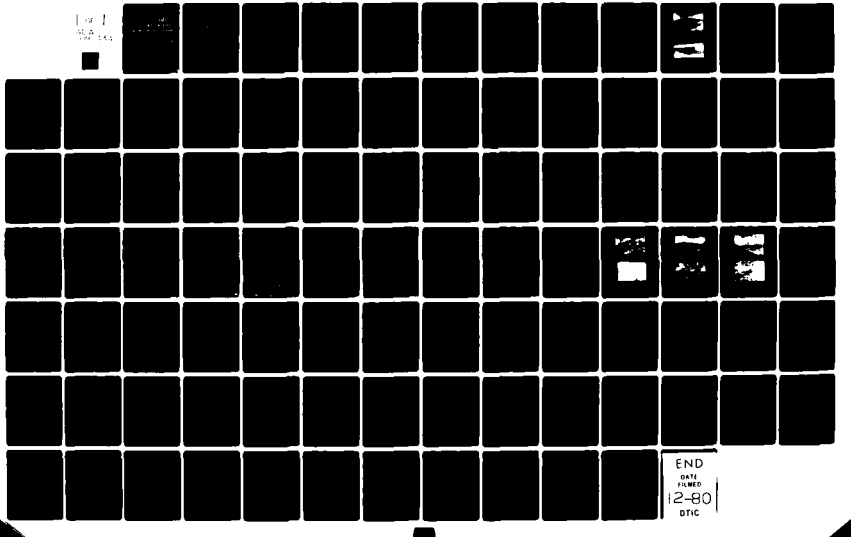
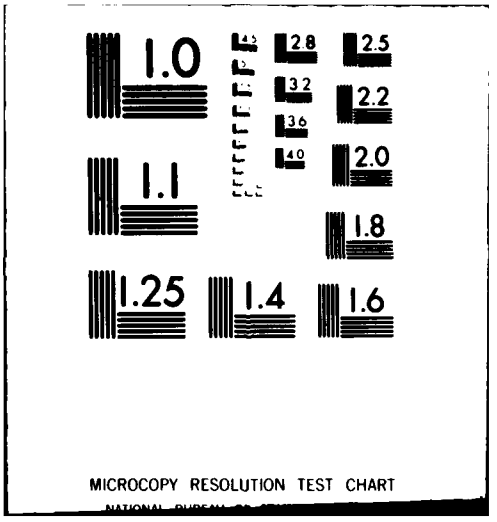
AD-A091 434 SCHNABEL ENGINEERING ASSOCIATES RICHMOND VA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. POTOMAC CREEK NUMBER 2 DAM (INVENT--ETC(U)
AUG 80 R E MARTIN DACW65-79-D-0004
UNCLASSIFIED NL



END
DATE FILMED
12-80
DTIC


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART

POTOMAC RIVER BASIN

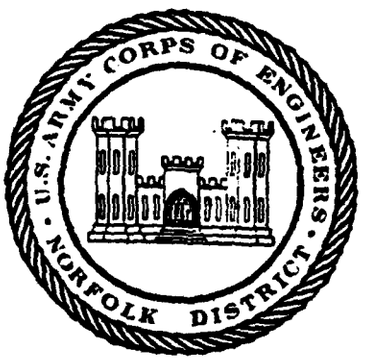
Name Of Dam: POTOMAC CREEK NO. 2

Location: STAFFORD COUNTY, VIRGINIA

Inventory Number: VA. NO. 17913

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

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

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.
AUGUST, 1980

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VA 17913	2. GOVT ACCESSION NO. AD-A091 434	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Inspection Report National Dam Safety Program Potomac Creek No. 2 Dam Stafford County, Virginia		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Schnabel Engineering Associates, P.C./ J. K. Timmons and Associates, Inc.		8. CONTRACT OR GRANT NUMBER(s) DACW 65-79-D-0004
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineering District, Norfolk 803 Front Street Norfolk, Virginia 23510		12. REPORT DATE August 1980 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

(See reverse side)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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.

POTOMAC RIVER BASIN

(6) National Dam Safety Program.

NAME OF DAM: POTOMAC CREEK (Number) NO. 2 DAM

LOCATION: ~~STAFFORD COUNTY, VIRGINIA~~

INVENTORY NUMBER: VA. [redacted] 17913),

Potomac River Basin,
Stafford County, Virginia,

PHASE I INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

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

(12) 92

BY (15) DACW65-79-D-0004

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

(9) Final rept., (11) Aug 80

(10) Ray E. Martin

394014

(13)

TABLE OF CONTENTS

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Potomac Creek No. 2
State:	Virginia
Location:	Stafford County
USGS QUAD Sheet:	Stafford
Coordinates:	Lat 38° 23.2' Long 77° 29.7'
Stream:	Tributary to Potomac Creek
Date of Inspection	1 May 1980

Potomac Creek Dam No. 2 is a zoned earthfill structure about 591 ft long and 37 ft high. The principal spillway consists of a rectangular concrete riser and an outlet pipe which extends through the structure. An earth emergency spillway is located at the left abutment with a 200 ft bottom width and 3H:1V side slopes. The structure is classified small in size and is assigned a significant hazard classification. The dam is located on a tributary to Potomac Creek approximately seven miles north of Fredericksburg, Virginia. The lake is used for flood control and recreation, is owned by Stafford County and maintained by the Stafford County Sanitation District.

Based on the criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the appropriate spillway Design Flood (SDF) is the ½ PMF. The spillways will pass 99 percent of the Probable Maximum Flood (PMF) and 198 percent of the SDF without overtopping the crest of the dam. The spillway is judged adequate.

The visual inspection revealed no apparent problems. There is no routine

maintenance operation program and no warning system. It is recommended that a warning system be established and the maintenance items listed in Section 7.2 be accomplished as part of the regular maintenance program within the next 12 months.

Prepared by:

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

Ray E. Martin, Ph.D., P.E.
Commonwealth of Virginia

Submitted by:

Original signed by:
JAMES A. WALSH

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

Approved:

Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Recommended by:

Original Signed by:
Ronald G. Vann

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

Date: AUG 29 1980

RESERVOIR AT NORMAL POOL

OVERVIEW OF DAM (UPSTREAM SLOPE)

1 MAY 1980

SECTION I - PROJECT INFORMATION

1.1 General:

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

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (see Reference 1, Appendix VIII. 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: Potomac Creek No. 2 is a zoned earthfill structure approximately 591 ft long and 37 ft high.* The crest of the dam is 14 ft wide. The downstream slope is approximately 2.5 horizontal to 1 vertical (2.5:1). The upstream slope is approximately 2.5 horizontal to 1 vertical (2.5:1) to elevation 80.6 msl. A 10 ft wide berm is shown in the design drawings (Plate No. 4, Appendix I) between elevations 80.6 and 79.6 msl. The upstream slope continues at 3 horizontal to 1 vertical (3:1) below elevation 79.6 msl. The crest of the dam is at elevation 102 msl.

The principal spillway consists of a 7.5 ft x 2.5 ft reinforced concrete riser inlet. The riser is connected to a 30 inch diameter reinforced concrete outlet pipe which runs through the dam. The riser crest overflow weir is at elevation of 94.1 msl. There is also a 1.67 ft x 1.83 ft rectangular low level inlet on the riser structure with an invert elevation of 79.1 msl which establishes the normal pool elevation. A 30 inch diameter sluice gate in the riser at an invert elevation of 69.5 msl is used to lower the pool level. The outlet pipe has a length of 200 ft and an invert elevation at the outlet structure of 67.1 msl (See PlateNo. 7, Appendix I).

An emergency spillway consisting of trapezoidal earthen channel is located at the left abutment, having a crest elevation of 95.1 msl. The emergency spillway has a 200 ft bottom width, side slopes of 3 horizontal to 1 vertical (3:1) and is located in a cut section (See Plates No. 2 and 3, Appendix I).

1.2.2 Location: Potomac Creek Dam No. 2 is located on a tributary of Potomac Creek approximately seven miles north of Fredericksburg, Virginia (See Plate No. 1, Appendix I).

1.2.3 Size Classification: The dam is classified as a "small" size structure because of the height of the dam and the lake storage potential.

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the proximity of several inhabited structures (motel and commercial facility) located several miles downstream, the dam is assigned a "significant" hazard classification. The hazard

classification used to categorize a dam is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by the Stafford County and maintained by the Stafford County Sanitation District.

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 United States Department of Agriculture (USDA), Soil Conservation Service (SCS). The structure was constructed by Draper Construction Company and Branch and Associates, Inc. and completed in 1972.

1.2.8 Normal Operational Procedures: The principal spillway is ungated; therefore, water rising above the crest of the riser inlet is automatically discharged downstream. Normal pool is maintained at elevation 79.5±, which is slightly above the crest of the orifice. Flood discharges which cannot be absorbed by storage and the riser flow through the emergency spillway at pool elevations and 95.1 msl.

1.3 Pertinent Data:

1.3.1 Drainage Area: The drainage area is 2.35 square miles.

1.3.2 Discharge at Dam Site: The maximum known flood is not known.

Principal Spillway Discharge:

Pool Elevation at Crest of Dam (elev 102)	115 CFS

Emergency Spillway Discharge:

Pool Elevation at Crest of Dam (elev 102)	10,000 CFS

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

Table 1.1 DAM AND RESERVOIR DATA

Item	Reservoir				
		Storage			
	Elevation feet msl	Area Acres	Acre Feet	Watershed Inches	Length Miles
Crest of Dam	102	59.5	708	5.65	.9
Emergency Spillway Crest	95.1	41.9	374	3.0	.7
Principal Spillway Crest	94.1	40	340	2.71	.7
Low Level Orifice	79.1	12	54	0.4	.3
Streambed at Downstream Toe of Dam	64.7	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was designed and constructed under the direction of the USDA, Soil Conservation Service (SCS) and was sponsored by Stafford County, Virginia. "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 seismic and resistivity surveys in the foundation, and excavation of 75 test pits. Subsurface profiles and a report of the investigation with foundation recommendations were prepared based upon geologic field reconnaissance, test pit data and laboratory testing. A copy of the geologic report is included as Appendix VI. Subsurface profiles are shown on Plates No. 3, 4 and 5 of Appendix I.

The dam is a zoned, compacted earthfill embankment. The earth fill requirements shown on Plate No. 4, Appendix I, specify that sand, silt and clay materials classifying as SC, ML and CL be used in the core or Zone 1 of the dam. Soil classification is by the Unified Soil Classification System, ASTM D-2487. The remainder of the embankment was constructed with assorted combinations of gravel, sand, silt and clay classifying as GC, GM and SM. Differentation of materials during construction was expected to be difficult and no distinct boundaries between Zones I and II were anticipated during construction (Sheet 6, Appendix IV). "As built" embankment slopes

for both zones are also illustrated on Plate No. 4, Appendix I.

A review of design data indicates the dam is founded on overburden and includes a cutoff trench which extends through sand and gravel to preconsolidated clays and/or sandstone bedrock. The cutoff also extends to the same materials in both abutments. No permeability test data was included with the information reviewed; however, material beneath the gravelly stratum was described as being "slowly" permeable. Details of the cutoff trench are provided on Plate No. 5, Appendix I.

A positive cutoff was not certain; therefore, an internal drainage system was constructed in order to collect seepage and control the phreatic surface within the embankment. This drainage system consists of 300 ft of 6 inch perforated corrugated metal pipe (CMP) enclosed in an envelope of coarse drain fill extending into the foundation soils. Collected water passes through two 6 inch non-perforated CMPs to the plunge pool. (See Plate No. 6, Appendix I). Six reinforced concrete anti-seep collars (See Plate No. 7, Appendix I) were installed around the principal spillway pipes and spaced at 20 ft intervals in order to control any potential piping problems along the pipes.

The principal spillway was designed as a drop inlet structure consisting of a two-stage reinforced concrete riser and a 30 inch diameter reinforced concrete outlet pipe. A riprapped plunge pool was included at the outlet end of the conduit to dissipate the energy of high velocity discharge. "As built" details are shown on Plate No. 7, Appendix I.

The emergency spillway is located in a gently sloping hillside in the abutment. The spillway is a 200 ft wide trapezoidal earthen channel bounded by 3H:1V cut slopes. The spillway is basically in cut materials; however, specifications required that the bottom of the spillway be undercut 1 ft and replaced by fill compacted to 95% of maximum dry density per ASTM D-698. Details of the spillway section are given on Plates No. 2 and 3 of Appendix I.

The design report and supplementary data provided by the SCS 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 direct shear and consolidated undrained triaxial compression tests as follows:

SECTION	SOIL	SHEAR STRENGTH PARAMENTERS	
		Angle of Internal Friction	Cohension
Embankment	SM	$\phi'_{DS} = 35.5^{o}$	c' = 375 psf
	CL	$\phi_{T} = 23.0^{o}$	c = 575 psf
	ML	$\phi_{T} = 14.0^{o}$	c = 725 psf
	SM	$\phi_{T} = 34.0^{o}$	c = 475 psf
Foundation	Sandy Soil	$\phi'_{DS} = 36.0^{o}$	c' = 225 psf
	Clay	$\phi_{CU} = 0^{o}$	c =2500 psf

The Swedish Circle Method of Analysis was used. The data included in Appendix V indicates an evaluation of 1) the sudden drawdown case (I), and 2) the steady seepage case (III) were performed. Cases I and III analyzed are in accordance with Reference 1, Appendix VIII. The upstream slope was checked for sudden drawdown for each pair (ϕ, c) of embankment design parameters. The parameters giving the lowest factor of safety were used to check the downstream slope for steady seepage. No berm and no foundation drain were assumed in the downstream slope analysis. Apparently only total strength parameters were utlized in 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 Evaluation: "As built" drawings are representative of the structure. There is sufficient information to evaluate foundation conditions and embankment stability.

SECTION 3 - VISUAL INSPECTION

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

3.1.1 General: An inspection was made 1 May 1980 and the weather was partly cloudy with a temperature of 60° F. The pool and tailwater levels at the time of inspection were 79.5 and 65.3 msl, respectively. This corresponds to normal pool and tailwater elevations. Ground conditions were wet at the time of inspection. Previous inspections have been made by the Soil Conservation Service as part of their annual inspection and reports of the inspections are included in Appendix VII.

3.1.2 Dam and Spillway: The embankment slopes were covered with 2 to 3 ft± tall grass and included scattered immature trees less than 3 inches in diameter (See Photos No. 1 and 2, Appendix II). The crest of the dam was sparsely vegetated and included some rutting as a result of vehicle traffic (Photo No. 2, Appendix II). Field measurements indicate both the upstream and downstream slopes are approximately 2.5H:1V. A 10 ft± wide berm occurs slightly above pool level along the toe of the upstream slope. The dam appears to be constructed with various combinations of sand, silt and gravel which visually range from SM to GM in accordance with Unified Soils Classification System. No surface erosion was noted on the embankment slopes.

Two wet or saturated areas were enountered along the toe of the downstream slope. The first is located at about the same elevation as the top of the principal spillway outlet. This area

is roughly 50 ft long, 25 ft wide and begins 25 ft left of the outlet. No flow or discoloration of water was observed. This area is believed to represent ponded water from recent rains. The second area is a 225 ft^{+} long saturated zone, which occurs to the right of the outlet, along the toe of the downstream slope. This saturated condition is the result of water flowing at approximately 5 gpm from a spring located immediately downstream from the embankment toe. This water flows down gradient along the toe of the slope toward the plunge pool. The area of saturation increases to a width of 25 ft^{+} near the outlet. Both saturated areas are illustrated on Sheet 1 of Appendix III.

Both abutments were well vegetated and only scattered, shallow erosional gullies (less than 1 ft deep) were noted along the embankment-abutment contacts. Surface soils in the surrounding area include alluvial and terrace deposits, which consist basically of assorted combinations of sand, silt, clay and gravel materials. Bedrock was not exposed at the site. No faults were observed in the field during this inspection and geologic maps of the area do not show the presence of faults in the immediate vicinity.

The riser structure and outlet pipe showed no signs of deterioration and were functioning properly at the time of inspection. The emergency gate was reportedly in good condition. The 6 inch CMP drain pipe present on the left side of the outlet pipe appeared to

be blocked with sediment. The right drain pipe was passing water at 2 gpm± and appeared to be functioning properly. The plunge pool riprap was intact, indicating no signs of movement or erosion.

The emergency spillway at the left abutment consists of a vegetated earthen channel with 3H:1V side slopes. Tall grass 2 to 3 ft± high was growing in the channel and on the adjacent slopes. A small group of pine trees were present near the end of the discharge channel along the base of the left cut slope (See Photo No. 3, Appendix II). Only minor surface erosion was noted in the channel.

3.1.3 Reservoir Area: The reservoir area was free of debris and the perimeter was wooded. The reservoir is located in a broad valley with side slopes at approximately 3H:1V. Sediment build-up was observed in the upper reaches of the reservoir.

3.1.4 Downstream Area: The downstream channel is located in a broad heavily wooded valley which included a 250 ft± wide floodplain. Approximately two miles downstream where Potomac Creek crosses U. S. Route 1, there is a motel and commercial facility about 10 ft and 12 ft, respectively above the streambed.

3.1.5 Instrumentation: No instrumentation (monuments, observation wells, piezometers, etc.) was encountered for the structure. A staff gage does not exist for this structure.

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

control are performed as the need arises. Uncontrolled growth encourages the development of deep-rooted vegetation. This type of growth under certain conditions can encourage piping within the embankment. Also, excessive growth inhibits effective visual inspections of the dam. A routine maintenance program should be initiated for this structure. The embankment, including its crest, slopes and emergency spillway should be mowed at least once a year, but more preferably twice a year. Trees presently growing in the embankment and in the emergency spillway should be cut to the ground. The crest of the dam should be reseeded or paved in attempt to control surface erosion. The minor surface erosion observed along the embankment-abutment contacts does not require any attention.

The saturated area located to the left of the outlet pipe is believed to be the result of ponded surface runoff. It is recommended that this area be monitored during routine maintenance operations in attempt to verify that it is not the result of seepage through the embankment. The saturated area located to the right of the outlet is the result of flow from a nearby spring. This saturated condition is not believed a hindrance to normal performance of the dam.

The outlet pipes and intake structure are in good structural condition. All operating appurtenances are functionally good. The left 6 inch CMP drain should be cleared and a staff gage should be installed to monitor water levels.

3.2.2 Downstream Area: A breach in Potomac Creek No. 2 Dam during extreme flooding would create a hazard to the downstream dwelling along U. S. Route 1.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Potomac Creek Dam No. 2 is used for flood control and recreational purposes. The normal pool elevation is maintained by a low level inlet acting as the principal spillway. Water automatically flows over the inlet at rates corresponding to the lake level. Floods which cannot be absorbed by storage pass through the emergency spillway.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the owner. Maintenance consists of intermittent inspection and the removal of debris, mowing of vegetative cover, and repair as required. Routine maintenance is not performed as indicated by the previous inspection reports.

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

4.4 Evaluation: The dam and appurtenances are in good operating condition; however, maintenance of the dam is inadequate. A routine maintenance program should be developed for this structure, and records maintained of all maintenance and operational procedures for future reference. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: Potomac Creek Dam No. 2 was designed by the Soil Conservation Service (SCS) as a single-purpose dam and complete hydrologic and hydraulic data are available including stage-discharge, stage-storage, stage-area, inflow hydrograph and flood routing data. This structure is a Class "C" dam according to the SCS classification method.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: According to Mr. Don Farmer (USDA, SCS), a maximum pool elevation has not been observed.

5.4 Flood Potential: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" (flood dishcarges that may be expected from the most severe combination of critcial meteorologic and hydrologic conditions that are reasonably possible in the region), or fractions thereof. The Probable Maximum Flood (PMF), ½ PMF and 100 Year Flood hydrographs were developed by the SCS method (References 4, 5 & 6, Appendix VII). Precipitation amounts for the flood hydrographs of the PMF and the 100 Year Flood are taken from U. S. Weather Bureau Information (References 5 & 7, Appendix VII). Appropriate adjustments for basin sixe and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulations: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 80 msl. Reservoir stage-storage data and stage-discharge data were determined from the design report and verified for pool elevations up to 102 msl. Above pool elevation 102 msl stage-storage data was extrapolated from the existing curves and stage-discharge data was computed for the non-overflow section along with extrapolation of stage-discharge curves. Floods were routed through the reservoir using the principal spillway discharge up to a pool storage.

elevation of 95.1 msl and combined principal and emergency discharges for pool elevations above 95.1 msl and combined spillways and non-overflow section for pool elevations above 102 msl.

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

Table 5.1 RESERVOIR PERFORMANCE

		Hydrograph		
	Normal Flow	100 Year Flood	½ PMF	PMF
Peak Flow, CFS				
Inflow	2.5	1679	6305	12,610
Outflow	2.5	264	4646	10,703
Maximum Pool Elevation				
Ft, msl	79.6	95.4	99.0	102.4
Non-Overflow Section (elev 102 msl)				
Depth of Flow, Ft	-	-	-	0.4
Duration, Hours	-	-	-	1.0
Velocity, fps	-	-	-	3.4
Emergency Spillway (elev 95.1 msl)				
Depth of Flow, Ft	-	-	3.9	7.3
Duration, Hours	-	-	8.0	8.0
Velocity, fps*	-	-	8.3	10.6
Tailwater Elevation				
Ft, msl	65	67	72.5	76.0

* Critical velocity at control section

5.7 Reservoir Emptying Potential: A 30 inch diameter gate at centerline elevation 71 msl is capable of draining the reservoir through the outlet culvert. Assuming that the lake is at normal pool elevation (79.6 msl) and there is 2.5 cfs inflow, it would take approximately one day to lower the reservoir to elevation 71 msl. This is equivalent to an approximate drawdown rate of 8.6 ft/day based on the hydraulic height measured from normal pool to the invert of the drawdown pipe divided by the time to dewater the reservoir.

5.8 Evaluation: The U. S. Army, Corps of Engineers, guidelines indicate the appropriate Spillway Design Flood (SDF) for a small size significant hazard dam is the 100 Year Flood to ½ PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 99 percent of the PMF without overtopping the crest of the dam (198 percent of the SDF).

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

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located along the western edge of the Coastal Plain Physiographic Province of Virginia. The floodplain, right abutment and adjacent hillsides are underlain by preconsolidated clays and sandstone bedrock belonging to the Patuxent Formation of Cretaceous Age. The left abutment is underlain by marine sands and gravels of Pliocene to Pleistocene Age. All of these formations dip gently eastward. Available geologic maps of the area do not indicate the presence of any faults in the site vicinity. Site geology is presented in more detail in the Design Geologic Report, which is included as Appendix VI.

No permeability test data was included with the information reviewed. However, subsurface and laboratory test data indicate that the overburden materials probably possess low to high natural permeabilities. It was recommended in the design report that the cutoff extend through gravel materials to the underlying low permeable materials , which probably refers to the clays and sandstones of the Patuxent Formation.

A consolidation test performed on a sample of highly plastic clay (CH) indicated that this material has been preconsolidated to loads in excess of those which would be applied by the constructed embankment. Other foundation materials were expected to consolidate somewhat when loaded, however, the consolidation potential of the foundation material was expected to be low and differential settlement was not expected to be a problem. Approximately 1 ft of settlement was specified in design of the embankment to compensate for residual

consolidation in the fill and foundation. Based upon design data, a stable foundation is assumed for this structure.

6.2 Embankment:

6.2.1 Materials: "As built" drawings describe the dam as a zoned structure. Zone I of the dam, consisting of the cutoff and interior core, was constructed with mixtures of sand, silt and clay materials classified as SC, CL and ML. Zone II was constructed with more permeable mixtures of sand, silt, clay and gravel classified as SM, GM and GC. Materials in both zones were to be compacted to 95% of maximum dry density in accordance with ASTM Standard D-698 (Standard Proctor). Maximum lift thickness of 9 inches and maximum rock sizes of 6 inches were specified.

6.2.2 Subdrains and Seepage: No special foundation treatment was required. In attempt to control seepage, a cutoff was constructed into "slowly permeable material" (clay or sandstone bedrock) below the gravelly stratum along centerline of the embankment. Details are shown on Plate No. 5 of Appendix I. An internal drainage system was also constructed, consisting of 300 ft of 6 inch perforated CMP enclosed in an envelope of course drain fill of variable depth. Drainage pipes were provided for transmitting the collected water to the plunge pool (See Plate No. 6, Appendix I). In attempt to prevent piping around the principal spillway pipe, 6 anti-seep collars were included as shown on Plate No. 7, Appendix I.

6.2.3 Stability: A stability analysis was performed for this structure and the report describing the engineering design data used is included in Appendix V. These data were reviewed along with the

stability analysis and were found to be acceptable. The factor of safety of the upstream slope for the drawn down condition is 1.81 as given in Appendix V. Reference 1, Appendix VIII recommends a factor of safety of 1.2. The factor of safety for the downstream slope under steady seepage conditions is indicated to be 1.92. The required factor of safety is 1.5 according to Reference 1.

The dam is 37 ft high and has a crest width of 14 ft. The upstream slope is 2.5H:1V with a 10 ft wide berm between elevations 79.6 and 80.6 msl. The downstream slope is 2.5H:1V. The dam is subjected to a sudden drawdown since the lake level can be drawn down 8.6 ft in one day. This exceeds the critical rate of 0.5 ft per day for earth dams. The existing pool is 0.5 ft above the maximum control storage pool, which is at the crest of the principal spillway. The dam experiences the maximum control storage pool with no apparent side effects.

According to the guidelines presented in Design of Small Dams, U.S. Department of the Interior, Bureau of Reclamation for small zoned dams, with stable foundations, subjected to a drawdown and composed of a CL, ML to SC "core" and a GC, GM to SM "shell", the recommended slopes are 3H:1V upstream and 2.5H:1V downstream. The recommended width is 17.5 ft. Based on these general guidelines, the dam has an inadequate upstream slope and inadequate crest width.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional

safety margins exist.

6.3 Evaluation: Based upon the visual inspection and the design report, the foundation is considered sound. According to general Bureau of Reclamation guidelines, the upstream slope is inadequate and the crest width is 3.5 ft less than recommended. However, based on review of the SCS stability analysis, the structure is considered stable as designed and constructed. Factors of safety for the upstream slope during the drawdown condition and for the downstream slope under steady seepage meet U.S. Army, Corps of Engineers guidelines. Overtopping of the dam is not a problem, as the spillway will pass 99 percent of the PMF (198 percent of the SDF). Since no undue settlement, cracking or sloughing was noted at the time of inspection, it appears that the embankment is adequate for maximum control storage with water at elevation 79.6 msl.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: Sufficient engineering data is available for assessing the dam. The visual inspection revealed no findings that proved the dam to be unsound. A routine maintenance program does not exist. Also, there is no emergency operation and warning plan. Overall, the dam was in good condition at the time of inspection. U.S. Army, Corps of Engineers' guidelines indicate the appropriate Spillway Design Flood (SDF) for this dam is the ½ PMF. The spillway will pass 99 percent of the PMF (198 percent of the SDF) without overtopping the crest of the dam. The spillway is judged adequate. Review of available stability data indicates the structure is stable as designed.

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

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

b) Trees present in the above described areas should be removed as part of an annual maintenance program.

c) The eroded crest of the dam should be reseeded or paved in order to prevent continued surface erosion.

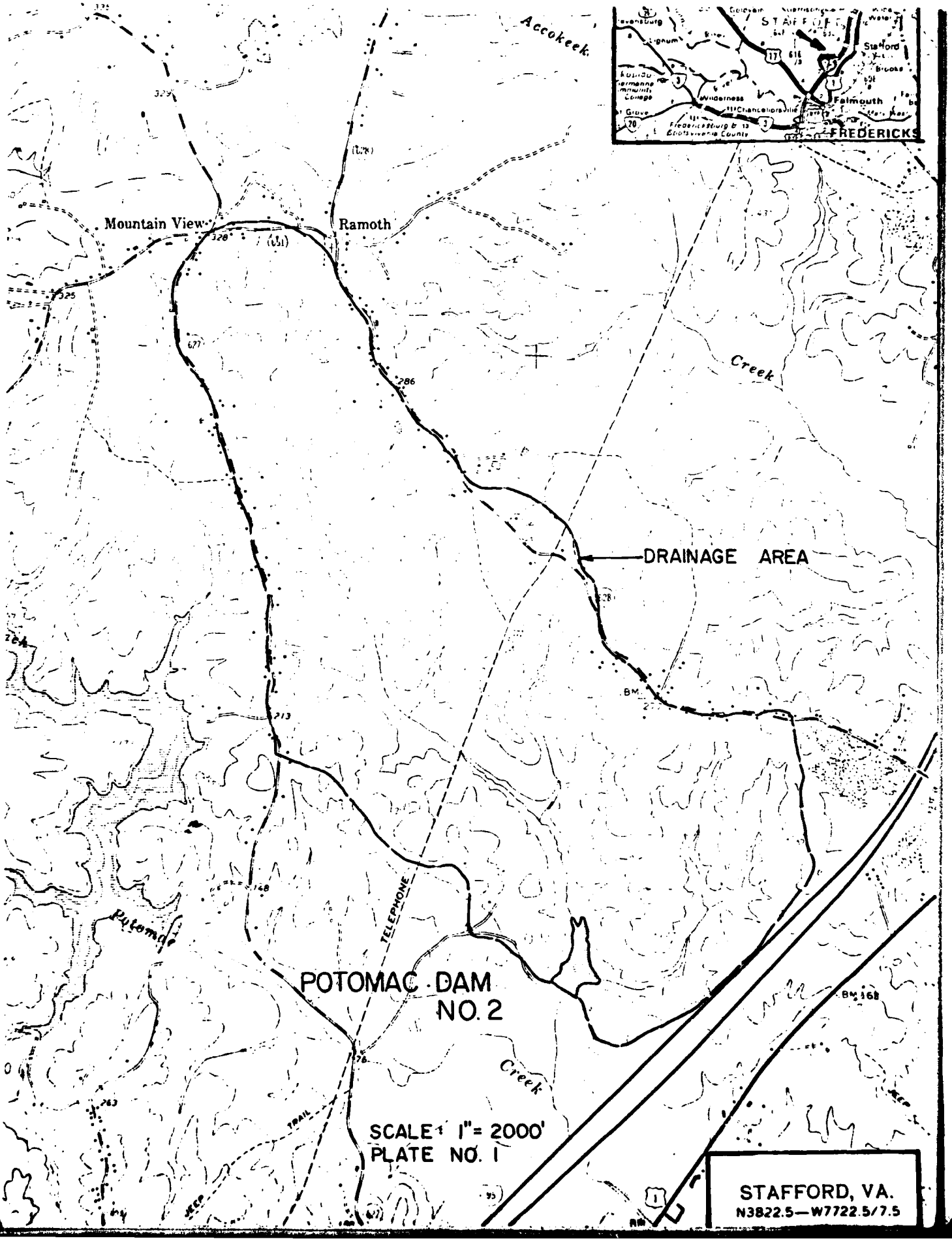
d) The saturated area located to the left of the outlet pipe should be monitored during routine maintenance in attempt to verify that it is not the result of seepage through the embankment. If increased saturation or flow should occur, a professional Geotechnical Engineer should be contacted to evaluate the problem and make recommendations for required corrective measures.

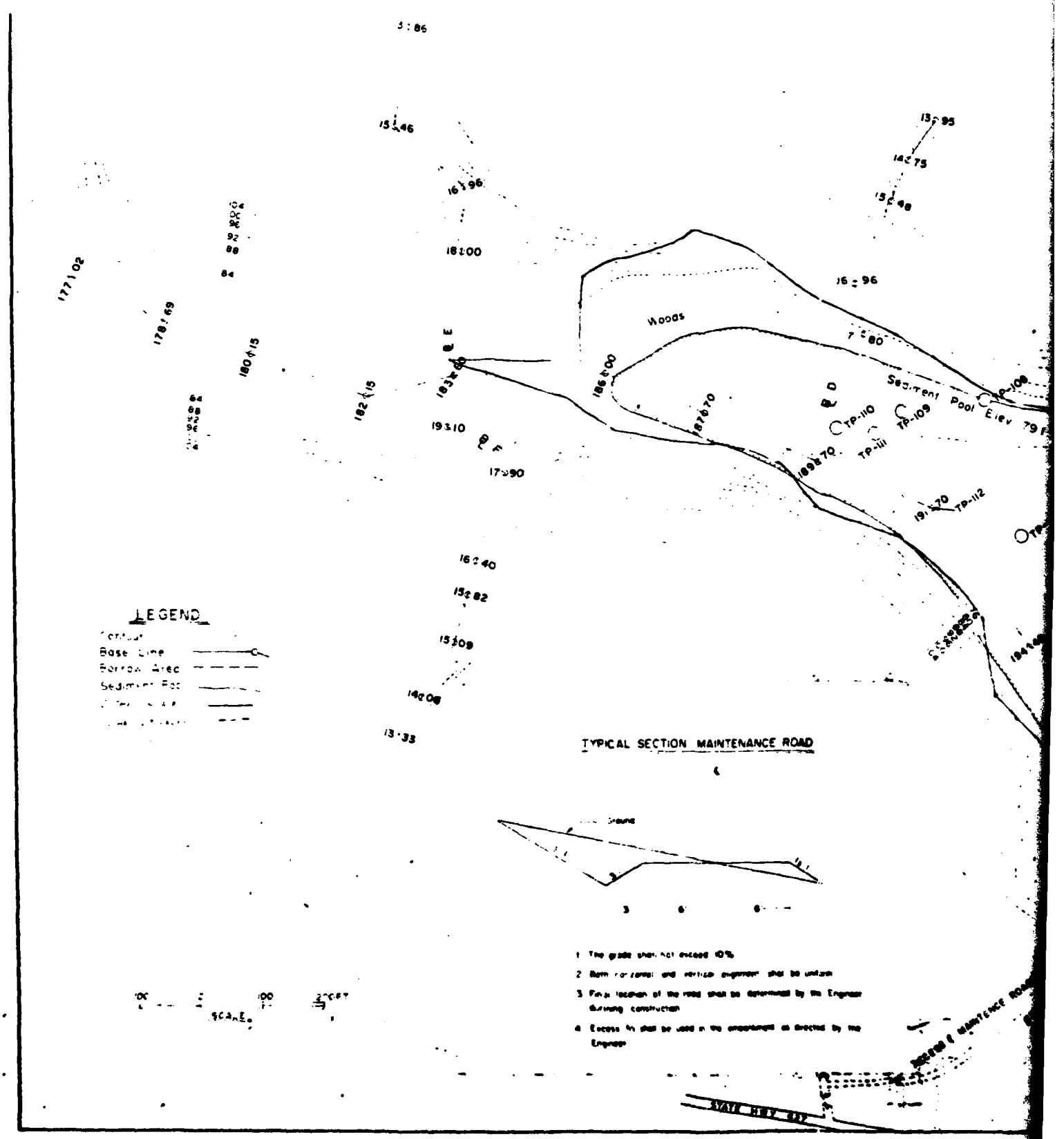
e) The 6 inch drain pipe should be unplugged and monitored to assure proper operation.

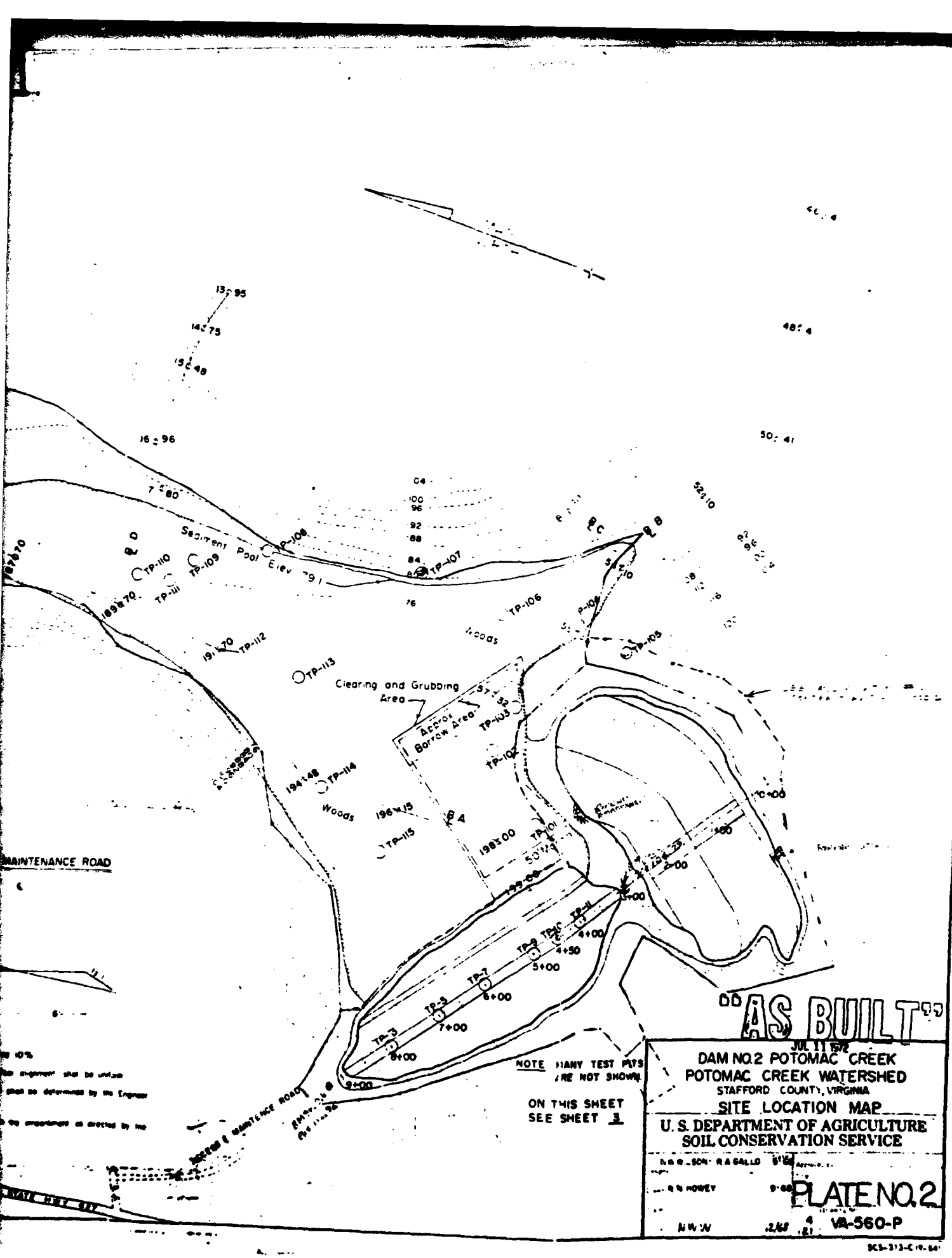
f) A staff gage should be installed to monitor water levels.

APPENDIX I

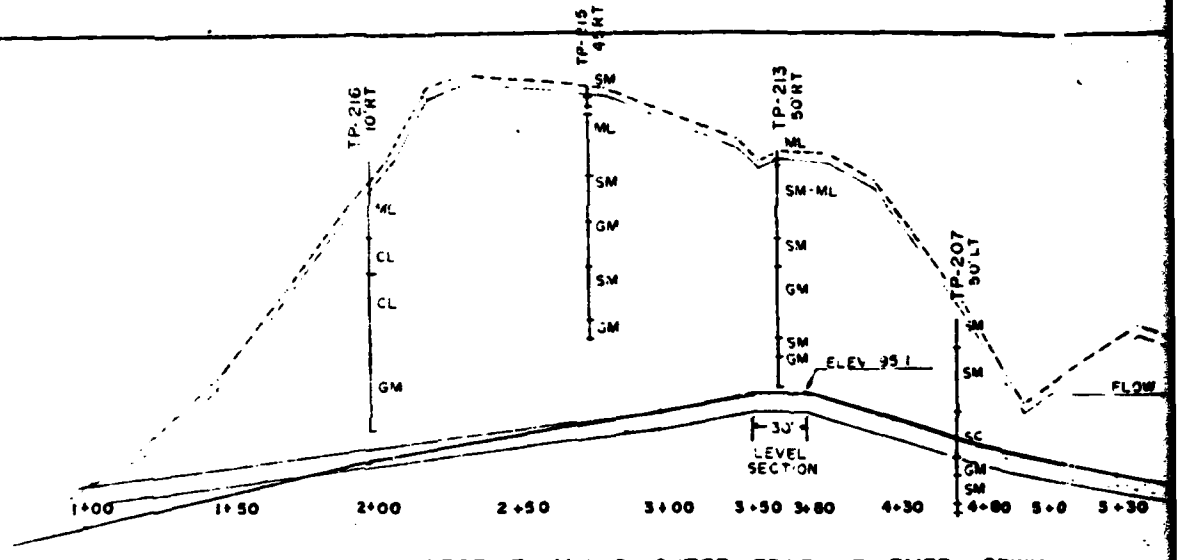
MAPS AND DRAWINGS


Accokeek
Mountain View
Ramoth
Creek
DRAINAGE AREA
Potomac
TELEPHONE
POTOMAC DAM
NO. 2
Creek
TRAIL
SCALE 1"= 2000'
PLATE NO. 1
STAFFORD, VA.
N3822.5—W7722.5/7.5
Stafford
Falmouth
FREDERICKS

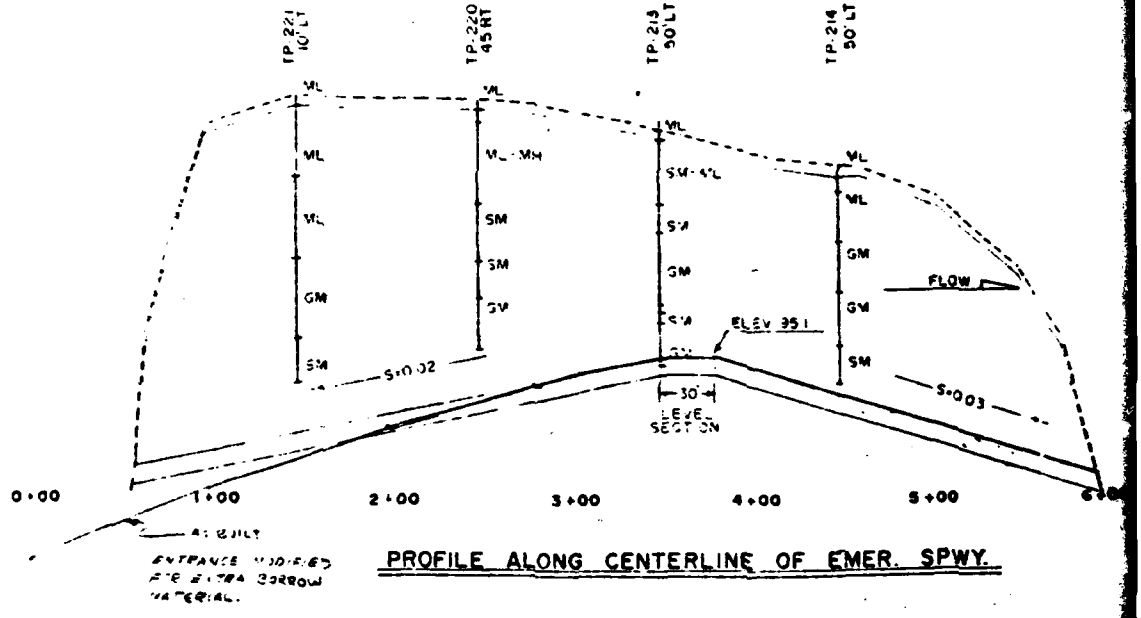

Woods
Sediment Pool Elev
TP-110
TP-109
TP-111
TP-112
LEGEND
Base Line
Borrow Area
Sediment Pool
TYPICAL SECTION MAINTENANCE ROAD
Ground
1 The grade shall not exceed 10%
2 Horizontal and vertical alignment shall be uniform
3 Final location of the road shall be determined by the Engineer during construction
4 Excess fill shall be used in the embankment as directed by the Engineer
SCALE
ACCESS & MAINTENANCE ROAD
STATE HWY 402


Segment Pool Elev 791
Clearing and Grubbing Area
Approx Borrow Area
Woods
TP-101
TP-102
TP-103
TP-104
TP-105
TP-106
TP-107
TP-108
TP-109
TP-110
TP-111
TP-112
TP-113
TP-114
TP-115
TP-1
TP-3
TP-5
TP-7
TP-9
TP-11
MAINTENANCE ROAD
NOTE MANY TEST PITS ARE NOT SHOWN ON THIS SHEET SEE SHEET 3
"AS BUILT"
JUL 11 '52
DAM NO.2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA
SITE LOCATION MAP
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PLATE NO.2
VA-560-P

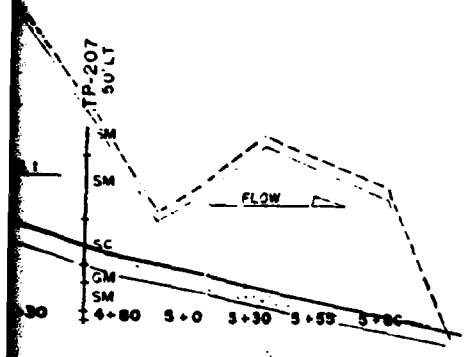
2



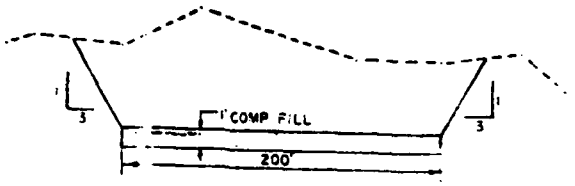
PROFILE ALONG OUTER EDGE OF EMER. SPWY.



PROFILE ALONG CENTERLINE OF EMER. SPWY.

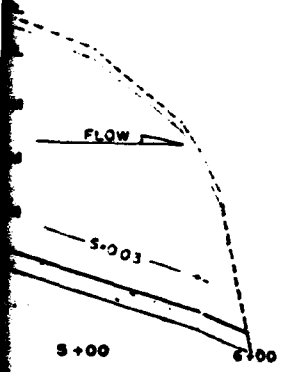


MER. SPWY.

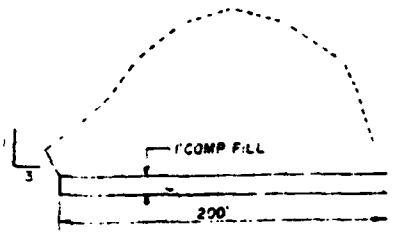


TYPICAL SECTION OF EMER. SPWY.

STA. 3+80



R. SPWY.



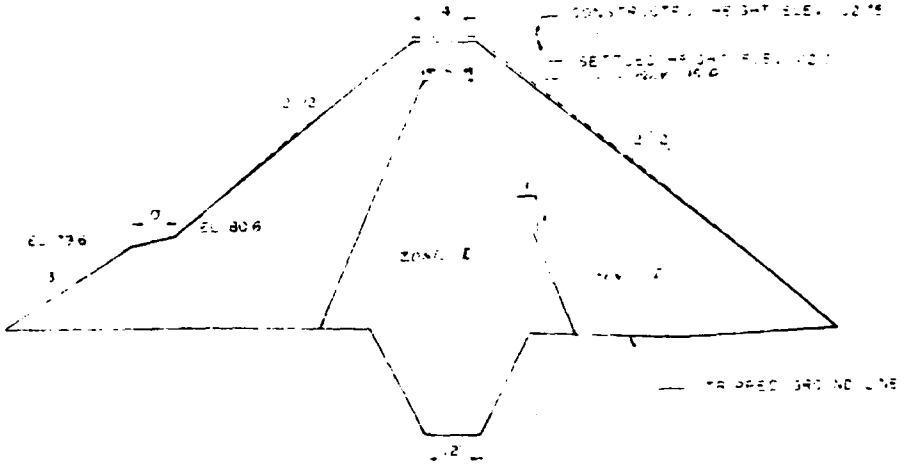
TYPICAL SECTION OF EMER. SPWY.

STA. 1+50

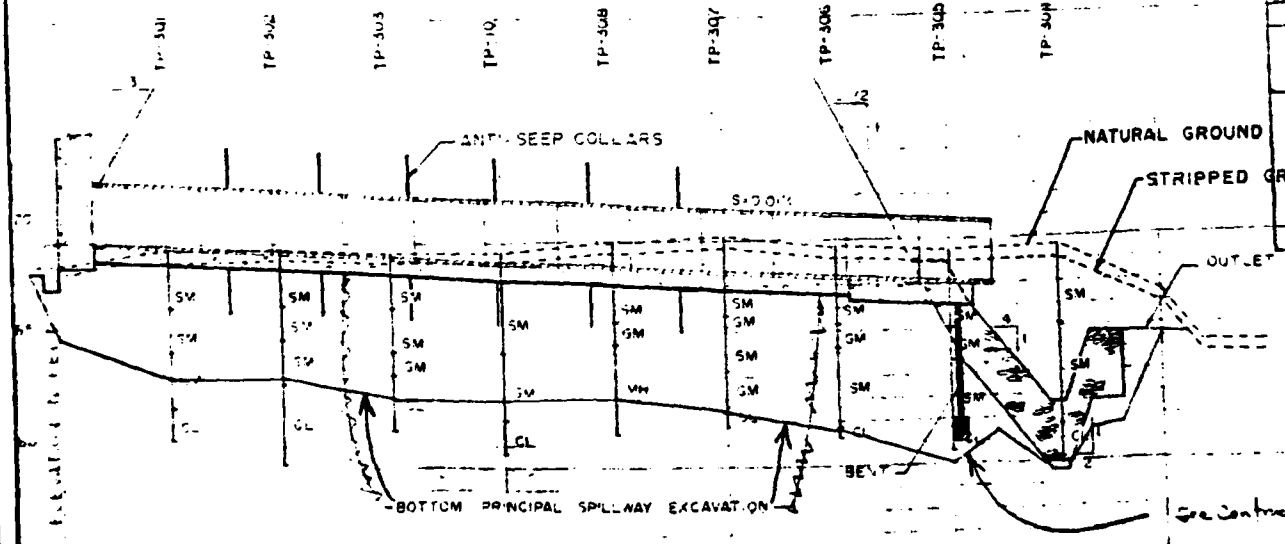
"AS BUILT"

DAM NO 2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
EMERGENCY SPILLWAY SECTIONS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE NO. 3



TYPICAL SECTION OF COMPACTED FILL



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

STATIONS ALONG ℄ OF PRINCIPAL SPILLWAY

EARTH FILL REQUIREMENTS

ZONE	MATERIAL	MAX. SIZE	MAX. LIFT	REQUIRED DENSITY	CLASS	REMARKS
EMBANKMENT	Sand, SM and clayey gravel, GC from the emergency spillway, and from the cut area represented by the following test pits					
	Test Pit — Depth ft	6"	9"	95% of maximum density, D, ASTM D-698, method A	A	
	45+45 E					

1. For soils adjacent to structures, max rock size = 3"
2. At time of placement
3. For typical compaction curves see sheet 21

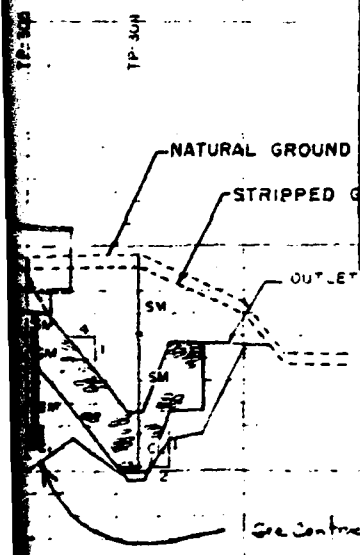
CUTOFF TRENCH DETAILS

The cutoff trench shall consist of the clayey sand and gravel from the emergency spillway, represented by material in the pit at 45+45 E TP-2.8 from [illegible]

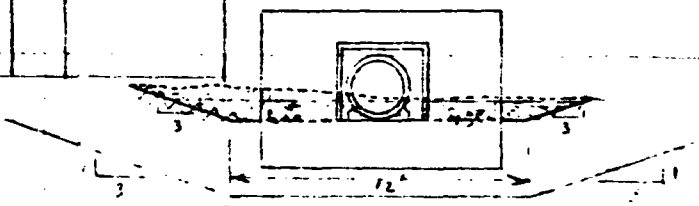
2. The Engineer may direct the fill placement such that the clays and more plastic soils will be placed in the central portion of the embankment and the sands and gravels will be placed downstream.

3. The foundation surface throughout the base area of the dam shall be moistened to a depth of [illegible] and compacted prior to placement of material.

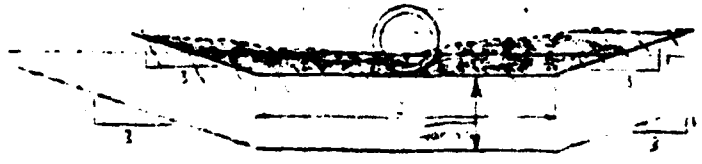
ZONE	MATERIAL	MAX. SIZE	MAX. LIFT	REQUIRED WATER CONTENT	CLASS	REMARKS
I	ML, CL, SC	3"	9"	-1% to +3% of OPTIMUM	A	95% max density ASTM D-698 (ASTM D-40) A
II	SM, GM, GC	3"	9"	—	T	ASTM D-[illegible]
NOTE	SEE MODIFICATION NO. 1					



See Contract modification No. 4 (Contract No 12-10-440-426)



PRINCIPAL SPILLWAY EXCAVATION AT ANTI-SEEP COLLARS
NOT TO SCALE



PRINCIPAL SPILLWAY EXCAVATION
NOT TO SCALE

JUL 21 1972

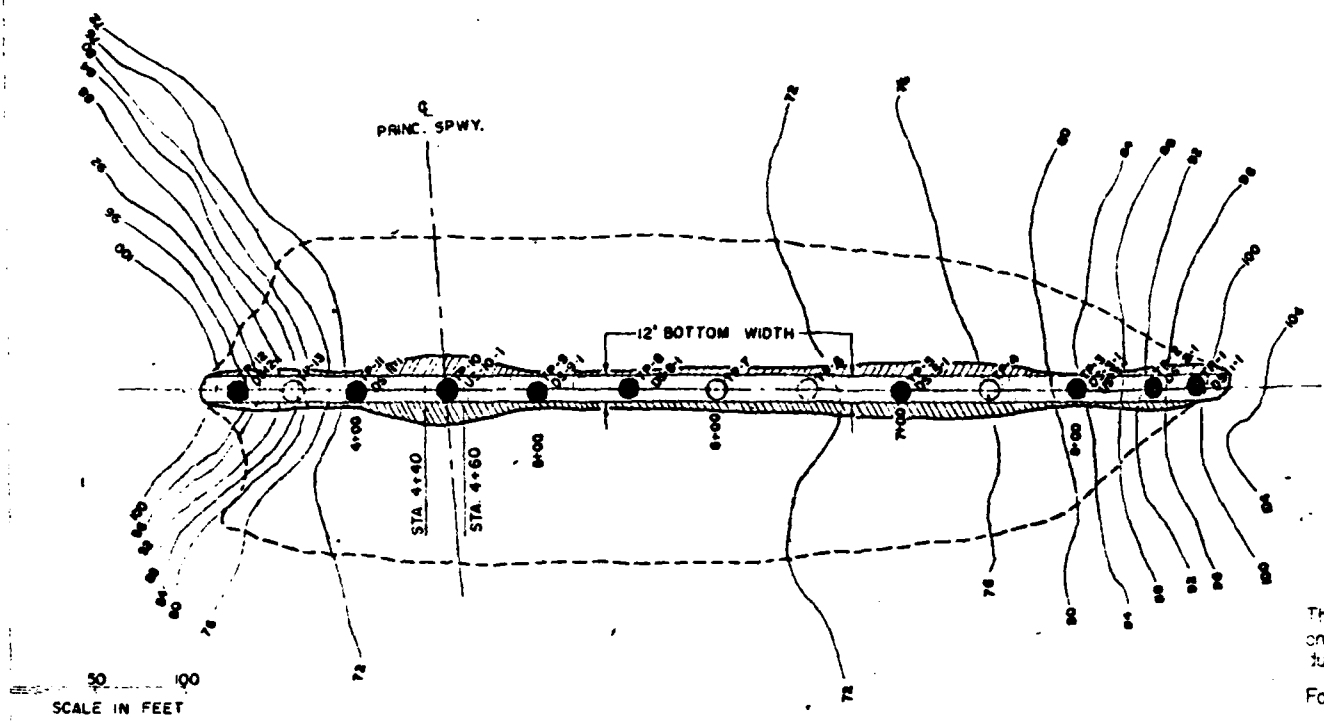
"AS BUILT"

DAM NO 2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA
FILL PLACEMENT & SPILLWAY EXCAVATION
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

W. R. WILSON — DRN
R. W. HOWEY — DES

PLATE NO. 4

A-560-D



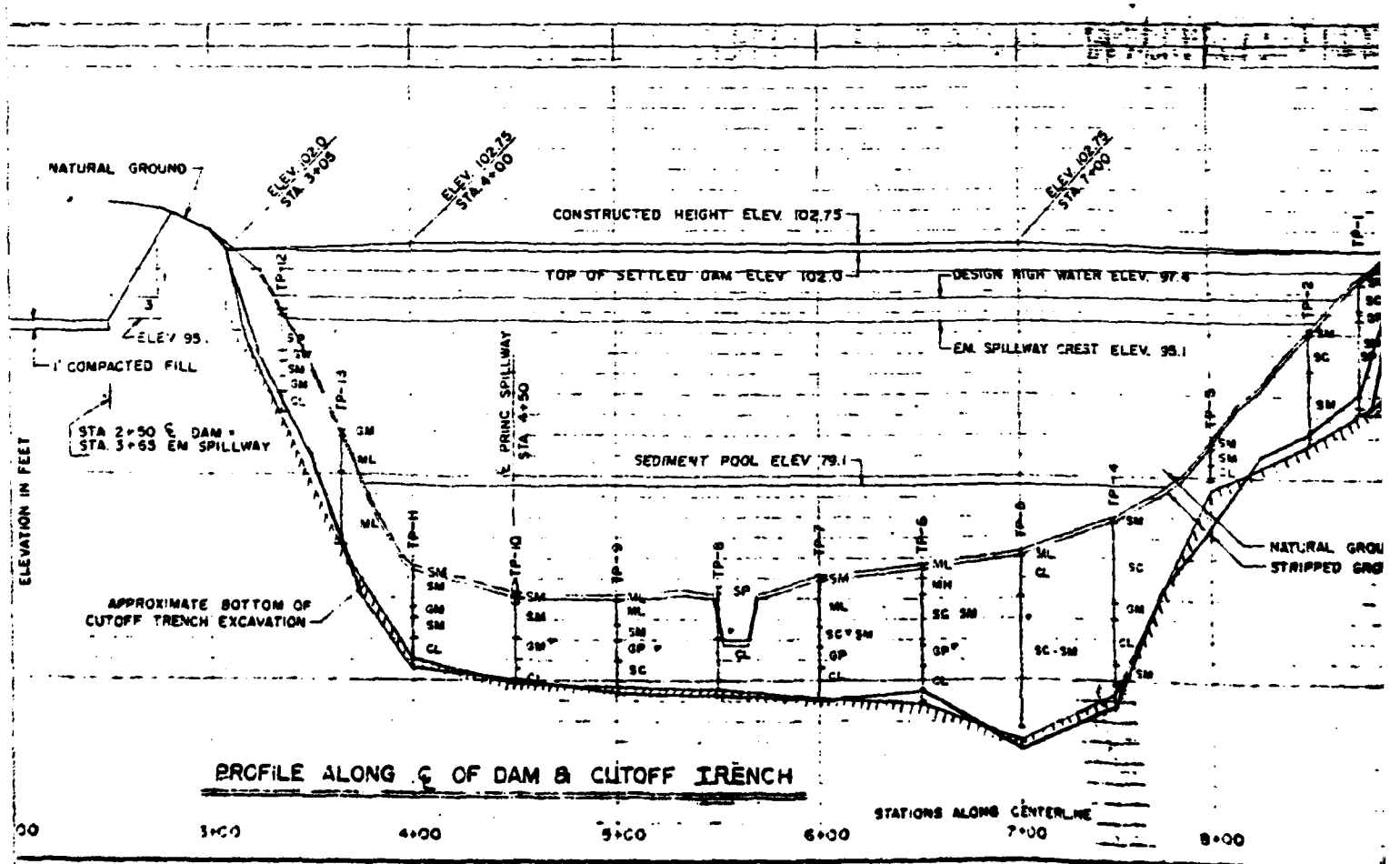
PLAN VIEW OF CUTOFF TRENCH

CONST

The prof es of the b
only approximate Th
during construction.

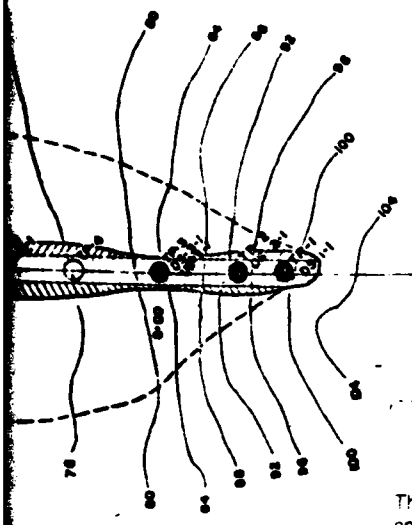
For logs of test hole

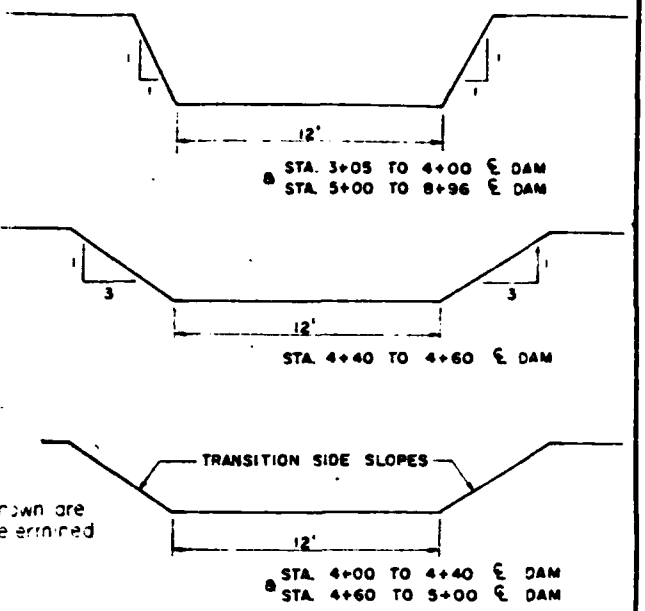
All rock exposed in
cleaned and shall be
agreement



PROFILE ALONG ℄ OF DAM & CUTOFF TRENCH

SECTIONS THROUGH CUTOFF TRENCH



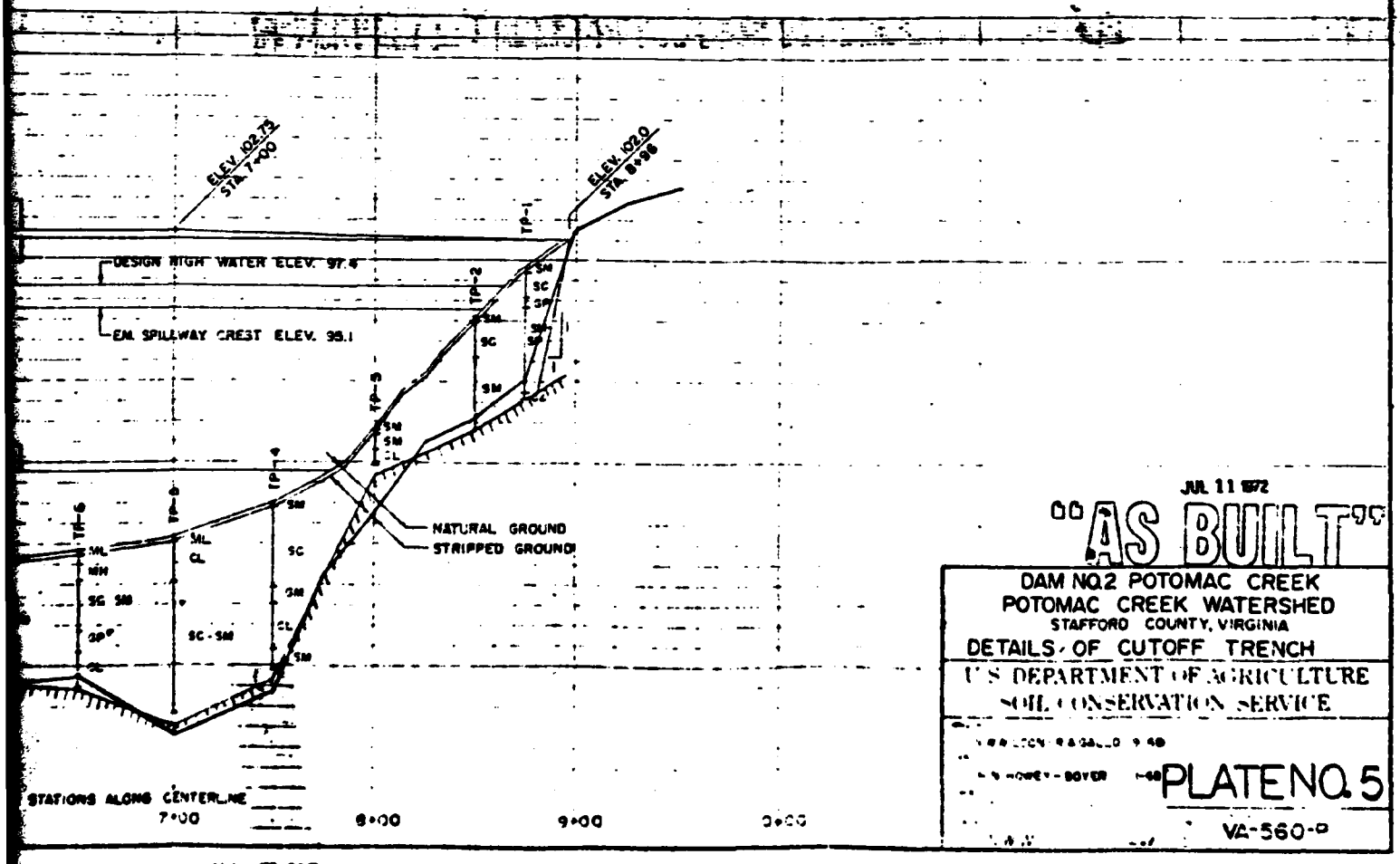


CONSTRUCTION DETAILS

The profiles of the bottom of all excavation as shown are only approximate. The required grades will be determined during construction.

For logs of test holes see sheet 18, 12 and 20

All rock exposed in bottom of cutoff shall be thoroughly cleaned and shall be inspected by the Engineer prior to the placement of compacted fill material.



JUL 11 1972

"AS BUILT"

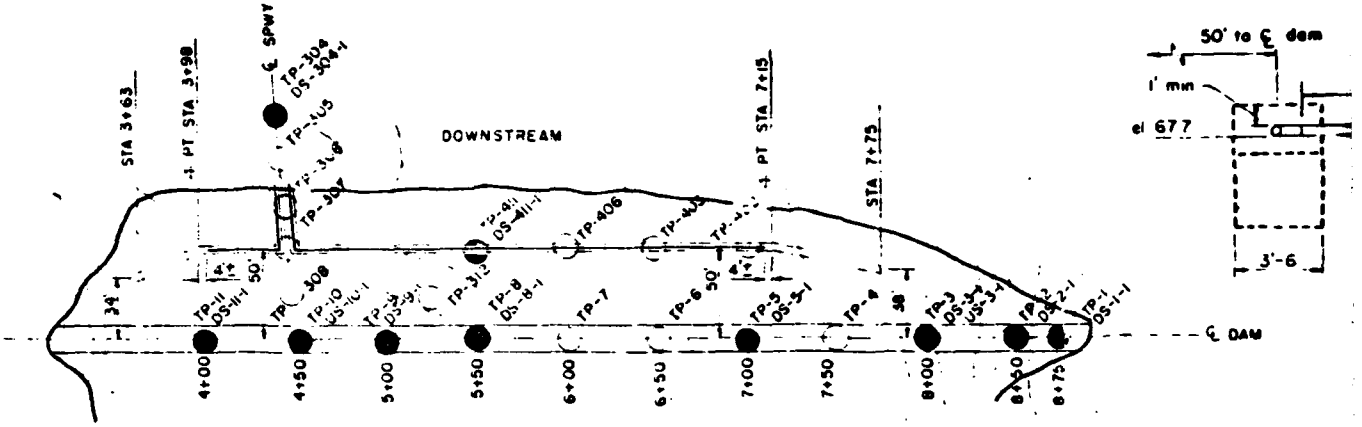
DAM NO.2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA

DETAILS OF CUTOFF TRENCH

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE NO. 5

VA-560-D



QUANTITY SUMMARY

[illegible]

[illegible] cubic yards drain fill

[illegible] lin ft of perforated pipe

[illegible] lin ft of non-perforated pipe

[illegible] 90° bi-pipe elbows

[illegible] metal end caps

2 small animal guards

[illegible] lin ft of 6" pipe for pay

CONSTRUCTION DETAILS

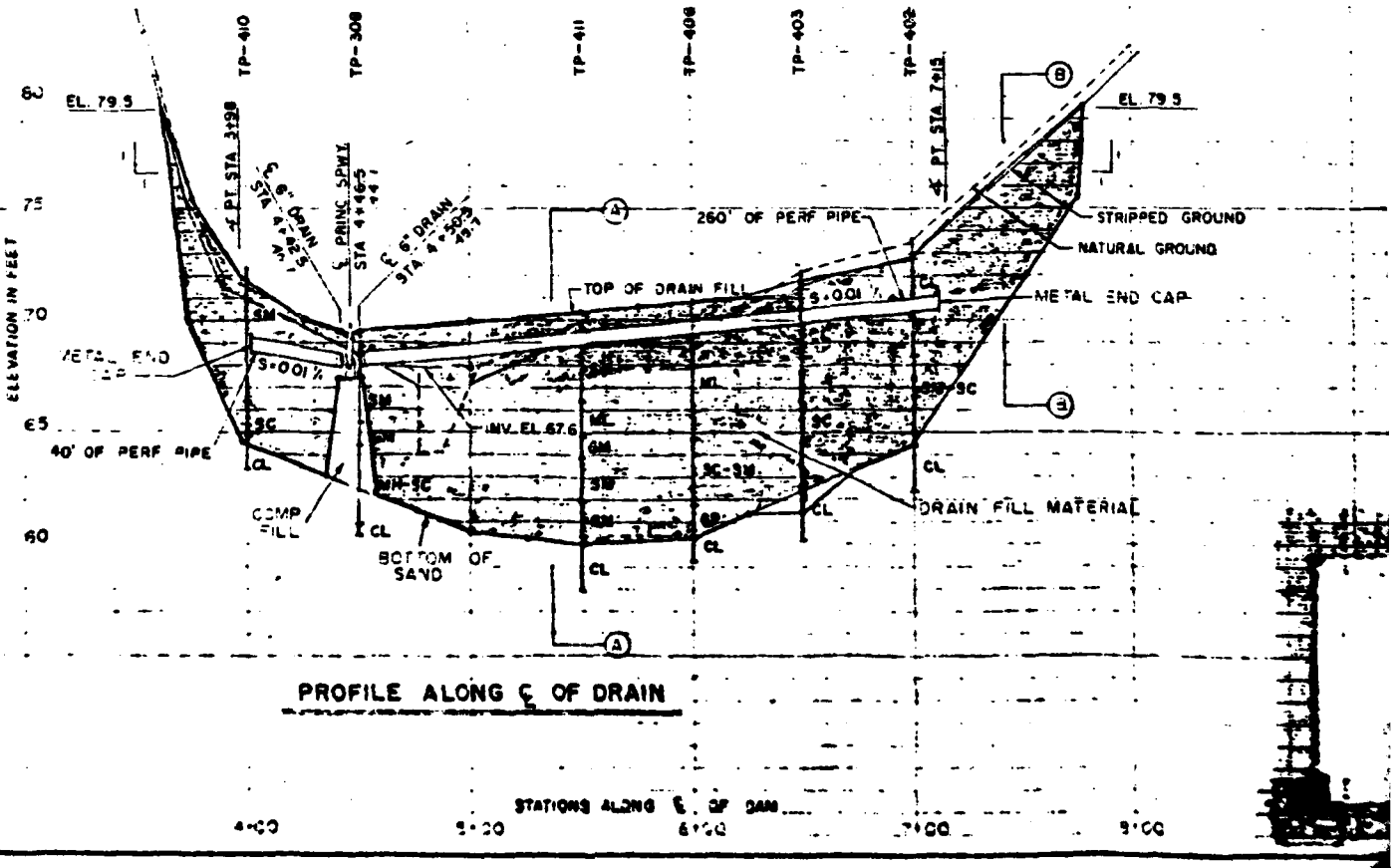
[illegible] pipe shall conform to Spec [illegible], and perforated pipe shall be 6 Dia., 18 Gauge, Shape I, Class I, Type A, and non-perforated pipe shall be 6 Dia., 18 Gauge, Shape I, Class II, Type A.

2 The profiles of the bottom of all excavation as shown are approximate. The required finished grades will be established by the Engineer.

3 For logs of test pits see sheets 18-20

0 50 100FT
SCALE

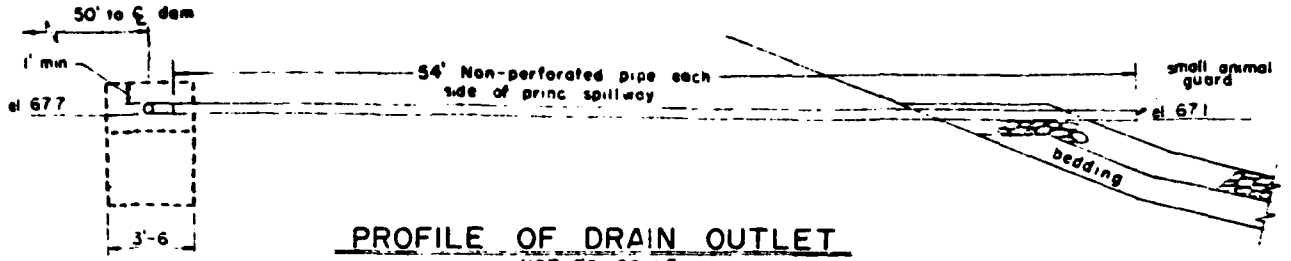
PLAN OF DRAINAGE SYSTEM



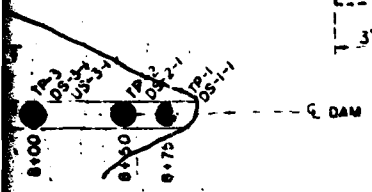
PROFILE ALONG ℄ OF DRAIN

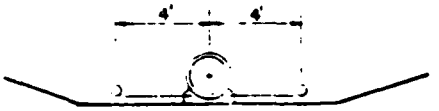
STATIONS ALONG ℄ OF DAM

4+00 5+00 6+00 7+00 8+00



PROFILE OF DRAIN OUTLET
NOT TO SCALE





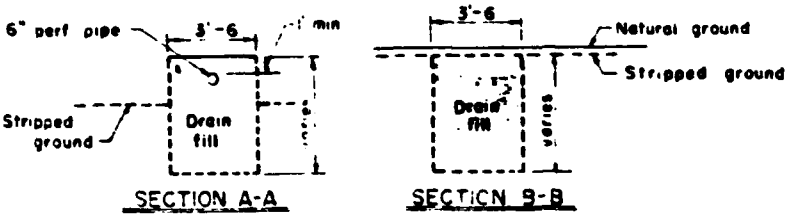
TYPICAL SECTION OF DRAIN OUTLET

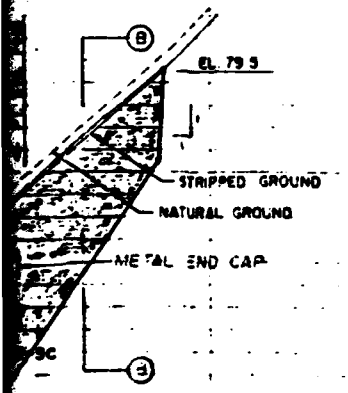
CONSTRUCTION DETAILS

e of conform to Specific and perforated
e 6 Dia, 18 Gauge, Shape I, Class I, Type A,
forated pipe shall be 6 Dia, 18 Gauge, Shape I,
pe A.

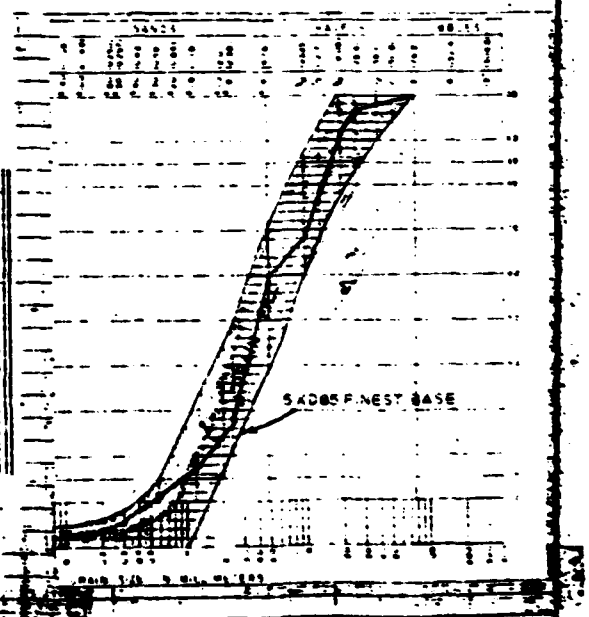
of the bottom of all excavation as shown are
The required finished grades will be established
sheet

est pits see sheets 18-20



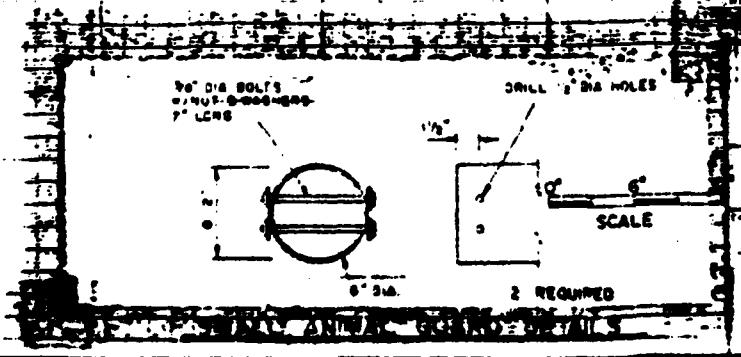


DESIGN DATA FOR DRAIN FILL	
Sieve no	% Passing
3"	100
1"	84 - 100
3/8	76 - 100
3/8	60 - 88
NO 4	34 - 71
NO 8	22 - 51
NO 16	9 - 34
NO 30	0 - 17
NO 50	0 - 9
NO 100	0 - 6
NO 200	< 5



"AS BUILT"
JUL 11 1972

AIN FILL MATERIAL

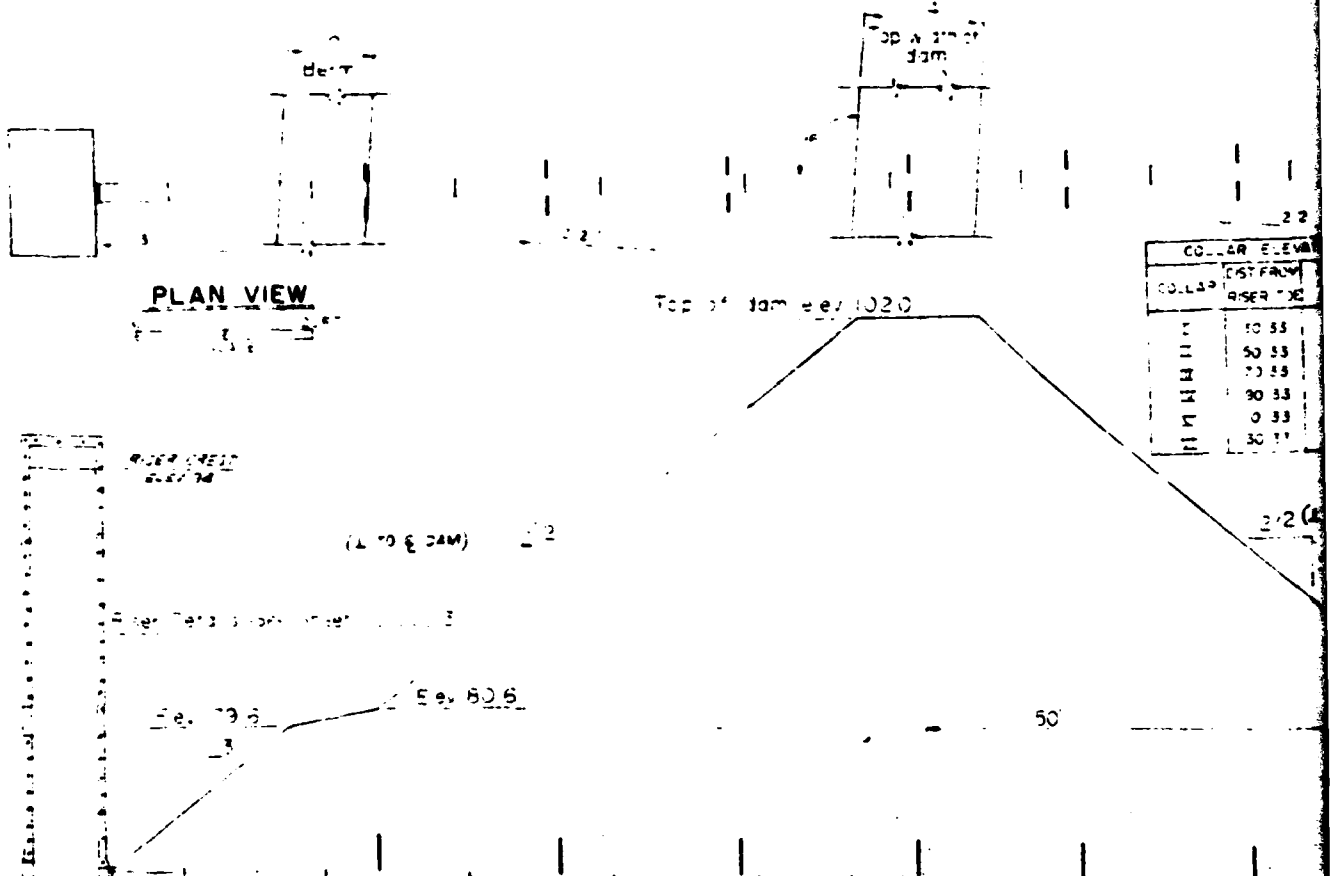


DAM NO.2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA
DRAINAGE DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PLATE NO.6
VA-560-P

RIPRAP NOTE

1 - Equipment placed riprap shall be well graded from 6" to 18" & shall be placed on 6" of bedding

2 Bedding shall meet the gradation requirement of ASTM C33



PIPE DATA

30" ℄ Reinforced concrete [illegible] pipe

(1) Section

(12) [illegible]' Section

(1) Nail piece for 10" wall

~~293~~ 0' Total for pay

Pressure head = 39.0' to design high water

Load = 22,000 lbs per lin ft based on OD of 2.96'

Min 3-edge bearing strength for 0.01" crack

Non-prestressed pipe = 10,440 lbs per lin ft AWWA-C-300

Min 3 edge bearing strength for 0.001" crack

Prestressed pipe = 8,000 lbs per lin ft AWWA-C-301

PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

0 4 8 CFT

Vertical Scale

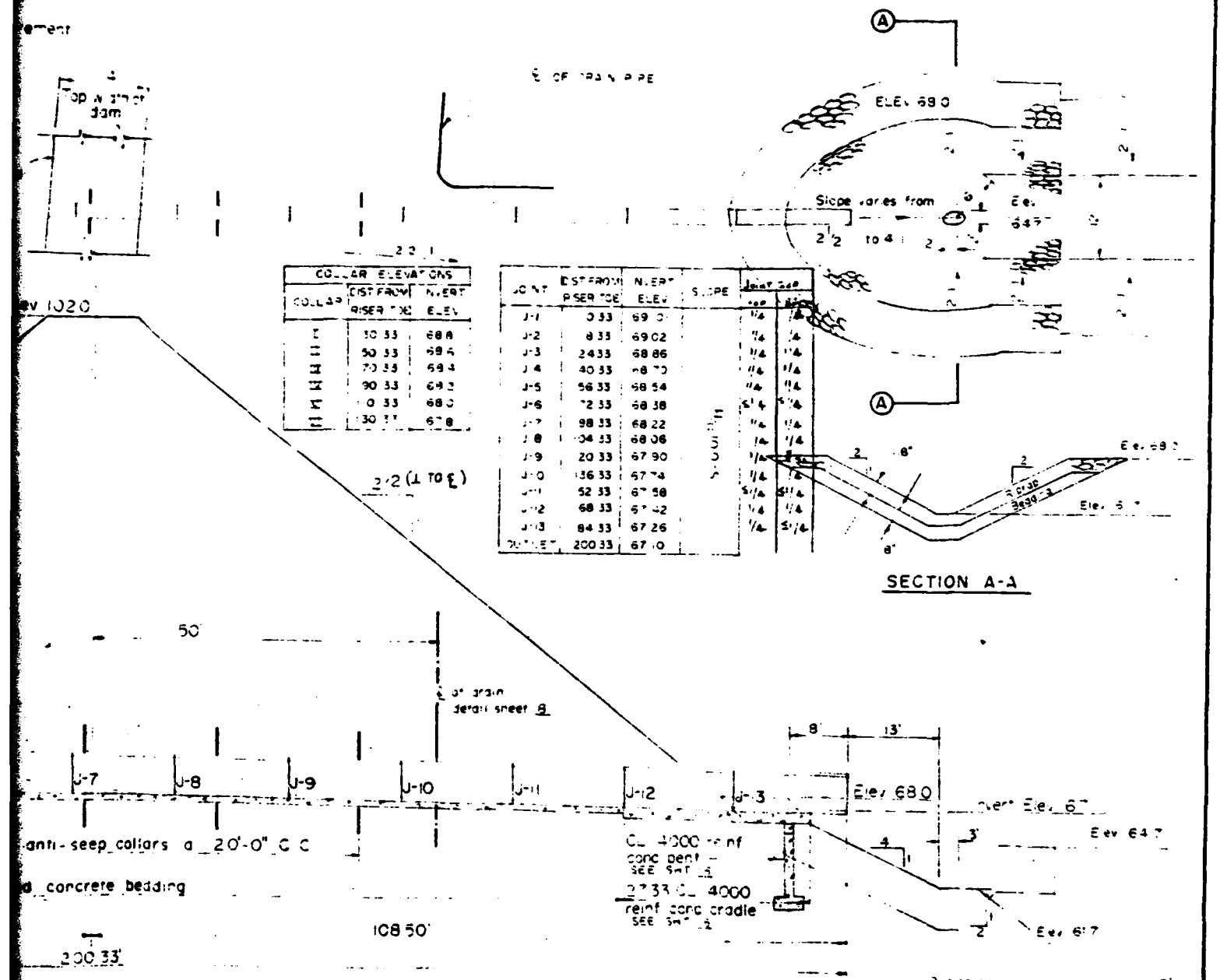
0 2

Hor zontal

1 of 2

...ded from

...ement



COLLAR ELEVATIONS		
COLLAR	DIST FROM RISER TOE	INVERT ELEV
I	10.33	688
II	50.33	684
III	70.33	683
IV	90.33	682
V	110.33	680
VI	130.33	678

JOINT	DIST FROM RISER TOE	INVERT ELEV	SLOPE	Joint Gap	
J-1	0.33	69.0		1/4	1/4
J-2	8.33	69.02		1/4	1/4
J-3	24.33	68.86		1/4	1/4
J-4	40.33	68.70		1/4	1/4
J-5	56.33	68.54		1/4	1/4
J-6	72.33	68.38		5/16	5/16
J-7	88.33	68.22		1/4	1/4
J-8	104.33	68.06		1/4	1/4
J-9	120.33	67.90		1/4	1/4
J-10	136.33	67.74		1/4	1/4
J-11	152.33	67.58		5/16	5/16
J-12	168.33	67.42		1/4	1/4
J-13	184.33	67.26		1/4	5/16
OUTLET	200.33	67.10			

...design high water

...based on OD of 2.96"

...gth for 0.01" crack

...,640 lbs per lin ft AWWA-C-300

...gth for 0.001" crack

...bs per lin ft AWWA-C-301

PIPE SUPPLIERS NOTES

Cast outside of spigot joint ring with concrete on one 16'-0" section

See pipe joint detail sheet 17

...Outlet channel bottom width = 2', side slopes = 3:1, bottom slope ...

AS BUILT

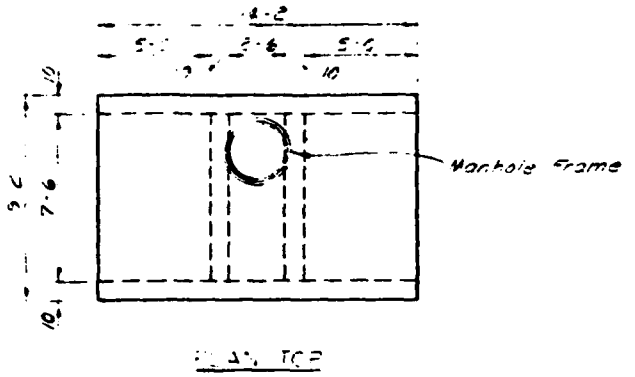
DAM NO. 2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA
PRINCIPAL SPILLWAY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE NO. 7

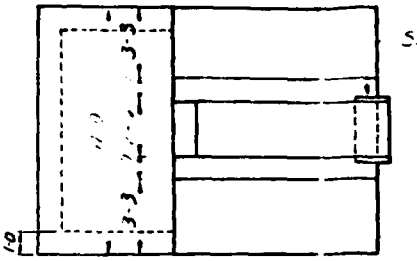
...-560-D

℄ OF PRINCIPAL SPILLWAY

...Major Grids Scale



PLAN TOP

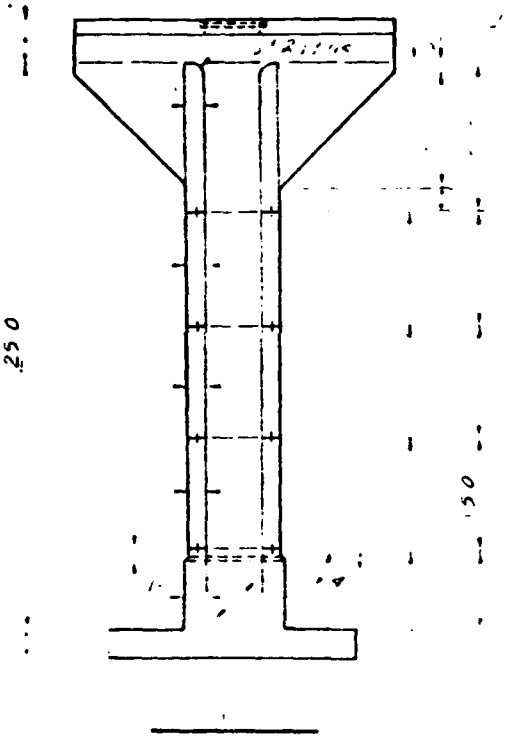


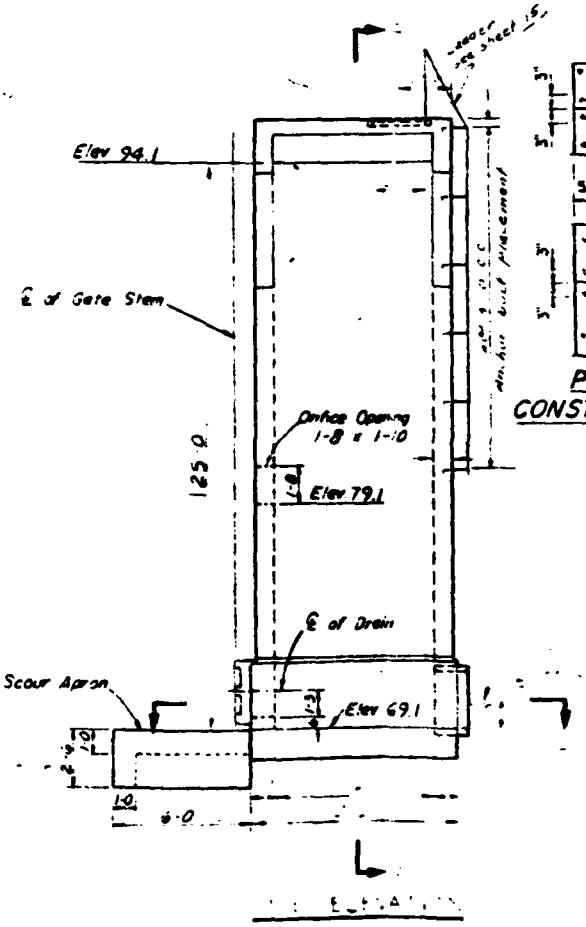
SECTION B B

Spigot Wall Fittin

CONSTR. J

1/8" x 5" Steel P
Continuous Thru
Splices Shall Be
1. Butt Welded
2. Lapped 3" Ap
3. Lapped 3" Ap





ELEVATION

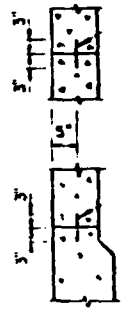
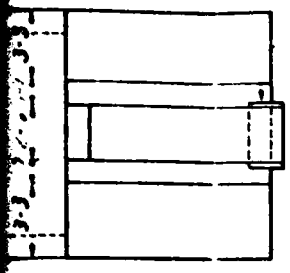


PLATE
CONSTR. JO

STANDARD COVERED RISER



Spigot Wall Fitting

CONSTR. JOINT

1/8" x 5" Steel Plate, Grade B or C. Continuous Thru Constr Joint Splices Shall Be Either
1. Butt Welded
2. Lapped 3" And Bolted
3. Lapped 3" And Fillet Welded

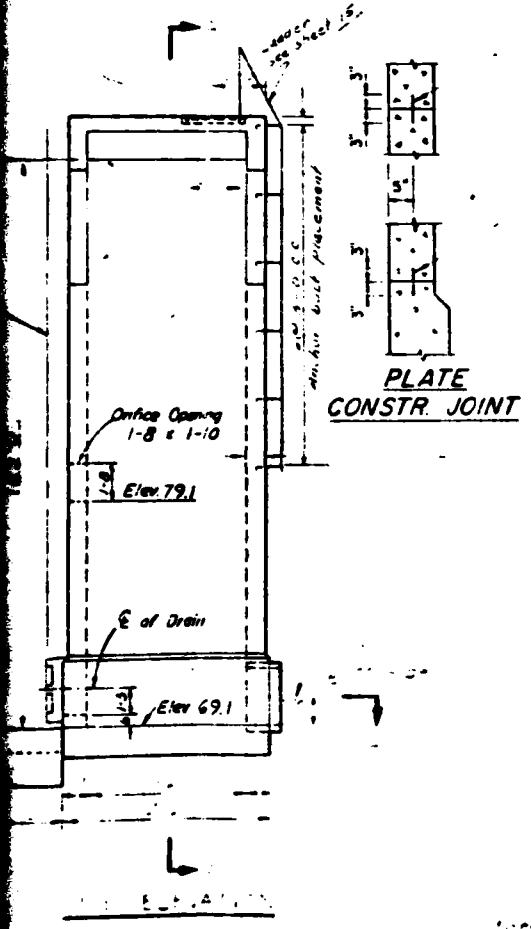
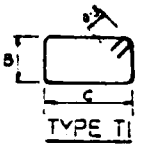
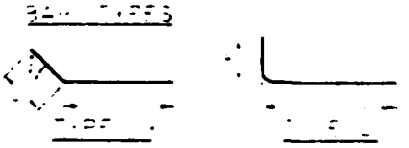


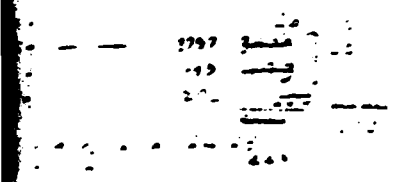
PLATE
CONSTR. JOINT

Mark	Size	Quantity	Length	A	B	C	Total Length
31	#5	1	10-10	1			115-6
32	#5	12	3-0	1			36-0
33	#5	36	7-0	21	3-1	3-11	252-0
34	#5	12	9-0	1			108-0
35	#5	9	10-6	1			105-0
36	#5	2	4-6	1			9-0
37	#5	6	5-0	21	2-3	3-0	30-0
38	#5	19	7-0	21	1-1	5-11	133-0
39	#5	10	8-3	1			82-6
310	#5	5	3-3	1			16-3
311	#5	3	2-3	1			6-9
312	#5	3	2-3	1			6-9
313	#5	3	3-3	1			9-9
314	#5	14	3-6	1			49-0
315	#5	10	3-0	21	1-7	5-5	60-0
316	#5	14	8-3	21	2-3½	5-4½	115-6
317	#5	4	8-0	21	2-3	5-3	32-0
318	#5	12	8-1	21	2-0	6-1	97-0
319	#5						
320	#5	11	7-	21	2-	5-8	
321	#6	12	4-0	1			48-0
R1	#5	21	11-8				233-4
R2	#6	14	8-3	1			115-6
R3	#5	8	3-3	1			26-0
R4	#5	21	11-8				233-4
R5	#5	40	8-0	21	2-3	5-3	320-0
R6	#6	8	9-3	1			148-6
R7	#5	9	3-3	1			29-3
R8	#5	28	8-3	21	2-3	5-2	226-6
R9	#5	20	6-3				35-
R10	#5	3	8-2	1			26-1
R11	#5	2	3	1			6-
R12	#5	20	3-				155-0
R13	#5	20	8-0	21	2-3	5-3	160-0
R14	#4	10	3'-2	T1	0-6	0-10	31-8
R15	#5	2	4-6	1			9-0





Bar Types



AS BUILT

JUL 11 '97

DAM NO. 2 POTOMAC CREEK
POTOMAC CREEK WATERSHED
STAFFORD COUNTY, VIRGINIA
RISER DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE NO. 8

APPENDIX II

PHOTOGRAPHS

PHOTO NO. 1

DOWNSTREAM SLOPE OF DAM

PHOTO NO. 2

UPSTREAM SLOPE OF DAM

PHOTO NO. 3

EMERGENCY SPILLWAY

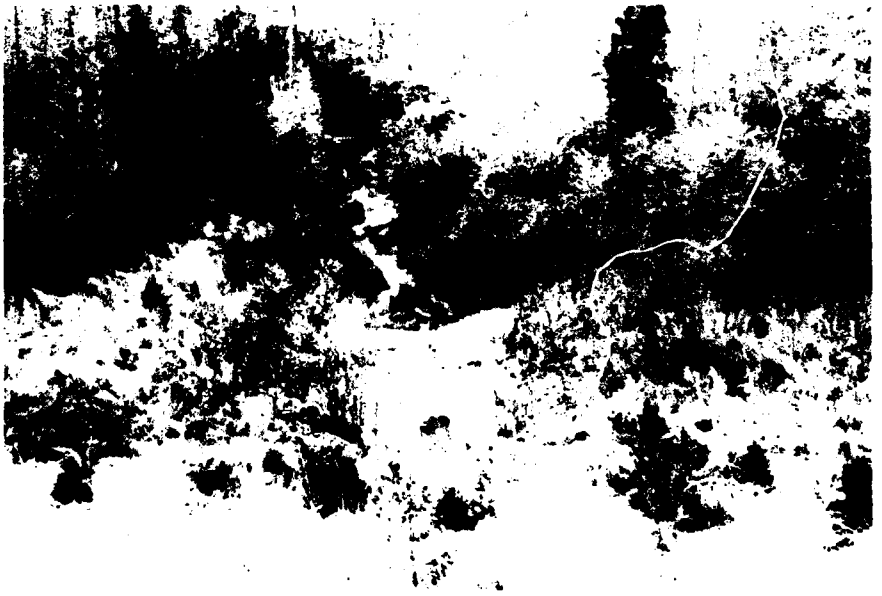


PHOTO NO. 4

DOWNSTREAM CHANNEL

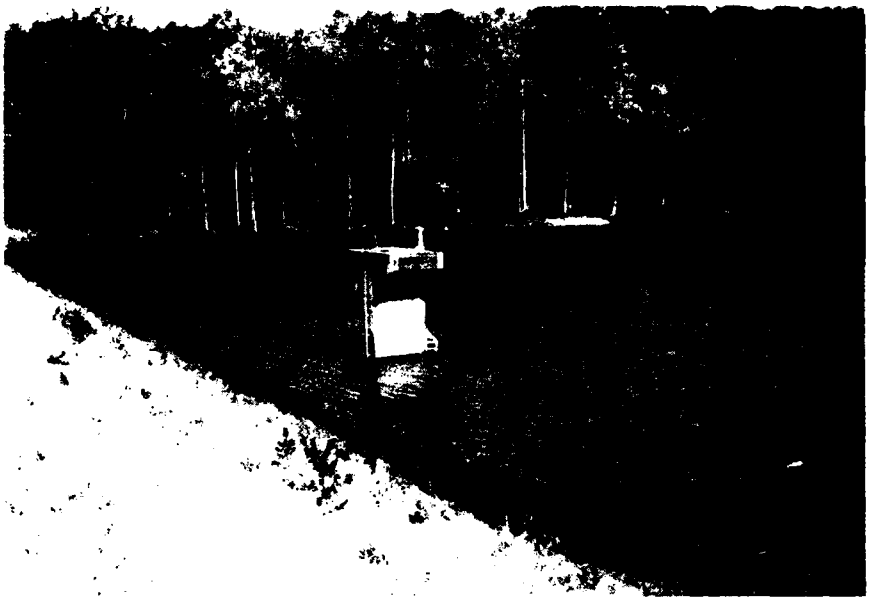


PHOTO NO. 5

INTAKE STRUCTURE

PHOTO NO. 6

OUTLET PIPE AND PLUNGE POOL

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam Potomac Creek No. 2 County Stafford State Virginia Coordinators Lat 38° 23.2' Long 77° 27.4'

Date(s) Inspection May 1, 1980 Weather Partly Cloudy Temperature 60°F

Pool Elevation at Time of Inspection 79.6 msl Tailwater at Time of Inspection 65.3 msl

Inspection Personnel:

Schnabel Engineering Associates, P.C.
Raymond A. DeStephen, P.E.
Stephen G. Werner (recorder)

J. K. Timmons and Associates, Inc.
Robert G. Roop, P.E.
Donald Balzer (recorder)

State Water Control Board
Ed Constantine

Russell and Axon, Engineers
Wayne Brooks (Owner's representative)

USDA, Soil Conservation Service
Don Farmer

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The slopes, crest, emergency spillway and abutment contacts were inspected and no cracks were noted. Both the upstream and downstream slopes are covered with tall grass (2-3 ft± high). Scattered immature evergreens and hardwoods (less than 3 inch diameter) occur on both slopes.	Both the grass and trees should be cut.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movements or cracking were noted on the dam or downstream beyond the embankment toe.	-
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No serious erosion was noted on the embankment. No stone or vegetation exists on the crest of the dam, which serves as a limited access roadway. Some rutting exists in the roadway area. Minor surface erosion, if present, was obscured by the thick grass cover. The embankment appears to be constructed with SM to GM materials. Both embankment slopes are 2.5H:1V. A 10 ft± wide berm exists at the toe of the upstream slope at pool level.	The crest of the dam should be grassed or surfaced in attempt to minimize surface erosion.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	The vertical and horizontal alignment of the dam appeared to be good.	-
RIPRAP FAILURES	The only riprap observed is in the plunge pool. This riprap was in good condition and appeared to be functioning properly.	-

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junctions of the embankment and abutments were well vegetated and no soils or bedrock were exposed. Only minor erosion, i.e. gullies less than 1 ft deep, were encountered intermittently along the junctions. The emergency spillway is also well vegetated. No faults or bedrock were observed in the vicinity. Surface soils exposed in surrounding area consist of alluvial or terrace sands, silts and clays.	The shallow gullies which are the result of surface runoff, do not require any attention.
ANY NOTICEABLE SEEPAGE	A wet or saturated area was encountered 25 ft± left of the outlet pipe at the downstream toe. No water flow or discoloration was noted. The ground to the right of the outlet pipe is also saturated as a result of water flowing from a small spring located 225 ft± west of the pipe at an estimated rate of 5 gpm. See the accompanying field sketch, Sheet 1.	The wet area to the left of the outlet pipe is believed to represent accumulated surface runoff. This area should be monitored to verify its origin.
STAFF GAGE AND RECORDER	None observed.	A staff gage should be installed.
DRAINS	Two 6 inch CMP drains occur exit, one on each side, beside the principal spillway outlet pipe. Clear water was flowing at 2 gpm± from the right CMP, while only a trace of water was dripping from the left CMP. Some sediment was present in the left pipe.	The left drain pipe should be unstopped.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There is no concrete weir.	-
APPROACH CHANNEL	The channel is 200 ft± wide, grassed and in good condition. Side slopes are roughly 3H:1V. Only minor surface erosion was noted. Tall grass 2 to 3 ft± high was growing in the channel and on the adjacent slopes.	Grass needs mowing.
DISCHARGE CHANNEL	The channel is grassed up to where it enters woods. The channel is in good condition. Numerous pine trees are growing on the left cut slope. Tall grass 2 to 3 ft± high was growing in the channel and on the adjacent slopes.	The grass should be cut and the trees should be removed.
BRIDGE AND PIERS	None	-

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling was observed in the 30 inch RCP.	Good condition
INTAKE STRUCTURE	The concrete is in good condition. The valves were operational during last check. No debris was observed.	-
OUTLET STRUCTURE	None	-
OUTLET CHANNEL	The plunge pool is in good condition and the riprap is in place.	-
EMERGENCY GATE	The 30 inch diameter gate is reportedly operational.	-

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Wooded and grassed slopes ranging from about 2H:1V to 3H:1V bound the reservoir. Except for some sloughing observed on the right side, the area appears to be in good condition. Some fallen trees exist on the right side.	-
SEDIMENTATION	Some sedimentation was observed in the upstream reaches of the lake.	-

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream area is wooded and includes heavy underbrush. Minor debris was observed. N = 0.1. The channel is 25 ft± wide.	-
SLOPES	Side slopes are about 3H:1V and the flood plain is 250 ft± wide.	-
APPROXIMATE NO. OF HOMES AND POPULATION	One motel and one commercial facility occur along U.S. Route 1 approximately 2 miles downstream with a flood elevation approximately 10 ft above the stream bed.	The motel has been flooded before.

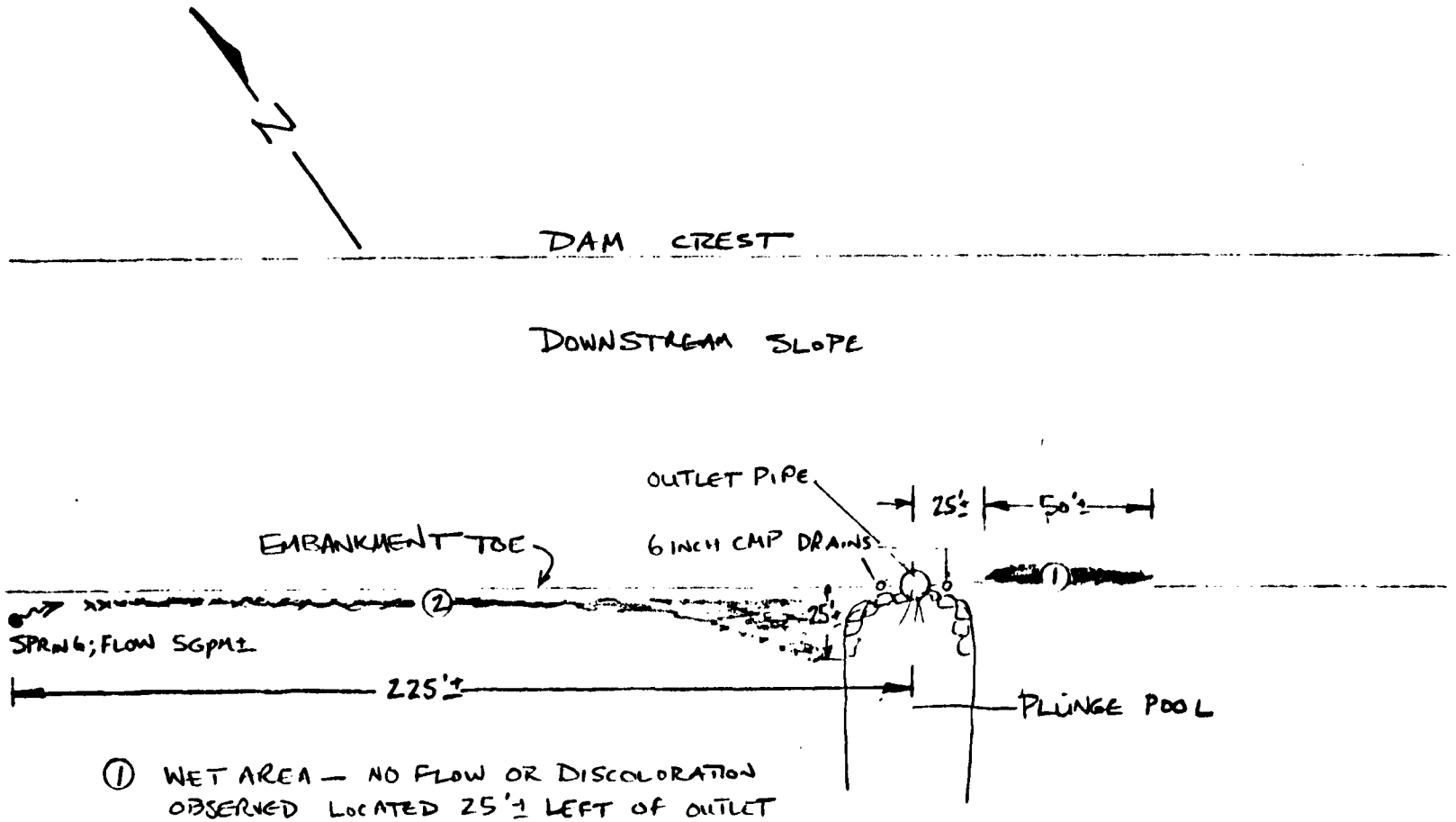
INSTRUMENTATION

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

BY SW DATE 5/11/88 SCHNABEL ENGINEERING ASSOCIATES SHEET NO. 1 OF 1

CHKD BY ..... DATE ..... CONSULTING ENGINEERS JOB NO. V80199

SUBJECT FIELD SKETCH - SATURATED AREAS



① WET AREA — NO FLOW OR DISCOLORATION OBSERVED LOCATED 25'± LEFT OF OUTLET AT ABOUT SAME ELEV AS TOP OF PIPE. AREA 50'± LONG AND 25'± WIDE.

② SATURATED AREA FORMED BY WATER FLOWING FROM A SPRING LOCATED 225'± RIGHT OF THE OUTLET. SATURATED AREA WIDENS TO 25'± NEAR THE PLUNGE POOL.

NO SCALE

APPENDIX IV

DESIGN REPORT SUMMARY

V

POTOMAC CREEK

WATERSHED PROJECT

DESIGN REPORT

Dam No. 2
Stafford County
Virginia

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

INDEX

DF-1

This single purpose dam is located approximately 4½ miles north of Falmouth, Virginia on a tributary of Potomac Creek. The Stafford, Virginia 7½ - minute quadrangle published by the U. S. Geological Survey can be used to locate the site. The location is approximately 38° 25' latitude and 77° 30' longitude.

The purpose of the structure is to reduce downstream flooding by providing temporary storage for the runoff from 1,504 acres. The temporary storage is released gradually through a two -stage principal spillway system. The results of the hydrologic and hydraulic computations are given on sheet 4 of this report.

The structure consists of a compacted earth fill with a cutoff extending through sands and gravels to hard clay and sandstone. A drainage system is located under the downstream portion of the earth fill to collect seepage and alleviate uplift pressures and to control the phreatic surface within the fill.

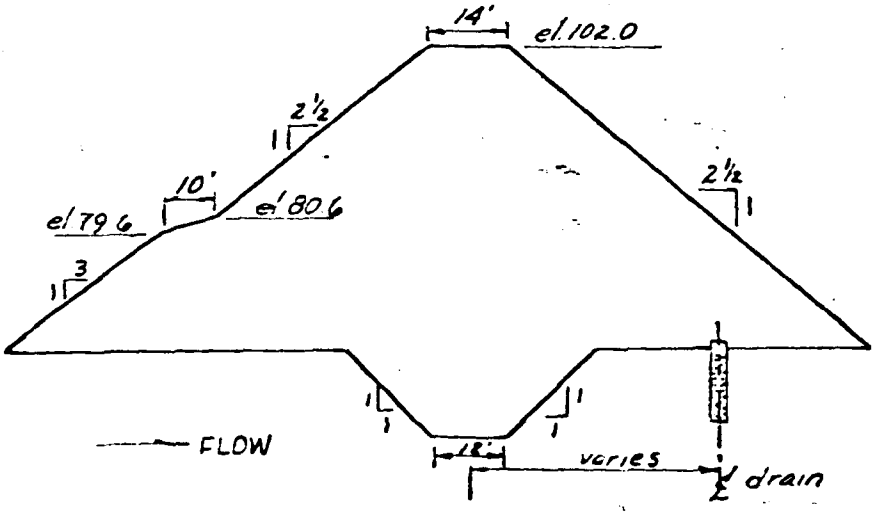
The principal spillway is a drop inlet structure consisting of a two -stage reinforced concrete riser, 30 -inch diameter reinforced concrete water pipe, and riprapped plunge pool to dissipate the energy of high velocity discharge at the outlet end of the conduit.

The emergency spillway is designed as an earth cut in the left abutment. Copies of reports covering geologic conditions and soil engineering tests are included in the design folder.

U S DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

DESIGN REPORT SUMMARY

I. Watershed Data		
A. Structure Class	C	
B. Drainage Area	1504	Ac.
C. Time of Concentration - T_c	1.5	Hrs.
D. Hydrologic Curve Number - C_n		
1. Moisture Condition II	61.5	
II. Principal Spillway		
A. Conduit		
1. Inside Dia.	30	in.
2. Length	200	Ft.
B. Riser		
1. Inside Dimensions	2.5x7.5	Ft.
2. Height (Floor to Crest)	25.0	Ft.
C. Weir Length	15	Ft.
D. Orifice Dimensions	22 x 20	in
E. Reservoir Drain Size	30	in.
F. Type of Energy Dissipater	Riprap Basin	
III. Emergency Spillway		
A. Width	200	Ft
B. Side Slopes	3:1	
C. Length of Level Section	30	Ft
D. Exit Slope	0.03	Ft/Ft
E. Max. Velocity in Exit Section @ D.H.W.	6.9	Ft/Sec.
F. Duration of Flow thru Emer. Spillway @ D.H.W.	11.0	Hrs.
G. Frequency of Use	ONCE EVERY 100 YEARS	
IV. Earth Fill		
A. Height	34.0	Ft.
B. Volume	60,100 ±	C.Y.
C. Compaction	95% standard proctor	



FILL PLACEMENT

U S DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

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

National Engineering Memorandum No. 27 (3/19/65), Limiting Criteria for the Design of Earth Dams
National Engineering Memorandum No. 50 (5/16/63), Drop Inlet Spillway Standards
National Engineering Handbook Section 4, Hydrology
National Engineering Handbook Section 5, Hydraulics
National Engineering Handbook Section 6, Structural Design
National Engineering Handbook Section 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. 12, Procedure for Computing Sediment Requirements for Retarding Reservoirs
Engineering Division Technical Release No. 29, Hydraulics of Two-Way Covered Risers
Engineering Division Technical Release No. 30, Structural Design of Standard Covered Risers
Engineering Division Technical Release No. 31, Structural Analysis and Design of Low Stage Inlets
Engineering Division Technical Release No. 37, Structural Analysis and Design of Base of Riser with Conduit Openings in both Endwalls

Copies of the above publications may be obtained from Mr. Tom F. McGourin, State Conservationist, USDA, Soil Conservation Service, Richmond, Virginia.

L. S. Button, Jr.
State Conservation Engineer

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

Element 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 ORIFICE	100 year sediment accumulation	79.1	12	54①	0.43	—	—	0
Crest of riser	1' below em. spwy. crest	94.1	39.5	340②	2.71	—	—	60
Crest of emergency spillway	100 year frequency storm, moisture condition II	95.1	42	374②	2.98	—	—	107
Design high water	1 X value from FS-1020 Sh. 2 ** moisture condition II	97.4	47	462②	3.68	6.15	2810	1530
Top of dam	1 X value from FS-1020 Sh. 5 ** moisture condition II	102.0	60	708②	5.64	21.38	12,539	10,200

* Volume expressed in inches of runoff from controlled watershed area of 1504 acres.
** Refer to hydrologic criteria in National Engineering Memorandum SCS-27
Time required to empty flood storage is 4.8 days.

① Does not include 48 ac.-ft prorated sediment allocated to flood pool
② Does not include 102 ac.-ft. of sediment storage

All the materials that will be used to construct this embankment are sufficiently high in shear strength and low in permeability to the extent they can be used anywhere in the fill. The silty sands will generally be placed downstream and the clays and silts in the cutoff trench and central area of the dam. No definite zoning is specified because the clays and sands and silts will not be easy to separate in the borrow areas. Mixing the materials will produce a good fill material for any part of the dam and separately we have defined how to place them.

Hard rock on which to bottom the cutoff trench was not located during the geologic investigation, but hard clay was located. Below this clay is mudstone and sandstone. The trench will most likely extend to rock, but as long as it extends into the hard clay a sufficient cutoff should result.

A drainage system to intercept any water and relieve any pressure that might build up in the foundation will be installed. This drain will also draw down the phreatic surface in the embankment. With good fill material in abundance and a good cutoff to rock or slowly permeable clays available, this 32' structure should present no construction problems.

We have not followed the soils labs recommendation to undercut the conduit to horizontal. Based on Advisory #6, paragraph 3, and the fact that long joints will be specified for the conduit, we do not feel the differential consolidation between the sands and gravels will be enough to adversely effect the functioning of the principal spillway.

APPENDIX V

SOIL TESTING SUMMARY
AND
STABILITY ANALYSIS

UNITED STATES GOVERNMENT

Memorandum

TO : L. S. Button, State Conservation Engineer, SCS, Richmond, Virginia

DATE: March 12, 1968

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

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

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 5 sheets.
2. Form SCS-128, Consolidation Test Data, 4 sheets.
3. Form SCS-355, Triaxial Shear Test Data, 4 sheets.
4. Form SCS-366, Direct Shear Test Data, 2 sheets.
5. Form SCS-352, Compaction & Penetration Resistance Report, 9 sheets.
6. Form SCS-130, Drain Materials, 1 sheet.
7. Form SCS-357, Summary - Slope Stability Analysis, 2 sheets.
8. Investigational Plans and Profiles.

DISCUSSION

FOUNDATION

A. Bedrock: Sandstone and dark gray mudstone underly the right abutment and the floodplain. Marine sands and gravels of the Pliocene or Pleistocene age underly the thin soil mantle on the left abutment. The residual soil is about 10 feet thick on the left abutment, from 4 to 13 feet thick on the right abutment and from 9 to 17 feet thick in the floodplain section.

B. Soil Classification: The soil overlying the bedrock at this site is stratified sands, silts and clays classed as SM, SC, SC-SM, ML, MH, CL and CH. The extent of each of the soil classes is shown clearly on the attached form SCS-35B. The alluvial soil on the right side of the channel appears to be predominately fine-grained soils classed as ML, MH, CL and CH. The alluvium on the left side of the channel appears to be predominately sandy soil classed as SM and SC.

There is a fairly continuous stratum of gravel that occurs at depths of from 4 to 8 feet in the floodplain. The gravel stratum ranges from 1 to 3 feet thick and it is logged as GM and GP.

The sandy soil at the surface in the vicinity of the channel and at the base of the left abutment contains from 15 to 17 percent fines. The sandy material represented by the other samples submitted contain more than 24 percent fines.

The fine-grained soils at the surface on the right side of the floodplain range from ML to CH.

C. Density: Core samples were submitted from TP #10, TP #3, and TP #401. The samples all represent the surface zone. The sandy soil from TP #10 contained 17 percent fines and the density ranged from 1.55 g/cc (96.7 pcf) to 1.60 g/cc (99.8 pcf). The sample from TP #3 contained 32 percent fines and had a density of 1.47 g/cc (91.7 pcf) to 1.56 g/cc (97.3 pcf). The sample from TP #401 contained 81 percent fines. The liquid limit is 52 and the PI is 25. The sample is classed as CH and the density of test specimens trimmed from the core sample ranged from 1.45 g/cc (90.5 pcf) to 1.50 g/cc (93.6 pcf).

D. Shear Strength: A direct shear test was made on sample 68W1587 from TP #3. This is a sandy soil from the right abutment. The sample from TP #10 was not suitable for testing, therefore, sample 68W1587 was the only sample available that could be used to provide shear strength information for the sandy material on this site. The shear strength values obtained are $\phi = 36°$, $c = 225$ psf. A consolidated undrained triaxial shear test was made on the CH sample from TH #401. The test was made at saturation. The test data indicate that CH is preconsolidated and the shear strength has been conservatively interpreted from the test data as $\phi = 0$, $c = 2500$ psf.

E. Consolidation: A consolidation test on the sample from TH #401 shows that the CH has been preconsolidated to loads in excess of those which will be applied by the proposed embankment. The minimum Pc is in the range of 7500 psf. The preconsolidation indicated by the test may be due to drying or possibly because the sample had a tendency to swell when the loading was less than 4000 psf.

The other foundation materials may consolidate somewhat when loaded. The consolidation potential is not expected to be high, however.

F. Permeability: The gravelly material logged as GP and GM in the floodplain may be quite permeable. We anticipate the cutoff trench will bottom on bedrock or in tight material below this depth, however.

EMBANKMENT

A. Classification: The samples submitted from the emergency spillway and from the borrow area are classed as CL, ML, GC, SC, and SM. It appear that the emergency spillway will yield about 45,000 cubic yards of material that may be used in the embankment. The total fill requirements are estimated to be about 57,500 cubic yards. The CL and ML samples from the spillway contain from 51 to 69 percent fines and

from 21 to 33 percent finer than the number 200 sieve. The sandy materials contain from 18 to 23 percent fines and from 10 to 11 percent finer than 0.002 mm. The gravel sample contains 49 percent gravel and 14 percent fines.

The samples submitted from the emergency spillway are classed as SC and CL.

B. Compacted Density: Standard Proctor compaction tests were made on the samples from emergency spillway and from the borrow area. The maximum dry densities obtained on the CL's ranged from 101.5 pcf to 113.5 pcf. The maximum density obtained on the SM and SC samples ranged from 110 pcf to 116 pcf. The Proctor density of the GC is 117.5 pcf and the ML has a Proctor density of 96.5 pcf.

C. Shear Strength: Shear tests were made on samples 68W1600, 1603 and 1605. The available quantity of each type of material tested is not known but it is considered that the samples tested cover the range of material sampled. The test data is summarized as follows:

Sample No.	Type of Shear Test	Soil Class	Test γ_d pcf	Percent of Theoretical Saturation	Shear Strength Values ϕ deg	c psf
68W1600	Direct	SM	104.8	Flooded	35.5	375
68W1603	Triaxial	CL	107.0	96	23.0	575
68W1604	Triaxial	ML	91.0	93	14.0	725
68W1605	Triaxial	SM	100.5	93	34.0	475

SLOPE STABILITY

The stability of 2 1/2:1 slopes was checked with a Swedish circle method of analyses. A phreatic line was assumed from emergency spillway elevation. The no drain condition was assumed for the analyses of the downstream slope and the full drawdown condition was assumed for analyses of the upstream slope. For a 37-foot embankment the lowest factors of safety were obtained when strength values of $\phi = 23^\circ$, c = 575 were used to represent the shear strength of the embankment. A 2 1/2:1 upstream slope has a factor of safety of 1.81 and a 2 1/2:1 downstream slope has a factor of safety of 1.92.

The shear test on the foundation materials indicate that the foundation is relatively strong and the analyses on the maximum embankment section is considered to represent conditions pretty well.

- -- L. S. Button -- 3/12/68
Lork P. Dunnigan
Subj: ENG 22-5, Virginia WP-08, Potomac Creek, Site No. 2

SETTLEMENT ANALYSES

The consolidation potential of the foundation material is expected to be low and differential settlement is not expected to be a problem.

RECOMMENDATIONS

A. Cutoff: In the floodplain section we recommend that the cutoff trench bottom in slowly permeable material below the gravelly stratum that occurs at depths of from 4 to 8 feet. The trench may have to extend to bedrock in some areas to accomplish this. We suggest that the trench on the abutment bottom on bedrock or if slowly permeable materials overly bedrock the trench could bottom at a shallower depth. We suggest that CL material be used for backfill. We recommend that the backfill be compacted to a minimum of 95 percent of standard Proctor density with the control based on the minus #4 fraction. A placement moisture content near optimum is suggested.

B. Principal Spillway: Two locations were investigated for the principal spillway. Location A crosses centerline at station 4+50 and location B crosses centerline at station 5+35.

The foundation materials at both locations consist of sandy and gravelly soil overlying silts and clays that logged as very hard. At location A the gray to black clay that is logged as very hard occurs at depths of from 5.5 to 8.0 feet. At location B the gravelly stratum occurs at depths of from 0 to 5.5 feet and the gray to black clay or green silt that is logged as very hard occur at depths of from 3.5 feet to 8 feet. The conduit may be located at either location. If location A is used we suggest that the conduit trench be excavated to the "very hard" clay that underlies the sand and gravel alluvium because of the possibility of non-uniform consolidation between the sands and the gravel. If location B is used it may be possible to bottom the trench in the GM. It occurs as a continuous stratum. If the GM is non uniform, the trench could be bottomed on the "very hard" clay or silt.

The trench backfill should be like that suggested for the cutoff trench.

C. Drain: Positive cutoff is not certain, therefore, we suggest a drain to provide a safe outlet for seepage that may occur through the foundation and also to prevent the phreatic line from emerging on the downstream slope. A trench drain located at about c/b = 0.6 could be used. The gradation limits suggested for a single filter are shown on the attached form SCS-130. If desired a double filter with the appropriate grading limits could be used.

5 -- L. S. Button -- 3/12/68
Lorn P. Dunnigan
Subj: ENG 22-5, Virginia WP-08, Potomac Creek, Site No. 2

D. Embankment Design:

1. Placement of Material: We assume that there will be about 45,000 cubic yards of material excavated from the emergency spillway. The materials are classed as CL, ML, SM and GC and they will make up about 77 percent of the fill. We don't know the volume of each of the soil classes represented but if possible we suggest that the CL and ML materials be used for a core section in the embankment. The SC and CL like samples 68W1606 and 1607 from the borrow area could also be used in the core section. The SM like samples 68W1600, 1602 and 1605 could be used anywhere in the embankment. We expect that the SM will be slightly more permeable than the CL, ML and SC and for this reason we suggest that it be utilized in the downstream section if practical.

   The GC material can probably be utilized to the best advantage in the shell section.

   We recommend that all of the embankment material be placed at a minimum of 95 percent of standard. Proctor density with the control based on the minus #4 fraction. If there is a significant amount of the GC the control might be altered to a method specification.

   We suggest a placement moisture content near optimum.

2. Slopes: The stability analyses based on the shear strength values of the samples submitted indicate that the proposed 2 1/2:1 slopes have acceptable factors of safety.

3. Settlement: An overfill allowance of .75-foot is suggested to compensate for residual consolidation in the fill and foundation.

Lorn P. Dunnigan

cc:
L. S. Button, Richmond (3)
N. F. Bogner, Upper Darby

MATERIALS TESTING REPORT | U.S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE | SUMMARY - SLOPE STABILITY ANALYSIS

PROJECT and STATE: [illegible] CREEK #2 MD

METHOD OF ANALYSIS: SWEDISH METHOD

ANALYZED AT: [illegible]

APPROVED BY: LPD

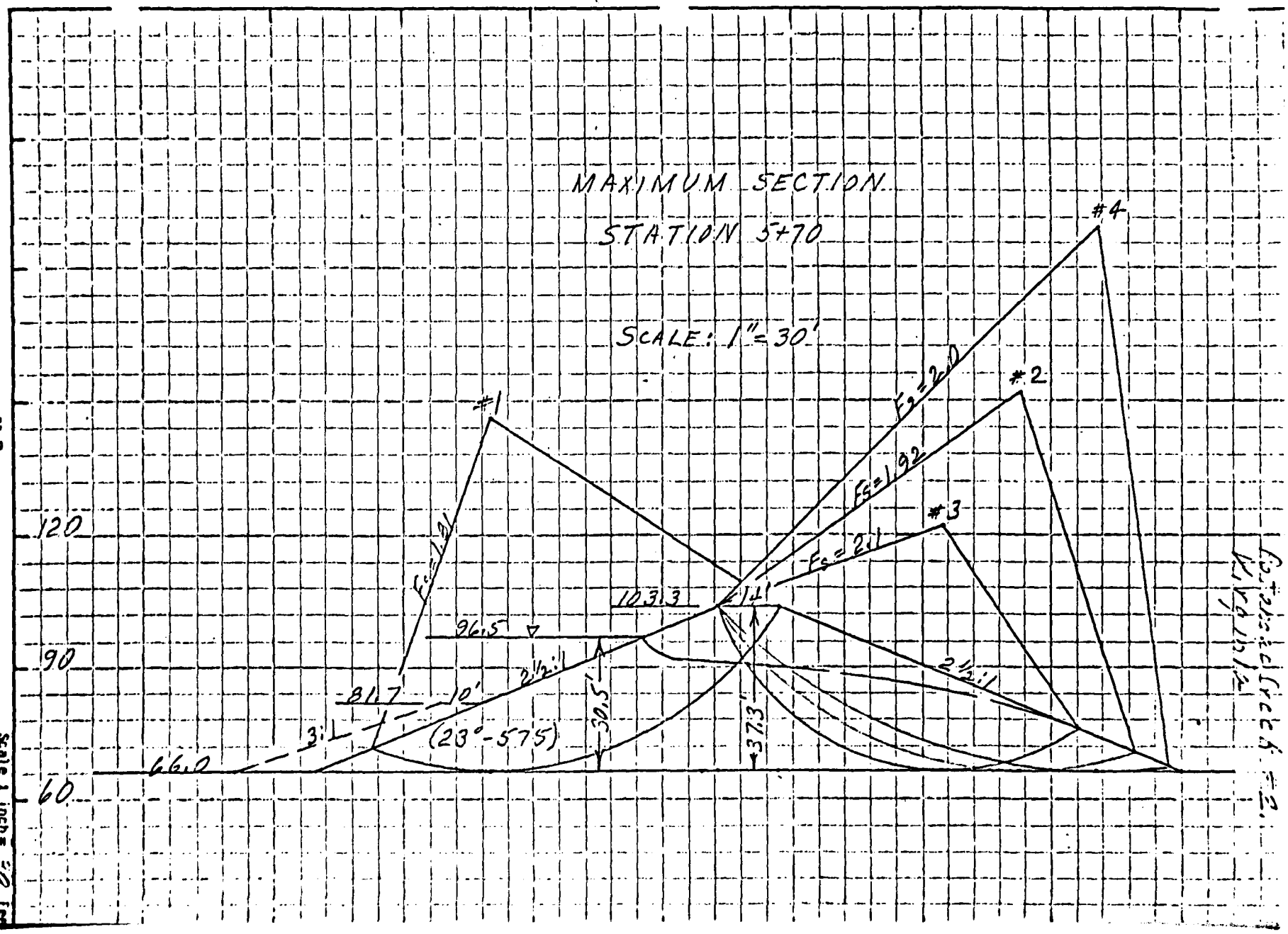
DATE: 2-6-74

	SOURCE AND USE OF MATERIALS	CLASSIFICATION	ADOPTED DESIGN DATA: γ_d (pcf)	γ_m (pcf)	γ_{sat} (pcf)	γ_{sub} (pcf)	ϕ (deg.)	tan ϕ	c (psf)	REMARKS
①	Found.	SM	94.6		121.0	59.5	36	0.727	225	
②	Found.	CH	92.2		113.5	51.0	0	0	2500	
③	Embank.	SM	105.7		129.5	66.0	35.5	0.713	375	
④	Embank.	CL	107.0	122.5	128.0	65.5	23	0.424	575	
⑤	Embank.	ML	91.0	113.0	118.0	55.5	14	0.249	725	
⑥	Embank.	SM	100.5	114.5	123.0	60.5	34	0.675	475	
⑦										
⑧										

TRIAL NO.		SLOPE	CONDITIONS	F_s
			MAXIMUM SECTION @ STATION 5+70	
1	Up	2½:1	Full drawdown - No berm - Arc cut from opp. shldr. thru emb. (23°-575) only.	1.81
1A	Up	2½:1	Same conditions as trial #1 but emb. (35.5°-375) only.	1.95
1B	Up	2½:1	Same conditions as trial #1 but emb. (34°-475) only.	2.0
1C	Up	2½:1	Same conditions as trial #1 but emb. (14°-725) only.	1.86
2	Dn	2½:1	No Drain - No berm - Arc cut from opp. shldr. thru emb. (23°-575) only.	1.92
3	Dn	2½:1	Same conditions as trial #2.	2.1
4	Dn	2½:1	Same conditions as trial #2.	2.0
			FLOOD PLAIN SECTION @ STATION 7+00	
5	Dn	2½:1	No Drain - No berm - Arc cut from opp. shldr. thru emb (23°-575) & 5' found (0°-2500).	3.5

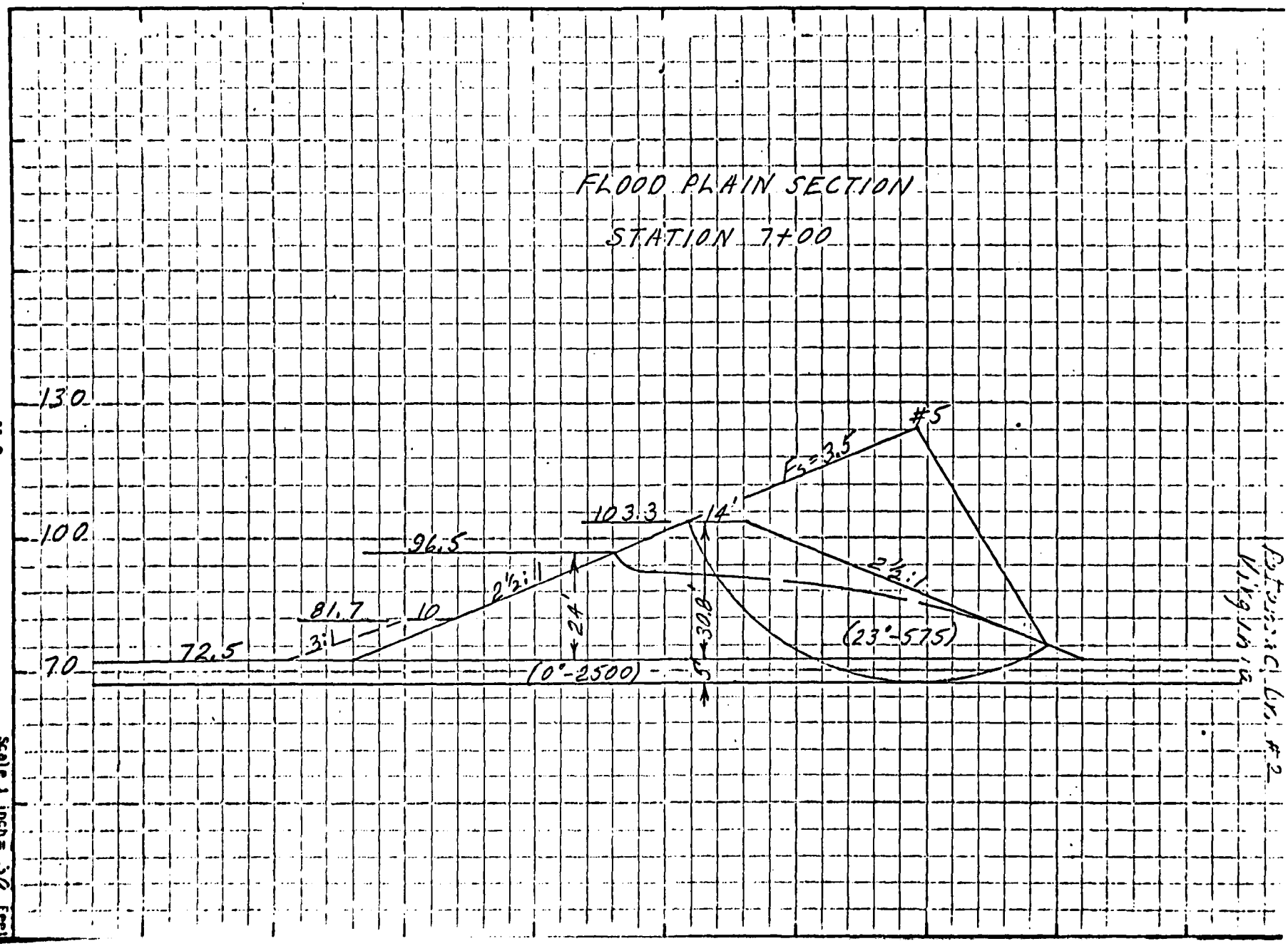
V-6

Sheet 7 of [illegible]



V-7

Scale 1 inch = 30 fe


FLOOD PLAIN SECTION
STATION 7+00
130
100
70
#5
Fs=3.5
103.3
14'
96.5
2½:1
81.7
10
3:1
2½:1
24'
30.8'
72.5
(23°-57.5)
(0°-25.00)
5'
Scale 1 inch = 30 Feet
V-8
Return to Cr. #2
Virginia

APPENDIX VI

GEOLOGIC REPORT

Form SCS VA-67
Sheet 1 of 6

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

L L Button, ?

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Stafford ; ___ ¼, ___ ¼, Sec. ___, T ___ R ___ ; Watershed Potomac Creek

Subwatershed ___ Fund class WP-2-2 (FP-2, WP-1, etc.) Site number 2 Site group Mulfield 46 Beltsville; I Structure class c

Investigated by Geologist (signature and title), Equipment used Front end loader (Type, size, make, model, etc.), Date 9/67

SITE DATA

Drainage area size 2.35 sq. mi., 1504 acres. Type of structure Earth Fill Purpose Flood Protection

Direction of valley trend (downstream) South Maximum height of fill 34.9 feet. Length of fill 650 feet.

Estimated volume of compacted fill required 57,494 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	102	13	10.8
Floodwater	429	45	28.1

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Coastal Plain Topography Gently Rolling Attitude of bed: Dip 5° SE Strike N

Steepness of abutments: Left 50 percent, Right 20 percent. Width of floodplain at centerline of dam 350 feet

General geology of site Potomac Creek Site 2 is located in Stafford County, Virginia, about 5 miles north of Fredericksburg. The site is on a northern tributary of Potomac Creek, in the Coastal Plain near its inner edge.

Hard, light-gray cross-bedded sandstone and dark gray hard clay of the Patuxent Formation (Cretaceous) underlies the right abutment, adjacent hillsides and the flood plain. The left abutment is underlain by marine sands and gravels of Pliocene or Pleistocene age, resting unconformably upon the Cretaceous rocks. The Aquia Formation, a hard glauconitic sand, may lie in patches upon the Patuxent Formation and below the Pleistocene sands and gravels. All units dip gently east-southeast.

Residual soil occurs on the dam abutments and adjacent hilltops. The B-horizon consists of brown to yellow-brown clayey sand (right abutment) to yellow-brown or yellow-red silty sand and sandy silt (left abutment). Below this are Pleistocene sands and gravels of marine origin, or hard Cretaceous sediments. The flood plain soil includes gray and brown mottled clays, silts, and sands, topas-quartz gravel, and gray sand.

2 of 6

Sandstone and hard gray clay outcrops along the right side of the Valley upstream, where the creek cuts into the hillside. The sandstone forms a cap layer over the mudstone. The stream pattern is a dendritic one with broad valleys incised in the Coastal Plain sediments.

Methods and Procedures

1. Soils were classified according to the Unified Soil System. The USDA System was used to correlate borrow material.

2. Seismic and resistivator surveys were made in the foundation.

Centerline of the Dam

The centerline of the dam is located on a wide flood plain between moderately sloping abutments. Gray sandstone, dark gray mudstone, and marine sands and gravels underlie the residual and alluvial soils. On the left abutment, residual soil extends from Station 3+90 to the top of the dam. Four feet of yellow-brown sand overlie a foot of gravel, which in turn overlies 1-2 feet of gray silty sand. Below this is another gravel layer then gray-green silty clay or sandy silt, mottled brown and yellow. This layer is a very hard parent material that may be of the Aquia or Patuxent formations.

On the right abutment, 3-4 feet of brown to yellow-brown clayey sand overlie gravel or gray to yellow-white silty sand. Gray, very hard clay lies at the bottom. On both abutments, the sand and gravel layers tend to intersect the slope rather than parallel it.

In the flood plain, 3-6 feet of silt, clay, or sand, mottled brown and gray (Ochlockonee Series), overlie 2-3 feet of gray silty to clayey sand. In some places this layer is missing and the top layer rests directly on 2-3 feet of topaz and quartx gravel. Below the gravel is dark gray to black silty clay, which was penetrated no more than 3 feet before refusal. Toward the left side of the flood plain, the top layer becomes a gray-brown silty sand, without mottles. In the vicinity of Station 5+25 the dark clay layer in the bottom becomes a green clayey sand or sandy clay (Aquia?). Cutoff varies from 8 feet to more than 17.5 feet below the flood plain. Thirteen test pits were dug along the centerline of the dam. They are TP-1 to TP-13.

Principal Spillway

Two pipe locations were investigated. Pipe "A" across the centerline of the dam at Station 4+50 on the centerline of the dam and Station 2+00 on the centerline of the pipe. The two centerlines form an angle of 86.5°. Conditions are generally the same as along the centerline in the flood plain, except that 2-3 feet of clayey silt or silty sand lie between the gravel layer and the hard dark clay layer along the downstream half of the pipe. Gravel is locally missing, and there are occasionally two layers of gravel separated by sand. The bedrock surface lies 8.0-9.5 feet below ground and undulates gently in elevation between 60.7 and 59.1 feet above sea level.

Pipe "B" crosses the centerline of the dam at Station 5+35 on the centerline of the dam and Station 1+75 on the centerline of the pipe. The two centerlines intersect at 70°. Again, conditions are similar to those of the flood plain portion of the centerline of the dam. The rock surface (refusal) lies from 6-12.5 feet below ground; elevation of rock varies from 59.6-57.7 feet above sea level. Fourteen test pits were dug along the pipe locations. They are TP 301 to TP 314.

Foundation

General foundation conditions are similar to conditions along the dam and pipe centerlines. Depth to rock averages about 11 feet below the surface and the water table is about 5-6 feet down. Eleven test pits were dug in the foundation. They are TP 401 to TP 411.

Emergency Spillway

The emergency spillway is located in a gently sloping hilltop, incised by a gully, left of the left abutment. Test pits were dug in a rectangular grid pattern with spacing usually of 100 feet. 4-6 feet of yellow-red to yellow-brown silty sand or sandy silt (Caroline Series) overlie 3-4 feet of red-gray or brown-gray mottled clayey silt or sand. The upper layer is often absent. Below the mottled layer, to a depth of 16 feet or more, are gravel and sand beds; the sand is generally yellow, gray, or white in color and probably is Pleistocene beach sand. Small pieces of decayed twigs were found embedded in sand at 10 feet or more here. No rock was encountered above grade. 21 test pits were dug in the spillway area. They are numbered TP-201 to TP-221.

Borrow Area

In addition to the material available in the spillway, borrow was prospected in the part of the flood plain and lower slopes within the sediment pool area. The borrow area extends about 750' upstream from the dam and is 400' wide. The materials are similar to those described earlier. The water table lies from 2.0-9.0 feet below ground. Gray-green very hard silty sand underlies the alluvium at about 8 feet in most places. It may be of the Aquia Formation. Sixteen test pits were dug in the borrow area. They are numbered TP-101 to TP-116.

Form 303-354
5 of 6 MAY 55

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SAMPLE LIST
SOIL AND FOUNDATION INVESTIGATIONS

Location Stafford County Owner _____

Watershed Potomac Creek Sub-watershed _____ Site No. 2

Submitted by Joseph W. Gaffney Date Nov. 19 67

Sent by Truck (carrier) Government B/L No. _____

Lab. No.	Field Sample No.	Sample Description		Depth		Type of Sample	
		Location	Grid or Station	From	To	Undist.	Dist.
	1-1	C/L Dam	8+75	4.0	12.5		X
	2-1	C/L Dam	8+50	1.0	4.0		X
	3-1	C/L Dam	8+00	1.0	2.5	X	
	3-2	C/L Dam	8+00	2.5	4.0		X
	5-1	C/L Dam	7+00	1.0	4.5		X
	8-1	C/L Dam	5+50	1.0	5.0		X
	9-1	C/L Dam	5+00	6.5	9.0		X
	10-1	C/L Dam	4+50	1.0	4.5	X	
	11-1	C/L Dam	4+00	5.0	7.0		X
	12-1	C/L Dam	3+35	8.0	10.0		X
	105-1	Sediment Pool	580' R	1.0	5.0		X
			STA. 1+65 C/L Dam				
	107-1	Sediment Pool	660' R	4.0	8.0		X
			STA. 4+40 C/L Dam				
	204-1	Spillway 200' R	STA. -1+00 C/L Dam	1.0	4.5		X
	204-2	Spillway 200' R	STA. -1+00 C/L Dam	7.5	10.0		X
	208-1	Spillway 200' L	STA. 0+00 C/L Dam	5.0	11.5		X
	208-2	Spillway 200' L	STA. 0+00 C/L Dam	11.5	14.0		X
	216-1	Spillway 200' R	STA. 1+00 C/L Dam	4.5	6.5		X
	218-1	Spillway	STA. 2+00 C/L Dam	1.0	4.0		X
	221-1	Spillway 200' R	STA. 2+00 C/L Dam	13.5	16.0		X
	303-1	Pipe "A"	1+75	1.0	2.5		X
	304-1	Pipe "A"	3+25	1.0	3.5		X

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

Form SCS-534
MAY 55

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SAMPLE LIST
SOIL AND FOUNDATION INVESTIGATIONS

Location Stafford County Owner _____

Watershed Potomac Creek Sub-watershed _____ Site No. 2

Submitted by Joseph W. Gaffney Date Nov. 1967

Sent by Truck (carrier) Government B/L No. _____

Lab. No.	Field Sample No.	Sample Description		Depth		Type of Sample	
		Location	Grid or Station	From	To	Undist.	Dist.
	401-1	50' R	7+00 C/L Dam	1.0	5.0	X	
	401-2	50' R	7+00 C/L Dam	11.5	15.5		X
	402-1	50' L	7+00 C/L Dam	5.0	9.0		X
	411-1	50' L	5+50 C/L Dam	3.5	5.0		X

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

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCS-376C
REV. 2-64
SHEET 1 OF 8

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

WATERSHED	SUBWATERSHED	COUNTY	STATE
Potomac Creek	--	Stafford	Virginia

SITE NO.	SITE GROUP	STRUCTURE CLASS	INVESTIGATED BY: (SIGNATURE OF GEOLOGIST)	DATE
2	I	c	Geologist	9/67

IN-SERVICE USE ONLY

INTERPRETATIONS AND CONCLUSIONS

1. The cutoff trench should be taken to bedrock. The dark gray, black, or green clays and clayey sands in which refusal occurred are very tight and should make a good foundation.

2. No rock will have to be removed from the emergency spillway.

3. Pipe B is the better location insofar as it lines up with the creek downstream. Some of the pipe will be in the stream, but as this portion lies in the foundation, a diversion will have to be made in any case.

4. Sufficient borrow is available to construct the embankment. Placement of borrow materials is given in the soil correlation chart. Good core material is to be had in several layers of the alluvial Ochlockonee Series and the Caroline Series in the emergency spillway. The water table should be lowered in the flood plain so as to give an average of 6 to 7 feet of dry borrow.

5. All topsoil should be stockpiled for use as top-dressing.

APPENDIX VII

PREVIOUS INSPECTION REPORTS

OPERATION AND MAINTENANCE INSPECTION REPORT

Watershed: Potomac Creek, Site #2 **Date: June 20, 1979**

Inspected by: R. E. Sotzing - Stafford Sanitary District, Wayne Brooks - Russell & Axon, Jean Jones - Tri-County SWCD, Jim Blodgett and Don Farmer - Soil Conservation Service.

1. There was no evidence of any major erosion problem at this time.

2. Although the vegetation was in fairly good shape, it was suggested that some lime and fertilizer be applied based on the results of a current soils test. It was also noted that occasional mowing would not only control weeds and shrubs, but it would also improve the vigor of the vegetation.

3. Volunteer pines and maples are still present on the dam and emergency spillway. These trees should be removed as soon as possible.

4. The principal spillway and foundation drains appear to be operating properly.

OPERATION AND MAINTENANCE PLAN

Potomac Creek Site #2

Stafford, Virginia

The County of Stafford is responsible for the proper operation and maintenance of this structure.

As part of the operation and maintenance, visual inspections will be made annually and after major storms. These inspections will include representatives of Stafford County, Tri-County Soil and Water Conservation District and the Soil Conservation Service. A report will be prepared after each of these inspections to document the groups findings, as well as, determining the type of maintenance required. A follow-up report will also be prepared showing the status of any required maintenance.

To sustain a vigorous stand of vegetation on the dam and spillway, the following maintenance should be performed:

A. LIME AND FERTILIZER - Lime and fertilizer should be applied based on recent soils test. Generally, liming and fertilizing should be done every 2-3 years.

   Apply lime and fertilizer between August 15 - October 1.

B. MOWING - If possible to do safely, mow the Sericea Lespedeza every 2-3 years in July 15 - August 15. However, it is not essential that the steep areas be mowed.

   Do not mow below 4 inches.

C. BRUSH CONTROL - All woody vegetation, trees, shrubs, etc. should be removed as soon as possible.

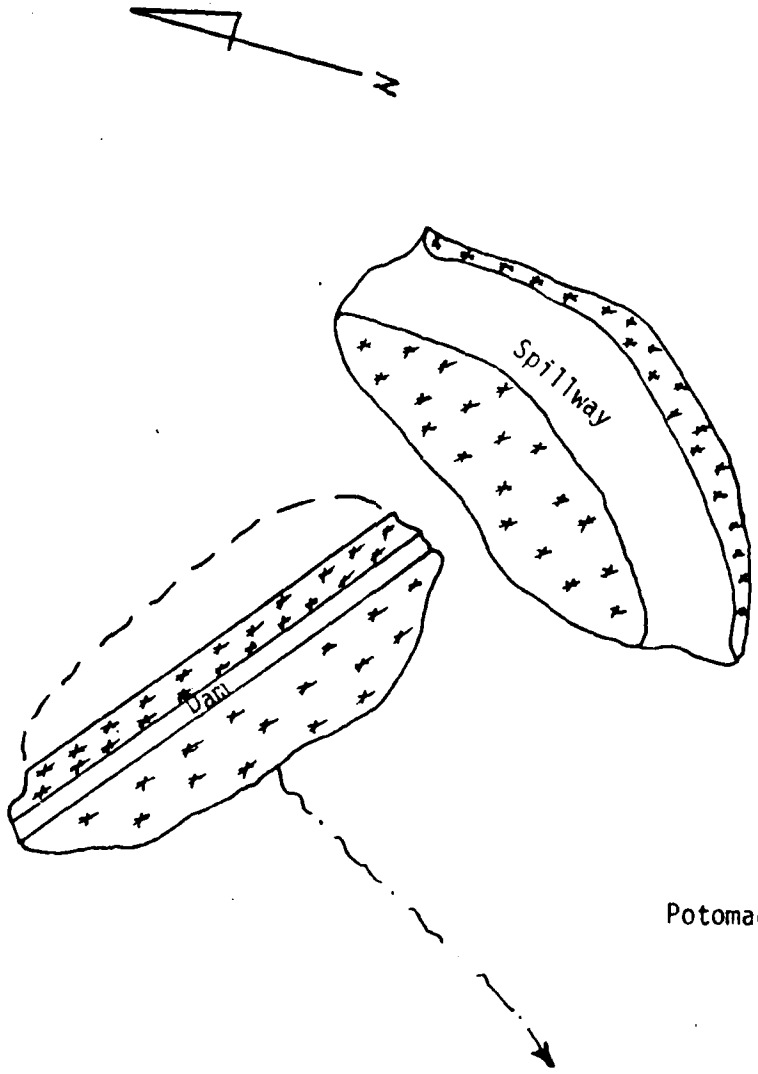
D. DEBRIS REMOVAL - All debris that has been deposited by flows through the emergency spillway should be removed.

E. TRAFFIC - 4-wheel drive or other vehicles should not be permitted on this site except to perform necessary maintenance.

OPERATION AND MAINTENANCE SCHEDULE

Potomac Creek #2

Maintenance Item	When	Area	Approx. Cost	Date Completed
Fertilizing & Liming	every 2-3 yrs. Aug. 15 - Oct. 1	Spillway - 5 ac. Dam - 2 ac.	$40/ac.	
Mowing	every 2-3 yrs.	Spillway - 5 ac. Dam - 2 ac.	$10/ac.	
Visual Inspection	Annually and after major storms	Dam, Spillway		



Potomac Creek #2 Watershed Project

Sericea lespedeza

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Not to scale

APPENDIX VIII - 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. Geologic Map of Virginia, Virginia Division of Mineral Resources, 1963.
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.
6. Design Report, Dam No. 2, Potomac Creek Watershed Project, Stafford County, Virginia, USDA Soil Conservation Service, 1968.
7. Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau, Washington, D. C., May 1961.