

**GEOTECHNICAL REPORT
SOUTH SPILLWAY
PARDEE DAM
CALAVERAS COUNTY, CALIFORNIA**

**Prepared For
EAST BAY MUNICIPAL UTILITY DISTRICT
By
WOODWARD-CLYDE CONSULTANTS**

**In Association With
AGS, INC.**

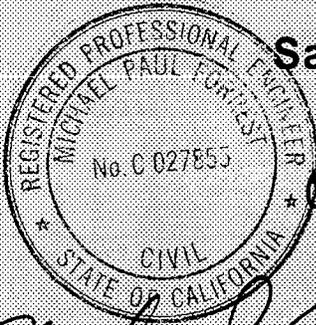
MARCH, 1993

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WCC Job #92C0389A AGS Job #920606A

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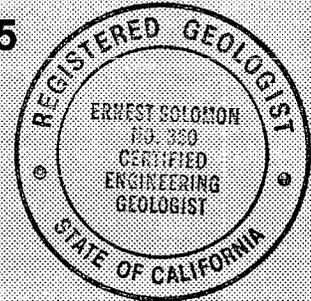
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Exp. 2/31/94

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MARCH, 1993



Ernest Solomon

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1.1 BACKGROUND

This geotechnical report was prepared by Woodward-Clyde Consultants (WCC) and its subconsultant, AGS, Inc., in support of the design of modifications to the Pardee Dam South Spillway. The South Spillway is located about 800 feet south of the dam, in a saddle of the left abutment ridge of Pardee Dam. The project site is in Calaveras County, California, about 4.5 miles north of the foothill town of Valley Springs.

The South Spillway is the main spillway for Pardee Dam. It has an approximately 800-foot wide ogee-crest weir with a crest elevation of 567.65 feet. The weir is separated into 20 bays by piers supporting a county road bridge that crosses the spillway. The spillway is 360 feet long and tapers to 425 feet wide at its downstream end. The elevation at the downstream end is 485 feet. The spillway training walls are 10 to 13 feet high. In the upper 60 feet of the spillway, design drawings indicate that the concrete is a minimum of 2 feet thick. The concrete may be as much as 15 feet thick beneath the spillway crest.

Woodward-Clyde Consultants performed a geological investigation of the South Spillway in 1987 and 1988. The investigation included: drilling 14 core borings in the spillway apron and two core borings in the reservoir upstream of the spillway (drilled from a barge); point-load testing of core samples; and geologic mapping of the spillway area.

Woodward-Clyde Consultants' Geological Investigation (1988) of the South Spillway indicated that the spillway is founded on a thin layer of soil or on weathered rock generally of low quality. The weathered rock and soil were considered to have a high erosion potential if exposed to high-velocity flow. The erosion potential decreased with depth and was much lower in slightly weathered rock which was found at depths ranging from 3 feet to the maximum

depth of boring, 45 feet. The report concluded that the foundation conditions were suitable for a labyrinth spillway crest.

1.2 PURPOSE AND SCOPE

The purpose of this geotechnical report is to provide geotechnical data and parameters for use in stability analyses and design of a new spillway structure. This report supplements data presented in WCC's 1988 report.

The scope of work for this geotechnical study consists of the following three tasks:

- Field exploration with monitoring and logging of rotary core borings;
- Testing of rock core samples; and
- Preparation of a geotechnical data report.

1.3 AUTHORIZATION

The work for this geotechnical exploration was performed in accordance with the August 25, 1992, Agreement for Engineering Design Services for Pardee Dam/South Spillway, Jackson Creek Spillway Modifications, between the East Bay Municipal Utility District (EBMUD) and WCC, and Addendum 2 of the September 22, 1992, Subcontract for Professional Services between WCC and AGS.

FIELD EXPLORATION AND LABORATORY TESTING

2.1 FIELD EXPLORATION

Two rock core borings were completed by AGS at South Spillway between February 16 and February 24, 1993. Both borings were drilled in the spillway structure; boring 93-1 was drilled below bay 9 and boring 93-2 was drilled below bay 12. Boring locations are shown on Figure 2, Site Plan and Geology.

The borings were logged from the drill cuttings, recovered core and one split-spoon sample, and from drilling performance information. The holes were grouted following completion of drilling. Logs of the borings are included in Appendix A. Logs of the 1988 borings completed by WCC are presented in Appendix B.

Core sampling in rock was performed using 5-foot long, 2.4-inch (HW bit size) and 2.06-inch inside diameter (NWD4 bit size), double tube core barrels with split inner barrels.

Core recovery ranged from 87.5% to 100%, and averaged 99.5%. Exploration boring data are summarized in Table 1.

A Standard Penetration Test (SPT) sampler was used to sample extremely weak concrete and rock at the concrete/rock interface in boring 93-2. The sampler was driven 0.2-foot. In addition, the concrete/rock interface was probed with an "L" -shaped steel rod and by hand. The geologist checked for voids or soft materials at the concrete/rock interface. The method of exploring the interface is included in Table 5 (Section 4.0) along with other data describing the characteristics of the concrete/rock interface.

TABLE 1 EXPLORATION BORING DATA SUMMARY					
BORING NUMBER	DEPTH ⁽¹⁾ DRILLED (feet)	APPROX. DEPTH TO ROCK (feet)	CORE ² RECOVERY (average %)	RQD (average%)	REMARKS
93-1	40.0	2.2	99	5	Lost circulation at 12.5'
93-2	40.0	2.4	100	29	Lost circulation at 23.0'
1. Approximate collar elevation 552.5 feet. 2. In rock, including run in concrete/rock interface					

Further details of the coring operations and logging procedures are presented in Appendix A.

2.2 LABORATORY TESTING

Six samples were selected for unconfined compression tests. The number of samples was limited because of the lack of cores of adequate length. Unit weights were also determined for each sample. The test data are summarized in Table 2. Further details of the tests are presented in Appendix C.

TABLE 2 SUMMARY OF ROCK STRENGTH TESTS			
SAMPLE ⁽¹⁾ NUMBER	DEPTH INTERVAL (feet)	UNCONFINED COMPRESSIVE STRENGTH (psi)	UNIT ⁽²⁾ WEIGHT (pcf)
93-1-5A	33.7 - 34.0	1610	159.0
93-1-6A	39.5 - 39.9	2000	161.3
93-2-1A	7.7 - 8.1	790	152.2
93-2-2A	12.6 - 13.1	1270	151.5
93-2-3A	18.8 - 19.9	420	169.0
93-2-4A	34.5 - 35.2	1580	172.8
1. Hole number (93-1) - box number (5A) 2. As-received condition; samples not oven dried.			

3.1 PHYSIOGRAPHY

The South Spillway is located in northwestern Calaveras County. The area is characterized by northwest-southeast-trending ridges and broad, rolling uplands cut by well-incised, west to southwest-flowing streams, such as the Mokelumne River. The spillway is located in a saddle in a northwest-trending ridge bounding the south arm of the reservoir. The spillway discharges into an area known as Mexican Gulch that trends westward and then northwestward from the saddle towards the Mokelumne River (Figure 2). The gulch has a steep gradient and steep transverse slopes.

3.2 GEOLOGIC SETTING

The project area is located in the Sierra Nevada geomorphic province, which extends some 400 miles from the Mojave Desert in the south to the Cascade Range (near the Oregon border) in the north. Much of the range consists of granitic rocks of Mesozoic age which comprise the Sierra Nevada batholith. In places, especially in the northern half, the batholithic rocks are flanked on the west by metamorphosed sedimentary and volcanic rocks of Mesozoic and Paleozoic age (Batemen and Wahrhaftig, 1966). Ultrabasic rocks, primarily serpentinite, occur in the region along linear belts often delineated by shear zones and faults. Late Tertiary alluvial and volcanoclastic deposits cover broad areas on the lower western slope of the range. The regional geology is shown on Figure 3.

The project area is in the metamorphic belt; Mesozoic-age metavolcanic bedrock underlies the site. The metavolcanic rocks are Jurassic-age Gopher Ridge Volcanics, which comprise much of the northwest-southeast-trending ridge in which the spillway is sited. Metasedimentary rock, mapped as the Jurassic-age Salt Springs Slate (WCC, 1988), occurs along the drainage about

500 feet west of the site. Colluvium occurs mid-slope on ridges in the project area, and landslides have been identified on the northeast-facing slopes of Mexican Gulch.

3.3 SITE GEOLOGY

Geologic units mapped by Woodward-Clyde Consultants (1988) at the spillway site include artificial fill, colluvium, slate, and metavolcanic rock. The results of subsurface exploration at the spillway indicates that metavolcanic rock is present beneath the structure. The geology of the South Spillway site is shown on Figure 2, Site Plan and Geology. Figure 4 shows the subsurface conditions beneath the structure parallel to its axis. The geologic units are discussed below.

3.3.1 Artificial Fill

Artificial fill (Qf) in the immediate project area includes the backfill behind the concrete spillway structure training walls, an area of apparently dumped materials on the slope northwest of the spillway chute, and materials immediately upstream of the ogee crest.

3.3.2 Colluvium

Colluvium (Qcol) has been mapped primarily west of the spillway structure on the slopes of Mexican Gulch. Some colluvium was also mapped on the slopes south of the spillway.

3.3.3 Slate

Salt Springs Slate (Jss) occurs west of the spillway along Mexican Gulch where the drainage trends northwesterly. The Salt Springs Slate includes dark gray, mica schist and black, sericite slate and appears to be crushed along its contact with the Gopher Ridge Volcanics in the floor of Mexican Gulch and on the slopes on the southwest side of Mexican Gulch. Some of the

landsliding on the southwest side of the gulch appears to have occurred in the crushed Salt Springs Slate.

3.3.4 Metavolcanic Rock

Woodward-Clyde Consultants (1988) identified the metavolcanic rock mapped at the South Spillway and encountered beneath the structure as part of the late Jurassic age, Gopher Ridge Volcanics (Jgo). This geologic unit consists largely of metamorphosed lapilli tuff and fine-grained volcanics (Earth Science Associates, 1992). Lapilli tuffs and the fine-grained volcanics crop out downstream of the spillway, and were recovered in core borings at the site. Metavolcanic breccia is reportedly less common.

The metavolcanic rock is typically light gray-green where fresh and weathers to light brown. The rock is generally intensely to closely fractured with local crushed zones; rock strength ranges from weak to moderately strong. Foliation is weakly developed.

3.4 ROCK MASS DISCONTINUITIES

Rock mass discontinuities include joints, shears, faults, foliation, and bedding planes. The general term "fracture" is often used to describe discontinuities in the rock mass. The rock is described as crushed, intensely fractured, moderately fractured, little fractured, or massive depending upon the fracture spacing (see Appendix A).

Fracture spacing in rock cores, from both the 1988 and present studies, was found to be intense (0.05 to 0.10 foot spacing) to close (0.10 to 0.50 foot spacing). Rock Quality Designation (RQD) ranges from zero to 80%, and is typically less than 50%.

The discontinuity data are based on mapping by WCC (1988) at the South Spillway and are summarized in Table 3. WWC identified four prominent joint sets; the strike of joint set number 4 is essentially parallel to the strike of the foliation.

TABLE 3 SUMMARY OF ROCK MASS DISCONTINUITIES ⁽¹⁾			
TYPE DISCONTINUITY	JOINT SET NO.	STRIKE	DIP
Joint	1	N70° - 80°W	55° - 70°SW
Joint	2	N50° - 55°W	67° - 73°SW
Joint	3	N15° - 35°W	18° - 35°SW
Joint	4	N10° - 20°W	80°NE - 90°
Foliation	--	N15° - 35°W	40° - 70°NE

1. Woodward-Clyde Consultants, 1988

3.5 GROUNDWATER

Fluid loss during drilling was recorded in borings 93-1 and 93-2. Because water was used in rotary coring of these borings, water levels were not measured. Water levels were measured in borings B-2 and B-3 as part of this investigation and in borings B-2, B-3, and B-4 as part of WCC's 1988 investigation.

Water levels appear to be related to reservoir water levels modified by site geology and topography. Water level data are summarized in Table 4. The reservoir water level on February 22, 1993 was at elevation 552.4 feet, 15.3 feet below spillway crest.

**TABLE 4
GROUNDWATER DATA**

BORING	DATE	DEPTH (feet)	ELEVATION ⁽¹⁾ (feet)	REMARKS
93-1	2/19/93	--	--	Not determined; circulation lost at 12.5'.
93-2	2/24/93	--	--	Not determined; circulation lost at 23.0'.
B-1	1/27/88 ⁽²⁾	--	--	Hole blocked at 3 feet; no data
B-2	1/27/88 ⁽²⁾	7.0	546.0	Res. W.S. 556.7 on 1/27/88
	2/16/93	11.2	541.8	Res. W.S. 551.3 on 2/19/93
	2/22/93	9.9	543.1	Res. W.S. 552.4 on 2/22/93
B-3	1/27/88 ⁽²⁾	17.0	535.5	Res. W.S. 556.1 on 1/27/88
	2/22/93	11.0	541.5	Res. W.S. 552.4 on 2/22/93
B-4	1/27/88 ⁽²⁾	22.0	543.5	Res. W.S. 556.7 on 1/27/88

1. Based on boring elevation taken from Figure 2, Site Plan
2. Woodward-Clyde Consultants, 1988.

4.1 GENERAL

The primary objective of this exploration program was to evaluate foundation conditions near the downstream toe of the ogee weir. Two borings, 93-1 and 93-2, were drilled through the concrete slab just downstream of the weir as part of this study. The work supplements an earlier study by WCC (1988), that included evaluation of the entire spillway foundation. Four borings, B-1, B-2, B-3, and B-4, were drilled near the toe of the weir as part of the earlier study.

4.2 CONCRETE/ROCK INTERFACE

Concrete thicknesses were 2.2 feet and 2.4 feet in borings 93-1 and 93-4, respectively. Borings B-2 and B-3, located near 93-1 and 93-2, encountered 2.0 and 2.4 feet of concrete, respectively. Borings B-1 and B-4, that were located in elevated portions on the sides of the spillway slab, encountered 3.0 and 4.0 feet of concrete, respectively.

Bonding of the concrete to the underlying bedrock was observed in boring 93-1, but not in the other borings. In boring 93-2, the concrete/rock interface was sampled with a 1.9-inch O.D. split-spoon sampler, and about 0.2 foot of crushed, weak concrete and rock was recovered.

The earlier borings (B-1 through B-4) also recovered a thin (0.05 to 0.3-foot) soil-like layer at the interface. Table 5 summarizes the exploration of the concrete/rock interface in borings 93-1 and 93-2.

TABLE 5 DESCRIPTION OF CONCRETE/ROCK INTERFACE			
BORING	APPROX. CONCRETE THICKNESS (feet)	EXPLORATION METHOD	DESCRIPTION OF CONCRETE/ROCK CONTACT AREA
93-1	2.2	HW core 1.5' - 2.6', 100% recovery, check w/probe and hand.	Concrete bonded to rock. Concrete and rock feel solid; no voids, edge or lip.
93-2	2.4	HW core 1.5' - 2.3', 87.5% recovery; SPT 2.3' - 2.5', 50 blows/0.2'; check w/probe and hand.	Concrete very weak, crushed at 2.3'; no bond to rock. SPT recovery crushed concrete, rock. Contact zone felt smooth; no voids, edge or lip.

4.3 ROCK CONDITION

The rock condition (weathering, rock strength, fracturing) as encountered in borings 93-1 and 93-2 is consistent with the previous exploration data based on the variability observed at the site.

Figure 4, Geologic Profile A-A', shows the zones of rock mass weathering beneath the ogee weir toe. The weathering classifications are grouped in accordance with the descriptions on the field logs. Weathering observed in borings 93-1 and 93-2 decreases with depth from moderately/slightly weathered to fresh. It should be anticipated that weathering conditions will vary from boring to boring as a result of the intensity and nature of the fractures and discontinuities along which weathering develops.

The rock cores obtained from borings 93-1 and 93-2 are described as weak, weak to moderately strong, or moderately strong. In general, rock strength appears to increase with depth reflecting the general decrease in weathering with depth.

Measurements of fracturing, such as fractures/foot and RQD (rock quality designation), do not appear to be related to depth; Figure 4 shows RQD and the distribution of fractures/foot for borings 93-1 and 93-2 and for borings B-1 through B-4. The core in borings 93-1 and 93-2

is generally described as closely to intensely fractured. The graphic logs and the fractures/foot indicate that the core from borings B-1 through B-4 is also generally closely to intensely fractured.

Fractures ranged from narrow to wide and appeared to be healed or filled with limonite stained clay. However, loss of circulation in both 93-1 and 93-2 suggests the presence of some open fractures in each boring.

Unconfined compression strengths of core samples from borings 93-1 and 93-2 ranged from 420 to 2000 psi. According to International Society for Rock Mechanics (1981), rock with unconfined compressive strengths of 145 to 725 psi is very weak; rock with unconfined compressive strengths of 725 to 3625 psi is weak. Photographs of the failed samples indicate that the cores failed along joints or foliation planes. These pre-existing planes of weakness had metallic oxide stain covering part to all of the surface. Unit weights ranged from 151.5 to 172.8 pcf. No unconfined compression tests were performed on cores from borings B-1 through B-4. Point load tests were performed on cores from borings B-1, B-2, and B-4 (WCC, 1988). Based on correlations with the Point Load Index, compressive strengths ranged from 100 psi to 1095 psi.

SUMMARY AND CONCLUSIONS

This report presents the results of the geotechnical exploration performed at the South Spillway. The exploration was conducted by AGS, Inc., under the general direction of WCC.

The purpose of the WCC/AGS field program was to explore the spillway foundation including the concrete/rock interface. The exploration consisted of two borings each 40 feet deep, drilled near the toe of the spillway weir.

Bedrock encountered in the borings consists primarily of moderately to slightly weathered, highly fractured metavolcanic rock with steeply dipping joints and foliation. Slightly weathered to fresh rock was encountered at depths varying from 12 to 23 feet. Foliation is weakly developed.

Bonding of the spillway concrete to the underlying rock was generally not observed at the concrete/rock interface. The concrete is often weak, and as much as 0.3-foot of crushed rock or other soil-like material was encountered at the interface. Only boring 93-1 recovered a core where the concrete was bonded to rock.

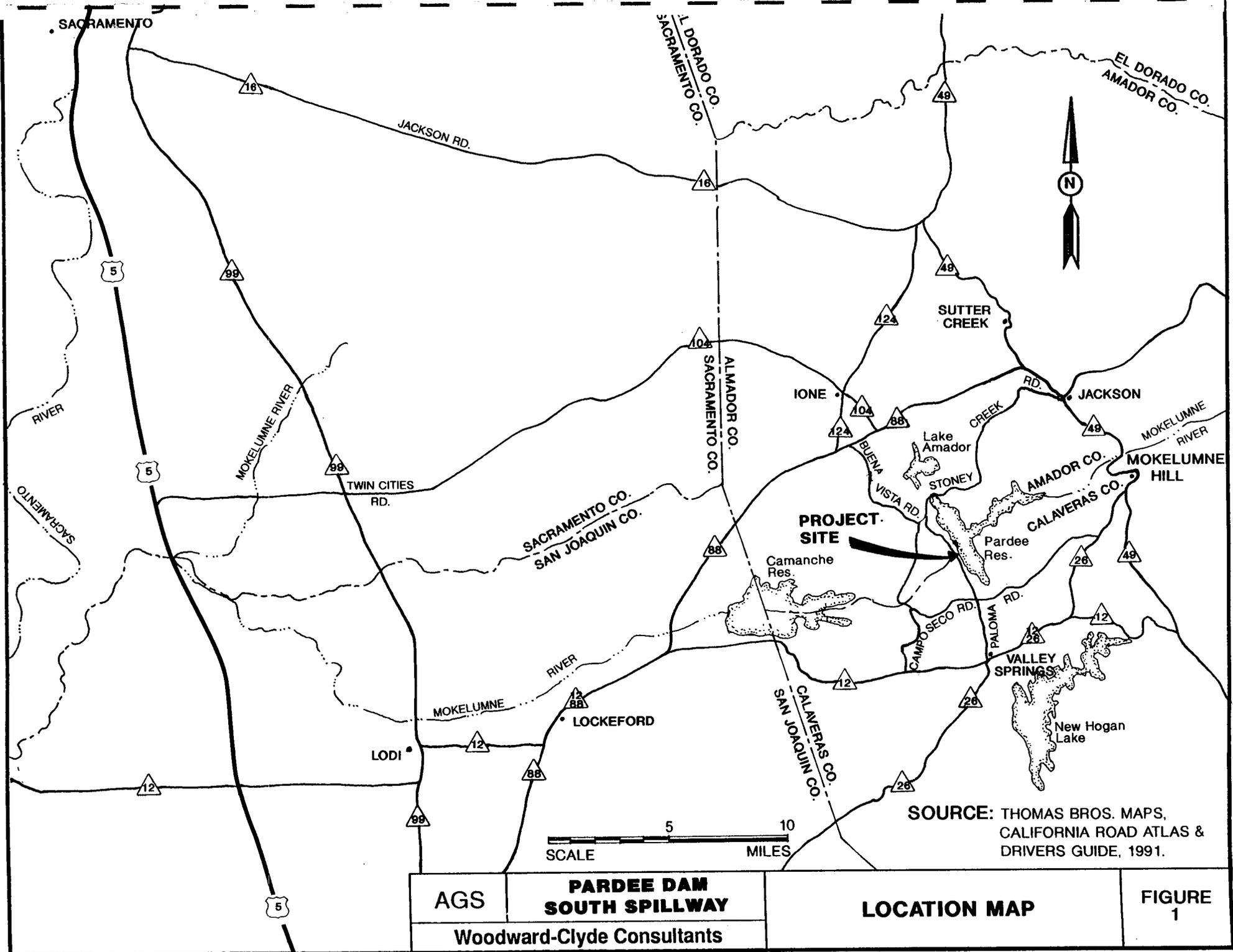
The results of the exploration support the conclusion of the earlier WCC study. The foundation conditions are considered suitable for a labyrinth spillway structure. Areas of highly weathered, or weak rock, would need to be excavated to more competent rock. Foundation rock will require careful cleaning to remove soil and crushed rock so that a sound concrete/rock bond may be obtained.

LIMITATIONS

This report has been prepared for the exclusive use of Woodward-Clyde Consultants and the East Bay Municipal Utility District for application only to the South Spillway at Pardee Dam, and is in accordance with generally accepted professional engineering geology principles and practices. There is no other warranty either expressed or implied.

The conclusions presented in this report are based on the assumption that the soil, rock and groundwater conditions do not deviate from the conditions encountered during the exploration programs as reported herein. To verify that the conditions used as a basis for design are encountered throughout the site, we recommend that we review foundation conditions during construction, including foundation excavation and preparation.

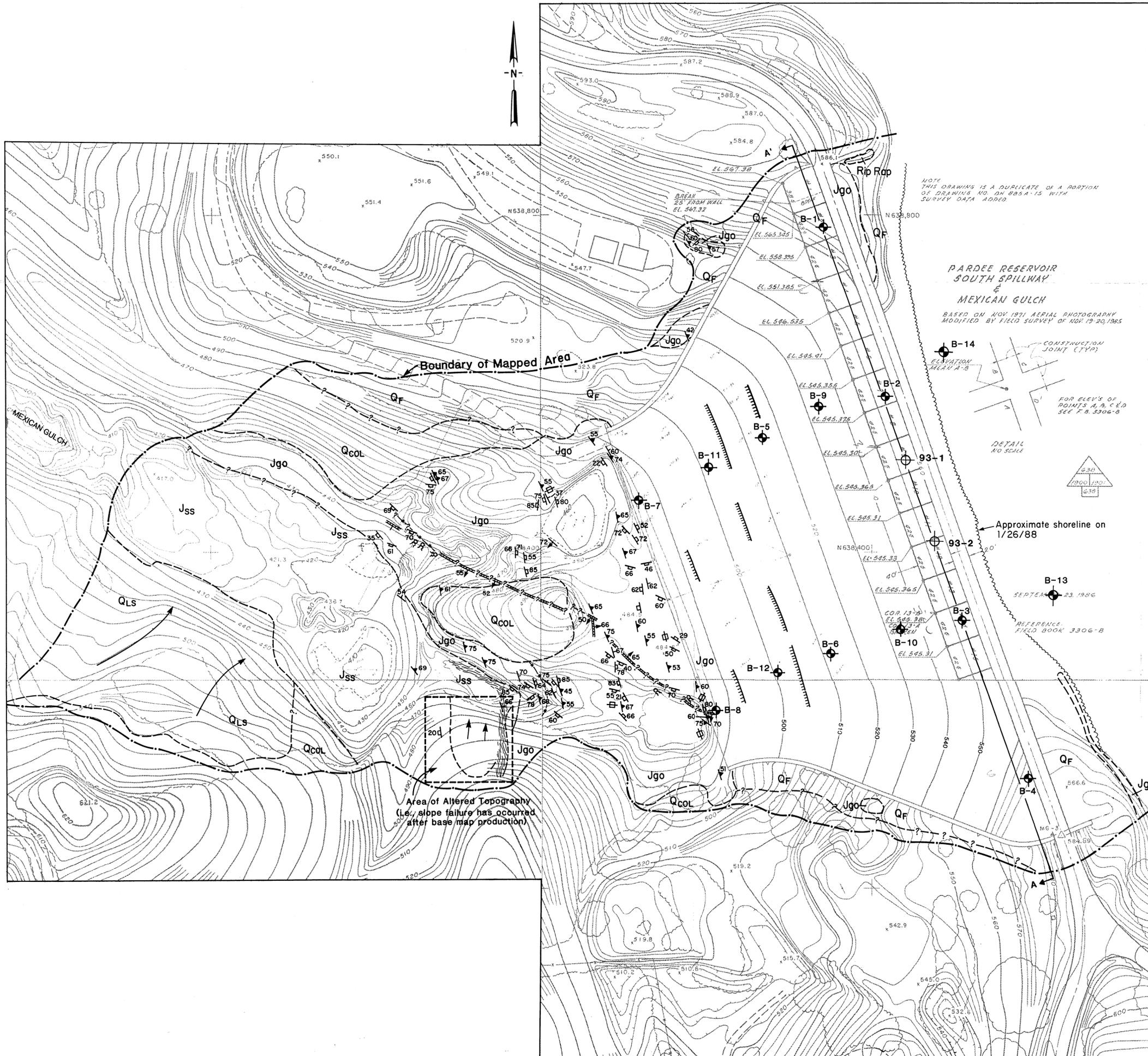
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AGS
**PARDEE DAM
 SOUTH SPILLWAY**
 Woodward-Clyde Consultants

LOCATION MAP

**FIGURE
 1**



LEGEND

- ? Approximate contact, question-marked where inferred
- Shear zone
- 30 ⊥ Strike and dip of beds (beds overturned)
- 60 ⊥ Strike and dip of shear
- Small shear zone, dashed with question marks where inferred (location based on aerial photo interpretations, arrow shows measured dip angle)
- 45 ⊥ Strike and dip of joint
- ⊥ Vertical joint
- 70 ⊥ Strike and dip of foliation
- ⊕ Spring
- Seep on spillway (Sept., 1987)
- B-1 ⊕ Exploratory boring; location approximate Boring WCC, 1988
- Landslide; arrows indicate direction of movement
- 93-1 ⊕ Boring WCC/AGS, 1993

CENOZOIC

- QUATERNARY
 - QF Fill material
 - QCOL Colluvium
 - QLS Landslide debris

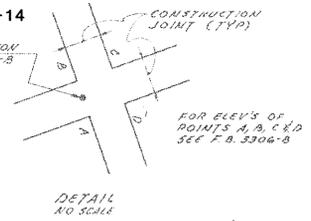
MESOZOIC

- JURASSIC
 - Jss Salt Springs slate: dark gray to black sericite slate and mica schist, with occasional meta-greywacke and meta-tuff; locally graphitic phyllite, foliated, weak when moderately weathered; typically weathers to depth of from 12 to 15 feet; weathers to a brownish-gray color. Thinly laminated. Often covered with veneer of alluvium in river channel.
 - Jgo Gopher Ridge volcanics: medium green to light olive-gray with some brownish-buff interbeds, includes metamorphosed very fine-grained tuff, medium-grained tuff, and fine- to coarse-grained volcanic breccia. Typically very strong when fresh; weak when completely weathered; typically weathers from 25 to 30 feet; weathers to a light to medium brown color. Bedding thickness from 3 inches to greater than 6 feet.

0 20 40 60 120 Feet
Scale: 1"=60'

NOTE: THIS DRAWING IS A DUPLICATE OF A PORTION OF DRAWING NO. D885A-15 WITH SURVEY DATA ADDED.

PARDEE RESERVOIR SOUTH SPILLWAY & MEXICAN GULCH
BASED ON NOV 1971 AERIAL PHOTOGRAPHY MODIFIED BY FIELD SURVEY OF NOV 19-20, 1985



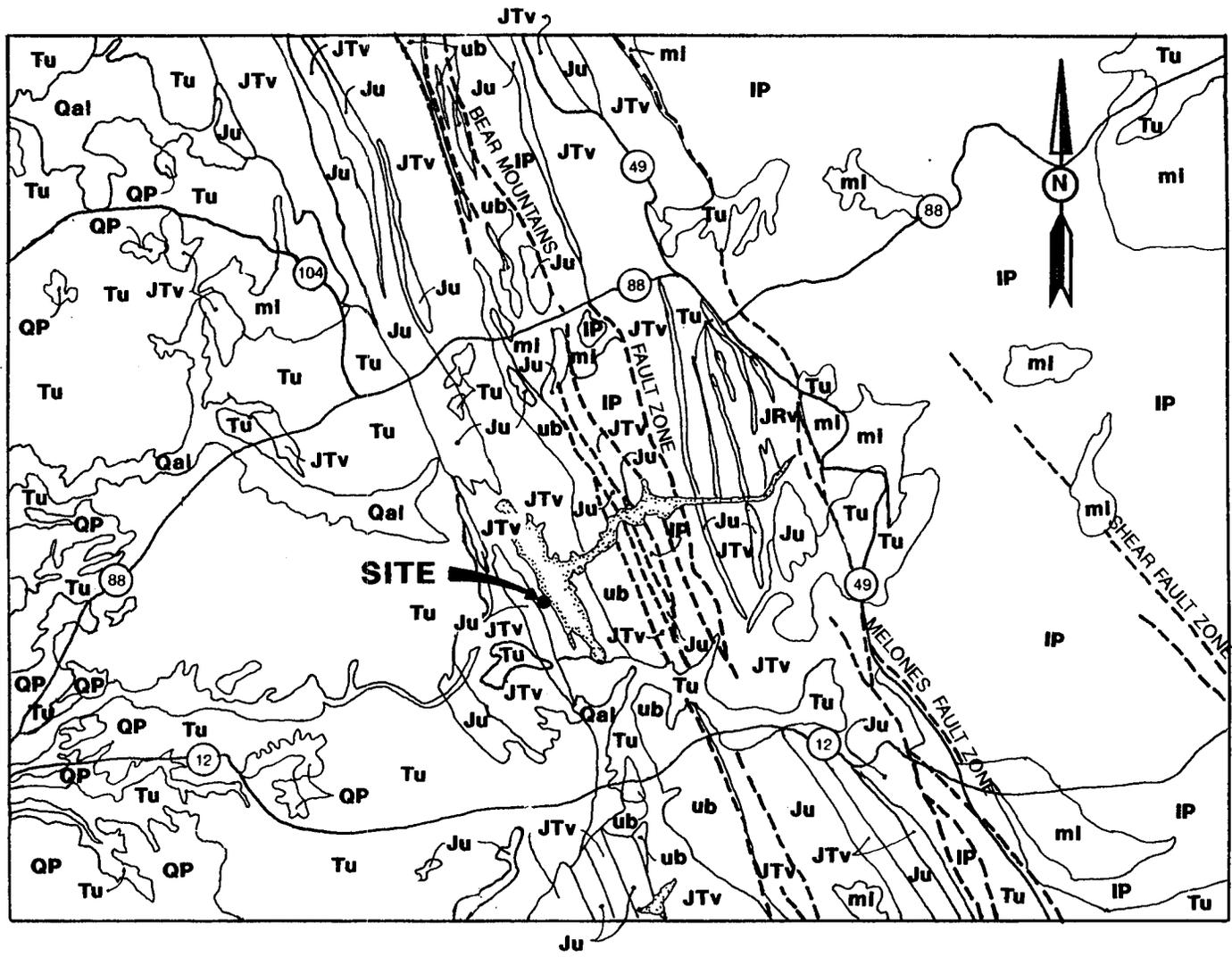
Approximate shoreline on 1/26/88

SEPTEMBER 23, 1986

REFERENCE: FIELD BOOK 3306-B

Area of Altered Topography (i.e., slope failure has occurred after base map production)

Note:
Geology by WCC, 1988.
See Figure 4 for profile.

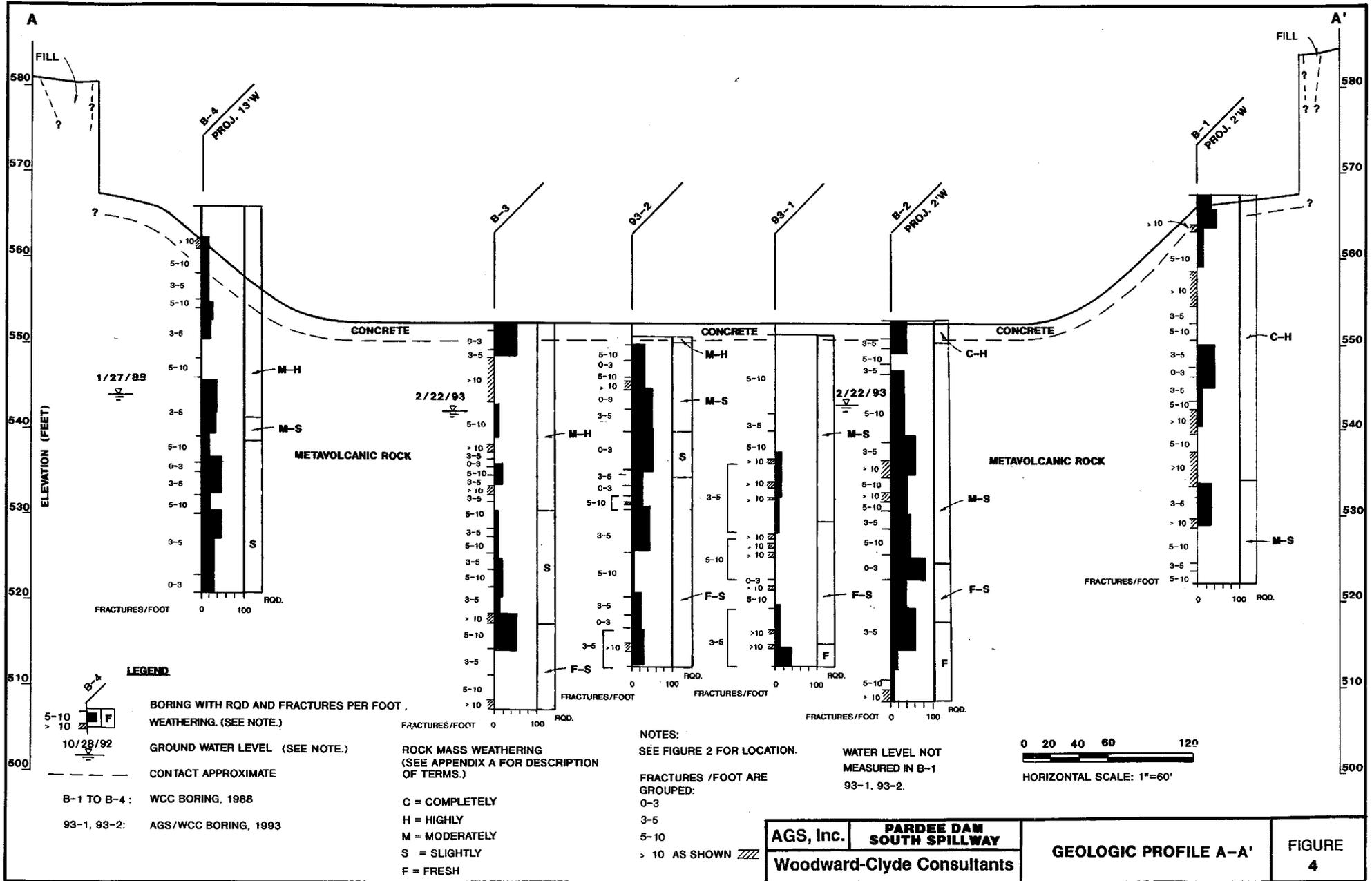


- LEGEND:**
- GEOLOGIC UNITS**
- Qal** Alluvium
 - QP** Plio - Pleistocene non - marine
 - Tu** Tertiary undifferentiated non - marine
 - Ju** Upper Jurassic
 - JTv** Jura - Triassic meta-volcanic
 - mi** Mesozoic granitic and basic intrusive rocks (serpentinite)
 - ub** Mesozoic ultra basic intrusive rocks
 - IP** Paleozoic
- GEOLOGIC SYMBOLS**
- Geologic contact, approximately located
 - Fault dashed where inferred



SOURCE: STRAND AND KOENIG, 1965.

AGS	PARDEE DAM SOUTH SPILLWAY	REGIONAL GEOLOGY	FIGURE 3
Woodward-Clyde Consultants			



APPENDIX A
FIELD EXPLORATION

A.1 EXPLORATION BORINGS

Two borings were drilled at the South Spillway for this study. The borings, which were drilled between February 16 and February 24, 1993, were each 40 feet deep and were logged from the drill cuttings, recovered soil sample and core, and transient drilling information. All borings were drilled using a crawler-mounted, Failing 250 drill rig equipped for rock core and rotary wash drilling by Pitcher Drilling Company of Palo Alto. The borings were grouted upon completion of drilling.

Borings 93-1 and 93-2 were located 2 feet downstream of the concrete bays in the spillway structure. A 6-inch tricone bit was used to start the borings in the spillway concrete and drilled to a depth of 1.5 feet.

In boring 93-1, a 2-foot long, HW (2.4 inch I.D.) core barrel was used to drill through the bottom of the concrete; a 5-foot long, HW double-tube core barrel with a split inner tube was used to sample the rock below the concrete to 29 feet. A 5-foot long, NWD4 (2.06 inch I.D.) double-tube core barrel with a split inner barrel was used below 29 feet.

In boring 93-2, the 2-foot long HW barrel was stopped short of the interface when the concrete became "soft". The interface zone was then sampled with an SPT sampler. The 5-foot long NWD4 core barrel, was used to sample the rock below the concrete.

Retrieved core samples were photographed in the split inner barrel, placed in partitioned, waxed-cardboard core boxes, logged, and photographed. Care was taken to keep sequential core runs in their proper order and orientation. The depth of the top and bottom of each core run was marked on wood blocks dividing the core runs. Hole, box number, and depth intervals

were marked on each box. Logs and photograph plates of boxed-core are presented in this appendix (Figures A-1 to A-5). Core recovery and RQD data are summarized in Table 1 (Section 2.3).

Soil sampling was performed once—in the soil-like, weak concrete/rock interface zone in boring 93-2. A disturbed sample was taken with a Standard Penetration Test (SPT) sampler. The SPT sampler was driven with a 140-pound hammer, falling 30 inches. Blow counts required for driving the sampler were recorded.

A.2 CONCRETE/ROCK INTERFACE PROBE

The concrete/rock interfaces were probed in borings 93-1 and 93-2 with an "L"-shaped steel rod to check for voids or soft materials. Both borings were also checked by hand.

LEGEND FOR ROCK CORE LOGS

1.0 Joint Descriptors

Discontinuity Type		Amount of Infilling	
F	- Fault	St	- Surface Stain
J	- Joint	Sp	- Spotty
Sh	- Shear	P	- Partially Filled
Of	- Foliation	F	- Filled
V	- Vein	N	- None
B	- Bedding		
M	- Mechanical		
Aperture (inches)		Surface Shape of Joint	
W	- Wide 0.5 - 2.0	W	- Wavy
MW	Mod. Wide 0.1-0.5	Pl	- Planer
N	- Narrow 0.05-0.1	St	- Stepped
VN	Very Narrow < 0.05		
T	- 0		

Type of Infilling	Roughness of Surface
C - Clay	Slk - Slickensided
Sd - Sand	S - Smooth
H - Healed	Sr - Slightly Rough
Ch - Chlorite	R - Rough
Ca - Calcite	VR - Very Rough
Fe - Iron Oxide	
G - Gypsum/Talc	
Q - Quartz	
N - None	

The dip of joint surfaces are measured relative to a plane normal to the long axis of the core.

2.0 RQD (Rock Quality Designation in %)

The percentage of each coring interval that is intact pieces of core greater than 4 inches in length. RQD is calculated by summing up the lengths of core greater than 4 inches in the core run and dividing by the length of the core run.

The RQD count does not include core that is highly weathered, completely weathered, or residual soil, or rock that is extremely weak. Very weak or stronger rock is counted for RQD.

3.0 Fractures/Ft (Fracture Frequency)

The number of naturally occurring fractures per foot of core run. Mechanical breaks are not counted.

4.0 Fracture Spacing Description

Description	Spacing (feet)
Crushed (may contain clay)	Less than 0.05
Intensely fractured	0.05 to 0.1
Closely fractured	0.1 to 0.5
Moderately fractured	0.5 to 1.0
Little fractured	1.0 to 3.0
Massive	3.0 and larger

5.0 Weathering Descriptors

Term	Description
Fresh - F	No visible sign of rock material weathering: perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered - S	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered - M	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered - H	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered - C	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock materials is converted to soil. The mass structure and material fabric are destroyed.

6.0 Strength Descriptors

Description	Field Identification
Very soft clay	Easily penetrated several inches by fist
Soft clay	Easily penetrated several inches by thumb
Firm clay	Can be penetrated several inches by thumb with moderate effort.
Stiff clay	Readily indented by thumb but penetrated only with great effort
Very stiff clay	Readily indented by thumbnail
Hard clay	Indented with difficulty by thumbnail
Extremely weak rock	Indented by thumbnail
Very weak rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer
Medium strong rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer
Strong rock	Specimen requires more than one blow of geological hammer to fracture it.
Very strong rock	Specimen requires many blows of geological hammer to fracture it.
Extremely strong rock	Specimen can only be chipped with geological hammer.

7.0 Graphic Descriptions

Lithology Sketch



Fracture with inclination from plane normal to axis of core.



Project Name: PARDEE DAM		Boring No.: 93-1		Sheet 1 of 3	
Project No.: 920608 A		Task:		Elevation and (Datum): 552.5' (approx.)	
Boring Location: SOUTH SPILLWAY, 9 th bay from right abutment				Date Started: 2/16/93	
Date Finished: 2/19/93		Completion Depth: 40.0 ft		Rock Depth: 2.2 ft.	
Drilling Co.: Pitcher Drilling		Driller: Wayne Baker		No. of Samples: Dist: Undist: Core:	
Drilling Eqpt.: Falling 250		Water: ①		First: Compl.: 24 hrs.:	
Drilling Method: Rotary Wash		Core Barrel: HW, NWD4		Length: 5 ft	
Casing Size:		Type:		Depth:	
Bits: Surface set diamond		Logged by: C. Andrews		Checked by: E. Solomon	

DEPTH (feet)	DESCRIPTION	ROCK CORE						SOIL SAMPLES				REMARKS	
		Sketch	Lithology	Run No.	Recov. (ft)	RQD	Fractures / ft	Weathering	Strength	Box No.	Type		Blow Count
0	SPILLWAY CONCRETE; with aggregate 0.25" to 2.5" maximum dimension												ca/16/93 Rock bit to 1 1/2 feet slow drilling
1													
2				1	1.2	0							Brain Core HW size 1.5' - 2.6' HW core barrel * 0 = 0% RQD 1.0' includes vertically fractured rock
3	GOPHER RIDGE VOLCANICS 2.2' - 4.0' METAVOLCANIC: green, recrystallized; weakly foliated; moderately strong; slightly weathered with dark brown stains in fractures; closely to intensely fractured; increasingly breccia/tuff-like J: VN-N; Fe, C; Sb, Sp; P-W; Sr			2	1.0	0	8-10	5	MS				2.0' - 3.0' HW core barrel * 0 = 0%
4				3	1.9	0	6-7						1.5' - 2.0' HW core barrel * 0 = 0%
5	J/F?: MW; C and rock "bits"; P-F; 15° P-W; S-Sr			4	5.0	0	7-8	5	MS	Box 1			3.0' - 5.5' HW core barrel * 9/10 = 0%
6	5.1' - 11.3': Breccia/tuff Metavolcanic texture, interbed;				5.0	0							5.5' - 10.5' HW core barrel * 10/50 = 20%
7	Slightly to moderately weathered along fractures; abundant partially healed fractures, closely fractured;												① Not determined, no circulation.
8	J: N-MW; Q; P-F; W; Sr-R												
9	J: MW; Q ^{Fe} ; P; W; R; intact with voids												
10	9.6' - 10.5': moderately strong to weak J: MW; Fe, C; P; P-W; Sr												
11	increasingly abundant quartz infilling												
12	J: N; Fe; plants; Sp-P; P-W; Sr									Box 2			10.5' - 12.5' HW core barrel * 0/2.0 = 0%
13	J: N; Fe, C; P; W; R J: MW; Fe, Q; Sp-P; F; W; R-VR												barrel blocked at bit
14										Box 3			12.5' - 15.5' HW core barrel, no circulation * 0/30 = 0%



Project Name : PARDEE DAM		Boring No.: 93-2		Sheet 1 of 3	
Project No.: 920606 A		Task:		Elevation and (Datum): 552.5' (approx.)	
Boring Location: SOUTH SPILLWAY, 12 bay from right abutment				Date Started: 2/22/93	Date Finished: 2/24/93
Drilling Co.: Pitcher Drilling		Driller: Wayne Baker		Completion Depth: 40.0 ft	Rock Depth: 2.4 ft
Drilling Eqpt.: Failing 250		No. of Samples:		Dist.:	Undist.: Core:
Drilling Method: Rotary Wash				Water: ①	First:
Core Barrel: HW/NWD 4		Length: 5 ft	Bit: Surface set diamond		Logged by: C. Andrews
Casing Size:		Type:	Depth:		Checked by: E. Solomon

DEPTH (feet)	DESCRIPTION	ROCK CORE							SOIL SAMPLES			REMARKS	
		Sketch	Lithology	Run No.	Recov. (ft)	RQD	Fractures / ft	Weathering	Strength	Box No.	Type		Blow Count
0	SPILLWAY CONCRETE with aggregate 0.25" to 2.5" maximum dimension												02/22/93 Rock bit into concrete with 6" tricone bit. Hard drilling - cobble size aggregate?
1													
2	weak concrete			1	0.7 0.8	0.8 0.8				Box 1			12:12 1.5'-2.3' HW core barrel * 0.8 = 0% RQD includes vertically fractured rock
3	GOPHER RIDGE VOLCANICS 2.4'-40.0' METAVOLCANIC: light orange brown with dark iron oxide stains in fractures; highly to completely weathered - friable to soil-like with fracture planes; very to extremely weak at contact; below contact slightly to moderately weathered; weak; closely fractured with abundant clay and limonite filled/healed fractures; color changes to green-gray with staining		MV				220 5-7	4-6 5-M		Box 1			12:50 concrete grinding up, 2.3'-2.5' Drive 1.9" STANDARD PENETRATION SAMPLER 2.5'-7.5' NWD4 core barrel
4			2	5.0 5.0	1.2 5.0								* 1.2 / 5.0 = 24%
5	J: N; C, Fe; P-F; P-W; Sr-S V: W; Q; F-P; W						2-3			Box 1			① NOT determined, no circulation.
6							5						
7	J/S: W; C, Fe, Q, rock bits; F; W; R						>20 10-20						
8	increasing quartz infilling and quartz healed fractures						2-3		MS-W				14:34 14:50 7.5'-12.5' NWD4 core barrel.
9	J: N-mw; C, Fe; F; P; Sr												* 2.1 / 5.0 = 42%
10	J: mw; C, Q; P-F; W; R						5		W				
11	V: N; Q; P-F; W-P; Sr								MS-W				
12									S MS	Box 2			
13			4	5.1 5.0	2.2 5.0		2-3						16:30 16:40 12.5'-17.5' NWD4 core barrel * 2.2 / 5.0 = 44%
14	J/V: mw; Q; P; W-P; S-Sr						*						



Project Name: PARDEE DAM

Boring No.: B-93-2

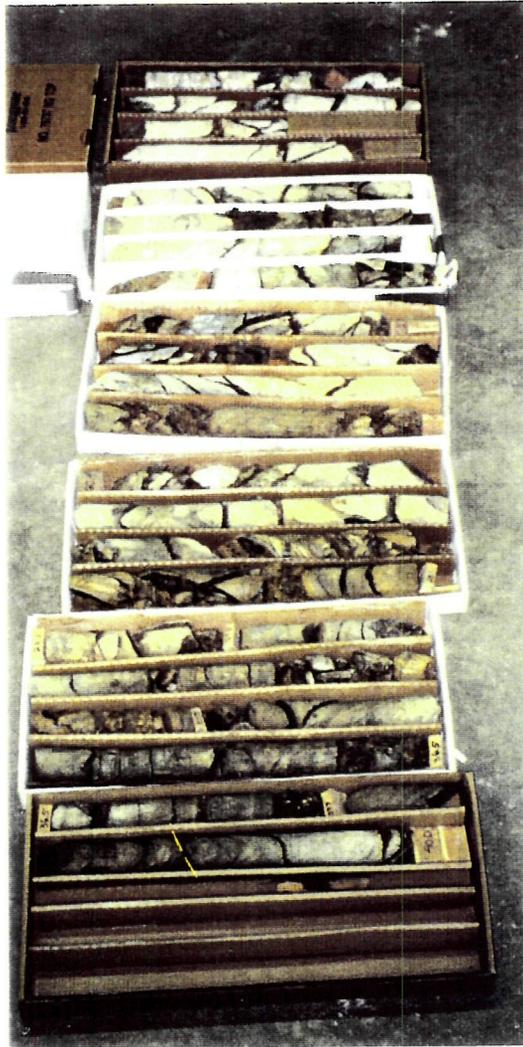
Sheet 3 of 3

DEPTH (feet)	DESCRIPTION	ROCK CORE						SOIL SAMPLES				REMARKS	
		Sketch	Lithology	Run No.	Recov. (%)	RQD	Fractures / ft	Weathering	Strength	No.	Type		Blow Count
31	2.4' - 40.0' METAVOLCANIC: (cont'd) 31.6' - 40.0': mostly coarse to med. grained, less fine crystalline texture.		MV	7	5.0	1.3	5	S	MS				* $\frac{0.3}{5.0} = 6\%$
32					5.0	5.2							
33	V: MW; Q; P-F						3						* $\frac{1.6}{4.3} = 37\%$
34	J: N-MW; Q, C, Fe; P-F; P			8	4.3	1.1	5		MS				
35					4.3	4.3	26%			-W			
36	V: N-MW; Q; P-F						2						
37													W
38							3						
39													MS
40	TOTAL DEPTH: 40 FEET.						4						
41													
42													
43													
44													
45													
46													
47													
48													

02/23/93
02/24/93
36.9' - 40.0' NW 1/4 core barrel.
* $\frac{1.3}{4.1} = 32\%$

16:17
08:20

Boring terminated 02/24/93 at 40 ft.
Grant to surface 02/24/93.
Groundwater not determined - no circulation maintained



BOX-1
1.5'-7.0'

BOX-2
7.0'-13.9'

BOX-3
13.9'-20.4'

BOX-4
20.4'-28.1'

BOX-5
28.1'-36.5'

BOX-6
36.5'-40.0'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-1	Figure A- 1
Woodward-Clyde Consultants			



BOX - 1
1.5' - 7.0'



BOX - 2
7.0' - 13.9'



BOX - 3
13.9' - 20.4'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-1	Figure A- 2
	Woodward-Clyde Consultants		



BOX - 4
20.4' - 28.1'



BOX - 5
28.1' - 36.5'



BOX - 6
36.5' - 40.0'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-1	Figure A- 3
Woodward-Clyde Consultants			



BOX-1
1.5'-8.8'

BOX-2
8.8'-17.5'

BOX-3
17.5'-26.4'

BOX-4
26.4'-35.5'

BOX-5
35.5'-40.0'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-2	Figure A- 4
Woodward-Clyde Consultants			



BOX - 1
1.5' - 8.8'

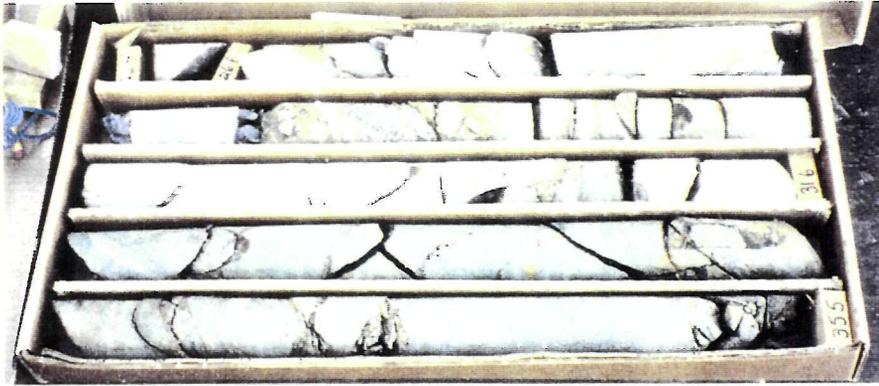


BOX - 2
8.8' - 17.5'



BOX - 3
17.5' - 26.4'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-2	Figure A- 5
Woodward-Clyde Consultants			



BOX - 4
26.4' - 35.5'



BOX - 5
35.5' - 40.0'

AGS	PARDEE DAM SOUTH SPILLWAY	CORE PHOTOS BORING 93-2	Figure A- 6
Woodward-Clyde Consultants			

APPENDIX B
LOGS OF CORE BORINGS FROM WOODWARD-CLYDE
CONSULTANTS 1988 GEOLOGICAL INVESTIGATION

BORING LOCATION TOP OF SPILLWAY - NORTH ABUTMENT		ELEVATION AND DATUM 567.5 feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER C. BAKER	DATE STARTED 9/10/87	DATE FINISHED 9/13/87
DRILLING EQUIPMENT JOY 22 TRUCKMOUNT		COMPLETION DEPTH 42.3'	ROCK DEPTH 23.2'
SIZE AND TYPE OF CASING NONE		NO. OF SAMPLES: WATER	DIST. FIRST UNDIST. COMPL. 12 CORE RUNS
DRILLING METHOD NX - WIRELINE		LOGGED BY: S. Bluestone CHECKED BY: T. Freeman	
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND IMPREGNATED	

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS		
		Fracture	Lith.	Run No.	Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type		Blow Count	Drilling Rate/Time
0	Concrete light grey; w/ aggregate from 0.25" to ~2" locally, small voids to 0.3" at ~1"; Generally, breaks around aggregate					100%	1	0.6/1.7 = 35%					BEGAN 1125 hrs DRILL FLUID RETURN 15 LT. GREY ER1 = 1.7'
1							4						
2							3						
3	Soil? loose, wet, light to med. brown, silty sand (Ss)?					100%	12	0.9/1.9 = 47%					ER2 = 3.6'
4	Metamorphosed Volcanic; light brown to buff; very weak to weak, completely weathered, foliated, recrystallized (?)						7						
5	(core ground & washed out ~ 6.1' to 8.5') fine grained meta-volcanic breccia BECOMES highly weathered to weak					61%	8						
6	① 70, S, VN to N, Fe, (+ soil?), W?, R ② 40-50, S, VN, Fe, SP, W, R ③ 30, S, VN, G-Fe, SP, PL to W, R												
7	④ 75-80, F(S?), VN, Fe, SP to Sr, PL, Sr ⑤ 30, S, VN, Fe, St, PL, Sr ⑥ 50, S, VN, Fe, SP, PL, Sr												
8	⑦ 70, S, VN, Fe, H, PL, Sr (core ground & washed out ~ 6.5' to 8.5')							0.4/4.9 = 8%					ER3 = 8.5'
9	⑧ 70-80, F(S?), VN, Fe, SP-St, PL to W, Sr ⑨ 30, S, VN, Fe, St, PL to W, Sr ⑩ 30, S, VN to N, Fe, St, W, Sr ⑪ 50, S, VN, Fe, SP, PL, S												
10													
11	BECOMES completely to highly weathered, weak; material appears lighter in color; less dense; welded ash tuff in cl. bds?					27%		0%					
12	(core washed out / ground from ~ 10' to 13.4')												
13													ER4 = 13.4'
14	⑫ 70, S(F?), VN to MW, Fe/4, F to SP, PL, Sr ⑬ 80, S, VN, Fe, St, PL, Sr ⑭ 50, S, VN, Fe, SP, PL to W, Sr ⑮ 30, S, VN, Fe, St, PL, Sr					58%		0%					NOTE: core ground yielding nuts
15													

Project Pardee Dam South Spillway	CORE LOG B-1	Fig. A-1a
Project No. 8710086A		

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS
		Fracture	Lith.	Run No. BOX No.	Recov. ft.	Fracture Freq.	RQD	No. Type	Blow Count	
15										
16	① 70-80, J, VN to M, W, Fe, St, W, Sr ⑩ 50, J, VN, Fe, St, PL to W, Sr (some soil fragments too)				58%	8	0%			CORE GROUND & LOST IN WASH
17	Welded meta-ash tuff, interbedded (biotite?) (core ground ~ 15.9' to 17.4')					7				ER 5 = 17.4'
18	①②③④ 80+, F, (J?), VN, St, PL, Sr ⑤⑥⑦⑧⑨ 20 to 35, J, VN to N, Fe, St, PL, Sr					5				
19	⑩ 60, J, VN, Fe-Ca, Sp, PL, Sr					3				
20	⑪ 55, J, N, G-Ca, F, PL, R				96%	3				
21	⑫⑬ 60 to 70, J, VN, H & Fe, F, PL, S					2				
22	⑭ 65, J, NN, Ca/Fe, Sp, W, R					5	1.1/5.0 = 22%			ER 6 = 22.4'
23	DENSELY WELDED META-ASH TUFF INTERBED					4				
24	⑮ 20, J, VN, N, N, W, Sr ⑯ ~60, J, N, Fe, F, St, Sr ⑰⑱ 20, J, VN, Fe, Sp, PL, Sr					4				
25	⑲ 50, J, VN, Fe, St, PL to W, Sr ⑳ 30, J, VN, Fe, Sp, PL, Sr				73%	6				
26	㉑ 25, J, VN to N, Fe, F to Sp, PL, Sr ㉒ 70, J, VN, Fe, St, PL, Sr to Sr ㉓ 70, J, VN to M, W, Fe, Sp, W, Sr to R					12	0.4/4.5 = 8.9%			CORE GROUND & WASHED
27	APPEARS completely to highly weathered, extremely weak. ? - ? - ? - ?					7				ER 7 = 27.0'
28	WELDED META-ASH TUFF; light gray highly weathered, weak.				100%	7	0.6/2.2 = 27%			
29	㉔⑤ 55 to 60, J, VN, Fe, Sp, PL, Sr ㉕ 35, J, VN, Fe-Ca, St, PL, Sr ㉖ 65, J, VN, Fe, St, PL, Sr					8				ER 8 = 29.2'
30	㉗⑧ 30, J, VN, Fe, Sp, PL, Sr ㉘⑨ 35 to 50, J, VN to N, H & Q/A? ㉙ 50, J, VN, Ca & Q, St, R					6				
31	Metamorphosed Volcanic; dark brown to green, foliated, completely weathered, extremely weak. Clayey seams? FRIABLE meta-pyroclastic? Increasingly mafic				69%	25				
32	? - ? - ? - ? - ?					25				CORE GROUND & WASHED
33						?				

Project Pardee Dam South Spillway
Project No. 8710086A

CONT. CORE LOG B-1

Fig. A-1b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	R/D	No. Type	Blow Count	
33	core ground/washed out.			42						ER9 = 33.4'
34										
35	Metamorphosed Volcanic; light brown, locally hornfelsic, foliated, moderately weathered, medium strong					3				
36	①③④⑤ 30, J, N, T, O, N, Fe, F, Pl, Sr ② 75, J, N, Fe, Pl, Sr				65%	3				
37						5				
38	④ 60 TO subvert, J, F?, W, St, R ⑦ 25, J, N, Fe, Sp, Pl, R ⑧⑨⑩ 65 TO 70, J, V, W, Fe & H, Sp, Pl, St, Sr Appears highly to completely weathered; weak					5	1.7/4.9 = 35%			ER10 = 38.3'
39						12				ended for day 11/11/87 BEGUN 9/13/87 0810 hrs.
40	①⑥⑧⑫ 70 TO 80, J, V, W, Fe, St, Pl, Sr ⑬ 65, J, V, W, Fe, St, Pl, S ⑭ 60, J, V, W, Fe, St, Pl, Sr ⑮ 70, J, N, Fe & CL, F, Pl, Sr				68%	8				
41	⑯⑰⑱ 25 TO 30, J, V, W, Fe, St, Pl, S					5	0%			
42						6				COR missing due to grinding & washout.
43						?				ER11 = 43.3'
44	①④⑦⑩⑬ 30 TO 45, J, V, W, Fe, St, Pl, Sr ②⑤⑥⑪ 70 TO 80, J, V, W, Fe, St, Pl, Sr ③ 65, J, V, W TO N?, Fe & CL, St & F?, W, S ④ 60, J, V, W, Fe, Sp, Pl, Sr				100%	5	0%			
45						6				0955 hrs. ER12 = 45.3'
46	<u>BOM = 45.3'</u>									
47										
48										
49										
50										

Project Pardee Dam South Spillway
Project No. B710086A

CONT. CORE LOG B-1

Fig. A-1c

BORING LOCATION TOP OF SPILLWAY ; NORTH OF CENTER		ELEVATION AND DATUM 553 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER P. BAKER	DATE STARTED 9/10/87	DATE FINISHED 9/11/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCKMOUNT	COMPLETION DEPTH 44.4'	ROCK DEPTH 2.2'	
SIZE AND TYPE OF CASING NONE	NO OF SAMPLES	DIST.	UNDIST.
DRILLING METHOD NX-WIRELINE	WATER	FIRST	COMPL.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No.	Type		Blow Count
0	CONCRETE; light gray w/ aggregate 0.25 to 0.2" w/ occasional small voids 0.1" to 0.2" TENDENCY TO BREAK AROUND AGGREGATE.					2					BEGAN 1130 hrs
1						3					Drill fluid is grayish color!
2	Soil GROUND CONCRETE in a matrix of stiff, moist, brown, silty clay (CL) small voids				63%	3+					Core ground & washed out immediately below contact.
3	Metavolcanic (andesite?); med. brown to blackish, recrystallized foliated, semi-schistose, locally moderately to slightly weathered, very weak, (metavolcanic breccia).					7+					ER1 = 3.5'
4	① 75 to 90, J, VN, N, Fe, N, S, PL, SR ② 10 to 20, J, VN, Ca, Li, SP, PL to ST, SR ③ 10 to 20, J, VN, N, PL to ST, SR (Note: high % joints subparallel to foliation)				100%	10					DRILLER NOTED "MUD SEAM" DRILL FLUID IS BROWN
5	① 50, F, VN, Fe, ST, PL to W, SR ② 55 to 70, J, VN, N, N, PL, S, ST, S ③ 10 to 30, J, VN, N, N, PL, S, ST, S ④ 20, J, N, Fe & G, P, PL to W, S, to R (Note: assoc. w/ G are healed joints)					4					ER2 = 5.6'
6	moderately to slightly weathered, medium strong				100%	6					
7						5					
8	① 50 to 70, J, VN, N, Fe, N to ST, PL, S ② 75 to 90, F? B?, N, N, N, Fe & Li, some Qtz?, SP to F, PL, SR ③ 10 to 20, J, VN, N, N, PL, S ④ 20 to 35, J, VN, N, N, PL, S to SR (w/ some Fe & Li, SP) ⑤ 80, J, N, N, W, Fe, ST, PL, SR					7					ER3 = 8.3'
9						5					
10						5					
11					98%	6					
12						6					
13						5					ER4 = 13.1'
14	① 45, J, VN, N, N, W, R ② NECH ③ 75, B? F?, VN to N, H, PL, S, to R ④ 55 & 65, J, VN, Fe, H, PL to W, SR ⑤ 75, J, VN, Fe, F, PL, SR					6					
15						3					

Project Pardee Dam South Spillway
Project No. 8710086A

CORE LOG B-2

Fig. A-2a

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS		
		Fracture	Lith.	Run No.	Box No.	Recov. ft.	Fracture Pctg.	ROD	No.	Type		Blow Count	Drilling Rate/Time
15	① 30 to 35, J, N, Fe & Mn?, Sp, Pl, Sr to R												
16	② 70, J, N, Fe, St, Pl, S (set of ~6 joints)												
	③ 20 to 30, J, N, Fe, St, Pl to W, Sr to S												
	④ 70, J, N, Fe, St, Pl, S												
	⑤ 75 to 80, J, N, Fe-Li, Sp to St, Pl, Sr												
17	intensely fractured zone (due to drilling technique?)												
18												ER 5 = 18.1'	
19	⑥ 30 to 60, J, N to N, Fe-Li, Sp, Pl to W, Sr												
	⑦ 80, J, N to M, W, Fe & G, P, Pl, R												
	⑧ 50, J, N, N, N, Pl, S												
	⑨ 10, J, N, N, N, Pl, S												
	⑩ 20, J, N, N, N, W, Sr												
20	⑪ thru ⑫ 50 to 65, J, N, Fe, St, N to Pl, Sr												
	fac. fams fractured zone from 20' to ~21.8'												
	⑬ 65 to 75, J, W, Fe, Sp, Pl, Sr												
	⑭ 55, J, N, Fe, St, Pl to W, Sr to S												
	⑮ 10, J, N to N, Fe-Ca?, Sp, St, Sr												
	⑯ 70, J, N, Fe, St, Pl, Sr												
21	⑰ 15, J, N, Fe, St, W, Sr												
	Meta-Ash Tuff interbeds, 3/4" to 1" thick, irregularly spaced totals 7 to 10% of rock mass, weak to med. strong												
	⑱ 15 to 20, J, N, N, N, Pl, S												
22	⑲ 75, B? F? MW, Ash, F, St, R												
	⑳ 50 to 65, J, N, Fe, St, Pl, Sr												
23	㉑ 55 to 60, J, N, N, N, Pl, St, Sr												
	㉒ 80, J, N, Fe, St, Pl to W, Sr												
	㉓ 25, J, N, N, N, Pl, S												
24	㉔ 60, J, N to N, Fe, Sp, Pl to W, Sr												
	㉕ 55 to 60, J, N, Fe, St, Pl to W, Sr												
	㉖ 65 to 70, J, N to M, W, R to G?, F, Pl to St, Vr												
25	㉗ 70 to 90, J, N, Fe-Ca?, Sp, N to M, W, St, Vr												
26												1630 hrs	
27												ER 7 = 27.6'	
28	㉘ 80, B? F?, M to W, Ash?, F, Pl to W, Sr (w/ elongate protolith minerals visible)												
	㉙ 70, J, N, Fe & H, F, Pl, Sr												
	㉚ 10 to 20, J, N, Fe-Ca?, Sp, Pl, Sr												
29	㉛ 60, J, N, Fe, St, Pl to W, Sr												
	Rock Mass is slightly weathered becomes strong												
30	㉜ 45, J, N to N, Fe, Sp, W, S												
												1640 hrs	
												ER 8 = 30.2'	
												Shut down 9/10/67 BEGAN 9/11/67 0810 hrs.	
31	㉝ 70 to 75, J, N to N, N to G?, N to F, Pl, Sr												
	㉞ 20 to 30, J, W, Fe, Sp to St, Pl, Sr												
	㉟ 55, J, N, H, P, Pl, Sr												
	Remineralized zone washed out 31.4' to 31.7'												
32	㊱ 70, J, N, H, P, Pl, Sr												
33												DRILLER NOTED "MUD" SEAM? DRILL FLUID DARK BROWN	

Project Pardee Dam South Spillway
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CONT. CORE LOG B-2

Fig. A-2b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No.	Recov. ft.	Fracture Freq.	R/D	No.	Type		Blow Count
33	③④⑥ (see prev. page) ⑤ 80, S, VN, Fe, St, Pl, Sr			42		5					ER9 = 33.7'
34	⑦ 60, S, VN, Fe, St, Pl, Sr Rock Material becomes Fresh at 33.7'					3					
35	⑧ 20, S, VN, Fe, sp, Pl, Sr ⑨ 60, S, VN, Fe, St, Pl, Sr ⑩ 40, S, VN, Mn, Pl, Sr <u>ROCK MASS FRESH AT 35'</u> ⑪ 70, S, VN, Fe, St, Pl, Sr to S				100%	3					
36	⑫ 30, S, VN, Fe, St, Pl, Sr ⑬ 50 to 60, S, VN, Fe, St, Pl, Sr					5					
37	⑭ 10 to 15, S, VN, Mn, Pl, Sr ⑮ 75 to 80, S, VN, Mn, Pl, Sr ⑯ 60, S, VN, Mn, Pl, S					4					
38	→ LIGHT GRFY, FRESH AT 35" ⑰ Mn ⑱ 70 to 80, S, VN, Fe, St, Pl, S ⑲ 20, S, VN, Fe, sp, W, Sr ⑳ 50, S, VN, Fe, sp, Pl, S					4					ER10 = 38.5'
39					100%	5					
40	㉑ 60, S, VN, Fe, sp, Pl, Sr ㉒ 80, S, VN, Fe, sp, W, Sr					5					ER11 = 40.9'
41						5					
42	Interbedded Meta-ash tuff; mod. welded, highly well-sorted, extremely weak most intensely foliated zone ㉓㉔㉕㉖㉗ 30 to 40, S, VN, Fe, St, Pl, Sr to Sr ㉘㉙ 70 to 80, S (F?), VN, Fe, Mn, sp, Pl, Sr to Sr				83%	9					
43						12					
44											ER12 = 44.4'
45	<u>BOH = 44.4'</u>										
46											
47											
48											
49											
50											

Project: Pardee Dam South Spillway
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CONT. CORE LOG B-2

Fig. A-2c

552.5

BORING LOCATION TOP OF SPILLWAY; SOUTH OF CENTER		ELEVATION AND DATUM 563 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER P. BAKER	DATE STARTED 9/11/87	DATE FINISHED 9/13/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCK MOUNT		COMPLETION DEPTH 45.3'	ROCK DEPTH ~ 2.8'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. 14 CORE RUNS
DRILLING METHOD NX - WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS
		Fracture	Lith. Run No.	Box No.	Recov. %	Fracture Freq.	ROD No.	Type	Blow Count	Drilling Rate/Time	
0	Concrete, light gray, w/ aggregate 0.25" to 2"; small local voids 0.1" to 0.5", generally breaks around aggregate					0					BEGAN 9/11/87 110613. DRILL FLUID GREY TO 11.6' DOWN
1											
2					72%	1					
3	SOIL SOFT TO FIRM (?), WET, BROWN, SILTY CLAY TO SILTY SAND (SC-SM)?					2					
4	Metavolcanic; fine-grained breccia (?), mafic, med. brown to gray, recrystallized locally foliated, highly weathered, weak					4					ER 1 = 3.9'
5	① 70, J, W, Fe, St, Pl, Sr ② 80, F?, T, H, N, Pl, Sr ③ 50, J, W, Fe, Sp, Pl, U, Sr ④ 50, J, W, Fe, St, Pl, Sr ⑤ 80, J (F?), U, W, Fe + G? air?, Sp, Pl, U, Sr				100%	2					NOTE: CORE ground & locally washed out. Only 2 discontinuities discernable. ER 2 = 5.5'
6	① 45, J, W, Fe, Sp, Pl, Sr ② 55, J, W, Fe, Sp to St, Pl, Sr ③ 75 to 80, F?, U, W, Fe-Ca?, F, Pl, Sr ④ 60, J, W, Fe, St, Pl, Sr				50%	15					
7	core ground locally.					20					ER 3 = 7.5'
8	① 70 to 80, J, W, Fe, Sp, Pl, Sr ② 40-45, J, W, Fe-Ca?, Sp to St, Pl, Sr ③ 60 to 70, J, W, Fe, St, Pl, Sr				90%	10					
9	core ground locally.					20					ER 4 = 9.5'
10	① 25 to 30, J, W, Fe, Sp, Pl, Sr ② 30 to 40, J, W, Fe-Ca?, St, Pl, Sr					5					
11	core ground locally.					9					
12	① 60, J, W, Fe, St, Pl, U, Sr ② 45, J, W, Fe-Ca?, Sp, Pl, Sr ③ 70, J, U, W, Fe-Ca, Sp, Pl, Sr				98%	8					
13	① 65, J, W, U, W, Fe, Sp, W, Sr to St					6					ER 5 = 13.5'
14	core ground locally.					0					
15	① 80, J, W, Fe, St, Pl, Sr ② 70, J, W, Fe, St, Pl, Sr ③ 50-55, J, W, Fe, St, Pl, U, Sr ④ 75, F, W, N, U, Pl, Sr to S				60%	17					

Project Pardee Dam South Spillway	CORE LOG B-3	Fig. A-3a
Project No. 8710086A		

DEPTH (FEET)	DESCRIPTION	ROCK CORE						SAMPLES				REMARKS	
		Fracture	Lith.	Run No.	Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type	Blow Count		Drilling Rate/Time
15	③ 75, F, VN, Fe, Sp, Pl, Sr to S ④ 50, J, VN, Fe, St, Pl, Sr					66%	4	0%					
16													ER 6 = 16.5'
17	① 80, J?, VN, Fe, St, Pl to W, Sr ② 35 to 40, J, VN to N, Fe & H, F, Pl, Sr core ground & washed out.					60%	10	20%					
18	③ 20, J, VN, H, P, Pl, Sr												
19	⑥ 60, J, VN, H, N, Pl to W, Sr ⑦ 75, J, N, Fe & H, F, Pl to W, Sr core ground into "nubs" at remineralized quartz vein												ER 7 = 19.0'
20													
21	① 25, J, N, F, W to Pl, Sr ② 70, J, N, Fe, St, Pl, Sr ③ 68 to 70, J, VN, Fe, Sp to St, Pl to W, Sr					56%	4	0%					
22													ER 8 = 22.2'
23	① 20, J, VN, Fe, Sp, W, Sr ② 35 to 40, J, VN to N, Fe, St, Pl, Sr ③ 20 to 25, J, VN, Fe, Sp, Pl, Sr ④ 50, J (conjugate set?), N, H, W, Fe, Pl, Sr												
24	⑩ 75 to 80, J, N, Fe, St, W, Sr ⑪ 50, J, VN, Fe, St, W, Sr ⑫ 20 to 75, J, N to M, W, G & H, F, W to Pl, Sr					100%	4	10%					
25	⑭ 50, J, VN to N, Fe, St, Sr color change to bluish-gray, slightly mottled; becomes moderately weathered locally, med. strong to strong.												
26	⑮ 60 to 80, F?, J?, W, Fe, Fr to St, W, Sr ⑯ 30, J, VN, Fe O?, St, Pl to W, Sr Rock material becomes fresh, strong; rock mass is slightly weathered.												
27	⑰ 60 to 80, F (S?), N to M, W, Fe & H, Fr to Sp, W, Sr ⑱ 35 to 40, J, N, Fe, St, Pl, Sr												ER 9 = 27.2'
28	⑲ 60, J, VN, Fe, St, Pl, Sr to Sr												
29	⑳ 80+, F?, N, Fe, St, Pl to W, Sr to Sr ㉑ 25 to 30, J, VN, Fe, St, Pl to W, Sr to Sr					100%	6	17%					
30	㉒ 70, J, VN to N, Fe, St, Pl, Sr												
31													
32	Rock mass becomes slightly weathered												ER 10 = 32'
33	㉓ 70 to 85, F, VN to N, Fe & H, St to F, W, Sr ㉔ 60, J, VN, Fe, St, Pl to W, Sr ㉕ 30, J, VN, N, St, Sr												

Project Pardee Dam South Spillway
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CONT. CORE LOG B-3

Fig. A-3b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type		Blow Count	Drilling Rate/Time
33	④⑥ 65, J, VN, N, N, PL TO ST, SR ⑤ 75, J, VN, FE, SP, ST TO PL, SR ~ CORE ground & slightly washed				100%	5	15%					ER 11 = 34'
34	①②③ 60, J, VN, FE, SP, PL TO W, SR ④⑤⑥ 50, J, N, FE, SE, ST, R					12						
35	④②③④⑤ 60 TO 85, F, VN TO N, FE + Qtz?, W, SR ⑥ 45, J, VN, FE, SP, PL, R					6						
36	with meta-ash tuff interbed w/ small voids, & resolutions? (0.2" to 0.5") along joints. mod. weathered, weak to med. strong.				100%	5	55%					
37	① 60, J, VN TO N, FE, G?, SP, SR TO R					6	2.3/4.2 = 55%					ER 12 = 38.2'
38	Metavolcanic; Andesitic, locally hornfelsic, light green-grey, slightly weathered to fresh, strong, locally mod. weathered along discontinuities					3						Shut down for exam 9/11/87 1730 hrs resumed 9/13/87 1145 hrs.
39	① 35, J, VN, N, W, SR ②③④⑤ 70 TO 80, J, VN TO W, PL, FE, ST TO SP, PL, SR					4						
40	⑥ 60, J, VN, FE, SP, W, R ⑦ 35 TO 50, J, VN, FE, SE, W, R ⑧⑨ 25 TO 30, J, VN, FE, SP, PL, S				80%	5	0%					
41	⑩ 40, J, VN TO W, Q, F, PL TO W, R ⑪⑫ 30, J, VN, FE, SP, PL, SR					7						
42	core missing is ground & washed out.					9						
43	⑬⑭⑮ 70 TO 80, J, VN TO N, FE, SP TO ST, PL TO W, SR ⑯⑰⑱⑲ 15 TO 25, J, VN, FE, ST, PL, SR					5						ER 13 = 43.2'
44	⑳ 40 TO 45, J, VN, FE, SP, PL, SR				100%	12	0%					
45												ER 14 = 45.5'
46	<u>BOM = 45.5'</u>											Completed 1300 hrs 9/13/87.
47												
48												
49												
50												

Project Pardee Dam South Spillway
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CONT. CORE LOG B-3

Fig. A-3c

BORING LOCATION TOP OF SPILLWAY ; SOUTH ABUTMENT		ELEVATION AND DATUM 567.5 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER C. PAKER	DATE STARTED 9/13/87	DATE FINISHED 9/15/87
DRILLING EQUIPMENT JOY 22 TRUCK MOUNT		COMPLETION DEPTH 45.2'	ROCK DEPTH ~4.2'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. 17 CORE RUNS
DRILLING METHOD NX - WIRELINE		WATER FIRST	COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS
		Fracture	Lith.	Run No. / Box No.	Recov. ft.	Fracture Freq.	ROD No.	Type	Blow Count	Drilling Rate/Time	
0	CONCRETE: light grey, aggregate ~0.5" to ~2.5", breaks around aggregate in general.			1	1.0/1.0	7					BTG MW 9/13/87 11:55 hrs. ER1 = 1.0'
1				2	1.5/1.5	1					ER2 = 2.5'
2	small intermittent voids from 0.01" - 0.3"			3	1.3/1.3	2					ER3 = 3.7'
3				4	1.2/1.2	2					
4	SOL DENSE (?), MOIST. LIGHT BROWN, SILTY SAND/S.M.			5	3.2/3.6	5					DRILL FLUID RETURN TURNS LIGHT BROWN. (FROM GREY)
5	Metavolcanic; (Andesite?), mafic pyroclastic, moderately recrystallized, foliated, highly to moderately weathered, medium strong			6	0.4/3.6	8					
6	①②③④⑤ 70 to 80, J (F?), V, Fe, Sr to sp, PL, Sr			7							ER4 = 7.3'
7	⑥ 50 to 70, J, V, to N, H w/ Fe & Q, F, PL, Sr			8							
8	⑦⑧ 30, J, V, Fe, Sp, PL, Sr			9							
9	⑨⑩⑪⑫ 40 to 50, J, T to V, Fe, Sp to Sr, PL, Sr			10	3.2/4.0	5					
10	⑬⑭⑮ 70 to 80 B? (F?), N, Fe, Sr, PL, Sr			11							ER5 = 11.3'
11				12	1.7/1.8	6					
12	⑯⑰⑱ 70 to 80, J? (F?), Fe, Sr, PL, Sr to Sr			13	0.4/1.8	4					ER6 = 13.1'
13	⑳㉑ 30 to 35, J, Fe, Sp to Sr, PL, S			14	96%	5					
14	㉒㉓㉔ 55 to 60, J, V, N w/ Fe, Sr to R			15	0.5/2.5	20%					
15	㉕㉖ 15-25, J, V, N to Fe, N to sp, PL, Sr to Sr										
16	Becomes increasingly weathered to ~17.3' due to interbedded welded ash tuff; buff fine grained, highly weathered, weak,										
17	2" to 12" thick beds										

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CORE LOG B-4

Fig. A-4a

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Frag.	RCD	No.	Type	Blow Count		Drilling Rate/Time
15	Meta-Ash Welded Tuff interbed, possible local shear intensely foliated, completely to highly weathered, extremely weak to weak											ER 7 = 15.5'
16	① 45, J, VN, Fe & CL, St to sp, PL, S											DRILLER OUT OF HYDRAULIC FLUID SHUT DOWN 16' 10" AT 9/13/87. Resumed 0830 9/14/87 0900 hrs ER 8 = 17.8'
17	②③④ 10 to 20, J, VN, Fe & CL, St to sp, PL, S ⑤⑥⑦ 70 to 80, J (F?) VN to N, CL & Fe, St to F, PL, S NOTE: These joints are subparallel to foliation & weak. (as above).				1.7/2.3 = 74%	4						
18	⑧⑨⑩ 65 to 70, J, VN, Fe, Sp, Sr ⑪⑫ 20, S, VN, Fe, St, PL, Sr				1.9/2.8 = 73.1%	10						0930 hrs. ER 9 = 20.2'
19	Rock remains highly weathered & weak through 24'											
20	⑬⑭⑮⑯⑰ 60 to 70, J, VN, Fe & CL, Sp to F, PL, St to Sr											
21	Welded Meta-ash tuff interbed; light grey, weathered phenocrysts											
22	⑱ 60 to 85, J, N, Q, F & H, W, R CORE GROUND/WASHED OUT - 21' to 23'				2.6/3.8 = 68%	3						
23	⑲ 40, J, VN, Fe, Sp, PL, Sr ⑳ 30, J, VN, Fe, Sp, PL, Sr ㉑ 30 to 60, J (?), N to VN, Fe, Sp & H, W (?), Sr NOTE: ㉑ appear as small dissolution cavities, some healed.											DRILLER BELIEVES LOST WATER AT 23.5' ER 10 = 24.0'
24	㉒ 60 to 80, J (F?), VN, Fe & Q, Sp to St, PL to W, Sr to R BECOMES MODERATELY WEATHERED AT 24'											
25	LOCALLY CORE FRACTURED DUE TO DRILLING.											
26	Metavolcanic Breccia; (mafic), light grey, moderately recrystallized, slightly weathered, medium strong to strong											
27	㉓⑳ 60 to 75, J, VN, Fe, Sp to St, PL, Sr (sub parallel to foliation)				2.2/2.5 = 88%	4						ER 11 = 26.5'
28	㉔⑳ 40 to 50, J, VN to T, Fe, St, PL, Sr to S ㉕⑳ 60 to 65, J, VN, Fe, Sp to St, PL to W, Sr ㉖⑳ 60, J, VN to T, Fe, St, PL, S				2.5/2.5 = 100%	7						
29	NOTE: Rock mass is slightly weathered to locally fresh at 26.5'											
30	㉗⑳ 65 to 70, J (F?), VN to T, Fe (& Q and), St, PL, Sr to S				4.2/4.5 = 100%	5						(NOTE: BARREL LODGED IN HOLE -> TUBE PACKED?)
31	㉘⑳ 50 to 65, J, VN, Fe, St, PL to St, Sr											
32	㉙⑳ 75 to 85, J?, Fe, St to F, PL to W, R NOTE: semi-healed dissolution cavities as at 23.8'				1.2/2.4 = 50%	2						

Project Pardee Dam South Spillway
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CONT. CORE LOG B-4

Fig. A-4b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type		Blow Count	Drilling Rate/Time
33	① 85 to 75, J, VN, PL, Fe, Sp, PL, S					3						ER 13 = 33.5'
34	② 50, J, VN, Fe, ST, PL, S to SR ③ 35, J, VN to T, Fe, Sp, PL, S Rock mass is less weathered below 33.5'; becomes strong.				100%	9	0.9/0.20%					
35	↓ core ground / med breaks.					7						ER 14 = 35.5'
36	④ 70, J, T, VN, Fe, St, PL, S to SR ⑤ 60, J, T, Fe, Sp to N, PL, S to SR ⑥ 45, J, VN, Fe, St, PL, S					3						
37	⑦ 50 to 60, J, VN, Fe, St, PL, S					3						
38						3						
39	↓ core ground? missing?					3						ER 15 = 39.9'
39	⑧ 50 to 60, J, Fe, St, PL to W, SR to S					3						
40	↑ WELDED ASH TUFF INTERBED (AS ABOVE) ⑨ 80, J (F), VN, Fe, St, PL, SR					3						
41	⑩ 30 to 60, J, VN, Fe, St to Sp, W, R ⑪ 75, J, VN, N, PL, S to S					3						
42	⑫ 55 to 70, J, VN to T, Fe, St, PL, R ⑬ 20 to 30, J, Fe, Sp to N, N, PL, S ⑭ 80-65, J, Fe, Sp, St to W, S					5						ER 16 = 41.9'
43						5						
44						2						
45						1						ER 17 = 45.2
BOH = 45.2'												completed 0855 9/19/87

Project Pardee Dam South Spillway
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CONT. CORE LOG B-4

Fig. A-4c

BORING LOCATION MIDDLE OF SPILLWAY ; NORTH OF CENTER		ELEVATION AND DATUM 515 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER P. BAKER	DATE STARTED 9/14/87	DATE FINISHED 9/15/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCKMOUNT		COMPLETION DEPTH 44.2'	ROCK DEPTH ~ 2.2'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. 13 CORE TUBS
DRILLING METHOD NX - WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARRELS SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Bpx No.	Recov. ft.	Fracture Freq.	ROD No.	Type	Blow Count		Drilling Rate/Time
0	Concrete; light grey, w/ aggregate from 0.25 to ~ 1.5", breaks around aggregate										
1	Soil? LOOSE, MOIST TO WET, DARK BROWN SILTY SAND TO CLAYEY SAND (SM-SC)			1	1.8/3.0 = 60%	3	0.8/3.0 = 27%				
2	Metavolcanic; Fine to Med. grained breccia? light brown to grey, recrystallized, foliated, moderately weathered to slightly weathered below 3 feet, Very weak to weak					4					ER 1 = 3.0'
3	DRILLER NOTES EASE IN DRILLING COMPARED W/ SOUTH SIDE BOPRES CLAIMS ITS "CLAYIER"					3					
4	① 80, J, VN, Fe, St, PL, ST, SR ② 80, J, VN, Fe, St, PL, SR ③ 20 TO 40, J, Fe, St, ST, R			2	3.2/3.5 = 91%	4	1.3/3.5 = 37%				
5						5					
6	core missing; WASHED OUT ? GROUND ?										ER 2 = 6.5'
7	① 65 TO 70, J, T, Fe & CL, Sp & F, PL, ST, SR ② 75 TO 80, J, VN, R, F & H, PL, SR					3					
8	Rock Material becomes slightly weathered to fresh, remains weak below 8 feet					4					ER 3 = 9.0'
9	① 65 TO 70, J, Fe, St, PL, ST, SR ② 70 TO 80, J, Fe, St, PL, SR, R					4					STOPPED FOR EVENING 1700 HRS 9/14/87 Resumed 0845 9/15/87
10	③ 60 TO 70, J, Fe, St, PL, SR TO R					3					
11						3					
12						3					ER 4 = 12.9'
13	① 65 TO 75, J, VN, Fe, St, PL, ST, SR ② (has some clay filling)					5					
14	② 70 TO 85, J, T, VN, Fe, St, PL, ST, SR					3					
15	③ 30 TO 40, J, Fe, St, PL, S					3					

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No.	Type	Blow Count		Drilling Rate/Time	
15	BECOMES COMPLETELY WEATHERED; EXTREMELY NEAR TO WEAR INTENSELY FOLIATED ZONE (DARKER BROWN COLOR)			51	3 4/3.4 = 91%	10							
16						3							FR5 = 16.5
17	Metavolcanic; Fine grained metavolcanic Breccia, green-gray to brown, phaneritic, recrystallized, abundant relict grains visible, slightly weathered, med. strong					4							
18	(165 to 70, S, N, Fe, St, PL, S)					3							
19	(20 to 35, S, N, Fe, St, PL, S) (70 to 108, S, N, Fe, St to Sp, PL to W, S) (H & F from ④ to ③)					2							ER6 = 19.5'
20	(as above)					3							
21	META-ASH TUFF INTERBEDD. BUFF TO LIGHT GRAY MOD WEATHERED, MED STRONG TO STRONG					3							
22	BECOMES LIGHTER GRAY (AS ABOVE 16.4') YET moderately weathered, med strong.					3							
23	(20 to 30, S, N, Fe, St, PL, S)					5							
24						3							ER7 = 24.3'
25	(20 to 30, S, N to MW, Fe & Qtz, St to Fe, PL, S)					4							
26	Highly weathered wear zone; Abundant QUARTZ crystals, (perhaps HIGH JOINTS, WEAKENED & GROUND WHILE DRILLING) WASHED OUT? IF CORE LOSS FROM 25 TO 26.4' HIGHLY WEATHERED ZONE?					10							DRILLER BELIEVES THAT HE HIT A "MUD ZONE"
27	CORE SPAN ON ITSELF TO 26.6'					5							
28	(60 to 75, S, N, Fe, St, PL, S to SF) NOTE ⑥ is decomposed for ~1" above ⑧					4							
29	CORE SPAN ON ITSELF 27.6 to 27.8					3							
30	Rock becomes slightly weathered;					4							ER8 = 29.3'
31	(68 to 75, S, T to VN, Fe, St, PL, S) (40 to 50, S, VN, Fe, St & H, St, VR (appear slightly stylonitic?))					4							
32						4							
33	Rock material is FRESH STRONG; ROCK MASS IS SLIGHTLY WEATHERED					3							ER9 = 32.8'

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CONT. CORE LOG B-5

Fig. A-5b

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RCD	No.	Type	Blow Count		Drilling Rate/ HOUR
33	①②③ 65 to 75, J, V, T, N, Fe to N, Sp to N, Pl, S											
34	④⑤ 60, J, T to N, N, N, Pl, Sr											
35	ROCK BECOMES Aphanitic, completely recrystallized, slightly weathered to fresh, strong to very strong (mass)				7.4/2.4 = 100%	3						ER10 = 35.2'
36	⑥⑦⑧ 65 to 75, F (J?), V, T, N, Fe, N to Sp, Pl, Sr					5						
37	⑨⑩ 30 to 40, J, V, N, Fe, Sr, Pl, Sp to S					1						
38	⑪ 70 to 85, J, Fe, Sr, W, Sp to S				4.2/4.3 = 98%	2						
39	FRESH ROCK MASS, VERY STRONG (locally some slight staining along discontinuities.)					2						ER11 = 39.5'
40	⑫⑬⑭ 70-75, F? (J?), T to V, Fe to N, Sr to N, Pl, Sp to Sr				2.1/2.1 = 100%	3						
41	⑮⑯ 20 to 30, J, V, N, Fe, Sr (N, N), Pl, Sr					3						ER12 = 41.6'
42	⑰ thru ⑳ 65 to 75, F? (J?), T to V, Fe to N, Sp to N, Pl, S				2.6/2.6 = 100%	3						
43						4						
44							1.9/2.6 = 73%					ER13 = 44.2'
45	<u>BOH = 44.2'</u>											Completed 1350 hrs
46												
47												
48												
49												
50												

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CONT. CORE LOG B-5

Fig. A-5c

BORING LOCATION MIDDLE OF SPILLWAY; SOUTH OF CENTER		ELEVATION AND DATUM 513 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER P. BAKER	DATE STARTED 9/13/87	DATE FINISHED 9/14/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCKMOUNT		COMPLETION DEPTH 42.7'	ROCK DEPTH ~2.0'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. CORE RUNS
DRILLING METHOD NX WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD No.	Type	Blow Count		Drilling Rate/Time
0	Concrete: light grey w/ aggregate - 0.25" to ~2", breaks around aggregate in general										BEGAN 9/13/87
1	1/2" REBAR w/ small voids around it 0.6'-0.7'										
2	small voids 0.25" to 0.5"										
3	Metavolcanic; mafic metavolcaniclastic, andesitic?, grey to light brown, foliated, recrystallized locally, slightly weathered, medium strong to strong				3.2'/3.2' = 100%						ER 1 = 3.2'
4	① 20, J, N to NW, Fe, St, Pt to W, S to R ② 25, J, Fe, St, Pl, S to SR ③ 30, 25, N, N, N, Pl, S (ground?) ④ 75, S, N, Fe, St, W, R										
5	becomes slightly weathered to fresh, medium strong										
6	① 20, J, N to NW, Fe, St, Pt to W, S to R ② 25, J, Fe, St, Pl, S to SR ③ 30, 25, N, N, N, Pl, S (ground?) ④ 75, S, N, Fe, St, W, R				4.0'/4.0' = 100%						
7	slightly darker zone, more intensely foliated, highly weathered, moderately strong to weak 6.4 to 6.7'										1430415 ER 2 = 7.2'
8											
9	① 20, J, N to NW, Fe, St, Pt to W, S to R ② 25, J, Fe, St, Pl, S to SR ③ 30, 25, N, N, N, Pl, S (ground?) ④ 75, S, N, Fe, St, W, R				3.7'/3.8' = 98%						
10											
11	① 20, J, N to NW, Fe, St, Pt to W, S to R ② 25, J, Fe, St, Pl, S to SR ③ 30, 25, N, N, N, Pl, S (ground?) ④ 75, S, N, Fe, St, W, R				3.7'/3.8' = 98%						ER 3 = 11.0'
12	WELDED-MFTA-ASH INTERBED., med. strong, slightly weathered to 11.8'										
13	① 20, J, N to NW, Fe, St, Pt to W, S to R ② 25, J, Fe, St, Pl, S to SR ③ 30, 25, N, N, N, Pl, S (ground?) ④ 75, S, N, Fe, St, W, R				2.7'/3.0' = 90%						
14	① 15 to 30, J, VN, Fe										ER 4 = 14.0'
15	Ash interbed, more intense foliation, slightly weathered, weak to medium strong										

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CORE LOG B-6

Fig. A-6a

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No. Type	Blow Count		Drilling Rate/ TIME
15	ROCK BECOMES FRESH, STRONG BELOW ~15'										
16	③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ 60, F (J?), VN, N to Fe, N to SE, PL, S				4.5/4.5 = 100%	4					
17	⑦ 40, J, VN to N, N, ST, R				4		3.3/4.5 = 73%				
18	⑫ ⑬ 80, J, VN to N, Fe & Ca, ST, PL to W, SR				4						15:50 hrs ER 5 = 18.5'
19	Metavolcanic; light greenish to olive grey, aphanitic, recrystallized, foliated, fine-grained. Fresh, strong rock mass and material										
20	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ 50 to 60, J, T to W, N to Fe, SP, PL, SR to S				4.9/5.0 = 98%	2					
21	⑤ 70, J, VN, CL, ST, PL, S				4		3.3/5.0 = 66%				
22	⑦ 20 to 30, J, T, N, N, ST, R				1						
23	LOCALIZED DENDRITIC MINERAL GROWTH ON SOME JOINT FACES On unweathered joint surfaces, some metamorphic minerals are visible; epidote, magnetite, garnet These fractures may have been induced by coring process along or sub-parallel to foliation				2						16:15 hrs ER 6 = 23.5'
24	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ 50 to 60, J, T to W, N to Fe, N to SP, PL, SR										
25	④ 45, J, VN, N, PL, SR ↑ slight increase in degree of weathering due to lithology 24.2-25.4 & jointing. Strong to med. strong, slightly grainier to fresh				4.5/4.5 = 100%	3					SMUT DOWN FOR EVENING. 16:30 hrs
26	⑦ 55, J, VN, Fe, SP to ST, PL, SR ⑩ 80-85, J, VN, Fe, ST, PL to W, SR ↑ slight increase in degree of weathering (as above) 26.3-26.6				4.5/4.5 = 100%	5		1.7/4.5 = 38%			
27					5						15:35 hrs ER 7 = 28.0'
28	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ 55 to 65, J, T to W, Fe SP to ST, PL, SR										
29	③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ 45 to 55, J, VN, Fe, SP to SE, PL, SR				4.1/4.2 = 98%	4					
30	⑩ ⑪ 80+, J, VN, Fe, ST, W to PL, SR				5		2.1/4.2 = 50%				
31					4						
32					5						13:50 hrs ER 8 = 32.2'
33					2						

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CONT. CORE LOG B-6

Fig. A-6b

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No.	Type	Blow Count		Drilling Rate/ Time
33	①③⑤⑥ 60 to 75, J, UN, Fe, St, PL, St to Sr	✓										
34	④⑤⑦⑩ 50 to 60, J, UN to N, Fe, St, PL to W, Sr	✓										
35	Slight increase in degree of weathering along discontinuities 34.2' to 35'	✓										
35	②⑧⑩ 20 to 30, J, Fe & CL, St & F, PL, S	✓			40/40 = 100%	4	1.9/40 = 4.8%					
36	① 50 to 60, J, UN, Fe, St, PL, Sr to S	✓										ER 9 = 36.2'
36	③⑦ 70', J, T to UN, Fe, St, PL & St, S	✓										
37	Slight increase in degree of weathering along discontinuities 36.6-37.2'	✓			100%	5	4.0%					
37	③⑩ 40 to 50, J, UN, Fe, Sp to St, PL, Sr	✓				3						ER 10 = 37.7'
38	① thru ⑤ 50 to 60, J, T to UN, Fe to N, Sp & St to N, PL, St to Sr	✓										
39	(note: opposite ends of ③ & ⑩ indicate a poss. conjugate set)	✓										
40		✓			5.0/5.0 = 100%	5						
41		✓				6	1.4/5.0 = 2.8%					
42		✓				6						
42		✓				3						ER 11 = 42.7'
43	<u>BOH = 42.7'</u>											BOH
44												
45												

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CONT. CORE LOG B-6

Fig. A-6c

BORING LOCATION BASE OF SPILLWAY; NORTH SIDE		ELEVATION AND DATUM 487 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER P. BAKER	DATE STARTED 9/15/87	DATE FINISHED 9/16/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCKMOUNT		COMPLETION DEPTH 44.3'	ROCK DEPTH ~ 1.9'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES: WATER	DIST. FIRST
DRILLING METHOD NX - WIRELINE		UNDIST. 11	CORE PLANS 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND IMPREGNATED	LOGGED BY: SBILVESTONE
			CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. %	Fracture	ROD	No.	Type		Blow Count	Drilling Rate/Time
0	(Concrete: light grey, w/ aggregate from 0.25" to 2". Breaks both sides & around agg. Small voids (to air) 0.6" to 0.9".											BEGAN DRILLING 1420 AB.
1	Soil? loose, dark brown, silty sand (5m)?											DRILL FLUID RETURN DARK BROWN
2	Metavolcanic; (Volcanic breccia w/ ash tuff) light grey to locally H. brown, recrystallized, relict minerals visible, foliated, moderately to highly weathered, medium strong				2.1/3.0 = 70%		1.4/3.0 = 47%					ER1 = 3.0'
3	65 to 75, F(S?), etc VN, Fe, ST, SP, PL											
4	core spun on itself.											
5	10 to 25, J, VN, Fe, ST, PL, S				3.7/3.7 = 100%		2.0/3.7 = 54%					
6	Rock material becomes slightly weathered, moderately strong to strong below ~ 4.5' (with locally weak decomposed zones along discontinuities) Rock mass remains moderately weathered											ER2 = 6.7'
7	85 to 90, J, T, Fe, ST, H, PL, SR											
8	55 to 70, J, VN, Fe, ST, PL, SR											
9	25 to 35, J, VN, Fe, ST, PL, S											
10	60, J, N to MW, Q & Fe, F & ST, PL, S											
11	80+, J, T to VN, Fe, ST, PL, S				4.9/5.0 = 98%		2.5/5.0 = 50%					1530 HRS
12	6.7 to 6.8'; rock locally decomposed											ER3 = 11.7'
13	Material very weak; decomposed from 10' to 12.3'											
14	Becomes more aphanitic, more crystallized, slightly weathered, strong to very strong											
15	60 to 75, F(S?), VN, TOT, Fe to N, ST, VN, PL, SR (note: @ has sparse etc)				41/4.3 = 95%		2.5/4.3 = 58%					

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS
		Fracture	Lith. Run No.	Box No.	Recov. ft.	Fracture Freq.	ROD	No. Type	Blow Count	
15	⑩ 20, S, N, Qtz, Sp, Pl, R		41		2					ER4=160'
16	⑩⑪⑫⑬⑭⑮⑯ 60 to 70, J, T to V, Fe to N, St to N, Pl, S				3.3/3.5 = 94%					
17	⑰ 70 to 80, J, T to V, Fe, St to H, Pl, S				3					
18	⑱ 30 to 50, S, N, Fe, St, Pl, Sr				3					
19					3					ER5=19.5'
20	⑰⑱⑲⑳㉑㉒㉓㉔㉕ 55 to 65, J, T to V, Fe to N, St to N, Pl, S to Sr				4					
21	⑳ 75 to 80, J, T, Fe, St to H, Pl, S to Sr				3					
22	㉑ 50, S, N, Fe, St, Pl, S				3					
23	rock weaker above weathered joint 22.1-22.3'				4					
24	rock mass remains slightly weathered to fresh; strong below 23.3'				3					ER6=24.3'
25	⑳㉑㉒㉓㉔㉕ 70 to 80, J, T to V, Fe, St, Pl, S				2					
26	㉖㉗㉘㉙㉚㉛ 55 to 65, J (F?), V to T, Fe, Sp (N, N), Pl, S to Sr				3					SHUT DOWN FOR evening 1650 hrs 9/15/57 resumed 0810 hrs 9/16/57
27					3					
28					4					
29					4					ER7=28.8'
30	⑳ 75 to 80, J, T, Fe to N (?), H, Pl, S (?)				1					
31	㉑㉒㉓ 55 to 60, J, (F?), T to V, Fe, St to Sp to N, Pl, S to Sr				3					
32	㉔㉕ 25 to 35, J, T to V, Fe, Sp, Pl to W, S to Sr				2					ER8=31.7'
33	rock becomes very strong to extremely strong. FRESH (ROCK MATERIAL & ROCK MASS)				0					

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CONT. CORE LOG B-7

Fig. A-7b

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type	Blow Count	
33	① 50 to 60, J, T, N, N, PL, W, SF	1	N	92	100%	1	100%				ER9 = 34.5'
34											
35	② 65 to 75, J, T, N, N, N, PL, SF	2	M	92	100%	1	100%				ER10 = 39.5'
36											
37											
38											
39		3	V	92	100%	1	100%				ER11 = 44.3'
40											
41											
42											
43		4	V	92	100%	0	100%				ER11 = 44.3'
44											
45								<u>BOH = 44.3'</u>			
46											
47											
48											
49											
50											

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CONT. CORE LOG B-7

Fig. A-7c

BORING LOCATION BASE OF SILLWAY ; SOUTH SIDE		ELEVATION AND DATUM 486 feet (Approx)	
DRILLING AGENCY P.C. EXPLORATION	DRILLER C. BAKER	DATE STARTED 9/15/87	DATE FINISHED 9/16/87
DRILLING EQUIPMENT JOY 22 TRUCKMOUNT		COMPLETION DEPTH 25.0	ROCK DEPTH 1.2'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. CORE RUNS
DRILLING METHOD NX-WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION (SEE GFOI MAP)	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No.	Type		Blow Count	Drilling Rate/Time
0	NOTE: BORING LOCATION OVER POTENTIAL SHEAR ZONE CONCRETE; light grey, aggregate from ~0.25" to 2"; breaks around aggregate, small voids to 0.2" at 0.3' and 0.4' to 1.1'											BEGAN 1000 HRS 9/15/87
1	① 65 to 70, J, (F?), T to V, Fe & CL, St, Pl, S -Metavolcanic; (Coarse grained metavolcanic breccia), dark brown to brown, slightly mottled, moderately recrystallized, relict grains visible, foliated, completely weathered, very weak to weak, (mafic?)			1	1.9/1.9 = 100%	4	428					1035 HRS ER 1 = 1.9'
2				2	1.9/1.9 = 100%	4	428					
3	② 65 to 70, J (F?) T to V, Fe & CL, St, Pl, S Rock becomes mod. weathered, weak to med. strong below 2.9'			2	1.9/1.9 = 100%	8	428					ER 2 = 2.9'
4	① thru ② 65 to 85, J, W, Fe, St, Pl, & W, R to SR NOTE: ③ thru ⑤ are decomposed for ~0.5" above them			3	3.9/4.2 = 93%	3	298					
5				4	3.9/4.2 = 93%	5	298					
6				5	3.9/4.2 = 93%	4	298					
7	core ground. Becomes mod. to slightly weathered below 7.1'			6	3.9/4.2 = 93%	4	298					ER 3 = 7.1'
8	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ 65 to 75, (S?) V, T, Fe, St, Pl, SR			7	5.0/5.0 = 100%	2	488					
9	① ② 20 to 30, J, V, Fe, St, St to Pl, SR			8	5.0/5.0 = 100%	4	488					
10	① ② 25 to 80, J, V, St, Pl to W, SR to S			9	5.0/5.0 = 100%	3	488					
11				10	5.0/5.0 = 100%	5	488					
12				11	5.0/5.0 = 100%	3	488					1215 HRS ER 3 = 12.1'
13	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ 60 to 70, J, W, Fe, Sp to St, Pl, Sr			12	4.0/4.1 = 98%	3	468					
14	③ 30, J, V, N to Fe, N to Sp, Pl, Sr			13	4.0/4.1 = 98%	5	468					
15	④ 75 to 80, J, V, Fe, St, Pl, S			14	1.9/4.1 = 46%							

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CORE LOG B-8

Fig. A-8a

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith. No.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD	No. Type	Blow Count		Drilling Rate/Time
15											
16											ER 5 = 16.2'
17	① thru ⑧ 60 to 70, J(F?), Vn to N, Fe, St to Sp, Pl, S to Sr										
18	① & ⑧ have ~1" of decomposed rock immed above joint plane. Becomes slightly weathered, local decomposed zones				2.8/2.8 = 100%						
19	① thru ⑩ 50 to 60, F(J?), T to Vn, Fe to Cl, St to F, Pl, S to Sr ↑ only slight on ⑩										ER 6 = 19.8'
20											
21											
22	Extremely decomposed, extremely weak. ↓ core ground				3.3/3.6 = 92%						
23	① thru ⑤, ① thru ⑫ 50 to 65, F(J?), T to Vn, Fe & Cl, St to F, Pl, S to Sr ↑ only on ⑧ to ⑫										
24	① 45, J, Vn, Fe, St, Pl, Sr										
25	Extremely decomposed rock; extremely weak										
26											
27											
28	① 50 to 65, F(J?), T to Vn, Fe, St (same Cl, H), Pl, S to Sr Rock becomes fresh and strong										
29	③ 30, J, Fe to N, Sp to N, Pl, S. ④ 80 to 85, J, Vn, Fe, St, Pl, S										
30					3.3/3.8 = 87%						
31	Metavolcanic, light greenish grey, foliated fine grained metavolcanic breccia, fresh rock material, strong										ER 9 = 31.1'
32	Note ① & ⑧ are heated. ① 55 to 70, J, T to Vn, Fe, St (to N, H), Pl, S to Sr										
33					4.1/4.1 = 100%						

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CONT. CORE LOG B-8

Fig. A-8b

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type	Blow Count		Drilling Rate/ Time	
33	① 75 to 80, J, V, Fe, St, Pl, S				4.4/4.1 = 100%	3							
34	Ash interbed; meta-ash tuff, weak mod. weathered					4							
35	① 75 to 80, J, V, Fe, St, Pl, S												ER 10 = 35.2'
36	② 60, J, T to V, Fe (to N), St, Pl, S				1.8/2.9 = 62%	3							
37	Core lost while attempting to recover core barrel.					4							NOTE: core barrel spread in Rod, had to use hydraulics, to remove
38	(core ground on itself @ 38.2') Rock Mass appears fresh, strong below 38.1', Possible local shear zones → healed					0.7							ER 11 = 38.1'
39	① ② ③ ④ 60 to 70, J (F'), T, Fe, St, Pl, S ⑤ 50 to 60, W, Q & Fe, Sp & St, Pl, Sr					1							Seal dam for opening 1710 hrs 7/15/87. Recovered 0516 7/15/87
40					8.0/10.0 = 80%	1							
41					4.7/4.7 = 100%	2							
42						2							
43	① 65 to 75, J, T, Fe, H, Pl, St, Sr ② ③ ④ ⑤ 45 to 55, J, V, T, Fe, St, Sp, Pl, S to Sr					1							ER 12 = 42.8'
44					2.2/2.2 = 100%	3							
45						5							ER 13 = 45'
BOM = 45.0'													Completed 9/14/87 021545.

Project Pardee Dam South Spillway
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CONT. CORE LOG B-8

Fig. A-8c

BORING LOCATION UPPER PART OF SPILLWAY; NORTH SIDE		ELEVATION AND DATUM 535 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER DON	DATE STARTED 9/17/87	DATE FINISHED 9/17/87
DRILLING EQUIPMENT ACKER SOIL MAX TRACKMOUNT		COMPLETION DEPTH 29.0'	ROCK DEPTH 2.8'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. CORE RUNS
DRILLING METHOD NX - WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. FREEMAN

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. Ft.	Fracture Freq.	ROD	No.	Type		Blow Count	Drilling Rate/Time
0	Concrete; light grey, aggregate 0.25" to 1.0"				100%							BEGAN 12:10 HRS. ER1 = 0.5'
1	Small focal voids from 1.6 to 1.7' (to ~ 0.3") and 2.1 to 2.4'. Breaks around aggregate.											
2	① 65 to 70, J, V, W, Fe, Sp, Pl, S (in cement)				2.9/3.0 = 97%							DRILL FLUID RETURN CHANGED COLOR FROM LT. GRAY TO BROWN AT ~ 2.8' 12:45 HRS.
3	Metavolcanic; (Andesite?), medium brown to grey, slightly mottled, foliated, relict grains visible, moderately recrystallized, moderately weathered, weak to medium strong (fine grained meta-ash tuff + breccia)											ER2 = 3.5'
4	① 55 to 65, J, Fe, T, V, W, Fe, St, Pl, S to Sr											
5	② 75, J, V, W, Fe, St, Pl, S to Sr (also sealed)											
6												
7	Core ground & washed out? (welded ash tuff) WEAK ZONE 6.6' to 7.3' interbed?											
8	WELDED ASH TUFF INTERBED (STRONGER THAN ABOVE)											
9	① 45 to 50, J, V, W, Fe, St to Sp, Pl, S ② 55 to 65, J, V, W, Fe, St to Sp, Pl, S ③ 50 to 55, J, T, Fe, St, Pl, S ④ 70, J, Fe, Sp, Pl, S				1.3/1.3 = 100%							ER4 = 9.3'
10	Becomes thinly bedded to laminated 6' to 24' WELDED META ASH TUFF INTERBED 10.0 to 10.1, 11.4 to 11.6 & 13.8 to 13.5'; med weak, strong				100%							ER5 = 9.9'
11	① 60 to 75, J, T, V, W, Fe, St, Pl, S ② 50, J, T, Fe, Sp, W, St (note: 1 bed w/ weak ash)				3.1/3.1 = 100%							
12	AS ABOVE LOAD CASTS / SOFT SED. DEFORMATION SEDIM. STRUCTURES ① 75 to 85, J, V, W, T, Fe, St, Pl to W, Sr ② 55 to 70, J, V, W, Fe, Sp, Pl, Sr											
13	(Small voids (exsolution cavities) ~ 10-1, 12, 13.8 from ~ 0.2" to 0.4") AS ABOVE											ER6 = 13.0'
14	① 65 to 70, J, V, W, Fe, St, Pl, S				100%							ER7 = 14.0'
15	(ENTIRE Ann interbedded meta ash tuff interbeds ~ 3" at 14.4' to 14.6', 15.2' to 15.3', 15.4' to 15.8, 15.9' to 16.7', + 7.5' to 18.2)											

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RCD	No.	Type	Blow Count		Drilling Rate/Time
15	Small exsolution voids 0.3 to 0.5"											
16	Core ground & washed out 16' to 16.7'?											
17	⑬ 65 to 70, J, N, Fe, St, Pt, W, S to Sr				4.0/5.0 = 80%	4	2.1/5.0 = 42%					
18	⑭ 75 to 90, J, Fe, St, H, Pt, W, S to Sr ⑯ 20 to 30, J, T, Fe, St, R, S				6							ER 8 = 18.0'
19												
20	Rock ground 19.6' to 20'											
21	⑰ 60 to 75, J, T, R, V, N, Fe, S, Pt, W, S to Sr Welded meta-ash interbed local voids to 0.2" from 21.2' to 21.4' coarse quartz grains				4.3/5.0 = 86%	3	1.5/5.0 = 30%					
22	⑱ 85 to 65, J(?), N, T, R, W, Qtz, F & H, W, R ⑲ 20 to 45, J, V, N, Fe, St, Pt, W, R ⑳ 50, J, V, N, Fe, Sp, R, S				4							ER 9 = 23.0'
23	㉑ 65 to 70, F(?), Fe, St, R, S to S ㉒ 70 to 85, J, V, W, Fe, St & H, R, S to Sr				100%	6	0%					ER 10 = 24.0'
24	㉓ 55 to 75, J(F?), V, N, T, Fe, St, R, S ㉔ 40 to 45, J, N, T, R, W, Qtz, F, W, R ㉕ 75 to 85, J, T, Fe, St, R, S				5							
25												
26	Rock becomes darker gray color more aphanitic, less ash interbeds to ~ 29' more mafic / less weathered				4.6/5.0 = 92%	4	1.2/5.0 = 24%					
27	Rock decomposed above ㉑				5							
28												
29	Core ground.				5.3							ER 11 = 29.0'
30	?-?-?-?-?-?-?-?-?-? Bands completely weathered, extremely weak volcanic ash interbed (basaltic?) locally clay soft to firm, moist, light gray clay clumps,				1.5/5.0 = 30%	7	3.2/5.0 = 64%					DRILLING EXTREMELY EASILY. CUTTINGS DARKER GRAY/ BROWN.
31	GROUND & WASHED OUT, Shear Zone? ~ 29.5 to ~ 32.5				4							
32	?-?-?-?-?-?-?-?-?-? Meta-ash tuff, Highly weathered, extremely weak											

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CONT. CORE LOG B-9

Fig. A-9b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith. Run No.	Recov. Box No.	Recov. ft.	Fracture Freq.	ROD	No. Type	Blow Count		Drilling Rate/Time
33	① Thin ⑤ 50, B? F?, TN, N, PL to slightly W, S	✓	22			6					ER 12 = 34.0'
34	ROCK GROUND 34' to 35'	✓									
35	Metavolcanic; metavolcanic breccia medium to fine grained, lt. brownish-green, more felsic, rock material slightly weathered, medium strong	✓				10					
36	① Thin ① 40 to 55, J, T to W, Fe, St, P, S	✓				8					
37		✓				5					
38	Rock intensely foliated/decomposed, local gouge zone, shear zone?	✓				6					
39		✓				2					ER 13 = 39.0'
40	<u>BOH = 39.0'</u>										
41											
42											
43											
44											
45											
46											
47											
48											

Project Pardee Dam South Spillway
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CONT. CORE LOG B-9

Fig. A-9c

BORING LOCATION UPPER PART OF SPILLWAY; SOUTH SIDE		ELEVATION AND DATUM 535 Feet (Approx)	
DRILLING AGENCY P.C. EXPLORATION	DRILLER DON	DATE STARTED 9/18/87	DATE FINISHED 9/18/87
DRILLING EQUIPMENT ACKER SOIL MAX TRUCK MOUNT		COMPLETION DEPTH 33.2'	ROCK DEPTH 1.3'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. 9 CORE PARS
DRILLING METHOD NX-WIRELINE		WATER FIRST	COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: S. BLUESTONE
		IMPREGNATED	CHECKED BY: T. FREEMAN

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Frag.	ROD No.	Type	Blow Count	Drilling Rate/Time		
0	Concrete. Light grey, 0.75" dia 0.25" x 0.75" tends to break around clasts. Small voids from 0.7' to 0.7' to ~0.3'											Beam 0925 9/18/87
1												
2	SLATE (meta-siltstone); DARK GRAY, aphanitic, fine grained, foliated slightly fissile, slightly weathered, parts easily to extremely weak thin bedded to laminated				2.5/3.6 = 69%							
3	① TRM ② SO, F(B?), T to VN, Fe, St, PL, S core ground/washed out? LOCAL LAMINAE more decomposed											ER 1 = 3.6'
4	① TRM ② SO, F(B?), T to VN, Fe, St (+ minor CL, SP), PL, S											
5	② TO TO 80, S, VN, Fe, St, PL, S											
6												
7	core ground?											ER 2 = 7.3'
8	① TRM ② SO, F(B?), T, VN, Fe + Qtz?, St & F (some H), PL, S ③ 40% Fe, St, PL, S Welded volcanic ash along foliation/bedding planes from 7.3' to 8.1' (gives rock lighter color)				1.7/1.9 = 89%							ER 3 = 9.2'
9	core ground? Ash interbedded; appear phyllitic (light grey) granitic texture.											
10	① TRM ② 60 to 70, F(B?), T, Fe & CL, St & sp, PL, S ③ 20 to 30, S, Fe, St, S.S											
11												
12	volc. ash interbed 11.2 to 11.6'											
13	core ground 12.9 to 14.2'?											
14	Metavolcanic; Brown to light grey, foliated, aphanitic, recrystallized, granoclastic locally, slightly weathered, medium strong											ER 4 = 14.2'
15												

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type	Blow Count		Drilling Rate/Min
15	①②③④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭ 55 to 65, J(F?), T, QN, Fe, St, Pl, S to Sp	✓	✓			5						
16	①②③④⑤ 15 to 25, J, Fe (spans QTE), Sp (± sp), Pl, St	✓	✓			4						
17	↓ Rock becomes grayer in color. becomes slightly weathered to fresh	✓	✓			4						
18	↓ small exsolution cavities 70 ~ 0.3" diam 17.4 to ~ 17.9'	✓	✓		4.8/5.0 = 96%	4						
19	Rock becomes fresh, strong. (19.4')	✓	✓			4						ERS = 19.4'
20	①②③④⑤⑥⑦⑧⑨⑩⑪⑫ 60 to 75, J(F?), T, Fe, St, Pl, S	✓	✓			2						
21	③④⑤ 20 to 30, J, T to VN, Fe ± spans QTE, St to sp, Pl, S	✓	✓			4						
22	④ 70 to 80, J, T to VN, Fe, St & H locally, Pl, S	✓	✓			4						
23		✓	✓		4.8/5.0 = 96%	3						
24		✓	✓			2						
25	① T to ⑥ 65 to 75, J, N, T, Sp (to N, N), Pl, S	✓	✓			4						ER 6 = 24.4'
26	core ground.	✓	✓		2.6/2.6 = 100%	7						
27	Remains fresh; becomes very strong	✓	✓			3						ER 7 = 27.0'
28	① 20, J, T, Fe to N, Sp to N, Pl, S	✓	✓		2.4/2.9 = 100%	0						
29	① T to ⑥ 20, J, T, Fe & ④ to N, Sp & Fe to N, Pl, S note: ① is VN & healed w/ QTE.	✓	✓			1						ER 8 = 29.4'
30		✓	✓			1						
31		✓	✓		3.8/3.8 = 100%	1						
32		✓	✓			2						
33	BDM = 33.2'	✓	✓			1						ER 9 = 33.2' Completed 12/4/65

CONT. CORE LOG B-10

Project Pardee Dam South Spillway
Project No. B710086A

Fig. A-10b

BORING LOCATION MIDDLE OF SPILLWAY ; NORTH OF CENTER		ELEVATION AND DATUM 502 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER C. BAKER	DATE STARTED 9/18/87	DATE FINISHED 9/18/87
DRILLING EQUIPMENT JOY 22 TRUCKMOUNT		COMPLETION DEPTH 30.0'	ROCK DEPTH 1.4'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. CORE
DRILLING METHOD NX - WIRELINE		WATER	FIRST COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: SB Bluestone
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS
		Fracture	Lith. Run No.	Precov. Box No.	Fracture Freq.	ROD No.	Type	Blow Count	Drilling Rate/Time	
0	concrete, light gray, w/ aggregate from 0.25" to ~2", ave ~.75", tends to break around agg, 1/2" rebar									Began Drilling 10:10 hrs 9/18/87
1										
2	Metavolcanic; (Andesitic?) Brownish green grey, recrystallized, foliated, highly weathered, weak ① 55 to 60, F? J? T Fe, St, Pl, S to Sr ↓ Becomes moderately weathered, medium strong			2.8/3.0 = 93%	4	10/3.0 = 33%				ER1 = 3.0'
3	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ 55 to 60, F? (J), Fe, V, Fe, Sr to Sp, Pl, S				4					
4	⑥ 70 to 30, J, V, Fe, Sp, St to Pl, R ⑧ 75 to 85, J, T, V, Fe, Sp & H, Pl to N, Sr		2.1	2.5/2.5 = 100%	3	0.6/2.5 = 24%				
5										ER2 = 5.5'
6	↓ Becomes grey to blue-grey, moderately to slightly weathered, fresh locally, medium strong to strong ① thru ⑬ 55 to 65, F? J? T, V, Fe, Sr, Sp, N, R ③ 60 to 80, J, T, V, N, Fe, Sr, Sp, St, Sr				3					
7										
8										
9										ER3 = 9.0
10	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ 55 to 60, J, V, N, T, Fe, Sr, N, S ⑦ to N, Pl, S 65, J, T, V, Fe, St, Pl, S			3.5/3.5 = 100%	3	1.7/3.5 = 49%				
11	↓ Rock Material becomes lighter brown-grey slightly weathered zone				4					
12	⑬ ⑭ 75, J, T, V, Fe, St, Pl, S			3.7/4.2 = 93%	3	0.8/4.2 = 19%				
13										ER4 = 13.2
14	w/ drz, sp. ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ 55 to 65, F? J? T, V, Fe, St, Sr, N, Pl, S ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ 20 to 85, J, V, Fe, Sp to F, Pl, S ⑦ 75 to 80, J, T, Fe, St, Pl, S				3					
15					4					

Project Pardee Dam South Spillway
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CORE LOG B-11

Fig. A-11a

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Frag.	ROD	No.	Type		Blow Count
15											
16	ROCK BECOMES GREYER IN APPEARANCE. SLIGHTLY WEATHERED, STRONG				4.6/4.8 = 96%	5	1.6/4.8 = 33%				
17						4					
18	①②③④⑤⑥⑦⑧⑨⑩ 56-65, J, T, VN, Fe, ST, PL, S					5					ER5 = 18'
19	⑪⑫⑬⑭ 20 TO 30, ST, Fe & sparse Qtz, ST TO SP, PL, S					6					
20	⑮ 75 TO 85, J, T, VN, Fe, ST, PL, S					5					
21	↓ BECOMES SLIGHTLY WEATHERED.				4.5/4.5 = 100%	5	2.0/4.5 = 44%				
22						5					
23	①②③④⑤ 20 TO 30, J, T, Fe, ST, PL, S					3					ER6 = 22.5'
24	⑥⑦⑧ 50 TO 60, JT (F?), Fe, ST, PL, S LOCAL ZONE OF close fracturing of quartz QUARTZ VEIN?					2					
25	Ground & washed				2.8/4.5 = 62%	2	1.1/4.5 = 24%				
26						3					
27	①②③④⑤ 50 TO 65, ST, Fe, ST, PL, SR					3					ER7 = 27
28	⑥⑦⑧⑨ 20 TO 30, ST, T, VN, Fe, ST, PL, S					4					
29	⑩ 65-1075, ST, VN, Q, H, PL, VN, SR				30/3.0 = 100%	2	1.7/3.0 = 57%				ER8 = 30'
30	<u>BHM = 30'</u>										
31											
32											
33											

Project Pardee Dam South Spillway
Project No. 8710086A

CONT. CORE LOG B-11

Fig. A-11b

BORING LOCATION MIDDLE OF SPILLWAY ; SOUTH OF CENTER		ELEVATION AND DATUM 501 Feet (Approx)	
DRILLING AGENCY P-C EXPLORATION	DRILLER C. BAKER	DATE STARTED 9/17/87	DATE FINISHED 9/18/87
DRILLING EQUIPMENT JOY 22 TRUCKMOUNT		COMPLETION DEPTH 39.0'	ROCK DEPTH 1.3'
SIZE AND TYPE OF CASING NONE		NO OF SAMPLES	DIST. UNDIST. 13 CORES
DRILLING METHOD MIX - WIRELINE		WATER FIRST	COMPL. 24 HRS.
CORE BARREL SPLIT	LENGTH 5 FEET	BIT DIAMOND	LOGGED BY: SBLUESTONE
		IMPREGNATED	CHECKED BY: T. Freeman

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	ROD No.	Type	Blow Count		Drilling Rate/Time
0	Concrete; light grey, aggregate 0.25" to 2"; small voids to 0.20" at ~1.8 to 1.2'; breaks around aggregate				1.4/1.4 = 100%	1	0.7/1.4 = 50%				Began 1020 hrs 9/14/87
1											ER 1 = 1.4'
2	Metavolcanic; (Andesitic), grey-brown, mottled, foliated w/ relict grains visible, recrystallized, moderately weathered, weak to medium strong				1.2/1.2 = 100%	4	0.9/1.2 = 75%				1115 hrs. ER 2 = 2.8'
3	DE 2 55 to 65, J, T, ON, Fe, St, PL, S										
4	DE 2 60 to 70, F (?), T to V, Fe, St, PL, S, Sr					2					
5	Locally rock material becomes highly weathered, weak, remainder is slightly weathered (Rock ground & washed from 5.5' to ~6.3')				2.7/3.5 = 77%	3	1.5/3.5 = 43%				drill fluid darker brown. ER 3 = 6.3'
6											
7	DE 2 45 to 60, J, T, ON, Fe, St, PL, S to Sr					3					
8	DE 2 30 to 45, J, T, ON, Fe, St, PL, S					4					
9	Becomes slightly weathered, strong				2.8/3.0 = 93%	4	1.0/3.0 = 33%				ER 4 = 9.3'
10	DE 2 45 to 55, J, T, Fe, S, Sr, PL, S					2					
11	DE 2 25 to 30, J, V, Fe, St, PL, S					3					
12					3.6/3.9 = 92%	4	1.7/3.9 = 44%				
13						2					ER 5 = 13.2'
14						1					
15					100%	3					

Project : Pardee Dam South Spillway
 Project No. B710086A
CORE LOG B-12
 Fig. A-12a

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. Ft.	Fracture Freq.	ROD	No.	Type	Blow Count		Drilling Rate/Time
15	①②③ 15 TO 30, J, VN, Fe, ST, PL, S											
16	③④⑤⑥⑦ 55 TO 70, J(F?), T, VN, Fe, ST, PL, SR TO S											
17												
18	ROCK MATERIAL REMAINS SLIGHTLY WEATHERED, STONIA											ER6 = 18.0'
19	①②③ 65 TO 70, F.(J?), T, Fe, ST TO SP, PL, S TO SR.											
20	①②③④⑤ 55 TO 70, J(F?), T TO VN, Fe, ST, PL, SR ②③④⑤⑥⑦ 20 TO 35, J, T TO VN, Fe, ST, PL, S ⑧ 85 TO 75, J, Fe, SP, ST TO W, SR.											
21												
22												
23	①②③④⑤⑥⑦⑧ 55 TO 70, J(F?), VN, Fe, ST, PL, S											ER8 = 23.3'
24												
25	ROCK BECOMES GRAYER; MORE AMPHIBOLIC											
26	① 80, J, T, Fe, ST, PL, S ② 50, J, T, VN, Fe, ST, PL ③ 85 TO 70, J, T TO VN, Fe, ST, PL.											ER9 = 26.1'
27												
28	ROCK BECOMES SLIGHTLY GRAYER; SLIGHTLY WEATHERED TO FRESH. ①②③④⑤ 55 TO 60, F? J? T TO VN, Fe, ST, PL, S											SHUT DOWN FOR ETC. 1305 9/17/87 RESUMED 0810 9/18/87
29	③⑥ 70 TO 85, J, VN TO T, Fe, ST, PL TO W, S											
30												ER11 = 30.1'
31	①②④⑤⑥ 60, F? J? T TO VN, Fe, VN, SP TO TON, PL, ST TO SR (NOTE: sparse QTZ on ④)											
32	① 20 TO 40, J, T, Fe?, ST, H, W, R											
33												

Project Pardee Dam South Spillway
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CONT. CORE LOG B-12

Fig. A-12b

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Prog.	ROD	No. Type	Blow Count	
33		6	✓			3				ER 12 = 34.0'
34	↘ Slight increase in size of visible relict grains	1	✓			1				
35	①②③④⑤⑥ 65 to 70, J, T to V, Fe, St to sparse Qtz, Pl, S	2	✓			2				
36	⑦ 65 to 70, J, N, Qtz, F & H, Pl to W, R? ⑧ 55 to 60, N, Qtz, F & H, Pl to W, R?	3	✓			2				
37	⑨ 40 to 50, J, V to T, Fe, St (± Qtz, Sp), Pl, Sr	4	✓			2				
38		5	✓			3				
39		6	✓			3				ER 13 = 39' Completed core was 9/18/57
40	<u>BOH = 39'</u>									
41										
42										
43										
44										
45										

Project Pardee Dam South Spillway
Project No. 8710086A

CONT. CORE LOG B-12

Fig. A-12c

BORING LOCATION <u>Southern Barge Location, 78'E.</u>		ELEVATION AND DATUM Approx Elev of <u>Mudline 546' ±</u>	
DRILLING AGENCY <u>P-C EXPLORATION</u>	DRILLER <u>Bob</u>	DATE STARTED <u>1/23/88</u>	DATE FINISHED <u>1/25/88</u>
DRILLING EQUIPMENT <u>SPRAGUE + HENWOOD SKID RIG</u>		COMPLETION DEPTH <u>45'</u>	ROCK DEPTH <u>12.0'?</u>
SIZE AND TYPE OF CASING <u>"H" flush-joint</u>		NO OF SAMPLES	DIST. UNDIST. CORE
DRILLING METHOD <u>ROTARY CORE</u>		WATER	FIRST COMPL. 24 HRS.
CORE BARREL <u>NW WIRELINE</u>	LENGTH <u>5'</u>	BIT <u>Diamond Impreg</u>	LOGGED BY: <u>K. Weaver</u>
			CHECKED BY: <u>D. Gross</u>

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. Box No.	Recov. ft. %	Fracture Freq.	RQD	No.	Type		Blow Count	Drilling Rate/Min
1	<u>Mud? Sediment and rock debris.</u>											
2												
3	<u>Metavolcanic: Green fine-grained schistose. Rough, weathered fracture and joint surfaces. (Debris?)</u>				<u>0.44/3.5 = 13%</u>		<u>0</u>		<u>Core pieces + frag.</u>	<u>N/A</u>	<u>~ 0.12 ft/min</u>	
4												<u>Install 15' HW Casing; 2' stickup. Resume drilling 10:57 A. Push casing 2' into "mud". 11:30 A end run.</u>
5	<u>Probably rock debris and bottom sediment.</u>											
6												<u>Driller reports ~ 3' very soft possibly sand.</u>
7												
8	<u>Metavolcanic: As above. Tuff: lt. brn., fine-grained; massive.</u>				<u>0.55/5.0' = 11%</u>		<u>0</u>		<u>Core pieces and fragments</u>	<u>N/A</u>	<u>0.15 ft/min</u>	
9	<u>Metavolcanic: greenish to tan, fine grained schistose, rough, with fracture + joint surfaces. Mod. weath. Inferred drilling down schistosity of mod-high weathered rock. Fractures ~ 80°</u>											<u>Resumed 11:45</u>
10												
11												
12	<u>End of run blocked in lt. brn clay. Possibly old soil? Metavolcanic: tan, schistose. Mod-highly weathered Fract 70° to vert.</u>				<u>0.45/3.5' = 13%</u>		<u>0</u>		<u>Pieces and fragments</u>	<u>N/A</u>	<u>0.11 ft/min</u>	
13	<u>① Fe, Fe, St, W, Sr, F-LS. Fragment of quartz at top of run.</u>				<u>3.2/3.5 = 91%</u>		<u>43%</u>				<u>0.08 ft/min</u>	<u>End 12:16 Resume 12:30</u>
14												
15												

Project No. <u>8710086A</u>	Pardee Dam South Spillway Geological Investigation	Boring B-13	Figure A-13a
Woodward-Clyde Consultants			

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Rtn No. Box No.	Recov. ft.	Fracture Freq.	ROD	No. Type	Blow Count	Drilling Rate		
16	Metavolcanic: brown, schistose, mod-highly weath. Locally gray Fo: Fe, St, Sr			4								End run 1:15P Added 5' casing Resumed 2 PM Brief circulation brown. Partially repaired, brn 2 1/2" sub twisted off; drilling stops. Resumed 8:15A 1/25/80
17					1.7/2.0 = 85%	16						
18												
19	① Fo: Fe, St, Sr. ③ ditto. ② C Sl-mod. weath.											
20					67%	3						
21	Mod. weath - highly weath. Low strength.				40"/60" = 67%	3						
22												
23	① J: Fe, St, St, R 40° ② Fo: Fe, C, P, W, Sr. 80° ③ J: Fe, St, St, Sr, 40°											End run 8:52 A Shift 78. Resume 9:20 A
24	④ Fracture: Fe, St, St, R, W ⑤ Sh: W, C, F											
25	⑥ J: Fe, St, St, R, 40° ⑦ Fo: Fe, St, St, Sr, 80°											
26	⑧ Sh: W, C, F											
27					4"/5" = 80%	2/10						Driller reports pump pressure up last foot. Assume last End 10:00 A Resume 10:20
28	① Fo: Fe, St, St, R. F. M-H weath ② J: Fe, St, St, R. S-M weath. LS											
29	③ Fo: Fe, St, St, SR ④ J: Fe, St, St, R											
30	⑤ J: Fe, St, St, VR				28"/36" = 78%							End 10:55 Resume 11:05 Stop 11:20 0.5' run. Problems. Replace bit Resume ~ 11:45 End run @ 12:15
31	① Fo: Fe, St, St, SR. Sl. weath, blue gray, H.S.											
32	① Fo: Fe, St, St, Sr ② J: Fe, St, P, St, SR				49/4" = 100%							

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS		
		Fracture	Lith.	Run No. BOX NO.	Recov. ft.	Fracture Freq.	RQD	No.	Type		Blow Count	Drilling Rate
31	① J: Fe, C, St, Sp, Sr. ② J: Fe, C, St, Sp, Sr ③ Fe, St, R.			22	100%		28%				0.13 ft/m.	End 12:15 Resume 12:25
35	① Fo: Fe, Mn, St, St, W, Sr. St. weath			42	70%		26%				0.025	Blocked End 12:45 Wireline malfunction. Pulled out. Resume 1:28
36	② J: Fe, St, W											
37	Metavolcanic: greenish gray, H.S., Fresh											
38	① J: Fe, Mn, St, Sr. ② J: C, Mn, S			22	83%	1	83%				0.10 ft/min	
39	③ J: Fe, Mn, St, St, Sr. ④ J: Fe St, St, R				3.5/4.2 = 83%							
40	⑤ J: Fe St, St, SR.											End 2:09 Resume 2:20
41	Metavolcanic, greenish-bluish gray, HS, fresh.											
42	① J: Fe St, St, SR. ② J: Fe, St, St, SR.			32	100%	1	100%				0.10 ft/min	
43												
44					4.3/4.0							
45												End: 3:00 PM Bottom of Hole Completed 1/25/88

Project No.
8710086A

Pardee Dam South Spillway
Geological Investigation

Boring B-13

Figure
A-13c

Woodward-Clyde Consultants

BORING LOCATION Northern barge location .59' E		ELEVATION AND DATUM Approx 82' at Mudline 552.5 ±	
DRILLING AGENCY P.C. Drilling Co.	DRILLER Bob Wharff	DATE STARTED 1/26/88	DATE FINISHED
DRILLING EQUIPMENT Sarge & Henwood Skid Rig	COMPLETION DEPTH 46' 5"	ROCK DEPTH 1.8'	
SIZE AND TYPE OF CASING 4" H flush joint	NO. OF SAMPLES	DIST.	UNDIST. CORE
DRILLING METHOD ROTARY CORE, SPLIT-TUBE	WATER	FIRST	COMPL. 24 HRS.
CORE BARREL NW WIRELINE	LENGTH 5'	BIT DIAMOND IMPREG.	LOGGED BY: K. Weaver
NW WIRELINE	5'	Diamond Impregnated	CHECKED BY: D. Gross

DEPTH (FEET)	DESCRIPTION	ROCK CORE				SAMPLES				REMARKS	
		Fracture Lith.	Run No. Box No.	Recov. %	Fracture Frag.	R.O.D.	No.	Type	Blow Count		Drilling Rate/Time
1	BOTTOM SEDIMENT: clay, sand, silt, gravel and rock fragments.										6'8" barge deck to "mud line" Start 10:03 AM. Install casing. Start coring 10:40 A Brn return flow after ~1.3'. Rapid to ~1.0'. 10:49 upchuck 10:58 end
2	tan to Metavolcanic: green, fine-grained. Fo: Fe, Mn, St, C, Sp; St, R. ~90° dip. M-H weath. LS.			0.75/3.0 = 25%	Fragmental	0/3.0 = 0				.22 ft/min	Resume 11:10 A
3											
4	Gray-green to tan, fragile, fragmental. (Photo taken while in split tube) Fo: Fe, Mn, C, St, Sp; Mod-H weath. LS. St, VR		2 11	2.1/2.9	Fragile / Fragmental	0/2.9 = 0				0.09 ft/min	End 11:41 A
5											Resume 11:54
6	Gray-gray green. S-Mod weath. MS-HS. ① J: Fe, Mn, St; St, VR.			3.0/3.0 = 100%		2.7/3.0 = 90%				0.09 ft/min	End 12:26
7	② Fo: Fe, Mn, St, P, W, R.		3		~10						Resume ~12:45
8	Color banding; numerous incipient fractures, both parallel to and oblique to schistosity. Fragile. ③ J: Fe, Mn, St; P-St, S-Sr.			3.0/3.0 = 100%	~10	2.7/3.0 = 90%				0.09 ft/min	
9											
10	Brown - Mod. weath. MS. ① Fo: Fe, Mn, St; St, W										End 1:36 P
11	② J: Fe, St; St, R.			2.9/5.0 = 58%		16" / 60" = 27%				~0.1 ft/min.	Frequent blocking core ground at 9 breaks.
12											
13											
14	Tuff (?) metamorphosed, med. - fine grained brown to green banded, speckled. M, MS. ① J: Fe, Mn stained, planar, smooth. ② ditto		5 1								Resume ~1:53 P

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES				REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No.	Type	Blow Count		Drilling Rate
16	⑤ J: Mn stained; planar, stepped, sl. rough. ⑥ J: Mn, Fe st, sp, C. St, R. ⑦ J: Fe, Mn, St, W, St, VR. ⑧ J: Fe, Mn, C, St, Sp, W, St, R.				4.8/5.0 = 96%	5	2.3/5.0 = 46%				5/27.0/8	
17	⑨ J: Fe, Mn, St, F, H.											
18	⑩ Sh, W. Crushed rk filling, Fe. ⑪ J: Fe, Mn St; St, VR. ⑫ J: Mn St. Pl, St, R. ⑬ ditto											2:20 P end run 2:36 P run run.
19	⑭ J: Mn, Fe, St; W, St, R.											
20	⑮ J: (all similar) Mn, Fe St; P, St, SR. ⑯ J: Mn, Fe, St; W, St, R.					4						
21	⑰ J: Mn, Fe, St, C, F, Sr.											
22	Med-fine grained, brown - lt tan, vertical color banding, M, MS				4.7/5 = 94%		1.3/5 = 26%				~ 0.15 ft/min.	
23												
24	Lt. brn to lt. green; vertical, wavy banding and veins, sl-mod weath... MS											End box 1 3:10 end run 7:35 AM start 1/27
25	Numerous incipient or healed fractures.											
26	⑱ J: Fe, Mn stained, St, R. ⑲ J: Fe, Mn, C, St, Sp, St, VR. ⑳ Fo: Fe, Mn St. St, VR.				5%	5	1.3/5 = 26%				0.09 ft/min	
27	㉑ J: Fe, Mn St; Ch, Sp, St, VR. ㉒ J: Fe, Mn St. St, VR. ㉓ Fo: Fe, Mn St, Ch, Sp; W, St, R.				5%		1.3/5 = 26%					
28	㉔ J: Fe, Mn, St, Sp, P; Pl, Sr. ㉕ Fo: Mn, Fe, Ch, St, Sp; W, St, VR.											End run 8:29A Resume 8:40A
29	Change to metavolcanic @ 27'											
30	Green, brown mottling, med-fine gr. sl. weath, M. S., steeply-dipping wavy foliation.											
31	Joints: 20-40°; Fe, Mn stained; planar, stepped, sl. rough.											
32	Foliation: 70° to vertical; wavy, stepped, rough to very rough; Fe + Mn stain. ① Discolored, altered .03' adj joint.				3.8/4.0 = 95%	5	0.9/4.0 = 23%				12 ft/min	End run 9:14

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Pardee Dam South Spillway
Geological Investigation

Boring B-14

Figure
A-14b

Woodward-Clyde Consultants

DEPTH (FEET)	DESCRIPTION	ROCK CORE					SAMPLES			REMARKS	
		Fracture	Lith.	Run No. Box No.	Recov. ft.	Fracture Freq.	RQD	No. Type	Blow Count		Drilling Rate
34	① J: Fe, Mn St.; St, VR. ② J and Fo. form ~ 90° L, both very steep Fe, Mn St.; Wavy, SR.										Resume 9:27 A
35	③ J and fractures: fragmental; Fe, Mn, St. ④ J: Fe, Mn St., P, St, SR.				3.4/3.6 = 94%					0.10 ft/min	
36	⑤ J: Fe, Mn St.; C, Sp. Rk med-fine grained, banded.				>10		1.9/3.6 = 53%				End run 10:06 A Resume: 10:17 A
37	Rk med-fine-grained, banded, mottled, sl. weath, high strength										
38	① Joints: Fe, Mn St. St, SR. ② J/Sr?: MW, crushed rk, clay-filled.					5					
39	③ J/Sr; MW, crushed rk, Fe, partially filled. St, VR.				4.6/5.0 = 92%		2.7/5.0 = 54%			0.10 ft/min	
40	④ J: Mn St; Fe Sp; St, Sr.										
41											End run 11:05
42	Joints: Mn stained, spotted Fe. planar, slightly rough, loc steep.										Resume ~ 11:16
43	Foliation: ① Mn st, stepped sl-rough.										
44											
45	Rock is gray green, sl. weath, med-fine grained; high strength.				4.9/5.0	5	2.6/5.0 = 52%			0.09 ft/min	
46											End run 12:12
47											Bottom of hole.

APPENDIX C
LABORATORY TESTING



TEI CONSULTING ENGINEERS
A Division of Testing Engineers, Inc.

March 9, 1993

Work Request # 92263

AGS, INC. CONSULTING ENGINEERS
120 Howard Street, Suite 600
San Francisco, CA 94105

Attention: Mr. Ernest Solomon

Subject: Rock Testing
South Spillway, Pardee Dam

Dear Mr. Solomon

As requested we have completed the rock testing at the subject location.

SCOPE

The scope of our work was to determine the uniaxial compressive strength and the unit weight of the submitted rock samples.

PROCEDURES AND RESULTS

A total of six specimens were cut for unit weight measurements and compression testing. The specimens were weighed, measured and sulphur capped. The compressive testing was performed in substantial accordance with ASTM D 2938. Photos 1 through 6 show the failure mode of the specimens. Almost all samples failed in shear. The results are as follows:

Core ID	Height* (inches)	Diameter (inches)	Unit Weight (pcf)	Compressive ** Strength (psi)
93-1-5a	3.95	2.05	159.0	1610
93-1-6A	3.92	2.02	161.3	2000
93-2-1A	3.98	2.05	152.2	790
93-2-2A	3.98	2.05	151.5	1270
93-2-3A	3.95	2.05	169.0	420
93-2-4A	3.93	2.05	172.8	1580

*) When capped the L/D ratio was greater than two.

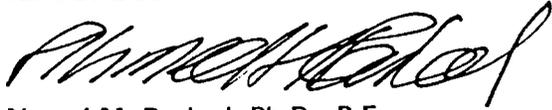
**) Tested on 3/1/93

AGS, INC. CONSULTING ENGINEERS
March 9, 1993
Page Two

If you have any questions regarding this report please contact the undersigned.

Sincerely,

TEI CONSULTING ENGINEERS

A handwritten signature in black ink, appearing to read 'Ahmed M. Rashed', written in a cursive style.

Ahmed M. Rashed, Ph.D., P.E.
Staff Engineer



Photo 1: Fracture surface of specimen 93-1-5a



Photo 2: Fracture surface of specimen 93-1-6A



Photo 3: Fracture surface of specimen 93-2-1A



Photo 4: Fracture surface of specimen 93-2-2A

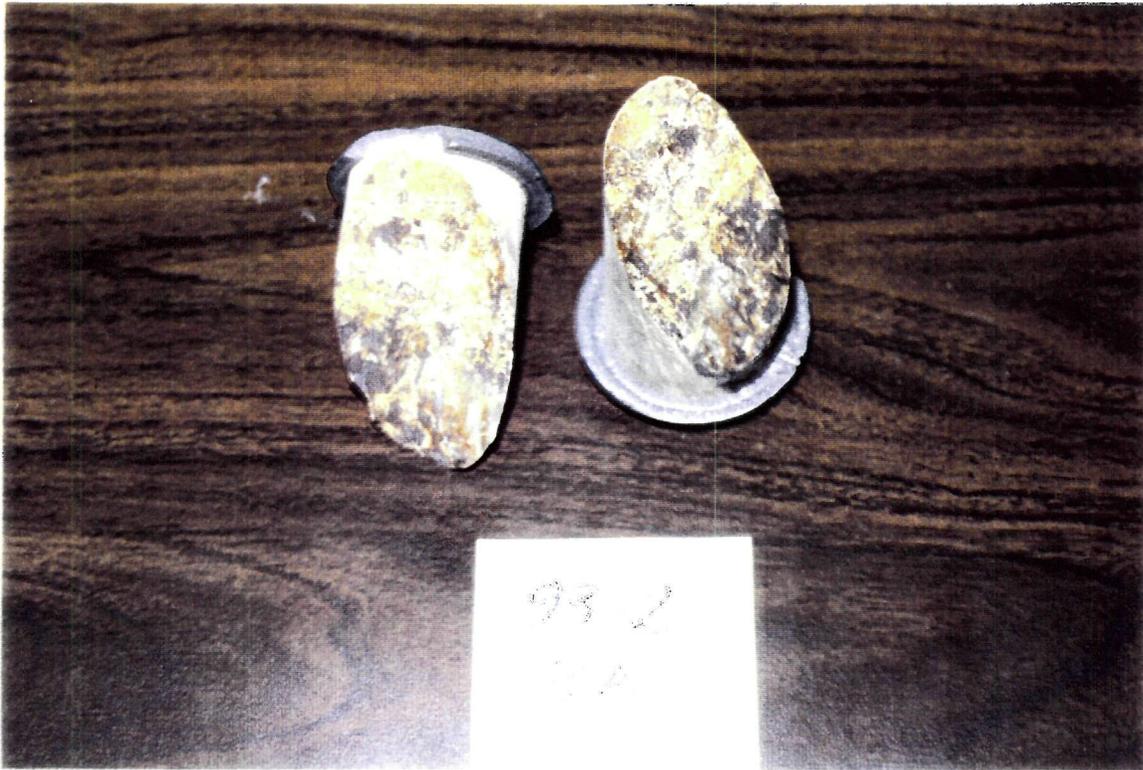


Photo 5: Fracture surface of specimen 93-2-3A



Photo 6: Fracture surface of specimen 93-2-4A.