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MATERIALS RESOURCE EVALUATION  
Cave Buttes Dam Site  
Maricopa County, Arizona

*John C. Gosner*  
11-11-76

prepared for

Flood Control District of Maricopa County  
3335 West Durango  
Phoenix, Arizona 85009

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ENGINEERS TESTING LABORATORIES, INC.

A350.906



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11 November 1976

Flood Control District  
of Maricopa County  
3335 West Durango  
Phoenix, Arizona 85009

Attention: Jack Leavitt

Project: Materials Resource Evaluation  
Cave Buttes Dam Site  
Maricopa County, Arizona

Job No. 612-687  
Inv. No. 112-0300

In accordance with our agreement, ETL No. 410-1558, and the Addendum dated 25 October 1976, this firm has performed soil and materials engineering services relative to the subject project.

The results of soil exploration services, laboratory testing and evaluation of potential quality, quantity and in-situ value of sand and gravel resources at the referenced project are presented in this report. The project site is located on those portions of federal property which fall within Rena Mining Claims No.'s 1, 2, 3, 4, 5 and 6 in Sections 3 and 4, T.4N., R.3E., G.&S.R.B.&M., Maricopa County, Arizona, at the proposed Cave Buttes Dam and Reservoir site, except for that portion of Claim No. 1 which lies north of the existing Cave Creek Dam. Our evaluation is limited to the sand and gravel deposits consisting of Recent and Quarternary alluvium which has been deposited upon the pre-existing bedrock and talus colluvium. In addition the quantity of the colluvial deposits, designated as "Older Alluvium" by the U. S. Army, Corps of Engineers, has been evaluated and potential quality and market value is presented.

The information obtained during our field exploration work and laboratory tests together with the following information prepared by

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the U. S. Army, Corps of Engineers form the basis for our evaluation.

1. U. S. Army, Corps of Engineers drawings entitled Cave Buttes Dam, General Plan of Geologic Exploration; Geologic Sections Dam Dike No's 1 and 2, Spillway and Outlet Works; Geologic Logs - Sheet 1; Geologic Logs - Sheet 2; Dam Foundation Plan of Soils Explorations; Zone III Material Borrow Areas Plan of Explorations; Dam Dikes No's 1 and 3 and Spillway Foundation Exploration Soil Logs; Zone III Material Borrow Area Exploration Soil Logs, Sheets 27 and 28.
2. U. S. Army, Corps of Engineers drawing entitled Cave Buttes Dam, Existing Cave Creek Dam Geologic and Foundation Explorations, Plan View, Profile and Geologic Logs.
3. U. S. Army, Corps of Engineers drawing entitled Cave Buttes Dam, Arizona, Borrow Area (1" = 80' dated 15 May 1975).

#### EXPLORATION

Nine test holes were excavated within the mining claims area at the locations shown on the attached site location plan in order to verify data accumulated by the U. S. Army, Corps of Engineers and to obtain representative samples for testing the quality of the alluvial materials and where possible to delineate the bedrock surface. Test hole numbers 5 and 9 were excavated using a Texoma drill with 24 and 36 inch diameter single flight augers provided by Bell Bottom Drilling Company. The remaining seven test holes were excavated using a Cat 225 Hydraulic Backhoe provided by Allen R. Lund. During excavation of the test holes encountered materials were continuously examined, visually classified and where applicable sampled.

In addition, a field survey within the mining claims area, limited to the valley floor, was performed. This field survey confirmed

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the validity of the various topographic maps of the existing gravel pits and enhanced the topographic relief as shown on the topographic plans prepared by the U. S. Army, Corps. of Engineers, in the undeveloped valley floor.

Representative material samples obtained during the field explorations were subjected to the following laboratory analyses:

<u>Test</u>	<u>Sample(s)</u>	<u>Purpose</u>
Percent Passing No. 200 Sieve	Representative Materials (10)	Classification
Atterberg Limits Tests	Representative Materials (10)	Classification

The results of the laboratory analyses are presented at the end of this report.

#### SITE AND SOIL CONDITIONS

The proposed Cave Buttes Dam and Reservoir is located approximately 1/2 mile north of the end of Seventh Street in a relatively narrow valley through Union Hills along the Cave Creek drainage, as shown on the attached Vicinity Plan. The valley floor is relatively level except at recent channel locations where channel banks and natural dikes are of varying heights and steepness and in the existing gravel pits which have large flat bottom depressions with relatively steep side slopes. The valley, in general, slopes down to the south. Vegetation in the valley floor consists of a sparse growth of mesquite, cacti and underbrush. Along the most recent channel the vegetation is somewhat denser, and in the bottom of the existing gravel pits the vegetation has been removed.

The recent alluvium is restricted to the valley floor while the older alluvium and colluvial deposits extend up the side of the valley. As disclosed by the test borings and illustrated on the Logs of Test Holes, the subsoil profile across the site is relatively

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uniform. The near surface soils outside the recent channel consist of 1 to 1.5 feet of sandy silt with occasional gravel and roots. In the recent channels this material has been eroded away. Underlying the near surface soil there is a deposit of sand, gravel and cobbles with varying amounts of silt and boulders extending to depths ranging from 7 to 14 feet in the undeveloped flood plain area. This material was classified by the U. S. Army, Corps of Engineers as Zone III material borrow. This sand and gravel deposit is underlain by another sand, gravel and cobble deposit containing varying amounts of medium to high plasticity clay fines which, in turn, is underlain at depth by bedrock. In the existing gravel pits the majority of the upper non-plastic sand, gravel and cobble deposit has been removed. The subsoil conditions encountered in the alluvial-colluvium ("Older Alluvium") deposits along the east side of the valley consisted of moderately to heavily cemented clayey sand underlain by moderately to heavily cemented silty clay, sand and gravel.

METHOD OF AND CRITERIA FOR EVALUATION

Quality: The following are standards established by American Society for Testing and Materials (ASTM) and American Association of State Highway and Transportation Officials (AASHTO) for various types of mineral aggregates. In addition the Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction (MAG-USSPWC) is presented. These standards are the most widely used and accepted criteria by private industry and government agencies.

1. Concrete:

A. Fine Aggregate: AASHTO: M6

- |                                       |              |
|---------------------------------------|--------------|
| 1) Friable Particle                   | 1% maximum   |
| 2) Material Passing<br>No. 200 Sieve  | 5% maximum   |
| 3) 3/8 Sieve                          | 100% passing |
| 4) Well Graded from Coarse<br>to Fine |              |

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ASTM: C33

- 1) Clay Lumps 3% maximum
- 2) Material Passing  
No. 200 Sieve 5% maximum
- 3) 3/8 Sieve 100% passing

MAG-USSPWC 701.3.2:

- 1) Conforms to ASTM: C33
- 2) Uniformly washed and free  
of deleterious material

B. Coarse Aggregate: AASHTO: M80

- 1) Clay Lumps 0.25% maximum
- 2) Material Passing  
No. 200 Sieve 1% maximum
- 3) 2½ inch\* Sieve 100% passing

ASTM: C33

- 1) Material Passing  
No. 200 Sieve 1% maximum
- 2) 4 inch\* Sieve 100% passing

MAG-USSPWC 701.3.3

- 1) Conforms to ASTM: C33

\*Maximum size depends upon size specified by user.

2. Asphaltic Concrete:

A. Fine Aggregate: AASHTO: M29

- 1) Material Passing  
No. 200 Sieve 10% maximum
- 2) 3/8 inch Sieve 100% passing

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MAG-USSPWC 701.3.1

- 1) Non-plastic
- 2) Conforms to AASHTO: M29
- 3) Material Passing  
No. 200 Sieve 8% maximum

B. Coarse Aggregate: AASHTO: M63 & 79

- 1) No. 16 Sieve 5% maximum
- 2) 2 inch Sieve 100% passing

3. Surface, Base and Subbase Course Material AASHTO: M147

- 1) Liquid Limit 25% maximum
- 2) Plasticity Index 6 maximum
- 3) Material Passing  
No. 200 Sieve 25% maximum
- 4) 2 inch Sieve 100% passing

ASTM: D1241

- 1) Liquid Limit 25% maximum
- 2) Plasticity Index 5 maximum
- 3) Material Passing  
No. 200 Sieve 15% maximum
- 4) 2 inch Sieve 100% passing

MAG-USSPWC 702.3

- 1) Plasticity Index 3 maximum
- 2) Liquid Limit 25% maximum

A majority of the local municipal building codes governing construction conform to the MAG-USSPWC. Based on the above information the following criteria has been used to designate which in-situ materials could be processed by normal procedures to produce the aforementioned mineral aggregates.

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1. Material smaller than cobble size (three inches or smaller).
2. Material containing less than 10 percent by weight passing the No. 200 sieve prior to processing.
3. Material containing non-plastic fines.

Using this criteria, the materials encountered at the site have been separated into three material types. 1) The near surface sandy silt is designated as material to be stripped and wasted. 2) The material classified as Zone III material borrow by the U. S. Army, Corps of Engineers (the non-plastic sand, gravel and cobbles designated on E.T.L.'s test hole logs) could be economically processed to conform to the mineral aggregate criteria. 3) The remaining material encountered at the site ("Older Alluvium"/colluvium or material containing plastic fines) is very expensive to prepare and process for use as mineral aggregate and has been designated as unclassified general fill material.

Quantity: The total volume of the mineral aggregate and the general unclassified fill material was computed by the end-area method at the eight sections shown on the attached site location plan. The volume of stripping was computed by measuring the total surface area within the project limits with a planimeter and multiplying this value by an average thickness (1.0 foot). The total surface area used in the computation included the surface area of the existing pits, as the material which was stripped from this area appears to have been redeposited on the adjacent surface, resulting in a depth in excess of 1.0 foot. The thickness of stripping (surface material to be wasted on the site) is based on the field exploration work and field observations.

The end-area cross-sections for each of the two material types were based on the topography developed during the field survey and an

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interpretation of the material thickness encountered in the field explorations performed by E.T.L. and by the U. S. Army, Corps of Engineers. The computations were performed on a Wang 2200 computer using a designated end-area by coordinates method. The computer printout of the end-areas is presented at the end of this report. The XO, YO, initial coordinates for Cross-Sections 1 through 7 and the Existing Dam (mineral aggregate), corresponds to the western intersection of the ground surface and the western limit of the recent non-plastic alluvium. This limit is designated by the symbol "... " on the site location plan. The data points were entered into the program in a clockwise manner around the section. The upper limit of the mineral aggregate was formed by the surface topography along the respective cross-sections. The lower limit of the mineral aggregate was established from the respective material thickness encountered in the field exploration work.

The process was repeated for each cross-section to determine the end areas for the unclassified general fill ("Older Alluvium"/Colluvium); designated on the computational sheets as Sections 1A through 7A and Existing Dam Section A. The lower limit of the mineral aggregate formed the upper limits of the unclassified general fill material. The lower limit of unclassified general fill was taken as the bed-rock surface, whether physically defined or interpolated.

The volume for each material type was computed by averaging adjacent end areas and multiplying by the average distance between the two cross-sections, except for that volume of material located within Mining Claim No. 6. The volume of material associated with Mining Claim No. 6 was computed by multiplying the respective end area of cross-section 7 and 7A by the north-south distance between cross-section location 6 and the south line of Section 4.

The total volume for each material type was corrected for the quantity of material to be stripped by reducing the computed total quantity by the volume of stripping.

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Based on the aforementioned quality requirements for mineral aggregate, the usable material was considered as that portion of the material smaller than cobble size. The quantity of cobbles was estimated by obtaining a weighted average of cobble quantity for each test hole or trench which presented details about material size. The cobble size material is normally separated and wasted on site. Therefore, the total volume of usable mineral aggregate is equal to the total volume of mineral aggregate less the volume of cobble size material.

The volumetric quantity of the various materials was computed in cubic yards and converted to a tonnage by the bulk density of the material. The bulk density of the two types of material is based upon in-place density tests performed by the U. S. Army, Corps of Engineers.

Market Value: The following royalties are presently being paid at various locations in the Phoenix area for mineral aggregate:

<u>Plant*</u>	<u>Royalty</u>
A	\$0.09/ton
B	0.12/ton
C	0.15/ton
D	0.135/ton

\*The general locations of these plants are shown on the Vicinity Plan.

The last renewal date for the royalty contracts listed above are not known nor is it known if the royalty is automatically renewed upon request of the leasee or is negotiated.

A royalty of \$0.15/ton is presently paid to the State of Arizona for mineral aggregates removed from the nearby gravel pit, Plant C.

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Material containing plastic fines (unclassified general fill) is in low demand in the immediate area and very costly to process for use as mineral aggregate. In addition the total quantity of this material may not be recoverable due to the thickness of the material, amount of oversize (larger than gravel size) material and high degree of cementation. Therefore, a market value of \$0.02/ton has been placed on this type material.

#### CONCLUSIONS

The total quantity of usable mineral aggregate is estimated to be approximately 1,220,500 cubic yards or 1,977,000 tons.

The total quantity of unclassified general fill is estimated to be approximately 2,529,500 cubic yards or 4,401,300 tons.

Several factors must be considered in order to establish a fair market value for in-place material. These factors should include a determination of market potential, cost of site development, distance to market, availability of alternate sources in the area and location of competition within the general area. A study which involves all these aspects and others is beyond the scope of this report; however, due to local competition combined with increasing development cost and haul distance, a market value of \$0.125/ton would appear to be justified for the usable mineral aggregate at the Cave Buttes Dam and Reservoir site covered under Rena Mining Claims No's 1 through 6. Therefore, the estimated total market value for the usable mineral aggregate is approximately \$247,200.00.

The total estimated market value of the unclassified general fill is approximately \$88,000.00.

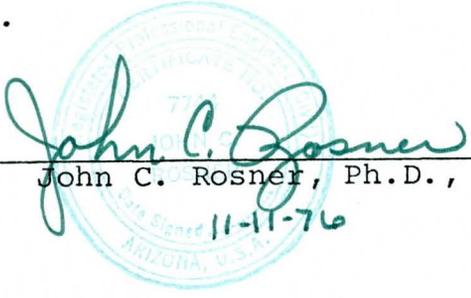
Should you have any questions concerning the results of our exploration

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program or if we may be of further assistance to you, please do not  
hesitate to contact us.

Respectfully submitted,  
ENGINEERS TESTING LABORATORIES, INC.  
Geotechnical Services

By: *Kenneth L. Ricker* and *John C. Rosner*  
Kenneth L. Ricker, P. E. John C. Rosner, Ph.D., P.E.



/jm

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## REPORT ON LABORATORY TESTS

Lab. No. 612-687

Date 11-11-76

Materials Resource Evaluation  
Cave Buttes Dam Site  
Project \_\_\_\_\_ Location Maricopa County, AZ  
Source of Sample AS Noted  
Material Subsoil Sampled By KLR/ETL  
Submitted By KLR/ETL Requested By KLR/ETL  
Tested Percent Minus No. 200 Sieve & Atterberg Limits

### TEST RESULTS

Test Hole No.	Depth (feet)	% -200	Liquid Limit (%)	Plasticity Index (%)
1	0-1.5	55.6	--	non-plastic
2	2-5	4.1	38	22
3	0-4	35.5	30	8
3	6-7	9.1	23	4
4	3-5	5.7	31	18
5	5-7	4.6	28	15
6	2-5	2.3	--	non-plastic
6	13-15	6.6	45	30
10	3-5	2.7	--	non-plastic
10	13-15	5.2	33	21

# UNIFIED SOIL CLASSIFICATION

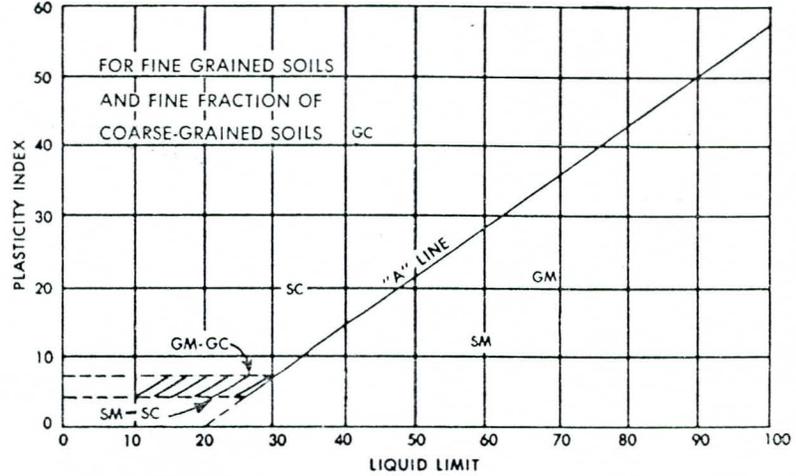
## COARSE-GRAINED SOIL

**MORE THAN 50% LARGER THAN 200 SIEVE SIZE**

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
○	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	<b>GRAVELS</b> More than half of coarse fraction is larger than No. 4 sieve size.
●	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
○	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	<b>SANDS</b> More than half of coarse fraction is smaller than No. 4 sieve size.
○	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
●	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
○	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
▨	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	
▨	GM-GC		

NOTE — Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols.

PLASTICITY CHART

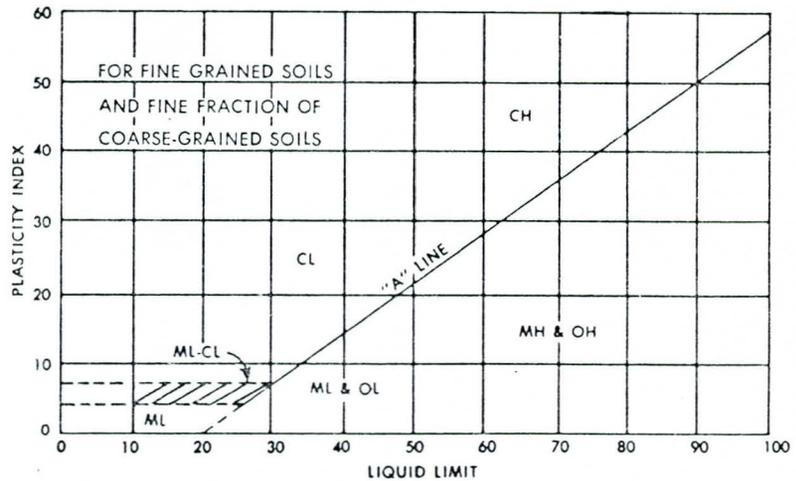


## FINE-GRAINED SOIL

**MORE THAN 50% SMALLER THAN 200 SIEVE SIZE**

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	<b>SILTS AND CLAYS</b> Liquid limit less than 50
▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
▨	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	<b>SILTS AND CLAYS</b> Liquid limit greater than 50
▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
▨	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

PLASTICITY CHART



## SOIL FRACTIONS

Component	Size Range
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel	3 in. to No. 4 sieve
Coarse Gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

# LOG OF TEST HOLE

Job. No. 612-687

Date 11-11-76

Project Materials Resource Evaluation Cave Buttes Dam Site Location Maricopa County, AZ  
 Size of hole 22" bucket Type of drill Cat 225 Hyd. Backhoe Driller --

Test Hole No. <u>1</u> Elev. <u>1565.9</u>			Test Hole No. <u>2</u> Elev. <u>1560.1</u>		
Location <u>See Site Plan</u>			Location <u>See Site Plan</u>		
Depth of Boring. Ft.	Class.	Description of Materials	Depth of Boring. Ft.	Class.	Description of Materials
1.5'	ML-SM	Sandy Silt-Silty Sand with occasional gravel and roots; light brown; loose; non-plastic.		GC-GP	Clayey Sand, Gravel and Cobbles with occasional boulders; brown; medium to high plasticity fines; medium dense.
5.0'	GW-GP	Sand and Gravel with some cobbles and occasional boulders and trace silt, brown; 10-15% cobbles & boulders; non-plastic; medium dense; roughly stratified.	4.0'	RK	Bedrock
6.5'	ML-SM	Sandy Silt-Silty Sand with occasional gravel and roots, light brown, medium dense, non-plastic.	6.0'		Test Hole Completed 10-22-76
14.0'	GW-GP	Sand and Gravel with some cobbles & occasional boulders and trace silt, brown; 10-15% cobbles & boulders; non-plastic; medium dense; roughly stratified.			
21.0'	GC-GP	Sand, Gravel & Cobbles with some clay & occasional boulders, brown; medium plasticity fines; medium dense; layer of cobbles at 16' to 18'.			
		Test Hole Completed 10-22-76			

# LOG OF TEST HOLE

Job. No. 612-687

Date 11-11-76

Project Materials Resource Evaluation  
Cave Buttes Dam Site Location Maricopa County, AZ  
 Size of hole 22" bucket Type of drill Cat 225 Hyd. Backhoe Driller --

Test Hole No. 3 Elev. 1582.4  
 Location See Site Plan

Test Hole No. 4 Elev. 1569.5  
 Location See Site Plan

Depth of Boring. Ft.	Class.	Description of Materials
5.0'	SC	Clayey Sand with occasional gravel; light brown; moderate to heavy cementation.
15.5'	GC-GM	Silty Clayey Sand and Gravel; with some cobbles; light brown; moderate to heavy cementation. Cobbles & boulder layer at 11-13' and 15.5'.
Test Hole Completed 10-22-76		

Depth of Boring. Ft.	Class.	Description of Materials
8.5'	GC-GP	Sand, Gravel and Cobbles with Clay; Brown; Medium plasticity fines; medium dense.
10.0'	RK	<u>Bedrock</u>
Test Hole Completed 10-22-76		

# LOG OF TEST HOLE

Job. No. 612-687

Date 11-11-76

Materials Resource Evaluation  
Cave Buttes Dam Site

Maricopa County, AZ

Project 24" & 36" dia. auger (5); Texoma Drill (5) Location \_\_\_\_\_  
Size of hole 22" bucket (6) type of drill Cat 225 Backhoe (6) Driller ---

Test Hole No. <u>5</u> Elev. <u>1569.9</u>			Test Hole No. <u>6</u> Elev. <u>1569.2</u>		
Location <u>See Site Plan</u>			Location <u>See Site Plan</u>		
Depth of Boring. Ft.	Class.	Description of Materials	Depth of Boring. Ft.	Class.	Description of Materials
3.0'	GP-GM	<u>Sand, Gravel, Cobbles and Boulders with trace silt, brown; 50% cobbles &amp; boulders, non-plastic fines; medium dense.</u>		GP-GM	<u>Sand, Gravel and Cobbles with trace silt and some boulders, brown; 10-20% cobbles and boulders; non-plastic fines; medium dense.</u>
	GC-GP	<u>Sand and Gravel with Cobbles and Clay; Brown; medium plasticity fines; medium dense.</u>	6.0'	GC-GP	<u>Sand, Gravel and Cobbles with Clay, brown; medium to high plasticity fines, medium dense. Numerous boulders 6-7½'.</u>
10.0'	RD	<u>Bedrock</u>			<u>Grades with less boulders and increased clay at 13'</u>
10.2'		<u>Test Hole Completed 10-21-76</u>	21.0'		<u>Test Hole Completed 10-22-76</u>

# LOG OF TEST HOLE

Job. No. 612-687

Date 11-11-76

Materials Resource Evaluation  
 Project Cave Buttes Dam Site Location Maricopa County, AZ  
 Size of hole 22" bucket Type of drill Cat. 225 Hyd. Backhoe Driller --

Test Hole No. 7 Elev. 1578.3

Location See Site Plan

Test Hole No. 8 Elev. 1580.8

Location See Site Plan

Depth of Boring, Ft.	Class.	Description of Materials	Depth of Boring, Ft.	Class.	Description of Materials
7.0'	GP-GW	<u>Sand and Gravel with Cobbles and occasional boulders and trace silt; brown; 10-20% cobbles &amp; boulders; non-plastic fines, medium dense.</u>		GM-GP	<u>Silty Sand and Gravel with Cobbles and some boulders, brown, 15-25% cobbles &amp; boulders, non-plastic fines, medium dense.</u>
	GC-GP	<u>Sand, Gravel and Cobbles with Clay and some boulders; brown; medium plasticity fines; medium dense.</u>  Boulder layer @ 11-12'	14.0'		
16.0'		Numerous boulders @ 15'-could not penetrate w/backhoe		ML	<u>Clayey Silt with Rock Fragments; tan (weathered bedrock) low to medium plasticity fines, stiff.</u>
		Test Hole Completed 10-22-76	21.0'		Test Hole Completed 10-22-76

# LOG OF TEST HOLE

Job. No. 612-687

Date 11-11-76

Materials Resource Evaluation  
Cave Buttes Dam Site

Mariocpa County, AZ

Project 36" diameter Location \_\_\_\_\_

Size of hole auger Type of drill Texoma Drill Driller --

Test Hole No. 9 Elev. 1589.0

No. \_\_\_\_\_ Elev. \_\_\_\_\_

Location See Site Plan

Location \_\_\_\_\_

Depth of Boring, Ft.	Class.	Description of Materials	Depth of Boring, Ft.	Class.	Description of Materials
12.5	GP-GW	Sand and Gravel w/Cobbles and occasional boulders and traces silt; brown; 10-15% cobbles & boulders; non-plastic fines.			
18.0	GC-GP	Clayey Sand and Gravel with Cobbles; brown; medium plasticity fines.			
		Auger refusal on boulders Test Hole Completed 10-21-76			

section existing dam

X0=	100.00	Y0=	92.00
X( 1)=	123.00	Y( 1)=	89.00
X( 2)=	388.00	Y( 2)=	90.00
X( 3)=	620.00	Y( 3)=	95.00
X( 4)=	875.00	Y( 4)=	96.00
X( 5)=	1278.00	Y( 5)=	109.00
X( 6)=	1303.00	Y( 6)=	100.00
X( 7)=	1278.00	Y( 7)=	97.00
X( 8)=	875.00	Y( 8)=	86.00
X( 9)=	620.00	Y( 9)=	81.00
X( 10)=	388.00	Y( 10)=	76.00
X( 11)=	123.00	Y( 11)=	84.00
AREA= 13466 SQUARE FEET			

section 1

X0=	100.00	Y0=	84.00
X( 1)=	160.00	Y( 1)=	88.00
X( 2)=	365.00	Y( 2)=	89.90
X( 3)=	400.00	Y( 3)=	83.00
X( 4)=	514.00	Y( 4)=	84.00
X( 5)=	710.00	Y( 5)=	88.00
X( 6)=	825.00	Y( 6)=	90.00
X( 7)=	1110.00	Y( 7)=	88.00
X( 8)=	1140.00	Y( 8)=	86.00
X( 9)=	1260.00	Y( 9)=	91.00
X( 10)=	1310.00	Y( 10)=	93.00
X( 11)=	1260.00	Y( 11)=	79.00
X( 12)=	1140.00	Y( 12)=	73.00
X( 13)=	825.00	Y( 13)=	80.00
X( 14)=	400.00	Y( 14)=	69.00
X( 15)=	160.00	Y( 15)=	75.00
AREA= 14995.5 SQUARE FEET			

section 2

X0=	100.00	Y0=	88.00
X( 1)=	210.00	Y( 1)=	79.00
X( 2)=	310.00	Y( 2)=	79.00
X( 3)=	690.00	Y( 3)=	84.00
X( 4)=	755.00	Y( 4)=	86.00
X( 5)=	870.00	Y( 5)=	80.00
X( 6)=	930.00	Y( 6)=	84.00
X( 7)=	1240.00	Y( 7)=	88.00
X( 8)=	1290.00	Y( 8)=	86.00
X( 9)=	1370.00	Y( 9)=	89.00
X( 10)=	1290.00	Y( 10)=	71.00
X( 11)=	755.00	Y( 11)=	72.00
X( 12)=	310.00	Y( 12)=	75.00
X( 13)=	210.00	Y( 13)=	76.00
AREA= 12125 SQUARE FEET			

COMPUTER PRINTOUT (continued)

section 3

X0=	100.00	Y0=	80.00
X( 1)=	290.00	Y( 1)=	76.00
X( 2)=	330.00	Y( 2)=	75.00
X( 3)=	380.00	Y( 3)=	80.00
X( 4)=	600.00	Y( 4)=	80.00
X( 5)=	692.00	Y( 5)=	70.00
X( 6)=	705.00	Y( 6)=	68.00
X( 7)=	850.00	Y( 7)=	69.00
X( 8)=	1070.00	Y( 8)=	70.00
X( 9)=	1082.00	Y( 9)=	80.00
X( 10)=	1202.00	Y( 10)=	82.00
X( 11)=	1216.00	Y( 11)=	84.00
X( 12)=	1290.00	Y( 12)=	85.00
X( 13)=	1370.00	Y( 13)=	85.00
X( 14)=	1290.00	Y( 14)=	68.50
X( 15)=	1070.00	Y( 15)=	64.00
X( 16)=	850.00	Y( 16)=	69.00
X( 17)=	705.00	Y( 17)=	68.00
X( 18)=	330.00	Y( 18)=	66.00
X( 19)=	200.00	Y( 19)=	70.00
AREA= 10427 SQUARE FEET			

section 4

X0=	100.00	Y0=	80.00
X( 1)=	160.00	Y( 1)=	75.00
X( 2)=	250.00	Y( 2)=	70.00
X( 3)=	262.00	Y( 3)=	62.00
X( 4)=	423.00	Y( 4)=	62.00
X( 5)=	435.00	Y( 5)=	70.00
X( 6)=	590.00	Y( 6)=	69.00
X( 7)=	770.00	Y( 7)=	70.00
X( 8)=	780.00	Y( 8)=	77.00
X( 9)=	900.00	Y( 9)=	64.00
X( 10)=	1150.00	Y( 10)=	64.00
X( 11)=	1203.00	Y( 11)=	80.00
X( 12)=	1262.00	Y( 12)=	84.00
X( 13)=	1150.00	Y( 13)=	62.50
X( 14)=	900.00	Y( 14)=	62.50
X( 15)=	590.00	Y( 15)=	60.00
X( 16)=	423.00	Y( 16)=	62.00
X( 17)=	262.00	Y( 17)=	62.00
X( 18)=	162.00	Y( 18)=	65.00
AREA= 6042 SQUARE FEET			

section 5

X0=	100.00	Y0=	76.00
X( 1)=	180.00	Y( 1)=	70.00
X( 2)=	310.00	Y( 2)=	73.00
X( 3)=	440.00	Y( 3)=	80.00
X( 4)=	480.00	Y( 4)=	70.00
X( 5)=	550.00	Y( 5)=	61.00
X( 6)=	690.00	Y( 6)=	60.00
X( 7)=	735.00	Y( 7)=	70.00
X( 8)=	1095.00	Y( 8)=	70.00
X( 9)=	1105.00	Y( 9)=	60.00
X( 10)=	1185.00	Y( 10)=	58.00
X( 11)=	1250.00	Y( 11)=	60.00
X( 12)=	1300.00	Y( 12)=	70.00
X( 13)=	1360.00	Y( 13)=	70.00
X( 14)=	1394.00	Y( 14)=	80.00
X( 15)=	1300.00	Y( 15)=	60.00
X( 16)=	1250.00	Y( 16)=	60.00
X( 17)=	1185.00	Y( 17)=	58.00
X( 18)=	1105.00	Y( 18)=	60.00
X( 19)=	690.00	Y( 19)=	60.00
X( 20)=	550.00	Y( 20)=	61.00
X( 21)=	440.00	Y( 21)=	60.00
X( 22)=	310.00	Y( 22)=	53.50
X( 23)=	180.00	Y( 23)=	58.00
AREA= 10320 SQUARE FEET			

section 6

X0=	100.00	Y0=	67.80
X( 1)=	250.00	Y( 1)=	69.20
X( 2)=	440.00	Y( 2)=	70.30
X( 3)=	740.00	Y( 3)=	67.10
X( 4)=	960.00	Y( 4)=	66.00
X( 5)=	1090.00	Y( 5)=	69.00
X( 6)=	1230.00	Y( 6)=	69.00
X( 7)=	1330.00	Y( 7)=	64.40
X( 8)=	1500.00	Y( 8)=	72.00
X( 9)=	1330.00	Y( 9)=	57.40
X( 10)=	1230.00	Y( 10)=	60.00
X( 11)=	1090.00	Y( 11)=	55.00
X( 12)=	960.00	Y( 12)=	50.00
X( 13)=	740.00	Y( 13)=	51.10
X( 14)=	440.00	Y( 14)=	54.30
X( 15)=	250.00	Y( 15)=	61.10
AREA= 16172 SQUARE FEET			

section 7

X0=	100.00	Y0=	67.80
X( 1)=	330.00	Y( 1)=	65.90
X( 2)=	550.00	Y( 2)=	67.30
X( 3)=	635.00	Y( 3)=	65.90
X( 4)=	635.00	Y( 4)=	51.80
X( 5)=	330.00	Y( 5)=	53.80
X( 6)=	200.00	Y( 6)=	54.80
AREA= 6395.5 SQUARE FEET			

## COMPUTER PRINTOUT (continued)

## section existing dam A

X0=	123.00	Y0=	84.00
X( 1)=	388.00	Y( 1)=	76.00
X( 2)=	620.00	Y( 2)=	81.00
X( 3)=	875.00	Y( 3)=	86.00
X( 4)=	1278.00	Y( 4)=	97.00
X( 5)=	875.00	Y( 5)=	65.70
X( 6)=	620.00	Y( 6)=	65.30
X( 7)=	388.00	Y( 7)=	60.00

AREA= 14477.65 SQUARE FEET

## section 1A

X0=	100.00	Y0=	84.00
X( 1)=	160.00	Y( 1)=	75.00
X( 2)=	400.00	Y( 2)=	69.00
X( 3)=	825.00	Y( 3)=	80.00
X( 4)=	1140.00	Y( 4)=	73.00
X( 5)=	1260.00	Y( 5)=	79.00
X( 6)=	1310.00	Y( 6)=	93.00
X( 7)=	1335.00	Y( 7)=	96.00
X( 8)=	1310.00	Y( 8)=	88.00
X( 9)=	1260.00	Y( 9)=	69.00
X( 10)=	1140.00	Y( 10)=	67.00
X( 11)=	825.00	Y( 11)=	64.00
X( 12)=	400.00	Y( 12)=	60.00
X( 13)=	160.00	Y( 13)=	70.00

AREA= 12005 SQUARE FEET

## section 2A

X0=	100.00	Y0=	83.00
X( 1)=	210.00	Y( 1)=	76.00
X( 2)=	310.00	Y( 2)=	75.00
X( 3)=	755.00	Y( 3)=	72.00
X( 4)=	1290.00	Y( 4)=	71.00
X( 5)=	1370.00	Y( 5)=	89.00
X( 6)=	1470.00	Y( 6)=	96.00
X( 7)=	1370.00	Y( 7)=	71.00
X( 8)=	1200.00	Y( 8)=	60.00
X( 9)=	800.00	Y( 9)=	48.00
X( 10)=	310.00	Y( 10)=	60.50
X( 11)=	210.00	Y( 11)=	62.00

AREA= 21137.5 SQUARE FEET

COMPUTER PRINTOUT (continued)

section 3A

X0=	100.00	Y0=	80.00
X( 1)=	200.00	Y( 1)=	70.00
X( 2)=	330.00	Y( 2)=	66.00
X( 3)=	705.00	Y( 3)=	68.00
X( 4)=	850.00	Y( 4)=	69.00
X( 5)=	1070.00	Y( 5)=	64.00
X( 6)=	1290.00	Y( 6)=	68.50
X( 7)=	1370.00	Y( 7)=	85.00
X( 8)=	1370.00	Y( 8)=	64.00
X( 9)=	1290.00	Y( 9)=	62.00
X( 10)=	1070.00	Y( 10)=	61.00
X( 11)=	850.00	Y( 11)=	56.00
X( 12)=	330.00	Y( 12)=	56.50
X( 13)=	200.00	Y( 13)=	60.00

AREA= 11480 SQUARE FEET

section 4A

X0=	100.00	Y0=	80.00
X( 1)=	162.00	Y( 1)=	65.00
X( 2)=	262.00	Y( 2)=	62.00
X( 3)=	423.00	Y( 3)=	62.00
X( 4)=	590.00	Y( 4)=	60.00
X( 5)=	900.00	Y( 5)=	62.50
X( 6)=	1150.00	Y( 6)=	62.50
X( 7)=	1262.00	Y( 7)=	84.00
X( 8)=	1550.00	Y( 8)=	88.00
X( 9)=	1550.00	Y( 9)=	60.00
X( 10)=	1262.00	Y( 10)=	56.50
X( 11)=	590.00	Y( 11)=	48.00
X( 12)=	162.00	Y( 12)=	50.00

AREA= 21708.5 SQUARE FEET

## COMPUTER PRINTOUT (continued)

## section 5A

X0=	100.00	Y0=	76.00
X( 1)=	180.00	Y( 1)=	58.00
X( 2)=	310.00	Y( 2)=	53.50
X( 3)=	440.00	Y( 3)=	60.00
X( 4)=	550.00	Y( 4)=	61.00
X( 5)=	690.00	Y( 5)=	60.00
X( 6)=	1105.00	Y( 6)=	60.00
X( 7)=	1185.00	Y( 7)=	58.00
X( 8)=	1250.00	Y( 8)=	60.00
X( 9)=	1300.00	Y( 9)=	60.00
X( 10)=	1394.00	Y( 10)=	80.00
X( 11)=	1815.00	Y( 11)=	92.00
X( 12)=	1815.00	Y( 12)=	58.00
X( 13)=	1185.00	Y( 13)=	54.00
X( 14)=	690.00	Y( 14)=	42.00
X( 15)=	310.00	Y( 15)=	48.00
X( 16)=	180.00	Y( 16)=	51.00

AREA= 26696 SQUARE FEET

## section 6A

X0=	100.00	Y0=	67.80
X( 1)=	250.00	Y( 1)=	61.10
X( 2)=	440.00	Y( 2)=	54.30
X( 3)=	740.00	Y( 3)=	51.10
X( 4)=	960.00	Y( 4)=	50.00
X( 5)=	1090.00	Y( 5)=	55.00
X( 6)=	1230.00	Y( 6)=	60.00
X( 7)=	1330.00	Y( 7)=	57.40
X( 8)=	1500.00	Y( 8)=	72.00
X( 9)=	1685.00	Y( 9)=	90.00
X( 10)=	1818.00	Y( 10)=	157.00
X( 11)=	1818.00	Y( 11)=	155.00
X( 12)=	1685.00	Y( 12)=	74.50
X( 13)=	1330.00	Y( 13)=	44.90
X( 14)=	1090.00	Y( 14)=	38.00
X( 15)=	740.00	Y( 15)=	39.90
X( 16)=	250.00	Y( 16)=	43.10

AREA= 22027.75 SQUARE FEET

## section 7A

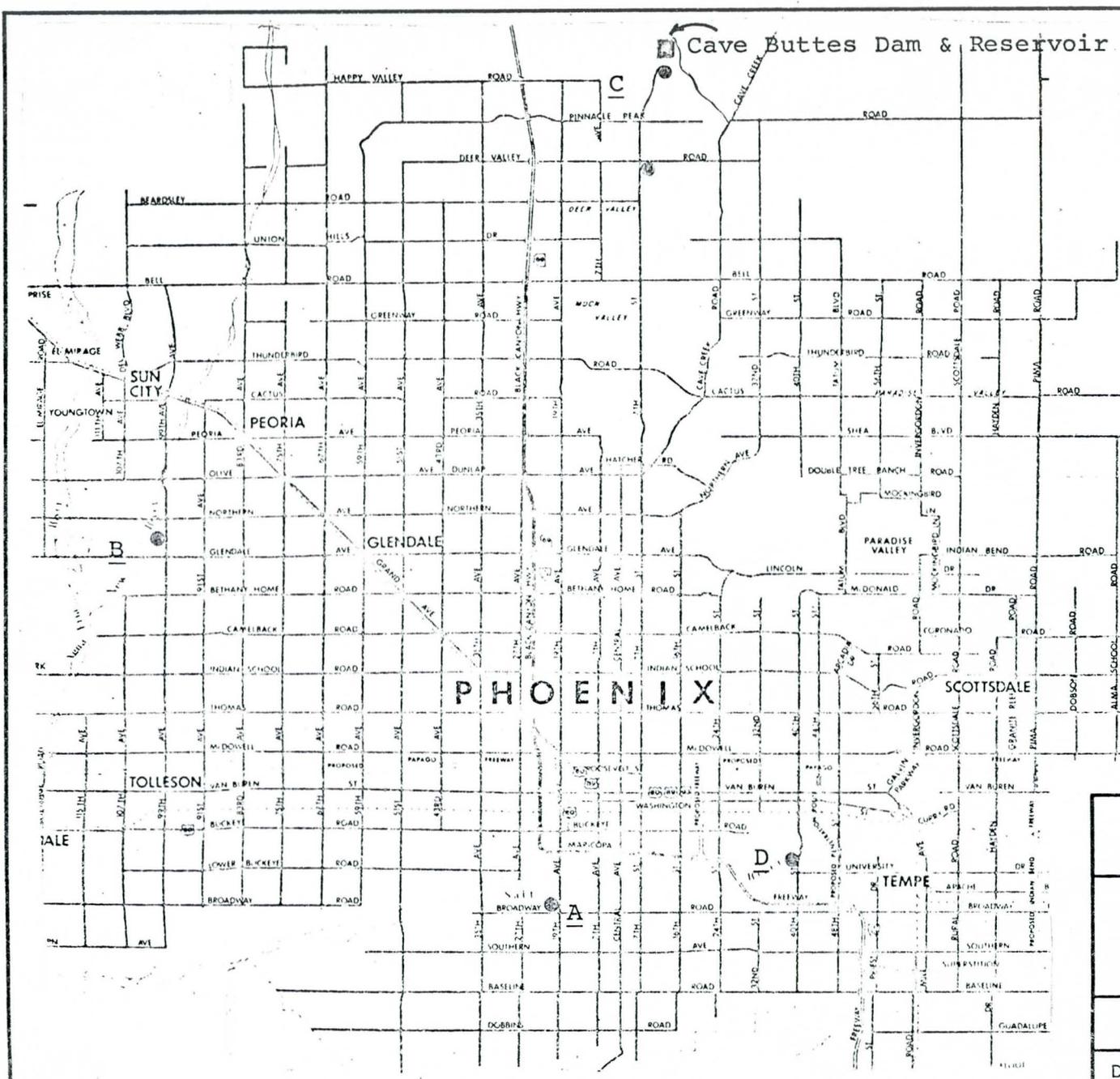
X0=	100.00	Y0=	67.80
X( 1)=	200.00	Y( 1)=	54.80
X( 2)=	330.00	Y( 2)=	53.80
X( 3)=	635.00	Y( 3)=	51.80
X( 4)=	635.00	Y( 4)=	31.00
X( 5)=	420.00	Y( 5)=	35.90
X( 6)=	220.00	Y( 6)=	39.00

AREA= 8203.25 SQUARE FEET

Cave Buttes Dam & Reservoir Site

LEGEND

● Existing Gravel Pit and Processing Plant Locations



VICINITY PLAN

MATERIALS RESOURCE EVAL.  
Cave Buttes Dam  
Site  
Maricopa County, AZ

ENGINEERS TESTING LABS

DATE: 11-11-76

JOB NO.612-687

