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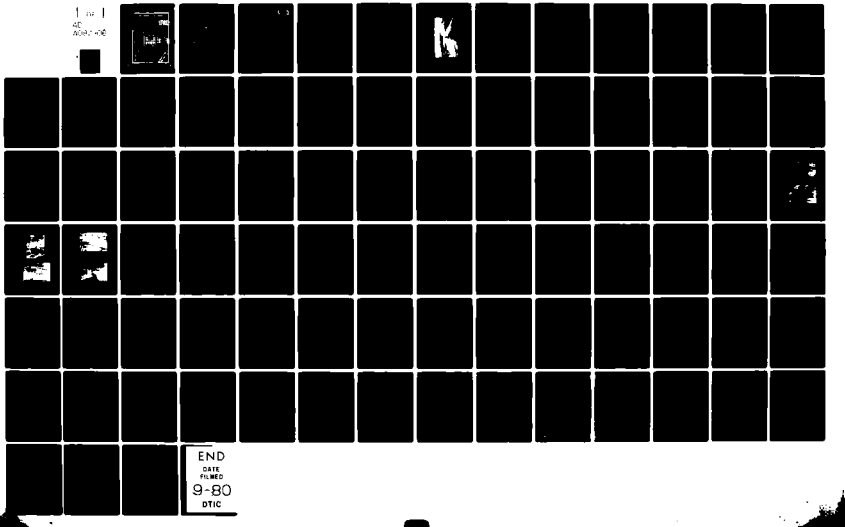

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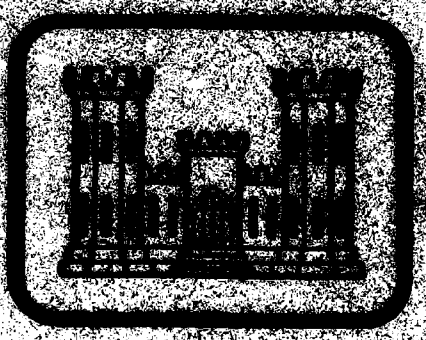
DER NO. 52-142

PIKE COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PREPARED FOR
DEPARTMENT OF THE ARMY
[illegible]more District, Corps of Engineers
Baltimore, Maryland 21203

BY
Berger Associates, Inc.
Harrisburg, Pennsylvania

JUNE 1980

BERGER ASSOCIATES, INC.
DACW31-80-C-0019

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PREFACE

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

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway 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

BRIEF ASSESSMENT OF GENERAL CONDITIONS AND RECOMMENDATIONS

Name of Dam: CRESCENT LAKE DAM

State & State No.: PENNSYLVANIA, 52-142

County: PIKE

Stream: DWARFSKILL CREEK

Date of Inspection: April 2, 1980

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in fair condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is intermediate and the hazard classification is high. The recommended Spillway Design Flood (SDF) for this structure is the Probable Maximum Flood (PMF). The spillway capacity is adequate for passing 58 percent of the PMF peak inflow without overtopping the dam. The spillway, therefore, is considered to be inadequate, but not seriously inadequate.

The following recommendations are presented for immediate action by the owner:

1. That the area at both ends of the spillway weir be cleared to a depth of at least 1.5 feet below the top of weir in order to increase the discharge capacity of the structure.
2. That the valve on the outlet pipe be maintained and operated at least once a year.
3. That all brush and high weeds be removed from the embankment on an annual basis.

4. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall, and

5. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: June 19, 1980

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER
No. 5557E

APPROVED BY:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer
DATE 11 July 1980

OVERVIEW

CRESCENT LAKE DAM

Photograph No. 1

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(6) PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

CRESCENT LAKE DAM

NDI-ID [redacted] PA-00413
DER-ID [redacted] 52-142

Delaware River Basin

[Pike County, Pennsylvania Phase I Inspection Report]

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 inspections of 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

Note: Spillway crest elevation on the design drawings is shown as elevation 82.0. The U.S.G.S. Quadrangle shows a reservoir elevation of 1211.0. The U.S.G.S. elevation is used as the spillway crest elevation in this report. All design elevations have to be increased by 1129 feet for comparison.

Crescent Lake Dam is a zoned earthfill structure. The embankment length is about 440 feet and it has a maximum embankment height of about 45 feet. The 126 foot long ogee spillway weir is located in the right abutment. The drawdown facility consists of a 24-inch pipe under the embankment. The flow through the pipe is controlled with a valve located in a vertical steel pipe manhole located near the centerline of the dam (Plate IV, Appendix E).

B. Location:

Dingman Township, Pike County
U.S.G.S. Quadrangle - Edgemere, Pa.
Latitude 41°-18.1', Longitude 74°-55.0'
Appendix E, Plates I & II

411005

C. Size Classification: Intermediate: Height = 45 feet
Storage = 239 Acre-feet

D. Hazard Classification: High (Refer to Section 3.1.E.)

E. Ownership: Mr. Lewis E. Miller
R.D. #1, Box 192
Milford, PA 18337

F. Purpose: Recreation

G. Design and Construction History

The design for the facilities was prepared by a Mr. Wilkins for Lewis E. Miller. A permit for construction of the dam was issued by PennDER on October 14, 1957, and construction started May 1, 1959. The early part of the construction, consisting mostly of clearing, grubbing and excavation of the trench for the drawdown pipe, was carried out without engineering supervision. A Mr. John B. Fredenstein, P.E., Matamoras, Pennsylvania, became full-time inspector in July, 1959. Construction was completed by December 31, 1959, with the exception of seeding and placing riprap in spillway discharge channel and around the outlet pipe.

H. Normal Operating Procedures

The reservoir is used for recreation and the pool level is maintained at the spillway weir elevation. All inflow is discharged over the spillway.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	6.24
Computed for this report:	6.16
Use:	6.16

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations

Maximum known flood, July 1969, estimated from records for the U.S.G.S. gaging station located on nearby Mill Creek	1722
Outlet works low-pool outlet at pool Elev. 1190	29

Outlet works at pool level Elev. 1211 (spillway crest)	75
Spillway capacity at pool Elev. 1216 (top of dam)	4908

C. Elevation (feet above mean sea level)

Top of dam (low point)	1216
Spillway crest	1211
Upstream pipe invert (estimated)	1185.25
Downstream pipe invert	1177.25
Streambed at centerline of dam (estimated)	1171

D. Reservoir (miles)

Length of normal pool	.4
Length of maximum pool	.5

E. Storage (acre-feet)

Spillway crest (Elev. 1211)	153
Top of dam (Elev. 1216)	239

F. Reservoir Surface (acres)

Top of dam (Elev. 1216)	21.4
Spillway crest (Elev. 1211)	13.8

G. Dam

Refer to Plates III & IV in Appendix E for plan and section.

Type: Zoned earthfill.

Length: 440 feet.

Height: 45 feet.

Top Width: Design - 10 feet; Surveyed - 12 feet.

Side Slopes:

	Design	Surveyed
Upstream	3H to 1V	2.8H to 1V
Downstream	2.5H to 1V	2.8H to 1V

Zoning: Clay core.

Cutoff: Trench excavated to 4 feet depth on centerline dam.

Grouting: None.

H. Outlet Facilities

Type: 24" cast iron pipe under embankment extended with CMP.

Location: Near center of dam.

Closure: 24" gate valve located in manhole near the centerline of the dam.

I. Spillway

Type: Concrete ogee weir.

Length of Weir: 126'.

Crest Elevation: 1211'. A 20 foot long low flow notch at Elevation 1210.8 is located near the center of the weir.

Location: Right abutment.

J. Emergency Outlet

See Section 1.3.H. above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The engineering data for Crescent Lake Dam is limited to design drawings (presented in Appendix E of this report), and a report prepared by the Pennsylvania Department of Environmental Resources (PennDER) on the application for construction of the dam. Letters in the file of PennDER indicate that slope stability calculations and soil test borings were not included in the design. The original design used embankment slopes 2H to 1V, which were changed at the request of PennDER to 3H to 1V on the upstream slope and 2.5H to 1V on the downstream slope. The spillway capacity was calculated by PennDER to be 5420 cfs, which exceeded the required capacity of 4120 cfs.

2.2 CONSTRUCTION

The available construction data are limited to some progress reports by the supervising engineer, inspection reports by PennDER and a few letters indicating changes made during construction. Plate IV, Appendix E, shows the final plan for the diversion (drawdown) pipe. A concrete manhole with a vertical steel pipe riser was constructed near the centerline of the dam. Letters indicate that suitable clay was available for the embankment construction and that unsuitable material in the creek bed was pushed downstream from the toe of the slope. A cutoff trench was excavated to four feet below streambed elevation and to at least 80 feet into the left bank. The bottom width of the trench was 12 feet with side slopes of 1H to 1V. Above the original ground, the core wall was to be sloped to an 8 foot width at the crest of the dam. The excavation in the left bank did not encounter rock. Progress reports indicate that placement of embankment material was completed on December 2, 1959.

Material from the spillway channel excavation was used to construct a road across the creek at the toe of the dam.

2.3 OPERATION

Formal records of operation are not maintained by the owner. Maximum discharges over the spillway are unknown. An inspection report by PennDER, dated April 1960, indicates that some erosion occurred in the spillway discharge channel. Additional riprap protection was requested. The same report states that water was flowing adjacent to the outlet pipe. The source of the flow was unknown, and the letter attributed this to either flow through the embankment or foundation, or to a spring located in the right toe of the embankment. Photographs indicate that the outlet pipe downstream of the roadway consists of a corrugated metal pipe.

2.4 EVALUATION

A. Availability

The available engineering data is contained in the files of PennDER, Harrisburg, Pennsylvania.

B. Adequacy

The available engineering and construction data, combined with the field inspection are considered to be adequate for making a reasonable assessment of the dam.

C. Operating Records

Operating records, including maximum pool levels, have not been maintained.

D. Post Construction Changes

The roadway constructed on top of the downstream toe was added during the construction. Comparing photographs taken in 1960 with existing conditions indicates that riprap was placed immediately downstream of the spillway weir in the spillway outlet channel.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Crescent Lake Dam is fair. The condition can be improved with some regular maintenance work. The spillway, located in the right abutment, is in good condition except for the presence of some obstructions in the forebay area. The embankment appears to be stable but has a growth of heavy weeds and some brush. Seepage was not detected on the slopes of the embankment except near the outlet of the drawdown (diversion) pipe.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report. Photographs of the facilities taken during the inspection are reproduced in Appendix C.

B. Embankment

The horizontal alignment of the embankment is good. The vertical profile of the dam (Plate A-II, Appendix A), indicates that the crest of the dam is about .5 foot above the design elevation except at the spillway wall.

The upstream slope is protected with riprap, and is overgrown with high weeds (see overview photograph). The crest of the dam is in good condition and has no apparent low spots. The downstream slope is covered with brush and weeds. Seepage or sloughage of the downstream slope was not detected during the visual inspection. A large amount of spoil was apparently deposited immediately downstream of the embankment. During the construction of the dam, a paved road was constructed over the spoil area which partially covers the downstream toe.

A small swale is located between the road and the embankment. Surface drainage caused some wet areas in this swale. An inlet carries the water from the swale under the road to an outlet further downstream.

Seepage water was noticed on both sides of the outlet pipe. This pipe is about 40 feet below the crest of the dam and about 165 feet downstream of the centerline embankment. The amount of water was about 8 to 10 gpm on the right side and 4 to 5 gpm on the left side of the pipe. The seepage is contributed to either foundation seepage or originating from the spillway through the fractured rock. Large boulders are in this area, and the slope appears to be stable.

C. Appurtenant Structures

The spillway is located in the right abutment and was excavated into the hillside. The approach to the spillway is directly from the reservoir. The forebay area is shallow and some weed growth at both ends slightly impedes the flow of water. The concrete ogee section is in good condition. Large rocks appear to have been placed against the spillway over about 30 feet of the spillway length near its center. The top of this rock is slightly lower than the top of the ogee weir (see Photographs No. 5 and 6). The spillway abutment walls have some cracks, especially the right wall. Failure of the right wall will, however, not endanger the safety of the structure (Photograph No. 5).

The emergency drawdown is a 24-inch cast iron pipe encased in concrete. The pipe was extended under the roadway fill with a corrugated metal pipe. The control is a gate valve located in the bottom of a manhole near the centerline of the embankment. The manhole is covered with a loose steel plate. Steel rungs provide access to the bottom of the manhole. The owner stated that the valve is difficult to operate and was last used in 1975. Due to the rusty and uncertain condition of the steel rungs, the valve was not inspected.

D. Reservoir Area

The reservoir area has flat to moderate slopes and is apparently stable. All banks are wooded, with several homes located around the reservoir. Siltation has not been reported.

E. Downstream Channel

The immediate downstream channel of the spillway is steep with large boulders and steep side slopes. A bridge crosses the channel about 400 feet downstream of the dam. The vertical clearance is more than adequate for the expected runoff. Three homes are located about a quarter-mile downstream of the dam, and a state highway bridge crosses the creek about half a mile downstream of the dam. A potential hazard to loss of life exists downstream if the dam fails. The hazard category is therefore considered to be "High."

3.2 EVALUATION

The overall visual evaluation of the facilities indicates that Crescent Lake Dam is in fair condition. The embankment appears to be stable and no excessive seepage was detected. The drawdown facilities have no means of positive closure of the upstream end. Recommendations include maintenance items discussed in Section 4.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The dam and reservoir were constructed for use as a recreational facility. The reservoir is maintained at the normal pool level (top of spillway). All inflow is discharged over the spillway. The drawdown facility was last used in 1975 to lower the pool level for maintenance of beaches.

4.2 MAINTENANCE OF DAM

The embankment has a heavy growth of weeds and some brush on the top and both slopes and is apparently not mowed.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility is the drawdown valve, located in a 30 foot deep manhole. This valve is only operated sporadically and there is no program for regular maintenance of the facility.

4.4 WARNING SYSTEM

There is no formally organized surveillance and downstream warning system in existence at the present time.

4.5 EVALUATION

The operational procedures for Crescent Lake Dam are minimal at the present time. It is recommended that a program be developed for regular maintenance of the dam, which should include the removal of weeds and brush, the clearing of the spillway forebay area and the greasing and operation of the drawdown valve on a regular basis. A formal surveillance plan and downstream warning system should be developed for implementation during periods of heavy or prolonged precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Crescent Lake Dam is limited. No area-capacity curve, frequency curve, unit hydrograph, design storm, design flood hydrograph, nor flood routings were available.

B. Experience Data

There are no records of flood levels at Crescent Lake Dam. Based on records of the U.S.G.S. stream gage on Mill Creek at nearby Mountainhome, Pa., the maximum inflow to Crescent Lake is estimated to be 1722 cfs. This flood event was passed apparently without difficulty.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event until the dam is overtopped. It was noted that a large pile of rocks is located just downstream of and against the weir near the center of the dam. Also, rocks and silt are deposited both upstream and downstream of the weir at the right end. This tends to reduce the discharge capacity and creates an additional obstruction on which debris can accumulate. A small low flow notch about 2 inches below the spillway crest is located near the center of the spillway. This was not considered in the computations in Appendix D.

Gold Key Lake, a natural lake, is located about 4 miles upstream from Crescent Lake on Dwarfskill Creek. The outlet of this lake has been altered from its natural condition by construction of a roadway. A 30-inch concrete pipe carries water under the roadway embankment.

D. Overtopping Potential

Crescent Lake Dam has a total storage capacity of 239 acre-feet and an overall height of 45 feet above streambed. These dimensions indicate a size classification of "Intermediate." The hazard classification is "High" (See Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is the Probable Maximum Flood (PMF). For this dam, the PMF peak inflow is 9126 cfs (See Appendix D for HEC-1 inflow computations).

Comparison of the estimated PMF peak inflow of 9126 cfs with the estimated spillway discharge capacity of 4908 cfs indicates that a potential for overtopping of the Crescent Lake Dam exists.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the PMF without overtopping. The spillway-reservoir system can pass a flood event equal to 58% of a PMF.

E. Spillway Adequacy

The intermediate size category and high hazard category, in accordance with the Corps of Engineers criteria and guidelines, indicates that the spillway design flood for this dam should be the full PMF.

Calculations show that the spillway discharge capacity and reservoir storage capacity are capable of handling 58% of the PMF with existing conditions. If the spillway would be unobstructed, the Crescent Lake Dam would have sufficient spillway discharge capacity and reservoir capacity to handle 66% of a PMF. Since the upstream Gold Key Lake is a natural lake, it was not considered to have failed.

Since the spillway discharge and reservoir storage capacity cannot pass the PMF but can pass more than one-half of the PMF without overtopping, the spillway capacity is judged to be inadequate, but not seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of Crescent Lake Dam did not detect any signs of embankment instability. The field survey indicates that the embankment slopes approximately match the design slopes and they appear to be adequate for the height of dam under consideration. The field survey indicates that the crest of the dam is above the design elevation except in a small area adjacent to the left spillway abutment wall. The downstream toe of the embankment is farther downstream than designed due to the construction of a roadway in this area. There were no signs of seepage except adjacent to the exit of the outlet pipe. This flow was reported in 1960 shortly after construction was completed and could originate from a spring or from the spillway channel through the fractured rock. It is not considered to be a threat to the stability of the dam embankment.

2. Appurtenant Structures

The valve is located in a deep steel manhole and has not been operated in five years. The manhole is near the centerline of the dam. The spillway ogee section in the right abutment appeared to be in good condition. The concrete did not show signs of significant deterioration. The left abutment wall, which retains the embankment, had some small cracks. The right abutment wall had rather serious cracking. This wall has, however, a limited function and protects the right hillside against constant erosion. Failure of the right wall would not endanger the safety of the embankment.

B. Design and Construction Data

The design of the embankment was limited to drawing a typical cross section, without using stability or seepage calculations. Construction information indicates that a trench was excavated to a depth of four feet below the stream bottom extending to at least 80 feet to the left of the old streambed. Other information is not available. It is unknown if the clay core shown was installed or that a more homogeneous earthfill was constructed.

Details of the spillway abutment walls are limited to what is shown on Plate V, Appendix E. Footings are not indicated. A six foot long cutoff wall is shown at the left abutment wall on Plate III.

C. Operating Records

Operating records for this dam have not been maintained by the owner.

D. Post Construction Changes

There are no indications that post construction modifications have been made to the dam or its appurtenant structures, with the exception that riprap was placed at some locations in the spillway discharge channel in an area adjacent and downstream of the spillway weir.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake-induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of the construction drawings indicate that Crescent Lake Dam is in fair condition. The embankment appears to be stable. The flow of water adjacent to the outlet pipe is not considered to be serious at the present time. The cracked right spillway abutment wall is not considered to endanger the safety of the structure.

The hydrologic and hydraulic computations indicate that the combination of storage capacity and the discharge of the spillway is sufficient to pass 58 percent of the PMF with the existing condition. The spillway is considered to be inadequate but not seriously inadequate.

B. Adequacy of Information

The design information contained in the files, combined with the visual inspection, are considered to be sufficiently adequate for making a reasonable assesment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

Additional studies are not required at this time.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for implementation by the owner:

1. That the area at both ends of the spillway weir be cleared to a depth of at least 1.5 feet below the top of weir in order to increase the discharge capacity of the structure.

2. That the valve on the outlet pipe be maintained and operated at least once a year.

3. That all brush and high weeds be removed from the embankment on an annual basis.

4. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.

5. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A

CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 52-145 NDI NO. PA-00 413

NAME OF DAM CRESCENT LAKE DAM HAZARD CATEGORY High

TYPE OF DAM Earth embankment

LOCATION Dingman TOWNSHIP Pike COUNTY, PENNSYLVANIA

INSPECTION DATE 4/2/80 WEATHER cloudy-cold TEMPERATURE 30-40

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

H. Jongsma None

R. Shireman

A. Bartlett

NORMAL POOL ELEVATION: 1211.0 (U.S.G.S.) AT TIME OF INSPECTION:

BREAST ELEVATION: 1216.0 POOL ELEVATION: 1211.17

SPILLWAY ELEVATION: 1211 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: No records

GENERAL COMMENTS:

Last opened valve in 1975 - to check. Difficult to open.
Highest pool 9" over spillway in Spring (estimated).

NDI NO. PA-00 413

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None evident.
B. UNUSUAL MOVEMENT BEYOND TOE	None evident. Slopes appear uniform.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None evident.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal - Good. Vertical - Refer to Profile, Plate A-II, Appendix A.
E. RIPRAP FAILURES	None evident.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Abutment at spillway is sound. Abutment at natural ground on left is sound. Concrete wingwall of spillway at right abutment.
G. SEEPAGE	No slope seepage evident. Wet spots in drainage swale adjacent to downstream toe of embankment. Steady flow of water on both sides of 24-inch outlet pipe (right 8-10 gpm, left 4-5 gpm). This seepage well beyond toe of dam.
H. DRAINS	12-inch pipe just below roadway.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Upstream slope - Riprap with brush growth. Crest - Light weed growth, some brush. Downstream slope - Light weed and brush growth.

NDI NO. PA-00 413

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Under water.
B. OUTLET STRUCTURE	No structure - Pipe extends out from hillside - about 6' is exposed (24" Ø CMP).
C. OUTLET CHANNEL	Small meandering stream leading to spillway main channel.
D. GATES	Valve in vertical manhole located on crest of dam.
E. EMERGENCY GATE	See D. above.
F. OPERATION & CONTROL	Last opened in 1975. According to Mr. Miller, difficult to operate.
G. BRIDGE (ACCESS)	None.

NDI NO. PA-00 413

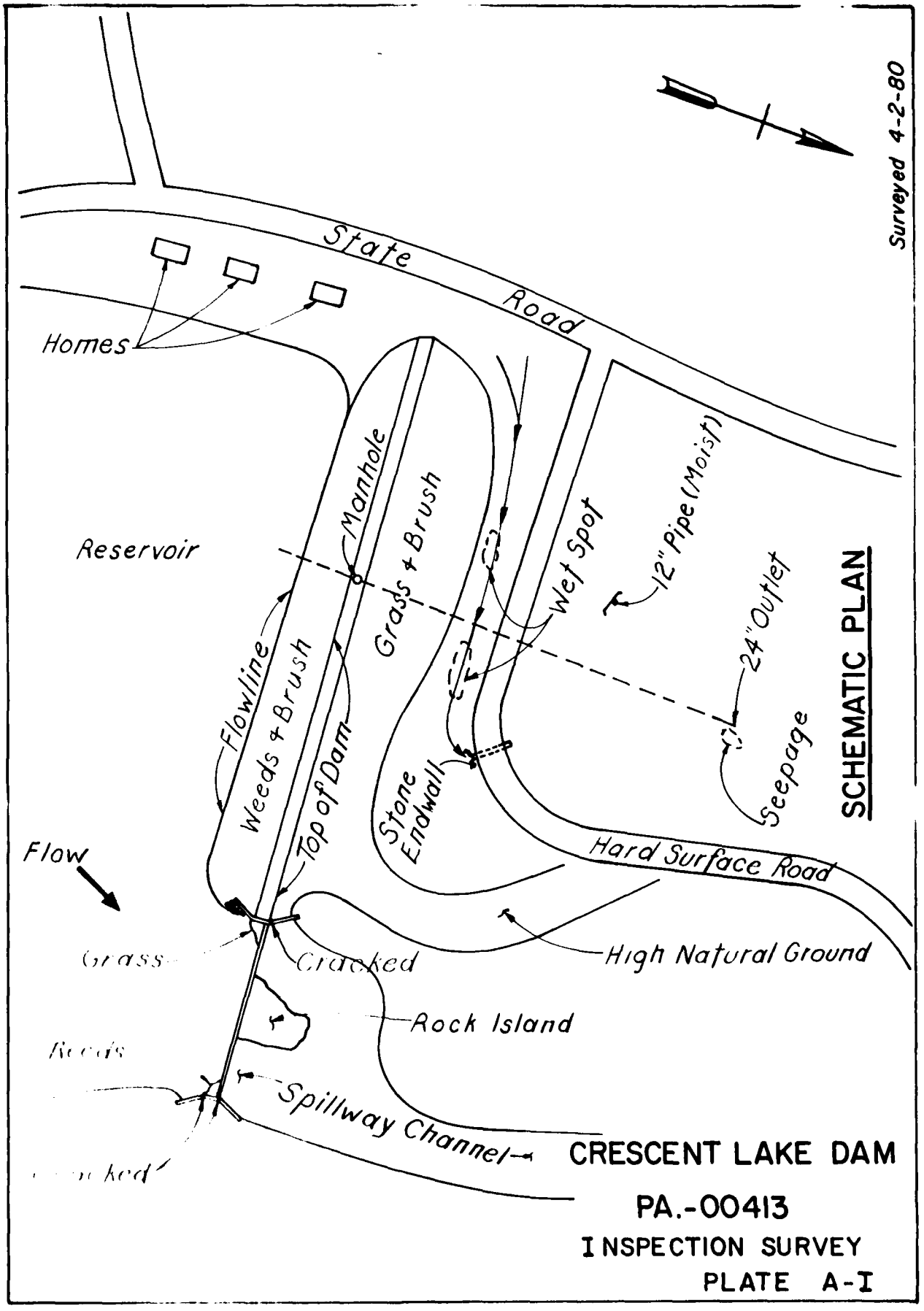
VISUAL INSPECTION
SPILLWAY

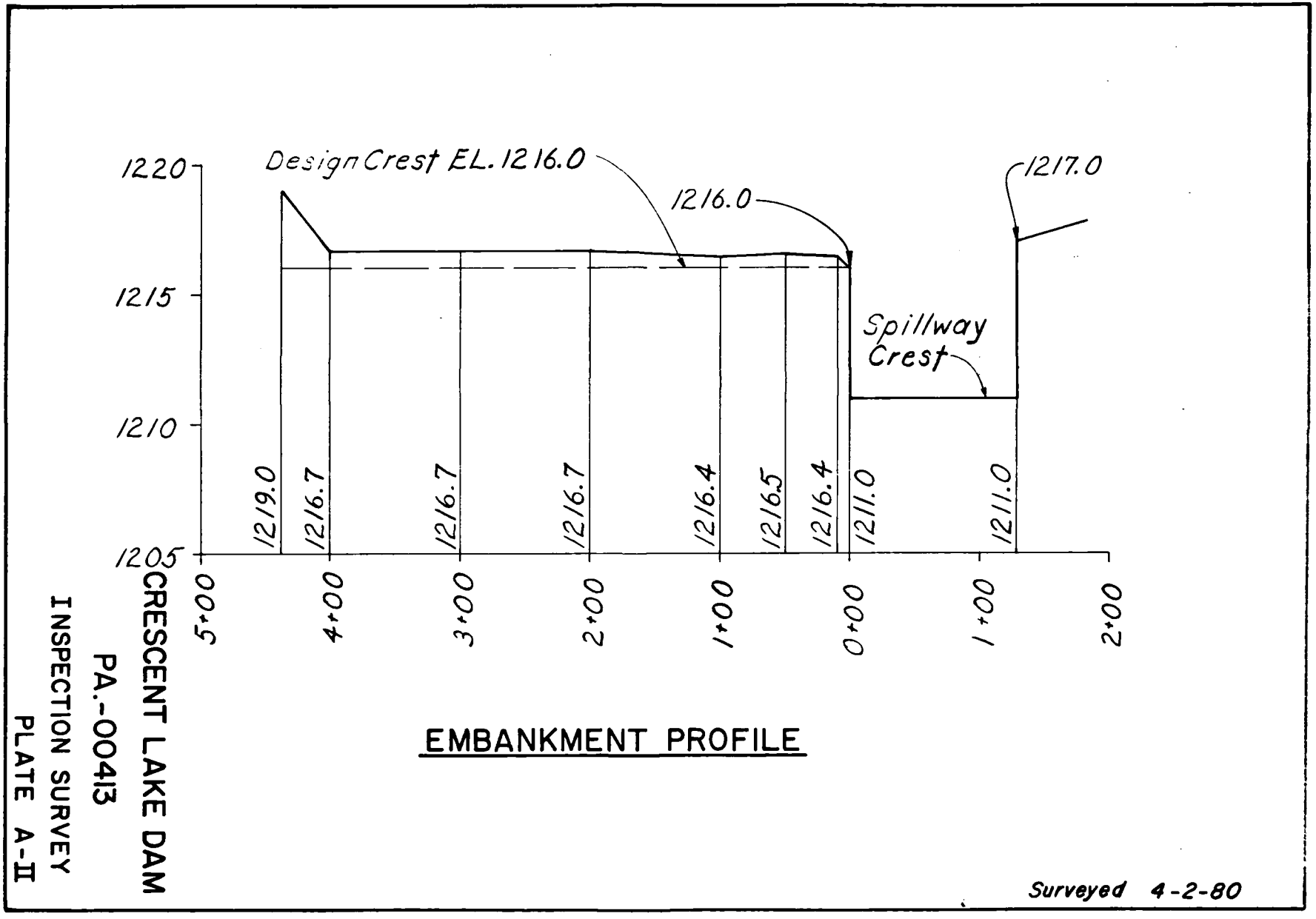
	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	The approach to the spillway is directly from the reservoir at the right side. The depth of the water upstream from the weir is shallow (1'-2'). Some reed growth is located at the right side of the spillway. A build-up of earth on the right side impedes the flow area.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	The concrete weir appears to be in good condition. The spillway abutment wall on the right side has several vertical cracks through the wall at the joints. One was also noted on the left wall.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	An island of rock butts against the weir near the center of its length on the downstream side. Refer to Plate No. A-I, Appendix A. The entire discharge channel is lined with large rocks and boulders.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	None. Estimated maximum flow in springtime about 9 inches over spillway.

NDI NO. PA-00413

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR	
Slopes	Wooded 2:1 to 1:1.
Sedimentation	None reported.
Watershed Description	Wooded with residential developments.
DOWNSTREAM CHANNEL	
Condition	Rock and boulders with steep side slopes.
Slopes	The slopes are wooded with exposed rocks and boulders.
Approximate Population	10-12.
No. Homes	3 homes adjacent to stream within 1/4 mile, plus community access bridge. State road about 1/2 mile downstream.

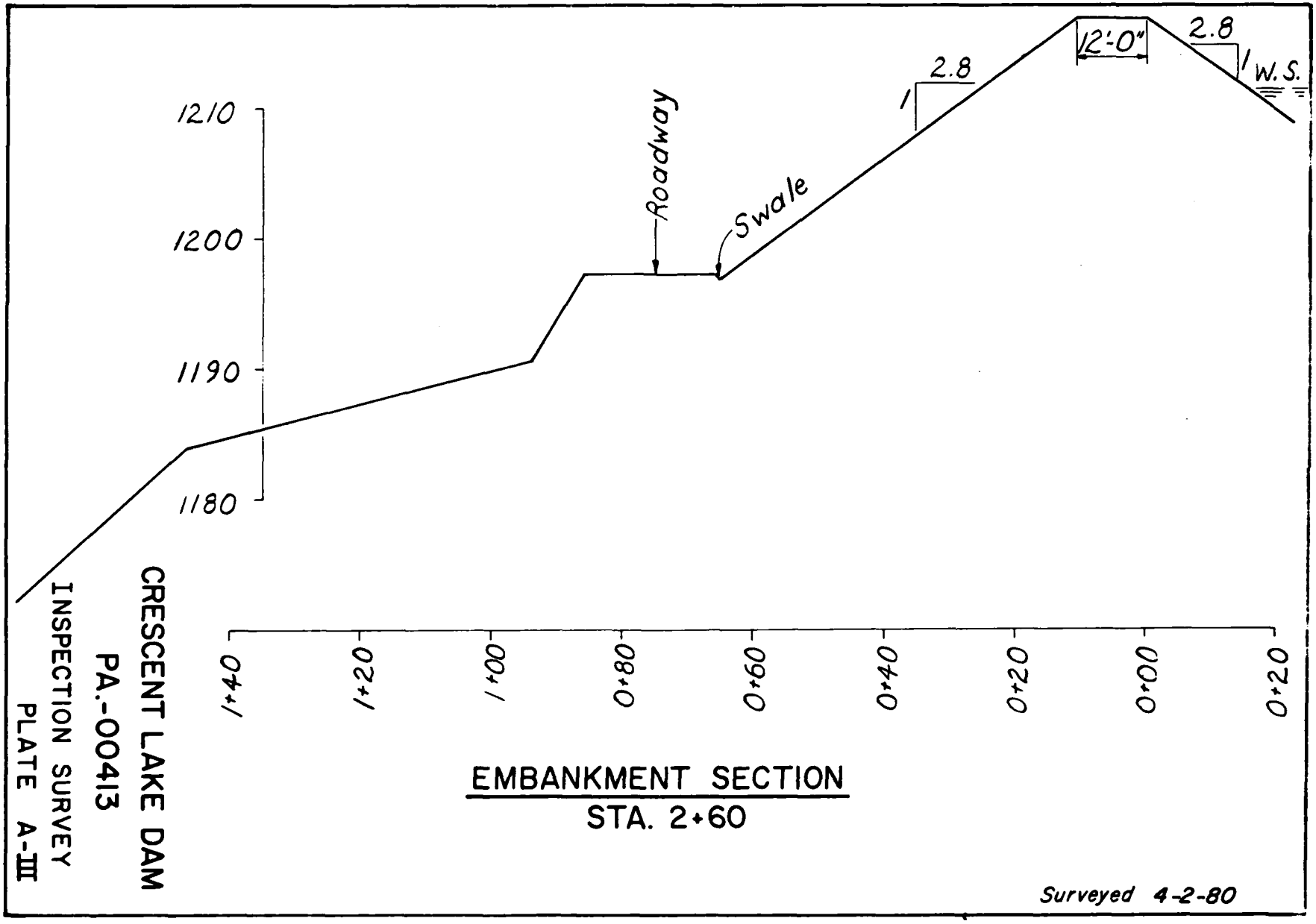

Surveyed 4-2-80
State Road
Homes
Reservoir
Manhole
Grass + Brush
Wet Spot
12" Pipe (Moist)
24" Outlet
Seepage
Flowline
Weeds + Brush
Top of Dam
Stone Endwall
SCHEMATIC PLAN
Flow
Hard Surface Road
Grass
Cracked
High Natural Ground
Rock Island
Reeds
Spillway Channel
CRESCENT LAKE DAM
PA.-00413
INSPECTION SURVEY
PLATE A-I



EMBANKMENT PROFILE

CRESCENT LAKE DAM
PA.-00413
INSPECTION SURVEY
PLATE A-II

Surveyed 4-2-80



EMBANKMENT SECTION
STA. 2+60

Surveyed 4-2-80

CRESCENT LAKE DAM
PA.-00413
INSPECTION SURVEY
PLATE A-III

APPENDIX B

CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 52-142 NDI NO. PA-00 413

NAME OF DAM CRESCENT LAKE DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	Not existing.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Edgemere, Pa. See Plate II, Appendix E
CONSTRUCTION HISTORY	Constructed in 1959 with a full-time supervising engineer on site. Control on diversion pipe changed to what is indicated on Plate IV, Appendix E. An access road constructed over the toe of the embankment.
GENERAL PLAN OF DAM	Plate III, Appendix E.
TYPICAL SECTIONS OF DAM	Plate III and IV, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	 Plate V, Appendix E. Limited to Plate V. None.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	No records.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.

NDI NO. PA-00413

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Road built over downstream toe of embankment. Riprap placed in spillway discharge channel.
HIGH POOL RECORDS	No records.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	No records.
SPILLWAY PLAN, SECTIONS AND DETAILS	Plate V, Appendix E.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	Plate IV, Appendix E.
CONSTRUCTION RECORDS	Progress reports by field engineer. Some inspection reports by PennDER.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Report by PennDER April 1960, indicates weed for riprap protection in spillway and near outlet pipe.
MISCELLANEOUS	

NDI NO. PA-00 413

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: woodland and swampy

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 1211 Acre-Feet 153

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 1216 Acre-Feet 239

MAXIMUM DESIGN POOL: Elev. 1216

TOP DAM: Elev. 1216

SPILLWAY:

a. Elevation 1211

b. Type concrete ogee

c. Width 126 feet

d. Length --

e. Location Spillover right abutment

f. Number and Type of Gates none

OUTLET WORKS:

a. Type 24" cast iron pipe

b. Location through embankment near center of dam

c. Entrance inverts 1185.25

d. Exit inverts 1177.25

e. Emergency drawdown facilities 24"

HYDROMETEOROLOGICAL GAGES:

a. Type None

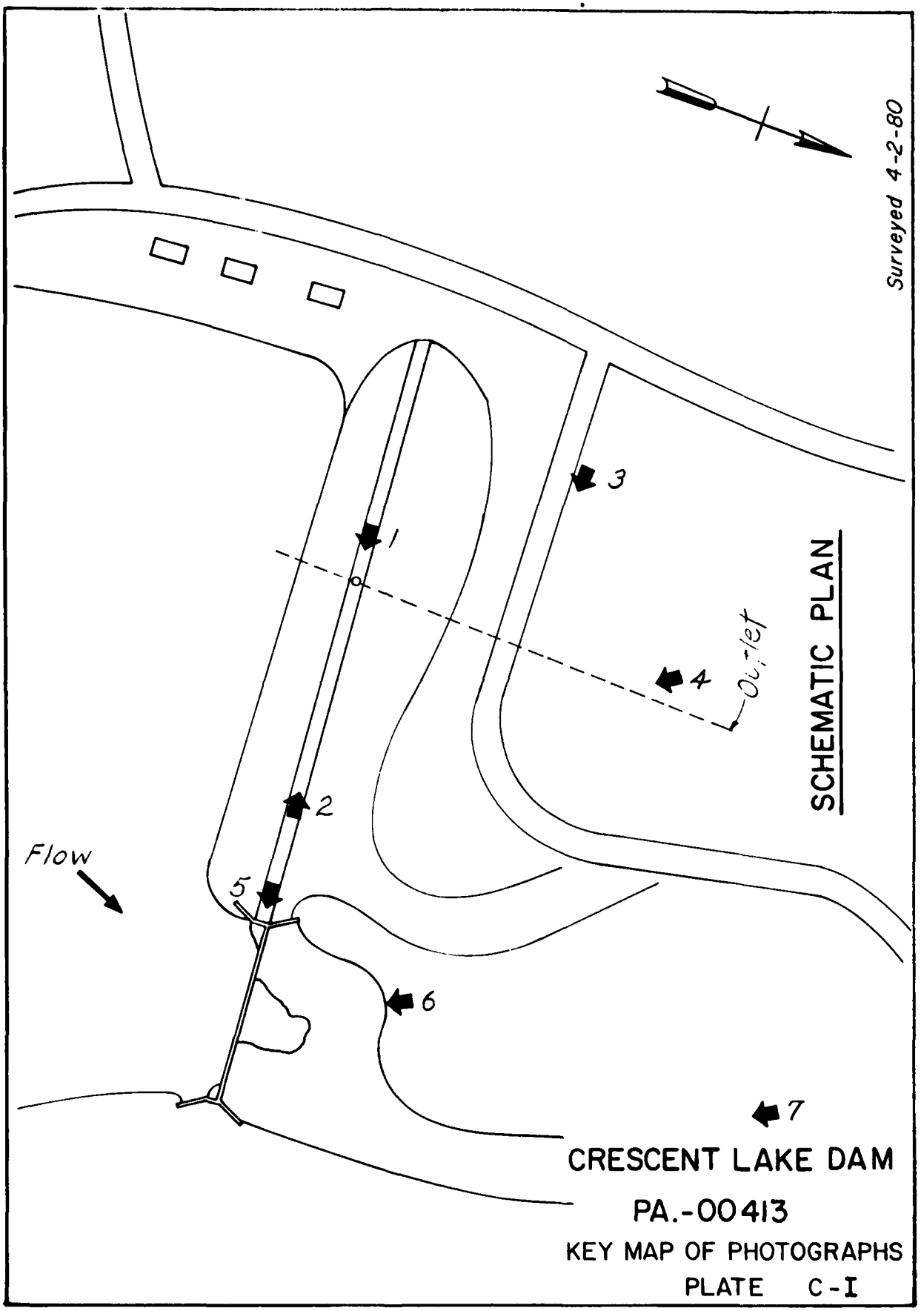
b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 4908 cfs

APPENDIX C

PHOTOGRAPHS

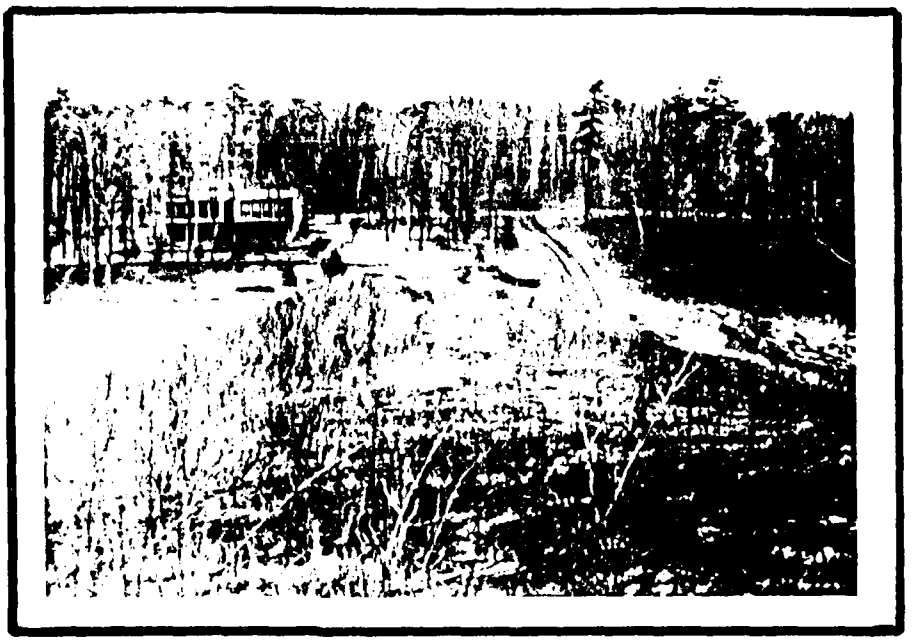


CRESCENT LAKE DAM

PA.-00413

KEY MAP OF PHOTOGRAPHS

PLATE C-I



LEFT END OF EMBANKMENT - NO. 2
NOTE: WEEDS AND BRUSH

RIGHT END OF EMBANKMENT TOE - NO. 3
NOTE: ROADWAY AND SPOIL AREA
SPILLWAY CHANNEL IN BACKGROUND

PA-00413
Plate [illegible]

EXIT OF OUTLET PIPE - NO. 4

SPILLWAY OGEE WEIR - NO. 5

PA-00413
Plate C-III

LOOKING UPSTREAM TO SPILLWAY - NO. 6
RIPRAP IN FOREGROUND

DOWNSTREAM CHANNEL LOOKING UPSTREAM FROM BRIDGE - NO. 7

APPENDIX D

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

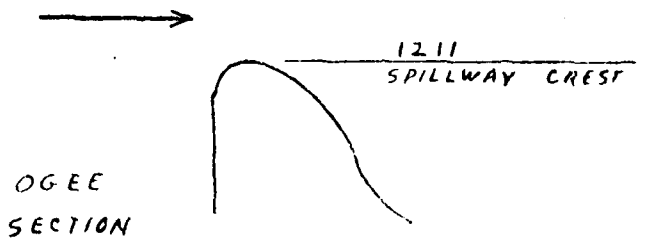
The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

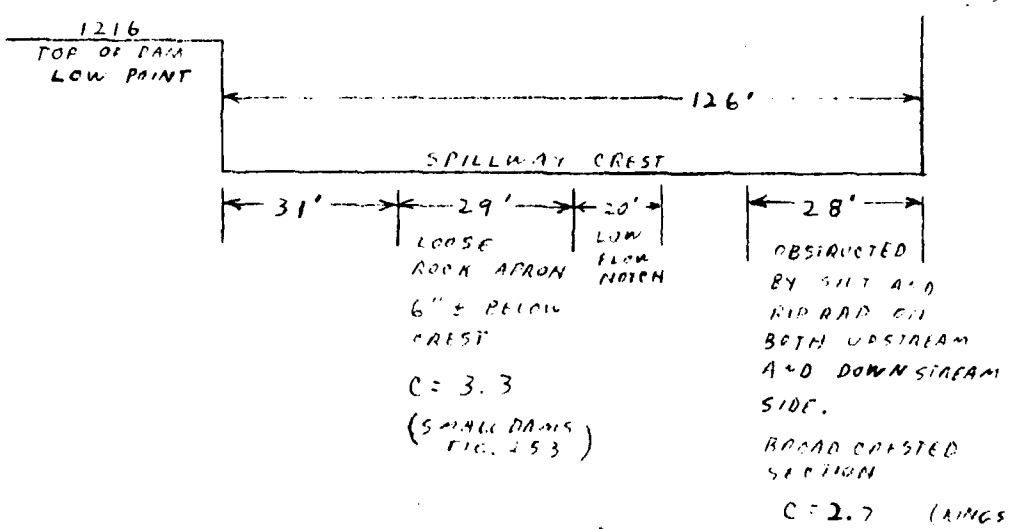
For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

BY RLS DATE 4/23/80 **BERGER ASSOCIATES** SHEET NO. 1 OF 8
CHKD. BY DATE PROJECT D9650
SUBJECT CRESCENT LAKE

SPILLWAY RATING



C = 3.88 (SMALL DAMS, FIG. 249)



$Q = C_1 L_1 H^{3/2} + C_2 L_2 H^{3/2} + C_3 L_3 H^{3/2}$

$= 3.3 \times 29 \times (5)^{1.5} + 2.7 \times 28 \times (5)^{1.5} + 3.88 \times (126-29-28) \times (5)^{1.5}$

$Q = 4908$ CFS

WITHOUT APRON OR OBSTRUCTION

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

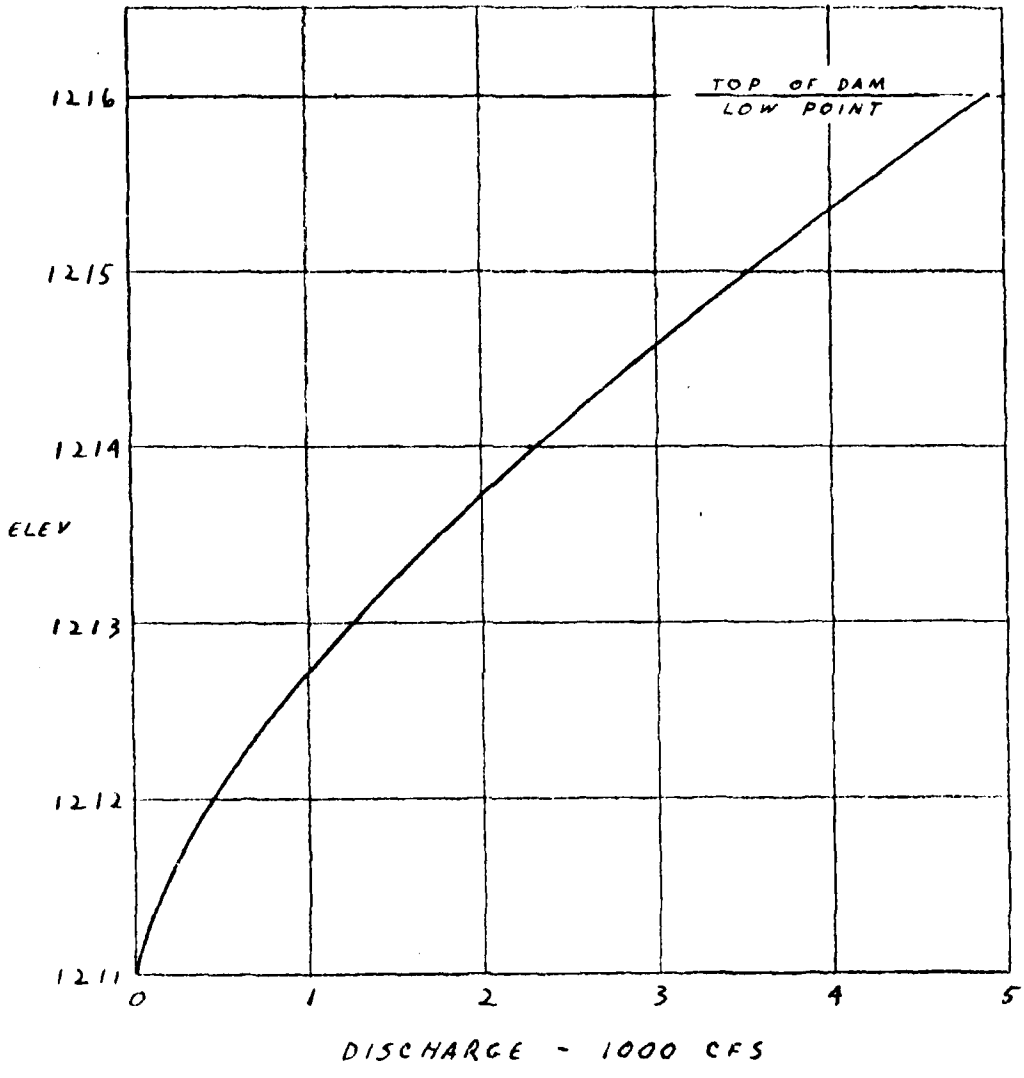
$= 3.88 \times 126 \times (5)^{1.5} = 5466$ CFS

BY R.I.S. DATE 4/23/80 **BERGER ASSOCIATES** SHEET NO. 2 OF 6

CHKD. BY ____ DATE ____ PROJECT D9650

SUBJECT CRESCENT LAKE

SPILLWAY RATING CURVE EXISTING



BY RLS DATE 3/2/80 **BERGER ASSOCIATES** SHEET NO. 3 OF 6
CHKD. BY DATE PROJECT D965C
SUBJECT CRESCENT LAKE

EMBANKMENT RATING

$Q = C L H^{3/2}$ $C = 2.7$

AT ELEV 1216.5

$2.7 \times 10 \times (.3)^{1.5} = 4$
$2.7 \times 90 \times (.05)^{1.5} = 3$
$2.7 \times 33 \times (.05)^{1.5} = 1$ $\Sigma = 8$ CFS

AT ELEV 1217

$2.7 \times 10 \times (.8)^{1.5} = 19$
$2.7 \times 90 \times (.55)^{1.5} = 99$
$2.7 \times 100 \times (.45)^{1.5} = 82$
$2.7 \times 200 \times (.3)^{1.5} = 89$
$2.7 \times 5 \times (.15)^{1.5} = 1$ $\Sigma = 290$ CFS

AT ELEV 1217.5

$2.7 \times 10 \times (1.3)^{1.5} = 40$
$2.7 \times 90 \times (1.05)^{1.5} = 261$
$2.7 \times 100 \times (.95)^{1.5} = 250$
$2.7 \times 200 \times (.8)^{1.5} = 386$
$2.7 \times 14 \times (.4)^{1.5} = 10$ $\Sigma = 947$ CFS

AT ELEV 1218

$2.7 \times 10 \times (1.8)^{1.5} = 66$
$2.7 \times 90 \times (1.5)^{1.5} = 409$
$2.7 \times 100 \times (1.4)^{1.5} = 421$
$2.7 \times 200 \times (1.3)^{1.5} = 800$
$2.7 \times 23 \times (.6)^{1.5} = 33$ $\Sigma = 1839$ CFS

BY RLS DATE 4/23/80 **BERGER ASSOCIATES** SHEET NO. 4 OF 8
CHKD. BY DATE PROJECT D965C
SUBJECT CRESCENT LAKE

DISCHARGE THROUGH ORIFICE WORKS

24" CIP

ORIFICE INVERT = 1186.25 (ESTIMATED FROM DRAWINGS)

$Q = C A \sqrt{2gH}$ $C = 0.6$

AT POOL ELEV. 1211

$H = 1211 - 1186.25 = 24.75$

$Q = 0.6 \times \pi \times (2)^2/4 \times (2 \times 32.2 \times 24.75)^{0.5}$

$= 75$ CFS

AT LOW POOL ELEV. 1190

$H = 1190 - 1186.25 = 3.75$

$Q = 0.6 \times \pi \times (2)^2/4 \times (2 \times 32.2 \times 3.75)^{0.5}$

$= 29$ CFS

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF POOL LEVELS FOR THIS DAM. BASED ON THE RECORDS OF THE GAGE STATION FOR MILL CREEK AT NEARBY MOUNTAINHOME, PA. (D.A. = 5.84 SQ MI.) THE MAXIMUM DISCHARGE AT THE GAGE OCCURRED IN JULY 1969 WHEN A DISCHARGE OF 1650 CFS WAS OBSERVED. THE MAXIMUM INFLOW TO CRESENT LAKE DAM IS ESTIMATED TO BE:

$$Q = \left(\frac{6.16}{5.84}\right)^{0.8} \times 1650$$

$$= 1722 \text{ CFS}$$

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 239 ACRE-FEET
MAXIMUM HEIGHT 45 FEET
SIZE CLASSIFICATION IS "INTERMEDIATE"

HAZARD CLASSIFICATION

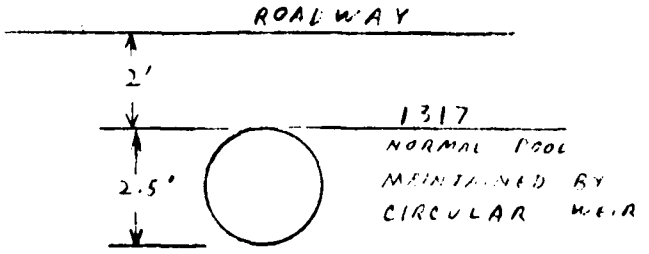
SEVERAL HOUSES ARE LOCATED ALONG THE DOWNSTREAM CHANNEL.
USE "HIGH"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE PROBABLE MAXIMUM FLOOD.

BY RLS DATE 4/25/80 **BERGER ASSOCIATES** SHEET NO. 6 OF 6
CHKD. BY ..... DATE ..... PROJECT 09650
SUBJECT CRESCENT LAKE

GOLD KEY LAKE SPILLWAY



$C = 0.6$

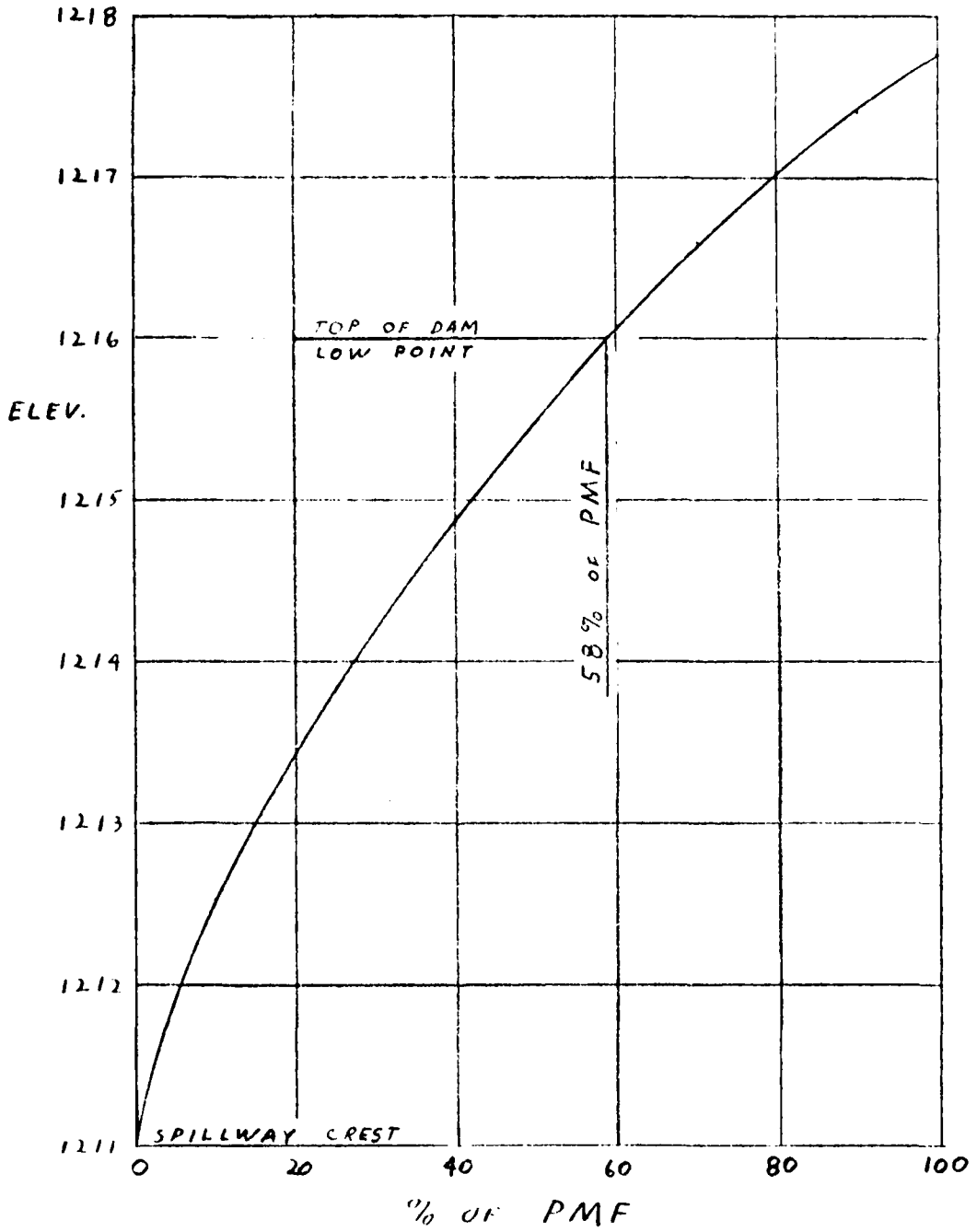
$Q = CA\sqrt{2gH}$

$= 0.6 \times \pi \times \frac{(2.5)^2}{4} \times (2 \times 32.2 \times 3.25)^{0.5}$

$= 42$ CFS

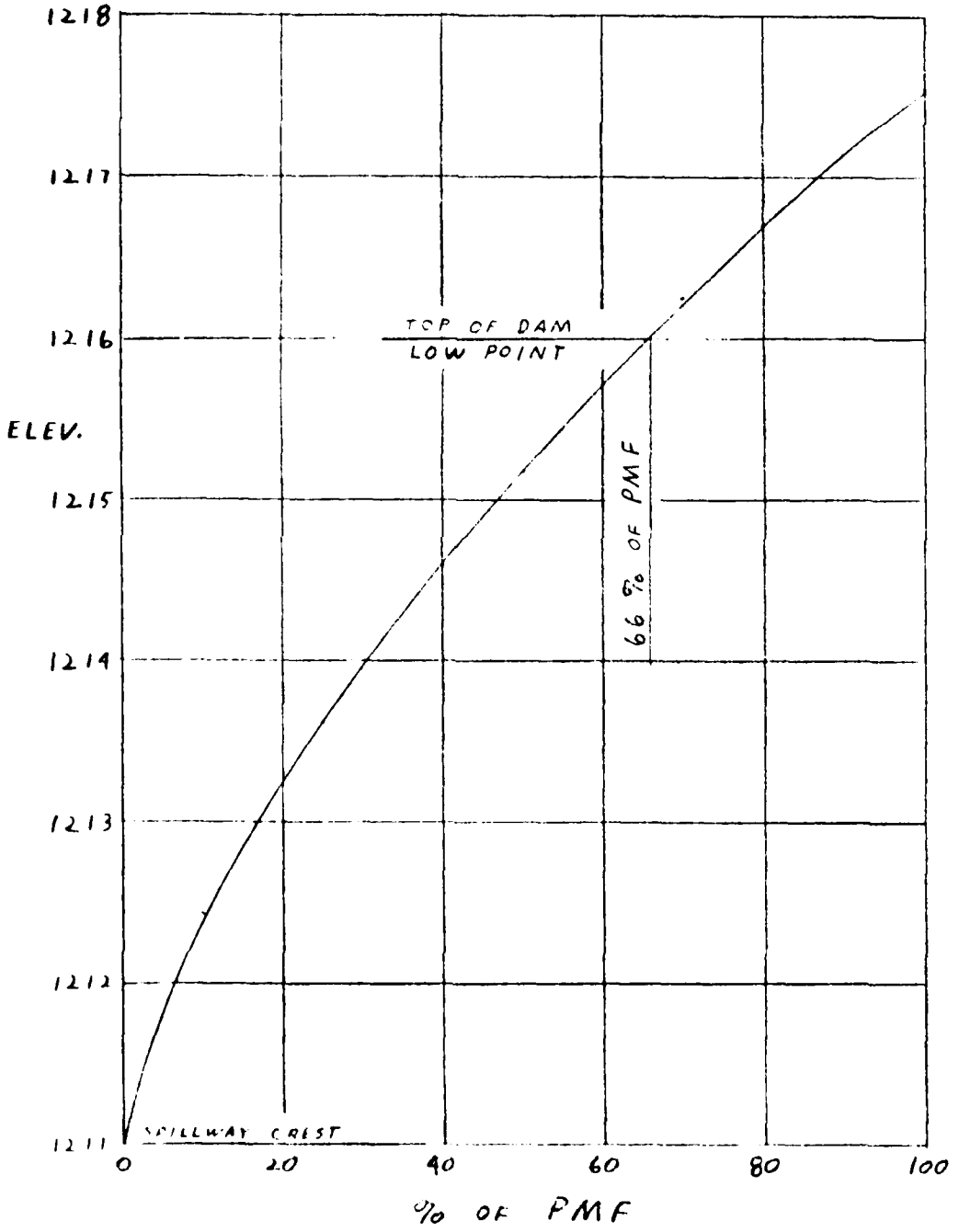
BY RLS DATE 4/24/80 **BERGER ASSOCIATES** SHEET NO. 1 OF 6
CHKD. BY ____ DATE ____ PROJECT D9650
SUBJECT CRESCENT LAKE

SPILLWAY CAPACITY CURVE — EXISTING



BY RLS DATE 1/24/80 **BERGER ASSOCIATES** SHEET NO. 8 OF 12
CHKD. BY DATE PROJECT D9650
SUBJECT CRESCENT LAKE

SPILLWAY CAPACITY CURVE UNOBSTRUCTED



HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: CRESCENT LAKE RIVER BASIN: DELAWARE

PROBABLE MAXIMUM PRECIPITATION (PMP) = 21.9 INCHES/24 HOURS[1]

(FOR FOOTNOTES SEE NEXT PAGE)

	STATION	1	2	3	4
	STATION DESCRIPTION	GOLD KEY LAKE		CRESCENT LAKE	CRESCENT LAKE DAM
	DRAINAGE AREA (SQUARE MILES)	1.44		4.72	
	CUMULATIVE DRAINAGE AREA (SQUARE MILE)	1.44		6.16	6.16
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%)[2]	6 HOURS	111		111	
	12 HOURS	123		123	
	24 HOURS	133		133	
	48 HOURS	142		142	
	72 HOURS	-		-	
	Zone I				
SNYDER HYDROGRAPH PARAMETERS	ZONE[3]	1		1	
	C_p / C_t[4]	.45/1.23		.45/1.23	
	L (MILES)[5]	2.60		4.68	
	L_{ca} (MILES)[5]	1.12		2.06	
	$T_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	1.69		2.43	
SPILLWAY DATA	CREST LENGTH (FT.)	2.5' dia.			126
	FREEBOARD (FT.)	2'			5
	DISCHARGE COEFFICIENT	0.6			3.88
	EXPONENT	-			1.5
	ELEVATION	1317			1211
AREA[6] (ACRES)	NORMAL POOL	140			13.8
	ELEV. _____ 1320	253		1220	27.5
	ELEV. _____				
STORAGE (ACRE-FEET)	NORMAL POOL[7]	672			153
	ELEV. _____[8] 1303	0		1177.7	0
	ELEV. _____[8]				
	ELEV. _____[8]				

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

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

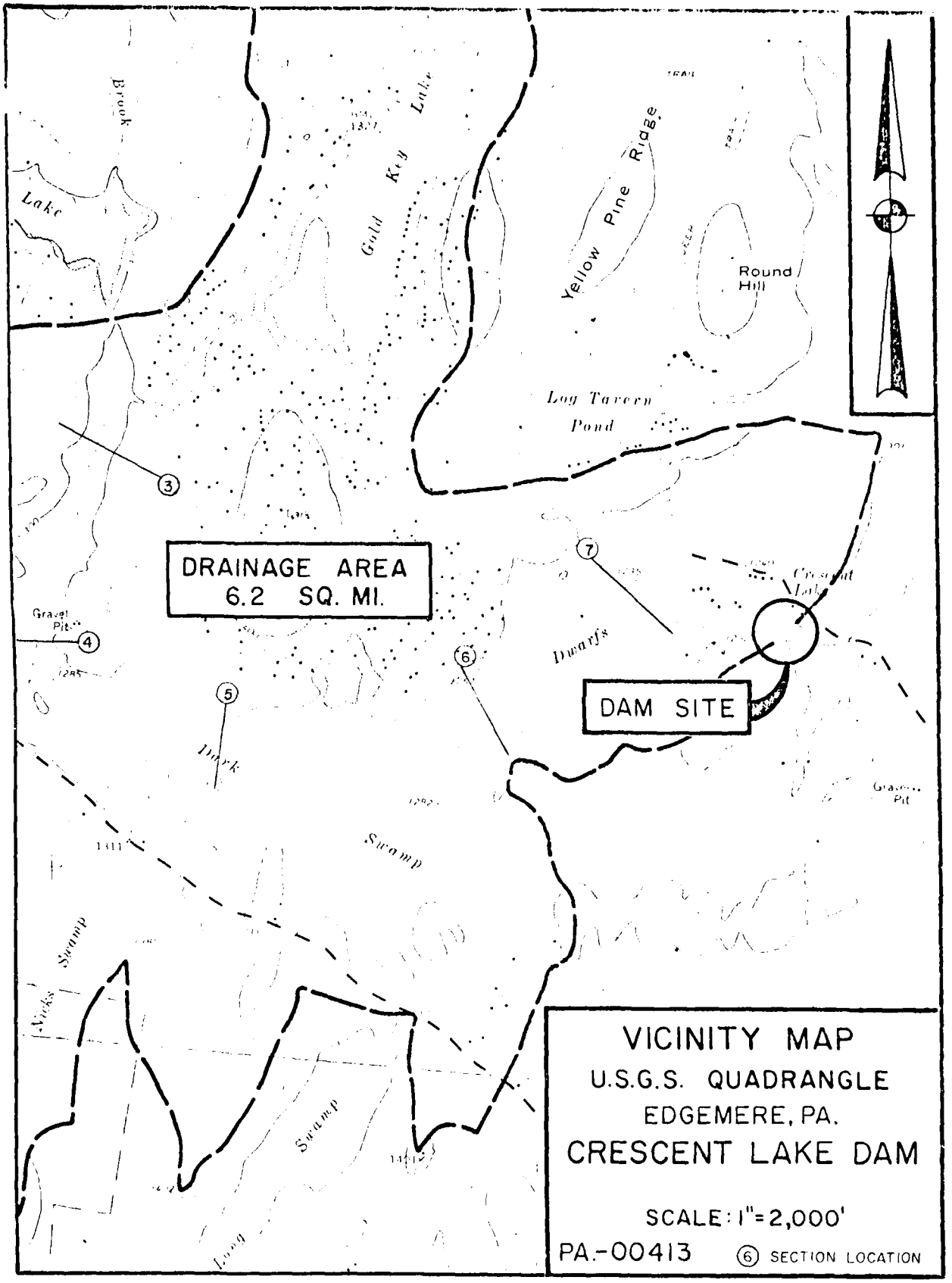
(4) Snyder's Coefficients.

(5) 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.

(6) Planimetered area encompased by contour upstream of dam.

(7) PennDER files.

(8) Computed by conic method.



VICINITY MAP

U.S.G.S. QUADRANGLE

EDGEMERE, PA.

CRESCENT LAKE DAM

SCALE: 1"=2,000'

PA.-00413 ⑥ SECTION LOCATION

```
**********
    1   A1      CRESENT LAKE DAM    ****    DWARFSKILL CREEK
    2   A2      DINGMAN TWP., PIKE COUNTY, PA.
    3   A3      NDI # PA-00413     PA DER # 52-142
    4   9   300      0      15       0       0       0       0       0      -4       0
    5   B1    5
    6   J     1      9       1
    7   J1    1     .9      .8      .7      .6      .5      .4     .25      .1
    8   K             1                                       1
    9   K1                INFLOW HYDROGRAPH - GOLD KEY LAKE SUBAREA
   10   M     1       1    1.44            6.16
   11   P            21.9     111     123     133     142
   12   T                                                    1     .05
   13   W   1.69     .45
   14   X   -1.5     .05       2
   15   K     1       2                                      1
   16   K1                RESERVOIR ROUTING - GOLD KEY LAKE
   17   Y                                     1
   18   Y1    1                                                    672      -1
   19   Y4  1317    1318    1319   1319.5    1320    1321
   20   Y5     0      35      42      288     675    3201
   21   $A     0     140     253
   22   $E  1303    1317    1320
   23   $$  1317
   24   $D  1319
   25   K     1       3                                      1
   26   K1                    ROUTING THRU REACH 2 - 3
   27   Y                                     1
   28   Y1    1
   29   Y6   .1     .07      .1    1296    1340    1350   .0036
   30   Y7    0    1340     500    1320     670    1300    1110    1296    1120    1296
   31   Y7 1390    1300    1600    1320    1770    1340
   32   K     1       4                                      1
   33   K1                    ROUTING THRU REACH 3 - 4
   34   Y                                     1
   35   Y1    1
   36   Y6   .1     .08      .1    1285    1320    3200   .0036
   37   Y7    0    1320     320    1320     380    1300     600    1285     700    1285
   38   Y7 1350    1300    1400    1320    1500    1320
   39   K     1       5                                      1
   40   K1                    ROUTING THRU REACH 4 - 5
   41   Y                                     1
   42   Y1    1
   43   Y6   .1     .08      .1    1270    1320    5000   .0027
   44   Y7    0    1320     250    1300     400    1280     600    1270     750    1270
   45   Y7 1000    1280    1150    1300    1400    1300
   46   K     1       6                                      1
   47   K1                    ROUTING THRU REACH 5 - 6
   48   Y                                     1
   49   Y1    1
   50   Y6   .1     .07      .1    1240    1300    4700   .002
1  51   Y7    0    1300     100    1280     200    1260     490    1240     510    1240
   52   Y7  600    1260     880    1280    1400    1300
   53   K     1       7                                      1
   54   K1                    ROUTING THRU REACH 6 - 7
   55   Y                                     1
   56   Y1    1
   57   Y6   .1     .07      .1    1214    1260    3400   .006
   58   Y7    0    1260     550    1240     700    1220     790    1214     800    1214
   59   Y7 1170    1220    1400    1240    1600    1260
```

```
                                                                                                                    1240      510      1240
   52            Y7   680    1260     880     1280     1400     1300
   53            K      1       7                                          1
   54            K1                   ROUTING THRU REACH 6 - 7
   55            Y                                  1
   56            Y1     1
   57            Y6    .1     .07      .1     1214     1260     3400     .006
   58            Y7     0    1260     550     1240      700     1220      790     1214      800     1214
   59            Y7  1170    1220    1400     1240     1600     1260
   60            K              8                                          1
   61            K1                   INFLOW HYDROGRAPH  -  CRESENT LAKE SUBAREA
   62            M      1       1    4.72                6.16
   63            P             21.9    111      123      133      142
   64            T                                                       1      .05
   65            W   2.43      .45
   66            X   -1.5     -.05       2
   67            K      2       9                                          1
   68            K1                   COMBINE HYDROGRAPHS
   69            K      1      10                                          1
   70            K1                   RESERVOIR ROUTING  -  CRESENT LAKE DAM
   71            Y                                  1
   72            Y1     1                                                153       -1
   73            Y4  1211  1211.5    1212   1212.5     1213     1214     1215     1216   1216.5     1217
   74            Y41217.5    1218
   75            Y5     0     156     440      807     1242     2271     3513     4908     5670     6742
   76            Y5  8222    9968
   77            $A     0    13.8    27.5
   78            $E1177.7    1211    1220
   79            $$  1211
   80            $D  1216
   81            K     99
1                                PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                    RUNOFF HYDROGRAPH AT          1
                                    ROUTE HYDROGRAPH TO           2
                                    ROUTE HYDROGRAPH TO           3
                                    ROUTE HYDROGRAPH TO           4
                                    ROUTE HYDROGRAPH TO           5
                                    ROUTE HYDROGRAPH TO           6
                                    ROUTE HYDROGRAPH TO           7
                                    RUNOFF HYDROGRAPH AT          8
                                    COMBINE  2 HYDROGRAPHS AT     9
                                    ROUTE HYDROGRAPH TO          10
                                    END OF NETWORK

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

 RUN  DATE= 09/24/79.
      TIME= 07.32.37.

                                    CRESENT LAKE DAM    ****    DWARFSKILL CREEK
                                    DINGMAN TWP., PIKE COUNTY, PA.
                                    NDI # PA-00413     PA DER # 52-142
```

CRESENT LAKE DAM **** DWARF HILL CREEK
DINGMAN TWP., PIKE COUNTY, PA.
NDI # PA-00413 PA DER # 52-142

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .90 .80 .70 .60 .50 .40 .25 .10

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

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH - GOLD KEY LAKE SUBAREA

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	1.44	0.00	6.16	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.90	111.00	123.00	133.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

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= 1.69 CP= .45 NTA= 0

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

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= 1.70 HOURS, CP= .45 VOL= 1.00

12.	46.	94.	148.	198.	233.	248.	240.	219.	200.
182.	166.	152.	138.	126.	115.	105.	96.	87.	80.
73.	66.	61.	55.	50.	46.	42.	38.	35.	32.
29.	27.	24.	22.	20.	18.	17.	15.	14.	13.
12.	11.	10.	9.	8.	7.	7.	6.	6.	5.
5.	4.	4.	4.	3.	3.	3.	2.	2.	2.
2.	2.								

END-OF-PERIOD FLOW

MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 24.88 22.49 2.39 [illegible]
(632.)(571.)(61.)(2355.57)

HYDROGRAPH ROUTING

RESERVOIR ROUTING - GOLD KEY LAKE

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	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	672.	-1

STAGE	1317.00	1318.00	1319.00	1319.50	1320.00	1321.00
FLOW	0.00	35.00	42.00	288.00	875.00	3201.00
SURFACE AREA=	0.	140.	253.			
CAPACITY=	0.	653.	1235.			
ELEVATION=	1303.	1317.	1320.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1317.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1319.0	0.0	0.0	0.

PEAK OUTFLOW IS 2329. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 2029. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 1721. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 1393. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 1033. AT TIME 44.25 HOURS

PEAK OUTFLOW IS 709. AT TIME 44.75 HOURS

PEAK OUTFLOW IS 426. AT TIME 45.75 HOURS

PEAK OUTFLOW IS 89. AT TIME 49.25 HOURS

PEAK OUTFLOW IS 33. AT TIME 49.50 HOURS

HYDROGRAPH ROUTING

ROUTING THRU REACH 2 - 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	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	0	0	0	0

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0700	.1000	1296.0	1340.0	1350.	.00360

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1340.00 590.00 1320.00 820.00 1300.00 1110.00 1296.00 1120.00 1296.00
1390.00 1300.00 1600.00 1320.00 1770.00 1340.00

STORAGE	0.00	12.35	47.24	90.98	133.37	189.42	244.12	302.48	364.50	430.17
	499.50	573.03	652.69	738.67	830.97	929.58	1034.51	1145.75	1263.31	1387.19
OUTFLOW	0.00	572.38	3734.60	10690.46	20606.43	33011.04	48127.15	65822.23	86088.66	108834.25
	134376.98	161896.93	192127.32	225473.93	262000.40	301794.75	344954.74	391581.90	441778.97	495648.62
STAGE	1296.00	1298.32	1300.63	1302.95	1305.26	1307.58	1309.89	1312.21	1314.53	1316.84
	1319.16	1321.47	1323.79	1326.11	1328.42	1330.74	1333.05	1335.37	1337.68	1340.00
FLOW	0.00	572.38	3734.60	10690.46	20606.43	33011.04	48127.15	65822.23	86088.66	108834.25
	134376.98	161896.93	192127.32	225473.93	262000.40	301794.75	344954.74	391581.90	441778.97	495648.62

MAXIMUM STAGE IS 1299.6

MAXIMUM STAGE IS 1299.4

MAXIMUM STAGE IS 1299.2

MAXIMUM STAGE IS 1298.9

MAXIMUM STAGE IS 1298.7

MAXIMUM STAGE IS 1298.4

MAXIMUM STAGE IS 1297.7

MAXIMUM STAGE IS 1296.4

MAXIMUM STAGE IS 1296.1

HYDROGRAPH ROUTING

ROUTING THRU REACH 3 - 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	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	0	0	0	0

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0800	.1000	1285.0	1320.0	3250.	.00360

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1320.00 320.00 1320.00 380.00 1300.00 600.00 1285.00 700.00 1285.00
1350.00 1300.00 1400.00 1320.00 1500.00 1320.00

STORAGE	0.00	21.09	56.86	107.31	172.45	252.27	346.78	455.97	579.85	718.[illegible]
	848.73	985.33	1123.32	1262.70	1403.48	1545.65	1689.21	1834.16	1980.50	2128.24
OUTFLOW	0.00	398.78	1538.40	3447.20	6914.58	11526.36	17656.97	25471.62	35127.91	47061.8[illegible]
	65317.81	83425.74	103316.58	124933.73	148229.95	173165.29	199705.45	227820.76	257485.28	286001.69
STAGE	1289.00	1296.84	1288.68	1290.53	1292.37	1294.21	1296.05	1297.89	1299.74	1301.5[illegible]
	1303.42	1305.26	1307.11	1308.95	1310.79	1312.63	1314.47	1316.32	1318.16	1320.00
FLOW	0.00	398.78	1538.40	3447.20	6914.58	11526.36	17656.97	25471.62	35127.91	47061.8[illegible]
	65317.81	83425.74	103316.58	124933.73	148229.95	173165.29	199705.45	227820.76	257485.28	286001.69

MAXIMUM STAGE IS 1289.4

MAXIMUM STAGE IS 1289.1

MAXIMUM STAGE IS 1288.8

MAXIMUM STAGE IS 1289.4

MAXIMUM STAGE IS 1287.8

MAXIMUM STAGE IS 1287.3

MAXIMUM STAGE IS 1286.9

[illegible]UM STAGE IS 1285.4

MAXIMUM STAGE IS 1285.2

HYDROGRAPH ROUTING

ROUTING THRU REACH 4 - 5

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	9	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSAK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0800	.1000	1270.0	1320.0	5000.	.00270

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1320.00 250.00 1300.00 400.00 1280.00 600.00 1270.00 750.00 1270.00
1000.00 1280.00 1150.00 1300.00 1400.00 1300.00

STORAGE	0.00	63.19	162.16	296.90	466.93	656.51	858.02	1071.45	1296.81	1534.09
	1783.79	2044.41	2362.42	2720.72	3088.96	3467.13	3855.25	4253.30	4661.28	5079.20
OUTFLOW	0.00	659.98	3241.03	7431.94	14083.87	24411.29	37097.98	52096.13	69382.16	88903.09
	110811.04	134969.81	159744.52	190814.46	225118.07	262562.33	303091.07	346669.31	393275.67	442 [illegible]6.07
STAGE	1270.00	1272.83	1275.26	1277.89	1280.53	1283.16	1285.79	1288.42	1291.05	[illegible]
	1296.32	1298.95	1301.58	1304.21	1306.84	1309.47	1312.11	1314.74	1317.37	1320.00
FLOW	0.00	659.98	3241.03	7431.94	14083.87	24411.29	37097.98	52096.13	69382.16	88903.09
	110811.04	134969.81	159744.52	190814.46	225118.07	262562.33	303091.07	346669.31	393275.67	442898.07

MAXIMUM STAGE IS 1274.1

MAXIMUM STAGE IS 1273.8

MAXIMUM STAGE IS 1273.5

MAXIMUM STAGE IS 1273.1

MAXIMUM STAGE IS 1272.7

MAXIMUM STAGE IS 1272.0

MAXIMUM STAGE IS 1271.2

MAXIMUM STAGE IS 1270.3

MAXIMUM STAGE IS 1270.1

HYDROGRAPH ROUTING

ROUTING THRU REACH 5 - 6

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	10	0	0	0	0

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

ORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0700	.1000	1240.0	1300.0	4700.	.02000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1300.00 100.00 1280.00 200.00 1260.00 490.00 1240.00 510.00 1240.00
680.00 1260.00 880.00 1280.00 1400.00 1300.00

STORAGE	0.00	19.19	63.12	131.81	225.24	343.42	486.34	652.11	834.48	1033.00
	1247.66	1478.46	1725.40	1989.43	2283.00	2609.92	2970.19	3363.82	3790.81	4251.15
OUTFLOW	0.00	875.20	4081.02	10918.46	22327.14	39198.06	62354.14	97386.17	142395.10	199111.02
	255644.53	324122.36	400686.28	484520.49	576081.85	678077.13	790917.83	915123.29	1051236.39	1199798.94
STAGE	1240.00	1243.16	1246.32	1249.47	1252.63	1255.79	1258.95	1262.11	1265.26	1268.42
	1271.58	1274.74	1277.89	1281.05	1284.21	1287.37	1290.53	1293.68	1296.84	1300.00
FLOW	0.00	875.20	4081.02	10918.46	22327.14	39198.06	62354.14	97386.17	142395.10	199111.02
	255644.53	324122.36	400686.28	484520.49	576081.85	678077.13	790917.83	915123.29	1051236.39	1199798.94

MAXIMUM STAGE IS 1244.5

MAXIMUM STAGE IS 1244.2

MAXIMUM STAGE IS 1243.9

MAXIMUM STAGE IS 1243.6

MAXIMUM STAGE IS 1243.3

MAXIMUM STAGE IS 1242.5

MAXIMUM STAGE IS 1241.5

M JM STAGE IS 1240.3

MAXIMUM STAGE IS 1240.1

HYDROGRAPH ROUTING

ROUTING THRU REACH 6 - 7

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	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	0	0	0	0

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0700	.1000	1214.0	1260.0	3400.	.00600

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1260.00 550.00 1240.00 700.00 1220.00 790.00 1214.00 800.00 1214.00
1170.00 1220.00 1400.00 1240.00 1600.00 1260.00

STORAGE	0.00	19.43	73.93	159.72	257.62	364.01	479.09	602.87	735.34	876.50
	1026.35	1185.19	1358.87	1549.70	1757.69	1982.84	2225.15	2484.61	2761.23	3055.00
OUTFLOW	0.00	481.72	2863.82	8913.41	19869.65	31972.89	48069.92	67146.93	89201.97	114252.13
	142326.70	173092.50	206488.37	243776.71	284989.59	330250.78	379712.10	433534.03	491878.76	554907.56
STAGE	1214.00	1216.42	1218.84	1221.26	1223.68	1226.11	1228.53	1230.95	1233.37	1235.79
	1238.21	1240.63	1243.05	1245.47	1247.89	1250.32	1252.74	1255.16	1257.58	1260.00
FLOW	0.00	481.72	2863.82	8913.41	19869.65	31972.89	48069.92	67146.93	89201.97	114252.13
	142326.70	173092.50	206488.37	243776.71	284989.59	330250.78	379712.10	433534.03	491878.76	554907.56

MAXIMUM STAGE IS 1218.2

MAXIMUM STAGE IS 1217.9

MAXIMUM STAGE IS 1217.6

MAXIMUM STAGE IS 1217.2

MAXIMUM STAGE IS 1216.9

MAXIMUM STAGE IS 1216.6

MAXIMUM STAGE IS 1215.9

Y UM STAGE IS 1214.4

MAXIMUM STAGE IS 1214.2

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH - CRESENT LAKE SUBAREA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.72	0.00	6.16	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.90	111.00	123.00	133.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

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= 2.43 CP= .45 NTA= 0

RECESSION DATA

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

UNIT HYDROGRAPH 87 END-OF-PERIOD ORDINATES, LAG= 2.44 HOURS, CP= .45 VOL= 1.00

17.	83.	129.	207.	293.	382.	460.	520.	560.	577.
542.	528.	495.	464.	435.	407.	382.	358.	335.	314.
295.	276.	259.	242.	227.	213.	200.	187.	175.	164.
154.	144.	135.	127.	119.	111.	104.	98.	92.	86.
81.	75.	71.	66.	62.	58.	55.	51.	48.	45.
42.	39.	37.	35.	32.	30.	29.	27.	25.	23.
22.	21.	19.	18.	17.	16.	15.	14.	13.	12.
12.	11.	10.	9.	9.	8.	8.	7.	7.	6.
6.	6.	5.	5.	5.	4.	4.			

0 END OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.88	22.49	2.39	273574.
										(632.)	(571.)	(61.)	(7746.75)

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COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
9	2	0	0	0	0	1	0	0

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

HYDROGRAPH ROUTING

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

HYDROGRAPH ROUTING

RESERVOIR ROUTING - CRESENT LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10	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	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	153.	-1

STAGE	1211.00	1211.50	1212.00	1212.50	1213.00	1214.00	1215.00	1216.00	1216.50	1217.00
	1217.50	1218.00								
FLOW	0.00	156.00	440.00	807.00	1242.00	2271.00	3513.00	4908.00	5670.00	6742.00
	8223.00	9968.00								

SURFACE AREA=	0.	14.	28.
CAPACITY=	0.	153.	336.
ELEVATION=	1178.	1211.	1220.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1211.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1216.0	0.0	0.0	0.

PEAK OUTFLOW IS 9113. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 7918. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 6786. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 5883. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 5022. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 4177. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 3344. AT TIME 42.50 HOURS

OUTFLOW IS 2092. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 837. 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	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50	RATIO 7 .40	RATIO 8 .25	RATIO 9 .10
HYDROGRAPH AT	1	1.44	1	3094.	2784.	2475.	2166.	1856.	1547.	1237.	773.	309.
	(	3.73)	(	87.60)(	78.84)(	70.08)(	61.32)(	52.56)(	43.80)(	35.04)(	21.90)(	8.76)
ROUTED TO	2	1.44	1	2329.	2029.	1721.	1393.	1033.	709.	426.	87.	33.
	(	3.73)	(	65.94)(	57.46)(	48.73)(	39.43)(	29.26)(	20.07)(	12.05)(	2.52)(	.93)
ROUTED TO	3	1.44	1	2324.	2027.	1717.	1389.	1030.	708.	424.	89.	33.
	(	3.73)	(	65.80)(	57.40)(	48.62)(	39.33)(	29.16)(	20.04)(	12.00)(	2.51)(	.93)
ROUTED TO	4	1.44	1	2304.	2005.	1696.	1390.	1011.	699.	419.	87.	33.
	(	3.73)	(	65.25)(	56.77)(	48.03)(	38.51)(	28.61)(	19.78)(	11.75)(	2.48)(	.93)
ROUTED TO	5	1.44	1	2233.	1939.	1638.	1304.	943.	654.	390.	81.	31.
	(	3.73)	(	63.24)(	54.89)(	46.09)(	36.91)(	26.76)(	18.53)(	11.05)(	2.41)(	.93)
ROUTED TO	6	1.44	1	2229.	1931.	1621.	1299.	943.	651.	388.	81.	31.
	(	3.73)	(	63.11)(	54.67)(	45.89)(	36.79)(	26.70)(	18.43)(	11.00)(	2.41)(	.93)
ROUTED TO	7	1.44	1	2208.	1915.	1606.	1285.	931.	647.	383.	81.	31.
	(	3.73)	(	62.53)(	54.22)(	45.47)(	36.39)(	26.36)(	18.32)(	10.86)(	2.39)(	.93)
HYDROGRAPH AT	8	4.72	1	8330.	7490.	6652.	5814.	4975.	4164.	3331.	2082.	833.
	(	12.22)	(	235.81)(	212.23)(	188.65)(	165.07)(	141.49)(	117.91)(	94.32)(	58.95)(	23.58)
2 COMBINED	9	6.16	1	9136.	7921.	6709.	5505.	5044.	4199.	3361.	2104.	845.
	(	15.95)	(	258.43)(	224.31)(	192.25)(	167.22)(	142.83)(	118.90)(	95.18)(	59.58)(	23.87)
ROUTED TO	10	6.16	1	9113.	7918.	6736.	5888.	5022.	4177.	3343.	2093.	837.
	(	15.95)	(	258.04)(	224.22)(	192.17)(	166.74)(	142.20)(	118.29)(	94.65)(	59.23)(	23.71)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1317.10	1317.00	1329.00
STORAGE	667.	653.	1003.
OUTFLOW	3.	0.	42.

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	1329.42	1.42	1331.	2329.	24.25	43.25	0.00
.90	1329.20	1.20	1286.	2029.	23.75	43.50	0.00
.80	1328.96	1.96	1235.	1721.	23.25	43.50	0.00
.70	1328.72	1.72	1184.	1394.	22.50	43.75	0.00

OF PMF	RESERVOIR W.S.ELEV	DEPTH OVER DAM	STORAGE AC-FT	OUTFLOW CFS	OVER TOP HOURS	MAX OUTFLOW HOURS	FAILURE HOURS
1.00	1320.62	1.62	1471.	2329.	24.25	43.25	0.00
.90	1320.50	1.50	1345.	2037.	23.75	43.50	0.00
.80	1320.36	1.36	1339.	1721.	23.25	43.50	0.00
.70	1320.22	1.22	1292.	1393.	22.50	43.75	0.00
.60	1320.07	1.07	1252.	1033.	21.50	44.25	0.00
.50	1319.86	.86	1199.	709.	20.75	44.75	0.00
.40	1319.62	.62	1141.	426.	19.00	45.75	0.00
.25	1319.10	.10	1023.	89.	10.25	49.25	0.00
.10	1317.94	0.00	800.	33.	0.00	49.50	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2324.	1299.6	43.50
.90	2027.	1299.4	43.50
.80	1717.	1299.2	43.75
.70	1389.	1298.9	44.00
.60	1030.	1298.7	44.25
.50	708.	1298.4	45.00
.40	424.	1297.7	46.00
.25	89.	1296.4	49.50
.10	33.	1296.1	49.75

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2304.	1289.4	43.75
.90	2005.	1289.1	43.75
.80	1696.	1288.8	44.00
.70	1360.	1288.4	44.25
.60	1011.	1287.8	44.75
.50	699.	1287.3	45.50
.40	415.	1286.9	46.50
.25	87.	1285.4	50.25
.10	33.	1285.2	50.50

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2233.	1274.1	44.25
.90	1938.	1273.8	44.50
.80	1628.	1273.5	44.75
.70	1304.	1273.1	45.00
.60	945.	1272.7	45.50
.50	654.	1272.0	46.50
.40	390.	1271.2	47.50
.25	85.	1270.3	51.25
.10	33.	1270.1	51.50

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2229.	1244.5	44.50
.90	1931.	1244.2	44.75
.80	1621.	1243.9	44.75
.70	1299.	1243.6	45.25
.60	943.	1243.3	45.75
.50	651.	1242.5	46.75
.40	388.	1241.5	48.00
.25	85.	1240.3	51.50
.10	33.	1240.1	51.75

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2209.	1218.2	44.75
.90	1915.	1217.9	45.00
.80	1606.	1217.6	45.25
.70	1285.	1217.2	45.50
.60	931.	1216.9	46.25
.50	647.	1216.6	47.00
.40	383.	1215.9	48.50
.25	84.	1214.4	52.00
.10	33.	1214.2	52.25

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1210.96	1211.00	1216.00
STORAGE	153.	153.	239.
OUTFLOW	0.	0.	4908.

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	1217.76	1.76	278.	9113.	6.75	43.25	0.00
.90	1217.40	1.40	270.	7918.	6.00	43.50	0.00
.80	1217.02	1.02	261.	6786.	5.25	42.50	0.00
.70	1216.60	.60	252.	5888.	3.75	42.50	0.00
.60	1216.07	.07	241.	5022.	1.00	42.50	0.00
.50	1215.48	0.00	228.	4177.	0.00	42.50	0.00
.40	1214.86	0.00	216.	3343.	0.00	42.50	0.00
.25	1213.83	0.00	197.	2092.	0.00	42.50	0.00
.10	1212.53	0.00	176.	837.	0.00	42.50	0.00

EOI ENCOUNTERED.

10

```
DAM SAFETY VERSION    JULY 1978
 LAST MODIFICATION  26 FEB 79
*****************************
   1          A1     CRESENT LAKE DAM    ****    DWARFSKILL CREEK
   2          A2     DINGMAN TWP., PIKE COUNTY, PA.
   3          A3     NDI # PA-00413     PA DER # 52-142
   4          B   300      0      15       0       0       0       0       0      -4       0
   5          B1    5
   6          J     1      9       1
   7          J1    1     .9      .8      .7      .6      .5      .4     .25      .1
   8          K            1                                       1
   9          K1                INFLOW HYDROGRAPH - GOLD KEY LAKE SUBAREA
  10          M     1      1    1.44.             6.16
  11          P           21.9     111     123     133     142
  12          T                                                   1     .05
  13          W  1.69     .45
  14          X  -1.5     .05       2
  15          K     1       2                                     1
  16          K1                RESERVOIR ROUTING - GOLD KEY LAKE
  17          Y                             1
  18          Y1    1                                           672      -1
  19          Y4 1317    1318    1319  1319.5    1320    1321
  20          Y5    0      35      42     288     875    3201
  21          $A    0     140     253
  22          $E 1303    1317    1320
  23          $$ 1317
  24          $D 1319
  25          K     1       3                                     1
  26          K1                   ROUTING THRU REACH 2 - 3
  27          Y                             1
  28          Y1    1
  29          Y6   .1     .07      .1    1296    1340    1350   .0036
  30          Y7    0    1340     540    1320     820    1300    1110    1296    1120    1296
  31          Y7 1390    1300    1600    1320    1770    1340
  32          K     1       4                                     1
  33          K1                   ROUTING THRU REACH 3 - 4
  34          Y                             1
  35          Y1    1
  36          Y6   .1     .08      .1    1285    1320    3250   .0036
  37          Y7    0    1320     520    1370     380    1300     600    1285     700    1285
  38          Y7 1350    1300    1400    1320    1500    1320
  39          K     1       5                                     1
  40          K1                   ROUTING THRU REACH 4 - 5
  41          Y                             1
  42          Y1    1
  43          Y6   .1     .08      .1    1270    1320    5000   .0027
  44          Y7    0    1320     250    1300     400    1280     600    1270     750    1270
  45          Y7 1000    1280    1150    1300    1400    1300
  46          K     1       6                                     1
  47          K1                   ROUTING THRU REACH 5 - 6
  48          Y                             1
  49          Y1    1
  50          Y6   .1     .07      .1    1240    1300    4700   .002
1 51          Y7    0    1300     130    1280     200    1260     490    1240     510    1240
  52          Y7  680    1260     880    1280    1400    1300
  53          K     1       7                                     1
  54          K1                   ROUTING THRU REACH 6 - 7
  55          Y                             1
  56          Y1    1
  57          Y6   .1     .07      .1    1214    1260    3400   .006
              Y7    0    1260     400    1240     200    1220     790    1214     [illegible]
```

```
54                                                    (CONTINUED FROM CARD 6 - 7
55          Y                                  1
56          Y1    1
57          Y6   .1     .07     .1    1214   1260   3400   .036
58          Y7    0     1260    550   1740    700   1220    790   1214    800   1214
59          Y7 1170     1220   1400   1240   1600   1260
60          K           8                                    1
61          K1                 INFLOW HYDROGRAPH - CRESENT LAKE SUBAREA
62          M     1     1      4.72          6.16
63          P           21.9   111    123    133    142
64          T                                          1     .05
65          W  2.43     .45
66          X  -1.5     -.05   2
67          K     2     9                                    1
68          K1                 COMBINE HYDROGRAPHS
69          K     1     10                                   1
70          K1                 RESERVOIR ROUTING - CRESENT LAKE DAM
71          Y                        1
72          Y1    1                                    153   -1
73          Y4 1211  1211.5   1212  1212.5   1213   1214   1215   1216  1216.5   1217
74          Y41217.5  1218
75          Y5    0     173    489    898   1383   2540   3911   5466   6314   7475
76          Y5 9049    10892
77          $A    0     13.8   27.5
78          $E1177.7    1211   1220
79          $$ 1211
80          $D 1216
81          K    99
1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                 RUNOFF HYDROGRAPH AT          1
                                 ROUTE HYDROGRAPH TO           2
                                 ROUTE HYDROGRAPH TO           3
                                 ROUTE HYDROGRAPH TO           4
                                 ROUTE HYDROGRAPH TO           5
                                 ROUTE HYDROGRAPH TO           6
                                 ROUTE HYDROGRAPH TO           7
                                 RUNOFF HYDROGRAPH AT          8
                                 COMBINE 2 HYDROGRAPHS AT      9
                                 ROUTE HYDROGRAPH TO          10
                                 END OF NETWORK

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

 RUN DATE= 80/04/24.
     TIME= 09.16.16.

                    CRESENT LAKE DAM    ****    DWARFSKILL CREEK
                    DINGMAN TWP., PIKE COUNTY, PA.
                    NDI # PA-00413     PA DER # 52-142

                                        JOB SPECIFICATION
                      NO     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
                     300       0      15       0       0       0       0       0      -4       0
```

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	2209.	1218.2	44.75
.90	1915.	1217.9	45.00
.80	1606.	1217.6	45.25
.70	1285.	1217.2	45.50
.60	931.	1216.9	46.25
.50	647.	1216.6	47.00
.40	383.	1215.9	48.50
.25	84.	1214.4	52.00
.10	33.	1214.2	52.25

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

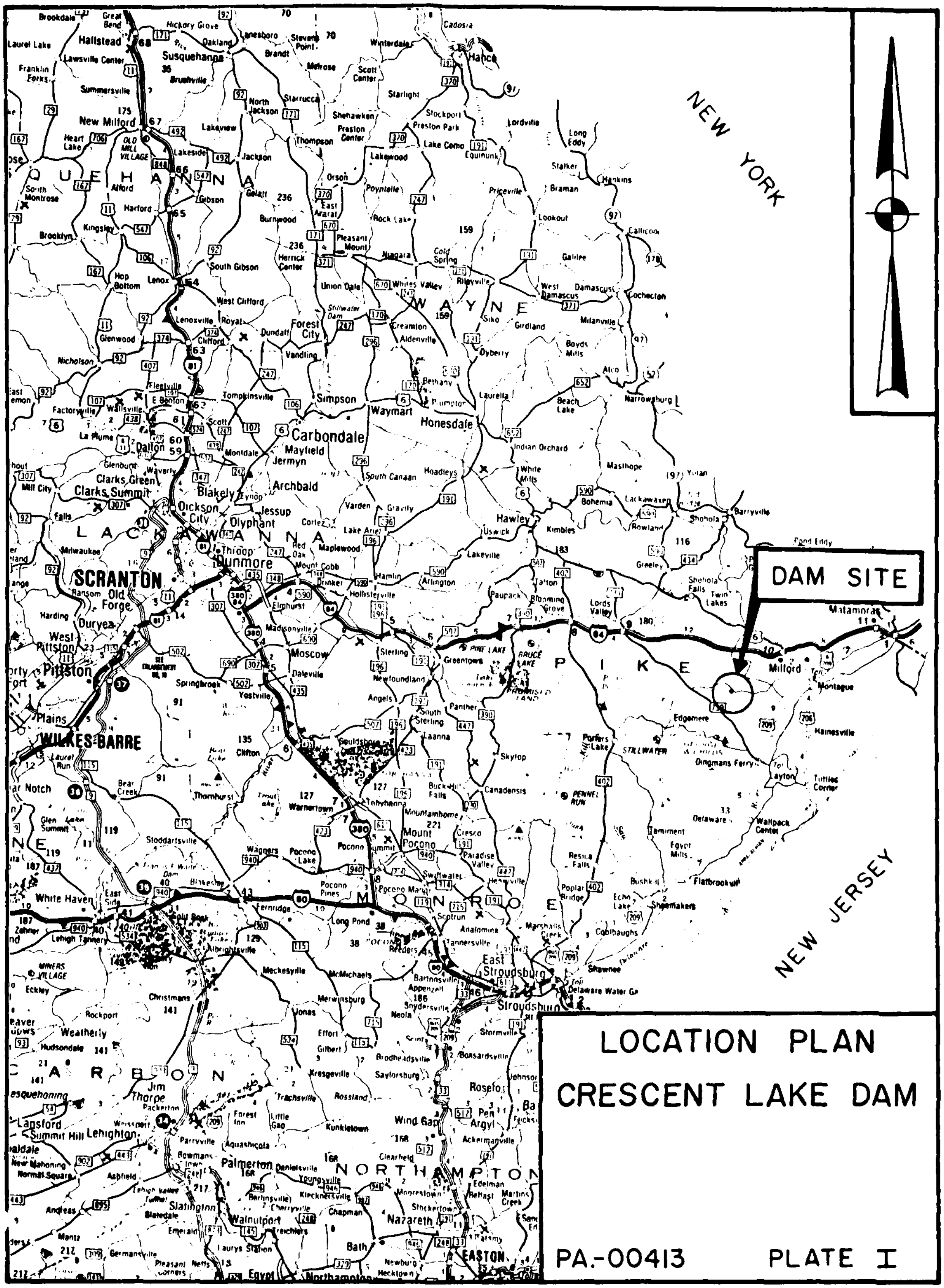
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1210.76	1211.00	1216.00
STORAGE	153.	153.	239.
OUTFLOW	0.	0.	5466.

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	1217.52	1.52	273.	9114.	6.00	43.25	0.00
.90	1217.14	1.14	264.	7920.	5.25	43.50	0.00
.80	1216.70	.70	254.	6783.	4.50	42.50	0.00
.70	1216.25	.25	244.	5887.	2.25	42.50	0.00
.60	1215.71	0.00	233.	5023.	0.00	42.50	0.00
.50	1215.18	0.00	223.	4183.	0.00	42.25	0.00
.40	1214.59	0.00	211.	3346.	0.00	42.25	0.00
.25	1213.61	0.00	194.	2093.	0.00	42.50	0.00
.10	1212.43	0.00	174.	837.	0.00	42.50	0.00

EOI ENCOUNTERED.
N
TERMINAL 254 TIME OUT.
BYE 80/04/24. 09.03.17.
Z

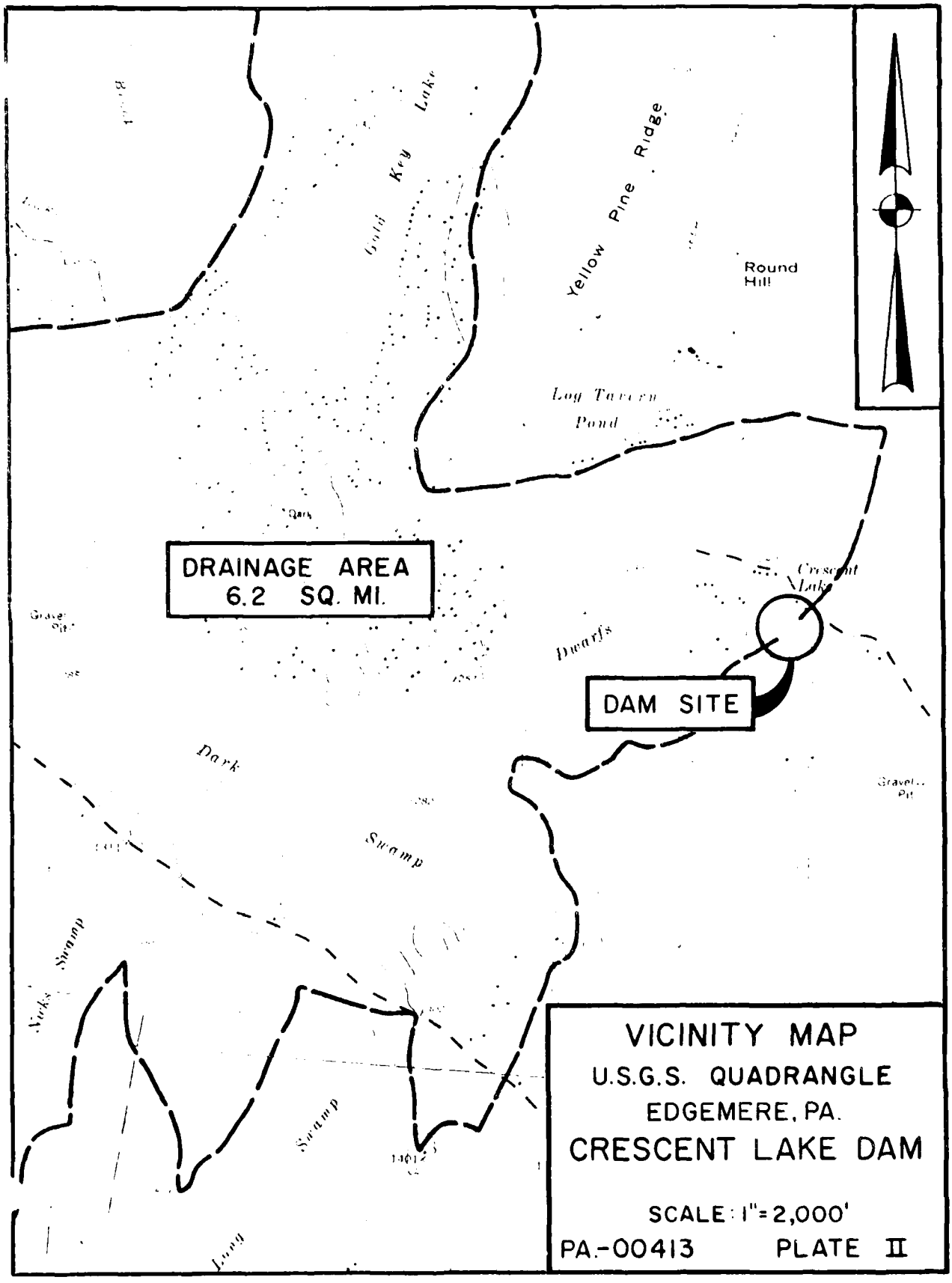
APPENDIX E

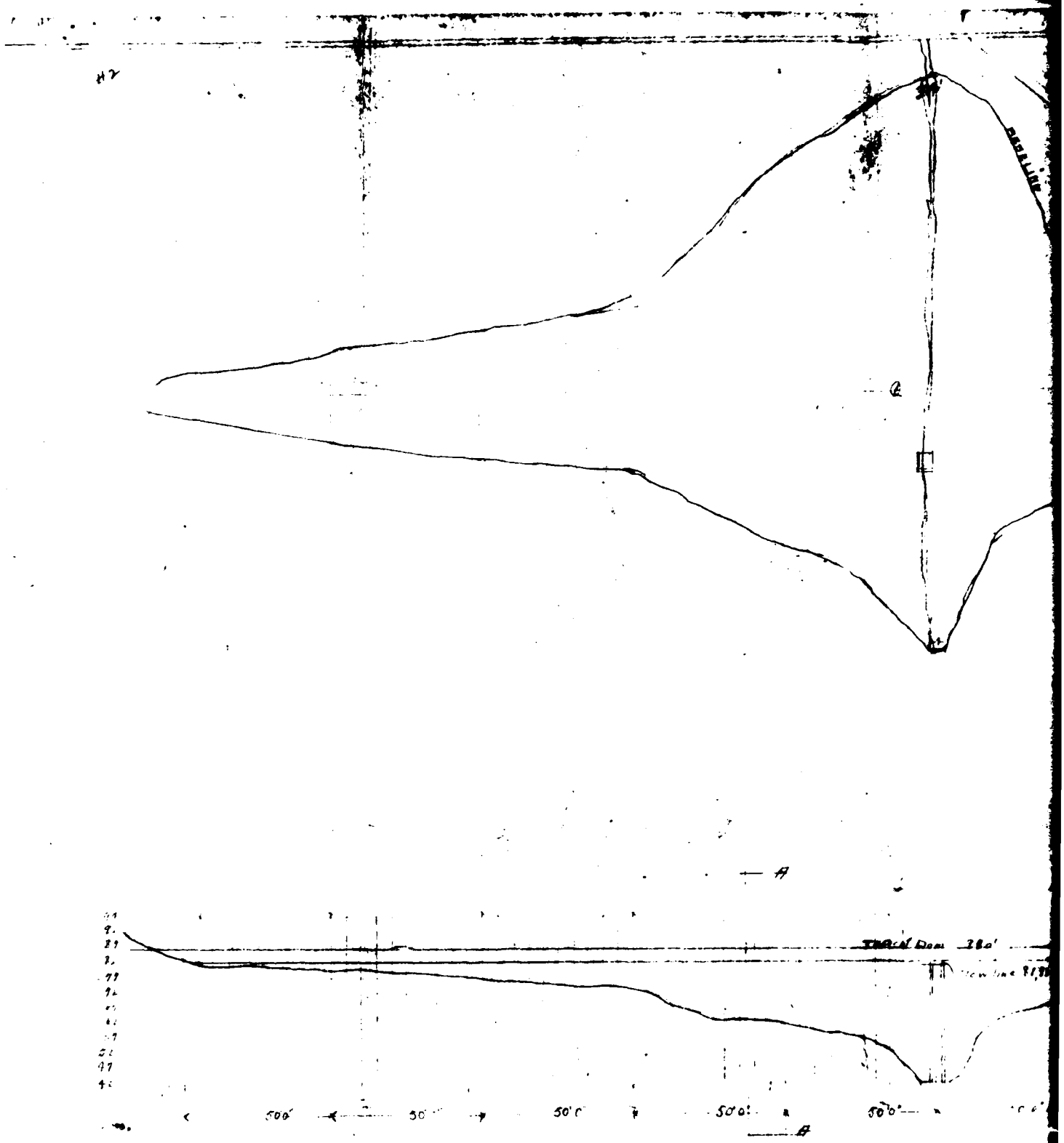
PLATES

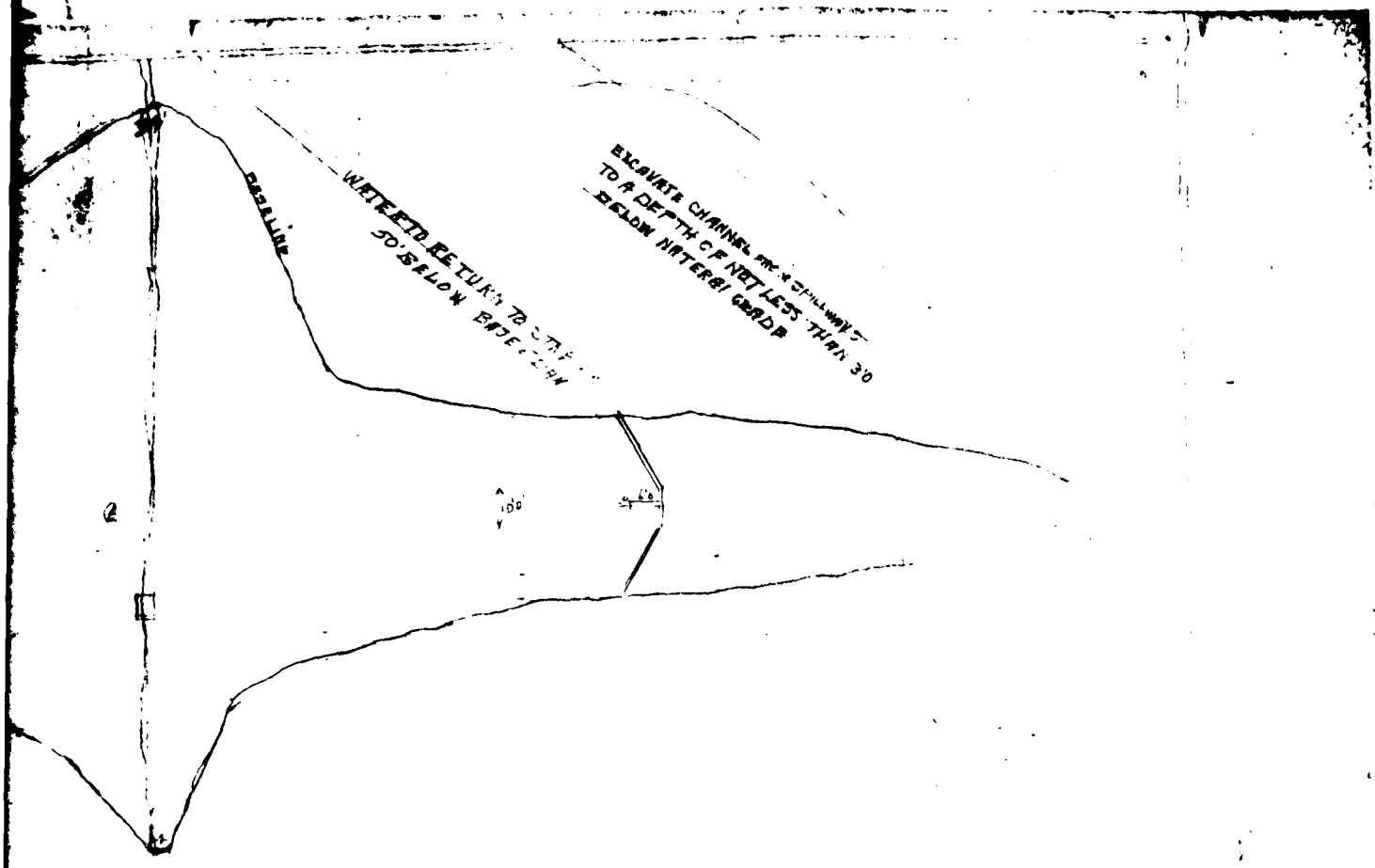


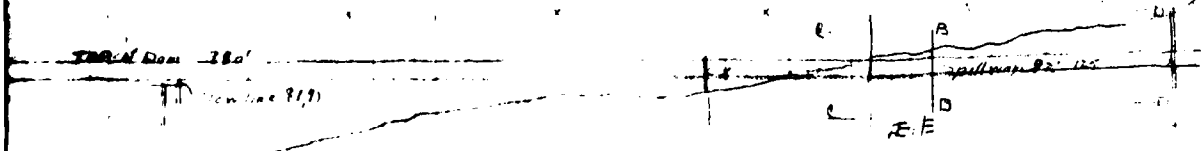
LOCATION PLAN
CRESCENT LAKE DAM

PA.-00413 PLATE I


Gold Key Lake
Yellow Pine Ridge
Round Hill
Log Tavern Pond
DRAINAGE AREA
6.2 SQ. MI.
Crescent Lake
Dwarfs
DAM SITE
Dark
Swamp
Sucks Swamp
Swamp
Gravel Pit
VICINITY MAP
U.S.G.S. QUADRANGLE
EDGEMERE, PA.
CRESCENT LAKE DAM
SCALE: 1" = 2,000'
PA.-00413 PLATE II

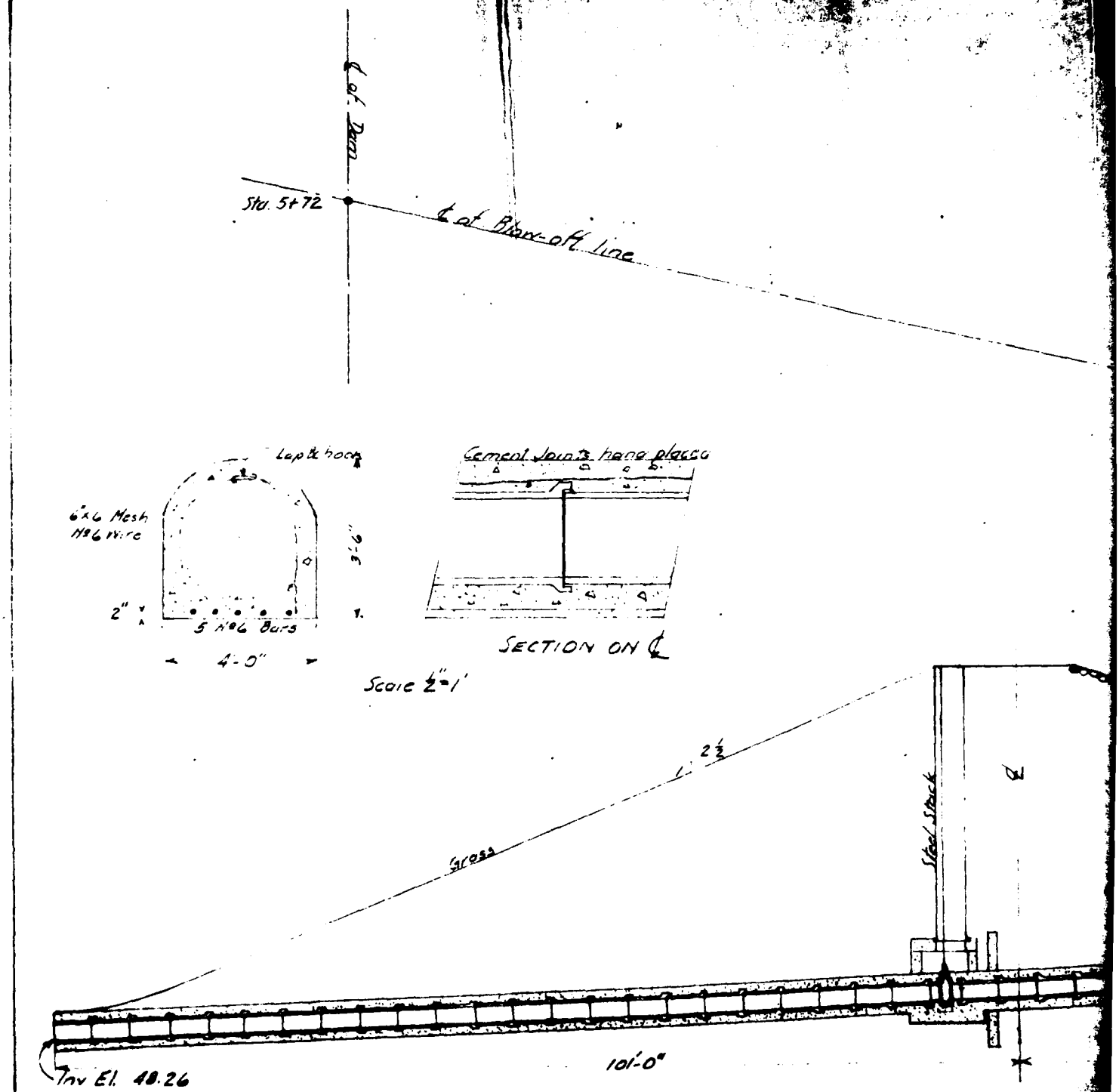

PIPELINE
A
B
500'
50'
50'
50'
50'

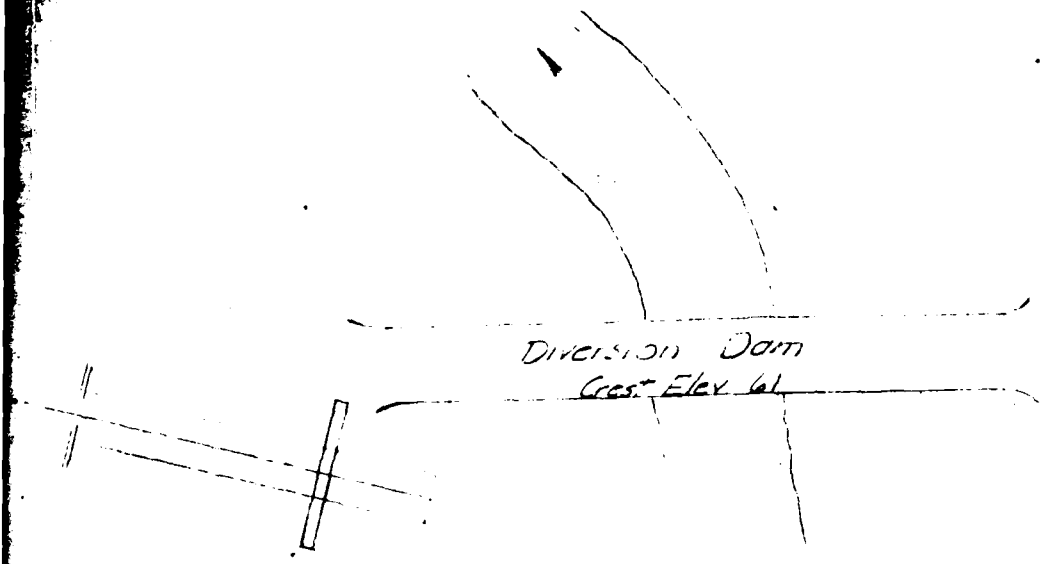




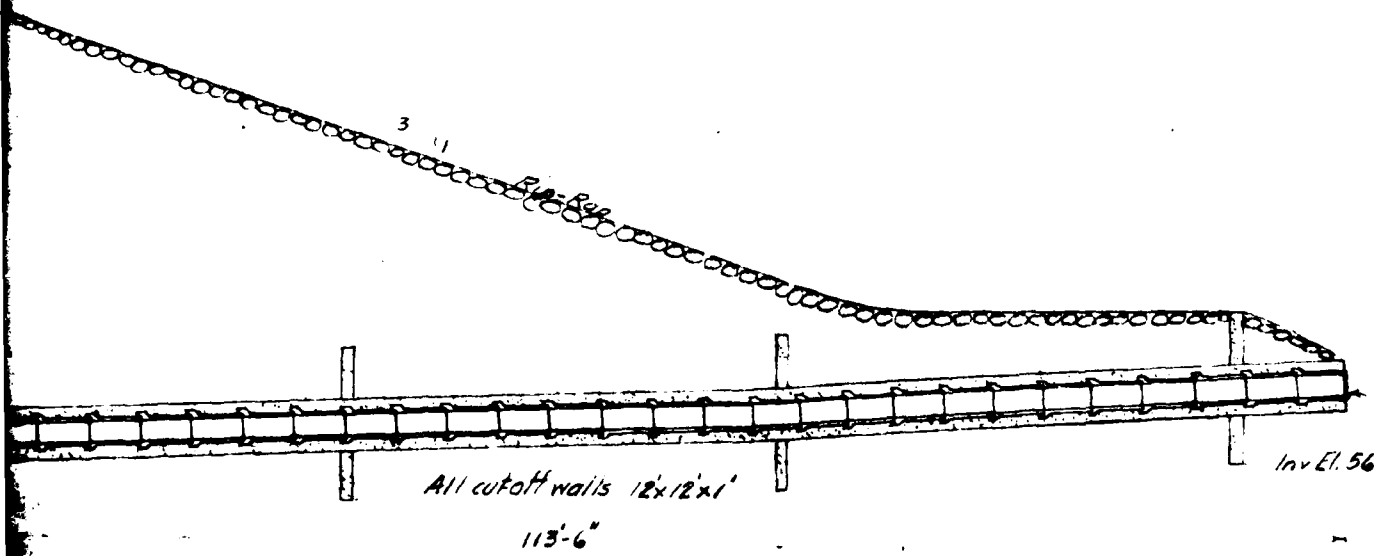
PLAN and SECTION of PROPOSED DAM
for
MR. LEWIS MILLER MILFORD
SCALE 1" = 100'

PA-00413
PLATE III


℄ of Dam
Sta. 5+72
℄ of Blow-off line
Lap & hook
6"x6" Mesh
#6 Wire
2"
5 #6 Bars
4'-0"
3'-2"
Cement Joints have placed
SECTION ON ℄
Scale ½"=1'
2½
Grass
Steel Stack
101'-0"
Inv El. 48.26
SECTION THRU BLOW
Sta. 5+72
Scale ½"=1'
John B Fredenstine



Plan
Scale 1" = 1'



All cutoff walls 12x12x1'

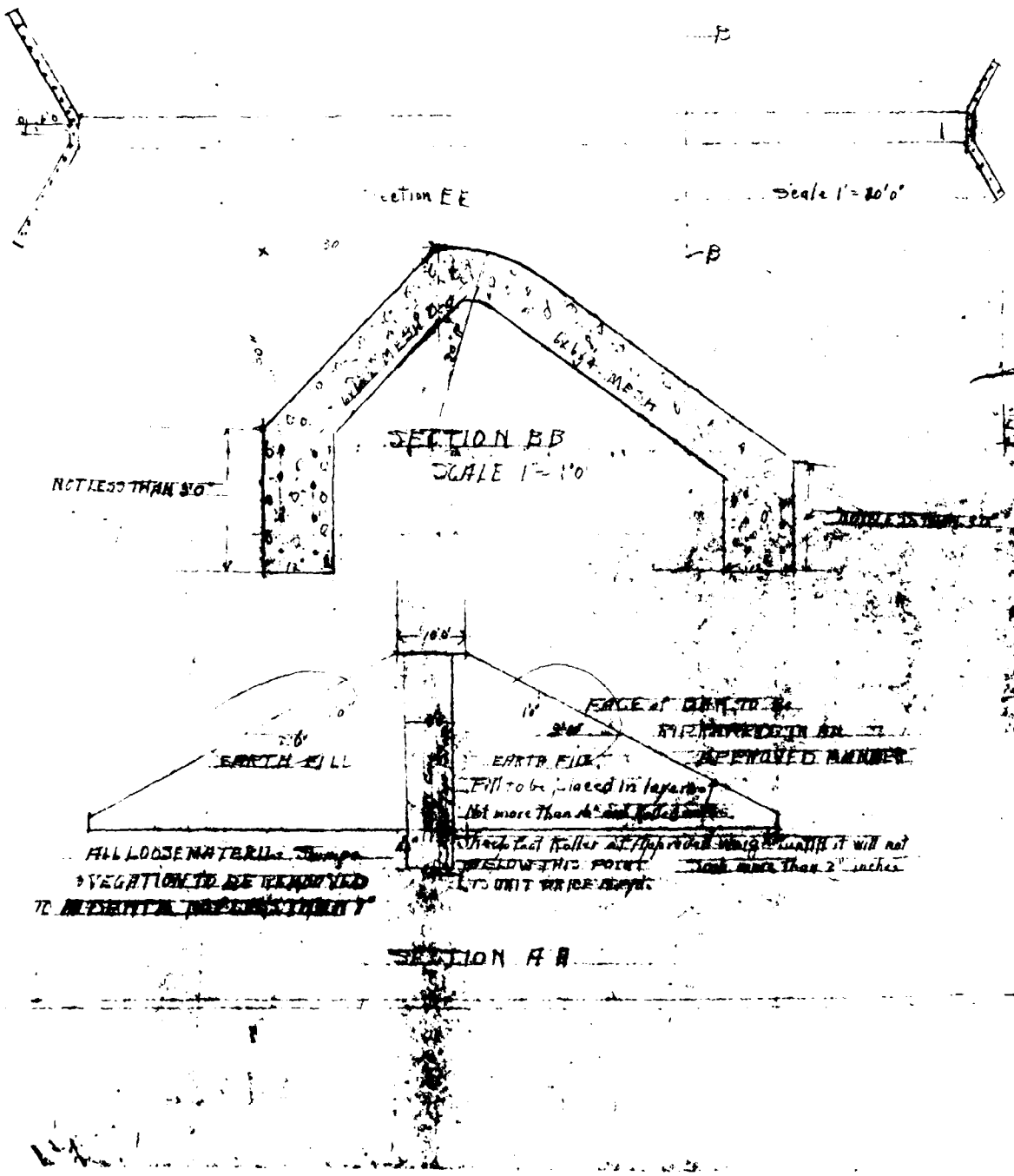
113'-6"

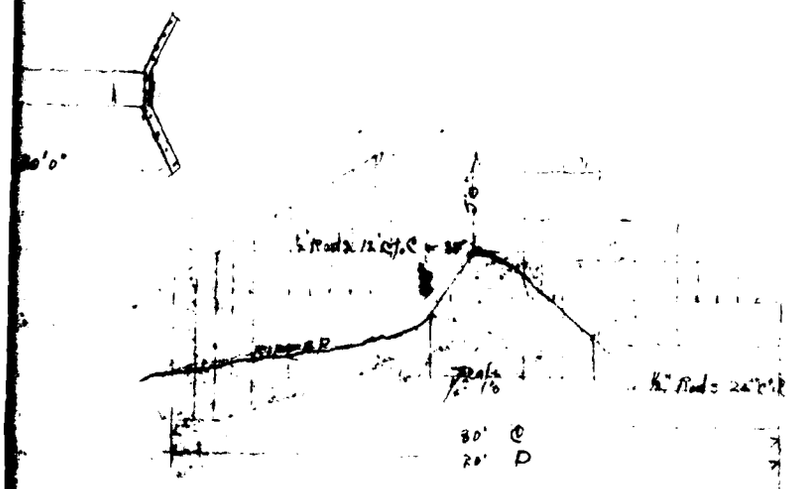
OFF

DAM
for
L. MILLER

J. B. Fredenstein
Org No 202 P.E. 5031

PA-0
PLATE


B
ection EE
Scale 1"=20'0"
B
SECTION BB
SCALE 1"=1'0"
NOT LESS THAN 8'0"
10'0"
EARTH FILL
EARTH FILL
ALL LOOSE MATERIAL
VEGETATION TO BE REMOVED
SECTION AA



Section Detail of Dam
for
MR LEWIS MILLER MILFORD
PIKE Co PA Scale as Noted

PA-00413
PLATE V

APPENDIX F

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Long Run - Walcksville Member of the Catskill formation.

Lithology: Predominantly medium to coarse grained, greenish gray to medium gray sandstone, interbedded with red shale, claystone and siltstone. The sandstone is very thick, bedded with distinct cross lamination. The beds are arranged in upward fining cycles, ten to hundred feet thick. Locally lenses of calcite cemented conglomerate are present at the base of the cycles; but these lenses rarely extend more than a few tens of feet laterally.

Structure

The dam is located near the eastern edge of the Pocono Plateau. The regional strike of the beds is N40°E and the dip is a few degrees to the northwest. Minor folds are superimposed on the regional dip and locally dips as high as 15° occur. No faults are mapped in the vicinity of the dam. Joint sets trending N2° to 13°E and N82°E to N75°W are reported.

Air photo fracture traces trend: N8°E, N60°E and N58°W.

Overburden

There is no information in file relating to borings or test pits. The site is within the glaciated area and a variable thickness of till can be expected to be present. Outwash sands and gravels commonly occur in the valleys. Outcrops of bedrock are noted on the plans, just below the toe of the dam. Photographs show outcrops on the valley side above the dam. An inspection report written during construction notes, however, that no rock was encountered in digging the puddle trench.

Aquifer Characteristics

The rocks of the Catskill Formation are essentially impermeable, and ground water movement is entirely along bedding planes and fractures. The most permeable aquifers in the area are in flacial outwash materials in the valleys.

Discussion

A small leak has been noted near the toe of the embankment. It is possible that this is due to ground water movement beneath the puddle trench, either in outwash materials, or along the contact between till and the bedrock. If no turbidity is observed in this leak, it probably does not pose a threat to safety. However, in the absence of specific foundation information, this leak should be checked in future inspection.

Sources of Information

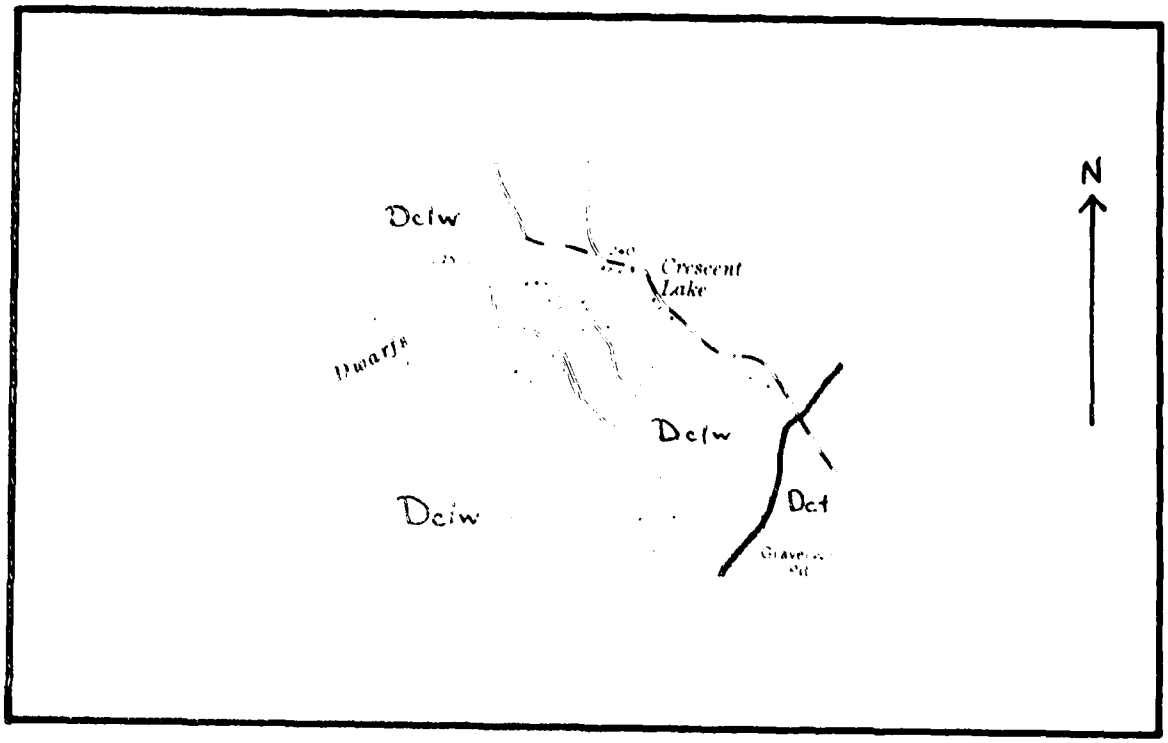
1. Fletcher, F.W. and Woodrow, Donald L. (1970), "Geology and Economic Resources of the Pennsylvania Portion of the Milford and Port Jervis 15-Minute Quadrangles," Pa. Geologic Survey, Harrisburg, Pa.

2. Sevon, W.D., et al, "Geology and Mineral Resources of Pike County," open file report, Pa. Geologic Survey, Harrisburg, Pa.

3. Air photographs dated 1973, scale 1:40,000.

4. Plans and inspection reports in file.

GEOLOGIC MAP - Crescent Lake Dam



Dclw — Catskill Fm.- Long Run/Walcksville member

Dct — Catskill Fm.- Towamensing member

—·—·— air photo fracture trace

SCALE 1:24000

CONTOUR INTERVAL 20 FEET


DATE
FILME
8-8