CEQA LEVEL DRAINAGE STUDY

Prepared for:

John and Polly Savage
365 Rancho Vista Place
Vista, CA 92083

PROJECT:
PDS2015-TPM-21221-PDS-PLN
TPM 21221
3-lot Subdivision
APN: 181-121-20

PREPARED BY:

dk Greene Consulting, Inc.
P.O. Box 143
Bonsall, CA 92003

August 15, 2015

Prepared under the supervision of:

_____
Kristin L. Greene, PE C57860 Date Exp. 6/30/16

SDC PDS RCVD 08-20-2015
TPM21221

CEQA LEVEL DRAINAGE STUDY
County of San Diego

Appendices

0.0 Declaration of Responsible Charge

I hereby declare that I am the Engineer-of-work for this project, that I have exercised responsible charge over the design of this project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer-of-work, of my responsibilities for project design.

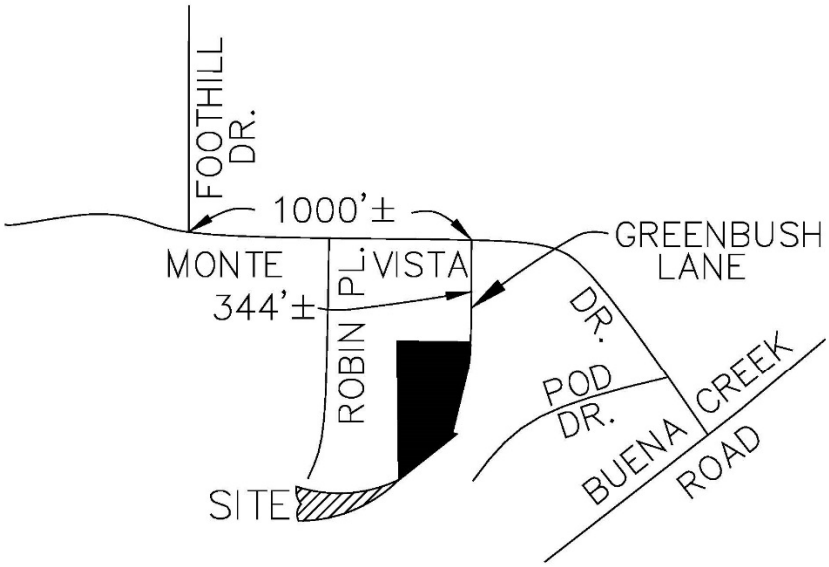
_____

Kristin L. Greene, PE C57860 Date
Exp. 6/30/16

1.0 Project Information

1.1 Introduction to Site and Project Description

The x acre site is located south of Monte Vista on Greenbush land in Vista, in the unincorporated area of San Diego County. (See Figure 1.1). The site is currently vacant and exists with gently sloping terrain. Greenbush Lane is an existing road and provides access to the parcel. The site is currently is vacant.



VICINITY MAP

Figure 1.1.1

The owner intends to create 3 lots for the purpose of single family residential development. The average lot size is 1/2 acre which is allowed by current zoning. Surrounding properties are similar in nature, developed residences on 0.5 acre or larger lots. See aerial view below.

Figure 1.1.2 Aerial View

This report will focus on the Hydrology for the existing and post-development condition and the grading associated with the 3 graded lots. This report will evaluate the Q_{100} for the existing condition and compare it to the Q_{100} for the proposed condition by using the Modified Rational Method and County of San Diego's Hydrology Manual to evaluate peak flows..

1.2 Existing Site Topography and Drainage Condition

Topography of the site was provided by Moreno Aerial Photo Surveys and is dated September 2014. The terrain is very gently sloping to the south and west with an overall slope of approximately 3%. There is one drainage basin which will be divided into sub-basins areas. There is a one natural outlet point at the south west point of the property.

An existing paved road (Greenbush Lane) is already constructed provides access to the property. The road basin area will be removed from the calculation of area as it will not be altered due to the development of this property.

Figure 1.2.1 The property looking north

The existing drainage pattern sheet flows to the south and to the west.

1.3 Proposed Topography and Drainage Condition

The proposed grading and drainage pattern will mimic the existing drainage condition and pattern. There will be one outlet point where runoff leaves the property the Outlet Points will remain in their original locations and will outlet at a non-erosive velocity. The runoff at the outlet point will drain through rip-rap that is sized for the Q_{100} over 100 feet from the property boundary allowing natural flow condition to be maintained. Sizing of the rip-rap will be completed at the final engineering phase.

Each of the 3 lots, averaging 0.56 acres, will maintain the existing drainage pattern to the west and south. There will be minimal grading for each of the lots which will allow for a large pad area (0.32-.40 acre) which with will create longer times of concentration (T_c) and therefore lower the Q for the drainage on the pads. The longer T_c will help mitigate the increase flow created by the addition of roof top impervious areas.

The existing roadway will remain and will not need to widened or improved.

2.0 Hydrology and Hydraulic Calculations

2.1 Method of Calculation

This Hydraulics and Hydrology Report was prepared using the following Manual:

Hydrology Manual, County of San Diego, 2003

The Rational Method was used to determine the 100 yr. Storm Q values.

The Rational Method uses the following formula to establish 100 year flow:

$$Q = C\ I\ A$$

where,

Q = the peak runoff in cubic feet per second

C = Runoff coefficient representing the ration of runoff to rainfall

I = time average intensity in inches per hour

A = Area of subbasin in acres

2.2 Soil Type, Imperviousness, Selection of "C"

A soils report has been prepared for the site and is included in the Appendix. According to the SCS Soil Survey for San Diego County, the soil type of this site is WmC (Wyman loam). This type of soil is classified as Hydrologic Soil Group "C".

The runoff coefficient "C" will be based on the Hydrologic Soil Group "C" for both the existing and proposed condition. The "C" for the existing conditions will be based on the 0% impervious condition (C_{pre} = .30). The proposed condition "C" value will be based on the low density residential for 2 du/acre, which is appropriated for this project (C_{post} = .42). See Appendices for Table 3-1.

2.3 Summary Table of Q Values

Calculations were conducted for this project and are provided in the spreadsheet table in the Appendices.

PRE VS. POST SUMMARY			
Node	**Pre Development Discharge Q100 (cfs)**	**Post Development Discharge Q100 (cfs)**	**Difference (cfs)**
Basin X	**2.42**		
Basin A, B, C, D		**3.17**	**0.75**

The difference between the pre and post condition is shown above. The overall site has an increase of 0.75 cfs during the Q(100) storm event. Mitigation for the increase in Q can be accomplished by individual bioretention basins on each lot OR a collective bioretention basin located at the outlet point of the property (southwest corner).

Sizing of the basin(s) will be calculated during the final engineering phase of the project.

3.0 Report Summary

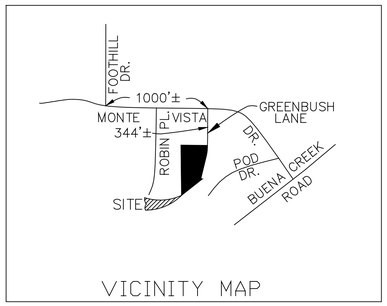
3.1 Recommendations

In my professional opinion, the proposed project will not substantially alter the existing drainage pattern of the area. The project has been designed to maintain the historical drainage pattern and to mitigate the increase in flow and velocity caused by the development of this project. Due to these mitigation measures, there will be no increase in runoff to offsite parcels due to the development of this project.

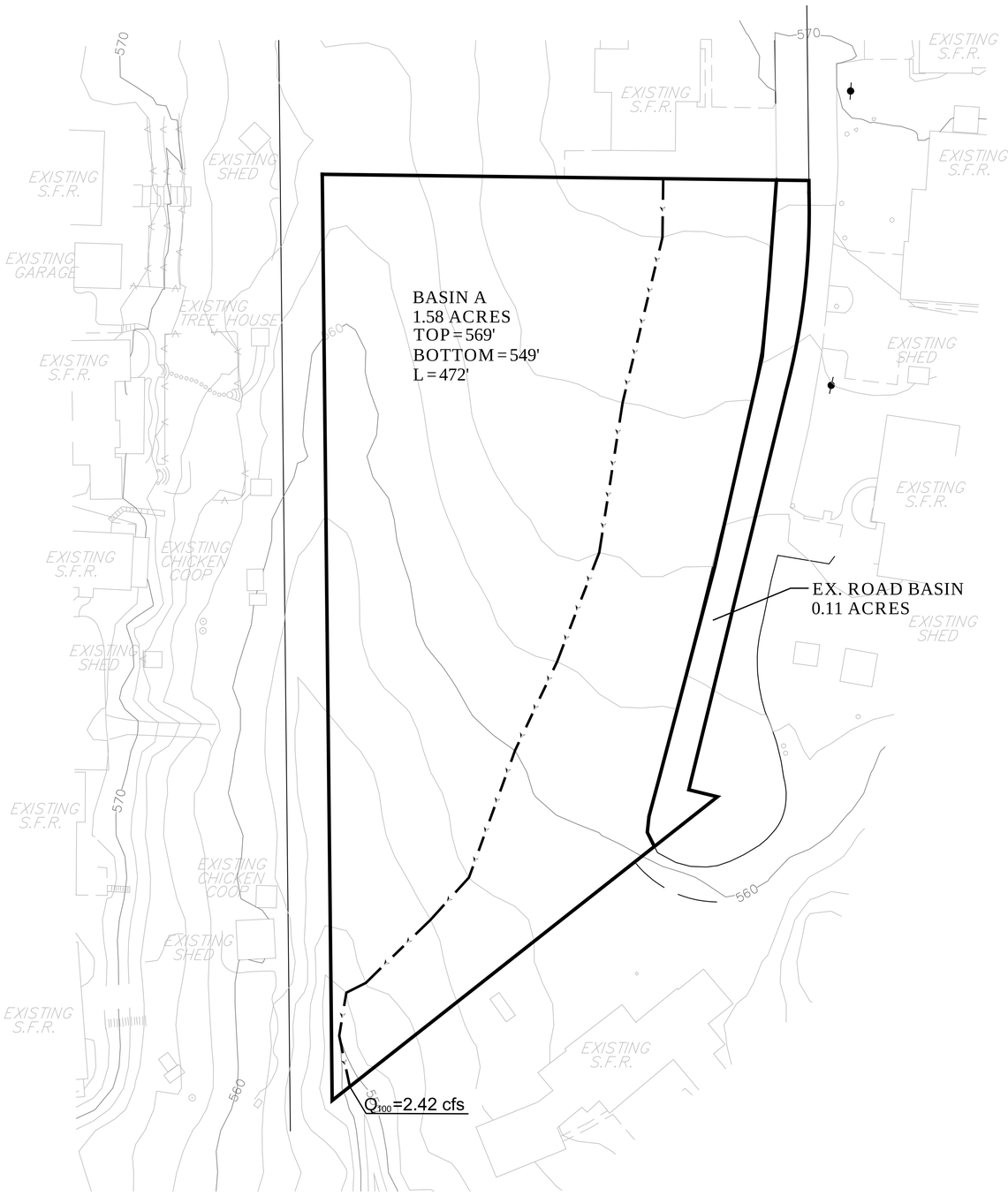
Appendices

Appendix A

EXISTING HYDROLOGY MAP



VICINITY MAP



DRAINAGE LEGEND

DRAINAGE PATH	
BASIN DELINEATION	
OUTFALL 1 FLOW LENGTH	L=215

0′ 30′ 60′ 90′

Prepared By:

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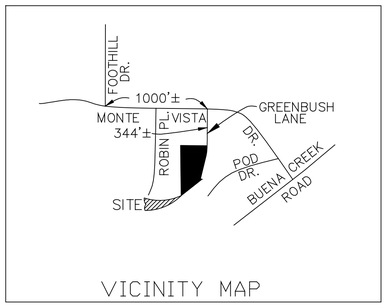
EMAIL: KRISTIN@DKGREENE.COM

JOB NO. 15-45

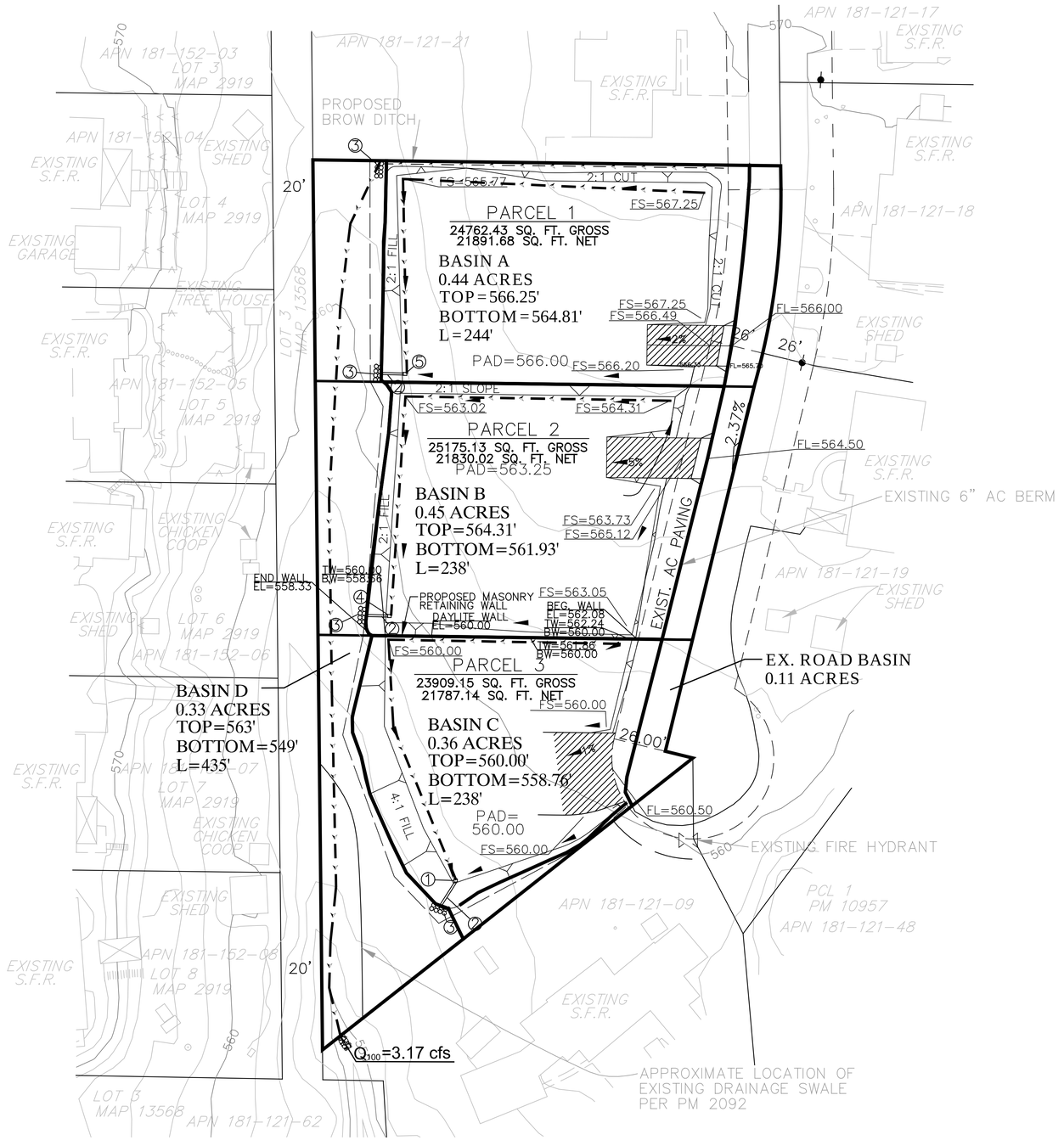
JUNE 17, 2015

EXISTING HYDROLOGY MAP

PROPOSED HYDROLOGY MAP



VICINITY MAP



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EXISTING HYDROLOGY MAP

JOB NO. 15-45

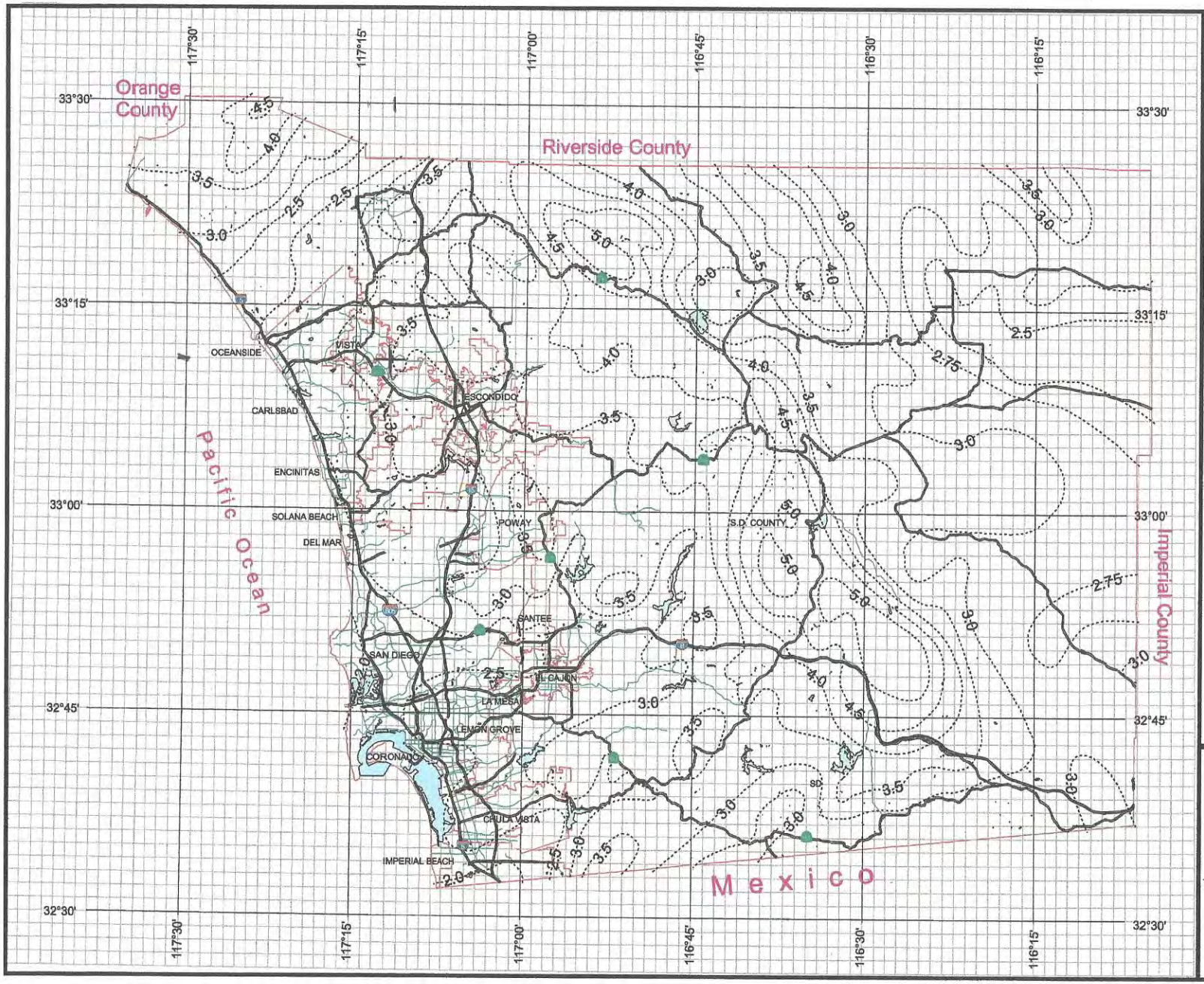
JUNE 17, 2015

Appendix B

PRE DEVELOPMENT CONDITION SUMMARY												
SYSTEM	**AREA (AC)**	**C**	**U/S ELEVATION (FT)**	**D/S ELEVATION (FT)**	**LENGTH (FT)**	**SLOPE (%)**	**P_6 (IN)**	**Ti from tab. 3-2**	**T_C (MIN) 3-4**	**SUM OF T_C (MIN)**	**I (IN/HR)**	**Q100 (CFS)**
Basin X	1.58	0.30	569.0	549.0	472	4.2	**3.5**	9.5	**3.0**	12.5	5.1	2.42
										Outfall 1		**2.42**

POST DEVELOPMENT CONDITION SUMMARY												
SYSTEM	**AREA (AC)**	**C**	**U/S ELEVATION (FT)**	**D/S ELEVATION (FT)**	**LENGTH (FT)**	**SLOPE (%)**	**P_6 (IN)**	**Ti from tab. 3-2**	**T_C (MIN) 3-4**	**SUM OF T_C (MIN)**	**I (IN/HR)**	**Q100 (CFS)**
Basin A	0.44	0.42	567.3	564.8	244	1.0	**3.5**	10.5	**3.2**	13.7	4.8	0.89
Basin B	0.45	0.42	564.3	561.9	238	1.0	**3.5**	10.5	**3.1**	13.6	4.8	0.91
Basin C	0.36	0.42	560.0	558.8	238	0.5	**3.5**	10.5	**4.0**	14.5	4.6	0.70
Basin D	0.33	0.42	563.0	549.0	435	3.2	**3.5**	10.5	**3.2**	13.7	4.8	0.67
Total	1.58								**Total**	**Outfall 1**		**3.17**

Note: The entire site is 1.69 ac. However the existing road area (0.11 ac.) has been removed from the calculations above as it will not affect the Pre- vs. Post Condition.



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

LAT 33°11'
LONG 117°12'

$P_6 = 3.5$

DPW GIS
Department of Public Works Geographic Information Services

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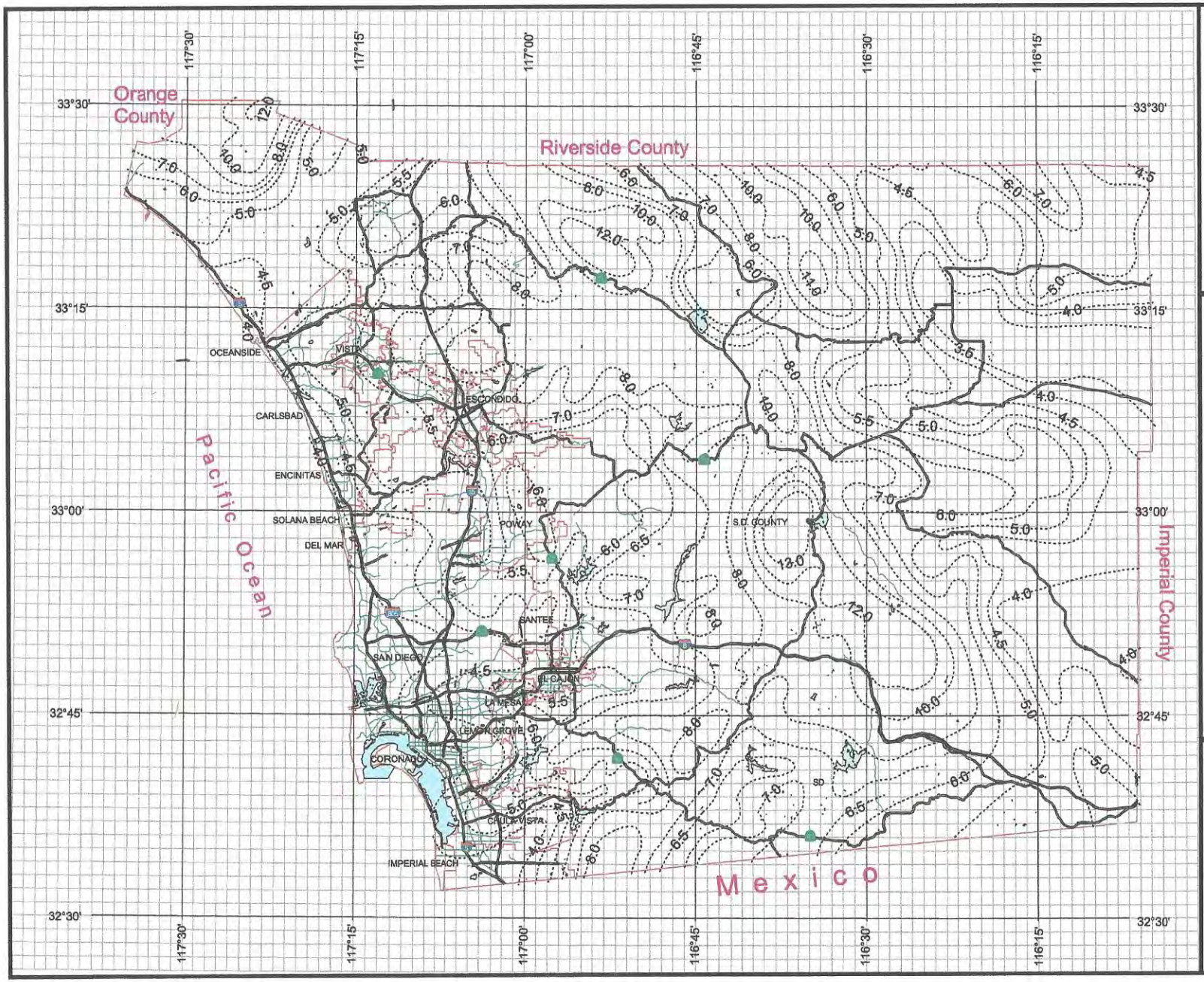
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

LAT 33° 11'
LONG 117° 12'

$P_{24} = 5.9$

DPW GIS
Department of Public Works Geographic Information Services

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3 0 3 Miles

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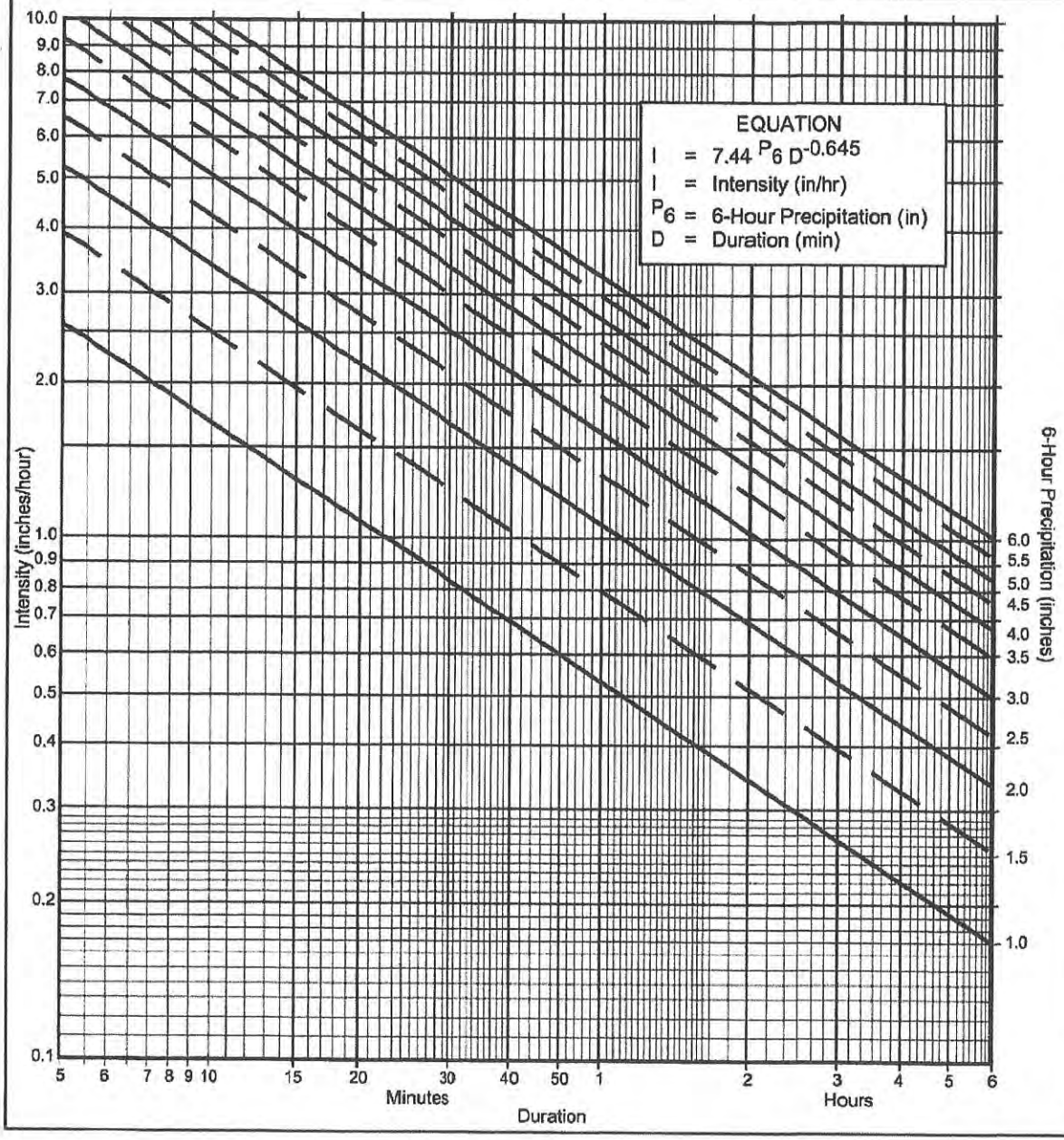


Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.5 in., P_{24} = 5.9, $\frac{P_6}{P_{24}}$ = 59 %(2)

(c) Adjusted P_6(2) = 3.5 in.

(d) t_x = _____ min.

(e) I = _____ in./hr. > See Spreadsheet

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

EXISTING

PROPOSED

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

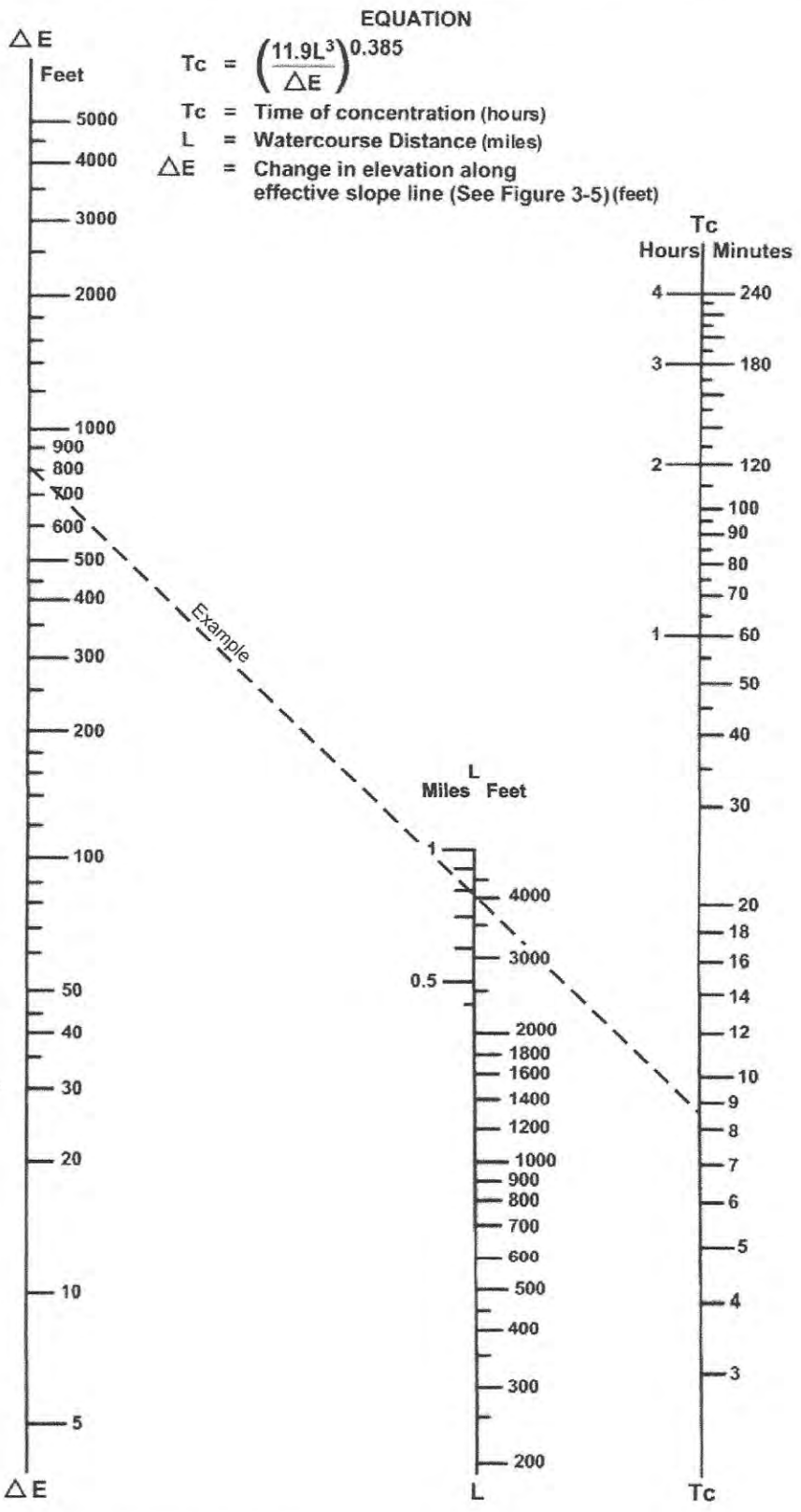
Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

EXISTING

PROPOSED

*See Table 3-1 for more detailed description

* 4% = 9.5



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

SOIL MAP

WmC = Wyman loan = Hydrologic Group "C"

EAST COUNTY SOIL CONSULTATION
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SANTEE, CALIFORNIA 92071
(619) 258-7901
Fax 258-7902

John & Polly Savage
365 Rancho Place
Vista, California 92083

February 26, 2015
Project No. 15-1108D1

Subject: Limited Geotechnical Investigation
Three Proposed Single-Family Residences
Greenbush Lane, APN 181-121-20
Vista Area, County of San Diego, California 92084

Dear Mr. & Mrs. Savage:

In accordance with your request, we have performed a limited geotechnical investigation at the subject site to discuss the geotechnical aspects of the project and provide recommendations for the proposed development.

Our investigation has found that the proposed building pads are underlain by topsoil and slopewash to a maximum depth of approximately 8 feet below existing grade. Dense granitic rocks were underlying these soils. It is our opinion that the construction of the proposed single-family residences is geotechnically feasible provided the recommendations herein are implemented in the design and construction.

Should you have any questions with regard to the contents of this report, please do not hesitate to contact our office.

Respectfully submitted,

Mamadou Saliou Diallo, P.E.
RCE 54071, GE 2704
MSD\md

TABLE OF CONTENTS

INTRODUCTION

This is to present the findings and conclusions of a limited geotechnical investigation for the proposed construction of three single-family residences to be located on the west side of Greenbush Lane, in the Vista area of the County of San Diego, California.

The objectives of the investigation were to evaluate the existing soils conditions and provide recommendations for the proposed development.

SCOPE OF SERVICES

The following services were provided during this investigation:

- Site reconnaissance and review of published geologic, seismological and geotechnical reports and maps pertinent to the project area
- Subsurface exploration consisting of five (5) test pits within the limits of the proposed area of development. The test pits were logged by our Staff Geologist.
- Collection of representative soil samples at selected depths. The obtained samples were sealed in moisture-resistant containers and transported to the laboratory for subsequent analysis.
- Laboratory testing of samples representative of the types of soils encountered during the field investigation
- Geologic and engineering analysis of the field and laboratory data, which provided the basis for our conclusions and recommendations
- Production of this report, which summarizes the results of the above analysis and presents our findings and recommendations for the proposed development.

SITE DESCRIPTION AND PROPOSED CONSTRUCTION

The subject site is an irregular-shaped residential lot located on the west side of Greenbush Lane, in the Vista area of the County of San Diego, California. The property, which encompasses an area of approximately 73,850 square feet is vacant and sloping gently to the west towards a drainage easement which runs north-south along the western property line. Vegetation consisted of a grass and trees. Site boundaries include Greenbush Lane to the east and residential developments to the remaining directions.

The Tentative Parcel Map prepared by ACAL Engineering and Surveying of Vista, California indicates that the parcel will be divided into 3 lots. It is our understanding that each lot will include a single-family residence. The structures will be one and/ or two-story, wood-framed and founded on continuous and spread footings with slab-on-grade floors.

FIELD INVESTIGATION AND LABORATORY TESTING

On February 12, 2015, five (5) test pits were excavated to a maximum depth of approximately 9 feet below existing grade with a Bobcat 331 mini-excavator equipped with a 18-inch bucket. The approximate locations of the test pits are shown on the attached Plate No. 1, entitled "Location of Exploratory Test Pits". A continuous log of the soils encountered was recorded at the time of excavation and is shown on Plate No. 2 entitled "Summary Sheet". The soils were visually and texturally classified according to the filed identification procedures set forth on the attached Plate No. 3 entitled "USCS Soil Classification".

Following the field exploration, laboratory testing was performed to evaluate the pertinent engineering properties of the foundation materials. The laboratory-testing program included moisture and density, particle size analysis and expansion index tests. These tests were performed in general accordance with ASTM standards and other accepted methods. Page L-1 and Plate No. 2 provide a summary of the laboratory test results.

GEOLOGY

Geologic Setting

The subject site is located within the southern portion of what is known as the Peninsular Ranges Geomorphic Province of California. The geologic map pertaining to the area (Reference No. 9) indicates that the site is underlain by granitic rocks (Kg).

Site Stratigraphy

The subsurface descriptions provided are interpreted from conditions exposed during the field investigation and/or inferred from the geologic literature. Detailed descriptions of the subsurface materials encountered during the field investigation are presented on the exploration logs provided on Plate No. 2. The following paragraphs provide general descriptions of the encountered soil types.

Topsoil

Topsoil is the surficial soil material that mantles the ground, usually containing roots and other organic materials, which supports vegetation. Topsoil was observed in the boreholes with a thickness of approximately 6 to 12 inches. It consisted of dark brown, silty sand that was moist, loose and porous in consistency with some organics (roots and rootlets).

Slopewash (Qsw)

Slopewash was encountered below the topsoil in most of the test pits with a thickness ranging from approximately 2 to 8 feet. It consisted of reddish brown, silty and clayey sand that was moist and loose to medium dense in consistency.

Granitic Rocks (Kg)

Granitic rocks were found below the topsoil and slopewash. The material was moist, dense in consistency and difficult to excavate.

SEISMICITY

Regional Seismicity

Generally, Seismicity within California can be attributed to the regional tectonic movement taking place along the San Andreas Fault Zone, which includes the San Andreas Fault and most parallel and subparallel faults within the state. The portion of southern California where the subject site is located is considered seismically active. Seismic hazards are attributed to groundshaking from earthquake events along nearby or more distant Quaternary faults. The primary factors in evaluating the effect an earthquake has on a site are the magnitude of the event, the distance from the epicenter to the site and the near surface soil profile.

According to the Fault-Rupture Hazard Zones Act of 1994 (revised Alquist-Priolo Special Studies Zones Act), quaternary faults have been classified as "active" faults, which show apparent surface rupture during the last 11,000 years (i.e., Holocene time). "Potentially-active" faults are those faults with evidence of displacing Quaternary sediments between 11,000 to 16,000 years old.

Seismic Analysis

Based on our evaluation, the closest known "active" fault is the Rose Canyon Fault located approximately 20 kilometers (12.5 miles) to the west. The Rose Canyon Fault is the design fault of the project due to the predicted credible fault magnitude and ground acceleration.

The Seismicity of the site was evaluated utilizing the 2008 USGS Hazard Maps and Seed and Idriss methods for active Quaternary faults within the regional vicinity. The site may be subject to a Maximum Probable Earthquake of 6.9 Magnitude along the Rose Canyon fault, with a corresponding Peak Ground Acceleration of 0.33g. The maximum Probable Earthquake is defined as the maximum earthquake that is considered likely to occur within a 100-year time period.

The effective ground acceleration at the site is associated with the part of significant ground motion, which contains repetitive strong-energy shaking, and which may produce structural deformation. As such, the effective or "free field" ground acceleration is referred to as the Repeatable High Ground Acceleration (RHGA). It has been determined by Ploessel and Slosson (1974) that the RHGA is approximately equal to 65 percent of the Peak Ground Acceleration for earthquakes occurring within 20 miles of a site. Based on the above, the calculated Credible RHGA at the site is 0.21g.

2013 CBC Seismic Design Criteria

A review of the active fault maps pertaining to the site indicates the location of the Rose Canyon Fault Zone approximately 20 km to the west. Ground shaking from this fault or one of the major active faults in the region is the most likely happening to affect the site. With respect to this hazard, the site is comparable to others in the general area. The proposed single-family residences should be designed in accordance with seismic design requirements of the 2013 California Building Code or the Structural Engineers Association of California using the following seismic design parameters:

PARAMETER	VALUE	2013 CBC and ASCE 7 REFERENCES
Site Class	D	Table 20.3-1/ ASCE 7, Chapter 20
Mapped Spectral Acceleration For Short Periods, S_s	1.039g	Figure 1613.3.1(1)
Mapped Spectral Acceleration For a 1-Second Period, S_1	0.408g	Figure 1613.3.1(2)
Site Coefficient, F_a	1.084	Table 1613.3.3(1)
Site Coefficient, F_v	1.592	Table 1613.3.3(2)
Adjusted Max. Considered Earthquake Spectral Response Acceleration for Short Periods, S_{MS}	1.127g	Equation 16-37
Adjusted Max. Considered Earthquake Spectral Response Acceleration for 1-Second Period, S_{M1}	0.649g	Equation 16-38
5 Percent Damped Design Spectral Response Acceleration for Short Periods, S_{DS}	0.751g	Equation 16-39
5 Percent Damped Design Spectral Response Acceleration for 1-Second Period, S_{D1}	0.433g	Equation 16-40

Geologic Hazard Assessment

Ground Rupture

Ground rupture due to active faulting is not considered likely due to the absence of known fault traces within the vicinity of the project; however, this possibility cannot be completely ruled out. The unlikely hazard of ground rupture should not preclude consideration of "flexible" design for on-site utility lines and connections.

Liquefaction

Liquefaction involves the substantial loss of shear strength in saturated soils, usually sandy soils with a loose consistency when subjected to earthquake shaking. Based on the absence of shallow groundwater, type and consistency of the underlying bedrock, it is our opinion that the potential for liquefaction is very low.

Landsliding

There is no indication that landslides or unstable slope conditions exist on or adjacent to the project site. There are no obvious geologic hazards related to landsliding to the proposed development or adjacent properties.

GEOTECHNICAL EVALUATION

Based on our investigation and evaluation of the collected information, we conclude that the proposed structural development is feasible from a geotechnical standpoint provided the recommendations provided herein will be properly implemented during construction.

In order to provide a uniform support for the structures, overexcavation and recompaction of the structural portions of the building pads will be required. The foundations may consist of reinforced continuous footings with conventional reinforced slabs. Recommendations and criteria for foundation design are provided in the Foundations and Slabs recommendations section of this report.

Compressible Soils

Our field observations and testing indicate low compressibility within the granitic rocks, which underlie the site. However, loose topsoil and loose slopewash were encountered to a depth of approximately 3 feet below surface grades. These soils are compressible. Due to the potential for soil compression upon loading, remedial grading of these near-surface soils (including overexcavation and recompaction) will be required.

Following implementation of the earthwork recommendations presented herein, the potential for soil compression resulting from the new development has been estimated to be low. The low-settlement assessment assumes a well-planned and maintained site drainage system. Recommendations regarding mitigation by earthwork construction are presented in the Grading and Earthwork Recommendations section of this report.

Expansive Soils

An expansion index test was performed on representative sample of the slopewash to determine volumetric change characteristics with change in moisture content. An expansion index of 27 was obtained which indicates a low expansion potential for the foundation soils.

Groundwater

Static groundwater was not encountered to the depths of the test pits. The building pads are located at elevations over 550 feet above Mean Sea Level. We do not expect groundwater to affect the proposed construction. Recommendations to prevent or mitigate the effects of poor surface drainage are presented in the Drainage section of this report.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based upon the analysis of the data and information obtained from our soil investigation. This includes site reconnaissance; field investigation; laboratory testing and our general knowledge of the soils native to the site. The site is suitable for the proposed residential development provided the recommendations set forth are implemented during construction.

GRADING AND EARTHWORK

Based upon the proposed construction and the information obtained during the field investigation, we anticipate that the proposed structures will be founded on continuous footings supported by properly compacted fill soils. The following grading and earthwork recommendations are based upon the limited geotechnical investigation performed, and should be verified during construction by our field representative.

Clearing and Grubbing

All areas to be graded or to receive fill and/or structures should be cleared of vegetation. Vegetation and the debris from the clearing operation should be properly disposed of off-site. The area should be thoroughly inspected for any possible buried objects, which need to be rerouted or removed prior to the inception of, or during grading. All holes, trenches, or pockets left by the removal of these objects should be properly backfilled with compacted fill materials as recommended in the Method and Criteria of Compaction section of this report.

Structural Improvement of Soils

Information obtained from our field and laboratory analysis indicates that loose topsoil and slopewash cover the building pad to a depth of approximately 2 to 3 feet below existing grade. These loose surficial soils are susceptible to settlement upon loading. Based upon the soil characteristics and the grading plan, we recommend the following:

* All topsoil and loose slopewash should be completely removed from areas, which are planned to receive compacted fills and/or structural improvements. The bottom of the removal area should expose competent materials as approved by ECSC&E geotechnical representative. Prior to the placement of new fill, the bottom of the removal area should be scarified a minimum depth of 6 inches, moisture-conditioned within 2 percent above the optimum moisture content, and then recompacted to at least 90 percent relative compaction (ASTM D1557 test method).

* Overexcavation should be completed for the structural building pads to a minimum depth of 2 feet below the bottom of the proposed footings or 3 feet below surface grade, whichever is greater. The limit of the required area of overexcavation should be extended a minimum of 5 feet laterally beyond the perimeter footings (building footprints).

* For non-structural areas, such as driveways, we recommend overexcavation to a minimum depth of 2 feet below existing grade.

* Soils utilized as fill should be moisture-conditioned and recompacted in conformance with the following Method and Criteria of Compaction section of this report. The actual depth and extent of any overexcavation and recompaction should be evaluated in the field by a representative of ECSC&E.

Transitions Between Cut and Fill

The proposed structures are anticipated to be founded in properly compacted fill. Cut to fill transitions below the proposed structures should be eliminated during the earthwork construction as required in the previous section.

Method and Criteria of Compaction

Compacted fills should consist of approved soil material, free of trash debris, roots, vegetation or other deleterious materials. Fill soils should be compacted by suitable compaction equipment in uniform loose lifts of 6 to 8 inches. Unless otherwise specified, all soils subjected to recompaction should be moisture-conditioned within 2 percent over the optimum moisture content and compacted to at least 90 percent relative compaction per ASTM test method D1557.

On-site soils, after being processed to delete the aforementioned deleterious materials, may be used for recompaction purposes. Should any importation of fill be planned, the intended import source(s) should be evaluated and approved by ECSCE prior to delivery to the site. Care should be taken to ensure that these soils are not detrimentally expansive.

Placement of Oversized Rock

All materials for capping the structural building pads should be free of rocks and debris in excess of 3-inch dimension. Select fill should extend a minimum of 5 feet laterally outside the structural footprints. Material up to 12-inch dimension may be placed between 3 and 10 feet from finish grades, but must remain at least 10 feet laterally from the face of permanent slopes and should also not be placed within the alignment of proposed utilities.

Although we do not anticipate earthwork to create oversized material from 12 to 48 inches in dimension, if encountered, it may be placed in approved non-structural fill areas. The oversized material should be placed in windrows surrounded by granular fill. The rock windrows should be flooded with water to facilitate filling of voids. Care should be taken to avoid nesting of oversize rocks and no large rock should be placed within 10 feet of any slope face. The non-structural rockfill should be capped with a minimum 3 feet of fill containing no rocks greater than 6-inch dimension.

Erosion Control

Due to the granular characteristics of on-site soils, areas of recent grading or exposed ground may be subject to erosion. During construction, surface water should be controlled via berms, gravel/ sandbags, silt fences, straw wattles, siltation basins, positive surface grades or other method to avoid damage to the finish work or adjoining properties. All site entrances and exits must have coarse gravel or steel shaker plates to minimize offsite sediment tracking. Best Management Practices (BMPs) must be used to protect storm drains and minimize pollution. The contractor should take measures to prevent erosion of graded areas until such time as permanent drainage and erosion control measures have been installed. After completion of grading, all excavated surfaces should exhibit positive drainage and eliminate areas where water might pond.

Standard Grading Guidelines

Grading and earthwork should be conducted in accordance with the standard-of-practice methods for this local, the guidelines of the current edition of the California Building Code, and the requirements of the jurisdictional agency. Where the information provided in the geotechnical report differs from the Standard Grading Guidelines, the requirements outlined in the report shall govern.

FOUNDATIONS AND SLABS

a. Continuous and spread footings are suitable for use and should extend to minimum depths of 12 and 18 inches for the proposed one and two-story structures respectively into the properly compacted fill soils. Continuous footings should be at least 12 and 15 inches in width respectively and reinforced with a minimum of four #4 steel bars; two bars placed near the top of the footings and the other two bars placed near the bottom of the footings. Isolated or spread footings should be at least 24 inches wide and reinforced with a minimum #4 bars spaced 12 inches on center each way and placed horizontally near the bottom. The above reinforcement is based on soil characteristics and is not intended to be in lieu of the project structural engineer requirements.

b. Interior floor slabs should be a minimum 4 inches thick. Reinforcement should consist of #3 bars placed at 16 inches on center each way within the middle third of the slabs by supporting the steel on chairs or concrete blocks "dobies". The slabs should be underlain by 2 inches of clean sand over a 10-mil visqueen moisture barrier. The effect of concrete shrinkage will result in cracks in virtually all-concrete slabs. To reduce the extent of shrinkage, the concrete should be placed at a maximum of 4-inch slump. The minimum steel recommended is not intended to prevent shrinkage cracks.

c. Where moisture sensitive floor coverings are anticipated over the slabs, the 10-mil plastic moisture barrier should be underlain by a capillary break at least 2 inches thick, consisting of coarse sand, gravel or crushed rock not exceeding 3/4 inch in size with no more than 5 percent passing the #200 sieve.

d. An allowable soil bearing value of 2,000 pounds per square foot may be used for the design of continuous and spread footings at least 12 inches wide and founded a minimum of 12 inches into properly compacted fill soils. This value may be increased by 400 psf for each additional foot of depth or width to a maximum of 4,000 lb/ft2.

e. Lateral resistance to horizontal movement may be provided by the soil passive pressure and the friction of concrete to soil. An allowable passive pressure of 250 pounds per square foot per foot of depth may be used. A coefficient of friction of 0.35 is recommended. The soils passive pressure as well as the bearing value may be increased by 1/3 for wind and seismic loading.

SETTLEMENT

Settlement of compacted fill soils is normal and should be anticipated. Because of the type and minor thickness of the fill soils anticipated under the proposed footings and the light building loads, total and differential settlement should be within acceptable limits.

TEMPORARY SLOPES

For the excavation of foundations and utility trenches, temporary vertical cuts to a maximum height of 4 feet may be constructed in fill or natural soil. Any temporary cuts beyond the above height constraints should be shored or further laid back following a 1:1 (horizontal to vertical) slope ratio. OSHA guidelines for trench excavation safety should be implemented during construction.

TRENCH BACKFILL

Excavations for utility lines, which extend under structural areas should be properly backfilled and compacted. Utilities should be bedded and backfilled with clean sand or approved granular soil to a depth of at least one foot over the pipe. This backfill should be uniformly watered and compacted to a firm condition for pipe support. The remainder of the backfill should be on-site soils or non-expansive imported soils, which should be placed in thin lifts, moisture-conditioned and compacted to at least 90% relative compaction.

DRAINAGE

Adequate measures should be undertaken after the structures and other improvements are in place, such that the drainage water within the site and adjacent properties is directed away from the foundations, footings, floor slabs and the tops of slopes via rain gutters, downspouts, surface swales and subsurface drains towards the natural drainage for this area. A minimum gradient of 1 percent is recommended in hardscape areas. In earth areas, a minimum gradient of 5 percent away from the structures for a distance of at least 10 feet should be provided. Earth swales should have a minimum gradient of 2 percent. Drainage should be directed to approved drainage facilities. Proper surface and subsurface drainage will be required to minimize the potential of water seeking the level of the bearing soils under the foundations, footings and floor slabs, which may otherwise result in undermining and differential settlement of the structures and other improvements.

FOUNDATION PLAN REVIEW

Our firm should review the foundation plans during the design phase to assure conformance with the intent of this report. During construction, foundation excavations should be observed by our representative prior to the placement of forms, reinforcement or concrete for conformance with the plans and specifications.

LIMITATIONS OF INVESTIGATION

Our investigation was performed using the skill and degree of care ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No

other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. This report is prepared for the sole use of our client and may not be assigned to others without the written consent of the client and ECSC&E, Inc.

The samples collected and used for testing, and the observations made, are believed representative of site conditions; however, soil and geologic conditions can vary significantly between exploration trenches, boreholes and surface exposures. As in most major projects, conditions revealed by construction excavations may vary with preliminary findings. If this occurs, the changed conditions must be evaluated by a representative of ECSC&E and designs adjusted as required or alternate designs recommended.

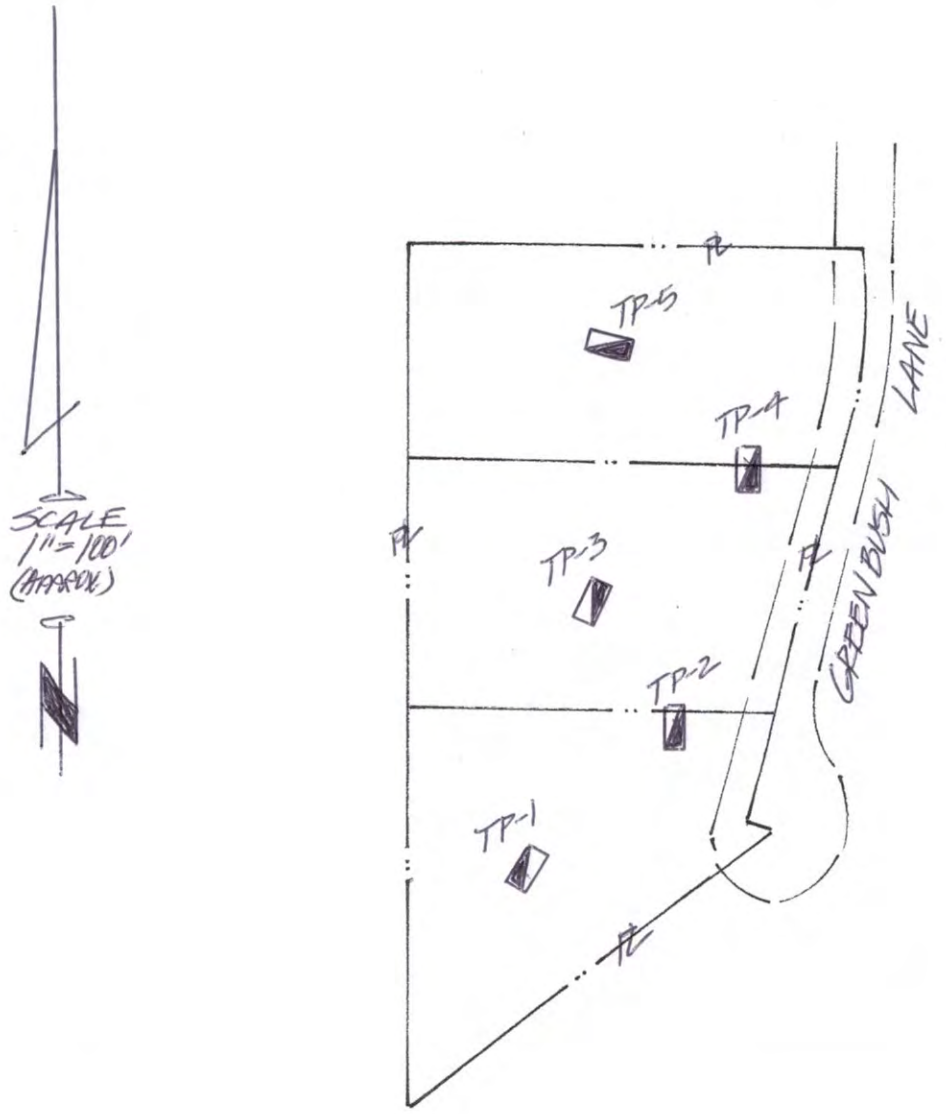
This report is issued with the understanding that it is the responsibility of the owner, or of his representative to ensure that the information and recommendations contained herein are brought to the attention of the project architect and engineer. Appropriate recommendations should be incorporated into the structural plans. The necessary steps should be taken to see that the contractor and subcontractors carry out such recommendations in the field.

The findings of this report are valid as of this present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside of our control. Therefore, this report is subject to review and should be updated after a period of two years.

ADDITIONAL SERVICES

The review of plans and specifications, field observations and testing under our direction are integral parts of the recommendations made in this report. If East County Soil Consultation and Engineering, Inc. is not retained for these services, the client agrees to assume our responsibility for any potential claims that may arise during construction. Observation and testing are additional services, which are provided by our firm, and should be budgeted within the cost of development.

Plates No. 1 through 3, Page L-1 and References are parts of this report.



TP-3
EXPLORATORY TEST PIT

EAST COUNTY SOIL CONSULTATION & ENGINEERING, INC. 10925 HARTLEY RD., SUITE I, SANTEE, CA 92071 (619) 258-7901 Fax (619) 258-7902	JOHN & POLLY SAVAGE / GREENBUSH LANE PROJECT
LOCATION OF EXPLORATORY TEST PITS	BY: ND / DATE: FEB 26 2015 PROJECT NO: 15-110BD1 / PLATE NO. 1

PLATE NO. 2
SUMMARY SHEET

TEST PIT NO. 1

DEPTH	SOIL DESCRIPTION	Y	M
Surface	**TOPSOIL** dark brown, moist, loose, porous, silty sand with rootlets		
1.0'	**SLOPEWASH** (Qsw) reddish brown, moist, loose, silty sand		
2.0'	becomes dense with gravel	114.0	6.6
3.0'	**GRANITIC ROCKS** (Kg) grayish brown, moist, dense, silty sand		
5.0'	refusal, bottom of test pit, no caving, no groundwater test pit backfilled with sheepsfoot roller 2/12/15		

TEST PIT NO. 2

DEPTH	SOIL DESCRIPTION	Y	M
Surface	**TOPSOIL** dark brown, moist, loose, porous, silty sand with rootlets		
0.5'	**SLOPEWASH** (Qsw) reddish brown, moist, loose, clayey sand		
1.0'	" " " " " "	100.7	19.2
2.5'	reddish brown, moist, medium dense, silty sand		
3.5'	" " " " " "	106.4	16.1
5.0'	" " " " " "	106.7	12.1
6.0'	" " " " " "	110.8	12.3
8.0'	**GRANITIC ROCKS** (Kg) grayish brown, moist, dense, silty sand		
9.0'	refusal, bottom of test pit, no caving, no groundwater test pit backfilled with sheepsfoot roller 2/12/15		

TEST PIT NO. 3

DEPTH	SOIL DESCRIPTION	Y	M
Surface	**TOPSOIL** dark brown, moist, loose, porous, silty sand with rootlets		
1.0'	**GRANITIC ROCKS** (Kg) grayish brown, moist, dense, silty sand		
2.5'	" " " " " "	112.7	7.3
3.0'	refusal, bottom of test pit, no caving, no groundwater test pit backfilled with sheepsfoot roller 2/12/15		

Y = DRY DENSITY IN PCF M = MOISTURE CONTENT IN %

PLATE NO. 2 (Continued)
SUMMARY SHEET

TEST PIT NO. 4

DEPTH	SOIL DESCRIPTION	Y	M
Surface	**TOPSOIL** dark brown, moist, loose, porous, silty sand with rootlets		
1.0'	**SLOPEWASH** (Qsw) reddish brown, moist, loose to medium dense, clayey sand	99.4	5.3
2.5'	" " " " " "	107.1	15.9
3.0'	reddish brown, moist, medium dense, silty sand		
3.5'	" " " " " "	111.7	12.8
6.0'	**GRANITIC ROCKS** (Kg) grayish brown, moist, dense, silty sand		
7.0'	refusal, bottom of test pit, no caving, no groundwater test pit backfilled with sheepsfoot roller 2/12/15		

TEST PIT NO. 5

DEPTH	SOIL DESCRIPTION	Y	M
Surface	**TOPSOIL** dark brown, moist, loose, porous, silty sand with rootlets		
1.0'	**SLOPEWASH** (Qsw) reddish brown, moist, loose to medium dense, clayey sand		
1.5'	" " " " " "	107.2	15.9
3.0'	reddish brown, moist, medium dense, silty sand		
4.0'	**GRANITIC ROCKS** (Kg) grayish brown, moist, dense, silty sand	123.4	7.2
5.0'	refusal, bottom of test pit, no caving, no groundwater test pit backfilled with sheepsfoot roller 2/12/15		

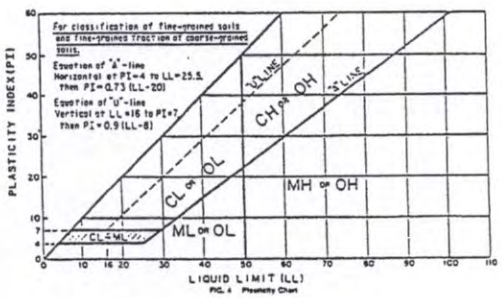
Y = DRY DENSITY IN PCF M = MOISTURE CONTENT IN %

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS (MORE THAN ½ OF SOIL > NO. 200 SIEVE SIZE)	GRAVELS (MORE THAN ½ OF COARSE FRACTION >NO. 4 SIEVE SIZE)	GW	WELL GRADED GRAVELS OR GRAVEL- SAND MIXTURES, LITTLE OR NO FINES
		GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (MORE THAN ½ OF COARSE FRACTION < NO. 4 SIEVE SIZE)	SW	WELL GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SM	SILTY SANDS, SILT-SAND MIXTURES
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN ½ OF SOIL < NO. 200 SIEVE SIZE)	SILTS & CLAYS LIQUID LIMIT < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS & CLAYS LIQUID LIMIT > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS, ORGANIC SILTS
HIGHLY ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

CLASSIFICATION CHART (UNIFIED SOIL CLASSIFICATION SYSTEM)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. STANDARD SIEVE SIZE	GRAIN SIZE IN MILLIMETERS
BOULDERS	Above 12 Inches	Above 305
COBBLES	12 Inches To 3 Inches	305 To 76.2
GRAVEL	3 Inches to No. 4	76.2 to 4.76
Coarse	3 Inches to ¾ Inch	76.2 to 19.1
Fine	¾ Inch to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.420
Fine	No. 40 to No. 200	0.420 to 0.074
SILT AND CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

EAST COUNTY SOIL CONSULTATION AND ENGINEERING, INC.
10925 HARTLEY ROAD, SUITE "I"
SANTEE, CALIFORNIA 92071

U.S.C.S. SOIL CLASSIFICATION

JOHN & POLLY SAVAGE
GREENBUSH LANE
PROJECT NO: 15-1108D1
PLATE NO. 3
FEB 26 2015

PAGE L-1
LABORATORY TEST RESULTS

EXPANSION INDEX TEST (ASTM D4829)

INITIAL MOISTURE CONTENT(%)	SATURATED MOISTURE CONTENT(%)	INITIAL DRY DENSITY (PCF)	EXPANSION INDEX	LOCATION
16.5	31.4	90.2	27	TP-4 @ 1.0'

PARTICLE SIZE ANALYSIS (ASTM D422)

U.S. Standard Sieve Size	Percent Passing TP-4 @ 1.0' Slopewash	Percent Passing TP-4 @ 2.0' Slopewash	Percent Passing TP-5 @ 4.5' Granitic Rocks
2"	-	-	-
1"	-	-	-
1/2"	-	-	-
3/8"	-	-	-
#4	-	100	100
#8	100	99	97
#16	98	91	89
#30	93	81	76
#50	82	67	55
#100	66	55	30
#200	49	47	11
USCS	**SC**	**SM**	**SP-SM**

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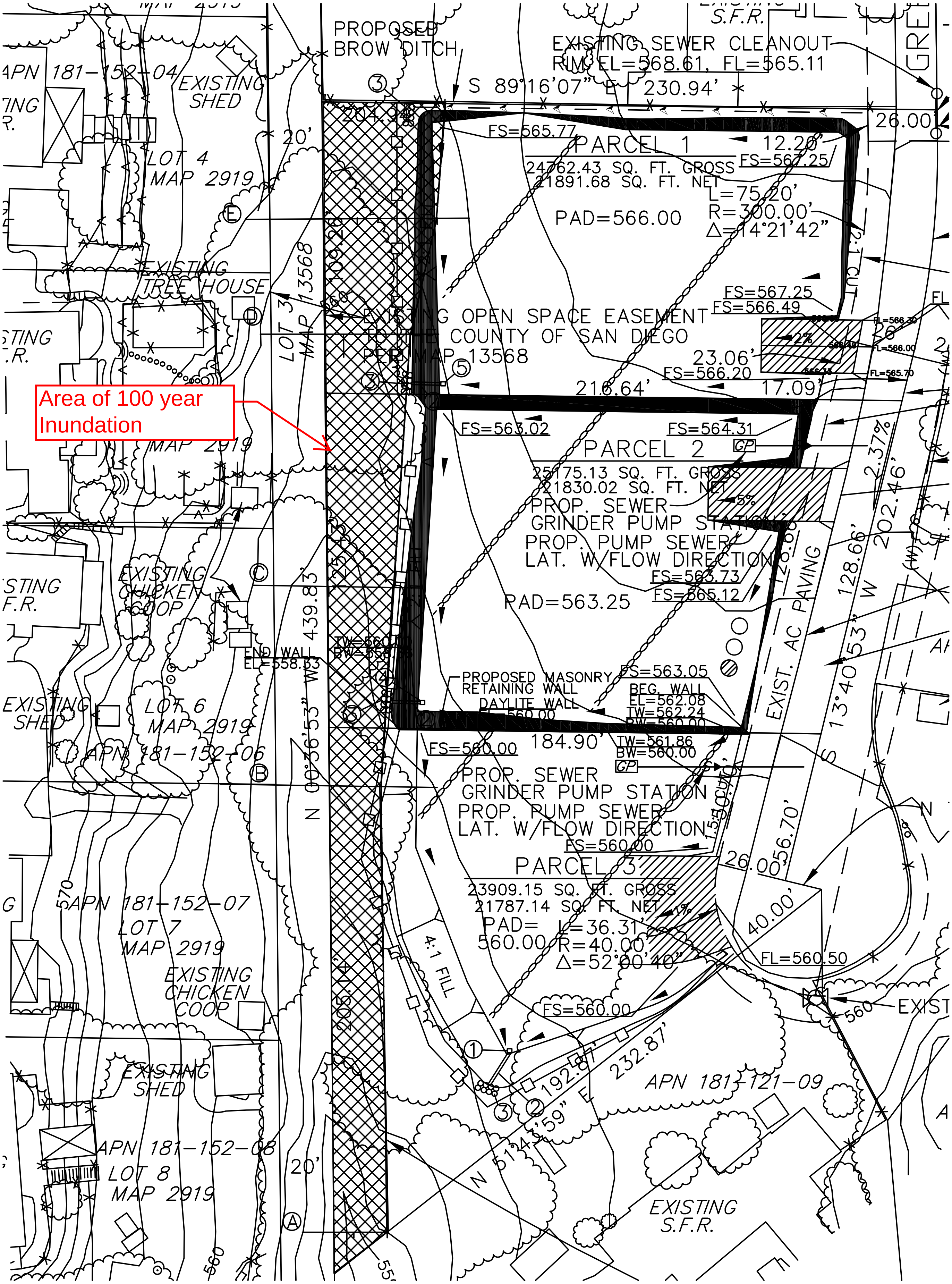
Appendix C



PROPOSED
BROW DITCH
EXISTING SEWER CLEANOUT
RIM EL=568.61, FL=565.11
S 89°16'07" E 230.94'
204.94'
26.00'
APN 181-152-04
EXISTING SHED
20'
FS=565.77
PARCEL 1
12.20'
24762.43 SQ. FT. GROSS
21891.68 SQ. FT. NET
FS=567.25
LOT 4
MAP 2919
L=75.20'
R=300.00'
Δ=14°21'42"
PAD=566.00
EXISTING TREE HOUSE
LOT 3
MAP 13568
EXISTING OPEN SPACE EASEMENT
TO THE COUNTY OF SAN DIEGO
PER MAP 13568
FS=567.25
FS=566.49
2%
23.06'
FS=566.20
216.64'
17.09'
Area of 100 year
Inundation
FS=563.02
FS=564.31
PARCEL 2
GP
MAP 2919
25175.13 SQ. FT. GROSS
21830.02 SQ. FT. NET
5%
PROP. SEWER
GRINDER PUMP STATION
PROP. PUMP SEWER
LAT. W/FLOW DIRECTION
2.37%
202.46'
128.66'
FS=563.73
FS=565.12
EXISTING CHICKEN COOP
PAD=563.25
439.83'
EXIST. AC PAVING
TW=560.
BW=558.
END WALL
EL=558.33
PROPOSED MASONRY
RETAINING WALL
FS=563.05
BEG. WALL
EL=562.08
TW=562.24
BW=560.00
DAYLITE WALL
EL=560.00
S 13°40'53" W
EXISTING SHED
LOT 6
MAP 2919
APN 181-152-06
FS=560.00
184.90'
TW=561.86
BW=560.00
GP
N 00°36'53" W
PROP. SEWER
GRINDER PUMP STATION
PROP. PUMP SEWER
LAT. W/FLOW DIRECTION
FS=560.00
56.70'
PARCEL 3
26.00'
23909.15 SQ. FT. GROSS
21787.14 SQ. FT. NET
1%
APN 181-152-07
LOT 7
MAP 2919
PAD=
560.00
L=36.31'
R=40.00'
Δ=52°00'40"
40.00'
4:1 FILL
FL=560.50
EXISTING CHICKEN COOP
FS=560.00
EXIST
560
192.87'
232.87'
APN 181-121-09
EXISTING SHED
N 51°43'59" E
APN 181-152-08
20'
LOT 8
MAP 2919
205.14'
EXISTING S.F.R.

WORKSHEET 4-3 SAVAGE TPM (name of project) **Peak Discharge Computation**

*****For use with NRCS Hydrologic Method Computations*****

Items in boxes are required input parameters for the SDUH Peak Discharge Program.

Computed by: KRISTIN GREENE Date: 8.14.15

Project Identification (Drainage Area Name): SAVAGE TPM

Geographic location of center of drainage area: Long: ____ " Lat: ____ "

47 ac / 640 ac/sq. Drainage Area: 0.1 – square miles

Storm Frequency (Section 2.3): 100 – year

6-Hour Storm Duration Precipitation (Appendix B): 3.5 – inches

24-Hour Storm Duration Precipitation (Appendix B): 5.9 – inches

Precipitation Zone Number (PZN): (Section 4.1.2.4 and Appendix C) PZN = 1.0 1.5 2.0 ____ 3.0 ____ 4.0

PZN Ajustment Factor for 5-year to 35-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 1.5 ____ 2.5 ____ 2.0 ____ 1.5

PZN Ajustment Factor for 35-year to 150-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 2.0 2.5 3.0 ____ 3.0 ____ 2.0

PZN Adjusted Runoff Curve Number (interpolate between nearest whole number PZN conditions): (Sections 4.1.2.4 and 4.2.4, Tables 4-6 and 4-10) $CN_{1.0 \text{ or } 2.0}$ 80 CN_X 85.5 $CN_{2.0 \text{ or } 3.0}$ 91

Watershed Length (L) (Section 4.3.1): 0.49 – miles $S = \frac{690 - 540}{.49} =$

Length to Centroid (L_c) (Section 4.3.1): .25 – miles

Slope (s) (Section 4.3.1): 306 – feet/mile Basin $\bar{n}$ Factor (Section 4.3.5): $\bar{n} = .020$ P 4.37-8

Corps lag (T_L) = 24 $\bar{n}$ $((L \times L_c)/s^{0.5})^m$ (Section 4.3.1.1)
OR
Corps lag (T_L) = 0.8 T_c (Section 4.3.1.2) Lag Time: .073 – hours

Time to Peak = 0.862 x Corps lag (Section 4.1.5.5): Time to Peak : .063 – hours

$Q_{100} = 422.7$

```
*****************************************************************
*************
  * The San Diego Unit Hydrograph (SDUH) Peak Discharge Program
uses the       *
  * procedures described in Section 4 of the San Diego County
Hydrology       *
  * Manual for NRCS Hydrologic Method calculations.  The SDUH
Peak Discharge   *
  * Program may be used only for determination of peak flow rate,
and may not  *
  * be used for detention basin design or other routing purposes
for which a   *
  * hydrograph is required.  To generate a hydrograph, the
calculation method  *
  * described in Section 4 of the San Diego County Hydrology
Manual may be     *
  * used, or a computer program that includes good documentation
of the        *
  * calculations (see Section 1.7 of the San Diego County
Hydrology manual).   *
  * Note: the RATHYDRO computer program is not based on the
calculation method *
  * described in Section 4 of the San Diego County Hydrology
Manual and may    *
  * not be used to generate a hydrograph based on the SDUH Peak
Discharge      *
  * Program output.
*

*****************************************************************
*************

   Project Identification:
   Storm Frequency (years) =  100
   Drainage Area (square miles) =    0.100
   6-Hour Rainfall (inches) =     3.50
   6-Hour Depth-Area Factor =    1.000
   24-Hour Rainfall (inches) =     5.90
   24-Hour Depth-Area Factor =    1.000
   Adjusted Curve Number = 85
   Unit Interval (minutes) =  5
   Watershed Lag Time (hours) =    0.100
   Peak Flow Rate (cfs) =      422.7
```

dk Greene Consulting, Inc.

Project: SAVAGE TPM
Subject: Q100 → Inundation
Job No: 15.45 Date: 8.15.15
By: KLG Page: ____ of ____

LAND USE ⇒ 1/2 & 1 ac Residential lots

OVERALL 47 ac.

2 TYPES
RESIDENTIAL

1/2 ac = 26.99 ac ⇒ 27 ac.

1 ac = 20 ac

20 ac.

1/2 Soil B = 5.2 = 5.2/47 =
Soil C = 9.5 9.5/47 =
Soil D = 5.3 5.3/47

= Soil D = 5.9 + 3.33 = 9.2 ac
= Soil C = 17.8

SEE WORKSHEET 4.2

Worksheet 4-2

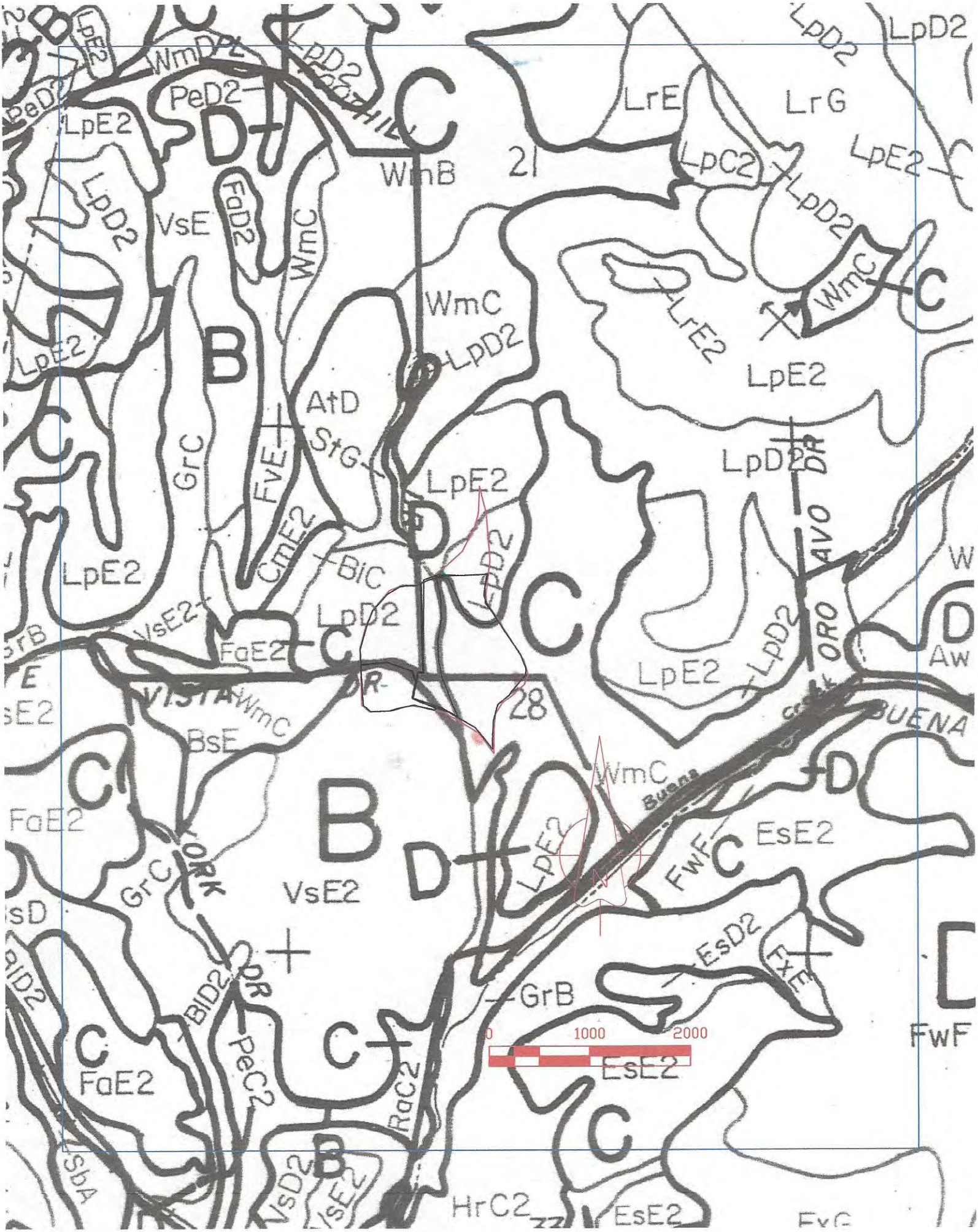
Overall Ac 47

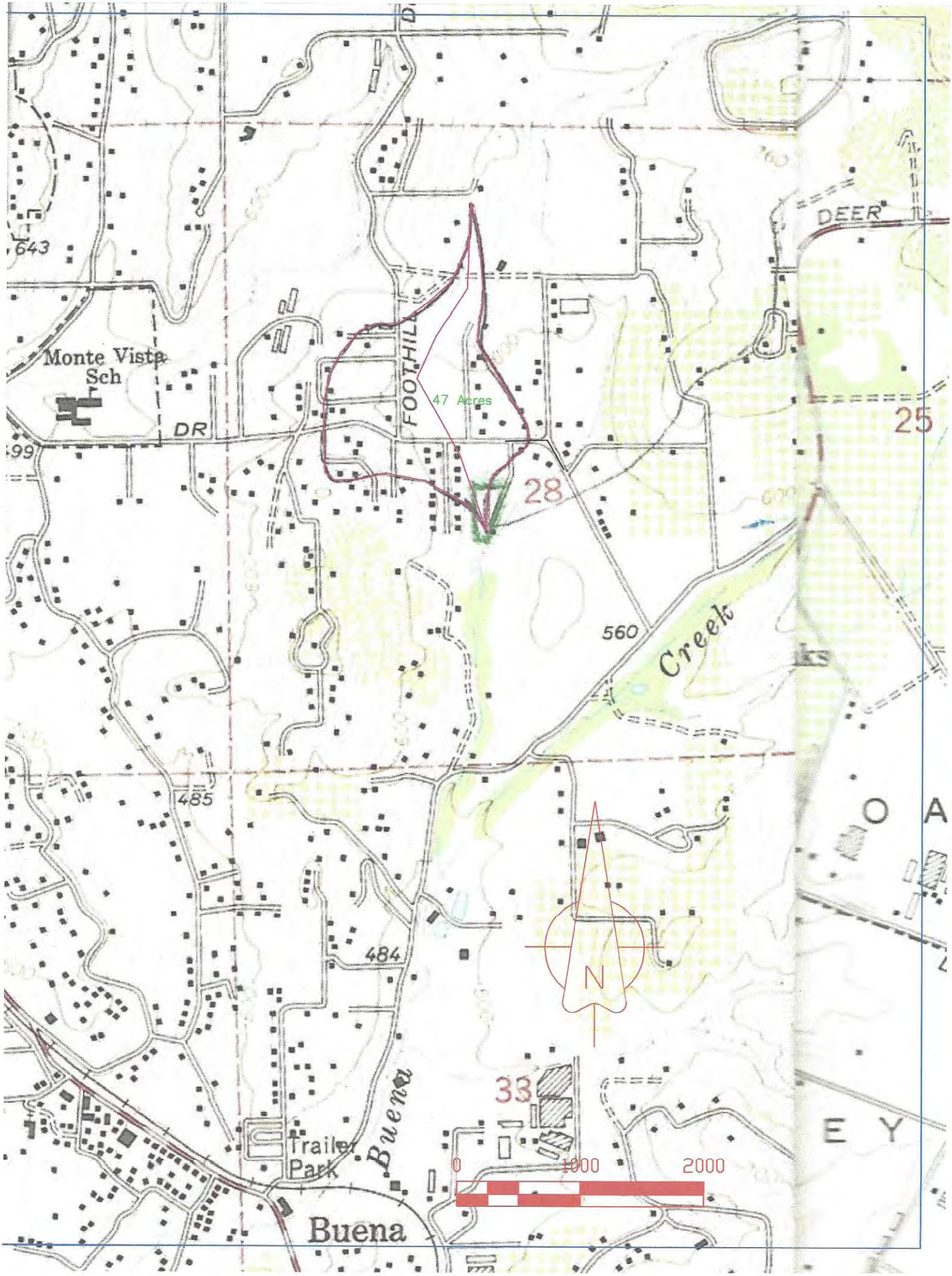
Land Use	Soil Group	Acres	CN_2	% of area	Partial CN
Res - 1/2	D	9.2	85	0.20	16.64
Res - 1/2	C	17.8	80	0.38	30.30
Res - 1 ac	D	5.3	84	0.11	9.47
Res - 1 ac	C	9.5	79	0.20	15.97
Res - 1 ac	B	5.2	68	0.11	7.52
				1.00	79.90
			Use		80

15.45

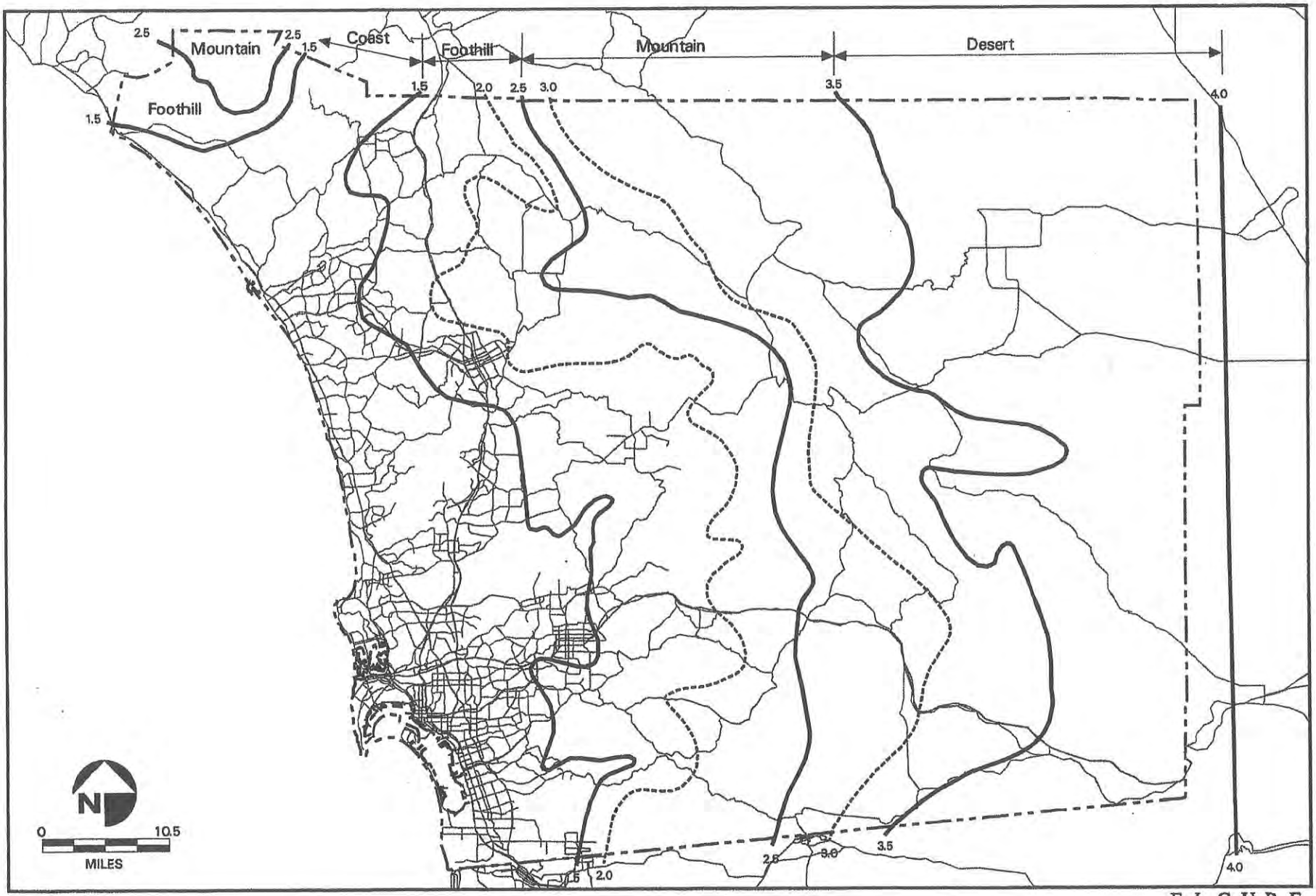
Table 4-2
RUNOFF CURVE NUMBERS[1] FOR PZN CONDITION = 2.0

Cover Description	Cover Treatment or Practice[2]	Hydrologic Condition[3]	Average Percent Impervious Area[4]	Curve Numbers for Hydrologic Soil Groups: A	B	C	D
Developing urban areas and newly graded areas (pervious areas only, no vegetation)				77	86	91	94
Impervious areas: Paved parking lots, roofs, and driveways (excluding right-of-way)				98	98	98	98
Residential districts by average lot size:[4]							
1/8 acre or less (town houses)			65%	77	85	90	92
1/4 acre			38%	61	75	83	87
1/3 acre			30%	57	72	81	86
1/2 acre			25%	54	70	80	85
1 acre			20%	51	68	79	84
2 acres			12%	46	65	77	82
Streets and roads	Paved; curbs and storm drains (excluding right-of-way)			98	98	98	98
	Paved; open ditches (including right-of-way)			83	89	92	93
	Gravel (including right-of-way)			76	85	89	91
	Hard surface (including right-of-way)			74	84	90	92
	Dirt (including right-of-way)			72	82	87	89
Urban districts[4]	Commercial and business		85%	89	92	94	95
	Industrial		72%	81	88	91	93
Western desert urban areas:							
Natural desert landscaping (pervious areas only)[5]				63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)				96	96	96	96


LpD2
LrE
LrG
LpE2
LpC2
WmB
21
VsE
FaD2
WmC
LrE2
AtD
StG
GrC
FvE
CmE2
BlC
VsE2
FaE2
28
VISTA
BsE
ORO
AVO
DR
BUENA
FaE2
GrC
FORK
VsE2
FwF
EsE2
EsD2
FXE
GrB
BlD2
PeC2
RaC2
HrC2
0
1000
2000


643
Monte Vista
Sch
DR
499
FOOTHILL
47 Acres
28
DEER
25
560
Creek
485
484
N
33
Trailer
Park
Buena
0
1000
2000
Buena

15.45



FIGURE

C-1

County of San Diego Hydrology Manual

Precipitation Zone Numbers (PZN)

PZN = 1.5

dk Greene Consulting, Inc.

Project: SAVAGE TPM
Subject: Q100
Job No: 15.45 Date: 8.15.15
By: KLG Page: ____ of ____

CORPS LAG

$$T_L = 24\bar{n}\left(\frac{L \times L_c}{S^{.5}}\right)^{.38}$$

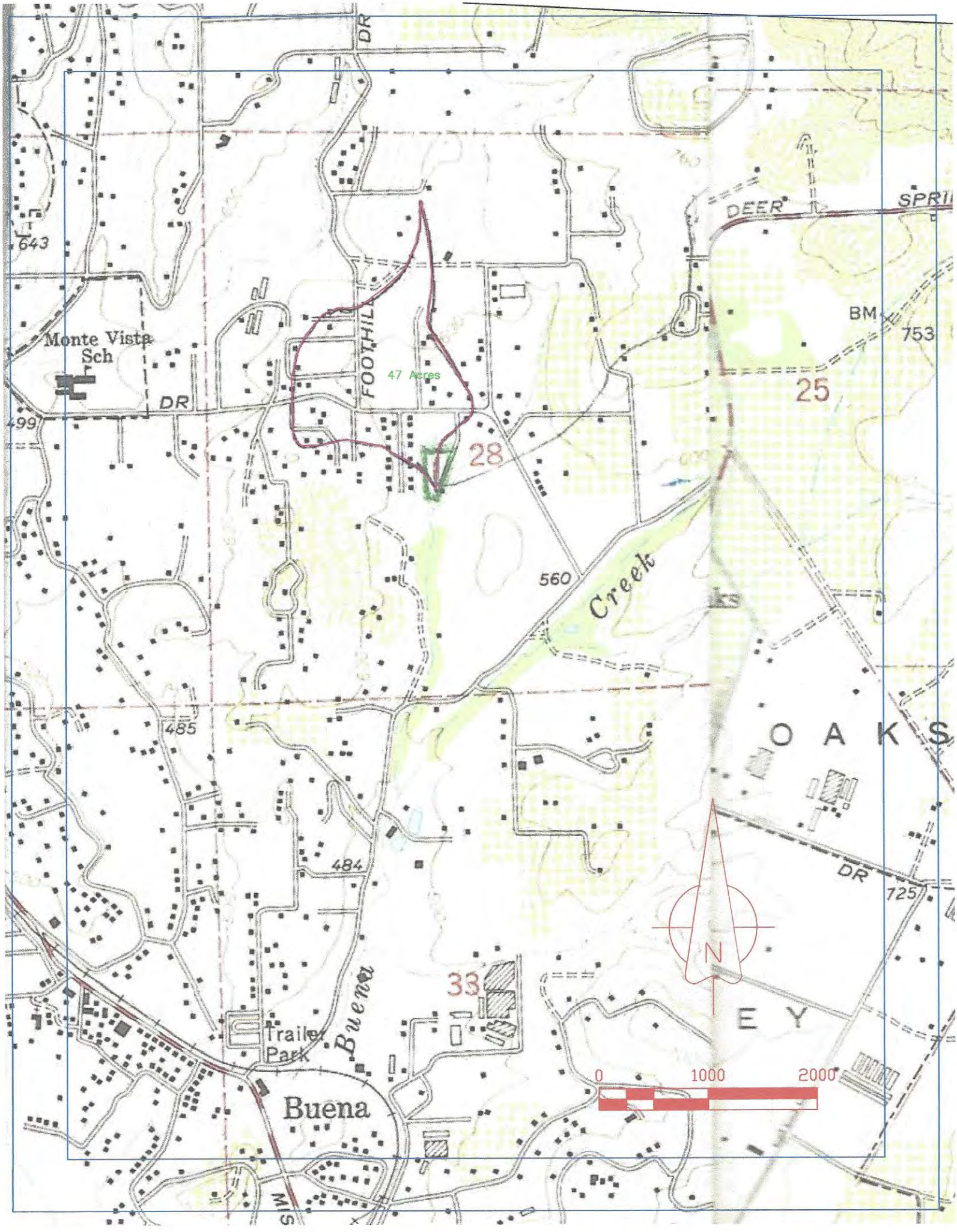
m = .38 for SD pg. 38 of Hydro Man.

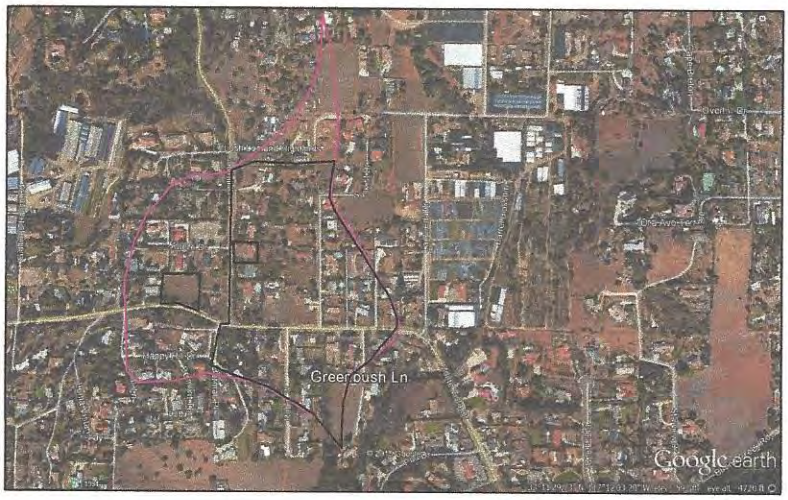
$$= 24(.02)\left[\frac{.49 \times .25}{(306)^{1/2}}\right]^{.38}$$

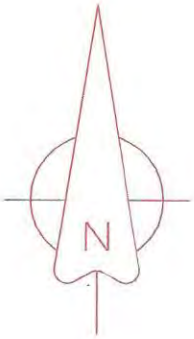
$$.48(.1517)$$

$$= .073 \text{ hrs}$$

$\frac{.1225}{17.49} \Rightarrow (.007)^{.38}$


DR
DEER
SPRI
643
Monte Vista
Sch
DR
499
FOOTHILL
47 Acres
28
BM
753
25
560
Creek
485
OAKS
484
DR
725
N
33
Trailer
Park
Buena
Buena
MS
EY
0
1000
2000

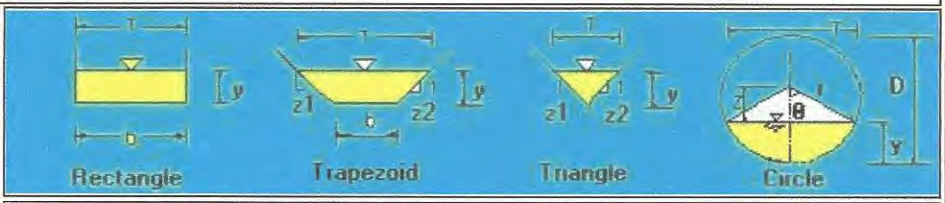

Greer Bush Ln
Google earth


N


0
1000
2000

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .0183 ft/ft	Water depth(y): 2.31 ft	Bottom width(b) 4.84 ft
Flow velocity 12.275 ft/s	LeftSlope(Z1): 4.44 ft/ft	RightSlope(Z2): 4.25 ft/ft
Flow discharge 422.7 ft^3/s	Input n value .020 or select r: clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 25.46 ft	Flow area 34.44 ft^2	Top width(T) 24.94 ft
Specific energy 4.65 ft	Froude number 1.84	Flow status Supercritical flow
Critical depth 3.08 ft	Critical slope 0.0049 ft/ft	Velocity head 2.34 ft

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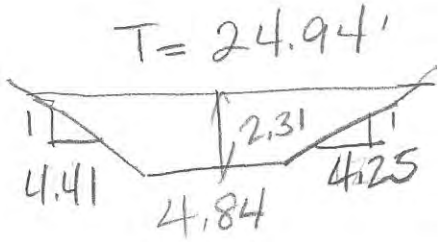
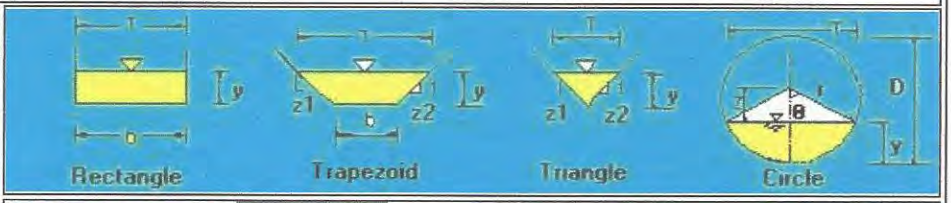
Section A



The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: .0183 ft/ft	Water depth(y): 1.37 ft	Bottom width(b) 14.65 ft
Flow velocity 9.193 ft/s	LeftSlope(Z1): 7.5 ft/ft	RightSlope(Z2): 20 ft/ft
Flow discharge 422.7 ft^3/s	Input n value .020 or select n: clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 52.51 ft	Flow area 45.98 ft^2	Top width(T) 52.38 ft
Specific energy 2.68 ft	Froude number 1.73	Flow status Supercritical flow
Critical depth 1.8 ft	Critical slope 0.0056 ft/ft	Velocity head 1.31 ft

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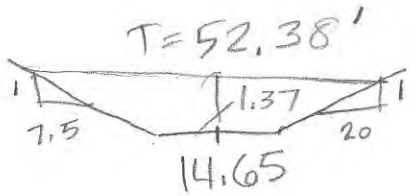
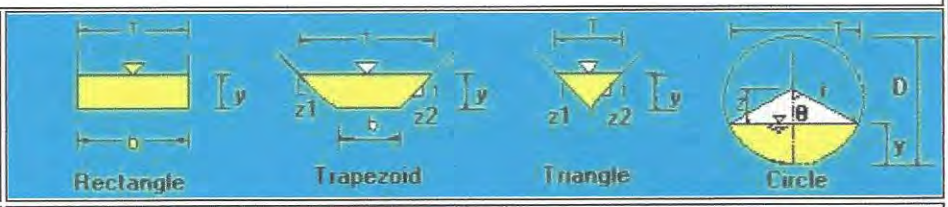
Section (B)



The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .0183 ft/ft	Water depth(y): 1.19 ft	Bottom width(b) 26.85 ft
Flow velocity 9.5 ft/s	LeftSlope(Z1): 7 ft/ft	RightSlope(Z2): 11 ft/ft
Flow discharge 422.7 ft^3/s	Input n value .020 or select r: clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 48.33 ft	Flow area 44.49 ft^2	Top width(T) 48.19 ft
Specific energy 2.59 ft	Froude number 1.74	Flow status Supercritical flow
Critical depth 1.64 ft	Critical slope 0.0055 ft/ft	Velocity head 1.4 ft

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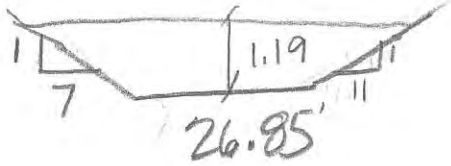
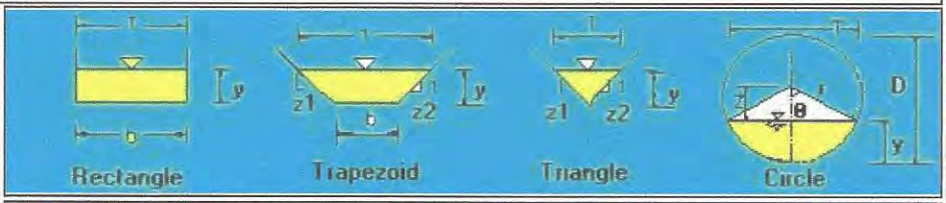
Section (C)

T = 48.19



The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .0183 ft/ft	Water depth(y): 1.21 ft	Bottom width(b) 25 ft
Flow velocity 9.356 ft/s	LeftSlope(Z1): 8.875 ft/ft	RightSlope(Z2): 11.5 ft/ft
Flow discharge 422.7 ft^3/s	Input n value .020 or select r: clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 49.78 ft	Flow area 45.18 ft^2	Top width(T) 49.66 ft
Specific energy 2.57 ft	Froude number 1.73	Flow status Supercritical flow
Critical depth 1.65 ft	Critical slope 0.0055 ft/ft	Velocity head 1.36 ft

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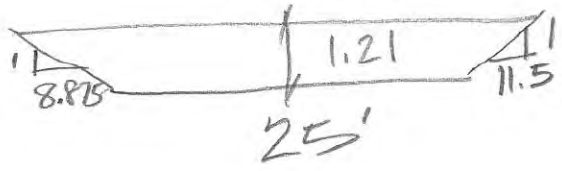
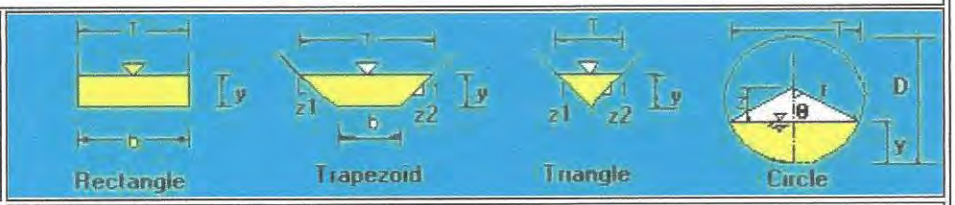
Section D

T = 49.66



The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .0183 ft/ft	Water depth(y): 1.01 ft	Bottom width(b) 36 ft
Flow velocity 8.686 ft/s	LeftSlope(Z1): 12.2 ft/ft	RightSlope(Z2): 12 ft/ft
Flow discharge 422.7 ft^3/s	Input n value .020 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 60.51 ft	Flow area 48.67 ft^2	Top width(T) 60.43 ft
Specific energy 2.18 ft	Froude number 1.71	Flow status Supercritical flow
Critical depth 1.38 ft	Critical slope 0.0057 ft/ft	Velocity head 1.17 ft

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Section E