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AUGUST, 1979

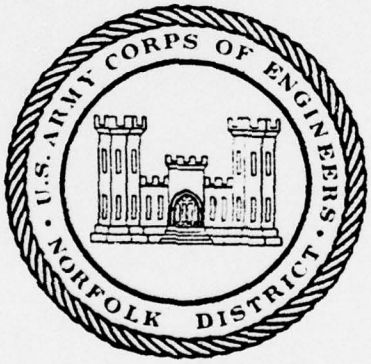
Name Of Dam: GENT BROTHERS DAM

Location: RUSSELL COUNTY, VIRGINIA

Inventory Number: VA. NO. 16706

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

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

BY

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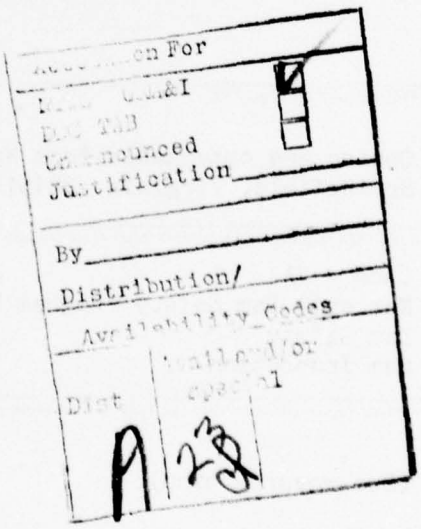
20. Abstract

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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NAME OF DAM: GENT BROTHERS DAM
LOCATION: RUSSELL COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 16706

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PREFACE

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

In reviewing this report, it should be realized that the reported conditon 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.

TABLE OF CONTENTS

Name of Dam: Gent Brothers Dam Va. No. 16706
State: Virginia
County: Russell
USGS Quad Sheet: Elk Garden
Coordinates: Lat 36° 58.2' Long 81° 57.4'
Stream: Doubles Branch
Date of Inspection: May 22, 1979

BRIEF ASSESSMENT OF DAM

Gent Brothers Dam is a homogeneous earthfill structure about 400 ft long and 48 ft high. The principal spillway consists of a 24 inch corrugated metal pipe riser and an 18 inch corrugated metal pipe which extends through the structure. There is an emergency spillway located on the left end of the dam, which is a 25 ft wide partially vegetated earth channel. The dam is located on the Doubles Branch about 1.5 miles north of Rosedale, Virginia. The dam was constructed for recreational purposes in 1975 and is owned and maintained by Gent Brothers, Inc.

The emergency spillway will pass the Probable Maximum Flood (PMF). 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, and the spillway is rated adequate. The emergency spillway will pass the ½ PMF with a depth of 3 ft, at a velocity of 12.6 fps and for a duration of 7 hours.

The visual inspection revealed no serious problems. The actual embankment structure appears to be similar to the design drawings, except that the dam and spillway have been raised 10 ft. This change in height was a cause for the

Soil Conservation Service (SCS) to not approve the final construction due to the limiting capacity of the approving office.

An accurate check on stability could not be made since sufficient design data, calculations, and construction data were not available. The upstream slope of the dam also appears to be slightly steeper than requirements recommended by the U. S. Bureau of Reclamation for small homogeneous dams subject to rapid drawdown. Therefore, we recommend that the water level in the lake not be lowered at a rate exceeding 6 inches/day. If this is not acceptable, the owner should then have a geotechnical engineering study performed to evaluate in detail the rapid drawdown stability of the dam.

Overall, the dam appeared to be in good condition at the time of the inspection. However, the following remedial measure is recommended:

(1) A staff gauge should be installed to monitor water levels.

The following routine maintenance and observation functions should be initiated:

Seepage observed near the downstream toe in the right abutment area may be related to spring activity; however, it is recommended that these areas be monitored quarterly to detect any increase in flow rates and related erosion.

Prepared by:

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for Jack G. Starr, P.E., R.A.
Chief, Engineering Division

Date: SEP 7 1979

OVERVIEW PHOTOGRAPH

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GENT BROTHERS DAM
Va. No. 16706

SECTION 1 - PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (See Reference 1, Appendix VI). 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: Gent Brothers Dam is a homogeneous earthfill structure approximately 400 ft long and 48 ft high.* The top of the dam is 20 ft wide and is at elevation 2172 M.S.L. Side slopes are 3 horizontal to 1 vertical (3:1) on the downstream side and on the upstream side (see Plates No. 2 and 4, Appendix I).

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

The principal spillway consists of a 24-inch diameter corrugated metal riser pipe and an 18-inch corrugated metal outlet pipe running through the dam. The riser crest is at elevation 2165 M.S.L., and the 18-inch outlet pipe is at elevation 2128 M.S.L. The riser has an 8-inch diameter inlet at elevation 2130 M.S.L. located below the crest, which is used to drain the lake.

The emergency spillway is an earth channel having a bottom width of 25 ft and a crest elevation of 2167. M.S.L. The emergency spillway is in a cut located on the left side of the dam. The emergency spillway is partially vegetated and has side slopes of about 2:1. The emergency spillway and top of dam form the access road to the lake.

1.2.2 Location: Gent Brothers Dam is located on the Doubles Branch, 1.5 miles north of Rosedale, Virginia (See Plate 1, Appendix 1).

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the dam height.

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the downstream proximity of several homes (1 mile$\pm$) and Va. Route 80, 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 Gent Brothers, Inc., owns and operates the dam.

1.2.6 Purpose: Recreation

1.2.7 Design and Construction History: The dam was constructed in 1975 and was designed and constructed under the supervision of the USDA, Soil Conservation Service (SCS).

1.2.8 Normal Operational Procedures: The principal spillway is ungated; therefore, water rising above the crest of the riser inlet automatically is discharged downstream in quantities based on the inlet capacity. Similarly, water is automatically passed through the emergency spillway in the event of an extreme flood which creates a pool elevation above that of the emergency spillway crest.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The drainage area is 0.20 square miles.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in April 1977; however, the pool elevation was not observed.

Principal Spillway Discharges:

Pool Elevation at Crest of Dam 29 CFS

Emergency Spillway Discharge:

Pool at Crest of Dam 1958 CFS

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

Table 1.1 DAM AND RESERVOIR DATA

Item	Elevation Feet MSL	Reservoir Storage Area Acres	Acre Feet	Watershed Inches	Length Miles
Crest of Dam	2172	5	101.5	.53	.25
Emergency Spillway Crest	2167	4	74.0	.40	.20
Principal Spillway Crest	2165	4	70.0	.30	.20
Streambed at Downstream Toe of Dam	2124	-	- 0	- 0	- 0

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was originally designed by the SCS according to criteria established for farm embankment ponds (Appendix IV). It was designed for recreational purposes with consideration given to peak flood by the use of an emergency spillway . The crest of the riser of the principal spillway was apparently established at elevation 2165 M.S.L. in order to provide storage for a sediment pool and provide recreation (fishing and aesthetics). The emergency spillway is constructed to accommodate larger flow rates before overtopping of the dam occurs. A subsurface investigation conducted by SCS at the site included seven hand auger borings. Six locations are given on Plate 2, Appendix I and a description of the materials encountered are provided on Sheets 1 and 2, Appendix IV.

2.2 Construction: Construction records were not available. The dam was reportedly constructed with equipment owned by the Gent brothers. Mr. Tom Jessee of the SCS (Lebanon office) was present during construction of the structure and has been able to clarify certain aspects related to its construction. The dam was originally constructed in 1975. Although density tests were not taken on the fill, the filling and compaction procedures were reportedly observed almost continually. All topsoil was removed prior to placing the fill.

Design drawings (Plates No. 2 and 4) show the structure as being an homogeneous earthfill embankment approximately 400

ft long and 38 ft high with an 80 ft wide crest. Side slopes are 3 horizontal to 1 vertical (3:1) on the downstream side and the upstream side. The embankment was constructed 10 ft higher than the design height specified by the SCS. This modification by the owner does not meet the SCS standards and specifications relative to the site investigations, design considerations and construction inspections. The stability of the designed structure met design criteria for farm embankment ponds; however, insufficient data exists for evaluating the stability of the structure as built.

A cutoff trench was constructed along the axis of the dam and extends to bedrock. An embankment or toe drain was provided to control the phreatic surface at the downstream slope. Design details are presented on Plate No. 3, Appendix I. The emergency spillway was located in a cut on the left side of the dam. It consists of an earth channel having a bottom width of 25 ft and 2:1 side slopes.

2.3 Operation: After completion of the dam seepage developed in the area of the right abutment. During the winter of 1976-1977 Cunningham Core Drilling and Grouting Corporation (Salem, Virginia) constructed a grout curtain from the center of the embankment to, and around, parts of the right abutment in an attempt to stop seepage. The actual depth of grout zone was not reported; however, the Owner stated that drilling and grouting continued until the seepage was no longer observed.

Other than the grouting program, there are no other known operation and instrumentation procedures.

2.4 Evaluation: Engineering calculations are not available and the design data by SCS is for a dam that is 10 ft lower than actually constructed. This modification by the owner does not meet the SCS standards and specifications relative to site investigations, design considerations, and construction inspections. The stability of the designed structure met design criteria for farm embankment ponds; however, insufficient data exists for evaluating the stability of the structure as built. Other than the increased height of the dam, the design drawings appear to be representative of the "as built" structure.

There are no records available for dam performance. The dam was inspected by SCS personnel on March 25, 1977. A letter report describing their findings is included in Appendix V. Details of the grouting program were not available; however, the SCS letter report indicates that the grouting significantly reduced the seepage in the right abutment area.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: The dam was generally in good condition at the time of inspection. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made 22 May 1979 and the weather was partly cloudy with a temperature of 65°F. The pool elevation at the time of inspection was 2165± M.S.L. and the tailwater elevation was 2120± M.S.L., which corresponds to normal flows. The ground was damp from previous rains.

3.1,2 Dam and Spillway: Grass on the embankment is well maintained. Cattle graze along the downstream slope, which causes minor deterioration to the embankment. The gravelled road which extends across the crest of the dam is also well maintained.

Wet areas caused by discharge from toe drains occur beside and beneath the principal spillway pipe. Seepage existed along the base of the downstream toe of the right abutment and two seeps were observed about 40 ft to the right of the intersection of the right abutment and the face of the dam. Flow was clear and generally less than 2 gpm. Minor iron-staining was encountered at a few locations, roughly midway between the seeps and the principal spillway. The Owner stated that these seeps are actually springs, which were present prior to construction of the dam.

The principal spillway intake and discharge pipe are in good condition. No debris was noted on the inlet. The 8"

gate was reportedly in operating condition. The principal spillway is an 18" bituminous coated CMP with a 24" CMP riser. The emergency spillway was in good condition.

3.1.3 Reservoir Area: The reservoir area showed no debris and no sediment was observed. The reservoir slopes are moderate to steep and show no sloughing or surface erosion except for a small eroded area located on the left side of the lake. The surrounding slopes are grassed and appear to consist of a thin soil cover over shale and thin-bedded limestone.

3.1.4 Downstream Area: The downstream channel showed no erosion or debris collection. The channel is 10 ft$^{\pm}$ wide and 2 ft$^{\pm}$ deep. Moderately steep to steep, grassed, natural slopes bound the stream. No sloughing or erosion was observed. A grassed floodplain several hundred ft wide exists below the impoundment. One home was observed approximately one mile downstream, and Va. Route 80 is about 1 1/4 mile downstream. A few homes and industrial developments are located near the intersection of Va. Route 80 and Va. Route 640.

3.2 Evaluation: Overall, the dam was in good condition at the time of inspection.

The seep present at the toe of the downstream slope at the right abutment may actually be a spring; however, this was not definitely confirmed. It is recommended that this area be monitored quarterly to detect any increase in flow rates and erosion. The two wet areas located 40 ft$^{\pm}$ to the right do appear to be springs, and they should also be monitored quarterly to detect any increase in flow rate and erosion.

During the 1977 inspection by SCS (Appendix V) several wet areas were reported to exist on the downstream face of the embankment approximately 15 vertical ft below the top of the dam. These wet spots were not apparent during this inspection.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Gent Brothers Dam is used for recreation. The normal pool elevation is maintained by a riser acting as the principal spillway. Operation of the 8" gate will lower the pool elevation below the riser top elevation to provide for maintenance. Large increases in inflows which cannot be absorbed by storage are passed through the emergency spillway when the pool rises above crest elevation, 2167 M.S.L.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the Gent brothers. Maintenance consists of dam inspection, debris removal, and mowing of the vegetative cover. The operating appurtenances are reportedly in working order. The vegetative growth in the embankment has been well maintained.

4.3 Warning System: No warning system exists.

4.4 Evaluation: The dam and appurtenances are in good operating condition. Maintenance is being routinely performed and is adequate. A mowing routine has been established; however, a routine check of all valves should be made.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Hydrologic Records: There are no records available.

5.2 Flood Experience: The maximum pool elevation observed was in April of 1977; however, the pool elevation is not known.

5.3 Flood Potential: 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. The Probable Maximum Flood (PMF) and ½ PMF were developed by the SCS method (Reference 4, Appendix VI). Precipitation amounts for the flood hydrographs of the PMF and ½ PMF are taken from the U. S. Weather Bureau Information (Reference 5, Appendix VI). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.4 Reservoir Regulation: For routing purposes, the pool at the beginning of the flood was assumed to be at elevation 2165 M.S.L. Reservoir stage-storage data and stage-discharge data were determined from the available plans, field measurements and USGS quadrangle sheets. Floods were routed through the reservoir using the principal spillway discharge up to a pool storage elevation of 2167 M.S.L. and a combined principal and emergency spillway discharge for pool elevations above 2167 M.S.L.

5.5 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 (PMF, ½ PMF) are shown in the following Table 5.1.

TABLE 5.1 RESERVOIR PERFORMANCE

	Normal Flow	Hydrograph ½ PMF	Hydrograph PMF
Peak Flow, CFS			
Inflow	0.5	1148	2296
Outflow		959	1909
Maximum Pool Elev. Ft, MSL	-	2170	2171.5
Non-Overflow Section (El 2172 MSL)			
Depth of Flow, Ft	-	-	-
Duration, Hours	-	-	-
Velocity, fps**	-	-	-
Emergency Spillway (El 2167 MSL)			
Depth of Flow, Ft	-	3.0	4.5
Duration, Hours	-	7.0	7.0
Velocity, fps**	-	12.6	15.4
Tailwater Elevation Ft. MSL	2118*	2120.5	2120.8

*This is the tailwater elevation observed during inspection and it corresponds to a normal flow.
**Critical Velocity at Control Section

5.6 Reservoir Emptying Potential: An 8-inch circular gate at elevation 2128 M.S.L. is capable of draining the reservoir through the 18-inch pipe. Assuming that the lake is at normal pool elevation (2165 M.S.L.) and no inflow, it would take approximately 2 days to lower the reservoir to elevation 2128 M.S.L. There are no methods for lowering the reservoir below this elevation.

5.7 Evaluation: Department of the Army (COE) guidelines indicate the appropriate SDF* for an intermediate size and 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 the PMF.

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

*Spillway design flood

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam site is located within the Valley and Ridge Physiographic Province of Virginia. In the Russel County area, the province consists of an alternating series of parallel ridges and intervening valleys which trend in a northeast-southwest direction. Most ridges are "held up" by sandstones and conglomerates, whereas valleys are underlain by less restant shales and limestones.

Gent Brothers Dam is reportedly founded on alluvial, colluvial, and/or residual soils which in turn are underlain by shales and thin-bedded limestone bedrock of the Martinsburg Formation. The overburden thickness ranged from 2.5 to 5 ft$^{+}_{-}$ in thickness at the hand auger locations shown on Sheet 2, Appendix I. Mr. Jessee stated that depth to bedrock was generally 2 to 3 ft.

The Martinsburg is predominantly shale, which is yellow to brown in color when weathered. The main body of the formation is described as a thin-bedded calcareous mudrock; however, many thin layers of fossiliferous limestones are scattered throughout the formation from bottom to top. Bedrock observed and past experience with the Martinsburg Formation indicates that the upper portion of the rock is generally weathered and fractured. Geologic maps of the area do not show the presence of faults in the immediate vicinity.

6.2 Embankment: The upstream and downstream slopes are 3 horizontal to 1 vertical with crest at elevation 2172 M.S.L. No berms exist on either slope. Normal pool level is elevation 2165 M.S.L. A typical section of the dam as designed is included on Plate 2, Appendix I. The embankment is actually 10 ft higher than originally designed. The embankment fill material appears to range from clayey silt (ML) to silty clay (CL) with various amounts of shale fragments. Most of the embankment material was cut from surrounding slopes. Mr. Jessee reported that most of the embankment was constructed with clay. Non-clay materials were generally placed downslope from the core trench, thus providing a good continuous clay core and upstream embankment. Compaction was initially done with a sheepsfoot roller but was later modified by use of construction equipment (pans, etc) which were more effective. An embankment or toe drain was included (See Plate 3, Appendix I) to control the phreatic surface at the downstream slope.

The emergency spillway is a side hill cut into residual soils and bedrock. The moderately steep to steep slopes which form the left side of the emergency spillway are cut into partially weathered shale and limestone and were considered safe and stable at the time of investigation. Minor sloughing of the slope can be expected from time to time, but no serious failures should be anticipated.

6.3 Evaluation:

6.3.1 Foundation and Abutments: Dam foundations must be evaluated on the basis of potential settlement, sliding and

seepage. Excessive settlement of the dam is not believed to be a problem because the structure rests upon fairly competent bedrock and thin alluvial, colluvial, and/or residual soils. 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 at the end of the construction period.

Sliding within the foundation bedrock does not appear likely based upon the nature of the Martinsburg Formation. In addition, a review of the geologic data and on-site observations indicate that there are probably no adversely oriented weak planes within the foundation rock that would act as a potential sliding plane.

The underlying bedrock appears to be fractured and weathered enough to allow some seepage beneath the dam. Since construction reports were not available for review, an accurate determination of the foundation conditions under the cutoff trench is not possible.

6.3.2 Embankment: A stability analysis is not required for farm ponds designed and constructed according to the criteria present in the Virginia SCS Standard (Appendix IV). Construction of the Gent Brothers Dam was reportedly in compliance with these specifications until the owner increased the height of the dam by approximately 10 ft. This modification by the Owner does not meet the SCS standards and specifications relative to the site investigations, design consi-

derations and construction inspection. An accurate check on the stability of this structure cannot be made since stability calculations, "as built" drawings and construction records are not available.

The downstream embankment slope meets the requirements recommended by the U. S. Bureau of Reclamation; however, the upstream slope is slightly steeper than recommended when subject to rapid drawdown. Since no undue settlement, cracking or seepage was noted at the time of inspection, it appears that the embankment is adequate for normal pool level with water at elevation 2165 M.S.L. Since the rapid drawdown stability is in question, the water level in the dam should not be lowered at a rate exceeding 6 inches per day. If this is not acceptable, a geotechnical engineering study is recommended in order to evaluate in detail the actual stability of the dam for the rapid drawdown condition.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Gent Brothers Dam at the time of inspection appeared sound and in a safe operating condition. The spillway will pass the PMF without overtopping. The SDF is the ½ PMF and the spillway is considered adequate. Maintenance procedures at the time of inspection appeared to be very good.

Based on the visual inspection and review of existing records, there is no serious problem that would require immediate action for the normal pool conditions. The actual embankment structure appears to be similar to the design drawings with the exception that is was constructed 10 ft$^{\pm}$ higher than specified. The downstream embankment slope meets the requirement recommended by the U. S. Bureau of Reclamation. (Reference 2, Appendix VI);however, the upstream slope is slightly steeper than recommended whensubject to rapid drawdown.

7.2 Recommendations and Remedial Measures: An accurate check on stability could not be made since sufficient design data, calculations and construction records were not available. Since only the rapid drawdown stability condition appears to be in question, the lake level should not be lowered at a rate exceeding 6 inches per day. If this is not acceptable, the Owner should provide a geotechnical engineering study which evaluates in detail the actual stability condition of the dam.

7.3 Remedial Measures:

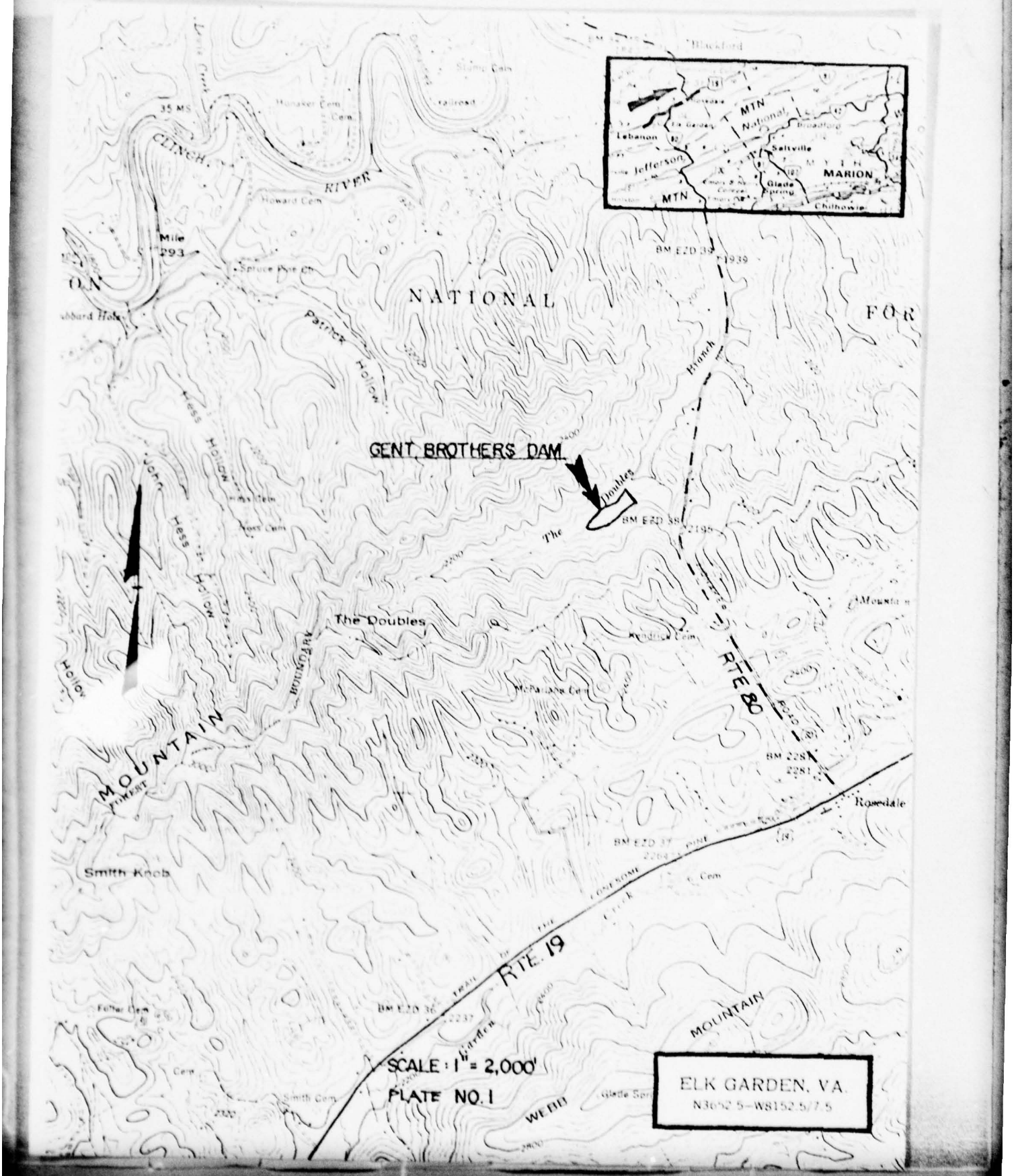
7.3.1 A staff gage should be installed to monitor water levels.

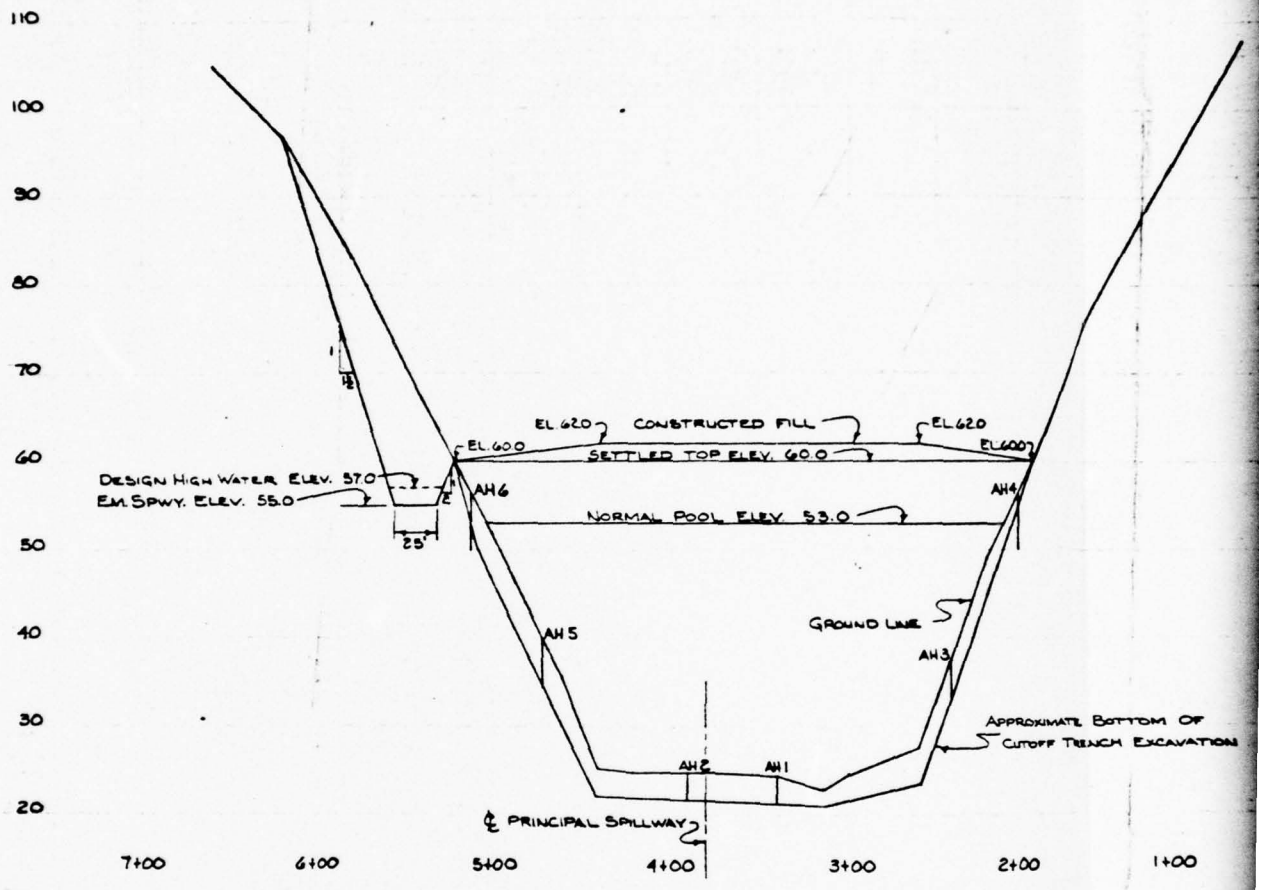
7.4 Required Maintenance:

7.4.1 The seep present at the toe of the downstream slope at the right abutment may actually be a spring; however, this was not definitely confirmed. We would recommend that this area be monitored quarterly to detect any increase in flow rates or erosion. The two wet areas located 40 ft± to the right appear to be springs. They should also be monitored to detect any increase in flow rate.

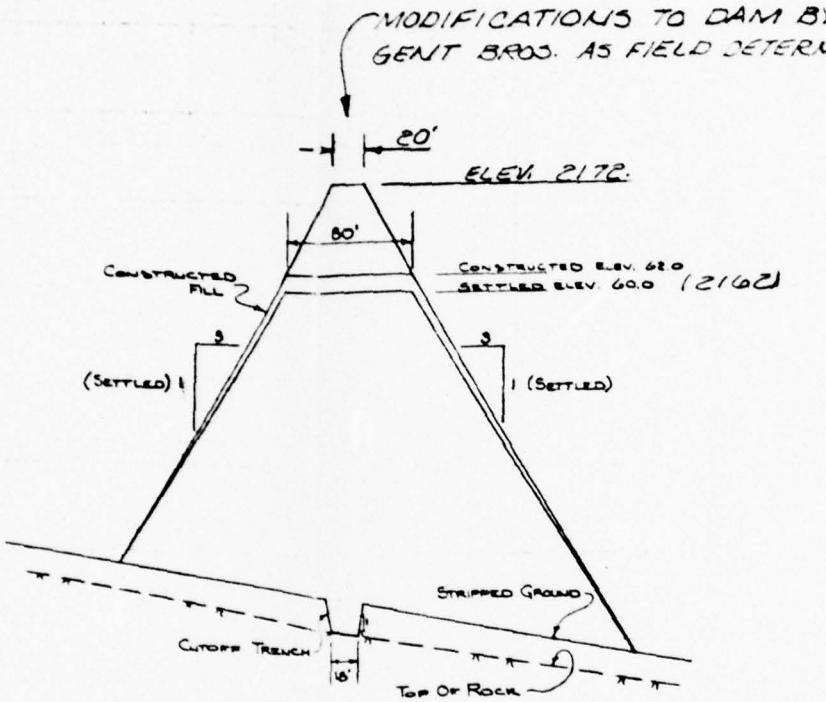
APPENDIX I

MAPS AND DESIGN DRAWINGS


CENT. BROTHERS DAM.
NATIONAL
FOR
CLINCH
RIVER
Mile 293
Spruce Run Ch.
Howard Cem.
Parker Hollow
Hess Hollow
The Doubles
BOUNDARY
MOUNTAIN
FOREST
Smith Knob
RTE. 80
RTE. 19
Rosedale
Lebanon
Jeffersonville
Saltville
MARION
Glade Spring
Chilhowie
MTN
SCALE: 1" = 2,000'
PLATE NO. 1
ELK GARDEN, VA.
N36°52'5-W81°52'5/7.5



PROFILE ALONG CENTERLINE OF DAM AND CUTOFF TRENCH



TYPICAL SECTION OF EMBANKMENT

3

PLATE No. 2

GENT BROTHERS POND

RUSSELL COUNTY, VIRGINIA

EMBANKMENT & FOUNDATION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

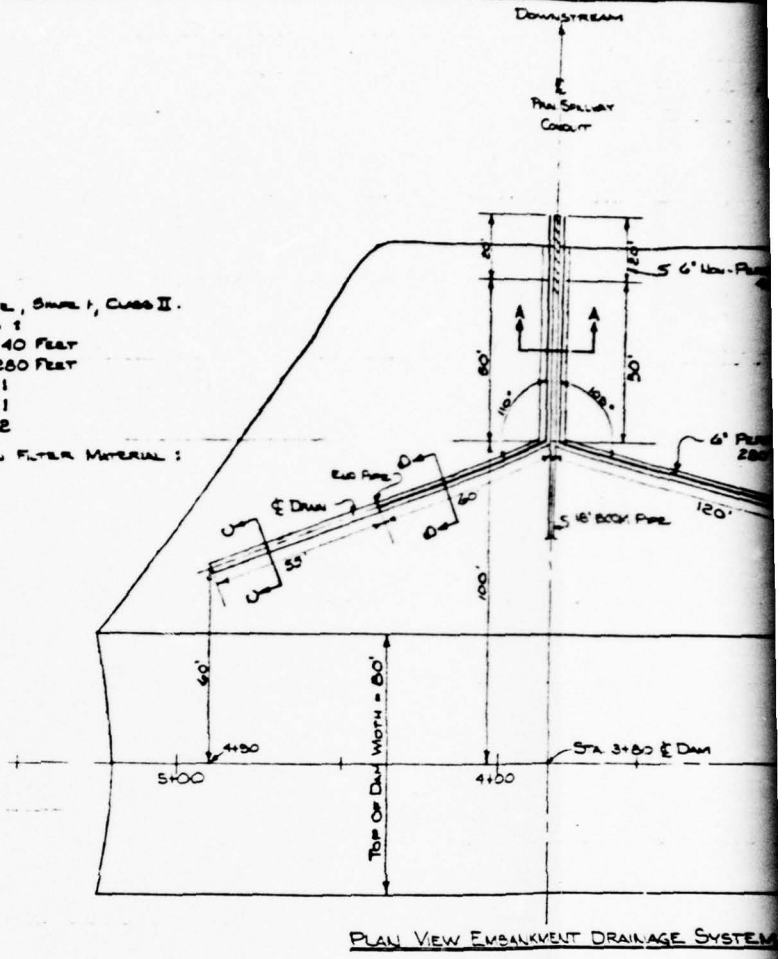
Designed	DCM	Date 10-73	Approved by
Drawn	DCM	10-73	Title
Traced			Title
Checked			Sheet No. / Drawing No.

NOTES:

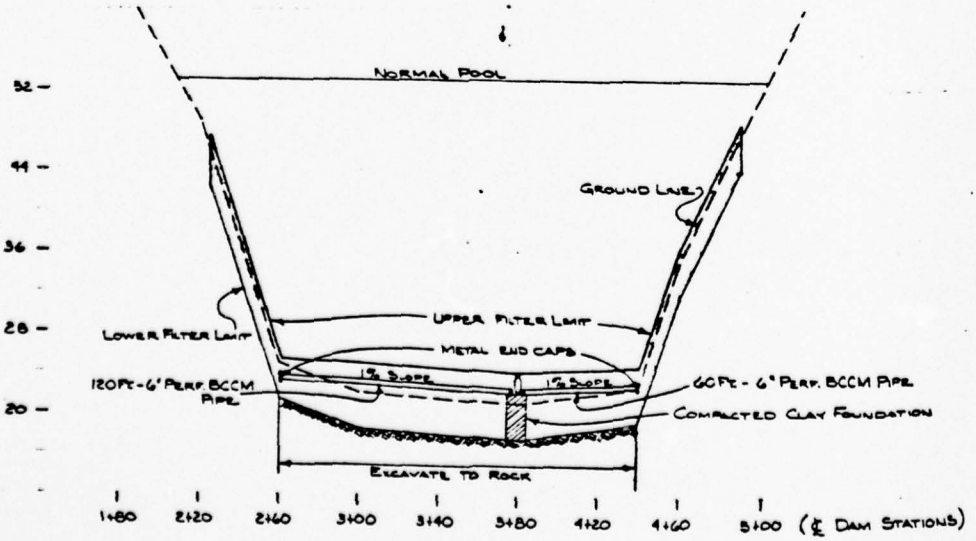
1. ALL DRAIN PIPE SHALL BE 6"ϕ, 16 GAGE, SHAPE I, CLASS II.
2. DRAIN PIPE & APPURTENANCES REQUIRED:
   - 6" NON-PERFORATED BCCM PIPE - 40 FEET
   - 6" PERFORATED BCCM PIPE - 280 FEET
   - 105° ELBOW - 1
   - 110° ELBOW - 1
   - METAL END CAPS - 2
3. GRADATION REQUIREMENTS FOR DRAIN FILTER MATERIAL:

U.S. STANDARD SIEVE DESIGNATION	% PASSING BY WEIGHT
3"	100
2"	90-100
¾"	78-91
⅜"	69-82
#4	57-72
#16	32-49
#50	4-18
#100	3-5
#200	3

4. DRAIN FILTER MATERIAL REQUIRED:
   200 CUBIC YARDS

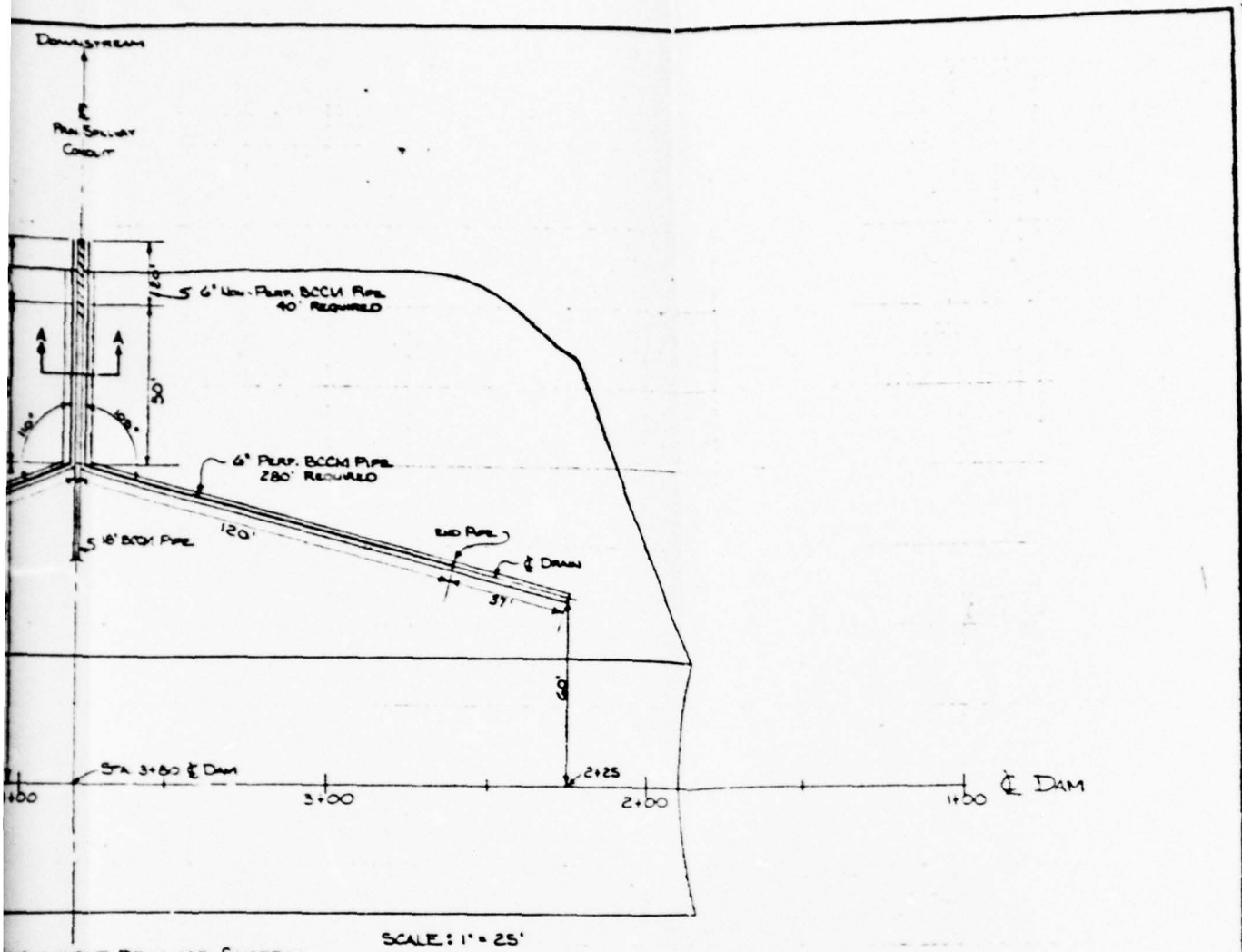


PLAN VIEW EMBANKMENT DRAINAGE SYSTEM



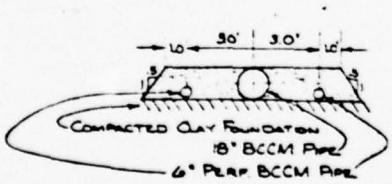
PROFILE OF DRAINAGE SYSTEM
(LOOKING UPSTREAM)

SECT



SCALE: 1" = 25'

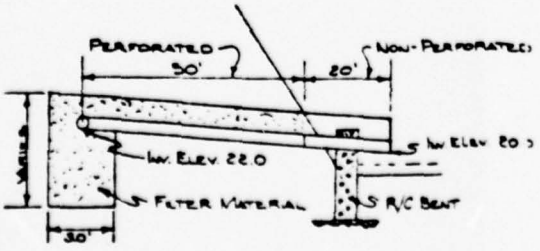
EMBANKMENT DRAINAGE SYSTEM



SECTION A-A

SECTION B-B

SECTION C-C



SECTION ALONG OUTLET PIPE

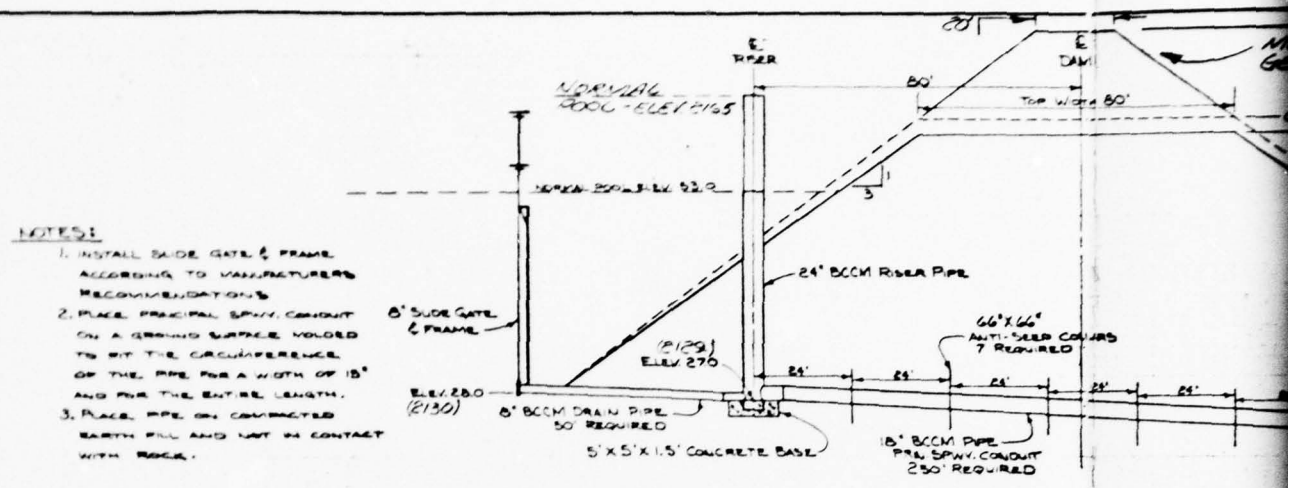
PLATE No. 3 2

GENT BROTHERS POND
RUSSELL COUNTY, VIRGINIA

EMBANKMENT DRAINAGE SYSTEM

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

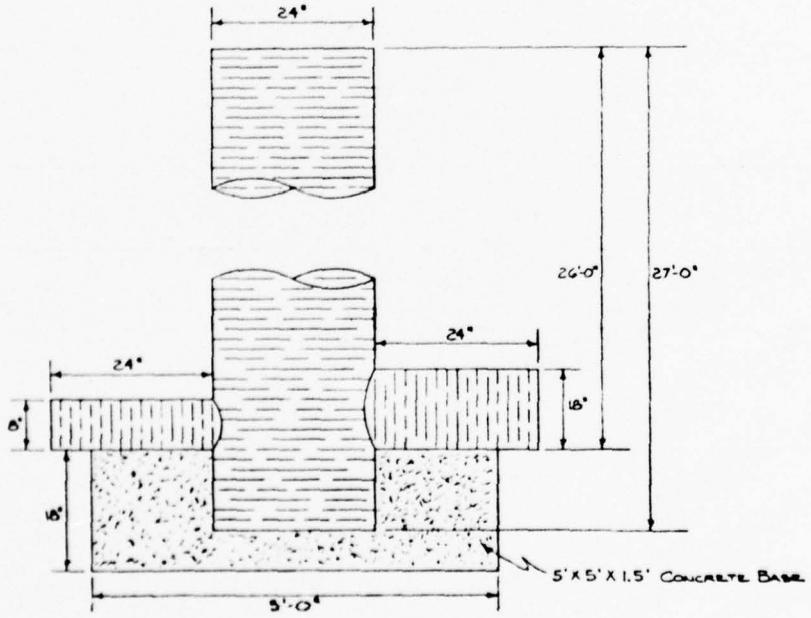
Designed	D.C.M.	Date 9-75	Approved by
Drawn	D.C.M.	9-75	Title
Traced			Title
Checked			Sheet No. / Drawing No.



NOTES:

1. INSTALL SLIDE GATE & FRAME ACCORDING TO MANUFACTURERS RECOMMENDATIONS
2. PLACE PRINCIPAL SPWY. CONDUIT ON A GROUND SURFACE MOLDED TO FIT THE CIRCUMFERENCE OF THE PIPE FOR A WIDTH OF 18" AND FOR THE ENTIRE LENGTH.
3. PLACE PIPE ON COMPACTED EARTH FILL AND NOT IN CONTACT WITH ROCK.

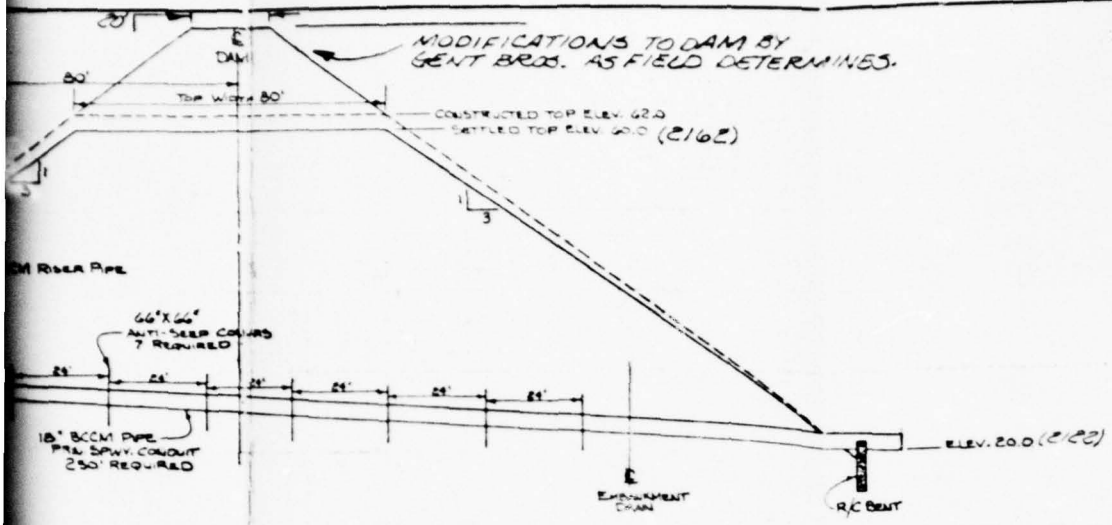
PROFILE ALONG ℄ PRINCIPAL SPILLWAY



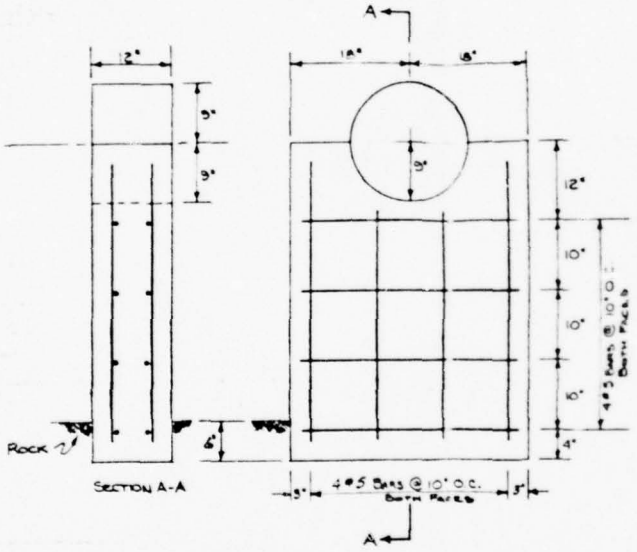
RISER TEE ASSEMBLY WITH BASE

NOTE:

FILL INSIDE OF RISER WITH CONCRETE TO OUTLET ELEV.
ALL CONCRETE 3000 PSI, NON-REINFORCED



PROFILE ALONG ℄ PRINCIPAL SPILLWAY



BENT DETAILS

BASE

2

PLATE No. 4

GENT BROTHERS POND
RUSSELL COUNTY, VIRGINIA

PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

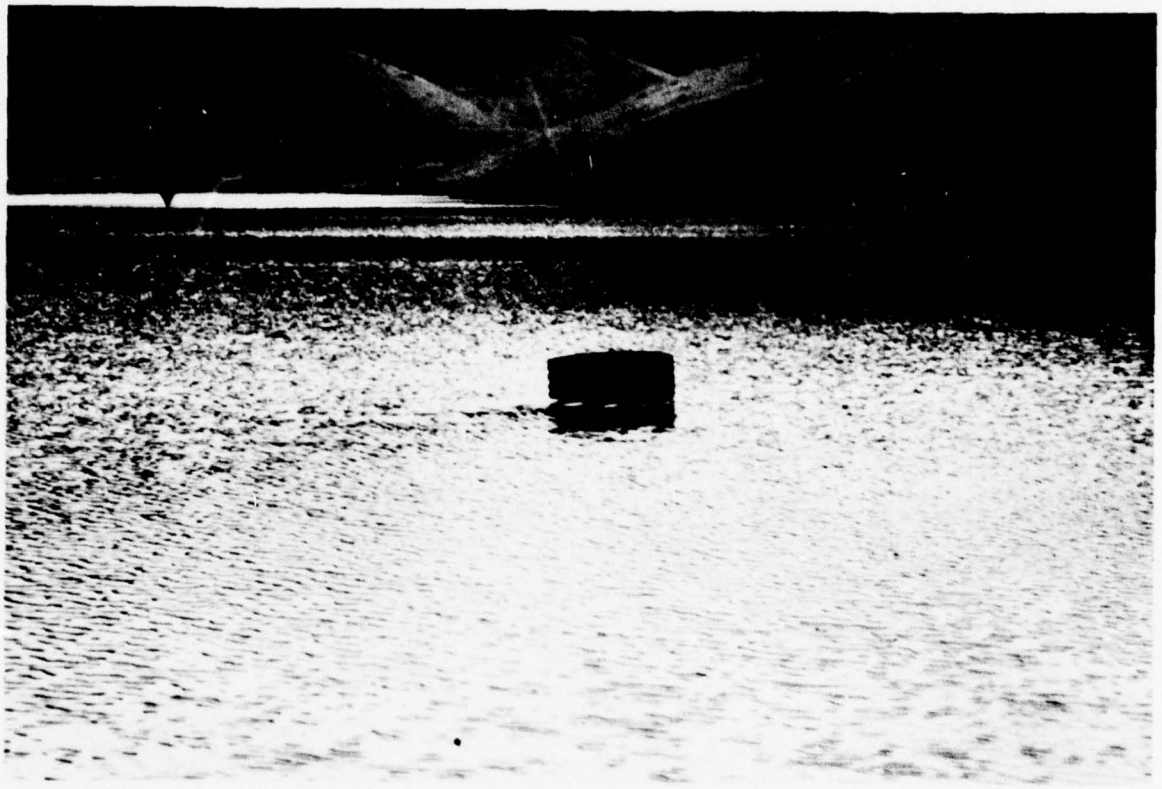
Designed	DDM	10-75	Approved by
Drawn	DDM	10-75	Title
Traced			
Checked			Sheet No. 2

APPENDIX II

PHOTOGRAPHS

VIEW OF SPRING LOCATED ALONG BASE OF RIGHT ABUTMENT

VIEW ACROSS UPSTREAM FACE OF BERM
(Note Intake and Rip Rap)



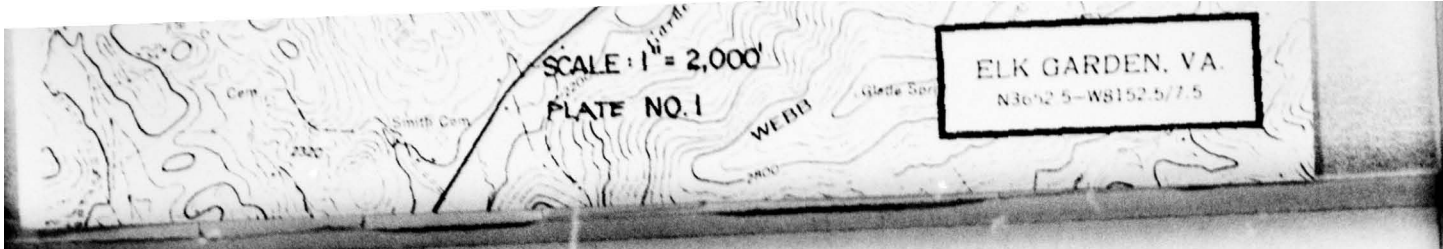
VIEW OF RISER INTAKE
(Note 8" Gate Location with Arrow. Also, Headwater Spring Locations in Background at Location of Cattle)

CLOSE-UP 18" PRINCIPAL SPILLWAY PIPE AND TOE DRAIN PIPES

VIEW OF DOWNSTREAM CHANNEL AND FLOODPLAIN

APPENDIX III

FIELD OBSERVATIONS



FIELD OBSERVATIONS

Name of Dam: Gent Brothers Dam

County: Russell

State: Virginia

Coordinates: Lat 36° 58.2' Long 81° 57.4'

Date of Inspection: May 22, 1979

Weather: Partly cloudy, temperature 65°F

Pool elevation at Time of Inspection: 2165 M.S.L. (top of intake)

Tailwater at Time of Inspection: 2120± M.S.L. (5 ft below pipe intake)

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Ray E. Martin, P.E.*
Stephen G. Werner (recorder)

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
William A. Johns (recorder)

State Water Control Board
Hugh Gildea, P.E.

Owner
R. W. Gent
Bud Gent

1 Embankment:

1.1 Surface Cracks: The slopes, crest, emergency spillway, and abutment contacts were inspected and no cracks were noted except for a few minor cracks on the downstream slope. These appear to be related to shrinkage and swelling of surface soils. The embankment is well maintained. Cattle graze on the downstream slope, but are prevented from entering the impoundment by a cattleguard and fence. The presence of

*Not present during May 22, 1979 inspection, but visited dam on June 11, 1979.

cattle on the downstream slope has caused some minor deterioration of the embankment surface. A gravel road extends across the embankment crest.

1.2 Unusual Movement: No unusual movements were noted on the dam, or downstream beyond the embankment toe.

1.3 Sloughing or Erosion: The only sloughing observed was on a slope directly across the lake from the pavillion. Only a minor failure had occurred. The embankment appeared to be constructed of SM, ML, and CL materials; depending upon the rock fragment content. The matrix was generally clayey silt to silty clay.

1.4 Alignment: The vertical and horizontal alignment of the dam appeared to be good. Side slopes of 3:1 on both sides of the embankment.

1.5 Riprap: Showed no displacement or washing; appeared to be in proper alignment and in good condition. Blocks of rock ranged from 0.5 to 3 ft$\pm$ in length and were reportedly hand placed.

1.6 Junctions: Conditions appeared good at the junction of the embankment and the abutments. R. W. Gent stated that the cutoff trench in the base of the dam was not constructed up the slope into the abutment. Steep shale slopes occur on the left and right abutments. Scattered outcrops of rock are exposed in the surrounding slopes. The slopes have a grassed, thin soil cover. Brown shale with gray, thin limestone interbeds are exposed in the left abutment along the left edge of the emer-

gency spillway. A bedrock strike of 57 degrees to the northeast and dip of 77 degrees northwest were recorded. A small anticlinal fold occurs along the right abutment behind the dam crest and slightly above the road. Thin-bedded limestone is exposed striking 25 degrees to the northeast. Bedding is essentially vertical, but does fan outward with variable dips to the northwest and southeast. No faults were observed.

1.7 Seepage: Wet areas present beside and beneath the principal spillway were covered with algae and moss. Seepage existed along the base of the downstream toe of the right abutment and two seeps occur about 40 ft to the right of the intersection of the right abutment and the face of the dam. Flow was clear and generally less than 2 gpm. Minor iron-staining was encountered at a few locations, roughly midway between the seeps and the principal spillway. R. W. Gent stated that these seeps are actually springs, which were present prior to construction of the dam. He further stated that seepage under and through the dam had once been a problem, however a grout curtain installed several years ago by Cunningham Core Drilling and Grouting Corporation (Salem, Virginia) corrected this. None of the wet areas or seeps appeared to represent water passing under or through the embankment.

1.8 Staff Gage: None.

1.9 Drains: In good condition.

2 Outlet Works:

PROFILE OF DRAINAGE SYSTEM
(LOOKING UPSTREAM)

2.1 Outlet Conduit: 18 inch CMP coated with asphalt. No cracking or spalling observed.

2.2 Intake Structure: 24 inch CMP stand pipe.

2.3 Outlet Structure: 18 inch CMP coated with asphalt.

3 Emergency Spillway:

3.1 Channel: Soil channel 25 ft wide, 5 ft deep and with 4% slope.

3.2 Emergency Gate: Operable.

4 Reservoir:

4.1 Slopes: Moderately steep to steep grassed slopes surround the reservoir. This type of topography characteristically develops on the Martinsburg Formation. Some borrow was taken from the slopes for construction of the dam. The slopes generally consist of a thin soil cover over shale and thin-bedded limestone. Surrounding roadcuts are close to vertical. A minor slope failure or slide exists on the left side of the reservoir, directly across from the pavillion.

4.2 Sedimentation: None; lake is clear and fed by a system of springs at the headwater of the lake.

5 Downstream Channel:

5.1 Condition: Good. Channel has rock and soil bottom. Downstream area consists of a clear valley.

5.2 Slopes: Downstream moderately steep to steep; natural slopes with scattered shale and limestone outcrops bound the floodplain. The floodplain is grassed, appears to be several hundred ft wide (measured 160 ft$\pm$) and slopes

gently northward. The immediate area is used as cattle pastureland.

A steep natural draw intersects the roadway several hundred ft from the cattleguard. A 6 inch and 12 inch corregated metal pipe extends beneath the gravel road allowing runoff to flow into the stream below the left downstream toe. Riprap has been placed below the outflow portion of the pipe. Water was draining over from the 12 inch pipe during the inspection.

5.3 Population and Facilities: Water could go over the road one mile downstream. A store is located at Route 640 and four houses are located in the floodplain in the same general area.

6 Instrumentation:

6.1 Monumentation: None.

6.2 Observation Wells and Piezometers: No observation wells or piezometers were noted in the field.

APPENDIX IV

DESIGN REPORT

TO GO WITH DUNCANS REPORT

RUSSELL CO.

SITE - TYPE 3 DDM

UNIFIED CLASS ML, CL

PERMEABILITY A MODERATE
C "

CENTER LINE BORINGS AND HEADING TO BOTTOM
DDM CENTER LINE 1 - SEE BORING SHEET

INDICATED BEDROCK, FRACTURES - SHALE ON FLOOR, LIMESTONE
IN BOTTOM
CRACKED, SHARPLES - MINE

(1)

Site No. 1 - Bottom 15 ft from channel / Melvin Silty Clayloam 30" [illegible] bedrock

(2)

Site No. 2 - Bottom [illegible] channel / same Tripland silt loam (Dunning) to 30"

South slope - Silt loam to [illegible] shale 14-14"
(3) 15 ft. above bottom

(4) Silty clay loam to weathered shale [illegible]
40 ft above bottom

North slope - Silty clay loam 60"+, 20 ft [illegible]
(5) bottom

(6) Silty clay loam to 60"+ [illegible] clay
material [illegible]

(7) 180 [illegible] above dam on gentle slope [illegible]
silty clay loam to 36" weathered shale [illegible]

U. S. Department of Agriculture
Soil Conservation Service

PEAK RATES OF DISCHARGE FROM SMALL WATERSHEDS

State [illegible]
County [illegible]
Cooperator [illegible]
Community [illegible]

Sheet No. 1 of 1
Field No. 1
Computed by [illegible] Date [illegible]
Checked by _____ Date _____

Drainage Area is 125 Acres.
Rainfall Freq. is 25 Years.

Rainfall Depth is 5 Inches.
Avg. Watershed Slope is [illegible] Percent.

Hydrologic Soil Group 1	Land Use 2	Treatment or Practice 3	Hydrologic Condition 4	Runoff Curve Number 5	Area (Ac.) 6	Col. 5 X Col. 6 7
B	Woods	None	Good	55	1.9	104.5
B	Pasture	None	Good	61	1.9	115.9
				TOTALS =	12.5	7424

Weighted Runoff Curve No. = $\frac{\text{Total Col. 7}}{\text{Total Col. 6}} = \frac{7424}{125} = 59$; Use 60

Q_1 (For ___ RCN_1) = Q(ES 1027 for _____ slopes) x Slope Correction Factor (Ex. 2-0)
= _____ x _____ = 95 cfs

Q_2 (For ___ RCN_2) = _____ x _____ = _____ cfs

Watershed RCN Minus RCN_1	C
1	.2
2	.4
3	.6
4	.8

$Q_2 - Q_1$ = _____ - _____ = _____ cfs

$\Delta Q = (Q_2 - Q_1) \times C$ = _____ x _____ = _____ cfs

Peak Discharge = $Q_1 + \Delta Q$ = _____ + _____ = _____ cfs

Runoff = _____ Inches (Exhibit 2-7A)

NOTE: Q_1 and Q_2 above refer to runoff resulting for RCN's to nearest 5 (60, 65; 65, 70, etc.). If computed RCN ends in 0 or 5 (60, 65, 70, etc.), Q_2 and the next three lines will not be needed. In this case, Q_1 runoff will be the Peak Discharge.

Runoff Data Sheet

VIRGINIA

SOIL CONSERVATION SERVICE

ENGINEERING STANDARD

POND

Definition

A water impoundment made by constructing a dam or embankment, or by excavating a pit or "dugout."

Ponds constructed by the first of these methods are referred to hereinafter as "Embankment Ponds" and those constructed by the latter method as "Excavated Ponds." Ponds resulting from both excavation and embankment are classified as "Embankment Ponds" where the depth of water impounded against the embankment at spillway elevation is 3 feet or more.

Purpose

Ponds are constructed to provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses.

Scope

This standard establishes the minimum acceptable quality for the design and construction of ponds located in predominantly rural or agricultural areas when:

1. Failure of the dam would not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.

2. The product of the storage times the effective height of the dam is less than 3,000. The storage is defined as the volume in acre-feet in the reservoir below the elevation of the crest of the emergency spillway and the effective height of the dam is defined as the difference in elevation in feet between the emergency spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no emergency spillway, the top of the dam becomes the upper limit.

3. The effective height of the dam (as defined above) is 35 feet or less and the dam is hazard class (a).

July 1978

378-2

Conditions Where Practice Applies

Site Conditions

Site conditions shall be such that the runoff from the design storm (see Table 4) can be safely passed through (1) a natural or constructed emergency spillway, ((2) a combination of a principal spillway and an emergency spillway, or (3) a principal spillway.)*

Drainage Area

The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough that surface runoff, together with groundwater flow, will maintain an adequate supply of water in the pond. The water quality shall be suitable for its intended use.

Reservoir Area

The topography and soils of the site shall permit storage of water at a depth and volume which will insure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. Where surface runoff is the primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses, or shall be of a type that sealing is practicable.

EMBANKMENT PONDS

Design Criteria

Foundation Cutoff

A cutoff of relatively impervious material shall be provided under the dam if necessary. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations, and side slopes not steeper than 1:1.

Seepage Control

Seepage control is to be included: (1) If pervious layers are not intercepted by the cutoff, (2) If seepage may create swamping downstream,

* The design of this type structure must be approved by an engineer.

(3) If needed to insure a stable embankment, or (4) If special problems require drainage for a stable dam. Seepage control may be accomplished by (1) foundation, abutment or embankment drains, (2) reservoir blanketing or (3) a combination of these measures.

Earth Embankment

Top width - The minimum top width of the dam is shown in Table 1. When the embankment top is to be used as a public road, the minimum width is to be 16 feet for one-way and 26 feet for two-way traffic. Guardrails are to be used when the embankment height exceeds 10 feet.

TABLE 1

Total Height of Embankment (Feet)	Top Width (Feet)
10 or less	6
11 - 14	8
15 - 19	10
20 - 24	12
25 - 34	14
35 - up	15

NOTE: For this standard, the maximum effective height of the dam is 35 feet.

Side Slopes -- The combined upstream and downstream side slopes of the settled embankment shall not be less than five horizontal to one vertical with neither slope steeper than 2:1. Slopes must be designed to be stable in all cases, even if flatter side slopes are required.

(Wave Erosion Protection -- Where needed to protect the face of the dam, special wave protection measures such as berms, rock riprap, sand-gravel, soil cement or special vegetation shall be provided. (Ref. Technical Release No. 56)).*

Freeboard -- The minimum elevation of the top of the settled embankment shall be 1.0 foot above the water surface in the reservoir with the emergency spillway flowing at design depth. The minimum difference in elevation between the crest of the emergency spillway and the settled top of the dam shall be 2.0 feet.

* The design of this type structure must be approved by an engineer.

Allowance for Settlement -- The design height of the dam shall be increased by the amount needed to insure that after all settlement has taken place the height of the dam will equal or exceed the design height. This increase shall not be less than five percent, except where detailed soil testing and laboratory analysis shows a lesser amount is adequate.

Principal Spillways

A pipe conduit, with needed appurtenances, shall be placed under or through the dam except where a rock or concrete spillway is used or where the rate and duration of flow can be handled safely by a vegetated or earth spillway.

Crest Elevation of Inlet -- The crest elevation shall not be less than 1.0 feet below the crest of the emergency spillway.

When design discharge of the principal spillway is considered in calculating peak outflow through the emergency spillway, the crest elevation of the inlet shall be such that full flow will be generated in the conduit before there is discharge through the emergency spillway. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

Size -- The capacity of the pipe conduit shall be adequate to discharge long duration, continuous, or frequent flows without flow through the emergency spillways. The diameter of the pipe shall not be less than 4 inches. If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the emergency spillway.

Pipe Conduits -- Pipe conduits under or through the dam shall meet the following requirements:

The pipe shall be capable of withstanding the external loading without yielding, buckling, or cracking. Pipe strength is not to be less than that of the grades indicated in Table 2 for (plastic pipe)* and in Table 3 for corrugated aluminum and galvanized steel pipe. The inlets and outlets shall be structurally sound and made from materials compatible with the pipe. All pipe joints are to be made watertight by the use of coupling or gaskets or by welding.

For dams 20 feet or less in effective height, the following pipe materials are acceptable; Cast-iron, steel, corrugated steel or aluminum, asbestos-cement, concrete, plastic, vitrified clay with rubber gaskets and (cast-in-place reinforced concrete)* Asbestos-cement, concrete, and vitrified clay pipe shall be laid in a concrete bedding. Plastic pipe that will be exposed to direct sunlight should

* The design of this type structure must be approved by an engineer.

TABLE 2

Acceptable PVC 1/ Pipe for use in Earth Dams

Nominal Pipe Size (inches)	Schedule for Standard Dimension Ratio (SDR)	Maximum Depth of Fill Over Pipe (feet)
4 or smaller	Sched. 40	15
	Sched. 80	20
	SDR 26	10
6, 8, 10, 12	Sched. 40	10
	Sched. 80	15
	SDR 26	10

1/ Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ASTM D 1785 or ASTM D 2241

TABLE 3

Minimum Gages - Corrugated Metal Pipe

2 1/2 - inch x 1/2 inch Corrugations

Fill Height Above Pipe (feet)	Steel - Minimum Gage						Aluminum 2/ Minimum Thickness (inches)			
	Pipe Diameter in Inches						Pipe Diameter in Inches			
	21 & Less	24	30	36	42	48	21 & Less	24	30	36
1 - 15	16	16	16	14	12	10	.06	.06	.075	.075
15 - 20	16	16	16	14	12	10	.06	.075	.105	.105
20 - 25	16	16	14	12	10	10	.06	.105	.135	3/
All Dams over 20 feet in effective height										
Up to 25	16	14	12	10	8	8	3/	3/	3/	3/

2/ Riveted or helical fabrication.
3/ Not permitted.

July 1978

be made of ultraviolet resistant materials, protected by coating or shielding or provisions made for replacement as necessary. Connections of plastic pipe to less flexible pipe or structures must be designed to avoid stress concentrations that could rupture the plastic.

For dams over 20 feet in effective height, conduits are to be reinforced concrete pipe*, cast-in-place reinforced concrete*, corrugated steel or welded steel pipe. The maximum height of fill over any steel pipe must not exceed 25 feet. Pipe shall be watertight. The joints between sections of pipe shall be designed to remain watertight after joint elongation caused by foundation consolidation. Concrete pipe shall have concrete bedding or a concrete cradle if required. Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a SAF* or impact basin* may be used to provide a safe outlet. Cathodic protection is to be provided for welded steel and corrugated steel pipe where the need and importance of the structure warrant. Cathodic protection should normally be provided for corrugated steel pipe where the saturated soil resistivity is less than 4,000 ohms-cm or the pH is lower than 5. (Engineering Practice Standard 432-F provides criteria for cathodic protection of welded steel pipe.)*

Antiseep Collars -- Antiseep collars are to be installed around the pipe conduit or pond drain pipe within the normal saturation zone when any of the following conditions exist:

1. The settled height of the dam exceeds 15 feet.
2. The conduit is of smooth pipe larger than 8 inches in diameter.
3. The conduit is of corrugated metal pipe larger than 12 inches in diameter.

The antiseep collars and their connections to the pipe shall be watertight. The collar material shall be compatible with pipe materials. The maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe.

Antivortex Devices -- Closed conduit spillways designed for pressure flow are to have adequate antivortex devices.

Trash Guards -- Where necessary to prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser.

Drain Pipe -- A pipe with a suitable valve shall be provided to drain the pool area where needed for proper pond management, or where required by state law. The principal spillway conduit may be used as a pond drain when so located as to accomplish this function.

* The design of this type structure must be approved by an engineer.

Water Supply Pipes -- Supply pipes through the dam to watering troughs and other appurtenances shall have an inside diameter of not less than 1-1/4 inches.

Emergency Spillways

Emergency spillways are provided to convey large flood flows safely past earth embankments.

An emergency spillway must be provided for each dam, unless the principal spillway is large enough to pass the routed design hydrograph peak discharge and the trash that comes to it without overtopping the dam. (A closed conduit principal spillway having a conduit with a cross-sectional area of 3 square feet or more, an inlet which will not clog, and an elbow designed to facilitate the passage of trash is the minimum size and design that may be utilized without an emergency spillway.)*

Capacity -- The minimum capacity of natural or constructed emergency spillways shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 4 less any reduction creditable to conduit discharge and detention storage.

TABLE 4

Drainage Area (acres)	Effective Height of Dam 4/ (feet)	Storage (Acre-feet)	Minimum Design Storm 5/ Frequency (years)	Min. Duration (hours)
20 or Less	20 or less	Less than 50	10	24
20 or Less	Over 20	Less than 50	25	24
Over 20	20 or Less	Less than 50	25	24
ALL OTHERS			50	24

4/ As defined under Scope.
5/ Select rainfall distribution based on climatological region.

The emergency spillway shall (1) safely pass the peak flow or ((2) the storm runoff shall be routed through the reservoir.)* The routing shall start with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days drawdown whichever is higher. The 10-day drawdown shall be computed from the crest of the emergency spillway or from the elevation that would be attained had the entire design storm been impounded whichever is lower. Emergency spillways are to provide for passage of the design flow at a safe velocity to a point downstream where the dam will not be endangered.

* The design of this type structure must be approved by an engineer.

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Cross Section -- Constructed spillways shall be trapezoidal and will be located in undisturbed or compacted earth. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having effective heights exceeding 20 feet the emergency spillway shall have a bottom width of not less than 10 feet.

Component Parts -- Constructed spillways are open channels and usually consist of an inlet channel, control section and an exit channel.

Upstream from the control section the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed spillway shall fall within the range established by discharge requirements and permissible velocities.

Structural Emergency Spillways*

Chutes or drops, when used for principal spillways or principal-emergency or emergency spillways, will be designed in accordance with the principles set forth in The Engineering Field Manual for Conservation Practices, National Engineering Handbook, Section 5 "Hydraulics," Section 11 "Drop Spillways," and Section 14 "Chute Spillways." The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 4 less any reduction creditable to conduit discharge and detention storage.

Visual Resource Design

Ponds in areas of high public visibility and those associated with recreation are to receive careful visual design. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material and plantings are to relate visually to their surroundings and to their function.

The embankment can be shaped to blend with the natural topography. The edge of the pond can be shaped so it is generally curvilinear rather than rectangular. Excavated material can be shaped so the final form is smooth, flowing and fitting to the adjacent landscape rather than angular geometric mounds. Where feasible, islands can be added for visual interest and wildlife value.

* The design of this type structure must be approved by an engineer.

APPENDIX V

PREVIOUS INSPECTION REPORT

HAND DELIVERED TO
WALTER GENT- 3-29-77
D.S.

P.O.Box 337, Lebanon, Virginia 24266

March 29, 1977

Gent Brothers
c/o Walter Gent
Honaker, Virginia 24260

Dear Sir:

This letter is in reference and a follow-up to the dam that was constructed and completed on your farm in 1975. As you are aware the Soil Conservation Service assisted you in site location, design, layout and supervision of construction of this dam.

You are also aware that during the planning stage we discussed with you the depths of water and height of dam under our approval authority. Prior to and during construction you decided to construct the dam ten feet higher than our design. The dam as constructed does not meet our standards and specifications relative to site investigations, design considerations, and construction inspections.

On 3/25/77, Duncan McGregor, Area Engineer, Larry Goff, Area Conservationist, Tommy Jessee, Soil Conservation Technician, and myself inspected the structure and observed the following items.

1. Several wet areas were observed on the downstream face of the embankment approximately 15 vertical feet below the top of the dam. We do not feel these areas present any immediate danger to the embankment, however, they should be observed periodically and any change in seepage noted.

2. A seepage in the area of the right abutment (looking downstream) has apparently been significantly reduced by grouting this past winter. These areas also should be observed periodically. Thes area at the toe of the embankment where sloughing has occurred should be repaired by gravel fill and installation of drain tile.

3. The entire embankment should be fenced to prevent livestock from trampling the area, also to protect and improve the vegetative cover.

4. The fence crossing the spillway should be kept free of debris.

5. The trash rack should be installed at the earliest possible date.

Please advise if we can be of further assistance on this matter.

C. S. Pendleton
District Conservationist

cc: Larry Goff
L. S. Button, Jr.

APPENDIX VI - 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 of the Appalachian Valley in Virginia, Bulletin No. 52 (Part 1), Charles Butts, Virginia Division of Mineral Resources, 1940, 568 pp.

4. Section 4, Hydrology, Part 1, Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U.S. Department of Agriculture, 1964.

5. Hydrometerologic Report No. 33, U.S Department of Commerce, Weather Bureau, U.S. Department of Army, Corps of Engineers, Washington, D.C., April 1956.