

CAL LAND ENGINEERING, INC.,

dba Quartech Consultants

576 E. Lambert Road, Brea, CA 92821

Ph: 714-671-1050; Fax: 714-671-1090

Drainage Study

Project Address: 9722 Phelan Road,
Oak Hills, CA
APN: 3064-041-02-0000

Date: August 8, 2012

08/08/2012

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A. PROJECT LOCATION/INFORMATION

The site is located at the northeast corner of Phelan Road and Baldy Mesa Road, Community of Oak Hills, California. The site is sloping down northwesterly..

Owner: David Eum

Proposal: Three commercial buildings and a restaurant

B. STUDY PURPOSE

The purpose of this study is to provide analysis (existing & proposed) of 100-yr return frequency.

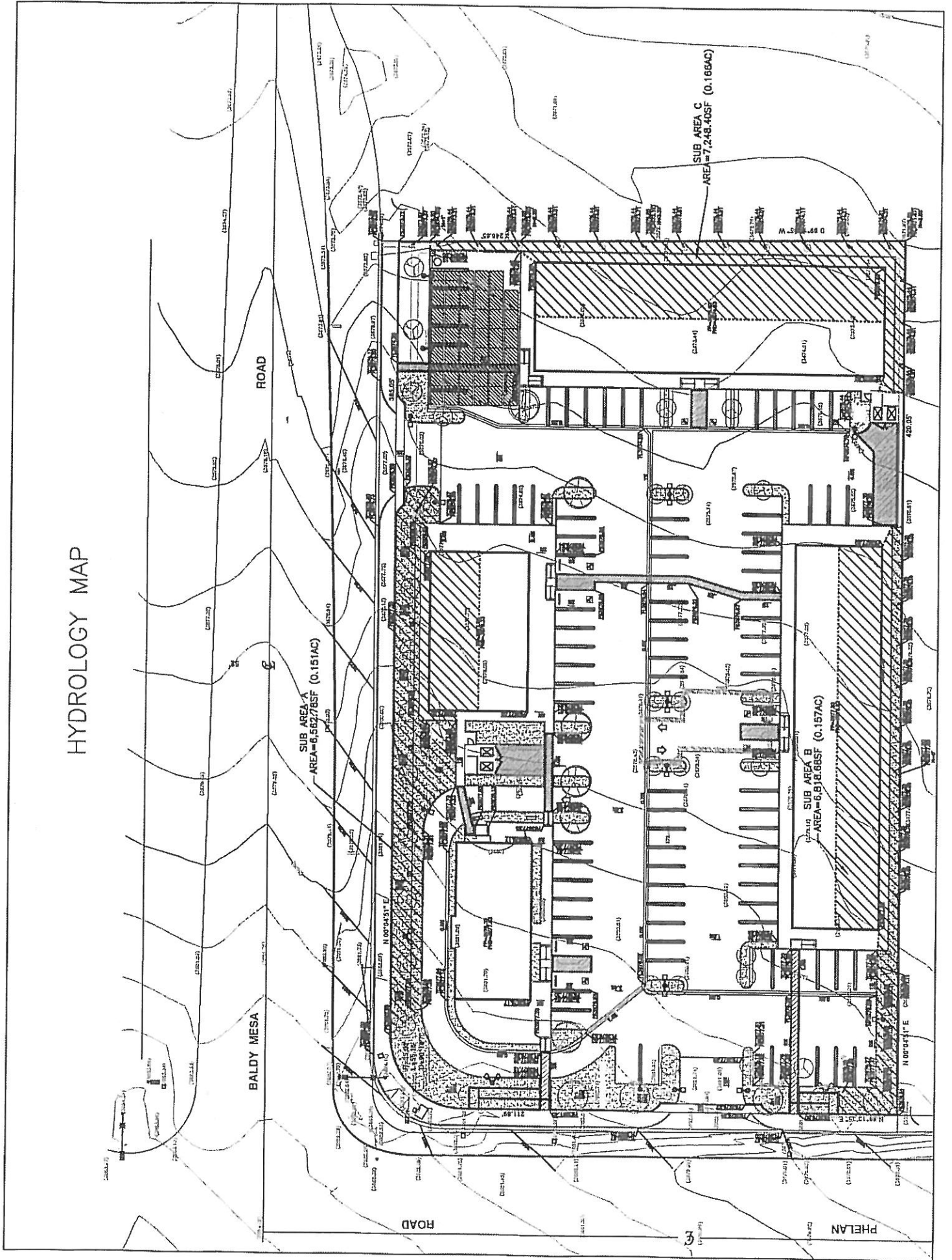
C. DRAINAGE CONCEPT

The project site encompasses approximately 2.36 acres (102,835.52 SF).

Under existing conditions, this project site is an undeveloped lot, which generally slopes from south to north. The runoff surface drains to adjacent neighbors on the north and east.

All run-offs will be collected by Cultec stormwater chambers system.

HYDROLOGY MAP



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D. HYDROLOGY CALCULATION

Post-development Runoff

Sub Area A

$$L = 238'$$

$$H = 2.38'$$

$$T_c = 6.8 \text{ min}$$

$$Y_{100} = 1.15'$$

$$I = 4.6 \text{ in/hr (Intensity-Duration Curves, see plate D-3)}$$

$$C = 0.9$$

$$A = 0.151 \text{ acres}$$

$$Q_{100} = C I A$$

$$Q_{100} = 0.9 * 4.6 * 0.151 = 0.63 \text{ cfs}$$

Sub Area B

$$L = 277'$$

$$H = 0.7'$$

$$T_c = 9.5 \text{ min}$$

$$Y_{100} = 1.15$$

$$I = 3.7 \text{ in/hr (Intensity-Duration Curves, see plate D-3)}$$

$$C = 0.9$$

$$A = 0.157 \text{ acres}$$

$$Q_{100} = C I A$$

$$Q_{100} = 0.9 * 3.7 * 0.157 = 0.55 \text{ cfs}$$

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Sub Area C

$$L = 282'$$

$$H = 1.4'$$

$$T_c = 8.5 \text{ min}$$

$$Y_{100} = 1.15$$

$$I = 4.1 \text{ in/hr (Intensity-Duration Curves, see plate D-3)}$$

$$C = 0.9$$

$$A = 0.166 \text{ acres}$$

$$Q_{100} = C I A$$

$$Q_{100} = 0.9 * 4.1 * 0.166 = 0.61 \text{ cfs}$$

Whole Site

$$L = 625'$$

$$H = 4.5'$$

$$T_c = 10.6 \text{ min}$$

$$Y_{100} = 1.15$$

$$I = 2.7 \text{ in/hr (Intensity-Duration Curves, see plate D-3)}$$

$$C = 0.9$$

$$A = 2.36 \text{ acres}$$

$$Q_{100} = C I A$$

$$Q_{100} = 0.9 * 2.7 * 2.36 = 5.73 \text{ cfs}$$

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E. HYDRAULIC CALCULATIONS

PVC Pipe for Sub Area A

n= 0.012 for CI pipe

$$V = (1.49/0.012) \times (R)^{2/3} \times (S)^{1/2} \text{ ft/sec}$$

$$Q = V \times A_p \text{ cfs}$$

$$A = 0.196 \text{ P}=1.571 \text{ R}=0.196/1.571=0.125 \text{ S}=0.045$$

$$V = (1.49/0.012) \times (0.125)^{2/3} \times (0.045)^{1/2} = 6.58$$

$$Q = 6.58 \times 0.196$$

$$Q = 1.29 \text{ cfs} > 0.63 \text{ cfs for 6" PVC pipe with 4.5\% slope}$$

PVC Pipe for Sub Area B

n= 0.009 for pvc pipe

$$V = (1.49/0.009) \times (R)^{2/3} \times (S)^{1/2} \text{ ft/sec}$$

$$Q = V \times A_p \text{ cfs}$$

$$A = 0.196 \text{ P}=1.571 \text{ R}=0.196/1.571=0.125 \text{ S}=0.005$$

$$V = (1.49/0.009) \times (0.125)^{2/3} \times (0.005)^{1/2} = 2.93$$

$$Q = 2.93 \times 0.196$$

$$Q = 0.57 \text{ cfs} > 0.55 \text{ cfs for 6" PVC pipe with 0.5\% slope}$$

PVC Pipe for Sub Area B+C

n= 0.009 for pvc pipe

$$V = (1.49/0.009) \times (R)^{2/3} \times (S)^{1/2} \text{ ft/sec}$$

$$Q = V \times A_p \text{ cfs}$$

$$A = 0.196 \text{ P}=1.571 \text{ R}=0.196/1.571=0.125 \text{ S}=0.021$$

$$V = (1.49/0.009) \times (0.125)^{2/3} \times (0.021)^{1/2} = 6.0$$

$$Q = 6.0 \times 0.196$$

$$Q = 1.18 \text{ cfs} > 1.16 \text{ cfs for 6" PVC pipe with 2.1\% slope}$$

Parkway Drain for Whole Site

n= 0.012 for concrete

$$V = (1.49/0.012) \times (R)^{2/3} \times (S)^{1/2} \text{ ft/sec}$$

$$Q = V \times A_p \text{ cfs}$$

$$A = 1.17 \text{ P}=7.67 \text{ R}=1.17/7.67=0.152 \text{ S}=0.002$$

$$V = (1.49/0.012) \times (0.152)^{2/3} \times (0.02)^{1/2} = 5.0$$

$$Q = 5.0 \times 1.17$$

$$Q = 5.85 \text{ cfs} > 5.73 \text{ cfs for 42"x4" parkway drain with 2.0\% slope}$$

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Cultec Stormwater Chambers

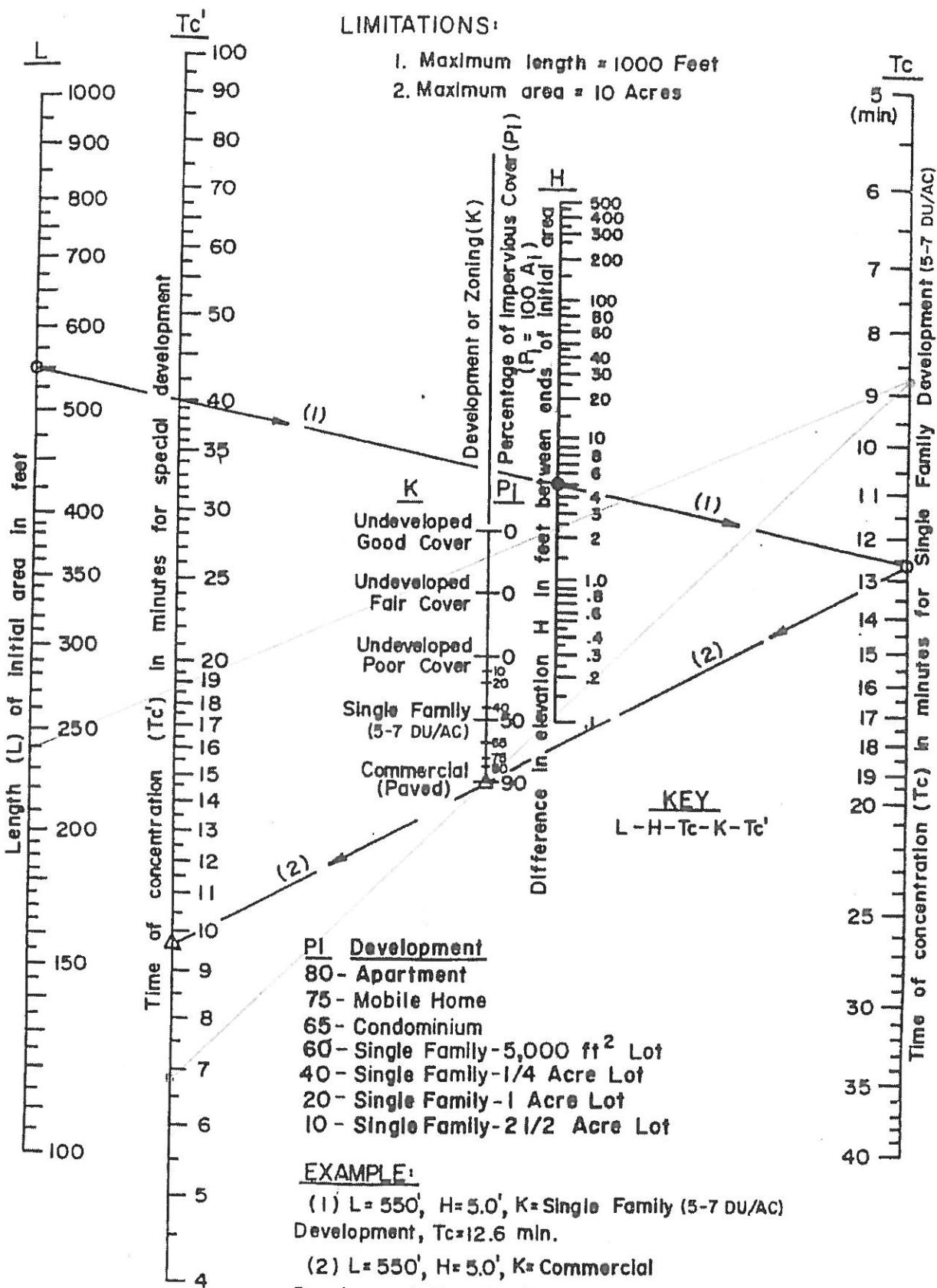
Design capture volume (See WQMP) = 6,530.65 cu. ft.

Cultec Recharge 900 HD volume capacity = 162.99 cu.ft.

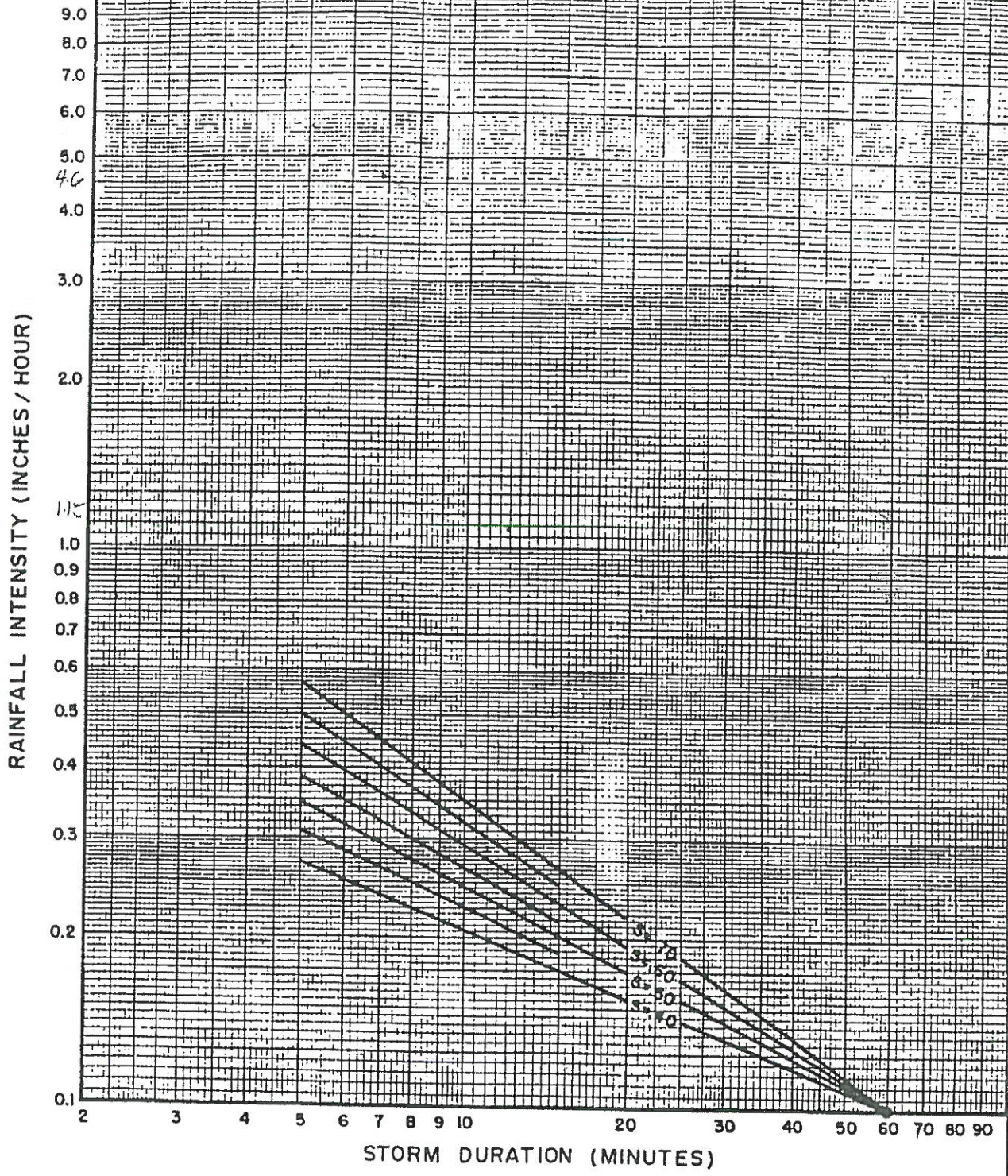
$6,530.65 / 162.99 = 40.07 = \text{use } 41 \text{ Cultec Recharger } 900 \text{ HD Stormwater Chambers}$

LIMITATIONS:

1. Maximum length = 1000 Feet
2. Maximum area = 10 Acres



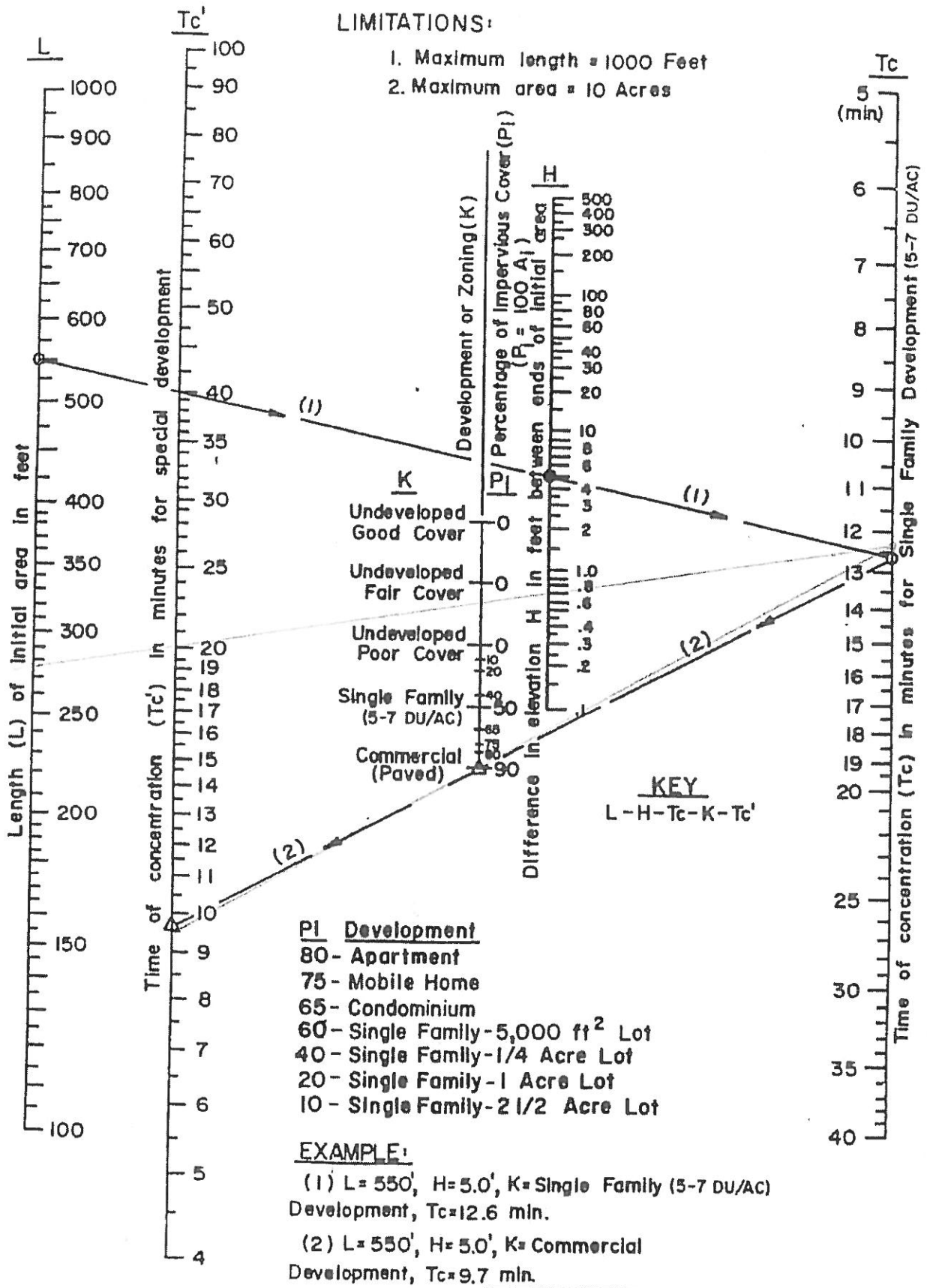
SUB AREA A



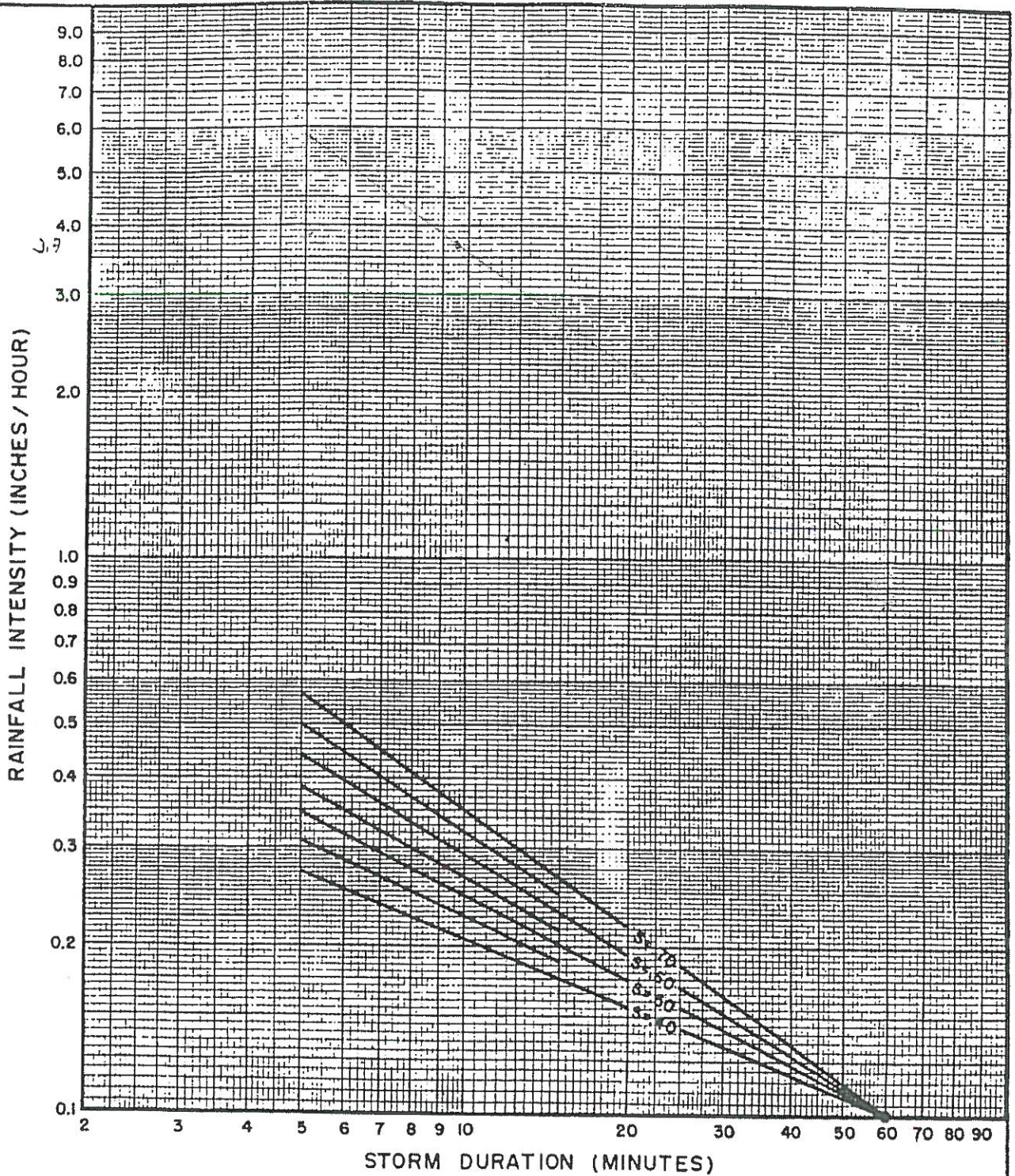
DESIGN STORM FREQUENCY = 100 YEARS
ONE HOUR POINT RAINFALL = 1.15 INCHES
LOG-LOG SLOPE = 60
PROJECT LOCATION = OAK HILLS

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

INTENSITY - DURATION
CURVES
CALCULATION SHEET



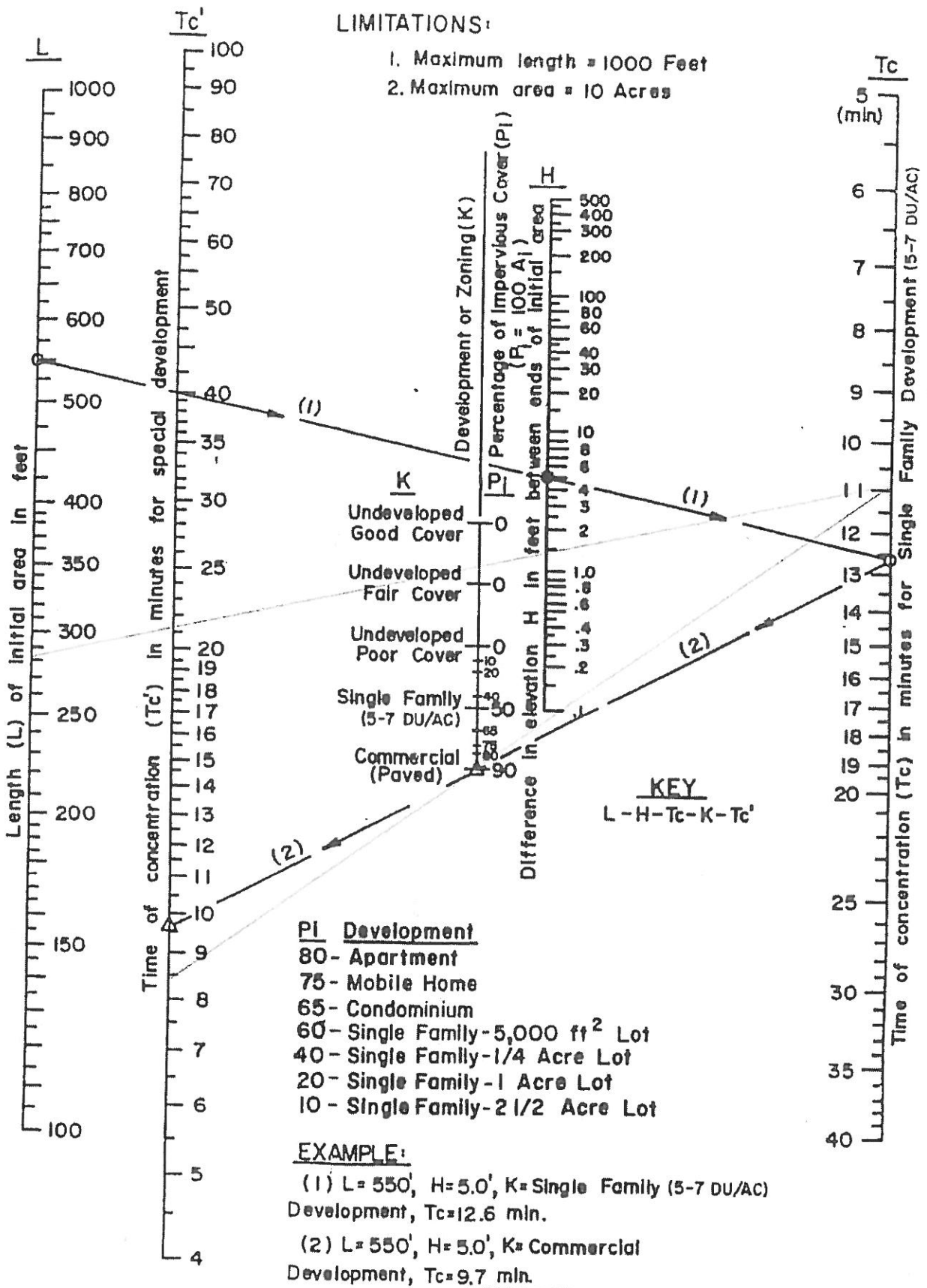
SUB AREA B



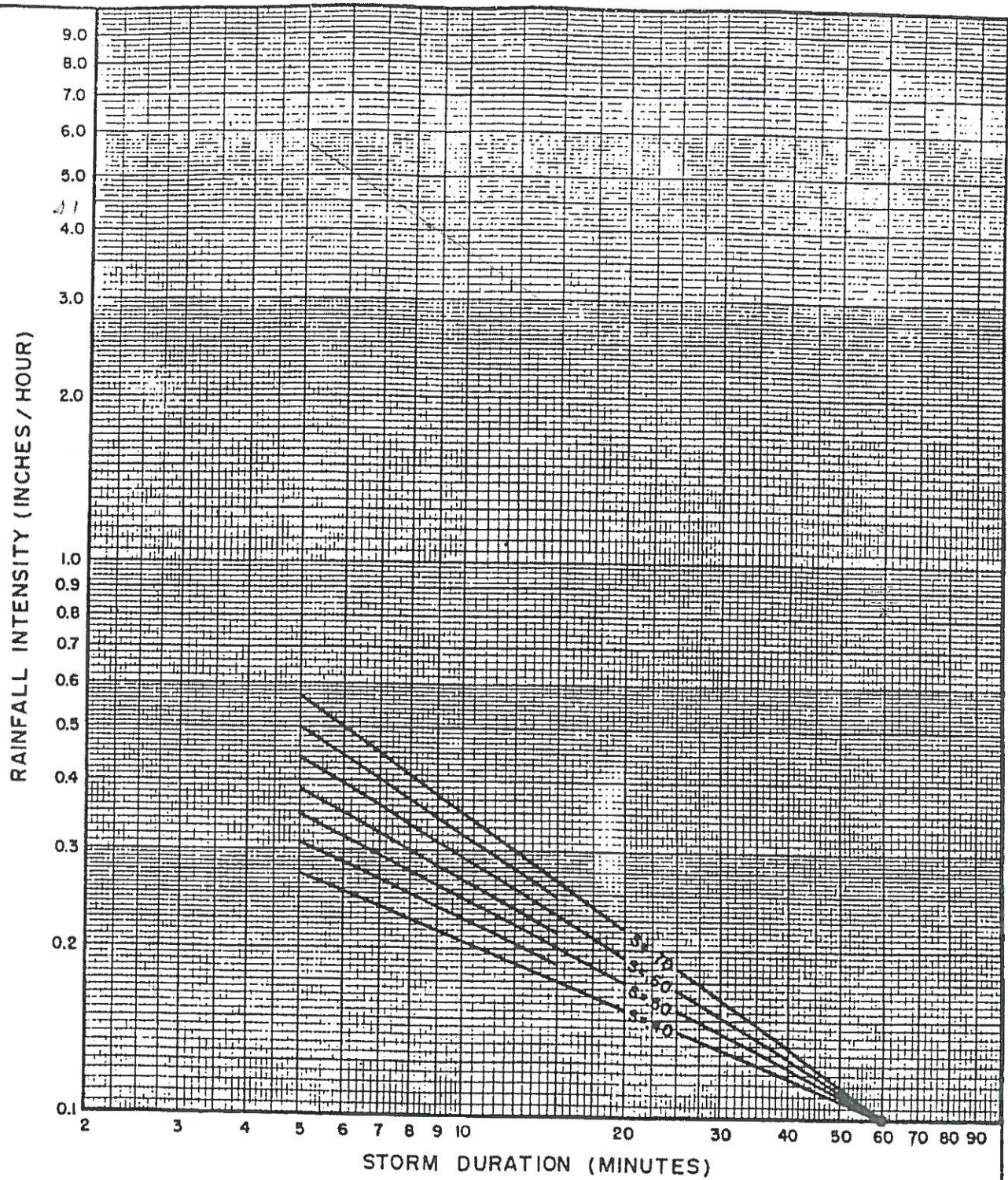
DESIGN STORM FREQUENCY = 100 YEARS
ONE HOUR POINT RAINFALL = 1.15 INCHES
LOG-LOG SLOPE = 60
PROJECT LOCATION = PAR HILLS

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**INTENSITY - DURATION
CURVES
CALCULATION SHEET**



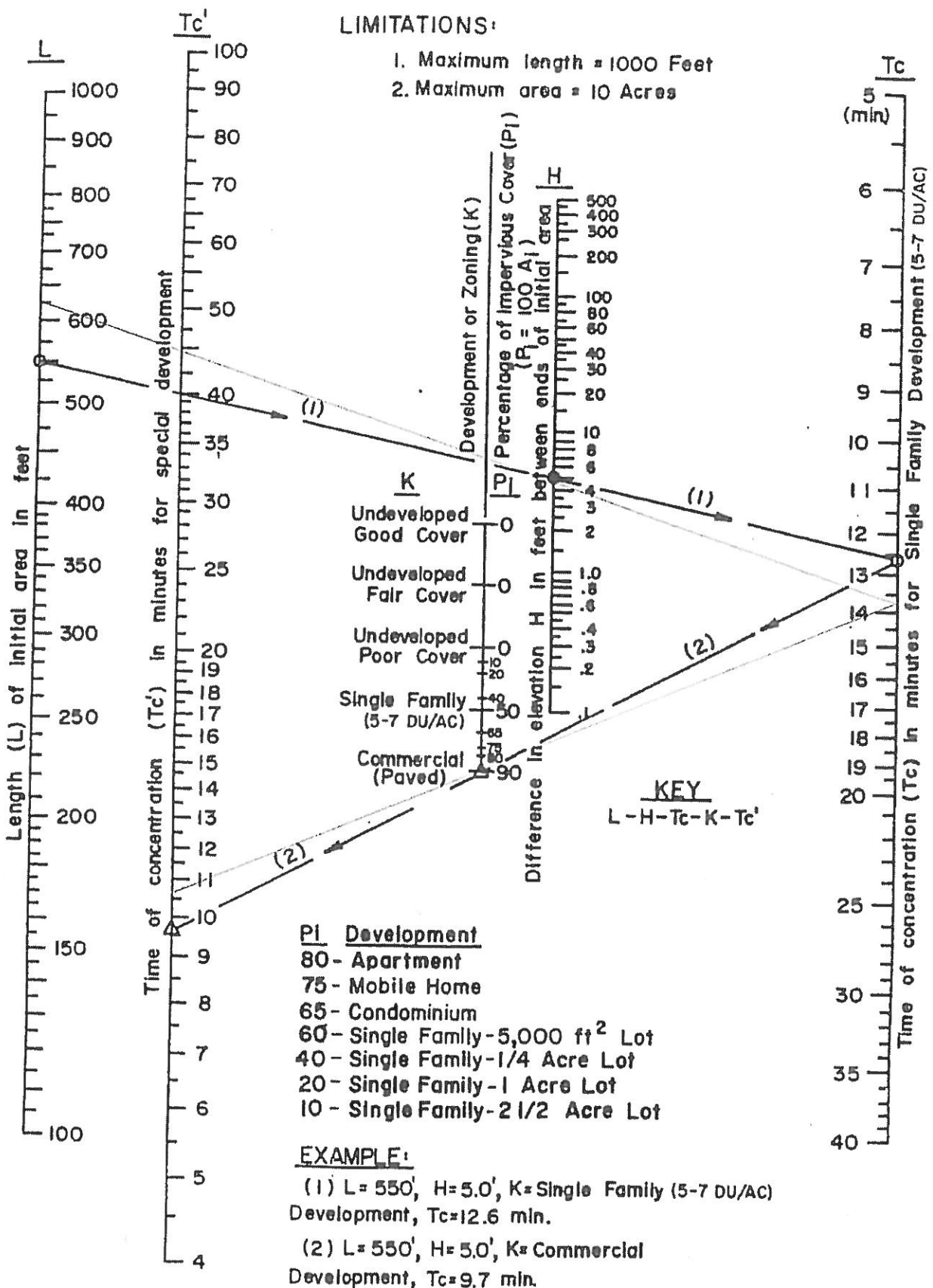
SUB AREA C



DESIGN STORM FREQUENCY = 100 YEARS
ONE HOUR POINT RAINFALL = 1.15 INCHES
LOG-LOG SLOPE = 60
PROJECT LOCATION = DAK MILL

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

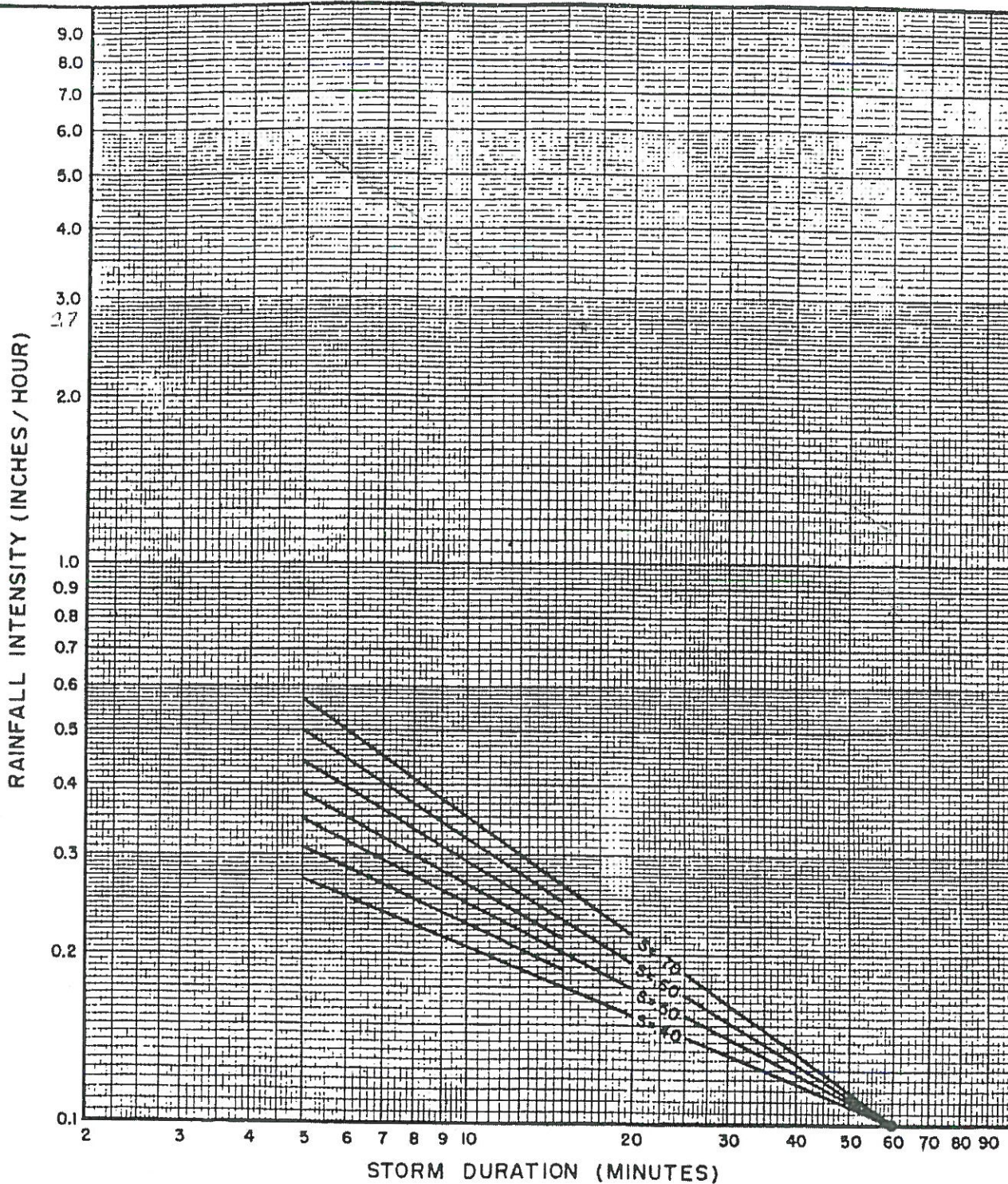
**INTENSITY - DURATION
CURVES
CALCULATION SHEET**



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA**

WINDLE SITE



DESIGN STORM FREQUENCY = 100 YEARS
ONE HOUR POINT RAINFALL = 1.15 INCHES
LOG-LOG SLOPE = 60
PROJECT LOCATION = OPAK HILL

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**INTENSITY - DURATION
CURVES
CALCULATION SHEET**