Martin R. Owen PE, GE
Geotechnical Engineer
4596 Mount Hubbard Avenue, San Diego, CA 92117
Phone/Text: 619-813-8462
Email: martinowen@geotechengineer.com

Job No. 190128
March 2, 2019

To: Ms. Jil Frederick

Subject: Preliminary Geotechnical Investigation
Proposed Lot Split
3790 Arroyo Sorrento Road
San Diego, CA 92130

Dear Ms. Frederick:

In accordance with your request, we have conducted a preliminary geotechnical investigation at the subject site.

SCOPE OF WORK

The scope of work performed for this investigation consisted of the following:

- Review of published geologic maps and referenced reports,
- Review of limited construction plans,
- Subsurface soil exploration,
- Storm water infiltration testing,
- Geologic site reconnaissance and analysis,
- Geotechnical engineering analysis and preparation of this report containing our findings, conclusions, and recommendations for design and construction of building foundations and floor slabs, site grading, and other geotechnical aspects of the proposed construction.

SITE DESCRIPTION AND PROPOSED CONSTRUCTION

The site location is shown on the attached Vicinity Map, Figure 1. For the purpose of this report, the front of the property faces south towards Arroyo Sorrento Road. The trapezoidalshaped, approximately 2.3-acre lot is located on a partially graded, terraced, southerly descending hillside with elevations ranging from approximately 160 feet msl at the high point to approximately 100 feet msl at the low point.

It is planned to split the property into two parcels, Parcels 1 and 2. Parcel 1 will comprise the northern 1.2 acres including the upper, terraced building pad. Parcel 2 will comprise the southern 1.1 acres including the lower, two terraced pads.

There is an existing, two-story, single-family residence, constructed in 1981, on Parcel 1. No building improvements or grading are currently proposed on Parcel 1.

There is an existing, one-story building on the middle terrace of Parcel 2. The building is currently utilized for storage. The building will be removed and a new single-family residence constructed in its place. In addition, an auxiliary structure and garage will be constructed on the lower terrace.

A steep (1:1) natural slope comprised of sandstone bedrock is located northwest of the proposed residence. An approximately 20-foot high, 2:1 fill slope ascending to Parcel 1 is located near the northern limits of Parcel 2. A 2:1 fill slope ranging from 5 to 15 feet is located on the mid and lower pads that comprise Parcel 2.

SUBSURFACE SOIL EXPLORATION AND INFILTRATION TESTING

The subsurface soil exploration consisted of machine excavating three test pits (TP-1 through TP-3) at the approximate locations shown on the attached Figure 2. Test pits were excavated to a maximum depth of 10 feet and logged by a licensed engineering geologist. The locations of the test pits are shown on the attached Figure 2. Logs of the test pits are provided on Figure 3. Geologic Cross Sections A-A’, B-B’ and C-C’ are presented as Figures 4A-4C.

SUBSURFACE SOIL CONDITIONS

Artificial Fill (Qaf): Most of Parcel 2 and the southeastern portion of Parcel 1 is covered with approximately 2½ to 9 feet of undocumented fill. The fill was encountered in all three of our test pits and the five test pits reported by SCST (2005). As encountered in our test pits, the fill consists of mottled brown and dark brown, loose to medium dense, medium- to coarse-grained, slightly silty to silty sand (SP-SW/SM). The fill was moist at the time of our investigation. The fill is poorly compacted and compressible and not suited in its present state for the intended development.

Slopewash (Qsw): The fill is underlain by natural Holocene to late Pleistocene-aged slopewash (colluvium) with thicknesses ranging from approximately 1 to 5 feet, as encountered in our test pit TP-1, and in test pits P-1 and P-5 as reported by SCST (2005). The slopewash encountered in our test pit TP-1 consisted of light to medium brownish gray, loose to medium dense, medium- to coarse-grained, slightly silty to silty sand (SP-SW/SM). The slopewash contained a few lenses of light brown material. The slopewash was moist at the time of our investigation. The slopewash is loose and compressible and not suited in its present state for the intended development.

Torrey Sandstone (Tt): Sedimentary bedrock of the middle Eocene-aged Torrey Sandstone Formation was encountered at depths ranging from approximately 2½ to 9 feet in our test pits, and in those reported by SCST (2005). The bedrock consisted primarily of light to medium brown, weathered, medium dense to dense, medium- to coarse-grained, slightly silty to silty, sandstone (SP-SW/SM). The sandstone was slightly moist to moist at the time of our observation.

Based on our review of the referenced SCST report and experience with this formation, the weathered Torrey Sandstone has a moderate potential for settlement upon wetting.

All soil and bedrock materials encountered have very low expansive characteristics based on visual examination.

INFILTRATION TESTING

In an effort to minimize groundwater pollution, the City of San Diego (amongst other California cities) requires that certain projects dispose of on-site generated storm water by constructing a storm water infiltration system on the property. Based on the original proposed configuration of the project, the site was considered a Priority Design Project (PDP) and required on-site infiltration. Revised site configuration subsequent to our field study, however, has changed the status of the development and on-site infiltration is no longer required. The results of our tests are included for possible, future reference.

Percolation tests were performed on pre-saturated soils using the open pit, falling head testing method (see BMP Design Manual, Appendix A) on February 6, 2019. The testing was performed at TP-1, near the east and west sides of the trench (see Figure 2).

Percolation rates were converted to infiltration rates using the Porchet Method. The test results are as follows:

WATER INFILTRATION RATES

Infiltration Test Pit No.	Ground Elevation (Feet) MSL	Test Pit Depth (Feet)	Percolation Rate Inches/Hour	Infiltration Rate Inches/Hour	Infiltration Rate Inches/Hour (FS = 2)
IT-1	**112.5**	**3.5**	**3.375**	**1.86**	**0.93**
IT-2	**113**	**3.5**	**3.0**	**1.67**	**0.83**

GROUNDWATER

No groundwater was encountered in the test pits. Perched (shallow) water conditions may develop at times of heavy irrigation or rainfall near the contact between the fill/slopewash and underlying sandstone bedrock.

GEOLOGY AND SEISMICITY

Regional Geologic Setting

The site is located in the Coastal Plains Physiographic Province of San Diego County within the Peninsular Ranges Geomorphic Province of California. According to a review of the Geology of the San Diego 30' x 60' Quadrangle, California, compiled by Michael P. Kennedy and Siang S. Tan (2008[1]) the western edge of the lot is underlain with late to middle Pleistocene-aged old paralic deposits, unit 6 (formerly called the Bay Point Formation by Kennedy, 1975[2]). Kennedy

---

[1] Kennedy, M.P., and Tan, S.S., 2008, Geologic Map of the San Diego 30' x 60' Quadrangle, California: California Geologic Survey, Regional Geologic Map Series, Map 3, scale 1:100,000.

[2] Kennedy, M.P., 1975, Geology of the San Diego Metropolitan Area, California: California Division of Mines and Geology Bulletin 200-A, 39 p., Plate 2A-Geologic Map of the Del Mar Quadrangle, scale 1:24,000.

and Tan (2008, p. 7) described these deposits as “Poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate."

Old paralic deposits were not recognized in our test pits and not reported in those by SCST (2005), but were observed along top of the natural slope near the northwestern corner of Parcel 2. The old paralic deposits consist of primarily brown, medium dense to dense, conglomerate with abundant round gravels and cobbles to 6 inches in maximum dimension in a silty sand matrix.

According to a review of the Geology of the San Diego 30' x 60' Quadrangle, California, compiled by Michael P. Kennedy and Siang S. Tan (2008), the entire lot is mapped as middle Eocene-aged Torrey Sandstone. Kennedy and Tan (2008, p. 12) described this formation as “White to light-brown, medium- to coarse-grained, moderately well indurated, massive and broadly cross-bedded, arkosic sandstone."

Geologic Structure and Bedding

Regional bedding within the Torrey Sandstone dips 5 degrees to the north-northwest near the site as reported by Kennedy (1975) and Kennedy and Tan (2008). Bedding within the Torrey Sandstone on the property ranged from 2 to locally 23 degrees to the north-northwest and locally to the east-southeast. Jointing in the sandstone is nearly vertical with joint planes spaced approximately 3 to 6 feet apart. The weathered sandstone appeared massive in the test pits during our observation.

Tectonic Setting

No major faults are known to traverse the subject site, but it should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones, which typically consist of several individual, en echelon faults that generally strike in a southeasterly – northwesterly direction. Some of these fault zones (and the individual faults within the zones) are classified as active. According to the criteria of the

California Division of Mines and Geology (currently California Geological Survey; CGS, 2018[3]), "sufficiently active" fault zones are those, which have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,700 years). An excerpt from the 2010 Fault Activity Map of California, Geologic Data Map No. 6, is attached in appendix A as Figure Ai showing the recency of faulting in the region.

A review of available geologic maps indicates that the Rose Canyon and Mount Soledad Fault segments of the Rose Canyon Fault Zone are the nearest active fault strands and are located about 5 miles southwest of the site. According to the 2008 National Seismic Hazard Maps - Fault Parameters (USGS website), the Maximum Magnitude earthquake on the Rose Canyon Fault Zone is 6.9 (Ellsworth) or 6.7 (Hanks) with a slip rate of 1.5. However, according to Rockwell (2010[4]), the maximum credible earthquake magnitude on the Rose Canyon Fault Zone is anticipated to be 7.3. The Rose Canyon Fault Zone is currently classified as a Type "B" fault (California Probabilistic Seismic Hazard Maps, Cao and others, June 2003[5]). The two nearest faults to the site are the Zone 12 Carmel Valley Fault (Kennedy, 1975; Kennedy and Tan, 2008, Appendix A, Figure Aii; City of San Diego, 2008, Appendix A Figure Aiii) and an unnamed Zone 12 fault, located about 1400 feet northwest and 400 feet southeast, respectively, from the site.

The Elsinore and San Jacinto Fault Zones are located about 29 and 54 miles, respectively, northeast of the site. The City of San Diego Seismic Safety Element estimates the maximum probable earthquake for both the San Jacinto and the Elsinore fault zones is between M 6.9 and 7.3, with a repeat interval of approximately 100 years. The maximum credible earthquake for both fault zones is estimated at M 7.6. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough and San Clemente Fault Zones to the southwest, and the Earthquake Valley Fault and San Andreas Fault Zones to the northeast.

---

[3] California Geological Survey (CGS), Revised 2018, Earthquake Fault Zones: A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture hazards in California: Special Publication 42.

[4] Rockwell, T., 2010, The Rose Canyon Fault Zone in San Diego: Fifth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics and Symposium in Honor of Professor I.M Idriss, May 24-29, 2010, San Diego, California, Paper No. 7.06c, 9 p.

[5] Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The revised 2002 California probabilistic seismic hazard maps, June 2003: Calif. Geologic Survey, 12 p., Appendix A.

However, a Maximum Magnitude Earthquake on the Rose Canyon Fault Zone is anticipated to generate ground accelerations on the site, greater than any of these other nearby fault zones.

In addition to the active strands of the Rose Canyon Fault Zone, three offshore potentially active strands of the Rose Canyon Fault Zone are located between about 3 and 4 miles west of the proposed development site. These fault breaks are considered potentially active, inactive, presumed inactive, or activity unknown, by the City of San Diego (2008[6]); potentially active faults have demonstrated movement during the Pleistocene Epoch [11,700 to 2.6 million years before the present), but no movement during Holocene (recent) times]. A fault activity map showing the locations of strands of the Rose Canyon Fault zone and other regional faults is attached in Appendix A as Figure Ai.

According to the Official Map of Alquist-Priolo Earthquake Fault Zones for the La Jolla Quadrangle, by the California Division of Mines and Geology (CDMG, 1991[7]), the site IS NOT located in an Alquist-Priolo Earthquake Fault Zone.

GEOLOGIC AND GEOTECHNICAL HAZARDS

General: No geologic hazards of sufficient magnitude to preclude development of the site as currently proposed are known to exist. The site is mapped within Geologic Hazard Category 53 according to the City of San Diego Seismic Study Map (see Figure Aiii). Areas within Category 53 are described as "Level or sloping terrain, unfavorable geologic structure, Low to moderate risk."

Ground Shaking: A likely geologic hazard to affect the site is ground shaking resulting from movement along one of the major active fault zones mentioned above. Probable ground shaking levels at the site could range from slight to severe, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the

---

[6] City of San Diego, 2008, Seismic Safety Study, Geologic Hazards and Fault, Map Sheet No. 38, scale 1' = 800', dated April 3, 2008.

[7] California Division of Mines and Geology, (CDMG) [currently called the California Geological Survey, CGS], 1991, Earthquake Hazard Zones (formerly Alquist-Priolo Special Studies Zone) Map of the La Jolla 7.5-minute quadrangle, scale 1:24,000.

proposed structure. Construction in accordance with the minimum requirements of the current building codes and local governing agencies should minimize potential damage due to seismic activity.

Landslide Potential and Slope Stability: A review of the geologic hazards maps (Figures Aiii and Aiv) indicates there are no known deep or suspected ancient landslides located on the site. Due to the site's gently to steeply sloping topography, underlying competent materials with bedding structure that is generally massive to favorable or neutral-dipping with respect to the slopes, landslide hazards do not present a significant risk to the proposed residential development.

As part of this investigation we reviewed the publication, "*Landslide Hazards in the Northern Part of the San Diego Metropolitan Area*" by Tan and Giffen (1995)[8]. This reference is a comprehensive study that classifies San Diego County into areas of relative landslide susceptibility. The subject site is located in an area classified as 3-1. The 3-1 is a general classification assigned to areas generally susceptible to slope movement. Slopes within Subarea 3-1 are considered at or near their stability limits due to a combination of weak materials and steep slopes (many slope angles exceed 15 degrees). Although most slopes within Subarea 3-1 do not currently contain landslide deposits, they can be expected to fail, locally, when adversely modified. It should be noted that this reference, typically classifies most hillside terrain, within the 3-category.

The natural sandstone hillside near the northwest corner of Parcel 2 has been over steepened by past grading operations and is inclined at a slope gradient of 1:1 for the lower approximately 10 feet. The sandstone is very dense and cemented. Bedding oriented neutral with respect to the slope face was observed. The slope has a gross factor of safety of at least 1.5, but may be prone to surface erosion (0-1 foot).

Fill slopes constructed with on-site soils and at maximum inclinations of 2:1 will be grossly stable with a minimum factor of safely of 1.5. The soils are sandy and prone to surface erosion.

---

[8] Tan, S.S. and Giffen, D.G, 1995, Landslide hazards in the Northern Part of the San Diego Metropolitan Area, San Diego County, California, Landslide Hazard Identification Map No. 35: California Division Mines and Geology Open File Report 95-04, pp. 1-6, Plate 35G, Del Mar Quadrangle, scale 1:24,000.

Liquefaction: The soil and bedrock materials at the site are not subject to liquefaction due to such factors as soil density, grain-size distribution, and groundwater conditions.

Soil Expansion: The expansion potential of the slightly silty to silty sandstone of the Torrey Sandstone that underlies the site is considered very low.

Flooding: The site is located outside the boundaries of both the 100-year and the 500-year floodplains according to the maps prepared by the Federal Emergency Management Agency.

Tsunamis and Seiches: Tsunamis are great sea waves produced by submarine earthquakes or volcanic eruptions. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Based on the project's elevated location, the site is considered to possess a low risk potential from tsunamis or seiche activity.

SEISMIC DESIGN VALUES

Seismic design values for the proposed buildings are presented in the attached Figure 5.

CONCLUSIONS

The site is suitable for construction of the proposed buildings, provided the recommendations presented in this report are followed. In general, all fill, slopewash and weathered sandstone will require removal and recompaction.

Storm water infiltration testing was performed in accordance with our proposed scope of work, but it was subsequently determined that storm water infiltration would not be necessary.

RECOMMENDATIONS

1. Site Grading and Compaction

- **Removal of Concrete and Other Debris**

  Concrete and other debris resulting from demolition of the existing structure should be removed from the site.

- **Removal and Recompaction of Fill, Slopewash and Weathered Sandstone**

  The existing fill, slopewash and weathered sandstone should be removed and recompacted. The approximate limits of the fill and slopewash are depicted on Figures 2, 3 and 4A-4C. The weathered sandstone occurs in the upper several feet below the slopewash.

  The weathered sandstone should be removed and recompacted to a minimum depth of 6 feet below the proposed building elevations or 2 feet below the contact with the slopewash or fill, whichever is deeper. Deeper removals may be necessary depending on the density of the weathered rock.

  The lateral limits of the removal should extend at least 5 feet outside the limits of the proposed buildings or equal to the vertical depth of the removals, whichever is greater.

  In areas where compacted fill will be placed over sloping bedrock, the fill should be horizontally benched into the bedrock and a keyway placed at the lower limits of the removal, below the toe of the graded slope. The keyway should be at least 8 feet wide and extend at least 2 feet vertically into dense, unweathered sandstone. The bottom of the keyway should be inclined at least 5 percent into the slope.

  The bottoms of the removals, benching, and keyway excavations should be observed and approved by the Geotechnical Engineer, or Engineer's representative prior to placement of compacted fill.

- **Excavation of Bedrock**

  The sandstone bedrock can be excavated with conventional earth-moving equipment.

- **Fill Slopes**

  Fill slopes should be inclined no steeper than 2:1.

- **Preparation of Fill Areas, Compaction**

  The on-site soils may be reused as compacted fill and trench backfill, provided they are free of organic materials and debris and rock fragments over 6 inches in maximum dimension. Any imported fill soils should be predominantly granular and approved by the Geotechnical Engineer.

  Prior to placing fill, the exposed sandstone bedrock should be scarified to a depth of 6 to 8 inches, and flooded for a period of at least 24 hours in an effort to reduce future potential settlement. The removal should then be blended to slightly above optimum moisture content and compacted to a minimum relative compaction of 90 percent as determined by ASTM D1557.

  All fill should also be compacted to a minimum relative compaction of 90 percent as determined by ASTM D1557. Fill should be placed at slightly above optimum moisture conditions in 6- to 8-inch thick layers, with each layer compacted by mechanical means.

  All fill placement and compaction should be performed in accordance with the grading requirements of the City of San Diego and should be observed and tested as necessary by the Geotechnical Engineer.

- **Material Shrinkage**

  Recompaction of the on-site soils may result in 5 to 10 percent shrinkage by volume.

2. Footings

- **Footing Depths**

  Footings for the proposed residence and garage/auxiliary building may be supported on continuous and/or individual spread concrete footings having a minimum depth of 18 inches below building pad grade or lowest adjacent exterior grade, whichever is deeper.

  In addition, footings for structures and retaining walls next to descending slopes should extend to a sufficient depth to provide at least 7 feet of horizontal distance from the bottom outer edge of the footings and the face of the slope.

- **Footing Reinforcing**

  All continuous footings should be reinforced with four No. 5 rebars placed two at the top and two at the bottom.

- **Allowable Soil Bearing Value**

  Footings may be designed for an allowable, dead plus live load, bearing value of 2,000 post, with a one-third increase for short term, wind, or seismic loads.

- **Lateral Load Resistance**

  An equivalent fluid, passive soil pressure of 300 pcf may be used for lateral load resistance. A soil/concrete friction factor of 0.35 may also be used. When combining

- **Cleaning of Footing Excavations**

  Footing excavations should be cleaned of loose soils prior to placing reinforcing steel and concrete.

- **Inspection of Footing Excavations**

  All footing excavations should be inspected and approved by the Geotechnical Engineer.

3. Floor Slabs

New floor slabs should be at least 5 inches thick and reinforced with No. 4 rebars spaced at 18 inches on centers in two directions and placed at mid-height in the slab. New floor slabs should be underlain by 4 inches of clean sand, with a 10-mil visqueen moisture barrier placed at mid height in the sand layer. All visqueen laps and splices should be in accordance with standard industry practices. Stego Wrap (15 mil) should be considered for areas with moisture sensitive flooring. Concrete should have a minimum, 28-day compressive strength of 3,000 psi and maximum water to cement ratio of 0.5. Concrete should be placed, finished, and cured in accordance with ACI guidelines. Garage floor slabs should have control joints spaced no greater than 10 feet in any direction.

4. *Driveway and Exterior Slabs*

Driveway and other exterior slabs should be at least 5 inches thick and reinforced with No. 4 rebars spaced at 18 inches on centers in two directions. Concrete should be placed, finished, and cured in accordance with ACI guidelines. Concrete should have a minimum 28-day compressive strength of 3,000 psi and maximum water to cement ratio of 0.5. Crack control joint spacing should not exceed 10 feet in any direction. Control joints should be scored to a minimum depth of 1.25 inches.

5. *Soil Values and Other Recommendations for Retaining Walls*

The following soil values may be used for design of new retaining walls:

- At rest equivalent fluid soil pressure = 75 pcf (basement wall, no rotation, 2:1 surcharge from slope).
- Allowable soil bearing pressure in recompacted fill = 2,000 psf. This value may be increased by one third for short-term seismic loads.
- Allowable, equivalent fluid, passive soil pressure in dense recompacted fill = 300 pcf. This value may be increased by one third for short term seismic loads.
- Allowable friction value between concrete and fill = 0.35. When combining passive and frictional resistance, the passive pressure should be reduced by one-third.

6. *Wall Drainage*

The above retaining wall soil values assume retaining walls will be properly drained. Wall drainage details are shown on Figure 6. Specifications for Class 2 Permeable Material are presented on Figure 7. Please note Class 2 Permeable Material is a mixture of sand and gravel and is not the same as Class 2 road base. No filter fabric is necessary with Class 2 Permeable Material. A 4-inch diameter perforated pipe should be placed at the bottom, rear side of the wall and drained at a minimum gradient of 1 percent to an approved outlet. We recommend SDR-35 PVC pipe or better. All joints should be glued and taped. The pipe should be encased in a filter sock.

We recommend that a concrete swale be constructed at the top of the wall so that slope runoff does not go over the top the wall and is directed away from the building. Storm water should be conveyed to the away from the structure and disposed of at a suitable location.

7. Drainage

Surface water should not be allowed to pond next to the buildings. Finished grades should slope a minimum of 2 percent away from the building. Roof gutters and downspouts connecting to solid, outlet pipes are recommended. Drainage water should be discharged to an approved outlet. Water should not be allowed to flow over the proposed fill slopes.

The on-site sandy soils used as fill will likely be prone to erosion on the proposed slope face. Proper landscaping should be installed to reduce these effects. A qualified landscape contractor should be consulted for recommendations.

8. Storm Water Infiltration

Storm water infiltration is not recommended at the site.

9. Review of Building Plans

Building plans should be reviewed by the Geotechnical Engineer to ensure that they conform with the recommendations presented in this report.

LIMITATIONS

The conclusions and recommendations presented in this report are subject to field conditions and may be modified as necessary during construction. This report should be considered valid for a period of three years and is subject to review and possible changes following that time. If significant modifications are made to the building plans, revision of this report may also be necessary.

Please note this report provides no warranty, either expressed or implied, concerning future building performance. Future damage from geotechnical or other causes is a possibility.

This opportunity to be of service is appreciated. If you have any questions, please do not hesitate to call or contact me.

.

Very truly yours,

Martin R Owen

Martin R. Owen PE, GE
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
MARTIN R. OWEN
No. 23155
Exp. 12/31/19
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
MARTIN R. OWEN
No. G.E. 000658
Exp. 12/31/19
GEOTECHNICAL
STATE OF CALIFORNIA

Scott C Burns

Scott Burns, PE
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
SCOTT C. BURNS
No. 55370
Exp. 12/31/18
CIVIL
STATE OF CALIFORNIA

Stephen E Jacobs

Stephen E. Jacobs, CEG
Engineering Geologist

CERTIFIED ENGINEERING GEOLOGIST
STEPHEN E. JACOBS
No. 1307
Exp. 08/31/19
ENGINEERING GEOLOGY
STATE OF CALIFORNIA

Attachments:

Figure 1 – VICINITY MAP
Figure 2 – GEOLOGIC MAP SHOWING TEST PIT LOCATIONS
Figure 3 – TEST PIT LOGS
Figures 4A-4C – GEOLOGIC CROSS SECTIONS
Figure 5 – SEISMIC DESIGN VALUES
Figure 6 - RETAINING WALL DRAINAGE
Figure 7 - SPECIFICATIONS FOR CALTRANS CLASS II PERMEABLE MATERIAL

Appendix A: Figure 1, Regional Geologic Map
Figure 2, Regional Fault Map
Figure 3, Landslide Hazards Map
Figure 4, Seismic Safety Study Map

FIGURE 1
VICINITY MAP

FIGURE 2
GEOLOGIC MAP SHOWING TEST PIT LOCATIONS

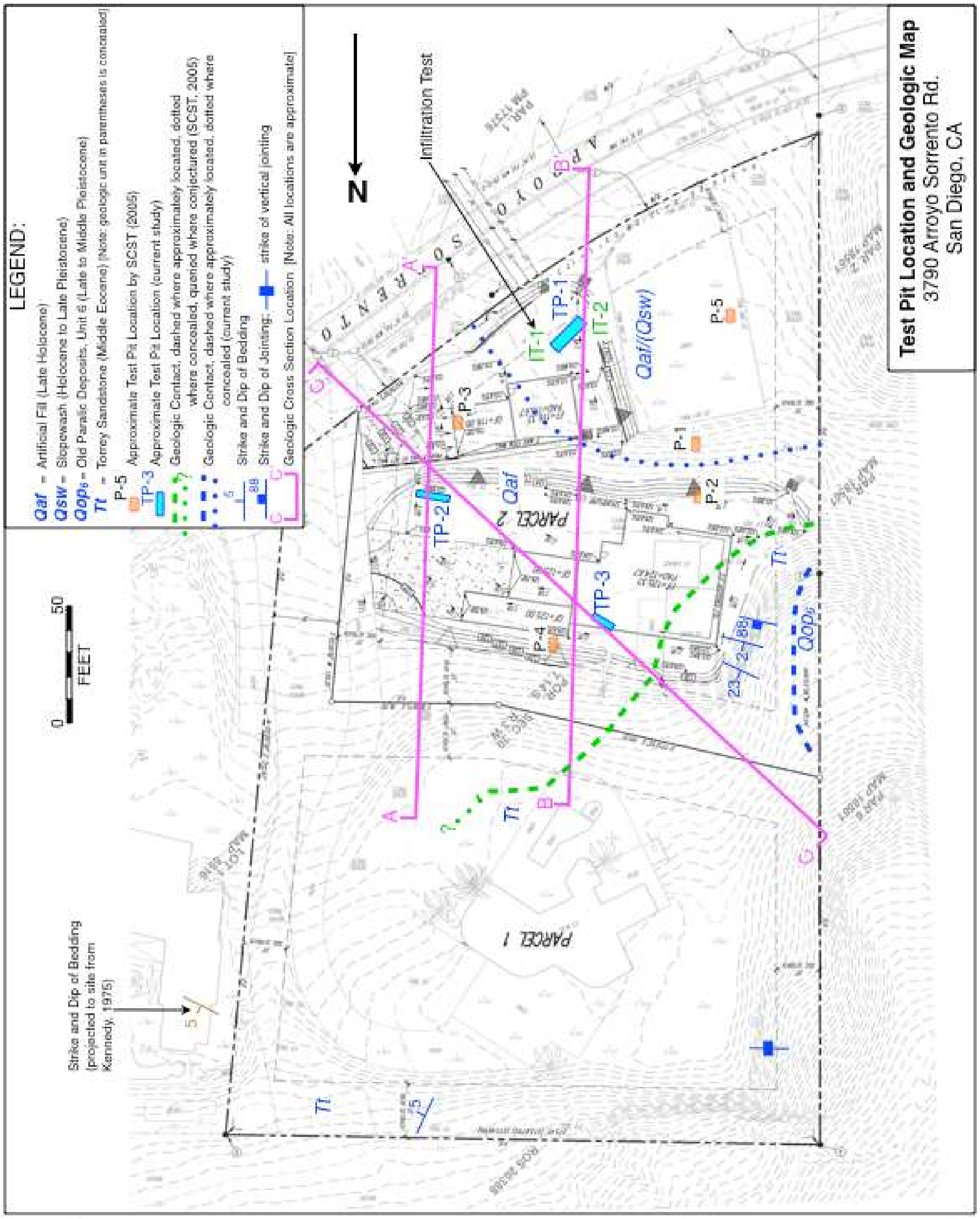


FIGURE 3
TEST PIT LOGS

TEST PIT TP-1

Depth Feet	Soil Description	Lab Results
0-3½ N 0-2½ S	**FILL:** Sand, medium- to coarse-grained (SP-SW/SM), slightly silty to silty, mottled dark brown and brown, common roots and rootlets, loose to medium dense, moist	**@1'** **D.D.=109 pcf** **M.C.=8.5%**
3½-4¾ N 2½-6 S	**SLOPE WASH**: Sand, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), light to medium brownish gray, few roots and rootlets, loose to medium dense, moist. @ ~4.5' & 5.5', two 3/4' & 1/4' lenses of very moist, medium dense, light brown, slightly silty sand, medium-to coarse-grained	**@2.5'** **D.D.=110 pcf** **M.C.=6.1%**
4¾-10 N 6-10 S	**TORREY SANDSTONE**: Sandstone, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), dark brown grading downward to brown, weathered, friable, medium dense to dense, slightly moist to moist	**@4.75'** **D.D.=99.8 pcf** **M.C.=3.9%**

Bottom of Test Pit = 10 feet
No Groundwater or Seepage
IT-1 on east side of pit, IT-2 on west side of pit

TEST PIT TP-2

Depth Feet	Soil Description	Lab Results
0-4 N 0-6 S	**FILL**: Sand, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), brown, numerous roots and rootlets to 1", loose to medium dense, moist	**@ 2.5'** **D.D. = 97.8 pcf** **M.C.=8.2%**
4-6½ N 6-6½ S	**TORREY SANDSTONE**: Sandstone, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), light to medium brown, weathered, friable, medium dense to dense, slightly moist to moist	**@ 5'** **D.D. = 106.2 pcf** **M.C. = 3.5%**

Bottom of Test Pit = 6½ feet
No Groundwater or Seepage

FIGURE 3
TEST PIT LOGS
(Continued)

TEST PIT TP-3

Depth Feet	Soil Description	Lab Results
0-2½	**FILL**: Sand, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), mottled brown and dark brown, numerous roots and rootlets to 1½", some white shell fragments (?), loose to medium dense, moist	**@2'** **D.D.=106.8** **M.C.=11.1%**
2½-6½	**TORREY SANDSTONE**: Sandstone, medium- to coarse-grained, slightly silty to silty (SP-SW/SM), light to medium brown, weathered, friable, few roots and rootlets, medium dense to dense, slightly moist to moist	**@3'** **M.C.=3.8%**

Bottom of Test Pit = 6½ feet
No Groundwater or Seepage

Notes: Test pits machine excavated, logged, and backfilled on February 6, 2019
All measurements taken from existing pad grade at top of test pit

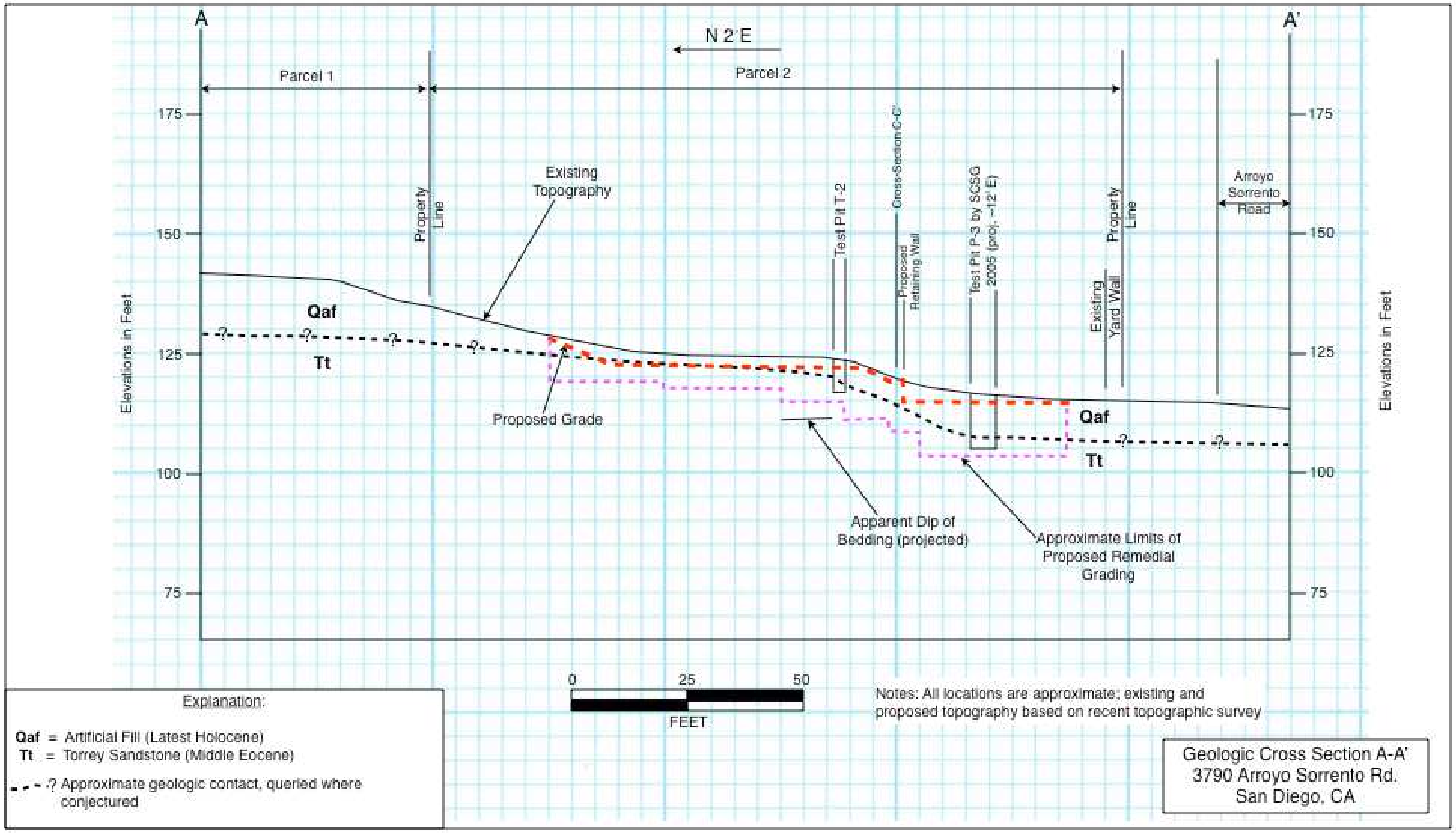

A
A'
N 2°E
Parcel 1
Parcel 2
175
150
125
100
75
Elevations in Feet
Property Line
Existing Topography
Test Pit T-2
Cross-Section C-C'
Proposed Retaining Wall
Test Pit P-3 by SCSG 2005 (proj. ~12' E)
Existing Yard Wall
Property Line
Arroyo Sorrento Road
Qaf
Tt
?
Proposed Grade
Apparent Dip of Bedding (projected)
Approximate Limits of Proposed Remedial Grading
0
25
50
FEET
Explanation:
Qaf = Artificial Fill (Latest Holocene)
Tt = Torrey Sandstone (Middle Eocene)
? Approximate geologic contact, queried where conjectured
Notes: All locations are approximate; existing and proposed topography based on recent topographic survey
Geologic Cross Section A-A'
3790 Arroyo Sorrento Rd.
San Diego, CA

FIGURE 4A

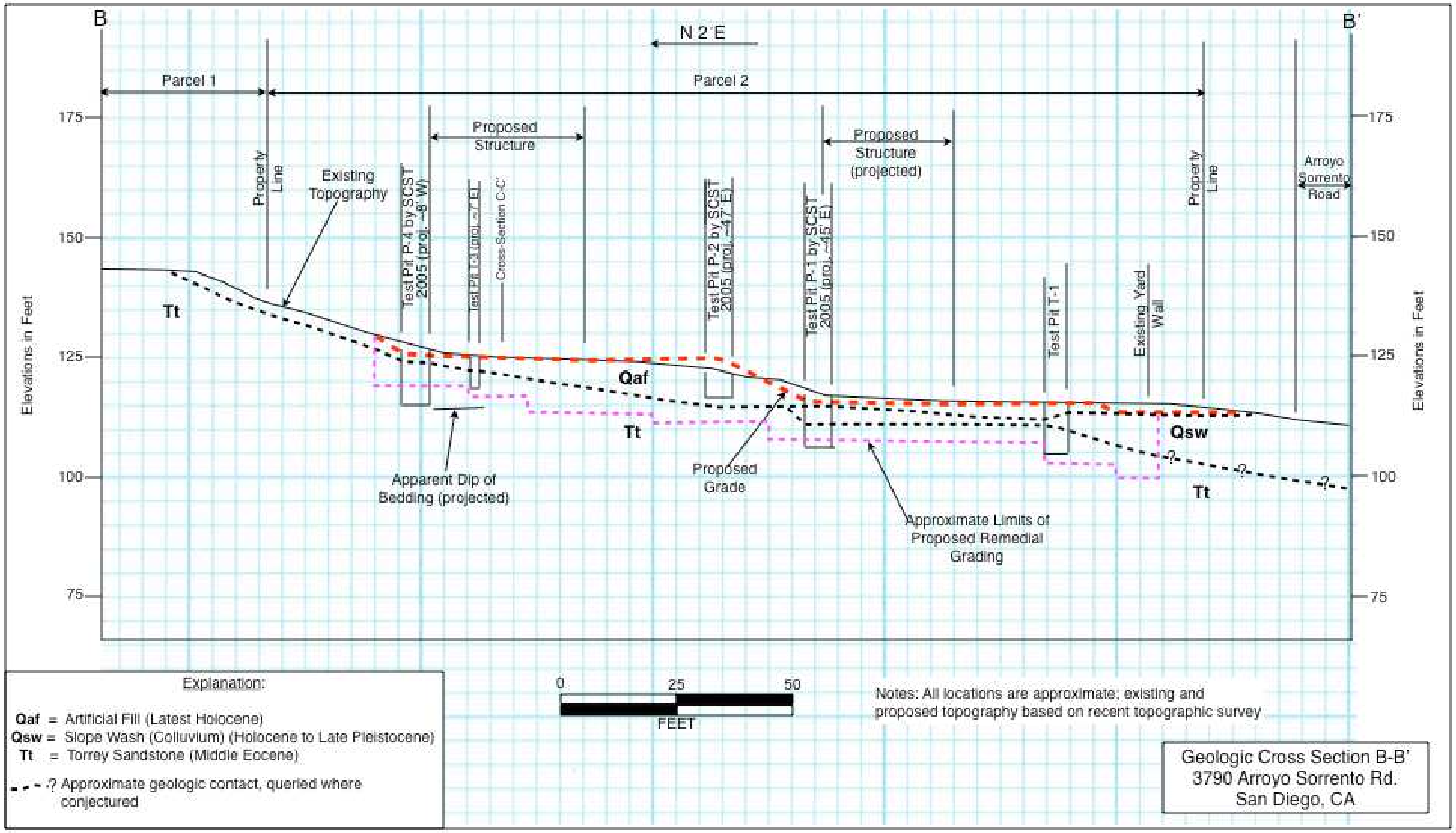
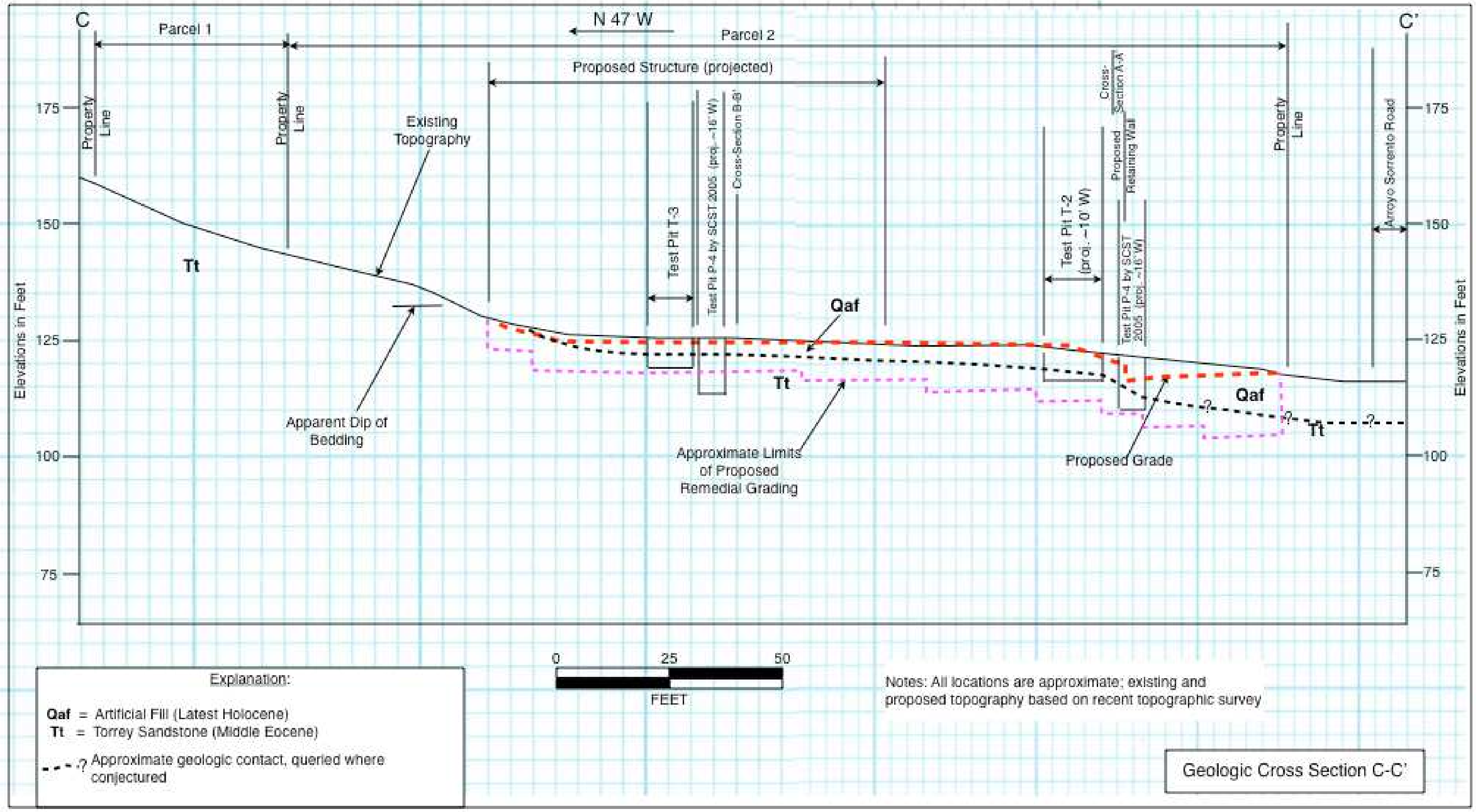

B
B'
N 2˚E
Parcel 1
Parcel 2
Property Line
Existing Topography
Test Pit P-4 by SCST 2005 (proj. ~8' W)
Proposed Structure
Test Pit T-3 (proj. ~7' E)
Cross-Section C-C'
Test Pit P-2 by SCST 2005 (proj. ~47' E)
Test Pit P-1 by SCST 2005 (proj. ~45' E)
Proposed Structure (projected)
Test Pit T-1
Existing Yard Wall
Property Line
Arroyo Sorrento Road
175
150
125
100
75
Elevations in Feet
Tt
Qaf
Tt
Qsw
?
?
?
Tt
Apparent Dip of Bedding (projected)
Proposed Grade
Approximate Limits of Proposed Remedial Grading
Explanation:
Qaf = Artificial Fill (Latest Holocene)
Qsw = Slope Wash (Colluvium) (Holocene to Late Pleistocene)
Tt = Torrey Sandstone (Middle Eocene)
? Approximate geologic contact, queried where conjectured
0
25
50
FEET
Notes: All locations are approximate; existing and proposed topography based on recent topographic survey
Geologic Cross Section B-B'
3790 Arroyo Sorrento Rd.
San Diego, CA

FIGURE 4B



Notes: All locations are approximate; existing and proposed topography based on recent topographic survey

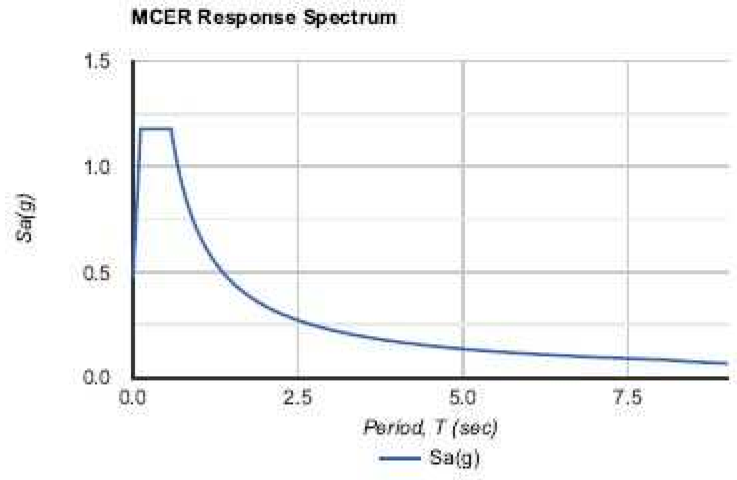
FIGURE 4C

FIGURE 5

SEISMIC DESIGN COEFFICIENTS

Date	2/5/2019, 12:11:51 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	**Value**	**Description**
S_S	1.121	MCE_R ground motion. (for 0.2 second period)
S_1	0.433	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.179	Site-modified spectral acceleration value
S_{M1}	0.678	Site-modified spectral acceleration value
S_{DS}	0.786	Numeric seismic design value at 0.2 second SA
S_{D1}	0.452	Numeric seismic design value at 1.0 second SA


MCER Response Spectrum

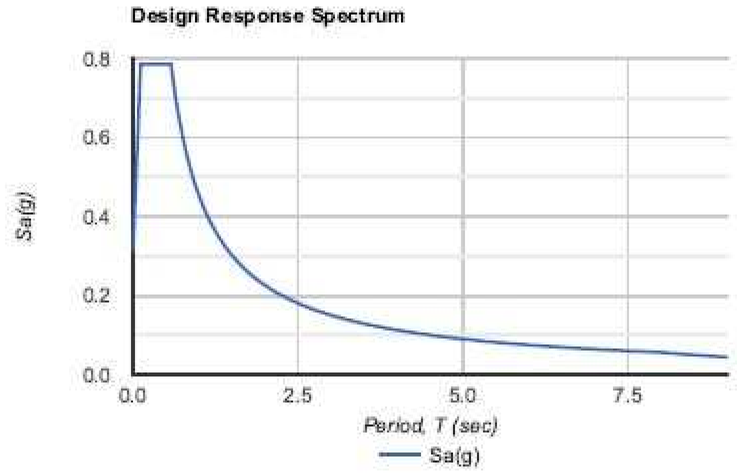
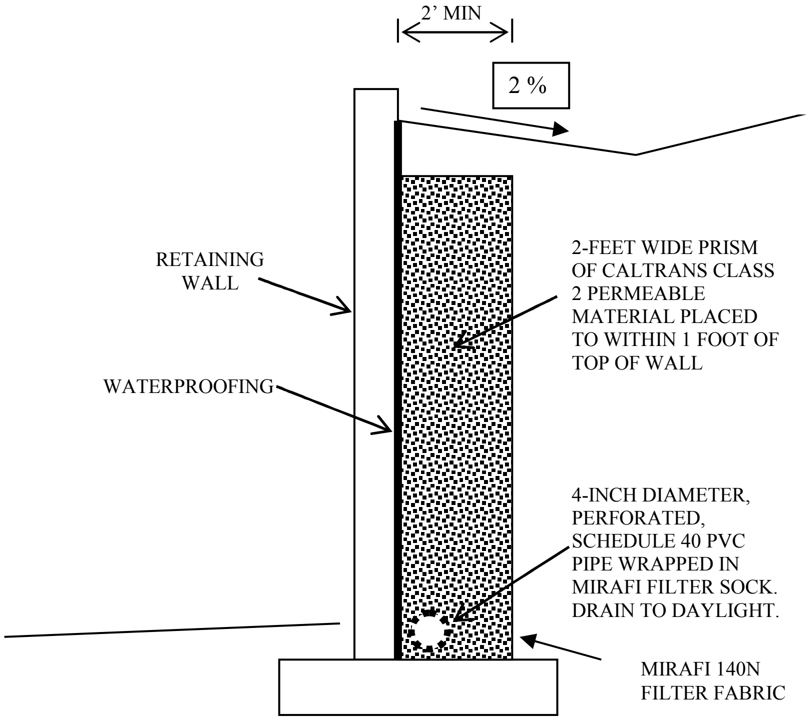

Design Response Spectrum

FIGURE 6
RETAINING WALL DRAINAGE



The percentage composition by weight of Class II Permeable Material should comply with the following graduation requirements:

Sieve Size	Percentage Passing
1"	100
3/4"	90–100
3/8"	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

Class 2 Permeable Material should also have a sand equivalent value of at least 75.

APPENDIX A – GEOLOGIC MAPS & FIGURES

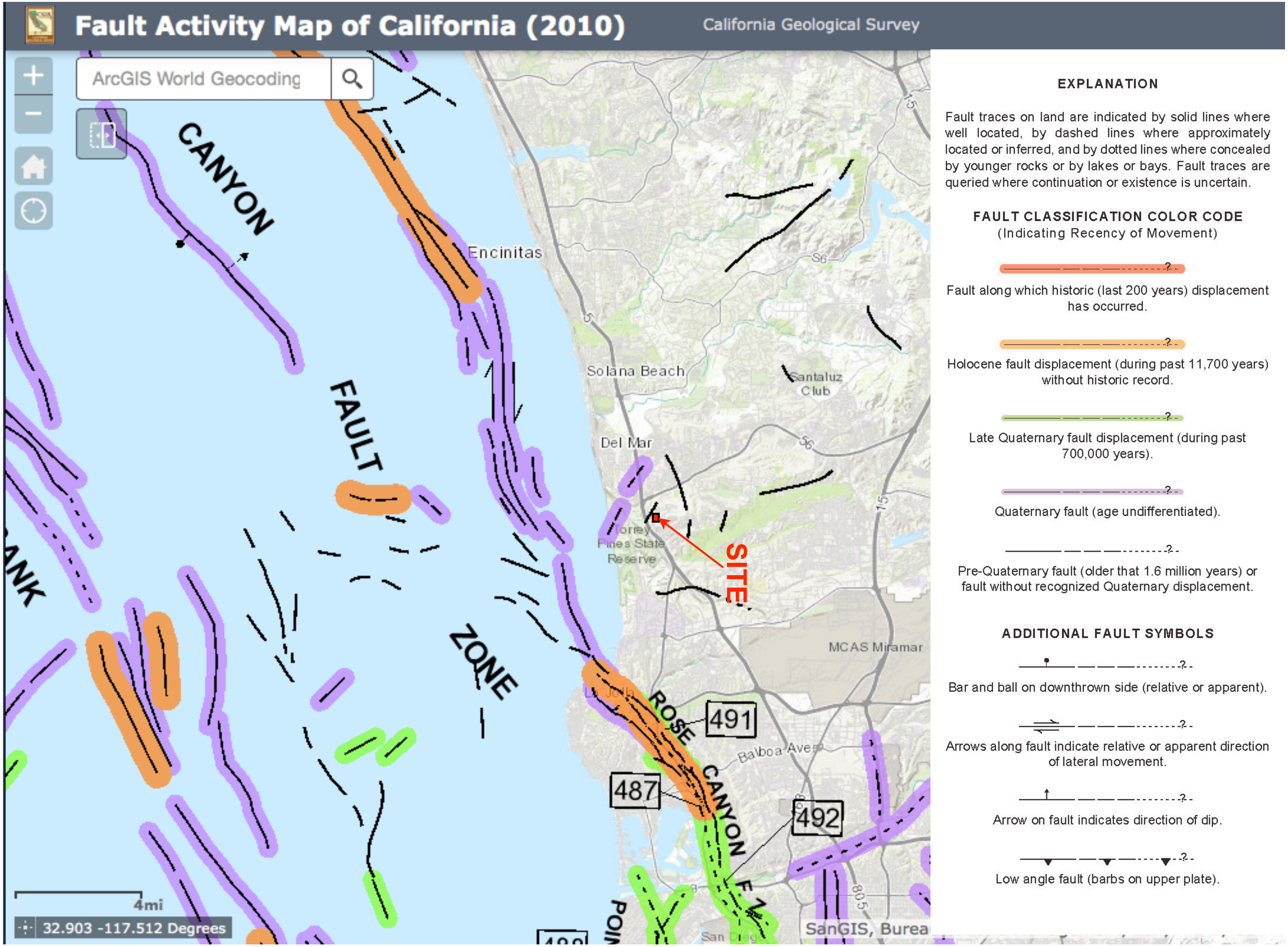
Reference: Excerpt of Fault Activity Map of California, compiled by Jennings and Bryant (2010)

N

Regional Fault Map

3790 Arroyo Sorrento Road

San Diego, CA



Fault Activity Map of California (2010)

California Geological Survey

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain.

FAULT CLASSIFICATION COLOR CODE

(Indicating Recency of Movement)

Fault along which historic (last 200 years) displacement has occurred.

Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

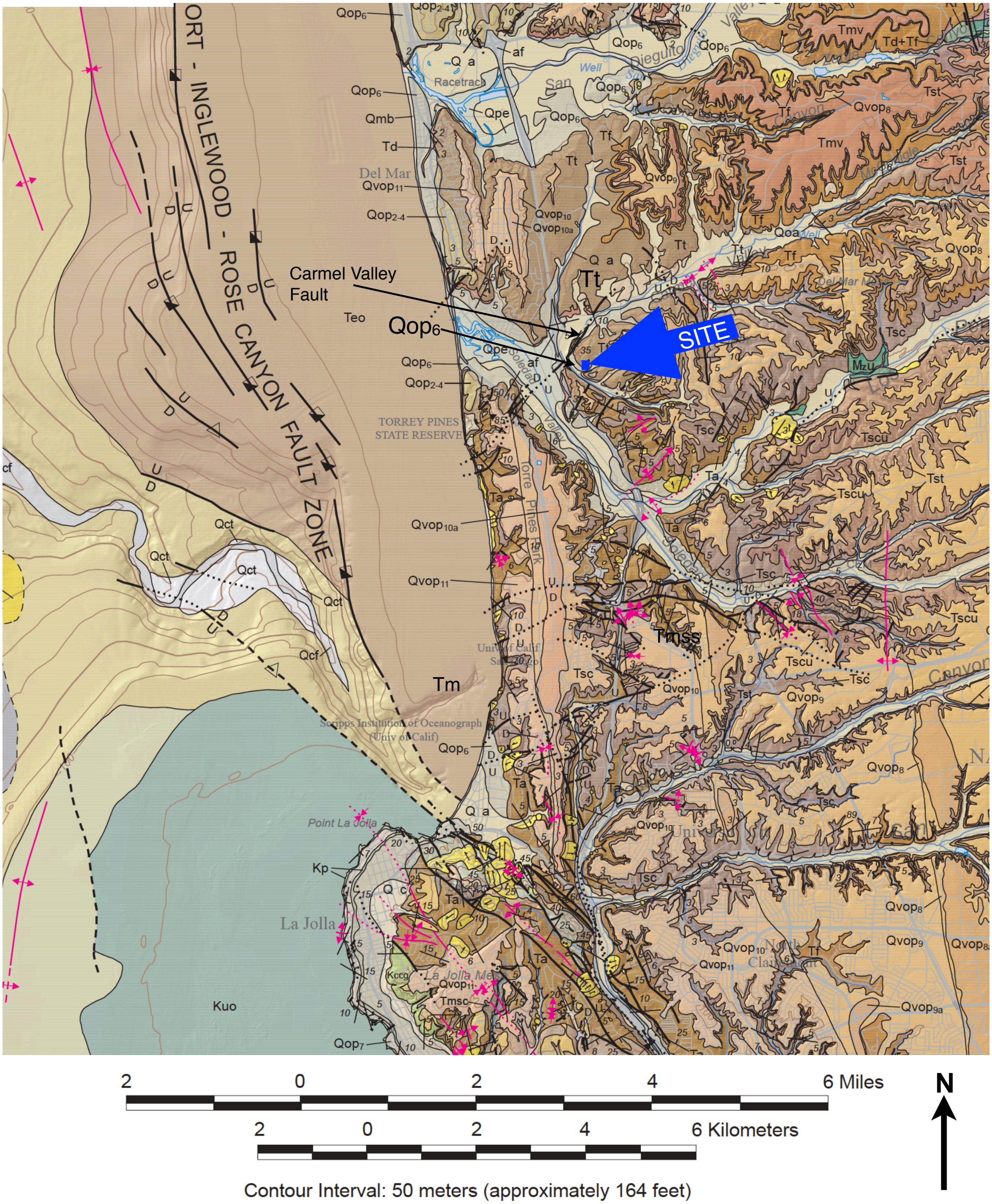
Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate).

EXPLANATION OF LOCAL GEOLOGIC MAP UNITS:

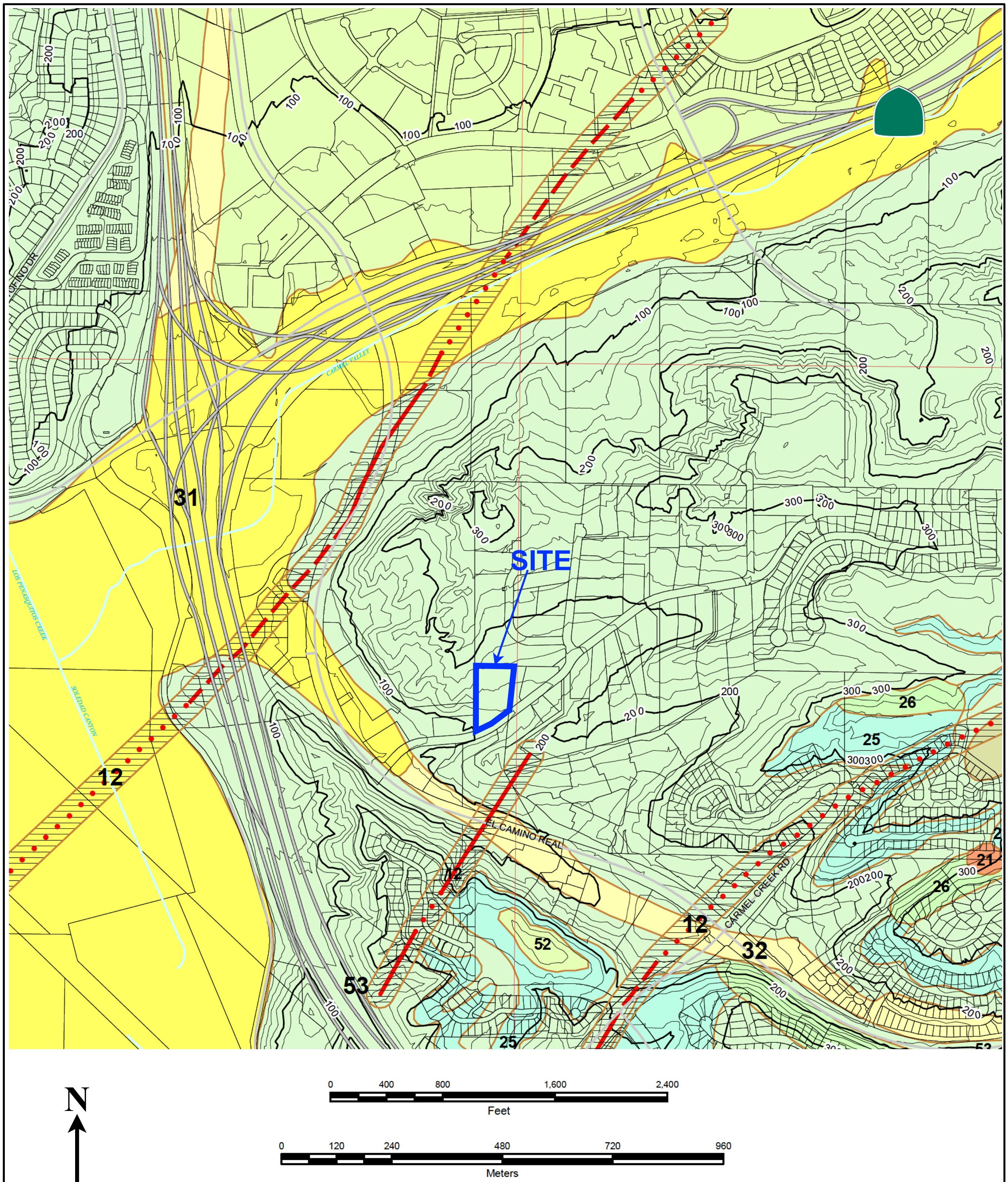
Qoa	Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)
Qop$_6$	Old paralic deposits, Unit 6 (late to middle Pleistocene)
Tt	Torrey Sandstone (middle Eocene)



Contour Interval: 50 meters (approximately 164 feet)
Bathymetric Contour Interval: 50 meters (approximately 164 feet)

Excerpt of the *Geologic Map of the San Diego 30' x 60' Quadrangle, California* by Kennedy and Tan: California Geological Survey, scale 1:100,000, dated 2008.

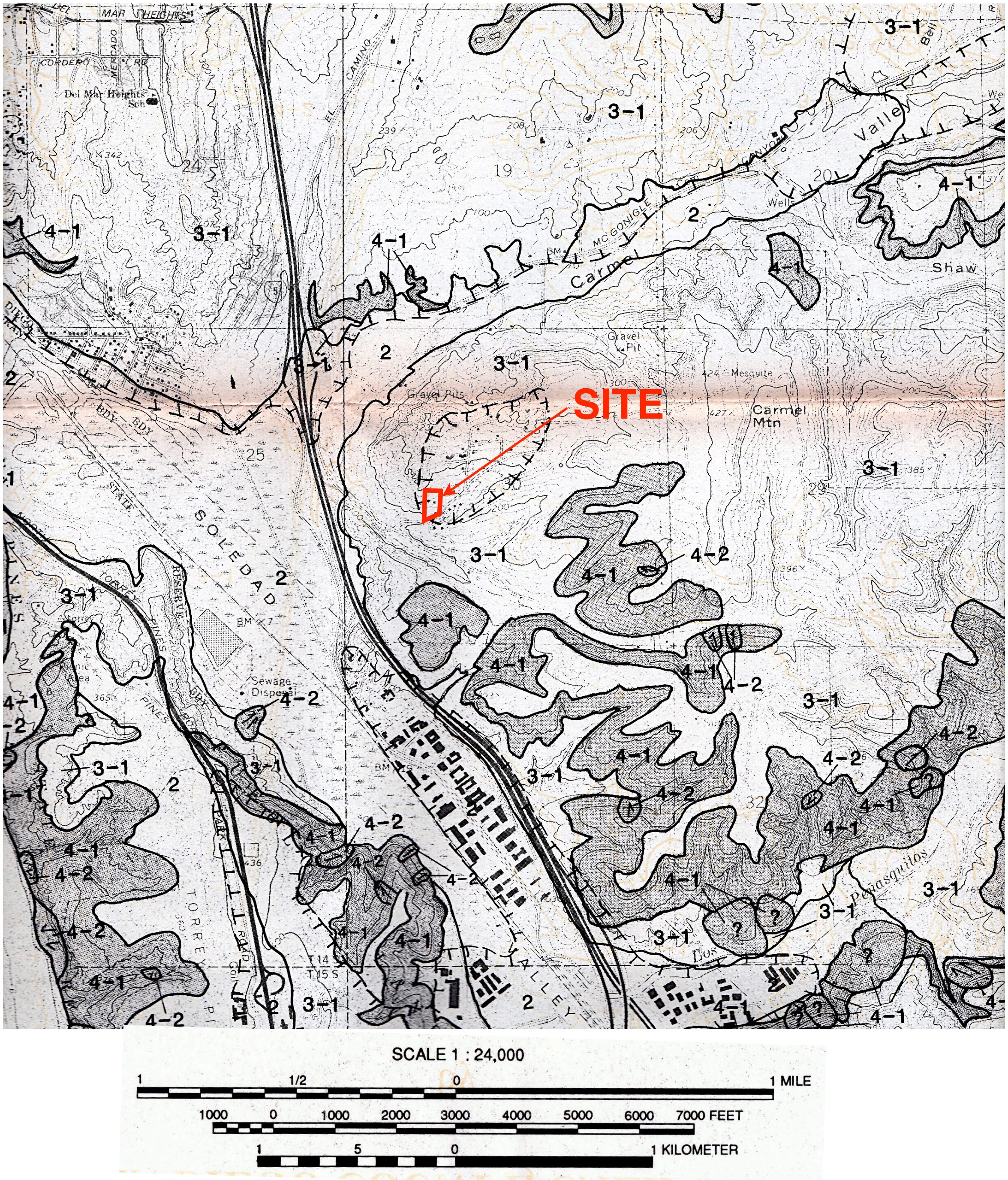
Regional Geologic Map
3790 Arroyo Sorrento Road
San Diego, CA



City of San Diego
SEISMIC SAFETY STUDY
Geologic Hazards and Faults

Reference: Excerpt of Seismic
Safety Study Map Sheet 38 by City
of San Diego (2008)

SEISMIC SAFETY STUDY MAP
3790 Arroyo Sorrento Road
San Diego, CA



Excerpt from: *LANDSLIDE HAZARD IDENTIFICATION MAP NO. 35 (PLATE 35G-DEL MAR QUADRANGLE) LANDSLIDE HAZARDS IN THE NORTHERN PART OF THE SAN DIEGO METROPOLITAN AREA, SAN DIEGO COUNTY*, DMG OPEN-FILE REPORT 95-04, compiled by Siang S. Tan and Desmond G. Giffen, California Department of Conservation, Division of Mines and Geology (1995)

N ↑

RELATIVE LANDSLIDE SUSCEPTIBILITY AREAS

1	2	3-1	3-2	4-1	4-2
Least Susceptible	Marginally Susceptible	Generally Susceptible		Most Susceptible	

---------------------------------Increasing landslide susceptibility------------------------------>

Landslide Hazards Map
3790 Arroyo Sorrento Road
San Diego, CA

SDVOSB . DVBE

SCST, Inc.
Corporate Headquarters
6280 Riverdale Street
San Diego, CA 92120
T 877.215.4321
P 619.280.4321
F 619.280.4717
W www.scst.com

July 16, 2018

SCST No. 0511139
Report No. 2

Ms. Jill Frederick
3790 Arroyo Sorrento Road
San Diego, California

Subject: UPDATE SEISMIC DESIGN RECOMMENDATIONS
FREDERICK RESIDENCE LOT SPLIT
3790 ARROYO SORRENTO ROAD
SAN DIEGO, CALIFORNIA

References: 1. SCST, Inc. (2005), *Report of Preliminary Geotechnical Investigation, Proposed Frederick Residential Lot Split, 3790 Arroyo Sorrento Drive, San Diego, California,* SCST No. 0511139-01, dated August 10

Dear Ms. Frederick:

SCST, Inc. (SCST) is pleased to provide update geotechnical recommendations for the subject project. The project is located at 3790 Arroyo Sorrento Road in the city of San Diego, California. We understand the project is a proposed split of the existing residential lot. SCST performed a geotechnical investigation for the subject property in August of 2005 (Reference 1). Since the time the referenced report was published, Seismic Design criteria has changed. Our updated Seismic Design Recommendations are presented below.

CBC Seismic Design Parameters

A geologic hazard likely to affect the project is ground shaking as a result of movement along an active fault zone in the vicinity of the subject site. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2016 CBC are presented below:

Site Coordinates: Latitude 32.92672°
Longitude -117.23399°
Site Class: D
Site Coefficients, F_a = 1.051
F_v = 1.567
Mapped Spectral Response Acceleration at Short Periods, S_s = 1.122g
Mapped Spectral Response Acceleration at 1-Second Period, S_1 = 0.433g
Design Spectral Acceleration at Short Period, S_{DS} = 0.786g
Design Spectral Acceleration at 1-Second Period, S_{D1} = 0.452g
Site Peak Ground Acceleration, PGA_M = 0.486g

Based on our review, the other conclusions and recommendations contained in the referenced geotechnical report are still valid and applicable to the project.

We appreciate the opportunity to be of service to you on this project. If you have any questions, comments, or require additional information, please call our office at (619) 280-4321.

Respectfully submitted,
SCST, INC.

REGISTERED PROFESSIONAL GEOLOGIST
DOUGLAS A. SKINNER
No. 2472
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Douglas A. Skinner, CEG 2472
Senior Geologist

DAS:hu

(1) Addressee via e-mail: jim@rafpacificagroup.com

SOUTHERN CALIFORNIA SOIL & TESTING

SC
ST

PHONE
(619) 280-4321
TOLL FREE
(877) 215-4321
FAX
(619) 280-4717

P.O. Box 600627
San Diego, CA 92160-0627
6280 Riverdale Street
San Diego, CA 92120
www.scst.com

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION FREDERICK RESIDENCE LOT SPLIT 3790 ARROYO SORRENTO DRIVE SAN DIEGO, CALIFORNIA

PREPARED FOR:

MS. JIL FREDERICK
C/O MR. CHRIS SIMPSON
SIMPSON CONSULTING GROUP, INC.
10054 PROSPECT AVENUE, SUITE B
SANTEE, CALIFORNIA 92071

PREPARED BY:

SOUTHERN CALIFORNIA SOIL & TESTING, INC.
6280 RIVERDALE STREET
SAN DIEGO, CALIFORNIA 92120

Providing Professional Engineering Services Since 1959

SOUTHERN CALIFORNIA SOIL & TESTING

SC
ST

PHONE
(619) 280-4321
TOLL FREE
(877) 215-4321
FAX
(619) 280-4717

P.O. Box 600627
San Diego, CA 92160-0627
6280 Riverdale Street
San Diego, CA 92120
www.scst.com

August 10, 2005

SCS&T No. 0511139
Report No. 1

Ms. Jill Frederick
c/o Mr. Chris Simpson
Simpson Consulting Group, Inc.
10054 Prospect Avenue, Suite B
Santee, California 92071

Subject: REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION
FREDERICK RESIDENCE LOT SPLIT
3790 ARROYO SORRENTO DRIVE
SAN DIEGO, CALIFORNIA

Dear Ms. Frederick:

In accordance with your request, we have completed a preliminary geotechnical investigation for the subject project. The findings and recommendations of our study are presented herewith.

In general, the findings of this study indicate that the site is suitable for the proposed development provided the recommendations presented herein are implemented. The main geotechnical conditions affecting the proposed development are the presence of loose to medium dense fill and slopewash deposits, as well as moderately compressible formational deposits. These conditions will require special site preparation and foundation considerations as described herein.

Should you have any questions regarding this document or if we may be of further service, please contact our office at your convenience.

Andrew Neauhaus
scst.com

Very truly yours,
SOUTHERN CALIFORNIA SOIL & TESTING, INC.

Daniel B. Adler, RCE 36037
Vice President

Douglas A. Skinner, PG 7971
Project Geologist

dskinner
@ scst.com

DBA:DAS:sd

(6) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

ATTACHMENTS

FIGURES

PLATES

APPENDICES

SOUTHERN CALIFORNIA SOIL & TESTING

SC
ST

PHONE
(619) 280-4321
TOLL FREE
(877) 215-4321
FAX
(619) 280-4717

P.O. Box 600627
San Diego, CA 92160-0627
6280 Riverdale Street
San Diego, CA 92120
www.scst.com

PRELIMINARY GEOTECHNICAL INVESTIGATION

FREDERICK RESIDENCE LOT SPLIT
3790 ARROYO SORRENTO DRIVE
SAN DIEGO, CALIFORNIA

1. INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of our preliminary geotechnical investigation for the proposed residential development located at 3790 Arroyo Sorrento Drive in the city of San Diego County, California. The site location is shown on Figure No. 1.

We understand that it is proposed to split an existing residential lot. It is likely that a new one and/or two-story residential structure of wood-frame construction will be built at the site. Shallow foundations and conventional concrete slab-on-grade floor systems are anticipated. Grading is expected to be relatively minor and consist of cuts and fills less than 5 feet from existing grades.

To assist in the preparation of this report, we were provided with a topographic survey prepared by Indigo Surveying, Inc., July 22, 2005. Site configuration, topography and the approximate locations of our subsurface excavations are shown on Plate No. 1.

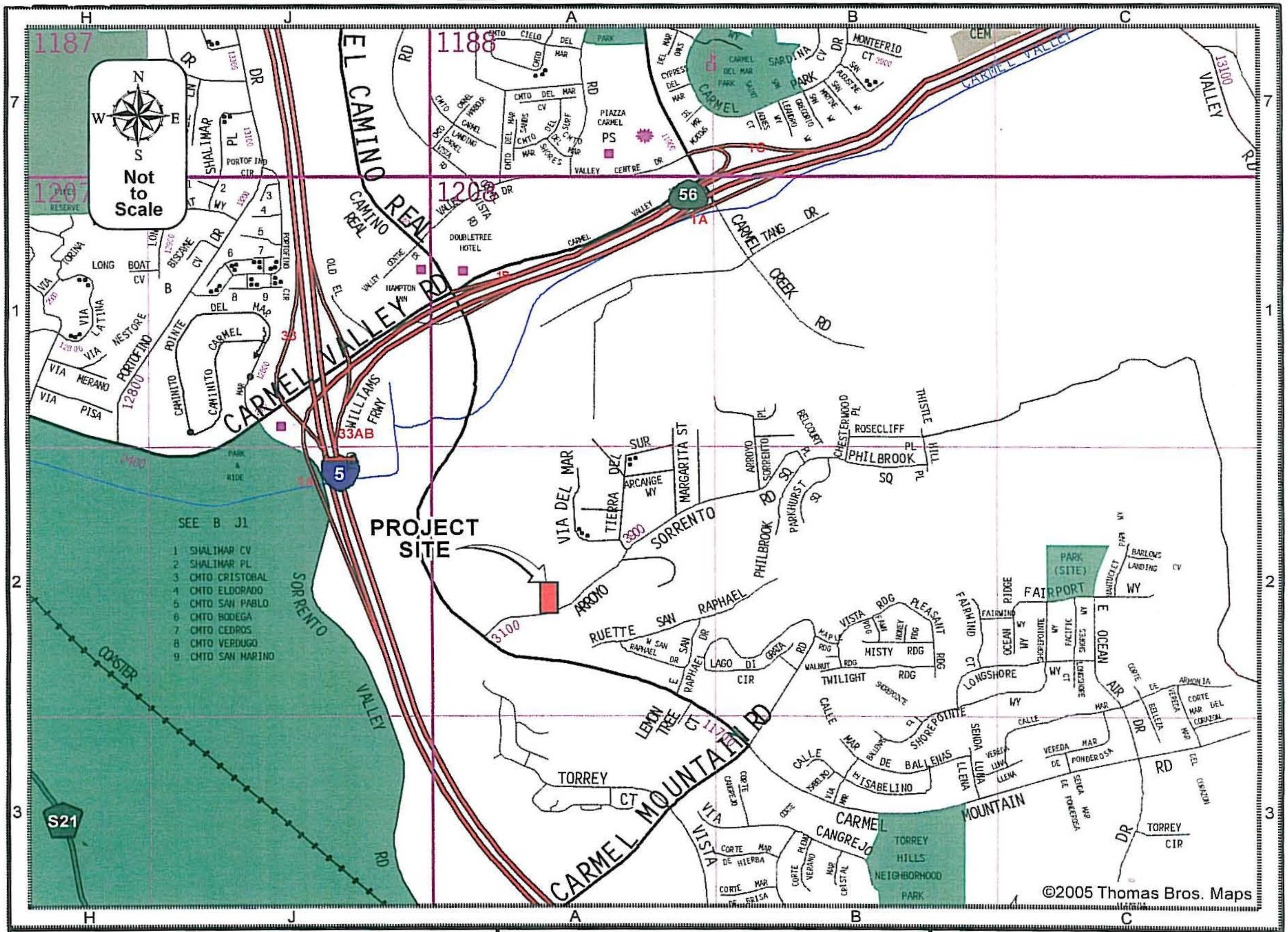
2. PROJECT SCOPE

The investigation consisted of: surface reconnaissance, subsurface exploration, disturbed and undisturbed sampling, laboratory testing, analysis of the field and laboratory data, review of relevant geologic literature and preparation of this report. More specifically, the intent of this analysis was to:

a) Explore the subsurface conditions to the depths influenced by the proposed construction.

b) Evaluate the pertinent engineering properties of the various strata that may influence the proposed construction, including bearing capacities, expansion characteristics and settlement potentials.

c) Describe the general geology at the site, including possible geologic hazards that could have an effect on development.



©2005 Thomas Bros. Maps

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

SITE LOCATION MAP
Frederick Residence
San Diego, California

Job No.: 0511139-1
Figure : 1

d) Address potential construction difficulties that may be encountered due to subsurface conditions, or groundwater, and provide preliminary recommendations concerning these conditions.

e) Develop geotechnical engineering criteria for site preparation and grading.

f) Recommend an appropriate foundation system for the type of structure anticipated and develop geotechnical engineering design criteria for the recommended foundation system.

3. FINDINGS

3.1 SITE DESCRIPTION

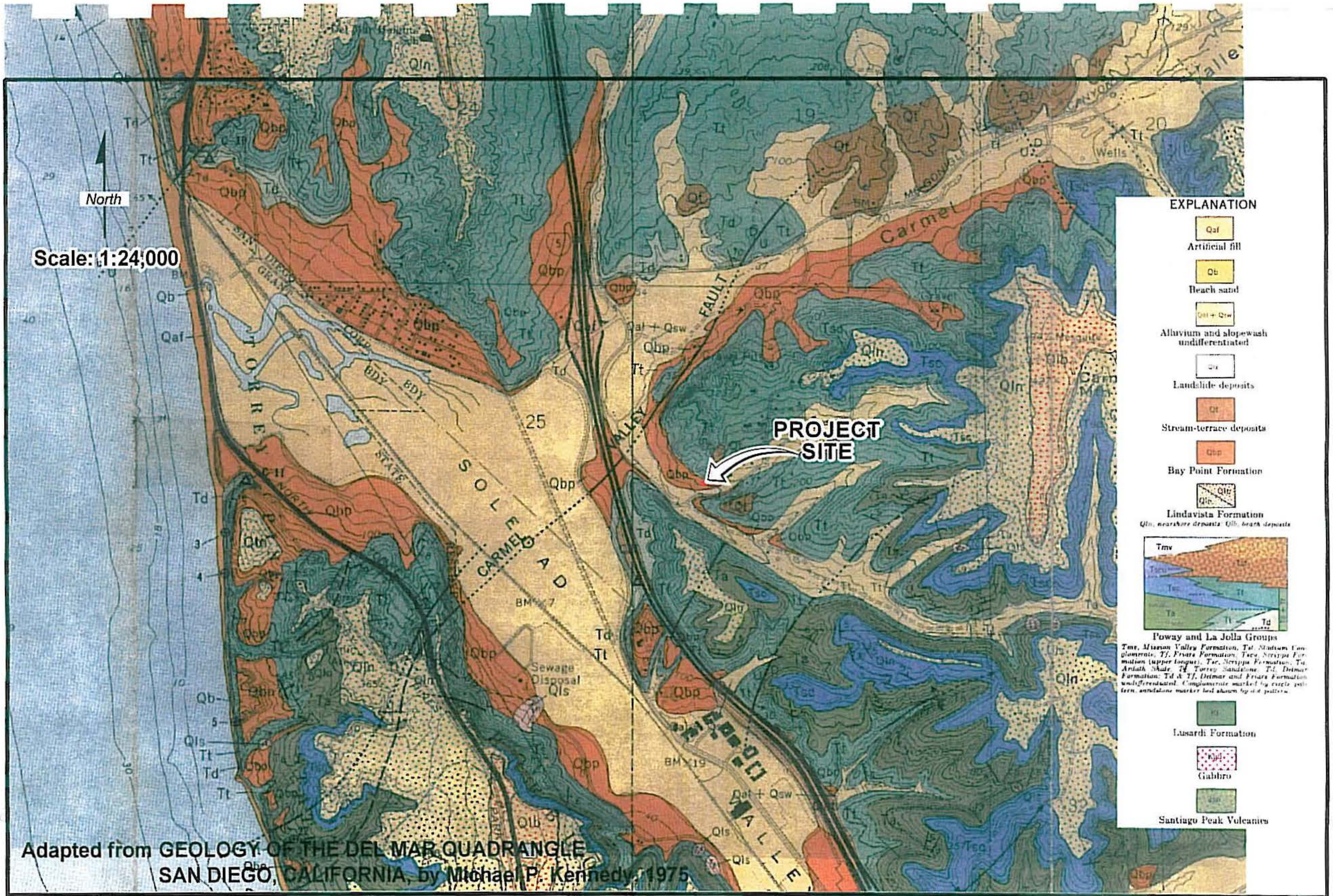
The project site is located north of Arroyo Sorrento Road in the Sorrento Hills area of San Diego, California. The site is bordered by undeveloped land to the north and northwest, commercial development to the southwest, similar residential development to the east, and Arroyo Sorrento Road to the south. A single-family residence and a pool occupy the northern portion of the site. A detached warehouse and garage occupy the central portion of the property. Existing improvements associated with the residence include concrete driveways, concrete walkways, concrete steps and small retaining walls. Landscaping is characterized by lawns, shrubs, and native vegetation.

Site topography generally slopes gently to steeply toward the south. A cut/fill pad, with associated cut and fill slopes, characterizes the northern portion of the site. A cut/fill pad, with associated cut and fill slopes and gently sloping terrain, also characterizes the southern portion of the site, which is occupied by the warehouse and garage. Slope inclinations generally range from about 2:1 to 1.5:1 (horizontal to vertical). The site ranges in elevation from approximately 120 feet above mean sea level (MSL) in the south to approximately 200 feet above MSL in the north.

3.2 SITE GEOLOGY

3.2.1 Geologic Setting and Subsurface Conditions

The project site is located within the Peninsular Ranges Geomorphic Province of California and the Coastal Plains Physiographic Province of San Diego County. The site is underlain by artificially-placed fill soils and Tertiary-aged sedimentary deposits. Detailed descriptions of each of the materials encountered are presented on the test pit logs, while a brief summary is presented below. A portion of the geologic map by Kennedy (1975) showing local geology is included as Figure No. 2.



Adapted from GEOLOGY OF THE DEL MAR QUADRANGLE SAN DIEGO, CALIFORNIA, by Michael P. Kennedy, 1975

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

LOCAL GEOLOGY MAP
Frederick Residence
San Diego, California

Job Number: 0511139-1

Figure: 2

Fill Soils: Fill soils were encountered in all the test pits. The fill generally consists of light gray brown to gray brown, humid to moist, loose to medium dense, silty sand. Minor amounts of trash and debris including plastic, wood, and concrete fragments were observed within the fill soil. The fill was encountered to a maximum depth of 9 feet in Pit No. 3.

Slopewash: Quaternary slopewash was observed in Pit 5 to a depth of 5 feet. These deposits consisted of gray brown, humid to moist, loose, silty sand.

Torrey Sandstone: Tertiary sedimentary deposits assigned to the Torrey Sandstone were observed in all of our test pits with the exception of Test Pit 2. Tan sandstones typical of the Torrey Sandstone Formation were also exposed in the on-site cut slopes. These deposits generally consist of highly weathered, tan brown, moist, loose to medium dense, sandstone

3.2.2 Tectonic Setting

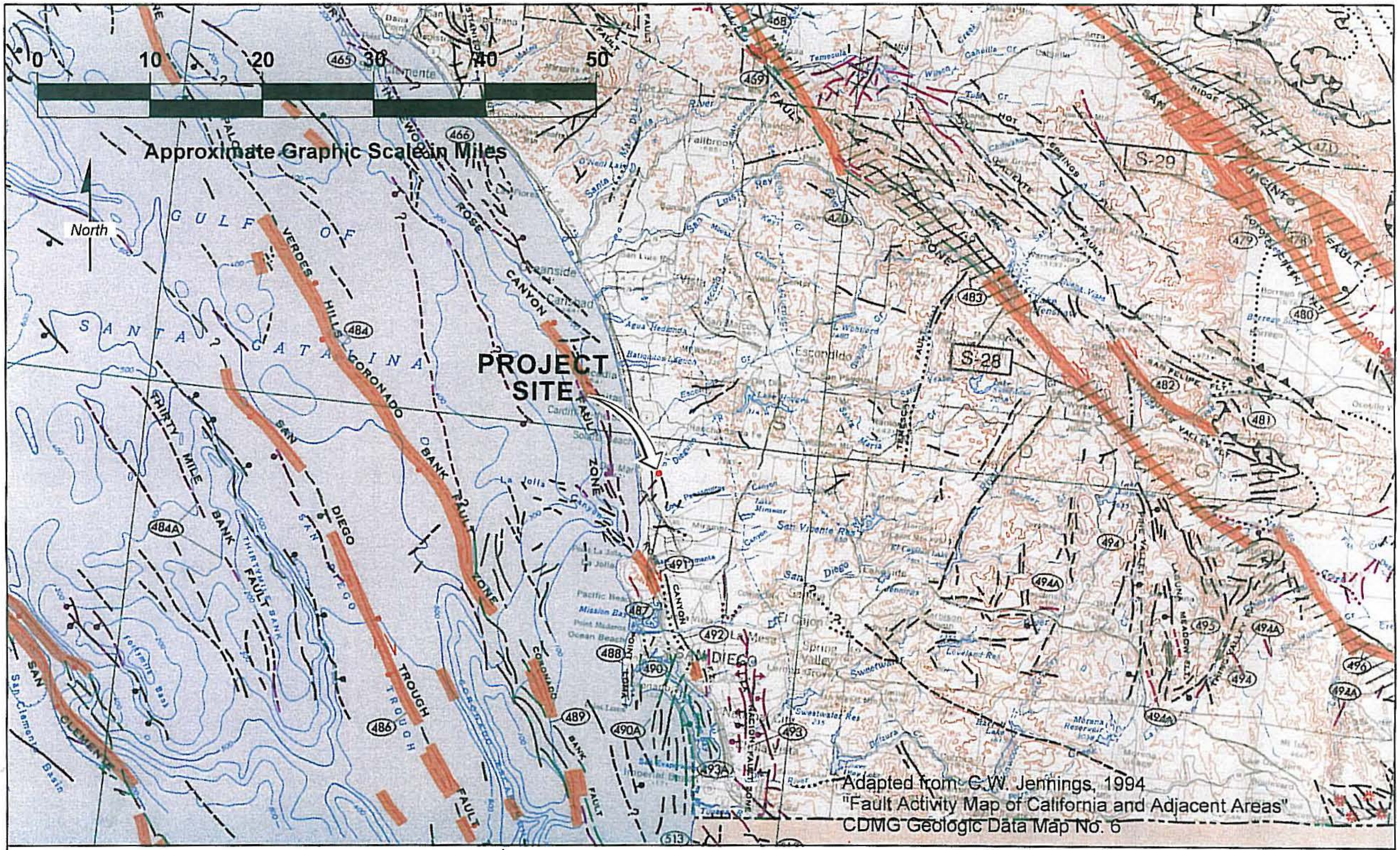
It should be noted that much of Southern California, including the San Diego area, is characterized by a series of Quaternary-age fault zones that typically consist of several individual en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as active, while others are classified as only potentially active according to the criteria of the California Geologic Survey (formerly California Division of Mines and Geology). Active fault zones are those that have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years) while potentially active fault zones have demonstrated movement during the Pleistocene Epoch (11,000 to 1.6 million years before the present) but no movement within the Holocene Epoch.

The site is located approximately 5 kilometers to the east of the Rose Canyon Fault Zone. Other active faults or fault zones in the region that could possibly affect the subject site include the Silver Strand and Spanish Bite Faults to the southeast, the Coronado Bank, San Diego Trough and San Clemente Fault Zones to the west, the Elsinore and San Jacinto Fault Zones to the northeast, and the Agua Blanca and San Miguel Fault Zones to the south. Local faulting is depicted on the geologic map by Kennedy (1975, Figure No. 2), while regional faulting is presented on the fault map by Jennings (1994), included as Figure No. 3.

3.3 GEOLOGIC HAZARDS

3.3.1 General

The site is located within an area that is subject to potential geologic hazards. Specific geologic hazards are discussed below.



Adapted from: C.W. Jennings, 1994
"Fault Activity Map of California and Adjacent Areas"
CDMG Geologic Data Map No. 6

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

REGIONAL FAULT MAP
Frederick Residence
San Diego, California

Job Number: 0511139-1
Figure: 3

3.3.2 Geologic Hazard Categories

As part of our investigation, we have reviewed the City of San Diego Seismic Safety Study. This study is the result of a comprehensive investigation of the city that rates areas according to geological risk potential (nominal, low, moderate and high), and identifies any potential geotechnical hazards and/or describes geomorphic conditions. The site is located in Geologic Hazards Category 53. Category 53 is assigned to areas with level to sloping terrain that might have unfavorable geologic structure. A portion of the City of San Diego Seismic Safety Study, showing the location of the subject site, is presented on Figure 4.

3.3.3 Groundshaking

A geologic hazard likely to affect the site is groundshaking as a result of movement along one of the major active faults mentioned above. Based upon the 2001 edition of the California Building Code, the following seismic design criteria are considered appropriate for the subject site:

Seismic Zone 4: Z = 0.40
Source Fault: Rose Canyon Fault
Seismic Source Type: B
Soil Profile Type: S_D
Distance to Seismic Source: kilometers
Near-Source Factor $N_a = 1.0$
Near-Source Factor $N_v = 1.2$

It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed structures. Probable groundshaking levels at the site could range from slight to strong depending on such factors as the magnitude of the seismic event and the distance to the epicenter.

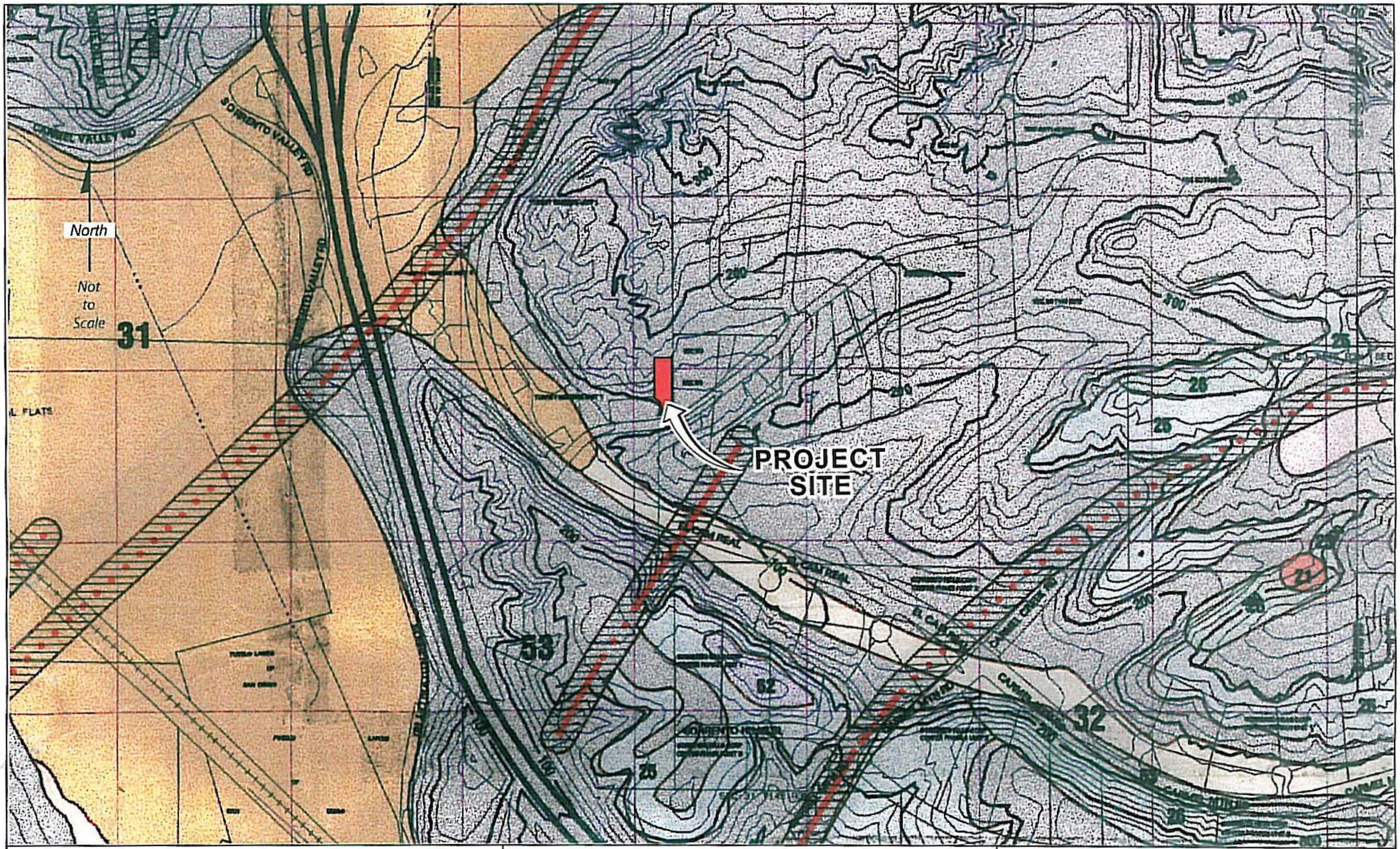
3.3.4 Surface Rupture and Soil Cracking

We are not aware of any evidence of on-site faulting, and the site is not considered susceptible to surface rupture. The risk of soil cracking from distant seismic events is considered to be minimal.

3.3.5 Landsliding

The subject site is located within Subarea Area 3-1. Area 3 is classified as generally susceptible to slope instability, while Subarea 3-1 includes slopes that are at or near their stability limits due to a combination of weak materials and steep slopes.

It should be noted that the Torrey Sandstone deposits exposed at the site are generally not susceptible to gross slope instability. A review of the referenced aerial photographs did not



SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

SEISMIC SAFETY MAP
Frederick Residence
San Diego, California

Job Number: 0511139-1
Figurer: 4

reveal evidence of landsliding on the site. In our opinion, the overall risk of deep-seated slope instability is low to moderate. A portion of Landslide Hazard Identification Map 35G is presented as Figure 5.

3.3.6 Liquefaction

The materials underlying the site are not considered subject to liquefaction due to such factors as soil type and density, as well as lack of shallow groundwater.

3.3.7 Tsunamis

Tsunamis are great sea waves produced by a submarine earthquake or volcanic eruption. Due to the elevation of the site and distance to the shore, tsunamis are not a significant risk with respect to the site.

3.3.8 Flooding

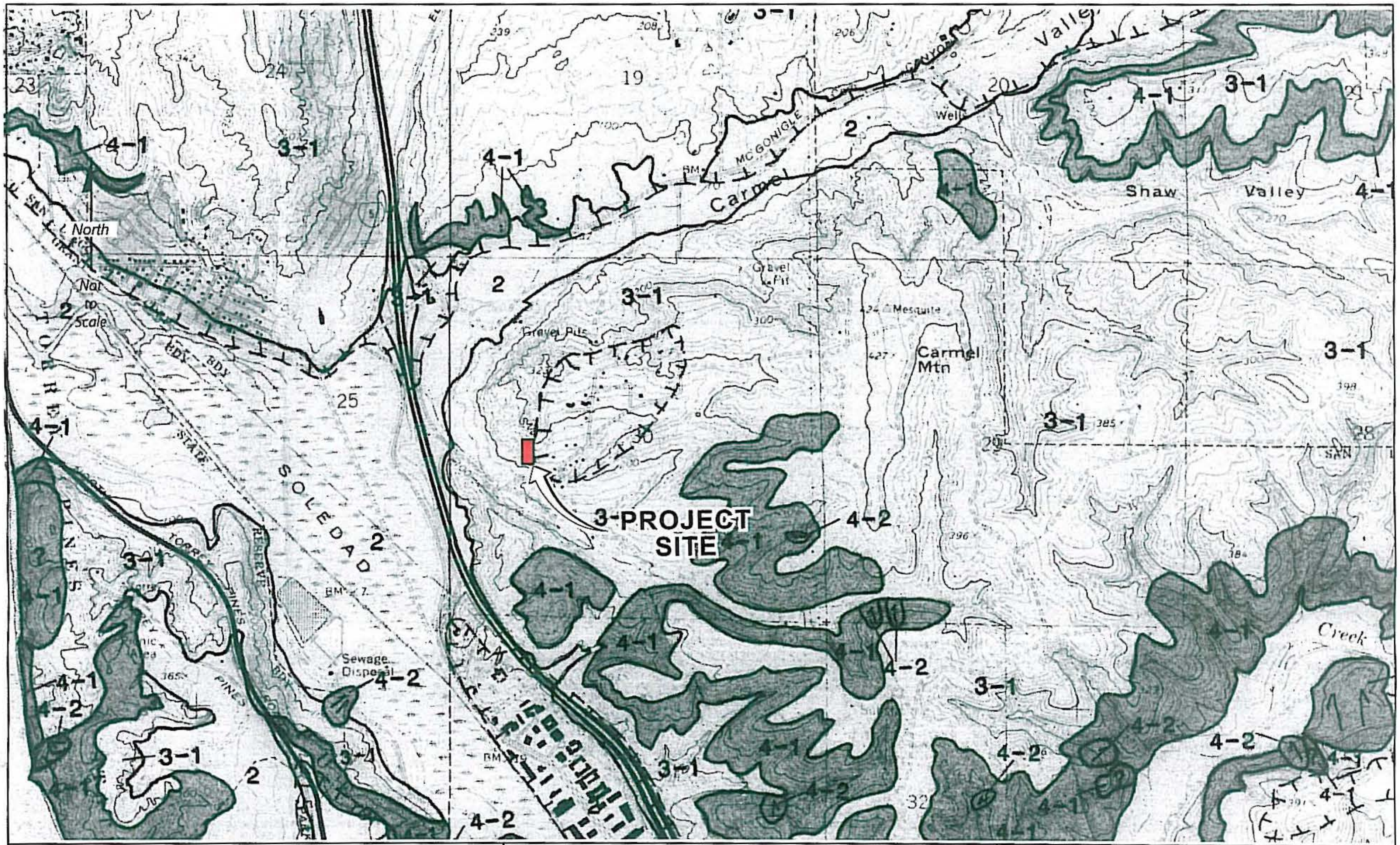
The site is located outside the boundaries of both 100-year and the 500-year flood zones. Accordingly, the risk of flooding is minimal.

3.3.9 Groundwater

The uppermost 6 inches of soils encountered in our test pits were generally found to be wet, and excess moisture was noted on the surface of the grass lawns in most areas. In addition, the fill encountered in Pit No. 4 was found to be moist to wet to a depth of about 6½ feet. This excess moisture appears to be a surficial condition caused by irrigation. This issue is addressed in later sections of this report.

4. CONCLUSIONS

In general, no geotechnical conditions were encountered that would preclude the development of the site as presently proposed, provided the recommendations presented herein are implemented. The main geotechnical conditions that will affect the development of the site, as presently planned, are the presence of loose to medium dense fill and slopewash deposits, as well as moderately compressible, weathered Torrey Sandstone. It is our opinion that the fill and slopewash soils are unsuitable, in their present condition, for the support of settlement sensitive improvements. It is recommended that the fill and slopewash be removed in their entirety and replaced as compacted fill where needed. In addition, existing Torrey Sandstone should also be partially removed and replaced as compacted fill.



SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

LANDSLIDE HAZARD MAP
Frederick Residence
Del Mar, California

Job Number: 0511139-1
Figure Number: 5

5. PRELIMINARY RECOMMENDATIONS

5.1 GRADING

5.1.1 Site Preparation

Site preparation should begin with the removal of any existing vegetation and deleterious matter from the areas of the site to be graded.

5.1.2 Compressible Soils

It is recommended that existing fill soils and slopewash underlying proposed settlement sensitive improvements be removed in their entirety. In addition, any formational deposits within 6 feet of proposed pad grade should be removed.

Based on our findings, it is estimated that maximum removal depth will be about 10 feet. Deeper removals may be necessary in localized areas. Actual removal depths will be determined by our representative during earth work. Lateral removal limits should be 5 feet beyond the perimeters of the improvements or equivalent to the removal depth, whichever is more. Removal bottoms should be observed by our representative.

5.1.3 Processing Fill Areas

Prior to placing any excavated soils or imported material, the surface exposed by excavation should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90% relative compaction. The maximum density and optimum moisture content for the evaluation of relative compaction should be determined in accordance with ASTM D 1557, Method A or C.

5.1.4 Compaction and Method of Filling

All fill should be compacted to at least 90 percent relative compaction. Fills should be placed at or slightly above optimum moisture content, in lifts 6- to 8-inches thick, and each lift should be compacted by mechanical means. Fills should consist of approved soil, free of trash, wood, metal, roots, vegetation, or other unsuitable materials.

Fills should be benched into temporary slopes and into competent natural soils when the natural slope is steeper than an inclination of 5:1 (horizontal to vertical). Keys should be constructed at the toes of all slopes. The keys should extend at least 1 foot into firm natural ground and should be sloped back at least 2% into the natural slope. Keys should have a minimum width of 15 feet.

Utility trench backfill within 5 feet of structures and beneath pavements should be compacted to a minimum of 90% relative compaction. The upper 12 inches of subgrade beneath paved areas should be compacted to 95% relative compaction. This compaction should be obtained by the paving contractor immediately prior to placing the aggregate base material, and should not be part of the mass grading requirements.

All grading and fill placement should be performed in accordance with the County of San Diego Grading Ordinance, the California Building Code, and the Recommended Grading Specifications attached hereto as Appendix A.

5.1.5 Fill Slope Grading

Fill slopes should be constructed at an inclination of 2:1 (horizontal:vertical) or flatter. Compaction of slopes should be performed by back-rolling with a sheepsfoot compactor at vertical intervals of 4 feet or less as the fill is being placed, and by track-walking the face of the slope when the fill is completed. As an alternative, the fill slopes can be overfilled by at least 2 feet and cut back to expose dense material at the design line and grade. Keys should be made at the toes of fill slopes in accordance with the recommendations presented above under "Compaction and Method of Filling." Furthermore, expansive soils should not be allowed within a distance from the face of fill slopes equal to 10 feet, or half the slope height, whichever is more. On site materials are moderately to highly susceptible to run off erosion. Timely proper landscaping is imperative.

5.1.6 Surface Drainage

Drainage around the proposed improvements should be designed to collect and direct surface water away from the improvements and top of slopes toward appropriate drainage devices. Rain gutters with downspouts that discharge runoff away from structure into controlled drainage devices are recommended.

The ground around the proposed improvements should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structures be sloped away at a gradient of at least 2%. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5% within the first 5 feet from the structure.

Drainage patterns provided at the time of fine grading should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth, and over-watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

On site materials are moderately susceptible to run off erosion. Timely proper landscaping is imperative.

5.1.7 Grading Plan Review

Grading plans should be submitted to SCS&T for review to ascertain that the intent of the recommendations contained in this report have been implemented, and no revised recommendations are necessary due to change in the development scheme.

5.2 SLOPE STABILITY

It is our opinion that fill slopes constructed at a 2:1 (horizontal:vertical) inclination will possess an adequate factor of safety with respect to deep-seated failure to a height of at least 15 feet (see Plate No. 12).

5.3 FOUNDATIONS

5.3.1 General

The proposed structures may be founded on conventional shallow foundations, which should have a minimum depth of 18 inches below lowest adjacent finish pad grade. For minor exterior improvements, a minimum footing depth of 12 inches is recommended. A minimum width of 12 and 24 inches is recommended for continuous and isolated footings, respectively. A bearing capacity of 2000 pounds per square foot (psf) may be assumed for footings founded in compacted fill. The bearing capacity may be increased by ⅓ when considering wind or seismic forces. Footings located adjacent to or within slopes should be extended to a depth such that a minimum setback distance of 7 feet exists between the outside bottom edge of the footing and the face of the slope. For retaining wall footings, a minimum setback of 10 feet is recommended.

5.3.2 Reinforcement

Both exterior and interior continuous footings should be reinforced with at least two No. 5 bars positioned near the bottom of the footing and at least two No. 5 bars positioned near the top of the footing. This reinforcement is based on soil characteristics and is not intended to be in lieu of reinforcement necessary to satisfy structural considerations.

5.3.3 Foundation Excavation Observation

It is recommended that all foundation excavations be approved by a representative from SCS&T prior to forming or placement of reinforcing steel.

5.3.4 Settlement Characteristics

The anticipated total and differential settlements for the proposed structure will be within tolerable limits provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to shrinkage during curing or redistribution of stresses and some cracks may be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

5.3.5 Expansive Characteristics

The prevailing foundation soils are judged to be nondetrimentally expansive. The recommendations contained in this report reflect this condition.

5.3.6 Foundation Plan Review

Foundation plans should be submitted to SCS&T for review to ascertain that the recommendations contained in this report have been implemented, and no revised recommendations are necessary due to changes in the development scheme.

5.4 CONCRETE SLABS-ON-GRADE

5.4.1 Interior Slabs-on-Grade

Concrete slabs-on-grade should have a thickness of 5 inches and be reinforced with at least No. 4 reinforcing bars placed at 18 inches on-center each way. Slab reinforcement should be placed approximately at mid-height of the slab and should extend at least 6 inches into the footings. Slabs-on-grade should be underlain by a 4-inch thick blanket of clean, poorly graded, coarse sand (sand equivalent = 30 or greater) or crushed rock. This blanket should consist of no more than 20% and 10% passing the #100 and #200 sieves, respectively. Where moisture sensitive floor coverings are planned, vapor retardant should be placed over the sand layer. An additional 2 inches of sand should be placed over the vapor retardant. Typically, visqueen is used as a vapor retardant. If visqueen is used, a minimum 10-mil is recommended.

It is our understanding that the moisture protection layer described above will allow the transmission of 6 to 12 pounds of moisture per 1000 square feet per day through the slab under normal conditions. Moisture emissions may vary widely depending upon factors such as concrete type and subgrade moisture conditions. If this amount of moisture is excessive, additional recommendations will be provided by this office. It is recommended that moisture emission tests be performed prior to the placement of floor coverings to ascertain whether moisture emission values are within the manufacturer's specifications. In addition, over-watering should be avoided, and good site drainage should be established and maintained to prevent the build-up of excess sub-slab moisture.

5.4.2 Exterior Slabs-on-Grade

Exterior concrete slabs should have a minimum thickness of 4 inches and should be reinforced with at least No. 3 bars at 18 inches on center each way. All slabs should be provided with weakened plane joints. Joints should be placed where cracks are anticipated to develop naturally, and should be in accordance with the American Concrete Institute (ACI) guidelines, Section 3.13. Alternative patterns consistent with ACI guidelines also can be used. The landscape architect can be consulted in selecting the final joint patterns to improve the aesthetics of the concrete slabs-on-grade.

A concrete mix with a 1-inch maximum aggregate size and a water/cement ratio of less than 0.6 is recommended for exterior slabs. A lower water content will decrease the potential for shrinkage cracks. It is strongly suggested that the driveway concrete mix have a minimum compressive strength of 3,000 pounds per square inch. This suggestion is meant to address early driveway use prior to full concrete curing. Both coarse and fine aggregate should conform to the "Standard Specifications for Public Works Construction" ("Greenbook"), prepared by Public Works Standards, Inc.

Special attention should be paid to the method of curing the concrete to reduce the potential for excessive shrinkage and resultant random cracking. It should be recognized that minor cracks occur normally in concrete slabs and foundations due to shrinkage during curing and redistribution of stresses. Some shrinkage cracks should be expected and are not necessarily an indication of excessive vertical movement or structural distress.

Factors that contribute to the amount of shrinkage that takes place in a concrete slab include joint spacing, depth, and design; concrete mix components; water/cement ratio and surface finishing techniques. According to the undated "Technical Bulletin" published by the Southern California Rock Products Association and Southern California Ready Mixed Concrete Association (see Appendix B), flatwork formed of high-slump concrete (high water/cement ratio) utilizing 3/8-inch maximum size aggregate ("Pea Gravel Grout" mix) is likely to exhibit extensive shrinkage and cracking. Cracks most often occur in random patterns between construction joints.

5.5 EARTH RETAINING WALLS

5.5.1 Foundations

The recommendations provided in the foundation section of this report are also applicable to earth retaining structures.

5.5.2 Passive Pressure

The passive pressure for the prevailing soil conditions may be considered to be 300 psf per foot of depth. This pressure may be increased by 1/3 for seismic loading. The coefficient of friction for concrete to soil may be assumed to be 0.30 for the resistance to lateral movement. When combining frictional and passive resistance, the friction should be reduced by 1/3. No passive pressures should be assumed for retaining wall footings along property lines. The upper 12 inches of soil should not be considered when calculating passive pressures for exterior walls.

5.5.3 Active Pressure

The active soil pressure for the design of unrestrained earth retaining structures with level backfills may be assumed to be equivalent to the pressure of a fluid weighing 37 pounds per cubic foot (pcf). An additional 16 pcf should be added to this value for 2:1 (horizontal to vertical) sloping backfill conditions. These pressures do not consider any other surcharge loads. If any are anticipated, this office should be contacted for the necessary increase in soil pressure. These values assume a drained backfill condition.

5.5.4 Retaining Wall Subdrains and Waterproofing

Retaining wall subdrains should be installed in accordance with the detail presented on Plate No. 13. Waterproofing specifications and details should be provided by the project architect. The geotechnical engineer should be requested to verify that retaining wall subdrains and waterproofing have been properly installed.

5.5.5 Backfill

All backfill soils should be compacted to at least 90 percent relative compaction. Expansive or clayey soils should not be used for backfill material. The wall should not be backfilled until the grout has reached an adequate strength.

5.5.6 Factor of Safety

The above values, with the exception of the allowable soil bearing pressure, do not include a factor of safety. Appropriate factors of safety should be incorporated into the design to prevent the walls from overturning and sliding.

6. LIMITATIONS

6.1 UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the geotechnical engineer so that he may make modifications if necessary.

6.2 CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

6.3 TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they are due to natural processes or the work of man on this or adjacent properties. In addition, changes in the standards-of-practice and/or government codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

6.4 PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations be based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

7. FIELD EXPLORATION

Five hand dug test pits were excavated on June 29 and July 5, 2005 at the locations indicated on the attached Plate No. 1. The field work was conducted under the supervision of our engineering geology personnel.

The pits were carefully logged when made. The logs are presented on Plate Nos. 3 through 7. The soils are described in accordance with the Unified Soil Classification System as illustrated on the attached simplified chart on Plate No. 2. In addition, a verbal textural description, the wet color, the apparent moisture and the density or consistency are provided. The density of granular soils is given as very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as very soft, soft, medium stiff, stiff, very stiff, or hard.

Disturbed samples of typical and representative soils were obtained and returned to the laboratory for testing.

8. LABORATORY TESTING

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed is presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.

b) **MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for representative soil samples. This information was an aid to classification and permitted recognition of variations in material consistency with depth. The dry unit weight is determined in pounds per cubic foot, and the in-place moisture content is determined as a percentage of the soil's dry weight. The results are on the pit logs.

c) **GRAIN SIZE DISTRIBUTION:** The grain size distribution was determined for representative samples of the native soils in accordance with ASTM D 422. The results of these tests are presented on Plate Nos. 8 and 9.

d) **MAXIMUM DENSITY/OPTIMUM MOISTURE:** The maximum dry density and optimum moisture content of a typical soil were determined in the laboratory in accordance with ASTM D 1557, Method A. The results of the test are presented herein.

Sample	Description	Maximum Density	Optimum Moisture
P2 @ 1'-3'	Brown, Slightly Silty Sand	117.3 pcf	9.3%

e) **DIRECT SHEAR TESTS:** A direct shear test was performed in accordance with ASTM D 3080. The shear stress was applied at a constant rate of strain of approximately 0.003 inch per minute. The results of this test are presented on Plate No. 10.

f) **SINGLE POINT CONSOLIDATION TESTS:** Single point consolidation tests were performed on selected "undisturbed" samples. The consolidation apparatus was designed to accommodate a 1-inch high by 2.375-inch or 2.500-inch diameter soil sample laterally confined by a brass ring. Porous stones were placed in contact with the top and bottom of the sample to permit the addition or release of pore fluid during testing. Selected loads were applied to the samples and the resulting deformations were recorded. The percent consolidation is reported as the ratio of the amount of vertical compression to the original sample height. The test samples were inundated to determine their behavior under the anticipated loads as soil moisture increases. The results of these tests are presented on Plate No. 11.

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION CHART

SOIL DESCRIPTION		GROUP SYMBOL	TYPICAL NAMES
I. COARSE GRAINED, 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 size but smaller than 3".	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravels, gravel sand mixtures, little or no fines.
	GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		GC	Clayey gravels, poorly graded gravel-sand, clay mixtures.
SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SANDS	SW	Well graded sand, gravelly sands, little or no fines.
		SP	Poorly graded sands, gravelly sands, little or no fines.
	SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, poorly graded sand and silty mixtures.
		SC	Clayey sands, poorly graded sand and clay mixtures.
II. FINE GRAINED, more than half of material is smaller than No. 200 sieve size.			
	SILTS AND CLAYS Liquid Limit less than 50	ML	Inorganic silts and very fine sands, rock flour, sandy silt or clayey-silt-sand mixtures with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays or low plasticity.
	SILTS AND CLAYS Liquid Limit 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.
III. HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.

∇ - Water level at time of excavation or as indicated
US - Undisturbed, driven ring sample or tube sample
SC - Sand Cone
CON - Consolidation
EI - Expansion Index
MS - Maximum Size of Particle
MAX - Maximum Density
ST - Shelby Tube
SPT - Standard Penetration Sample
pH - pH & Resistivity
SF/CL - Sulfate & Chloride

CK - Undisturbed chunk sample
☒ - Bulk Sample
SP - Standard penetration sample
DS - Direct Shear
SA - Sieve Analysis
PI - Plastic Index
RC - Relative Compaction
UC - Unconfined Compression
TX - Triaxial Compression
RS - Ring Shear
AL - Atterberg Limits

SC ST SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT		
	BY: DBA	DATE:	8/4/2005
	JOB NUMBER: 05111139-1	PLATE NO.:	2

LOG OF TEST PIT NUMBER P-1

Date Excavated:	06-29-05	Logged by:	DAS
Equipment:	Hand tools	Project Manager:	DBA
Surface Elevation (ft):	118	Depth to Water (ft):	N/A

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE (%)	DRY UNIT WT. (pcf)	LBAORATORY TESTS
			UNDISTURBED	BULK			
	SM/ SP	**FILL:** Grayish-brown, humid to moist, loose to medium dense, SLIGHTLY SILTY SAND		☒			
1				☒			
2			CK	☒			
	SM/ SP	**SLOPEWASH:** Light grayish-brown, moist, medium dense, SLIGHTLY SILTY SAND					
3				☒			
4			CK	☒			
5							
6							
	SM/ SP	**TORREY SANDSTONE:** Tan brown, humid, medium dense, SLIGHTLY SILTY SAND, highly weathered					
7				☒			
8							
9							
10			CK		5.8	97.7	

Pit ended at 10 feet

SC ST SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT	
	BY: DBA	DATE: 08-08-05
	JOB NO.: 0511139-1	PLATE NO. 3

LOG OF TEST PIT NUMBER P-2

Date Excavated:	06-29-05	Logged by:	DAS
Equipment:	Hand tools	Project Manager:	DBA
Surface Elevation (ft):	125	Depth to Water (ft):	N/A

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES UNDISTURBED	 BULK	MOISTURE (%)	DRY UNIT WT. (pcf)	LBAORATORY TESTS
	SM/ SP	**FILL:** Grayish-brown, humid, loose, SLIGHTLY SILTY SAND		☒			
1							
2			CK				
3							
4		Loose to medium dense					
5							
		Pit ended at 5.5 feet					
6							
7							
8							
9							
10							

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

FREDERICK RESIDENCE LOT SPLIT	
BY: DBA	DATE: 08-08-05
JOB NO.: 0511139-1	PLATE NO. 4

LOG OF TEST PIT NUMBER P-3

Date Excavated:	07-05-05	Logged by:	DAS
Equipment:	Hand tools	Project Manager:	DBA
Surface Elevation (ft):	116	Depth to Water (ft):	N/A

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE (%)	DRY UNIT WT. (pcf)	LBAORATORY TESTS
			UNDISTURBED	BULK			
	SM/ SP	**FILL:** Light grayish-brown, humid, loose, SLIGHTLY SILTY SAND		☒			
1							
2			CK				
3							
4							
9	SM/ SP	**TORREY SANDSTONE:** Tan, moist, medium dense, SLIGHTLY SILTY SAND, weathered					
10				☒			
11							
12		Pit ended at 12 feet					
13							
10							

SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT	
	BY: DBA	DATE: 08-08-05
	JOB NO.: 0511139-1	PLATE NO. 5

LOG OF TEST PIT NUMBER P-4

Date Excavated:	07-05-05	Logged by:	DAS
Equipment:	Hand tools	Project Manager:	DBA
Surface Elevation (ft):	126	Depth to Water (ft):	N/A

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES UNDISTURBED	SAMPLES BULK	MOISTURE (%)	DRY UNIT WT. (pcf)	LBAORATORY TESTS
	SM/ SP	**FILL:** Grayish-brown, humid to moist, loose, SLIGHTLY SILTY SAND		☒			
1							
2			CK				
3	SM/ SP	**TORREY SANDSTONE:** Tan to grayish-brown, moist, SLIGHTLY SILTY SAND, highly weathered					
4							
5							
6			CK		10.5	103.2	
7							
10				☒			
11							
12							

Pit ended at 12 feet

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

FREDERICK RESIDENCE LOT SPLIT	
BY: DBA	DATE: 08-08-05
JOB NO.: 0511139-1	PLATE NO. 6

LOG OF TEST PIT NUMBER P-5

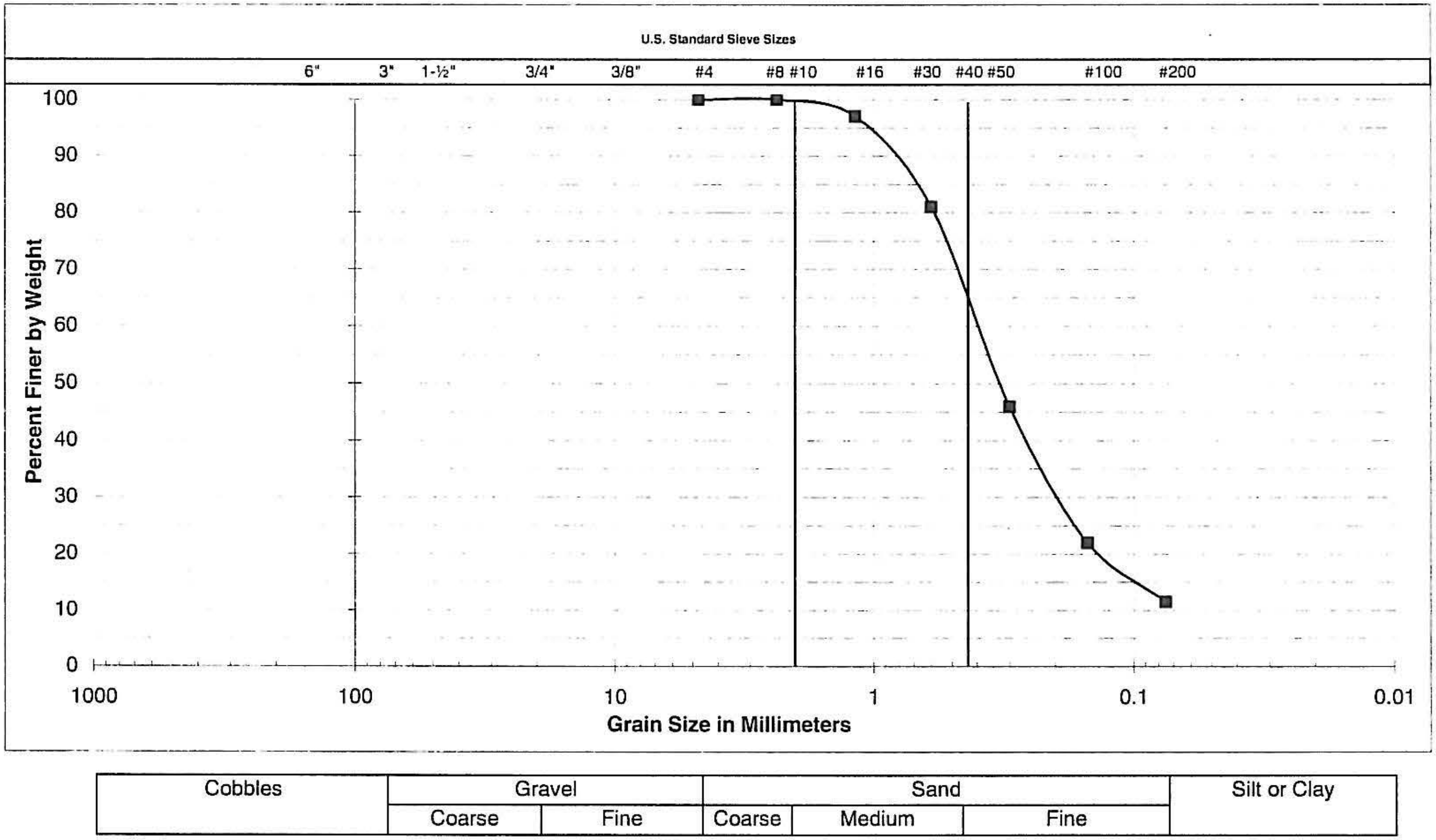
Date Excavated:	07-05-05	Logged by:	DAS
Equipment:	Hand tools	Project Manager:	DBA
Surface Elevation (ft):	112	Depth to Water (ft):	N/A

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE (%)	DRY UNIT WT. (pcf)	LBAORATORY TESTS
			UNDISTURBED	BULK			
	SM/ SP	**SLOPEWASH?:** Grayish-brown, humid, loose, SLIGHTLY SILTY SAND		☒			
1							
2			CK				
3							
4		Loose to medium dense					
5	SM/ SP	**TORREY SANDSTONE:** Tan brown, moist, medium dense, SLIGHTLY SILTY SAND, highly weathered		☒			
6		Pit ended at 6 feet					
7							
8							
9							
10							

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

FREDERICK RESIDENCE LOT SPLIT

BY: DBA	DATE: 08-08-05
JOB NO.: 0511139-1	PLATE NO. 7



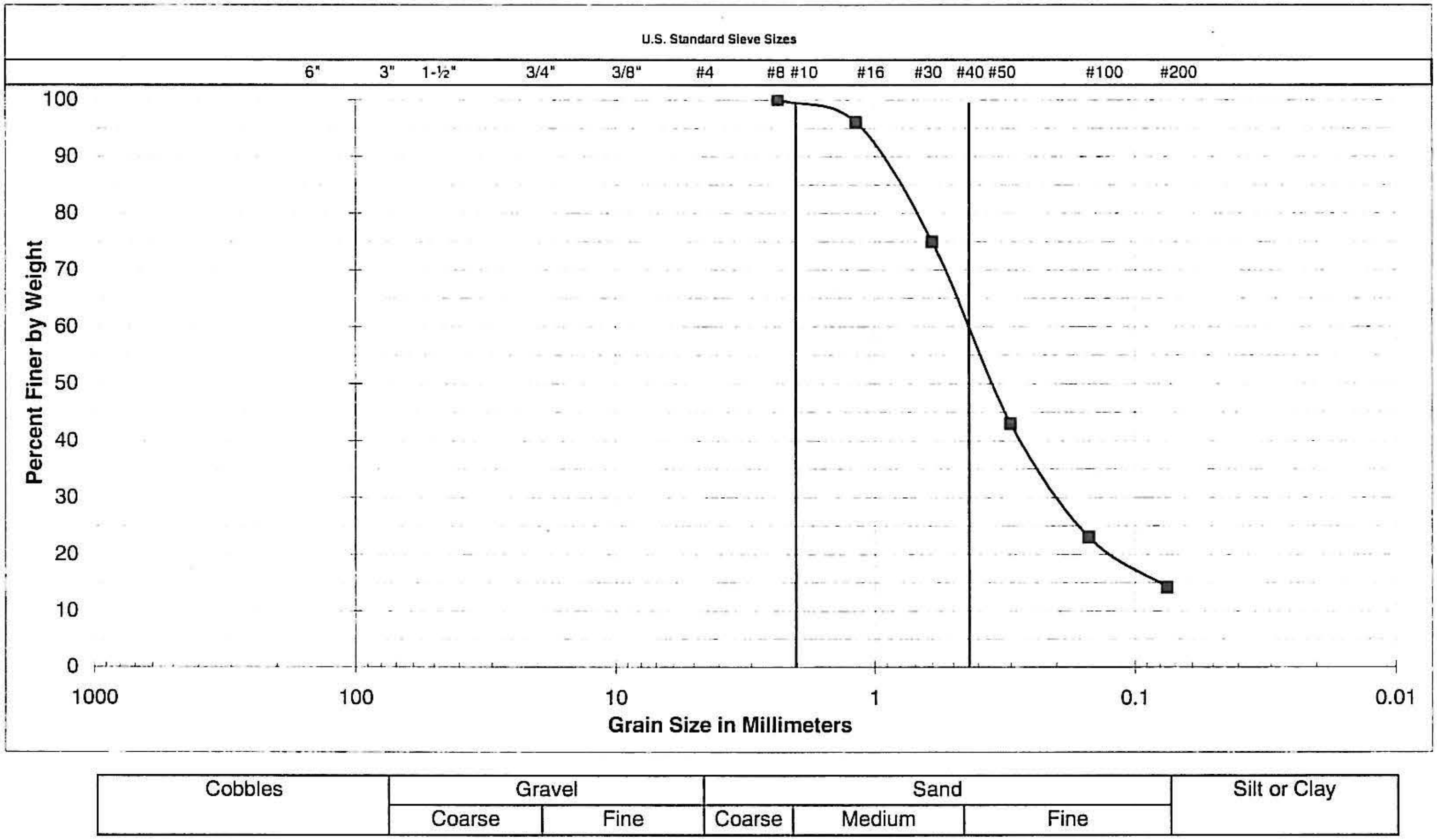
P2 @ 1'-3'

SC ST

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

FREDERICK RESIDENCE LOT SPLIT

By	GBF	Date	8/4/2005
Job Number	0511139-1	Plate	8



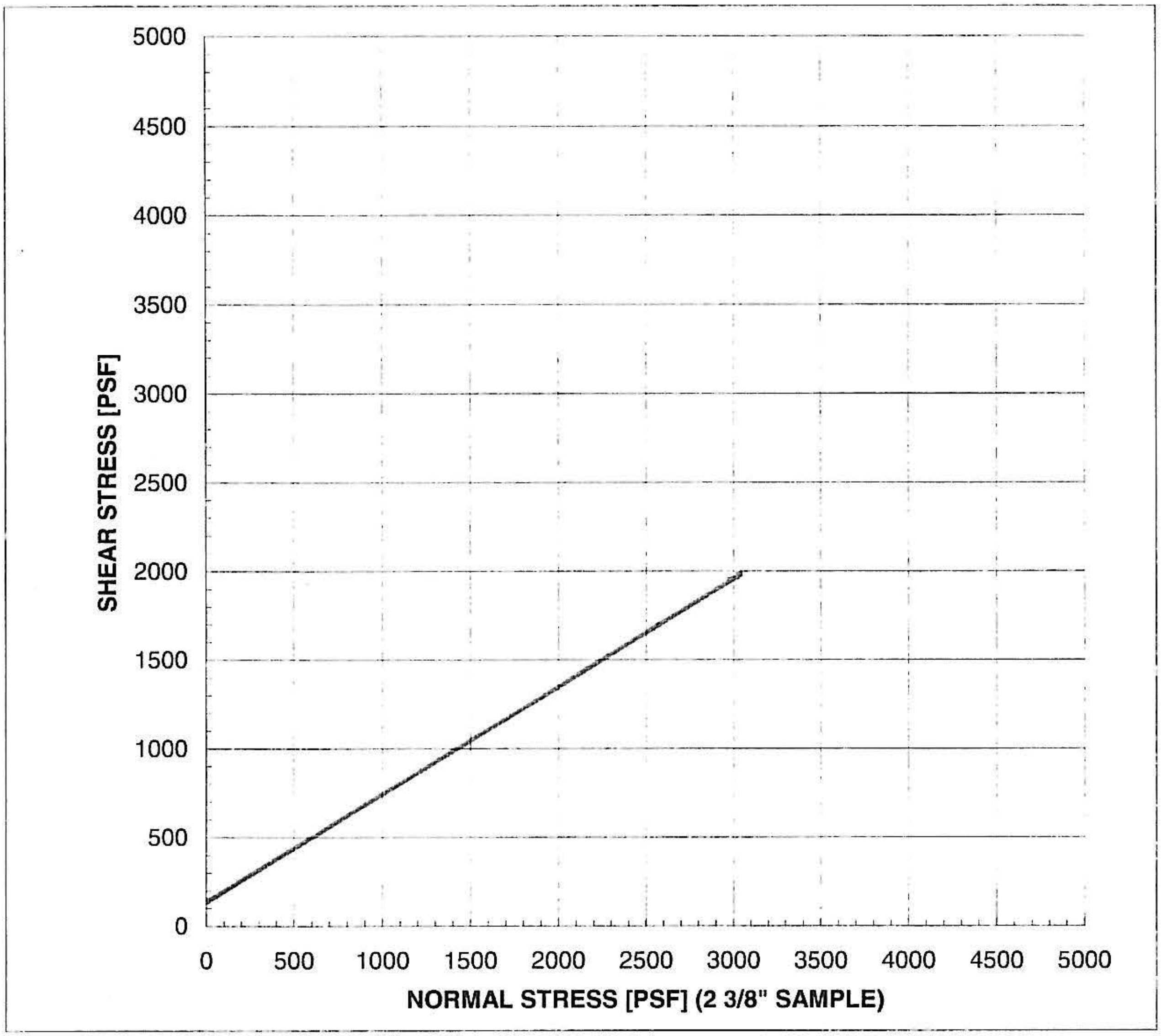
P4 @ 9'-12'

SOUTHERN CALIFORNIA
SOIL & TESTING, INC.

FREDERICK RESIDENCE LOT SPLIT

By	GBF	Date	8/4/2005
Job Number	0511139-1	Plate	9

DIRECT SHEAR SUMMARY



SAMPLE	DESCRIPTION	ANGLE OF INTERNAL FRICTION (°)	COHESION INTERCEPT (PSF)
P2 @ 1'-3'	Remolded to 90%	31 °	150

SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT		
	BY: DBA	DATE:	08-08-05
	JOB NUMBER: 0511139-1	PLATE NO.:	**10**

SINGLE POINT CONSOLIDATION TEST RESULT

SAMPLE NO.	P1 @ 10'	P4 @ 6'
INITIAL MOISTURE (%)	5.8	10.5
INITIAL DENSITY (PCF)	97.7	103.2
CONSOLIDATION BEFORE WATER ADDED (%)	3.0	3.8
CONSOLIDATION AFTER WATER ADDED (%)	4.3	4.8
FINAL MOISTURE (%)	18.5	14.8
AXIAL LOAD (KSF)	2.86	2.86

SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT	
	BY: DBA	DATE: 8/4/2005
	JOB NUMBER: 0511139-1	PLATE: 11

SLOPE STABILITY CALCULATIONS

JANBU'S SIMPLIFIED SLOPE STABILITY METHOD

$$\lambda C\phi = \frac{WH \tan \phi}{C} \qquad FS = Ncf\left(\frac{C}{WH}\right)$$

Assume Homogeneous Strength Parameters Throughout The Slope

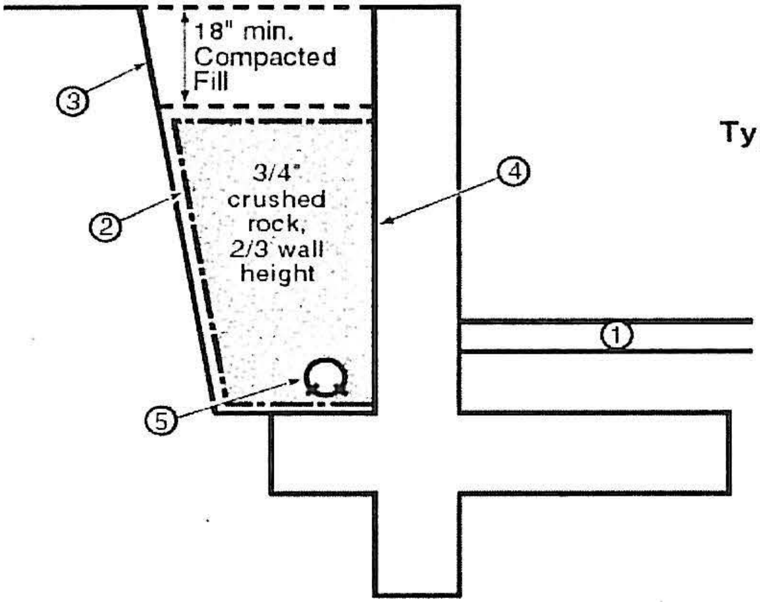
ϕ(E)	C (psf)	Ws (pcf)	Incl.	H (ft.)	FS
31	150	115	2:1	15	2.1

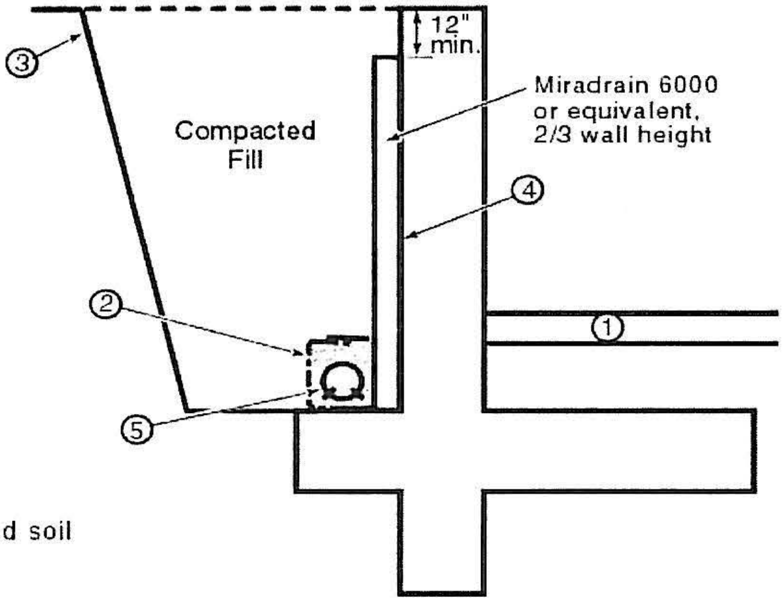
Where:
Φ = Angle of Internal Friction
C = Cohesion (psf)
Ws = Unit Weight of Soil (pcf)
H = Height of Slope (ft)
FS = Factor of Safety

SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT			
	BY:	DBA/SD	DATE:	8/4/2005
	JOB NUMBER:	0511139-1	PLATE NO:	12

Typical Retaining Wall Subdrain Detail

Not to Scale





① Floor Slab

② Filter Fabric between rock and soil

③ Backcut

④ Waterproof back of wall following architect's specifications

⑤ 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet, top of pipe below top of slab, encased in 3/4" crushed rock. Provide 3 cubic feet per linear foot crushed rock minimum. Crushed rock to be surrounded by filter fabric (Mirafi 140N or equivalent), with 6" minimum overlap.
Provide solid outlet pipe at suitable location.

SC ST SOUTHERN CALIFORNIA SOIL & TESTING, INC.	FREDERICK RESIDENCE LOT SPLIT		
	BY: DBA	DATE:	08-08-05
	JOB NUMBER: 0511139-1	PLATE NO.:	13

APPENDIX A

GRADING RECOMMENDATIONS

FREDERICK RESIDENCE LOT SPLIT
3790 ARROYO SORRENTO DRIVE
SAN DIEGO, CALIFORNIA

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the accompanying report and/or the attached special provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

SCS&T shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him appraised of work schedules, changes and new information and data so that he may provided these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations. The Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc.; construction should be stopped until the conditions are remedied or corrected or he shall recommended rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D 1557
Density of Soil In-Place - ASTM D 1556 or ASTM D 2922

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground, which is defined as natural soils which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut into firm competent formational soils. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above-described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities no to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary. All water wells, which will be abandoned, should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3 feet below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report.

When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction by sheepsfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cutback to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Soil Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than the allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall not release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper six inches should be compacted to at least 95 percent relative compaction.

EXPANSIVE SOILS: Detrimentally expansive soil is defined as clayey soil, which has an expansion index of 50 or greater when tested in accordance with the Uniform Building Code Standard 29-C.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over 6 inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material is provided by the geotechnical engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.

APPENDIX B

Southern
California
Rock
Products
Association

Southern
California
Ready Mixed
Concrete
Association

TECHNICAL BULLETIN

3/8” AGGREGATE “PEA GRAVEL GROUT” MIX FOR USE IN FLATWORK

“Pea Gravel” pump mixes are being used in many locations in Southern California for slabs on grade. Many complaints of ‘poor’ concrete, mainly cracking, are due to the use of these mixes. The ease of placing this “concrete” at long distances from the ready-mix truck with minimum manpower has been the primary reason for the increased use of small line grout pumps.

Slabs made of high slump concrete improperly cured in any environment, with or without reinforcement, will shrink excessively and crack extensively. These mixes tend to shrink more than conventional 1” aggregate concrete mixes because of the need for more sand or fines and water to make the mix more fluid or pumpable. This increased shrinkage will cause more cracking. Minimum cement contents are usually ordered for economy. This makes for a higher water/cement ratio that also leads to lower strengths and more cracking.

Freedom from random cracking is desired for all concrete floors. The degree to which random shrinkage cracking can be reduced is improved by using concrete with a minimum shrinkage potential that contains the maximum size of coarse aggregate and the maximum amount of coarse aggregate consistent with placing and finishing methods. A larger aggregate size permits a lower water content in the concrete which results in less shrinkage of the cement paste.

Suggested Spacing of Control Joints

Slab thickness inches	Less than ¾-in. aggregate spacing, ft.	Larger than ¾-in. aggregate spacing, ft.	Slump less than 4-in. spacing, ft.	Control Joint Min. depth Inches
3	6	8	9	0.75
4	8	10	12	1.00
5	10	13	15	1.25
6	12	15	18	1.50
7	14	18	21	1.75

Crack control of concrete slabs on grade is dependent upon slab thickness, shrinkage potential of the concrete, curing environment and suggested joint spacing as demonstrated by the above table.

Building Residential Driveways, Sidewalks and Patios in Southern California

Concrete is an excellent building material for residential construction. In addition to its superior overall appearance, it can be molded to many shapes and finished with many textures. Concrete may be colored or combined with stone, brick, or tile paving in many interesting patterns. Concrete is a good material to use for ground cover. Concrete slabs are low-maintenance, long-lasting home additions, especially when compared to other materials.

With carefull planning the average homeowner can construct his own patio or sidewalk, or he may choose to employ an experienced contractor. In either case the homeowner should familiarize himself with these guidelines so that the end result will be consistent with the homeowner's desires.

LAYOUT - JOINTS

The first task of the planning process is to determine the location and slope of the concrete. The concrete should be sloped so that water drains away from buildings and does not accumulate in low spots. A slope of 1 to 2% (or 1/8 to1/4 inch per linear foot) is generally recommended.

Concrete shrinks as it dries out and therefore will crack. In order to control cracks into straight lines and to minimize the occurrence of cracks, "contraction" and "isolation" joints are cut or tool grooved into concrete slabs. "Joints" are simply weakened cross sections in slabs resulting in good looking preplanned cracks. (figure 2)

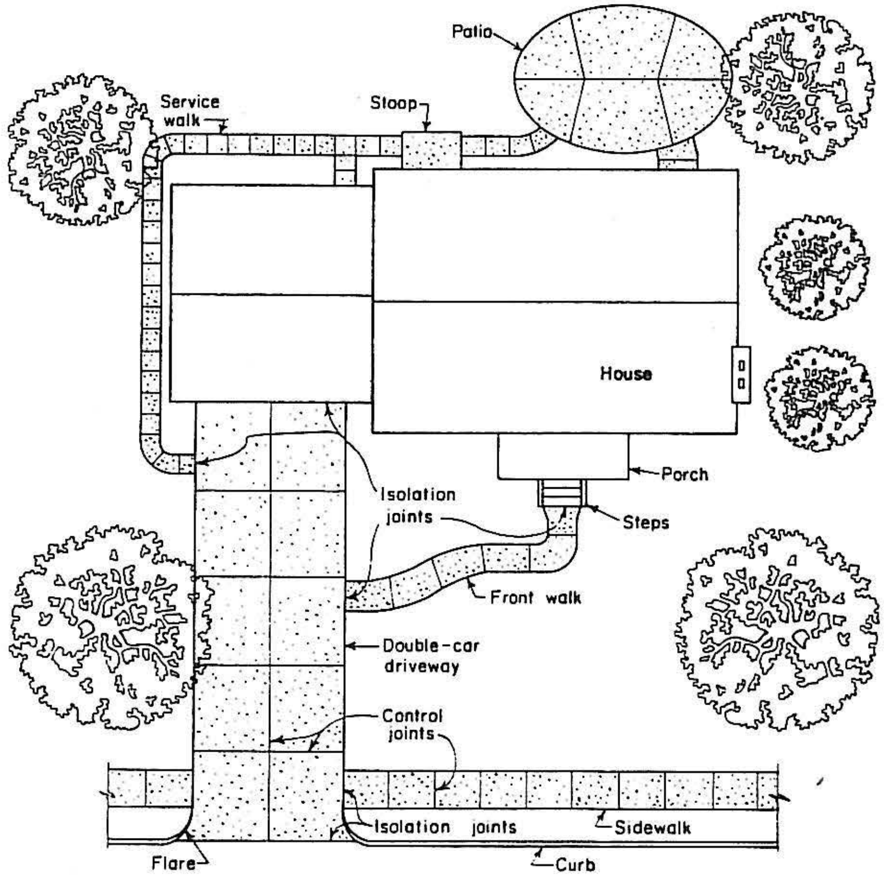


Fig. 1 Concrete walks, driveways, and patios should be provided with properly-placed joints.

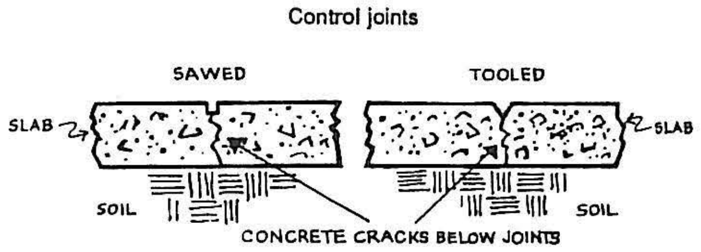


Fig. 2

A) **"Contraction Joints"**are grooves built into slabs which allow the concrete to break in a straight line. The maximum distance between contraction joints should generally be held down to about 10 feet. Slab sections should be approximately square and should not be L-shaped. The length of a slab should not exceed 1.5 times the width. Driveways which are two cars wide should be provided with a joint down the middle of the driveway (figure 1). Joints should be cut to a depth equal to at least 1/4 of the thickness of the slab (e.g. 1" deep in a 4" thick slab). If the joint is to be created by saw-cutting rather than by grooving with a tool before the concrete has hardened, the saw cutting should be done no later than the day after the concrete is placed (especially during hot weather), the same day, if possible.

B) **"Isolation Joints"** which separate the slab from adjacent fixed structures such as house footings and plumbing fixtures will allow the concrete to shrink back from those structures instead of cracking out in the middle of the slab. In order to prevent the new slab from bonding to existing structures and pipes, the slab should be isolated by placing premolded joint material or building paper between the new slab and those structures (figure 3). Either avoid installing drains cast into the new slab, or allow for slab movement around the drain. A wide joint space may be filled with caulking later.

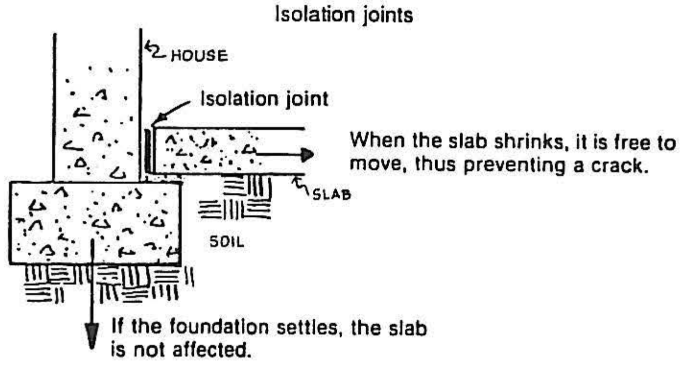


Fig. 3

Use isolation joints between concrete sections that need to move relative to each other.

SLAB THICKNESS - REINFORCING

Most walks and driveways are constructed approximately 4" thick unless vehicles heavier than cars frequently pass over the concrete. If the slab is subjected to heavier loads, a thickness of 5" is usually recommended. It is important that the slabs are uniformly thick. They should be as thick in the middle as they are at the edges.

Wire fabric or other types of steel reinforcing are generally not needed or recommended for walks, patios, and driveways.

FORMWORK AND SUBGRADE PREPARATION

It is important that the soil beneath the slab is cut to a uniform depth, is firm and compacted, and is moist but not wet. This soil must be stable or the concrete will crack. It is usually not necessary to place plastic sheeting under exterior concrete slabs and it is never recommended that the concrete is placed directly onto plastic sheeting. If plastic sheeting is to be used, place a 2" layer of damp, not wet, sand on top of the plastic so that the concrete can dry out uniformly throughout its depth.

Formwork must be sturdy and adequately braced. 2 x 4-inch boards are generally used and should be staked no more than 4 feet apart. All "butt joints" in the lumber should be backed up with a stake (figure 4). Remember, you will not have time to construct or reconstruct the formwork when the concrete arrives so do the necessary work now!

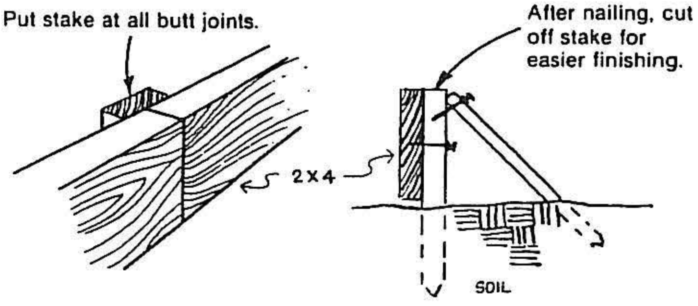


Fig. 4

TOOL UP FIRST!

Now is the time to line up the necessary tools, or to make sure the contractor has the tools he needs.

A) Sturdy wheelbarrows or buggies are needed if the concrete can not be placed directly from the truck chute, and if the concrete is not going to be pumped. A sturdy "wheelbarrow operator" or two would be a nice addition to the labor crew.

B) Short-handed, square-ended shovels are used to spread out the concrete in the forms, and to tamp down the concrete along the edges of the slab.

C) A straightedge (usually a 2 x 4 board) is used to strike off and level the concrete using a sawing style motion.

D) A wood or metal float is used to further level the concrete without sealing the surface (figure 5).

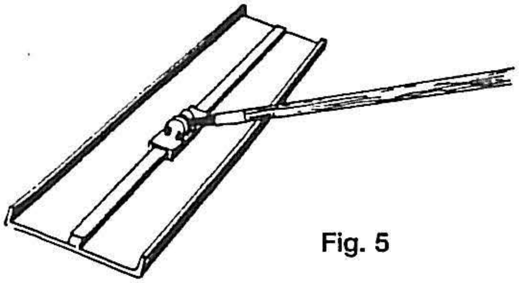


Fig. 5

Bull floats may be either wood or magnesium. For non-air-entrained concrete, wood bull floats may be best but for air-entrained concrete, metal bull floats are better. Bull floats are used to get rid of the high and low spots after staightedging.

E) Edger tools should be used all the way around the exposed edges so that a rounded edge is formed. In addition to making the concrete look good, rounded edges are safer is case of trips and falls.

F) Jointing tools are used to cut straight grooves into the concrete. The jointing tool should have a blade depth of at least one-fourth the depth of the slab (figure 6). A contractor may elect to saw-cut joints the next day or may use premolded plastic strips.

G) A trowel is used to seal and compact the top surface of the concrete. Repeated troweling will create a hard smooth slippery surface which usually is not desirable for exterior concrete exposed to rain or other water.

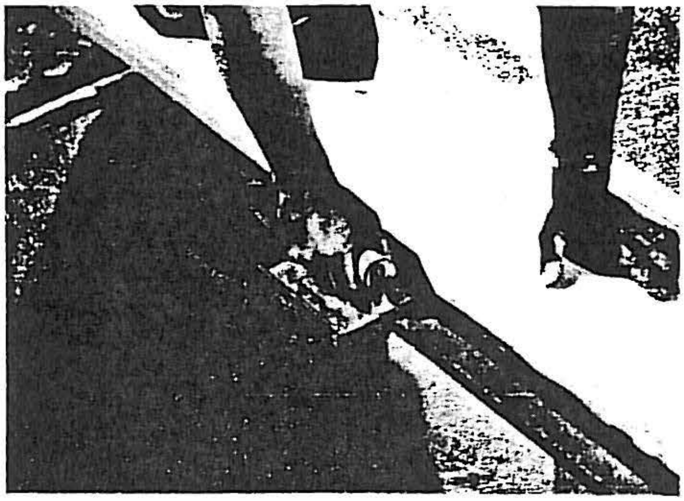


Fig. 6

A straightedge such as a board, 1 inch thick and at least 6 inches wide, is recommended as a guide when scoring with a groover.

H) A semi-stiff bristled push-broom may be used to create a roughened non-slip surface. In addition to providing an excellent non-slip surface, the use of a "broom finish" reduces or eliminates the need for troweling (figure 7).

I) A heavy spray application of liquid curing compound is the most practical method to prevent rapid drying and cracking of the slab. Water may be used istead but the concrete must be kept continually wet for three to seven days. The use of plastic sheeting may cause strong discoloration of the concrete surface.

ORDERING YOUR CONCRETE

If you order your own concrete, consult with your local ready-mixed concrete producer to select the correct concrete mixture for your needs. Unless your house is located at high elevations where freezing and thawing occurs regularly, there is no need to use air-entraining admixtures.

Be sure to tell the supplier if the concrete is to be pumped into place. Be sure that the truck has access to the point at which you want him to discharge his load. Check the width of driveways and the height of overhead power and telephone lines. Be advised that concrete trucks are heavy and may crack existing walks and driveways.

The use of pea gravel (3/8") pump mix is not recommended for residential use. This type of concrete shrinks more when it dries than concrete made with 1" gravel. Because it shrinks more it also cracks more. If the homeowner must use a 3/8" pump mix, please refer to the technical bulletin, 3/8" Aggregate "Pea Gravel Grout" Mix for Use in Flatwork, published by the Technical Committee of the Southern California Ready Mixed Concrete Association.

Concrete is sold in units of cubic yards (1 cubic yard equals 27 cubic feet). Order quantities small enough so that you can place and finish the concrete before it hardens. An experienced homeowner should order no more than 3 cubic yards at one time and should have at least one other person to help. Avoid placing

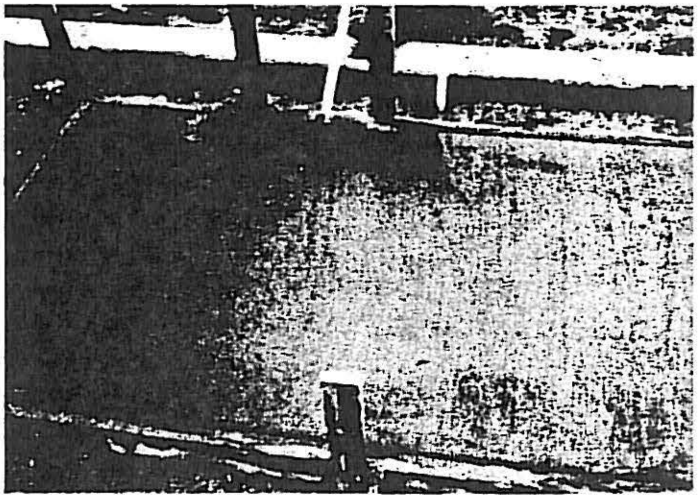


Fig. 7

Broomed finish can be obtained by pulling damp brooms across freshly-floated or troweled surfaces.

concrete during very hot and windy weather, or at least get more help. Concrete placed during hot weather will dry sooner and has a tendency to crack.

When placing your order remember to include an allowance for an additional 10%. This should prevent you from coming up just short of what you need due to waste, spillage, and variations in measurements.

SAFETY

Exercise crowd control over children, dogs, neighbors and the like. Beware of trucks as they back into position. Wear protective clothing like rubber gloves to keep the wet concrete off of your skin. People with sensitive skin can have their skin irritated by wet concrete.

SUMMARY

Further information including advice on special finishes is contained in the list of references in this publication. Building residential driveways, sidewalks and patios of concrete is a good outdoor project for the homeowner. Hopefully these guidelines will assist you in completing a successful and satisfying job.

(Illustrations in this publication courtesy of the National Association of Home Builders, the American Concrete Institute, and Portland Cement Association.)

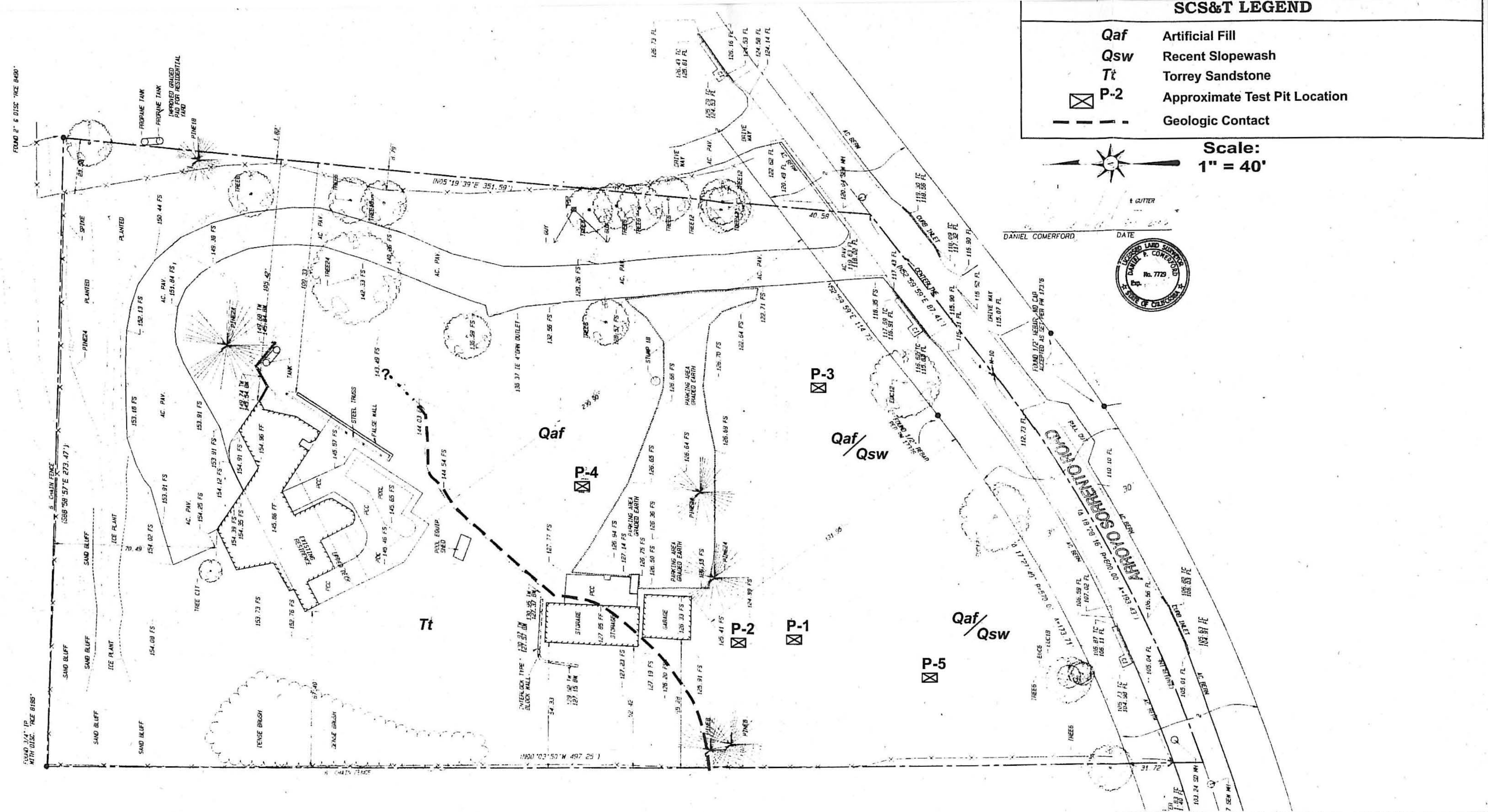
REFERENCES

1. "Concrete in Practice" (CIP) Series. Available from National Ready Mixed Concrete Association, 900 Spring Street, Silver Springs, Maryland 20910.
2. "Cement Mason's Guide," Publication No. PA122.02H, Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077
3. "Residential Concrete," National Association of Home Builders, 15th & "M" Streets, N.W., Washington, D.C. 20005.
4. "Concrete Craftsman Series - Slabs on Grade," American Concrete Institute, P.O. Box 19150 Redford Station, Detroit, Michigan 48219.
5. "Finishing Concrete Slabs, Exposed Aggregate, Patterns, and Colors" Publication No. IS206.01T, Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077.

Phone (818) 441-3107 for a list of our preferred ready mixed concrete providers.

CCPC
CALIFORNIA
CEMENT
PROMOTION
COUNCIL

Southern California
Ready Mixed
Concrete Association



SOUTHERN CALIFORNIA SOIL & TESTING, INC.

Frederick Residence

By:	DAS/DCD	Date:	8/04/05
Job No.:	0511139-1	Plate:	1