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NATIONAL DAM INSPECTION REPORT. TREESDALE FARM DAM, BUTLER COUN--ETC(U)
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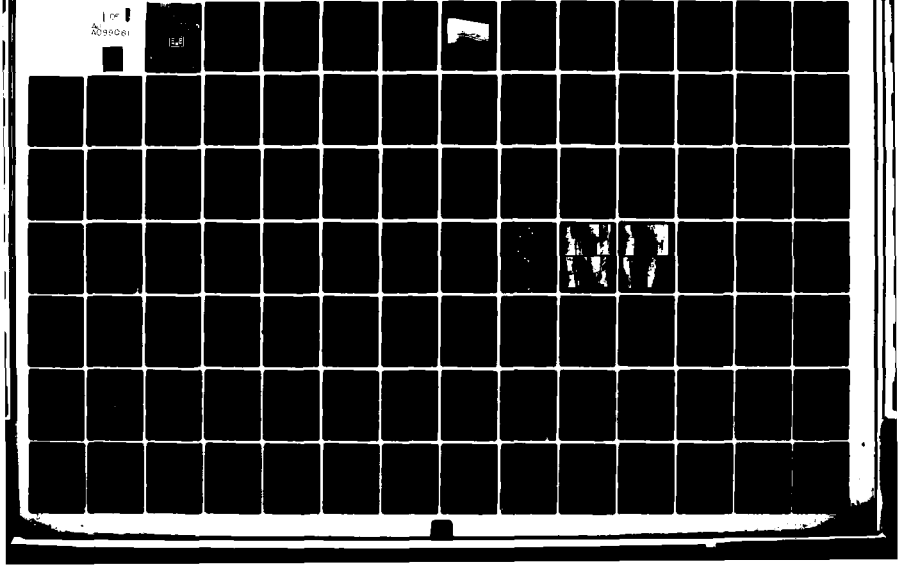


OHIO RIVER BASIN
BREAKNECK CREEK
BUTLER COUNTY

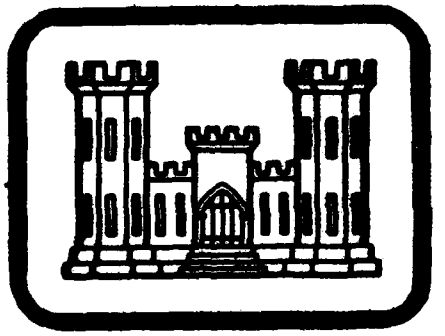
PENNSYLVANIA

NDI No. PA 01069
PENN DER No. 10-26

TREESDALE FARM DAM

TREESDALE FARM INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

BY

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MARCH 1981

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(6) OHIO RIVER BASIN

National Dam Inspection Report.

TREESDALE FARM DAM
BUTLER COUNTY, COMMONWEALTH OF PENNSYLVANIA
(NDI ~~NO.~~ PA 01069
Penn DER ~~NO.~~ 10-26)

Ohio River Basin, Breakneck Creek
Butler County, Pennsylvania

TREESDALE ~~FARM~~, INC.

PHASE I INSPECTION REPORT,
NATIONAL DAM INSPECTION PROGRAM

(12) 74

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC.
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Pittsburgh, Pennsylvania 15216

CONTRACT DAGW31-81-C-0027
(15)

Date: March 1981

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PREFACE

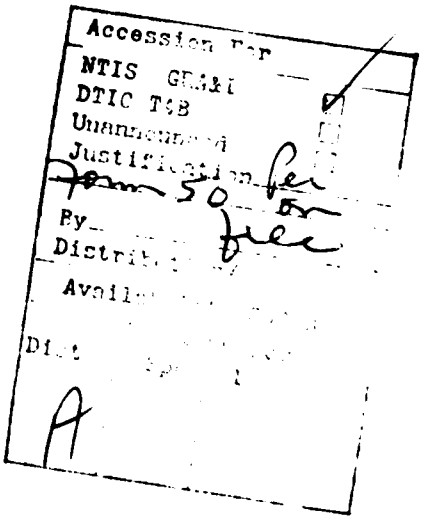
This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I investigations. Copies of these guidelines may be obtained fom the Department of the Army, Office of Chief of Engineers, Washington, DC 20314.

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 visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, materials testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for such studies which should be performed by the owner.

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 the dam depends on numerous and constantly changing internal and external factors which are 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 time in the future. Only through frequent inspections can some unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I investigations 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" (PMF) for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid 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 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS

NAME OF DAM:	Treesdale Farm Dam
STATE LOCATION:	Pennsylvania
COUNTY LOCATION:	Butler
STREAM:	Unnamed tributary of Breakneck Creek, Ohio River Watershed.
DATE OF INSPECTION:	December 8, 1980
COORDINATES:	Lat. 40 40' 36" Long. 80 1' 42"

ASSESSMENT

Repairs and modifications to Treesdale Farm Dam were in progress at the time of the field reconnaissance. The downstream embankment slope was unvegetated and would be subject to erosion if the spillways were activated.

The dam is classified as a "small" size "significant" hazard dam in accordance with U.S. Army Corps of Engineers dam safety criteria. The 100 year frequency storm is considered an appropriate spillway design flood. For this design flood, analysis using the HEC-1 Dam Safety computer program indicates a maximum reservoir elevation of 1102.1 or 0.3 feet above the crest of the existing embankment. The spillway system of the existing dam is therefore considered temporarily inadequate. Modifications in progress call for the embankment crest to be increased to El. 1103.5. These modifications, once complete, will provide adequate spillway capacity.

Taking into account the unfinished modifications, the dam is considered to be in good condition. However, several conditions and procedures require attention and should be addressed as soon as possible. Recommendations for addressing these conditions and procedures are outlined below.

RECOMMENDATIONS

1. Temporary Measures

   a. Complete the repairs and modifications to the dam and develop a dense grass cover on the downstream slope of the embankment and auxiliary spillway.

   b. Remove the fill (temporary access road) obstructing the downstream channel.

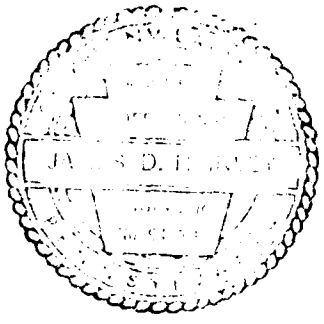
2. Long-Term Measures (Require continual attention)

   a. Develop plans to provide positive upstream control of the reservoir drain pipe. Implement plans if pipe leakage becomes evident.

   b. Develop a formal flood surveillance and warning plan to advise downstream residents when high flows are expected. The plan should include an evacuation procedure.

   c. Inspect the downstream embankment slope for evidence of seepage and piping at least once each month. Implement corrective measures if piping is noted.

d. Develop a more thorough maintenance program to regularly remove future tree growth from the embankment.



James D. Hainley, P.E.
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Vice President

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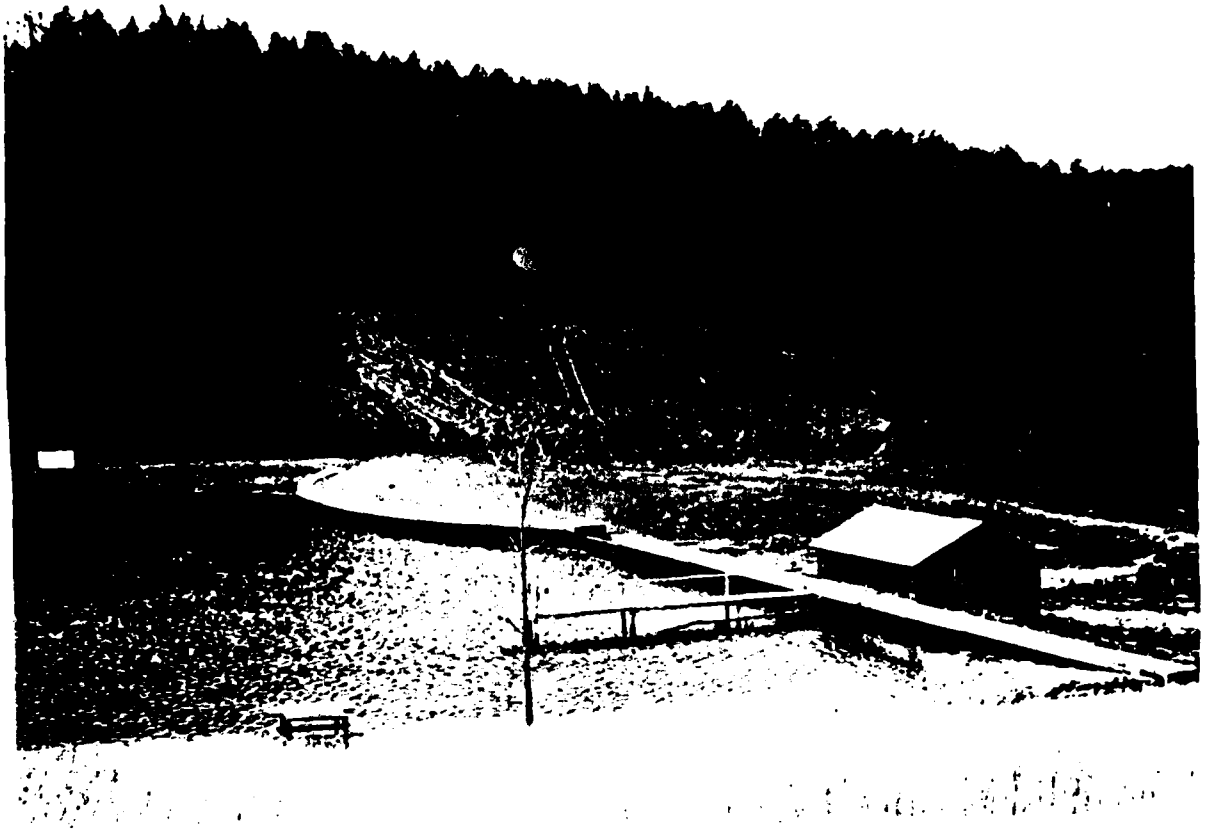
Project Engineer

APPROVED BY:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE: 5 May 81

TREESDALE FARM DAM



OVERVIEW OF DAM

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NATIONAL DAM INSPECTION PROGRAM
TREESDALE FARM DAM
NATIONAL I.D. NO. PA 1069
Penn. DER No. 10-26

SECTION 1
PROJECT INFORMATION

1.1 GENERAL

A. AUTHORITY: The Phase I investigation was performed pursuant to authority granted by Public Law 92-367 (National Dam Inspection Act) to the Secretary of the Army through the Corps of Engineers, to conduct inspections of dams throughout the United States.

B. PURPOSE: The purpose of the investigation is to make a determination on whether or not the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

A. DAM AND APPURTENANCES

1. Embankment: According to original design drawings, Treesdale Farm Dam was designed and constructed as an earthfill structure with a concrete core wall located at the dam centerline. The original embankment, constructed in 1925, is 320 feet long with a height of 19.8 feet from the downstream toe to the top of the core wall cap which serves as the dam crest. Compacted clay soil was used to construct upstream and downstream embankment sections.

   Modifications to improve embankment stability, increase freeboard, and repair deteriorating concrete began in the summer of 1980 and are in progress at this time. The modifications are shown on Plates No. 7 to 9.

   Design drawings do not indicate any type of drain system for the original embankment. Modifications now in progress include the installation of a drain system and the placement of additional fill on the downstream embankment slope.

2. Outlet Works: Outlet works consist of a reservoir drain and a pump system used for agricultural purposes. The reservoir drain reportedly consists of a 10 inch diameter cast iron pipe encased in concrete. The gate valve for this pipe is located near the downstream toe of the dam. A second gate valve located upstream from the core wall is not operable. The drain discharges into the principal spillway stilling basin.

3. Spillways: Design drawings for modifications now in progress indicate that three ungated spillways will be employed at Treesdale Farm Dam. These include:

   a. Principal Spillway: The principal spillway is located in the middle of the embankment and is used to control normal pool level and for flood discharge. The spillway consists

of a concrete weir (El. 1100.0) located at the core wall and a discharge channel with concrete bottom and sidewalls.

b. Auxiliary Spillway: The auxiliary spillway is excavated in soil at the right abutment and is still under construction. Plans are to seed the channel in the Spring of 1981. The crest of the auxiliary spillway will be at El. 1100.5 or 0.5 feet above the weir crest of the principal spillway.

c. Emergency Spillway: The hydraulic design upon which the modifications now in progress have been based consider an 87 feet long section of the embankment between principal and auxiliary spillways to act as an emergency spillway. The existing embankment section is 140 feet in length. The top of the concrete core wall cap (El. 1101.5) for this section will function as a weir crest. Water will be discharged onto the downstream slope of the embankment, and gabions will be placed on both sides of the channel for erosion protection

4. Downstream Conditions: Treesdale Farm Dam is located across an unnamed tributary of Breakneck Creek which it intersects about 1.7 miles below the dam. Route 228 crosses the tributary about 1 mile below the dam. Between the dam and Rt. 228, the tributary is narrow and meanders through woodland. Further downstream, the tributary flows through the town of Mars and then intersects Breakneck Creek. Breakneck Creek is a tributary of the Beaver River which is part of the Ohio River watershed.

B. LOCATION: The dam is located in Adams Township, Butler County about 1.3 miles southwest of Mars, Pennsylvania.

C. SIZE CLASSIFICATION: Treesdale Farm Dam has a maximum storage volume (El. 1101.8) of 57 acre feet and a toe to crest height of 19.8 feet. The dam is classified as a "small" size structure according to Corps of Engineer guidelines.

D. HAZARD CLASSIFICATION: Treesdale Farm Dam is classified as a "significant" hazard dam. If a dam failure would occur, four homes about 1 mile downstream of the dam could sustain damage though loss of life is not considered likely. Damage to Route 228 is also considered possible.

E. OWNERSHIP: The dam is owned by Treesdale Farms, Inc. of Mars, Pennsylvania. All correspondence concerning the maintenance and operation of the dam should be directed to:

Treesdale Farms, Inc.
RD #2
Mars, Pennsylvania 16046
Attn: Mr. Norman Datt
Phone No. (412) 625-1525

F. PURPOSE OF DAM: The purpose of the dam is to provide a water supply reservoir for Treesdale Farms.

G. DESIGN AND CONSTRUCTION HISTORY: Records indicate that construction of the dam began in 1924 and was completed in August, 1925. A construction permit, dated April 25, 1925, was issued by the Water

and Power Resource Board, Commonwealth of Pennsylvania after construction began. The name of the designer and contractor are unknown, though records indicate that Mr. A. H. Appel, an engineer contracted by Mr. J. C. Trees, owner of Treesdale Farms, was involved in the construction of the dam.

An inspection of Treesdale Farm Dam was made by Division of Dam Safety personnel (Department of Environmental Resources) during May, 1979. The reason for performing this inspection is unknown. Division of Dam Safety requested that the owner retain the services of a registered professional engineer to evaluate the stability and hydraulic capacity of the dam and recommend necessary modifications. This study was performed by Ronald E. Kelley Consulting Engineers, Greensburg, Pennsylvania during 1979 and 1980, and a report, dated March, 1980, was prepared. Records indicate that the recommended modifications and remedial measures proposed in the report were approved by the Division of Dam Safety on March 31, 1980. These modifications and remedial measures were not completed at the time of the field inspection (Dec. 8, 1980).

H. NORMAL OPERATING PROCEDURE: Treesdale Farm Dam was designed to operate as an uncontrolled structure. Normal pool level is maintained at El. 1100.0 by the weir crest of the principal spillway. An ungated auxiliary spillway excavated into the right abutment and an 87 feet long embankment section designed to operate as an emergency spillway will also be employed to discharge flood flows once construction modifications are completed.

The reservoir drain is normally closed except when it is necessary to lower the water level for maintenance and repairs.

1.3 PERTINENT DATA

Note: The elevations given below are based on mean sea level and were obtained from the original design plans dated 1925 (Plates No. 1 to 5). The elevation shown on drawing prepared by Ronald E. Kelley Consulting Engineers were based on an assumed elevation of 1105.5 feet for the principal spillway crest. The elevations on these drawings are 5.5 feet greater than elevations based on mean sea level.

A. Drainage Area: 0.49 sq. mi.

B. Discharge at Dam Facility:

Maximum flood at dam facility	Unknown
Spillway capacity at top of existing embankment @ El. 1101.8 (with emergency spillway activated)	211 cfs
Spillway capacity at top of proposed embankment @ El. 1103.5 (with emergency spillway activated)	1335 cfs

C. Elevations:

Top of existing embankment	1101.8
Top of proposed embankment	1103.5

Normal pool	1100.0
Principal (ungated) spillway overflow crest	1100.0
Crest of auxiliary spillway	
Existing elevation	1100.1
Proposed elevation	1100.5
Crest of emergency spillway	1101.5
Maximum tailwater	Unknown
Inlet invert of pond drain	Approx. 1083
Outlet invert of pond drain	Approx. 1082
Lowest point at toe of embankment	1082

D. Reservoir Length

Length of normal pool	1000 feet
Length of maximum pool	
Existing (El. 1101.8)	1030 feet
Proposed (El. 1103.5)	1050 feet

E. Reservoir Storage

Top of existing embankment	57 acre-feet
Top of proposed embankment	70 acre-feet
Top of core wall (El. 1101.5)	55 acre-feet
Principal (ungated) spillway overflow weir crest (El. 1100.0)	45 acre-feet
Normal pool	45 acre-feet
Sediment pool	Unknown

F. Reservoir Surface

Top of existing embankment	7.0 acres
Top of proposed embankment	8.0 acres
Top of core wall (El. 1101.5)	6.8 acres
Prinicpal (ungated spillway overflow weir crest	5.9 acres
Normal pool	5.9 acres
Sediment pool	Unknown

G. Embankment

Type	Earthfill
Length	320 feet
Height	
Existing	19.8 feet
Proposed	21.5 feet
Existing crest width	3 - 22 feet
Proposed crest width	10 - 35 feet
Slopes	
Downstream	3.5H:1V
Upstream	2.0H:1V
Impervious core	Yes
Cutoff provisions	Concrete core wall founded on rock
Grout curtain	None reported

H. Regulating Outlet (Principal Spillway)

Type	Overflow spillway with concrete weir
Length of weir	15.7 feet
Weir crest elevation	1100.0

I. Auxiliary Spillway

Type	Trapezoidal channel excavated in soil
Width	
Existing	14 feet
Proposed	20 feet
Crest elevation	
Existing	1100.1
Proposed	1100.5
Gate	None
Downstream Channel	Soil (to be seeded in Spring, 1981)
Upstream Channel	Soil (to be seeded in Spring, 1981)
Length of Channels	60 feet

J. Emergency Spillway

Type	Overflow spillway with concrete weir (core wall)
Width	
Existing	140 feet
Proposed	87 feet
Crest elevation	1101.5
Gate	None
Downstream Channel	Downstream slope of embankment
Upstream Channel	None
Length of Channel	Discharges on downstream slope of embankment

K. Outlet Works (Reservoir Drain)

Type	10 inch diameter C.I. pipe encased in concrete
Inlet	Type unknown
Conduit length	Approximately 140 feet
Gate Valve	Yes, at downstream toe
Anti-Seep collars	None reported. (except core wall)

SECTION 2
ENGINEERING DATA

2.1 DESIGN

A. Data Available: The following reports, drawings, and records may be obtained from the Pennsylvania Department of Environmental Resources, Harrisburg, Pennsylvania:

1. Miscellaneous design drawings of original embankment dated March 30, 1925.

2. Specifications for constructing the original embankment dated April 9, 1925.

3. Permit application to construct dam dated April 9, 1925.

4. Miscellaneous correspondence between Water and Power Resources Board and J.C. Trees (owner) concerning construction of dam.

5. Dam construction permit from Water and Power Resources Board dated April 13, 1925.

6. Inspection report, dated October 21, 1926, prepared by Water and Power Resource Board.

7. Correspondence concerning permit to draw down reservoir, dated August, 1955.

8. Inspection report dated August 7, 1967 prepared by Division of Dams and Encroachment (DER).

9. Correspondence concerning an April 20, 1979 inspection made by the Division of Dam Safety (DER).

10. Report entitled "Reinforcement of Embankment, Concrete Core Wall and Spillway for Earth Dam at Apple Orchard of Treesdale Farms, Inc." prepared by Ronald E. Kelley Consulting Engineers, Greensburg, Pennsylvania and dated March, 1980.

11. Correspondence dated March 31, 1980 from the Division of Dam Safety (DER) stating approval of proposed modifications.

B. Design Features: The design criteria used to construct the original embankment in 1925 is unknown. Plans and specifications for this construction were approved by the Water and Power Resource Board, Commonwealth of Pennsylvania. Design modifications now in progress were approved by the Division of Dam Safety, (Department of Environmental Resources). Principal design features are illustrated on Plates No. 1 through 9.

1. Field Investigation: There are no records indicating that a field investigation was undertaken prior to the construction of the original embankment. A survey of the original embankment was performed by Ronald E. Kelley Consulting Engineers in 1979 for the purposes of their study.

2. Embankment: Design drawings indicate that the embankment was designed as an earthfill structure with a core wall made of reinforced concrete. Clay soil, placed in 6 inch thick layers and compacted, was used to construct upstream and downstream embankment sections. Records indicate that the core wall was founded on shale for its entire length as shown on the design drawings.

   The upstream and downstream sections of the original embankment were not constructed as shown on the plans (Plate No. 1). Fill was not placed to the top of the core wall as shown. An inspection report, dated July 3, 1926, stated, "The earth embankment on the downstream side varies from about 3 feet below the top at the left end to 5 feet at the left of the spillway, on the upstream side, the embankment is about 3.5 feet below the top."

   The inclinations of the upstream and downstream slopes of the original embankment are 2H:1V and 2.5H:1V respectively. Modifications now in progress include the placement of additional fill on the downstream slope (Plate No. 7 and 8) and installation of a drain system (Plate No. 9). The inclination of the modified downstream slope section left of the principal spillway is 3.5H:1V rather than the 2H:IV slope shown on the modification plans (Plate No. 8). The drain system was installed to intercept seepage from the original embankment as shown on Plate No. 9. Recent repair work also includes the replacement of the core wall cap and grouting a crack in the core wall.

3. Outlet Works: The dam was designed with a 140 feet long reservoir drain pipe placed through the embankment. The pipe is 10 inches in diameter, made of cast iron, and encased in concrete. The original design drawings (Plate No. 1) show two gate valves on this pipe; one located upstream of the core wall and the other at the downstream toe of the embankment. The valve at the core wall is not operable and it is only necessary to open the downstream valve to operate the reservoir drain. A PVC pipe extension has been connected to this gate valve and discharges into the downstream channel.

   A pump system is also in use at the dam facility to supply water for agricultural purposes. The pump house for this system is located adjacent to the core wall about 70 feet right of the principal spillway.

4. Spillways: Three ungated spillways will be used for flood discharge. These are described below:

   a. Principal Spillway: The principal spillway, consisting of a concrete weir and discharge channel, is located at the middle of the embankment. This spillway is used to maintain normal pool level at El. 1100.0 and for flood discharge. The spillway weir is 15.7 feet in length and is at a level 1.5 feet below the top of the core wall. Modifications are planned to increase the hydraulic capacity of this spillway. Modifications include increasing the embankment height by placing additional fill on the downstream slope and constructing a trapezoidal shaped principal spillway channel lined with riprap (Plate No. 8).

b. Auxiliary Spillway: The auxiliary spillway is in the process of being excavated into soil at the right abutment. During our December 8, 1980 field reconnaissance, the spillway channel was about 14 feet wide with a crest elevation 1100.1 feet or 0.1 feet above normal pool level. Records indicate that an auxiliary spillway was constructed at the right abutment when the dam was built in 1925. It is unknown what has happened to the concrete apron of the original auxiliary spillway or why the area was filled in. Modifications now in progress call for grading the channel to El. 1100.5 and seeding during Spring, 1981.

c. Emergency Spillway: A 87 feet section of the embankment between the principal and auxiliary spillway will be used for an emergency spillway. As shown on Plate No. 2, the embankment has a height of about 7 feet at the proposed emergency spillway location. This section of embankment will be overtopped when the reservoir level exceeds the height of the core wall (El. 1101.5) which will function as a spillway crest. Modifications call for the downstream slope to be seeded and for rock gabions to be used at the sides of this section for erosion protection.

2.2 CONSTRUCTION

A. CONTRACTOR: The contractor responsible for the construction of the dam in 1925 is unknown. Modifications currently in progress are being made by W. M. Aiken and Sons, Mars, Pennsylvania.

B. CONSTRUCTION PERIOD: Construction of the dam began in 1924 and was completed in August, 1925. Modifications were begun during the summer of 1980. The owner claims that the modifications will be completed during Spring, 1981.

C. FIELD CHANGES:

1. Original Construction: Features which differ from the original design drawings dated March 1925 are described below:

   a. Fill for the upstream and downstream embankment sections was placed 3 to 5 feet below the top of the core wall rather than to the top of the wall.

   b. Fill was placed in the auxiliary spillway area and the concrete apron was removed.

2. Current Modifications: Features which differ from the design drawings included in the report prepared by Ronald E. Kelley Consulting Engineers are described below. Other changes may be evident after the design modifications are complete.

   a. Fill placed on the downstream embankment slope has an inclination of 3.5H:1V rather than 2.0H:1V.

   b. PVC pipe was used for the reservoir drain extension rather than cast iron pipe and the drain discharges directly into the stilling basin instead of into an adjoining channel as shown on Plate No. 7.

D. CONSTRUCTION INSPECTION: A site inspection was made by representatives of the Water and Power Resources Board, Commonwealth of Pennsylvania on October 21, 1926. The inspection report states that "this dam has been built according to the plans approved." It was noted, however, that embankment fill was not placed to the top of the core wall.

2.3 OPERATION. The owner, Treesdale Farms Inc. of Mars Pennsylvania is responsible for the operation of the dam. Flood discharge is uncontrolled and operation records are not maintained. The reservoir drain is normally closed except when it is necessary to lower the reservoir for repairs to the dam or for removal of sediment.

2.4 EVALUATION.

A. AVAILABILITY: Available design information and drawings were obtained from the Pennsylvania Department of Environmental Resources.

B. ADEQUACY: The available design information is considered adequate for the purposes of this Phase I inspection report.

C. VALIDITY: Based on the available data, there appears to be no reason to question the validity of the design information used for this report.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

A. GENERAL: The on-site reconnaissance of Treesdale Farm Dam was performed on December 8, 1980 and consisted of:

1. Visual observations of the earth embankment, abutments, principal spillway, and auxiliary spillway channel.

2. Visual observations of exposed sections of the core wall.

3. Evaluation of the downstream hazard potential.

4. Visual observation of the reservoir shoreline, upstream dams, and downstream channel.

5. Transit stadia survey of relative elevations along the top of the core wall, embankment crest, and across the downstream slope.

The visual observations were made during a period when the reservoir was about 2 feet lower than normal pool level. The reservoir was drawn down so that repairs and modifications to the dam could be performed.

A visual description checklist and field sketch are given in Appendix A. Specific obserations are shown on photographs in Appendix C.

B. EMBANKMENT:

1. Surficial: Embankment modifications were in progress at the time the field reconnaissance was made. Fill, consisting of predominately clay soil, had been placed on the downstream slope in order to increase the crest elevation along a section of embankment and to improve embankment stability. Due to construction not being completed, the downstream slope was unvegetated. Mr. Norman Datt of Treesdale Farms has stated that these areas will be seeded during Spring, 1981. The upstream slope was submerged and hence could not be observed. The concrete cap of the core wall was recently reconstructed and the exposed portion of the core wall appeared in excellent condition. The crest of the fill on the downstream slope left of the principal spillway varies from El. 1101.8 to El. 1102.5 rather than El. 1103.5 as proposed.

2. Seepage: No noticeable seepage was observed emanating from the downstream embankment slope. Water was present in the downstream channel even though the principal spillway was not in operation due to reservoir drawdown. Modifications now in progress include the installation of a drain system to intercept seepage from the original embankment (Plate No. 9). No discharge from the outlet pipes for this drain was noted during the site reconnaissance. It is unknown if the water in the downstream channel is caused by discharge from the drain system or from springs emanating from the abutments.

3. Wet Zones: A wet zone with ponded water was observed below the downstream toe and to the left of the downstream channel. The wet zone is situated in a low lying area and is believed subject to surface runoff from rainfall and springs in the left abutment. A spring emanating from the left abutment was observed and is shown on the field sketch.

C. DOWNSTREAM CONDITIONS:

1. Channel: The channel directly below the dam has been straightened and cleared of debris. The bottom and side slopes of the channel are unvegetated and final grading has not been completed. About 100 feet below the dam, the channel is obstructed by fill placed over a 12 inch diameter pipe (Photo No. 6). This was constructed for access to the left abutment and it will reportedly be removed when construction operations are complete. Downstream from this obstruction, the channel is narrow and meanders through woodland for about 1 mile before intersecting Route 228.

2. Development: Treesdale Farm Dam is located on an unnamed tributary of Breakneck Creek, which it intersects about 1.7 miles downstream of the dam. Route 228 crosses the tributary about 1 mile downstream of the dam. At this location, there are 4 houses adjacent to and within a 10 feet elevation difference of the tributary. The tributary then flows through the town of Mars before intersecting with Breakneck Creek. Between Route 228 and Breakneck Creek, there are about 10 buildings located adjacent to and within a 10 feet elevation difference of the tributary.

D. APPURTENANT STRUCTURES:

1. Reservoir Drain: The 10 inch diameter reservoir drain was reported to be operational at the time of the site reconnaissance. Access to the gate valve is by a manhole located near the downstream toe of the dam. The gate valve was recently opened to lower the reservoir for dam repairs and hence was not exercised.

2. Principal Spillway: Due to the lowered reservoir level, the principal spillway was not discharging at the time of the site reconnaissance. The concrete weir and spillway channel appeared in excellent condition. As part of the repair work in progress, the weir and sidewalls of the channel have been reconstructed and the channel bottom was sandblasted and coated with a bituminous mastic (Photo No. 4). Riprap along the sides of the spillway and in the stilling basin had yet to be placed. In its existing condition, the spillway will discharge onto unvegetated soil at the toe of the embankment.

3. Auxiliary Spillway: The auxiliary spillway was partially excavated into the left abutment at the time of the site reconnaissance. It is being excavated into soil and the channel, due to construction, was unvegetated. No evidence of the concrete apron of the original auxiliary spillway, constructed in 1925, was observed.

4. Emergency Spillway: Construction modifications to enable an 87 feet long section of the embankment between principal and auxiliary spillways to function as an emergency spillway were not completed at the time of the site reconnaissance. Overtopping of this section of the existing embankment will result in water being discharged onto a 140 feet long section of unvegetated embankment slope.

E. INSTRUMENTATION: No instrumentation was observed during the inspection.

F. RESERVOIR: The slopes of the reservoir shoreline have a moderate inclination and are vegetated with trees and brush. No evidence of instability was noted. Three small dams are located upstream of the reservoir as shown on Plate No. 6. These structures were constructed as sedimentation ponds and the dam for Pond #1 has been breached. Evidence of excessive sedimentation in the main reservoir was not evident.

3.2 EVALUATION

A. GENERAL: As previously stated, construction modifications were in progress at the time of the site reconnaissance. A comparison between all features of the existing embankment and the design drawings was therefore not possible. Deviations from design, to the extent now discernible, along with a description of potentially hazardous conditions (mostly temporary conditions caused by construction operations) are detailed below.

B. EMBANKMENT: The downstream slope of the embankment is unvegetated and would be prone to erosion in the event the dam is overtopped. Although temporary, this condition is considered to be a serious deficiency.

The crest of the fill on the downstream slope left of the principal spillway varies from El. 1101.8 to El. 1102.5 rather than El. 1103.5 as proposed (Plate No. 8). Until construction is completed, the dam will have less freeboard than planned. This may or may not be a deficiency, depending upon the results of the hydrologic/hydraulic analysis.

C. APPURTENENT STRUCTURES:

1. Reservoir Drain: The water in the cast iron reservoir drain pipe is under pressure due to the gate valve being located near the downstream toe of the embankment. Leakage from this pipe could result in internal erosion of the downstream slope and possible instability.

2. Principal Spillway: In its existing condition, the spillway, if activitated, will discharge onto unvegetated soil at the downstream toe of the embankment. Until the riprap stilling basin is constructed, this condition could cause erosion of the downstream toe area and result in possible instability.

3. Auxiliary Spillway: The auxiliary spillway channel has been partially excavated into soil at the left abutment and is unvegetated. Until suitable erosion protection is provided, discharge from the channel would cause erosion and possible instability of the embankment.

4. Emergency Spillway: When overtopped, an embankment section between the principal and auxiliary spillways would function as an emergency spillway. Erosion of the unvegetated downstream slope would occur and embankment instability is considered possible.

SECTION 4
OPERATIONAL FEATURES

4.1 PROCEDURE. Normal pool level is maintained by the uncontrolled weir crest of the principal spillway. Normal operating procedure does not require a dam tender. The only operational features of the dam are the reservoir drain gate valve which is normally kept closed and the pump system for water supply which is used as needed.

4.2 MAINTENANCE OF DAM. The dam is maintained by the owner; Treesdale Farms Inc., Mars, Pennsylvania. Maintenance normally consists of removing debris and cutting brush. Maintenance is generally performed on an "as-needed" basis. Major renovations were in progress at the time of the site reconnaissance.

4.3 INSPECTION OF DAM. Inspections are performed by personnel of Treesdale Farms on approximately a weekly basis. The inspections generally consist of visually examining the embankment and spillway channel for debris and erosion. Records indicate that the dam was inspected by state personnel in 1926, 1967, and 1979.

4.4 WARNING SYSTEM. There is no warning system or formal emergency procedure to alert downstream inhabitants upon the threat of a dam failure.

4.5 EVALUATION. Based on the observations made during the site reconnaissance, conversation with Treesdale Farm personnel, and photographs of the dam prior to the start of renovations, the maintenance and inspection procedures being followed at Treesdale Farm Dam are considered adequate with the exception of the following:

A. Photographs of the dam prior to the start of renovations showed several large trees growing on the embankment. Future tree growth on the embankment should be removed on a routine basis.

B. Records indicate that seepage from the original embankment was present in the past. A Division of Dam Safety inspection report, dated May 21, 1979, states that "the embankment was found to have problems on the right side. In this area there is seepage with piping evident." Although the concrete core wall has been repaired and a drain system has been constructed, the downstream slope of the existing embankment should be routinely inspected for evidence of seepage and piping.

SECTION 5
HYDROLOGY AND HYDRAULICS

5.1 AVAILABLE INFORMATION

A. DESIGN DATA: Treesdale Farm Dam has a watershed area of 312 acres which is primarily woodland and orchard. The watershed area has a maximum elevation of 1300 feet above mean sea level (MSL). The dam impounds a reservoir with a surface area of 5.9 acres and storage volume of 45 acre-feet at normal pool level (El. 1100.0). At the existing crest elevation of 1101.8, the dam can impound 57 acre-feet. If the crest height is increased to El. 1103.5 as shown on the design drawings, the dam can impound 70 acre-feet.

B. EXPERIENCE DATA: Records of reservoir levels are not kept though Treesdale Farms does maintain records of rainfall. There is no record or report of the embankment ever being overtopped during a period of heavy rainfall.

C. VISUAL OBSERVATIONS: The planned modifications to the principal, auxiliary, and emergency spillways were not completed at the time of the field reconnaissance. Observed conditions that would affect the performance of these spillways until the modifications are completed are summarized below:

1. Riprap on the sides of the principal spillway and in the stilling basin was not in place.

2. The excavation for the auxiliary spillway was not completed and the channel was not vegetated.

3. Fill operations on the downstream embankment slope were not completed. The slope was not vegetated and gabions for erosion protection were not in place.

D. OVERTOPPING POTENTIAL: The Corps of Engineer guidelines recommend a spillway design flood (SDF) of 100 year frequency to 0.5 times Probable Maximum Flood (PMF) for "small" size, "significant" hazard dams. Based on the size of the reservoir (57 acre-feet) and the distance to the closest damage center (1 mile), the 100 year frequency storm was considered an appropriate spillway design flood.

According to the U.S. Weather Bureau Technical Paper No. 40, the 100 year frequency rainfall amount for the dam site is 5.0 inches/ 24 hour. The report prepared by Ronald E. Kelley Consulting Engineers for the proposed modifications did include flood routing calculations using a rectangular hydrograph having an intensity of 5 inches/1 hour. For this rainfall amount, these calculations indicate a maximum reservoir elevation of 1102.7 feet and a peak inflow rate of 540 cfs using the Rational Method.

In order to evaluate if runoff from the 100 year frequency storm would overtop the existing embankment, an analysis was performed using the "HEC-1 Dam Safety Version" computer program and multiple regression flow frequency equation for the Ohio River Basin supplied

by the Baltimore District Corps of Engineers. A peak inflow rate of 497 cfs was calculated using the regression equation for the 100 year frequency storm. A summary of the dam safety analysis and supporting calculations are included in Appendix D.

5.2 EVALUATION

In order for the peak inflow of the computer developed hydrograph to closely approximate the 497 cfs required, it was necessary to increase the 100 year frequency rainfall by a factor of 2.4. The analysis indicated a maximum reservoir elevation of 1102.1 feet or a level 0.3 feet above the crest of the existing embankment. The spillway system of the existing dam is therefore considered temporarily inadequate.

Modifications in progress call for the embankment crest to be increased to El. 1103.5. Completion of proposed modifications will provide a spillway capacity of about 1600 cfs. The dam will therefore have adequate spillway capacity once the proposed modifications are completed.

SECTION 6
STRUCTURAL STABILITY

6.1 AVAILABLE INFORMATION

a. DESIGN AND CONSTRUCTION DATA:

1. Subsurface Exploration: The available information did not make any reference to a subsurface exploration of the dam site. The core wall is reportedly founded on shale bedrock and embankment soils obtained on site are predominately clay.

2. Laboratory Testing: No reference to laboratory testing was found from available sources.

3. Slope Stability Analysis: No calculations or references were found from available information.

b. OPERATING RECORDS: Operating records are not maintained for Treesdale Farm Dam.

c. POST CONSTRUCTION CHANGES: Modifications to improve embankment stability were in progress at the time of the site reconnaissance. Embankment modifications include the placement of additional fill on the downstream slope and the installation of a drain system to intercept seepage. These modifications are described in Section 2.1 B and 2.2 C.

6.2 EVALUATION

a. DESIGN DOCUMENTS: The available design documentation did not include an evaluation of structural stability.

b. VISUAL OBSERVATIONS: No evidence of instability was noted for the existing structure although structural modifications were in progress at the time of the site reconnaissance. Additional fill was to be placed on the downstream embankment slope and the slope was unvegetated. These conditions aside, the structural condition of the embankment is considered good. However, the potential for an unstable condition exists because of the following:

1. Water in the reservoir drain pipe is under pressure due to the gate valve being located near the downstream toe of the embankment. Leakage from this pipe could result in internal erosion of the downstream slope and possible instability.

2. Until dense vegetation is established on the downstream embankment slope and erosion control provisions are completed, the slope will be subject to erosion and possible instability if the spillways were to be activated.

c. Performance: The original embankment was reportedly never overtopped and has been structurally stable since its construction in 1925. The modifications now in progress are expected to improve the stability of the embankment. Cracks in the core wall have been sealed and an extensive drain system has been installed to intercept seepage. Additional fill placed on the downstream embankment slope should also improve stability by reducing the slope inclination from 2.5:1V to 3.5H:1V.

d. Seismic Stability: The dam is located in a Seismic Zone 1 area (low seismic probability). Based upon this low seismic probability and recommended criteria for the evaluation of seismic stability of dams, the seismic stability of the embankment is presumed to be adequate under these earthquake conditions.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS

7.1 ASSESSMENT

A. EVALUATION: Repairs and modifications to the embankment and appurtenant structures were in progress at the time of the site reconnaissance. Taking into account the unfinished modifications, the dam is considered to be in good condition.

The downstream embankment slope and auxiliary spillway channel were unvegetated and rock gabions and riprap for erosion protection were not in place at the time of the site inspection. Until modifications are complete, the embankment will be subject to erosion if the spillways are activated.

The "small" size and "significant" hazard classification of the dam dictates a Spillway Design Flood of 100 year frequency to 1/2 PMF. The 100 year frequency storm was selected as the Spillway Design Flood. For this design flood, the crest of the existing embankment (El. 1101.8) will be overtopped by 0.3 feet. The spillway system of the existing dam is therefore considered temporarily inadequate. Proposed modifications now in progress will provide adequate spillway capacity once completed.

B. ADEQUACY OF INFORMATION: The construction drawings and reports available for this review were of sufficient detail to adequately conduct a Phase I study.

C. URGENCY: The recommendations presented in Section 7.2 should be implemented as soon as possible.

D. NECESSITY FOR ADDITIONAL STUDY: At the present time, there is no need for additional study.

7.2 RECOMMENDATIONS

A. TEMPORARY MEASURES

1. Complete the repairs and modifications to the dam and develop a dense grass cover on the downstream slope of the embankment and auxiliary spillway.

2. Remove the fill (temporary access road) obstructing the downstream channel.

B. LONG-TERM MEASURES (REQUIRE CONTINUAL ATTENTION)

1. Develop plans to provide positive upstream control of the reservoir drain pipe. Implement plans if pipe leakage becomes evident.

2. Develop a formal flood surveillance and warning plan to advise downstream residents when high flows are expected. The plan should include an evacuation procedure.

3. Inspect the downstream embankment slope for evidence of seepage and piping at least once each month. Implement corrective measures if piping is noted.

4. Develop a more thorough maintenance program to regularly remove future tree growth from the embankment.

APPENDIX A

VISUAL OBSERVATIONS CHECK LIST AND FIELD SKETCH

VISUAL OBSERVATION CHECK LIST

Name Dam Treesdale Farm Dam County Butler State Pennsylvania National ID # 1069

Type of Dam Earth with Concrete Core Wall Hazard Category Significant

Date(s) Inspection Dec. 8, 1980 Weather Cloudy Temperature 55° F

Inspection Review Date Dec. 19, 1980

Pool Elevation at Time of Inspection 1098 ft. *(2 ft. below normal pool - See note #1) Tailwater at Time of Inspection See Note #2 M.S.L.

Inspection Personnel:

James D. Hainley, P.E.	Ackenheil & Associates	Supervising Principal
Timothy E. Debes, P.E.	Ackenheil & Associates	Hydrologist & Project Manager
Paul A. D'Amato, P.E.	Ackenheil & Associates	Geotechnical Engineer
Norman Datt, Vice-President	Treesdale Farms, Inc.	

Recorder Paul A. D'Amato

*Based on spillway crest elevation of 1100 feet obtained from design plans.

Notes

1. Reservoir level was lowered to allow for structural modifications.
2. No spillway discharge. Downstream channel blocked by temporary access road.

AABM Project No. B80074
Penn DER I.D. No. 10-26

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS*
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None. Additional fill being placed as part of structural modification. Not yet seeded.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good. Concrete cap of core wall was replaced during November, 1980. Additional fill being placed on downstream slope as part of structural modification.	
RIPRAP FAILURES	None	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SETTLEMENT	Could not evaluate evidence of any settlement because additional fill was recently placed on downstream slope.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Auxiliary spillway at right abutment was partially excavated. Areas at embankment and abutment junction are not vegetated.	
ANY NOTICEABLE SEEPAGE	No seepage was observed. Wet zone located below downstream toe and to the left of downstream channel. Water also observed in downstream channel (no spillway discharge).	
STAFF GAGE AND RECORDER	Rainwater gauge at farm office.	
DRAINS	No drain system installed in original dam. Drain system to intercept seepage from original downstream slope part of modifications in progress.	

OUTLET WORKS

(Reservoir Drain)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable. Reservoir drain conduit is cast iron with PVC extension downstream from gate valve.	
INTAKE STRUCTURE	N/A	
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	Reservoir drain conduit discharges into downstream channel. Downstream channel modifications are not complete.	
EMERGENCY GATE	N/A	

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Prinicipal spillway has concrete weir. Concrete in excellent condition. Concrete cap of core wall and concrete weir of principal spillway were reconstructed during November, 1980.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Bottom and sidewalls of principal spillway in excellent condition. Original concrete sidewalls were reconstructed during November, 1980. Concrete bottom of spillway was sand blasted and coated with bituminous mastic.	
BRIDGE AND PIERS	None	

AUXILIARY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	Excavated into soil. Still under construction. Will be seeded in Spring of 1981.	
DISCHARGE CHANNEL	Same as Approach Channel.	
BRIDGE AND PIERS	None	

(EMERGENCY SPILLWAY OR RIGHT CORE WALL)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Top of concrete core wall will function as a weir. Concrete is in excellent condition - cap recently replaced.	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	Discharge will occur onto the unvegetated downstream slope of the embankment.	
BRIDGE AND PIERS	Pier adjacent to pump house at emergency spillway section.	

INSTRUMENTATION

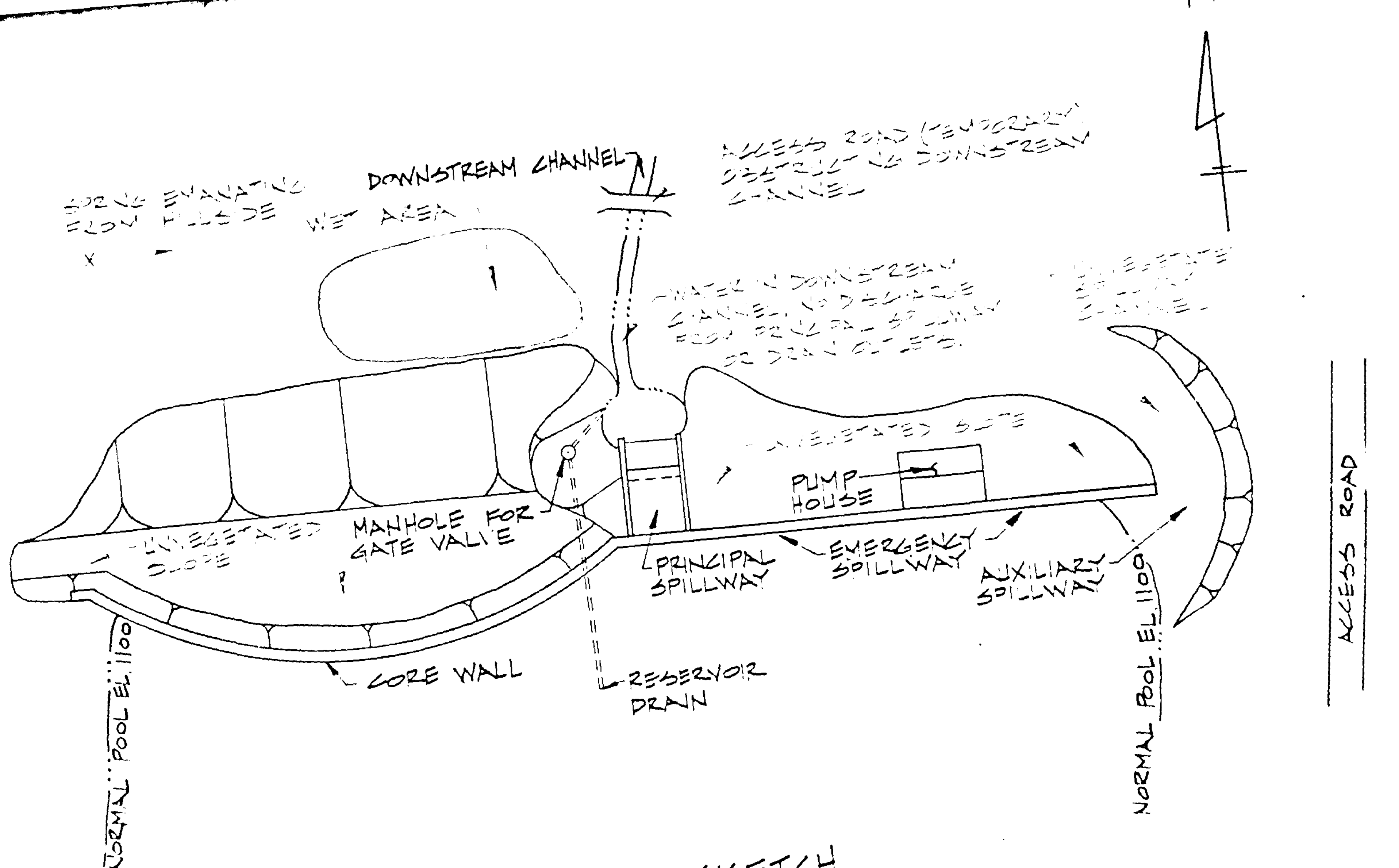
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes are stable and densely covered with trees and brush.	
SEDIMENTATION	Sedimentation not a significant problem. Three small dams are located upstream of the reservoir to collect sediment. Reservoir drained and dredged in 1960.	

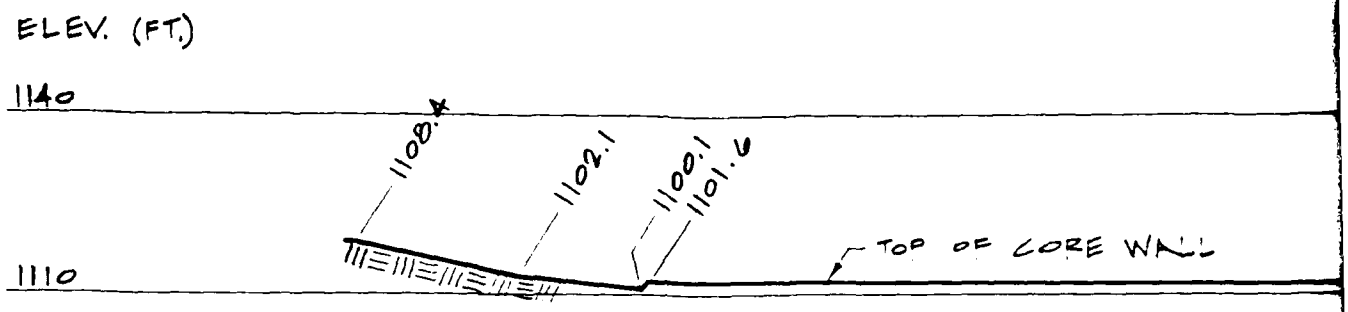
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream channel directly below dam is still under construction. Access road obstructs channel (See Photo No. 6).	
SLOPES	Gentle sloping and lined with trees and brush. Appear stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	There are 4 homes adjacent to and within a 10 feet elevation difference of the stream about 1 mile below the dam at Rt. 228. Further downstream. the stream flows through the town of Mars, where there are about 10 buildings within a 10 feet elevation difference of the stream.	

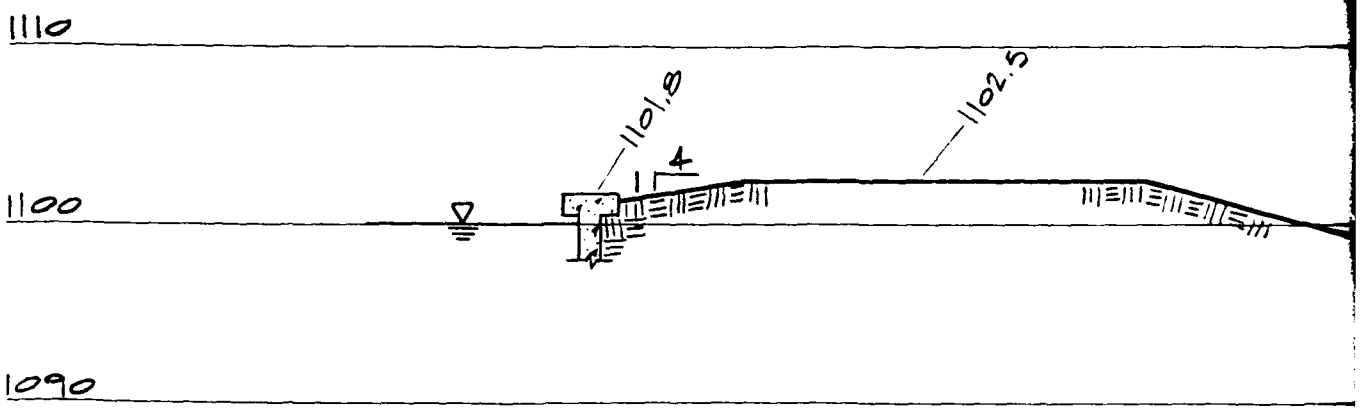


FIELD SKETCH
TREESDALE FARM DAM

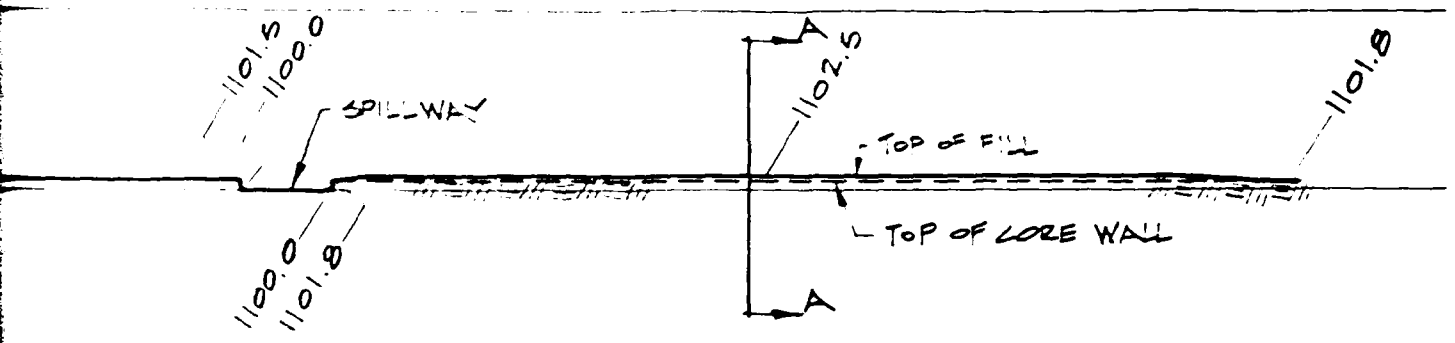
A 11



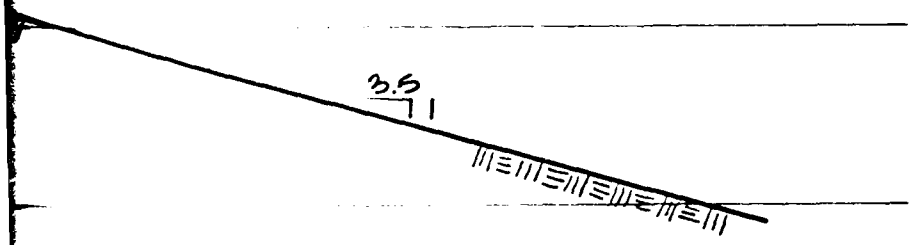
DAM CRE
1" = 30'



SECTION A-A
1" = 10'



CREST PROFILE - LOOKING UPSTREAM



DATE: MARCH 3, 1981	TREESDALE FARM DAM NATIONAL DAM INSPECTION PROGRAM	DAM CREST PROFILE AND SECTION
SCALE: AS SHOWN		
DR: JLM CK: PAD	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.	
DWG. NO. A 12		

APPENDIX B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM Treesdale Farm Dam

ID # NDI PA 1069

ITEM	REMARKS
AS-BUILT DRAWINGS	Only design drawings are available. Design drawings were provided by the Pennsylvania Dept. of Environmental Resources, Dam Safety Division. (See Plates No. 1 to 9)
REGIONAL VICINITY MAP	See Appendix E, U.S.G.S. 7.5 min. quadrangle map showing dam site location.
CONSTRUCTION HISTORY	Construction of the dam began in 1924 and was completed in August, 1925. Structural modifications began during the summer of 1980 and were not completed at the time of the field inspection.
TYPICAL SECTIONS OF DAM	See Plates No. 1, 2, 4, and 8.
OUTLETS - PLAN	See Plate No. 7
DETAILS	See Plates No. 4 and 8
CONSTRAINTS	Temporary access road with 12 inch diameter CMP obstructing downstream channel.
DISCHARGE RATINGS	See discharge rating calculations, Appendix D.
RAINFALL/RESERVOIR RECORDS	Rainfall records maintained by Treesdale Farms.

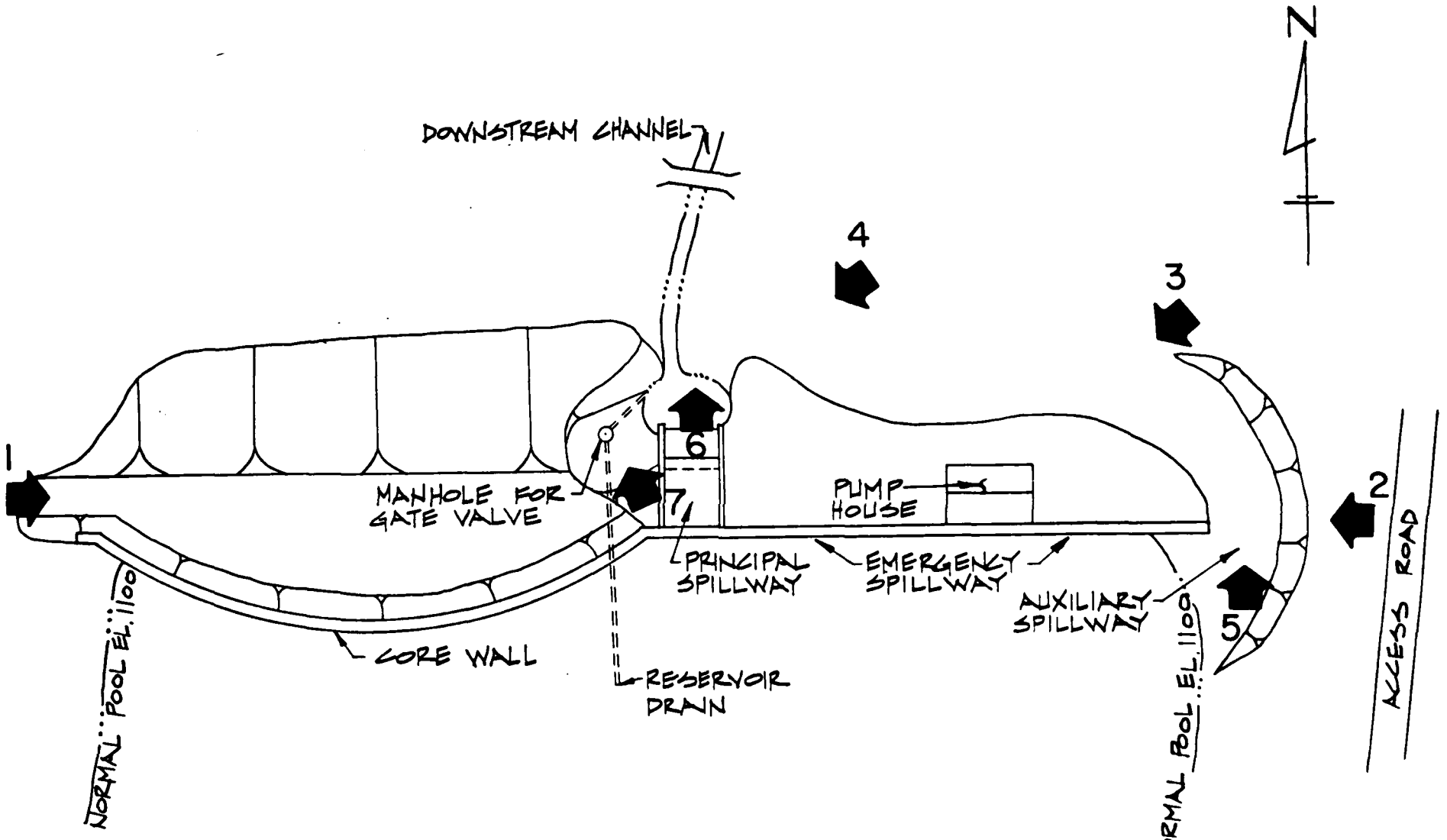
ITEM	REMARKS
DESIGN REPORTS	Report prepared by Ronald E. Kelley Consulting Engineers, Greensburg, Pennsylvania entitled "Reinforcement of Embankment, Concrete Core Wall and Spillway for Earth Dam at Apple Orchards of Treesdale Farms, Inc." and dated March, 1980.
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS	None except flood routing computations as described below.
HYDROLOGY & HYDRAULICS	Flood routing computations included in report prepared by Kelley Consulting Engineers.
DAM STABILITY	None
SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS	None
BORING RECORDS	None
LABORATORY	None
FIELD	None
POST-CONSTRUCTION SURVEYS OF DAM	Surveyed during 1979 by Ronald E. Kelley Consulting Engineers for their study. See Plate No. 6.
BORROW SOURCES	Fill for original embankment obtained on-site; exact location of borrow area unknown. Fill recently placed on downstream embankment slope obtained from hillside near left abutment.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Modifications began during the summer of 1980 and were not completed at time of site inspection (Dec. 8, 1980). Modifications include placing fill on downstream embankment slope, installing drain system, constructing auxiliary and emergency spillway and repairing deteriorated concrete.
HIGH POOL RECORDS	Core wall of embankment (El. 1101.5) reportedly never overtopped.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Report prepared by Ronald E. Kelley Consulting Engineers, (See "Design Reports")
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported
MAINTENANCE OPERATION RECORDS	Inspections performed by State personnel during 1926, 1967, and 1979.

ITEM	REMARKS
SPILLWAY PLAN	See Plate No. 7
SECTIONS	See Plates No. 7 and 8
DETAILS	See Plates No. 7 and 8
OPERATING EQUIPMENT PLANS & DETAILS	Gate valve of reservoir drain only operating feature. (See Plates No. 1, 3, and 7)
SPECIFICATIONS	Specifications for construction of original embankment contained in DER file. Specifications for modifications included in report prepared by Kelley Consulting Engineers (See Plates No. 6 - 9).
MISCELLANEOUS	The elevations shown on Plates No. 6-8 were based on an assumed principal spillway crest elevation of 1105.5. These elevations are 5.5 feet greater than elevations based on mean sea level.

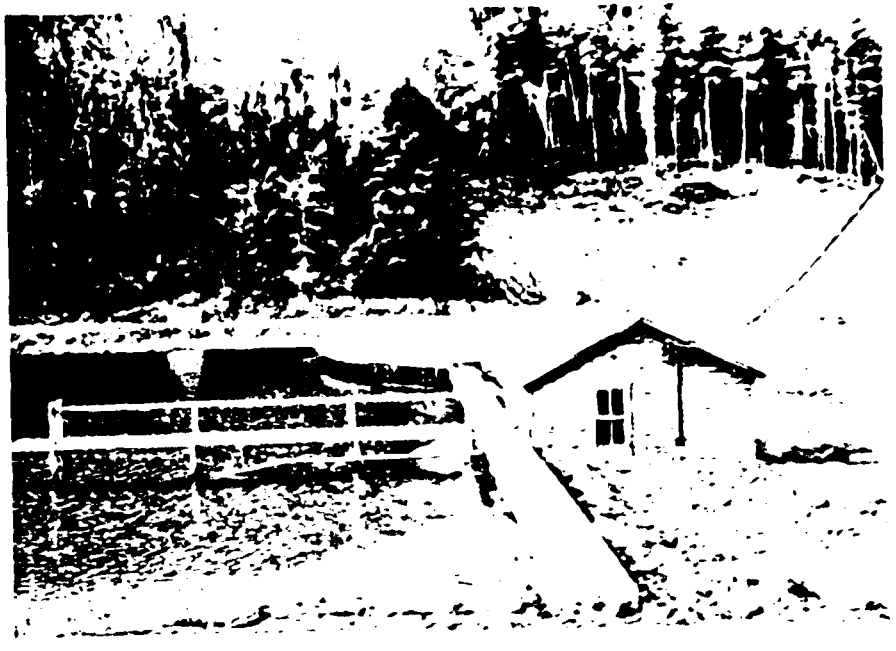
APPENDIX C

PHOTOGRAPHS



PHOTOGRAPH KEY MAP

1



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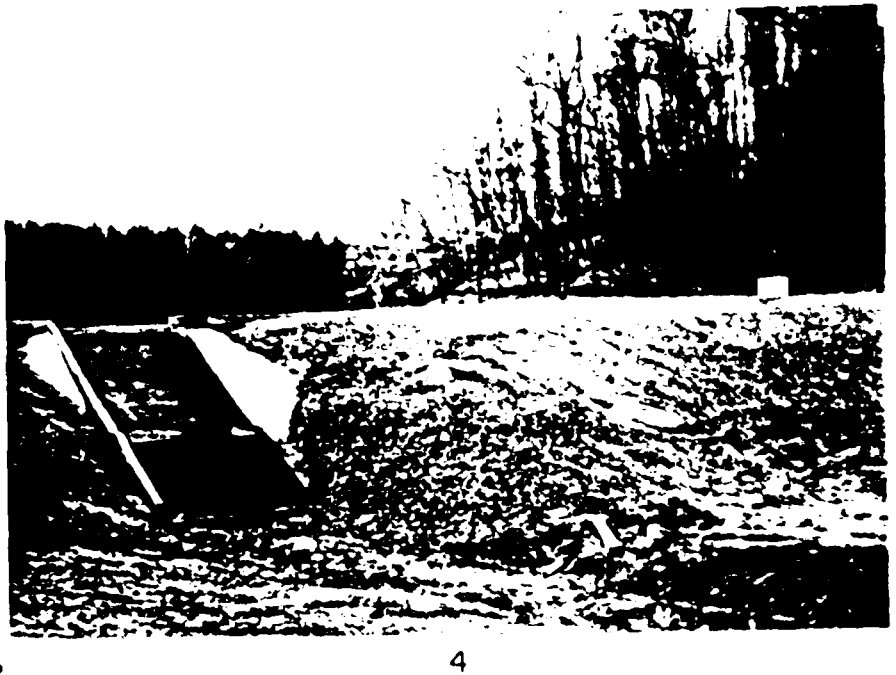

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5

6

7

8

APPENDIX D

HYDROLOGIC AND HYDRAULIC ENGINEERING AND COMPUTER DATA

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology: The dam overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version), July, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodolgoy used in the analysis is presented below.

1. Precipitation: The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

   The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps of Engineers.

2. Inflow Hydrograph: The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

   The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list give these parameters, their definition and how they were obtained for these analyses.

Parameter	Definition	Where Obtained
C_t	Coefficient representing variations of watershed	From Corps of Engineers *
L	Length of main stream channel	From U.S.G.S. 7.5 minute topographic map
L_{ca}	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic map
C	Peaking coefficient	From Corps of Engineers *
A	Watershed size	From U.S.G.S. 7.5 minute topographic map

3. Routing: Reservoir routing is accomplished by using Modified Puls routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation-discharge relationship.

Storage in the pool area is defined by an area-elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topgraphic maps or taken from reasonably accurate design data.

4. Dam Overtopping: Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtoppping.

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* Developed by the Corps of Engineers on a regional basis for Pennsylvania.

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Woodland and apple orchard.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1100.0 feet (45 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1101.8 feet (55 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1101.8 feet (existing), 1103.5 feet (design)

ELEVATION TOP DAM: 1101.8 feet (existing), 1103.5 feet (design)

EMERGENCY SPILLWAY

a. Elevation 1101.5 feet
b. Type Embankment overflow section (top of core wall will serve as weir crest)
c. Width 140 feet (existing), 87 feet (design)
d. Length 3 feet length over core wall
e. Location Embankment section between principal and auxiliary spillways
f. Number and Type of Gates None

OUTLET WORKS

a. Type Principal overflow spillway and auxiliary spillway channel
b. Location Principal spillway-center of embankment, auxiliary spillway-right abutment
c. Entrance Invert 1100.0 feet (principal spillway), 1101.1 feet (auxiliary spillway)
d. Exit Invert 1082 feet (principal spillway), 110.0 feet (auxiliary spillway)
e. Emergency Drawdown Facilities 10 inch diameter reservoir drain pipe with gate valve.

HYDROMETEOROLOGICAL GAGES

a. Type Rain gauge
b. Location Farm office of Treesdale Farms
c. Records Rainfall records

MAXIMUM NON-DAMAGING DISCHARGE 211 cfs. at El. 1101.8

HEC-1-DAM SAFETY VERSION
HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM:	Treesdale Farm Dam
Drainage Area	0.49 sq. mi.
Spillway Design Flood (100 year frequency)	5.0 in./24 hr.
Snyder Unit Hydrograph Parameters	
Zone	27
C_p	0.40
C_t	2.7
L	0.83 miles
L_{ca}	0.30 miles
$t_p = 2.7(L \times L_{ca})^{0.3}$	1.78 hour
Loss Rates	
Initial Loss	0.01 in.
Constant Loss Rate	0.0001 inches/hour
Basic Flow Generation Parameters	
Flow at Start of Storm	1.5 cfs/square mile
Base Flow Cutoff	0.05 Qp
Recession Ratio	2.0
Principal Spillway Data (Proposed modifications incomplete at time of site reconnaissance)	
Crest Length	15.7 feet
Freeboard	
Existing	1.8 feet
Proposed	3.5 feet
Discharge Coefficient	3.5
Exponent	1.5
Discharge Capacity	
Existing	100 cfs
Proposed	490 cfs
Auxiliary Spillway Data (Proposed modifications incomplete at time of site reconnaissance)	
Crest Length	
Existing	14 feet
Propsed	20 feet
Freeboard	
Existing	1.3 feet
Proposed	3.0 feet
Discharge Coefficient	3.0

Exponent	1.5
Discharge Capacity	
Existing	25 cfs
Proposed	66 cfs
Emergency Spillway Data (Proposed modifications incomplete at time of site reconnaissance)	
Crest Length	
Existing	140 feet
Proposed	87 feet
Freeboard	
Existing	0.3 feet
Proposed	2.0 feet
Discharge Coefficient	3.2
Exponent	1.5
Discharge Capacity	
Existing	90 cfs
Proposed	1110 cfs.

Notes:

1. Rainfall amount for 100 year frequency storm obtained from U.S. Weather Bureau TP 40.

2. Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (Cp and C).

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
A1   NON BREACH ANALYSIS OF TREESDALE FARM DAM
A2   SNYDER METHOD,100 YEAR FREQ. 24 HOUR STORM, MOD PULS ROUTING
A3   ADJUST LOSS RATES & RAINFALL TO INCREASE PEAK FLOW TO 497 CFS
B    150       0      20       0       0       0       0       0      -4       0
B1     5       0       0       0       0       0       0       0       0
J      1       9       0       0       0       0       0       0       0
J1   1.0     2.0     2.2     2.4     2.6     2.7     2.8     2.9     3.0
K      0    LAKE       0       0       0       0       1       0       0
K1       COMPUTATION OF INFLOW HYDROGRAPH
M      0       1    0.49       0       0       0       0       0       1
O     72       0
O1 0.002   0.006   0.002   0.002   0.008   0.003   0.002   0.010   0.003   0.006
O1 0.024   0.008   0.002   0.009   0.003   0.002   0.007   0.002   0.014   0.057
O1 0.019   0.017   0.068   0.023   0.022   0.085   0.028   0.055   0.216   0.072
O1 0.020   0.079   0.026   0.016   0.062   0.021   0.062   0.246   0.082   0.075
O1 0.295   0.098   0.094   0.369   0.123   0.237   0.934   0.311   0.087   0.344
O1 0.115   0.069   0.270   0.090   0.002   0.006   0.002   0.002   0.008   0.003
O1 0.002   0.010   0.003   0.006   0.024   0.008   0.002   0.009   0.003   0.002
O1 0.007   0.002
T      0       0       0       0       0       0       0       0       0
W   1.78    0.40       0       0       0       0       0       0       0
X   -1.5   -0.05     2.0       0       0       0       0       0       0
K      1     DAM       0       0       0       0       1       0       0
K1   MOD PULS ROUTING OF FLOW THRU TREESDALE FARM DAM
Y      0       0       0       1       1       0       0       0       0
Y1     1       0       0       0       0       0      45      -1       0
Y41100.0  1100.5  1101.0  1101.5  1101.8
Y5     0      19      60     122     211
$S     0     8.0      45      55      57      62      70     279       0
$E1082.0  1090.0  1100.0  1101.5  1101.8  1102.5  1103.5  1120.0       0
$$1100.0
$D1101.8     3.3     1.5     340
K     99
A
A
A
A
A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT LAKE
ROUTE HYDROGRAPH TO DAM
END OF NETWORK

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE: 18 MAR 81
RUN  TIME: 15. 1.59

NON BREACH ANALYSIS OF TREESDALE FARM DAM
SNYDER METHOD,100 YEAR FREQ. 24 HOUR STORM, MOD PULS ROUTING
ADJUST LOSS RATES & RAINFALL TO INCREASE PEAK FLOW TO 497 CFS

                                JOB SPECIFICATION
NQ      NHR     NMIN    IDAY     IHR     IMIN    METRC    IPLT    IPRT   NSTAN
150       0       20       0       0        0        0       0      -4       0
                       JOPER     NWT   LROPT   TRACE
                           5       0       0       0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                         NPLAN= 1 NRTIO= 9 LRTIO= 0
   RTIOS=   1.00   2.00   2.20   2.40   2.60   2.70   2.80   2.90   3.00

**********          **********          **********          **********

                          SUB-AREA RUNOFF COMPUTATION

          COMPUTATION OF INFLOW HYDROGRAPH

ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
LAKE        0       0       0       0       0       1       0       0

                              HYDROGRAPH DATA
IHYDG     IUHG    TAREA     SNAP    TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
    0        1     0.49      0.0     0.49     0.0     0.0       0       1       0

                                LOSS DATA
LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
    0     0.0     0.0    1.00     0.0     0.0    1.00     0.0     0.0     0.0     0.0

                          UNIT HYDROGRAPH DATA
                     TP=  1.78    CP=0.40    NTA=  0

                              RECESSION DATA
                STRTQ=   -1.50    QRCSN=   -0.05    RTIOR= 2.00


UNIT HYDROGRAPH 56 END-OF-PERIOD ORDINATES, LAG=   1.77 HOURS, CP= 0.40  VOL= 1.00
 5.     18.     37.     55.     68.     71.     66.     60.     54.     49.
44.     40.     36.     33.     30.     27.     24.     22.     20.     18.
16.     15.     13.     12.     11.     10.      9.      8.      7.      7.
 6.      5.      5.      4.      4.      4.      3.      3.      3.      2.
 2.      2.      2.      2.      1.      1.      1.      1.      1.      1.
 1.      1.      1.      1.      1.      0.
```

END-OF-PERIOD FLOW

MO.DA HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
	SUM	5.00	5.00	0.0	4791.						
		(127.)	(127.)	(0.)	(135.67)						

TOTAL RAIN 5.00, TOTAL RAINFALL EXCESS 5.00, TOTAL FLOW 4791.
TOTAL RAIN 10.01, TOTAL RAINFALL EXCESS 10.01, TOTAL FLOW 9568.
TOTAL RAIN 11.01, TOTAL RAINFALL EXCESS 11.01, TOTAL FLOW 10530.
TOTAL RAIN 12.01, TOTAL RAINFALL EXCESS 12.01, TOTAL FLOW 11482.
TOTAL RAIN 13.01, TOTAL RAINFALL EXCESS 13.01, TOTAL FLOW 12444.
TOTAL RAIN 13.51, TOTAL RAINFALL EXCESS 13.51, TOTAL FLOW 12925.
TOTAL RAIN 14.01, TOTAL RAINFALL EXCESS 14.01, TOTAL FLOW 13396.
TOTAL RAIN 14.51, TOTAL RAINFALL EXCESS 14.51, TOTAL FLOW 13873.
TOTAL RAIN 15.01, TOTAL RAINFALL EXCESS 15.01, TOTAL FLOW 14356.

********** ********** ********** **********

HYDROGRAPH ROUTING

MOD PULS ROUTING OF FLOW THRU TREESDALE FARM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.0	0.0	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	45.	-1

STAGE	1100.00	1100.50	1101.00	1101.50	1101.80
FLOW	0.0	19.00	60.00	122.00	211.00

CAPACITY=	0.	8.	45.	55.	57.	62.	70.	279.
ELEVATION=	1082.	1090.	1100.	1102.	1102.	1103.	1104.	1120.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1101.8	3.3	1.5	340.

PEAK OUTFLOW IS 194. AT TIME 18.00 HOURS
PEAK OUTFLOW IS 393. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 433. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 472. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 512. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 531. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 551. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 571. AT TIME 17.67 HOURS
PEAK OUTFLOW IS 590. AT TIME 17.67 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5
				1.00	2.00	2.20	2.40	2.60

OPERATION	STATION	AREA	RATIOS APPLIED TO PRECIPITATION RATIO 6	RATIO 7	RATIO 8	RATIO 9
			2.70	2.80	2.90	3.00

HYDROGRAPH AT LAKE	0.49	1	96.	393.	432.	471.	510.	530.	550.	569.	589.
			(1.27)	(5.56)	(11.12)	(12.23)	(13.34)	(14.45)	(15.01)	(15.57)	(16.12)	(16.68)
ROUTED TO DAM	0.49	1	194.	393.	433.	472.	512.	531.	551.	571.	590.
			(1.27)	(5.50)	(11.14)	(12.25)	(13.37)	(14.49)	(15.04)	(15.60)	(16.16)	(16.72)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1100.00	1100.00	1101.80
STORAGE	45.	45.	57.
OUTFLOW	0.	0.	211.

RATIO OF SDF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1101.74	0.0	57.	194.	0.0	18.00	0.0
2.00	1102.02	0.22	59.	393.	5.00	17.67	0.0
2.20	1102.06	0.26	59.	433.	5.67	17.67	0.0
2.40	1102.09	0.29	59.	472.	6.33	17.67	0.0
2.60	1102.12	0.32	59.	512.	6.67	17.67	0.0
2.70	1102.14	0.34	59.	531.	7.33	17.67	0.0
2.80	1102.15	0.35	60.	551.	7.33	17.67	0.0
2.90	1102.17	0.37	60.	571.	7.33	17.67	0.0
3.00	1102.18	0.38	60.	590.	8.00	17.67	0.0

BY PAD
DATE 1/26/81
CHECKED MLM
DATE 1/29/81

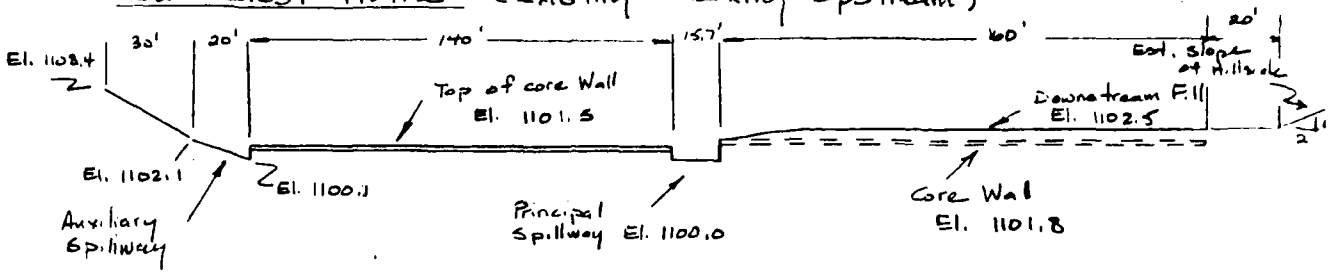
ACKENHEIL & ASSOCIATES
CONSULTING ENGINEERS
BALTIMORE MARYLAND

PROJECT NO 80074

SUBJECT Compute Rating Curve for Spillways
Treesdale Farm Dam

SHEET NO D-10 OF

Dam Crest Profile (Existing - looking Upstream)



1. Find discharge of Principal Spillway to El. 1101.5

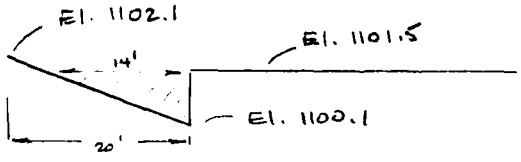
$Q = CLH^{1.5}$ $L = 15.7'$

sharp-crested weir $C = 3.22 + .44\ H/P$

Let $P = 5$ ft.

Reservoir Elev.	H	C	Q (cfs)
1100.0	0	—	0
1100.5	.5	3.26	18
1101.0	1.0	3.31	52
1101.5	1.5	3.35	97

2. Find discharge of Auxiliary Spillway to El. 1101.5



$Q = CLH^{3/2}$

let $C = 3.0$
use Avg H.

Reservoir Elevation	H	Avg. H	L	Q cfs.
1100.0	0	—	—	0
1100.5	.4	.2	4	1
1101.0	.9	.45	9	8
1101.5	1.4	.7	14	25

Combined for Both Spillways.

El. 1100.0 $Q = 0$
1100.5 $= 19$ cfs
1101.0 $= 60$ cfs
1101.5 $= 122$ cfs

PAD
1/26/81
MLM
1/29/81

PROJECT NO 80074

Compute Rating Curve for Spillways
Treesdale Farm dam.

SHEET NO D-11 OF ____

3. Find discharge over right core wall

For L → use length of wall + spillways
L = 140 + 15.7 + 14 ≈ 170 ft.
H = El. 1101.8 - 1101.5 = 0.3 ft.

Consider core wall to act as sharp crested weir

Let C = 3.22 + .44 H/P H = .3' P = 5'
C = 3.2

@El. 1101.8 $Q = (3.2 \times 170 \times 0.3^{1.5}) + 122 = 89 + 122 = 211$ cfs

4 Find discharge if entire dam is overtopped

Assume that fill downstream of curved core wall section will be eroded and that top of core wall for this section will act as sharp crested weir.

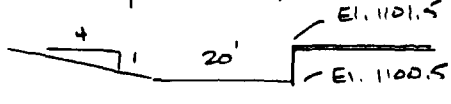
$Q = CLH^{3/2} + 211$ cfs. $C = 3.22 + .44\ H/P$
use P = 5'

Reservoir El.	H	L	C	Q (cfs)
1101.8	—	—	—	211
1102.0	0.2	365'	3.2	315
1102.5	0.7	↓	3.3	916
1103.0	1.2		3.3	1794
1103.5	1.7		3.4	2962
1104.0	2.2		3.4	4260

6 Find Discharge of Principal + Emergency spillway @ El. 1101.5 if Auxiliary spillway is completed according to Plan.

Discharge of Principal Spillway @ El. 1101.5 = 97 cfs.

Auxiliary Spillway



$Q = CLH^{3/2}$
let C = 3.0
let L = avg length = 22 ft.
let H = 1.0 ft.
$Q = 3.0 \times 22 \times 1.0^{3/2} = 66$ cfs.
Total = 97 + 66 = 163 cfs.

PAD
1/26/81

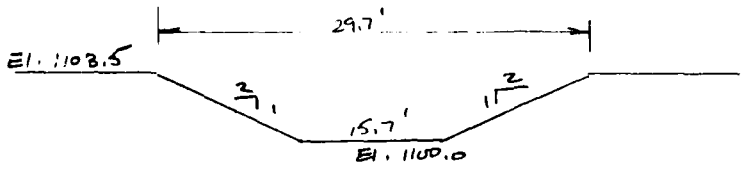
PROJECT NO 80074

Compute Rating Curve for Spillways
Treesdale Farm Dam.

SHEET NO. D-12 OF

Compute spillway discharge at crest of planned Embankment, El. 1103.5.

Principal Spillway Cross-Section



$Q = CLH^{3/2}$ $H = 3.5$ ft.

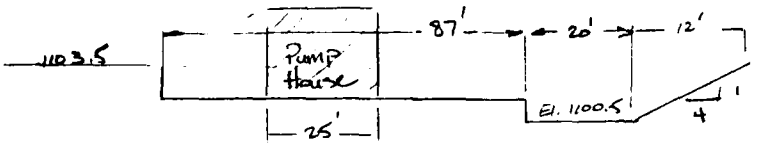
Use $C = 3.3$

Avg. $L = (15.7 + 29.7)/2 = 22.7'$ $Q = 3.3 \times 22.7 \times 3.5^{3/2} = 490$ cfs

Auxiliary Spillway

At El. 1101.5 $Q = 66$ cfs.

Emergency Spillway (Include Auxiliary Spillway above El. 1101.5.)



Not to scale

$Q = CLH^{3/2}$ Use $C = 3.3$

$L = 87 + 20 + 12/2 - 25 = 88'$ Use $L = 119$ ft.

$H = 2.0$ ft.

$Q = 3.3 \times 119 \times 2^{3/2} = 1110$ cfs

Total $Q = 490 + 66 + 1110 = 1666$ cfs

PAD
1/13/81
TED
FEB 19, 1981

PROJECT NO 80074

Treasdale Farm Dam.
Reservoir Storage Volume vs. Elevation SHEET NO D-13 OF ___

1. Reservoir surface area for different elevations were planimetered from Plate # 5. showing topography of reservoir area and dated March 30, 1925. Also used USGS topo map for area at El. 1120.
Storage volume was calculated by average end area method.

2. Area.

Plate #5 scale: 1 in. = 97.7 ft. (of reduction)

El. 1082.	Area = $0.50 in^2 \times 97.7^2 \div 43560$	=	0.11 acres
1082.5	Area = $2.35 in^2$	=	0.51
1090	Area = $7.2 in^2$	=	1.58
1095	Area = $17.0 in^2$	=	3.72
1100	Area = $27.1 in^2$	=	5.94

El. 1120 obtained from USGS Topo. scale: 1" = 2000'

1120 Area = $0.19 in^2 \times 2000^2 \div 43560$ = 17.45 acres

Top of emergency spillway El. = 1101.5 Area = $(17.45-5.94) \times \frac{1.5}{20} + 5.94 =$ 6.80
Top of core wall El. = 1101.8 Area = $(17.45-5.94) \times \frac{1.8}{20} + 5.94 =$ 6.97
Future top of dam = 1103.5 Area = $(17.45-5.94) \times \frac{3.5}{20} + 5.94 =$ 7.95

3. Storage Volume.

El. 1082 – 1082.5	Vol. = $(.11 + .51)/2 \times .5$	= .16 AF
1082.5 – 1090	Vol. = $(.51 + 1.58)/2 \times 7.5$	= 7.84
1090 – 1095	Vol. = $(1.58 + 3.72)/2 \times 5$	= 13.25
1095 – 1100	Vol. = $(3.72 + 5.94)/2 \times 5$	= 24.15
1100 – 1101.5	Vol. = $(5.94 + 6.80)/2 \times 1.5$	= 9.56
1101.5 – 1101.8	Vol. = $(6.80 + 6.97)/2 \times 0.3$	= 2.07
1101.8 – 1103.5	Vol. = $(6.97 + 7.95)/2 \times 1.7$	= 12.68

4. Σ Volume.

El. 1082	Vol. = 0
1082.5	.16 AF
1090	8.00 AF
1095	21.25 AF
1100	45.40 AF
1101.5	54.96 AF
1101.8	57.03 AF
1103.5	69.71 AF

Treesdale Farm Dam - Hydrology

D-14

Calculate Peak Inflow for 100 year Storm

Ohio River Basin, Regression equation for peak flow
(obtained from Baltimore Dist. Corps of Engineers)

$$Q_{100} = 120.38 \left(D.A. \times S^{1/2} \right)^{0.744089}$$

where

D.A = drainage area = 0.49 mi^2

S = slope of longest watercourse in ft./mi.

$$S = \frac{1260 - 1100}{4500/5280} = \frac{160 \text{ ft.}}{.852 \text{ mi.}} = 188 \text{ ft./mi.}$$

$$Q_{100} = 120.38 \left(.49 \times 188^{1/2} \right)^{0.744} = 497 \text{ cfs.}$$

BY PAD
DATE 3/18/81
CHECKED
DATE

ACKENHEIL & ASSOCIATES
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

JOB NO 80074

SUBJECT Treesdale Farm Dam Hydrology

SHEET NO D-15

Rainfall distribution for 100 year frequency - 24 hour storm.

TP-40 Rainfall

6 hr. - 3.9 in.
12 hr. - 4.8 in.
24 hr. - 5.0 in.

Divide into 4 - 6 hr. intervals
use 18 hr. rainfall of 4.9 in.

Obtain Rainfall Amounts for 20 min. time intervals.

Duration	Rainfall	% of 24 hr.	Inc. Rainfall	Rank	
6	3.9	78 %	3.9	1	
12	4.8	96 %	0.9	2	Use 4,2,1,3
18	4.9	98 %	0.1	3	Rank
24	5.0	100 %	0.1	4	

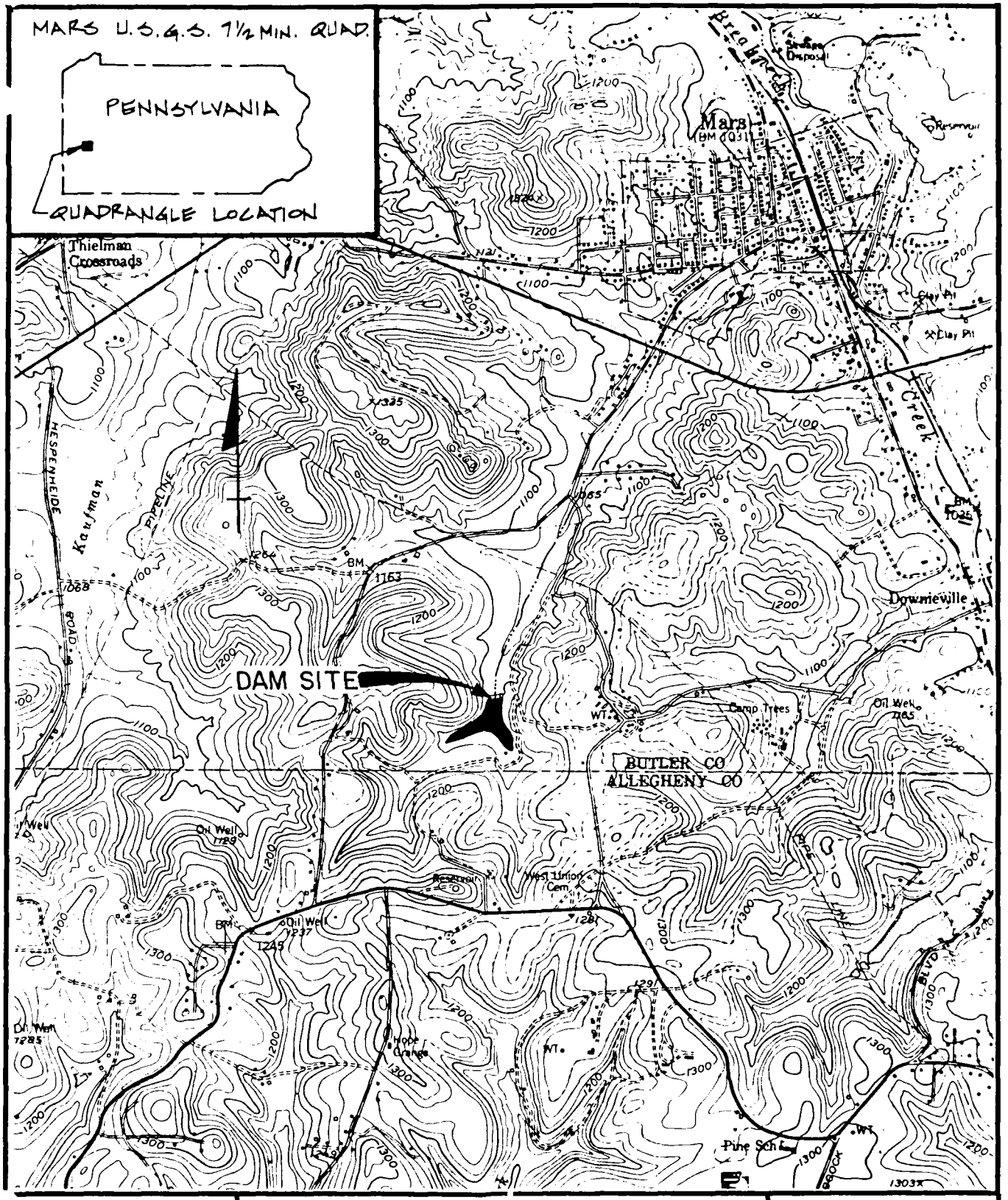
* See NOAA Hydro 35 distribution for 20 min. time Intervals (16, 63, 21)

Time	Inc. Rainfall	EM 1110-2-1411 Distribution	Rainfall / Inc.	20 mn int. Rainfall / Inc. 20	40	60
1	0.1	10%	0.010	.0016	.0063	.0021
2		12	0.012	.0019	.0076	.0025
3		15	0.015	.0024	.0095	.0032
4		38	0.038	.0061	.0239	.0080
5		14	0.014	.0022	.0088	.0029
6		11	0.011	.0018	.0069	.0023
7	0.9	10	0.090	.0144	.0567	.0189
8		12	0.108	.0173	.0680	.0227
9		15	0.135	.0216	.0851	.0284
10		38	0.342	.0547	.2155	.0718
11		14	0.126	.0202	.0794	.0265
12		11	0.099	.0158	.0624	.0208
13	3.9	10	0.390	.0624	.2457	.0819
14		12	0.468	.0749	.2948	.0983
15		15	0.585	.0936	.3686	.1229
16		38	1.482	.2371	.9337	.3112
17		14	0.546	.0874	.3440	.1147
18		11	0.429	.0686	.2703	.0901
19	0.1	10	0.010	.0016	.0063	.0021
20		12	0.012	.0019	.0076	.0025
21		15	0.015	.0024	.0095	.0032
22		38	0.038	.0061	.0239	.0080
23		14	0.014	.0022	.0088	.0029
24		11	0.011	.0018	.0069	.0023

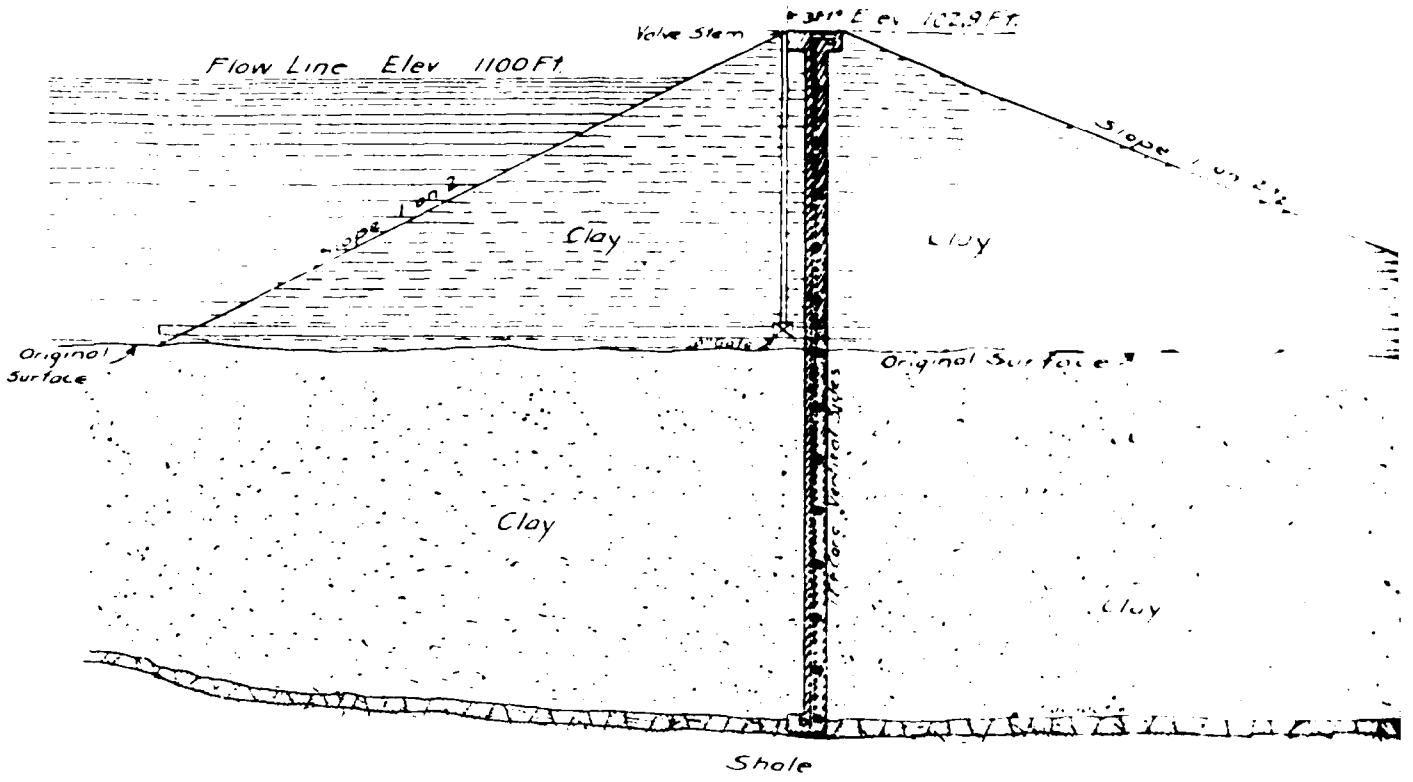
APPENDIX E

LOCATION PLAN AND PLATES

LIST OF PLATES



DATE: MARCH 3, 1981	TREESDALE FARM DAM NATIONAL DAM INSPECTION PROGRAM	LOCATION PLAN
SCALE: 1" = 2000'		
DR: JLM CK: PAD	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.	
DWG. NO. E 1		



CROSS SECTION
A B
SHOWING

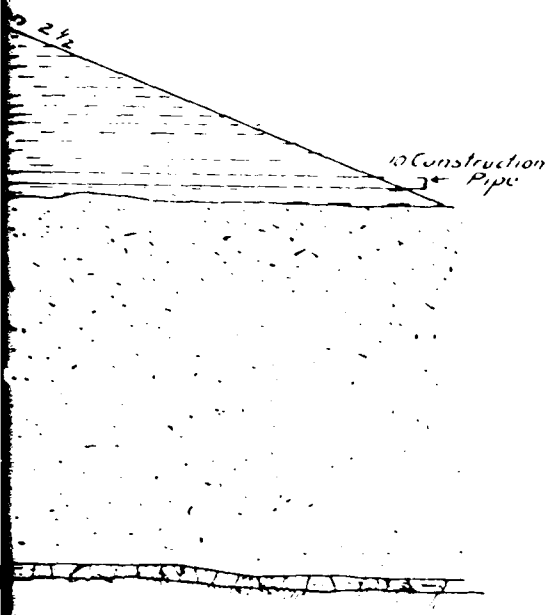
PROPOSED

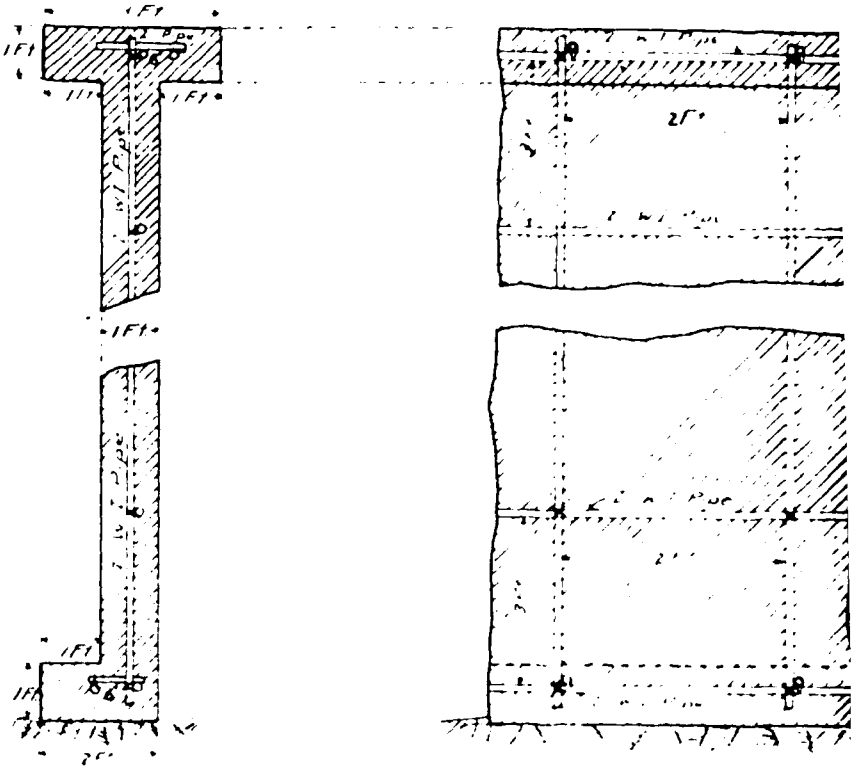
TREESDALE FARM DAM

J. C. TREES, ESQ.

SCALE 1" = 10'

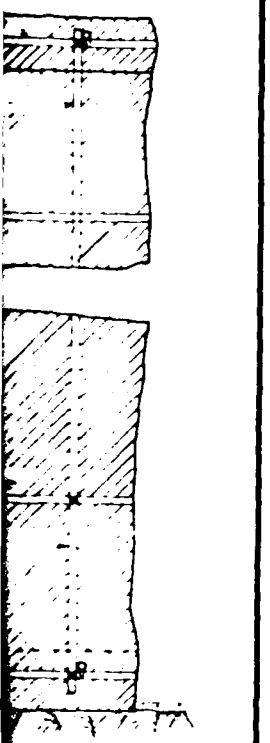
MARCH 30 1925.



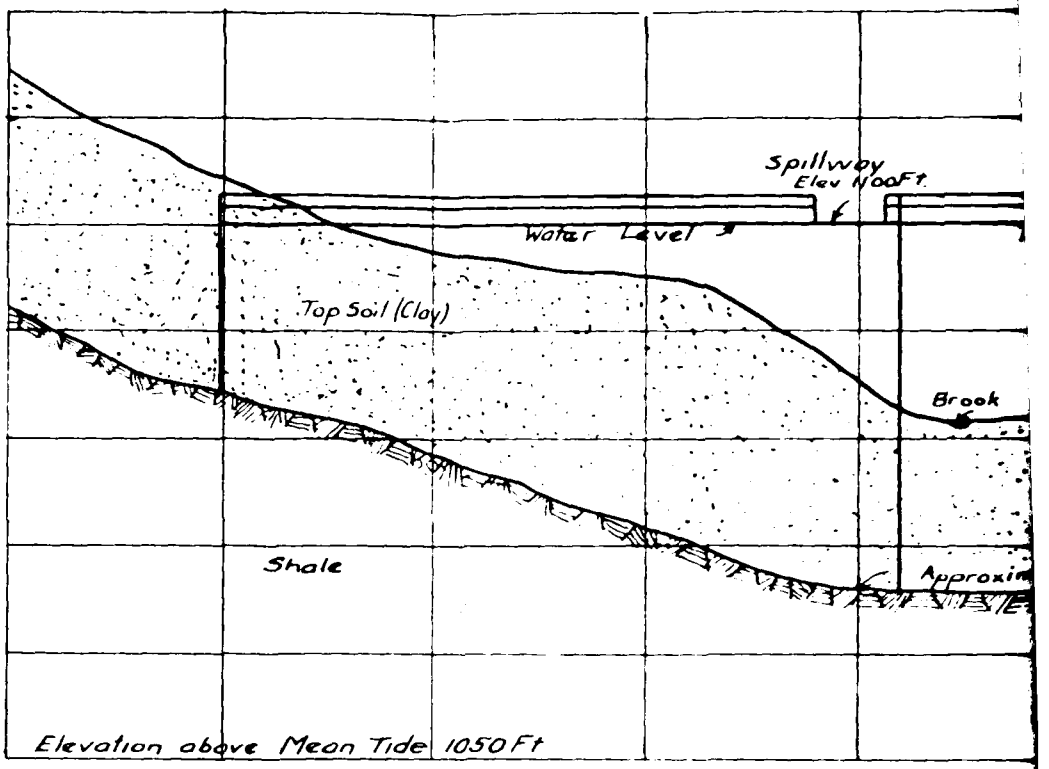


CROSS SECTIONS
SHOWING
REINFORCEMENT
SCALE 1"=3Ft.

PLATE



LATE NO. I



LONGITUDINAL

PROPOSE

TREESDALE FA

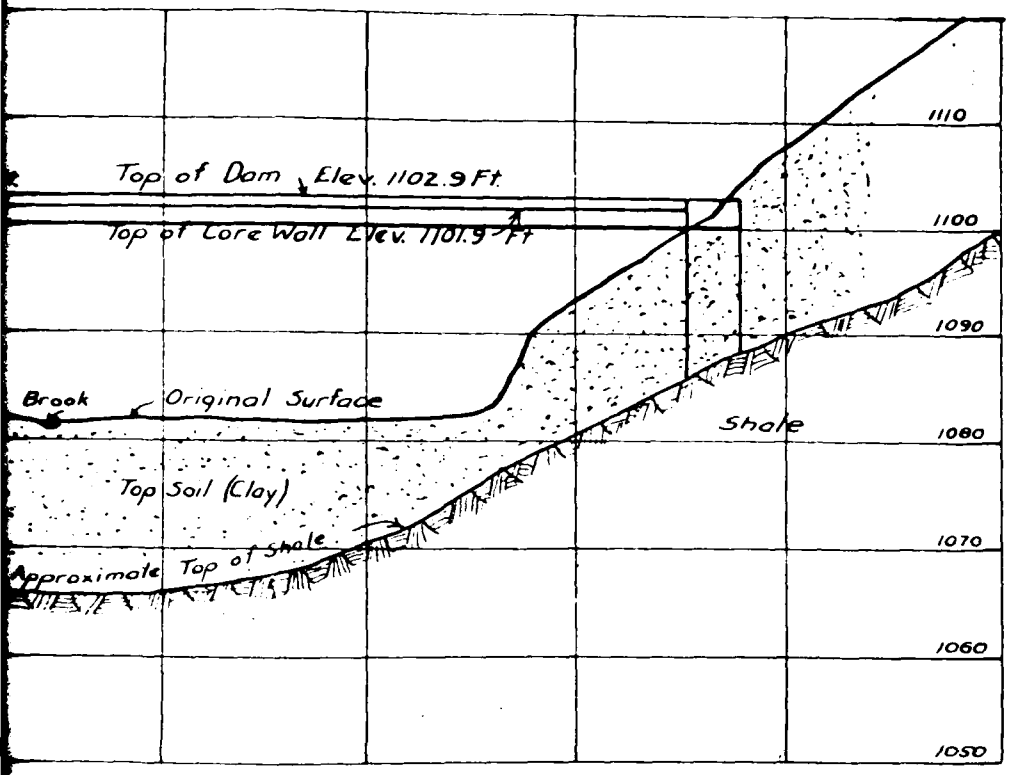
J.C. TREES,

SCALE

HORIZONTAL

VERTICAL

MARCH 30, 1



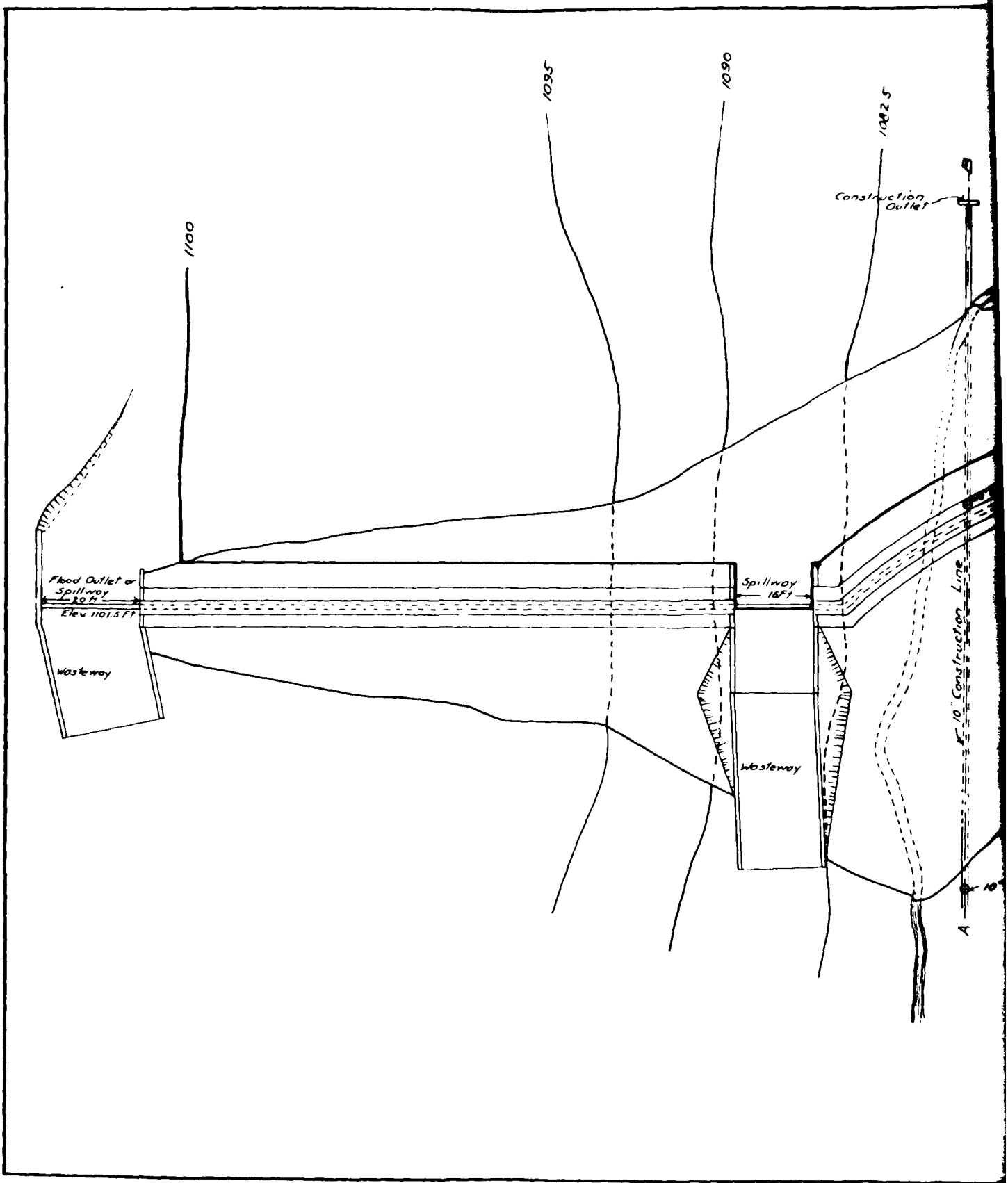
NAL SECTION
OPOSED

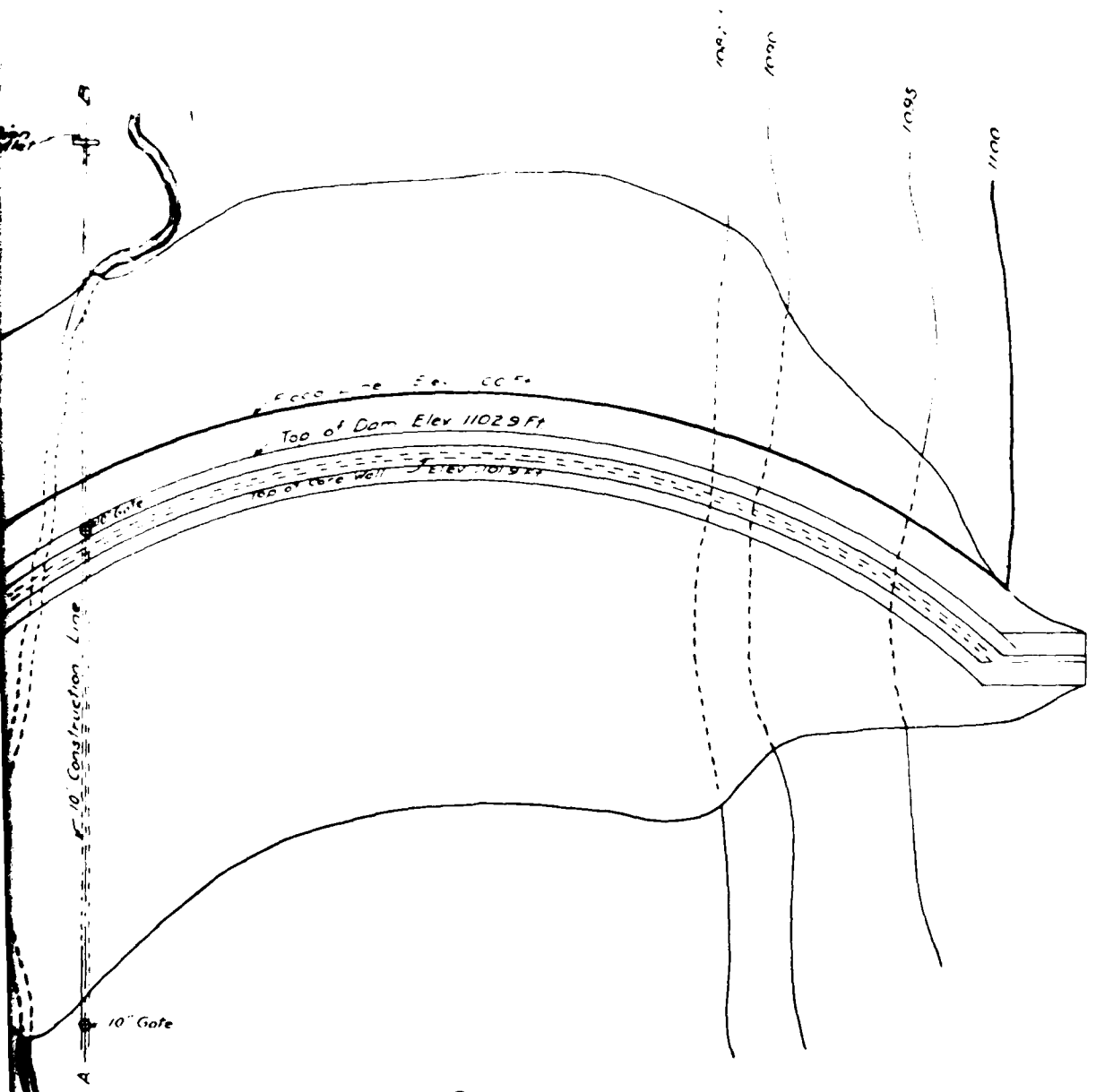
E FARM DAM

EES, ESQ.

CALE
TAL 1" = 50 Ft.
L 1" = 20 Ft.
H 30, 1925

PLATE NO. 2


1100
1095
1090
1082.5
Construction Outlet
Flood Outlet or Spillway
Elev 1101.5 Ft
Wasteway
Spillway
16Ft
Wasteway
10" Construction Line
A
B



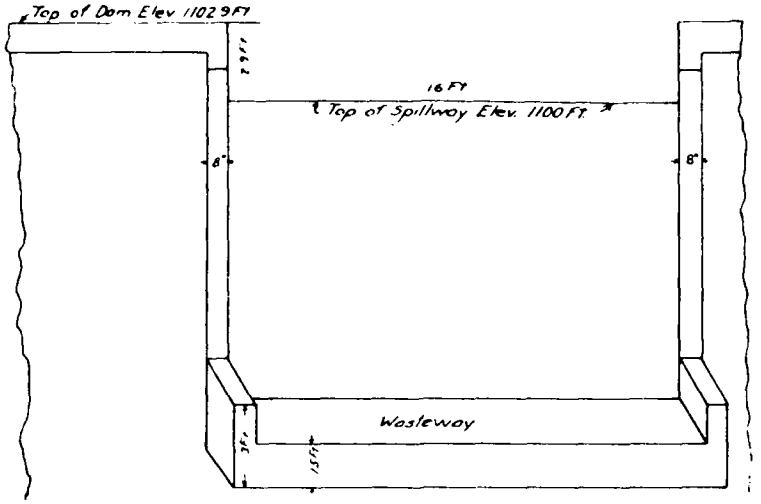
GENERAL PLAN

TREESDALE FARM RESERVOIR

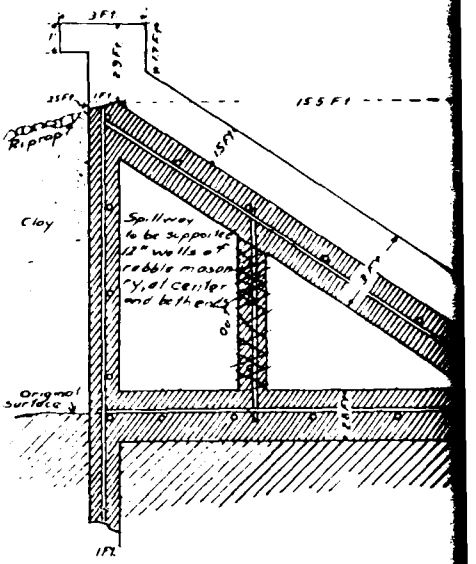
J.C. TREES, ESQ.

SCALE 1" = 20' MARCH 30, 1925

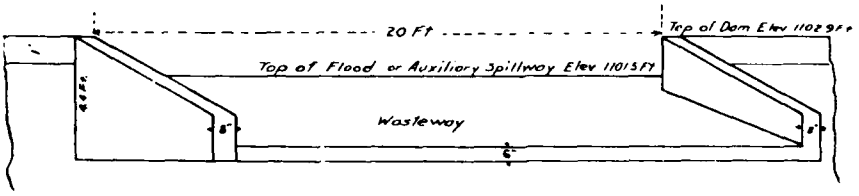
PLATE NO. 3



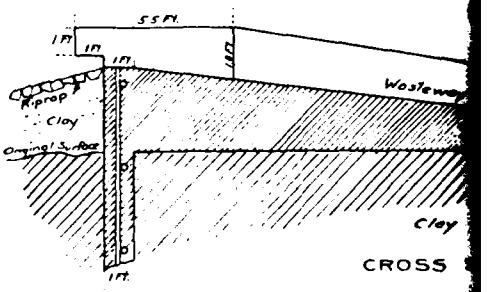
ELEVATION



MAIN SPILLWAY



ELEVATION



CROSS

AUXILIARY SPILLWAY

DETAIL

MAIN & AUXIL

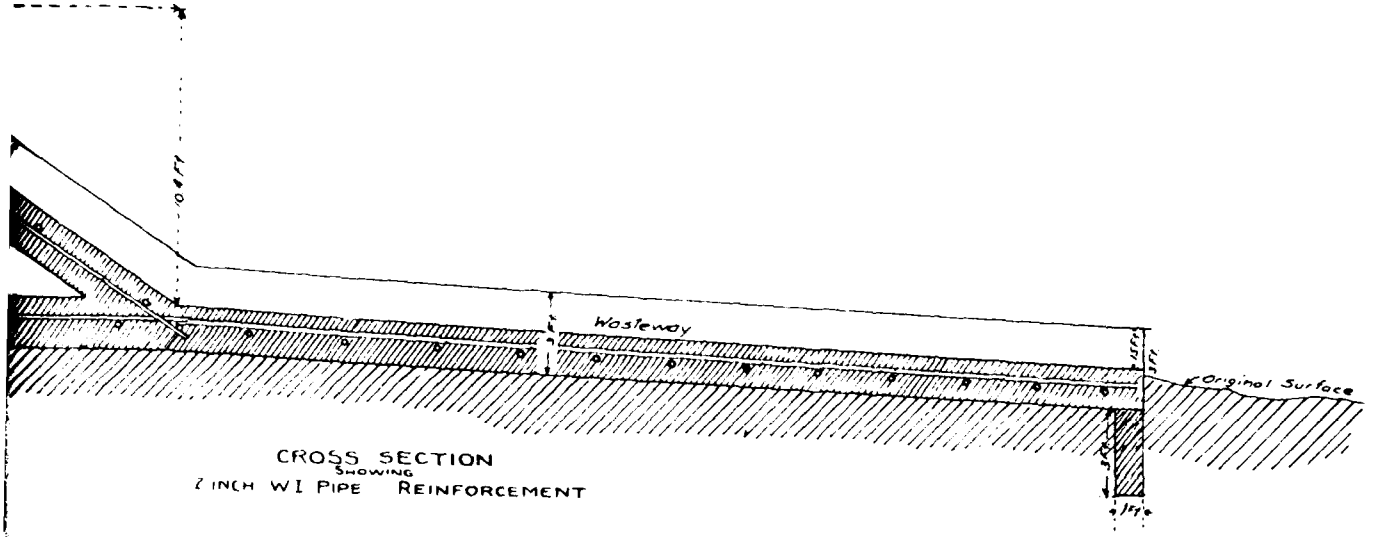
SHO

ELEVATION,- SECTIO

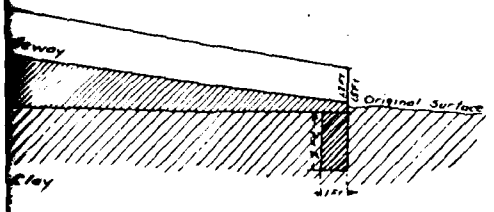
TREESDALE

J.C. TRE

SCALE 1 INCH = 5



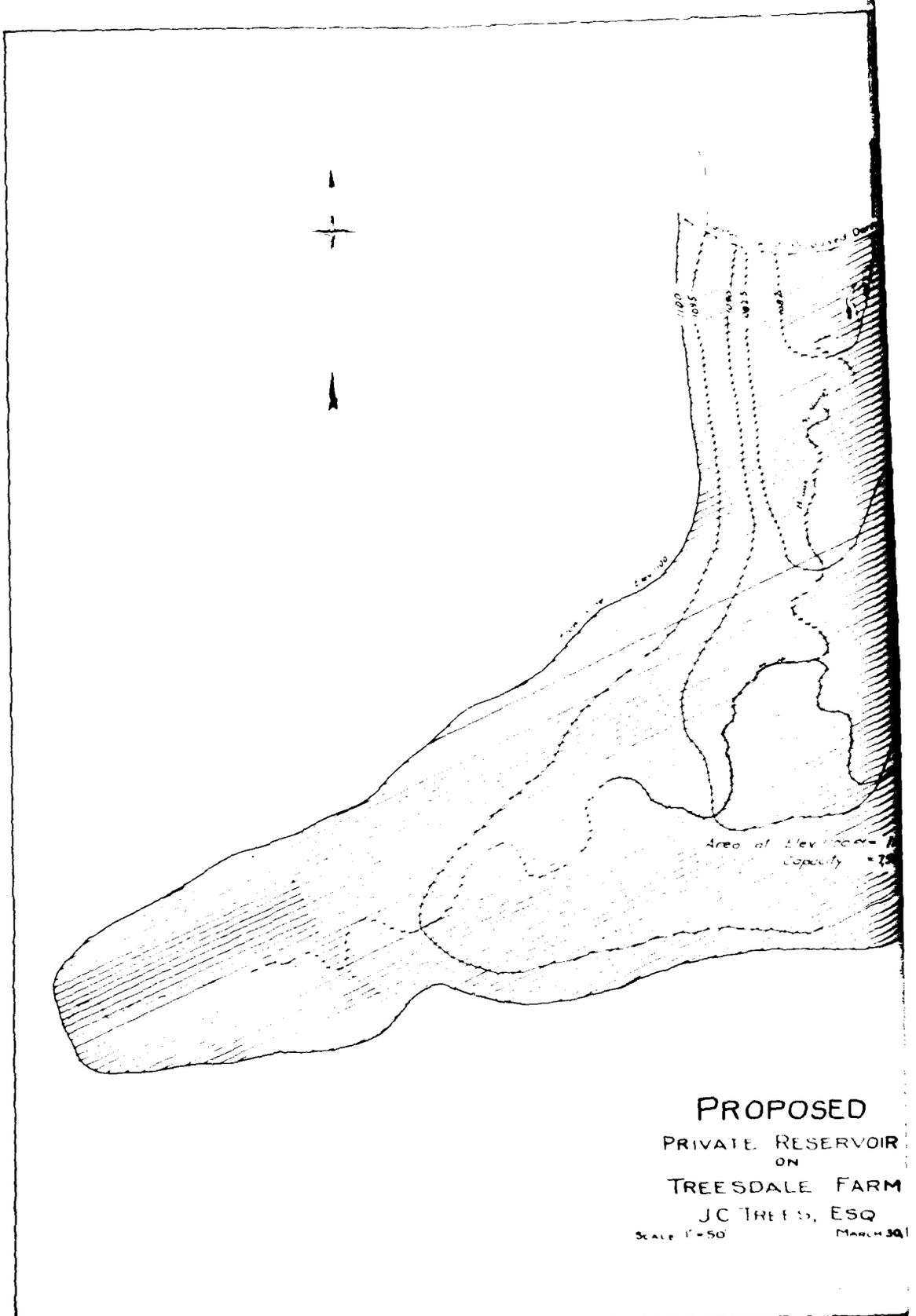
CROSS SECTION
SHOWING
2 INCH WI PIPE REINFORCEMENT



SS SECTION

AIL PLANS
OF
ILIARY SPILLWAY
SHOWING
TION & REINFORCEMENT
LE FARM DAM
REES, ESQ.
5 FT. MARCH 30 1925.

PLATE NO. 4



PROPOSED

PRIVATE RESERVOIR
ON
TREESDALE FARM
J C TREES, ESQ

SCALE 1"=50' MARCH 19

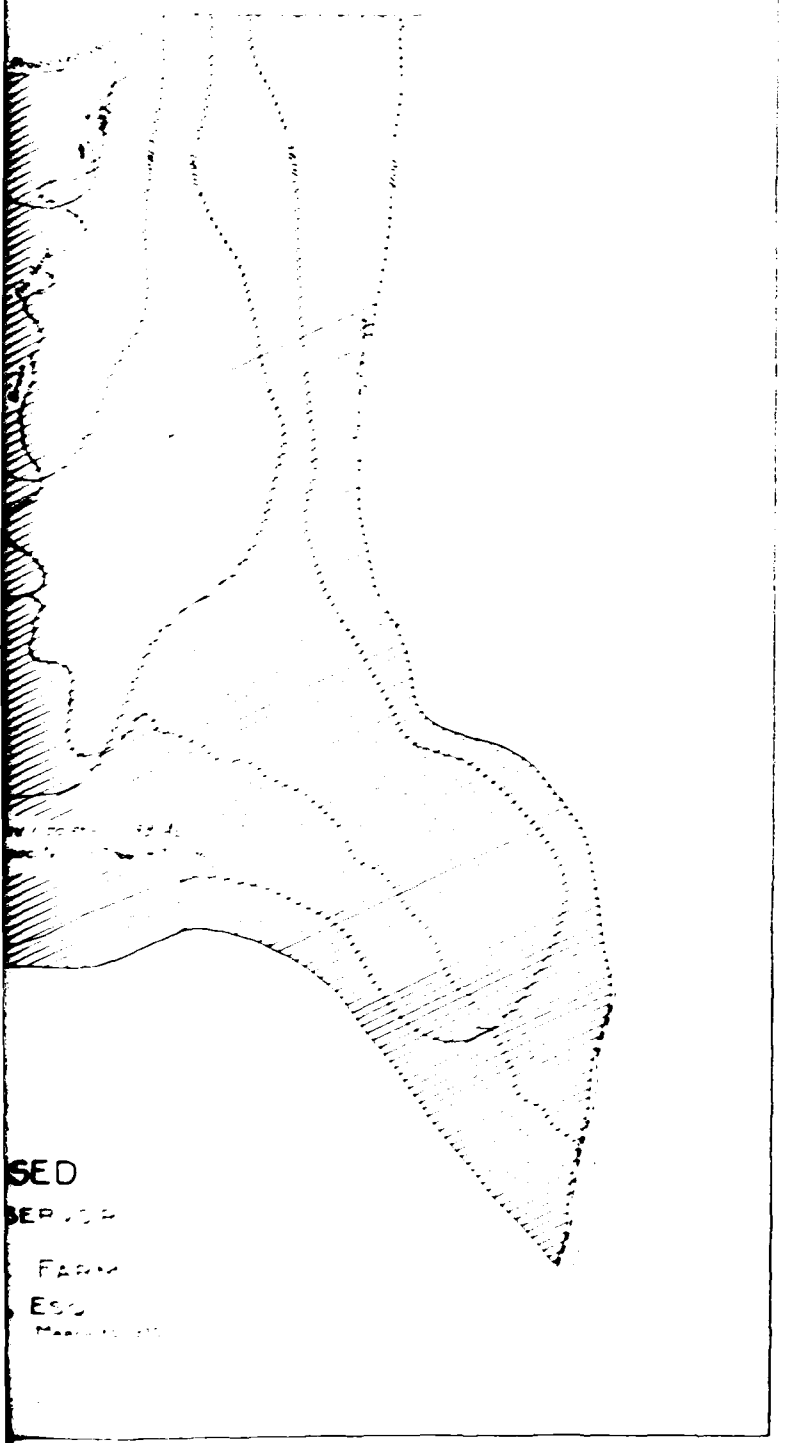
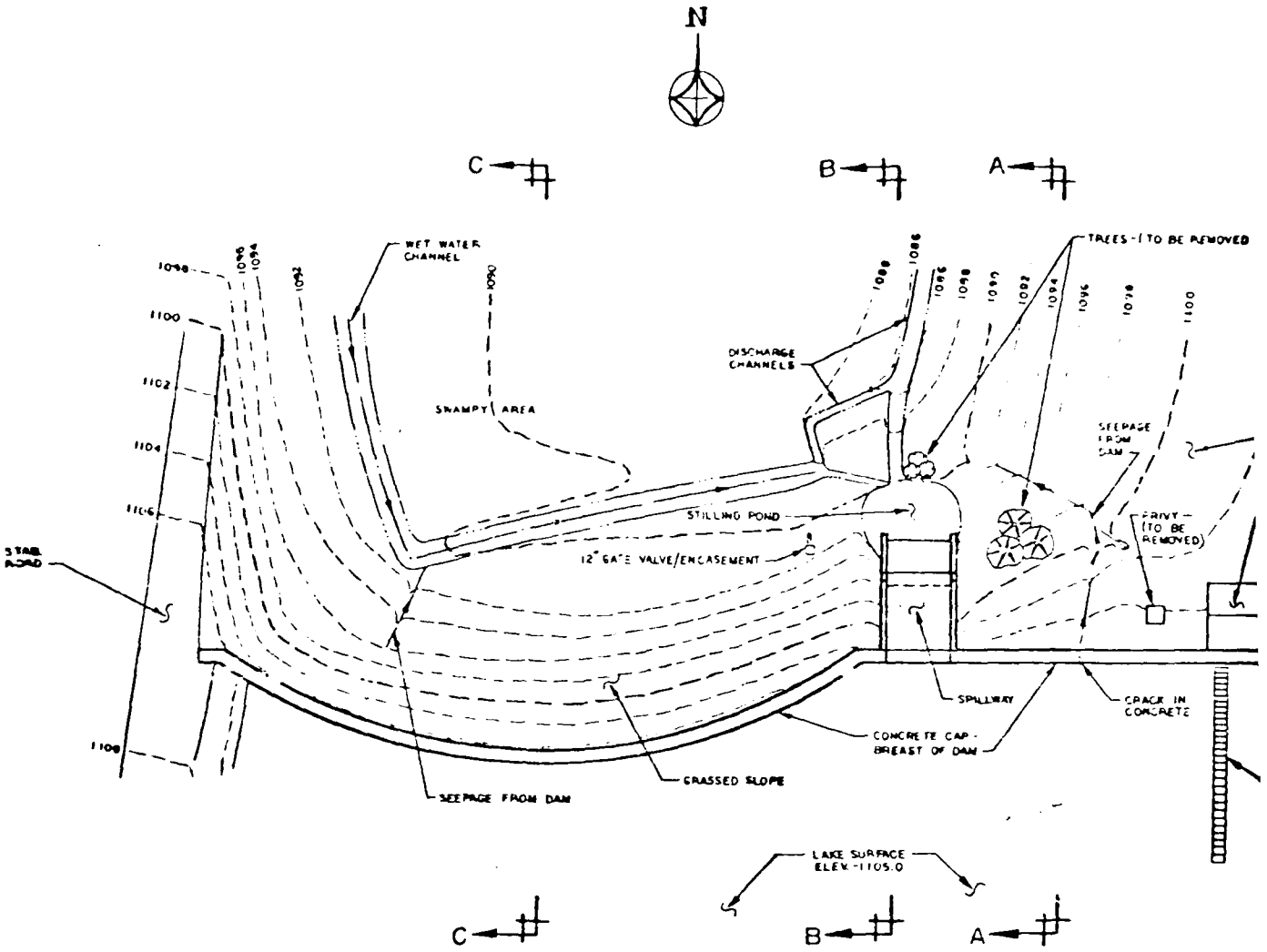


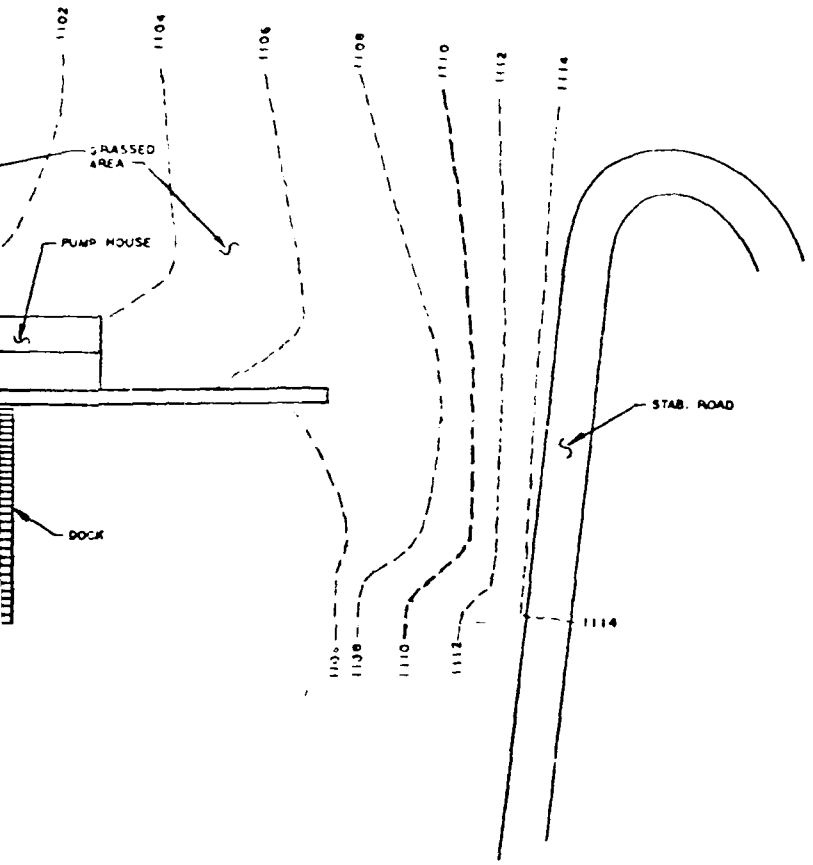
PLATE NO. 5

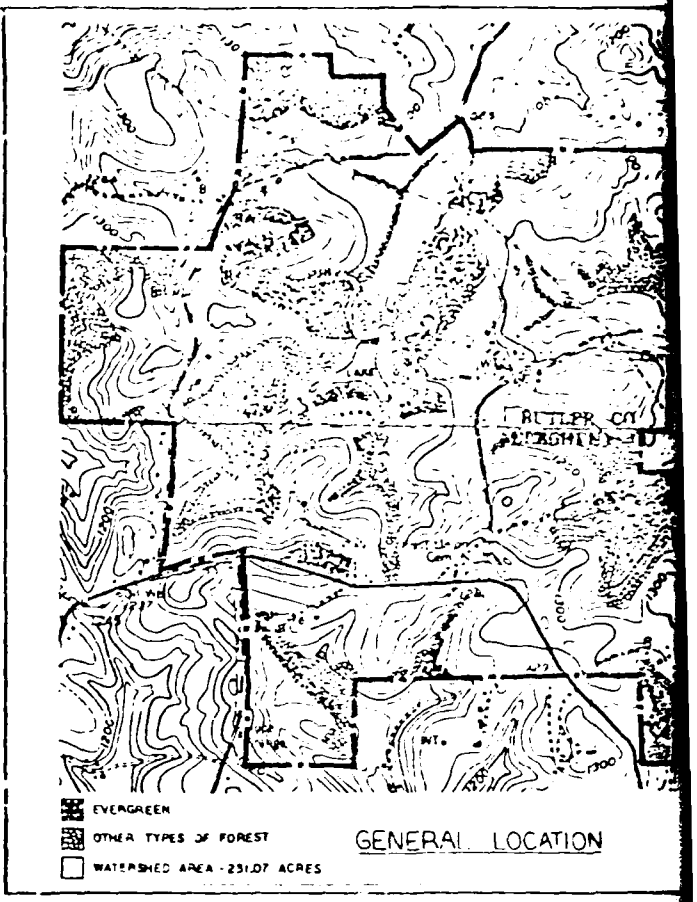


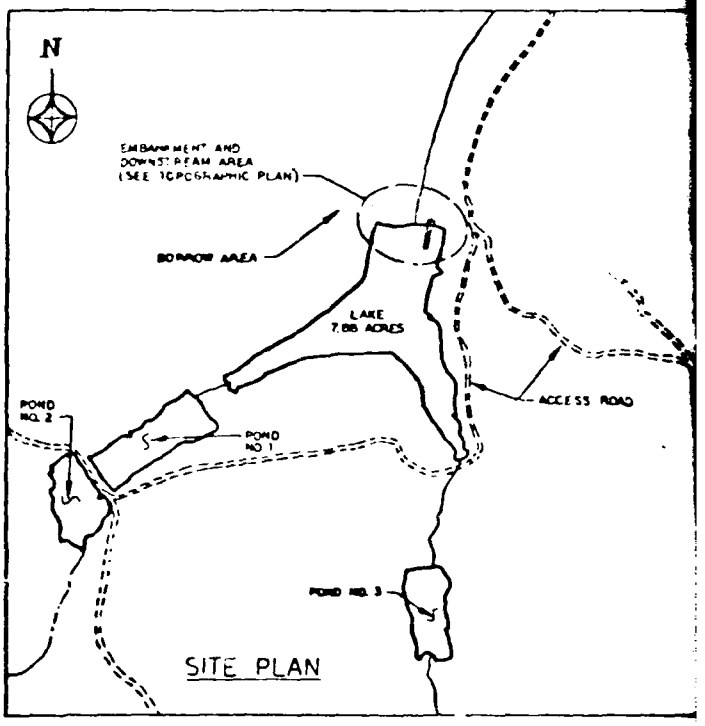
PLAN – EXISTING DAM AND SPILLWAY AREA

SCALE: 1"=20'

NOTI







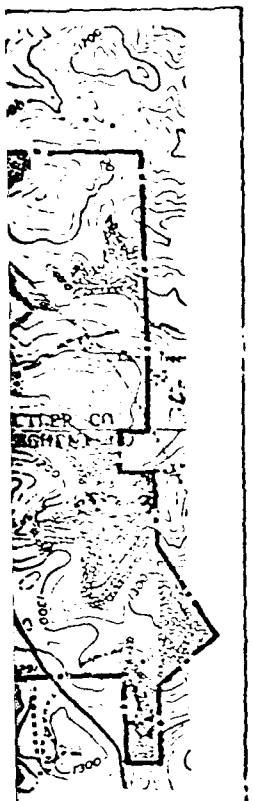
OTE ELEVATIONS SHOWN ARE 5.5' GREATER THAN ELEVATIONS BASED ON MEAN SEA LEVEL.

SHEET 1 OF 3

RONALD E. KELLEY CONSULTING ENGINEERS	EXISTING TOPOGRAPHY AND CONDITIO EMBANKMENT, SPILLWAY, AND FACIL	
TREESDALE FARMS, INC. APPLE ORCHARDS MARS, PENNSYLVANIA 16046	DRAWN BY	3-80
	CHECKED BY	3-80
	APPROVED BY	4-80

79-

PLATE NO. 6



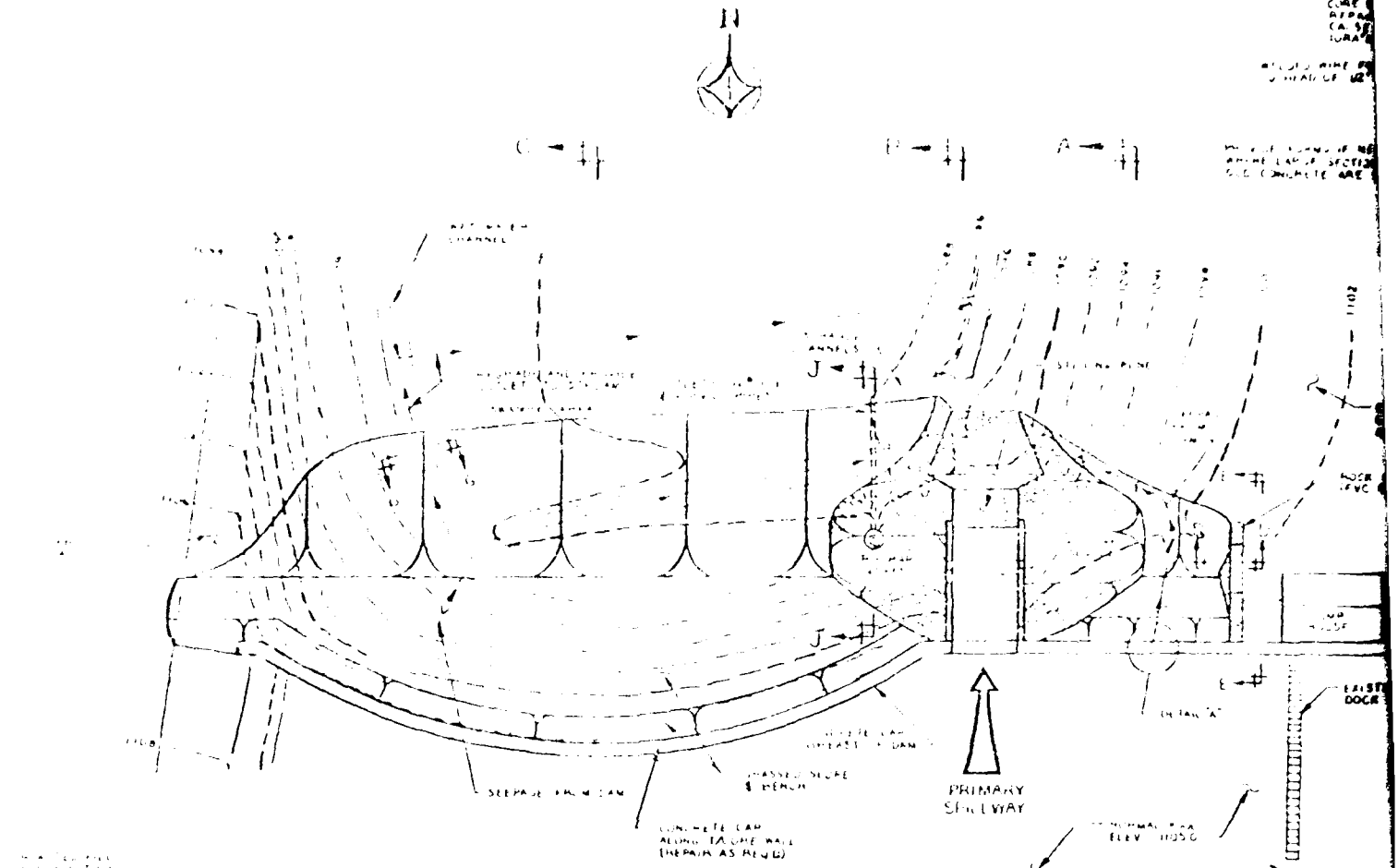
ATION

ACCESS ROAD

1 OF 3

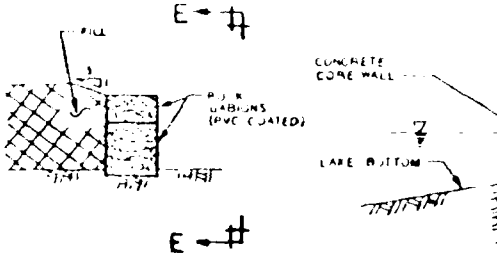
AND CONDITIONS OF
AY, AND FACILITIES

79-113-E1

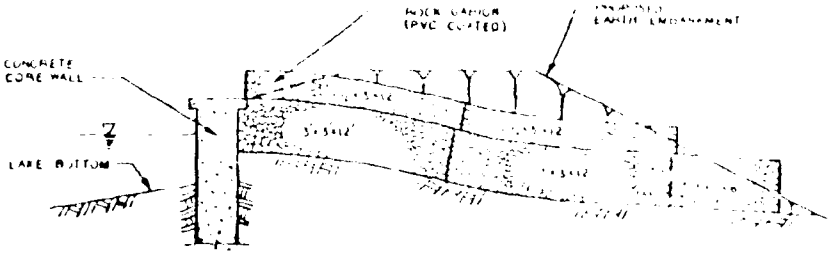


PLAN PROPOSED EMBANKMENT REINFORCEMENT
[1" = 40']

SECTION C-C
SCALE 1"=5'

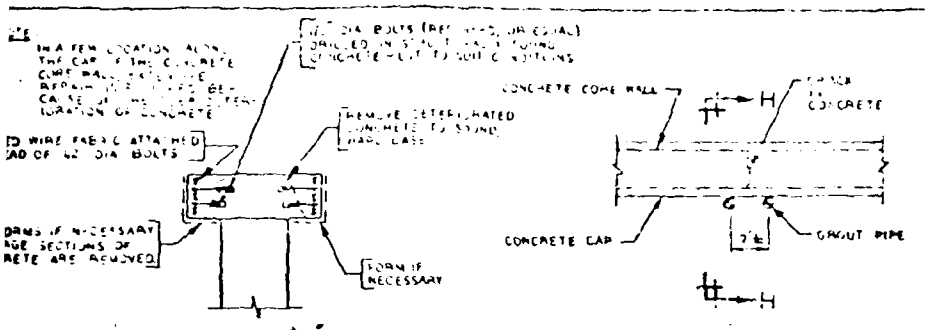


GABION RETAINING WALL
SECTION D-D
SCALE 1"=5'



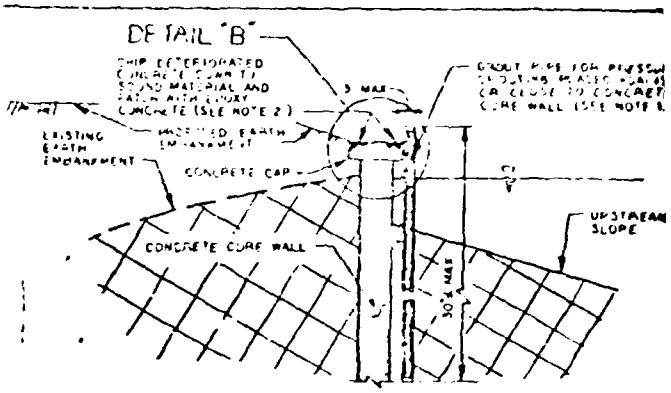
EARTH EMBANKMENT CLOSURE
SECTION E-E
SCALE 1"=5'

NOTE: ELEVATIONS SHOWN ARE 5.5' GREATER THAN ELEVATIONS BASED ON MEAN SEA LEVEL.

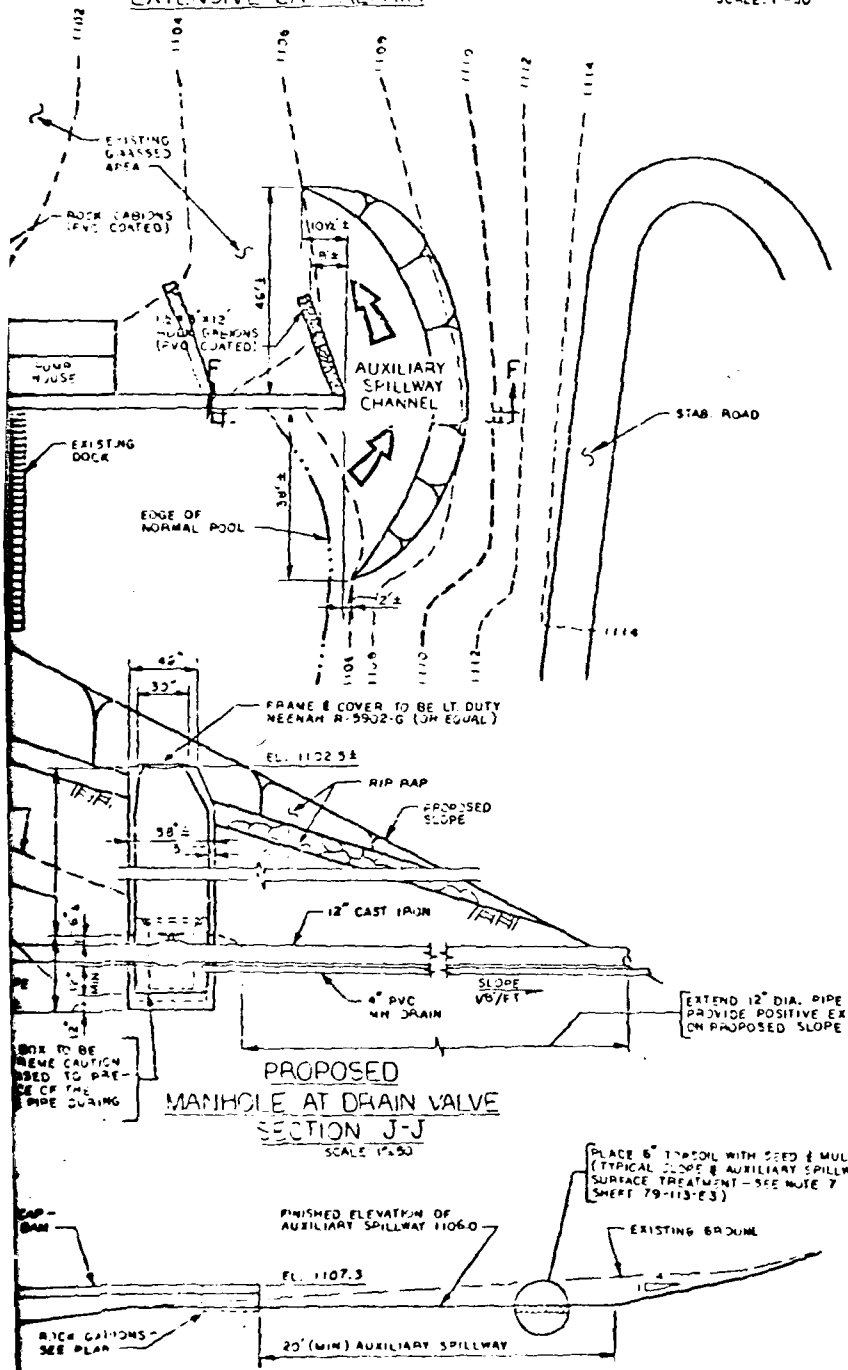


DETAIL "B"
EXTENSIVE CAP REPAIR

DETAIL "A"
SCALE: 1"=50'



SECTION H-H
SCALE 1"=50'



PROPOSED
MANHOLE AT DRAIN VALVE
SECTION J-J
SCALE 1"=50'

AUXILIARY SPILLWAY
SECTION F-F
SCALE 1"=50'

REINFORCEMENT AND REPAIR
OF CONCRETE AND EARTH DAM WITH SPILLWAY

1. Place drill pipes and grout area behind dam (upstream behind cracks in concrete core wall as shown in Detail "A".

   (a) Use grout mix of one part Portland Cement with one part water.

   (b) Pressure-grout each boring from the bottom upward, beginning at top of rock (or 3 maximum depth of drill hole, whichever occurs first).

   (c) Grout drill hole in 5-foot sections to refusal, using a maximum pressure of 1 psi foot of height, measured from the ground surface to the top of the section being

   (d) Place additional borings for grouting, if necessary and as directed by the Engineer and pump grout to achieve a more complete seal of the seepage.

2. Repair the existing concrete Cap on top of the concrete Core-Wall

   (a) Chip the spalled and deteriorated concrete down to sound, hard concrete using pneu tools or sand blasting equipment, if necessary. Flush surface thoroughly with clean water. Cracks and voids should be vacuumed or blown clear by use of oil-free, com air.

   (b) Clean all exposed steel to remove all rust, scale, dirt and other loose or foreign material. Steel may be cleaned using sandblasting, or such proprietary rust remo as the acid type in military spec. MIL-M-10578 or by application of caustic solut and wire brushing.

   (c) Apply "Colma Bonding Compound", as manufactured by the Sika Chemical Corporation equal, to bond the existing hard concrete to the subsequent "fresh-troweled" concr patching. (All work to be conducted in strict compliance with the Manufacturer's directions and instructions.) Apply Sika adhesive to metals as soon as possible after cleaning to prevent surface from reoxidizing.

   (d) Apply "Sika Dur Lo-Mod Gel" mortar, mixed with "Colma Quarzitic Aggregate" as manufactured by Sika Chemical Corporation, or equal, in a ratio of 1 part mortar 3 parts of Quarzitic Aggregate (which is a specially graded and oven-dried aggregate) or equal, to all concrete areas properly prepared to receive patching. This concrete material is to be mixed in a stiff mix and troweled in place to fit restore the original Cap geometry.

   (e) Seal the repaired concrete Cap with "Sikagard Hi-Bild" epoxy coating, limestone g in color. (Sandblast entire surface before application.) Extend the coating d the upstream, vertical face of the Core Wall to the top of water.

3. Repair and restore the concrete training walls along the existing Spillway, using materials and techniques described and required in Note 2.

4. Relocate the outdoor Privy along the right downstream abutment, as shown.

5. Place a compacted earth fill in front of the existing Embankment.

   (a) Cover the downstream slope of the existing Embankment with a crushed stone o drainage blanket as the earth fill is compacted from the bottom. (Provide 6 drains along the toe as shown.)

   (b) Place fill in lifts not to exceed 8 inches and compact to 90 percent of Modi Proctor. (95 percent adjacent the spillway and beneath the rip rap slopes.)

   (c) Provide rip rap slopes adjacent the Spillway Training Walls to prevent again and scour.

   (d) Clean the downstream channel of debris and trees. Form a Stilling Basin wit rip rap placed at the bottom of the Spillway.

Notes Continued on Drawing No. 79-113-E3

SHEET 2

RONALD E. KELLEY, CONSULTING ENGINEERS, CARNEGIE, PENNSYLVANIA	PROPOSED EMBANKMENT REINFO AND DETAILS			
TREESDALE FARMS, INC. APPLE ORCHARDS MARS, PENNSYLVANIA 16046	DESIGNED	WCA	1 80	79-
	DRAWN	CEL	1 80	
	CHECKED	REK	1 80	

PLATE NO. 7

PRESSURE
D AGAINST
CONCRETE
E NOTE 1)

UPSTREAM
SLOPE

crete core-wall

rock (or 30 feet

re of 1 psi per
tion being grouted.

the Engineer,

n using pneumatic
hly with clean
oil-free, compressed

or foreign
rust removers
stic solution

...
bonded" concrete
ufacturer's
as possible

ate" as
rt mortar to
dried
patching.
nce to fit and

limestone gray
ooting d...n

ony, using the same

d stone or slag
(Provide 6" Dia. PVC

t of Modified
slopes.)

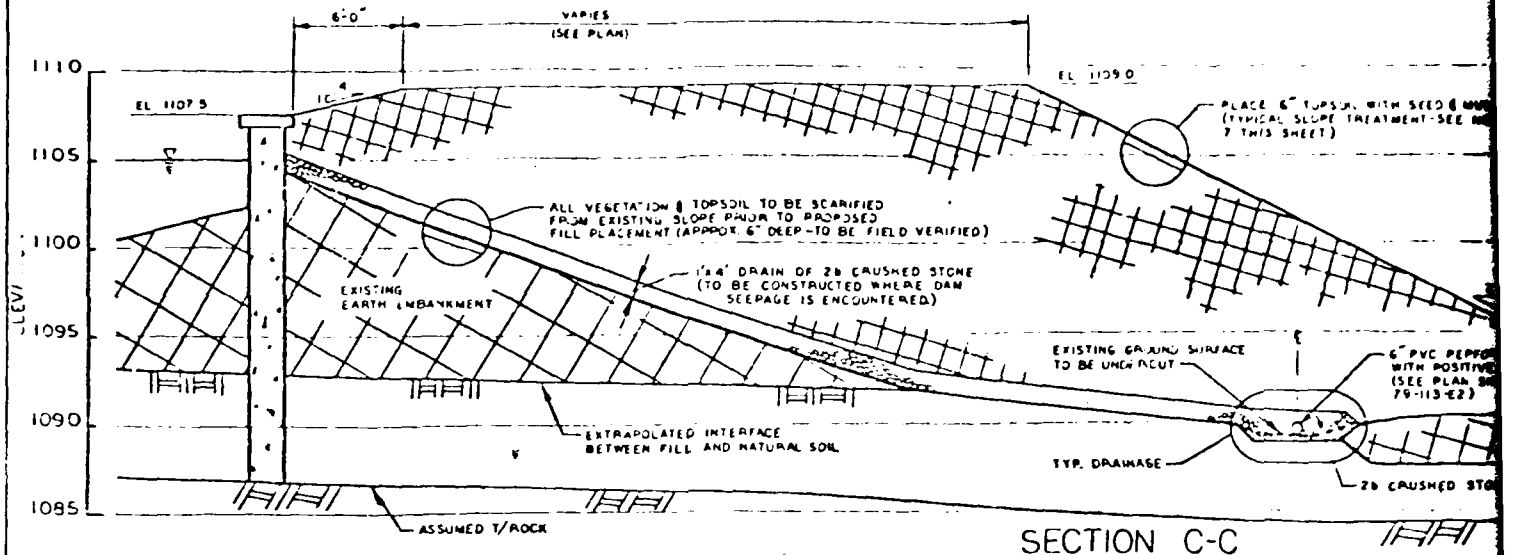
nst against erosion

Basin with large

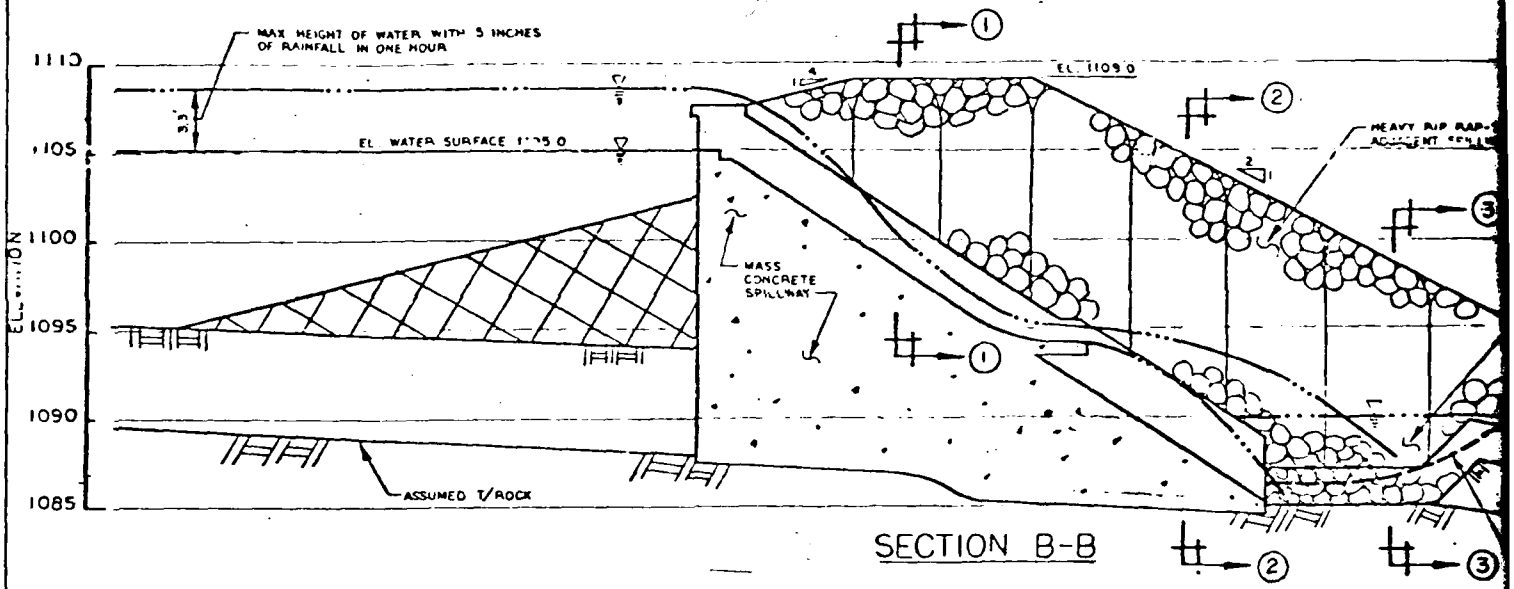
ET 2 OF 3

REINFORCEMENT
LS

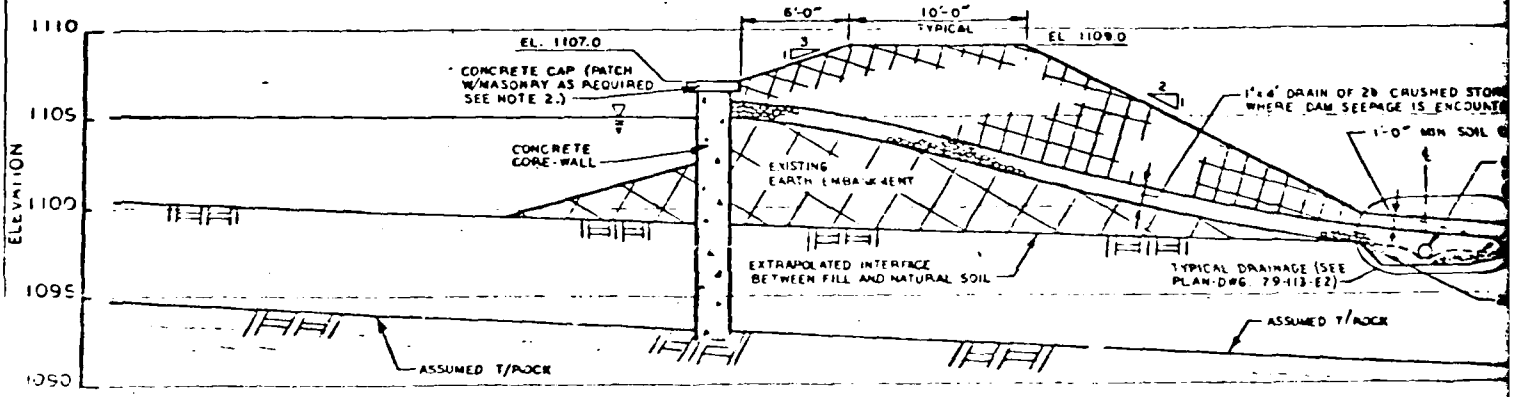
79-113-E2



SECTION C-C

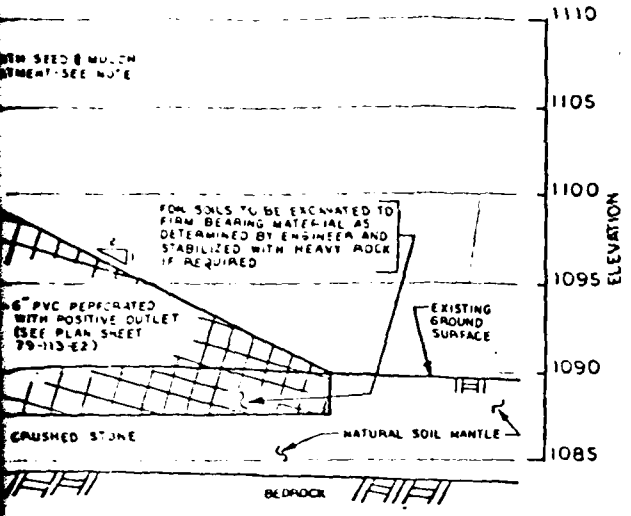


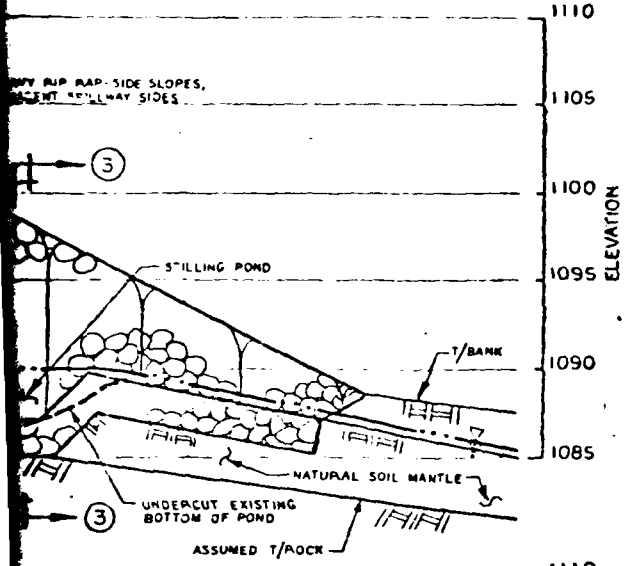
SECTION B-B

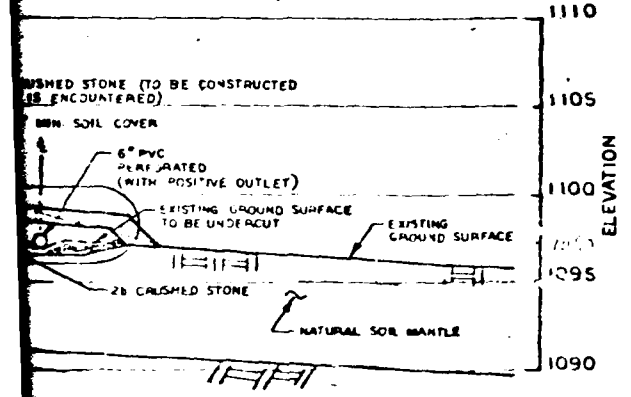


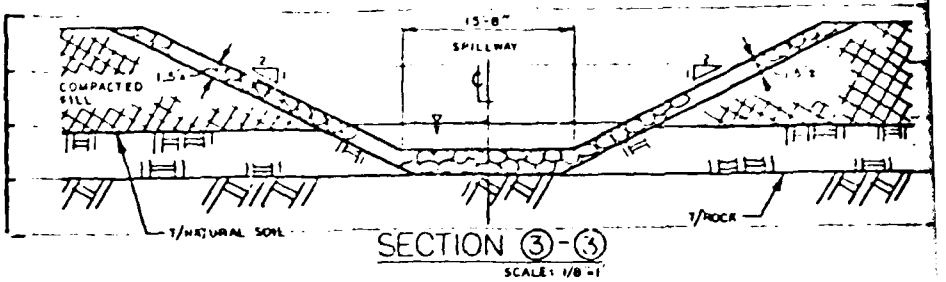
SECTION A-A

NOTE: ELEVATIONS SHOWN ARE 5.5' GREATER THAN ELEVATIONS BASED ON MEAN SEA LEVEL.

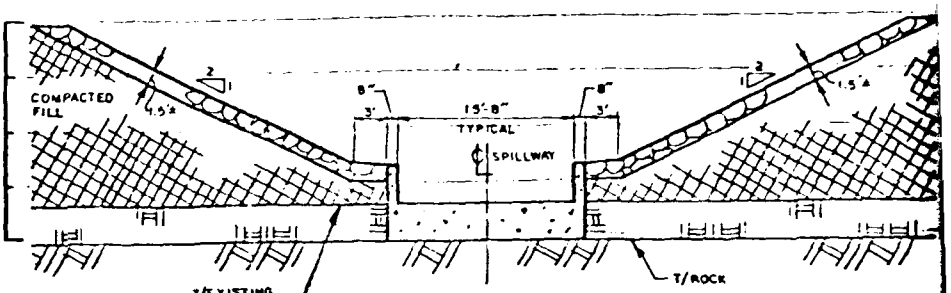




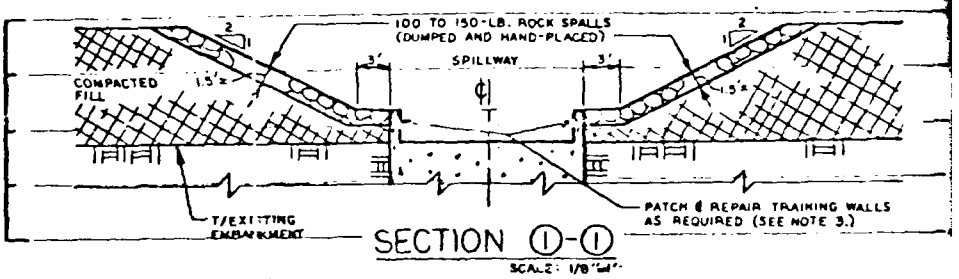




SECTION ③-③
SCALE: 1/8"=1'



SECTION ②-②
SCALE: 1/8"=1'



SECTION ①-①
SCALE: 1/8"=1'

REINFORCEMENT AND REPAIR
OF CONCRETE AND EARTH DAM WITH SPILLWAY

(Cont'd)

6. Provide a closure section using rock gabions placed along the eastern end of the earth embankment to protect the pump house. Gabions to be PVC coated.

   (a) Return PVC coated rock gabions at the extreme eastern end of the concrete cap to form the northeastern wall of the auxiliary spillway channel.

   (b) Grouting of the gabions with a lean mortar mix (1 part cement to 3 part sand) is desireable but not necessary.

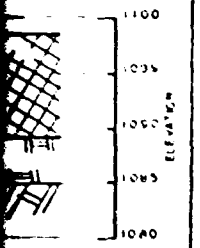
7. Fine grade, seed and mulch the exposed slopes of the new embankment, auxiliary spillway channel and all other surface areas of soil disturbed by the construction activities.

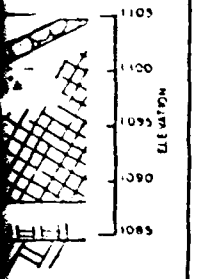
SHEET 3

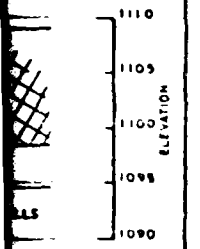
HAN

RONALD E. KELLEY, CONSULTING ENGINEERS, SHREVEPORT, PENNSYLVANIA 15601	SECTIONS THROUGH EMBANKMENT & SPILLWAY			
TREESDALE FARMS, INC. APPLE ORCHARDS MARS, PENNSYLVANIA 16046	DESIGNED BY	WAK	12-80	PROJECT 79-11
	CHECKED BY	RONJ	1-3-80	
	APPROVED BY	REK	1-4-80	

PLATE NO. 8





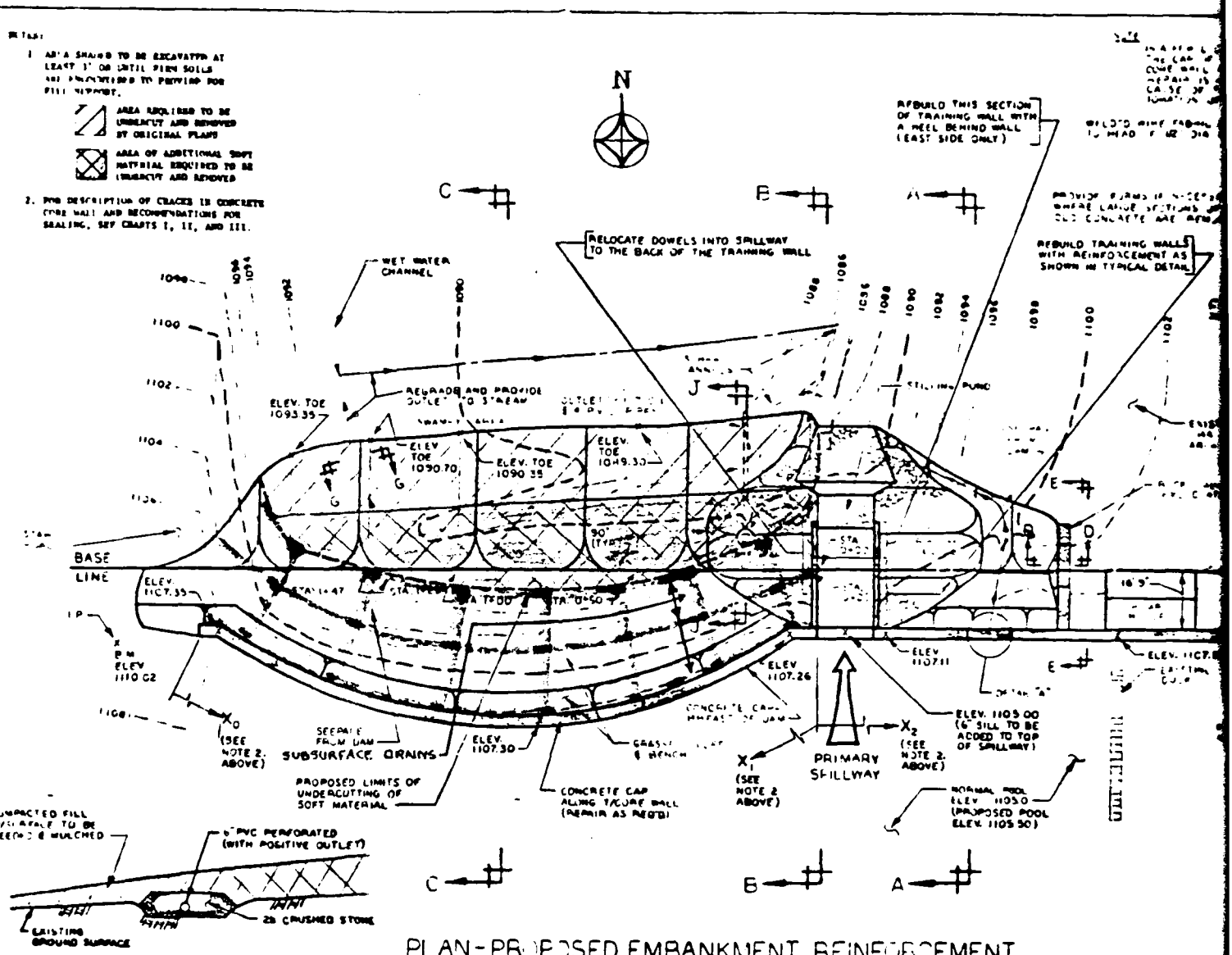


LS

ET 3 OF 3

ISH
LWAY

79-113-E3

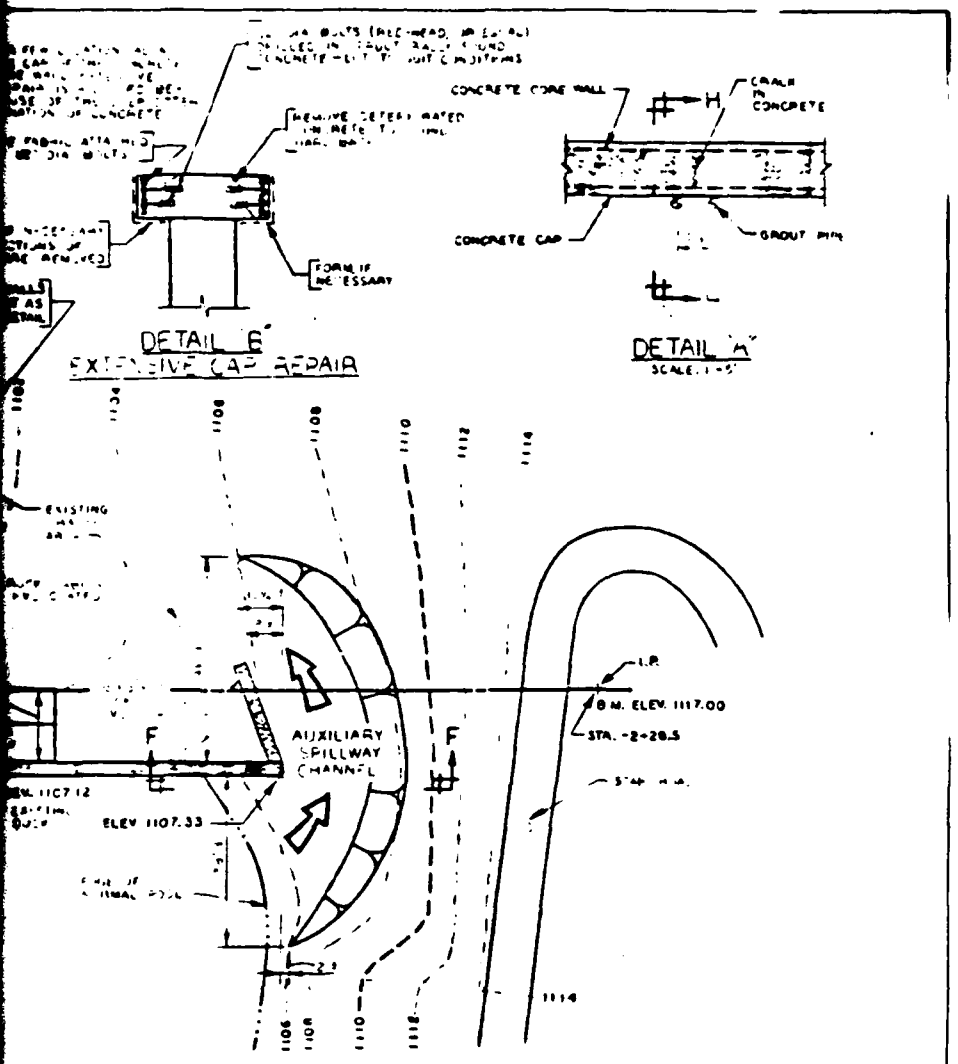


SECTION G-G
SCALE: 1"=5'

PLAN - PROPOSED EMBANKMENT REINFORCEMENT

NOTE: ELEVATIONS SHOWN ARE 5.5' GREATER THAN ELEVATIONS BASED ON MEAN SEA LEVEL.

PLATE NO. 9



K RONALD E KELLEY	PROPOSED EMBANKMENT REINFORCEMENT AND DETAILS		
TREESCALE FARMS INC. APPLE ORCHARDS MAPS PENNSYLVANIA 18046			79-117-E2 C

APPENDIX F

REGIONAL GEOLOGY

TREESDALE FARM DAM
NDI ID. NO. PA 1069
REGIONAL GEOLOGY

REGIONAL GEOLOGY

The dam is located in Butler County, approximately one mile south of Mars and immediately north of the Allegheny County-Butler County boundary line. Physiographically, the dam is located in the Kanawha section of the Allegheny Plateau Physiographic Province. The local structure of the plateau in the vicinity of the dam is a broad, shallow spoon shaped trough, trending approximately S30°W. A number of secondary subparallel folds are superimposed on the trough.

The dam is located approximately one mile east of the Mount Nebo Syncline axis which plunges at approximately 4 degrees to the south. The dam overlies the lower to middle portion of the Conemaugh Formation. These rocks are of Pennsylvanian Age and consist of interbedded and discontinuous members of shale, sandstone, limestone, and coal.

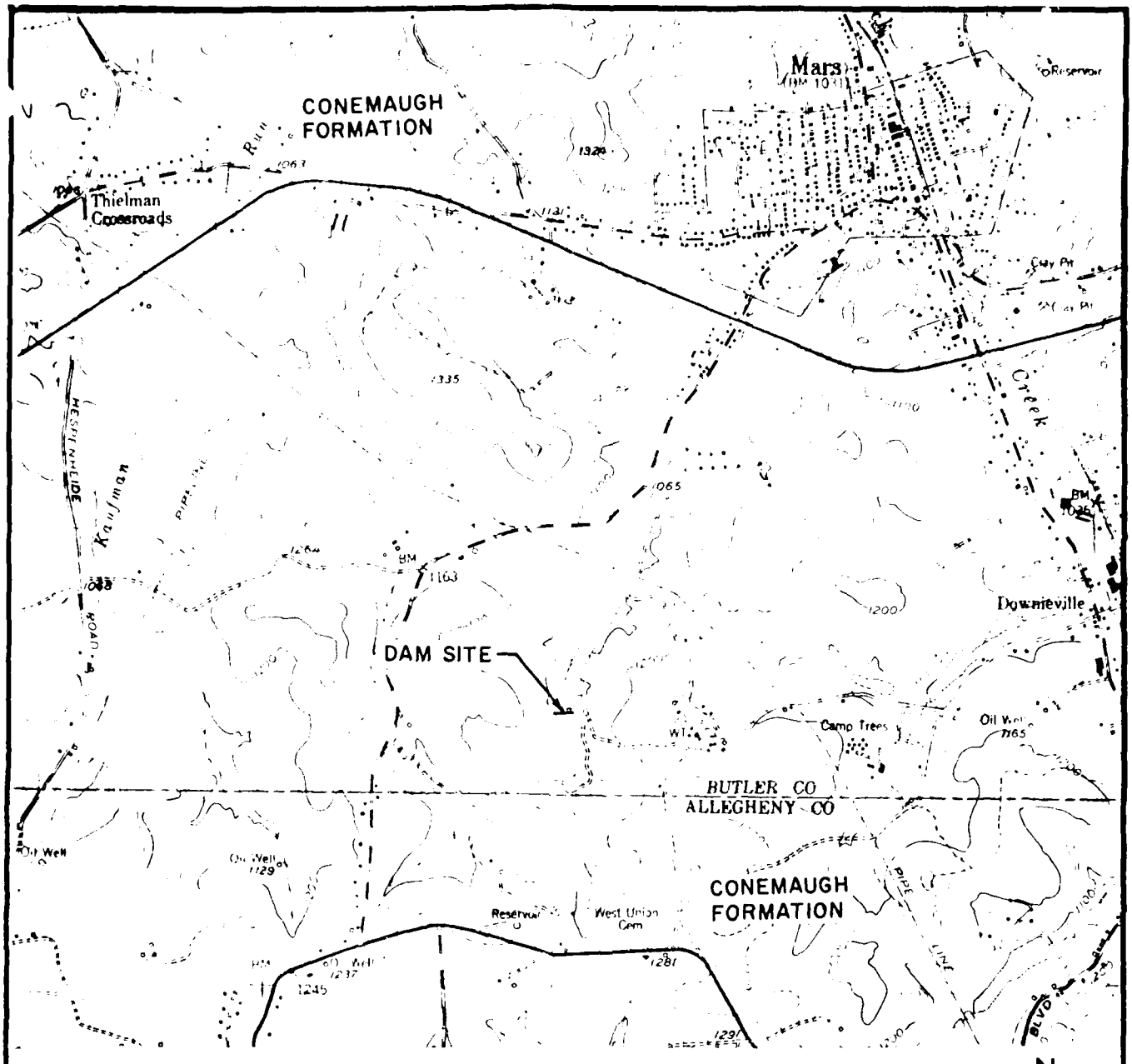
SITE GEOLOGY

No subsurface investigation was performed at the dam site. Records indicate that the dam overlies about a 10 to 20 feet layer of clay which overlies shale bedrock.

References

Engineering Characteristics of the Rock of Pennsylvania, McGlade, Geyer and Wilshusen, Pennsylvania Geological Survey, 1972.

Ground Water in Southwestern Pennsylvania, Arthur M. Piper, Pennsylvania Geological Survey, 1933.



MARS QUADRANGLE, BUTLER COUNTY, PENNSYLVANIA

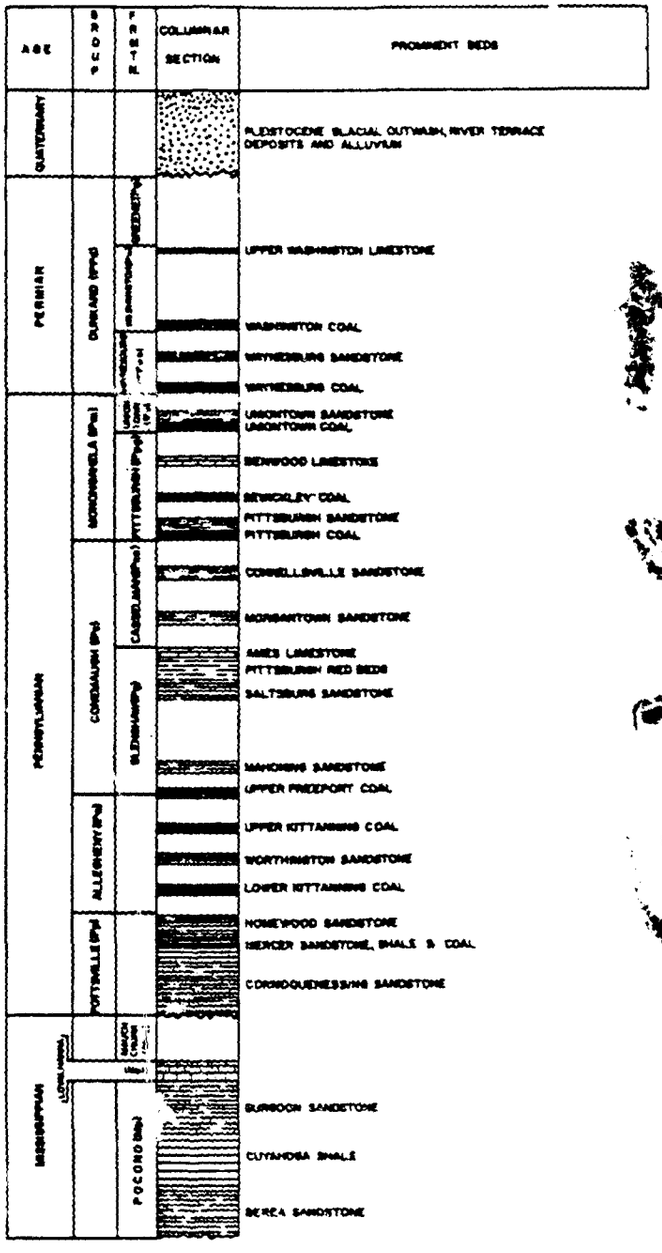
SCALE: 0 — 1/2 MILE 1:24000

CONTOUR INTERVAL 20FT. DATUM IS MEAN SEA LEVEL

DATA OBTAINED FROM PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES TOPOGRAPHIC AND GEOLOGIC SURVEY 1960

DATE: MARCH 3, 1981	TREESDALE FARM DAM NATIONAL DAM INSPECTION PROGRAM	GEOLOGIC MAP
SCALE: 1" = 2000'		
DR: JLM CK: PAD	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS PITTSBURGH, PA., CHARLESTON, W. VA. & BALTIMORE, MD.	
DWG. NO. F 2		

DATAPRINT M02467



DATE: MARCH 3, 1981	TREESDALE FARM DAM NATIONAL DAM INSPECTION PROGRAM	GEOLOGIC COLUMN
SCALE: None		
DR: AP CK: JEB	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS GEO SYSTEMS, INC 1000 BANKSVILLE RD / PITTSBURGH, PA 15216	
F3		