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NATIONAL DAM SAFETY PROGRAM. KINLOCH FARM DAM. INVENTORY NUMBER--ETC(U)
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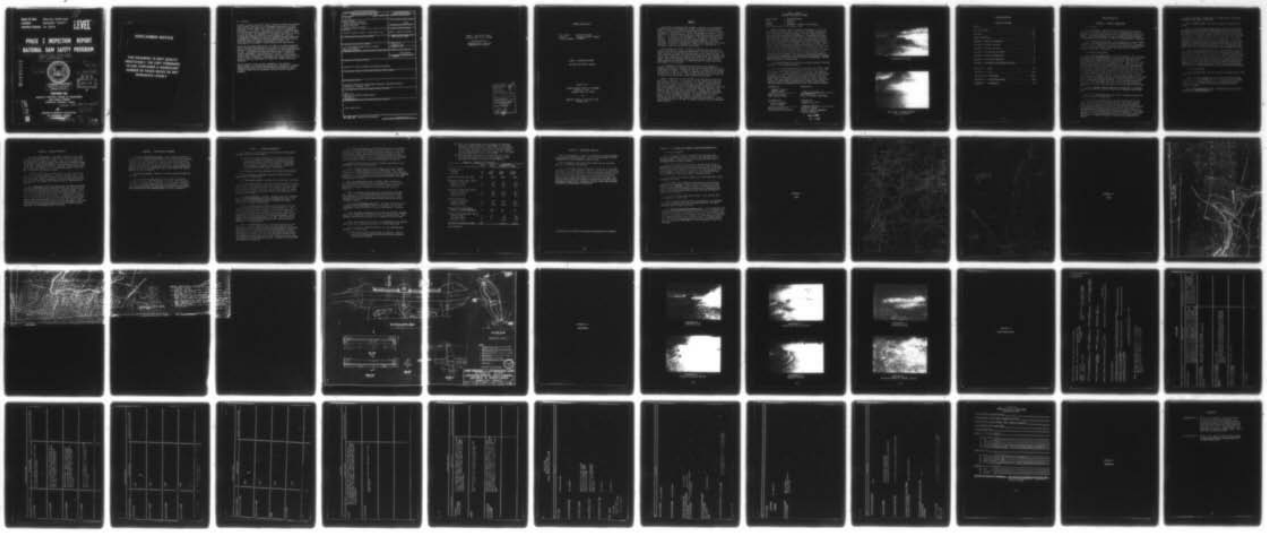

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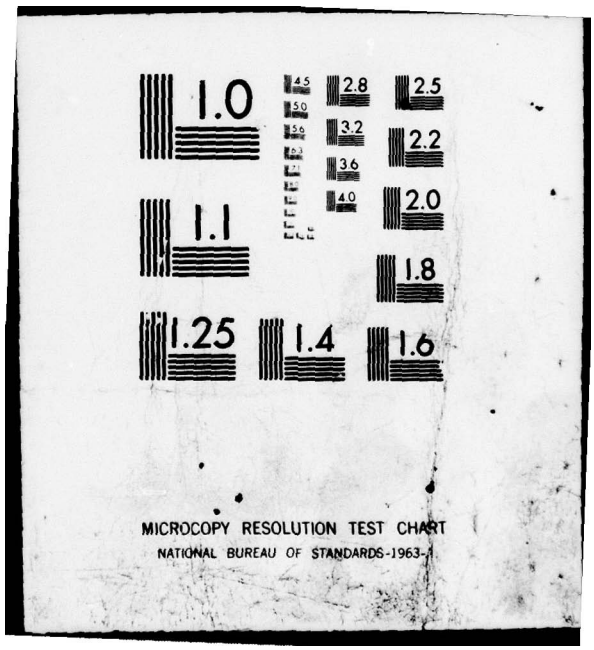
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Name Of Dam: KINLOCH FARM DAM
Location: FAUQUIER COUNTY
Inventory Number: VA. 06109

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Kinloch Farm Dam. Inventory Number: VA-06109. Fauquier County, Virginia. Phase I Inspection Report.

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Final rept.

Paul /Seiler

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BY

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DEWARD M. MARTIN & ASSOCIATES
WILLIAMSBURG, VIRGINIA
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20. Abstract

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

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

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

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

KINLOCH FARM DAM
FAUQUIER COUNTY, VIRGINIA
INVENTORY NO. VA 06109

POTOMAC RIVER BASIN

Name of Dam: Kinloch Farm Dam
Location: Fauquier County, Virginia
Inventory Number: VA 06109

PHASE I INSPECTION REPORT

National Dam Safety Program

Prepared for

NORFOLK DISTRICT CORPS OF ENGINEERS
803 Front Street
Norfolk, Virginia 23150

by

Deward M. Martin & Associates, Inc.
January 1979

PREFACE

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

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

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

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

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	:	Kinloch Farm Dam
State	:	Virginia
County	:	Fauquier
Stream	:	Mill-Run - Tributary to Broad Run
Date of Inspection	:	December 7, 1978

Kinloch Farm Dam, owned by Kinloch Farm Estate, a Trust, is located two (2) miles north of The Plains, Virginia, along Route 625. The dam is an earth embankment, 270 feet long and 29 feet high, with three uncontrolled spillways. The primary spillway, located in the center of the dam, is 82 feet wide; the secondary spillway, added in 1967, located at the left abutment, is 40 feet wide; and the emergency spillway, added in 1976, located beyond the right abutment, is 55 feet wide. The lake is used for recreation. The dam withstood the Tropical Storm Agnes in 1972, sustaining minor erosion which was repaired following the storm. The lake was empty at the time of inspection. The concrete slab on top of the dam, at the primary spillway, has a crack at the centerline along the axis of the dam. The downstream channel of the secondary spillway showed a wet spot at a rock outcrop about 50 feet below the embankment. The downstream flood plain has approximately 8 houses and I-66 is being constructed downstream. The dam has a high hazard classification.

The combined capacity of the three spillways passes 46 percent of the PMF and is rated inadequate.

The owner, at his own expense, should have soil samples taken along the embankment and have laboratory tests of the samples run to establish the design and stability of the dam. The combined capacity of the spillway should be increased to pass ½ PMF without overtopping the dam. Consideration should be given to develop a warning system procedure to alert residents in time of an emergency. The above should be scheduled with the owner's consulting engineers within three (3) months after release of this report. All work should be completed within twelve (12) months thereafter.

Submitted By:

Original signed by
JAMES A. WALSH

James A. Walsh, P.E.
Chief, Design Branch

Prepared By:

Paul Seiler, PE

PAUL SEILER, P.E.
Deward M. Martin & Associates

Recommended By:

Original signed by
ZANE M. GOODWIN

ZANE M. GOODWIN, P.E.
Chief, Engineering Division

Approved By:
Original signed by:

Douglas L. Haller

DOUGLAS L. HALLER
Colonel, Corps of Engineers
District Engineer

~~FEB 9 1979~~

MAR 9 1979

Upstream Face of Dam

Top of Dam - Looking Northeast
Principal Spillway

KINLOCH FARM DAM

TABLE OF CONTENTS

KINLOCH FARM DAM

SECTION 1. PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 Aug 72 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Appendix VI, Reference 1). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Kinloch Farm Dam is 720 feet long and 29 feet high from the crest of the principal spillway, at elevation 536, to the tailrace apron at elevation 507. The dam is an earth embankment with a core of selected fill. Slopes are 3:1 on the upstream side and 2.5:1 on the downstream side. There are three uncontrolled spillways. The primary spillway, located approximately in the center of the dam, has a concrete roadway slab for the crest, at elevation 536, and is 82 feet long with an 18 foot long large rock and shrubbery center section about 4 feet higher than the crest. The secondary spillway, located at the left end of the dam, is about 40 feet wide and at elevation 536.25. A single lane bridge structure passes over the secondary spillway providing three openings each 12 feet x 3.75 feet. The emergency spillway is located about 40 feet beyond the left abutment at elevation 538.5. It is a grassed spillway 55 feet wide. The lake drain pipe is 18-inches C.I. with a manually operated valve. An 18" weir was added to the secondary spillway about 1979.

1.2.2 Location: Kinloch Farm Dam is on Mill Run, a tributary to Broad Run, two miles north of The Plains, Virginia, along Route 625.

1.2.3 Size Classification: The dam is classified as small by storage capacity, (433 Acre feet).

1.2.4 Hazard Classification: The dam is located in an area where there are farms and homes downstream. There are secondary roads, railroad, and I-66 now under construction at Thoroughfare Gap in Bull Run Mountains. The dam has a high hazard classification in accordance with the guidelines contained in Section 2.1.2 of Recommended Guidelines for Safety Inspection of Dams, published by the Office, Chief of Engineers, U.S. Corps of Engineers. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: Kinloch Farm, an estate trust, The Plains, Virginia, is the owner of the dam.

1.2.6 Purpose of Dam: The lake is used for recreation purposes.

1.2.7 Design and Construction History: The dam was designed by Warren Perrow, Consultant, in 1963 and constructed about 1964. The embankment has a core of selected material from the site. The top of the dam is used as a bridle path and by the pick-up truck at the farm. The secondary spillway and a single lane bridge above it were constructed at the left end of the dam in 1967. A concrete curtain wall was added along the upstream side of the dam at the principal spillway to correct erosion in about 1971. A grass swale emergency spillway was constructed about 30 feet beyond the left abutment in 1976. Quible and Associates, Inc. of Chace City, Virginia, have been the consulting engineers since approximately 1971.

1.2.8 Normal Operating Procedures: Dam operations consist of observations and maintenance by the regular employees in charge of operating the estate. Weekly maintenance is done by landscape workers and construction is done by contracts. Water level of the lake can be drawn down by a manually operated valve. Observations by employees are not logged except through correspondence with consultants. Inspections are done on occasion by their consultants for improvements or changes of the lake or dam. In 1971, the embankment was noted in sound condition by the owner's consulting engineer.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 6.21 square miles.

1.3.2 Discharge at Dam Site: Discharge for 100 year storm is 2,879 cfs at an elevation of 539.85. Capacity with water level at the top of the dam is 2,190 cfs for the principal spillway; 1,170 cfs for the secondary spillway; and 2,020 cfs for the emergency spillway.

1.3.3 Dam and Reservoir data: Pertinent Data on the dam an reservoir are tabulated below:

TABLE 1.1 DAM AND RESERVOIR DATA

ITEM	RESERVOIR				
			Capacity		
	Elevation* Ft., msl	Area Acres	Acre Feet	Watershed Inches	Length Miles
Top of Dam	541	35	433	1.37	N.A.
Emergency Spillway	538.5	34	343	1.09	N.A.
Secondary Spillway	537.5	32.2	263	0.83	N.A.
Principal Spillway	536	32	253	0.80	0.4
Streambed	510				

*Add 3 feet to plan elevation to get msl elevation.

SECTION 2. ENGINEERING DATA

2.1 Design: The original design plans, by Warren Perrow, dated 1963, show general site developments, embankment and spillway riprap. There are no specifications or borings available from the owner for the original dam. The secondary spillway and a small bridge were designed in 1967 by Perrow. There are no boring logs available for this structure, which is a reinforced concrete 3-cell box on the secondary spillway. The curtain wall, added in 1971, and the emergency spillway were designed by Quible and Associates, Inc. The wall is a reinforced concrete design and the emergency spillway is a grass covered swale. No borings were No borings were taken for these. None of the design calculations were available from the owner's files.

*2.1.1 Geologic Investigations: There were no geologic investigations performed for the Kinloch Farm Dam.

*2.1.2 Geologic Setting of the Dam Site: The dam is located in the foothills of the Blue Ridge physiographic province where the Blue Ridge meets the Piedmont province. The bedrock at this site is part of the Catoctin Formation believed to be of the Cambrian to Pre-Cambrian time period.

The principal lithology of the Catoctin Formation is a medium-grained, well-foliated chlorite schist; however, lava flows and gneiss have also been observed in this formation. At the Kinloch Farm Dam site, a lava flow consisting of olivine basalt was observed, while no schist or gneiss was encountered.

2.2 Construction: There are no records or tests of construction.

2.3 Operation: There is no regular operation of the dam. Manual operation of the draw down valve is done by the person in charge of the estate at the site of the dam.

2.4 Evaluation: Some data on the dam is available from the owner through the owner's consultants. The data available, plans and correspondence appears to be on a professional level.

Complete design calculations, contract documents and records should be kept on file at the site by the owner.

Since a geotechnical investigation has not been performed, there is a total lack of information concerning the foundation conditions and the materials comprising the dam. In addition, there are no construction records available. Therefore, additional data, as described in Section 7.1, must be obtained.

*Information provided by Law Engineering Associates of Virginia.

SECTION 3. VISUAL INSPECTION

3.1 Dam and Foundation: Information observed in the field is outlined in Appendix IV. At the time of the site inspection, the pool had been completely drained. There was no evidence of any failures or bulging on either the upstream or downstream faces of the dam. There was no evidence of any settlement of the crest of the dam, although there was some cracking in the primary spillway. There was evidence of of a considerable amount of silt on the lake bottom, say about 12 inches.

There were two massive olivine basalt outcrops along either side of the secondary spillway. There was a small seepage area observed in the secondary spillway between the two rock outcrops. According to Mr. Harmon Stevenson, the General Superintendent of Kinloch Farm, the seepage area existed prior to construction of the dam.

3.2 Evaluation: The visual inspection revealed no apparent problems requiring immediate attention other than the wet area of the downstream reaches of the secondary spillway channel. Since the pool was drained during the site inspection and since the seepage area reportedly existed prior to construction of the dam, it is believed that the seepage water is supplied from the hillside to the left of the dam. The two rock outcrops along either side of the spillway suggest that the basalt may form a cradle along which water from the adjacent hillside is routed. It is not felt that this seepage will adversely affect the dam, although the source of the seepage should be checked.

SECTION 4. OPERATIONAL PROCEDURES

4.1 Procedures and Maintenance: The operating procedure is done as the need arises. Normal maintenance, such as grass cutting, is done by the regular employees of the estate or by specialists called in for each specific job. Observations of the dam is done as part of routine work by the estate manager. The consultant is used for any design or consultation other than grounds maintenance. No logs are kept of observations by the estate other than correspondence to the consultant.

4.2 Warning System: There is no warning system operated by the owner.

4.3 Evaluation: This dam does not require an elaborate operational system. When maintenance is needed, and completed, it should be kept in a log along with records of observations by the estate and annual inspections by the consultant. A warning system procedure should be considered which will forewarn population downstream of any impending danger to life or property.

SECTION 5. HYDRAULICS/HYDROLOGY

5.1 Design: General hydraulic and hydrologic design data used for analysis is as follows:

a) Design Plan "weir additions" from Quible & Associates. There is a three-foot difference in elevation of the normal water surface as shown on the USGS mapping and the designer's elevations. The designer's elevations were converted to match the USGS mapping. These elevations were then used in all computations.

b) Discharge curve for spillways, from Quible & Associates.

5.1.1 These data contained a spillway rating curve and some details of construction.

5.2 Hydrologic Records: No hydrologic records were available.

5.3 Flood Experience: No detailed flood experience is available; however, the owner stated the Agnes Flood of 1972 overtopped the dam for a short period of time. According to the owner, the overtopping had little or no effect on the earth dam. No further detailed information was available, however, an emergency spillway was added in 1976.

5.4 Flood Potential: General - Assuming the pool elevation to be at the primary spillway crest, elevation 536.0 msl. The PMF, ½ PMF and the 100 year flood were developed and routed through the reservoir and spillway.

5.4.1 The PMF, Probable Maximum Flood, was developed from data in Hydrometeorological Report 33 (Reference No. 1). The Probable Maximum Precipitation (PMP) for the Kinloch Dam area is 25-inches in 24 hours for a 200 square mile area. This value was modified for the Kinloch 5.92 square mile drainage area and inputted to the HEC-I program, Flood Hydrograph Package, which synthesized an inflow hydrograph of the PMF. The ½ PMF inflow hydrograph was constructed by reducing each calculated PMF hydrograph ordinate by one-half.

The inflow hydrographs were constructed utilizing the unit hydrograph concept. The unit hydrograph was developed using a one-hour duration of excess precipitation and Synder's parameters (Reference No. 2). The HEC-I program then distributed excess precipitation in time and amount. The distribution thus derived was modified by revising the percent hourly distribution within the maximum 6 hour precipitation to more closely conform to that used in TP 40 for the 100 year rainfall. Results of this analysis are presented in Table 5.1.

5.5 Reservoir Regulation: Kinloch Dam has three uncontrolled spillways, a primary spillway which utilizes 90 feet of a concrete roadway as the crest (el. 536.0); a secondary spillway, crest elevation 537.5, with a concrete wall serving as a crest, 42 feet long, and flows through a three cell box culvert downstream; and an emergency spillway which is a grassed swale about 55 feet wide with crest elevation at 538.5. Top of dam elevation is at 541 msl.

A gated 18-inch pipe for drainage purposes was assumed to be inoperative for routing computations.

5.5.1 Reservoir storage capacity above the primary spillway crest was calculated using contours from USGS quad. maps, planimetering areas and converting to volume in acre-feet. The composite spillway rating curve used was that given in the design data furnished. Routing was started assuming pool elevation at spillway crest and inflow equal to outflow.

5.6 Overtopping Potential: The PMF, ½ PMF, and 100 year flood inflow hydrographs were routed through the reservoir using the modified Puls method option of the HEC-I computer program with storage-outflow. Results of this routing are shown in Table 5.1.

5.6.1 A tailwater rating curve was not available for this dam. The tailwater elevation observed during field observation was approximately 508 msl with an assumed flow of 50 cfs. The 50 cfs was used as the normal base flow when routing the storms through the system.

5.7 Reservoir Emptying Potential: To empty the dam there is an 18-inch outlet pipe with an invert elevation of 513 msl and a discharge capacity of 40 cfs at normal water surface elevation m.s.l.

5.7.1 The above information was inputted to the HEC-I program, with 6 cfs inflow and a developed storage vs. outflow curve. This analysis indicated that the dam can be emptied in four (4) days.

5.7.2 This 18-inch outlet pipe was in operation at the time of inspection and the dam was drained at the time of inspection.

5.8 Evaluation: Summarizing Table 5.1, the following data resulted from this study:

a) Calculated spillway design flood is 5,380 cfs. This is capacity of the combined spillways with flood elevation at the top of the dam.

b) Based on the high hazard, small category, the spillways should be capable of passing ½ PMF to PMF. As the homes and railroad bridge are a considerable distance downstream from the dam, the ½ PMF appears to be a realistic value for the critical flood. The ½ PMF is 5,832 cfs. The spillways will pass 92% of ½PMF and 46% of PMF.

c) All hydrologic considerations presented in this report are based on present conditions and no allowances have been made for future development of the watershed.

TABLE 5.1 - RESERVOIR PERFORMANCE

	Normal Flow	100 Yr. Storm	Hydrograph 1/2 PMF	Hydrograph PMF
Peak Flow, cfs				
Inflow	50	2,879	5,832	11,664
Outflow	50	2,879	5,832	11,664
Maximum Elevation, Ft., msl	536	539.7	541.5	543.8
Principal Spillway (El. 536.0)				
Depth of Flow, Ft.	--	3.7	5.5	7.8
Duration, Hours	--	60	60	60
Velocity, f.p.s.	--	6.5	8.3	9.8
Secondary Spillway (El. 537.5)				
Depth of Flow, Ft.	--	2.2	4.0	6.3
Duration, Hours	--	18	50	60
Velocity, f.p.s.	--	6.5	8.0	8.0
Emergency Spillway				
Depth of Flow, Ft.	--	1.2	3.0	5.3
Duration, Hours	--	11	13	22
Velocity, f.p.s.	--	6.9	11.6	11.6
Percentage of Peak outflow passed by combined Spillways	--	100	92	46
Non-Overflow Section (El. 541.0)				
Depth of flow	--	--	.5	2.8
Duration, Hours	--	--	2.0	7.0
Velocity, f.p.s.	--	--	2.0	5.0
Tailwater Elevation, ft.,msl	508		N.A.*	N.A.*

* Not Available

SECTION 6. STRUCTURAL STABILITY

*6.1 Dam Foundation: Subsurface information is not available concerning the Kinloch Farm Dam. Therefore, an assessment of the integrity of the dam foundation cannot be made.

*6.2 Stability: Structural Calculations are not available and can therefore, not be checked.

*6.3 Evaluation: Visual observations do not reveal any problems which indicate instability. However, sufficient geotechnical information should be obtained to allow a stability analysis of the dam. An exploratory program of soil test borings should be performed to define the stratigraphy within the dam and foundation and to collect undisturbed samples of the soils in the dam. Laboratory testing should be performed to define the strength characteristics of these soils. Stability analyses under both undrained and drained loading should be conducted.

* Information provided by Law Engineering Associates of Virginia

SECTION 7. ASSESSMENT AND REMEDIAL MEASURES/RECOMMENDATIONS

7.1 Dam Assessment:

7.1.1 At the time of the inspection, the lake was empty making it impossible to detect seepage in the embankment due to the impoundment. This will need to be observed by the owner's consultant when the lake is filled.

7.1.2 The concrete slab on top of the dam at the primary spillway has a crack at its centerline along the axis of the dam. This can be from the erosion causing the upstream part of the slab to be unsupported. This crack could also be from settlement of the embankment. There is no evidence of any settlement in the area of this slab that would require immediate action.

7.1.3 There were no misalignments or slide conditions in the embankment observed.

7.1.4 There is no subsurface information or construction tests for the embankment. Due to lack of information, the stability of the embankment was not analized. The strength of the dam is supported by information from the owner's representative, who saw the Tropical Storm Agnes in 1972 flow over the dam at a depth of about 2 feet.

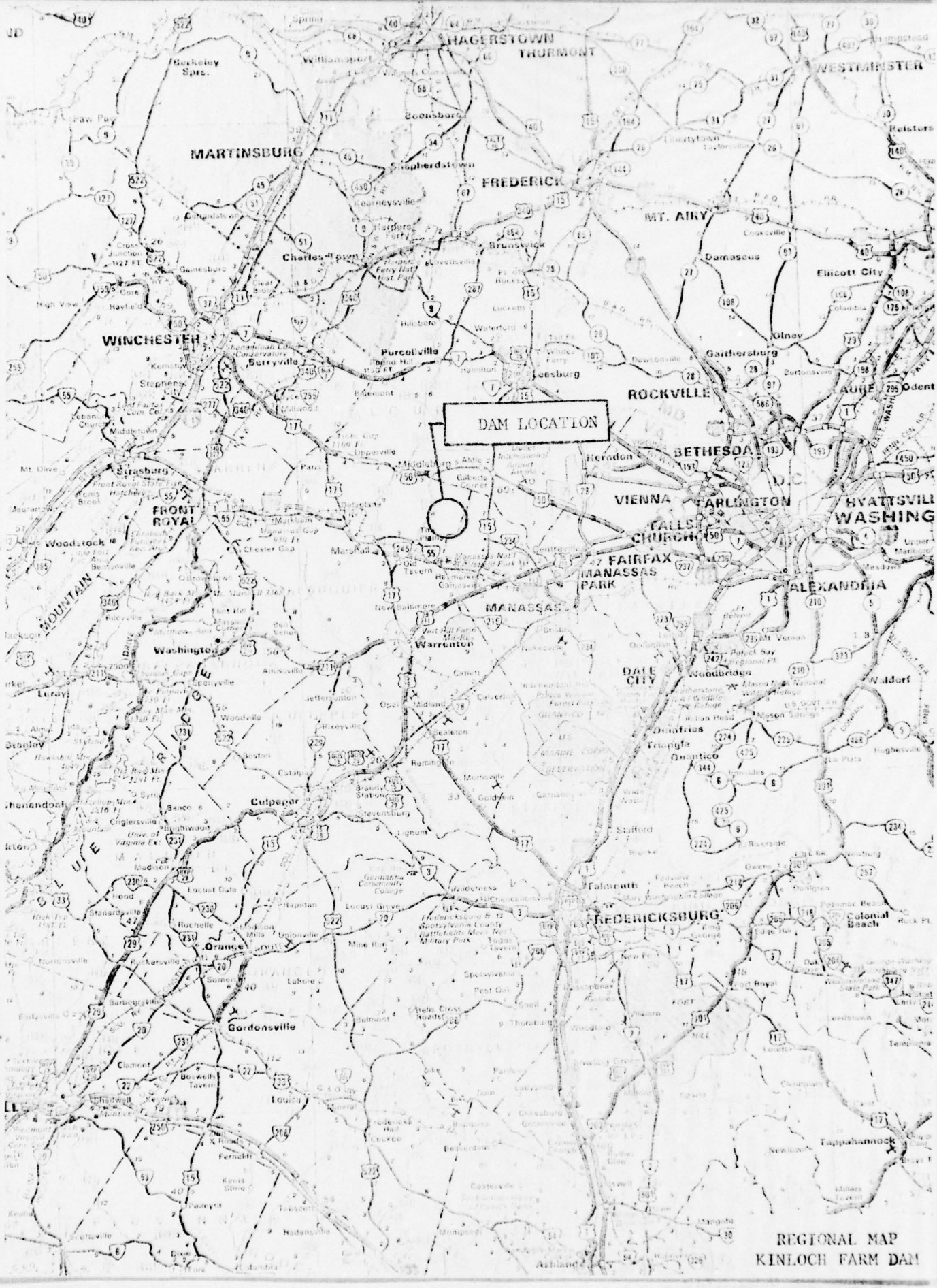
7.1.5 The seepage below the dam, from a rock outcrop, will not adversly affect the dam.

7.1.6 Based on the hydrologic considerations, the spillways are rated inadequate since the combined capacity of the three spillways will not pass the ½ PMF.

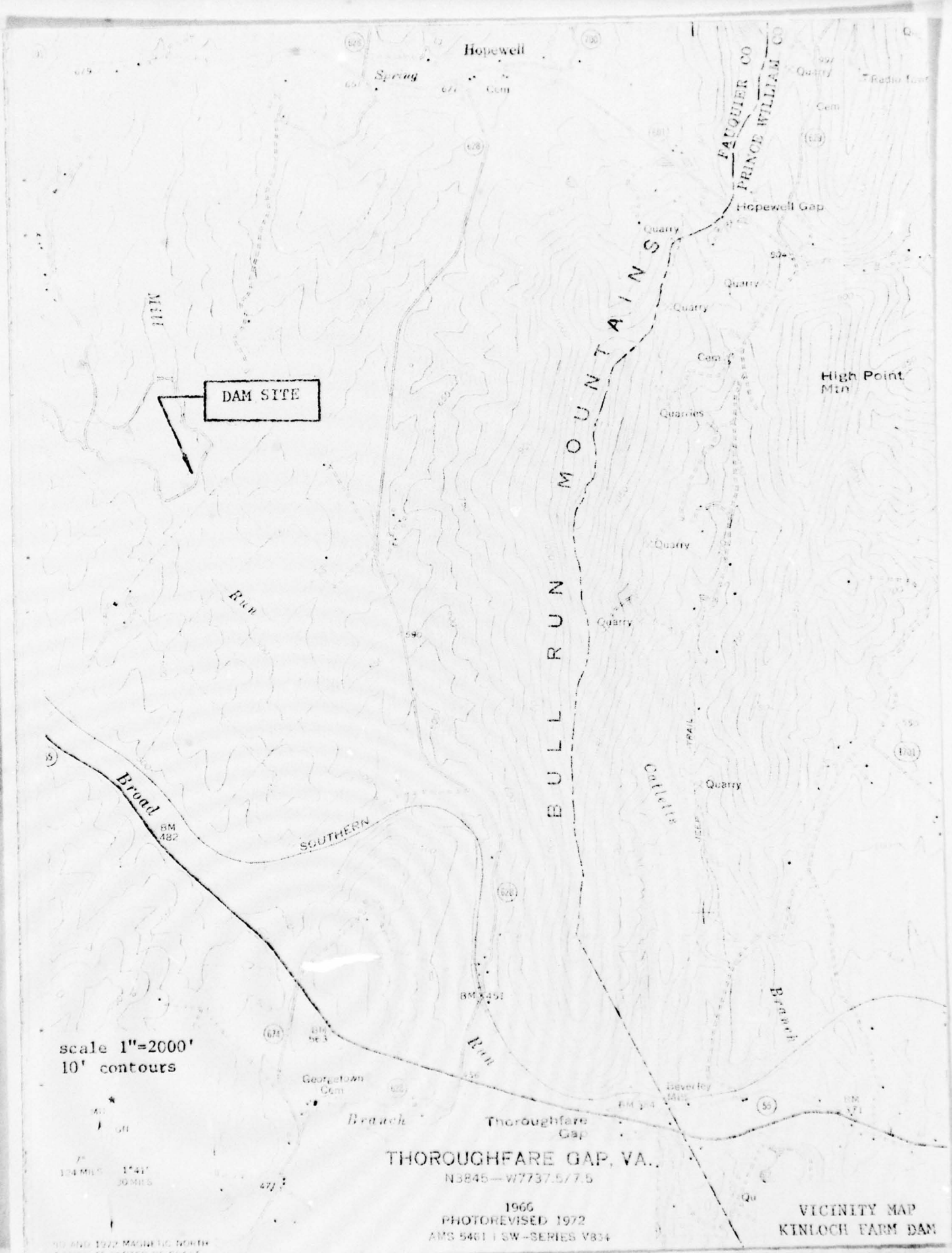
7.2 Remedial Measures/Recommendations: It is recommended that geotechnical exploration and evaluation of the dam be conducted, at the owner's expense, as outlined in Section 6.3. In addition, the source of the seepage in the secondary spillway shall be determined. The combined capacity of the spillways must be increased to pass the ½ PMF without overtopping the embankment. A warning system procedure should be established to alert residents in case of an emergency.

APPENDIX I.

MAPS



REGIONAL MAP
KINLOCH FARM DAM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DAM SITE
BULL RUN MOUNTAINS
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TRAIL
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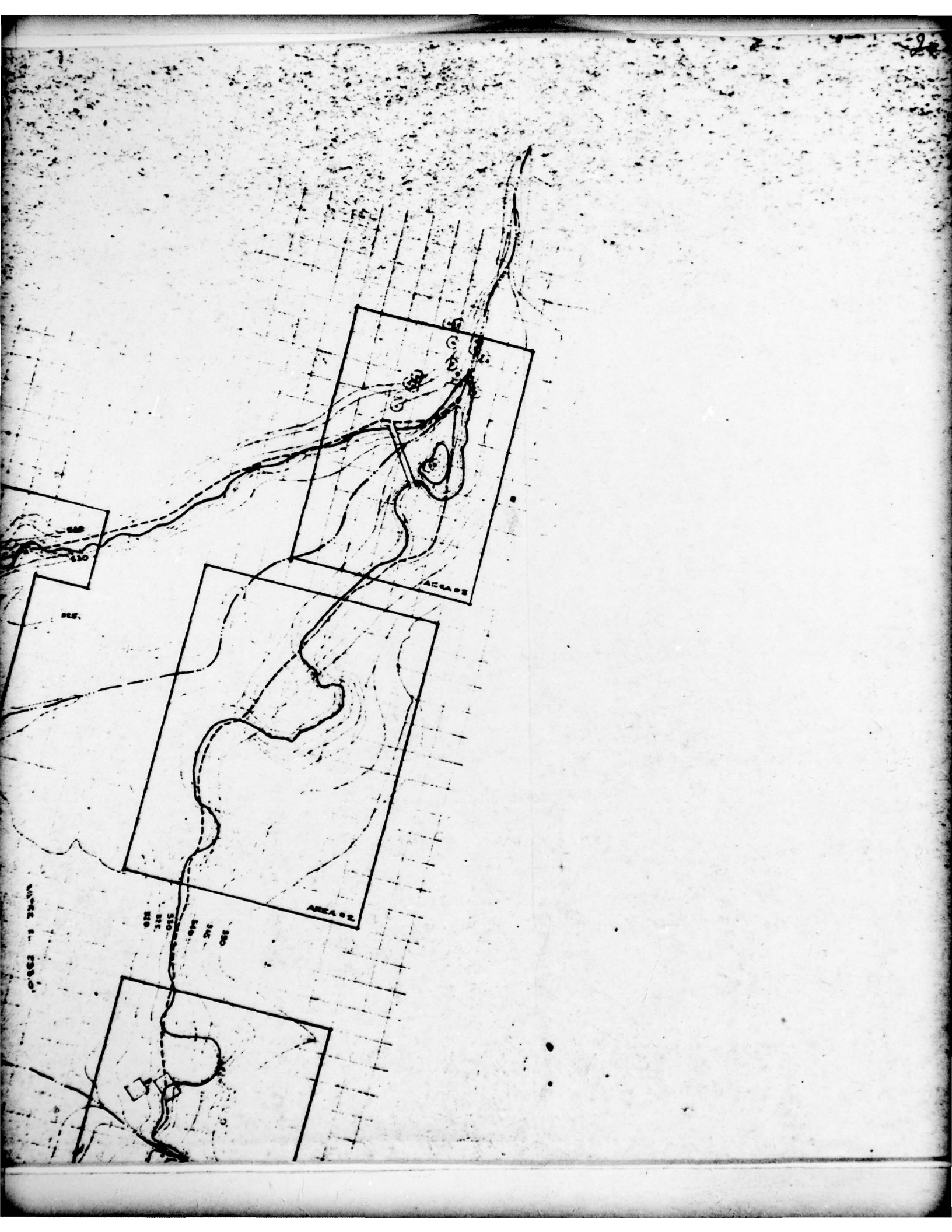
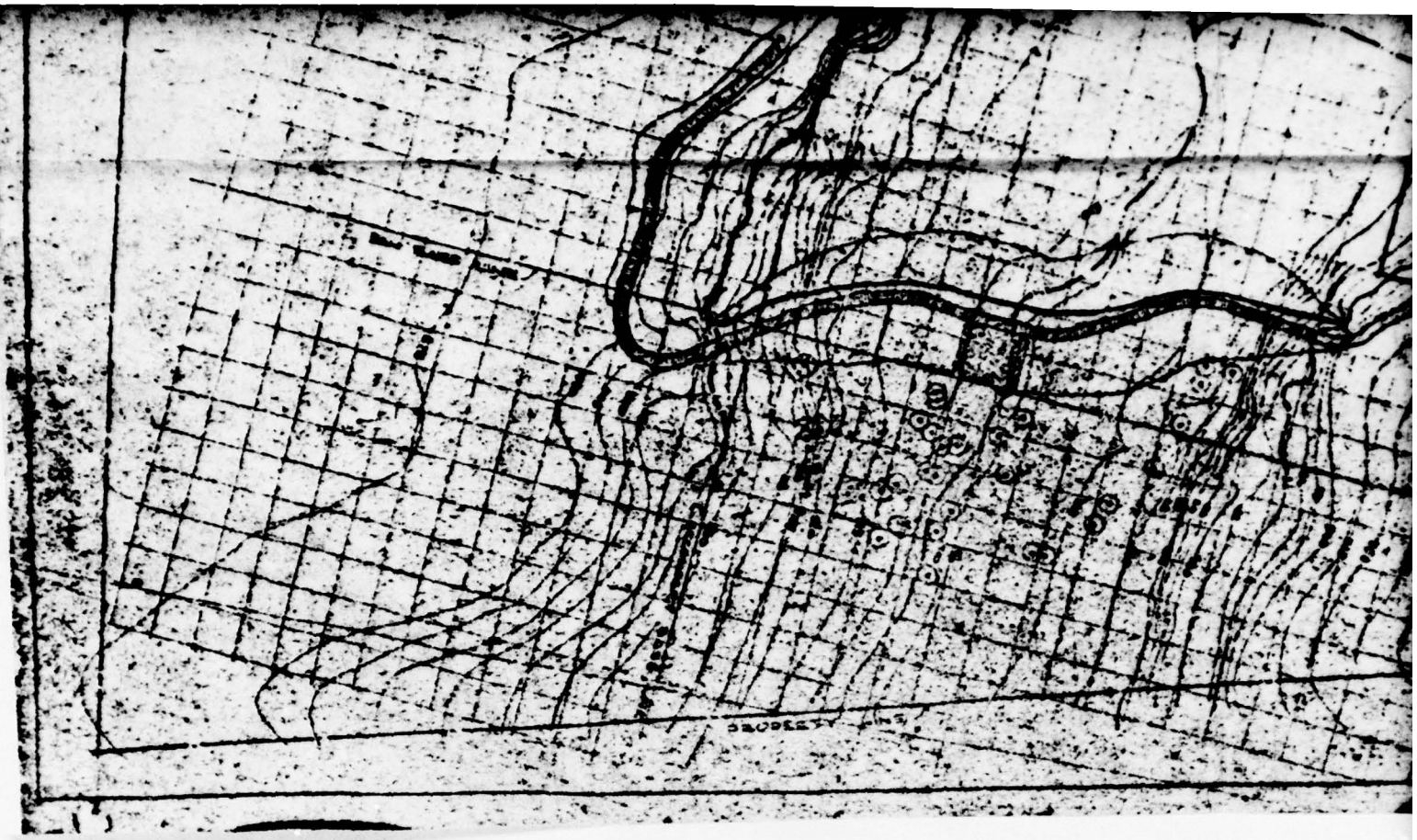
1966
PHOTOREVISED 1972
AMS 5461 I SW-SERIES V834
VICINITY MAP
KINLOCH FARM DAM

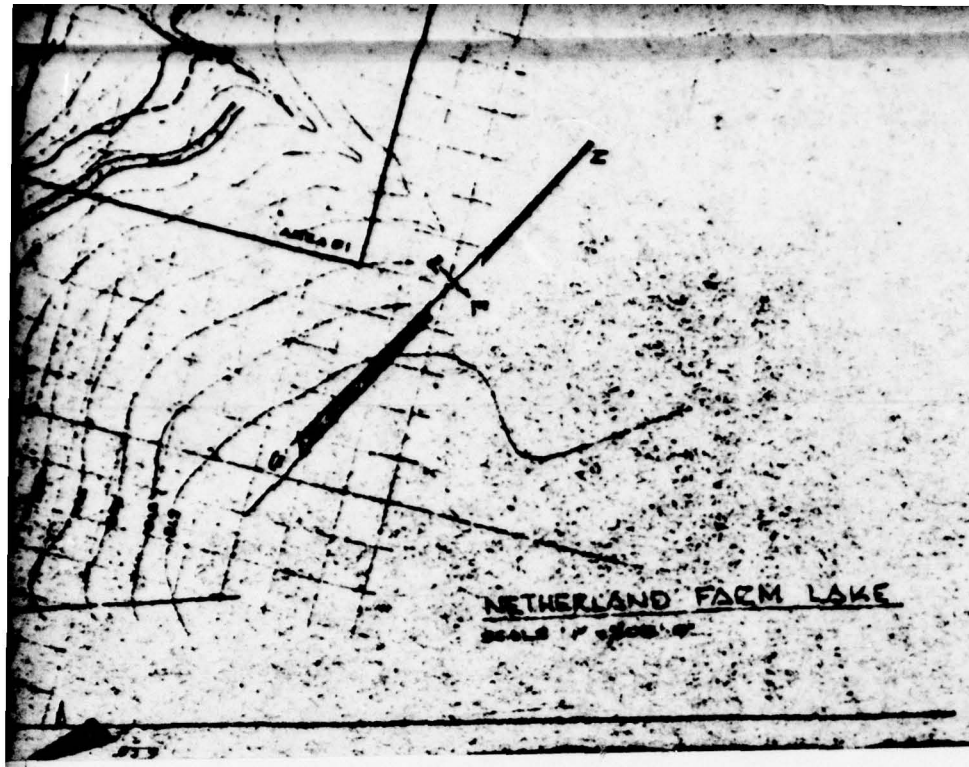
APPENDIX II

PLANS

ANALYSIS MAP - MAP
SHEET 30 OF 34


AREA 2
AREA 2





Double #
2394
703-372-

SURVEY INFORMATION NEEDED :

A. SURVEY OF AREA 1, 2, 3 & 4 AS INDICA
IN SCALE 1"=20'-0"

B. CONTOURS OF AREAS INDICATED (2' INTER
FROM EL. 520 TO 550

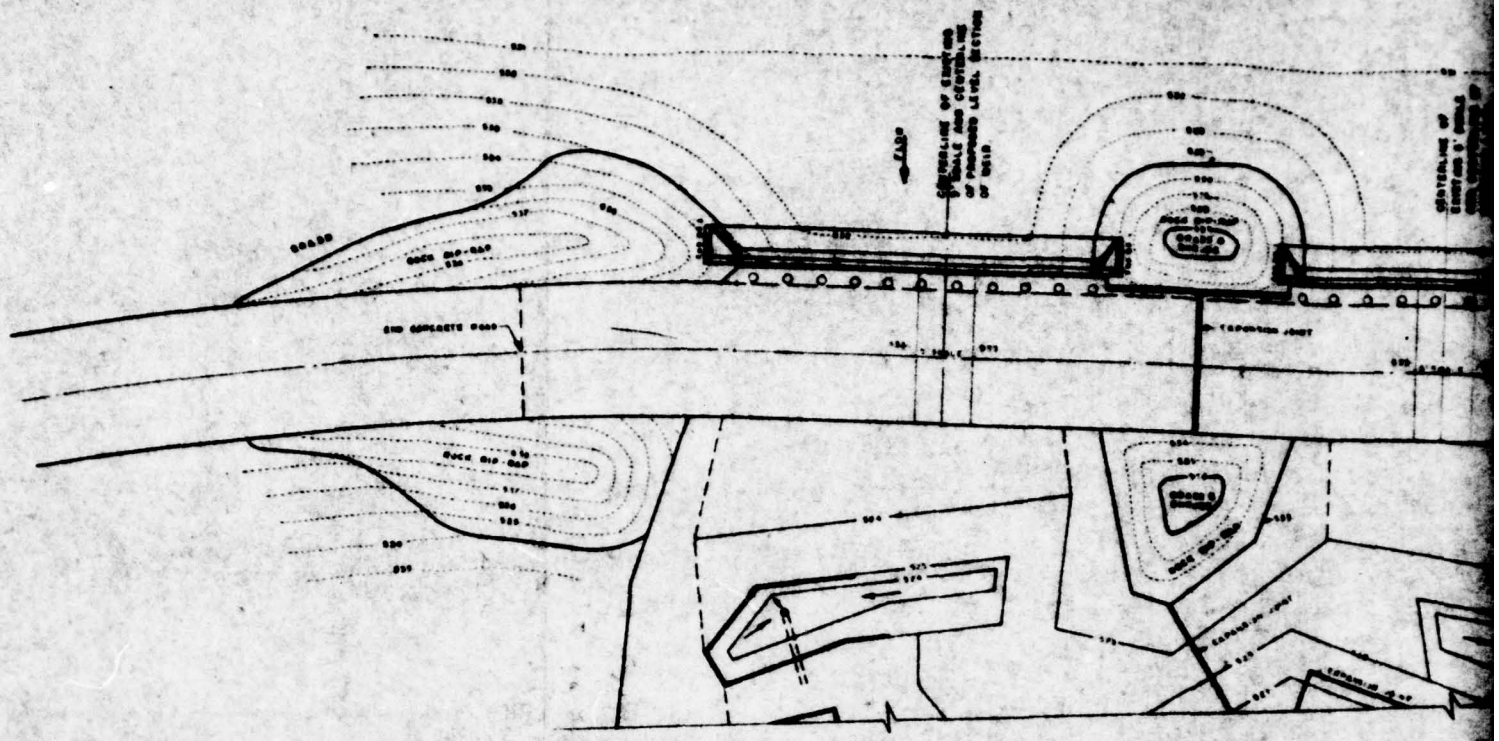
C. SHOWING LOCATIONS AND BASE ELEVAT
ALL TREES

D. SHOWING LOCATIONS AND ELEVATIONS (
OF ALL NATURAL ROCK FORMATIONS I
AREAS AS WELL AS IN ALL OTHER ARE
LAKE (ON THE BOTTOM OF PERIMETER O

(OUR INDENTION IS TO KEEP ALL NA
ROCK FORMATIONS, INCLUDING THE PO
BELOW SURFACE WHICH WOULD BE BUILT
SEE ABOVE WATER.)

E. INDICATE THE GRIDS WE HAVE IN OUR
ON THE SURVEY.

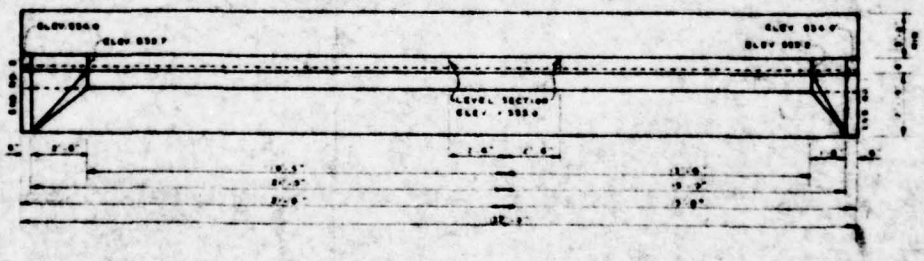
PLATE NO 1 / Reduced Kinlock Farm



PLAN VIEW OF PRINCIPLE SPILLWAY

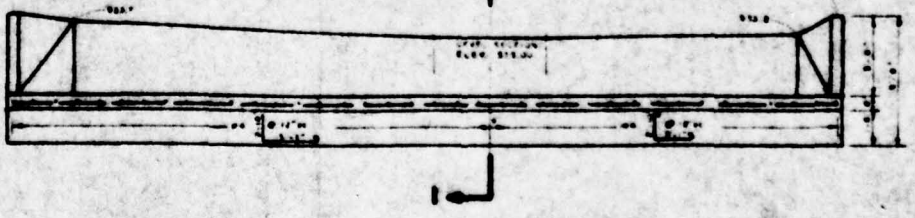
1/8" = 1'-0"

TAKEN FROM WARREN C PEARSON'S PLAN OF NOV 10, 1963 - REVISED JUL



TOP VIEW

1/8" = 1'-0"

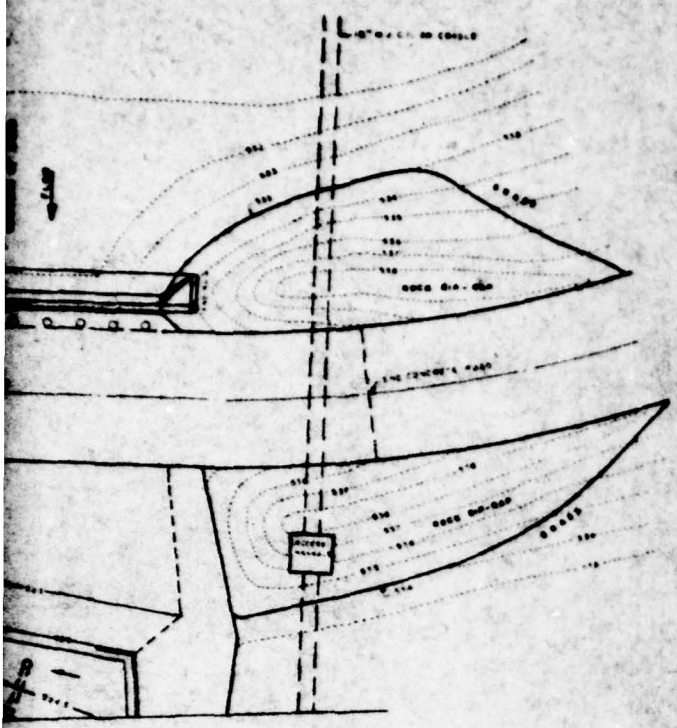


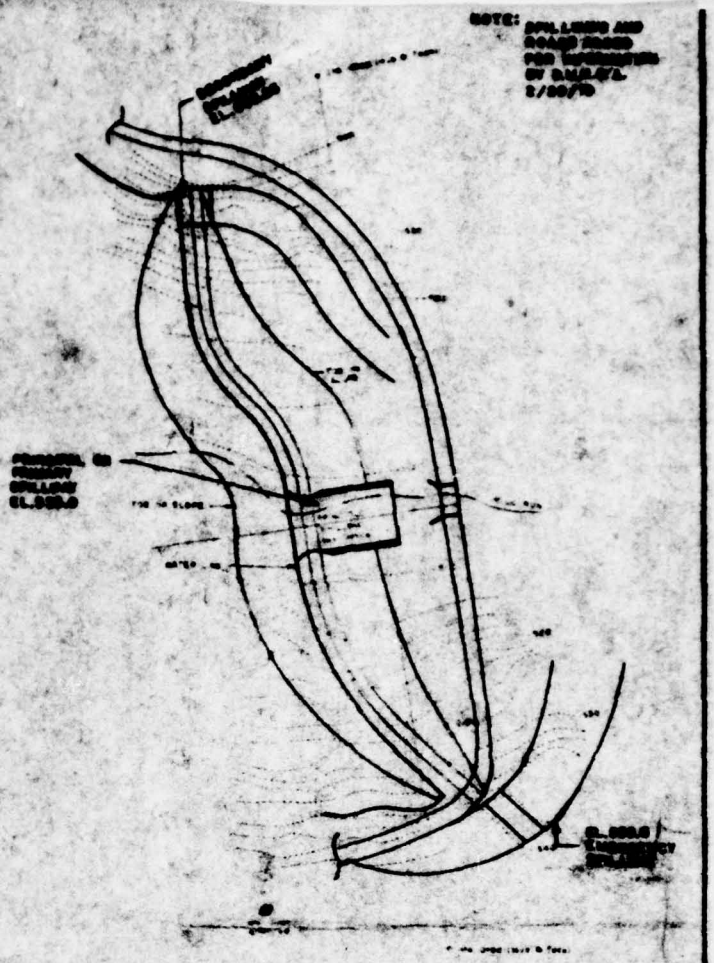
FRONT VIEW

1/8" = 1'-0"

END VIEW

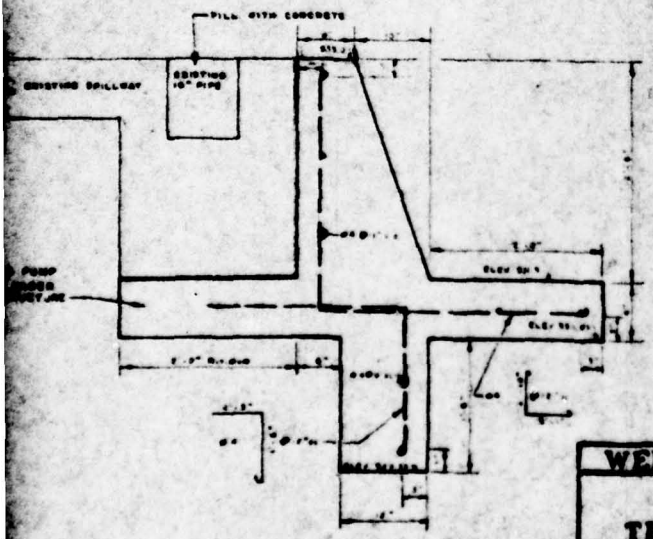
1/8" = 1'-0"





PLAN VIEW OF DAM

TAKEN FROM WARREN E. PERRON'S PLAN OF [illegible]



SECTION I-I

NOTES:

1. The Emergency Spillway Control Section (Elev 533.25) is to be used as the Datum Mark for the New Additions.
2. The outer layer of the Lake is to be lowered to Elev 528.00' or other approved methods of dewatering are to be used to prevent the concrete from being placed on saturated earth.
3. Areas adjacent to the Dike Walls are to be backfilled with crushed stone before replacing Rock Rip Rap.
4. Exposed areas of Concrete may be Rock-Veneered so as to blend with adjacent Rock Rip-Rap.
5. All Concrete is to be placed on undisturbed earth.
6. Surfaces of existing concrete that will be in contact with [illegible] shall be scrubbed clean before placement of concrete.

PLATE NO. 2

Reduced to Half Scale

[illegible] No. 2161

WEIR ADDITIONS - RECREATIONAL LAKE

KINLOCK FARM

THE PLAINS, FAUQUIER COUNTY, VIRGINIA

QUIBLE & ASSOCIATES

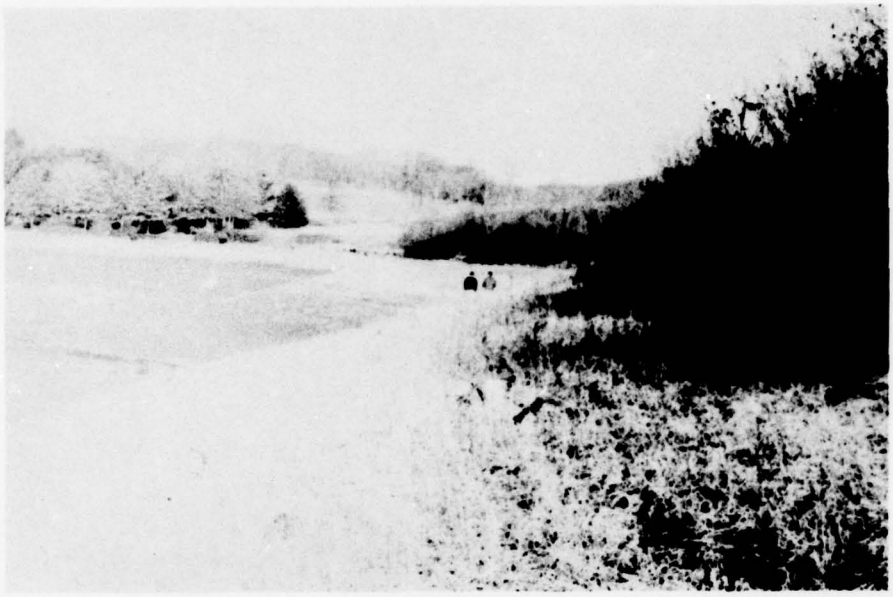
CHASE CITY, VIRGINIA

2

FILE NO	DATE	DESIGNED	DRAWN	SCALE	
07571-B	4-30-71	WLC	[illegible]	AS SHOWN	1 OF 1

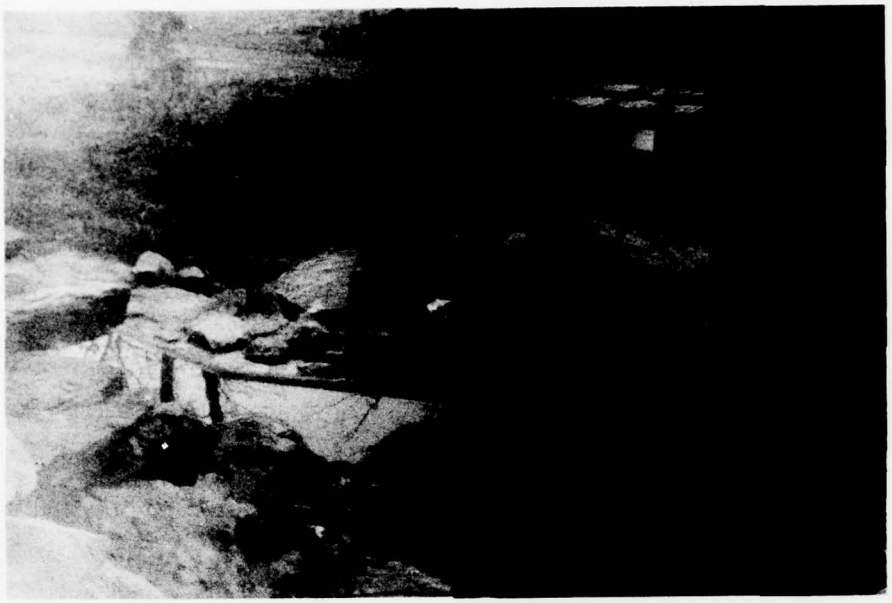
APPENDIX III

PHOTOGRAPHS



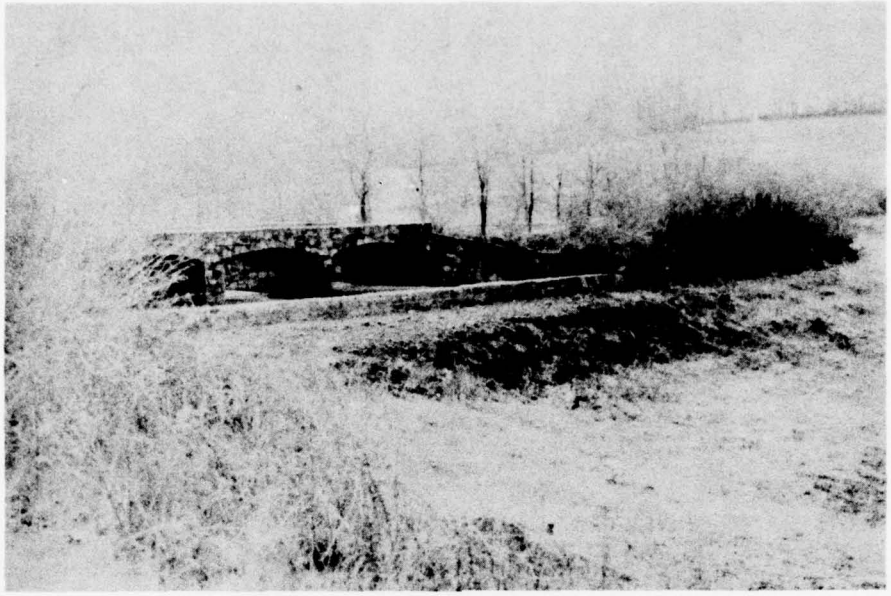
PHOTOGRAPH NO. 1
Back Face of Dam

PHOTOGRAPH NO. 2
Looking up Principal Spillway



PHOTOGRAPH NO. 3
Looking down Principal Spillway

PHOTOGRAPH NO. 4
Emergency Spillway



PHOTOGRAPH NO. 5
Secondary Spillway

PHOTOGRAPH NO. 6
Downstream Channel of Secondary Spillway

APPENDIX IV

FIELD OBSERVATIONS

Ref. Pg 323 Report 20 Nov. 1973 VA 06109 NAD VA 06107

KINLOCK FARM DAM - Off of Route 55-619 Hopewel Check List
Visual Inspection
Phase 1

STREAM: Mill Run
OWNER: Kinloch Farm Trust
ENG. BY: USDA SCS

CONSTRUCTED BY: Moore, Kelly & Reddish
QUAD: Thoroughfare Gap 1972

Name Dam Kinloch Farm Dam County Faquier State Virginia Coordinators Lat. 3851.9
Long. 7744.5

Date(s) Inspection 12/6/78
12/7/78 Weather Clear Temperature 55°

Pool Elevation at Time of Inspection Lake Empty M.S.L. Tailwater at Time of Inspection Lake empty M.S.L.

Inspection Personnel:

John Jones, Law Engr., Geo & Soils Harman Stevenson, Owner Representative

Tim Perry, SWCB, Northern Region

Forest Fister, DMM&A, Hydrology

Paul Seiler, DMM&A Civil Engr. Recorder

NOTE: The bench mark elevation used for design plans was an assumed elevation. To convert plan elevations to MSL, add 3 feet. MSL elevations are used in this Phase I report text. Appendix II elevations are not MSL.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The lake was empty at time of inspection, to remove silt. Lake was empty since Aug. 1978. There were no cracks visible in the embankment. The Concrete slab on top of dam at the primary spillway has longitudinal crack, which the owners representative, Mr. Harmon Stevenson, indicated erosion under slab at upstream side was repaired by adding a tee shaped wall,	4'-8" deep from top of slab to bottom of wall. Concrete was pumped under the upstream part of slab to form the concrete curtain wall in 1971-72.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None visible in earth embankment. Slopes are 3:1 upstream and 2.5:1 downstream.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None visible. The owner representative indicated that in 1972, Tropical Storm Agnes was about 2 feet over the top of spillway and caused minor damage to shrubs along roadway at the top of the dam.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No movement visible.	
RIPRAP FAILURES	None observed.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OUTLET	Drawdown pipe 18" Diameter with trash grate outlet invert 28 feet below crest. Valve open at time of inspection. Grate and pipe in good condition.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	1. Emergency spillway at right abutment is 55 feet wide - 2.5 above normal pool elevation of principal spillway, or at pool elevation 538.5. 2. Secondary spillway at left abutment is 0.25 ft. above principal spillway, is 42 ft. wide (less 2"-2' wide piers and 4 ft high/opening. Also has 18" weir wall above principal spillway. 3. Principal spillway at elevation 536, located at center of dam is 82 ft. wide with a large rock and shrub center about 3 to 4 ft. higher than the spillway and about 18 ft. wide.	
ANY NOTICEABLE SEEPAGE	The lake was empty at time of inspection.	
STAFF GAGE AND RECORDER	No gages.	
DRAINS		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None visible.	
INTAKE STRUCTURE	18-inch C.I. pipe on concrete cradle to drain lake, Manual control of gate valve - both in good condition.	
OUTLET STRUCTURE	18" C.I. on concrete cradle, gate valve manual control- in good condition.	
OUTLET CHANNEL	Outlet pipe discharges into the discharge channel below principal spillway. See discharge channel next page.	
EMERGENCY GATE	Lake drain gate valve in 18" C.I. pipe in operating condition.	

IRRIGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Secondary spillway at left end of dam has weir 1.5 feet above pool elevation.	
APPROACH CHANNEL	Riprap approximately from pool elevation to 2 feet below top of dam along back of dam and on lake for 200' from dam. Forests and grass above lake. Channel in good condition.	
DISCHARGE CHANNEL	Riprap and grass. Channel is about 15 feet wide with gradual slope to trees and grass about 3 feet above streambes. Slopes beyond banks are mostly flat. Discharge channel not eroded.	
BRIDGE AND PIERS	Masonry set in cement mortar, at secondary spillway; Bridge over spillway & spillway are in good condition.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	None.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	None.	
BRIDGE AND PIERS	None.	
GATES AND OPERATION EQUIPMENT	Lake drain has gate valve on 18" C.I. pipe. In operating condition.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER		

RESERVOIR

VISUAL EVALUATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Riprap is approximately from pool level to 2 feet below top of dam. Slopes are grass above riprap. Slopes do not show and slides and have good grass cover of dam. Shore line has grass and trees in the drainage area. The immediate area of half mile or more is in good condition.	
SEDIMENTATION	Lake drained to remove silt, estimated 6", 12" max. depth of silt.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Riprap downstream side of spillway channel is 30 feet wide, banks 3 feet high, small bridge structure 150 feet downstream. Riprap immediately below structure in streambed to absorbe energy. Width of flood plane 200 feet, which is grass and trees.	
SLOPES	Slopes beyond immediate stream banks are grass and some trees. The slopes in flood plain are mostly flat.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 8 homes 9,000± feet below dam. The stream under passes a railroad 7,000± feet downstream and parallels the railroad through Thoroughfare Gap. Interstate I-66 is under construction in the vicinity of Thoroughfare Gap. Estimated population at time of inspection is 25 to 30 persons.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
AN OF DAM	Kinloch Farm Dam.
GIONAL VICINITY MAP	See appendix.
NSTRUCTION HISTORY	Kinloch Farm Dam, built in 1966 1967 Secondary spillway added 1976 Emergency spillway added beyond west end of dam.
PICAL SECTIONS OF DAM	Upstream slope 3:1, downstream slope 2.5:1. Top width 20 ft. Height 29 ft.
DROLOGIC/HYDRAULIC DATA	See appendix.
ETS - PLAN	see appendix.
- DETAILS	
-CONSTRAINTS	
-DISCHARGE RATINGS	
ATURAL RESERVOIR RECORDS	

EM	REMARKS
ESIGN REPORTS	None available.
EOLOGY REPORTS	None available.
ESIGN COMPUTATIONS	Not available.
YDROLOGY & HYDRAULICS	See Section 5.
AM STABILITY	Design calculations not available
EEPAGE STUDIES	None available.
ATERIALS INVESTIGATIONS	
ORING RECORDS	
ABORATORY	None available.
IELD	
ST-CONSTRUCTION SURVEYS OF DAM	For addition of Secondary spillway and repairs. Added curtain wall at upstream side of crest.
ECIAL SOURCES.	[illegible] area, no analysis available.

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	See appendix.
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	None available. Manual control gate to drawdown lake

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Added Secondary spillway 1967 Added Emergency spillway 1976 Strengthened crest of Principle spillway 1972
HIGH POOL RECORDS	1972 Tropical storm Agnes overtopped crest by 18"±
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	See modifications above.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	By owner's employees for minor maintenance by contract for silt removal etc. No operations records logged.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: _____

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): _____

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): _____

ELEVATION MAXIMUM DESIGN POOL: _____

ELEVATION TOP DAM: _____

CREST: Principle Spillway

a. Elevation 538
b. Type Concrete slab crest
c. Width 20 ft.
d. Length 82 ft.
e. Location Spillover Approximately midway of length of embankment.
f. Number and Type of Gates One gate for draw down on 18" pipe.

OUTLET WORKS: _____

a. Type 18" C.I. pipe.
b. Location 50 ft. east of Principal spillway.
c. Entrance inverts 509
d. Exit inverts 507
e. Emergency draindown facilities Manual operation of gate valve.

HYDROMETEOROLOGICAL GAGES: _____

a. Type _____
b. Location _____
c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: The Principal & Emergency will pass ½ PMF. Nondam discharge 5380 cfs. - over this will top the dam.

APPENDIX V

REFERENCES

REFERENCES

Reference No. 1: Riedel, J.T.; Appleby, J.F.; and Schloemer, R.W.; Hydrometeorological Report No. 33, "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 200 to 100 Square Miles and Durations of 6, 12, 24, and 48 hours"; U.S. Department of Commerce, Weather Bureau, Hydrologic Services Division, 1956.

Reference No. 2: Synder, "F.F. Synthetic Unit-graphs", Transactions of the American Geophys. Union, Vol. 19, pp 497-545, 1938.

KINLOCH FARM DAM

List of Available Data

Furnished by:

Kinloch Farm

1. Contour Plan (Netherland Farm Lake)

2. Plans (Netherland Farm Lake) - 1964, 5 sheets prepared by Warren C. Perrow, Richmond, Virginia.

3. Plan - Weir Additions - Recreational Lake, 1971.

   Plan Topo portion kinloch Farm Lake, 1976.

   Plan - Repair of principle spillway - 1 sheet, 1972

   Plan - Repair of secondary spillway, 1972, prepared by Quible and Associates, Charles City, Virginia.

4. Various correspondance with Kinloch Farm Estate about the history of events of the dam.