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NATIONAL DAM SAFETY PROGRAM. GREENE MOUNTAIN LAKE DAM (INVENTOR--ETC(U)
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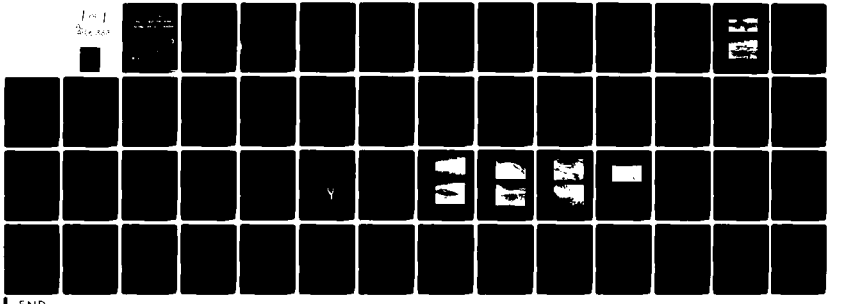

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RIVANNA RIVER BASIN

Name Of Dam: GREENE MOUNTAIN LAKE DAM

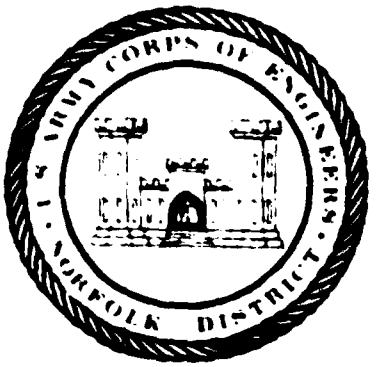
Location: GREENE COUNTY, VIRGINIA

Inventory Number: VA. NO. 07915

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

AD A106333



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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 Inspection 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 inspection. 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 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.

RIVANNA RIVER BASIN

NAME OF DAM: GREENE MOUNTAIN LAKE DAM
LOCATION: GREENE COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 07915

National Dam Safety Program. Greene Mountain Lake Dam (Inventory Number VA 07915), Rivanna River Basin, Greene County, Virginia. Phase I Inspection Report.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Ray E. /Martin Carl S. /Anderson, Jr.
Jack G. /Starr

PREPARED FOR
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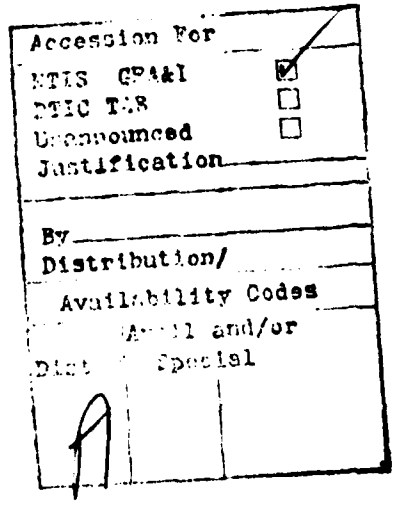

PREFACE

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 frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test 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 REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Greene Mountain Lake Dam
State:	Virginia
Location:	Greene County
USGS Quad Sheet:	Stanardsville
Coordinates:	Lat 38° 16.2' Long 78° 26.2'
Stream:	Blue Run
Date of Inspection:	May 6, 1981

Greene Mountain Lake Dam is a zoned earthfill structure about 450 ft long and 33 ft high. The principal spillway consists of a 66 inch diameter corrugated metal pipe (CMP) riser inlet, and a 60 inch diameter CMP outlet which extends through the structure. An earth emergency spillway is located at the right abutment with a 90 ft wide bottom and 3H:1V side slopes. The structure is classified intermediate in size and is assigned a significant hazard classification. The dam is located on Blue Run two miles south of Stanardsville, Virginia. The lake is used for recreational purposes and is owned and maintained by Mr. Larry Lamb.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the appropriate Spillway Design Flood (SDF) is the ½ PMF. The spillway will pass 15 percent of the Probable Maximum Flood (PMF) or 30 percent of the SDF without overtopping the dam. During the SDF, the dam will be overtopped by a maximum of 3.1 ft for a period of 4.5 hours at a maximum velocity of 7.5 fps. The spillway is judged seriously inadequate due to the detrimental effect of overtopping during the SDF.

Due to the inadequacy of the spillway and the resulting overtopping of the dam during the SDF, and also the lack of stability data, the potential for a breach of the dam exists. Based upon the possibility of a dam breach caused by overtopping during the SDF, the dam is assessed "unsafe, non-emergency."

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

It is, therefore, recommended that a qualified engineering firm be retained to perform a detailed hydrologic/hydraulic analysis of the dam and downstream damage reach. The owner is required to engage the services of a qualified 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 Commonwealth of Virginia regarding required remedial measures within six months of the data of the issuance of the approved Phase I inspection report.

The visual inspection did not reveal any problems which would require immediate attention. The dam is considered stable for normal pool conditions and a stability analysis is not required.

It is recommended that the owner implement an emergency action plan to warn downstream dwellings of any dangers which may be imminent.

The following routine maintenance and observation functions should be initiated as part of an annual maintenance program:

A regular maintenance operation program should be established and documented. The grass and weeds on the dam embankment and in the emergency spillway should be cut at least once a year and preferably twice a year. Maintenance is recommended in the early summer and fall. Existing trees on the dam should be cut to the ground. Trees greater than 3 inches in diameter should have their stumps and root structures removed and resulting holes backfilled.

The plunge pool area should be protected against further erosion by lining with riprap or utilizing some other effective measure. Erosion observed around the principal spillway outlet and areas of sloughing on the upstream slope near the embankment crest and on the downstream slope should be backfilled and seeded. The eroded areas present in the right emergency spillway should be stabilized and seeded to prevent further erosion. Vehicular traffic should be prohibited on the dam and the crest should be regraded as required and seeded.

The saturated downstream toe located to the left of the outlet pipe and a small area where intermittent flow is observed near the left embankment-abutment contact, are believed to be the result of seepage through the dam. These areas should be monitored quarterly to detect any increases in flow. Also, the dam and reservoir should be monitored during unusually heavy precipitation and runoff.

It is recommended that the open joint in the outlet pipe be repaired. Also, that a trash rack should be placed on the intake structure and a staff gage be installed to monitor water levels.

Prepared by:

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS & ASSOCIATES, INC.

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Commonwealth of Virginia

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Colonel, Corps of Engineers
Commander and District Engineer

Recommended by:

Original signed by
JAMES A. WALSH

for Jack G. Starr
Chief, Engineering Division

Date: SEP 11 1981

Green Mountain Lake

Dam

Overview Photographs

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 inspection 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 (see Reference 1, Appendix IV). 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: Greene Mountain Lake Dam is a zoned earthfill structure approximately 450 ft long and 33 ft high.* The crest of the dam is 16 ft wide and side slopes are approximately 3 horizontal to 1 vertical (3H:1V) on the upstream and downstream slopes of the dam. The crest of the dam is at elevation 559 msl (see Field Sketch 2, Appendix III). According to the owner a 12 ft$^{+}_{-}$ wide and 10 to 12 ft deep core trench was excavated for this embankment. The clay core extends upward to the crest of the dam. There is no internal drainage system for this dam. There is limited slope protection on the upstream slope.

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*Height is measured from the top of the dam to the downstream toe at the centerline of the stream.

The principal spillway consists of a 66 inch diameter CMP riser inlet. The riser is connected to a 60 inch diameter CMP outlet which runs through the dam. The riser crest is at elevation 550 msl. A 24 inch diameter sluice gate in the riser at an invert elevation of 528± msl is used to drain the lake. The outlet pipe has a length of approximately 160 ft with an invert elevation at the outlet structure of 527 msl (see Field Sketches 1 and 2, Appendix III).

The emergency spillway (EMS) consists of a vegetated earthen channel spillway located at the right abutment, with a crest elevation of 554 msl. The EMS has a bottom width of 90 ft, 3H:1V side slopes and is in a cut section (see Field Sketch 2, Appendix III).

1.2.2 Location: Green Mountain Lake Dam is located on Blue Run two miles south of Stanardsville, Virginia (see Plate 1, Appendix I).

1.2.3 Size Classification: The dam is classified as an intermediate size structure based on its maximum lake storage potential as defined in Reference 1, Appendix IV.

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the proximity of one inhabitable dwelling located ¼ mile downstream, the dam is assigned a "significant" hazard classification. The hazard classification used to categorize a dam 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 and maintained by Mr. Larry Lamb, Nathaniel Greene Development Corporation; Standardsville, Virginia 22973.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was designed by the owner with local SCS assistance. The dam was constructed by Mr. J. A. Dean of Elkton, Virginia and completed in 1969. The emergency spillway was widened 15 ft following the storm in 1972.

1.2.8 Normal Operational Procedures: The principal spillway is ungated, therefore, water rising above the crest of the riser inlet is automatically discharged downstream. Normal pool is maintained at elevation 550 msl at the crest of the riser. Flood discharges which cannot be absorbed by storage and the riser, flow through the emergency spillway at pool elevations above 554 msl. The 24 inch diameter gate at elevation 528 msl is manually operated and is used to lower the lake elevation below normal pool for maintenance purposes.

1.3 Pertinent Data:

1.3.1 Drainage Area: The drainage area is 7 square miles.

1.3.2 Discharge at Dam Site: According to the owner, Mr. Larry Lamb, the maximum known flood at the dam site occurred in June, 1972 when an estimated pool elevation of 559.5 msl was observed as a result of Tropical Storm Agnes. This corresponds to an approximate discharge of 3958 CFS. The emergency spillway was heavily eroded and the principal spillway outlet pipe was undermined causing a break in the pipe joint.

Principal Spillway Discharge:

Pool Elevation at Crest of Dam (elev 559)	472 CFS

Emergency Spillway Discharge

Pool Elevation at Crest of Dam (elev 559)	3076 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below:

Table 1.1 - DAM AND RESERVOIR DATA

	Reservoir				
			Storage		
	Elevation feet msl	Area Acres	Volume Acre Feet	Watershed Inches	Length Miles
Crest of Dam	559	134	1408	3.8	1.4
Emergency Spillway Crest	554	95	908	2.4	1.1
Principal Spillway Crest	550	61	508	1.4	.9
Streambed at Downstream Toe of Dam	526	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: There is no design data available. The dam was designed by the owner with SCS assistance. SCS Field Offices in Albermarle, Greene and Madison Counties have no records for this dam.

2.2 Construction: There are no construction records available. The dam was constructed by J. A. Dean of Elkton, Virginia and completed in 1969. According to the owner, the dam was constructed as a zoned embankment and includes a clay core. A core trench is 12 ft$^{+}_{-}$ wide, was excavated 10 to 12 ft below the streambed and extends vertically upward to the crest of the dam. The rest of the dam was constructed with granular residual soils. All fill was reportedly placed in 12 inch lifts and compacted with a sheepsfoot roller. The owner observed the fill placement periodically but no field density tests were performed to verify the percent compaction attained.

2.3 Evaluation: There is insufficient information to evaluate foundation conditions and embankment stability.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: At the time of inspection, the dam was in fair condition. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made on May 6, 1981. The weather was cloudy, the temperature was about 70°F, and the ground condition was dry. The pool and tailwater levels at the time of inspection were 550 and 526 msl, respectively. This corresponds to normal pool and tailwater elevations.

3.1.2 Dam and Spillway: The embankment slopes were grassed and appeared to be well maintained. The upstream slope is essentially lined at pool level with small trees and brush. Scattered trees exist along the left side of the downstream slope. More vegetation, consisting of trees, bushes and briers, occurs along the left downstream slope, left abutment contact (see Overview Photographs and Photograph No. 2, Appendix II).

Scattered erosion was encountered on the embankment and in the discharge section of the right emergency spillway. A small eroded area 1 to 2 ft long and 1 ft± deep occurs on the upstream slope edge of the crest, in line with the wood pier. Considerable erosion has occurred around the discharge outlet, extending approximately 24 ft along the pipe into the embankment. The erosion extends 2 to 3 ft on either side of the pipe, ranges from 1 to 3 ft in depth and has undermined the last 24 ft± of pipe. The joint of the last 20 ft section of outlet pipe is loose with a one inch gap observed. Approximately 118 ft to the left of the outlet is an eroded area and bulge on the downstream which appears to be

the result of sloughing. The area ranges from 10 to 15 ft in width, 1 to 2 ft in depth and extends from the crest of the dam to the downstream toe. Details of both areas are presented on Field Sketch 3, Appendix III. Two 100 ft long eroded areas occur 100 ft$^{+}_{-}$ and 200 ft$^{+}_{-}$ below the embankment crest along the right emergency spillway right downstream slope(See Field Sketch 1). These areas are washed areas which trend southward toward the discharge channel. The embankment crest is relatively bare because of vehicular traffic across the dam. Also, 4 wheel drive vehicle tracks extend across the downstream slope between the discharge outlet and right emergency spillway.

The basal 4 ft$^{+}_{-}$ of the downstream toe, extending from the discharge outlet to the left abutment is saturated. During the May 6, 1981 inspection flow estimated at 3 to 5 gpm was flowing from the center of a 2 ft$^{+}_{-}$ wide and 5 ft$^{+}_{-}$ long, wet and eroded area located near the left downstream toe, left abutment contact. Flow was clear and there was no iron staining. Details are provided on Field Sketch 4, Appendix III. On June 16, 1981, no flow was observed from this area.

The riser structure showed no signs of deterioration and was functioning properly at the time of inspection. The outlet pipe had one open joint in the last section of pipe which was caused by severe erosion at the plunge pool. The last section of pipe has been stabilized by a concrete cradle, but the joint is open allowing water to run under the pipe. The slide gate has never been in use. The plunge pool was void of riprap and indicated erosion.

3.1.3 Reservoir Area: The reservoir area was free of debris and the perimeter was tree and lawn area. The reservoir is located in a valley with side slopes at approximately 5H:1V.

3.1.4 Downstream Area: The downstream channel consists of an 8 ft wide channel located in a valley with moderate to steep side slopes. This valley is cultivated with patches of trees. Approximately ¼ mile downstream there is one dwelling and outbuildings adjacent to the streambed.

3.1.5 Instrumentation: No instrumentation (monuments, observation wells, piezometers, etc.) was encountered for the structure. There is no staff gage.

3.2 Evaluation:

3.2.1 Dam and Spillway: Overall, the dam was in fair condition at the time of the inspection. It is recommended that a routine maintenance program be initiated. The embankment, including its crest and slopes should be mowed at least once a year, but more preferable twice a year. The presence of trees on the embankment may promote the development of deep rooted vegetation and this type growth can encourage piping within an embankment. All trees growing on the embankment should be cut to the ground. Trees greater than 3 inches in diameter should have their root structures removed and resulting holes backfilled.

Erosion observed around the principal spillway pipe and outlet should be corrected and reseeded. The open joint in the outlet pipe should also be repaired. It is recommended that riprap be placed around the plunge pool to reduce erosion during periods of flooding. The small eroded area

present on the upstream slope near the embankment crest and the two eroded areas along the emergency spillway discharge channel should be backfilled and reseeded. It is further recommended that the bulge or area of embankment sloughing present on the downstream slope 118 ft$^{+}_{-}$ to the left of the discharge outlet be regraded and reseeded. Vehicular traffic should be prohibited on the downstream slope and across the embankment crest. It is recommended that the crest be reseeded.

Much of the saturated ground encountered along the downstream toe to the left of the discharge outlet is believed to be related to seepage through the dam, particularly the location of the 3 to 5 gpm flow near the left abutment, left downstream toe contact. These areas do not present a hindrance to the normal functioning of the dam; however, it is recommended that they be monitored quarterly to detect any increase in flow rates which may cause piping in the embankment. If increased flows should occur, a Professional Enginer with expertise in Geotechnical Engineering should be contacted to evaluate the problem and make recommendations for required corrective measures.

A trash rack should be placed on the intake structurc and a staff gage should be installed to monitor water levels.

3.2.2 Downstream Area: A breach in the Greene Mountain Lake Dam during extreme flooding would possibly create a hazard to the downstream dwelling.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedure: The normal storage pool is elevation 550 msl at the crest of the principal spillway inlet. The lake provides recreation for adjacent property owners. Water automatically passes through the principal spillway as the water level in the reservoir rises above the principal spillway crest. Water will also pass automatically through the emergency spillway when the water level in the reservoir reaches elevation 554 msl. A 24 inch slide gate valve at the low point in the riser structure is provided to drawdown the reservoir below normal pool.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the owner. Maintenance consists of inspection, debris removal, mowing of vegetative cover and repair. Maintenance is not routinely performed.

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

4.4 Evaluation: The dam and appurtenances are in good operating condition, and maintenance of the dam is inadequate. Documentation and implementation of a routine maintenance program should be developed for this structure. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This 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 is necessary.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: Greene Mountain Lake Dam was designed by the owner with SCS assistance. There are no hydrologic and hydraulic data available.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: According to Mr. Larry Lamb, an estimated maximum pool elevation of 559.5 msl occurred in June, 1972, as a result of Tropical Storm Agnes. This corresponds to a peak flow of approximately 3958 CFS.

5.4 Flood Potentials: 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 in the region), or fractions thereof. The Probable Maximum Flood (PMF), ½ PMF and 100 year flood hydrographs were developed by the HEC-1 method (Reference 4, Appendix IV). Precipitation amounts for the flood hydrograph of the PMF and 100 year flood were taken from U. S. Weather Bureau Information (Reference 5 and 6, Appendix IV). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulations: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 550 msl. Reservoir stage-storage data and stage-discharge data were computed from field sketches and available topographic data. Floods were routed through

the reservoir using the principal spillway discharge up to a pool storage elevation of 554 msl and a combined principal and emergency discharges for pool elevations above 554 msl. Pool elevations above 559 msl were routed over the non-overflow section of the dam.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the flood conditions (100 year flood, ½ PMF and PMF) are shown in the following Table 5.1:

Table 5.1 - RESERVOIR PERFORMANCE

	Hydrograph			
	Normal Flow	100 Year Flood	½ PMF	PMF
Peak Flow, CFS				
Inflow	7	4582	14,273	28,546
Outflow	7	2635	12,552	26,293
Maximum Pool Elevation				
Ft, msl	550.1	558.4	562.1	564.9
Non-Overflow Section (Elev 559 msl)				
Depth of Flow, Ft	-	-	3.1	5.9
Duration, Hours	-	-	4.5	6.5
Velocity, fps	-	-	7.5	10.4
Tailwater Elevation				
Ft, msl	526	531	536.5	540.5

*Critical velocity

5.7 Reservoir Emptying Potential: A 24 inch diameter gate at elevation 528 msl is capable of draining the reservoir through the outlet pipe. Assuming that the lake is at normal pool elevation (550 msl) and there is 7 cfs inflow, it would take approximately 5 days to lower the reservoir to elevation 530 msl. This is equivalent to an approximate drawdown rate of 4 ft/day based on the hydraulic height measured from normal pool to the invert of the drawdown pipe divided by the time to dewater the reservoir.

5.8 Evaluation: The U. S. Army, Corps of Engineers' guidelines indicate the appropriate Spillway Design Flood (SDF) for an intermediate size, significant hazard dam is the ½ PMF to PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 15 percent of the PMF without overtopping the crest of the dam (30 percent of the SDF). During the SDF, the dam will be overtopped by a maximum of 3.1 ft for a period of 4.5 hours and reach a maximum velocity of 7.5 fps.

Hydrologic data used in the evaluation pertains to present day conditions with no consideration given to future development.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located along the western edge of the Piedmont physiographic province of Virginia. The dam and impoundment appear to rest on the fault contact between the Lovingston Formation to the west and the Mechums River Formation to the east. The Lovingston consists basically of biotite quartz augen gneiss while the Mechums River Formation consists of metamorphosed sandstones and arkoses, schists and phyllites. Both formations are of Precambrian geologic age. Local geologic structure is controlled in part by the fault. Beds in the Mechum River Formation are overturned, striking to the northeast and dipping 80° to the southeast. Foliation strikes to the northeast and dips 65° to 70° to the southeast.

The potential for seepage within the foundation was apparently recognized since the owner reported that a cutoff trench was constructed. According to Mr. Lamb, a 12 ft± wide cutoff was excavated 10 to 12 ft below the streambed and extends vertically upward to the crest of the dam.

Gradual consolidation of underlying soils would be expected during application of fill materials. The underlying soils probably had essentially fully consolidated under the applied load not long after completion of construction. Based upon the performance history of this dam and the materials present in the abutments, a stable foundation is assumed.

6.2. Embankment:

6.2.1 Materials: The dam was designed as a zoned embankment. The more plastic materials (clays of low plasticity, visually classifying CL) encountered on site were placed in the core trench and central portion of the dam. It was reported that the remainder of the embankment was

constructed with SC to SM materials (Unified Soil Classification). Clayey silts usually ranging from ML to MH were also observed on the embankment. The fill was placed in 12 inch layers (loose thickness) and compacted with a sheepsfoot roller, however, no field density tests were performed.

6.2.2 Subdrains and Seepage: There is no internal drainage system for this structure. The downstream toe of the embankment is saturated from the left side of the outlet pipe to the left abutment-embankment contact and also a flow estimated at 3 to 5 gpm was noted from a small area near the abutment-embankment contact. Both conditions are believed to be related to seepage through the dam. The flowing seepage was not observed during a return visit to the dam on June 16, 1981.

6.2.3 Stability: There are no stability calculations for this structure. The dam is 33 ft high and has a crest width of 16 ft. Both the upstream and downstream slopes were measured to be 3H:1V.

Although the type materials used during construction cannot be confirmed visually, it is assumed the structure has a clay core constructed with CL materials and the remainder of the dam is constructed with SC to SM soils. Since the core width is unknown, the dam is assumed to be homogeneous for stability purposes. According to the guidelines present in Design of Small Dams, U. S. Department of the Interior Bureau of Reclamation, for small homogeneous dams with a stable foundation subjected to drawdown and composed of SC to SM materials, the recommended slopes are 2H:1V for the downstream and 3H:1V for the upstream slope. The existing embankment slopes meet the recommended guidelines. The recommended crest width is 16.6 ft, therefore, the existing crest width is 0.6 ft too narrow according to the guidelines.

6.2.4 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: An accurate check on the stability of this structure cannot be made since there is no design and construction data. Foundation conditions are not known, but a stable foundation is assumed based upon the materials exposed in the abutments. The embankment slopes meet the requirements recommended by the U. S. Bureau of Reclamation for small homogeneous earthfill dams on stable foundation and subject to a drawdown. The embankment crest is less than 1 ft too narrow and, therefore, is considered to meet the recommended guidelines. Overtopping is considered detrimental to the dam with respect to erosion because of the depth and duration of flood and also the velocity is greater than 6 fps, the effective eroding velocity for a vegetated earth embankment.

Based upon the visual inspection and the performance history of this structure, the foundation is considered stable and a stability analysis is not required. Since no undue settlement, cracking, or seepage was noted at the time of inspection, it appears that the embankment is adequate for control storage at elevation 550 msl.

The saturated ground existing along the downstream toe and the area of intermittent flow are believed to be related to seepage through the dam. This does not necessarily create an unsafe condition; however, these areas should be monitored periodically in attempt to detect any significant future flow which may result in piping within the embankment.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There is insufficient information to evaluate foundation conditions and embankment stability. The visual inspection revealed no findings that prove the dam to be unsound. A routine maintenance program does not exist. Also, there is no emergency operation and warning plan. Overall, the dam was in fair condition at the time of inspection. U. S. Army, Corps of Engineers guidelines indicate the appropriate Spillway Design Flood (SDF) for this dam is the ½ PMF. The spillway will pass 15 percent of the PMF (30 percent of the SDF) without overtopping the crest of the dam. Flows overtopping the dam at a maximum velocity of 7.5 fps during the SDF are considered detrimental to the embankment with respect to erosion. The spillway is judged seriously inadequate.

Due to the inadequacy of the spillway and the resulting overtopping of the dam during the SDF, and also the lack of stability data, the potential for a breach of the dam exists. Based upon the possibility of a dam breach caused by overtopping during the SDF, the dam is assessed "unsafe, non-emergency."

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

7.2 Recommended Remedial Measures: A qualified engineering firm should be retained to perform a detailed hydrologic/hydraulic analysis of the dam and downstream damage reach. The owner is required to engage the services of a qualified 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 Commonwealth of Virginia regarding required remedial measures within six months of the date of the issuance of the approved Phase I inspection report.

7.3 Required Maintenance and Observation: It is recommended that a regular maintenance operation program be established and documented for future reference. A formal emergency procedure should be prepared and furnished to all operating personnel. This should include how to operate the dam during an emergency, and who to notify including public officials, in case evacuation from the downstream area is necessary. Also, the inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months:

7.3.1 The grass and weeds on the dam embankment and in the emergency spillway should be cut at least once a year and preferably twice a year. Maintenance is recommended in the early summer and fall.

7.3.2 Existing trees on the dam should be cut to the ground. Trees greater than 3 inches in diameter should have their stumps and root structures removed and resulting holes backfilled and seeded.

7.3.3 The plunge pool area should be protected against further erosion by lining with riprap or utilizing some other effective measure.

7.3.4 Erosion observed around the principal spillway outlet should be backfilled and reseeded.

7.3.5 The open joint in the outlet pipe should be repaired.

7.3.6 The eroded areas present in the right emergency spillway should be stabilized and reseeded to prevent further erosion.

7.3.7 The small eroded area on the upstream slope near the embankment crest should be backfilled and reseeded.

7.3.8 The area of sloughing on the downstream slope should be backfilled and reseeded.

7.3.9 Vehicular traffic should be prohibited on the dam. Rutted areas in the crest should be backfilled as required and the embankment crest reseeded.

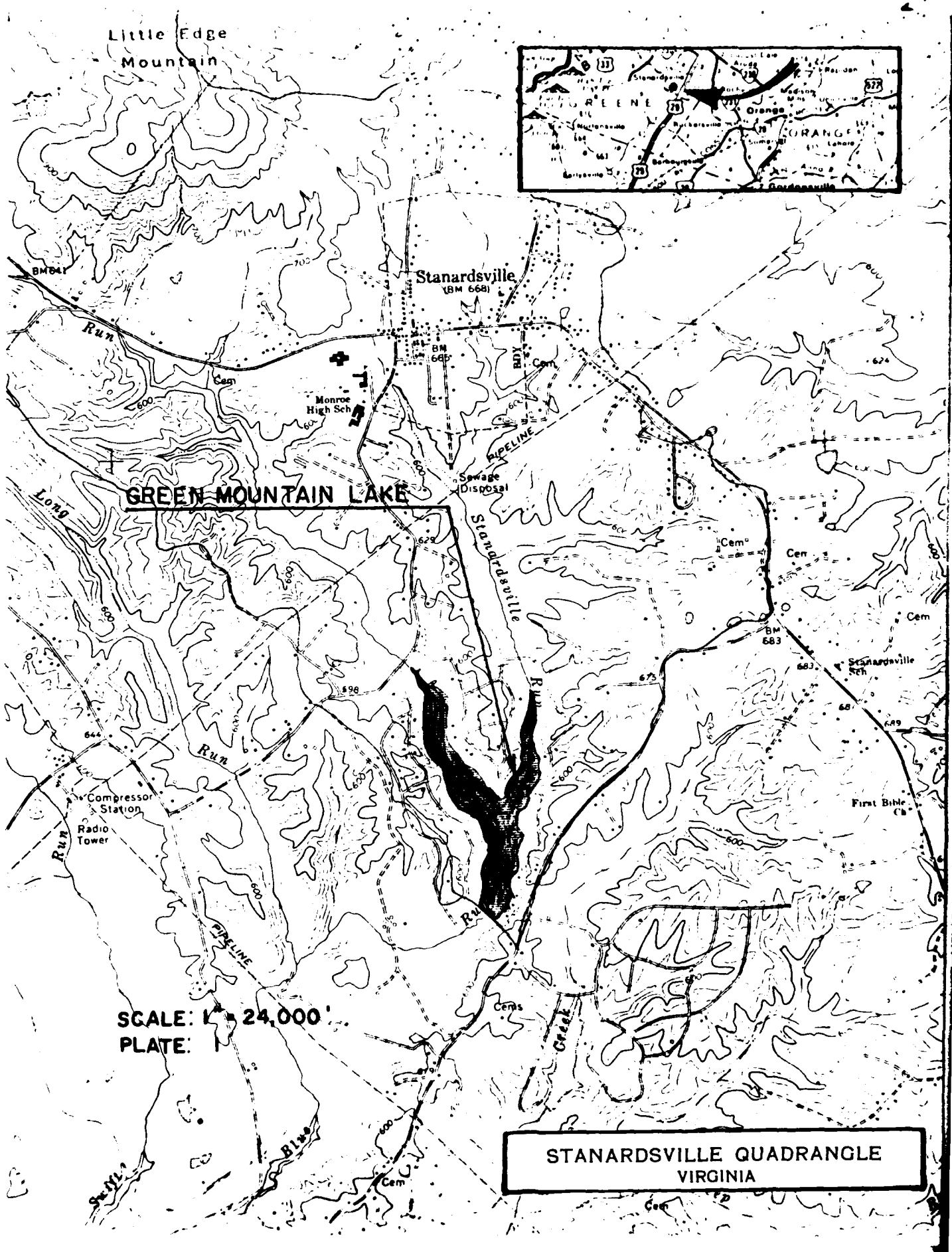
7.3.10 The saturated downstream toe and area of intermittent flow described in Field Sketch 4, Appendix III should be monitored quarterly to detect any increase in flows. If increased flows should occur, a Professional Engineer with expertise in Geotechnical Engineering should be contacted to evaluate the problem and make recommendations for required corrective measures.

7.3.11 A trash rack should be placed on the intake structure.

7.2.12 A staff gage should be installed to monitor water levels.

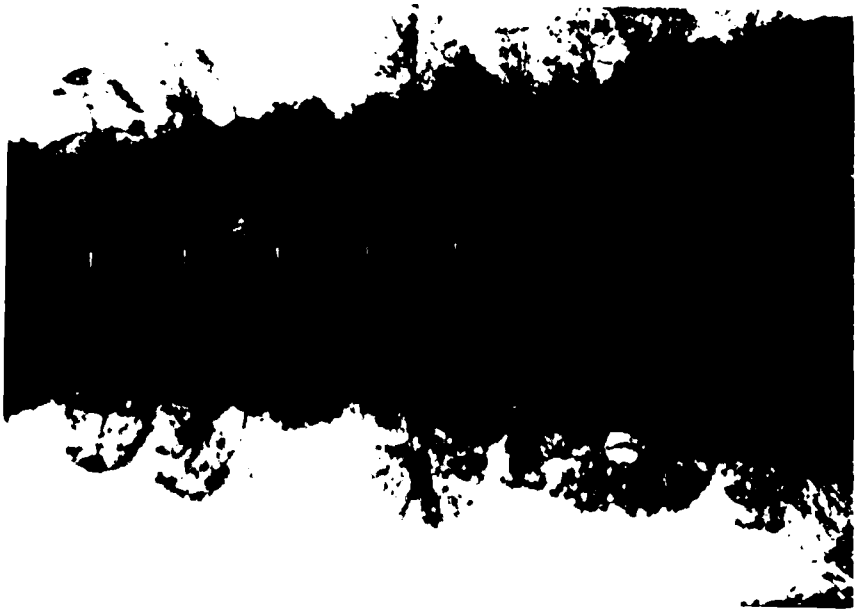
APPENDIX I

MAPS AND DRAWINGS


Little Edge Mountain
Stanardsville
(BM 668)
BM 668
Monroe High Sch
Sewage Disposal
GREEN MOUNTAIN LAKE
Standardsville Run
Long Run
Compressor Station
Radio Tower
PIPELINE
Cem
BM 683
Stanardsville Sch
First Bible Ch
Creek
Blue
SCALE: 1" = 24,000'
PLATE: I
STANARDSVILLE QUADRANGLE
VIRGINIA

APPENDIX II

PHOTOGRAPHS

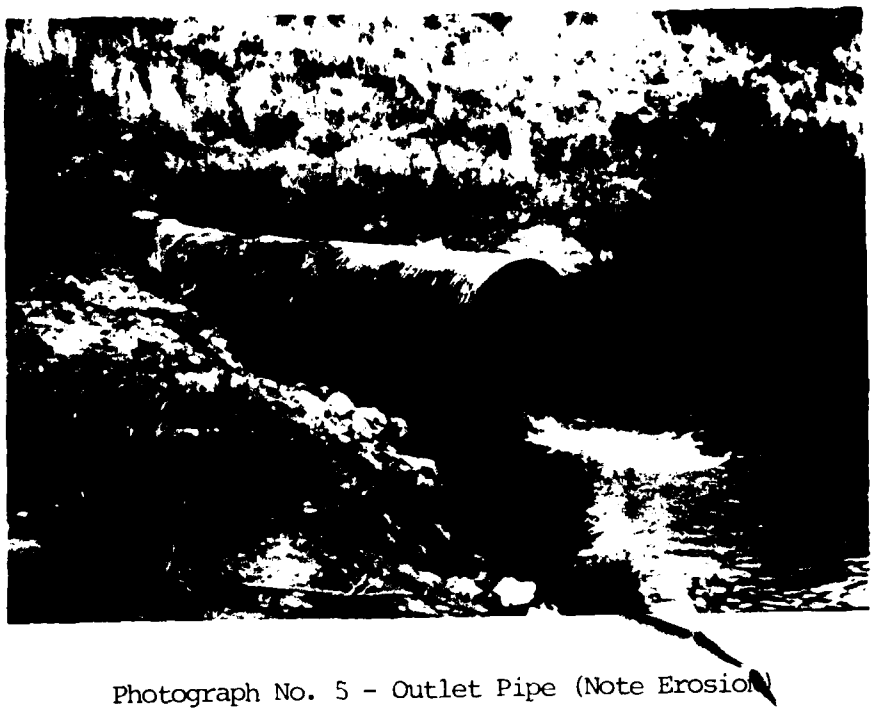


Photograph No. 1 - Upstream Face of Dam
and Pier to Drain Gate Stem

Photograph No. 2 - Downstream Face of Dam

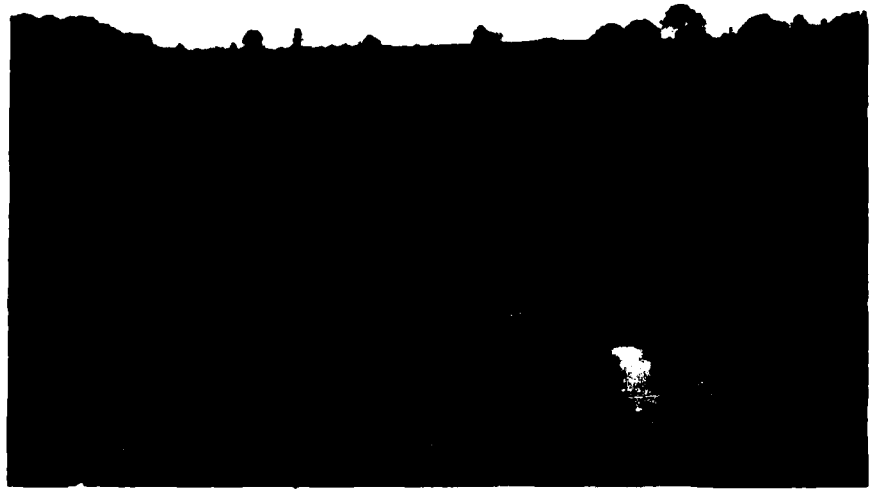
Photograph No. 3 - Intake Structure

Photograph No. 4 - Emergency Spillway



Photograph No. 5 - Outlet Pipe (Note Erosion)

Photograph No. 6 - Outlet Pipe Support
(Required Due to Erosion)



Photograph No. 7 - Downstream Area

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam Greene Mountain Lake County Greene State Virginia Coordinates: Lat 38° 16.2' Long 78°26.2'

Date(s) Inspection May 6, 1981 Weather Cloudy Temperature 70°F

Pool Elevation at Time of Inspection 550 msl Tailwater at Time of Inspection 526 msl

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Gilbert T. Seese
Stephen G. Werner
Raymond A. DeStephen, P.E.*

J. K. Timmons & Associates, Inc.
Robert G. Roop, P.E.
Steve Oddi

Recorder
Gilbert T. Seese

State Water Control Board
Hugh M. Gildea, P.E.

Owner
Larry Lamb

* Not present during this inspection but visited the site on June 16, 1981.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The slopes, crest and abutment contacts were inspected and no cracks were noted.	-
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movements were noted on the dam or beyond the downstream toe.	-
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion observed in two areas along the right end of downstream slope. The first at the contact with emergency spillway, approximately 200' below crest of dam. This area is 100'± long and 10'± wide and consists of a washed area. The second washed area is located 25'± from the first and is also 100 ft± in length. Considerable erosion exists around the principal spillway discharge outlet. Sloughing exists on the ds slope 118 ft± to the left of the outlet. Details are included on the field sketches. Four-wheel drive vehicle tracks also extend up the downstream slope between the discharge outlet and the right emergency spillway. An erosion gulley 1 ft± deep and 1 - 2 ft± wide exists on the upstream slope just below the embankment crest in line with wood pier.	See Field Sketches 3 and 4
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignment of the dam appeared to be good.	-
RIPRAP FAILURES	Riprap installed 1'± above and below normal pool level. No real concentrated effort to completely riprap the entire upstream slopes. Riprap in the form of concrete blocks and large rock is dumped along the outlet pipe wherever it is readily available.	

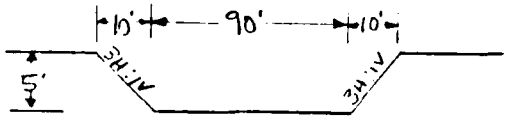
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The embankment ties in properly with the abutments. An emergency spillway bounds the right side of the dam. The owner reported that during flooding in 1972, a 15 ft wide section of the left abutment-embankment contact was severely eroded. This area was backfilled and regraded. Abundant vegetation in this area prevented examination of the previously damaged area. Highly weathered Lovingston gneiss is exposed in the roadway beyond the left abutment. Foliation strikes to the NE. Red residual soils (MH to CL) are exposed in the right abutment.	
ANY NOTICEABLE SEEPAGE	A saturated downstream toe extends from the left abutment-embankment contact to the discharge outlet. Clear flowing seepage estimated at 3 - 5 gpm was observed near the left abutment-embankment contact. On 6/16/81, no flow was observed.	See Field Sketches 3 and 4
DRAINS	None observed.	
MATERIALS	According to the owner, the dam has a clay core. A 12 ft± wide trench was excavated 10 to 12 ft± below the streambed. Clay was obtained from the hill bounding the right emergency spillway. The core extends essentially upward through the entire dam. The rest of the dam was constructed with granular residual soil (SM to SC). Reddish brown clayey silt, trace fine sand, with mica (ML to MH) is exposed on the embankment.	
VEGETATION	A few small trees occur on the downstream slope and essentially the entire upstream slope at pool level is lined with trees and brush. A good grass cover exists over most of the downstream and upstream slopes. The crest includes vehicle paths and since it is used for access from one side of the subdivision to the other. There is considerable honeysuckle, briers and small trees present along the left abutment-downstream slope contact.	Trees should be removed [illegible] crest paved or [illegible] [illegible].

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONTROL SECTIONS	66 inch CMP riser located 260 ft^{+} from the left side of the dam. There is some separation between the band and the riser. Pipe is 8 inches from the top. 1 ft vertical split below separated band.	-
APPROACH CHANNEL	There is no trash rack.	A trash rack should be installed.
DISCHARGE CHANNEL	60 inch CMP. 3 inch hole in top of pipe. Last joint of pipe is leaking. Owner is in the process of repairing. Severe erosion noted around the 1 1/3 pipe joints exposed. No riprap in plunge pool which is naturally made. The last section of pipe has been stabilized by a concrete cradle.	In good condition except for last joint. See Field Sheets 1 and 3
BRIDGE AND PIERS	40 ft pier located 250 ft from the left end of the dam.	-
EMERGENCY GATE	Valve present but has never been used, 24 inch diameter.	-
GATES AND OPERATION	-	-

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	Right end of dam	 4 ft from pool level to control section.	Good vegetation
APPROACH CHANNEL	Grassed		In good condition
DISCHARGE CHANNEL	Severe erosion along downstream toe at contact with emergency spillway.		-
BRIDGE AND PIERS	-		-
MISCELLANEOUS	-		-

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
MONUMENTATION/SURVEYS	None	-
OBSERVATION WELLS	None	-
WEIRS	None	-
PIEZOMETERS	None	-
STAFFGAGES	None	Should be installed.
OTHER	None	-

RESERVOIR

VISUAL EXAMINATION	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	5H:1V slopes with good vegetation, i.e., grass and brush. No erosion observed. There is a small amount of riprap along the upstream slope at pool level. The perimeter of the reservoir includes trees and residential lawn areas. There was no debris along the reservoir.	
SEDIMENTATION	Murky water; no apparent sedimentation.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	200 ft$^{+}_{-}$ wide floodplain. The channel is 8 ft$^{+}_{-}$ wide and 4 ft$^{+}_{-}$ deep. Left overbank N = 0.1 Right overbank N = 0.05	-
SLOPES	Left slope 3H:1V Right slope 10H:1V The valley includes patches of trees.	-
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately ¼ mile downstream there is one dwelling and outbuildings adjacent to the streambed.	Possible flooding could occur to the downstream dwelling.

CHECK LIST

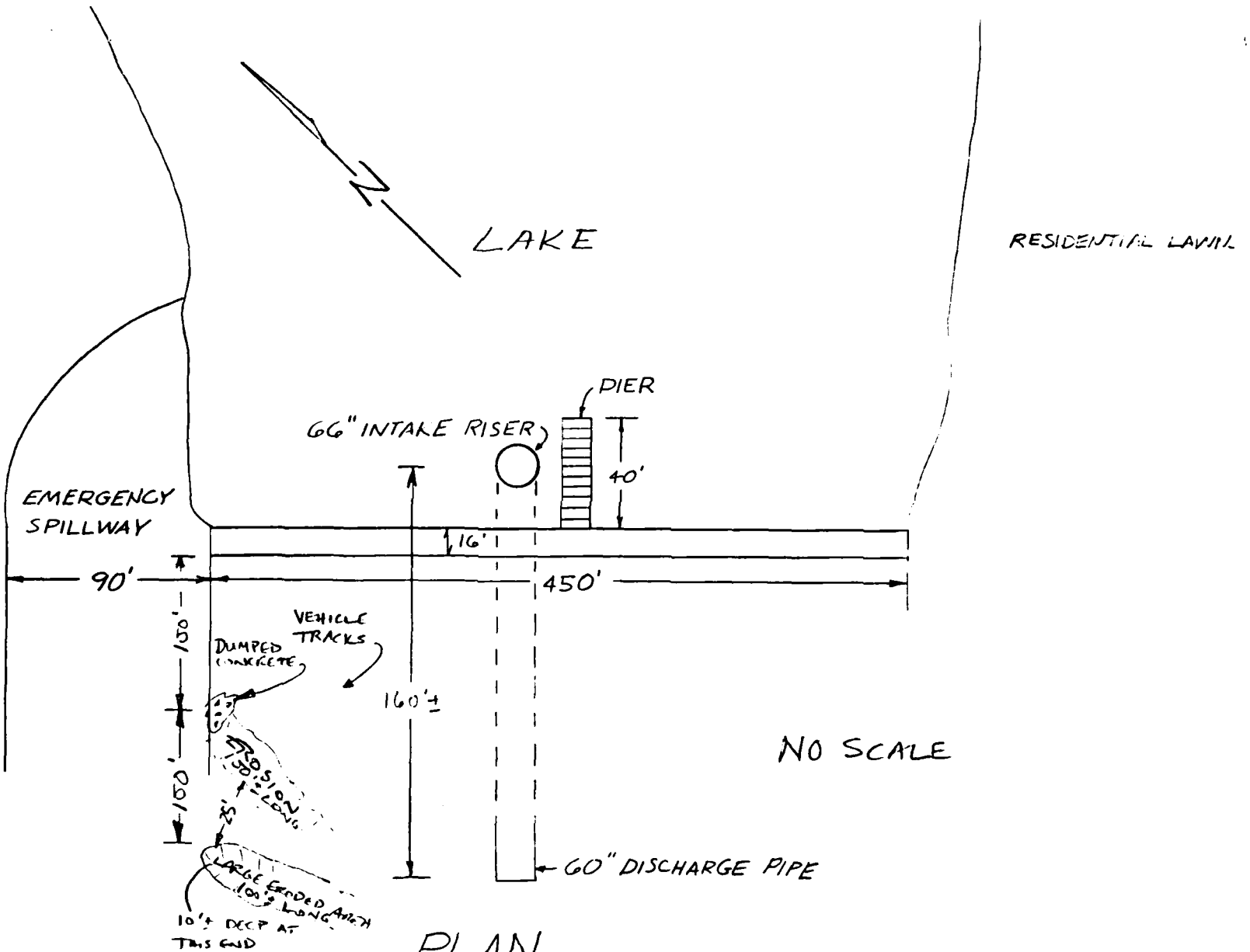
ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION

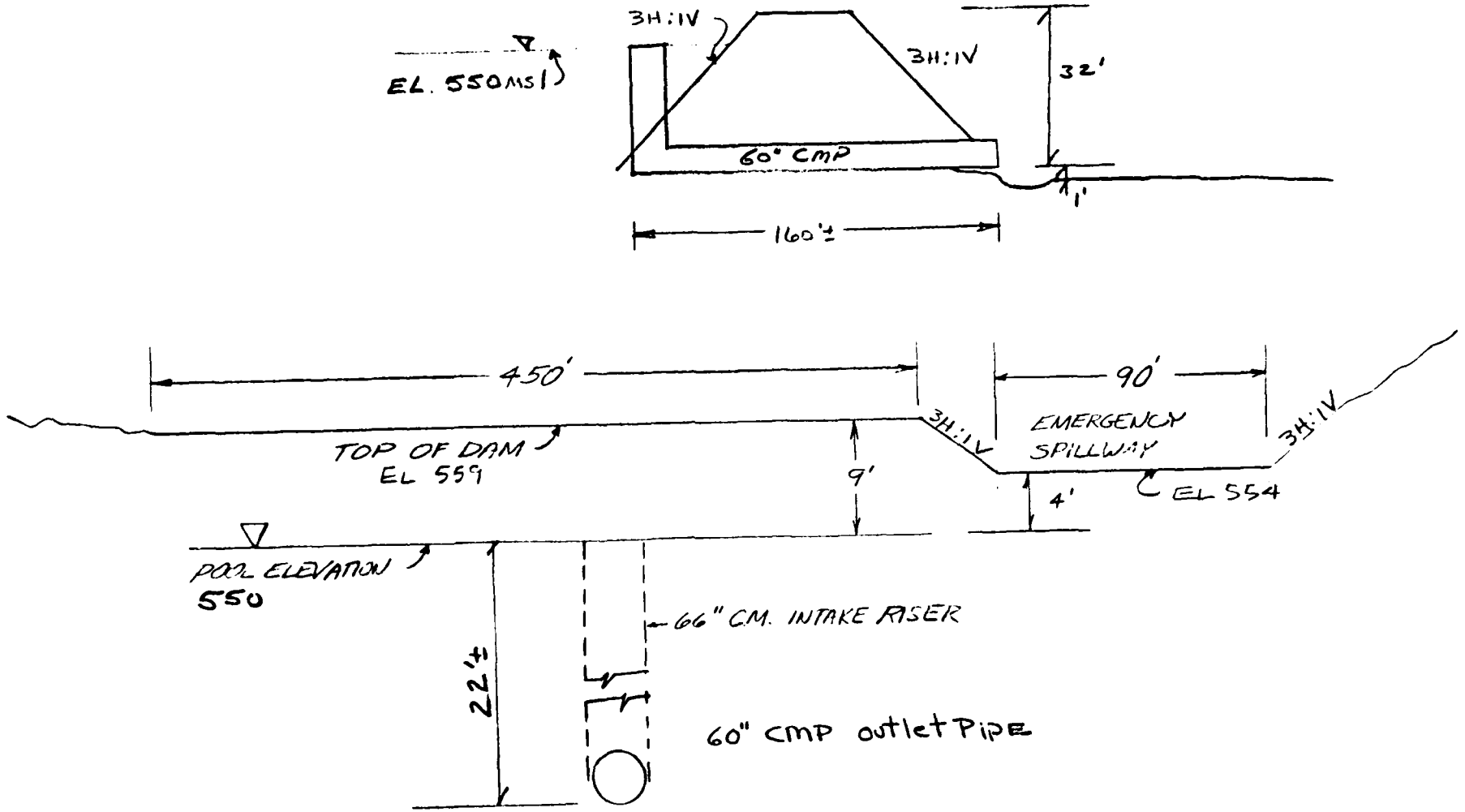
ITEM		REMARKS
REGIONAL VICINITY MAP	Stanardsville, Virginia U.S.G.S. 7½ minute topographic map	-
DESIGN/CONSTRUCTION HISTORY	The dam was designed with SCS assistance according to the owner. The dam was constructed by J. A. Dean of Elkton, Virginia and completed in 1969.	-
PLAN OF DAM	None available.	-
TYPICAL SECTIONS OF DAM	None available.	See Field Sketches
OUTLETS - PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	None available.	See Field Sketches
SPILLWAY- PLAN SECTION DETAILS	None available.	See Field Sketches
OPERATING EQUIPMENT - PLAN DETAILS	None	-

ITEM		REMARKS
MONITORING SYSTEMS	None	-
RAINFALL/RESERVOIR HIGHPOOL RECORDS	The flood in 1972 overtopped the dam by ½ ft.	-
GEOLOGY REPORTS	Geology and Mineral Resources of Greene and Madison Counties by R. M. Allen, Jr.; Virginia Division of Mineral Resources, Bulletin 78	-
BORROW SOURCES	None	-
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY-FIELD TEST DATA	None	-
HYDROLOGIC/HYDRAULIC DATA	None	-

ITEM		REMARKS
DESIGN REPORTS	None	-
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None	-
POST CONSTRUCTION ENGINEERING STUDIES RECORDS, SURVEYS	None	-
MODIFICATIONS	Emergency spillway widened as a result of the overtopping during the 1972 flood.	-
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Approximately 15 ft deep erosional notch developed as a result of the 1972 flood. This area has been backfilled.	-
MAINTENANCE OPERATION RECORDS	None	-



PLAN
GREEN MOUNTAIN LAKE
FIELD SKETCH 1
6 MAY 1981

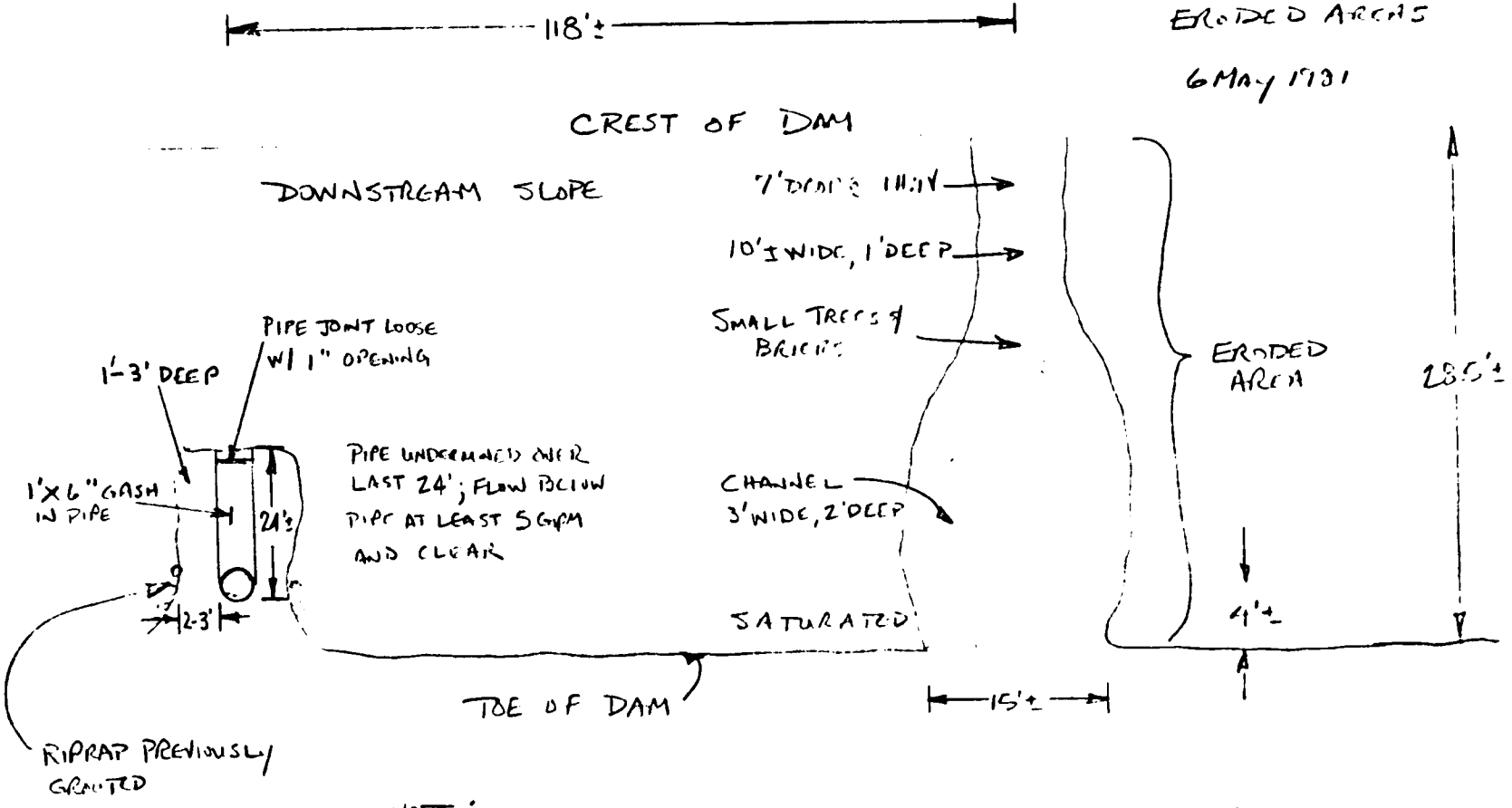


NO SCALE

PROFILE
GREEN MOUNTAIN LAKE
FIELD SKETCH 2
6 MAY 1981

GREEN MOUNTAIN DAM
FIELD SKETCH 3
ERODED AREAS

6 MAY 1981



NOTE:
THE EROSIONAL BULGE APPEARS TO BE THE RESULT OF EMBANKMENT SLOUGHING IT IS GRASSED OVER AND INCLUDES SEVERAL SMALL TREES AND BRIERS.

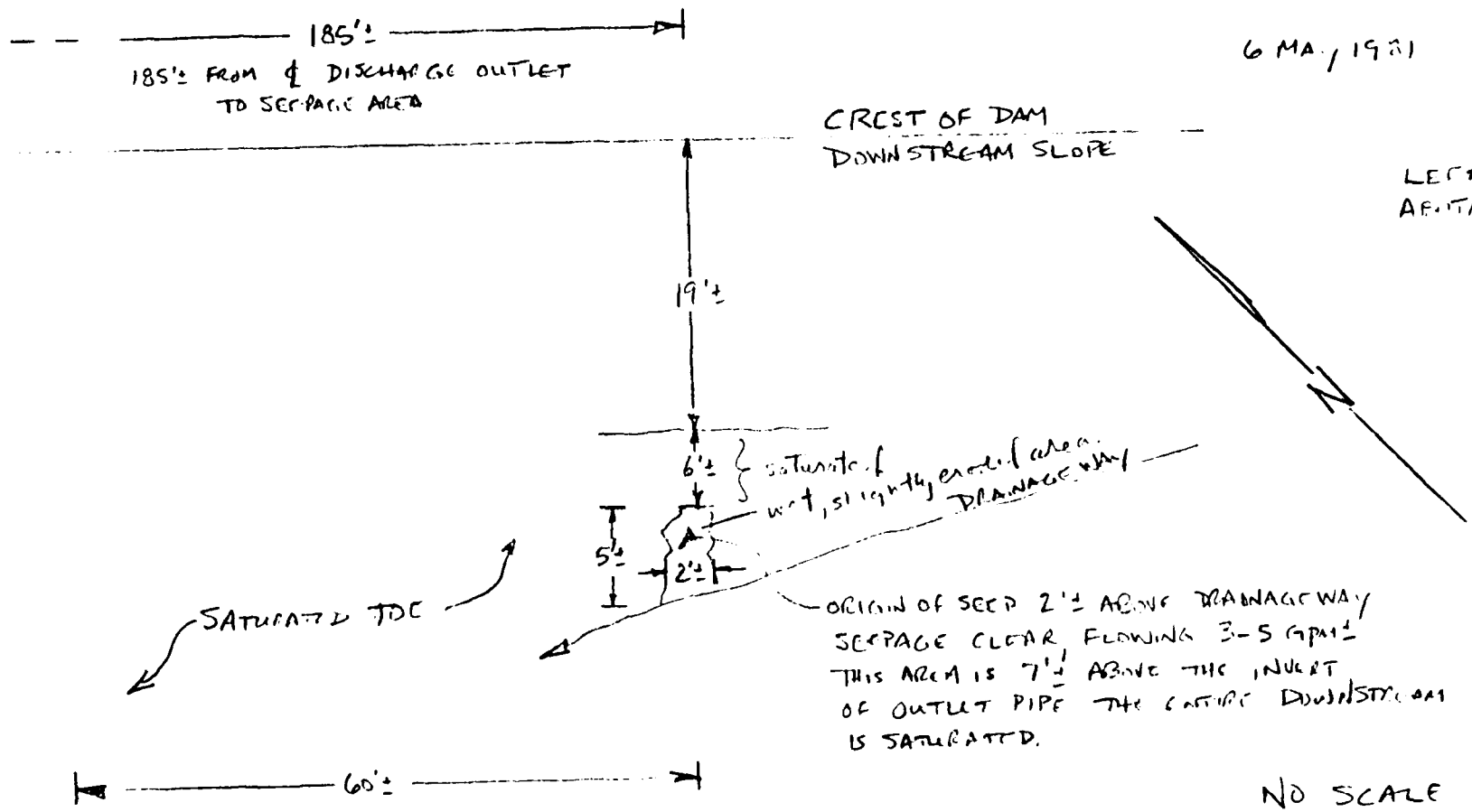
NO SCALE

N

SKETCH 3

GREEN MOUNTAIN DAM
FIELD SKETCH 4
SEEPAGE AREA

6 MAY 1981



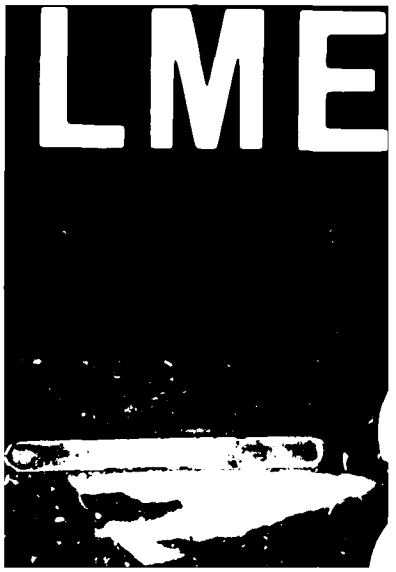
NO SCALE

A PLATFORM 2-7'± HIGH EXTENDS OFF THE LEFT ABUTMENT NEAR SEEPAGE FLOW. THE PLATFORM IS 20'± WIDE. MAY HAVE BEEN A CONSTRUCTION RAMP.

SKETCH 4

APPENDIX IV - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. Geology and Mineral Resources of Greene and Madison Counties by R. M. Allen, Jr., Virginia Division of Mineral Resources, Bulletin 78, 102 pp.
4. HEC-1 Dam Break Version, Flood Hydrograph Package, Users Manual for Dam Safety Investigations, the Hydrologic Engineering Center, U. S. Army Corps of Engineers, September, 1978.
5. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D. C., April, 1956.
6. Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau, Washington, D. C., May, 1961.


LME