PSOMAS

CONCEPTUAL HYDROLOGY

For

VTTM No. 67505
22255 Mulholland
22241 – 22255 Mulholland Drive,
Woodland Hills, CA 91364

Psomas Project No.: 1DSV011300
September 12, 2006

Prepared for:

DS Ventures, LLC
8383 Wilshire Blvd, Suite 1000
Beverly Hills, CA 90211
Telephone: (661) 664-6544

Prepared by:

PSOMAS
11444 West Olympic Blvd., Suite 750
West Los Angeles, California 90064
Telephone: (310) 954-3700
Fax: (310) 954-3777

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ALBERT PRIETO, P.E. R.C.E. No. 27245 Date: **9-12-06**

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1.0 PROJECT SUMMARY

1.1 PROJECT PURPOSE AND SCOPE

The purpose of this study is to demonstrate that the proposed project site can be designed to provide adequate flood protection for on-site improvements without adversely impacting existing off-site drainage facilities or adjacent properties through the use of storm drain systems.

Psomas has been retained by DS Ventures to prepare a conceptual hydrology report for the proposed Mulholland Project. The 6.2-acre project site is located northeast of the intersection of Mulholland Drive and San Feliciano Drive in Woodland Hills. The site was previously a privately-owned ranch property, and the proposed improvements involve the development per VTTM No. 67505, which consists of 29 detached single family residences. (See Hydrology Map, Section 4.0)

1.2 EXISTING AND PROPOSED DRAINAGE CONDITIONS

EXISTING DRAINAGE CONDITIONS

Storm runoff from the entire project site is currently conveyed by overland flow into existing Los Angeles County Flood Control District (LACFCD) storm drain system in San Feliciano Drive (Project No. 5229). Portions of the existing 81-inch County storm drain system and its fifteen-foot easement currently run through the southwest portion of the site.

The project area is currently undeveloped with varying slopes, ranging from 2% to 50%. Storm runoffs travel from the eastern, southern, and western end of the boundaries to the middle of the site and flow north towards San Feliciano Drive. The easterly boundary of the site is bordered by the Girard Reservoir. An existing 30-inch City of Los Angeles storm drain system (Plan D-17484) parallel to the centerline of Mulholland Drive collects runoff from the southern side of the road. The runoffs from the northern side of Mulholland Drive and the associated undeveloped area along the road outside the property boundaries are currently conveyed by overland flow into the project area which ultimately conveyed to the existing county system.

The existing condition is identified in the Existing Hydrology Map located in Appendix A. Existing condition hydrology results for the 25-year storm event are summarized in Table 1 below.

Table 1: Existing Condition Hydrology Summary

Area	Area (ac)	25-Year Storm Event			
		Time of Conc. (min)	Q_{25} (cfs)	Q_{25}/A (cfs/ac)	Total Q_{25} (cfs)
1A	10.1	10	25.86	2.56	25.86

PROPOSED DRAINAGE CONDITIONS

As with the existing condition, the times of concentration for sub-areas were calculated using the *TC* program. The *TC* calculations are provided in Section 2 respectively. Percent imperviousness was calculated for each individual subarea. Proposed condition hydrology results for the 25-year storm event are summarized in Table 2.

Table 2: Proposed Condition Hydrology Summary

Area	Sub area	Area (ac)	25-Year Storm Event[A]			
			Time of Conc. (min)	Q_{25} (cfs)	Q_{25}/A (cfs/ac)	Total Q_{25} (cfs)
A	1A	2.95	7	9.13	3.09	9.13
B	2B	7.15	11	17.69	2.47	17.69
	Total	10.1	--	--	--	26.82

Subarea 1A mainly consists of area in its natural stage without any site development. Runoff will follow its existing natural flow path through native vegetation along the Girard Reservoir into the existing County storm drain system on San Feliciano Drive. In addition to the natural flow, runoffs from a portion of the developed site will be collected by drainage inlets, which will then join the overland flow from the undeveloped areas in the natural drainage course. (See Hydrology Map, Section 4.0)

Subarea 2B will be developed with 29 detached single family residences. Associated site improvements include curb and sidewalks, common area landscaped for new construction, sidewalk dedication, drainage facilities, and paving and grading for access roads, driveways, and private street. Roof runoffs are conveyed through roof drains and then collected by catch basins with Drain Pac inserts that cleans the runoff before conveying into the existing storm drain system. The peak mitigation flow rate is calculated to be 1.03 cfs, and the volume of stormwater runoff to be mitigated from the proposed development is 0.33 acre-feet. (See Water Quality Calculations, Section 3.0) Proposed catch basins along the access road adjacent to Mulholland Drive will collect the runoffs from both the developed residential areas and the undeveloped areas along Mulholland Drive.

1.3 HYDROLOGIC ANALYSIS

The methodology described in the Los Angeles County Department of Public Works Hydrology Manual was used to compute storm water runoff rates from the project site to the existing storm drains. A hydrology study was tabulated and compared between the existing conditions and proposed conditions. Flows in excess of the proposed hydrologic study will be detained on-site.

The hydrologic methods used in this study were based on procedures described in the Los Angeles County Department of Public Works Hydrology Manual. The method used is the "Rational Method" (for sub-area time of concentration computation).

The *LACDPW TC (TC_calc_depth.xls, July 2004)* program was used to calculate the time of concentration and peak runoff flow rate for the existing and proposed conditions. Tc calculations are provided in Section 2. In accordance with LACDPW requirements, the 25-year storm event was used as the main design storm in this analysis.

The Mulholland project is located in Woodland Hills and in the Canoga Park quadrant of Isohyetal Map Figure LACDPW 1-H1.26, in the Appendix. The 50-year 24-hour rainfall Isohyet nearest the project area is 7.70. As mentioned in this report the 25-year storm event will be used. Thus, the 25-year 24-hour rainfall Isohyet in the project area is 6.76. As shown on figure LACDPW 1-H1-26 (included in the Appendix), the project falls within two LACDPW-defined soil classification types: 002 and 004. Because the project site consists of predominantly soil classification 002, calculations were based on the 002 soil type. The project area to be disturbed is 4.33 acres in size. The total tributary area to be studied is 10.1 acres in size.

1.4 CONCLUSIONS

The hydrology calculations demonstrate that the proposed site can be protected from flooding through the use of existing off-site condition in conjunction with proposed on-site drainage facilities. The following table summarizes the calculated flow rates and allowable discharge rates from each sub-area.

Table 3 – Existing vs. Proposed Condition Hydrology Comparison Summary:

25-Year Storm Event						
Drainage Area	**Area (ac)**			**Q_{25} (cfs)**		
	Exist.	**Prop.**	**Diff.**	**Exist.**	**Prop.**	**Diff.**
A	10.10	2.95	-7.15	25.86	9.13	-16.73
B	0.00	7.15	7.15	0	17.69	17.69
Total	10.10	10.10	0.00	25.86	26.82	+0.96

The entire existing tributary area runoffs convey to a single location downstream before entering the existing storm drain system. Since the tributary area is treated as a single entity during the calculations, uncertainties in the parameters will slightly modify the final results. As a result, after thorough examinations of the existing and proposed conditions, the difference between the peak flow rates is small enough to be considered negligible. Detention is therefore not necessary.

1.5 LIMITATIONS

- This report was prepared to comply with the guidelines established by the Los Angeles County Department of Public Works and their representatives. Evaluation of the appropriateness of these guidelines and the accuracy of County data was beyond the scope of this work.

- Usage of this report is limited to address the purpose and scope previously defined by the project owner. Psomas shall not be held responsible for any unauthorized application of this report and the contents herein.

- The opinions presented in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

Section 2.0

RATIONAL METHOD Tc CALCULATIONS

Mulholland Existing 25-year Hydrology

Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flowrate (cfs)
1A	10.1	0.24	25	2	1387	0.033	6.76	10	2.91	0.88	0.88	25.86

Mulholland Proposed 25-year Hydrology

Subarea	Area (acres)	%imp	Frequency	Soil Type	Length (ft)	Slope (ft/ft)	Isohyet (in.)	Tc-calculated (min.)	Intensity (in./hr)	Cu	Cd	Flowrate (cfs)
1A	2.95	0.23	25	2	899	0.0454	6.76	7	3.44	0.9	0.9	9.13
2B	7.15	0.65	25	2	1609	0.02635	6.76	11	2.78	0.87	0.89	17.69

Section 3.0

WATER QUALITY CALCULATIONS

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

PROJECT NAME

VTTM No. 67505

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

NOMENCLATURE

A_I = Impervious Area (acres)
A_P = Pervious Area (acres)
A_U = Contributing Undeveloped Upstream Area (acres)
A_{Total} = Total Area of Development and Contributing Undeveloped Upstream Area (acres)
C_D = Developed Runoff Coefficient
C_U = Undeveloped Runoff Coefficient
I_X = Rainfall Intensity (inches / hour)
Q_{PM} = Peak Mitigation Flow Rate (cfs)
T_C = Time of Concentration (minutes, must be between 5-30 min.)
V_M = Mitigation Volume (ft^3)

EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total} * \%$ of Development which is Impervious)

$A_P = (A_{Total} * \%$ of Development which is Pervious)

$A_U = (A_{Total} * \%$ of Contributing Undeveloped Upstream Area***)

$C_D = (0.9 * Imp.) + [(1.0 - Imp.) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$
$= C_D * I_X * A_{Total} * (1.008333 \text{ ft}^3\text{-hour / acre-inches-seconds})$

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$
$= (2{,}722.5 \text{ ft}^3 / \text{acre}) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total}	10.1	Acres
Type of Development	Ranch (Existing)	
Predominate Soil Type #	2	
% of Project Impervious	24 %	
% of Project Pervious	76 %	
% of Project Contributing Undeveloped Area	0	
A_I	1.03	Acres
A_P	9.07	Acres
A_U	0	Acres

Length = 1387 ft

Slope = 0.033 ft/ft

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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 0.1

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

C_D 0.2896

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.077323

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 61.32 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.

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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	0.1	0.2896	0.077323	61.32	46.32
2	61.32	n/a					
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-hour / acre-inches-seconds)

Q_{PM} 0.57 cfs

$C_D = 0.2896$

$I_{30} = 0.193$

$A_{total} = 10.1$ acres

use I_{30} since T_C is greater than 30 minutes

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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
Iteration # 1 → 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)

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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

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

$A_I = 1.03$ acres

$A_P = 9.07$ acres

$A_u = \phi$

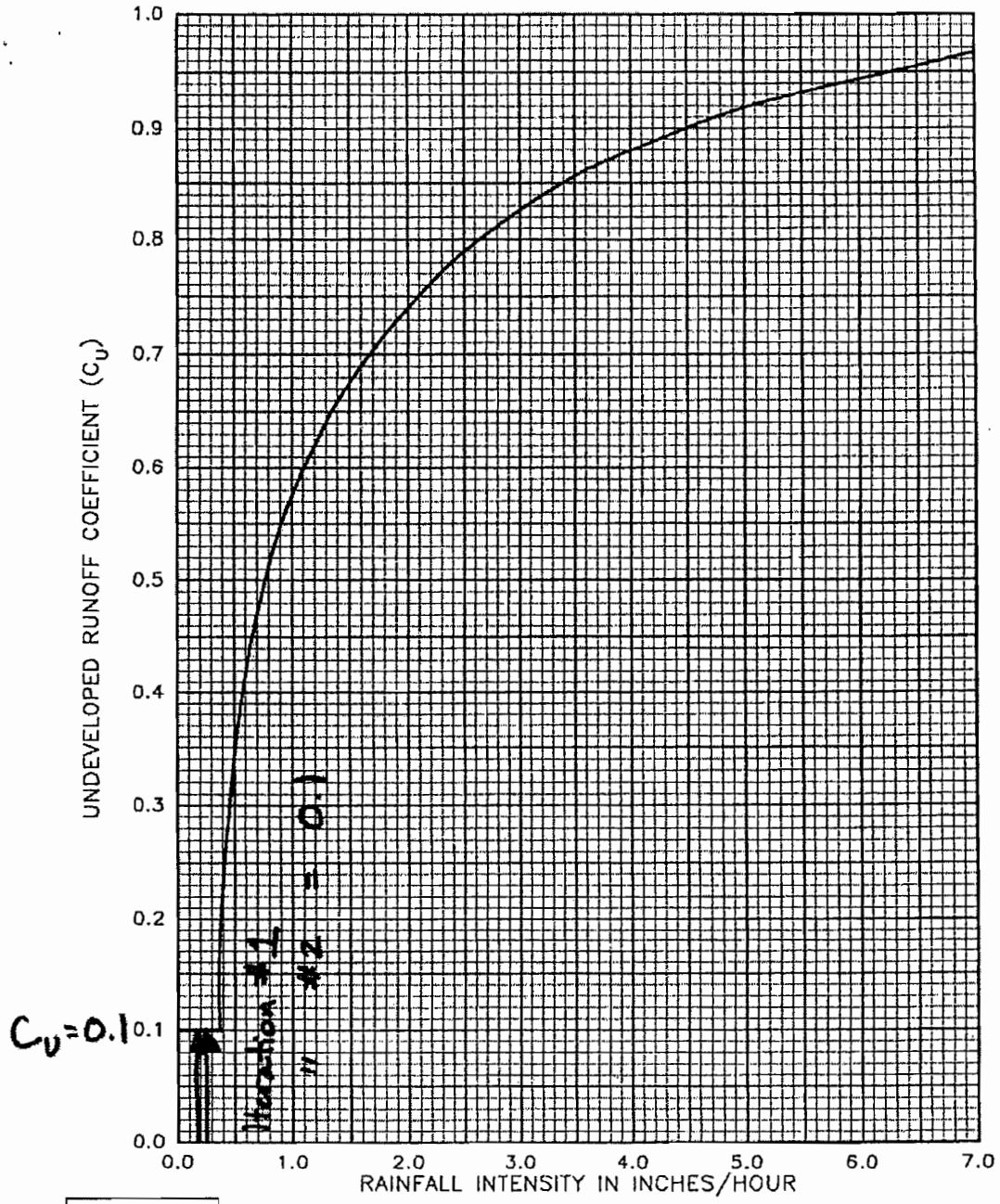
$C_u = 0.1$

$V_M = 4993\ ft^3$

$V_M = 0.11$ ac-ft

Existing Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS



Equation:	Los Angeles County Department of Public Works
$C_D = (0.9 * IMP) + (1.0 - IMP)\ C_U$ C_D = Developed runoff coefficient. Where: IMP = Proportion impervious. C_U = Undeveloped runoff coefficient.	RUNOFF COEFFICIENT CURVE SOIL TYPE NO. 006

NS006.SPG

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total}	10.1	Acres
Type of Development	Residential	
Predominate Soil Type #	2	
% of Project Impervious	53 %	
% of Project Pervious	47 %	
% of Project Contributing Undeveloped Area	0	
A_I	5.36	Acres
A_P	4.74	Acres
A_U	0	Acres

Length = 1609 ft

Slope = 0.0264 ft/ft

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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 0.1

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

C_D 0.524

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.139908

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 49.91 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.

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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	0.1	0.524	0.139908	49.91	34.91
2	49.91	n/a					
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-hour / acre-inches-seconds)

Q_{PM} 1.03 cfs

$C_D = 0.524$

$I_{30} = 0.193$

$A_{total} = 10.1$ acres

use I_{30} since T_C is greater than 30 minutes

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
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25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

DETERMINING THE VOLUME (V_M)

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

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

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

$A_I = 5.36$ acres $A_U = 0$

$A_P = 4.74$ acres

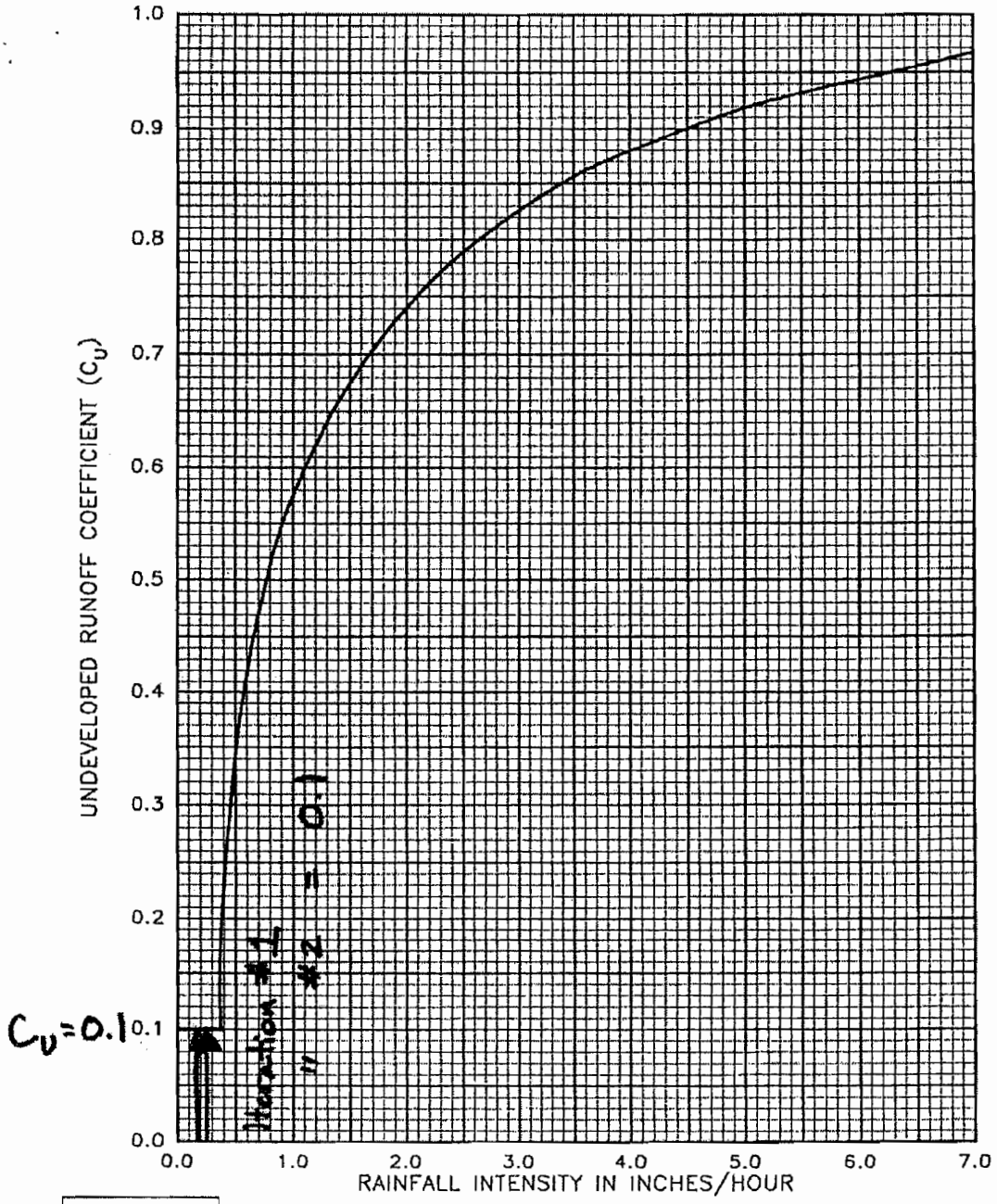
$C_U = 0.1$

$V_M = 14{,}424\ ft^3$

$V_M = 0.33$-ac-ft

Proposed Condition

APPENDIX A VOLUME & FLOW RATE CALCULATIONS



Equation:	Los Angeles County Department of Public Works
$C_D = (0.9 * IMP) + (1.0 - IMP)\ C_U$ C_D = Developed runoff coefficient. Where: IMP = Proportion impervious. C_U = Undeveloped runoff coefficient.	RUNOFF COEFFICIENT CURVE SOIL TYPE NO. 006

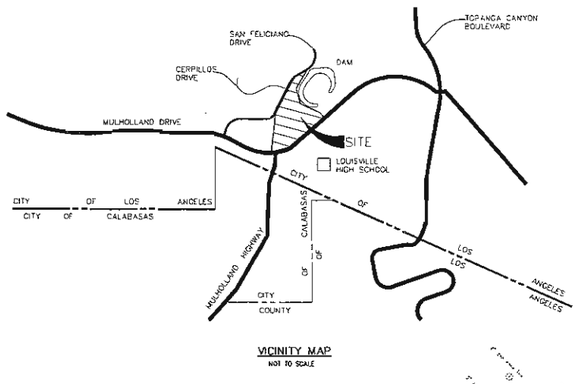
NS006.SPG

Section 4.0

EXHIBITS (EXISTING & PROPOSED DRAINAGE MAPS)

VESTING TENTATIVE TRACT MAP NO. 67505

22241 – 22255 MULHOLLAND DRIVE



VICINITY MAP
NOT TO SCALE

LEGEND / HYDROLOGIC DATA

- PROPERTY LINE
- DRAINAGE AREA BOUNDARY
- 1A / 10.1 AC — AREA DESIGNATION AND ACREAGE
- DRAINAGE FLOW PATH
  - STORM FREQUENCY: 25 YEARS
  - PREDOMINANT SOIL TYPE: 002
  - LAND USE: RESIDENTIAL
  - RAINFALL: 6.76 INCHES
- IMPERVIOUS AREA
- PREVIOUS AREA

% IMPERVIOUS CALCULATIONS		
DESCRIPTION	AREA (AC)	% IMPERVIOUS
IMPERVIOUS	1.03	100
PERVIOUS	9.07	15

GRAPHIC SCALE: 1"=30'
Note: For reduced sized prints, original scale is in inches

DS VENTURES, LLC

EXISTING HYDROLOGY MAP

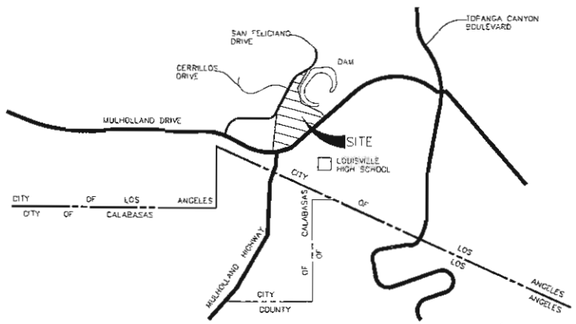
PSOMAS

DATE: 09-15-06 REVISED ON:
JOB No:1DSV011300

SHEET 1 OF 1

VESTING TENTATIVE TRACT MAP NO. 67505

22241 – 22255 MULHOLLAND DRIVE



VICINITY MAP
NOT TO SCALE

LEGEND / HYDROLOGIC DATA

- PROPERTY LINE
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUBAREA BOUNDARY
- 1A / 2.95 AC — AREA DESIGNATION AND ACREAGE
- DRAINAGE FLOW PATH
- STORM FREQUENCY: 25 YEARS
- PREDOMINANT SOIL TYPE: 002
- LAND USE: RESIDENTIAL
- RAINFALL: 6.76 INCHES
- IMPERVIOUS AREA
- OPEN SPACE
- PREVIOUS AREA

% IMPERVIOUS CALCULATIONS			
SUBAREA	DESCRIPTION	AREA (AC)	% IMPERVIOUS
1A	OPEN SPACE	0.35	85
	PERVIOUS	2.60	15
2B	OPEN SPACE	3.91	85
	PERVIOUS	2.22	15
	IMPERVIOUS	1.02	100

GRAPHIC SCALE 1"=30'

Note: For reduced sheet prints, original scale is in inches

DS VENTURES, LLC

PROPOSED HYDROLOGY MAP

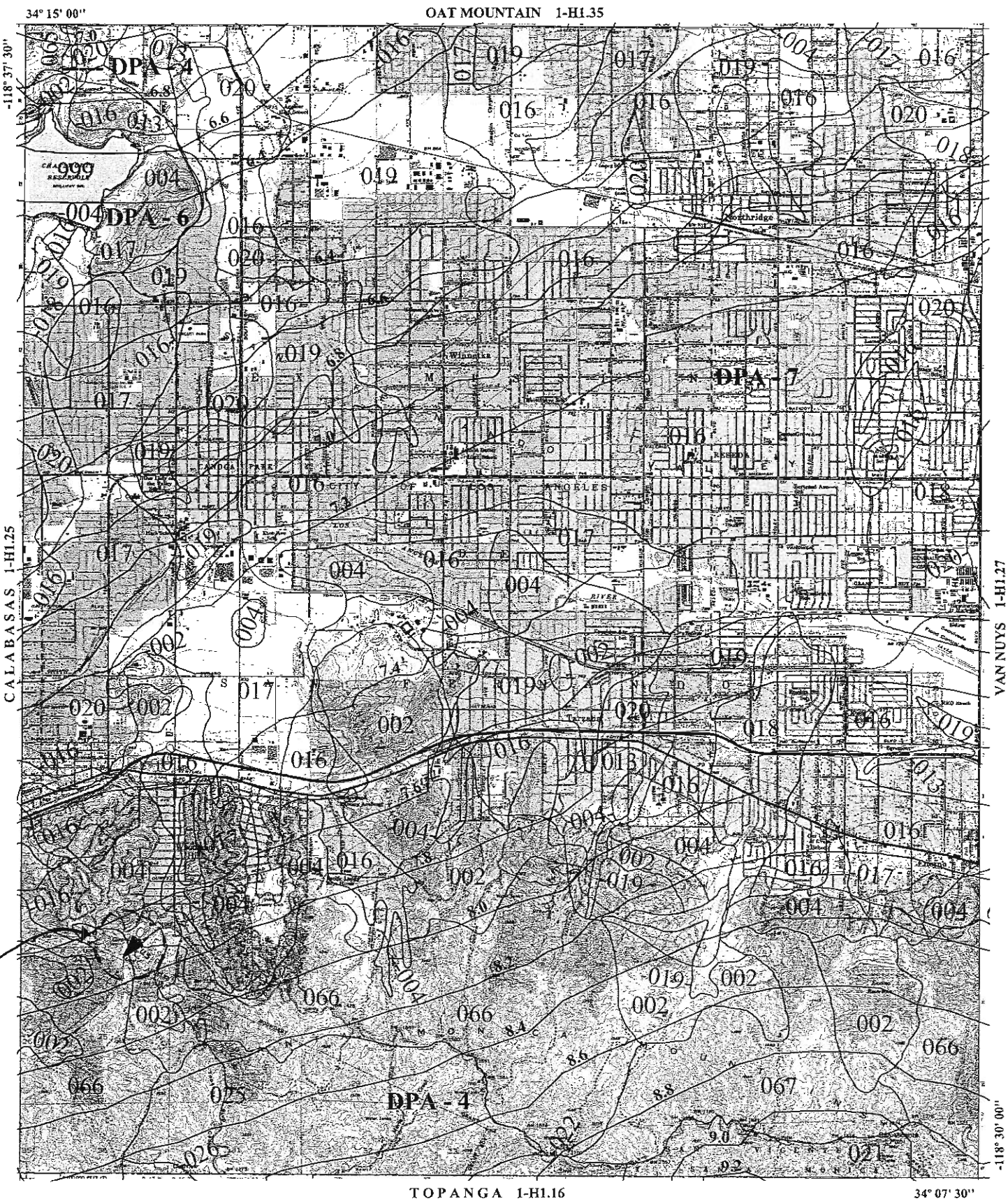
PSOMAS

DATE: 09-15-06 REVISED ON:
JOB No: 1DSV011.300

SHEET 1 OF 1

Appendix

REFERENCE MATERIALS



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N W E S

1 0 1 2 Miles

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

CANOGA PARK 1-H1.26
50-YEAR 24-HOUR ISOHYET

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works