Appendix E

Preliminary Hydrology and Water Quality Analysis

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Preliminary Drainage Report

For

Site 'D' Improvements

At Intersection of
Diamond Bar Boulevard and Brea Canyon Road
Diamond Bar, California

Prepared For:

Walnut Valley Unified School Districts
880 South Lemon Avenue
Walnut, CA 91789

Prepared By:

PENCO Engineering, Inc.
One Technology Park, J-725
Irvine, CA 92618

February 7, 2008
Revised April 6, 2009

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I Description and Site Location

The project, Site 'D' Improvements, is currently an undeveloped natural area. The property is mostly owned by Walnut Valley Unified School Districts with small portion owned by the City of Diamond Bar and Los Angeles County Department of Public Works. The site totals approximately 30.08 acres and is located in the City of Diamond Bar, California. It is bounded by Diamond Bar Boulevard to the north, Brea Canyon Road to the west, existing residential to the south and undeveloped area to the east. (See site map on Exhibit 'A')

II Hydrological Standards

The hydrology study was performed utilizing Los Angeles County Department of Public Works (LACDPW) Modified Rational Methodology (MODRAT) and in accordance with the requirements of the Los Angeles County Hydrology Manual. The MODRAT computer program was applied through Watershed Modeling System (WMS) as the interface. Hydrological parameters used in the study, such as soil classification and rainfall data, are based on the Los Angeles County Hydrology Manual 2006 version. LACDPW T_C calculator excel spreadsheet was used to compute the time of concentration. The 50-year capital flood storm event was used in the study. The 50-year, 24-hour rainfall for this site is 6.3 inches per Los Angeles County Hydrological Map 1-H1.12.

III Existing Condition

The site is mostly comprised of natural hillsides and canyons. Only a small area at eastern portion of property is draining northerly to Diamond Bar Boulevard following its natural flow path to an existing low point. The runoff from rest of area is flowing westerly to the Brea Canyon Channel, owned and operated by LACDPW.

Currently, Brea Canyon Channel is a trapezoidal concrete lined drainage facility at this reach. Under Diamond Boulevard, a double 8 feet by 8 feet reinforced concrete box (RCB) serves as roadway culvert. Between existing channel and Brea Canyon Road, an area of 1 acre, owned by the City of Diamond Bar, is draining to this channel as well.

The 50-year storm creates approximately 68.38 cfs of runoff from west portion of site including the slope from existing residential area adjacent southerly property. In addition to the runoff generated from the site, an existing 33" RCP is carrying off-site discharge of 83.94 cfs into the site according to the record drawings for LACDPW private drain No. 1437. Since the time of concentration for this off-site discharge is not available, direct summation of these two discharges shall be a conservative analysis. It totals 152.32 cfs at Brea Canyon Channel.

On east portion of the site, 50-year storm runoff of 3.38 cfs is discharged to Diamond Bar Boulevard. See Existing Hydrology Calculations in Appendix A and Hydrology Map in Appendix D.

IV Proposed Condition

The site developments will include both residential and commercial use. The 74 percent of impervious area for mixed multi-family residential and 91 percent for commercial have been used in the hydrology calculations. Together with the off-site discharge into the site, the 50-year storm runoff totals 174.80 cfs at Brea Canyon Channel confluence. As mentioned previously, the discharge is direct summation of proposed runoff and off-site runoff because time of concentration is not available.

The storm drain pipe from developed area will require a water quality device to clean the storm runoff before discharged to Brea Canyon Channel. This is to satisfy the Standard Urban Stormwater Mitigation Plan (SUSMP) required by Los Angeles County. Either flow based CDS unit or volume based water quality basin will meet the requirements. See Appendix B for SUSMP calculations.

According to the record plans for Brea Canyon Channel (LACDPW private drain No. 395), 25-year discharge of 2,285 cfs is shown at downstream side of Diamond Bar Boulevard culvert. LACDPW has requested the improvements shall be designed to meet 50-year storm runoff which is converted to 2,602 cfs. Again, for direct summation of two flows from the site and from the Channel, the 50-year discharge is calculated as 2,777 cfs at this reach. See Proposed Hydrology Calculations in Appendix A and Hydrology Map in Appendix D.

The proposed grading plan indicates that the existing Brea Canyon Channel at this reach will be replaced with reinforced concrete box (RCB) and the area created will be used for parking or landscaping. An existing tributary open channel east of project will be replaced with RCB as well for a proposed entrance to the site. To convey the 50-year discharge, proposed channel section shall be double cells 9 feet wide by 8 feet high RCB with average 20 feet cover based on the proposed grading plan. 50 feet of transition box will be constructed from proposed RCB section to existing culvert section under Diamond Bar Boulevard. A transition structure downstream of proposed RCB will be constructed to join existing trapezoidal channel. See Appendix C for conceptual Brea Canyon Channel plan.

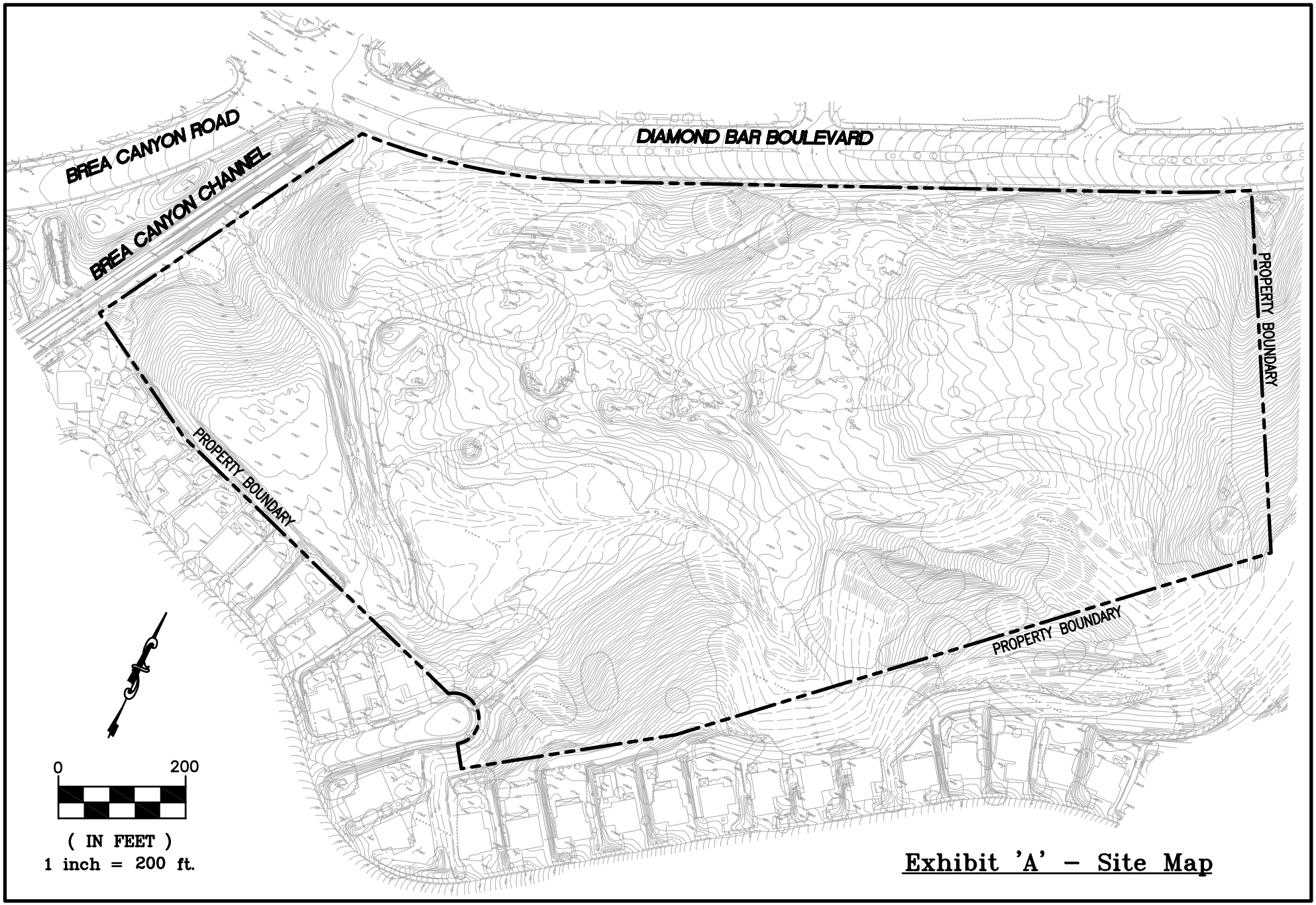

Exhibit 'A' – Site Map

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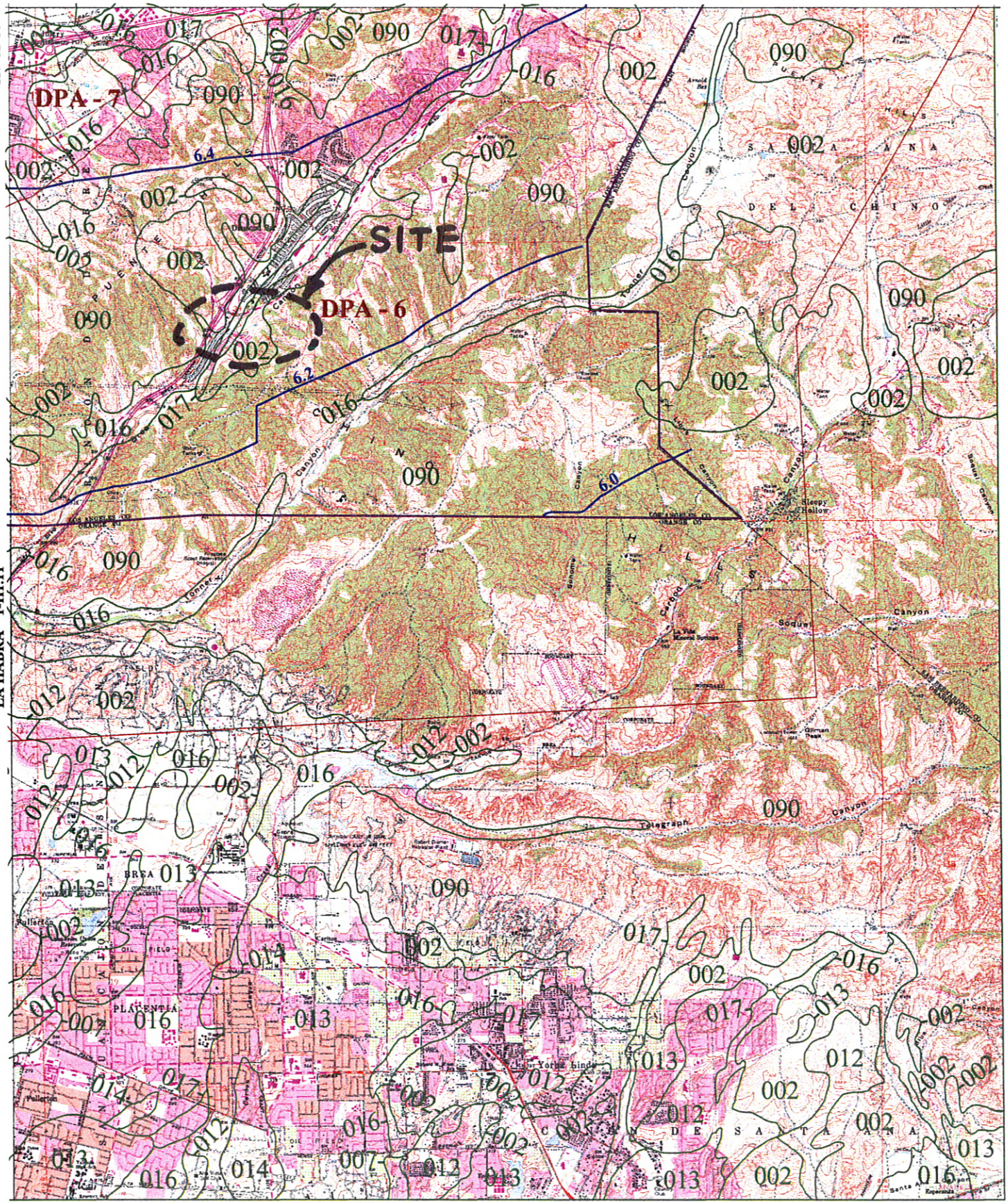

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N S E W

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

YORBA LINDA
50-YEAR 24-HOUR ISOHYET

1-H1.12

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

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Proportion Impervious Data

Code	Land Use Description	% Impervious
1111	High-Density Single Family Residential	42
1112	Low-Density Single Family Residential	21
1121	Mixed Multi-Family Residential	74
1122	Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	55
1123	Low-Rise Apartments, Condominiums, and Townhouses	86
1124	Medium-Rise Apartments and Condominiums	86
1125	High-Rise Apartments and Condominiums	90
1131	Trailer Parks and Mobile Home Courts, High-Density	91
1132	Mobile Home Courts and Subdivisions, Low-Density	42
1140	Mixed Residential	59
1151	Rural Residential, High-Density	15
1152	Rural Residential, Low-Density	10
1211	Low- and Medium-Rise Major Office Use	91
1212	High-Rise Major Office Use	91
1213	Skyscrapers	91
1221	Regional Shopping Center	95
1222	Retail Centers (Non-Strip With Contiguous Interconnected Off-Street	96
1223	Modern Strip Development	96
1224	Older Strip Development	97
1231	Commercial Storage	90
1232	Commercial Recreation	90
1233	Hotels and Motels	96
1234	Attended Pay Public Parking Facilities	91
1241	Government Offices	91
1242	Police and Sheriff Stations	91
1243	Fire Stations	91
1244	Major Medical Health Care Facilities	74
1245	Religious Facilities	82
1246	Other Public Facilities	91
1247	Non-Attended Public Parking Facilities	91
1251	Correctional Facilities	91
1252	Special Care Facilities	74
1253	Other Special Use Facilities	86
1261	Pre-Schools/Day Care Centers	68
1262	Elementary Schools	82
1263	Junior or Intermediate High Schools	82
1264	Senior High Schools	82
1265	Colleges and Universities	47
1266	Trade Schools and Professional Training Facilities	91
1271	Base (Built-up Area)	65
1271.01	Base High-Density Single Family Residential	42
1271.02	Base Duplexes, Triplexes and 2-or 3-Unit Condominiums and T	55

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APPENDIX A

Hydrology Calculations

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A.1
Existing Hydrology

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Project	Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculatec	Intensity (in./ Cu	Cd		Flowrate (cfs)
Diamond bar site D	A	30.7	0.01	50	2	1970	0.097	6.3	11	2.59	0.86	0.86	68.38
Diamond bar site D	B	1	0.01	50	2	557	0.1597	6.3	5	3.76	0.9	0.9	3.38

Discharge from Ex. 33" RCP based on
As-built drawings for Private Drain No. 1437
Los Angeles County Tract No. 34160

$Q_{25} = 73.7$ cfs into proposed site

$Q_{50} = (73.7)(1/0.878) = 83.94$ cfs

Total 50-year Discharge at Brea Canyon Channel

$Q_{50} = 83.94 + 68.38 = 152.32$ cfs

See Appendix D – Existing Hydrology Map

A.2
Proposed Hydrology

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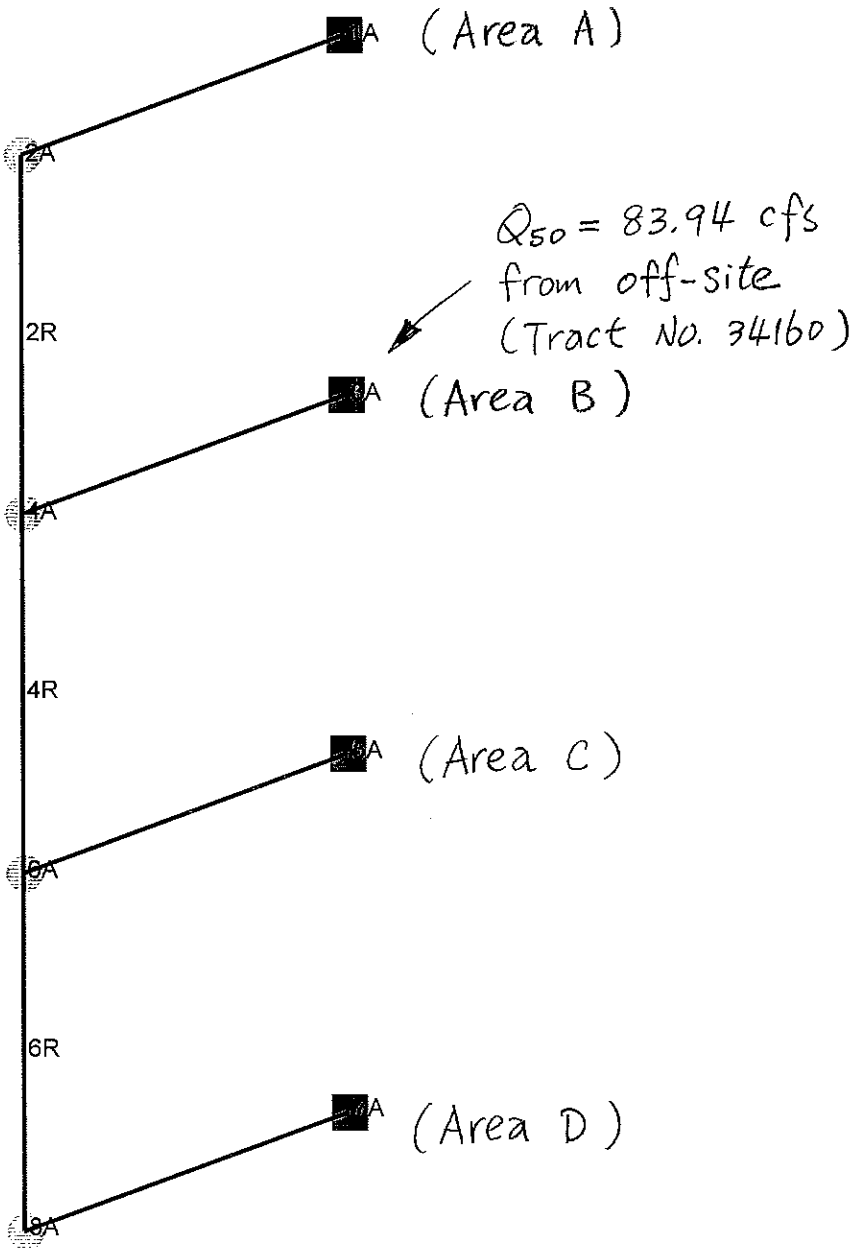
(Area A)
2A
Q_{50} = 83.94 cfs
from off-site
(Tract No. 34160)
2R
(Area B)
4R
(Area C)
6R
(Area D)

Project	Subarea	Area (acre:	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.	Tc-calculat	Intensity (ir	Cu	Cd	Flowrate (cfs)
Diamond bar site D	A	10.37	0.74	50	2	895	0.1028	6.3	6	3.45	0.9	0.9	32.20
Diamond bar site D	B	6.21	0.74	50	2	930	0.1183	6.3	6	3.45	0.9	0.9	19.28
Diamond bar site D	C	4.13	0.3	50	2	923	0.0791	6.3	7	3.21	0.89	0.89	11.80
Diamond bar site D	D	11.44	0.91	50	2	944	0.0382	6.3	8	3.01	0.88	0.9	30.99

Proposed Hydrology

File name: F:\JOB\2007\01776\Hydro\Hydrology\Proposed\untitled.lac Run date: Tue Feb 05 17:37:18 2008

Los Angeles County Flood Control District
Modified Rational Method Hydrology

Storm Frequency 50

LOCATION		SUBAREA AREA	SUBAREA Q	TOTAL AREA	TOTAL Q	TOTAL VOLUME	CONV TYPE	CONV LNGTH	CONV SLOPE	CONV SIZE	CONV Z	CONTROL Q	SOIL NAME	TC	RAIN	PCT IMPV
1	1A	10.4	32.07	10.4	32.07	2.320	0	0	0.00000	0.00	0.00	0	2	6	6.30	0.01
1	2A	0.0	0.00	10.4	32.07	2.320	4	100	0.10000	2.00	0.00	0	2	0	6.30	0.00
1	3A	6.2	19.12	16.6	51.00	3.703	0	0	0.00000	0.00	0.00	0	2	6	6.30	0.01
1	4A	0.0	0.00	16.6	51.00	3.703	4	192	0.08400	2.50	0.00	0	2	0	6.30	0.00
1	5A	4.1	11.66	20.7	62.25	4.607	0	0	0.00000	0.00	0.00	0	2	7	6.30	0.00
1	6A	0.0	0.00	20.7	62.25	4.603	4	944	0.03820	3.00	0.00	0	2	0	6.30	0.00
1	7A	11.4	30.33	32.1	90.86	7.145	0	0	0.00000	0.00	0.00	0	2	8	6.30	0.01
1	8A	0.0	0.00	32.1	90.86	7.145	0	0	0.00000	0.00	0.00	0	2	0	6.30	0.00

Normal End of MODRAT

134.94

146.19

174.80

These numbers are based on 83.94 cfs off-site discharge at Location "3A".

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APPENDIX B

SUSMP Water Quality Calculations

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PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total}	32.15	Acres
Type of Development	Residential & Commercial	
Predominate Soil Type #	002	
% of Project Impervious	74 %	
% of Project Pervious	26 %	
% of Project Contributing Undeveloped Area	0 %	
A_I	23.79	Acres
A_P	8.36	Acres
A_U	0	Acres

Area Breakdown

Residential	16.58 AC	74% impervious
Commercial	11.44 AC	91% impervious
Slopes	4.13 AC	30% impervious
	32.15 AC	74%

$$\text{impervious} = \frac{(16.58)(0.74)+(11.44)(0.91)+(4.13)(0.3)}{32.15} = 0.74$$

DETERMINING THE PEAK MITIGATED FLOW RATE (Q_{PM}):

In order to determine the peak mitigated flow rate (Q_{PM}) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation Q_{PM} for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity (I_X) values used.

By trial and error, determine the time of concentration (T_C), as shown below:

CALCULATION STEPS:

1. Assume an initial T_C value between 5 and 30 minutes.

T_C 15 minutes

2. Using Table 1, look up the assumed T_C value and select the corresponding I_X intensity in inches/hour.

I_X 0.267 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, C_U, using the runoff coefficient curve corresponding to the predominant soil type.

C_U 0.38

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

C_D 0.765

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.204

6. Calculate the time of concentration, $T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

Calculated T_C 40.7 minutes

7. Calculate the difference between the initially assumed T_C and the calculated T_C, if the difference is greater than 0.5 minutes. Use the calculated T_C as the assumed initial T_C in the second iteration. If the T_C value is within 0.5 minutes, round the acceptable T_C value to the nearest minute.

Use max. 30 minutes

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1	15	0.267	0.38	0.765	0.204	40.7	25.7
2	30	0.193	0.22	0.723	0.140		
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 30 minutes

8. Calculate the Peak Mitigation Flow Rate,
   $Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

Q_{PM} 4.49 cfs

$Q = (0.723)(0.193)(32.15) = 4.49$ cfs

Flow Base

Use CDS PMSU 40_30

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$$= (2722.5)[(23.79)(0.9) + (8.36)(0.193)]$$

$$= 62684\ ft^3 = 1.44\ ac\text{-}ft$$

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient

IMP = Proportion Impervious

C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 002

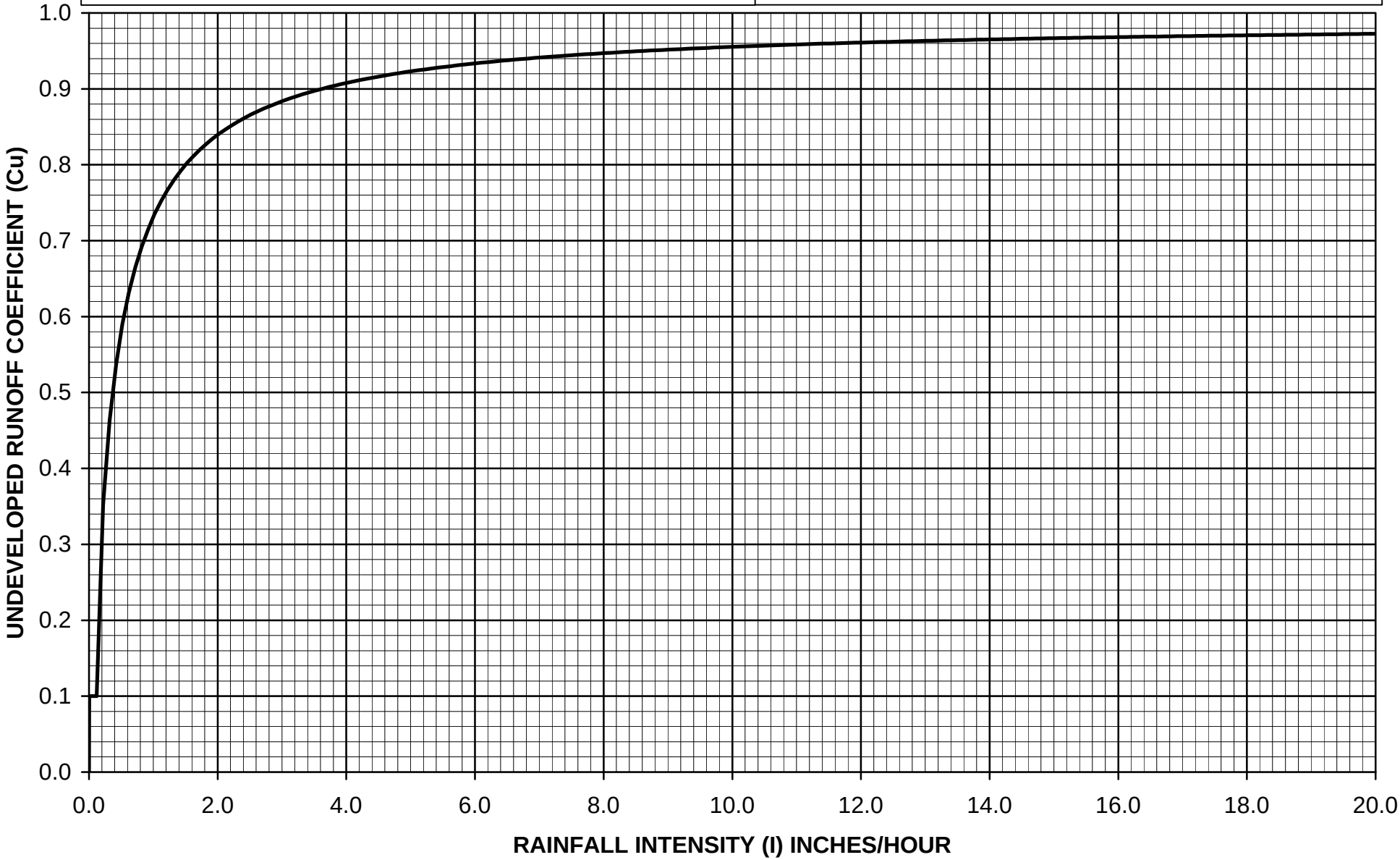

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

DETERMINING THE VOLUME (V_M)

TABLE — A
MODEL PERFORMANCE CAPABILITY

		MODEL NUMBER	DESIGN FLOW RATE CFS	MGD	M^3/sec	REFERENCE PAGE
PRECAST	INLINE	PMIU20_15	0.7	0.5	.02	9
		PMSU20_15_4	0.7	0.5	.02	
		PMSU20_15	0.7	0.5	.02	
		PMSU20_20	1.1	0.7	.03	
		PMSU20_25	1.6	1.0	.05	
		PMSU30_20	2.0	1.3	.06	
		PMSU30_30	3.0	1.9	.08	
		PMSU40_30	4.5	3.0	.13	
		PMSU40_40	6.0	3.9	.17	
	OFFLINE	PSWC30_30	3.0	1.9	.08	10
		PSWC40_40	6.0	3.9	.17	
		PSWC56_40	9.0	5.8	.25	
		PSWC56_53	14	9.0	.40	
		PSWC56_68	19	12	.54	
		PSWC56_78	25	16	.71	
		PSW30_30	3.0	1.9	.08	
		PSW50_42	9.0	5.8	.25	
		PSW50_50	11	7.1	.31	11
		PSW70_70	26	17	.74	
		PSW100_60	30	19	.85	
		PSW100_80	50	32	1.4	
		PSW100_100	64	41	1.8	
CAST IN PLACE		CSW150_134	148	95	4.2	12
		CSW200_164	270	174	7.6	
		CSW240_160	300	194	8.5	

Conversion: 1cfs ≅ 0.0283 cubic meters per second, or 1 M^3/sec ≅ 35.31cfs
1cfs ≅ 0.64512 MGD or 1MGD ≅ 1.55 cfs

MODEL DESIGNATIONS

PMSU= Precast Manhole Storm Water Unit
PSWC= Precast Storm Water Concentric
PSW = Precast Storm Water
CSW = Cast in Place Storm Water

X X _ X X (L or R)*

Screen Diameter
Screen Height
Feet
Tenths of a Foot
Tenths of a Foot
Feet

* L or R designates the location of the CDS when looking downstream. (L)eft represents being placed on the Left side of the stormdrain, (R)ight is placed on the right side.

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APPENDIX C

Conceptual Brea Canyon Channel Plan

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Based on LA County Private Drain NO. 395
(Brea Canyon Channel)

Q_{25} = 2285 cfs @ Diamond Bar Blvd. (DBB)

Q_{50} = 2285 / 0.878 = 2602 cfs @ DBB

From Proposed Development

Q_{50} = 174.8 cfs

Total Q_{50} at proposed RCB (Direct summation no confluence calculations)

Q_{50} = 2602 + 174.8 = 2777 cfs

Worksheet for Rectangular Channel - 1

Total
Q_{50} = 2,777 cfs
Double cells
Q_{50} = 1,389 cfs/cell

Project Description		
Flow Element:	Rectangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data			
Roughness Coefficient:	0.013		
Channel Slope:	0.00880	ft/ft	
Bottom Width:	9.00	ft	← Bottom width
Discharge:	1389.00	ft³/s	← Q per cell

Results			
Normal Depth:	7.28	ft	← Normal Depth
Flow Area:	65.51	ft²	
Wetted Perimeter:	23.56	ft	
Top Width:	9.00	ft	
Critical Depth:	9.05	ft	
Critical Slope:	0.00514	ft/ft	
Velocity:	21.20	ft/s	
Velocity Head:	6.99	ft	
Specific Energy:	14.27	ft	
Froude Number:	1.39		
Flow Type:	Supercritical		

8' high Box
(Remain as open channel flow)

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	7.28	ft
Critical Depth:	9.05	ft
Channel Slope:	0.00880	ft/ft
Critical Slope:	0.00514	ft/ft

SPAN			4'				5'						6'								7'								8'									
HEIGHT			2'		3'		4'		2'		3'		4'		5'		3'		4'		5'		6'		7'		3'		4'		5'		6'		7'		4'		5'		6'		7'		8'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T1	7"	7"	7"	7"	7"	7"	7"	7½"	7"	7½"	7"	7½"	7"	7½"	7"	9"	7"	9"	7"	9"	7"	9"	7½"	10"	7½"	10"	7½"	10"	7½"	10"	8"	10"	8"	11"	8"	11"	8"	11"	8"	11"	8"	11"	8"	11"
	Walls	T2	6"	6"	6"	6"	6"	7"	6"	6"	6"	6"	6"	7"	6½"	7½"	6"	6"	6"	7"	6½"	8"	7"	8½"	6"	6"	6"	7"	6½"	7½"	7"	9"	8"	9½"	6"	7½"	6½"	8"	7"	9"	8"	10"	8½"	11"
	Invert	T3	7"	7"	7"	7"	7"	7"	7"	8"	7"	8"	7"	8"	7"	8"	7"	9"	7"	9"	7"	9"	7"	9"	7½"	10½"	7½"	10½"	7½"	10½"	7½"	10½"	7½"	10½"	8"	11½"	8"	11½"	8"	11½"	8"	11½"	8"	11½"
Reinf	Spacing		1'-4"	1'-3"	1'-4"	1'-3"	1'-4"	1'-3"	11½"	1'-2"	11½"	1'-2"	11½"	1'-2"	11½"	1'-3"	11½"	1'-0"	11½"	1'-0"	11½"	1'-0"	11½"	1'-0"	11"	10½"	11"	10½"	11"	10½"	11"	10½"	11"	10½"	9"	10"	9"	10"	9"	10"	9"	10"	9"	10"
	"g"	Size Bar	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7
	"f"	Size Bar	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#6	#5	#6	#5	#6	#5	#6	#5	#6	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5
	"a"	Size Bar	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#7	#4	#7	#4	#7	#4	#7	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4
	"e"	Size Bar	#4	#4	#4	#5	#5	#6	#4	#4	#4	#5	#5	#6	#5	#7	#4	#5	#4	#6	#5	#6	#6	#7	#4	#5	#5	#5	#5	#6	#6	#7	#6	#7	#4	#5	#5	#6	#6	#6	#6	#7	#6	#7	#6	#7
Quantities	Concrete	CF/LF	14.0	14.0	15.5	15.5	17.0	17.8	16.3	17.8	17.8	19.3	19.3	21.6	21.3	23.8	20.1	24.6	21.6	27.0	23.6	29.7	25.8	32.2	23.7	30.6	25.2	33.3	27.2	35.5	29.4	39.1	32.4	41.8	29.2	40.1	31.2	42.4	33.4	45.5	36.4	48.9	39.0	52.6
	Reinforcement	LB/LF	78	89	84	95	93	112	119	112	122	121	134	137	145	162	186	162	192	179	206	190	227	212	207	197	220	208	227	228	252	262	260	276	283	237	302	266	340	279	350	312	360	326

SPAN			10'-0										12'										14'											
HEIGHT			5'		6'		7'		8'		9'		10'		6'		7'		8'		9'		10'		11'		12'		7'		8'		9'		10'		11'		12'		13'		14'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T1	9"	1'-½"	9"	1'-½"	9"	1'-½"	9"	1'-½"	9½"	1'-½"	9½"	1'-½"	10"	1'-2½"	10"	1'-2½"	10"	1'-2½"	10"	1'-2½"	10"	1'-2½"	10"	1'-2½"	10"	1'-2½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"	11½"	1'-4½"
	Walls	T2	8"	8"	8"	8½"	8"	9½"	8"	10½"	8½"	11½"	9½"	1'-½"	8"	8½"	8"	9"	8½"	10½"	9"	11½"	9½"	12½"	10"	1'-2"	11"	1'-3"	8½"	9½"	8½"	10½"	9"	11½"	9½"	12½"	10½"	1'-2"	11½"	1'-3"	12½"	1'-4½"	1'-1"	1'-6½"
	Invert	T3	9"	1'-½"	9"	1'-½"	9"	1'-½"	9"	1'-½"	9"	1'-½"	9"	1'-½"	10"	1'-3"	10"	1'-3"	10"	1'-3"	10"	1'-3"	10"	1'-3"	10"	1'-3"	10"	1'-3"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"	11½"	1'-5"
Reinf	Spacing		11"	7½"	10½"	7½"	10"	8"	10"	8"	10½"	8"	10½"	8½"	9"	8"	9"	8"	7½"	8"	7½"	8"	7½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	9"	8"	9"	8"
	"g"	Size Bar	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8
	"f"	Size Bar	#7	#5	#6	#5	#6	#5	#6	#5	#6	#5	#6	#5	#7	#7	#7	#7	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6
	"a"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4
	"b"	Size Bar	#5	#5	#4	#5	#5	#5	#6	#5	#6	#6	#6	#6	#5	#5	#5	#6	#5	#6	#5	#6	#6	#6	#5	#6	#6	#6	#5	#6	#6	#6	#5	#6	#6	#6	#6	#6	#7	#7	#7	#7	#7	#7	#7	#7
		Dim "B" Ft-Inches	1-9	2-7	2-0	2-9	2-3	2-9	2-7	3-1	2-7	3-1	2-7	3-1	2-7	3-1	3-0	3-2	3-6	3-2	3-6	3-4	3-9	3-4	3-9	3-4	3-9	3-4	2-7	2-7	3-3	3-3	4-0	4-0	4-0	4-0	4-7	4-4	4-7	4-11	5-3	4-11	5-3	4-11
		Dim "Bw" Ft-Inches	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-1	3-2	4-1	3-4	4-1	3-4	4-1	3-7	3-9	3-7	3-9	3-7	3-9	3-7	5-0	3-9	5-0	4-6	5-0	5-0	5-0	5-0	4-9	5-6	4-9	6-2	5-2	6-2	5-2	6-2
	"c"	Size Bar	#5	#5	#6	#5	#6	#6	#6	#6	#7	#6	#7	#6	#6	#6	#5	#6	#6	#6	#6	#6	#6	#6	#7	#7	#7	#7	#6	#6	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#8	#8
		Dim "C" Ft-Inches	3-1	2-9	3-9	3-3	4-6	4-3	5-6	4-6	6-0	4-9	6-0	4-9	3-10	3-7	4-6	4-4	5-7	5-0	6-6	5-2	7-2	5-4	7-5	5-7	7-5	5-7	4-3	3-11	5-6	5-2	7-9	5-8	8-6	6-5	8-10	6-6	9-0	6-10	9-3	6-10	9-3	6-10
	* "e"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5	#6	#6
Quantities	Concrete	CF/LF	42.7	55.6	44.7	58.2	46.7	61.8	48.7	65.6	52.5	70.0	56.3	74.5	55.0	76.3	57.0	79.1	59.8	83.8	62.7	88.1	65.9	92.7	69.1	98.8	73.7	104.0	71.8	99.7	73.9	104.0	76.9	108.0	80.0	113.0	84.2	119.1	88.8	124.0	94.1	131.0	98.1	137.0
	Reinforcement	LB/LF	370	454	381	494	418	494	460	510	486	550	518	568	543	604	563	646	600	663	614	688	627	691	701	749	733	764	662	710	715	783	756	820	807	846	833	873	881	958	884	976	1002	1110

* See Note 5

"d" bars, for earth covers up to and including 10'-0"							
Span	4'	5'	6'	7'	8'	10'	12'	14'
Number	5	6	8	10	13	14	16	19

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 1, 2006
PLANS APPROVAL DATE

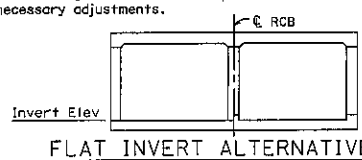
Dallas Forester
No. C37765
EXP. 12-31-06
CIVIL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

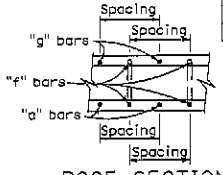
To get to the Caltrans web site, go to: http://www.dot.ca.gov

NOTES:

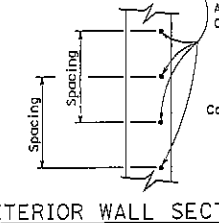
1. For boxes with span or height less than any of those shown in table, use next greater size box concrete dimensions and reinforcement. Make necessary changes in bar lengths and quantities.
2. For boxes with span or height or cover greater than those shown in tables, a special design is required.
3. Quantities are approximate and for design purposes only.
4. It is permissible to eliminate the 180° hooks on every other "e" bar.
5. "e" bars are at half spacing.
6. Provide paving notch when top is exposed and when pavement is portland cement concrete, and adjust quantities.
7. For design and details not shown, see Standard Plan D82.
8. This plan sheet may be used for multiple cell culverts by making necessary adjustments.



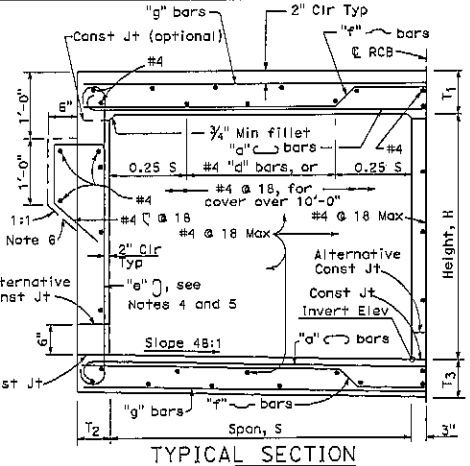
FLAT INVERT ALTERNATIVE



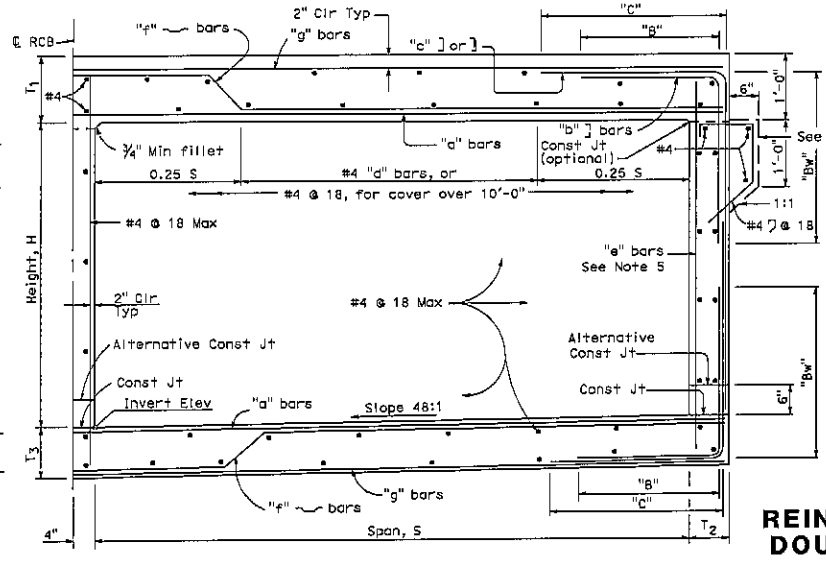
ROOF SECTION
SPANS 4' THRU 8'
INVERT SIMILAR



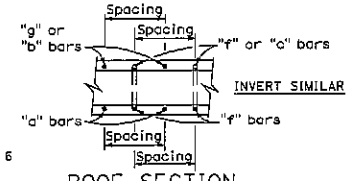
EXTERIOR WALL SECTION
SPANS 4' THRU 8'



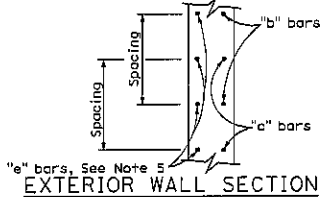
TYPICAL SECTION
SPANS 4' THRU 8'



TYPICAL SECTION
SPANS 10' THRU 14'



ROOF SECTION
SPANS 10' THRU 14'



EXTERIOR WALL SECTION
SPANS 10' THRU 14'

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

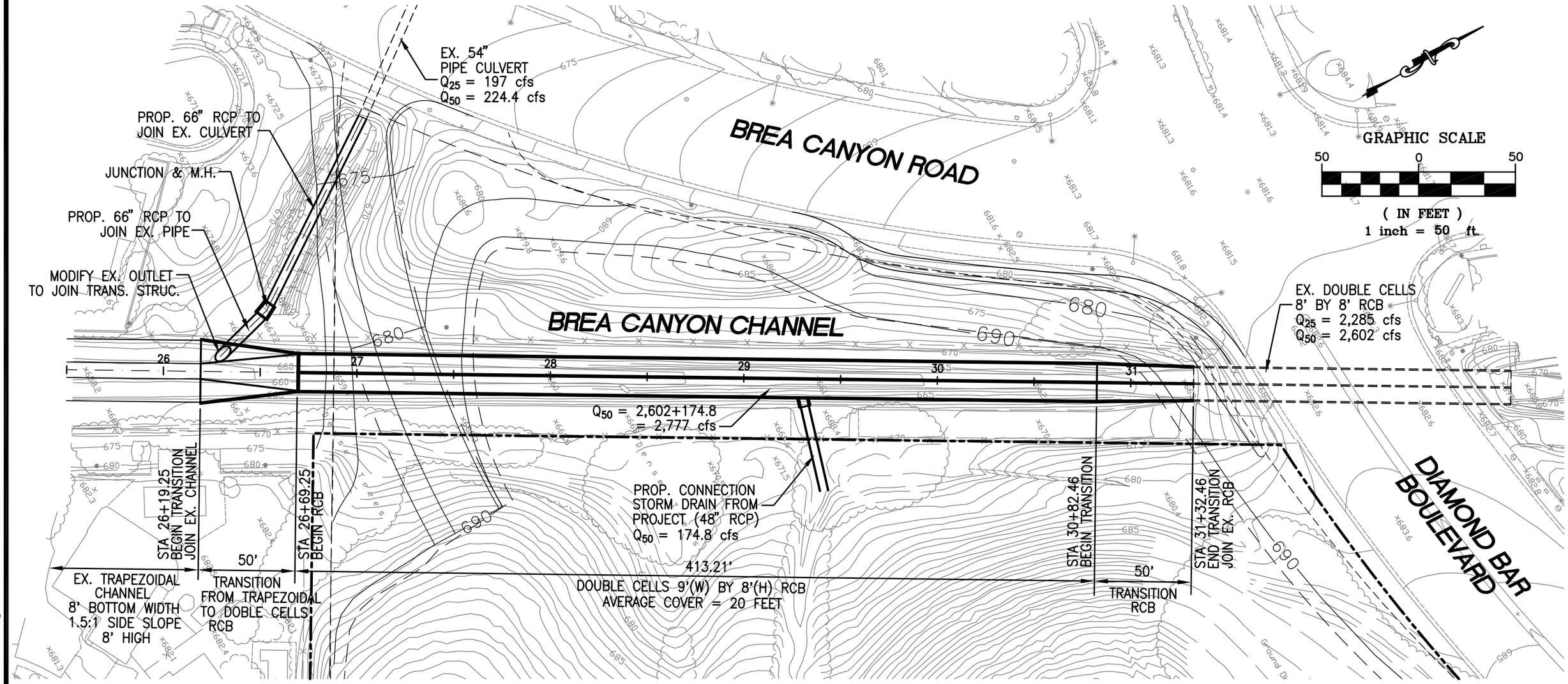
CAST-IN-PLACE REINFORCED CONCRETE DOUBLE BOX CULVERT

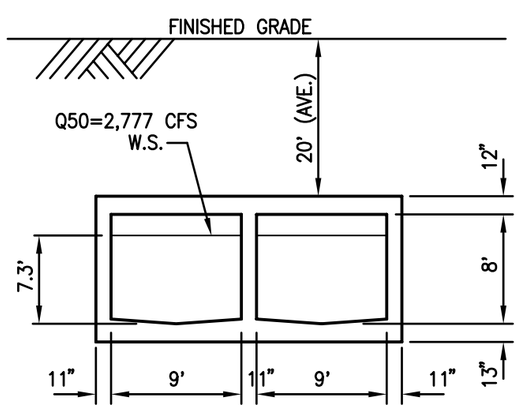
NO SCALE

D81

2006 STANDARD PLAN D81

1-24-06





TYPICAL RCB SECTION

PREPARED BY:

PENCO ENGINEERING, INC.

Civil Engineering
Planning
Surveying
Construction Management

One Technology Park, Building J-725, Irvine, California 92618
Telephone (949) 753-8111 Fax (949) 753-0775

WALNUT VALLEY UNIFIED SCHOOL DISTRICT

SITE D
BREA CANYON CHANNEL
DIAMOND BAR BLVD. AND BREA CANYON ROAD

CITY OF DIAMOND BAR

SHEET 1 OF 1

REFERENCE NUMBER 1776.01

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APPENDIX D

Hydrology Maps

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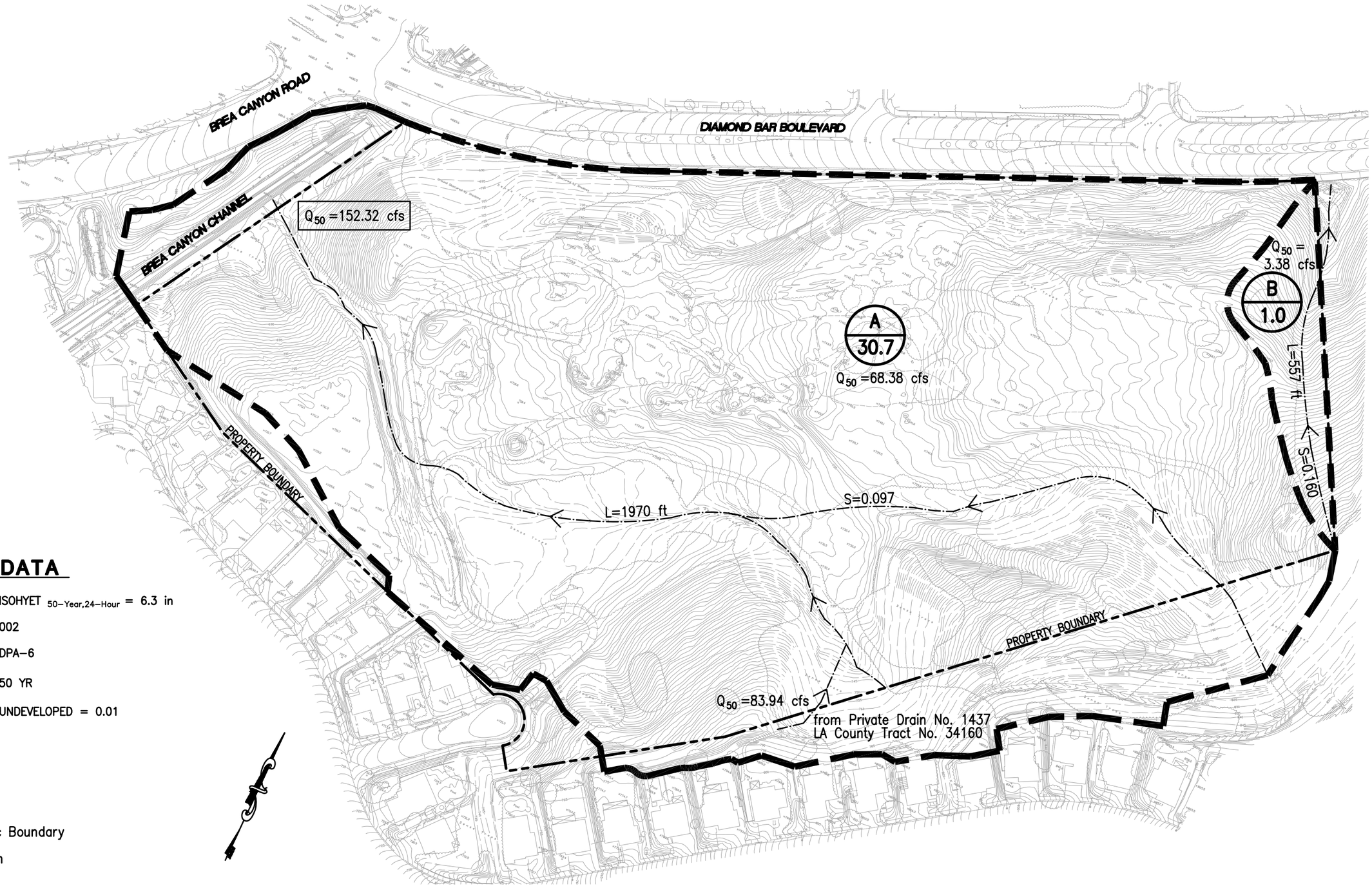

HYDROLOGY DATA

1.	RAINFALL	ISOHYET $_{50\text{-}Year,24\text{-}Hour}$ = 6.3 in
2.	SOIL TYPE	002
3.	DEBRIS ZONE	DPA-6
4.	FREQUENCY	50 YR
5.	IMPERVIOUS VALUE	UNDEVELOPED = 0.01

LEGEND

- Hydrologic Boundary
- Flow Path
- A5 / 1.25 — Subarea / Area (in Acres)

EL	Elevation
L	Lenght
S	Slope
cfs	Cubic Feet per second

GRAPHIC SCALE

150 0 150

(IN FEET)
1 inch = 150 ft.

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Telephone (949) 753-8111 Fax (949) 753-0775

WALNUT VALLEY UNIFIED SCHOOL DISTRICT

SITE D
EXISTIMG HYDROLOGY MAP
DIAMOND BAR BLVD. AND BREA CANYON ROAD

CITY OF DIAMOND BAR

SHEET 1 OF 1

REFERENCE NUMBER 1776.01

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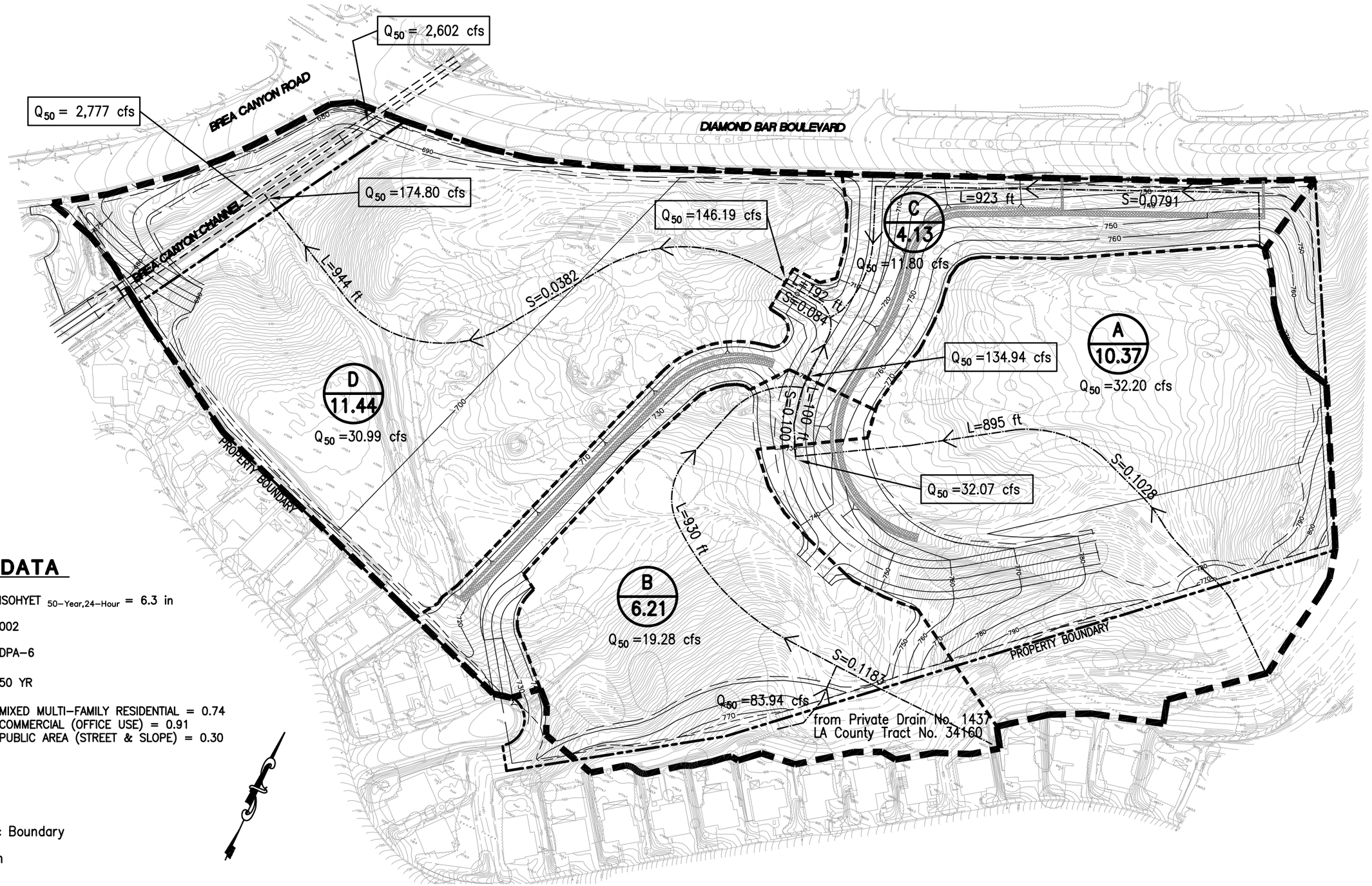

HYDROLOGY DATA

1.	RAINFALL	ISOHYET $_{50\text{-Year},24\text{-Hour}}$ = 6.3 in
2.	SOIL TYPE	002
3.	DEBRIS ZONE	DPA-6
4.	FREQUENCY	50 YR
5.	IMPERVIOUS VALUE	MIXED MULTI-FAMILY RESIDENTIAL = 0.74 COMMERCIAL (OFFICE USE) = 0.91 PUBLIC AREA (STREET & SLOPE) = 0.30

LEGEND

- Hydrologic Boundary
- Flow Path
- A5 / 1.25 — Subarea / Area (in Acres)

EL	Elevation
L	Lenght
S	Slope
cfs	Cubic Feet per second

GRAPHIC SCALE

150 0 150

(IN FEET)
1 inch = 150 ft.

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WALNUT VALLEY UNIFIED SCHOOL DISTRICT

SITE D
PROPOSED HYDROLOGY MAP
DIAMOND BAR BLVD. AND BREA CANYON ROAD

CITY OF DIAMOND BAR

SHEET
1 OF 1

REFERENCE NUMBER
1776.01

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