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NATIONAL DAM INSPECTION PROGRAM. MOUNTAIN SHADOW LAKE DAM (NDI --ETC(U)
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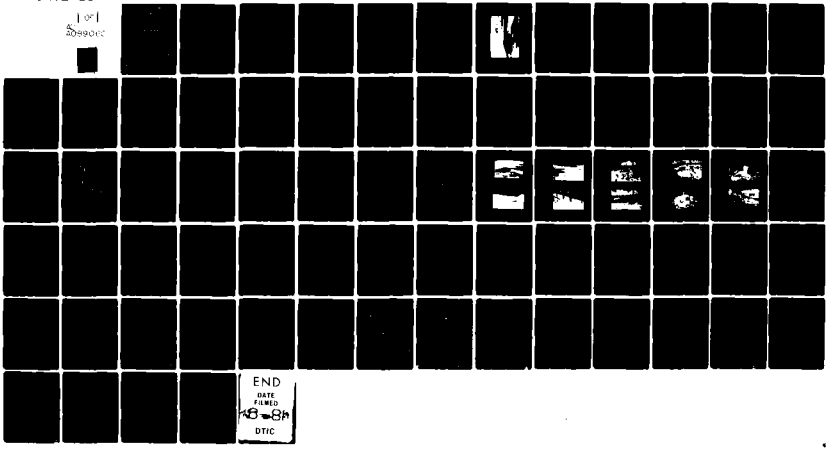

LEVEL II

AD A095062

BEAVER RUN, COLUMBIA COUNTY
SUSQUEHANNA RIVER BASIN

PENNSYLVANIA

MOUNTAIN SHADOW LAKE DAM

NDI ID NO. PA-00244
DER ID NO. 19-80

MESSRS. CORRADINI AND BUCHANAN

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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SUSQUEHANNA RIVER BASIN

BEAVER RUN, COLUMBIA COUNTY

PENNSYLVANIA

(1 National Dam Inspection Program.

MOUNTAIN SHADOW LAKE DAM

(NDI ID Number PA 00244
DER ID [redacted] 19-75)

~~MEGGRO, CORRADINI AND BUCHANAN~~

Susquehanna River Basin,
Beaver Run Columbia County
Pennsylvania.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Prepared by:

(12) 72

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

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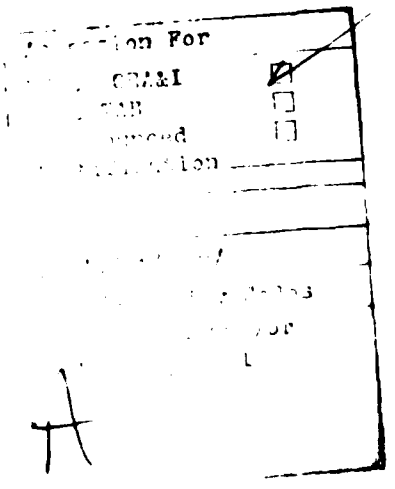
PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

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.



NDI ID No. PA-00244, DER ID No. 19-75

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION
AND
RECOMMENDED ACTION

NAME OF DAM:	Mountain Shadow Lake Dam NDI ID No. PA 00244 DER ID No. 19-80
SIZE:	Small (20 feet high; 360 acre-feet)
HAZARD CLASSIFICATION:	High
OWNER:	Messrs. Corradini and Buchanan Bloomsburg, PA
STATE LOCATED:	Pennsylvania
COUNTY LOCATED:	Columbia County
STREAM:	Beaver Run
DATE OF INSPECTION:	2 December 1980

The visual inspection and review of available design and construction data indicate that Mountain Shadow Lake Dam is in fair condition. The primary deficiency noted during the inspection was the lack of rock protection for the spillway discharge channel along the downstream toe of the embankment.

The hydrologic and hydraulic computation indicate that the combination of reservoir storage and spillway discharge capacity will pass 92% of the PMF prior to overtopping the embankment. Therefore, the spillway for Mountain Shadow Lake Dam is considered to be adequate.

It is recommended ~~that the following~~ actions be taken by the owner without delay: are listed.

1. Restore the riprap in the spillway discharge channel to design condition.

2. Assure that the outlet gate control is properly secured against tampering by unauthorized personnel.

3. Develop a formal surveillance and downstream emergency warning system for use during periods of high or prolonged precipitation.

4. Prepare an operation and maintenance manual or plan for use as a guide in the operation of the dam during normal and emergency conditions.

5. Develop a schedule for regular inspection and routine maintenance of the dam and appurtenances.

APPROVED BY:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

DATE: 9 APR 81

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

MOUNTAIN SHADOW LAKE DAM

OVERVIEW

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SHADOW LAKE DAM

NDI ID No. PA 00244
DER ID No. 19-80

SECTION 1

PROJECT INFORMATION

1.1 General.

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

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 Description of Project.

a. Description of Dam and Appurtenances. Mountain Shadow Lake Dam is an earthfill structure approximately 20 feet high and 550 feet in length, including spillway. The facility is provided with an uncontrolled, rectangular shaped, concrete spillway located near the left abutment. The spillway has an ogee weir 100 feet in length with a low flow notch 20 feet long and 2 feet deep. The low flow notch is equipped with wooden flashboards (See page C- 3 , photograph Appen ix C).

The outlet works consist of a 24-inch diameter reinforced concrete pipe which discharges at the downstream toe of the embankment near the original stream bed. Flow through this conduit is controlled by a manually operated sluice gate. The gate operating mechanism is located at the crest of the dam.

b. Location. Beaver Township, Columbia County
U.S.G.S. Quadrangle - Mayburt, Pa.
Latitude: 40° 58', Longitude: 76° 14.9',
Ref. Appendix E, Plates I & II.

c. Size Classification: Small: Height - 20 feet, Storage - 360 acre-feet.

d. Hazard Classification: High (Ref. Section 3.1.e.).

e. Ownership: Mr. Damyon Corradini and Dr. Buchanan, R.D. 3, Bloomsburg, Pa. 17815.

f. Purpose: Recreation.

g. Design and Construction History. The existing dam was constructed in 1977 overtop an older dam (Pine Lake Dam) which had been built around 1954 without the required permit from the Pennsylvania Department of Environmental Resources (PennDER).

The embankment of the older dam was tested for stability and suitability of material as part of the design of the new structure.

The design of the new embankment and spillway was performed by Ebeco Associates, Inc., Hazleton, Pa. Refer to Appendix E, for details.

The new facility was built by National Recreational Communities, Inc., but is currently being purchased by Mr. Damyon Corradini and Dr. Buchanan, both of whom own property adjacent to the lake.

h. Normal Operating Procedures. There are no formal operating procedures for the dam at the present time. It was reported by one of the prospective owners that a local resident had recently opened the outlet gate to its maximum extent, causing an almost total drawdown of the lake before the gate was closed.

Under normal conditions water flows over the spillway and through the outlet works, which is usually left partially open. The PennDER permit for this dam requires a minimum discharge of 0.4 cfs be maintained at all times. Excess inflow passes over the spillway.

1.3 Pertinent Data.

a. Drainage Area (square miles).

From files:	2.68
Computed for this report:	2.60
Use:	2.60

b. Discharge at Damsite (cubic feet per second).

Maximum known flood	unknown
Outlet works @ normal pool (El. 942.0)	40
Outlet works with maximum pool (El. 947.0)	53
Spillway with maximum pool (El. 947.0)	4,250

c. Elevations (feet above msl.).

Maximum pool (top of dam)	
Design conditions	948.0
Existing conditions (low point)	947.0
Spillway crest (Normal Pool)	
Design conditions	942.0
Existing conditions	942.0
Downstream invert of outlet works	933.2
Streambed at toe of dam	927.0

d. Reservoir Length (miles).

Spillway crest (El. 942.0)	1.0
Maximum pool (El. 947.0)	1.5

e. Storage (acre-feet).

Spillway crest (El. 942.0)	107.0
Maximum pool (El. 947.0)	360.0

f. Reservoir Surface (acres).

Spillway crest (El. 942.0)	35.0
Maximum pool (El. 947.0)	66.0

g. Dam.

NOTE: Refer to Plates in Appendix E for plan, sections and details.

Type:	Earthfill
Length:	550 feet
Height:	20 feet
Top Width:	17 feet
Side Slopes:	
Upstream	1V on 2H
Downstream	1V on 3H except 1V on 1.7H near right abutment
Zoning:	None
Cut-off:	Unknown
Grout Curtain:	Unknown

h. Outlet Works.

Type:	One 24-inch dia. RCPP
Length:	92 feet
Closure:	Sluice gate at upstream side of crest
Access:	Manhole on crest

i. Spillway.

Type:	Concrete ogee weir
Length of Weir:	100.0 feet
Low Flow Notch w/ Flashboards:	2' deep x 20' long in center of weir
Crest Elevation:	942.0 feet (ogeecrest)
Approach Channel:	Reservoir
Downstream Channel:	Concrete slab with riprap downstream

SECTION 2

ENGINEERING DATA

2.1 Design. A reasonably complete file of design data is available for Mountain Shadow Lake dam. Data available includes detailed plans and specifications, a report of soils investigation, and a hydrology report.

In addition, the PennDER files include a construction permit application report which contains a brief description and summary of the design aspects of the new facility.

No design data was found to exist for the old dam which had been located at this site.

The new structure appears to have been constructed as designed, with the exception of some minor changes to the outlet structure.

2.2 Construction. Construction data consists of inspection reports by PennDER personnel during and immediately following construction of the new dam and various related correspondence.

This information indicated that no major problems were encountered during construction and the dam was built in general accordance with the original design approved by PennDER.

2.3 Operation. No formal records of operation and maintenance are known to exist, other than a report by PennDER in June 1978 that the flashboards had failed as designed during a storm event the previous spring, and were subsequently replaced. It was noted during the recent inspection that Mr. Corradini had added some additional support to the flashboards, such that they may not function as originally intended.

2.4 Evaluation.

a. Availability. The available information for the existing dam consisted of a fairly complete set of design details including plans, specifications, hydrology report, soils investigation report, and PennDER permit records.

b. Adequacy. The available data, including that collected during the recent detailed visual inspection, are considered to be adequate to make a reasonable assessment of the dam.

SECTION 3

VISUAL INSPECTION

3.1 Observations.

a. General. The overall condition of the dam and appurtenances is fair. The primary deficiency is the recent removal of riprap from the spillway discharge channel which flows along the toe of the dam. This and some minor deficiencies are described briefly below. The visual inspection checklist and field sketch are provided in Appendix A of this report. Photographs taken during the inspection are reproduced in Appendix C.

The reservoir pool was approximately 0.5 feet below the spillway crest at the time of the inspection which was performed on 2 December 1980. Present during the inspection were one of the prospective owners and a representative of Ebeco Associates, designers of the new dam.

b. Embankment. The horizontal alignment of the dam is good and no signs of cracking or sloughing were observed. The maximum variation in the vertical alignment of the crest is approximately 0.8 feet with the low point located adjacent to the right spillway wall. The crest, downstream slope and the upper portion of the upstream slope are covered with grass and some weeds. The portion of the upstream slope below elevation 944.5 right of the spillway is protected with 18-24 inch rock in good condition. Some minor damage has been done to the crest and downstream face by a small bulldozer. Several trees ranging in size from 2 inches to 3 feet in diameter are growing at the downstream toe near the right abutment. Clear seepage estimated at 1 gpm is exiting from the hillside of the right abutment approximately 20 feet downstream of dam. The source is believed to be a spring as there is a spring approximately 50 feet away that is flowing at about 3 gpm.

c. Appurtenant Structures. The location of the spillway and outlet works are shown on the field sketch in Appendix A. The approach to the spillway is the reservoir and is clear. The spillway consists of a 100 foot long concrete ogee section with concrete walls extending 17 feet upstream and 23 feet downstream of the weir to protect the embankment. In the center of the weir is a 2 foot deep by 20 foot long notch equipped with wooden flashboards supported by five, one inch inside diameter pipes. The first 23 feet downstream of the weir is paved with concrete. The next 30-40 feet is lined with 18 to 24 inch rock. At the end of this rock the discharge channel bends sharply to the right, then narrows and runs along the toe of dam. All the original rock protection along the toe of dam has recently been bulldozed off the right bank and bottom of this channel and pushed against the left bank in an attempt to prevent additional erosion of the left bank. This work was reportedly done without the knowledge or consent of the owner. In the present condition, large spillway flows could erode the channel bottom and toe of the dam. This poses a hazard to the stability and safety of the dam. All concrete within the spillway area is in good condition with only minor surface cracking of the right spillway wall.

The outlet works consists of a 24-inch diameter reinforced concrete pressure conduit through the dam with a concrete headwall at the discharge end. The intake structure was not observed but the plans show it as a headwall equipped with a trash rack. Flow through the conduit is controlled by a sluice gate which is housed in a manhole that is located in line with the upstream side of the dam crest. The control for the gate is on top of the manhole and is not locked or secured in any manner. The interior of the manhole and the gate proper were not observed. Flow from the outlet drops approximately 8 feet over 12-15 inch riprap at a near vertical slope to the original streambed. The outlet structure and conduit are in good condition.

d. Reservoir Area. The reservoir slopes are moderate and partially wooded. These slopes appear stable with no potential for a massive slide. There is no residential development along the shoreline, although one house is located adjacent to the left abutment.

e. Downstream Channel. One dwelling is located about 100 feet from the toe of the dam. The first floor level is approximately 10 feet below the top of dam. The roadway which passes just upstream of this house crosses Beaver Run with a 5 foot high by 18.5 feet wide box culvert. The channel has flat side slopes for approximately one mile. The channel then becomes confined with steep side slopes and crosses Pa. Route 339 in the Village of Shumans approximately 3.4 miles downstream of the dam. Several houses are adjacent to the stream at this point. Beaver Run then flows into Catawissa Creek 0.4 miles further downstream. The downstream development is shown on Plate II in Appendix E. Downstream conditions warrant a high hazard classification for this dam.

3.2 Evaluation. The overall visual evaluation of this facility indicates that the dam and its appurtenances are in fair condition. The primary concern is the fact that the rock protection in the spillway discharge channel adjacent to the toe of the dam has been displaced. High spillway flows could erode the channel and toe of the dam and create a hazard to the safety of the dam. In addition, the control for the outlet works sluice gate should be secured in some manner to prevent unauthorized use.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure. The lake is maintained at spillway crest, elevation 942.0, with excess inflow discharging into Beaver Run. The 24 inch concrete conduit pipe is normally left partially open to maintain the minimum discharge of 0.4 c.f.s. In the center of the 100 foot ogee spillway, a 20 foot long section of wooden flashboards are laid horizontally, to a height of 2 feet. The top of the wooden flashboards is even with the ogee spillway crest. The new owner has strengthened the structure and it is doubtful if this structure would fail as designed. No formal operations manual exists.

4.2 Maintenance of Dam. The condition of the dam as observed by the inspection team was fair. Basic maintenance such as keeping the spillway clear, and repairing minor flood damage is performed by the owner. No formal maintenance manual exists.

4.3 Maintenance of Operating Facilities. The valve on the outlet works is operated on an irregular basis. Other maintenance is performed when required.

4.4 Warning System. No formal warning system exists.

4.5 Evaluation. Maintenance of the facility appears to be insufficient at this time. Formal operation and maintenance manuals are recommended to ensure that all needed maintenance is identified and performed regularly. In addition, a formal warning system for the protection of downstream inhabitants should be developed. Included in the plan should be provision for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

SECTION 5

HYDRAULICS & HYDROLOGY

5.1 Design Data. A hydrologic study is available for Mountain Shadow Lake Dam which includes unit hydrographs and flood hydrograph development. Detailed plans are available for the spillway and outlet works and were reviewed for this report.

5.2 Experience Data. Records of reservoir levels and/or spillway discharges are not available. The dam was completed in 1977 and no major flooding at this facility has been experienced. Discussion with the present owner indicated that in January 1978 the flashboard structure did fail as designed. The flashboard structure has subsequently been strengthened with two additional pins, and may not operate as intended. No other records of performance are available.

5.3 Visual Observations. On the date of the inspection, two conditions were observed that may prevent the facility from operating during a flood event as designed. As mentioned, the spillway flashboards have been strengthened and may not operate as intended during minor flood events. However during a major flood this would be of no significance and could be considered negligible. Secondly and more important, the spillway exit channel has been stripped of rock protection. The rock in the downstream channel has been moved toward the left channel bank. See field sketch provided in Appendix A for location of the spillway outlet channel and its relationship to the embankment. Large spillway flows may create scouring in the unprotected portion of the outlet channel and cause erosion to the embankment toe.

5.4 Method of Analysis. The facility has been analyzed in accordance with procedures and guidelines established by the U.S. Army Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. This analysis has been performed using a modified version of the HEC-1 program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. Capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the SDF for Mountain Shadow Lake ranges between the 1/2 Probable Maximum Flood (PMF) and the full PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure to downstream development (high). Due to the small storage (less than 400 acre-feet) and small height (approximately 20 feet) the SDF selected was 1/2 PMF.

b. Results of the Analysis. Mountain Shadow Lake was evaluated under near normal operating conditions. The starting lake elevation was set at spillway crest, elevation 942.0. For this study, the flashboards were assumed not to fail and the 24" outlet conduit was assumed obstructed, thereby providing a conservative discharge rating. The dam currently has 5 feet of freeboard, from ogee crest to low point of top of dam.

Spillway Capacity at top of dam	4250 cfs
Peak PMF Inflow	5020 cfs

From the above, it can be concluded that a potential for overtopping does exist. The overtopping analysis (using HEC-1DB) indicates that the discharge/storage capacity of Mountain Shadow Lake Dam is 92% of the PMF. Since the SDF for this dam is the 1/2 PMF, Mountain Shadow Lake Dam will perform adequately at the SDF. No Breach Analysis is required.

5.6 Spillway Adequacy. Under existing conditions Mountain Shadow Lake Dam can accommodate 92% of the PMF. Since the SDF for this dam is the 1/2 PMF, the spillway is considered adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) Embankment. Visual observations of Mountain Shadow Lake Dam indicate that the dam and appurtenances are in fair condition. The dam is constructed of random earth. The surface soil is visually classified as a silt, ML. It has a 17 foot crest, an upstream slope 2H:1V, and a downstream slope of 3H:1V varying to 1.7 H:1V right of the outlet structure. The upstream face of the embankment to the right of the spillway has been riprapped with 18-24 inch rock to a height 2.5 feet above the spillway weir elevation. Clear seepage estimated at 1 gpm is exiting from the hillside approximately 20 feet downstream of the right abutment. This seepage is believed to be a spring as there is a spring approximately 50 feet away that is flowing at about 3 gpm. Several trees 2 inches to 3 feet in diameter are growing at the downstream toe near the right abutment. Minor damage has been done to the downstream toe along the right side of the spillway channel by someone using a dozer to push rock from the channel bottom and right bank to the left bank of the channel leaving the toe of the dam unprotected from erosion and scour by discharges through the spillway.

(2) Appurtenant Structures. The outlet works is operable and appears to be in satisfactory condition. The valve is opened slightly to maintain a flow in Beaver Run. The concrete spillway structure is in good condition. Seven foot long seepage cut-off walls extend perpendicular to the spillway walls at mid embankment.

b. Design and Construction Data.

(1) Embankment. The new dam was built in 1976-1977. An existing embankment was raised approximately 8 feet and the slopes were flattened. Design data for the new dam consist of a soil investigation of the old embankment, hydrologic study, dam and spillway specifications, and several drawings showing a typical embankment cross section, outlet works sections, spillway, etc. In the soil investigation report the old embankment was evaluated for stability, permeability, and soil type. Borrow area fill required submittal by the Contractor for testing and approval.

Review of available information and discussion with the design engineer indicate that the reconstructed dam was designed and constructed with reasonable care. The design engineer was frequently on site to monitor the construction.

(2) Appurtenant Structures. Design drawings for the spillway and outlet works were available and reviewed. A difference was observed between design and as built conditions in that there is a concrete outlet structure, rather than the riprap lined stilling basin shown on the drawings.

c. Operating Records. No operating records are known to exist. The flashboard structure did fail as designed in January 1978.

d. Post-Construction Changes. PennDER has no reported changes after the new dam was constructed. The spillway flashboard support system has been modified; however, there is no record of this change.

e. Seismic Stability. Northeastern Engineering Company, Inc. did a soil investigation of the original embankment and state that the new dam should be stable. Visually the dam appears stable. The dam is believed to be statically stable and is therefore assumed to present no hazard from earthquakes as it is located in Seismic Zone 1.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment.

a. Safety. The visual inspection and review of available design and construction data indicate that Mountain Shadow Lake Dam is in fair condition. The primary deficiency noted during the inspection was the lack of rock protection for the spillway discharge channel along the downstream toe of the embankment.

The hydrologic and hydraulic computation indicate that the combination of reservoir storage and spillway discharge capacity will pass 92% of the PMF prior to overtopping the embankment. Therefore, in accordance with the criteria outlined and evaluated in Section 5.5, the spillway for Mountain Shadow Lake Dam is considered to be adequate.

b. Adequacy of Information. The design and construction data contained in PennDER files, in conjunction with data collected during the visual inspection, are considered to be adequate for making a reasonable assessment of this dam.

c. Urgency. The recommendations presented below should be implemented immediately.

d. Necessity for Additional Studies. The results of this inspection indicate no need for additional studies.

7.2 Recommendations.

1. The owner should restore the riprap protection for the spillway discharge channel to design condition without delay.

2. The owner should assure that the outlet gate control is properly secured against tampering by unauthorized personnel.

3. A formal surveillance and downstream emergency warning system should be developed for use during periods of high or prolonged precipitation.

4. An operation and maintenance manual or plan should be prepared for use as a guide in the operation on the dam during normal and emergency conditions.

5. A schedule should be developed for regular inspection and routine maintenance of the dam and appurtenances.

APPENDIX A

CHECKLIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name Dam Mt. Shadow Lake Dam County Columbia State Pennsylvania

Date(s) Inspection 2 Dec 80 Weather Ptly. Cloudy Temperature 50°

Pool Elevation at Time of Inspection 941.5 M.S.L. Tailwater at Time of Inspection 927.0 M.S.L.

Inspection Personnel:

J. Bianco (C.O.E.)
B. Cortright (C.O.E.)
J. Evans (C.O.E.)
E. Hecker (C.O.E.)
D. Corradini, Owner
J. Michel, Ebeco Assoc.

B. Cortright Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS
Any Noticeable Seepage	None observed. One gpm coming from hillside 20 feet d/s right abutment; source is apparently springs since another spring is about 50 feet away.
Junction of Embankment with: Abutments Spillway	Good. No signs of erosion or settlement
Surface Cracks	None observed
Crest alignment: Vertical Horizontal	Vertical - Good; max. variation of 0.8' Horizontal - Good; embankment is concave upstream
Unusual movement or cracking at or beyond the toe	None observed
Sloughing or Erosion: Embankment Crest/Slopes Abutment Slopes	None; however the crest and downstream face have minor damage due to movement of small bulldozer.
Riprap Failures	Riprap on upstream face in good condition. Riprap in spillway discharge channel adjacent to toe of dam has been recently pushed out of channel bottom and against left bank.
Staff Gage and Recorder	None
Instrumentation	None

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS
Outlet Conduit	24" diameter reinf. concrete pressure pipe - good condition
Intake Structure	Not observed; submerged
Outlet Structure	Concrete headwall w/ wingwalls in good condition
Outlet Channel	Plunges 8 feet over riprap immediately downstream of headwall; then into original streambed.
Emergency Gate	24" gate valve w/control on dam crest. Manhole interior and gate proper were not observed. Gate control is not locked and lake reportedly was drawn down by unauthorized personnel this past spring.

UNGATED SPILLWAY

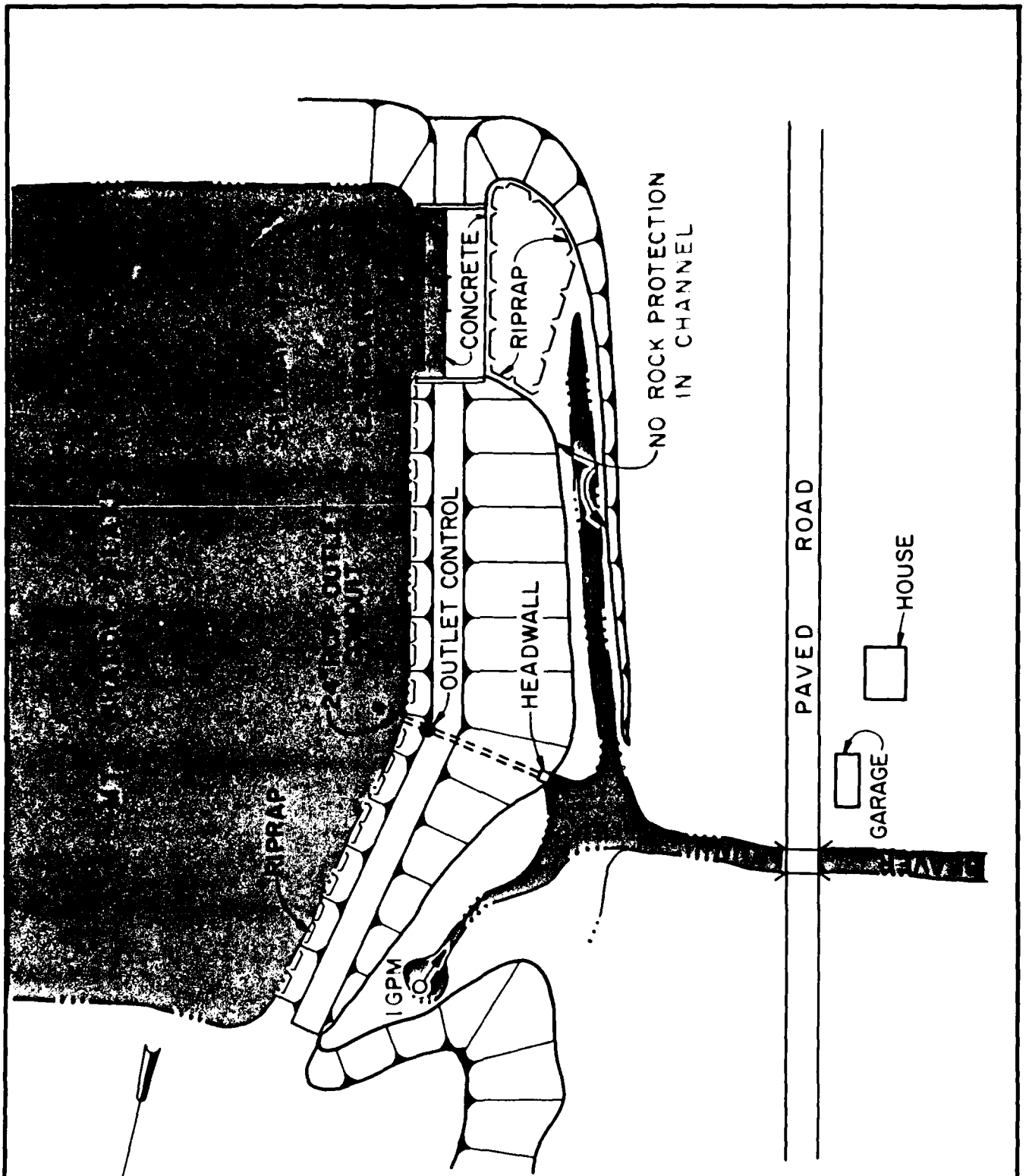
VISUAL EXAMINATION OF	OBSERVATIONS
Concrete Weir	Ogee weir; good condition 20-foot wide center section has wooden flashboards in good condition; slight leakage.
Approach Channel	Lake. Clear with no obstructions.
Bridge and Piers	None
Discharge Channel	Rock in good condition in upper part immediately downstream of spillway slab. Channel bends to right, narrows and parallels toe. Rock has been pushed out of channel bottom and from toe of dam to provide protection for left bank of channel.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS
Slopes	Moderate; no potential for massive slide Partially wooded No residential development adjacent to reservoir
Sedimentation	None observed

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS
Condition (Obstructions, Debris, etc.)	Roadway box culvert immediately d/s with 5'x 18 1/2' wide opening. Beaver Run crosses Pa. Route 339 approx. 3.4 miles d/s of dam in town of Shumans.
Slopes	Flat for 1.0 mile; then becoming confined with steep slopes until reaching Catawissa Creek 3.8 miles downstream of dam.
Approximate Number of Homes	One home immediately downstream of dam. Several houses 3.4 miles downstream in town of Shumans.



LEGEND

1 GPM – INDICATES LOCATION AND QUANTITY OF SEEPAGE

NOT TO SCALE

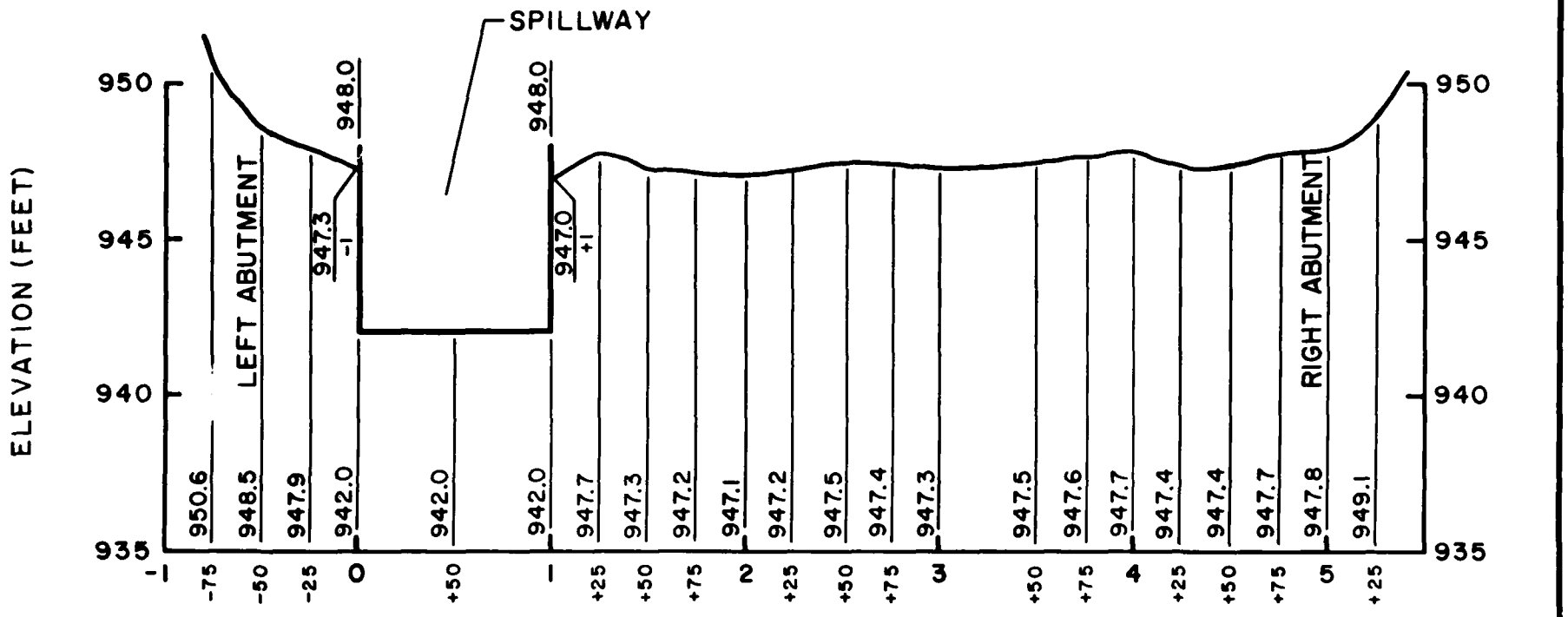
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SHADOW LAKE

D.CORRADINI, DR. BUCHANNAN

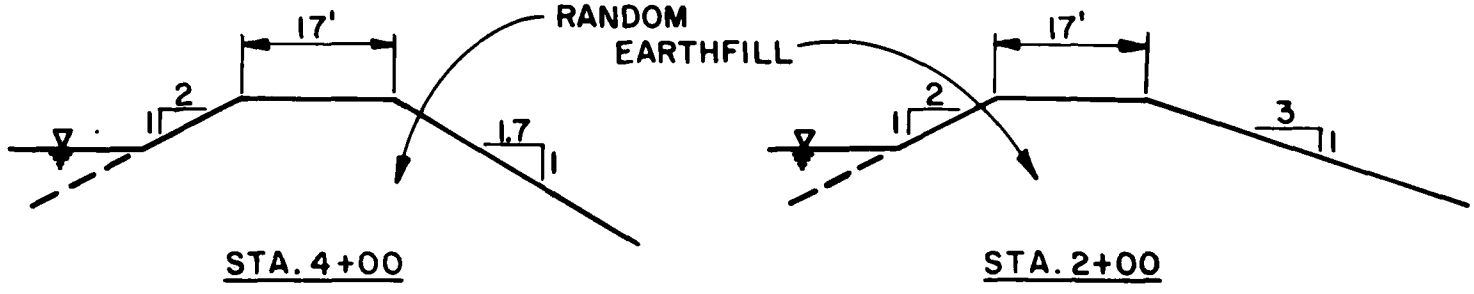
FIELD SKETCH

EXHIBIT A-1



TOP OF DAM - PROFILE

SCALE: HORIZ. 1 IN. = 80 FT.
VERT. 1 IN. = 5 FT.



STA. 4+00

STA. 2+00

EMBANKMENT SECTIONS

SCALE: 1 IN. = 20 FT.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SHADOW LAKE

D.CORRADINI, DR. BUCHANNAN

PROFILE AND SECTIONS

EXHIBIT A-2

APPENDIX B

CHECKLIST - ENGINEERING DATA

CLECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Mountain Shadow Lake Dam

NDI ID # PA

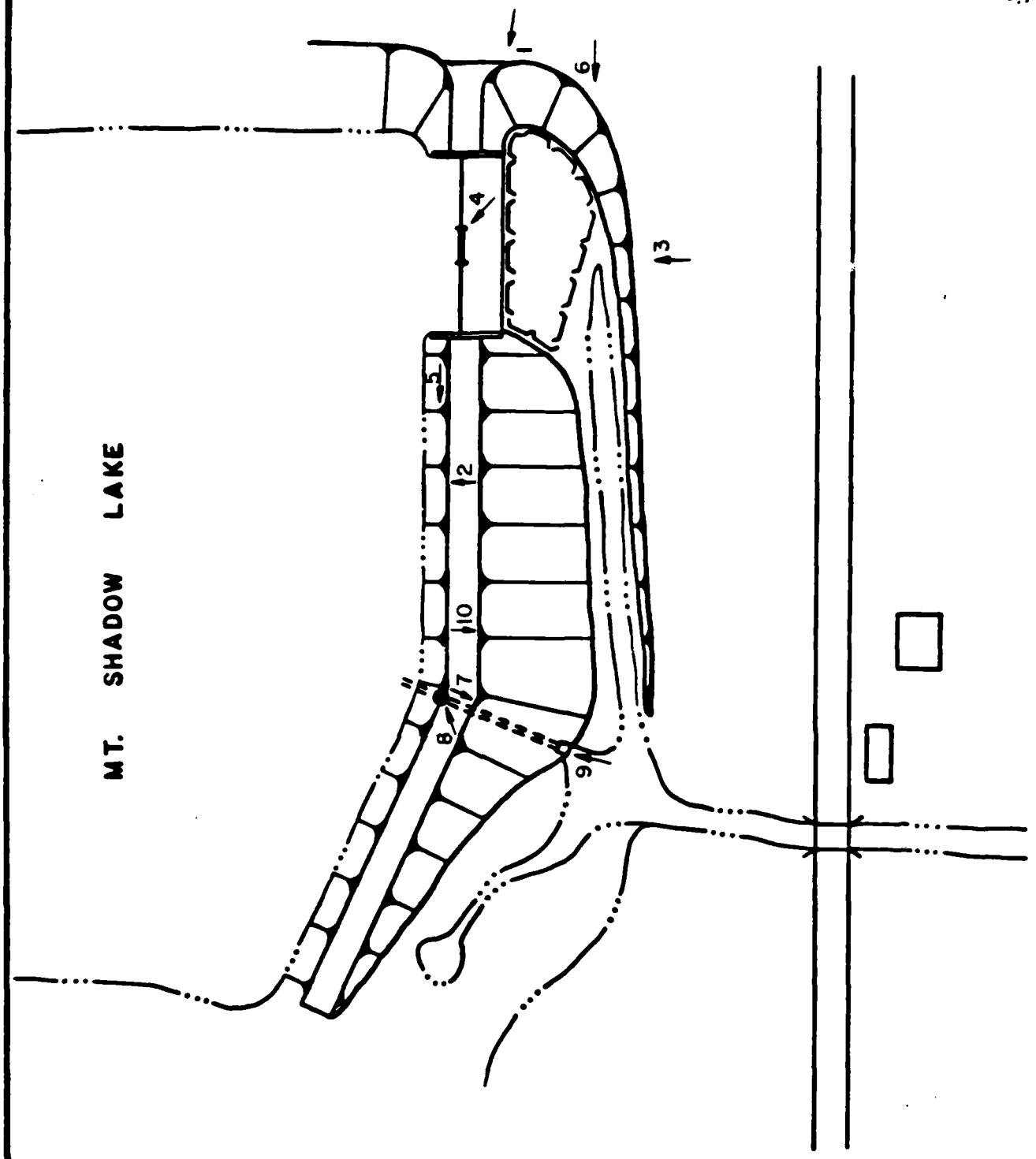
DER ID # 19-80

ITEM	REMARKS
As-Built Drawings	See Appendix E for plans.
Regional Vicinity Map	U.S.G.S. Nuremberg Quadrangle, 7-1/2 minute quad sheet. See Appendix E, Plate E-2.
Construction History	New Dam Built in 1976-1977 overtop existing dam (Pine Lake Dam). No existing data found on older dam. Pine Lake Dam built approximately in 1954 without a permit.
Typical Sections of Dam	See Appendix E for details. Sections of dam are also located in report listed below under Geology Reports.
Outlets - Plan Details Constraints Discharge Ratings	See Appendix E for details. Design computations are in report listed under Hydrology & Hydraulics section below.
Rainfall/Reservoir Records	None.
Design Reports	See following items.
Geology Reports	Soil Investigation, Mountain Shadow Lake, Luzerne County PA - by EBECO Associates, Inc., 1974.
Design Computations Hydrology & Hydraulics Dam Stability Seepage Studies	Hydrological study, Mountain Shadow Lake, Beaver Twp. Columbia County, PA. EBECO Associates, 1974. Flood Hydrograph Development. Hydrological Study, Pine Lake, Beaver Twp., Columbia Twp., PA. EBECO Associates, 1970, Flood Hydrograph Development.
Materials Investigations Boring Records Laboratory Field	Borings were taken in soil investigation mentioned above, geolog reports. Gradation analysis, unconfined compression tests, in place density tests and shear tests are also contained in this report.

ITEM	REMARKS
Post-Construction Surveys of Dam	None.
Monitoring Systems	None.
Modifications	Minor changes were noted in field inspection against plans shown in Appendix E, as mentioned in text of this report.
High Pool Records	None reported.
Post-Construction Engineering Studies and Reports	None reported. Modification or strengthening of the flaashboard Spillway has been done recently.
Prior Accidents or Failure of Dam Description Reports	None reported. However, flashboards in spillway have been reported to have failed as designed. Minor spillway flows.
Maintenance Operation Records	None.
Spillway Plan Sections Details	See Appendix E for plans of spillway.
Operating Equipment Plans and Details	See Appendix E for plans of low level drain (pond drain).
Specifications	None.
Miscellaneous	None.
Previous Inspections	Upon completion of dam in 1978, by PennDER.

APPENDIX C

PHOTOGRAPHS



LEGEND

← LOCATION AND ORIENTATION OF CAMERA

3 PHOTOGRAPH IDENTIFICATION NUMBER

NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SHADOW LAKE

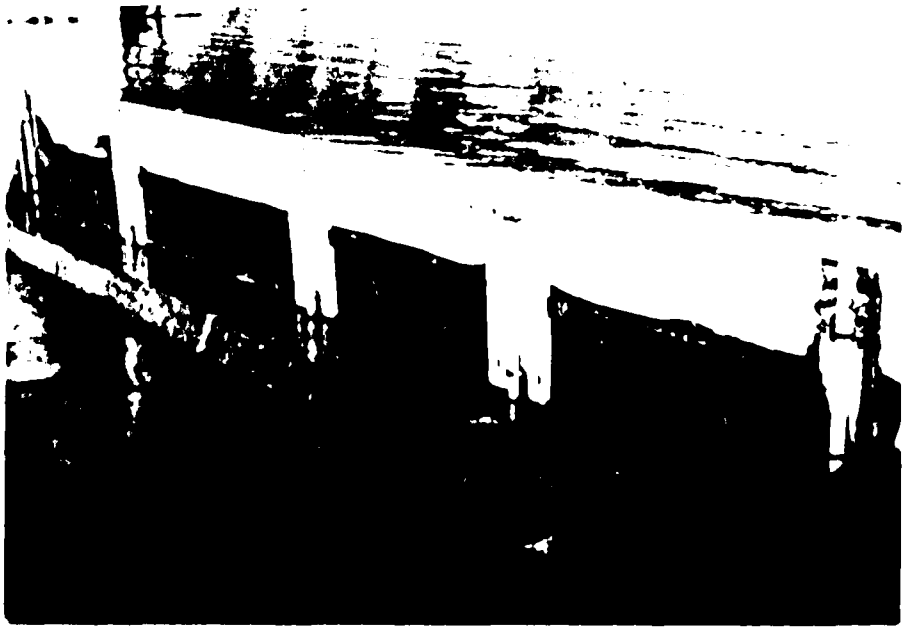
D.CORRADINI, DR. BUCHANNAN

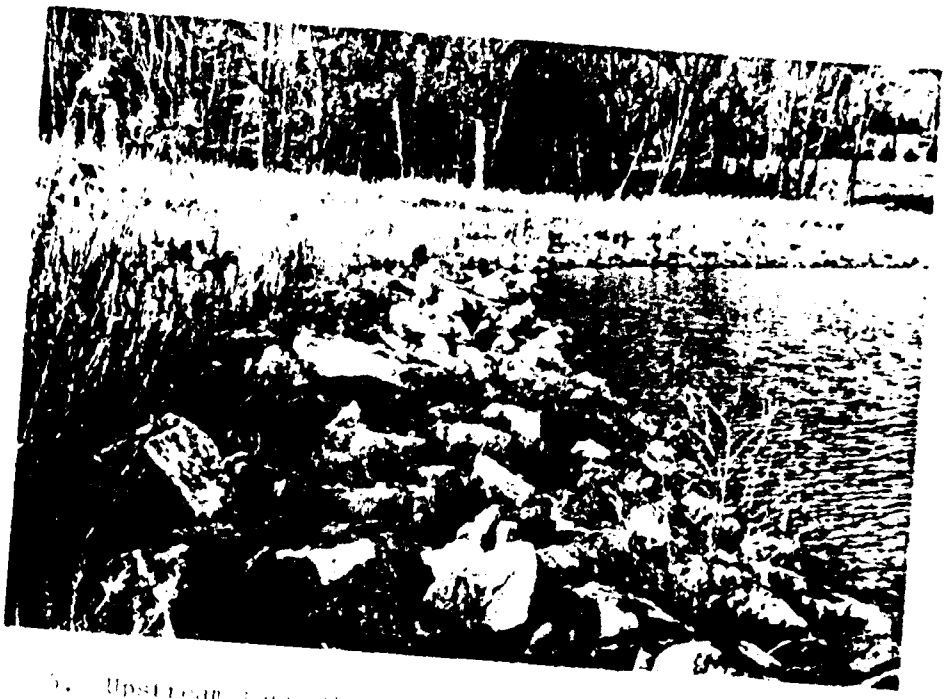
PHOTOGRAPH LOCATION PLAN

EXHIBIT C-1

1. Overview of Dam.

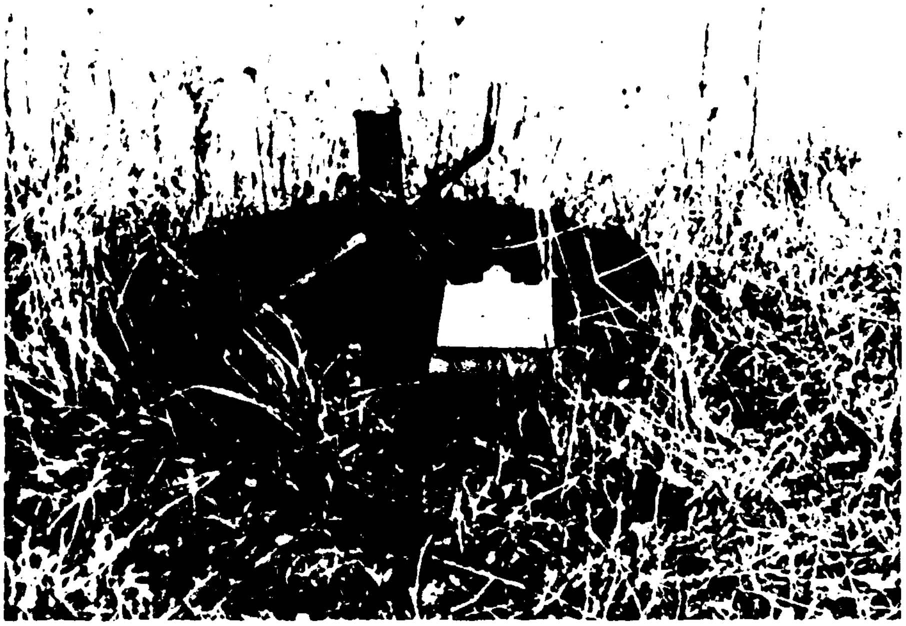
[illegible] and upper [illegible] discharge channel.



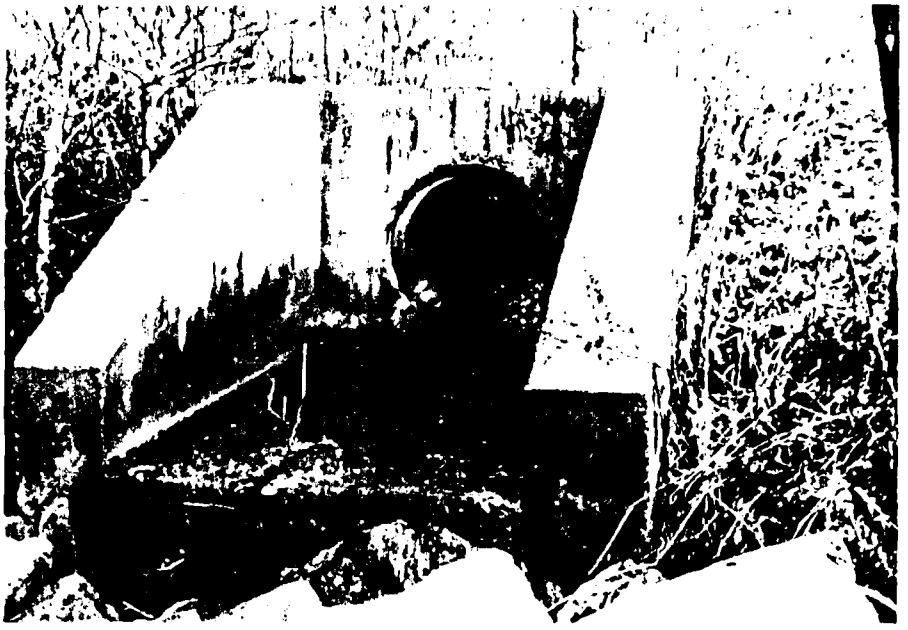


3. Upstream face of embankment.

7. Outlet works headwall and discharge channel.



8. [illegible] embankment crest.



9. Downstream end of outlet conduit and headwall.

10. Downstream hazard area from top of embankment.

APPENDIX D

HYDROLOGY AND HYDRAULICS

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequence resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

HYDROLOGY & HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: MOUNTAIN SHADOW LAKE DAM

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

SUSQUEHANNA RIVER BASIN

STATION	1	2	3
STATION DESCRIPTION	MOUNTAIN SHADOW LAKE DAM		
DRAINAGE AREA (SQUARE MILES)	2.60		
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	2.60		
ADJUSTMENT OF PMF FOR (1) DRAINAGE AREA LOCATION (%)	100%		
6 Hours	117		
12 Hours	127		
24 Hours	136		
48 Hours	143		
72 Hours	145		
SNYDER HYDROGRAPH PARAMETERS			
Zone (2)	13		
C_p (3)	0.50		
C_t (3)	1.85		
L^t (MILES) (4)	2.73		
L_{ca} (MILES (4)	1.12		
$tp = C_t (L \cdot L_{ca})$ 0.3 (HOURS)	2.59		
SPILLWAY DATA			
CREST LENGTH (FEET)	100.0		
FREEBOARD (FEET)	5.0		

(1) HYDROMETEOROLOGICAL REPORT 40 , U. S. Army Corps of Engineers, 1955.

(2) Hydrologic zone defined by Corps of Engineers, Baltimore District, For Determination of Snyder Coefficients (C_p and C_t).

(3) Snyder Coefficients

(4) L = Length of longest watercourse from dam to basin divide.
L_{ca} = Length of longest watercourse from dam to point opposite basin centroid.

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 1 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY _____ DATE 1-6-81

DAM CLASSIFICATION

SIZE OF DAM - SMALL
HAZARD - HIGH
REQUIRED SDF - ½ PMF TO FULL PMF

DAM STATISTICS

HEIGHT OF DAM - 20 feet
STORAGE AT NORMAL POOL - 107 AC-FT
STORAGE AT TOP OF DAM - 360 AC-FT

** ELEVATIONS
TOP OF DAM (DESIGN) - 948.0
TOP OF DAM (LOW POINT) - 947.?
NORMAL POOL - 942.0
SPILLWAY CREST - 942.0
STREAMBED AT CENTERLINE OF DAM - 927.8
OUTLET WORKS: INVERT - 933.6
OUTLET - 933.2 (FEILD MEASURED)

HYDROGRAPH PARAMETERS

RIVER BASIN - SUSQUEHANNA RIVER BASIN
ZONE - 13
SYNDERS COEFFICIENTS:

C_p - 0.5
C_t - 1.85

* MEASURED PARAMETERS - FROM U.S.G.S. QUAD SHEET

L = LENGTH OF THE LONGEST WATERCOURSE L = 2.73 MILES
L_{CA} = LENGTH OF THE LONGEST WATERCOURSE TO CENTROID OF THE BASIN L_{CA} = 1.12 MILES

* - U.S.G.S. QUAD SHEET ENTITLED NUREMBERG, PA.

L = 14,400 feet ; L_{CA} = 5900 feet
2.73 miles 1.12 miles

** - ALL ELEVATIONS ARE REFERENCED TO OGEE WEIR CREST EL. 942.0

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 2 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY DATE 1-6-81

NOTE. ELEVATIONS ARE REFERENCED TO DRAWINGS SHOWING SPILLWAY (OGEE WEIR) AT ELEVATION 942.0. THIS SEEMS REASONABLE WHEN EXAMINING U.S.G.S. MYERSBURG QUAD SHEET. THE LAKE DOES NOT HAVE AN ELEVATION GIVEN ON QUAD SHEET.

t_p = SNYDER'S BASIN LAG TIME TO PEAK IN HOURS

$$t_p = C_t (L L_{CA})^{0.3}$$

$$= 1.85(2.73(1.12))^{0.3} = 2.59 \text{ hours}$$

RESERVOIR CAPACITY

- SURFACE AREA AT NORMAL POOL (EL 942.0) = 35 ACRES
- SURFACE AREA AT ELEVATION 960.0 = 240 ACRES
  (PLANIMETERED VALUE)

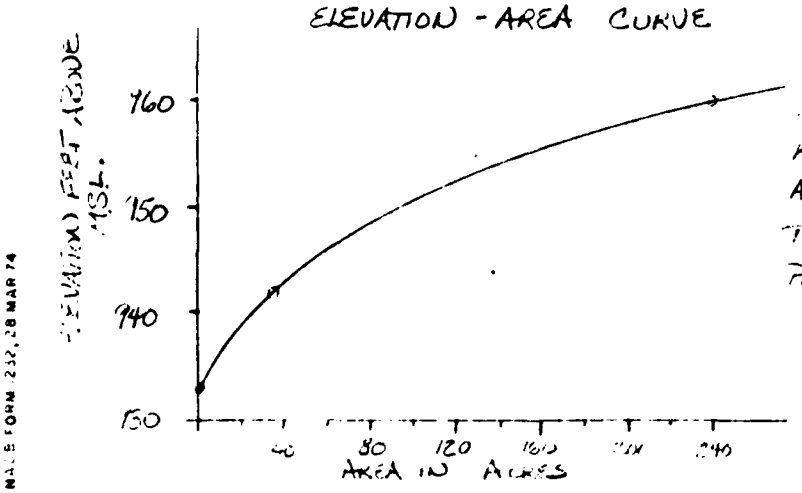
ASSUME CONICAL METHOD APPLIES TO FIND LOW POINT IN POOL, BELOW NORMAL POOL.

VOLUME AT NORMAL POOL = 107 AC-FT.
(FROM PENNDER FILES)

$V = \frac{1}{3} A H$ $\quad H = \frac{3V}{A} = \frac{3(107 \text{ AC FT})}{35 \text{ AC}} = 9.17$ feet.

ZERO ELEVATION 942.0 - 9.2 = 932.8

ELEVATION - AREA CURVE



FOR FLOOD ROUTING PURPOSES, ASSUME THE AVERAGE END AREA METHOD IS SUITABLE TO ELEVATIONS ABOVE NORMAL POOL - EL 942.0.

$$\Delta V = \left(\frac{A_1 + A_2}{2}\right) \Delta H$$

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BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 3 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY DATE 1-7-81

ELEVATION - STORAGE TABLE

ELEVATION (MSL)	AREA (ACRES)	ΔH (FT)	$\Delta V = \left(\frac{A_1+A_2}{2}\right)\Delta H$ (AC-FT)	CUMULATIVE VOLUME (AC-FT)	
932.8	0	-	0	0	↓ 0
942.0	35	-	107	107	110
943.0	42	1.0	38.5	145.5	145
944.0	48	1.0	45.0	190.5	190
945.0	53	1.0	50.5	241.0	240
946.0	60	1.0	56.5	297.5	300
947.0	66	1.0	63.0	360.5	360
948.0	75	1.0	70.5	431.0	430
949.0	85	1.0	80.0	511.0	510
950.0	95	1.0	90.0	601.0	600
960.0	240	10.0	1675.0	2276.0	2280

NOTE: DRAINAGE AREA ABOVE DAM = 2.60 mi^2

1" of runoff = $1in\left(\frac{ft}{12in}\right)(2.60\ mi^2)\left(\frac{640\ ac}{mi^2}\right)$ = 138.66 AC-FT

ELEVATION (MSL)	STORAGE (AC-FT)
932.8	0
942.0	110
943.0	145
944.0	190
945.0	240
946.0	300
* 947.0	360
948.0	430
949.0	510
950.0	600
960.0	2280

THIS DATA TO BE INPUT ON NS & NE CARDS.

* TOP OF DAM (LOW POINT)

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 4 OF 11 SHEETS

COMPUTED BY JB CHECKED BY DATE 1-7-81

PMP CALCULATIONS:

- APPROXIMATE RAINFALL INDEX = 22.2 INCHES (CORRESPONDING TO A DURATION OF 24 HOURS AND A DRAINAGE AREA OF 200 mi^2) - ALL SEASON ENVELOPE
- SUSQUEHANNA RIVER BASIN - GEOGRAPHIC AREA ADJUSTMENT MADE BY HYDROMET 40 - FIGURE 1 IS 100 %.
- DEPTH-AREA-DURATION - HYDROMET 40 VALUE.
- ASSUME VALUES CORRESPONDING TO A 10 mi^2 AREA MAY BE APPLIED TO THIS 2.60 mi^2 AREA

DURATION (HRS)	PERCENT OF INDEX RAINFALL
6	117
12	127
24	136
48	143
72	145

NOTE: HOP BROOK FACTOR IS INTERNALLY COMPUTED BY THE HECIDB PROGRAM. FOR A DRAINAGE AREA LESS THAN 10 SQUARE MILES THE ADJUSTMENT FACTOR = 0.80. THIS ADJUSTMENT, FOR BASIN SHAPE AND FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN.

SDF: BASED ON THE SMALL HEIGHT OF DAM AND THE SMALL STORAGE, THE SDF SELECTED FOR THIS POND WAS THE ½PMF. THIS IS IN ACCORDANCE WITH THE GUIDENCE PROVIDED.

∴ USE SDF = ½ PMF

MADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS — PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SPRINGS LAKE — SHEET 5 OF 11 SHEETS

COMPUTED BY JMB — CHECKED BY — DATE 1-2-81

EMERGENCY SPILLWAY CAPACITY :

NOTE: SPILLWAY IS NEAR LEFT ABUTMENT. SEE FIELD SKETCH IN APPENDIX A, EXHIBIT 1.

SPILLWAY DATA

TYPE - Ogee concrete weir
LENGTH - 100 feet
CREST ELEVATION - 942.0 M.S.L.
LOW POINT TOP OF DAM - 947.0 M.S.L.
SPILLWAY FREEBOARD - 5 feet
C VALUE - VARIABLE - DEPENDENT ON DEPTH OF FLOW OVER WEIR

ASSUME DESIGN HEAD IS 5 FEET. THIS WOULD BE A REASONABLE VALUE TO ASSUME.

∴ FROM DESIGN OF SMALL DAMS PG 378, FIGURES 249 & 250 WE FIND THAT: KNOWING $P = 2.5$ and $H_o = 5.0$

$\frac{P}{H_o} = \frac{2.5}{5.0} = 0.5$; $C_o = 3.80$ = DESIGN "C"

RIM ELEVATION (MSL)	H_e (ft)	H_o (ft)	$\frac{H_e}{H_o}$ (ratio)	$\frac{C}{C_o}$ (ratio)	C	$Q = CLH_e^{3/2}$ (CFS)	USE
942.0	0	5	0	0.80	3.04	0	0
943.0	1	5	0.20	0.85	3.23	323	320
944.0	2	5	0.40	0.90	3.42	967	970
945.0	3	5	0.60	0.94	3.57	1855	1860
946.0	4	5	0.80	0.97	3.69	2952	2950
947.0	5	5	1.00	1.00	3.80	4249	4250
948.0	6	5	1.20	1.02	3.88	5702	5700
949.0	7	5	1.40	1.05	3.99	7389	7390
950.0	8	5	1.60	1.07	4.07	9204	9210
960.0	18	5	3.60	1.19	4.52	31921	31930

* APPROXIMATE.

NA FORM 1-72-28 MAR 74

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SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 6 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY DATE 5 81

SPILLWAY RATING TABLE:

ELEVATION (MSL)	Q (CFS)
942.0	0
943.0	320
944.0	970
945.0	1860
946.0	2950
* 947.0	4250
948.0	5700
947.0	7390
950.0	9210
960.0	31900

* INDICATES LOW POINT TOP OF DAM

EMBANKMENT RATING CURVE:

THIS ANALYSIS ASSUMES THAT THE EMBANKMENT BEHAVES AS A BROAD CRESTED WEIR IF OVERTOPPING OCCURS. THE DISCHARGE CAN BE ESTIMATED BY:

$$Q = CL_1 H_w^{3/2}$$

WHERE:

Q = DISCHARGE OVER EMBANKMENT, IN CFS
L_1 = LENGTH OF EMBANKMENT, FT
H_w = WEIGHTED HEAD IN FEET, AVERAGE FLOW AREA WEIGHTED ABOVE LOW POINT OF DAM
C = COEFFICIENT OF DISCHARGE

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 7 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY DATE 5 81

LENGTH OF EMBANKMENT INNUNDATED VS RESERVOIR ELEVATION:

RESERVOIR ELEVATION (MSL)	EMBANKMENT LENGTH (ft)
947.0	0
948.0	450
949.0	495
950.0	510
960.0	550

* MAXIMUM LENGTH OF EMBANKMENT IS 550 feet

EMBANKMENT RATING TABLE ASSUME C = 2.85 *

RESERVOIR ELEVATION (MSL)	L_1 (ft)	L_2 (ft)	INCREMENTAL HEAD, H_i (ft)	① INCREMENTAL FLOW AREA, A_i (ft^2)	TOTAL FLOW AREA (ft^2)	② WEIGHTED HEAD (ft)	③ Q (CFS)
947.0	0	-	-	-	-	-	-
948.0	450	0	1.0	225.0	225.0	0.5	453
949.0	495	450	1.0	472.5	697.5	1.41	2362
950.0	510	495	1.0	502.5	1200.0	2.35	5236
960.0	550	510	10.0	5300.0	6500.0	11.81	63618

① $A_i = H_i[(L_1+L_2)/2]$

② $H_w = A_T/L_1$

③ $Q = CL_1H_w^{3/2}$

* - C = 2.85 from VARNELL & NAGLER FOR BROAD CRESTED WEIR.

NADB FORM 1232, 26 MAR 74

NA[illegible] STRUCTURES DIVISION CORPS OF ENGINEERS — PAGE

DAM SAFETY ANALYSIS

[illegible] MOUNTAIN SHADOW LAKE — SHEET [illegible]

COMPUTED BY RPB — CHECKED BY [illegible] — DATE 5 81

TOTAL FACILITY RATING CURVE *

TOTAL = SPILLWAY + EMBANKMENT

RESERVOIR ELEVATION (MSL)	SPILLWAY (CFS)	EMBANKMENT (CFS)	TOTAL (CFS)
942.0	0		
943.0	320	0	320
944.0	970	0	970
945.0	1860	0	1860
946.0	2950	0	2950
* 947.0	4250	0	4250
948.0	5700	450	6150
949.0	7390	7360	14750
950.0	9210	15240	24450
960.0	31900	43600	75500

* LOW POINT TOP OF DAM

* THESE VALUES DO NOT INCLUDE 24" OUTLET CONDUIT FOR PURPOSES OF ROUTING THE PMF PERCENTAGE FLOODS THE 24" CONDUIT WILL BE IGNORED AND THE ABOVE TABLE WILL BE INPUT ON THE J4 & J5 CARDS.

OUTLET WORKS:

THE 24" REINFORCED CONCRETE PRESSURE PIPE HAS A LENGTH OF APPROXIMATELY 12 FEET AND A SLOPE OF 0.0044 FT/FT OVER THE LENGTH THE UPSTREAM INVERT IS AT ELEVATION 933.0 AND THE DOWNSTREAM INVERT IS AT ELEVATION 9332 (FIELD INSPECTED VALUE).

THE INTAKE OF THE OUTLETWORKS IS SHOWN IN APPENDIX E THE WINGWALLS ARE PARALLEL TO THE DIRECTION OF FLOW AND THE INTAKE HAS A TRASH RACK ATTACHED.

NADB FORM 1232, 28 MAR 74

FOR APPROXIMATE VALUES [illegible] THE OUTLET STRUCTURE CAPACITY, THE STRUCTURE WAS ASSUMED TO HAVE A HEAD WALL WITH A SQUARE EDGE AND THEREFORE Ke 0.5. THIS VALUE WAS FOUND IN APPENDIX B OF HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS, U.S. DEPARTMENT OF COMMERCE, DEC. 1965. THIS ANALYSIS WILL ASSUME [illegible] CONTROL

Ke = 0.5
L = 92 FEET
D = 24 INCHES

HW [illegible] 133.2 Slope S_0 H h_0 433.2

SUBMERGED OUTLET CULVERT FLOWING FULL

$HW = H + h_0 - LS_0$

ASSUME THAT THE [illegible] IS [illegible] 0 FOOT TAILWATER [illegible] AT EL 135.3

LS_0 [illegible] FEET $H = HW - h_0 + LS_0$

H [illegible] DIFFERENTIAL HEAD BETWEEN [illegible] POOL ELEVATION AND DOWNSTREAM TAILWATER ASSUMED ELEV OF 135.3

POOL ELEVATION [illegible]	[illegible]	H FEET	Q CFS	REMARKS FOR OUTLET
135.[illegible]	[illegible]	0	0	
14[illegible]	[illegible]	[illegible]7	[illegible]	NORMAL POOL
143	[illegible]	7.7	44	
[illegible]	[illegible]	8.7	46	
145	[illegible]	[illegible]7	48	
146	[illegible]	[illegible]7	[illegible]	
14[illegible]	[illegible]	[illegible]	[illegible]	MAXIMUM POOL
[illegible]8	[illegible]	[illegible]7	[illegible]5	

[illegible] MAXIMUM FLOW

[illegible]

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

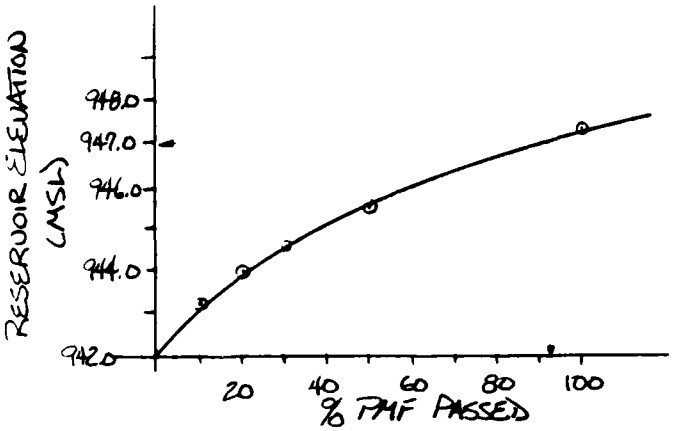
SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS MOUNTAIN SHADOW LAKE SHEET 10 OF 11 SHEETS

COMPUTED BY JPB CHECKED BY _____ DATE 1-8-81

RESULTS OF THE OVERTOPPING ANALYSIS:

AS CAN BE SEEN ON PAGE 5/5 OF THE OVERTOPPING ANALYSIS THE FOLLOWING CURVE CAN BE DRAWN FROM THE SUMMARY TABLE.



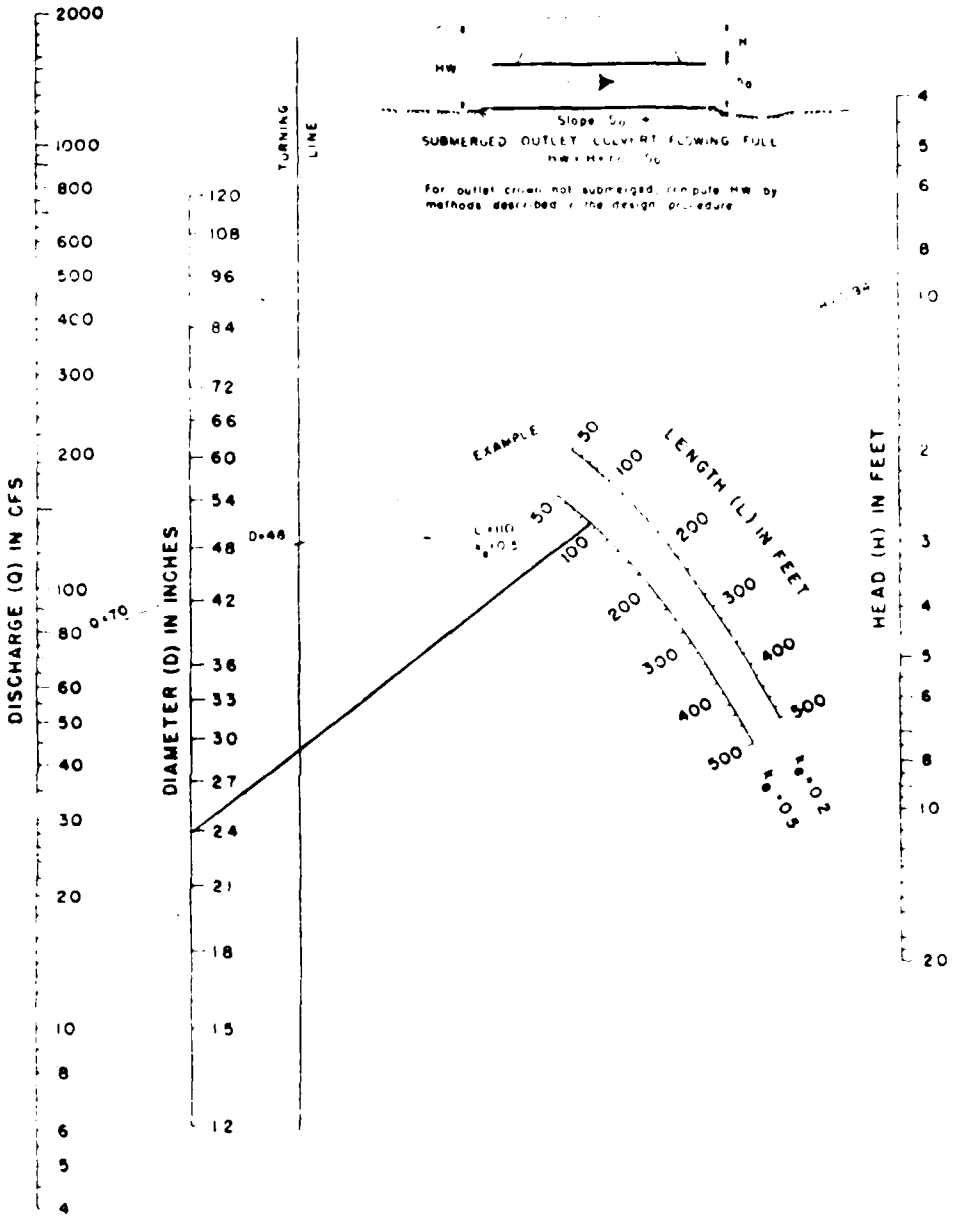
THE DAM AND SPILLWAY CAN ACOMMONDATE 92% OF PMF PRIOR TO OVERTOPPING THE EMBANKMENT.

TOP OF DAM AT ELEVATION 947.0

SINCE the SDF = ½ PMF , AND THIS FACILITY CAN ACOMMONDATE 92% OF THE PMF, THE SPILLWAY IS CONSIDERED TO BE ADEQUATE.

NADB FORM 1232, 28 MAR 74

CHART 9



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN 1963

```
1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  01 APR 80
 **********
     1              A1      MOUNTAIN SHADOW LAKE  DER NO. 70-19-80
     2              A2   DAM SAFTEY INSPECTION PROGRAM     1-8-81
     3              A3    OVERTOPPING ANALYSIS    ***  PRELIMINARY   ***
     4              B   144       0      20       0       0       0       0       0       0       0
     5              B1    5       0       0       0       0       0       0       0       0       0

     6              J     1       5       1
     7              J1  0.10    0.20    0.30    0.50    1.00
     8              K     0       1       0       0       0       0       1       0       0       0
     9              K1   RUNOFF FROM DRAINAGE AREA ABOVE MOUNTAIN SHADOW LAKE
    10              M     1       1    2.60       0    2.60       0       0       0       1       0
    11              P     0    22.2     117     127     136     143     145
    12              T     0       0       0       0       0       0     1.0    0.05       0       0
    13              W  2.59    0.50
    14              X  -1.5   -0.05       2
    15              K     1       1       0       0       0       0       1       0       0       0
    16              K1   ROUTING %PMF'S THRU MOUNTAIN SHADOW LAKE AND SPILLWAY
    17              Y     0       0       0       1       1       0       0       0       0       0
    18              Y1    1       0       0       0       0       0    -942.     -1       0       0
    19              Y4 942.0    943.0   944.0   945.0   946.0   947.0   948.0   949.0   950.0   960.0
    20              Y5    0     320     970    1860    2950    4250    6150    9750   14450   95500
    21              $S    0     110     145     190     240     300     360     430     510    2280
    22              $E 932.8    942.0   943.0   944.0   945.0   946.0   947.0   948.0   949.0   960.0
    23              $$ 942.0
    24              $D 947.0
    25              K    99
1                              PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                    RUNOFF HYDROGRAPH AT          1
                                    ROUTE HYDROGRAPH TO           1
                                    END OF NETWORK


1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  01 APR 80
 **********
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A-15

MOUNTAIN SHADOW LAKE

OVERTOPPING ANALYSIS

RUN DATE= 81/01/08.
TIME= 06.49.29.

MOUNTAIN SHADOW LAKE DER NO. 70-19-80
DAM SAFTEY INSPECTION PROGRAM 1-8-81
OVERTOPPING ANALYSIS *** PRELIMINARY ***

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
144	0	20	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .10 .20 .30 .50 1.00

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM DRAINAGE AREA ABOVE MOUNTAIN SHADOW LAKE

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	ISNOW	ISAME	LOCAL
1	1	2.60	0.00	2.60	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.20	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

MOUNTAIN SHADOW LAKE
OVERTOPPING ANALYSIS

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.59 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.25 AND R=10.64 INTERVALS

UNIT HYDROGRAPH 61 END-OF-PERIOD ORDINATES. LAG= 2.59 HOURS. CP= .50 VOL= 1.00

13.	50.	102.	163.	225.	277.	313.	328.	318.	291.
265.	241.	219.	200.	182.	165.	151.	137.	125.	114.
103.	94.	86.	78.	71.	65.	59.	54.	49.	44.
40.	37.	33.	30.	28.	25.	23.	21.	19.	17.
16.	14.	13.	12.	11.	10.	9.	8.	7.	7.
6.	6.	5.	5.	4.	4.	3.	3.	3.	3.
2.									

MOUNTAIN SHADOWLAKE

OVERTOPPING ANALYSIS

AC-FT	1960.	3.	3222.	3222.
THOUS CU M	2418.	3830.	3974.	3974.

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

HYDROGRAPH ROUTING

ROUTING %PMF'S THRU MOUNTAIN SHADOW LAKE AND SPILLWAY

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

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-942.	-1

STAGE	942.00	943.00	944.00	945.00	946.00	947.00	948.00	949.00	950.00	960.00
FLOW	0.00	320.00	970.00	1860.00	2950.00	4250.00	6150.00	9750.00	14450.00	95500.00
CAPACITY=	0.	110.	145.	190.	240.	300.	360.	430.	510.	2280.
ELEVATION=	933.	942.	943.	944.	945.	946.	947.	948.	949.	960.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
942.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TOPEL	COQD	EXPD	DAMWID
947.0	0.0	0.0	0.

STATION 1, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

Mountain Shadow Lake

Overtopping Analysis - Vs

D-19

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

1

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 FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .50	RATIO 5 1.00
HYDROGRAPH AT	1	2.60	1	502.	1005.	1507.	2512.	5024.
	(	6.73)	(	14.23)(	28.45)(	42.68)(	71.13)(	142.25)(
ROUTED TO	1	2.60	1	463.	940.	1435.	2401.	4898.
	(	6.73)	(	13.12)(	26.61)(	40.64)(	67.98)(	138.69)(

D-19

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	942.00	942.00	947.00
STORAGE	110.	110.	360.
OUTFLOW	0.	0.	4250.

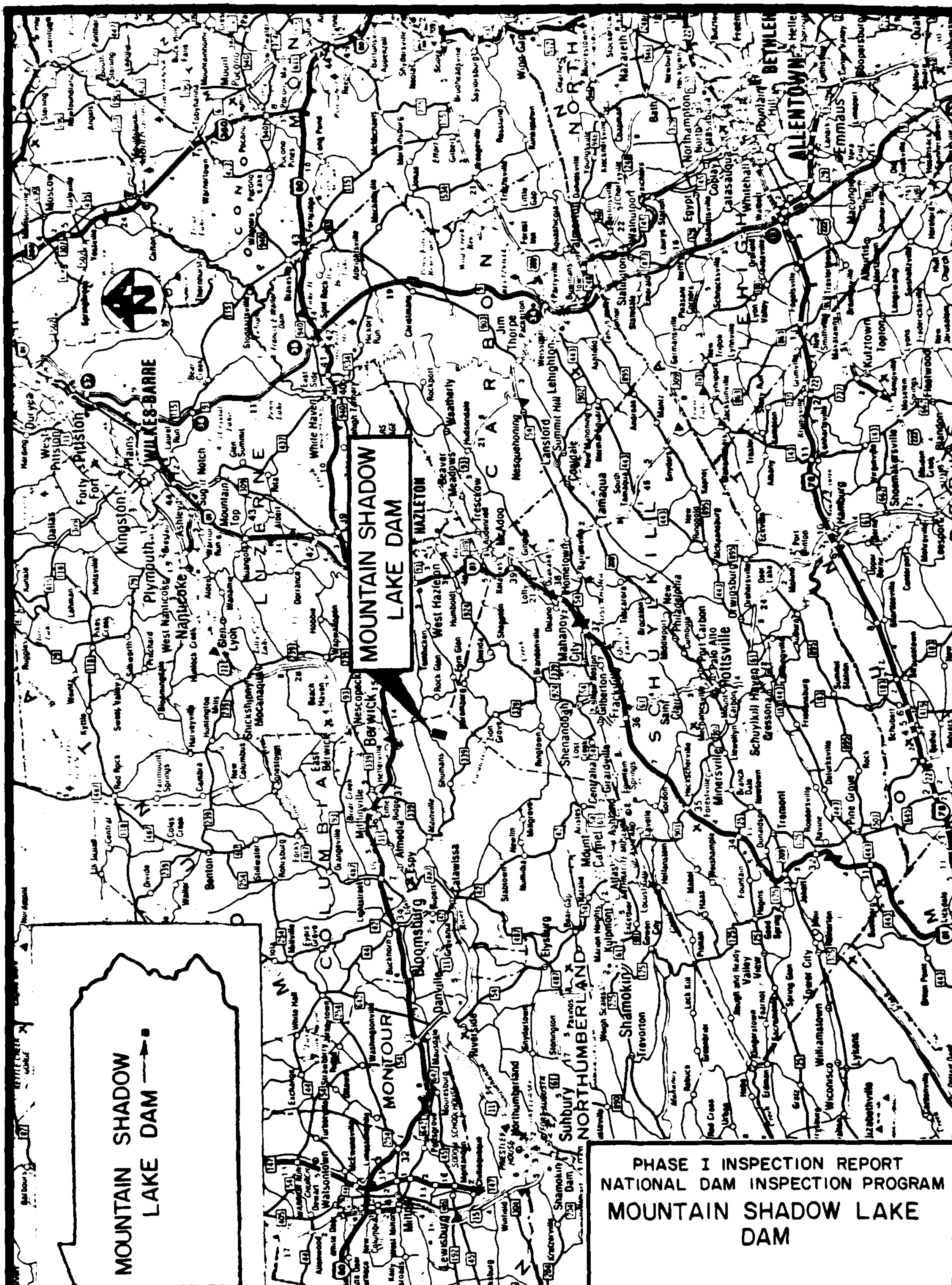
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	943.22	0.00	155.	463.	0.00	43.33	0.00
.20	943.95	0.00	188.	940.	0.00	43.00	0.00
.30	944.52	0.00	216.	1435.	0.00	43.00	0.00
.50	945.50	0.00	270.	2401.	0.00	43.00	0.00
1.00	947.34	.34	384.	4898.	2.33	42.67	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 01 APR 80

Mountain Shadows Lake
Overtopping Analysis Page 5/6

APPENDIX E

PLATES

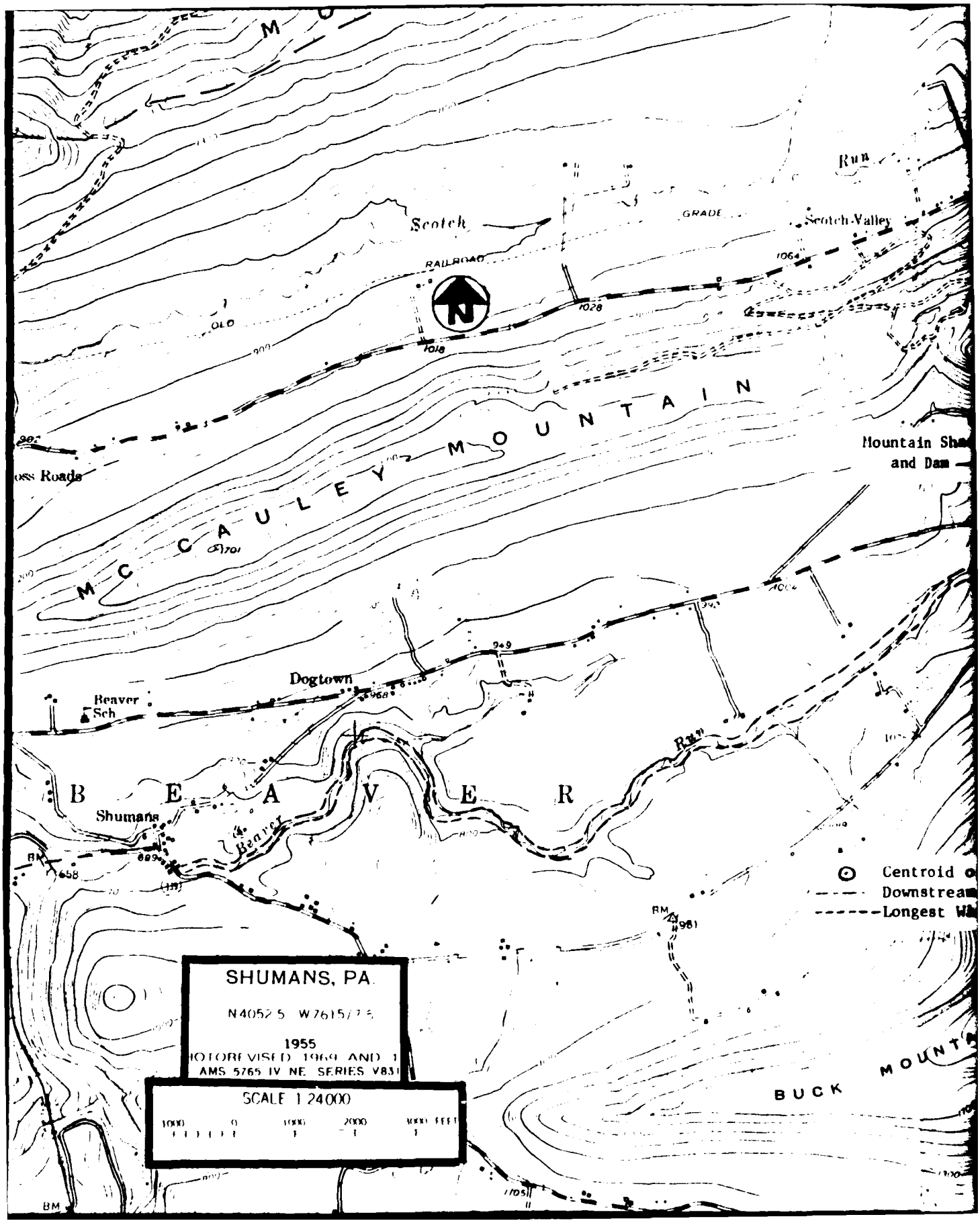


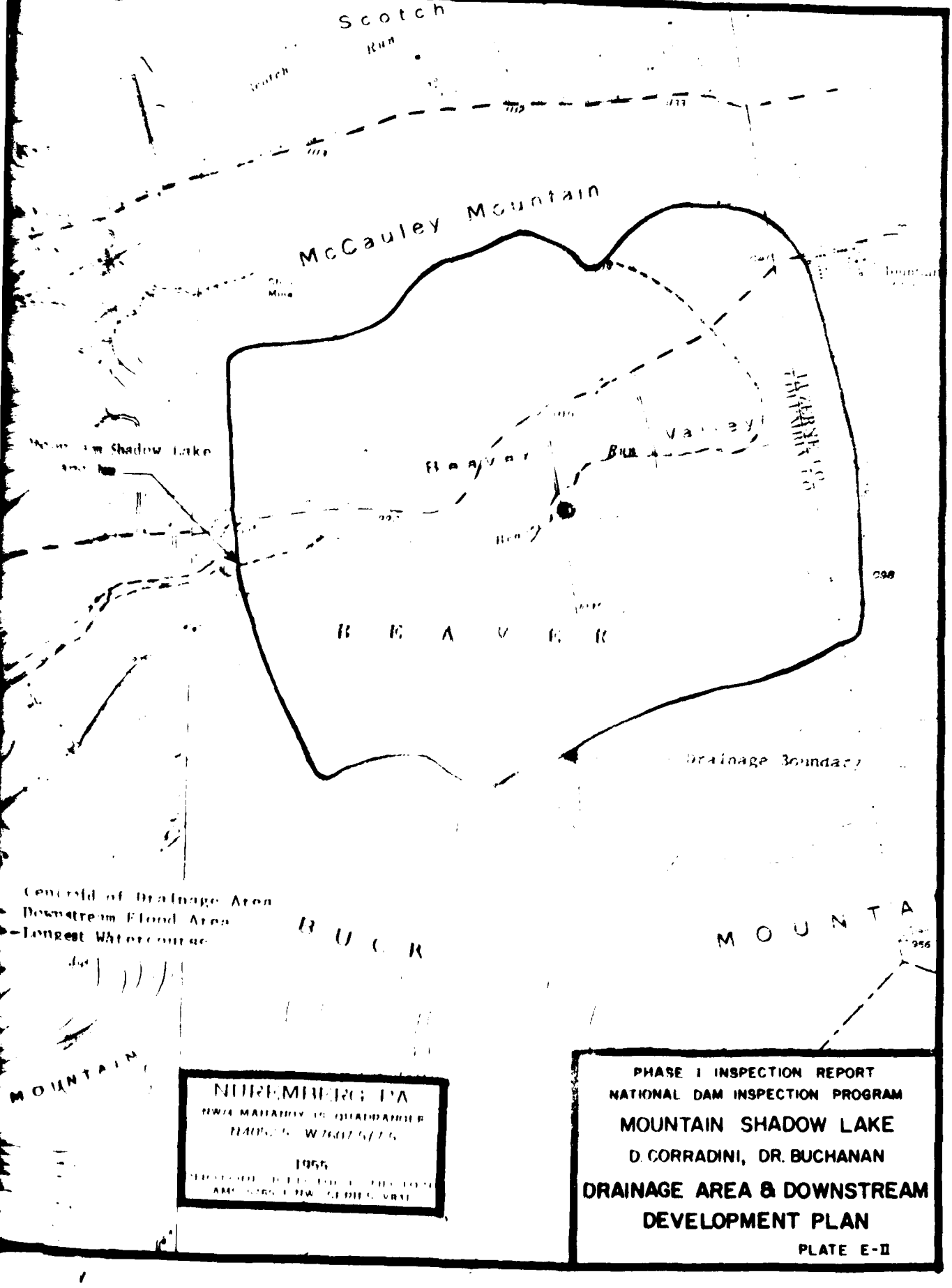
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SHADOW LAKE DAM

LOCATION MAP

PLATE E-I


Scotch
RAILROAD
GRADE
Scotch Valley
Run
OLD
1028
1018
1064
MCCAULEY MOUNTAIN
Mountain Sha
and Dam
oss Roads
Dogtown
Beaver
Sch
BEAVER
Shumans
Beaver
BM
658
889
968
949
981
Centroid o
Downstrea
Longest Wa
BUCK MOUNT
SHUMANS, PA.
N4052.5 W7615/7.5
1955
PHOTOREVISED 1969 AND 1
AMS 5765 IV NE SERIES V831
SCALE 1:24000
1000 0 1000 2000 3000 FEET



NUREMBERG PA
QUADRANGLE
1955

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

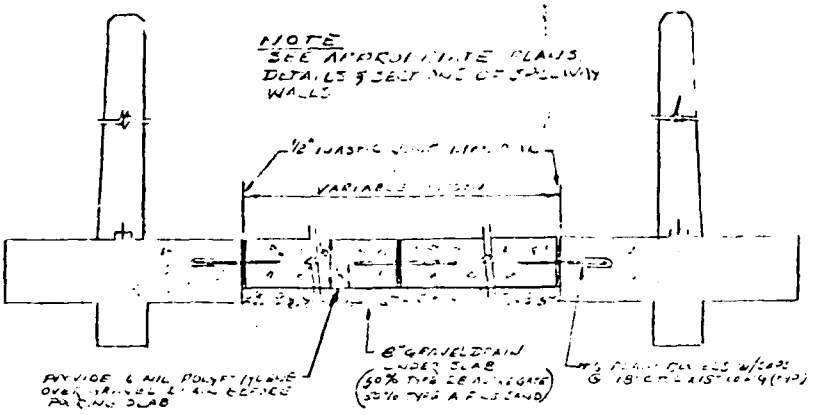
MOUNTAIN SHADOW LAKE

D. CORRADINI, DR. BUCHANAN

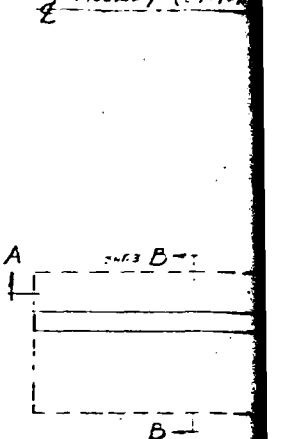
DRAINAGE AREA & DOWNSTREAM DEVELOPMENT PLAN

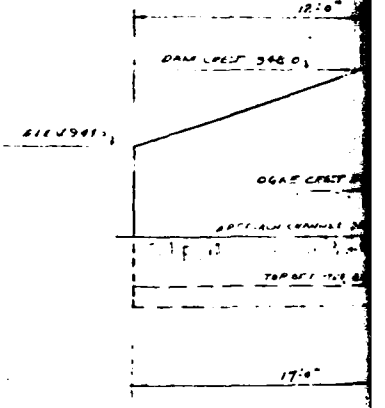
PLATE E-II

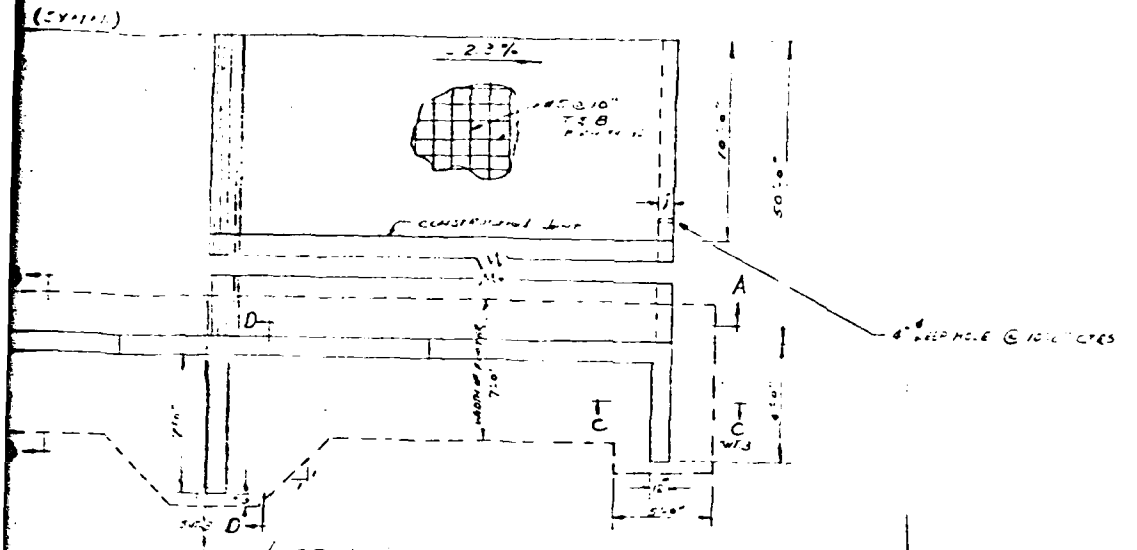
NOTE
SEE APPROXIMATE PLANS, DETAILS & SECTIONS OF SPILLWAY WALLS

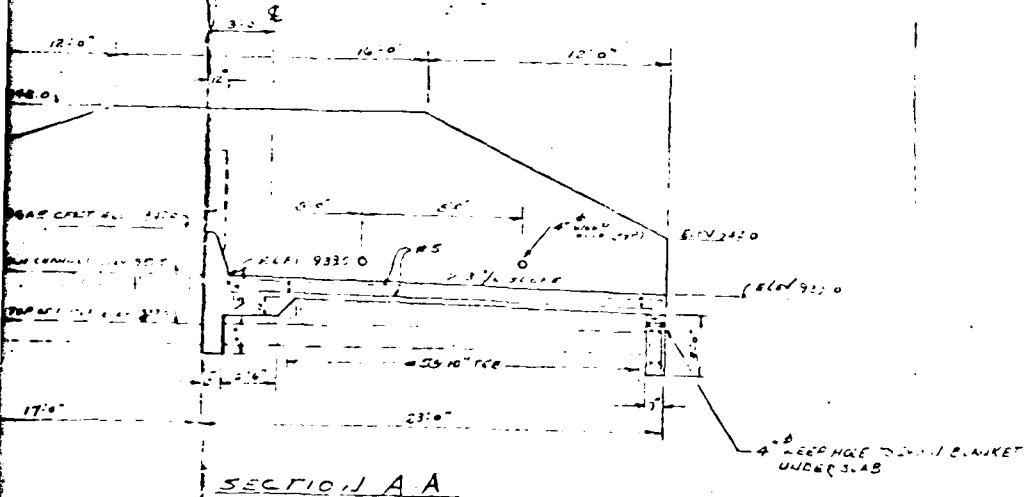


TYPICAL DETAIL SECTION OF SPILLWAY CHANNEL SLAB
NO SCALE

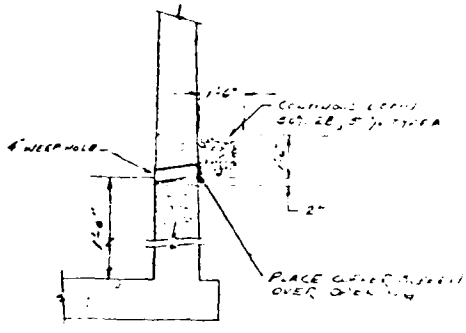








SECTION A-A



TYPICAL WALL SECTION AT WEEP HOLE

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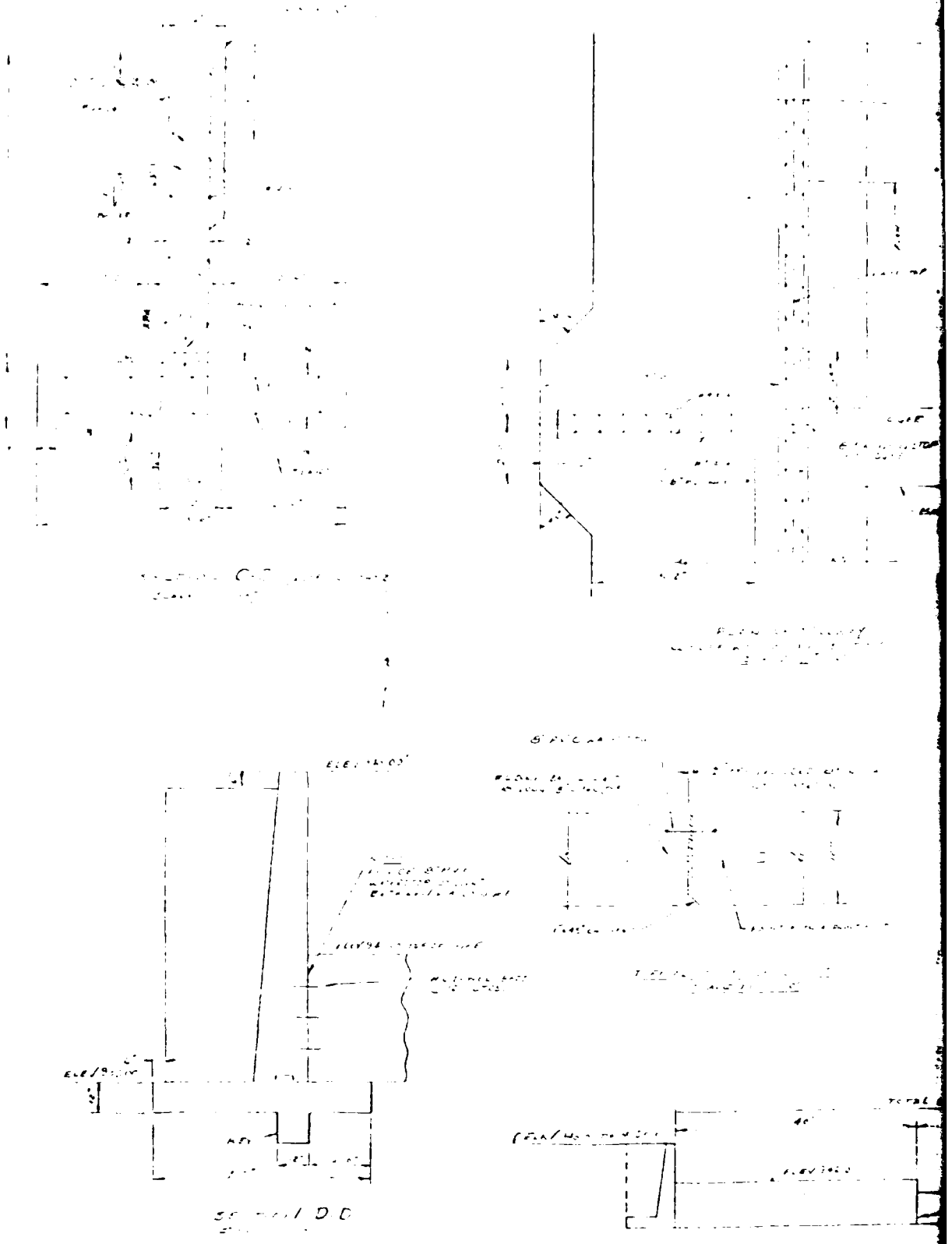
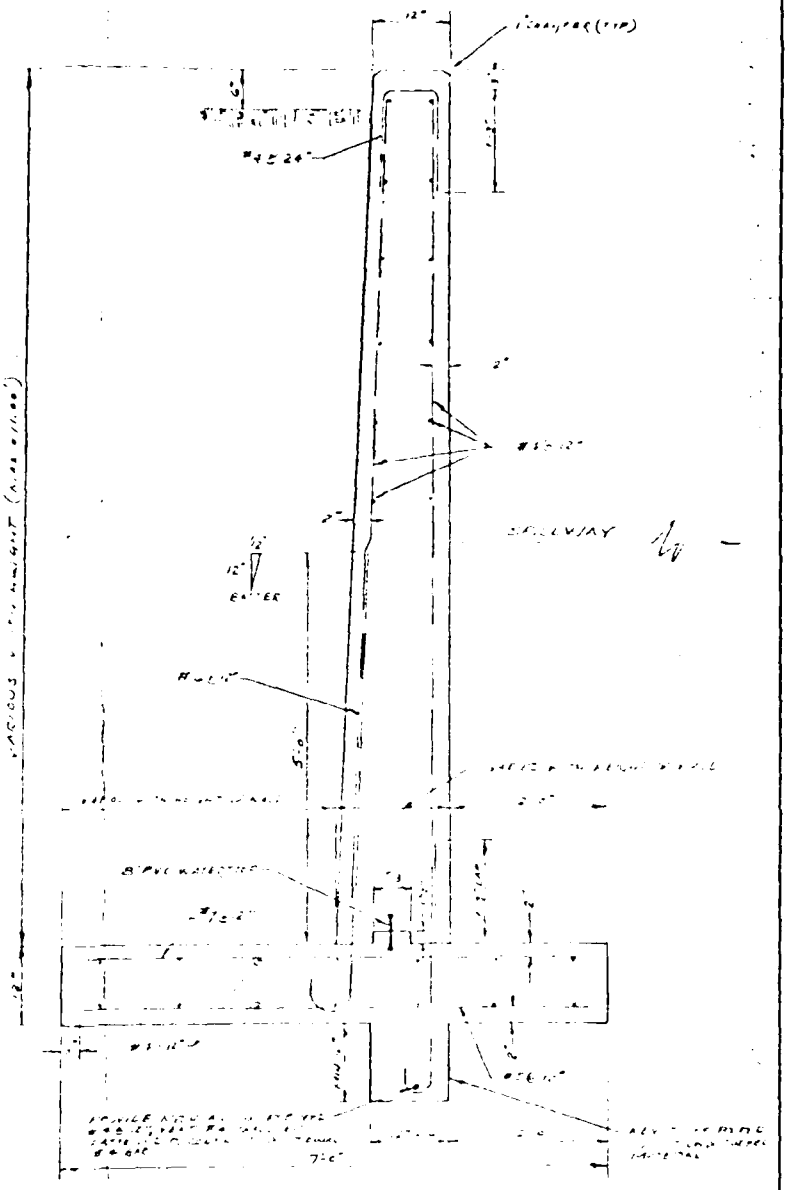
PLATE E-III

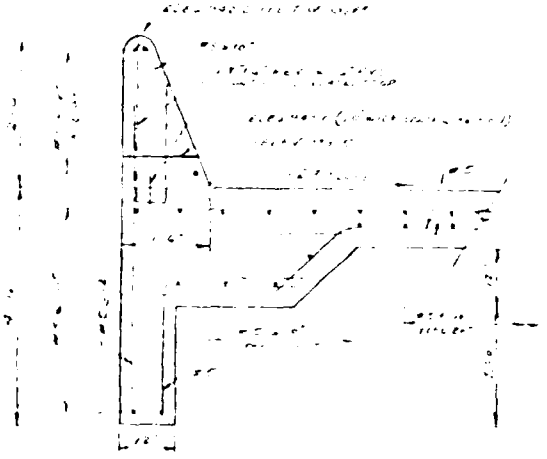
SPILLWAY WALL DESIGN
MOUNTAIN SHADOW LAKE DAM
PENNSYLVANIA

BRUNO ASSOCIATES, INC.





SPILLWAY



OGEE DETAIL

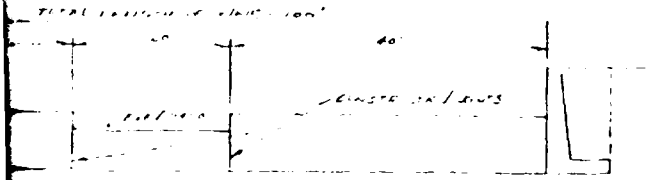
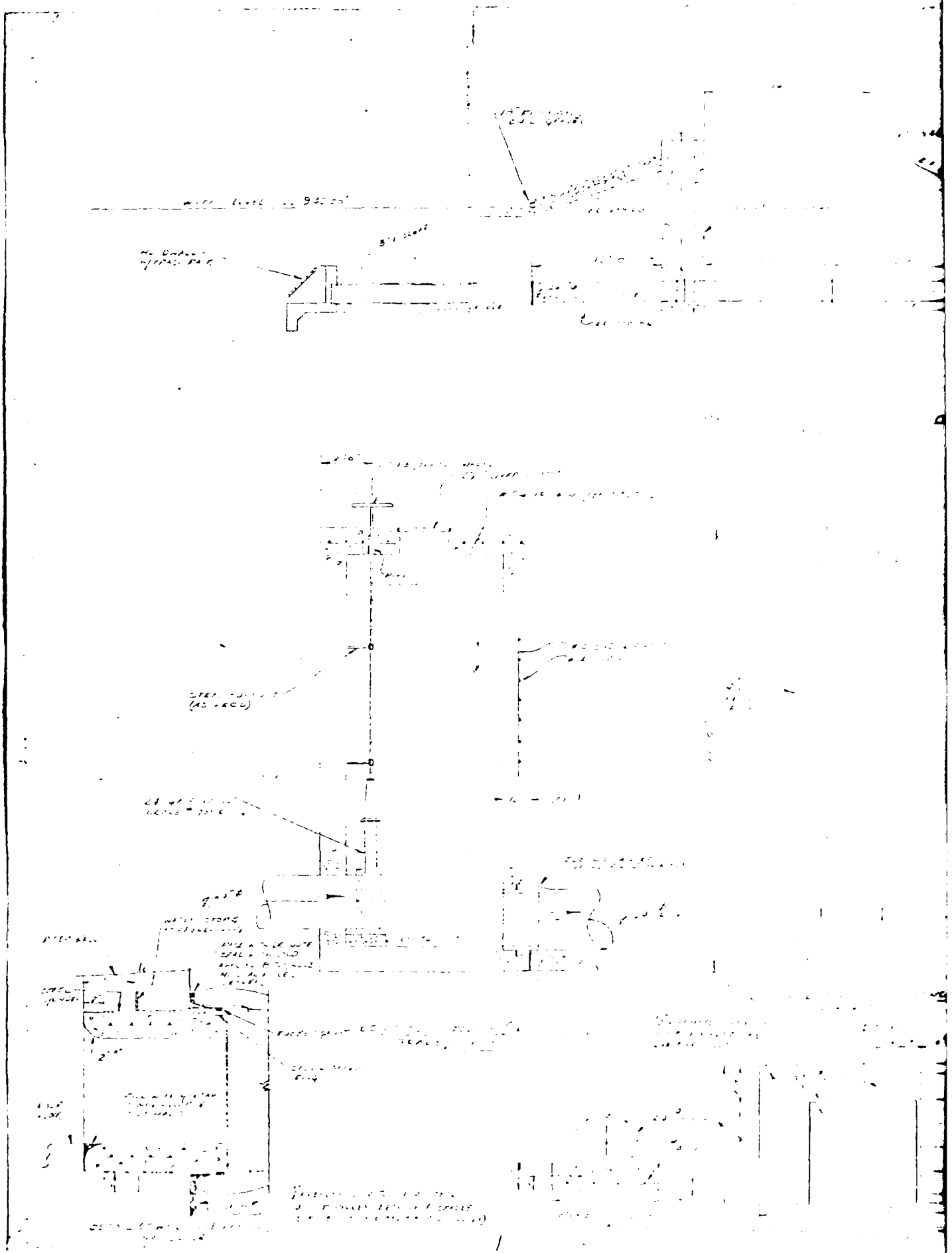
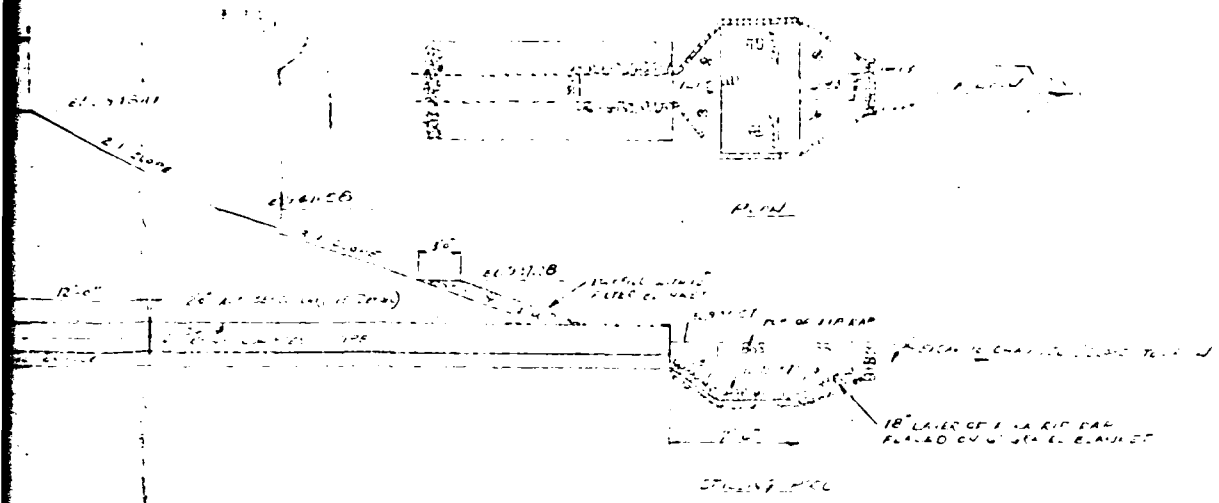
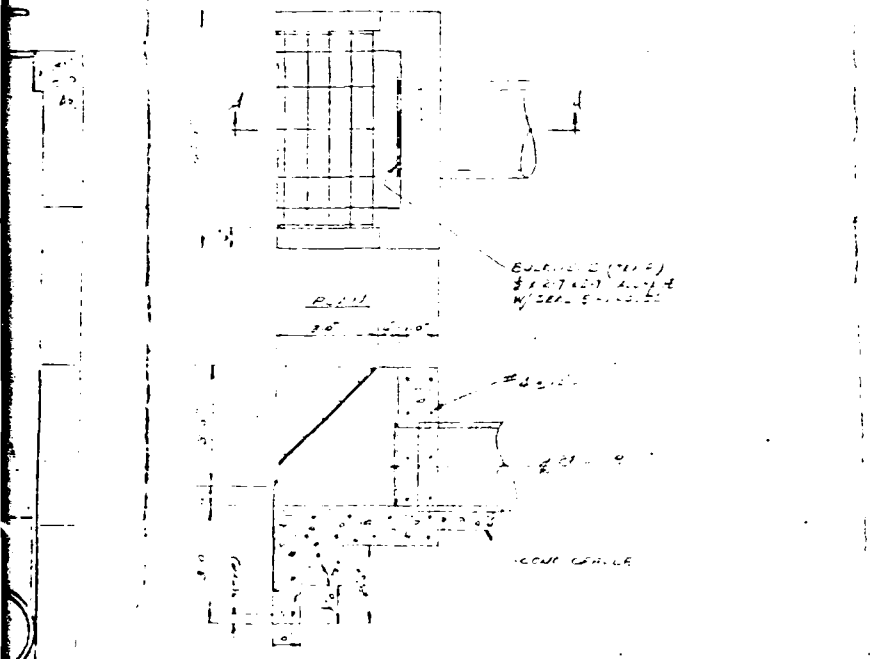


PLATE E-IX







NOTE:
ALL ITEMS ON THIS DRAWING HAVE BEEN INSTALLED BY THE OWNER UNDER PREVIOUS CONTRACT.

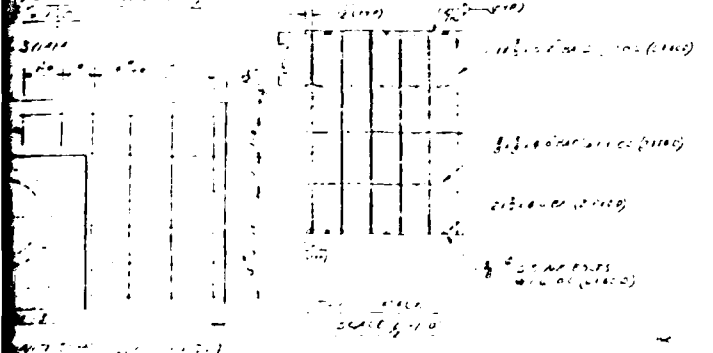


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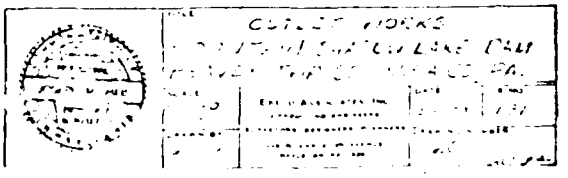
PLATE E-V



APPENDIX F

GEOLOGY

APPENDIX F - GEOLOGY

GENERAL GEOLOGY

The site is within the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. It is in a valley caused by the erosion of the weaker Mauch Chunk shales between the sandstones which constitutes the ridges of the valley. The Mauch Chunk shales constitute the bedrock underlying the dam site. The site should contain unconsolidated colluvial material probably exceeding a thickness of 2 meters. Pre-Wisconsinan glacial drift may also exist below the colluvium. The foundation for the dam is of a relatively impervious nature.

LEGEND
(Bedrock)

¶l LLEWELLYN FORMATION - Gray, fine- to coarse-grained sandstone, siltstone, shale, conglomerate, and numerous anthracite coals in repetitive sequences.

¶p POTTSVILLE GROUP - Gray conglomerate, fine- to coarse-grained sandstone, and siltstone and shale containing minable anthracite coals. Includes three formations. In descending order: Sharp Mountain--conglomerate and conglomerate sandstone; Schuylkill--sandstone and conglomerate sandstone; Tumbling Run--conglomeratic sandstone and sandstone.

Mmc MAUCH CHUNK FORMATION - Grayish-red shale, siltstone, sandstone, and some conglomerate; some local nonred zones. Includes Loyalhanna Member--crossbedded, sandy limestone at base of south-central and southwestern Pennsylvania; also includes Greenbrier Limestone Member and Wymps Gap and Deer Valley Limestones, which are tongues of the Greenbrier. Along Allegheny Front from Blair County to Sullivan County, Loyalhanna Member is greenish-gray, calcareous, crossbedded sandstone.

Mp POCONO FORMATION - Light-gray to buff or light-olive-gray, medium-grained, crossbedded sandstone and minor siltstone, commonly conglomeratic at base and in middle; medial conglomerate, where present, is used to divide into Mount Carbon and Beckville Members; equivalent to Burgoon Sandstone of Allegheny Plateau.

MDsk SPECHTY KOPF FORMATION - Light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and local polymictic diamictite, pebbly mudstone, and laminate; sometimes arranged in crude fining-upward cycles; locally has grayish-red shale near top and conglomerate at base and in middle.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MNT. SHADOW LAKE DAM

D. CORRADINI &
DR. BUCHANAN
GEOLOGIC MAP

FEB. 1981 EXHIBIT F-1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