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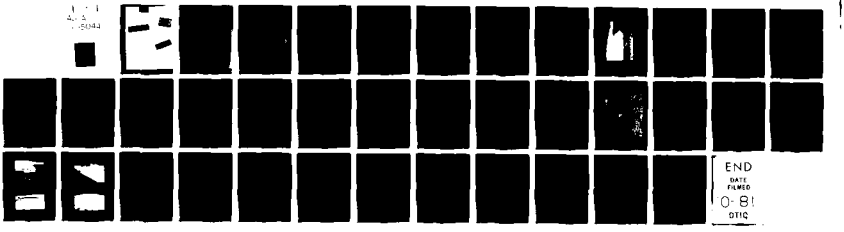

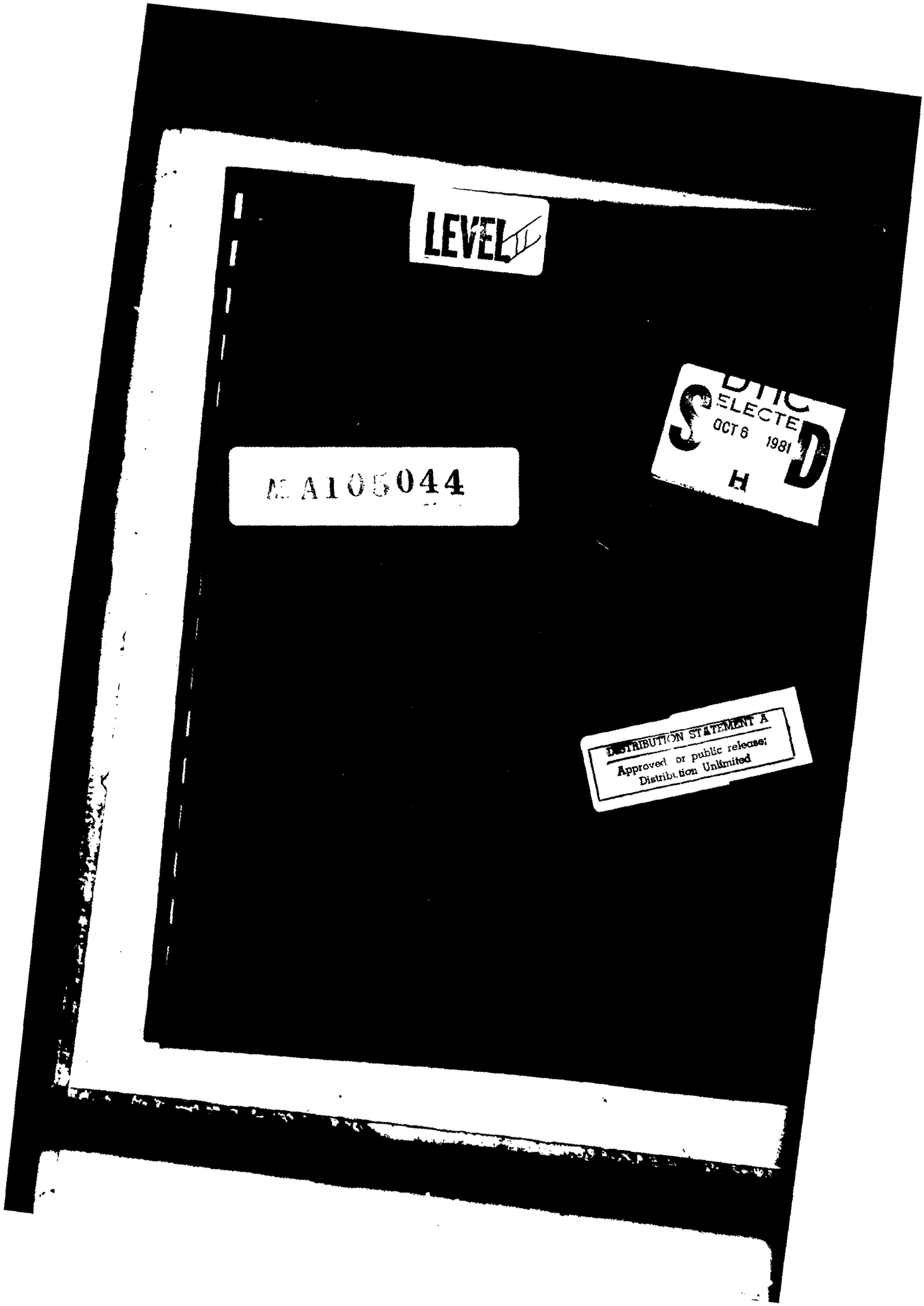
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7. AUTHOR(s) Kenneth Balk and Associates, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-78-C-0169
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams	
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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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

3 August 1979

ERRATA

The following pages are a revised SECTION 7 for the Loss Lake Dam report. They contain information not previously included in that section and should be used in lieu of page 10 of this report.

SIGNED
JACK R. NIEMI
Chief, Engineering Division

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SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Corrective measures should be taken for the deficiencies visually observed by the inspection team, i.e., seepage, erosion, lack of erosion protection in the spillway and outlet channel, and growth of vegetation on the embankment. The slopes of the dam are steeper than good engineering practice would dictate and the stability of the dam should be evaluated. Inadequate spillway capacity is also considered to be a deficiency.

b. Adequacy of Information. No engineering design and construction data was available and the conclusions of this report are based on performance and external 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 (including seismic analyses) were not available and this is considered a deficiency which should be rectified.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. The item recommended in paragraph 7.2.a should be pursued on a high priority basis.

d. Necessity for Phase II. Based on the result of the Phase I inspection, no Phase II inspection is recommended.

7.2 REMEDIAL MEASURES

a. Alternatives. The spillway will pass only 40 percent of the probable maximum flood without overtopping. The spillway capacity and/or height of dam should be increased to pass the probable maximum flood.

b. O&M Procedures. The following O&M procedures are recommended:

(1) Excessive vegetation should be removed from the crest and upstream and downstream slopes.

(2) Seepage should be monitored to determine the quantity of flow and sedimentation and corrective measures be designed by an experienced professional engineer based on appropriate analyses.

(3) Erosion channels should be filled and a grass cover planted to prevent recurrence.

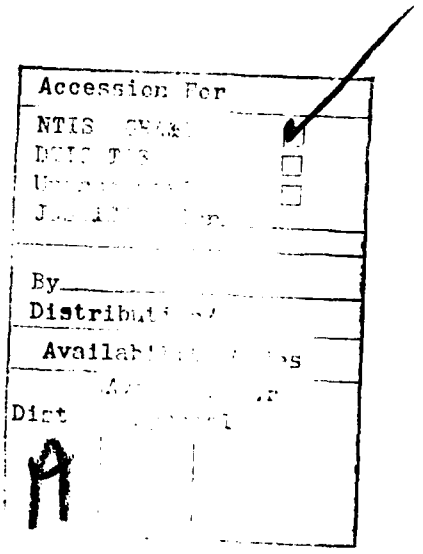
(4) The spillway and outlet channel should be protected from erosion.

(5) Up-to-date records of all future maintenance and repairs should be kept.

(6) An engineer experienced in dam design should be retained to evaluate the stability of the dam in view of the steep slopes.

(7) The dam should be periodically inspected by an engineer experienced in the design and construction of dams.

(8) Stability and seepage analyses should be performed by a professional engineer experienced in the design and construction of dams.



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

IN REPLY REFER TO

SUBJECT: Loss Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Loss Lake Dam.

It was prepared under the National Program of Inspection of Non-Federal Dams

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division

23 FEB 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

23 FEB 1979
Date

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Loss Lake
State Located	Missouri
County Located	Dent County
Stream	Tributary To Loss Creek
Date of Inspection	September 26, 1978

Loss Lake Dam, No. 30262 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U. S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Loss Lake Dam was visually inspected by an interdisciplinary team of engineers from Kenneth Balk & Associates, Inc. and Shannon & Wilson, Inc. The purpose of the inspection was to make a preliminary assessment of the general condition of the dam with respect to safety in order to determine if, in the opinion of the interdisciplinary team, the dam poses recognizable hazards to human life or property. This assessment is based solely upon data made available and visual evidence observed during the site visit.

To make a complete assessment of the safety of the dam would require detailed studies and engineering analyses beyond the scope of this preliminary assessment.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends five miles downstream of the dam. Within the damage zone are two dams (No. 30065 and No. 30142), two mobile homes, two houses, and three improved roads. Loss Lake Dam is in the intermediate size classification since it is greater than 40 feet high but is less than 100 feet high.

The inspection and evaluation indicate that the spillway of Loss Lake does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Loss Lake is a large size dam with a high hazard potential, required by the guidelines to pass the PMF. Considering the high hazard potential to loss of life and property downstream of the dam, the outlet facilities of Loss Lake Dam should be able to pass the PMF without overtopping the dam. However, it was determined that the spillway will only pass approximately 40 percent of the PMF without overtopping the dam.

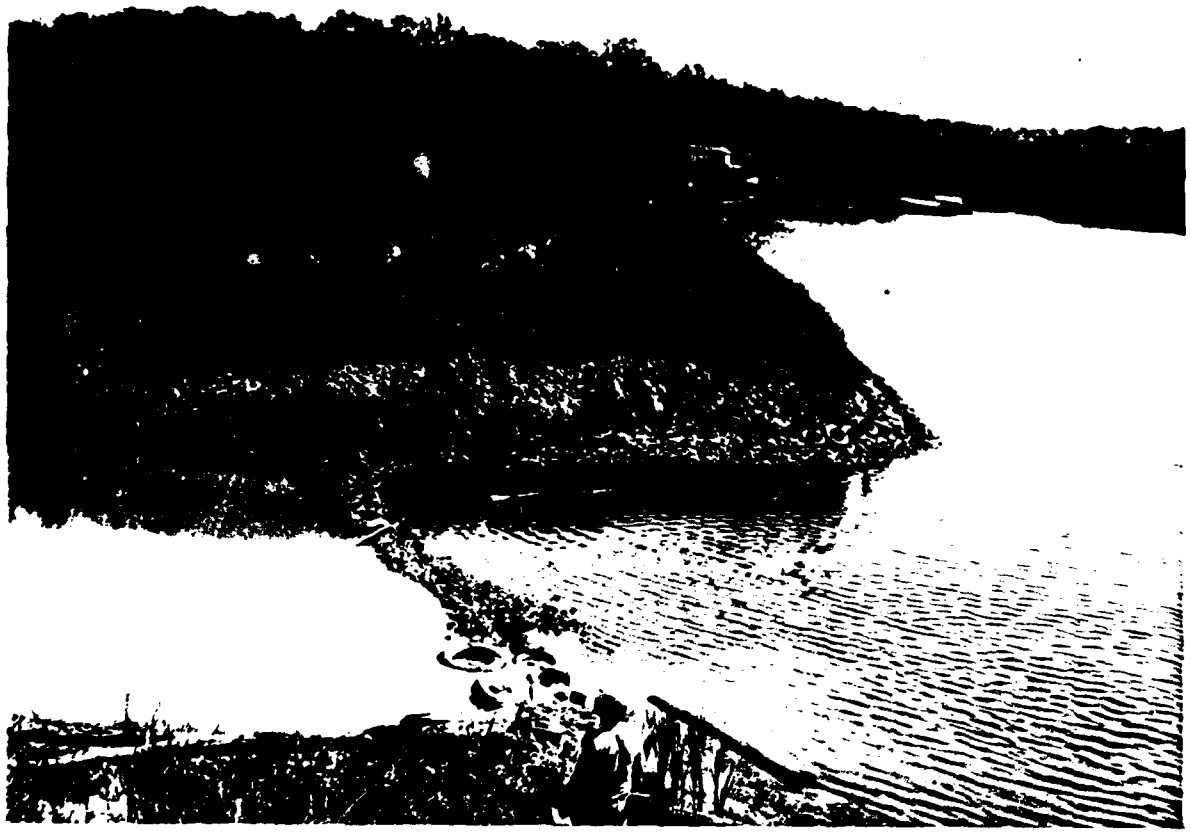
The evaluation of Loss Lake also indicated that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

Deficiencies visually observed by the inspection team were erosion, seepage at the toe, and thick brush on the crest and embankment slopes. Other deficiencies found were the lack of seepage records, operational records, seepage and stability analyses comparable to the requirements of the Recommended Guidelines, and seismic stability analyses. The embankment slopes are steeper than good engineering practice would dictate, consequently the stability of the dam should be evaluated.

It is recommended that action be taken in the near future to correct or control the deficiencies described.

Ervin H. Baumeyer, P.E.
Principal-In-Charge
Kenneth Balk and Associates, Inc.
St. Louis, Missouri

Lutz Kunze, P.E.
Principal Engineer
Shannon & Wilson, Inc.
St. Louis, Missouri



Overview of Lake and Dam

LOSS LAKE DAM
(Formerly No Name 112)

DENT COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30262

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY

Kenneth Balk & Associates, Inc.
St. Louis, Missouri
Shannon & Wilson, Inc.
St. Louis, Missouri

PREPARED FOR

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

NOVEMBER, 1978

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LOSS LAKE DAM - ID NO. 30262

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APPENDIX

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LIST OF PHOTOGRAPHS

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 St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Loss 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 data made available 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 built on Loss Creek in the northern part of Dent County, Missouri. Topography adjacent to the valley is rolling to steep. Topography in the vicinity of the dam is shown on Plate 1.

(2) A spillway is cut in natural soils on the left abutment.

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

b. Location. The dam is located in the northeastern portion of Dent County, Missouri, as shown on Plate 2. The lake formed by the dam is on the Missouri-Dent County Salem quadrangle sheet in the NW 1/4 of Section 29, T35N, R6W.

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, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c. Based on referenced guidelines, the Corps of Engineers has determined that this dam is in the High Hazard Classification and thus has been selected by the Corps of Engineers for a Phase I inspection.

e. Ownership. We understand that this dam is owned by Mr. I. N. Floyd, R.R. 4, Box 277, Salem, Missouri 65560.

f. Purpose of Dam. The dam forms a recreational lake.

g. Design and Construction History. There are no known design plans or construction records. The dam was completed in 1949. According to Mr. I. N. Floyd, the dam was constructed on an intermittent basis. The base of the dam was cleared to limestone bedrock the width of TD-18 tractor blade. Springs were evident during construction in both abutments. The embankment was reportedly built in intermittent stages over several years. No design or construction data other than the recollections of Mr. Floyd are known to exist.

h. Normal Operating Procedure. No operating records were found. Outflow passes through an uncontrolled spillway. Normal rainfall, runoff, transpiration, evaporation, and spillway discharges all combine to maintain a relatively stable water surface elevation.

1.3 PERTINENT DATA

a. Drainage Area - 582 acres.

b. Discharge at Damsite.

(1) Estimated spillway capacity - 619.8 cfs. at maximum pool.

(2) Estimated experienced maximum flood - approximately 2 feet below top of dam.

c. Elevation (U.S.G.S.)

(1) Top of dam - 1141.2±.

(2) Spillway crest - 1135.50.

(3) Streambed at centerline of dam - 1075 (est.).

(4) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 2650 feet ±.

e. Storage (Acre-feet).

(1) Normal 1667.5

(2) Maximum 2199.5

f. Reservoir Surface (Acres).

(1) Top of dam - 95.

(2) Spillway crest - 78.

g. Dam.

(1) Type - earth embankment.

(2) Length - 750 feet.

(3) Height - 66 feet maximum.

(4) Top width - 12 feet.

(5) Side Slopes - (Measured with a slope meter/inclinometer in degrees and converted to ratios.)

(a) Downstream - varies 2 H. to 1 V. typical.

(b) Upstream - 1.3 H. to 1 V. to waterline.

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel. - None.

i. Spillway.

(1) Type - Earthen, trapezoidal shape, on left abutment with fish screen.

(2) Length of Weir - 66'.

(3) Crest elevation - 1135.50.

j. Regulating Outlets. - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data are known to exist.

2.2 CONSTRUCTION

The dam was completed in 1949. No construction records, other than the recollections of Mr. Floyd, are known to exist.

2.3 OPERATION

No records of the maximum loading on the dam were available.

2.4 EVALUATION

a. Availability. No engineering or geological data are known to exist.

b. Adequacy. No engineering data was available to make a detailed assessment of the design, construction, and operation. Lack of seepage and stability analyses comparable to the requirements of the recommended guidelines is considered a deficiency which should be corrected.

c. Validity. No valid engineering data on design were available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General. A visual inspection of the Loss Lake Dam was carried out on September 26, 1978. Personnel making the inspection were employees of Kenneth Balk and Associates, Inc. and Shannon and Wilson, Inc. of St. Louis and included civil, geotechnical, and structural engineers and an engineering geologist. Specific observations are discussed below.

B. Dam. The inspection team observed the following at the dam.

The dam is an earth embankment with a narrow crest and a steep upstream slope. (1.3H. to 1V to the water line.) The downstream slope has an irregular surface with humps and benches which may be a sign of slope instability or may be due to the intermittent nature of the dam's construction. Some erosion channels were observed approximately 1/2 way down the slope.

The crest and upper portion of both slopes of the embankment are densely overgrown with chest high brush. The lower downstream slope has no grass or other vegetative cover to minimize erosion. The upstream slope is lined with a single row of rubber tires, slightly above the present water line. Seepage is evident although no flowing water was observed and cattails are growing along the toe of the dam and the ground at the toe and downstream is wet and marshy.

C. Appurtenant Structures. A spillway is located on the left abutment, cut into residual soil without any erosion protection. A small earth dike was located at the upstream end of the spillway and in line with the crest of the dam. A wire mesh screen is set up in the spillway outlet channel which has created a pool of muddy water with the small earth dike. Spillway discharges may endanger the integrity of the dam.

D. Reservoir Area. No wave wash, excessive erosion or slides were observed along the shore of the reservoir.

E. Damsite Geology.

1. Dam The area of the dam is underlain by bedrock units of the Gasconade Formation. Slopes adjacent to the dam are underlain by a thin veneer of colluvial soils and by fluvial soil in the flood plain of Loss Creek. On the topographic maps, numerous lakes and ponds are present more than a mile to the west and south of the dam site area, indicating Karst conditions. Within the immediate site area, Karst conditions appear to be absent but should not be ruled out without more detailed investigation.

2. Left Abutment - Bedrock units of a Gasconade formation were exposed in a borrow excavation above the embankment on the left abutment. The bedrock unit consisted of mottled brown and tan weathered chert with layers and zones of vuggs to several inches in diameter. The chert was close jointed and fractured. Occasional zones of crude bedding appeared to be horizontal. The unit appears permeable.

3. Right Abutment - Colluvial soils underlie the right abutment area. Weathered chert on trays are present in the hillside above the dam to a short distance to the southeast of the Floyd residence. Mr. Floyd reported that thick massive limestone beds were present in the excavation for the embankment on the right abutment.

3.2 EVALUATION

The existing conditions found, in our opinion, do not require immediate remedial action, but should be attended to in the near future.

In the opinion of the inspection team, the slopes of the embankment are steeper than good engineering practice would dictate and the irregular downstream face of the embankment may be a sign of instability. The services of a professional engineer experienced in the design of dams should be retained to evaluate the stability of the dam.

The brush on the embankment and existing seepage and marshy conditions observed at the toe, if left uncontrolled, may adversely affect the stability of the dam. The lack of a grass or other vegetative cover on the downstream slope to help minimize surface erosion is a deficiency. The spillway and outlet channel have no erosion protection against sustained flows, a condition which may endanger the integrity of the dam.

In the opinion of the inspection team, the services of a professional engineer experienced in the design of dams should be obtained to evaluate the deficiencies noted.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

No regulating structure exists at this dam. The lake level is affected by rainfall, runoff, evaporation, and the capacity of uncontrolled spillway.

4.2 MAINTENANCE OF DAM

No maintenance records of the dam were available. The amount and size of vegetation on the embankment suggests that maintenance, if any, has not been regular.

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

In our opinion, a regular program of vegetation control and maintenance should be initiated. The brush on the dam is a deficiency which should be corrected.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. There were no hydraulic and hydrological design data made available.

b. Experience Data. The drainage area and lake surface area are developed from USGS Salem Mo. Quadrangle. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations. The spillway and outlet channel are cut into residual soil on the left or west abutment. There is no protection against erosion for either the spillway or the outlet channel. Sustained spillway discharges will erode the spillway and may endanger the integrity of the dam. Some vegetation is growing in the outlet channel.

d. Overtopping Potential. The spillway has been found to be inadequate to pass the Probable Maximum Flood (PMF) without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

For the PMF, the dam would be overtopped to a maximum height of approximately 1.8 feet with a duration of overtopping of approximately 4.8 hours and a maximum discharge rate of 6016 cfs. In our opinion, failure of the dam may be expected to occur as a result of overtopping for this length of time.

The spillway has been found to be adequate to pass a flood of approximately forty percent (40%) of the PMF.

The spillway has been found to be adequate to pass the 100-year flood, which has a 1% chance of being equalled or exceeded at least once during any given year.

The estimated damage zone extends five miles downstream of the dam. Within the damage zone are two dams (No. 30065 and No. 30142) two mobile homes, two houses and three improved roads.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visually observed conditions which can affect the structural stability of this dam have been discussed in Section 3.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found except that discussed in Section 1.2.

c. Operating Records. No appurtenant structures requiring operation exist at the dam, therefore, no operating records exist.

d. Post-Construction Changes. No post-construction changes are known or apparent.

e. Seismic Stability. The location of Loss Lake Dam is in Seismic Zone 1. The seismic stability of this dam could not be evaluated due to lack of engineering design data. However, to our knowledge, an earthquake of the magnitude expected in Seismic Zone 1 has not caused a structural collapse of a dam of this size.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Corrective measures should be taken for the deficiencies visually observed by the inspection team, i.e. seepage, erosion, lack of erosion protection in the spillway and outlet channel, and growth of vegetation on the embankment. The slopes of the dam are steeper than good engineering practice would dictate and the stability of the dam should be evaluated. Inadequate spillway capacity is also considered to be a deficiency.

b. Adequacy of Information. No engineering design and construction data was available and the conclusions of this report are based on performance and external visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analysis comparable to the requirements of the recommended guidelines (including seismic analyses) were not available and this is considered a deficiency which should be rectified.

7.2 REMEDIAL MEASURES

a. O&M Procedures. The following O&M procedures are recommended:

(1) Excessive vegetation should be removed from the crest and upstream and downstream slopes.

(2) Seepage should be monitored to determine the quantity of flow and sedimentation and corrective measures should be designed by an experienced professional engineer based on appropriate analyses.

(3) Erosion channels should be filled and a grass cover planted to prevent recurrence.

(4) The spillway and outlet channel should be protected from erosion.

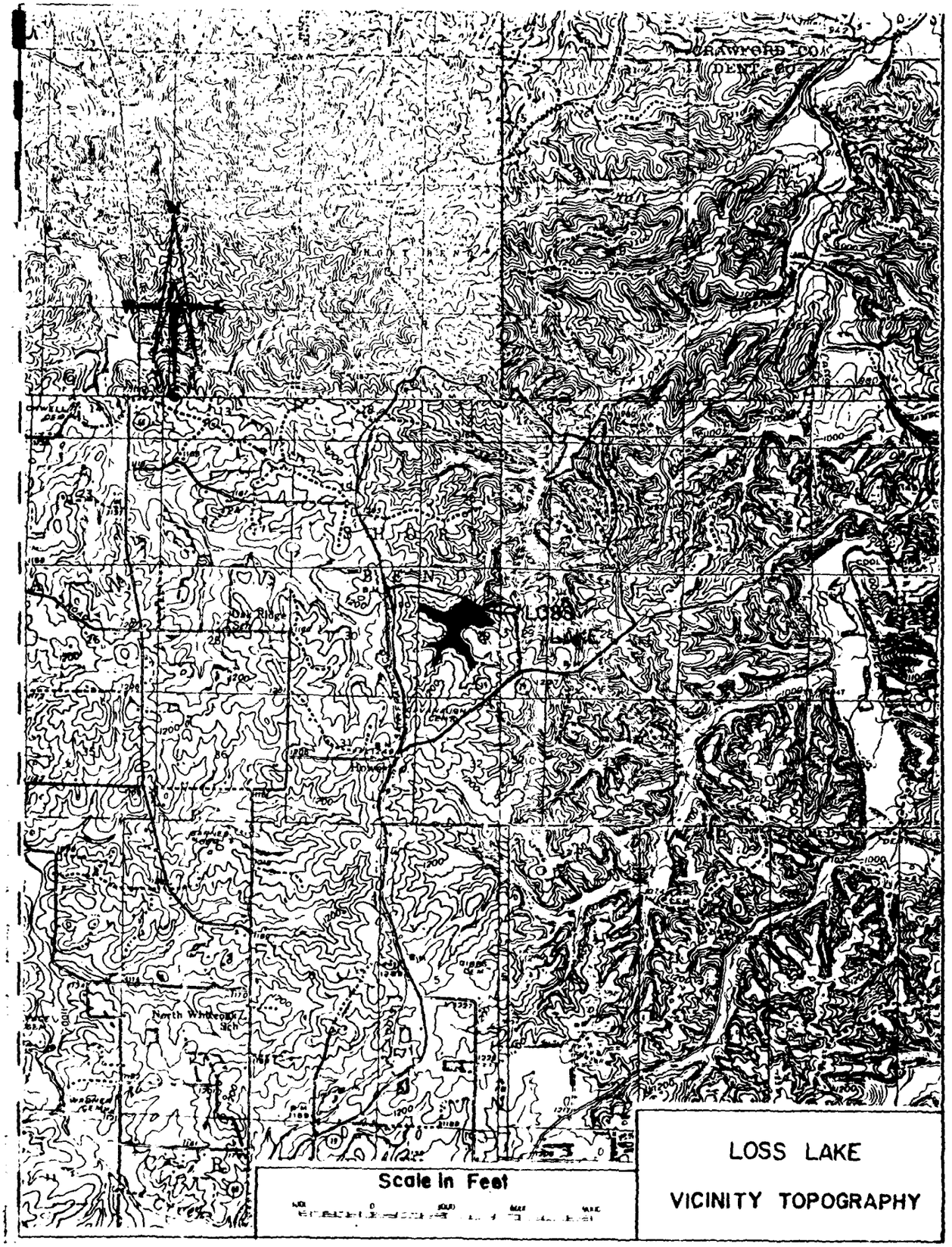
(5) Up-to-date records of all future maintenance and repairs should be kept.

(6) Spillway capacity and/or height of dam should be increased to pass 100 percent (100%) of the Probable Maximum Flood.

(7) An engineer experienced in dam design should be retained to evaluate the stability of the dam in view of the steep slopes.

(8) The dam should be periodically inspected by an engineer experienced in the design and construction of dams.

(9) Stability and seepage analyses should be performed by a professional engineer experienced in the design and construction of dams.



LOSS LAKE

VICINITY TOPOGRAPHY

PLATE 1

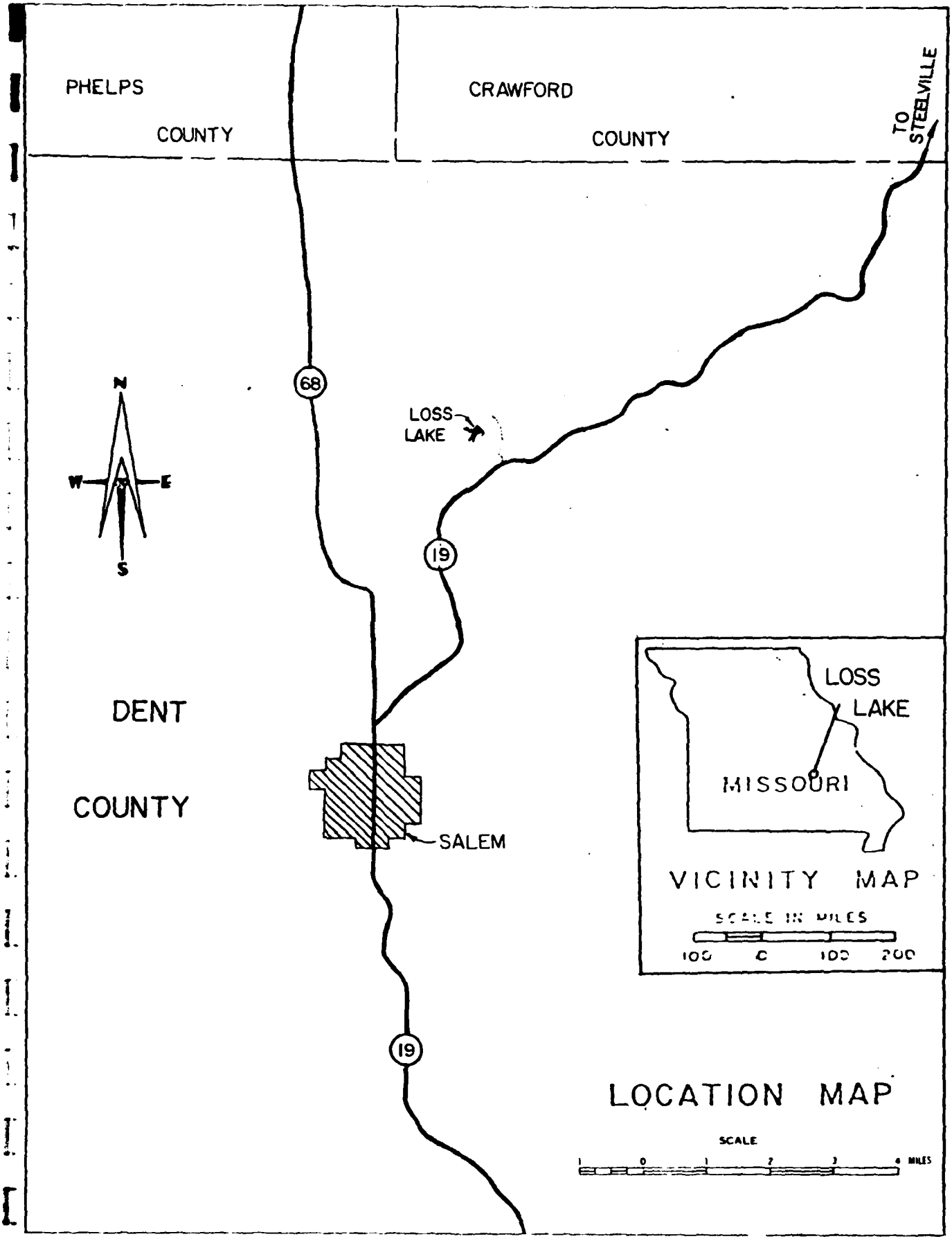
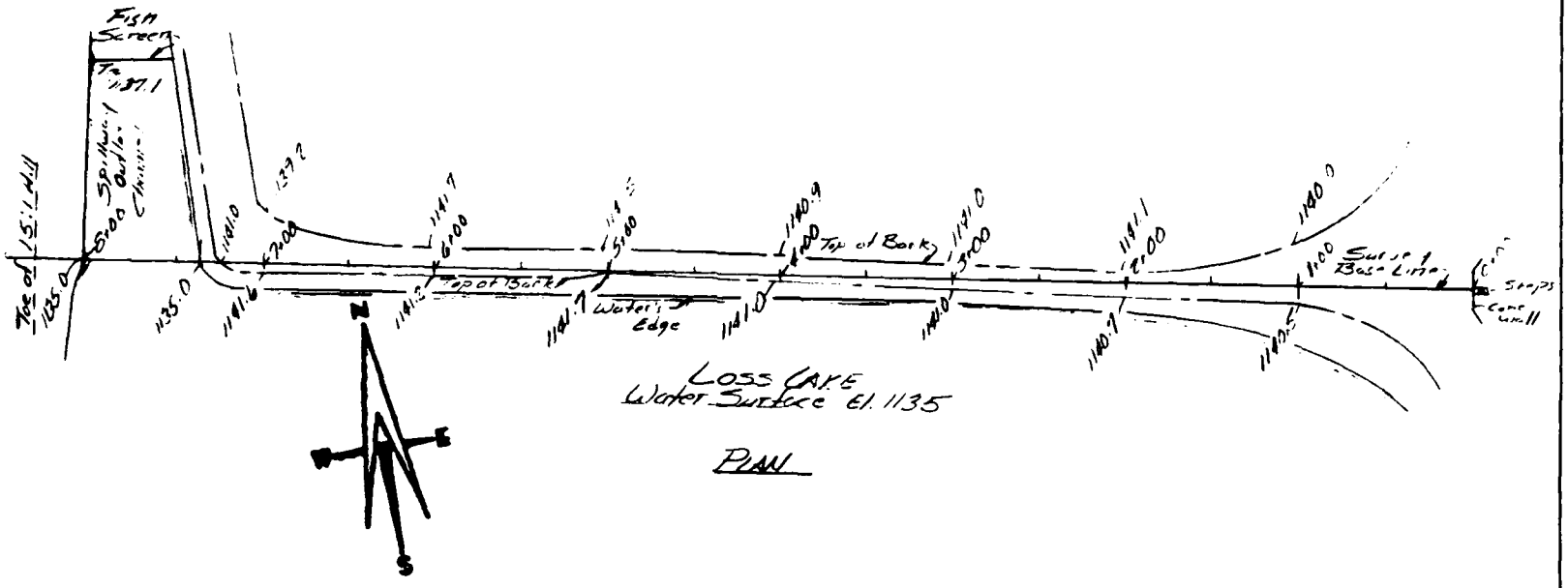

PHELPS
COUNTY
CRAWFORD
COUNTY
TO STEELVILLE
68
LOSS
LAKE
19
N
W
E
S
DENT
COUNTY
SALEM
19
LOSS
LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100
0
100
200
LOCATION MAP
SCALE
0
1
2
3
4 MILES

PLATE 2



LOSS LAKE
Water Surface El. 1135

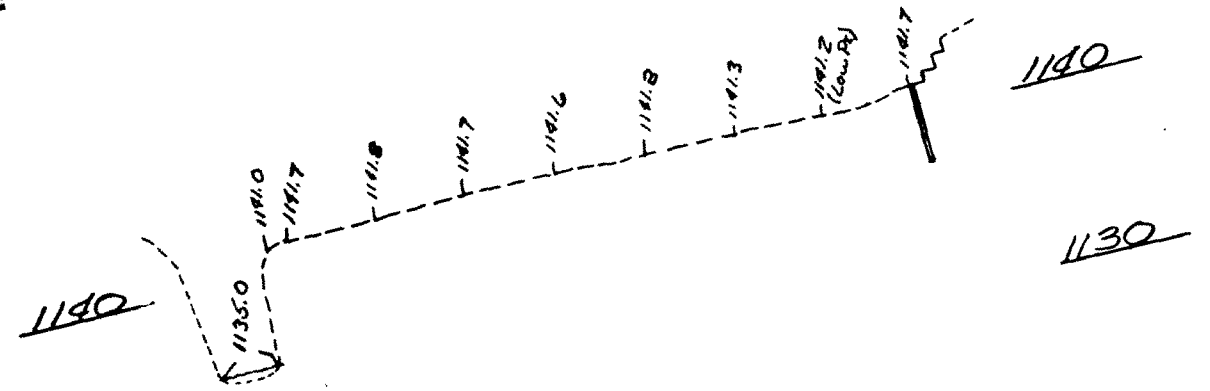
PLAN

LOSS LAKE

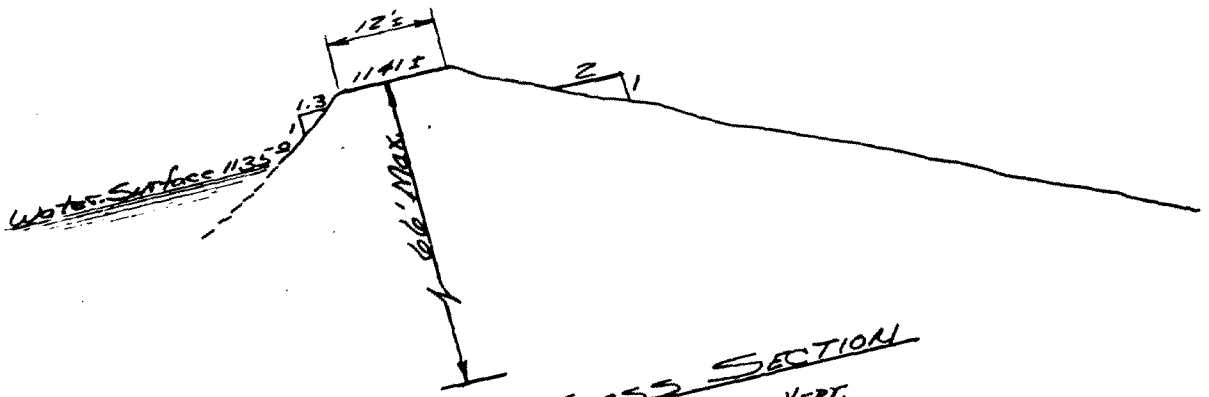
TOP OF DAM ELEVATIONS

SCALE: 1"=100'±

PLATE 3



PROFILE
SCALE: 1" = 200' H.
1" = 10' V.



TYPICAL CROSS SECTION
SCALE: 1" = 20' HORIZ. & VERT.

LOSS LAKE
DAM PROFILE
and CROSS SECTION

PLATE 4

PHOTO 1 Overview of Lake and Dam

PHOTO 2 View from Right Abutment

PHOTO 3 View of Spillway Looking Downstream

PHOTO 4 View of Downstream Slope from Left Abutment

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the total rainfall depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The nonpeak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by utilizing the Soil Conservation Service dimensionless unit hydrograph using Hydrologic Soils Groups "B" and "C", Antecedent Moisture Condition III, and SCS CN 82 used to determine rainfall excess.

Lag time was estimated using methods outlined in "Design of Small Dams", by the United States Department of The Interior, Bureau of Reclamation. Using this source, lag time is taken as 60% of the time of concentration.

Time of concentration was estimated utilizing methods outlined in the source quoted above, supplemented by data obtained during field investigation. The results of the field investigation and the computations indicated that a time of 35 minutes was appropriate. For this lake, a lag time of 0.35 hours was therefore selected.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the outlet works, spillway, and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The hydraulic capacity of the outlet works, spillway, and top of dam are defined by elevation-discharge curves.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed in the attached computer printout. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. The inflow hydrograph was routed through the reservoir using HEC-1's Modified Puls option. Releases were calculated for: 1) the spillway, and, 2) the flow over the top of the dam. These releases were then combined at each of their respective elevations. The flow over the top of the dam included flow through the swale.

Flow through the spillway was obtained by considering the spillway as a weir for the initial lower stages. For the subsequent higher stages, the spillway was considered as an open channel.

For the weir condition:

$$Q = CL(H)^{1.5}$$

where: C = Varies with head as outlined in "Handbook of Hydraulics" by Horace Williams King, revised by Ernest F. Brater.

L = Length in feet (varies with water surface)

H = Head of water in feet (varies with water surface)

Q = Discharge in cfs

For the open channel condition, the Bernoulli equation was written between the water surface in the lake and the energy gradient elevation in the channel.

This equation is simplified as follows:

$$\text{Stage} = \text{I.E.} + d_f + 1.5\,\frac{V^2}{2g}$$

where:

Stage = Pool elevation

I.E. = Invert elevation

d_f = Normal depth of flow in the channel for a given discharge

The above equation assumes an entrance loss coefficient of 0.5.

Flow over the top of dam was calculated using the weir flow equation:

$$Q = CL(H)^{1.5}$$

where: C = Varies with head as outlined in "Handbook of Hydraulics" by Horace Williams King, revised by Ernest F. Brater.

L = Length in feet (varies with water surface)

H = Head of water in feet (varies with water surface)

Q = Discharge in cfs

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********************************
    1                A1                    MASTERS LAKE MULTI-RESERVOIR ROUTING
    2                A2                                NOV.  1978
    3                A3                          MO. INV. NO. 30065
    4                B    2AA      -0       5      -0      -0      -0      -0      -0      -4      -0
    5                B1     5
    6                J      1       6       1
    7                J1   .10     .15     .20     .30     .50    1.00
    8                K      0  INFLOW                                3       1
    9                K1     SUBAREA  RUNOFF  FOR  LOSS  LAKE
   10                M      1       2    0.91                        1                       1
   11                P             26     100     120     130
   12                T                                                      -1      -83             .05
   13                W2           .35
   14                X   1.82     -.1       3
   15                K      1 ROUTING                         2       2       1
   16                K1    RESERVOIR  ROUTING  FOR  LOSS  LAKE
   17                Y                               1       1
   18                Y1     1                                       -1135.5      -1
   19                Y41135.5  1136.0  1136.5  1137.0  1137.5  1138.0  1138.5  1139.0  1139.5  1140.0
   20                Y41140.5  1141.0  1141.5  1142.0  1142.5  1143.0  1143.5  1144.0  1144.5
   21                Y5     0    4.26   15.85   36.06   63.04  106.37  152.86  226.95  294.85  375.06
   22                Y5468.49  572.80  793.25 2052.38 4071.13 6103.40 8150.0910214.0612290.51
   23                $S     0   40.04   80.64  121.81  163.52  205.80  248.64  292.04  336.00  380.52
   24                $S425.96  472.68  520.68  569.96  620.52  672.36  725.48  779.88  835.56
   25                $E1135.5  1136.0  1136.5  1137.0  1137.5  1138.0  1138.5  1139.0  1139.5  1140.0
   26                $E1140.5  1141.0  1141.5  1142.0  1142.5  1143.0  1143.5  1144.0  1144.5
   27                $$1135.5
   28                $D1141.2
   29                K      0  INFLOW                                3       1
   30                K1     SUBAREA  RUNOFF  FOR  MASTERS  LAKE
   31                M      1       2     3.3                        1                       1
   32                P             26     100     120     130
   33                T                                                      -1      -83             .04
   34                W2           .75
   35                X    6.6     -.1       3
   36                K      2                                 2       2       1
   37                K1    MASTERS AND LOSS  LAKES  HYDROGRAPHS  COMBINED
   38                K      1 ROUTING                         2       2       1
   39                K1    RESERVOIR  ROUTING  FOR  MASTERS  LAKE
   40                Y                               1       1
   41                Y1     1                                       -1001.67      -1
   42                Y41001.7 1002.00 1003.00 1004.00 1005.00 1006.00 1007.00 1008.00 1008.50 1009.00
   43                Y41009.5 1010.00 1010.50 1011.00 1012.00 1013.00 1014.00
   44                Y5     0     .83   11.75   30.74   46.04   57.25   66.61   80.98  124.08  223.69
   45                Y5360.03  690.21 1417.21 2153.37 5074.48 9911.2516026.37
   46                $S     0   11.72   48.52   87.24  127.88  170.44  214.92  261.32  285.24  309.64
   47                $S334.52  359.88  385.72  412.04  466.12  522.12  580.04
   48                $E1001.7 1002.00 1003.00 1004.00 1005.00 1006.00 1007.00 1008.00 1008.50 1009.00
   49                $E1009.5 1010.00 1010.50 1011.00 1012.00 1013.00 1014.00
   50                $$1001.7
   51                $D1009.8
   52                K     99
```

COMPUTER INPUT DATA

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 3 AUG 78

RUN: DATE= 11/27/78.
TIME= 17.16.38.

MASTERS LAKE MULTI-RESERVOIR ROUTING
NOV. 1978
MO. INV. NO. 30065

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	-0	5	-0	-0	-0	-0	-0	-4	-0
			JOPER	NWT	LROPT	TRACE			
			5	-0	-0	-0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1
RTIOS= .10 .15 .20 .30 .50 1.00

SUB-AREA RUNOFF COMPUTATION

SUBAREA RUNOFF FOR LOSS LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW	0	-0	-0	-0	3	1	-0	-0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.91	-0.00	.91	1.00	-0.000	-0	1	-0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
-0.00	26.00	100.00	120.00	130.00	-0.00	-0.00	-0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
-0	-0.00	-0.00	1.00	-0.00	-0.00	1.00	-1.00	-83.00	-0.00	.05

CURVE NO = -83.00 WETNESS = -1.00 EFFECT CN = 83.00

UNIT HYDROGRAPH DATA
TC= -0.00 LAG= .35

RECESSION DATA
STRTQ= 1.82 QRCSN= -.10 RTIOR= 3.00

UNIT HYDROGRAPH 23 END OF PERIOD ORDINATES, TC= -0.00 HOURS, LAG= .35 VOL= 1.00

125.	394.	810.	1079.	1116.	984.	776.	515.	362.	262.
185.	131.	92.	64.	46.	32.	23.	16.	12.	9.
6.	4.	1.							

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.00	.01	2.	1.01	12.05	145	.22	.20	.01	490.
1.01	.10	2	.01	.00	.01	2.	1.01	12.10	146	.22	.20	.01	466.

INPUT UNIT HYDROGRAPH

1.01	.15	3	.01	.00	.01	2.	1.01	12.15	147	.22	.20	.01	655.
1.01	.20	4	.01	.00	.01	3.	1.01	12.20	148	.22	.21	.01	802.
1.01	.25	5	.01	.00	.01	4.	1.01	12.25	149	.22	.21	.01	954.
1.01	.30	6	.01	.00	.01	4.	1.01	12.30	150	.22	.21	.01	1092.
1.01	.35	7	.01	.00	.01	5.	1.01	12.35	151	.22	.21	.01	1200.
1.01	.40	8	.01	.00	.01	5.	1.01	12.40	152	.22	.21	.01	1273.
1.01	.45	9	.01	.00	.01	5.	1.01	12.45	153	.22	.21	.01	1325.
1.01	.50	10	.01	.00	.01	5.	1.01	12.50	154	.22	.21	.01	1364.
1.01	.55	11	.01	.00	.01	5.	1.01	12.55	155	.22	.21	.01	1392.
1.01	1.00	12	.01	.00	.01	5.	1.01	13.00	156	.22	.21	.01	1413.
1.01	1.05	13	.01	.00	.01	5.	1.01	13.05	157	.26	.25	.01	1434.
1.01	1.10	14	.01	.00	.01	5.	1.01	13.10	158	.26	.25	.01	1462.
1.01	1.15	15	.01	.00	.01	5.	1.01	13.15	159	.26	.25	.01	1505.
1.01	1.20	16	.01	.00	.01	5.	1.01	13.20	160	.26	.25	.01	1557.
1.01	1.25	17	.01	.00	.01	5.	1.01	13.25	161	.26	.25	.01	1610.
1.01	1.30	18	.01	.00	.01	5.	1.01	13.30	162	.26	.25	.01	1656.
1.01	1.35	19	.01	.00	.01	5.	1.01	13.35	163	.26	.25	.01	1693.
1.01	1.40	20	.01	.00	.01	5.	1.01	13.40	164	.26	.25	.01	1718.
1.01	1.45	21	.01	.00	.01	5.	1.01	13.45	165	.26	.25	.01	1737.
1.01	1.50	22	.01	.00	.01	5.	1.01	13.50	166	.26	.25	.01	1751.
1.01	1.55	23	.01	.00	.01	5.	1.01	13.55	167	.26	.25	.01	1761.
1.01	2.00	24	.01	.00	.01	5.	1.01	14.00	168	.26	.25	.01	1768.
1.01	2.05	25	.01	.00	.01	5.	1.01	14.05	169	.32	.32	.01	1782.
1.01	2.10	26	.01	.00	.01	5.	1.01	14.10	170	.32	.32	.01	1812.
1.01	2.15	27	.01	.00	.01	5.	1.01	14.15	171	.32	.32	.01	1867.
1.01	2.20	28	.01	.00	.01	5.	1.01	14.20	172	.32	.32	.01	1939.
1.01	2.25	29	.01	.00	.01	5.	1.01	14.25	173	.32	.32	.01	2013.
1.01	2.30	30	.01	.00	.01	5.	1.01	14.30	174	.32	.32	.01	2078.
1.01	2.35	31	.01	.00	.01	5.	1.01	14.35	175	.32	.32	.01	2130.
1.01	2.40	32	.01	.00	.01	6.	1.01	14.40	176	.32	.32	.01	2165.
1.01	2.45	33	.01	.00	.01	6.	1.01	14.45	177	.32	.32	.00	2190.
1.01	2.50	34	.01	.00	.01	7.	1.01	14.50	178	.32	.32	.00	2209.
1.01	2.55	35	.01	.00	.01	8.	1.01	14.55	179	.32	.32	.00	2222.
1.01	3.00	36	.01	.00	.01	9.	1.01	15.00	180	.32	.32	.00	2232.
1.01	3.05	37	.01	.00	.01	10.	1.01	15.05	181	.20	.20	.00	2224.
1.01	3.10	38	.01	.00	.01	11.	1.01	15.10	182	.40	.39	.00	2204.
1.01	3.15	39	.01	.00	.01	12.	1.01	15.15	183	.40	.39	.00	2183.
1.01	3.20	40	.01	.00	.01	13.	1.01	15.20	184	.59	.59	.01	2234.
1.01	3.25	41	.01	.00	.01	14.	1.01	15.25	185	.69	.68	.01	2396.
1.01	3.30	42	.01	.00	.01	15.	1.01	15.30	186	1.68	1.66	.02	2811.
1.01	3.35	43	.01	.00	.01	16.	1.01	15.35	187	2.77	2.75	.02	3719.
1.01	3.40	44	.01	.00	.01	17.	1.01	15.40	188	1.09	1.08	.01	5142.
1.01	3.45	45	.01	.00	.01	18.	1.01	15.45	189	.69	.69	.00	6727.
1.01	3.50	46	.01	.00	.01	20.	1.01	15.50	190	.59	.59	.00	7757.
1.01	3.55	47	.01	.00	.01	21.	1.01	15.55	191	.40	.39	.00	7955.
1.01	4.00	48	.01	.00	.01	22.	1.01	16.00	192	.40	.39	.00	7882.
1.01	4.05	49	.01	.00	.01	23.	1.01	16.05	193	.30	.30	.00	6573.
1.01	4.10	50	.01	.00	.01	24.	1.01	16.10	194	.30	.30	.00	5521.
1.01	4.15	51	.01	.00	.01	25.	1.01	16.15	195	.30	.30	.00	4669.
1.01	4.20	52	.01	.00	.01	26.	1.01	16.20	196	.30	.30	.00	3997.
1.01	4.25	53	.01	.00	.01	27.	1.01	16.25	197	.30	.30	.00	3467.
1.01	4.30	54	.01	.00	.01	27.	1.01	16.30	198	.30	.30	.00	3079.
1.01	4.35	55	.01	.00	.01	28.	1.01	16.35	199	.30	.30	.00	2796.
1.01	4.40	56	.01	.00	.01	29.	1.01	16.40	200	.30	.30	.00	2598.
1.01	4.45	57	.01	.00	.01	30.	1.01	16.45	201	.30	.30	.00	2460.
1.01	4.50	58	.01	.01	.01	31.	1.01	16.50	202	.30	.30	.00	2363.
1.01	4.55	59	.01	.01	.01	32.	1.01	16.55	203	.30	.30	.00	2294.
1.01	5.00	60	.01	.01	.01	33.	1.01	17.00	204	.30	.30	.00	2246.
1.01	5.05	61	.01	.01	.01	34.	1.01	17.05	205	.24	.24	.00	2204.
1.01	5.10	62	.01	.01	.01	34.	1.01	17.10	206	.24	.24	.00	2154.
1.01	5.15	63	.01	.01	.01	35.	1.01	17.15	207	.24	.24	.00	2082.
1.01	5.20	64	.01	.01	.01	36.	1.01	17.20	208	.24	.24	.00	1997.
1.01	5.25	65	.01	.01	.01	37.	1.01	17.25	209	.24	.24	.00	1913.
1.01	5.30	66	.01	.01	.01	37.	1.01	17.30	210	.24	.24	.00	1842.
1.01	5.35	67	.01	.01	.01	38.	1.01	17.35	211	.24	.24	.00	1789.
1.01	5.40	68	.01	.01	.01	38.	1.01	17.40	212	.24	.24	.00	1754.

INPUT UNIT HYDROGRAPH

1.01	5.45	69	.01	.01	.01	40.	1.01	17.45	213	.24	.24	.00	1730.
1.01	5.50	70	.01	.01	.01	40.	1.01	17.50	214	.24	.24	.00	1712.
1.01	5.55	71	.01	.01	.01	41.	1.01	17.55	215	.24	.24	.00	1700.
1.01	6.00	72	.01	.01	.01	42.	1.01	18.00	216	.24	.24	.00	1692.
1.01	6.05	73	.07	.03	.04	46.	1.01	18.05	217	.02	.02	.00	1659.
1.01	6.10	74	.07	.04	.04	57.	1.01	18.10	218	.02	.02	.00	1570.
1.01	6.15	75	.07	.04	.04	80.	1.01	18.15	219	.02	.02	.00	1392.
1.01	6.20	76	.07	.04	.03	112.	1.01	18.20	220	.02	.02	.00	1157.
1.01	6.25	77	.07	.04	.03	147.	1.01	18.25	221	.02	.02	.00	915.
1.01	6.30	78	.07	.04	.03	180.	1.01	18.30	222	.02	.02	.00	759.
1.01	6.35	79	.07	.04	.03	209.	1.01	18.35	223	.02	.02	.00	680.
1.01	6.40	80	.07	.04	.03	232.	1.01	18.40	224	.02	.02	.00	609.
1.01	6.45	81	.07	.05	.03	251.	1.01	18.45	225	.02	.02	.00	546.
1.01	6.50	82	.07	.05	.03	267.	1.01	18.50	226	.02	.02	.00	489.
1.01	6.55	83	.07	.05	.02	281.	1.01	18.55	227	.02	.02	.00	438.
1.01	7.00	84	.07	.05	.02	294.	1.01	19.00	228	.02	.02	.00	393.
1.01	7.05	85	.07	.05	.02	305.	1.01	19.05	229	.02	.02	.00	352.
1.01	7.10	86	.07	.05	.02	315.	1.01	19.10	230	.02	.02	.00	315.
1.01	7.15	87	.07	.05	.02	324.	1.01	19.15	231	.02	.02	.00	282.
1.01	7.20	88	.07	.05	.02	332.	1.01	19.20	232	.02	.02	.00	253.
1.01	7.25	89	.07	.05	.02	340.	1.01	19.25	233	.02	.02	.00	227.
1.01	7.30	90	.07	.05	.02	347.	1.01	19.30	234	.02	.02	.00	203.
1.01	7.35	91	.07	.05	.02	354.	1.01	19.35	235	.02	.02	.00	182.
1.01	7.40	92	.07	.05	.02	360.	1.01	19.40	236	.02	.02	.00	163.
1.01	7.45	93	.07	.06	.02	366.	1.01	19.45	237	.02	.02	.00	153.
1.01	7.50	94	.07	.06	.02	371.	1.01	19.50	238	.02	.02	.00	152.
1.01	7.55	95	.07	.06	.02	376.	1.01	19.55	239	.02	.02	.00	152.
1.01	8.00	96	.07	.06	.02	381.	1.01	20.00	240	.02	.02	.00	152.
1.01	8.05	97	.07	.06	.01	386.	1.01	20.05	241	.02	.02	.00	152.
1.01	8.10	98	.07	.06	.01	390.	1.01	20.10	242	.02	.02	.00	152.
1.01	8.15	99	.07	.06	.01	394.	1.01	20.15	243	.02	.02	.00	152.
1.01	8.20	100	.07	.06	.01	398.	1.01	20.20	244	.02	.02	.00	152.
1.01	8.25	101	.07	.06	.01	402.	1.01	20.25	245	.02	.02	.00	152.
1.01	8.30	102	.07	.06	.01	405.	1.01	20.30	246	.02	.02	.00	152.
1.01	8.35	103	.07	.06	.01	408.	1.01	20.35	247	.02	.02	.00	152.
1.01	8.40	104	.07	.06	.01	412.	1.01	20.40	248	.02	.02	.00	152.
1.01	8.45	105	.07	.06	.01	415.	1.01	20.45	249	.02	.02	.00	152.
1.01	8.50	106	.07	.06	.01	417.	1.01	20.50	250	.02	.02	.00	152.
1.01	8.55	107	.07	.06	.01	420.	1.01	20.55	251	.02	.02	.00	152.
1.01	9.00	108	.07	.06	.01	423.	1.01	21.00	252	.02	.02	.00	152.
1.01	9.05	109	.07	.06	.01	425.	1.01	21.05	253	.02	.02	.00	152.
1.01	9.10	110	.07	.06	.01	428.	1.01	21.10	254	.02	.02	.00	152.
1.01	9.15	111	.07	.06	.01	430.	1.01	21.15	255	.02	.02	.00	152.
1.01	9.20	112	.07	.06	.01	432.	1.01	21.20	256	.02	.02	.00	152.
1.01	9.25	113	.07	.06	.01	434.	1.01	21.25	257	.02	.02	.00	152.
1.01	9.30	114	.07	.06	.01	436.	1.01	21.30	258	.02	.02	.00	152.
1.01	9.35	115	.07	.06	.01	438.	1.01	21.35	259	.02	.02	.00	152.
1.01	9.40	116	.07	.06	.01	440.	1.01	21.40	260	.02	.02	.00	152.
1.01	9.45	117	.07	.06	.01	442.	1.01	21.45	261	.02	.02	.00	152.
1.01	9.50	118	.07	.06	.01	444.	1.01	21.50	262	.02	.02	.00	152.
1.01	9.55	119	.07	.06	.01	445.	1.01	21.55	263	.02	.02	.00	152.
1.01	10.00	120	.07	.06	.01	447.	1.01	22.00	264	.02	.02	.00	152.
1.01	10.05	121	.07	.06	.01	448.	1.01	22.05	265	.02	.02	.00	152.
1.01	10.10	122	.07	.06	.01	450.	1.01	22.10	266	.02	.02	.00	152.
1.01	10.15	123	.07	.07	.01	451.	1.01	22.15	267	.02	.02	.00	152.
1.01	10.20	124	.07	.07	.01	453.	1.01	22.20	268	.02	.02	.00	152.
1.01	10.25	125	.07	.07	.01	454.	1.01	22.25	269	.02	.02	.00	152.
1.01	10.30	126	.07	.07	.01	455.	1.01	22.30	270	.02	.02	.00	152.
1.01	10.35	127	.07	.07	.01	457.	1.01	22.35	271	.02	.02	.00	152.
1.01	10.40	128	.07	.07	.01	458.	1.01	22.40	272	.02	.02	.00	152.
1.01	10.45	129	.07	.07	.01	459.	1.01	22.45	273	.02	.02	.00	152.
1.01	10.50	130	.07	.07	.01	460.	1.01	22.50	274	.02	.02	.00	152.
1.01	10.55	131	.07	.07	.01	461.	1.01	22.55	275	.02	.02	.00	152.
1.01	11.00	132	.07	.07	.01	462.	1.01	23.00	276	.02	.02	.00	152.
1.01	11.05	133	.07	.07	.01	463.	1.01	23.05	277	.02	.02	.00	152.
1.01	11.10	134	.07	.07	.01	464.	1.01	23.10	278	.02	.02	.00	152.

INPUT UNIT HYDROGRAPH

1.01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.01	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.01	11.20	136	.07	.07	.01	466.	1.01	23.20	280	.02	.02	.00	152.
1.01	11.25	137	.07	.07	.01	467.	1.01	23.25	281	.02	.02	.00	152.
1.01	11.30	138	.07	.07	.01	468.	1.01	23.30	282	.02	.02	.00	152.
1.01	11.35	139	.07	.07	.01	469.	1.01	23.35	283	.02	.02	.00	152.
1.01	11.40	140	.07	.07	.01	469.	1.01	23.40	284	.02	.02	.00	152.
1.01	11.45	141	.07	.07	.00	470.	1.01	23.45	285	.02	.02	.00	152.
1.01	11.50	142	.07	.07	.00	471.	1.01	23.50	286	.02	.02	.00	152.
1.01	11.55	143	.07	.07	.00	472.	1.01	23.55	287	.02	.02	.00	152.
1.01	12.00	144	.07	.07	.00	472.	1.02	0.00	288	.02	.02	.00	152.
									SUM	33.80	31.58	2.22	223429.
										(859.)	(802.)	(56.)	(6326.80)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7955.	2466.	776.	776.	223366.
CMS	225.	70.	22.	22.	6325.
INCHES		25.21	31.71	31.71	31.71
MM		640.23	805.50	805.50	805.50
AC-FT		1223.	1538.	1538.	1538.
THOUS CU M		1508.	1898.	1898.	1898.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	796.	247.	78.	78.	22337.
CMS	23.	7.	2.	2.	633.
INCHES		2.52	3.17	3.17	3.17
MM		64.02	80.55	80.55	80.55
AC-FT		122.	154.	154.	154.
THOUS CU M		151.	190.	190.	190.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1193.	370.	116.	116.	33505.
CMS	34.	10.	3.	3.	949.
INCHES		3.78	4.76	4.76	4.76
MM		96.03	120.83	120.83	120.83
AC-FT		183.	231.	231.	231.
THOUS CU M		226.	285.	285.	285.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1591.	493.	155.	155.	44673.
CMS	45.	14.	4.	4.	1265.
INCHES		5.04	6.34	6.34	6.34
MM		128.05	161.10	161.10	161.10
AC-FT		245.	308.	308.	308.
THOUS CU M		302.	380.	380.	380.

HYDROGRAPH AT STAINFLOW FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2387.	740.	233.	233.	67010.
CMS	68.	21.	7.	7.	1898.
INCHES		7.56	9.51	9.51	9.51

INPUT UNIT HYDROGRAPH

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1135.50	1135.50	1141.20
STORAGE	0.	0.	492.
OUTFLOW	0.	0.	661.

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
.10	1137.16	0.00	135.	45.	0.00	18.92	0.00
.15	1137.89	0.00	196.	96.	0.00	18.67	0.00
.20	1138.56	0.00	254.	161.	0.00	18.50	0.00
.30	1139.74	0.00	357.	334.	0.00	18.33	0.00
.50	1141.55	.35	525.	907.	2.67	17.58	0.00
1.00	1142.98	1.78	670.	6016.	4.83	16.17	0.00

COMPUTER SUMMARY ANALYSIS