FUGRO WEST, INC.

PRELIMINARY GEOTECHNICAL REPORT

Francisco Torres Apartments
El Colegio at Storke Road
Isla Vista, California

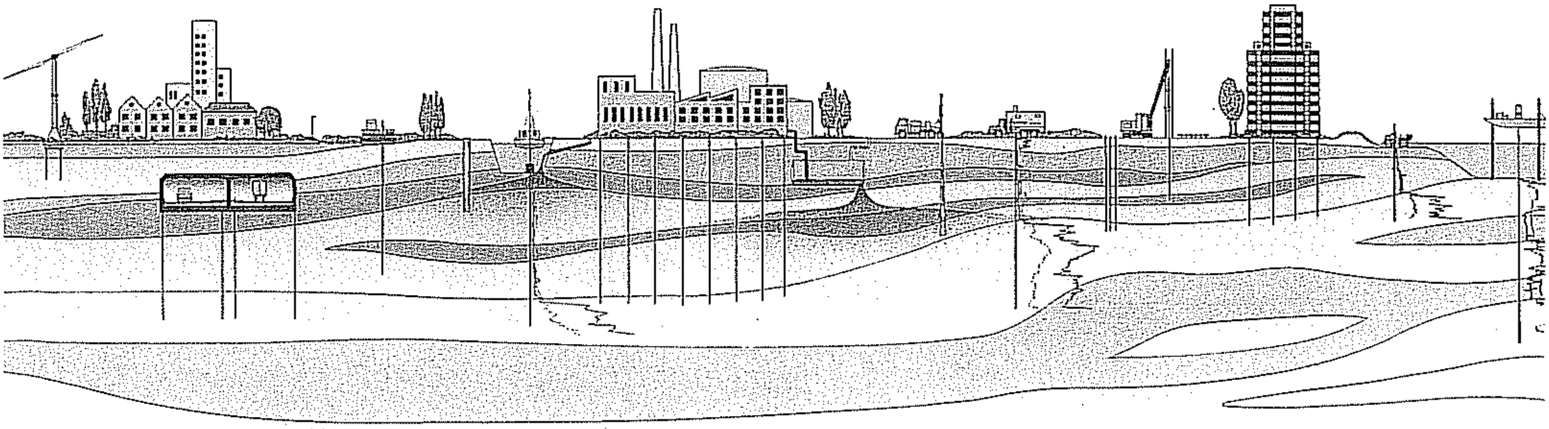
Prepared for:

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Prepared by:

FUGRO WEST, INC.

September 27, 2002



FUGRO WEST, INC.

660 Clarion Court, Suite A
San Luis Obispo, CA 93401
Tel: (805) 542-0797
Fax: (805) 542-9311

September 27, 2002
Project No. 3064.015

Facilities Management, Building 429
University of California
Santa Barbara, California 93101

Attention: Mr. Daniel Belding

Subject: Preliminary Geotechnical Report, Francisco Torres Apartments, El Colegio at Storke Road, Isla Vista, California

Dear Mr. Belding:

Fugro is pleased to submit this Preliminary Geotechnical Report for the Francisco Torres Apartments located at El Colegio and Storke Road in Isla Vista, California. This report was prepared according to our proposal dated August 2, 2002; and authorized by the UCSB Authorization No. 029/02-03 dated August 13, 2002. A summary of our finding was submitted electronically on August 14, 2002.

This report summarizes our geotechnical review of the existing apartment complex, and presents the field and laboratory data obtained during the evaluation. As part of our evaluation we have summarized the subsurface conditions encountered, seismic exposure and data for use with the building code, potential for the site to be impacted by liquefaction, and foundation support conditions for the existing buildings.

Please contact the undersigned if you have questions or we can be of additional service.

Sincerely,
FUGRO WEST, INC.

REGISTERED PROFESSIONAL ENGINEER JONATHAN D. BLANCHARD No. 2312 Exp. 12-31-03 GEOTECHNICAL STATE OF CALIFORNIA

Jonathan D. Blanchard, GE 2312
Associate Geotechnical Engineer
tel. 805-937-4636

Roger C. Slayman, CEG 1920
Engineering Geologist

Copies: 6 – Addressee plus 1 unbound copy

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1. SITE AND PROJECT DESCRIPTION

The Francisco Torres Apartments are located at the northeast corner of the intersection of El Colegio Road and Storke Road in Isla Vista, less than 1 mile west from the west gate of the University of California, Santa Barbara (UCSB) main campus. . The location of the site relative to nearby streets and campus landmarks is shown on Plate 1, Vicinity Map. The general layout of the site is shown on Plate 2, Site Plan. This project generally consists of a preliminary geotechnical study that was performed to provide input to the University's consideration of acquiring the subject property.

1.1 EXISTING FACILITY AND SITE CONDITIONS

The Francisco Torres Apartments are a building complex comprised of two 11-story towers and an interconnected 2-story common area. The building is reportedly supported on a shallow foundation system consisting of spread footings bearing in relatively undisturbed terrace deposits (LCA 1965). Column loads were reported to range from approximately 180 to 360 kips in the tower areas, and from 50 to 130 kips in the common area.

Patios, parking areas, and lawns border the apartment building. The main parking areas are on the north and west sides of the complex, and are paved with asphalt concrete. The terrain in the project area slopes gently north from El Colegio Road. Existing site grades range from approximately elevation (el.) 35 feet near El Colegio Road to el. 20 feet north of the building complex.

2. WORK PERFORMED

2.1 PURPOSE

The purpose of this report is to preliminarily evaluate of the geotechnical conditions at site as input to the University's considering the purchase of this property. The main geotechnical considerations that we evaluated for the project are characterization of the soil and groundwater conditions encountered, seismicity, fault rupture hazards, liquefaction hazards, and foundation support conditions for the existing buildings.

2.2 SCOPE

To evaluate the geotechnical considerations for the project, we have performed the following scope of work:

- Performing site visits to observe the general site conditions and coordinate the field exploration program;
- Reviewing existing geotechnical information provided by the University for the site;
- Performing field exploration consisting of:

  - Drilling 7 hollow-stem-auger borings to depths ranging from approximately 31 to 57 feet below the existing ground surface; and
  - Advancing 9 cone penetration test (CPT) soundings to depths ranging from approximately 27 to 50 feet below the existing ground surface.

- Laboratory testing of selected samples obtained from the borings; and,
- Preparing this report summarizing the data obtained for the site, and providing our conclusions and recommendations regarding;
  - Soil and groundwater conditions encountered;
  - Liquefaction potential of the soils encountered, and impacts to the building areas;
  - Potential for the site and vicinity to be underlain by active or potentially active faults;
  - Seismic data for use with Title 24 of California Code of Regulations; and
  - Foundation support considerations for the existing building.

2.3 FIELD EXPLORATION

2.3.1 Hollow Stem Auger Borings

The drilling subcontractor for the project was S/G Drilling Company of Lompoc, California. S/G used a CME75, truck-mounted drill rig to advance seven borings (B-1 through B-7) using 8-inch hollow stem augers on August 7 and 8, 2002. The borings were advanced to depths ranging from approximately 31 to 57 feet below the existing ground surface.

The borings were sampled using a 2-inch outside diameter standard penetration test (SPT) split spoon sampler. The split spoon sampler was driven into the materials at the bottom of the drill hole using a 140-pound automatic trip hammer with a 30-inch drop. The blow count (N-value) is the number of blows from the hammer that were needed to drive the sampler 1 foot, after the sampler had been seated at least 6 inches into the material at the bottom of the hole. The sample intervals, N-values, and a description of the subsurface conditions encountered are presented on the logs of the borings in Appendix A.

2.3.2 Cone Penetration Test Soundings

Fugro's Geosciences division from Santa Fe Springs, California performed the cone penetration testing for this project. Nine (9) CPT soundings were advanced to depths ranging from approximately 27 to 50 feet below the existing ground surface on August 12, 2002.

The CPT soundings were performed using an electric cone penetrometer that was advanced into the ground using a hydraulic ram mounted in a truck having a weight of approximately 25 tons. During penetration, the cone tip resistance (q_c) and sleeve friction (f_s)

were recorded using an on-board computer to provide an essentially continuous profile of the conditions encountered during penetration. The data was retrieved electronically for use in subsequent geotechnical analyses, and was plotted in the field as the data was being obtained. Logs of CPT soundings are presented in Appendix C.

2.4 LABORATORY TESTING

Laboratory tests for mechanical sieve analysis were performed as part of this program. The tests were performed in general accordance with the applicable standards of ASTM. The results of the tests are presented in Appendix B.

2.5 PREVIOUS REPORTS AND INVESTIGATIONS

As part of our evaluation, we reviewed various geotechnical studies that were previously prepared for the site vicinity. The principal geotechnical reports that we reviewed are referenced on Plate 2, and summarized below:

- LeRoy Crandall (1965), a foundation report prepared for the design of existing Francisco Torres apartment buildings;
- CFS (1997), a geologic hazards and fault evaluation report prepared for the Isla Vista Elementary school south of El Colegio Road, opposite of the subject site;
- CFS (2000), a fault evaluation report performed for the West Campus Green on the west side of Storke Road, opposite of the subject site; and
- Fugro (1996), a fault evaluation for the North Campus Tract 14003 on the west side of Storke Road, northwest of the subject site.

2.6 GENERAL CONDITIONS

Fugro prepared the conclusions, recommendations, and professional opinions of this report in accordance with the generally accepted geotechnical principles and practices at this time and location. This warranty is in lieu of all other warranties, either expressed or implied. This report was prepared for the exclusive use of the University of California and their authorized agents only. It is not intended to address issues or conditions pertinent to other parties or for other uses.

Our characterization of the subsurface conditions is based on explorations performed at specific locations, and the interpolation and extrapolation of data between points of exploration and testing. The boundaries and extent of the soil conditions described will vary between points of exploration, and transitions can be gradual. The subsurface soil and groundwater conditions will vary between points of exploration and observation, may change with time, and should be reviewed based on the conditions revealed during construction.

3. SITE CONDITIONS

3.1 GEOLOGIC SETTING

Francisco Torres Apartments are situated on the coastal plain south of the Santa Ynez Mountain Range. The Santa Ynez Mountain Range is part of the western Transverse Ranges, a predominantly east-west trending mountain block extending from Point Arguello eastward for 75 miles into Ventura County. The Santa Ynez Mountains and adjacent piedmont alluvial plain are composed almost entirely of sedimentary rocks ranging in age from late Jurassic to Recent.

In the Santa Barbara and Goleta area, the structure of the Santa Ynez mountains consists of a south-dipping homocline with east-west striking faults and related folds preserved on the coastal plain (Dibblee 1966). Late Pleistocene uplift has created the elevated UCSB-Isla Vista-Devereaux marine terrace. The More Ranch/Mission Ridge/Arroyo Parida faults are the principal fault system on the coastal plain, and form the northern boundary of this marine terrace.

The project site is located on the northern boundary of the marine terrace. The marine terrace is a wave-abraded surface that is typically covered with a thin veneer of marine sands and overlying alluvium. The topography of the marine terrace is gently sloping to the south to generally flat-lying. Stream erosion has subsequently dissected the terrace to produce the present isolated mesa surfaces with intervening drainages. The terrace is composed of late Pleistocene age marine sands, with discontinuous, basal, fossiliferous sand and is overlain in areas by estuarine and non-marine deposits. These units are undifferentiated and termed older alluvium by Dibblee (1966, 1987).

In the vicinity of the apartments, marine terrace sediments unconformably overlie a Quaternary age marine siltstone termed the "Pico" Formation. This marine siltstone is referred to as Pico Formation (in quotes) by Dibblee (1966) because it is not directly traceable to the Pico Formation in Ventura County. Microfaunal analyses of similar siltstone samples obtained in borings excavated for the San Clemente housing project east of the site confirm that the fossil assemblage is slightly older than the Santa Barbara Formation (personal comm. USGS). The "Pico" Formation rests unconformably on the Sisquoc Formation in the project area.

3.2 FAULTING

Regional compressive forces acting on the Santa Barbara coastal area have resulted in generally east-west trending folds and faults. Gurrola and Keller(1998) term the region the Santa Barbara Fold Belt (SBFB). The SBFB is characterized by active folding and buried reverse faulting. The SBFB is formed on the south limb of the Santa Ynez anticlinorium. The Santa Ynez anticlinorium is postulated by Namson and Davis (1992) to be related to a low angle, north dipping ramp of a detachment or decollement at 10 to 12 kilometers in depth.

Faults within the More Ranch fault zone are the closest faults to the site. The south branch of the More Ranch faults is mapped through the site, as shown on Plate 2. Other proximal faults include the offshore Coal Oil Point and Goleta Point faults. Faults are also mapped north of the site in the Goleta Valley including the Dos Pueblos fault, the Glen Annie fault, the Carneros fault, the Goleta fault, and the San Jose fault (Dibblee, 1987). The closest faults that are considered significant seismic sources for future earthquakes are the More Ranch and North Channel Slope faults (CDMG 1996).

3.2.1 More Ranch Fault

The More Ranch segment is the westernmost segment of the More Ranch/Mission Ridge/Arroyo Parida Fault System and is the closest significant regional fault system to the site. From west to east, the More Ranch/Mission Ridge/Arroyo Parida Fault System consists of the More Ranch, the Mission Ridge, and the Arroyo Parida faults. This fault system is topographically well expressed from Ellwood to Ojai and is the principal onshore fault on the Santa Barbara coastal plain. The More Ranch fault is a south-dipping, south side up reverse fault that is located along the north margin of the UCSB-Isla Vista-Devereaux terrace. The main campus, Isla Vista, and a portion of the west campus is located on the hanging wall of the More Ranch fault.

In the Goleta Valley, the locations and names of the faults within the More Ranch fault zone have varied. On the north margin of the UCSB-Isla Vista-Devereaux terrace, the More Ranch fault was mapped by Hill (1932) as two separate faults, the Elwood fault and the More Ranch fault. Upson (1951) and Dibblee (1966), later mapped these faults as a continuous east-west striking fault termed the More Ranch fault, which separates the UCSB/Isla Vista area from the Goleta Valley. Subsurface analysis of well log data by (Olson 1982) indicates vertical separations of approximately 1,000 feet for the north branch of the More Ranch fault. Northeast of the main campus at Mescalitan Island, the More Ranch fault has been mapped as a north and south branch.

North Branch. A study performed by Dames and Moore, (1973), exposed the fault in trench excavations at six locations and observed offsets in the terrace deposits of approximately two feet. The northern branch of the More Ranch fault is expressed as a discontinuous, north-facing scarp along the northern margin of the terrace and continues westward where it offsets the Ellwood terrace by approximately 18 feet. The age of the Ellwood terrace is estimated to be 47,000 years and the rate of vertical faulting of the More Ranch fault is 0.2 mm/yr. (Gurrola and others 1996). Based on the faulting rate, the amount of total displacement, and the relatively young geomorphic features, the northern branch is likely the major fault accommodating strain deformation in the fault zone. Although not encountered in trench explorations for the North Campus development (Fugro 1995, 1996), the north branch of the More Ranch fault is believed to be concealed beneath recent stream alluvium within Devereux creek. Review of geologic cross sections indicate that the downthrown block of the north More Ranch fault is infilled with a thick sequence of alluvium and Pleistocene-age Santa Barbara Formation strata.. The Sisquoc Formation on the downthrown block is measured to be at approximately el. –4,000 feet, msl (Olson 1982).

South Branch. The south branch of the More Ranch fault extends from Mescalitan Island westward across the Isla Vista mesa to the seacliff west of the project site. Although currently covered, the South Branch was reportedly observed by Dames & Moore (1973) to offset the marine terrace exposed in the seacliff. The south branch of the More Ranch fault has been previously mapped striking east-west along El Colegio Road in the Isla Vista area. The basis for this mapping is from projection of deep, oil well data, and water well data.

A discontinuous, relatively short fault coincident with the mapped trace of the south branch was encountered in a trench investigation for the Recreational Sports Center (K-C Geotechnical Associates 1990). West of the project area, the mapped trace of the south branch is coincident with a drainage alignment west of Married Student Housing. The south branch was also observed in a tank excavation located between the seacliff and the above ground oil storage tanks of the Elwood marine terminal (J. Blanchard 2000).

On the basis of the CPT soundings performed for Married Student Housing (CFS Geotechnical 2000), and the reported exposure in the seacliff, and tank excavation west of the site, the mapped trace of the south branch of the More Ranch fault was shown as trending through the north tower of Francisco Torres. The CPT and boring data from this study is generally consistent with respect to the amount and sense of displacement of the basal terrace deposit, along with the projected trend of the fault from the Married Student Housing located to the west. As shown on Plate 2, the fault trends along the north side of the north Francisco Torres Tower. On the basis of the northeasterly trend of the fault, an alternative interpretation could be that the fault is not the south branch, but a relatively short, tear fault between the north and south branches of the More Ranch fault.

The More Ranch fault zone is not classified as an active fault by the State of California, Division of Mines and Geology; however; the Santa Barbara County Seismic Safety Element (1978) classifies the north branch of the More Ranch fault as active. The south branch of the More Ranch fault is not listed in the Seismic Safety Element, but would likely be classified as potentially active based on the displacement of 47,000 year old terrace deposits west of the site.

3.2.2 North Channel Slope Fault

The North Channel Slope fault is located about 5 miles offshore and dips north beneath the coast of Santa Barbara. The North Channel Slope fault is a shallow, north-dipping, north-side-up, reverse fault. The fault projects underneath the UCSB-Isla Vista-Devereaux terrace. The fault is considered a potential seismic source in the CDMG (1996) fault database.

3.3 SUBSURFACE CONDITIONS

As encountered in the exploratory borings and CPT soundings, the site is underlain by artificial fill, terrace deposits, and "Pico" Formation. The logs for the borings and soundings are presented in Appendix A and C, respectively. The locations of the borings is shown on Plate 2. The following describes the geologic units encountered on the basis of the subsurface conditions encountered in the borings and CPT soundings, and review of the previous boring information available for the site (LeRoy Crandall Associates 1965).

Artificial Fill Materials (Af): Up to 3 feet of artificial fill material was encountered in the borings. The fill encountered consists of firm to stiff silty clay (CL-ML) to sandy clay (CL). The artificial fill materials encountered appear to be associated with previous site grading performed for the parking areas and driveways, and were covered by 2 to 3.5 inches of asphalt pavement in the borings.

The site was undeveloped at the time of the LCA (1965) field exploration; however, up to 5 feet of fill material was encountered in the common and south tower building areas. This fill may have been removed as part of the subsequent site grading. Fill materials associated with the grading or backfilling of the existing structures and utilities, although present, were not encountered in the explorations.

The artificial fill materials were underlain by terrace deposits where encountered.

Terrace Deposits (Qt): Undifferentiated older alluvial and marine terrace deposits were encountered below the artificial fill materials. The terrace deposits were encountered to depths ranging from approximately 30 to 36 feet in B-1 through B-5 drilled near the apartment building, and in adjacent CPT soundings. The thickness of the terrace deposits ranged from approximately 24 feet in B-6 to the maximum depth explored in B-7, approximately 30 feet. B-6 and B-7 were drilled near Storke Road, west of the apartment complex.

The terrace deposits consist of interbedded strata of medium to very dense silty sand (SM) and sand (SP-SM), and stiff to very stiff clay (CL). The soil grades to sandy clay (CL), clayey sand (SC) and silty clayey sand (SC-SM) at various depths within these strata. The terrace deposits were underlain by Pico Formation in B-1 through B-6. The thickness and composition of the terrace deposits encountered are similar to those reported by LCA (1965).

Sieve analyses tests were performed on selected samples of the terrace deposits obtained from the borings. The results of the sieve analyses are presented in Appendix B. The fines content for the samples tested ranged from approximately 7 to 43 percent.

"Pico" Formation: "Pico" Formation was encountered below the terrace deposits in each of the explorations, except for B-7 that was terminated in the terrace deposits at a depth of approximately 30 feet. The "Pico" Formation is composed of weakly to non-cemented units of dark gray siltstone and sandstone. The sandstone materials were mainly encountered in B-3 and B-5, and the adjacent CPT soundings. The "Pico" Formation was encountered from approximately 25 to 36 feet below the existing ground surface, to the maximum depths explored, approximately 50 feet. Although not specifically identified as such by LeRoy Crandall Associates, the depth and description of the formation was similarly reported in the LCA (1965) report.

3.4 GROUNDWATER CONDITIONS

Groundwater was encountered at depths ranging from 12 to 22 feet below the existing ground surface during our August 7 and 8, 2002 field exploration program. The groundwater level encountered ranged from approximately el. 7 feet to el. 10 feet. The groundwater gradient is generally to the north, and appears mounded south of the mapped trace of the south branch of the More Ranch fault.

Groundwater and seepage was encountered in the LCA (1965) borings at depths ranging from 23 to 34 feet below the existing ground surface during their August 1965 field exploration program. The groundwater level encountered at that time was approximately el. 0 feet, approximately 7 to 10 feet below the August 2002 groundwater elevations encountered.

The predominant groundwater table within the northern portion of the site appears to be perched within the lower terrace deposits and above the siltstone units of the Pico Formation. However, the sandstone units of the Pico Formation appear to be saturated and water bearing. Groundwater conditions will vary seasonally, due to storm runoff, groundwater pumping, irrigation, as well as other factors.

4. SEISMIC HAZARD ASSESSMENT

The project site is located in a seismically active region of central California relatively close to mapped active and potentially active faults. Seismic hazards for liquefaction and strong ground motion were evaluated for the site.

4.1 PROBABILISTIC STRONG GROUND MOTIONS

Peak horizontal ground accelerations were estimated for the site using probabilistic seismic hazard analyses. The intent of our evaluation was to estimate the strong ground motion that could result from earthquakes occurring on active and potentially active faults mapped within a 100-kilometer (62-mile) radius of the site. The probabilistic evaluation was performed using the computer program FRISKSP (Blake 2000) and the CDMG (1996) southern California fault database. The program FRISKSP is based on FRISK (McGuire 1978) and has been modified for the probabilistic estimation of seismic hazards using three-dimensional earthquake sources.

The fault search routine in FRISKSP found 30 active and potentially active mapped faults and fault segments within the 100-kilometer radius of the site. Summarized below are the results for 13 faults and fault segments that were considered to be the most capable of producing the high ground motion at the site.

Results of Fault Search

Fault or Fault Segment	Approximate Distance from Site (km)	Maximum Moment Magnitude (M_w)	Fault Length (km)	Slip Rate (mm/yr)
North Channel Slope	0.1	7.1	60	2 ± 2
More Ranch-M. Ridge-Arroyo Parida	0.8	6.7	65	0.4 ± 0.2
Santa Ynez (West)	15	6.9	65	2 ± 1
Red Mountain	21	6.8	39	2 ± 1
Santa Ynez (East)	23	7.0	68	2 ± 1
Montalvo-Oak Ridge Trend	26	6.6	37	1 ± 1
Los Alamos-West Baseline	30	6.8	28	0.7 ± 0.7
Ventura-Pitas Point	31	6.8	41	1 ± 0.5
Oak Ridge (Blind Thrust Offshore)	32	6.9	37	3 ± 3
Santa Cruz Island	39	6.8	50	1 ± 0.5
Santa Rosa Island	44	6.9	57	1 ± 0.5
Channel Island Thrust (Eastern)	49	7.4	65	1.5 ± 1
San Andreas (1857 Rupture)	72	7.8	345	34 ± 5

Note: 1 kilometer (km) = approximately 0.6 miles.

Additional information on these faults is presented in the CDMG (1996) fault database. The program FRISKSP was used to estimate peak horizontal ground accelerations associated with the following earthquake ground motions:

- Design-Basis Earthquake Ground Motion: An earthquake having a 10 percent chance of being exceeded in 50 years (Statistical Return Period ≈ 475 Years).
- Upper-Bound Earthquake Ground Motion: An earthquake having a 10 percent chance of being exceeded in 100 years (Statistical Return Period ≈ 950 Years).

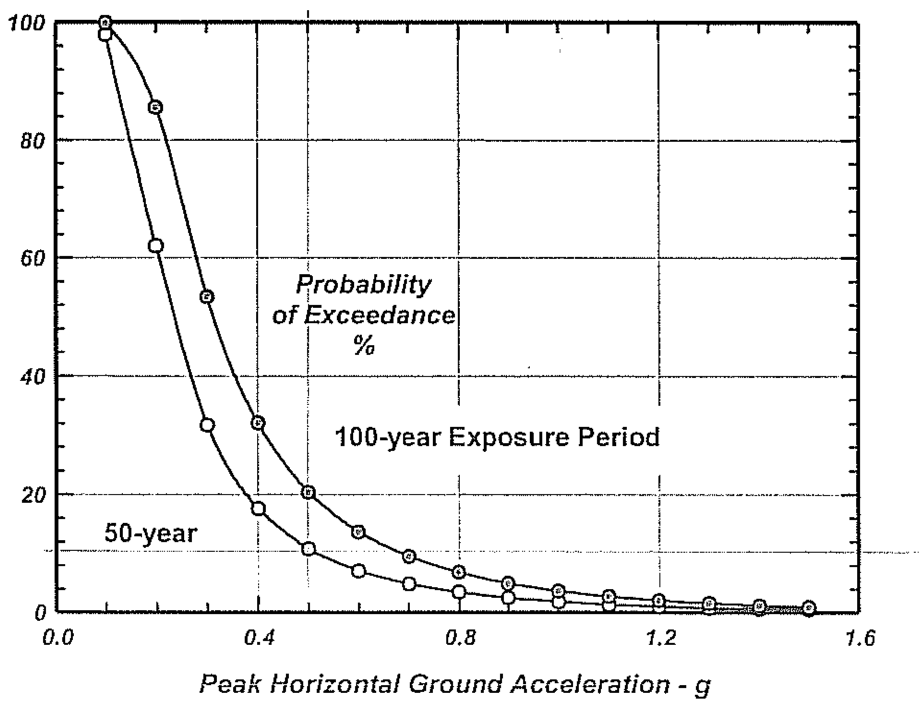
The probabilistic analyses were completed using the Boore et al. (1997) attenuation relationship assuming randomly oriented components of peak acceleration as well as the NEHRP site class "D" designation. A site class "D" designation includes stiff soil and indicates that material in the upper 100 feet of the site has an average shear wave velocity ranging between 180 and 360 meters per second. A summary of the probabilistic evaluation is presented in the table below. Shown are design-basis earthquake and upper-bound earthquake peak horizontal ground accelerations for the select individual faults as well as for all faults within the 100-kilometer search radius.

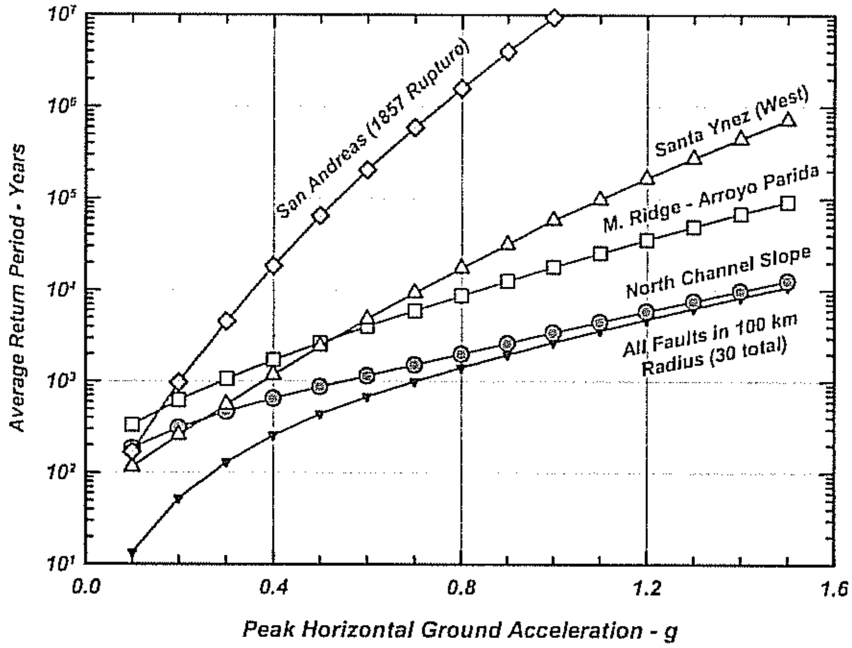
Results of the Probabilistic Seismic Hazard Analysis

Fault or Fault Segment	Peak Horizontal Ground Acceleration (g)	
	Design-Basis Earthquake (10% in 50 Years)	Upper-Bound Earthquake (10% in 100 Years)
North Channel Slope	0.30	0.53
More Ranch - M. Ridge – Arroyo Parida	0.15	0.28
Santa Ynez (West)	0.28	0.37
San Andreas – 1857 Rupture	0.15	0.20
All Faults in 100 km Search Radius	0.52	0.69

Note: All acceleration values in units of g ($9.81\ m/s^2$ or $32\ ft/s^2$)

The results of the probabilistic analyses are also plotted on the accompanying figures. The first plot presents the probability of exceedance versus peak horizontal ground acceleration for exposure periods of 50 and 100 years considering all 30 fault sources. The second plot that follows shows the average return period versus peak horizontal ground acceleration assuming all 30 faults sources, and the results for selected individual fault sources within 100 kilometers of the site. Either plot can be used to estimate the peak horizontal ground accelerations included in the above table.





4.2 LIQUEFACTION

Liquefaction is the loss of soil strength due to an increase in soil pore water pressures that results from seismic ground shaking. Three general geotechnical conditions should be present for liquefaction to occur: 1) groundwater is present within the potentially liquefiable material; 2) the soil is granular and meets a specific range of grain sizes; and 3) the soil is in a loose state of low relative density. If those conditions are present and strong ground motion occurs, portions of the soil column could liquefy, depending upon the intensity and duration of the strong ground motion.

Analyses were performed to evaluate the potential for the lower sandy portions of the terrace deposits to liquefy. The Pico Formation is comprised of dense sand and silt that is not considered vulnerable to liquefaction. The analysis considered a strong ground motion of 0.5g and a M7.1 earthquake based on the seismic analysis previously discussed in this report. The analysis was performed using procedures described in NCEER (1997) for liquefaction analyses using CPT data. Fines content data from the laboratory testing was used in association with these analyses. The results of the analyses are summarized on Plate 3.

Field data from the CPT data were obtained electronically using an onboard computer. These data were then imported into a GIS processor to spatially orient the digital information, and perform the liquefaction analyses using computer spreadsheets. The results of the analyses are presented on Plate 3 as a plot of the subsurface profile. The red line on Plate 3 is the estimated CPT tip resistance that is needed to resist liquefaction for the seismic conditions considered.

The tip resistance measured in the CPT soundings typically exceeds that value by a factor of 1.5 to 2 indicating a low potential for liquefaction. Due to the dense nature of the terrace deposits, they are not prone to significant seismic settlement in response to earthquake loads. The upper terrace deposits are above the expected groundwater level, are relatively dense, and therefore also have a low potential for liquefaction or seismic settlement.

5. SUMMARY OF FINDINGS

The following is a summary of the main geotechnical considerations that impact the site. Our evaluation is based on a program drilling 7 borings at the site, performing 9 cone penetration test (CPT) soundings, and reviewing previous data mainly from the LCA (1965) site investigation and the CFS (2000) fault evaluation performed for the West Campus Green.

- The site is underlain by a variable thickness of alluvium and marine terrace deposits that overlie siltstone and sandstone units of the Pico Formation. The upper 2 to 25 feet of the terrace deposits consists of predominantly medium stiff clay. The soil below the clay consists of dense sand and silty sand. The depth to the formational materials ranges from approximately 25 to 36 feet below the existing ground surface. Groundwater was encountered at depths ranging from approximately 12 to 22 feet below the existing ground surface during our field exploration program.
  - The building was designed considering a maximum allowable bearing pressure of 3,000 pounds per square foot. When considering seismic loads, the toe pressure can exceed the recommended bearing pressure provided the resultant seismic force is within the middle third of the footing.
  - We estimate that the soils encountered have a relatively low potential for liquefaction or seismic settlement in response to local or regional earthquakes. Static and seismic settlements are estimated to be less than 1 inch total for the static and seismic loading conditions considered.
  - The majority of static settlement resulting from the foundation loads imposed by the building complex has likely already occurred.
  - The variable thickness of clay alluvium results in a relatively non-uniform foundation support condition below the building. We expect that settlement of the clay alluvium in response to ongoing settlement or seismic events could be manifested as relatively abrupt differential settlement.
- A branch of the More Ranch fault displaces the base of the terrace deposits, and projects toward the north side of the north tower of the Francisco Torres buildings.
  - The offset in the basal terrace deposits indicate that the fault is "potentially active" according to the University Long Range Development Plan (LRDP), Environmental Impact Report. The LRDP classifies a fault as potentially active where the last inferred movement is between 11,000 years and 2 million years before present.

- Because the chance of an earthquake occurring on the fault during the life of the structure is relatively remote, the potential for the south branch of the More Ranch fault to rupture within the life of the building is relatively low. However if the fault were to rupture, several feet of ground displacement could occur in the vicinity of the north tower in association with a maximum earthquake on the More Ranch fault system.

- The site is in a seismically active region of California. The design basis ground motion for the site, having a 10 percent chance of being exceeded within a 50 year time period, is 0.52g. The site and the south coast area of Santa Barbara County is mapped as being underlain by the blind thrust North Channel Slope fault, estimated to be capable of generating a maximum earthquake of magnitude 7.1. The More Ranch fault zone is mapped through the site and has a maximum earthquake of magnitude 6.7.

- The site is within Seismic Zone 4 based on the 1997 Uniform Building Code and the 1998 California Building Code. On the basis of our characterization of the site seismicity, the following values can be used for evaluating the seismic vulnerability of the structure:

Uniform Building Code Chapter 16, Table Number	Seismic Parameter	Value for Buildings
16-I	Seismic Zone Factor (Z)	0.40
16-J	Soil Profile Type	(S_C), Very Dense Soil or Soft Rock
16-Q	Seismic Coefficient (C_a)	$0.40N_a$
16-R	Seismic Coefficient (C_v)	$0.56N_v$
16-S	Near Source Factor (N_a) for near-field (short period) response	1.5*
	Near Source Factor (Na) for far-field (long period) response	1.0
16-T	Near Source Factor (N_v) for near-field response	1.6
	Near Source Factor (N_v) for far-field response	1.0

* Near source factor of 1.1 can be used if criteria listed in 1997 UBC Section 1629.4.2 are met.

- In terms of seismic response, the building complex includes relatively tall and short building elements. The seismic vulnerability assessment of the structure should consider both near-field (short period) and far-field (long period) seismic response, as each will likely be the controlling seismic event for the shorter and taller portions of the building complex, respectively. When considering seismic response, the resultant force acting on the foundations should remain within the middle third of the building and each foundation element.

6. REFERENCES

Blanchard, J. D., (2000), Personal communication regarding fault observed in tank excavation performed in 1988.

Blake, T.F. (2000), "FRISKSP - A computer program for the probabilistic estimation of peak acceleration and uniform hazard spectra using 3-D faults as earthquake sources", Windows Version 4.0.

Boore, D.M., Joyner, W.B., and Fumal, T.E. (1997). "Equations for estimating horizontal response spectra and peak accelerations from western North America earthquakes: A summary of recent work." Seismological Research Letters, Vol. 68, No. 1, pp. 128-153.

California Division of Mines and Geology (1996), *California Fault Parameters*, DMG Open-File Report 96-08.

CFS Engineering Geology (1997), "Geologic Hazards Study, Isla Vista Elementary School, Isla Vista, California", unpublished consultant report for Goleta Union School District, June 11.

CFS Geotechnical Consultants (2000), "Fault Evaluation Report, West Campus Green, University of California, Santa Barbara, California", unpublished consultant report for UCSB, May 12.

Dames & Moore (1973), Geology and Seismicity, Preliminary Safety Analysis Report, Proposed Engineering Unit 2, unpublished consultant report for the University of California, UCSB Report No. 177, February 28.

Dibblee, T.W. Jr. (1966), *Geology of the Central Santa Ynez Mountains, Santa Barbara County, California*, California Division of Mines and Geology Bulletin 186.

Dibblee, T. W. Jr. (1987), *Geologic Map of the Goleta Quadrangle,* Dibblee Foundation Map DF-07.

Fugro West, Inc. (1995), "Supplement Fault Evaluation Report, Tract 14,003, North Campus, University of California, Santa Barbara, California", unpublished consultant report prepared for the University of California.

Fugro West, Inc. (1996), "Supplement Fault and Liquefaction Evaluation Report, Tract 14,003, North Campus, University of California, Santa Barbara, California", unpublished consultant report prepared for the University of California.

Gurrola, L.D., Chen, J.H., Keller, E.A. and Metcalf, J.G. (1996), "Dating of emergent marine terraces and rate of uplift for the western Santa Barbara Fold Belt, California", GSA Abstracts and Programs, vol. 28, no. 7, p. A-301.

Gurrola, L.D. and Keller, E.A. (1998), "Seismic Sources and Earthquake Hazards of the Santa Barbara Fold Belt, California", 1998 Annual SCEC Progress Report.

Hill, M.L. (1932), Mechanics of faulting near Santa Barbara, California Journal of Geology, v. 40, no. 6 pp. 535-556.

K-C Geotechnical Associates (1992), "Geotechnical Engineering Report, Recreational Sports Complex, University of California, Santa Barbara" ,unpublished consultant report prepared for University of California.

Jennings, C.W. (1994), "Fault activity map of California and adjacent areas," California Division of Mines and Geology, Geologic Map No. 6, Scale 1:750,000.

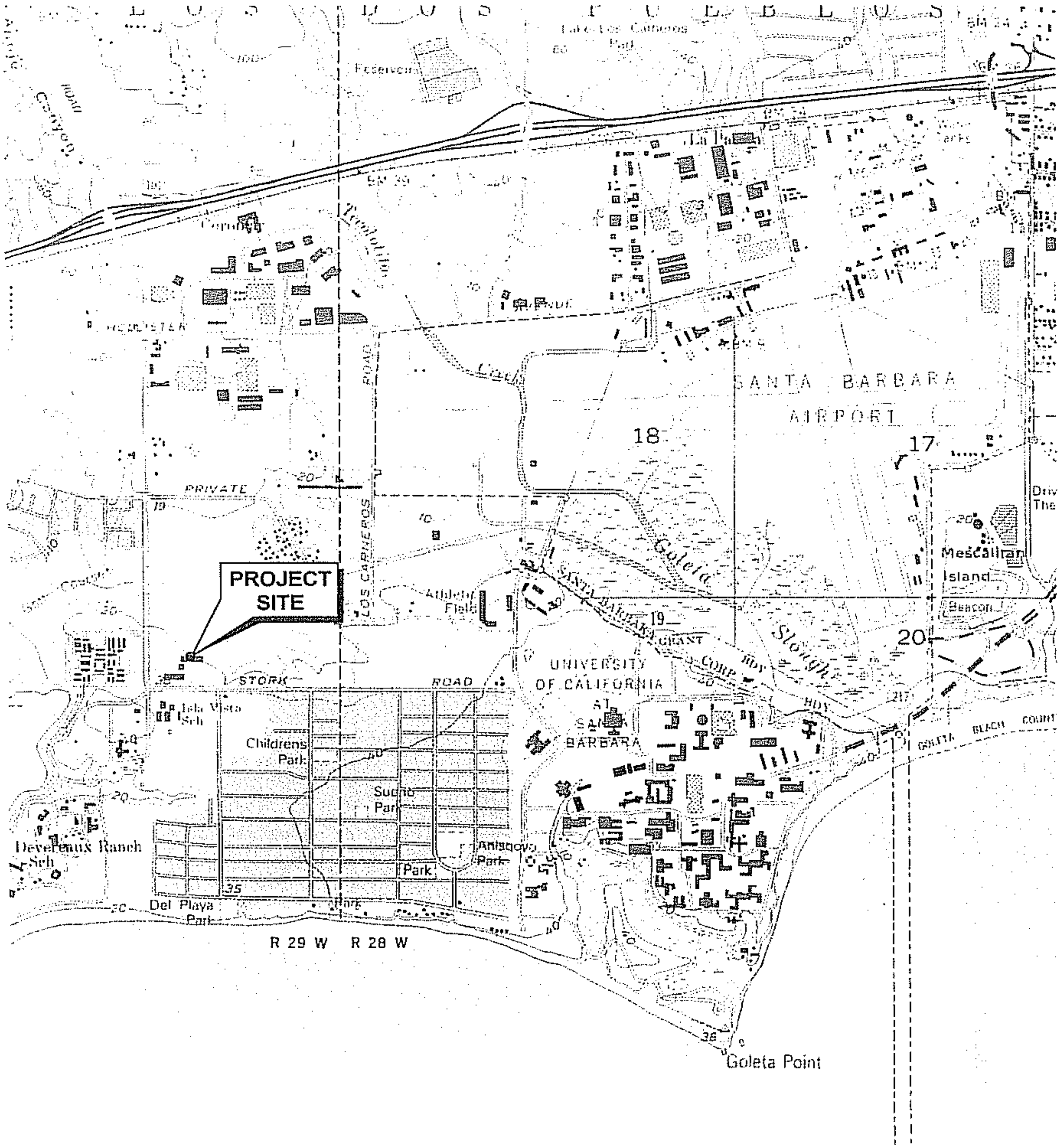
McGuire, R.K. (1978), "FRISK - Computer program for seismic risk analysis using faults as earthquake sources." *Open File Report No. 78-1007*, United States Geological Survey (USGS), Reston, Virginia.

Namson, J. and Davis, T. (1992), "Late Cenozoic Thrust Ramps of Southern California", Final Report of 1991 report to the Southern California Earthquake Center (SCEC).

Olson, D.J., (1982), Surface and Subsurface Geology of the Santa Barbara - Goleta Metropolitan Area, Santa Barbara County, California M.S. thesis, Oregon State University, Corvallis, Oregon.

Santa Barbara County Planning Department (1972), Santa Barbara County Comprehensive Plan, Seismic Safety and Safety Element.

Upson, J.E., (1951), Geology and groundwater resources of the South Coast basins of Santa Barbara and Ventura Counties, California, U.S.G.S. Water Supply Paper 1108.



BASE MAP SOURCE: USGS 7.5' Goleta quadrangle map.

NORTH

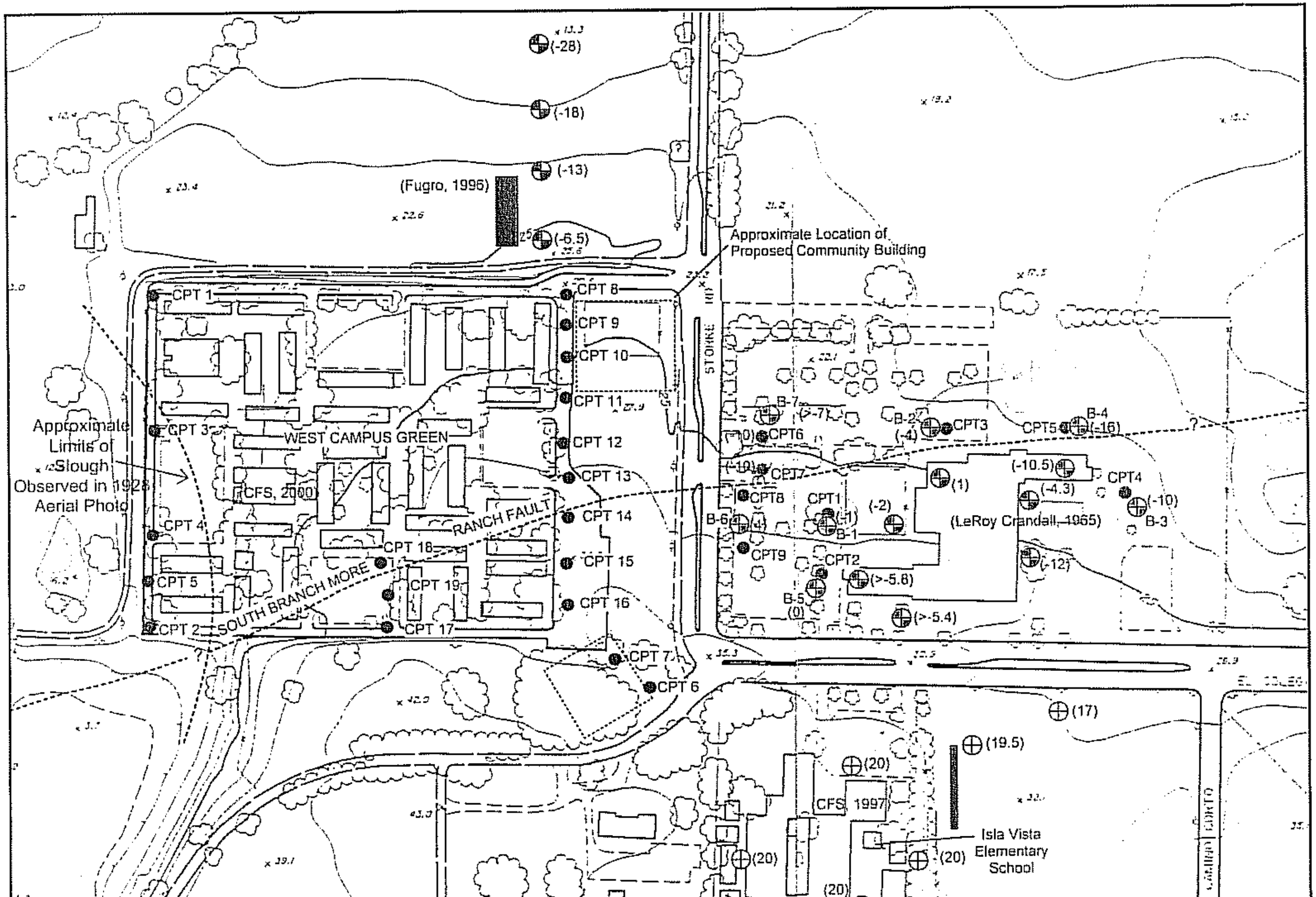
0 1000 2000

FEET

VICINITY MAP
Francisco Torres Apartments
Isla Vista, California

PLATE 1

University of California, Santa Barbara
Project No. 3064.015



Base Map: S.B. County Flood Control, Topography of the Goleta Valley, Sheets 47 & 48, 1991

LEGEND

- CPT Sounding Cone Penetrometer Test Location
- Boring Location, previous study, showing elevation (feet, msl) of bedrock
- Fault Trench Location
- LeRoy Crandall 1965 Study
- Fugro 1995 Study
- Fugro Current Study
- CFS 1997 Study
- CFS 2000 Study
- Inferred location of fault

(-4.3) - Underlying bedrock elevation

All locations and dimensions are approximate.

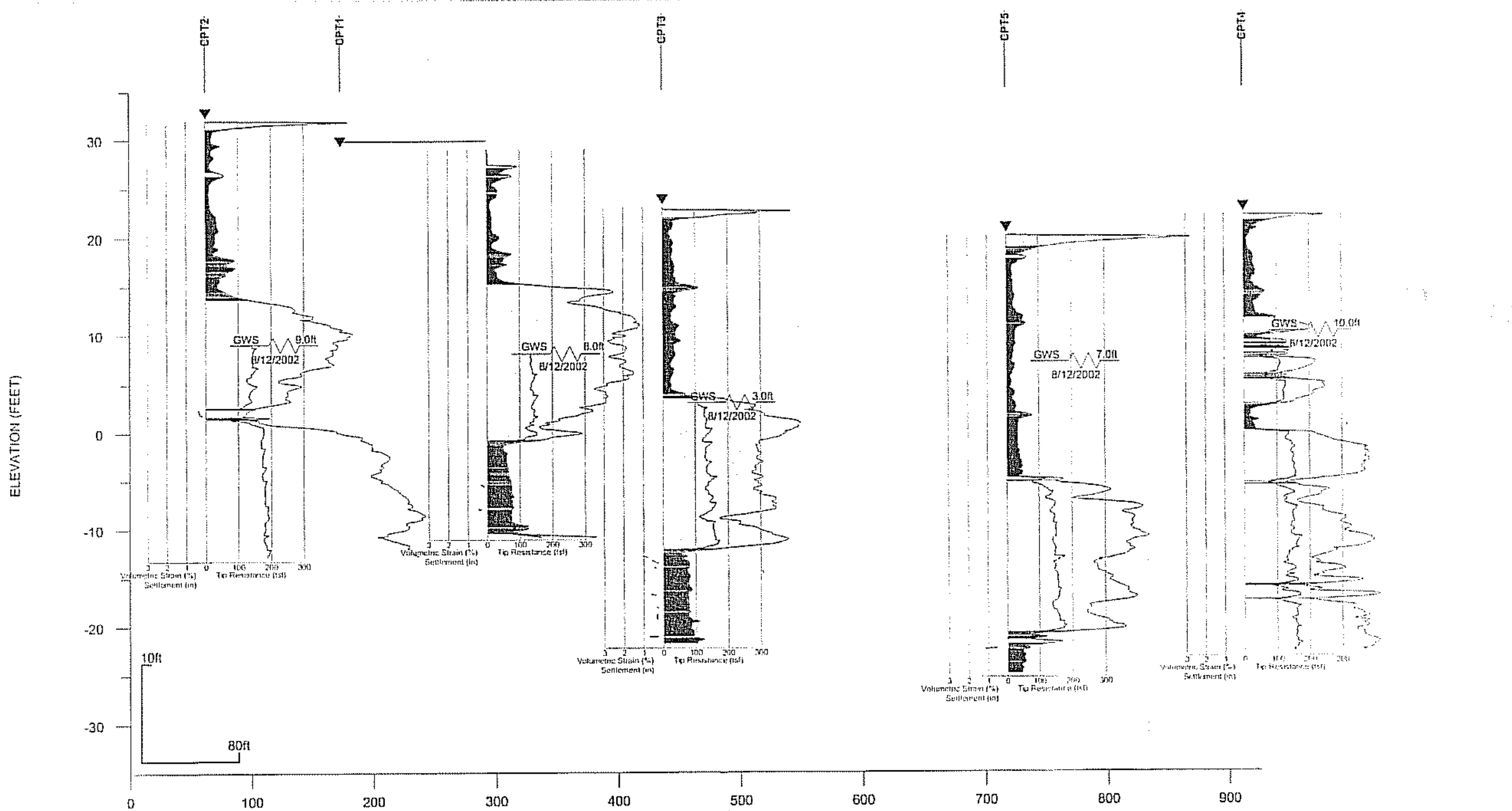
Approximate Scale

0 200' 400'

SITE PLAN
Francisco Torres Apartments
Isla Vista, California

PLATE 2

September 2002
Project No. 3064.015



SUBSURFACE CROSS SECTION WITH LIQUEFACTION EVALUATION

Magnitude = 7.1, Acceleration = 0.52 g

Francisco Torres Apartments

Isla Vista, California

PLATE 3