Don,

We could only find a correspondence file, rather small, within our archived records for non-jurisdictional dams. Attached are scanned images from this file. The two plates I mentioned during our telephone conversation are not attached to this email. Technically, it's just one plate filed in duplicate, and showing the plan and profile of the structure before the breach. During our conversation, you had also inquired on the ownership of the dam. The correspondence indicates a Mr. Geral Claridge as the original owner.

Good luck with your research. If you need further assistance, please do not hesitate to contact me.

Regards,
Nicole

Nicole Spence-Gibson
Engineering Section
Arizona Department of Water Resources
3550 North Central Avenue
Phoenix, Arizona 85012
(602) 771-8658

-----Original Message-----
From: Ragon, Rebecca AGC [mailto:Rebecca.Ragon@usace.army.mil]
Sent: Wednesday, September 08, 2010 7:03 AM
To: Nicole Spence Gibson
Subject: RE: Seeking info on an Arizona dam

Nicole,

Thank you very much for your help.

Becky

-----Original Message-----
From: Nicole Spence Gibson [mailto:nsgibson@azwater.gov]
Sent: Tuesday, September 07, 2010 4:40 PM
To: Ragon, Rebecca AGC; don lancaster
Cc: James Neely; Michael J. Johnson
Subject: RE: Seeking info on an Arizona dam

Becky,

I'll be glad to assist.

Don, I searched our database for Allen Reservoir. There were no listings under our jurisdictional dam safety program (our state's non-federal dam safety program), however, I found the name among the non-jurisdictional dams. The non-jurisdictional dams usually include the federal dams and/or dams that do not meet our height and storage criteria. The information we have on the non-jurisdictional dams are sparse and the data is usually not confirmed as we do not oversee them. The good news is there is a listing in Graham County

and some files were sent to State Records. I'm in the process of obtaining these records to confirm that it is indeed the correct dam you are researching. Once verified, I will call you to make arrangements to view.

Regards,
Nicole

Nicole Spence-Gibson
Engineering Section
Arizona Department of Water Resources
3550 North Central Avenue
Phoenix, Arizona 85012
(602) 771-8658

-----Original Message-----
From: Ragon, Rebecca AGC [mailto:Rebecca.Ragon@usace.army.mil]
Sent: Tuesday, September 07, 2010 11:14 AM
To: Nicole Spence Gibson; Michael J. Johnson
Cc: don lancaster; James Neely
Subject: FW: Seeking info on an Arizona dam

Nicole or Michael,

See request below concerning old dam in Arizona. Can you help?

Becky

-----Original Message-----
From: don lancaster [mailto:don@tinaja.com]
Sent: Tuesday, September 07, 2010 1:44 PM
To: Ragon, Rebecca AGC; James Neely; don@tinaja.com
Subject: Seeking info on an Arizona dam

There is a large and spectacularly failed dirt dam 2 miles southwest of Thatcher, Arizona

It appears on the topo map as "Allen Reservoir"

Its GPS coordinates are approximately **32.8334 **-109.7937

I seem unable to find who built this dam why or when.
Google links are uselessly misleading, especially the fishing info for a bone dry site.

It does appear to be a federal project of the 1930's to 1950's, judging by its size.
It is approximately 30 feet high by several hundred long and once stored many acres and acre feet.
Its primary purpose may have been flood control. It washed out "many" years ago.

I was unable to find it in your online directory.

Local "Allen" family historians seem unable to provide a clue.

It may be mentioned in any documents concerning endangered Central Dam which is two miles downstream northwest.

The information is needed for archaeological research into some major prehistoric canals in its immediate area.
The dam appears to straddle a canal without any regard to access. Proof of this is sorely needed.

Can you help?

--
Many thanks,

Don Lancaster voice phone: (928)428-4073
Synergetics 3860 West First Street Box 809 Thatcher, AZ 85552
rss: http://www.tinaja.com/whtnu.xml email: don@tinaja.com

Please visit my GURU's LAIR web site at http://www.tinaja.com

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

October 16, 1968

REPORT OF INVESTIGATION OF STRUCTURAL FAILURE

Structure Name and Location: Allen Dam, approximately 2 miles SW of Thatcher, Graham County, Arizona (Sec. 9, T7S, R25E, Gila and Salt River Meridian)

Owner: Geral Claridge

Authority: This committee was appointed by Mr. M. D. Burdick, Arizona State Conservationist, in his letter dated September 10, 1968 to E. J. Core, Head, E&WP Unit, Portland, Oregon

Composition of Committee:

Jack C. Stevenson, Chairman	Soil Mechanics Engineer	E&WP Unit, Portland
R. M. Arrington	Asst. State Cons. Engineer	Phoenix, Arizona
W. F. Mildner	Geologist, River Basins	Phoenix Arizona
Bob G. Kilcrease	Engr. Specialist	Willcox, Arizona

Mr. Martin Toney, Arizona State Highway Commission, in Charge of Dams, participated as an invited member of the investigating committee.

Failure Condition

Full breaching of the dam. The breach crossed the centerline of the dam at an angle of about 60°. The breach occurred about 225 feet from the interception of the top of the dam and the right abutment. See enclosed drawing and photos 1, 2 and 3.

The top width of the breach averaged about 50 feet. The bottom width of the breach was about an average of 20 feet wide. The breach had eroded to the lakebed sediments underlying the structure.

Cause of Failure

Piping through open cracks or channels through the embankment, or piping through continuous pervious zones through the structure.

Scope

On September 16, 1968 the committee visited the site and observed failure conditions. They were accompanied on this visit by Roy Ard, WUC, Safford.

Several backhoe pits were excavated to determine the type of fill materials, conditions of the fill still in place, type and condition of foundation materials in vicinity of breach. Three in-place density determinations were made. One sample was taken of the existing dam for analysis at the Portland MTS and one for analysis at the SCS Apache Junction construction laboratory.

On September 17, 1968 the committee met with Roy Ard and Geral Claridge, present owner of the structure, and discussed what could be recalled about the construction, operation and conditions leading to failure of the structure.

The committee reviewed the report of the failure prepared by J. J. Turner, State Conservation Engineer, dated September 3,1968 and a memorandum from Roy G. Ard to J. J. Turner dated September 6, 1968.

Construction drawings, specifications and construction control records were unobtainable.

Site Geology

The dam is located in a valley cut into Tertiary lake bed deposits. Lake bed clays (MH and CH) are exposed on each abutment. The valley floor is covered by a thin mantle of low density materials composed of sandy silts. Underlying the surficial deposits are lake bed clays. The lake bed materials have been preloaded and are very dense.

Design and Construction

Designed and constructed during middle 1930's as part of the Gila project. Constructed using PWA and possibly some CCC labor and equipment.

Design and construction file and records have not been located, probably disposed of.

Discussions between Bill Turner and three people involved in the project indicate the Allen dam was planned to be a retarding structure. No moisture control was used during construction. Sheepsfoot rollers were reported to have been used.

Reservoir Operations

During about the last 20 years the outlet conduit has not been functional. The conduit plugged sometime during 1948. Permanent storage has resulted. Sufficient water has been stored that boating and water skiing have been done during at least two years in the last 10.

Water levels have been maintained at about elevation 95 by natural runoff for several of the past 10 years. Mr. Claridge can only recall the reservoir being completely empty twice since the conduit plugged.

In August 1967 a fairly intense rainfall occurred during the afternoon. Mr. Claridge inspected the dam during the evening. Water was flowing

through the emergency spillway at a depth of 6 or 8 inches. This was the first time Mr. Claridge had seen or heard of the spillway functioning. Water had been within 1.5 to 2.0 feet of the spillway crest several times. Prior to the storm the water was about two feet deep in the reservoir.

At about 9:00 a.m., the day following the rain, Mr. Claridge was informed the dam was washing out. He drove to the site. He observed the breach was complete and the reservoir was emptying rapidly, eroding the fill.

Conditions Observed by Investigating Committee

The breach and remaining portions of the dam were examined. (See photos 1 and 2). Five pits and trenches were excavated with a rented backhoe.

Material in the bottom of the breach was clayey and contained a high level of moisture.

A backhoe pit was excavated in each face of the breach. The material excavated ranged from relatively clean gravels to quite plastic clays. (See photo #3). The moisture content varied from dry to approaching saturation. (See photo #8).

A backhoe trench was excavated into the lakebed sediments along the bottom of the breach. A shallow cutoff appears to have been excavated and backfilled with poorly compacted silty and clayey gravels. (See photos 4 and 5).

In-place density tests were conducted on material in the west face of the breach. The dry density ranged from 100.7 to 105.6 pcf, and the moisture content was 16.1%. This compares with a standard compaction density of 110.8 pcf and w_o of 15.8%.

Considerable variations in densities were observed. Additional in-place densities were not judged to be worth the effort needed to take them in the very gravelly fill. A 12" sand cone would have been required to determine the density of the gravelly material. The densities of some of the fill material, particularly high in the fill, was estimated to be about 75% of Standard Proctor density.

Inspection of the bottom of the breach showed that part of the embankment was placed in contact with the consolidated lakebed sediments. Part of the embankment was placed on unconsolidated alluvium, probably ranging from 2 to 6 feet thick, overlying the consolidated lakebed sediments. (See photo #5).

A longitudinal crack up to 3" or 4" in width was observed along the upstream face of the dam at about elevation 102. It started about 200 feet from the breach toward the left abutment and ran for about 40 feet. A backhoe pit was excavated across the crack. It went to a depth of about 3 feet. (See photos 6 and 7).

Probable Causes of Failure

1. Open cracks on channels through the embankment. Such cracks could have been caused by

   a. Differential settlement along the old channel line.

   b. Differential wetting and consolidation of the highly variable materials, both in density and type of fill.

   c. Dessication cracking.

2. Piping through continuous sand or gravel layers through the fill.

Suggested Repairs

The owner does not presently have a right to store water in the site. The suggested repairs are based on the assumption that either a water right will be obtained or the conduit will be repaired or replaced so no storage will occur.

To insure a safe structure after repairs, the following is necessary:

1. Slope back the breach banks to no steeper than 3 horizontal to 1 vertical.

2. Remove all vegetation from the upstream face of the remaining dam.

3. Excavate a cutoff trench into the consolidated lake sediments across the upstream toe of the remaining dam from the east abutment to at least Sta. 5+00.

4. Backfill the excavated breach with moisture conditioned ($\pm$ 2% of optimum) silty, clayey gravels placed in layers and compacted to about 95% of standard density ASTM D698.

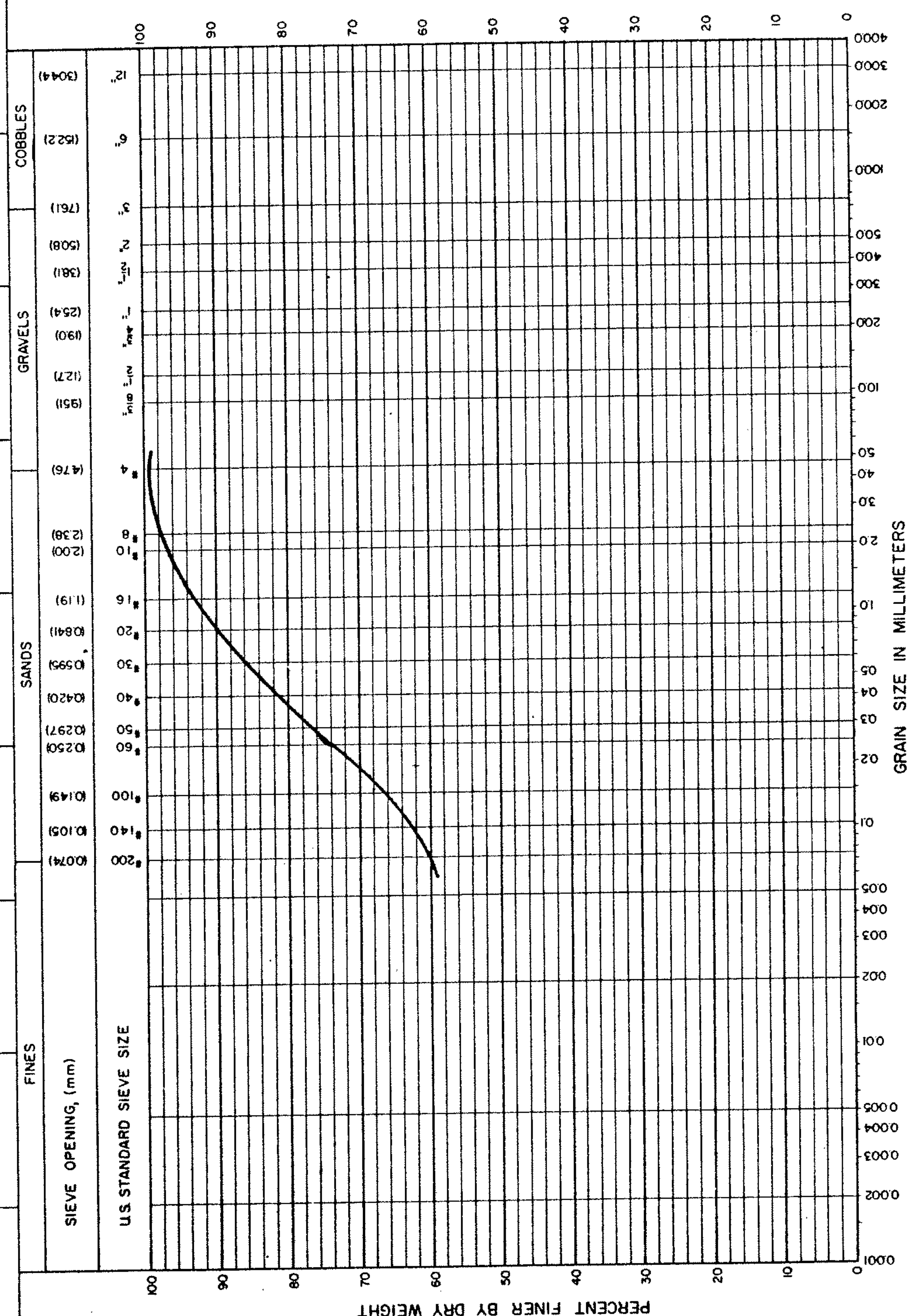
5. Fill the excavated cutoff trench and place a layer at least 10 feet thick (horizontal measurement) over the face of the remaining dam of materials moisture conditioned and compacted as described in 4 above.

Form SCS 353
9-64

LABORATORY NO. ____

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE		SAMPLE LOCATION
Allen Dam Thatcher, Arizona		Sta. 2+25 El. 82.3 West side
FIELD SAMPLE NO. 2 & 3	DEPTH	GEOLOGIC ORIGIN
TYPE OF SAMPLE Disturbed	TESTED AT S.C.S Apache Junction	APPROVED BY Ralph M Cavanagh	DATE 10-18-68
SYMBOL	DESCRIPTION	



C_c	C_u	$D_{MAX.}$	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}

UNDISTURBED CONDITION		
DRY UNIT WEIGHT	g/cc	pcf
MOISTURE	%	

SHRINKAGE LIMIT	%
SOLUBLE SALTS	%

ATTERBERG LIMITS	LL	PI
OVEN DRY		
AIR DRY		
NATURAL MOISTURE		

SPECIFIC GRAVITY (G_s)	
(+) #4	
(-) #4	

REMARKS:

Form SCS 352
Rev. 5-65

LABORATORY NO.

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Failure Investigation Allen Dam

FIELD SAMPLE NO	LOCATION	DEPTH
1	Sta. 2+25 El. 82.3 west side	

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	S. C. S. Apache Junction	Ralph M. Annuziata	10-18-68

CLASSIFICATION _____ LL _____ PI _____

MAX. PARTICLE SIZE INCLUDED IN TEST * 4 "

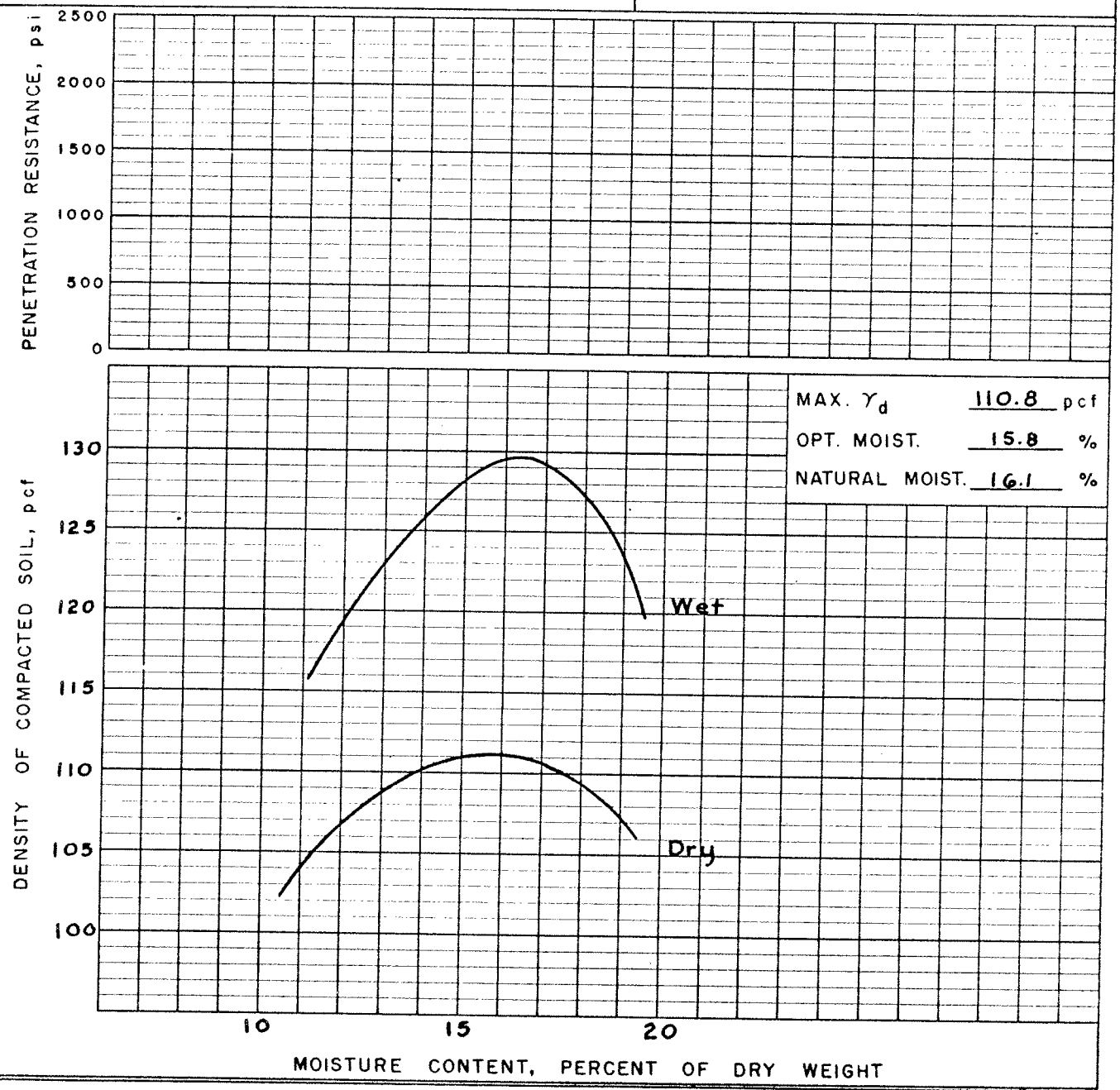
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 _____ ; PLUS NO. 4 _____

CURVE NO. _____ OF _____

STD. (ASTM D-698) ☒; METHOD A

MOD. (ASTM D-1557) ☐; METHOD _____

OTHER TEST ☐ (SEE REMARKS)



REMARKS

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 1

Project Failure Investigation Contract No.

Structure Allen Dam on west side of breach

Station Sta. 2+50 Distance (right)(left) from ℄ ℄ Elev. 80.7

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11:00 AM

Material Source

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0165	cf
C.	Initial reading	0.0062	cf
D.	Volume of hole "B-C"	0.0103	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.0005	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.0098	cf
G.	Weight of sample (soil & rock)	1.230	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.0837	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.146	lbs
J.	Apparent density of rock	164	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	116.9	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	100.7	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	90.8	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)		Gms
c.	Weight of can & sample (dry)		Gms
d.	Weight of can		Gms
e.	Weight of contained moisture "b-c"		Gms
f.	Weight of sample (dry) "c-d"		Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

Checked by Ralph M. Arrington Date 10-24-68

7-L-15000-444

USDA-SCS-PORTLAND, OREG. 1968

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 2

Project Failure Investigation Contract No.

Structure Allen Dam on west side of breach

Station 2+50 Distance (right)(left) from ℄ on ℄ Elev. 82.3

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11 AM

Material Source

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0211	cf
C.	Initial reading	0.0061	cf
D.	Volume of hole "B-C"	0.0150	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.000857	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.01414	cf
G.	Weight of sample (soil & rock)	1.793	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.1405	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.653	lbs
J.	Apparent density of rock	164.0	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	116.9	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	100.7	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	90.8	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)		Gms
c.	Weight of can & sample (dry)		Gms
d.	Weight of can		Gms
e.	Weight of contained moisture "b-c"		Gms
f.	Weight of sample (dry) "c-d"		Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

Checked by Ralph M. Arrington Date 10-24-68

7-L-15000-444

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 3

Project Failure Investigation Contract No. _____

Structure Allen Dam on west side of breach

Station 2+50 Distance (right)(left) from ℄ on ℄ Elev. 82.3

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11:00 AM

Material Source _____

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0199	cf
C.	Initial reading	0.0070	cf
D.	Volume of hole "B-C"	0.0129	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.000155	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.01275	cf
G.	Weight of sample (soil & rock)	1.586	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.0189	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.566	lbs
J.	Apparent density of rock	164.0	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	122.7	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	105.6	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	95.0	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)	150.0	Gms
c.	Weight of can & sample (dry)	135.6	Gms
d.	Weight of can	46.3	Gms
e.	Weight of contained moisture "b-c"	14.4	Gms
f.	Weight of sample (dry) "c-d"	89.3	Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

Checked by Ralph M Arrington Date 10-24-68

PORTLAND OREG. 1968

7-L-15000-444

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

March 5, 1969

REPORT OF INVESTIGATION OF STRUCTURAL FAILURE

Structure Name and Location:	Allen Dam, approximately 2 miles SW of Thatcher, Graham County, Arizona (Sec. 9, T&S, R25E, Gila and Salt River Meridian) 9
Owner:	Geral Claridge
Authority:	This committee was appointed by Mr. M. D. Burdick, Arizona State Conservationist, in his letter dated September 10, 1968 to E. J. Core, Head, E&WP Unit, Portland, Oregon.

Composition of Committee:

Jack C. Stevenson, Chairman	Soil Mechanics Engineer	E&WP Unit, Portland
R. M. Arrington	Asst. State Cons. Engr.	Phoenix, Arizona
W. F. Mildner	Geologist, River Basins	Phoenix, Arizona
Bob G. Kilcrease	Engr. Specialist	Willcox, Arizona

Mr. Martin Toney, Arizona State Highway Department, in Charge of Bridges and Dams, participated as an invited member of the investigating committee.

Failure Condition

Full breaching of the dam. The breach crossed the centerline of the dam at an angle of about 60°. The breach occurred about 225 feet from the interception of the top of the dam and the right abutment. See enclosed drawing and photos 1, 2 and 3.

The top width of the breach averaged about 50 feet. The bottom width of the breach was about an average of 20 feet wide. The breach had eroded to the lakebed sediments underlying the structure.

Cause of Failure

Piping through open cracks or channels through the embankment, or piping through continuous pervious zones through the structure.

Scope

On September 16, 1968 the committee visited the site and observed failure conditions. They were accompanied on this visit by Roy Ard, WUC, Safford.

Several backhoe pits were excavated to determine the type of fill materials, conditions of the fill still in place, type and condition of foundation materials in vicinity of breach. Three in-place density determinations were made. One sample was taken of the existing dam for analysis at the Portland MTS and one for analysis at the SCS Apache Junction construction laboratory.

On September 17, 1968 the committee met with Geral Claridge, present owner of the structure, and Roy Ard, and discussed what could be recalled about the construction, operation and conditions leading to failure of the structure.

The committee reviewed the report of the failure prepared by J. J. Turner, State Conservation Engineer, dated September 3, 1968 and a memorandum from Roy Ard to J. J. Turner dated September 6, 1968.

Construction drawings, specifications and construction control records were unobtainable.

Site Geology

The dam is located in a valley cut into Tertiary lake bed deposits. Lake bed clays (MH and CH) are exposed on each abutment. The valley floor is covered by a thin mantle of low density materials composed of sandy silts. Underlying the surficial deposits are lake bed clays. The lake bed materials have been preloaded and are very dense.

Design and Construction

Designed and constructed during middle 1930's as part of the Gila project. Constructed using PWA and possibly some CCC labor and equipment.

Design and construction file and records have not been located.

Discussions between Bill Turner and three people involved in the project indicate the Allen dam was planned to be a retarding structure. No moisture control was used during construction. Sheepsfoot rollers were reported to have been used.

Reservoir Operations

During about the last 20 years the outlet conduit has not been functional. The conduit plugged sometime during 1948. Permanent storage has resulted.

Sufficient water has been stored that boating and water skiing have been done during at least two years in the last 10.

Water levels have been maintained at about elevation 95 by natural runoff for several of the past 10 years. Mr. Claridge can only recall the reservoir being completely empty twice since the conduit plugged.

In August 1967 a fairly intense rainfall occurred during the afternoon. Mr. Claridge inspected the dam during the evening. Water was flowing through the emergency spillway at a depth of 6 or 8 inches. This was the first time Mr. Claridge had seen or heard of the spillway functioning. Previously water had been within 1.5 to 2.0 feet of the spillway crest several times. Prior to the storm the water was about two feet deep in the reservoir.

At about 9:00 a.m., the day following the rain, Mr. Claridge was informed the dam was washing out. He drove to the site. He observed the breach was complete and the reservoir was emptying rapidly, eroding the fill.

Conditions Observed by Investigating Committee

The breach and remaining portions of the dam were examined. (See photos 1 and 2). Five pits and trenches were excavated with a rented backhoe.

Material in the bottom of the breach was clayey and contained a high level of moisture.

A backhoe pit was excavated in each face of the breach. The material excavated ranged from relatively clean gravels to quite plastic clays. (See photo #3). The moisture content varied from dry to approaching saturation. (See photo #8).

A backhoe trench was excavated into the lakebed sediments along the bottom of the breach. A shallow cutoff appears to have been excavated and backfilled with poorly compacted silty and clayey gravels. (See photos 4 and 5).

In-place density tests were conducted on material in the west face of the breach. The dry density ranged from 100.7 to 105.6 pcf, and the moisture content was 16.1%. This compares with a standard compaction density of 110.8 pcf and w_o of 15.8%.

Considerable variations in densities were observed. Additional in-place densities were not judged to be worth the effort needed to take them in the very gravelly fill. A 12" sand cone would have been required to determine the density of the gravelly material. The densities of some of the fill material, particularly high in the fill, was estimated to be about 75% of Standard Proctor density.

Inspection of the bottom of the breach showed that part of the embankment was placed in contact with the consolidated lakebed sediments. Part of the embankment was placed on unconsolidated alluvium, probably ranging from 2 to 6 feet thick, overlying the consolidated lakebed sediments. (See photo #5).

A longitudinal crack up to 3" or 4" in width was observed along the upstream face of the dam at about elevation 102. It started about 200 feet from the breach toward the left abutment and ran for about 40 feet. A backhoe pit was excavated across the crack. It went to a depth of about 3 feet. (See photos 6 and 7).

Probable Causes of Failure

1. Open cracks or channels through the embankment. Such cracks could have been caused by -

a. Differential settlement along the old channel line.

b. Differential wetting and consolidation of the highly variable materials, both in density and type of fill.

c. Dessication cracking.

2. Piping through continuous sand or gravel layers through the fill.

The lack of design and construction records and the time period between the failure and the investigation makes it impossible to conclude which of the above causes likely resulted in the failure.

The lack of design and construction records, along with the apparent variability of materials and relative compaction in the fill makes it virtually impossible to compare the conditions at this dam with those at dams being constructed at present.

Suggested Repairs

The owner does not presently have a right to store water in the site. The suggested repairs are based on the assumption that either a water right will be obtained or the conduit will be repaired or replaced so no storage will occur.

To insure a safe structure after repairs, the following is necessary:

1. Slope back the breach banks to no steeper than 3 horizontal to 1 vertical.

2. Remove all vegetation from the upstream face of the remaining dam.

3. Excavate a cutoff trench into the consolidated lake sediments across the upstream toe of the remaining dam from the east abutment to at least Sta. 5+00.

4. Backfill the excavated breach with moisture conditioned ($\mp$ 2% of optimum) silty, clayey gravels placed in layers and compacted to about 95% of standard density ASTM D698.

5. Fill the excavated cutoff trench and place a layer at least 10 feet thick (horizontal measurement) over the face of the remaining dam of materials moisture conditioned and compacted as described in 4 above.

Covering the upstream face of the dam with a layer of the gravels available at the site would reduce maintenance problems and provide added protection against dessication cracking.

Jack C. Stevenson, Chairman

R. M. Arrington

W. F. Mildner

Bob C. Kilcrease

LABORATORY NO. 690202

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE	SAMPLE LOCATION
Allen Dam - Failure Investigation, Ariz.	3 miles south of Thatcher

FIELD SAMPLE NO.	DEPTH	GEOLOGIC ORIGIN
3	-	-

TYPE OF SAMPLE	TESTED AT	APPROVED BY	DATE
Disturbed	Portland, Ore.	GM Cunningham	11/1/68

SYMBOL **CL-1** DESCRIPTION **Light brown gray, calcareous, sandy silty clay**

GRAIN SIZE DISTRIBUTION

D_{90}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	D_{MAX}	C_u	C_c
-	-	0.0037	0.024	0.057	0.41	19.0	-	-

COBBLES | GRAVELS | SANDS | FINES

SIEVE OPENING, (mm)

U.S. STANDARD SIEVE SIZE

GRAIN SIZE IN MILLIMETERS

PERCENT FINER BY DRY WEIGHT

SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS							SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION		
		NATURAL MOISTURE		AIR DRY			OVEN DRY				MOISTURE	DRY UNIT WEIGHT	
(-) #4	(+) #4	LL	PI	LL	PI		LL	PI				g/cc	pcf
2.74	-	-	-	26	8		-	-	%	%	%		

REMARKS: **Positive reaction to HCL and benzidine**
Note: Two small pieces (½") of what appeared to be calcium deposits were found in the sample; they were easily broken down with a rubber mallet but were not
included in the classification analysis.

Form SCS 353
9-64

LABORATORY NO.

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE	SAMPLE LOCATION
Allen Dam Thatcher, Arizona	Sta. 2+25 El. 82.3 West side

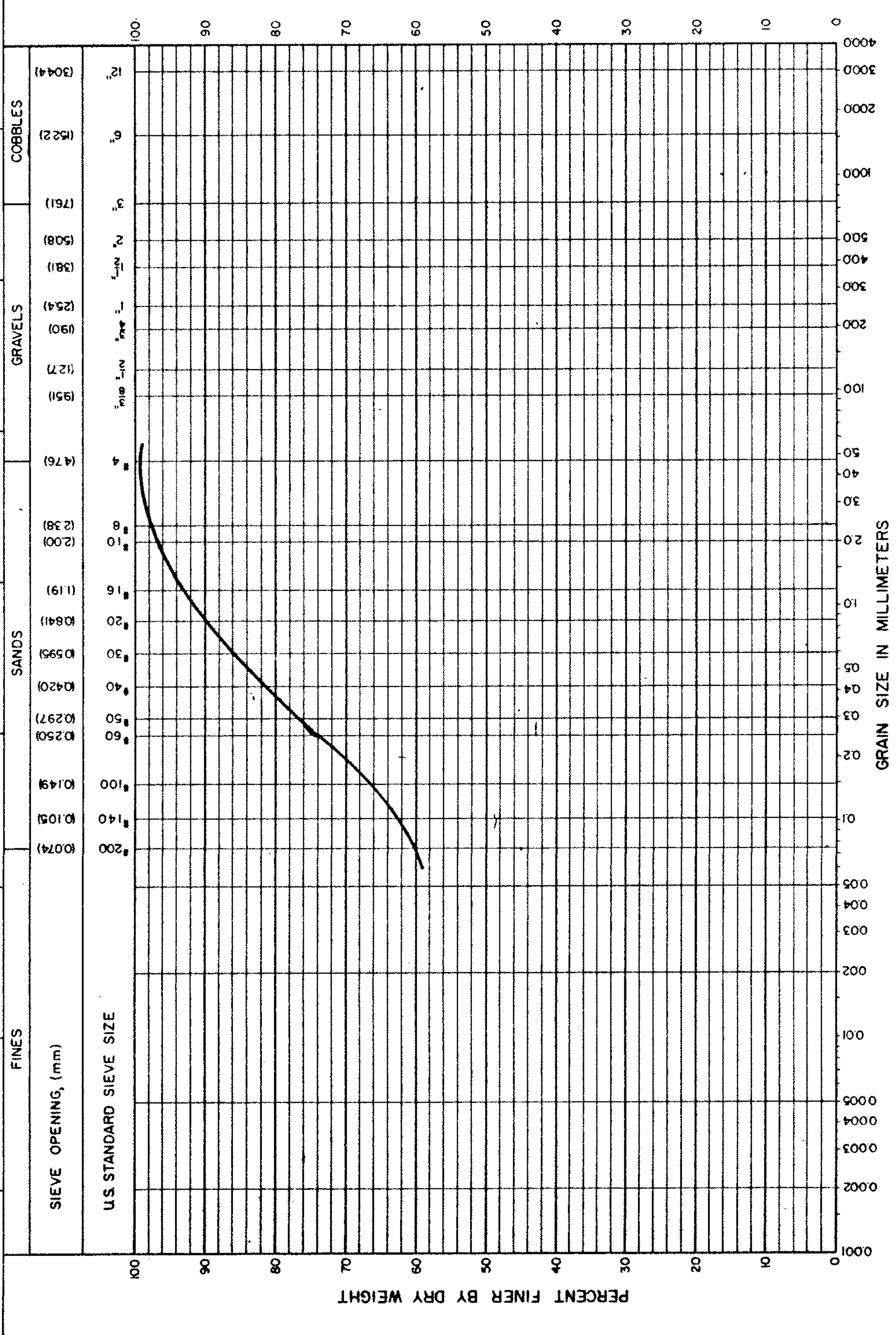
FIELD SAMPLE NO.	DEPTH	GEOLOGIC ORIGIN
2 & 3		

TYPE OF SAMPLE	TESTED AT	APPROVED BY	DATE
Disturbed	S.C.S Apache Junction	Ralph M Amungh	10-18-68

SYMBOL	DESCRIPTION

GRAIN SIZE DISTRIBUTION

C_c	
C_u	
D_{MAX}	
D_{85}	
D_{60}	
D_{50}	
D_{30}	
D_{15}	
D_{10}	



UNDISTURBED CONDITION

DRY UNIT WEIGHT	g/cc	pcf
MOISTURE	%	

SHRINKAGE LIMIT	%
SOLUBLE SALTS	%

ATTERBERG LIMITS

	LL	PI
OVEN DRY		
AIR DRY		
NATURAL MOISTURE		

SPECIFIC GRAVITY (G_s)

(+) #4	(-) #4

REMARKS:

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	COMPACTION AND PENETRATION RESISTANCE

PROJECT and STATE: Failure Investigation Allen Dam

FIELD SAMPLE NO	LOCATION	DEPTH
1	Sta. 2+25 El. 82.3 west side	

GEOLOGIC ORIGIN	TESTED AT	APPROVED BY	DATE
	S. C. S. Apache Junction	Ralph McAnnich	10-18-68

CLASSIFICATION _____ LL _____ PI _____

MAX. PARTICLE SIZE INCLUDED IN TEST * 4 "

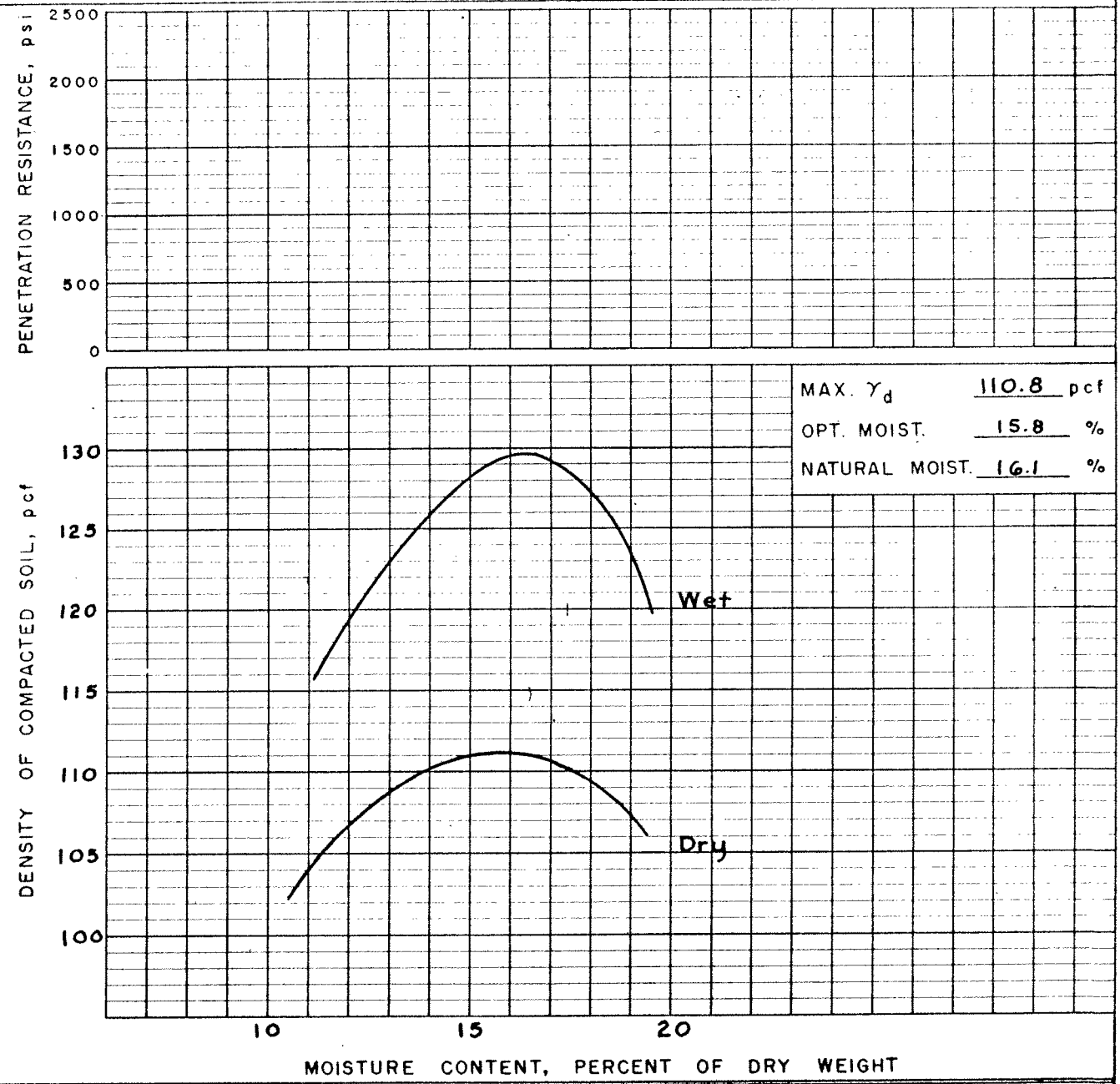
SPECIFIC GRAVITY (G_s) { MINUS NO. 4 _____ ; PLUS NO. 4 _____

CURVE NO. _____ OF _____

STD. (ASTM D-698) ☒; METHOD A

MOD. (ASTM D-1557) ☐; METHOD _____

OTHER TEST ☐ (SEE REMARKS)



MAX. γ_d 110.8 pcf

OPT. MOIST. 15.8 %

NATURAL MOIST. 16.1 %

REMARKS

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 3

Project Failure Investigation Contract No.

Structure Allen Dam on west side of breach

Station 2+50 Distance (right)(left) from ℄ on ℄ Elev. 82.3

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11:00 AM

Material Source

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0199	cf
C.	Initial reading	0.0070	cf
D.	Volume of hole "B-C"	0.0129	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.000155	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.01275	cf
G.	Weight of sample (soil & rock)	1.586	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.0189	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.566	lbs
J.	Apparent density of rock	164.0	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	122.7	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	105.6	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	95.0	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)	150.0	Gms
c.	Weight of can & sample (dry)	135.6	Gms
d.	Weight of can	46.3	Gms
e.	Weight of contained moisture "b-c"	14.4	Gms
f.	Weight of sample (dry) "c-d"	89.3	Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

Checked by Ralph M Arrington Date 10-24-68

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 2

Project Failure Investigation Contract No.

Structure Allen Dam on west side of breach

Station 2+50 Distance (right)(left) from ℄ on ℄ Elev. 82.3

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11 AM

Material Source

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0211	cf
C.	Initial reading	0.0061	cf
D.	Volume of hole "B-C"	0.0150	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.000857	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.01414	cf
G.	Weight of sample (soil & rock)	1.793	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.1405	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.653	lbs
J.	Apparent density of rock	164.0	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	116.9	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	100.7	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	90.8	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)		Gms
c.	Weight of can & sample (dry)		Gms
d.	Weight of can		Gms
e.	Weight of contained moisture "b-c"		Gms
f.	Weight of sample (dry) "c-d"		Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

Checked by Ralph M. Arrington Date 10-24-68

USDA-SCS
AZ-72
June 62

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA

FILL DENSITY AND MOISTURE DETERMINATION
(Volumeasure Method)

Test No. 1

Project Failure Investigation Contract No.

Structure Allen Dam on west side of breach

Station Sta. 2+50 Distance (right)(left) from ℄ ℄ Elev. 80.7

Samples by Bill Mildner & Ralph Arrington Date 10-16-68 Time 11:00 AM

Material Source

FILL DENSITY DETERMINATION (VOLUMEASURE METHOD)

A.	Volumeasure number		
B.	Final reading	0.0165	cf
C.	Initial reading	0.0062	cf
D.	Volume of hole "B-C"	0.0103	cf
E.	Volume of sample fraction larger than No. 4 Sieve "H/J"	0.0005	cf
F.	Volume of sample fraction smaller than No. 4 Sieve "D-E"	0.0098	cf
G.	Weight of sample (soil & rock)	1.230	lbs
H.	Weight of sample fraction larger than No. 4 Sieve	0.0837	lbs
I.	Weight of sample fraction smaller than No. 4 Sieve "G-H"	1.146	lbs
J.	Apparent density of rock	164	lbs/cf
K.	Maximum wet density	129.4	lbs/cf
L.	Fill wet density "I/F"	116.9	lbs/cf
M.	Fill moisture content (from g or i below)	16.1	%/100
N.	Fill dry density "L/(1.0 + M)"	100.7	lbs/cf
O.	Optimum moisture content	15.8	%
P.	Maximum dry density "K/(1.0 + M)"	110.8	lbs/cf
Q.	Percent compaction "(N x 100)/P"	90.8	%

FILL MOISTURE CONTENT DETERMINATION

a.	Can number		
b.	Weight of can & sample (wet)		Gms
c.	Weight of can & sample (dry)		Gms
d.	Weight of can		Gms
e.	Weight of contained moisture "b-c"		Gms
f.	Weight of sample (dry) "c-d"		Gms
g.	Moisture content "(e x 100)/f"	16.1	%
h.	Correction factor		
i.	Corrected moisture content		%

Tested by D. Lambson Date 10-18-68

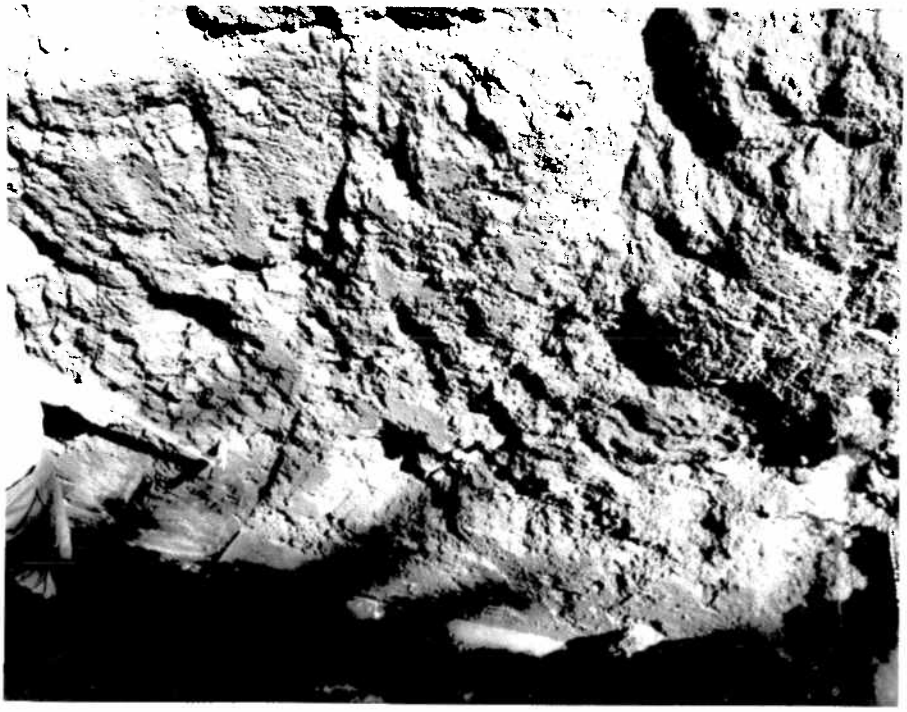
Checked by Ralph M. Arrington Date 10-24-68

Allen Dam, Graham County, Arizona

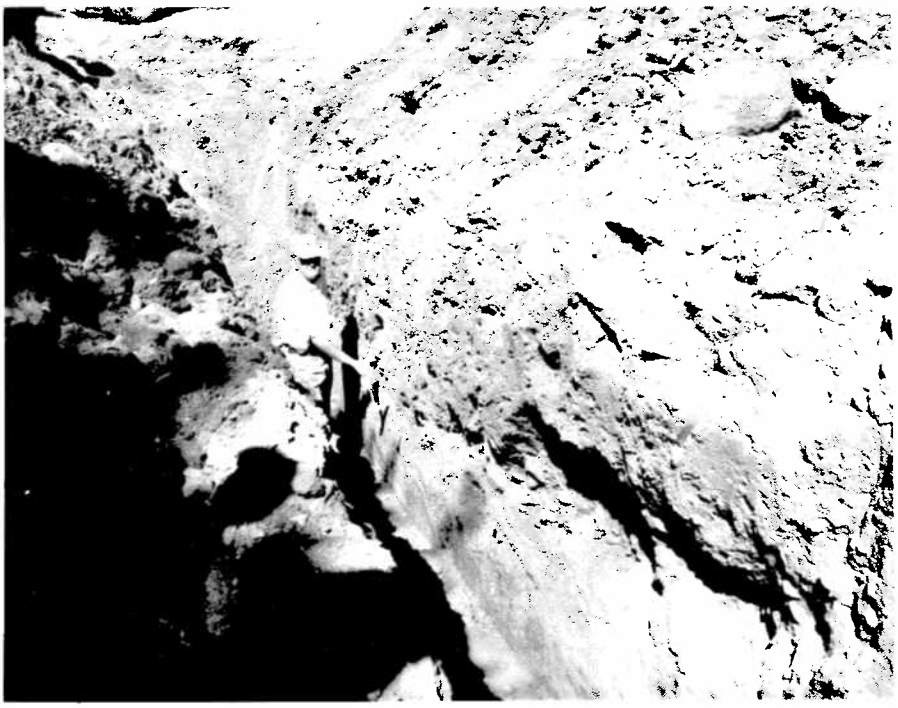
1. Looking northwest through washout - Sta. 2+50±.

2. Looking west facing failure section Sta. 2+00±.

3. Looking east face Sta. 3+00±.



4. Foundation trench through failure section. Note contact of cutoff, gravel layer, and lake bed sediments.



5. Foundation trench through failure section. Note base of cutoff by W. F. Mildner, Geologist.

6. Longitudinal cracking - Sta. 5+00± - length 40 ft. Near crest of embankment.

7. Profile of longitudinal crack Sta. 5+00±. Depth approx. 3'-0". Length 40'.

8. Trench excacated through U.S. slope Sta. 3+00±. Note delineated saturation line with very loose above and sl. consolidated below.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Arizona State Office
6029 Federal Building
Phoenix, Arizona 85025

September 4, 1968

Mr. Martin Toney
Engineer of Bridges and Dams
State Highway Department
1739 West Jackson Street
Phoenix, Arizona 85007

Dear Martin: Re: Allen Dam - Failure

The enclosed report is self-explanatory.

I'll keep you informed of our progress relative to investigating the possible cause of failure and will welcome your assistance.

Sincerely,

J. J. Turner
State Conservation Engineer

Enclosure

M. D. Burdick, State Conservationist
SCS, Phoenix, Arizona

September 3, 1968

J. J. Turner, State Conservation Engineer
SCS, Phoenix, Arizona

ENG - Allen Dam - Failure

During the middle 1930's the Gila Project, using PWA and possibly some CCC labor and equipment, built the Allen Reservoir Dam in Section 9, T7S, R25E. We have just learned that the dam failed in August 1967.

There was no damage as there are no improvements between the failed dam and the Central Graveyard Dam one and one-half miles downstream that was designed by SCS and farmer-constructed in 1948 with ACP assistance. The Central Graveyard Dam is about one-fourth mile long and impounds about 20' depth of water. The principal spillway is 18" or 24" corrugated metal pipe. I visited the site during construction and know that there was close moisture and compaction control.

I did not visit the Allen Dam nor the nearby Cluff Dams during their construction. I have talked to the following individuals who saw the dams during construction:

R. V. Boyle, then Project Manager, SCS
Myron H. Allen, then Range Specialist, SCS
Harold Watson, then tractor operator, SCS

All three agree that the Cluff Dams, designed to store water, were wet-rolled and that a soil scientist or engineer inspector was on the site constantly.

The Allen Dam, planned as a retarding dam, was not sprinkled and borrow pits were not wetted but sheep's-foot rollers were used.

The Allen Dam was about 30' high, one-fourth mile long and provided with an 18" CMP principal spillway. Some time after construction the owner plugged the principal spillway.

During a very brief visit to the site on August 27, 1968 Engineering Specialist Bob Kilcrease and I made the following observations:

1. A breach is now in the dam that is 10 to 20' wide at the bottom and 30 to 40' wide at the top.

2. The breach at the upper face of the dam is near the center and 150 to 200' to the right of the principal spillway and cuts through the embankment on about a 45 degree angle to the left.

3. The downstream end of the 18" CMP principal spillway is in good condition. The upstream end is not visible. Probably it is covered with silt.

4. A line of dead salt cedar stumps on the embankment about 3' above the present silt accumulation indicates that water remained at about that level for a period of years long enough to produce 3" to 4" tree trunks.

5. A row of live salt cedar on the embankment about 5' vertically above the row of dead stumps indicates that in recent years a waterline was maintained at about that elevation.

6. A deposit of debris some 5' to 7' above the presently live row of salt cedars may indicate the high water level at time of failure.

7. It appears that a relatively shallow key way was cut into lake bottom clays that apparently continue throughout the base and abutments of the dam.

Tentative Conclusion:

It is regretted that the present owner did not notify our Work Unit people at the time of failure. This would have enabled us to make a more positive evaluation of the probable causes of failure.

It would appear, however, that only during the high water period immediately preceding the failure did the embankment absorb enough moisture to cause consolidation resulting in cracks through which the water could pipe out.

Recommendations:

Because of the number and importance of "dry" dams that have been and are still being built in this desert climate I feel that a careful investigation should be made of this dam that failed over thirty years after construction.

As indicated above, three people have already been found that have personal knowledge of the structure. I will write ex-E.C.W. Administrator C. W. Bennett and Mike Busby, ex-Project Soil Scientist, who may be able to add additional information.

Geologist Bill Mildner visited the site and made sediment measurements in the late 1950's.

Roy Ard, Work Unit Conservationist, has agreed to locate people who may be able to help us round out the history of the structure.

I will discuss this failure with Messrs. Stevenson and Holland of the E&WP Unit, Portland, relative to possible participation in an investigation and will comply with Engineering Memorandum-53 (Rev. 1) that sets forth procedures for such investigations.

cc to:
Roy G. Ard, WUC, SCS, Safford, Arizona
E. J. Core, Head, E&WP Unit, SCS, Portland, Oregon
George Watt, Head, Design Section, SCS, Phoenix
Martin Toney, Engr. of Bridges & Dams
State Highway Department, Phoenix, Arizona

E. J. Core, Head, E&WP Unit
SCS, Portland, Oregon

September 10, 1968

M. D. Burdick, State Conservationist
SCS, Phoenix, Arizona

ENG - Allen Dam, Safford Work Unit - Failure

Confirming the understandings reached between you, Bill Turner and Jack Stevenson and in accordance with Engineering Memorandum-53 (Rev. 1), the following individuals will constitute the committee to investigate the cause of failure of the Allen Dam:

Jack Stevenson, E&WP Unit, Portland, Chairman
Ralph M. Arrington, Asst. State Conservation Engineer
Wm. F. Mildner, Geologist, River Basins
Bob G. Kilcrease, Engineering Specialist, Willcox

The Arizona State Dam Engineer has accepted our invitation to participate.

It is suggested that Phoenix members of the committee meet at Bill Turner's office at noon on October 15, 1968 and proceed to Safford that afternoon.

The structure in question is located in the south one-half of Section 9, T7S, R25E. This earth dam is believed to have been built by SCS-WPA during the 1930's. It reportedly failed in August 1967. However, the SCS Work Unit personnel were not notified until late August of this year.

M D Burdick

cc to:

Jack Stevenson, Head, Soil Mech. Lab., Portland
R. M. Arrington, Asst. State Cons. Engr., Phoenix
Wm. F. Mildner, Geologist, River Basins, Phoenix
Roy Ard, WUC, Safford
Bob G. Kilcrease, Eng. Spec., Willcox
Martin Toney, State Dam Engineer, Phoenix
C. J. Francis, Director, Engr. Division
SCS, Washington, D. C.

10-18-68
Investigation made Oct 16.
With committee noted above -
Nothing learned of design or construction -
General agreement on failure - (thru top)
Stevenson will write & distribute prelim.
report for review and comments.
T

206 South 17th Avenue
Phoenix, Arizona 85007
January 14, 1969

Mr. Jack C. Stevenson
Soil Mechanics Engineer
Regional Technical Service Center
Engineering & Watershed Planning Unit
701 N. W. Glisan Street
Portland, Oregon

Re: Allen Dam
Structural Failure

Dear Jack:

I have reviewed your draft of the Allen Dam report and consider it highly satisfactory. It appears to have summarized our thinking during the inspection trip. It is unfortunate that we could come to no definite conclusion due to the lack of records, witnesses and the passage of time.

It was a pleasure to make the trip with you and hope you will drop in when you are in this area.

Very truly yours,

WM. N. PRICE
State Highway Engineer

MARTIN TONEY
Engineer of Bridges and Dams

MT:rad

Regional Technical Service Center
Engineering & Watershed Planning Unit
701 N. W. Glisan Street
Portland, Oregon

December 23, 1968

To: Ralph M. Arrington, SCS, Phoenix, Arizona
W. F. Mildner, SCS, Phoenix, Arizona
Bob G. Kilcrease, SCS, Willcox, Arizona
Martin Toney, State Highway Commission, Phoenix, Arizona

FROM: Jack C. Stevenson, E&WP Unit, SCS, Portland, Oregon

SUBJECT: ENG - Allen Dam - Structural Failure

Attached is a draft copy of the Allen Dam report complete except for photos.

I would appreciate your early review. Would you try to have your comments to me by January 10, 1969 so we can wind up the report.

Attachment

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Arizona State Office
6029 Federal Building
Phoenix, Arizona 85025

April 2, 1969

Mr. Martin Toney
Engineer of Bridges and Dams
Department of Highways
1739 W. Jackson Street
Phoenix, Arizona 85007

Dear Mr. Toney:

We are transmitting one copy of the committee report on the Allen Dam Failure for your information.

We appreciate your cooperation and assistance in making the investigation and preparing the report.

As noted in the report, no helpful comparisons could be made to dams currently being constructed in Arizona. We, therefore, are not contemplating any changes in design or construction procedures at this time.

Thank you again.

Sincerely,

M. D. Burdick
State Conservationist

Arizona Water Commission
222 NORTH CENTRAL AVENUE, SUITE 850
Phoenix, Arizona 85004
TELEPHONE (602) 255-1550

12-11-80

Sample No. 3 is reported as having Positive Reaction to HCL & Benzidine - Benzidine is indicator for Montmorillonite Clay - which is highly piping susceptible when Na ion. is present. Alkali Prominent Area -

D.R. Cinquemani

DAM NAME: ALLEN
RESERVOIR NAME: ALLEN

ORIGINAL DATA SOURCE: SOD VIOLATION FILE
DATE: UNKNOWN

OWNER NAME: GERALD CLARIDGE CODE:
TITLE:
COMPANY:

ADDRESS:
CITY: STATE: ZIP:
OFFICE PHONE: HOME PHONE:

OTHER CONTACT: PHONE:
OWNER/CONTACTS UPDATED:

COUNTY: GRAHAM SECTION: 9 TOWNSHIP: 7S RANGE: 25E
LAT.: LONG.:
USGS QUAD: THATCHER SCALE: 7.5

TYPE OF DAM: EARTH HEIGHT:
RES. CAPACITY: RES. AREA:
SIZE:

NAME OF STREAM: DRAINAGE AREA:
NEAREST D.S. CITY: DISTANCE (mi.):
POPULATION: HAZARD CLASS:

PURPOSE OF DAM: USE OF STORED WATER:

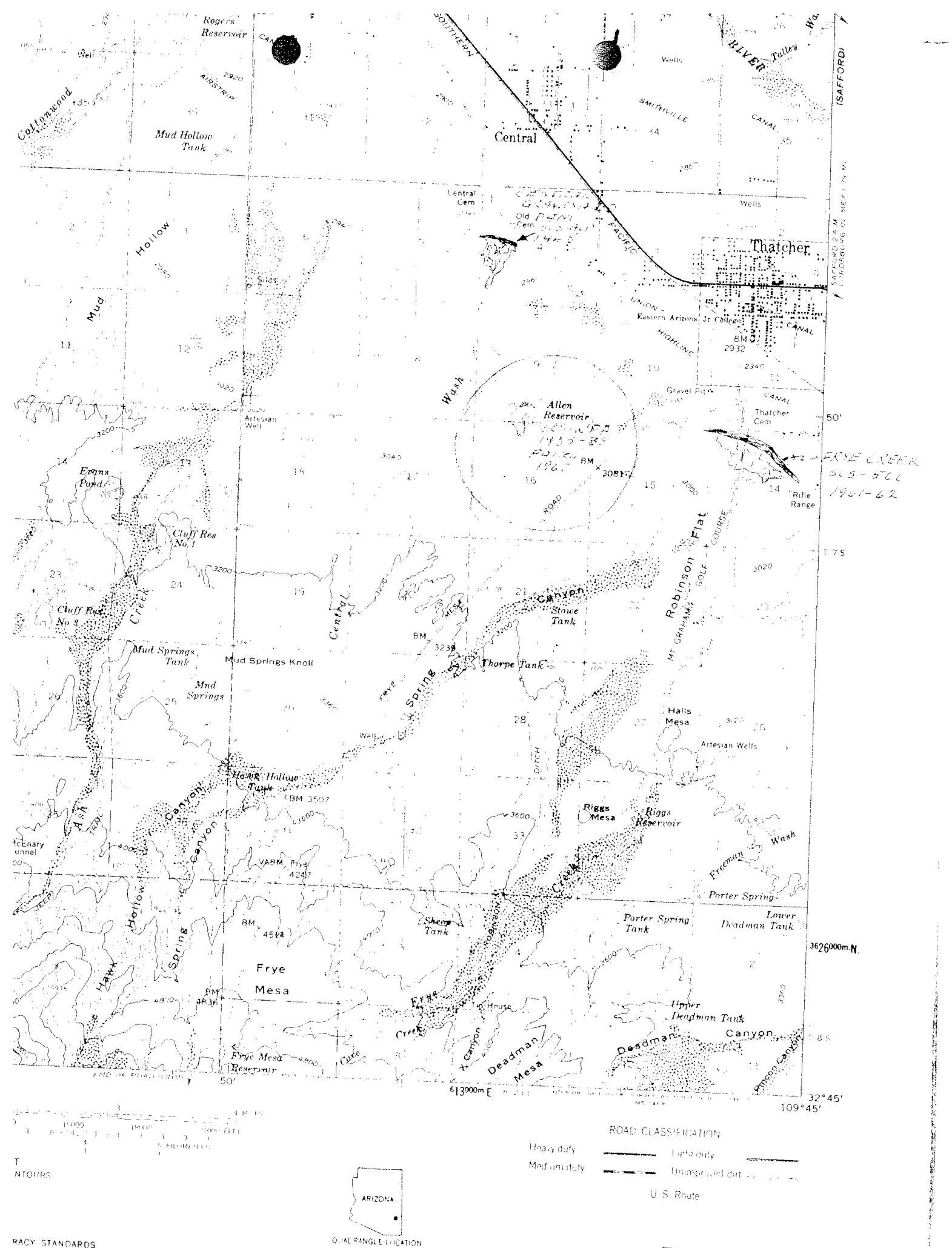
NATL. FOREST: AGENCY CODE: AMA:

CONSTR. START: CONSTR: COMPLETE:

ADWR SITE VISIT: ADWR ENGR.:
JURIS. DETERMINATION: NIJ; FAILED DATE: 69/03/05

FIRST CONTACT w/ OWNER:

APPLN. PACKAGE SENT:
APPLN. PACKAGE REC'D.:



ROAD CLASSIFICATION

Heavy duty — Light duty

Medium duty — Unimproved dirt

U S Route

ARIZONA

QUADRANGLE LOCATION

THATCHER, ARIZ.

N3245—W10945/15

1960

FRYE CANYON
SC 5-T7S
1961-62