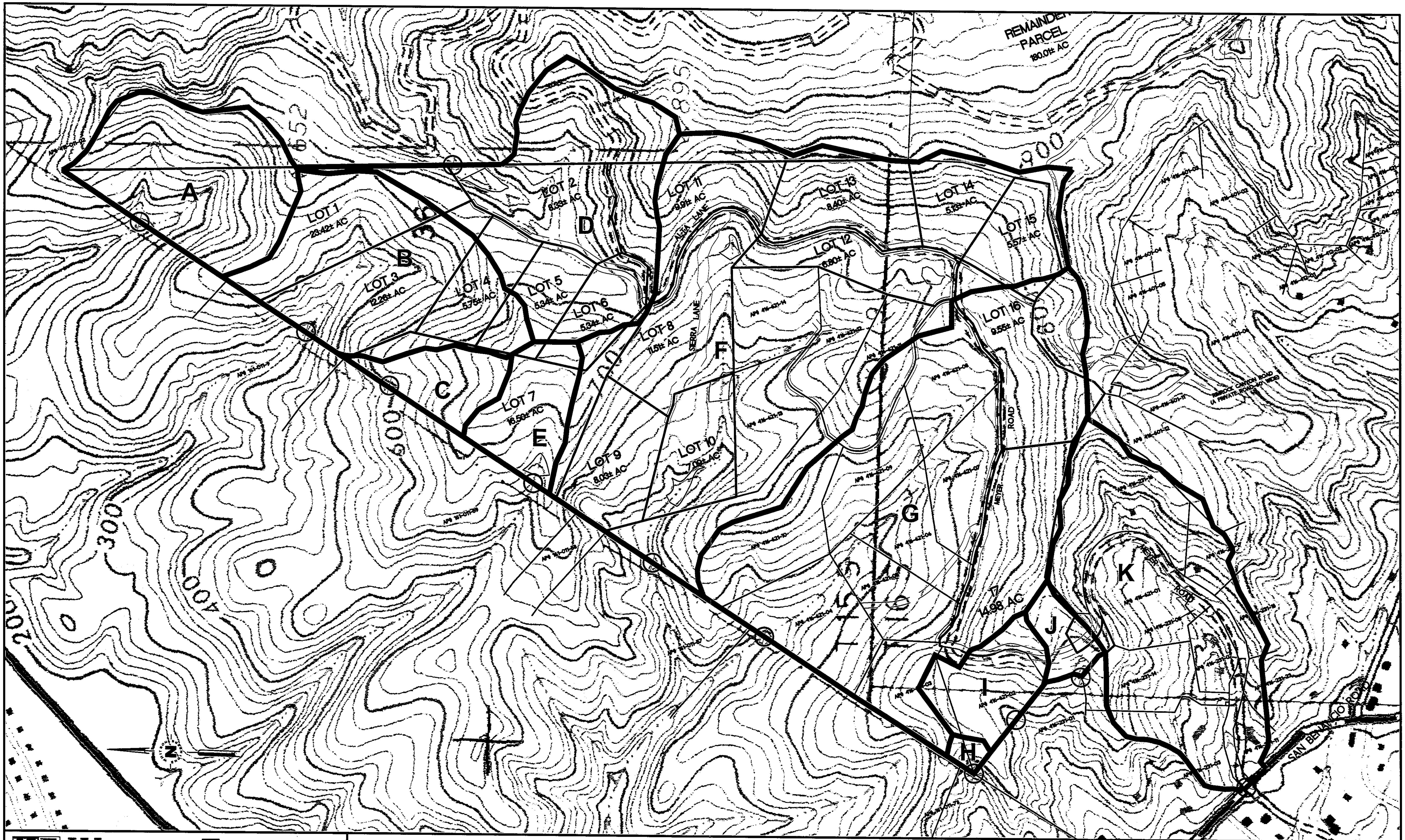
MONTEREY COUNTY CALIFORNIA

ATTACHMENT 1: VICINITY MAP

DRAWING PATH: T:\DWG\546\WATERSHED EXHIBIT.dwg

DATE:	JANUARY 8, 2007
SCALE:	1"=1000'
DRAWN:	K.A.Y.
CHECKED:	
PROJECT No.:	546.00

SHEET
1
OF 1



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CIVIL ENGINEERING ▪ LAND SURVEYING ▪ PROJECT MANAGEMENT

ENCINA HILLS

MONTEREY COUNTY CALIFORNIA

ATTACHMENT 2: WATERSHED MAP

DRAWING PATH: T:\DWG\546\WATERSHED EXHIBIT.dwg

DATE:	JANUARY 8, 2007
SCALE:	1"=500'
DRAWN:	K.A.Y.
CHECKED:	KMW
PROJECT No.:	546.00
SHEET	1 OF 1

ATTACHMENT 3

RATIONAL METHOD
RUNOFF CALCULATIONS

ENCINA HILLS SUBDIVISION

Project Name: ENCINA HILLS (WATERSHED A)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

10 year Runoff

Tc	20	minutes	←	Minimum Per Water Resources Agency
C	0.25		←	Runoff Coefficient of pervious surface
A	20.6	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	**6.6**	**cfs**		Q=CItA

100 year Runoff (No Development in this watershed)

Ap	20.6	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	-	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.25			Composite Runoff Coefficient
Total A	20.6	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	**9.9**	**cfs**		Q=CItA

Project Name: ENCINA HILLS (WATERSHED B)

Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

10 year Pre-Development Runoff

Tc	20	minutes	←	Minimum Per Water Resources Agency
C	0.25		←	Runoff Coefficient of pervious surface
A	27.7	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	**8.9**	cfs		Q=CItA

100 year Runoff (No Development in this watershed)

Ap	27.7	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	-	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.25			Composite Runoff Coefficient
Total A	27.7	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	13.3	cfs		Q=CItA

Project Name:	**ENCINA HILLS (WATERSHED C)**
Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

10 year Pre-Development Runoff

Tc	20	minutes	←	Minimum Per Water Resources Agency
C	0.25		←	Runoff Coefficient of pervious surface
A	5.8	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	**1.9**	cfs		Q=CItA

100 year Runoff (No Development in this watershed)

Ap	5.8	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	-	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.25			Composite Runoff Coefficient
Total A	5.8	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	**2.8**	cfs		Q=CItA

Project Name:	**ENCINA HILLS (WATERSHED D)**
Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	33.7	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	10.8	cfs		Q=CItA
Q 100 pre	16.2	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	31.8	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	1.92	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.29			Composite Runoff Coefficient
Total A	33.7	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	18.6	cfs		Q=CItA
Q 10 post	12.4	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	10.80	12965
30	10.80	19447
40	10.80	25930
50	10.80	32412
60	10.80	38895
90	10.80	58342
120	10.80	77789
150	10.80	97237
180	10.80	116684
210	10.80	136132
240	10.80	155579
270	10.80	175026
300	10.80	194474
330	10.80	213921

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	18.61	22328
30	1.57	15.19	27346
40	1.36	13.16	31577
50	1.22	11.77	35304
60	1.11	10.74	38673
90	0.91	8.77	47365
120	0.79	7.60	54692
150	0.70	6.79	61148
180	0.64	6.20	66984
210	0.59	5.74	72351
240	0.56	5.37	77347
270	0.52	5.06	82039
300	0.50	4.80	86476
330	0.47	4.58	90697

Storage Requirement

Qin	Qout	=(Qin - Qout)
22328	12965	9363
27346	19447	7899
31577	25930	5647
35304	32412	2892
38673	38895	-221
47365	58342	-10977
54692	77789	-23097
61148	97237	-36089
66984	116684	-49700
72351	136132	-63780
77347	155579	-78232
82039	175026	-92988
86476	194474	-107997
90697	213921	-123224

Detention 9363 cf

Project Name: ENCINA HILLS (WATERSHED E)

Project No. 546.00

Calculations by KAY/KMW/CLL

Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	7.9	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	2.5	cfs		Q=CItA
Q 100 pre	3.8	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	7.7	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	0.23	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.27			Composite Runoff Coefficient
Total A	7.9	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	4.1	cfs		Q=CItA
Q 10 post	2.7	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	2.53	3039
30	2.53	4554
40	2.53	6072
50	2.53	7590
60	2.53	9108
90	2.53	13662
120	2.53	18216
150	2.53	22770
180	2.53	27324
210	2.53	31878
240	2.53	36432
270	2.53	40986
300	2.53	45540
330	2.53	50094

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	4.09	4904
30	1.57	3.34	6006
40	1.36	2.89	6935
50	1.22	2.58	7754
60	1.11	2.36	8494
90	0.91	1.93	10403
120	0.79	1.67	12012
150	0.70	1.49	13430
180	0.64	1.36	14712
210	0.59	1.26	15891
240	0.56	1.18	16988
270	0.52	1.11	18018
300	0.50	1.06	18993
330	0.47	1.01	19920

Storage Requirement

Qin	Qout	= (Qin - Qout)
4904	3039	1865
6006	4554	1452
6935	6072	863
7754	7590	164
8494	9108	-614
10403	13662	-3259
12012	18216	-6204
13430	22770	-9340
14712	27324	-12612
15891	31878	-15987
16988	36432	-19444
18018	40986	-22968
18993	45540	-26547
19920	50094	-30174

Detention 1865 cf

Project Name: **ENCINA HILLS (WATERSHED F)**

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	←	
C	0.25		←	Runoff Coefficient of pervious surface
A	94.7	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	30.4	cfs		Q=CItA
Q 100 pre	45.5	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	91.1	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	3.61	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.27			Composite Runoff Coefficient
Total A	94.7	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	50.1	cfs		Q=CItA
Q 10 post	33.4	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	30.40	36480
30	30.40	54720
40	30.40	72960
50	30.40	91200
60	30.40	109440
90	30.40	164160
120	30.40	218880
150	30.40	273600
180	30.40	328320
210	30.40	383040
240	30.40	437760
270	30.40	492480
300	30.40	547200
330	30.40	601920

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	50.05	60065
30	1.57	40.87	73565
40	1.36	35.39	84945
50	1.22	31.66	94971
60	1.11	28.90	104036
90	0.91	23.60	127418
120	0.79	20.43	147129
150	0.70	18.28	164495
180	0.64	16.68	180196
210	0.59	15.45	194634
240	0.56	14.45	208072
270	0.52	13.62	220694
300	0.50	12.92	232632
330	0.47	12.32	243986

Storage Requirement

Qin	Qout	= (Qin - Qout)
60065	36480	23585
73565	54720	18845
84945	72960	11985
94971	91200	3771
104036	109440	-5404
127418	164160	-36742
147129	218880	-71751
164495	273600	-109105
180196	328320	-148124
194634	383040	-188406
208072	437760	-229688
220694	492480	-271786
232632	547200	-314568
243986	601920	-357934

Detention **23585 cf**

Project Name: ENCINA HILLS (WATERSHED F INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	
C	0.25		—	Runoff Coefficient of pervious surface
A	94.7	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	30.4	cfs		Q=CItA
Q 100 pre	45.5	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	89.4	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	5.27	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.29			Composite Runoff Coefficient
Total A	94.7	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	52.1	cfs		Q=CItA
Q 10 post	34.8	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	30.40	36480
30	30.40	54720
40	30.40	72960
50	30.40	91200
60	30.40	109440
90	30.40	164160
120	30.40	218880
150	30.40	273600
180	30.40	328320
210	30.40	383040
240	30.40	437760
270	30.40	492480
300	30.40	547200
330	30.40	601920

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	52.13	62556
30	1.57	42.56	76615
40	1.36	36.86	88467
50	1.22	32.97	98910
60	1.11	30.10	108350
90	0.91	24.57	132701
120	0.79	21.28	153230
150	0.70	19.04	171316
180	0.64	17.38	187668
210	0.59	16.09	202704
240	0.56	15.05	216700
270	0.52	14.19	229845
300	0.50	13.46	242278
330	0.47	12.83	254103

Storage Requirement

Qin	Qout	= (Qin - Qout)
62556	36480	26076
76615	54720	21895
88467	72960	15507
98910	91200	7710
108350	109440	-1090
132701	164160	-31459
153230	218880	-65650
171316	273600	-102284
187668	328320	-140652
202704	383040	-180336
216700	437760	-221060
229845	492480	-262635
242278	547200	-304922
254103	601920	-347817

Detention 26076 cf

Project Name: **ENCINA HILLS WATERSHED (G)**

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	75.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	24.2	cfs		Q=CItA
Q 100 pre	36.4	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	74.1	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	1.54	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.26			Composite Runoff Coefficient
Total A	75.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	38.3	cfs		Q=CItA
Q 10 post	25.5	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	24.20	29040
30	24.20	43560
40	24.20	58080
50	24.20	72600
60	24.20	87120
90	24.20	130680
120	24.20	174240
150	24.20	217800
180	24.20	261360
210	24.20	304920
240	24.20	348480
270	24.20	392040
300	24.20	435600
330	24.20	479160

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	38.28	45937
30	1.57	31.26	56262
40	1.36	27.07	64965
50	1.22	24.21	72633
60	1.11	22.10	79566
90	0.91	18.05	97448
120	0.79	15.63	112523
150	0.70	13.98	125805
180	0.64	12.76	137812
210	0.59	11.81	148854
240	0.56	11.05	159132
270	0.52	10.42	168785
300	0.50	9.88	177915
330	0.47	9.42	186598

Storage Requirement

Qin	Qout	= (Qin - Qout)
45937	29040	16897
56262	43560	12702
64965	58080	6885
72633	72600	33
79566	87120	-7554
97448	130680	-33232
112523	174240	-61717
125805	217800	-91995
137812	261360	-123548
148854	304920	-156066
159132	348480	-189348
168785	392040	-223255
177915	435600	-257685
186598	479160	-292562

Detention 16897 cf

Project Name: ENCINA HILLS (WATERSHED G INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	75.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	24.2	cfs		Q=CItA
Q 100 pre	**36.4**	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	71.0	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	4.56	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.29			Composite Runoff Coefficient
Total A	75.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	42.1	cfs		Q=CItA
Q 10 post	**28.0**	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	24.20	29040
30	24.20	43560
40	24.20	58080
50	24.20	72600
60	24.20	87120
90	24.20	130680
120	24.20	174240
150	24.20	217800
180	24.20	261360
210	24.20	304920
240	24.20	348480
270	24.20	392040
300	24.20	435600
330	24.20	479160

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	42.06	50469
30	1.57	34.34	61811
40	1.36	29.74	71373
50	1.22	26.60	79798
60	1.11	24.28	87414
90	0.91	19.83	107060
120	0.79	17.17	123622
150	0.70	15.36	138214
180	0.64	14.02	151406
210	0.59	12.98	163537
240	0.56	12.14	174828
270	0.52	11.45	185433
300	0.50	10.86	195464
330	0.47	10.35	205004

Storage Requirement

Qin	Qout	= (Qin - Qout)
50469	29040	21429
61811	43560	18251
71373	58080	13293
79798	72600	7198
87414	87120	294
107060	130680	-23620
123622	174240	-50618
138214	217800	-79586
151406	261360	-109954
163537	304920	-141383
174828	348480	-173652
185433	392040	-206607
195464	435600	-240136
205004	479160	-274156

Detention **21429 cf**

Project Name:	**ENCINA HILLS (WATERSHED H)**
Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

10 year Pre-Development Runoff

Tc	20	minutes	←	Minimum Per Water Resources Agency
C	0.25		←	Runoff Coefficient of pervious surface
A	0.8	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	**0.3**	**cfs**		Q=CItA

100 year Runoff (No Development in this watershed)

Ap	0.8	acres		Approx Area of Pervious Surface
Cp	0.3			Runoff Coefficient of pervious surface
Ai	-	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.25			Composite Runoff Coefficient
Total A	0.8	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	**0.4**	**cfs**		Q=CItA

Project Name: ENCINA HILLS (WATERSHED I)

Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

Pre-Development Runoff

Tc	20	minutes	←	Minimum Per Water Resources Agency
C	0.25		←	Runoff Coefficient of pervious surface
A	7.6	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	←	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	2.4	cfs		Q=CItA
Q 100 pre	3.6	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	7.3	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	0.22	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.27			Composite Runoff Coefficient
Total A	7.6	acres		
I (2 yr)	0.50	in/hr	←	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	←	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	3.9	cfs		Q=CItA
Q 10 post	2.6	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	2.40	2880
30	2.40	4320
40	2.40	5760
50	2.40	7200
60	2.40	8640
90	2.40	12960
120	2.40	17280
150	2.40	21600
180	2.40	25920
210	2.40	30240
240	2.40	34560
270	2.40	38880
300	2.40	43200
330	2.40	47520

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	3.91	4687
30	1.57	3.19	5740
40	1.36	2.76	6628
50	1.22	2.47	7411
60	1.11	2.26	8118
90	0.91	1.84	9943
120	0.79	1.59	11481
150	0.70	1.43	12836
180	0.64	1.30	14061
210	0.59	1.21	15188
240	0.56	1.13	16236
270	0.52	1.06	17221
300	0.50	1.01	18153
330	0.47	0.96	19039

Storage Requirement

Qin	Qout	= (Qin - Qout)
4687	2880	1807
5740	4320	1420
6628	5760	868
7411	7200	211
8118	8640	-522
9943	12960	-3017
11481	17280	-5799
12836	21600	-8764
14061	25920	-11859
15188	30240	-15052
16236	34560	-18324
17221	38880	-21659
18153	43200	-25047
19039	47520	-28481

Detention **1807 cf**

Project Name: ENCINA HILLS (WATERSHED I INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	7.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	2.4	cfs		Q=CItA
Q 100 pre	3.6	cfs		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	7.1	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	0.45	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.29			Composite Runoff Coefficient
Total A	7.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	4.2	cfs		Q=CItA
Q 10 post	2.8	cfs		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	2.40	2880
30	2.40	4320
40	2.40	5760
50	2.40	7200
60	2.40	8640
90	2.40	12960
120	2.40	17280
150	2.40	21600
180	2.40	25920
210	2.40	30240
240	2.40	34560
270	2.40	38880
300	2.40	43200
330	2.40	47520

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin - cf
20	1.92	4.19	5032
30	1.57	3.42	6163
40	1.36	2.97	7116
50	1.22	2.65	7956
60	1.11	2.42	8716
90	0.91	1.98	10675
120	0.79	1.71	12326
150	0.70	1.53	13781
180	0.64	1.40	15096
210	0.59	1.29	16306
240	0.56	1.21	17432
270	0.52	1.14	18489
300	0.50	1.08	19489
330	0.47	1.03	20440

Storage Requirement

Qin	Qout	= (Qin - Qout)
5032	2880	2152
6163	4320	1843
7116	5760	1356
7956	7200	756
8716	8640	76
10675	12960	-2285
12326	17280	-4954
13781	21600	-7819
15096	25920	-10824
16306	30240	-13934
17432	34560	-17128
18489	38880	-20391
19489	43200	-23711
20440	47520	-27080

Detention 2152 cf

Project Name: ENCINA HILLS (WATERSHED J)
Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	— Minimum Per Water Resources Agency
C	0.25		— Runoff Coefficient of pervious surface
A	3.1	acres	
I (2 yr)	0.50	in/hr	— Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	— Per Monterey County Plate No. 25
It	1.28	in/hr	It=7.75*I/SQRT(t)
Q 10 pre	1.0	cfs	Q=CItA
Q 100 pre	**1.5**	**cfs**	Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	3.0	acres	Approx Area of Pervious Surface
Cp	0.25		Runoff Coefficient of pervious surface
Ai	0.14	acres	Approx Area of Impervious Surface
Ci	0.90		Runoff Coeficient of impervious surface
Tc	20	minutes	
Weighted C	0.28		Composite Runoff Coefficient
Total A	3.1	acres	
I (2 yr)	0.50	in/hr	— Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	— Per Monterey County Plate No. 25
It	1.92	in/hr	It=7.75*I/SQRT(t)
Q 100 post	1.7	cfs	Q=CItA
Q 10 post	**1.1**	**cfs**	Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	1.00	1200
30	1.00	1800
40	1.00	2400
50	1.00	3000
60	1.00	3600
90	1.00	5400
120	1.00	7200
150	1.00	9000
180	1.00	10800
210	1.00	12600
240	1.00	14400
270	1.00	16200
300	1.00	18000
330	1.00	19800

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	1.67	1999
30	1.57	1.36	2448
40	1.36	1.18	2827
50	1.22	1.05	3161
60	1.11	0.96	3462
90	0.91	0.79	4240
120	0.79	0.68	4896
150	0.70	0.61	5474
180	0.64	0.56	5997
210	0.59	0.51	6477
240	0.56	0.48	6925
270	0.52	0.45	7345
300	0.50	0.43	7742
330	0.47	0.41	8120

Storage Requirement

Qin	Qout	= (Qin - Qout)
1999	1200	799
2448	1800	648
2827	2400	427
3161	3000	161
3462	3600	-138
4240	5400	-1160
4896	7200	-2304
5474	9000	-3526
5997	10800	-4803
6477	12600	-6123
6925	14400	-7475
7345	16200	-8855
7742	18000	-10258
8120	19800	-11680

Detention 799 cf

Project Name: **ENCINA HILLS (WATERSHED K)**
Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

Pre-Development Runoff

Tc	20	minutes	— Minimum Per Water Resources Agency
C	0.25		— Runoff Coefficient of pervious surface
A	37.6	acres	
I (2 yr)	0.50	in/hr	— Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	— Per Monterey County Plate No. 25
It	1.28	in/hr	It=7.75*I/SQRT(t)
Q 10 pre	12.1	cfs	Q=CItA
Q 100 pre	18.1	cfs	Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	37.0	acres	Approx Area of Pervious Surface
Cp	0.25		Runoff Coefficient of pervious surface
Ai	0.62	acres	Approx Area of Impervious Surface
Ci	0.90		Runoff Coeficient of impervious surface
Tc	20	minutes	
Weighted C	0.26		Composite Runoff Coefficient
Total A	37.6	acres	
I (2 yr)	0.50	in/hr	— Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	— Per Monterey County Plate No. 25
It	1.92	in/hr	It=7.75*I/SQRT(t)
Q 100 post	18.9	cfs	Q=CItA
Q 10 post	12.6	cfs	Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	12.10	14520
30	12.10	21780
40	12.10	29040
50	12.10	36300
60	12.10	43560
90	12.10	65340
120	12.10	87120
150	12.10	108900
180	12.10	130680
210	12.10	152460
240	12.10	174240
270	12.10	196020
300	12.10	217800
330	12.10	239580

100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	18.86	22628
30	1.57	15.40	27714
40	1.36	13.33	32001
50	1.22	11.93	35778
60	1.11	10.89	39193
90	0.91	8.89	48002
120	0.79	7.70	55428
150	0.70	6.89	61970
180	0.64	6.29	67885
210	0.59	5.82	73324
240	0.56	5.44	78386
270	0.52	5.13	83141
300	0.50	4.87	87639
330	0.47	4.64	91916

Storage Requirement

Qin	Qout	=(Qin - Qout)
22628	14520	8108
27714	21780	5934
32001	29040	2961
35778	36300	-522
39193	43560	-4367
48002	65340	-17338
55428	87120	-31692
61970	108900	-46930
67885	130680	-62795
73324	152460	-79136
78386	174240	-95854
83141	196020	-112879
87639	217800	-130161
91916	239580	-147664

Detention **8108 cf**

Project Name:	**ENCINA HILLS (WATERSHED K INCLUDING ADJACENT PARCEL)**
Project No.	546.00
Calculations by	KAY/KMW/CLL
Date:	3/22/2007

Pre-Development Runoff

Tc	20	minutes	—	Minimum Per Water Resources Agency
C	0.25		—	Runoff Coefficient of pervious surface
A	37.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (10 yr)	0.74	in/hr	—	Per Monterey County Plate No. 25
It	1.28	in/hr		It=7.75*I/SQRT(t)
Q 10 pre	12.1	cfs		Q=CItA
Q 100 pre	**18.1**	**cfs**		Q100=Q10*(1.11/0.74)

Post-Development Runoff

Ap	36.8	acres		Approx Area of Pervious Surface
Cp	0.25			Runoff Coefficient of pervious surface
Ai	0.84	acres		Approx Area of Impervious Surface
Ci	0.90			Runoff Coeficient of impervious surface
Tc	20	minutes		
Weighted C	0.26			Composite Runoff Coefficient
Total A	37.6	acres		
I (2 yr)	0.50	in/hr	—	Per Monterey County Plate No. 25
I (100 yr)	1.11	in/hr	—	Per Monterey County Plate No. 25
It	1.92	in/hr		It=7.75*I/SQRT(t)
Q 100 post	19.1	cfs		Q=CItA
Q 10 post	**12.8**	**cfs**		Q10=Q100*(.74/1.11)

10 year Pre-Development Outflow

Tc Min	Q cfs	Qout cf
20	12.10	14520
30	12.10	21780
40	12.10	29040
50	12.10	36300
60	12.10	43560
90	12.10	65340
120	12.10	87120
150	12.10	108900
180	12.10	130680
210	12.10	152460
240	12.10	174240
270	12.10	196020
300	12.10	217800
330	12.10	239580

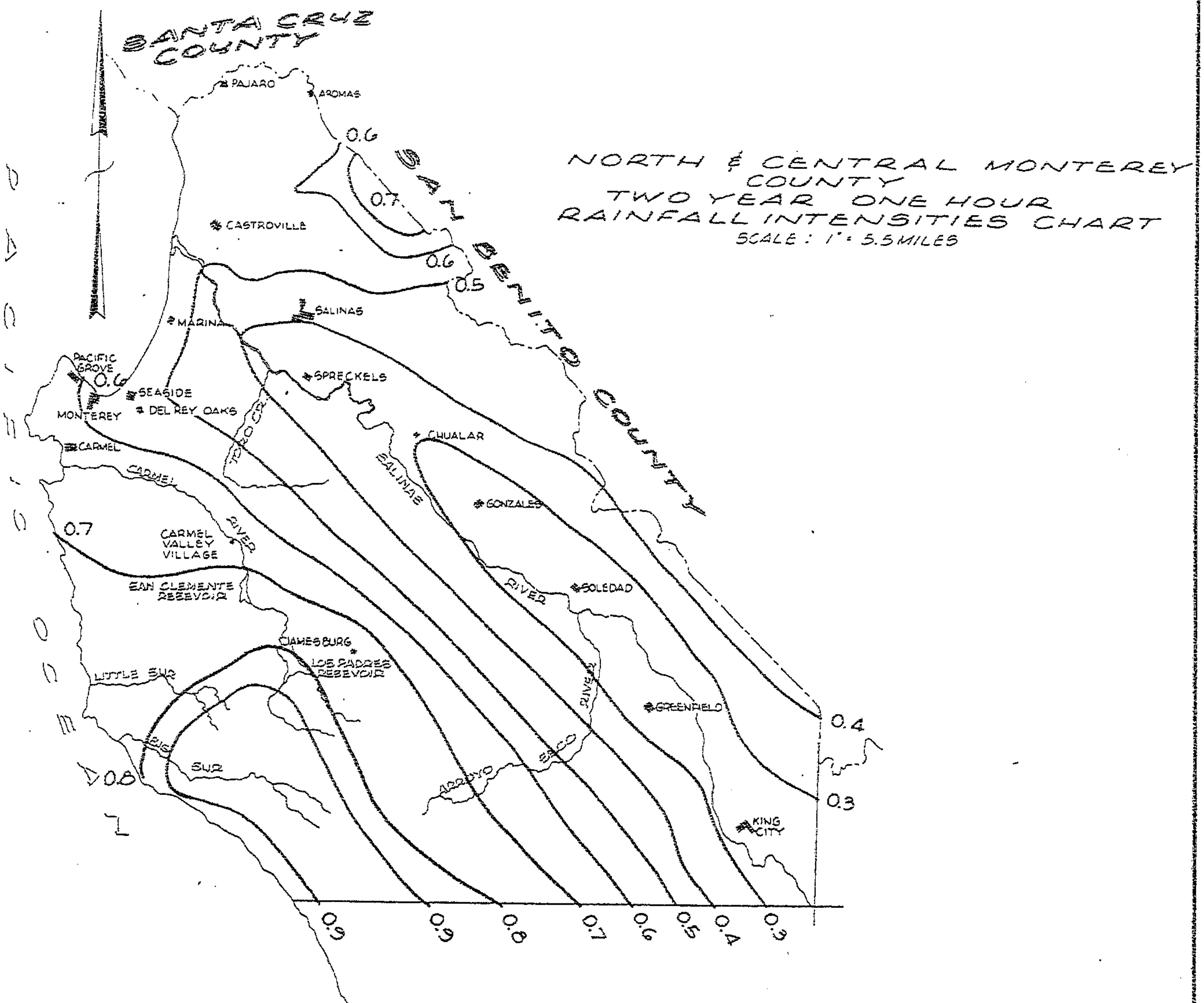
100 year Post-Development Inflow

Tc Min	I 100yr in/hr	Q cfs	Qin cf
20	1.92	19.13	22958
30	1.57	15.62	28118
40	1.36	13.53	32468
50	1.22	12.10	36300
60	1.11	11.05	39765
90	0.91	9.02	48702
120	0.79	7.81	56236
150	0.70	6.99	62874
180	0.64	6.38	68875
210	0.59	5.90	74393
240	0.56	5.52	79530
270	0.52	5.21	84354
300	0.50	4.94	88917
330	0.47	4.71	93257

Storage Requirement

Qin	Qout	= (Qin - Qout)
22958	14520	8438
28118	21780	6338
32468	29040	3428
36300	36300	0
39765	43560	-3795
48702	65340	-16638
56236	87120	-30884
62874	108900	-46026
68875	130680	-61805
74393	152460	-78067
79530	174240	-94710
84354	196020	-111666
88917	217800	-128883
93257	239580	-146323

Detention	**8438 cf**



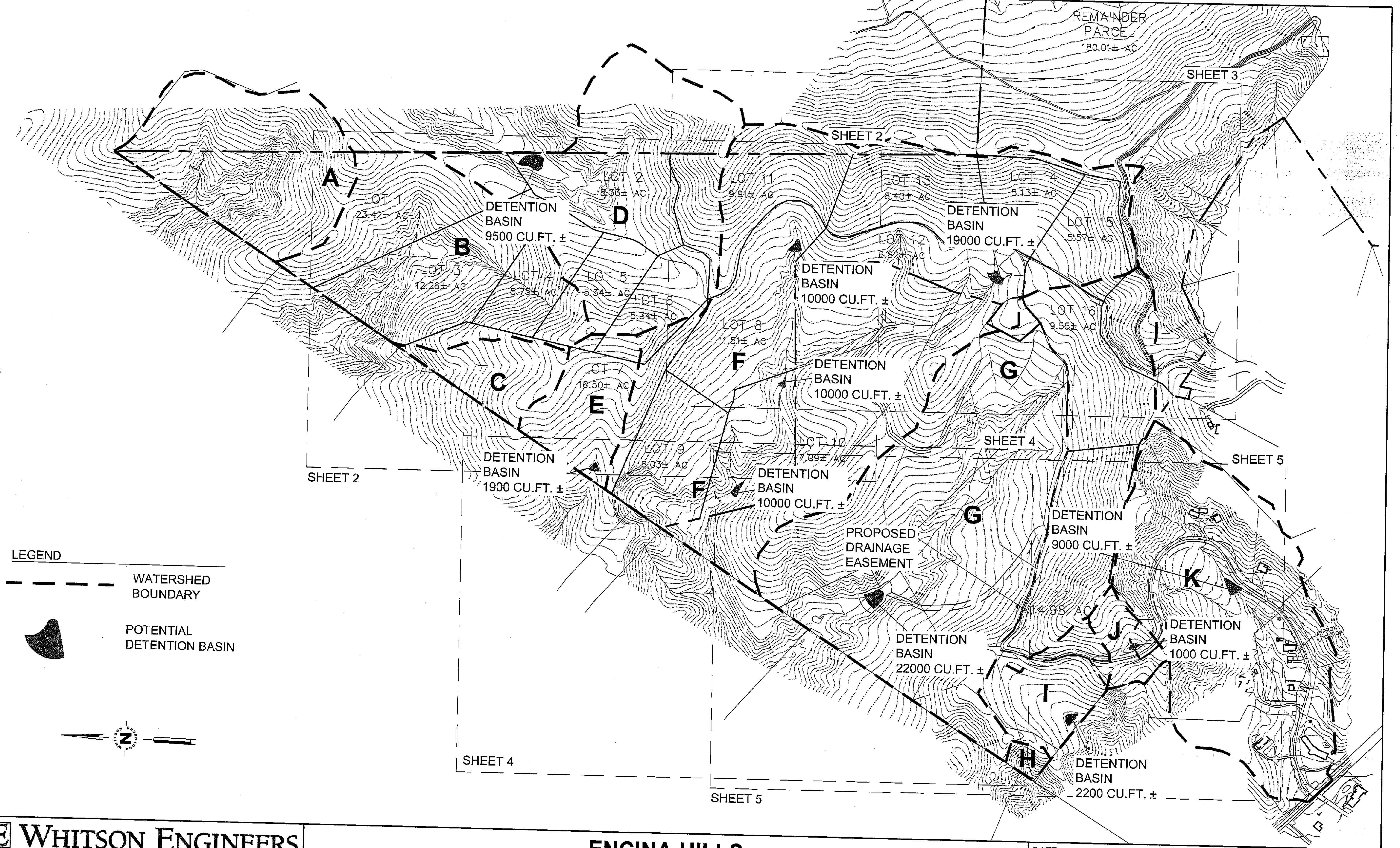
NORTH & CENTRAL MONTEREY COUNTY TWO YEAR ONE HOUR RAINFALL INTENSITIES CHART

SCALE : 1" = 5.5 MILES

NOTE :

1. Intensities for particular location in the Southern part of the County available from County Surveyors Office.
2. Conversion Factors.
   Intensity of a 10-year Design storm equals a 2 year Design Storm times 1.48
   " " " 25 year " " " " " " 1.73
   " " " 50 year " " " " " " 1.92
   " " " 100 year " " " " " " 2.22
3. The maximum intensity (I_t) for storms of various duration is determined by the formula. $I_t = 7.75\ i/\sqrt{t}$ in which variable are as follows.
   I_t : maximum intensity of storm of t minutes duration.
   i : one hour rainfall intensity from above chart and note 2.
   t : time in minutes shortest time it takes storm runoff to flow from the farthest point in the drainage area to the point in question
4. Example :
   Find maximum intensity of 20 minute storm in Chualar, expected to occur on the average of once in 25 years.
   Solution : From chart 0.3"/hr. intensity for 2-year design storm
   From note 2, 0.3 times 1.73 equals 0.82"/hr. the maximum intensity of a 25 year one hour design storm.
   From note 3, $I = 7.75\ i/\sqrt{t} = (7.75)(0.82)/\sqrt{20} = 1.42$"/hr.
   Therefore the maximum 20 min. intensity of a storm that on the average would occur once every 25 years would be 1.42"/hr.

MONTEREY COUNTY	DEPT. OF PUBLIC WORKS
STANDARD DETAILS RAINFALL INTENSITIES CHART	
APPROVED	DATE 10-24-77
REVISED	DATE
PLATE NO.	25



WE WHITSON ENGINEERS
9699 Blue Larkspur Lane ▪ Suite 105 ▪ Monterey, CA 93940
831 649-5225 ▪ Fax 831 373-5065
CIVIL ENGINEERING ▪ LAND SURVEYING ▪ PROJECT MANAGEMENT

MONTEREY COUNTY

ENCINA HILLS

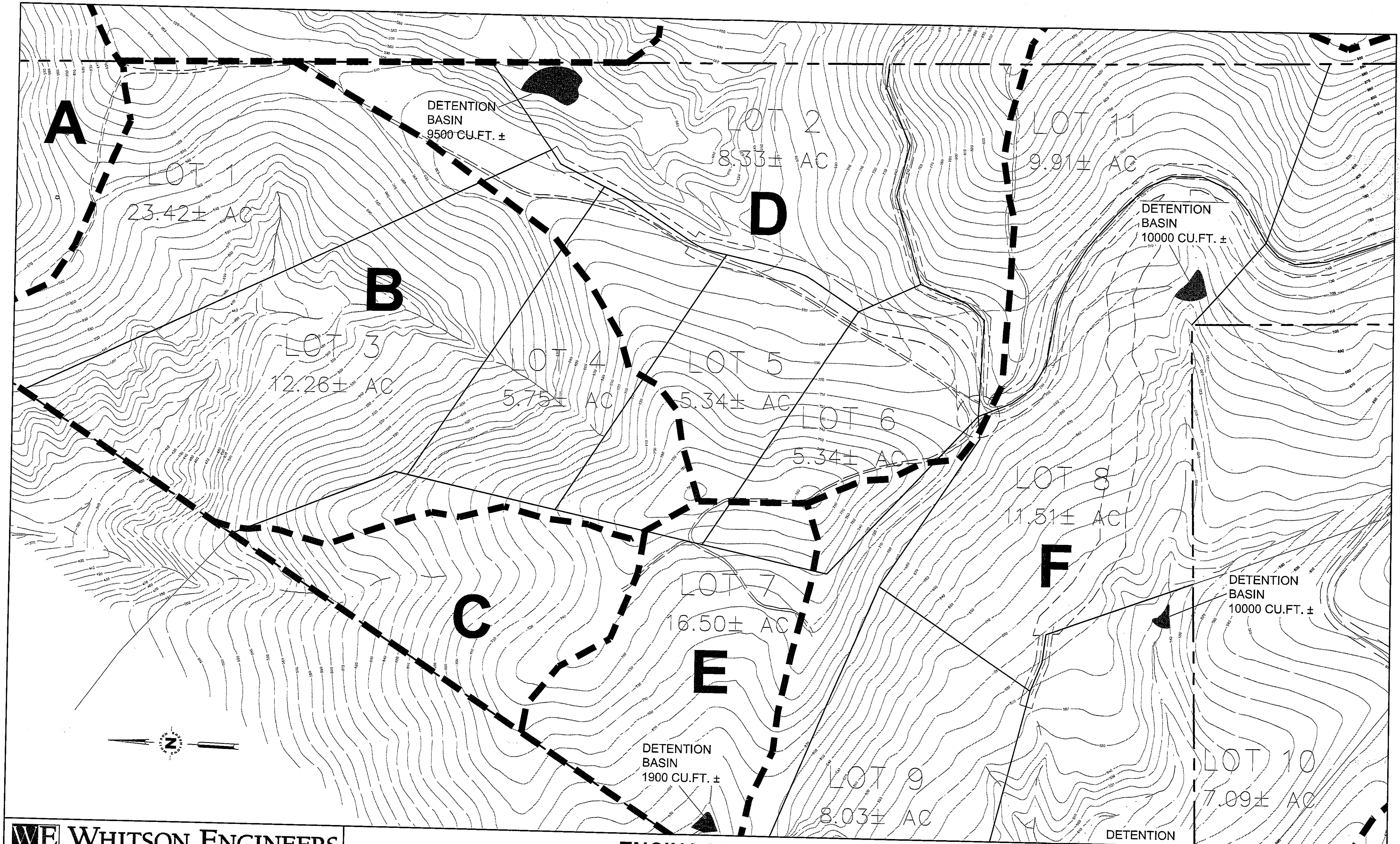
CALIFORNIA

ATTACHMENT 4: POTENTIAL DETENTION BASINS

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

DATE:	MARCH 22, 2007
SCALE:	1"=500'
DRAWN:	J.V
CHECKED:	K.W
PROJECT No.:	546.00

SHEET
1
OF 5



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ENCINA HILLS

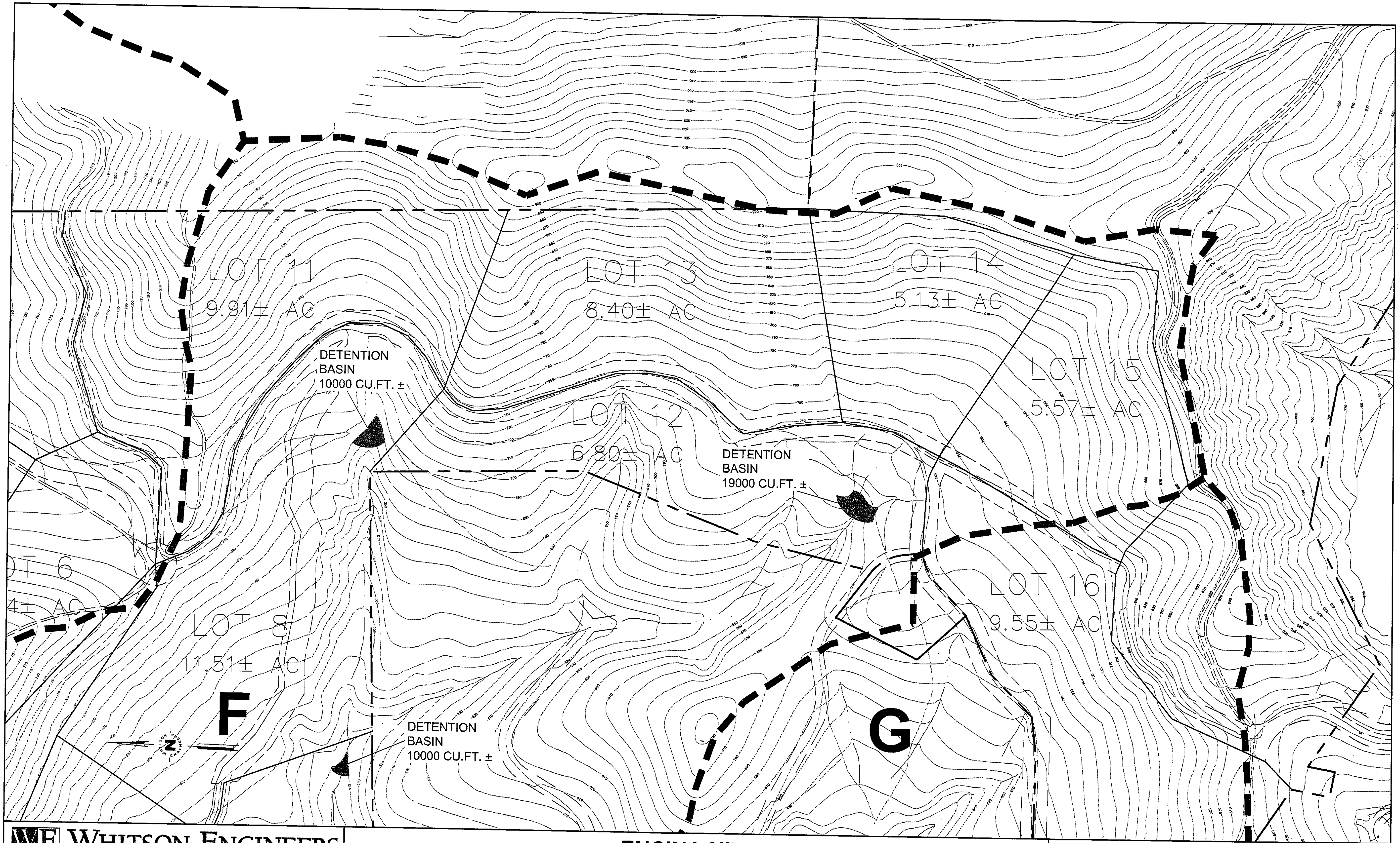
MONTEREY COUNTY
CALIFORNIA

ATTACHMENT 4: POTENTIAL DETENTION BASINS

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

DATE:	MARCH 22, 2007
SCALE:	1"=200'
DRAWN:	J.V
CHECKED:	K.W
PROJECT No.:	546.00

SHEET
2
OF 5



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ENCINA HILLS

MONTEREY COUNTY
CALIFORNIA

ATTACHMENT 4: POTENTIAL DETENTION BASINS

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

DATE: MARCH 22, 2007
SCALE: 1"=200'
DRAWN: J.V
CHECKED: K.W
PROJECT No.: 546.00

SHEET
3
OF 5

WE WHITSON ENGINEERS
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ENCINA HILLS

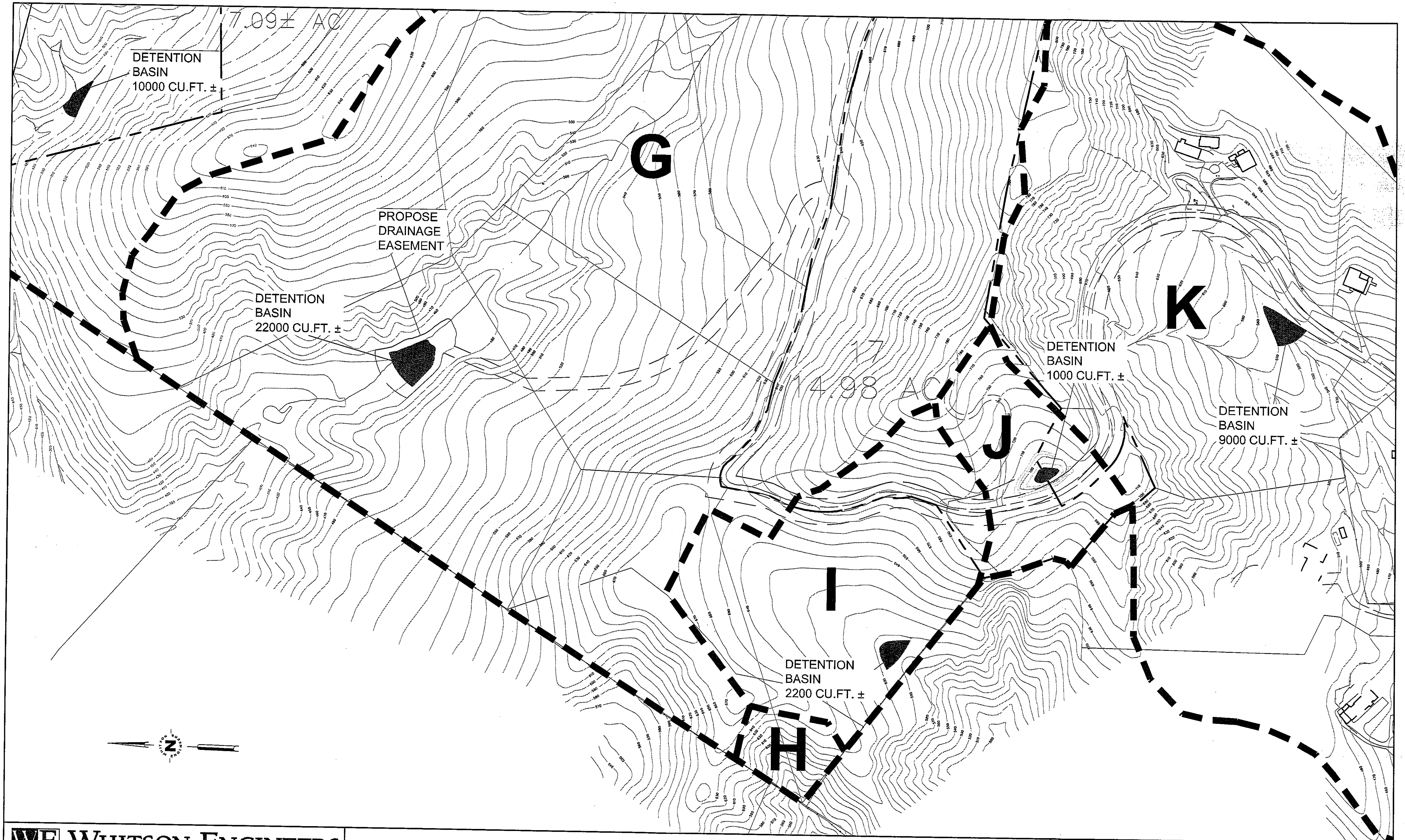
MONTEREY COUNTY CALIFORNIA

ATTACHMENT 4: POTENTIAL DETENTION BASINS

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

DATE:	MARCH 22, 2007
SCALE:	1"=200'
DRAWN:	J.V
CHECKED:	K.W
PROJECT No.:	546.00

SHEET
4
OF 5



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ENCINA HILLS

MONTEREY COUNTY CALIFORNIA

ATTACHMENT 4: POTENTIAL DETENTION BASINS

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

DATE:	MARCH 22, 2007	SHEET
SCALE:	1"=200'	5
DRAWN:	J.V	
CHECKED:	K.W	
PROJECT No.:	546.00	OF 5

APPENDIX H – PUBLIC SERVICE AND UTILITIES

Regional Water Quality Control Board (RWQCB). Written communication from Roger Briggs, Executive Officer, RWQCB to Pamela Lapham, Assistant Planner, PMC regarding California Utilities Company. April 7, 2006.

California-American Water Company. Will serve letter. April 19, 2001

California Utilities Service, Inc. Will serve letter. June 11, 2001.

California-American Water Company

Monterey Division
50 Ragsdale Dr., Suite 100, P.O. Box 951 • Monterey, CA 93942-0951

Terry Ryan
Vice President & Manager

April 19, 2001

RECEIVED
APR 23 2001
MICHAEL D. CLING
ATTORNEY AT LAW

443-618

Mr. Michael Cling, Attorney at Law
313 So. Main Street, Suite D
Salinas, CA 93901

RE: Harper Canyon Realty, LLC
APN:
416-521-001
416-521-002
416-521-003
416-521-004
416-521-005
416-521-006
416-521-007
416-521-008
416-521-009
416-521-010
416-521-011
416-521-012
416-521-013
416-521-016
416-611-001
416-611-002

This letter is to advise that the referenced property is located within the California-American Water Company (Cal-Am) service area. Cal-Am will serve water to these lots under the provisions of the rules, regulations and tariffs of the California Public Utilities Commission (CPUC) and in accordance with all applicable rules, regulations and ordinances and restrictions of any other regulatory agency with jurisdiction. The applicant for water service must comply with all Cal-Am rules and regulations as are on file with the CPUC and must obtain all required permits and pay all required fees as a condition of service.

Requirements for system improvements that may be necessary have not yet been determined. All costs required to upgrade the system for water service and fire protection to meet all applicable jurisdictional requirements for this project shall be the sole responsibility of the property owner. This may include, but is not limited to, source of supply, treatment, distribution and/or storage. The scope of this proposal to serve water is valid for an indefinite period of time, is subject to water availability to Cal-Am and to changes or modifications as approved, adopted or directed by the CPUC and/or other jurisdictions with authority.

Sincerely,

Terry Ryan

Terry Ryan

Administration

Customer Service
(831) 646-3200

Fax
(831) 375-4367

CALIFORNIA UTILITIES SERVICE, INC.

A California Corporation

Robert T. Adcock
President
(831) 424 - 0442 Phone

P. O. Box 510
Salinas, CA 9391
(831) 424 - 0611 Fa

June 11, 2001

Michael Cling, Attorney at Law
313 Main Street, Suite D
Salinas, CA 93901

RE: **Harper Canyon Realty, APN 416-611-001 and APN 416-611-002**

Dear Mr. Cling,

As per your request, this letter will confirm that your client's proposed subdivision is located within our certificated service area. California Utilities Service can and will provide public utility sewer service to the subdivision, located on the above-referenced property, in accordance with its rules and tariffs as approved by the California Public Utilities Commission.

California Utilities Service is a public utility wastewater treatment company that exists and operates under the jurisdiction of the California Public Utilities Commission.

It will be necessary for your client and the utility to enter into a sewer main extension agreement in order for sewer collection facilities to be brought to this subdivision. Upon request, the utility can prepare such a main extension agreement and forward it to you for execution.

If you have any questions or require additional information about our company, please do not hesitate to contact me at (831) 424-0442.

Sincerely,

Thomas R. Adcock
Vice President

TRA/ams

APPENDIX I – TRANSPORTATION AND CIRCULATION

Higgins Associates. Harper Canyon/Encina Hills Subdivision Traffic Impact Analysis. May 28, 2008.

HARPER CANYON / ENCINA HILLS SUBDIVISION

TORO PLANNING AREA
MONTEREY COUNTY, CALIFORNIA

TRAFFIC IMPACT ANALYSIS

Administrative Draft Report

Prepared For

Pacific Municipal Consultants
585 Cannery Row, Ste. 304
Monterey, CA 93940

May 28, 2008

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1 INTRODUCTION

This Traffic Impact Analysis (TIA) was commissioned to evaluate the potential traffic impacts associated with the implementation of the proposed Harper Canyon / Encina Hills Subdivision residential development along the State Route 68 corridor in Monterey County. This TIA serves as an update to the initial traffic impact analysis that was prepared by Higgins Associates for the proposed project during 2001. The time that lapsed between the preparation of the 2001 TIA and the public approval process for the project was considered too long; it was determined that the traffic conditions along the SR 68 corridor have changed and that the improvements identified and recommended to mitigate project impacts as part of the 2001 TIA might need to be revised. Furthermore, the County of Monterey decided that a full Environmental Impact Report (EIR) would be required for this proposed project.

1.1 Project Description

The proposed project site is located in Monterey County, approximately twelve miles east of the City of Monterey, ten miles west of Salinas and south of State Route 68. The project site of approximately 164 acres would be developed as 17 market-rate single family homes and one remainder parcel, approximately 180 acres in size that will be open space. State Route 68 would provide regional access to the project site. More specifically, the project site for the proposed Harper Canyon / Encina Hills Subdivision is located off San Benancio Road to the south of State Route 68 via Meyer Road. The location of the proposed project is shown in Exhibit 1A. The project site plan is shown in Exhibit 1B.

1.2 Scope of Work

The study area and specific scope of work was evaluated by the County of Monterey staff and deemed adequate. This traffic study analyzed the anticipated project traffic impacts on the local roadways and intersections. Study intersections were analyzed for the weekday morning (i.e., 7:00 to 9:00 a.m.) and evening (i.e., 4:00 to 6:00 p.m.) peak periods. Recommendations for mitigation measures to offset the traffic impacts from the proposed project are also provided. Exhibit 2 shows the extent of the study area. The following intersections and road segments were included in the analyses:

Intersections:

1. SR 218 / SR 68
2. York Road / SR 68
3. Pasadera Drive-Boots Road / SR 68
4. Laureles Grade / SR 68
5. Corral de Tierra Road / SR 68
6. San Benancio Road / SR 68

Road Segments:

1. SR 68 between SR 218 and York Road
2. SR 68 between York Road and Pasadera Drive-Boots Road
3. SR 68 between Pasadera Drive-Boots Road and Laureles Grade
4. SR 68 between Laureles Grade and Corral de Tierra Road
5. SR 68 between Corral de Tierra Road and San Benancio Road

The study analyzed traffic conditions under the following development scenarios:

- Existing Conditions
- Background Conditions
- Background + Project Conditions
- Cumulative Conditions

1.3 Intersection Traffic Operation Evaluation Methodologies

Intersection traffic operations were evaluated based on the Level of Service (LOS) concept. Quantitative Level of Service (LOS) analyses were performed for the study intersections based on the *2000 Highway Capacity Manual* methodologies using the Synchro analysis software. LOS is a quantitative description of an intersection's operation, ranging from LOS A to LOS F. Level of service A, represents free flow un-congested traffic conditions. Level of service F represents highly congested traffic conditions with unacceptable delay to vehicles at intersections. The intermediate levels of service represent incremental levels of congestion and delay between these two extremes. *Appendix A* provides the LOS descriptions for signalized intersections.

A saturation flow rate of 1600 vehicles per lane per hour was used for the eastbound through and westbound through movements along SR 68 at the request of Caltrans District 5 staff.

1.4 Road Segment Traffic Operation Evaluation Methodologies

Road segment traffic operations along the SR 68 corridor have been a topic of discussion for a very long time. Two commonly accepted methods used to evaluate the operations of road segments include the Highway Capacity Manual's Arterial and Two-Lane Highway methodologies.

SR 68 can be considered a Class I two-lane rural highway, but there are also a number of signalized intersections located along the study route. Although all methodologies previously used to evaluate road segments were based on the Level of Service (LOS) concept, different methodologies provided different results.

For example, the Synchro software allows the analysis of arterials based on the Highway Capacity Manual's (HCM) arterial analysis methodology. The results of the HCM's arterial analysis are strongly influenced by the operations of the signalized intersections along the corridor, and in this case yielded results that were significantly better than what is actually perceived in the field.

The HCS software allows the analysis of two-lane rural highways based on methodologies also included in the Highway Capacity Manual. This analysis is based on traffic volumes, road capacity, and the percent-time-spent-following for a two-lane rural highway. For this study, it was also found that the use of this software did not accurately reflect the actual conditions in the field.

It could be argued that SR 68 is a hybrid between a two-lane rural highway and a signalized arterial. Due to the unique characteristics of SR 68, and based on discussions with Monterey County staff, it was decided that an alternative method for analyzing the road segment operations would be appropriate.

GPS (Geographical Positioning System) and GIS (Geographical Information System)-based technology provides a way to evaluate road segments and corridors based on actual conditions that are experienced in the field. The method involves the use of a test vehicle equipped with a global positioning device. As the test vehicle travels along the study corridor, the GPS device records the position of the test vehicle in one-second intervals. The collected data can then be used to determine the travel speed, travel time, and delays along the corridor.

In this traffic study, road segment Levels of Service (LOS) were determined using GPS and GIS-based technology. The GPS approach to determine travel speed, travel time, and delay along SR 68 provided a more accurate sense of the existing traffic operations along SR 68 than the other methodologies previously mentioned.

The data obtained from the GPS-equipped test vehicle under existing traffic conditions was used to calibrate the Synchro traffic analysis software in order to assess the road segment operations under the projected traffic conditions (background, background plus project and cumulative).

1.5 Level of Service Standards

All of the study intersections and road segments are located along State Route 68. State Route 68 falls under the jurisdiction of Caltrans, therefore the Caltrans level of service standard of the transition between LOS C and LOS D was applied to the study intersections and road segments.

1.6 Modeling of Right-Turns-on-Red (RTOR)

All of the signalized study intersections allow right turns on red (RTOR), and these right turns can have an effect on the intersection LOS calculations. There are several options to model right turns on red with different traffic analysis software packages, but the only method prescribed by the HCM for modeling RTOR is to reduce the input volumes to account for vehicles turning right on red. Where an exclusive right turn lane movement runs concurrent with a protected left turn phase from the cross street, the HCM allows for the right turn volume to be reduced by the number of shadowed left turners. However, the length of the right turn lane affects the number vehicles that are able to turn right on red. This is because a short right turn lane can result in right turning vehicles being trapped in the queue with vehicles in the through lane. In order to represent the worst case scenario, it was assumed that no vehicles would be able to turn right on red.

1.7 Criteria for Significant Project Impact

In accordance with the California Environmental Quality Act (CEQA) and agency and professional standards, specific impact criteria have been applied to the study intersections and road segments to determine if a significant impact would occur due to the implementation of the proposed project.

Based on Monterey County Public Works Policy and professional standards, generally a significant impact at a **signalized study intersection** is defined to occur under the following scenarios:

- The addition of project traffic causes operations to deteriorate from an acceptable level of service (LOS A, B or C) to an unacceptable level of service (LOS D, E or F).
- For intersections already operating at LOS D or E, a significant impact would occur if a project adds 0.01 or more to the critical movement's volume-to-capacity ratio.
- For intersections already operating at LOS F, any increase (one vehicle) to the intersection's critical movement is considered significant.

A significant impact at an **unsignalized study intersection** is defined to occur under the following scenarios:

- The addition of project traffic causes any traffic movement to operate at LOS F, or any traffic signal warrant to be met.

A significant impact on a **study roadway segment** is defined to occur under the following scenarios:

- The addition of project traffic causes a roadway segment operating at LOS A through LOS E to degrade to a lower level of service D, E or F, or
- The addition of one project trip is added to a segment already operating at LOS F.

1.8 Previously Recommended Improvements along SR 68 Corridor

Certain segments along the SR 68 corridor currently operate below the LOS C/D standard established by Caltrans. Specific recommended improvements would enhance the level of operation at the study intersections to an acceptable level of service. Although the implementation of improvements at the intersections would not necessarily have an effect on the levels of service of the SR 68 road segments, it would facilitate a slight reduction of the travel time along the corridor.

In order to achieve acceptable levels of service for all of the SR 68 study road segments under existing conditions (and maintain this level of service through the cumulative scenario), the roadway would require widening to four lanes between Toro Park and SR 1.

Alternatively, a four-lane freeway parallel to the SR 68 corridor was considered, as part of the Fort Ord Reuse Plan. The County of Monterey and Caltrans are in consideration of the South Fort Ord Bypass along an alignment approximately one-half mile north of the existing SR 68 roadway. However, there are no short or long-term funding sources available for either one of these alternatives..

Furthermore, there are no feasible interim improvements that could be implemented along the corridor that would achieve and maintain the acceptable level of service standards (i.e., widening the entire corridor to a four-lane facility is not feasible at this time).

In 2001, the SR 68 Improvement Advisory Committee (sponsored by the County of Monterey) identified and prioritized a list of improvements for existing and future traffic conditions that would facilitate a slight reduction in the travel time along the corridor. The recommended SR 68 improvements are summarized in Table 1.

Subsequent to the 2001 SR 68 Improvement Advisory Committee recommendations, the Transportation Agency for Monterey County (TAMC) prepared a *Nexus Study for a Regional Development Impact Fee* dated May 14, 2004. Items 2, 4a, 6, and 8 in Table 1 are included in the TAMC regional impact fee.

Apart from the improvements listed in Table 1, a number of other minor improvements were also recommended in several other study reports for proposed developments along the SR 68 corridor. The following additional mitigation measures for the SR 68 corridor were also previously recommended:

1. Re-striping of the San Benancio Road northbound and southbound approaches at the SR 68 / San Benancio Road intersection to provide a left-turn/through lane and a right-turn lane on both approaches.
2. Install a right-turn overlap phase at the traffic signal on the northbound approach of the SR 68 / San Benancio Road intersection.
3. Install a right-turn overlap phase at the traffic signal on the northbound approach of the SR 68/ Corral de Tierra Road intersection.
4. Install a right-turn overlap phase on the traffic signal on the southbound approach of the SR 68/SR 218 intersection.

Table 1. SR 68 Traffic Improvements Identified by the Advisory Committee

Priority	Project	Estimated Cost (2001 Dollars)	Status
1	Install Opticom emergency vehicle preemption at the signal controlled intersections	$110,000	Completed
2	Dual left-turn lanes on westbound SR 68 at the Laureles Grade Road intersection	$1,360,000	95% designed; scheduled for construction in 2007.
3	Provide improved access onto SR 68 from Torero Drive	Caltrans budget item	Completed
4a (tie)	Dual left-turn lanes on westbound SR 68 at the intersection of Corral de Tierra Road	$755,000	In environmental phase; scheduled for construction in 2009.
4b (tie)	Continuously maintain the existing shoulder along SR 68 for safety reasons	Caltrans budget item	Ongoing
6	Extend the eastbound right turn lane at Laureles Grade Road	$500,000	95% designed; scheduled for construction in 2007.
7	Widen SR 68 to four lanes from State Route 218 to Ragsdale Drive	$1,626,351	Completed
8	Dual left-turn lanes on westbound SR 68 at the intersection with San Benancio Road	$2,852,000	In environmental phase; scheduled for construction in 2008.
9	South Fort Ord Bypass (Torero Drive to State Route 218)	$179,000,000	This project is included in the regional transportation plan as an unconstrained project. No funding has been identified for this improvement in the foreseeable future (20 years).

Source: County of Monterey Public Works Department, 2007.

Note: Items 2, 4a, 6 and 8 are included in the TAMC fee.

1.9 Regional Impact Fee Nexus Study Update

The Transportation Agency for Monterey County (TAMC) is currently in the process of updating the 2004 *Nexus Study for a Regional Development Impact Fee*. As of this writing, the project list in the *Regional Impact Fee Nexus Study Update* includes a project referred to as "SR 68 Commuter Improvements", which would widen SR 68 to four lanes from the existing 4-lane section adjacent to Toro Park to Corral de Tierra Road. The operational benefits associated with this improvement are discussed in Section 7.3 of this report.

1.10 Assumed Roadway Improvements

Discussions with County of Monterey and Caltrans District 5 staff have indicated that the following intersection improvements will be implemented within 1 to 5 years. Therefore, these improvements were assumed to be completed under the Background Traffic Conditions scenario.

1. York Road / SR 68 Intersection
    a. The addition of a fourth (south) York Road leg (to be implemented by the Monterra Ranch development).
    b. A second York Road southbound left-turn lane and eastbound acceleration lane (to be implemented by the Laguna Villas Condominium development).

2. Laureles Grade Road / SR 68 Intersection
    a. A second SR 68 westbound left-turn lane (SR 68 Advisory Committee Priority 2).
    b. Extension of the eastbound right-turn lane (SR 68 Advisory Committee Priority 6).

3. Corral de Tierra Road / SR 68 Intersection
    a. The addition of a fourth (north) Corral de Tierra Road leg (to be implemented by the Cypress Church access modification).
    b. A second SR 68 westbound left-turn lane (SR 68 Advisory Committee Priority 4a).

4. San Benancio Road / SR 68 Intersection
    a. A second SR 68 westbound left-turn lane (SR 68 Advisory Committee Priority 8).

2 EXISTING TRAFFIC CONDITIONS

This chapter provides a description of existing traffic conditions in terms of roadway facilities, bicycle and pedestrian facilities, transit service, traffic volumes, and intersection and roadway operations.

2.1 Existing Traffic Network

The study area, shown in Exhibit 2, stretches from the SR 68 / SR 218 intersection in the west to the SR 68 / San Benancio Road intersection in the east. A brief description of each of the roads in the study area follows:

State Route 68 (Monterey-Salinas Highway) is a two-lane rural highway connecting State Route 1 in Monterey and SR 101 in Salinas. The speed limit on SR 68 along the study area is 55 miles per hour. It serves as a commute route between Salinas and the Monterey Peninsula, provides access to the low-density developments along it, and functions as a scenic tourist route to the Monterey Peninsula.

State Route 218 (Canyon Del Rey Road) is a two-lane highway that connects State Route 68 and State Route 1. It provides access to Del Rey Oaks, Sand City and Seaside. The SR 218 / SR 68 intersection is signal controlled.

York Road provides access to some single unit housing developments as well as the Laguna Seca and Ryan Ranch Business Parks located to the north of SR 68. The speed limit on York Road is 25 miles per hour. The SR 68 / York Road intersection is signal controlled.

Pasadera Drive is a private road to the north off SR 68 and provides access to the Pasadera Country Club and its associated single unit housing development. The speed limit on Pasadera Drive is 25 miles per hour. The SR 68 / Pasadera Drive intersection is signal controlled.

Boots Road provides access to a small quantity of residential developments to the south of SR 68 and the speed limit on Boots Road is 25 miles per hour. The SR 68 / Boots Road intersection is signal controlled.

Laureles Grade Road is a two-lane north/south county road that connects SR 68 with Carmel Valley. The speed limit on Laureles Grade Road is 45 miles per hour and it also provides access to several residential developments. The SR 68 / Laureles Grade Road intersection is signal controlled.

Corral de Tierra Road is located to the west of San Benancio Road. It is a two-lane collector street with a speed limit of 35 miles per hour. The SR 68 / Corral Del Tierra Road intersection is signal controlled.

San Benancio Road is a two-lane collector street with a speed limit of 35 miles per hour and it provides access to several residential developments. The SR 68 / San Benancio Road intersection is signal controlled.

Meyer Road is a two-lane privately maintained road owned by Harper Canyon Realty LLC. The San Benancio Road / Meyer Road intersection is controlled by a stop sign on westbound Meyer Road.

2.2 Existing Transit Services

Monterey-Salinas Transit (MST) provides fixed-route bus service in Monterey County and Peninsula cities. Line 21 provides service between Monterey and Salinas via SR 68 with stops at various locations along SR 68. MST has reduced Line 21 service in recent years due to a lack of ridership on the route. In August 2003 weekday mid-day service was eliminated, and on July 30, 2005 service was further reduced to the current schedule which includes only one weekday morning round trip and a single westbound one-way trip on weekday afternoons. According to MST, most passengers traveling between Monterey and Salinas use MST's Line 20, which travels through Marina, due to the poor on-time performance of Line 21.

2.3 Existing Pedestrian and Bicycle Facilities

Pedestrian facilities include sidewalks, crosswalks and pedestrian signals. There is not a significant amount of foot-traffic in the vicinity of the proposed project and therefore sidewalks are not provided along SR 68, San Benancio Road and Meyer Road. Crosswalks and pedestrian signal phasing are provided at the signalized study intersections.

There are three basic types of bicycle facilities recognized in the County of Monterey. Each type is described below:

Bike path (Class I) - A completely separate right-of-way designed for the exclusive use of cyclists and pedestrians, with minimal crossings for motorists.

Bike lane (Class II) - A lane on a regular roadway, separated from the motorized vehicle right-of-way by paint striping, designated for the exclusive or semi-exclusive use of bicycles. Bike lanes allow one-way bike travel. Through travel by motor vehicles or pedestrians is prohibited, but crossing by pedestrians and motorists is permitted.

Bike route (Class III) - Provides shared use of the roadway, designated by signs or permanent markings and shared with motorists.

However, there are no bicycle facilities provided in the project vicinity.

2.4 Existing Traffic Data

The following sections present a description of the existing traffic network, existing traffic volumes, intersection levels of service, and an overview of traffic flow conditions within the study area under existing traffic conditions.

To establish existing traffic flow conditions, intersection traffic counts were collected during the weekday AM (i.e. 7:00 – 9:00 a.m.) and PM (i.e. 4:00 – 6:00 p.m.) peak hours at the 6 study intersections. The traffic counts were conducted between February 9th and August 29th, 2006. The traffic count dates are shown in Table 2. From the peak period traffic counts, the AM and PM peak hour turning movement volumes were identified. The existing AM and PM peak hour traffic volumes are presented on Exhibit 3.

Table 2
Dates of Manual Traffic Counts at Study Intersections

	INTERSECTION	COUNT DATE
1	SR 218 / SR 68	August 15, 2006
2	York Road / SR 68	August 16, 2006
3	Boots Road-Pasadera Drive / SR 68	August 16, 2006
4	Laureles Grade / SR 68	August 16 & August 29, 2006
5	Corral de Tierra Road / SR 68	August 22, 2006
6	San Benancio Road / SR 68	August 16, 2006

2.5 Existing Traffic Conditions – Intersection Operations

Intersection levels of service for existing traffic conditions are summarized on Exhibit 4. Level of service calculation worksheets for existing traffic conditions are included in *Appendix B.*

Five of the six study intersections operate below the level of service standard under existing traffic conditions. The following is a description of the operations of each intersection currently operating at deficient levels. Recommended mitigation measures are discussed in italics below the description of each intersection's operations.

York Road / SR 68 – Intersection # 2 (signalized) currently operates at LOS E during both the weekday AM and PM peak hours.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Pasadera Drive-Boots Road / SR 68 – Intersection # 3 (signalized) currently operates at LOS D during the weekday AM peak hour and LOS C during the weekday PM peak hour.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Laureles Grade Road / SR 68 – Intersection # 4 (signalized) currently operates at LOS D during the weekday AM peak hour and LOS F during the weekday PM peak hour.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Corral de Tierra Road / SR 68 – Intersection # 5 (signalized) currently operates at LOS D during the weekday AM peak hour and LOS E during the weekday PM peak hour.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

San Benancio Road / SR 68 – Intersection # 6 (signalized) currently operates at LOS E during the weekday AM peak hour and LOS F during the weekday PM peak hour.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

2.6 Existing Traffic Conditions – Road Segment Operations

To determine the existing conditions road segment operating conditions along the SR 68 corridor, the GPS and GIS-based technologies referenced in section 1.4 were used. The average travel speed was determined along an approximate 6.5 mile section of the SR 68 corridor starting at a point just west of the SR 68 / SR 218 intersection and ending at a point just east of the SR 68 / San Benancio Road intersection. Four one-way travel runs were performed during the weekday AM and PM peak hours as well as during the off-peak period. The off-peak runs were performed to provide a comparison between the peak hours and a relatively un-congested time period. It should be noted that there was a wide range in the speeds recorded; speeds in excess of 55 mph were recorded on sections of the corridor during both the peak periods as well as during the off-peak periods. However, for the purposes of this traffic analysis, the focus will be placed on the average travel speed and on areas of heavy congestion.
The results of the GPS travel runs can be seen graphically in Exhibits 5A through 5C and the results are briefly discussed below:

Eastbound AM Peak Period: When considering the two AM peak period GPS runs in the eastbound direction, the longest travel time along the 6.5 mile study corridor was 9.6 minutes. The average travel speeds on the segments ranged between 26 and 44 mph and the levels of service ranged from LOS D to LOS E. The most congested sections of the corridor were between York Road and San Benancio Road. Refer to Exhibit 5A for details.

Westbound AM Peak Period: When considering the two AM peak period GPS runs in the westbound direction, the longest travel time along the 6.5 mile study corridor was 10.0 minutes. The average travel speeds on the segments ranged between 31 and 40 mph and the level of service was LOS E on all the study segments. The most congested sections of the corridor were east of Corral de Tierra Road and east of Laureles Grade Road. Refer to Exhibit 5A for details.

Eastbound PM Peak Period: When considering two PM peak period GPS runs in the eastbound direction, the longest travel time along the 6.5 mile study corridor was 19.0 minutes. The average travel speeds on the segments ranged between 11 and 39 mph and the levels of service ranged from LOS E to LOS F. The most congested sections of the corridor were between San Benancio Road and Pasadera Drive. Refer to Exhibit 5B for details.

Westbound PM Peak Period: When considering the two PM peak period GPS runs in the westbound direction, the longest travel time along the 6.5 mile study corridor was 9.5 minutes. The average travel speeds on the segments ranged between 28 and 52 mph and the levels of service ranged from LOS B to LOS E. The most congested sections of the corridor were east of Corral de Tierra Road. Refer to Exhibit 5B for details.

Eastbound Off-Peak Period: When considering the two off-peak period GPS runs in the eastbound direction, the longest travel time along the 6.5 mile study corridor was 8.6 minutes. The average travel speeds on the segments ranged between 26 and 55 mph and the levels of service ranged from LOS E to LOS A. The most congested sections of the corridor were between Pasadera Drive and Laureles Grade Road and between Corral de Tierra Road and San Benancio Road. Refer to Exhibit 5C for details.

Westbound Off-Peak Period: When considering the two off-peak period GPS runs in the westbound direction, the longest travel time along the 6.5 mile study corridor was 9.0 minutes. The average travel speeds on the segments ranged between 20 and 53 mph and the levels of service ranged from LOS A to LOS F. The most congested sections of the corridor were east of SR 218 and west of San Benancio Road. Refer to Exhibit 5C for details.

Conclusion: It should be noted that the results discussed in the preceding paragraphs were based on the average travel speed for each segment along the 6.5 mile stretch of the corridor which included the stopped times at the signalized intersections. Portions of the individual segments operated at levels of service better or worse than the average, ranging from LOS A to LOS F. For details of each segment's level of service, refer to Exhibit 6.

The results show that, within the study corridor, congestion is experienced on SR 68 during both and AM and PM peak hours, with the most critical congestion occurring in the eastbound direction during the PM peak hour. It is anticipated that the widening of SR

68 to a 4-lane facility would improve the operating conditions along the corridor to acceptable levels of service.

Existing traffic conditions road segment levels of service, as well as AM and PM peak hour traffic volumes on the study road segments, are tabulated in Exhibit 6. These are based upon the turning volumes illustrated on Exhibit 3. Recommended mitigation measures for existing traffic conditions are shown in Exhibit 7.

3 BACKGROUND TRAFFIC CONDITIONS

This chapter presents a description of the traffic network, traffic volumes, and intersection levels of service within the study area under background (existing plus approved projects) traffic conditions.

3.1 Approved Projects

A number of other projects have been approved within the study area that have not yet been constructed. The list of approved projects relevant to this traffic study was developed in consultation with the County of Monterey Planning and Public Works staff. *Appendix C* includes a trip generation table of the approved projects that will most likely be implemented within the next 5 years. It is anticipated that the trips generated by the approved projects will impact the study street network prior to impacts being experienced by the proposed project.

3.2 Background Traffic Conditions - Intersection Operations

The traffic that would be generated by the approved projects was combined with the existing traffic volumes to obtain volumes for background traffic conditions. Background AM and PM peak hour turning volumes are illustrated on Exhibit 8. Intersection levels of service for background traffic conditions are summarized on Exhibit 4. The levels of service shown in Exhibit 4 reflect the improvements discussed in section 1.9 starting under background traffic conditions. Intersection level of service calculation worksheets for background traffic conditions is included in *Appendix D*.

Five of the six study intersections would operate below the level of service standard under background traffic conditions. The following is a description of the operations of each intersection that would operate at deficient levels of service. Recommended mitigation measures are discussed in italics below the description of each intersection's operations.

York Road / SR 68 – Intersection # 2 (signalized) would operate at LOS F during both the weekday AM and PM peak hours.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Pasadera Drive-Boots Road / SR 68 – Intersection # 3 (signalized) would operate at LOS E during the weekday AM peak hour and LOS D during the weekday PM peak hour.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Laureles Grade Road / SR 68 – Intersection # 4 (signalized) would operate at LOS E during the weekday AM peak hour and LOS F during the weekday PM peak hour.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

<u>Corral de Tierra Road / SR 68 – Intersection # 5 (signalized)</u> would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

<u>San Benancio Road / SR 68 – Intersection # 6 (signalized)</u> would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

3.3 Background Traffic Conditions – Road Segment Operations

With the use of the GPS and GIS-based technology, it was possible to accurately determine the operating conditions along the SR 68 corridor under existing traffic conditions. However, finding the correct methodology to determine the road segment levels of service for future conditions is more of a challenge. SR 68 is classified as a Class 1, 2-lane rural highway. The methodologies described in the Highway Capacity Manual to evaluate the operating conditions include two variables; travel speed and percent time spent following another vehicle. In an attempt to match the existing conditions travel speeds with results using other methodologies, it was found that the Highway Capacity Software (HCS) showed reasonably similar results. In an attempt to match the HCS results with the actual travel speed measured with the GPS methodology, it was found that in the case of SR 68, the percent time spent following does not really play a significant role in determining the average travel speed and corresponding LOS for the road segment.

The data obtained from the GPS-equipped test vehicle under existing traffic conditions was used to calibrate the Synchro traffic analysis software in order to assess the road segment operations under the projected traffic conditions (background, background plus project and cumulative). Exhibit 6 shows the actual speed on each study segment as recorded from the GPS device compared to the speed that was calibrated in Synchro under existing traffic conditions. Once the Synchro analysis software was calibrated for existing conditions, it was then used to estimate the projected average travel speeds for the future scenarios. The Synchro "Arterial Level of Service" reports are included in *Appendix E*. It should be noted that these reports were used to estimate the speeds on the study segments, which were then used to determine the levels of service based on the speeds in Table 3 (which can be found on Exhibit 6). Therefore, the only values utilized from the Synchro "Arterial Level of Service" reports were the arterial speeds.

Background traffic conditions road segment levels of service, as well as AM and PM peak hour traffic volumes on the study road segments, are tabulated in Exhibit 6. These are based upon the turning volumes illustrated in Exhibit 8. The Synchro arterial level of service reports used to estimate the projected travel speeds under background traffic conditions are included in *Appendix E.* As can be seen from Exhibit 6, the study road segments would continue to operate at unacceptable levels of service under background traffic conditions.

As identified under existing traffic conditions, congestion would continue to be experienced on SR 68 during both and the AM and PM peak hours, with the most critical congestion occurring in the eastbound direction during the PM peak hour. It is anticipated that the widening of SR 68 to a 4-lane facility would improve the operating conditions along the corridor to acceptable levels of service.

4 BACKGROUND PLUS PROJECT TRAFFIC CONDITIONS

This chapter presents a description of the traffic network, traffic volumes, and intersection levels of service within the study area under Background Plus Project Traffic Conditions. It also includes an evaluation of the sight distance at the project access intersection, as well as discussions on traffic operations and accident history on the local road network in the vicinity of the project site.

4.1 Project Description and Trip Generation

The proposed project site is located in Monterey County, approximately twelve miles east of the City of Monterey, ten miles west of Salinas and south of State Route 68. The project site of approximately 164 acres would be developed as 17 market-rate single family homes and one remainder parcel, approximately 180 acres in size that will be open space. State Route 68 would provide regional access to the project site; local access to the Harper Canyon / Encina Hills Subdivision will be provided by improving an existing dirt road (Meyer Road / Alta Lane) located off of San Benancio Road between State Route 68 and Harper Canyon Road.

The proposed project would generate an estimated 163 daily trips, with 13 trips generated during the AM peak hour (3 in, 10 out) and 17 trips generated during the PM peak hour (11 in, 6 out). The project trip generation table is shown in Exhibit 9.

4.2 Background Plus Project Traffic Conditions - Intersection Operations

The traffic that would be generated by the Harper Canyon / Encina Hills Subdivision was combined with the background traffic volumes to obtain background plus project traffic conditions. The AM and PM peak hour project trip assignment is illustrated on Exhibit 10. Background plus project AM and PM peak hour turning volumes are illustrated on Exhibit 11. Intersection levels of service for background plus project traffic conditions are summarized on Exhibit 4.

Intersection level of service calculation worksheets for background plus project traffic conditions are included in *Appendix F*.

Five of the six study intersections would continue to operate below the level of service standard under background plus project traffic conditions. The following is a description of the operations of each intersection that would operate at deficient levels of service. Recommended mitigation measures are discussed in italics below the description of each intersection's operations.

York Road / SR 68 – Intersection # 2 (signalized) would continue to operate at LOS F during both the weekday AM and PM peak hours.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Pasadera Drive-Boots Road / SR 68 – Intersection # 3 (signalized) would continue to operate at LOS E during the weekday AM peak hour and LOS D during the weekday PM peak hour.

The addition of a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Laureles Grade Road / SR 68 – Intersection # 4 (signalized) would continue to operate at LOS E during the weekday AM peak hour and LOS F during the weekday PM peak hour.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

Corral de Tierra Road / SR 68 – Intersection # 5 (signalized) would continue to operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

San Benancio Road / SR 68 – Intersection # 6 (signalized) would continue to operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

4.3 Background Plus Project Traffic Conditions – Road Segment Operations

Background plus project traffic conditions road segment levels of service, as well as AM and PM peak hour traffic volumes on the study road segments, are tabulated in Exhibit 6. These are based on the turning volumes illustrated in Exhibit 11. Exhibit 7 tabulates mitigation measures for background plus project traffic conditions. The Synchro arterial level of service reports used to estimate the projected travel speeds under background plus project traffic conditions are included in *Appendix E.*

As identified under existing traffic conditions, congestion would continue to be experienced on SR 68 during both and the AM and PM peak hours, with the most critical congestion occurring in the eastbound direction during the PM peak hour. It is anticipated that the widening of SR 68 to a 4-lane facility would improve the operating conditions along the corridor to acceptable levels of service.

Based on the criteria for significant project impacts discussed in Section 1.7 of this report, the addition of any project trips to road segments already operating at LOS F should be considered significant.

5 CUMULATIVE TRAFFIC CONDITIONS

This chapter presents a description of the traffic network, traffic volumes, and intersection levels of service within the study area under Cumulative Traffic Conditions. Various approved and proposed projects throughout the Cities of Marina, Seaside, Sand City, Monterey, Del Rey Oaks, Salinas, and Monterey County are anticipated to be developed, or at least partially developed, within approximately the next twenty-five years. The Cumulative Traffic Conditions scenario includes the existing traffic volumes plus the estimated traffic that would be generated by all approved and cumulative projects in the vicinity of the study area, as well as the proposed project. The horizon year for the Cumulative Traffic Conditions scenario is the year 2030. The AMBAG Regional Travel Model was used to estimate the Cumulative 2030 traffic volumes on the study road network.

5.1 Cumulative Projects

A number of projects have been proposed within the study area that have not yet been approved or even formally submitted for evaluation. The list of cumulative projects relevant to this traffic study was developed in consultation with the County of Monterey Planning and Public Works staff. *Appendix G* includes a trip generation table of the cumulative projects.

5.2 Cumulative Traffic Conditions - Intersection Operations

Cumulative traffic conditions AM and PM peak hour turning volumes are illustrated on Exhibit 12. Intersection levels of service for cumulative traffic conditions are summarized on Exhibit 4. Intersection levels of service calculation worksheets for cumulative traffic conditions are included in *Appendix H.*

All six of the study intersections would operate below the level of service standard under cumulative traffic conditions. The following is a description of the operations of each intersection that would operate at deficient levels of service. Recommended mitigation measures are discussed in italics below the description of each intersection's operations.

SR 218 / SR 68 Intersection #1 (signalized) would operate at LOS C during the weekday AM peak hour and LOS E during the weekday PM peak hour.

Widening and restriping the northbound approach to include one left-turn lane, one through lane, and one right-turn lane, widening the eastbound approach to include two left-turn lanes, two through lanes, and one right-turn lane, and the addition of southbound right-turn overlap phasing would improve operations at this intersection to acceptable levels of service during the AM and PM peak hours.

York Drive / SR 68 Intersection #2 (signalized) would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane, a second eastbound left-turn lane, and a second westbound through lane at this intersection would improve operations to an acceptable level of service during the AM and PM peak hours.

Pasadera Drive-Boots Road / SR 68 Intersection #3 (signalized) would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane at this intersection would improve operations to an acceptable level of service during the AM and PM peak hours.

Laureles Grade / SR 68 Intersection #4 (signalized) would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane, a second westbound through lane, and the addition of northbound right-turn overlap phasing at this intersection would improve operations to an acceptable level of service during the AM and PM peak hours.

Corral de Tierra Road / SR 68 Intersection #5 (signalized) would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane, a second westbound through lane, and the addition of northbound right-turn overlap phasing at this intersection would improve operations to an acceptable level of service during the AM and PM peak hours.

San Benancio Road / SR 68 Intersection #6 (signalized) would operate at LOS F during the weekday AM and PM peak hours.

The addition of a second eastbound through lane and a second westbound through lane at this intersection would improve operations to an acceptable level of service during the AM and PM peak hours.

5.3 Cumulative Traffic Conditions – Road Segment Operations

Cumulative traffic conditions road segment levels of service, as well as AM and PM peak hour volumes on the study road segments, are tabulated in Exhibit 6. These are based on the turning volumes illustrated on Exhibit 12. Exhibit 7 tabulates the recommended mitigation measures for cumulative traffic conditions. The Synchro arterial level of service reports used to estimate the projected travel speeds under cumulative traffic conditions are included in *Appendix E*.

As identified under existing traffic conditions, congestion would continue to be experienced on SR 68 during both and the AM and PM peak hours, with the most critical congestion occurring in the eastbound direction during the PM peak hour. It is anticipated that the widening of SR 68 to a 4-lane facility would improve the operating conditions along the corridor to acceptable levels of service.

Based on the criteria for significant project impacts discussed in Section 1.7 of this report, the addition of any cumulative trips to road segments already operating at LOS F should be considered significant.

6 PROJECT ACCESS AND SIGHT DISTANCE

6.1 Project Access

Access to the project site for the proposed Harper Canyon / Encina Hills Subdivision is located off San Benancio Road to the south of State Route 68; the location of the proposed project is shown in Exhibit 1A. San Benancio Road is a collector road providing access to several residential developments and the posted speed limit is 35 mph. Localized main access to the proposed project will be via Meyer Road. The proposed project would create 17 single-family residential parcels that range from 5.13 acres to 23.42 acres, associated roadway improvements and one remainder parcel of approximately 180 acres that would remain as open space.

State Route 68 provides regional access to the project site. Meyer Road would provide access to lots 15 through 17. Lots 1 through 7 and 11 through 14 would be accessed via Alta Lane and lots 8 through 10 would be accessed via Sierra Lane. Lot 7 would have an extended 12 foot wide driveway from Alta Lane extending behind lot 6.

6.2 Sight Distance Analysis

6.2.1 Speed Survey on San Benancio Road

A speed survey was conducted on San Benancio Road in the vicinity of the San Benancio Road / Meyer Road intersection. The speed survey was conducted in accordance with the requirements of the latest California Vehicle Code and the Caltrans Traffic Manual.

During the speed survey, Higgins Associates collected 106 readings (53 readings in the northbound travel direction and 53 readings in the southbound travel direction) using manual radar speed survey equipment. The survey radar device was calibrated and the speed surveys were conducted in good weather and under normal traffic conditions on May 5, 2006.

The speed survey data was analyzed and the results indicate that, in the northbound direction, the average travel speed on San Benancio Road in the vicinity of Meyer Road is 45 miles per hour, and the 85th percentile speed is 51 mph. In the southbound direction, the average speed is 46 mph, and the 85th percentile speed is 52 mph. The results of the speed survey are summarized on Exhibits 13 and 14.

6.2.2 Actual Sight Distance Currently Provided at the San Benancio Road / Meyer Road Intersection

Currently, a sight distance of about 240 feet is provided to the north of the intersection and about 250 feet of sight distance is provided to the south. This is based on a 13 foot setback from the edge of travel way. Corner sight distance is measured from a point 3.5 feet above the ground at the location of the driver on the minor street to a 4.25 feet object height in the center of the approaching lane of the major road. Photographs of the San Benancio Road / Meyer Road intersection, which were taken on May 9, 2006, are included in *Appendix I.*

6.2.3 Required Sight Distance at the San Benancio Road / Meyer Road Intersection to Accommodate Prevailing Traffic Speeds

Based on the prevailing traffic speeds on San Benancio Road and the standards set forth in *A Policy on Geometric Design of Highways and Streets*, published by the American Association of State Highway and Transportation Officials (AASHTO), 2001, the minimum sight distance that should be provided to allow for safe operating conditions at the San Benancio Road / Meyer Road intersection is 436 feet looking north from Meyer Road, and 423 feet looking south from Meyer Road. The sight distance calculations are included in Exhibit 15.

Based upon the available sight distances, neither direction meets AASHTO standards for sight distance. Therefore, existing conditions constitute substandard sight distances per AASHTO standards.

6.2.4 Remedial Measures

The lack of acceptable sight distance at this intersection could be improved by trimming vegetation and cutting back the embankment. However, the vertical curvature also contributes to the lack of acceptable sight distance at this location. Overlaying Meyer Road to raise the elevation of the vantage point of the driver on Meyer Road will also improve sight distance. The existing 240 and 250 foot sight distances at the San Benancio Road / Meyer Road intersection accommodate a speed of 35 mph, as shown in Exhibit 15. However, based on the speed survey, a speed limit of 35 mph on San Benancio Road in the vicinity of Meyer Road would not be enforceable.

6.3 General Recommendations Regarding the San Benancio Road / Meyer Road Intersection

The San Benancio Road / Meyer Road intersection should be upgraded to meet Monterey County standards for a private road / county road intersection. In addition, based on the Monterey County Left-Turn Policy, adopted on February 26, 1980, a southbound left-turn lane will be warranted under background plus project traffic conditions at the San Benancio / Meyer Road intersection. The left-turn channelization warrant is included as *Appendix J.*

In addition, the Meyer Road approach currently does not include standard tapers to accommodate right turns into and out of Meyer Road. The San Benancio Road / Meyer Road intersection should be upgraded per County of Monterey standards for a private road / county road intersection. This will also assist in improving sight distance at the intersection.

6.4 San Benancio Road Traffic Operations Analysis

6.4.1. Traffic Volumes and Level of Service

Based on the 2005 Annual Average Daily Traffic booklet, published by the Monterey County Department of Public Works, the 2005 Annual Average Daily Traffic (AADT) on San Benancio Road between SR 68 and Harper Canyon Road was 5,700 vehicles per day. San Benancio Road, a two-lane rural road, currently operates at LOS B, based on the Level of Service Threshold Volumes for Various Roadway Types, which are included in *Appendix K.*

The project will add approximately 160 daily trips on San Benancio Road, which is about a 3% increase in traffic. With the addition of project traffic, San Benancio Road will still operate at LOS B.

6.4.2 Accident Analysis

Accident history data on San Benancio Road was obtained from County of Monterey staff. The accident data indicate that during a five-year period (from January, 2001 until March, 2006) there were five collisions on San Benancio Road between SR 68 and Harper Canyon Road. Of the five reported collisions on San Benancio Road, three involved one vehicle that ran off the road and hit an object. The other two collisions involved two vehicles with one vehicle being broadsided by the other. Of the five reported collisions on San Benancio Road between SR 68 and Harper Canyon Road, all of them involved property damage with no injuries and no fatalities. A collision diagram summarizing the accident history on San Benancio Road (between SR 68 and Harper Canyon Road) within the last five years is shown on Exhibit 16. Table 4 compares the accident rate on San Benancio Road between SR 68 and Harper Canyon Road with the statewide average accident rate for 2-lane rural roads[1]. From Table 4 it can be seen that the accident rate on San Benancio Road, between SR 68 and Harper Canyon Road, is well below the statewide average for similar types of roads.

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[1] *2003 Collision Data on California State Highways*, published by Caltrans.

Table 4. Accident Rates on San Benancio Road Compared with Statewide Average Accident Rates on 2-Lane Rural Roads

	San Benancio Road Accident Rate	Statewide Average Accident Rate
Total Accidents	0.481 Acc / MVM*	1.24 Acc / MVM*
Fatality + Injury	0.00 Fatal + Injury / MVM*	0.57 Fatal + Injury /MVM*
Fatality	0.00 Fatal / 100 MVM*	3.84 Fatal / 100 MVM*

*Acc/MVM = accidents per million vehicle miles.

6.4.3 General Recommendations Regarding San Benancio Road

Field observations and comments from residents on San Benancio Road indicate that many of the private driveways along San Benancio Road experience limited sight distance conditions. Vegetation should be minimized where it interferes with sight distance. This is the responsibility of the County of Monterey within the public right of way and the individual property owner if a sight distance constraint is created by landscaping, fences or other physical features within the property owner's land. Enforcement is also recommended. However, it must be remembered that that there is a history of very few accidents on San Benancio Road. Relatively high speeds and increasing traffic volumes have apparently not resulted in a safety problem.

6.5 Meyer Road Traffic Operations Evaluation

Meyer Road is a privately maintained road owned by Harper Canyon Realty LLC, subject to easements in favor of other residences along the road. Meyer Road would be classified as a tertiary road based on Monterey County street classifications, as it would provide access to no more than 100 tributary dwelling units. The width of Meyer Road currently varies between approximately 10 to 13 feet. It is recommended that Meyer Road be upgraded per County of Monterey standards (for a tertiary private rural road) to a minimum surfaced roadbed width of 20 feet. Physical and topographic constraints may limit the ability to meet tertiary standards. At a minimum, a County of Monterey standard cul-de-sac street with 18 feet of paved width should be provided. Typical cross sections for these types of roads are included in *Appendix L.*

6.6 Project-Specific Recommendations

The following are project-specific recommendations based on the preceding analysis.

1. To the extent practical, trim or cut back the vegetation and embankment in the vicinity of the San Benancio Road / Meyer Road intersection to improve sight distance at the intersection. The precise extent of vegetation removal, embankment re-grading and resurfacing will require the review and approval by the Monterey County Public Works Department at the time of obtaining an Encroachment Permit.

2. To the extent practical, widen and resurface Meyer Road per County of Monterey standards for a cul-de-sac private road (i.e., to a minimum surfaced roadbed width of 18 feet) per Monterey County Public Works Standard Detail Plate No. 5, included herein as *Appendix L*.

3. To the extent practical, provide right turn tapers at the San Benancio Road / Meyer Road intersection per County of Monterey standards for a private road / county road intersection as described in the Monterey County Roadway Design Standards, page 18, item P (included as *Appendix M*) or similar to the standard Caltrans Access Openings on Expressways, Figure 205.1 (included as *Appendix N*).

4. Construct a southbound San Benancio Road left-turn lane per Monterey County standards at the San Benancio Road / Meyer Road intersection.

7 CONCLUDING COMMENTS AND RECOMMENDATIONS

7.1 Concluding Comments

This traffic impact analysis evaluated the anticipated impacts from the increase in traffic that would be generated by the proposed Harper Canyon / Encina Hills Subdivision on the surrounding road network. Four traffic scenarios were assessed in the traffic analysis, namely, existing traffic conditions, background (existing plus approved projects) traffic conditions, background plus project traffic conditions, and cumulative traffic conditions.

The results have been thoroughly discussed in the preceding chapters of this report and the conclusion is that a number of mitigating improvements would be required, beginning under existing traffic conditions, to achieve and maintain acceptable levels of service on the study road network. These improvements, which for the most part are based on existing deficiencies in the road network, would not be triggered by the proposed project. In addition, funding for the implementation of these improvements along the entire corridor is not available.

Based on the careful evaluation of the traffic impacts, no project-specific mitigation measures are recommended at the study intersections numbered 1 through 6 or on the study road segments. However, there are project-specific recommendations for the project access at San Benancio Road and Meyer Road (see Section 6.3 of this report).

Although the proposed project would not cause any of the study intersections or road segments to degrade to a lower level of service, the project would generate traffic that would be added to the road network, which is already operating at deficient levels.

It is therefore recommended that the proposed Harper Canyon / Encina Hills Subdivision project contribute funds to improve the operating conditions on the SR 68 corridor. A series of intersection improvements were identified by the Highway 68 Advisory Committee. These have been assumed in this report to be fully funded and in place under Background traffic conditions. If they are not implemented because of funding shortfalls, the Harper Canyon / Encina Hills Subdivision project could contribute toward the implementation of any one or combination of more than one of the identified improvements as part of the TAMC impact fee program.

7.2 Widening SR 68 to Four Lanes from Toro Park to West End of Toro Park Estates

In November 2006, Higgins Associates explored the possibility of adding a 1.1 mile extension of the 4-lane freeway portion of SR 68, from where the freeway currently ends to the west end of Toro Park Estates in order to provide a net reduction in travel time along the SR 68 corridor. The Harper Canyon / Encina Hills Subdivision project could contribute toward this improvement in lieu of or in addition to the other improvements. The freeway extension would provide several benefits to the SR 68 corridor. One benefit would be a reduction in the travel time on SR 68 in both directions. The freeway extension would reduce the *combined* eastbound and westbound travel time through the

SR 68 corridor by approximately 286 seconds (4.7 minutes) during the weekday AM and PM peak hours. The traffic generated by the Harper Canyon / Encina Hills Subdivision project would increase the *combined* eastbound and westbound travel time through the SR 68 corridor by approximately 32 seconds. Therefore the implementation of the freeway extension would more than offset the increase in travel time caused by the proposed project. The calculations used to estimate the reduction in travel time with the freeway extension are shown in *Appendix O* and are based on the average travel speeds through the SR 68 corridor in Exhibits 5A and 5B. The increase in travel time caused by the project was estimated using the Synchro arterial analysis reports which are included in *Appendix P*.

Another benefit of extending the freeway would be a reduction in the length of the queue on westbound SR 68 east of San Benancio Road during the weekday AM peak hour, which is currently up to 2.5 miles long. It is also reasonable to assume that it would reduce the number of accidents per year on SR 68, as the state-wide accident rates on 4-lane freeways are about half of those on 2-lane highways. In addition, it would eliminate the observed phenomenon of drivers exiting westbound SR 68 at the Portola Drive interchange to cut through the neighborhoods in Toro Park Estates. Drivers do this to get ahead of traffic by re-entering the SR 68 traffic stream at Torero Drive. This phenomenon, which occurs daily during the weekday AM peak hour, was evident in the data collection and was confirmed through discussions with Monterey County staff.

If this improvement was to be implemented, a decision would have to be made regarding the existing intersection on SR 68 at Torero Drive. There would be several options; the intersection could be closed off and only used as an emergency access. In this case, existing traffic would be diverted to the Portola Drive interchange. Another option would be to convert the intersection to right-in, right-out access only, in which case the road segment would operate more as an expressway than a freeway. Other options could also be explored, such as allowing eastbound SR 68 left-turns onto Torero Drive, but prohibiting southbound Torero Drive left-turns onto SR 68.

Fair share contributions from the Harper Canyon / Encina Hills Subdivision project, as well as other proposed projects in the vicinity of the SR 68 corridor, could be combined to fund this improvement. Or an agreement could be made for the project to provide all or a portion of the funds to pay the "soft costs" of the freeway extension project (e.g. a Project Study Report).

7.3 Widening SR 68 to Four Lanes from Toro Park to Corral de Tierra Road

As was mentioned in Section 1.9 of this report, the Transportation Agency for Monterey County (TAMC) is currently in the process of updating the 2004 *Nexus Study for a Regional Development Impact Fee*. As of this writing, the project list in the *Regional Impact Fee Nexus Study Update* includes a project referred to as "SR 68 Commuter Improvements", which would widen SR 68 to four lanes from the existing 4-lane section (adjacent to Toro Park) to Corral de Tierra Road. This improvement partially overlaps with the improvement described in Section 7.2, as it would double the length of roadway being widened from 1.1 miles to approximately 2.3 miles. The geometric design details of this improvement are not known at this time. Therefore it would be difficult, if not impossible, to determine the additional reduction in travel time that would take place along the SR 68 corridor with this improvement in place. However, it is clear that this improvement would result in an additional reduction in travel time along the corridor, over what was analyzed by the 1.1 mile freeway extension, as well as reduce queuing during the peak periods, and provide safety benefits, as discussed in Section 7.2.

7.4 Discussion on Intersections

No project-specific mitigation measures were identified for the study intersections numbered 1 through 6. It should be acknowledged that the intersection operating conditions are based on the average delay for vehicles and they do not necessarily reflect the operating conditions of the road segments. However, there are project-specific recommendations for the project access at San Benancio Road and Meyer Road.

7.5 Discussion on Road Segments

With the use of the GPS and GIS-based technology, it was possible to accurately determine the operating conditions along the SR 68 corridor under existing traffic conditions. The travel speed based assessment of the operating conditions along the SR 68 corridor confirmed the longstanding opinion that levels of service on SR 68 are unacceptable. SR 68 should be widened to a 4-lane facility to ensure acceptable levels of service.

7.6 Significant Impacts on Intersections and Road Segments

Based on the significant impact criteria listed in section 1.7 of this report, the implementation of the proposed project will have a significant impact on four of the six study intersections (i.e., for intersections already operating at LOS F, any increase, even one vehicle, to the intersection's critical movement is considered significant) and four of the five study road segments (i.e., the addition of one project trip added to a segment already operating at LOS F is considered significant).

7.7 Recommended Mitigation Measures on Study Road Network

The recommended mitigation measures for each traffic scenario are listed below. To minimize confusion, mitigation measures will not be repeated under subsequent traffic scenarios if they were already identified under a preceding scenario.

- **Mitigation Measures Recommended for Existing Traffic Conditions**

Mitigation #1 – A second westbound through lane should be added at the York Road / SR 68 intersection.

Mitigation #2 – A second westbound through lane should be added at the Pasadera Drive / SR 68 intersection.

Mitigation #3 – A second eastbound through lane and a second westbound through lane should be added at the Laureles Grade Road / SR 68 intersection.

Mitigation #4 – A second eastbound through lane and a second westbound through lane should be added at the Corral de Tierra Road / SR 68 intersection.

Mitigation #5 – A second eastbound through lane and a second westbound through lane should be added at the San Benancio Road / SR 68 intersection.

The SR 68 corridor should be widened to a 4-lane facility to ensure acceptable operating conditions.

- **Mitigation Measures Recommended for Background Traffic Conditions**

No new mitigation measures are recommended under background traffic conditions.

The same mitigation measures recommended under existing traffic conditions would also be recommended under background traffic conditions.

- **Mitigation Measures Recommended for Background Plus Project Traffic Conditions**

Regarding the study intersections numbered 1 through 6 and the study road segments, the same mitigation measures recommended under existing and background traffic conditions would also be recommended under background plus project traffic conditions.

Mitigation #6 – The study project should pay a pro-rata contribution toward Mitigations 11 through 17, or any combination thereof. The payment of a pro-rata contribution towards the implementation of Mitigation #16 or #17 alone would offset the increase in delay and travel time along the SR 68 corridor caused by the project. Preferably, the project would fund the preparation of planning studies and/or design of the freeway extension project, if these stages of the implementation have not yet occurred.

The study project should pay the TAMC Regional Traffic Impact Fee to mitigate cumulative impacts along SR 68. Through the payment of the TAMC Regional Traffic Impact Fee, the proposed project would thus directly contribute to improvements along the SR 68 corridor. However, if the project contributes to the extension of the freeway, then they should be credited for the TAMC fee as they would be contributing their fair share towards cumulative impacts along SR 68.

Mitigation #7 – To the extent practical, trim or cut back the vegetation and embankment in the vicinity of the San Benancio Road / Meyer Road intersection to improve sight distance at the intersection. The precise extent of vegetation removal, embankment re-grading and resurfacing will require the review and approval by the Monterey County Public Works Department at the time of obtaining an Encroachment Permit.

Mitigation #8 – To the extent practical, widen and resurface Meyer Road per County of Monterey standards for a cul-de-sac private road (i.e., to a minimum surfaced roadbed width of 18 feet) per Monterey County Public Works Standard Detail Plate No. 5, included herein as *Appendix L*.

Mitigation #9 – To the extent practical, provide right turn tapers at the San Benancio Road / Meyer Road intersection per County of Monterey standards for a private road / county road intersection as described in the Monterey County Roadway Design Standards, page 18, item P (included as *Appendix M*) or similar to the standard Caltrans Access Openings on Expressways, Figure 205.1 (included as *Appendix N*).

Mitigation #10 – Construct a southbound San Benancio Road left-turn lane per Monterey County standards at the San Benancio Road / Meyer Road intersection.

➢ **Mitigation Measures Recommended for Cumulative Traffic Conditions**

Mitigation #11 – Widen and restripe the northbound approach to include one left-turn lane, one through lane, and one right-turn lane, widen and restripe the eastbound approach to include two left-turn lanes, two through lanes and one right-turn lane, and install right-turn over lap phasing at the SR 218 / SR 68 intersection.

Mitigation #12 – A second eastbound through lane and a second eastbound left-turn lane should be added at the York Road / SR 68 intersection.

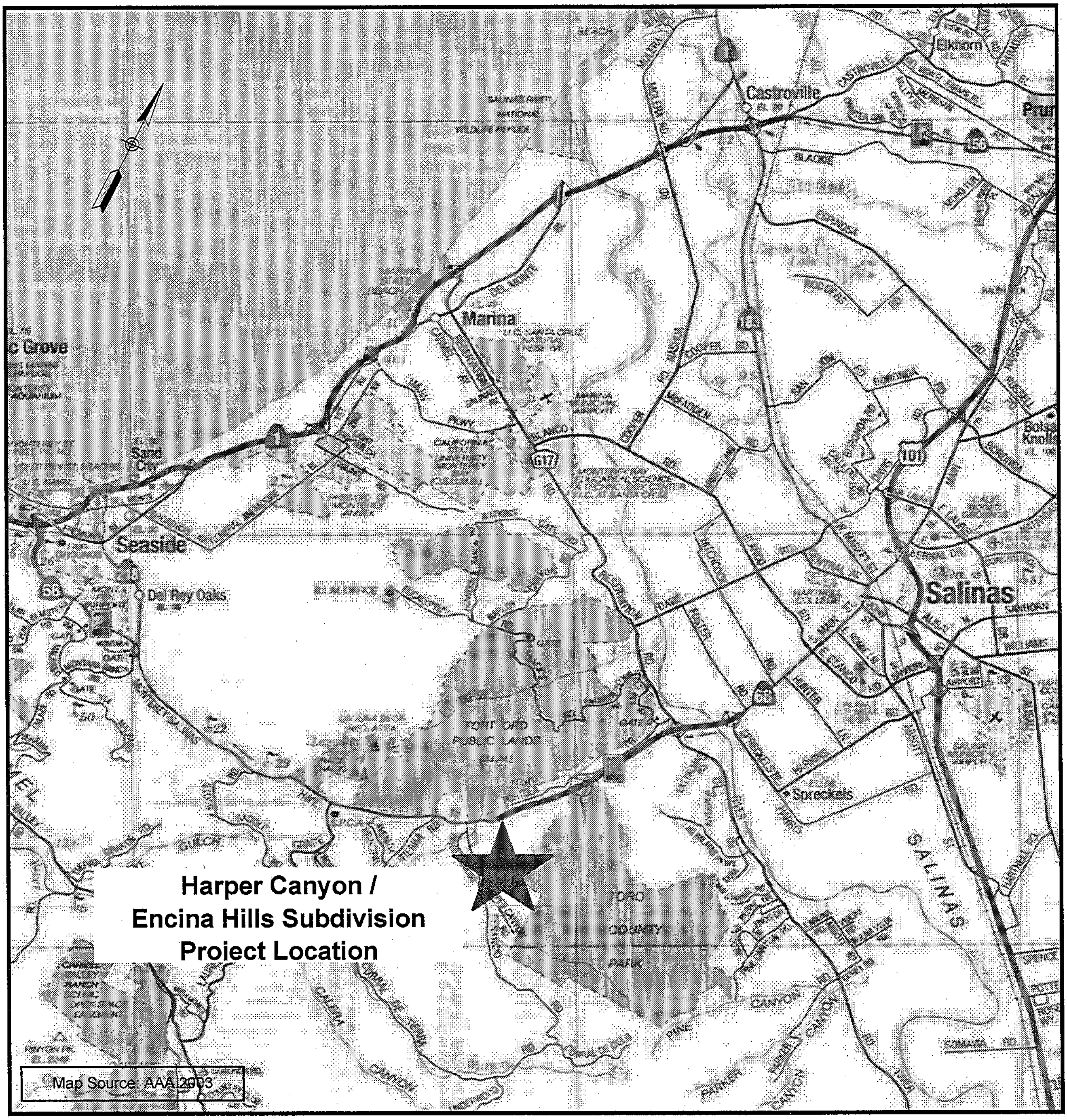
Mitigation #13 – A second eastbound through lane should be added at the Pasadera Drive / SR 68 intersection.

Mitigation #14 – Convert the northbound right-turn to right-turn overlap phasing at the Laureles Grade Road / SR 68 intersection.

Mitigation #15 – Convert the northbound right-turn to right-turn overlap phasing at the Corral de Tierra Road / SR 68 intersection.

Mitigation #16 – Widen SR 68 to four lanes from Toro Park to the west end of Toro Park Estates. This improvement could be implemented at any time and therefore applies to all development scenarios.

Mitigation #17 – Widen SR 68 to four lanes from Toro Park to Corral de Tierra Road. This improvement could be implemented at any time and therefore applies to all development scenarios.



Map Source: AAA 2003

Exhibit 1A

Project Location Map

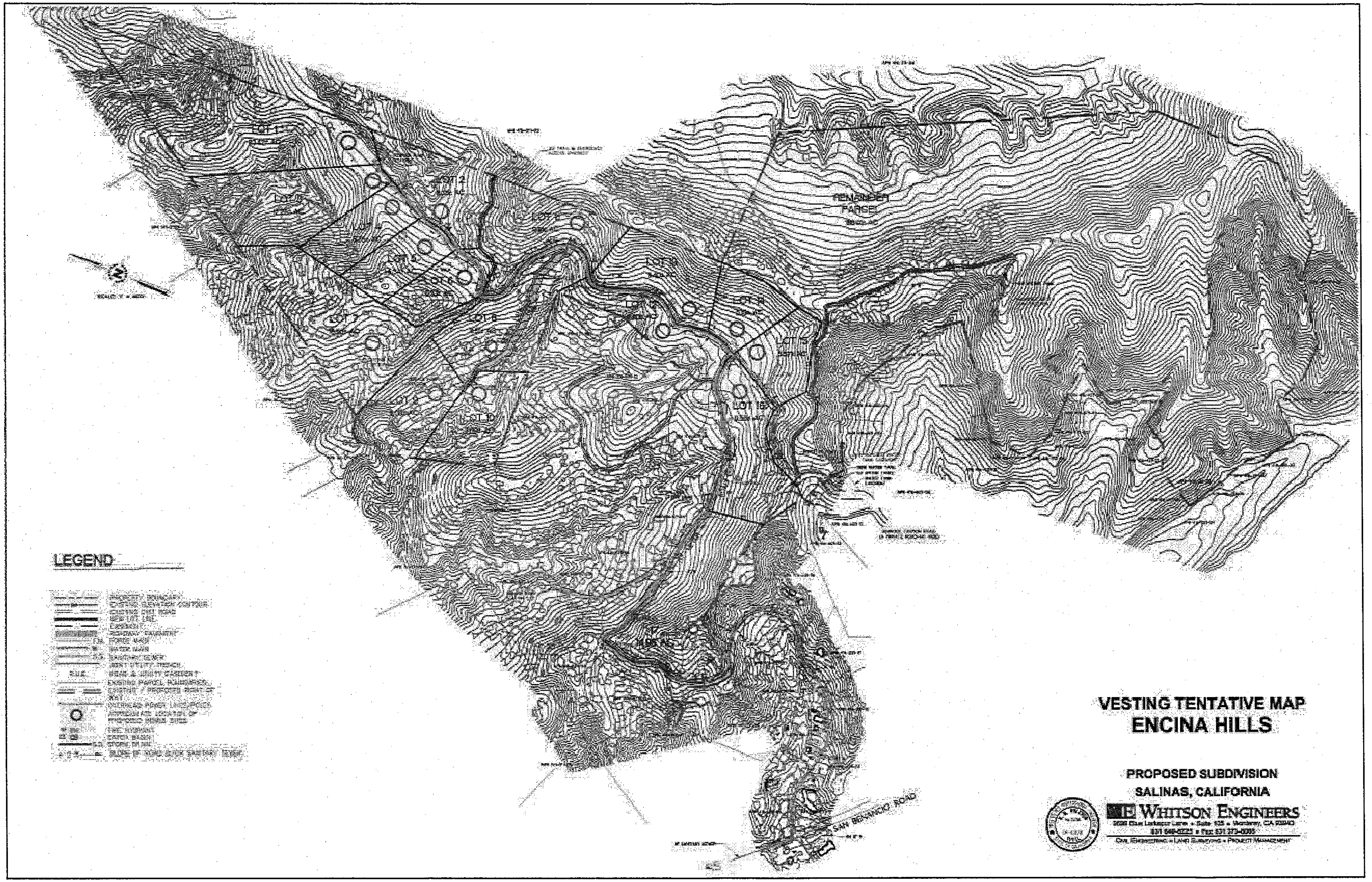


Exhibit 1B
Project Site Plan

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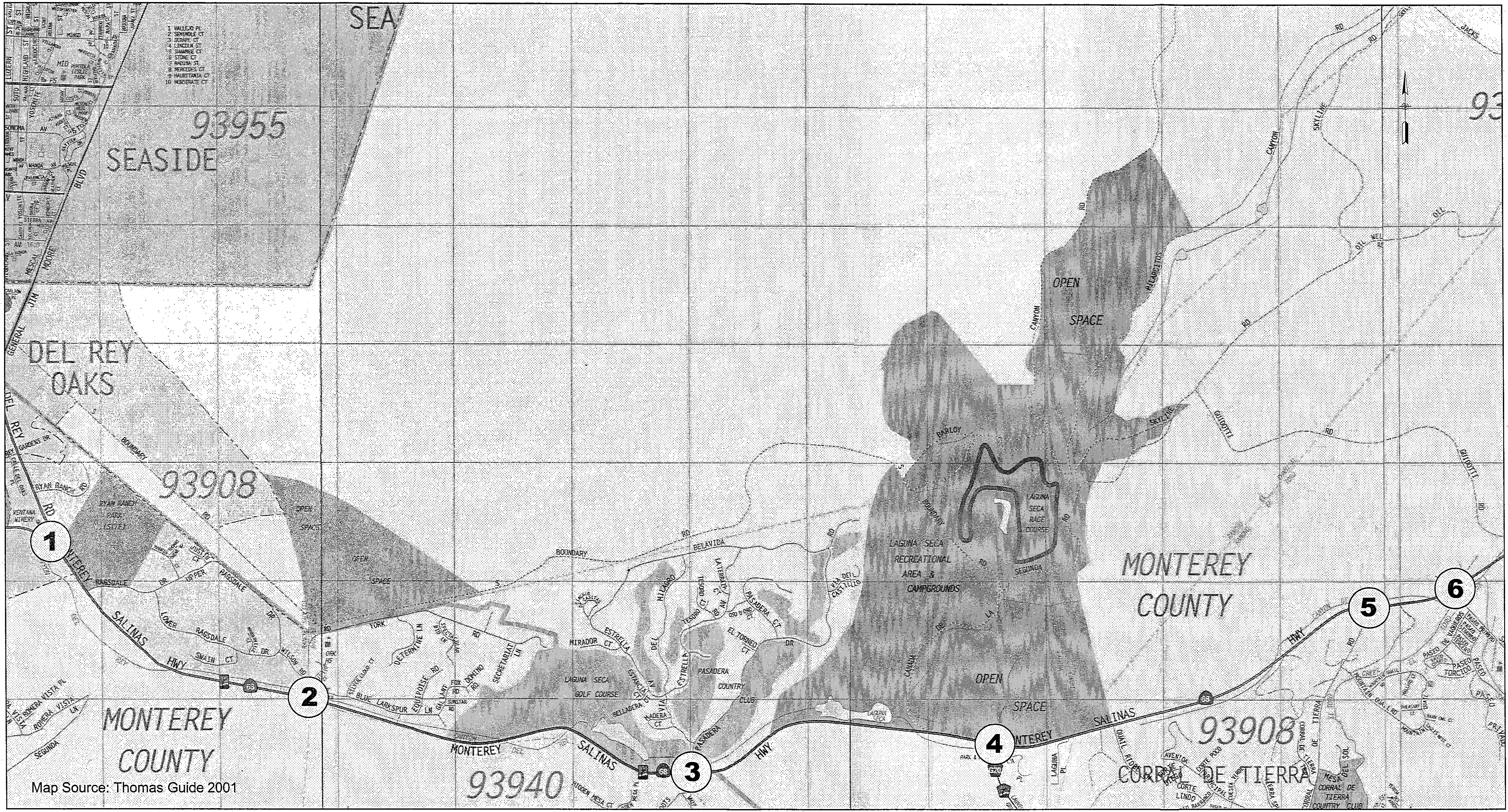
Exhibit 2
Study Area



Map Source: Thomas Guide 2001

Study Intersection Number ⓧ

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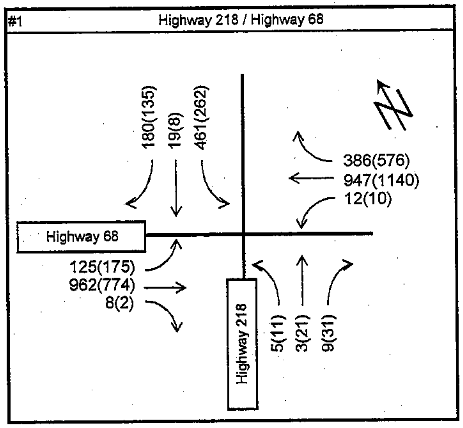
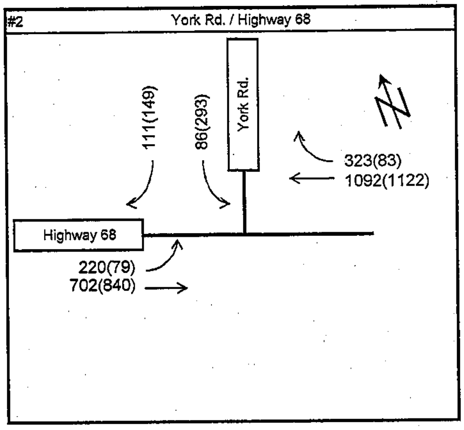
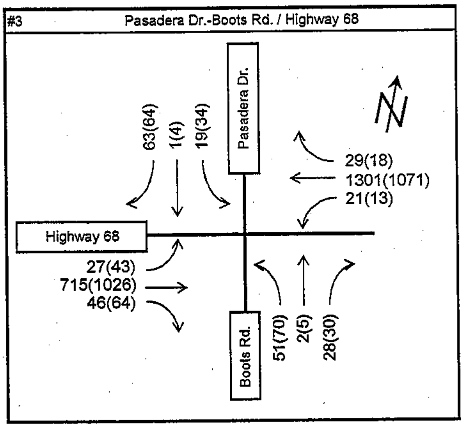
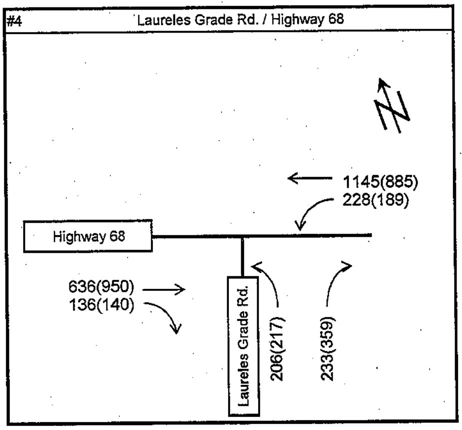
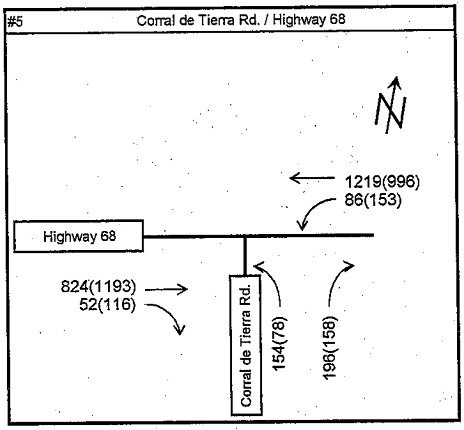
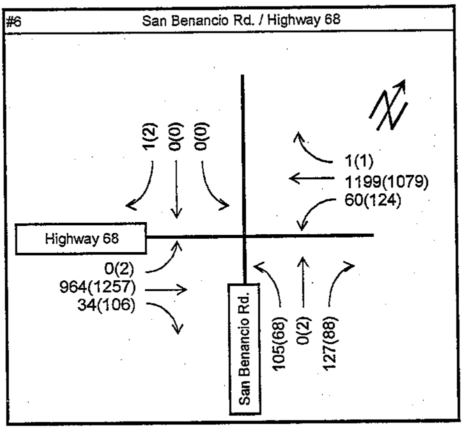


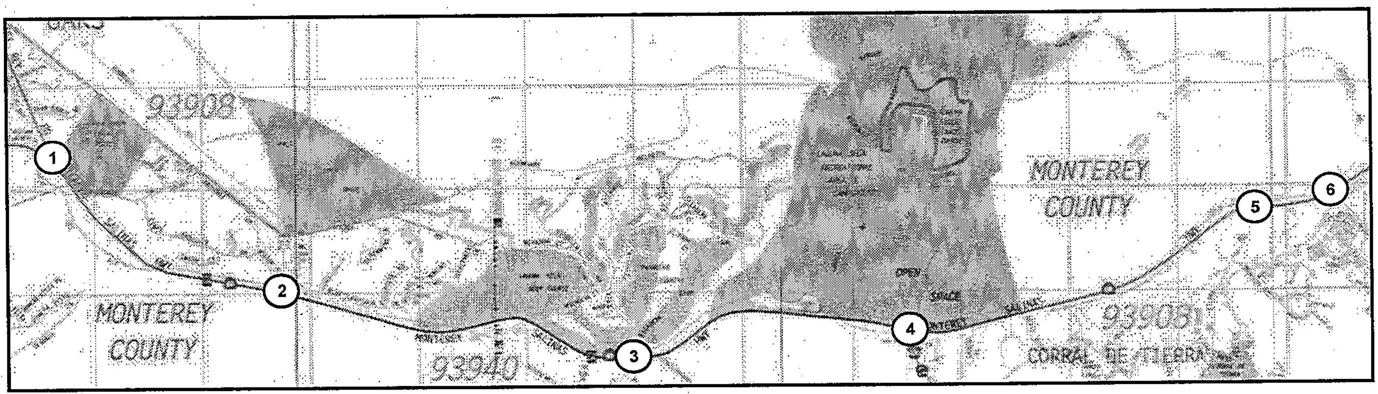












Notes:

1. XX (YY) = AM (PM)
2. Turning movement counts were conducted on the following dates:

8/15/06 - Intersection #1 (AM & PM Peak Hours)
8/16/06 - Intersection #2, 3, 6 (AM & PM Peak Hours)
8/16/06 - Intersection #4 (PM Peak Hour)
8/22/06 - Intersection #5 (AM & PM Peak Hours)
8/29/06 - Intersection #4 (AM Peak Hour)

Exhibit 3
Existing Conditions
AM & PM Peak Hour Volumes

Intersection						Existing Conditions				Background Conditions				Background + Project Conditions				Cumulative Conditions			
						AM Peak Hr		PM Peak Hr		AM Peak Hr		PM Peak Hr		AM Peak Hr		PM Peak Hr		AM Peak Hr		PM Peak Hr	
	N-S Street	E-W Street	Existing Lane Configuration	Existing Intersection Control	LOS Standard	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Highway 218	Highway 68	NB 1-L, 1-T/R SB 2-L, 1-T, 1-R EB 1-L, 1-T, 1-T/R WB 1-L, 2-T, 1-R	Signal	C/D	21.0	C	24.0	C	22.5	C	32.5	C	22.6	C	32.6	C	31.6	C	72.4	E
					Mitigation #11													*21.2*	*C*	*26.6*	*C*
2	York Road	Highway 68	SB 1-L, 1-R EB 1-L, 1-T WB 1-T, 1-R	Signal	C/D	63.6	E	76.3	E												
					Including 2nd SBL & 4th Leg					88.1	F	81.6	F	88.9	F	82.0	F	124.4	F	106.6	F
					Mitigation #1	*19.9*	*B*	*21.7*	*C*	*25.9*	*C*	*30.8*	*C*	*26.5*	*C*	*31.4*	*C*				
					Mitigation #12													*25.2*	*C*	*22.4*	*C*
3	Pasadera Drive-Boots Road	Highway 68	NB 1-L, 1-T/R SB 1-L/T, 1-R EB 1-L, 1-T, 1-R WB 1-L, 1-T, 1-R	Signal	C/D	36.8	D	29.5	C	69.0	E	44.2	D	70.0	E	44.7	D	123.3	F	106.5	F
					Mitigation #2	*11.5*	*B*	*18.2*	*B*	*13.3*	*B*	*23.3*	*C*	*13.3*	*B*	*23.6*	*C*				
					Mitigation #13													*11.9*	*B*	*12.2*	*B*
4	Laureles Grade Road	Highway 68	NB 1-L, 1-R EB 1-T, 1-R WB 1-L, 1-T	Signal	C/D	38.8	D	82.6	F												
					Including 2nd WBL					60.3	E	91.2	F	60.9	E	91.9	F	107.0	F	160.9	F
					Mitigation #3	*14.8*	*B*	*25.3*	*C*	*16.3*	*B*	*25.5*	*C*	*16.4*	*B*	*25.5*	*C*				
					Mitigation #14													*13.9*	*B*	*21.2*	*C*
5	Corral de Tierra Road	Highway 68	NB 1-L, 1-R EB 1-T, 1-R WB 1-L, 1-T	Signal	C/D	35.5	D	68.0	E												
					Including 2nd WBL & 4th Leg					131.5	F	144.5	F	132.4	F	146.0	F	197.5	F	268.9	F
					Mitigation #4	*19.0*	*B*	*20.3*	*C*	*20.1*	*C*	*21.0*	*C*	*27.5*	*C*	*21.6*	*C*				
					Mitigation #15													*34.1*	*C*	*29.2*	*C*
6	San Benancio Road	Highway 68	NB 1-L/T, 1-R SB 1-L/T, 1-R EB 1-L, 1-T, 1-R WB 1-L, 1-T/R	Signal	C/D	71.7	E	116.5	F												
					Including 2nd WBL					82.9	F	136.6	F	84.9	F	139.1	F	159.8	F	237.0	F
					Mitigation #5	*22.0*	*C*	*17.0*	*B*	*20.4*	*C*	*21.1*	*C*	*20.5*	*C*	*24.1*	*C*	*22.9*	*C*	*29.4*	*C*

Notes:

1. L, T, R = Left, Through, Right
2. NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound
3. Levels of service in red borders represent significant project impacts per CEQA guidelines.

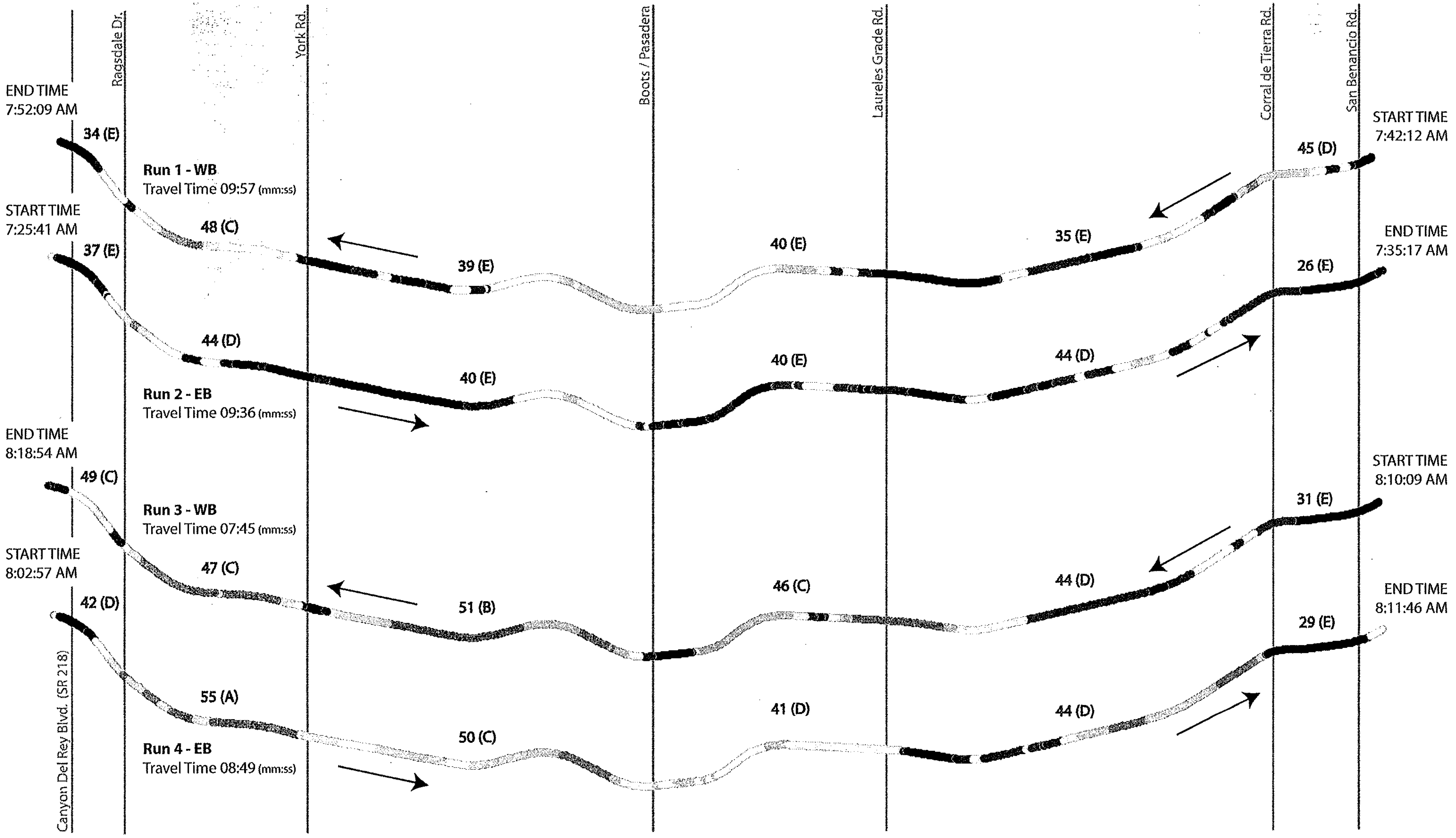
HIGGINS ASSOCIATES

Exhibit 4

Intersection Levels of Service

Highway 68 Between SR 218 and San Benancio Road

Total Distance Approximately 6.5 Miles



Legend

●	LOS A > 55 mph	●	LOS D 40.1 - 45 mph
●	LOS B 50.1 - 55 mph	●	LOS E 25.1 - 40 mph
○	LOS C 45.1 - 50 mph	●	LOS F ≤ 25 mph

XX (Y) = Avg. Speed (LOS)

N

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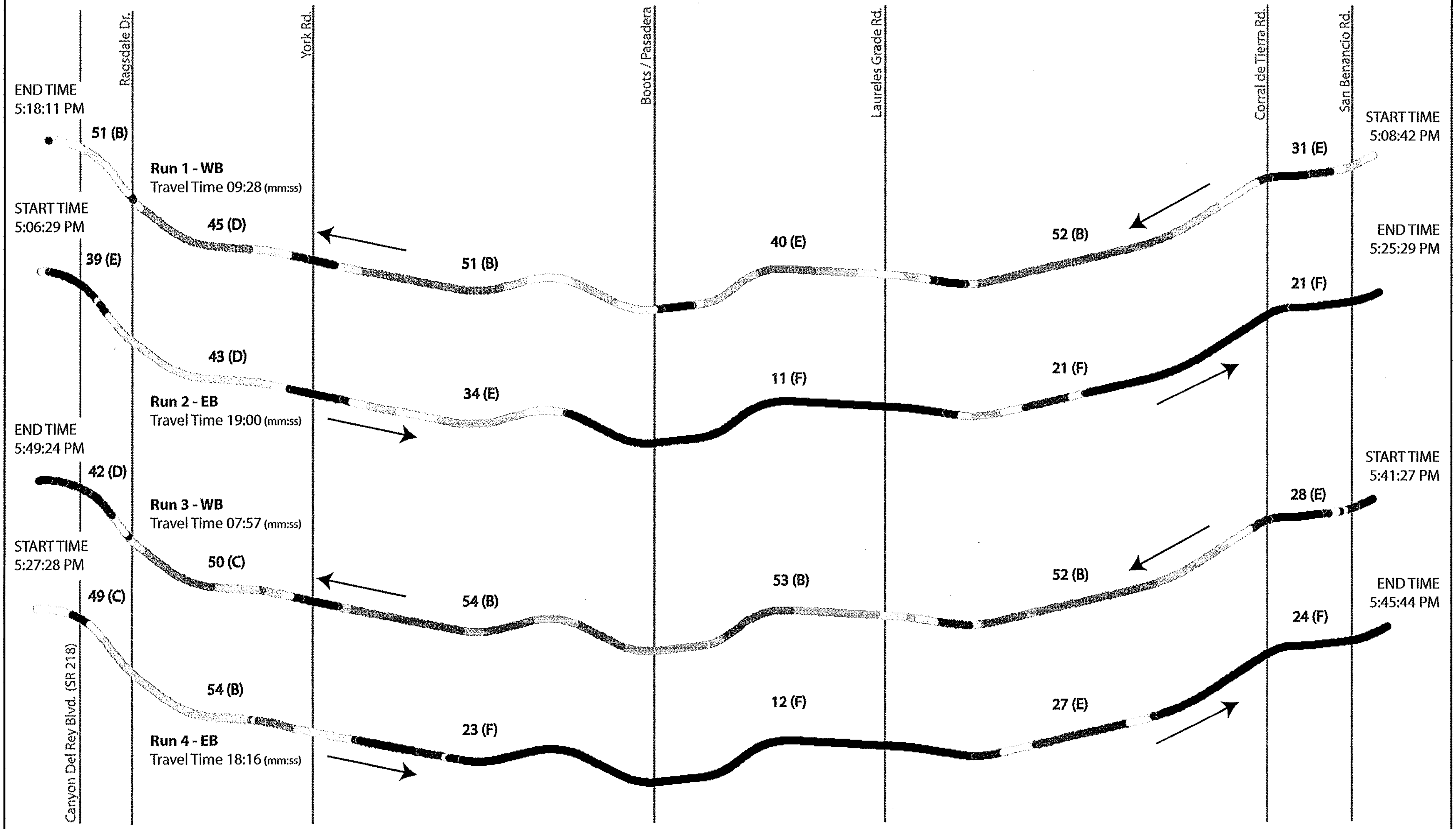
CIVIL & TRAFFIC ENGINEERS

EXHIBIT 5A

AM Peak Hr. Average Travel Speeds
Along SR 68 Corridor

Highway 68 Between SR 218 and San Benancio Road

Total Distance Approximately 6.5 Miles



Legend

- ● LOS A > 55 mph
- ○ LOS B 50.1 - 55 mph
- ○ LOS C 45.1 - 50 mph
- ○ LOS D 40.1 - 45 mph
- ● LOS E 25.1 - 40 mph
- ● LOS F ≤ 25 mph

XX (Y) = Avg. Speed (LOS)

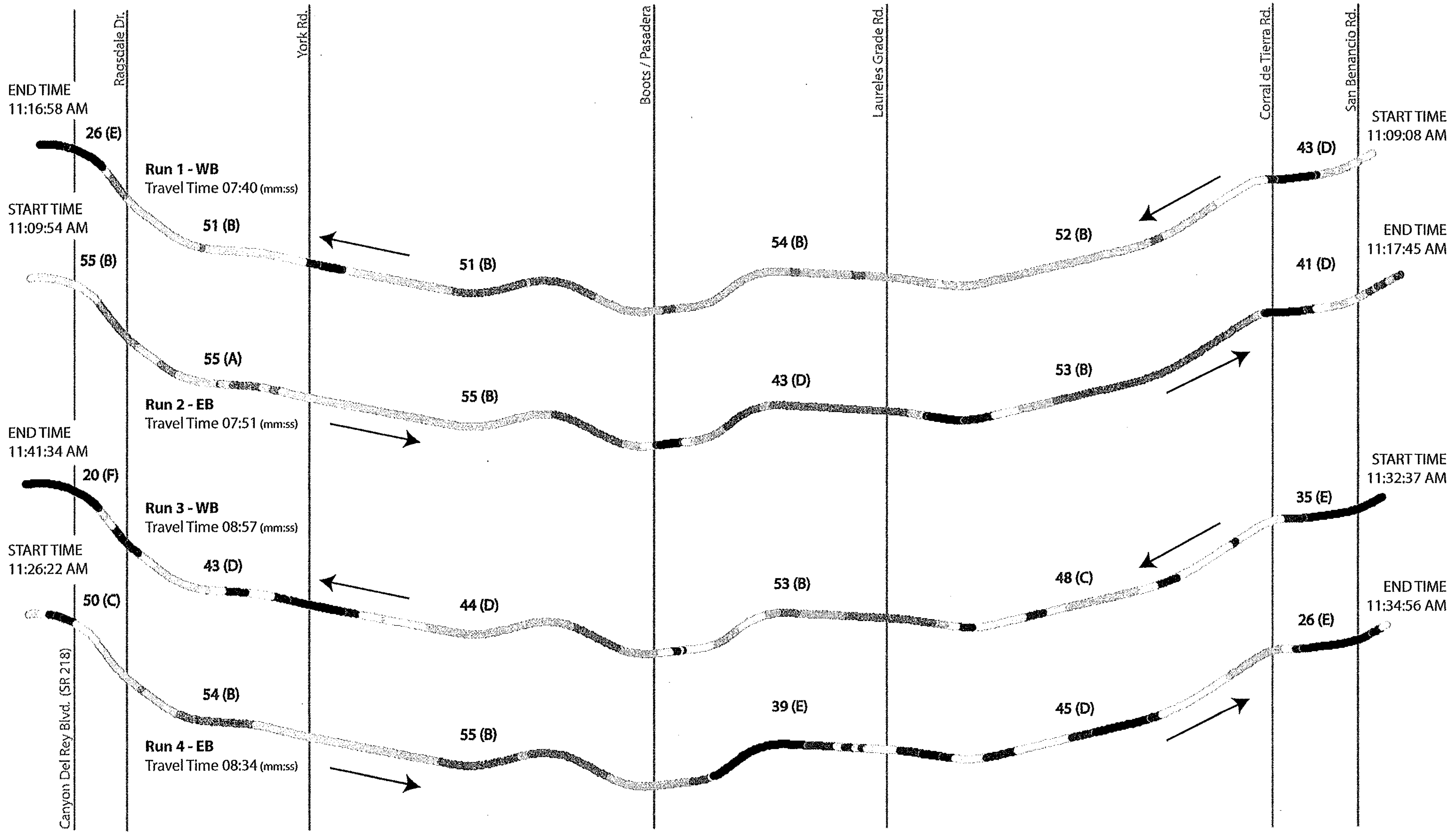
HIGGINS ASSOCIATES
CIVIL & TRAFFIC ENGINEERS

EXHIBIT 5B

PM Peak Hr. Average Travel Speeds Along SR 68 Corridor

Highway 68 Between SR 218 and San Benancio Road

Total Distance Approximately 6.5 Miles



Legend

- ● LOS A > 55 mph
- ● LOS B 50.1 - 55 mph
- ○ LOS C 45.1 - 50 mph
- ○ LOS D 40.1 - 45 mph
- ● LOS E 25.1 - 40 mph
- ● LOS F ≤ 25 mph

XX (Y) = Avg. Speed (LOS)

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CIVIL & TRAFFIC ENGINEERS

EXHIBIT 5C

Off-Peak Average Travel Speeds
Along SR 68 Corridor

Road Segment	Type	Direction	LOS Std.	Existing Conditions										Background Conditions						Background + Project Conditions						Cumulative Conditions					
				AM Peak Hr					PM Peak Hr					AM Peak Hr			PM Peak Hr			AM Peak Hr			PM Peak Hr			AM Peak Hr			PM Peak Hr		
					GPS		Synchro			GPS		Synchro																			
				Volume	Speed^{1}	LOS^{3}	Speed^{2}	LOS^{3}	Volume	Speed^{1}	LOS^{3}	Speed^{2}	LOS^{3}	Volume	Speed^{4}	LOS^{3}	Volume	Speed^{4}	LOS^{3}	Volume	Speed^{4}	LOS^{3}	Volume	Speed^{4}	LOS^{3}	Volume	Speed^{4}	LOS^{3}	Volume	Speed^{4}	LOS^{3}
1 Highway 68 Between Highway 218 and York Rd.	2-Lane Arterial	EB	C/D	1,432	37.0	E	37.2	E	1,067	39.0	E	38.8	E	1,612	36.6	E	1,224	38.8	E	1,613	36.6	E	1,228	38.8	E	1,708	36.3	E	1,415	32.4	E
		WB		1,345	34.0	E	34.3	E	1,726	42.0	D	41.8	D	1,464	33.3	E	1,951	36.9	E	1,468	32.9	E	1,953	36.7	E	1,573	29.6	E	2,057	24.5	F
2 Highway 68 Between York Rd. and Boots Rd.-Pasadera Dr.	2-Lane Arterial	EB	C/D	788	40.0	E	39.6	E	1,133	23.0	F	23.3	F	869	40.1	D	1,296	22.2	F	870	40.1	D	1,300	22.2	F	959	39.3	E	1,579	16.8	F
		WB		1,415	39.0	E	39.0	E	1,205	51.0	B	47.1	C	1,548	34.1	E	1,323	46.9	C	1,552	33.9	E	1,325	46.9	C	1,781	28.7	E	1,485	44.8	D
3 Highway 68 Between Boots Rd.-Pasadera Dr. and Laureles Grade Rd.	2-Lane Arterial	EB	C/D	772	40.0	E	39.6	E	1,090	11.0	F	11.2	F	858	41.7	D	1,241	10.9	F	859	41.7	D	1,245	10.8	F	933	40.8	D	1,516	8.7	F
		WB		1,351	40.0	E	40.0	E	1,102	40.0	E	39.7	E	1,472	29.0	E	1,223	34.9	E	1,476	28.8	E	1,225	34.8	E	1,715	18.7	F	1,378	25.3	E
4 Highway 68 Between Laureles Grade Rd. and Corral de Tierra Rd.	2-Lane Arterial	EB	C/D	876	44.0	D	44.0	D	1,309	21.0	F	21.2	F	976	38.1	E	1,483	15.7	F	977	38.0	E	1,487	15.6	F	1,062	33.4	E	1,803	12.6	F
		WB		1,373	35.0	E	35.4	E	1,074	52.0	B	51.9	B	1,508	28.8	E	1,218	51.6	B	1,512	28.6	E	1,220	51.5	B	1,749	21.8	F	1,347	47.3	C
5 Highway 68 Between Corral de Tierra Rd. and San Benancio Rd.	2-Lane Arterial	EB	C/D	1,020	26.0	E	26.1	E	1,365	21.0	F	21.2	F	1,125	35.7	E	1,536	20.1	F	1,126	35.5	E	1,540	19.9	F	1,252	23.5	F	1,889	13.8	F
		WB		1,305	31.0	E	31.0	E	1,149	28.0	E	27.5	E	1,444	14.6	F	1,289	15.6	F	1,448	14.5	F	1,298	15.4	F	1,700	10.4	F	1,498	9.8	F

Notes:
1. Average travel speed obtained from data collection in the field using GPS technology.
2. Average travel speed obtained from Synchro software calibrated with results from GPS data collection.
3. Level of service based on speeds in Table 3.
4. Speed as calculated in Synchro software.
5. Levels of service in red borders represent significant project impacts per CEQA guidelines.

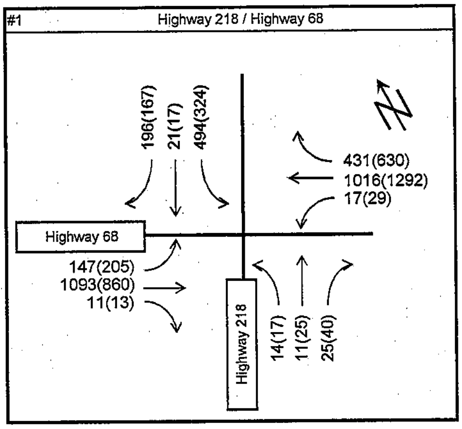
Table 3.

Level of Service	Average Travel Speed (mph)
A	>55
B	50.1 - 55
C	45.1 - 50
D	40.1 - 45
E	25.1 - 40
F	<= 25

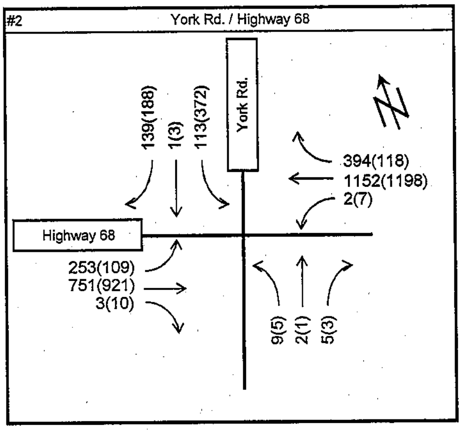
Exhibit 6
Road Segment Levels of Service

HIGGINS ASSOCIATES

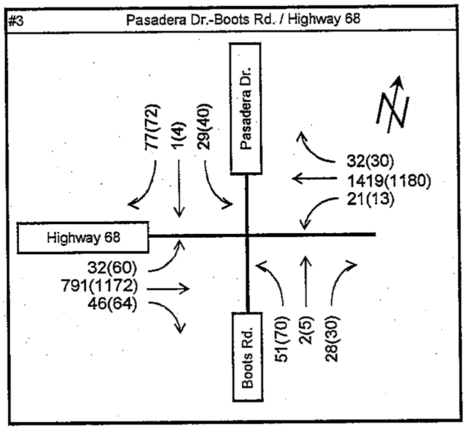
#1 Highway 218 / Highway 68



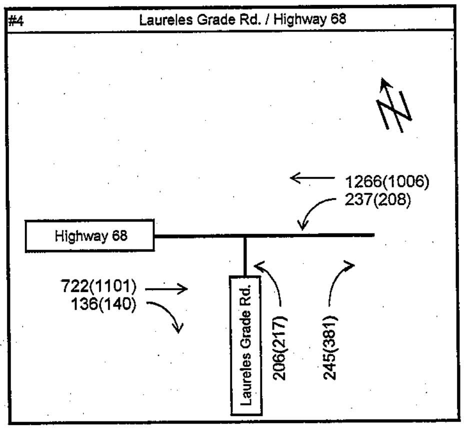
#2 York Rd. / Highway 68



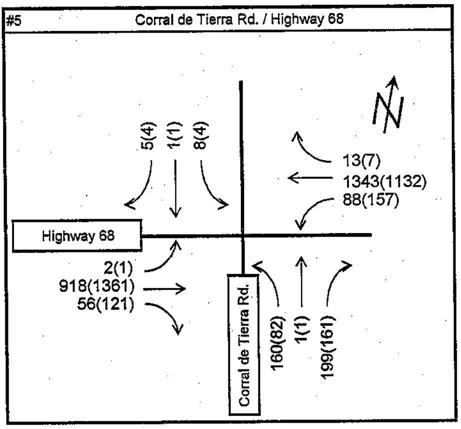
#3 Pasadera Dr.-Boots Rd. / Highway 68



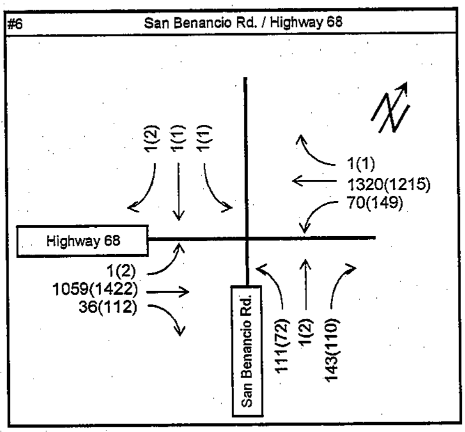
#4 Laureles Grade Rd. / Highway 68



#5 Corral de Tierra Rd. / Highway 68



#6 San Benancio Rd. / Highway 68



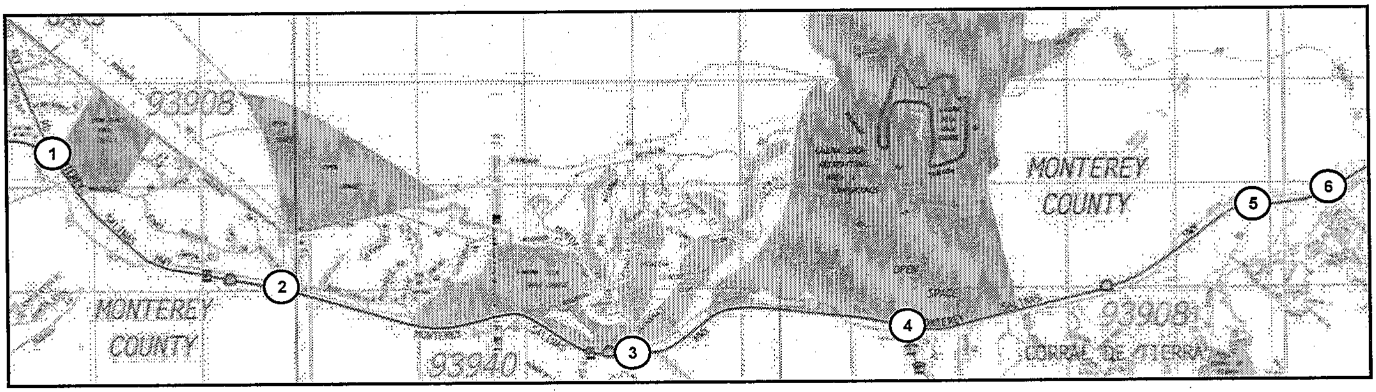


Exhibit 8
Background Conditions
AM & PM Peak Hour Volumes

Harper Canyon / Encina Hills Subdivision - Project Trip Generation

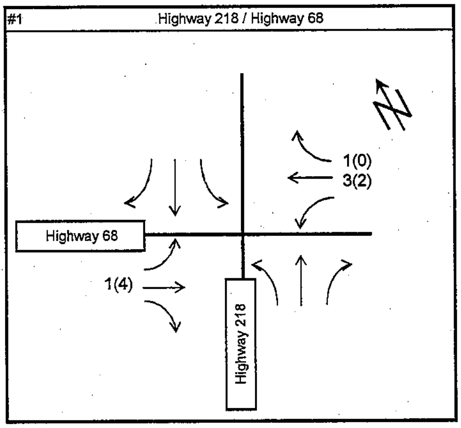
TRIP GENERATION RATES (per Dwelling Unit)[1]	ITE LAND USE CODE	DAILY TRIP RATE	AM PEAK HOUR				PM PEAK HOUR			
			PEAK HOUR RATE	% OF ADT	% IN	% OUT	PEAK HOUR RATE	% OF ADT	% IN	% OUT
Harper Canyon / Encina Hills Subdivision	210	9.57	0.75	8%	25%	75%	1.01	11%	63%	37%

GENERATED TRIPS	PROJECT SIZE	DAILY TRIPS	AM PEAK HOUR				PM PEAK HOUR			
			PEAK HOUR TRIPS	% OF ADT	TRIPS IN	TRIPS OUT	PEAK HOUR TRIPS	% OF ADT	TRIPS IN	TRIPS OUT
Harper Canyon / Encina Hills Subdivision	17 Units	163	13	8%	3	10	17	10%	11	6
TOTAL GENERATED TRIPS	**17 Units**	**163**	**13**	**8%**	**3**	**10**	**17**	**10%**	**11**	**6**

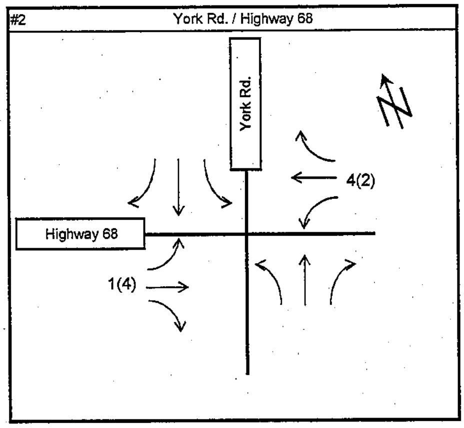
Notes:
1. Trip generation rates published by Institute of Transportation Engineers, "Trip Generation," 7th Edition, 2003.

Exhibit 9
Project Trip Generation

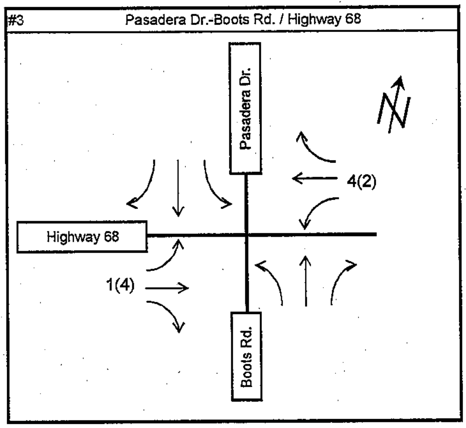
#1 Highway 218 / Highway 68



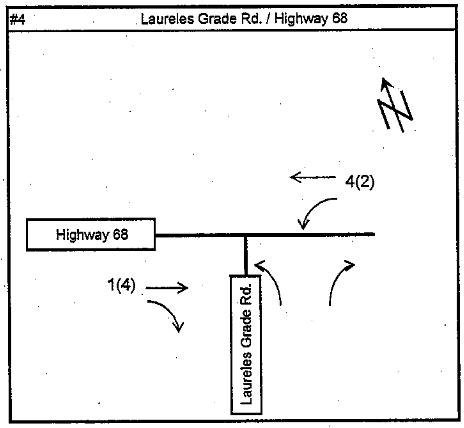
#2 York Rd. / Highway 68



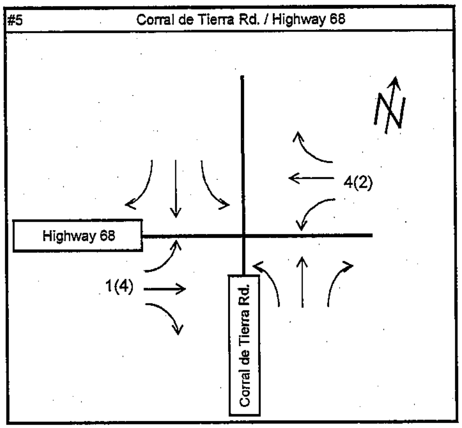
#3 Pasadera Dr.-Boots Rd. / Highway 68



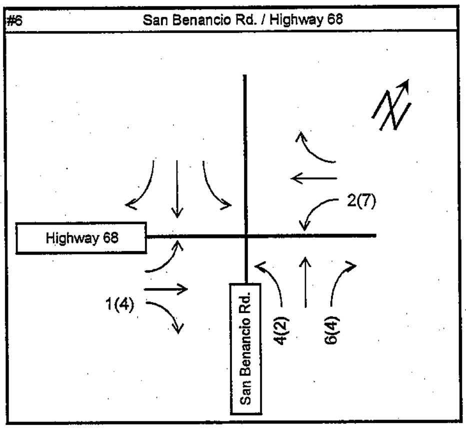
#4 Laureles Grade Rd. / Highway 68



#5 Corral de Tierra Rd. / Highway 68



#6 San Benancio Rd. / Highway 68



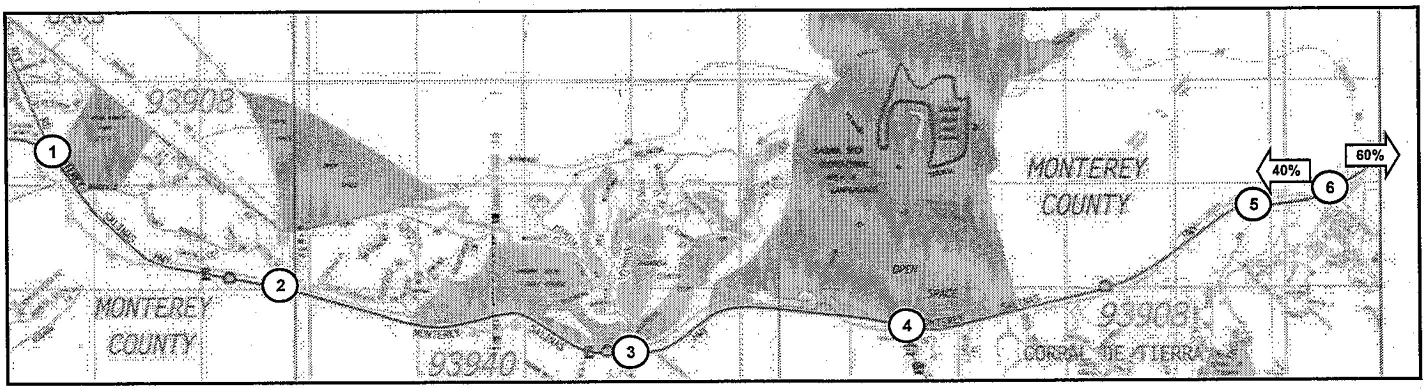
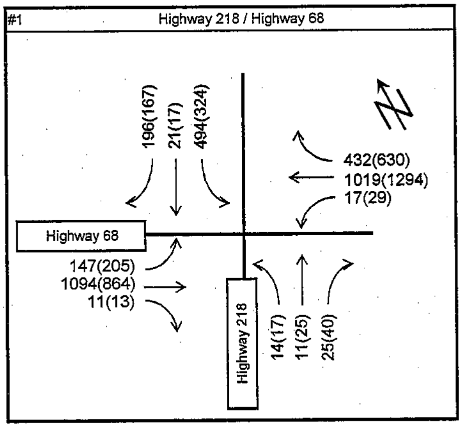
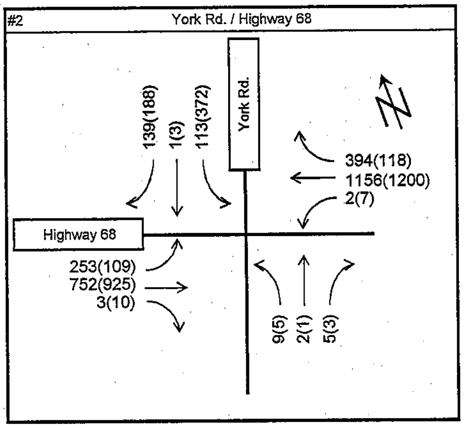
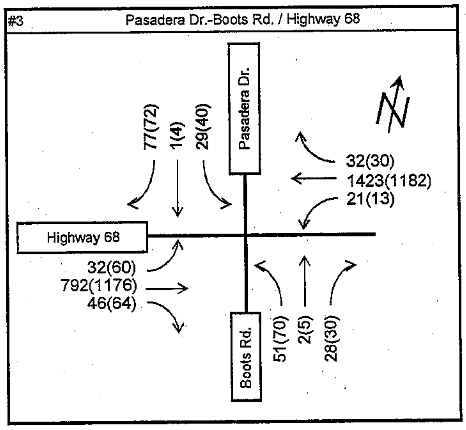


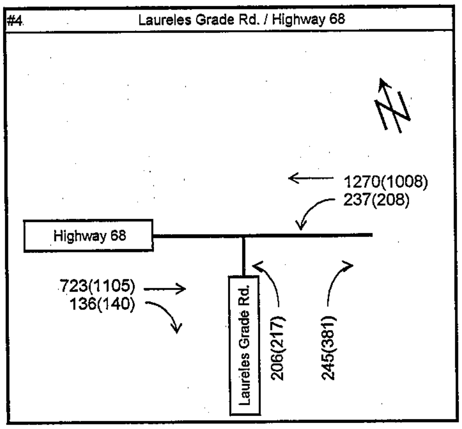
Exhibit 10

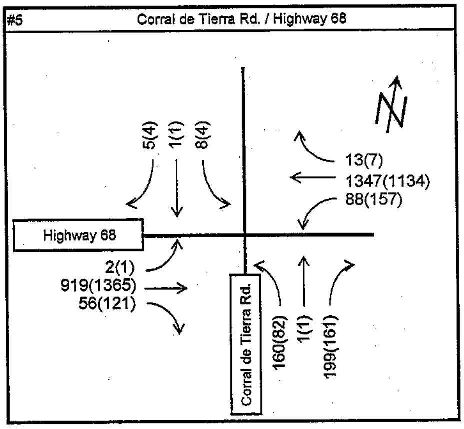
Project Trip Distribution and Assignment
AM & PM Peak Hour Volumes

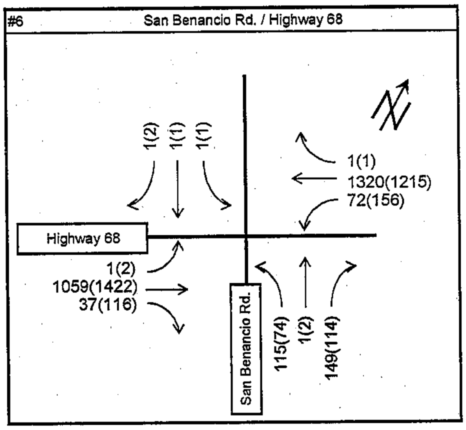












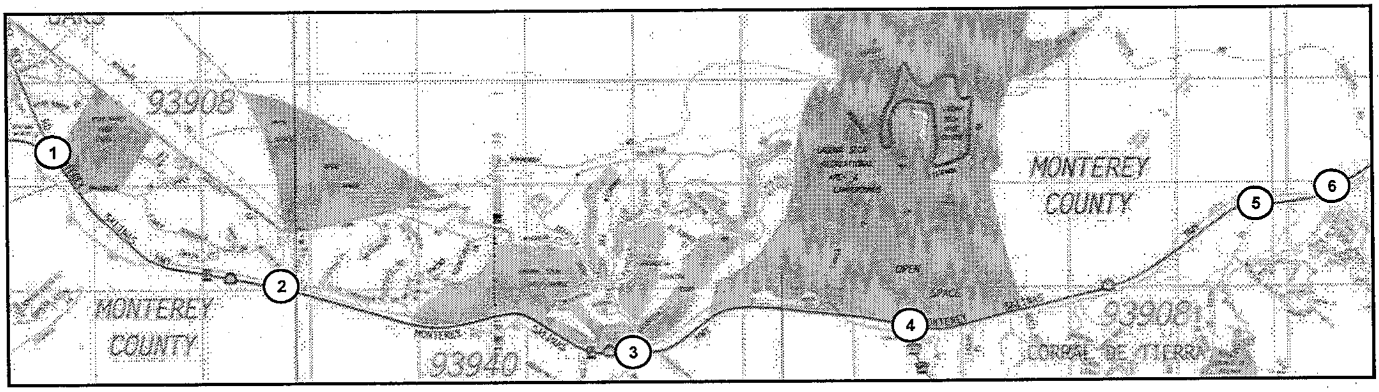


Exhibit 11

Background + Project Conditions AM & PM Peak Hour Volumes

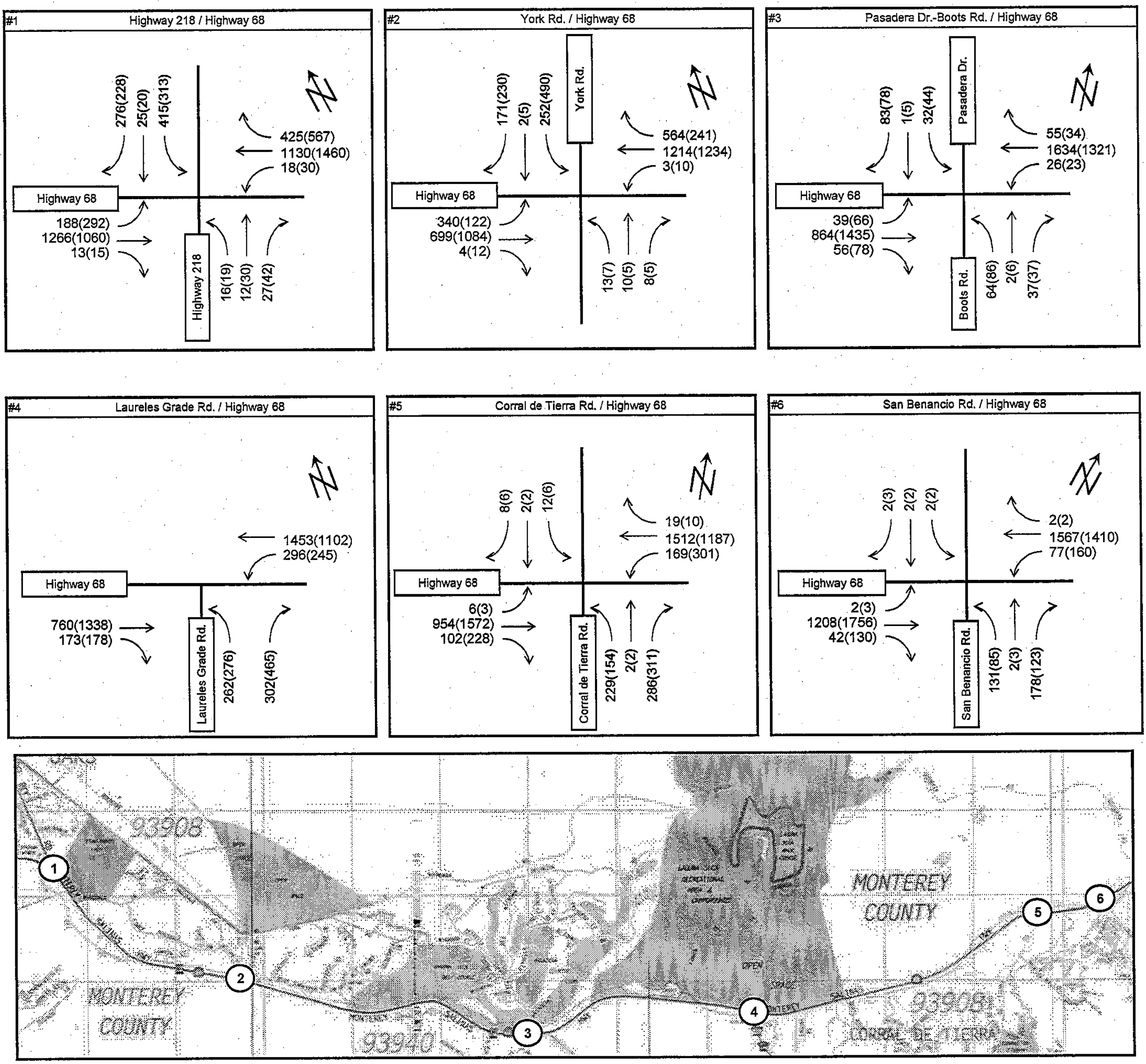


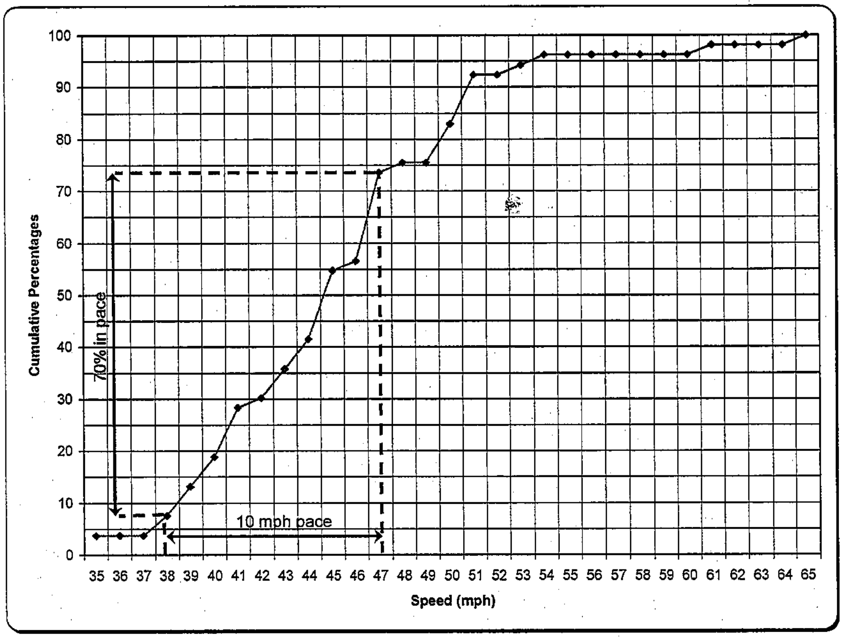
Exhibit 12
Cumulative Conditions
AM & PM Peak Hour Volumes

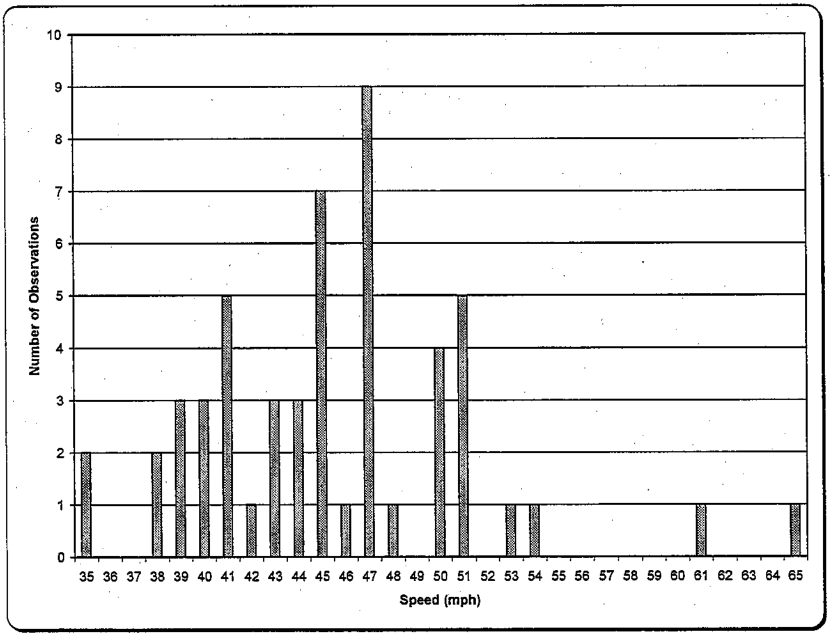
San Benancio Road Speed Study

Location:	**San Benancio Road at Meyer Road**				
Direction:	**NB**	50th percentile speed (median)	45 mph	Average Speed:	45 mph
Day of the Week:	Friday	85th percentile speed (critical):	51 mph	Standard Deviation:	6 mph
Date:	May 5, 2006	10 mph pace speed[2]:	38 to 47	Mode[1]:	47 mph
Time of Day:	3:00 PM - 4:30 PM	Percent in pace speed:	70 %	% Exceeding Speed Limit	17 %
Posted Speed Limit[3]:	50 mph	Range of speeds:	35 to 65		
Vehicles Observed:	53				

Survey Data

Speed (mph)	Number of Obs.	Percent. of Total	Cumul. Percent.
35	2	4	4
36	0	0	4
37	0	0	4
38	2	4	8
39	3	6	13
40	3	6	19
41	5	9	28
42	1	2	30
43	3	6	36
44	3	6	42
45	7	13	55
46	1	2	57
47	9	17	74
48	1	2	75
49	0	0	75
50	4	8	83
51	5	9	92
52	0	0	92
53	1	2	94
54	1	2	96
55	0	0	96
56	0	0	96
57	0	0	96
58	0	0	96
59	0	0	96
60	0	0	96
61	1	2	98
62	0	0	98
63	0	0	98
64	0	0	98
65	1	2	100





Notes:

[1] If there is more than one mode, the highest speed is presented in the summary.

[2] If there is more than one 10 mph pace speed, the average is presented in the summary.

[3] Refers to speed limit as posted on day and at the location of the speed survey.

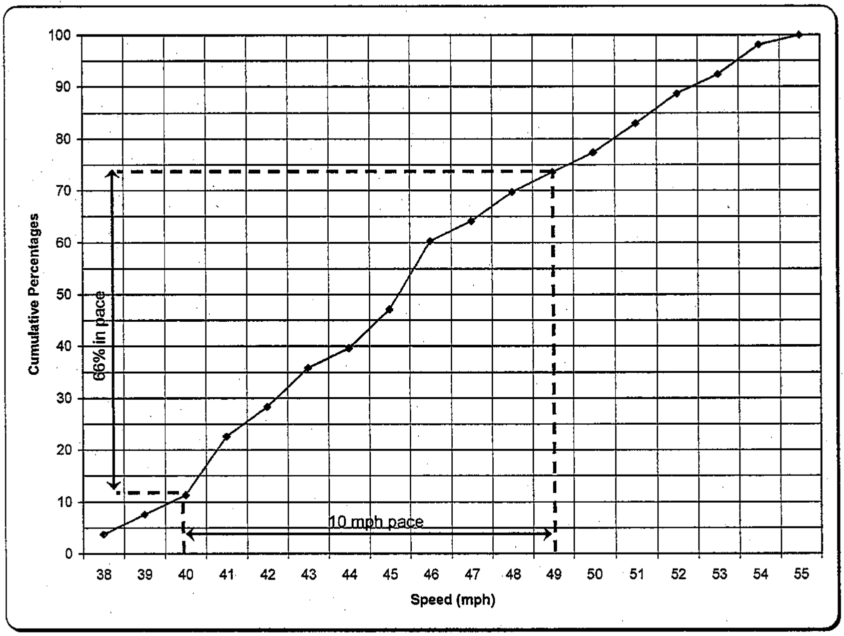
Exhibit 13
San Benancio Road Speed Study
Northbound Travel Direction

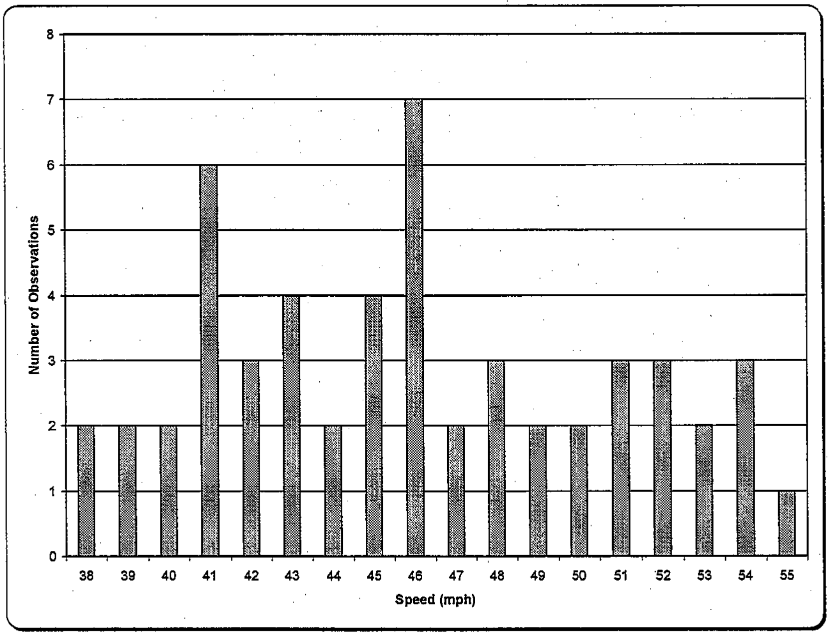
San Benancio Road Speed Study

Location:	**San Benancio Road at Meyer Road**				
Direction:	**SB**	50th percentile speed (median)	46 mph	Average Speed:	46 mph
Day of the Week:	Friday	85th percentile speed (critical):	52 mph	Standard Deviation:	5 mph
Date:	May 5, 2006	10 mph pace speed[2]:	40 to 49	Mode[1]:	46 mph
Time of Day:	3:00 PM - 4:30 PM	Percent in pace speed:	66 %	% Exceeding Speed Limit	23 %
Posted Speed Limit[3]:	50 mph	Range of speeds:	38 to 55		
Vehicles Observed:	53				

Survey Data

Speed (mph)	Number of Obs.	Percent. of Total	Cumul. Percent.
38	2	4	4
39	2	4	8
40	2	4	11
41	6	11	23
42	3	6	28
43	4	8	36
44	2	4	40
45	4	8	47
46	7	13	60
47	2	4	64
48	3	6	70
49	2	4	74
50	2	4	77
51	3	6	83
52	3	6	89
53	2	4	92
54	3	6	98
55	1	2	100





Notes:

[1] If there is more than one mode, the highest speed is presented in the summary.

[2] If there is more than one 10 mph pace speed, the average is presented in the summary.

[3] Refers to speed limit as posted on day and at the location of the speed survey.

Exhibit 14

San Benancio Road Speed Study

Southbound Travel Direction

Sight Distance From Meyer Road (At San Benancio Road) With Measured 85th Percentile Speeds

Direction	Design Speed	Brake Reaction		Braking Distance (feet)		Total Distance (feet)		Measured Sight Distance (feet)	Available Sight Distance Acceptable?	Cause(s) of Sight Distance Constraint
		Time	Distance	2% upgrade	2% upgrade	2% upgrade	2% upgrade			
Looking North	52 mph	2.5	190.7	245.0		435.7		240	No	Vegetation, embankment, and crest vertical curve.
Looking South	51 mph	2.5	187.0		235.7		422.7	250	No	Vegetation, embankment, and crest vertical curve.

Notes:

1. Source: *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, 2001
2. Design speeds of 51 and 52 mph are based upon a field speed survey performed on May 5, 2006. A speed limit of 35 mph is posted on San Benancio Road just south of SR 68. There is no posted speed limit on San Benancio Road in the vicinity of Meyer Road.

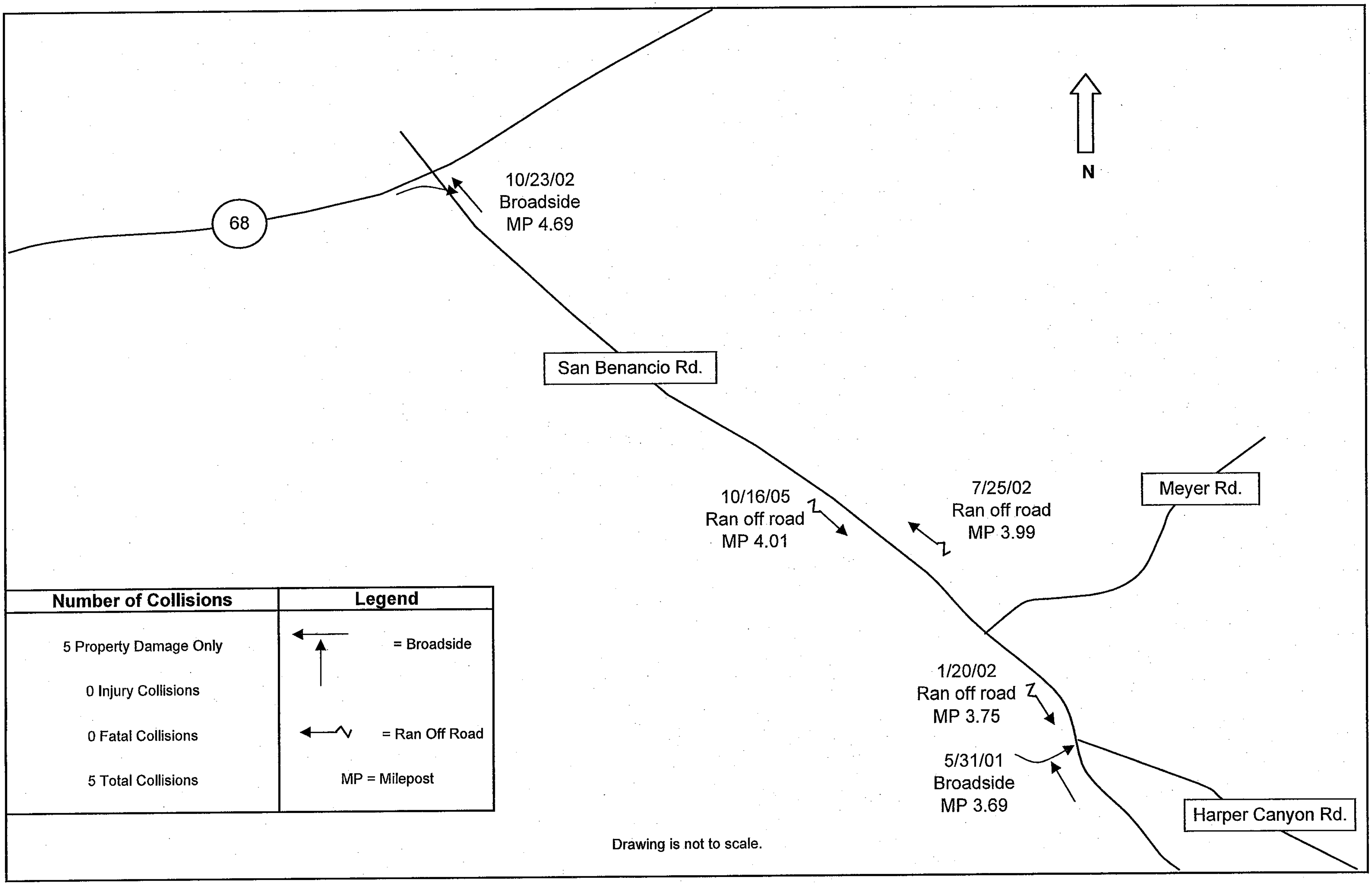
Sight Distance From Meyer Road (At San Benancio Road) With 40 MPH Speeds

Direction	Design Speed	Brake Reaction		Braking Distance (feet)		Total Distance (feet)		Measured Sight Distance (feet)	Available Sight Distance Acceptable?	Cause(s) of Sight Distance Constraint
		Time	Distance	2% upgrade	2% upgrade	2% upgrade	2% upgrade			
Looking North	40 mph	2.5	146.7	145.0		291.7		240	No	Vegetation, embankment, and crest vertical curve.
Looking South	40 mph	2.5	146.7		145.0		291.7	250	No	Vegetation, embankment, and crest vertical curve.

Sight Distance From Meyer Road (At San Benancio Road) With 35 MPH Speeds

Direction	Design Speed	Brake Reaction		Braking Distance (feet)		Total Distance (feet)		Measured Sight Distance (feet)	Available Sight Distance Acceptable?	Cause(s) of Sight Distance Constraint
		Time	Distance	2% upgrade	2% upgrade	2% upgrade	2% upgrade			
Looking North	35 mph	2.5	128.3	111.0		239.3		240	Yes	Vegetation, embankment, and crest vertical curve.
Looking South	35 mph	2.5	128.3		111.0		239.3	250	Yes	Vegetation, embankment, and crest vertical curve.

Exhibit 15
Sight Distance Calculations



Number of Collisions
5 Property Damage Only
0 Injury Collisions
0 Fatal Collisions
5 Total Collisions

Exhibit 16

Collision Diagram for San Benancio Road

APPENDIX A

LEVEL OF SERVICE (LOS) DESCRIPTION
SIGNALIZED INTERSECTIONS

The capacity of an urban street is related primarily to the signal timing and the geometric characteristics of the facility as well as to the composition of traffic on the facility. Geometrics are a fixed characteristic of a facility. Thus, while traffic composition may vary somewhat over time, the capacity of a facility is generally a stable value that can be significantly improved only by initiating geometric improvements. A traffic signal essentially allocates time among conflicting traffic movements that seek to use the same space. The way in which time is allocated significantly affects the operation and the capacity of the intersection and its approaches.

The methodology for signalized intersection is designed to consider individual intersection approaches and individual lane groups within approaches. A lane group consists of one or more lanes on an intersection approach. The outputs from application of the method described in the HCM 2000 are reported on the basis of each lane. For a given lane group at a signalized intersection, three indications are displayed: green, yellow and red. The red indication may include a short period during which all indications are red, referred to as an all-red interval and the yellow indication forms the change and clearance interval between two green phases.

The methodology for analyzing the capacity and level of service must consider a wide variety of prevailing conditions, including the amount and distribution of traffic movements, traffic composition, geometric characteristics, and details of intersection signalization. The methodology addresses the capacity, LOS, and other performance measures for lane groups and the intersection approaches and the LOS for the intersection as a whole.

Capacity is evaluated in terms of the ratio of demand flow rate to capacity (v/c ratio), whereas LOS is evaluated on the basis of control delay per vehicle (in seconds per vehicle). The methodology does not take into account the potential impact of downstream congestion on intersection operation, nor does the methodology detect and adjust for the impacts of turn-pocket overflows on through traffic and intersection operation.

LEVEL OF SERVICE (LOS) CRITERIA FOR SIGNALIZED INTERSECTIONS

(Reference Highway Capacity Manual 2000)

Level of Service	Control Delay (seconds / vehicle)
A	<10
B	>10 - 20
C	>20 - 35
D	>35 - 55
E	>55 - 80
F	>80

Appendix B

Intersection Level of Service Calculation Worksheets

Existing Conditions

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	3200		1444	3200	1568	1770	1449		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1752	3200		1444	3200	1568	1770	1449		3433	1863	1583
Volume (vph)	125	962	8	12	947	386	5	3	9	461	19	180
Peak-hour factor, PHF	0.82	0.82	0.82	0.94	0.94	0.94	0.85	0.85	0.85	0.79	0.79	0.79
Adj. Flow (vph)	152	1173	10	13	1007	411	6	4	11	584	24	228
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	152	1183	0	13	1007	411	6	15	0	584	24	228
Heavy Vehicles (%)	3%	2%	13%	25%	4%	3%	2%	2%	22%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	8.5	35.2		0.5	27.2	43.1	1.3	1.3		15.9	15.9	15.9
Effective Green, g (s)	8.7	37.2		0.7	29.2	46.4	1.5	1.5		17.2	17.2	17.2
Actuated g/C Ratio	0.12	0.51		0.01	0.40	0.64	0.02	0.02		0.24	0.24	0.24
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	210	1640		14	1287	1089	37	30		813	441	375
v/s Ratio Prot	c0.09	c0.37		0.01	0.31	0.09	0.00	c0.01		c0.17	0.01	
v/s Ratio Perm						0.17						0.14
v/c Ratio	0.72	0.72		0.93	0.78	0.38	0.16	0.50		0.72	0.05	0.61
Uniform Delay, d1	30.8	13.7		35.9	18.9	6.2	34.9	35.2		25.5	21.4	24.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.0	1.5		201.0	3.1	0.2	0.8	4.7		2.8	0.0	2.4
Delay (s)	41.8	15.2		236.9	22.0	6.4	35.7	39.9		28.3	21.5	27.0
Level of Service	D	B		F	C	A	D	D		C	C	C
Approach Delay (s)		18.2			19.5			38.7			27.8	
Approach LOS		B			B			D			C	

Intersection Summary

HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1600	1600	1583	1770	1568
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1600	1600	1583	1770	1568
Volume (vph)	220	702	1092	323	86	111
Peak-hour factor, PHF	0.92	0.92	0.93	0.93	0.55	0.55
Adj. Flow (vph)	239	763	1174	347	156	202
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	239	763	1174	347	156	202
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	16.8	110.8	89.8	89.8	19.0	19.0
Effective Green, g (s)	17.0	112.8	91.8	91.8	19.2	19.2
Actuated g/C Ratio	0.12	0.81	0.66	0.66	0.14	0.14
Clearance Time (s)	4.2	6.0	6.0	6.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	4.5	3.5	3.5
Lane Grp Cap (vph)	215	1289	1049	1038	243	215
v/s Ratio Prot	c0.14	0.48	c0.73		0.09	
v/s Ratio Perm				0.22		c0.13
v/c Ratio	1.11	0.59	1.12	0.33	0.64	0.94
Uniform Delay, d1	61.5	5.1	24.1	10.6	57.1	59.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	94.5	1.0	66.6	0.3	5.9	44.5
Delay (s)	156.0	6.0	90.7	11.0	63.1	104.3
Level of Service	F	A	F	B	E	F
Approach Delay (s)		41.8	72.5		86.4	
Approach LOS		D	E		F	

Intersection Summary

HCM Average Control Delay	63.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Existing AM
11/6/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1545	1770	1566			1773	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.73	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1545	1384	1566			1356	1583
Volume (vph)	27	715	46	21	1301	29	51	2	28	19	1	63
Peak-hour factor, PHF	0.87	0.87	0.87	0.95	0.95	0.95	0.88	0.88	0.88	0.90	0.90	0.90
Adj. Flow (vph)	31	822	53	22	1369	31	58	2	32	21	1	70
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	31	822	53	22	1369	31	58	34	0	0	22	70
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	3.1	109.2	109.2	3.7	109.8	109.8	9.8	9.8			9.8	9.8
Effective Green, g (s)	2.8	111.2	111.2	3.4	111.8	111.8	9.9	9.9			9.9	9.9
Actuated g/C Ratio	0.02	0.81	0.81	0.02	0.82	0.82	0.07	0.07			0.07	0.07
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	36	1303	1290	44	1310	1265	100	114			98	115
v/s Ratio Prot	c0.02	0.51		0.01	c0.86			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.04
v/c Ratio	0.86	0.63	0.04	0.50	1.05	0.02	0.58	0.30			0.22	0.61
Uniform Delay, d1	66.7	4.8	2.4	65.7	12.4	2.3	61.3	60.0			59.7	61.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	95.3	1.1	0.0	8.7	37.5	0.0	7.9	1.5			1.2	8.8
Delay (s)	161.9	6.0	2.4	74.4	49.8	2.3	69.2	61.5			60.8	70.2
Level of Service	F	A	A	E	D	A	E	E			E	E
Approach Delay (s)		11.1			49.2			66.4			68.0	
Approach LOS		B			D			E			E	

Intersection Summary

HCM Average Control Delay	36.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	136.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	1770	1600	1770	1547
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	1770	1600	1770	1547
Volume (vph)	636	136	228	1145	206	233
Peak-hour factor, PHF	0.96	0.96	0.98	0.98	0.87	0.87
Adj. Flow (vph)	662	142	233	1168	237	268
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	662	142	233	1168	237	268
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	52.4	52.4	15.9	72.0	18.3	18.3
Effective Green, g (s)	54.4	54.4	15.6	74.0	18.0	18.0
Actuated g/C Ratio	0.54	0.54	0.16	0.74	0.18	0.18
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	870	861	276	1184	319	278
v/s Ratio Prot	0.41		0.13	c0.73	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.76	0.16	0.84	0.99	0.74	0.96
Uniform Delay, d1	17.7	11.4	41.0	12.5	38.8	40.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.1	20.1	22.7	9.0	43.8
Delay (s)	21.5	11.5	61.1	35.2	47.8	84.5
Level of Service	C	B	E	D	D	F
Approach Delay (s)	19.8			39.5	67.3	
Approach LOS	B			D	E	

Intersection Summary

HCM Average Control Delay	38.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	1752	1600	1752	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	1752	1600	1752	1583
Volume (vph)	824	52	86	1219	154	196
Peak-hour factor, PHF	0.85	0.85	0.98	0.98	0.90	0.90
Adj. Flow (vph)	969	61	88	1244	171	218
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	969	61	88	1244	171	218
Heavy Vehicles (%)	2%	2%	3%	2%	3%	2%
Turn Type		pm+ov	Prot			Perm
Protected Phases	2	3	1	6	3	
Permitted Phases		2				3
Actuated Green, G (s)	87.2	107.3	9.3	100.2	20.1	20.1
Effective Green, g (s)	89.2	109.0	9.0	102.2	19.8	19.8
Actuated g/C Ratio	0.69	0.84	0.07	0.79	0.15	0.15
Clearance Time (s)	6.0	3.7	3.7	6.0	3.7	3.7
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	1098	1376	121	1258	267	241
v/s Ratio Prot	0.61	0.01	0.05	c0.78	0.10	
v/s Ratio Perm		0.03				c0.14
v/c Ratio	0.88	0.04	0.73	0.99	0.64	0.90
Uniform Delay, d1	16.2	1.8	59.3	13.4	51.8	54.2
Progression Factor	1.00	1.00	0.98	1.48	1.00	1.00
Incremental Delay, d2	10.3	0.0	5.1	10.4	4.6	33.4
Delay (s)	26.5	1.8	63.4	30.2	56.3	87.6
Level of Service	C	A	E	C	E	F
Approach Delay (s)	25.1			32.4	73.9	
Approach LOS	C			C	E	

Intersection Summary

HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Existing AM
11/6/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0			4.0
Lane Util. Factor		1.00	1.00	1.00	1.00			1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.97			1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00			1.00
Frt		1.00	0.85	1.00	1.00			1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (prot)		1600	1583	1687	1600			1770	1542			1583
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (perm)		1600	1583	1687	1600			1770	1542			1583
Volume (vph)	0	964	34	60	1199	1	105	0	127	0	0	1
Peak-hour factor, PHF	0.83	0.83	0.83	0.96	0.96	0.96	0.77	0.77	0.77	0.25	0.25	0.25
Adj. Flow (vph)	0	1161	41	62	1249	1	136	0	165	0	0	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1161	41	62	1250	0	0	136	165	0	0	4
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)		83.3	83.3	12.9	99.9			11.3	11.3			5.4
Effective Green, g (s)		85.3	85.3	12.6	101.9			11.0	11.0			5.1
Actuated g/C Ratio		0.66	0.66	0.10	0.78			0.08	0.08			0.04
Clearance Time (s)		6.0	6.0	3.7	6.0			3.7	3.7			3.7
Vehicle Extension (s)		3.0	3.0	2.5	3.0			2.5	2.5			2.5
Lane Grp Cap (vph)		1050	1039	164	1254			150	130			62
v/s Ratio Prot		c0.73		0.04	c0.78			0.08				
v/s Ratio Perm			0.03						c0.11			c0.00
v/c Ratio		1.11	0.04	0.38	1.00			0.91	1.27			0.06
Uniform Delay, d1		22.4	7.9	55.0	13.9			59.0	59.5			60.2
Progression Factor		1.32	1.27	1.00	1.00			1.00	1.00			1.00
Incremental Delay, d2		54.7	0.0	1.1	24.7			46.5	168.2			0.3
Delay (s)		84.3	10.1	56.1	38.6			105.5	227.7			60.5
Level of Service		F	B	E	D			F	F			E
Approach Delay (s)		81.7			39.4			172.5			60.5	
Approach LOS		F			D			F			E	

Intersection Summary

HCM Average Control Delay	71.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Highway 68 & Hwy 218

Existing PM
11/6/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1769	3200	1559	1656	1603		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1769	3200	1559	1656	1603		3433	1863	1583
Volume (vph)	175	774	2	10	1140	576	11	21	31	262	8	135
Peak-hour factor, PHF	0.94	0.94	0.94	0.92	0.92	0.92	0.66	0.66	0.66	0.83	0.83	0.83
Adj. Flow (vph)	186	823	2	11	1239	626	17	32	47	316	10	163
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	186	825	0	11	1239	626	17	79	0	316	10	163
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	50%	2%	2%	2%	9%	14%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	9.3	44.5		0.6	35.8	49.0	4.8	4.8		13.2	13.2	13.2
Effective Green, g (s)	9.5	46.5		0.8	37.8	52.3	5.0	5.0		14.5	14.5	14.5
Actuated g/C Ratio	0.11	0.56		0.01	0.46	0.63	0.06	0.06		0.18	0.18	0.18
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	203	1797		17	1461	1060	100	97		601	326	277
v/s Ratio Prot	c0.11	0.26		0.01	c0.39	c0.10	0.01	c0.05		0.09	0.01	
v/s Ratio Perm						0.30						0.10
v/c Ratio	0.92	0.46		0.65	0.85	0.59	0.17	0.81		0.53	0.03	0.59
Uniform Delay, d1	36.3	10.7		40.9	20.0	9.0	36.9	38.4		31.0	28.3	31.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	40.2	0.1		62.0	4.7	0.7	0.3	37.1		0.6	0.0	2.6
Delay (s)	76.4	10.9		102.9	24.7	9.7	37.2	75.5		31.7	28.3	34.0
Level of Service	E	B		F	C	A	D	E		C	C	C
Approach Delay (s)		22.9			20.1			68.8			32.4	
Approach LOS		C			C			E			C	

Intersection Summary

HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1600	1600	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1600	1600	1583	1770	1583
Volume (vph)	79	840	1122	83	293	149
Peak-hour factor, PHF	0.88	0.88	0.86	0.86	0.90	0.90
Adj. Flow (vph)	90	955	1305	97	326	166
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	90	955	1305	97	326	166
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	5.8	98.0	88.0	88.0	21.8	21.8
Effective Green, g (s)	6.0	100.0	90.0	90.0	22.0	22.0
Actuated g/C Ratio	0.05	0.77	0.69	0.69	0.17	0.17
Clearance Time (s)	4.2	6.0	6.0	6.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	4.5	3.5	3.5
Lane Grp Cap (vph)	82	1231	1108	1096	300	268
v/s Ratio Prot	c0.05	0.60	c0.82		c0.18	
v/s Ratio Perm				0.06		0.10
v/c Ratio	1.10	0.78	1.18	0.09	1.09	0.62
Uniform Delay, d1	62.0	8.6	20.0	6.6	54.0	50.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	128.4	3.5	89.6	0.1	77.1	4.4
Delay (s)	190.4	12.1	109.6	6.6	131.1	54.5
Level of Service	F	B	F	A	F	D
Approach Delay (s)		27.4	102.5		105.3	
Approach LOS		C	F		F	

Intersection Summary

HCM Average Control Delay	76.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1625			1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.69	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1280	1625			1334	1583
Volume (vph)	43	1026	64	13	1071	18	70	5	30	34	4	64
Peak-hour factor, PHF	0.93	0.93	0.93	0.91	0.91	0.91	0.75	0.75	0.75	0.61	0.61	0.61
Adj. Flow (vph)	46	1103	69	14	1177	20	93	7	40	56	7	105
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	46	1103	69	14	1177	20	93	47	0	0	63	105
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	5.0	112.1	112.1	1.5	108.6	108.6	15.2	15.2			15.2	15.2
Effective Green, g (s)	4.7	114.1	114.1	1.2	110.6	110.6	15.3	15.3			15.3	15.3
Actuated g/C Ratio	0.03	0.80	0.80	0.01	0.78	0.78	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	58	1280	1267	15	1241	1228	137	174			143	170
v/s Ratio Prot	c0.03	c0.69		0.01	c0.74			0.03				
v/s Ratio Perm			0.04			0.01	c0.07				0.05	0.07
v/c Ratio	0.79	0.86	0.05	0.93	0.95	0.02	0.68	0.27			0.44	0.62
Uniform Delay, d1	68.5	9.2	3.0	70.7	13.6	3.6	61.3	58.5			59.6	60.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	51.1	6.4	0.0	197.1	14.9	0.0	12.6	0.8			2.2	6.5
Delay (s)	119.6	15.6	3.0	267.7	28.5	3.6	73.9	59.4			61.8	67.4
Level of Service	F	B	A	F	C	A	E	E			E	E
Approach Delay (s)		18.8			30.8			69.0			65.3	
Approach LOS		B			C			E			E	

Intersection Summary

HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	142.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	1770	1600	1770	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	1770	1600	1770	1583
Volume (vph)	950	140	189	885	217	359
Peak-hour factor, PHF	0.97	0.97	0.89	0.89	0.74	0.74
Adj. Flow (vph)	979	144	212	994	293	485
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	979	144	212	994	293	485
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	73.0	73.0	15.3	92.0	38.3	38.3
Effective Green, g (s)	75.0	75.0	15.0	94.0	38.0	38.0
Actuated g/C Ratio	0.54	0.54	0.11	0.67	0.27	0.27
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	857	848	190	1074	480	430
v/s Ratio Prot	c0.61		c0.12	0.62	0.17	
v/s Ratio Perm		0.09				c0.31
v/c Ratio	1.14	0.17	1.12	0.93	0.61	1.13
Uniform Delay, d1	32.5	16.6	62.5	20.0	44.5	51.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	77.9	0.1	99.8	13.1	2.3	83.1
Delay (s)	110.4	16.7	162.3	33.0	46.8	134.1
Level of Service	F	B	F	C	D	F
Approach Delay (s)	98.4			55.7	101.2	
Approach LOS	F			E	F	

Intersection Summary

HCM Average Control Delay	82.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Existing PM
11/6/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	1770	1600	1770	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	1770	1600	1770	1568
Volume (vph)	1193	116	153	996	78	158
Peak-hour factor, PHF	0.94	0.94	0.88	0.88	0.79	0.79
Adj. Flow (vph)	1269	123	174	1132	99	200
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1269	123	174	1132	99	200
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type		pm+ov	Prot			Perm
Protected Phases	2	3	1	6	3	
Permitted Phases		2				3
Actuated Green, G (s)	84.3	103.5	13.1	101.1	19.2	19.2
Effective Green, g (s)	86.3	105.2	12.8	103.1	18.9	18.9
Actuated g/C Ratio	0.66	0.81	0.10	0.79	0.15	0.15
Clearance Time (s)	6.0	3.7	3.7	6.0	3.7	3.7
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	1062	1330	174	1269	257	228
v/s Ratio Prot	c0.79	0.01	c0.10	0.71	0.06	
v/s Ratio Perm		0.06				c0.13
v/c Ratio	1.19	0.09	1.00	0.89	0.39	0.88
Uniform Delay, d1	21.8	2.6	58.6	9.5	50.3	54.4
Progression Factor	1.00	1.00	1.07	0.58	1.00	1.00
Incremental Delay, d2	97.1	0.0	46.3	4.9	0.7	29.1
Delay (s)	118.9	2.6	109.3	10.4	51.0	83.5
Level of Service	F	A	F	B	D	F
Approach Delay (s)	108.7			23.6	72.7	
Approach LOS	F			C	E	

Intersection Summary			
HCM Average Control Delay	68.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0			4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (prot)	1770	1600	1583	1736	1600			1777	1583			1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (perm)	1770	1600	1583	1736	1600			1777	1583			1583
Volume (vph)	2	1257	106	124	1079	1	68	2	88	0	0	2
Peak-hour factor, PHF	0.91	0.91	0.91	0.93	0.93	0.93	0.76	0.76	0.76	0.50	0.50	0.50
Adj. Flow (vph)	2	1381	116	133	1160	1	89	3	116	0	0	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1381	116	133	1161	0	0	92	116	0	0	4
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	78.6	78.6	21.6	98.9			7.3	7.3			5.4
Effective Green, g (s)	1.0	80.6	80.6	21.3	100.9			7.0	7.0			5.1
Actuated g/C Ratio	0.01	0.62	0.62	0.16	0.78			0.05	0.05			0.04
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7			3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5			2.5
Lane Grp Cap (vph)	14	992	981	284	1242			96	85			62
v/s Ratio Prot	0.00	c0.86		c0.08	c0.73			0.05				
v/s Ratio Perm			0.07						c0.07			c0.00
v/c Ratio	0.14	1.39	0.12	0.47	0.93			0.96	1.36			0.06
Uniform Delay, d1	64.1	24.7	10.1	49.2	11.9			61.4	61.5			60.2
Progression Factor	1.22	0.65	0.48	1.00	1.00			1.00	1.00			1.00
Incremental Delay, d2	0.4	177.0	0.0	0.9	14.0			77.4	222.6			0.3
Delay (s)	78.8	193.0	4.9	50.1	25.9			138.7	284.1			60.5
Level of Service	E	F	A	D	C			F	F			E
Approach Delay (s)		178.3			28.4			219.8			60.5	
Approach LOS		F			C			F			E	

Intersection Summary

HCM Average Control Delay	116.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Highway 68 & York Rd.

Existing AM - Mitigated
11/9/2006

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1600	3200	1583	1770	1568
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1600	3200	1583	1770	1568
Volume (vph)	220	702	1092	323	86	111
Peak-hour factor, PHF	0.92	0.92	0.93	0.93	0.55	0.55
Adj. Flow (vph)	239	763	1174	347	156	202
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	239	763	1174	347	156	202
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	15.4	54.6	35.0	35.0	14.8	14.8
Effective Green, g (s)	15.6	56.6	37.0	37.0	15.0	15.0
Actuated g/C Ratio	0.20	0.71	0.46	0.46	0.19	0.19
Clearance Time (s)	4.2	6.0	6.0	6.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	4.5	3.5	3.5
Lane Grp Cap (vph)	347	1138	1487	736	334	295
v/s Ratio Prot	0.14	c0.48	c0.37		0.09	
v/s Ratio Perm				0.22		c0.13
v/c Ratio	0.69	0.67	0.79	0.47	0.47	0.68
Uniform Delay, d1	29.7	6.4	18.0	14.6	28.7	30.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.5	1.9	3.2	0.8	1.2	6.7
Delay (s)	36.3	8.2	21.2	15.4	30.0	36.8
Level of Service	D	A	C	B	C	D
Approach Delay (s)		14.9	19.9		33.8	
Approach LOS		B	B		C	

Intersection Summary

HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Existing AM - Mitigated
11/9/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1548	1770	1580			1776	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.71	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1548	1384	1580			1323	1583
Volume (vph)	27	715	46	21	1301	29	51	2	28	19	1	63
Peak-hour factor, PHF	0.87	0.87	0.87	0.95	0.95	0.95	0.88	0.88	0.88	0.90	0.90	0.90
Adj. Flow (vph)	31	822	53	22	1369	31	58	2	32	21	1	70
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	31	822	53	22	1369	31	58	34	0	0	22	70
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	1.6	57.4	57.4	1.6	57.4	57.4	6.6	6.6			6.6	6.6
Effective Green, g (s)	1.3	59.4	59.4	1.3	59.4	59.4	6.7	6.7			6.7	6.7
Actuated g/C Ratio	0.02	0.75	0.75	0.02	0.75	0.75	0.08	0.08			0.08	0.08
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	29	1197	1184	29	2394	1158	117	133			112	134
v/s Ratio Prot	c0.02	c0.51		0.01	0.43			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.04
v/c Ratio	1.07	0.69	0.04	0.76	0.57	0.03	0.50	0.26			0.20	0.52
Uniform Delay, d1	39.1	5.2	2.6	38.9	4.4	2.6	34.7	34.0			33.8	34.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	189.0	1.8	0.0	71.7	0.4	0.0	3.3	1.0			0.9	3.6
Delay (s)	228.1	7.0	2.6	110.6	4.8	2.6	38.0	35.0			34.7	38.5
Level of Service	F	A	A	F	A	A	D	D			C	D
Approach Delay (s)		14.3			6.4			36.9			37.6	
Approach LOS		B			A			D			D	

Intersection Summary

HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Existing AM - Mitigated
11/9/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	1770	3200	1770	1563
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	1770	3200	1770	1563
Volume (vph)	636	136	228	1145	206	233
Peak-hour factor, PHF	0.96	0.96	0.98	0.98	0.87	0.87
Adj. Flow (vph)	662	142	233	1168	237	268
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	662	142	233	1168	237	268
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	19.9	19.9	10.7	34.3	15.7	15.7
Effective Green, g (s)	21.9	21.9	10.4	36.3	15.4	15.4
Actuated g/C Ratio	0.37	0.37	0.17	0.61	0.26	0.26
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1174	581	308	1946	457	403
v/s Ratio Prot	0.21		c0.13	c0.36	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.56	0.24	0.76	0.60	0.52	0.67
Uniform Delay, d1	15.1	13.1	23.4	7.2	19.0	19.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.2	9.7	0.4	1.0	4.1
Delay (s)	15.6	13.3	33.1	7.7	20.0	23.9
Level of Service	B	B	C	A	B	C
Approach Delay (s)	15.2			11.9	22.1	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	59.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	1752	3200	1752	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	1752	3200	1752	1583
Volume (vph)	824	52	86	1219	154	196
Peak-hour factor, PHF	0.85	0.85	0.98	0.98	0.90	0.90
Adj. Flow (vph)	969	61	88	1244	171	218
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	969	61	88	1244	171	218
Heavy Vehicles (%)	2%	2%	3%	2%	3%	2%
Turn Type		pm+ov	Prot			Perm
Protected Phases	2	3	1	6	3	
Permitted Phases		2				3
Actuated Green, G (s)	87.2	107.3	9.3	100.2	20.1	20.1
Effective Green, g (s)	89.2	109.0	9.0	102.2	19.8	19.8
Actuated g/C Ratio	0.69	0.84	0.07	0.79	0.15	0.15
Clearance Time (s)	6.0	3.7	3.7	6.0	3.7	3.7
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	2196	1376	121	2516	267	241
v/s Ratio Prot	0.30	0.01	c0.05	c0.39	0.10	
v/s Ratio Perm		0.03				c0.14
v/c Ratio	0.44	0.04	0.73	0.49	0.64	0.90
Uniform Delay, d1	9.2	1.8	59.3	4.9	51.8	54.2
Progression Factor	1.00	1.00	0.90	1.16	1.00	1.00
Incremental Delay, d2	0.6	0.0	16.0	0.6	4.6	33.4
Delay (s)	9.8	1.8	69.5	6.2	56.3	87.6
Level of Service	A	A	E	A	E	F
Approach Delay (s)	9.4			10.4	73.9	
Approach LOS	A			B	E	

Intersection Summary

HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0			4.0
Lane Util. Factor		0.95	1.00	1.00	0.95			1.00	1.00			1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	0.98			1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00			1.00	1.00			1.00
Frt		1.00	0.85	1.00	1.00			1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (prot)		3200	1583	1687	3200			1770	1546			1583
Flt Permitted		1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (perm)		3200	1583	1687	3200			1770	1546			1583
Volume (vph)	0	964	34	60	1199	1	105	0	127	0	0	1
Peak-hour factor, PHF	0.83	0.83	0.83	0.96	0.96	0.96	0.77	0.77	0.77	0.25	0.25	0.25
Adj. Flow (vph)	0	1161	41	62	1249	1	136	0	165	0	0	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1161	41	62	1250	0	0	136	165	0	0	4
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)		81.0	81.0	8.6	93.3			17.9	17.9			5.4
Effective Green, g (s)		83.0	83.0	8.3	95.3			17.6	17.6			5.1
Actuated g/C Ratio		0.64	0.64	0.06	0.73			0.14	0.14			0.04
Clearance Time (s)		6.0	6.0	3.7	6.0			3.7	3.7			3.7
Vehicle Extension (s)		3.0	3.0	2.5	3.0			2.5	2.5			2.5
Lane Grp Cap (vph)		2043	1011	108	2346			240	209			62
v/s Ratio Prot		c0.36		0.04	c0.39			0.08				
v/s Ratio Perm			0.03						c0.11			c0.00
v/c Ratio		0.57	0.04	0.57	0.53			0.57	0.79			0.06
Uniform Delay, d1		13.3	8.7	59.1	7.6			52.6	54.4			60.2
Progression Factor		1.69	1.61	1.00	1.00			1.00	1.00			1.00
Incremental Delay, d2		1.0	0.1	5.9	0.9			2.5	17.2			0.3
Delay (s)		23.5	14.1	65.1	8.5			55.1	71.6			60.5
Level of Service		C	B	E	A			E	E			E
Approach Delay (s)		23.2			11.1			64.1			60.5	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	22.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Highway 68 & York Rd.

Existing PM - Mitigated
11/9/2006

	↗	→	←	↖	↘	↙
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1600	3200	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1600	3200	1583	1770	1583
Volume (vph)	79	840	1122	83	293	149
Peak-hour factor, PHF	0.88	0.88	0.86	0.86	0.90	0.90
Adj. Flow (vph)	90	955	1305	97	326	166
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	90	955	1305	97	326	166
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	5.1	50.5	41.2	41.2	17.8	17.8
Effective Green, g (s)	5.3	52.5	43.2	43.2	18.0	18.0
Actuated g/C Ratio	0.07	0.67	0.55	0.55	0.23	0.23
Clearance Time (s)	4.2	6.0	6.0	6.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	4.5	3.5	3.5
Lane Grp Cap (vph)	120	1070	1761	871	406	363
v/s Ratio Prot	0.05	c0.60	0.41		c0.18	
v/s Ratio Perm				0.06		0.10
v/c Ratio	0.75	0.89	0.74	0.11	0.80	0.46
Uniform Delay, d1	35.9	10.7	13.4	8.5	28.6	26.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.3	10.0	1.9	0.1	11.2	1.1
Delay (s)	61.3	20.7	15.3	8.6	39.8	27.1
Level of Service	E	C	B	A	D	C
Approach Delay (s)		24.2	14.9		35.5	
Approach LOS		C	B		D	

Intersection Summary

HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	78.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Existing PM - Mitigated
11/9/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1625			1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1334	1625			1334	1583
Volume (vph)	43	1026	64	13	1071	18	70	5	30	34	4	64
Peak-hour factor, PHF	0.93	0.93	0.93	0.91	0.91	0.91	0.75	0.75	0.75	0.61	0.61	0.61
Adj. Flow (vph)	46	1103	69	14	1177	20	93	7	40	56	7	105
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	46	1103	69	14	1177	20	93	47	0	0	63	105
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	5.2	89.4	89.4	1.5	85.7	85.7	13.3	13.3			13.3	13.3
Effective Green, g (s)	4.9	91.4	91.4	1.2	87.7	87.7	13.4	13.4			13.4	13.4
Actuated g/C Ratio	0.04	0.77	0.77	0.01	0.74	0.74	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	74	1239	1226	18	2378	1177	151	185			151	180
v/s Ratio Prot	c0.03	c0.69		0.01	0.37			0.03				
v/s Ratio Perm			0.04			0.01	c0.07				0.05	0.07
v/c Ratio	0.62	0.89	0.06	0.78	0.49	0.02	0.62	0.25			0.42	0.58
Uniform Delay, d1	55.6	9.7	3.1	58.3	6.2	3.9	49.8	47.7			48.7	49.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	15.1	8.5	0.0	107.6	0.2	0.0	7.3	0.7			1.9	4.8
Delay (s)	70.8	18.2	3.2	165.8	6.4	3.9	57.1	48.5			50.5	54.4
Level of Service	E	B	A	F	A	A	E	D			D	D
Approach Delay (s)		19.3			8.2			54.2			52.9	
Approach LOS		B			A			D			D	

Intersection Summary

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	118.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	1770	3200	1770	1583
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	1770	3200	1770	1583
Volume (vph)	950	140	189	885	217	359
Peak-hour factor, PHF	0.97	0.97	0.89	0.89	0.74	0.74
Adj. Flow (vph)	979	144	212	994	293	485
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	979	144	212	994	293	485
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	24.0	24.0	10.2	37.9	23.8	23.8
Effective Green, g (s)	26.0	26.0	9.9	39.9	23.5	23.5
Actuated g/C Ratio	0.36	0.36	0.14	0.56	0.33	0.33
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1165	576	245	1788	583	521
v/s Ratio Prot	c0.31		c0.12	0.31	0.17	
v/s Ratio Perm		0.09				c0.31
v/c Ratio	0.84	0.25	0.87	0.56	0.50	0.93
Uniform Delay, d1	20.8	15.9	30.1	10.1	19.3	23.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	0.2	25.5	0.3	0.7	23.5
Delay (s)	26.3	16.0	55.6	10.4	19.9	46.7
Level of Service	C	B	E	B	B	D
Approach Delay (s)	25.0			18.3	36.6	
Approach LOS	C			B	D	

Intersection Summary

HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	71.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Existing PM - Mitigated
11/13/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	1770	3200	1770	1568
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	1770	3200	1770	1568
Volume (vph)	1193	116	153	996	78	158
Peak-hour factor, PHF	0.94	0.94	0.88	0.88	0.79	0.79
Adj. Flow (vph)	1269	123	174	1132	99	200
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1269	123	174	1132	99	200
Heavy Vehicles (%)	2%	2%	2%	2%	2%	3%
Turn Type		pm+ov	Prot			Perm
Protected Phases	2	3	1	6	3	
Permitted Phases		2				3
Actuated Green, G (s)	80.1	99.4	17.2	101.0	19.3	19.3
Effective Green, g (s)	82.1	101.1	16.9	103.0	19.0	19.0
Actuated g/C Ratio	0.63	0.78	0.13	0.79	0.15	0.15
Clearance Time (s)	6.0	3.7	3.7	6.0	3.7	3.7
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	2021	1280	230	2535	259	229
v/s Ratio Prot	c0.40	0.01	c0.10	0.35	0.06	
v/s Ratio Perm		0.06				c0.13
v/c Ratio	0.63	0.10	0.76	0.45	0.38	0.87
Uniform Delay, d1	14.6	3.5	54.6	4.3	50.2	54.3
Progression Factor	1.00	1.00	1.30	0.73	1.00	1.00
Incremental Delay, d2	1.5	0.0	11.5	0.5	0.7	28.4
Delay (s)	16.1	3.5	82.2	3.7	50.9	82.7
Level of Service	B	A	F	A	D	F
Approach Delay (s)	15.0			14.1	72.2	
Approach LOS	B			B	E	

Intersection Summary

HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0			4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00			1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85			0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (prot)	1770	3200	1583	1736	3200			1777	1583			1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00			1.00
Satd. Flow (perm)	1770	3200	1583	1736	3200			1777	1583			1583
Volume (vph)	2	1257	106	124	1079	1	68	2	88	0	0	2
Peak-hour factor, PHF	0.91	0.91	0.91	0.93	0.93	0.93	0.76	0.76	0.76	0.50	0.50	0.50
Adj. Flow (vph)	2	1381	116	133	1160	1	89	3	116	0	0	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1381	116	133	1161	0	0	92	116	0	0	4
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	79.7	79.7	15.0	93.4			12.8	12.8			5.4
Effective Green, g (s)	1.0	81.7	81.7	14.7	95.4			12.5	12.5			5.1
Actuated g/C Ratio	0.01	0.63	0.63	0.11	0.73			0.10	0.10			0.04
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7			3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5			2.5
Lane Grp Cap (vph)	14	2011	995	196	2348			171	152			62
v/s Ratio Prot	0.00	c0.43		c0.08	0.36			0.05				
v/s Ratio Perm			0.07						c0.07			c0.00
v/c Ratio	0.14	0.69	0.12	0.68	0.49			0.54	0.76			0.06
Uniform Delay, d1	64.1	15.8	9.7	55.4	7.2			56.0	57.3			60.2
Progression Factor	1.32	0.74	0.48	1.00	1.00			1.00	1.00			1.00
Incremental Delay, d2	3.5	1.5	0.2	8.2	0.7			2.5	19.3			0.3
Delay (s)	88.1	13.2	4.8	63.6	8.0			58.5	76.6			60.5
Level of Service	F	B	A	E	A			E	E			E
Approach Delay (s)		12.6			13.7			68.6			60.5	
Approach LOS		B			B			E			E	

Intersection Summary

HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Appendix C

TRIP GENERATION FOR APPROVED PROJECTS

PROJECT	SIZE	DAILY TRIP RATE	DAILY TRIPS	AM PEAK HOUR				PM PEAK HOUR			
				PEAK HOUR VOL.	(% OF DAILY)	IN	OUT	PEAK HOUR VOL.	(% OF DAILY)	IN	OUT
City of Marina:											
1. Marina Heights Subdivision[2]											
Townhomes	102 Units	5.86	598	45	(8%)	8	37	55	(9%)	37	18
Single-Family Detached Housing	948 Units	9.57	9,072	711	(8%)	177	534	958	(11%)	613	345
2. CSUMB North Campus Housing[3]	492 Units	-	2,627	204	(8%)	46	158	261	(10%)	169	92
3. CSUMB Students (2010)[3]	1,994 Students	-	4,354	384	(9%)	307	77	384	(9%)	116	268
4. Reservation Road Condominiums	14 Units	5.86	82	6	(7%)	1	5	7	(9%)	5	2
5. Paddon Place Subdivision	15 Units	9.57	144	11	(8%)	3	8	15	(10%)	10	5
6. 249 Carmel	10 Units	9.57	96	8	(8%)	2	6	10	(10%)	7	3
7. Crescent/Carmel Subdivision	14 Units	9.57	134	11	(8%)	3	8	14	(10%)	9	5
8. Hotel - 323 Reservation Road[4]	39 Rooms	8.92	348	26	(7%)	15	11	27	(8%)	13	14
9. University Villages[5]											
Phase 1	- -	-	48,241	1,958	(4%)	1,056	902	4,282	(9%)	2,195	2,087
10. MBEST[6]	- -	-	5,631	385	(7%)	301	84	604	(11%)	201	403
11. Marina Landing Redevelopment[7]	300,000 S.F.	-	11,886	357	(3%)	218	139	1,044	(9%)	530	514
12. 3200 Seaside											
Single-Family Detached Housing	17 Units	9.57	163	13	(8%)	3	10	17	(10%)	11	6
Carriage Units	12 Units	6.72	81	6	(7%)	1	5	7	(9%)	5	2
13. 3110 Seacrest	7 Units	9.57	67	5	(7%)	1	4	7	(10%)	5	2
14. MPC Satellite Campus	700 Students	1.20	840	84	(10%)	69	15	84	(10%)	54	30
15. FORA Business Park[8]	43,381 S.F.	-	326	46	(14%)	40	6	45	(14%)	7	38
16. MST Transit Station[9]	- -	-	2,793	56	(2%)	13	43	104	(4%)	59	45
17. Cypress Knolls[10]	- -	-	5,088	299	(6%)	128	171	396	(8%)	207	189
City of Seaside:											
18. Seaside Resort[11]	- -	-	5,672	267	(5%)	145	122	362	(6%)	180	182
19. City Center (Fremont/Broadway)											
Sit-Down Restaurants	24,674 S.F.	108.55	2,678	25	(1%)	13	12	227	(8%)	145	82
Bank	4,000 S.F.	246.49	986	49	(5%)	27	22	183	(19%)	92	91
Commercial/Retail Space[12]	15,326 S.F.	44.32	679	20	(3%)	12	8	42	(6%)	18	24
20. MPC Satellite Campus	400 Students	1.20	480	48	(10%)	39	9	48	(10%)	31	17
21. The Pointe											
Condominiums	6 Units	5.86	35	3	(9%)	1	2	3	(9%)	2	1
Commercial/Retail[12]	3,000 S.F.	44.32	133	4	(3%)	2	2	8	(6%)	4	4
22. Lexus Service Center[13]	5,123 S.F.	20.00	102	15	(15%)	10	5	17	(17%)	9	8
23. Georis Building (commercial)[12]	3,978 S.F.	44.32	176	5	(3%)	3	2	11	(6%)	5	6
24. Dentistry for Children	4,835 S.F.	36.13	175	12	(7%)	9	3	18	(10%)	5	13
25. First National Bank	4,939 S.F.	156.48	773	20	(3%)	10	10	164	(21%)	82	82
26. Ord Military Housing											
RCI Development Area	- -	-	7,200	536	(7%)	172	364	691	(10%)	408	283
City of Sand City:											
27. Costco Expansion	16,795 S.F.	56.02	941	14	(1%)	10	4	85	(9%)	43	42
28. Design Center[14]											
Apartments	30 Units	6.72	202	15	(7%)	3	12	19	(9%)	12	7
Commercial/Retail[12]	20,000 S.F.	44.32	886	27	(3%)	16	11	54	(6%)	24	30
Office	20,000 S.F.	11.01	220	31	(14%)	27	4	30	(14%)	5	25
City of Monterey:											
29. Ryan Ranch Business Park (Buildout)											
CHOMP Medical Offices (remainder)[18]	138,380 S.F.	-	5,443	343	(6%)	271	72	426	(8%)	115	311
6 & 8 Lower Ragsdale Dr. (Office)	63,985 S.F.	11.01	704	99	(14%)	87	12	95	(13%)	16	79
30. Del Monte Beach Tract 2 Resubdivision	17 Homes	9.57	163	13	(8%)	3	10	17	(10%)	11	6
31. St. John the Baptist Greek Orth. Church	8,300 S.F.	9.11	76	6	(8%)	3	3	5	(7%)	3	2
32. Calvalry Chappel Expansion	25,932 S.F.	9.11	236	19	(8%)	10	9	17	(7%)	9	8
City of Del Rey Oaks:											
33. Safeway Supermarket (former Ralph's)	54,000 S.F.	102.24	5,521	176	(3%)	107	69	564	(10%)	288	276
City of Salinas:											
34. Tynan Village Mixed Use Development[15]	- -	-	2,758	173	(6%)	60	113	233	(8%)	132	101
35. Hartnell College Expansion[16]	3,000 Students	1.54	4,620	420	(9%)	380	40	510	(11%)	345	165
36. Monte Bella Subdivision	550 Units	9.57	5,264	413	(8%)	103	310	556	(11%)	373	183
Unincorporated Monterey County:											
37. CSUMB East Campus Housing[17]	125 Homes	9.57	1,196	94	(8%)	24	70	126	(11%)	81	45
38. East Garrison[18]	- -	-	12,391	975	(8%)	247	728	1,315	(11%)	793	522
39. Monterra Ranch	151 Homes	9.57	1,445	113	(8%)	28	85	153	(11%)	103	50
40. Pasadera	43 Homes	9.57	412	32	(8%)	8	24	43	(10%)	29	14
41. Harper 14 Lots of Record	14 Homes	9.57	134	11	(8%)	3	8	14	(10%)	9	5
42. Oaks Subdivision	11 Homes	9.57	105	8	(8%)	2	6	11	(10%)	7	4
43. Laguna Seca Business Park											
York Road Office Building[19]	20,000 S.F.	11.01	220	31	(14%)	27	4	30	(14%)	5	25
Jessen Office Building[20]	16,388 S.F.	-	345	31	(9%)	26	5	39	(11%)	10	29
44. Tanimura Family Residential	73 Lots	9.57	699	55	(8%)	14	41	74	(11%)	48	26
TOTAL APPROVED PROJECTS			155,641	8,718	(6%)	4,294	4,424	14,511	(9%)	7,694	6,817

Notes:

1. Traffic volumes are based on trip generation rates quoted by the Institute of Transportation Engineers, *Trip Generation*, 6th Edition, 1997, and 7th Edition, 2003, unless otherwise noted.
2. Trip generation from *Marina Heights Environmental Impact Report Traffic Study*, Higgins Associates, April 2003.
3. Trip generation from *California State University at Monterey Bay (CSUMB) 2004 Master Plan Update Traffic Impact Study Report*, Higgins Associates, July 26, 2004.
4. Trip generation for hotel land use assumes 100% occupancy.
5. Trip generation from *Marina University Villages Mixed Use Development Traffic Impact Study Report*, Higgins Associates, December 17, 2004.
6. University of California Monterey Bay Education, Science and Technology Center (UCMBEST Center) Traffic Analysis Report, Higgins Associates, October 31, 2003. Assumes 25% of project is built out by year 2010.
7. Daily and PM peak hour trip generation from *Environmental Impact Report For The Proposed Marina Landing Shopping Center Project*, Earth Metrics Inc., February 1998. AM peak hour trip generation derived based upon same derivation assumptions as utilized in said report.
8. Trip generation takes into account office tennants that would relocate to this new office space from existing office space off of Second Avenue north of Imjin Parkway that would be removed as part of the second phase of the Marina University Villages development.
9. Trip generation for Marina Transit Center from Letter to E. Spencer, "Marina Transit Station Traffic Study, Marina, California – Revised Project Definition," Higgins Associates, September 14, 2006. Project includes upgraded transit facility, commercial space, and apartments.
10. Trip generation from *Cypress Knolls Traffic Impact Analysis*, Higgins Associates, November 2006.
11. Trip generation from *Transportation Impact Analysis for Seaside Resort*, Fehr & Peers, May 2004.
12. ITE does not provide AM peak hour trip rates for the "specialty retail" land use. Rates used here are published by San Diego Association of Governments, *Brief Guilde of Vehicular Traffic Generation Rates for the San Diego Region*, July 1998.
13. ITE doesn not provide weekday daily trip rates for the "automobile care center" land use. Rates used here are published by San Diego Association of Governments, *Brief Guilde of Vehicular Traffic Generation Rates for the San Diego Region*, July 1998.
14. City of Sand City describes project as 80,000 square feet over 4 floors, with commercial/retail and office space on first two floors. Assumed each floor equal in size.
15. Trip generation from *Tynan Village Mixed Use Development Traffic Impact Study Report*, Higgins Associates, November 2004.
16. Trip generation from *Hartnell College Master Plan TIA*, Fehr & Peers, September 2005.
17. Trip generation from *CSUMB East Campus Housing Traffic Study*, Wilbur Smith Associates, January 2004.
18. Full buildout of East Garrison development will not occur until 2030. Fifty percent of the development is assumed to be constructed by the year 2010. Trip generation represents trips external to the development itself.
19. Size of building unknown – square footage used to derive trip generation is assumed, based upon other buildings within business park.
20. Trip generation from Letter to J. Jessen, "Trip Generation Study for Jessen Office Building Project, Laguna Seca Office Park Lot #13," Higgins Associates, June 6, 2006. Project includes both standard and medical office space.

Appendix D

Intersection Level of Service Calculation Worksheets

Background Conditions

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1568	1770	1669		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1568	1770	1669		3433	1863	1583
Volume (vph)	147	1093	11	17	1016	431	14	11	25	494	21	196
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	1188	12	18	1104	468	15	12	27	537	23	213
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	160	1200	0	18	1104	468	15	39	0	537	23	213
Heavy Vehicles (%)	2%	2%	2%	2%	4%	3%	2%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	8.2	36.9		0.7	29.4	45.1	2.1	2.1		15.7	15.7	15.7
Effective Green, g (s)	8.4	38.9		0.9	31.4	48.4	2.3	2.3		17.0	17.0	17.0
Actuated g/C Ratio	0.11	0.52		0.01	0.42	0.64	0.03	0.03		0.23	0.23	0.23
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	198	1658		21	1338	1094	54	51		777	422	358
v/s Ratio Prot	c0.09	0.38		0.01	c0.34	0.10	0.01	c0.02		c0.16	0.01	
v/s Ratio Perm						0.20						0.13
v/c Ratio	0.81	0.72		0.86	0.83	0.43	0.28	0.76		0.69	0.05	0.59
Uniform Delay, d1	32.6	14.0		37.0	19.4	6.6	35.6	36.1		26.6	22.8	26.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	20.4	1.5		129.6	4.2	0.2	1.0	45.1		2.5	0.0	2.2
Delay (s)	53.0	15.5		166.6	23.6	6.7	36.6	81.2		29.1	22.8	28.2
Level of Service	D	B		F	C	A	D	F		C	C	C
Approach Delay (s)		19.9			20.3			68.8			28.7	
Approach LOS		B			C			E			C	

Intersection Summary

HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1663		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1663		3433	1863	1568
Volume (vph)	253	751	3	2	1152	394	9	2	5	113	1	139
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	275	816	3	2	1252	428	10	2	5	123	1	151
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	275	816	3	2	1252	428	10	7	0	123	1	151
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	17.8	107.6	107.6	4.4	94.0	94.0	1.5	3.1		16.6	17.8	17.8
Effective Green, g (s)	18.0	109.6	109.6	4.4	96.0	96.0	1.7	3.1		16.6	18.0	18.0
Actuated g/C Ratio	0.12	0.73	0.73	0.03	0.64	0.64	0.01	0.02		0.11	0.12	0.12
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	213	1171	1159	52	1026	1015	20	34		381	224	189
v/s Ratio Prot	c0.16	0.51		0.00	c0.78		0.01	0.00		c0.04	0.00	
v/s Ratio Perm			0.00			0.27						c0.10
v/c Ratio	1.29	0.70	0.00	0.04	1.22	0.42	0.50	0.21		0.32	0.00	0.80
Uniform Delay, d1	65.8	11.0	5.4	70.6	26.8	13.2	73.6	72.1		61.4	58.0	64.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	161.4	2.1	0.0	0.3	108.0	0.5	30.2	3.0		0.5	0.0	21.1
Delay (s)	227.3	13.1	5.4	70.9	134.9	13.7	103.7	75.1		61.9	58.0	85.1
Level of Service	F	B	A	E	F	B	F	E		E	E	F
Approach Delay (s)		66.9			104.0			91.9			74.6	
Approach LOS		E			F			F			E	

Intersection Summary

HCM Average Control Delay	88.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	149.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Background AM
11/8/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1545	1770	1567			1772	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.71	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1545	1370	1567			1321	1583
Volume (vph)	32	791	46	21	1419	32	51	2	28	29	1	77
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	860	50	23	1542	35	55	2	30	32	1	84
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	35	860	50	23	1542	35	55	32	0	0	33	84
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	3.1	109.2	109.2	3.8	109.9	109.9	10.8	10.8			10.8	10.8
Effective Green, g (s)	2.8	111.2	111.2	3.5	111.9	111.9	10.9	10.9			10.9	10.9
Actuated g/C Ratio	0.02	0.81	0.81	0.03	0.81	0.81	0.08	0.08			0.08	0.08
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	36	1293	1279	45	1301	1256	109	124			105	125
v/s Ratio Prot	c0.02	0.54		0.01	c0.96			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.05
v/c Ratio	0.97	0.67	0.04	0.51	1.19	0.03	0.50	0.26			0.31	0.67
Uniform Delay, d1	67.4	5.5	2.6	66.2	12.8	2.5	60.8	59.5			59.8	61.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	138.2	1.4	0.0	9.5	91.4	0.0	3.6	1.1			1.7	13.3
Delay (s)	205.6	6.9	2.6	75.7	104.3	2.5	64.4	60.7			61.5	74.9
Level of Service	F	A	A	E	F	A	E	E			E	E
Approach Delay (s)		14.0			101.6			63.0			71.2	
Approach LOS		B			F			E			E	

Intersection Summary			
HCM Average Control Delay	69.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	722	136	237	1266	206	245
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	785	148	258	1376	224	266
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	785	148	258	1376	224	266
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	75.5	75.5	11.8	91.0	19.3	19.3
Effective Green, g (s)	77.5	77.5	11.5	93.0	19.0	19.0
Actuated g/C Ratio	0.65	0.65	0.10	0.78	0.16	0.16
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1033	1022	329	1240	280	245
v/s Ratio Prot	0.49		0.08	c0.86	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.76	0.14	0.78	1.11	0.80	1.09
Uniform Delay, d1	14.8	8.3	53.0	13.5	48.7	50.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.0	11.2	61.2	15.0	82.2
Delay (s)	17.9	8.4	64.2	74.7	63.7	132.7
Level of Service	B	A	E	E	E	F
Approach Delay (s)	16.4			73.0	101.2	
Approach LOS	B			E	F	

Intersection Summary

HCM Average Control Delay	60.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

5: Highway 68 & Corral de Tierra Rd.

11/8/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3400	1600			1757	1583		1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3400	1600			1757	1583		1783	1583
Volume (vph)	2	918	56	88	1343	13	160	1	199	8	1	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	998	61	96	1460	14	174	1	216	9	1	5
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	998	61	96	1474	0	0	175	216	0	10	5
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.0	91.2	91.2	7.4	97.3			30.8	30.8		2.9	2.9
Effective Green, g (s)	1.0	93.2	93.2	7.1	99.3			30.8	30.8		2.9	2.9
Actuated g/C Ratio	0.01	0.62	0.62	0.05	0.66			0.21	0.21		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	12	994	984	161	1059			361	325		34	31
v/s Ratio Prot	0.00	0.62		c0.03	c0.92			0.10			c0.01	
v/s Ratio Perm			0.04						c0.14			0.00
v/c Ratio	0.17	1.00	0.06	0.60	1.39			0.48	0.66		0.29	0.16
Uniform Delay, d1	74.1	28.4	11.2	70.0	25.4			52.6	54.8		72.5	72.4
Progression Factor	1.00	1.00	1.00	0.98	1.33			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.5	29.5	0.1	0.5	176.9			1.0	5.1		4.8	2.4
Delay (s)	80.6	57.9	11.3	69.2	210.7			53.6	59.9		77.3	74.8
Level of Service	F	E	B	E	F			D	E		E	E
Approach Delay (s)		55.3			202.0			57.1			76.5	
Approach LOS		E			F			E			E	

Intersection Summary

HCM Average Control Delay	131.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Background AM
11/8/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Volume (vph)	1	1059	36	70	1320	1	111	1	143	1	1	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1151	39	76	1435	1	121	1	155	1	1	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1151	39	76	1436	0	0	122	155	0	2	1
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.2	104.9	104.9	10.4	114.1			12.3	12.3		5.3	5.3
Effective Green, g (s)	0.9	106.9	106.9	10.1	116.1			12.0	12.0		5.0	5.0
Actuated g/C Ratio	0.01	0.71	0.71	0.07	0.77			0.08	0.08		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	11	1140	1128	220	1238			142	123		61	53
v/s Ratio Prot	0.00	0.72		c0.02	c0.90			0.07			c0.00	
v/s Ratio Perm			0.02						c0.10			0.00
v/c Ratio	0.09	1.01	0.03	0.35	1.16			0.86	1.26		0.03	0.02
Uniform Delay, d1	74.1	21.5	6.3	66.8	17.0			68.2	69.0		70.2	70.1
Progression Factor	0.86	1.18	1.35	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	18.9	0.0	0.7	81.3			36.7	166.8		0.2	0.1
Delay (s)	64.9	44.4	8.6	67.5	98.3			104.9	235.8		70.3	70.2
Level of Service	E	D	A	E	F			F	F		E	E
Approach Delay (s)		43.2			96.7			178.2			70.3	
Approach LOS		D			F			F			E	

Intersection Summary

HCM Average Control Delay	82.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Highway 68 & Hwy 218

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1559	1656	1673		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1559	1656	1673		3433	1863	1583
Volume (vph)	205	860	13	29	1292	630	17	25	40	324	17	167
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	935	14	32	1404	685	18	27	43	352	18	182
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	949	0	32	1404	685	18	70	0	352	18	182
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	9%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	8.8	42.9		2.2	36.3	50.5	4.0	4.0		14.2	14.2	14.2
Effective Green, g (s)	9.0	44.9		2.4	38.3	53.8	4.2	4.2		15.5	15.5	15.5
Actuated g/C Ratio	0.11	0.54		0.03	0.46	0.65	0.05	0.05		0.19	0.19	0.19
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	192	1731		51	1477	1086	84	85		641	348	296
v/s Ratio Prot	c0.13	0.30		0.02	c0.44	c0.12	0.01	c0.04		0.10	0.01	
v/s Ratio Perm						0.32						0.11
v/c Ratio	1.16	0.55		0.63	0.95	0.63	0.21	0.82		0.55	0.05	0.61
Uniform Delay, d1	37.0	12.4		39.9	21.4	8.7	37.8	39.0		30.6	27.7	31.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	115.2	0.3		21.7	13.4	1.1	0.5	43.2		0.8	0.0	3.2
Delay (s)	152.2	12.7		61.5	34.9	9.7	38.3	82.3		31.3	27.8	34.2
Level of Service	F	B		E	C	A	D	F		C	C	C
Approach Delay (s)		39.3			27.2			73.3			32.2	
Approach LOS		D			C			E			C	

Intersection Summary

HCM Average Control Delay	32.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	83.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1653		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1653		3433	1863	1583
Volume (vph)	109	921	10	7	1198	118	5	1	3	372	3	188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	118	1001	11	8	1302	128	5	1	3	404	3	204
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	118	1001	11	8	1302	128	5	4	0	404	3	204
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	7.8	105.7	105.7	0.8	98.5	98.5	0.8	3.2		19.9	21.9	21.9
Effective Green, g (s)	8.0	107.7	107.7	0.8	100.5	100.5	1.0	3.2		19.9	22.1	22.1
Actuated g/C Ratio	0.05	0.73	0.73	0.01	0.68	0.68	0.01	0.02		0.13	0.15	0.15
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	96	1167	1155	10	1089	1078	12	36		463	279	237
v/s Ratio Prot	c0.07	0.63		0.00	c0.81		0.00	0.00		c0.12	0.00	
v/s Ratio Perm			0.01			0.08						c0.13
v/c Ratio	1.23	0.86	0.01	0.80	1.20	0.12	0.42	0.11		0.87	0.01	0.86
Uniform Delay, d1	69.8	14.4	5.4	73.3	23.5	8.2	73.0	70.8		62.6	53.4	61.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	165.7	6.9	0.0	169.7	97.2	0.1	35.8	1.4		16.4	0.0	26.3
Delay (s)	235.5	21.3	5.4	243.0	120.7	8.3	108.8	72.2		79.0	53.5	87.6
Level of Service	F	C	A	F	F	A	F	E		E	D	F
Approach Delay (s)		43.5			111.4			92.5			81.7	
Approach LOS		D			F			F			F	

Intersection Summary

HCM Average Control Delay	81.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	147.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Background PM
11/8/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1620			1781	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1353	1620			1335	1583
Volume (vph)	60	1172	64	13	1180	30	70	5	30	40	4	72
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	1274	70	14	1283	33	76	5	33	43	4	78
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	1274	70	14	1283	33	76	38	0	0	47	78
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	5.3	112.0	112.0	1.6	108.3	108.3	13.0	13.0			13.0	13.0
Effective Green, g (s)	5.0	114.0	114.0	1.3	110.3	110.3	13.1	13.1			13.1	13.1
Actuated g/C Ratio	0.04	0.81	0.81	0.01	0.79	0.79	0.09	0.09			0.09	0.09
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	63	1299	1285	16	1257	1244	126	151			125	148
v/s Ratio Prot	c0.04	c0.80		0.01	c0.80			0.02				
v/s Ratio Perm			0.04			0.02	c0.06				0.04	0.05
v/c Ratio	1.03	0.98	0.05	0.88	1.02	0.03	0.60	0.25			0.38	0.53
Uniform Delay, d1	67.7	12.2	2.6	69.5	15.1	3.3	61.2	59.1			59.8	60.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	122.5	20.4	0.0	161.3	30.7	0.0	7.9	0.9			1.9	3.4
Delay (s)	190.2	32.6	2.6	230.7	45.8	3.3	69.1	60.0			61.7	64.1
Level of Service	F	C	A	F	D	A	E	E			E	E
Approach Delay (s)		38.4			46.7			66.0			63.2	
Approach LOS		D			D			E			E	

Intersection Summary

HCM Average Control Delay	44.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	1101	140	208	1006	217	381
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1197	152	226	1093	236	414
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1197	152	226	1093	236	414
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	86.0	86.0	8.3	98.0	32.3	32.3
Effective Green, g (s)	88.0	88.0	8.0	100.0	32.0	32.0
Actuated g/C Ratio	0.63	0.63	0.06	0.71	0.23	0.23
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1006	995	196	1143	405	353
v/s Ratio Prot	c0.75		c0.07	0.68	0.13	
v/s Ratio Perm		0.10				c0.27
v/c Ratio	1.19	0.15	1.15	0.96	0.58	1.17
Uniform Delay, d1	26.0	10.7	66.0	18.0	48.1	54.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	95.5	0.1	111.6	17.0	2.1	103.7
Delay (s)	121.5	10.7	177.6	35.0	50.2	157.7
Level of Service	F	B	F	D	D	F
Approach Delay (s)	109.0			59.5	118.7	
Approach LOS	F			E	F	

Intersection Summary

HCM Average Control Delay	91.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Background PM
11/8/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3433	1600			1775	1568		1791	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3433	1600			1775	1568		1791	1583
Volume (vph)	1	1361	121	157	1132	7	82	1	161	4	1	4
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1479	132	171	1230	8	89	1	175	4	1	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1479	132	171	1238	0	0	90	175	0	5	4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	92.6	92.6	11.0	102.5			26.0	26.0		2.7	2.7
Effective Green, g (s)	0.8	94.6	94.6	10.7	104.5			26.0	26.0		2.7	2.7
Actuated g/C Ratio	0.01	0.63	0.63	0.07	0.70			0.17	0.17		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	9	1009	998	245	1115			308	272		32	28
v/s Ratio Prot	0.00	c0.92		c0.05	c0.77			0.05			c0.00	
v/s Ratio Perm			0.08						c0.11			0.00
v/c Ratio	0.11	1.47	0.13	0.70	1.11			0.29	0.64		0.16	0.14
Uniform Delay, d1	74.2	27.7	11.2	68.1	22.8			54.0	57.7		72.5	72.5
Progression Factor	1.00	1.00	1.00	1.04	0.72			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.4	215.1	0.3	1.9	53.2			0.5	5.1		2.3	2.3
Delay (s)	79.7	242.8	11.4	72.7	69.7			54.5	62.8		74.8	74.9
Level of Service	E	F	B	E	E			D	E		E	E
Approach Delay (s)		223.7			70.1			60.0			74.8	
Approach LOS		F			E			E			E	

Intersection Summary

HCM Average Control Delay	144.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1776	1539		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1776	1539		1817	1583
Volume (vph)	2	1422	112	149	1215	1	72	2	110	1	1	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1546	122	162	1321	1	78	2	120	1	1	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1546	122	162	1322	0	0	80	120	0	2	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	100.8	100.8	17.5	117.0			9.3	9.3		5.3	5.3
Effective Green, g (s)	1.0	102.8	102.8	17.2	119.0			9.0	9.0		5.0	5.0
Actuated g/C Ratio	0.01	0.69	0.69	0.11	0.79			0.06	0.06		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	1097	1085	375	1269			107	92		61	53
v/s Ratio Prot	0.00	c0.97		c0.05	c0.83			0.05			0.00	
v/s Ratio Perm			0.08						c0.08			c0.00
v/c Ratio	0.17	1.41	0.11	0.43	1.04			0.75	1.30		0.03	0.04
Uniform Delay, d1	74.1	23.6	8.0	61.8	15.5			69.4	70.5		70.2	70.2
Progression Factor	1.13	1.45	0.95	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	184.7	0.0	0.6	36.8			23.3	195.7		0.2	0.2
Delay (s)	84.5	219.0	7.7	62.4	52.3			92.7	266.2		70.3	70.4
Level of Service	F	F	A	E	D			F	F		E	E
Approach Delay (s)		203.4			53.4			196.8			70.4	
Approach LOS		F			D			F			E	

Intersection Summary

HCM Average Control Delay	136.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1663		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1770	1663		3433	1863	1568
Volume (vph)	253	751	3	2	1152	394	9	2	5	113	1	139
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	275	816	3	2	1252	428	10	2	5	123	1	151
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	275	816	3	2	1252	428	10	7	0	123	1	151
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	14.2	51.6	51.6	0.7	37.9	37.9	0.7	4.8		9.2	12.9	12.9
Effective Green, g (s)	14.4	53.6	53.6	0.7	39.9	39.9	0.9	4.8		9.2	13.1	13.1
Actuated g/C Ratio	0.17	0.64	0.64	0.01	0.47	0.47	0.01	0.06		0.11	0.16	0.16
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	302	1017	1007	15	1515	749	19	95		375	290	244
v/s Ratio Prot	c0.16	0.51		0.00	c0.39		0.01	0.00		c0.04	0.00	
v/s Ratio Perm			0.00			0.27						c0.10
v/c Ratio	0.91	0.80	0.00	0.13	0.83	0.57	0.53	0.07		0.33	0.00	0.62
Uniform Delay, d1	34.3	11.4	5.6	41.5	19.2	16.0	41.5	37.6		34.7	30.1	33.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	30.7	5.2	0.0	4.0	4.2	1.5	36.3	0.3		0.5	0.0	4.8
Delay (s)	65.0	16.6	5.6	45.5	23.4	17.5	77.8	38.0		35.2	30.1	38.1
Level of Service	E	B	A	D	C	B	E	D		D	C	D
Approach Delay (s)		28.7			21.9			61.4			36.8	
Approach LOS		C			C			E			D	

Intersection Summary

HCM Average Control Delay	25.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	84.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1548	1770	1581			1775	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1548	1370	1581			1347	1583
Volume (vph)	32	791	46	21	1419	32	51	2	28	29	1	77
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	860	50	23	1542	35	55	2	30	32	1	84
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	35	860	50	23	1542	35	55	32	0	0	33	84
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	1.8	58.6	58.6	1.7	58.5	58.5	9.1	9.1			9.1	9.1
Effective Green, g (s)	1.5	60.6	60.6	1.4	60.5	60.5	9.2	9.2			9.2	9.2
Actuated g/C Ratio	0.02	0.73	0.73	0.02	0.73	0.73	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	32	1165	1153	30	2327	1126	151	175			149	175
v/s Ratio Prot	c0.02	c0.54		0.01	0.48			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.05
v/c Ratio	1.09	0.74	0.04	0.77	0.66	0.03	0.36	0.18			0.22	0.48
Uniform Delay, d1	40.9	6.6	3.2	40.7	6.0	3.2	34.3	33.6			33.7	34.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	188.8	2.7	0.0	72.7	0.8	0.0	1.5	0.5			0.8	2.1
Delay (s)	229.7	9.3	3.2	113.4	6.8	3.2	35.8	34.1			34.5	36.8
Level of Service	F	A	A	F	A	A	D	C			C	D
Approach Delay (s)		17.1			8.2			35.2			36.2	
Approach LOS		B			A			D			D	

Intersection Summary

HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	83.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

4: Highway 68 & Laureles Grade Rd.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1563
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1563
Volume (vph)	722	136	237	1266	206	245
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	785	148	258	1376	224	266
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	785	148	258	1376	224	266
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	19.6	19.6	9.5	32.8	19.6	19.6
Effective Green, g (s)	21.6	21.6	9.2	34.8	19.3	19.3
Actuated g/C Ratio	0.35	0.35	0.15	0.56	0.31	0.31
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1113	551	509	1793	550	486
v/s Ratio Prot	0.25		0.08	c0.43	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.71	0.27	0.51	0.77	0.41	0.55
Uniform Delay, d1	17.5	14.6	24.4	10.5	16.9	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.6	1.9	0.5	1.3
Delay (s)	19.4	14.8	24.9	12.5	17.4	19.0
Level of Service	B	B	C	B	B	B
Approach Delay (s)	18.7			14.4	18.3	
Approach LOS	B			B	B	

Intersection Summary

HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	62.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Background AM - Mitigated
11/14/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3400	3200			1757	1583		1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3400	3200			1757	1583		1783	1583
Volume (vph)	2	918	56	88	1343	13	160	1	199	8	1	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	998	61	96	1460	14	174	1	216	9	1	5
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	998	61	96	1474	0	0	175	216	0	10	5
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	61.8	61.8	6.3	67.0			21.4	21.4		2.8	2.8
Effective Green, g (s)	0.8	63.8	63.8	6.0	69.0			21.4	21.4		2.8	2.8
Actuated g/C Ratio	0.01	0.58	0.58	0.05	0.63			0.19	0.19		0.03	0.03
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	13	1856	918	185	2007			342	308		45	40
v/s Ratio Prot	0.00	0.31		c0.03	c0.46			0.10			c0.01	
v/s Ratio Perm			0.04						c0.14			0.00
v/c Ratio	0.15	0.54	0.07	0.52	0.73			0.51	0.70		0.22	0.12
Uniform Delay, d1	54.3	14.1	10.1	50.6	14.2			39.6	41.3		52.5	52.4
Progression Factor	1.00	1.00	1.00	0.95	0.92			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.5	1.1	0.1	1.4	1.9			1.3	7.0		2.5	1.4
Delay (s)	59.7	15.2	10.2	49.6	14.9			40.9	48.4		55.0	53.8
Level of Service	E	B	B	D	B			D	D		E	D
Approach Delay (s)		15.0			17.1			45.0			54.6	
Approach LOS		B			B			D			D	

Intersection Summary

HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Background AM - Mitigated
11/14/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1775	1545		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1775	1545		1817	1583
Volume (vph)	1	1059	36	70	1320	1	111	1	143	1	1	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1151	39	76	1435	1	121	1	155	1	1	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1151	39	76	1436	0	0	122	155	0	2	1
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.2	67.3	67.3	6.5	72.6			13.9	13.9		5.2	5.2
Effective Green, g (s)	0.9	69.3	69.3	6.2	74.6			13.6	13.6		4.9	4.9
Actuated g/C Ratio	0.01	0.63	0.63	0.06	0.68			0.12	0.12		0.04	0.04
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	14	2016	997	184	2170			219	191		81	71
v/s Ratio Prot	0.00	0.36		c0.02	c0.45			0.07			c0.00	
v/s Ratio Perm			0.02						c0.10			0.00
v/c Ratio	0.07	0.57	0.04	0.41	0.66			0.56	0.81		0.02	0.01
Uniform Delay, d1	54.1	11.8	7.7	50.1	10.3			45.4	47.0		50.3	50.2
Progression Factor	0.82	1.59	1.44	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	1.0	0.1	1.1	1.6			2.5	21.9		0.1	0.1
Delay (s)	46.3	19.7	11.2	51.2	11.9			47.8	68.8		50.4	50.3
Level of Service	D	B	B	D	B			D	E		D	D
Approach Delay (s)		19.4			13.9			59.6			50.3	
Approach LOS		B			B			E			D	

Intersection Summary

HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1653		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1770	1653		3433	1863	1583
Volume (vph)	109	921	10	7	1198	118	5	1	3	372	3	188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	118	1001	11	8	1302	128	5	1	3	404	3	204
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	118	1001	11	8	1302	128	5	4	0	404	3	204
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	11.3	78.4	78.4	0.6	67.5	67.5	0.6	2.7		18.8	20.5	20.5
Effective Green, g (s)	11.5	80.4	80.4	0.6	69.5	69.5	0.8	2.7		18.8	20.7	20.7
Actuated g/C Ratio	0.10	0.68	0.68	0.01	0.59	0.59	0.01	0.02		0.16	0.17	0.17
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	172	1086	1074	9	1877	928	12	38		545	325	277
v/s Ratio Prot	c0.07	c0.63		0.00	0.41		0.00	0.00		c0.12	0.00	
v/s Ratio Perm			0.01			0.08						c0.13
v/c Ratio	0.69	0.92	0.01	0.89	0.69	0.14	0.42	0.11		0.74	0.01	0.74
Uniform Delay, d1	51.8	16.3	6.2	58.9	17.1	11.0	58.6	56.7		47.5	40.4	46.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.5	12.9	0.0	230.5	1.3	0.1	35.8	1.2		5.4	0.0	10.1
Delay (s)	64.3	29.3	6.2	289.4	18.4	11.1	94.4	57.9		52.9	40.4	56.4
Level of Service	E	C	A	F	B	B	F	E		D	D	E
Approach Delay (s)		32.7			19.2			78.2			54.0	
Approach LOS		C			B			E			D	

Intersection Summary

HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	118.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1620			1781	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1353	1620			1335	1583
Volume (vph)	60	1172	64	13	1180	30	70	5	30	40	4	72
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	1274	70	14	1283	33	76	5	33	43	4	78
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	1274	70	14	1283	33	76	38	0	0	47	78
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	8.4	109.2	109.2	1.5	102.3	102.3	11.1	11.1			11.1	11.1
Effective Green, g (s)	8.1	111.2	111.2	1.2	104.3	104.3	11.2	11.2			11.2	11.2
Actuated g/C Ratio	0.06	0.82	0.82	0.01	0.77	0.77	0.08	0.08			0.08	0.08
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	106	1312	1298	16	2461	1218	112	134			110	131
v/s Ratio Prot	c0.04	c0.80		0.01	0.40			0.02				
v/s Ratio Perm			0.04			0.02	c0.06				0.04	0.05
v/c Ratio	0.61	0.97	0.05	0.88	0.52	0.03	0.68	0.28			0.43	0.60
Uniform Delay, d1	62.2	10.8	2.3	67.1	6.0	3.7	60.5	58.4			59.1	60.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	10.1	18.3	0.0	161.3	0.3	0.0	15.1	1.2			2.7	7.1
Delay (s)	72.3	29.1	2.3	228.4	6.3	3.7	75.6	59.6			61.8	67.1
Level of Service	E	C	A	F	A	A	E	E			E	E
Approach Delay (s)		29.8			8.6			70.2			65.1	
Approach LOS		C			A			E			E	

Intersection Summary

HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	135.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Background PM - Mitigated
11/13/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1562
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1562
Volume (vph)	1101	140	208	1006	217	381
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1197	152	226	1093	236	414
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1197	152	226	1093	236	414
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	44.8	44.8	11.8	60.3	32.0	32.0
Effective Green, g (s)	46.8	46.8	11.5	62.3	31.7	31.7
Actuated g/C Ratio	0.46	0.46	0.11	0.61	0.31	0.31
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1468	726	387	1955	550	485
v/s Ratio Prot	c0.37		0.07	c0.34	0.13	
v/s Ratio Perm		0.10				c0.27
v/c Ratio	0.82	0.21	0.58	0.56	0.43	0.85
Uniform Delay, d1	23.9	16.5	43.0	11.7	28.0	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	0.1	1.9	0.3	0.5	13.6
Delay (s)	27.4	16.6	44.8	12.0	28.5	46.6
Level of Service	C	B	D	B	C	D
Approach Delay (s)	26.2			17.6	40.0	
Approach LOS	C			B	D	

Intersection Summary

HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3433	3200			1775	1568		1791	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3433	3200			1775	1568		1791	1583
Volume (vph)	1	1361	121	157	1132	7	82	1	161	4	1	4
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1479	132	171	1230	8	89	1	175	4	1	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1479	132	171	1238	0	0	90	175	0	5	4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.1	87.2	87.2	11.3	97.1			21.2	21.2		2.6	2.6
Effective Green, g (s)	1.1	89.2	89.2	11.0	99.1			21.2	21.2		2.6	2.6
Actuated g/C Ratio	0.01	0.64	0.64	0.08	0.71			0.15	0.15		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	14	2039	1009	270	2265			269	237		33	29
v/s Ratio Prot	0.00	c0.46		c0.05	0.39			0.05			c0.00	
v/s Ratio Perm			0.08						c0.11			0.00
v/c Ratio	0.07	0.73	0.13	0.63	0.55			0.33	0.74		0.15	0.14
Uniform Delay, d1	68.9	17.1	10.1	62.5	9.7			53.1	56.8		67.6	67.6
Progression Factor	1.00	1.00	1.00	1.14	0.64			1.00	1.00		1.00	1.00
Incremental Delay, d2	2.2	2.3	0.3	3.6	0.8			0.7	11.4		2.1	2.2
Delay (s)	71.1	19.4	10.3	74.6	7.1			53.8	68.1		69.7	69.8
Level of Service	E	B	B	E	A			D	E		E	E
Approach Delay (s)		18.7			15.3			63.3			69.8	
Approach LOS		B			B			E			E	

Intersection Summary

HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Background PM - Mitigated
11/13/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1776	1544		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1776	1544		1817	1583
Volume (vph)	2	1422	112	149	1215	1	72	2	110	1	1	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1546	122	162	1321	1	78	2	120	1	1	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1546	122	162	1322	0	0	80	120	0	2	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	91.4	91.4	12.0	102.1			14.2	14.2		5.3	5.3
Effective Green, g (s)	1.0	93.4	93.4	11.7	104.1			13.9	13.9		5.0	5.0
Actuated g/C Ratio	0.01	0.67	0.67	0.08	0.74			0.10	0.10		0.04	0.04
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	13	2135	1056	274	2379			176	153		65	57
v/s Ratio Prot	0.00	c0.48		c0.05	0.41			0.05			0.00	
v/s Ratio Perm			0.08						c0.08			c0.00
v/c Ratio	0.15	0.72	0.12	0.59	0.56			0.45	0.78		0.03	0.04
Uniform Delay, d1	69.1	15.0	8.4	61.8	7.8			59.5	61.6		65.2	65.2
Progression Factor	1.27	1.30	0.78	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	3.8	1.5	0.2	2.8	0.9			1.4	21.9		0.1	0.2
Delay (s)	91.3	21.0	6.7	64.7	8.8			60.8	83.5		65.3	65.4
Level of Service	F	C	A	E	A			E	F		E	E
Approach Delay (s)		20.1			14.9			74.4			65.3	
Approach LOS		C			B			E			E	

Intersection Summary

HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Appendix E

Synchro Arterial Level of Service Reports

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	I	60	126.1	38.5	164.6	2.10	46.0	A
Olmsted Rd.	I	52	36.4	75.0	111.4	0.53	17.0	E
Hwy 218	I	45	87.9	15.6	103.5	1.09	38.0	B
Ragsdale Dr.	I	50	29.6	1.9	31.5	0.33	37.2	B
York Rd.	I	48	81.7	7.3	89.0	1.09	44.1	A
Boots Rd.	I	42	135.9	8.4	144.3	1.59	39.6	B
Laureles Grade Rd.	I	50	96.7	25.4	122.1	1.34	39.6	B
Corral de Tierra Rd.	I	55	113.3	28.3	141.6	1.73	44.0	A
San Benancio Rd.	I	60	64.8	84.3	149.1	1.08	26.1	D
Total	I		772.4	284.7	1057.1	10.87	37.0	B

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	III	14	610.1	39.8	649.9	2.42	13.4	E
Corral de Tierra Rd.	III	41	94.8	30.7	125.5	1.08	31.0	A
Laureles Grade Rd.	III	45	138.5	37.4	175.9	1.73	35.4	A
Pasadera Dr.	III	60	93.2	46.7	139.9	1.55	40.0	A
York Rd.	III	60	170.5	91.5	262.0	2.84	39.0	A
Ragsdale Dr.	III	60	65.3	18.9	84.2	1.09	46.6	A
Hwy 218	III	60	36.4	27.3	63.7	0.61	34.3	A
Olmsted Rd.	III	60	83.9	41.9	125.8	1.40	40.0	A
Josselyn Cyn. Rd.	III	30	63.0	12.7	75.7	0.53	25.0	B
Total	III		1355.7	346.9	1702.6	13.25	28.0	B

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	III	47	45.0	10.5	55.5	0.51	33.2	A
Olmsted Rd.	III	60	36.9	28.6	65.5	0.47	26.0	B
Hwy 218	III	46	85.0	11.3	96.3	1.09	40.8	A
Ragsdale Dr.	III	60	29.6	0.3	29.9	0.32	38.8	A
York Rd.	III	52	76.2	14.2	90.4	1.09	43.4	A
Boots Rd.	III	25	248.8	18.3	267.1	1.73	23.3	C
Laureles Grade Rd.	III	15	322.2	109.3	431.5	1.34	11.2	E
Corral de Tierra Rd.	III	36	173.1	120.6	293.7	1.73	21.2	C
San Benancio Rd.	III	60	108.0	198.1	306.1	1.80	21.2	C
Total	III		1124.8	511.2	1636.0	10.09	22.2	C

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	I	52	167.5	22.7	190.2	2.42	45.9	A
Corral de Tierra Rd.	I	47	34.9	12.2	47.1	0.36	27.5	C
Laureles Grade Rd.	I	60	227.3	35.6	262.9	3.79	51.9	A
Pasadera Dr.	I	54	89.5	32.4	121.9	1.34	39.7	B
York Rd.	I	60	409.1	111.7	520.8	6.82	47.1	A
Ragsdale Dr.	I	54	72.4	15.0	87.4	1.09	44.9	A
Hwy 218	I	60	73.9	32.1	106.0	1.23	41.8	B
Olmsted Rd.	I	60	107.8	201.8	309.6	1.80	20.9	E
Josselyn Cyn. Rd.	I	60	39.8	52.0	91.8	0.66	26.0	D
Total	I		1222.2	515.5	1737.7	19.51	40.4	B

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	I	60	126.1	67.8	193.9	2.10	39.0	B
Olmsted Rd.	I	52	36.4	92.6	129.0	0.53	14.7	F
Hwy 218	I	45	87.9	17.1	105.0	1.09	37.4	B
Ragsdale Dr.	I	50	29.6	2.4	32.0	0.33	36.6	B
York Rd.	I	48	81.7	15.2	96.9	1.09	40.5	B
Boots Rd.	I	43	132.7	9.8	142.5	1.59	40.1	B
Laureles Grade Rd.	I	51	94.8	21.0	115.8	1.34	41.7	B
Corral de Tierra Rd.	I	55	113.3	50.4	163.7	1.73	38.1	B
San Benancio Rd.	I	60	64.8	44.0	108.8	1.08	35.7	B
Total	I		767.3	320.3	1087.6	10.87	36.0	B

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	III	14	610.1	87.2	697.3	2.42	12.5	E
Corral de Tierra Rd.	III	41	94.8	171.5	266.3	1.08	14.6	D
Laureles Grade Rd.	III	45	138.5	77.8	216.3	1.73	28.8	B
Pasadera Dr.	III	60	93.2	99.6	192.8	1.55	29.0	B
York Rd.	III	60	170.5	129.1	299.6	2.84	34.1	A
Ragsdale Dr.	III	60	65.3	26.8	92.1	1.09	42.6	A
Hwy 218	III	60	36.4	29.2	65.6	0.61	33.3	A
Olmsted Rd.	III	60	83.9	48.2	132.1	1.40	38.1	A
Josselyn Cyn. Rd.	III	30	63.0	14.3	77.3	0.53	24.5	B
Total	III		1355.7	683.7	2039.4	13.25	23.4	C

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	III	47	45.0	11.2	56.2	0.51	32.8	A
Olmsted Rd.	III	60	36.9	33.8	70.7	0.47	24.1	B
Hwy 218	III	46	85.0	14.5	99.5	1.09	39.5	A
Ragsdale Dr.	III	60	29.6	0.3	29.9	0.32	38.8	A
	III	52	76.2	19.5	95.7	1.09	41.0	A
Boots Rd.	III	25	248.8	30.8	279.6	1.73	22.2	C
Laureles Grade Rd.	III	15	322.2	121.9	444.1	1.34	10.9	E
Corral de Tierra Rd.	III	36	173.1	224.3	397.4	1.73	15.7	D
San Benancio Rd.	III	60	108.0	214.5	322.5	1.80	20.1	C
Total	III		1124.8	670.8	1795.6	10.09	20.2	C

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	I	52	167.5	44.1	211.6	2.42	41.2	B
Corral de Tierra Rd.	I	47	34.9	48.0	82.9	0.36	15.6	F
Laureles Grade Rd.	I	60	227.3	37.0	264.3	3.79	51.6	A
Pasadera Dr.	I	54	89.5	48.9	138.4	1.34	34.9	B
York Rd.	I	60	409.1	113.9	523.0	6.82	46.9	A
Ragsdale Dr.	I	54	72.4	16.3	88.7	1.09	44.2	A
Hwy 218	I	60	73.9	46.3	120.2	1.23	36.9	B
Olmsted Rd.	I	60	107.8	341.8	449.6	1.80	14.4	F
Josselyn Cyn. Rd.	I	60	39.8	104.6	144.4	0.66	16.5	E
Total	I		1222.2	800.9	2023.1	19.51	34.7	B

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	I	60	126.1	67.8	193.9	2.10	39.0	B
Olmsted Rd.	I	52	36.4	92.6	129.0	0.53	14.7	F
Hwy 218	I	45	87.9	16.4	104.3	1.09	37.7	B
Ragsdale Dr.	I	50	29.6	2.4	32.0	0.33	36.6	B
York Rd.	I	48	81.7	15.2	96.9	1.09	40.5	B
Boots Rd.	I	43	132.7	9.8	142.5	1.59	40.1	B
Laureles Grade Rd.	I	51	94.8	21.0	115.8	1.34	41.7	B
Corral de Tierra Rd.	I	55	113.3	50.5	163.8	1.73	38.0	B
San Benancio Rd.	I	60	64.8	44.6	109.4	1.08	35.5	B
Total	I		767.3	320.3	1087.6	10.87	36.0	B

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	III	14	610.1	87.2	697.3	2.42	12.5	E
Corral de Tierra Rd.	III	41	94.8	173.0	267.8	1.08	14.5	D
Laureles Grade Rd.	III	45	138.5	79.1	217.6	1.73	28.6	B
Pasadera Dr.	III	60	93.2	101.2	194.4	1.55	28.8	B
York Rd.	III	60	170.5	131.1	301.6	2.84	33.9	A
Ragsdale Dr.	III	60	65.3	26.8	92.1	1.09	42.6	A
Hwy 218	III	60	36.4	29.9	66.3	0.61	32.9	A
Olmsted Rd.	III	60	83.9	48.2	132.1	1.40	38.1	A
Josselyn Cyn. Rd.	III	30	63.0	14.3	77.3	0.53	24.5	B
Total	III		1355.7	690.8	2046.5	13.25	23.3	C

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	III	47	45.0	11.2	56.2	0.51	32.8	A
Olmsted Rd.	III	60	36.9	33.8	70.7	0.47	24.1	B
Hwy 218	III	46	85.0	14.5	99.5	1.09	39.5	A
Ragsdale Dr.	III	60	29.6	0.3	29.9	0.32	38.8	A
	III	52	76.2	19.7	95.9	1.09	40.9	A
Boots Rd.	III	25	248.8	31.4	280.2	1.73	22.2	C
Laureles Grade Rd.	III	15	322.2	123.5	445.7	1.34	10.8	E
Corral de Tierra Rd.	III	36	173.1	226.4	399.5	1.73	15.6	D
San Benancio Rd.	III	60	108.0	218.2	326.2	1.80	19.9	C
Total	III		1124.8	679.0	1803.8	10.09	20.1	C

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	I	52	167.5	44.1	211.6	2.42	41.2	B
Corral de Tierra Rd.	I	47	34.9	49.0	83.9	0.36	15.4	F
Laureles Grade Rd.	I	60	227.3	37.6	264.9	3.79	51.5	A
Pasadera Dr.	I	54	89.5	49.4	138.9	1.34	34.8	B
York Rd.	I	60	409.1	114.7	523.8	6.82	46.9	A
Ragsdale Dr.	I	54	72.4	16.3	88.7	1.09	44.2	A
Hwy 218	I	60	73.9	46.8	120.7	1.23	36.7	B
Olmsted Rd.	I	60	107.8	341.8	449.6	1.80	14.4	F
Josselyn Cyn. Rd.	I	60	39.8	104.6	144.4	0.66	16.5	E
Total	I		1222.2	804.3	2026.5	19.51	34.7	B

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	I	60	126.1	152.9	279.0	2.10	27.1	C
Olmsted Rd.	I	52	36.4	173.6	210.0	0.53	9.0	F
Hwy 218	I	45	87.9	22.2	110.1	1.09	35.7	B
Ragsdale Dr.	I	50	29.6	2.7	32.3	0.33	36.3	B
York Rd.	I	48	81.7	16.8	98.5	1.09	39.8	B
Boots Rd.	I	43	132.7	12.6	145.3	1.59	39.3	B
Laureles Grade Rd.	I	51	94.8	23.8	118.6	1.34	40.8	B
Corral de Tierra Rd.	I	55	113.3	73.2	186.5	1.73	33.4	C
San Benancio Rd.	I	60	64.8	100.8	165.6	1.08	23.5	D
Total	I		767.3	578.6	1345.9	10.87	29.1	C

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	III	14	610.1	180.6	790.7	2.42	11.0	E
Corral de Tierra Rd.	III	41	94.8	278.1	372.9	1.08	10.4	E
Laureles Grade Rd.	III	45	138.5	147.9	286.4	1.73	21.8	C
Pasadera Dr.	III	60	93.2	206.0	299.2	1.55	18.7	C
York Rd.	III	60	170.5	186.3	356.8	2.84	28.7	B
Ragsdale Dr.	III	60	65.3	38.8	104.1	1.09	37.7	A
Hwy 218	III	60	36.4	37.2	73.6	0.61	29.6	B
Olmsted Rd.	III	60	83.9	86.5	170.4	1.40	29.6	B
Josselyn Cyn. Rd.	III	30	63.0	25.3	88.3	0.53	21.4	C
Total	III		1355.7	1186.7	2542.4	13.25	18.8	C

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Josselyn Cyn. Rd.	III	47	45.0	21.4	66.4	0.51	27.7	B
Olmsted Rd.	III	60	36.9	116.2	153.1	0.47	11.1	E
Hwy 218	III	46	85.0	19.3	104.3	1.09	37.7	A
Ragsdale Dr.	III	60	29.6	0.4	30.0	0.32	38.6	A
York Rd.	III	52	76.2	44.7	120.9	1.09	32.4	A
Boots Rd.	III	25	248.8	121.4	370.2	1.73	16.8	D
Laureles Grade Rd.	III	15	322.2	231.3	553.5	1.34	8.7	F
Corral de Tierra Rd.	III	36	173.1	321.4	494.5	1.73	12.6	E
San Benancio Rd.	III	60	108.0	361.0	469.0	1.80	13.8	E
Total	III		1124.8	1237.1	2361.9	10.09	15.4	D

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
San Benancio Rd.	I	52	167.5	107.7	275.2	2.42	31.7	C
Corral de Tierra Rd.	I	47	34.9	97.0	131.9	0.36	9.8	F
Laureles Grade Rd.	I	60	227.3	61.2	288.5	3.79	47.3	A
Pasadera Dr.	I	54	89.5	101.8	191.3	1.34	25.3	D
York Rd.	I	60	409.1	139.3	548.4	6.82	44.8	A
Ragsdale Dr.	I	54	72.4	16.5	88.9	1.09	44.1	A
Hwy 218	I	60	73.9	106.8	180.7	1.23	24.5	D
Olmsted Rd.	I	60	107.8	455.6	563.4	1.80	11.5	F
Josselyn Cyn. Rd.	I	60	39.8	193.1	232.9	0.66	10.2	F
Total	I		1222.2	1279.0	2501.2	19.51	28.1	C

Appendix F

Intersection Level of Service Calculation Worksheets

Background + Project Conditions

1: Highway 68 & Hwy 218

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1568	1770	1669		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1568	1770	1669		3433	1863	1583
Volume (vph)	147	1094	11	17	1019	432	14	11	25	494	21	196
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	1189	12	18	1108	470	15	12	27	537	23	213
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	160	1201	0	18	1108	470	15	39	0	537	23	213
Heavy Vehicles (%)	2%	2%	2%	2%	4%	3%	2%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	9.4	39.4		0.8	30.8	47.0	2.1	2.1		16.2	16.2	16.2
Effective Green, g (s)	9.6	41.4		1.0	32.8	50.3	2.3	2.3		17.5	17.5	17.5
Actuated g/C Ratio	0.12	0.53		0.01	0.42	0.64	0.03	0.03		0.22	0.22	0.22
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	217	1694		23	1342	1089	52	49		768	417	354
v/s Ratio Prot	c0.09	0.38		0.01	c0.35	0.10	0.01	c0.02		c0.16	0.01	
v/s Ratio Perm						0.20						0.13
v/c Ratio	0.74	0.71		0.78	0.83	0.43	0.29	0.80		0.70	0.06	0.60
Uniform Delay, d1	33.1	13.9		38.5	20.2	6.9	37.1	37.7		27.9	23.9	27.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.6	1.3		93.8	4.2	0.2	1.1	55.4		2.6	0.0	2.4
Delay (s)	44.7	15.1		132.3	24.4	7.1	38.3	93.1		30.5	23.9	29.6
Level of Service	D	B		F	C	A	D	F		C	C	C
Approach Delay (s)		18.6			20.5			77.9			30.1	
Approach LOS		B			C			E			C	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1663		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1663		3433	1863	1568
Volume (vph)	253	752	3	2	1156	394	9	2	5	113	1	139
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	275	817	3	2	1257	428	10	2	5	123	1	151
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	275	817	3	2	1257	428	10	7	0	123	1	151
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	17.8	107.7	107.7	4.3	94.0	94.0	1.5	3.1		16.6	17.8	17.8
Effective Green, g (s)	18.0	109.7	109.7	4.3	96.0	96.0	1.7	3.1		16.6	18.0	18.0
Actuated g/C Ratio	0.12	0.73	0.73	0.03	0.64	0.64	0.01	0.02		0.11	0.12	0.12
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	213	1172	1160	51	1026	1015	20	34		381	224	189
v/s Ratio Prot	c0.16	0.51		0.00	c0.79		0.01	0.00		c0.04	0.00	
v/s Ratio Perm			0.00			0.27						c0.10
v/c Ratio	1.29	0.70	0.00	0.04	1.23	0.42	0.50	0.21		0.32	0.00	0.80
Uniform Delay, d1	65.8	10.9	5.4	70.7	26.8	13.2	73.6	72.1		61.4	58.0	64.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	161.4	2.1	0.0	0.3	110.1	0.5	30.2	3.0		0.5	0.0	21.1
Delay (s)	227.3	13.0	5.4	71.0	137.0	13.7	103.7	75.1		61.9	58.0	85.1
Level of Service	F	B	A	E	F	B	F	E		E	E	F
Approach Delay (s)		66.8			105.6			91.9			74.6	
Approach LOS		E			F			F			E	

Intersection Summary

HCM Average Control Delay	88.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	149.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1545	1770	1567			1772	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.71	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1545	1370	1567			1321	1583
Volume (vph)	32	792	46	21	1423	32	51	2	28	29	1	77
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	861	50	23	1547	35	55	2	30	32	1	84
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	35	861	50	23	1547	35	55	32	0	0	33	84
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	3.1	109.2	109.2	3.8	109.9	109.9	10.8	10.8			10.8	10.8
Effective Green, g (s)	2.8	111.2	111.2	3.5	111.9	111.9	10.9	10.9			10.9	10.9
Actuated g/C Ratio	0.02	0.81	0.81	0.03	0.81	0.81	0.08	0.08			0.08	0.08
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	36	1293	1279	45	1301	1256	109	124			105	125
v/s Ratio Prot	c0.02	0.54		0.01	c0.97			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.05
v/c Ratio	0.97	0.67	0.04	0.51	1.19	0.03	0.50	0.26			0.31	0.67
Uniform Delay, d1	67.4	5.5	2.6	66.2	12.8	2.5	60.8	59.5			59.8	61.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	138.2	1.4	0.0	9.5	93.0	0.0	3.6	1.1			1.7	13.3
Delay (s)	205.6	6.9	2.6	75.7	105.9	2.5	64.4	60.7			61.5	74.9
Level of Service	F	A	A	E	F	A	E	E			E	E
Approach Delay (s)		14.0			103.2			63.0			71.2	
Approach LOS		B			F			E			E	

Intersection Summary

HCM Average Control Delay	70.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	723	136	237	1270	206	245
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	786	148	258	1380	224	266
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	786	148	258	1380	224	266
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	75.5	75.5	11.8	91.0	19.3	19.3
Effective Green, g (s)	77.5	77.5	11.5	93.0	19.0	19.0
Actuated g/C Ratio	0.65	0.65	0.10	0.78	0.16	0.16
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1033	1022	329	1240	280	245
v/s Ratio Prot	0.49		0.08	c0.86	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.76	0.14	0.78	1.11	0.80	1.09
Uniform Delay, d1	14.8	8.3	53.0	13.5	48.7	50.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.0	11.2	62.4	15.0	82.2
Delay (s)	18.0	8.4	64.2	75.9	63.7	132.7
Level of Service	B	A	E	E	E	F
Approach Delay (s)	16.5			74.1	101.2	
Approach LOS	B			E	F	

Intersection Summary

HCM Average Control Delay	60.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3400	1600			1757	1583		1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3400	1600			1757	1583		1783	1583
Volume (vph)	2	919	56	88	1347	13	160	1	199	8	1	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	999	61	96	1464	14	174	1	216	9	1	5
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	999	61	96	1478	0	0	175	216	0	10	5
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.0	91.2	91.2	7.4	97.3			30.8	30.8		2.9	2.9
Effective Green, g (s)	1.0	93.2	93.2	7.1	99.3			30.8	30.8		2.9	2.9
Actuated g/C Ratio	0.01	0.62	0.62	0.05	0.66			0.21	0.21		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	12	994	984	161	1059			361	325		34	31
v/s Ratio Prot	0.00	0.62		c0.03	c0.92			0.10			c0.01	
v/s Ratio Perm			0.04						c0.14			0.00
v/c Ratio	0.17	1.01	0.06	0.60	1.40			0.48	0.66		0.29	0.16
Uniform Delay, d1	74.1	28.4	11.2	70.0	25.4			52.6	54.8		72.5	72.4
Progression Factor	1.00	1.00	1.00	0.98	1.33			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.5	29.8	0.1	0.5	178.6			1.0	5.1		4.8	2.4
Delay (s)	80.6	58.2	11.3	69.4	212.3			53.6	59.9		77.3	74.8
Level of Service	F	E	B	E	F			D	E		E	E
Approach Delay (s)		55.5			203.6			57.1			76.5	
Approach LOS		E			F			E			E	

Intersection Summary

HCM Average Control Delay	132.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Volume (vph)	1	1059	37	72	1320	1	115	1	149	1	1	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1151	40	78	1435	1	125	1	162	1	1	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1151	40	78	1436	0	0	126	162	0	2	1
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.2	104.7	104.7	10.6	114.1			12.3	12.3		5.3	5.3
Effective Green, g (s)	0.9	106.7	106.7	10.3	116.1			12.0	12.0		5.0	5.0
Actuated g/C Ratio	0.01	0.71	0.71	0.07	0.77			0.08	0.08		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	11	1138	1126	225	1238			142	123		61	53
v/s Ratio Prot	0.00	0.72		c0.02	c0.90			0.07			c0.00	
v/s Ratio Perm			0.03						c0.11			0.00
v/c Ratio	0.09	1.01	0.04	0.35	1.16			0.89	1.32		0.03	0.02
Uniform Delay, d1	74.1	21.6	6.4	66.6	17.0			68.3	69.0		70.2	70.1
Progression Factor	0.86	1.18	1.35	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	19.4	0.0	0.7	81.3			43.3	188.7		0.2	0.1
Delay (s)	64.9	44.9	8.6	67.3	98.3			111.6	257.7		70.3	70.2
Level of Service	E	D	A	E	F			F	F		E	E
Approach Delay (s)		43.7			96.7			193.8			70.3	
Approach LOS		D			F			F			E	

Intersection Summary

HCM Average Control Delay	84.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

1: Highway 68 & Hwy 218

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1559	1656	1673		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1559	1656	1673		3433	1863	1583
Volume (vph)	205	864	13	29	1294	630	17	25	40	324	17	167
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	939	14	32	1407	685	18	27	43	352	18	182
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	953	0	32	1407	685	18	70	0	352	18	182
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	9%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	8.8	42.9		2.2	36.3	50.5	4.0	4.0		14.2	14.2	14.2
Effective Green, g (s)	9.0	44.9		2.4	38.3	53.8	4.2	4.2		15.5	15.5	15.5
Actuated g/C Ratio	0.11	0.54		0.03	0.46	0.65	0.05	0.05		0.19	0.19	0.19
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	192	1731		51	1477	1086	84	85		641	348	296
v/s Ratio Prot	c0.13	0.30		0.02	c0.44	c0.12	0.01	c0.04		0.10	0.01	
v/s Ratio Perm						0.32						0.11
v/c Ratio	1.16	0.55		0.63	0.95	0.63	0.21	0.82		0.55	0.05	0.61
Uniform Delay, d1	37.0	12.5		39.9	21.5	8.7	37.8	39.0		30.6	27.7	31.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	115.2	0.3		21.7	13.7	1.1	0.5	43.2		0.8	0.0	3.2
Delay (s)	152.2	12.8		61.5	35.2	9.7	38.3	82.3		31.3	27.8	34.2
Level of Service	F	B		E	D	A	D	F		C	C	C
Approach Delay (s)		39.2			27.4			73.3			32.2	
Approach LOS		D			C			E			C	

Intersection Summary

HCM Average Control Delay	32.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	83.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Highway 68 & York Rd.

Background + Project PM
11/8/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1653		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1653		3433	1863	1583
Volume (vph)	109	925	10	7	1200	118	5	1	3	372	3	188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	118	1005	11	8	1304	128	5	1	3	404	3	204
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	118	1005	11	8	1304	128	5	4	0	404	3	204
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	7.8	105.7	105.7	0.8	98.5	98.5	0.8	3.2		19.9	21.9	21.9
Effective Green, g (s)	8.0	107.7	107.7	0.8	100.5	100.5	1.0	3.2		19.9	22.1	22.1
Actuated g/C Ratio	0.05	0.73	0.73	0.01	0.68	0.68	0.01	0.02		0.13	0.15	0.15
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	96	1167	1155	10	1089	1078	12	36		463	279	237
v/s Ratio Prot	c0.07	0.63		0.00	c0.81		0.00	0.00		c0.12	0.00	
v/s Ratio Perm			0.01			0.08						c0.13
v/c Ratio	1.23	0.86	0.01	0.80	1.20	0.12	0.42	0.11		0.87	0.01	0.86
Uniform Delay, d1	69.8	14.5	5.4	73.3	23.5	8.2	73.0	70.8		62.6	53.4	61.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	165.7	7.1	0.0	169.7	97.9	0.1	35.8	1.4		16.4	0.0	26.3
Delay (s)	235.5	21.7	5.4	243.0	121.5	8.3	108.8	72.2		79.0	53.5	87.6
Level of Service	F	C	A	F	F	A	F	E		E	D	F
Approach Delay (s)		43.8			112.1			92.5			81.7	
Approach LOS		D			F			F			F	

Intersection Summary

HCM Average Control Delay	82.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	147.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1620			1781	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1353	1620			1335	1583
Volume (vph)	60	1176	64	13	1182	30	70	5	30	40	4	72
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	1278	70	14	1285	33	76	5	33	43	4	78
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	1278	70	14	1285	33	76	38	0	0	47	78
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	5.3	112.0	112.0	1.6	108.3	108.3	13.0	13.0			13.0	13.0
Effective Green, g (s)	5.0	114.0	114.0	1.3	110.3	110.3	13.1	13.1			13.1	13.1
Actuated g/C Ratio	0.04	0.81	0.81	0.01	0.79	0.79	0.09	0.09			0.09	0.09
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	63	1299	1285	16	1257	1244	126	151			125	148
v/s Ratio Prot	c0.04	c0.80		0.01	c0.80			0.02				
v/s Ratio Perm			0.04			0.02	c0.06				0.04	0.05
v/c Ratio	1.03	0.98	0.05	0.88	1.02	0.03	0.60	0.25			0.38	0.53
Uniform Delay, d1	67.7	12.3	2.6	69.5	15.1	3.3	61.2	59.1			59.8	60.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	122.5	21.1	0.0	161.3	31.2	0.0	7.9	0.9			1.9	3.4
Delay (s)	190.2	33.4	2.6	230.7	46.2	3.3	69.1	60.0			61.7	64.1
Level of Service	F	C	A	F	D	A	E	E			E	E
Approach Delay (s)		39.1			47.1			66.0			63.2	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	44.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Background + Project PM
11/8/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	1105	140	208	1008	217	381
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1201	152	226	1096	236	414
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1201	152	226	1096	236	414
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	86.0	86.0	8.3	98.0	32.3	32.3
Effective Green, g (s)	88.0	88.0	8.0	100.0	32.0	32.0
Actuated g/C Ratio	0.63	0.63	0.06	0.71	0.23	0.23
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1006	995	196	1143	405	353
v/s Ratio Prot	c0.75		c0.07	0.69	0.13	
v/s Ratio Perm		0.10				c0.27
v/c Ratio	1.19	0.15	1.15	0.96	0.58	1.17
Uniform Delay, d1	26.0	10.7	66.0	18.1	48.1	54.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	97.1	0.1	111.6	17.4	2.1	103.7
Delay (s)	123.1	10.7	177.6	35.5	50.2	157.7
Level of Service	F	B	F	D	D	F
Approach Delay (s)	110.5			59.8	118.7	
Approach LOS	F			E	F	

Intersection Summary

HCM Average Control Delay	91.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Background + Project PM
11/8/2006

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3433	1600			1775	1568		1791	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3433	1600			1775	1568		1791	1583
Volume (vph)	1	1365	121	157	1134	7	82	1	161	4	1	4
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1484	132	171	1233	8	89	1	175	4	1	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1484	132	171	1241	0	0	90	175	0	5	4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	92.6	92.6	11.0	102.5			26.0	26.0		2.7	2.7
Effective Green, g (s)	0.8	94.6	94.6	10.7	104.5			26.0	26.0		2.7	2.7
Actuated g/C Ratio	0.01	0.63	0.63	0.07	0.70			0.17	0.17		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	9	1009	998	245	1115			308	272		32	28
v/s Ratio Prot	0.00	c0.93		c0.05	c0.78			0.05			c0.00	
v/s Ratio Perm			0.08						c0.11			0.00
v/c Ratio	0.11	1.47	0.13	0.70	1.11			0.29	0.64		0.16	0.14
Uniform Delay, d1	74.2	27.7	11.2	68.1	22.8			54.0	57.7		72.5	72.5
Progression Factor	1.00	1.00	1.00	1.04	0.73			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.4	217.3	0.3	1.9	54.4			0.5	5.1		2.3	2.3
Delay (s)	79.7	245.0	11.4	72.7	70.9			54.5	62.8		74.8	74.9
Level of Service	E	F	B	E	E			D	E		E	E
Approach Delay (s)		225.8			71.1			60.0			74.8	
Approach LOS		F			E			E			E	

Intersection Summary

HCM Average Control Delay	146.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1776	1539		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1776	1539		1817	1583
Volume (vph)	2	1422	116	156	1215	1	74	2	114	1	1	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1546	126	170	1321	1	80	2	124	1	1	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1546	126	170	1322	0	0	82	124	0	2	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	100.2	100.2	18.1	117.0			9.3	9.3		5.3	5.3
Effective Green, g (s)	1.0	102.2	102.2	17.8	119.0			9.0	9.0		5.0	5.0
Actuated g/C Ratio	0.01	0.68	0.68	0.12	0.79			0.06	0.06		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	1090	1079	388	1269			107	92		61	53
v/s Ratio Prot	0.00	c0.97		c0.05	c0.83			0.05			0.00	
v/s Ratio Perm			0.08						c0.08			c0.00
v/c Ratio	0.17	1.42	0.12	0.44	1.04			0.77	1.35		0.03	0.04
Uniform Delay, d1	74.1	23.9	8.3	61.5	15.5			69.5	70.5		70.2	70.2
Progression Factor	1.13	1.45	0.96	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	188.8	0.0	0.6	36.8			26.3	212.4		0.2	0.2
Delay (s)	84.5	223.4	7.9	62.0	52.3			95.8	282.9		70.3	70.4
Level of Service	F	F	A	E	D			F	F		E	E
Approach Delay (s)		207.0			53.4			208.4			70.4	
Approach LOS		F			D			F			E	

Intersection Summary

HCM Average Control Delay	139.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Highway 68 & York Rd.

Background + Project AM - Mitigated
11/14/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1663		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1770	1663		3433	1863	1568
Volume (vph)	253	752	3	2	1156	394	9	2	5	113	1	139
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	275	817	3	2	1257	428	10	2	5	123	1	151
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	275	817	3	2	1257	428	10	7	0	123	1	151
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	22.0	75.0	75.0	0.6	53.4	53.4	1.1	5.0		12.1	15.6	15.6
Effective Green, g (s)	22.2	77.0	77.0	0.6	55.4	55.4	1.3	5.0		12.1	15.8	15.8
Actuated g/C Ratio	0.20	0.70	0.70	0.01	0.50	0.50	0.01	0.05		0.11	0.14	0.14
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	355	1113	1101	10	1601	792	21	75		375	266	224
v/s Ratio Prot	0.16	c0.51		0.00	c0.39		0.01	0.00		c0.04	0.00	
v/s Ratio Perm			0.00			0.27						c0.10
v/c Ratio	0.77	0.73	0.00	0.20	0.79	0.54	0.48	0.09		0.33	0.00	0.67
Uniform Delay, d1	41.9	10.5	5.1	54.8	22.8	18.9	54.4	50.7		45.5	40.7	45.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.3	2.9	0.0	9.6	2.9	1.1	26.6	0.5		0.5	0.0	8.1
Delay (s)	53.1	13.4	5.1	64.5	25.7	20.1	81.0	51.2		46.1	40.7	53.1
Level of Service	D	B	A	E	C	C	F	D		D	D	D
Approach Delay (s)		23.3			24.3			68.7			49.9	
Approach LOS		C			C			E			D	

Intersection Summary

HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Background + Project AM - Mitigated
11/14/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1548	1770	1581			1775	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.74	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1548	1370	1581			1347	1583
Volume (vph)	32	792	46	21	1423	32	51	2	28	29	1	77
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	861	50	23	1547	35	55	2	30	32	1	84
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	35	861	50	23	1547	35	55	32	0	0	33	84
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	1.8	58.7	58.7	1.7	58.6	58.6	9.1	9.1			9.1	9.1
Effective Green, g (s)	1.5	60.7	60.7	1.4	60.6	60.6	9.2	9.2			9.2	9.2
Actuated g/C Ratio	0.02	0.73	0.73	0.02	0.73	0.73	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	32	1166	1154	30	2328	1126	151	175			149	175
v/s Ratio Prot	c0.02	c0.54		0.01	0.48			0.02				
v/s Ratio Perm			0.03			0.02	0.04				0.02	c0.05
v/c Ratio	1.09	0.74	0.04	0.77	0.66	0.03	0.36	0.18			0.22	0.48
Uniform Delay, d1	40.9	6.6	3.2	40.8	6.0	3.2	34.3	33.6			33.8	34.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	188.8	2.7	0.0	72.7	0.8	0.0	1.5	0.5			0.8	2.1
Delay (s)	229.7	9.3	3.2	113.5	6.8	3.2	35.8	34.1			34.5	36.9
Level of Service	F	A	A	F	A	A	D	C			C	D
Approach Delay (s)		17.1			8.2			35.2			36.2	
Approach LOS		B			A			D			D	

Intersection Summary

HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	83.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Background + Project AM - Mitigated
11/14/2006

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1563
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1563
Volume (vph)	723	136	237	1270	206	245
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	786	148	258	1380	224	266
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	786	148	258	1380	224	266
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	19.6	19.6	9.5	32.8	19.6	19.6
Effective Green, g (s)	21.6	21.6	9.2	34.8	19.3	19.3
Actuated g/C Ratio	0.35	0.35	0.15	0.56	0.31	0.31
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1113	551	509	1793	550	486
v/s Ratio Prot	0.25		0.08	c0.43	0.13	
v/s Ratio Perm		0.09				c0.17
v/c Ratio	0.71	0.27	0.51	0.77	0.41	0.55
Uniform Delay, d1	17.5	14.6	24.4	10.6	16.9	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.6	2.0	0.5	1.3
Delay (s)	19.4	14.8	24.9	12.5	17.4	19.0
Level of Service	B	B	C	B	B	B
Approach Delay (s)	18.7			14.5	18.3	
Approach LOS	B			B	B	

Intersection Summary

HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	62.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

5: Highway 68 & Corral de Tierra Rd.

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**
Lane Configurations	↰	↑↑	↱	↰↰	↑↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3400	3200			1757	1583		1783	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3400	3200			1757	1583		1783	1583
Volume (vph)	2	919	56	88	1347	13	160	1	199	8	1	5
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	999	61	96	1464	14	174	1	216	9	1	5
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	999	61	96	1478	0	0	175	216	0	10	5
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.3	94.9	94.9	9.1	102.4			25.3	25.3		3.0	3.0
Effective Green, g (s)	1.3	96.9	96.9	8.8	104.4			25.3	25.3		3.0	3.0
Actuated g/C Ratio	0.01	0.65	0.65	0.06	0.70			0.17	0.17		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	15	2067	1023	199	2227			296	267		36	32
v/s Ratio Prot	0.00	0.31		c0.03	c0.46			0.10			c0.01	
v/s Ratio Perm			0.04						c0.14			0.00
v/c Ratio	0.13	0.48	0.06	0.48	0.66			0.59	0.81		0.28	0.16
Uniform Delay, d1	73.8	13.7	9.8	68.4	12.9			57.6	60.0		72.4	72.3
Progression Factor	1.00	1.00	1.00	0.86	1.72			1.00	1.00		1.00	1.00
Incremental Delay, d2	4.0	0.8	0.1	1.1	1.3			3.1	16.3		4.2	2.3
Delay (s)	77.8	14.5	9.9	60.0	23.4			60.7	76.3		76.6	74.5
Level of Service	E	B	A	E	C			E	E		E	E
Approach Delay (s)		14.3			25.6			69.4			75.9	
Approach LOS		B			C			E			E	

Intersection Summary

HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Background + Project AM - Mitigated
11/14/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1775	1546		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1775	1546		1817	1583
Volume (vph)	1	1059	37	72	1320	1	115	1	149	1	1	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1151	40	78	1435	1	125	1	162	1	1	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1151	40	78	1436	0	0	126	162	0	2	1
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.2	99.3	99.3	8.5	106.6			19.8	19.8		5.3	5.3
Effective Green, g (s)	0.9	101.3	101.3	8.2	108.6			19.5	19.5		5.0	5.0
Actuated g/C Ratio	0.01	0.68	0.68	0.05	0.72			0.13	0.13		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	11	2161	1069	179	2317			231	201		61	53
v/s Ratio Prot	0.00	0.36		c0.02	c0.45			0.07			c0.00	
v/s Ratio Perm			0.03						c0.10			0.00
v/c Ratio	0.09	0.53	0.04	0.44	0.62			0.55	0.81		0.03	0.02
Uniform Delay, d1	74.1	12.3	8.1	68.7	10.4			61.1	63.4		70.2	70.1
Progression Factor	0.81	1.13	1.39	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	3.1	0.8	0.1	1.2	1.3			2.1	20.0		0.2	0.1
Delay (s)	62.8	14.8	11.3	69.9	11.6			63.2	83.4		70.3	70.2
Level of Service	E	B	B	E	B			E	F		E	E
Approach Delay (s)		14.7			14.6			74.5			70.3	
Approach LOS		B			B			E			E	

Intersection Summary

HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1653		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1770	1653		3433	1863	1583
Volume (vph)	109	925	10	7	1200	118	5	1	3	372	3	188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	118	1005	11	8	1304	128	5	1	3	404	3	204
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	118	1005	11	8	1304	128	5	4	0	404	3	204
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	11.3	78.9	78.9	0.6	68.0	68.0	0.6	2.6		19.8	21.4	21.4
Effective Green, g (s)	11.5	80.9	80.9	0.6	70.0	70.0	0.8	2.6		19.8	21.6	21.6
Actuated g/C Ratio	0.10	0.67	0.67	0.01	0.58	0.58	0.01	0.02		0.17	0.18	0.18
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	170	1080	1068	9	1868	924	12	36		567	336	285
v/s Ratio Prot	c0.07	c0.63		0.00	0.41		0.00	0.00		c0.12	0.00	
v/s Ratio Perm			0.01			0.08						c0.13
v/c Ratio	0.69	0.93	0.01	0.89	0.70	0.14	0.42	0.11		0.71	0.01	0.72
Uniform Delay, d1	52.5	17.0	6.4	59.6	17.5	11.3	59.3	57.5		47.4	40.4	46.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.3	14.1	0.0	230.5	1.3	0.1	35.8	1.4		4.2	0.0	8.6
Delay (s)	65.8	31.1	6.4	290.1	18.9	11.4	95.1	58.9		51.6	40.4	54.8
Level of Service	E	C	A	F	B	B	F	E		D	D	D
Approach Delay (s)		34.5			19.7			79.0			52.6	
Approach LOS		C			B			E			D	

Intersection Summary

HCM Average Control Delay	31.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	119.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Background + Project PM - Mitigated
11/14/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	3200	1583	1770	1620			1781	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	3200	1583	1353	1620			1335	1583
Volume (vph)	60	1176	64	13	1182	30	70	5	30	40	4	72
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	1278	70	14	1285	33	76	5	33	43	4	78
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	65	1278	70	14	1285	33	76	38	0	0	47	78
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	8.4	109.2	109.2	1.5	102.3	102.3	11.1	11.1			11.1	11.1
Effective Green, g (s)	8.1	111.2	111.2	1.2	104.3	104.3	11.2	11.2			11.2	11.2
Actuated g/C Ratio	0.06	0.82	0.82	0.01	0.77	0.77	0.08	0.08			0.08	0.08
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	106	1312	1298	16	2461	1218	112	134			110	131
v/s Ratio Prot	c0.04	c0.80		0.01	0.40			0.02				
v/s Ratio Perm			0.04			0.02	c0.06				0.04	0.05
v/c Ratio	0.61	0.97	0.05	0.88	0.52	0.03	0.68	0.28			0.43	0.60
Uniform Delay, d1	62.2	10.9	2.3	67.1	6.0	3.7	60.5	58.4			59.1	60.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	10.1	18.9	0.0	161.3	0.3	0.0	15.1	1.2			2.7	7.1
Delay (s)	72.3	29.8	2.3	228.4	6.3	3.7	75.6	59.6			61.8	67.1
Level of Service	E	C	A	F	A	A	E	E			E	E
Approach Delay (s)		30.4			8.6			70.2			65.1	
Approach LOS		C			A			E			E	

Intersection Summary

HCM Average Control Delay	23.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	135.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Background + Project PM - Mitigated
11/14/2006

Movement	→ EBT	↘ EBR	↙ WBL	← WBT	↖ NBL	↗ NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1562
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1562
Volume (vph)	1105	140	208	1008	217	381
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1201	152	226	1096	236	414
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1201	152	226	1096	236	414
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	45.0	45.0	11.8	60.5	32.0	32.0
Effective Green, g (s)	47.0	47.0	11.5	62.5	31.7	31.7
Actuated g/C Ratio	0.46	0.46	0.11	0.61	0.31	0.31
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1472	728	386	1957	549	484
v/s Ratio Prot	c0.38		0.07	c0.34	0.13	
v/s Ratio Perm		0.10				c0.27
v/c Ratio	0.82	0.21	0.59	0.56	0.43	0.86
Uniform Delay, d1	23.9	16.5	43.1	11.7	28.1	33.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	0.1	1.9	0.3	0.5	13.8
Delay (s)	27.4	16.6	45.0	12.0	28.6	46.9
Level of Service	C	B	D	B	C	D
Approach Delay (s)	26.2			17.7	40.2	
Approach LOS	C			B	D	

Intersection Summary

HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	102.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Background + Project PM - Mitigated
11/14/2006

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3433	3200			1775	1568		1791	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3433	3200			1775	1568		1791	1583
Volume (vph)	1	1365	121	157	1134	7	82	1	161	4	1	4
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	1484	132	171	1233	8	89	1	175	4	1	4
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	1	1484	132	171	1241	0	0	90	175	0	5	4
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.2	95.6	95.6	12.1	106.2			21.9	21.9		2.7	2.7
Effective Green, g (s)	1.2	97.6	97.6	11.8	108.2			21.9	21.9		2.7	2.7
Actuated g/C Ratio	0.01	0.65	0.65	0.08	0.72			0.15	0.15		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	14	2082	1030	270	2308			259	229		32	28
v/s Ratio Prot	0.00	c0.46		c0.05	0.39			0.05			c0.00	
v/s Ratio Perm			0.08						c0.11			0.00
v/c Ratio	0.07	0.71	0.13	0.63	0.54			0.35	0.76		0.16	0.14
Uniform Delay, d1	73.8	17.1	10.0	67.0	9.5			57.6	61.6		72.5	72.5
Progression Factor	1.00	1.00	1.00	1.13	0.65			1.00	1.00		1.00	1.00
Incremental Delay, d2	2.2	2.1	0.3	3.6	0.8			0.8	14.0		2.3	2.3
Delay (s)	76.0	19.2	10.2	79.5	6.9			58.4	75.6		74.8	74.9
Level of Service	E	B	B	E	A			E	E		E	E
Approach Delay (s)		18.5			15.7			69.8			74.8	
Approach LOS		B			B			E			E	

Intersection Summary

HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1776	1544		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1776	1544		1817	1583
Volume (vph)	2	1422	116	156	1215	1	74	2	114	1	1	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1546	126	170	1321	1	80	2	124	1	1	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1546	126	170	1322	0	0	82	124	0	2	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	99.2	99.2	12.8	110.7			15.6	15.6		5.3	5.3
Effective Green, g (s)	1.0	101.2	101.2	12.5	112.7			15.3	15.3		5.0	5.0
Actuated g/C Ratio	0.01	0.67	0.67	0.08	0.75			0.10	0.10		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	2159	1068	273	2404			181	157		61	53
v/s Ratio Prot	0.00	c0.48		c0.05	0.41			0.05			0.00	
v/s Ratio Perm			0.08						c0.08			c0.00
v/c Ratio	0.17	0.72	0.12	0.62	0.55			0.45	0.79		0.03	0.04
Uniform Delay, d1	74.1	15.4	8.6	66.5	7.9			63.4	65.8		70.2	70.2
Progression Factor	1.16	1.59	1.13	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	4.6	1.5	0.2	3.8	0.9			1.3	22.0		0.2	0.2
Delay (s)	90.5	25.9	9.9	70.3	8.8			64.7	87.7		70.3	70.4
Level of Service	F	C	A	E	A			E	F		E	E
Approach Delay (s)		24.7			15.8			78.6			70.4	
Approach LOS		C			B			E			E	

Intersection Summary

HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

TRIP GENERATION FOR CUMULATIVE PROJECTS

PROJECT	SIZE	DAILY TRIP RATE	DAILY TRIPS	AM PEAK HOUR				PM PEAK HOUR			
				PEAK HOUR VOL.	(% OF DAILY)	IN	OUT	PEAK HOUR VOL.	(% OF DAILY)	IN	OUT
City of Marina:											
1. K-8 School	850 Students		1,377	451	(33%)	248	203	128	(9%)	66	62
2. MBEST [2]	- -	-	16,894	1,155	(7%)	902	253	1,813	(11%)	603	1,210
3. CSUMB Students (2010-2025)[3]	6,389 Students	-	10,476	924	(9%)	739	185	924	(9%)	277	647
4. University Villages[4]											
Phases 2, 3, and Opportunity Phases	- -	-	66,345	4,328	(7%)	2,918	1,410	6,578	(10%)	2,858	3,720
5. Marina Station[5]	- -	-	25,837	2,276	(9%)	1,201	1,075	2,605	(10%)	1,179	1,426
City of Seaside:											
6. Ord Military Housing											
Seaside Development Area	- -	-	9,185	258	(3%)	133	125	839	(9%)	416	423
7. Main Gate Shopping Center	650,000 S.F.	-	25,897	538	(2%)	328	210	2,437	(9%)	1,170	1,267
8. East of Gen. Jim Moore Bl. Housing	1,800 Units[6]	9.57	17,226	1,350	(8%)	338	1,012	1,818	(11%)	1,182	636
9. Former First Tee Site (Golf Course)[7]	- -	-	1,028	43	(4%)	32	11	79	(8%)	29	50
10. Del Monte Hotel	98 Rooms	8.23	807	51	(5%)	28	23	60	(6%)	35	25
11. Seaside Auto Center Redevelopment[8]	- -	- -		-	-	-		-	-	-	
12. Plaza de Espritu (Commercial/Retail)[9]	4,709 S.F.	44.32	209	6	(3%)	4	2	13	(6%)	6	7
13. Laguna Grande Plaza (Commercial/Retail)[9]	6,941 S.F.	44.32	308	9	(3%)	5	4	19	(6%)	8	11
14. Diaz Restaurants	2,000 S.F.	127.15	254	23	(9%)	12	11	22	(9%)	13	9
15. Ahmed Ali Retail Store	6,464 S.F.	44.32	286	9	(3%)	5	4	18	(6%)	8	10
City of Sand City:											
16. Monterey Bay Shores Hotel	100 Rooms[11]	8.23	823	52	(3%)	29	23	61	(6%)	35	26
17. Collections on Monterey Bay	100 Rooms[11]	8.23	823	52	(15%)	29	23	61	(17%)	35	26
18. South of Tioga (The Orosco Group)[12]											
Apartments	30 Units	6.72	202	15	(7%)	3	12	19	(9%)	12	7
Commercial/Retail	20,000 S.F.	44.32	886	27	(3%)	16	11	54	(6%)	24	30
Office	20,000 S.F.	11.01	220	31	(14%)	27	4	30	(14%)	5	25
City of Del Rey Oaks:											
19. The Resort at Del Rey Oaks	- -	-	12,897	879	(7%)	694	185	1,001	(8%)	308	693
City of Monterey											
20. Ryan Ranch Business Park											
101 Wilson Road (Medical Offices)[13]	26,453 S.F.	-	867	66	(8%)	52	14	91	(10%)	25	66
1 Swain Court (Office/Indust. Research)	127,412 S.F.	11.01	1,403	197	(14%)	173	24	190	(14%)	32	158
21. 2711 Garden Road (Office)	23,080 S.F.	11.01	254	36	(14%)	32	4	34	(13%)	6	28
Unincorporated Monterey County:											
22. East Garrison [14]	- -	-	12,392	865	(7%)	112	753	1,130	(9%)	717	413
23. Monterey Airport Expansion (Project 2)[15]	355,000 S.F.	-	1,082	154	(14%)	115	39	185	(17%)	62	123
24. Monterey Horse Park [16]	- -	-	1,507	151	(10%)	132	19	204	(14%)	20	184
25. MRWMD Master Plan Update	- -	-	1,932	180	(9%)	114	66	210	(11%)	60	150
26. Corral De Tierra Shopping Center[17]	Mixed Use	-	5,100	95	(2%)	63	32	235	(5%)	108	127
27. Wang Subdivision[18]											
Single-Family Homes	23 Units	9.57	220	17	(8%)	4	13	23	(10%)	14	9
Inclusionary Housing	6 Units	5.86	35	3	(9%)	1	2	3	(9%)	2	1
28. Ferrini Ranch											
Single-Family Homes	212 Units	9.57	2,029	159	(8%)	40	119	213	(10%)	137	76
Wine Tasting [19]	15,000 S.F.	-	665	0	(0%)	0	0	57	(9%)	36	21
29. Laguna Seca Villas (Condominiums)[20]	104 Units	-	664	53	(8%)	9	44	62	(9%)	42	20
Carmel Valley:											
30. September Ranch	110 Units	9.57	1,053	83	(8%)	21	62	111	(11%)	70	41
31. Rancho Canada	281 Units	9.57	2,689	211	(8%)	53	158	284	(11%)	179	105
TOTAL CUMULATIVE PROJECTS			223,871	14,747	(7%)	8,612	6,135	21,611	(10%)	9,779	11,832

Notes:

1. Traffic volumes are based on trip generation rates quoted by the Institute of Transportation Engineers *Trip Generation*, 6th Edition, 1997, and 7th Edition, 2003, unless otherwise noted.
2. *Unversity of California Monterey Bay Education, Science and Technology Center (UCMBEST Center) Traffic Analysis Repo*, Higgins Associates, October 31, 2003. Assumes 25% of project is built out by year 2010, with remaining 75% built out over the following 15-20 years.
3. Trip generation from *California State University at Monterey Bay (CSUMB) 2004 Master Plan Update Traffic Impact Study Repo*, Higgins Associates, July 26, 2004.
4. Trip generation from *Marina University Villages Mixed Use Development Traffic Impact Study Repor*, Higgins Associates, December 17, 2004.
5. Trip generation for Marina Station from *Marina Station Traffic Impact Analysis*, Higgins Associates, December 6, 2006. Project includes residential, commercial, office, and industrial uses.
6. Number of units for this project are unknown; number used here is estimate based upon City of Seaside's maximum housing density for this land use (8 units/acre).
7. Trip generation from *The First Tee Traffic Analysis Study*, Higgins Associates, July 2002.
8. Seaside Auto Center Redevelopment would only reconfigure the access roadways to the auto center, and reconstruct the internal roadways.
9. ITE does not provide AM peak hour trip rates for the "specialty retail" land use. Rates used here are published by San Diego Association of Governments, *Brief Guilde of Vehicular Traffic Generation Rates for the San Diego Regio*, July 1998.
10. Although project has been approved by the City of Sand City, its construction has been halted by the California Coastal Commission; therefore, its construction timeline is unknown. For that reason, this project is analyzed as a cumulative project.
11. Exact size of projects unknown. Analysis assumes 100 hotel rooms.
12. City of Sand City anticipating application submittal in near future, but uncertain of exact project definition. Analysis assumes project identical to "Design Center" (Approved project #28 -- see *Exhibit 6A*).
13. Daily and PM peak hour trip generation based upon fitted curve equations, rather than any specific trip generation rates.
14. Full buildout of East Garrison development will not occur until 2030. Fifty percent of the development is assumed to be constructed by the year 2015. Trip generation represents trips external to the development itself.
15. Trip generation from *Airport Road Extension & Monterey Peninsula Airport North-side Development Project Traffic Impact Study Report*, Higgins Associates, January 28, 2005.
16. Letter to D. Munn, *Monterey Horse Park, Monterey County, California - Estimated Trip Generation of Proposed New Facilit*, Higgins Associates, January 14, 2004.
17. AM and PM peak hour trip generation from *Corral De Tierra Mixed Use Devlopment Final Traffic Repor*, Hexagon Transportation Consultants, April 8, 2005. Daily trip generation estimated, based upon trip generation assumptions utilized in peak hour trip generation derivation in said report.
18. Trip generation from *Wang Subdivision Traffic Impact Analysis*, Higgins Associates, December 21, 2005.
19. Wine tasting facility not anticipated to be open during the AM peak hour.
20. Daily, AM peak hour, and PM peak hour trip generation for the Laguna Seca Villas project taken from Laguna Seca Villas Initial Study, Monterey County Planning and Building Inspection Department, March 2006. Inbound and outbound distributions derived from ITE *Trip Generation* (Source #1), above.

Appendix H

Intersection Level of Service Calculation Worksheets

Cumulative Conditions

HCM Signalized Intersection Capacity Analysis
1: Highway 68 & Hwy 218

Cumulative AM
1/26/2007

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1568	1770	1670		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1568	1770	1670		3433	1863	1583
Volume (vph)	188	1266	13	18	1130	425	16	12	27	415	25	276
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	1376	14	20	1228	462	17	13	29	451	27	300
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	204	1390	0	20	1228	462	17	42	0	451	27	300
Heavy Vehicles (%)	2%	2%	2%	2%	4%	3%	2%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	7.9	38.9		0.7	31.7	49.5	2.2	2.2		17.8	17.8	17.8
Effective Green, g (s)	8.1	40.9		0.9	33.7	52.8	2.4	2.4		19.1	19.1	19.1
Actuated g/C Ratio	0.10	0.52		0.01	0.42	0.67	0.03	0.03		0.24	0.24	0.24
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	181	1650		20	1360	1123	54	51		827	449	381
v/s Ratio Prot	c0.12	c0.43		0.01	0.38	0.10	0.01	c0.03		0.13	0.01	
v/s Ratio Perm						0.20						c0.19
v/c Ratio	1.13	0.84		1.00	0.90	0.41	0.31	0.82		0.55	0.06	0.79
Uniform Delay, d1	35.6	16.4		39.2	21.3	6.1	37.6	38.2		26.3	23.2	28.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	105.2	4.0		201.2	8.6	0.2	1.2	62.4		0.6	0.0	10.0
Delay (s)	140.8	20.5		240.4	29.9	6.3	38.9	100.6		26.9	23.2	38.2
Level of Service	F	C		F	C	A	D	F		C	C	D
Approach Delay (s)		35.9			26.0			82.8			31.1	
Approach LOS		D			C			F			C	

Intersection Summary

HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	79.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1737		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1737		3433	1863	1568
Volume (vph)	340	699	4	3	1214	564	13	10	8	252	2	171
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	370	760	4	3	1320	613	14	11	9	274	2	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	370	760	4	3	1320	613	14	20	0	274	2	186
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	20.8	104.9	104.9	6.4	90.3	90.3	1.5	8.7		12.3	19.1	19.1
Effective Green, g (s)	21.0	106.9	106.9	6.4	92.3	92.3	1.7	8.7		12.3	19.3	19.3
Actuated g/C Ratio	0.14	0.71	0.71	0.04	0.61	0.61	0.01	0.06		0.08	0.13	0.13
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	247	1138	1126	75	983	972	20	101		281	239	201
v/s Ratio Prot	c0.21	0.47		0.00	c0.82		0.01	0.01		c0.08	0.00	
v/s Ratio Perm			0.00			0.39						c0.12
v/c Ratio	1.50	0.67	0.00	0.04	1.34	0.63	0.70	0.20		0.98	0.01	0.93
Uniform Delay, d1	64.7	11.9	6.3	69.0	29.0	18.3	74.0	67.5		68.8	57.2	64.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	244.2	1.8	0.0	0.2	161.1	1.7	80.1	1.0		46.4	0.0	43.2
Delay (s)	308.9	13.7	6.3	69.2	190.1	19.9	154.2	68.4		115.3	57.2	107.9
Level of Service	F	B	A	E	F	B	F	E		F	E	F
Approach Delay (s)		110.0			136.1			103.7			112.1	
Approach LOS		F			F			F			F	

Intersection Summary

HCM Average Control Delay	124.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	150.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Cumulative AM
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1545	1770	1562			1772	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.72	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1545	1367	1562			1329	1583
Volume (vph)	39	864	56	26	1634	55	64	2	37	32	1	83
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	939	61	28	1776	60	70	2	40	35	1	90
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	42	939	61	28	1776	60	70	42	0	0	36	90
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	4.0	109.0	109.0	3.8	108.8	108.8	13.1	13.1			13.1	13.1
Effective Green, g (s)	3.7	111.0	111.0	3.5	110.8	110.8	13.2	13.2			13.2	13.2
Actuated g/C Ratio	0.03	0.79	0.79	0.03	0.79	0.79	0.09	0.09			0.09	0.09
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	47	1271	1258	44	1269	1225	129	148			126	150
v/s Ratio Prot	c0.02	0.59		0.02	c1.11			0.03				
v/s Ratio Perm			0.04			0.04	0.05				0.03	c0.06
v/c Ratio	0.89	0.74	0.05	0.64	1.40	0.05	0.54	0.28			0.29	0.60
Uniform Delay, d1	67.8	7.1	3.1	67.5	14.4	3.1	60.4	58.9			58.9	60.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	91.2	2.4	0.0	26.4	184.6	0.0	4.6	1.1			1.3	6.3
Delay (s)	159.0	9.6	3.1	93.9	199.1	3.1	65.0	59.9			60.1	67.0
Level of Service	F	A	A	F	F	A	E	E			E	E
Approach Delay (s)		15.2			191.2			63.1			65.1	
Approach LOS		B			F			E			E	

Intersection Summary

HCM Average Control Delay	123.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	139.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Cumulative AM
1/26/2007

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	760	173	296	1453	262	302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	826	188	322	1579	285	328
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	826	188	322	1579	285	328
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	74.9	74.9	12.4	91.0	19.3	19.3
Effective Green, g (s)	76.9	76.9	12.1	93.0	19.0	19.0
Actuated g/C Ratio	0.64	0.64	0.10	0.78	0.16	0.16
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1025	1014	346	1240	280	245
v/s Ratio Prot	0.52		0.09	c0.99	0.16	
v/s Ratio Perm		0.12				c0.21
v/c Ratio	0.81	0.19	0.93	1.27	1.02	1.34
Uniform Delay, d1	16.0	8.8	53.5	13.5	50.5	50.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	0.1	31.1	129.4	58.4	177.4
Delay (s)	20.6	8.8	84.6	142.9	108.9	227.9
Level of Service	C	A	F	F	F	F
Approach Delay (s)	18.4			133.1	172.6	
Approach LOS	B			F	F	

Intersection Summary

HCM Average Control Delay	107.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Cumulative AM
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3400	1600			1758	1583		1785	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3400	1600			1758	1583		1785	1583
Volume (vph)	6	954	102	169	1512	19	229	2	286	12	2	8
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	1037	111	184	1643	21	249	2	311	13	2	9
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	7	1037	111	184	1664	0	0	251	311	0	15	9
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	1.0	88.6	88.6	6.1	93.4			33.1	33.1		4.5	4.5
Effective Green, g (s)	1.0	90.6	90.6	5.8	95.4			33.1	33.1		4.5	4.5
Actuated g/C Ratio	0.01	0.60	0.60	0.04	0.64			0.22	0.22		0.03	0.03
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	12	966	956	131	1018			388	349		54	47
v/s Ratio Prot	0.00	0.65		c0.05	c1.04			0.14			c0.01	
v/s Ratio Perm			0.07						c0.20			0.01
v/c Ratio	0.58	1.07	0.12	1.40	1.63			0.65	0.89		0.28	0.19
Uniform Delay, d1	74.3	29.7	12.6	72.1	27.3			53.1	56.7		71.2	71.0
Progression Factor	1.00	1.00	1.00	0.98	1.30			1.00	1.00		1.00	1.00
Incremental Delay, d2	56.2	50.8	0.2	186.3	286.0			3.7	23.5		2.8	2.0
Delay (s)	130.5	80.5	12.9	256.9	321.4			56.8	80.2		74.0	73.0
Level of Service	F	F	B	F	F			E	F		E	E
Approach Delay (s)		74.3			315.0			69.8			73.6	
Approach LOS		E			F			E			E	

Intersection Summary

HCM Average Control Delay	197.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Cumulative AM
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1775	1542		1817	1583
Volume (vph)	2	1208	42	77	1567	2	131	2	178	2	2	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1313	46	84	1703	2	142	2	193	2	2	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1313	46	84	1705	0	0	144	193	0	4	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	103.8	103.8	11.4	113.9			12.3	12.3		5.4	5.4
Effective Green, g (s)	1.0	105.8	105.8	11.1	115.9			12.0	12.0		5.1	5.1
Actuated g/C Ratio	0.01	0.71	0.71	0.07	0.77			0.08	0.08		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	1129	1117	242	1236			142	123		62	54
v/s Ratio Prot	0.00	0.82		c0.03	c1.07			0.08			c0.00	
v/s Ratio Perm			0.03						c0.13			0.00
v/c Ratio	0.17	1.16	0.04	0.35	1.38			1.01	1.57		0.06	0.04
Uniform Delay, d1	74.1	22.1	6.7	66.0	17.0			69.0	69.0		70.1	70.1
Progression Factor	0.90	1.17	1.25	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	74.3	0.0	0.6	175.9			79.3	291.5		0.3	0.2
Delay (s)	67.3	100.3	8.4	66.6	192.9			148.3	360.5		70.5	70.3
Level of Service	E	F	A	E	F			F	F		E	E
Approach Delay (s)		97.1			187.0			269.8			70.4	
Approach LOS		F			F			F			E	

Intersection Summary

HCM Average Control Delay	159.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Highway 68 & Hwy 218

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3200		1770	3200	1560	1656	1682		3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3200		1770	3200	1560	1656	1682		3433	1863	1583
Volume (vph)	292	1060	15	30	1460	567	19	30	42	313	20	228
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	317	1152	16	33	1587	616	21	33	46	340	22	248
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	317	1168	0	33	1587	616	21	79	0	340	22	248
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	9%	2%	2%	2%	2%	2%
Turn Type	Prot			Prot		pm+ov	Split			Split		Perm
Protected Phases	5	2		1	6	7	8	8		7	7	
Permitted Phases						6						7
Actuated Green, G (s)	8.8	42.1		2.1	35.4	52.6	4.0	4.0		17.2	17.2	17.2
Effective Green, g (s)	9.0	44.1		2.3	37.4	55.9	4.2	4.2		18.5	18.5	18.5
Actuated g/C Ratio	0.11	0.52		0.03	0.44	0.66	0.05	0.05		0.22	0.22	0.22
Clearance Time (s)	4.2	6.0		4.2	6.0	5.3	4.2	4.2		5.3	5.3	5.3
Vehicle Extension (s)	2.5	2.5		3.0	2.5	2.5	2.0	2.0		2.5	2.5	2.5
Lane Grp Cap (vph)	187	1658		48	1406	1098	82	83		746	405	344
v/s Ratio Prot	c0.18	0.36		0.02	c0.50	0.12	0.01	c0.05		0.10	0.01	
v/s Ratio Perm						0.27						c0.16
v/c Ratio	1.70	0.70		0.69	1.13	0.56	0.26	0.95		0.46	0.05	0.72
Uniform Delay, d1	38.0	15.6		41.0	23.8	7.9	38.9	40.3		28.9	26.4	30.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	334.8	1.3		33.8	67.6	0.5	0.6	81.7		0.3	0.0	6.8
Delay (s)	372.8	16.8		74.8	91.4	8.5	39.5	122.1		29.2	26.4	37.7
Level of Service	F	B		E	F	A	D	F		C	C	D
Approach Delay (s)		92.8			68.3			104.7			32.6	
Approach LOS		F			E			F			C	

Intersection Summary

HCM Average Control Delay	72.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	85.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1723		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1770	1723		3433	1863	1583
Volume (vph)	122	1084	12	10	1234	241	7	5	5	490	5	230
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	1178	13	11	1341	262	8	5	5	533	5	250
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	133	1178	13	11	1341	262	8	10	0	533	5	250
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	7.8	103.9	103.9	1.6	97.5	97.5	0.8	3.2		22.4	24.4	24.4
Effective Green, g (s)	8.0	105.9	105.9	1.6	99.5	99.5	1.0	3.2		22.4	24.6	24.6
Actuated g/C Ratio	0.05	0.71	0.71	0.01	0.67	0.67	0.01	0.02		0.15	0.16	0.16
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	95	1136	1124	19	1068	1056	12	37		516	307	261
v/s Ratio Prot	c0.08	0.74		0.01	c0.84		0.00	0.01		c0.16	0.00	
v/s Ratio Perm			0.01			0.17						c0.16
v/c Ratio	1.40	1.04	0.01	0.58	1.26	0.25	0.67	0.27		1.03	0.02	0.96
Uniform Delay, d1	70.5	21.6	6.3	73.4	24.8	9.9	73.9	71.8		63.3	52.1	61.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	231.6	36.8	0.0	36.3	122.8	0.2	102.1	3.9		48.4	0.0	43.9
Delay (s)	302.1	58.4	6.3	109.7	147.6	10.1	176.0	75.7		111.7	52.1	105.7
Level of Service	F	E	A	F	F	B	F	E		F	D	F
Approach Delay (s)		82.3			125.0			120.3			109.4	
Approach LOS		F			F			F			F	

Intersection Summary

HCM Average Control Delay	106.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	149.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Highway 68 & Pasadera Dr.

Cumulative PM
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	1600	1583	1770	1600	1583	1770	1625			1782	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00			0.71	1.00
Satd. Flow (perm)	1770	1600	1583	1770	1600	1583	1346	1625			1331	1583
Volume (vph)	66	1435	78	23	1321	34	86	6	37	44	5	78
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	1560	85	25	1436	37	93	7	40	48	5	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	72	1560	85	25	1436	37	93	47	0	0	53	85
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	5.3	110.5	110.5	2.3	107.5	107.5	14.8	14.8			14.8	14.8
Effective Green, g (s)	5.0	112.5	112.5	2.0	109.5	109.5	14.9	14.9			14.9	14.9
Actuated g/C Ratio	0.04	0.80	0.80	0.01	0.77	0.77	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	63	1273	1259	25	1239	1226	142	171			140	167
v/s Ratio Prot	c0.04	c0.97		0.01	0.90			0.03				
v/s Ratio Perm			0.05			0.02	c0.07				0.04	0.05
v/c Ratio	1.14	1.23	0.07	1.00	1.16	0.03	0.65	0.27			0.38	0.51
Uniform Delay, d1	68.2	14.5	3.1	69.7	16.0	3.7	60.8	58.3			58.9	59.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	157.6	108.6	0.0	180.0	80.9	0.0	10.4	0.9			1.7	2.4
Delay (s)	225.8	123.1	3.2	249.7	96.9	3.7	71.2	59.1			60.6	62.2
Level of Service	F	F	A	F	F	A	E	E			E	E
Approach Delay (s)		121.4			97.1			67.1			61.6	
Approach LOS		F			F			E			E	

Intersection Summary

HCM Average Control Delay	106.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	141.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰↰	↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1600	1583	3433	1600	1770	1546
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1600	1583	3433	1600	1770	1546
Volume (vph)	1338	178	245	1102	276	465
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1454	193	266	1198	300	505
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1454	193	266	1198	300	505
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			Perm
Protected Phases	2		1	6	8	
Permitted Phases		2				8
Actuated Green, G (s)	86.0	86.0	8.3	98.0	32.3	32.3
Effective Green, g (s)	88.0	88.0	8.0	100.0	32.0	32.0
Actuated g/C Ratio	0.63	0.63	0.06	0.71	0.23	0.23
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	3.0
Lane Grp Cap (vph)	1006	995	196	1143	405	353
v/s Ratio Prot	c0.91		c0.08	0.75	0.17	
v/s Ratio Perm		0.12				c0.33
v/c Ratio	1.45	0.19	1.36	1.05	0.74	1.43
Uniform Delay, d1	26.0	11.0	66.0	20.0	50.1	54.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	206.0	0.1	190.2	40.2	7.1	209.4
Delay (s)	232.0	11.1	256.2	60.2	57.3	263.4
Level of Service	F	B	F	E	E	F
Approach Delay (s)	206.2			95.8	186.6	
Approach LOS	F			F	F	

Intersection Summary

HCM Average Control Delay	160.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.44		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	1600	1583	3433	1600			1775	1568		1793	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	1600	1583	3433	1600			1775	1568		1793	1583
Volume (vph)	3	1572	228	301	1187	10	154	2	311	6	2	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	1709	248	327	1290	11	167	2	338	7	2	7
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	1709	248	327	1301	0	0	169	338	0	9	7
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	92.6	92.6	5.3	96.8			31.5	31.5		2.9	2.9
Effective Green, g (s)	0.8	94.6	94.6	5.0	98.8			31.5	31.5		2.9	2.9
Actuated g/C Ratio	0.01	0.63	0.63	0.03	0.66			0.21	0.21		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	9	1009	998	114	1054			373	329		35	31
v/s Ratio Prot	0.00	c1.07		c0.10	0.81			0.10			c0.01	
v/s Ratio Perm			0.16						c0.22			0.00
v/c Ratio	0.33	1.69	0.25	2.87	1.23			0.45	1.03		0.26	0.23
Uniform Delay, d1	74.3	27.7	12.1	72.5	25.6			51.7	59.2		72.5	72.4
Progression Factor	1.00	1.00	1.00	1.03	0.78			1.00	1.00		1.00	1.00
Incremental Delay, d2	20.6	316.5	0.6	843.0	106.3			0.9	56.8		3.9	3.7
Delay (s)	94.9	344.2	12.7	917.8	126.2			52.6	116.1		76.4	76.1
Level of Service	F	F	B	F	F			D	F		E	E
Approach Delay (s)		301.9			285.2			94.9			76.3	
Approach LOS		F			F			F			E	

Intersection Summary

HCM Average Control Delay	268.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.55		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	116.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Cumulative PM
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.97		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	1600	1583	3273	1600			1777	1539		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	1600	1583	3273	1600			1777	1539		1817	1583
Volume (vph)	3	1756	130	160	1410	2	85	3	123	2	2	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	1909	141	174	1533	2	92	3	134	2	2	3
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	1909	141	174	1535	0	0	95	134	0	4	3
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	100.4	100.4	17.8	116.9			9.3	9.3		5.4	5.4
Effective Green, g (s)	1.0	102.4	102.4	17.5	118.9			9.0	9.0		5.1	5.1
Actuated g/C Ratio	0.01	0.68	0.68	0.12	0.79			0.06	0.06		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	1092	1081	382	1268			107	92		62	54
v/s Ratio Prot	0.00	c1.19		c0.05	c0.96			0.05			c0.00	
v/s Ratio Perm			0.09						c0.09			0.00
v/c Ratio	0.25	1.75	0.13	0.46	1.21			0.89	1.46		0.06	0.06
Uniform Delay, d1	74.1	23.8	8.3	61.8	15.5			70.0	70.5		70.1	70.1
Progression Factor	1.11	1.21	0.84	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	337.0	0.0	0.6	102.3			52.5	255.6		0.3	0.3
Delay (s)	83.1	365.9	7.0	62.4	117.9			122.5	326.1		70.5	70.4
Level of Service	F	F	A	E	F			F	F		E	E
Approach Delay (s)		340.9			112.2			241.6			70.4	
Approach LOS		F			F			F			E	

Intersection Summary

HCM Average Control Delay	237.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.62		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	113.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Highway 68 & Hwy 218

Cumulative AM - Mitigated
1/26/2007

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3200	1583	1770	3200	1568	1770	1863	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3200	1583	1770	3200	1568	1770	1863	1583	3433	1863	1583
Volume (vph)	188	1266	13	18	1130	425	16	12	27	415	25	276
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	1376	14	20	1228	462	17	13	29	451	27	300
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	204	1376	14	20	1228	462	17	13	29	451	27	300
Heavy Vehicles (%)	2%	2%	2%	2%	4%	3%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot		pm+ov	Split		Perm	Split		pm+ov
Protected Phases	5	2		1	6	7	8	8		7	7	5
Permitted Phases			2			6			8			7
Actuated Green, G (s)	6.9	39.4	39.4	0.7	33.2	47.3	2.1	2.1	2.1	14.1	14.1	21.0
Effective Green, g (s)	7.1	41.4	41.4	0.9	35.2	50.6	2.3	2.3	2.3	15.4	15.4	22.5
Actuated g/C Ratio	0.09	0.54	0.54	0.01	0.46	0.67	0.03	0.03	0.03	0.20	0.20	0.30
Clearance Time (s)	4.2	6.0	6.0	4.2	6.0	5.3	4.2	4.2	4.2	5.3	5.3	4.2
Vehicle Extension (s)	2.5	2.5	2.5	3.0	2.5	2.5	2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	321	1743	862	21	1482	1126	54	56	48	696	378	469
v/s Ratio Prot	0.06	c0.43		0.01	0.38	0.08	0.01	0.01		c0.13	0.01	c0.06
v/s Ratio Perm			0.01			0.21			c0.02			0.13
v/c Ratio	0.64	0.79	0.02	0.95	0.83	0.41	0.31	0.23	0.60	0.65	0.07	0.64
Uniform Delay, d1	33.2	13.8	7.9	37.5	17.8	5.8	36.1	36.0	36.4	27.8	24.5	23.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	2.4	0.0	173.4	3.9	0.2	1.2	0.8	13.8	1.8	0.1	2.5
Delay (s)	36.8	16.2	8.0	211.0	21.7	6.0	37.3	36.8	50.2	29.7	24.6	25.7
Level of Service	D	B	A	F	C	A	D	D	D	C	C	C
Approach Delay (s)		18.8			19.6			43.5			28.0	
Approach LOS		B			B			D			C	

Intersection Summary

HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	76.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑	↱	↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3200	1583	1770	3200	1583	1770	1737		3433	1863	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3200	1583	1770	3200	1583	1770	1737		3433	1863	1568
Volume (vph)	340	699	4	3	1214	564	13	10	8	252	2	171
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	370	760	4	3	1320	613	14	11	9	274	2	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	370	760	4	3	1320	613	14	20	0	274	2	186
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	10.9	48.8	48.8	2.7	40.4	40.4	0.7	5.1		10.6	14.6	14.6
Effective Green, g (s)	11.1	50.8	50.8	2.7	42.4	42.4	0.9	5.1		10.6	14.8	14.8
Actuated g/C Ratio	0.13	0.60	0.60	0.03	0.50	0.50	0.01	0.06		0.12	0.17	0.17
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	447	1908	944	56	1592	788	19	104		427	324	272
v/s Ratio Prot	c0.11	0.24		0.00	c0.41		0.01	0.01		c0.08	0.00	
v/s Ratio Perm			0.00			0.39						c0.12
v/c Ratio	0.83	0.40	0.00	0.05	0.83	0.78	0.74	0.19		0.64	0.01	0.68
Uniform Delay, d1	36.1	9.1	7.0	40.0	18.3	17.5	42.0	38.1		35.5	29.1	33.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.0	0.2	0.0	0.4	4.1	5.4	96.7	0.9		3.3	0.0	7.2
Delay (s)	49.1	9.3	7.0	40.4	22.4	23.0	138.7	39.0		38.8	29.1	40.2
Level of Service	D	A	A	D	C	C	F	D		D	C	D
Approach Delay (s)		22.3			22.6			80.1			39.3	
Approach LOS		C			C			F			D	

Intersection Summary

HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	85.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↱			↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	3200	1583	1770	3200	1547	1770	1577			1775	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.73	1.00			0.71	1.00
Satd. Flow (perm)	1770	3200	1583	1770	3200	1547	1367	1577			1326	1583
Volume (vph)	39	864	56	26	1634	55	64	2	37	32	1	83
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	939	61	28	1776	60	70	2	40	35	1	90
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	42	939	61	28	1776	60	70	42	0	0	36	90
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	2.6	60.2	60.2	2.6	60.2	60.2	9.4	9.4			9.4	9.4
Effective Green, g (s)	2.3	62.2	62.2	2.3	62.2	62.2	9.5	9.5			9.5	9.5
Actuated g/C Ratio	0.03	0.72	0.72	0.03	0.72	0.72	0.11	0.11			0.11	0.11
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	47	2314	1145	47	2314	1119	151	174			146	175
v/s Ratio Prot	c0.02	0.29		0.02	c0.56			0.03				
v/s Ratio Perm			0.04			0.04	0.05				0.03	c0.06
v/c Ratio	0.89	0.41	0.05	0.60	0.77	0.05	0.46	0.24			0.25	0.51
Uniform Delay, d1	41.7	4.7	3.4	41.4	7.4	3.4	35.9	35.0			35.0	36.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	91.2	0.2	0.0	18.6	1.7	0.0	2.2	0.7			0.9	2.5
Delay (s)	133.0	4.8	3.5	60.0	9.1	3.5	38.1	35.7			35.9	38.6
Level of Service	F	A	A	E	A	A	D	D			D	D
Approach Delay (s)		9.9			9.7			37.2			37.8	
Approach LOS		A			A			D			D	

Intersection Summary

HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

Cumulative AM - Mitigated
1/26/2007

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1573
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1573
Volume (vph)	760	173	296	1453	262	302
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	826	188	322	1579	285	328
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	826	188	322	1579	285	328
Confl. Peds. (#/hr)			1		1	1
Turn Type		Perm	Prot			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	22.4	22.4	11.9	38.0	12.5	24.4
Effective Green, g (s)	24.4	24.4	11.6	40.0	12.2	23.8
Actuated g/C Ratio	0.41	0.41	0.19	0.66	0.20	0.40
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	2.5
Lane Grp Cap (vph)	1297	642	662	2126	359	726
v/s Ratio Prot	0.26		0.09	c0.49	c0.16	0.09
v/s Ratio Perm		0.12				0.12
v/c Ratio	0.64	0.29	0.49	0.74	0.79	0.45
Uniform Delay, d1	14.3	12.1	21.6	6.7	22.8	13.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.2	0.4	1.4	11.4	0.3
Delay (s)	15.3	12.3	22.1	8.1	34.3	13.7
Level of Service	B	B	C	A	C	B
Approach Delay (s)	14.7			10.4	23.3	
Approach LOS	B			B	C	

Intersection Summary

HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3400	3200			1758	1583		1785	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3400	3200			1758	1583		1785	1583
Volume (vph)	6	954	102	169	1512	19	229	2	286	12	2	8
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	1037	111	184	1643	21	249	2	311	13	2	9
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	7	1037	111	184	1664	0	0	251	311	0	15	9
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	3%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	88.4	88.4	12.5	99.8			26.9	39.4		4.5	4.5
Effective Green, g (s)	0.8	90.4	90.4	12.2	101.8			26.9	39.1		4.5	4.5
Actuated g/C Ratio	0.01	0.60	0.60	0.08	0.68			0.18	0.26		0.03	0.03
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	3.7		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	2.5		3.0	3.0
Lane Grp Cap (vph)	9	1929	954	277	2172			315	455		54	47
v/s Ratio Prot	0.00	0.32		0.05	c0.52			c0.14	c0.06		c0.01	
v/s Ratio Perm			0.07						0.14			0.01
v/c Ratio	0.78	0.54	0.12	0.66	0.77			0.80	0.68		0.28	0.19
Uniform Delay, d1	74.5	17.5	12.7	66.9	16.1			58.9	49.9		71.2	71.0
Progression Factor	1.00	1.00	1.00	0.87	1.83			1.00	1.00		1.00	1.00
Incremental Delay, d2	167.2	1.1	0.2	3.7	1.8			13.1	3.9		2.8	2.0
Delay (s)	241.7	18.6	13.0	61.8	31.4			72.0	53.7		74.0	73.0
Level of Service	F	B	B	E	C			E	D		E	E
Approach Delay (s)		19.4			34.4			61.9			73.6	
Approach LOS		B			C			E			E	

Intersection Summary

HCM Average Control Delay	34.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Cumulative AM - Mitigated
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1775	1561		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1775	1561		1817	1583
Volume (vph)	2	1208	42	77	1567	2	131	2	178	2	2	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	1313	46	84	1703	2	142	2	193	2	2	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	2	1313	46	84	1705	0	0	144	193	0	4	2
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	97.3	97.3	8.8	104.8			21.4	21.4		5.4	5.4
Effective Green, g (s)	1.0	99.3	99.3	8.5	106.8			21.1	21.1		5.1	5.1
Actuated g/C Ratio	0.01	0.66	0.66	0.06	0.71			0.14	0.14		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	2118	1048	185	2278			250	220		62	54
v/s Ratio Prot	0.00	0.41		c0.03	c0.53			0.08			c0.00	
v/s Ratio Perm			0.03						c0.12			0.00
v/c Ratio	0.17	0.62	0.04	0.45	0.75			0.58	0.88		0.06	0.04
Uniform Delay, d1	74.1	14.5	8.8	68.5	13.3			60.3	63.2		70.1	70.1
Progression Factor	0.81	0.94	1.23	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.4	1.2	0.1	1.3	2.3			2.6	29.8		0.3	0.2
Delay (s)	65.7	14.7	10.9	69.8	15.6			62.9	93.0		70.5	70.3
Level of Service	E	B	B	E	B			E	F		E	E
Approach Delay (s)		14.7			18.2			80.1			70.4	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3200	1583	1770	3200	1567	1770	1863	1550	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3200	1583	1770	3200	1567	1770	1863	1550	3433	1863	1583
Volume (vph)	292	1060	15	30	1460	567	19	30	42	313	20	228
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	317	1152	16	33	1587	616	21	33	46	340	22	248
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	317	1152	16	33	1587	616	21	33	46	340	22	248
Confl. Peds. (#/hr)				1		1			1	1		
Turn Type	Prot		Perm	Prot		pm+ov	Split		Perm	Split		pm+ov
Protected Phases	5	2		1	6	7	8	8		7	7	5
Permitted Phases			2			6			8			7
Actuated Green, G (s)	10.5	60.6	60.6	3.5	53.6	68.1	3.1	3.1	3.1	14.5	14.5	25.0
Effective Green, g (s)	10.7	62.6	62.6	3.7	55.6	71.4	3.3	3.3	3.3	15.8	15.8	26.5
Actuated g/C Ratio	0.11	0.62	0.62	0.04	0.55	0.70	0.03	0.03	0.03	0.16	0.16	0.26
Clearance Time (s)	4.2	6.0	6.0	4.2	6.0	5.3	4.2	4.2	4.2	5.3	5.3	4.2
Vehicle Extension (s)	2.5	2.5	2.5	3.0	2.5	2.5	2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	362	1976	977	65	1755	1165	58	61	50	535	290	414
v/s Ratio Prot	c0.09	0.36		0.02	c0.50	0.08	0.01	0.02		c0.10	0.01	0.06
v/s Ratio Perm			0.01			0.31			c0.03			0.09
v/c Ratio	0.88	0.58	0.02	0.51	0.90	0.53	0.36	0.54	0.92	0.64	0.08	0.60
Uniform Delay, d1	44.7	11.6	7.5	48.0	20.5	7.1	48.0	48.3	48.9	40.1	36.6	32.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.2	0.4	0.0	6.1	7.0	0.3	1.4	5.2	96.4	2.2	0.1	2.0
Delay (s)	64.9	12.0	7.5	54.1	27.5	7.4	49.4	53.5	145.3	42.3	36.6	34.8
Level of Service	E	B	A	D	C	A	D	D	F	D	D	C
Approach Delay (s)		23.2			22.4			94.9			39.0	
Approach LOS		C			C			F			D	

Intersection Summary

HCM Average Control Delay	26.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	101.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Highway 68 & York Rd.

Cumulative PM - Mitigated
1/26/2007

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑	↱	↰	↑↑	↱	↰	↱		↰↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3200	1583	1770	3200	1583	1770	1723		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3200	1583	1770	3200	1583	1770	1723		3433	1863	1583
Volume (vph)	122	1084	12	10	1234	241	7	5	5	490	5	230
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	133	1178	13	11	1341	262	8	5	5	533	5	250
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	133	1178	13	11	1341	262	8	10	0	533	5	250
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	4.3	43.8	43.8	0.7	40.0	40.0	0.7	2.9		16.2	18.0	18.0
Effective Green, g (s)	4.5	45.8	45.8	0.7	42.0	42.0	0.9	2.9		16.2	18.2	18.2
Actuated g/C Ratio	0.06	0.56	0.56	0.01	0.51	0.51	0.01	0.04		0.20	0.22	0.22
Clearance Time (s)	4.2	6.0	6.0	4.0	6.0	6.0	4.2	4.0		4.0	4.2	4.2
Vehicle Extension (s)	4.5	4.5	4.5	3.0	4.5	4.5	4.5	3.0		3.0	3.5	3.5
Lane Grp Cap (vph)	189	1796	888	15	1647	815	20	61		682	416	353
v/s Ratio Prot	c0.04	c0.37		0.01	c0.42		0.00	0.01		c0.16	0.00	
v/s Ratio Perm			0.01			0.17						c0.16
v/c Ratio	0.70	0.66	0.01	0.73	0.81	0.32	0.40	0.16		0.78	0.01	0.71
Uniform Delay, d1	37.9	12.4	7.9	40.4	16.5	11.5	40.1	38.2		31.0	24.7	29.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.8	1.1	0.0	103.2	3.5	0.4	21.1	1.3		5.8	0.0	6.6
Delay (s)	50.7	13.5	7.9	143.6	20.1	11.9	61.2	39.4		36.8	24.7	35.8
Level of Service	D	B	A	F	C	B	E	D		D	C	D
Approach Delay (s)		17.2			19.6			49.1			36.4	
Approach LOS		B			B			D			D	

Intersection Summary

HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑↱			↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.87			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	1770	3200	1583	1770	3200	1583	1770	1625			1782	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00			0.72	1.00
Satd. Flow (perm)	1770	3200	1583	1770	3200	1583	1346	1625			1338	1583
Volume (vph)	66	1435	78	23	1321	34	86	6	37	44	5	78
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	1560	85	25	1436	37	93	7	40	48	5	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	72	1560	85	25	1436	37	93	47	0	0	53	85
Turn Type	Prot		Perm	Prot		Perm	Perm			Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8			4		4
Actuated Green, G (s)	4.3	51.5	51.5	1.8	49.0	49.0	10.1	10.1			10.1	10.1
Effective Green, g (s)	4.0	53.5	53.5	1.5	51.0	51.0	10.2	10.2			10.2	10.2
Actuated g/C Ratio	0.05	0.69	0.69	0.02	0.66	0.66	0.13	0.13			0.13	0.13
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0	6.0	4.1	4.1			4.1	4.1
Vehicle Extension (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	92	2218	1097	34	2114	1046	178	215			177	209
v/s Ratio Prot	c0.04	c0.49		0.01	0.45			0.03				
v/s Ratio Perm			0.05			0.02	c0.07				0.04	0.05
v/c Ratio	0.78	0.70	0.08	0.74	0.68	0.04	0.52	0.22			0.30	0.41
Uniform Delay, d1	36.2	7.1	3.8	37.7	8.1	4.6	31.2	29.9			30.3	30.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	34.1	1.1	0.0	57.7	1.0	0.0	2.8	0.5			1.0	1.3
Delay (s)	70.2	8.2	3.9	95.3	9.0	4.6	34.0	30.5			31.2	32.0
Level of Service	E	A	A	F	A	A	C	C			C	C
Approach Delay (s)		10.6			10.4			32.8			31.7	
Approach LOS		B			B			C			C	

Intersection Summary

HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	77.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: Highway 68 & Laureles Grade Rd.

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰↰	↑↑	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	1.00	0.97	0.95	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3200	1583	3433	3200	1770	1569
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3200	1583	3433	3200	1770	1569
Volume (vph)	1338	178	245	1102	276	465
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1454	193	266	1198	300	505
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1454	193	266	1198	300	505
Confl. Peds. (#/hr)			1		1	1
Heavy Vehicles (%)	2%	2%	2%	4%	2%	2%
Turn Type		Perm	Prot			pm+ov
Protected Phases	2		1	6	8	1
Permitted Phases		2				8
Actuated Green, G (s)	38.7	38.7	8.0	50.4	18.1	26.1
Effective Green, g (s)	40.7	40.7	7.7	52.4	17.8	25.5
Actuated g/C Ratio	0.52	0.52	0.10	0.67	0.23	0.33
Clearance Time (s)	6.0	6.0	3.7	6.0	3.7	3.7
Vehicle Extension (s)	2.5	2.5	2.5	2.5	3.0	2.5
Lane Grp Cap (vph)	1665	824	338	2144	403	592
v/s Ratio Prot	c0.45		0.08	0.37	0.17	c0.08
v/s Ratio Perm		0.12				0.24
v/c Ratio	0.87	0.23	0.79	0.56	0.74	0.85
Uniform Delay, d1	16.5	10.2	34.4	6.8	28.1	24.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.1	11.1	0.3	7.3	11.3
Delay (s)	21.8	10.3	45.5	7.1	35.4	35.9
Level of Service	C	B	D	A	D	D
Approach Delay (s)	20.5			14.0	35.7	
Approach LOS	C			B	D	

Intersection Summary

HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Highway 68 & Corral de Tierra Rd.

Cumulative PM - Mitigated
1/26/2007

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1770	3200	1583	3433	3200			1775	1568		1793	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (perm)	1770	3200	1583	3433	3200			1775	1568		1793	1583
Volume (vph)	3	1572	228	301	1187	10	154	2	311	6	2	6
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	1709	248	327	1290	11	167	2	338	7	2	7
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	1709	248	327	1301	0	0	169	338	0	9	7
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		pm+ov	Split		Perm
Protected Phases	5	2		1	6		8	8	1	4	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	0.8	91.2	91.2	17.7	107.8			20.5	38.2		2.9	2.9
Effective Green, g (s)	0.8	93.2	93.2	17.4	109.8			20.5	37.9		2.9	2.9
Actuated g/C Ratio	0.01	0.62	0.62	0.12	0.73			0.14	0.25		0.02	0.02
Clearance Time (s)	4.0	6.0	6.0	3.7	6.0			4.0	3.7		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			3.0	2.5		3.0	3.0
Lane Grp Cap (vph)	9	1988	984	398	2342			243	438		35	31
v/s Ratio Prot	0.00	c0.53		c0.10	0.41			0.10	c0.09		c0.01	
v/s Ratio Perm			0.16						0.13			0.00
v/c Ratio	0.33	0.86	0.25	0.82	0.56			0.70	0.77		0.26	0.23
Uniform Delay, d1	74.3	23.1	12.8	64.8	9.1			61.8	52.0		72.5	72.4
Progression Factor	1.00	1.00	1.00	1.00	0.79			1.00	1.00		1.00	1.00
Incremental Delay, d2	20.6	5.1	0.6	10.2	0.8			8.4	7.9		3.9	3.7
Delay (s)	94.9	28.2	13.4	75.2	8.0			70.1	59.9		76.4	76.1
Level of Service	F	C	B	E	A			E	E		E	E
Approach Delay (s)		26.4			21.5			63.3			76.3	
Approach LOS		C			C			E			E	

Intersection Summary

HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Highway 68 & San Benancio Rd.

Cumulative PM - Mitigated
1/26/2007

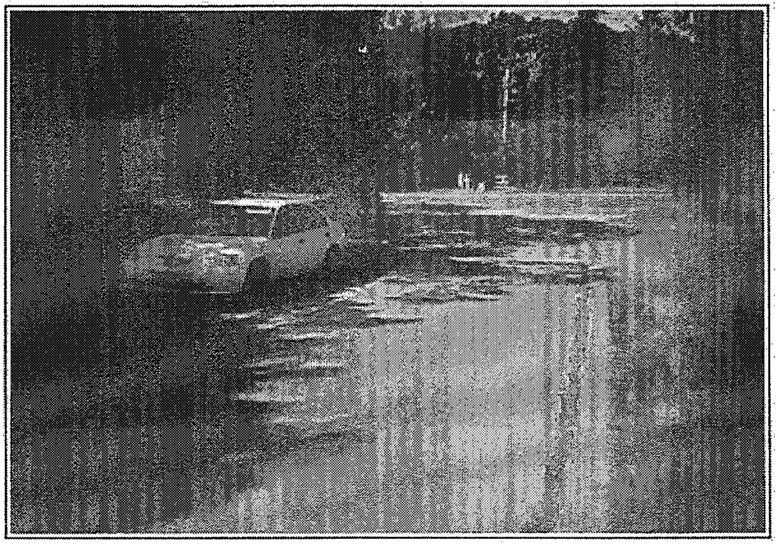
	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰↰	↑↱			↰↑	↱		↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (prot)	1770	3200	1583	3273	3200			1777	1559		1817	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.98	1.00
Satd. Flow (perm)	1770	3200	1583	3273	3200			1777	1559		1817	1583
Volume (vph)	3	1756	130	160	1410	2	85	3	123	2	2	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	1909	141	174	1533	2	92	3	134	2	2	3
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	3	1909	141	174	1535	0	0	95	134	0	4	3
Confl. Peds. (#/hr)				1		1			1	1		
Heavy Vehicles (%)	2%	2%	2%	7%	3%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Prot		Perm	Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2						3			4
Actuated Green, G (s)	1.3	99.4	99.4	13.9	112.0			14.2	14.2		5.4	5.4
Effective Green, g (s)	1.0	101.4	101.4	13.6	114.0			13.9	13.9		5.1	5.1
Actuated g/C Ratio	0.01	0.68	0.68	0.09	0.76			0.09	0.09		0.03	0.03
Clearance Time (s)	3.7	6.0	6.0	3.7	6.0			3.7	3.7		3.7	3.7
Vehicle Extension (s)	3.0	3.0	3.0	2.5	3.0			2.5	2.5		2.5	2.5
Lane Grp Cap (vph)	12	2163	1070	297	2432			165	144		62	54
v/s Ratio Prot	0.00	c0.60		c0.05	0.48			0.05			c0.00	
v/s Ratio Perm			0.09						c0.09			0.00
v/c Ratio	0.25	0.88	0.13	0.59	0.63			0.58	0.93		0.06	0.06
Uniform Delay, d1	74.1	19.5	8.6	65.5	8.3			65.2	67.6		70.1	70.1
Progression Factor	1.03	1.60	1.42	1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.8	3.2	0.1	2.4	1.3			3.9	54.3		0.3	0.3
Delay (s)	82.0	34.4	12.5	67.9	9.6			69.2	121.9		70.5	70.4
Level of Service	F	C	B	E	A			E	F		E	E
Approach Delay (s)		33.0			15.5			100.0			70.4	
Approach LOS		C			B			F			E	

Intersection Summary

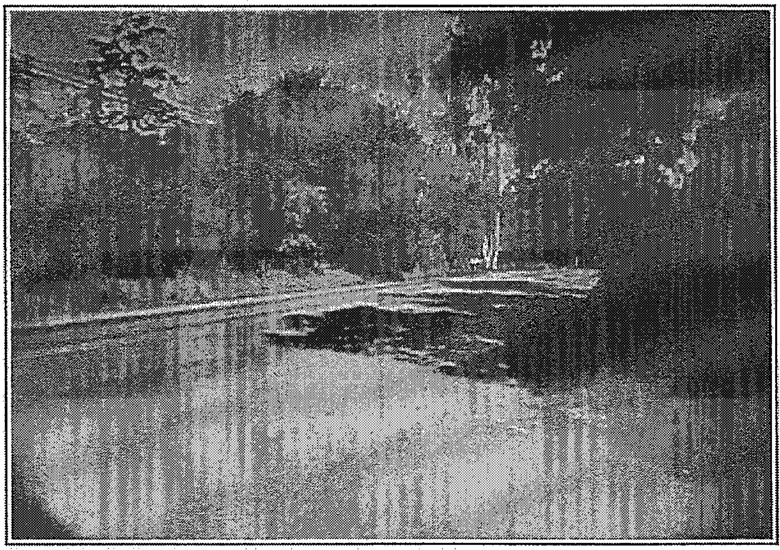
HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Appendix I



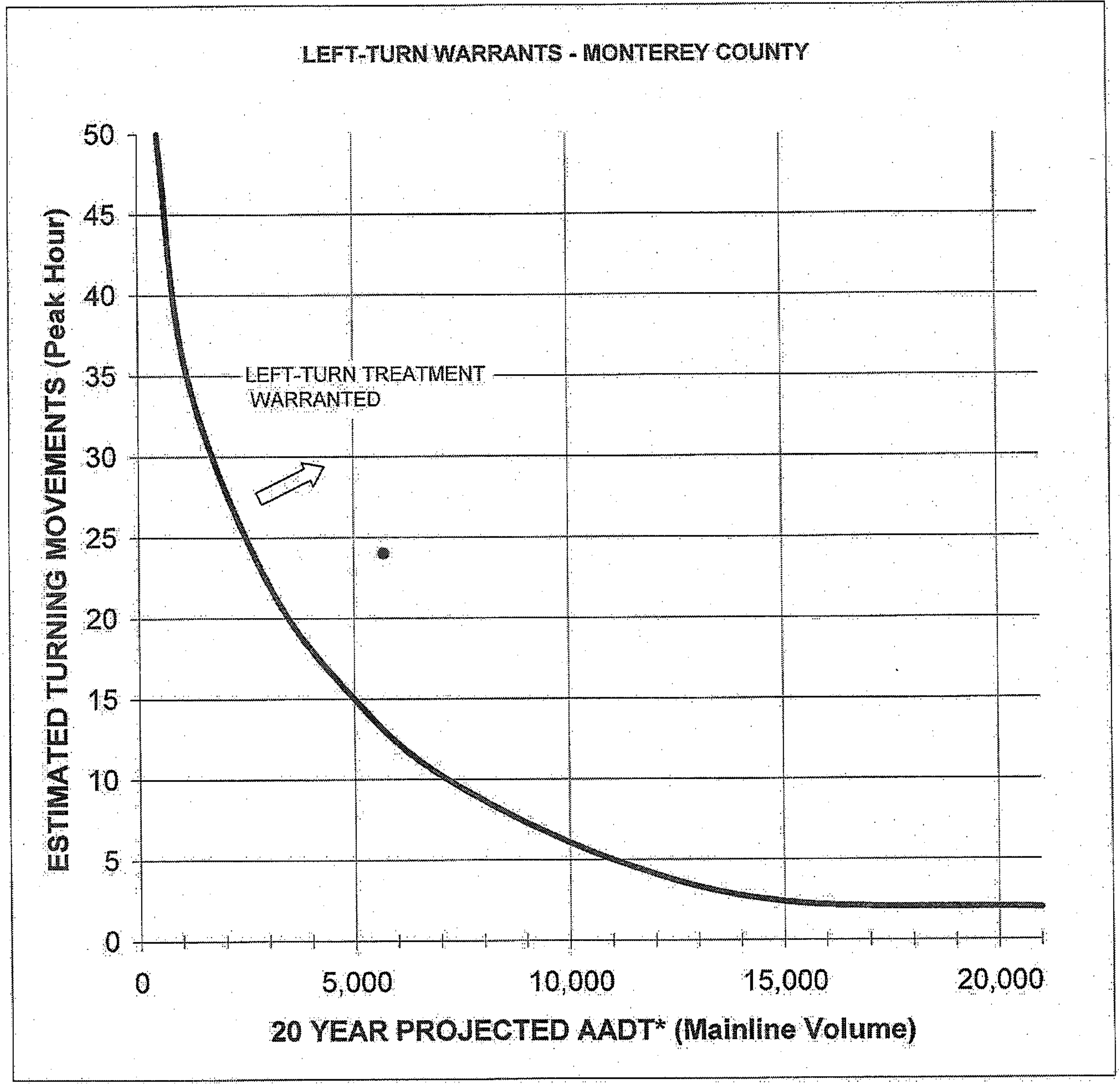
From Meyer Road Looking West toward San Benancio Road



From Meyer Road Looking North on San Benancio Road

From Meyer Road Looking South on San Benancio Road

Appendix J
San Benancio / Meyer Road Intersection
Southbound Approach



Analysis Scenario	Left Turn Volume	20-Yr. Mainline Volume*	Warrant Met?
A. Back+Project PM	24	5700	Yes

Adapted from Monterey County
Left Turn Policy, adopted on
February 26, 1980.

*Note: The mainline volume of 5,700 vehicles per day is the 2005 annual average daily traffic volume on San Benancio Road

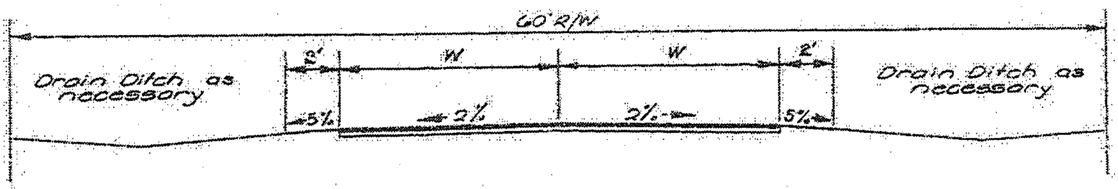
APPENDIX K
LEVEL OF SERVICE THRESHOLD VOLUMES FOR VARIOUS ROADWAY TYPES
TOTAL DAILY VOLUMES IN BOTH DIRECTIONS (ADT)

ROADWAY TYPE	CODE	LOS A	LOS B	LOS C	LOS D	LOS E
10-Lane Freeway	10F	64,000	99,000	139,000	160,000	182,000
8-Lane Freeway	8F	51,000	79,000	112,000	136,000	146,000
6-Lane Freeway	6F	39,000	59,000	85,000	102,000	110,000
8-Lane Expressway	8E	35,000	54,000	75,000	90,000	98,000
6-Lane Expressway	6E	28,000	42,000	56,000	67,000	74,000
4-Lane Freeway	4F	26,000	40,000	57,000	69,000	74,000
8-Lane Divided Arterial (w/ left-turn lane)	9	40,000	47,000	54,000	61,000	68,000
6-Lane Divided Arterial (w/ left-turn lane)	7	32,000	38,000	43,000	49,000	54,000
4-Lane Expressway	4E	18,000	27,000	36,000	45,000	50,000
4-Lane Divided Arterial (w/ left-turn lane)	5	22,000	25,000	29,000	32,500	36,000
4-Lane Undivided Arterial (no left-turn lane)	4	16,000	19,000	22,000	24,000	27,000
2-Lane Rural Highway	2R	4,000	8,000	12,000	17,000	25,000
2-Lane Arterial (w/ left-turn lane)	3	11,000	12,500	14,500	16,000	18,000
2-Lane Collector	2	6,000	7,500	9,000	10,500	12,000
2-Lane Local	1	1,200	1,400	1,600	1,800	2,000
1-Lane Freeway Diamond Ramp	1D	11,000	12,800	14,700	16,500	18,300
2-Lane Freeway Diamond Ramp	2D	22,000	25,600	29,400	33,000	36,600
1-Lane Freeway Loop Ramp	1L	9,000	10,500	12,000	13,500	15,000
2-Lane Freeway Loop Ramp	2L	16,000	18,700	21,300	24,000	26,700

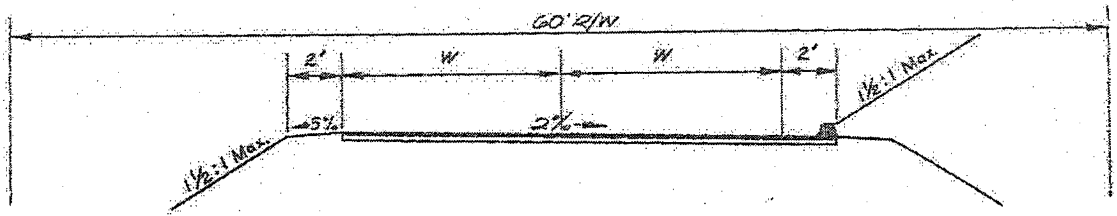
Notes:

1. The above threshold volumes for preliminary planning purposes only. If available, the results of detailed level of service analyses will typically have priority over the levels of service derived from this table. In that case this table can be used by the analyst for providing additional considerations for recommending the appropriate general roadway type for the specific condition being analyzed.
2. All above facilities assume a 60%/40% peak hour directional split. All above facilities assume peak hour representing approximately 10% of the Average Daily Traffic (ADT), except for mainline freeway facilities, which assume peak hour representing 9% of the Average Daily Traffic (ADT).
3. Based on *Highway Capacity Manual*, Transportation Research Board, 2000.
4. Freeway thresholds are consistent with conditions utilizing a .95 peak hour factor, with 2% trucks and slightly over a one-mile average interchange spacing.
5. Expressways are consistent with the average of a multi-lane highway (with no signals) and Class 1 arterial (with an average signal spacing of 0.8 signals per mile and a .45 G/C ratio).
6. Arterial thresholds are consistent with the average of Class 1 and Class 2 arterials with an assumed signal density of two signals per mile. This assumes a divided arterial with left-turn lanes. Thresholds for four-lane undivided arterials assume approximately two-thirds the capacity of a four-lane divided arterial due to the impedance in traffic flow resulting from left-turning vehicles waiting in the inside through lane, thus significantly reducing the capacity of the roadway.
7. Rural highways are generally consistent with the *2000 Highway Capacity Manual* rural highway, assuming 8% trucks, 4% RV's, 20% no-passing, and level terrain. The greatest difference is that it assumes a maximum capacity (upper end of LOS E) of 25,000 rather than the 28,000 calculated using the new *Highway Capacity Manual*.
8. Two-lane collectors assume approximately three-fourths of the capacity of a two-lane arterial with left-turn lanes. This is based on the assumption that left-turn channelization is not provided on a two-lane collector.
9. Local street level of service thresholds are based upon "Neighborhood Traffic Related Quality-of-Life Considerations" which assumes a standard suburban neighborhood, 40-foot roadway width, and 25 mile per hour speed limit with normal speed violation rates.
10. Capacities for Diamond Ramps and Loop Ramps may be slightly higher or lower than the planning level capacities indicated above. The *2000 Highway Capacity Manual* (2000 HCM) states that the capacity of a one-lane diamond to be 2,200 vehicles per hour (vph), and 1,800 vph for a small radius loop ramp. Two-lane freeway ramp capacities are estimated in the 2000 HCM to be 4,400vph for a two-lane diamond, and 3,200vph 20 for a two-lane small radius loop. Varying intermediate capacities are provided for incremental conditions between these extremes. Capacities given for each service level assume the same level of service for the adjoining merging roadway as well as level of service being determined by volume-to-capacity and not attainable speed. Level of service will be controlled by freeway level of service if worse than ramp. Mitigations of level of service deficiencies may include the addition of a lane on the freeway ramp, the addition of an auxiliary lane on the freeway mainline, the addition of approach lanes at the ramp junction with the local intersecting street, and/or geometric modifications to improve the efficiency of the ramp itself or its termini. The appropriate mitigation should be determined on a case-by-case basis, considering freeway main line volumes and weaving, the extent that the freeway ramp volume exceeds the above planning thresholds, and the level of service of the ramp intersection with the local street.
11. All volumes are approximate and assume ideal roadway characteristics.

Appendix L



RURAL ROAD



RURAL SIDEHILL ROAD

Street Classification	W Under 5ac.	Over 5ac.
Secondary Road	11'	10'
Tertiary Road	10'	9'
Cul-de-sac Road	9'	8'

MONTEREY COUNTY DEPT. OF PUBLIC WORKS

STANDARD DETAILS

RURAL ROAD
(PRIVATE ONLY)

APPROVED DATE 10-24-77

REVISED	DATE

PLATE NO. 5

Source:
Standard Details
County of Monterey, California
October 1977

such intersection shall be rounded with a curve having a radius of not less than 15 feet. In any case, a greater curve radius may be required if streets or alleys intersect other than at right angles.

O. TEMPORARY TERMINUS

Streets which are to be extended and whose temporary terminus cannot be seen may require a temporary turning circle. A defeasible easement shall be provided for uniform sidewalk width or to contain shoulders and slopes. The turning circle shall conform to the requirements of Section 3.45c of Ordinance 1713.

P. PRIVATE ROAD INTERSECTIONS

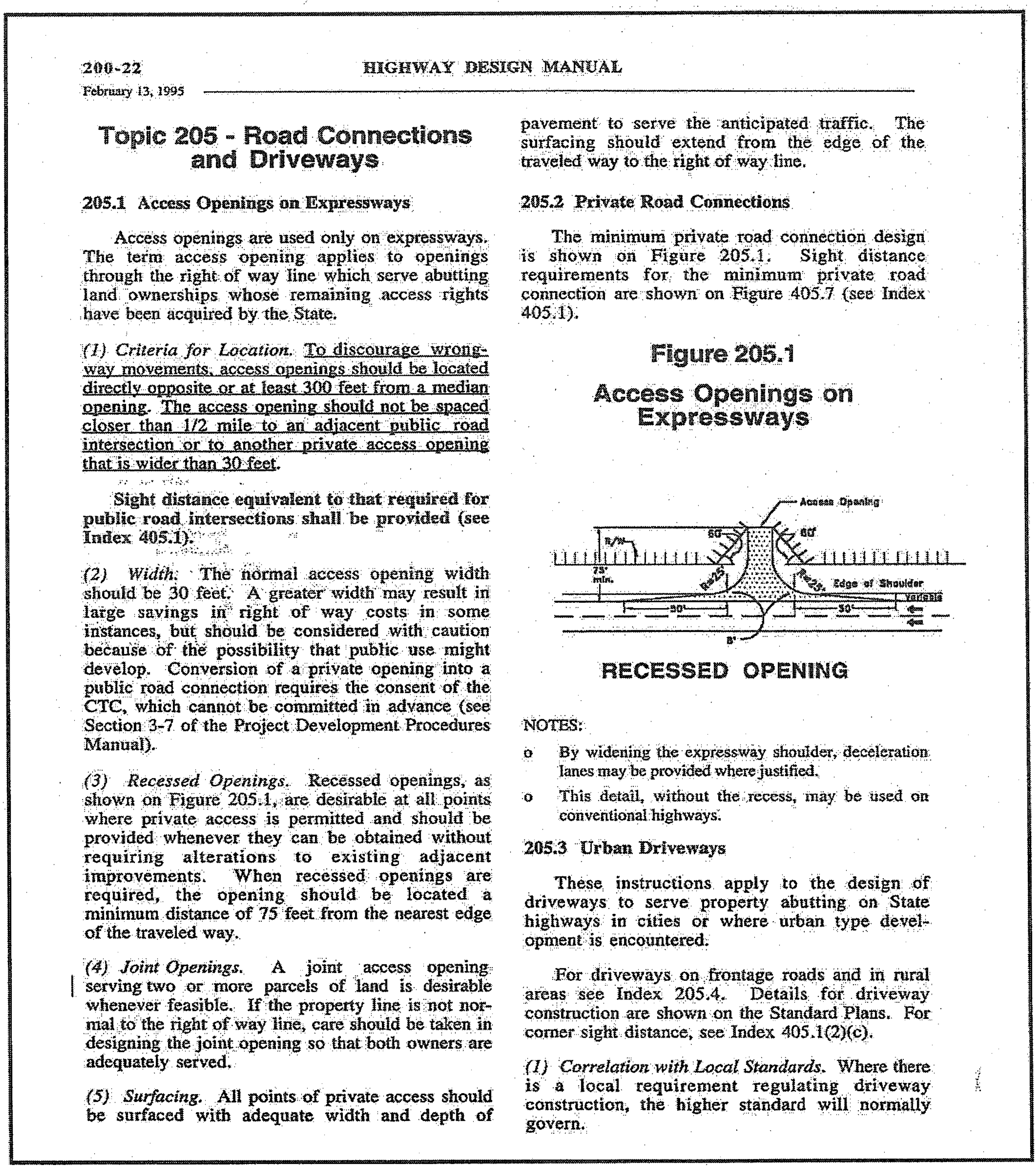
A private road intersecting with a county road, when planned to serve private road subdivisions that provide access to more than 20 dwelling units or when planned to handle an average daily traffic of 200 vehicles per day shall be designed in accordance to the Standard Street Classification applicable including location, alignment, grade and improvements.

Q. HORIZONTAL ALIGNMENT

The centerline curve radius of all streets and highways shall conform to acceptable engineering standards of design as shown in the latest edition of the California Department of Transportation Planning Manual Part VII. Generally, horizontal curves shall be as long as practical. Use of superelevated curves shall be avoided by increasing the centerline radius where practical. Superelevation shall not exceed 8%. The runoff length shall provide a maximum superelevation runoff rate of 3% per second at design speed in any travel lane.

Except in hillside subdivisions where approved on the tentative map, the use of compound curves and reverse curves shall be held to a minimum. As far as practical, tangents shall be provided between all curves and be not less

Source:
Roadway Design Standards
County of Monterey, California
October 1977



Topic 205 - Road Connections and Driveways

205.1 Access Openings on Expressways

Access openings are used only on expressways. The term access opening applies to openings through the right of way line which serve abutting land ownerships whose remaining access rights have been acquired by the State.

(1) Criteria for Location. To discourage wrong-way movements, access openings should be located directly opposite or at least 300 feet from a median opening. The access opening should not be spaced closer than 1/2 mile to an adjacent public road intersection or to another private access opening that is wider than 30 feet.

Sight distance equivalent to that required for public road intersections shall be provided (see Index 405.1).

(2) Width. The normal access opening width should be 30 feet. A greater width may result in large savings in right of way costs in some instances, but should be considered with caution because of the possibility that public use might develop. Conversion of a private opening into a public road connection requires the consent of the CTC, which cannot be committed in advance (see Section 3-7 of the Project Development Procedures Manual).

(3) Recessed Openings. Recessed openings, as shown on Figure 205.1, are desirable at all points where private access is permitted and should be provided whenever they can be obtained without requiring alterations to existing adjacent improvements. When recessed openings are required, the opening should be located a minimum distance of 75 feet from the nearest edge of the traveled way.

(4) Joint Openings. A joint access opening serving two or more parcels of land is desirable whenever feasible. If the property line is not normal to the right of way line, care should be taken in designing the joint opening so that both owners are adequately served.

(5) Surfacing. All points of private access should be surfaced with adequate width and depth of pavement to serve the anticipated traffic. The surfacing should extend from the edge of the traveled way to the right of way line.

205.2 Private Road Connections

The minimum private road connection design is shown on Figure 205.1. Sight distance requirements for the minimum private road connection are shown on Figure 405.7 (see Index 405.1).

Figure 205.1

Access Openings on Expressways

RECESSED OPENING

NOTES:

- By widening the expressway shoulder, deceleration lanes may be provided where justified.
- This detail, without the recess, may be used on conventional highways.

205.3 Urban Driveways

These instructions apply to the design of driveways to serve property abutting on State highways in cities or where urban type development is encountered.

For driveways on frontage roads and in rural areas see Index 205.4. Details for driveway construction are shown on the Standard Plans. For corner sight distance, see Index 405.1(2)(c).

(1) Correlation with Local Standards. Where there is a local requirement regulating driveway construction, the higher standard will normally govern.

Source:
California Department of Transportation
Highway Design Manual, 1995

Appendix O

Freeway Mitigation Reduction in Travel Time Estimations

Freeway Mitigation Travel Time Comparison - Harper Canyon / Encina Hills Subdivision

	Existing AM Peak Hour Volumes		**Background + Project AM Peak Hour Volumes**		Approximate Reduction in Travel Time with Freeway Extension (seconds)	Approximate Increase in Travel Time with Project Over Entire Corridor (seconds)	Net Reduction in Travel Time with Freeway Extension Over Entire Corridor (seconds)
	Existing 2-Lane Rural Highway		Proposed 4-Lane Freeway				
	Speed	Travel Time	Speed	Travel Time			
EB	47 mi/hr 68.9 ft/s	92	65 mi/hr 95.3 ft/s	66	-26	0	-26
WB	8 mi/hr 11.7 ft/s	540	13.7 mi/hr 20.1 ft/s	315	-225	7	-218

Synchro Arterial Travel Time Results

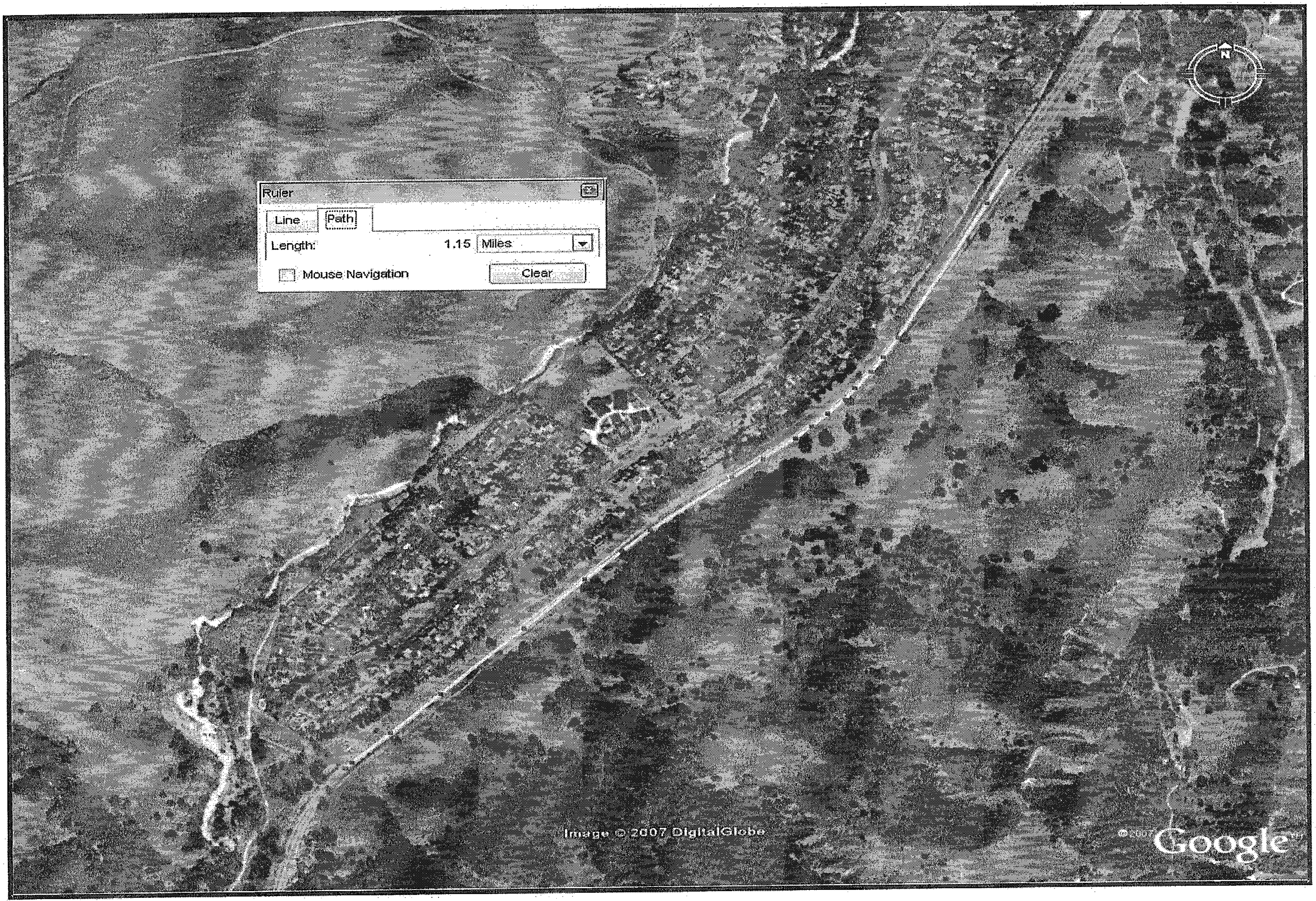
	Back AM	B+P AM	Difference	Rounded[5]
EB	761.2	756.0	-5.2	0
WB	1109.3	1116.6	7.3	7.0

	Existing PM Peak Hour Volumes		**Background + Project PM Peak Hour Volumes**		Approximate Reduction in Travel Time with Freeway Extension (seconds)	Approximate Increase in Travel Time with Project Over Entire Corridor (seconds)	Net Reduction in Travel Time with Freeway Extension Over Entire Corridor (seconds)
	Existing 2-Lane Rural Highway		Proposed 4-Lane Freeway				
	Speed	Travel Time	Speed	Travel Time			
EB	53 mi/hr 77.7 ft/s	82	65 mi/hr 95.3 ft/s	66	-16	8	-8
WB	51 mi/hr 74.8 ft/s	85	65 mi/hr 95.3 ft/s	66	-19	17	-2

	Back PM	B+P PM	Difference	Rounded[5]
EB	1169.3	1177.7	8.4	8.0
WB	1275.0	1292.2	17.2	17.0

Total	**-286**	**32**	**-254**
Project Percent		11%	

Notes:
1. All travel times are in seconds.
2. Segment length = 1.2 miles (6,336 feet).
3. Segment extends from existing 4-lane section (adjacent to Toro Park) to west end of Toro Park Estates (see attached graphic).
4. Increases in travel times with project are based on "Background" vs. "Background + Project" AM and PM peak hour volumes in Synchro arterial analysis reports.
5. Negative numbers were "rounded" to zero.



Length: 1.15 Miles

☐ Mouse Navigation

Appendix P

Synchro Travel Time Reports

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Olmsted Rd.	I	60	32.0	92.6	124.6	0.39	11.3	F
Hwy 218	I	60	76.2	17.1	93.3	1.27	49.0	A
Ragsdale Dr.	I	60	25.7	2.4	28.1	0.26	33.9	C
York Rd.	I	60	65.3	15.2	80.5	1.09	48.7	A
Boots Rd.	I	60	104.4	9.8	114.2	1.74	54.8	A
Laureles Grade Rd.	I	60	80.4	21.0	101.4	1.34	47.6	A
Corral de Tierra Rd.	I	60	104.4	50.4	154.8	1.74	40.5	B
San Benancio Rd.	I	60	31.6	32.7	64.3	0.36	20.3	E
Total	I		520.0	241.2	761.2	8.20	38.8	B

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Corral de Tierra Rd.	I	60	31.6	164.3	195.9	0.36	6.7	F
Laureles Grade Rd.	I	60	104.4	77.8	182.2	1.74	34.4	B
Pasadera Dr.	I	60	80.4	99.6	180.0	1.34	26.8	D
York Rd.	I	60	104.4	129.1	233.5	1.74	26.8	D
Ragsdale Dr.	I	60	65.3	26.8	92.1	1.09	42.6	A
Hwy 218	I	60	25.7	29.2	54.9	0.26	17.3	E
Olmsted Rd.	I	60	76.2	48.2	124.4	1.27	36.7	B
Josselyn Cyn. Rd.	I	60	32.0	14.3	46.3	0.39	30.3	C
Total	I		520.0	589.3	1109.3	8.20	26.6	D

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Olmsted Rd.	I	60	32.0	86.4	118.4	0.39	11.9	F
Hwy 218	I	60	76.2	17.1	93.3	1.27	49.0	A
Ragsdale Dr.	I	60	25.7	2.5	28.2	0.26	33.8	C
York Rd.	I	60	65.3	15.2	80.5	1.09	48.7	A
Boots Rd.	I	60	104.4	9.8	114.2	1.74	54.8	A
Laureles Grade Rd.	I	60	80.4	21.2	101.6	1.34	47.5	A
Corral de Tierra Rd.	I	60	104.4	50.5	154.9	1.74	40.4	B
San Benancio Rd.	I	60	31.6	33.3	64.9	0.36	20.1	E
Total	I		520.0	236.0	756.0	8.20	39.0	B

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Corral de Tierra Rd.	I	60	31.6	166.0	197.6	0.36	6.6	F
Laureles Grade Rd.	I	60	104.4	79.1	183.5	1.74	34.1	B
Pasadera Dr.	I	60	80.4	101.2	181.6	1.34	26.6	D
York Rd.	I	60	104.4	131.1	235.5	1.74	26.6	D
Ragsdale Dr.	I	60	65.3	28.8	94.1	1.09	41.7	B
Hwy 218	I	60	25.7	29.2	54.9	0.26	17.3	E
Olmsted Rd.	I	60	76.2	46.5	122.7	1.27	37.3	B
Josselyn Cyn. Rd.	I	60	32.0	14.7	46.7	0.39	30.1	C
Total	I		520.0	596.6	1116.6	8.20	26.4	D

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Olmsted Rd.	I	60	32.0	33.8	65.8	0.39	21.3	D
Hwy 218	I	60	76.2	14.5	90.7	1.27	50.4	A
Ragsdale Dr.	I	60	25.7	0.3	26.0	0.26	36.6	B
York Rd.	I	60	65.3	19.5	84.8	1.09	46.2	A
Boots Rd.	I	60	104.4	30.8	135.2	1.74	46.3	A
Laureles Grade Rd.	I	60	80.4	121.9	202.3	1.34	23.8	D
Corral de Tierra Rd.	I	60	104.4	224.3	328.7	1.74	19.1	E
San Benancio Rd.	I	60	31.6	204.2	235.8	0.36	5.5	F
Total	I		520.0	649.3	1169.3	8.20	25.2	D

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Corral de Tierra Rd.	I	60	31.6	46.2	77.8	0.36	16.8	E
Laureles Grade Rd.	I	60	104.4	37.0	141.4	1.74	44.3	A
Pasadera Dr.	I	60	80.4	48.9	129.3	1.34	37.3	B
York Rd.	I	60	104.4	113.9	218.3	1.74	28.7	C
Ragsdale Dr.	I	60	65.3	16.3	81.6	1.09	48.1	A
Hwy 218	I	60	25.7	46.3	72.0	0.26	13.2	F
Olmsted Rd.	I	60	76.2	341.8	418.0	1.27	10.9	F
Josselyn Cyn. Rd.	I	60	32.0	104.6	136.6	0.39	10.3	F
Total	I		520.0	755.0	1275.0	8.20	23.1	D

Arterial Level of Service: EB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Olmsted Rd.	I	60	32.0	38.9	70.9	0.39	19.8	E
Hwy 218	I	60	76.2	14.5	90.7	1.27	50.4	A
Ragsdale Dr.	I	60	25.7	0.3	26.0	0.26	36.6	B
York Rd.	I	60	65.3	19.7	85.0	1.09	46.1	A
Boots Rd.	I	60	104.4	31.4	135.8	1.74	46.1	A
Laureles Grade Rd.	I	60	80.4	123.5	203.9	1.34	23.7	D
Corral de Tierra Rd.	I	60	104.4	226.4	330.8	1.74	18.9	E
San Benancio Rd.	I	60	31.6	203.0	234.6	0.36	5.6	F
Total	I		520.0	657.7	1177.7	8.20	25.1	D

Arterial Level of Service: WB Highway 68

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Corral de Tierra Rd.	I	60	31.6	47.2	78.8	0.36	16.6	E
Laureles Grade Rd.	I	60	104.4	37.6	142.0	1.74	44.1	A
Pasadera Dr.	I	60	80.4	49.4	129.8	1.34	37.2	B
York Rd.	I	60	104.4	114.7	219.1	1.74	28.6	C
Ragsdale Dr.	I	60	65.3	14.8	80.1	1.09	49.0	A
Hwy 218	I	60	25.7	46.8	72.5	0.26	13.1	F
Olmsted Rd.	I	60	76.2	351.2	427.4	1.27	10.7	F
Josselyn Cyn. Rd.	I	60	32.0	110.5	142.5	0.39	9.9	F
Total	I		520.0	772.2	1292.2	8.20	22.8	D