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NATIONAL DAM SAFETY PROGRAM. DAM ON THE HEADWATERS OF SQUALL CR--ETC(U)
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LEVEL II

ROANOKE RIVER BASIN

Name Of Dam: DAM ON THE HEADWATERS OF SQUALL CREEK

Location: PATRICK COUNTY, VIRGINIA

Inventory Number: VA 14104

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

U.S. ARMY CORPS OF ENGINEERS · NORFOLK DISTRICT ·

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

FEBRUARY 1978

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Dam on the Headwaters of Squall Creek

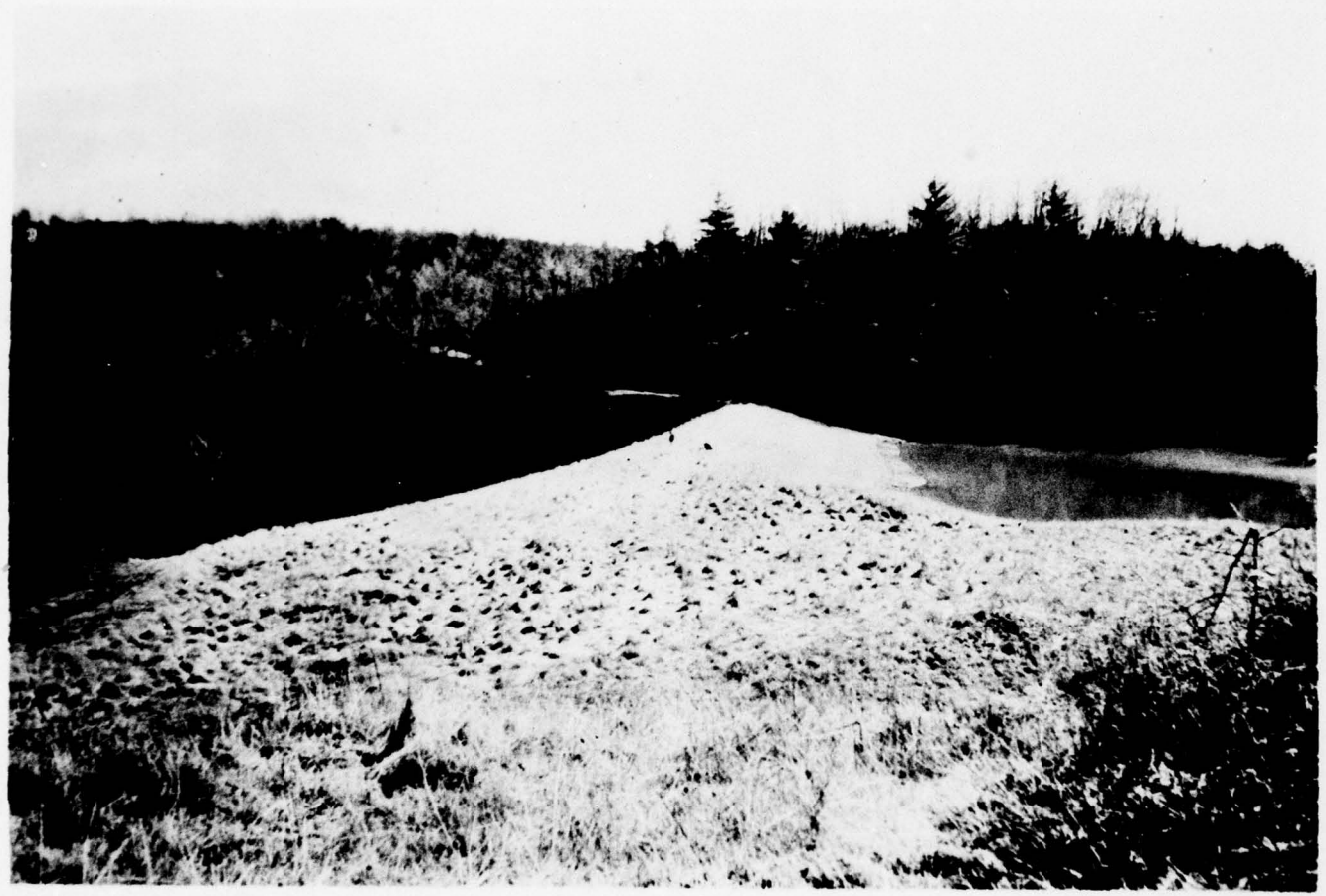
State Located: Virginia
County Located: Patrick
Coordinates: Lat: 36 39.4; Long: 80 27.9
Stream: Tributary of Squall Creek
Date of Inspection: 15 December 1977

The 87 feet high dam on the headwaters of Squall Creek was neither designed nor constructed by approved state of art methods. Despite these major shortcomings, the only visible signs of distress are the severe erosion on the downstream slope and minor seepage, flowing clear, at the downstream toe. Hydraulic analyses indicate that the existing spillway is adequate for the probable maximum flood; however, in the event of a dam failure a possible hazard does exist for the downstream inhabitants. Because of this hazard potential and the lack of available design and construction data, it is recommended that the owner solicit the services of a qualified consultant to evaluate the stability of the dam. The results of this evaluation shall be forwarded to the Commonwealth of Virginia, Attention: State Water Control Board, no later than 180 days after receipt of the Phase I Inspection Report. The alternative to this recommendation would be draining the reservoir and removing the earth dam. If this latter alternative is not considered acceptable, every effort should be made to arrest and prevent further erosion from occurring on the downstream slope until the dam can be adequately evaluated. In addition to the erosion prevention, a plan or method of dewatering the reservoir should be established to supplement the existing 8-inch corrugated pipe.

Approved:

Ronald H. Routh

RONALD H. ROUTH
LTC, Corps of Engineers
Acting District Engineer



DAM ON THE HEADWATERS OF SQUALL CREEK - OVERVIEW OF DAM FROM LEFT ABUTMENT

ABSTRACT

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
DAM ON THE HEADWATERS OF SQUALL CREEK: I.D. #VA14101

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 within the Commonwealth of Virginia.

1.1.2 Purpose of Inspection. The purpose of the Phase I investigation program is to identify expeditiously those dams which may be a potential hazard to human life or property.

ABSTRACT

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances. The dam on the headwaters of Squall Creek is an earthfill structure with a maximum height of approximately 87 feet. The crest width varies from 17 to 26 feet. The downstream embankment slope varies from 3h to 1v near the crest to 2.5h to 1v near the bottom. This slope transition occurs at a vertical distance of approximately 35 feet below the crest. The visible portion of the upstream face has a slope of approximately 4h to 1v; however, it appears that the slope flattens to 6h to 1v near the existing pool level. The only permanent means of lowering the water level is a partially obstructed 8 inch corrugated pipe which runs through the dam and surfaces at the downstream toe. An emergency spillway with a crest elevation approximately 4 feet below the dam crest has been cut into the undisturbed subgrade on the left abutment.

1.2.2 Location. The dam is located on a tributary of Squall Creek in Patrick County, Virginia.

1.2.3 Size Classification. The Squall Creek dam with its maximum height of 87 feet and maximum storage capacity of 200 acre feet is classified in the intermediate category.

1.2.4 Hazard Classification. The immediate downstream population is estimted at approximately 14 persons. Based on this estimate the dam has been placed in hazard category II.

1.2.5 Ownership. The dam is currently owned by Wilton A. Stanley who lives in Claudeville, Virginia.

1.2.6 Purpose of Dam. The dam was originally constructed to create a recreation lake for a proposed subdivision. However, the proposed development was never constructed thereby negating the original purpose.

1.2.7 Design and Construction History. The dam was constructed in 1970 by the original owners, Messrs. Crossingham and Lewis. There are no known design or construction records available. Discussions with Mr. Stanley indicated that the dam was constructed of local residual material with no design or quality control measures. Hand auger borings performed by the Wilmington District (SAW) in June 1976 confirmed this lack of quality control. A report of the SAW inspection is attached as Appendix III.

1.3 Pertinent Data. The only available data were acquired through the visual inspections by the Wilmington District and the Norfolk District and through the use of U.S.C.G.S. topographic maps. Using these sources and sound engineering judgement, the following pertinent data were derived:

1.3.1 Drainage Areas. The drainage area above the dam is approximately 81 acres. The total drainage area of Squall Creek is approximately 1,165 acres.

1.3.2 Discharge at Damsite.

1.3.2.1 The maximum flood at the damsite is unknown.

1.3.2.2 The only diversion outlet is an 8 inch corrugated pipe which is apparently blocked or partially collapsed.

1.3.2.3 The existing spillway is ungated and supports an estimated capacity of 500 cfs with 1 foot of freeboard.

1.3.3 Elevation (ft above MSL). The following elevations were estimated from a U.S.C.G.S. topographic map.

1.3.3.1	Top of Dam	2585
1.3.3.2	Maximum pool-design discharge	2584
1.3.3.3	Full flood control pool	Unknown
1.3.3.4	Recreation pool	Unknown
1.3.3.5	Spillway crest (ungated)	2581
1.3.3.6	Upstream diversion pipe invert	Unknown
1.3.3.7	Downstream division pipe invert	2500
1.3.3.8	Stream bed at center line of dam	Unknown
1.3.3.9	Maximum tailwater	Unknown

1.3.4 **Reservoir**

1.3.4.1	Length of maximum pool	1075 feet
1.3.4.2	Length of recreation pool	Unknown
1.3.4.3	Length of flood control pool	Unknown

1.3.5 **Storage (acre-feet)**

1.3.5.1	Recreation pool	Unknown
1.3.5.2	Flood control pool	Unknown
1.3.5.3	Storage at Crest of Spillway	170
1.3.5.4	Maximum pool	195
1.3.5.5	Design surcharge	25
1.3.5.6	Top of dam	202

1.3.6 **Reservoir Surface (acres)**

1.3.6.1	Top of Dam	7.4
1.3.6.2	Maximum pool	7.0
1.3.6.3	Flood control pool	Unknown
1.3.6.4	Recreation pool	Unknown
1.3.6.5	Spillway crest	6.5

1.3.7 **Dam**

1.3.7.1	Type	Earthfill
1.3.7.2	Length	350 feet
1.3.7.3	Height	87 feet
1.3.7.4	Top Width	21 feet I 4feet
1.3.7.5	Sides Slopes	U/S 4:1, D/S 3:1 to 2.5:1 near toe
1.3.7.6	Zoning	N/A
1.3.7.7	Impervious Core	N/A
1.3.7.8	Cutoff	Unknown
1.3.7.9	Grout curtain	N/A

1.3.8 **Diversion Outlet**

1.3.8.1	Type	8 inch diameter, helical corrugated pipe
1.3.8.2	Length	Unknown
1.3.8.3	Closure	N/A
1.3.8.4	Access	D/S only
1.3.8.5	Regulating Facilities	None

1.3.9 Spillway

1.3.9.1	Type	Ungated, uncontrolled, grassed
1.3.9.2	Length of weir	averages 21 feet
1.3.9.3	Crest elevation	2581 feet MSL
1.3.9.4	U/S Channel	N/A
1.3.9.5	D/S Channel	2% slope

1.3.10 Regulating Outlets None

2. Engineering Data. There are no known design or construction records available. As previously stated, the only data available for evaluating the dams safety was derived from the visual inspections.

3. Visual Inspection

3.1 Findings

3.1.1 General: The Phase I inspection of the dam on the headwaters of Squall Creek was performed on 15 December 1977. The inspection was accomplished at the request of the State Water Control Board because of the known potential hazard to the downstream residents. A previous visual inspection has been performed by the Wilmington District in June 1976 at the Commonwealth's request. A copy of their inspection report is attached as Appendix III.

3.1.2 Dam

3.1.2.1 Embankment. The earth fill dam was constructed from local residual material which had been weathered from underlying schist or phylite bedrock. The only sign of distress on the embankment was the severe erosion on the downstream slope. The erosion gullies ranging in depth from 6 inches to 3 feet were more pronounced near the abutment contacts where surface runoff was being channeled from the abutment slopes. Vegetative cover ranged from adequate near the dam crest to nonexistant in the areas of severe erosion. The visible portion of the upstream slope was 4h to 1v.

3.1.2.2 Seepage. An estimated seepage of less than 0.1 c.f.s. was noted at the downstream toe. The seepage was eminating from a swampy area approximately 30 feet downstream of the toe and from piles of stumps, fallen trees and vegetative debris at the downstream toe. The seepage was flowing clear indicating material piping was not occurring. Clear flow was also noted by the SAW during their 1976 inspection. One seepage exit point was noted in the swampy area; however, for the most part, the tree debris and tall grass obscurred the exact exit points. No seepage was observed on the embankment.

3.1.3 Appurtenant Structures. The only appurtenant structure is the 8 inch corrugated pipe which is the only visible means of regulating the level of the reservoir. The effluent invert, approximately elevation 2500' MSL, is approximately 60 feet from the confluence of the unnamed tributary and Squall Creek. The effluent flow rate was estimated at 0.1 c.f.s. at the time of the inspection. It should be noted that the flow estimated by SAW with a cap cover over the pipe was approximately the same as the flow with the cap removed. The relatively low flow indicated that the pipe is either blocked by debris or partially collapsed.

3.1.4 Reservoir Area. The reservoir is relatively small, 7 acres, with steeply sloping boundaries. These partially wooded slopes range from near vertical on the south shore to 10h to 1v at the west end. The north slopes have been exposed as a result of the borrow operation for the dam. As a result of this operation severe erosion will cause excessive sedimentation in the reservoir until the slopes are protected by vegetation.

3.1.5 Downstream Channel. The downstream creek channel is flowing on rock and the width varies from 10 to 25 feet with overbanks 2 to 6 feet above the stream bed. There is a difference in elevation of approximately 1000 feet from the dam site to the confluence of Squall Creek and Dan River, a distance of approximately 1.1 miles. The slope for approximately one-half mile below the dam is approximately 4 percent. At this point, the stream bed drops approximately 700 feet at a 1v to 1h slope and then flattens again near the Dan River confluence. The overbanks are thickly wooded which would retard large flows and dampen potential flood waves. The nearest inhabited area is located adjacent to the confluence of Squall Creek and the Dan River.

3.2 Evaluation. As indicated by the visual inspection report, the dam has not been properly maintained, especially, the downstream slope. Efforts have been made by Mr. Stanley to fill the erosion gullies and seed the slopes; however, these efforts have not been successful in preventing erosion as evidenced by the attached photographs. Continued erosion could possibly cause a failure of the dam. In addition to the severe erosion problem, the limited ability to regulate the reservoir level is highly undesirable. The existing 8 inch corrugated pipe is not adequate, especially in its impaired condition.

4. Operational procedures. There are no maintenance or warning systems associated with this structure. This fact is undesirable for a structure of this magnitude.

5. Hydraulic/Hydrologic Data

5.1 Design Data. The one percent flood, the standard project flood (S.P.F.) and the probable maximum flood (P.M.F.) were routed through the spillway with the beginning pool level assumed at the crest of the emergency spillway. A summary of the routing calculations are attached with the hydrologic and hydraulic data in Appendix II. The probable maximum flood for the entire drainage area (1165 acres) of Squall Creek above its confluence with the Dan River yielded a flow of 8,400 cfs. or approximately 12 times the peak for the area above the dam. In terms of volume during a PMF, the dam is only controlling approximately 7 percent of the flood waters at the location of the nearest inhabitants.

5.2 Visual Observations. The spillway has been excavated through undisturbed ground with an exit channel slope of approximately 2 percent. This spillway slope and geometry can support velocites up to 7 feet per second provided a vigorous grass cover is maintained. Spillway erosion is anticipated for floods more severe than the SPF.

5.3 Overtopping Potential. The flood routing calculations indicate that the existing spillway will pass the probable maximum flood without overtopping.

5.4 Evaluation. In the event of a dam failure, particularly in the absence of local flooding, a possible hazard exists for those inhabitants presently located 1.1 miles downstream of the dam. Any future development closer to the dam's downstream face would create a higher hazard potential.

6. Evaluation of Structural Stability

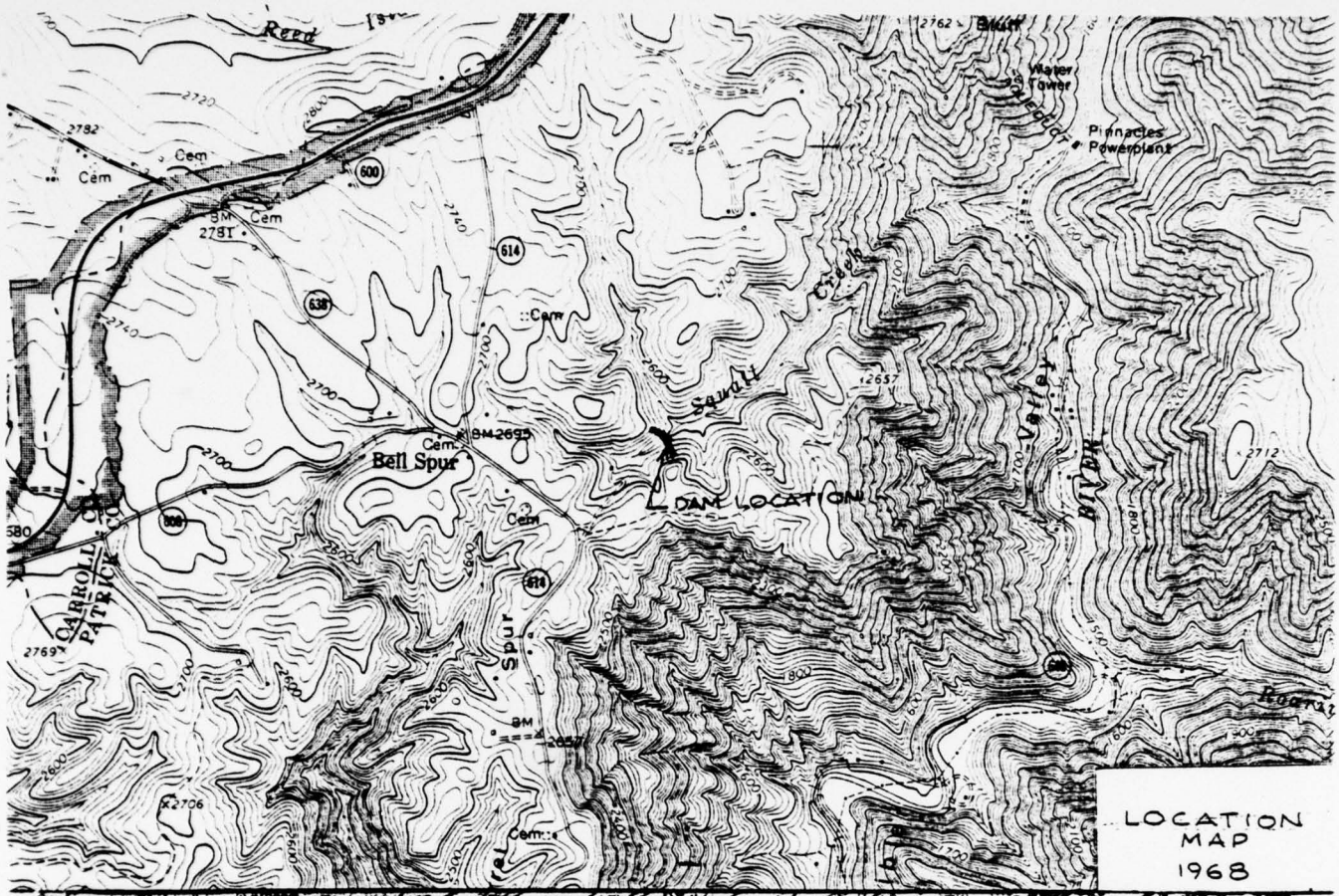
A theoretical analysis of the dam's stability was not possible because of the lack of pertinent design and construction data. However, a visual inspection of the embankment slopes indicates a favorable comparison with earth dams that have proven safe in service. The relatively flat slopes create a massive earth structure to retain a relatively small reservoir. However, the lack of quality control during construction resulted in a loosely placed fill of micaceous silts and clays. This condition is conducive to piping and possible slope failures. The severe erosion on the downstream slope will also adversely affect the stability of the dam if allowed to continue. However, a comparison between the Norfolk District and the Wilmington District inspections indicates that no adverse changes have occurred since the June 1976 inspection.

7. Assessment and Remedial Measures

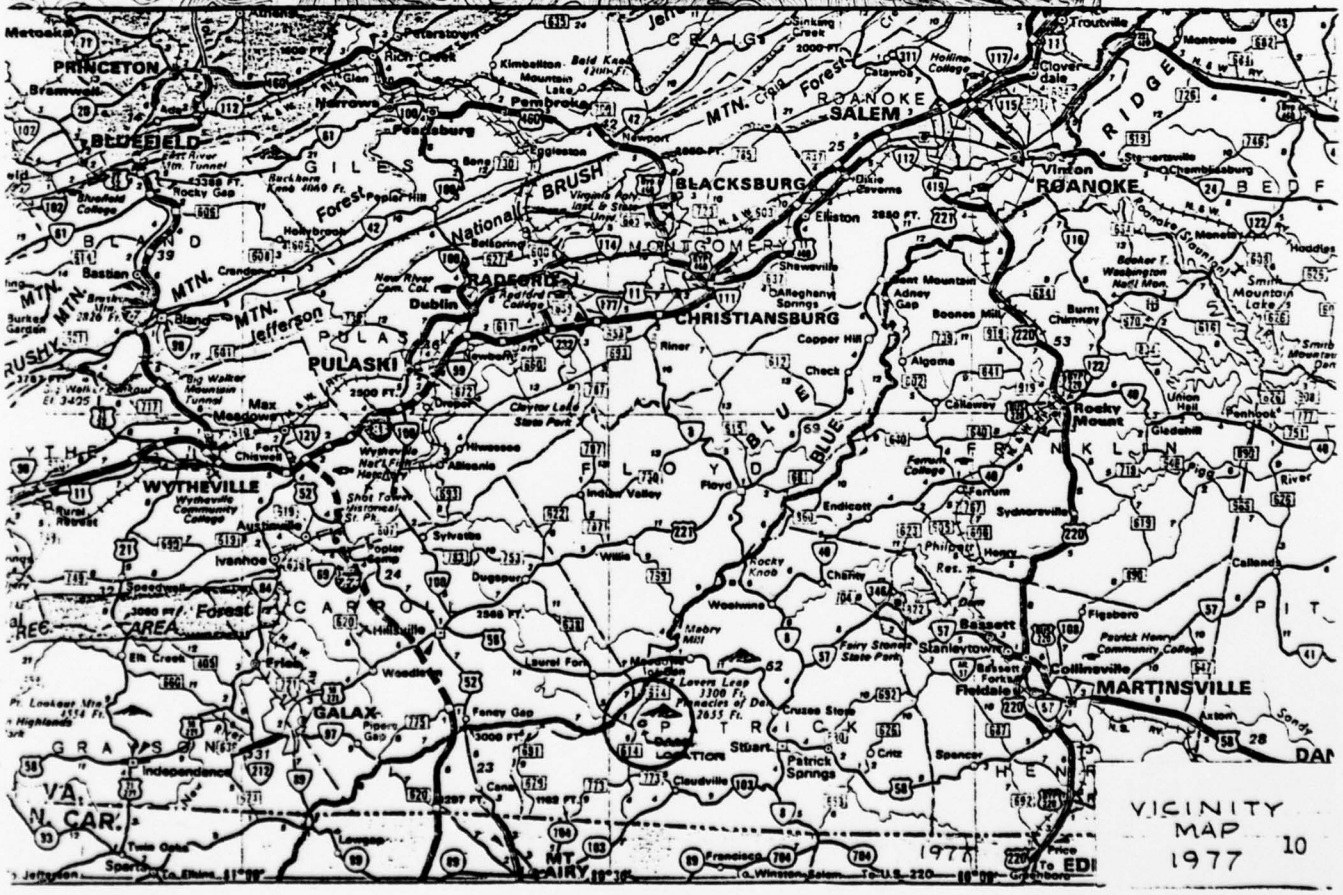
7.1 Dam Assessment. The data acquired from the visual inspections by SAW and NAC was used as a basis for evaluating the safety of the dam on the headwaters of the Squall Creek. The hydrologic and hydraulic analyses indicate that a potential hazard does exist despite the fact that the spillway is capable of controlling the probable maximum flood. There are no obvious signs of failure to warrant urgent remedial treatment. However, the severe erosion and the lack of pertinent design and construction records dictate the need for a detailed analysis of the earth structure. Therefore, it is recommended that a qualified consultant be enlisted by the owner to evaluate the stability and safety of the dam. This evaluation should include an analysis of the foundation conditions, a stability analysis of the earth embankment and a seepage analysis. The alternative to an extensive evaluation of the dam's stability would be draining the reservoir and removing the dam. Considering that the dam serves no useful purpose, this alternative might be the most desirable.

7.2 Remedial Measure. The severe erosion problem should be addressed immediately to prevent further slope deterioration. After filling and seeding the existing gullies, measures should be taken to prevent erosion while the vegetative cover is being established. In an effort to prevent further erosion, surface runoff from the adjacent abutments should be redirected away from the embankment slopes.

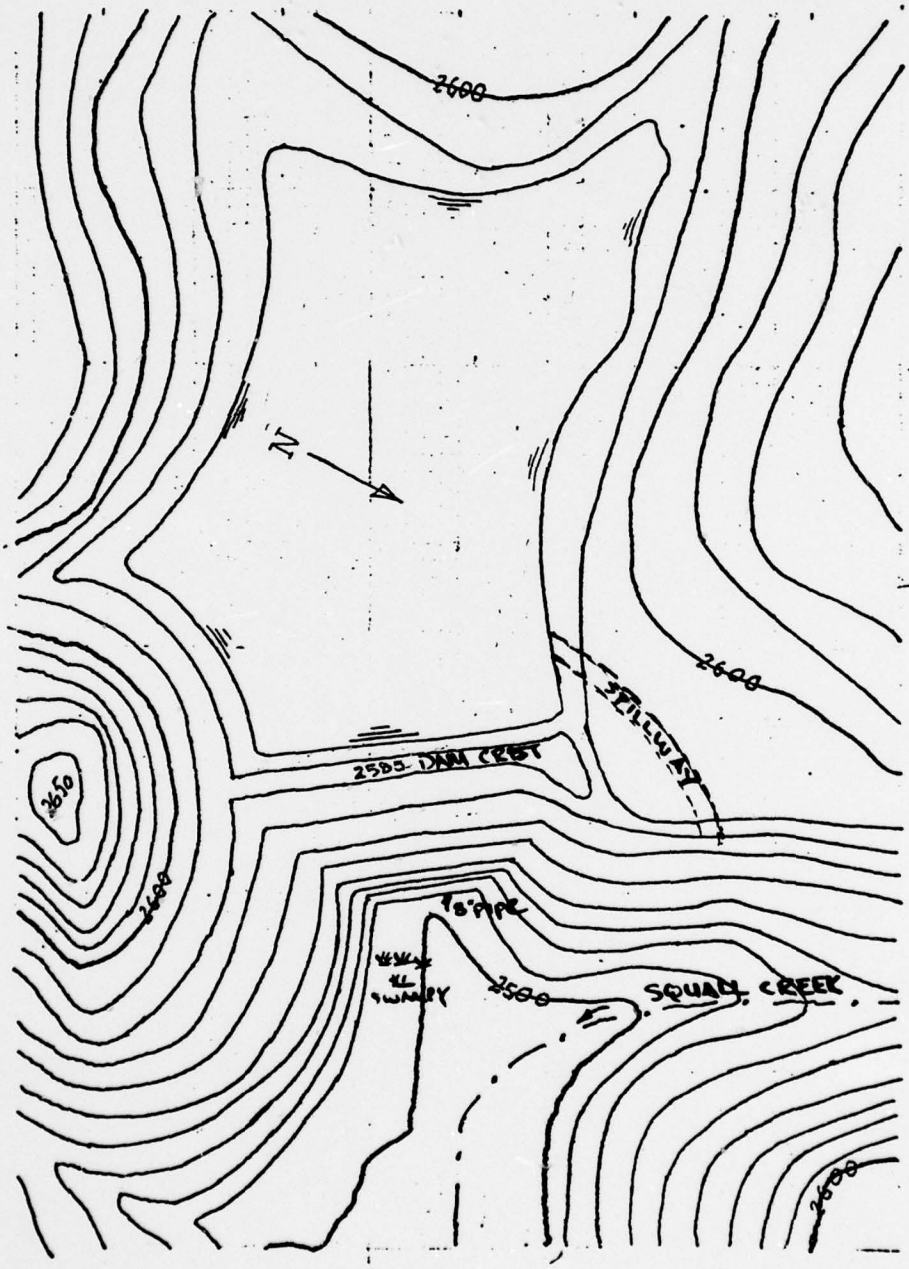
7.3 Recommended Operation and Maintenance Procedures. In addition to preventing the embankment erosion, the owner should establish a program to monitor the seepage flow at the downstream tow and the effluent flow from the 8 inch corrugated pipe. The monitoring program should be implemented to insure that material piping and increased seepage do not occur at a later date. A method of dewatering the reservoir should also be established in case the structural stability of the dam deteriorates and becomes an immediate threat to the downstream inhabitants.



LOCATION MAP 1968



VICINITY MAP 1977



TOPOGRAPHY OF DAM AND SURROUNDING AREA
NOT TO SCALE
DECEMBER 1977

Appendix I

Check List - Visual Inspection

Incl 3.

Check List
Visual Inspection
Phase 1

Name Dam on the Headwaters of Squall's Creek County ~~Patrick~~ State Virginia Coordinators Norfolk District

Date(s) Inspection 15 Dec 77 Weather Sunny Temperature 50°F

Pool Elevation at Time of Inspection Est. 2573 M.S.L. Tailwater at Time of Inspection Est. 2500 M.S.L.

Inspection Personnel:

Ed Strawsnyder

Dave Pezza

Larry Holland

Ed Strawsnyder Recorder

Appendix I

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No visible surface cracks were noted on either the U/S or D/S slopes.	The small cracks observed during the SAW inspection in June 1976 were probably shrinkage cracks as stated in their inspection report.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking was observed at or beyond the toe.	The SAW inspection in 1976 did not detect any movement at or beyond the toe.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Severe erosion is prominent on the D/S embankment slope from approximately 35' vertically below the crest to the toe. The embankment area adjacent to the right abutment has erosion gullies ranging from 6" to 3' deep. The vegetative cover ranges from sparse to nonexistant in these areas of erosion. Large cobbles and boulders and vegetative debris were noted in these gullies.	The D/S slope varies from 1v to 3h to 1v to 2.5h. The transition occurs at a vert. distance of 35' below the crest. This steeper slope and the runoff from the abutment have created the severe erosion problem. To prevent further erosion and possible failure, it is recommended that the gullies be filled and seeded. In addition, runoff from the abutments should be diverted and channelled away from the D/S slope.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	The centerline of the dam is approximately straight and perpendicular to the existing abutments. Elevations across the 350' dam vary approximately 1 foot.	
RIPRAP FAILURES	(N.A.)	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
R. T. Abutment:	An unimproved access road slopes down along the right abutment to the dam crest. This road intercepts runoff from the Rt. abutment slopes and diverts it down the D/S embankment slope, thus contributing to the severe erosion. Also, the Rt. abutment has been cut to a 1v. to 1h. slope andadjacent to the embankment contact.	The runoff intercepted by the road should be diverted away from the embankment slopes or channelled into a paved ditch.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Severe erosion is prominent along the contact between the Rt. abutment and the embankment as discussed above. Minor erosion was noted at the contact between the Lt. abutment and the embankment. The spillway (emergency) is cut into the undisturbed left abutment approximately 250' north of the embankment.	Runoff from the abutment slopes should be diverted away from the embankment slopes. The existing erosion should be arrested by a vegetative cover.
ANY NOTICEABLE SEEPAGE	Seepage was noted near the D/S toe at several locations. These locations included debris piles consisting of tree trunks, limbs etc. and a small swampy area approximately 30' D/S of the toe. The seepage was flowing clear and at a rate less than 0.1 cfs. This rate compares closely to the flow indicated by SAW in their 1976 inspection report.	The inspection was performed approximately 24 hours after a heavy rainfall (1 in 8hrs). Squalls Creek at its confluence with the Dan River was flowing muddy; whereas, the flow at the confluence of Squall Creek and the dam discharge was clear. Mr. Stanley, the owner, indicated that the swampy area had existed before the construction of the dam.
NOTICEABLE SEEPAGE	The old stream channel is still visible adjacent to the right abutment. The presence of the debris obscurred the actual source of the seepage exit points. A small seepage boil was noted in the swampy area. It was also flowing clear.	
DRAINS	The only drainage structure through the dam is an 8" helical corrugated pipe. The pipe was open at the time of the inspection and was discharging at the rate of approximately 37 GPM. The flow was clear. (This flow rate is similar to the flow rate observed by SAW in June 1976)	The pipe is the only existing means of draining the lake. It is believed that the pipe is partially blocked as a result of debris or damage incurred during construction.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR(NA)		
APPROACH CHANNEL There is very little vegetative cover within the spillway channel. Some rock outcrops are present.	The emergency spillway is cut into the left abutment. The base of the channel ranges in width from 20 to 26 feet. The side slopes are erratic with slopes ranging from 1v to 2h to 1v to 1v.	The crest of the spillway is approximately 4 feet below the crest of the dam. It is recommended that a vegetative cover be established in the spillway to minimize erosion.
DISCHARGE CHANNEL	The approach channel is approximately 300' long and drops approximately 5.5' from influent to discharge. The spillway discharges into Squalls Creek down a slope of vl to 1h.	The spillway discharges into Squalls Creek proper, thereby, minimizing the effect on the dam. The sides of the channel near the discharge point should be builtup to prevent water from spilling over onto the left abutment/embankment contact.
BRIDGE AND PIERS		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir incorporates a drainage area of approximately 81 acres. The reservoir slopes range from near vertical on the southside to 1v. to 10h at the west end. The slopes are mostly wooded or grassed except where the slopes (Lt. abutment) have been excavated for borrow.	
SEDIMENTATION	Based on the observed erosion patterns on the open cut slopes, it is anticipated that sedimentation will be heavy until the unprotected slopes are seeded.	The exposed cut slopes on the left abutment slopes should be seeded to minimize crosion and sedimentation.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Squalls Creek flows predominantely on rock (Phyllite) with minor obstructions such as fallen trees between the dam and the confluence with the Dan River. It's banks are heavily wooded.	
SLOPES	The stream's slope is approximately 1v to 25h for a distance of approximately 0.5 miles below the dam. At the latter point the Creek falls approximately 700 feet in approximately 1/2 mile to its conflunce with the Dan River	
APPROXIMATE NO. OF HOMES AND POPULATION	There are 4 houses at the confluence of Squall's Creek and the Dan River. The population is estimated at 14 people. Another 5 houses are located within 1 mile D/S of the Squall Creek confluence with the Dan River with an estimated population of 21 persons.	Two of the houses are directly adjacent to Squall's Creek.

Appendix II

Check List - Engineering Data

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Appendix II

EM	REMARKS
AN OF DAM	There were no design documents for the inspected dam. A sketch of the dam is attached.
GIONAL VICINITY MAP	Use U.S.G.S. quad sheet
NSTRUCTION HISTORY	The earth dam was constructed in 1970 for a lake in a subdivision which was not developed. The owners at that time were Mr. Crossingham and Mr. Lewis. Since that time the dam has been sold at public auction to Mr. Wilton A. Stanley.
PICAL SECTIONS OF DAM	See attached plan sketch
DROLOGIC/HYDRAULIC DATA	Refer to hydraulic/hydrologic report attached with check list.
UTLETS - PLAN - DETAILS -CONSTRAINTS -DISCHARGE RATINGS	Data were not available
AINFALL/RESERVOIR RECORDS	Unknown

'EM	REMARKS
ESIGN REPORTS	Not Available
EOLOGY REPORTS	Not Available
ESIGN COMPUTATIONS YDROLOGY & HYDRAULICS	Refer to computations prepared by NAO
AM STABILITY EEPAGE STUDIES	Report prepared by SAW in July 1976 at the request of the Va. State Water Control Board.
IATERIALS INVESTIGATIONS ORING RECORDS ABORATORY IELD	No exixting subsurface data were available. Based on our field investigation and laboratory testing, the material used to construct the dam consists of a low plasticity silt and clay derived from a highly weathered schist. Boulder size material (weathered schist) was noted in the embankment.
OST-CONSTRUCTION SURVEYS OF DAM	(Refer to SAW report, dated July 76)
ORROW SOURCES.	The borrow material was taken from the left abutment area and consisted of highly weathered schist which classified as above.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	(None available - Visual observations indicate that the water level has been approximately 1.5' higher than on the day of NAO inspection.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	(Refer to SAW report dated July 76)
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Information not available
MAINTENANCE OPERATION RECORDS	None available

TEM	REMARKS
PILLWAY PLAN SECTIONS DETAILS	Refer to Sketches and photographs
PERATING EQUIPMENT LANS & DETAILS	(NA)

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 81 acres

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): Not Applicable

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not Applicable

ELEVATION MAXIMUM DESIGN POOL: Dependent of freeboard

ELEVATION TOP DAM: Estimated at 2585' MSL

CREST:

a. Elevation - Approximately 2581' MSL
b. Type - Uncontrolled, grassed, emergency spillway
c. Width - Varies from 17 to 26 feet, averages 21 feet
d. Length - 300 feet
e. Location Spillover - 250 feet north of left abutment
f. Number and Type of Gates - None

OUTLET WORKS:

a. Type - 8 inch helical corrugated pipe
b. Location - Downstream toe/runs through dam
c. Entrance inverts - Unknown
d. Exit inverts - Approximately 2500' MSL
e. Emergency draindown facilities - None

HYDROMETEOROLOGICAL GAGES:

a. Type - Non-recording precipitation
b. Location - Meadows of Dan
c. Records -

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

Flood	1% 1/	SPF 2/	PMF 3/
Reservoir:			
Peak inflow (c.f.s.)	260.0	317.0	708.0
Peak elevation (feet, m.s.l.)	2,582.3	2,582.8	2,584.3
Remaining freeboard (feet, m.s.l.)	2.7	2.2	0.7
Spillway:			
Peak outflow (c.f.s.)	180.0	250.0	585.0
Peak velocity (f.p.s.)	6.1	6.7	8.5
Duration 4 f.p.s. (hrs.)	2.5	6.0	7.0
Duration 6 f.p.s. (hrs.)	0.5	1.5	5.0
Duration 8 f.p.s. (hrs.)	0	0	1.0

1/ The 1 Percent Exceedence Frequency Flood has 1 chance in 100 of being exceeded in any given year.

2/ The Standard Project Flood is an estimate of flood discharges that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the geographical region involved, excluding extremely rare combinations.

3/ The Probable Maximum Flood 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.

Appendix III

Wilmington Districts' Inspection Report

SAWEN-DF

2 July 1976

MEMORANDUM FOR RECORD

SUBJECT: Inspection of Dam on Headwaters of Squall Creek, Patrick County, VA.

1. Date of Inspection: 14 and 15 June 1976.

2. Personnel: The inspection party consisted of the following individuals from the Wilmington District (SAW), U. S. Army Corps of Engineers:

Mr. Allen L. Hurlocker	-	Civil Engineer
Mr. Henry Jerome	-	Hydraulic Engineer
Mr. David Leitch	-	Hydraulic Engineer
Mr. Michael Wiggin	-	Engineer Student Trainee

3. Background: On 6 April 1976, Mr. Berkley Adkins, Superintendent of the Electric Department of the City of Danville, Va., contacted SAW personnel and expressed his concern for the safety of the subject dam. The Corps of Engineers has no authority to inspect dams at the request of private citizens; therefore, Mr. Adkins was referred to the Virginia State Water Control Board (SWCB). On 7 June 1976, SAW received a letter, dated 4 June 1976, from Mr. A. H. Paessler, Deputy Executive Secretary of SWCB, requesting that SAW assist the State of Virginia in evaluating the safety of the dam. Mr. Paessler was informed, by SAWEN-DF letter dated 8 June 1976, that a preliminary inspection of the dam would be made at an early date and that Mr. Robert Gay of his office would be informed of the details of the inspection by telephone. On 9 June 1976, Mr. Hurlocker called Mr. Gay and informed him that the inspection would be performed on 14 and 15 June 1976. Permission to inspect the dam was obtained from the owner, Mr. S. J. Lewis, on 9 June 1976.

4. Location of Dam: The dam is located on an unnamed tributary of Squall Creek, just above its confluence with Squall Creek in Patrick County, Va. Squall Creek is a tributary of the Dan River.

5. Description of Dam: The dam, which was constructed in 1970, is an earth fill structure with a height of 82 feet at its maximum section. The dam is approximately 350 feet long, and the top width varies between 17 and 23 feet. The downstream face has a slope of approximately 3 horizontal to 1 vertical (3H to 1V), and the visible portion of the upstream face has a slope of approximately 4H to 1V. The emergency overflow spillway is located through the north abutment and has an average bottom width of approximately 25 feet. The crest of the spillway is approximately 3.5 feet below the top of the dam. An eight-inch-diameter corrugated metal pipe, protruding from the downstream toe of the dam, is the only visible means of draining the lake. The dam controls a drainage area of approximately 77 acres of steeply rolling terrain.

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6. Observations and Comments:

a. Very little vegetation is growing on the embankment.

b. Both faces of the dam are covered with erosion gullies. The gullies on the upstream face have a maximum depth of approximately six inches. The gullies on the downstream face vary from a few inches deep up to five feet in depth. In many cases logs and tree limbs were visible in the sides and bottoms of the gullies on the downstream face.

c. A pile of tree trunks, limbs and other vegetative debris, is partially embedded in the fill near the downstream toe. Another pile of tree debris is located approximately 30 feet downstream of the toe of the dam. Water is seeping from beneath both piles of debris, and a small swamp has developed below the pile downstream of the toe. Water was also seeping from beneath a soil mound located approximately 90 feet downstream of the toe on the south side of the valley. All seepage water was clear.

d. The outlet end of the 8-inch pipe is capped with a metal plate. The seal between the pipe and plate is not watertight, and as a result a considerable amount of leakage was occurring around the end of the pipe (approximately 0.1 cubic foot per second).

e. No seepage was observed discharging from the fill of the downstream face of the dam.

f. A very minor amount of seepage was observed on the northeast side of the ridge which forms the north abutment of the dam. This water was clear.

g. A series of small cracks, running parallel to the axis of the dam, was observed on the downstream face of the dam. The cracks were located about 35 feet down the slope from the crest near the dam centerline and extended approximately 50 feet horizontally. The cracks were approximately 1/16" wide. The material in the vicinity of these cracks was clayey, and it appeared that these were shrinkage cracks.

h. The dam is constructed of soil and rock which varies in size from silts and clays up to boulders. The majority of the granular material could be pulverized by hand. A hand auger hole was drilled near the centerline of the dam at mid-height of the downstream face. The hole was advanced to a depth of approximately 10 feet where refusal occurred. It is believed that a boulder was encountered which prevented further penetration. The material encountered in the hole was a clay of low plasticity. The auger was advanced into the fill with less effort than one would expect to be required to advance it in a material of this type which had been compacted to the densities normally used in dam construction. Another hand auger hole was drilled in natural ground approximately 20 feet downstream of the toe of the dam. The material in this hole was a silty sand. The water table was encountered at a depth of one foot. The hole would not stay open below the water table and was terminated at a depth of two feet.

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i. It appears that additional fill has been placed recently on the crest and downstream face, near the south abutment. This fill extends down the slope for approximately 20 to 30 feet. In the section near the south abutment, this material is on a slope of 1.5H to 1V. It appears that this fill was placed to repair erosion which was noted during an earlier SWCB inspection.

j. The access road on the south abutment slopes downward toward the dam. The road is graded in a manner which allows runoff, intercepted by the road, to run along the interface between the embankment fill and natural ground of the south abutment. This condition undoubtedly contributed to the formation of the deep erosion gullies in the fill adjacent to the south abutment.

7. Conclusions:

a. The number and depth of the erosion channels on the downstream face indicate the lack of an adequate maintenance program for the dam. If allowed to continue uncontrolled, this erosion represents a real threat to the structural stability of the dam.

b. The method of capping the outlet pipe is highly undesirable. The pipe is capped at its outlet end; therefore, it is under a high pressure produced by the lake. If the pipe has any leaks, this pressure would greatly accelerate piping (subsurface erosion) of the soil surrounding the pipe. Piping of soil surrounding pipes through earth dams is not uncommon, and the stains and erosion near the lower end of this pipe indicate that it may have occurred in this dam. It is possible that piping would be observed at a higher lake level.

c. The seepage observed below the dam was estimated to total approximately 0.1 cubic foot per second. This water was clear, and little or no subsurface erosion was taking place. It is probable that the quantity of seepage would increase as the lake level is increased. The possibility of subsurface erosion increases as the quantity of seepage increases. An increase in the quantity of seepage and any associated subsurface erosion would adversely affect the stability of the dam. The tree debris and the swamp downstream of the dam obscure the exact exit points of the seepage.

d. The tree trunks and limbs observed in the fill are indicative of poor quality control during construction. Based on the observed conditions, one must conservatively assume that this type of debris is present throughout the dam.

e. The ease with which the hand auger was advanced is an indication that the material was not properly compacted. Admittedly, this is a subjective indicator and is by no means conclusive.

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f. The grading of the access road to allow runoff to run over the embankment fill is undesirable and is an indication of poor construction and/or design. Without design plans and specifications, it is impossible to determine if the dam was constructed as designed.

g. Rough hydrologic calculations indicate that by utilizing the available surcharge capacity the emergency spillway can probably accommodate a flood resulting from a rainfall which has a 1% probability of occurrence before over-topping the dam. For other hydraulic considerations, see the attached Memorandum for Record dated 17 June 1976, by Mr. Henry L. Jerome.

8. Recommendations: For a dam to be considered safe, every feature must be designed, constructed, and maintained in a manner which leaves no doubt as to its integrity. The crest width and side slopes of this dam compare favorabley with dams which have proven safe in service. However, this outward impression of stability is undermined by conditions, detailed above, which raise questions concerning the adequacy of the quality control during construction, the maintenance, and the design of the dam. It is believed that these conditions are serious enough to question the safety of the dam and to consider it unsafe until more detailed inspections and analysis are made. Therefore, it is recommended that the lake be drained and the owner retain the services of a Professional Engineer, experienced in the design and construction of earth dams, to perform a detailed inspection in order to evaluate the condition of the dam and to execute a plan to correct any deficiencies which may be discovered.

1 Incl
Memo dtd 17 Jun 76

Allen L. Hurlocker
ALLEN L. HURLOCKER
Civil Engineer

Henry L. Jerome
HENRY L. JEROME
Hydraulic Engineer

NOTED:

E. G. Long, Jr. for
E. G. LONG, JR.
Chief, Engineering Division

Homer Johnstone, Jr.
HOMER JOHNSTONE
Colonel, Corps of Engineers
District Engineer

SAWEN-PH

17 June 1976

MEMORANDUM FOR RECORD

GENERAL

1. A field inspection of a privately owned dam in Patrick County, Virginia was made on 14 and 15 June 1976 by a team from the Wilmington District. The team was composed of Messers Hurlocker and Wiggins from the Design Branch and Jerome and Leitch from the Hydrologic Engineering Section of the Planning and Reports Branch. The team was to report on the apparent safety of the dam.

2. The dam is located on an unnamed stream, just above its junction with Squall Creek, which in turn is a tributary of the Dan River. The dam controls a drainage area of about 77 acres of steeply rolling terrain. The stream's slope is about 5' per 100' above the dam, as is Squall Creek's slope for a distance of about 3,000 feet below the dam. At the latter point, Squall Creek falls nearly 900 feet in approximately ½ mile to its confluence with the Dan River.

3. The dam is an earth structure about 350' feet long at its top rising 82' in height above its downstream toe. Its downstream face has a slope of about 3:1 and its upstream face has a 4:1 slope on its visible portion. At the time of the inspection, the impounded water surface was about 12.5' below the top of the dam and about 9 feet below the crest of an emergency spillway located about 250' left of the left end of the dam. The only drainage structure through the dam is an eight-inch helical corrugated metal pipe. Its upper end is submerged in the lake and its lower 10' feet are exposed unsupported. At present, there is a drop of 1 foot from the pipe invert to the downstream channel. This pipe was reportedly used as a diversion device during construction of the dam, but has since been capped with a steel plate bolted across the pipe end. Seepage through the dam near its toe combined with leakage from the pipe are estimated to total less than 0.2 cfs.

HYDRAULIC CONSIDERATIONS

4. The emergency spillway was apparently excavated through undisturbed material. Its side slopes are irregular and the spillway crest averages 20 to 25 feet in width. Rough calculations indicate that there is between 4 and 4½ inches of surcharge capacity between the spillway crest and the top of the dam. With a static pool elevation of 1 foot below the top of the dam, the spillway capacity is approximately 350 cfs. Rough calculations indicate the surcharge capacity is probably adequate to accommodate a flood resulting from a rainfall which has a 1% probability of occurrence before over topping the dam.

5. With a full pool, a sudden failure of the dam would send a flood wave down the valley to the Dan River, a distance of about 1 mile, in less than 5 minutes. The crest of such a wave would vary from about 25 feet near the dam to about 15 feet at the river. No inspection was made of the area downstream from the dam, so the consequences of such a flood wave are unknown.

6. This memo covers hydraulic considerations: no attempt has been made by the undersigned to evaluate the structural stability of the dam.

HENRY L. JEROME
Hydrologic Engineering Section

Appendix IV

Photographs

VIEW LOOKING DOWNSTREAM FROM CREST OF DAM - NOTE EROSION ON THE DOWNSTREAM SLOPE

VIEW LOOKING NW FROM RIGHT ABUTMENT ACROSS DAM CREST - NOTE FROSION AT EMBANKMENT - ABUTMENT CONTACT

VIEW OF SPILLWAY - LOOKING DOWNSTREAM FROM UPSTREAM ENTRANCE

VIEW OF DOWNSTREAM END OF SPILLWAY LOOKING EAST