AD-A106 606 BLACK AND VEATCH KANSAS CITY MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. RISS LAKE DAM (MO 10926), MISSOURI--ETC(U)
APR 79 P R ZAMAN, E R BURTON, H L CALLAHAN DACW43-79-C-0040

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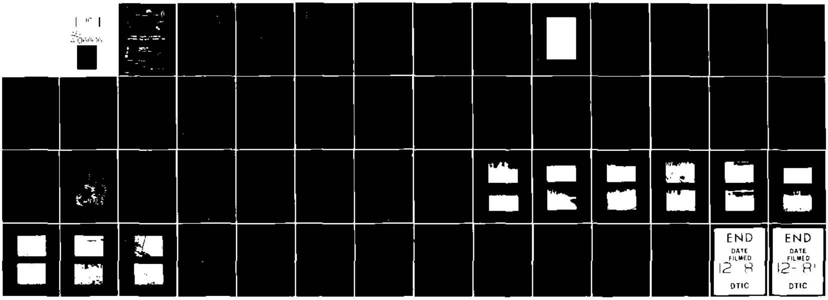

LEVEL II

MISSOURI-KANSAS CITY BASIN

AD A106606

RISS LAKE DAM

PLATTE COUNTY, MISSOURI

MO 10626

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PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
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St. Louis District

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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MISSOURI-KANSAS CITY BASIN

RISS LAKE DAM

PLATTE COUNTY, MISSOURI

MO 10926

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
...Serving the Army
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St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

APRIL 1979

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Riss Lake Dam Mo. ID No. 10926

This report presents the results of field inspection and evaluation of the Riss Lake Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 5 SEP 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 5 SEP 1979
Date

RISS LAKE DAM

PLATTE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10926

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

APRIL 1979

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Riss Lake Dam
State Located	Missouri
County Located	Platte County
Stream	White Aloe Branch
Date of Inspection	3 April 1979

Riss Lake Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers, failure would threaten life and property of a substantial number of people downstream of the dam. Part of the City of Parkville is within the damage zone. Approximately 50 to 60 residential and commercial buildings, some storage tanks, State Highway 9, and the Burlington Northern Railroad are within the estimated damage zone which extends approximately one mile between the dam and the Missouri River.

Our inspection and evaluation indicates the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass the probable maximum flood without overtopping but will pass 90 percent of the probable maximum flood, which is greater than the estimated 100-year flood. The spillway design flood recommended by the guidelines is 100 percent of the probable maximum flood. The probable maximum flood is defined as the flood discharge which may be expected from the most severe combination of critical meteorologic and hydrologic conditions which are reasonably possible in the region.

Deficiencies visually observed by the inspection team were erosion of the upstream face due to wave action, ponded water on the dam crest due to poor drainage of rainwater, trees and brush growing on the embankment, animal burrows, and seepage at several locations below the dam.

Seepage and stability analyses required by the guidelines were not available.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, detailed seepage and stability analyses of the existing dam, as required by the guidelines, should be performed. A detailed report discussing each of these deficiencies is attached.

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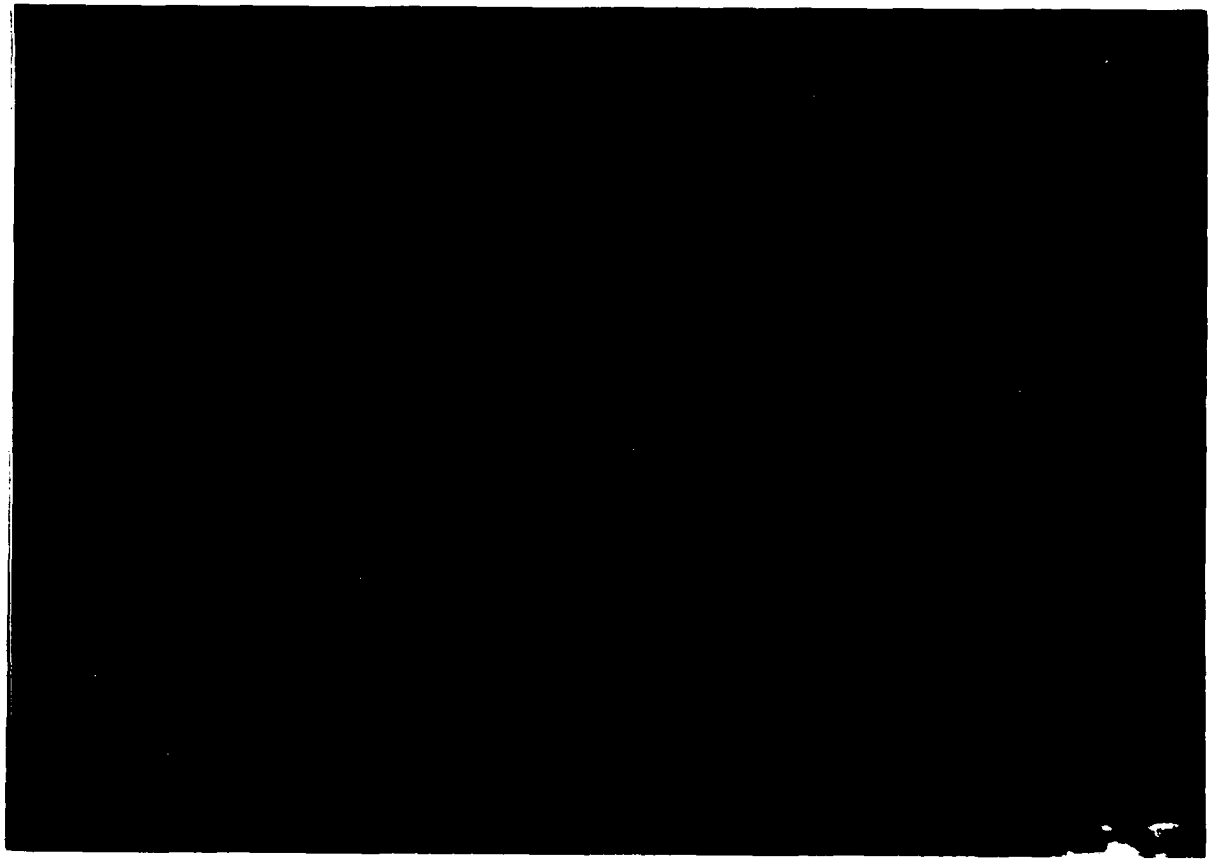
Harry L. Callahan, Partner
Black & Veatch



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
RISS LAKE DAM

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APPENDIX

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the Riss Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the valley of White Aloe Branch approximately one mile above its confluence with the Missouri River (Plate 1). The watershed area is roughly pear shaped with steeply sloping hills in the lower, broader part and more moderate slopes in the upper basin (Plate 2). The dam is approximately 1,200 feet long along the crest and 90 feet high. The dam crest is 80 feet wide and is dished to the axis and sloped toward a crest drain near the west end of the dam. The broad crest and high abutments suggest that the dam may have originally been planned for an additional 20 to 30 feet of height. The back face of the dam slopes uniformly from the crest to the valley floor below. The front face appears to have a bench just below the water level.

(2) The spillway or outlet from the lake is an uncontrolled 24-inch steel pipe installed through the embankment near the west end. There is a concrete headwall at the inlet end of the pipe. Flow through the pipe discharges into a natural plunge pool at the outlet end. There is no emergency spillway.

(3) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in southeastern Platte County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Parkville, Missouri in Section 25 of T51N, R34W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the intermediate size category.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: The Riss Lake Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, agricultural, industrial and commercial facilities, and to important public utilities, main highways, or railroads. For the Riss Lake Dam the estimated flood damage zone extends approximately one mile downstream of the dam to the Missouri River. Part of the City of Parkville is within the damage zone. Approximately 50 to 60 residential and commercial buildings, some storage tanks, State Highway 9, and the Burlington Northern Railroad are within the damage zone.

e. Ownership. The dam is owned by the Riss Estate, 1012 Baltimore, Suite 700, Kansas City, Missouri 64105.

f. Purpose of Dam. The dam forms a 131-acre recreational lake.

g. Design and Construction History. Data relating to the design and construction of the dam were not available.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, evaporation, and overflow through the uncontrolled spillway outlet pipe all combine to maintain a relatively stable water surface elevation.

1.3 PERTINENT DATA

a. Drainage Area - 1,283 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through an uncontrolled spillway.

(2) Estimated experienced maximum flood at damsite - Unknown; however, in September of 1977 a rainfall of 8.75 inches in 24 hours was measured near Parkville.

(3) Estimated ungated spillway capacity at maximum pool elevation 65 cfs (top of Dam El.891.0).

c. Elevation (Feet above m.s.l.).

(1) Top of dam - 891.0 ± (see Plate 3)

(2) Spillway pipe invert - 872.0

(3) Streambed at toe of dam - 798.0 ±

(4) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 7,500 feet ±

(2) Length of normal pool - 5,300 feet ±

e. Storage (Acre-feet).

(1) Top of dam - 7,720

(2) Spillway invert - 4,230

(3) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 220

(2) Spillway crest - 131

g. Dam.

(1) Type - Earth embankment

(2) Length - 1,200 feet

(3) Height - 93 feet ±

(4) Top width - 80 feet

(5) Side slopes - upstream face 1.0 V on 2.6 H, downstream face 1.0 V on 2.7 H (see Plate 4)

(6) Zoning - Unknown.

(7) Impervious core - Unknown.

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel - None.

i. Spillway.

(1) Type - 24-inch steel pipe.

(2) Width of channel - Not applicable.

(3) Inlet invert elevation - 872.0 feet m.s.l.

(4) Outlet invert elevation 847.7 feet m.s.l.

(5) Gates - None.

(6) Upstream channel - Not applicable.

(7) Downstream channel - Natural open channel comprised of broken limestone and shale.

j. Regulating Outlets - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data were unavailable.

2.2 CONSTRUCTION

Construction records were unavailable, however, the owners estimated that the dam was built in 1953.

2.3 OPERATION

The maximum recorded loading on the dam is unknown.

2.4 GEOLOGY

The dam is located across a steep-sided valley formed in the Zarah Subgroup of the Kansas City Group and the Lansing Group of the Pennsylvanian System. The Zarah Subgroup consists of limestones and shales of the Wyandote and Bonner Springs formations. All units in the Zarah Subgroup are variable in thickness. The limestone units vary in thickness from less than one foot to greater than 40 feet. The units are thin-bedded to massive and are composed of varying amounts of clastic materials in a calcareous matrix. The shale units vary in thickness from a few inches to greater than 40 feet. Joints are present in some units but not in others and vary from widely spaced to closely spaced and opened to closed. The joints are better developed in the limestone units. The Lansing Group consists of limestone and shales of the Plattsburg, Vilas, and Stanton formations. The Plattsburg formation consists of the Merriam limestone, Hickory Creek shale, and Spring Hill limestone members. The limestones range in thickness from one to 20 feet, and the shale units are generally less than two feet thick. The Vilas formation consists of silty to sandy shale with a local sandstone unit. The formation varies in thickness from five to 20 feet. The Stanton formation consists of limestones and shales and is divided into the Captain Creek limestone, the Eudora shale, the Stoner limestone, the Rock Lake shale, and the South Bend limestone members. The limestones vary in thickness from two to 15 feet, and the shales vary in thickness from five to 16 feet. Vertical joints are well developed in the Captain Creek Member. The presence of solutioning in the limestones of the Zarah Subgroup and the Lansing Group is not known.

The soil of the site area consists of the Knox Silt Loam soil series, an Eolian deposit of silt and some sand which is modified to varying degrees from weathering. The soil occurs on steep slopes and is highly susceptable to erosion. For engineering purposes it is classified as an ML or CL soil.

No drawings were available for the dam. Four memoranda from the Kansas City District Corps of Engineers discussing previous inspections were available. The geology at the dam is discussed in the October 31, 1969 memorandum by Golder and Craddock. According to the description, the Spring Hill limestone member of the Plattsburg formation is exposed above the top of the dam in both abutments. The Bonner Springs and the Wyandote formations comprise the abutments of the dam. The Farley limestone member of the Wyandote formation outcrops at approximately elevation 840 or just below midway of the embankment (Plate 4). The Argentine member of the Wyandote formaton is anticipated to form the lower portion of the abutements and the valley floor.

2.5 EVALUATION

a. Availability. No engineering data could be obtained.

b. Adequacy. No engineering data were available upon which to make a detailed assessment of the design, construction, and operation. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record.

c. Validity. The validity of the design, construction, and operation could not be determined due to the lack of engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Riss Lake Dam was made on 3 April 1979. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and geotechnical engineering. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following conditions at the dam. Embankment material was being eroded from the face of the dam at normal water level due to wave action and absence of slope protection. Several erosion ditches due to surface runoff were observed on the front and back slopes. These ditches were generally 6 to 8 inches deep and were stabilized by grass cover. Erosion of the right abutment at the discharge end of the outlet pipe was observed. Some erosion of the left abutment was occurring at the location of concentrated seepage areas. Ponded water and heavy aquatic vegetation over 15 to 20 percent of the embankment crest area were observed. This ponding results from control and collection of rainfall runoff onto the crest by upstream and downstream berms at the top edge of the embankment. The crest is sloped toward the right abutment to a drain inlet; however, the inlet is presently above the existing pond elevation. This ponding on the crest has resulted in some seepage from the front face of the dam near the normal reservoir level. The dam was covered with a heavy stand of grass and a number of small trees (4 to 15 inch diameter) were observed on the front and back slope. There was no evidence of mowing or brush cutting. Two large animal burrows (8 to 12 inches diameter) were seen, one on the upstream face and one on the downstream face of the embankment. No evidence of embankment cracking or sliding was observed.

Seepage was observed in several areas below the dam. Locations and estimated quantities of seepage are as follows:

- Non-flowing seepage from both right and left abutments at the embankment, abutment interface.
- Two to five gallons per minute seepage from limestone member bedding joint in area of outlet pipe on right abutment.
- Five to ten gpm seepage from the right abutment Farley limestone member approximately 400 feet downstream from dam.

- Twenty gpm seepage from right abutment limestone member approximately 800 to 1,000 feet downstream from dam.

- Fifteen to twenty gpm seepage from left abutment limestone member.

All seepage flows were clear water; however, a bright orange deposit was observed at several seepage areas (Photo 18). Samples taken from these deposits were identified as hydrated ferric hydroxide.

The area below the downstream toe of the embankment was soft and wet with some standing water and aquatic vegetation. It was undetermined whether this condition was due to seepage or poor drainage. There was no evidence of embankment instability observed.

c. Appurtenant Structures. The spillway outlet is a 24-inch steel pipe with concrete headwall at the inlet end. Only about five feet of the pipe at each end was observable. The pipe appeared to be in good condition; some surface rust was observed but the metal appeared to be sound. The inspection team could not see daylight through the pipe. It is suspected that the pipe was not constructed to a straight alinement.

d. Geology. Bedrock outcrops were observed along the right and left abutments. The formations exposed were the Wyandote, Bonner Springs, and Plattsburg in the respective locations described in Section 2.4. The embankment was apparently constructed of silty clay borrowed from the valley in which the dam was constructed. There are no known stability problems with the geologic units in the abutments and foundation. The limestones were jointed, and, approximately 400 feet downstream from the embankment, clear water was flowing from the Farley limestone unit at approximately elevation 840.

e. Reservoir Area. Erosion due to wave action was observed along the shore of the reservoir. No slides of reservoir banks were observed.

f. Downstream Channel. The channel downstream of the spillway outlet pipe is a natural stream through soil, broken shale, and limestone. The slope is fairly steep with some falls or cascades. Brush and tree cover along the banks is moderately heavy.

3.2 EVALUATION

The various deficiencies observed at the time of the inspection are not believed to represent an immediate safety hazard. They do, however, warrant monitoring and control. The absence of riprap on the face of the dam has resulted in wave action erosion of the embankment. If not corrected, wave action will continue to erode the embankment and could lead to slope stability problems. Other erosion areas observed were minor and unlikely to cause any safety problems. Ponding of water on the crest of the dam can result in saturation conditions in the upper part of the embankment which could lead to stability problems. The growth of trees and brush and the uncut grass is not presently a serious problem; however, if allowed to go unchecked it could cause deterioration of the dam embankment. The roots of trees can loosen the embankment material and also can leave voids through which water can pass. Brush on the dam prevents inspection of the embankment and kills the smaller grasses whose roots are more effective in protecting the surface soil of the slope from erosion. The brush and tall uncut grass provides habitat for burrowing animals which can damage the embankment. The several areas of seepage which were observed should be monitored regularly for quality and quantity. Seepage can cause internal erosion creating cavities and underground channels, thereby weakening the embankment and/or abutments.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled spillway outlet pipe.

4.2 MAINTENANCE OF DAM

No evidence of maintenance of the dam was observed. The dam was inspected by the Kansas City District of the Corps of Engineers in October 1968 and May 1974. The dam was inspected in June 1978 by a private consultant under contract with the owner to perform annual inspections of the dam.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

It appears that recommendations from previous inspections and reports have not been implemented; however, no urgent need was indicated. The inspections would be more valuable if some quantitative measurements and records were made, particularly with regards to seepage quantities and lake level measurements.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Design data pertaining to hydrology and hydraulics were unavailable.

b. Experience Data. The drainage area and lake surface area are developed from USGS Parkville Quadrangle Map. The spillway and dam layouts are from surveys made during the inspection.

c. Visual Observations.

(1) The spillway appears to be in good condition. The lake level at the time of the inspection was below the inlet level and there was no flow through the pipe. Only the inlet and outlet ends were observable. The spillway pipe discharges with a free outfall into a naturally eroded plunge pool. There were no obstructions to flow in the downstream channel.

(2) No facilities are available which could serve to draw down the pool.

(3) A spillway outlet pipe is located near the right abutment. Spillway discharges do not endanger the integrity of the dam.

d. Overtopping Potential. The spillway capacity is limited by the size of the outlet pipe. However, the height of the dam above the spillway pipe inlet provides adequate storage capacity to store the probable maximum flood, if the flood occurs when the reservoir is at normal pool level. The probable maximum flood is defined as the flood discharge which may be expected from the most severe combination of critical meteorologic and hydrologic conditions which are reasonably possible in the region. The recommended hydrologic-hydraulic criteria establishes antecedent flood conditions as the probable maximum flood being preceded by five days by a standard project flood which is about 50 percent of the probable maximum flood. The limited capacity of the spillway outlet pipe results in a slow draw down of the lake level such that for the recommended antecedent conditions, the lake level would be about 5.6 feet above normal lake level. Consequently, the probable maximum flood would overtop the dam. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 141 cfs of the total discharge from the reservoir of 206 cfs. The estimated duration of overtopping is 5.75 hours with a maximum height over the dam of 0.6 feet. For the recommended antecedent conditions, the maximum flood contained by the dam without overtopping would be 90 percent of the probable maximum flood. This flood would be greater than a 100 year frequency flood. Due to the size of the reservoir and the high downstream hazard, the spillway and reservoir should be capable to pass or contain the probable maximum flood.

Evidence of erosion observed during the inspection indicates that the embankment material is susceptible to erosion and overtopping of the dam would cause erosion of the dam. Due to the broad crest width of the dam and shallow overtopping depth calculated, it would require a long period of time to cause a serious potential for failure by erosion.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend downstream of the dam to the Missouri River, a distance of approximately one mile. Part of the City of Parkville including 50 dwellings or more, several buildings and storage tanks, State Highway 9, and the Burlington Northern Railroad could be severely damaged and lives could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found. Detailed seepage and stability analysis should be performed as required by the guidelines.

c. Operating Records. No operational records exist.

d. Post Construction Changes. No record was available of post construction changes. Observations by the inspection team have been interpreted to indicate that the dam crest drainage provisions may have been a post construction change. The erosion ditches down the upstream and downstream faces which are stabilized by grass cover, end at the edge of the berm along the edges of the crest. It appeared that the berms were constructed after the erosion ditches were formed. Some settlement of the embankment has apparently taken place creating the ponding condition on the crest.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several conditions observed during the visual inspection by the inspection team should be monitored and/or controlled. These are inadequate spillway capacity, erosion of the front face of the embankment at normal lake level, erosion at the right and left abutments, ponding of surface drainage on the crest of the dam, seepage from the right and left abutments, the growth of brush and trees on the embankment, and animal burrows in the embankment.

b. Adequacy of Information. Due to the lack of engineering design data, the conclusions in this report were based only on performance history and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. It is the opinion of the inspection team that a program should be developed as soon as possible to implement remedial measures recommended in paragraph 7.2b. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam or identify any serious dangers which would require a Phase II investigation.

e. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the recommended stability analysis.

7.2 REMEDIAL MEASURES

a. Alternatives. The present spillway has the capacity to pass 90 percent of the probable maximum flood without overtopping the dam. In order to pass 100 percent of the probable maximum flood as required by the Recommended Guidelines, the spillway size and/or height of dam would need to be increased.

b. Operation and Maintenance Procedures. The following operation and maintenance procedures are recommended:

(1) Riprap should be placed on the upstream face of the dam at the normal lake level to prevent erosion of the embankment material.

(2) The drainage problem on the crest of the dam should be corrected to prevent ponding.

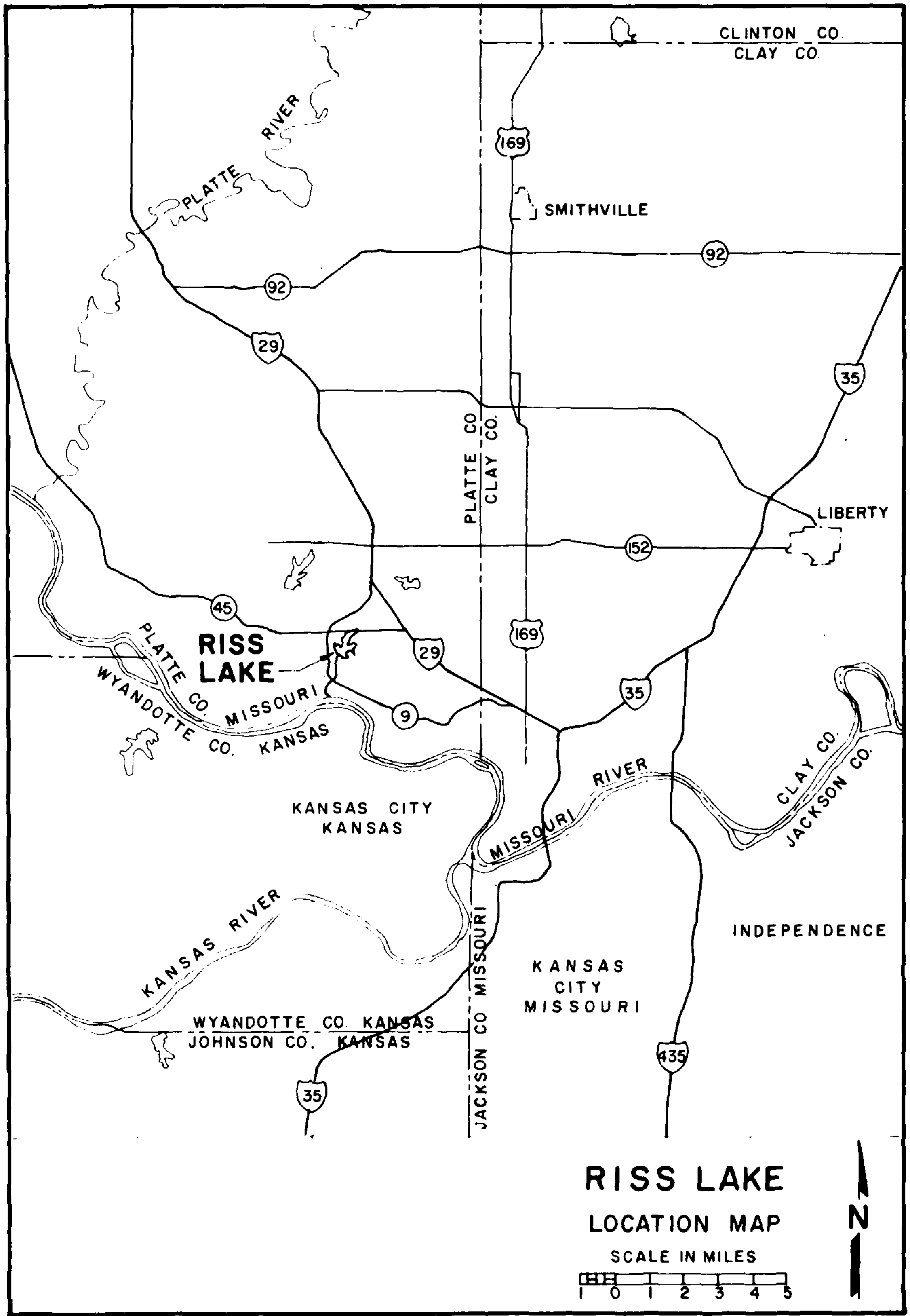
(3) The seepage areas noted during the visual inspection should be closely monitored and documented as to quantity of flow. Any significant changes should be evaluated by an engineer experienced in the design, construction, and inspection of dams.

(4) The animal burrows in the embankment should be filled with compacted earth. Control measures should be implemented to discourage increased animal activity in the area.

(5) A regular maintenance program to remove and control the growth of brush and trees on the embankment should be developed by an engineer experienced in the maintenance of earth dams. Grass cover on the embankments should be cut periodically.

(6) Seepage and stability analysis as required by the guidelines were not available which is considered a deficiency which should be corrected. An engineer experienced in the design of earth dams should be engaged to perform these analyses.

(7) A detailed inspection of the dam should be made periodically by an engineer experienced in design and construction of dams. This inspection should include measurement of seepage flows and analyzing water samples taken from the seeps and lake. It is suggested that these inspections be made at least once a year or following periods of extremely heavy rainfall or high water levels in the reservoir. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increase.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WYANDOTTE CO. KANSAS
KANSAS CITY KANSAS
MISSOURI RIVER
CLAY CO.
JACKSON CO.
INDEPENDENCE
KANSAS RIVER
MISSOURI
KANSAS CITY MISSOURI
WYANDOTTE CO. KANSAS
JOHNSON CO. KANSAS
JACKSON CO
35
435
RISS LAKE
LOCATION MAP
SCALE IN MILES
1 0 1 2 3 4 5
N

PLATE I

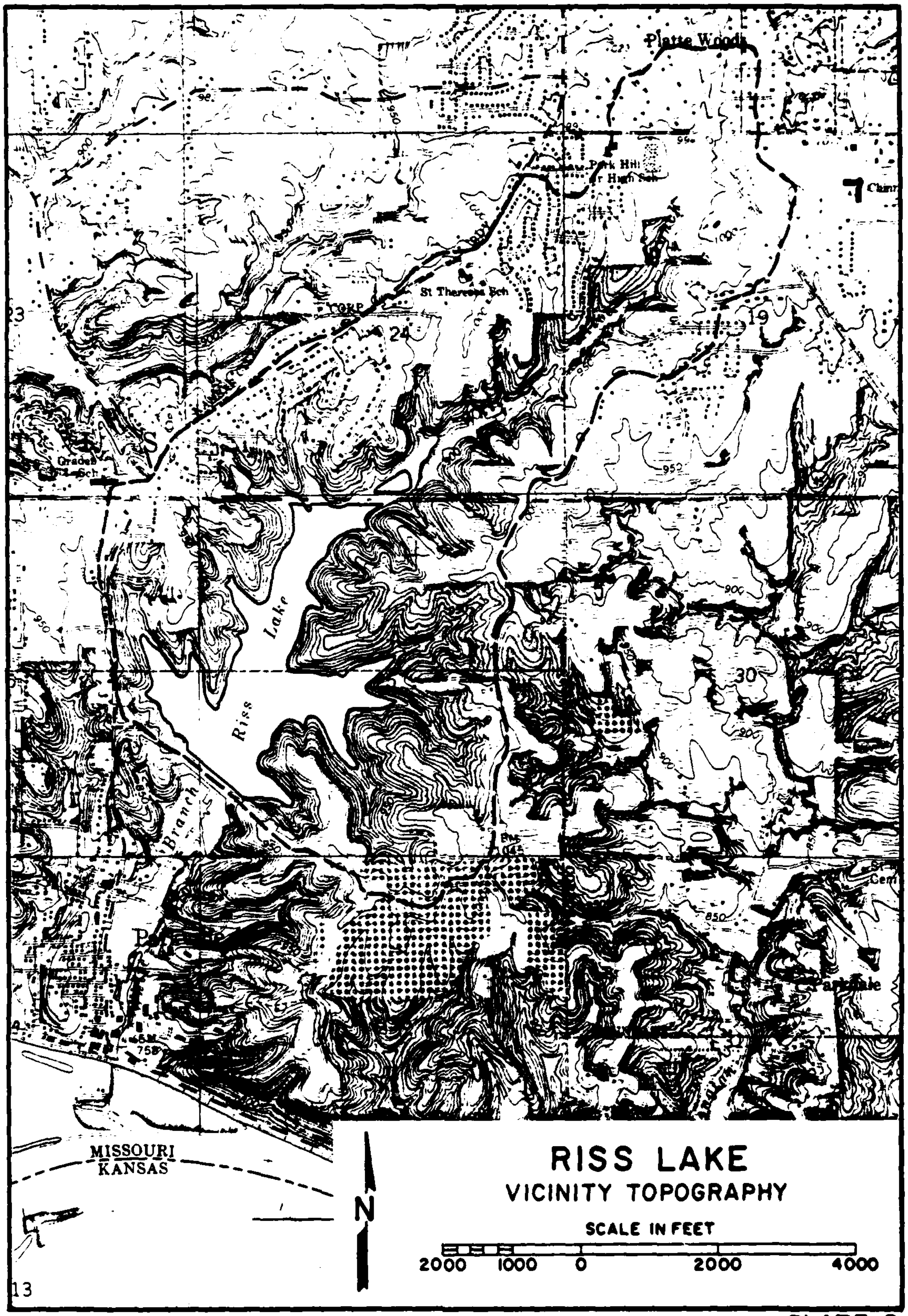
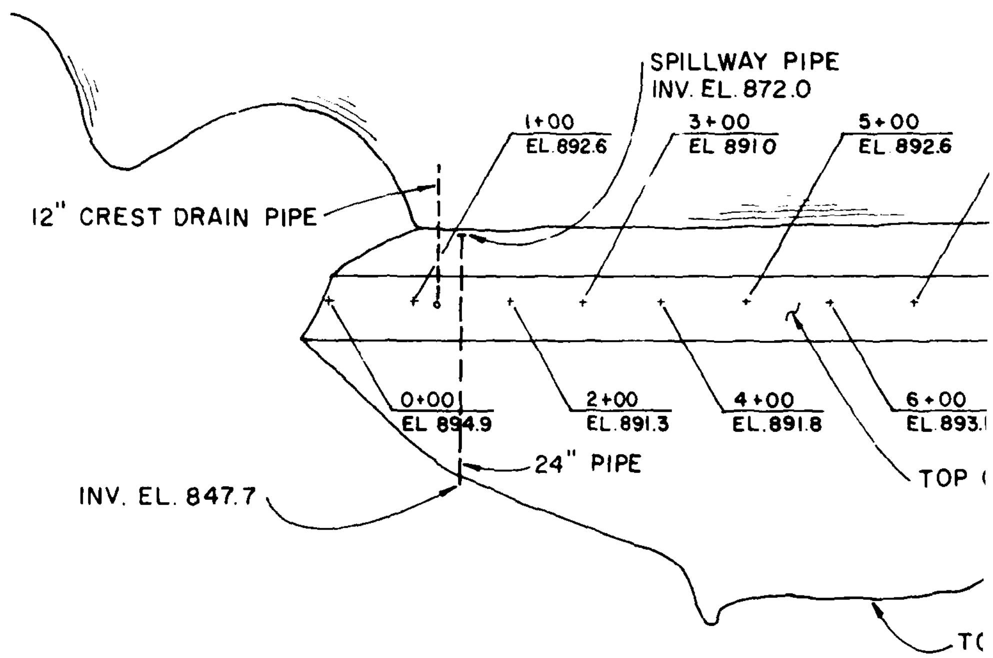
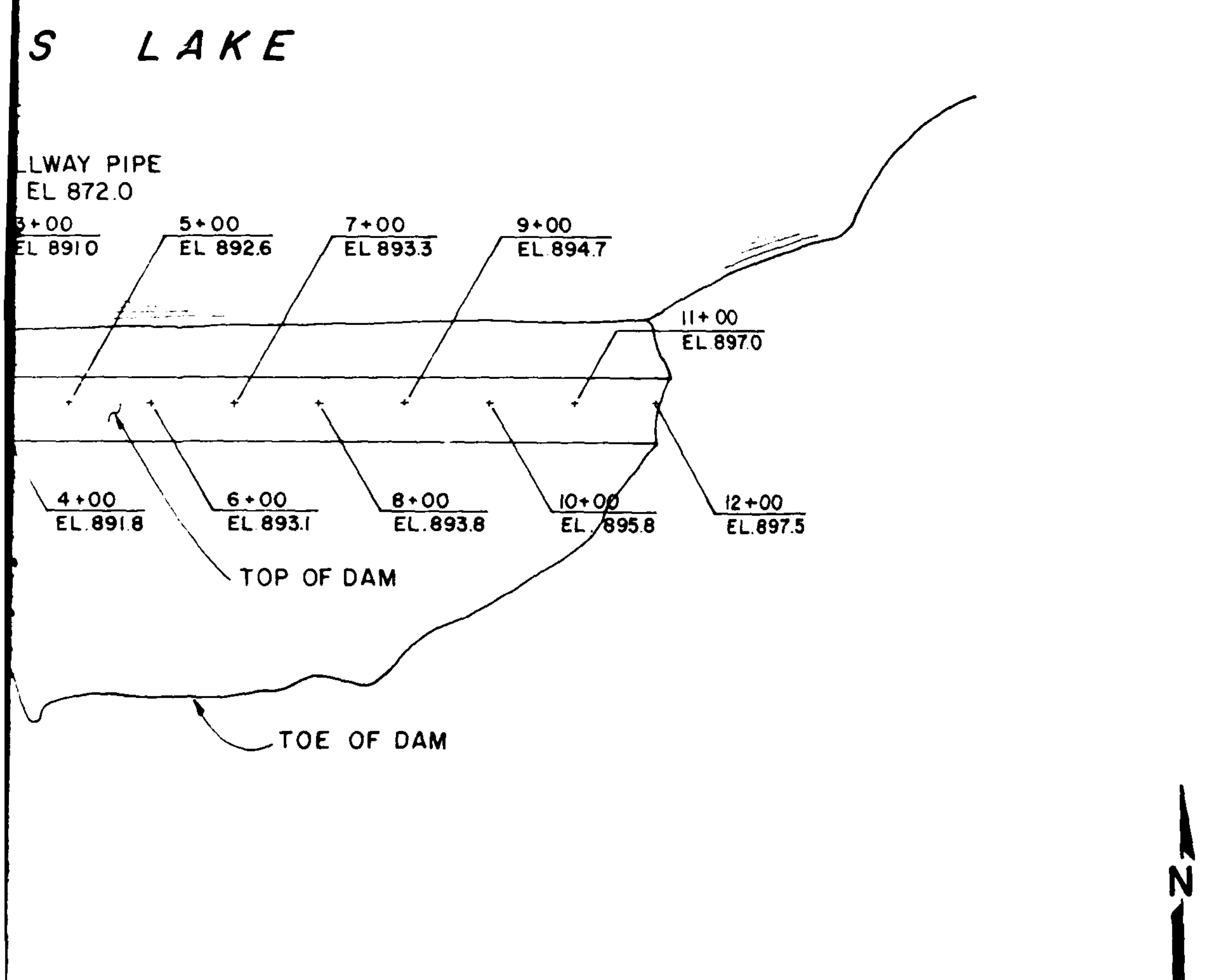

Platte Woods
Park Hill
St Theresa Sch
24
19
30
952
900
850
Riss Lake
Branch
MISSOURI
KANSAS
N
RISS LAKE
VICINITY TOPOGRAPHY
SCALE IN FEET
2000 1000 0 2000 4000
13

PLATE 2

RISS LAKE

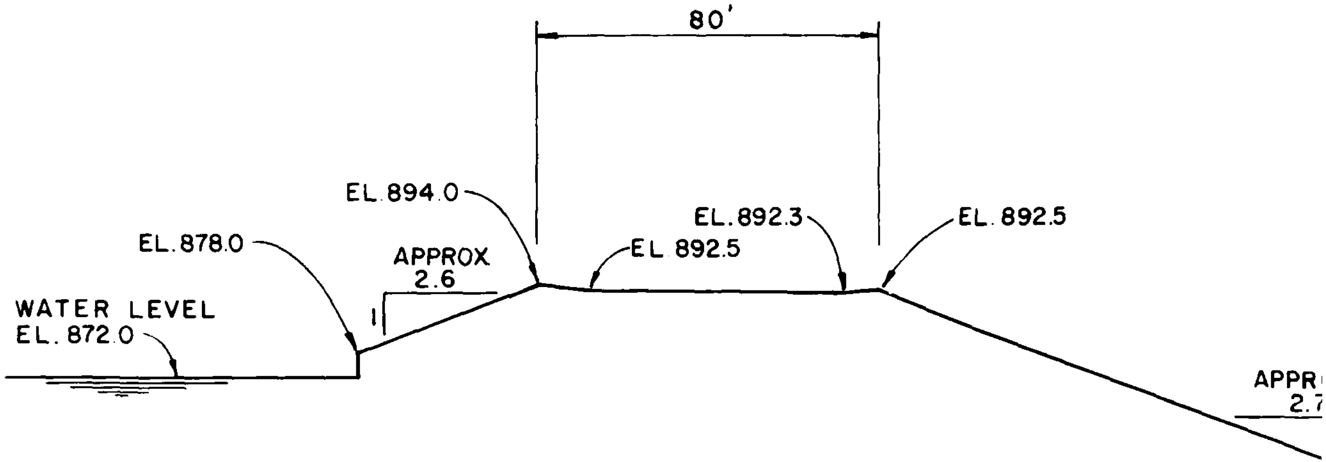


SPILLWAY PIPE
INV. EL. 872.0
1+00
EL. 892.6
3+00
EL. 891.0
5+00
EL. 892.6
12" CREST DRAIN PIPE
0+00
EL. 894.9
2+00
EL. 891.3
4+00
EL. 891.8
6+00
24" PIPE
INV. EL. 847.7
TOP



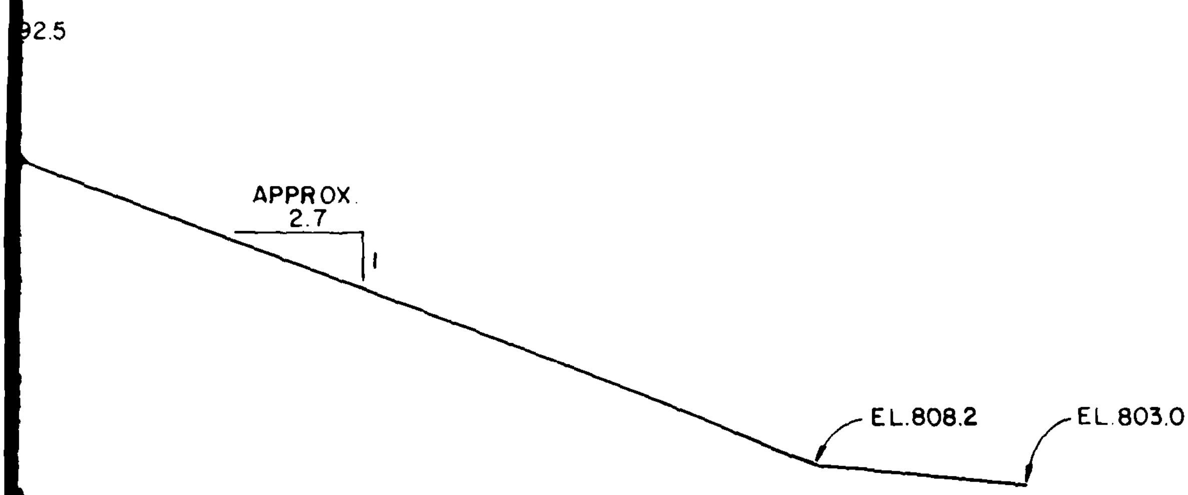
RISS LAKE
PLAN

PLATE 3



SECTION TAKEN AT APPROX. STA. 8+00

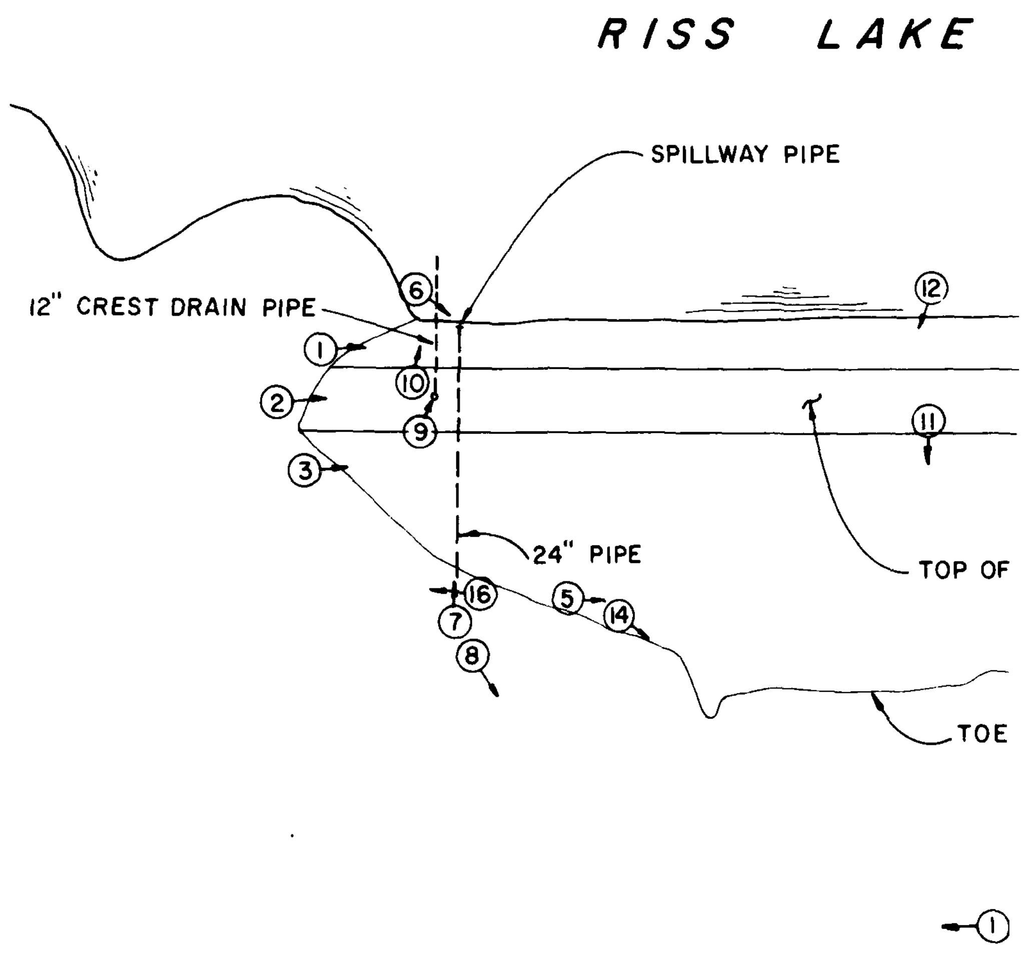
1

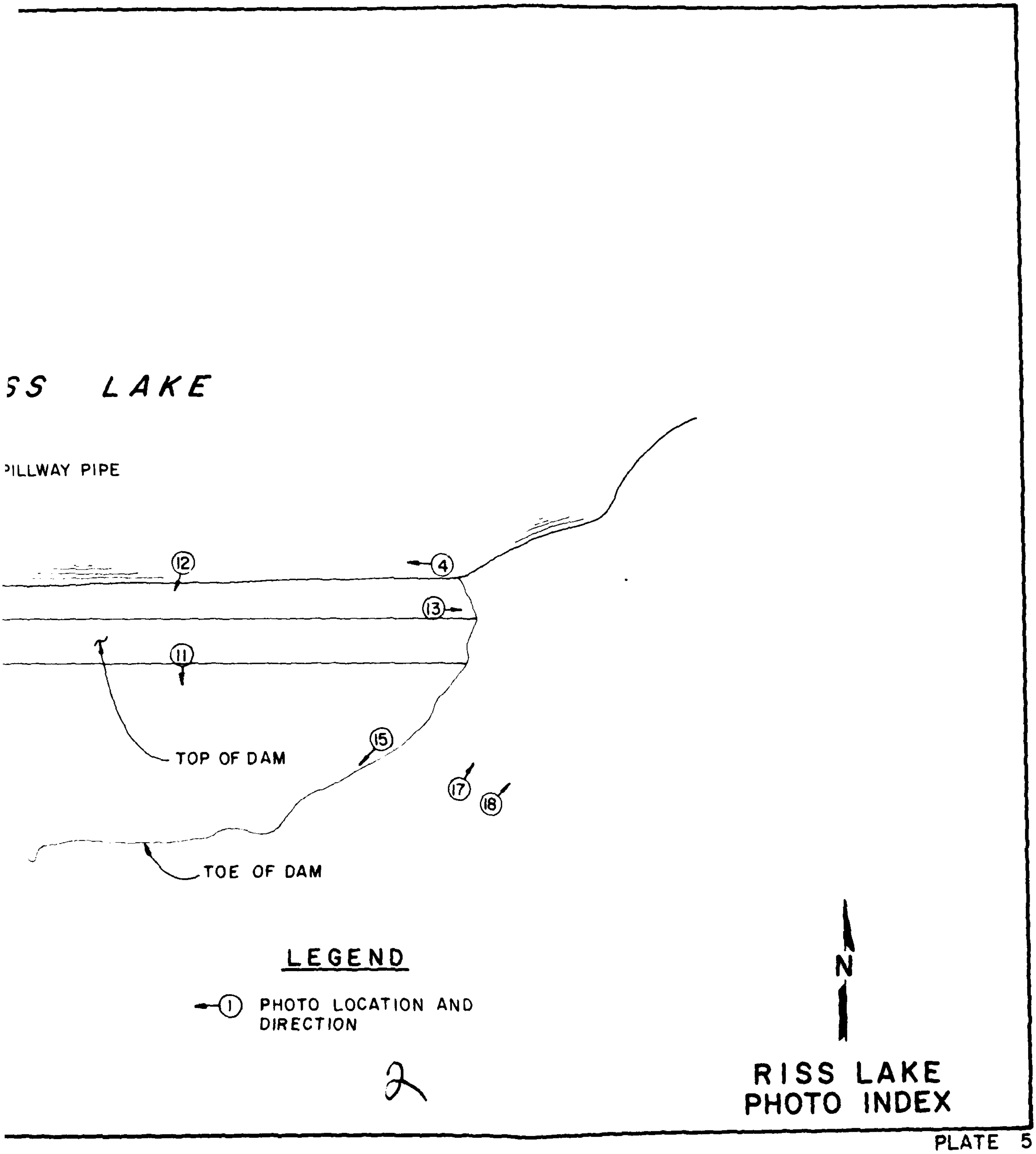


2

RISS LAKE
TYPICAL SECTION

PLATE 4


RISS LAKE
SPILLWAY PIPE
12" CREST DRAIN PIPE
24" PIPE
TOP OF
TOE
1
2
3
5
6
7
8
9
10
11
12
14
16
1



RISS LAKE
PHOTO INDEX

PLATE 5

PHOTO 1: UPSTREAM FACE OF DAM AT CREST

PHOTO 2: CREST OF DAM

PHOTO 3: DOWNSTREAM SLOPE OF DAM AT CREST

PHOTO 4: UPSTREAM FACE OF DAM AT WATER LINE

PHOTO 5: DOWNSTREAM SLOPE OF DAM AT TOE

PHOTO 6: SPILLWAY PIPE INLET

PHOTO 7: SPILLWAY PIPE OUTLET

PHOTO 8: CHANNEL BELOW SPILLWAY PIPE

PHOTO 9: DAM CREST DRAIN INLET

PHOTO 10: DAM CREST DRAIN PIPE

PHOTO 11: DAMAGE ZONE VIEWED FROM TOP OF DAM

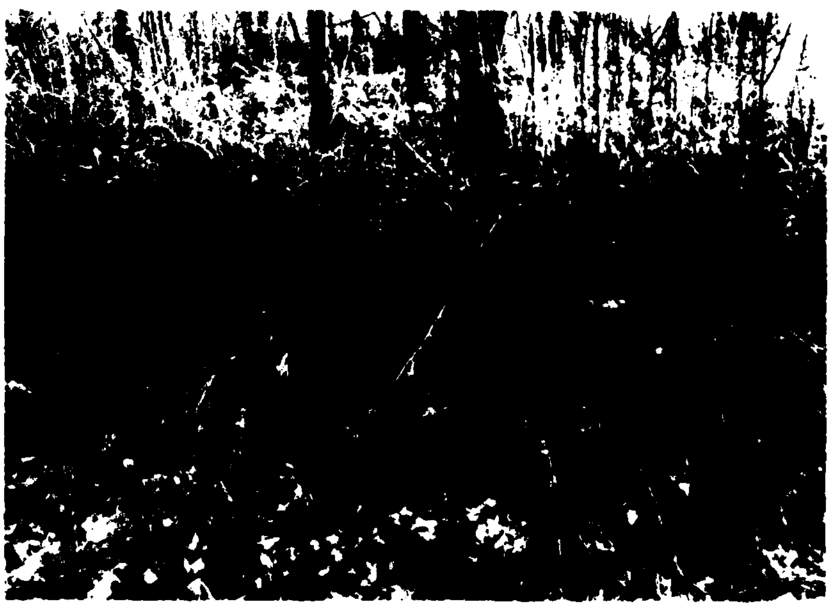


PHOTO 12: EROSION OF FRONT FACE NEAR LAKE LEVEL

PHOTO 13: ANIMAL BURROW IN EMBANKMENT

PHOTO 14: SEEPAGE AT DOWNSTREAM EMBANKMENT - RIGHT ABUTMENT INTERFACE

PHOTO 15: SEEPAGE AT DOWNSTREAM EMBANKMENT - LEFT ABUTMENT INTERFACE

PHOTO 16: SEEPAGE AT DISCHARGE CHANNEL

PHOTO 17: SEEPAGE THROUGH LEFT ABUTMENT

PHOTO 18: SEEPAGE THROUGH LEFT ABUTMENT

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrographs and hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33.

200 square mile, 24 hour rainfall inches	- 24.6
10 square mile, 6 hour percent of 24 hour 200 square mile rainfall	- 101%
10 square mile, 12 hour percent of 24 hour 200 square mile rainfall	- 120%
10 square mile, 24 hour percent of 24 hour 200 square mile rainfall	- 130%

b. Drainage area = 1,283 acres.

c. Time of concentration: $T_c = (11.9 \times L^3/H)^{0.385} = 0.59$ hours = 35 minutes (L = 1.53 miles length of longest watercourse in miles, H = 168 feet = elevation difference in feet) (2).

d. The soil association in this watershed is mainly Knox (3).

e. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 82 and antecedent moisture condition III. The hydrologic soil group in the basin was B.

2. Spillway release rates are based on the pressure flow through the pipe acting as an orifice.

Orifice flow equation:

$Q = A\ [2gH/k]^{1/2}$ (A = 3.14 sq ft = net area of the orifice in square feet, g = gravitational acceleration, K = 6.2 = total loss coefficient, H = difference between the energy gradient elevation upstream and tailwater elevation downstream (4).

Discharge rates over the top of the dam are based on the broad-crested weir equation:

$$Q = CLH^{1.5} \quad (C = 2.8,\ L = 100 \text{ to } 920 \text{ feet}).$$

3. The relationship between elevation and storage volume for the reservoir was determined from a contour map of the reservoir area. A planimeter measurement was made of the area enclosed by each contour line. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

4. Floods are routed through the spillway using HEC-1, modified Puls to determine the capability of the spillway.

(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, Davis, California.

(2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.

(3) Mid-America Regional Council, Regional Soils Guide, March 1976, Kansas City, Missouri.

(4) "Hydraulic Design of Reservoir Outlet Structures," Engineering Manual 1110-2-1602, U. S. Army Corps of Engineers, 1 August 1963.

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*************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM S[illegible]SION       JULY 1978
LAST [illegible]ICATION  25 SEP 78
*************************************
   1          A1***** RISS LAKE DAM I.D.#30326 - MISSOURI DAM INSPECTION STUDY *****
   2          A2ROUTING COMPUTATION FOR RISS LAKE RESERVOIR
   3          A3DRAINAGE AREA = 1253 ACRES = 2.005 SQ.MI.
   4          B    300       0       5       3       3       0       0       0       0       0.
   5          B1     5
   6          J      1       2       3
   7          J1 0.498      1.
   8          K      0       1                               3       1
   9          K1 RISS LAKE DAM      (24HR, PROBABLE MAXIMUM RUNOFF)
  10          M      1       2   2.005                       1
  11          P           24.6     131     120     130
  12          T                                                      -1      -66
  13          W2           3.35
  14          K                          1
  15          K      1       2                                       1
  16          K1 ROUTING THROUGH RISS LAKE RESERVOIR
  17          Y                                  1       1
  18          Y1     1                                            -372       -1
  19          Y4872.0 874.0   875.0   880.0   885.0   891.0   891.3   891.5   892.6   893.3
  20          Y4894.9
  21          Y5 0.   50.     51.     56.     60.     65.     82.     200.    1140.   2560.
  22          Y5E970.
  23          SS 0.   27.     107.    230.    561.    996.5   1707.5  2676.5  3931.5  5522.
  24          SS7438. 9833.
  25          SE770.  800.    810.    820.    830.    840.    850.    860.    870.    880.
  26          SE890.  900.
  27          $$ 872.0
  28          SD 891.0       0.     1.5     0.
  29          A     99
```

Standard Project Flood Ratio 1

```
PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

          RUNOFF HYDROGRAPH AT            1
          ROUTE HYDROGRAPH TO             2
          END OF NETWORK
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION RATIO 1 .50	RATIO 2 1.00
HYDROGRAPH AT	1	2.01	1	7216.	16060.
	(	5.19)	(	204.35)(	454.76)(
ROUTED TO	2	2.01	1	55.	62.
	(	5.19)	(	1.56)(	1.76)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	672.00	872.00	891.00
STORAGE	4250.	4250.	7723.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	872.00	872.00	891.00
STORAGE	4250.	4250.	7723.
OUTFLOW	0.	0.	55.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	879.13	0.00	5383.	55.	0.00	24.50	0.00
1.00	887.61	0.00	7019.	62.	0.00	24.67	0.00

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  25 SEP 78
**********************************
A1***** KISS LAKE DAM (MO ...) - MISSOURI DAM INSPECTION STUDY *****
A2 ROUTING COMPUTATION FOR KISS LAKE RESERVOIR
A3 DRAINAGE AREA = 1283 ACRES = 2.005 SQ.MI.
B    288       0       5       0       0       0       0       0       0       0
B1     5
J      1       9       1
J1    .5     .55      .7     .75      .8     .85      .9     .95      1.
K      0       1                               3       1
K1 KISS LAKE DAM      (COMP. PROBABLE MAXIMUM RUNOFF)
M      1       2   2.005                       1
P           24.5     121     123     133
T                                                     -1     -62
W2          0.25
X                      1
K      1       2                                       1
K1 ROUTING THROUGH KISS LAKE RESERVOIR
Y                                      1       1
Y1     1                                          -875.0      -1
Y4 872.0 874.0   875.0   880.0   885.0   891.0   891.3   891.8   892.6   893.3
Y4 894.0
Y5 0.    50.     51.     55.     60.     65.     82.    300.   1140.   2560.
Y5 3770.
SA 0.    27.    107.    230.    501.   995.5  1707.5  2575.5  3931.5   5522.
SA 7405. 9929.
SE 790. 801.    810.    820.    830.    840.    850.    860.    870.    880.
SE 890. 900.
SS 872.0
SD 891.0       0.     1.5      0.
K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1 .60	RATIO 2 .65	RATIO 3 .70	RATIO 4 .75	RATIO 5 .80	RATIO 6 .85	RATIO 7 .90	RATIO 8 .95	RATIO 9 1.00
HYDROGRAPH AT	1	2.01	1	10021.	10856.	11691.	12526.	13362.	14197.	15032.	15867.	16702.
	(	5.19)	(	283.77)(	307.41)(	331.06)(	354.71)(	378.36)(	402.00)(	425.65)(	449.33)(	472.95)
ROUTED TO	2	2.01	1	61.	61.	62.	63.	63.	64.	65.	69.	70.
	(	5.19)	(	1.72)(	1.73)(	1.75)(	1.77)(	1.79)(	1.81)(	1.83)(	1.95)(	[illegible])

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	875.92	872.00	891.00
STORAGE	4270.	4250.	7723.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	875.40	872.00	891.00
	STORAGE	4270.	4250.	7723.
	OUTFLOW	52.	0.	65.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.60	885.71	0.00	6644.	61.	0.00	24.00	0.00
.65	886.50	0.00	6801.	61.	0.00	24.00	0.00
.70	887.30	0.00	6957.	62.	0.00	24.00	0.00
.75	888.10	0.00	7114.	63.	0.00	24.00	0.00
.80	888.89	0.00	7270.	63.	0.00	24.00	0.00
.85	889.68	0.00	7425.	64.	0.00	24.00	0.00
.90	890.40	0.00	7582.	65.	0.00	24.00	0.00
.95	891.07	.07	7739.	69.	.92	24.00	0.00
1.00	891.59	.53	7860.	205.	5.75	24.00	0.00

END

DATE

FILMED

12-81

DTIC

END
DATE
FILMED
12-81
DTIC