TerraCosta Consulting Group

Geotechnical Engineering

Coastal Engineering

Maritime Engineering

Project No. 2694
March 25, 2011

DRAFT

Mr. Bob Stark
ICF JONES & STOKES
9775 Businesspark Avenue, Suite 200
San Diego, California 92131

LIMITED GEOTECHNICAL DESIGN STUDY
CARBON LA COSTA PUBLIC BEACH ACCESS
21728.5 PACIFIC COAST HIGHWAY
MALIBU, CALIFORNIA

Dear Mr. Stark:

In accordance with our Proposal No. 10082 dated November 11, 2010, TerraCosta Consulting Group, Inc. (TCG) has completed a limited geotechnical design study in support of the proposed Carbon La Costa Beach Access project located at 21728.5 Pacific Coast Highway in Malibu, California.

INTRODUCTION

This report presents the results of our limited geotechnical investigation for the proposed Carbon La Costa Public Beach Access project. The objective of this geotechnical investigation is to provide geologic and geotechnical information in support of the design for the project.

SCOPE OF WORK

Specifically, our scope of work included:

- Performing a review of the City of Malibu's files relating to development and geologic/geotechnical conditions on the site and adjacent properties;
- Performing a geologic site reconnaissance;

- Performing a limited geotechnical investigation consisting of excavation of three hand-dug test pits and jet probing to determine the bedrock elevation and relative thickness of sand overburden;

- Review of published geologic maps and available historical aerial and terrestrial photographs;

- Geologic and geotechnical engineering analysis of data obtained; and

- Preparation of this report presenting findings and recommendations for the proposed project.

PROJECT DESCRIPTION

The proposed project is located southerly of the intersection of Pacific Coast Highway and Rambla Vista Road in the Malibu, California. More specifically, the site is located at 34°2’17”N 118°38’51”W (Figure 1). The existing site is a southerly facing sand- and rock-covered coastal beach backed up against Pacific Coast Highway and flanked by private residential structures (Photos 1A and 1B). Figure 2 shows the general limits of the project and adjacent improvements.

We understand that the project will consist of improving beach access and developing additional parking for beach users. A review of the preliminary design indicates that the site will be developed by construction of an articulating seawall to provide support and protection for new off-street parking. The new access will include a combination of steps, landings, and ramps to provide ADA access to the beach. The final design will need to accommodate elevation changes ranging from 0 to +15 feet MSL at the street. From our review of topographic maps, as well as observations made during our reconnaissance, the project will also likely have to incorporate drainage through the wall.

PREVIOUS STUDIES

From our review of available documents, we found that two previous site-specific geotechnical studies were performed by Robertson Geotechnical of Westlake Village, California. We also reviewed selected geotechnical studies, reports, maps, historical photographs, and other information germane to the project site. A list of documents reviewed is provided in Appendix A.

HISTORICAL BACKGROUND

As many of our major highways began, Pacific Coast Highway through Malibu was nothing more than a wagon trail serving the local Rindge Ranch. During the early 1900s, a legal battle was fought between Mrs. Rindge, trying to protect and preserve her ranch, and the City of Los Angeles and State of California, who wanted to establish a coastal route between Los Angeles and Ventura County. By the 1920s, the courts had forced Mrs. Rindge to convey an easement for the coastal route. From review of historical photographs, it appears that the highway was constructed by cutting into the hillsides and filling over the beach to create the new roadbed (Photos 2A and 2B). These original fills are believed to still exist under Pacific Coast Highway north of the subject site.

SITE AND SUBSURFACE CONDITIONS

The general geologic site conditions are presented on the Geologic Site Map (Figure 3). Generalized geologic cross sections are presented as Figures 4 and 5. Surface conditions in the area generally consist of a sand and cobble beach. Exposed bedrock can be seen outcropping on the westerly end of the project site in the surf zone. Aerial photographs, as well as coastal maps and observations made during our site reconnaissance, indicate an exposed offshore reef exists to the west of the site as well. Both east and west of the site are residential structures. To the north is Pacific Coast Highway.

Geology

From our review of referenced maps and geotechnical reports, as well as observations made during our site reconnaissance, the site appears to be underlain by four soil and rock units. These units are described below.

Fill: Fill soils underlie Pacific Coast Highway along the northerly limits of the site. Fill soils were not encountered in any of the test pits excavated at the time of our field exploration program. However, fill soils have been described on adjacent properties as consisting of brown, loose sand with scattered gravels. Fill soils are estimated to be on the order of 5-feet thick under Pacific Coast Highway and are likely locally derived.

Riprap: Riprap exists along the northerly limits of the site adjacent to Pacific Coast Highway. Riprap consists of large cobble- to boulder-sized rock ranging from approximately 1 to 5+ feet in diameter. Much of this riprap was likely placed over the years, with the most recent placed during the February 1989 storms (Photo 3).

Beach Deposits: Beach deposits, consisting of sand, cobbles and occasional boulders, underlie the entire site. Beach sand is medium to coarse grained, and generally light gray-brown in color. A cobble and boulder shingle, ranging up to 4 feet in thickness, is estimated to underlie the northerly half of the site.

Bedrock: Two different bedrock units are described and mapped in the September 5, 1995, Robertson report as underlying the site. On the easterly half of the site, bedrock was encountered in a soil boring at approximately -5 feet MSL during their April 10, 1989, subsurface investigation and at -2 feet MSL during their October 12, 1990, subsurface investigation. Bedrock on the easterly side of the site is identified as the Calabasas Formation. The boring logs describe the Calabasas Formation as consisting of a siltstone with thin sandy layers. The upper 6± feet of the Calabasas Formation is described as being weathered, broken fractured, dark gray to black, moist to very moist, and dense. Below 6 feet, the formation is described as light gray siltstone down to 22 feet (-14 feet MSL) below existing ground surface. Below 22 feet in depth down to the bottom of the exploratory hole (approximately -24 feet MSL), the formation is described as consisting of a very hard, gray to blue-gray siltstone within sandstone interbeds.

The westerly half of the site is mapped as being underlain by the Conejo Volcanics. Regional mapping describes the Conejo Volcanics as consisting of basalt flows and breccia, with some andesite, arkose, and tuft. The Conejo Volcanics could be seen outcropping on the beach and in the surf zone to the west of the site and in the road cut for Pacific Coast Highway northeast of the site.

GEOLOGIC STRUCTURE AND FAULTING

No bedrock elements were exposed on the site that could be mapped or measured for geologic structure. However, review of reports on adjacent properties indicate that the bedrock structure in the northern hillsides is reported to be mapped as dipping between 20 and 45+ degrees north-northeast. While no faulting was observed or reported to exist across the property, a strand of the Malibu Coast Fault is mapped as existing on the northerly side of Pacific Coast Highway. A review of the State of California Earthquake Fault Zones Map, Malibu Beach Quadrangle (Figure 6) did not reveal any active fault zones delineated across or adjacent to the subject property. The nearest active fault zone is mapped as existing approximately 2 to 3 miles westerly of the site.

SEISMICITY

No faults were mapped as existing on the site, nor was any evidence of faulting observed during our reconnaissance. A preliminary seismic analysis was performed using the computer program *EQ Fault* to estimate peak site accelerations from an earthquake occurring on nearby faults. The program found that the closest major fault to the site is the Malibu Coast Fault, approximately 2 miles from the site. The Santa Monica Fault is located approximately 2.2 miles from the site. The program estimates that, for a 6.7 maximum magnitude earthquake occurring on the Malibu Coast Fault, the site will experience a peak site acceleration of 0.58g. Results of the analysis are presented in Appendix B.

The 2009 Earthquake Probability Mapping Program, available on the USGS Geologic Hazards web site, indicates that there is a better than 99 percent probability that an earthquake of greater than Magnitude 5 will occur within a 50 km radius within the next 50 years that will affect the site.

SLOPE STABILITY

Current mapping by others, as well as observations made during our site reconnaissance, indicates that a landslide exists on the hillside northerly of the site. Our review of referenced reports and mapping indicates that the landsliding is limited to the north side of Rambla Vista approximately 200 feet northerly of the project site. Based on our reconnaissance, as well as our document review, there is no obvious indication that ground instability due to landsliding will affect the property.

SURFACE WATER

Our review of available topographic information and observations made during our reconnaissance indicate that local surface water on Pacific Coast Highway appears to drain to the easterly side of the lot, where it flows through a breach in the curb and gutter onto the beach where it percolates into the porous beach deposits.

GROUNDWATER

Groundwater was encountered in all excavations, including those performed by Robertson Geotechnical. It is expected that the underlying bedrock creates a perching horizon and that groundwater will fluctuate, depending upon irrigation, seasonal rainfall, and tides.

FINDINGS AND CONCLUSIONS

Findings

Our study indicates that the subject site is primarily underlain by beach deposits consisting of sand, gravel, cobble, and boulders, which are in turn underlain by dense formational soils and bedrock. Minor fills and riprap underlay the northerly limits of the property adjacent to Pacific Coast Highway. Competent bedrock is estimated to underlie the site at an elevation of -2 to -5 feet (NGVD) in the area of the proposed seawall. We anticipate that bedrock will consist of dense siltstones of the Calabasas Formation on the easterly side of the site and be underlain by Conejo Volcanics on the westerly side of the property.

Based on our understanding of the proposed improvements, and our review of the subsurface conditions at the site, the proposed structure will be founded in competent bedrock.

Cuts and Excavations

As we understand, the seawall foundation will be founded into the bedrock below an approximate elevation of -2 feet NGVD. We anticipate that the bedrock will generally be excavatable with large construction equipment. However, very hard and cemented zones may require heavy ripping or breaking to achieve the desired excavation depths. It should be anticipated that excavations will require dewatering and possibly shoring to support and prevent collapse of excavation sidewalls.

RECOMMENDATIONS

Site Preparation and Earthwork Operations

All grading and site preparation should be performed under the observation of the geotechnical engineer in accordance with the most recent edition of the Standard Specifications for Public Works and the City of Malibu and County of Los Angeles Regional Supplement Amendments.

All vegetation, debris, and other deleterious materials should be removed from areas to receive fill prior to site grading. In general, all structural fills should be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method 1557-09. Moisture content in any fill soils should be maintained between the optimum moisture content and 2 percent over optimum. We recommend that all imported wall backfill soils be non-expansive and free-draining.

The geotechnical engineer should review all plans to determine whether the intent of the recommendations presented herein has been properly interpreted and incorporated into the contract documents.

Excavations and Shoring Requirements

We recommended that all trenches and excavations be designed and constructed in accordance with OSHA and Cal OSHA regulations. For preliminary planning purposes, we recommend using an OSHA soil classification of Type C for all excavations. However, due to the high probability of perched groundwater and extreme seepage forces, we recommend that the shoring design be reviewed by a capable engineer experienced with shoring design.

Wall Design

Foundations

We recommend that the foundation consist of a spread footing type foundation founded in the underlying bedrock. A net allowable pressure of 3,000 psf may be used for the design of the new seawall foundation. We recommend that all foundations be embedded a minimum of 24 inches into bedrock. We also recommend that a 1-foot-wide keyway/cut-off wall be excavated along the seaward side of the footing, extending an additional 24 inches below the bottom of the footing excavation to prevent localized piping and undermining of the wall foundation.

Concrete Slab-on-Grade

From a geotechnical perspective, we recommend that all proposed slab-on-grade pavements have a minimum thickness of 4 inches. However, this minimum thickness does not consider the structural requirements associated with loading conditions and subgrade support. We recommend that the minimum thickness of the proposed concrete slab-on-grade, including slab reinforcement, be determined and confirmed by either a structural engineer or civil engineer experienced in design of concrete slabs-on-grade. Furthermore, we recommend that the proposed concrete slabs-on-grade be designed in accordance with the UBC and the American Concrete Institute's Committee Report No. 360. Lastly, we recommend that the construction of the proposed concrete slab-on-grade conform to the guidelines and specifications presented in ACI Committee Report No. 302. For the design of concrete slabs-on-grade, we recommend using a modulus of subgrade reaction equal to 100 pounds per cubic inch.

Lateral Resistance

For preliminary design purposes, we recommend . . .

Static Loading

We recommend that walls restrained from movement at the top be designed for the active case equivalent fluid pressure of 45 pcf plus an additional uniform load of 8H psf for granular backfill materials in the backfill prism (that zone of soil extending upward and outward on a 0.8 to 1 plane from the bottom outside edge of the retaining wall footing). This active earth pressure value assumes that well draining granular soils are utilized for backfill and that no surcharge loads, such as footings or vehicular traffic, will act on the wall. Increases in lateral earth pressures due to surcharge loads are a function of load type and location. Specific recommendations for surcharge loads need to be developed on a case-by-case basis. If there are surcharge loads adjacent or near the proposed wall, additional recommendations will be required, which can be provided when requested.

We expect that in general, the existing on-site soils will be suitable for backfill. If imported granular soils are used for wall backfill, we recommend that they conform to pervious backfill, as outlined in the Standard Specifications for Public Works Construction, Section 300-3.5.2 (1995 Edition).

We recommend providing all retaining walls with a backfill drainage system adequate to prevent the buildup of hydrostatic pressures.

Seismic Loading

For non-yielding walls that are 10 feet in height, we recommend the following pseudo-static earth pressure component that is distributed in the following manner:

- Beginning at the top of the wall, the pressure is equal to 12 psf;
- The pressure remains uniform at 12 psf to the mid-height of the wall; and

- The pressure then decreases linearly from 12 psf to 6 psf at the bottom of the wall.

If the wall can rotate 0.0005 radians, the additional earth pressure for seismic conditions reduces to a pressure distribution of an invert triangle that has a maximum value of 60 psf (i.e., 6 pcf times 10 feet) at the top of the wall and a minimum value of 0 psf at the bottom of the wall.

The seismic component of lateral earth pressure corresponds to site acceleration estimated to have a 10 percent chance of exceedance in 50 years.

Seismic Design Parameters

Construction Material Compatibility and Corrosion Protection

Preliminary Pavement Design

LIMITATIONS

Coastal engineering and the earth sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our evaluation of the technical information gathered, partly on our understanding of the proposed construction, and partly on our general experience. Our engineering work and judgments rendered meet the current professional standards. We do not guarantee the performance of the project in any respect. This warranty is in lieu of all other warranties, express or implied.

We appreciate the opportunity to be of service and trust this information meets your needs. If you have any questions, please give us a call.

Very truly yours,

TERRACOSTA CONSULTING GROUP, INC.

DRAFT

Walter F. Crampton, Principal Engineer
R.C.E. 23792, R.G.E. 245

DRAFT

Gregory A. Spaulding, Project Geologist
P.G. 5892, C.E.G. 1863

WFC/GAS/jg
Attachments

PHOTO 1A

Site Photo taken December 16, 2010, Looking East

PHOTO 1B

Site Photo taken December 16, 2010, Looking West

Source: Los Angeles Public Library (http://jpg3.lapl.org/pics06/00022946.jpg)

PHOTO 2A

Pacific Coast Highway along the Malibu Coastline, circa 1930s

Source: Los Angeles Public Library (http://jpg3.lapl.org/pics37/00068058.jpg

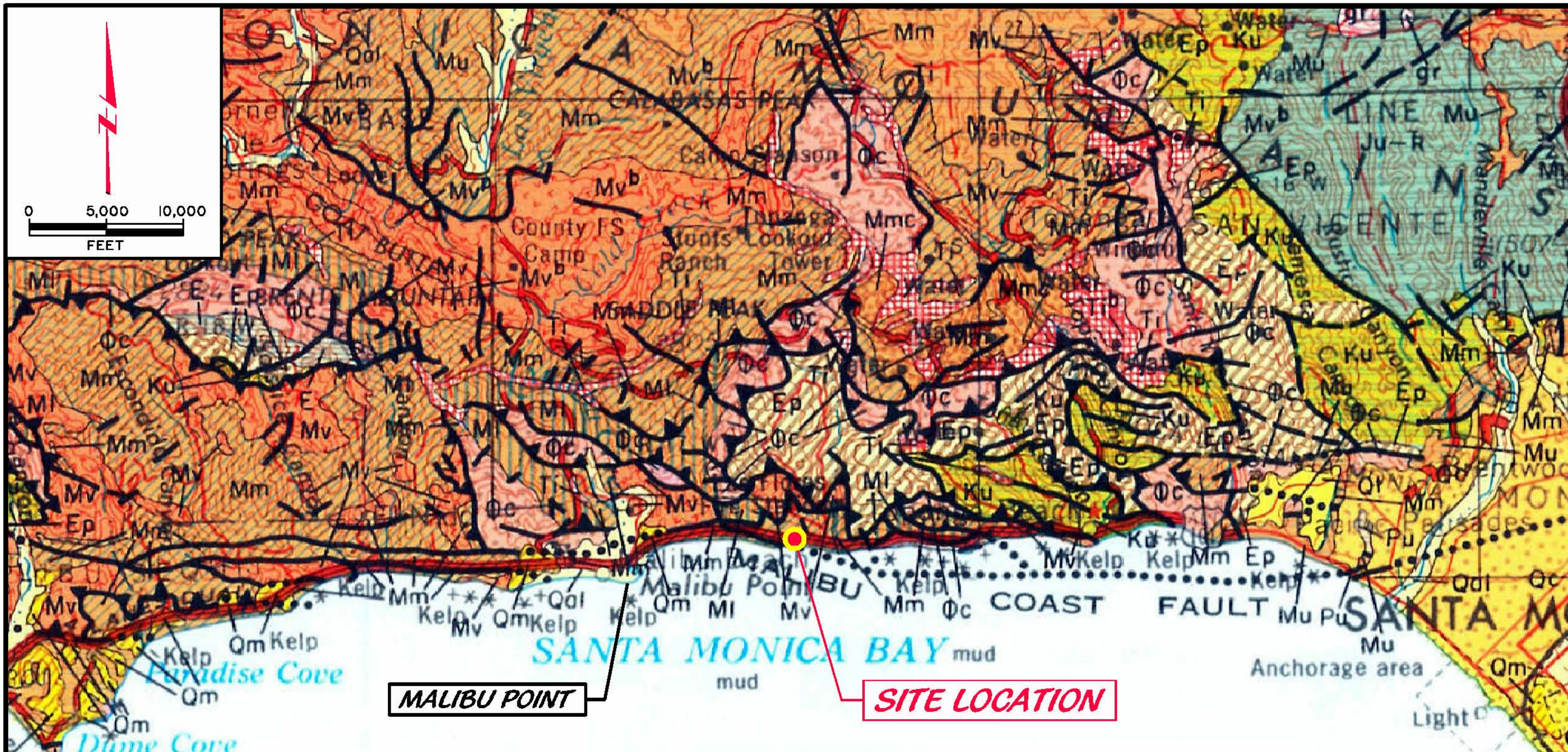
PHOTO 2B

Pacific Coast Highway, circa 1930s

Source: Los Angeles Public Library (http://jpg1.lapl.org/00083/00083400.jpg)
Photo Date: February 4, 1989

PHOTO 3

Carbon/La Costa Beach during February 1989 Storms



VICINITY/GEOLOGIC MAP

REFERENCE:

Geologic Map of California, Los Angeles Sheet, Jennings & Strand, 1969.

LEGEND: *(Geology surrounding Site Location, only)*

Symbol	Description
Qal	Alluvium
Qm	Pleistocene marine and marine terrace deposits
Mv	Miocene volcanic: Mv^r —rhyolite; Mv^a —andesite; Mv^b —basalt; Mv^p —pyroclastic rocks
Mm	Middle Miocene marine
Ml	Lower Miocene marine
Φc	Oligocene nonmarine
Ku	Upper Cretaceous marine
Ep	Paleocene marine
Ti	Tertiary intrusive (hypabyssal) rocks: Ti^r —rhyolite; Ti^a —andesite; Ti^b —basalt

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Project Name: Carbon La Costa Public Beach Access • Project Number: 2694 • Figure 1

BASE PHOTO DATED OCTOBER 23, 2007,
GOOGLE INC., GOOGLE EARTH [SOFTWARE].
AVAILABLE FROM http://www.google.com/

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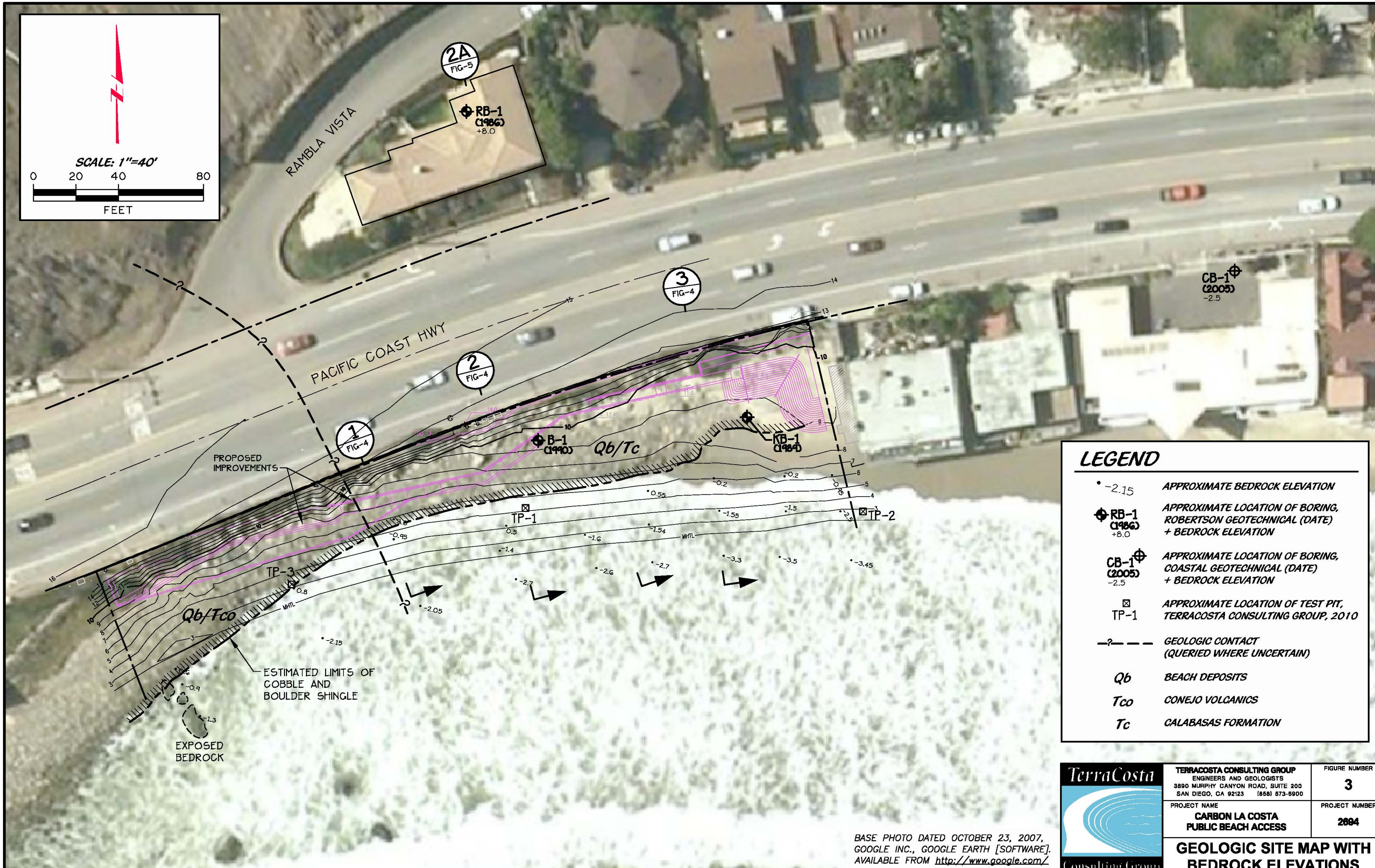
FIGURE NUMBER: 2

PROJECT NAME: CARBON LA COSTA PUBLIC BEACH ACCESS

PROJECT NUMBER: 2694

SITE PLAN WITH
PRELIMINARY PLAN DESIGN



LEGEND

• -2.15	APPROXIMATE BEDROCK ELEVATION
RB-1 (1986) +8.0	APPROXIMATE LOCATION OF BORING, ROBERTSON GEOTECHNICAL (DATE) + BEDROCK ELEVATION
CB-1 (2005) -2.5	APPROXIMATE LOCATION OF BORING, COASTAL GEOTECHNICAL (DATE) + BEDROCK ELEVATION
TP-1	APPROXIMATE LOCATION OF TEST PIT, TERRACOSTA CONSULTING GROUP, 2010
—?— — —	GEOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
Qb	BEACH DEPOSITS
Tco	CONEJO VOLCANICS
Tc	CALABASAS FORMATION

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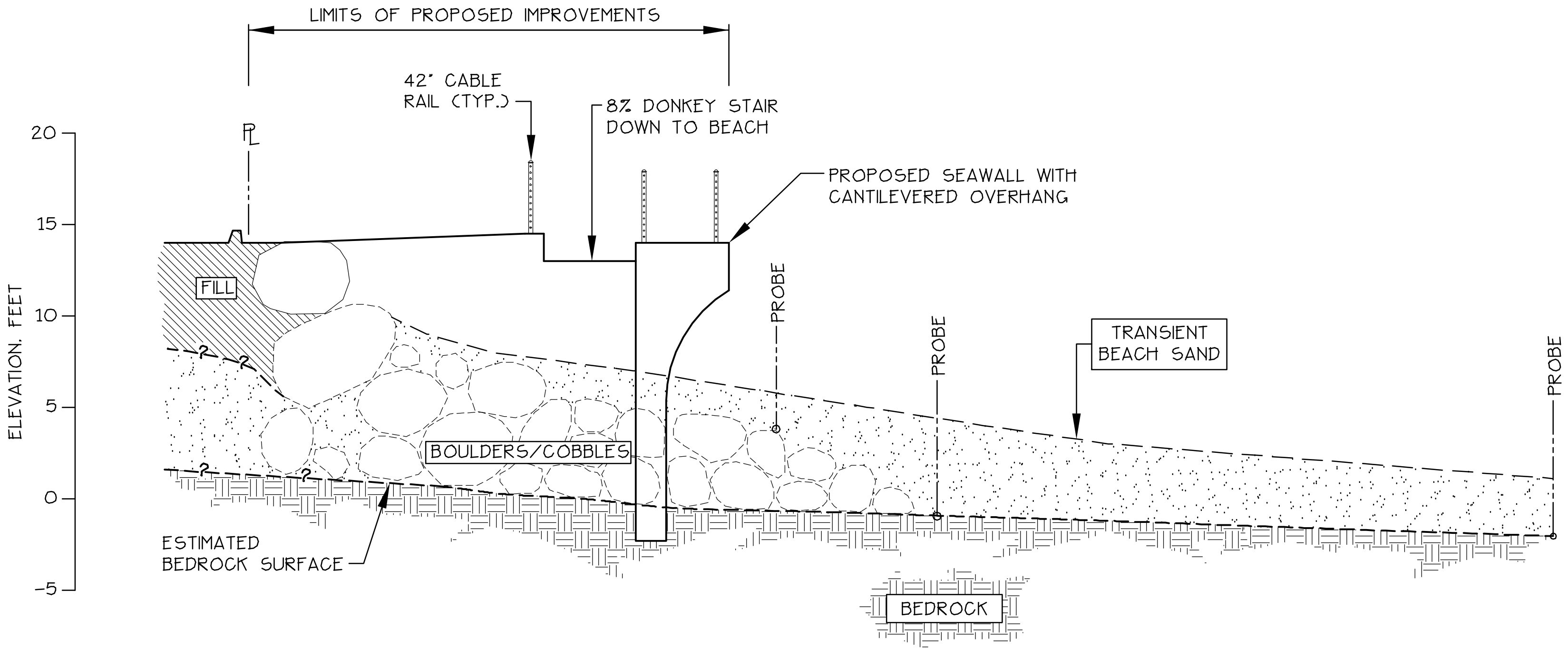
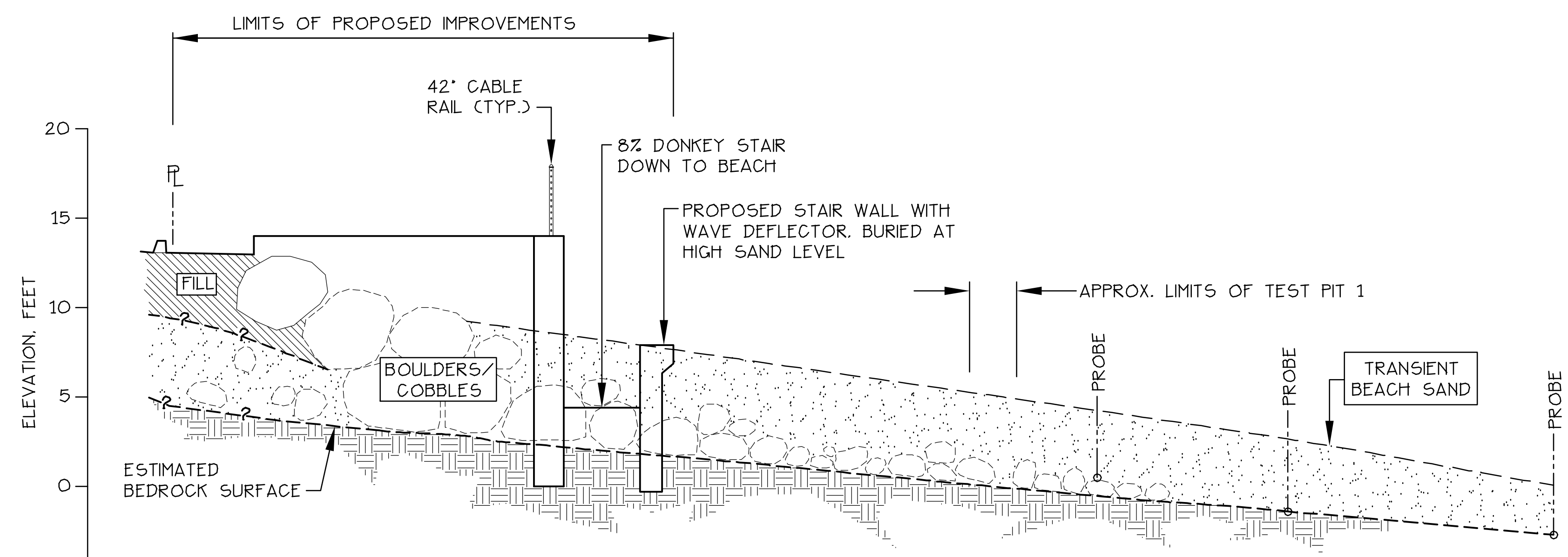
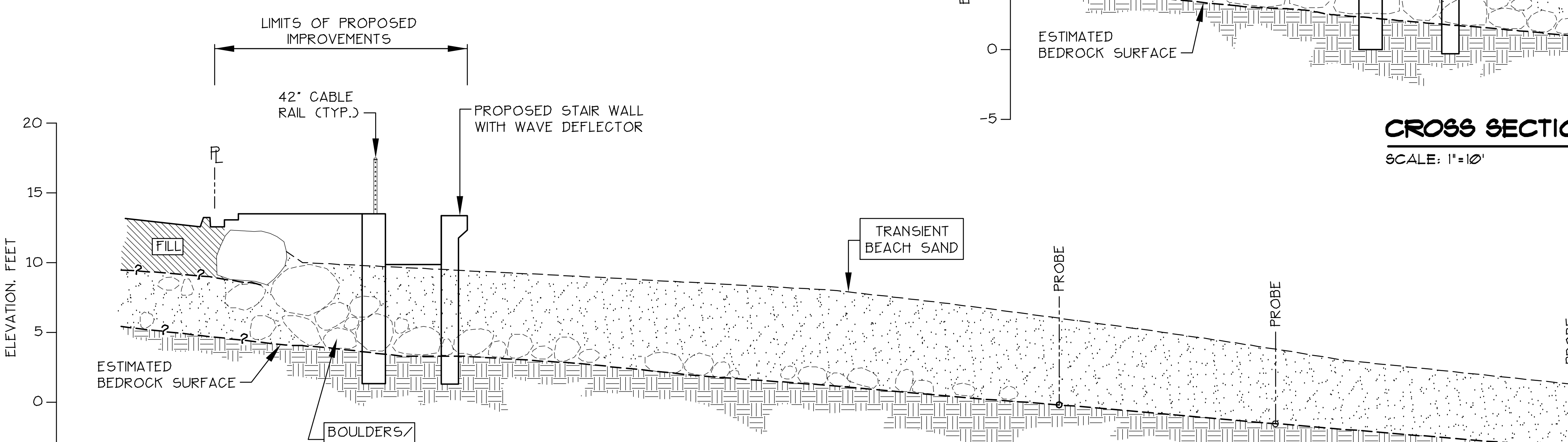
TERRACOSTA CONSULTING GROUP ENGINEERS AND GEOLOGISTS 3890 MURPHY CANYON ROAD, SUITE 200 SAN DIEGO, CA 92123 (858) 573-6900		FIGURE NUMBER 3
PROJECT NAME CARBON LA COSTA PUBLIC BEACH ACCESS		PROJECT NUMBER 2694
GEOLOGIC SITE MAP WITH BEDROCK ELEVATIONS		



CROSS SECTION 1
SCALE: 1"=10'
FIG 3



CROSS SECTION 2
SCALE: 1"=10'
FIG 3



CROSS SECTION 3
SCALE: 1"=10'
FIG 3

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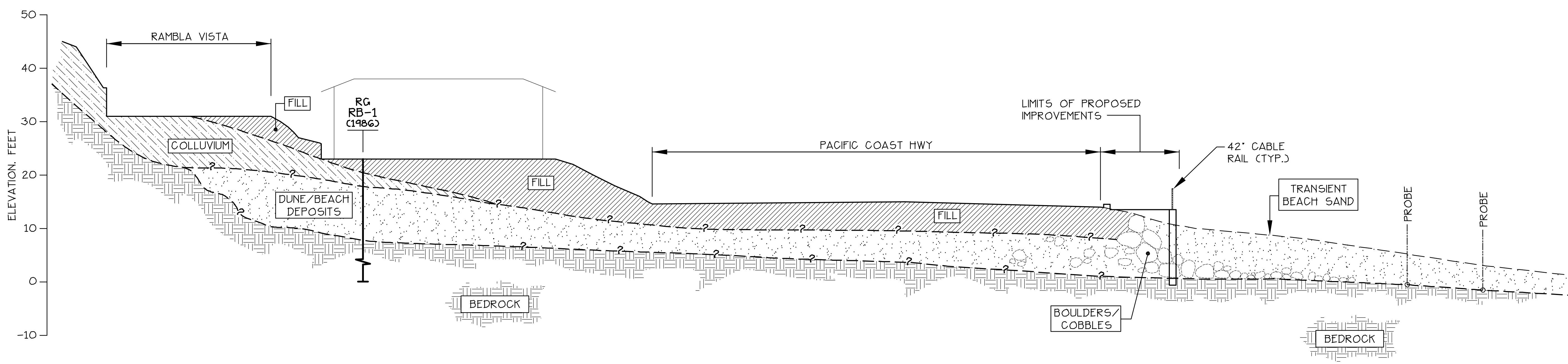
FIGURE NUMBER
4

PROJECT NAME
CARBON LA COSTA PUBLIC BEACH ACCESS

PROJECT NUMBER
2694

CROSS SECTIONS



CROSS SECTION 2A FIG 3

SCALE: 1"=20'

LEGEND

RB-1 *APPROXIMATE LOCATION OF BORING BY ROBERTSON GEOTECHNICAL, 1986*

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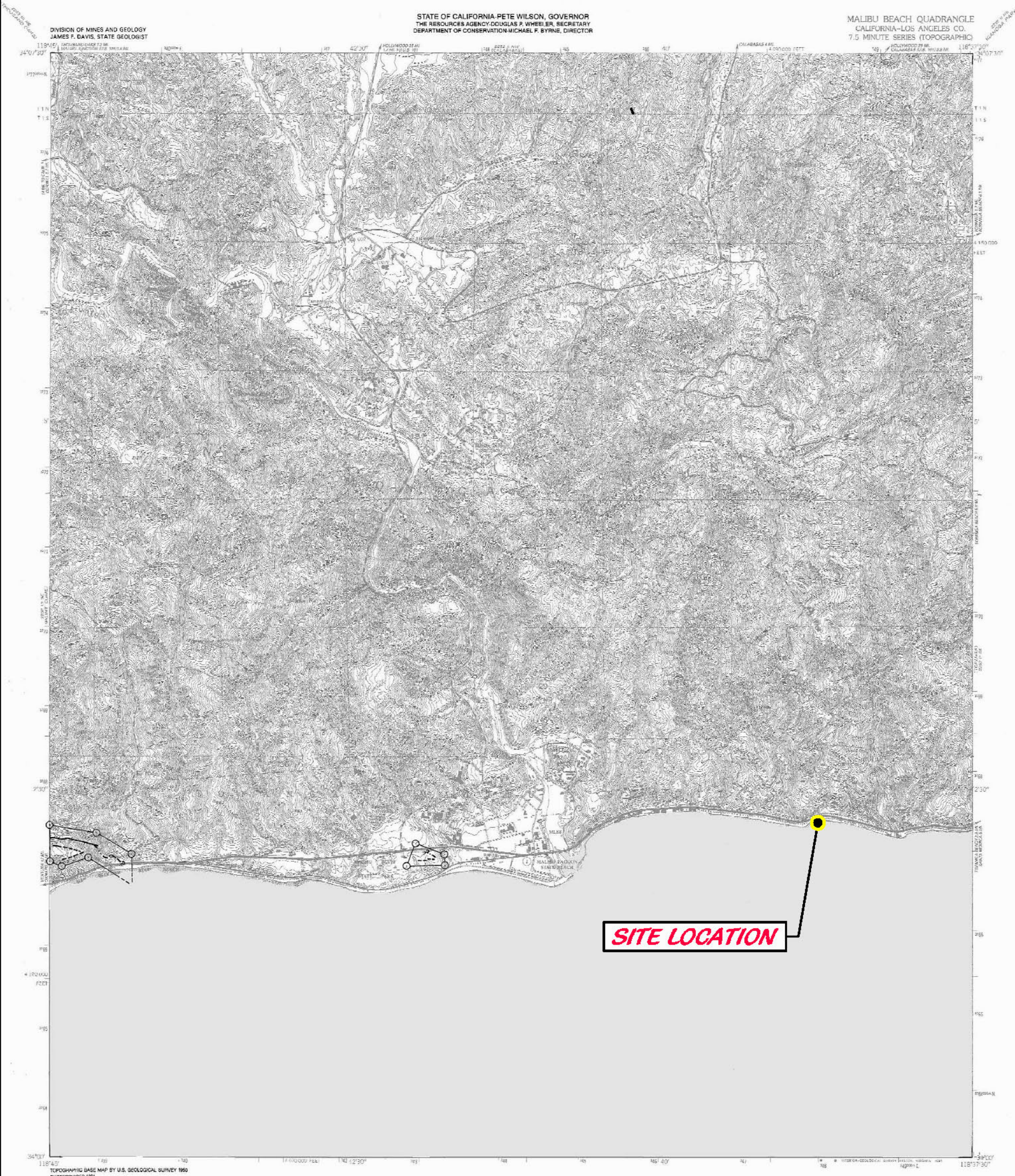
FIGURE NUMBER 5

PROJECT NAME **CARBON LA COSTA PUBLIC BEACH ACCESS**

PROJECT NUMBER 2694

CROSS SECTIONS



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY 1950
PHOTOREVISED 1981

SCALE 1:24,000

CONTOUR INTERVAL 25 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 4 FEET

MAP EXPLANATION

Active Faults

Faults considered to have been active during Holocene time and to have potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

Earthquake Fault Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define Earthquake Fault Zone segments.

Seaward projection of zone boundary.

STATE OF CALIFORNIA
EARTHQUAKE FAULT ZONES

Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Earthquake Fault Zoning Act)

MALIBU BEACH QUADRANGLE

OFFICIAL MAP

Effective: June 1, 1995

James F. Davis State Geologist

REFERENCES USED TO COMPILE FAULT DATA

Malibu Beach Quadrangle

Drumm, P.L., 1992, Holocene displacement of the central splay of the Malibu Coast Fault Zone, Latigo Canyon, Malibu in Pipkin, B.W., and Proctor, R.J., eds., Engineering geology practice in southern California: Association of Engineering Geologists Special Publication No.4, p.247-254.

Rzonca, G.F., Spellman, H.A., Fall, E.W., and Shlemon, R.J., 1991, Holocene displacement of the Malibu Coast Fault Zone, Winter Mesa, Malibu, California: engineering geologic implications: Bulletin of the Association of Engineering Geologists, v.XXVIII, no.2, p.147-158.

Treiman, J.A., 1994, Malibu Coast Fault Zone, Los Angeles County, California: California Division of Mines and Geology Fault Evaluation Report FER-229 (unpublished).

Yerkes, R.F., and Campbell, R.H., 1980, Geologic map of east-central Santa Monica Mountains, Los Angeles County, California: U.S. Geological Survey Miscellaneous Investigations Series, Map I-1146, scale 1:24,000.

For additional information on faults in this map area, the rationale used for zoning, and additional references consulted, refer to unpublished Fault Evaluation Reports on file at regional offices of DMG.

IMPORTANT - PLEASE NOTE

1) *This map may not show all faults that have the potential for surface fault rupture, either within the Earthquake Fault Zones or outside their boundaries.*
2) Faults shown are the basis for establishing the boundaries of the Earthquake Fault Zones.
3) The identification and location of these faults are based on the best available data. However, the quality of data used is varied. Traces have been drawn as accurately as possible at this map scale.
4) Fault information on this map is not sufficient to serve as a substitute for the geologic site investigations required under Chapter 7.5 of Division 2 of the California Public Resources Code.

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EARTHQUAKE FAULT ZONES

APPENDIX A

LIST OF DOCUMENTS REVIEWED

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California Department of Conservation, Division of Mines and Geology, 2001, *Seismic Hazard Zone Report for the Malibu Beach 7.5-Minute Quadrangle*, *Los Angeles County, California*, Seismic Hazard Zone Report 050.

California Department of Conservation, Division of Mines and Geology, 1969, *Geologic Map of California, Los Angeles Sheet*, Map Scale 1:250,000.

City of Malibu, February 2002, *Guidelines for the Preparation of Engineering Geologic and Geotechnical Reports and Procedures for Report Submittal*, Version 1.0, prepared by Bing Yen & Associates, Inc., City of Malibu Geotechnical Staff, Building and Safety Department.

Coastline Geotechnical Consultants, Inc., 2005, *Geotechnical Engineering and Engineering Geology Investigations, Proposed Residential Development, 21650-21656 Pacific Coast Highway, Malibu, California*, September 19, 2005, Project No. 2286C-055.

Coastline Geotechnical Consultants, Inc., 1989, *Parameters for Design of Bulkhead Support Piles, 21614 through 21624 Pacific Coast Highway, Malibu, California*, November 3, 1989, Project No. 104C(B-D)-099.

David C. Weiss Structural Engineer & Associates, Inc., 1990, *Wave Uprush Study, Parcels 1 and 2, Doc. No. 9-1399688*, *Pacific Coast Highway, Malibu, California*, December 13, 1990, Job No. OBE1.190.

Geolabs-Westlake Village, 2009, *Ancient Landslide Remediation, 21651 & 21653 Rambla Vista, City of Malibu, California*, November 30, 2009, W.O. 8943.

Geology & Soils Consultanst, Inc., 1973, *Foundation Recommendations*, *Proposed Residence, 21711 Pacific Coast Highway, Malibu, California*, January 17, 1973, GSC 627.

Robertson Geotechnical, Inc., 1997, *Addendum Report*, *Response to City of Malibu Review Sheet*, *Proposed Residence, Parcel 1, Document No. 90-1399688, 21724 Pacific Coast Highway*, *Malibu, California*, February 20, 1997, 2101SMLA.629.

Robertson Geotechnical, Inc., 1995, *Updated Engineering Geologic and Geotechnical Engineering Exploration, Proposed Residence*, *Parcel 1, Document No. 90-1399688, 21724 Pacific Coast Highway, Malibu, California*, September 5, 1995, 2101SMLA629.

Robertson Geotechnical, Inc., 1990, *Preliminary Geologic Soils Engineering Exploration, Parcel 1 Per Document No. 90-1399688, 21724 Pacific Coast Highway, Malibu, California*, December 27, 1990, 1541OBLA.114.

Robertson Geotechnical, Inc., 1986, *Updated Geologic and Soils Engineering Exploration, Proposed Single Family Residence, 21715 Rambla Vista, Malibu, California*, July 16, 1986, 1086GULA.114.

U.S. Geological Survey, 2005, *Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Southern California*, Version 1.0, compiled by R.F. Yerkes and R.H. Campbell, Open-File Report 2005-1019 (http://pubs.usgs.gov/of/2005/1019).

Software

USGS Geologic Hazards Science Center, 2009 Earthquake Probability Mapping (https://geohazrads.usgs.gov/eqprob/2009/index.php).

EQFAULT, Version 3.00, A computer program for the deterministic estimation of peak acceleration using three-dimensional California faults as earthquake sources (www.thomasfblake.com).

APPENDIX B

DETERMINISTIC SEISMIC ANALYSIS

TerraCosta Consulting Group

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*                       *
*    E Q F A U L T      *
*                       *
*    Version 3.00       *
*                       *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 2694

DATE: 01-28-2011

JOB NAME: Carbon/La Costa Beach Access

CALCULATION NAME: Seismic Analysis

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\CGSFLTE.DAT

SITE COORDINATES:
   SITE LATITUDE: 34.0380
   SITE LONGITUDE: 118.6477

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 8) Bozorgnia Campbell Niazi (1999) Hor.-Soft Rock-Uncor.
   UNCERTAINTY (M=Median, S=Sigma): M   Number of Sigmas: 0.0
   DISTANCE MEASURE: cdist
   SCOND: 1
   Basement Depth: 5.00 km   Campbell SSR: 1   Campbell SHR: 0
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 3.0

Pleist-Uncor

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

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ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
MALIBU COAST	2.0(3.2)	6.7	0.579	X
SANTA MONICA	2.2(3.5)	6.6	0.567	X
ANACAPA-DUME	4.3(6.9)	7.5	0.554	X
PALOS VERDES	7.6(12.3)	7.3	0.358	IX
HOLLYWOOD	14.2(22.8)	6.4	0.147	VIII
NEWPORT-INGLEWOOD (L.A.Basin)	14.9(24.0)	7.1	0.188	VIII
NORTHRIDGE (E. Oak Ridge)	16.4(26.4)	7.0	0.216	VIII
SIMI-SANTA ROSA	19.0(30.6)	7.0	0.161	VIII
PUENTE HILLS BLIND THRUST	20.3(32.7)	7.1	0.182	VIII
UPPER ELYSIAN PARK BLIND THRUST	20.8(33.5)	6.4	0.105	VII
SANTA SUSANA	20.9(33.6)	6.7	0.116	VII
VERDUGO	22.1(35.6)	6.9	0.125	VII
SIERRA MADRE (San Fernando)	22.4(36.1)	6.7	0.106	VII
OAK RIDGE (Onshore)	23.3(37.5)	7.0	0.127	VIII
HOLSER	24.5(39.4)	6.5	0.082	VII
RAYMOND	25.2(40.6)	6.5	0.078	VII
SAN GABRIEL	26.4(42.5)	7.2	0.106	VII
SIERRA MADRE	28.1(45.2)	7.2	0.117	VII
SAN CAYETANO	28.6(46.0)	7.0	0.099	VII
OAK RIDGE(Blind Thrust Offshore)	34.2(55.1)	7.1	0.097	VII
CHANNEL IS. THRUST (Eastern)	35.7(57.4)	7.5	0.125	VII
VENTURA - PITAS POINT	35.7(57.5)	6.9	0.069	VI
WHITTIER	36.4(58.6)	6.8	0.052	VI
CLAMSHELL-SAWPIT	37.2(59.9)	6.5	0.048	VI
OAK RIDGE MID-CHANNEL STRUCTURE	39.0(62.7)	6.6	0.055	VI
SANTA YNEZ (East)	40.1(64.5)	7.1	0.058	VI
M.RIDGE-ARROYO PARIDA-SANTA ANA	43.2(69.5)	7.2	0.069	VI
SAN JOSE	43.6(70.2)	6.4	0.036	V
SAN ANDREAS - Mojave M-1c-3	44.9(72.3)	7.4	0.064	VI
SAN ANDREAS - Whole M-1a	44.9(72.3)	8.0	0.101	VII
SAN ANDREAS - 1857 Rupture M-2a	44.9(72.3)	7.8	0.087	VII
SAN ANDREAS - Cho-Moj M-1b-1	44.9(72.3)	7.8	0.087	VII
RED MOUNTAIN	45.2(72.7)	7.0	0.055	VI
SAN ANDREAS - Carrizo M-1c-2	46.4(74.6)	7.4	0.061	VI
SAN JOAQUIN HILLS	48.0(77.2)	6.6	0.042	VI
CHINO-CENTRAL AVE. (Elsinore)	49.1(79.0)	6.7	0.039	V
SANTA CRUZ ISLAND	49.8(80.2)	7.0	0.049	VI
CUCAMONGA	51.9(83.5)	6.9	0.043	VI
NEWPORT-INGLEWOOD (Offshore)	52.1(83.9)	7.1	0.042	VI
GARLOCK (West)	56.1(90.3)	7.3	0.044	VI

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BIG PINE	56.8(91.4)	6.9	0.032	V
PLEITO THRUST	57.0(91.8)	7.0	0.041	V
ELSINORE (GLEN IVY)	59.3(95.4)	6.8	0.028	V
NORTH CHANNEL SLOPE	63.5(102.2)	7.4	0.049	VI
SANTA YNEZ (West)	64.5(103.8)	7.1	0.032	V
SAN JACINTO-SAN BERNARDINO	66.9(107.6)	6.7	0.022	IV
CORONADO BANK	67.3(108.3)	7.6	0.045	VI
SAN ANDREAS - San Bernardino M-1	68.1(109.6)	7.5	0.041	V
SAN ANDREAS - SB-Coach. M-1b-2	68.1(109.6)	7.7	0.048	VI
SAN ANDREAS - SB-Coach. M-2b	68.1(109.6)	7.7	0.048	VI
CLEGHORN	70.3(113.2)	6.5	0.017	IV
WHITE WOLF	71.2(114.6)	7.3	0.039	V
SANTA ROSA ISLAND	72.1(116.0)	7.1	0.033	V
ELSINORE (TEMECULA)	79.3(127.6)	6.8	0.019	IV
SAN JACINTO-SAN JACINTO VALLEY	81.0(130.4)	6.9	0.020	IV
NORTH FRONTAL FAULT ZONE (West)	82.1(132.1)	7.2	0.030	V
LOS ALAMOS-W. BASELINE	91.2(146.8)	6.9	0.020	IV
HELENDALE - S. LOCKHARDT	91.8(147.7)	7.3	0.023	IV
GARLOCK (East)	93.2(150.0)	7.5	0.027	V
ROSE CANYON	94.4(152.0)	7.2	0.021	IV
LENWOOD-LOCKHART-OLD WOMAN SPRGS	96.1(154.7)	7.5	0.026	V

-END OF SEARCH- 61 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE MALIBU COAST FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 2.0 MILES (3.2 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.5792 g