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NATIONAL DAM SAFETY PROGRAM. FALLING CREEK DAM (INVENTORY NUMBE--ETC(U)
SEP 79

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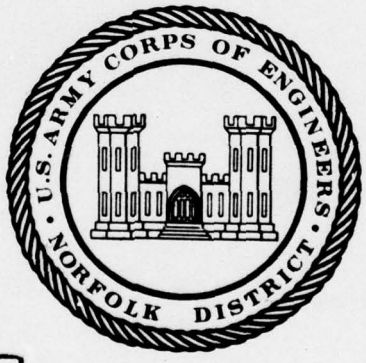
ROANOKE RIVER BASIN

Name Of Dam: FALLING CREEK
Location: BEDFORD COUNTY
Inventory Number: 01910

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
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SEPTEMBER 1979

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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.

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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 aide 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 REPORT

BRIEF ASSESSMENT

Name of Dam:	Falling Creek Dam
State:	Virginia
County:	Bedford
USGS Quad Sheet:	Stewartville
Stream:	Falling Creek
Date of Inspection:	2 May 1979

Falling Creek Dam is an earthfill structure about 350 feet long and 42 feet high. The dam is owned and operated by the city of Roanoke, Virginia and supplies water to the Roanoke Water System. The dam is classified as an intermediate size with a significant hazard classification. The spillway consists of a concrete-lined-open-channel spillway with the crest at elevation 1669 mean sea level (m.s.l.). Two 12-inch pipes pass through the dam from a 3-level intake tower to a filtration plant below the dam.

Based on the criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) appropriate for this dam is 1/2 PMF to the PMF. Because of the risk involved in this project, the 1/2 PMF has been selected as the appropriate SDF. The spillway will pass 10 percent of the PMF without overtopping the dam; therefore, the spillway is rated inadequate. The (SDF) will overtop the dam by a maximum of 3 feet, remain above the dam for a duration of 5.2 hours with an average critical velocity of 7.6 feet per second.

The visual inspection revealed no apparent problems that need immediate attention; although, it is recommended that an annual inspection and maintenance program be initiated and address the suggestion in section 7.2.

Submitted by: Original signed by JAMES A. WALSH
JAMES A. WALSH, P.E.
Chief, Design Branch

Recommended by: ORIGINAL SIGNED BY: JOHN R. PHILPOTT for
CARL S. ANDERSON, JR., P.E.
Acting Chief, Engineering Division

Approved by: Original signed by: Douglas L. Haller
DOUGLAS L. HALLER
Colonel, Corps of Engineers
District Engineer

Date: SEP 21 1979

OVERALL VIEW - FALLING CREEK

MAY 1979

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 through 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 (Appendix VI, Reference 1). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Falling Creek Dam is an earthen embankment dam about 350 feet long and 42* feet high. The top of the dam is 20 feet wide with an elevation of 1672.5 at the centerline of the dam. The upstream slope has a 1 vertical to 2 horizontal slope (1:2), with slope protection, and the downstream slope also has a (1:2) slope.

The nature of the embankment, and the foundation are unknown. The available drawings developed in 1934 were based on assumptions which show an impervious core keyed into foundation bedrock. There is no reference to a foundation drainage system. Plan views and cross sections are shown on Plates II and I, Appendix I, respectively.

The principal spillway consists of a concrete lined open channel spillway with a crest elevation of 1669. Flow passes through the spillway discharge channel that curves toward the central axis of the dam about 200 feet below the toe of the dam. Natural spring flows and flows from the toe area merge with flows in the spillway channel to form the downstream channel.

An intake tower for water supply to the filtration plant is located in the reservoir, 100 feet upstream of the crest of the embankment. Three 10-inch intakes at elevations 1661, 1651, and 1641 serve two 12-inch feeder lines through the dam to the filtration plant. Another 10-inch intake at elevation 1634 can be used to dewater the reservoir.

*The height is the difference in elevation between the streambed at the downstream toe and the crest of the dam.

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of height (42 feet).

1.2.4 Hazard Classification: The dam is located in a rural area above several homes and is therefore given a significant hazard classification in accordance with guidelines contained in section 2.1.2 of Reference 1, Appendix VI. 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: City of Roanoke, Virginia

1.2.6 Purpose: Water Supply

1.2.7 Design and Construction History: The dam was constructed in 1897-98. The contractor is not known. Flashboards were installed in 1924. The side channel spillway was modified in 1927, then replaced with a 6-foot-diameter CMP spillway in 1975. In July 1979, the city of Roanoke removed the 6-foot diameter CMP spillway and restored the spillway to its original size (1927, without flashboards).

1.2.8 Normal Operational Procedures: Water is withdrawn from the reservoir through a 3-level intake system to supply the city of Roanoke, Virginia. The intake at elevation 1661 is left open while other valves are not used. A divers report, Appendix IV, describes the state of the intake structure. Regulation or flows is largely automatic with water rising above the crest of the spillway passing freely downstream.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 1.36 square miles.

1.3.2 Discharge at Dam Site:

Spillway
pool level at top of dam . . . . . 544 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	Acre-feet	Watershed, inches	Length, miles
Top of dam	1672	23	284	3.92	.59
Spillway crest	1669	19.2	218	3.00	.57
Streambed	1630±				

SECTION 2

ENGINEERING DATA

2.1 Design: Design data were provided by the owners. The data reviewed included the following:

a. As-built drawings developed in 1934 by Allan J. Saville Engineers of Richmond, Virginia. The drawings show surveyed plan view and cross sections of the dam and original spillway. Internal profiles of the dam were based on assumptions which show an impervious core keyed into foundation bedrock. The plan view and cross sections are in Appendix I, Plates II and I, respectively.

b. An as-built structural drawing of the intake (Stack) structure developed in 1931 by the Roanoke Waterworks Company. The drawing shows a plan and cross section of the structure and is provided in Appendix IV.

c. A 1972 diver's inspection report of the intake structure with all comments noted on the drawing in Appendix IV.

d. Pool elevation records are available through the city.

There was no other information available pertaining to the original structure and the modifications made in 1924 and 1975. No information was available concerning geologic and embankment conditions.

2.2 Construction: The only available information are photographs taken in 1924 showing the construction of the filtration plant and the surrounding area. There were no original construction records or records of the modification made in 1924 and 1975.

2.3 Operations: No formal operation or maintenance records are kept with respect to the dam. The normal pool level was raised from elevation 1669 by installation of flashboards on the spillway crest in 1924, but the actual height is not known. In 1975, the normal pool level was raised to elevation 1671.5 by modification of the spillway. In July 1979, the pool level was lowered to elevation 1669 when the spillway was restored to its original form.

2.4 Evaluation: The available information is considered inadequate to provide sufficient information to determine the stability of the embankment. Hydraulic evaluations were based on measurements determined during the visual inspection, and available pool records.

SECTION 3

VISUAL INPSECTION

3.1 Findings:

3.1.1 General: The results of the 2 May 1979 inspection 1/ are recorded in Appendix III. At the time of the inspection, the pool elevation was approximately 1671.5 feet m.s.l., or about normal pool elevation. The outlet works were open for water supply. Flow was passing through the principal spillway. Prior to the field inspection, the only known inspection was an underwater inspection of the intake structure. In general, the inspection reported some structural deterioration, with the reservoir mudline covering the low level intake.

3.1.2 Dam Embankment: No cracking, sloughing, or settlement was observed. However, the downstream slope was heavily vegetated, as shown in Appendix II, Photo 2. Also portions of the upstream right abutment junction had eroded due to surface runoff. Plus, a recent fill around the downstream end of the principal spillway had collapsed creating sinks in the embankment, Appendix II, Photo 7. The erosion and the sinks were caused by surface runoff, not flow through the embankment.

Four clear seeps were located as shown on Plate II, Appendix I. One in each downstream abutment and one in each downstream junction. The seep in the left abutment was passing less than 1 GPM. The seep in the left junction was passing a minimum of 15 GPM, Appendix II, Photo 5. The quantity of the seepage on the right side could not be measured. It is suspected that the junction seeps came from drains. There is no explanation for the abutment seeps.

3.1.3 Appurtenant Structures: Observations of the intake structure were impossible, because it was submerged at the time of the inspection, Appendix II, Photo I. However, the 1972 diver's report (Appendix IV) notes some deterioration of the structure.

3.1.4 Principal Spillway: The entrance of the spillway has two 12-inch stoplogs serving as a weir. Two chains, one attached to each stoplog, are available to raise and lower the stoplogs. Metal channel fence posts serve as lift guides.

3.1.5 Instrumentation: The only instrumentation is a staff gage located on the intake structure which was submerged at the time of the inspection.

1/ Following the inspection, in July 1979, the city of Roanoke removed the 6-foot diameter CMP spillway and restored the spillway to its original size (1927, without flashboads). See appendix V.

3.1.6 Reservoir Area: The reservoir area did not have any shoreline erosion or apparent slope failures. The water was free of debris.

3.1.7 Downstream Channel: No erosion was observed in the downstream area. However, the channel is overgrown with trees and shrubs, Appendix II, Photo 4. The filtration plant is immediately downstream. About 6 to 7 homes and stores are located along Route 635 at the Route 24 intersection, 1.5 miles downstream.

3.2 Evaluation: Overall the dam appears to be in fair condition under normal pool operation. However, the following areas needed to be corrected or examined in greater detail:

a. All the trees, brush, and root systems should be removed. All subsequent holes should be dressed with compacted fill and seeded. The trees are not an immediate danger to the dam's safety, but will be detrimental to the long-term stability of the dam. Because of the steepness of the slopes, the size and number of trees involved, the removal of these trees under normal pool conditions may require the supervision of a qualified engineer to assure that the integrity of the dam is maintained.

b. The erosion of the right upstream abutment junction should be filled with compacted material, contoured to facilitate drainage, and seeded.

1/ c. The soil in the sinkhole area should be removed and backfilled with an engineered fill, contoured, and seeded.

d. All noted seeps should be monitored for erosion during periodic inspections. If erosion develops, then the services of a qualified geotechnical engineering firm should be retained to recommend immediate remedial measures.

e. The downstream channel within 100 feet of the spillway should be cleared of heavy vegetation and brush.

1/ f. The use of one chain for each stoplog is an awkward method to regulate the stoplogs. An alternate method should be developed to expediently remove the stoplogs during high flows.

g. The staff gage should be extended above normal pool level.

1/ The owner has corrected remedial measures during the restoration of the original spillway in July 1979.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The normal storage pool is elevation 1669.0, which is the spillway crest. The reservoir provides water for the city of Roanoke, Virginia. Three water intake elevations 1661, 1651, and 1641, of which the upper valve is opened, allow water to flow into the intake structure. Water is withdrawn from the intake structure by means of two 12-inch water supply pipes. Blowoff valves are located below the toe of the dam if dewatering the reservoir is necessary.

4.2 Maintenance: A routine maintenance program has not been established for the Falling Creek Reservoir Dam, although periodic maintenance has occurred. Copper sulfate is added to the reservoir when necessary. A representative from the filtration plant below the dam monitors pool levels during floods.

4.3 Warning System: At the present time, there is no warning system or evacuation plan in operation.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, an annual maintenance and inspection program should be initiated to help detect and control problems that may occur.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Design calculations for the dam are on file at the owner's office.

5.2 Hydrologic Records: None were available.

5.3 Flood Experience: The maximum observed flood caused a slight flow over the left portion of the embankment in the Spring of 1977. No damage occurred during the short duration of overtopping.

5.4 Flood Potential: The PMF and 1/2 PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 2, Appendix VI) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's Tc and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from the U.S. Weather Bureau Publications (Reference 3 Appendix VI). Losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch/hour.

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

Regulation of flow from the reservoir has been set to allow water to enter the intake at elevation 1661 and collect within the intake structure. Flow occurs through a 12-inch water supply pipe to the filtration plant below the dam. Water also flows past the dam through the spillway at elevation 1669.0.

The storage curve supplied by the owner was extended above the top of the dam by use of U.S. Geological Survey Quadrangle maps. Rating curves were developed for the spillway, non-overflow section of the dam, and the drawdown outlet. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the crest of the spillway. Flow through the water supply pipe was neglected during routing.

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

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal flow	Hydrograph 1/2 PMF	Hydrograph PMF(a)
Peak flow c.f.s.			
Inflow	2	6968	13936
Outflow	-	6932	13550
Maximum elevation, ft m.s.l.		1675.55	1677.25
Spillway (Elevation 1669)			
Depth of flow, ft		6.55	8.25
Duration, hrs		6	9
Velocity, fps (b)		11.7	13.2
Non-overflow section (El. 1672.5)			
Depth of flow, ft		3.05	4.75
Duration, hrs		5.2	8
Velocity, fps (b)		7.6	10.0
Tailwater elevation, ft m.s.l.	1630±		

(a) 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 the region.

(b) Average critical velocity.

5.7 Reservoir Emptying Potential: Two 12-inch blow off valves located below the toe of the dam can be operated to empty the reservoir from normal pool (El. 1669) in less than 5 days under normal conditions.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant) the recommended Spillway Design Flood is 1/2 PMF to the PMF. Because of the risk involved in this project, the 1/2 PMF has been selected as the appropriate SDF. The spillway will pass 10 percent of the PMF without overtopping the dam; therefore, the spillway is rated inadequate. The (SDF) will overtop the dam by a maximum of 3 feet, remain above the dam for a duration of 5.2 hours with an average critical velocity of 7.6 feet per second.

Conclusions pertain to present day conditions. 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 pertaining to the foundation design. The area generally consists of residual soils overlying granite and granitic gneiss bedrock. The as-built drawings assume an embankment keyed into bedrock, but there are no records to verify this condition. Based on the visual inspection, the dam appears to be on a stable foundation.

6.2 Embankment:

6.2.1 Materials: There is no information pertaining to the embankment other than the assumed impervious core shown on the drawings. There is no known verification of the core. Photographs do indicate that borrow areas were located within the reservoir area. The material in this area is typically residual silts and clays.

6.2.2 Stability: There are no known stability calculations on the dam. The embankment is 20 feet wide with a 1V:2H side slopes. According to the guidelines outlined in Appendix VI, Reference 1, for homogeneous earthfilled dams on stable foundations, the recommended minimum width for this type dam is 19 feet with side slopes of 1V:2.5H downstream, and 1V:3H upstream for clay/silt soils. Based on these guidelines, the width is typical, but the slopes are considered to be too steep.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 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 no available information to determine the nature of the embankment. Also, the dam has inadequate slopes based on typical design guidelines.

However, the visual inspection revealed no evidence of instability or stress in the embankment; therefore, the dam is considered stable and adequate for normal pool operations. The unfavorable conditions noted are the inability of the spillway to pass more than 10 percent of the PMF, the embankment slopes that are steeper than that recommended in Reference 1, Appendix VI, and the absence of stability studies for review. It is recommended that a thorough investigation be initiated to establish the adequacy of the embankment stability under full loading conditions.

Overtopping flows during the SDF which overtops the dam by a 3 feet for about 5 hours at a velocity of 7.6 fps is considered detrimental to the dam. The SDF velocity is above the typical permissible velocity of 6.0 fps for vegetated compacted earth dams.

SECTION 7

ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Assessment: The Falling Creek Reservoir, as observed 2 May 1979, appears to be in fair condition with the reservoir level at normal pool. However, the absence of stability studies prevents the determinaton of the adequacy of the embankment under full loading conditions.

Reference 1, Appendix VI, recommends a Spillway Design Flood (SDF) of 1/2 PMF to the PMF. Because of the limited risk involved in this project, 1/2 PMF has been selected as the appropriate SDF. The spillway will pass 10 percent of the PMF without overtopping the dam; therefore, the spillway is rated inadequate. Flows overtopping the dam during the SDF are considered detrimental to the embankment.

Based on the visual inspection and review of existing records, there are no apparent problems that required immediate action.

7.2 Recommendations/Remedial Measures: The following actions are suggested and should be initiated within 12 months. These measures are suggested for monitoring and maintenance purposes only.

a. All the trees, brush, and root systems should be removed. All subsequent holes should be dressed with compacted fill and seeded. The trees are not an immediate danger to the dam's safety, but will be detrimental to the long-term stability of the dam. Because of the steepness of the slopes, the size and number of trees involved, the removal of these trees under normal pool conditions may require the supervision of a qualified engineer to assure that the integrity of the dam is maintained.

b. The erosion of the right upstream abutment junction should be filled with compacted material, contoured to facilitate drainage, and seeded.

1/ c. The soil in the sinkhole area should be removed and backfilled with an engineered fill, contoured, and seeded.

d. All noted seeps should be monitored for erosion during periodic inspections. If erosion develops, then the services of a qualified geotechnical engineering firm should be retained to recommend immediate remedial measures.

e. The downstream channel within 100 feet of the spillway should be cleared of heavy vegetation and brush.

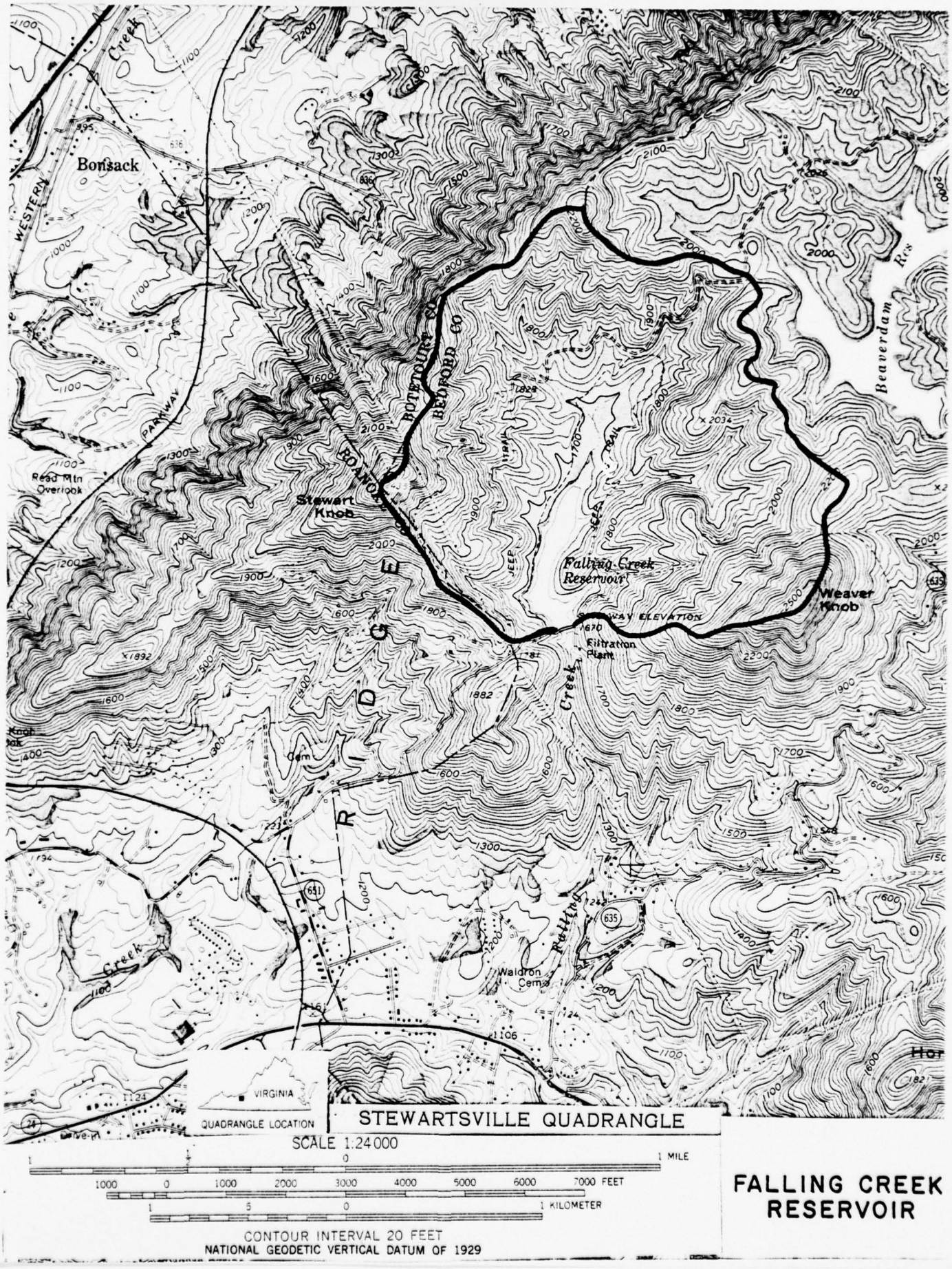
1/ f. The use of one chain for each stoplog is an awkward method to regulate the stoplogs. An alternate method should be developed to expediently remove the stoplogs during high flows.

g. The staff gage should be extended above normal pool level.

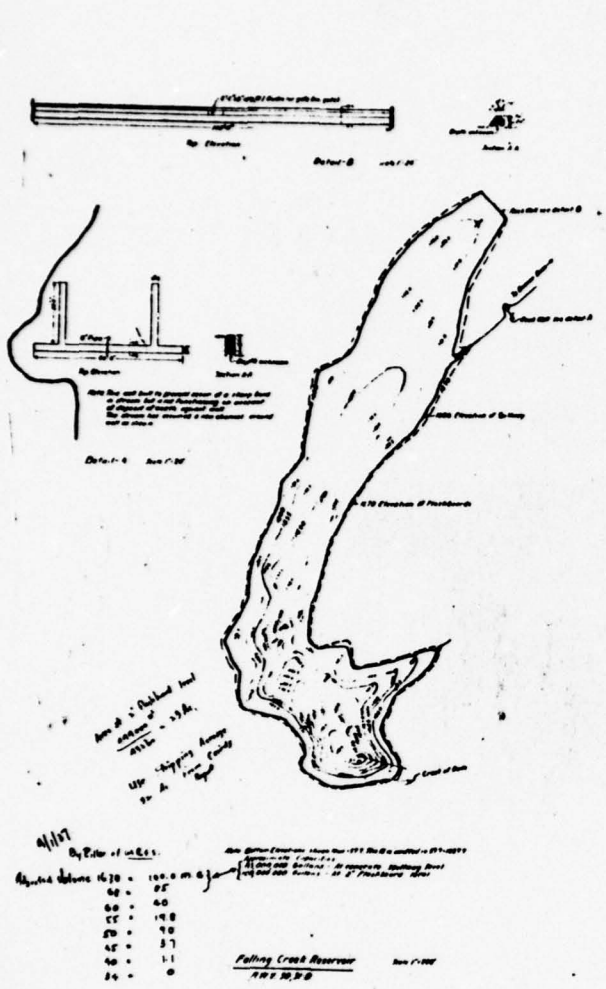
h. A thorough investigation to establish the adequacy of the embankment stability under full loading conditions should be performed.

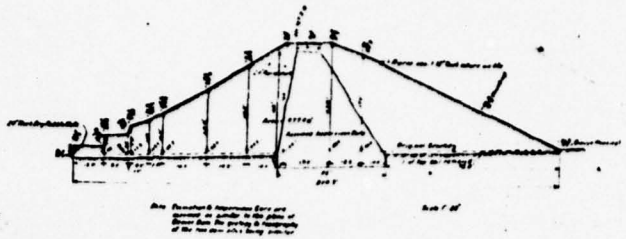
1/ The owner has corrected remedial measures during the restoration of the original spillway in July 1979.

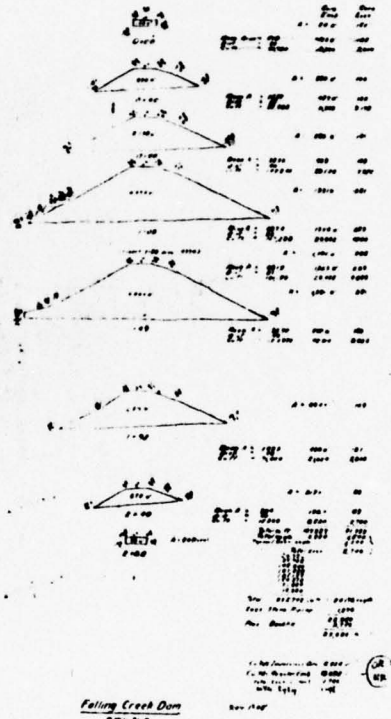
APPENDIX I
MAPS AND PLATES



FALLING CREEK RESERVOIR







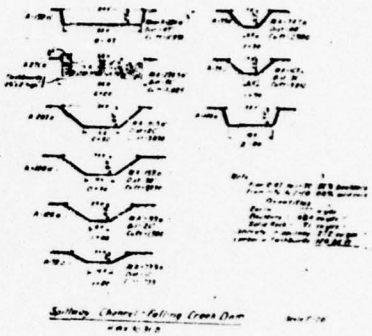


PLATE I

VALUATION OF
ROANOKE WATER WORKS CO.
ROANOKE VA
FALLING CREEK DAM & FILTER PLANT
MAR 5, 1930 SCALE AS NOTED
ALLEN J. SAVILLE, INC. CONSULTING
ENGINEERS
ROANOKE VA.
SURVEY BY - GWR DRAWN BY - JNS TRACED BY - LBY COMPARED BY - RWS

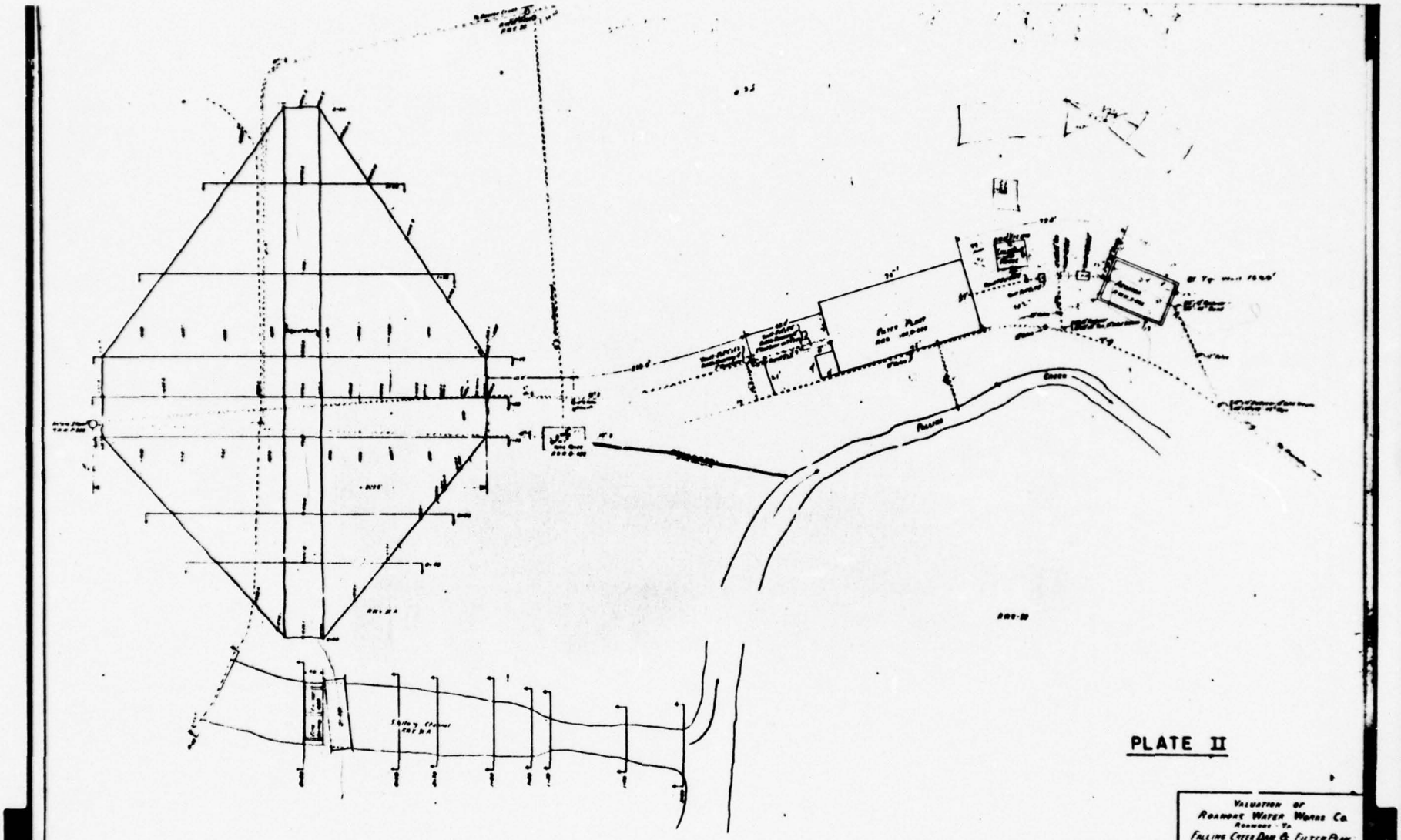


PLATE II

VALUATION OF
ROANOKE WATER WORKS CO.
ROANOKE - VA
FALLING CREEK DAM & FILTER PLANT
FEB 27, 1934 SCALE 1"=20'
ALLEN J. SAVILLE, INC ENGINEERS
RICHMOND - VA
Surveyed By - GBR Traced By - LBV
Drawn By - RHS Compared By - RHS

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RWV-3-B

APPENDIX II

PHOTOGRAPHS

PHOTO #1 INTAKE STRUCTURE

PHOTO #2 TYPICAL VIEW OF DOWNSTREAM SLOPE

PHOTO # 3 EMERGENCY SPILLWAY

PHOTO # 4 EMERGENCY SPILLWAY
DISCHARGE CHANNEL

PHOTO # 5 SEEP AT JUNCTION LEFT ABUTMENT AND EMBANKMENT

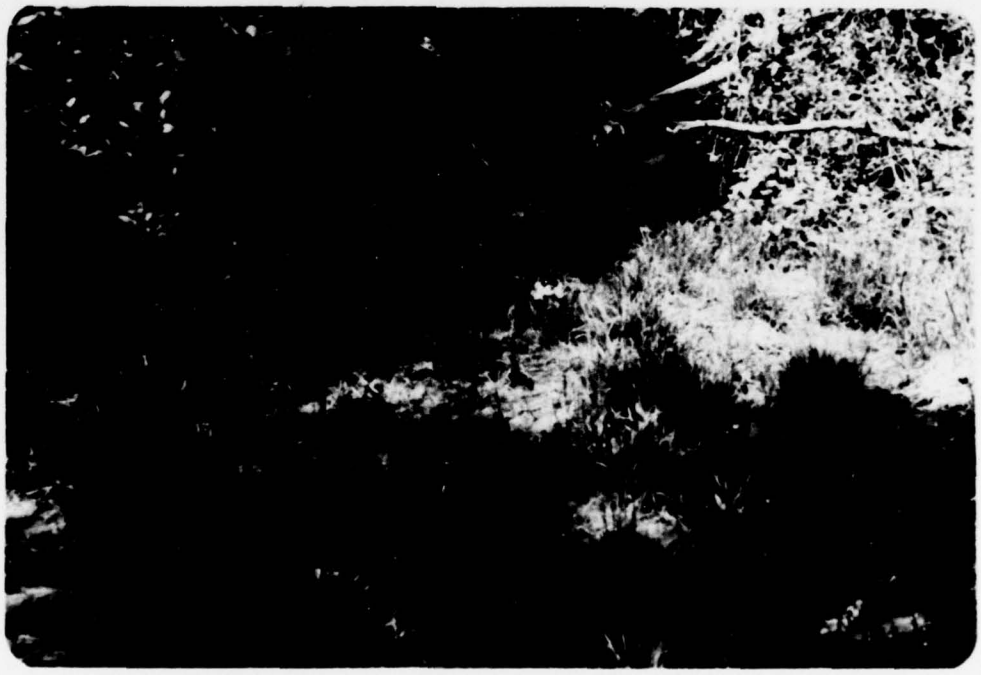


PHOTO # 6 SEEP AT TOE OF DAM

PHOTO #7 EROSION AROUND DOWNSTREAM
END OF EMERGENCY SPILLWAY

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase 1

Name Dam Falling Creek County Bedford State Virginia Coordinates Lat. 3718.1, Long. 7950.2

Date(s) Inspection 2 May 1979 Weather Clear Temperature 60°±F

Pool Elevation at Time of Inspection 1671± m.s.l. Tailwater at Time of Inspection 1625± m.s.l.

Inspection Personnel:

J. Robinson, COE
D. Pezza, COE
R. Feazell, City of Roanoke
B. Taran, COE
C. Sluss, City of Roanoke
D. Harvey, SWCB
J. Irving, COE

D. Pezza Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No cracks were observed. Downstream slope heavily vegetated with brush and trees up to 18 inches in diameter.	All trees and heavy vegetation should be removed from the face of the dam. All subsequent holes should be dressed with compacted fill and seeded.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No movement or cracking was observed. The downstream area is wet with swamp-like vegetation.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Sinks have developed in downstream fill around the corrugated spillway. According to Sluss, the fill on top of the dam is compacted, but the side slopes are dumped fill. The erosion was caused by surface runoff not by flow through the embankment. The fill was placed during 1975 construction of the spillway channel.	The sinks should be backfilled with compacted material and contoured to facilitate drainage.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignments of the crest do not deviate from the available drawings. The top of the dam serves as a crushed gravel road. Six-inch-high wind rows are evident along the road surface.	None.
RIPRAP FAILURES	No failures were observed. The upstream slope is riprapped, but submerged, and therefore, not observable. The downstream slope is riprapped with cobbles, boulders, and is covered with vegetation.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The upstream right junction (right of the spillway) has eroded. The upstream left junction serves as a boat ramp. The boat ramp is the lowest elevation of the embankment. It was noted by Feazell that this portion of the dam was over-topped within the last 2 years. The road across the dam turns downstream on the left abutment and leads to the filtration plant.	The eroded area should be backfilled with compacted fill and contoured to facilitate drainage.
ANY NOTICEABLE SEEPAGE	Four clear seeps were located. One in each downstream abutment and one in each downstream junction. The seep in the left abutment was passing less than 1 GPM. The seep in the left junction was passing a minimim 15 GPM. The seeps on the right side could not be measured for various reasons. It is suspected that junction seeps come from foundation drains. There is no explanation for the abutment seeps.	The abutment seeps should be monitored on a periodic basis. If erosion, sloughing, or settlement should occur immediate remedial measures should be taken.
DRAINS	Based on the noted seepage and wet conditions at the base of the dam, it is suspected that the dam has subsurface drains. Drains are probably located at the toe and at junctions from the middle of the dam to the toe of the dam.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE	The intake "stack" structure is submerged. It has three intake levels. The top level has an open 10-inch valve. The bottom two are closed. An outlet pipe passes through the dam and ties into a 16-inch pipe which leads to the filtration plant. The line has a blowoff valve that discharges into the downstream channel when opened.	The divers report explains the condition of all valves and stems on the stack.
OUTLET STRUCTURE	Two 12-inch blowoff valves located below the toe of the dam may be operated to draw water from the reservoir while the lines serve water to the filtration plant.	Valves have not been operated.
OUTLET CHANNEL	No formed channel is apparent, but a flat wet area does pass some flow which originates from the four seep areas.	None.
EMERGENCY GATE	The two blowoff valves serve as an emergency release for the reservoir.	None.

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Concrete headwall has an open crack approximately 1/16-inch wide through the wall directly over the spillway pipe. The cracks run from the top of the headwall to the top of the pipe.	The elevation of the crack is above the top of dam elevation.
APPROACH CHANNEL	The approach channel is shallow with no debris.	None.
DISCHARGE CHANNEL	The spillway is a 72-inch CMP. The mouth has two 12-inch stoplogs serving as a weir. Two inches of water is flowing through the pipe. The spillway crest is at elevation 1671.0 (normal pool).	None.
DISCHARGE CHANNEL	Channel cut into natural terrain exposing weathered granitic gneiss. Overburden is a micaceous, non-plast residual silt. The channel is overgrown with trees and shrubs. The original concrete and stone spillway has eroded and some debris is located downstream.	The channel should be cleared of vegetation and debris.
BRIDGES AND PIERS	The piers for the old bridge over the original spillway are still visible at the downstream side of the outlet channel.	None.

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None.	
WEIRS	Stoplogs across outlet channel serve as a weir. The two boards sit on a third board flush with the invert. Two chains, one attached to each stoplog, are available to raise and lower the stoplogs. Metal channel fence posts serve as lift guides.	The use of one chain for each stoplog is an awkward method to regulate the stoplogs.
PIEZOMETERS	None.	
STAFF GAGES	There is a staff gage located on the intake structure and is submerged.	Staff gage should be extended above normal pool level.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The surrounding upstream area is heavily mountainous terrain. There are no visible slope failures. Many trees are down around the reservoir edge due to a winter ice storm. The water is free from debris.	The fallen trees should not cause an immediate debris problem.
SEDIMENTATION	No sedimentation observed. Divers inspected the intake tower in 1972 and their report is recorded on the drawings.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel below the spillway is 8-10 feet wide and 6-8 feet deep with rocks and some tree limbs in the immediate vicinity. The seeps at the toe of the dam keep the area wet with a small channel to pass the flow into the main channel that enters from the right side of the dam.	None.
SLOPES	The right slope is steep and wooded. The left slope is mild to steep with the road, filtration plant, and other small buildings in the immediate (mild) area.	None.
APPROXIMATE NO.	The filtration plant is immediately downstream. About 6 to 7 homes and stores are located along Route 635 at the Route 24 intersection 1.5 miles downstream.	None.

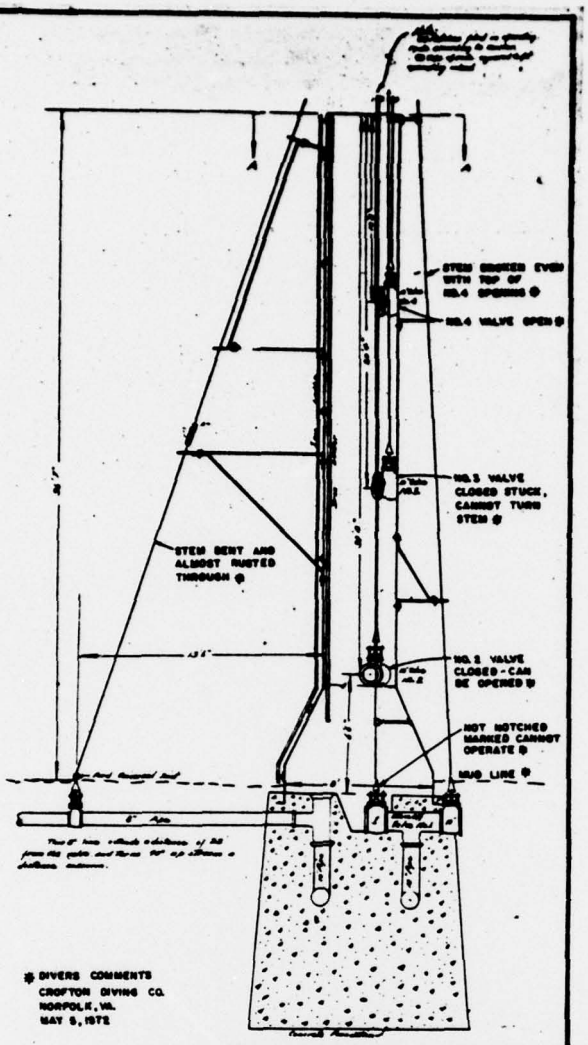
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available drawings show a plan view and profiles of the dam and original spillway.
REGIONAL VICINITY MAP	No map available. Other than USGS Stewartsville quad sheet.
CONSTRUCTION HISTORY	The dam was constructed in 1897-98. The contractor is unknown. Splashboards were installed in 1924. The spillway was modified in 1927 and again in 1975. The city has maintained a photographic record of actual construction of the dam.
TYPICAL SECTION OF DAM	Sections are shown on available drawings.
HYDROLOGIC/HYDRAULIC DATA	The dam has a 906-acre drainage area with a 85 MG normal storage. Elevation storage records are available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	There are no plans or details available. Also constraints and discharge ratings are unknown.
RAINFALL/RESERVOIR RECORDS	The city of Roanoke maintains pool elevation records. Rainfall records are available from N.W.S. in Roanoke.

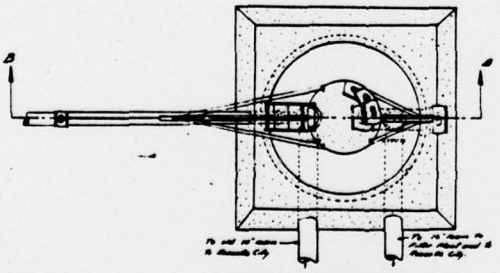
ITEM	REMARKS
DESIGN REPORTS	There are no design reports.
GEOLOGY REPORTS	There are no geology reports.
DESIGN COMPUTATIONS DAM STABILITY SEEPAGE STUDIES	There are no known computations, stability analyses, and seepage studies.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	There are no data pertaining to investigations and testing.
COST-CONSTRUCTION SURVEYS OF DAM	Cross sections of the dam were taken and prepared by Allan J. Saville Engineers of Richmond, Virginia in 1934. This information is recorded on the drawings. The intake structure was inspected in 1972 and a divers report is recorded on the drawings.
BORROW SOURCES	The only available information are construction photographs. These photographs indicate that at least a portion of the embankment material came from within the reservoir area.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	The most recent modification to the spillway (1976-1977) is not recorded on the drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Valve locations and locations of multilevel withdrawal points are shown on the drawings.
MONITORING SYSTEMS	A staff gage is installed on the outlet structure in the reservoir. There are no other monitoring systems.
MODIFICATIONS	The spillway has been modified on two occasions as noted in the construction history. The latest modification was the installation of a 72-inch corrugated metal pipe in the old spillway. This in effect has reduced the effective waterway area.
HIGH POOL RECORDS	There are no available records, but the filtration plant operator indicated the dam was occasionally near or bearly overtopped during the past 2 years. The city engineer indicated that the low point on the dam is at approximately 1671.7 feet m.s.l.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	Records are not available as no operation is required at the dam other than to adjust valve settings on the outlet works. Raw water withdrawal to the filtration plant records are available.

APPENDIX IV
DIVERS REPORT "STACK"



PROJECTION OF MIDDLE SECTION ON VERTICAL PLANE
SECTION - B-B



PROJECTION ON HORIZONTAL PLANE
VIEW - A-A

STACK

AT FALLING CREEK RESERVOIR, BEDFORD COUNTY, VIRGINIA.

FROM DATA AVAILABLE AFTER COMPLETION OF WORK BY THE DEEP SEA DIVER.

ROANOKE WATER WORKS COMPANY — ROANOKE, VIRGINIA, OCTOBER 6, 1931.

DRAWN & TRACED BY — H. M. HARRIS, DRAFTSMAN.

FY-0068
67

APPENDIX V

POST VISUAL INSPECTION MODIFICATIONS TO SPILLWAY

City of Roanoke, Virginia

DIRECTORATE OF UTILITIES & OPERATIONS

Utility Line Facilities
~~REFUSE COLLECTION DEPT.~~
AIRPORT / MARKET DEPT.

WATER DEPT.
SEWAGE TREATMENT DEPT.

14 August 1979

Mr. Jim Robinson
U.S. Army, Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510

Subject: Falling Creek Dam, Bedford County
Spillway Modification

Dear Jim:

As per our recent telecon, this letter is to officially inform you we have completed all of our proposed work on the spillway of our Falling Creek Dam as we outlined in our meeting on 12 July 1979 in Richmond. The scope of the work was to remove the 6-foot culvert and return the spillway to its original condition that existed prior to 1974.

The spillway is now 27'8" between the concrete sides instead of the assumed 20'. I was not satisfied with the assumed elevations on the dam and water level so I had our survey crew run from the known elevation of the filter plant floor of 1609' and I have enclosed their sketch showing the elevations across the top of the dam in the center of the road, the spillway concrete 1668.99', bridge deck, water level at that time, and the concrete lip that was in front of the culvert, 1669.34'. As we suspected, the concrete lip was higher than the concrete spillway so we removed it and leveled the entire area from the lake to the concrete spillway to a level below the concrete spillway. The approach channel from the lake to the concrete spillway is rock lined and the sides between the spillway and bridge are also rock lined as shown on the old drawings.

Instead of the top of the dam lowering with age, we have actually built up the dam with the continual road work on the top of the dam and the lowest point is now 1672.5'. With the concrete spillway at 1668.99', this gives a usable spillway height of 3.51', a width of 27.67' for an area of 97.12 sq. ft. before overtopping. I also took measurements of the area downstream of the spillway through the bridge abutments to assure myself we didn't restrict the flow and those areas are shown on a rough sketch attached. As you can see, there is more usable area downstream of the spillway so we have a good 3.51' x 27.67' spillway. The actual height of the concrete sides is 4'3" with dirt and rock sides sloping upward above that.

Mr. Jim Robinson
U.S. Army, Corps of Engineers, Norfolk District
14 August 1979

If you need anymore information, please let me know. For your information, on Saturday, 11 August 1979, the water level was approximately 1" below the spillway when a thunderstorm dumped 2.45" of rain in about an hour and then another .13" of rain later in the evening. The rain brought up the water level about 3" to give us approximately 2" across the spillway. On Monday morning, 13 August, the flow was still the full width of the spillway and about 1/2" to 1" deep. We do appreciate having the rain gauge because I think it will show less effects than assumed from the watershed.

Thank you for your assistance and please feel free to contact me at any time, 703/981-2601.

Sincerely yours,

M. Craig Stuss

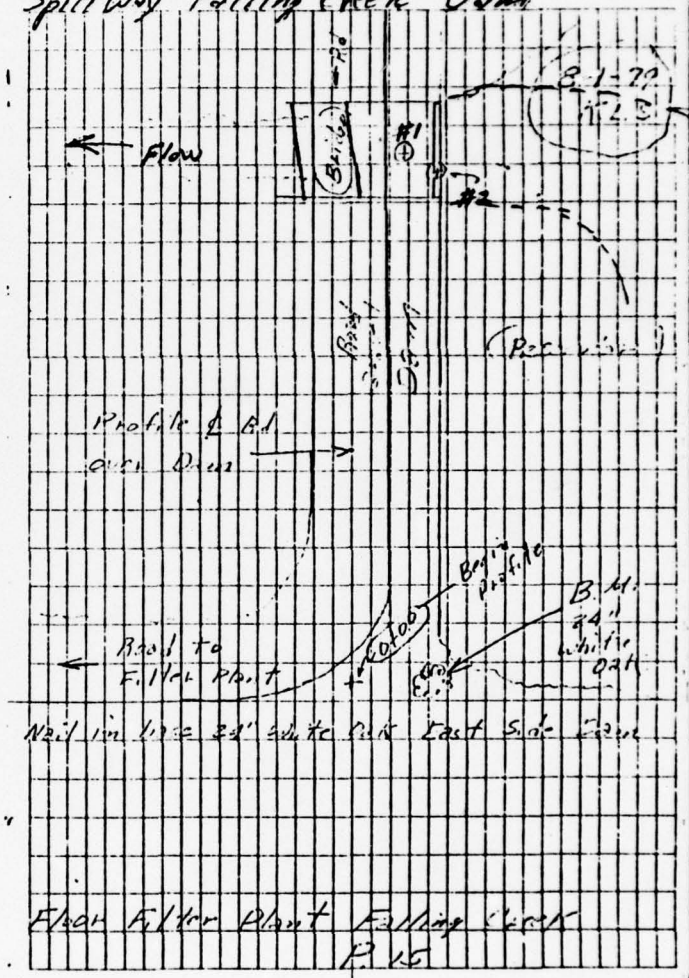
M. Craig Stuss, Manager
Water Department

MCS:ac

Attachments (2)

Elev from Filter Plant Floor To Spillway Falling Creek Dam

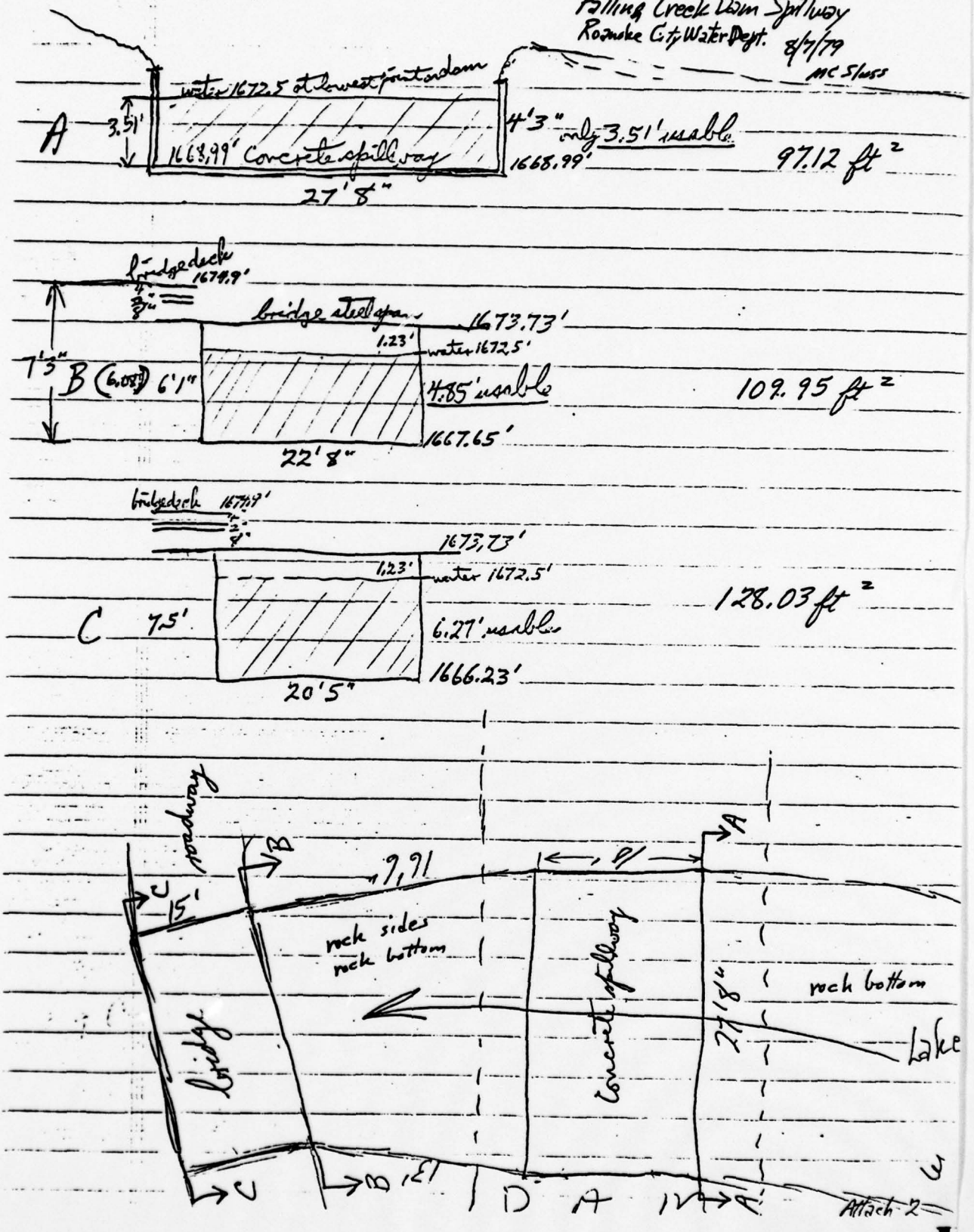
water level			8.56	1669.31
Bridge Sec.			3.0	1674.9
Top Conc. at edge water	#2		8.53	1669.34
3+40	Spillway #1 (concrete)		8.88	1668.99
3+00			3.9	1674.0
2+50			5.0	1672.9
2+00			5.3	1672.6
1+50			5.4	1672.5
1+00			5.3	1672.6
0+50			5.1	1672.8
0+00			4.3	1673.6
B.M.			1.52	1676.35
TP	15.98	1677.87	0.62	1661.89
TP	21.34	1662.51	0.12	1641.17
TP	15.25	1641.29	0.38	1626.04
BM	1742	1626.42		1609.0



Attach 1

Attach 1

Falling Creek Dam Spillway
Roanoke City Water Dept. 8/7/79
MC Sloss



APPENDIX VI

REFERENCES

APPENDIX VI

REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, July 1978).

3. "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian," Hydrometeorological Report No. 33, (U. S. Weather Bureau, April 1956).