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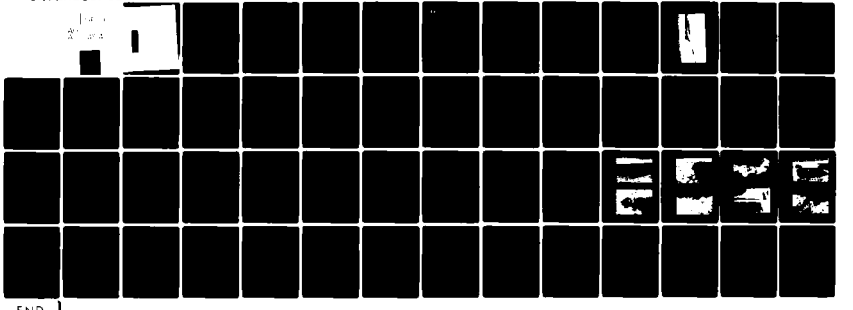

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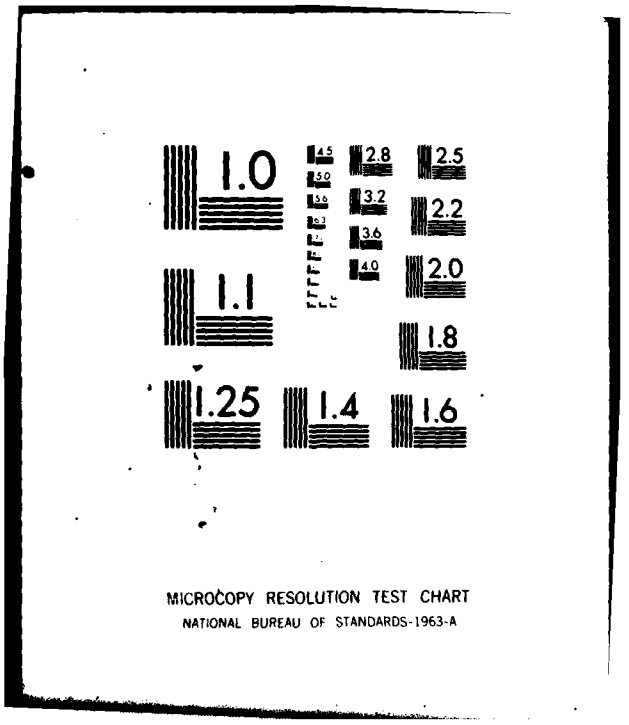
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Inventory Number VA 05910, Potomac River Basin

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REPORT DOCUMENTATION PAGE

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7. AUTHOR(s): Michael Baker, Jr., Beaver, Pennsylvania 15009	8. CONTRACT OR GRANT NUMBER(s): DACW 65-78-D-0010
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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CORRESPONDENCE (OWNER'S PROPOSED INTENTIONS)

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Fairfax County Park Authority

4030 Hummer Road, Annandale, Virginia 22003
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Dorothy S. Norpel

July 21, 1980

Mr. R.V. Davis, Executive Secretary
State Water Control Board
P.O. Box 11143
Richmond, VA 23230

Re: Lake Fairfax Dam Inventory
No. 05910

Dear Mr. Davis:

The Fairfax County Park Authority received, on June 20, 1980, your Phase I Inspection Report National Dam Safety Program for the Lake Fairfax Dam. I want to take this opportunity to thank the Corps of Engineers and your consultants, Michael Baker Jr., Inc., for the timely response in inspecting the dam and preparing the required reports.

The recommended remedial measures outlined in the report, (Section 7.2), will be accomplished as funds are available and actions are approved by the Fairfax County Park Authority Board. A qualified geotechnical engineering firm will be contracted to perform a stability check of the dam. A formal warning system and emergency action plan will be developed and put into effect as funds are available and actions are approved by the Fairfax County Park Authority Board.

The following repair items outlined in the report will be remedied under a current detail development contract by SCS Engineers and by FCPA Park Operations Division and implemented as funds are available and actions are approved by the Fairfax County Park Authority Board.

1. All erosion areas will be filled, graded and seeded to provide a permanent cover on all of the embankment area.

2. The outlet section of the 12" concrete pipe in the right downstream abutment will be reattached to the pipe immediately after the erosion gully below the pipe is repaired.

3. Additional rip rap will be placed on the left side of the upstream embankment adjacent to the right training wall of the emergency spillway approach channel.

4. The crumbling cinder blocks on the left training wall of the emergency spillway approach channel will be replaced.

5. The cracks in the cinder block training walls of the rectangular portion of the discharge channel will be repaired.

6. Debris caught in the emergency spillway will be removed.

7. The hole in the concrete chute just downstream of the road will be repaired; the large void under the downstream end of the chute will be filled.

8. The emergency gate will be repaired and maintained in an operable condition.

9. The emergency spillway will be redesigned to accommodate a 100 year storm.

The findings in this preliminary report have answered many of our questions. As per phone conversation with Mr. Robert Gay of your office on July 18, 1980, the recommendations in the final report are not expected to change. We are, therefore, notifying our design consultants to proceed in this direction.

We look forward to the receipt of the final, approved Phase I Report later this month.

Sincerely,

Louis A. Cable
Assistant Director

LAC/CJH/JES/mlb

cc: Joseph Downs, Director, FCPA
James Heberlein, Asst. Director, FCPA
Dick Jones, Supt. Land Acquisition, FCPA
Jay Jorgensen, Supt. Development, FCPA
Don Lederer, Supt. Design, FCPA
Gil Aldridge, Supt. Conservation, FCPA
Payne Johnson, Plan Review, DEM
Puller Hughes, Soil & Water Conservation
John Koenig, Storm Drainage, DPW
Kevin Boyer, SCS Engineers
Jack Starr, Engineering, Corps of Eng.
Robert Gay, Water Control Board

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Lake Fairfax Dam
State: Virginia
County: Fairfax
USGS 7.5 Minute Quadrangle: Vienna, VA-MD
Stream: Colvin Run
Date of Inspection: 15 April 1980

BRIEF ASSESSMENT OF DAM

Lake Fairfax Dam is an earthfill embankment approximately 26.2 feet high and 500 feet long with a 31 foot wide cinder block and concrete emergency spillway adjacent to the left abutment. The principal spillway is a 24 inch corrugated metal pipe acting as a riser. The dam is located in Reston, Virginia; it is owned by the Fairfax County Park Authority and is used for recreation. Lake Fairfax Dam is a "small" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 100-year flood was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 1.4 feet with an average critical velocity of 5.5 f.p.s. Total duration of dam overtopping would be approximately 4.8 hours. The spillway is capable of passing up to 35 percent of the SDF or 5 percent of the Probable Maximum Flood (PMF) and is adjudged as inadequate, but not seriously inadequate.

Based on the inadequacy of the spillway and the wet areas and seeps on and below the downstream slope, the dam is assessed as unsafe, non-emergency.

The wet areas and seeps on and below the downstream embankment require further investigation to determine if they pose a threat to the stability of the dam. A qualified geotechnical engineering firm should be retained to perform a stability check of the dam. The owner is required to engage the services of a qualified geotechnical engineering firm within two months of the issuance of the approved Phase I inspection report. The owner is required to have the consultant's report and to have reached an agreement with the state regarding required remedial measures within six months of the issuance of the approved Phase I inspection report.

A warning system and emergency action plan should be developed and put into effect as soon as possible.

The following repair items should be accomplished as part of the general maintenance of the dam:

1) All areas of erosion should be regraded and reseeded; a good grass cover should be established over the entire embankment.

2) The outlet section of the 12 inch concrete pipe in the right downstream abutment should be reattached to the pipe when the erosion gully below the pipe is repaired.

3) Additional riprap should be placed on the left side of the upstream embankment adjacent to the right training wall of the emergency spillway approach channel.

4) The crumbling cinder blocks on the left training wall of the emergency spillway approach channel should be replaced.

5) The cracks in the cinder block training walls of the rectangular portion of the discharge channel should be patched.

6) The logs caught in the emergency spillway should be removed.

7) The hole in the concrete chute just downstream of the road should be repaired; the large void under the downstream end of the chute should be filled.

8) The emergency gate should be repaired and maintained in an operable condition.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL BAKER III
NO. 3176
CERTIFIED PROFESSIONAL ENGINEER

SUBMITTED: ORIGINAL SIGNED BY: JOHN H. SALLEY
for James A. Walsh, P.E.
Chief, Design Branch

RECOMMENDED: Original signed by JACK G. STARR
Jack G. Starr, P.E.
Chief, Engineering

APPROVED: Original signed by: Douglas L. Haller
Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: JUL 31 1980

NAME OF DAM: LAKE FAIRFAX DAM

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: LAKE FAIRFAX DAM ID# VA 05910

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life and property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Lake Fairfax Dam is an earthfill embankment approximately 26.2 feet high[1] and 500 feet long. The upstream embankment slope is estimated to be approximately 2H:1V (Horizontal to Vertical), and the downstream embankment slope is approximately 3H:1V. The crest of the dam is approximately 29 feet wide; an asphalt road and a narrow gauge railroad run along the crest. There is no information available on any possible zoning of the embankment or the existence of an internal drainage system. There is upstream slope protection consisting of riprap.

The principal spillway is a 24 inch corrugated metal pipe acting as a fixed crest riser. The riser is located approximately 40 feet from the upstream face of the embankment. The crest of the riser is at elevation 262.1 feet Mean Sea Level (M.S.L.). The principal

[1]Measured from the streambed at the downstream toe of dam to the embankment crest.

spillway outlet conduit is a 24 inch corrugated metal pipe which discharges into a partially riprapped stilling basin at the toe of the embankment.

The emergency spillway is located adjacent to the left[2] abutment. The emergency spillway approach channel is a short section with a riprapped bottom and cinder block training walls. There is an ogee-shaped weir 31.2 feet long, with a minimum crest elevation of 262.1 feet M.S.L., at the downstream end of the approach channel. Water flowing over the weir enters a rectangular channel approximately 80 feet long and 31.2 feet wide. The channel has a concrete bottom and cinder block walls approximately 5 feet high. There are two bridges across this portion of the discharge channel: a footbridge, which crosses at a right angle approximately 20 feet downstream of the weir, and a bridge for a narrow gauge railroad, crossing at a skew near the downstream end of the rectangular channel. There is a chain-link fence suspended from the upstream side of the foot bridge. The railroad bridge has 2 piers of 5 inch cast-iron pipe near the center of the channel. Upon leaving the rectangular channel, water flows over an 18 foot wide asphalt road which runs along the crest of the dam and then into a roughly shaped concrete chute approximately 75 feet long. Broken pieces of concrete, which act as energy dissipators, are embedded in the concrete at irregular intervals. The chute is approximately 30 feet wide at its upstream end and 15 feet wide at its downstream end. The sides of the chute are protected with riprap and broken concrete slabs. The chute discharges into a riprapped channel which joins the original streambed after approximately 200 feet.

The emergency drawdown gate is located a short distance upstream of the riser-barrel junction of the principal spillway. The controls and supports for the gate project directly from the lake. There is no operating platform. There is no information available on the size or type of the emergency drawdown gate.

[2]Facing downstream.

There is a 12 inch diameter concrete pipe located in the right downstream abutment. This pipe apparently drains the right hillside downstream of the dam.

1.2.2 Location: Lake Fairfax Dam is located on Colvin Run in Reston, Virginia. A Location Plan is included with this report.

1.2.3 Size Classification: The maximum height of the dam is 26.2 feet; the reservoir storage capacity at the crest of the dam (elevation 266.3 feet M.S.L.) is 239 acre-feet. Therefore, the dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: There is no development in the area immediately downstream of the dam. State Routes 7 and 674 are both within 1.8 miles downstream of Lake Fairfax Dam. Although loss of life is not highly probable, severe economic loss due to the blockage of State Routes 7 and 674 is likely in the event of a dam failure. Lake Fairfax Dam is therefore considered in the "significant" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by the Fairfax County Park Authority, 4030 Hummer Road, Annandale, Virginia 22003.

1.2.6 Purpose of Dam: The dam is used for recreation.

1.2.7 Design and Construction History: According to the present owner, the dam was constructed by the previous owner, Mr. James Crippin and was completed in 1956.

The embankment was overtopped and seriously damaged in June 1972. Fairfax County Park Authority personnel reconstructed the embankment using shale from the hillside to the south of the dam and then covered the shale with soil. These were apparently the same materials used in the original construction of the dam.

1.3 Pertinent Data

1.3.1 Drainage Area: The total drainage area tributary to the dam is 4.25 square miles. 0.91 square mile of the drainage area is controlled by Lake Anne Dam, which is located approximately 0.6 mile upstream of Lake Fairfax Dam.

1.3.2 Discharge at Dam Site: The maximum discharge from the reservoir is unknown.

Principal Spillway:
Pool level at top of dam. . . . . 26 c.f.s.

Emergency Spillway:
Pool level at top of dam. . . . . 807 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Capacity Area acres	Reservoir Capacity Acre-feet	Reservoir Capacity Watershed inches	Length feet
Top of dam (minimum)	266.3	31.3	239	1.1	2000
Emergency spillway weir crest	262.1	20.5	132	0.6	1400
Principal spillway crest (normal pool)	262.1	20.5	132	0.6	1400
Streambed at downstream toe of dam	240.1	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: Design plans, specifications, and boring logs were not available for use in preparing this report.

2.2 Construction: Construction records, as-built plans, and inspection logs were not available for review.

2.3 Evaluation: No stability analyses or hydrologic and hydraulic data were available for review. No construction records or as-built plans were available to adequately assess the condition of the dam. All evaluations and assessments in this report were based upon field observations, conversations with representatives of the owner, and office analyses.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was conducted on 15 April 1980. At the time of the inspection, the pool elevation was 262.3 feet M.S.L. and the tailwater elevation was 244.0 feet M.S.L. The weather was cool and partly cloudy with temperatures in the mid 50's°F. The ground surface at the embankment and abutments was generally dry. The dam and appurtenant structures at the time of inspection were found to be in fair overall condition. The following are brief summaries of deficiencies found during the inspection. A Field Sketch of conditions is shown as Plate 1. The complete visual inspection check list is given in Appendix III. There is no record of any previous inspections.

3.1.2 Dam: The embankment was found to be in generally fair condition with no surface cracks or sloughs. There is almost no grass on the steep, moderately eroded upstream slope. The left side of the downstream slope has a fairly good cover of grass, but there are scattered traces of erosion in this area. The right side of the downstream slope is slightly uneven; grass cover is sparse and scattered, and moderate erosion has taken place in bare areas. A shallow erosion gully has formed on the lower portion of the downstream slope approximately 100 feet from the right abutment. There is an erosion gully at the outlet of a 12 inch concrete pipe in the right downstream abutment. The pipe apparently drains the right downstream hillside. The outlet section of the pipe has broken off due to erosion of the soil support. Riprap has been placed on the upstream slope. It is partially covered by soil in the upper portions. There are no apparent failures but the slope is uneven in some areas. The stone is hard and angular and ranges in diameter from 1 foot to 2 feet. The stone does not cover the entire slope on the left side of the embankment adjacent to the right training wall of the emergency spillway approach channel. The unprotected slope in this area is very steep; the embankment has apparently eroded away from behind the training wall.

The junctions of the embankment and abutments appear to be in good condition. There is some minor erosion at the upstream end of the right training wall of the emergency spillway approach channel. Otherwise, the junction of the spillway and dam appears to be in good condition.

There is minor seepage along most of the downstream toe of the embankment. There is a concentration of clear seepage in an area 15 feet by 15 feet just below the toe, 140 feet from the right abutment. The soil in this area is soft, wet, silty clay. There is a wet area halfway up the downstream slope 175 feet from the right abutment. No flow rates large enough to measure were found.

No evidence of an internal drainage system was found during the inspection.

3.1.3 Appurtenant Structures: The top row of cinder blocks on the left training wall of the emergency spillway approach channel is crumbling. The ogee weir in the emergency spillway appears to be in good condition. There are four medium-size logs caught on or just upstream of the weir. There are some cracks in the cinder block training walls of the rectangular portion of the discharge channel. There are a few logs caught on the energy dissipators in the roughly shaped concrete chute portion of the discharge channel. There is a hole approximately 8 inches in diameter in the concrete near the left edge of the chute just downstream of the road and there are cracks and some erosion around the edges of the chute. There is a large void under the chute at its downstream end; a surveyor's rod was pushed into this void to a depth of 11 feet. Both bridges and the road across the emergency spillway appear to be in good condition.

The principal spillway intake structure appears to be in satisfactory condition. The outlet structure was submerged at the time of the inspection and could not be examined closely. The 50 foot long by 30 foot wide stilling basin is protected on the bottom and the left side by angular riprap. There is minor erosion on a portion of the left side

of the basin. No stone was placed on the right side of the basin and moderate erosion is present there.

There is an emergency gate, but there is no information available on the size or type of gate. The gate is controlled by a stem which rises above normal pool just upstream of the principal spillway intake. The controls for the gate appear to be in poor condition; according to the owner, the gate is no longer operable.

3.1.4 Reservoir Area: The land surrounding the reservoir is part of a county park. The slopes are gentle to moderate and well covered with short grass. There are also thin-to-medium density wooded areas on the right side and upstream end. There are recreation facilities, including a swimming pool and a boat dock, on the left side of the reservoir. The slopes appear to be in good condition with no evidence of erosion. The extent of sedimentation was not directly observed. It is not expected to be significant.

3.1.5 Downstream Channel: There is no debris blocking the channel for the principal spillway, which is the natural stream channel. The slope of the channel downstream of the dam is approximately 0.6 percent. Vegetation consists of short grass and scattered trees. The channel curves gently to the right side of the valley. The right side of the valley is used as a picnic area.

3.1.6 Instrumentation: There are two staff gages painted on the training walls of the emergency spillway, one on the right side of the approach channel and one on the left side between the bridges.

3.2 Evaluation: In general, the dam and appurtenant structures are in fair condition. The wet areas and seeps on and below the downstream embankment require further investigation to determine if they pose a threat to the stability of the dam. A qualified geotechnical engineering firm should be retained to perform a stability check of the dam. All areas of erosion should be regraded and reseeded; a good grass cover should be established over the entire embankment. The outlet section of the 12 inch concrete pipe in the right

downstream abutment should be reattached to the pipe when the erosion gully below the pipe is repaired. Additional riprap should be placed on the left side of the upstream embankment adjacent to the right training wall of the emergency spillway approach channel. The crumbling cinder blocks on the left training wall of the emergency spillway approach channel should be replaced. The cracks in the cinder block training walls of the rectangular portion of the discharge channel should be patched. The logs caught in the emergency spillway should be removed. The hole in the concrete chute just downstream of the road should be repaired; the large void under the downstream end of the chute should be filled. The emergency gate should be repaired and maintained in an operable condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Operation of the dam is an automatic function, controlled by the principal spillway and the emergency spillway. Water entering the reservoir flows into the principal spillway at elevation 262.2 feet M.S.L. and into the emergency spillway at elevation 262.1 feet M.S.L.

4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the owner. An inspection or maintenance schedule has not been implemented. The only maintenance performed regularly is cutting the grass on the embankment.

4.3 Maintenance of Operating Facilities: The only control equipment at the dam is the emergency gate located upstream of the principal spillway riser. According to the owner, the gate was damaged during the heavy rains from the remnants of Hurricane Agnes in June 1972 and is no longer operable.

4.4 Warning System: At the present time, there is no warning system in operation. The current emergency action plan consists of the following:

1) During periods of heavy rains, the depth of flow through the emergency spillway is continually monitored.

2) When the flow in the emergency spillway reaches a depth of 2 feet, preparations to sandbag the top of the dam are begun.

4.5 Evaluation: Maintenance of the dam in the past has been inadequate. Regular inspections should be made of the dam, appurtenant structures, and operating equipment. A thorough check list should be compiled for use by the owner's representatives as a guide for the inspections. Maintenance items should be corrected annually. A warning system should be developed and put into operation.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: No design data were available for use in preparing this report.

5.2 Hydrologic Records: No rainfall or streamflow records are available at the dam site.

5.3 Flood Experience: There are no exact high water marks from past floods available at the dam site. The dam was overtopped and partially destroyed during the heavy rains from the remnants of Hurricane Agnes in June 1972. The right half of the embankment was overtopped and damaged. Water flowed over the railroad and asphalt road and eroded the downstream embankment. When overtopping ceased, the face of the downstream embankment in the damaged area was almost vertical. Fairfax County Park Authority personnel reconstructed the embankment using shale from the hillside to the right of the dam and then covered the shale with soil. These were apparently the same materials used in the original construction of the dam.

5.4 Flood Potential: The Probable Maximum Flood (PMF), 1/2 Probable Maximum Flood (1/2 PMF), and the 100-year flood were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix IV) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's T_c and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to the unit hydrograph was taken from publications by the U.S. Weather Bureau and the National Oceanic and Atmospheric Administration (References 16 and 17, Appendix IV). Rainfall losses for the 100-year flood were estimated at an initial loss of 1.5 inches and a constant loss rate of 0.15 inch per hour thereafter. An initial loss of 1.0 inch and a constant loss rate of 0.05 inch per hour were used for the PMF and 1/2 PMF.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, Paragraph 1.3.3.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by both the crest of the riser, at elevation 262.1 feet M.S.L., and by the weir in the emergency spillway, at its minimum elevation of 262.1 feet M.S.L.

Outlet discharge capacity was computed by hand; reservoir area was planimetered from the Vienna, Virginia-Maryland, 7.5 minute USGS quadrangle; and storage

capacity was computed by the HEC-1 DB program. All flood routings were begun with the reservoir at normal pool. Flow through the principal spillway was included in the routings.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal(a)	Hydrographs 100-year flood	1/2 PMF	PMF(b)
Peak flow, c.f.s.				
Inflow	8	2993	7582	17,167
Outflow	8	2976	7571	17,143
Peak elev., ft. M.S.L.	262.4	267.7	269.0	270.8
Emergency spillway (c) (elev. 262.1 feet M.S.L.)				
Depth of flow, ft.	.3	5.6	6.9	8.7
Average velocity, f.p.s.	2.5	11.0	12.2	13.7
Duration of flow, hrs. (d)	-	-	-	-
Non-overflow section (c) (elev. 266.3 ft. M.S.L.)				
Depth of flow, ft.	-	1.4	2.7	4.5
Average velocity, f.p.s.	-	5.5	7.6	9.8
Total duration of over-topping, hrs.	-	4.8	14.5	22.0
Tailwater elev., ft. M.S.L.	244.0	-	-	-

(a) Conditions at time of inspection.
(b) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.
(c) Velocity estimates were based on critical depth at control section.
(d) There is normally flow through the emergency spillway.

5.7 Reservoir Emptying Potential: The reservoir could be drawn down by means of the 24 inch diameter[3] emergency gate located at the riser barrel junction of the principal spillway, if it was repaired. Neglecting inflow, the reservoir can be drawn down from normal pool in

[3]This is an assumed diameter. The actual size of the emergency gate is unknown.

approximately 2.0 days. This is equivalent to an approximate drawdown rate of 9.4 feet per day, based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 Evaluation: Lake Fairfax Dam is a "small" size - "significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range between the 100-year flood and the 1/2 PMF. Because of the risk involved, the 100-year flood has been selected as the SDF. The 100-year flood was routed through the reservoir and found to overtop the dam by a maximum depth of 1.4 feet with an average critical velocity of 5.5 f.p.s. Total duration of dam overtopping would be 4.8 hours. The spillway is capable of passing up to 35 percent of the SDF or 5 percent of the PMF.

Conclusions pertain to present-day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: There is no information available on the foundation conditions. The dam is located near the fall line between the Piedmont and Coastal Plain of Virginia. The predominate deposit in the area had been previously mapped as Wissahickon schist but is now classified as a schist of uncertain age. No evidence of an internal drainage system was found during the inspection. It is not known how the dam is keyed into the foundation. As noted in the visual inspection, there are seeps and wet areas on and below the downstream embankment.

6.2 Embankment:

6.2.1 Materials: According to the owner's representatives, the downstream portion of the embankment is constructed of shale covered with a thin layer of soil. (According to local geologic conditions, this material is most probably schist.) There is no information on any possible zoning of the embankment. The area soils are generally low-plastic silts and clays.

6.2.2 Stability: There are no available stability calculations. The dam is 26.2 feet high and the crest is 29 feet wide. The embankment has an estimated upstream slope of 2H:1V and a measured downstream slope of 3H:1V. The dam is subject to a sudden drawdown because the approximate reservoir drawdown rate of 9.4 feet per day exceeds the critical rate of 0.5 foot per day for earth dams. The existing pool is at maximum storage pool.

According to the guidelines presented in Design of Small Dams by the U.S. Department of the Interior, Bureau of Reclamation, for small homogeneous dams with a stable foundation, subjected to a drawdown, and composed of silty and clayey gravels (GC, GM); the recommended slopes are 3H:1V upstream and 2H:1V downstream. The recommended crest width is 15 feet. Based on these guidelines, the crest width and downstream slope are more than adequate; however, the upstream slope is inadequate.

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6.2.3 Seismic Stability: Lake Fairfax Dam is located near the borderline between Seismic Zones 1 and 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. Based on the Bureau of Reclamation guidelines, the upstream slope of the embankment is inadequate, and the visual inspection revealed seeps and wet areas on and below the downstream embankment. A qualified geotechnical engineering firm should be retained to perform a stability check of the dam.

Also, the dam would be overtopped by the SDF, as described in Section 5 of this report. Overtopping flows are shallow and only last 4.8 hours, but the velocity approaches 6 f.p.s. Overtopping during the SDF would be detrimental to the stability of the embankment, especially considering the fact that the embankment partially failed during the June 1972 flood.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: No engineering data were available for review. The dam and appurtenant structures are generally in fair condition. Maintenance of the dam is inadequate. The wet areas and seeps on and below the downstream embankment require further investigation; a stability check of the dam is therefore required.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 100-year flood was selected as the SDF for the "small" size - "significant" hazard classification of Lake Fairfax Dam. It has been determined that the dam would be overtopped by the SDF by a maximum depth of 1.4 feet with an average critical velocity of 5.5 f.p.s. Total duration of overtopping would be approximately 4.8 hours. The spillway is capable of passing up to 35 percent of the SDF or 5 percent of the PMF.

Overtopping flows are shallow and only last 4.8 hours, but the velocity approaches 6 f.p.s., the effective eroding velocity for a vegetated earth embankment. Overtopping during the SDF would be detrimental to the stability of the embankment.

The spillway is adjudged as inadequate, but not seriously inadequate.

7.2 Recommended Remedial Measures: A qualified geotechnical engineering firm should be retained to perform a stability check of the dam. The owner is required to engage the services of a qualified geotechnical engineering firm witnin two months of the issuance of the approved Phase I inspection report. The owner is required to have the consultant's report and to have reached an agreement with the state regarding required remedial measures within six months of the date of the issuance of the approved Phase I inspection report. A formal warning system and emergency action plan should be developed and put into effect as soon as possible.

The following repair items should be accomplished as part of the general maintenance of the dam:

1) All areas of erosion should be regraded and reseeded; a good grass cover should be established over the entire embankment.

2) The outlet section of the 12 inch concrete pipe in the right downstream abutment should be reattached to the pipe when the erosion gully below the pipe is repaired.

3) Additional riprap should be placed on the left side of the upstream embankment adjacent to the right training wall of the emergency spillway approach channel.

4) The crumbling cinder blocks on the left training wall of the emergency spillway approach channel should be replaced.

5) The cracks in the cinder block training walls of the rectangular portion of the discharge channel should be patched.

6) The logs caught in the emergency spillway should be removed.

7) The hole in the concrete chute just downstream of the road should be repaired; the large void under the downstream end of the chute should be filled.

8) The emergency gate should be repaired and maintained in an operable condition.

APPENDIX I

PLATES

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Location Plan

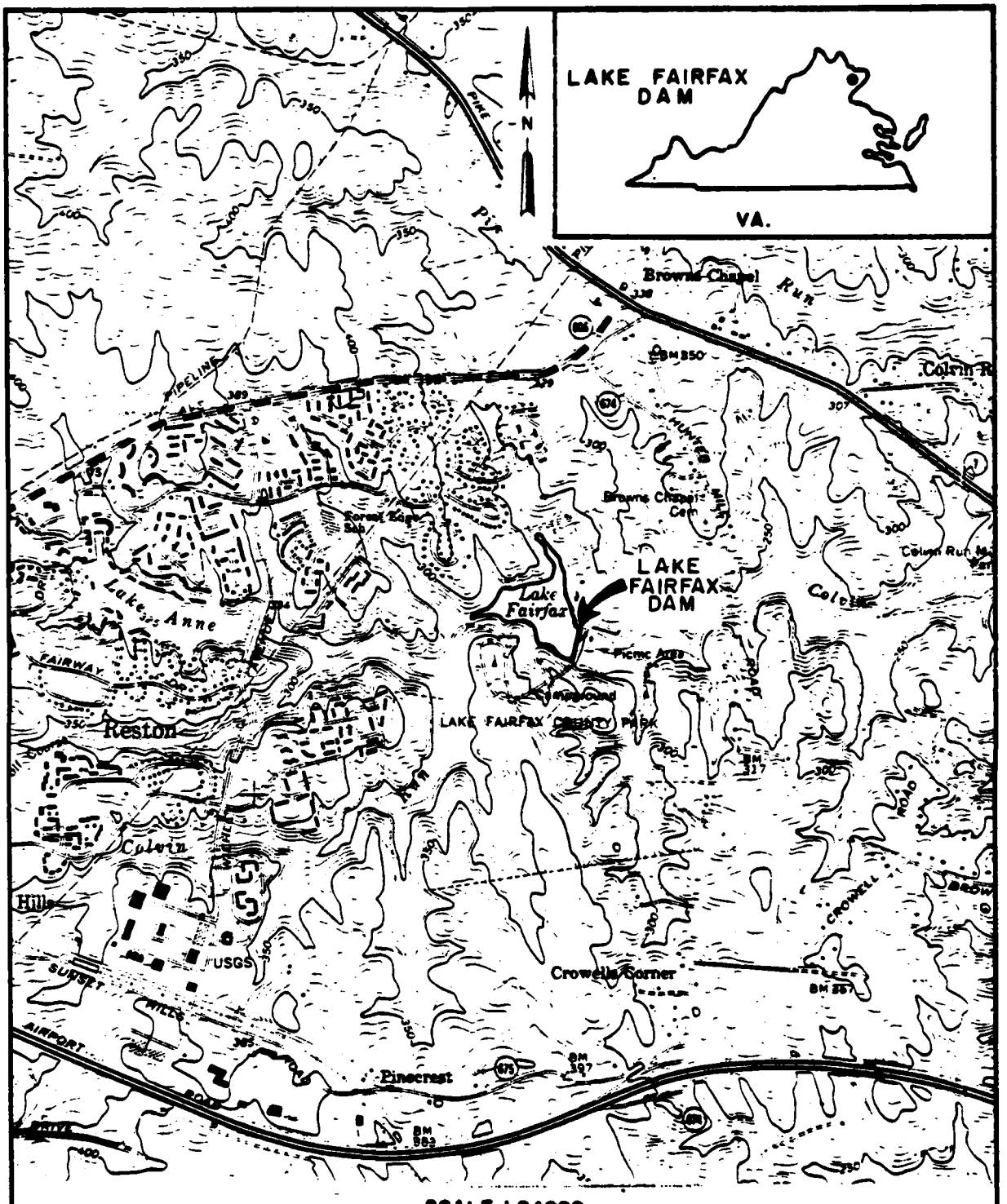
Plate 1: Field Sketch

Plate 2: Top of Dam Profile

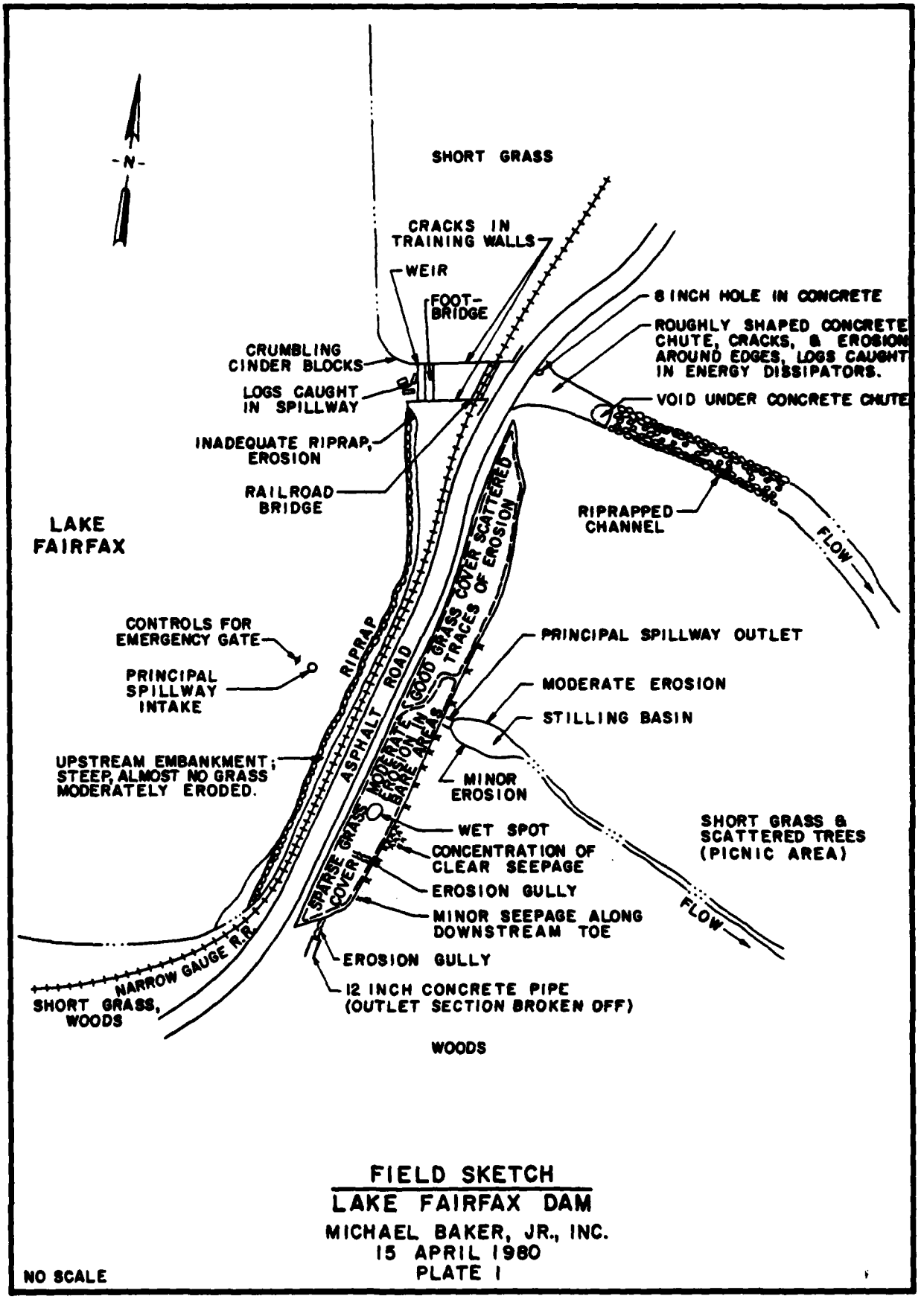
Plate 3: Typical Cross Section

Plate 4: Sketch of Emergency Spillway

NAME OF DAM: LAKE FAIRFAX DAM



LOCATION PLAN



FIELD SKETCH

LAKE FAIRFAX DAM

MICHAEL BAKER, JR., INC.

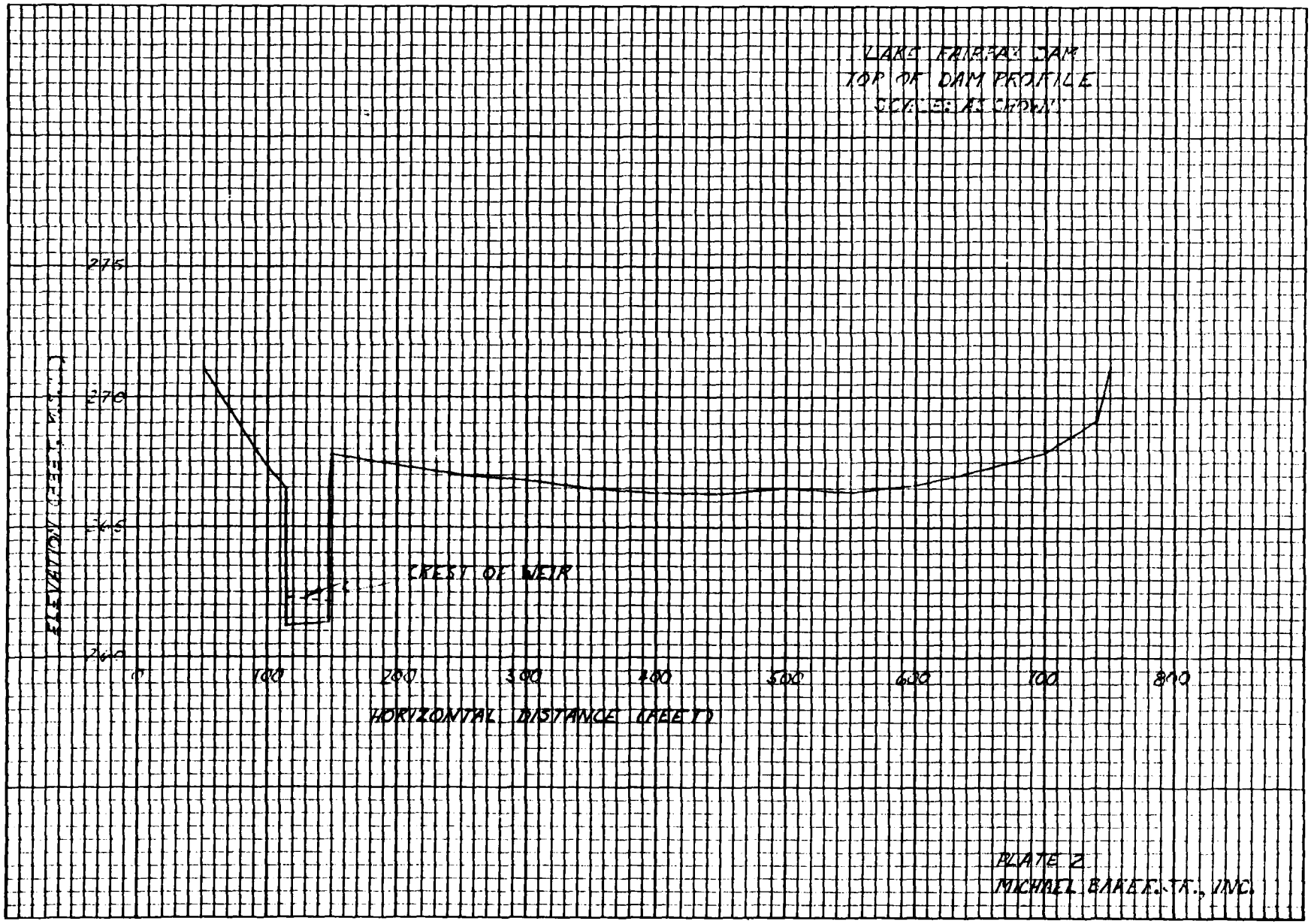
15 APRIL 1980

PLATE 1

NO SCALE

KEUFFEL & ESSER CO. MADE IN U.S.A.

46 0703



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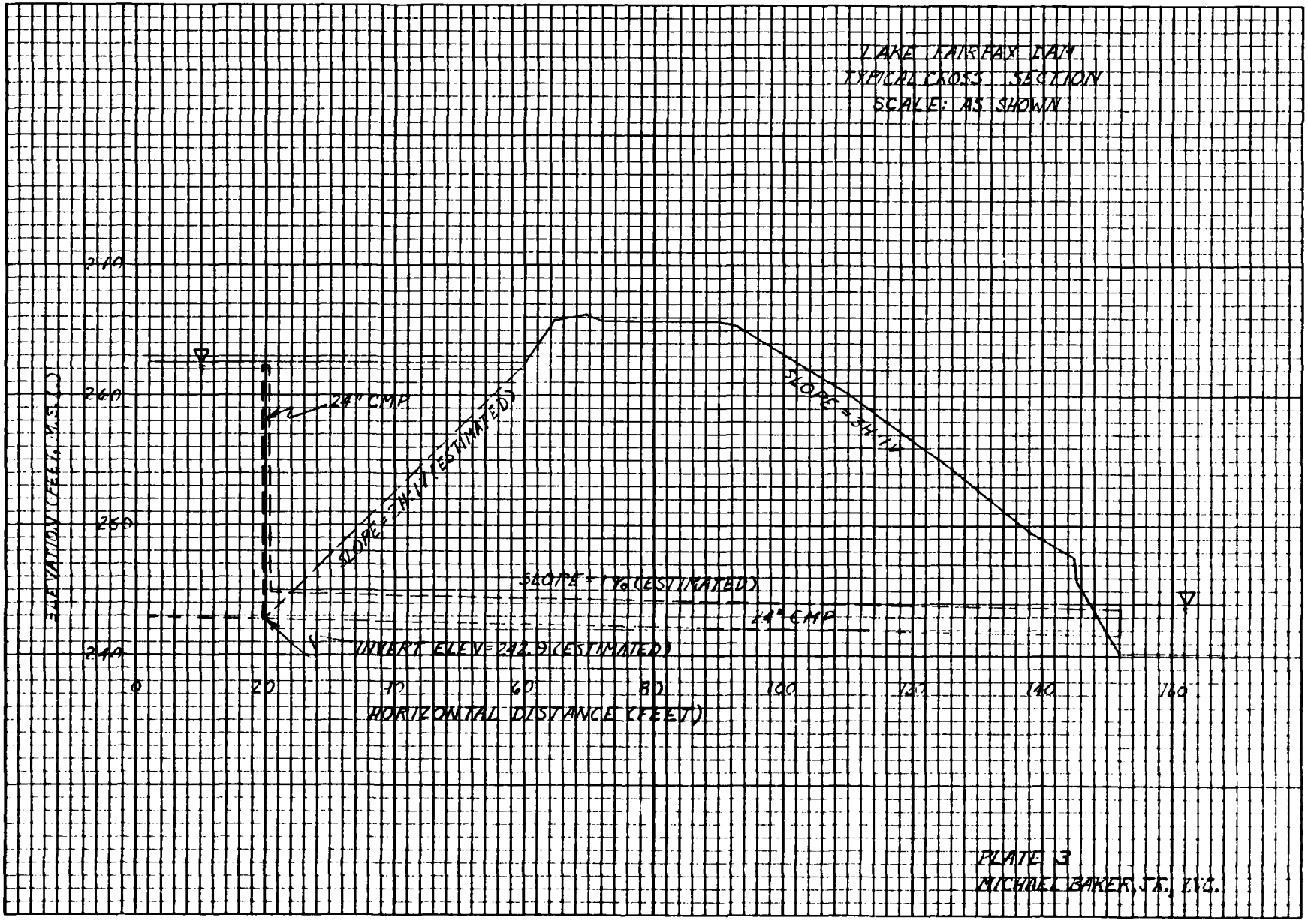
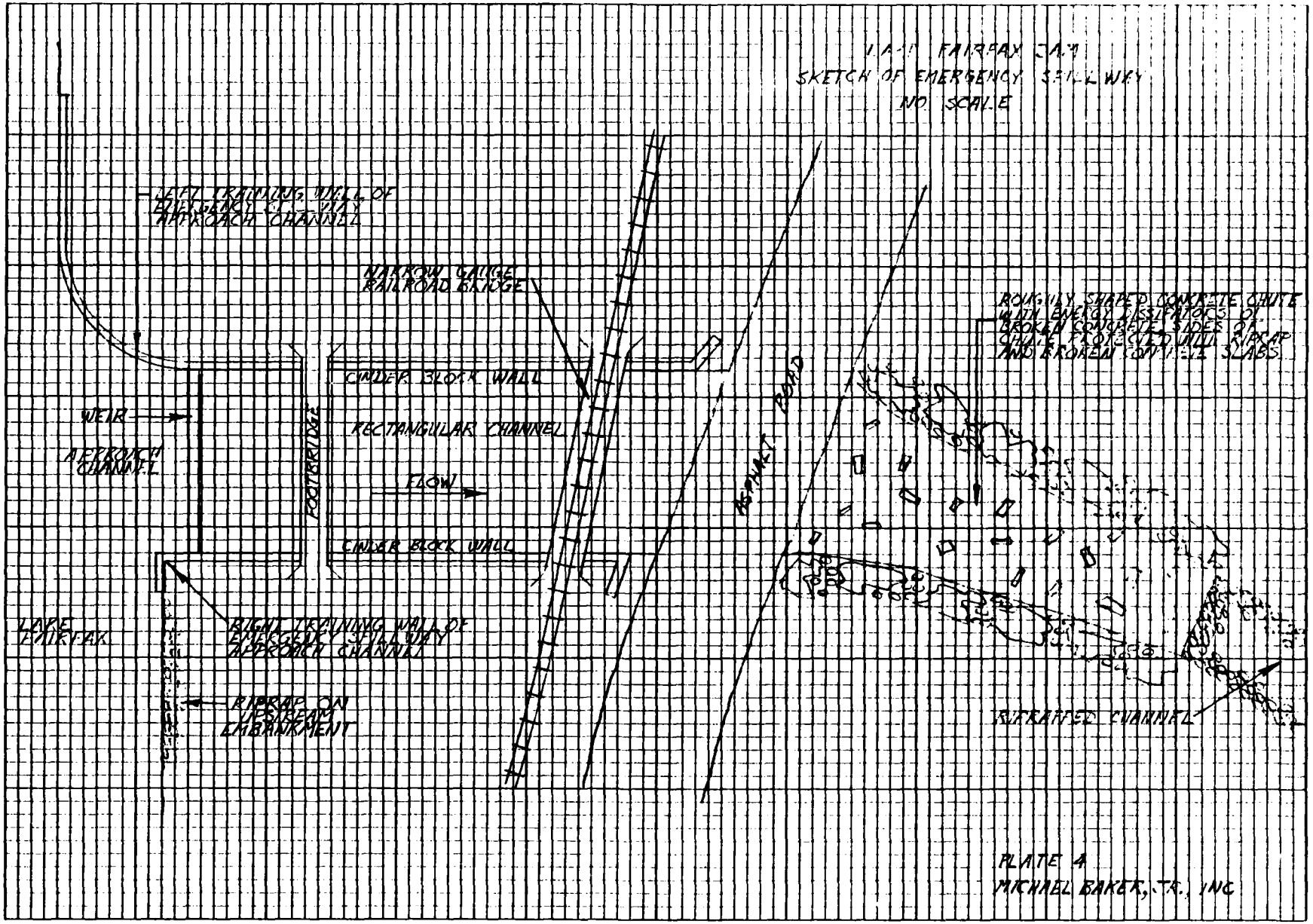


PLATE 3
MICHAEL BAKER, JR., INC.

KEUFFEL & ESSER CO MADE IN U.S.A.



APPENDIX II

PHOTOGRAPHS

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Photo 1: Principal Spillway Intake and Controls for Emergency Gate

Photo 2: Stilling Basin; Principal Spillway Outlet is Submerged

Photo 3: Upstream Embankment from Left Side of Dam

Photo 4: Downstream Embankment from Right Abutment

Photo 5: Inadequate Riprap and Erosion of Embankment Adjacent to Right Training Wall of Emergency Spillway Approach Channel

Photo 6: Crumbling Cinder Blocks on Left Training Wall of Emergency Spillway Approach Channel

Photo 7: Upstream Portion of Emergency Spillway from Asphalt Road across Emergency Spillway

Photo 8: Downstream Portion of Emergency Spillway

Note: Photographs were taken on 15 April 1980.

NAME OF DAM: LAKE FAIRFAX DAM

LAKE FAIRFAX DAM

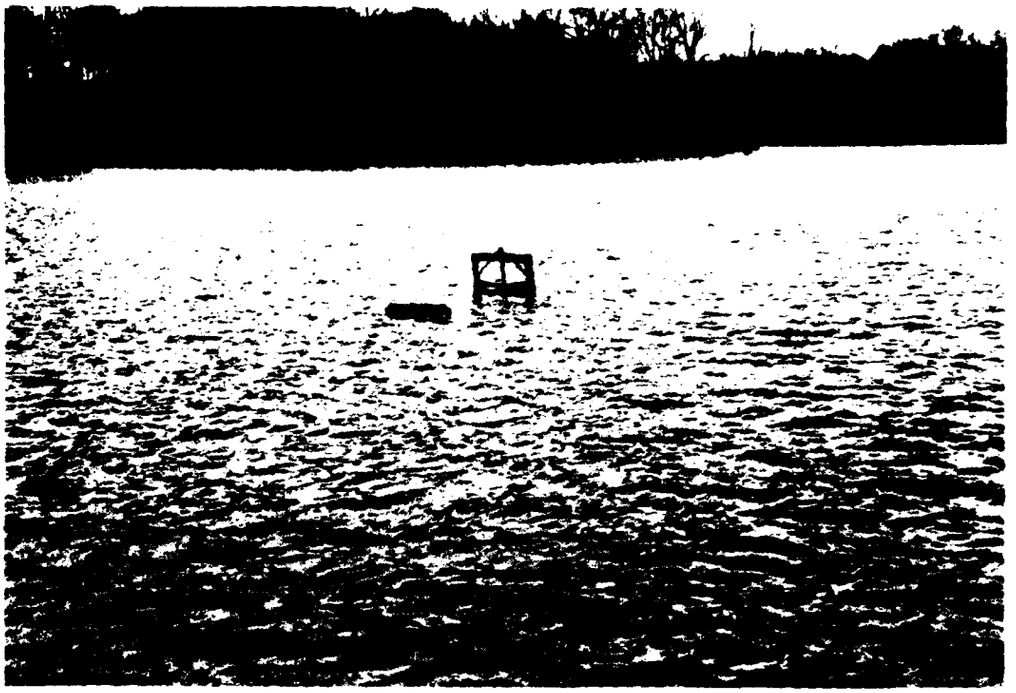

PHOTO 1. Principal Spillway Intake and Controls for Emergency Gate

PHOTO 2. Stilling Basin; Principal Spillway Outlet is Submerged

PHOTO 3. Upstream Slope from Left Side of Dam

PHOTO 4. Downstream Slope from Right Abutment

PHOTO 5. Inadequate Riprap and Erosion of Embankment Adjacent to Right Training Wall of Emergency Spillway Approach Channel

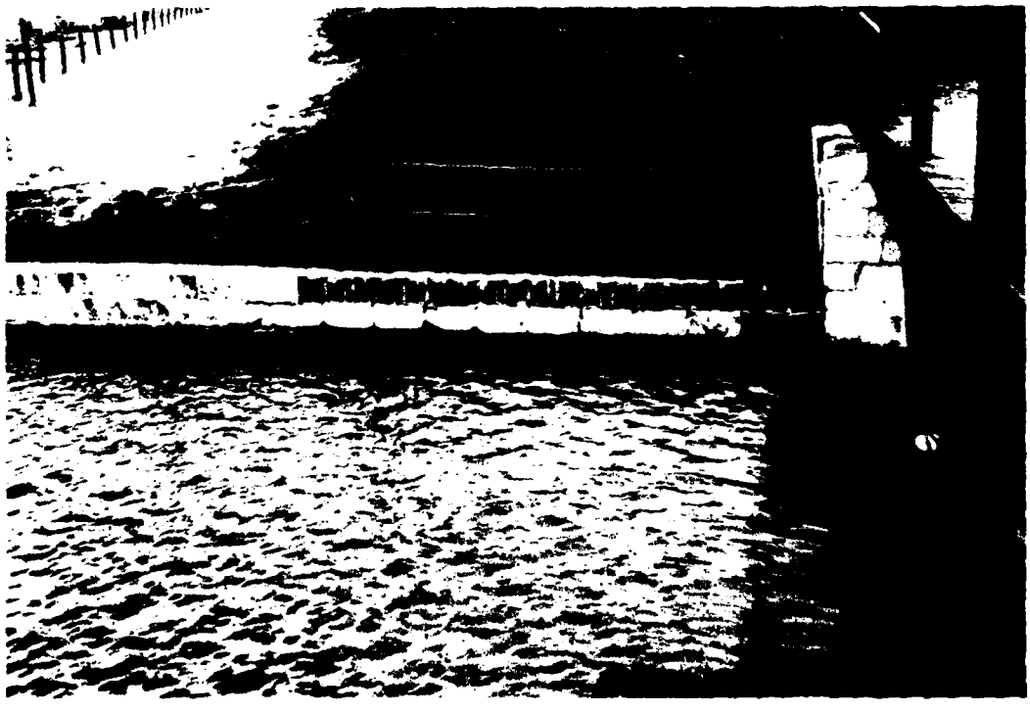

PHOTO 6. Crumbling Cinder Blocks on Left Training Wall of Emergency Spillway Approach Channel

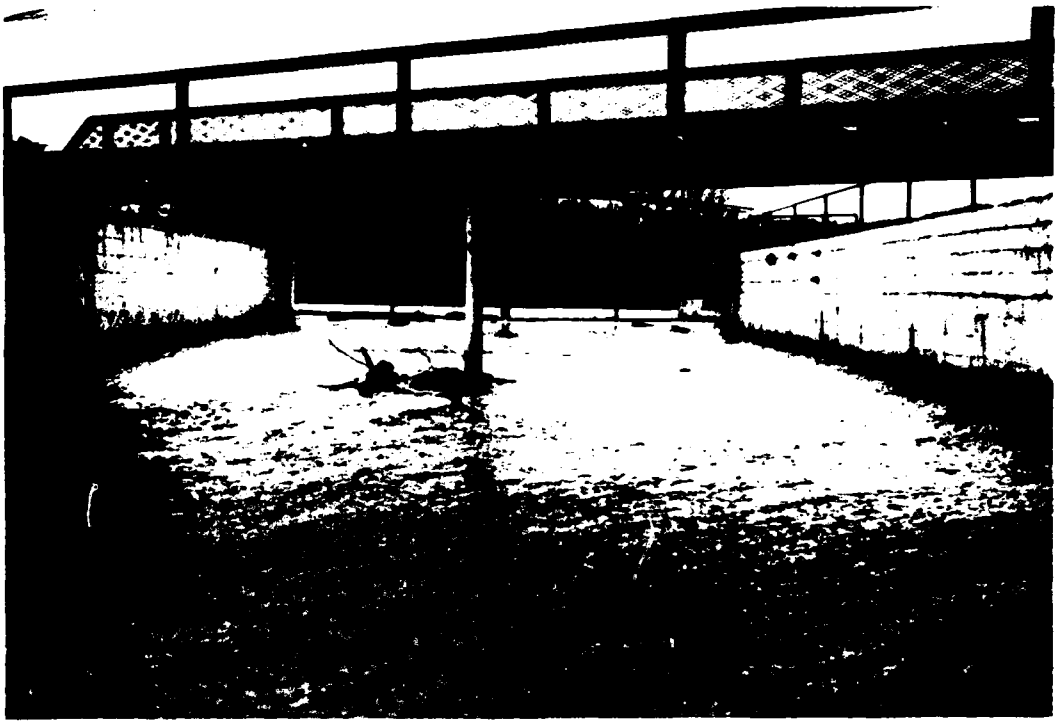

PHOTO 7. Upstream Portion of Emergency Spillway from Asphalt Road across Emergency Spillway

PHOTO 8. Downstream Portion of Emergency Spillway

APPENDIX III

VISUAL INSPECTION CHECK LIST

Phase 1
Visual Inspection
Check List

Name of Dam Lake Fairfax Dam County Fairfax State Virginia Coordinates Lat. 3858.0
Long. 7719.0

Date of Inspection 15 April 1980 Weather Cool, partly cloudy Temperature 55° F.

Pool Elevation at Time of Inspection 262.3 ft. M.S.L. Tailwater at Time of Inspection 244.0 ft. M.S.L.

III-1

Inspection Personnel:

Michael Baker, Jr., Inc.:

Jeffrey A. Quay
Jeffrey S. Maze
William L. Sheafer

Virginia State Water Control Board:

Edwin B. Constantine, III

Owner's Representatives:

Kevin R. Boyer, P.E. (SCS Engineers)

William L. Sheafer Recorder

EMBANKMENT

Name of Dam LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	There is almost no grass on the steep, moderately eroded upstream slope. The left side of the downstream slope has a fairly good cover of grass, but there are scattered traces of erosion in this area. The right side of the downstream slope is slightly uneven; grass cover is sparse and scattered and moderate erosion has taken place in bare areas. A shallow erosion gully has formed on the lower portion of the downstream slope approximately 100 ft. from the right abutment. There is an erosion gully at the outlet of a 12 in. concrete pipe in the right downstream abutment. The outlet section has broken off due to erosion of the soil support.	All areas of erosion should be regraded and reseeded; a good grass cover should be established over the entire embankment. The outlet section of the pipe should be reattached to the pipe when the erosion gully below the pipe is repaired.

EMBANKMENT

Name of Dam LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The crest is approximately 1 ft. lower in the middle than on the ends. A two-lane asphalt road and a narrow gage railroad of the type found in amusement parks run along the crest of the dam; the railroad is on the upstream side. The embankment is moderately curved with its concave side toward the reservoir.	
RIPRAP	Riprap has been placed on the upstream slope. It is partially covered by soil in the upper portions. There are no apparent failures but the slope is uneven in some areas. The stone is hard and angular (diameters range from 1 to 2 ft.) The stone does not cover the entire slope on the left side of the embankment adjacent to the right training wall of the emergency spillway approach channel. The unprotected slope in this area is very steep; the embankment has apparently eroded away from behind the training wall.	The stone appears to adequately protect the fill from wave action. Additional stone should be placed in the deficient slope area near the wall on the left side of the embankment.
EMBANKMENT MATERIALS	The embankment was apparently constructed of red and brown, damp to moist, clayey and sandy silt with some rock fragments. The foundation bedrock is shown as schist on a geologic map.	Compaction appears to have been adequate. There is no information available on possible zoning of the embankment or on the existence of a keyway or impervious core.

EMBANKMENT

Name of Dam LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junctions of the embankment and abutments appear to be in good condition. There is some minor erosion at the upstream end of the right training wall of the emergency spillway approach channel. Otherwise, the junction of the spillway and dam appears to be in good condition.	
ANY NOTICEABLE SEEPAGE	There is minor seepage along most of the downstream toe of the embankment. There is a concentration of clear seepage in a 15 ft. by 15 ft. area just below the toe, 140 ft. from the right abutment. The soil in this area is soft, wet, silty clay. There is a wet area halfway up the downstream slope 175 ft. from the right abutment. No flow rates large enough to measure were found.	The wet areas and seeps require further investigation to determine if they pose a threat to the stability of the dam. A qualified geotechnical engineering firm should be retained to perform a stability check of the dam.
STAFF GAGE AND RECORDER	There are staff gages painted on the training walls at two locations in the emergency spillway. No records were found.	
DRAINS	No evidence of an internal drainage system for the dam was found during the inspection.	

OUTLET WORKS

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OUTLET CONDUIT	The outlet conduit is a 24 in. diameter C.M.P.	
INTAKE STRUCTURE	The principal spillway intake structure is a vertical section of 24 in. diameter C.M.P. acting as a riser. The trash rack is a metal grill, open at the top, which encircles the pipe. It appears to be in satisfactory condition.	
OUTLET STRUCTURE	The 24 in. C.M.P. outlet conduit protrudes from the embankment toe with no visible supporting structure. It discharges into a partially riprapped stilling basin. The outlet was completely submerged at the time of the inspection and could not be examined closely.	
OUTLET CHANNEL	The 50 ft. long by 30 ft. wide stilling basin is protected on the bottom and the left side by angular riprap. There is minor erosion on a portion of the left side of the basin. No stone was placed on the right side and moderate erosion has taken place there. There are a few small trees growing on both banks. The outlet channel is the original stream channel.	The areas where erosion has occurred should be regraded and reseeded. If erosion reoccurs, the entire pool should be riprapped.
EMERGENCY GATE	There is an emergency gate, but there is no information available on the size or type of the gate. The gate is controlled by a stem which rises above normal pool just upstream of the principal spillway intake, so the emergency gate presumably discharges into the outlet conduit. The controls for the gate appeared to be in poor condition.	According to the owner, the gate was damaged during the heavy rains from the remnants of Hurricane Agnes in June 1972 and is no longer operable. The gate should be repaired and maintained in an operable condition.

EMERGENCY SPILLWAY

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There is a 31.2 ft. long ogee-shaped weir downstream of a short approach channel. The crest is 0.25 ft. higher at the left training wall than at the right training wall. The concrete appears to be in good condition. There are 4 medium-size logs caught on or just upstream of the weir.	The logs should be removed.
APPROACH CHANNEL	The approach channel is a short section with a riprapped bottom and cinder block training walls. The channel narrows as it approaches the weir. The left training wall is approximately 2 ft. high; the right training wall is approximately 6 ft. high and has a staff gage painted on its upstream end. The top row of cinder blocks on the left training wall is crumbling.	The crumbling cinder blocks should be replaced.
DISCHARGE CHANNEL	Water flowing over the weir enters a rectangular channel approximately 80 ft. long and 31.2 ft. wide. The channel has a concrete bottom and cinder block walls approximately 5 ft. high; there are some cracks in the walls. Upon leaving the rectangular channel, water flows over the road on the dam crest and into a roughly shaped concrete chute approximately 75 ft. long. Broken pieces of concrete, which act as energy dissipators, are embedded in the concrete at irregular intervals. A few logs are lodged on the dissipators. The concrete chute is approximately 30 ft. wide at its upstream end and 15 ft. wide at its downstream end. There is a hole approximately 8 in. in diameter in the concrete near the left edge of the chute just (continued next page)	The cracks in the cinder block training walls should be patched. The hold and all large cracks in the concrete chute should be repaired. The void under the downstream end of the chute should be filled. The logs lodged in the dissipators should be removed.

EMERGENCY SPILLWAY

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DISCHARGE CHANNEL (continued)	downstream of the road and there are cracks and some erosion around the edges of the concrete. There is a large void under the chute at its downstream end; a surveyor's rod was pushed into this void to a depth of 11 ft. The sides of the chute are protected with riprap and broken concrete slabs. The chute discharges into a riprapped channel which joins the original streambed after approximately 200 ft.	
BRIDGE AND PIERS	There are two bridges across the rectangular portion of the discharge channel: a footbridge which crosses at a right angle approximately 20 ft. downstream of the weir and a bridge for the narrow gage railroad, crossing at a skew near the downstream end of the rectangular channel. There is a chain-link fence suspended from the upstream side of the footbridge. The railroad bridge has 2 piers of 5 in. C.I.P. near the center of the channel. Both bridges appear to be in good condition.	If it became clogged with debris, the chain-link fence would restrict flows.

INSTRUMENTATION

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	No permanent markers were found.	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	There are two staff gages painted on the training walls of the emergency spillway, one on the right side of the approach channel and one between the bridges on the left side of the discharge channel.	

RESERVOIR

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The land surrounding the reservoir is part of a county park. The slopes are gentle to moderate and well covered with short grass. There are also thin-to-medium density wooded areas on the right side and upstream end. There are recreation facilities, including a swimming pool and a boat dock, on the left side of the reservoir. The slopes appear to be in good condition, with no evidence of erosion.	
SEDIMENTATION	The extent of sedimentation was not directly observed. It is not expected to be significant.	

DOWNSTREAM CHANNEL

Name of Dam: LAKE FAIRFAX DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	There is no debris blocking the channel for the principal spillway. The outlet channel is the natural stream channel.	
SLOPES	The slope of the channel downstream of the dam is approximately 0.6%. The overbanks consist of clayey silt and rock fragments. Vegetation consists of short grass and scattered trees. The channel curves gently to the right side of the valley. The right side of the valley is used as a picnic area.	
APPROXIMATE NO. OF HOMES AND POPULATION	There are no homes in the downstream area.	

APPENDIX IV

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GENERAL REFERENCES

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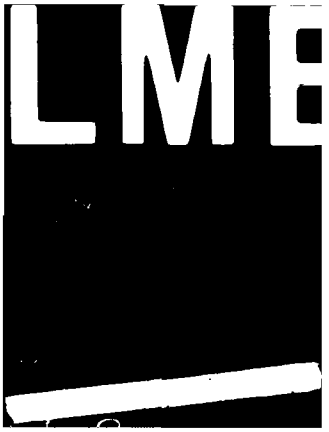
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