MONTEREY PENINSULA WATER SUPPLY PROJECT
NEW LOS PADRES DAM
GEOTECHNICAL STUDIES

PREPARED FOR
THE MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT
MONTEREY, CALIFORNIA

BY
BECHTEL CORPORATION
JUNE 1992

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NEW LOS PADRES DAM
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1.0 INTRODUCTION

1.1 PURPOSE

This report presents the results of a preliminary design phase geotechnical investigation of the New Los Padres Dam Project in accordance with the October 7, 1991 Agreement between the Monterey Peninsula Water Management District (MPWMD) and Bechtel Corporation (BECORP). The investigation was performed by Bechtel's Geotechnical Services Group.

The objective of this limited investigation is to evaluate the foundation conditions at the proposed dam site and characterize selected borrow areas, as outlined in subsection 1.2, in support of the preliminary design and cost estimate prepared in June 1989 (Bechtel, 1989). A roller compacted concrete dam (RCC) is recommended for this site in accordance with the findings set forth in Section 2.2 of that report.

The New Los Padres Dam site is located on the Carmel River about 24 miles upstream from its mouth and approximately 2,400 feet downstream from the existing Los Padres Dam (Figure 1.1). The proposed location of the site, on the Carmel Valley, California 7.5 minute quadrangle, is in Sections 4 and 5, Township 18 South, Range 3 East, MDB&M.

1.2 SCOPE OF WORK

The geotechnical scope of work for the limited preliminary design phase investigation of an RCC dam with a 24,000 acre–foot reservoir capacity at the proposed New Los Padres Dam site consisted of the following tasks:

- Drilling two vertical and one inclined borings at the dam site in overburden soils without sampling and in rock by the diamond coring method. The total length of the 3 borings was 440 feet.

- Excavating 13 backhoe trenches in gravelly soils in selected borrow areas between the existing Los Padres Dam and the proposed dam site. The bulk samples were evaluated in the field and laboratory for their suitability as construction materials for an RCC dam and for use as borrow or fill in associated structures.

- Performing a seismic refraction survey at the dam site, consisting of nine 200–foot lines, to determine the depth to sound rock and the compressional velocities of soil and rock materials.

- Conducting a total of 28 field pressure permeability tests in 3 borings.

- Completing the two vertical borings as monitoring wells.

- Performing laboratory testing of granitic rock cores from the borings to include deformability, unconfined compressive strength, tensile strength and petrographic analysis.

- Surveying the locations and elevations of borings, trenches and seismic shot points.

- Performing laboratory testing of construction materials for an RCC dam to include soil classification, density, sulfate soundness, resistance to abrasion, potential reactivity and mortar bar expansion.

- Conducting a reconnaissance survey of three quarry sites.

- Reducing and analyzing data and preparing a geotechnical report.

- Based on information derived from this 1991 program of Preliminary Geotechnical Studies, developing a plan of field investigation and laboratory testing needed for preliminary design together with a schedule and estimate of cost.

This limited study, performed during a six–month period, November 1991 to April 1992, is considered adequate as the initial phase of preliminary design, but much more extensive geotechnical investigations will be necessary to better define the critical design parameters (Section 7.0).

1.3 DESCRIPTION OF PROJECT

The geotechnical scope of work was designed to characterize the site for a gravity arch RCC dam impounding a reservoir with a 24,000 acre–foot capacity (Figures 1.2 and 1.3). The height of the proposed dam above the existing river bed is 261 feet with a crest elevation of 1,130 feet and spillway crest elevation of 1120 feet.[1] The proposed spillway is a stepped type. The outlet works consist of a multi–level inlet, a steel–lined conduit embedded in the dam and an outlet structure housing an energy dispersion valve that discharges into a stilling basin. Two fish collection facilities and associated access roads are part of the project.

1.4 PREVIOUS GEOTECHNICAL INVESTIGATIONS

A reconnaissance level site study, performed by Bechtel in the Spring 1989, consisted of: geologic mapping of the dam site at a scale of 1" = 200'; a cursory inspection of the reservoir area; a brief construction materials survey; and a preliminary analysis of seismicity (Bechtel, 1989). No subsurface investigations were performed.

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1 Based on a new reservoir elevation/capacity curve by Bestor Engineers, Inc. using aerial photos flown in November 1991, a 24,000 acre-foot reservoir will have a dam crest elevation of 1140 feet and spillway crest elevation of 1130 feet. The earlier curve was based on a 1947 survey.

Other geotechnical investigations, mainly concerning the New San Clemente Dam project, were performed in the region prior to the 1989 Bechtel studies. The New San Clemente damsite is located on the Carmel River about 7 miles downstream from the New Los Padres damsite (Figure 1.1). Information from the New San Clemente damsite reports was applicable to this Bechtel report with respect to Section 3, the geologic setting. The pertinent references are listed in Section 8.

2.0 SUMMARY

This summary, based upon a program of geotechnical investigations performed during November 1991 through April 1992, presents a preliminary assessment of the foundation conditions and the suitability of naturally occurring aggregates and borrow materials for the proposed New Los Padres Dam site. This proposed gravity arch RCC dam has a reservoir capacity of 24,000 AF and is located on the Carmel River approximately seven miles southeast of Carmel Valley Village near the community of Princes Camp. Additional geotechnical investigations will be required for preliminary design as well as for final design.

- Based on the information acquired from three borings and observation of surficial geological features, the foundation conditions at the New Los Padres Dam site appear to be suitable for the proposed RCC dam.

- A preliminary seismic analysis indicates that the maximum credible earthquake (MCE) acceleration, associated with the potentially active Cachagua fault, is, with some uncertainty, about 0.55 units of gravity at the New Los Padres Dam (Bechtel, 1989). The Cachagua fault is about 1,800 feet downstream from the site. No known active faults underlie the site.

- Terrace and stream channel deposits lying in an area about 0.5 mile upstream of the dam site may be marginally acceptable as a source of aggregates for an RCC dam. Preliminary indications are that the deposits, with an estimated waste of 30 to 40 percent, might yield the 640,000 cubic yards required for the dam that would impound a 24,000 AF reservoir. Limited laboratory tests indicate that the materials are of inferior quality but may be acceptable for use in the central portion of the dam with processing. Prudent material surveys usually require proven borrow area volumes double or even triple the required yardage. At present, the borrow areas investigated, comprised of terrace and stream channel deposits as well as required dam foundation excavation, may yield an estimated 735,000 cubic yards of usable aggregates but their quality demands more

convincing definition than it has been possible to obtain from the present program of exploration and tests.

- Extensive areas of terrace deposits lie immediately downstream of the site on the left bank of the river. The quality of the materials in these deposits is expected to be similar to the materials in the deposits that have been investigated upstream of the dam site.

- The reservoir would lie in relatively impermeable rocks so leakage should be negligible. A few shallow landslides occur within the reservoir area. The potential for siltation is considered moderate, but must be confirmed by detailed studies.

- Average stripping depths, as estimated from the existing ground surface to the upper surface of the dam foundation, are: right abutment–45 feet; channel section–15 feet; and left abutment–35 feet. Maximum stripping depths may be 70 feet locally.

- Foundation treatment beneath the dam will require consolidation grouting, local placement of dental concrete, and curtain grouting. Based upon an average fracture permeability of 8.4×10^{-6} cm per second, a low value, the average grout take is estimated to be less than 0.5 sacks of cement per foot of grout hole to a maximum depth of 175 feet.

- Quarry Sites A and B, immediately upstream of the site, appear suitable as a source of construction materials for an RCC dam. These sites, which would yield crushed granitic rock, require future study to determine rock quality and quantity. Alternate Quarry Site C will only be considered for further investigation if Quarry Sites A and B prove unsatisfactory.

3.0 GEOLOGIC SETTING

3.1 REGIONAL GEOLOGY

3.1.1 General

The proposed New Los Padres Dam site and reservoir are located in the northern Santa Lucia Range of the southern Coast Ranges geomorphic province (Figure 3.1). This province contains a series of northwest–trending mountains and valleys that are usually controlled by complex geologic structures, the most important of which is the San Andreas rift zone (Figure 3.2). The Santa Lucia range is the westernmost mountainous region of the province, and it is bordered on the east by the Sierra de Salinas and the Salinas Valley and on the west by the Pacific Ocean. It extends from Monterey Bay on the north to Morro Bay on the south (Figure 1.1).

The topography of the Santa Lucia range is characterized by deep V–shaped canyons and high, narrow ridges. Elevations range from about 860 feet at the dam site to over 2,600 feet at Hennickson's Ridge in the reservoir area. The Carmel River drains the northern part of the Santa Lucia range and the southwest slope of the Sierra de Salinas. The Carmel River follows the regional geologic structure but also is superimposed across some regional features.

During the late Pliocene (about 3 million years ago), uplift accompanied by folding and faulting accentuated the northwest structural trend of the folds and faults formed by earlier disturbances. In the mid–Pleistocene, uplift and renewal of folding and faulting caused streams to rejuvenate and dissect former erosional surfaces. Regional uplift has continued during the Quaternary as shown by several levels of terrace deposits, up to 150 feet above the present streambed, that occur along the canyon walls of the Carmel River.

A basement complex of metamorphic and granitic crystalline rocks forms the Salinian block (Figure 3.1). The metamorphic Sur series, probably of Paleozoic age, includes gneisses, schists, quartzites, marbles, and granulites. The Cretaceous granitic rocks range from quartz monzonite to gabbro in composition, and they contain small ultramafic bodies. Overlying the crystalline basement complex in the Santa Lucia range are Miocene age marine sedimentary rocks that extend in a belt from near Monterey southeastward along the east side of the range.

The Coast Ranges have undergone at least four crustal disturbances:

- The early Cretaceous (about 100–140 million years ago) orogeny in the Salinian block marked by the intrusion of granitic plutons into the metamorphic complex.

- Early Tertiary (about 35–65 million years ago) thrust faulting which brought uppermost Jurassic and Cretaceous sedimentary rocks into juxtaposition with Franciscan rocks.

- Prolonged Cenozoic (last 65 million years) strike–slip faulting of great displacement along the San Andreas fault system.

- Late Pliocene and Pleistocene folding and faulting.

The Salinian block is that segment of the Coast Ranges that lies between the Sur–Nacamiento fault zone on the southwest and the San Andreas fault zone on the northwest. The Franciscan basement complex south of the Sur–Nacamiento fault zone became positioned adjacent to the Salinian block as the result of sea floor spreading with the continent moving westward over the oceanic crust. The Salinian block has undergone over 300 miles of right lateral displacement along the San Andreas fault to reach its present position. Other major structures in the region include the San Gregorio–Hosgri, Monterey Bay and Rinconada fault zones, all of which are thought to be related to the San Andreas fault system.

The Santa Lucia range, in which the proposed dam site is located, is dissected by a complex system of high angle reverse faults and some localized normal faults that effectively divide the range into many fault blocks (Figure 3.2). Sections of Tertiary sediments have been downfaulted into the basement rocks along some of these faults. Faults within the project area considered potentially active (movement having occurred within the last 2 to 3 million years) are the Tularcitos, Rinconada–Reliz, Cachagua, Chupines, Navy, and Cypress Point faults (Corps of Engineers, 1981). Rocks in the Santa Lucia range have been folded on a regional scale but much of the folded structure has been disrupted or destroyed by subsequent periods of crustal disturbance.

3.1.2 Geologic Units

The oldest bedrock unit underlying the proposed dam site and reservoir area is Paleozoic age metamorphic rocks of the Sur series comprised of schists, gneisses, quartzites, marbles, and a variety of contact metamorphic rocks. The Sur metamorphic rocks also occur as inclusions within the Santa Lucia intrusives.

The middle to late Cretaceous Santa Lucia intrusives occur as large plutonic masses as well as smaller dikes which range in composition from quartz monzonite to gabbro. A few small, ultrabasic intrusives occur within these granitic rocks. The Santa Lucia intrusives comprise the bulk of the bedrock cropping out in the study area (Figure 3.1).

The area north of New Los Padres damsite is underlain by the lower to middle Miocene age marine sandstones of the Vaqueros–Temblor formations. Several small areas are capped by the shales and silicious shales of the Monterey formation of Miocene age.

A series of extensive and well developed stream terraces occur along the Carmel River in the study area. At least two and possibly three levels of rock–cut terraces are present. Terrace morphology suggests a late Pleistocene age, so they probably were formed between 10,000 and 125,000 years ago (Rogers Johnson & Associates, July 1984).

Recent alluvial sands and gravels are located in the channel of the Carmel River and also in the reservoir of Los Padres Dam. These deposits are unconsolidated and consist mostly of granitic and metamorphic clasts.

3.1.3 Geologic Structure

The most important geologic structural feature in the study area is the Cachagua fault, which lies about 1,800 feet northeast (downstream) of the dam site. It is a steeply southwest dipping reverse fault (Dibblee, 1972). The Cachagua fault forms the boundary between the crystalline basement rocks and the Tertiary marine sedimentary rocks along a portion of its length in the study area. The total displacement on the fault is not known. According to Rogers E. Johnson and Associates (January 1985), the Cachagua fault is estimated to have initiated movement in late Pliocene, but there is no evidence of late Pleistocene or younger displacement. No active faults (movement during the last 11,000 years) are known to underlie the proposed dam site or reservoir area.

Numerous discontinuous small faults and shears, with zones of breakage and gouge on the order of several inches thick, are found throughout the basement rocks in the Santa Lucia mountains. These faults are considered to be inactive.

The basement rocks are also strongly jointed and fractured with a predominant northwestern and east–west trend of the joint sets with vertical to moderate dips (Converse, 1986). Locally, flow banding in the granitic rocks and foliation in the metamorphic rocks occurs.

The unconformity between the crystalline basement rocks and the overlying sedimentary rocks probably formed in early to mid Tertiary time in the northern Santa Lucia mountains. The unconformable surface is quite irregular and shows considerable topographic relief (Rogers Johnson and Associates, January 1985).

The Miocene age sedimentary rocks in the northern Santa Lucia mountains have been folded into a series of anticlines and synclines with low to moderate dips. Near the Cachagua fault zone, these sedimentary rocks have been thoroughly jointed and fractured.

The stream channel and river terrace alluvial deposits appear undeformed and are typically flat lying.

3.2 SEISMICITY

The New Los Padres Dam site is located in an active seismic area due to the presence of the San Andreas fault zone to the east and the Palo Colorado–San Gregorio, Hosgri and Monterey Bay fault zones offshore to the west and north (Figure 3.2). The Monterey Bay fault zone is a series of en–echelon, discontinuous faults trending northwesterly across Monterey Bay. Another major structural feature is the Sur–Nacimiento fault zone to the south of the study area, but there is no conclusive evidence that this fault has been active during the last 11,000 years (Page, 1970).

Based on the historic record for the period 1926–1973, the area within a 50–mile radius of the dam site has experienced 141 shocks of magnitude 4 or larger. Statistically, this region experiences three magnitude 4.0 – 4.9 events per year, one magnitude 5.0 – 5.9 event every three years, and one magnitude 6.0 – 6.1 event every 19 years (Corps of Engineers, 1981). The majority of the shocks originate from the San Andreas fault zone, which is about 25 miles to the east of the site. The Loma Prieta earthquake of 1989, about 60 miles from the dam site, had a magnitude of 7.1 and is the closest historic earthquake of greater than 7 magnitude in the project area. Two recorded earthquakes in the Monterey Bay region occurred in 1926 when two 6.1 magnitude shocks occurred approximately 32 and 42 miles, respectively, northwest of the dam site. In 1952, a magnitude 6.0 shock occurred about 55 miles southeast of the site.

Geomatrix Consultants (1985) evaluated the Tularcitos and Cachagua faults which are about 2.5 miles and 0.3 mile, respectively, from the dam site (Figure 3.2). They suggest that the Tularcitos fault is probably active (has undergone slip in the past 11,000 years)

based on geomorphic evidence. The Cachagua fault does not show definitive evidence of Holocene slip and is probably not active. Geomatrix Consultants have assigned a maximum credible earthquake magnitude of 6.75 for the Tularcitos fault and 6.25 for the Cachagua.

Seismic activity is continuing in the region. The dam site and reservoir will probably be periodically subjected to varying intensities of shaking as the result of earthquakes originating along the active fault systems within the area.

For maximum credible earthquake (MCE) acceleration estimates, the center crest location of the New Los Padres Dam on Figure 1.2 and an enlargement of Figure 3.2 were used to develop distance estimates to the nearest significant regional faults. The equivalents of Table 3 in Bechtel's June 1988 report (Section 7.0) were then developed using these distances and the same maximum magnitudes for each fault and the same acceleration attenuation curves. The results are shown below.

MCE ACCELERATIONS – NEW LOS PADRES DAM SITE

Fault	Closest Dist. (km)	Max Mag. (Richter)	Average Acceleration (g)
Cachagua	0.5	6.25	0.55
Tularcitos	5.0	6.75	0.44
Blue Rock	4.7	6.10	0.34
Chupines	11.0	6.50	0.25
Navy	23.2	6.00	0.11
San Gregorio–Sur–Hosgri	20.7	7.70	0.30
Cypress Point	30.8	6.00	0.08
Rinconada	17.0	7.60	0.33
San Andreas	47.0	7.80	0.16

This preliminary analysis indicates that the MCE acceleration comes from the Cachagua fault and is, with some uncertainty, about 0.55g for the New Los Padres site.

No separate hazard analyses were performed for this site. Rather, Figure 5 of Bechtel's June 1988 report (Section 8.0) was consulted to find the 1,000–year acceleration. This figure gives area contours of the 1,000–year return period acceleration for the faults considered above using the Joyner and Boore (1981) attenuation curves. The San Gregorio–Sur–Hosgri fault system dominates the results. Figure 5 (Bechtel, June 1988) shows that the 1,000–year return period acceleration at New Los Padres, under the assumptions used, is about 0.48g.

This value may be compared to the MCE value of 0.57g and the 1,000–year return period value of 0.50g for the New San Clemente Dam site of Bechtel's June 1988 report. The New Los Padres Dam site, therefore, is closely comparable from the point of view of ground shaking potential. The issue of fault offset is more critical for the New Los Padres Dam because the Cachagua fault passes within 1,800 feet (about 500 m) of the site. A more precise location of the Cachagua fault relative to New Los Padres Dam is not necessary to estimate expected peak ground acceleration because the acceleration attenuation curves that were used flatten at small distances. However, the small scale map used to develop this table (Figure 3.2) cannot be used to address the question of potential fault offset near or through the dam. Fault offset design criteria for this site will depend on detailed geologic and geophysical field surveys of the area.

3.3 PHYSIOGRAPHY

The Carmel River flows through diverse terrain in the study area (Figure 3.1). Downstream from the dam site in the vicinity of Princes Camp, the river has a low gradient and is flanked by broad terrace deposits. At the dam site, the canyon narrows and the gradient of the river steepens. The reservoir area, partially occupied by the existing Los Padres reservoir, typically displays narrow, U–shaped canyons. The major tributaries to the Carmel River in this reach include Danish Creek, Cachagua Creek, Pine Creek, San Clemente Creek, and two unnamed tributaries known as Jeep Trail Creek and Landing Strip Creek. Some of the canyon walls are modified by rock–cut benches overlain by terrace deposits that are perched at several levels above the stream bed.

Typically, the steep slopes are moderately vegetated with trees and brush, with the north and east aspect slopes having more deeply developed soil and more vegetation.

The climate in the study area is characterized by warm and dry summers and wet winters. The normal annual precipitation in the Carmel River drainage above the existing San Clemente Dam varies from 20 to 40 inches, the higher values occurring in the southern portion of the watershed upstream from Los Padres Reservoir (Monterey Peninsula Water Management District, 1987). The average annual precipitation in the New Los Padres Dam site area is 27 inches. There are pronounced fluctuations in precipitation with severe droughts and extremely wet periods common over the past 200 years. Rainfall in the watershed typically occurs between November and April. After filling the existing Los Padres and San Clemente Dams, usually by mid December, water overflows to the lower Carmel River.

The Carmel River in the study area drains a 125 square mile area upstream of the existing San Clemente Dam (Figure 1.1) and 45 square miles upstream from the New Los Padres Dam. The period of highest stream flow in the river usually occurs from January through April, when average monthly flows range between 200 and 400 cubic feet per second (cfs).

4.0 GEOTECHNICAL INVESTIGATIONS

4.1 GENERAL

Geotechnical field investigations were performed by the Bechtel Geotechnical Services Group between November 18 and December 13, 1991 and also on April 7 and 8, 1992 to provide data for preliminary design studies.

The scope of work included geologic mapping, rock core drilling, pressure permeability testing, seismic refraction surveys, backhoe trenching, laboratory rock testing, laboratory RCC materials testing and land surveying of exploration features. A Bechtel engineering geologist planned and supervised the exploration program, administered the subcontracts, evaluated the data, and prepared the specifications and this technical report.

Continental Drilling Company West of Madera, California, and Kleinfelder, Inc. of Pleasanton, California, were Bechtel's drilling and trenching and RCC materials testing subcontractors, respectively. Bechtel conducted the seismic refraction surveys. The core testing was performed in Bechtel's Rock Mechanics Laboratory in San Francisco. Topographic surveying was conducted by Bestor Engineers of Monterey, California.

4.2 GEOLOGIC MAPPING

Aerial photographs, colored stereo pairs, from the AV 3489 series at a scale of 1:13000 and flown on February 14, 1989 were used to map the geology of the site and upstream borrow and quarry areas. These data were transferred to a topographic map with a scale of 1:2400 (1 inch equals 200 feet) and a ten–foot contour interval (Figure 5.1). The geologic contacts of the resulting geologic map were field checked. A geologic section was prepared along the proposed dam axis (Figure 5.2) and geologic sections were drawn in the borrow areas (Figure 5.4). A preliminary geologic map was also prepared for an alternate rock quarry site about 1.8 air miles northwest of the site (Appendix D).

4.3 CORE DRILLING

Core drilling was conducted in three borings located along the proposed RCC dam axis (Figure 4.1). Borings RA–1 and LA–1 are vertical, and boring C–1 is drilled at an inclination of 65°. A summary of exploration, presenting surveyed location coordinates and pertinent drilling quantities, is shown on Table 4.1. Geologic Drill Logs and appended Fracture Logs are presented in Appendix A. Borings RA–1 and LA–1 are completed as monitoring wells and their logs are shown in Appendix A. The overburden soils were penetrated without sampling, but their drill cuttings were described on the Geologic Drill Logs.

All drilling and sampling operations performed by Continental Drilling were administered by Bechtel engineering geologists, who logged and photographed the core, recorded drilling data, and selected rock samples for laboratory testing. Core drilling was performed in accordance with ASTM D–2113 using a Mobile B–80 truck–mounted hydraulic rotary drill rig and two skid–mounted CP–15 hydraulic rotary drill rigs. Additional support equipment consisted of a flatbed truck with a hoist , a water tank, an FMC water pump, and three $^1/_2$ ton pickups. A Bell 206 helicopter transported the skid rigs and equipment during mobilization–demobilization from the laydown area on the right abutment to and from the LA–1 and C–1 drill pads.

A five–foot long double tube core barrel with a split inner tube was used for wireline type rock core drilling. Bottom discharge, diamond bits (1.86 inch I.D., 2.98 inch O.D.) were used. The drilling fluid was clean water obtained locally from the Carmel River. At the completion of drilling, the inclined boring was completely filled with a cement–bentonite grout mixture. Borings RA–1 and LA–1 were completed as monitoring wells.

Rock cores were placed in wooden core boxes and wooden blocks were used to separate the core runs. The rock cores are stored at the MPWMD self storage shed in Carmel Valley village. Photographs of the cores are filed at the Bechtel Geotechnical Services office in San Francisco. A complete set of core photographs was provided to MPWMD.

Eleven rock core samples were selected from the borings and identified with regard to boring, sample number, depth, and date. These core samples were transported by car to the Bechtel Rock Mechanics Laboratory in San Francisco for testing. Laboratory rock test results are briefly discussed in subsection 6.2 and shown on Table 6.1. Detailed laboratory procedures and data are presented in Appendix C.1.

4.4 PRESSURE PERMEABILITY TESTING

A total of 28 field pressure permeability tests were conducted in rock in borings RA–1, LA–1 and C–1. A double pneumatic packer apparatus to test an interval of about ten feet of rock was used in accordance with Soil Manual Designation E–18, U.S. Bureau of Reclamation.

Water testing equipment consisted of an FMC water pump, a three–way valve, a Trident two–inch diameter flow meter calibrated in tenths of a cubic foot, pressure gauges with a 0–100 psi range, and a double pneumatic packer. The permeability testing equipment setup was calibrated in the field to determine water take.

Rock permeability test data are shown on the Geologic Drill Logs, Appendix A.2 and test results are summarized in Table 4.2.

4.5 SEISMIC REFRACTION SURVEY

A seismic refraction survey, with a total of 9 seismic refraction lines, was conducted in the foundation area of the proposed RCC dam (Figure 4.1). A two–man crew headed by a Bechtel geophysicist conducted the survey from December 10 to 13, 1991 using a 12–channel EG&G Geometrics ES–1225 exploration seismograph. Detailed field and office procedures and data evaluation are presented in Appendix B. A summary of exploration showing the shot point coordinates is shown on Table 4.1.

4.6 BACKHOE TRENCHING

Some potential borrow areas for the development of construction materials for an RCC dam were investigated by 13 backhoe trenches from December 2 to 4, 1991 (Figures 5.3 and 5.4). The trenches were excavated to depths ranging from 6 to 15 feet using a Case 680H backhoe with a one cubic yard bucket (15 feet is the depth limit of the backhoe). In the terrace deposits, boulders up to 10 feet in greatest dimension resulted in refusal in six of the trenches.

The trenches were logged and photographed by a Bechtel geologist and grab samples were placed in unlined 50 pound capacity canvas sacks, 5 sacks per trench. The samples were stored on site and transported to the Kleinfelder laboratory in Livermore for testing at the completion of the field work. The trench logs are shown in Appendix A.5. A summary of exploration and a tabulation of construction materials test results are presented in Tables 4.1 and 5.3, respectively. Appendix C.3 reports the laboratory RCC materials testing results. A set of photos was provided to MPWMD.

4.7 LABORATORY ROCK TESTING

Eleven NX–sized rock core samples were selected by Bechtel geologists from dam foundation borings RA–1, C–1 and LA–1 and transported to Bechtel's Rock Mechanics and Geotechnical Laboratory in San Francisco.

Intact rock core samples were prepared and tested according to ASTM D–2938, D–3148 and D–3967. Eight samples were tested for axial and lateral deformability and unconfined compressive strength; and 5 samples were tested for indirect (Brazilian) tensile strength. In addition, 4 thin sections of rock cores were prepared and examined with the petrographic microscope by a Bechtel geologist. Appendix C.2 presents a petrographic description of the selected core samples. A summary of the test results is presented in Table 6.1 and the procedures and test data are shown in Appendix C.1.

4.8 LABORATORY RCC MATERIALS TESTING

Sixty five canvas sacks of RCC borrow materials, obtained from 13 backhoe trenches (refer to subsection 4.6), were delivered to the Kleinfelder laboratory in Pleasanton on December 6, 1991. The tests performed under this subcontract were for evaluation of RCC materials and included: 13 combined gradations; 5 each of bulk unit weight, specific gravity–absorption, sulfate soundness, resistance to abrasion, materials finer than No. 200 sieve and Atterberg limits; and 3 each of potential reactivity by the chemical method and by mortar bar expansion (subsection 6.3). Test results are summarized in Table 6.2. Test results are reported in Appendix C.3.

5.0 ENGINEERING GEOLOGY OF THE SITE

5.1 GENERAL

An RCC gravity dam, ranging in dam crest elevation from 1,110 feet for 16,000 acre–feet of storage to 1,130 feet for 24,000 acre–feet, is being considered for this site which is approximately 0.6 air miles downstream from the existing Los Padres Dam (Figure 1.1). As shown on the USGS Carmel Valley quadrangle map, the site is located in Sections 4 and 5, Township 18S, Range 3E. The present access to the proposed dam site is by a road 0.8 mile long from the intersection of the Cachagua Grade road and the village of Princes Camp.

Aerial photographs AV 3489 at a scale of 1 : 13,000 and flown on February 14, 1989 were used to map the site. The site topography is displayed on two maps: (1) Bestor Engineers Inc., December 1991, scale 1 inch = 100 feet, contour interval 5 feet; and (2) Hammon, Jensen, Wallen & Associates February, 1989 (revised 4–4–89), scale 1 inch = 200 feet, contour interval 10 feet.

5.1.1 Rock Units

The New Los Padres Dam site is underlain by Mesozoic granitic rocks ranging from quartz monzonite to diorite in composition. The light to dark gray granitic rocks are fine to coarse grained and range from fresh to decomposed, being altered in part. The rock alteration, probably hydrothermal in origin, predominantly affects the dark ferromagnesium minerals, with hornblende and biotite altered to chlorite and sericite respectively. Occasional veins of feldspar and pegmatite were noted. Infrequent mineralization is usually pyrite with rare calcite. The rock mineralogy is presented in Appendices A.2 and C.2.

These igneous rocks contain some metamorphic inclusions of older schist and gneiss, probably of the Sur series. The rare inclusions have a maximum dimension of about

30 feet as observed in exposures at the dam site; they are usually weathered and their borders are commonly sheared.

River terrace deposits comprised of unconsolidated silt, sand and gravel up to 3 feet in diameter overlie portions of the bedrock on the right abutment. Fresh bedrock is well exposed in portions of the northeast trending channel. The right abutment is masked by a deep cover of residual soil and colluvium and moderate vegetation of trees and brush. The steeper left abutment, with a cover of soil and colluvium supporting a moderate to light vegetation, displays some rock outcrops as shown on Figure 5.1. No landslides were mapped in the dam foundation area.

5.1.2 Geologic Structure

The major joint sets in the foundation area (Fig. 5.1), mostly measured in the channel section, have the following strikes and dips: N 10–20° W, 50–90° W; N 10–20° E, 20–90° E; N 70–75° E, 80° N to 80° S; N 40–65° W, 35° N to 70° S; East–West, 75° N to 80° S; and sub–horizontal. Where fresh, the joints are tight with no staining or coatings. Some joint sets were persistent and could be traced for more than 30 feet. The orthogonal joint pattern has divided the rock into rectangular blocks, which range in size from less than a foot to about 3 feet.

A summary of granitic rock fractures is shown on Table 5.1. Based upon an evaluation of fracture logs and geologic drill logs (Appendix A) as well as pressure permeability tests (Table 4.2), the following foundation fractures characteristics are presented:

- On average, 84 percent of the fractures are spaced between 0.1 and 0.5 feet apart. Twelve percent of the fractures are spaced between 0.1 and <0.05 feet apart in fracture zones where most of the core loss occurred during hard rock drilling. Only about 4 percent of the fractures are spaced at intervals greater than 0.5 feet.

- The average Rock Quality Designation (RQD) is 18 percent. The average number of fractures per foot of core length is 4.4 (about 3–inch spacing) which substantiates the low RQD value.

- The average dips of the fractures measured in vertical borings RA–1 and LA–1 are: 0–30 degrees, 45 percent; 31–60 degrees, 40 percent; and 61–90 degrees, 15 percent. About 25 percent of these fractures intersect as measured in the core samples.

- The roughness of the core fracture surfaces, averaged for the 3 borings, are: smooth, 10 percent; moderately smooth, 25 percent; moderately rough, 30 percent; and rough, 35 percent.

- On average, about 30 percent of the fracture surfaces are fresh; 50 percent are stained with iron and manganese oxides and occasionally with chlorite; and 20 percent are stained and also contain coatings up to 3 mm thick of silt, crushed rock fragments, pyrite mineralization or rarely calcite or clay.

- About 5 percent of core fractures display slickensides, usually associated with chlorite staining and smooth or moderately smooth fracture surfaces. The slickensides probably indicate movement along fracture surfaces due to re–adjustment of blocks of rock as regional uplift and erosion slowly occur over time.

- As shown on Table 4.2, there is a poor correlation between fracture permeability and fracture spacing. The low permeability indicates that the fractures are tight even when fracture zones of intensely fractured to crushed rock (<0.05 – 0.1 ft) are present. Clay coatings on fracture surfaces are rare in the sampled cores.

- Healed fractures, usually sealed with silica, comprise about one percent of the core fractures.

Based upon the above data, the closely spaced fractures in the dam foundation appear to be tight and interlocking even though only 30 percent of the fractures are fresh, and 5 percent display slickensides. These fracture data indicate the rock has a high angle of internal friction (probable high shear strength) and a low hydraulic conductivity (probable low seepage), both positive attributes for a dam foundation.

No faults were noted in the borings or in the exposed bedrock at the dam site. The Cachagua fault, which separates the granitics from Tertiary sedimentary rocks, occurs about 1,800 feet downstream from the proposed dam axis; this fault is probably not active (no movement during the last 11,000 years) but needs to be explored during the next phase of investigation to confirm this designation.

5.2 FOUNDATION CONDITIONS

A brief discussion of the foundation conditions for an RCC arched gravity dam with a height of 260 feet above the present stream bed are presented below. The stripping estimates for the dam foundation area, shown on Table 5.2, are based on geologic mapping, 3 borings, 2 trenches and a seismic refraction survey.

5.2.1 Right Abutment

The topographic slope averages about 30 percent from the Carmel River channel at 870 feet to abutment Elevation 1,130. The slope flattens at the terrace between Elevations 985 and 1,050 feet and is rather uniform above that elevation.

In the dam foundation, bedrock is exposed over about 15 percent of the area and occurs only in the lower abutment between the channel and Elevation 985. Elsewhere, the right abutment is covered with residual soil, slopewash or stream terrace deposits (Figure 5.1). A moderate covering of trees and brush grows on the right abutment. No ground water was encountered in Boring RA–1, drilled to a depth of 125 feet in November, 1991.

Table 5.2 shows the stripping estimates for the right abutment. The hard granitic rock will require drilling and blasting for excavation. The decomposed rock and the weathered, closely jointed rock can be removed by ripping. Common excavation can remove the soil, colluvium and terrace materials. The deep overburden at elevation 1130 (dam crest), estimated to be about 60 feet thick (Figure 5.2), may require extending the dam to the east and result in additional excavation.

5.2.2 Channel Section

The width of the channel section including the stream and adjacent younger terrace deposits ranges from 90 to 200 feet. The stream gradient in this reach averages 1.2 percent.

Rock outcrops, which border about 50 percent of the channel area, are fresh with tight joints. The stream and terrace sediments are composed of unconsolidated silt, sand and gravel up to boulder size. Tree cover is moderate and brush cover is light. The elevation of the ground water in the channel area is determined by the stage of the Carmel River.

The stripping estimates for the channel area are shown on Table 5.2. Overburden and rock removal are as described for the right abutment. Some shaping of the rock will be required in this area to accommodate the geometry of the dam.

5.2.3 Left Abutment

A 50 percent slope is the average from the channel to the 1,130 foot elevation. A terrace between elevations 945 and 990 feet slopes rather steeply. The abutment is even and uniform in the foundation area.

Bedrock is exposed over approximately 20 percent of the foundation area, occurring near the channel and in the gully upstream from the dam axis. The left abutment is masked by residual soil, and colluvium. Tree cover is light and brush cover is moderate on this abutment. Ground water was encountered at a depth of 80.5 feet (elev. 905.5) in boring LA–1 in December, 1991.

The stripping estimates for the left abutment are presented on Table 5.2. The methods for excavation of rock and overburden are the same as described for the right abutment. The estimated 40–foot thick overburden at elevation 1,130 may require extending the dam to the west, resulting in additional excavation.

5.2.4 *Appurtenant Works*

The spillway and most of the outlet works are incorporated into the RCC dam, and stripping estimates are the same as for the dam (Figure 1.3). The spillway, with a crest elevation of 1,120 feet, will discharge into the river where rock is exposed in the right channel area. A 5 foot wide near–vertical shear zone containing crushed rock and clayey gouge seams trends N 45 W in the spillway stilling basin (Figure 5.1). The intake and conduit of the outlet works are located on the upper left abutment just upstream of the dam axis (Figure 1.2); stripping estimates would be the same as for the left abutment foundation area.

5.3 FOUNDATION TREATMENT OF DAM

The base of the RCC dam will be keyed into sound and competent rock that is expected to require consolidation grouting. Differential weathering along some fractures and shear zones will require overexcavation and backfilling with dental concrete. A grout curtain along the axis of the dam will have a maximum depth of about 175 feet with an estimated average take of less than 0.5 sack of cement per foot of grout hole. Immediately downstream from the grout curtain, a row of drain holes may be needed to handle potential uplift pressures.

In the spillway stilling basin area, #9 anchor bars will be grouted into the rock. In addition, drain holes may be required in the concrete slab.

5.4 RESERVOIR AREA

The 24,000 acre foot reservoir will inundate the existing Los Padres Dam and Reservoir and extend the reservoir over a mile upstream. Less than 1 mile of transmission lines and dirt roads will need relocation. The clearing of a moderate cover of trees, predominately oaks and conifers, and a moderate cover of brush will be necessary.

The reservoir area is underlain by the granitic complex and the older, complexly folded meta–sediments of the Sur series. A geologic contact between the granitic and metamorphic rocks has been mapped just downstream of the Los Padres Dam (Figure 5.1). It is uncertain if this is an intrusive contact or an ancient fault contact. Reservoir leakage does not seem to be a problem. A few shallow landslides, mostly in the colluvium and older alluvium, were noted in the reservoir area. There is a potential for siltation especially under conditions where the vegetative cover is removed by forest fires followed by high intensity storms.

5.5 CONSTRUCTION MATERIALS

5.5.1 General

Construction materials possibly suitable for an RCC dam lie within two air miles distance of the dam site and consist of three types: alluvial stream bed and terrace deposits, granitic quarry rock and materials from required foundation excavations (Figures 5.3, 5.4, 5.5 and Tables 5.3, 5.4 and 6.2). Limited subsurface investigations were conducted in Borrow areas A and B (terrace deposits) and Borrow Area D (required foundation excavation) during this study. Surficial inspections and geologic mapping without benefit of subsurface data were performed at Borrow Area C (stream bed materials), the downstream borrow areas and Quarry Sites A, B and C. All construction material quantities are estimated and would require either initial or additional subsurface investigations, sampling and testing to determine accurate values and suitable quality.

5.5.2 *Aggregate, Borrow and Fill*

Borrow Areas A, B, and C

Borrow Areas A and B, shown on Figure 5.3, were investigated by means of 11 backhoe trenches to a maximum depth of 15 feet (subsection 4.6). No trenching was conducted in Borrow area C, the stream channel deposits, because of the high water table. Based on geologic mapping (Figure 5.1) and trenching (Appendix A.5), geologic sections were prepared for these borrow areas (Figure 5.4). Grab samples from the exploratory trenches were tested in the laboratory, as discussed in subsection 6.3, and the results are summarized on Table 6.2. All of these data were considered in estimating the volumes of usable materials suitable for roller compacted concrete (RCC) as shown on Table 5.3, Construction Materials Tabulation.

Field observations during sampling, confirmed by laboratory testing, indicate the following characteristics for materials in Borrow Areas A and B:

- Scalping and crushing of sound plus 3–inch gravel will be necessary to provide a satisfactory gradation for the RCC mix.

- Aggregate particles composed of schist and gneiss, rich in dark minerals and mica, as well as coarse–grained granitics, especially diorite, are usually weathered, soft and friable. The elimination of these weaker aggregate particles and mica during processing will preclude an increase in fines due to breakdown in production handling and will result in a higher strength RCC mix.

- The fines (minus 200 screen fraction) are predominantly non–plastic, which is desirable for use in a RCC mix in limited quantities.

- Residual soils and colluvium should be wasted because of weathered materials, excessive fines and a paucity of gravels.

General observations based on areal reconnaissance suggest:

- Terrace deposits upstream of the existing Los Padres Dam contain a high proportion of metamorphic clasts, which have the potential to break down during RCC materials processing.

- The younger alluvium (stream channel and bar deposits) is superior in quality to the older alluvium (terrace deposits).

- The higher elevation terrace deposits are older and more weathered than the lower elevation terrace deposits.

- A large terrace deposit of older alluvium, located immediately downstream of the proposed dam site on the left bank of the Carmel River, could be developed to supplement the volume of RCC materials obtained from Borrow Areas A, B, C and D. Subsurface investigations will be necessary to determine the quantity and quality of these materials.

Required Foundation Excavations

All of the materials obtained from required foundation excavations (Borrow Area D) can be used in the RCC concrete mix except residual soils, colluvium and decomposed rock. An estimated waste of 50 percent is expected in the older terrace deposits mostly because of excessive fines and weathered clasts. The waste in the non–decomposed rock and the younger alluvium in the channel is estimated to be 30 percent. Of course, all rocks and gravels greater than 3 inches in size must be crushed to meet the RCC mix requirements.

Downstream Borrow Areas

An estimated 10 million cubic yards of alluvial stream channel, younger stream terrace and older stream terrace deposits, assuming the silts, sands and gravels are 10 feet thick, are within two air miles of the site. All of these unconsolidated sediments were deposited

by the Carmel River and Cachagua Creek during the last 2 million years. These materials are downstream from the dam site in the alluvial valley containing Princes Camp. An estimated 35 percent of this volume is probably unsuitable for RCC mix because: it contains more than 12 percent or less than 6 percent non–cohesive fines (–#200 screen); it contains more than 5 percent cohesive fines; it contains weathered clasts that would break down during excavation, transportation and processing; it contains minerals reactive with the alkalis in cement such as the silica in chert; it contains excessive mica; and it contains organic material. All gravels larger than 3 inches in diameter must be crushed to meet the minus 3 inch mix specifications. Excavation of the alluvial deposits will be by common methods; material below the stream level will probably be removed with a dragline.

5.5.3 Rock Quarries

A reconnaissance of three proposed quarry sites for the New Los Padres Dam was conducted on April 7 and 8, 1992. The purpose of the survey was to determine the feasibility of the quarry sites to produce good quality crushed rock in sufficient quantities to construct the proposed RCC dam based upon a surface inspection of the potential quarries.

The locations of the three quarry sites, designated A, B and C, are shown on Figure 5.5. The criteria considered for quarry selection included rock quality and quantity, ground–water inflow, surface drainage, haul distance from the damsite, site access, material waste, ease of subsurface exploration, fisheries impact and environmental impact.

The hard, fractured, fresh to slightly weathered granitic rock in the quarries will require drilling and blasting. The overlying waste materials can be excavated by common methods (residual soil and colluvium), ripping (decomposed rock) and drilling and blasting (weathered rock). The hard rock should be stable at a 0.5:1 overall cut slope with 30 foot high vertical cuts and 15 foot wide benches. The benches should be sloped to

drain. The blasted rock must be crushed to produce the minus 3–inch aggregate size and the 6 to 12 percent of non–cohesive fines needed for the RCC mix.

Quarry Site A

Quarry Site A is located just upstream of the proposed New Los Padres damsite on the left bank of the Carmel River (Figures 5.3 and 5.5). An exposure of slightly weathered and jointed granitic rock about 200 feet long lies between elevations 900 and 1,000 feet (Figure 5.1). The rock is similar to that described at the damsite, ranging from quartz monzonite to diorite in composition. The prominent minerals are feldspar, quartz, mica, augite and hornblende. The crystalline rock texture varies from fine to coarse grained. The rock is altered, in–part, with the formation of chlorite. The most prominent joint sets have the following attitudes: N80°E, 90; N30°E, 85°E; N55°W, 55°N; and sub–horizontal. The fracture interval is variable, ranging from less than one foot to three feet.

The limits of the proposed quarry are shown on Figure 5.3. The base of the quarry is about 30 feet above the Carmel River at an elevation of 900 feet, so ground–water inflow into the excavation should be slight. The top of the quarry is at elevation 1,200 feet. Well defined gullies border the quarry and will provide drainage for surface runoff. The average slope is 30 degrees. Most of the rock is masked by residual soil. Tree cover is moderate at the lower elevations and along the gullies while brush cover is moderate to heavy on the upper slopes.

Considering 40 percent waste of residual soil, colluvium, decomposed rock and highly to moderately weathered rock, the estimated usable in–place quarry rock is about 516,000 cubic yards. After excavation by drilling and blasting, the loose rock will have a swell factor of about 70 percent of the in–place rock or 877,000 cubic yards; this will be the volume stockpiled. Rock available as in–place aggregate in the RCC dam, with a swell factor of 40 percent of the in–situ quarry rock, totals 722,000 cubic yards (Church, Western Construction Magazine, Nov. 1958). Quarry A can furnish the RCC and concrete construction material needs of about 670,000 cubic yards for a dam with a crest elevation of

1130 feet (24,000 A.F.). For Quarry A with a maximum elevation of 1125 feet rather than 1200 feet, the rock available as in–place aggregate in the RCC dam would be 479,000 cubic yards, well below the required amount.

All quantities in Quarry Site A are estimated and would require subsurface investigations, sampling and testing to determine accurate values and suitable quality. The proposed exploration program is as follows: drill 3 diamond core rock borings with a total footage of 500 feet and complete the borings as monitoring wells; perform a seismic refraction geophysical survey; and conduct a limited laboratory testing program to include unit weight, unconfined compressive strength and thin–section analysis. The borings will required helicopter access. A preliminary design geotechnical report should be prepared for the quarry studies.

Quarry Site B

This alternate quarry site is located immediately upstream of the damsite on the east side of the Carmel River as shown on Figures 5.3 and 5.5. Highly weathered and jointed exposures of granitic rock occur along the road and on the steep road cut (Figure 5.1). A slightly weathered and jointed outcrop of granitic rock exposed in the gully on the south border of the site has these joint set attitudes: N70°W, 75°N and 80°S; N5°W, 55°E; and sub–horizontal. Rectangular blocks of rock are formed by joints spaced less than one foot to three feet apart.

The base of Quarry Site B will be at elevation of 950 feet, approximately 65 feet above the Carmel River channel. A spring flowing less than one gallon per minute in April 1992 was present near the prominent gully. Groundwater is not expected to be a problem however. The average topographic slope is 32 degrees to the maximum quarry elevation at 1,200 feet. Most of the site is masked with residual soil. The fairly regular–shaped and uniform slope is covered with a moderate growth of trees and brush.

The estimated volume of rock available from alternate Quarry Site B as suitable in-place aggregate in the RCC dam is 884,000 cubic yards considering a 40 percent waste of residual

soil, colluvium, older terrace deposits, decomposed rock, highly to moderately weathered rock and rock fines. For Quarry B with a maximum elevation of 1125 feet rather than 1200 feet, the rock available as in–place aggregate in the RCC dam would be 294,000 cubic yards.

Since this is an alternative quarry site, no subsurface exploration will be considered unless Quarry Site A proves unsatisfactory.

Quarry Site C

Quarry Site C is located in Section 31, T17S, R3E, MDB&M just north of the Carmel River and about two air miles from the proposed dam site. The geological reconnaissance survey route, performed on foot, is depicted on Figure 5.5. A geological map of the quarry site and vicinity, blown up to a scale of about 1 inch=500 feet from the 1:24,000 Carmel Valley quadrangle topographic map, is shown on Figure 5.6. Aerial photographs in color at a scale of 1:6,000 (4293–13–1 and 2; 8155–1) and flown on 6–18–87 were used to prepare the geological map. Fresh granitic rock is exposed along the river channel area, and weathered to decomposed rock extends up to about elevation 1,220 feet. The following prominent joint sets divide the rock into rectangular blocks ranging from 3 inches to 3 feet in size as exposed on the right bank of the Carmel River near Pine Creek: N80°W, 15°N and 70°N; N30°E, 90°; N70°W, 15°S; N15°E, 90°; and near horizontal.

The boundaries of this alternate quarry site, extending from elevation 720 (about 30 feet above the Carmel River channel) to elevation 1,220, are shown on Figure 4. Ground–water flow into the proposed excavation should be limited. The triangular shaped ridge is very steep with an average slope of 35 degrees. Tree cover is light on the lower slopes and moderate in the channel area; brush cover is heavy on the slopes.

The rock from Quarry Site C available as in–place aggregate in the RCC dam totals 3,654,000 cubic yards; this is considering 25 percent waste and a 40 percent swell factor.

Since this is an alternate quarry site, no subsurface exploration will be considered unless Quarry Sites A and B prove unsatisfactory.

6.0 LABORATORY TESTING

6.1 GENERAL

Rock core samples from borings and bulk grab samples from backhoe trenches were obtained in the field and transported for testing to Bechtel's Rock Mechanics and Geotechnical laboratory in San Francisco and the Kleinfelder laboratory in Pleasanton, respectively. Subsections 4.7 and 4.8 briefly describe the number and type of tests performed and reference the appropriate tables and appendices in this report.

This section will summarize the laboratory test results for dam foundation rocks (subsection 6.2) and RCC borrow materials (subsection 6.3). Laboratory reports that present test data are shown in Appendix C.

6.2 ROCK TESTING

Table 6.1 shows unconfined compressive strength, Brazilian tensile strength, elastic modulus and Poisson's ratio values for the tested NX–size rock cores obtained from the proposed dam foundation area. Refer to Appendix C.1 for the laboratory rock testing report.

The compressive strength ranged from 4,080 to 15,610 pounds per square inch (psi) and averaged 10,000 psi. The variation in strength values is probably largely due to different degrees of weathering and alteration in the rock cores.

The average value of Brazilian tensile strength is 870 psi, and the narrow range is between 740 and 1,110 psi. The average ratio of unconfined compressive strength to tensile strength is 12, which is a reasonable value.

The static elastic modulus of rock core ranges from 3.1 to 7.4 million psi. For comparison, a value of 4.5 million psi has been reported in the literature for quartz diorite (Appendix C.1). A value of 3.5 million psi is recommended for preliminary design.

Poisson's Ratio ranges from 0.01 to 0.24. Published values for diorite are between 0.05 and 0.28 (Appendix C.1). For preliminary design a recommended value is 0.20.

6.3 RCC MATERIALS TESTING

Thirteen backhoe trenches were excavated (Figures 5.3 and 5.4) and bulk samples for testing were placed in 50 pound capacity canvas sacks. Five sacks were collected per trench. The sack samples excluded plus 3–inch gravel (estimated in field) and residual soils (Appendix A.5). The materials in the five sacks from each trench were composited in the laboratory to form a single trench sample.

The laboratory tests performed were as follows:

Borrow Area	A				A					B		D	
Trench Sample Nos.	1	2	3	4	5	6	7	8	9	10	11	12	13
Tests (ASTM Standard)													
Bulk Unit Weight or Density (C–29)		X	X			X				X	X		
Grading (C–136)	X	X	X	X	X	X	X	X	X	X	X	X	X
Specific Gravity –Absorption (C–127, 128)		X	X			X				X	X		
Soundness		X	X			X				X	X		
Resistance to Abrasion (C–131)		X	X			X				X	X		
Potential Reactivity		X				X				X			
Mortar Bar Expansion		X				X				X			
Materials Finer than No. 200 Sieve (C–117)		X	X			X				X	X		
Atterberg Limits		X	X			X				X	X		

Trench samples 2, 3, 6, 10 and 11 were considered as representative of RCC construction materials in Borrow Areas A and B and were selected for all of the above tests. Trench samples 1 and 5, which also contain suitable materials, were selected for grading only. Trench samples 4, 7, 8, 9, 12 and 13 are composed of colluvial soils which are unsuitable as RCC materials because they are weathered, contain excessive fines and lack gravel–size aggregates. Borrow Area C, the stream channel deposits, was not sampled because of high water table conditions. A summary of selected laboratory test results is presented in

Table 6.2. The mortar bar expansion tests are in progress and results will be reported when they become available. Refer to Appendix C.3 for the laboratory RCC Materials testing report prepared by Kleinfelder.

Based upon an evaluation of the data in Table 6.2, the following comments are offered for the RCC materials:

- The grading of the materials can be improved by crushing and blending in the plus 3–inch gravels, which comprise the following field estimated total volume of these samples: T–2 35%; T–3 15%; T–6 30%; T–10 30%; T–11 40%.

- Almost all of the fines are non–plastic silts in quantities suitable for an RCC mix (ideal mix is well–graded with 30–40% sands and between 6 and 12 percent non–plastic fines by total weight).

- Specific gravity, unit weight (dry rodded) and absorption values are within acceptable limits.

- Abrasion loss and sulfate soundness are too high; unsound, soft clasts, typically composed of weathered or altered mafic minerals (biotite, chlorite, hornblende) in metamorphic or diorite rocks must be discarded prior to materials processing.

7.0 FUTURE TESTING NEEDS

The geotechnical work conducted to date is only the first phase of preliminary design. Since geotechnical studies are exploratory in nature, the present knowledge is used to plan the next phase of work.

The additional geotechnical investigations recommended to be performed in the next phase of site exploration are outlined below:

- Drill 4 vertical borings and one inclined boring at the dam site. The total length of the 5 core borings will be about 700 feet. Determine the in situ modulus of elasticity of the foundation rock by means of dilatometer tests. Complete the 4 vertical borings as monitoring wells. Conduct field pressure permeability tests in 5 borings and perform TV borehole camera surveys in the 4 vertical borings.

- Drill 3 vertical borings at Quarry Site A and complete the borings as monitoring wells. The total length of the 3 core borings will be about 450 feet.

- Excavate 12 trenches in gravelly soils in the terrace deposits downstream from the proposed dam on the left bank of the Carmel River. Evaluate the bulk samples in the laboratory for their suitability as construction materials for an RCC dam.

- Conduct seismic refraction surveys to determine: the shear and compressional wave velocities of in situ rock at the dam site; the location of the Cachagua Fault; the depth to sound rock at the proposed fish structures; the thickness of the construction materials in the borrow areas; and the depth to useable rock in Quarry Site A.

- Excavate 2 trenches across the Cachagua Fault, map the geology of the trenches and the fault area, and sample the trench materials for possible age–dating.

- Map the geology of the reservoir area and evaluate the potential geologic hazards such as seepage, sedimentation and slope instability.

- Conduct laboratory testing of granitic rock cores and construction materials to include both dam site, borrow and quarry sources.

- Reduce and analyze the geotechnical data and prepare a preliminary design report.

The geotechnical studies required for final design will depend upon the results of the recommended investigations listed above.

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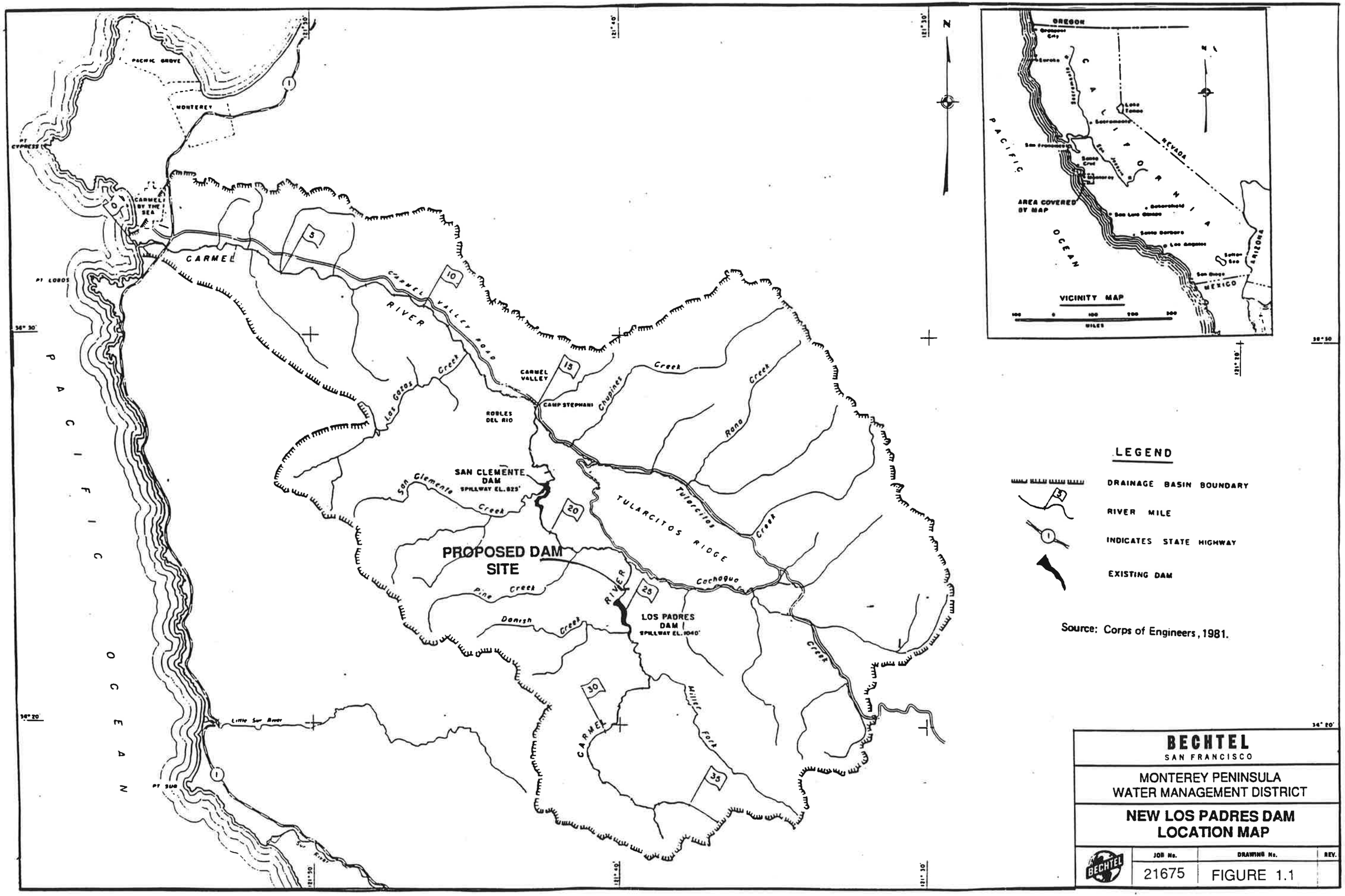
FIGURES



LEGEND

- DRAINAGE BASIN BOUNDARY
- RIVER MILE
- INDICATES STATE HIGHWAY
- EXISTING DAM

Source: Corps of Engineers, 1981.

BECHTEL
SAN FRANCISCO

MONTEREY PENINSULA
WATER MANAGEMENT DISTRICT

NEW LOS PADRES DAM
LOCATION MAP

JOB No.	DRAWING No.	REV.
21675	FIGURE 1.1	

RCC GRAVITY DAM

MAIN SPILLWAY
CREST EL 1120

INTAKE

DAM CREST EL 1130

R=1100'

0.8H:1V

0.5H:1V (TYP)

BACKFILL

EL 880

EL 863

OUTLET CONDUIT

OUTLET

ROAD

ACCESS

EST. SOUND ROCK
CONTOUR (TYP)

EL 866

ACCESS ROAD

EL 1130

ACCESS ROAD

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

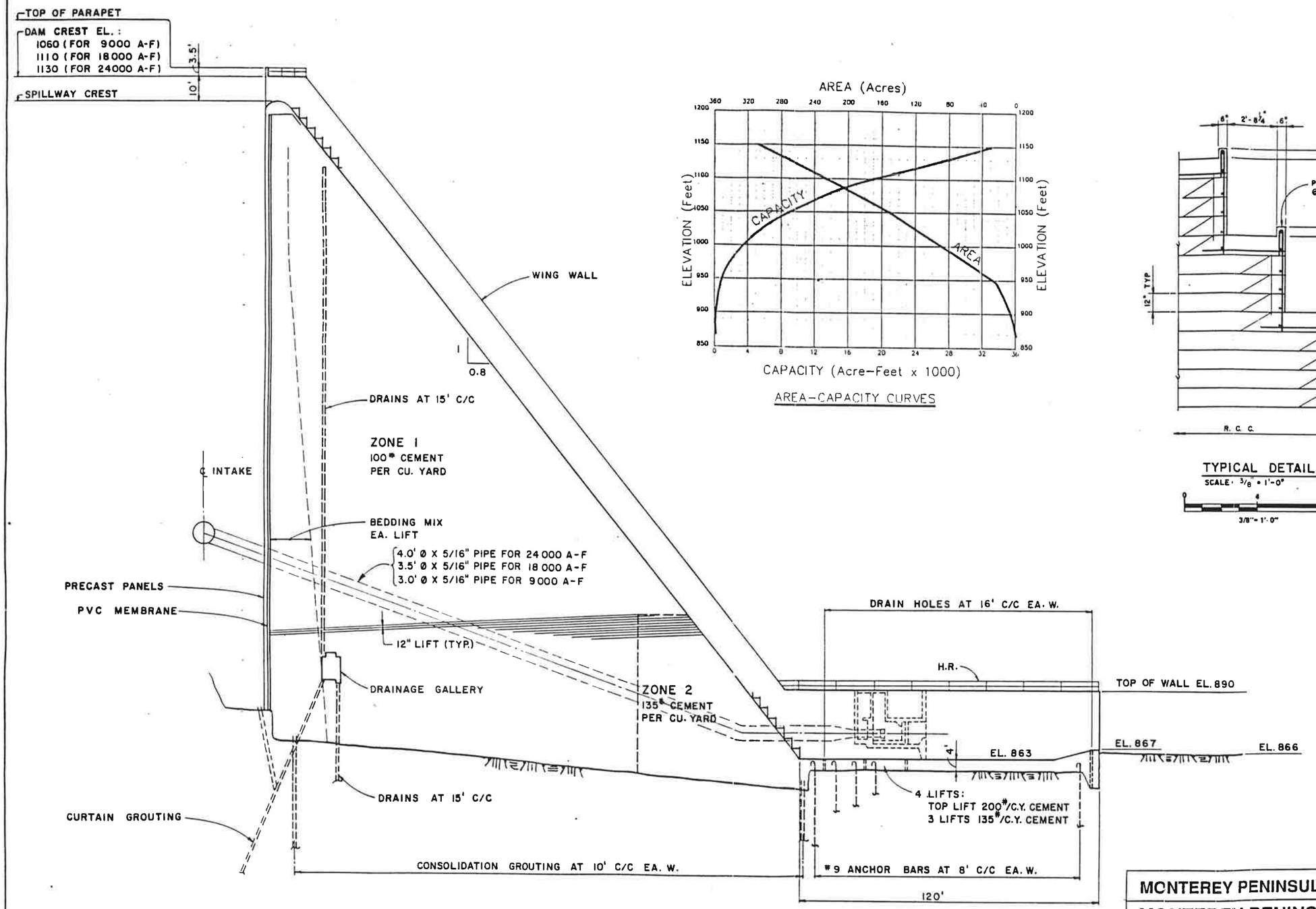
MONTEREY PENINSULA WATER SUPPLY PROJECT

NEW LOS PADRES DAM - 24,000 AF
PLAN VIEW

JUNE 1989

Bechtel Civil, Inc.
San Francisco, California

FIGURE 1.2



AREA-CAPACITY CURVES

TYPICAL DETAIL

SCALE: 3/8" = 1'-0"

3/8"= 1'-0"

0 20 40 60

1" = 20'

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

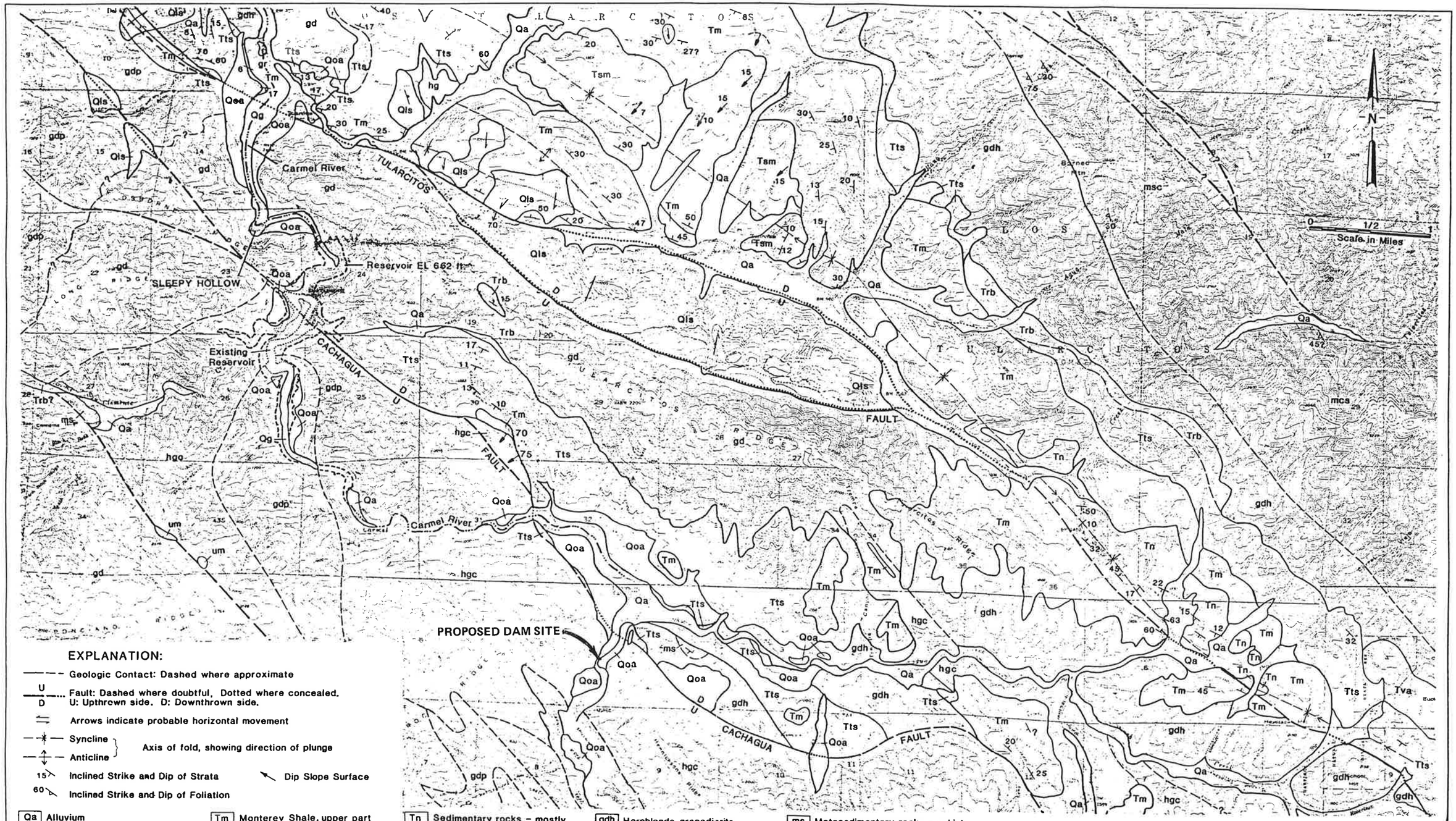
MONTEREY PENINSULA WATER SUPPLY PROJECT

NEW LOS PADRES DAM
SECTION VIEWS AND AREA-CAPACITY CURVES

JUNE 1989

Bechtel Civil, Inc.
San Francisco, California

FIGURE 1.3



EXPLANATION:

- Geologic Contact: Dashed where approximate
- Fault: Dashed where doubtful, Dotted where concealed. U: Upthrown side. D: Downthrown side.
- Arrows indicate probable horizontal movement
- Syncline / Anticline — Axis of fold, showing direction of plunge
- 15 Inclined Strike and Dip of Strata — Dip Slope Surface
- 60 Inclined Strike and Dip of Foliation

Qa Alluvium	Tm Monterey Shale, upper part hard silicious shale	Tn Sedimentary rocks – mostly terrestrial greenish claystone, minor sandstone	gdh Hornblende granodiorite
Qg Stream gravel	Tts Temblor Fm., sandstone, undivided	gr Granitic rocks, mainly quartz monzonite	hg Hornblende gabbro
Qls Landslide rubble	Tva Volcanic Rocks, andesite flows	gd Quartzdiorite	hgc Coarse-grained hornblende gabbro
Qoa Older alluvium	Trb Red beds of Robinson Canyon, conglomerate, sandstone, clay	gdp Porphyritic granodiorite	um Undifferentiated metamorphics
Tsm Santa Margarita Sandstone			msc Metamorphic rocks, schist

ms Metasedimentary rocks – schist, gneiss, quartzite

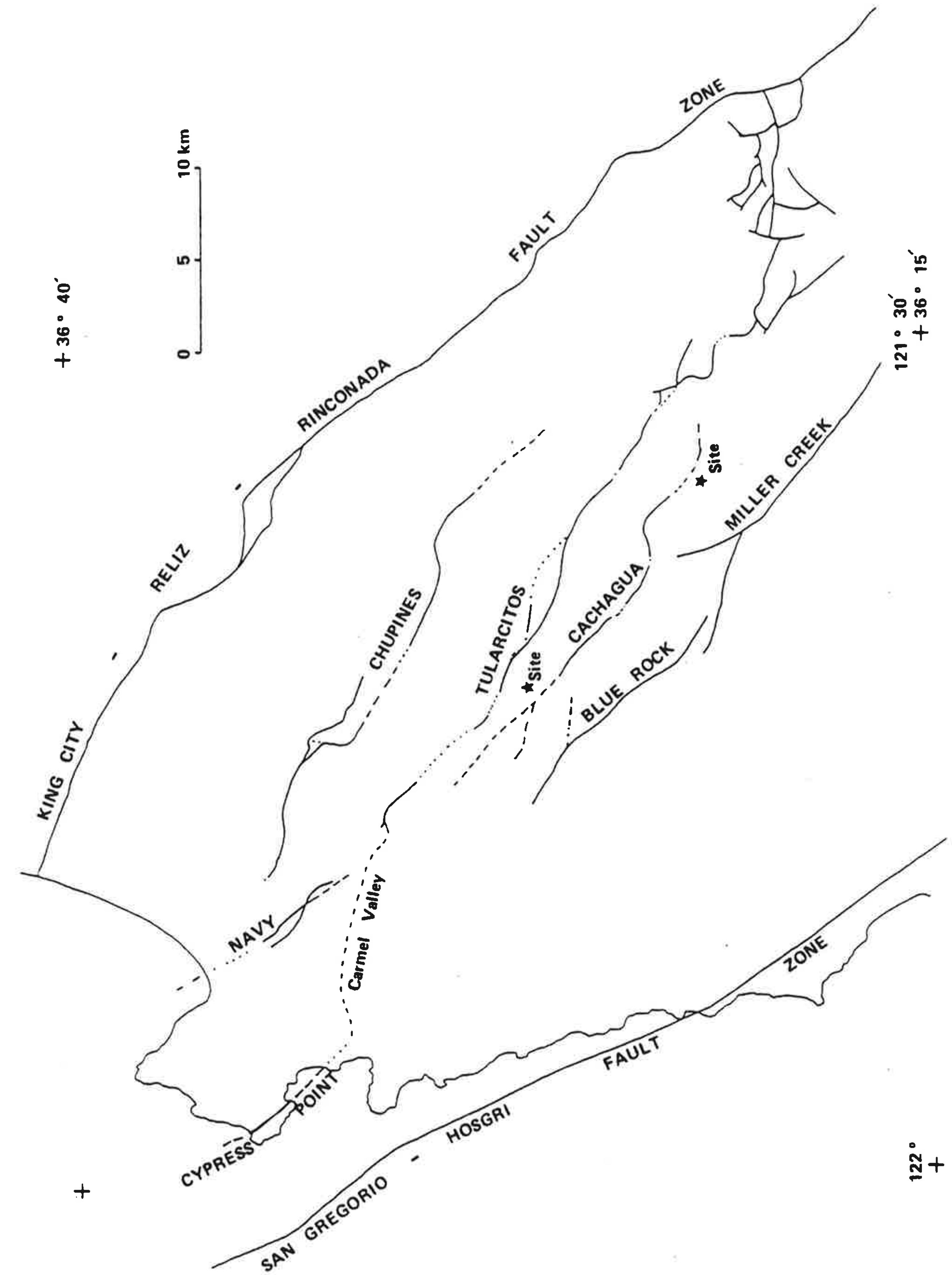
m Metasedimentary rock – marble

Source: Converse, 1986

Reference: Dibblee, 1972

REGIONAL GEOLOGY MAP

FIGURE 3.1



FAULT MAP.
FIGURE 3.2

SIZE D 22 X 34

EXPLANATION

RA-1 ● Borings, diamond coreholes

T-1 ● Trenches

SP-D SP-E ●---● Refraction seismic lines, shot points

A A' Geologic section

NOTES:

1. Contours in dense tree areas may be sub-standard.
2. Contour interval = 10'
3. Refer to Table 4.1 for summary of exploration.
4. Refer to Figure 5.2 for geologic section A - A'
5. Refer to Appendix A for geologic drill logs and trench logs.
6. Refer to Appendix B for seismic refraction survey report.

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV.	ENGR	PROJ ENGR.	APPD

SCALE | DESIGNED | DRAWN | CHIEF ENGR

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SAN FRANCISCO

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
MONTEREY PENINSULA WATER SUPPLY PROJECT

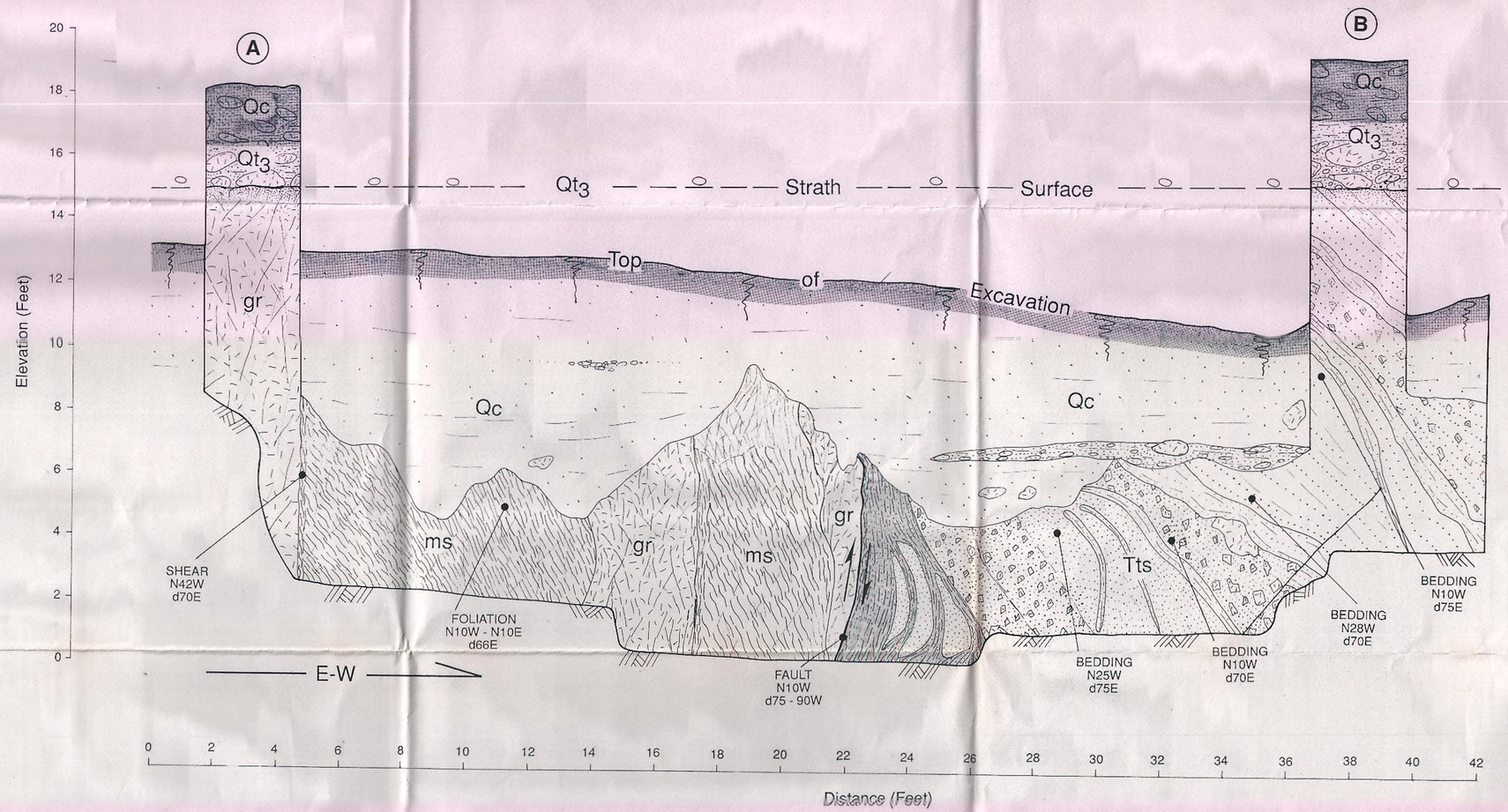
NEW LOS PADRES DAM PROJECT

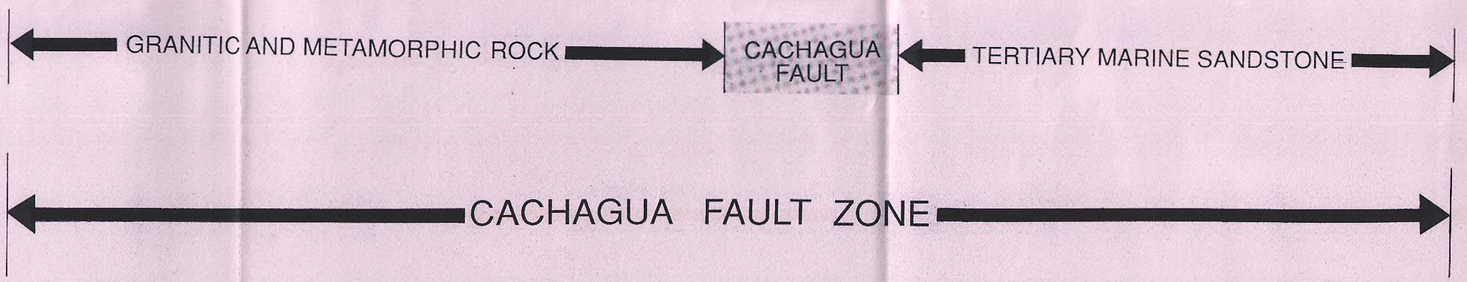
LOCATION OF EXPLORATION

JOB No.	DRAWING No.	REV.
21675	FIGURE 4.1	

CACHAGUA FAULT EXCAVATION LOG

NEW LOS PADRES WATER SUPPLY PROJECT





EXPLANATION

EARTH MATERIALS

SURFICIAL UNITS

Qc	**Colluvium**	Massive brownish red silty sand with occasional cobbles and boulder clasts and gravely lines; upper 2 to 3 feet composed of dark gray to black, organic soil.
Qt_3	**Terrace deposits**	Boulders and cobbles in a very coarse sand matrix.

BEDROCK FORMATION

Tts	**Tertiary marine sandstone**	Coarse-grained sandstone and conglomerate with red brown beds of clayey sandstone.
ms / gr	**Granitic and metasediments**	Highly fractured and sheared light gray granitic (gr) rocks and dark brown to black fine grained schist (ms).

DISCUSSION

This exposure was made by excavating a vertical cut into a side-slope of a tributary canyon that crosses the Cachagua fault. The exposures labled (A) and (B) represent the projections of two backhoe test pits excavated into the slope (away from viewer) in order to expose the strath surface of the Quaternary stream terrace deposit (Qt_3) that rests on top of the bedrock.

The geologic relationships exposed in this excavation demonstrate that movement along the Cachagua fault has influenced the bedrock units, but not the overlying Quaternary stream terrace deposits. The crystalline bedrock (gr and ms) on the west side of the fault possesses a shear fabric that approximates the fault orientation (N10W). The sandstone strata (Tts) dips steeply (70 degrees) to the east, away from the fault at angles and directions that are inconsistent with the regional southwest-dipping geologic structure of this sedimentary bedrock unit as depicted on Engineering Geologic Cross Section 5-5' (Drawing 4-2).

The main zone of faulting is characterized as a 2- to 6-foot wide sequence of highly sheared and disrupted clayey sandstone with dismembered sandstone pods. The fault surface is defined by a 2- to 6-inch wide clay gouge that dips generally 75 to 90 degrees southwest and strikes N10W.

The overlying Quaternary stream terrace deposit (Qt_3) can be projected across the trace of the fault without offset or interruption. Outside of the canyon area, the Qt_3 strath surface can be continuously traced from a point located approximately 125 feet upstream from the excavation, to a point downstream, past the excavation, for a horizontal distance of nearly 300 feet. The same strath surface can be correlated

CACHAGUA FAULT EXCAVATION LOG

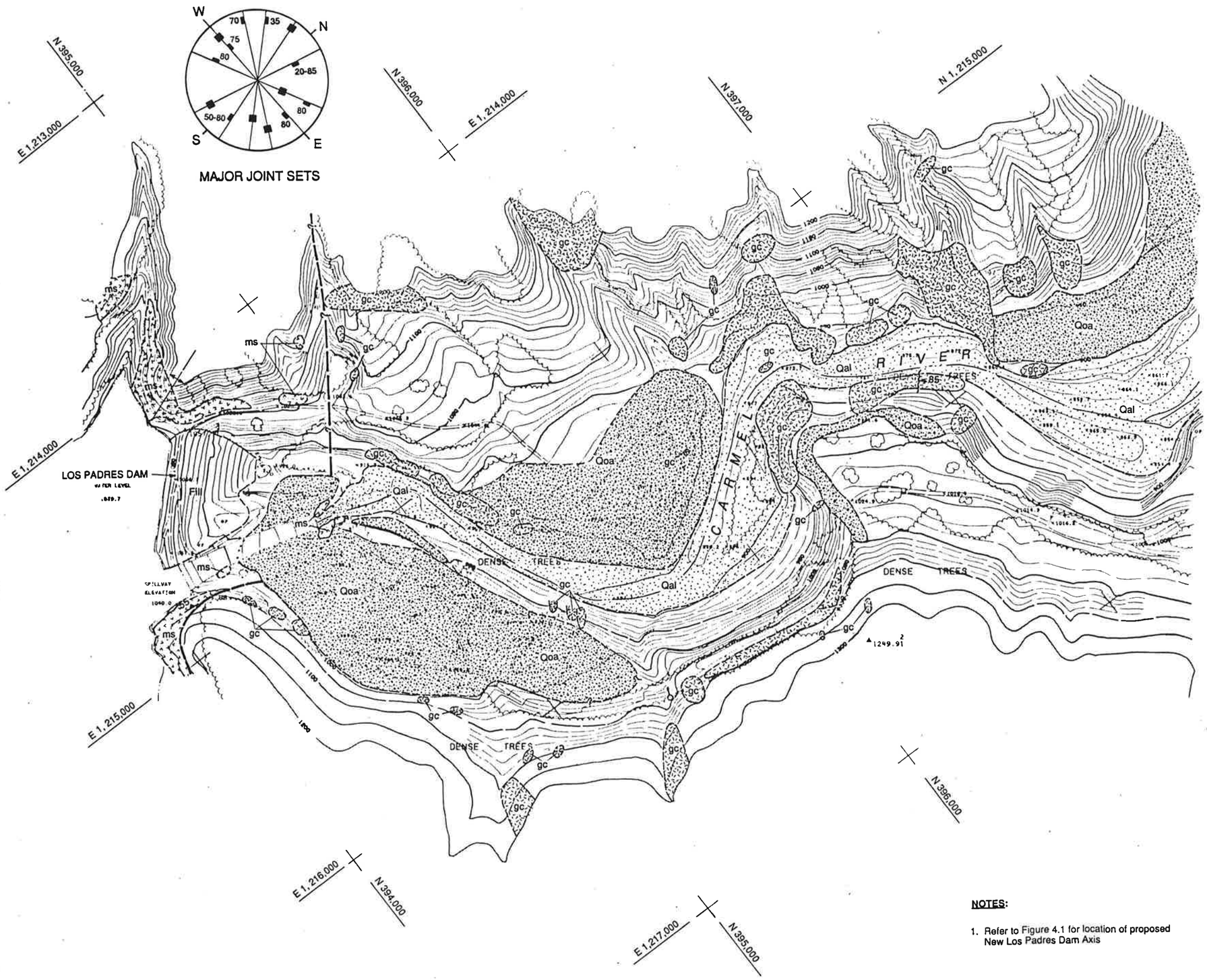
Monterey Peninsula Water Management District
Geotechnical and Engineering Studies
New Los Padres Water Supply Project
Monterey County, California

THE MARK GROUP, INC. ENGINEERS & GEOLOGISTS
In Association With
MORRISON KNUDSEN CORPORATION
William Cotton and Associates

PREPARED BY: W. COTTON, J. WALLACE, C. SNEDDON
REVIEWED BY: W. COLE

PROJECT NO. 94-1198801.80
DRAWING NO. E-2

SIZE D 22 X 34



EXPLANATION

- RESIDUAL SOIL AND COLLUVIUM: overlies bedrock, unconsolidated ; includes slopewash, talus and rock-soil debris; usually supports a vegetative cover. Holocene in age.
- Qal — RECENT ALLUVIUM: river channel, terrace and flood plain deposits of gravel, sand, and silt; unconsolidated. Holoicene in age.
- Qoa — OLDER ALLUVIUM: stream terrace deposits of gravel, sand, silt and minor clay; unconsolidated to slightly consolidated, covered by residual soil and colluvium in part; probably Quaternary in age.
- gc — GRANITIC COMPLEX: heterogeneous mixtures of granitic rocks with lessor inclusions of older meta-sedimentary rocks; granitic rocks range from quartz monzonite to diorite in composition and are Mesozoic in age.
- ms — META-SEDIMENTARY ROCKS: typically schist or gneiss, some granitic inclusions. Mesozoic or older in age.
- Bedrock outcrop, limits approximate
- Geologic contact, dashed where approximate, dotted where concealed
- 80 — Strike and dip of joint
- 55 — Strike and dip of foliation
- 85 — Strike and dip of shear
- Anticline, showing trace of axial plane
- Active landslide scar, contains minor landslide debris
- Seep, less than 1 gpm

N

0 200 400 600 800

SCALE IN FEET

NOTES:

1. Refer to Figure 4.1 for location of proposed New Los Padres Dam Axis

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR

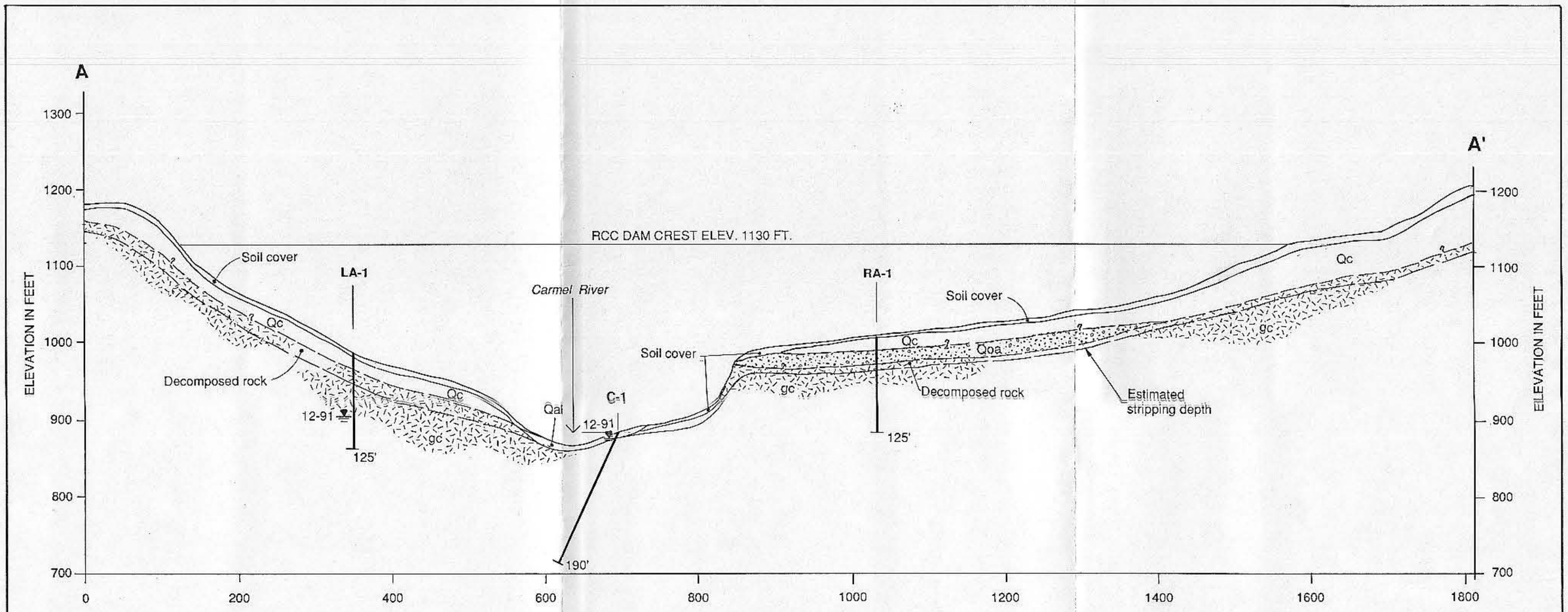
SCALE AS SHOWN | DESIGNED BISIO/MULLEN | DRAWN RNG | CHIEF ENGR

BECHTEL
SAN FRANCISCO

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
MONTEREY PENINSULA WATER SUPPLY PROJECT

NEW LOS PADRES DAM PROJECT
GEOLOGIC MAP

JOB No.	DRAWING No.	REV.
21675	FIGURE 5.1	



EXPLANATION

Qs - Residual soil

Qc - Colluvium

Qal - Recent alluvium

Qoa - Older alluvium

gc - Granitic complex

Geologic contact, dashed where approximate, queried where questionable.

LA-1 - Boring

12-91 ▼ Ground-water level, date of measurement

NOTES:

1. Refer to Figure 4.1 for location of section A -A'
2. Refer to Figure 5.1 for geologic map and a comprehensive legend.
3. Refer to Appendix A.2 for geologic drill logs

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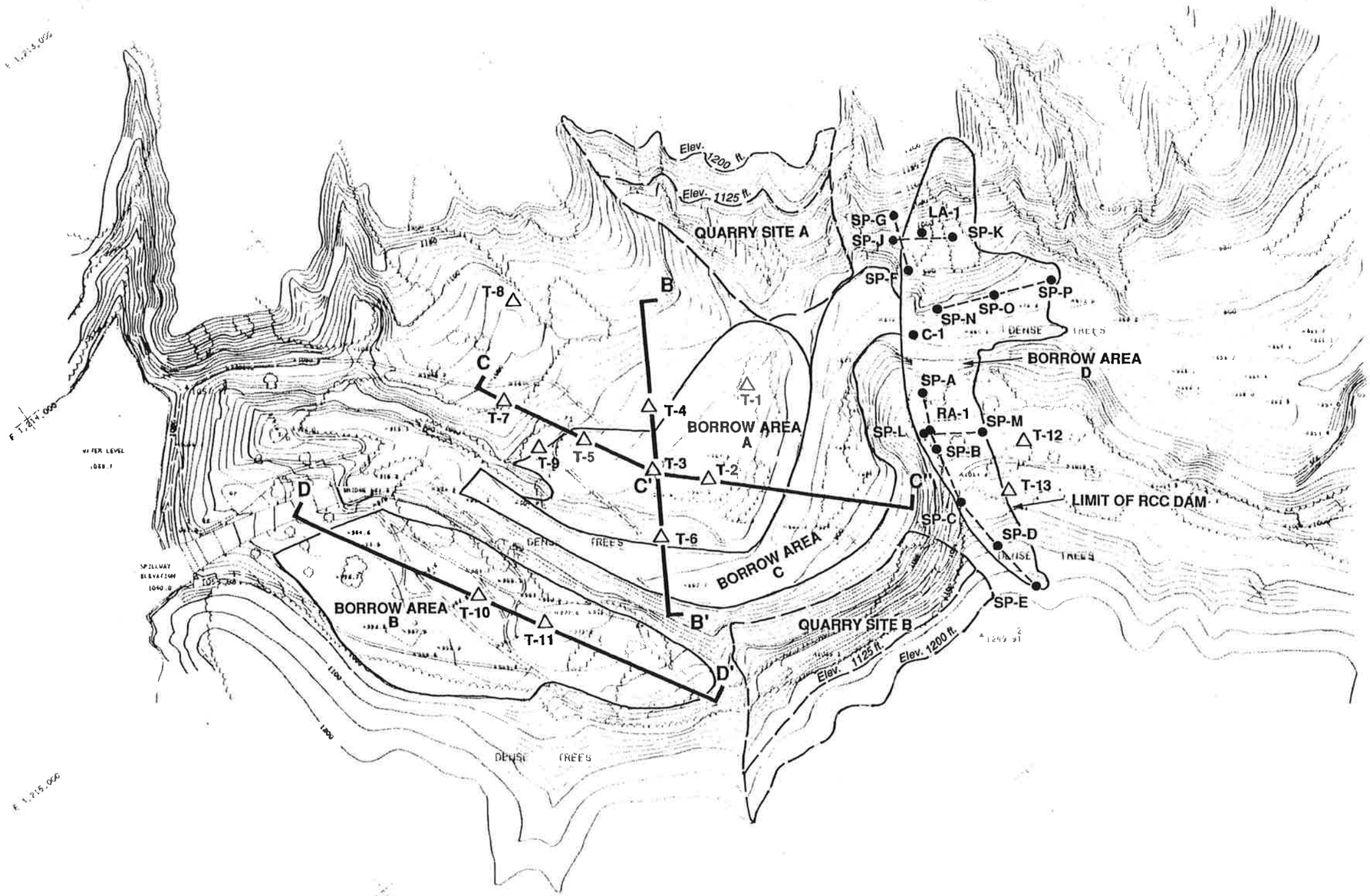
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
MONTEREY PENINSULA WATER SUPPLY PROJ.

NEW LOS PADRES DAM PROJECT
GEOLOGIC SECTION A - A'

JOB No.	DRAWING No.	REV.
21675	FIGURE 5.2	

SIZE D 22 X 34



EXPLANATION

RA-1 ● Borings, diamond coreholes

T-1 △ Trenches

SP-D ●---● SP-E Refraction seismic lines, shot points

B ⌊ B' Geologic section

NOTES:

1. Refer to Figure 5.2 for geologic sections
2. Refer to Table 5.3 for construction material tabulation.
3. Refer to Appendix A.5 for trench logs.
4. Refer to Appendix B for seismic refraction survey report.

0 200 400 600 800

SCALE IN FEET

No	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPR

SCALE | DESIGNED | DRAWN | CHIEF ENGR

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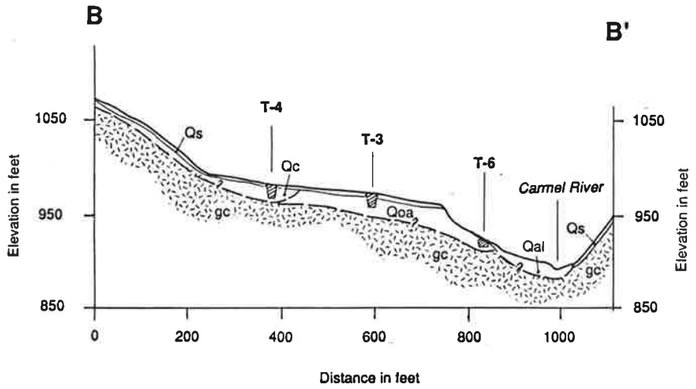
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
MONTEREY PENINSULA WATER SUPPLY PROJECT

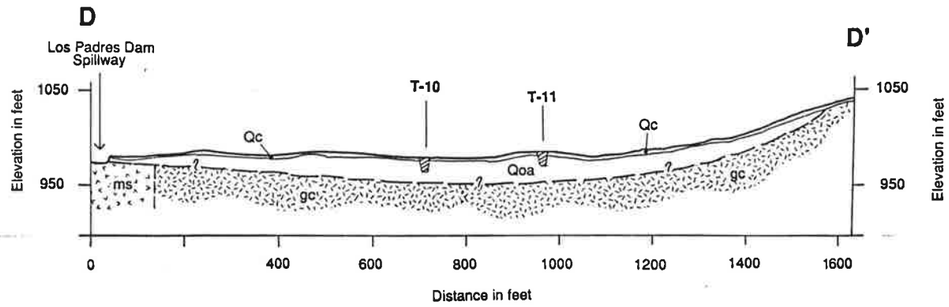
NEW LOS PADRES DAM PROJECT

CONSTRUCTION MATERIALS MAP

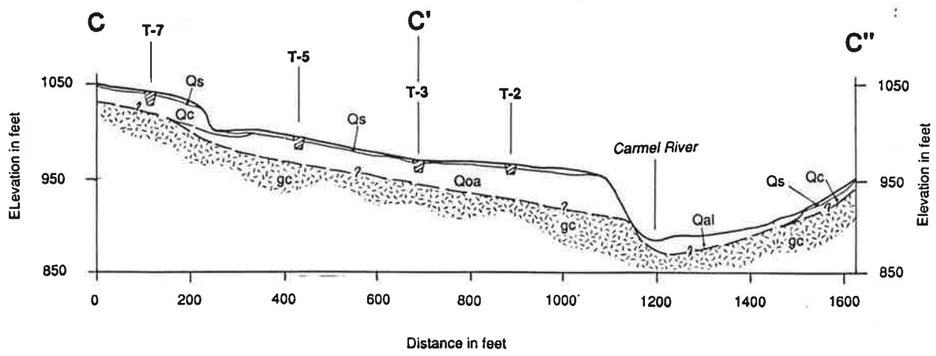
JOB No.	DRAWING No.	REV.
21675	FIGURE 5.3	



GEOLOGIC SECTION B - B'



GEOLOGIC SECTION D - D'



GEOLOGIC SECTION C - C' -C"

EXPLANATION

Qs - Residual soil

Qc - Colluvium

Qal - Recent alluvium

Qoa - Older alluvium

gc - Granitic complex

ms - Meta-sedimentary rocks

T-4 Trenches

—— –?– – Geologic contact, dashed where approximate, queried where questionable.

NOTES:

1. Refer to Figure 5.1 for comprehensive explanation.
2. Refer to Figure 5.3 for location of geologic sections.
3. Refer to Appendix A.5 for trench logs.

0 200 400 600

SCALE IN FEET

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ ENGR	APPD

SCALE AS NOTED | DESIGNED K. BIBIO | DRAWN K.V.G | CHIEF ENGR

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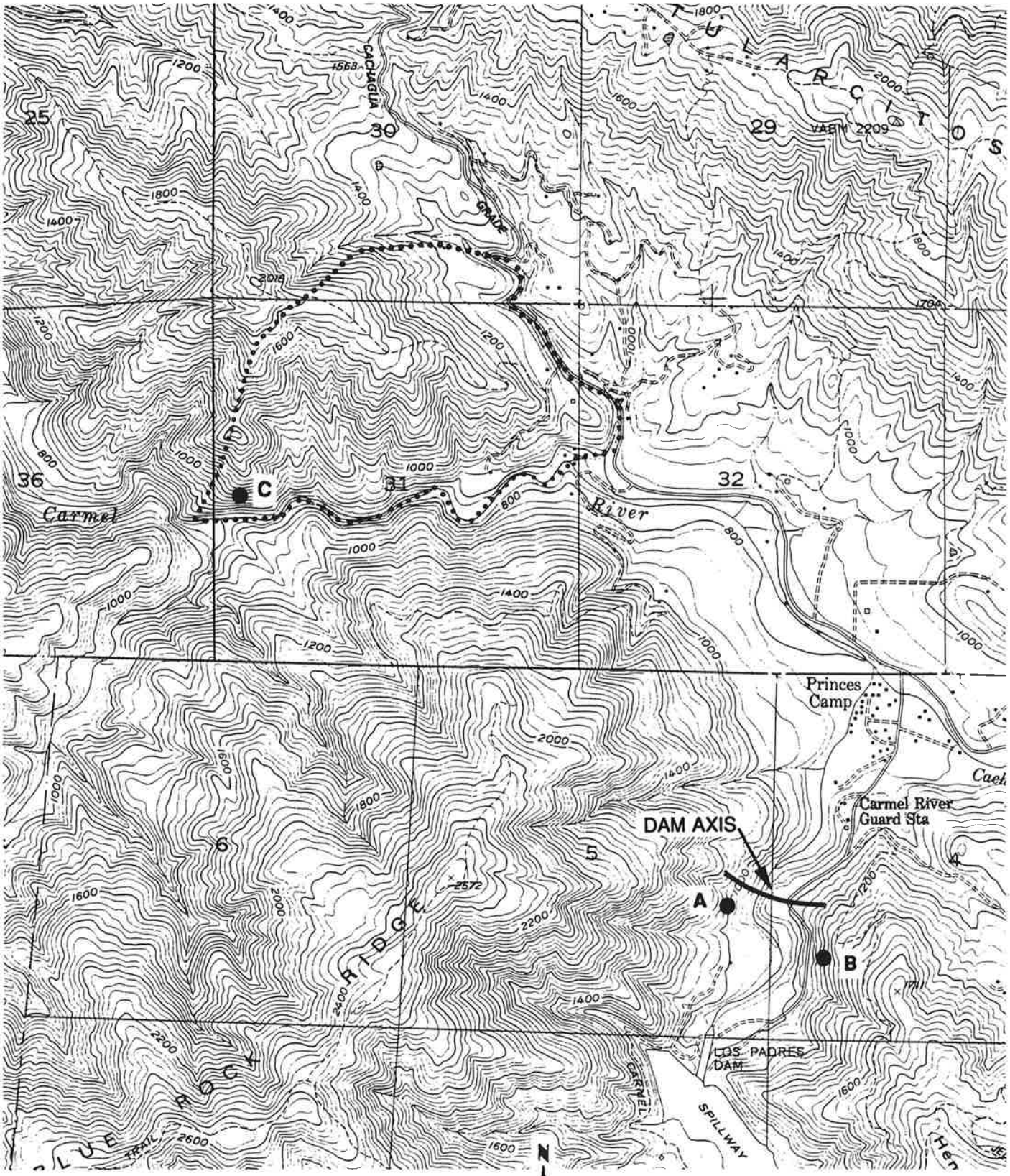
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
MONTEREY PENINSULA WATER SUPPLY PROJECT

NEW LOS PADRES DAM PROJECT
GEOLOGIC SECTIONS B-B', C-C' AND D-D'

JOB No.	DRAWING No.	REV.
21675	FIGURE 5.4	



EXPLANATION

..... Recon survey route, Quarry C

A ● Quarry site

N

APPROXIMATE SCALE 1:24,000

0 1000 2000 3000 4000

APPROXIMATE SCALE IN FEET

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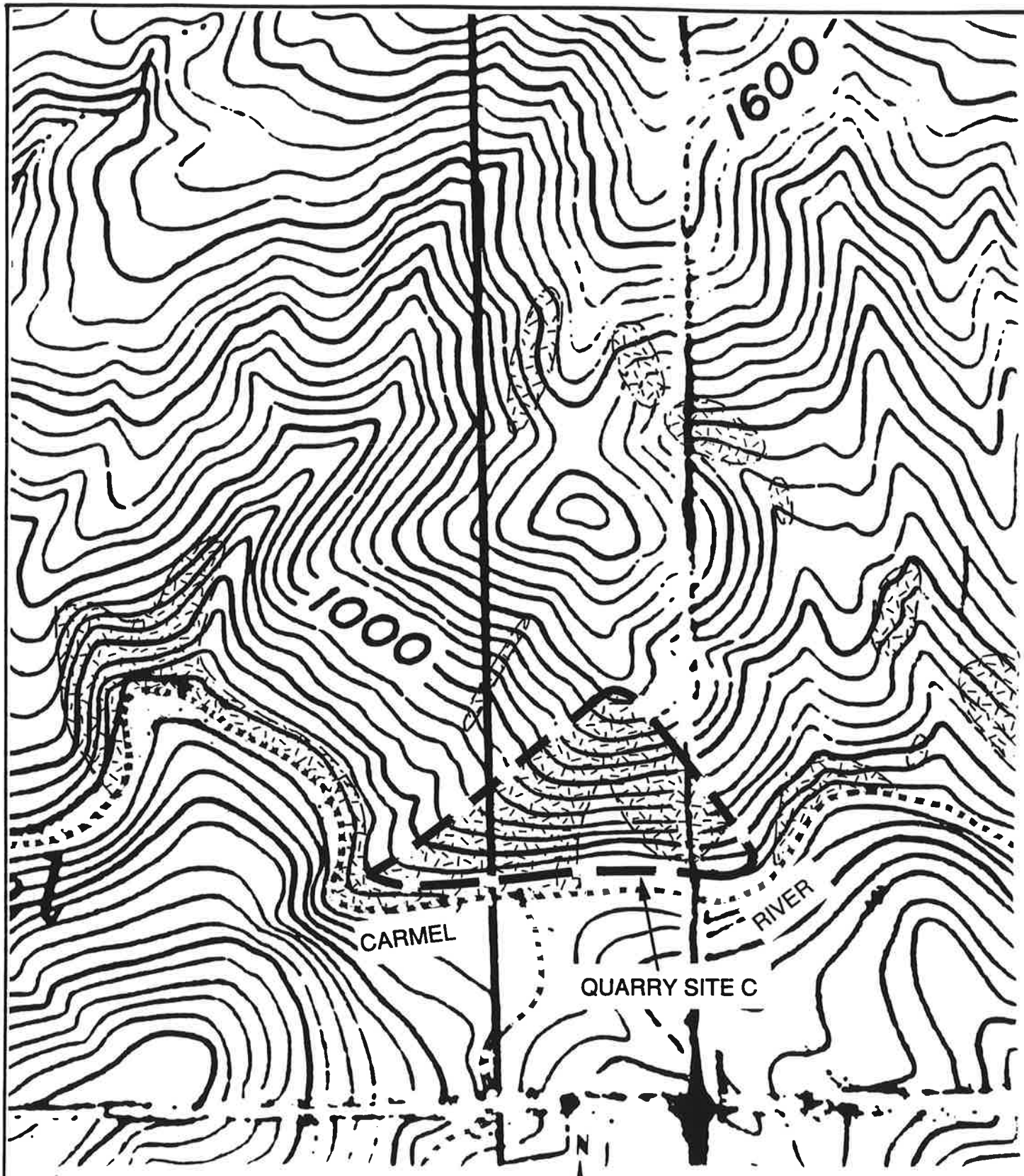
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

NEW LOS PADRES DAM PROJECT
LOCATION OF QUARRIES A, B, AND C

JOB No.	DRAWING No.	REV.
21675	FIGURE 5.5	



EXPLANATION

Granitic bedrock outcrop

Limit of quarry

APPROXIMATE SCALE 1:6,000

0 250 500 1000 1250

APPROXIMATE SCALE IN FEET

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MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

NEW LOS PADRES DAM PROJECT
GEOLOGIC MAP OF QUARRY C

JOB No.	DRAWING No.	REV.
21675	FIGURE 5.6	

TABLES

TABLE 4.1
SUMMARY OF EXPLORATION

Feature	North	East	Angle from Horizontal	Bearing	* Ground Elevation (ft)	Depth Length (ft)	Vertical Depth Top of Rock	Elevation Top of Rock (ft)
Borings								
RA–1	396444.53	1215891.14	90°		1006.79	125.0	37.7	969.1
C–1	396597.21	1215598.11	65°	N35W	887.00	190.0	7.3	879.7
LA–1	396824.72	1215341.76	90°		985.95	125.0	25.0	979.0
Trenches								
T–1	396035.73	1215393.12			966.2	15		
T–2	395735.09	1215567.12			962.9	11		
T–3	395603.59	1215429.26			968.4	12		
T–4	395722.67	1215250.96			980.8	15		
T–5	395480.39	1215209.12			990.6	11		
T–6	395488.73	1215626.18			923.3	10		
T–7	395340.39	1214939.65			1038.9	15		
T–8	395572.87	1214689.49			1063.4	6	6.0	1057.4
T–9	395338.80	1215136.04			989.0	15		
T–10	394870.37	1215414.04			980.9	13		
T–11	394992.65	1215623.44			978.9	13		
T–12	396671.64	1216112.56			1012.7	15		
T–13	396530.99	1216215.71			1039.3	15		
Refraction Shot Points								
SP–A	396492.84	1215774.74			988.3			
SP–B	396418.37	1215958.28			1011.1			
SP–C	396377.35	1216152.22			1039.0			
SP–D	396384.92	1216342.26			1089.7			
SP–E	396406.04	1216532.29			1144.7			
SP–F	396708.78	1215420.04			949.1			
SP–G	396783.00	1215246.00			1031.0			
SP–J	396731.33	1215306.96			982.2			
SP–K	396896.65	1215419.69			975.9			
SP–L	396414.76	1215886.16			1007.4			
SP–M	396579.00	1216000.00			1009.0			
SP–N	396709.33	1215581.50			886.4			
SP–O	396892.00	1215659.48			867.8			
SP–P	397080.04	1215736.35			882.9			

* All elevations are measured above mean sea level.

TABLE 4.2

PRESSURE PERMEABILITY TEST SUMMARY

Boring	Depth Interval (ft)	Permeability (cm/sec)	Fracture Spacing (ft)
RA–1	50.7 – 62.3	3.8×10^{-5}	<0.05′ to 0.8′
	60.7 – 72.3	1.7×10^{-5}	<0.05′ to 0.6′
	70.7 – 82.3	9.2×10^{-6}	<0.05′ to 0.5′
	80.7 – 92.3	8.1×10^{-6}	<0.05′ to 0.5′
	90.7 – 102.3	3.2×10^{-6}	<0.05′ to 0.4′
	101.0 – 112.3	2.1×10^{-6}	<0.05′ to 0.9′
	111.0 – 122.3	1.8×10^{-6}	<0.05′ to 0.3′
C–1	37.8 – 47.4*	1.2×10^{-5}	<0.05′ to 0.4′
65° inclin.	46.9 – 56.5	4.9×10^{-5}	<0.05′ to 0.8′
	56.0 – 65.6	0.0	<0.05′ to 0.4′
	65.1 – 74.7	0.0	<0.05′ to 0.4′
	74.2 – 83.8	0.0	<0.05′ to 0.3′
	83.3 – 92.9	0.0	<0.05′ to 0.7′
	92.4 – 102.0	0.0	<0.05′ to 0.5′
	101.5 – 111.2	0.0	<0.05′ to 0.4′
	110.7 – 120.3	0.0	<0.05′ to 0.7′
	119.8 – 129.4	1.4×10^{-6}	<0.05′ to 0.4′
	128.9 – 138.5	2.5×10^{-6}	<0.05′ to 0.6′
	138.0 – 147.6	1.2×10^{-6}	<0.05′ to 0.3′
	147.1 – 156.7	6.7×10^{-6}	<0.05′ to 0.3′
	157.2 – 166.8	0.0	<0.05′ to 0.4′
LA–1	50.8 – 61.3	0.0	<0.05′ to 0.5′
	60.7 – 71.2	3.9×10^{-6}	<0.05′ to 0.7′
	70.6 – 81.1	1.6×10^{-6}	<0.05′ to 0.6′
	80.9 – 91.4	0.0	<0.05′ to 1.0′
	90.7 – 101.2	7.4×10^{-5}	<0.05′ to 1.1′
	100.7 – 111.2	3.5×10^{-6}	<0.05′ to 0.8′
	110.9 – 121.4	0.0	<0.05′ to 1.2′

* corrected to true depth from inclined depth

TABLE 5.1

GRANITIC ROCK FRACTURE SUMMARY (1)

BORING	*LENGTH (feet)* (2)	*INCLI-NATION*	*CORE RECOVERY*	*RQD* (3)	*FRACTURE SPACING* (4)				*FRACTURES per foot average*
					SF	*MF*	*CF*	*1F–C*	
RA–1	87.3	90°	83%	15%	<1%	2%	89%	8%	4.4
C–1	181.9	65°	82%	14%	<1%	3%	78%	18%	4.4
LA–1	100	90°	81%	24%	<1%	4%	85%	10%	4.3
Average			82%	18%	<1%	3%	84%	12%	4.4

NOTES:

(1) Based on geologic drill logs and fracture logs (Appendix A)

(2) Length of boring rock measured along core axis

(3) Rock Quality Designation (RQD) – sum of all core pieces 4" in length and longer divided by length of core run, expressed as %.

(4) Fracture spacing measured in the core in feet:

Slightly fractured (SF)	1.0 – 3.0
Moderately fractured (MF)	0.5 – 1.0
Closely fractured (CF)	0.1 – 0.5
Intensely fractured (IF) to crushed (c)	<0.05 – 0.1

Table 5.2

Foundation Stripping Estimates
RCC Dam, 260 feet in height

Right Abutment	Ranges from 25 to 70 feet; average 45 feet. Remove all residual soil, colluvium, terrace deposits and decomposed rock and 5 to 15 feet of weathered, loose or highly fractured rock.
Channel Section	Ranges from 5 to 20 feet; average 15 feet. Remove all alluvial deposits and 1 to 10 feet of weathered, loose or highly fractured rock or for shaping.
Left Abutment	Ranges from 20 to 50 feet; average 35 feet. Remove all residual soil, colluvium, decomposed rock and 5 to 15 feet of weathered, loose or highly fractured rock.

TABLE 5.3
CONSTRUCTION MATERIALS TABULATION

Borrow Area	Topography	Description of Materials (1)	Estimated Thickness	Estimated % >3 inch	Depth Ground Water	Estimated Waste	Volume Usable (4)	Remediation	Haul Distance
A	River terrace, 100 ft relief, moderate vegetation, existing dirt roads.	Older alluvium, unconsolidated: • Residual soil, sandy silt: gravel < 1-5%, sand 20-25%, silt 70-80%. • Terrace deposits: gravel 15-60%, sand 30-75%, silt 5-20%.	1 – 3 ft 7 – 35 ft	0 – 1% 0 – 42%	>15 ft	156,000 yd3	234,000 yd3	Screening, washing, crushing > 3 inch gravel.	0.2 miles, need road.
B	River terrace, 50 ft relief, very light vegetation, existing dirt roads.	Older alluvium, unconsolidated: • Colluvium, silty sand: gravel 0 - 10%, sand 60 - 65%, silt 25 - 30%. • Terrace Deposits: gravel 15-60-%, sand 35-85%, silt 0-10%.	1 – 3 ft 5-20 ft	0% 0 - 45%	>15 ft	121,000 yd3	208,000 yd3	Screening, washing, crushing > 3 inch gravel.	0.4 miles, existing road.
C (2)	Stream channel, sand bars, low terraces, light to moderate vegetation.	Younger alluvium, unconsolidated: gravel, sand and silt.	5 – 15 ft	0 – 40%	<5 ft	44,000 yd3	104,000 yd3	Screening, crushing > 3 inch gravel.	0 - 0.4 miles
D (3)	At dam site: 300 ft relief, steep abutments, narrow channel moderate vegetation.	Residual soil, younger & older alluvium, decomposed rock, weathered/fractured rock.	10 - 70 ft	0-45%	3->125	317,000 yd3	189,000 yd3	Screening, washing, crushing >3 inch rock.	0 miles
Quarry Site									
A	Steep abutments with 30° average slope; 300 ft relief. Max. elevation 1200 ft.	Residual rock, collovium, decomposed rock, weathered and fractured rock, fresh rock.	20-160 ft	–	>30 ft	344,000 yd3	516, 000 yd3	Drilling and blasting, crushing, screening.	0 miles
A	Steep abutments with 25° average slope; 225 ft relief. Max. elevation 1125 ft.	Residual Rock, collovium, decomposed rock, weathered and fractured rock, fresh rock.	20-130 ft	–	>30 ft	280,000 yd3	340,000 yd3	Drilling and blasting, crushing, screening.	0 miles
B	Steep abutments with 32° average slope; 250 ft relief. Max. elevation 1200 ft.	Residual soil, colluvium, older alluvium, decomposed rock, weathered and fractured rock, fresh rock.	20-140 ft	–	>30 ft	420,000 yd3	630,000 yd3	Drilling and blasting, crushing, screening.	0 miles
B	Steep abutments with 35° average slope; 175 ft relief. Max. elevation 1125 ft.	Residual soil, colluvium, older alluvium, decomposed rock, weathered and fractured rock, fresh rock.	20-100 ft	–	>30 ft	256,000 yd3	210,000 yd3	Drilling and blasting, crushing, screening.	0 miles
C	Steep abutments with 32° average slope; 500 ft relief.	Residual soil, colluvium, decomposed rock, weathered and fractured rock, fresh rock.	20–250 ft	–	>30 ft	870,000 yd3	2,610,000 yd3	Drilling and blasting, crushing, screening.	1.8 air miles

Notes

(1) Based on exploratory trenches, maximum depth 15 feet; refer to trench logs, Appendix A.4.

(2) No subsurface exploration conducted.

(3) Required foundation excavation for RCC dam.

(4) In quarry rock, the swell factor is 40% of useable volume (i.e., 1.4 x useable volume for in-place aggregate in RCC dam).

TABLE 6.1
NEW LOS PADRES DAM
21675-000
TEST SUMMARY

Sample Id.	Unit Weight (pcf)	Strength (psi)		Elastic Parameters		Rock Description **
		Unconfined Compressive	Brazilian Tensile	Modulus (psi)	Poisson Ratio	
C-1 S-1 (20.9-21.9 ft.)	166.3	15610	770	5.00E+06	0.01	Medium-grained granodiorite or quartz diorite
C-1 S-2 (96.65-97.33 ft.)	179.0	4080	740	5.50E+06	0.01	Fine-grained quartz diorite
LA-1 S-1 (44.5-45.15 ft.)	166.0	16700	870	7.40E+06	0.11	Medium-grained quartz monzonite or quartz diorite
LA-1 S-2 (69.15-69.95 ft.)	168.0	8500	1110	3.50E+06	..22	Medium-grained quartz monzonite or quartz diorite
LA-1 S-3 (88.2-88.78 ft.)	171.7	6740	-	-*	-*	Medium-grained quartz monzonite or quartz diorite
LA-1 S-4 (120.15-1250.65 ft.)	165.4	11400	-	3.10E+06	0.24	Medium-grained quartz monzonite or quartz diorite, partially altered
RA-1 (59.97.60-2 ft.)	174.7	10370	840	-*	-*	Medium-grained diorite
RA-1 (74.6-75.1 ft.)	176.3	5930	-	-*	-*	Medium-grained diorite, slightly altered

* Strain gages malfunctioned.

** For a more detailed description of rock mineralogy, see section on Petrographic Description (Attachment No.1)

TABLE 6.2
LABORATORY RCC MATERIALS TESTING SUMMARY

Borrow Area	Trench No.	Sample Depth	Field Class.	Mechanical Analysis			Atterberg Limits			Specific Gravity		Unit Weight (pcf)	Absorption	Abrasion (% loss)
				Gravel (3–inch)	Sand	Fines	LL	PL	PI	Bulk	App.			
A	T–2	3–11 ft.	GP	30%	58%	12%	21	NP	NP	2.54	2.60	119	1.7%	44.2
	T–3	0–12 ft.	ML,SM-GP	49%	42%	9%	NP	NP	NP	2.63	2.73	115	2.4%	49.0
	T–6	3–10 ft.	GP-SW	34%	57%	9%	26	19	6	2.56	2.63	115	1.9%	57.2
B	T–10	3–13 ft.	GP	36%	56%	8%	NP	NP	NP	2.67	2.74	123	1.7%	57.1
	T–11	5–13 ft.	SP-GP	40%	55%	5%	NP	NP	NP	2.64	2.68	116	1.2%	48.8

Notes:

1. Refer to Trench Logs for field description and sampling intervals (Appendix A.5)
2. Refer to subsections 4.8, 5.5 and 6.3 and Appendix C.3 for additional data
3. Refer to Figures 5.3 and 5.4 for location of borrow areas and trenches
4. Refer to Table 5.3 for construction materials tabulation

APPENDIX A.1

Terminology Used in Boring Logs

APPENDIX A .1

Terminology Used in Boring Logs

RQD

RQD is the sum in inches of all pieces of core 4" in length and longer, divided by the length of core run in inches, expressed as %.

Fracturing

- Massive > 3'
- Slightly fractured – 1' – 3'
- Moderately fractured – 0.5' – 1.0'
- Closely fractured – 0.1' – 0.5'
- Intensely fractured – 0.05' – 0.1'
- Crushed – <0.05' (approx 0.6")

Weathering – Alteration

Degree of weathering and alteration are determined using the following terminology:

- Fresh – No alteration or discoloration, no staining in fractures.
- Slight – Slight discoloration up to 1/16" into core from the fractures; fractures lightly stained; coatings of silt or clay are uncommon.
- Moderate – Significant portion (<50%) of minerals in rock altered, discolored or stained; fractures stained; coatings of silt or clay sometimes present.
- High – Most (>50%) rock altered, discolored or stained; fractures highly stained; coatings of silt, clay or altered minerals often present.
- Decomposed – Minerals completely altered, severe loss of strength.

Hardness

Field determination of rock hardness is performed using a steel knife blade:

- Very hard – Cannot be scratched with knife blade.
- Hard – Can be scratched by knife blade, but only with great difficulty.
- Medium hard – Can be scratched by knife blade.
- Medium soft – Easily scratched by knife blade.
- Soft – Can be gouged 1/8" to 1/4" with knife blade.
- Very soft – Can be cut in half or nearly so with knife blade.

APPENDIX A.2

Geologic Drill Logs

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	1 OF 4	RA-1

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Right Abut. near Dam Axis	N 396,444.5 E 1,215,891.1	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
11-19-91	11-22-91	Continental Drilling	Mobile B-80	3"	37.7	87.3	125.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
75.5/83%	5	3	1010.29	1006.8	▽ / None / ▼	37.7'/969.1

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	2.25" I.D./125'	Ron Bisio

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION (Template: BCHTLLS)	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							1006.8					
TC	9.5										0.0 - 37.7 ft. **OVERBURDEN**, Holocene.	Drill with water 0.0-125.0 ft.
											0.0 - 4.0 ft. **Residual Soil**, Silty Sand (SM), brown, sand with 45% silt, 5% subangular gravel to 2-inch diameter; fine to coarse grained, moist; displays roots.	Using 3-inch tri-cone rock bit (TC) to 10 ft.
							1002.8					
								5			4.0 - 23.0 ft. **Colluvium**, Silty Sand (SM), brown, sand with 30% silt, 15% gravel up to 6 inches diameter; fine to medium grained, poorly graded arkosic sand, some mica; medium dense, moist.	Ream NX casing to 33 ft.
NX	25.0							10				Using NX wire-line system with 5 ft. long double tube core barrel and split tube inner barrel; diamond bit 2.98-inch O.D., 1.86-inch I.D.
								15				
								20				0.0-37.7 ft. 80-100% water return
							983.8					
								25			23.0 - 37.7 ft. **Terrace Deposits (?)**, Gravelly silty sand (SP), light brown, sand with 25% silt, 15% gravel to 1.5 ft.; arkosic cuttings rich in biotite mica; fine- to coarse-grained sand, skip-graded.	
								30				
NX	4.5	1.3	29%									CORE RUN #1

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	2 OF 4	RA-1

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							969.1					34.5-39.0 ft. RQD=0% LP=0.3 ft.
NX	5.0	0.5	10%					40			37.7 - 125.0 ft. **MESOZOIC GRANITIC COMPLEX**, Heterogeneous granitic rocks ranging from quartz monzonite to diorite. Gradational contacts between rock types. 37.7 - 46.8 ft. **Decomposed Granitic Rock**, gray, cuttings composed of 60% feldspar, 30% biotite mica and hornblende and 10% quartz; decomposed to highly weathered, iron stained. Blocks of harder quartz diorite, with feldspar pegmatite dikes, up to 1.3 ft. long, intensely to closely fractured.	37.7-51.5 ft. Intermittent water return 0-75%. Temporary water loss at 45.0, 48.5, and 51.5 ft. CORE RUN #2 39.0-44.0 ft. RQD=0% LP=0.1 ft.
NX	5.0	2.2	44%					45				CORE RUN #3 44.0-49.0 ft. RQD=0% LP=0.2 ft.
							960.0				46.8 - 49.0 ft. **Quartz Diorite**, dark gray, decomposed to highly weathered, closely fractured, stained with oxides. Fracture zone 47.3 - 47.5 ft.	
NX	5.0	4.7	94%				957.8	50			49.0 - 64.0 ft. **Diorite**, gray, highly to slightly weathered, closely fractured to crushed, oxide staining; medium grained, 45-65% feldspar, 25-55% biotite and hornblende, 5-10% quartz. Highly weathered above 53 ft. Fracture zones 51.0-51.8, 52.3-52.4, 55.1-55.4, 55.7-55.8, and 58.5-58.6 ft.	CORE RUN #4 49.0-54.0 ft. RQD=20% LP= 0.3 ft. 51.5-75.0 ft. 95-100% water return.
NX	5.0	5.0	100%	1.6	50	10		55				CORE RUN #5 54.0-59.0 ft. RQD=26% LP=0.4 ft.
NX	5.0	5.0	100%					60				CORE RUN #6 59.0-64.0 ft. RQD=28% LP=0.6 ft.
NX	5.0	5.0	100%	0.8	60	10	942.8	65			64.0 - 69.0 ft. **Quartz Diorite**, dark gray, medium hard, slightly weathered, closely fractured, lightly stained with oxides of iron and manganese. Slight alteration 66.0-69.0 ft. Fracture zone 67.7-67.8 ft.	CORE RUN #7 64.0-69.0 ft. RQD=22% LP=0.3ft.
NX	5.0	5.0	100%				937.8	70			69.0 - 74.0 ft. **Granodiorite**, gray, medium hard, slightly weathered, closely fractured, unstained to lightly stained with oxides; some feldspar veins to 0.15 ft. thick. Slight alteration. fracture zones 70.1-70.2 and 73.0-73.1 ft.	CORE RUN #8 69.0-74.0 ft. RQD=24% LP=0.5 ft.
NX	5.0	5.0	100%				932.8				74.0 - 84.0 ft. **Diorite**, dark gray, medium hard, slightly weathered, moderately to slightly	

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Right Abut. near Dam Axis

Last Update: 1-28-92

HOLE NO. RA-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	3 OF 4	RA-1

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				0.5	70	10					hydrothermally altered, moderately to closely fractured with iron and magnesium oxides and chlorite staining. Some slickensides noted; some veins of feldspar pegmatite; alteration products of chlorite and muscovite. Fracture zone 77.8-77.9 ft.	75.0-115 ft. 95-100% water return.
NX	5.0	5.0	100%					80				CORE RUN #9 74.0-79.0 ft. RQD=40% LP=0.5 ft.
					↓	↑						CORE RUN #10 79.0-84.0 ft. RQD=36% LP=0.8 ft.
NX	4.0	3.5	88%	0.5	80	10	922.8	85			84.0 - 88.0 ft. **Granodiorite**, gray, hard, slightly weathered, slightly altered, closely fractured with stains of iron/manganese oxides and some chlorite.	CORE RUN #11 84.0-88.0 ft. RQD=18% LP=0.4 ft.
NX	5.0	4.4	88%				918.8	90			88.0 - 115.0 ft. **Quartz Diorite**, dark gray, hard, fresh to slightly weathered, slightly to moderately altered, closely fractured to crushed in zones of core loss; stains on fracture surfaces of iron, manganese oxides, chlorite and minor fillings of crushed rock up to 5 mm thick. Medium to coarse grained, 65% feldspar, 35% mica and hornblende, 15% quartz. Slightly altered: 88.0-93.0, 103.8-113.8 ft. Fracture zones: 90.4-90.8, 91.3-91.5, 92.8-93.8, 94.3-94.6, 99.3-99.5, 99.9-100.2, 104.2-104.4, 107.4-107.7, 108.8-109.6, and 114.0-114.1 ft.	CORE RUN #12 88.0-93.0 ft. RQD=12% LP=0.3 ft.
					↑	↓						
NX	1.0	0.6	60%									CORE RUN #13 93.0-94.0 ft. RQD=0%
NX	5.0	5.0	100%					95				CORE RUN #14 94.0-99.0 ft. RQD=14% LP=0.5 ft.
				0.2	85	10						
NX	4.0	3.1	78%					100				CORE RUN #15 99.0-103.0 ft. RQD=0% LP=0.1 ft.
					↓	↑						
NX	0.8	0.5	63%									CORE RUN #16 103.0-103.8 ft. RQD=0%
NX	0.6	0.2	33%									
NX	4.4	3.9	89%					105				CORE RUN #17 103.8-104.4 ft. RQD=0%
				0.1	95	10						CORE RUN #18 104.4-108.8 ft. RQD=18% LP=0.4 ft.
NX	5.0	4.6	92%					110				CORE RUN #19 108.8-113.8 ft. RQD=8% LP=0.4 ft.
					↑	↓						
NX	4.0	3.8	95%				891.8					CORE RUN #20 113.8-117.8 ft.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Right Abut. near Dam Axis

Last Update: 1-28-92

HOLE NO. RA-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	4 OF 4	RA-1

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN. CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				0.1	105	10					(Template: BCHTLLS)	RQD=0% LP=0.4 ft.
											115.0 - 119.6 ft. **Quartz Diorite**, light gray, hard, fresh to slightly weathered, lightly altered, closely to intensely fractured, unstained; medium grained, 45-60% feldspar, 25-40% quartz, 15% biotite and hornblende. Fracture zone 116.3-116.6 ft.	115-125 ft. 100% water return.
NX	5.0	5.0	100%									CORE RUN #21 117.8-122.8 ft. RQD=10% LP=0.4 ft.
							887.2	120			119.6 - 125.0 ft. **Granodiorite**, gray, hard, slightly weathered to fresh, closely fractured, unstained. Fracture zone 120.7-120.8 and 123.1-123.5 ft.	
NX	2.2	2.2	100%									CORE RUN #22 122.8-125.0 ft. RQD=0% LP=0.3 ft.
							881.8	125			Bottom of boring at 125.0 ft.	PACKER TESTS 50.7-62.3 ft. 60.7-72.3 ft. 70.7-82.3 ft. 80.7-92.3 ft. 90.7-102.3 ft. 101.0-112.3 ft. 111.0-122.3 ft.
												Samples for testing: 59.7-60.2 ft. 74.6-75.1 ft. 118.2-118.6 ft.
												Completed boring as monitoring well: 115' PVC pipe and 20' slotted screen, interval 98.0-118.0 ft.
												Fracture log attached.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: **Right Abut. near Dam Axis**

Last Update: 1-28-92

HOLE NO. **RA-1**

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	1 OF 6	C-1

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Channel near Dam Axis	N 396,597.2 E 1,215,598.1	-65.0	N35W

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
11-20-91	11-25-91	Continental Drilling	CP-15	3"	8.1	181.9	190.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
148.9/82%	11	4	---		▽ 2.5/ 11-20-91	8.1'/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	None	T.F. Mullen

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE
NX	7.3							0		
NX	3.0	3.0	100%					5		
NX	3.7	3.8	103%					10		
NX	5.0	5.0	100%					15		
NX	1.1	1.0	91%					20		
NX	5.0	4.8	96%					25		
NX	4.1	4.0	98%					30		
NX	2.3	2.2	96%							
NX	2.4	2.0	83%							

(Template: BCHTLLS)

DESCRIPTION AND CLASSIFICATION

0.0 - 8.1 ft. **OVERBURDEN**, Holocene.

0.0 - 8.1 ft. **Alluvium**, Sandy Gravel (GP), subrounded, well graded sand, fine to coarse grained. Clasts of granodiorite boulders, slightly weathered, hard, up to 4 feet in diameter.

8.1 - 190.0 ft. **MESOZOIC GRANITIC COMPLEX**, Heterogeneous granitic rocks ranging from quartz monzonite to diorite. Gradational contacts between rock types.

8.1 - 30.0 ft. **Quartz Diorite**, dark gray, hard slightly to moderately weathered, intensely to closely fractured with traces of manganese oxide, chlorite, and pyrite mineralization and thin coatings of clay and crushed rock chips on some fracture surfaces. Medium to coarse grained, 35-50% feldspar, 30% biotite and hornblende, and 10-35% quartz. Fracture zones: 9.8-11.0, 11.0-11.3, 11.8-12.0, 12.7-12.8, 13.1-13.3, 14.7-15.0, 15.8-15.9, 16.1-16.9, 17.6-17.8, 18.3-18.5, 19.7-20.9, 24.9-25.1, 28.4-28.5, and 28.7-29.1 ft.

30.0 - 38.0 ft. **Granodiorite**, gray, hard, slightly to moderately weathered, fine to coarse grained, 65-85% feldspar, 10-15% biotite and hornblende, and 5-20% quartz, intensely to closely fractured. Light mineralization and clay on most fracture surfaces, some stained with oxides. Feldspar pegmatite at 32.6-32.9 ft. Fracture zones: 31.2-32.2, 33.2-34.0, 34.7-35.3, 36.2-36.5, 37.3-37.7, and 37.9-38.0 ft.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Drill with water 0.0-190.0 ft.

Ream NX casing to 7.25 ft.

Using NX-wireline system with 5 ft. long double tube core barrel and split tube inner barrel; diamond bit 2.98-inch O.D., 1.86-inch I.D.

Ream NX casing to 9.5 ft.

CORE RUN #1
7.3-10.3 ft.
RQD=0%
LP=0.3 ft.
DWR=100%

CORE RUN #2
11.0-14.7 ft.
RQD=14%
LP=0.5 ft.
DWR=100%

CORE RUN #3
14.7-19.7 ft.
RQD=15%
LP=0.4 ft.
DWR=100%

CORE RUN #4
19.8-20.9 ft.
RQD=0%
LP=0.2 ft.
DWR=100%

CORE RUN #5
20.9-25.9 ft.
RQD=36%
LP=1.0 ft.
DWR=100%

CORE RUN #6
25.9-30.0 ft.
RQD=41%
LP=0.5 ft.
DWR=100%

CORE RUN #7
30.0-32.3 ft.
RQD=23%
LP=0.5 ft.
DWR=100%

CORE RUN #8
32.3-34.7 ft.
RQD=0%
LP=0.2 ft.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	2 OF 6	C-1

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS / % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	(Template: BCHTLLS) DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NX	5.1	4.2	82%									DWR=100%
											38.0 - 38.9 ft. **Quartz Diorite**, dark gray, medium hard, slightly to moderately weathered, >50% biotite and hornblende, intensely to closely fractured. Fracture zone: 38.4-38.7 ft.	CORE RUN #9 34.7-39.8 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	2.5	2.3	92%					40			38.9 - 58.3 ft. **Quartz Monzonite**, light gray, hard, fine to coarse grained, 5-10% biotite and hornblende, traces of pyrite, intensely to closely fractured. Fracture surfaces fresh to moderately weathered, includes thin deposits of mineralization and clay. Feldspar pegmatite at 53.1-53.2 and 56.3-56.6 ft. Fracture zones: 39.8-40.2, 42.6-43.1, 43.8-43.9, 46.8-46.9, 47.8-48.2, 48.6-48.7, 49.2-49.3, 54.9-55.1, 55.1-55.7, 57.4-57.6, and 57.7-58.1 ft.	CORE RUN #10 39.8-42.3 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	4.0	3.1	78%									CORE RUN #11 42.3-46.3 ft. RQD=10% LP=0.4 ft. DWR=%
NX	5.0	3.6	72%	0.2	25	10		45				CORE RUN #12 46.3-51.3 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	5.0	4.7	94%									CORE RUN #13 51.3-56.3 ft. RQD=44% LP=0.9 ft. DWR=100%
NX	2.0	1.8	90%	0.7	35	10		50				CORE RUN #14 56.3-58.3 ft. RQD=23% LP=0.5 ft. DWR=100%
NX	4.0	3.6	90%								58.3 - 62.3 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, fresh to moderately weathered, slightly to moderately altered, intensely to closely fractured. Fracture surfaces slightly to moderately weathered, includes thin coatings of mineralization and clay. Minor amounts of chlorite and muscovite. Felspar pegmatite at 60.7-61.4 ft., intensely fractured with hairline cracks, brittle, very hard, traces of biotite and muscovite. Fracture zones: 58.5-58.8, 59.7-59.9, and 60.1-60.5 ft.	CORE RUN #15 58.3-62.3 ft. RQD=10% LP=0.4 ft. DWR=100%
NX	5.0	2.6	52%					55				CORE RUN #16 62.3-67.3 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	5.0	2.8	56%	0.0	45	10					62.3- 63.2 ft. **Granodiorite**, gray, hard, crushed to closely fractured, fresh to slightly weathered, 10-15% biotite and hornblende. Feldspar pegmatite 0.2 ft. thick. Fracture zones: 62.3-62.4 and 62.4-62.6 ft.	
								60			63.2 - 69.1 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, 40-50% biotite and hornblende, fresh to moderately weathered, slightly altered, crushed to closely fractured; fracture surfaces unstained to stained, some coatings of clay and mineralization; alteration products of chlorite and muscovite. Feldspar pegmatite 0.2 ft. thick. Fracture zones: 64.5-64.8, 67.3-67.5, 67.8-67.9, 68.5-68.7, and 68.9-69.1 ft.	CORE RUN #17 67.3-72.3 ft. RQD=8% LP=0.4 ft. DWR=100%
NX	5.0	3.6	72%								69.1- 72.8 ft. **Quartz Monzonite**, light gray, hard, fine to coarse grained, 10-15% biotite and hornblende, intensely to closely fractured; fracture surfaces fresh to slightly	CORE RUN #18 72.3-77.3 ft. RQD=7% LP=0.4 ft. DWR=0%
								65				
								70				

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Channel near Dam Axis

Last Update: 1-27-92

HOLE NO. C-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	3 OF 6	C-1

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION (Template: BCHTLLS)	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
											weathered, includes thin deposits of mineralization, some slickensides. Feldspar pegmatite 0.2 ft. thick. Fracture zone: 69.1-69.4 ft.	
NX	5.0	4.5	90%	0.0	55	10		80			72.8 - 75.3 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, fresh to moderately weathered, 40-50% biotite and hornblende, crushed to closely fractured. Fracture surfaces slightly to moderately weathered, includes thin coatings of mineralization and clay, some slickensides. Fracture zones: 73.3-73.6 and 74.3-74.5 ft.	CORE RUN #19 77.3-82.3 ft. RQD=7% LP=0.4 ft. DWR=100%
NX	5.0	3.3	66%								75.3 - 78.3 ft. **Quartz Monzonite**, light gray, hard, fine to coarse grained, 7-10% biotite and hornblende, intensely to closely fractured. Fracture surfaces fresh to moderately weathered, includes thin deposits of mineralization and clay. Fracture zones: 77.3-77.8 and 77.9-78.2 ft.	CORE RUN #20 82.3-87.3 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	5.0	4.2	84%	0.0	60	10		85			78.3 - 107.3 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, 40-65% feldspar, 40-50% biotite and hornblende, and 5-15% quartz, fresh to moderately weathered, slightly to highly hydrothermally altered, crushed to closely fractured, some veins of feldspar pegmatite. Fracture surfaces slightly to moderately weathered, includes thin coatings of mineralization and clay. Alteration products of chlorite, sericite, and muscovite. Fracture zones: 79.2-80.0, 82.9-83.4, 83.7-83.8, 84.1-84.2, 84.5-84.6, 85.4-85.6, 87.6-88.3, 88.7-89.2, 89.3-91.5, 93.3-93.7, 94.4-94.7, 100.1-100.6, 101.2-101.4, 102.5-102.9, 103.6-104.0, 104.3-104.4, and 104.8-105.3 ft.	CORE RUN #21 87.3-92.3 ft. RQD=7% LP=0.3 ft. DWR=100%
NX	5.0	5.0	100%					90				CORE RUN #22 92.3-97.3 ft. RQD=49% LP=0.7 ft. DWR=100%
NX	5.0	4.8	96%	0.0	70	10		95				CORE RUN #23 97.3-102.3 ft. RQD=37% LP=0.7 ft. DWR=100%
NX	5.0	3.7	74%					100				CORE RUN #24 102.3-107.3 ft. RQD=8% LP=0.4 ft. DWR=100%
NX	5.0	4.5	90%	0.0	80	10		105			107.3 - 108.9 ft. **Granodiorite**, gray, hard, fine to coarse grained, 50-60% feldspar, 30-40% biotite and hornblende, and 10% quartz, intensely to closely fractured, slightly altered; small deposits of muscovite and sericite on fracture surfaces. Fracture zones: 107.3-107.8, 108.0-108.2, and 108.4-108.6 ft.	CORE RUN #25 107.3-112.3 ft. RQD=12% LP=0.6 ft. DWR=100%
								110			108.9 - 109.4 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, 40-50% biotite and hornblende, intensely to closely fractured, slightly to highly altered, fracture surfaces coated with chlorite and sericite, slickensides. Fracture zone: 108.9-109.2 ft.	
NX	5.0	4.0	80%								109.4 - 110.6 ft. **Quartz Monzonite**, light gray,	CORE RUN #26 112.3-117.3 ft. RQD=16% LP=0.4 ft. DWR=100%

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Channel near Dam Axis

Last Update: 1-27-92

HOLE NO. C-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	4 OF 6	C-1

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	(Template: BCHTLLS) DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
											hard, fine to coarse grained, 7-10% biotite and hornblende, closely to moderately fractured, slightly altered, some veins of feldspar pegmatite.	
NX	5.0	4.2	84%	0.0	90	10		120			110.6 - 125.0 ft. **Diorite**, dark gray, medium hard, fine to medium grained, 30-50% biotite and hornblende, 5-10% quartz, intensely to closely fractured with crushed zones, slightly to highly hyrothermally altered, fracture surfaces stained and coated with clay and fillings of crushed rock and alteration products of chlorite, sericite, and muscovite; slickensides. Fracture zones: 112.6-112.8, 112.8-113.0, 113.7-113.9, 115.5-116.0, 120.5-120.9, and 124.2-124.8 ft.	CORE RUN #27 117.3-122.3 ft. RQD=14% LP=0.4 ft. DWR=100%
NX	4.5	4.0	89%									CORE RUN #28 122.3-126.8 ft. RQD=23% LP=0.6 ft. DWR=100%
NX	4.4	4.3	98%	0.0	100	10		125			125.0 - 125.3 ft. **Granodiorite**, gray, hard, fine to coarse grained.	
											125.3 - 131.2 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, fresh to moderately weathered, slightly to highly altered, intensely to closely fractured. Fracture surfaces slightly to moderately weathered, includes thin coatings of mineralization and clay and alteration products of chlorite, sericite, and muscovite; some slickensides. Fracture zones: 125.9-126.2, 128.0-128.2, 128.3-128.4, 128.4-128.6, and 130.5-131.1 ft.	CORE RUN #29 126.8-131.2 ft. RQD=25% LP=0.7 ft. DWR=100%
NX	5.1	3.5	69%					130				CORE RUN #30 131.2-136.3 ft. RQD=15% LP=0.5 ft. DWR=100%
NX	4.7	3.5	74%	0.1	110	10		135			131.2 - 158.8 ft. **Granodiorite**, gray, hard, fine to coarse grained, 50-60% feldspar, 25-40% biotite and hornblende, and 10% quartz, fresh to moderately weathered, intensely to closely fractured with crushed zones, slightly to highly altered; weathered fracture surfaces coated with thin deposits of clay and mineralization and alteration products of chlorite, muscovite, and sericite on fracture surfaces; some slickensides; some veins of feldspar pegmatite up to 0.4 ft. thick. Fracture zones: 131.2-131.8, 133.0-133.2, 134.3-134.7, 136.9-137.2, 138.4-138.8, 139.0-139.4, 139.7-139.8, 141.7-141.8, 143.5-144.0, 145.7-145.8, 146.0-146.2, 146.8-147.0, 147.0-147.5, 147.8-148.1, 149.5-150.3, 152.7-152.8, 153.1-153.3, 153.6-153.7, 155.1-155.2, 155.4-155.5, 156.2-156.3, 152.7-152.8, 157.6-157.8, 158.0-158.5, and 158.5-158.8 ft.	CORE RUN #31 136.3-141.0 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	4.5	3.0	67%					140				CORE RUN #32 141.0-145.5 ft. RQD=22% LP=0.6 ft. DWR=100%
NX	4.0	2.7	68%	1.4	120	10		145				CORE RUN #33 145.5-149.5 ft. RQD=0% LP=0.2 ft. DWR=%
NX	2.8	1.7	61%					150				CORE RUN #34 149.5-152.3 ft. RQD=0% LP=0.1 ft. DWR=100%
NX	5.0	4.5	90%									CORE RUN #35 152.3-157.3 ft. RQD=0% LP=0.2 ft. DWR=100%

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Channel near Dam Axis

Last Update: 1-27-92

HOLE NO. C-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	5 OF 6	C-1

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION (Template: BCHTLLS)	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NX	5.0	2.5	50%	0.1	130	10		160			158.8 - 162.3 ft. **Quartz Diorite**, dark gray, medium hard, fine to medium grained, 40-50% biotite and hornblende, fresh to moderately weathered, intensely to closely fractured. Fracture surfaces slightly to moderately weathered, includes thin coatings of mineralization and clay. Dark minerals oriented 45 degrees relative to core axis 159.9-160.3 ft. Fracture zones: 158.8-158.9 and 159.6-159.8 ft.	CORE RUN #36 157.3-162.3 ft. RQD=0% LP=0.2 ft. DWR=100%
NX	5.0	4.3	86%					165			162.3 - 167.3 ft. **Granodiorite**, gray, hard, fine to coarse grained, 65-75% feldspar, 15-25% biotite and hornblende, and 10% quartz, fresh to slightly weathered, intensely to closely fractured with crushed zones; fracture surfaces unstained to light coatings of calcite, clay, and crushed rock; some veins of feldspar pegmatite. Fracture zones: 163.6-163.7 and 164.0-164.1 ft.	CORE RUN #37 162.3-167.3 ft. RQD=17% LP=0.4 ft. DWR=100%
NX	3.4	2.0	59%	0.4	140	10					167.3 - 168.4 ft. **Quartz Monzonite**, light gray, hard, fine to coarse grained, 7-10% biotite and hornblende, fresh to slightly weathered, intensely fractured.	CORE RUN #38 167.3-170.7 ft. RQD=0% LP=0.2 ft. DWR=100%
NX	5.0	4.0	80%					170			168.4 - 180.2 ft. **Granodiorite**, gray, hard, fine to coarse grained, 10-40% biotite and hornblende, fresh to slightly weathered, intensely to closely fractured; fracture surfaces fresh to moderately weathered, includes thin coatings of mineralization and clay; some slickensides noted. Fracture zones: 171.2-171.4, 171.7-171.8, 172.6-172.7, 173.0-173.3, 173.4-173.5, 174.6-174.7, 175.7-176.2, and 179.1-179.2 ft.	CORE RUN #39 170.7- 175.7 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	4.5	3.5	78%	0.0	135	10		175				CORE RUN #40 175.7-180.2 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	5.0	4.8	96%					180			180.2- 190.0 ft. **Quartz Monzonite**, light gray, hard, fine to coarse grained, 7-10% biotite and hornblende, fresh to slightly weathered, intensely to closely fractured with some crushed zones; fracture surfaces fresh to moderately weathered, includes thin deposits of mineralization and clay; some veins of feldspar pegmatite up to 0.4 ft. thick. Fracture zones: 181.3-181.4, 186.2-186.6, and 188.1-188.2 ft.	CORE RUN #41 180.2-185.2 ft. RQD=0% LP=0.3 ft. DWR=100%
NX	2.8	2.8	100%					185				CORE RUN #42 185.2-188.0 ft. RQD=100% LP=0.3 ft. DWR=100%
NX	2.0	1.5	75%									CORE RUN #43 188.0-190.0 ft. RQD=19% LP=0.4 ft. DWR=100%
											Bottom of boring at 190.0 ft.	Boring backfilled with cement/bentonite grout.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Channel near Dam Axis

Last Update: 1-27-92

HOLE NO. C-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	6 OF 6	C-1

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS/N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	(Template: BCHTLLS) DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
												PACKER TESTS 41.4-51.9 ft. 51.6-62.1 ft. 61.7-72.2 ft. 71.6-82.1 ft. 81.6-92.2 ft. 91.6-102.2 ft. 101.6-112.1 ft. 111.6-122.1 ft. 121.6-132.1 ft. 131.6-142.2 ft. 141.7-152.2 ft. 151.6-162.2 ft. 161.7-172.2 ft. 172.9-183.4 ft. Samples for testing: 20.9-21.9 ft. 96.7-97.3 ft. 122.6-123.2 ft. 165.5-165.9 ft. Fracture log attached.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Channel near Dam Axis

Last Update: 1-27-92

HOLE NO. C-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	1 OF 4	LA-1

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Left Abutment near Dam Axis	N 396,824.7 E 1,215,341.8	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
11-26-91	12-4-91	Continental Drilling	CP-15	3"	25.0	100.0	125.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
80.7/81%	6	4	988.25	986.0	▽ 80.5/905.5 12-12-91 /	25.0/961.0

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	2.25" I.D./125'	T.F. Mullen

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION (Template: BCHTLLS)	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							986.0					
NX	23.0										0.0 - 25.0 ft. **OVERBURDEN**, Holocene. 0.0 - 7.0 ft. **Residual Soil**, Silty Sand (SM), medium brown sand with 40% silt, 5% gravel up to 6 inches diameter; fine to coarse grained, moist, dense; supports vegetative cover.	Drill with water 0.0-125' Ream NX casing to 23.0'.
							979.0	5			7.0 - 25.0 ft. **Colluvium**, Silty Sand (SM), medium brown sand with 25% silt, 5% gravel up to 6 inches diameter; poorly graded, fine to medium grained, moist, dense, clasts slightly to highly weathered.	No drill water return 14-23'. Drill with tri-cone rock bit (TC) 23-25', no drill water return. Ream NX casing to 25.7'.
								10				
								15				Rig chatter, hard drilling at 25'.
								20				Using NX wire-line system with 5 ft. long double tube core barrel and split tube inner barrel; diamond bit 2.98-inch O.D., 1.86-inch I.D.
TC	2.0											
NX	0.8	0.5	63%				961.0	25			25.0 - 125.0 ft. **MESOZOIC GRANITIC COMPLEX**, Heterogeneous granitic rocks ranging from quartz monzonite to quartz diorite. Gradational contacts between rock types.	CORE RUN #1 25.0-25.8 ft. RQD=0% DWR=0% Blocked off
NX	2.2	1.3	59%									
NX	5.0	1.2	24%					30			25.0 - 40.0 ft. **Decomposed Granitic Rock**, light gray, medium soft to very hard, decomposed to highly weathered, fine to medium grained, 60% feldspar, 25% quartz, and 15% biotite and hornblende. Intensely to closely fractured with crushed and severely weathered rock in zones of core loss, fracture surfaces generally slightly to moderately weathered with iron oxide stains. Fracture zones: 26.1-26.4, 28.9-29.2, and 38.4-38.5 ft.	CORE RUN #2 25.8-28.0 ft. RQD=0% DWR=0% CORE RUN #3 28.0-33.0 ft. RQD=7% DWR=0%
NX	5.0	0.3	6%									CORE RUN #4 33.0-38.0 ft. RQD=0% DWR=0%

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE	Last Update:	HOLE NO.
Left Abutment near Dam Axis	1-30-92	LA-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	2 OF 4	LA-1

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
												Fast drilling.
NX	2.0	1.3	65%									CORE RUN #5 38.0-40.0 ft. RQD=0% DWR=0% Blocked off at 40'.
NX	3.0	1.7	57%				946.0	40			40.0 - 53.0 ft. **Granodiorite**, gray, hard to very hard, fine to coarse grained, 40-65% feldspar, 20-25% biotite and hornblende, and 10-40% quartz, closely to moderately fractured with zones of crushed and intensely fractured rock. Fracture surfaces slightly to moderately stained with iron and magnesium oxides. Feldspar pegmatite inclusion at 45.2-45.4 ft. Fracture zones: 43.1-43.2, 45.4-45.9, 48.5-48.6, 49.2-49.3, 49.5-49.7, 51.3-51.5, and 51.6-51.7 ft.	CORE RUN #6 40.0-43.0 ft. RQD=86% DWR=0%
NX	5.0	3.2	64%					45				Advance NX casing to 33'. Clean out hole to 43'. Hole unstable 39-40'.
NX	5.0	3.9	78%					50				CORE RUN #7 43.0-48.0 ft. RQD=29% DWR=0% Grout 37-48' with cement. Redrill to 48'.
NX	5.0	5.0	100%	0.0	40	10	933.0	53			53.0 - 63.0 ft. **Quartz Diorite**, very hard, slightly weathered, slightly altered, closely to moderately fractured. Stains of iron and magnesium oxides and fillings of clayey silt up to 3 mm thick on fracture surfaces. Feldspar pegmatite inclusion at 58.9-61.2 ft. Fracture zones: 57.0-57.3 and 59.5-59.6 ft.	CORE RUN #8 48.0-53.0 ft. RQD=19% DWR=100% CORE RUN #9 53.0-58.0 ft. RQD=25% DWR=100%
NX	5.0	4.7	94%					60				CORE RUN #10 58.0-63.0 ft. RQD=14% DWR=100%
NX	5.0	4.3	86%	0.1	50	10	923.0	65			63.0 - 94.0 **Granodiorite**, gray, hard, slightly to moderately weathered, slightly to moderately hydrothermally altered, intensely to moderately fractured with zones of crushed rock. Fracture surfaces stained with iron and magnesium oxides and chlorite and minor fillings of crushed rock up to 3 mm thick. Minor amounts of alteration products of chlorite and muscovite, some slickensides noted, feldspar pegmatite with large biotite phenocrysts at 93.2-94.0 ft. Fracture zones: 66.0-66.2, 69.0-69.3, 71.6-71.7, 72.6-72.7, 73.1-73.5, 74.8-74.9, 75.8-76.0, 76.4-77.0, 77.5-77.7, 80.4-80.5, 84.7-85.0, 88.2-88.3, 92.1-92.6, 92.6-92.7, and 93.0-94.0 ft.	CORE RUN #11 63.0-68.0 ft. RQD=31% DWR=100%
NX	4.7	5.1	109%					70				CORE RUN #12 68.0-72.7 ft. RQD=15% DWR=100%
NX	5.3	4.6	87%									CORE RUN #13 72.7-78.0 ft. RQD=0% DWR=100%

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Left Abutment near Dam Axis

Last Update: 1-30-92

HOLE NO. LA-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	3 OF 4	LA-1

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				0.0	60	10						
NX	5.0	5.0	100%					80				CORE RUN #14 78.0-83.0 ft. RQD=0% DWR=100%
NX	5.0	5.0	100%	0.0	70	10		85				CORE RUN #15 83.0-88.0 ft. RQD=49% DWR=100%
NX	5.0	4.7	94%					90				CORE RUN #16 88.0-93.0 ft. RQD=45% DWR=100%
NX	5.0	2.8	56%	1.0	80	10	892.0	95			94.0 - 98.4 ft. **Quartz Diorite**, dark gray, medium hard, closely fractured with iron oxide and chlorite on fracture surfaces. Moderately hydrothermally altered; chlorite and muscovite present. Fracture zone: 94.0-94.1.	CORE RUN #17 93.0-98.0 ft. RQD=9% DWR=100%
NX	5.0	4.2	84%				887.6	100			98.4 - 125.0 ft. **Granodiorite**, gray, hard, slightly weathered to fresh, partially altered, intensely to moderately fractured. Fracture surfaces stained with traces of iron and magnesium oxides, chlorite, and calcite. Also, minor amounts of crushed rock fillings up to 3 mm thick on some surfaces. Some slickensides noted. Feldspar pegmatite at 110.9-111.1 ft. Fracture zones: 98.6-99.1, 99.2-99.4, 99.6-99.7, 101.7-101.8, 103.2-103.3, 103.8-104.0, 104.3-104.6, 104.6-104.8, 118.6-118.7, 122.2-122.3, 122.8-122.9, and 123.2-123.4 ft.	CORE RUN #18 98.0-103.0 ft. RQD=0% DWR=100%
NX	5.0	5.0	100%	0.1	90	10		105				CORE RUN #19 103.0-108.0 ft. RQD=20% DWR=100%
NX	5.0	5.0	100%					110				CORE RUN #20 108.0-113.0 ft. RQD=41% DWR=100%
NX	5.0	5.0	100%									CORE RUN #21 113.0-118.0 ft. RQD=78% DWR=100%

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: **Left Abutment near Dam Axis**

Last Update: 1-30-92

HOLE NO. LA-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
New Los Padres Dam	21675	4 OF 4	LA-1

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	(Template: BCHTLLS) DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				0.0	100	10						
NX	5.0	5.0	100%					120				CORE RUN #22 118.0-123.0 ft. ROD=48% DWR=100%
NX	2.0	1.9	95%				861.0	125				CORE RUN #23 123.0-125.0 ft. ROD=0% DWR=100%
											Bottom of boring 125.0 ft.	PACKER TESTS 50.8-61.3 ft. 60.7-71.2 ft. 70.6-81.1 ft. 80.9-91.4 ft. 90.7-101.2 ft. 100.7-111.2 ft. 110.9-121.4 ft. Samples for testing: 44.4-45.2 ft. 69.2-69.9 ft. 88.3-88.7 ft. 120.2-120.7 ft. Completed boring as monitoring well: 2-inch PVC piezometer installed; screened interval 104.3-123.4 ft. Fracture log attached.

NX = CORE BARREL; TC = TRICONE BIT; LP = LONG PIECE OF CORE; DWR = DRILL WATER RETURN

SITE: Left Abutment near Dam Axis

Last Update: 1-30-92

HOLE NO. LA-1

APPENDIX A.3

Fracture Logs

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA–1

Depth (ft)	Description of Geologic Feature*
37.7	Fracture, 0°, moderately smooth, stained with iron oxide.
37.7–38.0	Fracture, 60°, smooth, stained with iron oxide, intersects fractures above and below.
38.0	Fracture, 0°, smooth, stained with iron oxide, some rock fragments.
38.1	Fracture, 5°, moderately smooth, stained with iron oxide.
38.4	Fracture, 5°, moderately smooth, stained with iron oxide.
38.5	Fracture, 5°, moderately smooth, stained with iron oxide.
38.7	Fracture, 5°, moderately smooth, stained with iron oxide.
38.8	Fracture, 5°, moderately smooth, stained with iron oxide.
39.0	Fracture, 10°, smooth, stained with iron oxide.
39.0–46.8	Core loss 7.3 feet, probably decomposed rock.
46.8	Fracture, 10°, moderately smooth, stained with iron oxide and manganese oxide.
46.8–47.0	Fracture, 50°, smooth, stained with iron oxide and manganese oxide, intersects fractures above and below.
46.9	Fracture, 10°, moderately smooth, stained with iron oxide and manganese oxide.
47.0	Fracture, 50°. moderately rough, stained with iron oxide and manganese oxide, numerous rock chips.
47.2	Feldspar vein, 0°, 2 cm width.
47.3–47.5	Fracture zone, several wedge–shaped rock fragments, stained with iron oxide, coated with clay and crushed rock particles, highly weathered.
47.3–47.8	Fracture, 65°, moderately smooth, coated with reddish clay and crushed rock fragments, intersects fracture below.
47.8	Fracture, 50°, moderately smooth, stained with iron oxide and manganese oxide, coated with clay.
47.9	Fracture, 35°, moderately smooth, stained with iron oxide and manganese oxide, coated with clay.
48.0	Fracture, 35°, moderately smooth, stained with iron oxide and manganese oxide, coated with clay.
48.0–48.7	Fracture, 75°, moderately rough and irregular, stained with iron oxide and manganese oxide, coated with clay, intersects fractures above and below; cut by 0° (horizontal) fractures at 0.2 foot spacing.
49.0–49.3	Core loss 0.3 feet, probably decomposed rock.
49.3	Fracture, 5°, smooth, stained with iron and manganese oxides.
49.4	Fracture, 0°, rough, stained with iron and manganese oxides.
49.8	Fracture, 5°, rough and irregular, stained with iron and manganese oxides.
49.9	Fracture, 30°, smooth, stained with iron and manganese oxides, intersects fracture above.
50.0	Fracture, 45°, smooth, stained with iron and manganese oxides.
50.2	Fracture, 45°, moderately rough, stained with iron and manganese oxides, numerous rock chips.
50.3	Fracture, 45°, smooth, stained with iron and manganese oxides.
50.4	Fracture, 45°, moderately smooth, stained with iron and manganese oxides, several wedge–shaped rock chips.
50.5	Fracture, 60°, moderately rough, stained with iron and manganese oxides, numerous rock chips.
50.6	Fracture, 60°, moderately smooth, stained with iron and manganese oxides,

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
	intersects fracture above.
50.7	Fracture, 65°, smooth, stained with iron and manganese oxides.
51.0	Fracture, 65°, smooth, stained with iron and manganese oxides.
51.0–51.8	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, coatings of crushed rock particles, highly weathered.
51.8	Fracture, 45°, smooth, stained with iron and manganese oxides.
52.0	Fracture, 45°, smooth, stained with iron and manganese oxides.
52.1	Fracture, 45°, smooth, stained with iron and manganese oxides.
52.2	Fracture, 45°, smooth, stained with iron and manganese oxides.
52.3–52.4	Fracture zone, numerous rock fragments with coatings of crushed rock, stained with iron and manganese oxides, highly weathered.
52.4	Fracture, 0°, smooth, lightly stained with iron and manganese oxides.
52.5	Fracture, 45°, smooth, lightly stained with iron and manganese oxides, intersects fractures above and below.
52.6	Fracture, 45°, smooth, lightly stained with iron and manganese oxides.
52.9	Fracture, 0°, rough, lightly stained with iron and manganese oxides.
53.2	Fracture, 60°, moderately rough, fresh, intersects fracture above.
53.5	Fracture, 5°, moderately rough, fresh.
54.0	Drill break, 0°, rough, fresh.
54.1	Fracture, 45°, smooth, obtained with iron oxide and manganese oxide.
54.2–54.7	Fracture, 70°, smooth, stained with iron and manganese oxides, intersects fractures below.
54.3	Fracture, 0°, smooth, stained with iron and manganese oxides.
54.5	Fracture, 0°, smooth, stained with iron and manganese oxides.
54.6	Fracture, 0°, smooth, stained with iron and manganese oxides.
54.5	Fracture, 60°, smooth, stained with iron and manganese oxides.
54.8–55.2	Fracture, 65°, smooth, stained with iron and manganese oxides, intersects fractures below.
54.9	Fracture, 15°, smooth, stained with iron and manganese oxides.
55.0	Fracture, 15°, smooth, stained with iron and manganese oxides.
55.1–55.4	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed rock, moderately weathered.
55.6	Fracture, 25°, smooth, stained with iron and manganese oxides.
55.7–55.8	Fracture zone, numerous rock fragments with some crushed rock, stained with iron and manganese oxides, moderately weathered.
55.8	Fracture, 10°, smooth, stained with iron and manganese oxides.
55.9	Fracture, 30°, moderately smooth, stained with iron and manganese oxide.
56.0	Fracture, 30°, moderately smooth, stained with iron and manganese oxides, intersects fracture above.
56.3	Fracture, 5°, rough, stained with iron and manganese oxides.
56.4	Fracture, 50°, rough, stained with iron and manganese oxides.
56.8	Fracture, 45°, moderately smooth, undulating, stained with iron and manganese oxides.
57.1	Fracture, 5°, moderately rough, stained with iron and manganese oxides.
57.1	Fracture, 75°, moderately smooth, undulating, stained with iron and manganese oxides.
57.9	Fracture, 70°, moderately rough, stained with iron and manganese oxides.
58.1	Fracture, 25°, smooth, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
58.5–58.6	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed particles, slightly weathered.
58.7	Fracture, 45°, smooth, stained with iron and manganese oxides.
58.8	Fracture, 60°, moderately smooth, irregular to curved, stained with iron and manganese oxides.
59.0	Drill break, 15°, moderately smooth, fresh.
59.0	Healed fracture, 50°, irregular, sealed with silica.
59.2	Fracture, 10°, rough, fresh.
59.4	Fracture, 30°, rough, fresh.
59.6	Fracture, 0°, moderately rough, lightly stained with iron oxide.
60.2	Fracture, 30°, rough, fresh.
60.3	Fracture, 30°, moderately smooth, stained with iron and manganese oxides.
60.4	Fracture, 30°, moderately smooth, stained with iron and manganese oxides.
60.5	Fractures, 30°, moderately smooth, stained with iron and manganese oxides.
60.6	Fracture, 50°, moderately rough, lightly stained with iron and manganese oxides; intersects fracture below.
60.8	Fracture, 5°, rough, lightly stained with iron and manganese oxides.
61.1	Fracture, 60°, moderately smooth, lightly stained with iron and manganese oxides, intersects fracture below.
61.4	Fracture, 25°, moderately smooth, lightly stained with iron and manganese oxides.
61.5	Fracture, 25°, moderately smooth, lightly stained with iron and manganese oxides.
61.7	Fracture, 75°, smooth, stained with iron and manganese oxides.
61.8	Fracture, 75°, smooth, stained with iron and manganese oxides.
62.0	Fracture, 60°, smooth, stained with iron and manganese oxides and epidote.
62.0–62.3	Seam, 60°, granodiorite altered to epidote and chlorite.
62.3	Fracture, 5°, moderately smooth, stained with iron oxide and manganese oxide.
62.4	Fracture, 30°, rough, stained with iron and manganese oxides, intersects fracture above.
63.0	Fracture, 15°, smooth, fresh.
63.1	Fracture, 45°, moderately smooth, lightly stained with iron and manganese oxides.
63.2	Fracture, 0°, rough, lightly stained with iron and manganese oxides.
63.5	Fracture, 75°, moderately smooth, stained with epidote.
64.0	Fracture, 10°, moderately smooth, lightly stained with iron oxide.
64.1	Fracture, 30°, smooth, stained with iron and manganese oxides.
64.2	Fracture, 0°, rough, fresh.
64.3	Fracture, 45°, moderately smooth, lightly stained with iron and manganese oxides, intersects fracture above.
64.3–64.8	Healed fracture, 70°, irregular, sealed with silica.
64.8	Fracture, 25°, rough, lightly stained with iron and manganese oxides.
65.0	Fracture, 45°, smooth, stained with iron and manganese oxides.
65.4	Fracture, 45°, smooth, stained with iron and manganese oxides.
65.6	Fracture, 45°, moderately rough and stepped, stained with iron and manganese oxides.
65.9	Fracture, 20°, smooth, stained with iron and manganese oxides.
66.0	Fracture, 35°, smooth, stained with iron and manganese oxides, intersects

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
	fracture below, cone fracture.
66.0	Fracture, 35°, smooth, stained with iron and manganese oxides, intersects fracture above, cone fracture.
66.1	Fracture, 25°, moderately smooth, stained with iron and manganese oxides.
66.4	Fracture, 15°, smooth, fresh.
66.6	Fracture, 30°, smooth, fresh.
66.7	Fracture, 30°, smooth, lightly stained with iron and manganese oxides.
66.8	Fracture, 45°, smooth, lightly stained with iron and manganese oxides, intersects fracture above.
67.1	Fracture, 45°, moderately rough, stained with iron and manganese oxides, several wedge–shaped rock chips.
67.3	Fracture, 20°, moderately smooth, stained with iron and manganese oxides, cone fracture with wedge–shaped rock chips.
67.3–67.6	Fracture, 60°, rough, stained with iron and manganese oxides, intersects fractures above and below.
67.4	Fracture, 45°, moderately smooth, lightly stained with iron and manganese oxides.
67.6	Fracture, 0°, moderately smooth, lightly stained with iron and manganese oxides.
67.7–67.8	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed rock particles, slightly weathered.
67.9	Healed fracture, 45°, sealed with epidote, cone fracture.
68.0	Fracture, 30°, moderately smooth, fresh.
68.2–68.7	Fracture, 75°, undulating, lightly stained with iron and manganese oxides, intersects fracture below.
68.4	Fracture, 10°, rough, lightly stained with iron and manganese oxides.
68.8	Fracture, 10°, rough, lightly stained with iron and manganese oxides.
68.9	Fracture, 45°, moderately rough, stained with iron and manganese oxides, intersects fracture above.
69.0	Fracture, 0°, moderately smooth, lightly stained with iron and manganese oxides.
69.1	Fracture, 50°, moderately smooth, lightly stained with iron and manganese oxides, intersects fracture below.
69.2	Fracture, 0°, smooth, fresh.
69.4	Fracture, 45°, moderately smooth, stained with iron and manganese oxides.
69.7	Fracture, 5°, moderately smooth, lightly stained with iron and manganese oxides.
70.0	Fracture, 15°, moderately smooth, stained with iron and manganese oxides.
70.1– 70.2	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed particles, moderately weathered.
70.2	Fracture, 45°, smooth, stained with iron and manganese oxides.
70.3	Vein of feldspar, 45°, 1 cm thick.
70.3–70.8	Fracture, 75°, moderately smooth, stained with iron and manganese oxides, intersects fractures above and below.
70.6	Fracture, 0°, moderately smooth, irregular, stained with iron and manganese oxides.
71.0	Fracture, 45°, moderately rough, stained with iron and manganese oxides, coated with 1 mm thick gray clay and crushed rock particles.
71.3	Fracture, 45°, moderately smooth, irregular, stained with iron oxide, coated with crushed rock particles.
71.3–72.1	Healed fracture, 80°, sealed with feldspar and silica.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
71.3	Vein of feldspar, 80°, 5 cm thick.
72.1	Fracture, 50°, moderately smooth, stained with iron and manganese oxides, coated with crushed rock particles.
72.2	Fracture, 60°, moderately smooth, stained with iron and manganese oxides, coated with crushed rock particles.
72.6	Fracture, 0°, moderately smooth, lightly stained with iron and manganese oxides.
73.0–73.1	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed rock particles, slight alteration.
73.1–73.5	Fracture, 65°, moderately smooth, irregular, stained with iron and manganese oxides, some wedge–shaped chips, intersects fractures above and below.
73.5	Fracture, 30°, moderately smooth, lightly stained with iron oxide, few rock particles.
73.9	Fracture, 45°, moderately rough, fresh.
74.0	Drill break, 0°, moderately rough, fresh.
74.1	Fracture, 15°, smooth, lightly stained with iron and manganese oxides
74.2	Fracture, 15°, smooth, lightly stained with iron and manganese oxides.
74.4	Fracture, 10°, moderately smooth, lightly stained with iron and manganese oxides.
74.8	Fracture, 5°, moderately smooth, irregular, fresh.
75.3	Fracture, 45°, moderately rough, lightly stained with iron and manganese oxides.
75.5	Vein of feldspar, 20°, partially altered to green epidote.
75.9	Fracture, 45°, moderately rough, stained with iron and manganese oxides, coated with crushed rock particles 1 mm thick.
76.0–77.0	Fracture, 85°, moderately smooth, irregular, stained with iron and manganese oxides and chlorite, some slickensides, intersects fractures above and below.
76.4	Incipient fracture, 0°, hairline crack.
76.7	Fracture, 60°, moderately rough, stained with iron and manganese oxides, coated with crushed rock particles 2 mm thick.
76.9–77.3	Healed fracture, 65°, sealed with feldspar.
77.3	Fracture, 45°, moderately smooth, fresh.
77.6–77.8	Vein of pegmatite (feldspar, hornblende)?, 45°, partially altered to epidote.
77.8–77.9	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, some crushed rock, slightly weathered, altered in part.
77.9	Fracture, 60°, moderately smooth, stained with iron and manganese oxides.
78.2–78.5	Vein of feldspar, 60°, altered in part.
78.6	Fracture, 45°, moderately smooth, stained with iron oxide and chlorite, slickensides.
79.0	Drill break, 0°, moderately rough, fresh.
79.1	Fracture, 60°, moderately rough, stained with iron oxide and chlorite.
79.3	Healed fracture, 60°, sealed with silica.
79.5	Fracture, 60°, moderately rough, stained with iron oxide and chlorite.
79.8	Fracture, 45°, moderately smooth, fresh.
80.1	Fracture, 0°, moderately smooth, stained with chlorite, pyrite crystals noted.
80.3	Fracture, 15°, moderately smooth, stained with chlorite, slickensides.
80.3–81.0	Fracture, 80°, moderately smooth, stained with chlorite, slickensides, intersects fractures above and below.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
81.0	Fracture, 45°, smooth, stained with chlorite, coated with crushed rock particles, slickensides.
81.3	Fracture, 15°, moderately smooth, stained with iron oxide and chlorite, slickensides.
81.3–81.8	Fracture, 75°, moderately smooth, stained with chlorite, slickensides, intersects fractures above and below.
81.6	Fracture, 30°, smooth, stained with chlorite, slickensides.
81.7	Fracture, 30°, smooth, stained with chlorite, slickensides.
81.7–82.3	Incipient fracture, 75°, irregular, hairline crack.
82.6	Fracture, 45°, moderately smooth, stained with chlorite, some wedge–shaped chips, pyrite noted.
82.6–83.4	Fracture, 80°, moderately smooth, stained with chlorite, pyrite, intersects fracture above.
83.7	Fracture, 20°, smooth, stained with chlorite.
83.8	Fracture, 45°, rough, stained with iron oxide and chlorite.
84.0	Drill break, 0°, rough, fresh.
84.1	Fracture, 20°, moderately smooth, stained with iron and manganese oxides.
84.5	Fracture, 10°, rough, fresh.
84.5	Fracture, 50°, moderately rough, stained with iron oxide.
84.8	Fracture, 10°, moderately rough, stained with iron oxide.
85.1	Fracture, 30°, moderately smooth, stained with iron and manganese oxides, intersects fracture below.
85.2	Fracture, 45°, smooth, lightly stained with iron and manganese oxides.
85.4–85.7	Vein of feldspar, 60°, 3 cm thick.
85.8	Fracture, 45°, moderately rough, stained with iron and manganese oxides, coated with crushed rock fragments.
86.1	Incipient fracture, 45°, hairline crack.
86.3	Fracture, 20°, moderately smooth, stained with iron and manganese oxides, coated with chlorite and epidote.
86.4	Fracture, 45°, rough, stained with iron and manganese oxides, some wedge–shaped rock chips.
86.5	Fracture, 45°, rough, stained with iron and manganese oxides, some wedge–shaped rock chips.
86.6	Fracture, 45°, rough, stained with iron and manganese oxides, some wedge–shaped rock chips.
86.7	Fracture, 60°, moderately smooth, lightly stained with iron and manganese oxides.
87.0	Fracture, 30°, moderately rough, lightly stained with iron and manganese oxides.
87.1	Fracture, 30°, moderately rough, lightly stained with iron and manganese oxides.
87.3	Fracture, 60°, smooth, stained with chlorite.
87.4	Fracture, 30°, smooth, lightly stained with iron oxide.
87.5–88.6	Core loss 1.1 feet, probably crushed and altered rock.
88.6	Fracture, 60°, smooth, lightly stained with iron and manganese oxides.
89.0	Fracture, 45°, smooth, stained with iron and manganese oxides.
89.5	Fracture, 45°, moderately smooth, irregular, lightly stained with iron and manganese oxides.
89.7	Fracture, 10°, smooth, stained with iron and manganese oxides.
89.7	Fracture, 65°, moderately rough, stained with iron and manganese oxides.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
90.0	Fracture, 45°, moderately smooth, stained with iron and manganese oxides, intersects fractures above and below.
90.1–90.3	Vein of feldspar, 50°, slightly altered.
90.2	Fracture, 0°, rough, fresh.
90.2	Fracture, 50°, moderately smooth, stained with iron and manganese oxides.
90.4–90.8	Fracture zone, numerous rock fragments, stained with iron oxide, manganese oxide and epidote, some crushed rock, altered in part.
91.1	Fracture, 30°, rough, stained with iron oxide, manganese oxide and epidote.
91.3–91.5	Fracture zone, numerous rock fragments, stained with iron and manganese oxides, altered in part.
91.5	Fracture, 65°, smooth, stained with iron and manganese oxides.
91.9	Fracture, 10°, smooth, lightly stained with iron and manganese oxides.
92.1	Fracture, 45°, smooth, stained with iron and manganese oxides, coated with 5 mm thick crushed rock fragments.
92.3	Fracture, 45°, moderately smooth, stained with chlorite.
92.4	Fracture, 45°, moderately smooth, stained with chlorite.
92.6	Fracture, 45°, moderately smooth, stained with chlorite.
92.8	Fracture, 45°, moderately smooth, stained with chlorite.
92.8–93.8	Fracture zone, numerous rock fragments, stained with chlorite and iron oxide and coated with clay, moderately altered; core loss 0.4 feet.
93.8	Fracture, 0°, moderately smooth, fresh.
93.8–93.9	Vein of feldspar, 10°, 3 cm thick.
94.0	Fracture, 10°, moderately smooth, fresh.
94.1	Drill break, 0°, moderately rough, fresh.
94.2	Fracture, 5°, rough, irregular, fresh.
94.3–94.6	Fracture zone, numerous rock fragments, stained with chlorite and iron oxides, moderately altered.
95.0	Fracture, 10°, moderately smooth, irregular, fresh.
95.1	Fracture, 45°, moderately smooth, stained with chlorite, iron oxide and manganese oxide.
95.4	Fracture, 10°, moderately smooth, stained with iron and manganese oxides, coated with crushed rock fragments.
95.5	Fracture, 50°, smooth, stained with iron and manganese oxides, coated with crushed rock fragments.
95.6	Fracture, 50°, smooth, stained with iron and manganese oxides, coated with crushed rock fragments; intersects fracture above.
95.7	Fracture, 15°, rough, stained with chlorite.
95.8	Fracture, 45°, smooth, lightly stained with iron oxide and chlorite, intersects fractures above and below.
96.0	Fracture, 15°, smooth, lightly stained with iron oxide and chlorite.
96.4	Incipient fracture, 0°, hairline crack.
96.7	Fracture, 10°, rough, stained with chlorite, coated with crushed rock particles.
96.8	Fracture, 60°, moderately smooth, stained with chlorite, slickensides.
97.0	Fracture, 10°, smooth, stained with chlorite.
97.1	Fracture, 60° moderately smooth, stained with chlorite, slickensides, intersects fracture below.
97.4	Fracture, 15°, moderately rough, fresh.
97.5	Fracture, 15°, moderately rough, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
97.7	Fracture, 0°, moderately smooth, fresh.
97.9	Incipient fracture, 10°, hairline crack.
98.0	Incipient fracture 30°, hairline crack.
98.2	Fracture, 20°, moderately smooth, stained with chlorite, slickensides.
98.3	Fracture, 20°, moderately smooth, stained with chlorite, slickensides.
98.3	Fracture, 60°, moderately rough, fresh.
98.7	Fracture, 10°, moderately rough, fresh.
99.0	Drill break, 5°, moderately rough, fresh.
99.1	Fracture, 10°, moderately smooth, lightly stained with chlorite, slickensides.
99.2	Fracture, 10°, moderately smooth, lightly stained with chlorite, slickensides.
99.3	Fracture, 10°, moderately smooth, lightly stained with chlorite, slickensides.
99.3–99.5	Fracture zone, few wedge–shaped rock fragments, stained with iron oxide, manganese oxide and chlorite, slightly altered.
99.7	Fracture, 0°, moderately rough, lightly stained with chlorite, pyrite noted.
99.8	Fracture, 0°, moderately smooth, stained with chlorite, slickensides.
99.8	Fracture, 35°, smooth, stained with chlorite, slickensides, intersects fracture above.
99.9–100.2	Fracture zone, numerous rock fragments, stained with chlorite, slickensides, some crushed rock particles, slightly altered.
100.3	Fracture, 50°, moderately smooth, irregular, stained with chlorite, slickensides, intersects fracture below.
100.4	Fracture, 30°, smooth, stained with chlorite, slickensides.
100.5	Fracture, 10°, moderately smooth, stained with chlorite, iron oxide and manganese oxide.
100.5	Fracture, 60°, smooth, stained with chlorite, slickensides.
100.8	Fracture, 50°, moderately rough, stained with chlorite.
100.9	Fracture, 0°, moderately smooth, stained with chlorite.
101.0	Fracture, 10°, smooth, stained with chlorite.
101.1	Fracture, 45°, smooth, stained with chlorite, coated with crushed rock.
101.1–101.4	Vein of feldspar, 60°.
101.4	Fracture, 75°, moderately smooth, stained with chlorite, intersects fracture below.
101.4	Fracture, 50°, moderately smooth, stained with chlorite.
101.5	Fracture, 10°, smooth, stained with chlorite, slickensides.
101.6	Fracture, 10°, smooth, stained with chlorite.
101.7	Fracture, 15°, rough, stained with chlorite.
101.8	Fracture, 15°, rough, stained with chlorite.
101.9	Fracture, 15°, rough, stained with chlorite.
101.9–103.1	Core loss 1.2 feet, probably crushed rock fragments.
103.1–103.8	Fracture zone, numerous rock fragments, stained with chlorite, some crushed rock particles, moderately altered.
103.8–104.2	Core loss 0.4 feet, probably crushed rock fragments.
104.2–104.4	Fracture zone, numerous rock fragments, stained with chlorite, some crushed rock particles, slightly altered.
104.4	Drill break, 45°, moderately rough , fresh.
104.7	Fracture, 45°, smooth, stained with chlorite, slickensides.
104.9	Fracture, 10°, moderately smooth, fresh.
104.9	Fracture, 45°, moderately smooth, stained with chlorite, coated with crushed rock fragments, intersects fractures above and below.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
105.0	Fracture, 60°, moderately smooth, irregular, stained with chlorite.
105.3	Fracture, 60°, moderately smooth, irregular, stained with chlorite, intersects fracture above.
105.5	Fracture, 10°, moderately smooth, stained with chlorite.
105.6	Fracture, 10°, moderately smooth, stained with chlorite.
105.9	Incipient fracture, 25°, hairline crack.
106.1–106.5	Fracture, 65°, moderately smooth, stained with chlorite, slickensides, intersects fracture below.
106.3	Fracture, 5°, smooth, stained with chlorite, slickensides, some wedge–shaped rock particles.
106.5	Fracture, 60°, moderately smooth, stained with chlorite, slickensides.
106.8	Fracture, 60°, moderately smooth, stained with chlorite, slickensides.
107.1	Fracture, 10°, smooth, stained with chlorite, slickensides, some wedge–shaped rock fragments.
107.4	Fracture, 20°, smooth, stained with chlorite, slickensides.
107.4–107.7	Fracture zone, numerous rock fragments, fresh.
107.7–107.9	Vein of feldspar, 0°, altered.
107.9	Fracture, 10°, moderately smooth, stained with chlorite, coated with crushed rock fragments, some rock particles.
108.1	Fracture, 20°, smooth, fresh, slickensides.
108.3	Fracture, 10°, smooth, fresh.
108.3–108.8	Core loss 0.5 feet, probably crushed, altered quartz diorite.
108.8–109.6	Fracture zone, numerous rock fragments and crushed rock, stained with chlorite, slightly altered.
109.6–110.0	Core loss 0.4 feet, probably crushed and altered quartz diorite.
110.0	Fracture, 25°, moderately smooth, stained with chlorite, coated with 5 mm thick crushed rock particles.
110.0	Fracture, 50°, moderately rough, irregular, fresh, intersects fractures above and below.
110.2	Fracture, 20°, moderately rough, fresh.
110.2–110.7	Fracture, 75°, smooth, stained with chlorite, intersects fracture below.
110.7	Fracture, 65°, smooth, stained with chlorite.
111.6	Fracture, 15°, moderately rough, fresh.
111.7	Fracture, 60°, moderately smooth, lightly stained with chlorite.
111.8	Fracture, 60°, moderately smooth, lightly stained with chlorite.
112.0	Fracture ,30°, moderately smooth, lightly stained with chlorite.
112.0–112.9	Fracture ,85°, moderately smooth, lightly stained with chlorite, intersects fractures above and below.
112.5	Fracture, 5°, moderately smooth, lightly stained with chlorite.
112.7	Fracture, 5°, moderately smooth, lightly stained with chlorite.
112.9	Fracture, 15°, moderately smooth, lightly stained with chlorite.
112.9–113.8	Fracture, 85°, moderately smooth, stained with chlorite, intersects fracture above and below.
113.5	Fracture, 0°, moderately rough, fresh.
113.8	Dull break, 0°, moderately rough, fresh.
113.8–114.0	Core loss 0.2 feet, probably crushed rock.
114.0–114.1	Fracture zone, numerous rock fragments, fresh.
114.1	Fracture, 25°, moderately rough, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
114.4	Fracture, 30°, moderately rough, fresh.
114.3–114.5	Vein of feldspar, 40°, fresh.
114.6	Fracture, 15°, moderately rough, fresh.
114.8	Fracture, 45°, moderately rough, fresh, intersects fracture below.
115.0	Fracture, 0°, moderately rough, fresh.
115.1	Fracture, 0°, moderately rough, fresh.
115.3	Fracture, 45°, moderately smooth, fresh.
115.5	Fracture, 15°, moderately smooth, fresh; intersects fracture below.
115.7	Fracture, 5°, moderately smooth, fresh.
115.5–116.3	Fracture, 85°, moderately smooth, coated with crushed rock fragments to 3 mm thick, intersects fracture below.
116.3–116.6	Fracture zone, numerous rock fragments, stained with chlorite, coated with some clay, some crushed rock particles, moderately altered.
116.6–117.4	Fracture, 80°, moderately smooth, irregular, stained with chlorite, coated with crushed rock fragments.
117.4	Fracture, 20°, rough, fresh.
117.7	Fracture, 20°, rough, fresh.
117.8	Fracture, 25°, rough, fresh.
118.0	Fracture, 0°, moderately rough, fresh.
118.1	Fracture, 60°, moderately smooth, fresh, intersects fracture below.
118.3	Fracture, 10°, moderately smooth, fresh.
118.3–119.6	Vein of pegmatite (quartz, feldspar), 85°, partially altered.
118.8	Fracture, 10°, moderately smooth, fresh.
118.9	Fracture, 0°, moderately rough, fresh.
118.9	Fracture, 60°, moderately smooth, fresh, several wedge–shaped chips and crushed rock.
119.3	Fracture, 5°, moderately smooth, fresh, some rock fragments.
119.6	Fracture, 5°, moderately smooth, fresh.
119.8	Fracture, 5°, moderately smooth, fresh.
119.9	Fracture, 5°, moderately smooth, fresh.
120.1	Fracture, 5°, moderately smooth, fresh.
120.2	Fracture, 35°, moderately smooth, fresh, intersects fracture above.
120.3	Fracture, 0°, moderately smooth, fresh.
120.4	Fracture, 5°, moderately smooth, fresh.
120.5	Fracture, 5°, moderately smooth, fresh.
120.7–120.8	Fracture zone, numerous rock fragments, fresh.
120.8	Fracture, 45°, moderately smooth, fresh.
120.9	Fracture, 10°, moderately smooth, fresh.
121.1	Fracture, 10°, moderately smooth, fresh.
121.2	Fracture, 10°, moderately smooth, fresh.
121.3	Fracture, 0°, moderately smooth, fresh.
121.5	Fracture, 0°, moderately smooth, fresh.
121.6	Fracture, 0°, moderately smooth, fresh.
121.8	Fracture, 0°, moderately rough, fresh, several rock chips.
121.9	Fracture, 15°, moderately smooth, fresh.
122.0	Fracture, 15°, moderately smooth, fresh.
122.3	Fracture, 15°, moderately smooth, fresh, several rock chips.
122.4	Fracture, 15°, moderately smooth, fresh, several rock chips.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring RA-1

Depth (ft)	Description of Geologic Feature*
122.5	Fracture, 15°, moderately smooth, fresh.
122.7	Drill break, 0°, moderately rough, fresh.
122.8	Fracture, 15°, moderately smooth, fresh.
122.9	Fracture, 15°, moderately smooth, fresh.
123.0	Fracture, 15°, moderately smooth, fresh.
123.1–123.5	Fracture zone, numerous rock fragments, fresh.
123.5	Fracture, 60°, moderately rough, fresh.
123.7	Incipient fracture, 65°, hairline crack.
123.9	Fracture, 65°, moderately smooth, fresh, intersects fracture below.
124.0–124.5	Fracture, 75°, moderately smooth, fresh, intersects fractures below.
124.2–125.0	Fracture, 75°, moderately smooth, fresh, intersects fractures below.
124.2	Fracture, 5°, moderately smooth, fresh.
124.4	Fracture, 30°, moderately smooth, fresh.
124.5	Fracture, 5°, moderately smooth, fresh.
124.7	Fracture, 0°, moderately smooth, fresh.
125.0	Drill break, 0°, moderately rough, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
7.0 – 8.1	Fracture zone, crushed to intensely spaced fractures, predominate fractures oriented 10° to 60°, numerous wedge–shaped rock fragments.
8.1 – 8.9	Fracture, 80°, moderately rough, slightly weathered.
9.8 – 11.0	Fracture zone, rubble, exhibits mechanical wear.
11.0 – 11.3	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, rough, fresh.
11.3 – 11.6	Fracture, 60°, moderately rough, coated with light gray clay.
11.6	Fracture, 60°, moderately rough, lightly coated with light gray clay.
11.8	Fracture, 60°, moderately rough, lightly coated with light gray clay.
11.8 – 12.0	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, lightly stained with iron oxide, lightly coated with light gray clay.
12.0 – 12.7	Fracture, 90°, moderately rough lightly coated with olive gray clay, trace of pyrite.
12.3	Fracture, 70°, moderately rough, slightly weathered, intersects 90° fracture above.
12.7 – 12.8	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, predominate fracture orientation 0° to 60°, slightly weathered.
12.8	Fracture, 60°, moderately rough, lightly stained with iron oxide.
13.1	Fracture, 60°, moderately rough, lightly stained with iron oxide.
13.1 – 13.3	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, stained with iron oxide.
13.3	Fracture, 10°, moderately rough, lightly stained with iron oxide.
13.4	Fracture, 10°, moderately rough, lightly stained with iron oxide.
13.5	Fracture, 10°, moderately rough, fresh.
13.6	Fracture, 45°, rough, fresh.
14.1	Fracture, 50°, rough, fresh.
14.2	Fracture, 50°, rough, fresh, intersects 50° fracture above.
14.7 – 15.0	Fracture zone, intensely fractured to crushed, numerous wedge–shaped rock fragments.
15.0	Fracture, 45°, moderately rough, fresh, exhibits mechanical wear.
15.3	Fracture, 50°, moderately smooth, fresh.
15.8	Mechanical break, 0°, rough, fresh.
15.8 – 15.9	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, fresh.
15.9	Fracture, 50°, moderately rough, trace of light gray clay.
16.1	Fracture, 90°, moderately rough, trace of light gray clay.
16.1 – 16.9	Fracture zone, intensely spaced intersecting fractures, numerous wedge–shaped rock fragments predominate fracture orientation 60° to 90°, slightly weathered.
17.3	Fracture, 45°, moderately rough, fresh.
17.6	Fracture, 30°, moderately rough, slightly weathered.
17.6 – 17.8	Fracture zone, intensely spaced intersecting fractures, numerous wedge–shaped rock fragments.
17.8	Fracture, 50°, moderately rough, coated with medium gray clay, moderately weathered.
18.3	Fracture, 50°, moderately rough, coated with medium gray clay, moderately weathered.
18.3 – 18.5	Fracture zone, crushed, lightly stained with iron oxide.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
18.5	Fracture, 50°, moderately rough, trace of iron oxide.
19.2	Fracture, 40°, moderately rough, coated with medium dark gray mineralization, moderately weathered.
19.2	Fracture 80°, moderately rough, coated with medium dark gray mineralization, moderately weathered, intersects 40°, fracture above.
19.2 – 19.4	Fracture, 90°, moderately rough, coated with medium light gray clay, moderately weathered, intersected by numerous wedge–shaped rock fragments.
19.7	Fracture, 45°, moderately rough, lightly coated with medium gray clay.
19.7 – 20.9	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, predominate fracture oriented 60°, traces of light gray clay.
20.9	Drill break, 0°, rough, fresh.
21.9	Fracture, 70°, rough, fresh.
21.9 – 22.0	Fracture, 90°, rough, fresh, partially intersects 70° fracture above.
22.3	Fracture, 10°, moderately rough, fresh.
22.4	Fracture, 10°, moderately rough, lightly stained with iron oxide.
22.7	Fracture 15°, rough, fresh.
22.8	Fracture, 5°, moderately rough, trace of light gray clay.
23.0	Fracture, 5°, moderately rough, coated with dark gray clay, moderately weathered.
23.0	Fracture, 20°, moderately rough, coated with dark gray clay, moderately weathered, intersects 5° fractures above and below.
23.0	Fracture, 5°, moderately rough, coated with dark gray clay, moderately weathered.
23.2	Fracture, 20°, moderately rough, slightly weathered.
23.2 – 23.4	Fracture, 90°, moderately rough, coatings of medium gray clay, slightly weathered.
23.4	Fracture, 10°, moderately rough, slightly weathered.
23.6	Fracture, 30°, moderately rough, trace of with medium gray clay.
23.7	Fracture, 30°, moderately rough, trace of with medium gray clay.
23.9	Fracture, 20°, rough, fresh.
24.0	Fracture, 10°, rough, fresh.
24.1	Fracture, 10°, rough, fresh.
24.5	Fracture, 10° rough, fresh, trace of pyrite.
24.9	Fracture, 20°, rough, fresh.
24.9 – 25.1	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, fresh.
25.5	Fracture, 70°, moderately rough, fresh.
25.7 – 25.9	Core loss 0.2 foot.
25.9 – 26.0	Drill break, 80°, stepped, fresh.
26.0	Fracture, 45°, stepped, fresh.
26.4	Fracture, 10°, moderately rough, irregular, lightly stained with iron oxide and chlorite, coated with medium gray clay, moderately weathered.
26.7	Fracture, 60°, moderately rough, irregular, lightly stained with iron oxide and chlorite, coated with medium gray clay, moderately weathered.
26.7	Fracture, 10°, stepped, fresh.
26.9	Fracture, 0° rough, irregular, fresh.
26.9	Fracture, 30°, rough, irregular, fresh, partially intersects 0° fracture above.
27.4	Mechanical break, 5°, stepped, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
27.4	Mechanical break, 10°, stepped, fresh.
27.6	Fracture, 50°, rough, irregular, fresh.
27.9	Fracture, 10°, moderately rough, fresh.
28.0	Fracture, 20°, rough, irregular, fresh.
28.1	Fracture, 20°, moderately rough, irregular, trace of medium gray clay.
28.2	Fracture, 45°, moderately rough, trace of medium gray clay and crushed rock chips.
28.3	Fracture, 10°, moderately rough, trace of medium gray clay.
28.4 – 28.5	Fracture zone, crushed, coated with medium gray clay, highly weathered.
28.7 – 29.1	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, predominate fracture orientation 50° to 90°, slightly weathered.
29.5	Fracture, 60°, moderately rough, lightly stained with manganese oxide.
29.5	Fracture, 10°, moderately rough, lightly stained with manganese oxide, partially intersects 60° fracture above.
30.0	Drill break.
30.1	Fracture, 60°, moderately rough, coated with light brownish gray clay, moderately weathered.
30.6	Fracture, 5°, rough, irregular, slightly weathered.
30.6	Fracture, 80°, rough, irregular, slightly weathered, partly intersects 5° fracture above.
30.9	Fracture, 20°, moderately rough, irregular, fresh.
31.1	Fracture, 50°, rough, fresh.
31.2 – 32.2	Fracture zone, crushed to intensely spaced fractures, numerous wedge–shaped rock fragments, traces of medium light gray clay.
32.3	Drill break.
32.2 – 32.3	Core loss 0.1 foot.
32.6 – 32.9	Vein of feldspar, 70°.
32.7	Fracture, 10°, moderately smooth, fresh.
32.7 – 32.8	Fracture, 90°, moderately smooth, fresh.
32.8	Fracture, 10°, moderately smooth, fresh.
32.9	Fracture, 40°, rough, irregular, fresh, abundant biotite.
33.0	Fracture, 50°, moderately rough, small amount of light medium gray clay, slightly weathered.
33.2 – 34.0	Fracture zone, crushed, numerous wedge–shaped rock fragments.
33.5	Fracture, 60°, moderately rough, coated with medium gray clay, moderately weathered.
33.5	Fracture, 30°, moderately rough, coated with medium gray clay, partially intersects 60° fracture above.
34.0	Fracture, 85°, moderately rough, small amount of medium gray clay, slightly weathered.
34.0 – 34.3	Fracture, 75°, moderately rough, irregular, traces of medium gray clay, slightly weathered.
34.3	Fracture, 60°, moderately rough, irregular, slightly weathered.
34.3 – 34.7	Core loss 0.4 foot.
34.7 – 35.3	Fracture zone, intensely spaced intersecting fractures, numerous wedge–shaped rock fragments, slightly weathered.
35.3	Fracture, 20°, moderately rough, coated with medium gray clay, moderately weathered.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
35.5	Fracture, 40°, stepped, fresh.
35.5	Fracture, 80°, stepped, fresh, intersects 40° fracture above.
35.7	Fracture, 20°, rough, irregular, fresh.
35.7	Fracture, 60°, rough, irregular, fresh, intersects 20° fracture above.
35.8	Fracture, 30°, rough, irregular, fresh.
35.9	Fracture, 30°, stepped, fresh.
35.9 – 36.2	Fracture, 90°, moderately rough, coated with medium light gray mineralization, moderately weathered.
36.2 – 36.5	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, moderately weathered, predominate fracture oriented 70°, stained with manganese oxide, abundant biotite.
36.5 – 36.7	Fracture, 50°, rough, fresh, abundant biotite and large feldspar phenocysts.
36.7	Fracture, 60°, stepped, fresh.
36.9	Fracture, 65°, stepped, fresh.
37.0	Fracture, 65°, stepped, fresh.
37.0 – 37.3	Fracture, 80°, moderately rough, coated with medium light gray mineralization, moderately weathered.
37.3 – 37.7	Fracture zone, crushed, stained with manganese oxide, coated with calcite.
37.7	Fracture, 50°, moderately rough, coated with light gray mineralization, moderately weathered.
37.7	Fracture, 50°, moderately rough, coated with light gray mineralization, moderately weathered, intersects 50° fracture above.
37.9 – 38.0	Fracture zone, crushed, fresh, abundant biotite.
38.0	Fracture, 10°, rough, irregular, coated with medium light gray mineralization, moderately weathered.
38.1	Fracture, 10°, rough, irregular, fresh, abundant biotite.
38.2	Fracture, 10°, stepped, fresh.
38.3	Fracture, 15°, moderately rough, fresh.
38.4	Fracture, 15°, moderately rough, small amount of medium dark gray clay, slightly weathered.
38.4 – 38.7	Fracture zone, intensely spaced intersecting fractures, numerous wedge–shaped rock fragments, fractures oriented 80° to 90° and 10°, traces of chlorite, abundant biotite.
38.7	Fracture, 20°, moderately rough, irregular, small amount of medium gray clay, slightly weathered.
38.9 – 39.8	Core loss 0.9 foot.
39.8 – 40.2	Fracture zone, crushed rubble, slightly weathered, some medium dark gray mineralization, exhibits mechanical wear.
40.2	Fracture, 45°, medium gray clay seam 6 mm thick, highly weathered.
40.2 – 40.8	Healed fracture, 80°, sealed with silica, very irregular, <1 mm thick.
40.5	Fracture, 20°, moderately rough, fresh, intersects 80° fracture above.
40.8	Fracture, 40°, moderately rough, fresh.
41.0	Fracture, 75°, moderately rough, trace medium light gray clay, slightly weathered, intersects 40° fracture above.
41.3 – 41.7	Fracture, 70°, rough, irregular, coated with very fine sand, silt, and some clay, moderately weathered, trace pyrite.
41.4	Fracture, 30°, moderately rough, fresh, intersects 70° fracture above.
41.8	Fracture, 45°, moderately rough, irregular, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
42.1	Fracture, 60°, moderately rough, small amount medium gray clay, slightly weathered.
42.1 – 42.3	Core loss 0.2 foot.
42.3	Drill break.
42.6	Fracture, 45°, moderately rough, fresh.
42.6	Fracture, 60°, moderately rough, fresh, intersects 45° fractures above.
42.6 – 43.1	Fracture zone, crushed fresh.
43.1	Fracture, 60°, moderately rough, irregular, small amount of medium gray mineralization, slightly weathered.
43.1	Fracture, 20°, moderately rough, irregular, small amount of medium gray mineralization, slightly weathered intersects 60° fracture above.
43.1 – 43.6	Fracture, 90°, rough, irregular, coated with medium gray clay and crushed rock fragments, moderately weathered.
43.6	Fracture, 60°, moderately rough, coated with medium gray clay, <1 mm thick., moderately weathered.
43.8 – 43.9	Fracture zone, crushed, intersecting 45° fractures.
43.9	Fracture, 45°, rough, fresh.
44.3	Fracture, 40°, rough, irregular, fresh.
44.6	Fracture, 60°, moderately rough, small amount of medium gray mineralization, slightly weathered.
44.6	Fracture, 15°, moderately rough, small amount of medium gray mineralization, slightly weathered, intersects 60° fracture above.
44.6 – 45.4	Fracture, 90°, moderately rough, moderate amount light gray clay and mineralization, moderately weathered.
44.8	Fracture, 25°, moderately rough, moderate amount light gray clay and mineralization, moderately weathered, intersects 90° fracture above.
45.0	Fracture, 25°, moderately rough, moderate amount light gray clay and mineralization, moderately weathered, intersects 90° fracture above.
45.1	Fracture, 25°, moderately rough, moderate amount light gray clay and mineralization, moderately weathered, intersects 90° fracture above.
45.4 – 46.3	Core loss 0.9 foot.
46.3	Drill break.
46.5	Fracture, 20°, rough, irregular, trace of medium gray mineralization.
46.3 – 46.5	Fracture, 40°, moderately rough, moderate amount of medium gray mineralization and biotite, moderately weathered.
46.6	Fracture, 20°, rough, irregular, moderate amount of medium gray mineralization, moderately weathered.
46.8	Fracture, 10°, stepped, fresh.
46.8 – 46.9	Fracture zone, rubble, exhibits mechanical wear.
46.9	Fracture, 20°, moderately rough, fresh.
47.0	Fracture, 30°, moderately rough, irregular, fresh.
46.9 – 47.0	Fracture, 80°, occurs along side of core, rough, irregular, fresh.
47.3	Fracture, 20°, rough, fresh.
47.3 – 47.5	Fracture, 60°, numerous wedge–shape rock fragments, rough, fresh.
47.6	Fracture, 30°, moderately rough, trace medium gray mineralization.
47.8	Fracture, 25°, moderately rough, irregular, fresh.
47.8 – 48.2	Fracture zone, crushed, moderate amounts of medium light gray clay and mineralization.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
48.2	Fracture, 50°, moderately rough, trace of pyrite.
48.4	Fracture, 30°, moderately rough, fresh.
48.6	Fracture, 5°, rough, irregular, fresh.
48.6 – 48.7	Fracture zone, crushed, fresh.
48.7 – 49.0	Fracture, 65°, moderately rough, moderate amount of medium gray mineralization.
49.0	Fracture, 30°, rough, irregular, trace light gray clay.
49.2 – 49.3	Fracture zone, parallel 20° fractures intersected by 65° fracture, moderately rough, abundant medium light gray mineralization, highly weathered.
49.5	Fracture, 30°, moderately rough, fresh.
49.5 – 49.9	Fracture, 70°, rough, irregular, fresh.
49.9 – 51.3	Core loss 0.4 foot.
51.3 – 51.8	Healed fracture, 70°, sealed with silica, irregular, <1 mm thick.
51.8	Fracture, 30°, moderately rough, fresh.
51.8 – 52.1	Fracture, 60°, stepped, slightly weathered.
51.8 – 52.1	Fracture, 90°, stepped, fresh, intersects 60° fracture above.
52.7	Fracture, 50°, stepped, moderate amount of very light gray mineralization.
52.7 – 53.0	Fracture, 85°, stepped, moderate amount of very light gray mineralization, intersects 50° fracture above.
53.1	Fracture, 65°, rough, irregular, fresh.
53.1 – 53.2	Vein of feldspar, 65°, rough, irregular, numerous healed hairline fractures.
53.4	Fracture, 55°, rough, irregular, fresh.
53.6	Fracture, 0°, rough, irregular, fresh.
53.7	Fracture, 20°, rough, irregular, fresh.
54.5	Fracture, 30°, rough, irregular, fresh.
54.5 – 54.9	Fracture, 80°, moderately rough, moderate amount of white clay.
54.9 – 55.1	Fracture zone, crushed.
55.1 – 55.7	Fracture zone, intensely spaced intersecting fractures, numerous wedge–shaped rock fragments, intersecting fractures oriented 80° to 90° and 30° to 40°.
55.7 – 56.0	Fracture, 60°, rough, fresh, trace pyrite.
56.0 – 56.3	Core loss 0.3 foot.
56.3	Drill break 60°, rough, irregular, fresh.
56.6	Fracture, 60°, rough, irregular, fresh.
56.3 – 56.6	Vein of feldspar, 20°, numerous healed hairline fractures oriented 20° to 70°.
56.9	Fracture, 10°, rough, irregular, fresh.
56.7	Fracture, 20°, rough, irregular, fresh.
57.3	Fracture, 20°, moderately rough, irregular, fresh.
57.4	Fracture, 15°, rough, small amount of medium light gray mineralization.
57.4 – 57.6	Fracture zone, crushed.
57.6	Fracture, 10°, rough, fresh.
57.6 – 57.7	Fracture, 90°, rough, fresh.
57.7	Fracture, 10°, rough, fresh.
57.7 – 58.1	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments oriented 0° to 5°, rough, irregular, fresh.
58.1 – 58.3	Core loss 0.2 foot.
58.3 – 58.5	Fracture, 75°, intensely spaced fractures, moderately rough, irregular, small amount of greenish gray clay.
58.5 – 58.8	Fracture zone, rubble, exhibits mechanical wear, small amount of greenish gray

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
	mineralization on surfaces.
58.8	Fracture, 10°, moderately rough, small amount of greenish gray mineralization.
58.9 – 59.1	Fracture, 70°, occurs along side of core, moderately rough, moderate amount of greenish gray mineralization.
59.1	Fracture, 5°, stepped, fresh, trace of pyrite.
59.1 – 59.3	Fracture, 75°, moderately rough, small amount of medium dark gray and greenish gray mineralization.
59.3	Fracture, 45°, moderately rough, fresh, trace of pyrite.
59.3	Fracture, 30°, stepped, fresh, trace of pyrite, intersects 45° fracture above.
59.3 – 59.7	Fracture, 60°, moderately rough, irregular, small amount of dark greenish gray mineralization, numerous wedge–shaped rock fragments.
59.7 – 59.9	Fracture zone, crushed, fresh.
59.9	Fracture, 20°, rough, moderate amount of greenish gray mineralization.
60.1	Fracture, 30°, rough, irregular, fresh.
60.1 – 60.5	Fracture zone, crushed to intensely spaced intersecting fractures.
61.0	Fracture, 30°, stepped, fresh.
61.3	Fracture, 50°, moderately rough, moderate amount of medium dark gray mineralization.
61.6	Fracture, 10°, rough, moderate amount of greenish gray mineralization.
61.7	Fracture, 20°, rough, irregular, moderate amount of greenish gray mineralization.
61.9 – 62.3	Core loss 0.4 foot.
62.3 – 62.4	Fracture zone, rubble, exhibits mechanical wear.
62.4	Fracture, 50°, moderately rough, irregular, moderate amount of light brownish gray mineralization.
62.4 – 62.6	Fracture zone, crushed.
62.6	Fracture, 70°, rough, irregular, fresh.
62.6	Fracture, 60°, rough, irregular, fresh, intersects 70° fracture above.
62.8	Fracture, 20°, rough, irregular, fresh.
63.0 – 63.2	Vein of feldspar, 20°.
63.0	Fracture, 50°, rough, irregular, fresh.
63.2	Fracture, 20°, stepped, fresh.
63.3	Fracture, 40°, moderately rough, irregular, fresh.
63.3 – 63.6	Healed fracture, 60°, sealed with silica.
63.7	Fracture, 65°, coated with medium dark gray clay, 1–3 mm thick, highly weathered.
63.9	Fracture, 60°, stepped, slightly altered, small amount of muscovite.
64.2	Fracture, 25°, stepped, fresh, abundant biotite.
64.3	Fracture, 25°, stepped, fresh, abundant biotite.
64.5	Fracture, 70°, moderately rough, coated with moderate amount of medium dark gray mineralization and crushed rock chips.
64.5 – 64.8	Fracture zone, crushed.
64.9	Fracture, 20°, moderately smooth, moderate amount of brownish gray mineralization, stained with chlorite, slightly altered.
64.9 – 67.3	Core loss 2.4 feet.
67.3 – 67.5	Fracture zone, rubble, exhibits mechanical wear.
67.5	Fracture, 45°, rough, slightly altered, trace of chlorite.
67.7	Fracture, 40°, stepped, slightly altered, small amount of muscovite.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
67.8 – 67.9	Fracture zone, rubble, exhibits mechanical wear.
67.9	Fracture, 45°, moderately rough, irregular, stained with chlorite, slightly altered, muscovite.
67.9	Fracture, 45°, moderately rough, irregular, stained with chlorite, slightly altered, muscovite, intersects 45° fracture above.
68.3	Fracture, 0°, moderately rough, moderate amount of greenish gray mineralization.
68.5	Fracture, 45°, rough, irregular, fresh.
68.5	Fracture, 70°, rough, irregular, fresh, intersects 45° fracture above.
68.5 – 68.7	Fracture zone, crushed.
68.7 – 68.9	Fracture, 80°, moderately rough, irregular, moderate amount of greenish gray mineralization.
68.9 – 69.4	Fracture zone, crushed.
69.2 – 69.4	Fracture, 90°, stepped, moderate amount of medium light gray mineralization.
69.4 – 70.1	Fracture, 90°, stepped, moderate amount of medium light gray mineralization, halves crushed, numerous rock fragments.
70.1 – 72.3	Core loss 1.2 feet.
72.6	Drill break, 0°, stepped, fresh.
72.6 – 72.9	Fracture, 80°, rough, slightly weathered, slickensides, intersected by intensely spaced fractures.
73.1	Fracture, 30°, moderately rough, coated with medium light gray clay, 1–3 mm thick, highly weathered.
73.1 – 73.2	Healed fracture, 55°, sealed with silica.
73.2	Fracture, 25°, rough, fresh.
73.2 – 73.4	Vein of feldspar, 25°.
73.3	Fracture, 25°, rough, irregular, fresh.
73.3 – 73.6	Fracture zone, rubble, exhibits mechanical wear.
73.6	Fracture, 45°, moderately rough, coated with medium light gray clay, 1–3 mm thick, highly weathered.
73.8	Fracture, 15°, rough, irregular, moderate amount of greenish gray mineralization.
74.1	Incipient fracture, 65°, hairline crack.
74.3 – 74.5	Fracture zone, crushed, moderate amount of greenish gray mineralization and biotite on surfaces.
74.9	Fracture, 70°, moderately rough, abundant greenish gray mineralization, numerous wedge–shaped rock fragments.
75.0	Fracture, 5°, stepped, fresh, intersects 70° fracture above.
75.3	Fracture, 0°, moderately rough, slightly weathered, highly weathered.
75.3	Fracture, 45°, moderately rough, abundant greenish gray mineralization, highly weathered.
75.3 – 75.9	Fracture, 90°, rough, irregular, small amount of medium gray mineralization.
75.5	Fracture, 15°, moderately rough, small amount of medium gray mineralization, intersects 90° fracture above.
75.7	Fracture, 15°, moderately rough, small amount of medium gray mineralization, intersects 90° fracture above.
75.8	Fracture, 15°, moderately rough, small amount of medium gray mineralization, intersects 90° fracture above.
75.9 – 77.3	Core loss 1.4 feet, intersects 90° fracture above.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
77.3 – 77.8	Fracture zone, rubble, exhibits mechanical wear.
77.8	Fracture, 50°, moderately rough, moderate amount of medium light gray mineralization.
77.9 – 78.2	Fracture zone, crushed.
78.2 – 78.5	Fracture, 75°, rough, irregular, abundant dark greenish gray mineralization, highly weathered.
78.6 – 78.7	Fracture, 60°, rough, irregular, fresh.
78.8 – 78.9	Fracture, 30°, rough, coated with crushed rock and greenish gray mineralization, highly weathered.
79.1	Fracture, 20°, stepped, moderate amount of greenish gray mineralization.
79.1 – 79.2	Fracture 55°, moderately smooth, medium soft greenish gray mineralization, 1–3mm thick, highly weathered.
79.5 – 79.6	Healed fracture, 30°, sealed with silica.
79.5 – 79.6	Healed fractures, 30°, sealed with silica, parallel with 30° fracture above.
79.8 – 80.0	Fracture zone, crushed.
80.3	Fracture, 30°, moderately rough, irregular, moderate amount of medium light gray mineralization.
80.4	Fracture, 5°, moderately rough, irregular, moderate amount of medium light gray mineralization.
80.6 – 80.7	Fracture, 30°, moderate rough, moderate amount of greenish gray mineralization.
80.9 – 81.0	Fracture, 30°, rough, coated with crushed rock chips, moderately weathered.
81.1	Fracture, 45°, moderately rough, irregular, fresh.
81.2	Fracture, 15°, moderately rough, irregular, fresh.
81.5	Fracture, 20°, rough, irregular, fresh, abundant biotite.
81.8	Fracture, 30°, rough, moderate amount of greenish gray mineralization, exhibits mechanical wear.
81.8 – 82.3	Core loss 0.5 foot.
82.3	Drill break, 45°, moderately rough, fresh.
82.6	Fracture, 5°, rough, irregular, slightly altered, traces of biotite and muscovite.
82.9	Fracture, 40°, rough, irregular, fresh, crushed rock chips.
82.9 – 83.4	Fracture zone, crushed.
83.4	Fracture, 60°, rough, irregular, moderate amount of medium light gray mineralization.
83.5	Fracture, 55°, moderately rough, coated with medium light gray clay, 1 mm thick, highly weathered.
83.7 – 83.8	Fracture zone, crushed.
83.8	Fracture, 20°, rough, irregular, slightly altered, small amount of biotite and muscovite.
84.1 – 84.2	Fracture zone, intensely spaced fractures, 10° to 20°, fresh.
84.3	Fracture, 15°, rough, fresh.
84.5 – 84.6	Fracture zone, crushed and intensely fractures, numerous wedge–shaped rock fragments, fractures oriented 20° and 60°.
84.6 – 85.6	Fracture, 80°, moderately smooth, coated with greenish gray clay, 1–3mm thick, highly weathered.
84.8	Fracture, 30°, rough, slightly weathered, intersects 80° fractures above.
84.9	Fracture, 55°, rough, slightly weathered, intersects 80° fracture above.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG
Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
85.4 – 85.6	Fracture zone, intensely spaced fractures, exhibits mechanical wear.
85.6 – 87.3	Core loss 0.7 foot.
87.3	Drill break.
87.5	Fracture, 45°, moderately rough, irregular, moderate amount of greenish gray mineralization, slickensides.
87.6 – 88.3	Fracture zone, crushed, moderate amounts of medium soft greenish gray mineralization on surfaces.
88.6 – 88.7	Fracture, 30°, rough, irregular, fresh.
88.6 – 88.7	Fracture, 10°, rough, irregular, fresh, partially intersects 30° fracture above.
88.7 – 89.2	Fracture zone, intensely spaced fractures, oriented 0° and 90°, moderate amounts of medium soft greenish gray mineralization.
89.2	Fracture, 40°, rough, slightly weathered.
89.3 – 91.5	Fracture zone, crushed and intensely spaced fractures oriented 10° to 40°, moderately altered, coated with chlorite, slickensides, traces of muscovite.
90.1 – 90.9	Fractures, 70°, 3–subparallel fractures, rough, irregular, moderately weathered, occurs within fracture zone.
91.1 – 91.5	Fracture, 70°, rough, irregular, moderate amount of greenish gray mineralization, occurs within fracture zone.
91.5 – 92.3	Core loss 0.8 foot.
92.3 – 92.8	Fracture, 75°, rough, moderate amount of greenish gray mineralization.
93.3	Fracture, 45°, moderately rough, moderate amount of greenish gray mineralization.
93.3 – 93.7	Fracture zone, intensely spaced fractures oriented 20° to 45°, rough, small amount of greenish gray mineralization.
93.7	Fracture, 30°, moderately rough, moderately altered, coated with chlorite, slickensides.
94.2	Fracture, 10°, rough, irregular, moderately altered, coated with chlorite.
94.4	Fracture, 30°, rough, slightly altered.
94.4 – 94.7	Fractured zone, intensely spaced fractures oriented 50° to 60°.
94.7 – 94.8	Fracture, 45°, moderately rough, coated with dark greenish gray clay, 1–3 mm thick, highly weathered.
95.1	Fracture, 40°, moderate rough, irregular, slightly weathered.
95.5	Fracture, 20°, rough, moderately altered, moderate amount of muscovite and sericite.
95.7	Fracture, 25°, moderately rough, irregular, slightly altered, stained with chlorite.
96.0 – 96.4	Fracture, 70°, moderately rough, irregular, slightly altered, stained with chlorite.
96.7	Fracture, 25°, rough, fresh, slightly altered.
97.3	Fracture, 45°, rough, irregular, fresh.
97.6	Fracture, 65°, moderately rough, irregular, moderately altered, coated with chlorite.
98.0	Fracture, 65°, moderately rough, moderately altered, coated with chlorite.
98.3	Fracture, 45°, moderately rough, irregular, slightly altered, stained with chlorite.
99.0	Fracture, 25°, rough, irregular, slightly altered, stained with chlorite.
99.0 – 99.4	Fracture, 70°, moderately rough, highly altered, coated with chlorite, intersects

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

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Depth (ft)	Description of Geologic Feature*
	25° fracture above.
99.4 – 99.5	Fracture, 35°, moderately rough, moderately altered, coatedwith chlorite and sericite, intersects 70° fracture above.
100.1	Fracture, 5°, rough, highly altered, coated with medium soft chlorite.
100.1 – 100.6	Fracture zone, intensely spaced fractures oriented 0° to 30°, moderate amount of medium dark gray mineralization, slightly altered.
101.2	Fracture, 25°, rough, irregular, slightly altered.
101.2 – 101.4	Fracture zone, crushed to intensely spaced fractures, slightly altered, small amount of sericite.
101.3	Fracture, 30°, rough, fresh, intersects fracture zone above.
101.7	Fracture, 40°, rough, irregular, fresh.
101.9	Fracture, 40°, rough, irregular, fresh.
102.1 – 102.3	Core loss 0.2 foot.
102.3	Fracture, 40°, moderately rough, moderately altered and weathered, coated with chlorite and dark greenish gray clay.
102.5	Fracture, 20°, moderately rough, traces of sericite.
102.5	Fracture, 65°, moderately rough, traces of sericite, intersects 20° fracture above.
102.5 – 102.9	Fracture zone, rubble, exhibits mechanical wear.
103.1	Fracture, 45°, rough, moderately altered, coated with chlorite.
103.6	Fracture, 60°, moderately rough, moderately altered, coated with chlorite.
103.6	Fracture, 10°, stepped, moderately altered, coated with chlorite, intersects 60° fracture above.
103.6 – 104.0	Fracture zone, rubble, exhibits mechanical wear.
104.0	Fracture, 0°, moderately rough, irregular, moderately altered.
104.3	Fracture, 15°, moderately rough, moderately altered.
104.3 – 104.4	Fracture zone, numerous intensely spaced intersecting fractures, 10° to 50°, moderately altered.
104.6	Fracture, 65°, rough, irregular, highly altered.
104.6	Fracture, 0°, stepped, slightly altered, intersects 65° fracture above.
104.8	Fracture, 45°, rough, moderately altered.
104.8 – 105.3	Fracture zone, crushed.
105.3	Fracture, 10°, rough, irregular, moderately altered, moderate amount of dark gray mineralization.
105.5	Fracture, 55°, moderately rough, irregular, moderately altered, abundant muscovite and sericite, moderate amount of dark gray mineralization.
105.6 – 105.8	Fracture, 60°, rough, moderately altered, coated with crushed rock chips.
105.8	Fracture, 25°, rough, slightly altered.
106.0 – 107.3	Core loss 1.3 feet.
107.3 – 107.8	Fracture zone, numerous intensely spaced intersecting fractures, slightly altered.
107.8 – 108.0	Fracture, 90°, rough, irregular, slightly altered.
107.9	Fracture, 10°, rough, irregular, slightly altered, intersects 90° fracture above.
108.0 – 108.2	Fracture zone, numerous subparallel fractures oriented 50° to 60°, intersected by wedge–shaped fragments.
108.3	Fracture, 50°, rough, irregular, adjacent to 6 mm thick seam of biotite, slightly altered, muscovite and sericite present.
108.4 – 108.6	Fracture zone, numerous intensely spaced intersecting fractures oriented 30° to 70°, slightly altered.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
108.7	Fracture, 30°, moderately rough, irregular fresh.
108.9	Fracture, 35°, rough, slightly altered, trace sericite.
108.9 – 109.2	Fracture zone, numerous intensely spaced intersecting fractures oriented 50° to 70°, moderate amount of greenish gray mineralization.
109.2 – 109.4	Fracture, 85°, moderately rough, severely altered, coated with chlorite, slickensides.
109.8	Fracture, 20°, rough, irregular, slightly altered.
110.4	Fracture, 60°, rough, irregular, moderately altered small amount of medium light gray mineralization.
110.5 – 111.0	Fracture, 75°, rough, slightly weathered.
110.6	Fracture, 45°, stepped, fresh, intersects 75° fracture above, adjacent to vein of feldspar.
111.4	Incipient fracture, 45°, hairline cracks.
111.5	Incipient fracture, 45°, hairline cracks, intersects 45° fracture above.
111.6 – 111.8	Fracture, 80°, moderately rough, irregular, moderately altered.
111.8 – 112.3	Core loss 0.5 foot.
112.3	Fracture, 0°, moderately rough, slightly altered, slightly weathered.
112.6	Fracture, 10°, rough, slightly altered, stained with chlorite.
112.6	Fracture, 15°, rough, irregular, slightly altered, intersects 10° fracture above.
112.6 – 112.8	Fracture zone, numerous intensely spaced intersecting fractures, slightly altered, stained with chlorite.
112.8	Fracture, 45°, moderately rough, slightly altered, slickensides.
112.8	Fracture, 20°, rough, irregular, slightly altered.
112.8 – 113.0	Fracture zone, crushed.
113.0	Fracture, 20°, moderately rough, irregular, small amount of greenish gray mineralization, moderately altered.
113.0	Fracture, 70°, moderately rough, irregular, slightly weathered, moderately altered, intersects 20° fracture above.
113.4	Fracture, 5°, moderately rough, slightly altered, small amount greenish gray mineralization.
113.5	Fracture, 10°, rough, slightly altered, trace sericite.
113.6	Fracture, 20°, rough, irregular, moderately altered, coated with chlorite.
113.6	Fracture, 20°, rough, irregular, moderately altered, coated with chlorite, intersects 20° fracture above.
113.7	Fracture, 20°, rough, irregular, slightly altered, stained with chlorite.
113.7 – 113.9	Fracture zone, crushed.
113.9	Fracture, 10°, stepped, fresh, abundant biotite.
114 – 114.3	Fracture, 70°, rough, irregular, moderately altered, muscovite.
114.1	Fracture, 30°, rough, fresh, abundant biotite, intersects 70° fracture above.
114.3	Mechanical break, 0°.
114.4	Fracture, 20°, rough, slightly altered, abundant biotite, stained with chlorite.
114.6	Fracture, 10°, rough, small amount of greenish gray mineralization.
115.0	Fracture, 20°, rough, irregular, small amount of greenish gray mineralization, moderately altered.
115.0 – 115.5	Fracture, 80°, rough, severely altered, coated with chlorite.
115.1	Fracture, 45°, rough, slightly weathered, intersects 80° fracture above.
115.3	Fracture, 45°, rough, slightly weathered, intersects 80° fracture above.
115.3	Fracture, 30°, rough, slightly weathered, intersects 80° fracture above.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
115.5 – 116.0	Fracture zone, numerous intensely spaced intersecting fractures, moderately altered.
116.0	Drill break, 0°, rough, fresh.
116.3	Drill break, 0°, rough, fresh.
116.3 – 117.3	Core loss 1.0 foot.
117.3 – 117.5	Fracture, 80°, moderate rough, irregular, small amount of greenish gray mineralization, slightly weathered.
117.5 – 117.6	Vein of feldspar, 0°.
117.6	Fracture, 40°, stepped, slightly altered.
118.0	Fracture, 45°, moderately rough, irregular, slightly altered, coated with chlorite.
118.0 – 118.2	Fracture, 75°, rough, slightly altered, intersects 45° fracture above.
118.2	Fracture, 15°, moderately rough, irregular, slightly altered.
118.4 – 118.6	Fracture, 70°, stepped, slightly altered, trace of sericite.
118.7	Fracture, 40°, rough, moderately altered, coated with chlorite.
118.7	Fracture, 20°, rough, irregular, moderately altered.
118.8 – 118.9	Fracture, 70°, rough, irregular, moderately altered, coated with chlorite, partly intersects 20° fracture below.
118.9	Fracture, 20°, rough, slightly altered.
119.1	Fracture, 0°, rough, slightly altered, trace of sericite.
119.4	Fracture, 20°, rough, slightly altered, trace of sericite.
119.5 – 119.7	Fracture, 60°, rough, severely altered, coated with chlorite and sericite.
119.6 – 120.0	Fracture, 70°, rough, irregular, slightly altered, intersects 70° fracture above.
119.9 – 120.0	Fracture, 45°, rough, slightly altered, intersects 70° fracture above.
119.9 – 120.0	Fracture, 50°, rough, moderately altered, located with chlorite.
120.2 – 120.4	Fracture, 55°, smooth, moderately weathered, coated with dark greenish gray clay and crushed rock.
120.5	Fracture, 25°, rough, moderately weathered, coated with dark greenish gray clay and crushed rock.
120.5 – 120.9	Fracture zone, crushed.
121.2– 121.3	Fracture, 60°, moderately smooth, moderately weathered, coated with dark greenish gray clay and crushed rock.
121.4	Fracture, 60°, moderately rough, moderately weathered, coated with clay.
121.5 – 122.3	Core loss 0.8 foot.
122.3 – 122.6	Fracture, 60°, moderately smooth, moderately altered, coated with chlorite, slickensides.
122.6	Fracture, 10°, rough, irregular, slightly altered.
123.2	Fracture, 50°, moderately rough, irregular, coated with chlorite, slickensides.
123.4	Fracture, 45°, rough, crushed rock contact, fresh.
123.4 – 123.6	Healed fracture, 70°, rough, partially sealed with biotite.
123.7	Fracture, 45°, rough, moderately altered.
123.8 – 124.0	Fracture, 20°, rough, irregular, fresh.
124.2	Fracture, 50°, moderately rough, slightly weathered slickensides, intersects 20° fracture above.
124.2 – 124.8	Fracture zone, numerous crushed and intensely spaced intersecting fractures, severely altered, coated with chlorite and sericite.
124.7 – 125.0	Fracture, 70°, moderately rough, moderately altered, coated with chlorite, some slickensides.
124.7 – 125.0	Fracture, 70°, moderately rough, moderately altered, coated with chlorite, some

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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Depth (ft)	Description of Geologic Feature*
	slickensides.
125.0	Fracture, 20°, rough, crushed contact, fresh.
125.0 – 125.2	Fracture, 70°, moderately rough, moderately altered, coated with chlorite and crushed rock, intersects 70° fracture above.
125.1 – 125.3	Fracture, 55°, rough, irregular, slightly altered, intersects 70° fracture above.
125.3	Fracture, 40°, rough, irregular, fresh.
125.6	Fracture, 40°, rough, irregular, fresh.
125.6 – 125.8	Fracture, 60°, rough, moderately altered, intersects 40° fracture above.
125.9 – 126.2	Fracture zone, crushed.
126.2 – 126.8	Core loss 0.5 foot.
126.8	Drill break.
127.3	Fracture, 30°, moderately rough, irregular, fresh.
127.3	Fracture, 45°, moderately rough, irregular, fresh.
127.3 – 128.0	Fracture, 85°, moderately rough, irregular, coated with dark greenish gray clay and chlorite, slickensides.
128.0 – 128.2	Fracture zone, rubble, exhibits mechanical wear.
128.2	Fracture, 70°, rough, severely altered, coated with chlorite and sericite.
128.3 – 128.4	Fracture zone, crushed.
128.4 – 128.6	Fracture zone, numerous intensely spaced intersecting fractures, moderately altered with sericite.
128.6	Fracture, 45°, rough, irregular, moderately altered, coated with chlorite and biotite, trace of sericite.
129.3	Fracture, 45°, rough, irregular, moderately altered, coated with chlorite and biotite, trace of sericite.
129.4	Fracture, 30°, rough, fresh.
129.5 – 129.9	Fracture, 70°, rough, moderately altered, abundant sericite.
129.7	Fracture, 30°, rough, moderately altered, abundant sericite, intersects 70° fracture above.
129.8	Fracture, 10°, rough, moderately altered, abundant sericite, intersects 70° fracture above.
129.8 – 129.9	Fracture, 45°, rough, moderately altered, abundant sericite, intersects 70° fracture above.
130.1	Fracture, 0°, rough, irregular, slightly altered, trace of sericite.
130.5	Fracture, 10°, rough, irregular, slightly altered, trace of sericite.
130.5 – 131.1	Fracture zone, numerous intensely spaced intersecting fractures.
131.1 – 131.2	Core loss 0.1 foot.
131.2 – 131.8	Fracture zone, numerous intensely spaced intersecting fractures, moderately altered, coated with chlorite, slickensides.
131.8 – 131.9	Fracture, 80°, moderately rough, occurs along side of core, coated with chlorite, slickensides.
132.3	Fracture, 10°, rough, irregular, slightly altered, stained with chlorite and sericite.
132.6	Fracture, 30°, rough, moderately altered, stained with chlorite.
132.8	Fracture, 60°, rough, irregular, moderately altered, stained with chlorite.
133 – 133.2	Fracture zone, crushed, stained with chlorite.
133.4 – 133.8	Fracture, 70°, rough, slightly weathered, coated with chlorite.
133.5	Fracture, 5°, rough, irregular, slightly altered, trace of sericite, intersects 70° fracture above.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
133.7	Fracture, 60°, moderately rough, irregular, severely altered, coated with chlorite, slickensides.
133.8 – 133.9	Fracture, 60°, rough, stained with chlorite.
133.8	Fracture, 30°, rough, stained with chlorite.
133.8 – 134.3	Fracture, 85°, rough, stained with chlorite, intersects 30° fracture above.
133.8	Fracture, 25°, rough, slightly weathered, intersects 85° and 60° fractures above.
134.0	Fracture, 25°, rough, stained with chlorite, intersects 85° fracture above.
134.1	Fracture, 20°, rough, fresh, intersects 85° fracture above.
134.3 – 134.7	Fracture zone, rubble, exhibits mechanical wear.
134.7 – 136.3	Core loss 1.6 feet.
136.3 – 136.6	Fracture, 70°, moderately smooth, coated with clay, 3 mm thick, slickensides.
136.6	Fracture, 5°, rough, irregular, fresh.
136.8	Fracture, 30°, rough, irregular, fresh.
136.9	Fracture, 40°, rough, irregular, fresh, abundant biotite.
136.9 – 137.2	Fracture zone, numerous crushed and intensely spaced intersecting fractures, slightly altered.
137.5	Incipient fracture, 75°, hairline crack.
137.5 – 137.7	Fracture, 75°, moderately rough, fresh, occurs along core side.
137.7 – 137.8	Fracture, 45°, rough, severely altered, slickensides.
137.8 – 138.4	Fracture, 65°, rough, slightly weathered with crushed rock on surfaces, numerous wedge–shaped rock fragments.
138.4 – 138.8	Fracture zone, crushed, vein of feldspar.
138.8 – 139.0	Fracture, 65°, rough, moderately altered.
139.0 – 139.4	Fracture zone, crushed, vein of feldspar, fresh.
139.7	Fracture, 10°, rubble, exhibits mechanical wear, slightly weathered.
139.7 – 139.8	Fracture zone, crushed.
139.8 – 141.0	Core loss 0.2 foot.
141.0	Fracture, 0°, fresh, numerous rock chips, exhibits mechanical wear.
141.1	Fracture, 20°, rough, irregular, fresh exhibits mechanical wear.
141.2	Fracture, 25°, rough, irregular, fresh.
141.3	Fracture, 10°, rough, fresh.
141.4	Fracture, 20°, rough, fresh.
141.4	Fracture, 5°, rough, fresh.
141.6	Fracture, 10°, rough, fresh.
141.7 – 141.8	Fracture zone, numerous intensely spaced intersecting fractures, rough, fresh.
141.7 – 142.0	Fracture, 75°, moderately rough, moderately weathered, coated with calcite, extends through fracture zone.
142.0	Fracture, 40°, rough, irregular, fresh.
142.2	Fracture, 25°, rough, slightly altered, trace of sericite.
142.2	Fracture, 45°, rough, irregular, fresh, partially intersects 25° fracture above.
142.8	Fracture, 40°, rough, slightly altered, moderate amount of medium light gray mineralization.
143.2	Fracture, 50°, rough, irregular, slightly altered, trace of sericite.
143.1 – 143.2	Fracture, 70°, rough, irregular, slightly altered, trace of sericite, intersects 50° fracture above.
143.4	Fracture, 40°, rough, fresh.
143.5	Fracture, 30°, rough, irregular, fresh.
143.5 – 144.0	Fracture zone, numerous crushed and intensely spaced intersecting fractures,

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
	rough, moderately weathered.
144.0 – 145.5	Core loss 0.5 foot.
145.5	Drill break.
145.5 – 145.7	Fracture, 90°, rough, moderately weathered, moderately altered.
145.7 – 145.8	Fracture zone, intensely spaced intersecting fractures, rough, moderately weathered, moderately altered.
145.8 – 146.0	Fractures, 90°, two parallel fractures along opposite core sides, rough, moderately weathered.
146.0	Fracture, 40°, rough, irregular, slightly altered.
146.0 – 146.2	Fracture zone, intensely spaced intersecting fractures, rough, irregular, moderately altered.
146.2	Fracture, 30°, rough, irregular, fresh, exhibits mechanical wear.
146.2 – 146.6	Fracture, 90°, moderately rough, slightly weathered, moderately altered, sericite.
146.3 – 146.6	Fracture, 60°, moderately rough, moderately weathered.
146.4 – 146.7	Fracture, 60°, moderately rough, moderately weathered.
146.5 – 146.8	Fracture, 75°, moderately rough, moderately weathered, intersects 60° fractures above.
146.8 – 147.0	Fracture zone, crushed, moderately weathered.
147.0	Fracture, 60°, moderately rough, slightly weathered.
147.0 – 147.5	Fracture zone, numerous intensely spaced intersecting fractures and wedge–shaped rock fragments, rough, moderately weathered.
147.5	Fracture, 45°, rough, fresh, crushed rock.
147.7	Fracture, 20°, stepped, fresh, crushed rock.
147.7	Fracture, 40°, rough, slightly weathered, small amount of medium light gray mineralization, intersects 20° fracture above.
147.8	Fracture, 30°, rough, slightly weathered.
147.8 – 148.1	Fracture zone, rubble, exhibits mechanical wear.
148.1	Fracture, rough, irregular, slightly weathered.
148.2 – 149.5	Core loss 1.3 feet.
149.5 – 150.3	Fracture zone, rubble, exhibits mechanical wear.
150.4	Fracture, 30°, rough, fresh.
150.4	Fracture, 30°, rough, fresh.
150.5	Fracture, 25°, rough, fresh.
150.6	Fracture, 25°, rough, fresh.
150.7	Fracture, 45°, rough, fresh.
150.7 – 150.8	Fracture, 80°, rough, irregular, fresh, occurs along side of core.
150.8	Fracture, 40°, rough, irregular, fresh.
151.0	Fracture, 30°, rough, fresh.
151.2 – 152.3	Core loss 0.1 foot.
152.3	Drill break.
152.4	Fracture, 10°, rough, irregular, slightly weathered.
152.5	Fracture, 20°, rough, irregular, slightly weathered.
152.5 – 152.7	Fracture, 60°, rough, slightly weathered, small amount of brownish gray mineralization.
152.7 – 152.8	Fracture zone, numerous intensely spaced intersecting fractures.
152.8	Fracture, 30°, rough, slightly weathered.
153.0	Fracture, 35°, rough, moderately weathered, moderate amount of medium gray mineralization.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
153.0	Fracture, 40°, rough, irregular, fresh.
153.1	Fracture, 15°, rough, crushed rock, fresh.
153.1 – 153.3	Fracture zone, numerous intensely spaced intersecting fractures, slightly weathered.
153.4 – 153.6	Fracture, 90°, rough, numerous crushed rock fragments.
153.5	Fracture, 35°, rough, irregular, fresh, intersects 90° fracture above.
153.6 – 153.7	Fracture zone, numerous crushed and intensely spaced intersecting fractures, fresh.
153.7	Fracture, 20°, rough, irregular, slightly weathered.
153.7 – 154.3	Fracture, 90°, rough, irregular, slightly weathered, numerous rock fragments.
154.0	Fracture, 20°, rough, irregular, fresh, intersects 90° fracture above.
154.1	Fracture, 40°, rough, irregular, fresh, intersects 90° fracture above.
154.4	Fracture, 25°, rough–stepped, fresh.
154.5	Fracture, 10°, rough, fresh.
154.6	Fracture, 40°, rough, fresh.
154.7 – 155.1	Fracture, 70°, moderately rough, slightly weathered, small amount of medium gray mineralization, slickensides.
154.8	Fracture, 20°, rough, irregular, fresh, intersects 70° fracture above.
154.8	Fracture, 25°, rough, irregular, fresh, intersects 70° fracture above.
154.9	Fracture, 10°, rough, irregular, fresh, intersects 70° fracture above.
154.9	Fracture, 40°, rough, irregular, fresh, intersects 70° fracture above.
155.1	Fracture, 20°, rough, fresh.
155.1 – 155.2	Fracture zone, crushed, fresh.
155.2	Fracture, 30°, moderately rough, fresh.
155.4 – 155.5	Fracture zone, numerous intensely spaced intersecting fractures and wedge–shaped rock fragments, fresh.
155.5	Fracture, 20°, rough, irregular, fresh.
155.6	Fracture, 30°, rough, fresh.
155.8	Fracture, 25°, rough, fresh, coated with crushed rock.
156.0	Fracture, 45°, rough, irregular, fresh.
156.1	Fracture, 10°, rough, fresh.
156.2	Fracture, 20°, rough, fresh, coated with crushed rock, slightly weathered.
156.2 – 156.3	Fracture zone, crushed, fresh.
156.3	Fracture, 20°, rough, fresh, coated with crushed rock, slightly weathered.
156.3 – 156.7	Fracture, 80°, rough, irregular, moderate amount of medium gray mineralization, crushed rock.
156.4	Fracture, 10°, rough, irregular, fresh, intersects 80° fracture above.
156.5	Fracture, 20°, rough, irregular, fresh, intersects 80° fracture above.
152.7 – 152.8	Fracture zone, crushed, fresh.
156.8 – 157.3	Core loss 0.5 foot.
157.3	Drill break, 40°, rough, irregular, fresh.
157.5	Fracture, 40°, rough, irregular, fresh.
157.6	Fracture, 40°, rough, fresh.
157.3 – 157.6	Fracture, 90°, moderately smooth, moderately weathered, coated with clay and crushed rock fragments, 3 mm thick.
157.6 – 157.8	Fracture zone, crushed rubble, exhibits mechanical wear.
157.8	Fracture, 20°, rough, irregular, fresh.
157.8 – 158.0	Fracture, 90°, moderately rough, moderate amount of medium gray

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
	mineralization.
157.9	Fracture, 0°, stepped, fresh.
158.0 – 158.5	Fracture zone, crushed and intensely spaced fractures, highly weathered, coated with medium gray mineralization.
158.5 – 158.9	Fracture zone, rubble, exhibits mechanical wear.
158.9	Fracture, 5°, rough, fresh.
159.2	Fracture, 45°, stepped, fresh.
159.3	Fracture, 45°, moderately rough, slightly weathered.
159.3	Fracture, 30°, rough, irregular, fresh, intersects 45° fracture above.
159.4	Fracture, 25°, rough, moderately weathered.
159.5	Fracture, 20°, rough, irregular, fresh.
159.6 – 159.8	Rubble, slightly weathered, mechanically worn.
159.8 – 162.3	Core loss 0.5 foot.
162.3	Drill break, 30°, rough, irregular, fresh.
162.5	Fracture, 30°, rough, irregular, trace of medium light gray mineralization.
162.6	Fracture, 40°, rough, irregular, fresh.
162.6 – 162.8	Fracture, 60°, moderately rough, highly weathered, coated with calcite and crushed rock fragments, 1–3 mm thick.
162.6	Fracture, 30°, rough, slightly weathered, intersects 60° fracture above.
162.7	Fracture, 30°, rough, slightly weathered, intersects 60° fracture above.
162.7	Fracture, 10°, rough, slightly weathered, intersects 30° fracture above.
162.9	Fracture, 10°, rough, irregular, coated with crushed rock, slightly weathered.
163.0 – 163.1	Fracture, 60°, rough, small amount of medium light gray mineralization.
163.1	Fracture, 5°, rough, slightly weathered, crushed rock.
163.1 – 163.2	Fracture, 70°, rough, irregular, slightly weathered.
163.2	Fracture, 5°, mechanical break.
163.2 – 163.5	Fracture, 70°, moderately rough, severely weathered, coated with medium gray calcite, numerous wedge–shaped rock fragments.
163.5	Fracture, 20°, moderately rough, slightly weathered, crushed rock.
163.6 – 163.9	Fracture, 60°, moderately smooth, moderately weathered, coated with calcite.
163.6	Fracture, 30°, rough, fresh, partially intersects 60° fracture above.
163.6 – 163.7	Fracture zone, crushed portion of wedge, occurs along 60° fracture above.
163.7	Fracture, 15°, rough, irregular, fresh, intersects 60° fracture above.
164.0	Fracture, 45°, rough, fresh.
164.0 – 164.1	Fracture zone, rubble, exhibits mechanical wear.
164.1	Fracture, 30°, rough, moderately weathered, moderate amount of medium light gray mineralization.
164.2	Fracture, 10°, stepped, fresh.
164.4	Fracture, 40°, rough, fresh.
164.5	Fracture, 45°, rough, fresh.
164.7	Fracture, 60°, rough, fresh.
164.5 – 165.3	Fracture, 80°, rough, irregular, moderately weathered, moderate amount of medium light gray mineralization.
165.5	Fracture, 20°, rough, irregular, fresh.
165.9	Fracture, 20°, rough, irregular, fresh.
165.9 – 166 .5	Fracture, 80°, rough, irregular, slightly weathered, some medium light gray mineralization.
166.2	Fracture, 20°, rough, irregular, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
166.2	Fracture, 80°, rough, irregular, fresh, intersects 20° fracture above.
166.4	Fracture, 40°, rough, irregular, fresh, intersects 20° fracture above.
166.5	Fracture, 0°, rough, irregular, fresh, intersects 20° fracture above.
166.6	Fracture, 45°, rough, highly weathered, coated with medium gray mineralization.
166.6 – 167.3	Coreloss 0.7 foot.
167.3 – 168.4	Fracture zone, rubble, exhibits mechanical wear, small amounts of medium gray mineralization.
168.4	Fracture, 45°, moderately rough, fresh.
168.4	Fracture, 45°, moderately rough, fresh, intersects 45° fracture above.
168.6	Fracture, 45°, moderately rough, trace of medium gray mineralization.
168.7	Fracture, 45°, moderately rough, trace of medium gray mineralization.
168.7 – 168.9	Fracture, 90°, moderately rough, coated with medium gray mineralization.
168.9	Fracture, 45°, moderately rough, trace of medium light gray mineralization.
168.9 – 169.2	Fracture, 80°, moderately rough, moderately weathered, moderate amount of medium light gray mineralization.
169.2	Fracture, 45°, rough, fresh, crushed wedge–shaped rock fragments.
169.3	Fracture, 45°, rough, fresh, crushed wedge–shaped rock fragments.
169.3 – 169.7	Fracture, 60°, rough, moderately weathered, moderate amount of medium light gray mineralization.
168.7 – 170.7	Core loss 1.0 foot.
170.7	Drill break.
170.8	Fracture, 30°, rough, irregular, fresh.
170.7 – 171.1	Fracture, 90°, rough, small amount of medium gray mineralization.
170.9	Fracture, 25°, rough, irregular, fresh, intersects 90° fracture above.
170.9	Fracture, 45°, stepped, fresh, partially intersects 90° fracture above.
170.9 – 171.1	Fracture, 60°, rough, irregular, small amount of medium light gray mineralization, intersects 90° fracture above.
171.2	Fracture, 40°, right, irregular, small amount of medium light gray mineralization.
171.4	Fracture, 30°, right, irregular, small amount of medium light gray mineralization.
171.2 – 171.4	Fracture zone, rubble, fresh, exhibits mechanical wear.
171.4 – 171.5	Fracture, 90°, rough, moderate amount of medium gray mineralization.
171.5	Fracture, 30°, rough, irregular, fresh, intersects 90° fracture above.
171.7	Fracture, 10°, rough, fresh.
171.7 – 171.8	Fracture zone, crushed to intensely spaced fractures, fresh.
171.8	Fracture, 40°, rough, fresh.
171.9	Fracture, 45°, moderately rough, small amount of medium light gray mineralization.
172.0	Fracture, 45°, moderately rough, irregular, small amount of medium light gray mineralization.
172.2	Fracture, 50°, rough, fresh.
172.4	Fracture, 60°, rough, fresh.
172.4	Fracture, 45°, rough, fresh, partially intersects 60° fracture above.
172.6	Fracture, 45°, rough, irregular, fresh, crushed rock.
172.6 – 172.7	Fracture zone, numerous intensely spaced intersecting fractures and crushed wedge–shaped rock fragments, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
172.7	Fracture, 30°, moderately rough, irregular, small amount of mineralization.
173.0	Fracture, 60°, moderately rough, irregular, moderate amount of medium dark gray mineralization, slickensides.
173.0 – 173.3	Fracture zone, numerous wedge–shaped rock fragments, fresh.
173.2	Fracture, 60°, rough, fresh.
173.3	Fracture, 45°, rough, fresh.
173.4 – 173.5	Fracture zone, rubble, fresh, exhibits mechanical wear.
173.5 – 173.7	Fracture, 60°, rough, moderately weathered, moderate amount of medium light gray mineralization, crushed rock.
173.7	Fracture, 20°, rough, fresh.
173.7 – 173.9	Fracture, 90°, moderately rough, moderately weathered, moderate amount of medium light gray mineralization, crushed rock.
173.8	Fracture, 45°, rough, fresh, partially intersects 90° fracture above.
173.9	Fracture, 0°, rough, fresh.
174.1	Fracture, 45°, rough, irregular, fresh.
174.1 – 174.2	Fracture, 70°, rough, small amount of medium light gray mineralization.
174.2	Fracture, 20°, rough, fresh.
174.4	Fracture, 30°, rough, fresh, exhibits mechanical wear.
174.4 – 174.6	Fracture, 90°, moderately rough, highly weathered, coated with medium dark gray mineralization, 2 mm thick.
174.6 – 174.7	Fracture zone, crushed.
174.7 – 175.7	Core loss 1.0 foot.
175.7 – 176.2	Fracture zone, numerous intensely spaced intersecting fractures and wedge–shaped rock fragments, fresh.
176.2	Fracture, 45°, rough, irregular, fresh.
176.5	Fracture, 45°, rough–stepped, fresh.
176.5	Fracture, 45°, rough–stepped, fresh, intersecting 45° fracture above.
176.7	Fracture, 45°, rough, fresh.
176.9	Fracture, 30°, rough, fresh.
176.9 – 178.9	Fracture, 90°, rough, irregular, highly weathered, coated with medium light gray mineralization, wedge–shaped rock fragments.
176.9 – 177.2	Fracture, 60°, rough, slightly weathered, intersects 90° fracture above.
177.3	Fracture, 20°, rough–stepped, fresh, intersects 90° fracture above.
177.5	Fracture, 30°, rough, fresh, intersects 90° fracture above.
177.6 – 177.9	Fracture, 70°, rough, fresh, numerous wedge–shaped rock fragments
178.0	Fracture, 45°, rough, fresh, intersects 90° fracture above.
178.1	Fracture, 45°, rough, irregular, fresh, intersects 90° fracture above.
178.5	Fracture, 30°, rough, fresh, intersects 90° fracture above.
178.8	Fracture, 60°, rough, irregular, fresh, intersects 90° fracture above.
178.9	Fracture, 60°, rough, irregular, fresh.
179.1	Fracture, 60°, rough, irregular, fresh.
179.1 – 179.2	Fracture zone, crushed.
178.5 – 180.2	Core loss 0.7 foot.
180.2 – 181.0	Fracture, 90°, rough, irregular, moderate amount of medium light gray mineralization, occurs along side of core.
180.8	Fracture, 45°, rough, fresh, partially intersects 90° fracture above.
181.0	Fracture, 30°, rough–stepped, fresh, crushed rock.
181.0 – 181.6	Fracture, 70°, rough, irregular, small amount of medium light gray

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
	mineralization.
181.3 – 181.4	Fracture zone, intensely spaced fractures, fresh.
181.5 – 181.7	Fracture, 60°, rough, moderate amount of medium light gray mineralization.
181.7 – 181.9	Fracture, 60°, rough, moderate amount of medium light gray mineralization.
181.7 – 182.2	Fracture, 70°, rough, moderate amount of medium light gray mineralization.
182.0 – 182.7	Fracture, 80°, rough, irregular, moderate amount of medium light gray mineralization.
182.2 – 182.9	Fracture, 70°, rough, irregular, moderate amount of medium light gray mineralization.
182.4	Fracture, 30°, rough, irregular, fresh, intersects 70° and 80° fractures above.
182.5 – 183.0	Fracture, 60°, moderately rough, moderate amount of medium light gray mineralization.
182.6 – 183.0	Fracture, 60°, moderately rough, moderate amount of medium light gray mineralization.
182.6 – 182.8	Fracture, 60°, stepped, fresh, partially intersects 60° fracture above.
183.0	Fracture, 45°, rough, irregular, fresh.
183.1 – 183.5	Vein of feldspar, 45°.
183.4	Fracture, 45°, rough, fresh.
183.1 – 183.6	Fracture, 70°, rough, lightly stained with chlorite, intersects 45°, fracture above.
183.6 – 183.9	Fracture, 60°, moderately rough, irregular, fresh.
183.9	Fracture, 45°, rough, fresh, intersects 60° fracture above.
184.2	Fracture, 45°, rough, fresh.
184.4 – 184.9	Fracture, 60°, moderately rough, moderate amount of medium light gray mineralization.
184.5	Fracture, 45°, rough, fresh, intersects 60° fracture above.
184.7	Fracture, 45°, rough, fresh, intersects 60° fracture above.
184.8	Fracture, 45°, rough, fresh, intersects 60° fracture above.
184.8	Fracture, 45°, rough, fresh, intersects 60° fracture above.
184.9 – 185.0	Fracture, 70°, moderately rough, highly weathered, coated with medium light gray mineralization
185.0 – 185.2	Core loss, 0.2 foot.
185.2	Drill break, 30°, rough, irregular, fresh.
185.4	Fracture, 30°, rough, irregular, fresh.
185.5	Fracture, 45°, rough, irregular, fresh.
185.7	Fracture, 45°, rough, irregular, fresh, wedge–shaped rock fragments.
185.8	Fracture, 45°, rough, irregular, fresh, wedge–shaped rock fragments.
185.8 – 186.2	Fracture, 80°, rough, moderate amount of medium gray mineralization, slickensides.
186.0	Fracture, 45°, rough, irregular, fresh, partially intersects 80° fracture above.
186.2 – 186.6	Fracture zone, rubble, exhibits mechanical wear, small amount of mineralization.
186.6	Fracture 45°, rough, fresh.
186.7	Fracture, 45°, rough, fresh.
186.9	Fracture, 45°, rough, fresh.
186.6 – 187.0	Fracture, 80°, rough, rough, moderate amount of mineralization.
187.0	Fracture, 20°, rough, irregular, fresh.
187.2	Fracture, 30°, rough, irregular, fresh.
187.5	Fracture, 30°, stepped, fresh.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring C–1

Depth (ft)	Description of Geologic Feature*
187.5 – 188.0	Fracture, 60°, rough, rough, moderate amount of medium gray mineralization, crushed, rock fragments.
188.0	Drill break, 45°, rough, irregular, fresh, crushed, rock fragments.
188.1	Fracture, 30°, rough, fresh, crushed, rock fragments.
188.2	Fracture, 30°, rough, fresh.
188.3	Fracture, 30°, rough, fresh, wedge–shaped rock fragments.
188.4	Fracture, 45°, rough, irregular, fresh.
188.4 – 188.7	Fracture, 60°, rough, small amount of medium light gray mineralization, crushed, rock fragments.
188.6	Fracture, 30°, rough, fresh, intersects 60° fracture above.
188.6	Fracture 45°, rough, slightly weathered, intersects 60° fracture above.
188.7	Fracture, 30°, rough, slightly weathered.
188.1	Fracture, 30°, rough, fresh, crushed rock.
188.1 – 188.2	Fracture zone, crushed, fresh.
188.2	Fracture, 30°, rough, fresh, crushed rock.
189.5	Fracture, 20°, rough–stepped, fresh, crushed rock.
189.5 – 190.0	Core loss 0.5 foot.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA–1

Depth (ft)	Description of Geologic Feature*
25.0	Fracture, 50°, rough, stained with iron and manganese oxides.
25.2	Fracture, 45°, rough, stained with iron and manganese oxides.
25.2	Fracture, 30°, fresh, rough, irregular, extends only partially through core, intersects 45° fracture above.
25.0 – 25.5	Fracture, 90°, extends along side of core, stained with iron oxide, rough, intersects 30° and 45° fractures above.
25.5 – 25.8	Core loss 0.3 foot, core bit blocked off.
25.8	Fracture, 30°, rough, moderately weathered, moderate amount of medium gray mineralization, 1 mm thick.
26.1	Fracture, 45°, rough, moderately weathered.
26.1	Fracture, 45°, moderately rough, crushed wedge, very dark red, mechanically worn piece of rubble, partially intersects 45° fracture above.
26.1 – 26.4	Fracture zone, intensely fractured, rough, irregular, moderately weathered.
26.4	Fracture, 60°, rough, irregular, moderately weathered.
26.5	Fracture, 45°, moderately rough, irregular, moderately weathered, stained with iron oxide.
26.5 – 26.8	Fracture, 60°, rough, stained with iron oxide, crushed wedge–shaped fragments
26.6	Fracture, 60°, rough, irregular, fresh, partially intersects 60° fracture above.
26.8	Fracture, 30°, rough, moderately weathered, stained with iron oxide.
27.1 – 28.0	Core loss 0.9 foot.
28.0	Drill break.
28.0 – 28.5	Fractures, 90°, two subparallel fractures, moderately weathered, coated with hard, medium brown mineralization, 1 mm thick.
28.4	Fracture, 30°, moderately smooth, irregular, moderately weathered, stained with iron oxide.
28.5	Mechanical break, 45°.
28.5	Mechanical break, 10°, intersects above break.
28.6	Fracture, 60°, moderately smooth, irregular, slightly weathered, stained with iron and manganese oxides.
28.9	Fracture, 30°, rough, irregular, slightly weathered, stained with iron and manganese oxides.
28.9 – 29.2	Fracture zone, numerous intensely spaced intersecting fractures, slightly weathered, stained with iron and manganese oxides, exhibits mechanical wear.
29.2 – 33.0	Core loss 0.8 feet.
33.0	Fracture, 45°, rough, irregular, highly weathered, coated with hard, medium light brown mineralization, 3 mm thick.
33.2	Fracture, 30°, moderately rough, irregular, slightly weathered, stained with iron and manganese oxides.
33.2 – 38.0	Core loss 4.8 feet.
38.0	Fracture, 45°, moderately rough, moderately weathered, coated with light brown, mineralization, 1 mm thick.
38.4 – 38.5	Fracture, 70°, rough, slightly weathered, extends along side of core and intersects fracture zone below.
38.2 – 38.5	Fracture, 60°, rough, slightly weathered, extends along side of core and intersects fracture zone below.
38.4 – 38.5	Fracture zone, numerous intensely spaced fractures, fresh.
38.5 – 38.9	Fracture, 65°, rough, slightly weathered, stained with iron and manganese

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
	stains; intersects fracture zone above.
38.8	Fracture, 45°, rough, irregular, slightly weathered, stained with iron and manganese oxides.
38.9	Fracture, 20°, moderately rough, irregular, slightly weathered, stained with iron and manganese oxides.
38.9 – 39.1	Fracture, 70°, rough, irregular, moderately weathered, stained with iron and manganese oxides; coated with medium hard, medium brown mineralization, 1 mm thick.
39.1	Fracture, 10°, moderately rough, irregular, slightly weathered, stained with iron and manganese oxides.
39.1	Fracture, 45°, moderately rough, slightly weathered, stained with iron oxide.
39.2 – 39.3	Fracture, 70°, moderately rough, irregular, moderately weathered, stained with iron and manganese oxides, coated with medium hard, light medium brown mineralization, 3 mm thick, intersects 30° fracture below.
39.3	Fracture, 30°, moderately rough, moderately weathered, coated with medium hard, medium brown mineralization, 3 mm thick.
39.3 – 40.0	Core loss 0.7 foot.
40.0	Mechanical break, stepped, fresh.
40.4	Fracture, 30°, moderately rough, slightly weathered.
40.4 – 40.5	Fracture, 70°, rough, irregular, slightly weathered, stained with manganese oxides.
40.5	Fracture, 30°, moderately rough, moderately weathered, stained with manganese oxide, coated with dark brown mineralization, 1 mm thick.
40.5	Fracture, 30°, moderately rough, moderately weathered, stained with iron and manganese oxides, deposits of brown mineralization, 1 mm thick.
41.2	Fracture, 30°, moderately rough, irregular, slightly weathered, lightly stained with iron oxide.
41.6	Fracture, 45°, rough, moderately weathered, coated with medium brown fine sand and clay, 3 mm thick.
41.7	Mechanical break, 0°, stepped, fresh.
41.7 – 43.0	Core loss 1.3 feet.
43.0	Drill break, 0°.
43.1	Fracture, 30°, moderately rough, slightly weathered, stained with manganese oxides, minor amount of muscovite.
43.1 – 43.2	Fracture zone, crushed to intensely fractured, slightly weathered, stained with iron and manganese oxides.
43.2	Fracture, 30°, moderately rough, slightly weathered, stained with manganese oxide, abundant biotite and muscovite.
43.3	Fracture, 45°, moderately rough, irregular, slightly weathered, stained with iron and manganese oxides, abundant biotite and muscovite.
43.4	Fracture, 45°, moderately smooth, slightly weathered, slickensides on feldspar phenocrysts.
43.6	Fracture, 30°, moderately smooth, fresh.
43.7 – 44.1	Fracture, 60°, moderately rough, slightly weathered, lightly stained with manganese oxide, lightly coated with medium brown clay and silt, 1 mm thick.
44.4	Fracture, 10°, rough, fresh.
45.2	Fracture, 45°, moderate rough, fresh.
45.3	Fracture, 45°, moderate rough, moderately weathered, stained with iron and

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
	manganese oxides, coated with medium brown silt and clay, 1 mm thick.
45.3 – 45.4	Vein of feldspar, sharp contacts, 5 cm thick.
45.4	Fracture, 30°, smooth.
45.4 – 45.9	Fracture zone, crushed rock, slightly weathered.
45.9	Fracture, 30°, rough, moderately weathered, stained with iron and manganese oxides, coated with light brown silt and clay, 3 mm thick, some crushed rock.
46.1	Fracture, 20°, stepped, slightly weathered, stained with iron and manganese oxides, mechanically worn.
46.2	Fracture, 60°, moderately rough, irregular, moderately weathered, coated with medium soft, brownish gray mineralization, 1 mm thick.
46.2 – 48.0	Core loss 1.8 feet.
48.0	Drill break.
48.0 – 48.2	Fracture, 90°, moderately smooth, moderately weathered, stained with iron oxide, intersects fracture below.
48.2	Fracture, 45°, rough, irregular, crushed rock, mechanically worn.
48.3	Fracture, 20°, moderately smooth, moderately weathered, stained with iron and manganese oxides, light brown mineralization, 1 mm thick.
48.5	Fracture, 30°, moderately smooth, moderately weathered, stained with iron and manganese oxides, light brown mineralization, 1 mm thick.
48.5 – 48.6	Fracture zone, numerous intensely spaced intersecting fracture, stained with iron and manganese.
48.8	Fracture, 20°, moderately rough, slightly weathered, stained with iron and manganese oxides.
49.0	Fracture, 20°, moderately rough, slightly weathered, stained with iron and manganese oxides.
49.2	Fracture, 30°, rough, slightly weathered, stained with iron and manganese oxides.
49.2 – 49.3	Fracture zone, numerous intensely spaced fractures, slightly weathered.
49.3	Fracture, 0°, moderate rough, slightly weathered, stained with iron and manganese oxides.
49.4 – 49.5	Fracture, 45°, moderately rough, moderately weathered, coated with medium soft, medium brown mineralization, 1 mm thick.
49.5 – 49.7	Fracture zone, intersecting 90° and 45° fractures, numerous rock fragments, slightly weathered, feldspar vein.
49.7	Fracture, 70°, moderately rough, slightly weathered.
49.9	Fracture, 0°, moderately rough, slightly weathered.
50.0	Fracture, 10°, moderately rough, slightly weathered, stained with iron and manganese oxides, slightly altered, sericite present.
50.5 – 50.7	Fracture, 60°, rough, slightly weathered, stained with iron and manganese oxides, partially intersects 0° fracture below.
50.7	Fracture, 0°, moderately rough, fresh.
50.7 – 50.9	Incipient fracture, 60°, hairline crack.
50.9	Fracture, 45°, rough, moderately weathered, coated with medium soft light brown mineralization, 1 mm thick.
51.3	Fracture, 20°, moderate rough, slightly weathered.
51.3 – 51.5	Fracture zone, crushed and intensely spaced fractures, slightly weathered.
51.6 – 51.7	Fracture zone, crushed, slightly weathered.
51.7	Fracture, 45°, moderate rough, slightly weathered.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
51.7 – 51.9	Incipient fracture, 60°, rough, intersects 45° and 30° fractures above and below.
51.9	Fracture, 30°, moderately rough, moderately weathered, lightly coated with light brown mineralization.
51.9 – 53.0	Core loss 1.1 feet
53.0	Fracture, 45°, moderately rough, slightly weathered.
53.3	Fracture, 30°, moderately smooth, slightly weathered, stained with manganese oxides.
53.4	Fracture, 20° moderately rough, moderately weathered, coated with medium soft mineralization, 1 mm thick.
53.4 – 53.9	Fracture, 90°, rough, moderately weathered, coated with light brown silt and clay, 3 mm thick, slightly altered, sericite present.
53.9	Fracture, 20°, stepped, fresh.
53.9 – 54.2	Fractures, two subparallel fractures, 70° and 90°, rough, moderately weathered, coated with light brown silt and clay, 3 mm thick.
54.2 – 54.7	Fracture, 90°, rough, moderately weathered, deposits of light brown silt and clay, 3 mm thick
54.4	Fracture, 0°, rough, fresh, intersects 90° fracture above.
54.4 – 54.6	Fracture, 60°, rough, moderately weathered, intersects 90° fracture above.
54.5 – 54.8	Fracture, 90°, rough, moderately weathered, intersects 90° fracture above.
54.8	Fracture, 30°, moderately rough, slightly weathered, numerous rock fragments.
54.8 – 55.1	Fracture, 60°, moderately rough, moderately weathered, coated with light brown silt and clay and white calcite, 1 mm thick.
55.1	Fracture, 30°, moderately rough, slightly weathered, numerous rock fragments, stained with manganese oxides.
55.1 – 55.7	Fracture, 90°, rough, irregular, moderately weathered, deposits of light brown, silt and clay, 3 mm thick, numerous wedge–shaped rock chips.
55.3	Fracture, 45°, stepped, slightly weathered, intersects 90° fracture above.
55.5	Fracture, 45°, rough, slightly weathered, intersects 90° fracture above.
55.7	Fracture, 30°, stepped, slightly weathered, pink stains.
55.7 – 56.0	Healed fracture, 90°, rough, irregular, sealed with medium hard mineralization, 3 mm thick.
55.8 – 56.5	Fracture, 80°, rough, irregular, moderately weathered, coated with medium hard, olive brown to light brown mineralization, 3 mm thick.
56.1	Fracture, 0°, rough, fresh, intersects 80° fracture above.
56.3	Fracture, 30°, rough, fresh, partially intersects 80° fracture above.
57.0	Fracture, 60°, rough, slightly weathered, slightly altered, sericite, abundant biotite filling up to 3 mm thick.
57.0 – 57.3	Fracture zone, predominantly fracture oriented 70°, moderately rough, slightly weathered, stained light olive brown.
57.3	Fracture, 20°, moderately rough, irregular, fresh.
57.5	Fracture, 45°, moderately rough, irregular, fresh.
57.7	Fracture, 45°, rough, moderately weathered, coated with light brown silt and clay.
58.0	Fracture, 30°, moderately smooth, slightly weathered, stained light olive gray.
58.2	Fracture, 45°, moderately rough, slightly weathered.
58.3	Fracture, 30°, smooth, moderately weathered, coated with olive brown silt and clay, 1 mm thick.
58.4	Fracture, 20°, moderately rough, exhibits mechanical wear.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
58.5	Fracture, 60°, moderately rough, fresh.
58.7	Fracture, 0°, stepped, fresh.
58.8 – 61.2	Vein of feldspar, 2.4 feet thick.
58.9	Healed fracture , 20°, partly sealed with feldspar 1 mm thick.
59.0	Fracture. 20°, moderately smooth, slightly weathered, coated with medium light gray deposits, 1 mm thick.
59.0 – 59.4	Healed fracture, 70°, sealed with feldspar, 1 mm thick.
59.1 – 59.4	Fracture, 70°, rough, moderately weathered, coated with light olive gray mineralization, 1 mm thick.
59.4	Fracture, 20°, stepped, slightly weathered, slightly altered, crushed contacts, muscovite present.
59.4 – 59.5	Fracture , 70°, rough , moderately weathered, coated with hard gray mineralization.
59.5 – 59.6	Fracture zone, crushed.
59.6	Fracture, 45°, rough slightly weathered, stained with iron oxide.
60.0	Fracture, 20°, moderately smooth, slightly weathered.
60.4	Fracture, 30°, moderately rough, irregular, fresh.
60.4 – 60.9	Fracture, 70°, moderately smooth, irregular, numerous wedge–shaped rock fragments.
60.6	Fracture, 10°, smooth, irregular, moderately weathered, intersects 70° fracture above.
60.7 – 61.3	Fracture, 70°, moderately smooth, irregular, moderately weathered , coated with hard, olive gray mineralization , 1 mm thick.
60.8	Fracture, 45°, moderately smooth, moderately weathered, intersects 70° fracture above.
61.0	Fracture, 10°, moderately smooth, moderately weathered, intersects 70° fracture above.
61.2	Fracture, 30°, moderately rough, slightly weathered, stained with iron oxide, intersects 70° fracture above.
61.2 – 61.7	Fracture, 70°, moderately rough, severely weathered, coated with hard, medium gray mineralization, 3 mm thick.
61.3	Fracture, 0°, moderately rough, moderately weathered, stained with iron and manganese oxides, coated with medium gray mineralization 1 mm thick, intersects 70° fracture above.
61.4	Fracture, 30°, moderately rough, moderately weathered, coated with medium gray mineralization, 1 mm thick, intersects 70° fracture above.
61.6 – 62.7	Fracture, 80°, moderately rough, moderately weathered, coated with medium gray mineralization, 3 mm thick.
62.0	Fracture, 30°, moderately rough, slightly weathered, intersects 80° fracture above.
62.3	Fracture, 20°, moderately rough, slightly weathered, intersects 80°, fracture above.
62.4	Fracture, 0°, moderately rough, slightly weathered, intersects 80°, fracture above.
62.6	Fracture, 30°, moderately rough, slightly weathered, intersects 80°, fracture above.
62.7 – 63.0	Core loss 0.3 foot.
63.0 – 63.2	Fracture, 60°, moderately rough, slightly weathered, stained with iron and

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG
Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
	manganese oxides, intersects 90° fracture below.
63.0–64.2	Fracture, 90°, moderately rough, irregular coated with hard, light gray mineralization, 1–3 mm thick.
63.2	Fractures two intersecting 30° fractures, moderately rough irregular, crushed contacts, intersects 90° fracture above.
63.4	Fracture, 45°, moderately rough, irregular, fresh, intersects 90° fracture above.
63.6	Fracture, 20°, moderately rough irregular, fresh, intersects 90° fracture above.
63.8	Fracture 20°, moderately rough, irregular, fresh, intersects 90° fracture above.
63.9	Fracture, 45°, rough, irregular, slightly weathered stained with manganese oxide, intersects 90° fracture above.
64.0	Fracture, 60°, rough, irregular, slightly weathered stained with manganese oxide, intersects 90° fracture above, numerous wedge–shaped rock fragments.
64.2	Fracture, 45°, stepped, fresh, intersects 90° fracture above.
64.6	Fracture, 30°, moderately rough, slightly weathered, stained with manganese oxides.
65.3	Fracture, 30°, moderately rough, fresh.
65.6	Fracture, 60°, rough, irregular, severely weathered, coated with grayish purple silt and crushed rock fragments, 3 mm thick.
65.8	Fracture, 30°, moderately rough, fresh.
66.0	Fracture, 30°, moderately rough, slightly weathered stained light grayish purple.
66.0 – 66.2	Fracture zone, rubble, exhibits mechanical wear.
66.2	Fracture, 60°, moderately rough, moderately weathered, stained moderate reddish brown.
66.6	Fracture, 30°, moderately rough, fresh, abundant biotite.
66.6 –67.0	Fracture, 70°, rough, moderately weathered, numerous wedge–shaped rock clips coated with medium gray mineralization, 1 mm thick.
66.7	Fracture, 30°, rough, fresh, abundant biotite.
67.0	Fracture, 30°, moderately rough, fresh.
67.1	Fracture 30°, moderately rough, fresh.
67.2.	Fracture, 45°, moderately rough, irregular, slightly weathered.
67.3	Fracture, 45°, moderately rough, irregular, slightly weathered.
67.3 –68.0	Core loss, 0.7 foot.
68.0 – 68.7	Fracture, 75°, moderately rough, moderately weathered, coated with olive gray silt and clay, 1 mm thick.
68.5	Fracture, 0°, rough, slightly weathered, intersects 75° fracture above.
68.6	Fracture, 30°, stepped, moderately weathered, stained light brownish gray.
68.7	Fracture, 30°, stepped, slightly weathered, stained light brownish gray.
68.7 – 68.9	Incipient fracture, 90°, stepped, hairline crack.
68.9	Fracture, 30°, moderately rough, slightly weathered, stained light brownish gray.
69.0 – 69.3	Fracture zone, crushed, slightly weathered, stained with iron and manganese oxides.
69.9	Fracture, 30°, moderately rough, irregular, fresh.
70.0 – 70.5	Fracture, 70°, moderately rough, moderately weathered, coated with gray silt and very fine sand.
70.2	Fracture, 60°, rough, fresh, partially intersects 70° fracture above.
70.4	Fracture, 45°, moderately rough, fresh.
70.4 –70.9	Fracture, 70°, moderately rough, moderately weathered, stained light olive gray.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
70.6	Fracture, 0°, rough, fresh, partially intersects 70°fracture above.
70.7	Fracture, 0°, rough, fresh, irregular, partially intersects 70° fracture above.
70.9–71.5	Fracture, 75°, moderately rough, irregular, moderately weathered, coated with light olive gray clay and very fine sand.
71.1	Fracture 0°, moderately rough, fresh, irregular, intersects 75° fracture above.
71.3	Fracture, 10°, rough, fresh, irregular, partially intersects 75° fracture above.
71.6	Fracture, 30°, moderately rough, moderately weathered, coated with light olive gray mineralization.
71.6– 71.7	Fracture zone, crushed, moderately weathered, coated with light olive gray mineralization.
72.1	Fracture, 45°, rough, slightly weathered.
72.3	Fracture, 45°, rough, slightly weathered.
72.6	Fracture, 30°, moderately rough, slightly weathered.
72.6–72.7	Fracture zone, crushed.
72.7	Fracture, 60°, moderately rough, slightly weathered.
72.8	Fracture, 30°, moderately rough, slightly weathered.
73.1 – 73.5	Fracture zone, predominant fracture oriented 60°, moderately smooth, irregular, moderately weathered, stained with iron–oxide, coated with olive–gray mineralization numerous intensely spaced, intersecting fractures.
73.5 – 73.9	Fracture, 90°, moderately smooth, irregular, moderately weathered, coated with light olive gray, very fine sand.
73.7	Fracture, 30°, stepped, fresh, intersects 90° fracture above.
73.7 – 74.1	Incipient fracture, 80°, hairline crack.
73.9 – 74.2	Fracture, 60°, moderately smooth, moderately weathered, light olive gray mineralization, stained with iron oxide stains.
74.1	Fracture, 20°, rough, slightly weathered, large biotite phenocrysts present.
74.2–74.4	Fracture, 60°, moderately rough, moderately weathered, coated with medium hard mineralization, 3 mm thick.
74.2	Fracture, 30°, stepped, fresh, partially intersects 60° fracture above.
74.3 – 74.4	Healed fracture, 35°, partially sealed.
74.4 – 74.5	Fracture, 60°, moderately rough, slightly weathered.
74.4 –74.5	Incipient fracture, 30°, hairline crack, intersects 60° fracture above.
74.6 – 74.8	Fracture, 60°, moderately rough, moderately weathered, coated with light olive gray very fine sand and silt.
74.8 – 74.9	Fracture zone, crushed.
75.1	Healed fracture, 45°, irregular, sealed with silica, 1 mm thick.
75.7	Incipient fracture, 45°, hairline crack.
75.8 – 76.0	Fracture zone, crushed and intensely spaced intersecting fractures, moderately weathered.
76.0	Healed fracture, 10°, 3 mm thick, hard, partially intersects fracture zone above.
76.0 –76.4	Fracture 90°, moderately smooth, irregular, moderately weathered, coated with olive gray mineralization, 1 mm thick.
76.4 – 77.0	Fracture zone, numerous crushed and intensely spaced intersecting fractures, stained with iron oxide.
76.9 – 77.2	Fracture, 70°, moderately smooth, moderately weathered, coated with olive gray mineralization, 1 mm thick.
77.1	Healed fracture, 30°, partially sealed.
77.1 – 77.5	Fracture, 80°, moderately rough, irregular, moderately weathered, coated with

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
	hard, olive gray mineralization, 1 mm thick.
77.5 – 77.7	Fracture zone, numerous intensely spaced intersecting fractures, moderately weathered, coated with medium light gray mineralization.
77.7 – 78.0	Core loss 0.3 foot.
78.0 – 78.3	Fracture, 85°, extends along side of core, moderately smooth, moderately weathered, stained light olive gray.
78.3	Fracture, 30°, moderate rough, irregular, moderately weathered, stained light olive gray.
78.3 – 78.4	Fracture, 70°, moderately rough, irregular, moderately weathered, coated with olive gray silt and clay, 1 mm thick, partially intersects 30° fracture above.
78.4	Fracture, 45°, moderately smooth, irregular, stained light olive gray and with traces of iron and manganese oxides.
78.5	Fracture, 45°, moderately rough, slightly weathered, intersects 45° fracture above.
78.6	Fracture, 30°, moderately rough, slightly weathered.
78.7	Fracture, 30°, moderately rough, irregular, slightly weathered.
78.8	Fracture, 30°, moderately rough, irregular, slightly weathered, lightly stained with iron oxides.
79.0	Fracture, 0°, moderately rough, irregular, fresh.
79.3	Fracture, 30°, moderately rough, irregular, fresh, partially intersects 45° fracture below.
79.3	Fracture, 45°, moderately rough, irregular, slightly weathered, numerous wedge–shaped rock chips.
79.6	Fracture, 30°, rough, irregular, fresh.
79.8	Fracture, 10°, moderately rough, moderately weathered, coated with calcite, 3 mm thick.
79.8 – 79.9	Fracture, 45°, rough, irregular, fresh, partially intersects 10° fracture above.
80.1	Fracture, 30°, moderately rough, fresh.
80.3	Fracture, 40°, moderately rough, slightly weathered, traces of light olive gray very fine sand and silt.
80.4	Fracture, 60°, rough, fresh.
80.4 – 80.5	Fracture zone, crushed and intensely spaced intersecting fractures, fresh.
80.5	Fracture, 45°, moderately rough, slightly weathered, trace of oxide stains.
80.5	Fracture, 45°, moderately rough, slightly weathered, trace of oxide stains, intersects 45° fracture above.
80.7	Fracture, 45°, moderately rough, slightly weathered, trace of light olive gray mineralization.
80.9	Fracture, 45°, moderately rough, fresh.
81.1	Fracture, 45°, moderately rough, fresh.
81.3	Fracture, 45°, rough, slightly weathered, trace of iron oxide stains.
81.4	Fracture, 45°, rough, slightly weathered, lightly stained with iron oxide, trace of sericite.
81.7	Fracture, 30°, moderately rough, slightly weathered, trace of sericite and coatings of very fine sand and silt.
81.8	Fracture, 30°, moderately rough, slightly weathered, trace of sericite and coatings of very fine sand and silt.
81.9	Fracture, 45°, moderately rough, irregular, moderately weathered, coated with light olive gray mineralization.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
82.0 – 82.4	Fracture, 60°, moderately smooth, severely weathered, coated with olive gray silt, clay, and crushed rock fragments.
82.4 – 82.7	Fracture, 60°, moderately rough, moderately weathered, stained with iron and manganese oxides, coated with light olive gray silt.
82.6	Fracture, 30°, moderately rough, irregular, moderately weathered, stained with iron and manganese oxides, intersects 60° fracture above.
82.8	Fracture, 30°, stepped, slightly weathered, deposits of light gray fine sand.
83.0	Fracture, 45°, moderately rough, irregular, moderately weathered, coated with hard, olive gray mineralization.
83.1	Fracture, 30°, moderately rough, irregular, slightly weathered, stained with iron and manganese oxides.
83.2	Fracture, 30°, moderately rough, irregular, slightly weathered, stained medium olive brown.
83.4	Fracture, 30°, rough, irregular, fresh.
83.5	Fracture, 45°, moderately rough, moderately weathered, stained grayish olive and with iron and manganese oxides, moderately altered, sericite present.
84.0	Fracture, 30°, moderately rough, irregular, moderately weathered, coated with light olive brown silt and fine sand.
84.0 – 84.2	Fracture, 70°, rough, fresh.
84.0 – 84.2	Fracture, 70°, rough, fresh, intersects 70° fracture above.
84.2	Fracture, 30°, moderately rough, slightly weathered.
84.2 – 84.5	Fracture, 70°, occurs along side of core, moderately smooth, moderately weathered, coated with grayish olive sandy clay, 3 mm thick.
84.3 – 84.5	Fracture, 45°, moderately rough, irregular, slightly weathered.
84.5 – 84.7	Fracture, 45°, moderately rough, moderately weathered, stained with iron and manganese oxides.
84.7 – 85.0	Fracture zone, crushed.
85.0	Fracture, 45°, moderately rough, moderately weathered, coated with medium gray clay.
85.2 – 85.4	Fracture, 60°, moderately rough, irregular, slightly weathered, stained with chlorite.
85.3	Fracture, 45°, moderately rough, slightly weathered, intersects 60° fracture above.
85.8	Fracture, 45°, moderately smooth, slightly weathered, stained medium light gray.
85.9	Fracture, 45°, moderately smooth, irregular, moderately weathered, slickensides, coated with medium light gray mineralization, 2 mm thick.
86.9	Fracture, 70°, rough, moderately weathered, stained with iron and manganese oxides, coated with light olive gray mineralization, 1 mm thick.
87.3	Fracture, 45°, moderately rough, moderately weathered, coated with light olive gray mineralization, 1 mm thick.
88.0	Fracture, 0°, rough, irregular, fresh.
88.1 – 88.2	Fractures, two partially intersecting fractures, 45° each, moderately rough, moderately weathered, stained pale olive and with iron and manganese oxides.
88.2 – 88.3	Fracture zone, crushed to intensely fractured, numerous wedge-shaped rock fragments.
88.3	Fracture, 30°, moderately smooth, moderately weathered, stained light olive brown and with iron oxide.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
88.3	Fracture, 45°, smooth, moderately weathered, stained with iron oxide and chlorite, slightly altered.
88.8	Fracture, 45°, smooth, moderately weathered, stained with iron oxide and chlorite, slightly altered.
89.1	Fracture, 60°, stepped, moderately weathered, coated with light olive gray mineralization, 1 mm thick.
89.1 – 89.5	Fracture, 80°, moderately smooth, coated with olive gray to olive brown mineralization, 1 mm thick.
89.5	Fracture, 60°, moderately rough, slightly weathered, stained light olive gray and with iron oxide.
89.8	Fracture, 45°, moderately rough, fresh.
90.0	Fracture, 45°, moderately rough, fresh.
90.2	Fracture, 45°, moderately smooth, moderately weathered, coated with chlorite 1 mm thick, slickensides.
90.3	Fracture, 60°, moderately smooth, irregular, moderately weathered, coated with medium gray clay, 1 mm thick, slickensides.
90.6	Fracture, 60°, moderately rough, slightly weathered.
90.8	Fracture, 30°, stepped, fresh.
91.9	Fracture, 60°, moderately rough, slightly weathered, lightly stained with iron oxide.
92.1 – 92.6	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock chips, predominant fractures oriented 70° to 90°, moderately rough, irregular, slightly weathered, stained with iron oxide.
92.6 – 92.7	Fracture zone, crushed, and intensely spaced fractures, feldspar vein.
92.7 – 93.0	Core loss 0.3 foot.
93.0 – 94.0	Fracture zone, crushed to intensely fractured, stained with iron oxide, slightly weathered, predominant fractures oriented 0° to 30°.
94.0 – 94.1	Fracture zone, crushed rubble, exhibits mechanical wear.
94.1 – 94.3	Fracture, 60°, moderately smooth, severely weathered, stained with iron oxide and chlorite, coated with calcite, partially intersects 30° fracture below.
94.3	Fracture, 30°, moderately smooth, moderately weathered, coated with medium hard olive gray mineralization.
94.3 – 94.5	Fracture, 70°, numerous wedge–shaped rock fragments, moderately rough, irregular, fresh.
94.8	Fracture, 30°, moderately rough, moderately weathered, stained with chlorite, moderately hydrothermally altered.
95.0	Fracture, 30°, moderately smooth, severely altered, abundant chlorite staining, minor calcite.
95.5	Fracture, 60°, rough, severely altered, abundant chlorite and iron oxide, staining, sericite and minor calcite.
95.6	Fracture, 45°, rough, severely altered, abundant chlorite and iron oxide staining, sericite and minor calcite.
95.8 – 98.0	Core loss 2.2 feet.
98.0	Drill break.
98.0 – 98.2	Fracture, 90°, moderately smooth, moderately weathered, coated with fine grained, greenish gray mineralization, 1 mm thick.
98.0 – 98.2	Fracture, 50°, moderately smooth, moderately weathered, coated with fine grained, greenish gray mineralization, 1 mm thick, intersects 90° fracture

* Inclination of feature measured with respect to a plane normal to the axis of the core.

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FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
	above.
98.2	Fracture, 30°, moderately smooth, moderately weathered, slightly altered, sericite.
98.2 – 98.4	Fracture, 90°, moderately smooth, severely weathered and altered, intersected by calcite vein, 1–3 mm thick.
98.4	Fracture, 10°, moderately rough, exhibits mechanical wear.
98.4 – 98.6	Fracture, 90°, moderately rough, moderately weathered, coated with light olive gray clay, 1 mm thick.
98.6	Fracture, 45°, moderately rough, irregular, stained with iron oxide and chlorite.
98.6 – 99.1	Fracture zone, intensely spaced intersecting fractures, predominant fractures oriented 45° to 90°, includes moderately healed fracture sealed with calcite 1–3 mm thick.
98.8 – 99.2	Fracture, 90°, moderately rough, irregular, moderately weathered, coated with light olive gray sandy clay, 1 mm thick, slickensides.
99.1	Fracture, 45°, rough, irregular, fresh, intersects 90° fracture above.
99.1 – 99.2	Fracture, 90°, moderately rough, irregular, moderately weathered, lightly coated with calcite.
99.2 – 99.4	Fracture zone, numerous wedge–shaped rock fragments, includes moderately healed fracture, 50°, sealed with calcite, <1 mm thick.
99.4 – 99.6	Fracture, 50°, moderately smooth, moderately weathered, coated with medium gray mineralization.
99.6 – 99.7	Fracture zone, crushed, and intensely spaced fractures, fresh.
99.7	Fracture, 30°, moderately rough, irregular.
99.7 – 99.9	Fracture, 50°, moderately smooth, moderately weathered, coated with medium gray sandy clay, 1–3 mm thick.
99.9 – 100.1	Fracture, 50°, moderately smooth, moderately weathered, coated with medium gray sandy clay, 1–3 mm thick.
100.1 – 100.2	Fracture, 35°, moderately rough, irregular, moderately weathered, stained with chlorite and iron oxide.
100.3	Mechanical break, 0°.
100.4 – 101.4	Fracture, 80°, rough, moderately weathered, stained with chlorite and iron oxide, numerous wedge–shaped rock fragments.
100.6	Fracture, 45°, moderately rough, irregular, slightly weathered, partially intersects 80° fracture above.
101.0	Fracture, 30°, moderately rough, slightly weathered, intersects 80° fracture above.
101.1	Fracture, 30°, moderately rough, slightly weathered, intersects 80° fracture above.
101.3	Fracture, 30°, moderately rough, fresh, intersects 80° fracture above.
101.4	Fracture, 30°, moderately rough, fresh, intersects 80° fracture above.
101.5	Fracture, 30°, rough, fresh.
101.7 – 101.8	Fracture zone, crushed rubble, exhibits mechanical wear.
102.0	Fracture, 30°, rough, fresh.
102.0 – 102.2	Fracture, 90°, rough, moderately weathered, stained with chlorite and iron oxide, coated with fine– and medium–grained rock particles.
102.2 – 103.0	Core loss 0.8 foot.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
103.0	Drill break.
103.3 – 105.6	Fracture, 90°, moderately rough, moderately weathered, stained with iron oxide chlorite, coated with fine–grained rock particles, 1 mm thick, numerous rock chips.
103.1 – 103.2	Fracture, 60°, moderately rough, stained with iron oxide chlorite, coated with fine–grained rock particles, 1 mm thick, numerous rock chips, partially intersects 90° fracture above.
103.2 – 103.3	Fracture zone, crushed.
103.4	Fracture, 30°, rough, irregular, slightly weathered, partially intersects 90° fracture above.
103.5	Fracture, 0°, moderately rough, irregular, fresh, partially intersects 90° fracture above.
103.6	Fracture, 10°, moderately rough, irregular, fresh, partially intersects 90° fracture above.
103.8	Fracture, 10°, moderately rough, irregular, slightly weathered, partially intersects 90° fracture above.
103.8 – 104.0	Fracture zone, crushed and intensely spaced intersecting fractures.
104.0	Fracture, 25°, moderately rough, irregular, slightly weathered, intersects 90° fracture above.
104.0	Fracture, 30°, moderately rough, irregular, slightly weathered, intersects 90° and 25° fractures above.
104.1	Fracture, 30°, moderately rough, fresh, intersects 90° fracture above.
104.2	Fracture, 30°, moderately rough, slightly weathered, intersects 90° fracture above.
104.3	Fracture, 30°, moderately rough, fresh, intersects 90° fracture above.
104.3 – 104.6	Fracture zone, crushed, moderately weathered, intersects 90° fracture above.
104.6	Fracture, 30°, rough, irregular, moderately weathered, coated with crushed rock particles, intersects 90° fracture above.
104.6 – 104.8	Fracture zone, numerous wedge–shaped rock fragments, moderately weathered.
105.3	Fracture, 30°, rough, irregular, fresh, partially intersects 90° fracture above.
105.7 – 105.9	Fracture, 60°, rough, slightly weathered.
106.4	Fracture, 10°, moderately rough, fresh.
106.4 – 107.3	Fracture, 80°, moderately smooth, highly weathered, stained with iron oxide, coated with light olive brown clayey sand, 1–3 mm thick, slickensides.
106.9	Fracture, 0°, rough, fresh.
107.0	Fracture, 60°, rough, moderately weathered, coated with light olive gray clayey sand and rock particles, 1 mm thick.
108.0	Fracture, 45°, moderately rough, slightly weathered.
108.3	Fracture, 45°, stepped, slightly weathered.
108.4	Fracture, 45°, stepped, slightly weathered.
108.6	Fracture, 45°, stepped, moderately weathered, coated with dusky yellow fine–grained particles.
109.0	Fracture, 45°, moderately rough, fresh.
109.0 – 109.5	Fracture, 70°, moderately rough, irregular, highly weathered, coated with light olive gray clay, 1 mm thick.
109.5	Fracture, 70°, moderately rough, irregular, moderately weathered, stained with light olive gray and with iron oxide.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
109.6	Fracture, 70°, moderately rough, irregular, moderately weathered, stained with light olive gray and with iron oxide.
109.8	Fracture, 20°, moderately rough, moderately weathered, trace calcite mineralization.
110.1	Fracture, 45°, moderately rough, moderately weathered, lightly coated with medium gray mineralization, 1 mm thick.
110.9	Fracture, 45°, rough, irregular, fresh.
110.9 – 111.1	Vein of feldspar, 45°, 6 cm thick.
111.5	Fracture, 45°, rough, slightly weathered, stained medium light gray.
111.9	Fracture, 60°, rough, irregular, moderately weathered, coated with yellowish gray clayey sand, 1 mm thick.
112.5	Fracture, 40°, rough, irregular, slightly weathered.
112.5 – 112.7	Fracture, 80°, rough, occurs along side of core, rough, fresh.
113.0	Fracture, 60°, rough, irregular, fresh.
113.1 – 113.6	Fracture, 70°, moderately rough, irregular, numerous wedge–shaped fragments, lightly stained with iron oxide, coated with light olive gray clayey sand and some calcite.
113.3 – 113.9	Fracture, 70°, moderately rough, irregular, highly weathered, numerous wedge–shaped fragments, lightly stained with iron oxide, coated with light olive silty clay, <1 mm thick, intersects 70° fracture above.
113.2	Fracture, 30°, rough, moderately weathered, coated with light olive gray silty clay, 1 mm thick, intersects 70° fracture above.
113.6	Fracture, 0°, stepped, fresh, partially intersects 70° fracture above.
113.8	Fracture, 30°, rough, irregular, slightly weathered, intersects 70° fracture above.
114.3	Fracture, 45°, rough, fresh.
114.6	Fracture, 30°, moderately smooth, stained yellowish gray.
114.8	Fracture, 45°, moderately rough, coated with light gray calcite, 1 mm thick.
116.0	Fracture, 45°, rough, slightly weathered, lightly stained with iron and manganese oxides.
116.2	Fracture, 30°, moderately rough, fresh.
116.9	Fracture, 45°, moderately rough, slightly weathered, lightly stained with iron and manganese oxides, lightly coated with calcite.
117.3	Fracture, 45°, moderately rough, slightly weathered, lightly stained with iron and manganese oxides, lightly coated with calcite.
117.8	Fracture, 45°, moderately rough, slightly weathered, lightly stained with iron and manganese oxides, lightly coated with calcite.
117.9	Fracture, 20°, rough, slightly weathered, lightly coated with calcite.
118.0	Fracture, 0°, rough, irregular, slightly weathered, lightly stained with manganese oxide.
118.0 – 118.5	Fracture, 90°, moderately rough, irregular, moderately weathered, coated with medium light gray calcite, 1 mm thick.
118.5	Fracture, 45°, moderately rough, irregular, moderately weathered, coated with medium light gray calcite, 1 mm thick.
118.6 – 118.7	Fracture zone, crushed rubble, slightly weathered, lightly stained with iron oxide and manganese oxides.
118.8	Fracture, 45°, rough, fresh.
118.9	Fracture, 45°, moderately smooth, moderately weathered, coated with medium dark gray clay and trace of calcite, 1 mm thick.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

NEW LOS PADRES DAM SITE

FRACTURE LOG

Attachment to Geologic Drill Log of Boring LA-1

Depth (ft)	Description of Geologic Feature*
118.9 – 119.3	Fracture, 70°, numerous wedge–shaped rock fragments, slightly rough, coated with medium dark gray clay and trace of calcite, 1 mm thick.
119.1 – 119.4	Fracture, 70°, numerous wedge–shaped rock fragments, slightly rough, coated with medium dark gray clay and trace of calcite, 1 mm thick.
119.5	Fracture, 45°, rough, coated with medium gray mineralization and crushed rock, 1 mm thick.
119.5	Fracture, 0°, rough, fresh, intersects 45° fracture above.
119.8	Fracture, 45°, moderately rough, slightly weathered, stained medium light gray.
120.2	Fracture, 10°, moderately rough, slightly weathered, stained medium light gray.
120.7	Incipient fracture, 0°, hairline crack.
121.2	Fracture, 10°, moderately rough, slightly weathered, lightly coated with medium light gray mineralization.
121.2 – 121.3	Fracture, 60°, moderately rough, fresh, partially intersects 10° fracture above.
121.6	Fracture, 45°, rough, irregular, moderately weathered, coated with calcite, 1 mm thick.
121.8	Fracture, 45°, rough, irregular, moderately weathered, coated with calcite, 1 mm thick.
121.8	Fracture, 45°, rough, slightly weathered.
122.2	Fracture, 45°, rough, slightly weathered.
122.2 – 122.3	Fracture zone, 60°, intensely fractured, rough, fresh.
122.3	Fracture, 30°, rough, fresh.
122.8	Fracture, 45°, moderately rough, slightly weathered, lightly stained with chlorite.
122.8 – 122.9	Fracture zone, crushed.
123.0	Fracture, 60°, moderately smooth, slightly weathered, irregular, stained medium light gray.
123.2	Fracture, 60°, slightly rough, irregular, slightly weathered, stained medium light gray.
123.2 – 123.4	Fracture zone, intensely spaced fractures, numerous wedge–shaped rock fragments, stained with manganese oxides.
123.4	Fracture, 60°, moderately smooth, irregular, slightly weathered, lightly stained with manganese oxide.
123.4 – 124.9	Fracture, 70°, moderately rough, irregular, moderately weathered, stained brownish gray to medium light gray.
123.8	Fracture, 30°, rough, slightly weathered, intersects 70° fracture above.
123.9 – 124.7	Fracture, 70°, moderately rough, irregular, stained brownish gray to medium light gray.
124.0	Fracture, 0°, rough, irregular, fresh, intersects 70° fracture above.
124.2	Fracture, 30°, moderately rough, slightly weathered, intersects 70° fracture above.
124.2	Fracture, 45°, moderately rough, irregular, coated with medium light gray silt and sand and some calcite, 1 mm thick, intersects 70° fracture above.
124.6	Fracture, 45°, moderately rough, irregular, slightly weathered, partially intersects 70° fracture above.
124.7	Fracture, 45°, moderately rough, irregular, slightly weathered, partially intersects 70° fracture above.
124.7 – 125.0	Core loss 0.3 foot.

* Inclination of feature measured with respect to a plane normal to the axis of the core.

APPENDIX A.4

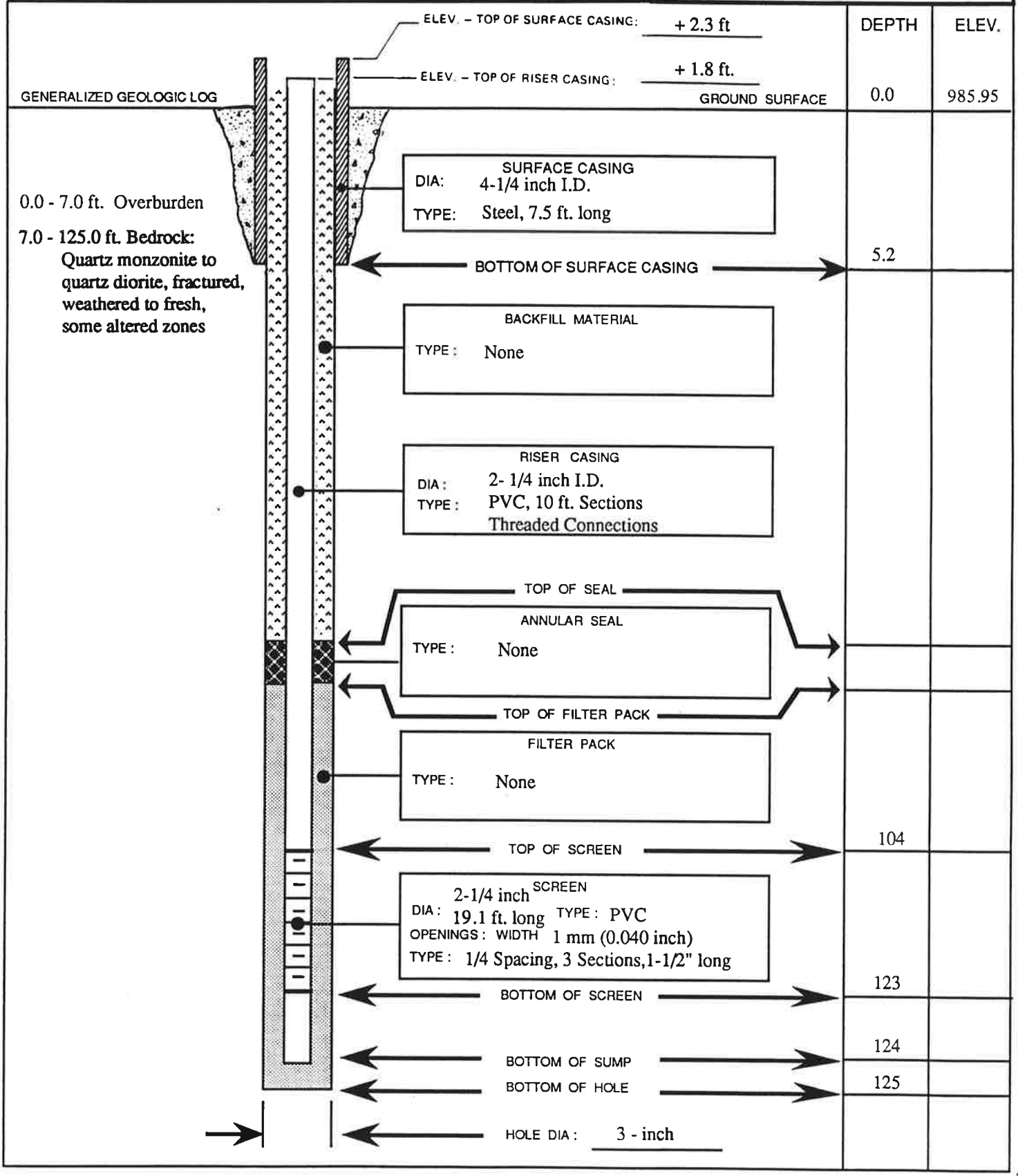
Monitoring Well Logs

OBSERVATION WELL

PROJECT	WELL NO.
NEW LOS PADRES DAM SITE	LA-1

JOB NO.	SITE	COORDINATES
21675	LEFT ABUTMENT NEAR AXIS	N 396,824.72 E 1,215,341.76

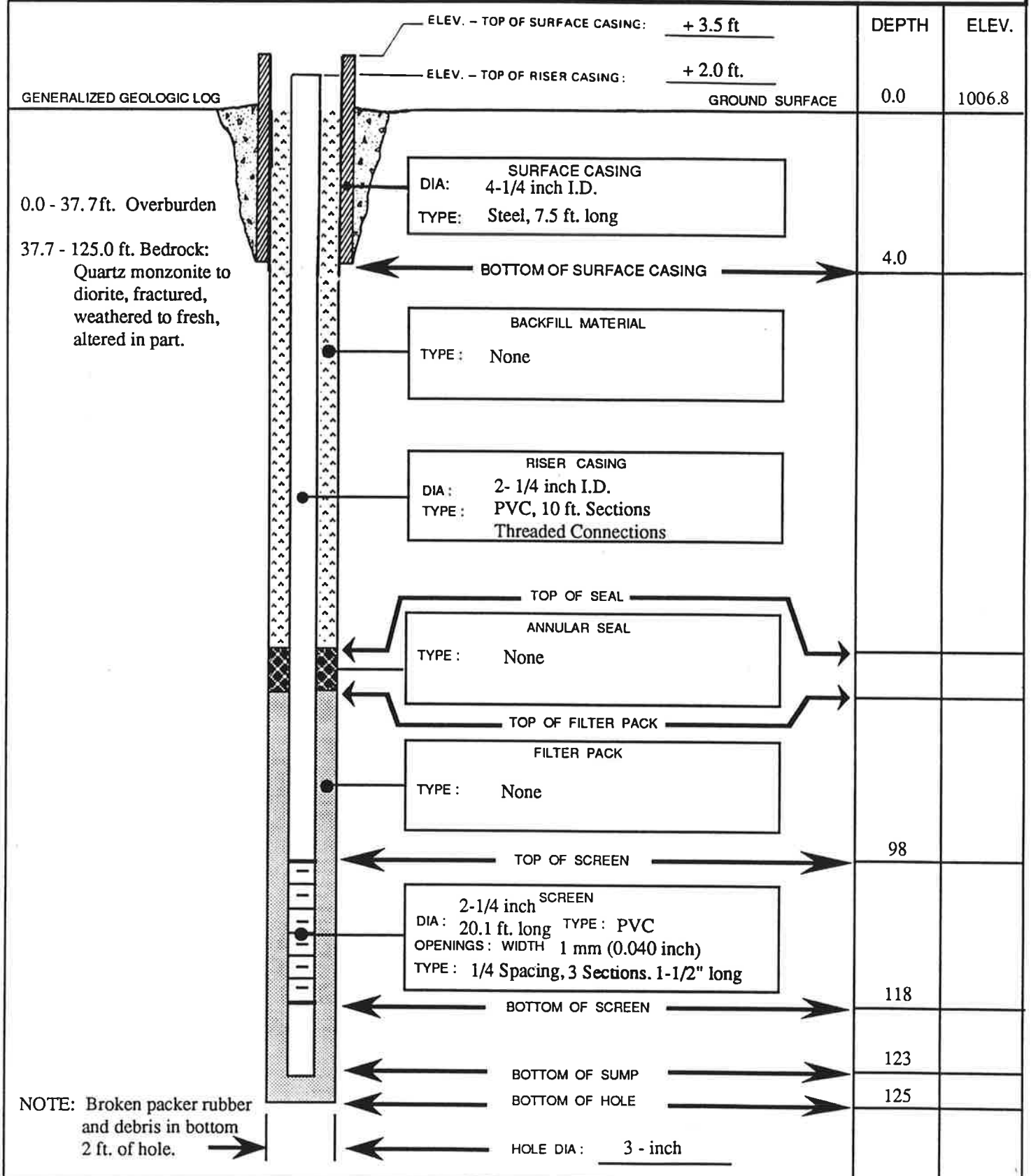
BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
12-4-91	12-4-91	T. F. MULLEN	GROUND SURFACE



	DEPTH	ELEV.
GROUND SURFACE	0.0	985.95
BOTTOM OF SURFACE CASING	5.2	
TOP OF SEAL		
TOP OF FILTER PACK		
TOP OF SCREEN	104	
BOTTOM OF SCREEN	123	
BOTTOM OF SUMP	124	
BOTTOM OF HOLE	125	

OBSERVATION WELL

PROJECT: NEW LOS PADRES DAM SITE			WELL NO.: RA-1
JOB NO.: 21675	SITE: RIGHT ABUTMENT NEAR AXIS	COORDINATES: N 396,444.53 E 1, 215,891.14	
BEGUN: 11-22-91	COMPLETED: 11-22-91	PREPARED BY: R. BISIO	REFERENCE POINT FOR MEASUREMENTS: GROUND SURFACE



DEPTH	ELEV.
0.0	1006.8
4.0	
98	
118	
123	
125	

APPENDIX A.5

Trench Logs

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-1

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 15' x15'

Ground Elevation: 966 — Ground Water Elevation: None — Date Excavated: Dec. 2, 1991

Bottom Elevation: 951 — Location: Borrow Area A -- northwest end

Depth: 15' — N396035.73 E 1215393.12

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML) brown, roots, silt 70%, sand 25%, gravel 5%, moist.	ML			Using Case 680H backhoe; bucket 2.5' wide, 1 yd^3 vol.
3-7	TERRACE DEPOSITS Silty Gravelly Sand (SP), brown, dry; poorly graded, some mica, arkosic, sand 55%, gravel 35%, silt 10%; +3" 90% of gravel, max. 4', avg. 1'. Granitic clasts fresh, hard, unstained, rounded, poorly graded.	SP		2.5	Grab samples placed in unlined canvas sacks. Hard digging; boulders to 4' diameter.
7-12	Gravelly Silty Sand (SW), brown to tan, moist, well graded, some mica, arkosic, sand 75%, silt 10%, gravel 15%; + 3" 0%, some gravel weathered and easily crushed.			5.0	
12-15	Gravelly Silty Sand (SW), tan, moist, well graded, some mica, arkosic, sand 60%, gravel 30%, silt 10%; + 3" 50%, max. gravel 1', avg. 3"; about 50% gravel weathered and crushed with hammer blows.	SW	2 sacks	7.5	Easier digging, no boulders.
				10.0	
		SW	3 sacks	12.5	
	Total depth 15'			15.0	Limit of backhoe 15'. Backfilled trench.

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE
Trench No.: T-2
Job. No.: 21675-000
Trench Dimensions*: Trench 4' x 24' x 11'
Ground Elevation: 963
Ground Water Elevation: None
Date Excavated: Dec. 2, 1991
Bottom Elevation: 952
Location: Borrow Area A, northeast end
N 395735.09 E 1215567.12
Depth: 11 ft.

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML), brown, roots, moist; silt 75% sand 20%, gravel 5%; + 3" 0%, max. gravel 6", avg <1".	ML		2.5	Using Case 680H backhoe with 1 yd³ bucket. Grab samples placed in unlined canvas sacks, 50 lb; +3" gravel scalped.
3-11	TERRACE DEPOSITS Silty Sandy Gravel (GP), brown, dry, skip graded, some mica, arkosic. Gravel 55%, sand 35%, silt 10%; + 3" 70%, max. 6', avg. 6". Rounded granitic clasts, hard, fresh. Some schist clasts (~15% total gravel) highly weathered to moderately weathered.	GP	1 sack	5.0	Hard digging; boulders to 4' diameter.
			1 sack	7.5	
			3 sacks	10.0	Sides caving in ~1'.
	Total Depth 11'			11	Refusal at 11'; too many boulders >5' diameter. Backfilled trench.
				12.5	
				15.0	

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-3

Job. No.: 21675-000 — Trench Dimensions*: 3x17x12

Ground Elevation: 968 — Ground Water Elevation: None — Date Excavated: Dec. 2, 1991

Bottom Elevation: 956 — Location: Borrow Area A -- northeast end
N 395603.59 E 1215429.28

Depth: 12'

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML) brown, roots, moist, silt 70%, sand 25%, gravel 5%; + 3" gravel 0%.	ML	1 sack	2.5	Using case 680 H backhoe with 1 yd^3 bucket. Grab samples placed in 50 lb., unlined canvas sacks; + 3" gravel scalped.
3-9	TERRACE DEPOSITS Silty Sand (SM): reddish brown, medium to coarse grained, poorly graded, moist, arkosic, sand 65%, silt 15%, gravel 20%; +3" 0%, avg. gravel 1/4", few decomposed.	SM	1 sack	5.0	Easy digging, straight sides with no caving.
9-12	Sandy Gravel (GP): reddish brown, skip graded, fine to coarse grained, some mica, moist, arkosic, gravel 60%, sand 30%, silt 10%; +3% 70%, max. gravel 3', avg. 5"; schist clasts, which predominate, are highly weathered; granitic clasts typically sound, all uncoated and rounded.	GP	3 sacks	7.5 10.0	Refusal at 12 ft; may be bedrock.
	Total Depth 12'			12 12.5 15.0	Backfilled trench.

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-4

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 20' x 15'

Ground Elevation: 981 — Ground Water Elevation: None — Date Excavated: Dec. 2, 1991

Bottom Elevation: 966 — Location: West of Borrow Area A

Depth: 15' — N 395722.67 E 1215250.96

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML), brown, roots, moist, silt 75% sand, 24%, gravel 1%, + 3" gravel 0%.	ML		2.5	Using Case 680H backhoe, 1 yd³ bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
3-15	COLLUVIUM Silty Sand (SM), red-brown, well graded sand, moist, some mica, arkosic. Sand 75%, silt 20%, gravel 5%; + 3" gravel 3%. max. 6", few decomposed clasts, sub-rounded to angular gravel.	SM	2 sacks	5.0 7.5	Easy digging, straight walls with no caving.
			1 sack	10.0 12.5	
	Total depth 15.0'		2 sacks	15.0	Limit of backhoe 15' Backfilled trench

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-5

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 18' x 11'

Ground Elevation: 991' — Ground Water Elevation: None — Date Excavated: Dec. 3, 1991

Bottom Elevation: 980' — Location: Borrow Area A -- central

Depth: 11 ft. — N 395480.39 E 1215209.12

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-2	RESIDUAL SOIL Sandy Silt (ML), brown, roots, moist, silt 80%, sand 20%, gravel < 1%.	ML			Using Case 680H backhoe, 1 yd^3 bucket.
2-11	TERRACE DEPOSITS Gravelly Silty Sand (SM), brown, well graded sand, skip-graded gravel, some mica, arkosic. Sand 50%, silt 20%, gravel 30%; + 3" gravel 50%, max. gravel 8', avg. 4", subrounded, ~40% decomposed, mostly metamorphic rocks.	SM	2 sacks	2.5	Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
			1 sack	5.0	Easy digging to 7', hard digging beyond.
			2 sacks	7.5	
	Total depth 11 ft.			10.0	
				11.0	Refusal at 11'; boulder > 8' diameter.
				12.5	Backfilled trench.
				15.0	

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-6

Job. No.: 21675-000 — Trench Dimensions*: Trench 5' x 20' x 10'

Ground Elevation: 923 — Ground Water Elevation: None — Date Excavated: Dec. 3, 1991

Bottom Elevation: 913 — Location: Borrow Area A -- east central

Depth: 10' — N 395488.73 E 1215626.18

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML), dark brown, roots, moist, silt 75%, sand 20%, gravel 5%; + 3" gravel 0%.	ML		2.5	Using Case 680H backhoe, 1 yd^3 bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
3-7	TERRACE DEPOSITS Silty Sandy Gravel (GP), brown, skip-graded, moist, some mica, arkosic. Gravel 45%, sand 40%, silt 15%; + 3" gravel 70%, max. gravel 4', avg. 1. Clasts hard and uncoated, mostly granitic, rounded to sub-rounded; few highly weathered to decomposed, mostly schist.	GP	1 sack	5.0	
			1 sack		Hard digging in gravel; boulders to 5'; sides caving.
7-10	Gravelly Sand (SW), tan, well graded sand, dry, some mica, arkosic. Sand 50%, gravel 45%, silt 5%; + 3" gravel 75%, max. gravel 6', avg. 5". Gravel fresh to moderately weathered.	SW	3 sacks	7.5	Gravel broken by bucket in sacks 3,4,5; not natural.
	Total Depth 10'			10.0	Refusal at 10', large boulders >6'; bedrock? Backfilled trench.
				12.5	
				15.0	

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-7

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 17' x 15'

Ground Elevation: 1039 — Ground Water Elevation: None — Date Excavated: Dec. 3, 1991

Bottom Elevation: 1024 — Location: South of Borrow Area A

Depth: 15' — N 395340.39 E 1214939.65

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	RESIDUAL SOIL Sandy Silt (ML), dark brown, roots, dry; silt 70%, sand 25%, gravel <5%; + 3" gravel 0%.	ML		2.5	Using Case 680H backhoe, 1 yd^3 bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
3-7	COLLUVIUM Silty Gravelly Sand (SP), brown, skip-graded, dry, some mica, arkosic. Sand 50%, gravel 25%, silt 25%; + 3" gravel 60%, max. gravel 2', avg. 4". 60% sub-rounded, highly weathered clasts and about 40% hard, sound, uncoated. Some feldspars and ferromagnesium minerals weathered.	SP	2 sacks	5.0	Hard digging 3-7'; large gravel.
7-10	Silty Sand (SM), brown, well graded, moist, some mica, arkosic. Sand 65%, silt 25%, gravel 5%; + 3" gravel 2%, max. gravel 6", avg. 1/4". All minerals except quartz are weathered in part.	SM	1 sack	7.5 10.0	Easy digging below 7' straight walls.
	Total Depth 15'		2 sacks	12.5 15.0	Limit of backhoe 15'. Backfilled trench.

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-8

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 15' x 6'

Ground Elevation: 1063' — Ground Water Elevation: None — Date Excavated: Dec. 3, 1991

Bottom Elevation: 1057 — Location: Southwest of Borrow Area A

Depth: 6' — N 395572.87 E 1214689.49

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-1	RESIDUAL SOIL Silty Sand(SM), brown, roots, moist, sand 70%, silt 25%, gravel 5%; + 3" gravel 0%.	SM			Using Case 680H backhoe, 1 yd^3 bucket.
		SM		2.5	Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
			1 sack		
1-4	COLLUVIUM Gravelly Silty Sand (SM), red brown, moist, abundant mica, arkosic. Sand 70%, gravel 15%, silt 15%; + 3" gravel 5%, max. gravel 1', avg. 1". Sediments weathered in part, except for quartz.	SM	4 sacks	5.0	Harder digging at 4 feet.
				6	Refusal at bedrock at 6'. Backfilled trench.
4-6	DECOMPOSED ROCK Arkosic, highly weathered to decomposed granodiorite bedrock.			7.5	
	Total Depth 6.0'.			10.0	
				12.5	
				15.0	

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-9

Job. No.: 21675-000 — Trench Dimensions*: Trench 3' x 18' x 15'

Ground Elevation: 989' — Ground Water Elevation: None — Date Excavated: Dec. 4, 1991

Bottom Elevation: 974' — Location: Southeast of Borrow Area A

Depth: 15' — N 395338.80 E 1215136.04

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
1-3	RESIDUAL SOIL Sandy Silt (ML), brown, roots, moist, silt 70%, sand 25%, gravel <5%; + 3" gravel 1%.	ML			Using Case 680H backhoe, 1 yd^3 bucket.
				2.5	Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
3-11	COLLUVIUM Gravelly Silty Sand (SM), red-brown, dry, some mica, arkosic. Sand 60%, silt 25%, gravel 15%; + 3" gravel 7%, max. gravel 4', avg. 5". Much of gravel highly weathered to decomposed, subrounded.	SM		5.0	Harder digging at 5', decomposed boulders.
11-15	TERRACE DEPOSITS Silty Gravelly Sand (SM), brown, dry, well graded, some mica, arkosic. Sand 55%, gravel 30%, silt 15%; + 3" gravel 20%. max. gravel 2', avg. 6". Approximately 50% of gravel highly weathered to decomposed including all schist clasts.		2 sacks	7.5	
			1 sack	10.0	
		SM	2 sacks	12.5	
	Total Depth 15'			15.0	Limit of backhoe 15'. Backfilled trench.

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-10

Job. No.: 21675-000 — Trench Dimensions*: Trench 5' x 18' x 13'

Ground Elevation: 981' — Ground Water Elevation: None — Date Excavated: Dec. 4, 1991

Bottom Elevation: 968' — Location: Borrow Area B -- Central N 394870.37 E 1215414.04

Depth: 13'

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-3	COLLUVIUM Silty Sand (SM), brown, roots, moist, sand 65%, silt 25%, gravel 10%; + 3" gravel 0%, max. gravel 2', avg. 4".	SM		2.5	Using Case 680H backhoe, 1 yd^3 bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
3-13	TERRACE DEPOSITS Silty Sandy Gravel (GP), brown, moist, some mica, skip-graded, arkosic. Gravel 50%, sand 40%, silt 10%; + 3" gravel 60%. About 40% of clasts, mostly schists with some coarse-grained granite, are highly weathered to decomposed.	GP	2 sacks	5.0	Very hard digging, caving of sides.
			1 sack	7.5	Broke tooth on bucket; obtained spare and replaced.
			2 sacks	10.0	
				12.5	Refusal due to large boulders.
	Total Depth 13'			13	Backfilled trench.
				15.0	

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE Trench No. T-11

Job. No.: 21675-000 Trench Dimensions*: Trench 5' x 18' x 13'

Ground Elevation: 979' Ground Water Elevation: None Date Excavated: Dec. 4, 1991

Bottom Elevation: 966' Location: Borrow Area B -- north end

Depth: 13' N 394992.65 E 1215623.44

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
0-1.5	COLLUVIUM Silty Sand (SM), brown, moist, roots, sand 60%, silt 30%, gravel 10%; + 3"gravel 0%.	SM			Using Case 680H backhoe, 1 yd^3 bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
		SP		2.5	
1.5-5	TERRACE DEPOSITS Gravelly Sand (SP), buff, moist, poorly graded, clean, some mica, no fines, arkosic. Sand 85%, gravel 15%; + 3" gravel 50%, max. gravel 2', avg. 4"; subrounded, fresh, uncoated.			5.0	Hard Digging below 5'. Caving at sides.
5-13	Silty Sandy Gravel (GP), light brown, moist, some mica, skip-graded, arkosic. Gravel 60%, sand 35%, silt 5%; + 3" gravel 75%, max. gravel 6', avg. 5"; about 20% highly weathered to decomposed, sub-rounded to rounded. Clasts of granite, meta-sediment, schist and gabbro.	GP	2 sacks	7.5	
				10.0	
			3 sacks	12.5	Refusal due to large boulders. Backfilled trench.
				13	
				15.0	

* Width x length x depth in feet.

Total Depth 13'

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No.: T-12

Job. No.: 21675-000 — Trench Dimensions*: Trench 2.5' x 15' x 15'

Ground Elevation: 1013' — Ground Water Elevation: None — Date Excavated: Dec. 4, 1991

Bottom Elevation: 998' — Location: Right abutment of dam site

Depth: 15' — N 396671.64 E 1216112.56

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
4	RESIDUAL SOIL Silty Sand (SM), brown, moist, roots; sand 50%, silt 45%, gravel <5%; + 3" gravel 0%.	SM		2.5	Using Case 680H backhoe, 1 yd^3 bucket. Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
15	COLLUVIUM Silty Sand (SM), brown, moist, poorly graded, some mica, arkosic. Sand 55%, silt 30%, gravel 15%; + 3" gravel 1%, max. gravel 6", avg. 1/4".	SM	5 sacks	5.0 7.5 10.0 12.5	Easy digging with straight walls.
	Total Depth 15'			15.0	Limit of backhoe 15'. Backfilled trench.

* Width x length x depth in feet.

TRENCH LOG

Project: NEW LOS PADRES DAM SITE — Trench No. T-13

Job. No.: 21675-000 — Trench Dimensions*: Trench 2.5' x 15' x 15'

Ground Elevation: 1039' — Ground Water Elevation: None — Date Excavated: Dec. 4, 1991

Bottom Elevation: 1024' — Location: Right abutment of dam site

Depth: 15' — N 396530.99 E 1216215.71

DEPTH IN FEET	DESCRIPTION	SYMBOL	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	REMARKS
2	RESIDUAL SOIL Silty Sand (SM), brown, moist, roots, arkosic; sand 45%, silt 40%, gravel 15%; + 3" gravel 5%, max. size 6".	SM			Using Case 680H backhoe, 1 yd^3 bucket.
				2.5	Grab samples placed in 50 lb, unlined canvas sacks; + 3" gravel scalped.
15	COLLUVIUM Silty Gravelly Sand (SM), brown, moist, some mica, skip graded, arkosic. Sand 45%, gravel 35%, silt 20%; + 3" gravel 50%, max. gravel 1.5', avg. 3", sub-angular; 60% of gravel highly weathered to decomposed.			5.0	
			2 sacks		Hardest digging at 5', straight walls.
				7.5	
		SM	2 sacks		
				10.0	
				12.5	
			1 sack		
	Total Depth 15'			15.0	Limit of backhoe 15'. Backfilled trench

* Width x length x depth in feet.

APPENDIX B.1

Seismic Refraction Survey Report

APPENDIX B

New Los Padres Dam
Seismic Refraction Survey

June 11, 1992

Summary

This appendix presents the results of a shallow seismic refraction survey that was conducted between December 10th and 13th, 1991, at the proposed New Los Padres dam site, located immediately downstream from the existing Los Padres dam in the Carmel River Valley, California. The investigation was performed for Monterey Peninsula Water Management District as part of a geotechnical study of the site. The primary objective of the seismic refraction survey, in conjunction with the borehole data, is to estimate the depth to rock to be used in overburden volume estimations.

The areas of the upper dam site abutments are moderately sloping and are generally wooded. The areas of the mid to lower abutments show gentle terrace topography and light shrub and grass vegetation. The channel area is also generally wooded with significant boulder fields and rock outcrops.

The layout of the seismic refraction survey, consisting of nine 200' lines, is shown in Figure 4.1 in the main report. The locations of the lines initially were determined using hand-held compass and tape measure readings from various cultural reference points and locations of the existing Boreholes RA-1, LA-1 and C-1. These locations were subsequently surveyed, so that the locations of the seismic lines as shown in the figure are "as built".

Considering both seismic refraction and independent borehole data, the abutment and spillway areas of the site can be briefly characterized. The entire site is comprised of a Mesozoic granitic complex overlain by Quaternary deposits. Within the granitic complex, the seismic data differentiates an upper portion of decomposed granitic rock with a velocity of 7,000 to 8,200 ft/s from a lower more competent granitic rock of +10,000 ft/s velocity. Within the overlying Quaternary deposits, the seismic data differentiate the upper residual soil with a velocity of 1,100 to 1,500 ft/s

from the lower colluvium and terrace deposits - seismically undifferentiable in this data - with velocities of 2,600 to 3,800 ft/s.

Lines 1 to 4 show that the top of the granitic complex is approximately 40 feet deep at the lower right abutment near Borehole RA-1, increasing to a depth of about 60 feet near the top of the right abutment (see Figure 5.2, main text). Along these four lines, the faster competent granitic rock was too deep to observe. The seismic data of Line 1 suggest the possibility that on the west side of this line, toward the river, but before the topographic drop to the river channel, the depth to the granitic complex deepens to about 56 feet - this interpretation does not appear to agree with surface outcrop of rock in the nearby channel, but indicates local model complications due to probable topographic complexity or lateral heterogeneity. Line 7 confirms that the depth to the granitic complex in the vicinity of boring RA-1 is about 40 feet, but 200 feet downstream this depth may increase to as much as 52 feet.

Lines 5 and 6 along the left abutment indicate that the depth to the top of the granitic complex is shallower than for the right abutment. Down slope of Borehole LA-1 the top of the decomposed granite appears at a depth of about 30 feet, shallowing to about 20 feet in an up slope distance of 200 feet. The seismic data are consistent with the observation in Borehole LA-1 in that the thickness of the decomposed granite is about 15 feet.

Lines 8 and 9 indicate that the granitic complex is about 10 feet deep in the area of the spillway covered by these lines. The data appear to indicate that the depth to channel rock is 30 to 40 feet. The interpreted velocities for competent rock for these lines appear high (14,000 to 20,000 ft/s), and the interpreted depths are significantly deeper than indicated in the Borehole C-1. It is possible that the seismic data have been complicated by the presence of boulders or other structural lateral heterogeneities that exist, with the result that the actual top of competent rock has both a velocity and depth less than indicated by the seismic data.

Introduction

The purpose of the refraction survey, performed by Bechtel between the 10th and 13th of December 1991, was to provide information, in conjunction with independent geotechnical data, on the thickness and seismic velocity of near-surface materials at the site.

Nine seismic refraction lines were shot with an actual survey coverage length of 1,800 feet. Data from existing Boreholes RA-1, LA-1 and C-1 (whose locations are shown in the main text Figure 4.1) were used to aid in the interpretation of these refraction lines. The seismic refraction lines are represented in Figure 5.5 of the main report as dashed lines with noted shotpoints at both ends ("A" and "B"), which correspond to the survey points as follows:

Line	Shotpoint A	Survey Point	Shotpoint B	Survey Point
1	L1-1	SP-A	L1-2	SP-B
2	L2-3	SP-B	L2-4	SP-C
3	L3-5	SP-C	L3-6	SP-D
4	L4-7	SP-D	L4-8	SP-E
5	L5-9	SP-G	L5-10	SP-F
6	L6-11	SP-J	L6-12	SP-K
7	L7-13	SP-L	L7-14	SP-M
8	L8-15	SP-N	L8-16	SP-O
9	L9-17	SP-O	L9-18	SP-P

Lines 1 through 4 run along the axis of the right abutment of the proposed dam. Line 1 crosses Borehole RA-1 about 75' from Shotpoint L1-2. Line 7 runs approximately perpendicular to Line 1, coming within about 10' of Borehole RA-1. Lines 5 and 6 were run approximately parallel and perpendicular, respectively, to the dam axis at the midpoint of the left abutment. Line 6 is located about 25' east of

Borehole LA-1. Lines 8 and 9 were run along the proposed spillway directly to the west of the Carmel River. Borehole C-1 is located in the proposed spillway area, directly east of the Carmel River, approximately 100 feet upstream (south) from the end of Line 8.

Data Acquisition

The seismic refraction data were recorded on an EG&G Geometrics ES-1225 exploration seismograph, from signals detected by Mark Products 8 Hz vertical geophones mounted on three-inch spikes. These geophones were connected to a 12-takeout, 50-foot-spacing cable. For all the seismic spreads, geophones were spaced from 5 to 30 feet apart with the closer spacing near the shot ends. Seismic energy was provided by a 16-pound sledge hammer striking an inch thick steel plate approximately one square foot in area. The ES-1225 is a digital stacking recorder, and for each seismic record, several blows were stacked.

The accumulated sledge hammer blows were enhanced with post-stacking trace size adjustments and travel times read from the cathode ray tube (CRT) of the ES-1225. The seismic signals are printed on the ES-1225's paper recorder as a permanent record of that shot point. This record would be designated, for example, as "L2-3", if it were taken beginning from the location of the 3rd shot point of the survey, corresponding to a shot for Line 2.

Since the sledge hammer always provided a downgoing impulse, and the geophones were consistently hooked up with proper polarity, the records were enhanced to display the (often weak) first downgoing signal on each trace. For a given deployment of geophones, shots (hammer blow points) were made at each end of the spread, completing a reversed refraction record pair and providing data for an interpretation of dipping strata. A pair of reversed refraction records, using

the same geophone deployment (with the exception of the first geophone as noted below), is termed a refraction "line".

For the shots made at the ends of each line, the first geophone at that end was moved to a distance half way between the shot point and the second geophone. This choice of shot positions satisfies both the demands of reciprocity (requiring an exact duplication of the path from shot to furthest geophone in the forward and reverse record directions) and the demands of coverage (favoring close geophone spacing near the shot point for ray paths in near-surface materials).

Data Processing

All records were analyzed for consistency. An example of the type quality arrivals typical of this refraction survey is indicated by Figure B.1-1. First-arrival times for each of the 18 records of the survey were picked, tabulated, and entered into a Microsoft Excel worksheet. Series of arrival times for each record were grouped by eye into approximately collinear sets. For a given series of arrival time points, a simple least-squares Excel library algorithm was used to fit the "best" straight line through these points. Each identified line segment corresponds to an apparent velocity for a discrete homogeneous layer. All the records indicate at least three linear sets of arrival times for each record. In some cases, alternative groupings of arrival time data points, allowing alternative interpretations of apparent velocities, occurred. These are discussed below. Plots of both the raw arrival time data and preferred segmentation of the data are shown for each record in Figure B.1-2. These plots were then interpreted by an iterative process as described in the following paragraphs.

An analytical algorithm for the time-intercept method (see Dobrin, 1976) for one or two layers over a half-space, with freely dipping planar interfaces, was

developed for use on a hand calculator. The algorithm requires travel-time reciprocity for all interpreted layers. The reciprocity time was estimated by extrapolating the data's straight line arrival time fit to the end of the spread farthest from the shot point. The algorithm computes depths to layers under each shot point using trigonometric relations among apparent layer velocities and intercept times of arrivals from each layer. The apparent velocities are simply computed from the slope of the straight line fit to first break arrival times, while the intercept time is an extrapolation of the straight line back to the shot point end of the spread. Knowing the length of the spread, it is sufficient to know a layer's intercept time (close end) and its reciprocity time (far end) to compute the apparent velocity of that layer. A schematic of the travel-time plot values used in this interpretation process, along with the trial solution appropriate to these values, is shown in Figure B.1-3.

The algorithm imposes some constraints on the fits to the data. First, the travel-times must approach zero at the shot point. Second, reciprocity is required as noted above. That is, the total travel-time from shot to farthest geophone must be the same for each layer for both the forward and reversed directions of each record pair. Thus, while a dipping refractor may have differing apparent velocities when shot up- or down-dip, refractions from a given layer share a common total travel time. Third, the model assumes that the subsurface is composed of discrete layers of constant velocity, so that the data can be fit with piece-wise continuous straight line segments, and that these velocities increase with depth. In this study area, the effect of surface topography and probable lateral heterogeneities led to some lines giving data that could not fit well within the constraints of this simple model. In these cases, as discussed in the next section, velocities were assumed to be consistent with those observed on nearby, better resolved lines with structures that were geophysically consistent with the known, expected, or possible geologic structures at the site (see Mooney, 1973).

Interpretation Methodology and Results

Data from each seismic refraction line and the interpreted model straight line segments are shown in Figure B.1-2. Considering all constraints imposed by the model, most importantly that total travel times be equal for each refractor, each spread's time-distance plot is fit with three, and sometimes four, straight line segments. The modeling algorithm responds with a dipping interface and homogeneous velocities for each layer.

After each line was processed and interpreted individually and independently, adjacent and crossing lines were checked and often re-interpreted for consistency. All available borehole information was also used for interpretation consistency. The nine lines were composited into five cross-sections as shown in Figures B.1-4 to B.1-7.

In Figures B.1-4 through B.1-7, the seismic refraction survey results are given for each line (shown as a heavy line at the ground surface indicating the shot and geophone spread) with interpreted velocity interfaces shown as solid lines directly below the surface refraction lines. The assumed model yields planar, dipping boundaries, with the dip angle relative to the ground surface by definition. Therefore, the results, which are presented with respect to the actual ground surface elevation, show the attitudes of the interpreted interfaces adjusted relative to the actual topography of the site. Compressional velocity for each layer is indicated.

As noted above and shown in Figures B.1-4 through B.1-7, some lines cross each other, providing data overlap near the intersection points. The locations of seismic refraction lines that intersect the alignments of the cross-section figures are indicated. It was found that interpretations of intersecting refraction lines were relatively consistent with regard to layer velocities and interface depths, and this can be verified by comparing alignment interpretations at these intersection points.

A number of the seismic lines pass near Boreholes RA-1, LA-1 and C-1. Lithologic drill logs for these boreholes appear in Appendix A.2. Correlation of refraction and borehole data showed good agreement on depth to lithologic interfaces and between the lithologies described in the borehole logs and the compressional velocities measured in the seismic refraction survey. This has allowed us to adopt the lithologic descriptions of the borehole logs in the results presented below.

Right Abutment

Lines 2, 3, and 4 were straight-forward in their interpretation. That is, following the interpretation process described above, the initial identification of arrivals with associated refractors led to consistency both in reciprocity times for the forward and reverse shots for a given line and in interpreted layer thicknesses and velocities between the lines. Further, the lines readily correlated to lithology observed in Borehole RA-1. The top stratum of residual soil maintains a thickness for the three lines of 5 to 7 feet with a velocity of 1,200 to 1,400 feet/second. The second layer observed increases in thickness from about 34 feet at the west end on Line 2 to as much as 53 feet at the east end on Line 4. The lithologic log of Borehole RA-1 indicated that this layer corresponds to the colluvium and terrace deposits. With the second layer velocities for the three lines ranging from 2,700 to 3,800 feet/second, the colluvium and terrace deposits are seismically undifferentiable. The third layer observed in all three lines has a velocity of 7,000 to 8,200 feet/second. While this velocity is low for competent granitic rock, it is appropriate for the decomposed granitic rock observed in Borehole RA-1 immediately below the terrace deposits. A higher velocity corresponding to competent granitic rock below the decomposed granitic rock was not observed in these three lines. Figure B.1-4 shows the interpreted cross-section of these three lines.

Interpretation of Line 1 is not as straight-forward as it is for Lines 2, 3, and 4. While Line 1 does show apparently three refractors, like Lines 2, 3, and 4, and the sets of travel-times for the shotpoint shared by Lines 1 and 2 are very similar, the forward and reverse reciprocal times for the second refractor of Line 1 appear to differ by at least 10 ms. The seismic data plot for Line 1 in Figure B.1-2 shows the data with refractors for the forward and reverse shots interpreted independently. Single shot interpretation of a seismic line (that is, interpreting each shotpoint of a line independently as though it was not reversed) results in two different models of non-dipping layers for the line. If notable dip is indeed present along the strata of an unreversed line, then the depths and velocities estimated from the single shot interpretations can be misleading. Single shot interpretations of both ends of a line, when consistent proper reversed line interpretation is problematic, however, is at least instructive. Here, the single shot interpretation of L1-2 is not only fairly consistent with Line 2, but the interface depths are consistent with the lithologic interface depths in Borehole RA-1, located along Line 1 about 75 feet from Shotpoint L1-2 (SP-B). In contrast, the single shot interpretation of L1-1 has the depth to the top of the third layer at about 56 feet. The lack of reciprocity of the second layer suggests that the interface between the second and third layers is more complicated than a simple planar interface. A qualitative interpretation of the seismic data is that the interface between the colluvium / terrace deposits and decomposed granite continues westward from Shotpoint L1-2, as it does in Line 2 at about a 40 foot depth, until at about two/thirds the length of the line to Shotpoint L1-1, the interface bends downward until it is about 56 feet deep at L1-1 - this interpretation does not appear to agree with surface outcrop of rock in the nearby channel, but indicates local model complications due to probable topographic complexity or lateral heterogeneity. Figure B.1-4 shows the interpreted integrated cross-section of Lines 1 through 4.

Line 7, running perpendicular to Line 1, also shows complications of reciprocity for the arrivals from the second of three layers. As for Line 1, the travel-

time data for Line 7 is interpreted as two single shots in Figure B.1-2. Constraints on the interpretation of the south end of Line 7 (Shotpoint L7-13 at Survey Point SP-L) come not only from the intersection with Line 1, but also the proximity of Borehole RA-1. The data of this line, particularly from shotpoint L7-14, suggest that the second layer of colluvium / terrace deposits may thicken to the north, so that the top of the decomposed granite is of the order of 36 feet below Shotpoint L7-13 (SP-L), but about 52 feet below Shotpoint L7-14 (SP-M). A degree of lateral heterogeneity in the second layer is also suggested in the difference in apparent velocity between individually interpreted shots. Lateral heterogeneity could also be contributing to an apparent northward thickening of the colluvium / terrace deposits. The available data could not resolve this point. Figure B.1-6 shows the interpreted cross-section for Line 7.

Left Abutment

Initial interpretation of Lines 5 and 6 appears straight-forward. In Figure B.1-2 the data plots for these lines show consistent 3-layer models. The first layer with a velocity of 1,100 to 1,200 feet/second corresponds well with the residual soil logged in the nearby Borehole LA-1. For Line 5 the thickness of the first layer is about 4 feet below Shotpoint L5-10 and increases up slope to a thickness of about 11 feet below Shotpoint L5-9. For Line 6 the thickness of the first layer is 5 to 6 feet. The second layer for both lines has a velocity of 3,000 to 3,600 feet/second, corresponding to the colluvium. The thickness of the second layer of Line 5 is 27 feet at Shotpoint L5-10 and decreases up slope to 14 feet at Shotpoint L5-9. At the intersection with Line 6, for which the thickness of the second layer is 28 to 30 feet along the entire line, Line 5 gives an estimated 21 feet of thickness of the second layer. Line 5 is located along a topographic edge and may more accurately be indicating a thinning of the colluvium toward this edge than Line 6, which may not be as well situated to detect this effect. Finally, the third layer for both lines has a velocity of 9,500 to 10,000 feet/second, which is interpreted to correspond to competent granitic rock.

Lithologic data from Borehole LA-1 located near and up slope from Line 6 indicate that the interpretations of Lines 5 and 6 described above require adjustment. First, the thickness of the colluvium in Borehole LA-1 is only 18 feet. Second, there are 15 feet of decomposed granite directly below the colluvium and above the more competent granite. Travel-time analysis of Line 6 indicates that a 15-foot thick layer with a velocity of 7,000 feet/second - a more appropriate velocity for the decomposed granite - located between the second and third layers, described above, would indeed be a hidden layer. That is, the 15 feet of decomposed granite would not be observable in the seismic data. Further, consideration of 15 feet of 7,000 feet/second material results in diminishing the thickness of the second layer (colluvium) by 3 to 4 feet. Both inclusion of the decomposed granite and the thinning of the colluvium brings Line 6 into good agreement with Borehole LA-1. The effect of considering 15 feet of decomposed granite below the colluvium is also assumed for Line 5. The resulting four-layer models for Lines 5 and 6 are shown in Figure B.1-5.

Spillway

Lines 8 and 9 both clearly indicate three layers, as shown in the data plots in Figure B.1-2. The first layer is 8 to 10 feet thick and has a velocity of 1,100 to 1,400 feet/second, corresponding to residual soil. The second layer has a velocity of 7,700 feet/second, appropriate for decomposed granite. Similar to Borehole C-1, no colluvium or terrace deposits, identifiable by a velocity of about 2,500 to 4,000 feet/second, are observed here. Thickness of the second layer in Line 8 is nearly constant at 31 to 35 feet. However, over the length of Line 9 the second layer thins to 20 feet thick at the Shotpoint L9-18. The velocity of the third layer at 14,000 to 20,000 feet/second is high and is obviously associated with competent granite.

The good quality and consistency of the data for Lines 8 and 9 notwithstanding, there are notable differences between the interpreted seismic data

here and the data of Borehole C-1. Borehole C-1 does show an 8-foot overburden layer, consistent with Lines 8 and 9, but there is no clear indication of decomposed granite, let alone 20 to 30+ feet of it. Boulder fields and rock outcrops are observed in the immediate area of these lines, so that a depth to competent rock of 30 to 40 feet, as interpreted for the seismic data, seems high. Despite the good quality of the data, it is possible that the seismic data have been rendered misleading by the presence of boulders or other structural lateral heterogeneities, so that the top of competent rock has both a velocity and depth somewhat less than indicated.

Summary of Conclusions

The following is a summary of the results of the seismic refraction survey at the site of the proposed New Los Padres dam.

Lines 1 to 4 show that the top of the granitic complex is approximately 40 feet deep at the lower right abutment near Borehole RA-1, increasing to a depth of about 60 feet near the top of the right abutment (see Figure 5.2, main report). Along these four lines, the faster competent granitic rock was too deep to observe. The seismic data of Line 1 suggest the possibility that on the west side of this line, toward the river, but before the topographic drop to the river channel, the granitic complex deepens to about 56 feet. This interpretation does not appear to agree with surface outcrop of rock in the nearby channel, but indicates local model complications due to probable topographic complexity or lateral heterogeneity. Line 7 confirms that the depth to the granitic complex in the vicinity of Borehole RA-1 is about 40 feet, but 200 feet downstream it may increase to as much as 52 feet.

Lines 5 and 6 along the left abutment indicate that the depth to the top of the granitic complex is shallower than it is for the right abutment. Down slope of Borehole LA-1 the top of the decomposed granite appears at a depth of about 30 feet, shallowing to about 20 feet in an up slope distance of 200 feet. The seismic data are

consistent with the observation in Borehole LA-1 that the thickness of the decomposed granite is about 15 feet.

Lines 8 and 9 indicate that the granitic complex is about 10 feet deep in the area of the spillway covered by these lines. The data appear to indicate that the depth to channel rock is 30 to 40 feet. The interpreted velocities for competent rock for these lines appear high (14,000 to 20,000 ft/s) and the interpreted depths are significantly different than indicated in Borehole C-1. With the observation here of boulder fields and rock outcrops, it is possible that the seismic data have been complicated by the presence of boulders or other structural lateral heterogeneities, so that the actual top of competent rock has a velocity and depth less than indicatednt rock has a velocity and depth less than indicated.

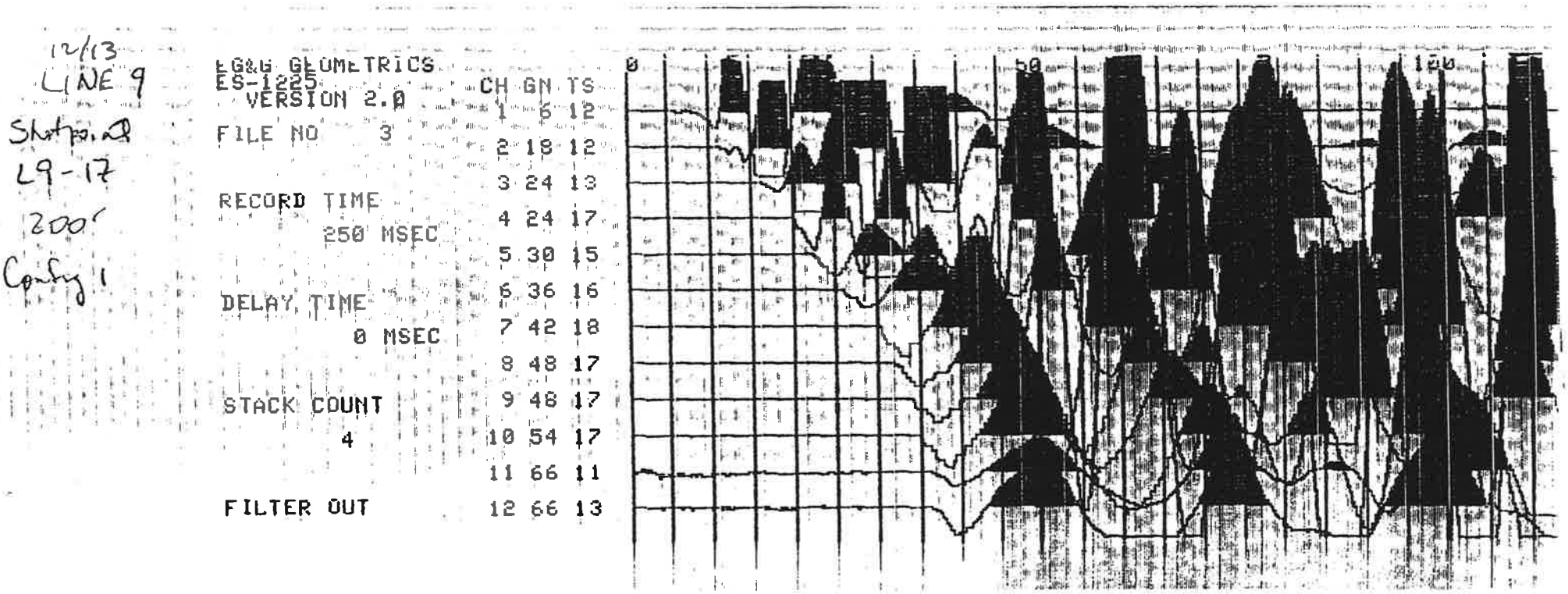
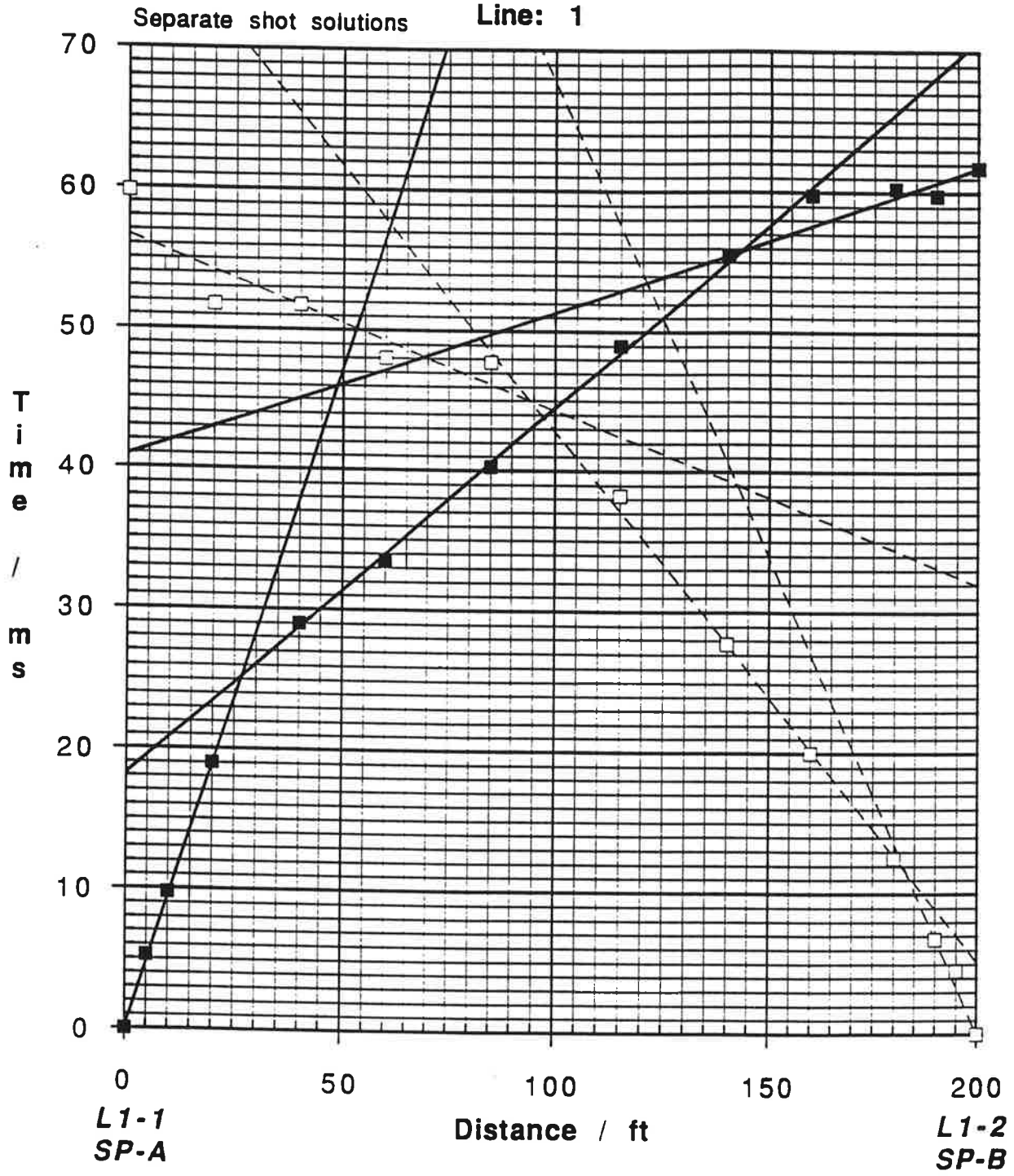


Figure B.1-1. Example recording of a seismic refraction record. This record is for shotpoint L9-17 of Line 9. The geophone distances are 5, 10, 20, 40, 60, 85, 115, 140, 160, 180, 190, and 200 feet for geophones 1 through 12, respectively. The vertical timing lines are given at 5 millisecond intervals. Refraction data used for analysis corresponds primarily to the downward first-arrival time as a function of distance. Signal-to-noise at the far end geophones for other lines was often worse than shown here.

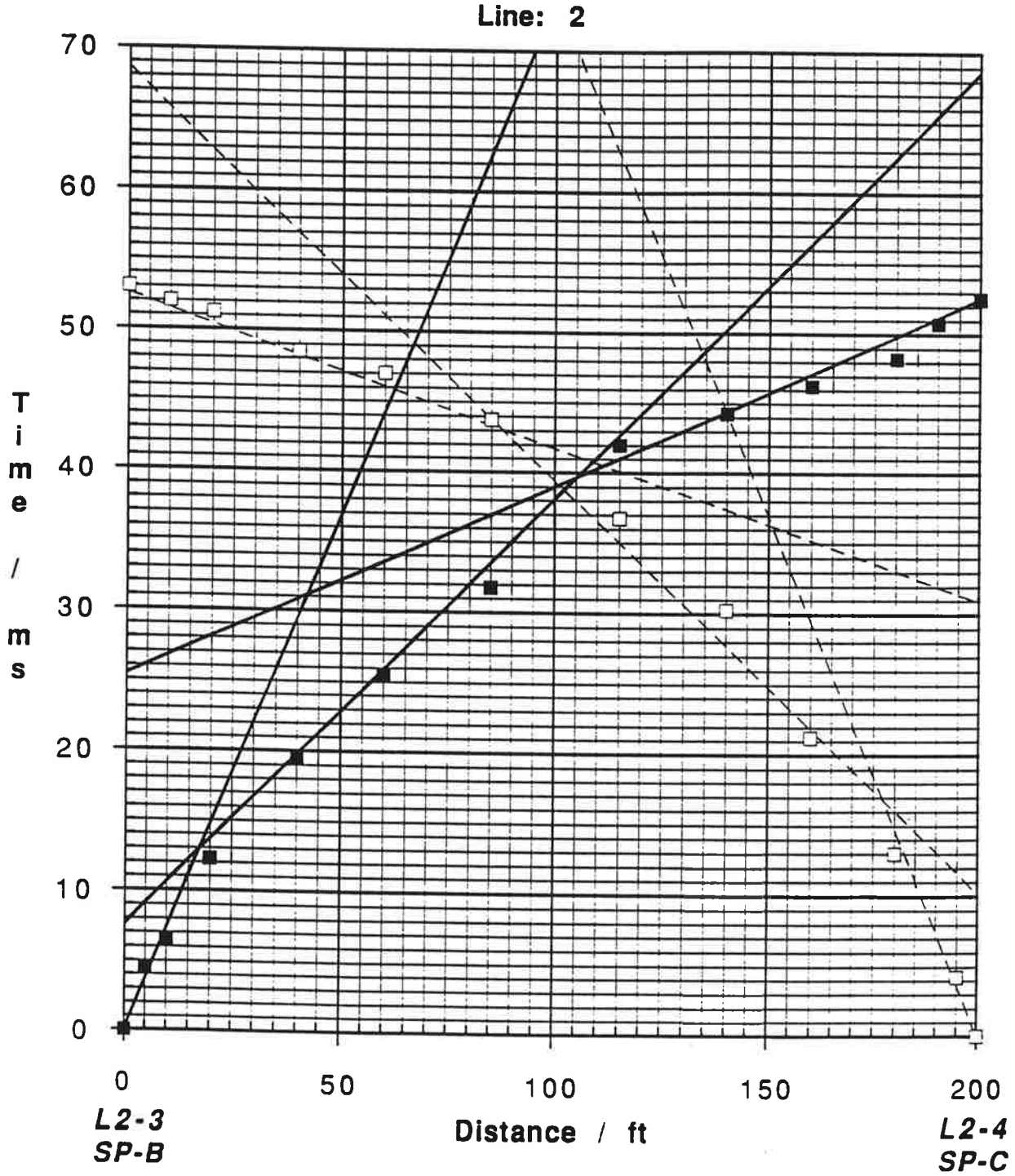
Figure B.1-2. Plots of travel-time data and interpreted direct and refracted arrivals for the 9 lines of the seismic refraction survey are given in the following panels. L*n*-*m* indicates shotpoint, where *n* corresponds to the line number and *m* corresponds to the shot number. Also shown are the survey points SP-# corresponding to the shotpoints - for example, shotpoints L1-2 and L2-3 were both located at survey point SP-B. The survey points are used to mark locations of the seismic survey lines given in the plan map shown in Figure 4.1 of the main text.

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



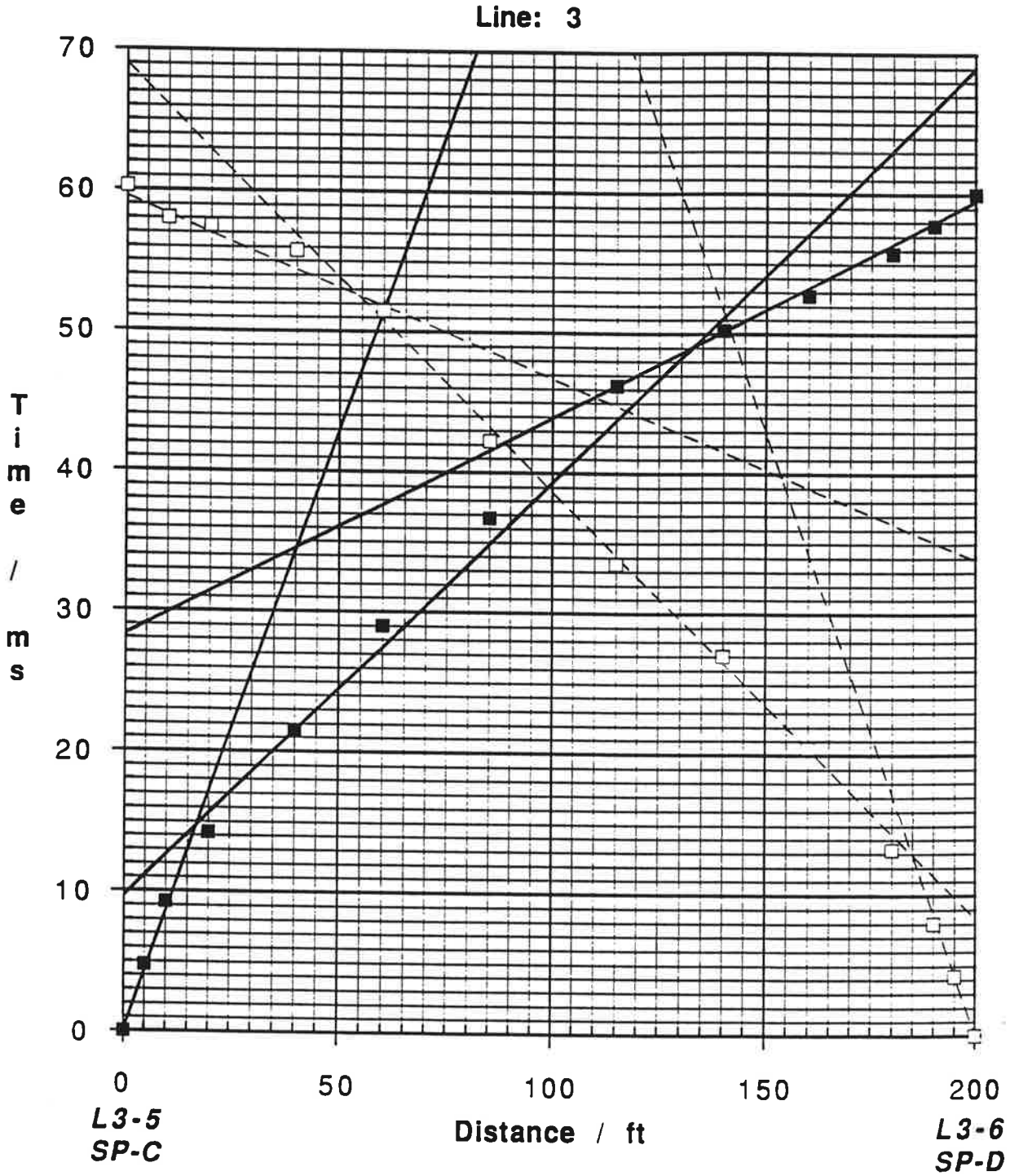
Plot Ln1a NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



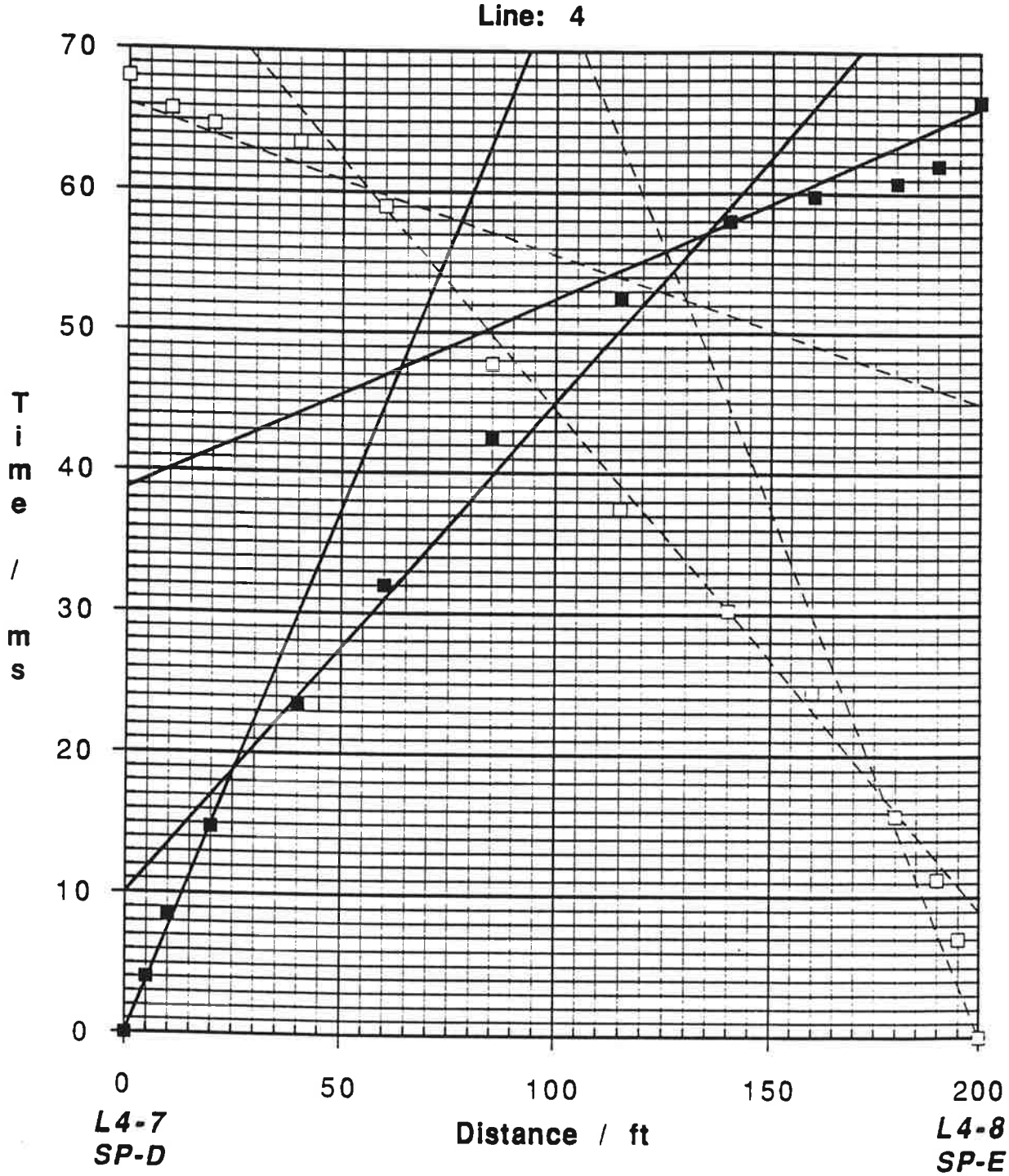
Plot Ln2 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



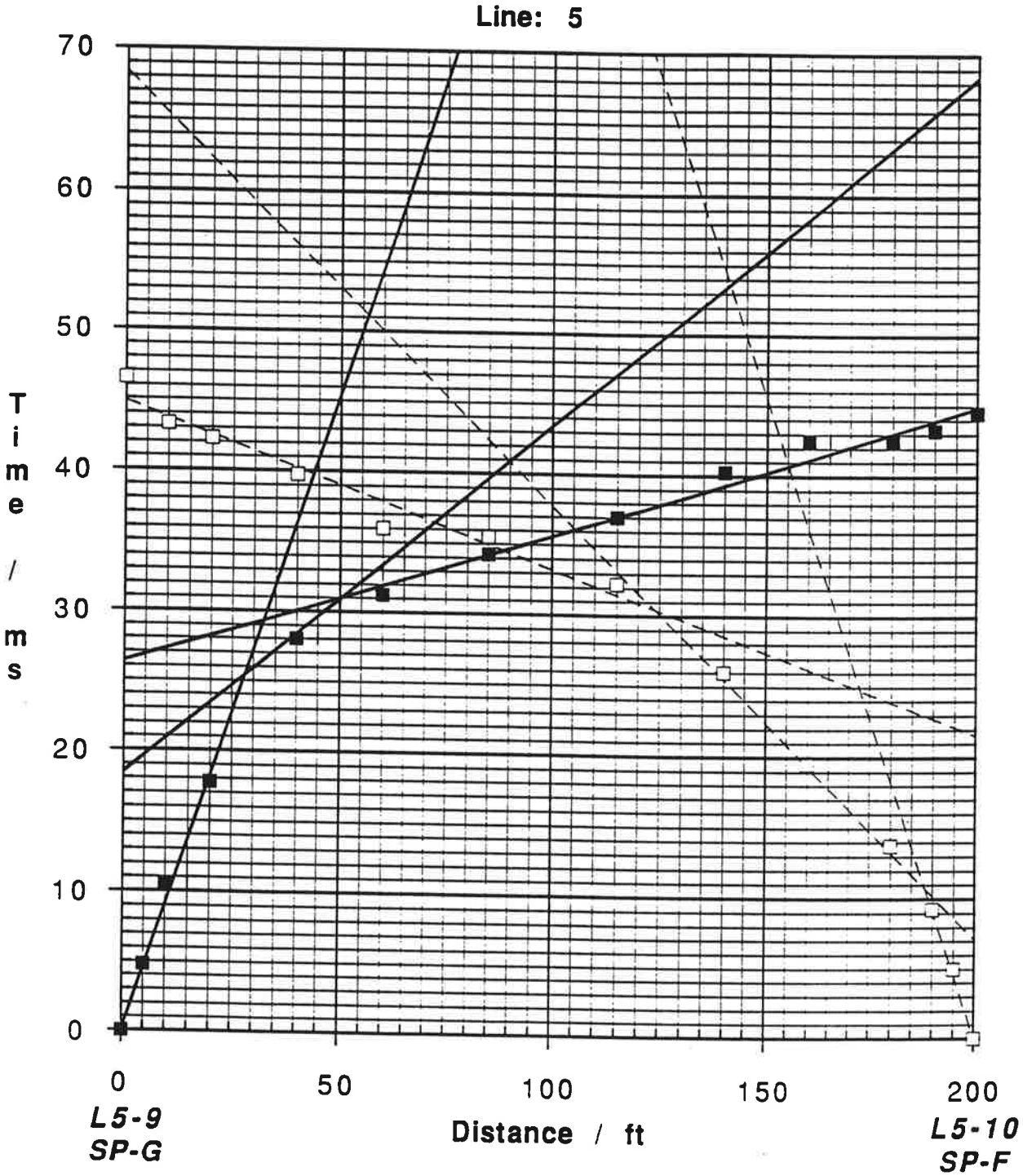
Plot Ln3 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



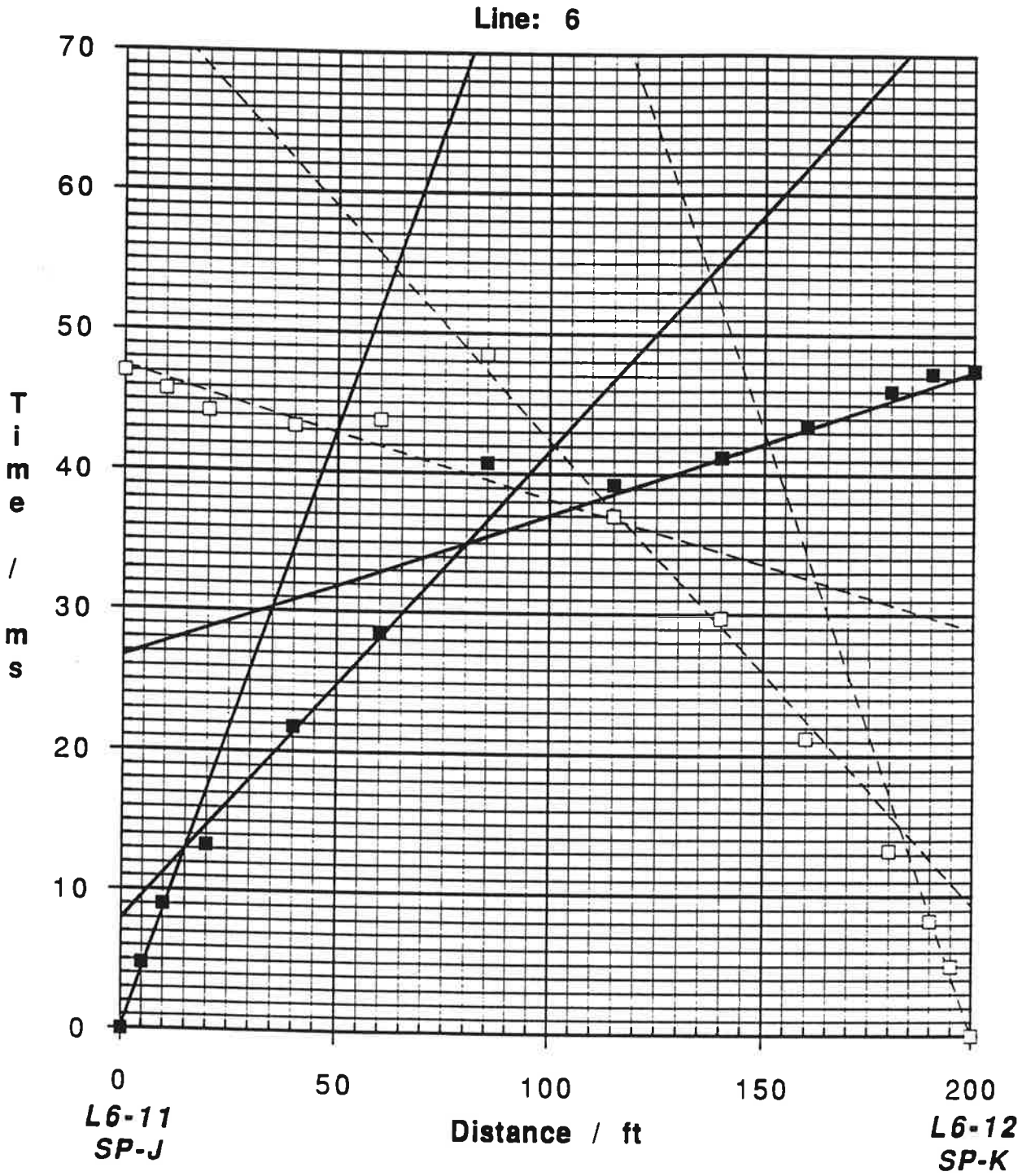
Plot Ln4 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



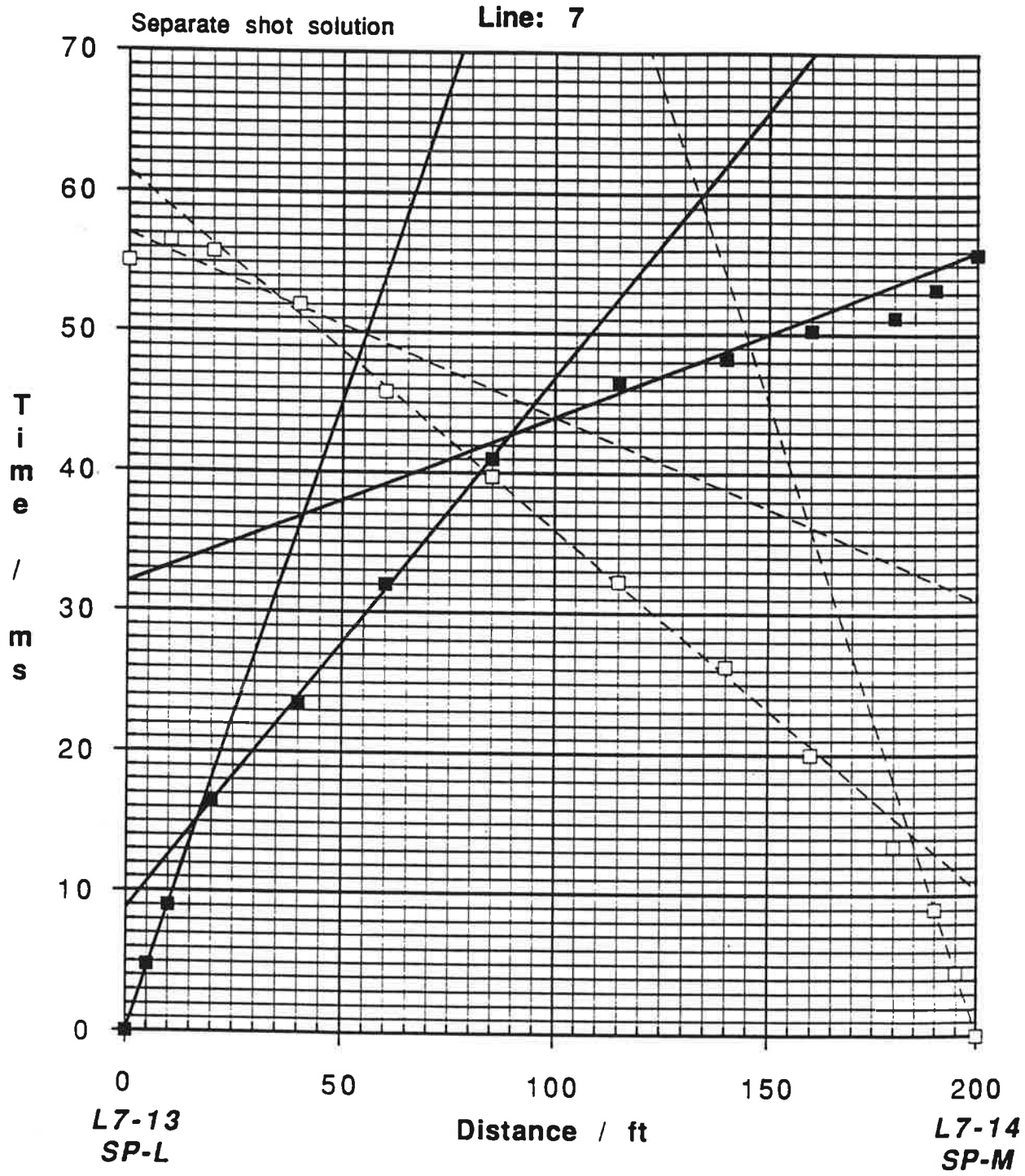
Plot Ln5 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



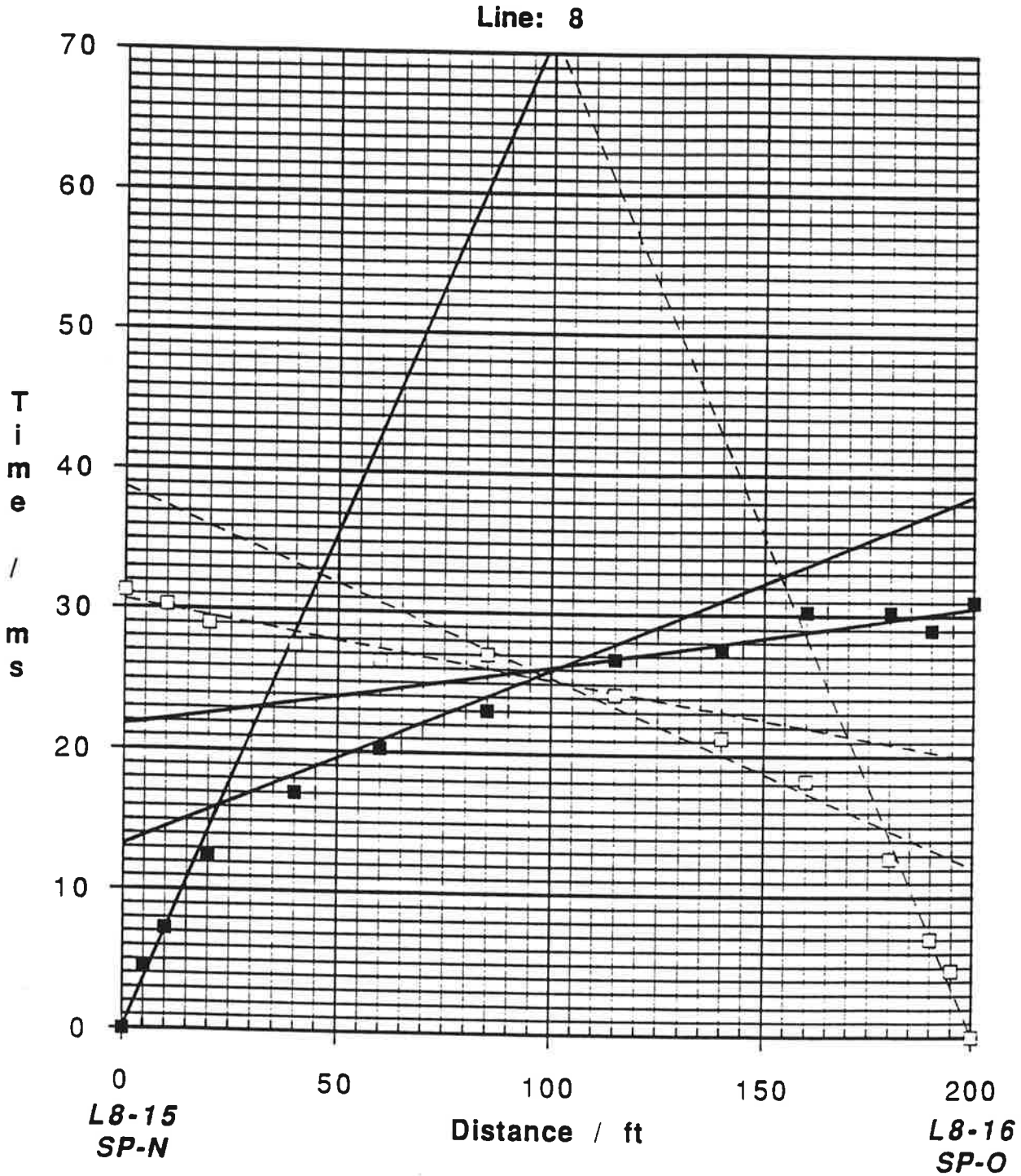
Plot Ln6 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



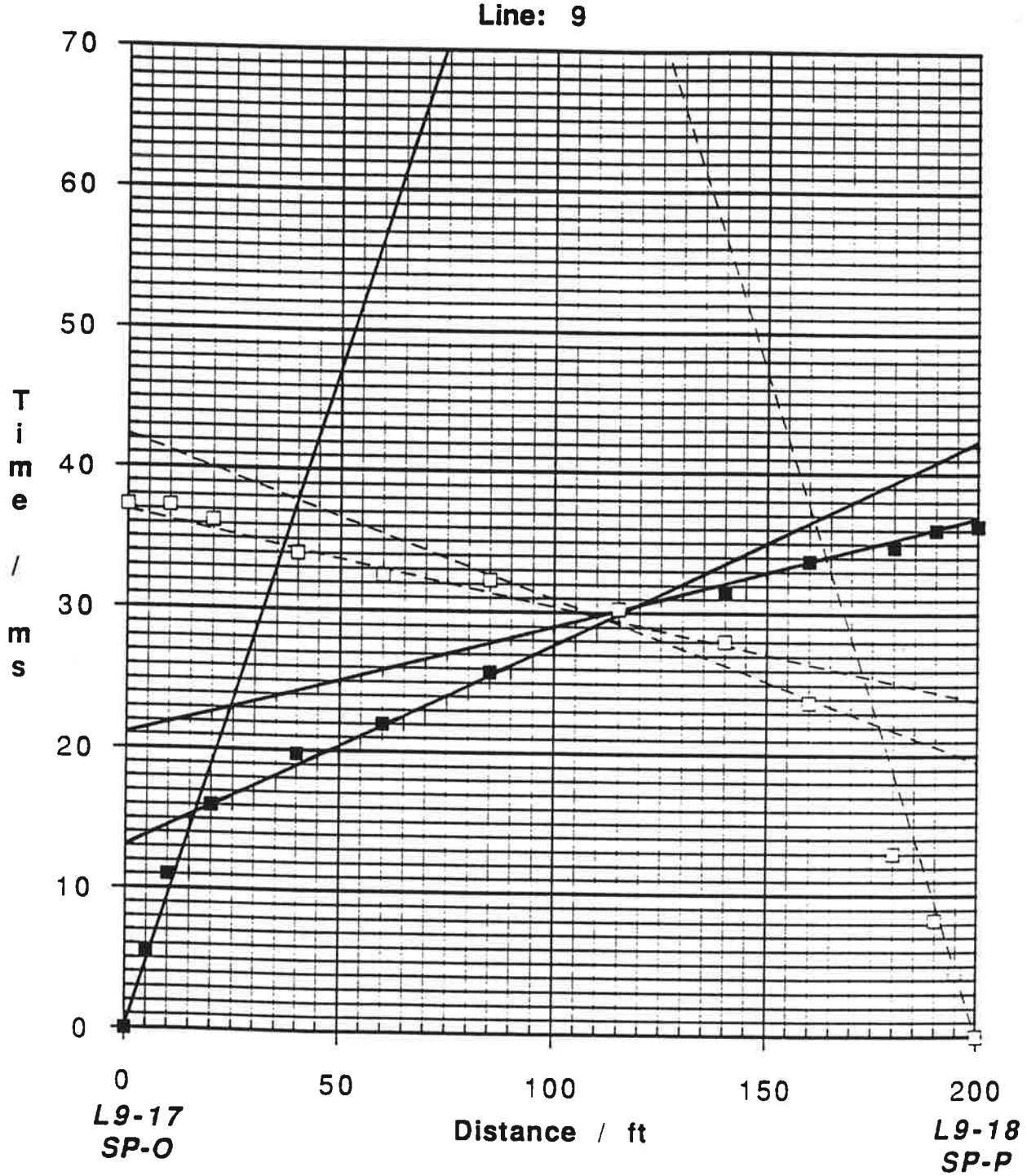
Plot Ln7a NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



Plot Ln8 NLPD

NEW LOS PADRES DAM SEISMIC REFRACTION SURVEY



Plot Ln9 NLPD

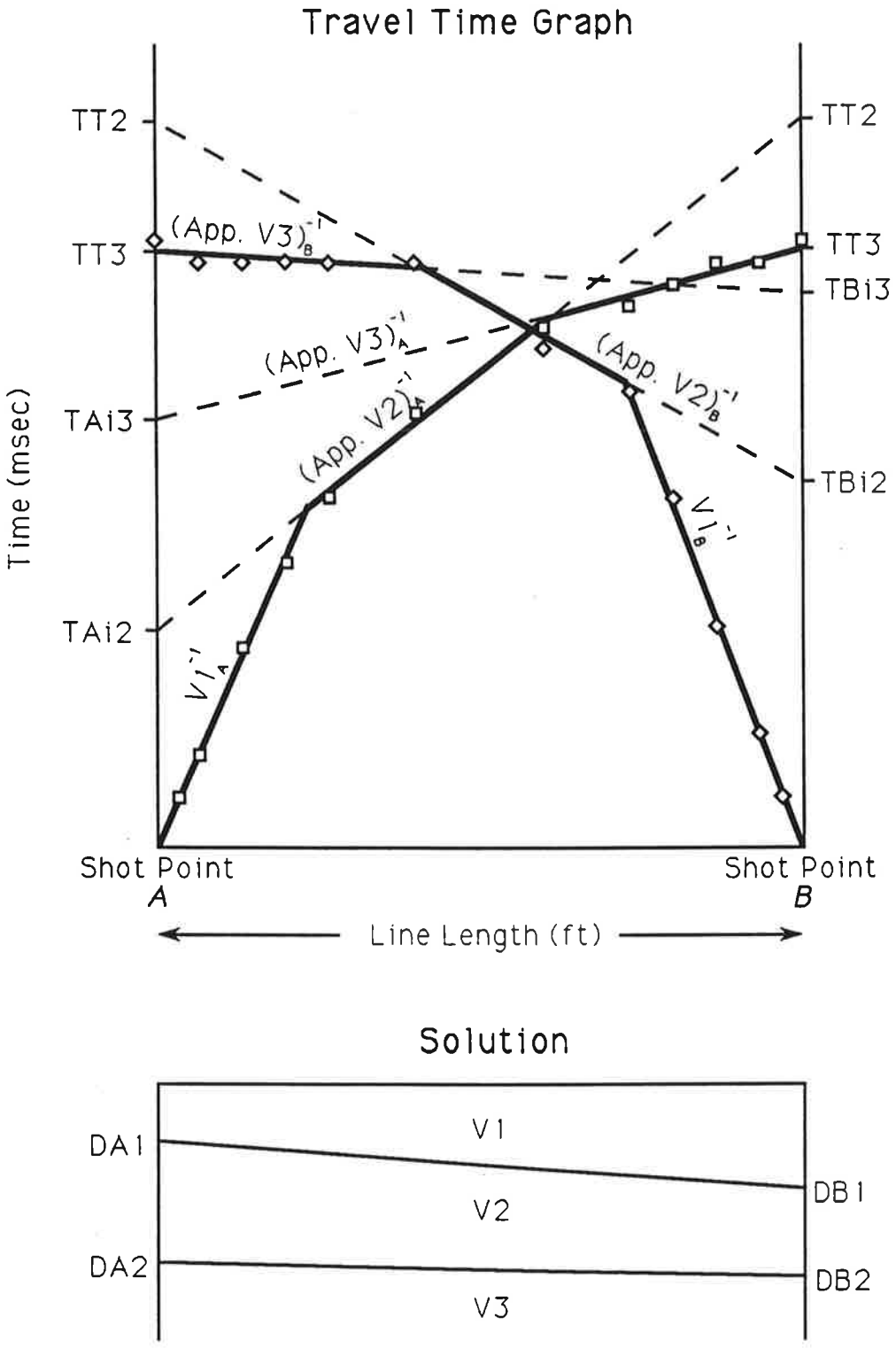


Figure B.1-3. Idealized travel-time curves and the corresponding solution for a reversed seismic refraction line. Line segments are drawn through first-arrival picks read from the data. Apparent velocities, intercept times (eg. TAi2), and total travel times (eg. TT2) are used to develop velocity profile solution. See text and appendix for details.

New Los Padres Dam Seismic Survey
Velocity Cross-Sections Along Seismic Lines 1 - 4

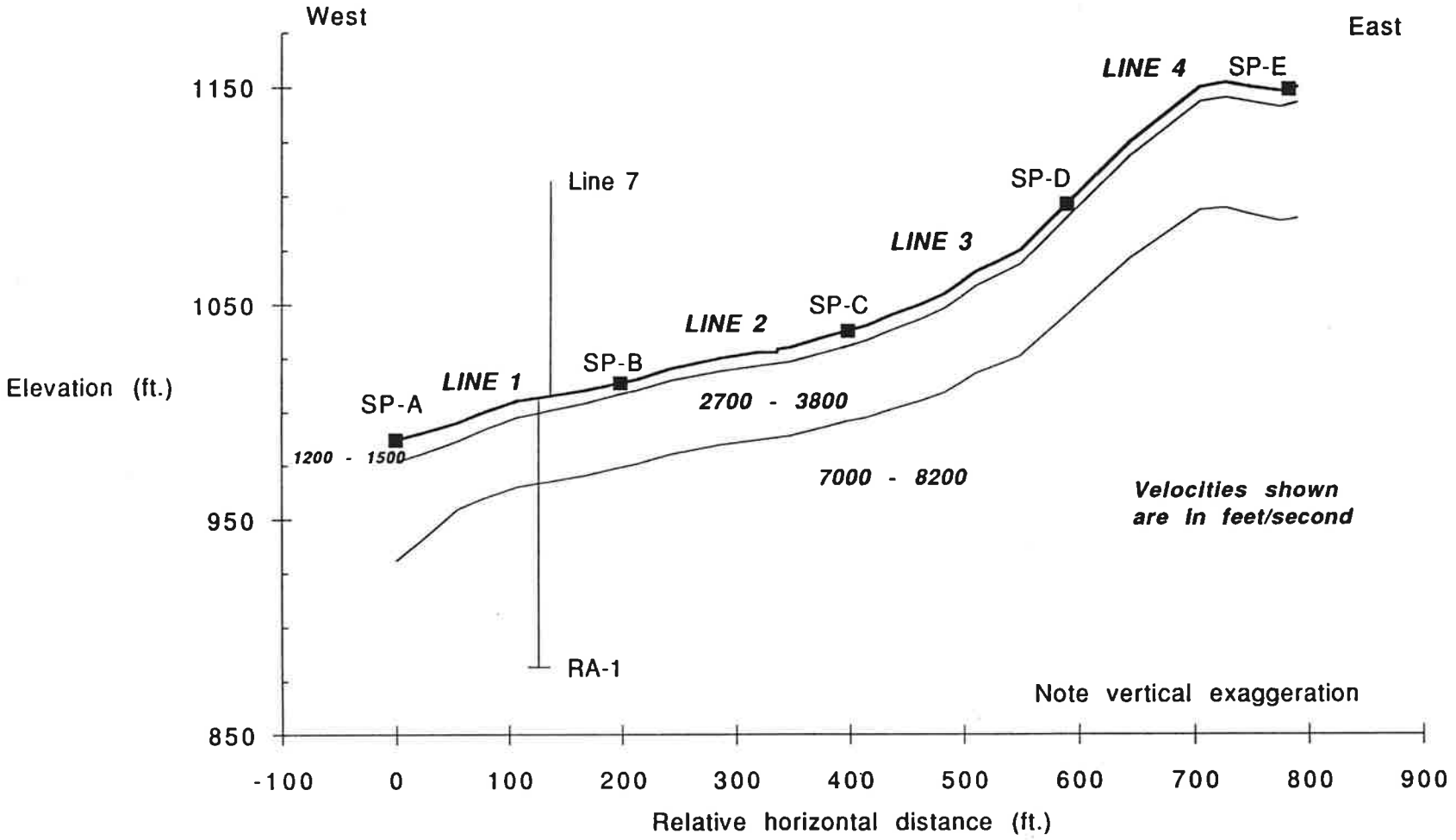


Figure B.1-4

New Los Padres Dam Seismic Survey
Velocity Cross-Sections Along Seismic Lines 5 and 6

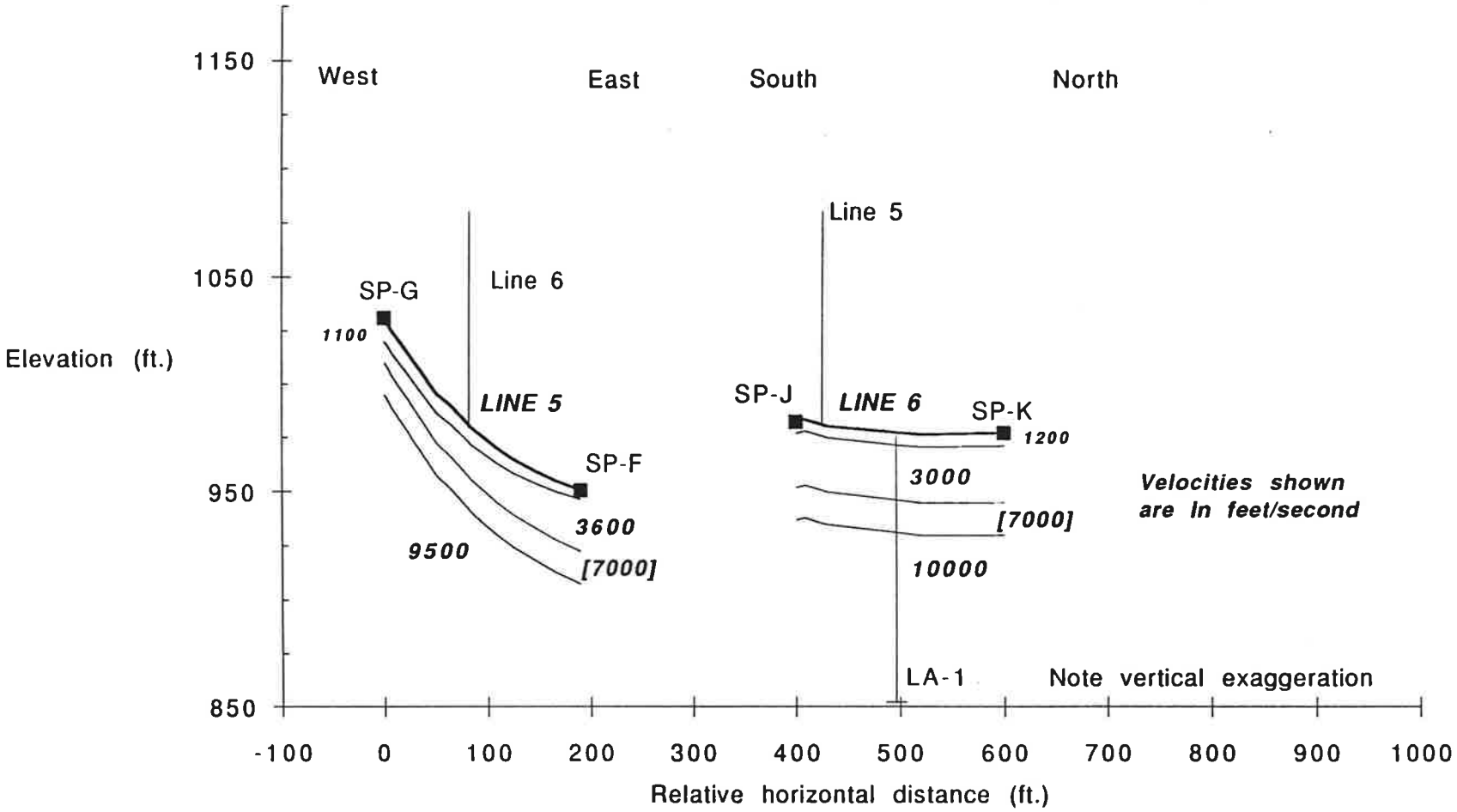


Figure B.1-5

New Los Padres Dam Seismic Survey
Velocity Cross-Section Along Seismic Line 7

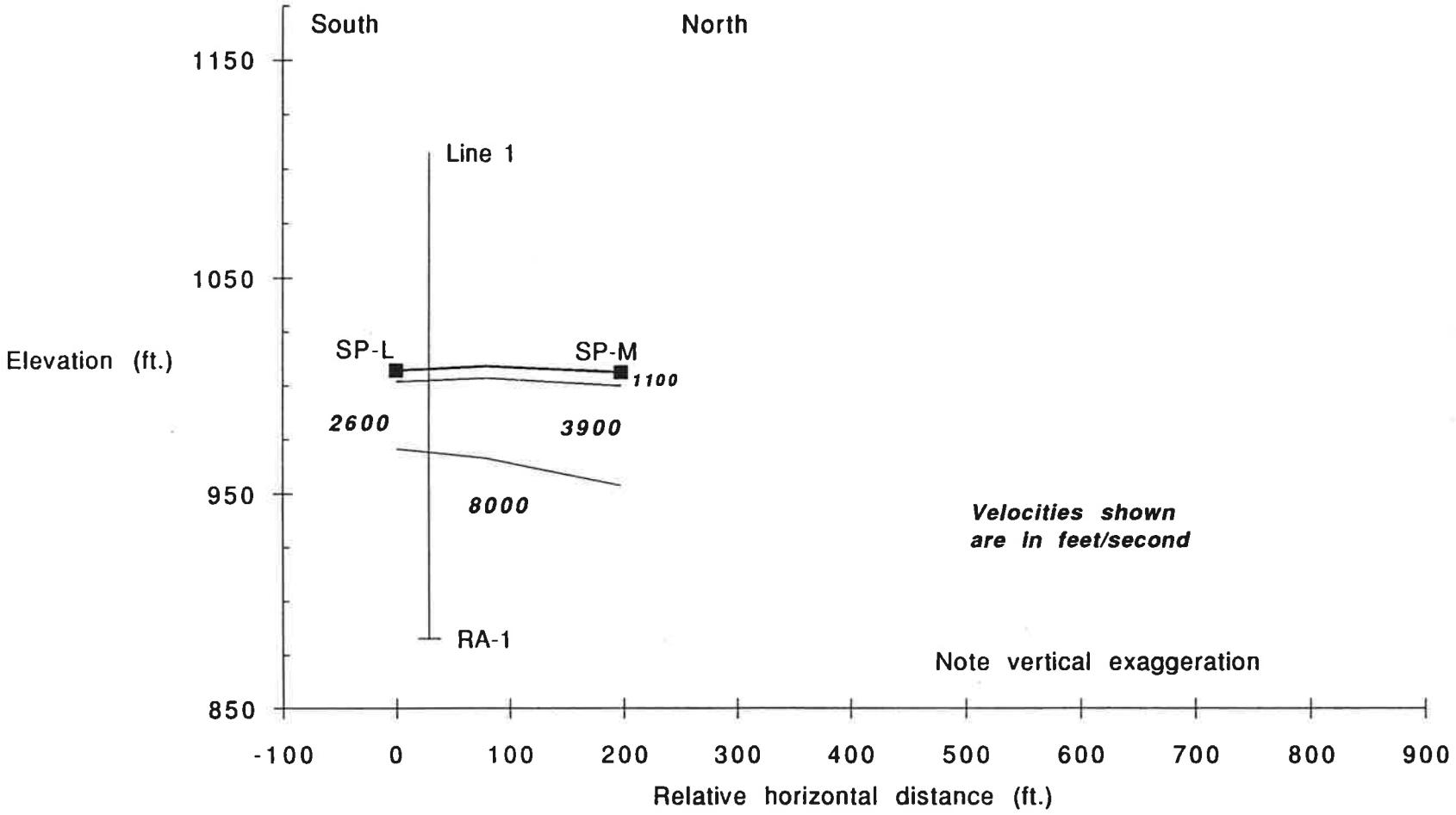


Figure B.1-6

New Los Padres Dam Seismic Survey
Velocity Cross-Sections Along Seismic Lines 8 and 9

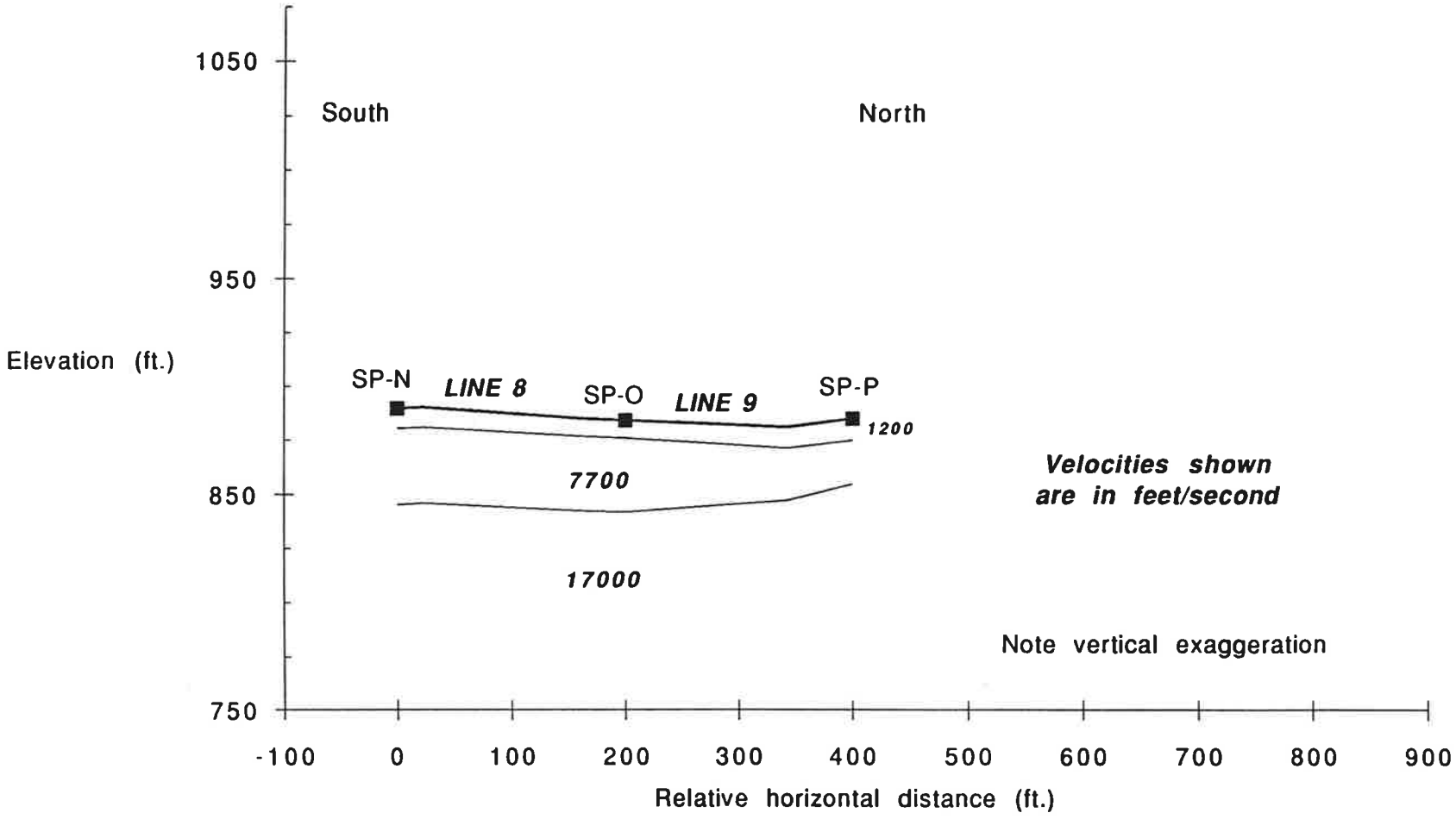


Figure B.1-7

APPENDIX C.1

Laboratory Rock Testing Report

Results of PETROGRAPHIC ANALYSES and DEFORMABILITY, UNCONFINED COMPRESSIVE STRENGTH AND BRAZILIAN TENSILE STRENGTH OF ROCK CORES

Project:

NEW LOS PADRES DAM

Job No: 21675-000

February 1992

BECHTEL CORPORATION
Geotechnical Laboratory

50 Beale Street
San Francisco, CA 94015
U.S.A.

Petrographic Analyses
and
Laboratory Measurements of
Deformability, Unconfined Compressive Strength
and
Brazilian Tensile Strength of Rock Cores
from
New Los Padres Dam Site, Monterey California

Introduction

This report discusses the results of petrographic analyses and strength and deformability tests performed on NX-sized rock cores received from the site of the proposed New Los Padres Dam, Monterey, California. Eleven rock cores were received from the site. Petrographic analyses were performed using thin sections prepared from four rock cores typical of the eleven received. Unconfined compression with deformability measurements were performed on samples prepared from eight rock cores. Brazilian indirect tensile strength tests were performed on disks prepared from five rock cores.

Core Identification and Sample Preparation

As soon as the rock cores were received from the site, they were inspected and visual descriptions of the cores were made. Out of the eleven rock cores, four cores were selected for making thin sections to perform detailed petrographic analyses. Some were stained to detect K-Feldspar. Small lengths were then cut with the help of a circular diamond-saw with water as coolant from these four cores and these were shipped to an external agency, Cal-Brea for making thin sections.

For unconfined compression tests with deformation measurements, eight cores were selected. Each core was then rough-cut to a length of approximately 2 to 2.5 times the diameter. Final trimming of the end surfaces for smoothness, flatness and parallelism was done using carborundum powder with water using a vibratory platform. All finished samples conformed to the specifications of ASTM, i.e., D2938 and D3148, latest revision.

For deformation measurements, paper-backed resistance wire gages of gage length 1.0 inch were bonded to each of the eight samples. The gages were bonded within middle third height of sample to minimize the influence of end effects. One gage was bonded along the axial direction and the other was bonded along the circumference. A dummy rock sample with a set of axial and lateral gages was prepared and was used in succession for all the eight samples. The Measurements

Group 3800 strain indicator and channel selector were used in half-bridge configuration to track the changes in strain readings upon loading. The accuracy of the Wheatstone circuit was verified using shunt calibration with high-precision resistors.

For Brazilian tensile strength tests, five samples were prepared. Sample thickness was approximately equal to the radius of the cores.

TEST PROCEDURES

Petrographic Analyses:

Petrographic analyses were performed according to methods described by Kerr, 1959 and Travis, 1955. A Zeiss petrographic microscope with polarizing plates was used for the examination. The results of the petrographic analyses are presented in **Attachment No.1**, which also includes visual descriptions of all the cores.

Unit Weight:

The unit weight of the rock specimens ranged between 165 pcf (lbs/ cft) and 179 lbs/cft.

Unconfined Compression Tests with Deformability Measurements:

Unconfined compression tests were performed following ASTM procedure D2938. The duration of loading for each sample was generally less than 5 minutes. The tests were performed using a 400,000 pounds capacity Forney Compression tester with a spherically seated bearing platen. Two oil-hardened, steel platens 2.0 inches in diameter and 2 inches in thickness were used to reduce stress concentration at the ends of the sample. Both vertical (axial) and lateral strain readings were taken at 500 pounds interval up to 11,000 lbs and then afterwards at 1,000 pounds interval. Decrease in strain in the axial direction was consistent with shortening of specimen while increase in strain in the lateral direction denoted increase in radius of the specimen. The load at failure was noted by the position of the dummy pointer in the load dial of the testing machine. The nature of failure was noted.

The test data were interpreted using a Microsoft^{R} Excel spreadsheet program and the values of Elastic Modulus, Poisson Ratio and the Unconfined compressive strength were calculated. **Attachment 2** provides the test data as well as the test plots. For three of the samples, the strain gages did not function properly and thus the deformability measurement data for these samples were not included for interpretation of their compressibility characteristics.

The **Summary Table No.1** includes the values of Unconfined compressive strength, Elastic Modulus and Poisson Ratio, and a brief description of the sample.

Brazilian Tensile Strength Tests:

Brazilian (Indirect Tension) tests were conducted on five samples and the test procedure generally followed the specifications outlined in ASTM D3967.

The Forney compression tester was used to apply the diametral load. Thin strips of precompressed plywood were used to insure strip loading and reduce stress-concentration. Test duration was generally less than 5 minutes. The load at failure was noted. The samples generally failed along the loaded diameter with minor crushing at the loading ends.

The Brazilian tensile strength was calculated using the elastic formula for horizontal stresses across the loaded diameter. The results are included in the summary table. Raw data sheets are in the laboratory files and are available on request.

DATA INTERPRETATION AND RECOMMENDATIONS

The **Summary Table No.1** provides unconfined compressive strength, Brazilian tensile strength, elastic modulus, Poisson's Ratio and a brief description of the rock sample.

The rock is generally medium to fine-grained granodiorite or quartz diorite. The compressive strength varied between 4,080 psi for the weakest rock to 15,610 psi for the strongest rock. the average value of unconfined compressive strength is 10,000 psi. The compressive strength of rocks is controlled by the mineral makeup, degree of weathering and the nature and orientation of weakness planes. The test samples have undergone different degrees of alteration and weathering as described in Attachment 1 and this could explain the variation in compressive strength.

The variation in tensile strength is somewhat narrow ranging between 740 psi and 1,110 psi. The average value of Brazilian tensile strength is 870 psi. The ratio of unconfined compressive strength to tensile strength is between 5 and 20. The average ratio is 12.

The static elastic modulus varies between 3.1 million psi and 7.4 million psi and is generally in the range of values given in the published literature for dioritic rocks. A conservative value of **3.5** million psi is recommended for the preliminary design.

For comparison, a value of 4.5 million psi has been reported for quartz diorite from Idaho, USA (Handbook on Mechanical Properties of Rocks, Vol. II, page 340, ed. Lama and Vutukuri, 1978).

The Poisson Ratio was very low at 0.01 for two of the specimens, while for the other three specimens it was between 0.11 and 0.24. For preliminary design, a value of **0.20** is recommended. Published values of Poisson Ratio for dioritic rocks from other parts of the United States is of the order of 0.05 to 0.28 (Handbook on Mechanical Properties, Vol. II, page 340-341, ed. Lama and Vutukuri, 1978). Poisson Ratio is generally low for weak rocks while it is higher for stiff rocks.

New Los Padres
Feb 1992/mb

References

Kerr, P.F., (1959): Optical Mineralogy, McGraw-HIll Book Co., Inc., New York, 442p.

Lama and Vutukuri (1978): Handbook on Mechanical Properties of Rocks, Vol II., pages 340-341.

Travis, R.B. (1955): Classification of Rocks, Colorado School of Mines Quarterly, Vol. 50, No.1, 98p.

New Los Padres
Feb 1992/mb

TABLE 1
NEW LOS PADRES DAM
21675-000
TEST SUMMARY

Sample Id.	Unit Weight (pcf)	Strength (psi)		Elastic Parameters		Rock Description **
		Unconfined Compressive	Brazilian Tensile	Modulus (psi)	Poisson Ratio	
C-1 S-1 (20.9-21.9 ft.)	166.3	15610	770	5.00E+06	0.01	Medium-grained granodiorite or quartz diorite
C-1 S-2 (96.65-97.33 ft.)	179.0	4080	740	5.50E+06	0.01	Fine-grained quartz diorite
LA-1 S-1 (44.5-45.15 ft.)	166.0	16700	870	7.40E+06	0.11	Medium-grained quartz monzonite or quartz diorite
LA-1 S-2 (69.15-69.95 ft.)	168.0	8500	1110	3.50E+06	..22	Medium-grained quartz monzonite or quartz diorite
LA-1 S-3 (88.2-88.78 ft.)	171.7	6740	-	- *	- *	Medium-grained quartz monzonite or quartz diorite
LA-1 S-4 (120.15-1250.65 ft.)	165.4	11400	-	3.10E+06	0.24	Medium-grained quartz monzonite or quartz diorite, partially altered
RA-1 (59.97.60-2 ft.)	174.7	10370	840	- *	- *	Medium-grained diorite
RA-1 (74.6-75.1 ft.)	176.3	5930	-	- *	- *	Medium-grained diorite, slightly altered

* Strain gages malfunctioned.

** For a more detailed description of rock mineralogy, see section on Petrographic Description (Attachment No.1)

ATTACHMENT NO. 1

VISUAL DESCRIPTION OF ROCK CORES AND PETROGRAPHIC ANALYSES OF THIN SECTIONS

New Los Padres
Feb 1992/mb

NEW LOS PADRES DAM
PETROGRAPHIC DESCRIPTION OF
CORE SAMPLES

Summary
In this section samples from Cores RA-1, LA-1, and C-1 are described. Core samples were examined in hand sample without the aid of a microscope. The macroscopic descriptions of selected intervals from the core are included here. Four thin sections of parts of Cores RA-1 and C-1 were made and examined with the petrographic microscope. Petrographic descriptions of thin sections are included under the appropriate sample numbers.

Samples ranged from quartz monzonite to diorite. The major minerals present were plagioclase feldspar, quartz, and biotite. Most samples were slightly altered: feldspar crystals showed slight alteration, some biotite crystals were partially altered to chlorite, and traces of clay and calcite were present. Where fractures (ranging from one to a few millimeters wide) were present, alteration was more intense adjacent to the fractures.

Hole RA-1 **59.7-60.2**

Hand Specimen
The core sample is a medium-grained diorite with 45% feldspar, 5% quartz, 30% biotite, and as much as 20% hornblende. The rock is altered with a small amount of clayey material, iron oxide, chlorite, and calcite along fracture surfaces.

Hole RA-1 **74.6-75.1**

Hand Specimen
The core sample has a color index of about 40 and is slightly altered.

Thin Section
The rock is a medium-grained diorite and shows slight alteration. Chlorite is present as an alteration product and occurs as very fine-grained fibrous and radiating aggregates.

Plagioclase feldspar	48%
Quartz	5%
Biotite	20%
Hornblende	25%
Chlorite	2%

Hole RA-1 **118.2-118.6**

Hand Specimen

Sections of the core appear to show more alteration than the thin section. There is a layer of calcite along a fracture and the feldspar appears white and slightly clayey in parts.

Thin Section

The rock is a medium-grained quartz diorite. Some biotite crystals are partially altered to chlorite. The feldspar is slightly altered in places.

Plagioclase feldspar	46%
Quartz	38%
Biotite	15%
Chlorite	<1%

Hole LA-1, S-1 **44.9-45.15**

Hand Specimen

The core sample is a medium-grained quartz monzonite or quartz diorite, containing 40% feldspar, 40% quartz, and 20% biotite. The feldspar minerals appear slightly altered. A fracture contains a small amount of calcite.

Hole LA-1, S-2 **69.15-69.85**

Hand Specimen

The core sample is a medium-grained quartz monzonite or quartz diorite, containing 45% feldspar, 30% quartz, and 25% biotite. The sample is moderately altered. There are several fracture surfaces that are coated with iron oxide minerals and parts of the core sample are friable. The feldspar minerals appear altered and clayey in places.

Hole LA-1, S-3 **88.3-88.78**

Hand Specimen

The core sample is a medium-grain quartz monzonite or quartz diorite containing 45% feldspar, 30% quartz, and 25% biotite. The feldspars appear partially altered and a fracture surface is coated with small amounts of iron oxide and calcite and a light green mineral (chlorite?).

Hole LA-1, S-4 120.15-120.65

Hand Specimen
The core sample is a medium-grained quartz monzonite or quartz diorite containing 45% feldspar, 30% quartz, and 25% biotite. It is partially altered, and there is calcite along a fracture surface.

Hole C-1, S-1 20.9-21.9
Hand Specimen
The core sample is a medium-grained granodiorite or quartz diorite with 35% feldspar, 35% quartz, 20% biotite, and 10% hornblende. Some feldspar crystals are partially altered to clay minerals. Occasional veins from one to a few millimeters thick are present, one with biotite and a few with partially altered feldspar crystals.

Hole C-1, S-2 96.65-97.33
Hand Specimen
The sample is a fine-grained quartz diorite or diorite with about 45% feldspar, 30% biotite, 10% hornblende, and 15% quartz. The feldspar appears slightly altered.

Hole C-1, S-3 122.63-123.23

Hand Specimen
The core sample is composed of two rock types, a medium-grained diorite with a color index of 40 and a fine-grained diorite or gabbro with a color index of 50. The finer-grained rock contains more mafic minerals than the coarser grained rock. The boundary between the two rock types is sharp. Both rock types appear relatively unaltered.

Thin Section

The sample for the thin section was taken from the medium-grained material. The sample is a medium-grained diorite. Several biotite crystals are partially altered to chlorite. Some hornblende has been altered to what appears to be very fine-grained aggregates of clay minerals (?). A very minor amount of calcite is present as part of the alteration assemblage. The plagioclase shows incipient alteration. The sample is slightly altered throughout and the alteration is not concentrated in any particular part of the thin section.

Plagioclase feldspar	55%
Quartz	10%
Biotite	19%
Hornblende	15%
Chlorite	1%
Calcite	trace
Iron oxide minerals	trace
Clay minerals (?)	trace

Hole C-1, S-4 165.46-165.85

Hand Specimen

The rock is a medium- to coarse-grained quartz monzonite. Some feldspar crystals are as large as 10 to 20 mm, but are not abundant or prominent enough to call the rock a porphyry. The feldspar appears partially altered and the rock has a few thin veins about a millimeter or two thick filled with what appears to be fine-grained feldspar.

Thin Section

The quartz monzonite is only slightly altered. Several biotite crystals have been partially altered to chlorite. There is incipient alteration of the feldspar minerals resulting in a fine-grained aggregate (clay minerals?) within and around the edges of the feldspar crystals, but the alteration material makes up less than one percent of the rock.

Plagioclase feldspar	35%
K-feldspar	25%
Quartz	30%
Biotite	10%
Clay minerals(?)	<1%
Hornblende	<1%
Chlorite	trace
Iron oxide minerals	trace

ATTACHMENT NO. 2

RESULTS OF UNCONFINED COMPRESSIVE STRENGTH TESTS WITH DEFORMABILITY MEASUREMENTS

New Los Padres
Feb 1992/mb

Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No. C-1 S-1 (20.9-21.9 ft.)

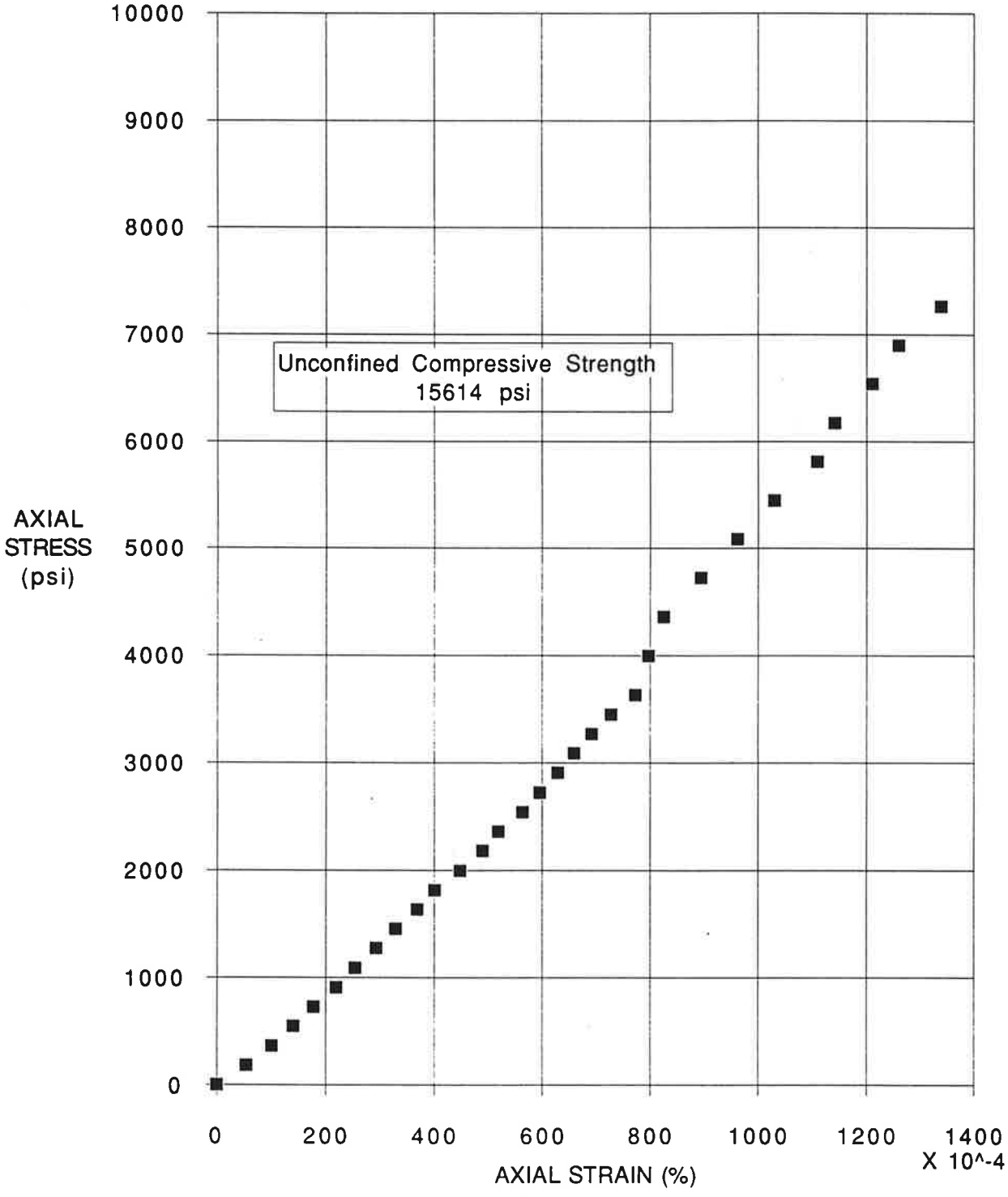
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.080	, 4.085	, 4.083	Ave Length (in)	=	4.083
Diameter (in)	=	1.865	, 1.880		Ave Diameter (in)	=	1.873
Area (sq. in)	=	2.754			Volume (cu. in)	=	11.243
Weight (g)	=	490.700			Unit Wt (pcf)	=	166.268

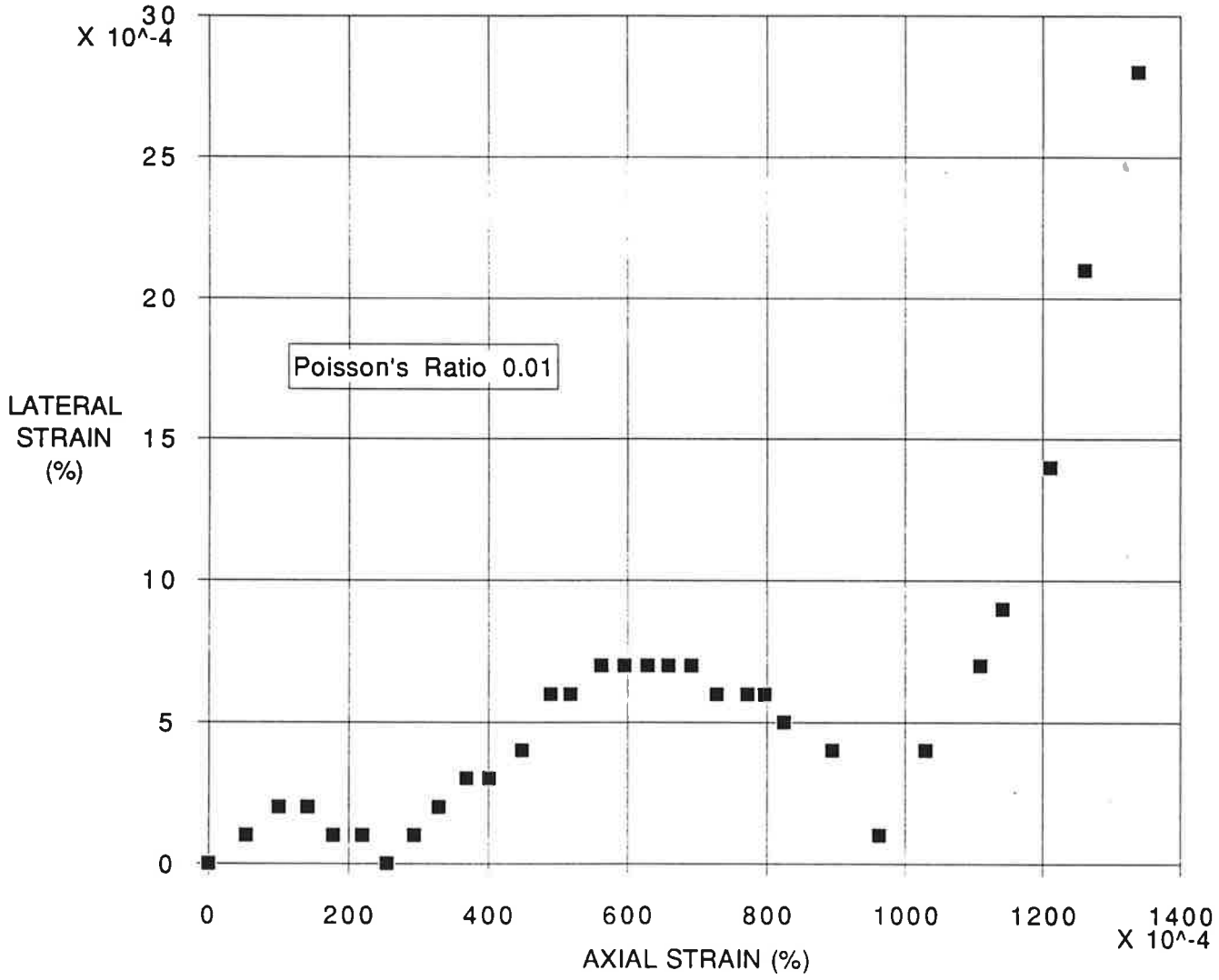
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	1	0	3357	0
500	182	-53	54	3358	1
1000	363	-100	101	3359	2
1500	545	-140	141	3359	2
2000	726	-177	178	3358	1
2500	908	-218	219	3358	1
3000	1089	-253	254	3357	0
3500	1271	-292	293	3356	1
4000	1453	-328	329	3355	2
4500	1634	-368	369	3354	3
5000	1816	-400	401	3354	3
5500	1997	-447	448	3353	4
6000	2179	-489	490	3351	6
6500	2360	-518	519	3351	6

7000	2542	-562	563	3350	7
7500	2724	-595	596	3350	7
8000	2905	-628	629	3350	7
8500	3087	-658	659	3350	7
9000	3268	-691	692	3350	7
9500	3450	-727	728	3351	6
10000	3631	-771	772	3351	6
11000	3994	-796	797	3351	6
12000	4358	-824	825	3352	5
13000	4721	-893	894	3353	4
14000	5084	-961	962	3356	1
15000	5447	-1029	1030	3361	4
16000	5810	-1109	1110	3364	7
17000	6173	-1141	1142	3366	9
18000	6536	-1210	1211	3371	14
19000	6900	-1260	1261	3378	21
20000	7263	-1338	1339	3385	28

NEW LOS PADRES DAM
21675-000
C-1 S-1 (20.9-21.9 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
C-1 S-1 (20.9-21.9 ft.)
LATERAL STRAIN - AXIAL STRAIN



Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No.: C-1 S-2 (96.65-97.33 ft.)

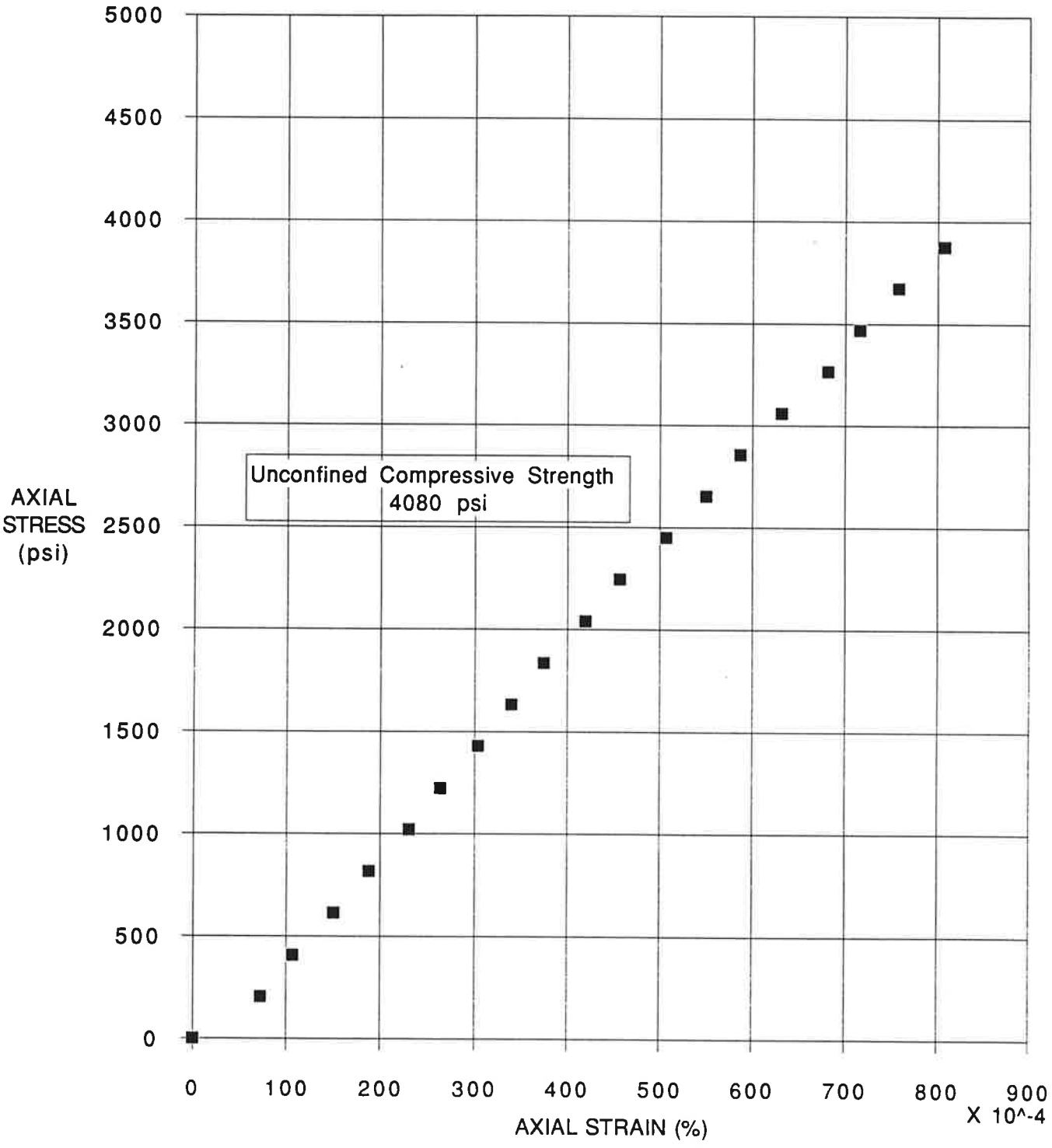
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.158	, 4.160	, 4.159	Ave Length (in)	=	4.159
Diameter (in)	=	1.769	, 1.764		Ave Diameter (in)	=	1.767
Area (sq. in)	=	2.451			Volume (cu. in)	=	10.193
Weight (g)	=	478.830			Unit Wt (pcf)	=	178.956

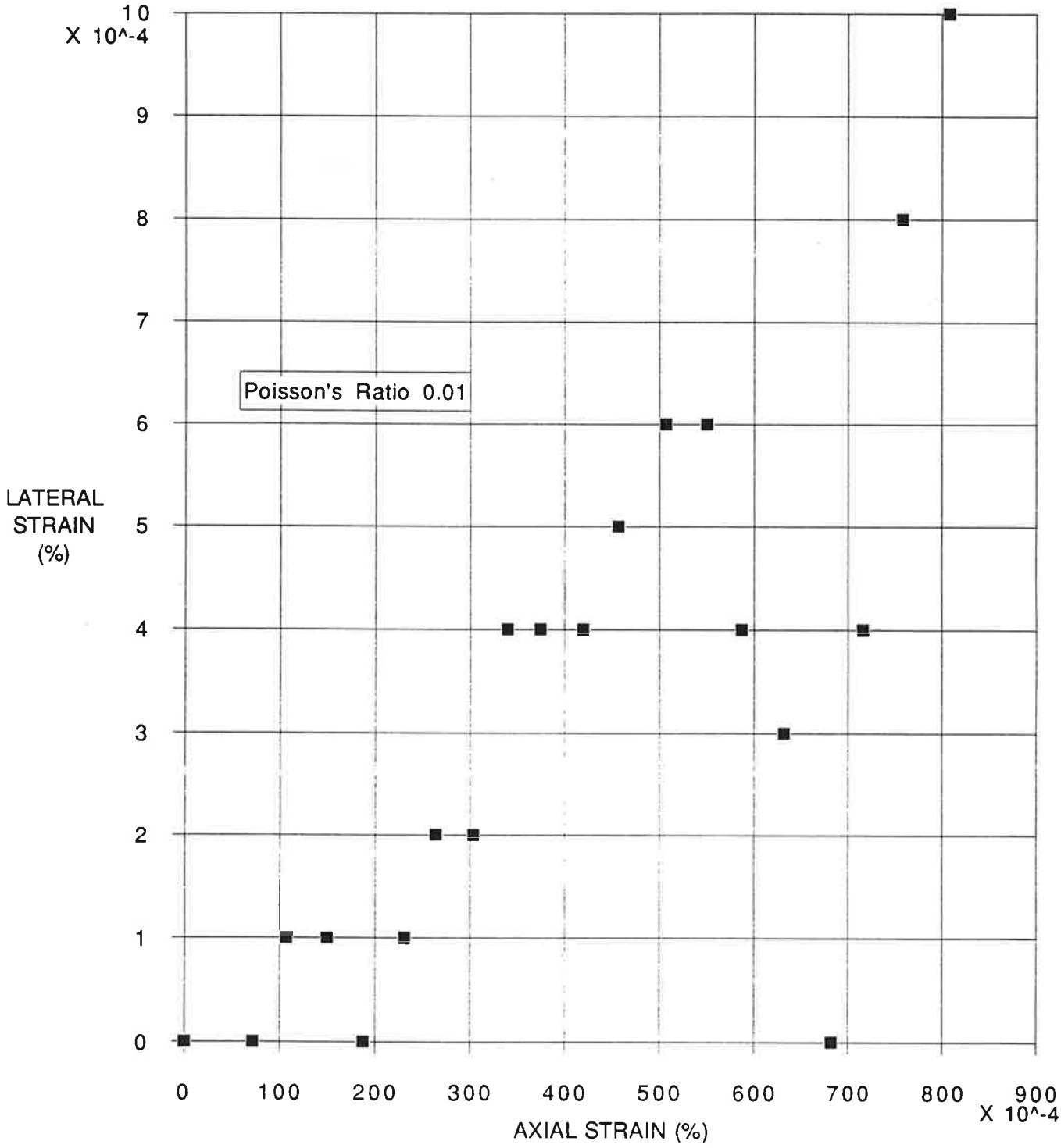
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	1	0	2629	0
500	204	-71	72	2629	0
1000	408	-106	107	2630	1
1500	612	-149	150	2628	1
2000	816	-187	188	2629	0
2500	1020	-230	231	2630	1
3000	1224	-263	264	2631	2
3500	1428	-303	304	2631	2
4000	1632	-339	340	2633	4
4500	1836	-374	375	2633	4
5000	2040	-419	420	2633	4
5500	2244	-456	457	2634	5
6000	2448	-506	507	2635	6
6500	2652	-549	550	2635	6

7000	2856	-586	587	2633	4
7500	3060	-631	632	2632	3
8000	3264	-681	682	2629	0
8500	3468	-715	716	2625	4
9000	3672	-757	758	2621	8
9500	3876	-807	808	2619	10

NEW LOS PADRES DAM
21675-000
C-1 S-2 (96.65-97.33 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
C-1 S-2 (96.65-97.33 ft.)
LATERAL STRAIN - AXIAL STRAIN



Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No. LA-1 S-1 (44.5-45.15 ft.)

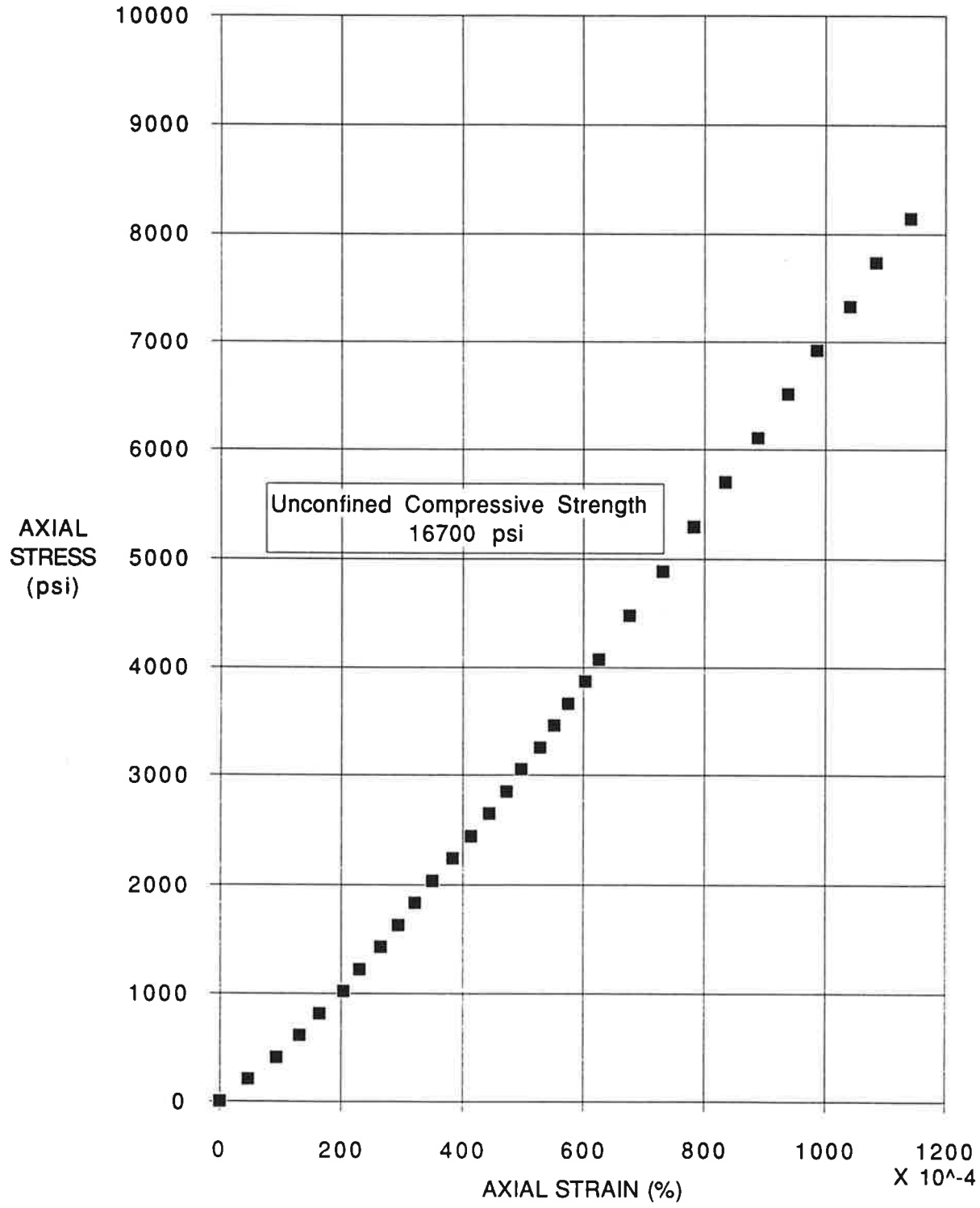
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.352	, 4.357	, 4.354	Ave Length (in)	=	4.354
Diameter (in)	=	1.767	, 1.770		Ave Diameter (in)	=	1.769
Area (sq. in)	=	2.456			Volume (cu. in)	=	10.696
Weight (g)	=	466.060			Unit Wt (pcf)	=	165.993

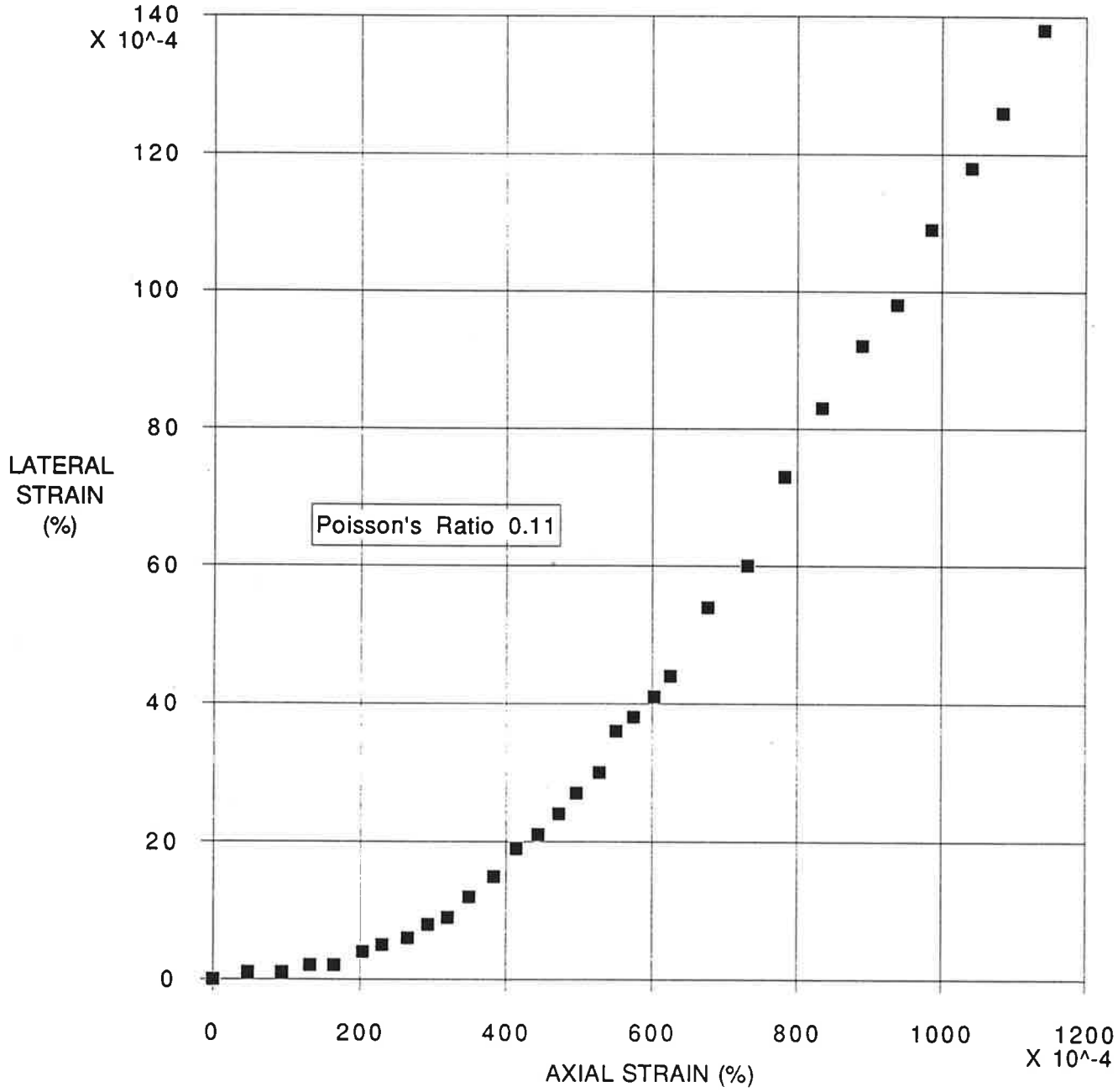
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	0	0	4324	0
500	204	-47	47	4323	1
1000	407	-94	94	4325	1
1500	611	-132	132	4326	2
2000	814	-165	165	4326	2
2500	1018	-204	204	4328	4
3000	1221	-231	231	4329	5
3500	1425	-266	266	4330	6
4000	1628	-294	294	4332	8
4500	1832	-321	321	4333	9
5000	2035	-350	350	4336	12
5500	2239	-384	384	4339	15
6000	2443	-414	414	4343	19
6500	2646	-444	444	4345	21

7000	2850	-473	473	4348	24
7500	3053	-497	497	4351	27
8000	3257	-528	528	4354	30
8500	3460	-551	551	4360	36
9000	3664	-575	575	4362	38
9500	3867	-603	603	4365	41
10000	4071	-626	626	4368	44
11000	4478	-677	677	4378	54
12000	4885	-732	732	4384	60
13000	5292	-783	783	4397	73
14000	5699	-835	835	4407	83
15000	6106	-890	890	4416	92
16000	6514	-939	939	4422	98
17000	6921	-986	986	4433	109
18000	7328	-1041	1041	4442	118
19000	7735	-1084	1084	4450	126
20000	8142	-1142	1142	4462	138

NEW LOS PADRES DAM
21675-000
LA-1 S-1 (44.5-45.15 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
LA-1 S-1 (44.5-45.15 ft.)
LATERAL STRAIN - AXIAL STRAIN



Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No. LA-1 S-2 (69.15-69.95 ft.)

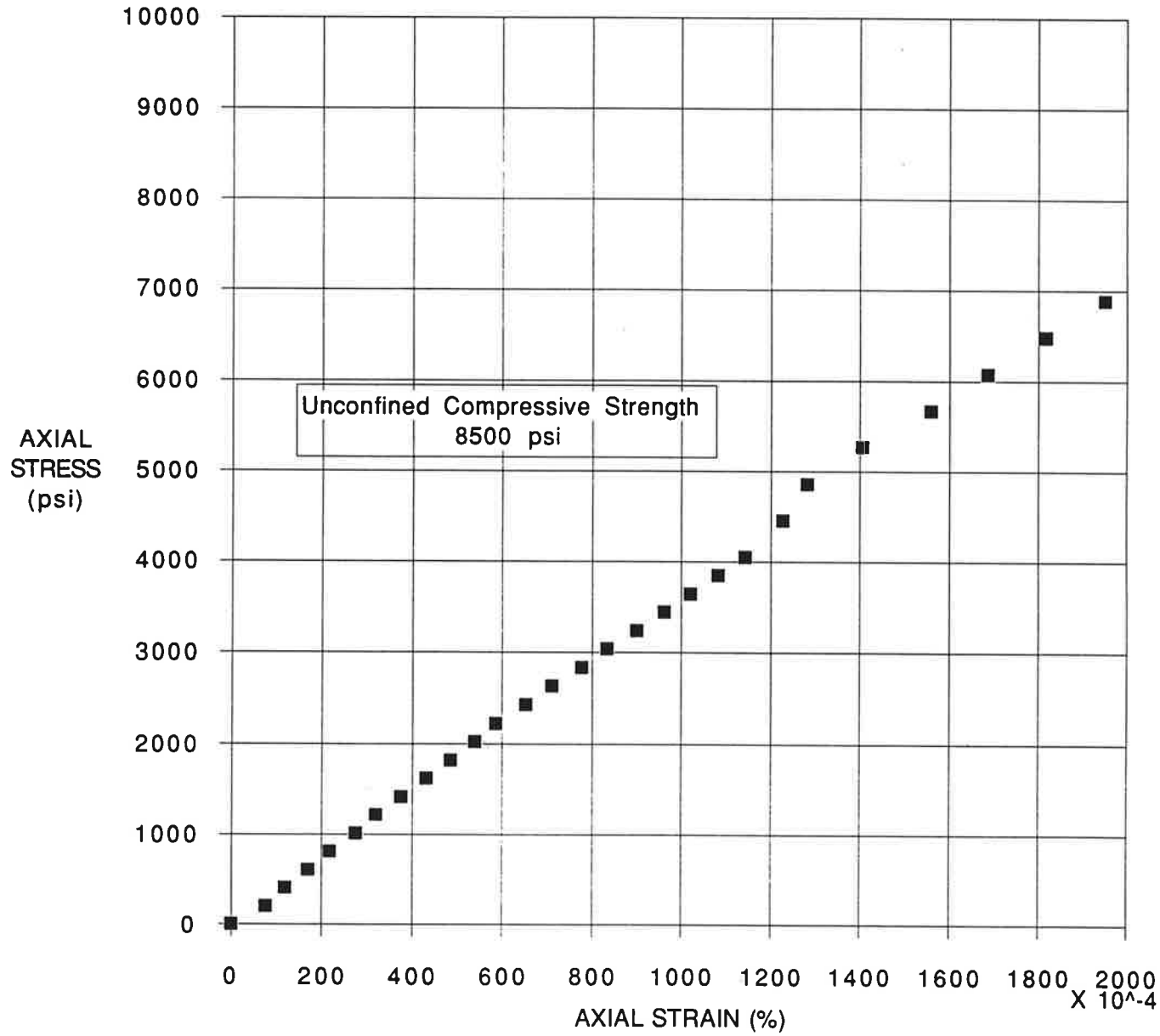
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.030	, 4.035	, 4.039	Ave Length (in)	=	4.035
Diameter (in)	=	1.775	, 1.772		Ave Diameter (in)	=	1.774
Area (sq. in)	=	2.470			Volume (cu. in)	=	9.967
Weight (g)	=	439.380			Unit Wt (pcf)	=	167.939

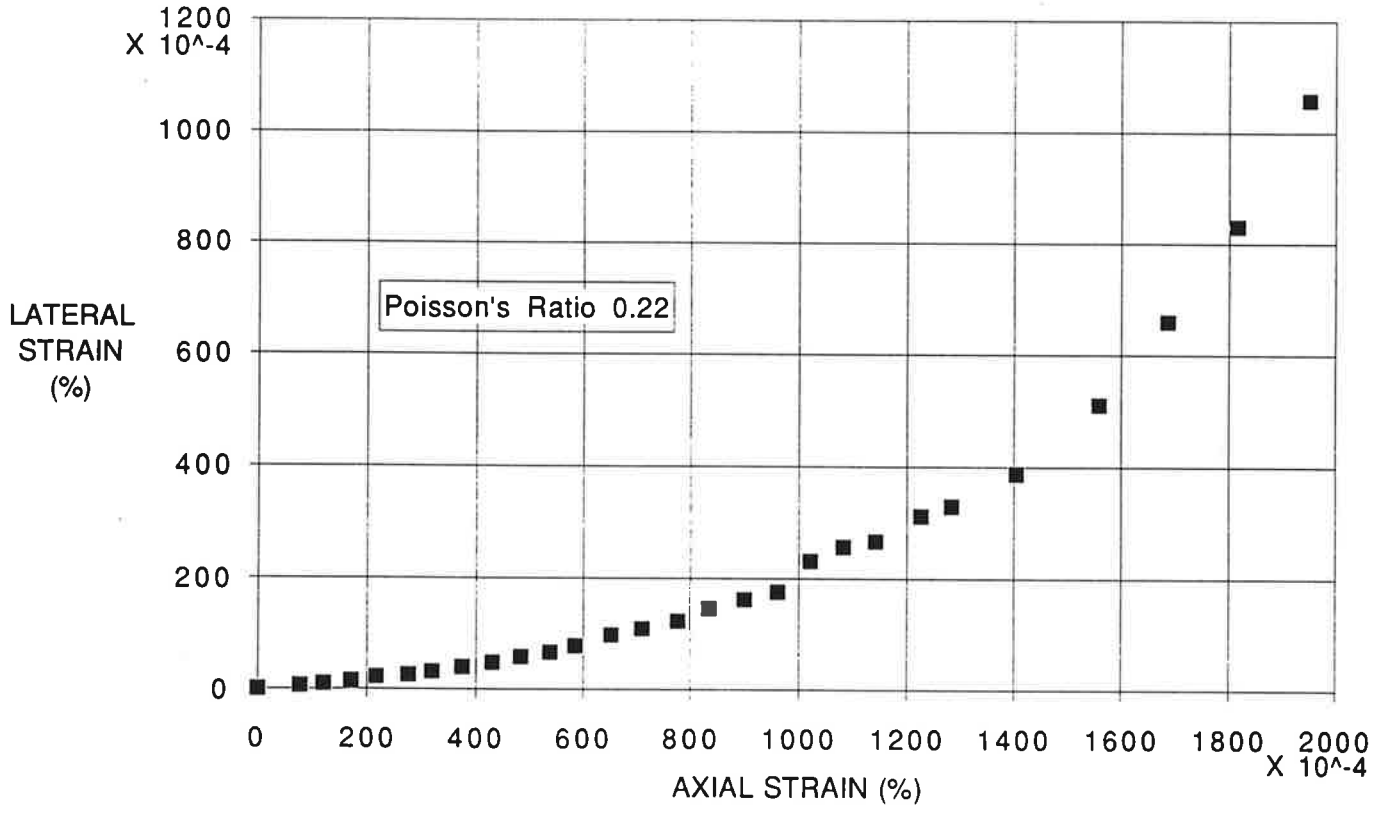
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	-6	0	3949	0
500	202	-83	77	3955	6
1000	405	-126	120	3959	10
1500	607	-176	170	3964	15
2000	810	-224	218	3971	22
2500	1012	-282	276	3975	26
3000	1214	-326	320	3980	31
3500	1417	-381	375	3988	39
4000	1619	-437	431	3996	47
4500	1822	-491	485	4007	58
5000	2024	-545	539	4015	66
5500	2226	-592	586	4027	78
6000	2429	-659	653	4046	97
6500	2631	-717	711	4058	109

7000	2834	-783	777	4071	122
7500	3036	-840	834	4095	146
8000	3238	-906	900	4111	162
8500	3441	-967	961	4125	176
9000	3643	-1027	1021	4180	231
9500	3846	-1088	1082	4206	257
10000	4048	-1148	1142	4216	267
11000	4453	-1233	1227	4261	312
12000	4858	-1289	1283	4278	329
13000	5262	-1411	1405	4336	387
14000	5667	-1565	1559	4459	510
15000	6072	-1692	1686	4607	658
16000	6477	-1823	1817	4778	829
17000	6882	-1957	1951	5007	1058

NEW LOS PADRES DAM
21675-000
LA-1 S-2 (69.15-69.95 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
LA-1 S-2 (69.15-69.95 ft.)
LATERAL STRAIN - AXIAL STRAIN



Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No.: LA-1 S-3 (88.3-88.78 ft.)

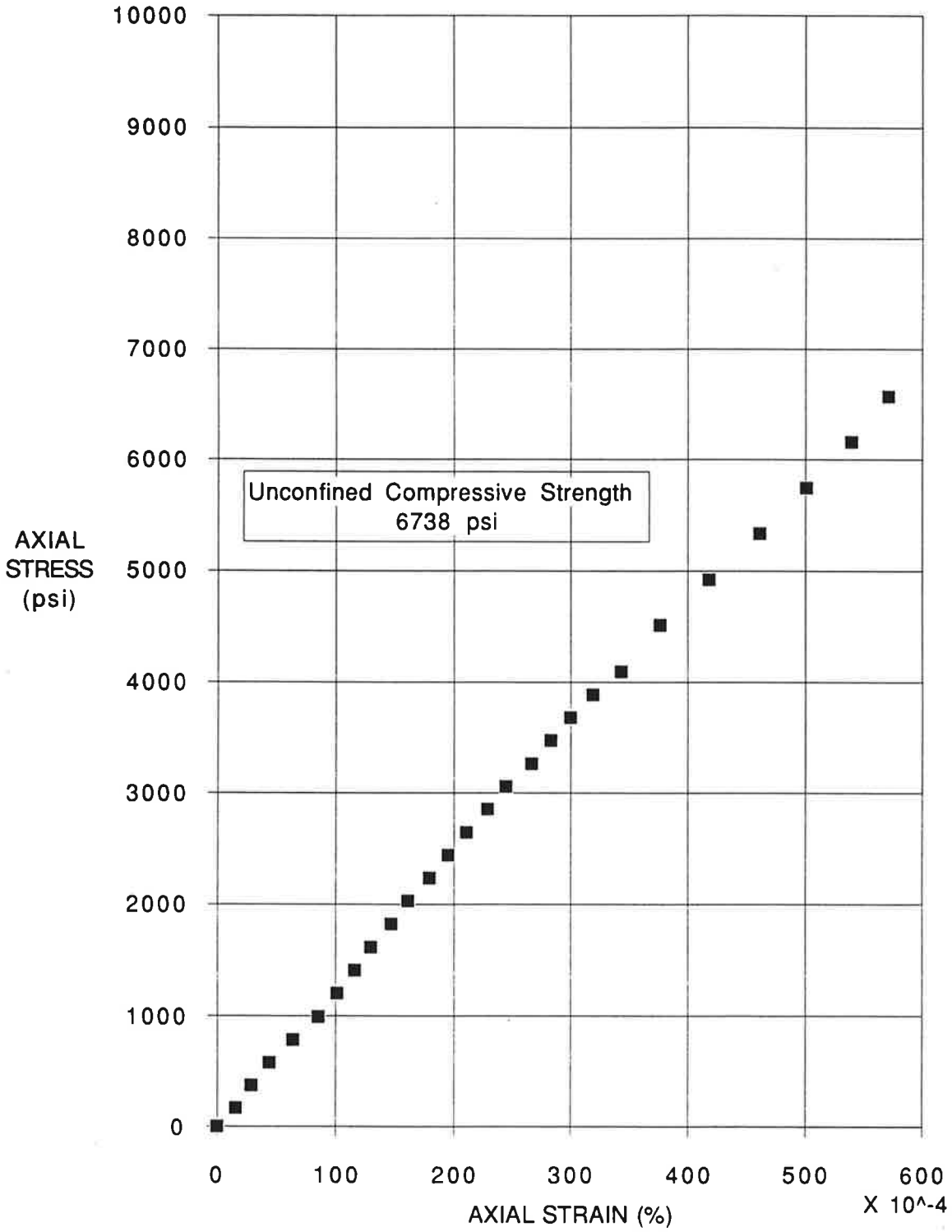
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	3.972	, 3.968	, 3.976	Ave Length (in)	=	3.972
Diameter (in)	=	1.770	, 1.740		Ave Diameter (in)	=	1.755
Area (sq. in)	=	2.419			Volume (cu. in)	=	9.608
Weight (g)	=	432.990			Unit Wt (pcf)	=	171.670

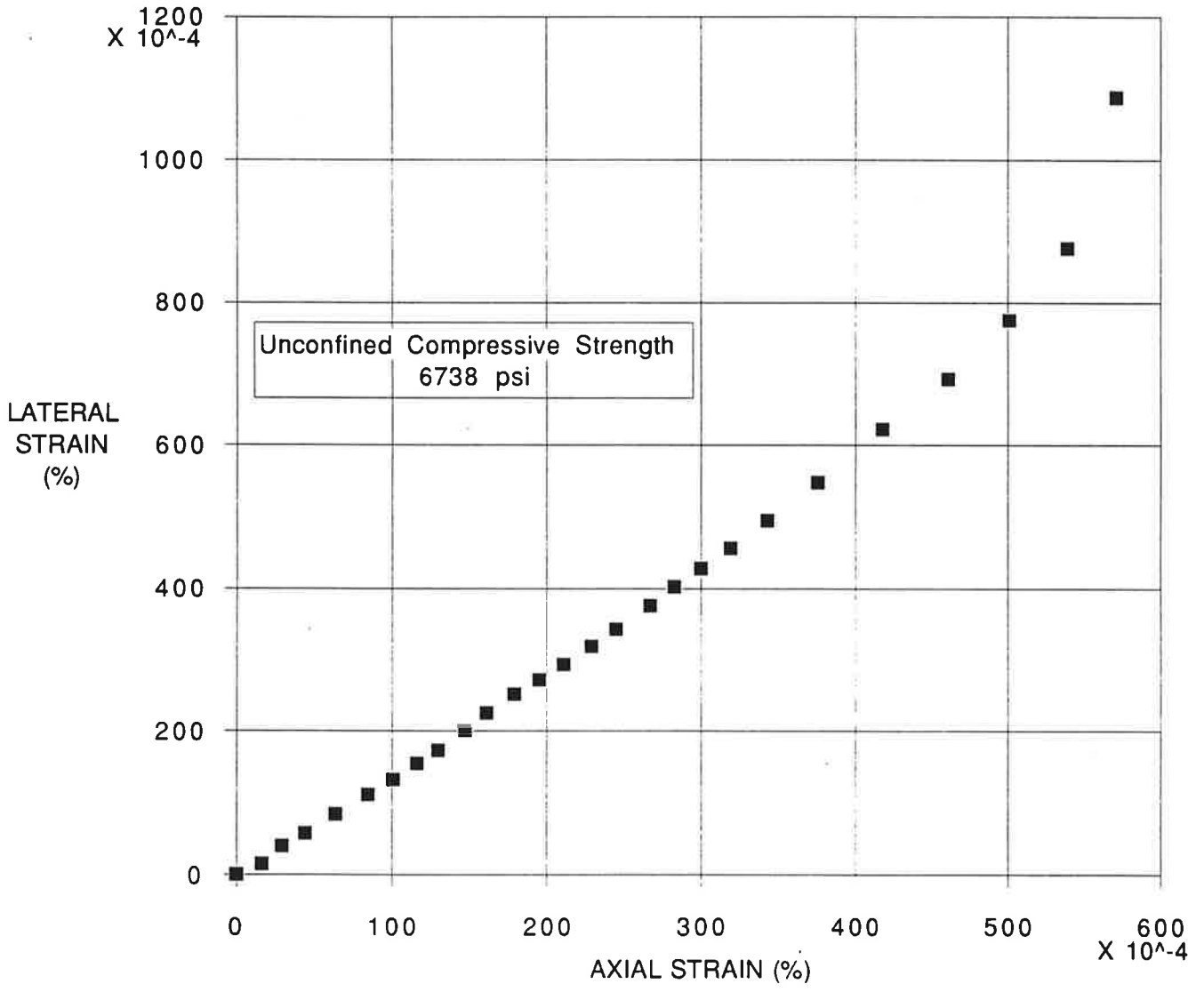
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
100	0	-25	0	4160	0
500	165	-41	16	4175	15
1000	372	-54	29	4200	40
1500	579	-69	44	4217	57
2000	785	-89	64	4244	84
2500	992	-110	85	4271	111
3000	1199	-126	101	4292	132
3500	1406	-141	116	4314	154
4000	1612	-155	130	4333	173
4500	1819	-172	147	4361	201
5000	2026	-186	161	4385	225
5500	2232	-204	179	4411	251
6000	2439	-220	195	4431	271
6500	2646	-236	211	4453	293

7000	2852	-254	229	4479	319
7500	3059	-270	245	4503	343
8000	3266	-292	267	4536	376
8500	3472	-308	283	4562	402
9000	3679	-325	300	4588	428
9500	3886	-344	319	4616	456
10000	4093	-368	343	4654	494
11000	4506	-401	376	4707	547
12000	4919	-443	418	4782	622
13000	5333	-486	461	4852	692
14000	5746	-526	501	4935	775
15000	6159	-564	539	5037	877
16000	6573	-596	571	5247	1087

NEW LOS PADRES DAM
21675-000
LA-1 S-3 (88.3-88.78 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
LA-1 S-3 (88.3-88.78 ft.)
LATERAL STRAIN - AXIAL STRAIN



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Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No. LA-1 S-4 (120.15-120.65 ft.)

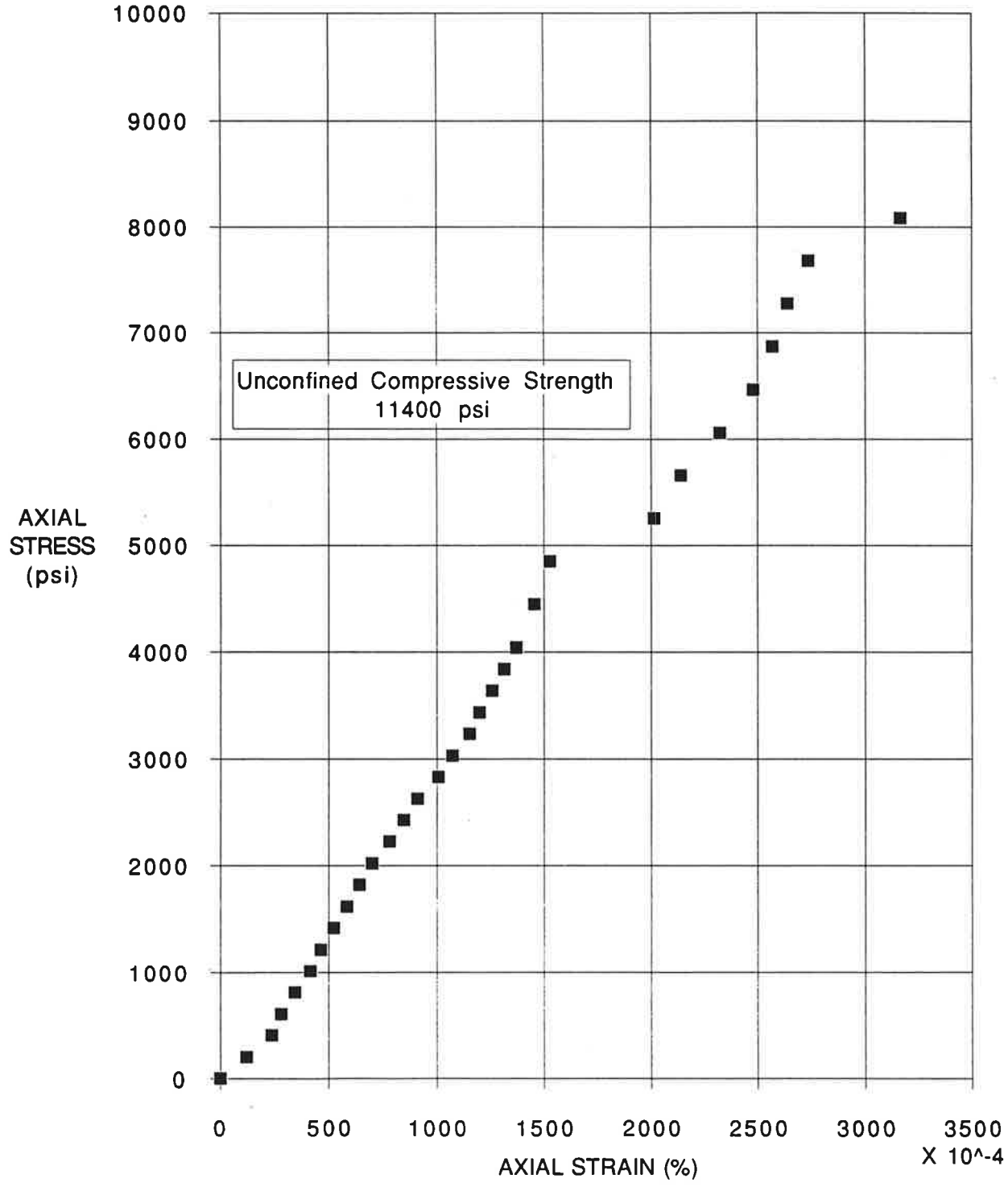
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.079	, 4.076	, 4.085	Ave Length (in)	=	4.080
Diameter (in)	=	1.775	, 1.775		Ave Diameter (in)	=	1.775
Area (sq. in)	=	2.474			Volume (cu. in)	=	10.096
Weight (g)	=	438.300			Unit Wt (pcf)	=	165.385

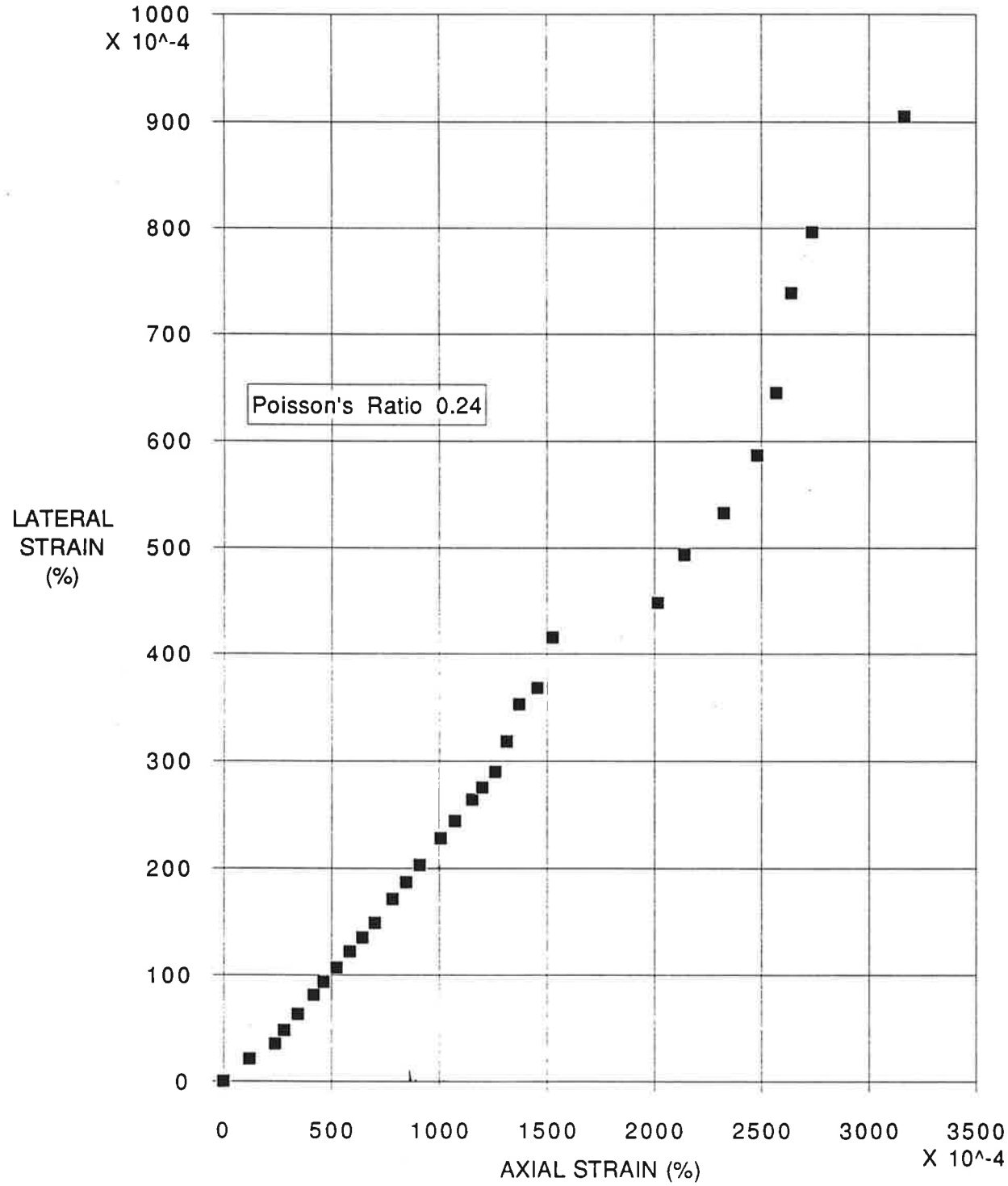
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	0	0	3678	0
500	202	-120	120	3699	21
1000	404	-238	238	3713	35
1500	606	-280	280	3726	48
2000	808	-344	344	3741	63
2500	1010	-416	416	3759	81
3000	1212	-464	464	3771	93
3500	1414	-524	524	3785	107
4000	1616	-585	585	3800	122
4500	1819	-644	644	3813	135
5000	2021	-701	701	3827	149
5500	2223	-783	783	3849	171
6000	2425	-847	847	3865	187
6500	2627	-911	911	3881	203

7000	2829	-1007	1007	3906	228
7500	3031	-1074	1074	3922	244
8000	3233	-1154	1154	3942	264
8500	3435	-1199	1199	3953	275
9000	3637	-1259	1259	3968	290
9500	3839	-1315	1315	3996	318
10000	4041	-1371	1371	4031	353
11000	4445	-1456	1456	4046	368
12000	4849	-1527	1527	4093	415
13000	5254	-2015	2015	4126	448
14000	5658	-2141	2141	4171	493
15000	6062	-2324	2324	4211	533
16000	6466	-2480	2480	4265	587
17000	6870	-2571	2571	4323	645
18000	7274	-2642	2642	4417	739
19000	7678	-2739	2739	4474	796
20000	8082	-3165	3165	4583	905

NEW LOS PADRES DAM
21675-000
LA-1 S-4 (120.15-120.65 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
LA-1 S-4 (120.15-120.65 ft.)
LATERAL STRAIN - AXIAL STRAIN



Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No.: RA-1 (59.7-60.2 ft.)

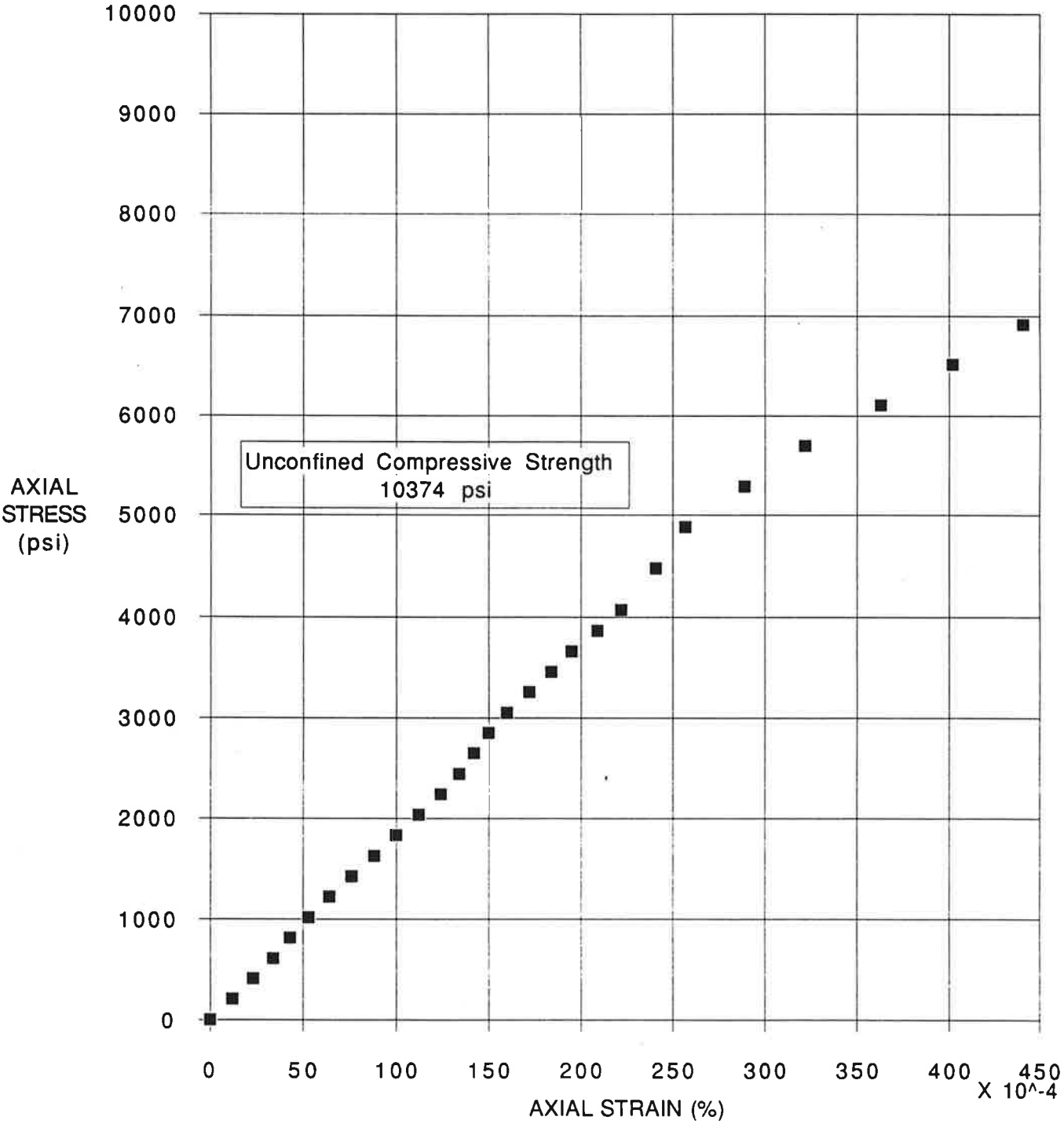
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	4.020	4.000	3.970	Ave Length (in)	=	3.997
Diameter (in)	=	1.768	1.770		Ave Diameter (in)	=	1.769
Area (sq. in)	=	2.458			Volume (cu. in)	=	9.823
Weight (g)	=	450.380			Unit Wt (pcf)	=	174.665

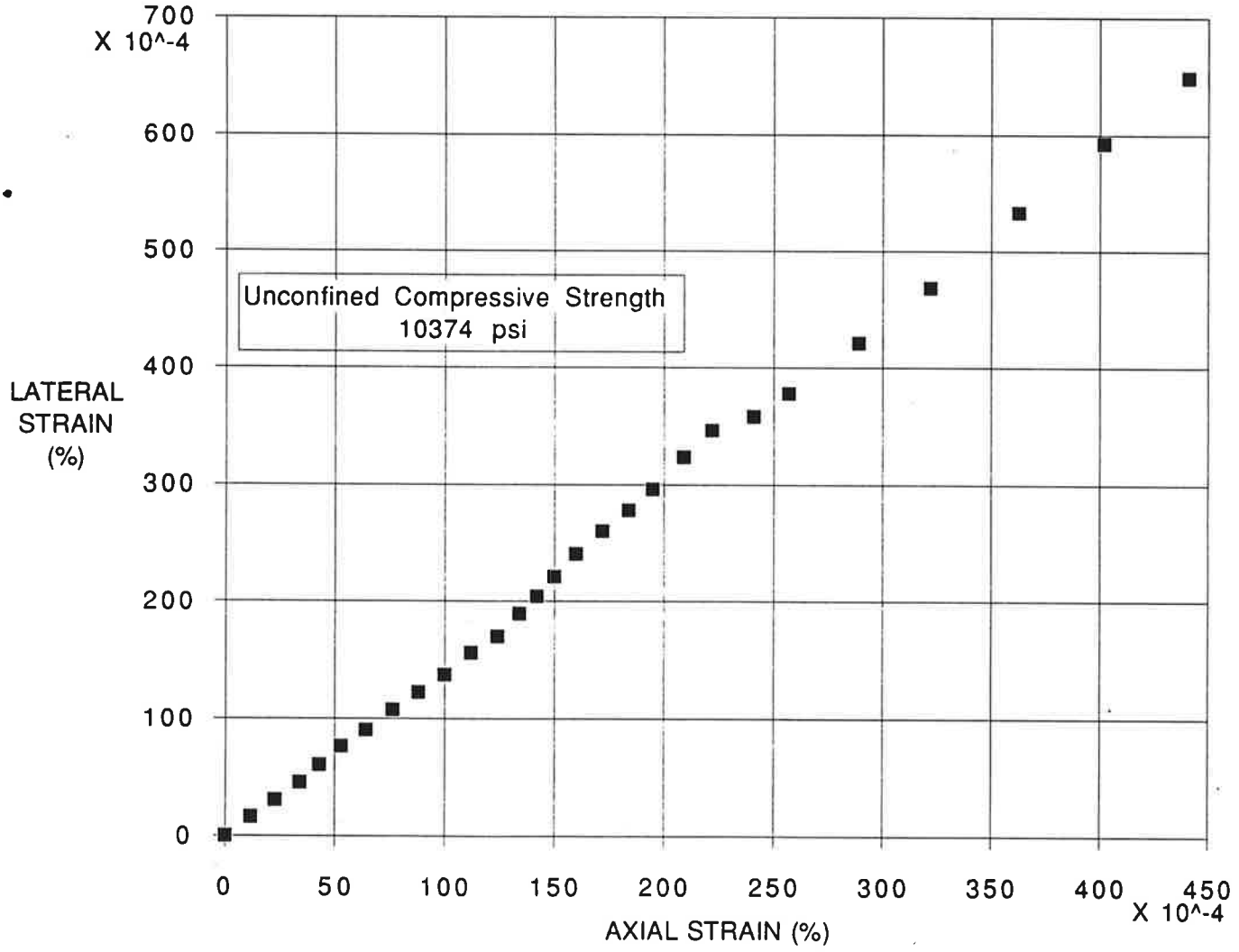
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	194	0	2224	0
500	203	182	12	2240	16
1000	407	171	23	2254	30
1500	610	160	34	2269	45
2000	814	151	43	2284	60
2500	1017	141	53	2300	76
3000	1221	130	64	2314	90
3500	1424	118	76	2331	107
4000	1627	106	88	2346	122
4500	1831	94	100	2361	137
5000	2034	82	112	2380	156
5500	2238	70	124	2394	170
6000	2441	60	134	2413	189
6500	2645	52	142	2428	204

7000	2848	44	150	2445	221
7500	3052	34	160	2464	240
8000	3255	22	172	2484	260
8500	3458	10	184	2502	278
9000	3662	-1	195	2520	296
9500	3865	-15	209	2547	323
10000	4069	-28	222	2570	346
11000	4476	-47	241	2582	358
12000	4882	-63	257	2602	378
13000	5289	-95	289	2645	421
14000	5696	-128	322	2692	468
15000	6103	-169	363	2757	533
16000	6510	-208	402	2817	593
17000	6917	-247	441	2873	649
18000	7324	-289	483	2955	731
19000	7731	-336	530	3070	846

NEW LOS PADRES DAM
21675-000
RA-1 (59.7-60.2 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
RA-1 (59.7-60.2 ft.)
LATERAL STRAIN - AXIAL STRAIN



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Bechtel Corporation
Geotechnical Laboratory

Deformability and Uniaxial Compression Test

Project : New Los Padres Dam
Job No.: 21675-000
Sample Identification No.: RA-1 (74.6-75.1 ft.)

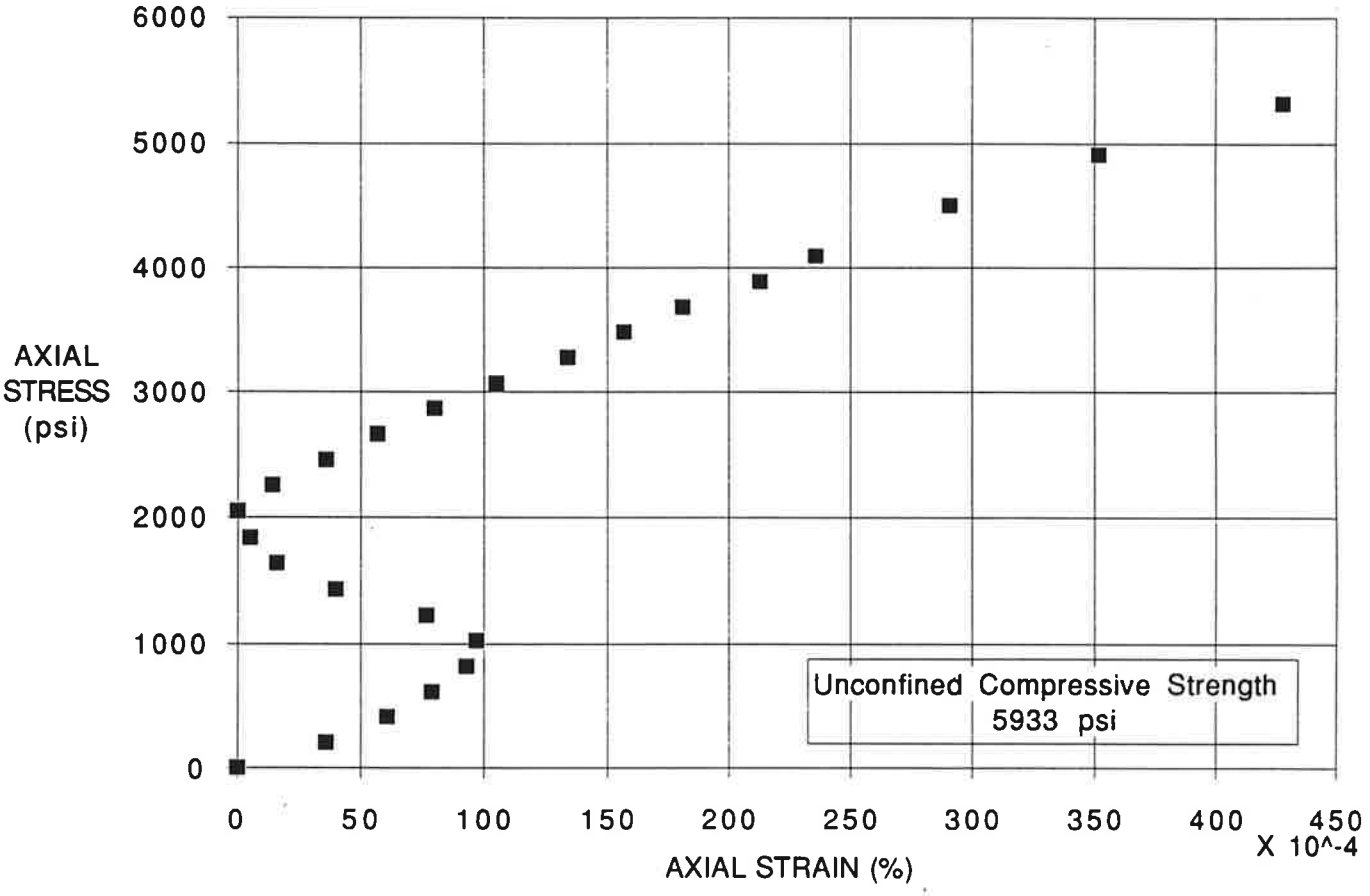
Date : February 6,1992
Test Performed by : Sundaram / Badua

Length of sample (in)	=	3.936	, 3.942	, 3.940	Ave Length (in)	=	3.939
Diameter (in)	=	1.767	, 1.761		Ave Diameter (in)	=	1.764
Area (sq. in)	=	2.444			Volume (cu. in)	=	9.627
Weight (g)	=	445.590			Unit Wt (pcf)	=	176.318

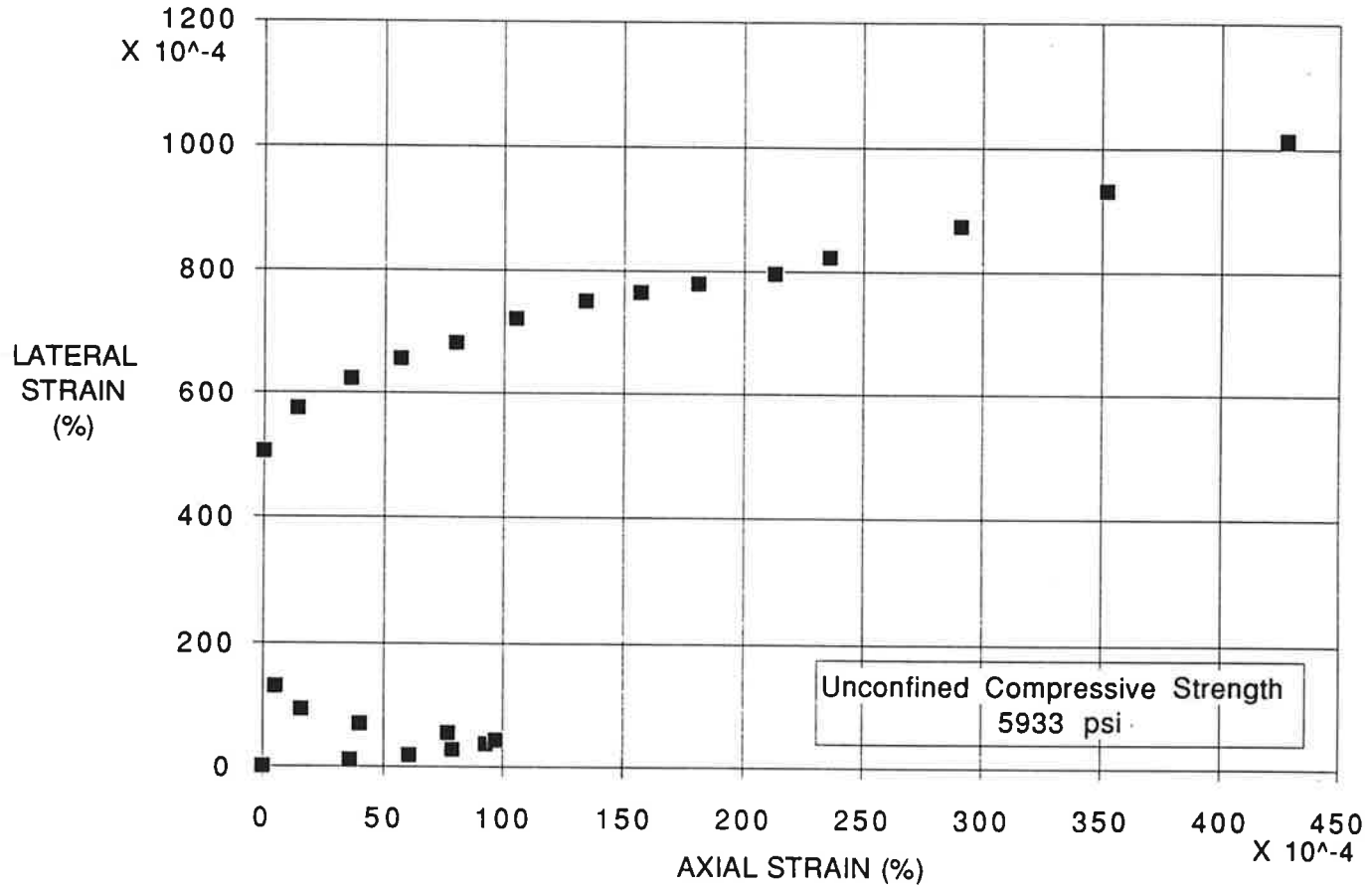
Measured Load (lbs)	Axial Stress (psi)	Measured Axial Strain (microns)	Axial Strain (microstrains)	Measured Lateral Strain (microns)	Lateral Strain (microstrains)
0	0	0	0	2522	0
500	205	-36	36	2533	11
1000	409	-61	61	2541	19
1500	614	-79	79	2550	28
2000	818	-93	93	2559	37
2500	1023	-97	97	2566	44
3000	1228	-77	77	2577	55
3500	1432	-40	40	2592	70
4000	1637	-16	16	2615	93
4500	1841	-5	5	2652	130
5000	2046	0	0	3026	504
5500	2250	-14	14	3096	574
6000	2455	-36	36	3145	623
6500	2660	-57	57	3178	656

7000	2864	-80	80	3204	682
7500	3069	-105	105	3244	722
8000	3273	-134	134	3273	751
8500	3478	-157	157	3287	765
9000	3683	-181	181	3302	780
9500	3887	-213	213	3318	796
10000	4092	-236	236	3345	823
11000	4501	-291	291	3395	873
12000	4910	-352	352	3453	931
13000	5319	-428	428	3535	1013

NEW LOS PADRES DAM
21675-000
RA-1 (74.6-75.1 ft.)
AXIAL STRESS - AXIAL STRAIN



NEW LOS PADRES DAM
21675-000
RA-1 (74.6-75.1 ft.)
LATERAL STRAIN - AXIAL STRAIN



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APPENDIX C.2

Petrographic Description of Core Samples

NEW LOS PADRES DAM
PETROGRAPHIC DESCRIPTION OF
CORE SAMPLES

Summary
In this section samples from Cores RA-1, LA-1, and C-1 are described. Core samples were examined in hand sample without the aid of a microscope. The macroscopic descriptions of selected intervals from the core are included here. Four thin sections of parts of Cores RA-1 and C-1 were made and examined with the petrographic microscope. Petrographic descriptions of thin sections are included under the appropriate sample numbers.

Samples ranged from quartz monzonite to diorite. The major minerals present were plagioclase feldspar, quartz, and biotite. Most samples were slightly altered: feldspar crystals showed slight alteration, some biotite crystals were partially altered to chlorite, and traces of clay and calcite were present. Where fractures (ranging from one to a few millimeters wide) were present, alteration was more intense adjacent to the fractures.

Hole RA-1 59.7-60.2

Hand Specimen
The core sample is a medium-grained diorite with 45% feldspar, 5% quartz, 30% biotite, and as much as 20% hornblende. The rock is altered with a small amount of clayey material, iron oxide, chlorite, and calcite along fracture surfaces.

Hole RA-1 74.6-75.1

Hand Specimen
The core sample has a color index of about 40 and is slightly altered.

Thin Section
The rock is a medium-grained diorite and shows slight alteration. Chlorite is present as an alteration product and occurs as very fine-grained fibrous and radiating aggregates.

Plagioclase feldspar	48%
Quartz	5%
Biotite	20%
Hornblende	25%
Chlorite	2%

Hole RA-1 118.2-118.6

Hand Specimen

Sections of the core appear to show more alteration than the thin section. There is a layer of calcite along a fracture and the feldspar appears white and slightly clayey in parts.

Thin Section

The rock is a medium-grained quartz diorite. Some biotite crystals are partially altered to chlorite. The feldspar is slightly altered in places.

Plagioclase feldspar	46%
Quartz	38%
Biotite	15%
Chlorite	<1%

Hole LA-1, S-1 44.9-45.15

Hand Specimen

The core sample is a medium-grained quartz monzonite or quartz diorite, containing 40% feldspar, 40% quartz, and 20% biotite. The feldspar minerals appear slightly altered. A fracture contains a small amount of calcite.

Hole LA-1, S-2 69.15-69.85

Hand Specimen

The core sample is a medium-grained quartz monzonite or quartz diorite, containing 45% feldspar, 30% quartz, and 25% biotite. The sample is moderately altered. There are several fracture surfaces that are coated with iron oxide minerals and parts of the core sample are friable. The feldspar minerals appear altered and clayey in places.

Hole LA-1, S-3 88.3-88.78

Hand Specimen

The core sample is a medium-grain quartz monzonite or quartz diorite containing 45% feldspar, 30% quartz, and 25% biotite. The feldspars appear partially altered and a fracture surface is coated with small amounts of iron oxide and calcite and a light green mineral (chlorite?).

Hole LA-1, S-4 120.15-120.65

Hand Specimen
The core sample is a medium-grained quartz monzonite or quartz diorite containing 45% feldspar, 30% quartz, and 25% biotite. It is partially altered, and there is calcite along a fracture surface.

Hole C-1, S-1 20.9-21.9
Hand Specimen
The core sample is a medium-grained granodiorite or quartz diorite with 35% feldspar, 35% quartz, 20% biotite, and 10% hornblende. Some feldspar crystals are partially altered to clay minerals. Occasional veins from one to a few millimeters thick are present, one with biotite and a few with partially altered feldspar crystals.

Hole C-1, S-2 96.65-97.33
Hand Specimen
The sample is a fine-grained quartz diorite or diorite with about 45% feldspar, 30% biotite, 10% hornblende, and 15% quartz. The feldspar appears slightly altered.

Hole C-1, S-3 122.63-123.23

Hand Specimen
The core sample is composed of two rock types, a medium-grained diorite with a color index of 40 and a fine-grained diorite or gabbro with a color index of 50. The finer-grained rock contains more mafic minerals than the coarser grained rock. The boundary between the two rock types is sharp. Both rock types appear relatively unaltered.

Thin Section

The sample for the thin section was taken from the medium-grained material. The sample is a medium-grained diorite. Several biotite crystals are partially altered to chlorite. Some hornblende has been altered to what appears to be very fine-grained aggregates of clay minerals (?). A very minor amount of calcite is present as part of the alteration assemblage. The plagioclase shows incipient alteration. The sample is slightly altered throughout and the alteration is not concentrated in any particular part of the thin section.

Plagioclase feldspar	55%
Quartz	10%
Biotite	19%
Hornblende	15%
Chlorite	1%
Calcite	trace
Iron oxide minerals	trace
Clay minerals (?)	trace

Hole C-1, S-4 165.46-165.85

Hand Specimen

The rock is a medium- to coarse-grained quartz monzonite. Some feldspar crystals are as large as 10 to 20 mm, but are not abundant or prominent enough to call the rock a porphyry. The feldspar appears partially altered and the rock has a few thin veins about a millimeter or two thick filled with what appears to be fine-grained feldspar.

Thin Section

The quartz monzonite is only slightly altered. Several biotite crystals have been partially altered to chlorite. There is incipient alteration of the feldspar minerals resulting in a fine-grained aggregate (clay minerals?) within and around the edges of the feldspar crystals, but the alteration material makes up less than one percent of the rock.

Plagioclase feldspar	35%
K-feldspar	25%
Quartz	30%
Biotite	10%
Clay minerals(?)	<1%
Hornblende	<1%
Chlorite	trace
Iron oxide minerals	trace

APPENDIX C.3

Laboratory RCC Materials Testing Report

KLEINFELDER

transmittal

Date December 26, 1991

File 11-4089-01

Copies 3

To Mr. Jock Langbeim

Bechtel Corporation

50 Beale Street

San Francisco, California 94119-3965

Subject **New Los Padres Dam Project/Lab Testing**

We are sending ☒ Attached ☐ Under separate cover

The following: Test Pit Combined Gradings

Via:

- ☐ Messenger
- ☐ First Class Mail
- ☐ Air
- ☐ Express
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Remarks

By Horace Jones/tb

Horace Jones
Laboratory Manager

HJ/tb52-63

Las Padres Dam Project
December 26, 1991
File: 11-4089-01

The Following Table Presents Test Data
Conducted In Accordance With ASTM C-136

Gradation:

Sieve Size	T-3	T-5	T-6	T-7	T-8	T-9	T-10	T-11	T-12	T-13
3"						100				
2 1/2"		100	100			99	100	100		100
2"	100	97	98		100	96	97	97		95
1 1/2"	97	93	95	100	97	92	88	87		87
1"	86	90	85	97	95	87	84	80	100	80
3/4"	81	88	81	96	94	85	79	74	97	78
1/2"	72	86	76	94	93	81	75	69	93	76
3/8"	66	85	73	93	92	79	72	66	91	74
#4	51	79	66	89	87	74	65	60	85	69
#8	42	71	55	81	78	67	57	47	77	59
#16	36	59	44	69	64	58	47	36	66	48
#30	29	47	31	59	50	47	33	23	56	39
#50	20	35	20	45	33	33	20	13	47	31
#100	13	25	13	32	21	21	12	7	38	23
#200	9.3	18.4	9.3	24.5	13.9	14.4	8.1	4.7	31.1	19.3

HJ/tb52-63

KLEINFELDER

transmittal

Date January 6, 1992

File 11-4089-01

Copies 3

To Mr. Jock Langbeim DEC 1 0 1991

Bechtel Corporation

50 Beale Street

San Francisco, California 94119-3965

Subject **New Los Padres Dam Project - Lab Testing**

We are sending ☒ Attached ☐ Under separate cover

The following:

5 - Dry Rodded Unit Weight	5 - Los Angeles Rattler Test
3 - Grading Analysis	5 - % Finer Than #200 (Wash)
5 - Atterberg Limits	
5 - Specific Gravity & Absorption of portion retained on #4 sieve. C-127	
5 - Specific Gravity & Absorption of portion passing #4 sieve. C-128	

Via:

- ☐ Messenger
- ☐ First Class Mail
- ☐ Air
- ☐ Express
- ☐ United Parcel
- ☐ Air Freight
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Remarks Following tests are in progress. Results will be reported as soon as testing is complete: Mortar Bar Expansion; Soundness; Potential Reactivity

By A. Sami Samadi

A. Sami Samadi, P.E.
Civil Engineer

SS/tb52-77.1

KLEINFELDER 6880 Koll Center Parkway, Suite 200, Pleasanton, CA 94566 (415) 484-1700

New Los Padres Dam Project
January 6, 1992
File: 11-4089-01

GRADING ANALYSIS
(ASTM C-136)
% PASSING

Sieve Size	T-1	T-2	T-4
3"		100	
2 1/2"		--	
2"	100	96	
1 1/2"	98	--	
1"	94	88	
3/4"	91	85	
1/2"	89	80	100
3/8"	87	77	99
#4	82	70	97
#8	67	60	88
#16	51	49	73
#30	36	38	57
#50	21	27	40
#100	12	17	27
#200	6.7	11.6	17.3

% FINER THAN #200 SIEVE (WASH)
(ASTM C-117)

SAMPLE ID	T-2	T-3	T-6	T-10	T-11
% Finer Than #200 Sieve	10.7	8.8	8.9	7.8	5.0

SS/tb52-77

KLEINFELDER

DRY RODDED UNIT WEIGHT
(ASTM C-29)

Sample ID	Unit Weight (pcf) Trial Number 1	2	3	Average Unit Weight (pcf)
T-2	117.1	119.5	120.0	119
T-3	115.1	114.4	115.4	115
T-6	113.0	114.3	116.5	115
T-10	112.6	124.2	122.9	123
T-11	115.7	114.0	117.2	116

LOS ANGELES RATTLER TEST
(ASTM C-131)

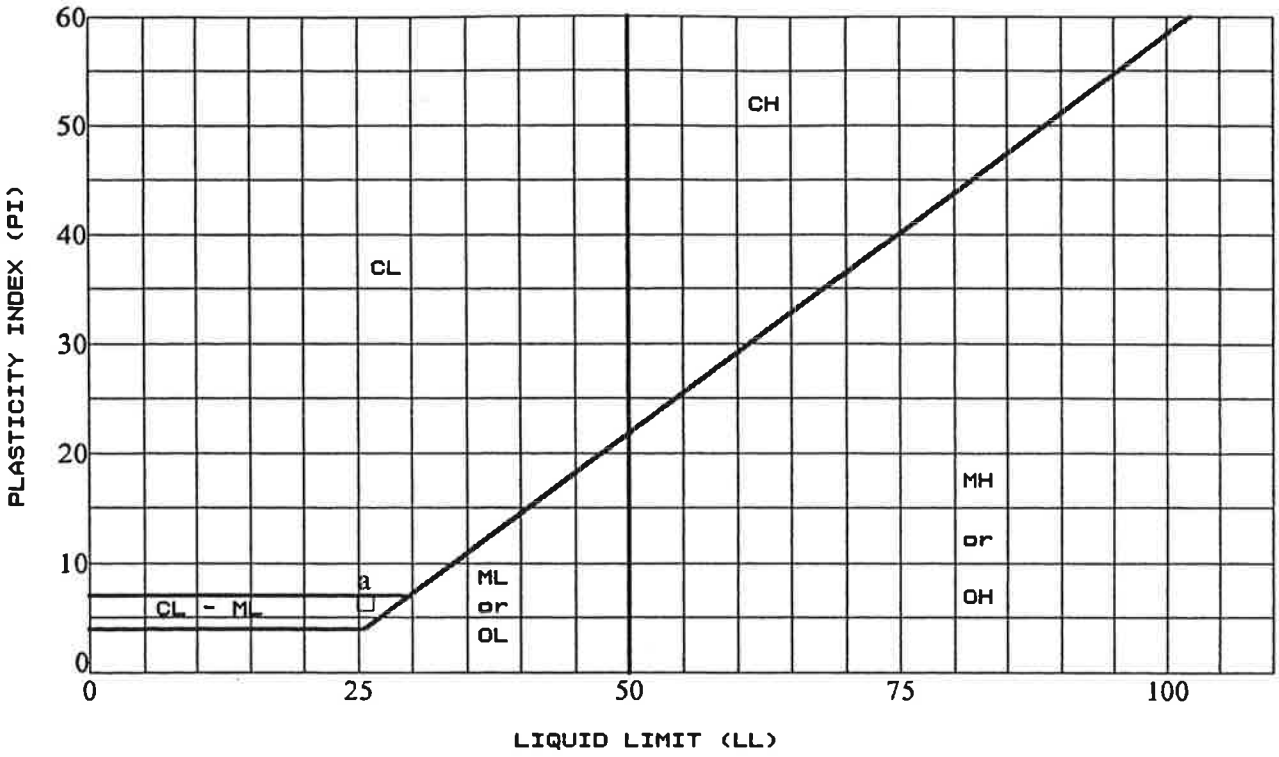
SAMPLE ID	T-2	T-3	T-6	T-10	T-11
% Loss After 500 Rev.	44.2	49.0	57.2	57.1	48.8

SPECIFIC GRAVITY & ABSORPTION TESTS
(ASTM C-127 & C-128)

Sample ID	T-2	T-3	T-6	T-10	T-11
Bulk SP. GR. (SSD)/+#4	2.74	2.71	2.67	2.73	2.72
Bulk SP. GR. (SSD)/-#4	2.45	2.55	2.50	2.64	2.58
Bulk SP. GR. (SSD)/Combined	**2.54**	**2.63**	**2.56**	**2.67**	**2.64**
Apparent SP. GR./+#4	2.82	2.78	2.74	2.77	2.78
Apparent SP. GR./-#4	2.51	2.69	2.57	2.73	2.62
Apparent SP. GR/Combined	**2.60**	**2.73**	**2.63**	**2.74**	**2.68**
% Absorption/+#4	1.6	1.5	1.6	1.0	1.5
% Absorption/-#4	1.7	3.2	2.0	2.0	1.0
% Absorption/Combined	**1.7**	**2.4**	**1.9**	**1.7**	**1.2**

Note: Combined values are the weighted averages proportional to the % passing and retained on #4 sieve.

SS/tb52-77



Symbol	Boring	Depth	LL	PL	PI	Sample Description
a	T-6		26	19	6	Olive Brown Clayey Silt(ML-CL)
	T-2		21	NP	NP	Olive Brown Sand (w/Trace of Clay)
	T-3		NP	NP	NP	Olive Brown Sand (w/Trace of Silt)
	T-10		NP	NP	NP	Olive Brown Sand (w/Trace of Silt)
	T-11		NP	NP	NP	Olive Brown Sand (w/Trace of Silt)

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER

PROJECT NO. 11-4089-01

Bechtel Corporation
New Los Padres Dam Project

PLASTICITY CHART

PLATE

KLEINFELDER

transmittal

Date March 2, 1992

File 11-4089-01

Copies 3

To Mr. Jock Langbeim
Bechtel Corporation
50 Beale Street
San Francisco, California 94119-3965

Subject **New Los Padres Dam Project - Lab Testing**

We are sending ☒ *Attached* ☐ *Under separate cover*

The following:

5 - Sodium Sulfate Soundness (ASTM C-88)

3 - Potential Reactivity (ASTM C-289)

Via:

- ☐ *Messenger*
- ☐ *First Class Mail*
- ☐ *Air*
- ☐ *Express*
- ☐ *United Parcel*
- ☐ *Air Freight*
- ☐ _____

Transmitted:

- ☐ *As Requested*
- ☐ *For Approval*
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Remarks Test remaining for completion -
3 Potential Reactivity
Mortar Bar Method ASTM C-227

By Horace Jones
Horace Jones
Laboratory Manager

HJ/tb53-61.1

KLEINFELDER 6880 Koll Center Parkway, Suite 200, Pleasanton, CA 94566 (415) 484-1700

New Los Padres Dam Project
File: 11-4089-01

SAMPLE #T-2
ASTM C-88

Sieve Size	Original Grading	Wt. Test Fraction	Percent Loss	Total Weighted % Loss	Coarse Grading	Weighted Coarse % Loss	Fine Grading	Weighted Fine % Loss
2 1/2 X 1 1/2"	4	4975.0	5.16	0.21	13	0.67	--	--
1 1/2" X 3/4"	11	1514.0	5.58	0.61	33	1.84	--	--
3/4" X 3/8"	11	1013.0	13.45	1.49	33	4.44	--	--
3/8" X #4	7	289.9	22.4	1.57	21	0.47	--	--
Total	--	--	--	--	100	7.4	--	--
3/8" X #4	[1](7)	(289.9)	(22.4)	(1.57)	--	--	9	0.20
#4 X #8	10	100.0	24.60	2.46	--	--	14	3.44
#8 X #16	11	100.0	17.10	1.87	--	--	15	2.57
#16 X #30	11	100.0	14.30	1.57	--	--	15	2.15
#30 X #50	11	100.0	13.90	1.53	--	--	15	2.09
Minus #50	24	--	--	--	--	--	32	--
Total	100	--	--	11.3	100	7.4	100	10.5

Note: (1) The 3/8" X #4 screen is double entered so the coarse and fine aggregate calculations can be completed.

The aggregate in these five samples went from one extreme to another; they either broke down to sand sizes or showed little or no distress.

HJ/tb53-61

New Los Padres Dam Project
File: 11-4089-01

SAMPLE #T-3
ASTM C-88

Sieve Size	Original Grading	Wt. Test Fraction	Percent Loss	Total Weighted % Loss	Coarse Grading	Weighted Coarse % Loss	Fine Grading	Weighted Fine % Loss
2 1/2" X 1 1/2"	3	5009.0	17.00	0.51	5	0.85	--	--
1 1/2 X 3/4"	16	1565.7	18.26	2.92	33	6.03	--	--
3/4" X 3/8"	15	1010.1	19.35	2.90	31	6.00	--	--
3/8" X #4	15	289.9	25.41	3.81	31	7.88	--	--
Total	--	--	--	--	100	20.8	--	--
3/8" X #4	[1](15)	(288.9)	(25.41)	(3.81)	--	--	22	5.59
#4 X #8	9	100.0	22.50	2.03	--	--	14	3.15
#8 X #16	6	100.0	16.80	1.01	--	--	9	1.51
#16 X #30	7	100.0	9.50	0.67	--	--	11	1.05
#30 X #50	9	100.0	9.30	0.84	--	--	14	1.30
Minus #50	20	--	--	--	--	--	30	--
Total	100	--	--	14.7	100	20.8	100	12.6

Note: (1) The 3/8" X #4 screen is double entered so the coarse and fine aggregate calculations can be completed.

The aggregate in these five samples went from one extreme to another; they either broke down to sand sizes or showed little or no distress.

HJ/tb53-61

New Los Padres Dam Project
File: 11-4089-01

SAMPLE #T-6
ASTM C-88

Sieve Size	Original Grading	Wt. Test Fraction	Percent Loss	Total Weighted % Loss	Coarse Grading	Weighted Coarse % Loss	Fine Grading	Weighted Fine % Loss
2 1/2" X 1 1/2"	5	4547	24.51	1.23	15	3.68	--	--
1 1/2" X 3/4"	14	1546.5	50.93	7.13	41	20.8	--	--
3/4" X 3/8"	8	1010.2	39.81	3.18	23	9.16	--	--
3/8" X #4	7	289.7	43.49	3.04	21	9.13	--	--
Total	--	--	--	--	100	42.9	--	--
3/8" X #4	[1](7)	(289.7)	(43.49)	(3.04)	--	--	10	4.35
#4 X #8	9	100.0	29.50	2.66	--	--	12	3.54
#8 X #16	11	100.0	18.70	2.06	--	--	15	2.81
#16 X #30	13	100.0	14.70	1.91	--	--	18	2.65
#30 X #50	11	100.0	12.10	1.33	--	--	15	1.82
Minus #50	22	--	--	--	--	--	30	--
Total	100	--	--	22.5	100	42.9	100	15.2

Note: (1) The 3/8" X #4 screen is double entered so the coarse and fine aggregate calculations can be completed.

The aggregate in these five samples went from one extreme to another; they either broke down to sand sizes or showed little or no distress.

HJ/tb53-61

New Los Padres Dam Project
File: 11-4089-01

SAMPLE #10
ASTM C-88

Sieve Size	Original Grading	Wt. Test Fraction	Percent Loss	Total Weighted % Loss	Coarse Grading	Weighted Coarse % Loss	Fine Grading	Weighted Fine % Loss
2 1/2" X 1 1/2"	12	4504.6	17.71	2.13	34	6.02	--	--
1 1/2" X 3/4"	9	1623.2	26.19	2.36	26	6.81	--	--
3/4" X 3/8"	7	1020	28.53	2.00	20	5.71	--	--
3/8" X #4	7	289.2	34.65	2.43	20	6.93	--	--
Total	--	--	--	--	100	25.5	--	--
3/8" X #4	[1](7)	(289.2)	(34.65)	(2.43)	--	--	10	3.47
#4 X #8	8	100.0	27.50	2.20	--	--	11	3.03
#8 X #16	10	100.0	16.20	1.62	--	--	14	2.27
#16 X #30	14	100.0	10.70	1.50	--	--	19	2.03
#30 X #50	13	100.0	10.50	1.37	--	--	18	1.89
Minus #50	20	--	--	--	--	--	28	--
Total	100	--	--	15.6	100	25.5	100	12.7

Note: (1) The 3/8" X #4 screen is double entered so the coarse and fine aggregate calculations can be completed.

The aggregate in these five samples went from one extreme to another; they either broke down to sand sizes or showed little or no distress.

HJ/tb53-61

New Los Padres Dam Project
File: 11-4089-01

SAMPLE #T-11
ASTM C-88

Sieve Size	Original Grading	Wt. Test Fraction	Percent Loss	Total Weighted % Loss	Coarse Grading	Weighted Coarse % Loss	Fine Grading	Weighted Fine % Loss
2 1/2" X 1 1/2"	13	4644.7	8.84	1.15	32	2.83	--	--
1 1/2" X 3/4"	13	1539.8	22.33	2.90	33	7.37	--	--
3/4" X 3/8"	8	1037.0	19.12	1.53	20	3.82	--	--
3/8" X #4	6	289.0	20.10	1.21	15	3.02	--	--
Total	--	--	--	--	100	17.0	--	--
3/8" X #4	[1](6)	(289.0)	(20.10)	(1.21)	--	--	9	1.81
#4 X #8	13	100.0	21.40	2.78	--	--	20	4.28
#8 X #16	11	100.0	11.0	1.21	--	--	16	1.76
#16 X #30	13	100.0	8.30	1.08	--	--	20	1.66
#30 X #50	10	100.0	5.80	0.58	--	--	15	0.87
Minus #50	13	--	--	-	--	--	20	--
Total	100	--	--	12.4	100	17.0	100	10.04

Note: (1) The 3/8" X #4 screen is double entered so the coarse and fine aggregate calculations can be completed.

The aggregate in these five samples went from one extreme to another; they either broke down to sand sizes or showed little or no distress.

HJ/tb53-61

New Los Padres Dam Project
File: 11-4089-01

POTENTIAL REACTIVITY
(ASTM C-289)

Sample Number	RC	SC	
T-2	185.0	19.0	Innocuous
T-6	143.0	25.3	Innocuous
T-10	153.0	24.3	Innocuous

HJ/tb53-61