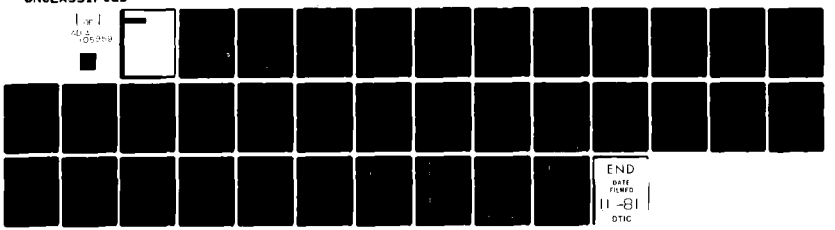
AD-A105 959 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. FAIRVIEW LAKE DAM (MO 10976), MISS--ETC(U)
AUG 78 K ALEXANDER, C N HSIEH

UNCLASSIFIED NL

1 of 1
AD A 105959



END
DATE FILMED
11-81
DTIC

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER / 2. GOVT ACCESSION NO. AD-A105 959	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Fairview Lake Dam (MO 10976) Boone County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Corps of Engineers, St. Louis District	8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE September 1978
	13. NUMBER OF PAGES Approximately 30
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)* UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

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.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

FAIRVIEW LAKE DAM
BOONE COUNTY, MISSOURI
MISSOURI INVENTORY NO. 10976

(6) PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Fairview Lake Dam (MO 10976).
Missouri - Kansas City Basin. Boone County,
Missouri. Phase I Inspection Report.

(9) Final rept.

(10) Ken /Alexander Chien (Nancy) /Hsieh

(12) 36

PREPARED BY: ST. LOUIS DISTRICT CORPS OF ENGINEERS
FOR: GOVERNOR OF MISSOURI
AUG[redacted]78

(11)

1-1525

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Fairview Lake Dam
State Located: Missouri
County Located: Boone County
Stream: Tributary to County House Branch
Date of Inspection: 13 April 1978

Fairview Lake Dam was inspected by a team of engineers from the St. Louis District, U. S. Army 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 assessment of the dam size and hazard classification was based on "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 engineeers.

Based on the guidelines, this dam is classified small size dam with high downstream hazard potential. A sudden failure will significantly increase the potential for loss of life; serious damage to homes; and extensive damage to property downstream of the dam.

Based on hydraulic - hydrologic analysis, the drop inlet spillway does not meet the criteria set forth in the guidelines for a dam of the size and hazard classification designated. The drop inlet spillway will not pass a one percent chance flood (100 year flood) without overtopping. The dam will begin to be overtopped by 15 percent of the Probable Maximum Flood (PMF) which is less than the 50 percent PMF recommended in the guidelines for a dam of this size and hazard potential. Overtopping is likely to cause a sudden failure of the dam. This dam is classified as unsafe for overtopping conditions discussed above. However, no conditions were observed that would pose an emergency at non-overtopping conditions.

Based on a visual inspection and available data, the Fairview Lake Dam has the following additional deficiencies which are considered to have an adverse effect on the safety of the dam:

a. Extensive erosion and undermining at the exit portals of the corrugated metal pipes.

b. Heavy vegetation and trees growing on the downstream slope of the dam.

c. The dam does not have seepage or stability analyses records available. In accordance with the above guidelines, the absence of such records is a deficiency which should be rectified.

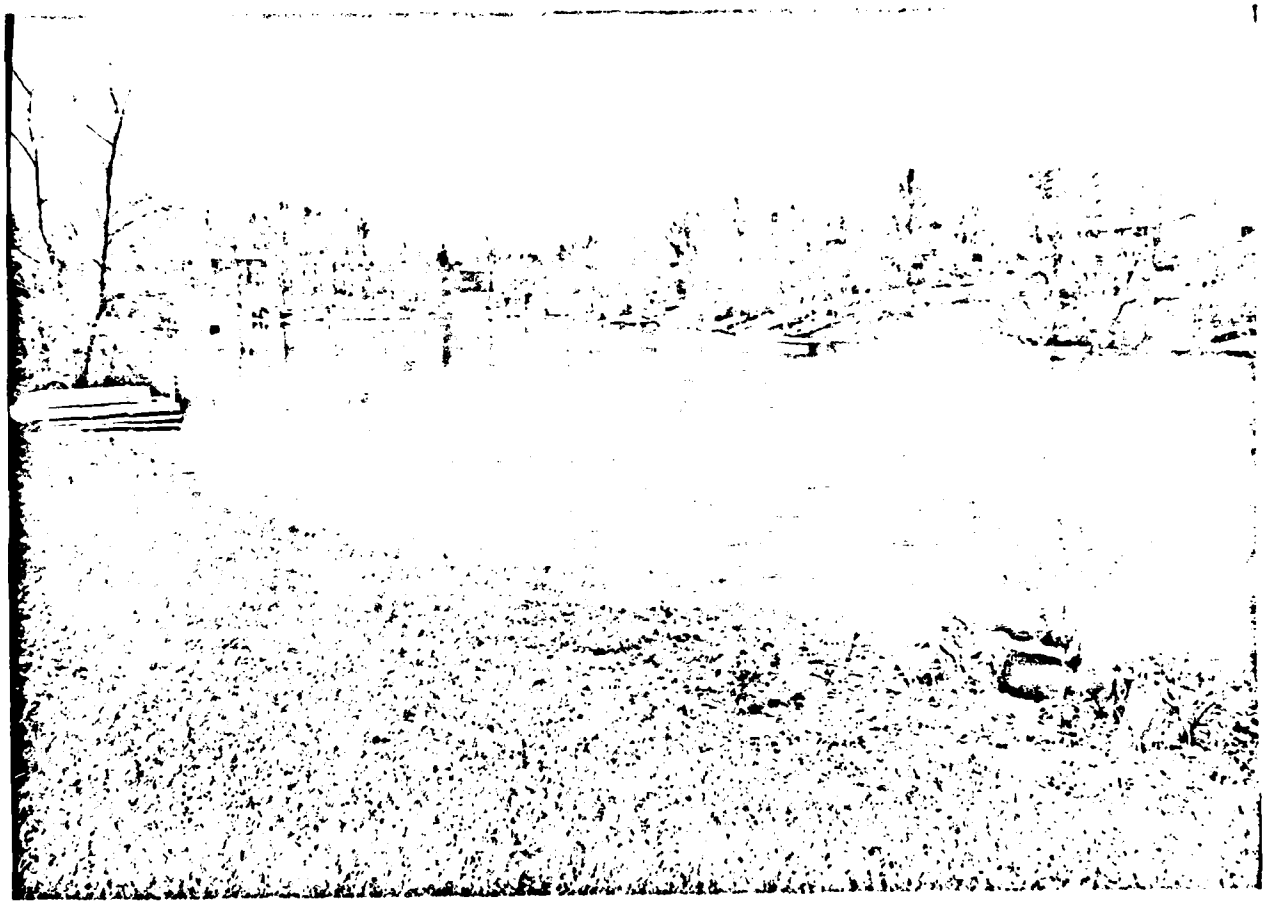
It is recommended that the owner take the necessary action in the near future to correct or control the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

Ken Alexander
KEN ALEXANDER
Soils Engineer

Chien Hsieh
CHIEN (NANCY) HSIEH
Hydraulic Engineer

Submitted By _____ 21 Sept 78
Chief, Engineering Division — Date

Approved By _____ 22 Sep 78
Colonel, CE, District Engineer — Date



OVERVIEW OF FAIRVIEW LAKE DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
FAIRVIEW LAKE DAM - ID NOS. 10976

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF PLATES

LIST OF PHOTOGRAPHS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
FAIRVIEW LAKE DAM ID NO. 10976

SECTION I - 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 a safety inspection of the Fairview Lake Dam.

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 Guidelines. The inspection and evaluation were performed in accordance with the investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams" Appendix D, published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenance.

The dam is an earth structure north of the Missouri River near Columbia, Missouri. Topography near the dam is gently rolling and is shown on PLATE 1.

The spillway is a 44-foot long curb opening drop inlet, which has eight 5-foot long by 8-inch high openings at the east overbank abuting the dam (see Photo 1). The water enters the openings and drops through a vertical shaft and flows to the downstream river channel through a 30 inch corrugated metal pipe and exit channel (see Photos 2 and 3). The earth embankment of the dam supports an asphalt paved roadway with concrete curb gutter on both sides and a 4-foot wide sidewalk on the south of the road (see Photo 4).

The pertinent physical data are given in paragraph 1.3 below and the general layout of the dam is shown on PLATE 3.

b. Location. The dam is located in the SW 1/4 of Section 15, T48N, R3W at west side of city of Columbia, Missouri, Boone County, as shown on PLATES 1 and 2.

c. Size Classification. The size classification of a dam and impoundment is based on the height of the dam and storage capacity. Fairview Lake Dam is in the small size category (per the guidelines referenced in paragraph 1.1c above).

d. Hazard Classification. The dam is in the high hazard classification.

e. Ownership. Dam is owned by Fairview Lake Association, Dr. Thomas E. Coyle (President of the Association), 601 Eastlake Drive, Columbia, Missouri 65201.

f. Purpose of Dam. The dam impounds water for the purpose of recreation.

g. Design and Construction History. The inspection team was unable to find any design data on the dam. Recent information obtained from Mr. Carl Hulen, the original owner, indicated that the dam was constructed during 1947-1948 by the Bill Goodson Construction Co.

h. Normal Operating Procedure. The lake level is governed by the drop inlet spillway.

1.3 PERTINENT DATA

a. Drainage Areas - 46 Acres

b. Dishcarge at Damsite.

(1) All discharge at the damsite is through curb opening drop inlet with 30 inch CMP.

(2) Ungated spillway capacity at maximum pool elevation is 45 cfs., estimated.

c. Elevation. (feet above MSL)

(1) Top Dam - 711.5 ±

(2) Stream bed at centerline of dam - 677 ± Est.

(3) Maximum tailwater - unknown

d. Reservoir.

(1) Length of Maximum Pool (feet) - 700 ±

e. Storage. Unknown.

f. Reservoir Surface. (Acres) - Top of dam 2± Est.

g. Dam.

(1) Type - earth embankment

(2) Length, (feet) - 230 ±

(3) Height, (feet) - 35 Est.

(4) Top width (feet) - 28 ±

(5) Side Slopes
Upstream IV on 1H
Downstream IV on 3 H

h. Diversion and Regulating Tunnel. None

i. Spillway.

(1) Type and Size - 44 feet (8 - 5-foot x 8-inch) curb opening drop inlet for a 30 inch CMP

(2) Invert elevation, (feet MSL) - 709.9 ±

j. Regulating Outlets. None

SECTION II - ENGINEERING DATA

2.1 DESIGN

Design data for this structure was not available.

2.2 CONSTRUCTION

The dam was constructed in 1947 and 1948 by the Bill Goodson Construction Company. The original owner (Mr. Carl Hulen) reported all embankment material was compacted with a sheepsfoot roller.

2.3 OPERATION

No operational records were found. The dam has a high level uncontrolled spillway for controlling lake level.

2.4 EVALUATION

a. Availability. None

b. Adequacy.

c. Validity. No valid engineering data was found on design or construction of the dam.

SECTION III - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the dam outlet spillway and exit channel was made on 13 April 1978 by Corps of Engineers, St. Louis District personnel.

b. Dam. The location, profile, and section of the dam is shown on PLATES 1 through 5.

The exposed portion of the dam upstream slope above the water level was very steep (estimated 1V on 1H) with heavy growth of trees and brush (see Photo 8). The downstream slope near the left abutment was very steep, irregular, and had a very heavy growth of vegetation (see Photo 6). The slope near the center of the dam became less steep with a berm beginning approximately one-third of the downstream height from the crown of the dam (see Photo 5). The Missouri Geological Survey reported that several years ago a slide had occurred near the right abutment. This slide was reported to contain only waste material that was placed on the downstream slope of the dam. No evidence of this slide is presently visible. The material on the downstream slope near the left abutment appears to be waste material placed after construction of the dam.

c. Appurtenant Structure.

Some deterioration of concrete was noticed at the lower end of the horizontal lip of the curb opening drop inlet spillway (see Photo 1). Two pipes were visible on the downstream slope of the dam. One 30-inch CMP was near the left abutment to release the water from the upstream spillway. One 14 inch CMP was near the center of the dam several feet above the toe to drain the storm water from pavement on top of the embankment of the dam. A significant amount of erosion and undermining at the exit ends of both pipes were noticed (see photos 2 and 7). The collapse of the slab downstream of the 30-inch pipe, as shown in Photo 2, was probably attributed to flow overtopping the sides of slab in sufficient quantity and rate to cause erosion and undermining.

d. Lake Area. No wave wash, excessive erosion or slides were observed along the shore of the lake area.

e. Downstream Channel.

The discharge from the spillway flows through the 30-inch pipe into the exit channel which is protected with broken concrete slabs and dump stones. Erosion has occurred along the exit channel (see Photo 3).

3.2 EVALUATION

The deficiencies observed during this inspection and noted herein, if left uncontrolled or uncorrected, could lead to a serious potential for failure.

SECTION IV - OPERATIONAL PROCEDURE

4.1 PROCEDURES

There is no controlled outlet works for the dam; therefore, no regulating procedure exists. The pool is controlled by rainfall, runoff, evaporation, and the capacity of the uncontrolled spillway and outlet.

4.2 MAINTENANCE OF DAM

Based on the amount of vegetation on the downstream slope of the dam, no maintenance has been accomplished on the dam for several years.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at the dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

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

4.5 EVALUATION

If lack of maintenance is allowed to continue, a serious potential for failure may develop

SECTION V - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Design data are not available.

b. Experience Data. The drainage area and lake surface area were obtained from the USGS Columbia and Huntsdale Qudrangles. The alinement of the dam, spillway, and outlet was developed from surveys made during the inspection.

c. Visual Observations.

(1) Drawdown facilities necessary to evacuate the pool did not exist at the lake.

(2) The observed condition of the spillway, culvert and exit channel are discussed in Section 3, paragraphs 3.1c and 3.1e.

d. Overtopping Potential. The drop inlet spillway and pipe of the dam is too small to pass one-half of the probable maximum or the one percent chance flood (100 year flood) without overtopping. The probable maximum flood is defined as the flood that may be expected from the most severe combination of critical meteorologic amd hydrologic conditions that are reasonably possible in the region. The one percent chance flood is a flood that would have a one percent chance of being exceeded in any given year. The drop inlet spillway and pipe has a capacity for passing 15 percent of the PMF without overtopping. Routing the one-half PMF through the lake reveals that the dam would be overtopped for approximately 4.5 hours with a maximum of 1.7 feet water and 440 cfs discharge over the top of the dam. Hydrologic and hydraulic computations are presented in Appendix A. Overtopping of the magnitude described above is likely to cause sudden failure of the dam. The tsunami wave from a sudden failure of this dam will threaten the safety of the people and property downstream of the dam.

SECTION VI - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Conditions observed which affect the structural stablity of the dam is discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found.

c. Operating Records. No appurtenant stuctures requiring operation exist at the dam.

d. Seismic Stability. Since the dam is located in Seismic Zone 1, it is not likely that an earthquake would occur of sufficient intensity to cause severe damage or failure of the dam.

SECTION VII - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The dam inspected did not have seepage or stability analyses records. To assure that conventional safety margins exist, these records should be obtained. Other deficiencies observed which could lead to unsafe conditions are:

(1) Heavy growth of vegetation and trees on the downstream slope and a few trees on the upstream slope of the dam

(2) Erosions at exit portals and exit channel of the 30- and 14-inch pipes.

(3) Inadequate spillway.

b. Adequacy of Information. Due to the lack of engineering design and construction data, the conclusions in this report were based on performance history and visual conditions. Guidelines furnished for inspection of dams requires that seepage and stability analyses be on file for each dam inspection. No such data was available for the dam.

c. Urgency. The stability and seepage data discussed in paragraph 7.1a above should be obtained to assure that conventional safety margins exist. Also, means of controlling the seepage referred to in paragraph 7.1a above should be accomplished. If stability or seepage data indicates an unsafe condition, the condition should be corrected. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the other deficiencies listed in paragraph 7.1a are not corrected they could continue to deteriorate and lead to a serious potential failure. Therefore, these deficiencies should be corrected or controlled in the near future.

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

e. Seismic Stability. The dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to cause structure failure to the earth dam.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) The outlet size and/or height of the dam should be increased to pass the probable maximum flood without overtopping the dam or to use other positive means for protecting the dam from sudden failure due to overtopping.

(2) If stability analysis of the dam shows an unacceptable factor of safety, methods of stabilizing the dam should be studied.

b. O&M Maintenance and Procedures. The following Operation and maintenance procedures are recommended:

(1) Remove trees and heavy vegetation from the slopes of the dam.

(2) Repair erosion and undermining and provide erosion protection and/or energy dissipators at the exit end of the two pipes on the downstream slope of Fairview Lake Dam.

(3) Keep the culverts and spillway clean.

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

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 total 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 non-peak 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 deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions.

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.

b. A triangular weir formula is used for the dam overtopping analysis.

$$Q = C^1 \, ZH^{2.5} = CH^{2.C}$$

$$C^1 = 2.4$$

$$Z = \frac{1}{2} \left(\frac{1}{S_1} + \frac{1}{S_2} \right)$$

(S is the slope of the top of the dam ft./ft.) H = Head on the lowest point of the dam.

```
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  29 AUG 78
 ********************************
      1              A1        DAM INSPECTION 13 APRIL 1978
      2              A2        FAIRVIEW LAKE DAME COLUMBIA MO
      3              A3        SCS HYDROGRAPHS PMP AND 1PMP
      4              B    288      0       5       0       0       0       0       0      -5       0
      5              B1     5
      6              J      1      4       1
      7              J1   1.0     .2      .3      .5
      8              K      0      1       0       0       1       3       1
      9              K1       CALCULATION OF INFLOW HYDROGRAPH OF FAIRVIEW LAKE DAMD
     10              M      1      2     .07       0       0       1       0       0       1
     11              P      0     25     102     121     130
     12              T      0      0       0       0       0       0      -1     -85
     13              W2     0    .07
     14              X     30     40       2
     15              K      1      2       0       0       0       0       1
     16              K1       ROUTED FLOW THROUGH DROP INLET SPILLWAY AND 30 INCH CMP AND TOP OF DAM
     17              Y      0      0       0       1       1
     18              Y1     1      0       0       0       0       0  -709.9      -1
     19              Y4 709.9    710     711   711.9     713     718
     20              Y5     1     32      40      45      50      70
     21              SA     0    2.3     2.3     2.4     2.5     2.5     3.0
     22              SE 677.3  709.9     710     711   711.9     713     718
     23              SS 709.9
     24              SD 711.5    120     2.5       1
     25              K     99
 1                        PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                          RUNOFF HYDROGRAPH AT          1
                          ROUTE HYDROGRAPH TO           2
                          END OF NETWORK

 1********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
```

DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 29 AUG 78
****** **********

RUN DATE= 78/09/01.
TIME= 09.16.39.

DAM INSPECTION 13 APRIL 1978
FAIRVIEW LAKE DAME COLUMBIA MO
SCS HYDROGRAPHS PMP AND 1PMP

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	-5	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH OF FAIRVIEW LAKE DAME

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.07	0.00	.07	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.00	102.00	121.00	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	-85.00	0.00	0.00

CURVE NO = -85.00 WETNESS = -1.00 EFFECT CN = 85.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .07

RECESSION DATA
STRTQ= 30.00 QRCSN= 40.00 RTIOR= 2.00

TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

UNIT HYDROGRAPH 6 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .07 VOL= 1.00
257. 203. 58. 17. 5. 2.

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	0.00	.01	28.	1.01	12.05	145	.21	.20	.01	69.
1.01	.10	2	.01	0.00	.01	26.	1.01	12.10	146	.21	.20	.01	97.
1.01	.15	3	.01	0.00	.01	24.	1.01	12.15	147	.21	.20	.01	105.

1.01	.20	4	.01	0.00	.01	23.	1.01	12.20	148	.21	.20	.01	109.
.01	.25	5	.01	0.00	.01	21.	1.01	12.25	149	.21	.20	.01	110.
.01	.30	6	.01	0.00	.01	20.	1.01	12.30	150	.21	.20	.01	110.
1.01	.35	7	.01	0.00	.01	18.	.01	12.35	151	.21	.20	.01	110.
1.01	.40	8	.01	0.00	.01	17.	1.01	12.40	152	.21	.20	.01	110.
1.01	.45	9	.01	0.00	.01	16.	1.01	12.45	153	.21	.20	.01	110.
1.01	.50	10	.01	0.00	.01	15.	1.01	12.50	154	.21	.20	.01	111.
1.01	.55	11	.01	0.00	.01	14.	1.01	12.55	155	.21	.20	.01	111.
1.01	1.00	12	.01	0.00	.01	13.	1.01	13.00	156	.21	.21	.01	111.
1.01	1.05	13	.01	0.00	.01	12.	1.01	13.05	157	.26	.25	.01	122.
1.01	1.10	14	.01	0.00	.01	11.	1.01	13.10	158	.26	.25	.01	130.
1.01	1.15	15	.01	0.00	.01	11.	1.01	13.15	159	.26	.25	.01	133.
1.01	1.20	16	.01	0.00	.01	10.	1.01	13.20	160	.26	.25	.01	134.
1.01	1.25	17	.01	0.00	.01	9.	1.01	13.25	161	.26	.25	.01	134.
1.01	1.30	18	.01	0.00	.01	9.	1.01	13.30	162	.26	.25	.01	134.
1.01	1.35	19	.01	0.00	.01	8.	1.01	13.35	163	.26	.25	.01	135.
1.01	1.40	20	.01	0.00	.01	8.	1.01	13.40	164	.26	.25	.01	135.
1.01	1.45	21	.01	0.00	.01	7.	1.01	13.45	165	.26	.25	.01	135.
1.01	1.50	22	.01	0.00	.01	7.	1.01	13.50	166	.26	.25	.01	135.
1.01	1.55	23	.01	0.00	.01	6.	1.01	13.55	167	.26	.25	.01	135.
1.01	2.00	24	.01	0.00	.01	6.	1.01	14.00	168	.26	.25	.01	135.
1.01	2.05	25	.01	0.00	.01	5.	1.01	14.05	169	.32	.31	.01	152.
1.01	2.10	26	.01	0.00	.01	5.	1.01	14.10	170	.32	.31	.01	164.
1.01	2.15	27	.01	0.00	.01	5.	1.01	14.15	171	.32	.31	.01	168.
1.01	2.20	28	.01	0.00	.01	4.	1.01	14.20	172	.32	.31	.01	169.
1.01	2.25	29	.01	.00	.01	4.	1.01	14.25	173	.32	.31	.00	170.
1.01	2.30	30	.01	.00	.01	4.	1.01	14.30	174	.32	.31	.00	170.
1.01	2.35	31	.01	.00	.01	4.	1.01	14.35	175	.32	.31	.00	170.
1.01	2.40	32	.01	.00	.01	4.	1.01	14.40	176	.32	.31	.00	170.
1.01	2.45	33	.01	.00	.01	3.	1.01	14.45	177	.32	.31	.00	170.
1.01	2.50	34	.01	.00	.01	3.	1.01	14.50	178	.32	.31	.00	170.
1.01	2.55	35	.01	.00	.01	3.	1.01	14.55	179	.32	.31	.00	171.
1.01	3.00	36	.01	.00	.01	3.	1.01	15.00	180	.32	.32	.00	171.
1.01	3.05	37	.01	.00	.01	3.	1.01	15.05	181	.19	.19	.00	139.
1.01	3.10	38	.01	.00	.01	3.	1.01	15.10	182	.39	.38	.00	163.
1.01	3.15	39	.01	.00	.01	3.	1.01	15.15	183	.39	.38	.00	195.
1.01	3.20	40	.01	.00	.01	3.	1.01	15.20	184	.58	.58	.01	254.
1.01	3.25	41	.01	.00	.01	3.	1.01	15.25	185	.68	.67	.01	320.
1.01	3.30	42	.01	.00	.01	3.	1.01	15.30	186	1.65	1.63	.01	599.
1.01	3.35	43	.01	.00	.01	3.	1.01	15.35	187	2.71	2.70	.02	1077.
1.01	3.40	44	.01	.00	.01	3.	1.01	15.40	188	1.07	1.06	.01	930.
1.01	3.45	45	.01	.00	.01	3.	1.01	15.45	189	.68	.67	.00	576.
1.01	3.50	46	.01	.00	.01	3.	1.01	15.50	190	.58	.58	.00	402.
1.01	3.55	47	.01	.00	.01	3.	1.01	15.55	191	.39	.39	.00	290.
1.01	4.00	48	.01	.00	.01	3.	1.01	16.00	192	.39	.39	.00	232.
1.01	4.05	49	.01	.00	.01	3.	1.01	16.05	193	.30	.30	.00	192.
1.01	4.10	50	.01	.00	.01	3.	1.01	16.10	194	.30	.30	.00	169.
1.01	4.15	51	.01	.00	.01	3.	1.01	16.15	195	.30	.30	.00	163.
1.01	4.20	52	.01	.00	.01	3.	1.01	16.20	196	.30	.30	.00	161.
1.01	4.25	53	.01	.00	.01	3.	1.01	16.25	197	.30	.30	.00	161.
1.01	4.30	54	.01	.00	.01	3.	1.01	16.30	198	.30	.30	.00	161.
1.01	4.35	55	.01	.00	.01	3.	1.01	16.35	199	.30	.30	.00	161.
1.01	4.40	56	.01	.00	.01	3.	1.01	16.40	200	.30	.30	.00	161.
1.01	4.45	57	.01	.00	.01	3.	1.01	16.45	201	.30	.30	.00	161.
1.01	4.50	58	.01	.00	.01	3.	1.01	16.50	202	.30	.30	.00	161.
1.01	4.55	59	.01	.00	.01	3.	1.01	16.55	203	.30	.30	.00	161.
1.01	5.00	60	.01	.00	.01	3.	1.01	17.00	204	.30	.30	.00	161.
1.01	5.05	61	.01	.00	.01	3.	1.01	17.05	205	.23	.23	.00	144.
1.01	5.10	62	.01	.00	.01	3.	1.01	17.10	206	.23	.23	.00	131.
1.01	5.15	63	.01	.00	.01	3.	1.01	17.15	207	.23	.23	.00	128.

1.01	5.20	64	.01	.00	.01	3.	1.01	17.20	208	.23	.23	.00	127.
1.01	5.25	65	.01	.00	.01	3.	1.01	17.25	209	.23	.23	.00	126.
1.01	5.30	66	.01	.00	.01	3.	1.01	17.30	210	.23	.23	.00	126.
1.01	5.35	67	.01	.00	.01	3.	1.01	17.35	211	.23	.23	.00	126.
1.01	5.40	68	.01	.00	.01	3.	1.01	17.40	212	.23	.23	.00	126.
1.01	5.45	69	.01	.00	.01	3.	1.01	17.45	213	.23	.23	.00	126.
1.01	5.50	70	.01	.01	.01	3.	1.01	17.50	214	.23	.23	.00	126.
1.01	5.55	71	.01	.01	.01	3.	1.01	17.55	215	.23	.23	.00	126.
1.01	6.00	72	.01	.01	.01	3.	1.01	18.00	216	.23	.23	.00	126.
1.01	6.05	73	.07	.03	.04	9.	1.01	18.05	217	.02	.02	.00	71.
1.01	6.10	74	.07	.03	.04	14.	1.01	18.10	218	.02	.02	.00	39.
1.01	6.15	75	.07	.03	.03	17.	1.01	18.15	219	.02	.02	.00	37.
1.01	6.20	76	.07	.03	.03	18.	1.01	18.20	220	.02	.02	.00	34.
1.01	6.25	77	.07	.04	.03	19.	1.01	18.25	221	.02	.02	.00	32.
1.01	6.30	78	.07	.04	.03	20.	1.01	18.30	222	.02	.02	.00	30.
1.01	6.35	79	.07	.04	.03	20.	1.01	18.35	223	.02	.02	.00	28.
1.01	6.40	80	.07	.04	.03	21.	1.01	18.40	224	.02	.02	.00	26.
1.01	6.45	81	.07	.04	.02	22.	1.01	18.45	225	.02	.02	.00	24.
1.01	6.50	82	.07	.04	.02	23.	1.01	18.50	226	.02	.02	.00	23.
1.01	6.55	83	.07	.04	.02	23.	1.01	18.55	227	.02	.02	.00	21.
1.01	7.00	84	.07	.04	.02	24.	1.01	19.00	228	.02	.02	.00	20.
1.01	7.05	85	.07	.05	.02	24.	1.01	19.05	229	.02	.02	.00	18.
1.01	7.10	86	.07	.05	.02	25.	1.01	19.10	230	.02	.02	.00	17.
1.01	7.15	87	.07	.05	.02	25.	1.01	19.15	231	.02	.02	.00	16.
1.01	7.20	88	.07	.05	.02	25.	1.01	19.20	232	.02	.02	.00	15.
1.01	7.25	89	.07	.05	.02	26.	1.01	19.25	233	.02	.02	.00	14.
1.01	7.30	90	.07	.05	.02	26.	1.01	19.30	234	.02	.02	.00	13.
1.01	7.35	91	.07	.05	.02	27.	1.01	19.35	235	.02	.02	.00	12.
1.01	7.40	92	.07	.05	.02	27.	1.01	19.40	236	.02	.02	.00	11.
1.01	7.45	93	.07	.05	.02	27.	1.01	19.45	237	.02	.02	.00	11.
1.01	7.50	94	.07	.05	.01	28.	1.01	19.50	238	.02	.02	.00	10.
1.01	7.55	95	.07	.05	.01	28.	1.01	19.55	239	.02	.02	.00	10.
1.01	8.00	96	.07	.05	.01	28.	1.01	20.00	240	.02	.02	.00	10.
1.01	8.05	97	.07	.05	.01	28.	1.01	20.05	241	.02	.02	.00	10.
1.01	8.10	98	.07	.05	.01	29.	1.01	20.10	242	.02	.02	.00	10.
1.01	8.15	99	.07	.05	.01	29.	1.01	20.15	243	.02	.02	.00	10.
1.01	8.20	100	.07	.05	.01	29.	1.01	20.20	244	.02	.02	.00	10.
1.01	8.25	101	.07	.05	.01	29.	1.01	20.25	245	.02	.02	.00	10.
1.01	8.30	102	.07	.05	.01	29.	1.01	20.30	246	.02	.02	.00	10.
1.01	8.35	103	.07	.05	.01	30.	1.01	20.35	247	.02	.02	.00	10.
1.01	8.40	104	.07	.06	.01	30.	1.01	20.40	248	.02	.02	.00	10.
1.01	8.45	105	.07	.06	.01	30.	1.01	20.45	249	.02	.02	.00	10.
1.01	8.50	106	.07	.06	.01	30.	1.01	20.50	250	.02	.02	.00	10.
1.01	8.55	107	.07	.06	.01	30.	1.01	20.55	251	.02	.02	.00	10.
1.01	9.00	108	.07	.06	.01	31.	1.01	21.00	252	.02	.02	.00	10.
1.01	9.05	109	.07	.06	.01	31.	1.01	21.05	253	.02	.02	.00	10.
1.01	9.10	110	.07	.06	.01	31.	1.01	21.10	254	.02	.02	.00	10.
1.01	9.15	111	.07	.06	.01	31.	1.01	21.15	255	.02	.02	.00	10.
1.01	9.20	112	.07	.06	.01	31.	1.01	21.20	256	.02	.02	.00	10.
1.01	9.25	113	.07	.06	.01	31.	1.01	21.25	257	.02	.02	.00	10.
1.01	9.30	114	.07	.06	.01	31.	1.01	21.30	258	.02	.02	.00	10.
1.01	9.35	115	.07	.06	.01	31.	1.01	21.35	259	.02	.02	.00	10.
1.01	9.40	116	.07	.06	.01	32.	1.01	21.40	260	.02	.02	.00	10.
1.01	9.45	117	.07	.06	.01	32.	1.01	21.45	261	.02	.02	.00	10.
1.01	9.50	118	.07	.06	.01	32.	1.01	21.50	262	.02	.02	.00	10.
1.01	9.55	119	.07	.06	.01	32.	1.01	21.55	263	.02	.02	.00	10.
1.01	10.00	120	.07	.06	.01	32.	1.01	22.00	264	.02	.02	.00	10.
1.01	10.05	121	.07	.06	.01	32.	1.01	22.05	265	.02	.02	.00	10.
1.01	10.10	122	.07	.06	.01	32.	1.01	22.10	266	.02	.02	.00	10.
1.01	10.15	123	.07	.06	.01	32.	1.01	22.15	267	.02	.02	.00	10.

1.01	10.20	124	.07	.06	.01	32.	1.01	22.20	268	.02	.02	.00	
1.01	10.25	125	.07	.06	.01	32.	1.01	22.25	269	.02	.02	.00	10.
1.01	10.30	126	.07	.06	.01	32.	1.01	22.30	270	.02	.02	.00	10.
1.01	10.35	127	.07	.06	.01	33.	1.01	22.35	271	.02	.02	.00	10.
1.01	10.40	128	.07	.06	.01	33.	1.01	22.40	272	.02	.02	.00	10.
1.01	10.45	129	.07	.06	.01	33.	1.01	22.45	273	.02	.02	.00	10.
1.01	10.50	130	.07	.06	.01	33.	1.01	22.50	274	.02	.02	.00	10.
1.01	10.55	131	.07	.06	.01	33.	1.01	22.55	275	.02	.02	.00	10.
1.01	11.00	132	.07	.06	.01	33.	1.01	23.00	276	.02	.02	.00	10.
1.01	11.05	133	.07	.06	.01	33.	1.01	23.05	277	.02	.02	.00	10.
1.01	11.10	134	.07	.06	.01	33.	1.01	23.10	278	.02	.02	.00	10.
1.01	11.15	135	.07	.06	.00	33.	1.01	23.15	279	.02	.02	.00	10.
1.01	11.20	136	.07	.06	.00	33.	1.01	23.20	280	.02	.02	.00	10.
1.01	11.25	137	.07	.06	.00	33.	1.01	23.25	281	.02	.02	.00	10.
1.01	11.30	138	.07	.06	.00	33.	1.01	23.30	282	.02	.02	.00	10.
1.01	11.35	139	.07	.06	.00	33.	1.01	23.35	283	.02	.02	.00	10.
1.01	11.40	140	.07	.06	.00	33.	1.01	23.40	284	.02	.02	.00	10.
1.01	11.45	141	.07	.06	.00	33.	1.01	23.45	285	.02	.02	.00	10.
1.01	11.50	142	.07	.06	.00	33.	1.01	23.50	286	.02	.02	.00	10.
1.01	11.55	143	.07	.06	.00	33.	1.01	23.55	287	.02	.02	.00	10.
1.01	12.00	144	.07	.06	.00	33.	1.02	0.00	288	.02	.02	.00	10.
									SUM	32.50	30.47	2.03	17140.
										(825.)	(774.)	(51.)	(485.35)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1077.	166.	59.	59.	17115.
CMS	30.	5.	2.	2.	485.
INCHES		25.03	31.59	31.59	31.59
MM		635.79	802.37	802.37	802.37
AC-FT		93.	118.	118.	118.
THOUS CU M		115.	145.	145.	145.

1

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 FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4
				1.00	.20	.30	.50
HYDROGRAPH AT	1	.07	1	1077.	215.	323.	538.
	(	.18)	(	30.50)(	6.10)(	9.15)(	15.25)(
ROUTED TO	2	.07	1	1026.	47.	195.	486.
	(	.18)	(	29.05)(	1.32)(	5.52)(	13.77)(

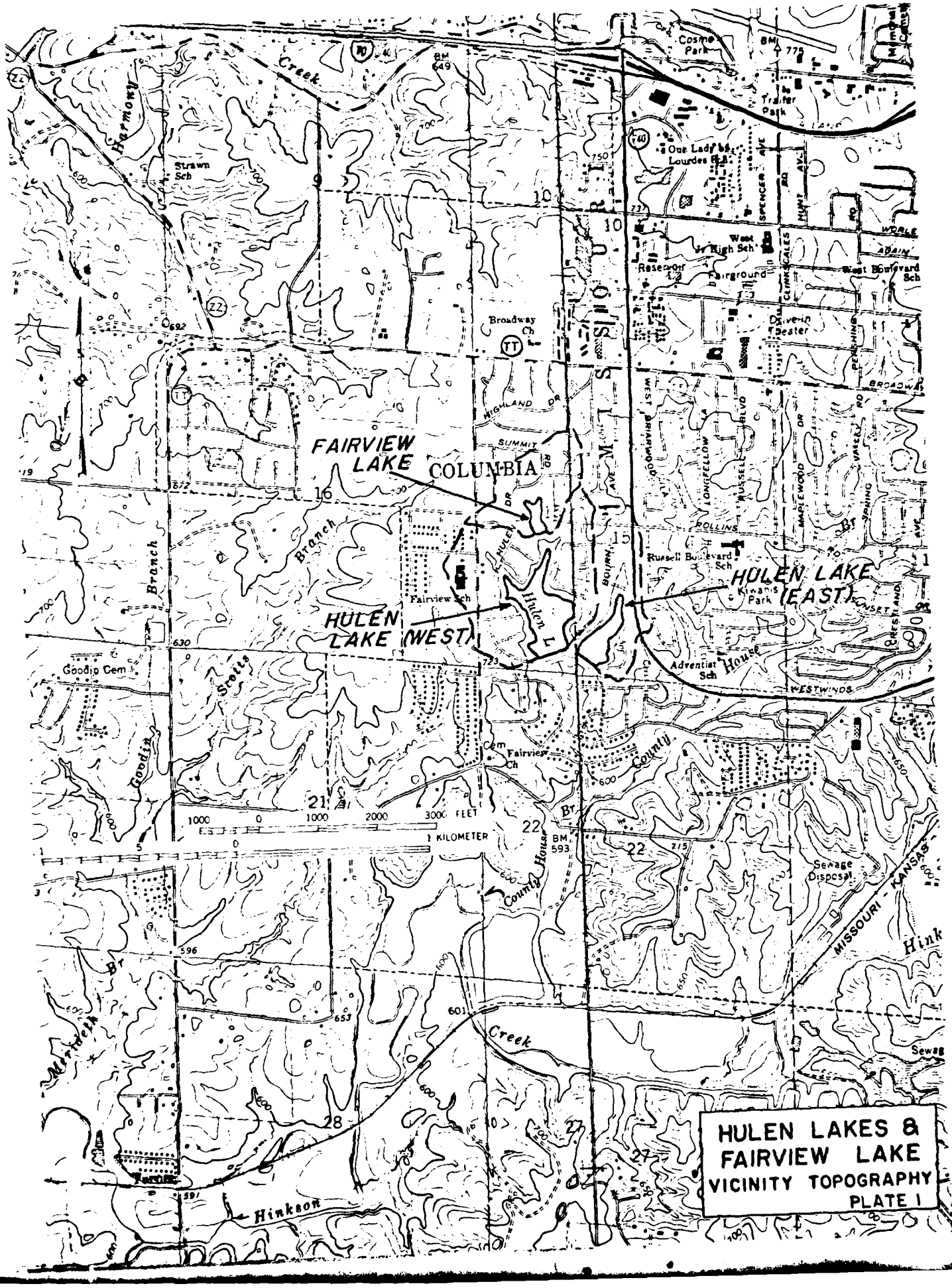
1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	709.90	709.90	711.50
	STORAGE	25.	25.	29.
	OUTFLOW	1.	1.	43.

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
.15	711.09	0.00	29.	40.	0.00	15.92	0.00
1.00	713.81	2.31	35.	1026.	6.25	15.67	0.00
.20	711.72	.22	29.	47.	.83	16.00	0.00
.30	712.58	1.08	31.	195.	2.58	15.75	0.00
.50	713.18	1.68	33.	486.	4.50	15.67	0.00

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 29 AUG 78
****


FAIRVIEW LAKE
COLUMBIA
HULEN LAKE (WEST)
HULEN LAKE (EAST)
Harmony Creek
Strawn Sch
Cosmo Park
Trailer Park
Our Lady of Lourdes R.C.
West High Sch
Reservoir
Fairground
West Boulevard Sch
Broadway Ch
Drive-in Theater
Fairview Sch
Russell Boulevard Sch
Kiwanis Park
Adventist Sch
House
Goodip Cem
Scotts Branch
Goodip Branch
Fairview Cem
Fairview Ch
Hulen Br
County Line
Sewage Disposal
Missouri - Kansas
Merrick Creek
Hinkson Creek
Terrace
Hinkson
1000 0 1000 2000 3000 FEET
1 KILOMETER
HULEN LAKES & FAIRVIEW LAKE
VICINITY TOPOGRAPHY
PLATE I

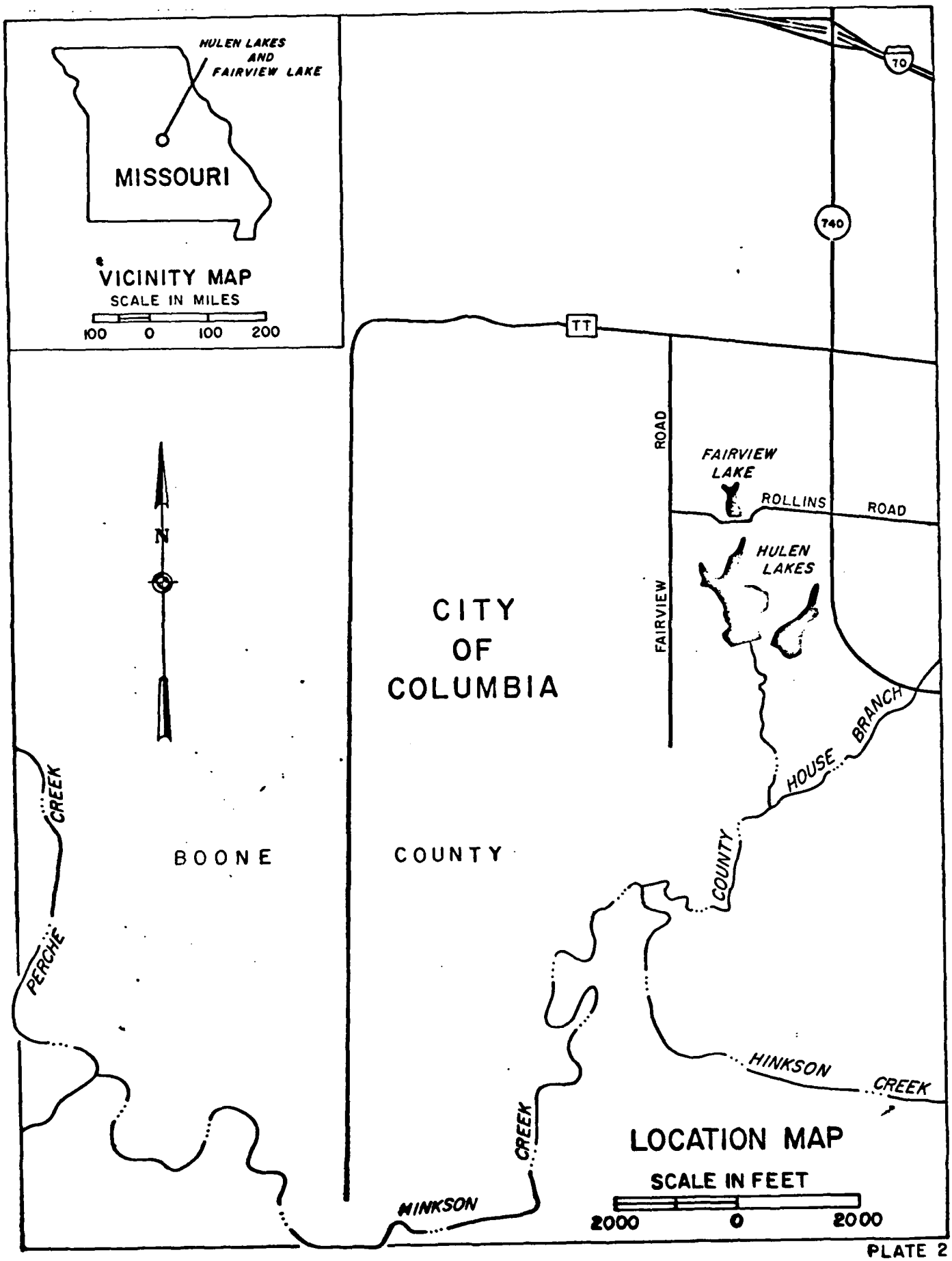
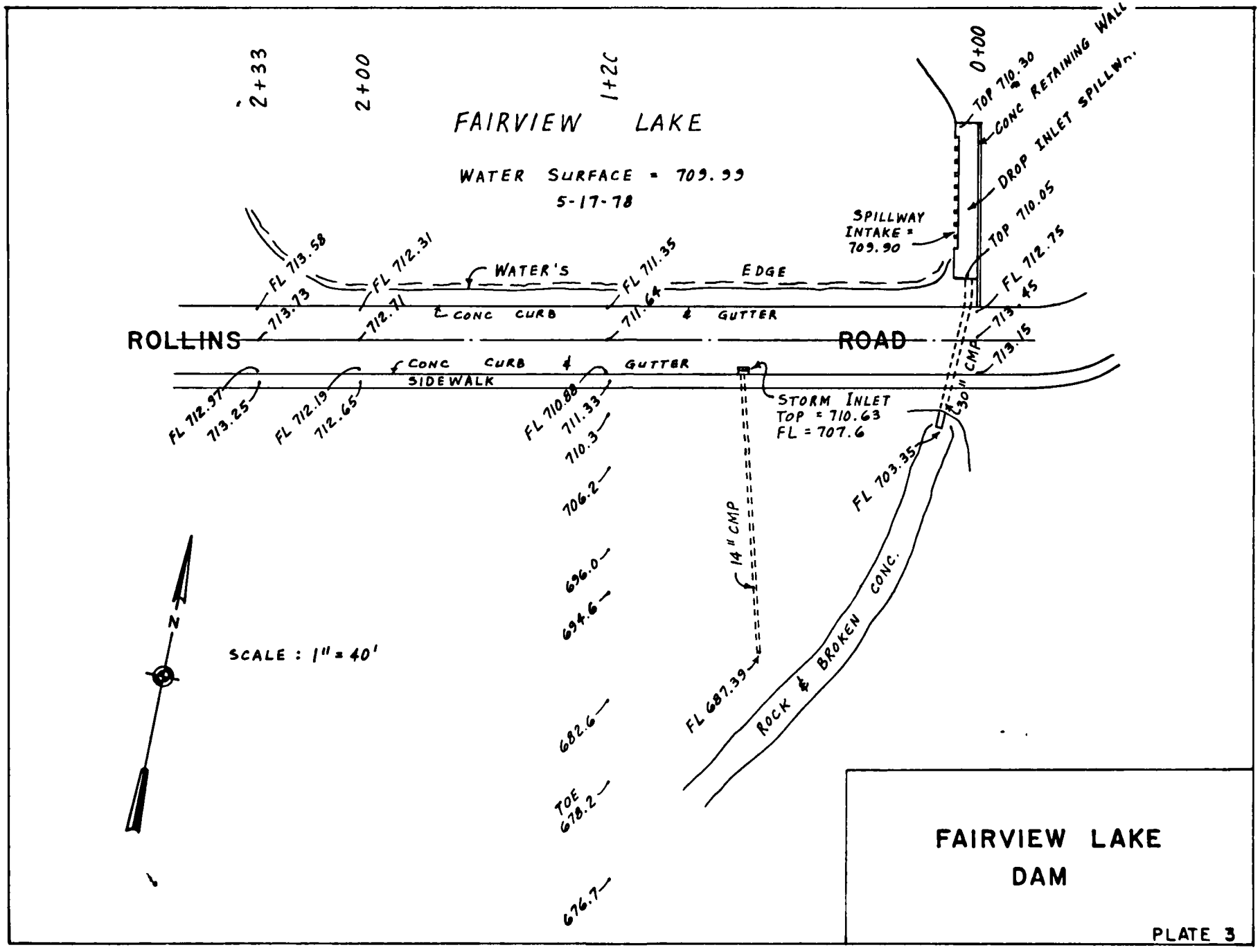

HULEN LAKES AND FAIRVIEW LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
70
740
TT
ROAD
FAIRVIEW LAKE
ROLLINS ROAD
HULEN LAKES
FAIRVIEW
N
CITY OF COLUMBIA
HOUSE BRANCH
CREEK
BOONE
COUNTY
COUNTY
PERCHE
HINKSON
CREEK
CREEK
HINKSON
LOCATION MAP
SCALE IN FEET
2000 0 2000

PLATE 2



FAIRVIEW LAKE DAM

PLATE 3

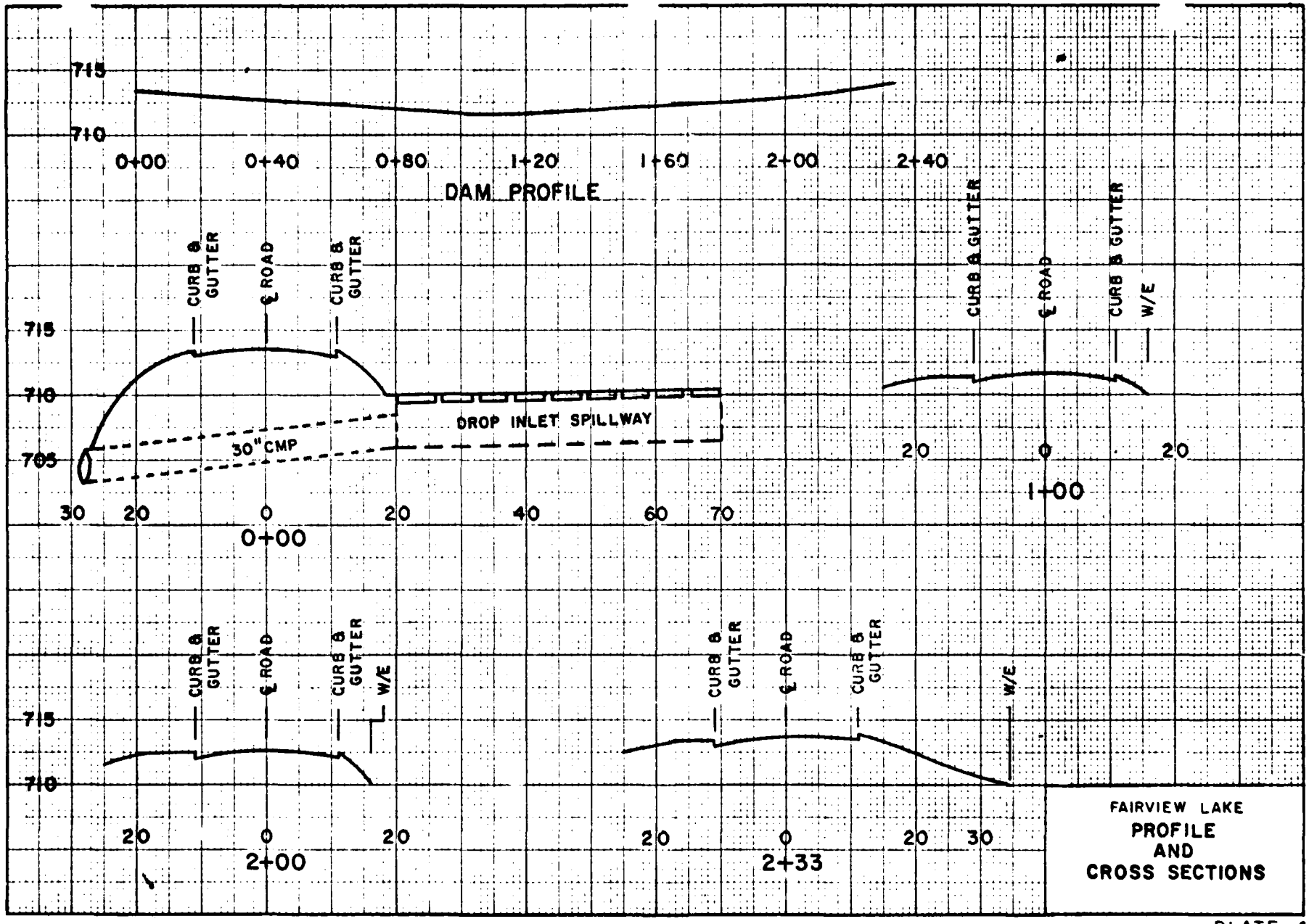

715
710
0+00
0+40
0+80
1+20
1+60
2+00
2+40
DAM PROFILE
CURB & GUTTER
℄ ROAD
CURB & GUTTER
715
710
705
DROP INLET SPILLWAY
30" CMP
30 20 0 20 40 60 70
0+00
CURB & GUTTER
℄ ROAD
CURB & GUTTER
W/E
20 0 20
1+00
CURB & GUTTER
℄ ROAD
CURB & GUTTER
W/E
715
710
20 0 20
2+00
20 0 20 30
2+33
FAIRVIEW LAKE
PROFILE
AND
CROSS SECTIONS

PLATE 4

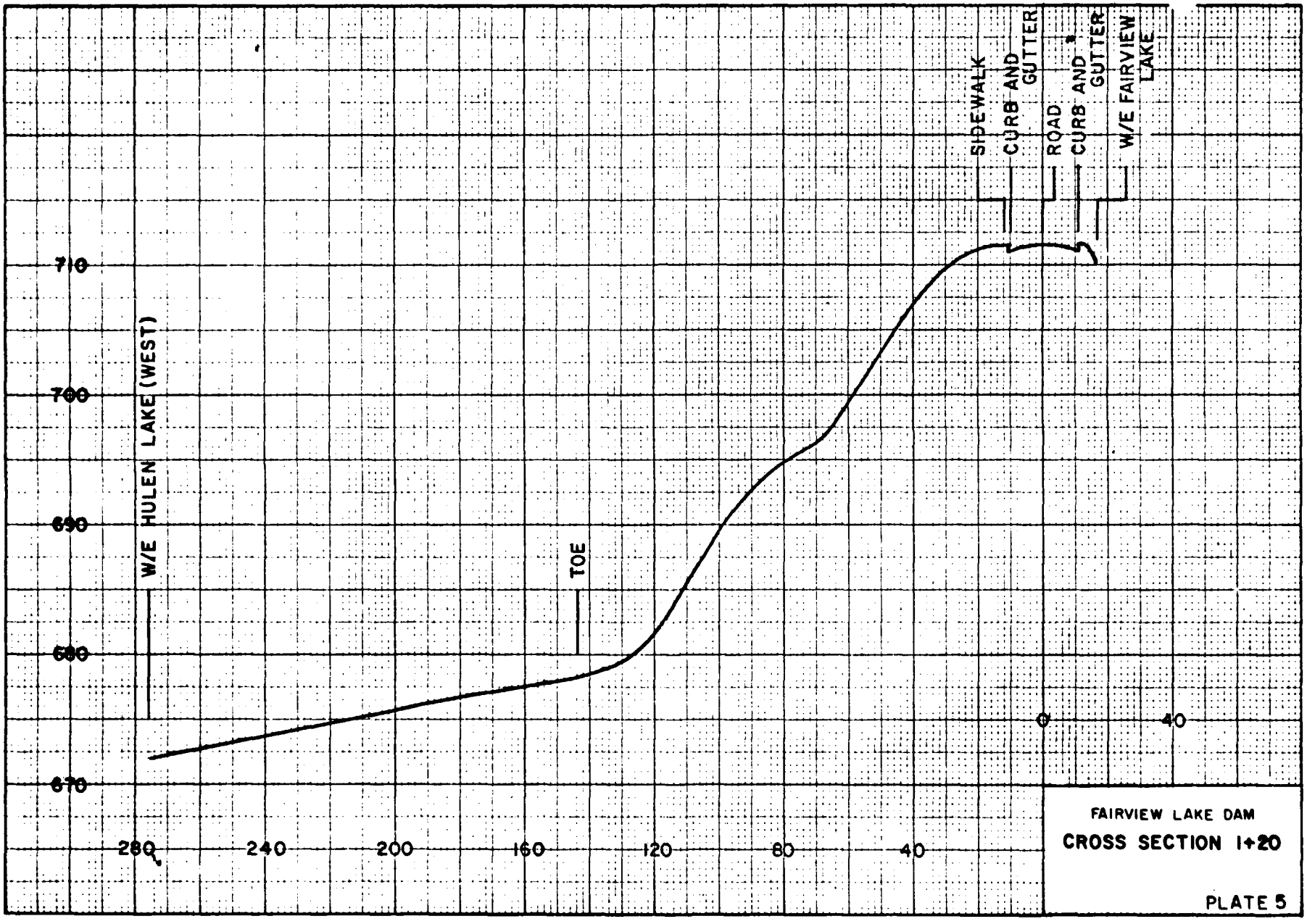

SIDEWALK
CURB AND GUTTER
ROAD
CURB AND GUTTER
W/E FAIRVIEW LAKE
W/E HULEN LAKE (WEST)
TOE
710
700
690
680
670
280
240
200
160
120
80
40
0
40
FAIRVIEW LAKE DAM
CROSS SECTION 1+20
PLATE 5

PHOTO 1

Curb opening drop inlet spillway, Fairview Lake Dam

PHOTO 2

30" CMP and Exit Portal, Fairview Lake Dam

PHOTO 3
Exit Channel, Fairview Lake Dam

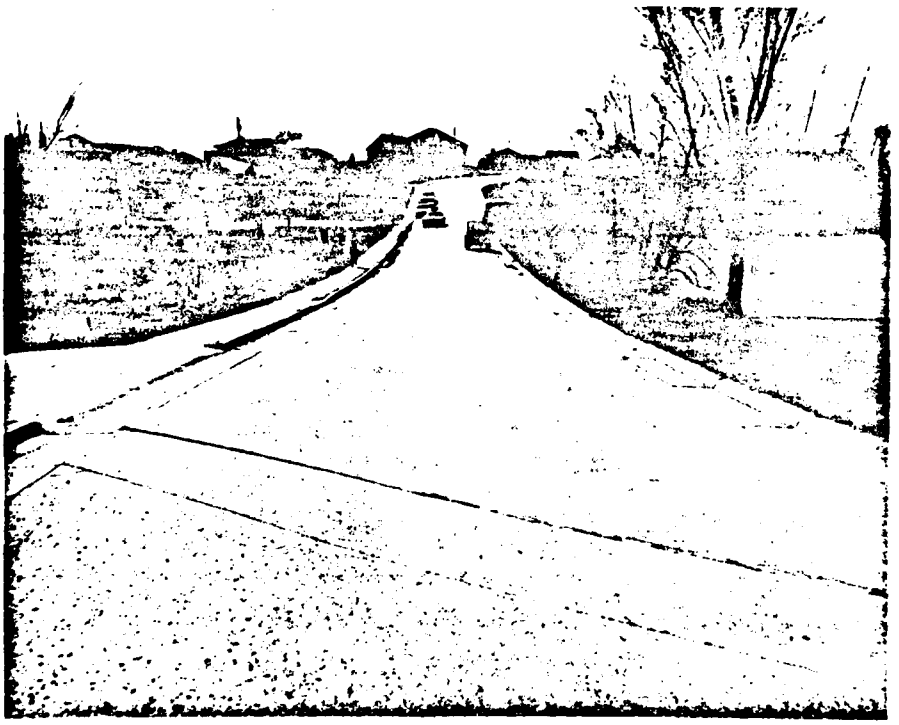


PHOTO 4
Fairview Lake Dam

PHOTO 5

Downstream Slope of Fairview Lake Dam (1 of 2)

PHOTO 6

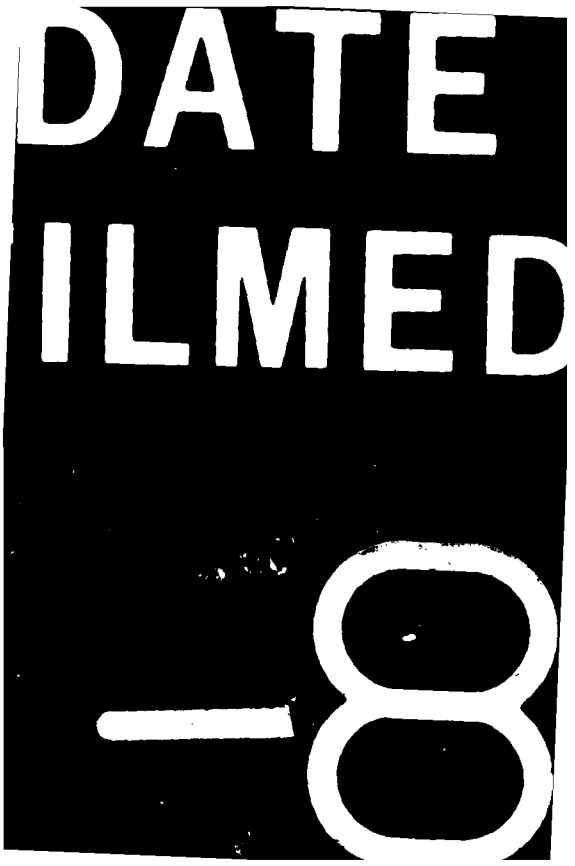
Downstream of Fairview Lake Dam (2 of 2)

PHOTO 7

14" CMP (Downstream) Fairview Lake Dam

PHOTO 8

Upstream slope of Fairview Lake Dam


DATE
ILMED
-8