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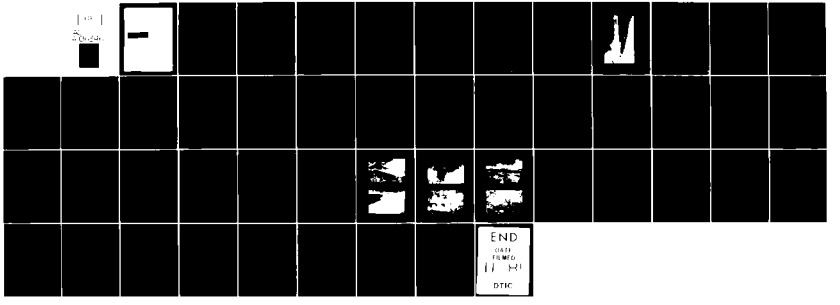

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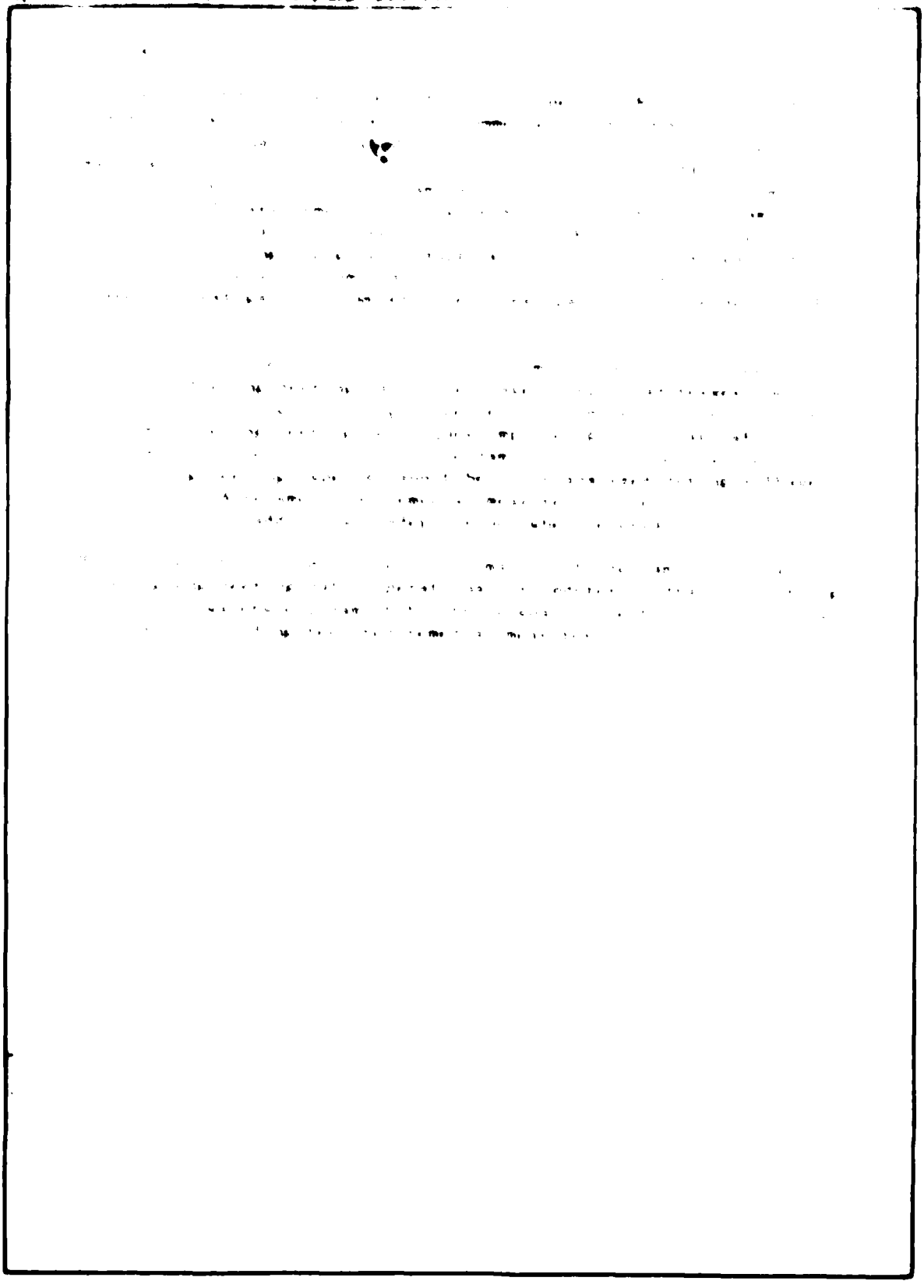

PREFACE

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 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

CONTENTS

NAME OF DAM: WARRENTON LAKE DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Warrenton Lake Dam
State: Commonwealth of Virginia
County: Fauquier
USGS 7.5 Minute Quadrangles: Warrenton, Virginia and Marshall, Virginia
Stream: Unnamed Tributary to Cedar Creek
Date of Inspection: 20 May 1981

BRIEF ASSESSMENT OF DAM

Warrenton Lake Dam is an earthfill embankment approximately 24.9 feet high[1] and 369 feet long. The principal spillway is a 48-inch diameter concrete drop inlet riser located near the center of the dam. An open channel emergency spillway is located on the left abutment. The dam, located about 1.5 miles northeast of Warrenton, Virginia, is used for recreation. The dam is owned by Melvin Helinick, Forest Road, RFD 4, Warrenton, Virginia 22186. Warrenton Lake Dam is a "small" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. The dam and appurtenant structures were in fair overall condition at the time of inspection. Maintenance of the dam is considered to be inadequate.

There is a slope failure on the downstream face of the dam midway up the slope. This failure extends the length of the embankment. Because the embankment slopes are steeper than those recommended in the Bureau of Reclamation's guidelines for small dams and because of the slope failure observed, a stability check of the dam is required.

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 spillway is capable of passing 100 percent of the SDF or 39 percent of the Probable Maximum Flood (PMF) without overtopping the dam. The spillway is adjudged as adequate.

Due to the embankment stability problems observed, the dam is assessed as unsafe, non-emergency.

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

NAME OF DAM: WARRENTON LAKE DAM

It is recommended that, within two months of the date of notification of the Governor of the Commonwealth of Virginia, a qualified geotechnical engineering firm should be retained by the owner to perform a stability check of the dam and to further evaluate the wet area to the right of the principal spillway.

Within six months of the notification of the Governor, the consultant's report of appropriate remedial measures should have been completed and the owner should have an agreement with the Commonwealth of Virginia for a reasonable time frame in which all remedial measures will be completed

Visual inspection and office analyses indicate deficiencies requiring remedial treatment.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be completed annually.

A flood warning system and emergency action plan should be promptly developed and put into operation. It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel. This should include:

1) How to operate the dam in an emergency.

2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

3) Procedures to evaluate inflow during periods of emergency operation.

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

1) Remove all trees and brush growing on the embankment by cutting them off at ground level. Trees with a trunk diameter of greater than 3 inches should also have their root systems removed and the resultant holes backfilled, compacted, regraded and seeded.

2) Backfill, compact, and seed the depression on the crest and all areas of erosion.

3) Remove the debris lodged in the principal spillway riser and install a trash rack.

NAME OF DAM: WARRENTON LAKE DAM

4) Repair the leak in the principal spillway and monitor for future leakage.

5) Extend the outlet pipe, fill, compact, and seed the eroded area. The length to which the pipe and embankment must be extended should be determined as part of the stability analysis of the dam. Provide erosion protection for the channel downstream from the outlet pipe.

6) Provide erosion protection for the upstream face of the embankment.

7) Clear the downstream channel of debris, trees, and brush.

8) Install a staff gage to monitor reservoir levels above normal pool.

MICHAEL BAKER, JR., INC.

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

COMMONWEALTH OF VIRGINIA
MICHAEL
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NO. 3176

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NAME OF DAM: WARRENTON LAKE DAM

OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: WARRENTON LAKE DAM ID# VA 06134

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 (Reference 12, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Warrenton Lake Dam is an earthfill embankment approximately 24.9 feet high[1] and 369 feet long. The crest of the dam is about 16.4 feet wide and the minimum elevation of the crest is 1005.9 feet Temporary Bench Mark (T.B.M.)[2]. The slope of the upstream face of the embankment is approximately 2.9H:1V (Horizontal to Vertical) and the slope of the downstream face of the embankment is 2.6H:1V. The slope of the downstream face increases to 1.3H:IV in the area above and around the outlet pipe. There is no information available on any possible zoning of the

[1]Measured from the streambed at the downstream toe to the embankment crest.
[2]All elevations are referenced to a Temporary Bench Mark located on top of the concrete intake riser. The assumed elevation is 1000.0 feet.

embankment. No evidence of an internal drainage system for the dam was found. There is no slope protection on the embankment.

The principal spillway is a 48-inch diameter concrete riser. It is located near the center of the dam and has a crest elevation of 1000.0 feet T.B.M. Water passing into the intake riser is transmitted through an 18-inch diameter concrete pipe that extends through the embankment. The pipe discharges into the natural stream channel.

The emergency spillway is a trapezoidal shaped grass lined channel located in the left abutment, with a crest elevation of 1001.6 feet T.B.M. and a bottom width of [illegible] feet. The discharge channel follows the left abutment slope and enters the downstream channel after passing through a [illegible] area for a short distance.

The reservoir has a drainage area of [illegible] square miles. The watershed consists primarily of grassland. The area around Warrenton Lake Dam is a newly built residential development.

1.2.2 Location. Warrenton Lake Dam is located in Fauquier County, Virginia on an unnamed tributary to Cedar Run approximately [illegible] miles northeast of Warrenton, Virginia. A location plan is included with this report in Appendix I.

1.2.3 Size Classification. The height of the dam is 24.9 feet and the reservoir storage capacity at the crest of the dam (elevation 1005.9 feet T.B.M.) is [illegible] acre-feet. The dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspections of Dams.

1.2.4 Hazard Classification. The road into the home development crosses the streambed channel 500 feet downstream and a second dam is located [illegible] feet downstream of Warrenton Lake Dam. Several homes are located in the floodplain. Loss of human life in the event

NAME OF DAM: WARRENTON LAKE DAM

of a dam failure is not considered highly probable; however, economic losses due to damage to the road, homes, and downstream dam are likely in the event of a dam failure. Warrenton Lake Dam is considered to be 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 is not related to stability or probability of failure.

1.2.5 Ownership: The dam and reservoir are owned by Melvin Helinick, Forest Road, RFD 4, Warrenton, Virginia 22186.

1.2.6 Purpose of Dam: The reservoir is used for recreational purposes.

1.2.7 Design and Construction History: A member of the homeowners' association reported that a gully was cut in the emergency spillway about 10 feet below the crest of the dam during a storm which occurred around 1976. A sewerline was placed in the emergency spillway at a depth of about 5 feet when this gully was repaired one year later. No other information on the design or construction history was available for use in this report.

1.2.8 Normal Operating Procedure: The reservoir level is maintained automatically by the crest of the principal spillway (elevation 1000.0 feet T.B.M.). No formal operating procedures are followed for this structure.

1.3 Pertinent Data

1.3.1 Drainage Area: The total drainage area tributary to Warrenton Lake Dam is 0.59 square miles.

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

Pool level at minimum top of dam:

Principal Spillway	28.0 c.f.s.
Emergency Spillway	1880.0 c.f.s.

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

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation (feet T.B.M.)	Area (acres)	Reservoir Capacity Acre-feet	Watershed (inches)	Length (feet)
Top of dam	1005.9	14.2	112.3	3.8	[illegible]
Emergency spillway	1001.6	10.3	87.5	2.2	[illegible]
Principal spillway crest	1000.0	8.8	46.3	1.5	[illegible]
Streambed at toe	981.0	-	-	-	-

NAME OF DAM: WARRENTON LAKE DAM

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SECTION 3 - VISUAL INSPECTION

General. The field inspection was conducted [illegible] May [illegible]. At the time of inspection the pool elevation was at [illegible] feet T.B.M. and the tailwater elevation was 483.1 feet T.B.M. The weather was clear with a tempera-ture of [illegible] degrees Fahrenheit. The dam and all appurtenant structures were found to be in fair overall condition at the time of the inspection. No conditions were found during the inspection which require immediate remedial treatment. The following are brief summaries of these deficiencies. A Field Sheet of conditions found during the inspection is presented in Appendix I. The complete visual inspection checklist is provided in Appendix III. No record was found of any previous inspections.

Dam. The embankment was found to be in fair condition. The upstream face of the embank-ment is covered with small trees and brush [illegible] diameter at and above normal pool level. Erosion of the face is occurring below these trees resulting in a vertical drop on the face of 2-3 [illegible] feet. Severe erosion is also occurring on the downstream face of the embankment at and above the outlet pipe. It appears that the slope of the embankment around the outlet pipe was increased, decreasing the bottom width of the embankment to allow for a shorter length of pipe through the embankment. It is in this steeper portion of the embankment where the severe erosion is taking place. There is a small depression on the downstream edge of the embankment crest. An erosion gully has developed at the junction of the upstream edge of the embankment crest and the emergency spillway. A wet area was observed along the toe of the dam to the right of the outlet pipe. There was no measurable flow from the area. No evidence of an internal drainage system was found during the inspection.

NAME OF DAM: WARRENTON LAKE DAM

Visual signs of instability were noted along the downstream slope. Sloughing and signs of slope failure with a 1 foot scarp exist along the length of this slope midway up the embankment.

3.1.3 Appurtenant Structures: The principal spillway (as described in Section 1.2.1) was found to be in fair condition. The intake consists of a 48-inch diameter concrete riser pipe. There is no trash rack protecting the pipe, and debris was observed in the bottom of the pipe. There also appears to be a leak in the lower section of the riser.

The outlet pipe is an 18-inch diameter concrete pipe. As discussed in Section 3.1.2, the pipe is not long enough. The outlet channel is a natural channel. There is debris in the channel approximately 10 feet downstream from the outlet pipe. This debris has blocked the channel outlet, forming a pool which backs up to the outlet pipe. The reservoir slopes gently up to the entrance of the emergency spillway. The spillway is a trapezoidal earth channel. There is a good cover of grass in the channel. The discharge channel is a trapezoidal earth channel consisting of rocky soil with a sparse cover of grass. Residents near the dam indicated that, during a storm approximately 5 years ago, the emergency spillway was activated. A gully was cut in the channel approximately 5 feet deep. A sewer line was reportedly laid in this when it was repaired 1 year later. The channel is infringed upon by wooden fences surrounding the residents' property on the left abutment. A dike with its crest 4-5 feet below the top of dam forms the left side of the channel. The channel becomes very steep beyond the embankment. There is a home approximately 150 feet downstream from the dike which will be effected if flows in the spillway cause the dike to fail.

3.1.4 Reservoir Area: The slopes of the reservoir are moderate to mild with no signs of erosion or instability. They were grass covered with a number of residences surrounding the reservoir.

Sedimentation does not appear to be a problem. Soundings were taken, and the depth of the normal pool was measured to be 13.4 feet near the riser pipe. No significant accumulations of debris were observed in the reservoir area.

3.1.5 Downstream Channel: A road into the housing development crosses the downstream channel 560 feet downstream, and another dam is 1900 feet downstream from the dam. The channel has moderate slopes. Two homes are located in the flood plain between the road and the downstream dam.

3.1.6 Instrumentation: There was no instrumentation present at the dam.

3.2 Evaluation: In general, the dam and appurtenant structures were found to be in fair condition. The slope failure on the downstream face should be investigated and repaired. The erosion of the upstream face is not considered to be a serious problem at this time. However, the trees and brush should be removed and another means of erosion protection provided. The depression on the downstream edge of the embankment crest should be filled in. The erosion gully at the junction of the upstream edge of the embankment crest and the emergency spillway should be filled, compacted, and reseeded. The wet area along the toe of the dam to the right of the outlet pipe is probably the result of poor surface drainage. The area should be regraded to improve surface drainage and monitored for seepage.

The debris should be removed from the intake pipe and a trash rack installed. The leak in the pipe should be sealed. The outlet pipe should be extended. The debris should be removed from the outlet channel and the channel graded to improve flow out of the channel. The fences infringing on the spillway channel should be removed. Because of the steepness of the channel, erosion may be a problem if the spillway is activated. Erosion protection should be provided in the downstream sections of the emergency spillway channel, especially along the dike.

A staff gage should be installed to monitor reservoir levels above normal pool.

NAME OF DAM: WARRENTON LAKE DAM

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 1000.0 feet T.B.M. When inflow is sufficient to cause the reservoir level to rise above elevation 1001.6 feet T.B.M., discharge takes place through the emergency spillway on the left abutment.

4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the owner. An inspection or maintenance schedule has not been instituted.

4.3 Maintenance of Operating Facilities: None were observed at the time of the inspection.

4.4 Warning System: At the time of inspection, there was no warning system or emergency action plan in operation.

4.5 Evaluation: Maintenance of the dam in the past has been inadequate. Regular inspections of the dam and appurtenant structures should be made and documented. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and implemented as soon as possible. This plan should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area becomes necessary.

The local Emergency Services Coordinator of the State Office of Energy and Emergency Services can assist in the preparation of an emergency warning plan.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

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

5.2 Hydrologic Information: No rainfall, stream gage or reservoir stage records are maintained for this dam.

5.3 Flood Experience: No records were available. As described in Section 3, a deep gully was cut in the emergency spillway during a storm which occurred around 1976.

5.4 Flood Potential: The Probable Maximum Flood (PMF), 1/2 Probable Maximum Flood (1/2 PMF), and 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 PMF were estimated at an initial loss of 1.0 inches and a constant loss rate of 0.05 inches per hour thereafter. 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 inches per hour thereafter.

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

Regulation of flow from the reservoir is primarily automatic. Normal flows are maintained by the crest of the principal spillway at elevation 1000.0 feet T.B.M. Water may also discharge through the emergency spillway on the left abutment when the reservoir rises above an elevation of 1001.6 feet T.B.M.

Outlet discharge capacity was computed by hand. Reservoir area was estimated from the Warrenton, Virginia and Marshall, Virginia, 7.5 minute USGS quadrangles, and storage capacity curves above normal pools were 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[1]	Hydrographs 100-Year	1/2 PMF	PMF[2]
Peak flow, c.f.s.				
Inflow	1.0	1404.0	3553.0	7106.0
Outflow	1.0	1115.0	3255.0	7025.0
Peak elev., ft. T.B.M.	1000.0	1004.6	1006.7	1007.9
Non-overflow section (elev. 1005.9 ft. T.B.M.)				
Depth of flow, ft.	-	0.0	0.8	2.01
Average velocity, f.p.s.[3]	-	0.0	4.1	6.6
Total duration of over-topping, hrs.	-	0.0	0.6	1.17
Tailwater elev., ft. T.B.M.	983.1	-	-	-

[1]Conditions at time of inspection.
[2]The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meterologic and hydrologic conditions that are reasonably possible in a region.
[3]Velocity estimates were based on critical depth at control section.

5.7 Reservoir Emptying Potential: No facilities for drawing down the reservoir were observed at the time of the inspection.

5.8 Evaluation: Warrenton Lake 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. Due to the risk involved, the 100-year flood was selected as the SDF. The 100-year flood was routed through the reservoir and found that the spillways will pass the SDF without overtopping the dam. The spillways are capable of passing up to 38 percent of the PMF or 100 percent of the SDF without overtopping the dam.

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

NAME OF DAM: WARRENTON LAKE DAM

SECTION 6 - STABILITY ANALYSIS

6.1 Foundation and Abutments: No information is available on the foundation conditions other than observations made at the time of the inspection. The Geologic Map of Virginia shows the dam is located within the Blue Ridge Province. This particular location is characterized by Metamorphosed Sedimentary Rock of uncertian age. Soil samples taken from the area were found to be dark brown sandy silt with a trace of clay.

No evidence of substantial seepage was observed during the inspection or any problems associated with piping of the foundation or abutment materials. Based on the visual inspection of the dam, it is believed no internal drainage system for the dam exists. Information on the keying of the dam into the foundation was unavailable.

6.2 Embankment

6.2.1 Materials: There was no information describing the nature of the materials or any zoning within the embankment. The outer embankment was found to be clayey silt of low plasticity.

6.2.2 Stability: Design Plans and previous stability analysis results were unavailable for this inspection. The dam is 24.9 feet high with a crest width of 16.4 feet. The upstream slope was measured to be 2.9H:1V. The downstream slope varies between 2.6H:1V and 1.3H:1V and is inconsistent throughout the downstream face. The discontinuity exists around the discharge pipe (see Field Sketch) where the slope is 1.3H:1V. The outlet facilities did not provide the capability to drain the reservoir in the event of an emergency. Therefore, the embankment is not considered susceptible to rapid drawdown.

According to the guidelines presented in Design of Small Dams by the U.S. Department of the Interior, Bureau of Reclamation for small dams of the described material with stable foundations not subject to rapid drawdown, the recommended slopes are 3H:1V for the upstream face and 2.5H:1V for the

downstream slope. The recommended crest width is 14.5 feet. The crest width is within these guidelines, while the upstream slope and portions of the downstream slope are inadequate.

Visual signs of instability were noted along the downstream slope. Sloughing and signs of slope failure existed along the length of this slope midway up the embankment with a 1 foot scarp. Erosion is occurring all around the downstream end of the outlet pipe making the inadequate slope within this area even more unsafe. Depressions were also found along the downstream edge of the crest. These depressions are probably ruts created by vehicles driving over the dam.

Operating records were unavailable for this inspection. A nearby resident of Warrenton Lake, reported that approximately 5 years ago (1976), a deep gully was washed out in the emergency spillway. The wash out zone extended to a depth of 10 feet below the crest of the dam. One year later, the emergency spillway was repaired. A sewerline was placed within the emergency spillway area at the time of the repairs approximately 5 feet below the present surface.

6.3 Evaluation: The results of a previous stability analysis were unavailable for review as a part of this evaluation. Other visual signs of instability were noted as previously mentioned in Section 6.2.2. The present conditions of the aforementioned problems indicate that a stability check of the dam should be performed by a geotechnical engineer. This analysis should include consideration of the slope failure on the downstream face of the embankment and the excessively steep embankment section at the outlet pipe. Measures for repairing these problems and extending the present outlet pipe should be prepared.

SECTION 7 - ASSESSMENT REMEDIAL MEASURES

7.1 Dam Assessment: There is insufficient information to evaluate foundation conditions and embankment stability. There were no engineering data available for use in preparing this report. Deficiencies discovered during the field inspection and office analyses require remedial treatment. The dam and appurtenant structures are generally in fair overall condition. Maintenance of the dam is considered inadequate.

The area of slope failure along the downstream face of the dam, and the steep embankment slopes indicate that a detailed stability analysis should be performed.

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 Warrenton Lake Dam. The spillways are capable of passing up to 100 percent of the SDF or 38 percent of the PMF without overtopping the dam. Therefore, the spillway is adjudged adequate.

Due to the embankment stability problems observed, the dam is assessed as unsafe, non-emergency.

There is no warning system or emergency action plan currently in operation.

7.2 Recommended Remedial Measures. It is recommended that within two months of the date of notification of the Governor of the Commonwealth of Virginia, a qualified geotechnical engineering firm should be retained by the owner to perform a stability check of the dam and to further evaluate the wet area to the right of the principal spillway.

Within six months of the notification of the Governor the consultant's report of appropriate remedial measures should have been completed and the owner should have an agreement with the Commonwealth of Virginia for a reasonable time frame in which all remedial measures will be complete.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be completed annually.

NAME OF DAM WARRENTON LAKE DAM

A formal warning system and emergency action plan should be developed and implemented as soon as possible.

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

1) Remove all trees and brush growing on the embankment by cutting them off at ground level. Trees with a trunk diameter greater than 3 inches should also have their root systems removed and the resultant holes backfilled, compacted, regraded, and seeded.

2) Backfill, compact, and seed the depression in the crest and all areas of erosion.

3) Remove the debris lodged in the principal spillway and install a trash rack.

4) Repair the leak in the principal spillway riser and monitor for future leakage.

5) Extend the outlet pipe, fill, compact, and seed the eroded area. The length to which the pipe and embankment must be extended should be determined as part of the stability analysis of the dam. Provide erosion protection for the channel downstream from the outlet pipe.

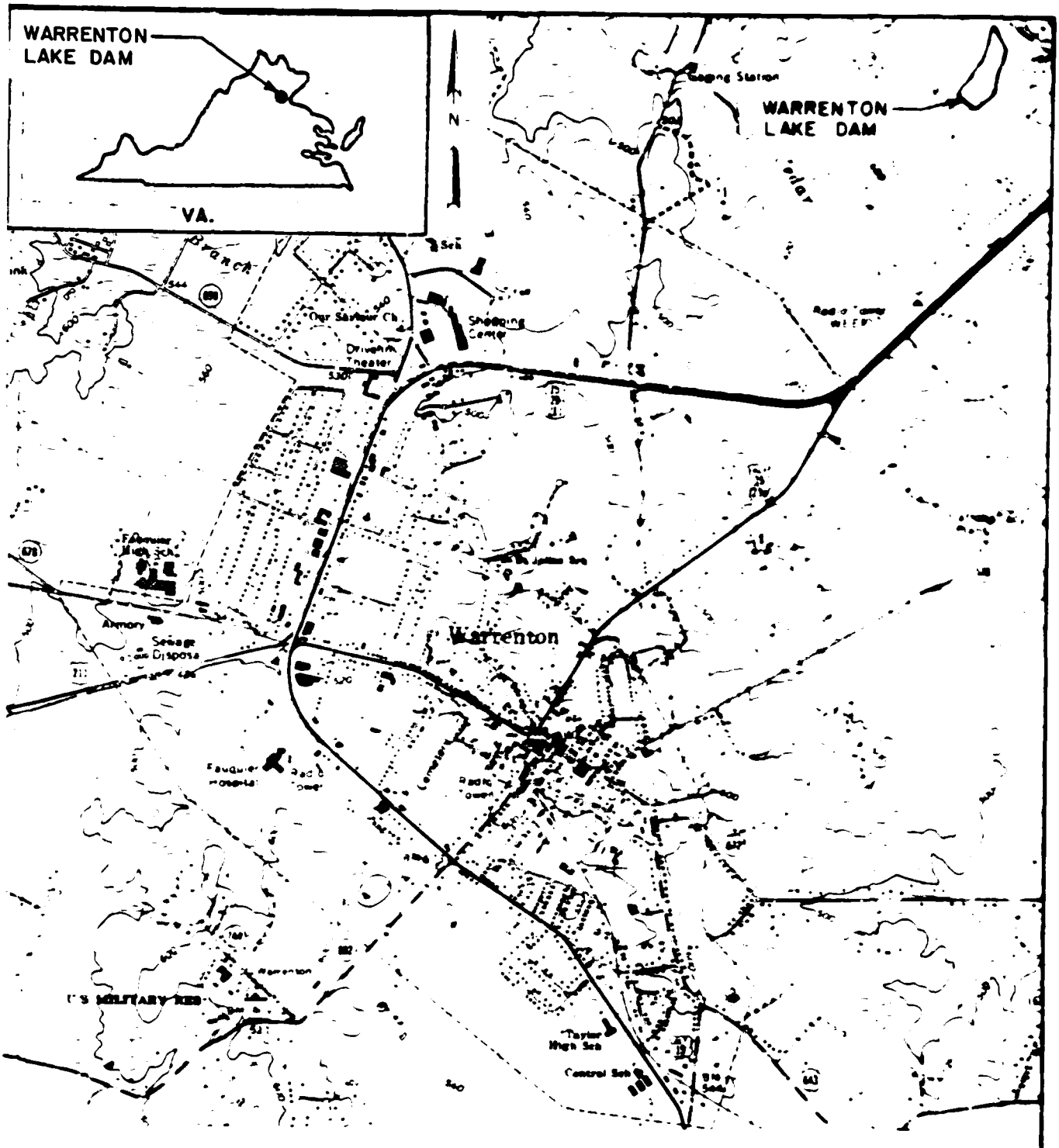
6) Provide erosion protection for the upstream face of the embankment.

7) Clear the downstream channel of debris, trees, and brush.

8) Install a staff gage to monitor reservoir levels above normal pool.

CONTENTS

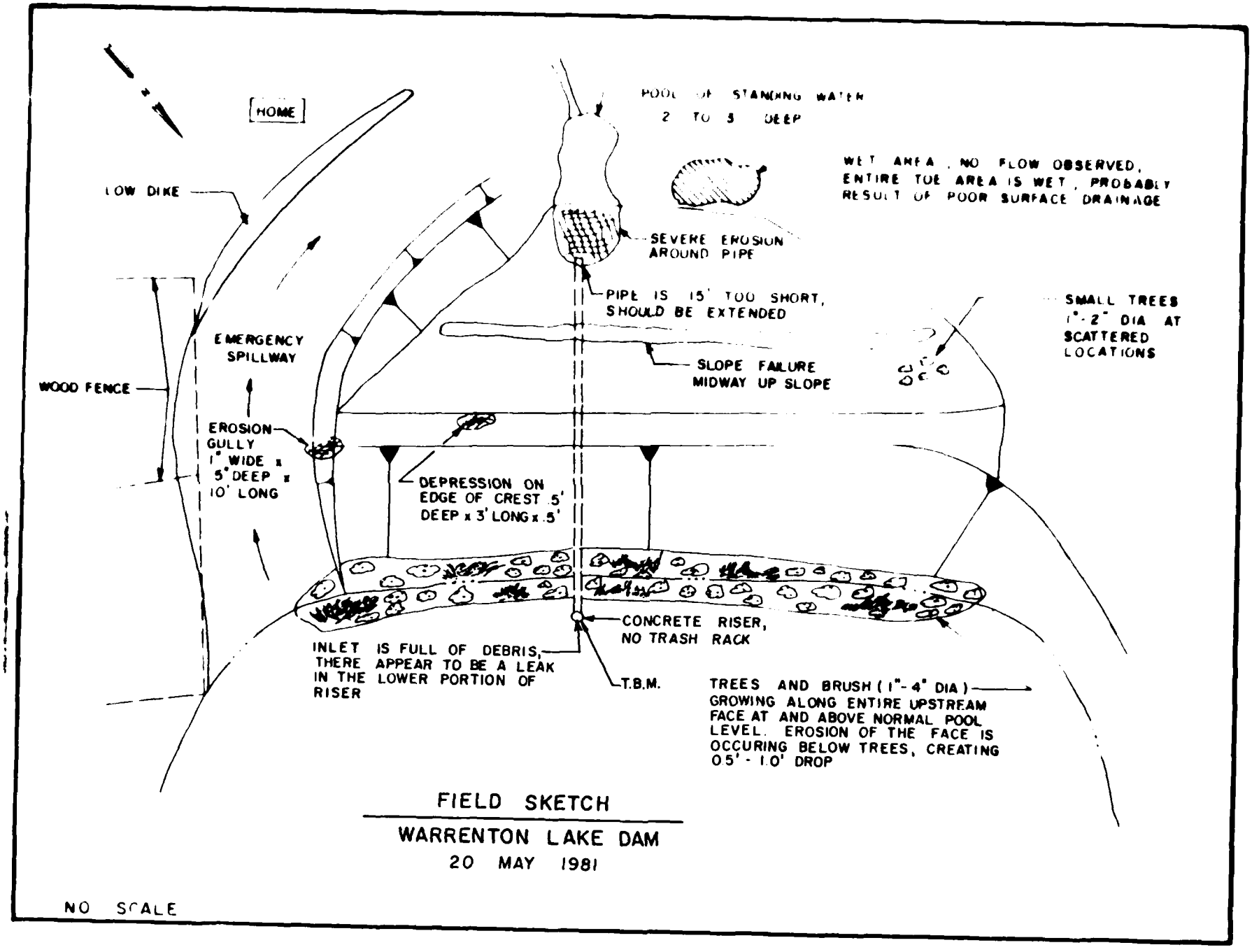
NAME OF DAM: WARRENTON LAKE DAM



REFERENCES
U S G S 7 5' WARRENTON, VA
QUADRANGLE PHOTOREVISED 1978

LOCATION PLAN

WARRENTON LAKE DAM



FIELD SKETCH

WARRENTON LAKE DAM

20 MAY 1981

NO SCALE

MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

Box 280

Computed by

Reviewed by

S.O. No.

Sheet No.

Drawing No.

Date

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject

Computed by

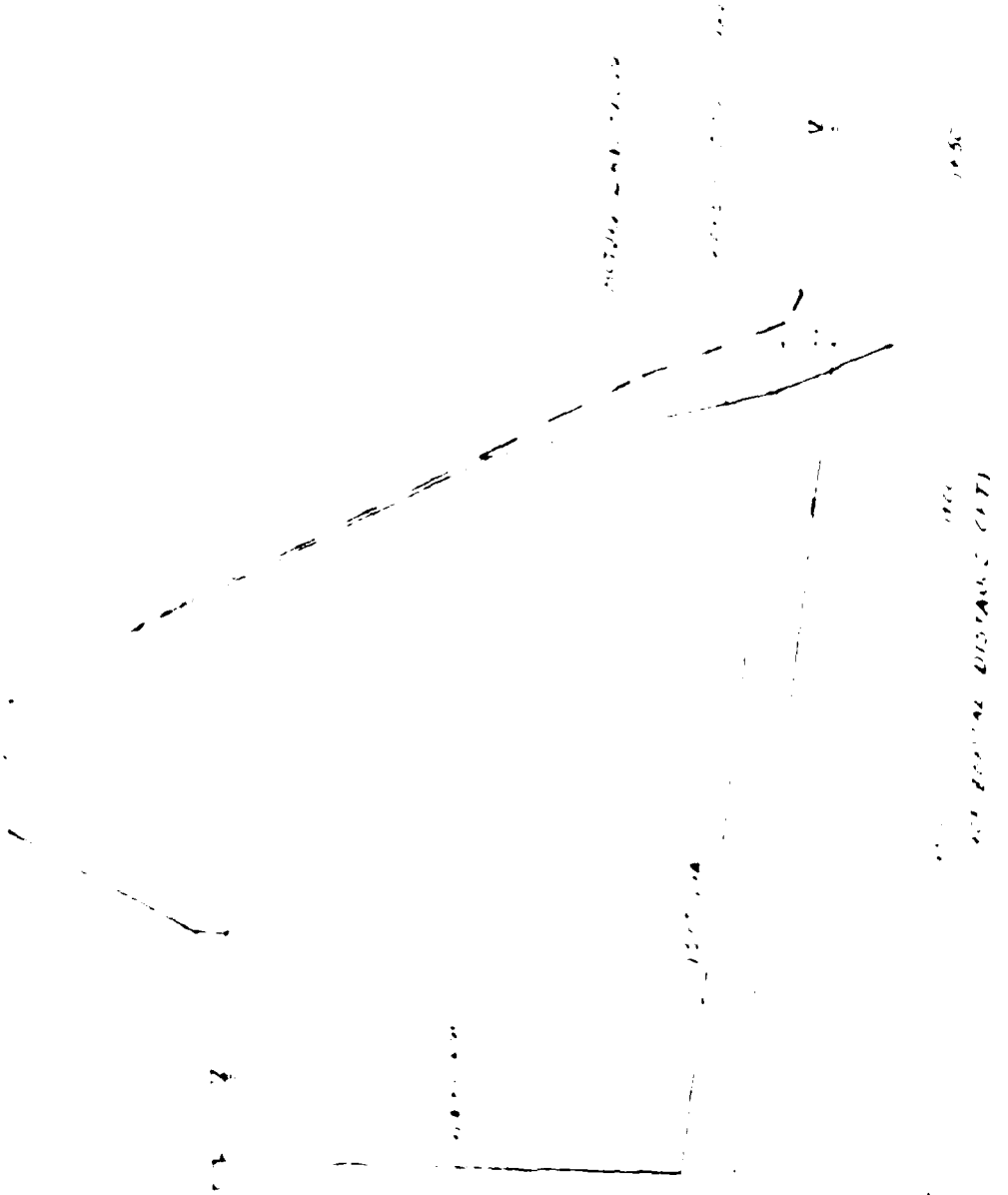
Checked by

S.O. No.

Sheet No. ... of

Drawing No.

Date



APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 20 May 1981.

NAME OF DAM: WARRENTON LAKE DAM

WARRENTON LAKE DAM

PHOTO 1. Downstream Face of Embankment

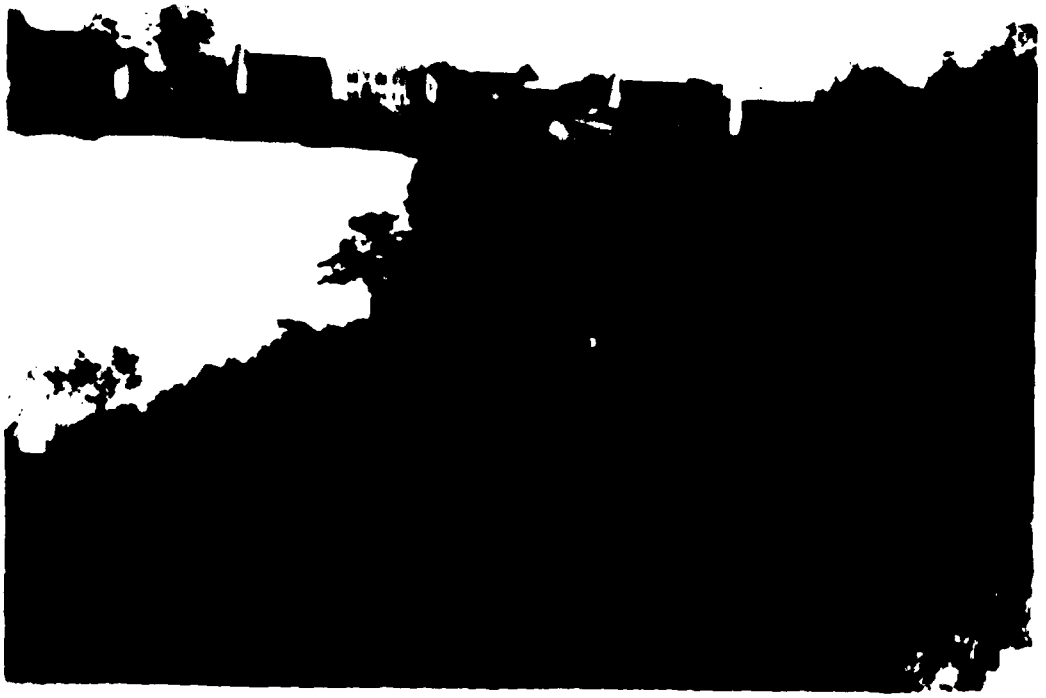


PHOTO 2. Upstream Face of Embankment

PHOTO 3. Riser Crest

PHOTO 4. Eroded Area Around Outlet Pipe

WARRENTON LAKE DAM

PHOTO 5. Emergency Spillway

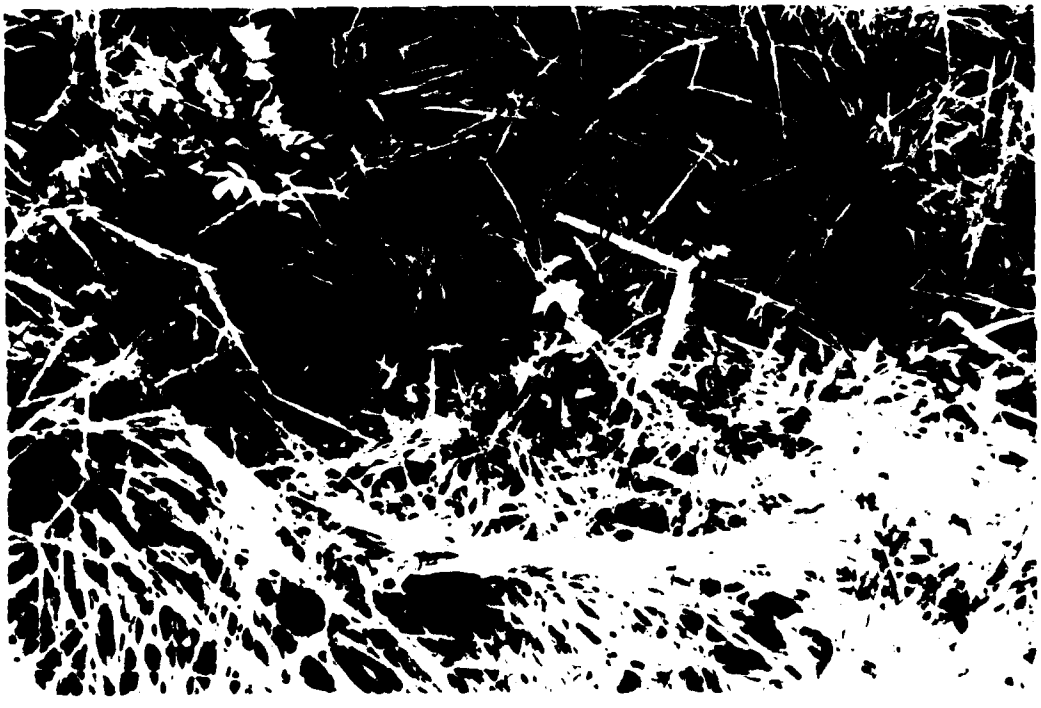


PHOTO 6. Typical Area of Slope Failure on Downstream Face of Embankment

APPENDIX III

VISUAL INSPECTION CHECK LIST

Check List
Visual Inspection
Phase I

Name of Dam Warrenton Lake County Fauquier State Virginia Coordinates Lat. 3841.1
Long. 7744.8

Date of Inspection 20 May 1981 Weather Clear Temperature 65°F.

Pool Elevation at Time of Inspection 999.8 T.B.M. Tailwater at Time of Inspection 983.1 T.B.M.

Inspection Personnel:

Michael Baker, Jr., Inc.

Wayne D. Lasch
Steve M. Lockington
Dave W. Miller

Owner's Representatives:

Home Owners' Association Representatives

Becky Crouch
Audrey Graham
Don Philp

Virginia State Water Control Board

Hugh Gildea

Wayne D. Lasch Recorder

EMBANKMENT

Name of Dam WARRENTON LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None were observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None were observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The upstream face of the embankment is covered with small trees and brush (1-4 in. dia.) at and above normal pool level. Erosion of the face is occurring below these trees, resulting in a vertical drop in the face of 0.2-0.5 ft. Severe erosion is also occurring on the downstream face of the embankment at and above the outlet pipe exit. It appears that the slope of the embankment around the outlet pipe was increased, decreasing the bottom width of the embankment to allow for a shorter length of pipe through the embankment. It is in this steeper portion of the embankment where the severe erosion is taking place. Sloughing and a one ft. scarp exist along the length of the downstream slope and indicates a slope failure.	The erosion of the upstream face is not considered to be a serious problem at this time. However, the trees and brush should be removed and another means of erosion protection provided. The embankment at and above the outlet pipe should be repaired. The embankment should be filled in and compacted to, at a minimum, the slope of the surrounding embankment and the outlet pipe extended as necessary. A qualified geotechnical engineer should investigate the slope failure and perform a stability analysis of the dam.

EMBANKMENT

Name of Dam WARRENTON LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	There is a small depression on the downstream edge of the embankment crest between the outlet works and the emergency spillway. No other problems were observed.	Fill in the depression.
RIPRAP FAILURES	This is not applicable.	

EMBANKMENT

Name of Dam [illegible]

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	An [illegible] gully [illegible] the junction [illegible] upstream edge of the embankment crest and the emergency spillway. No other problems were observed.	The gully should be filled, compacted, and reseeded.
ANY NOTICEABLE SEEPAGE	A wet area was observed along the toe of the dam to the right of the outlet pipe. There was no measurable flow from the area. No other problems were observed.	This wet area is probably the result of poor surface drainage. The area should be regraded to improve drainage and monitored for seepage.
STAFF GAGE AND RECORDER	There were none.	A staff gauge should be installed to monitor pool levels above normal pool.
DRAINS	There were none.	

OUTLET WORKS

Name of Dam: WARRENTON LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None were observed.	
INTAKE STRUCTURE	The intake consists of a 48-in. dia. concrete riser pipe. There is no trash rack protecting the pipe, and there is debris in the bottom of the pipe. There also appears to be a leak in the lower section of the riser.	The debris should be removed from the pipe and a trash rack installed. The leak in the pipe should be sealed.
[illegible]	The outlet pipe is an 18-in. dia. [illegible] concrete pipe. As discussed in previous sections, the pipe is not [illegible]	The pipe should be extended a minimum of 15 ft.
[illegible]	[illegible] channel is a natural channel. [illegible] the channel approximately [illegible] stream from the pipe. [illegible] the channel [illegible] which backs up to	The debris should be removed and the channel graded to improve flow out of the channel.

[illegible]GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
[illegible] WEIR	There was no concrete weir.	
[illegible] CHANNEL	The reservoir slopes gently up to the entrance of the emergency spillway. The spillway is a trapezoidal earth channel. There is a good cover of grass in the channel. Residents near the dam indicated that, during a storm approximately [illegible] years ago, the emergency spillway was activated. A gully was cut in the channel approximately [illegible] ft. deep. A sewer line was reportedly laid in this gully when it was repaired 1 year later. The channel is restricted also by wooden fences surrounding the residents property on the left abutment.	The fences infringing on the channel should be removed.
[illegible]	The discharge channel is a trapezoidal earth channel consisting of rocky soil with a sparse cover of grass. A dike with its crest 4 ft. below the top of [illegible] the left side of the channel. [illegible]	

INSTRUMENTATION

Name of Dam: WARRENTON LAKE DAM

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
INSTRUMENTATION/SURVEYS	None were observed	
OBSERVATION WELLS	None were observed	
WEIRS	None were observed	
PIEZOMETERS	None were observed	
OTHER		

RESERVOIR

Name of Dam: WARRENTON LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes of the reservoir are moderate to mild with no signs of erosion or instability. They were grass covered with a number of residences surrounding the reservoir.	
SEDIMENTATION	Sedimentation does not appear to be a problem. Soundings were taken, and the depth of the normal pool was measured to be 13.4 ft. near the riser pipe.	

DOWNSTREAM CHANNEL

Name of Dam: WARRENTON LAKE DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	A road into the housing development crosses the downstream channel 560 ft. downstream, and another dam is 1900 ft. downstream from the dam.	
SLOPES	The channel has moderate slopes.	
APPROXIMATE NO. OF HOMES AND POPULATION	Two homes are located in the flood plain between the road and the downstream dam.	

APPENDIX IV

GENERAL REFERENCES

GENERAL REFERENCES

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5. HR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).

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16. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.

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