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NATIONAL DAM SAFETY PROGRAM. DIXIANA DAM (INVENTORY NUMBER VA-1--ETC(U)
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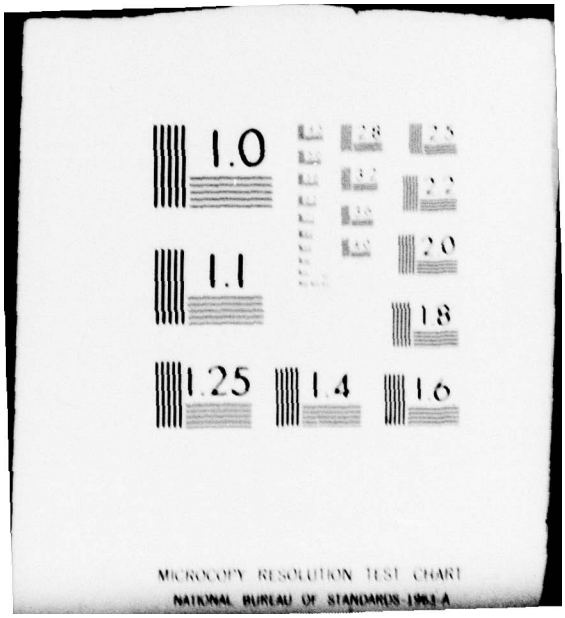
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SEPTEMBER, 1979

Name Of Dam: DIXIANA DAM
Location: WISE COUNTY, VIRGINIA
Inventory Number: VA. NO. 19505

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.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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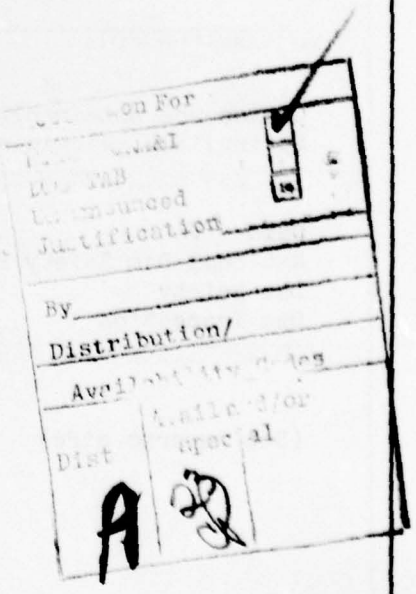
20. Abstract

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

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

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



NAME OF DAM: DIXIANA DAM
LOCATION: WISE COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 19505

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED FOR
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PREFACE

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

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

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

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

TABLE OF CONTENTS

Name: Dixiana Dam Va. No. 19505
State: Virginia
County: Wise
USGS Quad Sheet: Flat Gap
Coordinates: Lat 37° 3.1' Long 82° 40.4'
Stream: Guess River
Date of Inspection: June 12, 1979

BRIEF ASSESSMENT OF DAM

Dixiana Dam is a zoned earthfill structure about 200 ft long and 27 ft high. This impoundment is located on the Guest River approximately 1.6 miles north of Dixiana, Virginia. The impoundment is used for supply of fresh water for the coal preparation process at the Flat Gap Mine. The spillway is used during periods of above normal flow only, and consists of a 23 ft wide weir with 2:1 side slopes located at the right abutment. Normal flow passes through one of two 10" diameter steel decant pipes which are used to draw off water from the impoundment. The roadway which forms the left abutment is 2 ft below the crest of the dam and acts as an overflow spillway.

This dam has been scheduled for enlargement (increased height of 7 ft) by the Flat Gap Mining Company. Plans have been prepared for the enlargement and implementation has started on the spillway.

The dam is a "small" size and "significant" hazard structure The spillway will pass 30 percent of the PMF without overtopping the dam. The appropriate spillway design flood (SDF) is the ½ Probable Maximum Flood (½ PMF), and during the SDF the dam will be overtopped by 1.1 ft for a period of one hour at a critical velocity of 3 fps. Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the

spillway is rated inadequate.

The embankment structure appears similar to the drawings recently developed by D'Appolonia Consulting Engineers, Inc. for reconstruction of the dam. Data, methods, and recommendations developed by the consultant are adequate for the present plan. Stability analyses were performed by an adaptation of the Modified Bishop Method. Minimum factors of safety of 1.54 and 1.43 were determined for the static and seismic cases, respectively for the reconstructed dam. Since the dam is to be modified in the near future and stability analyses have been performed, additional studies are not necessary.

The visual inspection revealed no apparent problems with the embankment and appurtenant structures and there are no immediate needs for remedial measures. The slopes, the crest of the structure, and the spillway should be mowed twice per year, preferably in the spring and fall. Seepages and wet areas on the downstream slope appear to be related to seepage through the dam and should be monitored quarterly and during high pool levels to detect any increase in flow.

Prepared by:

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

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

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District Engineer

Recommended by:

Original signed by:
Carl S. Anderson, Jr.

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

Date: SEP 27 1979

OVERVIEW PHOTO

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
DIXIANA DAM VA. NO. 19505

SECTION 1 - PROJECT INFORMATION

1.1 General:

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

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

1.2 Project Description:

1.2.1 Dam and Appurtenances: Dixiana Dam is a zoned earthfill structure. approximately 200 ft long and 27 ft high. The top of the dam is 12-15 ft wide and is at elevation 2314± msl. Side slopes are approximately 2.2 horizontal to 1 vertical (2.2:1) on the upstream slope and 1.8:1 on the downstream slope.

There are two 10 inch steel decant pipes which pass through the center of the dam with an elevation of 2287± msl. The decent pipes are valved and control the flow rate into the Guest River during periods of normal flow. The spillway is trapezoidal, and is with 2:1 side slopes approximately 23 ft wide at elevation 2308.7 msl and is located at the right abutment. All flows greater than normal pass through the spillway (See Plate No. 2 of Appendix I).

The roadway adjacent to the dam is 2 ft below the dam crest and acts as an overflow spillway when the pool elevation exceeds 2312 msl.

1.2.2 Location: Dixiana Dam is located on the Guest River 1.6 miles north of Dixiana, Virginia, (See Plate 1, Appendix I).

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

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the downstream proximity of the Flat Gap Mine coal preparation plant and several homes approximately 1,300 ft 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 Flat Gap Mining Co., Inc.

1.2.6 Purpose: The dam supplies fresh water for the Flat Gap Mining Company coal preparation operations.

1.2.7 Design and Construction History:

The dam was constructed under the supervision of the Flat Gap Mining Company. No design drawings or data were available for the original design. D'Appolonia Consulting Engineers, Inc., prepared a Future Use and Modifications Report in 1979 for the impoundment. Modifications to the spillway have begun. YEAR COMPL ?.

1.2.8 Normal Operational Procedures: The principal spillway is gated and submerged, therefore, water automatically is discharged downstream in quantities based on the pipe capacity and valve restriction.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The drainage area is 0.37 square miles .

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

Spillway Discharge:

Pool Elevation at Crest of Dam (El 2314 msl)	850 CFS

Roadway Discharge:

Pool Elevation at Crest of Dam	294 CFS

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

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation Feet msl	Reservoir			
		Area Acres	Acre Feet	Watershed Inches	Length Miles
Crest of Dam	2314	6	115	5.8	.3
Roadway	2312	5.5	95	4.8	.3
Spillway	2308.7	5	63	3.2	.2
Streambed at Toe of Dam	2287	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The Dixiana Dam was constructed in 1952 in order to develop a fresh water reservoir for the coal preparation plant located in the Steer Branch Hollow, approximately 2500 ft downstream. All phases of mining operations are controlled and regulated by the U.S. Department of Labor, Mine Safety and Health Administration (MSHA); the Virginia Division of Mines and Quarries (VDMQ); and the Virginia Division of Mined Land Reclamation (DMLR). The Dixiana Dam was constructed and is currently maintained in compliance with standards required by the above governmental agencies. Design and "As Built" data were not available; however, the Owner is presently initiating the required engineering studies necessary to continue mining operations at this general location for the next 30 years.

In February 1978, a surficial reconnaissance and preliminary study was undertaken by D'Appolonia Consulting Engineers, Inc. to evaluate site conditions and determine modifications required at the fresh water reservoir. Conceptual plans for proposed modifications were prepared and in July 1978, a detailed field investigation was undertaken by D'Appolonia to further evaluate subsurface conditions at the fresh water reservoir. The summary of the modifications is included in Appendix V. (From Reference 7, Appendix VI).

The subsurface investigation conducted at the Dixiana Dam site consisted of drilling 3 test borings and 1 auger boring. An observation well was installed in each boring in order to

monitor the piezometric surface through the embankment. Test boring locations and a subsurface profile are presented on Plate 2, Appendix I. Test boring logs and laboratory test data are presented in Appendix IV.

The dam is a zoned earthfill embankment which includes a clay core. It is not known if the structure is keyed into bedrock. Soils encountered in three test borings (locations given on Plate 2, Appendix I) drilled in the embankment were described by D'Appolonia to consist of alternating layers of dense silty sands, medium dense to dense sandy silts and sandy gravel, medium stiff sandy clays, and medium dense to very dense sand and silty sand, with Standard Penetration Test blow counts ranging from 5 to 45 blows per foot. The embankment fill is underlain by sandstone at varying depths of 22 feet, 40 feet, and 31.5 feet, for borings BW-1, BW-2, and BW-3 respectively; however, bedrock descriptions are not provided on the boring logs.

Based upon the test boring data, the dam does not appear to have an internal drainage system. Furthermore, it is not known whether the two 10 inch decant lines which regulate the reservoir level have anti-seep collars. The geotechnical consultant stated that the water readings taken from observation wells installed in the borings (and at BW-2A) appear to reflect the changes in the level of the phreatic surface through the embankment. D'Appolonia's most recent water observation well readings indicated a phreatic level approximately 15

feet below the crest of the embankment, which corresponded with the seepage noted on the downstream face of the embankment in the D'Appolonia report.

The emergency spillway is located in the right abutment in cut and fill overburden materials. The channel is approximately 100 ft long and 21 ft wide. Side slopes vary throughout the channel. A concrete weir roughly 1 ft wide and 1 ft high exists at the spillway entrance.

2.2 Construction: Construction records are not available for this structure.

2.3 Operation: Four water observation wells were installed in July 1978 for monitoring the water levels through the embankment.

2.4 Evaluation: Original engineering calculations and drawings are not available, but the drawings for the modification plan are representative of the dam and the hydrologic and hydraulic calculations are adequate. The following modifications are planned for the Dixiana Dam (makeup water reservoir) in the proposed 30 year coal refuse disposal plan for the Flat Gap Mining facility:

(1) Abandoning the existing 10-inch steel decant lines by filling the pipes with grout and removing the valve house.

(2) Constructing a drainage blanket on the downstream face of the existing embankment to prevent piping (internal erosion) of the fine-grained soils into the "shot" rock buttress.

(3) Regrading the existing spillway to divert the storm flow around the toe of the embankment buttress.

(4) Constructing a shot rock buttress and raising the crest of the embankment from Elevation 2314 to

Elevation 2321 in order to provide sufficient freeboard to route the 80 percent PMP storm around the embankment utilizing the regraded spillway and State Route 620.

(5) Possible installation of a siphon system to maintain the impoundment level at Elevation 2296 in order to provide the capability of storing the 10-year, 24-hour storm while surface mining the Taggart coal seam. This would only be required for an approximate two-year period if the makeup water impoundment is used for sedimentation control. The siphon will not be constructed until required for surface mining operations.

SECTION 3 - VISUAL INSPECTION

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

3.1.1 General: An inspection was made 12 June 1979 and the weather was fair with the temperature 72°F. At the time of inspection the pool elevation was 2308.1 msl and the tailwater was 2287± msl. This corresponds to the normal operating conditions for this impoundment. Ground conditions were dry at the time of inspection.

3.1.2 Dam and Spillway: There are two 10" steel decant pipes used to draw water from the impoundment. Only one 10" pipe has never been opened. The spillway surface was in a stripped state since construction is in progress to widen the facility. The existing concrete weir in the spillway showed signs of weathering and spalling of the concrete surface. The outlet channel is trapezoidal shaped approximately 2 ft wide and 1 ft deep with 2:1 side slopes. A floodplain above the channel has slopes of approximately 5:1.

There is no intake structure or stilling basin for this dam. There is a small plunge pool below the decant pipes which does not serve the spillway.

The embankment, particularly the downstream slope, was covered with grass and weeds; however, the vegetation was not dense enough to hinder visual inspection. This vegetative cover appears to adequately impede surface erosion. The entire downstream toe was saturated and marshy areas consisting

of cattails and marsh grass occur along the left and right downstream embankment abutment junctions. These areas are each 20 ft± wide and thin toward the decant house. Heavy iron-staining was observed and seepage was estimated at about one gpm in both marshy areas. The upstream slope was blanketed with riprap, which extends approximately 3 to 4 ft above pool level. The riprap consists of sandstone blocks ranging from 1 to 3 ft± in length. The crest of the embankment was essentially free of erosion. Only minor sloughing was observed in the abutment areas, particularly in the basal 15 ft of the emergency spillway. Four water observation wells are located along the crest of the dam, and water levels varied from 8 to 18 ft below the top of the dam or between elevation 2306 and 2296 msl. This is generally within the elevation range of the wet spots and seepage observed along the downstream slope.

Only limited outcrops were observed in the immediate area. Flat-lying sandstone bedrock is exposed along the haul road, which traverses the upper portion of the right abutment, while occasional sandstone and shale exposures occur along Route 620. No faults were observed in the field during this investigation and geologic maps of the area do not show the presence of faults in the immediate vicinity.

3.1.3 Reservoir Area: The reservoir is heavily wooded with side slopes of approximately 2:1. At the time of inspection, no collection of debris was observed on the reservoir slopes. Some sediment was noted at the upper inlet of the reservoir.

3.1.4 Downstream Area: The downstream area is a narrow a grass covered and wooded floodplain with 1.5:1 side slopes. A house trailer and mine operations facility are located about 1,300 ft downstream.

3.2 Evaluation:

3.2.1 Dam and Spillway: Overall, the dam was in good condition at the time of inspection. The principal spillway pipe which was in use appears to be in good working condition. The iron stained seepages observed in the marshy areas located along both the downstream slope/abutment junctions and the saturated downstream toe are of concern because they appear to be the result of seepage through the embankment. These seepage areas should be monitored quarterly to detect any increase in flow rates. The embankment including its crest, slopes, and the emergency spillway should be mowed twice per year in the spring and fall. The seepage monitoring procedure should be continued until the planned modifications to the dam are completed.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: This impoundment is used to store fresh water for supply to the coal preparation plant at the Dixiana mining operations. The normal pool elevation is maintained by the operation of the valves on the two 10" steel decant pipes which pass under the dam. It should be noted that it has only been necessary to utilize one decant pipe since the dam was constructed, consequently one of the decant pipes has never been used. Large increases of inflow that cannot be handled by the decant pipe are automatically passed through the trapezodial shaped spillway. If the pool exceeds elevation 2312$^{\pm}$ msl (2 ft below dam crest), the adjacent roadway to the left of the dam will act as an overflow spillway.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of Flat Gap Mining Company. There is no known maintenance procedure other than an occasional mowing of the embankment.

4.3 Warning System: None exists.

4.4 Evaluation: The operating procedures are adequate; however, the maintenance procedures are insufficient. A routine maintenance program should be established.

SECTION 5 - HYDRAULICS/HYDROLIGIC DATA

5.1 Design: No data was available.

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

5.3 Flood Experience: The maximum pool elevation observed was in June 1977, however, the pool elevation is not known.

5.4 Flood Potential: In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonable possible), or fractions thereof.

The Probable Maximum Flood (PMF), ½ PMF and 100 year flood hydrographs were developed as outlined in Reference 4, Appendix VI. Precipitation amounts for the flood hydrographs of the PMF ½ PMF, and 100 year flood are taken from the U. S. Weather Bureau Information (References 5 & 6, Appendix VI). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulation: For routing purposes, the pool at the beginning of the flood was assumed to be at elevation 2308.7 msl. Reservoir stage-storage data and stage-discharge data were taken from the report prepared by D'Appolonia. The decant pipes were not utilized in flood routing. The roadway which is 2 feet lower than the dam crest was utilized as a spillway. The inflow hydrograph was routed through the spillway, roadway and over the non-overflow section of the dam.

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

TABLE 5.1 RESERVOIR PERFORMANCE

	Normal Flow	Hydrograph 100-Year	½ PMF	PMF
Total Flow (CFS)				
Inflow	1	828	2706	5411
Outflow	1	476	2468	4775
Maximum Pool Elev. (Ft., msl)		2312.1	2315.1	2316.5
Non-overflow Section (El 2314 msl)				
Depth of Flow (ft)		-	1.1	2.5
Duration (hrs)		-	1	1.5
Velocity (fps)		-	3	6
Roadway (El 2312 msl)				
Depth of Flow (cfs)		.1	3.2	4.5
Duration (hrs)		.25	2	5
Velocity (fps)		-	7.2	8.3
Spillway (El 2308.7 msl)				
Depth of Flow (ft)		3.4	6.4	7.8
Duration (hrs)		10	10	10
Velocity (fps)		8.8	11.1	12.5
Tailwater	2287	2290	2292	2298

5.7 Reservoir Emptying Potential: The two 10 inch decant pipes can drain the reservoir in 2 to 3 days based on normal inflow of one CFS.

5.8 Evaluation: Department of the Army, COE, guidelines indicate the appropriate Spillway Design Flood (SDF) for a small size and significant hazard dam is the 100 year flood to ½ PMF. Due to the risk involved the ½ PMF has been selected as the SDF. The spillway will pass 30 percent of the PMF. The SDF will overtop the dam by a maximum of 1.1 feet, remain above the dam for 1 hour with a critical velocity of 3 fps. The spillway is inadequate.

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 site is located within the southeast portion of the Appalachian Plateau (locally Cumberland Plateau) Physiographic Province of Virginia. The Cumberland Plateau is a stream dissected plateau which is underlain by sedimentary rocks up to upper Pennsylvanian in age (see Reference 3, Appendix VI). Throughout much of Wise County the ground surface is extremely rugged.

The dam site is underlain by rocks of the Wise Formation of Middle to Upper Pennsylvanian Age. This formation consists of alternating beds of sandstone, shale and coal; however, many beds of clay also occur within the formation. In Wise County the Wise Formation varies in thickness from 2100 to 2300 ft and thins in a northeasterly direction. Bedrock is generally flat-lying; however, the presence of the Powell Valley anticline (a dome-like structure) causes steepening of bedding dips in the southern part of the county.

The test borings indicate that the embankment is underlain by a thin veneer of overburden, which in turn, rests directly upon bedrock. Below the embankment, approximately 15 ft of overburden soils consisting of sandy gravels, sandy clay and sand and rock fragments were penetrated in Boring BW-2 before terminating the boring on bedrock. Only 1.5 ft of overburden was encountered in Boring BW-3 and

the embankment fill was apparently not penetrated in Boring BW-1. The sandy gravel in Boring BW-2 may represent stream-deposited gravels which rest upon residual soils. The boring logs show the overburden materials as being non-plastic except for a 3 ft layer of sandy clay which directly underlies the gravel in Boring BW-2. The horizontal extent of the sandy clay is not known.

6.2 Embankment: A cross section through the embankment is presented as Section A-A on Plate 2 of Appendix I. The embankment is approximately 200 ft long, 27 ft high, and has a crest width of about 15 ft at elevation 2314 msl. The upstream slope is approximately 2.2:1 (horizontal to vertical) and the downstream slope is approximately 1.8:1. The upstream slope is blanketed with riprap which extends 3 to 4 ft above pool level.

Based upon the test boring data, the embankment appears to consist of a reasonably distinct layering of sand, silt and clay materials which were visually classified as SM, ML and CL (Unified Soil Classification System) on the boring logs. The basal 8 to 10 ft$^{\pm}$ of embankment fill consisted of silty clay to clayey silt in Borings BW-1 and BW-3. This material was not present in Boring BW-2, where gravel was encountered. The remainder of the embankment consists primarily of sandy silt (with sand to clay layers), which in turn is capped by 5 ft$^{\pm}$ of silty sand fill.

The Dixiana Dam reportedly contains a clay core; however, the extent of the core and whether the core is keyed into bedrock is not known. Review of the test boring data indicates the basal 8 to 10 ft± of the embankment consists of low plastic silty clay and clayey silt materials at only two boring locations. The borings do not confirm the existence of the clay core.

6.3 Evaluation:

6.3.1 Foundation and Abutments: Dam foundations must be evaluated on the basis of potential settlement, sliding and seepage. Excessive settlement of the dam is not believed to be a problem because the structure rests upon firm to very compact overburden soils and fairly competent weathered sandstone.

The Taggart coal seam, which has been mined extensively in the surrounding area, is exposed above the crest of the impoundment. Consequently, abandoned mine shafts do not apparently exist below the embankment. Subsidence related to mineshaft collapse does not appear to be a problem.

Sliding within the foundation bedrock would not normally appear to be a problem based upon the presence of bedrock, particularly sandstones and shales of the Wise Formation. A review of the geologic literature; however, indicates the many beds of clay shales occur within the formation. Based upon the present height of the dam and its reported safe performance for 27 years, failure related to sliding does not appear likely.

The potential for seepage exists within the foundation since the dam appears to be founded, at least in part, on alluvial, colluvial and/or residual soils possessing various rates of permeability. Approximately 15 ft of overburden was penetrated in Boring BW-2 before encountering bedrock. The permeability of underlying bedrock may also vary considerably, based upon composition, degree of fracturing and weathering. Although the condition of the underlying bedrock is not known, some seepage should be expected in the upper portion of the bedrock. It is not known whether a key trench was included in the construction of the clay core; however, its absence is suggested by the extremely moist condition which exists along the entire downstream toe of the dam. This appears to be the result of seepage through or beneath the dam. The water levels measured in the water observation wells generally correspond with the elevations of saturated areas and seepages located in the downstream slope.

The abutment slopes were considered safe and stable at the time of the inspection. Only minor sloughing was observed, particularly in the basal 15 ft of the emergency spillway.

6.3.2 Embankment: No undue settlement or cracking was noted at the time of inspection. The seepage observed is apparently related to seepage through the dam. It appears

that the embankment is adequate for normal pool level with water at elevation 2308± msl.

Stability analyses were performed by D'Appolonia for the proposed modifications and are summarized on Plate 3, Appendix I. Analyses were performed using the computer program STABL, developed by Purdue University for the Indiana State Highway Commission. STABL solves general slope stability problems by an adaptation of the Modified Bishop Method of Slices. A source listing of STABL was submitted to MSHA in August 1976 and is not included herein. The factors of safety and critical failure surfaces are shown on Plate 3, Appendix I. The stability analyses were performed for both static and pseudostatic (seismic) earthquake loading cases and minimum factors of safety of 1.54 and 1.43 were determined, respectively. Since the dam will be modified in the near future and stability analyses have been performed for this modification, no additional studies are recommended to evaluate the stability of the existing dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: Dixiana Dam at the time of inspection appeared in good operating condition. The spillway will pass 30 percent of the PMF without overtopping the dam. The SDF is the ½ PMF and the spillway is considered inadequate. The SDF will overtop the dam by 1.1 ft for 1 hour.

There is no apparent problem that requires immediate remedial measures for the normal pool conditions based on the visual inspection and a review of existing records. The actual embankment structure appears to be similar to the drawings developed by D'Appolonia. The dam is to be modified in the near future and stability analyses have been performed for the modified structure. Data, methods, and recommendations developed by the consultant are adequate for the present plan and additional studies are not necessary.

7.2 Remedial Measures: There is no immediate need for remedial measures; however, the following maintenance and monitoring procedures should be implemented within 12 months.

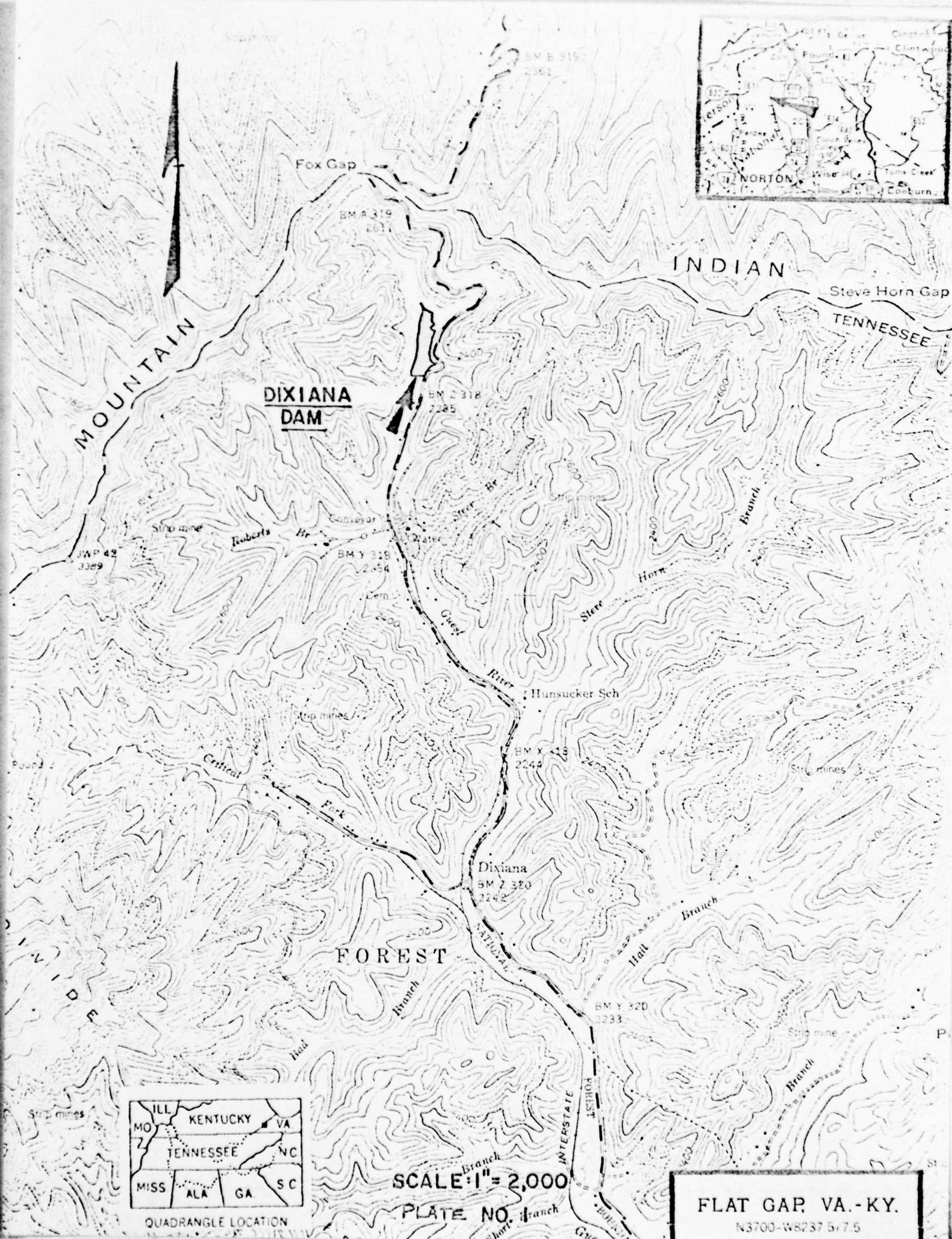
7.2.1 The grass and weeds along the dam crest, slopes and within the emergency spillway should be cut twice per year, preferably in the spring and fall.

7.2.2 All seepage and wet areas described along the downstream slope should be monitored quarterly, to detect any increase in flows. This will be necessary until the modified structure is constructed.

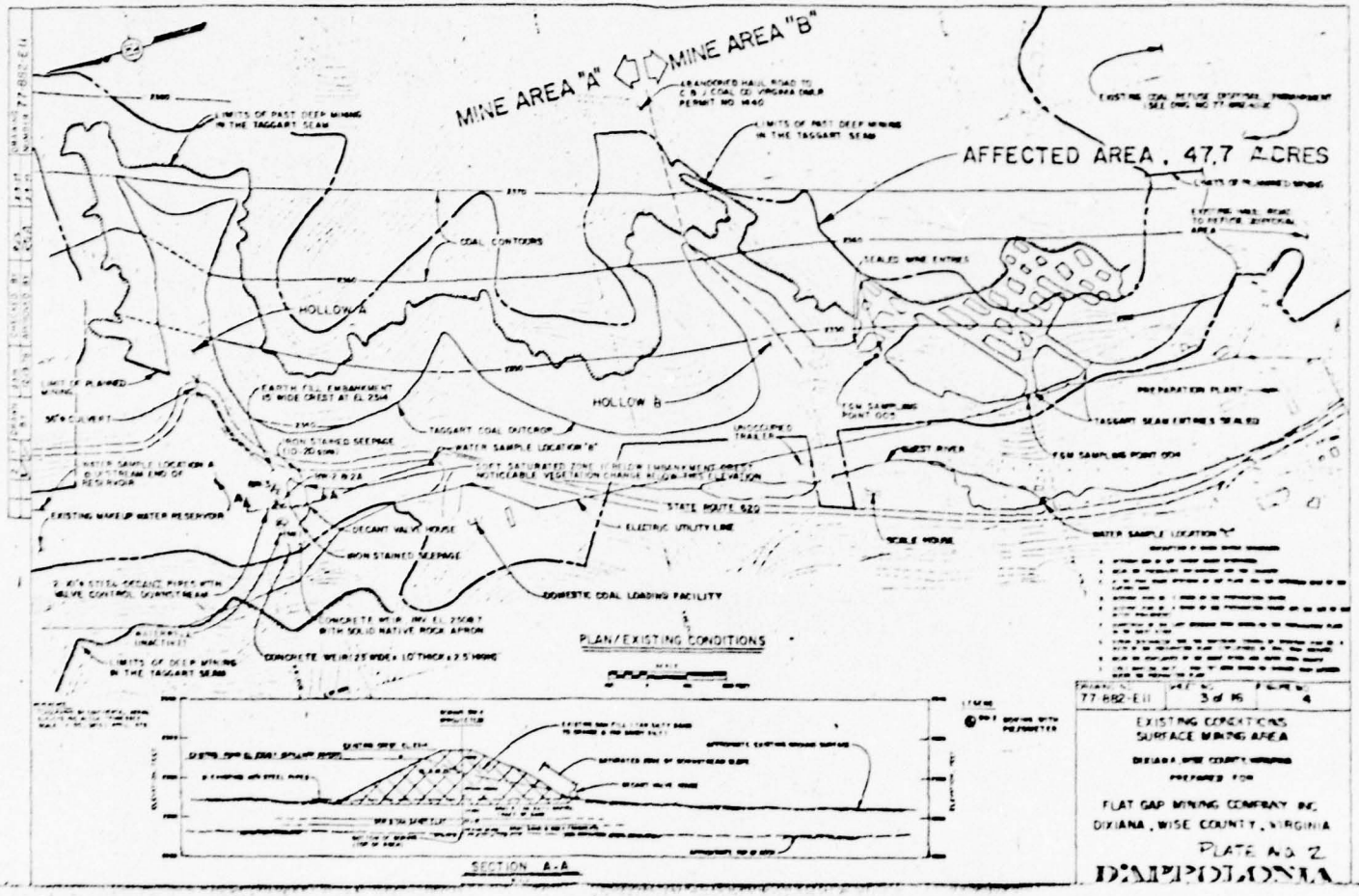
7.2.3 Since the spillway is being modified to conform to the improvement plan which is adequate, there are no remedial measures required for the spillway.

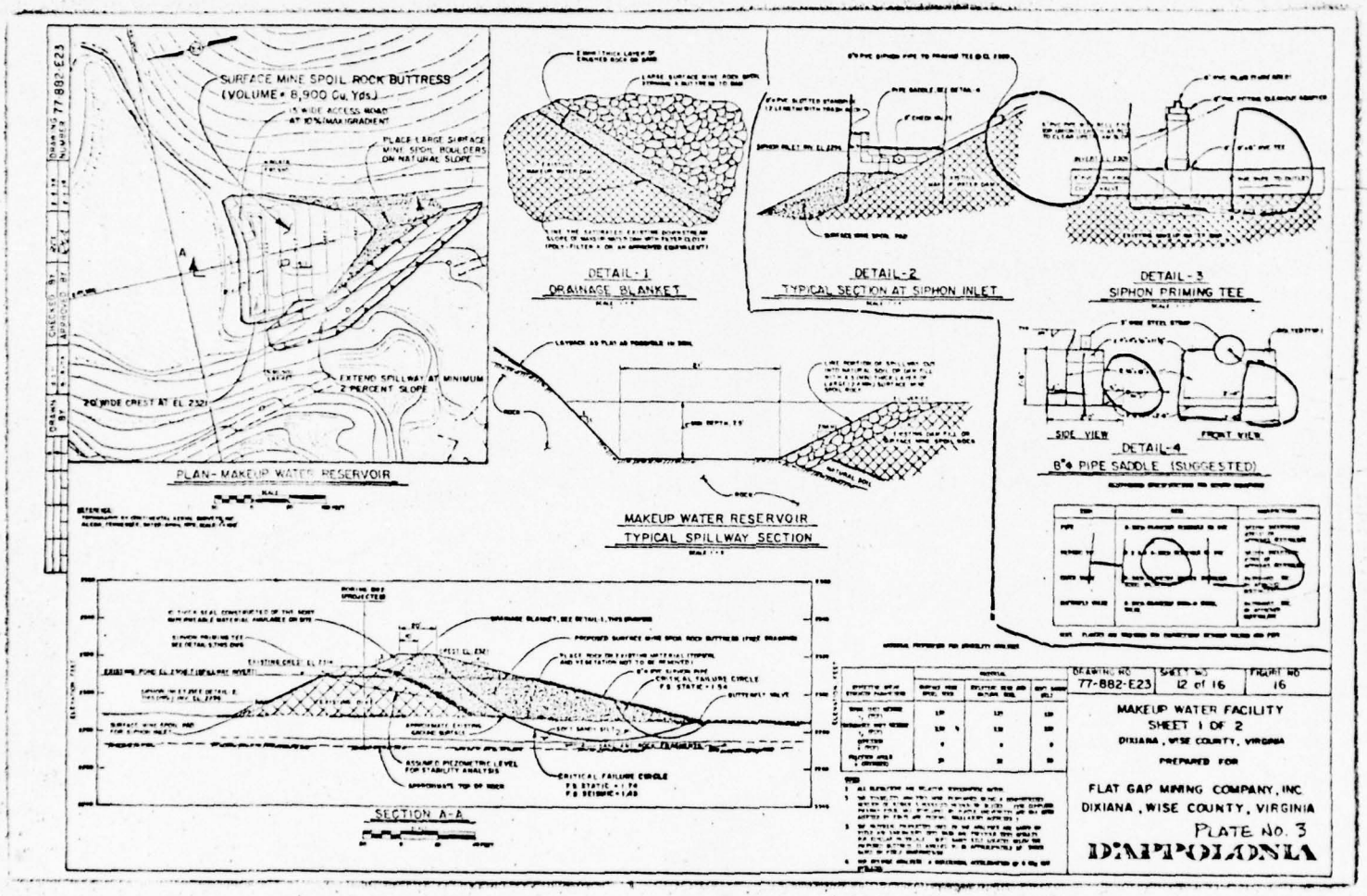
APPENDIX I

MAPS AND DRAWINGS



DIXIANA DAM
Fox Gap
BM A 319
2617
BM B 319
2361
INDIAN
MOUNTAIN
Steve Horn Gap
TENNESSEE
BM Z 318
2285
Strip mine
Roberts Br
Conveyor
Water
Steer Br
Strip mines
Branch
JWP 42
3389
BM Y 318
2254
Cem
Steve Horn
Guest
River
Hunsucker Sch
Strip mines
Critical
Fork
BM X 319
2244
Strip mines
Dixiana
BM Z 320
2242
FOREST
NATIONAL
Hall Branch
Hall
Branch
BM Y 320
2233
Strip mine
Branch
FOREST
INTERSTATE
Strip mines
Branch
Short Branch
NORTON
Wise
Pound
Clintwood
Coeburn
KENTUCKY
ILL
MO
VA
TENNESSEE
NC
MISS
ALA
GA
S C
QUADRANGLE LOCATION
SCALE: 1" = 2,000'
PLATE NO. I
FLAT GAP, VA.-KY.
N3700-W8237.5/7.5


MINE AREA "A"
MINE AREA "B"
AFFECTED AREA, 47.7 ACRES
HOLLOW A
HOLLOW B
COAL CONTOURS
LIMITS OF PAST DEEP MINING IN THE TAGGART SEAM
EARTH FILL EMBANKMENT 10 WIDE CREST AT EL 2514
TAGGART COAL OUTCROP
IRON STAINED SEEPAGE
WATER SAMPLE LOCATION "B"
WATER SAMPLE LOCATION "A"
EXISTING MAKE-UP WATER RESERVOIR
DECANT VALVE HOUSE
STATE ROUTE 629
ELECTRIC UTILITY LINE
SCALE HOUSE
DOMESTIC COAL LOADING FACILITY
CONCRETE WEIR (IMP.) EL 2504.7 WITH SOLID NATIVE ROCK APRON
CONCRETE WEIR 25' WIDE x 10' THICK x 2.5' HIGH
LIMITS OF DEEP MINING IN THE TAGGART SEAM
PREPARATION PLANT
TAGGART SEAM ENTRIES
RIVER
PLAN/EXISTING CONDITIONS
SECTION A-A
77 882-E11
3 of 16
4
EXISTING OPERATIONS
SURFACE MINING AREA
PREPARED FOR
FLAT GAP MINING COMPANY INC.
DIXIANA, WISE COUNTY, VIRGINIA
PLATE NO 2
DIMPIDONIA



DRAWING NO.	SHEET NO.	PRINT NO.
77-882-E23	12 of 16	16

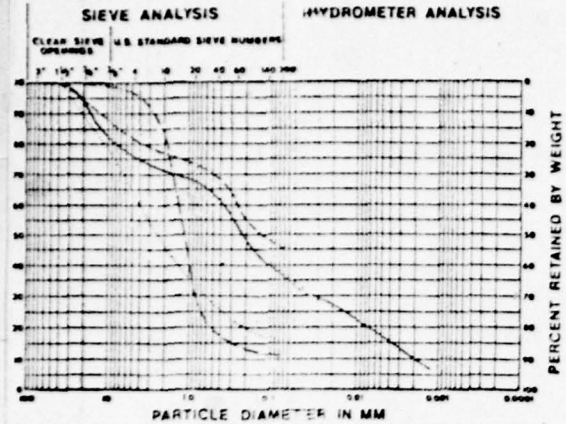
MAKEUP WATER FACILITY
SHEET 1 OF 2
DIXIANA, WISE COUNTY, VIRGINIA

PREPARED FOR

FLAT GAP MINING COMPANY, INC.
DIXIANA, WISE COUNTY, VIRGINIA

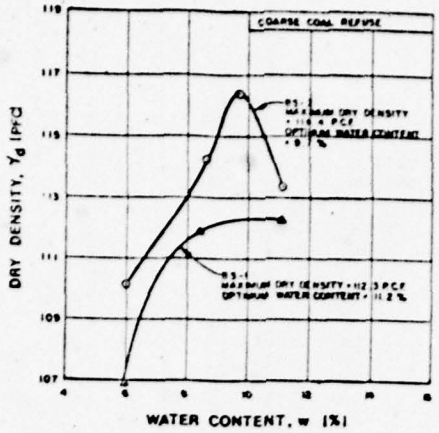
PLATE NO. 3

DIMPTOLONIA



SOIL	BORING	SAMPLE	DEPTH (ft)	SOIL DESCRIPTION	USCS	G_s	C_u	W.S.
—	BH-1	ST-7	15.0-17.5	SHALE SILT WITH SOME SAND SIZE SANDSTONE FRAGMENTS	SM			
—	BH-2	ST-8	15.0-17.5	SILT AND SAND SIZE SHALE AND SANDSTONE FRAGMENTS	SM			
—	BH-2	ST-4	11.0-12.5	BLACK COARSE COAL REFUSE				
—	BH-3	ST-5	20.0-22.5	GRAY COARSE COAL REFUSE				

GRAIN SIZE ANALYSIS

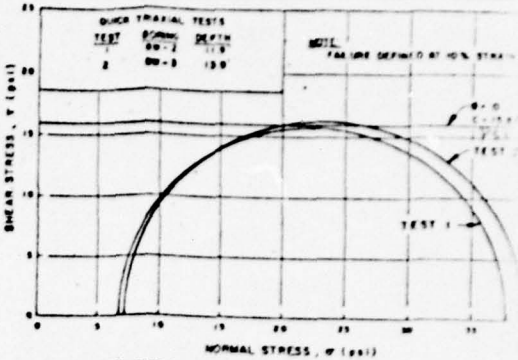


ASTM DESIGNATION USED	STANDARD
ASTM DESIGNATION	
STANDARD PROCTOR	
MODIFIED PROCTOR	

NOTE: BAG SAMPLES (BS-1 AND BS-2) WERE OBTAINED FROM THE EXISTING COARSE COAL REFUSE EMBANKMENT ON 10-2-78

COARSE COAL REFUSE

COMPACTION TEST

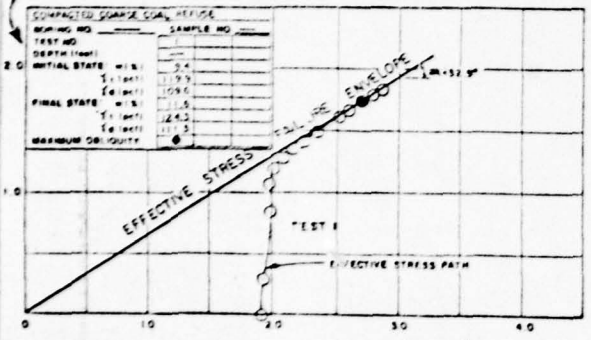


NOTE: SAMPLES TESTED CONSISTED OF ORANGE AND TAN SANDY SILT FROM BORINGS LOCATED AT THE BASE OF WATER RESERVOIR

QUICK TRIAXIAL TESTS

BORING NUMBER	DEPTH (ft)	MATERIAL	WET DENSITY (pcf)	WATER CONTENT (%)
BH-1	15.0-17.5	SHALE SILT WITH SOME SANDSTONE FRAGMENTS	99.9	19.7
BH-2	10.0-12.5	SILT AND SAND SIZE SANDSTONE FRAGMENTS	133.3	14.8
BH-1	130.0-132.5	BLACK COARSE COAL REFUSE	109.6	12.8
BH-2	12.0-14.5	SILTY CLAY AND SAND SIZE SANDSTONE FRAGMENTS	132.8	10.8
BH-3	20.0-22.5	GRAY COARSE COAL REFUSE	127.6	8.7
BH-3	30.0-32.5	WEATHERED GRAY SHALE AND SILT	132.5	13.6

EFFECTIVE SHEAR STRESS, $\bar{q} = \left[\frac{\sigma_3 - \sigma_1}{2}\right]$, Kg/cm²



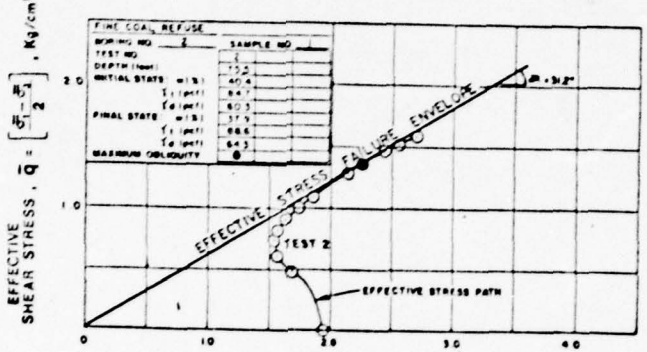
$\phi' = 32.9°$
$\delta = 40.3°$
$\sin\delta = \tan\phi'$
$r = \frac{1}{\cos\delta}$
$\varepsilon = 0$

TEST PARAMETERS	
TEST NO	
STRAIN RATE (in/min)	
BACK PRESSURE (kg/cm^2)	
CONSOLIDATION TIME (days)	

SAMPLE DIMENSIONS	
DIAMETER (inches)	
LENGTH (inches)	

COMPACTED COARSE COAL REFUSE

EFFECTIVE SHEAR STRESS, $\bar{q} = \left[\frac{\sigma_3 - \sigma_1}{2}\right]$, Kg/cm²



$\phi' = 31.8°$
$\delta = 37.5°$
$\sin\delta = \tan\phi'$
$r = \frac{1}{\cos\delta}$
$\varepsilon = 0$

TEST PARAMETERS	
TEST NO	2
STRAIN RATE (in/min)	0.0016
BACK PRESSURE (kg/cm^2)	3.09
CONSOLIDATION TIME (days)	

SAMPLE DIMENSIONS	
DIAMETER (inches)	2.87
LENGTH (inches)	5.99

FINE COAL REFUSE

CONSOLIDATED UNDRAINED TRIAXIAL STRENGTH TESTS

SOILS PROPERTIES

- w - WATER CONTENT
- γ_d - DRY DENSITY
- LL - LIQUID LIMIT
- PL - PLASTIC LIMIT
- D_{10} - DIAMETER AT WHICH 10% OF THE SOIL IS FINER
- D_{60} - DIAMETER AT WHICH 60% OF THE SOIL IS FINER
- C_u - COEFFICIENT OF UNIFORMITY (D_{60}/D_{10})
- γ_t - WET DENSITY
- G_s - SPECIFIC GRAVITY

SHEAR STRENGTH PARAMETERS

- σ_1, σ_3 - PRINCIPAL STRESSES
- τ - SHEAR STRESS
- σ - NORMAL STRESS
- ϕ - SLOPE OF FAILURE ENVELOPE
- ϕ' - ANGLE OF INTERNAL FRICTION
- c - COHESION
- ϕ_{CU} - DRAINED ANGLE OF INTERNAL FRICTION
- ϕ_{UU} - TOTAL STRESS ANGLE OF INTERNAL FRICTION
- NOTE: EFFECTIVE STRESS PARAMETERS

DRAWING NO	SHEET NO
77-882-E13	13 of 16

LABORATORY TEST D

DIXIANA WISE, COUNTY, V

PREPARED FOR

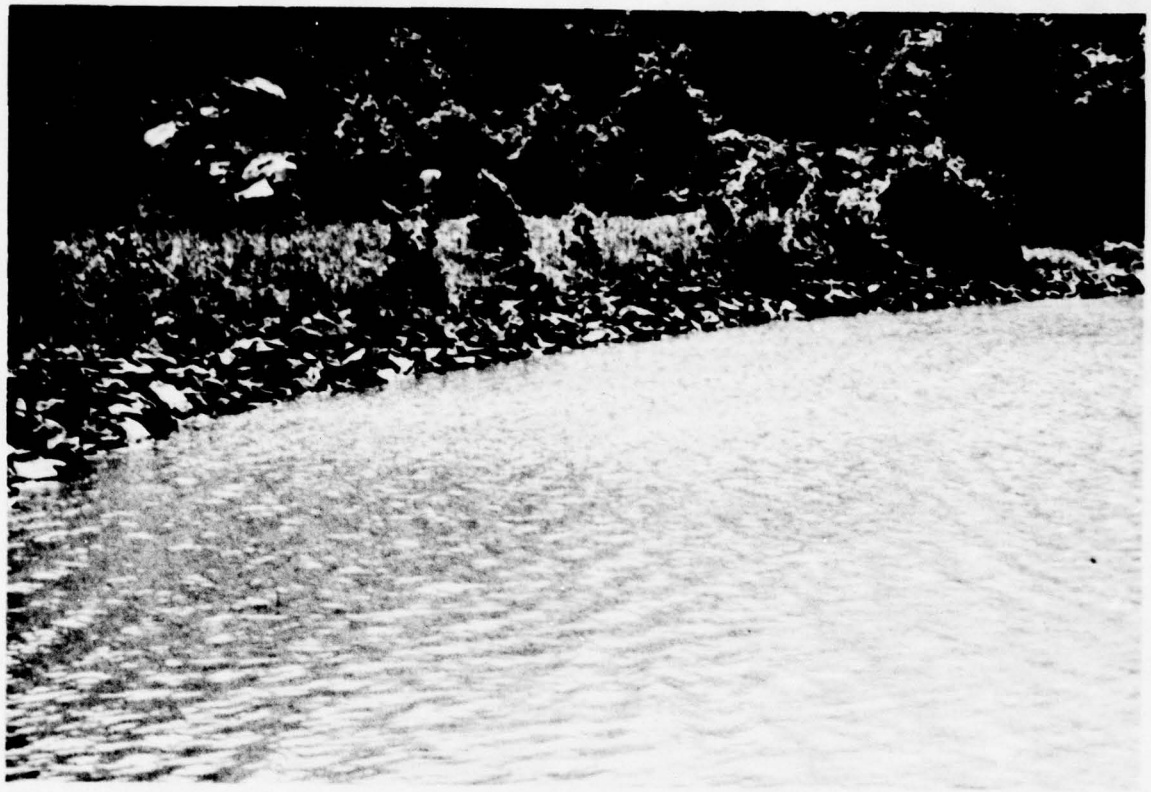
FLAT GAP MINING COMPA

DIXIANA, WISE COUNTY, V

PLATE No. 4

APPENDIX II

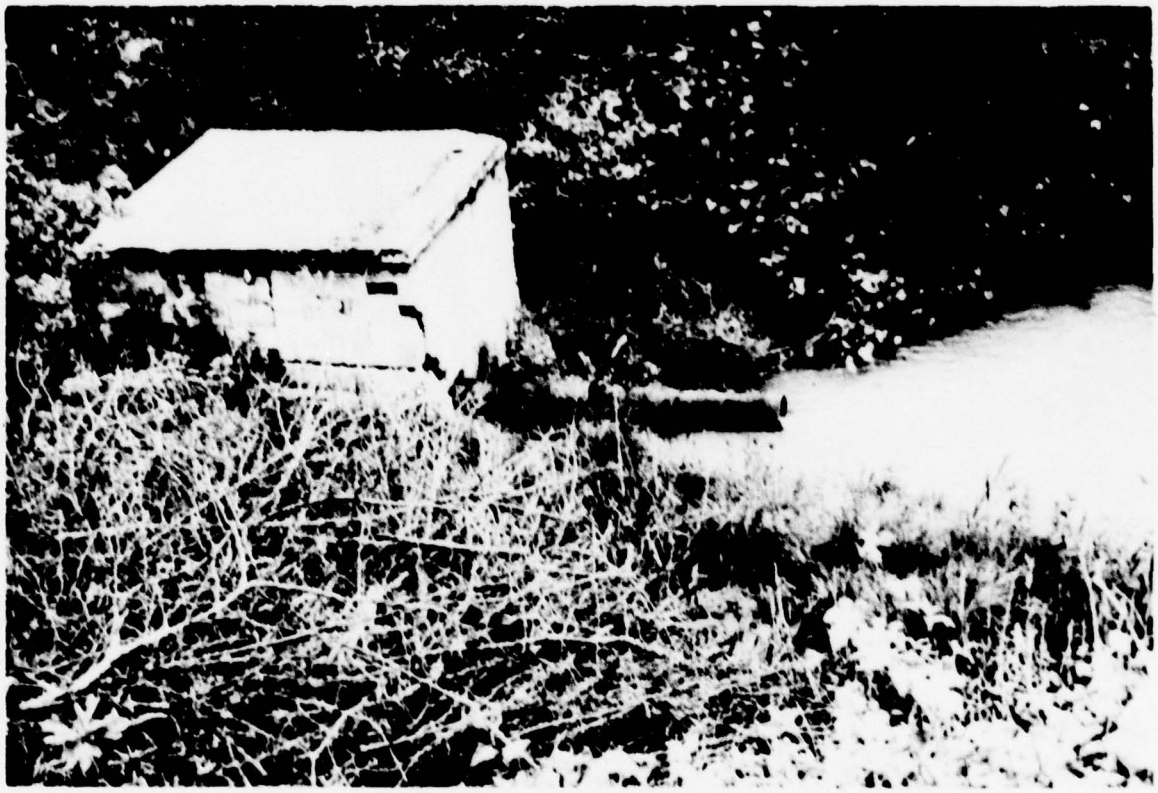
PHOTOGRAPHS



VIEW OF UPSTREAM FACE OF DAM AND RIP RAP

VIEW OF DOWNSTREAM CHANNEL AREA
(NOTE: STATE ROADWAY TO LEFT OF OUTLET CHANNEL)

VIEW OF LEFT ABUTMENT



PRINCIPAL SPILLWAY DISCHARGE

EMERGENCY SPILLWAY LOOKING UPSTREAM

DOWNSTREAM FACE OF EARTH EMBANKMENT
(NOTE: WATER OBSERVATION WELLS SHOWN BY ARROWS)

APPENDIX III

FIELD OBSERVATIONS

FIELD OBSERVATIONS

Name of Dam: Dixiana Dam

County: Wise

State: Virginia

Coordinates: Lat 37° 03.1' Long 82° 40.4'

Date of Inspection: June 12, 1979

Weather: Fair, temperature 72°F

Pool Elevation at Time of Inspection: 2308± msl

Tailwater at Time of Inspection: 2287± msl

Inspection Personnel:

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

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

State Water Control Borad
Hugh Gildea, P.E.

Flat Gap Mining Company, Inc.
Delbert Sturgill
Doyle Ayers

Mine Safety and Health Administration
Phil Muron, Jr.
Doug Carico

Virginia Division of Mines and Quarries
Lewis Wheatley
Gene Fry

1 Embankment:

1.1 Surface Cracks: The slopes, crest, emergency spillway, and abutment contacts were inspected and no cracks were noted. The embankment was covered with grass and weeds, however the vegetation was not dense enough to hinder visual inspection.

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

1.3 Sloughing or Erosion: No sloughing or erosion was noted on the embankment. Some erosion was noted in the basal 15 ft of the emergency spillway.

1.4 Alignment: The vertical and horizontal alignment of the dam was visually observed and appeared to be satisfactory. Upstream and downstream slopes are 2.2:1 and 1.8:1,respectively.

1.5 Riprap: Riprap, consisting of sandstone blocks 1 to 3 ft long, extends 3 to 4 ft above water level on the upstream slope. The riprap generally showed no displacement or washing and appeared to be in proper alignment.

1.6 Junctions: The left abutment ties into the adjacent road. The emergency spillway separates the embankment from the right abutment, which consists of moderately steep to steep highly vegetated natural slopes.. It appears that some fill consisting of rock and soil debris occurs above the emergency spillway.

1.7 Seepage: Iron-stained seepage estimated at about one gpm and 8-10 ft$^{\pm}$ below normal pool was encountered along the left and right downstream abutment embankment junctions in areas containing abundant cattails and marsh grass. The downstream toe of the structure was also saturated.

1.8 Staff Gage: None found.

1.9 Drains: None.

2 Outlet Works:

2.1 Intake Structure: There is no intake structure.

2.2 Outlet Channel: Approximately 2 ft wide and 1 ft deep with small plunge pool for decant pipes.

2.3 Emergency Gate: None

3 Overflow Spillway:

3.1 Concrete Weir: 1 ft high approximately 23 ft wide.

3.2 Discharge Channel: 23 ft wide, earth, trapezoidal shaped with 2:1 side slopes.

4 Reservoir:

4.1 Slopes: Moderately steep to steep heavily wooded natural slopes surround the impoundment.

4.2 Sedimentation: Some sediment was observed at the upper limits of the reservoir.

5 Downstream Channel:

5.1 Condition: The channel is 2 ft wide and 1 ft deep and lies within a grassed floodplain 100 ft$^{\pm}$ wide with 1.5:1 slope.

5.2 Slopes: Steep, wooded natural slopes occur to the left along the road. The floodplain extends to the right of the road. Bedrock exposed along the small haul road present along the right abutment is flat lying and consists of sandstone.

5.3 Population and Facilities: Coal stock piles and a tipple exist to the right and downstream from the dam, but are topographically above the impoundment. A mining scale house and trailer are located approximately 1300 ft downstream.

6 Instrumentation:

6.1 Monumentation: None

6.2 Observation Wells and Piezometers: Four water observation wells with locking caps exist on the structure. The

following water levels were measured during the inspection.

BW-3 Plugged with gravel and dry at 10.5 ft below the top of embankment.

BW-2A 8.7 ft below the top of embankment (Elev. 2305.3)

BW-2 18 ft below the top of embankment (Elev. 2296)

BW-1 14 ft below the top of embankment (Elev. 2300)

An inoperative water observation well also exists to the right of BW-1. Water observation well designations correspond to boring numbers in D'Appolonia report.

APPENDIX IV

BORING LOGS AND LABORATORY TESTING

BY

D'APPOLONIA CONSULTING ENGINEERS, INC.

DATE BEGAN: 7-14-78 | BORING NO. BH-1 | FIELD ENGINEER: T. HICKS

DATE FINISHED: 7-14-78 | N 80,932.5 E 87,455.6 | CHECKED BY: J. MURRAY

GROUND SURFACE EL: 2312.1

ELEV (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS
2310	5	S-1		DENSE TAN SILTY SANDS 5.0'	sm
	10	S-2		MEDIUM DENSE ORANGE AND TAN SANDY SILT 10.0'	ml
2300	15	S-3		MEDIUM STIFF ORANGE AND TAN SANDY CLAY 15.0'	cl
		7 / 14		ORANGE AND TAN SANDY SILT 18.5'	ml
	20	S-4			
		S-5		TAN SILTY CLAY	sm
2290					
7-14-78 ▽	25	S-6			
2285.1				27.0'	
				BOTTOM OF BORING 27.0'	

PENETRATION RESISTANCE (BLOWS PER FOOT): 10 30 50; 75/0.0

WATER CONTENT (PERCENT): 20 40

SHEET 1 OF 1

DATE BEGAN: 7-15-78

DATE FINISHED: 7-15-78

GROUND SURFACE EL: 2312.1

BORING NO. BW-2

N 80,926.3 E 87,505.6

FIELD ENGINEER: T. HICKS

CHECKED BY: J. MURRAY

ELEV (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
2310	5	S 1		DENSE TAN SILTY SAND	sm		
				5.0'			
	10	S 2					
2300		8 15					
	15	S 3		MEDIUM DENSE ORANGE AND TAN SANDY SILT	ml		
	20						
2290		9 30					
	25			25.0'			
		S 4		DENSE GRAY AND TAN SILTY GRAVEL--TRACE OF SAND	gm-ml		
	30						
2280		10 0		32.5'			
-15-78				GRAY AND TAN SANDY CLAY	cl		
	35	11 0		35.5'			
		S 5		MEDIUM DENSE GRAY SAND AND ROCK FRAGMENTS	sp		
2272.1	40			TOP OF BEDROCK 40.0'		75/0.1	
				BOTTOM OF BORING 40.0'			

DATE BEGAN: 7-15-78

DATE FINISHED: 7-15-78

GROUND SURFACE EL: 2311.8

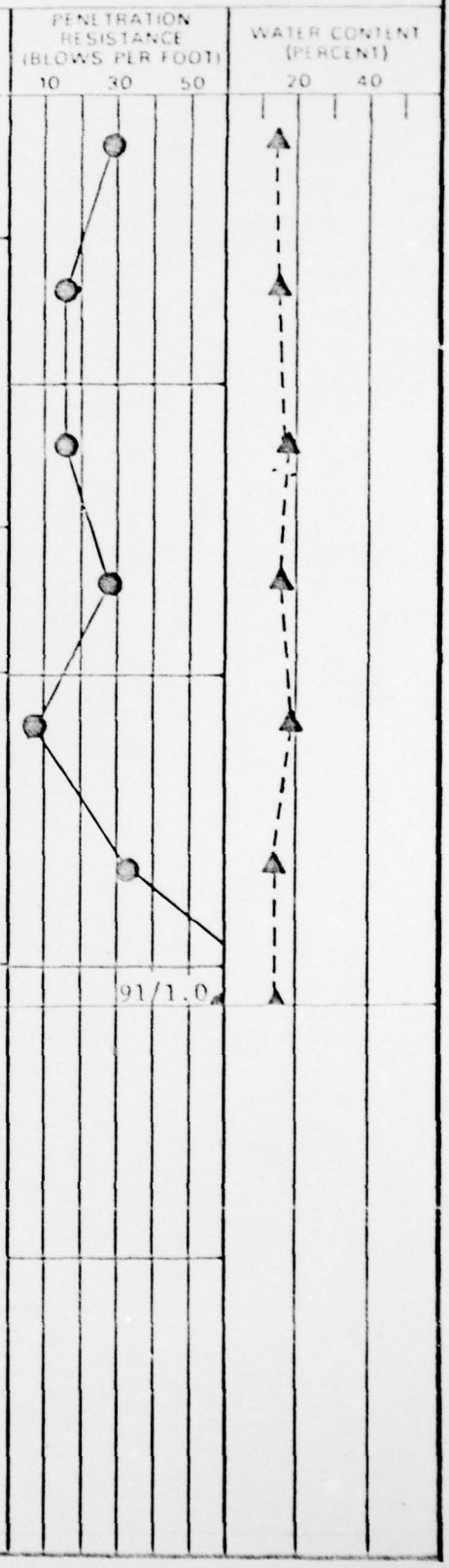
BORING NO. BW-3

N 80,922.7 E 87,544.4

FIELD ENGINEER: T. HICKS

CHECKED BY: J. MURRAY

ELEV (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS
2310		S-1		MEDIUM DENSE TAN AND GRAY SANDY SILTS	ml-sm
	5			5.0'	
		S-2		MEDIUM DENSE TAN AND GRAY SANDY SILT--TRACE OF CLAY	ml
-15-78					
	10	S-3			
2300		12/22			
	15			15.0'	
		S-4		MEDIUM DENSE ORANGE AND GRAY SANDY SILT	ml-sm
	20			20.0'	
2290		S-5		MEDIUM STIFF TO HARD ORANGE AND TAN CLAYEY SILTS--TRACE OF SAND	cl-ml
	25				
		S-6			
	30			30.0'	
2280.3		S-7		VERY DENSE GRAY SILTY SAND TOP OF BEDROCK 31.5'	ml-sm
				BOTTOM OF BORING 31.5'	



APPENDIX V

PLANNED MODIFICATIONS

BY

D'APPOLONIA CONSULTING ENGINEERS, INC.

U.S. DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
P.O. Box 560
560 Park Ave. NW
Norton, Virginia 24273

June 7, 1979

Mr. Theshel W. Bowers
Vice President
Clear Cap Mining Company, Inc.
P. O. Box 406
Norton, Virginia 24273

Re: Plan review reports for Clear Water Dam, I.D. Number 1211-VA5-0025-02A and Steer Branch Slurry Facility, I.D. Number 1211VA5-0025-01A by Denver Technical Support Center, Mine Waste Branch

Dear Mr. Bowers:

The refetenced reports recommend that the plan be approved provided supplemental information is transmitted and minor deficiencies rectified. Final approval is contingent upon this; however, work to effect the plans can commence.

Sincerely,

FRANK C. MANN
Acting District Manager

cc: File

UNITED STATES DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

TECHNICAL SUPPORT

MINE WASTE PLAN REVIEW
DIXIANA-MAKEUP WATER FACILITY
I.D. NO. 1211-VA5-0025-02A

Flat Gap Mining Company
Dixiana, Wise County, Virginia

May 29, 1979

by

Stephen W. Dmytriw
Civil Engineer

Issuing Office
Division of Safety Technology
Donald Hutchinson, Chief

DENVER TECHNICAL SUPPORT CENTER

A. Z. Dimitroff, Chief

P.O. Box 25367, Denver Federal Center
Denver, Colorado 80225

MATERIAL REVIEWED

The facility was purchased from the Old Ben Coal Company by Flat Gap Mining Company in 1977. The new owner hired E. D'Appolonia Consulting Engineers, Pittsburgh, Pennsylvania to develop a suitable plan to rehabilitate the facility. Their plan, dated March 1979, includes an engineering design report entitled "Proposed Modification and Future Coal Refuse Disposal Plan" and 16 standard size engineering drawings.

PREVIOUS REPORTS

Considering a change in ownership there are no pertinent previous DTSC reports other than site visits which are not listed herein.

REVIEW COMMENTS

The primary thrust of the design is to raise the dam embankment crest 7 feet, enlarge the principal (right abutment) spillway and construct a massive shot rock buttress on the downstream slope after placing a filter blanket. The two gated decant pipes through the embankment will be sealed with grout. The enlarged principal spillway can accommodate slightly less than 0.5 probable maximum precipitation (PMP) at a depth of 3.3 feet. Excess storm runoff that produces reservoir depths greater than 3.3 feet above the principal spillway invert will flow out of the impoundment along State Highway 620 (emergency spillway) bordering the left abutment. With both spillways in operation during a 6-hour PMP event, ample freeboard is provided.

The plan is basically sound; however, there are a number of questions which should be addressed.

1. Provide a spillway channel profile for this facility and in all future submittals. This should include the inlet invert elevation to aid the contractor.

2. The inclusion of smaller size riprap for the principal spillway lining and slope protection for State Highway 620 is required to form a more compact, erosion resistant mass. A gradation band is required.

3. The specifications state that shot rock will be segregated from overlying soil; however, there is no screening provision. A qualified engineer or representative of the consultant should be on the site during this operation.

4. The use of crushed rock for the 2-foot-thick filter blanket on the embankment face is vague in that neither maximum size nor fines content have been established. It is suggested that the stone size not exceed 1-1/2 inches and that minus #200 material be limited to not more than 3 percent. This further suggests utilization of a manufactured material. Gradation tests representative of the material to be placed should be submitted.

5. The material used for raising the embankment described as being "the most impermeable soil available" should be located by the consultant and defined by appropriate index property tests. Test data should be submitted prior to placement.

6. Since the primary element used in the slope stability analysis is the rock buttress, the inadequacy of the triaxial testing on the embankment material is not a consideration. However, in future submittals where the critical failure surface extends into earth materials, the test data and procedure will be more closely scrutinized.

7. The use of visual soil classifications will not be acceptable in future reports without a substantial number of consistent test results. A tabulated summary of test data should be included in every submittal. The consultant should provide index property data on the "sandy silt" foundation at this site.

8. Insufficient reservoir topography increased the review period. Future submittals, lacking adequate mapping information will be returned.

CONCLUSION AND RECOMMENDATIONS

The deficiencies noted herein are minor and relatively simple to remedy. Most of the problems have been discussed with the designer and a general agreement has been reached. The plan is recommended for approval provided the noted deficiencies are corrected. If there are any questions, please contact this office.

Stephen W. Dmytriw
Civil Engineer

Approved:

Robert I. Fujimoto, Chief
Mine Waste Branch

Date: May 29, 1979

8.0 MODIFICATIONS TO MAKEUP WATER RESERVOIR

8.1 GENERAL

The modifications presented herein for the makeup water reservoir include:

- Abandoning the existing 10-inch steel decant lines by filling the pipes with grout and removing the valve house.
- Constructing a drainage blanket on the downstream face of the existing embankment to prevent piping (internal erosion) of the fine-grained soils into the "shot" rock buttress.
- Regrading the existing spillway to divert the storm flow around the toe of the embankment buttress.
- Constructing a shot rock buttress and raising the crest of the embankment from Elevation 2314 to Elevation 2321 in order to provide sufficient freeboard to route the 80 percent PMP storm around the embankment utilizing the regraded spillway and State Route 620.
- Possible installation of a siphon system to maintain the impoundment level at Elevation 2296 in order to provide the capability of storing the 10-year, 24-hour storm while surface mining the Taggart coal seam. This would only be required for an approximate two-year period if the makeup water impoundment is used for sedimentation control. The siphon will not be constructed until required for surface mining operations.

The modifications to the makeup water impoundment were designed in accordance with prudent engineering practice and current federal (MSHA and OSM) and state (VDMQ and DMLR) regulatory criteria for impounding facilities. Since this structure is capable of impounding more than 20 acre-feet, has an embankment height of 26 feet, and is 2,500 feet upstream of the coal cleaning plant, it is classified as a Class C structure. As a result, the proper design storm consists of the 80 percent PMP. The following sections present the modifications to the makeup water reservoir as shown in plan and section in Figure 16.

8.2 ABANDONMENT OF EXISTING DECANT LINES

The existing 10-inch-diameter steel decant lines will be plugged by pumping cement into the pipes. To minimize the pressure head in the decant lines during the filling, the impoundment should be lowered as much as practical. The downstream end of the existing lines should be fitted with a flanged connection to facilitate the plugging operations. An expansive cement mix should be used and should consist of the following:

- Compressive Strength at 28 Days — 2,000 psi
- Bentonite — 2 to 5 percent
- Water-Cement Ratio — 0.5

The viscosity of the grout should be adjusted through addition of bentonite during the operation to suit pumping and plugging of the pipes. Approximately six to ten cubic yards of grout will be required to fill the pipes. Upon completion of the pumping operations, the existing valves should be closed to prevent the concrete grout from draining out.

8.3 DRAINAGE BLANKET

A drainage blanket will be constructed against the downstream face of the existing embankment from Elevation 2410 to the toe of the embankment. The drainage blanket will consist of the following items:

- A layer of filter cloth placed on the existing face of the makeup water embankment to prevent internal erosion (piping) of the fine-grained materials within the embankment. The filter cloth should be placed with a minimum of one-foot overlap and extend beyond each abutment, tying into the natural hillside.

- Smaller shot rock or sand must be placed against the filter cloth to protect the lining from damage during construction of the large rock buttress. A minimum thickness of two feet of material is required over the entire area.

8.4 SPILLWAY

The existing spillway alignment will be altered to channel the discharge downstream of the proposed buttress toe. The spillway alignment and de-

of 1:1 and 2:1 on the east and west sides, respectively, should be maintained. The slope of the spillway should be a minimum of two percent with a depth of 7.5 feet maintained to the toe of the buttress. Any portion of the spillway not excavated in rock should be lined with large shot rock (two-foot diameter) from the surface mine operations.

8.5 BUTTRESS

The shot rock buttress will be constructed using surface mine spoil resulting from proposed mining operations in the vicinity. The rock should be placed by end dumping into the valley and spread with heavy earthmoving machinery. Large voids should be choked with smaller rock to maintain a stable embankment configuration. Surficial soils should be segregated before placement of the rock to maintain a relatively free-draining buttress.

Larger shot rock (greater than two feet in diameter) should be placed on the existing natural slope from the toe of the embankment to State Route 620 to protect the natural hillside from severe erosion should the roadway be activated as a spillway during a storm. The hydraulics of the reservoir embankment are discussed in detail in Section 10.2.

The foundation for the buttress is wet and relatively compressible. Consequently, to avoid potential problems with these materials, the buttress was designed with a very flat outside slope (4:1) and a relatively free draining material. The buttress itself serves as a toe drain. Any settlement which occurs after construction should be noted and additional material placed to achieve the required crest elevation.

A seal consisting of a 10-foot-wide zone of the most impermeable soil available is also required along the upstream face to minimize seepage through the upper portion of the buttress, as shown in Figure 16.

8.6 SIPHON SYSTEM (Temporary for Surface Mining)

A siphon system may be installed to maintain the reservoir impoundment level at Elevation 2296 for sedimentation control of the proposed surface

mining. The siphon consists of an eight-inch-diameter polyvinylchloride (PVC) pipe, upstream check valve, and downstream butterfly valve as shown in Figure 16. Storm water that collects in the reservoir will be siphoned off after the system is primed. Priming requires that both valves be closed and water pumped into the pipe through a tee located at the maximum elevation of the pipe. Specifications and manufacturers recommendations for the siphon equipment are shown in Figure 16 and in the guideline technical specifications in Figure 19.

The siphon is designed to decant the makeup water reservoir to Elevation 2296 in order to provide retention of the 10-year, 24-hour storm below the spillway outlet. Drawdown of the reservoir by the siphon for this storm will require less than 10 days. Retention of storms larger than the 10-year recurrence interval for sedimentation control is not required by state or federal regulatory agencies and is controlled by the spillway outlet works.

The siphon inlet and check valve will be supported by a saddle as shown in detail in Figure 16. The siphon inlet riser should be slotted and a trash rack attached to prevent clogging. A pad constructed of surface mine spoil rock will form a platform for the siphon inlet works. During cold weather, no water should be allowed to remain in the siphon when not in operation.

If the makeup water reservoir is not used for sedimentation control associated with surface mining activities, then the siphon will not be constructed. The spillway will serve as the only outlet for storm water. If necessary to evacuate water below the spillway, pumps can be mobilized, as required.

APPENDIX VI - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. The Geology and Mineral Resources of Wise County and the Coal-Bearing Portion of Scott County, Virginia, Bulletin 24, J. Brian Eby, Virginia Division of Mineral Resources, 1923, 617 pp.
4. HEC-1 Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers), July 1978.
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. Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau, Washington, D. C., May 1961.
7. Report; Proposed Modifications and Future Coal Refuse Disposal Plan, Steer Branch Coal Refuse Disposal Facility and Preparation Plant; Makeup Water Reservoir, D'Appolonia Consulting Engineers, Inc., March 1979, 41 pp.