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Name Of Dam: CHERRYSTONE NO. 2A

Location: PITTSYLVANIA COUNTY, VIRGINIA

Inventory Number: VA. NO. 14303

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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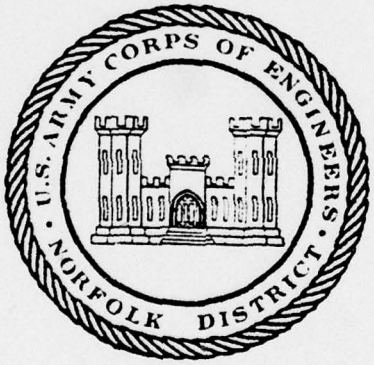

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NORFOLK DISTRICT CORPS OF ENGINEERS
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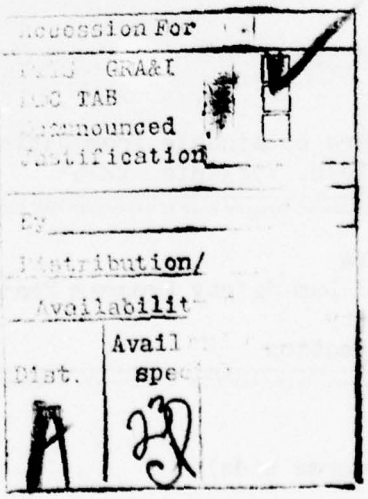
20. Abstract

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.



NAME OF DAM: CHERRYSTONE NO. 2A
LOCATION: PITTSYLVANIA COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 14303

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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(10) James A. Walsh

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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 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.

Name of Dam: Cherrystone No. 2A Va. No. 14303
State: Virginia
County: Pittsylvania
USGS Quad Sheet: Chatham
Coordinates: Lat 36° 50.8' Long 79° 25.9'
Stream: Roaring Fork Creek
Date of Inspection: May 1, 1979

BRIEF ASSESSMENT OF DAM

Cherrystone Dam No. 2A is a zoned earth-fill structure about 400 ft long and 68 ft high. The principal spillway consists of a 36 inch prestressed cylinder concrete pipe, which extends through the structure. Water is discharged into the principal spillway through a reinforced concrete riser and is expelled into a riprap plunge pool. The emergency spillway is a 200 ft wide vegetated earth channel. The dam is located on Roaring Fork Creek near its junction with Cherrystone Creek about 2.5 miles northwest of Chatham, Virginia. The dam was constructed for flood control and recreational purposes.

The dam is of "intermediate" size and has been assigned a "significant" hazard classification. The appropriate spillway design flood is the ½ Probable Maximum Flood (½ PMF). The emergency spillway will pass 70 percent of the PMF prior to overtopping. Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the spillway is rated adequate.

The actual embankment structure appears to be similar to the "as built" drawings. A summary of the stability analysis of the upstream and downstream slopes under rapid

drawdown and steady seepage conditions was reviewed, and assumptions, test data, and the resultant factors of safety were found to be acceptable.

The visual inspection revealed an immediate need to prevent the further use by four-wheel drive vehicles on the embankment. The vehicle path developed on the downstream slope should be graded and reseeded in order to diminish the potential of embankment erosion. Otherwise, there are no apparent problems and there are no immediate needs for remedial measures. The slopes, the crest of the structure, and the spillway should be mowed twice per year and small trees or saplings removed once per year. A damp area was observed in the vehicle track at the base of the downstream slope and should be inspected quarterly to detect any increase in seepage rates that may undermine the integrity of the dam.

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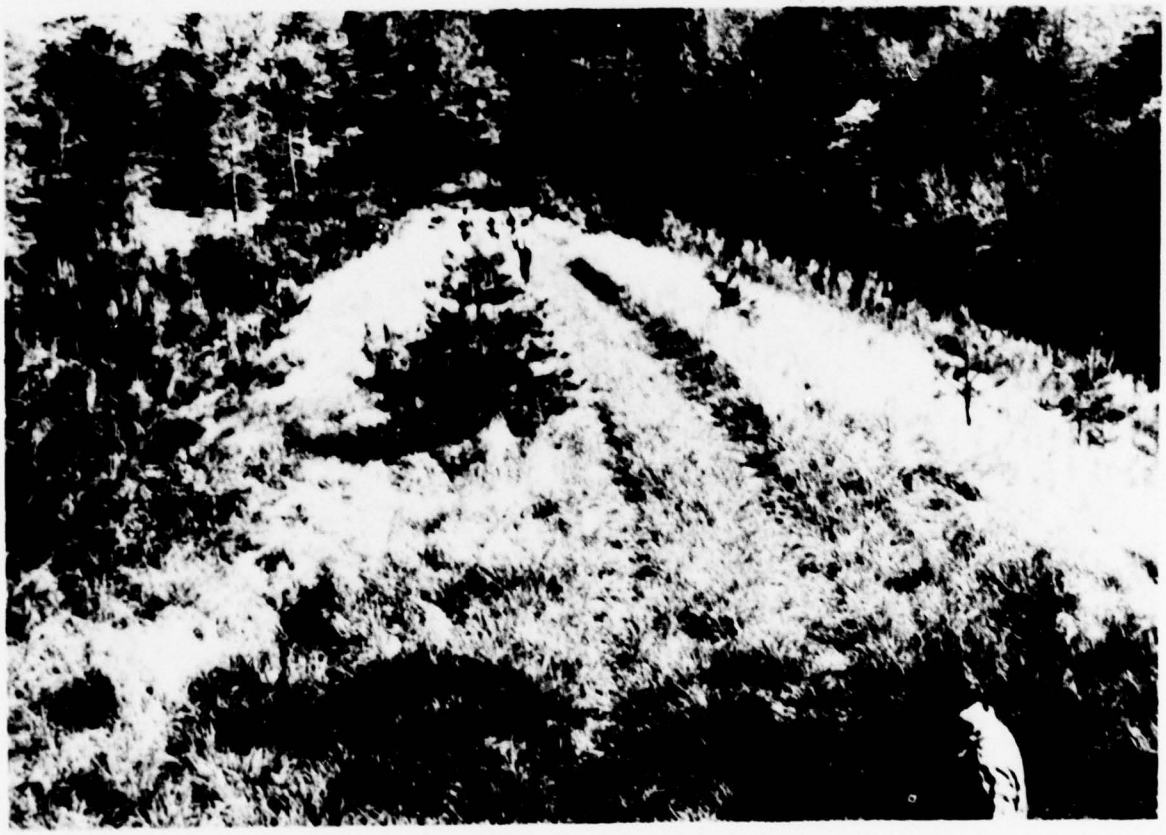


OVERVIEW PHOTO

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CHERRYSTONE DAM NO. 2A, VA. NO. 14303

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: Cherrystone Dam No. 2A, is a zoned earth-fill structure approximately 400 ft long and 68 ft high. The top of the dam is 20 ft wide and is at elevation 706.7 M.S.L. Side slopes are 2.5 horizontal to 1 vertical (2.5:1) on the downstream side and 3:1 and 2.5:1 on the upstream side. A ten foot wide berm exists on the upstream slope at elevation 675.8 M.S.L.

The principal spillway consists of a 36-inch diameter prestressed cylinder reinforced concrete pipe, running through the dam. Discharge into the conduit is provided by a reinforced concrete riser with low stage and crest inlets at elevations of 674.5 and 687 M.S.L. The riser has a 36-inch diameter inlet at elevation 647 M.S.L. located below the inlet crest, which is used to drain the lake.

The emergency spillway, which is a vegetated earth channel having a bottom width of 200 ft. has a crest elevation of 700.1 M.S.L. The emergency spillway is in a cut and is located off the right side of the reservoir. The cut is in residual soil and weathered schist and granite bedrock. The emergency spillway has a vegetative cover in all areas, and has side slopes of about 3:1.

1.2.2 Location: Cherrystone Dam No. 2A is located on Roaring Fork Creek, 800 ft± west of its juncture with Cherrystone Creek, which is approximately 2.5 miles northwest of Chatham, Virginia (See Sheet 1, Appendix I).

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the dam height of 68 ft and maximum storage capacity of 1636 acre-feet.

1.2.4 Hazard Classification: The dam is located in a rural and forested area; however, based upon the downstream proximity of industrial development and a few inhabited structures near the intersection of Va. Route 57 and Cherrystone Creek, the dam is assigned a "significant"

hazard classification. 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: The Town of Chatham has a special land use permit with the Pittsylvania Soil & Water Conservation District for the construction and operation of the dam.

1.2.6 Purpose: Flood Control and Recreation

1.2.7 Design and Construction History: The dam was designed and constructed under the supervision of the U. S. Soil Conservation Service. Responsibility for construction was by the Pittsylvania Soil and Water Conservation District. The dam was completed in 1968.

1.2.8 Normal Operational Procedures: The principal spillway is ungated, therefore, water rising above the crest of the low stage 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.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The original design (SCS) indicated a drainage area of 5.7 square miles which has been verified and found to be reasonable.

1.3.2 Discharge at Dam Site: Maximum known flood at the dam site occurred in 1972 when the pool elevation reached elevation 680 M.S.L. All discharge was through

the principal spillway.

Principal Spillway Discharges:

Pool Elevation at Crest of Dam 218 CFS

Emergency Spillway Discharge:

Pool at Crest of Dam 9590 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 Area Acres	Capacity Acre Feet	Watershed Inches	Length Miles
Crest of dam	706.1	87	1636	5.38	1.4
Emergency spillway crest	700.1	72	1116	3.67	1.29
Principal Spillway crest (crest inlet)	687	41.9	420	1.38	1.2
Principal Spillway Crest (Low stage inlet - normal pool)	674.5	16.5	116	.38	.80
Streambed at Toe of Dam	639	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was designed and constructed under the direction of the U. S. Soil Conservation Service (SCS) and was sponsored by the Town of Chatham. "As built" drawings and design data are available in the office of the State Conservationist, U. S. Soil Conservation Service, Federal Building, Room 9201, 5th and Marshall Streets, Richmond, Virginia 23240.

A subsurface investigation was conducted at the site by the SCS during the initial design stages. The investigation consisted of drilling 3 core borings, 8 auger borings, and excavating 42 test pits. Subsurface profiles and a report of the investigation with foundation recommendations were prepared based upon permeability tests, test borings, and test pit data. The Geologic Investigation Report and the Embankment and Foundation Summary Report are included in Appendix VI. Boring and test pit locations are shown on Sheet 2, Appendix I.

The dam is a zoned, compacted earthfill embankment. The earth fill requirements shown on Sheet 4, Appendix I, specify that clayey silts classified ML and MH be used in the core or Zone 1 of the dam. Classification of materials is by the Unified Soil Classification System, ASTM D-2487. On the downstream side the core is blanketed with silty sands classified SM, designated Zone 3. Zones 1 and 3 are covered on the upstream and downstream slopes by

Zone 2 or a low permeable shell, which consists of silty sands classified SM. A drainage system is located under the downstream portion of the embankment to control the phreatic surface and to collect seepage.

A review of design drawings indicates the dam is founded on overburden and includes a cutoff trench which extends into weathered bedrock. Electrical resistivity surveys indicate that the upper 24 ft$\pm$ of bedrock beneath the dam is fractured and contains some water, however orientation of the dam and the geologic structure is such that only minor seepage was anticipated beneath the cutoff. This was not considered critical in the Embankment and Foundation Summary. This report further recognized the potential for piping and cracking in the embankment materials but specified design and construction procedures were expected to minimize this problem.

The Embankment and Foundation Summary stated that positive cutoff could not be obtained at the dam centerline due to the fractured nature of the underlying bedrock. Blanket drains were constructed on the bedrock on the abutments and a foundation drain was installed in the flood plain in order to outlet any seepage that bypassed the cutoff and to control the phreatic line in the embankment. Drainage details are presented on Sheet 5, Appendix I. Eleven reinforced concrete anti-seep collars were also installed around the principal spillway pipe. The columns are on 24 ft intervals in order to control any potential

piping problems along the pipe (Sheet 3, Appendix I).

The principal spillway (drop inlet structure consisting of a two-stage reinforced concrete riser) was designed to pass the peak discharge of a 100-year storm with 13.1 ft freeboard at the crest of the emergency spillway. The emergency spillway was designed to function as a relief to storms in excess of the 100-year storm.

The emergency spillway is separated from the dam by a broad hillside and was constructed by making a cut into residual soils and weathered phyllite bedrock. The spillway is basically in cut material; however, specifications required that the bottom of the spillway contain 1 ft of fill compacted to 95% of maximum density, per ASTM D-698.

The design report includes detailed laboratory test data describing the physical properties of the materials used to construct the embankment. Shear strength parameters used in design for the embankment, and foundation material were determined by triaxial compression tests as follows:

SECTION	SHEAR STRENGTH PARAMETERS	
	Angle of Internal Friction	Cohesion
Embankment	$\phi = 26.5^{o}$	C = 600 psf
Foundation	$\phi = 34.5^{o}$	C = 275 psf

The Modified Swedish Circle Method of Analysis was used and included evaluation of 1) the sudden drawdown case (I), and 2) the steady seepage case (III). Only total strength parameters were utilized in a total stress analysis. The

Summary of Embankment and Foundation Analysis included in Appendix V states "No further stability analyses were thought to be necessary due to the conservative approach and high safety factors for a total stress analysis."

2.2 Construction: The construction records were not furnished by the SCS office in Richmond, but they are available from the SCS office in Washington, D.C.

2.3 Operation: There are no operation records.

2.4 Evaluation: Engineering calculations are adequate and the design drawings are representative of the dam. There are no records available for dam performance.

SECTION 3 - VISUAL INSPECTION

3.1 General:

An inspection was made 1 May 1979 and the weather was fair with a temperature of 70°F. The pool elevation at the time of inspection was 674.5 M.S.L. and the tailwater elevation was 641.1 M.S.L., which corresponds to normal flows.

3.2 Findings: Field observations are outlined in Appendix III.

3.2.1 Dam and Spillway: Both the slopes and crest of the embankment were overgrown with tall grass (3 to 4 ft±) and numerous small pine trees (1" to 2" diameter) were also present, particularly near the abutments. Vegetation along the emergency spillway was well maintained at the time of the inspection. A path has been developed along the downstream slope by four-wheel drive vehicle traffic. A damp area exists in a track of this path, approximately 20 ft left of the outlet pipe and 5.5 ft above the top of the pipe. No flow was observed from this spot.

The intake structure was in good condition and no cracking or spalling was observed. The trash rack had no debris and was in good condition.

3.2.2 Reservoir Area: The reservoir showed a small amount of debris. The side slopes were estimated to be 3:1. No sedimentation was observed.

3.2.3 Downstream Areas: The downstream channel showed no erosion or debris collection. The channel is approximately 4 ft deep and 15 ft wide with 1:1 side slopes. Along either side of the channel is a broad floodplain which has about a 3:1 slope and heavy woods. The floodplain is 200± ft wide. A few homes and industrial development are located near the intersection of Virginia Route 57 and Cherrystone Creek.

3.3 Evaluation:

3.3.1 Dam and Spillway: Overall, the dam was in good condition at the time of inspection. However, some minor remedial measures are required. Uncontrolled growth encourages the development of deep-rooted vegetation. This type of growth can encourage piping within the embankment and undermine riprap protection. Also, excessive growth inhibits effective visual inspections of the dam. The embankment, including its crest, slopes, and the emergency spillway, should be mowed at least once a year, but more preferably twice a year. Small trees presently growing on the embankment should be removed.

Attempts have been made to prevent the driving of four-wheel drive vehicles on the embankment. This type of vehicular activity tends to damage the embankment slopes and makes these areas more susceptible to erosion, which in turn increases the potential for slope failure. In order to insure the integrity of the dam, this vehicular traffic must be prevented.

The damp area observed along the downstream toe of the embankment in the vehicle path is minor and was not considered a problem at the time of the inspection. This damp spot should be monitored quarterly in order to detect any increase in seepage.

The intake structure appears to be in good condition and we recommend a regular maintenance program.

The outlet drains from the downstream drainage blanket were submerged in the discharge pool of the principal spillway at the time of inspection.

3.3.2 Downstream Areas: The downstream channel appears to have not suffered any effects from this impoundment in the past and none is anticipated in the future.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Cherrystone Dam No. 2A is used for recreation and flood control purposes. The normal pool elevation is maintained by a riser-type inlet acting as the principal spillway. During periods of below normal flows, when the pool level drops below the low stage inlet, there is no flow through the dam. The only inlet below the low stage crest is the 36 inch head gate used to drain the lake. During periods of above normal flows, the pool elevation rises above the low stage inlet increasing the flow through the inlet. Large increases in inflows which cannot be absorbed by storage are passed through the emergency spillway when the pool rises above elevation 700.1 M.S.L.

4.2 Maintenance of Dam and Appurtenances: The maintenance is the responsibility of the Pittsylvania Soil and Water Conservation District and the Town of Chatham. The maintenance consists of mowing vegetation on dam, clearing trash rack of debris, and general inspection of facilities.

4.3 Warning System: No warning system exists.

4.4 Evaluation: The dam and appurtenances are in good operating condition and maintenance is being routinely performed except on the vegetative cover of the embankment. A mowing routine should be established and all trees removed from embankments.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: Cherrystone Dam No. 2A was designed by the Soil Conservation Service (SCS) as a multipurpose dam and complete hydrologic and hydraulic data are available. This structure is a Class "B" dam by the SCS classification method.

The crest of the low stage inlet of the principal spillway was established at elevation 674.5 M.S.L. in order to provide storage for a sediment pool and provide recreation (fishing and aesthetics). The capacity of the principal spillway was established to provide a maximum pool elevation at the emergency spillway crest during a 100-year Flood. The emergency spillway is designed to accommodate a flood less than the PMF which is SCS standards for a Class "B" structure.

5.2 Hydrologic Records: There are no hydrologic records available for this drainage area.

5.3 Flood Experience: The maximum pool elevation observed was 5 ft above normal pool during the Tropical storm Agnes rainfall in June 1972.

5.4 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 hydrographs were developed by

the SCS method (Reference 4, Appendix VI). Precipitation amounts for the flood hydrographs of the PMF and ½ PMF were taken from the U. S. Weather Bureau information (Reference 5, Appendix VI). Appropriate adjustments for basin size and shape were accounted for and emergency spillway hydrograph determination procedures as outlined in Reference 5, Appendix V were used for the flood hydrographs. These hydrographs were routed through the spillway to determine maximum pool elevations.

5.5 Reservoir Regulation: For routing purposes the pool elevation at the beginning of the flood was assumed at elevation 674.5 M.S.L. Reservoir stage-storage data and stage-discharge data were taken from the SCS hydraulic calculations available. The principal spillway was used during flood routing and storage data for pool elevations above the dam crest were extrapolated from SCS data. Spillway ratings were adjusted to accomodate the dam crest as an overflow wier during periods of pool elevations above the dam crest.

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

Table 5.1 RESERVOIR PERFORMANCE

	Normal Flow	Hydrograph	
		½ PMF	PMF
Peak Flow,CFS			
Inflow	18	8248	16,496
Outflow	6	6004	16,238
Maximum Pool Elevation Ft, MSL		705.2	708.1
	-		
Non-Overflow Section (El 706.7 MSL)			
Depth of Flow, Ft	-	-	1.4
Duration, Hours	-	-	3.0
Velocity, fps**	-	-	5.8
Emergency Spillway (El 700.1)			
Depth of Flow, Ft	-	5.2	8.0
Duration, Hours	-	9.5	11
Velocity, fps**	-	9.8	12.6
Tailwater Elevation Ft. MSL	636.5	638.2	643.5

5.7 Reservoir Emptying Potential: A 36-inch circular gate at elevation 647.0 M.S.L. will drain the reservoir through the 36 inch pipe. Assuming that the lake is at normal pool elevation (674.5 M.S.L.) and a reservoir inflow of 18 CFS is maintained, it would take less than one day to lower the reservoir to elevation 647 M.S.L.. There are no methods for lowering the reservoir below this elevation.

5.8 Evaluation: Hydrologic and hydraulic determinations of the project as prepared by the SCS appear reasonable. The appropriate spillway design flood is the ½ PMF due to the "significant" hazard conditions existing downstream. The dam will be overtopped by the PMF by 1.4 ft for a period of 3 hours which may cause severe erosion but will pass 70 percent of the PMF before the dam is overtopped.

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

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: Cherrystone Dam No. 2A is founded on alluvial and residual soils, all of which are underlain by rocks previously mapped as Wissahickon Schist. The structure includes a 30 ft± wide cutoff trench, which extends to weathered and fractured gneiss bedrock. The principal spillway is founded on this same material. The emergency spillway is cut into weathered phyllite. "As built" drawings of these various areas are shown on Sheets 2, 4, and 5, Appendix I. The test boring and test pit logs are included as Sheets 7, 8, and 9, Appendix I.

The dam site is located within the Piedmont Physiographic Province of Virginia, which is underlain by igneous, metamorphic and sedimentary rocks of Precambrian through Triassic age (see Reference 3, Appendix VI). Pittsylvania County lies entirely within the Piedmont province and most of the county is characterized by a broad and gently rolling plateau. This plateau has been dissected into a series of complex slopes by the action of streams and other erosional agents. The slopes are rounded and commonly mantled by a layer of soil and weathered rock material. The geology of the Piedmont is not as well understood as that of other provinces, because of the limited number of rock outcrops exposed. Thick residual soil covers of up to 100 ft are common. Furthermore, geologic structure is complicated by the effects of metamorphism.

The Chatham area has not been geologically mapped in

detail, therefore only limited information is available. The dam site is underlain by what is believed to be metamorphic rocks of the Wissahickon Schist Formation of Precambrian or Early Cambrian age. The detailed geologic report describes the bedrock underlying the embankment as consisting of amphibolite and hornblende - biotite - sericite - feldspar gneiss intruded with pegmalite dikes in the left abutment. The emergency spillway is underlain by sericite phyllite intruded by pegmatite dikes and quartz veins. The thickness of the rock sequence is unknown. Numerous outcrops were encountered in the abutment areas of the dam and along the emergency spillway. Foliation or "slaty cleavage" measured in scattered outcrops along the abutments appears to strike between north and 15 degrees to the northeast and dips variably from 60 to 90 degrees to the southeast. No faults were observed in the field during this investigation and geologic maps of the area do not show the presence of faults in the immediate vicinity.

The centerline of the dam is characterized by a thin soil cover, which overlies weathered gneiss bedrock. Alluvium (stream deposited materials) ranging in thickness from about 3 to 7.5 ft was penetrated in the narrow floodplain (65 ft$\pm$). The alluvium consists of SM and GM material. All soils were classified in accordance with the Unified Soils Classification System. The alluvial soils are underlain by residual soils, which are derived from the in-place weathering of bedrock.

The residuum consists of 4 ft$^{\pm}$ of micaceous, clayey silt to silty clay classified ML to CL. Very thin (4.5 ft$^{\pm}$) residual soils were penetrated in the abutments. An old log wier dam used to exist 110 ft$^{\pm}$ upstream, but was removed prior to construction of this structure. Approximately 16 ft of pond sediment (clayey silt with layers of silty sand) had accumulated behind this dam.

The potential for seepage exists within the foundation. The flood plain deposits probably range from low permeable to permeable. Electrical resistivity surveys indicated that bedrock along the centerline of the dam was generally fractured to a depth of about 24 ft and contained some water, however only small amounts of seepage were expected based upon the orientation of the dam versus the orientation of foliation in the bedrock. Pressure test results made in three test borings are presented on Sheet 9, Appendix I. The design report indicated "All materials involved at the site appear to be highly susceptible to piping and cracking. Even so, gradations are similar enough from interface to interface such that we do not anticipate any problem. Using flat excavated slopes and high placement moisture contents will help minimize the piping and cracking tendencies." The design report indicated the need for an impermeable core keyed into weathered gneiss bedrock. Some seepage was expected to occur below the cutoff, but it was not believed to be critical with respect to stability of the base, loss of beneficial storage or capacity of the drainage system.

6.2 Embankment: The upstream slope is 2.5 horizontal to 1 vertical with crest at elevation 706.7. At elevation 676.8 the slope flattens to 10 horizontal to 1 vertical forming a berm for a vertical distance of 1 ft. The slope continues at 3 horizontal to 1 vertical to natural ground. Normal pool level is elevation 674.5 or 2.5 ft below this berm. The downstream slope is 2.5 horizontal to 1 vertical.

A sloping core consisting of clayey silts classified ML and MH with 1.5 horizontal to 1 vertical upstream slope and 1 horizontal to 1 vertical downstream slope is provided to elevation 700. A typical section of the dam is included on Sheet 4, Appendix I. The core material is designated Zone 1. The downstream slope of the core is blanketed with silty sand classified SM material, which is designated Zone 3 material. Zone 3 extends to elevation 690 with a 2.5 horizontal to 1 vertical downstream slope. Zone 2 blankets the downstream and upstream sides with slopes of 2.5 horizontal to 1 vertical to elevation 706.7. On the upstream slope a small bench was constructed at elevation 676.8, below which the slope flattens to 3 horizontal to 1 vertical. Zone 2 consists of silty sands classified SM.

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 weathered bedrock and loose to compact alluvial

and 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. "As built" drawings do not show the constructed top of dam but indicate the top of settled dam estimated at elevation 706.7

Sliding within the foundation bedrock does not appear likely based upon the design load and the nature of the underlying weathered bedrock. In addition, brief field inspection and a review of the geologic data does not indicate the presence of adversely oriented weak planes or zones within the foundation rock that would act as a potential sliding plane.

Seepage was not considered a problem in design because the orientation of the dam was different than that of the bedrock foliation. Since construction reports were not available for review, an accurate determination of the foundation conditions under the cutoff trench is not possible.

The emergency spillway is separated from the dam by a broad hillside. Side slopes of 3 horizontal to 1 vertical have been cut into residual soils and weathered phyllite to form the sides of the spillway. The slopes were considered safe and stable at the time of the inspection.

6.3.2 Embankment: 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 674.5

The strength parameters described in Section 2 were used in the stability analysis. The report describing the engineering design data used in the stability analysis is included in Appendix IV. These data were reviewed along the stability analyses and were found to be acceptable. The factor of safety of the upstream slope for the drawdown condition is 1.68 as given in Appendix IV. Reference 1, Appendix VI recommends a factor of safety of 1.2. The factor of safety for the downstream slope under steady seepage condition with drain (shell) at c/b = 0.6 is 1.63. The required factor of safety is 1.5 according to Reference 1.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The Cherrystone Dam No. 2A at the time of inspection appeared sound and in a safe operating condition. Based on the "intermediate" size classification and "significant" hazard classification, the spillway design flood is the ½ PMF. The spillway will pass 70 percent of the PMF without overtopping the dam and is considered adequate.

There is no apparent problem that requires immediate action for the normal pool conditions based on the visual inspection and a review of existing records. The actual embankment structure appears to be similar to the "as built" drawings. Without the construction records, the conformance of the embankment material properties to design requirements cannot be assessed. The design factor of safety for rapid drawdown and steady seepage cases meet the requirement of Reference 1, Appendix VI,

7.2 Remedial Measures: There are no other immediate needs for remedial measures; however the following maintenance procedures should be implemented within 12 months and should be included in addition to existing annual maintenance items and procedures.

7.2.1 There is an immediate need to prevent the further driving of four-wheel drive vehicles on the embankment.

The vehicle path should be graded and reseeded in order to diminish the potential of embankment erosion.

7.2.2 The grass and weeds along the dam crest, slopes, and within the emergency spillway should be cut at least once and preferably twice a year. We would recommend maintenance in the early summer and fall. All appurtenances should be maintained in an operating condition and routine observation of structures should be recorded.

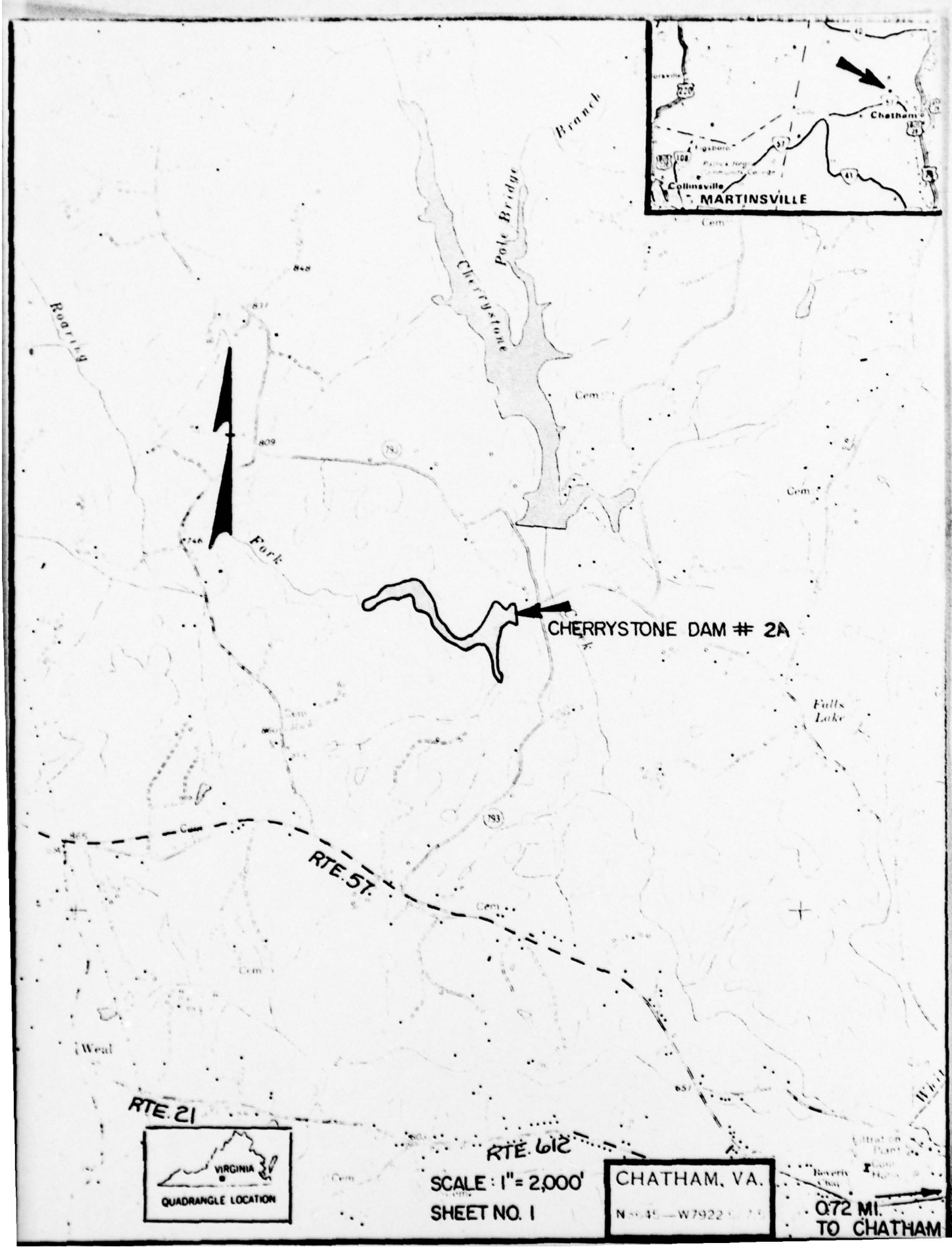
7.2.3 Removal of all trees or saplings from the above described areas should be accomplished every year.

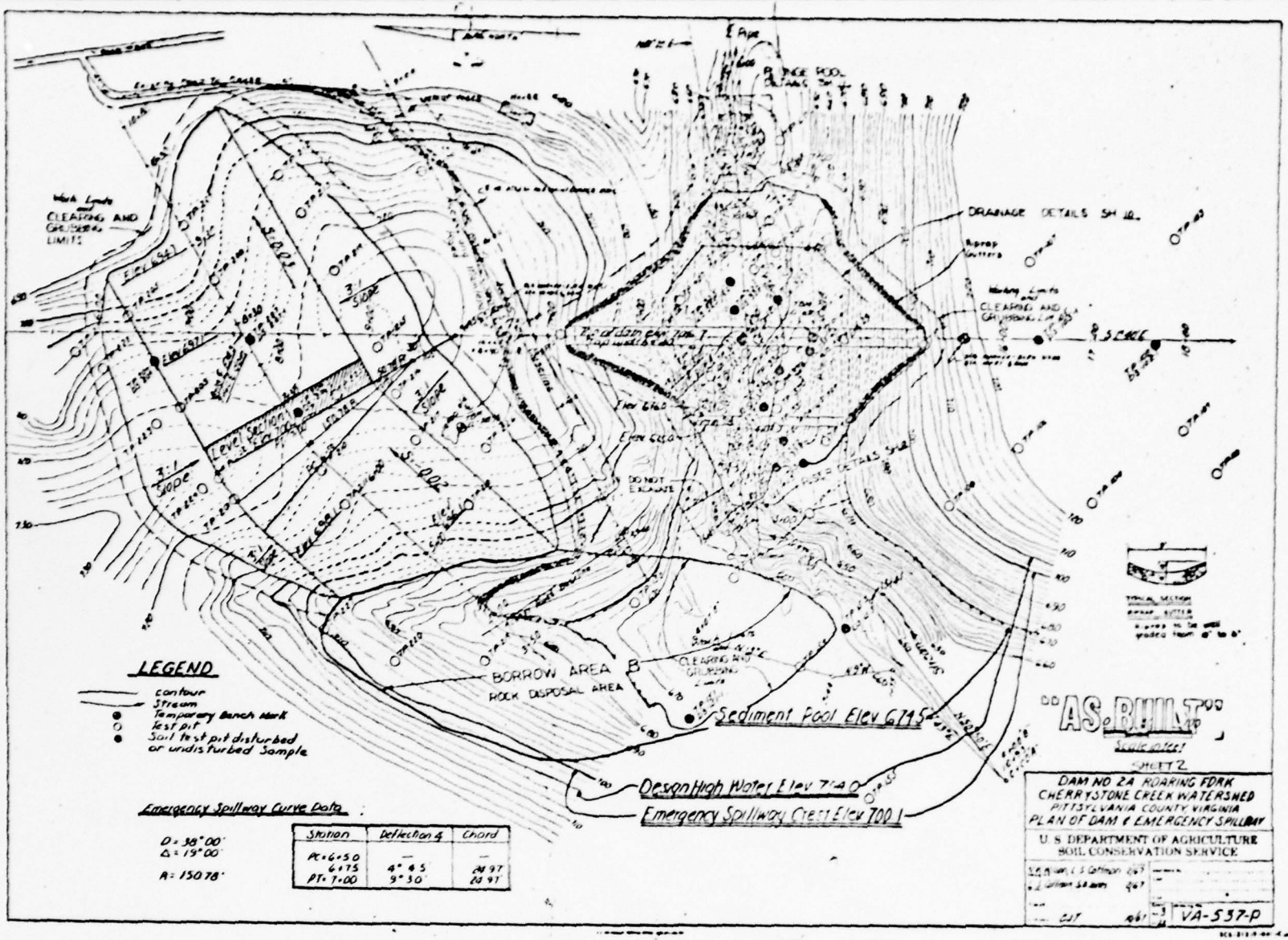
7.2.4 Quarterly inspection of the damp spot described in the vehicle path near the toe of the downstream slope should be done to detect any increase in seepage.

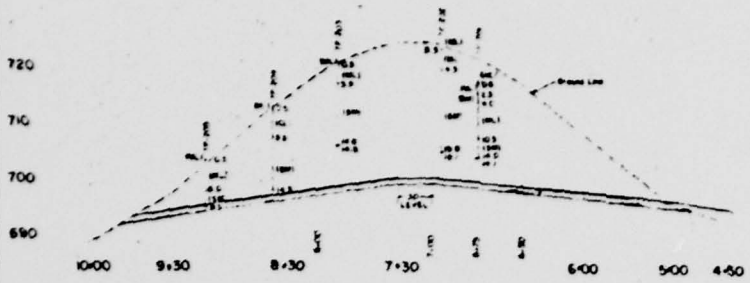
7.2.5 Install a staff gage to monitor high water levels.

APPENDIX I

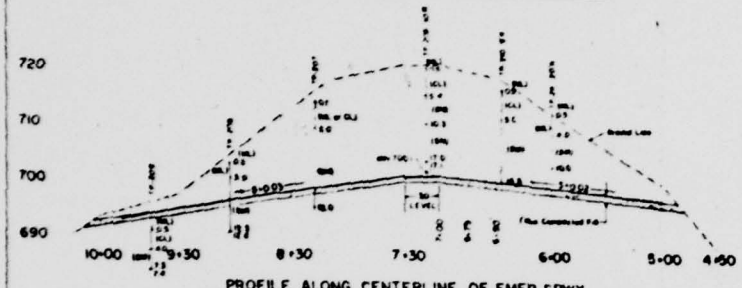
MAPS AND DRAWINGS


Chatham
Collinsville
MARTINSVILLE
Pole Bridge Branch
Cherrystone
Roaring Fork
CHERRYSTONE DAM # 2A
Falls Lake
RTE. 57
RTE. 21
RTE. 612
VIRGINIA
QUADRANGLE LOCATION
SCALE: 1" = 2,000'
SHEET NO. 1
CHATHAM, VA.
0.72 MI. TO CHATHAM

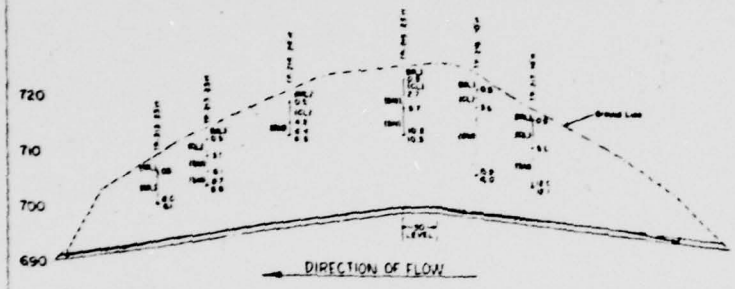

CLEARING AND GRUBBING LIMITS
DRAINAGE DETAILS SH 10
CLEARING AND GRUBBING LIMITS
3:1 SLOPE
Level Section
BORROW AREA
ROCK DISPOSAL AREA
DO NOT EXCAVATE
Sediment Pool Elev 674.5
Design High Water Elev 714.0
Emergency Spillway Crest Elev 700.1
"AS BUILT"
SHEET 2
LEGEND
contour
Stream
Temporary Bench Mark
test pit
Soil test pit disturbed or undisturbed Sample
Emergency Spillway Curve Data
D = 38°00'
Δ = 19°00'
A = 150.78'
Station
Deflection Δ
Chord
PC 6+50.0
6+75
PT 7+00.0
4° 45'
9° 30'
24.97
24.91
DAM NO 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY VIRGINIA
PLAN OF DAM & EMERGENCY SPILLWAY
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-597-P



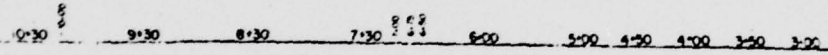
PROFILE ALONG OUTER EDGE OF EMER SPWY

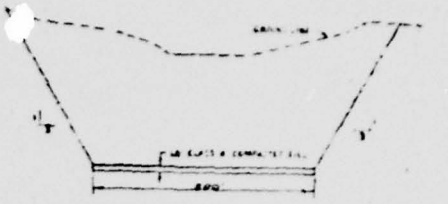


PROFILE ALONG CENTERLINE OF EMER SPWY

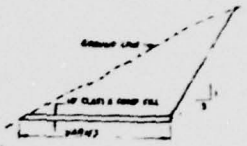


PROFILE ALONG INSIDE EDGE OF EMER SPWY





TYPICAL SECTION OF EMER SPWY
STA 7+00



TYPICAL SECTION OF EMER SPWY
STA 5+00

"AS BUILT"
SHEET 3

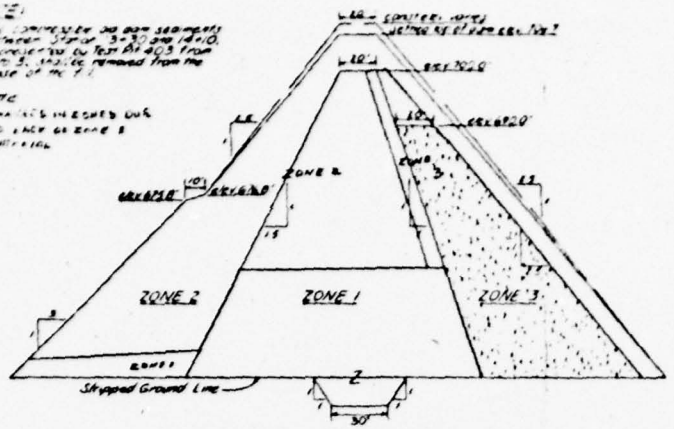
DAM NO 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
PROFILES AND TYPICAL SECTIONS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-537-P

NOTE:
The compaction on dam sediments between Sta. 3+30 and 10+10, represented by Test Pit 403 from 1 to 5, was not removed from the face of the fill.

NOTE:
[illegible] INCHES OVER TO LACK OF ZONE 3 MATERIAL



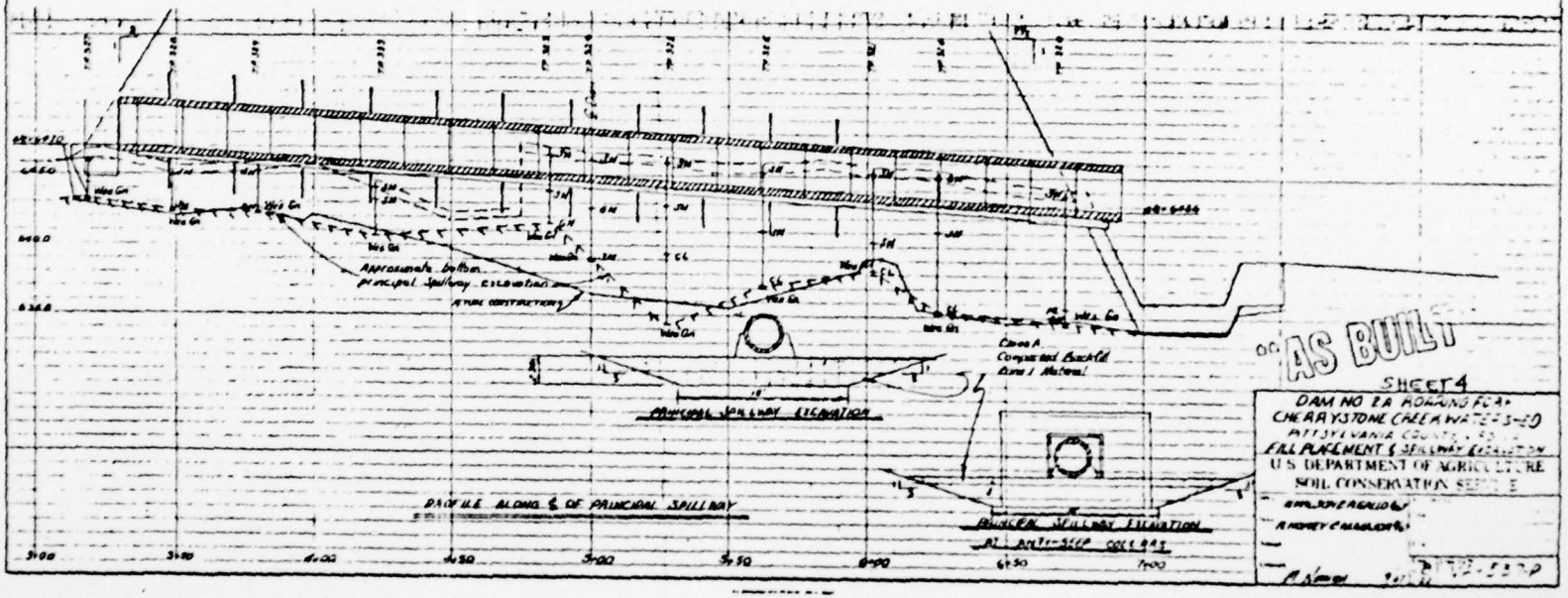
TYPICAL SECTION OF COMPACTED FILL

EARTH FILL REQUIREMENTS					
ZONE	MATERIAL	LIFT THICKNESS (Loose)	LIFT THICKNESS (Compacted)	COMPACTION	CONTROL TEST
1	Impervious to pervious fine sandstone fragments by TP 206A from 10 to 55 and TP 155 from 10 to 40 selected from the emergency spillway and placed as directed in Zone 1 emergency spillway	6"	4"	Four passes of sheepsfoot roller	A	95% of max. density ASTM D 698 Method A
2	Silty sandstone fragments by TP 207 from 50 to 90 and TP 206A from 5 to 10 & 55 to 60 from emergency spillway	6"	4"	Four passes of sheepsfoot roller	A	95% of max. density ASTM D 698 Method A
3	Unselected rock excavation from emergency spillway	6"	4"	Four passes of sheepsfoot roller	A	95% of max. density ASTM D 698 Method A

The maximum lift thickness is measured prior to compaction
For typical compaction curves refer to sheet 21

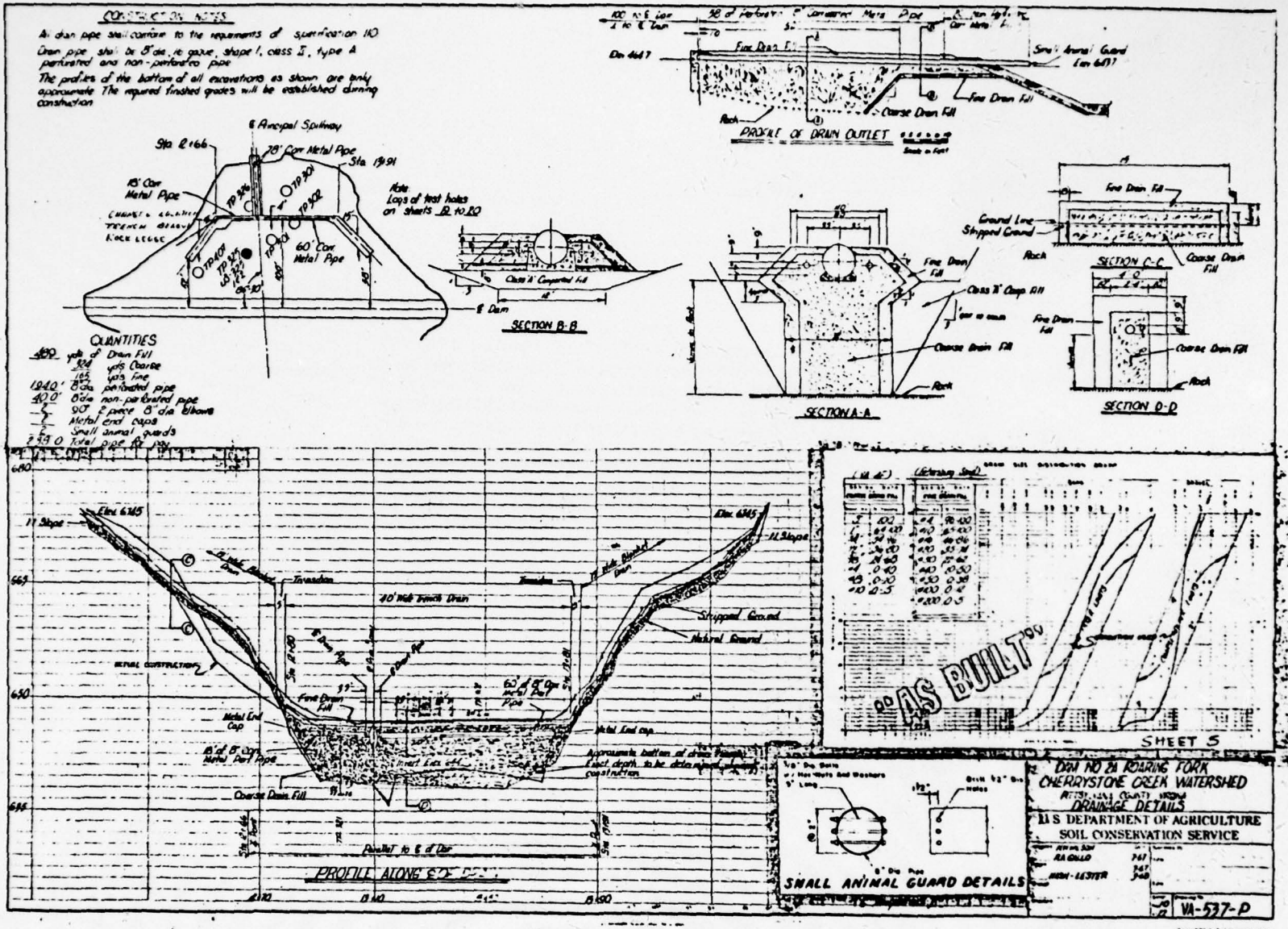
The foundation surface throughout the base area of the dam shall be scarified to a depth of 6" and compacted prior to placement of compacted fill.

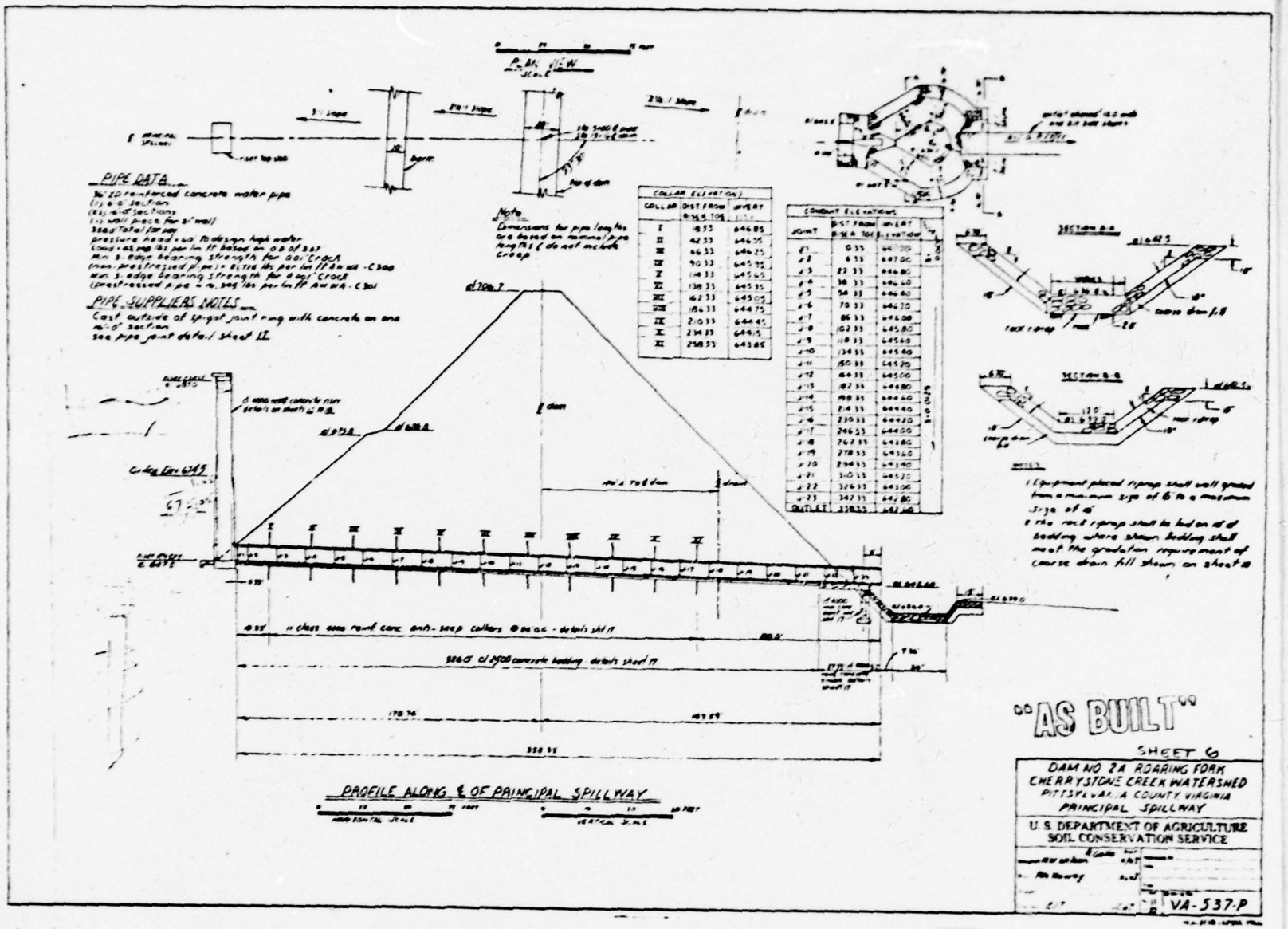
See sheets 12 to 21 for legal of test holes



SHEET 4

DAM NO 2A MORNING FLAT
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VA.
FILL PLACEMENT & SPILLWAY EXCAVATION
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE


CONSTRUCTION NOTES
All drain pipe shall conform to the requirements of specification 110
Drain pipe shall be 8" dia. 16 gauge, shape 1, class 3, type A perforated and non-perforated pipe
The profiles of the bottom of all excavations as shown are only approximate The required finished grades will be established during construction
QUANTITIES
499 yds of Drain Fill
324 yds Coarse
165 yds Fine
1940' 8" dia perforated pipe
400' 8" dia non-perforated pipe
— 90° 2 piece 8" dia Elbows
— Metal end caps
— Small animal guards
2340 Total pipe for dam
℄ Principal Spillway
Sta 2+66
78" Corr Metal Pipe
Sta 19+91
45° Corr Metal Pipe
60° Corr Metal Pipe
Note Lays of test holes on sheets 8 to 10
℄ Dam
SECTION B-B
PROFILE OF DRAIN OUTLET
Fine Drain Fill
Coarse Drain Fill
Small Animal Guard (on 60°)
Rock
SECTION A-A
SECTION C-C
SECTION D-D
Ground Line Stripped Ground
Class 'A' Compacted Fill
Elev 6345
11 Slope
Tieback
20' Wide Trench Drain
Stripped Ground
Natural Ground
Metal End Cap
Approximate bottom of drain Final depth to be determined during construction
Parallel to ℄ of Dam
PROFILE ALONG ℄ OF DAM
AS BUILT
SHEET 5
SMALL ANIMAL GUARD DETAILS
DAM NO 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
DRAINAGE DETAILS
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-537-D


PIPE DATA
PIPE SUPPLIERS NOTES
Note
Dimensions for pipe lengths are based on nominal pipe lengths (do not include coupling)
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY
"AS BUILT"
SHEET 6
DAM NO 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY VIRGINIA
PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
VA-537-P

TEST PITS (BACKHOE)

TP 1, 10'R STA. 13+44 C/L DAM, ELEV. 661.0
TW [illegible]
- 0.0 3.0 Cobbles and gravels - hard subangular gray gneiss (+4 60% est by wt) w/sand, silty - brown - wet w/streams - 1.4 loose (GM)
- 3.0 3.1 Gneiss - backhoe refusal.

TP 2, 2'R STA. 13+[illegible] C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - residual (ML)
- 0.3 3.0 Clay, silty w/cobbles (+4 20% est) yellow red - hard - moist - dry hole (CL)
- 3.0 3.6 Weathered gneiss - backhoe refusal

TP 3, 8'R STA. 12+83 C/L DAM, ELEV. 656.0
TW [illegible]
- 0.0 0.3 Topsoil - residual (ML)
- 0.3 4.0 Weathered fractured gneiss - salt and pepper and red yellow - hard - dry hole
- 4.0 4.1 Gneiss - backhoe refusal

TP 4, 3'L STA. 14+00 C/L DAM, ELEV. 663.0
TW [illegible]
- 0.0 0.3 Topsoil (ML)
- 0.3 2.3 Clay, silty - brown red - hard - moist - dry hole (CL)
- 2.3 2.4 Mica feldspar gneiss - dense refusal

TP 5, 2'L STA. 11+11 C/L DAM, ELEV. 707.3
TW [illegible]
- 0.0 0.3 Topsoil (ML)
- 0.3 4.2 Silt, clayey - red brown to 3.0 yellow red to 4.2 - hard - moist - dry hole - few cobbles and splines gneiss (ML)
- 4.2 4.3 Biotite feldspar gneiss - backhoe refusal

TP 101, STA. 19+33 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna Series (ML)
- 0.3 3.3 Clay, silty - bright yellow red - hard - moist - dry hole (CL)
- 3.3 3.6 Weathered gneiss - backhoe refusal

TP 102, 99'R STA. 17+40 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 4.7 Clay, silty - bright yellow red - hard - moist - dry hole (CL)
- UD 102-1 1.0-4.7
- 4.7 7.1 Silt, sandy - red - hard - moist - dry hole (ML)
- 7.1 7.2 Highly weathered olive gneiss - weak backhoe refusal

TP 103, 110'L STA. 17+00 C/L DAM
TW [illegible]
- 0.0 0.6 Topsoil - Fluvanna Series (ML)
- 0.6 2.6 Clay silty w/cobbles - bright yellow red - hard - moist - dry hole (CL)
- 2.6 2.7 Weathered hornblend gneiss - backhoe refusal

TP 104, 100'R STA. 16+70 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 4.3 Clay, silty - bright yellow red - hard - moist - dry hole (CL)
- 4.3 4.4 Weathered gneiss - backhoe refusal

TP 105, STA. 14+30 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna Series (ML)
- 0.3 4.4 Clay, silty - yellow red - hard - moist - dry hole (CL)
- 4.4 8.5 Silt, clayey w/sand - red - hard - moist (ML)
- UD 105-1 4.4-8.5
- 8.5 8.6 Highly weathered gneiss - backhoe refusal

TP 106, 125'R STA. 14+17 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 3.6 Clay silty - bright yellow red - hard moist (CL)
- 3.6 7.3 Silt, sandy w/clay - red - hard - moist - dry hole - some splines weathered gneiss to 3.0 feet (ML)
- 7.3 7.3 Weathered gneiss - weak backhoe refusal

TP 107, 85'L STA. 14+20 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 3.0 Silt, clayey w/cobbles - yellow red and yellow brown - hard moist - dry hole (ML)
- 3.0 3.0 Weathered gneiss - backhoe refusal

TP 108, 104'R STA. 15+43 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 3.0 Silt, clayey red w/cobbles gneiss - hard - moist - dry hole (ML)
- 3.0 3.1 Weathered gneiss - backhoe refusal

TP 109, 100'R STA. 16+00 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 4.3 Clay silty - red - hard - moist (CL)
- 4.3 8.4 Silt, sandy - red yellow - hard - moist - dry hole (ML)
- 8.4 8.5 Hornblende gneiss - backhoe refusal

TP 110, 147'R STA. 16+51 C/L DAM
TW [illegible]
- 0.0 0.3 Topsoil - Fluvanna series (ML)
- 0.3 3.4 Silt, clayey - brown to yellow red - hard - moist - 25% est angular amphibolite and hornblende gneiss cobbles - dry hole (ML)
- 3.4 3.5 Hornblende gneiss - backhoe refusal

TP 130, 291'R STA. 11+95 C/L DAM, ELEV. 667.4
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Clay silty - red - hard - moist (CL)
- 3.0 8.0 Silt, clayey - red - hard - moist - dry hole (ML)
- 8.0 8.2 Sand, silty - white - hard - weathered pegmatite

TP 131, 410'R STA. 12+50 C/L DAM, ELEV. 667.4
TW [illegible]
- 0.0 0.3 Topsoil - Nason series (ML)
- 0.3 9.0 Silt, clayey w/sand - yellow red - hard - moist - dry hole (ML)
- UD 131-1 1.0-9.0
- 9.0 9.0 Mica phyllite - backhoe refusal

TP 161, 365'R STA. 12+00 C/L DAM, ELEV. 667.0
TW [illegible]
- 0.0 0.3 Topsoil - dam sediment (ML)
- 0.3 7.3 Silt, clayey brown w/few brown lenses and mottling - hard - moist (ML)
- 7.3 8.0+ Sand, silty - brown - medium moist - dry hole (SM)

TP 132, 110'R STA. 12+72 C/L DAM, ELEV. 663.0
TW [illegible]
- 0.0 0.3 Topsoil - dam sediment (ML)
- 0.3 8.0+ Silt, clayey - brown w/few mottles - few lenses - sand, silty - hard to medium - moist - dry hole - seismic velocity 3000 ft/sec at 17.0 ft. (ML)
- UD 132-1 1.0-8.0

TP 134, 360'R STA. 13+77 C/L DAM, ELEV. 663.0
TW [illegible]
- 0.0 0.3 Topsoil dam sediment (ML)
- 0.3 9.0+ Silt, sandy w/clay - sand in pockets and lenses that range to 2' thick (+200 30% est) medium - moist - dry hole (ML)

TP 135, 207'R STA. 16+30 C/L DAM, ELEV. 689.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 6.3 Clay, silty - yellow red - hard - moist - dry hole (CL)
- 6.3 6.6 Weathered gneiss backhoe refusal

TP 136, 180'L STA 8+56 C/L DAM ELEV 718.5
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Clay silty - yellow red - hard - moist (CL)
- 3.0 4.0 Sand, silty - red yellow - hard - moist - dry hole (SM)
- 4.0 4.7 Weathered mica phyllite - backhoe refusal

TP 201, 107'R STA. 7+50 C/L DAM, ELEV. 717.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.3 Silt, clayey - yellow red - hard - moist (ML)
- 3.3 4.0 Sand, silty - red - micaceous - hard - moist (SM)
- 4.0 10.3 Silt, clayey - red - hard - moist - dry hole (ML)
- 10.3 14.0 Sand, silty - yellow brown - micaceous - hard - moist - dry hole (SM)
- 14.0 14.1 Weathered mica phyllite - gray - bucket auger refusal

TP 203, 130'R STA. 7+30 C/L DAM, ELEV. 724.5
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 4.3 Silt, clayey - yellow red - hard - moist - wavy lower boundary (ML)
- 4.3 10.0 Sand silty - brown yellow - very hard - micaceous - dips very hard - moist - dry hole (SM)
- 10.0 10.1 Weathered mica phyllite - colored red olive gray - bucket auger refusal - seismic velocity 3000 ft/sec at 34.5 ft.

TP 205, 81'R STA. 6+00 C/L DAM, ELEV. 720.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Silt, clayey - yellow red - hard - moist (ML)
- 3.0 14.0 Sand, silty - brown yellow - damp - very hard - dry hole (SM)
- 14.0 14.9 Weathered mica phyllite - bucket auger refusal - seismic velocity 3000 ft/sec at 18.1 ft.

TP 206, 31'R STA. 0+81 C/L DAM, ELEV. 711.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Clay, silty - yellow red - hard - moist (CL)
- UD 206-1 1.0-3.0
- 3.0 14.3+ Sand, silty - brown red - micaceous - hard - moist - dry hole (SM)

TP 207, 10'L STA. 0+33 C/L DAM, ELEV. 705.3
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 6.0 Silt, clayey - yellow red - hard - moist (ML)
- 6.0 8.0+ Sand, silty - brown yellow - hard - moist - dry hole (SM)

TP 208, 81'R STA. 0+22 C/L DAM, ELEV. 710.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.6 Clay silty - yellow red - hard - moist (CL)
- 3.6 10.3 Sand, silty - pale yellow white - hard - damp - weathered pegmatite dike (SM)
- UD 208-1 3.6-10.3
- 10.3 17.0 Sand, silty yellow brown - micaceous - hard - moist - dry hole (SM)
- 17.0 17.1 Gray phyllite - bucket auger refusal

TP 207, 7'R STA. 7+00 C/L DAM, ELEV. 713.3
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Silt, clayey - yellow red - hard - moist (ML or CL)
- 3.0 10.0+ Sand silty - yellow brown - hard - moist - micaceous - dry hole (SM)
- UD 207-1 3.0-10.0

TP 208, 70'L STA. 7+29 C/L DAM, ELEV. 707.0
TW [illegible]
- 0.0 0.3 Topsoil (ML)
- 0.3 3.0 Silt, clayey - yellow red - hard - moist (ML)
- 3.0 12.3 Sand, silty - micaceous - yellow brown - hard - moist - dry hole (SM)
- 12.3 12.4 Gray phyllite bucket auger refusal

TP 209, 110'L STA. 6+90 C/L DAM, ELEV. 691.1
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 4.0 Clay, silty - brown red - hard - moist (CL)
- 4.0 7.3 Sand, silty - gray and yellow brown - hard to very hard - moist - saprolite from phyllite - dry hole (SM)
- 7.3 7.4 Weathered phyllite - backhoe refusal

TP 210, 145'R STA. 0+40 C/L DAM, ELEV. 710.0
TW [illegible]
- 0.0 0.3 Topsoil Tatum series (ML)
- 0.3 3.0 Clay, silty - yellow red - hard - moist (CL)
- 3.0 16.3+ Sand, silty - yellow brown - micaceous - hard - moist - dry hole (SM)

TP 211, 100'R STA. 0+73 C/L DAM, ELEV. 711.0
TW [illegible]
- 0.0 0.3 Topsoil Tatum series (ML)
- 0.3 6.0 Silt, clayey - yellow red - hard - moist (ML)
- 6.0 10.0+ Sand, silty - micaceous - yellow brown - hard - moist - dry hole (SM)

TP 212, 109'L STA. 7+00 C/L DAM, ELEV. 709.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 6.0 Silt, clayey - yellow red - hard - moist - dry hole (ML)
- 6.0 6.1 Weathered mica phyllite - hard - backhoe refusal

TP 213, 100'L STA. 0+79 C/L DAM, ELEV. 712.9
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.9 Clay, silty - yellow red - hard - moist (CL)
- 3.9 6.1 Sand, silty - yellow brown - hard - moist w/weathered gray phyllite (SM)
- 6.1 8.7 Sand, silty - pale yellow white - hard - weathered pegmatite - dry hole (SM)
- 8.7 8.8 Weathered phyllite - backhoe refusal - seismic velocity 15,900 ft sec at 33 ft.

TP 214, 79'L STA. 0+01 C/L DAM, ELEV. 710.3
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 4.3 Clay, silty - yellow red - hard - moist (CL)
- 4.3 6.4 Sand, silty w/angular phyllite gravels - hard - saprolite from mixed phyllite and pegmatite - dry hole (SM)
- 6.4 6.5 Weathered phyllite - backhoe refusal

TP 215, 14'R STA. 9+00 C/L DAM, ELEV. 721.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 2.7 Clay, silty - yellow red - hard - moist (CL)
- 2.7 5.7 Sand, silty - white - hard - moist - weathered pegmatite (SM)
- 5.7 10.3 Sand, silty - gray - very hard - moist - saprolite from phyllite - dry hole (SM)
- 10.3 10.3 Weathered phyllite bucket auger refusal - seismic velocity 3000 ft/sec at 18.4 ft.

TP 216, 65'R STA. 9+29 C/L DAM, ELEV. 721.0
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 3.0 Clay, silty - yellow red - hard - moist (CL)
- 3.0 13.0 Sand, silty - yellow brown - micaceous - hard - moist to damp - dry hole (SM)
- 13.0 13.0 Mica phyllite - gray - bucket auger refusal

TP 217, 117'R STA. 9+50 C/L DAM, ELEV. 710.3
TW [illegible]
- 0.0 0.3 Topsoil - Tatum series (ML)
- 0.3 7.0 Clay, silty - yellow red - hard - moist (CL)
- 7.0 13.0 Sand, silty - yellow brown and white - hard - moist - mixed weathered mica phyllite and pegmatite - dry hole (SM)
- [illegible] 13.1 Biotite phyllite - bucket auger refusal

SHEET 7

DAM NO 2 ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY VIRGINIA
LOGS OF TEST HOLES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by: Samuel Rush, C.E. Young
Title: Geologist & Civil Engineer
Checked by: [illegible]
Title: Geologist

[illegible] State Conservation Engineer

VA-537-P

TP 407, 40'L STA. 12+00 C/L DAM, ELEV. 850.0
FM 12-14-55

0.0	0.5	Topsoil - colluvial in old quarry pit
0.5	6.0	Silt, sandy - brown and yellow brown - hard moist - dry hole (ML)
		MS 407-1 L.0-6.0
6.0	6.1	Weathered gneiss - bedrock refusal

TP 301, 73'L STA. 17+25 C/L DAM, ELEV. 845.0
FM 12-7-55

0.0	0.5	Topsoil - alluvial (SM)
0.5	4.0	Cobbles and gravels angular hard gray gneiss - (+6 70% est) w/sand w/silt - medium - moist - debris rubbles from old dam (GM)
4.0	8.0	Sand, poorly graded - brown - loose - damp (SP)
		MS 301-1 L.0-8.0
8.0	10.1	Sand, silty - gray - loose - medium grained - wet w/water 8.0 (SM)
10.1	10.2	Weathered gneiss - bedrock refusal

TP 401, 210'L STA. 13+35 C/L DAM, ELEV. 843.0
FM 12-8-55

0.0	0.2	Topsoil, sand - alluvial (SM)
0.2	6.0	Sand, poorly graded - loose - brown - moist (SP)
		MS 401-1 L.0-6.0
6.0	8.0+	Sandy silty - gray - soft - loose - wet w/water 6.0 (SM)

+ Continued from TP 110

AH 111, 26'L STA. 22+73 C/L DAM
FM 12-14-55

0.0	0.5	Topsoil - Fluvanna series (ML)
0.5	9.0+	Silt, clayey - red - hard - moist - dry hole (ML)

AH 112, STA. 21+01 C/L DAM
FM 12-14-55

0.0	0.5	Topsoil - Fluvanna series (ML)
0.5	8.0	Silt, clayey - red - hard - moist (ML)
8.0	9.0+	Sand, silty - yellow brown - micaceous - hard - moist - dry hole (SM)

AH 113, 37'R STA. 20+62 C/L DAM
FM 12-14-55

0.0	0.5	Topsoil - Fluvanna series (ML)
0.5	8.0+	Silt, clayey - red - hard - moist - dry hole (ML)

AH 120, 268'R STA. 20+01 C/L DAM
FM 12-14-55

0.0	0.5	Topsoil - dam sediment (SM)
0.5	8.0+	Sand, silty - brown - medium - moist w/water 8.0 (SM)

AH 129, 204'R STA. 17+35 C/L DAM
FM 12-14-55

0.0	0.5	Topsoil - dam sediment over Fluvanna series (SM)
0.5	6.5	Silt, sandy - light gray - brown - medium - moist (ML)
6.5	7.0	Silt, clayey - red - hard - moist - dry hole (ML)
7.0	7.1	Gneiss - auger refusal

AH 130, 600'R STA. 17+11 C/L DAM
FM 12-14-55

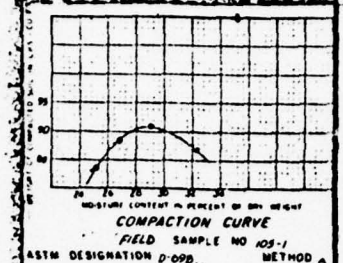
0.0	0.5	Topsoil - dam sediment (SM)
0.5	8.0	Sand, silty - brown - medium moist - dry hole (SM)
8.0	8.1	Gneiss - auger refusal

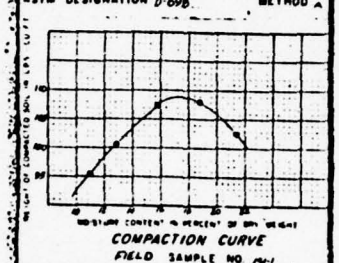
AH 131, 536'R STA. 16+05 C/L DAM
FM 12-14-55

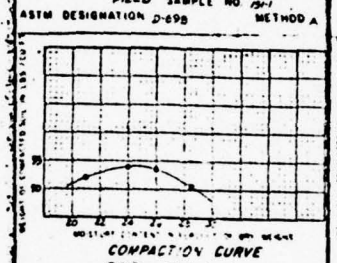
0.0	0.5	Topsoil - dam sediment (SM)
0.5	2.0	Sand, silty w/silt, sandy - brown - medium - moist (SM)
2.0	6.0	Silt, sandy - gray yellow - medium -moist (ML)
6.0	6.5	Sand, silty - gray yellow - medium - moist (SM)
6.5	9.0	Silt, sandy - gray yellow - medium - moist - dry hole (ML)
9.0	9.1	Gneiss - auger refusal

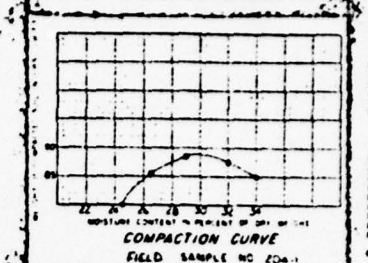
AH 132, 914'R STA. 19+06 C/L DAM
FM 12-14-55

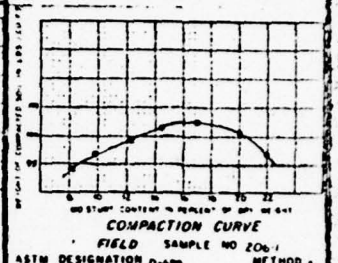
0.0	0.5	Topsoil - dam sediment (SM)
0.5	1.5	Sand, silty - brown - medium - moist (SM)
1.5	9.0	Silt, sandy - brown - medium - moist - dry hole (ML)
9.0	9.1	Gneiss - auger refusal

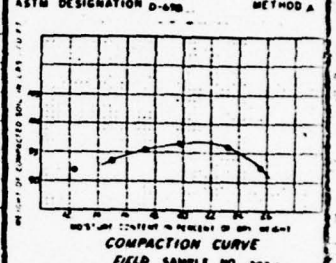


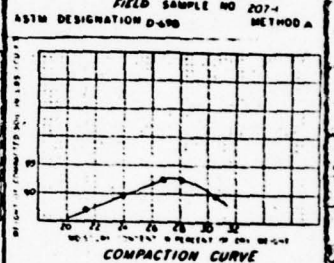












KEY

TEST HOLE PROBABLE SYSTEM

Centerline of dam	1 - 99
Borrow area	101 - 199
Emergency spillway	200+ - 299
Centerline of center structure	301 - 399
Foundation	401 - 499
Toe drain	501 - 599

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW	Well graded gravels; gravel-sand mixtures
GP	Poorly graded gravels
GM	Silty gravels; gravel-sand-silt mixtures
GC	Clayey gravels; gravel-sand-clay mixtures
SW	Well graded sands; sand-gravel mixtures
SP	Poorly graded sands
SM	Silty sands; sand-silt mixtures
SC	Clayey sands; sand-clay mixtures
ML	Silts; silty, v. fine sands; sandy or clayey silts
CL	Clays of low to medium plasticity; silty, sandy or gravelly clays
CH	Clays of high plasticity; fat clays
MH	Elastic silts; diatomaceous or diatomaceous silts
OH	Organic silts and organic silty clays of low plasticity

SYMBOLS

AH	Auger hole
TP	Test pit
MS	Undisturbed sample
MS	Undisturbed sample
PP	Pocket penetrometer reading in tons/sq. ft.
DD	Dry density
M	Moisture
pcf	pounds/cubic foot
ft/sec	feet/secondds

Ground water levels at test pits were dependent from September 6, 1955 to October 12, 1955. Moisture conditions during the investigation were normal.

List of precipitation:

Sept. 13 - approx 2" rain

All soil and rock descriptions and classification were determined by visual examination.

(ML) - Soil classification by visual inspection
ML - Unified classification by soils laboratory

"AS BUILT"

SHEET 8

DAM NO. 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
LOGS OF TEST HOLES

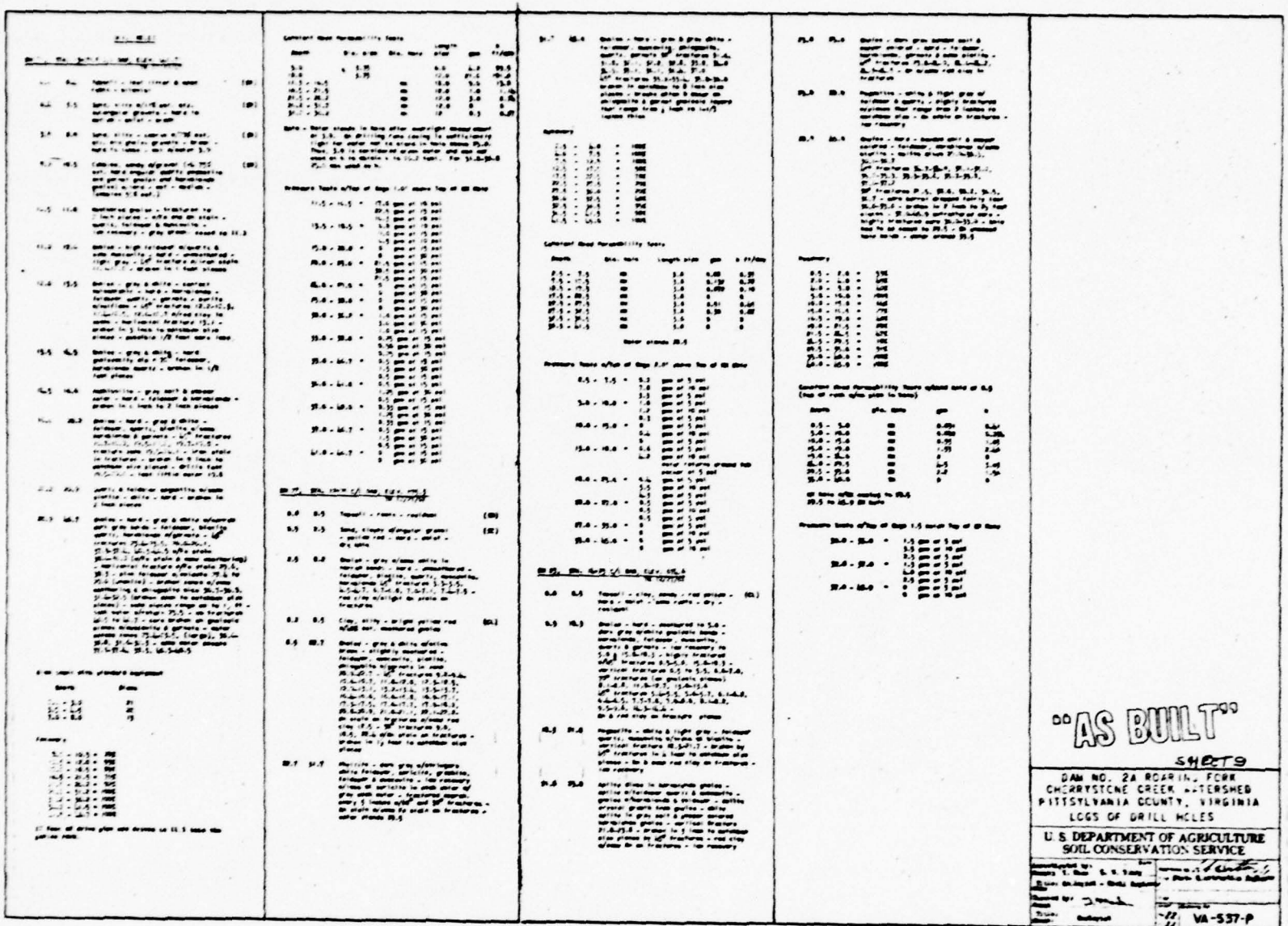
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Investigated by [illegible] Date
Drawn by S. Hart, C.H. Young
Title
Checked by [illegible]
Traced by [illegible]
Title Geologist

Approved
for State Conservationist
Title Engineer

Date
-21
-22

VA-537-P



"AS BUILT"

SHEET 9

DAN NO. 2A ROARING FORK
CHERRYSTONE CREEK WATERSHED
PITTSYLVANIA COUNTY, VIRGINIA
LOGS OF DRILL HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-537-P

APPENDIX II

PHOTOGRAPHS

UPSTREAM FACE OF IMPOUNDMENT

PHOTO #1

VIEW OF INTAKE STRUCTURE
Note: Emergency Spillway Entrance in Background

PHOTO #2

ENTRANCE TO EMERGENCY SPILLWAY

PHOTO #3

VIEW OF VEGETATION WHICH HAS BEEN STRIPPED BY 4-WHEEL VEHICLES

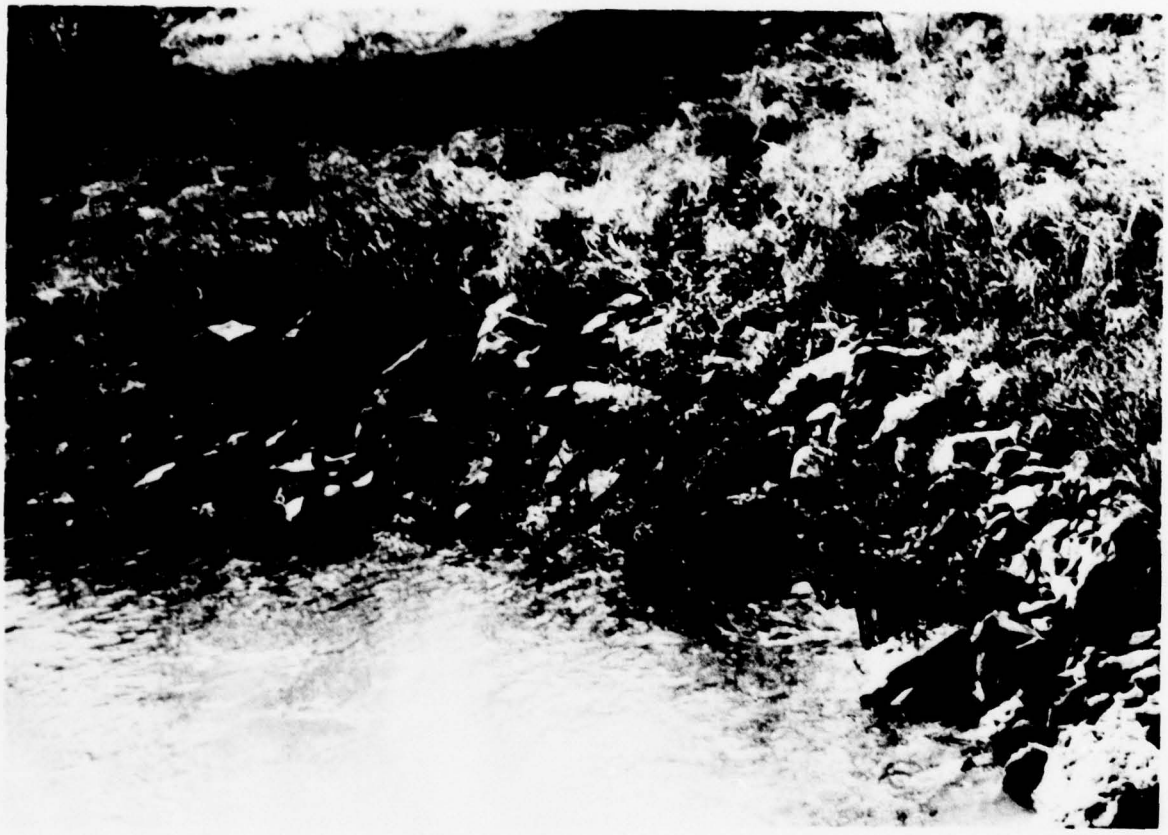
PHOTO #4

STILLING BASIN AND OUTLET CHANNEL

PHOTO #5

CLOSE-UP STILLING BASIN

PHOTO #6



CLOSE-UP RIP RAP IN STILLING BASIN

PHOTO #7

APPENDIX III

FIELD OBSERVATIONS

FIELD OBSERVATIONS

Name of Dam: Cherrystone No. 2A

County: Pittsylvania

State: Virginia

Coordinates: Lat 36° 50.8' Long 79° 25.9'

Date of Inspection: May 1, 1979

Weather: Fair, temperature 68°

Pool Elevation at Time of Inspection: 675 M.S.L.

Tailwater at Time of Inspection: 1.75 ft below invert of pipe

Inspection Personnel:

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

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

U.S.D.A. Soil Conservation Service
Russell Vaughan, Jr.

Town of Chatham, Virginia
Bert Williamson

State Water Control Board
Hugh Gildea, P.E.

Pittsylvania SWCD
Robert Stump

1. Embankment:

1.1 Surface Cracks: The slopes, crest, emergency spillway, and abutment contacts were inspected and no cracks were noted. With the exception of small trees growing on the slopes, the emergency spillway appeared to be well

maintained at the time of the inspection. The embankment slopes and crest were overgrown with tall grass (3 to 4 ft±), making observations difficult. Scattered pine trees (1 to 2" diameter) were also present, particularly near the abutments.

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

1.3 Sloughing or Erosion: No sloughing or erosion was noted except for a path formed by four-wheel drive vehicles.

1.4 Alignment: The vertical and horizontal alignment of the dam was visually observed to be in accordance with "as built" drawings.

1.5 Riprap: None present except in stilling basin. This riprap was reportedly repaired after Hurricane Agnes and appeared to be in good condition.

1.6 Junctions: Conditions appear good at the junction of the embankment and the abutments. Mica schist and garnet gneiss are exposed in the right abutment. Measured foliation strikes N5E and dips 80SE. An old roadbed or haul road is also exposed. Steeper slopes form the left abutment and a greater number of outcrops exist. Bedrock exposed consists primarily of garnet gneiss, but includes mica schist, quartz veins and some granite. Foliation strikes N to N15E and dips 60 to 90SE.

1.7 Seepage: A damp area exists in a track of the four-wheel drive vehicle path, approximately 20 ft left of the outlet pipe and 5.5 ft above the top of the pipe. No flow was observed from this spot.

1.8 Staff Gage: None found.

1.9 Drains: Surface rock drains along the left and right abutments on the upstream and downstream sides are becoming clogged with logs and other debris.

2 Reservoir:

2.1 Slopes: Gentle to moderate, wooded slopes with scattered underbrush bound the reservoir. Small amounts of debris were present. Moderately steep slopes form the abutments.

2.2 Sedimentation: None observed.

3 Downstream Channel:

3.1 Condition: No debris. Floodplain was 200 ft^{+} wide and heavily wooded. The channel was about 15 ft wide and 4 ft deep.

3.2 Slopes: 1:1 in channel and 3:1 at edge of floodplain. The downstream area consists of a thickly vegetated, broad floodplain with slightly to moderately sloping hillsides. Topographic relief appears to decrease rapidly to the east of Route 793.

3.3 Population and Facilities: None observed. Homes and industry exist in Chatham.

4 Principal Spillway:

4.1 Intake Structure: Good condition. Valve operational in 1972. Some repair then. No maintenance since. Trash rock in good condition. No debris.

4.2 Outlet Structure: 36" reinforced concrete cylinder pipe. 6" water flow. No cracking or spalling observed.

5 Emergency Spillway:

5.1 Channel Section: Good condition except where four-wheel drive path exists on side slopes.

6 Instrumentation:

6.1 Monumentation: None.

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

APPENDIX IV

STABILITY ANALYSIS

UNITED STATES GOVERNMENT

Memorandum

TO : Louis S. Button, Jr., State Conservation Engineer, SCS, Richmond, Virginia 23240 DATE: April 27, 1967

FROM : Lorn P. Dunnigan, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG 22-5 - Virginia WP-08, Cherrystone Creek, Site No. 2 (Pittsylvania County)

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 4 sheets.
2. Forms SCS-128 & 128A, Consolidation Test Data, 3 sheets.
3. Form SCS-355A, Triaxial Shear Test Data, 4 sheets.
4. Form SCS-352, Compaction and Penetration Resistance, 7 sheets.
5. Form SCS-357, Summary - Slope Stability Analysis, 3 sheets.
6. Form SCS-130, Drain Materials, 1 sheet.
7. Investigational Plans and Profiles.

INTRODUCTION

The "gallon-can" undisturbed samples of the foundation materials were rather well battered upon receipt at the Laboratory. The samples should be packed better to withstand the rough treatment in shipment. It is suggested the samples be shipped in a larger box that cannot be so readily thrown around. The box should also have handles.

Experience at the Laboratory indicates the large boxes that have been adequately packed and equipped with handles have resulted in the least sample disturbances. Good undisturbed samples have been received that were packed in sawdust, foam rubber, and styrofoam. The foam rubber needs to be tightly packed, and the styrofoam was cut to fit the sample containers.

DISCUSSION

FOUNDATION

A. Classification: Six to ten feet of Recent alluvium, consisting of silty and sandy SM and ML soils, blanket the weathered gneiss bedrock at the dam ℄ in the narrow floodplain.

An old log dam was located 110 feet upstream from the ℄ of the proposed dam. Approximately 16 feet of pond sediments were deposited behind the old dam.

2 -- Louis S. Button, Jr. -- 4/27/67
Lorn P. Dunnigan
Subj: ENG 22-5 - Virginia WP-08, Cherrystone Creek, Site No. 2
(Pittsylvania County)

The right abutment consists of weathered gneiss bedrock which is blanketed with sandy residual soils from depths of 1 foot in the lower abutment to depths of 4.5 feet in the upper abutment.

The left abutment consists of weathered gneiss with 3 feet of soil cover in the lower portion and weathered mica phyllite with 10 feet of soil cover in the upper portion.

B. Dry Unit Weight: Core opening dry densities of the undisturbed SM samples of floodplain alluvium varied from 1.34 gm/cc (83.6 pcf) to 1.52 gm/cc (94.8 pcf). In-place dry densities measured in the field varied from 79.3 pcf to 85.4 pcf.

The undisturbed ML samples, 67W2389 (403.1) and 67W2390 (404.1), of the old pond sediments deposited in the floodplain at the upstream toe of the dam, had core opening dry densities of 1.16 gm/cc (72.4 pcf) to 1.36 gm/cc (84.9 pcf). Field density measurements of the same material varied from 76.0 pcf to 82.7 pcf.

C. Consolidation: A one-dimensional consolidation test was made on the non-plastic SM sample, 67W2387 (335.2), of the sandy floodplain alluvium at the dam ℄. The void ratio-pressure curve from the plot of the consolidation test data shows the material is somewhat pre-consolidated. The percent consolidation curve shows the foundation alluvium will have a consolidation potential of approximately 4.5% under the load of the proposed 64-foot high dam.

D. Permeability: The fine sandy SM material piped during the falling head permeability test so a permeability rate was not obtained.

Electrical resistivity surveys indicate the shallow bedrock is fractured to a depth of approximately 24 feet.

E. Shear Strength: Consolidated, undrained triaxial shear tests were made on the non-plastic SM samples, 67W2388 (325.2) and 67W2387 (335.2). Saturated total stress shear parameters of $\phi = 34.5°$ and $c = 275$ psf were determined as the minimum foundation values for the SM materials from the plots of the test data.

Shear tests were not considered necessary for the undisturbed samples of the low density pond sediments near the upstream toe of the proposed 64-foot high dam as the material would certainly be too weak to support the proposed 64-foot high dam.

3 -- Louis S. Button, Jr. -- 4/27/67
Lorn P. Dunnigan
Subj: ENG 22-5 - Virginia WP-68, Cherrystone Creek, Site No. 2
(Pittsylvania County)

EMBANKMENT

A. Classification: The major portion of the borrow materials consist of residual soils (Tatum series) that have weathered from phyllite in the left abutment in the area of the emergency spillway. The weathered surface materials like Sample 67W2394 (204.1) class as MH materials and the deeper, less weathered materials like Sample 67W2396 (207.1) class as SM materials with plasticity indices of zero.

Approximately one-third of the required embankment yardage is available from Borrow Area "A" on the right abutment of the dam. The soil is weathered from hornblende gneiss and classes as low plasticity ML and MH material.

Approximately 15,800 cubic yards of rippable and non-rippable mica phyllite occurs in the emergency spillway cut.

B. Compacted Dry Density: Standard Proctor compaction (ASTM D-698, Method A) yielded maximum dry densities of 97.0 pcf to 109.0 pcf for the coarse-grained SM materials in the left abutment borrow areas. The fine-grained ML and MH borrow materials of the right abutment had Standard dry densities of 91.0 pcf to 92.5 pcf.

C. Shear Strength: Consolidated, undrained triaxial shear tests were made on the MH sample, 67W2394 (204.1), and the SM sample, 67W2396 (207.1). The test specimens were compacted to approximately 95% of Standard. Saturated total stress shear parameters of $\phi = 16°$ and c = 1275 psf were obtained for the MH material and $\phi = 26.5°$ and c = 600 psf were obtained for the SM material.

The low plasticity ML materials at compacted densities of 95% of Standard are expected to have strength similar to that of the SM material in the proposed 64-foot high dam.

D. Consolidation: The consolidation potential of the SM materials and the sandy ML materials at the base of the proposed 64-foot high dam is estimated at 3%, based on a comparison with the test data for the sandy ML sample, 66W3090, from Site No. 1.

The consolidation potential of the more plastic MH materials is expected to be higher than that of the SM materials and is estimated at 6% at the base of the maximum section.

An average settlement of 3% of the embankment height is expected to occur in the floodplain section for a zoned embankment with a fine-grained center section.

4 -- Louis S. Button, Jr. -- 4/27/67
Lorn P. Dunnigan
Subj: ENG 22-5 - Virginia WP-08, Cherrystone Creek, Site No. 2
(Pittsylvania County)

STABILITY ANALYSIS:

The proposed 64-foot high, Class B flood control structure was analyzed using a modified Swedish circle method. The shear parameters previously discussed were used in the analysis. The minimum embankment values of $\beta = 26.5°$ and $c = 600$ psf from the test on the SM borrow materials gave adequate safety factors so the greater values for the fine-grained MH material were not used in the analysis.

The downstream $2\frac{1}{2}$:1 slope without a drain yielded a safety factor of 1.50, which is adequate for the proposed Class B embankment. The upstream $2\frac{1}{2}$:1 slope with a 10-foot berm at elevation 675.5 can be expected to have a similar safety factor for the full drawdown analysis.

SETTLEMENT ANALYSIS:

Differential settlement is not expected to cause any cracking problems as the compacted ML and MH center section materials will deform sufficiently without cracking over the 2:1 slopes of the abutments.

RECOMMENDATIONS

A. Site Preparation: Complete removal of the old pond sediments from beneath the base of the dam up to the spine of hard gneiss described in the geology report is recommended to assure the stability of the upstream section.

B. Centerline Cutoff: A 30-foot wide cutoff trench, extending as deeply into the weathered bedrock as is possible to excavate with ordinary earth-moving equipment, is recommended to cut off as much seepage as possible. Side slopes of 1:1 or flatter are expected to spread differential settlements sufficiently to avoid embankment cracking. Flatter side slopes of 6:1 are recommended in the vicinity of the principal spillway trench to provide a crossing for heavy equipment working the principal spillway trench and to spread any differential settlements on the conduit at the intersection with the centerline cutoff.

Backfill with the fine-grained ML or MH materials compacted to 95% of Standard density. Care should be used to avoid drying cracks in the plastic MH materials. Place the backfill materials with moisture contents at or above optimum to obtain maximum deformability and the lowest permeability.

C. Principal Spillway: The proposed pipe location "A" at Dam ℄ Station 13+16 appears to be satisfactory; however, the bedrock profile is rather uneven and the alluvial deposits are thicker downstream than upstream. Some

5 -- Louis S. Patton, Jr. -- 4/27/67
Lora P. Dunnigan
Subj: ENG 22-5 - Virginia WP-03, Cherrystone Creek, Site No. 2
(Pittsylvania County)

differential settlements may develop along the conduit but they are not expected to be severe enough to create any problems.

Provide 3:1 side slopes for the principal spillway trench to avoid transverse cracking through the dam along the principal spillway due to differential settlements. Backfill with ML or MH materials with moisture contents at or above optimum and compact to a minimum density of 95% of Standard.

Pipe elongation calculations for a 64-foot high dam (B = 356) on 10 feet of foundation with a consolidation potential of 4.5% show a horizontal strain of approximately 0.005 ft/ft.

A ϕ angle of 28° is recommended for conduit design.

D. Drainage: Positive cutoff cannot be obtained at the centerline due to the fractured nature of the bedrock. Blanket drains placed on the bedrock on the steep abutments from c/b = 0.6 to c/b = 0.7 and a foundation drain in the floodplain are recommended to outlet seepage that by-passes the cutoff and to control the phreatic line in the embankment.

Recommended filter limits for the foundation drain are shown on the Drain Materials Form SCS-130 in the attachments.

E. Embankment Design: The following are recommended:

1. Selectively place the fine-grained materials (ML and MH) in the center section of the embankment at moisture contents at or above optimum and compact to a minimum density of 95% of Standard to form an impervious core section.

2. Place the SM materials in the outer sections at minimum densities of 95% of Standard to provide better drainage characteristics in the embankment than would be obtained for a homogeneous embankment and to test utilize the higher ϕ angle in the drained downstream slope.

3. Provide a 2½:1 upstream slope above a 10-foot berm at elevation 675.5 and a 3:1 slope below the berm.

4. Provide a 2½:1 downstream slope with a drain at c/b = 0.6.

5. Provide an overfill of 2.0 feet across the floodplain section from Stations 12+50 to 14+00.

Prepared by: [illegible]
Edgar F. Steele

Attachments

[illegible]

Much more material was logged from this site than will be needed for construction. Although the spillway cut and dam fill are almost balanced, the south abutment was logged in case the spillway material proved undesirable or insufficient. As it turns out, the recent dam alluvium and silts at the emergency spillway entrance will probably be needed along with the emergency spillway cut.

The recent dam alluvium will make good fill when compacted, but we will excavate it from under the fill in the foundation because it is highly compressible in an uncompacted state. The weathered phyllite in the emergency spillway was not sampled and analyzed due to a misunderstanding as to whether we were planning to use it. This is the same material that can be seen in road cuts in the area and also that is being used in the construction of cherrystone site 1. It will be good fill material as long as it is not exposed to the air because it becomes unstable and weathers to a powder. The sample taken from cherrystone 1 is correlated for use on this site.

The stability of the slopes was analyzed with shear parameters of ϕ = 24.5° and c = 610 psf. The soils lab used these values since they are the minumim ones of the samples tested. The weathered mica phyllite was tested (triaxial shear) during the analysis of site 1 and the parameters were found to be greater than the ones used for this site. No furthur stability analysis were thought necessary due to the conservative approach and high safety factors for a total stress analysis.

Fill moisture content during construction should be controlled very close to or above optimum in the ML and MH material to help prevent drying cracks. The shell materials should be controlled close to optimum moisture also but a wider range can be allowed than in the core, cutoff trench and conduit trench. Compaction should be to a minimum of 95% standard proctor as recommended by the soils lab. The 30' bottom width recommended for the cutoff trench was checked and found to be sufficient.

A 2 foot filter blanket, 15 feet wide, is to be built up the abutments and the seepage will outlet into a 1' trench drain and out along the principal spillway. The foundation materials and zone 3 fill are quite fine and it is felt a two-element filter will be needed to reach a 5/16" slot size. Based on our knowledge of available materials, the limits recommended by the soils lab will be very expensive because they are not locally available.

All materials involved at the site appear to be highly susceptible to piping and cracking. Even so, gradations are similar enough from interface to interface such that we do not anticipate any problem. Using flat excavated slopes and high placement moisture contents will help minimize the piping and cracking tendencies.

Consideration was given to making this a concrete gravity, variable thickness arch dam. The dam was designed by a computer program developed by Portland Cement Association, however the results are not complete at this time. This was done to give us a better idea for future possibilities

as to when a concrete arch dam is economically feasible. Two basic requirements for this type of structure seem to be:

A. Reasonably sound bedrock must be within practical reach at all points on the axis.

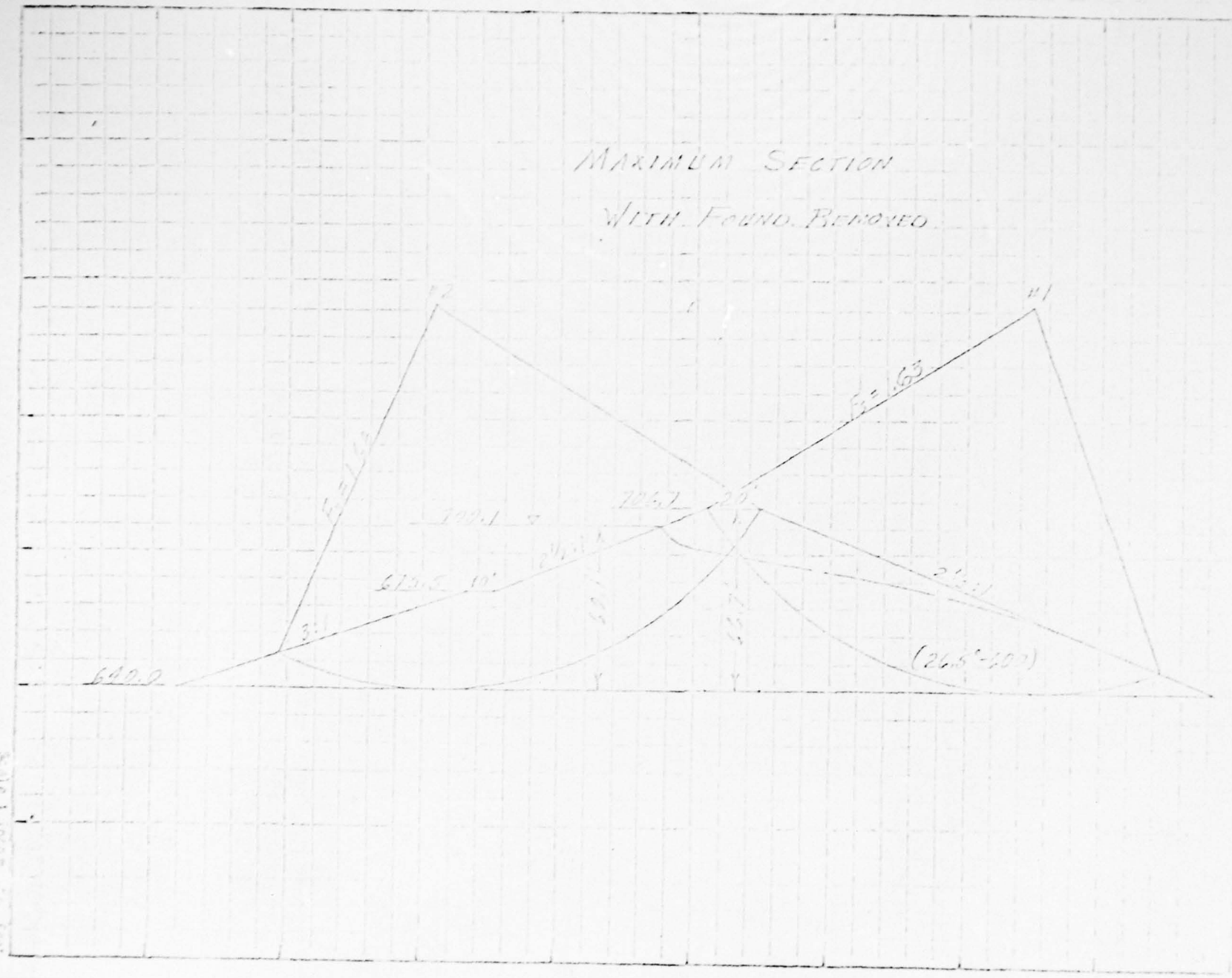
B. As a rule of thumb, the length of the dam at the crest, from abutment to abutment, should not exceed about 6 times the height from crest to floodplain bedrock.

The information will be supplied to the unit on this possibility when our study is completed.

This structure is moved 100 ft. downstream from its original location to avoid the old dam sediments and to provide a better location for the riser. If the old location was used, 30 ft. of sediment would have to be excavated to place the riser.

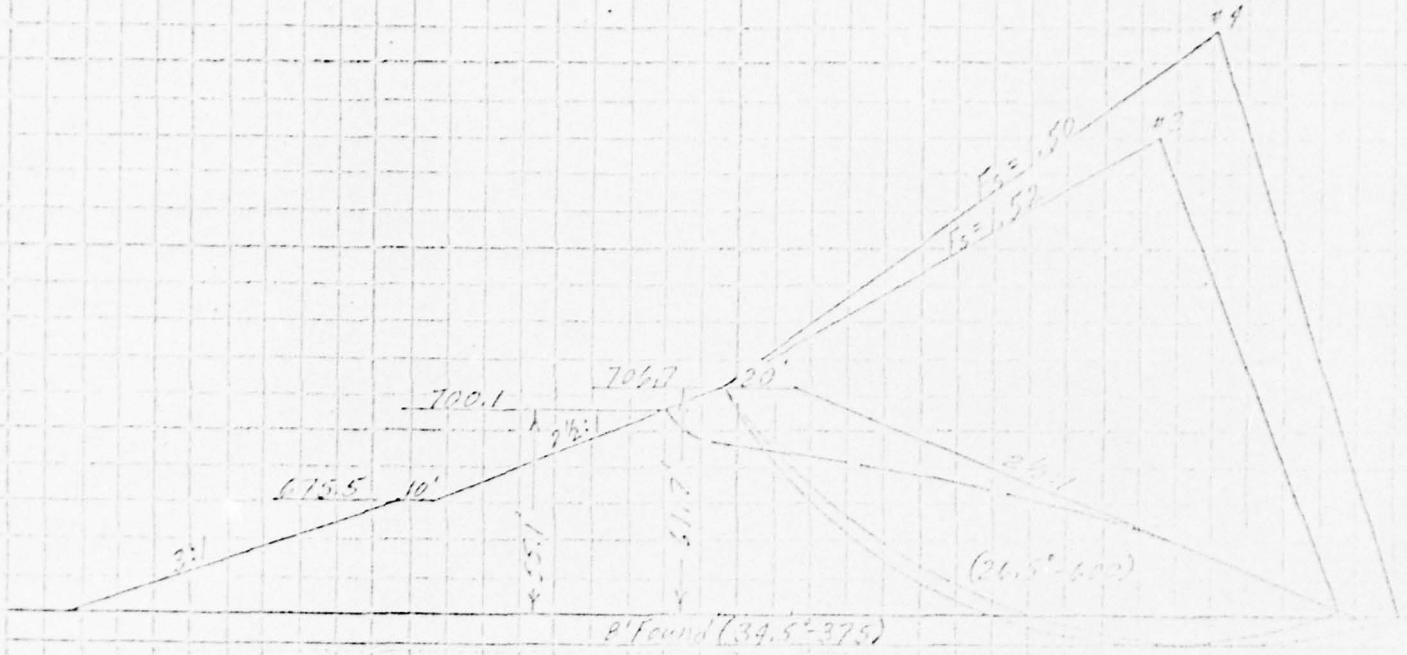
SOURCE AND USE OF MATERIALS	CLASSIFICATION	ADOPTED DESIGN DATA							REMARKS
		γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	γ_{sub} (pcf)	ϕ (deg)	$\tan\phi$	c (psf)	Sat. Shear Values.
① Found.	SM	95.6		118.0	56.5	34.5°	0.687	300	
② Found.	SM	84.5		116.5	53.0	34.5°	0.687	275	
③ Embank.	MH	91.9	110.0	123.5	61.2	16°	0.287	1075	
④ Embank.	SM	92.1	109.0	116.5	54.0	26.5°	0.499	600	
⑤									
⑥									
⑦									
⑧									

TRIAL NO.		SLOPE	CONDITIONS	F_s
			Maximum Section - With Found Removed	
1	Dn	2½:1	No drain - No berm - Arc cut from opp. shldr. thru Emb. (26.5°-600) only.	1.03
2	Up	2½:1	Full drawdown - 10' berm @ elev. 125.5 - Arc cut from opp. shldr. thru Emb. (26.5°-600) only.	1.08
			Maximum Section - With Found.	
3	Dn	2½:1	No Drain - No berm - Arc cut from opp. shldr. thru Emb. (26.5°-600) & Found (34.5°-275)	1.52
4	Dn	2½:1	No Drain - No berm - Arc cut from opp. shldr. thru Emb. (26.5°-600) & Found (34.5°-275)	1.53


MAXIMUM SECTION
WITH FOUND REMOVED
640.0
625.5
10'
3:1
2:1
(26.5'-40')

MAXIMUM SECTION

WITH FOUND



APPENDIX V

DESIGN REPORT

[illegible]
WATERSHED PROTECTION
PROJECT

DESIGN REPORT

SITE 2A
PITTSYLVANIA COUNTY
VIRGINIA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

INDEX

I- General
II- Layout
III- Hydraulic Design
IV- Foundation & Embankment Design
A- Geology Report
B- Soil Testing Report
C- Analysis
V- Structural
VI- Quantities
VII- Specifications
VIII- Notes to Consfruction Engineer

STATE OFFICE

This flood-water retarding dam is located approximately 6 miles west of Chatham, Virginia, on Chatt Creek. Sheet 1 of this report, together with the Chatham, Virginia, 15-minute quadrangle published by the U. S. Geological Survey, may be used to locate this structure.

This is one of three proposed flood-water retarding structures in the Chatt Creek watershed. The purpose of the dam is to reduce downstream flooding by providing temporary storage for the runoff from 5.10 square miles. The dam will retard a 100-year frequency storm without discharge occurring in the emergency spillway. The temporary storage is released gradually through a two-stage principal spillway system.

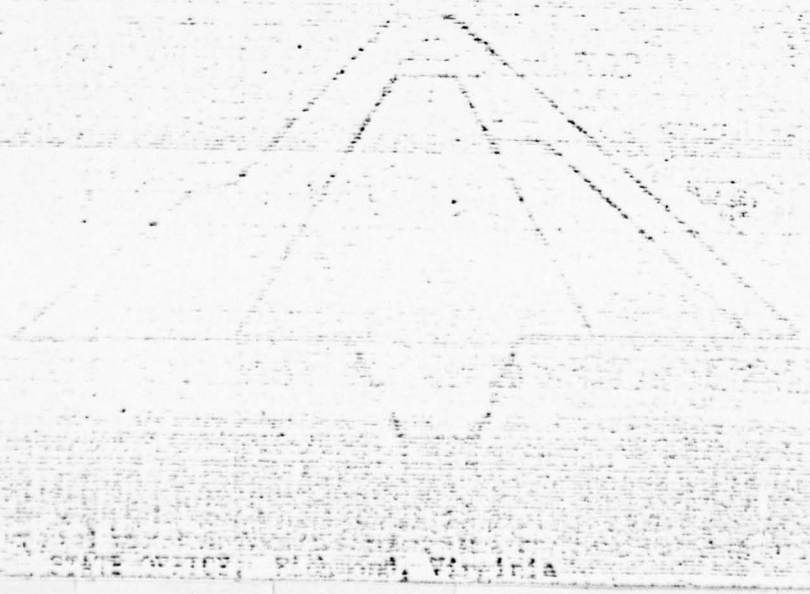
The results of hydrologic and hydraulic computations are given on sheet 4 of this report.

The structure consists of a compacted earth fill with a cutoff, extending to firm weathered rock. A drainage system is located under the downstream portion of the earth fill to control the phreatic surface and to collect seepage.

The principal spillway is a drop inlet structure consisting of a two-stage reinforced concrete riser, 36-inch diameter reinforced concrete water pipe, and a riprapped plunge pool to dissipate the energy of high velocity discharge at the outlet end of the conduit.

The emergency spillway is designed as an earth and rock cut in the left abutment.

Copies of reports covering geologic conditions and soil engineering tests are included in the design folder.



Chatt Creek, Chatham, Virginia

SECTION REPORT SUMMARY

I. Watershed data

A. Structure class	'b'	
B. Drainage area	3.495	Sq. Mi.
C. Time of concentration - T_c	2.6	Hrs.
D. Hydrologic curve number - C_n		
1. Moisture condition II	66	
2. Moisture condition III		

II. Principal spillway

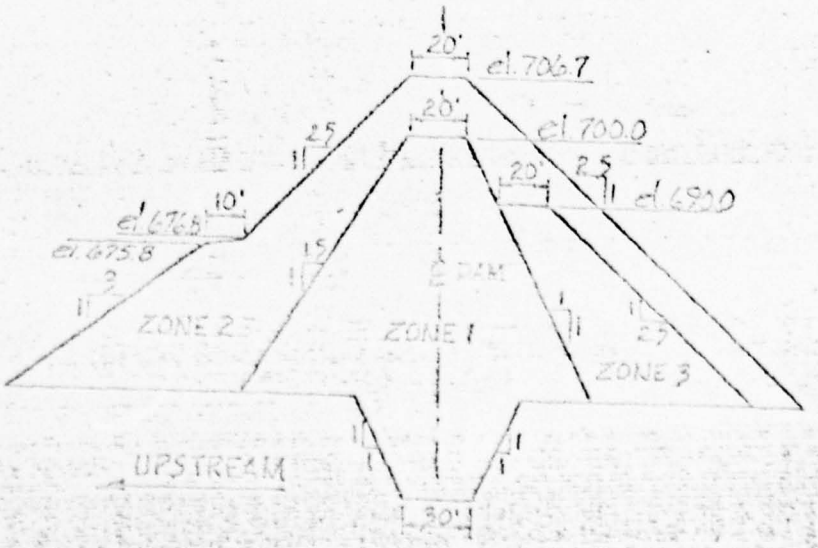
A. Conduit		
1. Size (I.D.)	36	In.
2. Length	358	Ft.
B. Riser		
1. Size	3 x 9	Ft.
2. Height	40.0	Ft.
C. Weir length	16.0	Ft.
D. Orifice size	27 x 13	In.
E. Pond drain size	36	In.
F. Type of energy dissipator	RIPRAPPED PLUNGE POOL	

III. Emergency spillway

A. Width	200	Ft.
B. Side slopes	3:1	
C. Length of level section	50	Ft.
D. Exit slope	0.03	Ft./Ft.
E. Maximum velocity at control section (D.E.W.)	8.3	Ft./Sec.
F. Duration of flow (D.E.W.) through emergency spillway	8.2	Hrs.
G. Frequency of use	1%	

IV. Earth fill

A. Height	62	Ft.
B. Volume	75,550	C.Y.
C. Compaction	CLASS A, 95% S.P.	



Typical Cross Section

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

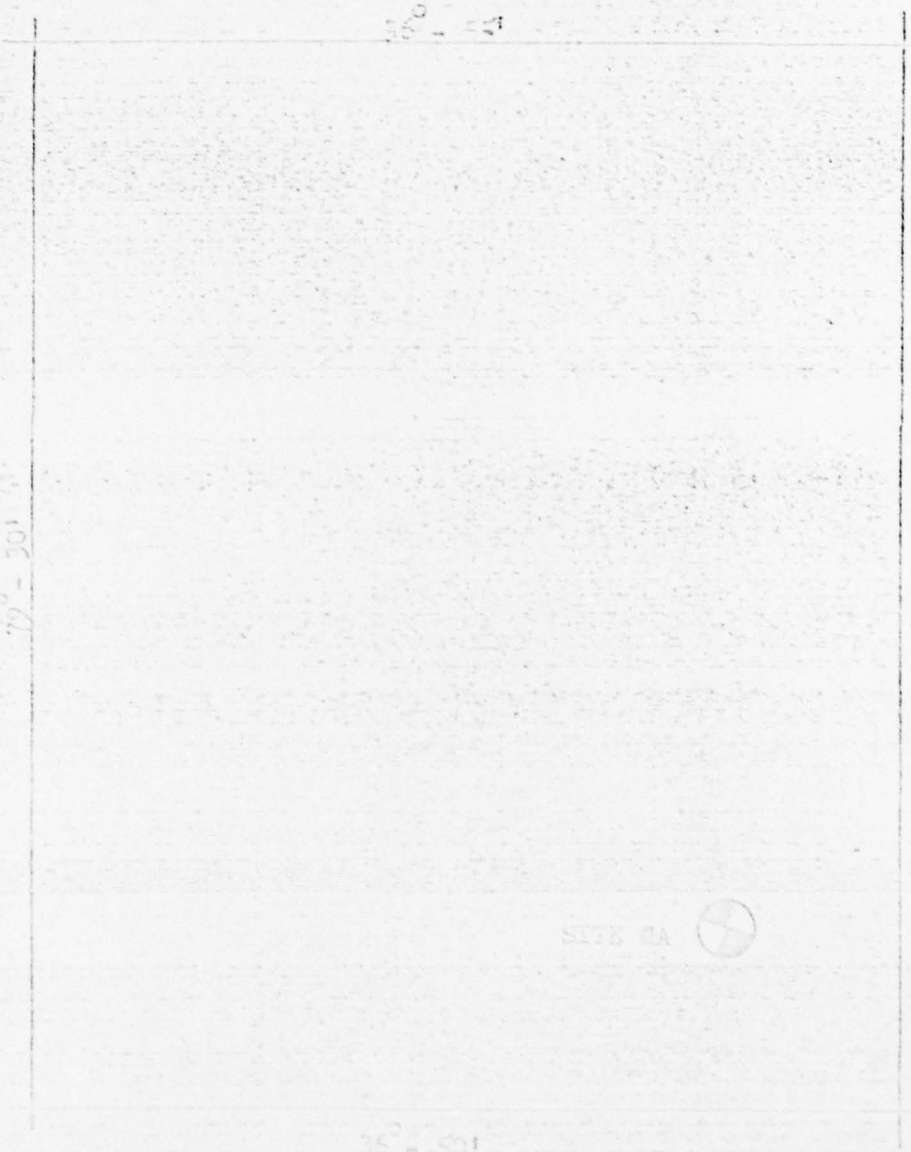
Elevation of Structure	Determining Factor	Elevation	Surface Area Acres	Storage		Inflow		Peak Outflow c.f.s.
				Acre-Feet	Inches*	Volume Inches*	Rate c.f.s.	
Invert of outlet	100 year sediment accumulation	674.5	16.5	116 ①	0.38	—	—	0
Crest of riser	③ SET TO STORE 1"	687.0	41.9	304 ②	1.00	—	—	44
Crest of emergency spillway	100 year frequency storm, moisture condition II	700.1	72.0	1000 ②	3.28	—	—	206
Design high water	1.2 X value from TR-1000 Sh. 3 ** moisture condition II	704.0	81.0	1291 ②	4.23	6.66	6,273	4120
Top of dam	1.2 X value from TR-1020 Sh. 1 ** moisture condition II	706.7	87.0	1520 ②	4.99	12.64	12,329	9950

*Volume expressed in inches of runoff from controlled watershed area of 3648 acres.
**Refer to hydrologic criteria in National Engineering Memorandum SCS-27
Time required to empty flood storage is 10.3 DAYS

① DOES NOT INCLUDE 114 ACRE-FEET OF SEDIMENT ALLOCATED TO FLOOD POOL.
② DOES NOT INCLUDE 290 ACRE-FEET OF SEDIMENT STORAGE
③ ESTABLISHED IN THE PLANNING PHASE TO PROVIDE DESIRED PROTECTION.

State Office, Richmond, Virginia

CREEKSTONE CREEK
WATERSHED PROTECTION PROJECT
DAM NO. 2A
PITTSYLVANIA COUNTY, VIRGINIA



Reference:

Chatham, Va.
15' Quadrangle

A summary of pertinent design information is given on Sheet 2 of this report.

Criteria and procedures used in this design are given in the following Soil Conservation Service publications:

National Engineering Memorandum No. 27, Limiting Criteria for the Design of Earth Dams
National Engineering Memorandum No. 50, Drop Inlet Spillway Structure
National Engineering Handbook No. 4A, Hydrology
National Engineering Handbook No. 5, Hydraulics
National Engineering Handbook No. 6, Structural Design
National Engineering Handbook No. 8, Geology
Engineering Division Technical Release No. 2, Earth Spillways
Engineering Division Technical Release No. 5, Structural Design of Underground Conduits
Engineering Division Technical Release No. 10, Storage - Discharge Relations of Detention Reservoirs
Engineering Division Technical Release No. 12, Procedure for Computing Sediment Requirements for Retarding Structures
Engineering Division Technical Release No. 18, Joint Cap Computations for Reinforced Concrete Pipe Drop Inlet Barrels
Engineering Division Technical Release No. 26, The Use of Soils Containing More Than 5 Percent Rock Larger Than The No. 4 Sieve
Engineering Division Technical Release No. 27, Laboratory and Field Test Procedure for Control of Density and Moisture of Compacted Earth Embankments, with Appendix: Details on Construction Control Tests for Rocky Soils in Compacted Earth Embankments.
Engineering Division Technical Release No. 30, Structural Design of Standard Covered Flume
Weather Bureau Technical Paper No. 40.

Copies of the publications referred to in this report may be obtained from Mr. Tom F. McGourin, State Conservationist, USDA-Soil Conservation Service, Richmond, Virginia.

L. L. Sutton, Jr.

L. L. Sutton, Jr.
State Conservation Engineer

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Pittsylvania ¼ ¼ Sec ___ T ___ R ___ Meridian Cherrystone

Quadrangle ___ Fund class P2 (PRS, WPA, etc.) Site number 2 Job group 2 Structure class b

Investigated by D. Nash, Geologist Equipment used Allis-Chalmers tractor Date 12/66
(signature and title) (Dragline, Trac. Mtd. Auger, etc.)
Caterpillar D8 Dozer

SITE DATA

Drainage area size 5.70 sq. mi., 3648 acres. Type of structure Earth fill Purpose Flood control

Direction of valley trend (downstream) east Maximum height of fill 63.2 feet. Length of fill 400 feet.

Estimated volume of compacted fill required 64352 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth of Dam (feet)
Sediment	230	15	56.6
Floodwater	1003	70	14.0

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description piedmont Topography rolling Attitude of gneissosity Dip 70°E Strike N 05°E

Steepness of abutments: Left 30 percent, Right 35 percent. Width of floodplain at centerline of dam 60 feet

General geology of site: Cherrystone #2 is located in Pittsylvania county 2½ miles north west of the town on Chatham, Virginia.

The geologic history and resulting geology present on this site presents a fascinating story to both the geologist and engineer. The first rock deposited here on this site is sericite schist. This is metamorphosed these sediments that sedimented westward from an island arc that existed over half a billion years ago. This island arc lay approximately where the modern Atlantic coast is at present. This soft rock occure in the emergency spillway area.

Next at approximately one quarter billion years ago a basic stock intruded the area to the right of the foundation. Dikes from this basic stock extended out into the foundation area. This lava was metamorphased by subsequent heat and pressure to amphibolite (black hard salt and pepper hornblende and feldspar rock) in the stock area and hornblende - biotite - dacite - feldspar gneiss in the area interlaced by dikes and old sediments.

[illegible] pegmatite dikes that cut across the area on the left abutment and in the emergency spillway. These dikes weathered more extensively than the sericite phyllite. Their greatest prevalence is in the saddle where the emergency spillway cut is placed. This, this saddle is due to lithologic control. Pegmatite dikes contain the minerals feldspar quartz and white mica. Feldspar is the main constituent. It weathers to a white saccharoidal flour.

Then followed eons of weathering and stripping with jointing of the rock. Flat deeply weathered surfaces were formed and then cut into as the uplift process rested for a while. During these periods some flattening was achieved. The first of these, or the Schooley peneplane, rides high on the tops of the hills and does not effect the structure. The second flattening was the Harrisburg peneplane. It is on this old surface that the emergency spillway is placed.

Finally in the middle of the 19th century a log weir dam was built. The centerline of this dam was 110 feet upstream from the centerline of our proposed dam. The logs were bolted to the gneiss rock by square iron bolts that measured 1x1x24 inches. A rock race was installed that follows the left abutment to an old stone mill 400 feet downstream from the log wier dam. The height of the old dam, that has now been completely washed away, was 20 feet. The impact of the old dam on the site is that former dam deposited approximately 16 feet of pond sediment (CL with layers of SM) upstream. This modern sediment was investigated for borrow.

The stream pattern is strongly entrenched dendritic. The strength of this entrenchment is shown by the fact that Roaring Run flows through hard hornblende gneiss although softer sericite phyllite occurs on the left abutment. Roaring Run cut a deep narrow gash into the pond sediments after the breakof the old dam in 1905.

Methods and Procedures

1. Soils to be used as fill material were classified by the USDA classification system. This is primarily to establish a correlation of materials. Layers within these soil profiles are classified by the Unified system.

2. Dry densities were taken with the Eley Volumeter and the Speedy Moisture Tester. Test experience has shown that these densities often run high in fat clays (CL and CH). This is due to the inability of the steel balls to properly pulverize the clay. Thus, all of the moisture does not come into contact with the calcium carbide.

3. [illegible] was used in the foundation area. These measurements are influenced by moisture conditions. Consideration should be given to moisture, density, and texture (from undisturbed samples) in the evaluation of this data.

4. Seismic velocities were checked in the emergency spillway area to determine the rippability of the sericite schist. In the pond sediments area of the permant pool the seismic surveys were used to determine the depth to gneiss rock.

5. The resistiviter was used to gain an indication of the fracturing of the gneiss in the foundation area. Water was determined to be present in the rock from these surveys.

Centerline of the Dam

The centerline of the dam is located on weathered fractured gneiss. Minerals present in this rock are black hornblende, white feldspar, biotite mica, and muscovite mica. The attitude on the gneissocity at the centerline of the dam is N05°E, 70°E. The rock is hard. The rock was formed by the injection of basic dike rock into sediments. Subsequent to this injection the rock was metamorphised.

This metamorphism partially integrated the acid and basic cations present. However, bands of black hornblende feldspar gneiss occur alternating with bands of lighter muscovite-biotite feldspar gneiss. Electrical surveys indicate that the rock is fractured to a depth of approximately 24 feet. This fracturing is not noticeable at the surface.

The floodplain at the centerline of the dam is narrow. It extends from station 13+10 to station 13+75 on the dam centerline. Alluvial SM and GM material is present in the narrow floodplain. This alluvium ranges in depth from 3.0 to 7.5 feet.

Shallow residual soil and weathered fractured gneiss occur on the steep abutments.

The soil ranges up to 4.0 feet of yellow red clayey silt (ML or CL).

To investigate the centerline of the dam 5 test pits were dug. These are numbered TP-1 through TP-5.

Principal Spillway

Two proposed pipe locations were investigated. Pipe A crosses the centerline of the dam at station 13+16 on the centerline of the dam and station 5+00 on the centerline of Pipe A. It forms a 95° 30' angle with the centerline of the dam.

Pipe B crosses the centerline of the dam at station 12+60 on the centerline of dam and station 5+00 on the centerline of the pipe. It forms a 96° angle with the centerline of the dam.

The recent sediments in the floodplain area of the foundation are complex. Generally two types of alluvium are present. The more modern of these is brown and gray, brown silty sand and sandy gravel (SM and GM). This material was probably deposited after the rupture of the former dam at the turn of the 20th century. The older sediments in the foundation consist of 5.0 feet of brown silty sand (SM) overlying 3.0 feet of gray and yellow red silty clay (CL).

Hard fractured gneiss underlies both proposed pipe locations.

On proposed pipe location A, brown and gray brown silty sand and sandy gravel (SM, SP, and GM) occur from station 3+25 to 5+10 on the centerline of the pipe. This alluvium has a depth of 3.5 feet. From station 5+10 to station 6+75 on the centerline of Pipe A 5.0 feet of brown silty sand (SM) overlie 3.0 feet of gray and yellow silty clay (CL). The elevations on this proposed pipe range from 634.0 to 641.5. This is a relief of 7.5 feet.

On proposed pipe location B recent stream alluvium occurs on the entire length of the pipe. This material is brown and brown gray SM and GM material. It ranges from 3.0 to 6.4 feet in depth. The elevations on this proposed pipe range from 635.0 to 644.5. This is a relief of 9.5 feet.

To investigate these pipe locations 20 test pits were dug. These are numbered TP 301 through TP 303 and TP 320 through TP 336.

Foundation

Foundation conditions in the floodplain are generally similar to those conditions described on the centerlines of the proposed pipe locations.

On the abutments in the foundation area very shallow residual soil occurs. This soil ranges in thickness up to 4.5 feet. It is a yellow red silty clay (CL). On the left abutment a mill race crosses the centerline of the dam at 12+70 on the centerline of the dam.

A flat bench of old alluvial gravel 100 feet wide at station 12+72 on the centerline of the dam. This bench is 12.0 feet thick on the downstream side. On the upstream side this bench is 1.0 feet thick. This is due to a spine of hornblende gneiss that is on the upstream side of the bench. It is due to this rock spine that this modern bench was preserved after the rupture of the dam.

Downstream from the foundation area 6.0 feet of loose sand (SP) occurs in the outfall channel of pipe A. This alluvium was sampled (DS 601-1) for possible use as filter material.

Hornblende, feldspar, biotite, and muscovite gneiss underlies the foundation area.

Besides the holes on the centerlines of the dam and pipes, 9 test pits were dug in the foundation area. These are numbered TP 401 through 407, 501 and 601.

Emergency Spillway

The centerline of the emergency spillway crosses the centerline of the dam at station 7+60 on the centerline of the dam and station 8+18 on the centerline of the emergency spillway.

The centerline of the dam has a 30° dog leg to the left at station 9+95. At approximately station 9+55, on the centerline of the dam the gneiss in the foundation borders mica phyllite. Thus, whereas the foundation is underlain by gneiss the emergency spillway is underlain by mica phyllite.

The phyllite as observed in a road cut downstream from the emergency spillway is generally highly fractured. Black manganese oxide occurs on the fracture planes that are generally one foot apart. Cross fractures are present. The weathered phyllite in the road cut is soft and crumbles on handling.

This mica phyllite is a softer rock than the gneiss. It is derived from metamorphised sediments. Interspersed within the mica phyllite are dikes of weathered pegmatite that are approximately 3 feet in thickness. Approximately 15,800 cubic yards of rippable and nonrippable mica phyllite occurs in the emergency spillway cut.

Residual soil weathered from mica phyllite (Catoctin series) occurs in the emergency spillway cut area. This soil has 4.0 feet of yellow red silty clay (ML and CL) below the topsoil. Below this B horizon of clay accumulation the C horizon is a yellow brown micaceous silty sand (SM) that ranges from 2 to 11 feet in thickness. Interspersed within this C horizon of material weathered from phyllite is a pale yellow white silty sand (SM) that is weathered from pegmatite.

Approximately 25,000 cubic yards of soil material is present in the emergency spillway cut.

To investigate the emergency spillway area 27 test pits were dug. These are numbered TP 201 through TP 227.

Borrow Area

Three borrow areas were investigated. These are lettered borrow areas A, B and C.

Borrow area A is located on the slope rising above the dam on the right side of the stream valley. This borrow area extends on the centerline of the dam from station 16+00 to 23+00. The borrow area is 150 feet wide. The soil present is weathered from hornblende gneiss. In the part of the area closer to the dam the soil is shallower but has more clay. Here, 4.0 feet of yellow red silty clay (CL) occur above 3.0 feet of red sandy clayey silt (ML). In the part of the borrow area farther from the dam red clayey silt (ML) occurs overlying yellow brown micaceous silty sand (SM). Two acres are present in this borrow area approximately equally divided between the deeper and shallower soils. Approximately 24,000 cubic yards of ML and CL material is present in borrow area A.

To investigate Borrow area A 13 test pits were dug. These are numbered TP 101 through TP 113.

Borrow Area B is upstream from the dam on the left side of the permanent pool. It extends from the upstream edge of the emergency spillway cut into the permanent pool area. On the higher elevations present in the borrow area in and above the permanent pool residual soil weathered from phyllite (Catum series) occurs. This is similar to the Tatum series described in the emergency spillway. At a lower elevation on the hillside is a colluvial soil derived from this residual material (Seneca series). This soil has 9.0 feet of yellow red clayey silt (ML) present. In the floodplain 17.0 feet of recent dam sediment is present. This sediment which has accumulated within the last 150 years is brown mottled clayey silt (ML) interbedded with lenses of brown sand (SM).

Borrow Area B covers 2½ acres. An estimated 40,000 cubic yards of material is available here. The lenses of SM material in the ML dam sediment should mix to give a ML. General mixing of the residual, colluvial and alluvial materials should yield a ML. Approximately half of this borrow area is below the permanent pool elevation with half above permanent pool.

To investigate borrow area B 6 test pits were dug. These are numbered TP 150 through TP 155.

Borrow Area C is located in the floodplain area of the permanent pool on the right side of the stream valley. Recent dam sediment occurs here. This soil has an average of 8.0 feet of ML alluvium interlayed with SM lenses. This borrow area covers 12 acres. Approximately 18,000 cubic yards of material is available here.

To investigate area C 5 test pits were dug. These are numbered TP 128 through TP 152.

SOIL AND FOUNDATION INVESTIGATIONS

Location Pittsylvania County Owner

Watershed Cherrystone Creek Sub-watershed Roaring Run Site No. 2

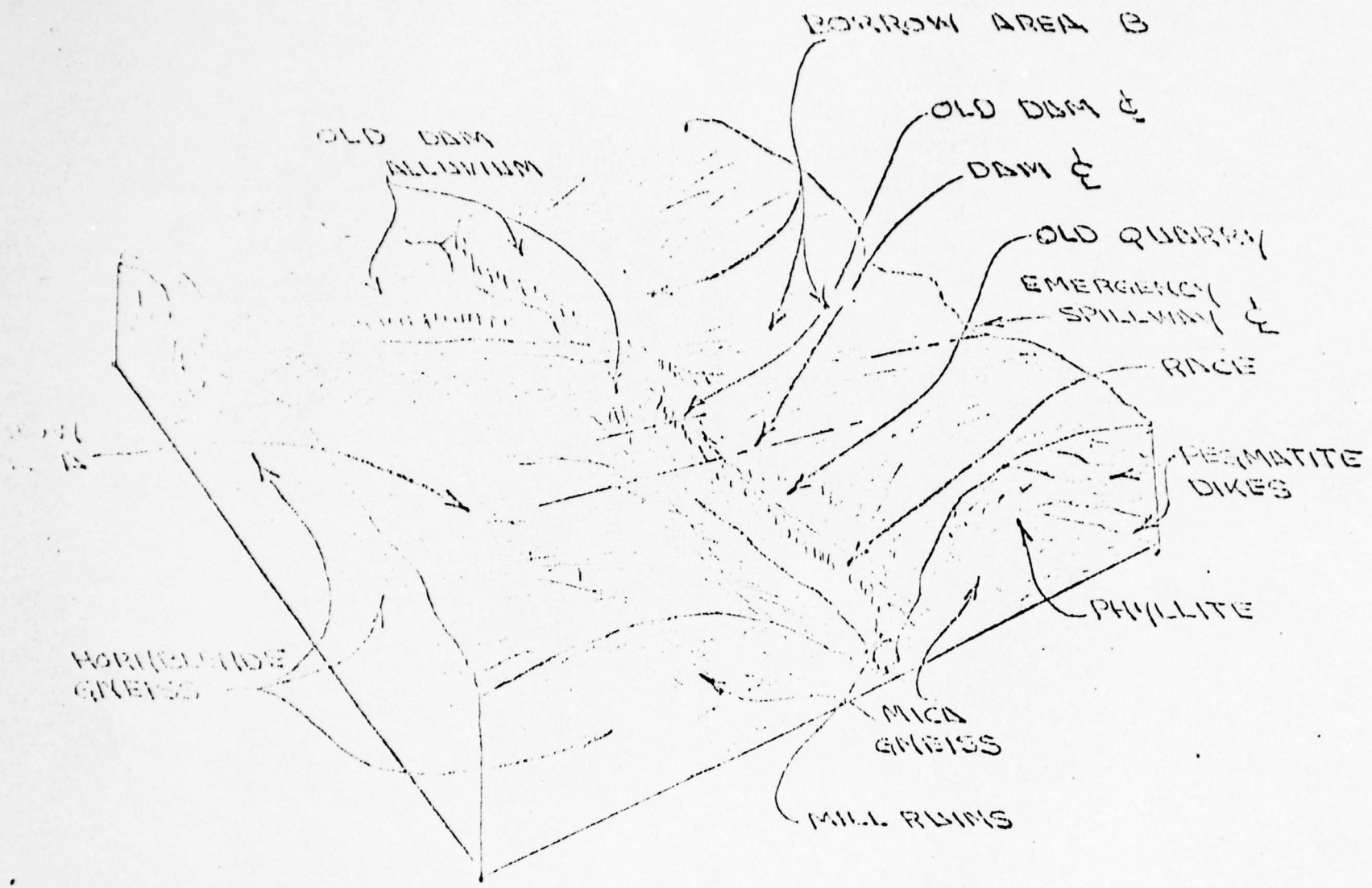
Submitted by Mack T. Date 1-15-57

Sent by truck (carrier) Government B/L No.

Lab. No.	Field Sample No.	Sample Description: Location	Grid or Station	Depth: From	Depth: To	Type of Sample: Undist.	Type of Sample: Dist.
	102-1	Borrow Area A	05'R 17+69 C/L Dam	1.0	4.7		large
	105-1	" " "	16'+38 C/L Dam	4.4	5.5		"
	151-1	Borrow Area B	418'R 12+54 C/L Dam	1.0	9.5		"
	153-1	" " "	318'R 14+29 C/L Dam	1.0	9.5		"
	204-1	EAS	31'R 6+61 C/L Dam	1.0	5.5		"
	206-1	"	81'R 8+22 C/L Dam	5.4	10.3		"
	207-1	"	7'R 7+68 C/L Dam	5.0	19.0		"
	303	C/L Pipe	41'L 13+51 C/L Dam	1.8	6.3		"
	324-1	" "	02'R 13+31 C/L Dam	1.0	4.0		"
	332-1	" "	142'R 13+50 C/L Dam	15.0	15.0		"
	333-1	" "	76'R 13+36 C/L Dam	1.4	4.0		"
	401-1	Foundation	15'R 13+66 C/L Dam	1.0	1.3		"
	407-1	"	40'L 12+44 C/L Dam	1.0	6.0		small
	501-1	Toe Drain	75'R 13+25 C/L Dam	4.0	8.0		"
	601-1	Outfall Channel 216'R13+55 C/L Dam		1.0	6.0		large
	rock	old quarry					"
	322-1	C/L Pipe	28'L 13+05 C/L Dam	4.0	5.0	can	
	322-2	" "	" " "	7.0	12.0	"	
	325-1	" "	60'L 12+96 C/L Dam	1.0	2.0	"	
	325-2	" "	" " "	5.0	5.5	"	
	335-1	" "	36'R 13+34 C/L Dam	1.0	2.0	"	
	335-2	" "	" " "	2.0	3.0	"	
	403-1	Foundation	38'R 13+80 C/L Dam	2.0	3.0	"	
	404-1	"	14'R 13+59 C/L Dam	2.0	3.0	"	

Original to Soils Laboratory
Copy to Eond WP Unit
Distribute other copies as directed by State Conservationist

VA-537-G



BLOCK DIAGRAM OF SITE - CHERRY STONE #2

VA-537-G

In West Virginia County Pittsylvania Watershed Cherrystone Subwatershed Roaring Fork

Site Number 2 Site group I Structure class b Investigated By Geologist Date 12/66
(Signature and title)

INTERPRETATIONS AND CONCLUSIONS

1. The cutoff should be taken to rock in the floodplain and on the abutments. Slight water may pass through the rock. Slight fracturing was observed in the gneiss in the foundation area. The floodplain is narrow. Cutoff should be good although the resistivitor indicates fracturing to be present.

2. With the above conditions in mind, the installation of a toe drain should be considered.

3. The small bench of recent dam sediment that occurs 150 feet right of station 13+75 on the centerline of the dam, has a dry density that ranges 76.0 to 82.7 pcf for ML material. The depth of this bench ranges up to 17.0 feet on the downstream side. This bench should not be considered for removal. The reason for this is that there is a spine of hard gneiss on the upstream edge of this bench. This spine comes within 1 foot of the surface of the bench. (TP 402) This rock will stop any of the light ML from sliding.

   If proposed pipe A is used the remaining foundation should present no problems in bearing strength of soil material.

4. Two proposed pipe locations were investigated. Pipe A has a lower rockline that is less regular than pipe B. Pipe A has a short straight outfall channel. Pipe B has a curved outfall channel that passes through loose SP material. Pipe A will have a water problem for the stream will either have to cross the pipe location or pass through gneiss rock that outcrops upstream from the small bench in the foundation.

   Weighing these factors the geologist favors the pipe A location. The reason for this is that the curved outfall channel of pipe B through loose SP material could be a serious problem. It will be hard to handle the water problem during construction of a pipe on location A. However, this can be solved by pumping if necessary.

some rock will have to be removed from both proposed pipes. The lesser quantity of rock will have to be removed from proposed pipe A.

Use of pipe A will remove some soft gray CL material that has a dry density that ranges as low as 77.8 pcf. Even for a 63 foot high dam the small amount of this material in the foundation should not present a stability problem. Removal of this CL material by replacement with the clay cushion under the pipe could however be advantageous for foundation stability.

5. Approximately 15,800 cubic yards of phyllite rock occurs in the emergency spillway cut. Of this rock an estimated 1,200 cubic yards has a seismic velocity greater than 5,000 ft/sec. This rock is considered to be non-rippable phyllite.

   It is suggested that rock removal be placed in the contract. With lack of drilling information it is suggested that the geophysical information be used.

6. Sufficient borrow is present to construct the dam. The emergency spillway will supply 59,000 cubic yards of material for the 64,000 cubic yard dam. Placement of this material from the cut is suggested in the soil correlation chart. It is suggested that the weathered rippable phyllite present in the cut be placed on the back side of the embankment above permanent pool elevation.

   The remaining borrow can be obtained from borrow area B. B horizon of residual soil from the area covered by TP 150, TP 219, TP 220 and TP 227 can be used as core with the sandy C horizon used in the shell. Colluvial soil from the area covered by TP 151 can be used for core. The upper part of the core or the upstream shell can be constructed from recent dam sediment.

   If good core is considered necessary by design, borrow area A offers the best core material. Fluvanna series soil which is from basic rock generally has a higher clay content than Tatum series soil. One disadvantage is that Fluvanna series may have some montmorillonite clay present that may cause the soil to be well drained.

   The structure of montmorillonite resembles a coiled spring. Thus these particles do not compact tightly. A permeability test on Fluvanna soil will show if any montmorillonite is present. However, Fluvanna series does not have as high a montmorillonite content as Davidson or Lloyd series of the same basic rock catena.

   Borrow Area C can be used if necessary. But it is not considered to be needed for construction material.

7. Gneissic rock can be used as riprap. A sample of this was submitted. It is suggested that the non-rippable phyllite be wasted. On exposition the phyllite rapidly disintegrates.

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 and Ground-water Resources of Pittsylvania and Halifax Counties, Bulletin 75, Harry E. LeGrand, Virginia Division of Mineral Resources, 1960, 86 pp.
4. Section 4, Hydrology, Part 1, Watershed Planning, SCS National Engineering Handbook, Soil Conservation Service, U.S. Department of Agriculture, 1964.
5. Hydrometerological Report No. 33, U.S. Department of Commerce, Weather Bureau, U.S. Department of Army, Corps of Engineers, Washington, D.C., April 1956.