Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Monday, Nov 20 2017

POST DEVELOPMENT: 302 to 301 Pipe Flow (3rd Assumption)

Circular

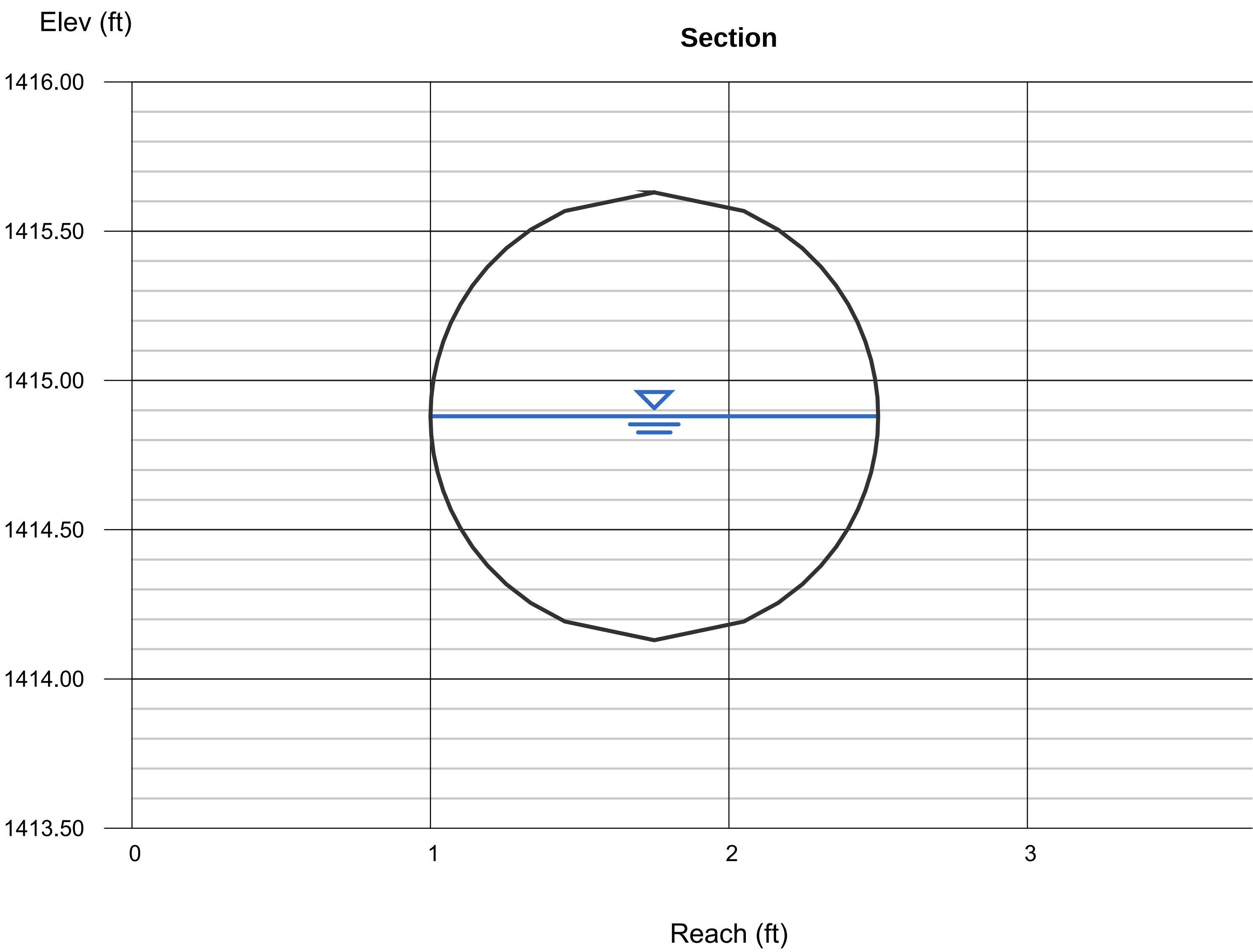
Diameter (ft)	=	1.50
Invert Elev (ft)	=	1414.13
Slope (%)	=	0.50
N-Value	=	0.010

Calculations

Compute by:		Known Q
Known Q (cfs)	=	4.74

Highlighted

Depth (ft)	=	0.75
Q (cfs)	=	4.740
Area (sqft)	=	0.89
Velocity (ft/s)	=	5.34
Wetted Perim (ft)	=	2.36
Crit Depth, Yc (ft)	=	0.84
Top Width (ft)	=	1.50
EGL (ft)	=	1.19

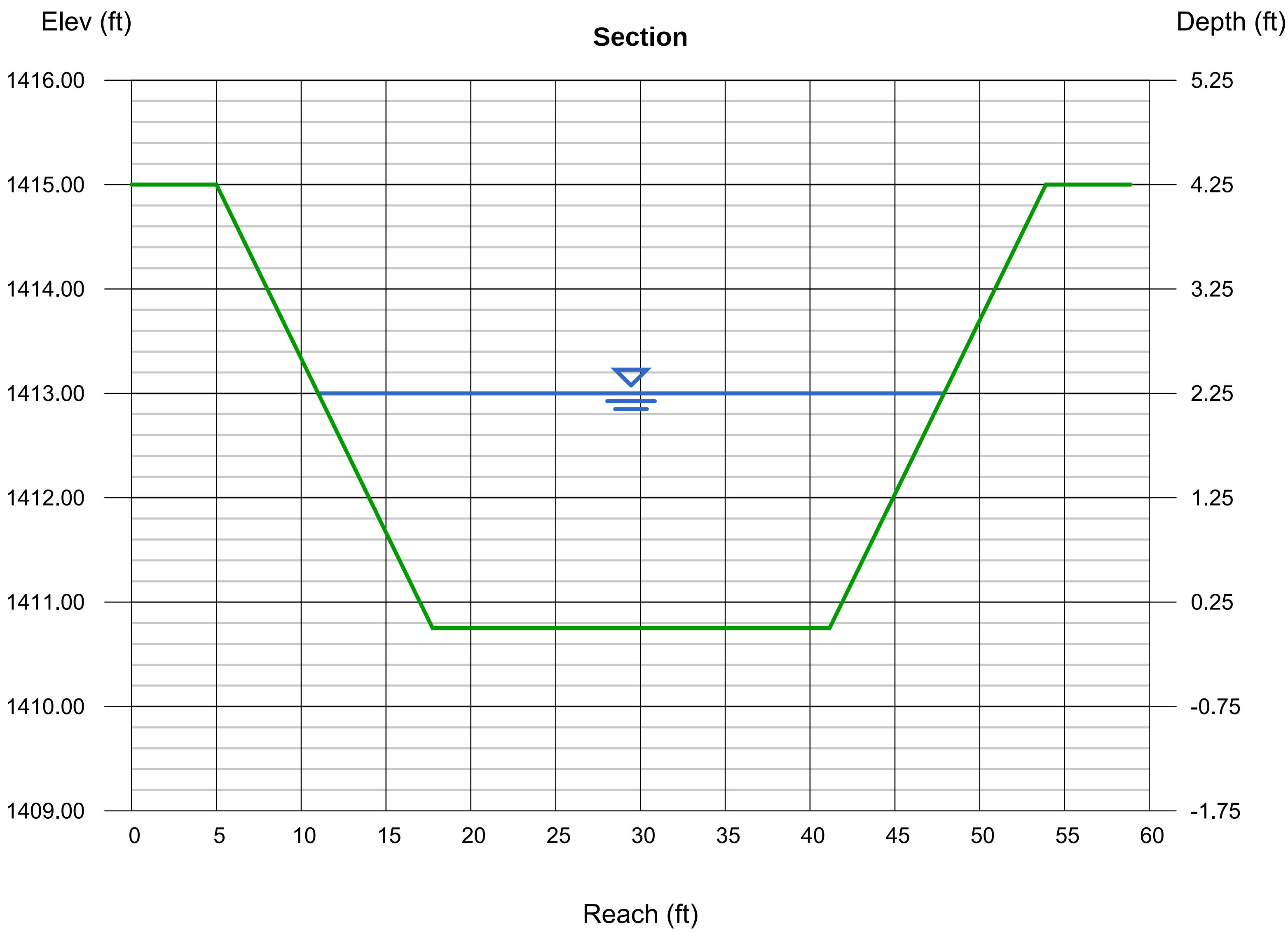


Channel Report

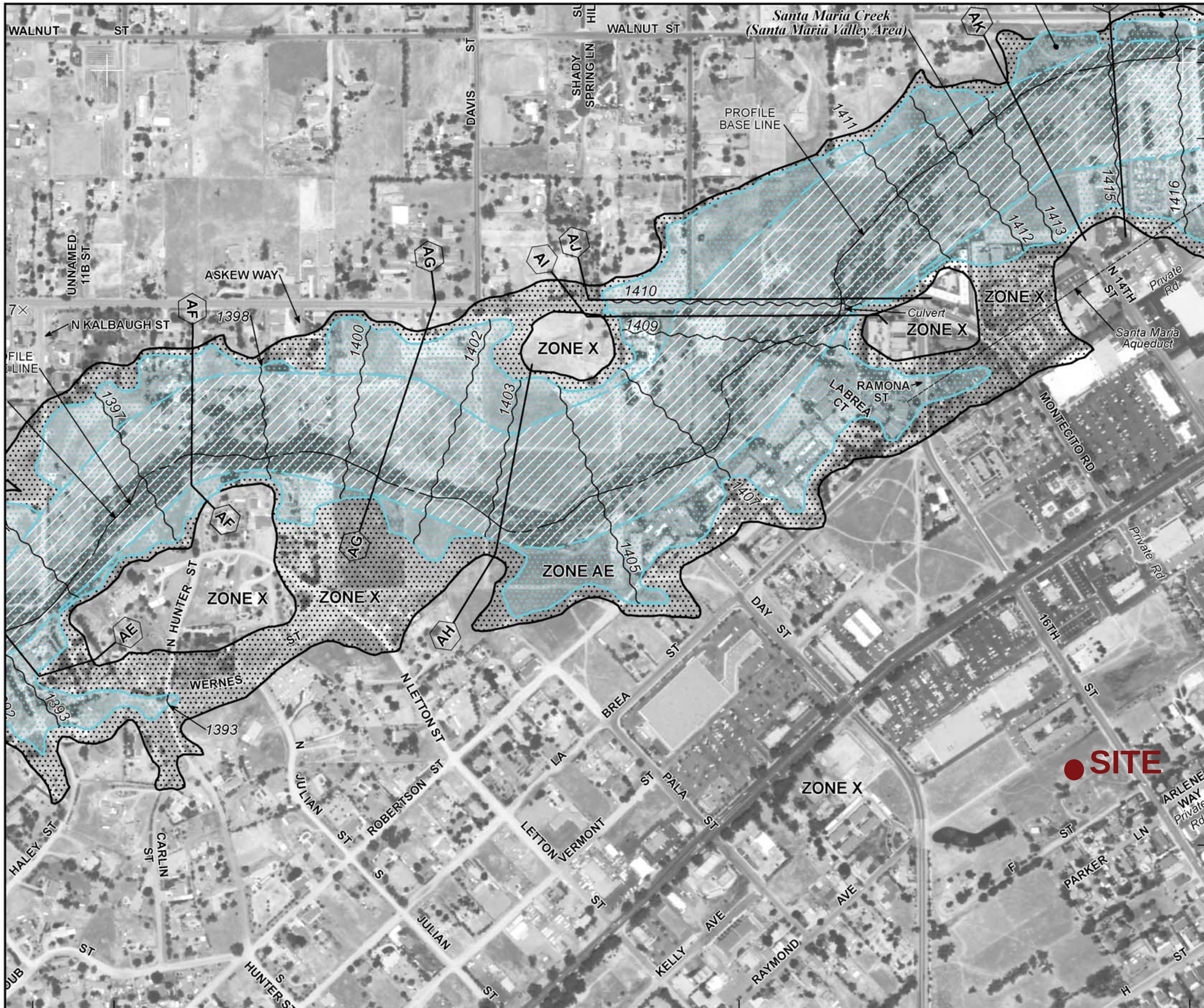
Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. | Tuesday, Nov 21 2017

POST-DEVELOPMENT: Q100 Channel

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 23.40	Depth (ft)	= 2.25
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 111.10
Total Depth (ft)	= 4.25	Area (sqft)	= 67.84
Invert Elev (ft)	= 1410.75	Velocity (ft/s)	= 1.64
Slope (%)	= 0.20	Wetted Perim (ft)	= 37.63
N-Value	= 0.060	Crit Depth, Yc (ft)	= 0.86
		Top Width (ft)	= 36.90
Calculations		EGL (ft)	= 2.29
Compute by:	Known Q		
Known Q (cfs)	= 111.10		



C. FLOOD MAPS



ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1117G

FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1117 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY	060284	1117	G

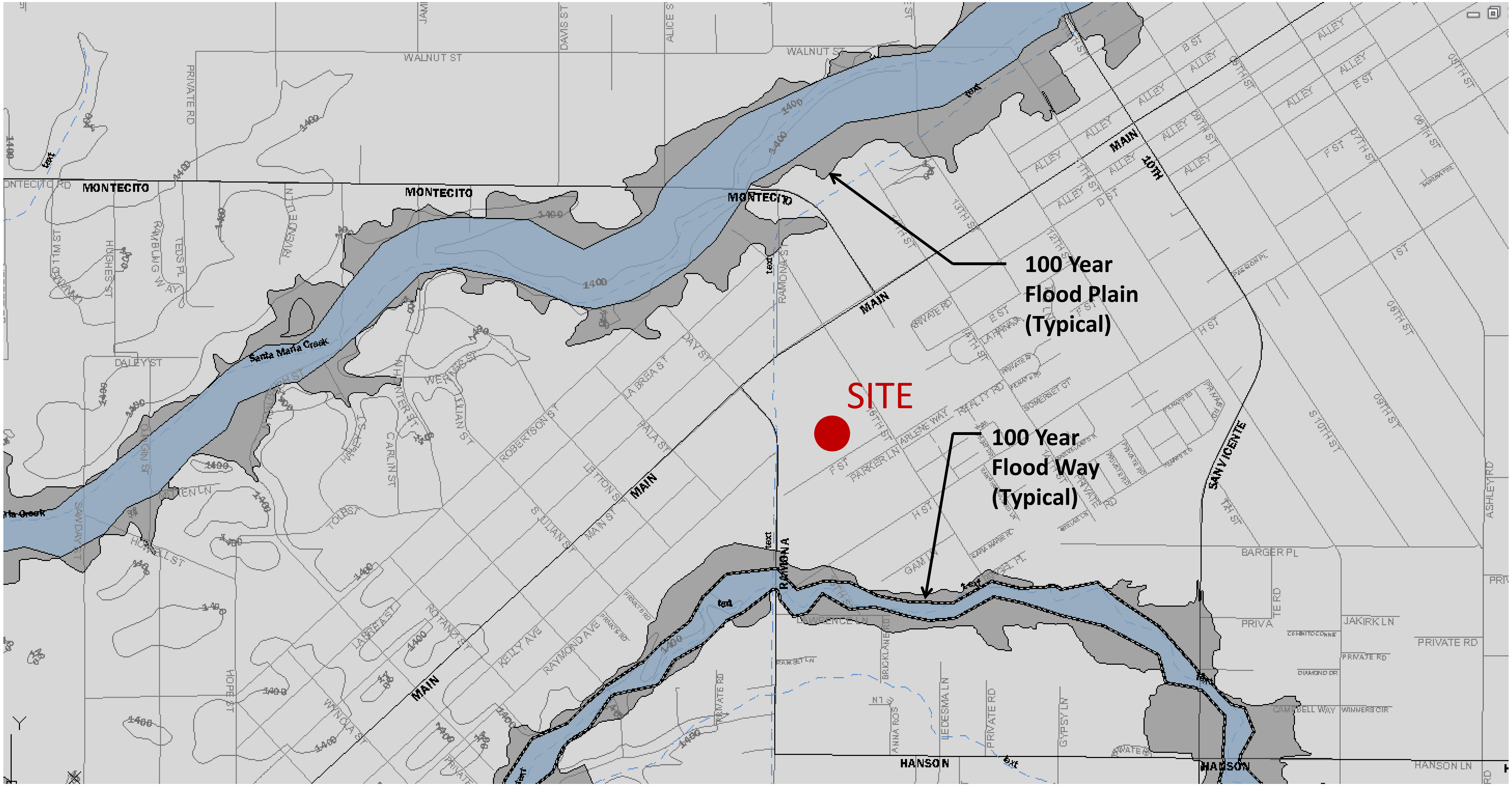
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 06073C1117G

MAP REVISED MAY 16, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



SAN DIEGO COUNTY FLOOD MAP

NTS

Note: Floodplain and floodway information per SANGIS GIS Data dated 9/30/2014

D. HYDROLOGIC SOIL GROUP MAP

United States Department of Agriculture

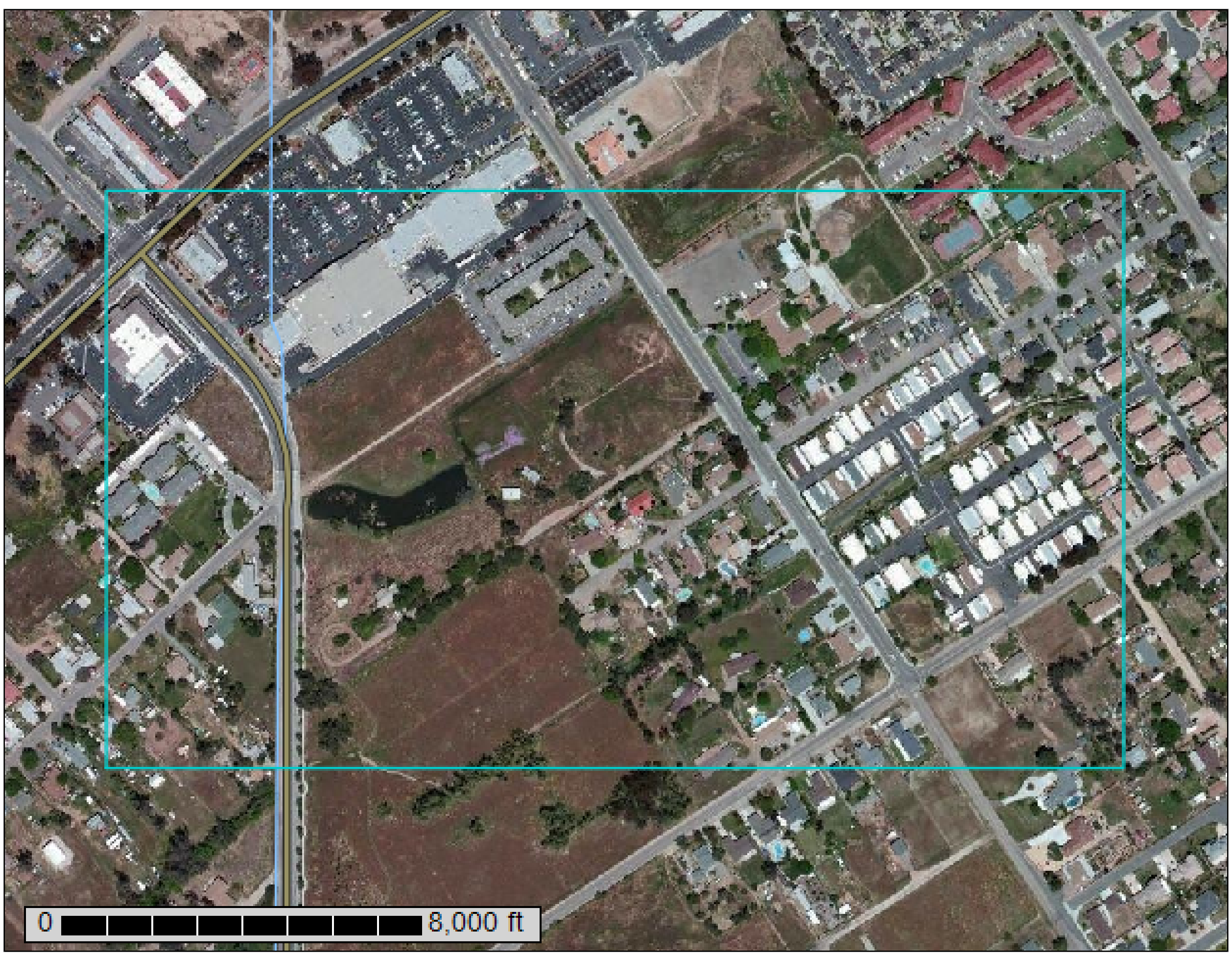
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

San Diego County Area, California



May 15, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:3,990 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 7, Nov 15, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 2, 2010—Jun 3, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BlC	Bonsall sandy loam, 2 to 9 percent slopes	7.9	10.7%
PeC	Placentia sandy loam, 2 to 9 percent slopes	65.7	89.2%
RkA	Reiff fine sandy loam, 0 to 2 percent slopes	0.1	0.1%
Totals for Area of Interest		**73.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

BlC—Bonsall sandy loam, 2 to 9 percent slopes

Map Unit Setting

Elevation: 200 to 2,500 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 240 to 340 days

Map Unit Composition

Bonsall and similar soils: 85 percent
Minor components: 15 percent

Description of Bonsall

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Weathered granite

Typical profile

H1 - 0 to 10 inches: neutral, sandy loam
H2 - 0 to 10 inches: neutral, sandy loam
H2 - 0 to 10 inches: neutral, sandy loam
H3 - 0 to 10 inches: moderately alkaline, sandy loam
H3 - 0 to 10 inches: moderately alkaline, sandy loam
H4 - 0 to 10 inches: moderately alkaline, sandy loam
H4 - 0 to 10 inches: moderately alkaline, sandy loam
H5 - 0 to 10 inches: slightly alkaline, sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)

Minor Components

Placentia

Percent of map unit: 5 percent

Fallbrook

Percent of map unit: 5 percent

Bosanko

Percent of map unit: 5 percent

PeC—Placentia sandy loam, 2 to 9 percent slopes

Map Unit Setting

Elevation: 50 to 2,500 feet
Mean annual precipitation: 12 to 18 inches
Frost-free period: 200 to 300 days

Map Unit Composition

Placentia and similar soils: 85 percent
Minor components: 1 percent

Description of Placentia

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 13 inches: slightly acid, sandy loam
H2 - 0 to 13 inches: moderately alkaline, sandy loam
H3 - 0 to 13 inches: moderately alkaline, sandy loam
H3 - 0 to 13 inches: moderately alkaline, sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 25.0
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)

Minor Components

Unnamed, ponded

Percent of map unit: 1 percent
Landform: Depressions

RkA—Reiff fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 30 to 500 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 240 to 275 days

Map Unit Composition

Reiff and similar soils: 85 percent
Minor components: 15 percent

Description of Reiff

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 14 inches: neutral, fine sandy loam
H2 - 14 to 43 inches: slightly alkaline, stratified sandy loam to loam
H3 - 43 to 60 inches: slightly alkaline, stratified sandy loam to loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: A

Minor Components

Visalia

Percent of map unit: 5 percent

Ramona

Percent of map unit: 5 percent

Plecentia

Percent of map unit: 5 percent

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ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 7.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

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Construction Testing & Engineering, Inc.
Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

GEOTECHNICAL INVESTIGATION
PROPOSED VILLAGE PLACE APARTMENTS
521 16TH STREET
RAMONA, CALIFORNIA

Prepared for:

RA BURCH CONSTRUCTION, INC.
ATTENTION: BOB BURCH
P.O. BOX 1590
RAMONA, CALIFORNIA 92065

Prepared by:

CONSTRUCTION TESTING & ENGINEERING, INC.
1441 MONTIEL ROAD, SUITE 115
ESCONDIDO, CALIFORNIA 92026

CTE JOB NO.: 10-13565G MARCH 7, 2017

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1.0 INTRODUCTION AND SCOPE OF SERVICES

1.1 Introduction

This report presents the results of the geotechnical investigation, performed by Construction Testing and Engineering, Inc. (CTE), and provides conclusions and preliminary recommendations for the proposed improvements at the subject site located at 521 16th Street in Ramona, California. The recent investigation was performed in general accordance with the terms of CTE proposal G-3980A, dated February 1, 2017.

CTE understands that the proposed site improvements include multiple two-story, wood-frame apartment buildings with drive and parking areas, a stormwater retention basin, associated utilities, landscaping, and other ancillary improvements. According to the project grading plan, site work will include raising existing grades up to five feet from current elevations to create the building pads and surrounding areas. Preliminary recommendations for excavations, fill placement, and foundation design for the proposed improvements are presented herein. Reviewed references are provided in Appendix A.

1.2 Scope of Services

The scope of services provided included:

- Review of readily available geologic and geotechnical reports.
- Coordination of utility mark-out and location.
- Obtaining a Boring Permit through the County of San Diego Department of Environmental Health (DEH).

- Excavation of exploratory borings and soil sampling utilizing a limited access, track-mounted drill rig, due to soft site conditions at the time of the field evaluation.
- Laboratory testing of selected soil samples.
- Description of site geology and evaluation of potential geologic hazards.
- Engineering and geologic analysis.
- Preparation of this preliminary geotechnical investigation report.

2.0 SITE DESCRIPTION

The project site is located at 521 16th Street in Ramona, California (Figure 1). The site is currently a grass covered vacant lot with some scattered trees. The site is bounded by 16th Street to the east, an existing apartment complex to the north, Single-family residences to the south, and a small residential farm to the west. A draining channel/creek runs east to west along the northern property line before turning southwest and meeting a shallow pond on the adjacent western property. An old concrete slab was observed along the west-central property boundary.

An abandoned well (or similar) appears to be present along the west-central property boundary. The presumed abandoned well should be further researched and properly abandoned in accordance with the requirements and permitting of the agency having jurisdiction, which is anticipated to be the County of San Diego Department of Environmental Services. CTE or another qualified consultant can be contacted to provide further evaluation of this site feature.

Saturated (from recent rains) and burrowed soils were encountered across the surface of the site necessitating the use of a track-mounted drill rig. The project area generally descends gradually to the west with elevations ranging from approximately 1414 feet msl (above mean sea level) in the southeastern portion of the site to approximately 1410 feet msl in the northwestern portion of the site.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

3.1 Field Investigation

CTE performed the field investigation on February 17, 2017. The field work consisted of site reconnaissance and excavation of six borings. The borings were advanced to a maximum depth of approximately 20.25 feet below ground surface (bgs). Bulk samples were collected from the cuttings, and relatively undisturbed samples were collected by driving Standard Penetration Test (SPT) and Modified California (CAL) samplers. The Borings were advanced with a CME-75 track-mounted, limited access drill rig equipped with eight-inch-diameter, hollow-stem augers. The approximate locations of the exploratory soil borings are shown on the attached Figure 2.

The soils were logged in the field by a CTE Engineering Geologist and were visually classified in general accordance with the Unified Soil Classification System. The field descriptions have been modified, where appropriate, to reflect laboratory test results. Boring logs, including descriptions of the soils encountered, are included in Appendix B. The approximate locations of the borings are presented on Figure 2.

3.2 Laboratory Testing

Laboratory tests were conducted on selected soil samples for classification purposes, and to evaluate physical properties and engineering characteristics. Laboratory tests included: Expansion Index

(EI), Gradation, 200 Wash, In-Place Moisture and Density, Atterberg Limits, Resistance "R" Value, and Chemical Characteristics. Test descriptions and laboratory test results for the selected soils are included in Appendix C. Some laboratory tests remain pending at the time of issuance of this report. Should the results of pending tests necessitate modifications to the recommendations herein, an updated report or addendum will be issued.

4.0 GEOLOGY

4.1 General Setting

Ramona is located within the Peninsular Ranges physiographic province, which is characterized by northwest-trending mountain ranges, intervening valleys, and predominantly northwest trending regional faults. The region can be further subdivided into the coastal plain area, a central mountain-valley area and the eastern mountain valley area. The project site is located in the eastern portion of the central mountain area. The central-mountain area ranges in elevation from approximately 500 to 5000 feet above mean sea level and is characterized by Cretaceous and Jurassic crystalline ridges and mountains with intermountain basins that are generally underlain with moderate thickness of alluvium and residual soils.

4.2 Geologic Conditions

Based on the regional geologic map prepared by Hernandez, et al. (2007), the near surface geologic unit underlying the site consists of deeply weathered, Cretaceous Japatul Valley Tonalite. Based on the recent explorations, Quaternary Alluvium and Residual Soil overlie the Tonalite at the site. Descriptions of the geologic and soil units encountered are presented below.

4.2.1 Quaternary Alluvium

The Quaternary Alluvium generally consists of loose to very dense, slightly moist to wet, light brown to dark brown, silty, poorly graded, and clayey, sands as well as firm to hard, sandy clays and silts. This unit was found to extend to a maximum encountered depth of 18.5 feet bgs during the investigation. The interpreted depth of alluvium / top of Tonlite bedrock across the site is depicted as depth contours on Figure 2. As shown on Figure 2, the depth of the alluvium is deepest along the northern portion of the site adjacent to existing creek/drainage channel, and thins toward the south across a subsurface granitic bedrock high. However, localized deeper alluvium may be encountered during grading and construction, especially along the northern portion of the property. Alluvium is not considered suitable for support of proposed improvements unless prepared as recommended herein.

4.2.2 Residual Soil

Residual soil was observed overlying the Tonalite in Borings B-5 and B-6. Where observed, these materials generally consist of medium dense to very dense, slightly moist, brown to gray brown, clayey, fine grained sands with silt and trace medium to coarse sands. The top of the residual soil recognized in Borings B-5 and B-6 is at a consistent depth as the top of the weather Tonalite bedrock observed in Borings B-2 and B-3, approximately three to four feet below existing ground surface, indicating that either the residual soil was eroded from the bedrock high (B-2, B-3 area) or was too thin to be recognized based on the sampling interval in the borings. Therefore, it is possible that residual soils could be present further north than shown on Figure 2. Residual soils are not considered suitable for support of proposed improvements unless prepared as recommended herein.

4.2.3 Cretaceous Japatul Valley Tonalite-deeply weathered

Weathered Cretaceous-age Japatul Valley Tonalite (bedrock) was encountered in each of the borings below the alluvium and/or residual soil. As observed in situ, this unit is generally medium to coarse grained, pale gray to white with abundant mafic inclusions, and moderately to strongly foliated. The bedrock generally excavated as dense to very dense, slightly moist, brown to gray and red brown, silty, fine grained sand with clay. The bedrock is anticipated to become less weathered and increasingly difficult to excavate with depth. These materials are anticipated to be suitable for support of proposed compacted fill materials, as recommended herein.

4.3 Groundwater Conditions

During the recent investigation, groundwater was encountered in Borings B-1 and B-4, at a depth of approximately 10.5 and 8.0 feet bgs, respectively. Because of the recent heavy precipitation during the time of our explorations, groundwater levels may have been seasonally elevated. Also, groundwater depths are anticipated to be shallower with closer proximity to the drainage channel to the north and the pond to the west. While groundwater conditions may vary, especially following periods of sustained precipitation or irrigation, it is generally not anticipated to affect the proposed shallow construction activities or the completed improvements if proper site drainage is designed, installed, and maintained as per the recommendations of the project civil engineer. In addition, site plans indicate grading to raise the elevation of the pad, further distancing the groundwater from proposed improvements. However, if or where present at shallower depths during proposed grading, localized diversion of groundwater or stabilization using medium- to high-strength geogrid and/or rock could be necessary.

4.4 Geologic Hazards

Geologic hazards that were considered to have potential impacts to site development were evaluated based on field observations, literature review, and laboratory test results. It appears that the geologic hazards at the site are primarily limited to those caused by shaking from earthquake-generated ground motions. The following paragraphs discuss the geologic hazards considered and their potential risk to the site.

4.4.1 Surface Fault Rupture

Based on the site reconnaissance and review of referenced literature, the site is not within a State of California-designated Alquist-Priolo Earthquake Fault Studies Zone or Local Special Studies Zone and no known active fault traces underlie, or project toward, the site. According to the California Division of Mines and Geology, a fault is active if it displays evidence of activity in the last 11,000 years (Hart and Bryant, revised 2007). Therefore, the potential for surface rupture from displacement or fault movement beneath the proposed improvements is considered to be low.

4.4.2 Local and Regional Faulting

The California Geological Survey (CGS) and the United States Geological Survey (USGS) broadly group faults as “Class A” or “Class B” (Cao, 2003; Frankel et al., 2002). Class A faults are generally identified based upon relatively well-defined paleoseismic activity, and a fault-slip rate of more than 5 millimeters per year (mm/yr). In contrast, Class B faults have comparatively less defined paleoseismic activity and are considered to have a fault-slip rate less than 5 mm/yr. The nearest known Class B fault is the Earthquake Valley Fault, which is approximately 32.2 kilometers northeast of the site (Blake, T.F., 2000). The nearest known Class A fault is the Julian segment of the Elsinore Fault, which is located approximately 23 kilometers northeast of the site.

The site could be subjected to significant shaking in the event of a major earthquake on any of the faults noted above or other faults in the southern California or northern Baja California area.

4.4.3 Liquefaction and Seismic Settlement Evaluation

Liquefaction occurs when saturated fine-grained sands or silts lose their physical strengths during earthquake-induced shaking and behave like a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with water level, soil type, material gradation, relative density, and probable intensity and duration of ground shaking. Seismic settlement can occur with or without liquefaction; it results from densification of loose soils.

The site is underlain at shallow depths by dense to very dense Tonalite. In addition, loose surficial soils within proposed improvement areas are to be overexcavated and then compacted as engineered fill. Therefore, the potential for liquefaction or significant seismic settlement at the site is considered to be negligible to low.

4.4.4 Tsunamis, Seiche, and Flooding Evaluation

According to State of California Emergency Management Agency mapping, the site is not located within a tsunami inundation zone based on distance from the coastline and elevation above sea level. Damage resulting from oscillatory waves (seiches) is considered unlikely due to the absence of significant nearby confined bodies of water. According to FEMA (2007), the site is mapped in Zone X, which is determined to be outside the 0.2% annual chance floodplain. However, based on our general observations, in the event of extremely high precipitation, and due to the adjacent creek and pond at the site, localized flooding could occur. However, proposed plans indicate raising the site grades two to five feet, which will further reduce the chance for flooding to affect proposed improvements.

4.4.5 Landsliding

Based on document review, no landslides are mapped in the site area. In addition, landslides or similar associated features were not observed during the recent field exploration at the relatively level site. Based on the investigation findings, landsliding is not considered to be a significant geologic hazard at the site.

4.4.6 Compressible and Expansive Soils

Loose alluvium and shallow residual soils are considered to be potentially compressible. Therefore, these soils should be overexcavated, thoroughly blended or processed, and placed as properly compacted fill as recommended herein, where compacted fill or settlement-sensitive improvements are proposed. Based on the field data, site observations, and laboratory results, the underlying residual soil and bedrock at depth are not considered to be subject to significant compressibility under the proposed loads. Shallow residual soil and bedrock should also be overexcavated and then compacted to provide a more uniform bottom of overexcavation elevation.

Based on observation and laboratory test results, soils at the site are generally anticipated to exhibit low to medium expansion potential (Expansion Index generally less than 70). Therefore, the recommendations provided herein take into consideration the adverse impacts of potentially expansive soils to site development. However, it is anticipated that on the order of five feet of soils will be imported to construct the building pads. Therefore, additional evaluation of near-surface soils should be performed based on field observations during grading activities, and additional modified recommendations could be appropriate.

4.4.7 Corrosive Soils

Chemical testing was performed to evaluate the potential effects that site soils may have on concrete foundations and various types of buried metallic utilities. Soil environments detrimental to concrete generally have elevated levels of soluble sulfates and/or pH levels less than 5.5. According to American Concrete Institute (ACI) Table 318 4.3.1, specific guidelines have been provided for concrete where concentrations of soluble sulfate (SO_4) in soil exceed 0.1 percent by weight. These guidelines include low water: cement ratios, increased compressive strength, and specific cement type requirements.

Based on the representative area Sulfate and pH testing, site soils are anticipated to generally have a negligible corrosion potential to Portland cement concrete improvements.

A minimum resistivity value less than 5,000 ohm-cm, and/or soluble chloride levels in excess of 200 ppm generally indicate a corrosive environment to buried metallic utilities and untreated conduits. Based on the resistivity values of our laboratory tested soils, site materials are anticipated to have a negligible to low corrosion potential for buried uncoated/unprotected metallic conduits.

The results of the testing are presented in the attached Appendix C. However, CTE does not practice corrosion engineering. Therefore, a corrosion engineer or other qualified consultant could be contacted if site specific corrosivity issues are of concern. It is also recommended that additional testing of near surface soils, which are anticipated to consist of unknown imported soils, following preparatory grading.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

CTE concludes that the proposed improvements at the site are feasible from a geotechnical standpoint, provided the preliminary recommendations in this report are incorporated into the design and construction of the project. Recommendations for the proposed earthwork and improvements are included in the following sections and Appendix D. However, recommendations in the text of this report supersede those presented in Appendix D should variations exist. These recommendations should either be evaluated as appropriate and/or updated during or following rough grading at the site, which is anticipated to import several feet of unknown soils to raise the site.

5.2 Site Preparation

Prior to grading, the site should be cleared of any existing building materials or improvements that are not to remain. Objectionable materials, such as debris and vegetation, not suitable for structural backfill should be properly disposed of offsite.

Based on site conditions and proposed improvements, the following preliminary recommendations are provided. During or following site rough grading (specifically the import of fill soils to raise the pad elevations by several feet) it is anticipated that all building foundations will bear in competent, compacted fill soils as recommended herein. In the area of the proposed compacted fill and improvements, existing soils should be excavated to a minimum depth of four feet below existing grades, five feet below proposed grades, or to the depth of competent materials, whichever depth is greatest. If encountered, localized areas of loose and potentially compressible material could require overexcavation to deeper elevations, based on conditions observed during grading. It is anticipated that excavations in the northern portion of the site will extend greater than four feet, due to loose and potentially compressible soils. However, due to the presence of shallow groundwater in this area, excavations should extend to competent materials or a maximum of two feet above groundwater, whichever is shallowest. Where feasible, overexcavations should extend at least five feet laterally beyond the limits of the proposed toe of slope created by the fill placement, or to property lines. If applicable, overexcavations adjacent to existing structures should not extend below a 1:1 plane extended down from the bottom of the existing footing outer edge or as recommended during grading based on exposed conditions. Depending on the extent of overexcavation alternating slot excavations may be recommended during earthwork.

Existing below-ground utilities should be redirected around the proposed structure where feasible. Utilities at an elevation to extend through the proposed footings should generally be sleeved and caulked to minimize the potential for moisture migration below the building slabs. Abandoned pipes exposed by grading should be securely capped to prevent moisture from migrating beneath foundation and slab soils or should be filled with minimum two-sack cement/sand slurry.

A CTE geotechnical representative should observe the exposed ground surfaces at the overexcavation bottoms to evaluate the exposed conditions. The exposed subgrades to receive fill should be proof-rolled or scarified a minimum of nine inches, moisture conditioned to a minimum of three percent above optimum, and properly compacted prior to additional fill placement.

If yielding or saturated conditions (pumping) are observed that prohibit compaction of soils with standard equipment, the bottom of the excavations may be stabilized as follows, or by other suitable proposed methods depending on available materials during grading:

- Oversize rock or crushed concrete materials (generally one-foot minus) can be placed and track-rolled into the exposed saturated or yielding subgrade until a firm subgrade is attained. This material should be selectively placed to avoid nesting and/or bridging of the individual concrete particles.
- Following emplacement of the rock materials, the prepared subgrade could require to be overlain with a stabilization geotextile material. Based on previous experience, we typically recommend one of the following: Tensar BX-1200, Tensar TX-160, Hanes TerraGrid RX1200, Mirafi BXG12, or approved equivalent. Geotextile should be installed in general accordance with manufacturer's recommendations.
- A minimum of 12 inches of granular material should be placed above the geotextile. Based on the availability of site materials and equipment, this material may consist of finely crushed concrete, on-site soils blended with coarse crushed concrete, imported gravel, or Class 2 Aggregate Base. Specific granular material to be used at the base of excavation should be approved by the geotechnical engineer prior to placement. If used, open-graded crushed concrete or imported gravel must be wrapped by a geotechnical filtration/separation fabric in order to minimize migration of fines into the void spaces. Mirafi 140N or similar filter fabric is anticipated to be adequate for separation purposes.

- Granular on-site soils should then be placed in lifts and compacted to the proposed subgrade elevations. These fill materials should be placed and compacted in accordance with recommendations provided in this report.

5.3 Site Excavation

Generally, excavation of site materials may be accomplished with heavy-duty construction equipment under normal conditions. However, based on the subsurface investigation it is anticipated that the Cretaceous Tonalite will become increasingly difficult to excavate with depth. Deeper excavations within the native material could require the use of specialized equipment.

5.4 Fill Placement and Compaction

Granular fill and backfill should be compacted to a minimum relative compaction of 90 percent at a moisture content of at least three percent above optimum, as evaluated by ASTM D 1557. The optimum lift thickness for fill soil will depend on the type of compaction equipment used. Generally, backfill should be placed in uniform, horizontal lifts not exceeding eight inches in loose thickness. Fill placement and compaction should be conducted in conformance with local ordinances.

5.5 Fill Materials

Properly moisture-conditioned very low to medium expansion potential soils derived from the on-site excavations are considered suitable for reuse on the site as compacted fill. If used, these materials should be screened of organics and materials generally greater than three inches in maximum dimension. If encountered during grading, high or very high expansion soils should be blended with granular materials to reduce the Expansion Index to a value generally below 70. Irreducible materials greater than three inches in maximum dimension should generally not be used in shallow fills (within three feet of proposed grades). In utility trenches, adequate bedding should surround pipes.

Imported fill beneath structures, flatwork, and pavements should have an Expansion Index of 50 or less (ASTM D 4829). Imported fill soils for use in structural or slope areas should be evaluated by the geotechnical engineer before being imported to the site.

Retaining wall backfill located within a 45-degree wedge extending up from the heel of the wall should consist of soil having an Expansion Index of 20 or less (ASTM D 4829) with less than 30 percent passing the No. 200 sieve. The upper 12 to 18 inches of wall backfill could consist of lower permeability soils, in order to reduce surface water infiltration behind walls. The project structural engineer and/or architect should detail proper wall backdrains, including gravel drain zones, fills, filter fabric, and perforated drain pipes. A conceptual wall backdrain detail, which may be suitable for use at the site, is provided as Figure 4.

5.6 Temporary Construction Slopes

The following recommended slopes should be relatively stable against deep-seated failure, but may experience localized sloughing. On-site soils are considered Type B and Type C soils with recommended slope ratios as set forth in Table 5.6.

TABLE 5.6 RECOMMENDED TEMPORARY SLOPE RATIOS		
SOIL TYPE	SLOPE RATIO (Horizontal: vertical)	MAXIMUM HEIGHT
B (Cretaceous Tonalite)	1:1 (OR FLATTER)	10 Feet
C (Alluvium and Residual Soil)	1.5:1 (OR FLATTER)	10 Feet

Actual field conditions and soil type designations must be verified by a "competent person" while excavations exist, according to Cal-OSHA regulations. In addition, the above sloping recommendations do not allow for surcharge loading at the top of slopes by vehicular traffic, equipment or materials. Appropriate surcharge setbacks must be maintained from the top of all unshored slopes.

5.7 Foundation and Slab Recommendations

The following recommendations are for preliminary design purposes only. These foundation recommendations should be reevaluated after review of the project grading and foundation plans, and after completion of rough grading of the building pad area, which is anticipated to place several feet of imported soils across the surface of the site. Upon completion of rough pad grading, Expansion Index of near surface soils should be verified, and these recommendations should be updated, as necessary. Lightly loaded upright structures such as flagpoles and other supports may be designed in accordance with current California Building Code or applicable standards assuming code minimum design values or as per the recommendations provided herein.

5.7.1 Shallow Spread Foundations

Foundation recommendations presented herein are based on the generally anticipated low to medium expansion potential of properly blended and moisture conditioned on-site soils (Expansion Index of generally 70 or less). However, imported soils are anticipated to cap the site and lower Expansion Indexes should likely be present across the surface of the site.

Following the recommended preparatory grading, continuous and isolated spread footings are anticipated to be suitable for use at this site. It is anticipated that the proposed footings will be founded entirely in properly compacted fill placed as recommended herein. Footings should not straddle cut-fill interfaces.

Foundation dimensions and reinforcement should be based on an allowable bearing value of 2,500 pounds per square foot for footings founded in suitable fill materials and embedded a minimum of 24 inches below the lowest adjacent rough subgrade elevation. If utilized, continuous footings should be at least 18 inches wide; isolated footings should be at least 24 inches in least dimension. The bearing values may be increased by 250 psf for each additional six-inches of width or depth up to a maximum of 3,500 psf. The above bearing values may also be increased by one third for short duration loading which includes the effects of wind or seismic forces. A 145-pci uncorrected subgrade modulus is also considered suitable for elastic design of foundation improvements.

Minimum footing reinforcement for continuous footings should consist of four No. 5 reinforcing bars; two placed near the top and two placed near the bottom, or as per more stringent requirements provided by the project structural engineer. The structural engineer should design isolated footing reinforcement. Footing excavations should be maintained at, or be brought to, a minimum moisture content of three percent above optimum prior to concrete placement.

5.7.2 Foundation Settlement

The maximum total static settlement is expected to be on the order of one inch and the maximum differential static settlement is expected to be on the order of ½ inch over a distance of approximately 40 feet. Due to the proposed grading at the site and the dense to very dense nature of underlying materials, dynamic settlement is not expected to adversely affect the proposed improvements.

5.7.3 Foundation Setback

Footings for structures should be designed such that the horizontal distance from the face of adjacent slopes to the outer edge of footings is at least 10 feet. In addition, footings should be founded beneath a 1:1 plane extended up from the nearest bottom edge of adjacent trenches and/or excavations. Deepening of affected footings may be a suitable means of attaining the prescribed setbacks.

5.7.4 Interior Concrete Slabs-On-Grade

Concrete slabs should be designed based on the anticipated loading, but should measure at least 4.5 inches in thickness. Minimum slab reinforcement should consist of No. 4 reinforcing bars, placed on maximum 18-inch centers, each way, at or above mid-slab height, but with proper concrete cover.

Slabs subjected to heavier loads or traffic may require thicker slab sections and/or increased reinforcement. A 125-pci subgrade modulus is considered suitable for elastic design of minimally embedded improvements such as slabs-on-grade. Slab on grade subgrade areas should be maintained at a minimum three percent above optimum moisture content or be brought to three percent above optimum moisture content just prior to placement of underlayments or concrete.

In moisture-sensitive floor areas, a suitable vapor retarder of at least 15-mil thickness (with all laps or penetrations sealed or taped) overlying a four-inch layer of consolidated crushed aggregate or gravel (with SE of 30 or more) should be installed, as per the 2013 CBC/Green Building Code. This recommended protection is generally considered typical in the industry. If proposed floor areas or coverings are considered especially sensitive to moisture emissions, additional recommendations from a specialty consultant could be obtained. CTE is not an expert at preventing moisture penetration through slabs. Therefore, a qualified architect or other experienced professional should be contacted if moisture penetration is a more significant concern.

5.8 Seismic Design Criteria

The seismic ground motion values listed in the table below were derived in accordance with the ASCE 7-10 Standard and 2013 CBC. This was accomplished by establishing the Site Class based on the soil properties at the site, and then calculating the site coefficients and parameters using the United States Geological Survey Seismic Design Maps application and site coordinates of 33.0343 degrees latitude and -116.8769 degrees longitude. These values are intended for the design of structures to resist the effects of earthquake ground motions.

TABLE 5.8
SEISMIC GROUND MOTION VALUES

PARAMETER	VALUE	CBC REFERENCE (2013)
Site Class	D	ASCE 7, Chapter 20
Mapped Spectral Response Acceleration Parameter, S_S	1.081	Figure 1613.3.1 (1)
Mapped Spectral Response Acceleration Parameter, S_1	0.401	Figure 1613.3.1 (2)
Seismic Coefficient, F_a	1.068	Table 1613.3.3 (1)
Seismic Coefficient, F_v	1.599	Table 1613.3.3 (2)
MCE Spectral Response Acceleration Parameter, S_{MS}	1.154	Section 1613.3.3
MCE Spectral Response Acceleration Parameter, S_{M1}	0.641	Section 1613.3.3
Design Spectral Response Acceleration, Parameter S_{DS}	0.769	Section 1613.3.4
Design Spectral Response Acceleration, Parameter S_{D1}	0.427	Section 1613.3.4
Peak Ground Acceleration PGA_M	0.445	ASCE 7, Section 11.8.3

5.9 Lateral Resistance and Earth Pressures

Lateral loads acting against retaining walls may be resisted by friction between the footings and the supporting compacted fill soil or passive pressure acting against structures. If frictional resistance is used, an allowable coefficient of friction of 0.30 (total frictional resistance equals the coefficient of friction multiplied by the dead load) is recommended for concrete cast directly against compacted fill. A design passive resistance value of 250 pounds per square foot per foot of depth (with a maximum value of 2,000 pounds per square foot) may be used. The allowable lateral resistance can be taken as the sum of the frictional resistance and the passive resistance, provided the passive resistance does not exceed two-thirds of the total allowable resistance. Retaining walls should not be underlain by uncompacted soils as defined by a 1:1 plane extending downward from the foundation bottom outer edges.

If proposed, retaining walls up to approximately eight feet high and backfilled using granular soils may be designed using the equivalent fluid weights given below.

TABLE 5.9
EQUIVALENT FLUID UNIT WEIGHTS
(pounds per cubic foot)

WALL TYPE	LEVEL BACKFILL	SLOPE BACKFILL 2:1 (HORIZONTAL: VERTICAL)
CANTILEVER WALL (YIELDING)	35	54
RESTRAINED WALL	65	80

Traffic surcharges on retaining walls should generally be equal to 1/3 of the vertical load of the traffic located within ten lateral feet of wall.

Lateral pressures on cantilever retaining walls (yielding walls) due to earthquake motions may be calculated based on work by Seed and Whitman (1970). The total lateral thrust against a properly drained and backfilled cantilever retaining wall above the groundwater level can be expressed as:

$$P_{AE} = P_A + \Delta P_{AE}$$

For non-yielding (or "restrained") walls, the total lateral thrust may be similarly calculated based on work by Wood (1973):

$$P_{KE} = P_K + \Delta P_{KE}$$

Where P_A = Static Active Thrust (determined using Table 5.9)
P_K = Static Restrained Wall Thrust (determined using Table 5.9)
ΔP_{AE} = Dynamic Active Thrust Increment = $(3/8)\ k_h\ \gamma H^2$
ΔP_{KE} = Dynamic Restrained Thrust Increment = $k_h\ \gamma H^2$
k_h = 2/3 Peak Ground Acceleration = 2/3 (PGA_M)
H = Total Height of the Wall
γ = Total Unit Weight of Soil ≈ 135 pounds per cubic foot

The static and increment of dynamic earth pressure in both cases may be applied with a line of action located at H/3 above the bottom of the wall (SEAOC, 2013).

These values assume non-expansive backfill and free-draining conditions. Measures should be taken to prevent moisture buildup behind all retaining walls. Drainage measures should include free-draining backfill materials and sloped, perforated drains. These drains should discharge to an appropriate off-site location. A general or conceptual detail for Retaining Wall Drainage, which may be appropriate for the subject site based on the review of the project structural engineer and architect, is attached as Figure 4. Waterproofing should be as specified by the project architect or the waterproofing specialty consultant.

5.10 Exterior Flatwork

To reduce the potential for cracking in exterior flatwork for non-traffic areas caused by minor movement of subgrade soils and typical concrete shrinkage, it is recommended that such flatwork measure a minimum 4.5 inches thick and be installed with crack-control joints at appropriate spacing as designed by the project architect. Additionally, it is recommended that flatwork be installed with at least No. 3 reinforcing bars on maximum 18-inch centers, each way, at above mid-height of slab but with proper concrete cover, or other reinforcement per the project consultants. Doweling of flatwork joints at critical pathways or similar could also be beneficial in resisting minor subgrade movements.

All subgrades should be prepared according to the earthwork recommendations previously given before placing concrete. Positive drainage should be established and maintained next to all flatwork. Subgrade materials shall be maintained at, or be elevated to, above optimum moisture content prior to concrete placement.

5.11 Pavements

Pavement sections provided are based on an preliminary Resistance “R”-Value results, estimated traffic indices, and the assumption that the upper foot of compacted fill subgrade and overlying aggregate base materials are properly compacted to a minimum 95% relative compaction at a minimum of three percent above optimum moisture content (as per ASTM D 1557). Actual R-Value should be determined following grading of subgrade areas and the pavement sections should be modified, as appropriate.

TABLE 5.11 RECOMMENDED AC OR PCC PAVEMENT SECTION THICKNESSES					
Traffic Area	Assumed Traffic Index	Preliminary Subgrade "R"-Value	Asphalt Pavements		Portland Cement Concrete Pavements On Subgrade (INCHES)
			AC Thickness (INCHES)	CalTrans Class II or Crushed Miscellaneous Aggregate Base Thickness (INCHES)	
Auto Parking and Light Drive Areas	5.0	35+	3.0	5.0	6.0
Moderate to Heavy Drive Areas	6.0	35+	3.0	8.0	7.0

Asphalt paved areas should be designed, constructed, and maintained in accordance with, for example, the recommendations of the Asphalt Institute, or other widely recognized authority. Concrete paved areas should be designed and constructed in accordance with the recommendations of the American Concrete Institute or other widely recognized authority, particularly with regard to thickened edges, joints, and drainage. The Standard Specifications for Public Works construction ("Greenbook") or Caltrans Standard Specifications may be referenced for pavement materials specifications.

5.12 Drainage

Surface runoff should be collected and directed away from improvements by means of appropriate erosion-reducing devices, and positive drainage should be established around proposed improvements. Positive drainage should be directed away from improvements and slope areas at a minimum gradient of two percent for a distance of at least five feet. However, the project civil engineer should evaluate the on-site drainage and make necessary provisions to keep surface water from affecting the site.

Generally, CTE recommends against allowing water to infiltrate building pads or adjacent to slopes and improvements. However, it is understood that some agencies are encouraging the use of storm-water cleansing devices. Therefore, if storm water cleansing devices must be used, it is generally recommended that they be underlain by an impervious barrier and that the infiltrate be collected via subsurface piping and discharged off site. If infiltration must occur, water should infiltrate as far away from structural improvements as feasible. Additionally, any reconstructed slopes descending from infiltration basins should be equipped with subdrains to collect and discharge accumulated subsurface water as feasible. Infiltration testing was beyond the scope of CTE's work for this project and infiltration rates for the site supplied by others do not necessarily reflect the observations made by CTE in performing the work for this report.

5.13 Slopes

Based on observed conditions and anticipated soil strength characteristics, cut and fill slopes, if proposed at the site, should be constructed at ratios of 2:1 (horizontal: vertical) or flatter. These fill slope inclinations should exhibit factors of safety greater than 1.5.

Although properly constructed slopes on this site should be grossly stable, the soils will be somewhat erodible. Therefore, runoff water should not be permitted to drain over the edges of slopes unless that water is confined to properly designed and constructed drainage facilities. Erosion-resistant vegetation should be maintained on the face of all slopes. Typically, soils along the top portion of a fill slope face will creep laterally. CTE recommends against building distress-sensitive hardscape improvements within five feet of slope crests.

5.14 Plan Review

CTE should be authorized to review the project grading and foundation plans, prior to commencement of earthwork to identify potential conflicts with the intent of the geotechnical recommendations.

5.15 Construction Observation

The recommendations provided in this report are based on preliminary design information for the proposed construction and the subsurface conditions observed in the exploration areas. The interpolated subsurface conditions should be checked in the field during construction to verify that conditions are as anticipated. Foundation recommendations may be revised upon completion of grading and as-built laboratory test results.

Recommendations provided herein are based on the understanding and assumption that CTE will provide the observation and testing services for the project. All earthwork should be observed and tested to verify that grading activities have been performed according to the recommendations contained within this report. CTE should evaluate all footing trenches before reinforcing steel placement.

6.0 LIMITATIONS OF INVESTIGATION

The field evaluation, laboratory testing, and geotechnical analysis presented in this report have been conducted according to current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered during construction.

The recommendations presented herein have been developed in order to reduce the potential adverse effects of expansive soils and fill soils. However, even with the design and construction precautions provided, some post-construction heave and soil movement should be anticipated.

The findings of this report are valid as of the 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, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

CTE's conclusions and recommendations are based on an analysis of the observed conditions. If conditions different from those described in this report are encountered, this office should be notified and additional recommendations, if required, will be provided.

The opportunity to be of service on this project is appreciated. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

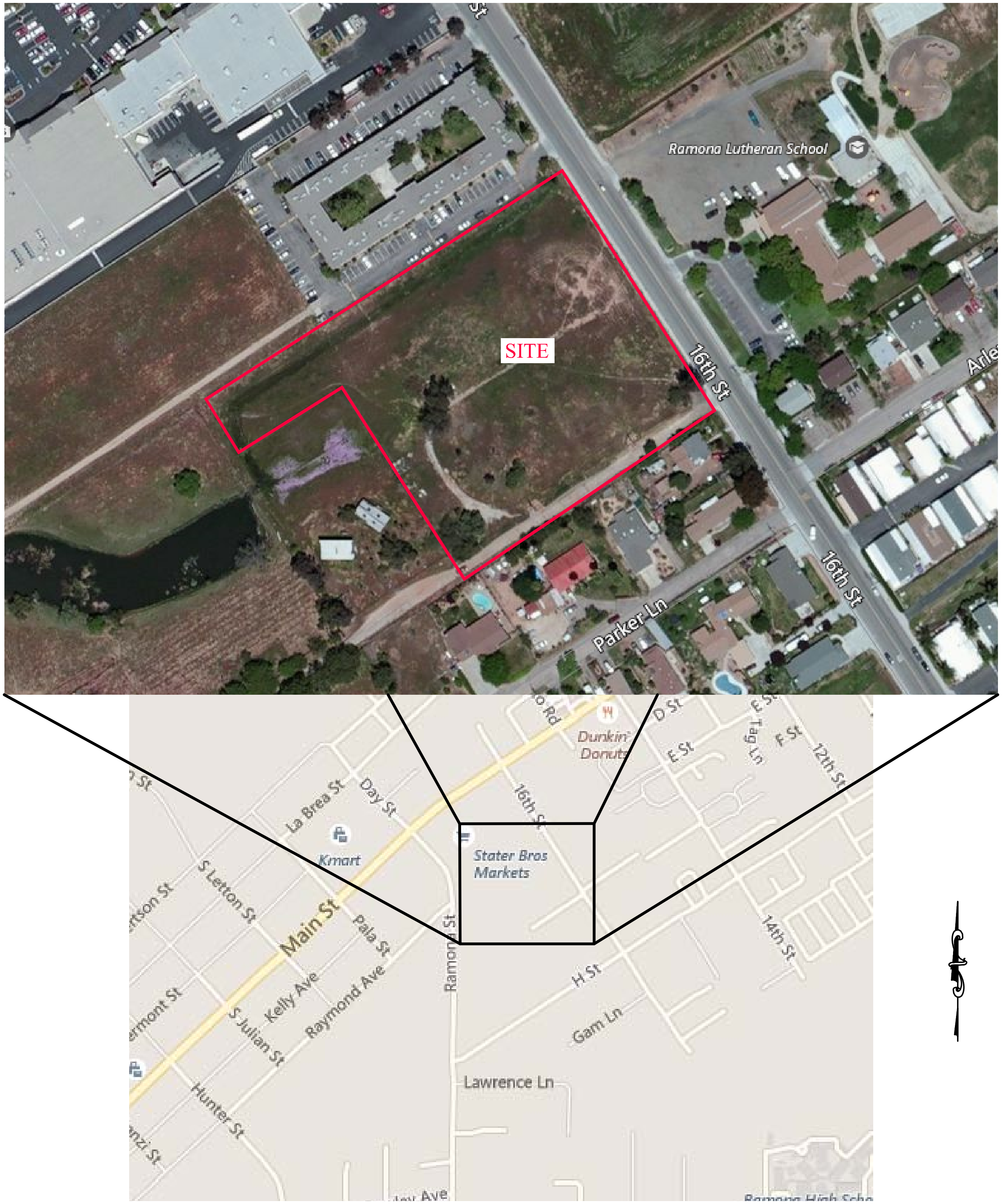
Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, INC.

Dan T. Math, GE #2665
Principal Engineer

Martin E Siem, CEG #2311
Engineering Geologist

Dennis Kilian, CEG #2672
Project Geologist

DAK/DTM/MES:nri



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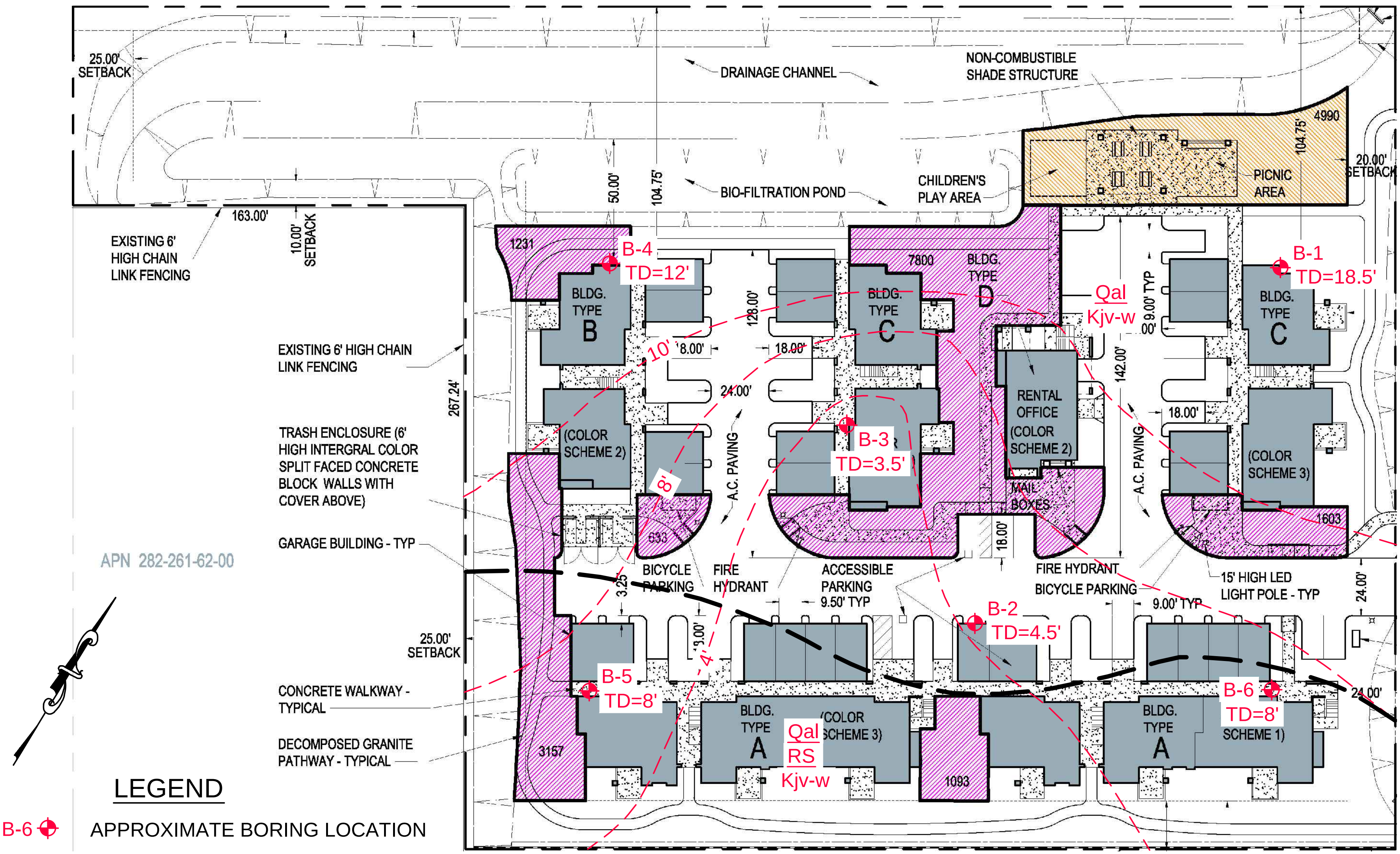
SITE INDEX MAP PROPOSED VILLAGE PLACE APARTMENTS 521 16TH STREET RAMONA, CALIFORNIA	SCALE: AS SHOWN	DATE: 3/17
	CTE JOB NO.: 10-13565G	FIGURE: 1



LEGEND

B-6 ⊕	APPROXIMATE BORING LOCATION
— — —	APPROXIMATE GEOLOGIC CONTACT
— 8' —	APPROXIMATE DEPTH TO Kjv-w
Qal	QUATERNARY ALLUVIUM
RS	RESIDUAL SOIL
Kjv-w	CRETACEOUS JAPATUL VALLEY TONALITE-DEEPLY WEATHERED

60' 0 30' 60'

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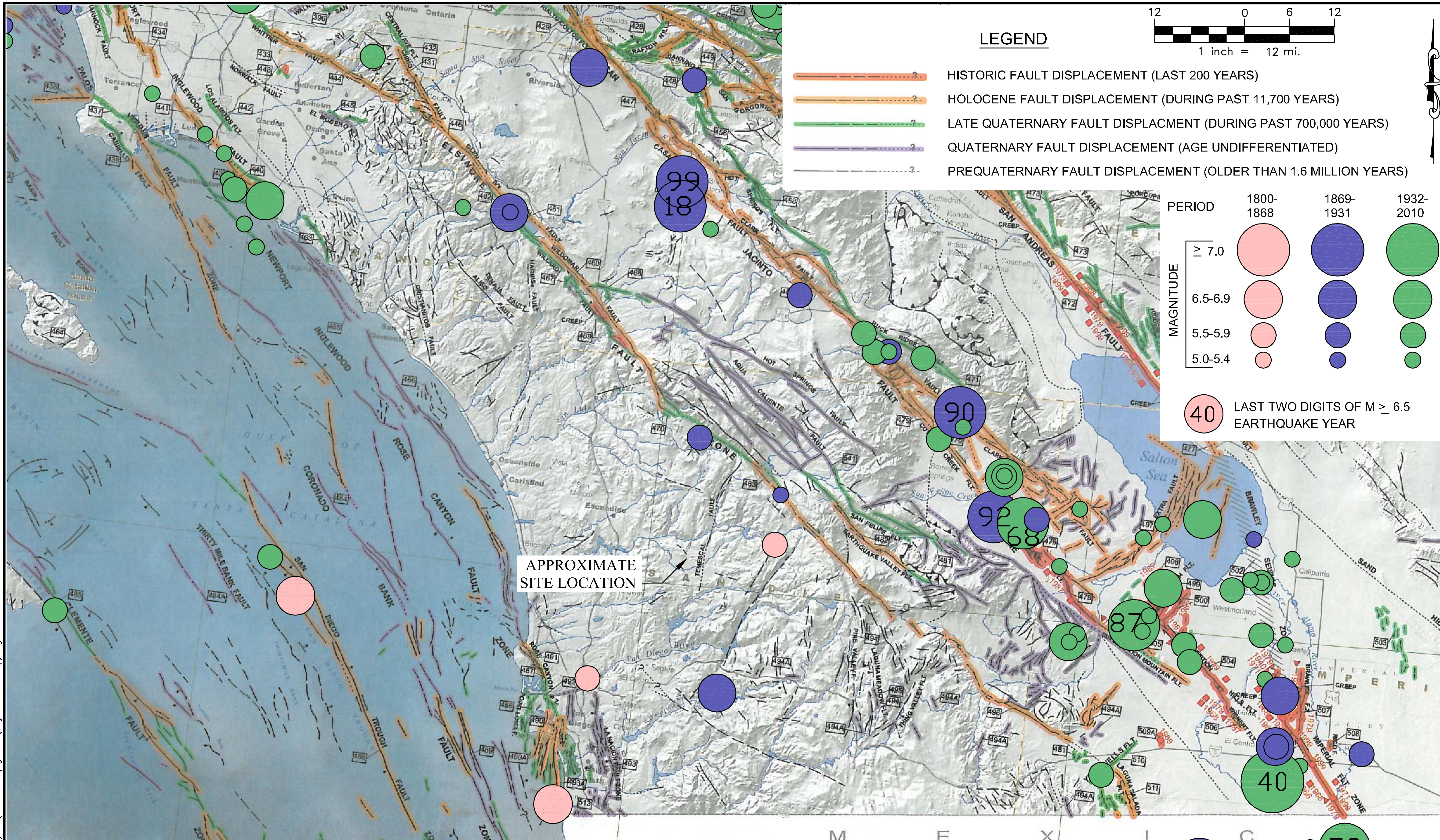
BORING LOCATION/GEOLOGIC MAP

PROPOSED VILLAGE PLACE APARTMENTS
521 16TH STREET
RAMONA, CALIFORNIA

CTE JOB NO: 10-13565G
SCALE: 1" = 60'
DATE: 3/17
FIGURE: 2



NOTES: FAULT ACTIVITY MAP OF CALIFORNIA, 2010, CALIFORNIA GEOLOGIC DATA MAP SERIES MAP NO. 6;
EPICENTERS OF AND AREAS DAMAGED BY M≥5 CALIFORNIA EARTHQUAKES, 1800–1999 ADAPTED AFTER TOPPOZADA, BRANUM, PETERSEN, HALLSTORM, CRAMER, AND REICHLE, 2000, CDMG MAP SHEET 49
REFERENCE FOR ADDITIONAL EXPLANATION; MODIFIED WITH CISN AND USGS SEISMIC MAPS

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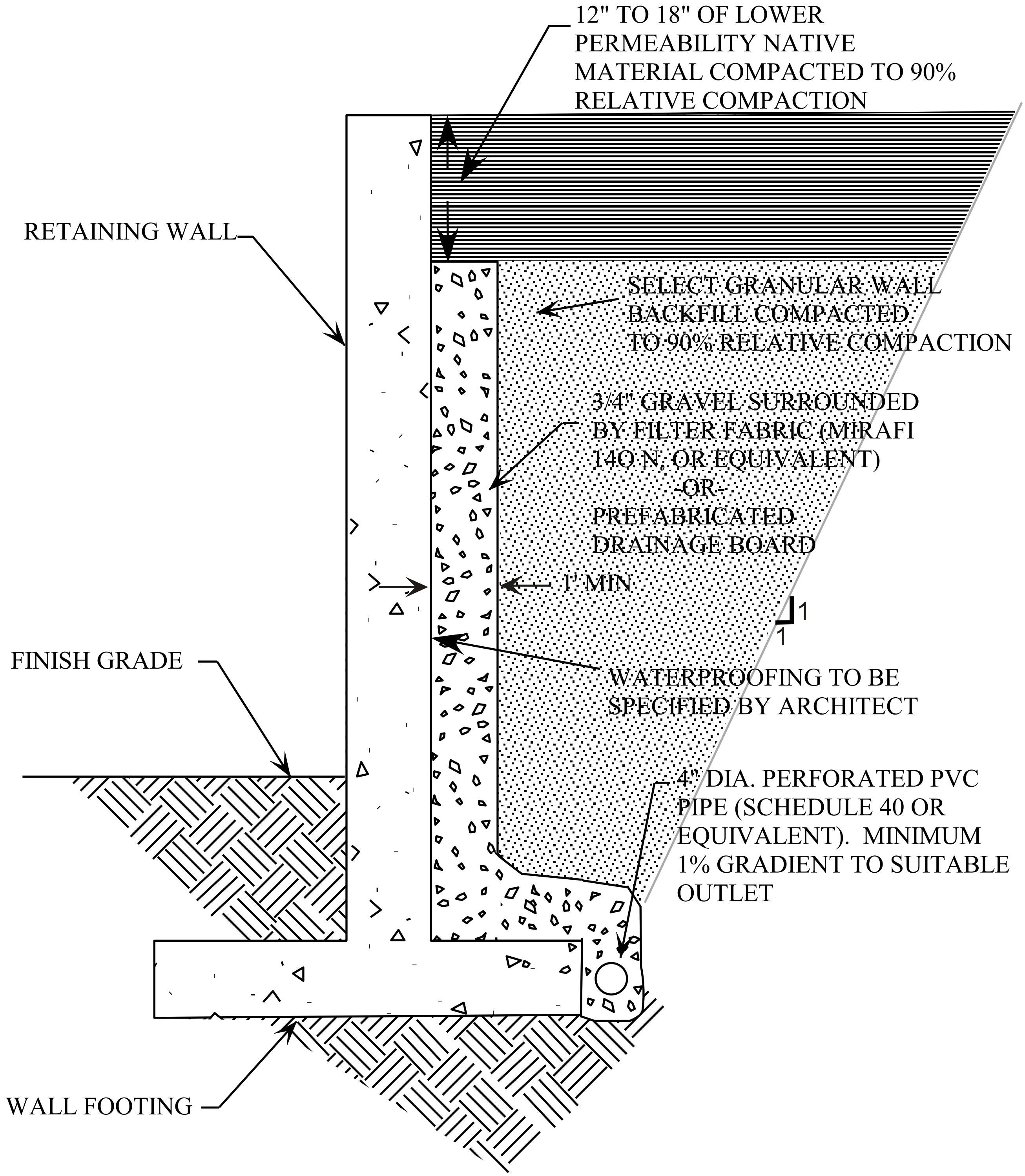
REGIONAL FAULT AND SEISMICITY MAP
PROPOSED VILLAGE PLACE APARTMENTS
521 16th STREET
RAMONA, CALIFORNIA

CTE JOB NO: 10-13565G
SCALE: 1 inch = 12 miles
DATE: 3/17
FIGURE: 3

\\ESC_SERVER\Projects\10-13565G\Figure 3 (Regional Fault Map).dwg



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Inspection | Testing | Geotechnical | Environmental & Construction Engineering | Civil Engineering | Surveying

RETAINING WALL DRAINAGE DETAIL

CTE JOB NO: 10-13565G	
SCALE: NO SCALE	
DATE: 03/17	FIGURE: 4

APPENDIX A

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REFERENCES

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APPENDIX B

EXPLORATION LOGS

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DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 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
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING — U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

FIGURE: BL1

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PROJECT: | DRILLER: | SHEET: of
CTE JOB NO: | DRILL METHOD: | DRILLING DATE:
LOGGED BY: | SAMPLE METHOD: | ELEVATION:

BORING LEGEND

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0								Block or Chunk Sample	
								Bulk Sample	
5									
								Standard Penetration Test	
10								Modified Split-Barrel Drive Sampler (Cal Sampler)	
								Thin Walled Army Corp. of Engineers Sample	
15								Groundwater Table	
								Soil Type or Classification Change	
20								? — ? — ? — ? — ? — ? — ? —	
								Formation Change [(Approximate boundaries queried (?)]	
25						"SM"		Quotes are placed around classifications where the soils exist in situ as bedrock	

FIGURE: BL2

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1413'

BORING: B-1

Depth (Feet)	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	DESCRIPTION	Laboratory Tests
0				SM	Quaternary Alluvium: Loose to medium dense, moist, brown to red brown, silty fine SAND with trace clay.	CHEM
	15 31 32			SM	Very dense, slightly moist, light brown, silty fine SAND.	
5	13 23 34	97.8	23.6	CL	Hard, slightly moist to moist, pale gray brown, fine sandy CLAY with silt.	MD, AL
10	10 12 16		▼	SM	Medium dense, moist to wet, brown and light brown, silty fine SAND with interbedded medium sand and clayey sand.	GS
15	8 10 12			SP	Medium dense, wet, brown, poorly graded SAND with silt.	GS
20	50/3"			SM	Weathered Cretaceous Japatul Valley Tonalite: Excavates as: Very dense, moist, brown to gray brown, silty fine SAND.	
25					Total Depth: 20.25' Groundwater at ~10.5' Backfilled with Bentonite	

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1413'

BORING: B-2

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM/SC		Quaternary Alluvium: Loose to medium dense, moist, brown silty to clayey fine SAND.	
						SM		Weathered Cretaceous Japatul Valley Tonalite: Excavates as: Very dense, slightly moist, red brown, silty fine SAND with trace clay.	
5		X	22 50/3"						
10		X	20 50/3"						
								Total Depth: 10.8' No Groundwater Backfilled with Bentonite	
15									
20									
25									

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1413'

BORING: B-3

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0	X					SM/SC		Quaternary Alluvium: Loose to medium dense, moist, brown silty to clayey fine SAND.	RV
	X					SM		Weathered Cretaceous Japatul Valley Tonalite: Excavates as: Dense, slightly moist, light brown, silty, fine SAND with trace clay.	
5		CAL	18 14 28						AL, GS
10		SPT	50/5"					Very dense, gray brown.	
15		CAL	50/6"						
								Total Depth: 15.5' No Groundwater Backfilled with Bentonite	
20									
25									

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1412'

BORING: B-4

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		Quaternary Alluvium: Very loose to loose, moist to wet, brown to red brown, silty fine SAND with trace clay.	
5			5 9 12			CL		Very stiff, slightly moist, light brown and brown, silty CLAY with sand and interbedded sandy clay/clayey sand.	EI
10			2 3 4			SC/SM		Loose, moist to wet, gray brown, fine clayey to silty fine SAND.	WA
15			50/3"			SM		Weathered Cretaceous Japatul Valley Tonalite: Excavates as: Very dense, slightly moist, gray brown, silty fine SAND, trace clay.	
20			50/3"						
								Total Depth: 20.25' Groundwater at ~8' Backfilled with Bentonite	
25									

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1413'

BORING: B-5

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0	X					SM/SC		Quaternary Alluvium: Loose to medium dense, slightly moist to moist, brown to red brown, silty to clayey fine SAND.	EI
	X					CL		Residual Soil: Dense to very dense, slightly moist, brown, clay, with trace medium to coarse sands.	
5		X	10 18 50	120.1	13.7				MD, AL
								Weathered Cretaceous Japatul Valley Tonalite: Excavates as:	
10		X	50/6"			SM		Very dense, slightly moist, gray brown, silty fine SAND, trace clay.	
								Total Depth: 10.5' No Groundwater Backfilled with Bentonite	
15									
20									
25									

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PROJECT:	Proposed Village Place Apartments	DRILLER:	BAJA	SHEET:	1 of 1
CTE JOB NO:	10-13565G	DRILL METHOD:	LAR-8" Hollow Stem	DRILLING DATE:	2/17.17
LOGGED BY:	DK	SAMPLE METHOD:	Bulk, CAL, SPT	ELEVATION:	~1414'

BORING: B-6

Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		Quaternary Alluvium: Loose to medium dense, slightly moist to moist, brown, silty fine SAND with clay.	
						SC		Residual Soil: Medium dense, slightly moist, brown to gray brown, clayey fine SAND with silt, trace medium to coarse sands.	
5		X	11 11 16						
								Weathered Cretaceous Japatul Valley Tonalite: Excavates as:	
10		X	50/6"			SM		Very dense, slightly moist, gray brown, silty fine SAND, trace clay.	
								Total Depth: 10.5' No Groundwater Backfilled with Bentonite	
15									
20									
25									

APPENDIX C

LABORATORY METHODS AND RESULTS

APPENDIX C
LABORATORY METHODS AND RESULTS

Laboratory Testing Program

Laboratory tests were performed on representative soil samples to detect their relative engineering properties. Tests were performed following test methods of the American Society for Testing Materials or other accepted standards. The following presents a brief description of the various test methods used.

Classification

Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D2487. The soil classifications are shown on the Exploration Logs in Appendix B.

Expansion Index

Expansion testing was performed on selected samples of the matrix of the on-site soils according to ASTM D 4829.

Particle-Size Analysis

Particle-size analyses were performed on selected representative samples according to ASTM D 422.

Chemical Analysis

Soil materials were collected with sterile sampling equipment and tested for Sulfate and Chloride content, pH, Corrosivity, and Resistivity.

Atterberg Limits

The procedure of ASTM D4518-84 was used to measure the liquid limit, plastic limit and plasticity index of representative samples.

In-Place Moisture and Density

To determine the moisture and density of in-place site soils, a representative sample was tested for the moisture and density at time of sampling.

Resistance “R”-Value

The resistance “R”-value was determined by the California Materials Method No. 301 for representative subbase soils. Samples were prepared and exudation pressure and “R”-value determined. The graphically determined “R”- value at exudation pressure of 300 psi is the value used for pavement section calculation.

EXPANSION INDEX TEST

ASTM D 4829

LOCATION	DEPTH (feet)	EXPANSION INDEX	EXPANSION POTENTIAL
B-4	5	81	High
B-5	0-5	0	Very Low

200 WASH ANALYSIS

LOCATION	DEPTH (feet)	PERCENT PASSING #200 SIEVE	CLASSIFICATION
B-4	10	37.0	SM/SC

IN-PLACE MOISTURE AND DENSITY

LOCATION	DEPTH (feet)	% MOISTURE	DRY DENSITY
B-1	5	23.8	97.8
B-5	5	13.7	120.1

SULFATE

LOCATION	DEPTH (feet)	RESULTS ppm
B-1	0-5	109.2

CHLORIDE

LOCATION	DEPTH (feet)	RESULTS ppm
B-1	0-5	20.1

p.H.

LOCATION	DEPTH (feet)	RESULTS
B-1	0-5	7.21

RESISTIVITY

CALIFORNIA TEST 424

LOCATION	DEPTH (feet)	RESULTS ohms-cm
B-1	0-5	9170

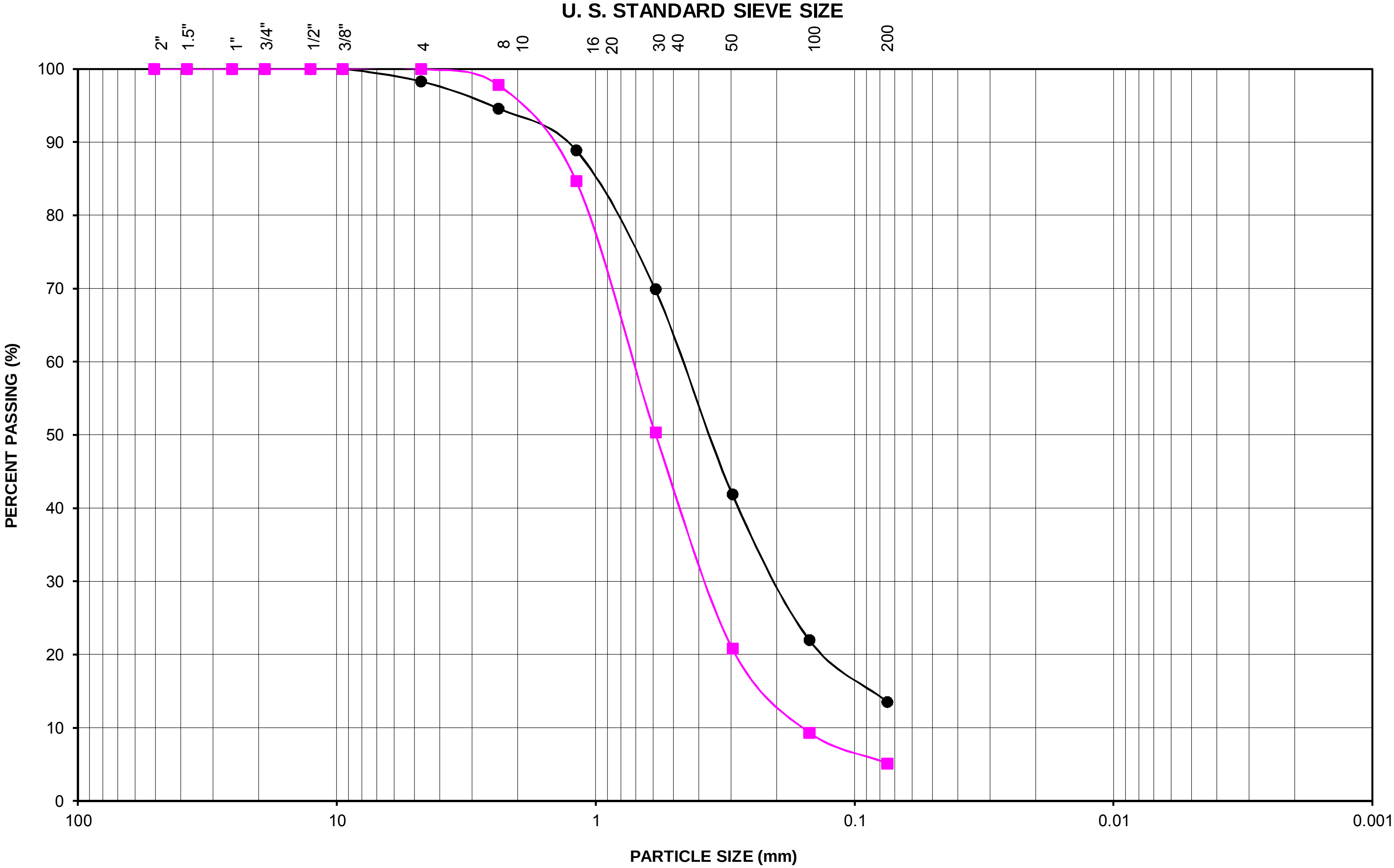
ATTERBERG LIMITS

LOCATION	DEPTH (feet)	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION
B-1	5	46	28	CL
B-5	5	32	20	CL

RESISTANCE "R"-VALUE

CALTEST 301

LOCATION	DEPTH (feet)	R-VALUE
B-3	0-5	37



PARTICLE SIZE ANALYSIS

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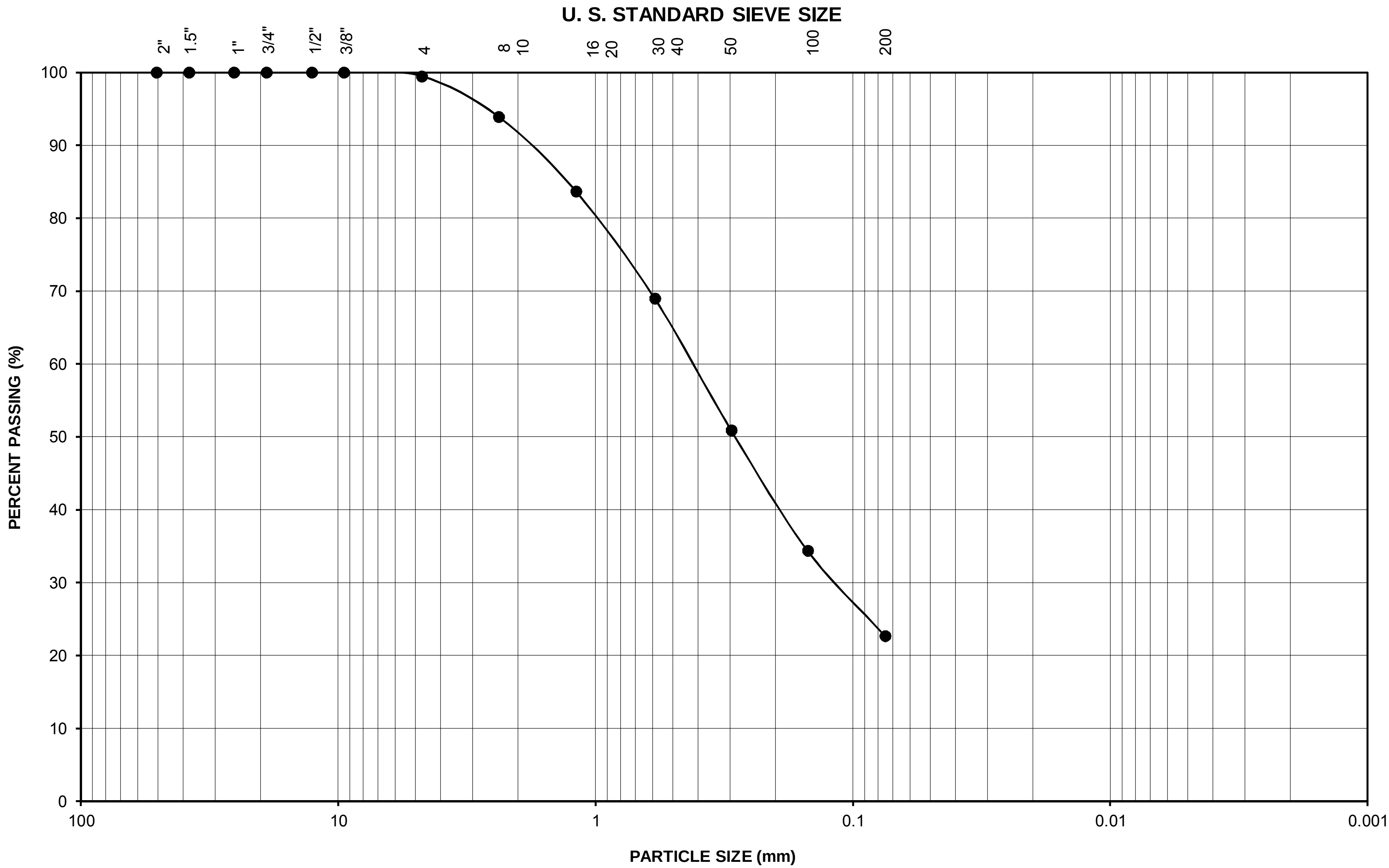
Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-1	10	●	-	-	SP-SM
B-1	15	■	-	-	SP
CTE JOB NUMBER:		10-13565G		FIGURE:	C-1



PARTICLE SIZE ANALYSIS

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Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
B-3	5	●	-	-	SM

CTE JOB NUMBER: 10-13565G FIGURE: C-2

APPENDIX D

STANDARD SPECIFICATIONS FOR GRADING

Section 1 - General

Construction Testing & Engineering, Inc. presents the following standard recommendations for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications. Recommendations contained in the body of the previously presented soils report shall supersede the recommendations and or requirements as specified herein. The project geotechnical consultant shall interpret disputes arising out of interpretation of the recommendations contained in the soils report or specifications contained herein.

Section 2 - Responsibilities of Project Personnel

The geotechnical consultant should provide observation and testing services sufficient to general conformance with project specifications and standard grading practices. The geotechnical consultant should report any deviations to the client or his authorized representative.

The Client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the geotechnical consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services. During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project.

The Contractor is responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including, but not limited to, earth work in accordance with the project plans, specifications and controlling agency requirements.

Section 3 - Preconstruction Meeting

A preconstruction site meeting should be arranged by the owner and/or client and should include the grading contractor, design engineer, geotechnical consultant, owner's representative and representatives of the appropriate governing authorities.

Section 4 - Site Preparation

The client or contractor should obtain the required approvals from the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, root of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.

Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and other man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or rerouting pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the geotechnical consultant at the time of demolition.

Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the contractor from damage or injury.

Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the geotechnical consultant.

<u>Section 5 - Site Protection</u>

Protection of the site during the period of grading should be the responsibility of the contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the geotechnical consultant, the client and the regulating agencies.

Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas cannot be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.

Rain related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions as determined by the geotechnical consultant. Soil adversely affected should be classified as unsuitable materials and should be subject to overexcavation and replacement with compacted fill or other remedial grading as recommended by the geotechnical consultant.

The contractor should be responsible for the stability of all temporary excavations. Recommendations by the geotechnical consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and, therefore, should not be considered to preclude the responsibilities of the contractor. Recommendations by the geotechnical consultant should not be considered to preclude requirements that are more restrictive by the regulating agencies. The contractor should provide during periods of extensive rainfall plastic sheeting to prevent unprotected slopes from becoming saturated and unstable. When deemed appropriate by the geotechnical consultant or governing agencies the contractor shall install checkdams, desilting basins, sand bags or other drainage control measures.

In relatively level areas and/or slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1.0 foot; they should be overexcavated and replaced as compacted fill in accordance with the applicable specifications. Where affected materials exist to depths of 1.0 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. If field conditions dictate, the geotechnical consultant may recommend other slope repair procedures.

Section 6 - Excavations

6.1 Unsuitable Materials

Materials that are unsuitable should be excavated under observation and recommendations of the geotechnical consultant. Unsuitable materials include, but may not be limited to, dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft bedrock and nonengineered or otherwise deleterious fill materials.

Material identified by the geotechnical consultant as unsatisfactory due to its moisture conditions should be overexcavated; moisture conditioned as needed, to a uniform at or above optimum moisture condition before placement as compacted fill.

If during the course of grading adverse geotechnical conditions are exposed which were not anticipated in the preliminary soil report as determined by the geotechnical consultant additional exploration, analysis, and treatment of these problems may be recommended.

6.2 Cut Slopes

Unless otherwise recommended by the geotechnical consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal: vertical).

The geotechnical consultant should observe cut slope excavation and if these excavations expose loose cohesionless, significantly fractured or otherwise unsuitable material, the materials should be overexcavated and replaced with a compacted stabilization fill. If encountered specific cross section details should be obtained from the Geotechnical Consultant.

When extensive cut slopes are excavated or these cut slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top of the slope.

6.3 Pad Areas

All lot pad areas, including side yard terrace containing both cut and fill materials, transitions, located less than 3 feet deep should be overexcavated to a depth of 3 feet and replaced with a uniform compacted fill blanket of 3 feet. Actual depth of overexcavation may vary and should be delineated by the geotechnical consultant during grading, especially where deep or drastic transitions are present.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm drainage swale and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slopes of 2 percent or greater is recommended.

Section 7 - Compacted Fill

All fill materials should have fill quality, placement, conditioning and compaction as specified below or as approved by the geotechnical consultant.

7.1 Fill Material Quality

Excavated on-site or import materials which are acceptable to the geotechnical consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement. All import materials anticipated for use on-site should be sampled tested and approved prior to and placement is in conformance with the requirements outlined.

Rocks 12 inches in maximum and smaller may be utilized within compacted fill provided sufficient fill material is placed and thoroughly compacted over and around all rock to effectively fill rock voids. The amount of rock should not exceed 40 percent by dry weight passing the 3/4-inch sieve. The geotechnical consultant may vary those requirements as field conditions dictate.

Where rocks greater than 12 inches but less than four feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the recommendations below. Rocks greater than four feet should be broken down or disposed off-site.

7.2 Placement of Fill

Prior to placement of fill material, the geotechnical consultant should observe and approve the area to receive fill. After observation and approval, the exposed ground surface should be scarified to a depth of 6 to 8 inches. The scarified material should be conditioned (i.e. moisture added or air dried by continued discing) to achieve a moisture content at or slightly above optimum moisture conditions and compacted to a minimum of 90 percent of the maximum density or as otherwise recommended in the soils report or by appropriate government agencies.

Compacted fill should then be placed in thin horizontal lifts not exceeding eight inches in loose thickness prior to compaction. Each lift should be moisture conditioned as needed, thoroughly blended to achieve a consistent moisture content at or slightly above optimum and thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials and weather conditions.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal: vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least six-foot wide benches and a minimum of four feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area after keying and benching until the geotechnical consultant has reviewed the area. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface or previously compacted fill should be processed by scarification, moisture conditioning as needed to at or slightly above optimum moisture content, thoroughly blended and recompacted to a minimum of 90 percent of laboratory maximum dry density. Where unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be over-excavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

Rocks 12 inch in maximum dimension and smaller may be utilized in the compacted fill provided the fill is placed and thoroughly compacted over and around all rock. No oversize material should be used within 3 feet of finished pad grade and within 1 foot of other compacted fill areas. Rocks 12 inches up to four feet maximum dimension should be placed below the upper 10 feet of any fill and should not be closer than 15 feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures or deep utilities are proposed. Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so those successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the geotechnical consultant at the time of placement.

The contractor should assist the geotechnical consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill. The contractor should provide this work at no additional cost to the owner or contractor's client.

Fill should be tested by the geotechnical consultant for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Test D 1556-00, D 2922-04. Tests should be conducted at a minimum of approximately two vertical feet or approximately 1,000 to 2,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the geotechnical consultant.

7.3 Fill Slopes

Unless otherwise recommended by the geotechnical consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal: vertical).

Except as specifically recommended in these grading guidelines compacted fill slopes should be over-built two to five feet and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the geotechnical consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

At the discretion of the geotechnical consultant, slope face compaction may be attempted by conventional construction procedures including backrolling. The procedure must create a firmly compacted material throughout the entire depth of the slope face to the surface of the previously compacted firm fill intercore.

During grading operations, care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately established desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding four feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly dozer trackrolled.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished using a berm and pad gradient of at least two percent.

Section 8 - Trench Backfill

Utility and/or other excavation of trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 90 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to one foot wide and two feet deep may be backfilled with sand and consolidated by jetting, flooding or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of backfill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the contractor may elect the utilization of light weight mechanical compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review of the geotechnical consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the geotechnical consultant. Clean granular backfill and/or bedding are not recommended in slope areas.

Section 9 - Drainage

Where deemed appropriate by the geotechnical consultant, canyon subdrain systems should be installed in accordance with CTE’s recommendations during grading.

Typical subdrains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications.

Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, and concrete swales).

For drainage in extensively landscaped areas near structures, (i.e., within four feet) a minimum of 5 percent gradient away from the structure should be maintained. Pad drainage of at least 2 percent should be maintained over the remainder of the site.

Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns could be detrimental to slope stability and foundation performance.

Section 10 - Slope Maintenance

10.1 - Landscape Plants

To enhance surficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the southern California area and plants relative to native plants are generally desirable. Plants native to other semi-arid and arid areas may also be appropriate. A Landscape Architect should be the best party to consult regarding actual types of plants and planting configuration.

10.2 - Irrigation

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.

Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.

10.3 - Repair

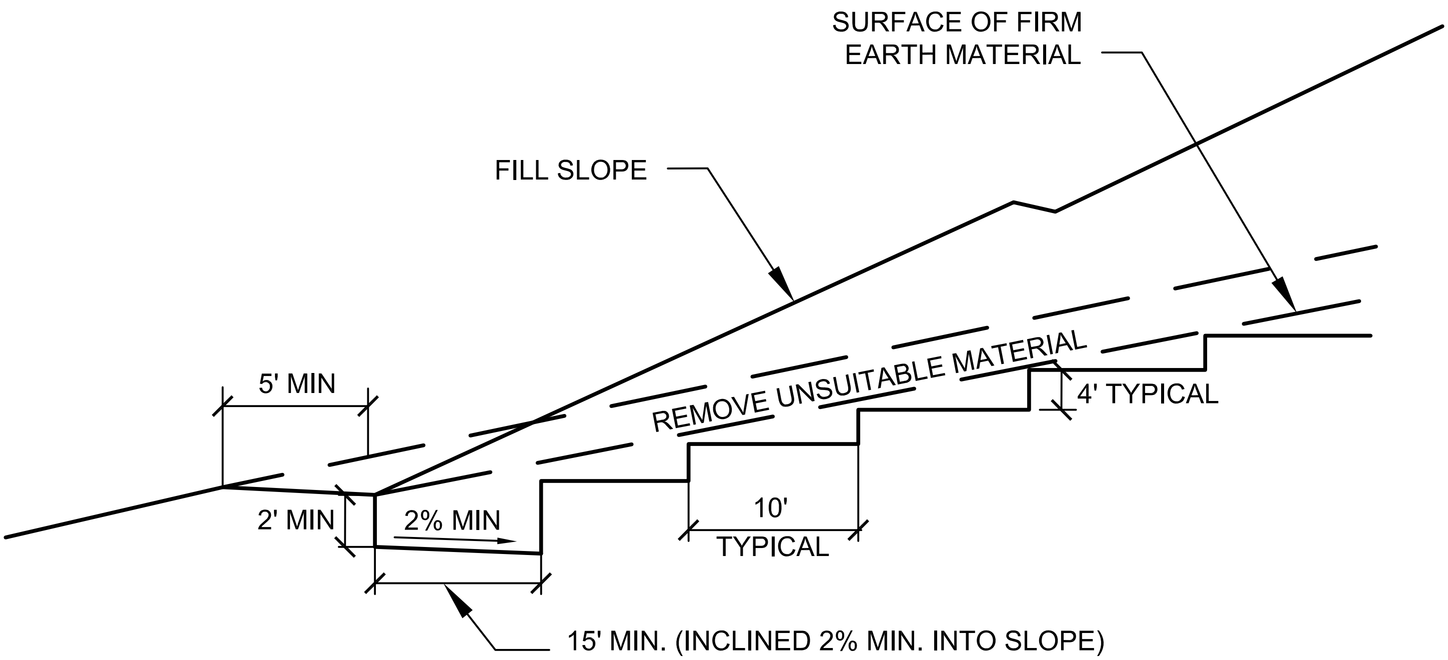
As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period prior to landscape planting.

If slope failures occur, the geotechnical consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

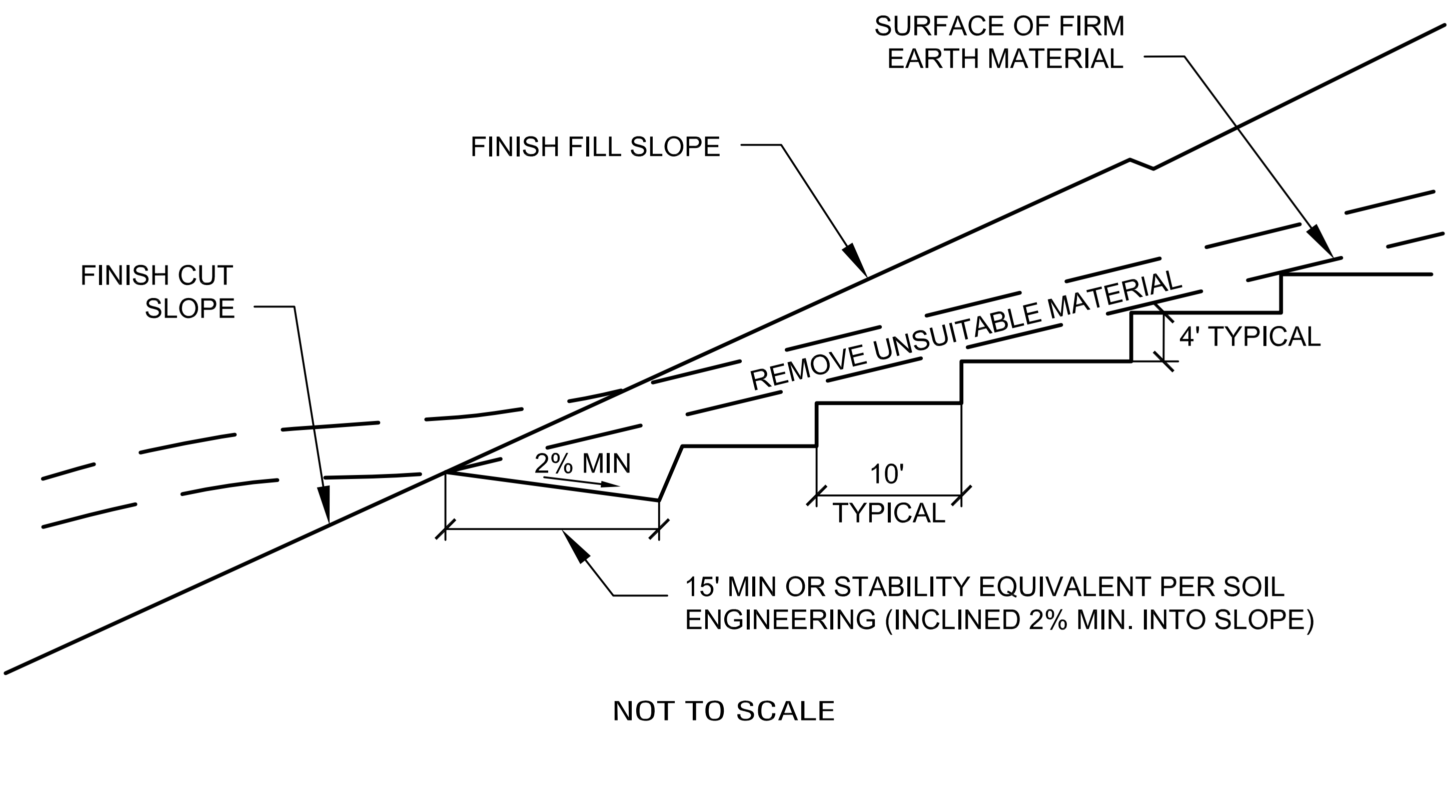
If slope failures occur as a result of exposure to period of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer one foot to three feet of a slope face).

BENCHING FILL OVER NATURAL

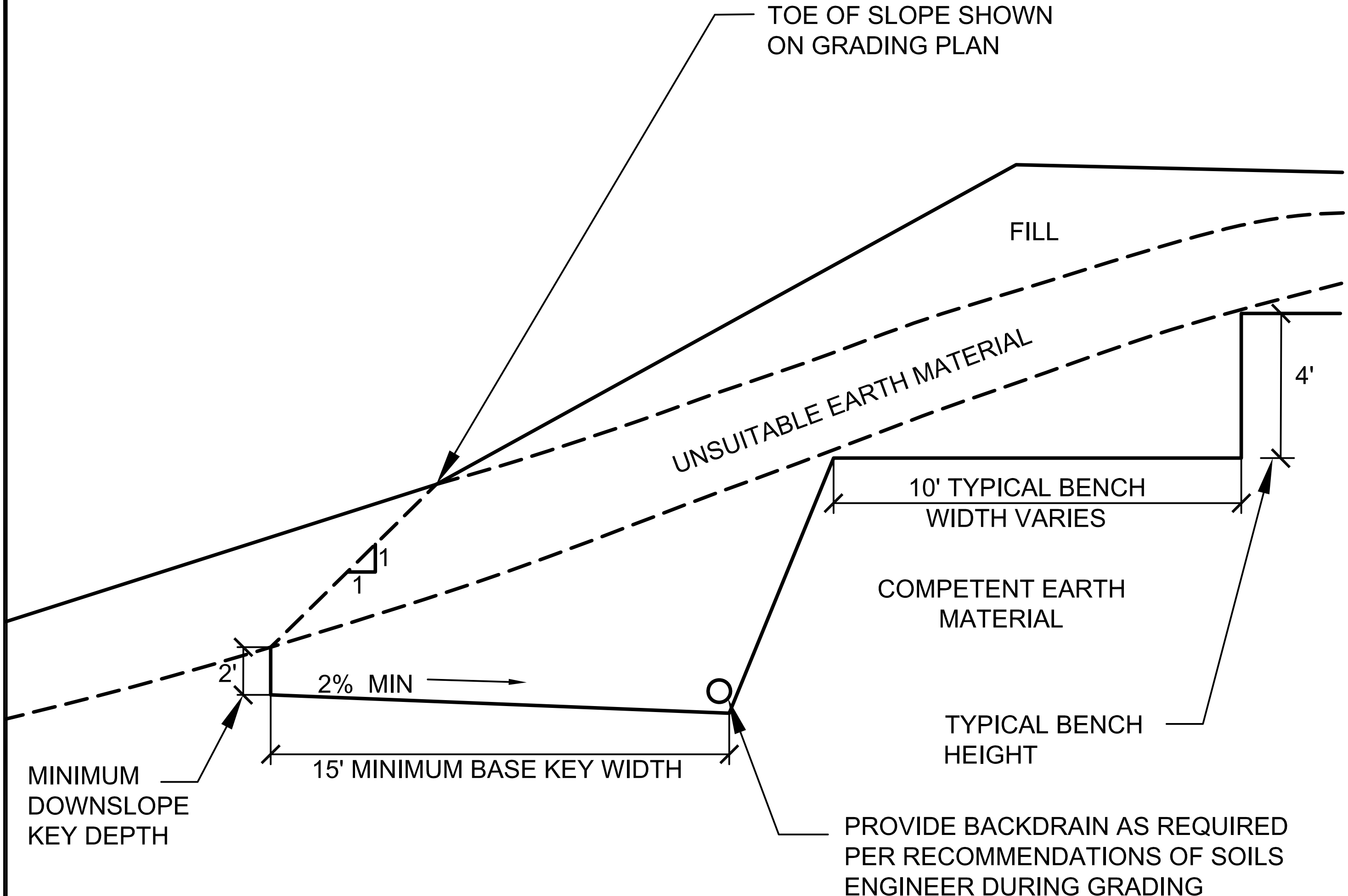


BENCHING FILL OVER CUT



NOT TO SCALE

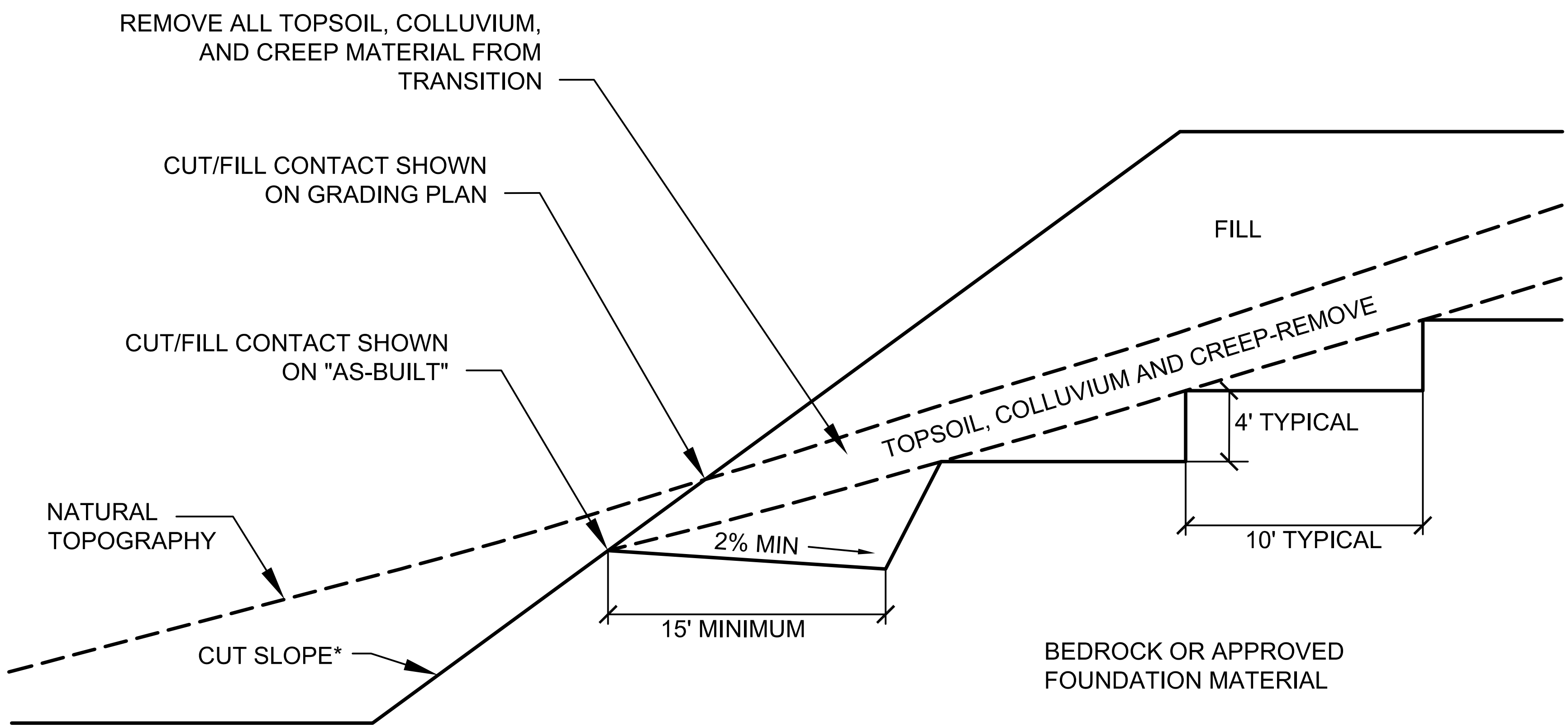
BENCHING FOR COMPACTED FILL DETAIL



WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, BENCHING IS NOT NECESSARY. FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.

NOT TO SCALE

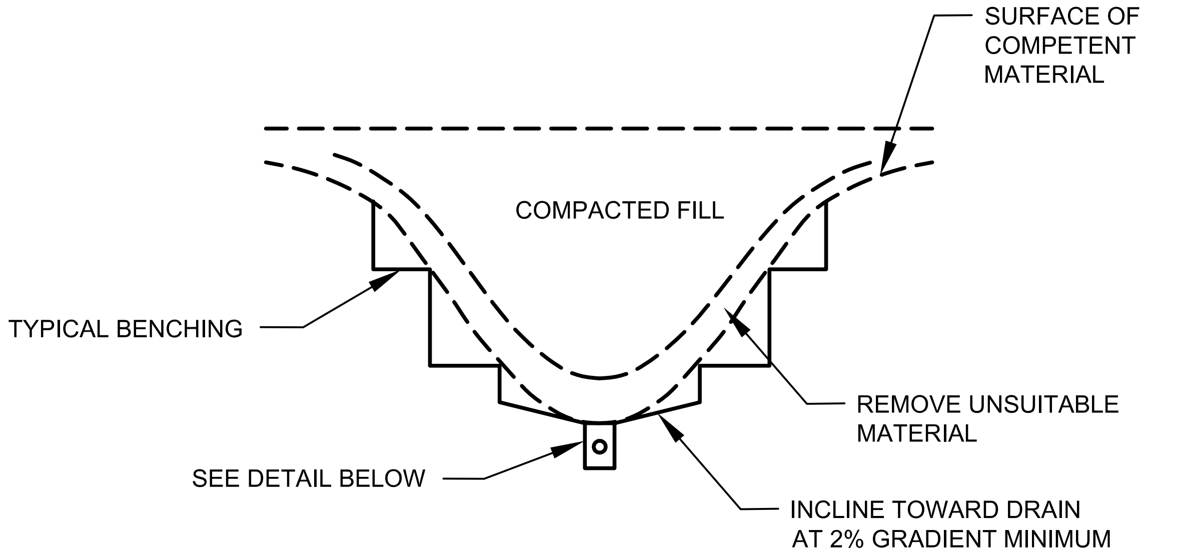
FILL SLOPE ABOVE NATURAL GROUND DETAIL



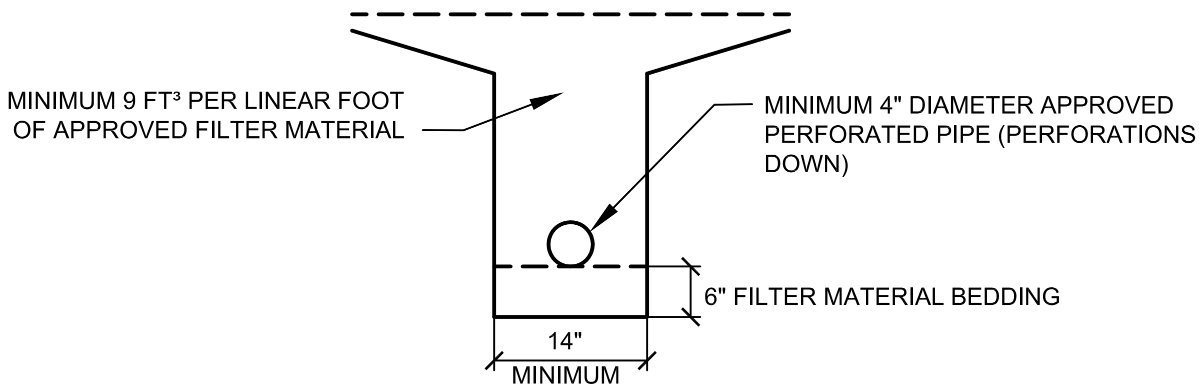
*NOTE: CUT SLOPE PORTION SHOULD BE MADE PRIOR TO PLACEMENT OF FILL

NOT TO SCALE

FILL SLOPE ABOVE CUT SLOPE DETAIL



DETAIL



CALTRANS CLASS 2 PERMEABLE MATERIAL FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1"	100
¾"	90-100
⅜"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi

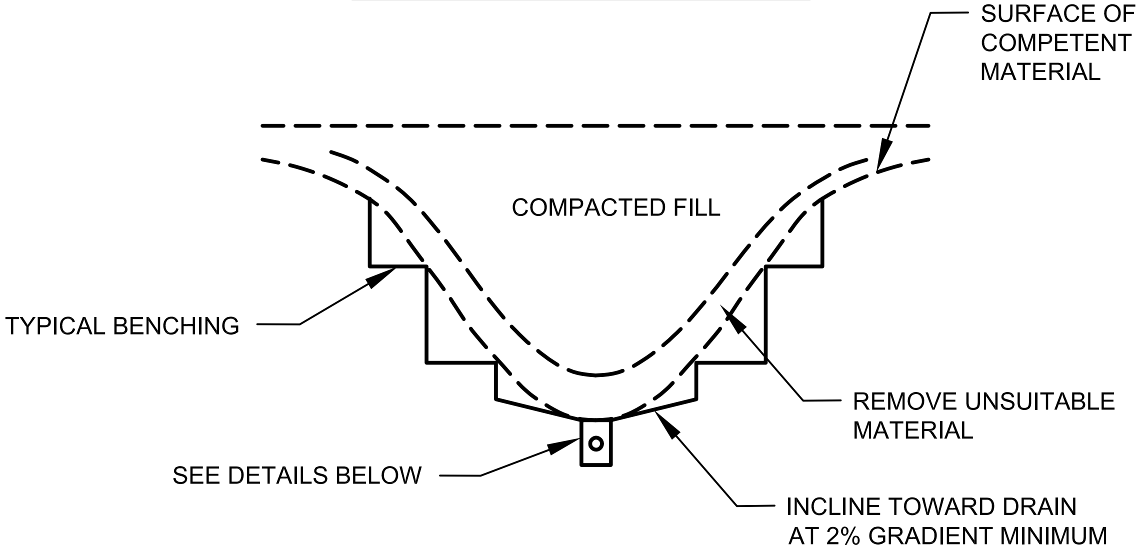
PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA, SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING

LENGTH OF RUN	PIPE DIAMETER
INITIAL 500'	4"
500' TO 1500'	6"
> 1500'	8"

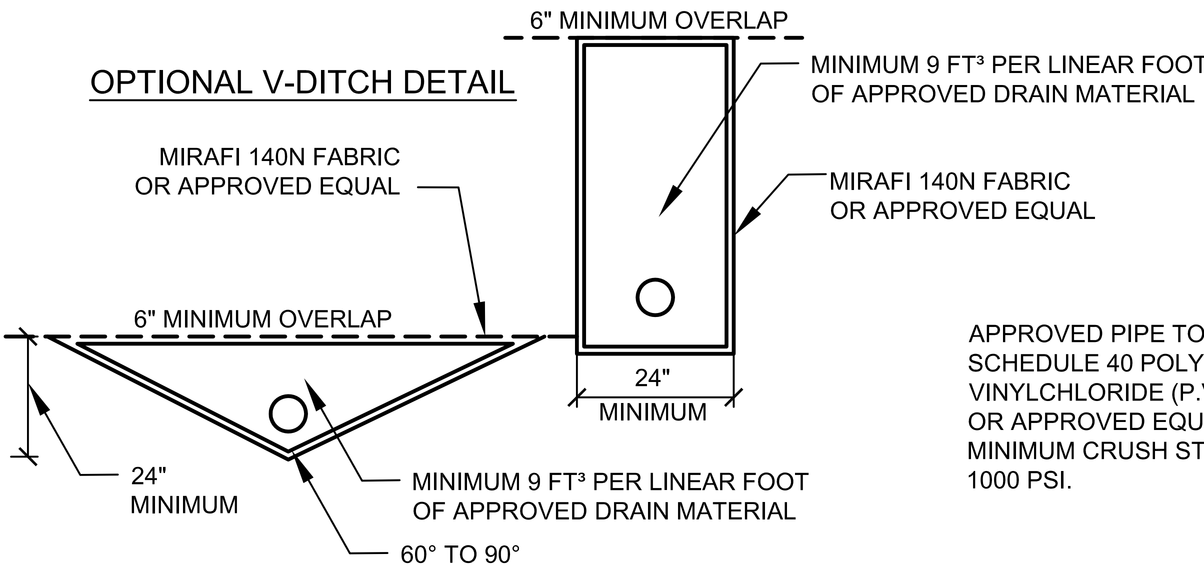
NOT TO SCALE

TYPICAL CANYON SUBDRAIN DETAIL

CANYON SUBDRAIN DETAILS



TRENCH DETAILS



APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYLCHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 PSI.

DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 ½"	88-100
1"	5-40
¾"	0-17
⅜"	0-7
NO. 200	0-3

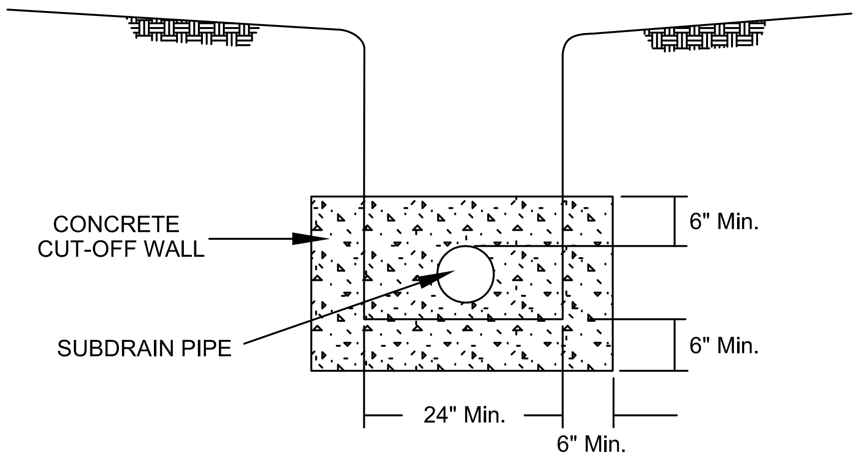
PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA, SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING

LENGTH OF RUN	PIPE DIAMETER
INITIAL 500'	4"
500' TO 1500'	6"
> 1500'	8"

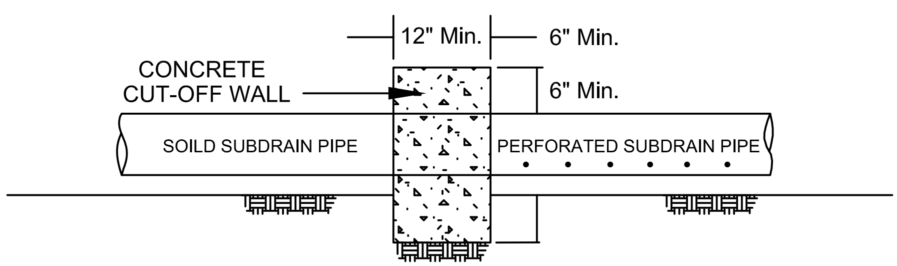
NOT TO SCALE

GEOFABRIC SUBDRAIN

FRONT VIEW



SIDE VIEW



NOT TO SCALE

RECOMMENDED SUBDRAIN CUT-OFF WALL