LEVEL II

(1)

SUSQUEHANNA RIVER BASIN

UNNAMED TRIBUTARY TO HOP BOTTOM CREEK, SUSQUEHANNA COUNTY

PENNSYLVANIA

LOOMIS LAKE DAM

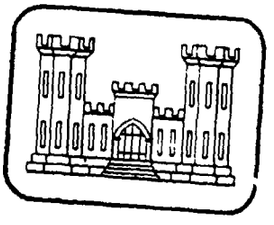
NDI No. PA 00048

PennDER NO. 58-127

Dam Owner: Irving N. Loomis, Sr.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



"Original contains color plates: All DTIC reproductions will be in black and white"

prepared for

DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

Baltimore, Maryland 21203

prepared by

MICHAEL BAKER, JR., INC.

Consulting Engineers

4301 Dutch Ridge Road

Beaver, Pennsylvania 15009

Contract DACW31-81-C-0011

June 1981

PREFACE

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

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

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

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" 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 REPORT
NATIONAL DAM INSPECTION PROGRAM

Loomis Lake Dam, Susquehanna County, Pennsylvania
NDI No. PA 00048, PennDER No. 58-127
Unnamed Tributary to Hop Bottom Creek
Inspected 29 October 1980

ASSESSMENT OF GENERAL CONDITIONS

Loomis Lake Dam is owned by Irving N. Loomis, Sr., and is classified as a "Significant" hazard - "Small" size dam. The dam was found to be in fair overall condition at the time of inspection.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillway will pass the spillway design flood (SDF) without overtopping the dam. A spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF) is required for Loomis Lake Dam. The 1/2 PMF was chosen as the SDF. Therefore, the spillway is considered "Adequate."

The inspection revealed certain items of remedial work which should be performed by the owner immediately. Items 3 through 5 below should be performed under the guidance of a qualified professional engineer experienced in the design and construction of earth dams. These include:

1) Monitor the area of sloughing on the downstream slope for continued/progressive movement.

2) Monitor the seeps at the toe of dam at stations 6+25 and 7+50 for turbidity and/or an increase in flow.

If either of items 1 or 2 above increases, then more detailed investigations and corrective measures may become necessary.

3) Repair the seep area at the left junction of the spillway weir and left training wall by placing additional clay fill upstream of the weir and repairing the joint filler. The seep should then be monitored during future inspections of the dam.

4) Monitor the seep entering the discharge channel from the stone wall on the right side of the spillway discharge channel.

5) Develop a means of emergency upstream closure for the outlet conduit passing through the embankment.

6) Remove the cattails and debris from the spillway discharge channel.

7) Remove the vegetation and sediment from the discharge channel (concrete flume) of the outlet works.

8) Cut the trees and brush on the upstream and downstream slopes and continue to maintain this item in the future.

9) Fill the animal/rodent hole observed and implement a rodent control program.

10) Replace the wood cover on the valve pit for the abandoned outlet works or fill in with earth.

11) Coordinate with the township to expedite repairs to the abutment supports of the bridge over the spillway channel.

In addition, the following operational measures are recommended to be undertaken by the owner:

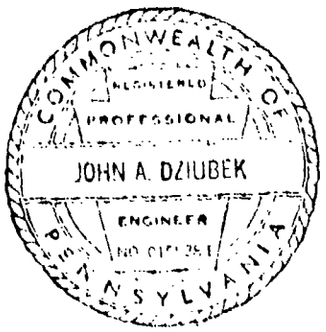
1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, operation and record keeping procedures be developed and implemented. An emergency drawdown plan should be prepared in case emergency drawdown of the reservoir should become necessary. These should be included in a formal maintenance and operations manual for the dam.

LOOMIS LAKE DAM



Submitted by:

MICHAEL BAKER, JR., INC.

John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 26 June 1981

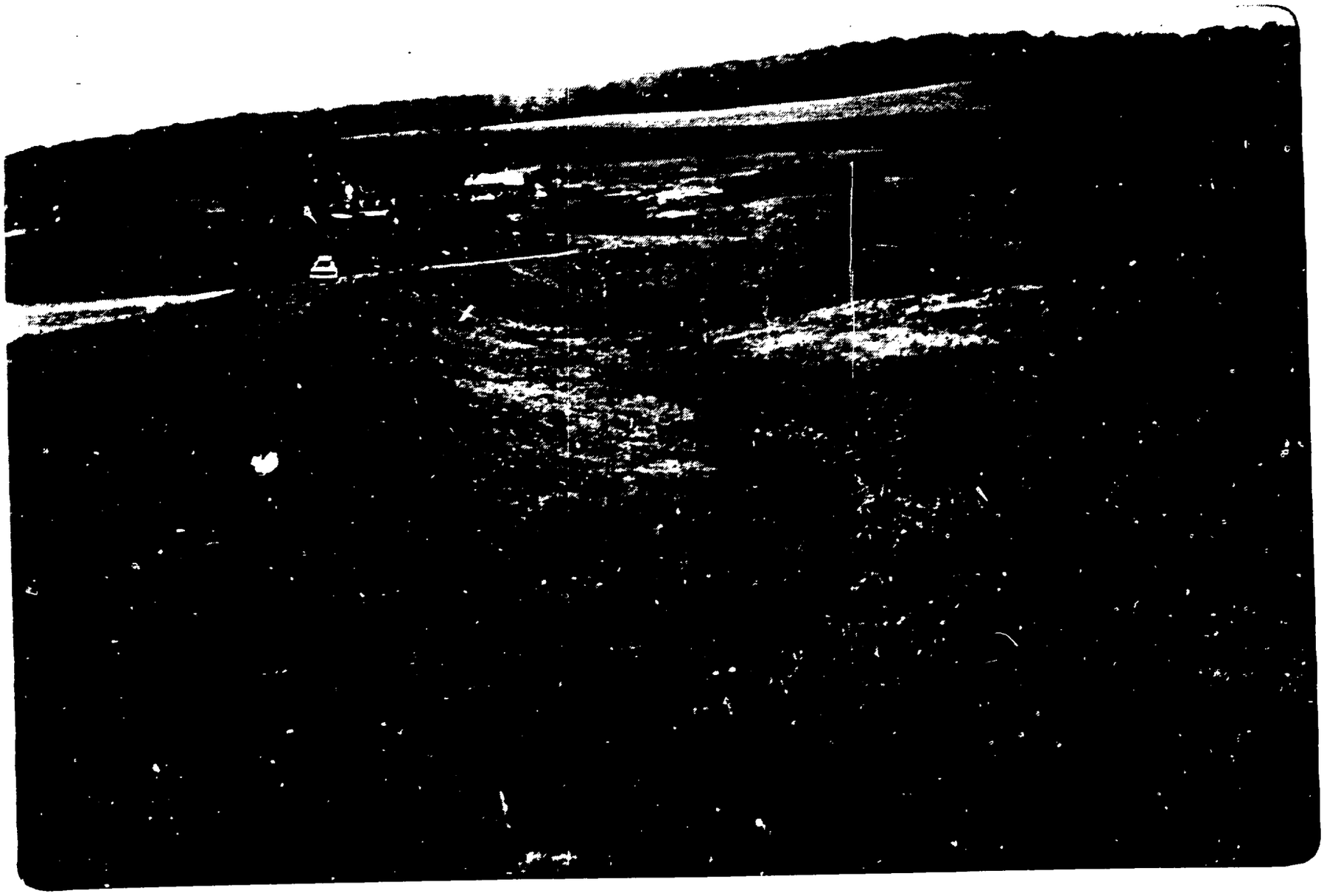
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

Date: 7 JUL 81

LOOMIS LAKE DAM



Overall View of Dam From Right Abutment

TABLE OF CONTENTS

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LOOMIS LAKE DAM
NDI No. PA 00048, PennDER No. 58-127

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT -

a. Description of Dam and Appurtenances - Loomis Lake Dam is an earthfill embankment 866 feet long and 21.5 feet high. The embankment has a crest width of 24 feet and side slopes of 3H:1V (Horizontal to Vertical) upstream and 2H:1V downstream. The upstream face of the embankment is protected with riprap at normal pool level. Loomis Lake is referred to as Lake Chrisann on the USGS 7.5 minute topographic quadrangle, Montrose East, Pennsylvania. The design plans refer to the dam as Lake Louise.

The spillway, located at the right abutment of the dam, consists of a concrete ogee weir which is 40 feet long perpendicular to the direction of flow. The crest of the spillway weir is approximately 50 feet upstream from the upstream crest of the dam. The left spillway training wall is a concrete wall which extends from the weir to the upstream crest of the dam. The crest of the upstream section of the training wall is 5 feet above the crest of the weir; the remaining 7.5 feet are 6.5 feet above the crest of the weir. The right spillway training wall consists of a concrete wing wall which extends 36 feet from the right end of the weir and into the right abutment. This wall runs parallel to the crest of the weir and its crest is 5 feet above the crest of the weir. A dry masonry wall extends 9 feet downstream from the junction of the weir and right wing wall. The remainder of the

right side of the spillway discharge channel is formed by natural earth and rock.

The upstream portion of the spillway discharge channel is rectangular with a rock bottom. The channel is 40 feet wide immediately downstream from the weir and tapers to 21 feet wide at the upstream crest of the dam. There is a bridge over the spillway discharge channel along the crest of the dam. There is approximately 14 feet of clearance between the channel invert and the underside of the bridge. Downstream from the bridge, the discharge channel is a trapezoidal channel lined with riprap.

The outlet works are located to the right of the center of the dam and consist of an 18 inch cast iron pipe (C.I.P.) with a gate valve on the downstream slope. The intake is submerged at the toe of the upstream slope. There are three concrete anti-seep collars which are spaced 25 feet apart along the length of the pipe. A 12 inch cast iron outlet pipe which outlets at the toe of the left section of the embankment has been plugged with concrete.

b. Location - Loomis Lake Dam is located on an unnamed tributary to Hop Bottom Creek in Bridgewater Township, Susquehanna County, Pennsylvania, approximately 3.4 miles east of Montrose. The dam can be found on the USGS 7.5 minute topographic quadrangle, Montrose East, Pennsylvania. The coordinates of the dam are N 41° 50.6' and W 75° 47.9'. There are several names by which the lake is known. It is referred to as Lake Chrisann on the USGS quadrangle. The plates included in Appendix E show the name of the lake as Lake Louise. However, the present owner of the dam refers to the lake as Loomis Lake.

c. Size Classification - The height of the dam is 21.5 feet. Storage at the top of the dam (Elevation 1416.4 feet Mean Sea Level [ft. M.S.L.]) is 627 acre-feet. The dam is therefore in the "Small" size category.

d. Hazard Classification - One home and garage are located 500 feet downstream from the dam. These structures range from 5 feet above the streambed to 10 feet above the streambed. Loss of a few lives and economic damage to these structures are likely in the event of a dam failure. The dam is therefore in the "Significant" hazard category.

e. Ownership - The dam is owned and operated by Mr. Irving N. Loomis, Sr., Box 363, Montrose, Pennsylvania.

f. Purpose of Dam - The impoundment created by the dam is used for recreational purposes.

g. Design and Construction History - The dam was designed in 1959 by Mr. Jay W. Salisbury, P.E., of Chinchilla, Pennsylvania. Changes to the design were added by Emerson C. Willson, registered architect, in 1961. The dam was constructed by Irving N. Loomis & Sons of Montrose, Pennsylvania. Construction started in December of 1959 and was completed in December of 1961.

h. Normal Operational Procedures - The reservoir is typically maintained at the spillway crest elevation (Elevation 1410.0 ft. M.S.L.). The owner of the dam visits the dam once a week and makes a complete physical inspection twice a year.

1.3 PERTINENT DATA

a. Drainage Area (square miles) - 1.14

b. Discharge at Dam Site (c.f.s.)

Maximum Flood -	Unknown
Spillway Capacity - (at Pool El. 1416.4 ft. M.S.L.)	2760

c. Elevation* (feet above Mean Sea Level [ft. M.S.L.]) -

Design Top of Dam	1417.5
Minimum Top of Dam at Existing Low Point -	1416.4
Maximum Design Pool -	1417.0
Spillway Crest -	1410.0
Streambed at Toe of Dam -	1394.9
Maximum Tailwater of Record -	Unknown

*All elevations are referenced to the spillway crest, Elevation 1410.0 feet M.S.L., as estimated from the USGS 7.5 minute topographic quadrangle, Montrose East, Pennsylvania. The elevation for the spillway crest, as noted in design drawings by Jay W. Salisbury, is shown as 1393.0 ft. M.S.L. Plans by Emerson C. Willson show 1391.5 feet as the spillway crest elevation. This gives elevation differences of 17.0 and 18.5 feet respectively between those cited in this report and those shown on the available plans for the dam.

d. Reservoir (feet)

Length of Normal Pool -	2450
Length of Maximum Pool -	2650

e. Storage (acre-feet)

Top of Dam (El. 1416.4 ft. M.S.L.) -	627
Normal Pool (El. 1410.0 ft. M.S.L.) -	373

f. Reservoir Surface (acres) -

Top of Dam (El. 1416.4 ft. M.S.L.) -	46
Normal Pool (El. 1410.0 ft. M.S.L.) -	34

g. Dam -

Type - Homogeneous earthfill	
Total Length Not Including Spillway (feet)	866
Height (feet) Design -	22.6
Field -	21.5
Top Width (feet) -	24
Side Slopes - Upstream -	3H:1V
Downstream -	2H:1V
Zoning -	None
Impervious Core - Embankment constructed of "Hard Pan Fill."	
Cutoff -	None
Drains -	None

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Concrete ogee weir	
Location - Right abutment	
Length of Crest Perpendicular to Flow (feet) -	40
Crest Elevation (ft. M.S.L.) -	1410
Gates -	None
Downstream Channel - Riprapped channel along the toe of the dam.	

j. Outlet Works

The outlet works consist of an 18-inch C.I.P. with a gate valve on the downstream slope. The outlet works are located to the right of the center of the dam. The intake is submerged at the toe of the upstream slope. The pipe is encased in concrete (3 ft. by 3 ft.) with three (5 ft. by 5 ft.) anti-seep collars spaced at 25 foot centers. The outlet pipe discharges onto a concrete flume which conveys the flow to the toe of the dam and spillway outlet channel.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information reviewed consisted of Pennsylvania Department of Environmental Resources (PennDER) File No. 58-127. This file contained the following information:

1) The application made by Irving N. Loomis, Sr., to the Water Power Resources Board for Construction of the dam, dated 16 March 1959.

2) Plans and specifications for the construction of the dam prepared by Jay W. Salisbury, P.E., of Chinchilla, Pennsylvania, dated 25 May 1959.

3) A request from Mr. Virgil E. Wood for a hearing on the application for the dam. Mr. Wood, owner of property immediately downstream of the dam, felt the dam was a hazard to his property.

4) A transcript of a hearing which was conducted on 10 November 1959, concerning the application of this dam.

5) Permit issued from the Water and Power Resources Board to Irving N. Loomis, Sr., to construct the dam, dated 10 November 1959.

6) Plan and details of the dam prepared by Emerson C. Willson, registered architect, Clarks Green, Pennsylvania, 1961.

7) Various memorandums regarding the construction progress of the dam. Several photos taken by the Water and Power Resources Board during construction were also enclosed.

8) The latest inspection of the dam was conducted on 15 May 1963 by the Water and Power Resources Board. No problems were discovered during the inspection.

2.2 CONSTRUCTION

During construction, periodic inspections were made by personnel of the Water and Power Resources Board.

Irving N. Loomis & Sons, the contractor on this project, started work in December of 1959 and finished the project in December 1961.

No "as-built" plans were available for review. Minor changes were made in the design plans during construction:

1) The upstream slope of the embankment developed sliding problems near a 12-inch C.I.P. inlet. To correct this situation, the contractor drove sheet piling along the toe, thus severing the 12-inch C.I.P. The C.I.P. was then plugged with concrete.

2) An 18 inch C.I.P. was then installed for the outlet works at its present location. The intake is submerged at the toe of the upstream slope and has a gate valve and valve chamber on the downstream toe.

2.3 OPERATION

Mr. Irving N. Loomis, Sr., is responsible for all operations and maintenance on the dam.

2.4 EVALUATION

a. Availability - The information reviewed from the PennDER File No. 58-127 is readily available.

b. Adequacy - The information contained in the PennDER File No. 58-127 is considered adequate for Phase I Inspection of this dam.

c. Validity - There is no reason at the present time to doubt the validity of the available engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The dam and its appurtenant structures were found to be in fair overall condition at the time of inspection on 29 October 1980. No unusual weather conditions were present at the time of inspection. Noteworthy deficiencies observed during the visual inspection are summarized in the following paragraphs. The complete visual inspection check list, field sketch, top of dam profile, and typical cross-section are given in Appendix A.

b. Dam - The following is a list of deficiencies noted during the visual inspection of the embankment and abutments:

1) A minor area of sloughing, 8 feet wide by 6 feet high, was observed at station 5+00 on the downstream slope approximately one half the way up the slope even with the valve box.

2) Scattered locations of trees and brush were observed on the downstream slope and in the riprap upstream.

3) An animal/rodent hole was observed near station 6+00 on the downstream slope, approximately 20 feet below the crest of the dam.

4) Two clear seeps were observed at the downstream toe at station 6+25 and station 7+50. The approximate rates of flow were 0.25 g.p.m. and 1 g.p.m., respectively.

c. Appurtenant Structures - The following is a list of deficiencies noted during the visual inspection of the appurtenant structures:

1) Seepage was observed flowing from beneath the left downstream end of the spillway weir. The flow rate was estimated at 3 g.p.m. Additional clay fill upstream of the weir and repair of the joint filler between the weir and training wall will reduce or eliminate this seepage.

2) A minor amount (0.5 g.p.m.) of clear seepage was entering the discharge channel from the stone wall on the right side of the spillway discharge channel.

3) Cattails and debris were observed in the spillway discharge channel.

4) The bridge over the spillway discharge channel has badly fractured concrete and rock foundation supports.

5) Vegetation and sediment has accumulated in the discharge channel (concrete flume) of the outlet works.

6) The wood cover on the abandoned outlet works valve pit is deteriorated and should be replaced (or the pit filled in) for the protection of anyone walking on the dam.

d. Reservoir Area - The reservoir slopes are moderate with a good growth of ground cover. A small amount of sedimentation was present in the upper portion of the reservoir. Located upstream of Loomis Lake Dam is Heart Lake (PennDER No. 58-98), a natural lake with a small amount of flood storage.

e. Downstream Channel - One home and one garage are located downstream of the dam. Loss of life may occur in the event of a dam failure. In addition, the township road may suffer economic damage.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal procedures for lowering the reservoir or evacuating the downstream area during an impending failure of the dam. It is recommended that formal emergency procedures be adopted, prominently displayed, and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

Generally, the maintenance procedures are considered adequate; however, a more conscientious program to record future maintenance performed would be desirable.

4.3 MAINTENANCE OF OPERATING FACILITIES

The 18-inch gate valve which can be used for emergency drawdown is operated twice a year. Maintenance is performed on an as-needed basis. It is recommended that a formal operation and preventive maintenance schedule be developed and implemented. An emergency drawdown plan should be developed in case an emergency drawdown should become necessary.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in the event of a dam failure. It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The current operational features are adequate for the purpose they serve. It is recommended that a formal maintenance and operations manual be prepared for the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - No hydraulic or hydrologic design calculations are available for Loomis Lake Dam.

b. Experience Data - No information concerning the effects of significant floods on the dam is available.

c. Visual Observations - The spillway channel is overgrown with brush which should not significantly affect flow from the spillway during times of high flow; however, this brush should be removed. The channel under the bridge along the crest of the dam is several feet lower than the spillway and should pass flows from the spillway. No problems were observed which would indicate that the dam and appurtenant facilities could not perform satisfactorily during a flood event.

d. Overtopping Potential - Loomis Lake Dam is a "Small" size - "Significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Because the dam is on the upper end of the "Small" size category in terms of storage capacity, the 1/2 PMF was chosen as the SDF.

The hydraulic capacity of the dam, reservoir, and spillway was assessed by utilizing the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1 DB. The hydrologic characteristics of the basin, specifically, the Snyder's unit hydrograph parameters, were obtained from a regionalized analysis conducted by the Baltimore District of the U.S. Army Corps of Engineers.

Heart Lake was assumed to have no effect on Loomis Lake for this routing.

The analysis revealed that the spillway can pass the 1/2 PMF without overtopping the dam. During the SDF, the reservoir water surface elevation is 0. 32 feet below the top of the spillway training walls. The dam, reservoir, and spillway can safely pass the SDF without overtopping the dam.

e. Spillway Adequacy - As outlined above, the spillway capacity is sufficient to pass the SDF. The spillway is therefore considered to be "Adequate."

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The area of minor sloughing on the downstream slope does not appear to represent a threat to the continued structural stability of the dam at the present time. It is recommended that this area be monitored during future inspections to ensure that this condition does not become serious.

The areas where seepage was observed should be monitored in future inspections for increase in flow and/or turbidity.

b. Design and Construction Data - No design data were available for review. During construction, the upstream slope moved downward and into the reservoir area at approximately station 6+50 (stationing from the visual inspection). According to the owner's representative, the embankment foundation at the location of the slide of the upstream slope was an organic clay. Apparently, wood piling driven at the toe of the dam was necessary to stabilize the slope. This slope movement damaged the original outlet works, leading to abandonment of these outlet works and installation of the current outlet works system. Also, according to the PennDER File No. 58-127, the upstream and downstream slopes were originally constructed steeper than the design. These slopes were later revised (flattened) at the request of PennDER representatives. A leak developed along the outlet conduit shortly after the reservoir was filled. The leak was reportedly due to undercompaction of the earthfill around the conduit. This material was required to be excavated and recompacted in a satisfactory manner. Subsequent inspections did not note any seepage at this location. Additional changes required during construction of the dam were the placement of riprap in the spillway discharge channel to protect the toe of the dam, and the installation of a splash basin for the discharge from the outlet conduit.

General experience with slopes of inclinations and heights similar to those of this dam indicates that the stability could be shown to meet the necessary criteria. However, because of the history of unsatisfactory performance of the

upstream slope during construction (note that the existing slope is flatter than the original construction slope) and the fact that minor sloughing was observed on the downstream slope during the visual inspection, it is recommended that future inspections carefully monitor the area of sloughing and that quantitative assessments of the stability be performed if additional or progressive signs of slope distress are observed.

c. Operating Records - No operating records are available. Nothing in the procedures described by the owner's representative indicates concern relative to the structural stability of the dam.

d. Post-Construction Changes - Construction and post-construction changes have been discussed in paragraph 6.1.b. No additional changes affecting the structural stability of the dam have been performed.

e. Seismic Stability - The dam is located in Seismic Zone 1 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of minor seismic activity. Therefore, further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - Loomis Lake Dam was found to be in fair overall condition at the time of inspection. Loomis Lake Dam is a "Significant" hazard - "Small" size dam requiring a spillway capacity in the range of the 100-year flood to the 1/2 PMF. The 1/2 PMF was chosen as the SDF. As presented in Section 5, the spillway and reservoir are capable of passing the 1/2 PMF without overtopping the dam. Therefore, the spillway is considered "Adequate."

The clear seeps and localized sloughing observed during the visual inspection do not indicate immediate concern for the continued structural stability of the dam. It is recommended that future inspections monitor the seeps and area of sloughing. Should turbidity or an increase in flow be observed for the seeps or continued/ progressive movement occur at the area of sloughing, then more detailed investigations should be performed.

b. Adequacy of Information - The information available and the observations made during the visual inspection are considered sufficient for this Phase I Inspection Report.

c. Urgency - The owner should immediately initiate the actions discussed in paragraph 7.2.

d. Necessity for Additional Data/Evaluation - No further investigation is necessary at this time.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed certain items of remedial work which should be immediately performed by the owner. Items 3 through 5 below should be performed under the guidance of a qualified professional engineer experienced in the design and construction of earth dams. These include:

1) Monitor the area of sloughing on the downstream slope for continued/progressive movement.

2) Monitor the seeps at the toe of the dam at stations 6+25 and 7+50 for turbidity and/or an increase in flow.

If either of items 1 or 2 above increases, then more detailed investigations and corrective measures may become necessary.

3) Repair the seep area at the left junction of the spillway weir and left training wall by placing additional clay fill upstream of the weir and repairing of the joint filler. The seep should then be monitored during future inspections of the dam.

4) Monitor the seep entering the discharge channel from the stone wall on the right side of the spillway discharge channel.

5) Develop a means of emergency upstream closure for the outlet conduit passing through the embankment.

6) Remove the cattails and debris from the spillway discharge channel.

7) Remove the vegetation and sediment from the discharge channel (concrete flume) of the outlet works.

8) Cut the trees and brush on the upstream and downstream slopes and continue to maintain this item in the future.

9) Fill the animal/rodent hole observed and implement a rodent control program.

10) Replace the wood cover on the valve pit for the abandoned outlet works or fill in with earth.

11) Coordinate with the township to expedite repairs to the abutment supports of the bridge over the channel.

In addition, the following operational measures are recommended to be undertaken by the owner:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, operation and record keeping procedures be developed and implemented. An emergency drawdown plan should be developed in case emergency drawdown should become necessary. These procedures should be included in a formal maintenance and procedures manual for the dam.

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH, TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Check List
Visual Inspection
Phase 1

Name of Dam Loomis Lake Dam **County** Susquehanna **State** PA **Coordinates** Lat. N 41°50.6'

Long. W 75°47.9'

NDI # PA 00048
PennDER # 58-127

Date of Inspection 29 October 1980 **Weather** Overcast **Temperature** 45° F.

Pool Elevation at Time of Inspection 1409.8 ft.* M.S.L. **Tailwater at Time of Inspection** 1394.9 ft. M.S.L.

*All elevations are referenced to the spillway crest, Elevation 1410.0 ft. M.S.L., as estimated from the USGS 7.5 minute topographic quadrangle, Montrose East, PA. These elevations are 18.5 ft. higher than those shown on the available plans for the dam.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Wayne D. Lasch
Jeffrey S. Maze

Owner's Representatives:

Mr. Irving Loomis, Jr.
Mr. Rolland Loomis

James G. Ulinski **Recorder**

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: LOOMIS LAKE DAM
NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

EMBANKMENT

Name of Dam LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Small amount of sloughing on downstream slope at Sta. 5+00. This area is about 6 ft. wide by 8 ft. high. Some scattered locations of brush and trees were observed on the downstream slope.	Observe this area in future inspections. Cut the brush and trees.

EMBANKMENT

Name of Dam LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good	
RIPRAP FAILURES	Minor amount of brush in upstream riprap.	Cut the brush.
ANIMAL/RODENT HOLES	Animal/rodent holes were observed near Sta. 6+00 on the downstream face approximately 20 feet below the crest.	Fill the animal/rodent holes and start a rodent control program.

EMBANKMENT

Name of Dam LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good	
ANY NOTICEABLE SEEPAGE	Small amount of clear seepage at downstream slope at Sta. 6+25, Sta. 7+50. The approximate rates of flow were 0.25 g.p.m. and 1 g.p.m., respectively.	These areas should be observed in future inspections and the condition recorded.
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	

PRESENT
OUTLET WORKS

Name of Dam: LOOMIS LAKE DAM
NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not Applicable	
INTAKE STRUCTURE	Submerged at time of inspection. No upstream closure is provided.	Upstream closure for the pipe should be provided.
OUTLET STRUCTURE	Good condition	
OUTLET CHANNEL	Vegetation and sediment has built up in the outlet channel.	Remove sediment and vegetation.
EMERGENCY GATE	Valve leaks a small amount of discharge.	

ABANDONED
OUTLET WORKS

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not Applicable	
INTAKE STRUCTURE	The upstream end of the pipe was plugged with concrete after pipe was damaged during construction.	
OUTLET STRUCTURE	The outlet end of the pipe could not be located.	
OUTLET CHANNEL	Not Applicable	
EMERGENCY GATE	Wood cover on valve pit on downstream slope is badly deteriorated.	Valve pit needs new cover or to be filled in for the protection of the general public.

UNGATED SPILLWAY

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Small amount of seepage between ogee spillway and training wall; estimated flow rate of 3 g.p.m.	Additional clay fill upstream of weir and/or repair of the joint material between the weir and training wall may reduce seepage. Observe seepage in future inspections and record the condition observed.
APPROACH CHANNEL	Good condition	
DISCHARGE CHANNEL	Small amount of debris and cattails. Minor amount (0.5 g.p.m.) of clear seepage entering from stone wall on right side of channel.	Remove debris and cattails. Observe seepage in future inspections and record the condition observed.
BRIDGE AND PIERS	Bridge over spillway channel with no piers in channel; however, bridge abutments and underlying rock are badly fractured.	The township has responsibility for the bridge and piers. Repairs are reportedly planned for the bridge.

GATED SPILLWAY - Not Applicable

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

INSTRUMENTATION

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

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

RESERVOIR

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

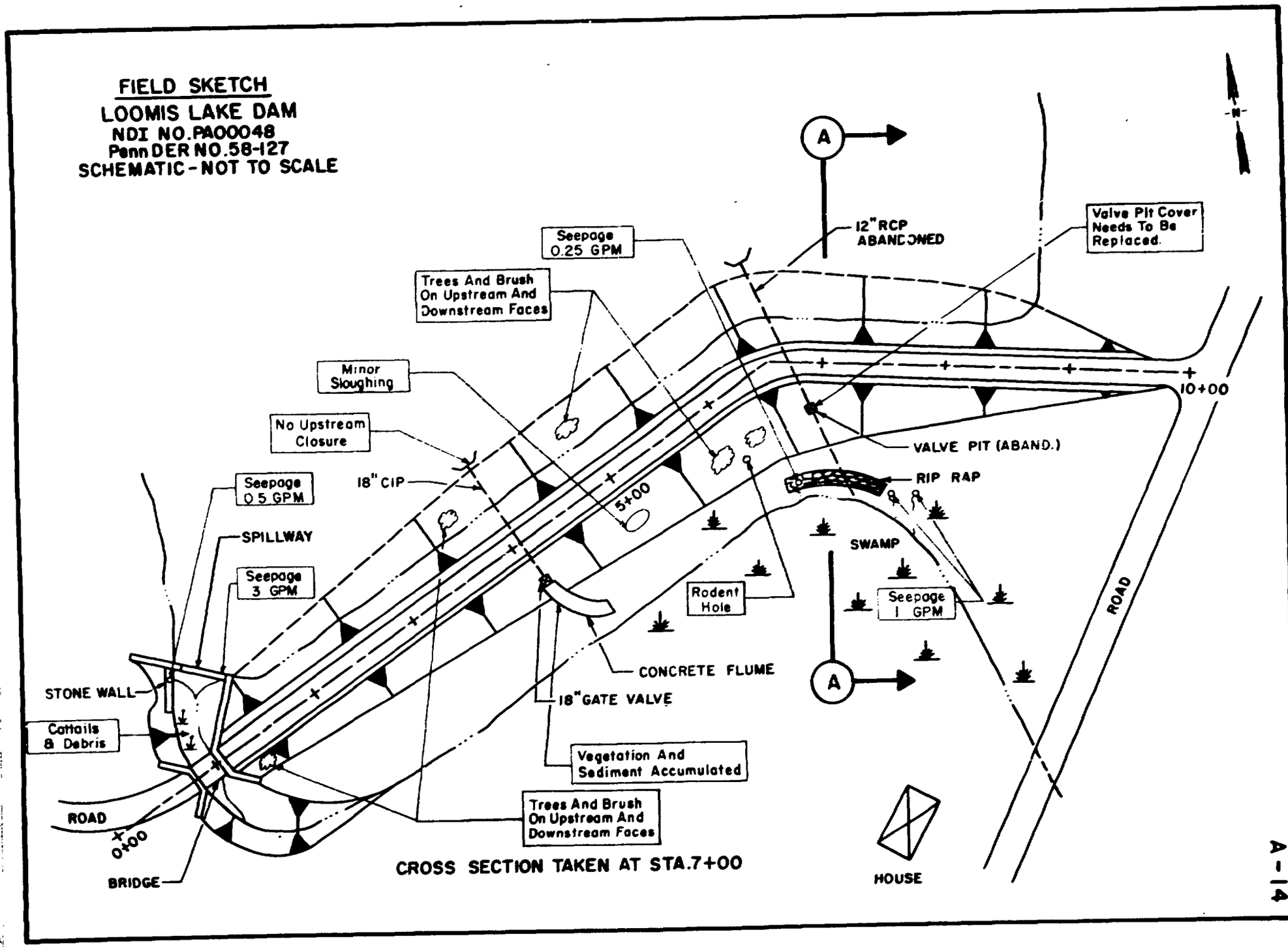
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate sloping with good growth of ground cover.	
SEDIMENTATION	Small amount of sediment in upper portion of reservoir.	
UPSTREAM DAMS	Lake Heart (PennDER # 58-98) is located upstream. No real embankment was observed. Some stonework has been placed in the outlet channel and a 30 ft. long, 20 in. C.M.P. on a 1% slope serves as the outlet for the lake.	

DOWNSTREAM CHANNEL

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)		
SLOPES	Moderately sloping with good growth of ground cover.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home and garage 500 ft. downstream of dam with a township road 600 ft. downstream.	


FIELD SKETCH
LOOMIS LAKE DAM
NDI NO. PA00048
Penn DER NO. 58-127
SCHEMATIC - NOT TO SCALE
A
12" RCP ABANDONED
Valve Pit Cover Needs To Be Replaced.
Seepage 0.25 GPM
Trees And Brush On Upstream And Downstream Faces
Minor Sloughing
No Upstream Closure
10+00
VALVE PIT (ABAND.)
RIP RAP
18" CIP
5+00
Seepage 0.5 GPM
SPILLWAY
SWAMP
Seepage 3 GPM
Rodent Hole
Seepage 1 GPM
ROAD
CONCRETE FLUME
STONE WALL
18" GATE VALVE
Cattails & Debris
Vegetation And Sediment Accumulated
Trees And Brush On Upstream And Downstream Faces
ROAD
0+00
BRIDGE
CROSS SECTION TAKEN AT STA.7+00
HOUSE
A-14

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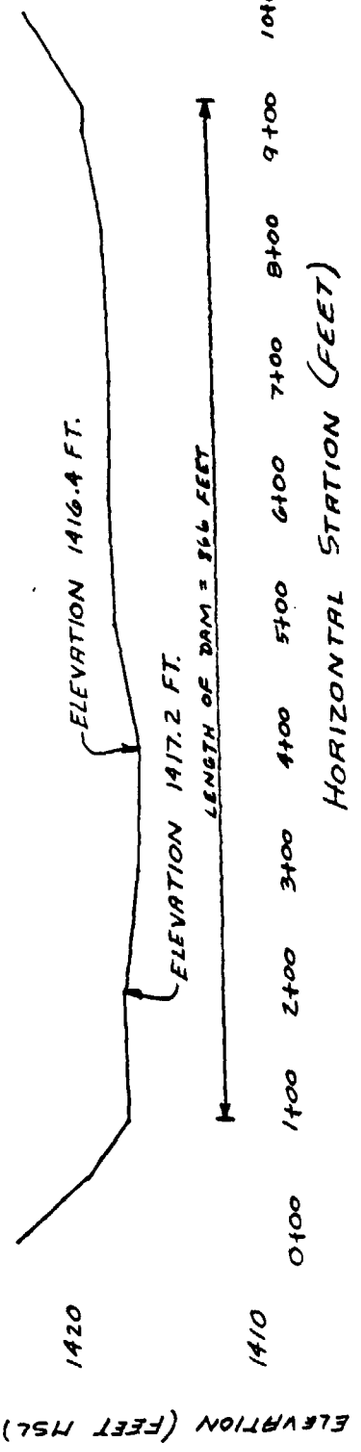
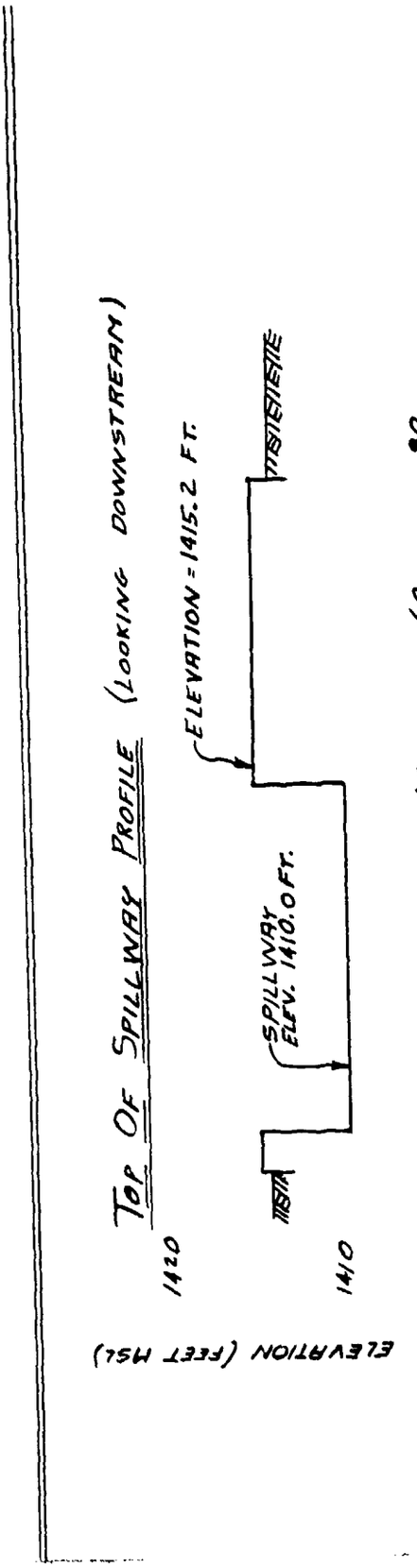
LOOMIS LAKE DAM

TOP OF DAM PROFILE
TOP OF SPILLWAY PROFILE

DATE OF INSPECTION: 29 October 1980





NOTE: Elevation On Plans By J.W. Alisbury Differs From USGS Montrose East, Pa. Quad. By 18.5 Feet. Elevation Determined By Using Field Notes And USGS Quad.

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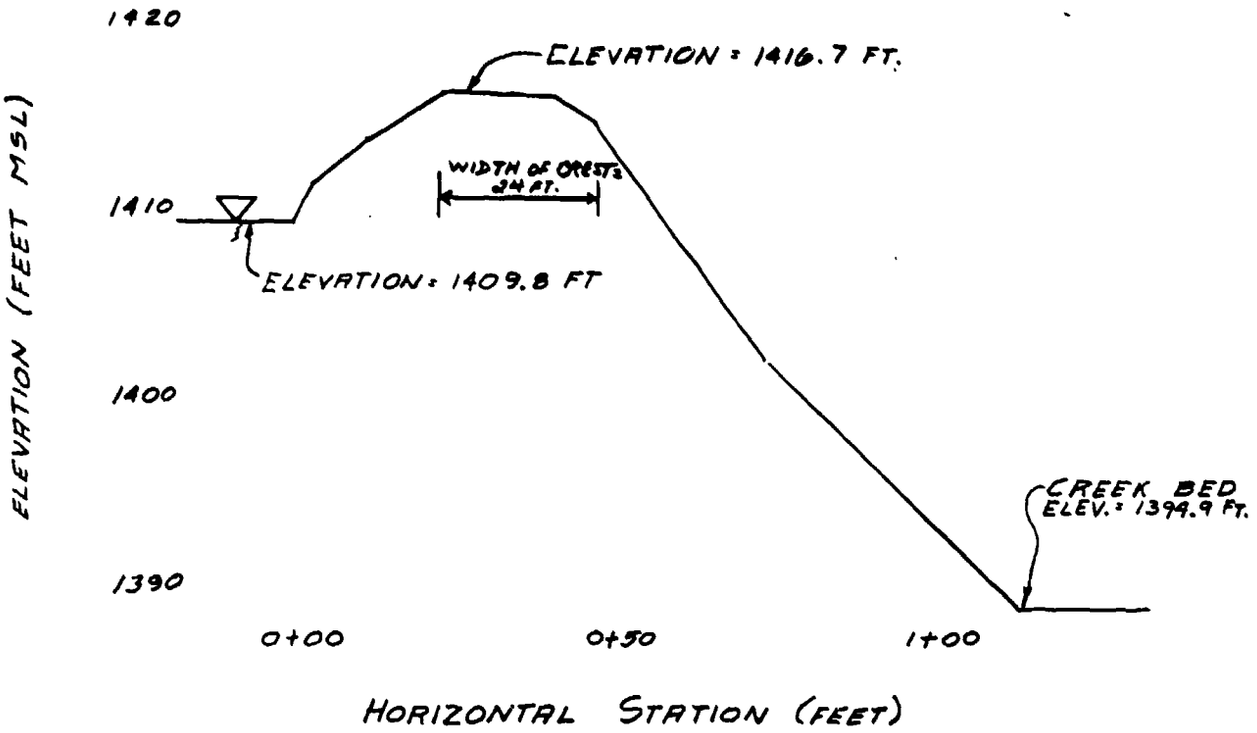
08

LOOMIS LAKE DAM

TYPICAL CROSS-SECTION

DATE OF INSPECTION: 29 October 1980

Typical Cross-Section @ Sta. 7+00



APPENDIX B

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: LOOMIS LAKE DAM
NDI # PA 00048

ITEM	REMARKS
PLAN OF DAM	See Plate 3 of this report.
REGIONAL VICINITY MAP	A USGS 7.5 minute topographic quadrangle of Montrose East, Pennsylvania was used to prepare the vicinity map which is enclosed in this report as the location plan (Plate 1).
CONSTRUCTION HISTORY	The dam was constructed by Irving M. Loomis & Sons with construction starting in December of 1959 and being completed in December of 1961.
TYPICAL SECTIONS OF DAM	See Plate 3
HYDROLOGIC/HYDRAULIC DATA	No information available.
OUTLETS - PLAN	See Plates 3 and 7 of this report.
- DETAILS	See Plates 3 and 7 of this report.
- CONSTRAINTS	No information available.
- DISCHARGE RATINGS	No information available.
RAINFALL/RESERVOIR RECORDS	No information available.

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

ITEM	REMARKS
DESIGN REPORTS	No information available.
GEOLOGY REPORTS	No geology reports are available for the dam. See Appendix F for regional geology.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No design computations are available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No information available.
POST-CONSTRUCTION SURVEYS OF DAM	None performed
BORROW SOURCES	Borrow was removed from area northeast of dam and from the bottom of the lake.

Name of Dam: LOOMIS LAKE DAM

NDI # PA 00048

ITEM	REMARKS
MONITORING SYSTEMS	None observed
MODIFICATIONS	None observed
HIGH POOL RECORDS	No information available.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None performed
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	No information available.

ITEM	REMARKS
SPILLWAY PLAN,	
SECTIONS, and DETAILS	See Plates 3 and 7 of this report.
	See Plates 3 and 7 of this report.
OPERATING EQUIPMENT PLANS & DETAILS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.14 sq.mi., mild slopes partially wooded, with some residential development

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1410.0 ft. M.S.L. (373 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1416.40 ft. M.S.L. (627 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1416.4 ft. M.S.L. (mininum top of dam)

SPILLWAY:

a. Crest Elevation 1410.0 ft. M.S.L.
b. Type Concrete ogee weir
c. Length of Crest Perpendicular to Flow 40 ft.
d. Location Spillover Right abutment
e. Number and Type of Gates None

OUTLET WORKS:

a. Type 18 in. diameter cast iron blow-off pipe
b. Location 320 ft. left of spillway
c. Entrance Inverts Unknown
d. Exit Inverts 1402.09 ft.
e. Emergency Drawdown Facilities The outlet works serve as the drawdown facilities

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam - Overall View of Dam from Right Abutment

Photograph Location Plan

Photo 1 - View of Spillway Crest from Right Abutment

Photo 2 - View of Township Road Bridge over Spillway Outlet Channel

Photo 3 - View of Spillway Outlet Channel Along Toe of Dam

Photo 4 - View of Downstream Channel from Crest of Dam

Photo 5 - View Along Upstream Slope from Right Abutment

Photo 6 - View Along Downstream Slope from Right Abutment

Photo 7 - View of Valve Box and Outlet Channel for the Outlet Channel

Photo 8 - Close-up of the Valve Box and Outlet Channel for the Outlet Conduit

Note: Photographs were taken on 29 October 1980.

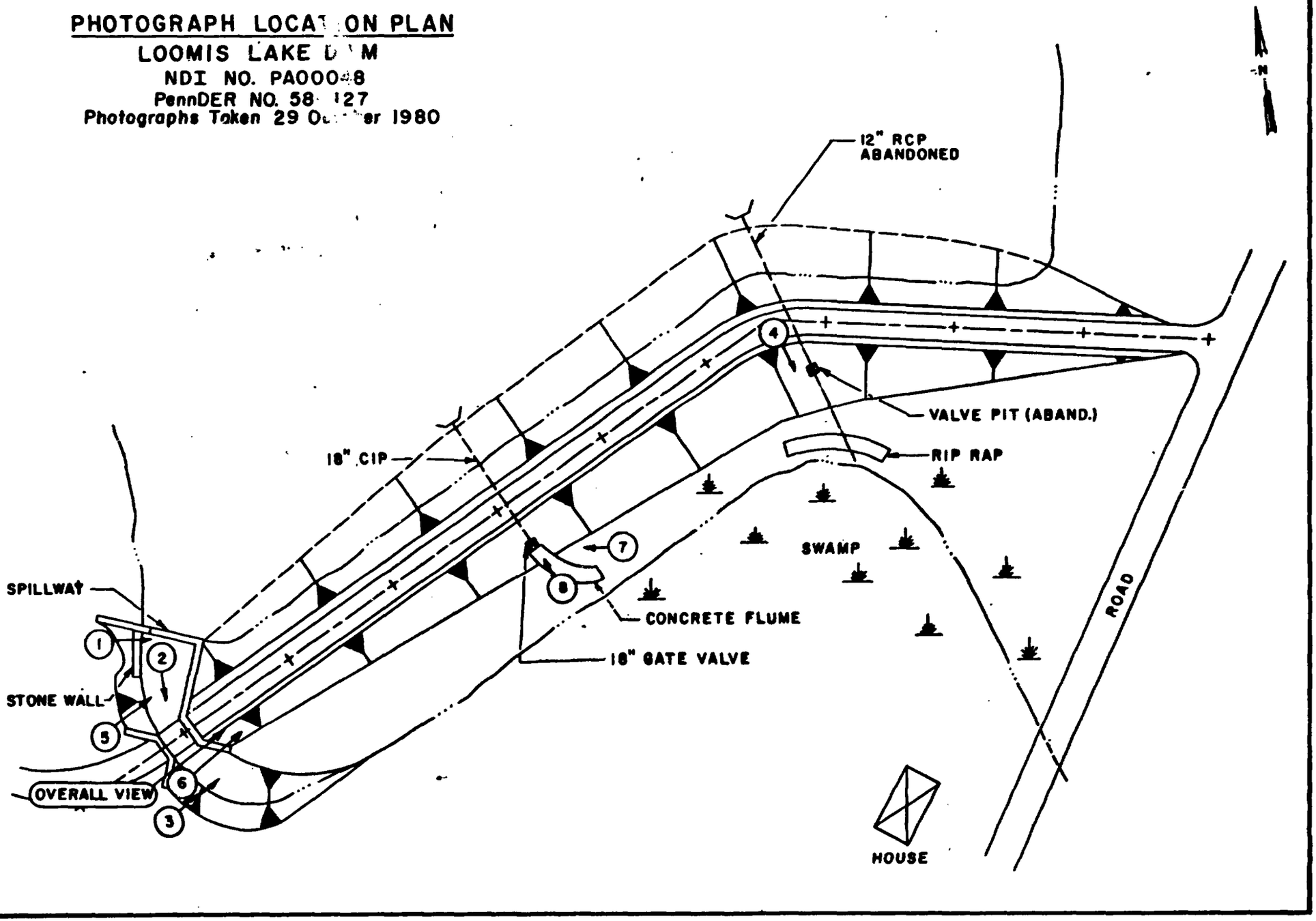
PHOTOGRAPH LOCATION PLAN

LOOMIS LAKE DAM

NDI NO. PA00048

PennDER NO. 58-127

Photographs Taken 29 October 1980



LOOMIS LAKE DAM

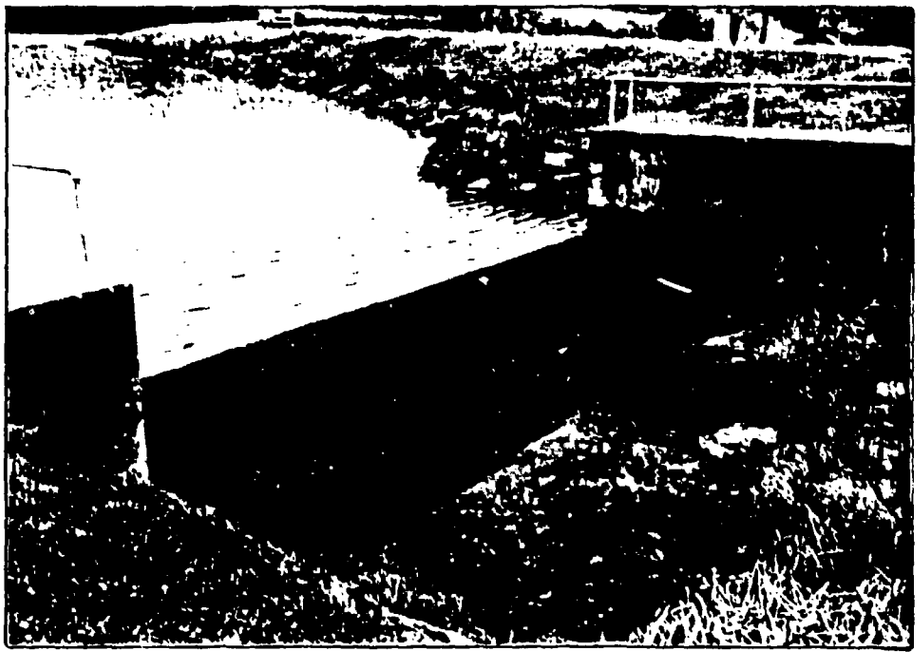


PHOTO 1. View of Spillway Crest from Right Abutment

PHOTO 2. View of Township Road Bridge over Spillway Outlet Channel

PHOTO 3. View of Spillway Outlet Channel Along Toe of Dam

PHOTO 4. View of Downstream Channel from Crest of Dam

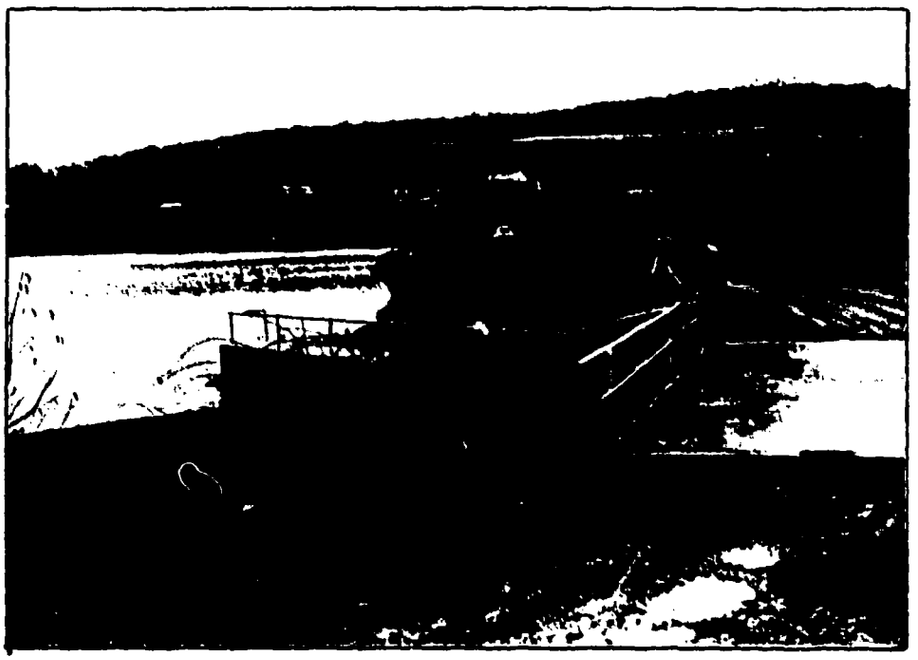


PHOTO 5. View Along Upstream Slope from Right Abutment

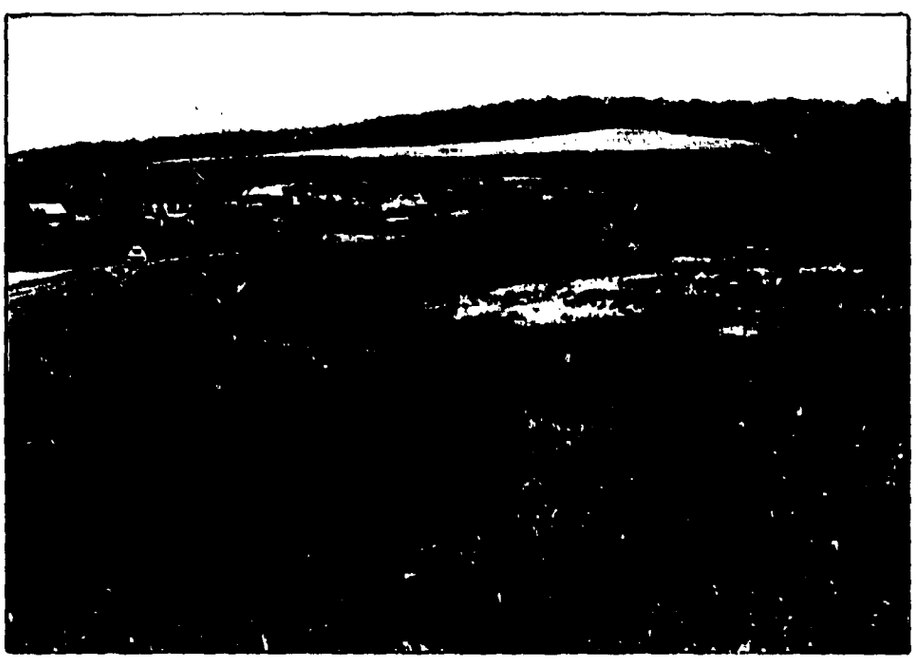


PHOTO 6. View Along Downstream Slope from Right Abutment

PHOTO 7. View of Valve Box and Outlet Channel for the Outlet Conduit

PHOTO 8. Close-up of Valve Box and Outlet Channel for the Outlet Conduit

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject LOOMIS LAKE DAM S.O. No. _____
APPENDIX D - HYDROLOGIC AND Sheet No. _____ of _____
HYDRAULIC COMPUTATIONS Drawing No. _____
Computed by _____ Checked by _____ Date _____

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variations of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed, however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: LOOMIS LAKE DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	LOOMIS LAKE DAM				
Drainage Area (square miles)	1.14				
Cumulative Drainage Area (square miles)	1.14				
Adjustment of PMF for Drainage Area (%)[1]	ZONE I				
6 Hours	137				
12 Hours	147				
24 Hours	156				
48 Hours	160				
72 Hours	---				
Snyder Hydrograph Parameters					
Zone [2]	ZONE 11				
C_p/C_t [3]	0.62/1.50				
L (miles) [4]	1.78				
L_{ca} (miles) [4]	0.64				
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	1.56				
Spillway Data					
Crest Length (ft)	40.0				
Freeboard (ft)	6.4				
Discharge Coefficient	(DISCHARGE RATING CURVE				
Exponent	DEVELOPED ON SHEETS 6-8)				

(1) Hydrometeorological Report 40, Office of Hydrology, U.S. Weather Bureau, May 1965.

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

(3) Snyder's Coefficients.

(4) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

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Subject LOOMIS LAKE DAM — S.O. No.
HYDRAULIC DATA — Sheet No. 2 of 13
Drawing No.
Computed by GWT — Checked by WDL — Date 12-10-80

STORAGE CALCULATIONS

AREA VS. ELEVATION DATA (MEASURED FROM QUADS)

ELEVATION (FT)	SURFACE AREA (ACRES)
1410	33.98
1420	53.26
1440	82.64

NORMAL POOL STORAGE

STORAGE VOLUME : $V_{NP} = h/3\,(A_1 + A_2 + \sqrt{A_1 A_2})$

h = ESTIMATED AVERAGE DEPTH = 12.2 FT
A_1 = SURFACE AREA OF NORMAL POOL = 33.98 Ac.
A_2 = SURFACE AREA OF RESERVOIR BOTTOM = 27.23 Ac.
(ESTIMATED FROM AVERAGE DEPTH AND RESERVOIR SIDE SLOPES)

NORMAL POOL STORAGE : $V_{NP} = 12.2/3\,(33.98 + 27.23 + \sqrt{33.98 \times 27.23})$

$V_{NP} = 372.62$ AC.-FT.

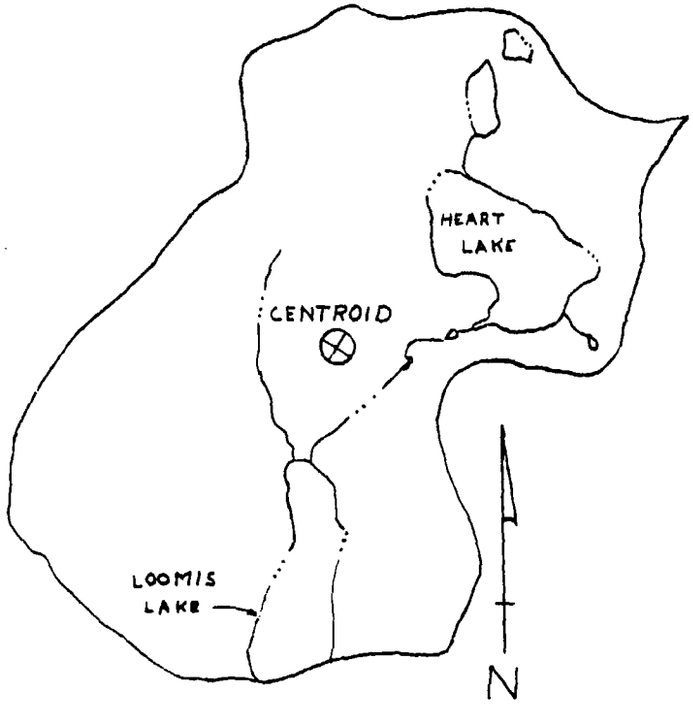
TOP OF DAM STORAGE

627 Ac.-Ft. (FROM HEC-1 ANALYSIS)

SNYDER'S UNIT HYDROGRAPH PARAMETERS

$L = 1.78$ Mi., $L_{ca} = 0.64$ Mi.
$C_p = 0.62$, $C_T = 1.50$
$t_p = 1.50\,(L \times L_{ca}) = 1.50(1.78 \times 0.64)^{0.3} = 1.56$
WATERSHED IS IN ZONE II

DRAINAGE AREA = 1.14 Sq. Mi.



LOOMIS LAKE:
DRAINAGE AREA AND CENTROID MAP

QUAD:
MONTROSE EAST

0 2000 4000 6000 FEET

SCALE: 1" = 2000'

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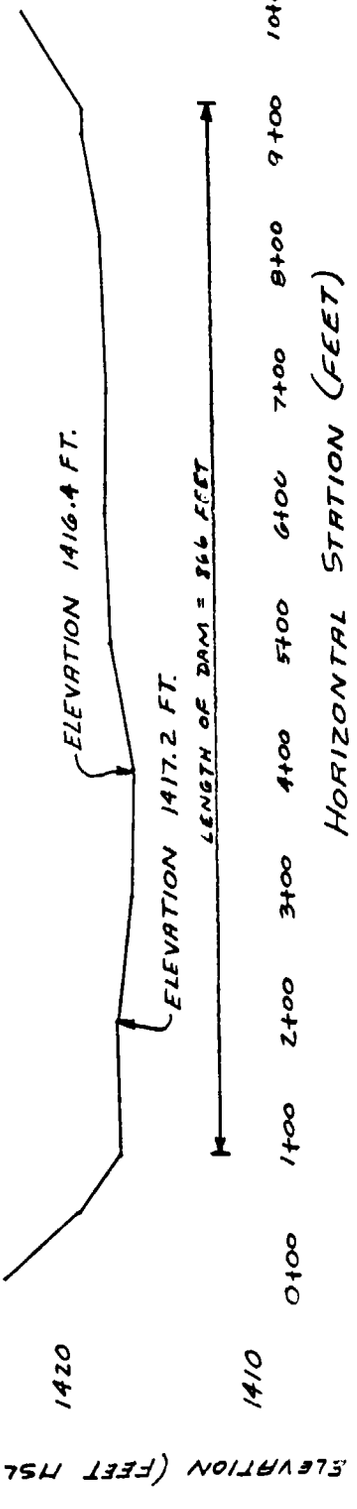
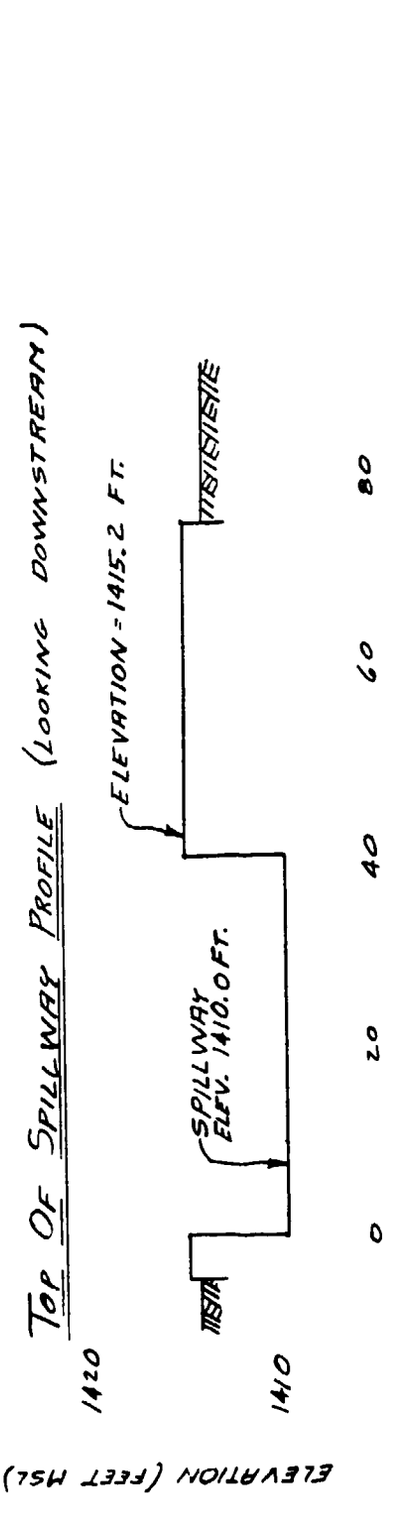
Subject LOOMIS LAKE DAM — S.O. No. 13937-00-ARA-08
TOP OF DAM PROFILE — Sheet No. 4 of 13
TOP OF SPILLWAY PROFILE — Drawing No.
Computed by GWT — Checked by WDC — Date 11-17-80





NOTE: ELEVATION ON PLANS BY J.W. ALISBURY DIFFERS FROM USGS MONTROSE EAST, PA. QUAD. BY 18.5 FEET. ELEVATION DETERMINED BY USING FIELD NOTES AND USGS QUAD.

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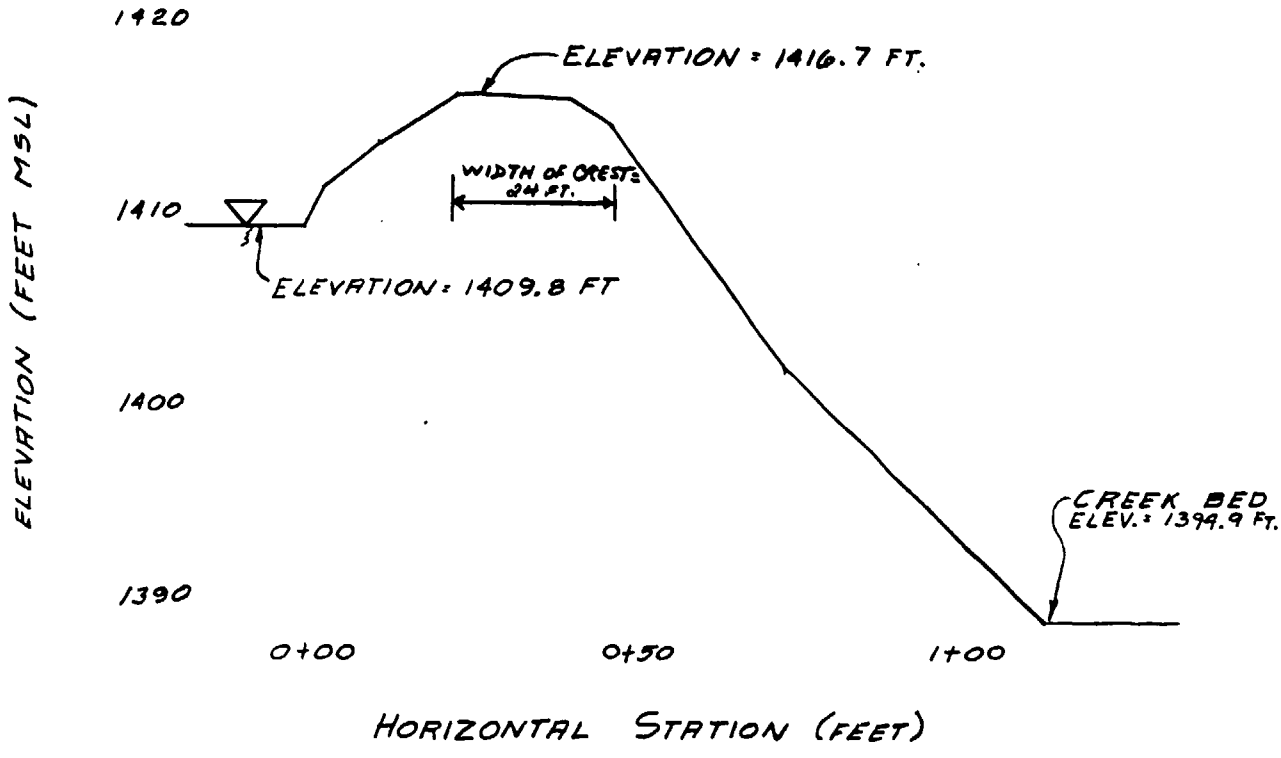
Subject LOOMIS LAKE DAM S.O. No. 13837-00-AAA-00
TYPICAL CROSS-SECTION Sheet No. 5 of 13
Drawing No.
Computed by GWT Checked by WJL Date 11-18-80

TYPICAL CROSS-SECTION @ STA. 7+00



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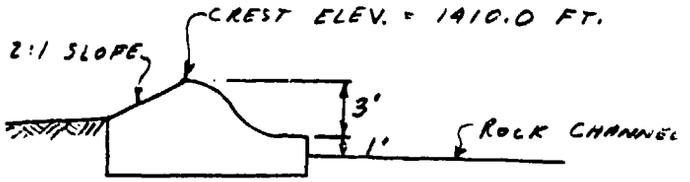
Subject LOONIS LAKE DAM — S.O. No.
SPILLWAY RATING — Sheet No. 6 of 13
Drawing No.
Computed by GWT — Checked by WDL — Date 12-11-80

SPILLWAY PROFILE

SPILLWAY IS CONCRETE, OGEE WEIR WITH AN INCLINED FACE



THE GENERALIZED DESIGN CURVES FOR SHAPING OGEE WEIRS IN DESIGN OF SMALL DAMS, U.S. DEPT. OF THE INTERIOR, BUREAU OF RECLAMATION, WERE USED TO DETERMINE THAT THE DESIGN HEAD FOR THIS WEIR IS APPROXIMATELY 2.0 FT. (H_o = 2.0 FT.)

$\frac{P}{H_o} = \frac{\text{APPROACH DEPTH}}{H_o} = \frac{2.0}{2.0} = 1$

USING FIGURES 249-254 IN DESIGN OF SMALL DAMS:
FOR $\frac{P}{H_o} = 1$, C_o FOR A VERTICAL-FACED WEIR IS 3.88
CORRECTION FACTOR FOR THE INCLINED FACE IS 0.994
$C_{INCLINED} = 0.994 \times 3.88 = 3.86$

SPILLWAY RATING

$Q = CLH^{3/2}$
$Q = 154.4\ H^{3/2}$

C = WEIR COEFFICIENT = 3.86
L = WEIR LENGTH = 40 FT
H = VARIES

ELEVATION, (FT)	DEPTH, H (FT)	Q (CFS)
1410.0	0	0
1411.0	1.0	154.40
1412.0	2.0	436.71
1413.0	3.0	802.28
1414.0	4.0	1,235.20
1415.0	5.0	1,726.24
1416.0	6.0	2,269.21
1417.0	7.0	2,859.53
1417.5	7.5	3,171.31
1418.0	8.0	3,493.67

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Subject LOOMIS LAKE DAM S.O. No.
SPILLWAY TRAINING WALL RATINGS Sheet No. 7 of 13
Drawing No.
Computed by GWT Checked by WDL Date 12-11-80

WEIR FLOW OVER SPILLWAY TRAINING WALLS FROM RESERVOIR.

$Q = C L H^{3/2}$

C VARIES WITH THE HEAD (FROM TABLE 5-3 BRATER + KING)
L = LENGTH OF TRAINING WALL BEING OVERTOPED
H = VARIES

RIGHT TRAINING WALL (5 FT. WIDE)				
ELEVATION (FT)	C	L (FT)	H (FT)	Q (CFS)
1415.2	2.34	0	0	0
1415.5	2.42	35.0	0.3	13.92
1416.0	2.68	35.0	0.8	67.12
1416.5	2.65	35.0	1.3	137.48
1417.0	2.65	35.0	1.8	223.99
1417.5	2.66	35.0	2.3	324.74
1418.0	2.66	35.0	2.8	436.20

LEFT TRAINING WALL (5 FT. WIDE)				
ELEVATION, (FT)	C	L, (FT)	H, (FT)	Q, (CFS)
1415.4	2.34	43.5	0	0
1415.5	2.34	43.5	0.1	3.22
1416.0	2.70	43.5	0.6	54.58
1416.5	2.67	43.5	1.1	133.99
1417.0	2.65	43.5	1.6	233.30
1417.5	2.65	43.5	2.1	350.80
1418.0	2.66	43.5	2.6	485.10

LEFT TRAINING WALL (2 FT. WIDE)				
ELEVATION, (FT)	C	L, (FT)	H, (FT)	Q, (CFS)
1416.7	2.54	7.5	0	0
1417.0	2.57	7.5	0.3	3.17
1417.5	2.60	7.5	0.8	13.95
1418.0	2.73	7.5	1.3	30.35

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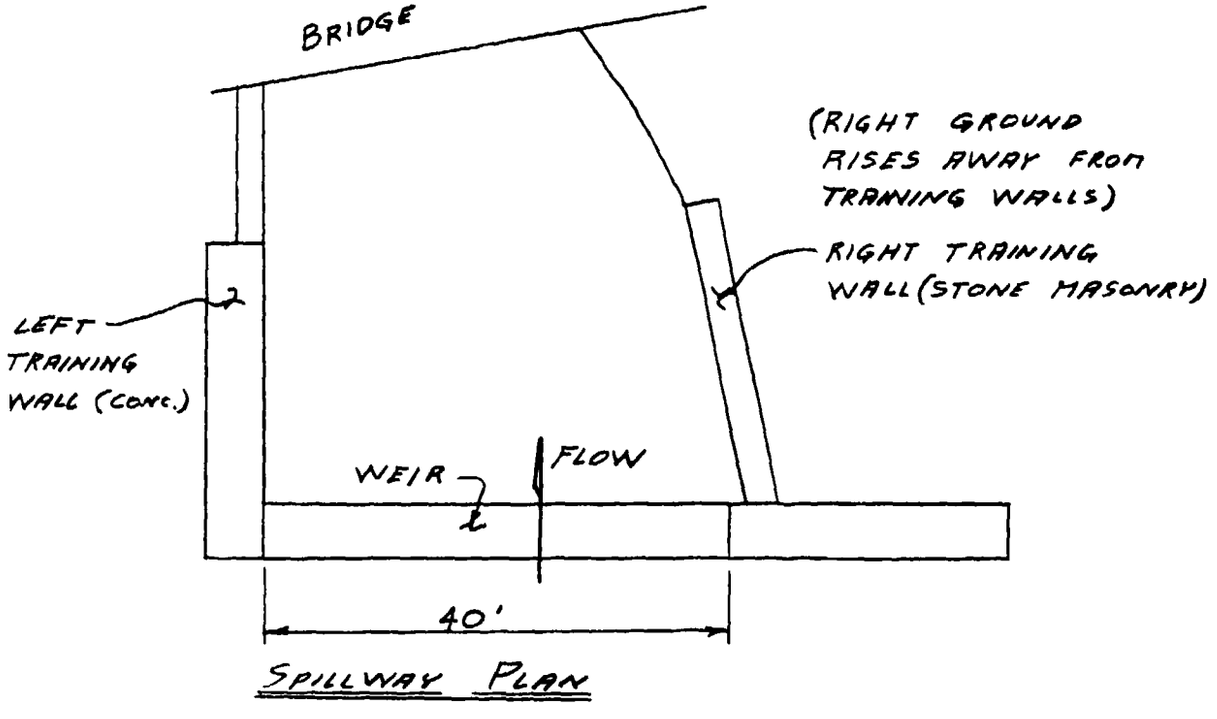
Subject LOOMIS LAKE DAM S.O. No.
COMBINED RATING CURVE Sheet No. 8 of 13
Drawing No.
Computed by GWT Checked by WDL Date 12-11-80

SPILLWAY CHANNEL CAPACITY WAS CONSIDERED AND FOUND TO BE EQUAL TO OR GREATER THAN THE SPILLWAY CAPACITY

ELEVATION, (FT)	Q RT. TRAIN. WALL, (CFS)	Q LT. TRAIN. WALL, (CFS)	Q LT. TRAIN. WALL, (CFS)	Q. SPILLWAY, (CFS)	TOTAL Q, (CFS)
1410.0	0	0	0	0	0
1411.0	0	0	0	154.40	154.40
1412.0	0	0	0	436.71	436.71
1413.0	0	0	0	802.28	802.28
1414.0	0	0	0	1,235.20	1,235.20
1415.0	0	0	0	1,726.24	1,726.24
1416.0	67.12	54.58	0	2,269.21	2,390.91
1417.0	223.99	233.30	2.17	2,859.53	3,319.99
1417.5	324.74	350.80	13.95	3,171.31	3860.80
1418.0	436.20	485.10	30.35	3,493.67	4,445.32



SPILLWAY PLAN

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  HBJ UPDATE         04 JUN 79
**********
     1              A1       NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
     2              A2       HYDROLOGIC AND HYDRAULIC ANALYSIS OF LOOMIS LAKE DAM
     3              A3       UNIT HYDROGRAPH BY SNYDERS METHOD
     4              B     300        0       15        0        0        0        0        0       -4        0
     5              B1      5
     6              J       1        5        J
     7              J1    1.0     0.75     0.50     0.25     0.10
     8              K       0        1                                    1
     9              K1       RUNOFF HYDROGRAPH TO DAM
    10              M       1        1     1.14
    11              P               22.2      137      147      156      160
    12              T                                                    1.0     0.05
    13              R    1.56     0.62
    14              X    -1.5    -0.05      2.0
    15              K       1        2                                    1
    16              K1       ROUTING FOR LOOMIS LAKE DAM
    17              Y                                 1        1
    18              Y1                                                -1410.0     -1
    19              Y4    1410     1411     1412     1413     1414     1415     1416     1417   1417.5     1418
    20              Y5       0    154.4    436.7    862.3   1235.2   1726.2   2390.9   3320.0   3860.8   4445.3
    21              $A   27.23    33.98    53.26    82.64
    22              $E 1397.8     1410     1420     1440
    23              $$ 1410.0
    24              $J 1416.4     3.08      1.5      866
    25              $L       0      300      520      850      925      960
    26              $J 1416.4   1417.0   1417.5   1418.0   1418.5   1419.0
    27              K      99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**********

 RUN  DATE 06/22/81
      TIME    11.41
```

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
HYDROLOGIC AND HYDRAULIC ANALYSIS OF LOOMIS LAKE DAM
UNIT HYDROGRAPH BY SNYDERS METHOD

JOB SPECIFICATION

NJ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JLPER	NRT	LROPT	TRACE
5	0	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= 1.00 0.75 0.50 0.25 0.15

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF HYDROGRAPH TO DAM

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISAME	ISAPE	LOCAL
1	1	1.14	0.0	1.14	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	22.20	137.00	147.00	156.00	160.30	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CRVNU	ALSMX	RTIMP
0	0.0	0.0	1.00	0.0	0.0	1.00	1.00	0.00	0.0	0.0

UNIT HYDROGRAPH DATA
TP= 1.50 CP=0.62 NTA= 0

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

UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG= 1.50 HOURS, CP= 0.62 VOL= 1.00

17.	53.	125.	193.	292.	286.	297.	273.	251.	194.
152.	133.	114.	96.	80.	67.	57.	48.	40.	33.
28.	24.	20.	17.	14.	12.	10.	8.	7.	6.
5.	4.	3.	3.	2.					

END-OF-PERIOD FLOW

	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
10.CA	14.40												
									SUM	28.42	26.35	2.06	7004.
										722.31	669.31	52.31	2226.61

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

HYDROGRAPH ROUTING

ROUTING FOR LOOMIS LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
0	0	0	0.0	0.0	0.0	-1410.	-1

STAGE	1410.00	1411.00	1412.00	1413.00	1414.00	1415.00	1416.00	1417.00	1417.50	1418.00
FLOW	0.0	154.40	436.70	802.30	1235.20	1720.20	2350.00	3320.00	3800.00	4445.30
SURFACE AREA=		27.	34.	53.	83.					
CAPACITY=		0.	373.	805.	2154.					
ELEVATION=		1398.	1410.	1420.	1440.					

CREL	SPWID	CCOW	EXPW	ELEVL	CCOL	LAREA	EXPL
1410.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	CCOD	EXPD	DAMWID
1416.4	3.1	1.5	866.

CREST LENGTH	0.	300.	520.	850.	925.	960.
AT OR BELOW ELEVATION	1416.4	1417.0	1417.5	1418.0	1418.5	1419.0

PEAK OUTFLOW IS 3772. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 2647. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 1665. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 793. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 452. AT TIME 42.50 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	RATIO APPLIED TO FLOWS				
				RATIO 1 1.00	RATIO 2 0.75	RATIO 3 0.50	RATIO 4 0.25	RATIO 5 0.15
HYDROGRAPH AT	1	1.14 (2.95)	1	4016. (113.72)	3012. (85.29)	2008. (56.86)	1004. (28.45)	602. (17.06)
ROUTED TO	2	1.14 (2.95)	1	3772. (106.82)	2647. (74.95)	1665. (47.15)	793. (22.45)	452. (12.79)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

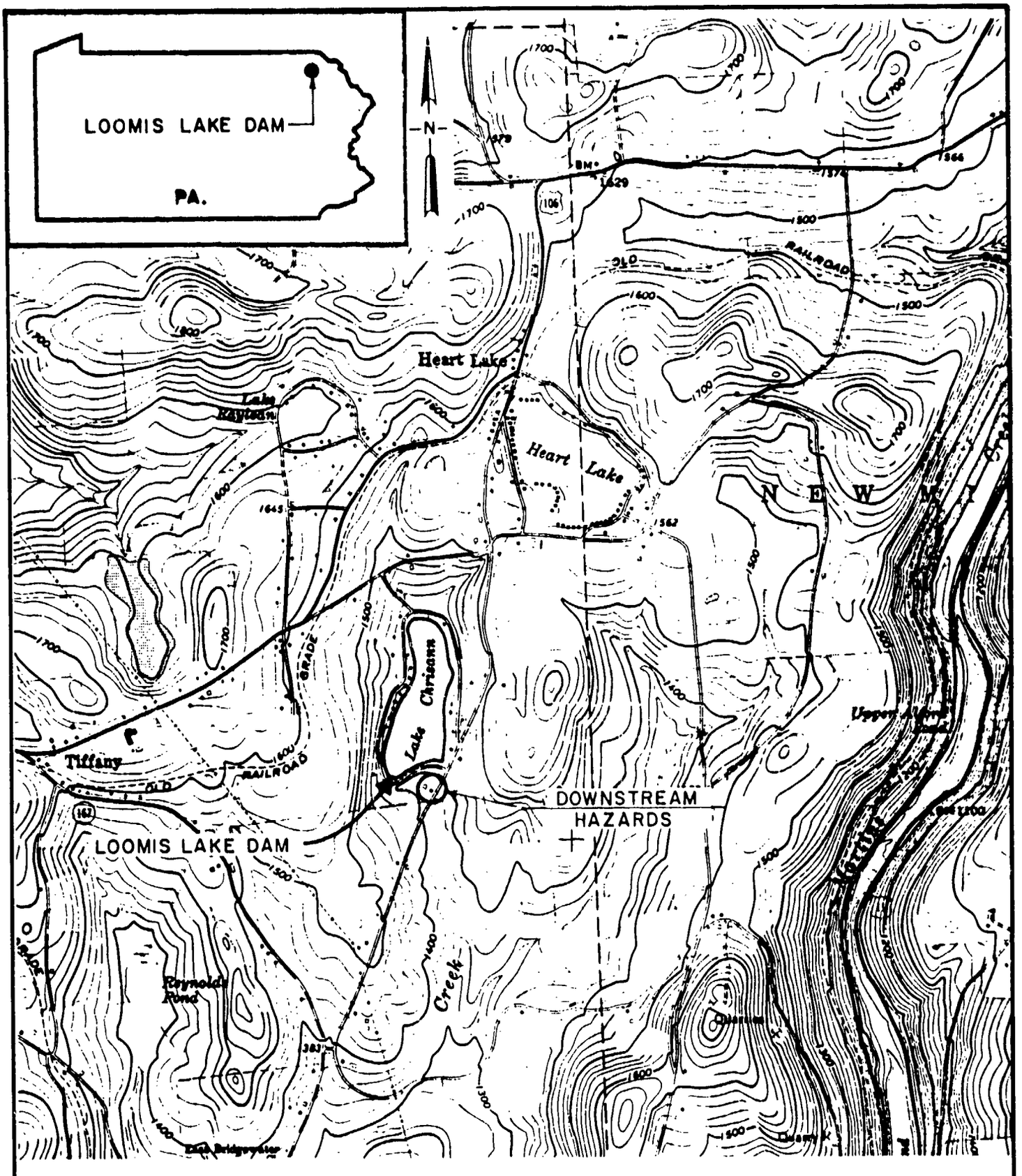
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1410.00	1410.00	1416.40
STORAGE	373.	373.	627.
OUTFLOW	0.	0.	2762.

RATIO OF PMF	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	1417.15	0.75	662.	3712.	2.25	41.50	0.0
0.75	1416.28	0.0	621.	2647.	0.0	42.00	0.0
0.50	1414.88	0.0	559.	1665.	0.0	42.00	0.0
0.25	1412.97	0.0	481.	793.	0.0	42.25	0.0
0.15	1412.04	0.0	446.	452.	0.0	42.50	0.0

APPENDIX E

PLATES

CONTENTS



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

REFERENCES:
1. U.S.G.S 7.5' MONTROSE EAST, PA. QUADRANGLE. PHOTOREVISED 1978

PLATE 1 LOCATION PLAN

LOOMIS LAKE DAM

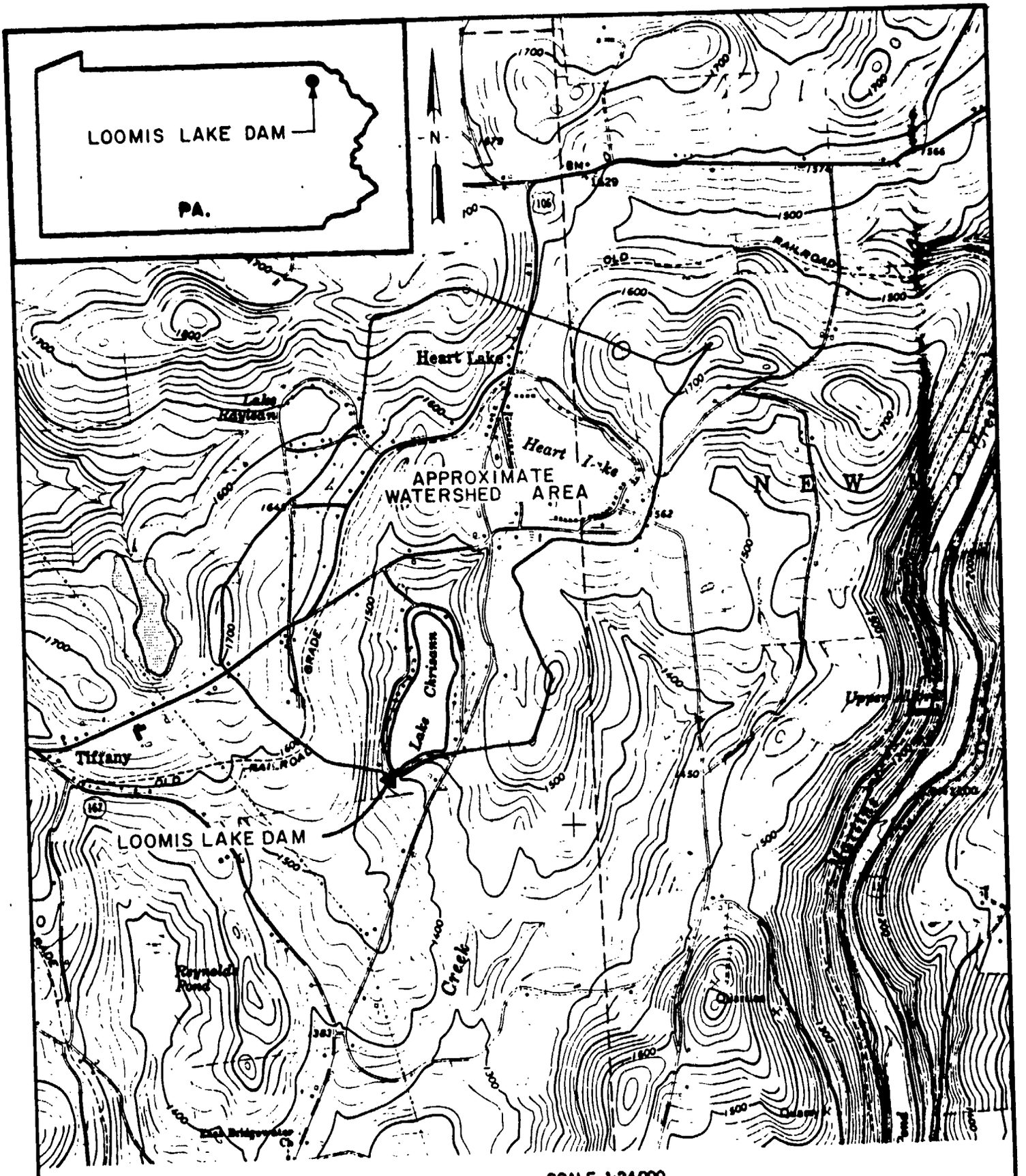
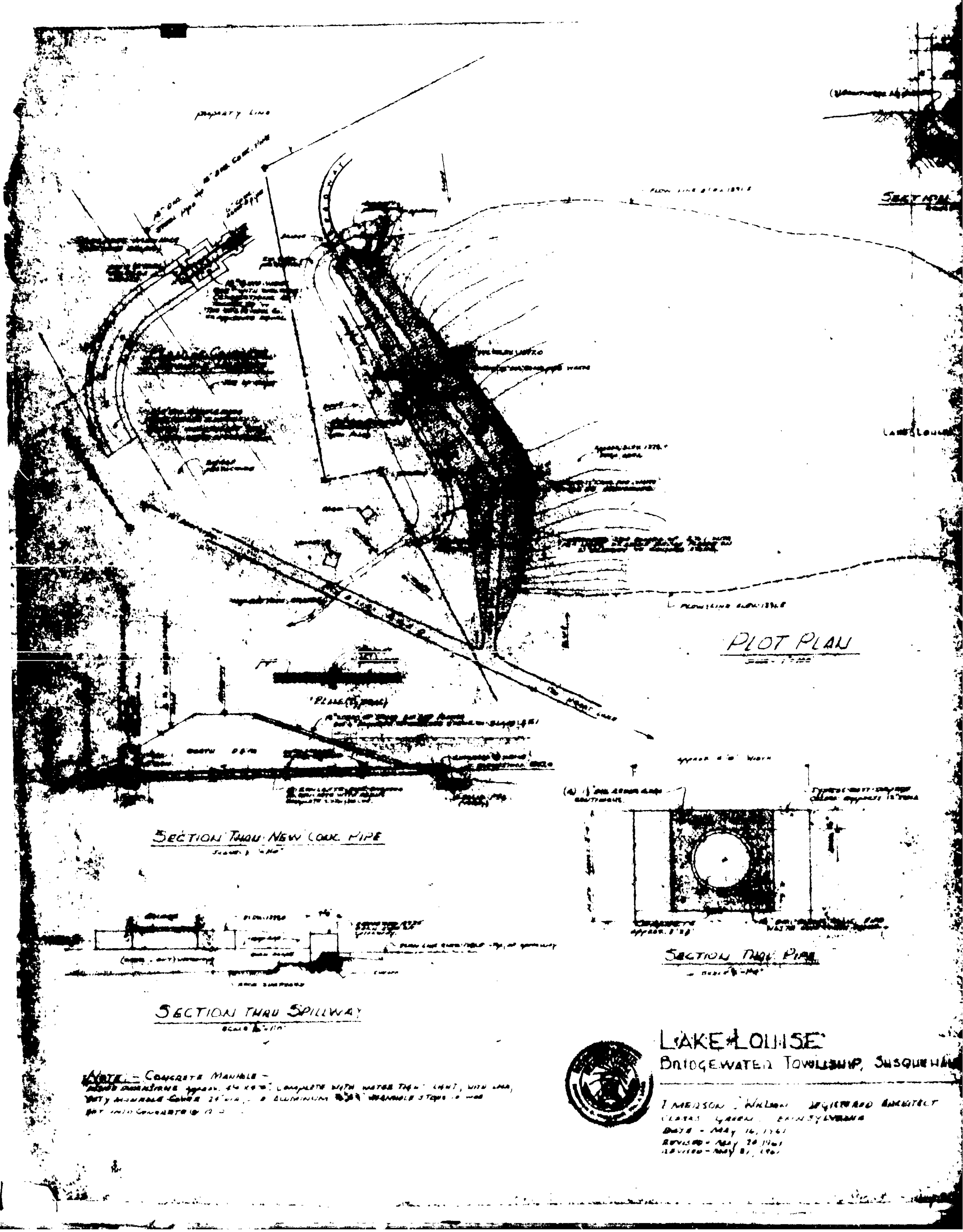


PLATE 2 WATERSHED MAP

LOOMIS LAKE DAM

REFERENCES:
1. U.S.G.S. 7.5' MONTROSE EAST, PA. QUADRANGLE. PHOTOREVISED 1978


PROPERTY LINE
PLOT PLAN
SECTION THRU NEW CONC. PIPE
SECTION THRU PIPE
SECTION THRU SPILLWAY
NOTE – CONCRETE MANHOLE –
LAKE LOUISE
BRIDGEWATER TOWNSHIP, SUSQUEHA

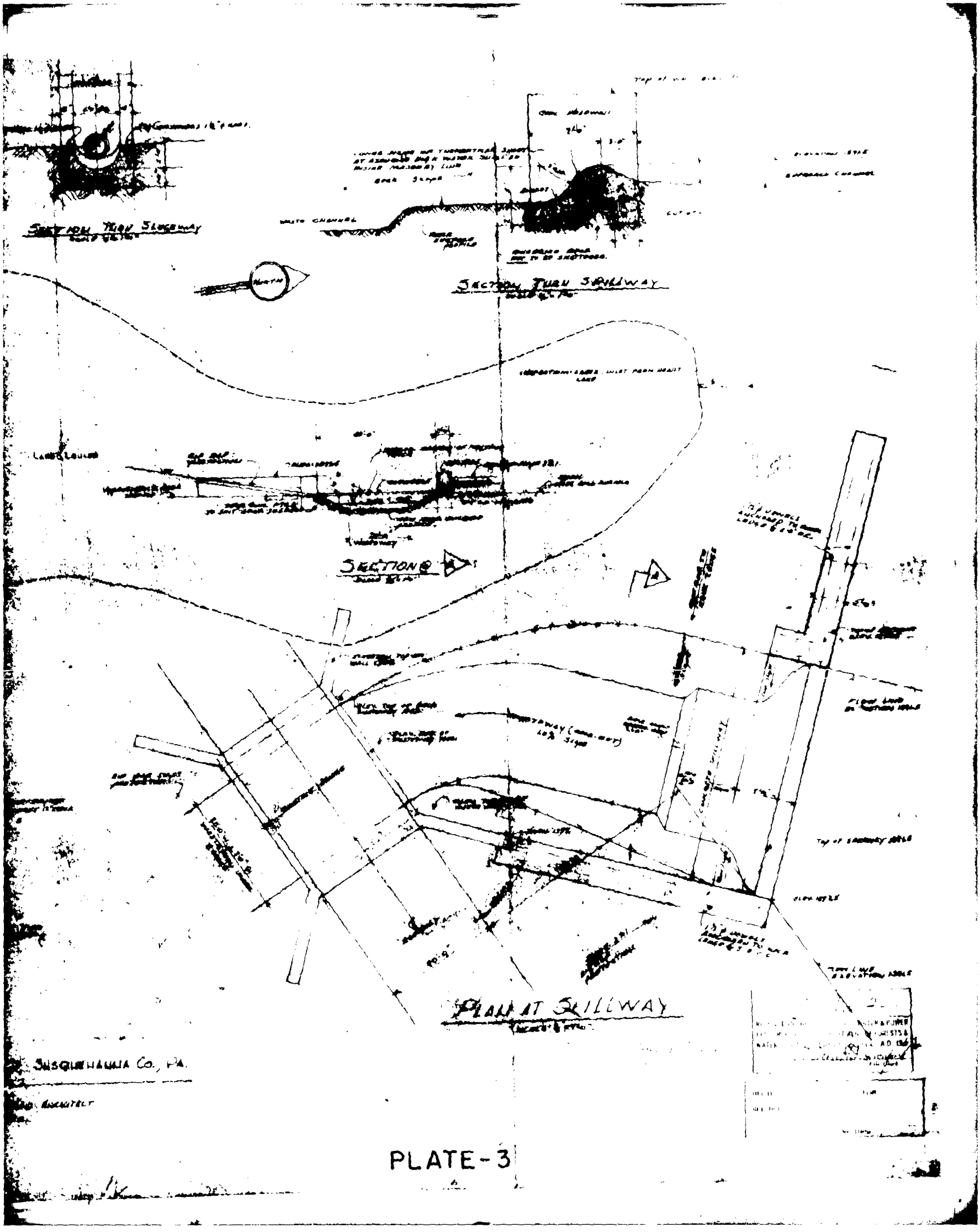
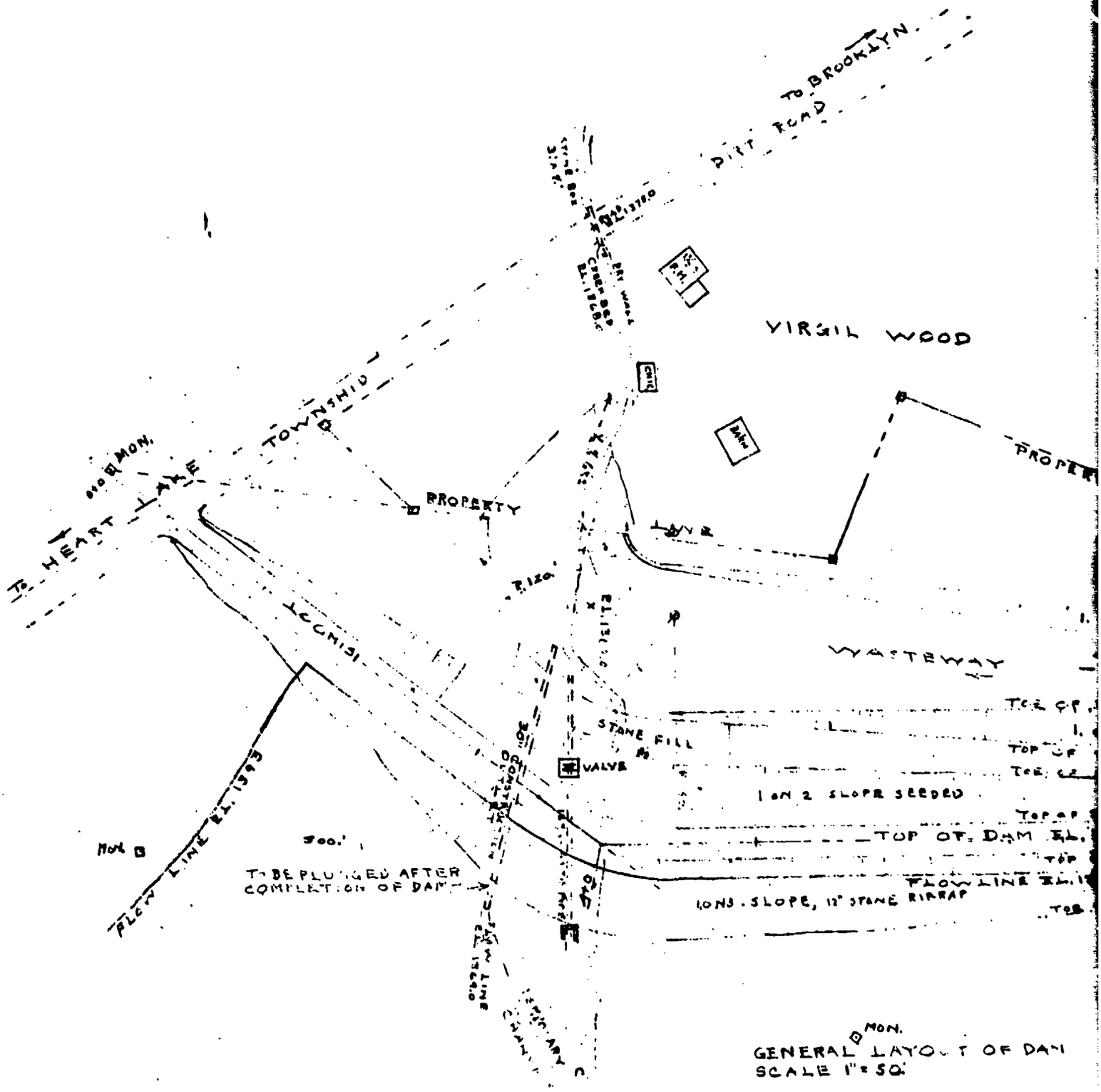

SECTION THRU SPILLWAY
SECTION THRU SPILLWAY
SECTION @
PLAN AT SPILLWAY
SUSQUEHANNA CO., PA.

PLATE-3


TO BROOKLYN
DIRT ROAD
VIRGIL WOOD
PROPERTY
TOWNSHIP
TO HEART LAKE
PROPERTY
WASTEWAY
TOE OF
TOP OF
1 ON 2 SLOPE SEEDED
TOP OF DAM EL.
FLOW LINE EL.
10 NS. SLOPE, 12" STONE RIPRAP
STONE FILL
VALVE
300.'
TO BE PLUGGED AFTER COMPLETION OF DAM
FLOW LINE EL. 1393
GENERAL LAYOUT OF DAM
SCALE 1" = 50'

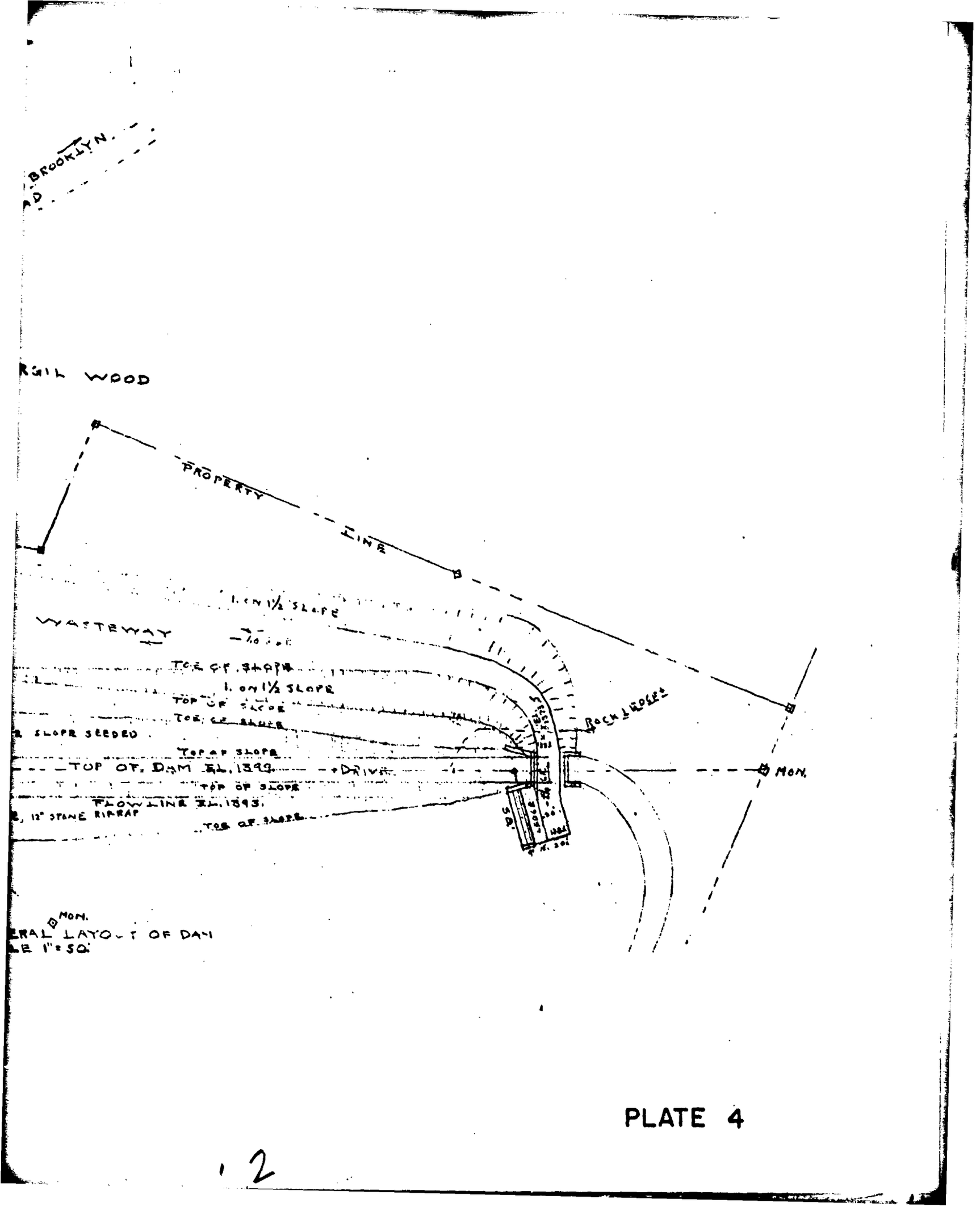
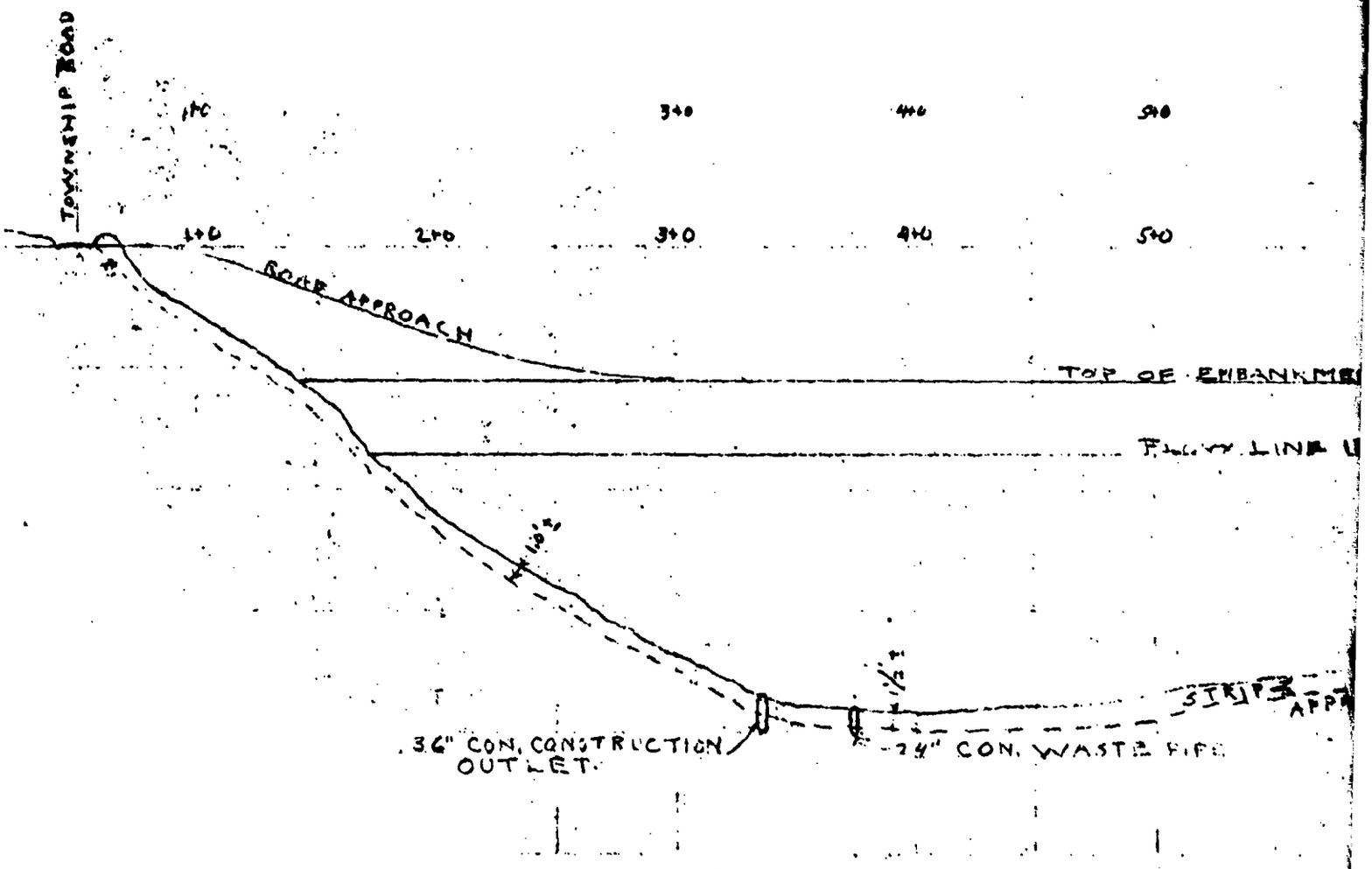

BROOKLYN
RAIL WOOD
PROPERTY LINE
WASTEWAY
1. on 1½ SLOPE
TOE OF SLOPE
1. on 1½ SLOPE
TOP OF SLOPE
TOE OF SLOPE
SLOPE SEEDED
TOP OF SLOPE
TOP OF DAM EL. 1399
DRIVE
MON.
TOP OF SLOPE
FLOW LINE EL. 1393.
12" STONE RIPRAP
TOE OF SLOPE
ROCK SLOPE
MON.
ERAL LAYOUT OF DAM
LE 1" = 50'

PLATE 4

12

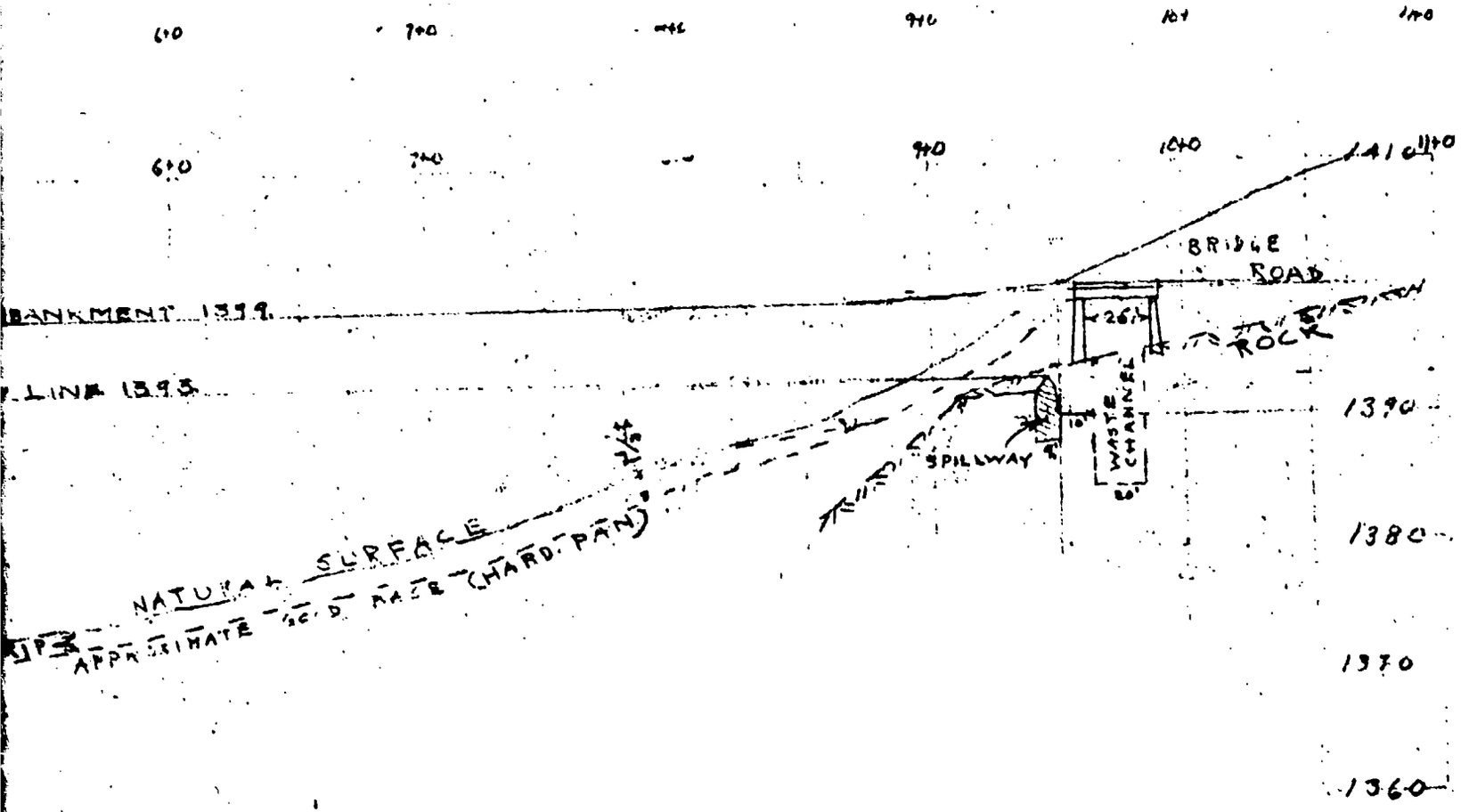


UPSTREAM

PROFILE ON CENTER LINE

SCALES HORIZONTAL 1" =

VERTICAL 1" =



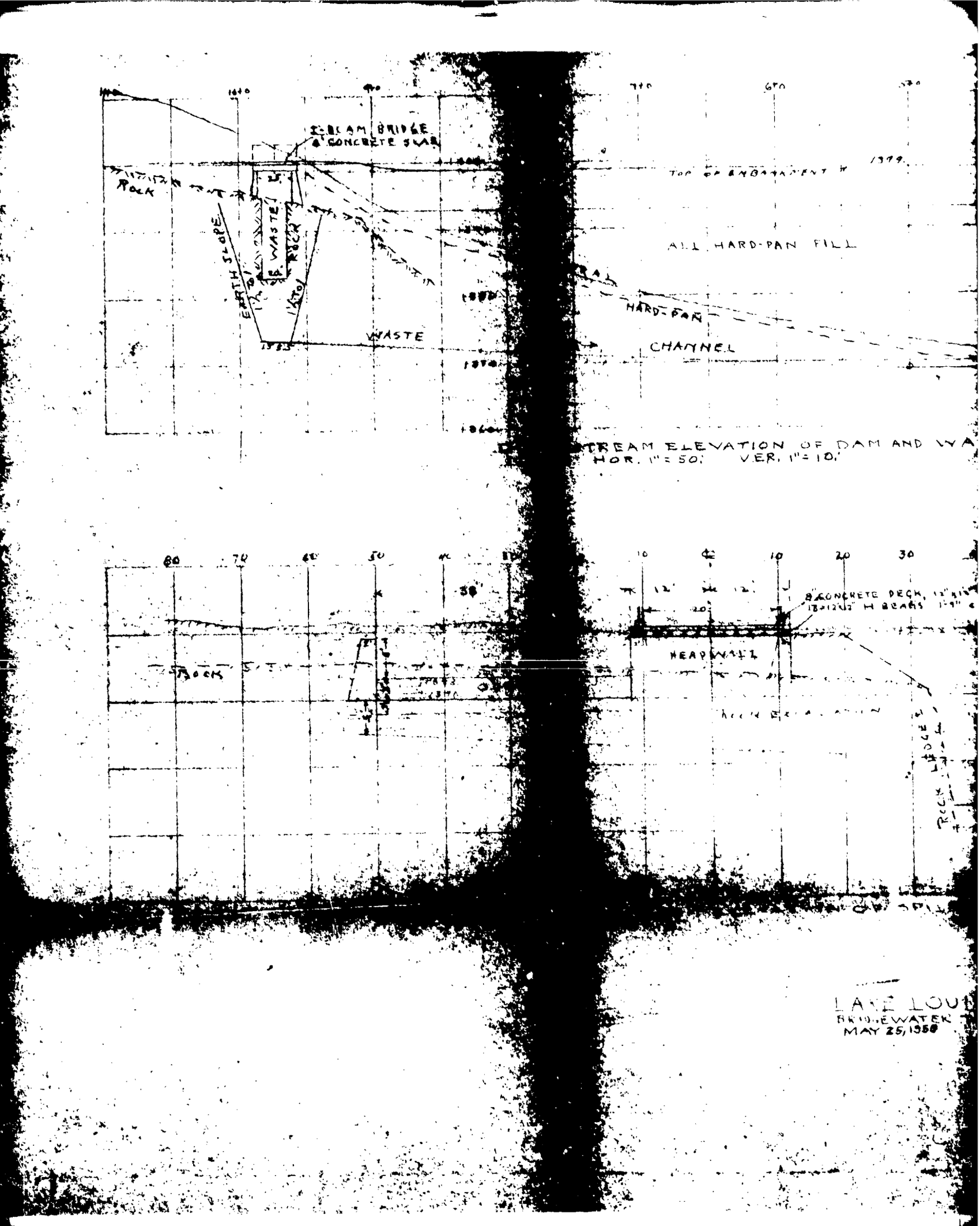
AM
R LINE OF DAM
AL 1" = 50'
1" = 10'

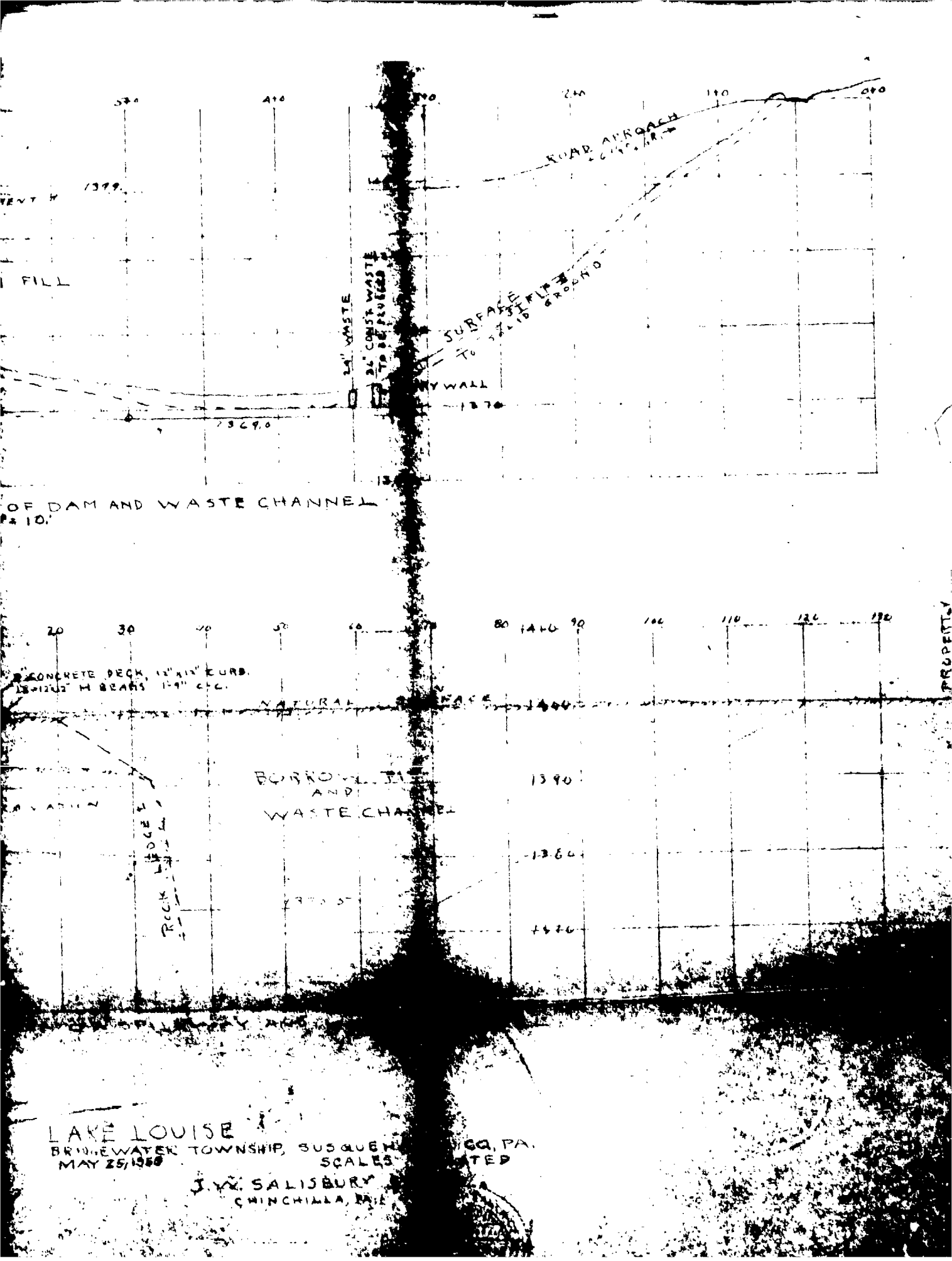
LAKE LOUISE

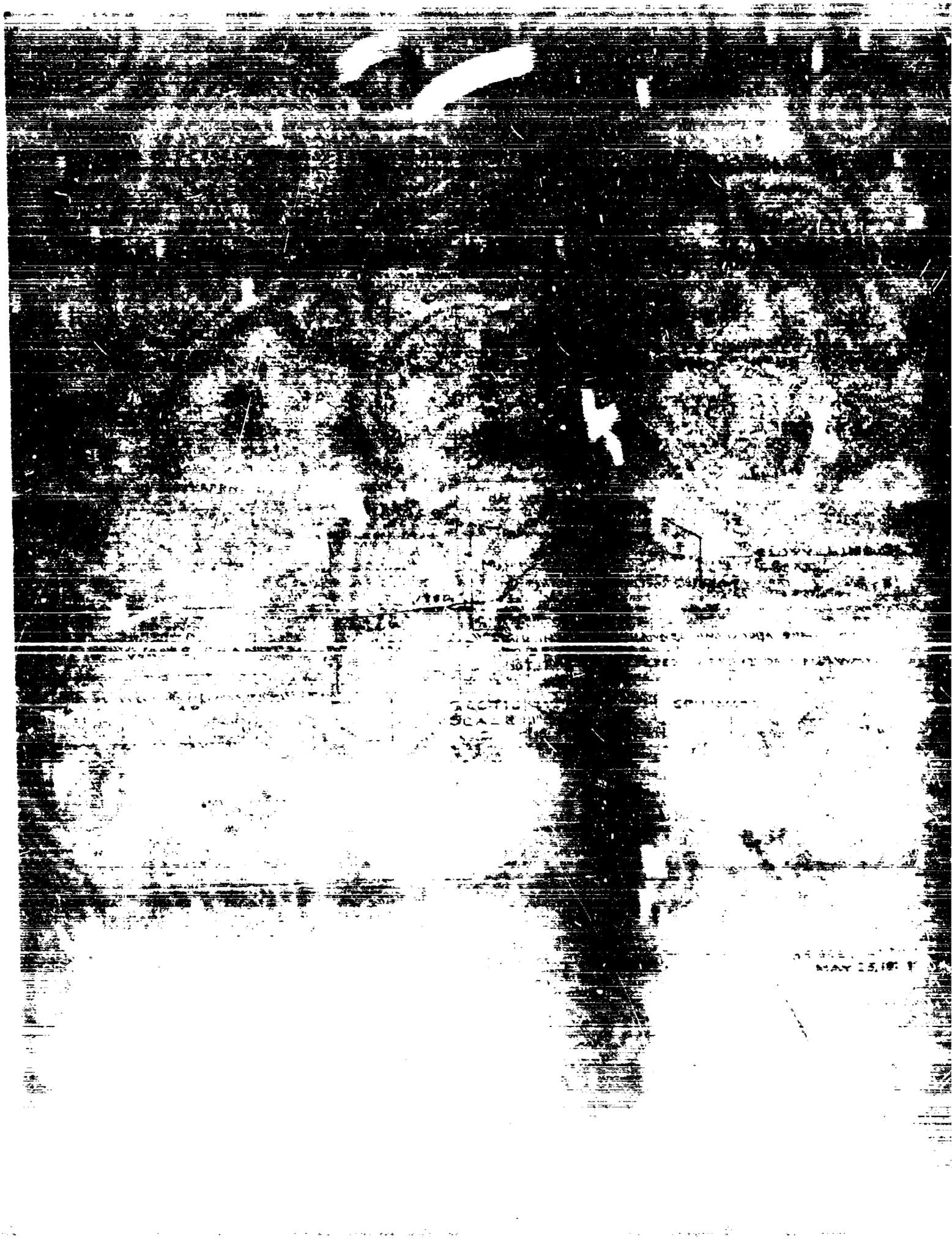
BRIDGEWATER TOWNSHIP, SUSQUEHANNA CO., PA.
MAY 25, 1958 SCALES INDICATED

J.VV. SALISBURY C.E.
CHINCHILLA, PA.

PLATE 5


I-BEAM BRIDGE
& CONCRETE SLAB
ROCK
EARTH SLOPE
WASTE
ROCK
WASTE
TOP OF EMBANKMENT
ALL HARD-PAN FILL
HARD-PAN
CHANNEL
STREAM ELEVATION OF DAM AND WA
HOR. 1" = 50.' VER. 1" = 10.'
ROCK
CONCRETE DECK,
HEADWALL
LAKE LOU
BRIDGEWATER
MAY 25, 1958


ROAD APPROACH
SURFACE
TO
GROUND
WALL
FILL
OF DAM AND WASTE CHANNEL
CONCRETE DECK, 12" & 15" CURB.
NATURAL
BORROW
AND
WASTE CHANNEL
PROPERTY
LAKE LOUISE
BRIDGEWATER TOWNSHIP, SUSQUEH
MAY 25, 1959
SCALES
J. W. SALISBURY
CHINCHILLA, PA.



APPENDIX F

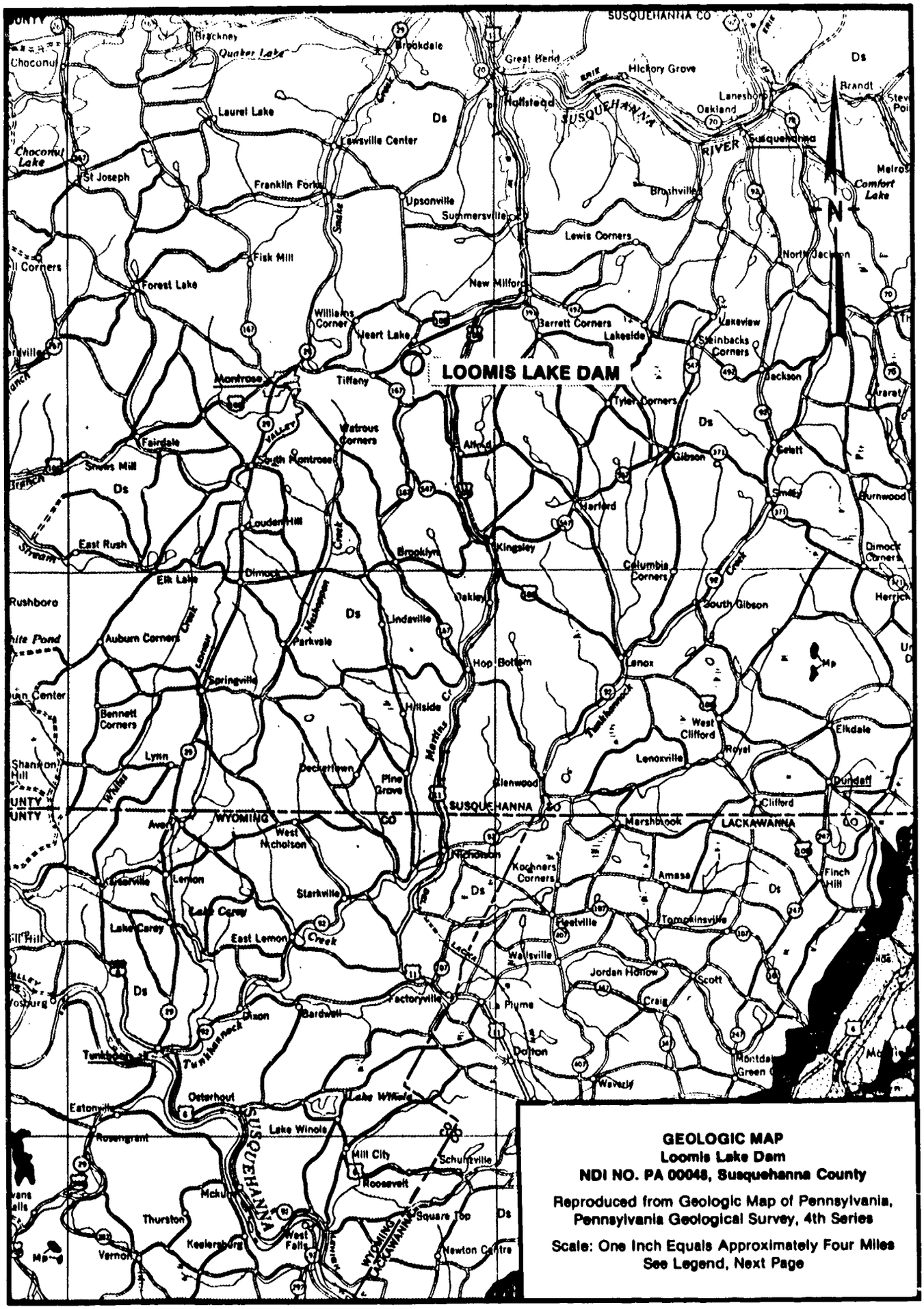
REGIONAL GEOLOGY

Loomis Lake Dam
NDI No. PA 00048, PennDER No. 58-127

REGIONAL GEOLOGY

Loomis Lake Dam is located in the Glaciated Low Plateaus section of the Appalachian Plateaus physiographic province. The area has been glaciated at least three times and is presently covered with Wisconsin Stage glacial deposits. Maximum relief in the vicinity of the dam is approximately 300 feet with most of the drainage to the south. According to the Soil Conservation Service's Soil Survey for Susquehanna County, the surface soils in the vicinity of the dam consist primarily of very stoney, silt loams on the western end of the dam and silt loams on the eastern end of the dam. All soils are of the Volusia-Mardin association. No test boring data were available for review; thus, the thickness of this overburden is difficult to ascertain.

Geologic references indicate that the bedrock in the vicinity of the dam consists of members of the Catskill formation in the Susquehanna Group. The Catskill formation is composed of red and gray shales and sandstones of Upper Devonian age. The formation also contains scattered, thin streaks of coal and scattered fish remains. The strata of the Catskill formation was deposited in a bay or delta front environment and remain essentially horizontal after the Appalachian Uplift.



GEOLOGIC MAP
Loomis Lake Dam
NDI NO. PA 00048, Susquehanna County

Reproduced from Geologic Map of Pennsylvania, Pennsylvania Geological Survey, 4th Series

Scale: One Inch Equals Approximately Four Miles
See Legend, Next Page

GEOLOGY MAP LEGEND

DEVONIAN

UPPER

WESTERN PENNSYLVANIA

Dos Dr

Oswayo Formation
Greenish gray to gray shales, siltstones and sandstones becoming increasingly shaly westward; considered equivalent to type Oswayo. Riceville Formation Dr *in Erie and Crawford Counties; probably not distinguishable north of Corry.*

Dcr

Cattaraugus Formation
Red, gray and brown shale and sandstone with the proportion of red decreasing westward; includes Venango sands of drillers and Salamanca sandstone and conglomerate; some limestone in Crawford and Erie counties.

Conneaut Group
Alternating gray, brown, greenish and purplish shales and siltstones; includes "pink rock" of drillers and "Chemung" and "Girard" Formations of northwestern Pennsylvania.

Dca

Canadaway Formation
Alternating brown shales and sandstones; includes "Portage" Formation of northwestern Pennsylvania.

CENTRAL AND EASTERN PENNSYLVANIA

Dos

Oswayo Formation
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses; includes red shales which become more numerous eastward. Relation to type Oswayo not proved.

Dck

Catskill Formation
Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Dm

Marine beds
Gray to olive brown shales, graywackes, and sandstones; contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base.

Ds

Susquehanna Group
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports; barbs on "Chemung" side of line.

MIDDLE AND LOWER

Dh

Hamilton Group

Mahantango Formation
Brown to olive shale with interbedded sandstones which are dominant in places (Montebello); highly fossiliferous in upper part; contains "Centerfield coral bed" in eastern Pennsylvania.

Marcellus Formation
Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.

Onondaga Formation
Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places; includes Selinsgrove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Keyser Shale in easternmost Pennsylvania; in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert.

Dmo

Oriskany Formation
White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgeley) at the top; dark gray, cherty limestone with some interbedded shales and sandstones below (Shriver).

Helderberg Formation
Dark gray, calcareous, thin bedded shale (Mandata) at the top, equivalent to Port Ewen Shale and Heerkill Limestone in the east; dark gray, cherty, thin bedded, fossiliferous limestone (New Scotland) with some local sandstones in the middle; and, at the base dark gray, medium to thick bedded, crystalline limestone (Coeymans), sandy and shaly in places with some chert nodules.