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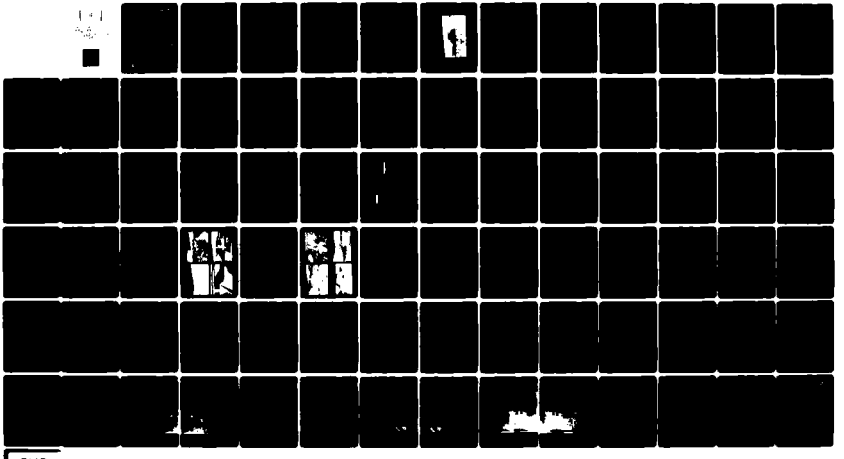

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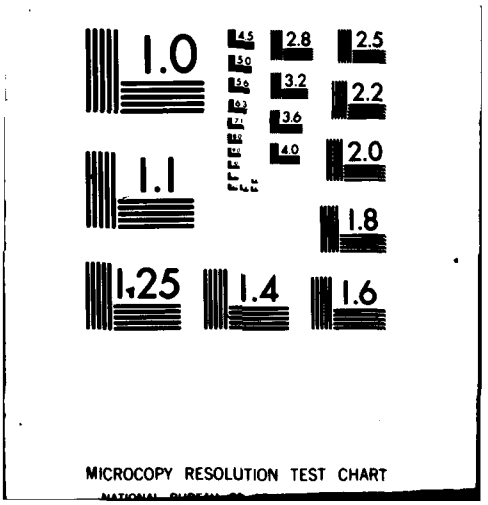
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SUSQUEHANNA RIVER BASIN
POTTER RUN, CENTRE COUNTY

PENNSYLVANIA

PENN NURSERY DAM

NDI I.D. No. PA-00470
PENNDER I.D. No. 14-117

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

PREPARED FOR

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

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

JANUARY 1980

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10 Bernard N. Mihalcin 15 DACW31-80-C-0016

11 Jan 82

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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 topograhic 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.

6 National Dam Safety Program. Penn Nursery Dam (NDI I.D. Number PA-00417), PennDER I.D. Number 14-111), Susquehanna River Basin, Potter Run, Centre County, Pennsylvania. Phase I Inspection Report.

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Penn Nursery Dam: NDI I.D. No. PA-00470

Owner:	Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER)
State Located:	Pennsylvania (PennDER I.D. No. 14-117)
County Located:	Centre
Stream:	Potter Run
Inspection Date:	28 November 1979
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

Based on a visual inspection, operational history, and available engineering data, the dam is considered to be in good condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possibly loss of life, the SDF is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store approximately 92 percent of the PMF prior to embankment overtopping. Based on screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate.

Deficiencies noted by the inspection team included a seepage condition along a portion of the downstream embankment toe approximately 160 feet to the right of the left abutment hillside and a minor vertical crack in the concrete spillway overflow wall.

It is recommended that the owner:

a. Complete the current assessment of the seepage condition at Penn Nursery Dam and immediately implement remedial measures.

b. Fill and seal the vertical crack in the concrete spillway overflow wall.

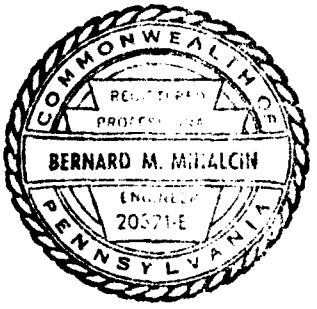
c. Revise the current operation and maintenance manual to include a formal emergency warning system that provides for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



Date 12 Feb 1980

Date 12 March 1980

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OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
PENN NURSERY DAM
NDI #PA-00470, PENNDER #14-117

SECTION 1
GENERAL INFORMATION

1.0 Authority.

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

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. Penn Nursery Dam is a 23-foot high earth embankment approximately 600 feet long, including spillway. The facility is served by an uncontrolled, reinforced concrete, flat-crested, straight drop type overflow spillway located 150 feet from the right abutment. The length of the spillway crest is 40 feet. Drawdown capability is provided by a 2.0- by 2.5-foot rectangular concrete box culvert located at the base of the left spillway wingwall. Flow through the culvert is controlled via a sluice gate operated manually from the embankment crest.

b. Location. Penn Nursery Dam is located on Potter Run in Potter Township, Centre County, Pennsylvania. The site is located on the grounds of the Penn Nursery State Forestry, just off U. S. Route 322 approximately 15 miles southeast of State College, Pennsylvania. The dam and reservoir are contained within the Spring Mills, Pennsylvania 7.5 minute U.S.G.S. topographic quadrangles (see Figure 1, Appendix E). The coordinates of the dam are N 40° 46.6' and W 77° 37.2'.

c. Size Classification. Small (23 feet high, 293 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Commonwealth of Pennsylvania
Department of Environmental Resources

f. Purpose. Irrigation.

g. Historical Data. Penn Nursery Dam was designed by the PennDER, Bureau of Engineering. Its purpose is to provide the major portion of the water storage needed to meet the irrigation requirements of the nursery. The facility was constructed by D. E. Smith, Inc., of Mifflintown, Pennnsylvania under the supervision of the Pennsylvania Department of General Services (formerly the General State Authority) and was completed in November 1972.

Correspondence and data contained in PennDER files indicate the facility has encountered significant seepage problems during its brief history. In February 1973 seepage was first reported along the downstream embankment toe to the left of the spillway. No soil movement was evident and it was observed that seepage ceased at pool levels below elevation 1489 feet (4 feet below normal pool). At that time it was speculated that the seepage was due to the lack of a suitable cutoff beneath the left side of the embankment. Subsequently, the pool was drawn down and a graded filter placed at the downstream embankment toe. In 1974 the seepage condition was reportedly stabilized and apparently did not reoccur until June 1978 when it was reported that the area at the downstream embankment toe to the left of the spillway had become wet. Three months later it was reported that a definite increase in the rate of seepage was evident and that a serious condition may be developing. Fine earth materials were observed to have been deposited along the toe. Once again, the reservoir level was lowered, this time by 2 feet, to ensure safety. The problem has not been resolved to date. However, the PennDER is actively pursuing the various alternatives available.

1.3 Pertinent Data.

a. Drainage Area (square miles). 3.1

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Rating curves provided in Appendix D (Sheet 11).

Discharge Capacity of Spillway at Maximum Pool ≅ 4210 cfs (see Appendix D, Sheet 6).

c. Elevation (feet above mean sea level). The following elevations were obtained from available drawings and

through field measurements based on the elevation of the spillway crest at 1493 feet (see Appendix D, Sheet 2, Note 1).

Top of Dam	1503
Maximum Design Pool	1502
Maximum Pool of Record	Not known
Normal Pool	1493
Spillway Crest	1493
Upstream Outlet Invert	1480.5
Downstream Outlet Invert	1480
Streambed at Dam Centerline	Not known
Maximum Tailwater	Not known

d. Reservoir Length (feet).

Top of Dam	2000
Normal Pool	1400

e. Storage (acre-feet).

Top of Dam	293
Normal Pool	54
Design Pool	234
Design Surcharge	59

f. Reservoir Surface (acres).

Top of Dam	32
Normal Pool	12
Maximum Design Pool	29

g. Dam.

Type	Homogeneous rolled earth.
Length	560 feet (excluding spillway).
Height	23 feet (field measured; base of stilling basin to top of embankment crest).
Top Width	15 feet.
Upstream Slope	2H:1V

	Downstream Slope	2H:1V
	Zoning	Homogeneous earth.
	Impervious Core	None indicated.
	Cutoff	Design drawings indicate a partial cutoff trench excavated to rock along embankment centerline, to the right of the spillway, 10 feet wide at base with 1H:1V side slopes.
	Grout Curtain	None indicated.
h	Diversion Canal and Regulating Tunnels.	None.
i.	Spillway.	
	Type	Uncontrolled, reinforced concrete, flat-crested, straight drop type spillway.
	Crest Elevation	1493 feet.
	Crest length	40 feet.
j.	Outlet Conduit.	
	Type	2.0- by 2.5-foot concrete box culvert located at base of left spillway wingwall.
	Length	13 feet.
	Closure and Regulating	Flow through the culvert is controlled via sluice gate operated manually from the embankment crest.

Access	Manually operated drawdown control mechanism is accessible from the left abutment.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No formal design reports or calculations are available for any aspect of the facility. Design drawings, contract specifications, and miscellaneous design data are contained in PennDER files. A formal operation and maintenance manual dated January 1973 by PennDER discusses design features of the facility in detail.

b. Design Features.

1. Embankment. Available data indicates the embankment is a homogeneous earth fill. A partial cutoff trench excavated to rock is provided along the embankment centerline to the right of the spillway. The upstream and downstream embankment faces are both sloped at 2H:1V. Dumped limestone riprap protects the upstream slope against wave action while the rest of the embankment is grass covered. The top width of the fill is 15 feet. Drawings indicate a foundation drainage blanket and toe drain have been provided (see Figures 2 and 3).

2. Appurtenant Structures.

a) Spillway. The spillway is an uncontrolled, reinforced concrete, straight drop overflow type structure. The crest is 40 feet long and set 10 feet below the top of the wingwalls. A reinforced concrete stilling basin is provided immediately below the weir. It measures 40 feet by 40 feet and has a 2-foot high end sill (see Figure 4).

b) Outlet Conduit. The outlet conduit is incorporated into the spillway structure and is situated at the base of the left wingwall. The conduit is a 2.0- by 2.5-foot concrete box culvert, 13 feet long, that discharges into the base of the stilling basin. Flow through the outlet is controlled via 24-inch slide gate at its inlet end.

c. Specific Design Data and Criteria.

1. Hydrology and Hydraulics. No formal design reports or calculations are available. Information contained in PennDER files indicates the spillway was designed to discharge a flow of 3390 cfs while providing a freeboard of 1-foot. A formal manual by PennDER, Division of Completed Projects, entitled "Operation and Maintenance Manual for

Penn Nursery Irrigation Dam" dated January 1973 is available at the main office of the nursery. The manual contains miscellaneous design information on the entire facility as well as outlet conduit and spillway rating curves, and a reservoir area-capacity curve.

2. Embankment. Available design data are limited to general information contained in the operation and maintenance manual, design drawings, contract specificaitons, and correspondence from PennDER files. Standard compaction curves for five borrow area samples are presented in the design drawings with detailed logs of borings and test pits.

3. Appurtenant Structures. Design data are limited to general information contained in PennDER files as stated above. Correspondence indicates that the facility is provided with an Armco medium duty sluice gate (24-inch by 24-inch) and Armco "CPE-2" manual lift mechanism.

2.2 Construction Records.

Design drawings, contract specifications and construction progress reports are contained in PennDER files.

2.3 Operational Records.

No records of the day-to-day operation of the facility are maintained.

2.4 Other Investigations.

The owner through the PennDER, Division of Completed Projects, is currently investigating seepage conditions at the facility. The seepage was originally observed and assessed in 1973. Correspondence related to the problem are contained in PennDER files.

2.5 'Evaluation.

The data available are considered adequate to make a reasonable Phase I assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the facility suggests it to be well maintained and in good condition.

b. Embankment. Observations made during the visual inspection indicate the embankment is in good condition. No evidence of sloughing, excess settlement, animal burrows, or signs of maintenance neglect were observed (see Photograph 1 and 2).

As indicated previously in Section 1.2.g., the facility has experienced a seepage condition at the left abutment for several years. On the day of the inspection, the field team observed a drainage trench that had been excavated several feet downstream of the left abutment toe (see Photograph 6). The trench is approximately 100 feet long and is cut about 160 feet to the right of the extreme left abutment contact. The trench was apparently dug in an effort to evaluate the seepage condition along the downstream embankment toe where fine materials were observed. A v-notch weir has been installed to facilitate measurement of seepage. The field team estimated the current rate of seepage at about 30 gpm. A wet condition still exists in the immediate toe area (see Photograph 5); however, no seepage was observed through the downstream embankment face.

c. Appurtenant Structures.

1. Spillway. The visual inspection revealed that the spillway is in good condition. A vertical crack near the center of the concrete overflow was the only evidence of concrete deterioration observed by the inspection team (see Photographs 3 and 7).

2. Outlet Conduit. At the time of inspection, the outlet conduit was inundated and discharging in an effort to maintain a low pool level (see Photographs 3 and 4).

d. Reservoir Area. The general area surrounding the reservoir is composed of approximately equal portions of wooded and grassy hillsides with moderate slopes. No signs of slope distress were observed.

e. Downstream Channel. The stream (Potter Run), into which the spillway discharges, flows in a generally northerly

direction through a narrow, wooded valley that essentially parallels U. S. Route 322. At a distance of about 1.2 miles downstream of the embankment, Potter Run passes four residences which have been constructed in close proximity to the streambed. Potter Run, in this area, is a swift moving stream on a steep grade. Further downstream, approximately 1.7 miles from the embankment, Potter Run passes directly through the community of Potters Mills, Pennsylvania. It is estimated that in the reach between Penn Nursery Dam and Potters Mills an embankment breach could result in a substantial loss of life and extensive property damage. As many as 50 persons could be affected by such an event. Consequently, the hazard classification of this facility is considered to be high.

3.2 Evaluation.

The overall condition of the facility is considered to be good. Deficiencies noted by the inspection team include seepage along the downstream embankment toe and a minor vertical crack in the concrete spillway overflow wall.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

According to the operation and maintenance manual, Penn Nursery Dam is designed to be essentially self-regulating with excess inflows being automatically discharged over the emergency spillway. During periods of low flow in the dry summer months, a 2-inch diameter opening near the center base of the spillway carries sufficient flow to support fish life in the stream below the dam. The 2.0- by 2.5-foot outlet conduit is not designed to maintain low flow requirements, but to provide drawdown capability. Typically, the sluice gate that controls flow through the conduit is opened twice yearly to ensure its operability. In recent months the gate has remained partially open in order to maintain a low pool due to the seepage condition at the downstream embankment toe.

4.2 Maintenance of Dam.

The dam as designed requires only limited maintenance which is performed by Penn Nursery staff in accordance with the procedures and guidelines set forth in the operation and maintenance manual.

4.3 Maintenance of Operating Facilities.

See Section 4.2 above.

4.4 Warning System.

No formal system is in effect that would provide for the warning of downstream residents during an embankment emergency.

4.5 Evaluation.

As noted during the visual inspection, the facility appears to be well maintained. A formal operation and maintenance manual is available; however, it is recommended that the current manual be revised to include a formal emergency warning system that provides for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design reports or calculations are available. Information contained in PennDER files indicates the spillway was designed to discharge a flow of 3390 cfs while providing a freeboard of 1-foot. The operation and maintenance manual contains some design information including outlet conduit and spillway rating curves, and a reservoir area-capacity curve. Data from the available rating curves is considered valid and was used in the analysis contained in Appendix D.

5.2 Experience Data.

Daily records of reservoir levels and/or spillway discharge are not available.

5.3 Visual Observations.

On the date of the inspection, no conditions were observed that would indicate the spillway could not perform satisfactorily during a flood event within the limits of its design capacity.

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. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical 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 procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Penn Nursery Dam

ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure to downstream developments (high). Due to the high potential for damage to downstream residences and possibly loss of life, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Penn Nursery Dam was evaluated under near normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of 1493 feet (MSL), with the spillway weir discharging freely. However, the usually discharging outlet conduit was assumed to be non-functional for the purpose of analysis. In any event, the flow capacity of the outlet conduit is not such that it would significantly increase the total discharge capabilities of the facility. The spillway is an uncontrolled, reinforced concrete, straight drop overflow type structure. All pertinent engineering calculations relative to the evaluation of this facility are provided in Appendix D.

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Penn Nursery Dam can accommodate about 92 percent of the PMF (SDF) prior to overtopping of the embankment (Appendix D, Summary Input/Output Sheets, Sheet C). The peak PMF inflow of approximately 4905 cfs was slightly attenuated by the discharge/storage capabilities of the dam and reservoir such that the resulting peak PMF outflow was about 4860 cfs (Summary Input/Output Sheets, Sheets B and C). Under the PMF, the embankment would be overtopped for approximately 2.5 hours, with a maximum depth of inundation equal to about 0.5 feet above the low top of dam elevation of 1503.0 feet (Summary Input/Output Sheets, Sheet C).

5.6 Spillway Adequacy.

Although Penn Nursery Dam cannot accommodate its SDF (the PMF), the possible downstream consequences of embankment failure due to overtopping were not evaluated. In accordance with Corps directive ETL-1110-2-234, breaching analysis was not performed, since the facility can safely pass a flood of at least 1/2 PMF magnitude. Since Penn Nursery Dam cannot accommodate a PMF-size flood, its spillway is considered to be inadequate, but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations the embankment is in good condition. The seepage condition noted at the left abutment is presently the only major concern and should be rectified as quickly as possible. It was noted that the owner is currently investigating the condition and remedial recommendations are expected soon. The reservoir level is being maintained below normal pool to curtail seepage.

b. Appurtenant Structures.

1. Spillway. Visual observations indicate the spillway is in good condition. The vertical crack noted in the overflow wall should be filled immediately to preclude further concrete deterioration and corrosion of the reinforcing.

2. Outlet Conduit. The outlet conduit was functioning during the inspection and was totally inundated.

6.2 Design and Construction Techniques.

Correspondence, specifications, contract drawings, and construction progress reports indicate that the facility was designed and constructed in accordance with generally accepted practices.

6.3 Past Performance.

According to available correspondence and discussions with representatives of the owner, the facility has performed satisfactorily since its completion with the exception of the persistent seepage along the left abutment-embankment contact.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. As the facility appears well constructed and sufficiently stable, it is believed that it can withstand the expected dynamic forces; however, no calculations and/or investigations were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection suggests the facility is well maintained and in good condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possibly loss of life, the SDF for the facility is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store approximately 92 percent of the PMF prior to embankment overtopping. Based on screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate.

Deficiencies noted by the inspection team included a seepage condition along a portion of the downstream embankment toe approximately 160 feet to right of the extreme left abutment and a vertical crack in the concrete spillway overflow wall.

b. Adequacy of Information. The available data are considered sufficient to make a reasonable Phase I assessment of the facility.

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

d. Necessity for Additional Investigations. An investigation of the seepage condition is currently in progress. No additional investigations are currently deemed necessary.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Complete the current assessment of the seepage condition at Penn Nursery Dam and immediately implement remedial measures.

b. Fill and seal the vertical crack in the concrete spillway overflow wall.

c. Revise the current operation and maintenance manual to include a formal emergency warning system that provides for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

APPENDIX A

VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Penn Nursery Dam STATE Pennsylvania COUNTY Centre

NDI # PA — 00470 PENNDER # 14-117

TYPE OF DAM Earth SIZE Small HAZARD CATEGORY High

DATE(S) INSPECTION 28 November 1979 WEATHER Overcast TEMPERATURE 30° @ 9:00 a.m.

POOL ELEVATION AT TIME OF INSPECTION 1491.1 M.S.L.

TAILWATER AT TIME OF INSPECTION - M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
B. M. Mihalcin	Penn Nursery Personnel	
D. J. Spaeder	C. Cooper (Superintendent)	
D. L. Bonk		

RECORDED BY D. L. Bonk

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - Good. Vertical - Good.
RIPRAP FAILURES	Dumped limestone riprap, apparently functioning adequately, but some weathering evident.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Toe along left abutment is saturated with evidence of fines.
ANY NOTICEABLE SEEPAGE	Evidence of prior seepage along toe of left abutment. Drainage ditch cut parallel to toe about 15 feet from embankment. Seepage being monitored by PennDER, Bureau of Design.
STAFF GAGE AND RECORDER	None.
DRAINS	None observed. Exit of toe drain was submerged.

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
INTAKE STRUCTURE	Submerged, not observed.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Same as above.
OUTLET STRUCTURE	Same as above.
OUTLET CHANNEL	Flow through the outlet is discharged into the spillway stilling basin and ultimately into the stream below.
GATE(S) AND OPERATIONAL EQUIPMENT	Sluice gate operated by manual lift mechanism. Lift mechanism in excellent condition. Gate partially opened to maintain pool in drawdown status.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA · 00470
TYPE AND CONDITION	Reinforced concrete, flat crested, straight drop overflow type structure located 150 feet from right abutment in good condition. Vertical crack observed near the center of the concrete overflow wall.
APPROACH CHANNEL	N/A.
SPILLWAY CHANNEL AND SIDEWALI S	Concrete wingwalls in excellent condition. No evidence of external deterioration was observed.
STILLING BASIN PLUNGE POO!.	Reinforced concrete stilling basin located immediately below overflow weir. Excellent condition.
DISCHARGE CHANNEL	The channel beyond the stilling basin is unlined and trapezoidal in shape. It extends approximately 400 feet to the original stream channel.
BRIDGE AND PIERS EMERGENCY GATES	None.

SERVICE SPILLWAY

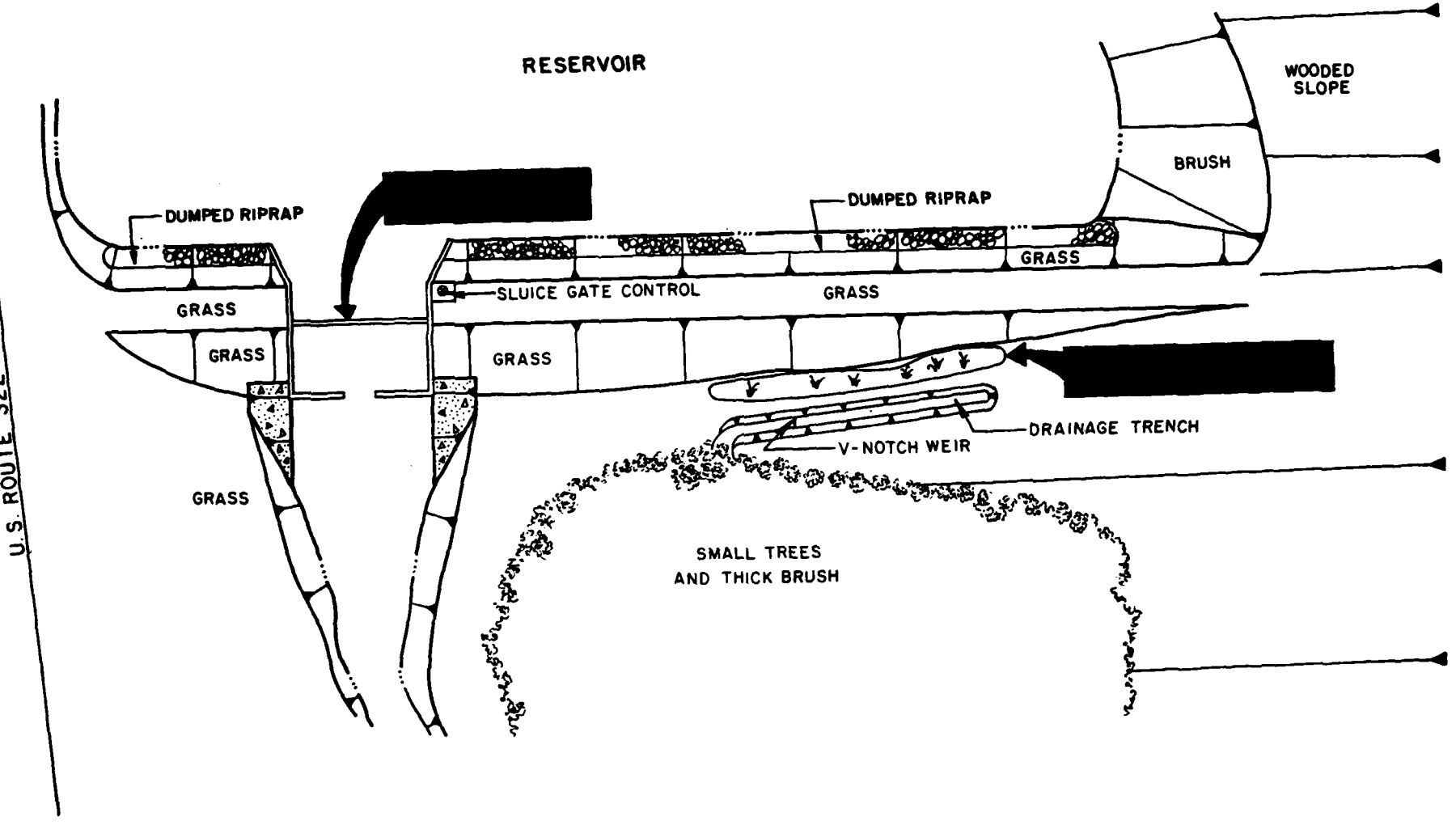
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
TYPE AND CONDITION	N/A.
APPROACH CHANNEL	N/A.
OUTLET STRUCTURE	N/A.
DISCHARGE CHANNEL	N/A.

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
MONUMENTATION SURVEYS	None.
OBSERVATION WELLS	None.
WEIRS	Plywood V-notch weir in drainage trench along left abutment. Flow estimated to be 30 gpm.
PIEZOMETERS	None.
OTHERS	None.

RESERVOIR AREA AND DOWNSTREAM CHANNEL

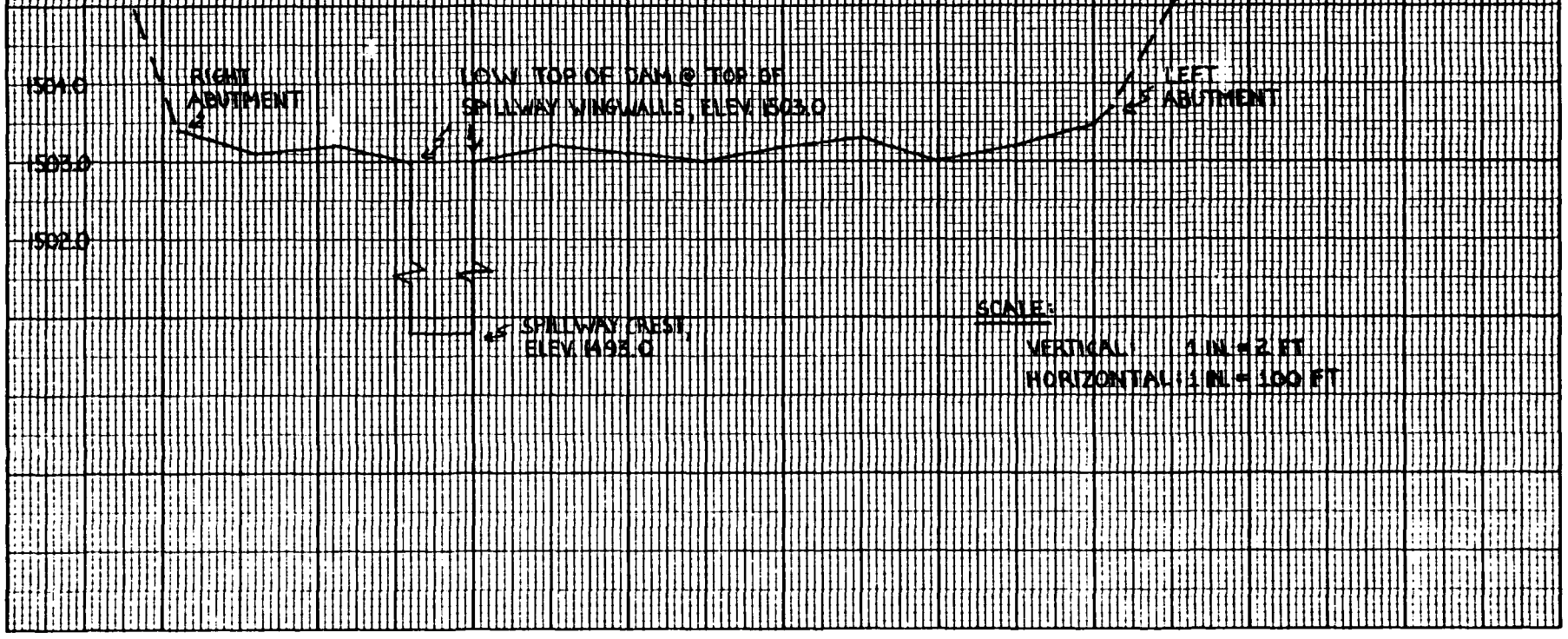
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00470
SLOPES: RESERVOIR	The general area surrounding the reservoir is composed of approximately equal portions of wooded and grassy hillsides with moderate slopes.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Beyond the dam Potter Run flows in a generally northerly direction through a narrow, wooded valley that essentially parallels U. S. Route 322. The stream passes directly through the community of Potters Mills, Pennsylvania, about 1.7 miles downstream of the embankment.
SLOPES: CHANNEL VALLEY	Narrow, wooded valley with steep confining slopes. The slope of the streambed is also steep.
APPROXIMATE NUMBER OF HOMES AND POPULATION	It is estimated that in the reach between the dam and Potters Mills as many as 50 persons that could be affected by an embankment breach.



PENN NURSERY DAM
GENERAL PLAN - FIELD INSPECTION NOTES

PENN NURSERY DAM

PROFILE OF DAM CREST
FROM FIELD SURVEY



SCALE:
VERTICAL: 1 IN. = 2 FT.
HORIZONTAL: 1 IN. = 100 FT.

APPENDIX B

ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Penn Nursery Dam

ITEM	REMARKS	NDI# PA - 00470
PERSONS INTERVIEWED AND TITLE	Charles Cooper - Penn Nursery Superintendent	
REGIONAL VICINITY MAP	See Appendix E, Figure 1.	
CONSTRUCTION HISTORY	Designed by PennDER, Bureau of Engineering. Constructed by D. E. Smith, Inc. of Mifflintown, Pennsylvania. Daily inspection provided by the General State Authority (GSA). Completed in November 1972.	
AVAILABLE DRAWINGS	Set of 5 design drawings by PennDER, Bureau of Engineering. Dated April 1971 are contained in PennDER files.	
TYPICAL DAM SECTIONS	See Appendix E, Figure 3.	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Appendix E, Figure 4. See Appendix E, Figure 5. See Appendix D, Sheet 11.	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 00470
SPILLWAY: PLAN SECTION DETAILS	See Appendix E, Figure 2. See Appendix E, Figure 4. See Appendix E, Figure 4.	
OPERATING EQUIPMENT PLANS AND DETAILS	See Appendix E, Figure 5. Shop Drawings and specifications for slide gate and control mechanism are contained in the operation and maintenance manual.	
DESIGN REPORTS	None available.	
GEOLOGY REPORTS	No formal reports are available. Significant geologic data are contained in PennDER files (see Appendix F).	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	No formal reports or calculations are available. Outlet and spillway rating curves as well as a reservoir area-capacity curve are contained in the operation and maintenance manual.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Boring logs depicted on Drawing 2 of 5 (S-2) of design set (not included in Appendix E).	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA - 00470
BORROW SOURCES	Within reservoir.
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Seepage at left abutment is presently being assessed by the PennDER. No formal report is expected.
HIGH POOL RECORDS	No formal records are maintained.
MONITORING SYSTEMS	Plywood V-Notch weir (90°) is being used to monitor seepage. PennDER, Bureau of Design has the records. Rain gauge is located adjacent the nursery office and is read daily.
MODIFICATIONS	None, except for seepage control measures along downstream toe to left of spillway.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 00470
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	Formal manual at nursery office.	
OPERATION: RECORDS MANUAL	Formal manual at nursery office.	
OPERATIONAL PROCEDURES	Self-regulating.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	None.	
MISCELLANEOUS		

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CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # 00470
PENNDER ID # 14-117

SIZE OF DRAINAGE AREA: 3.1 square mile

ELEVATION TOP NORMAL POOL: 1493 STORAGE CAPACITY: 54 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: 1502 STORAGE CAPACITY: 234 acre-feet

ELEVATION TOP DAM: 1503 STORAGE CAPACITY: 293 acre-feet

SPILLWAY DATA

CREST ELEVATION: 1493 feet.

TYPE: Uncontrolled, reinforced concrete, rectangular, straight drop.

CREST LENGTH: 40 feet.

CHANNEL LENGTH: 54 feet.

SPILLOVER LOCATION: 150 feet from right abutment.

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: 2.0-by 2.5-foot concrete box culvert.

LOCATION: Base of spillway left wingwall.

ENTRANCE INVERTS: 1480.5 feet.

EXIT INVERTS: 1480 feet.

EMERGENCY DRAWDOWN FACILITIES: 24-inch slide gate.

HYDROMETEOROLOGICAL GAGES

TYPE: rain gauge.

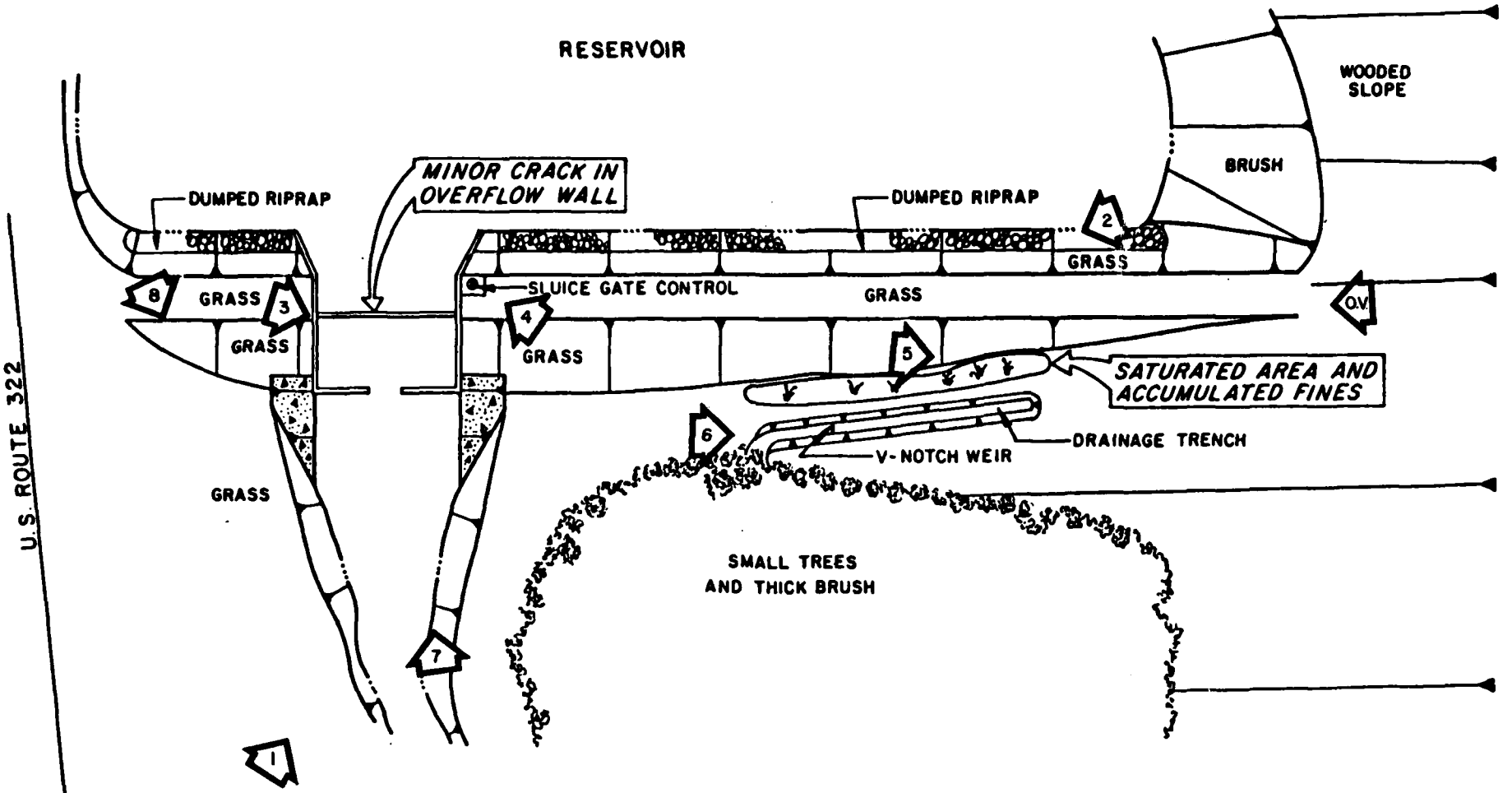
LOCATION: Adjacent to nursery office.

RECORDS: Daily.

MAXIMUM NON-DAMAGING DISCHARGE: Not known.

APPENDIX C

PHOTOGRAPHS



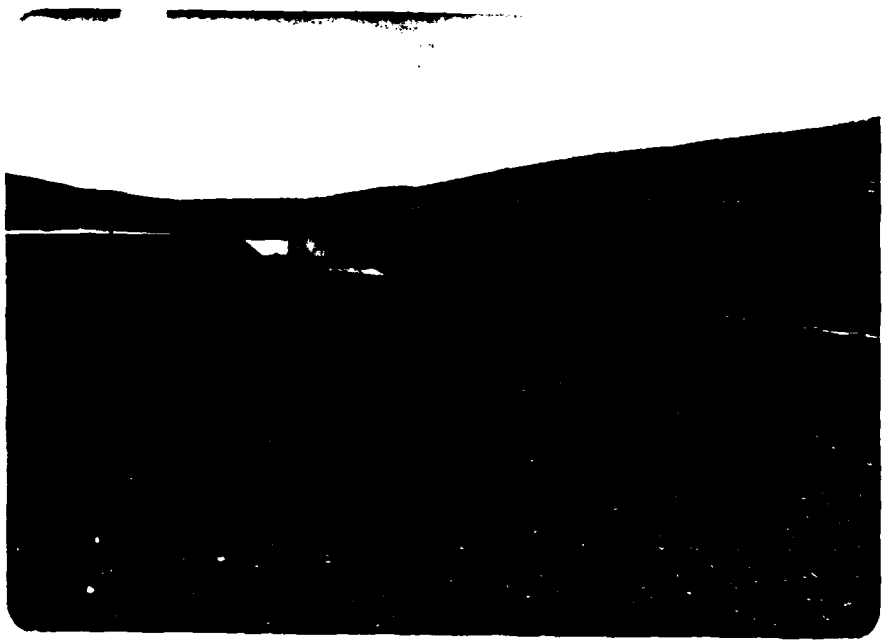
PENN NURSERY DAM
PHOTOGRAPH KEY MAP

PHOTOGRAPH 1 View of the embankment and surrounding watershed.

PHOTOGRAPH 2 View of the upstream face of the embankment as seen from the left abutment.

PHOTOGRAPH 3 View of the spillway and outlet control mechanism atop the left wingwall.

PHOTOGRAPH 4 Close-up view of outlet control mechanism.



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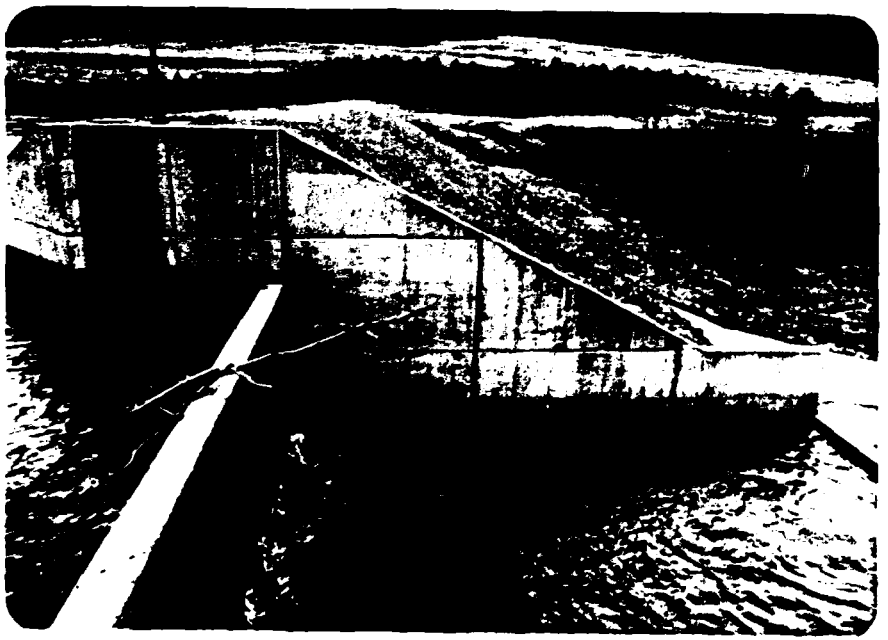

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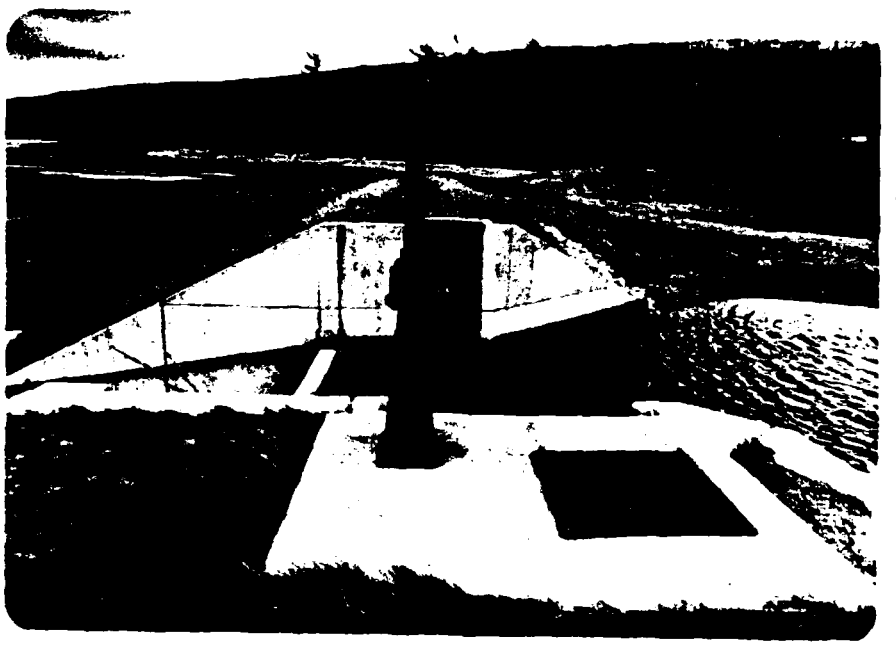

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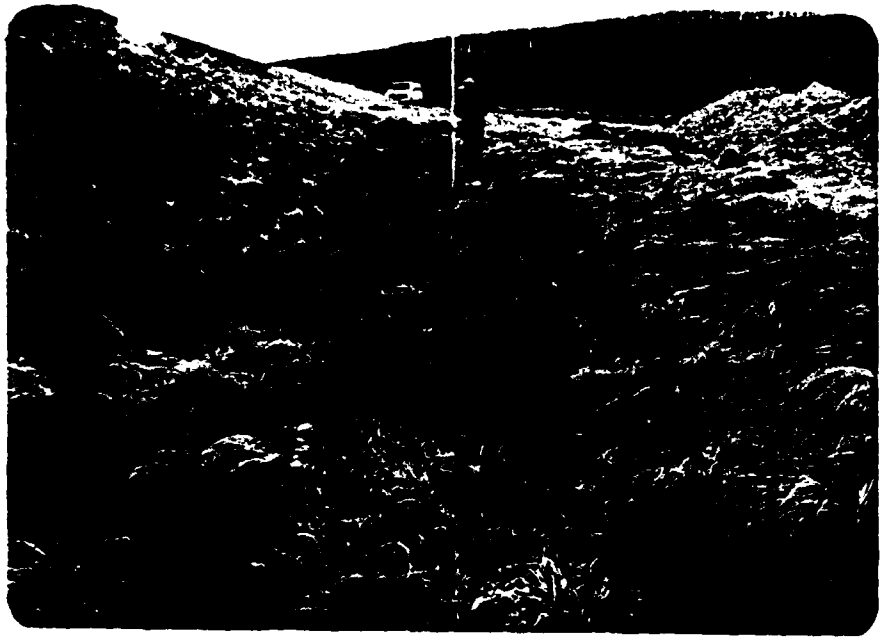
PHOTOGRAPH 5 View of the wet area along downstream toe of left abutment.

PHOTOGRAPH 6 View of recently excavated drainage trench located 15 feet downstream and parallel to the toe of the left abutment.

PHOTOGRAPH 7 View of the spillway, looking upstream.

PHOTOGRAPH 8 View of the area immediately downstream of the embankment.



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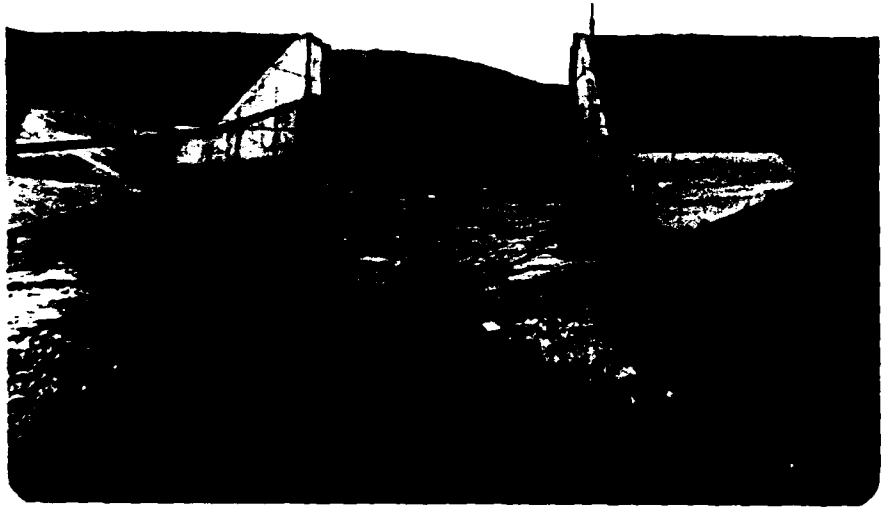

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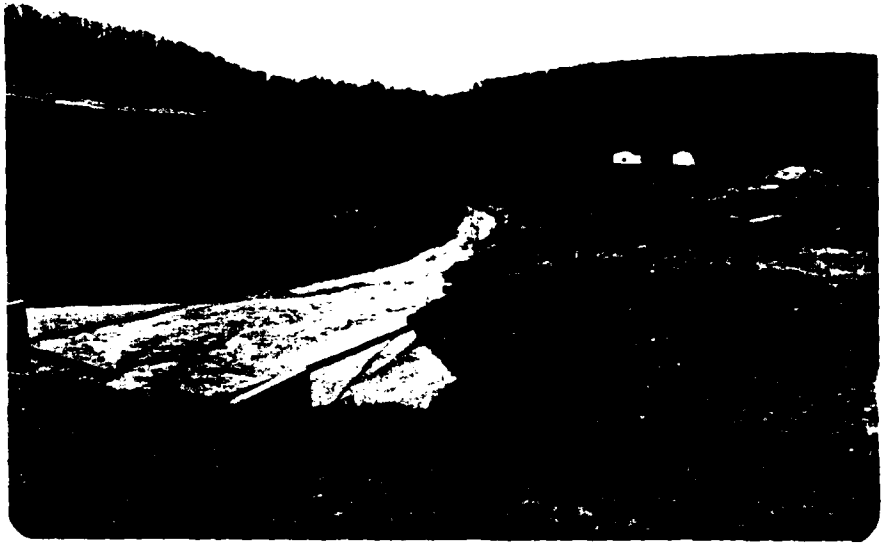

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APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

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 consequences 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 AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: PENN NURSERY DAM

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

STATION	1	2	3
STATION DESCRIPTION	PENN NURSERY DAM		
DRAINAGE AREA (SQUARE MILES)	3.1		
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	-		
ADJUSTMENT OF PMF FOR DRAINAGE AREA LOCATION (%) (1)			
6 HOURS	121		
12 HOURS	131		
24 HOURS	140		
48 HOURS	147		
72 HOURS	149		
SNYDER HYDROGRAPH PARAMETERS			
ZONE (2)	18		
C_p (3)	0.50		
C_t (3)	2.10		
L (MILES) (4)	3.8		
L_{ca} (MILES) (4)	1.9		
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (HOURS)	3.8		
SPILLWAY DATA			
CREST LENGTH (FEET)	40		
FREEBOARD (FEET)	10		

(1) HYDROMETEOROLOGICAL REPORT 40, U.S. WEATHER BUREAU, 1965.

(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.

SUBJECT DAM SAFETY INSPECTION
PENN NURSERY DAM

BY DFS DATE 12-31-79 PROJ. NO. 79-203-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 1 OF 12

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DAM STATISTICS

- HEIGHT OF DAM = 23 FT (FIELD MEASUREMENT)
- NORMAL POOL STORAGE CAPACITY = 54 ACRE-FT (NOTE 1)
- MAXIMUM POOL STORAGE CAPACITY = 293 ACRE-FT (NOTE 1)
  (@ LOW TOP OF DAM)
- DRAINAGE AREA = 3.1 SQUARE MILES (PLANIMETERED ON USGS 7.5 MINUTE TOPO QUADS: CENTRE HALL, SPRING MILLS, DANVILLE PA)
- ELEVATION OF TOP OF DAM (DESIGN) = 1503.0 (SEE NOTE 1)
- ELEVATION OF TOP OF DAM (FIELD) = 1503.0
- NORMAL POOL ELEVATION = 1492.0 (SEE NOTE 1)
- UPSTREAM INLET INVERT ELEVATION = 1480.5 (SEE NOTE 1)
- DOWNSTREAM OUTLET INVERT (DESIGN) = 1480.0 (SEE NOTE 1)
- DOWNSTREAM OUTLET INVERT (FIELD) = 1480.0
- STREAMBED AT DAM CENTERLINE = 1480.0

SUBJECT Dam Safety Inspection
Penn Nursery Dam

BY DJS DATE 12-31-79 PROJ. NO. 79-302-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 2 OF 2

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Note 1: Taken from "Operation and Maintenance Manual for Penn Nursery Irrigation Dam, Centre County, Pennsylvania". From the USGS Topo Quad, Spring Mills, PA, it is apparent that the elevations reported in this manual are in error. Normal pool is reported to be at elevation 1511.0, whereas the Topo Map indicates normal pool is somewhere below elevation 1500. At elevation 1500, the surface area is 25 acres, as planimetered on the Topo. The area vs. elevation curve given in the manual indicates a surface area of 25 acres occurs at elevation 1518.0. Thus, it will be assumed that all elevations reported in the manual are high by 18.0 feet. Therefore, normal pool will be assumed at 1511 - 18, or 1493 feet, which does correlate with the Topo Map? (Note: The elevations used in this analysis are considered estimates and are not necessarily accurate.)

Dam Classification

Dam Size: Small (Ref 1, Table 1)

Hazard Classification: High (Field Speculation)

Required SDF: ½ PMF to PMF (Ref 1, Table 3)

Hydrograph Parameters

- Length of Longest Watercourse: $L = 3.8$ miles

- Length of Longest Watercourse from Dam to a Point Opposite Basin Centroid: $L_{CA} = 1.1$ miles (Measured on USGS Topo Map, Centre Hall, PA Quad)

SUBJECT Dam Safety Inspection
Penn Nursery Dam

BY DSS DATE 12-27-79 PROJ. NO. 79-303-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 3 OF 12

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C_t = 2.10
C_p = 2.50

(Supplied by COE, page 18, Susquehanna River Basin)

Snyder's Standard Lag: $t_p = C_t (L \cdot L_{ca})^{0.3}$
$= (2.10)(3.8 \times 1.9)^{0.3}$
$= 3.8$ hours

(Note: Hydrograph variables used here are defined in reference 3, in section entitled "Snyder Synthetic Unit Hydrograph".)

Reservoir Capacity

- Reservoir surface areas above Top of Dam:

SA_{1503} = 31.5 acres (see note 1)
SA_{1500} = 54 acres (Planimetered on USGS Top Quad: Centre Hall, SW 3.75 min. series, PA)

- Assume that the modified prismoidal relationship adequately models the surface area-storage relationship above elevation 1503.

(Ref 14, p. 5)

$$\Delta V_{1-2} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 \cdot A_2}\right)$$

where ΔV_{1-2} = incremental volume between elevations 1 and 2 (Acre-ft),
h = Elevation 1 − Elevation 2 (ft),
A_1 = Surface area @ Elev 1 (Acres),
A_2 = Surface area @ Elev 2 (Acres)

SUBJECT DAM SAFETY INSPECTION
PENN NURSERY DAM

BY DJS DATE 12-31-79 PROJ. NO. 79-333-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 4 OF 12

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ALSO, ASSUME THAT THE SURFACE AREA VARIES LINEARLY BETWEEN ELEVATIONS 1503 AND 1520:

$$A_L = A_{1503} + \left(\frac{\Delta SA}{\Delta H} \times H\right)$$

$$= 31.5 + \left(\frac{54-31.5}{1520-1503} \times H\right)$$

$$= 31.5 + 1.32H$$

WHERE H = ELEV L − 1503 (FT)

ELEVATION - STORAGE RELATIONSHIP:

	RESERVOIR ELEVATION (FT)	A_L (ACRES)	ΔV_{1-2} (AC-FT)	TOTAL VOLUME * (AC-FT)
	1480.5			0
	1486.0			4
	1488.0			12
	1490.0			25
	1492.0			43
(NORMAL POOL)	1493.0			54
	1495.0			80
	1497.0			114
	1499.0			156
	1501.0			204
(LOW TOP OF DAM)	1503.0	31.5		263
	1504.0	32.8	33.1	335
	1506.0	35.5	68.3	398
	1508.0	38.1	73.6	467
	1510.0	40.7	78.8	546

* VOLUMES FOR ELEVATIONS AT OR BELOW ELEVATION 1503 TAKEN FROM ELEVATION-STORAGE CURVE (SEE NOTE 1).

SUBJECT Dam Safety Investigation
Penn Nursery Dam

BY DJS DATE 12-31-79 PROJ. NO. 79-333-420

CHKD. BY DLB DATE 1-2-80 SHEET NO. 5 OF 12

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PMP Calculations

- From Reference 9, Figure 2, obtain PMP values for a basin of drainage area 200 square miles, for a duration of 24 hours:

  PMP = 22.2 inches

- From Ref. 9, Figure 1, the geographic adjustment factor = 103%

- Area correction factor (Ref 9):

Duration (hours):	6	12	24	48	72
Factor (%):	117.5	127.0	136.0	145.5	145.0

- Total Correction Factor (1.03 x Area Correction Factor):

Duration (hrs):	6	12	24	48	72
Factor (%):	121	131	140	147	149

- Hop Brook Factor (adjustment for basin shape and for the greater likelihood of a severe storm centering over a small basin) for a drainage area of 31 square miles is 1.12.

SUBJECT DAM SAFETY INSPECTION
PENN NURSERY DAM

BY DJS DATE 12-31-79 PROJ. NO. 79-203-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 6 OF 12

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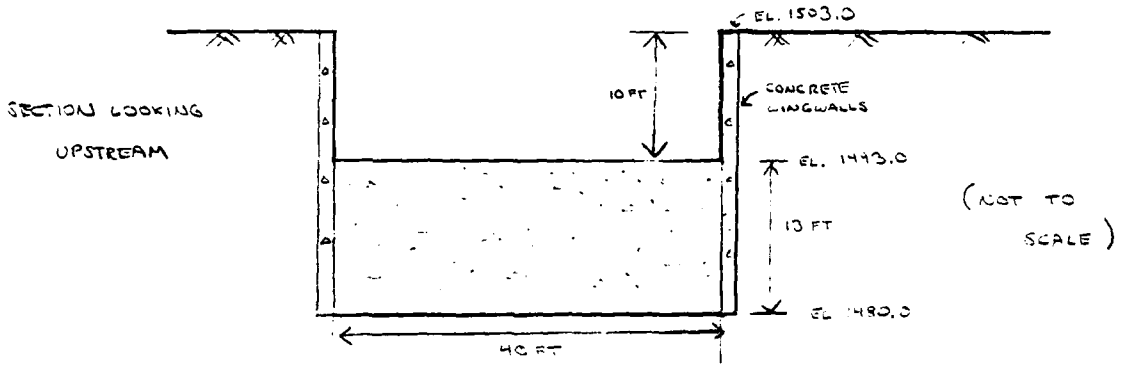
SPILLWAY CAPACITY



(BASED ON FIELD NOTES)

- DISCHARGE IS CONTROLLED BY A STRAIGHT-DROP CONCRETE SPILLWAY, WITH CREST AT ELEVATION 1493.0. A SPILLWAY RATING CURVE WAS PROVIDED IN THE OPERATION AND MAINTENANCE MANUAL (SEE NOTE 1), FROM WHICH THE FOLLOWING DATA WERE OBTAINED:

SPILLWAY RATING TABLE:

RESERVOIR ELEVATION (FT)	DISCHARGE (CFS)		RESERVOIR ELEVATION (FT)	DISCHARGE (CFS)
1493.0	0		1503.0	3590
1494.0	110	(TOP OF DAM)	1503.5	4310 *
1495.0	340		1504.0	4860 *
1496.0	670		1504.5	5540 *
1497.0	1060		1505.0	6240 *
1498.0	1480		1505.5	6980 *
1499.0	1950		1506.0	7740 *
1500.0	2440		1506.5	8530 *
1501.0	3000		1507.0	9340 *

SUBJECT DAM SAFETY INSPECTION
FRYS HOSIERY DAM

BY DJS DATE 12-31-79 PROJ. NO. 79-303-470
CHKD. BY DLB DATE 1-2-80 SHEET NO. 7 OF 12

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* → $Q = CLH^{3/2}$, $C = 3.33$, $L = 40$ FT, H = RES ELEV − 1493.0
(C-VALUE CONSISTENT WITH THAT USED IN RATING CURVE.)

EMBANKMENT RATING CURVE

- ASSUME THAT THE EMBANKMENT BEHAVES ESSENTIALLY AS A BROAD-CRESTED WEIR WHEN OVERTOPPING OCCURS. THUS, THE DISCHARGE CAN BE ESTIMATED BY THE RELATIONSHIP

$$Q = CLH^{3/2} \qquad \text{(REF 5, p. 5-23)}$$

WHERE Q = DISCHARGE OVER EMBANKMENT (CFS)
L = LENGTH OF EMBANKMENT INVOLVED (FT)
H = HEAD ON WEIR; IN THIS CASE, IT IS THE AVERAGE "FLOW-AREA" WEIGHTED HEAD ABOVE THE CREST, USING THE LOW TOP OF DAM AS THE DATUM. (FEET)
C = COEFFICIENT OF DISCHARGE, DEPENDENT ON HEAD AND WEIR BREADTH.

LENGTH OF EMBANKMENT INUNDATED VS. RESERVOIR ELEVATION:

ELEVATION (FT)	LENGTH (FT)	ELEVATION (FT)	LENGTH (FT)
1503.0	0	1504.0	610
1503.1	170	1505.0	630
1503.2	400	1506.0	630
1503.3	500	1507.0	640
1503.5	550	1508.0	660
1503.7	600	1509.0	690

(BASED ON FIELD MEASUREMENTS & USGS TOPO: SPRINGFIELD HILLS, PA.)

SUBJECT DAM SAFETY INSPECTION

PENN NURSERY DAM

BY DTS DATE 12-31-79 PROJ. NO. 79-202-470

CHKD. BY DLB DATE 1-2-80 SHEET NO. 8 OF 12

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ASSUME THAT INCREMENTAL DISCHARGES OVER THE EMBANKMENT ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW (BETWEEN RESERVOIR ELEVATIONS) CAN BE ESTIMATED BY $H_i [(L_1+L_2)/2]$, WHERE L_1 = LENGTH AT LOWER ELEVATION, L_2 = LENGTH AT HIGHER ELEVATION, H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW-AREA" WEIGHTED HEAD, H_w, = (TOTAL FLOW AREA / L_2).

EMBANKMENT RATING TABLE:

RESERVOIR ELEVATION (FT)	L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	① INCREMENTAL FLOW AREA, A_i (FT²)	TOTAL FLOW AREA, A_T (FT²)	③ WEIGHTED HEAD, H_w (FT)	③ H_w/L	④ C	⑤ Q (CFS)
1503.0	—	0	—						
1503.1	0	170	0.1	8.5	8.5	0.1	0.01	2.93	30
1503.2	170	400	0.1	28.5	37	0.1	0.01	2.96	110
1503.3	400	500	0.1	45	82	0.3	0.01	2.97	130
1503.5	500	550	0.2	105	187	0.3	0.02	2.99	370
1503.7	550	600	0.2	115	302	0.5	0.03	3.02	610
1504.0	600	610	0.3	182	484	0.8	0.05	3.03	1330
1505.0	610	620	1.0	615	1099	1.8	0.12	3.04	4550
1506.0	620	630	1.0	635	1734	2.7	0.18	3.07	8550
1507.0	630	640	1.0	635	2369	3.7	0.25	3.08	13000
1508.0	640	650	1.0	650	3009	4.6	0.31	3.09	18000
1510.0	650	670	2.0	1340	4349	6.4	0.43	3.09	31000

① $A_i = H_i \left(\frac{L_1+L_2}{2}\right)$

③ $H_w = A_T / L_2$

③ L = LENGTH OF CREST = 15 FT (FIELD MEASUREMENT)

④ $C = f(H, L)$; FROM REF 2, FIG 34

⑤ $Q = CL_2H_w^{3/2}$

PROJECT DAM SAFETY INSPECTION
PENN NURSERY DAM

BY RTS DATE 1-2-80 PROJ. NO. 79-227-470

CHKD. BY DLS DATE 1-2-80 SHEET NO. 9 OF 12

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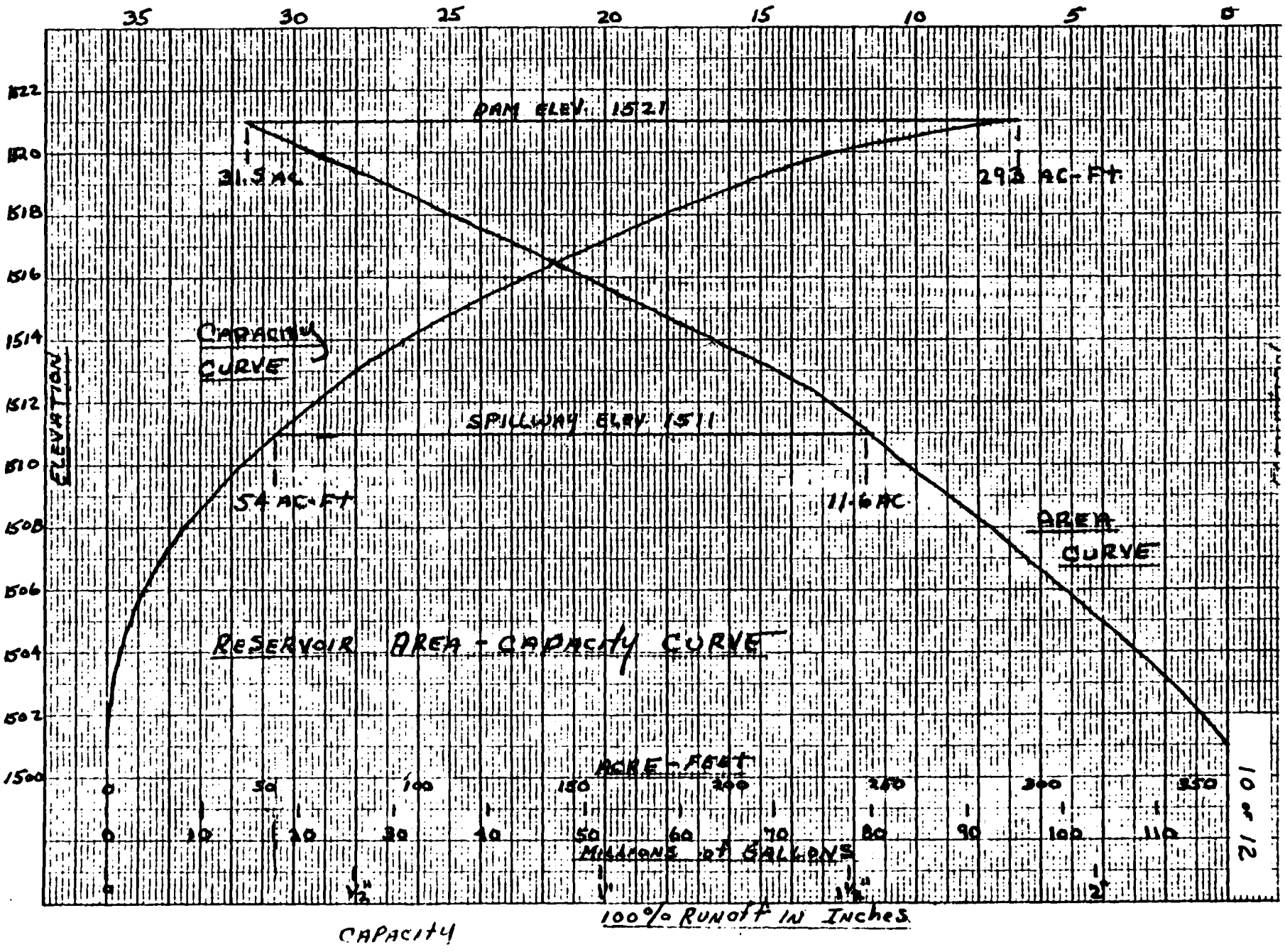
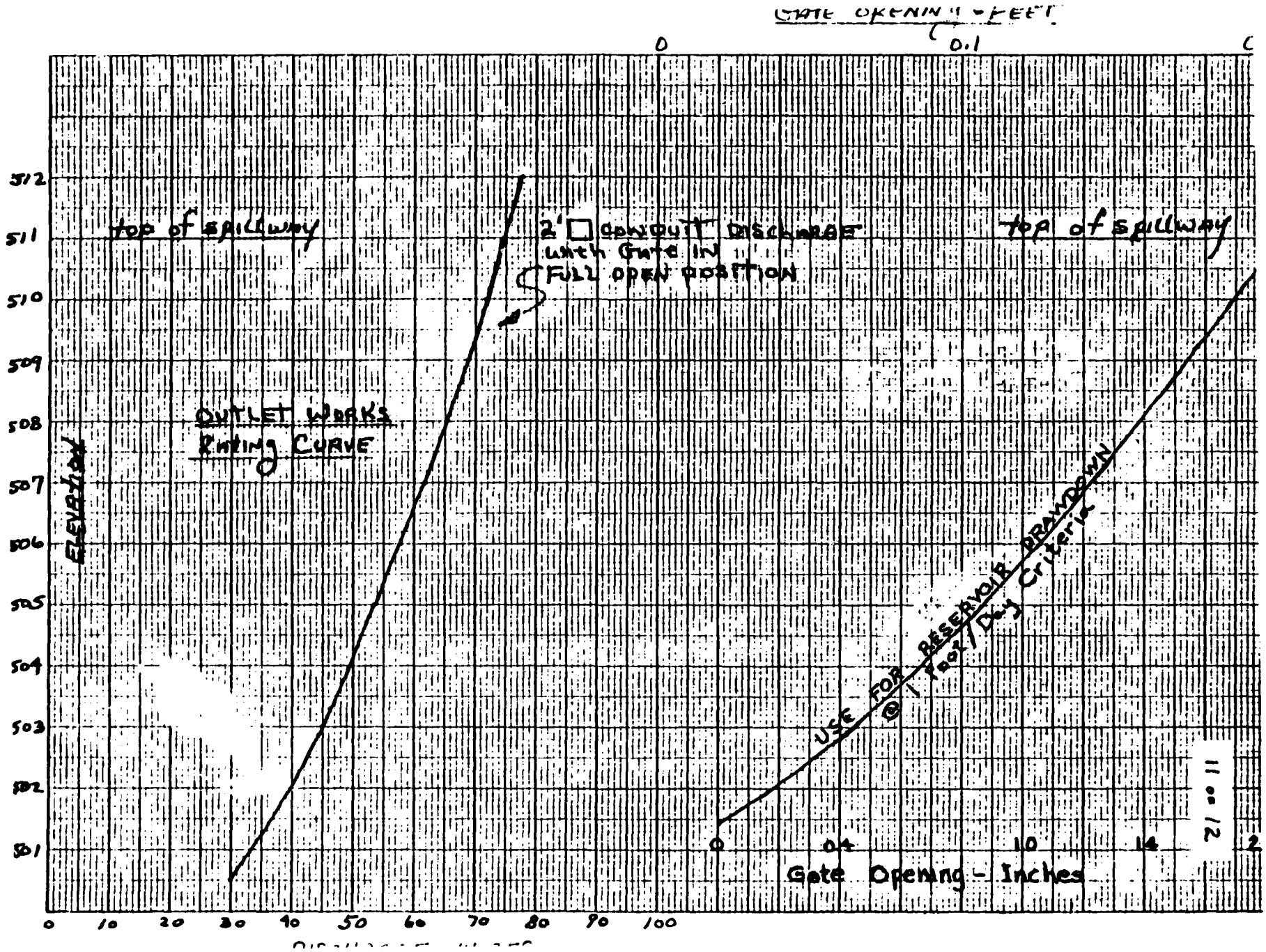
TOTAL FACILITY RATING TABLE

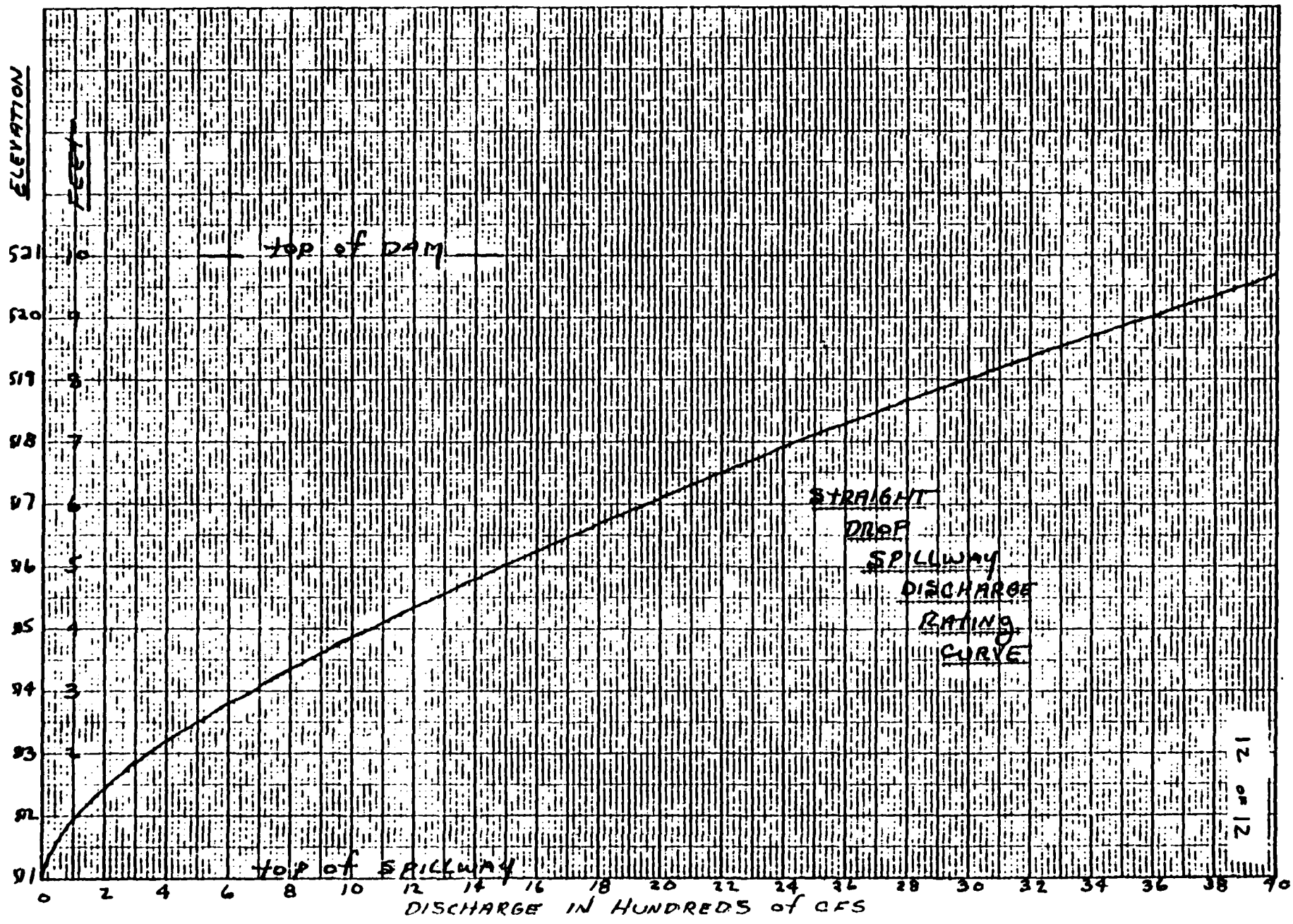
$Q_{TOTAL} = Q_{SPILLWAY} + Q_{EMBANKMENT}$

	RESERVOIR ELEVATION (FT)	$Q_{SPILLWAY}$ (CFS)	$Q_{EMBANKMENT}$ (CFS)	Q_{TOTAL} (CFS)
	1493.0	0	—	0
	1494.0	110	—	110
	1495.0	340	—	340
	1496.0	670	—	670
	1497.0	1060	—	1060
	1498.0	1480	—	1480
	1499.0	1950	—	1950
	1500.0	2440	—	2440
	1501.0	3000	—	3000
	1502.0	3590	—	3590
(LOW TOP OF DAM)	1502.0	4310	0	4310
	1502.3	4340 *	40	4380
	1502.3	4405 *	130	4535
	1502.5	4535 *	370	4905
	1502.7	4665 *	640	5305
	1504.0	4960	1220	6180
	1505.0	5540	4550	10,090
	1506.0	6240	8580	14,820
	1508.0	7740	20,120	27,860
	1510.0	9340	34,020	43,360

* BY LINEAR INTERPOLATION


35
30
25
20
15
10
5
0
1522
1520
1518
1516
1514
1512
1510
1508
1506
1504
1502
1500
ELEVATION
DAM ELEV. 1521
31.5 AC.
293 AC-FT
CAPACITY CURVE
SPILLWAY ELEV 1511
54 AC-FT
11.6 AC
AREA CURVE
RESERVOIR AREA - CAPACITY CURVE
ACRE-FEET
0
50
100
150
200
250
300
350
0
10
20
30
40
50
60
70
80
90
100
110
MILLIONS of GALLONS
1/2"
1"
1 1/2"
2"
CAPACITY
100% RUNOFF IN Inches
10 of 12


GATE OPENING - FEET
0
0.1
top of spillway
2' □ CONDUIT DISCHARGE
with Gate in
FULL OPEN POSITION
top of spillway
OUTLET WORKS
RATING CURVE
Q
ELEVATION
512
511
510
509
508
507
506
505
504
503
502
501
0
10
20
30
40
50
60
70
80
90
100
DISCHARGE - CFS
USE FOR RESERVOIR DRAWDOWN
@ 1 Foot / Day Criteria
0
04
10
14
2
Gate Opening - Inches
11 = 12


ELEVATION
top of DAM
top of SPILLWAY
STRAIGHT DROP SPILLWAY DISCHARGE RATING CURVE
DISCHARGE IN HUNDREDS of CFS
521
520
519
518
517
516
515
514
513
512
511
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40

SUBJECT DAM SAFETY INSPECTION

PENN NURSERY DAM

BY DJS DATE 1-2-80 PROJ. NO. 79-203-470

CHKD. BY DLB DATE 1-7-80 SHEET NO. A OF C

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OVERTOPPING

SUMMARY INPUT/OUTPUT SHEETS

DAM SAFETY INSPECTION
PENN NURSERY DAM ****** OVERTOPPING ANALYSIS ******
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	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= .50 .60 .70 .80 1.00

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

SUB-AREA RUNOFF COMPUTATION

RUNOFF INTO RESERVOIR

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	3.10	0.00	3.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.20	121.00	131.00	140.00	141.00	119.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

INITIAL AND CONSTANT RAINFALL LOSSES AS PER COE

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= 3.80 CP= .50 NTA= 0

BASE FLOW PARAMETERS AS PER COE

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

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=15.41 AND R=20.51 INTERVALS

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 3.81 HOURS, CP= .50 VOL= .99

4.	16.	33.	53.	76.	101.	127.	155.	182.	207.
226.	245.	259.	268.	273.	271.	262.	249.	237.	226.
215.	205.	195.	186.	177.	169.	161.	153.	146.	139.
132.	126.	120.	114.	109.	104.	99.	94.	90.	85.
81.	77.	74.	70.	67.	64.	61.	58.	55.	52.
50.	47.	45.	43.	41.	39.	37.	35.	34.	32.
31.	29.	28.	26.	25.	24.	23.	22.	21.	20.
19.	18.	17.	16.	15.	15.	14.	13.	13.	12.
12.	11.	10.	10.	10.	9.	9.	8.	8.	7.
7.	7.	6.	6.	6.	6.	5.	5.	5.	5.

SUBJECT DAM SAFETY INSPECTION

PENN NURSERY DAM

BY ZZS DATE 1-7-80 PROJ. NO. 79-203-470

CHKD. BY DLG DATE 1-7-80 SHEET NO. 8 OF C

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END-OF-PERIOD FLOW

HO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

HO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
		SUM	26.46	23.85	2.61	188630.
			(672.)(606.)(66.)(5342.)			

INFLOWS INTO RESERVOIR — PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4905.	4117.	1672.	656.	188824.
CMS	139.	117.	53.	19.	5347.
INCHES		12.35	22.47	23.61	23.61
MM		313.79	570.70	599.67	599.67
AC-FT		2041.	3713.	3901.	3901.
THOUS CU M		2518.	4580.	4812.	4812.

INFLOWS INTO RESERVOIR — 0.8 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3924.	3294.	1498.	525.	151059.
CMS	111.	93.	42.	15.	4278.
INCHES		9.88	17.97	18.89	18.89
MM		251.04	456.56	479.73	479.73
AC-FT		1633.	2970.	3121.	3121.
THOUS CU M		2015.	3664.	3850.	3850.

HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

RSVRIC	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.5	0.000	0.00	1	1	0	0		0
	AMSKK	STORA	ITYP	RMSKK	X	TSK	STORA	ISPRAT
	1	1	0	0.000	0.000	0.000	54.	-1

STAGE	1493.00	1494.00	1495.00	1496.00	1497.00	1498.00	1499.00	1500.00	1501.00
	1503.00	1503.20	1503.30	1503.50	1503.70	1504.00	1505.00	1506.00	1508.00
FLOW	0.	110.	340.	670.	1060.	1480.	1950.	2440.	3000.
	4210.	4380.	4535.	4805.	5305.	6140.	10090.	14820.	27460.
CAPACITY	0.	4.	12.	25.	43.	54.	80.	114.	156. 204.
	293.	325.	393.	467.	546.				
ELEVATION	1481.	1488.	1488.	1490.	1492.	1493.	1495.	1497.	1499. 1501.
	1503.	1504.	1506.	1508.	1510.				

CREL	SPWID	COQD	EXPS	ELEVI	COQL	CAREA	EXPL
1493.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1503.0	0.0	0.0	0.

SUBJECT DAM SAFETY INSPECTION

Penn Nursery Dam

BY ZSC DATE 1-7-80 PROJ. NO. 79-203-472

CHKD. BY DLG DATE 1-7-80 SHEET NO. 2 OF 2

RESERVOIR OUTFLOW HYDROGRAPHS; OVERTOPPING OCCURS AT ≈ 0.92 PMF

PEAK OUTFLOW IS 4856. AT TIME 43.75 HOURS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4856.	4049.	1871.	655.	188742.
CMS	138.	115.	53.	19.	5345.
INCHES		12.15	22.46	23.60	23.60
CM		308.62	570.41	599.40	599.40
AC-FT		2008.	3711.	3900.	3900.
THOUS CU M		2477.	4577.	4810.	4810.

PEAK OUTFLOW IS 3747. AT TIME 44.25 HOURS

0.8 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3747.	3256.	1497.	524.	150990.
CMS	106.	92.	42.	15.	4276.
INCHES		9.77	17.96	18.88	18.88
CM		248.16	456.41	479.51	479.51
AC-FT		1614.	2969.	3120.	3120.
THOUS CU M		1991.	3662.	3848.	3848.

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1493.00	1493.00	1503.00
STORAGE	54.	54.	291.
OUTFLOW	0.	0.	4210.

SPILL. OR 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
.50	1499.50	0.00	178.	2390.	0.00	44.00	0.00
.60	1500.78	0.00	199.	2878.	0.00	44.00	0.00
.70	1501.51	0.00	227.	3298.	0.00	44.00	0.00
.80	1502.25	0.00	260.	3747.	0.00	44.25	0.00
.92 *	1503.0	—	293.	4210.	—	—	—
1.00	1503.52	.52	310.	4856.	2.50	43.75	0.00

* INTERPOLATED VALUES; OVERTOPPING OCCURS AT APPROXIMATELY 0.92 PMF

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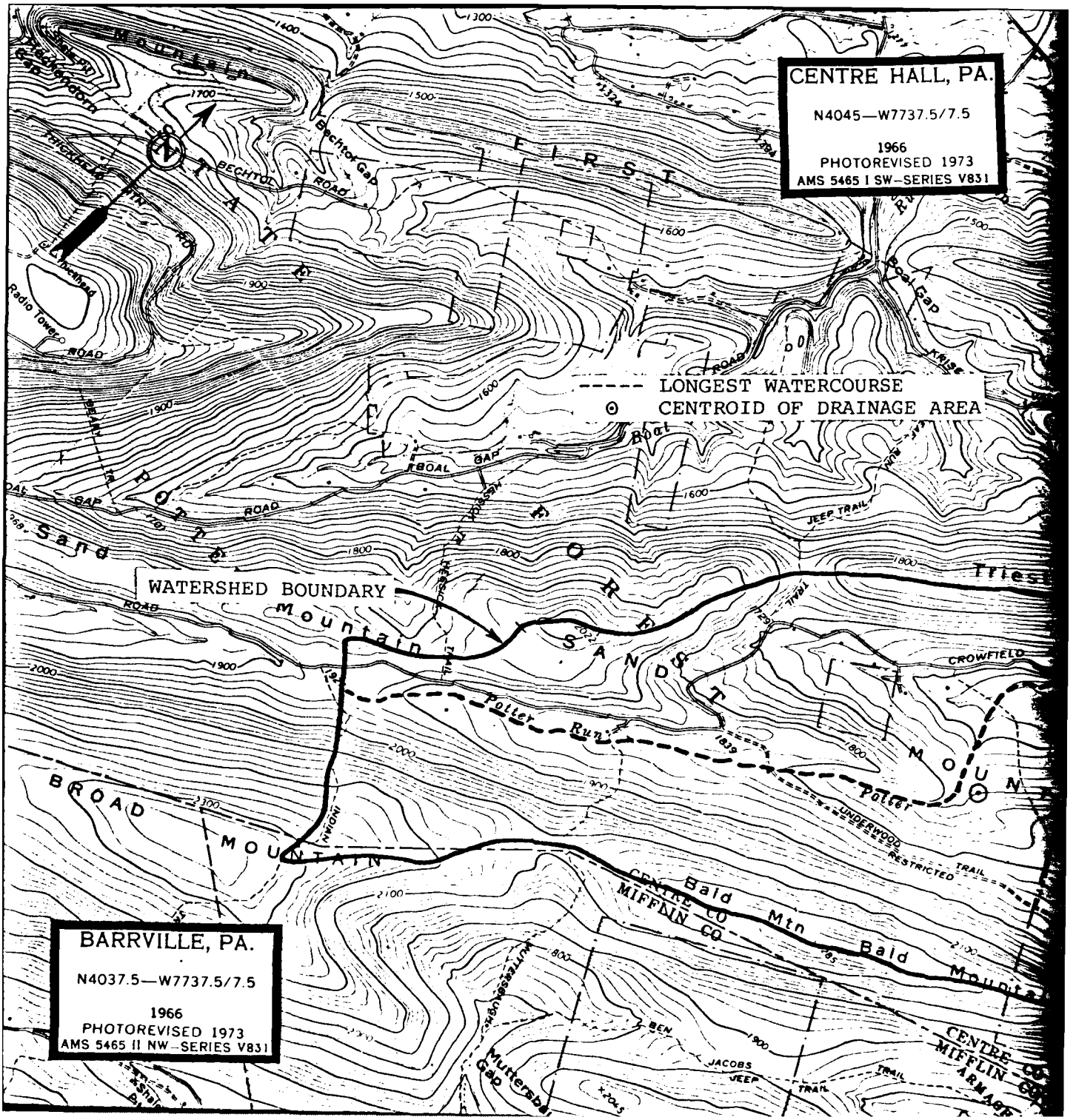
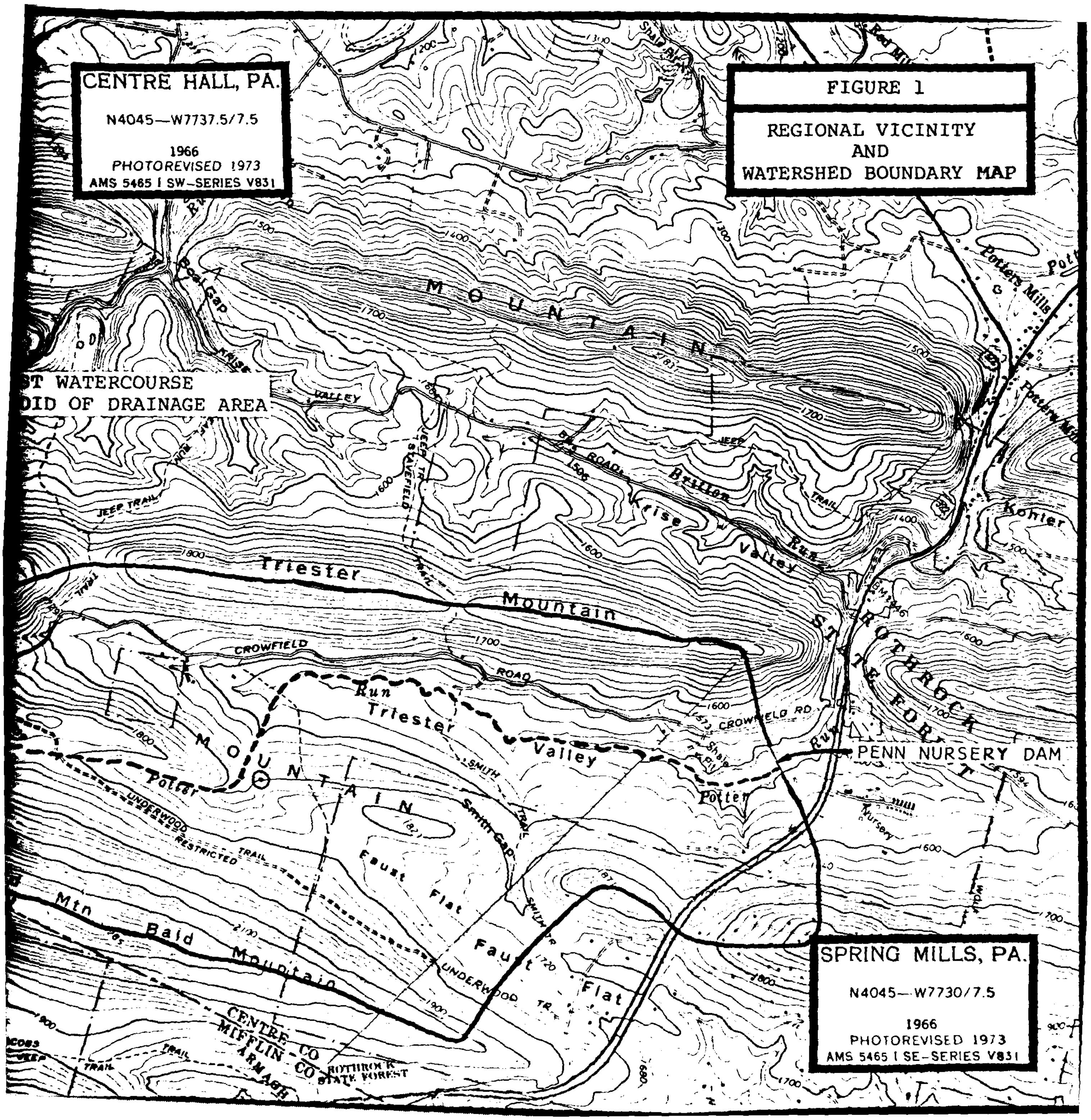
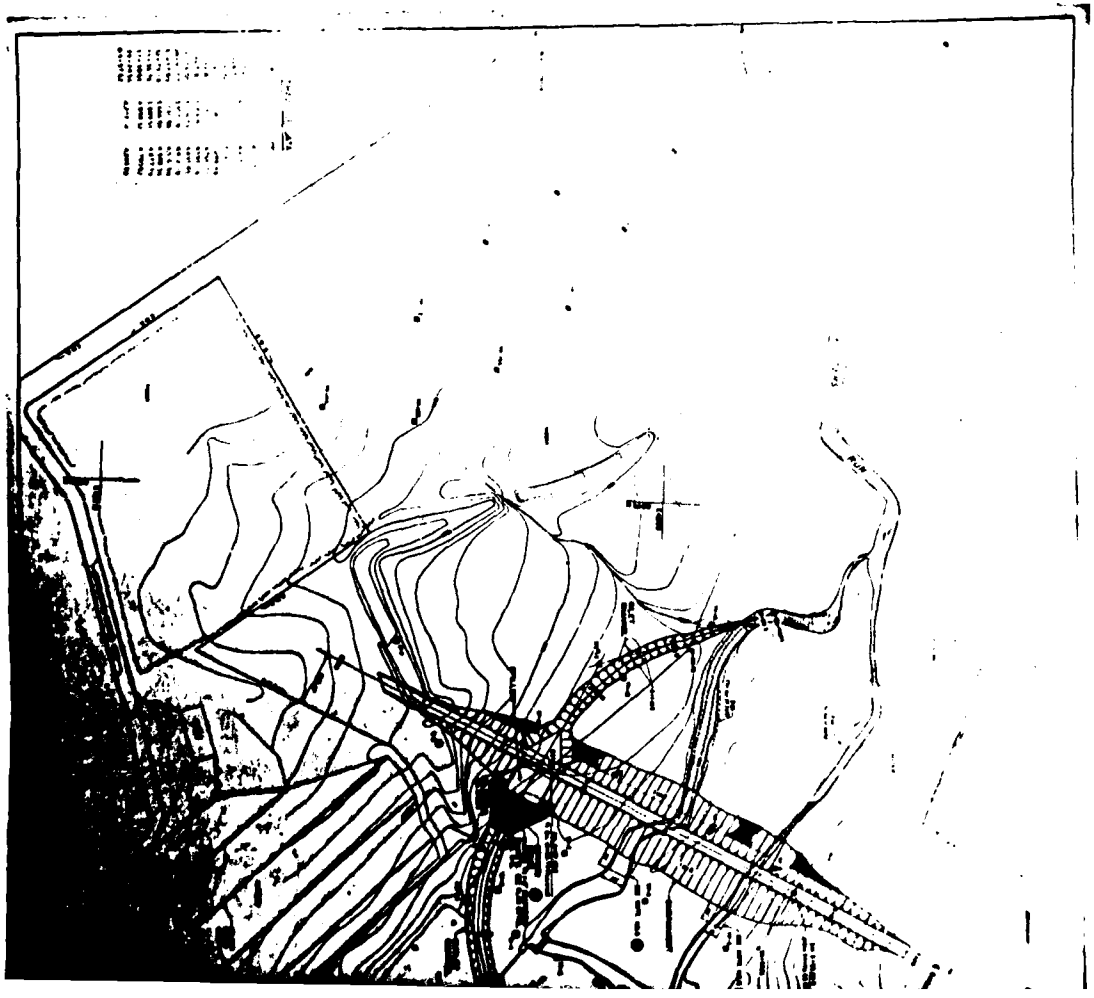
APPENDIX E

FIGURES

LIST OF FIGURES


CENTRE HALL, PA.
N4045—W7737.5/7.5
1966
PHOTOREVISED 1973
AMS 5465 I SW-SERIES V831
BARRVILLE, PA.
N4037.5—W7737.5/7.5
1966
PHOTOREVISED 1973
AMS 5465 II NW-SERIES V831
WATERSHED BOUNDARY
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA
Potter Run
Bechtol Gap
Boal Gap
Mutterbaugh Gap
Sand Mountain
Broad Mountain
Bald Mtn
CENTRE CO
MIFFIN CO
ROAD
JEEP TRAIL
TRAIL
RESTRICTED


CENTRE HALL, PA.
N4045—W7737.5/7.5
1966
PHOTOREVISED 1973
AMS 5465 I SW–SERIES V831
FIGURE 1
REGIONAL VICINITY
AND
WATERSHED BOUNDARY MAP
ST WATERCOURSE
OID OF DRAINAGE AREA
PENN NURSERY DAM
SPRING MILLS, PA.
N4045—W7730/7.5
1966
PHOTOREVISED 1973
AMS 5465 I SE–SERIES V831
MOUNTAIN
Triester Mountain
Triester Run
Triester Valley
Bald Mountain
Faust Flat
Kriese Valley
Britton Run
Potter Run
Smith Gap
CROWFIELD ROAD
UNDERWOOD TRAIL
CENTRE CO
MIFFLIN CO
ROTHROCK STATE FOREST
Potters Mills
Kohler



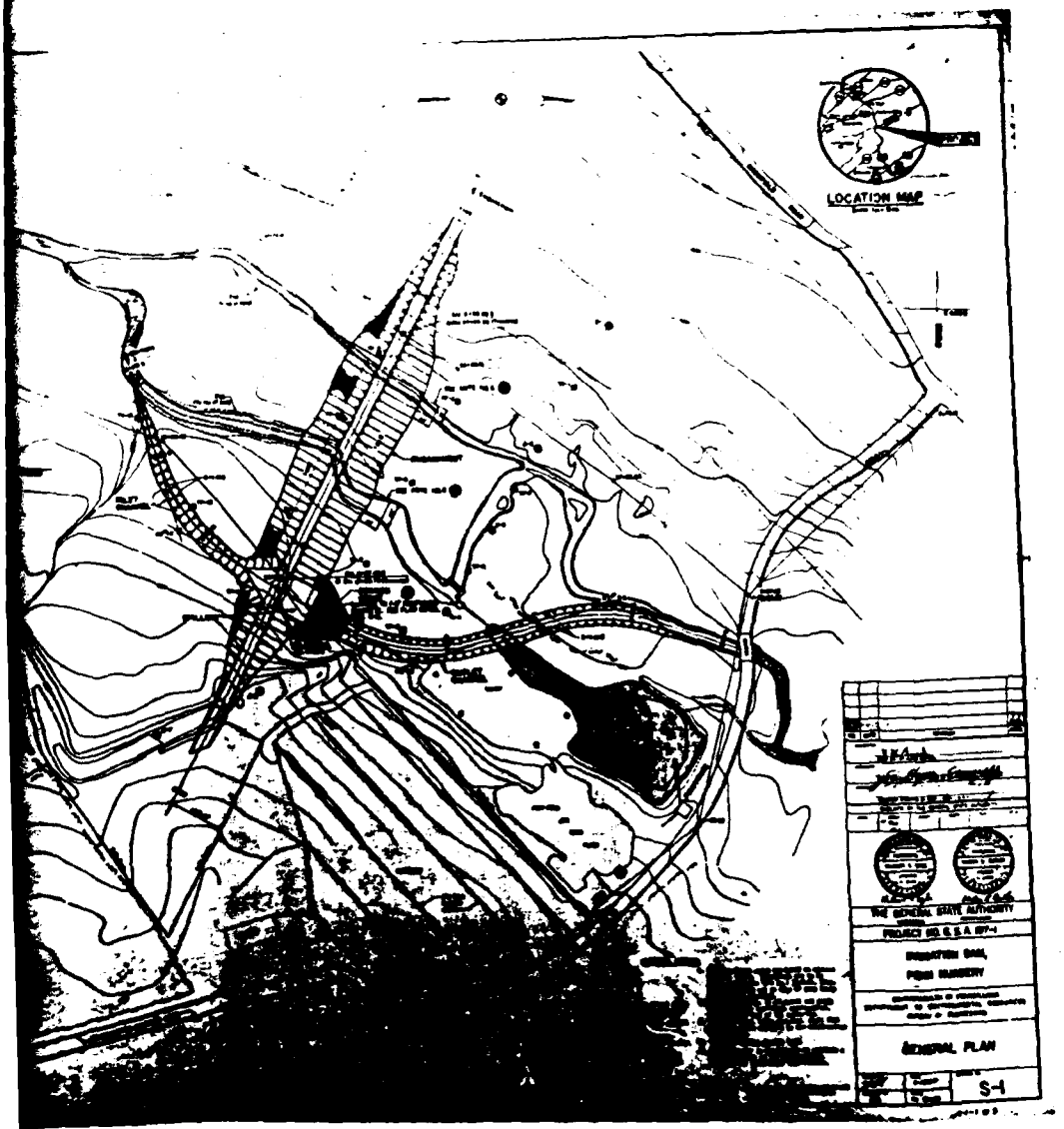


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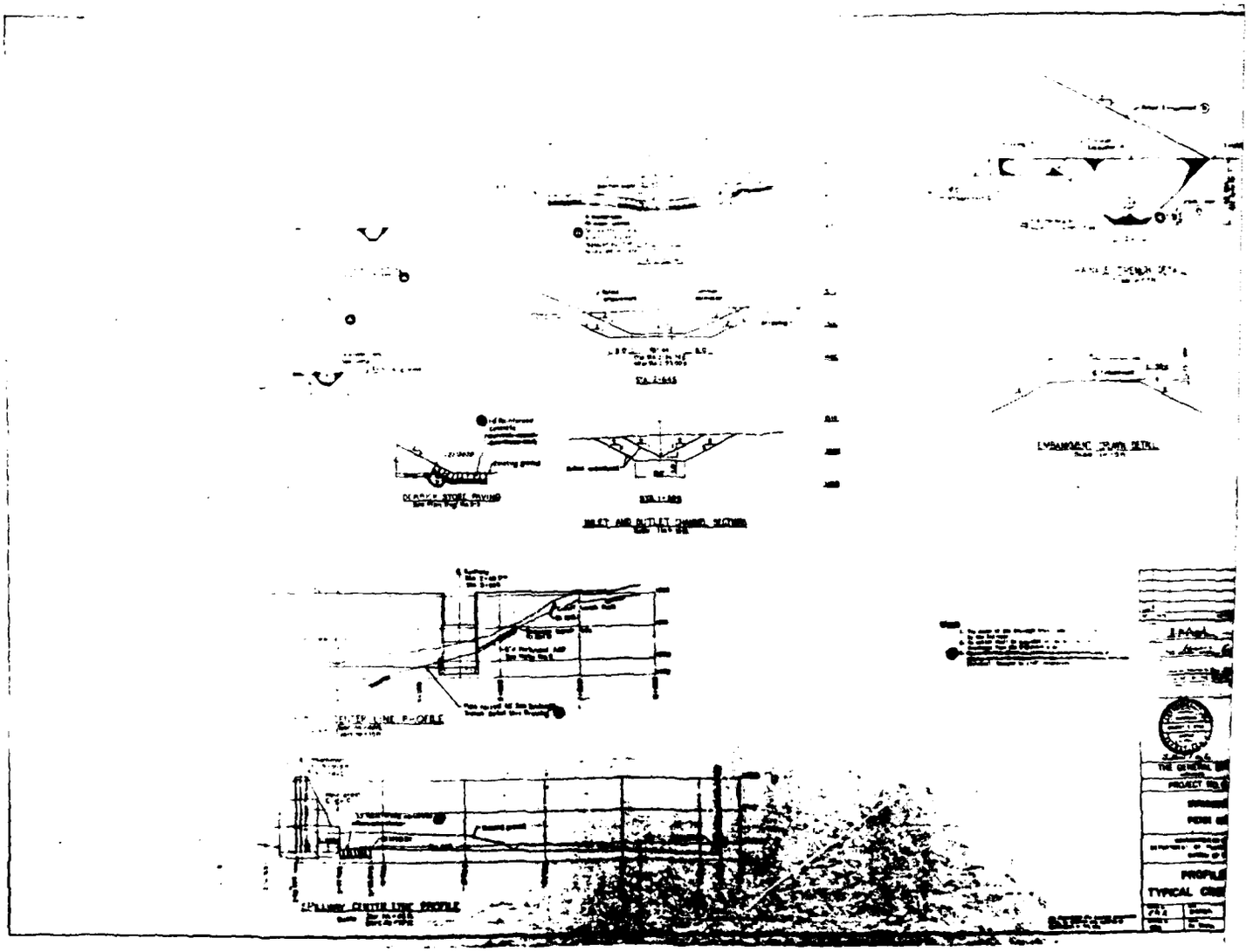
FIGURE 2



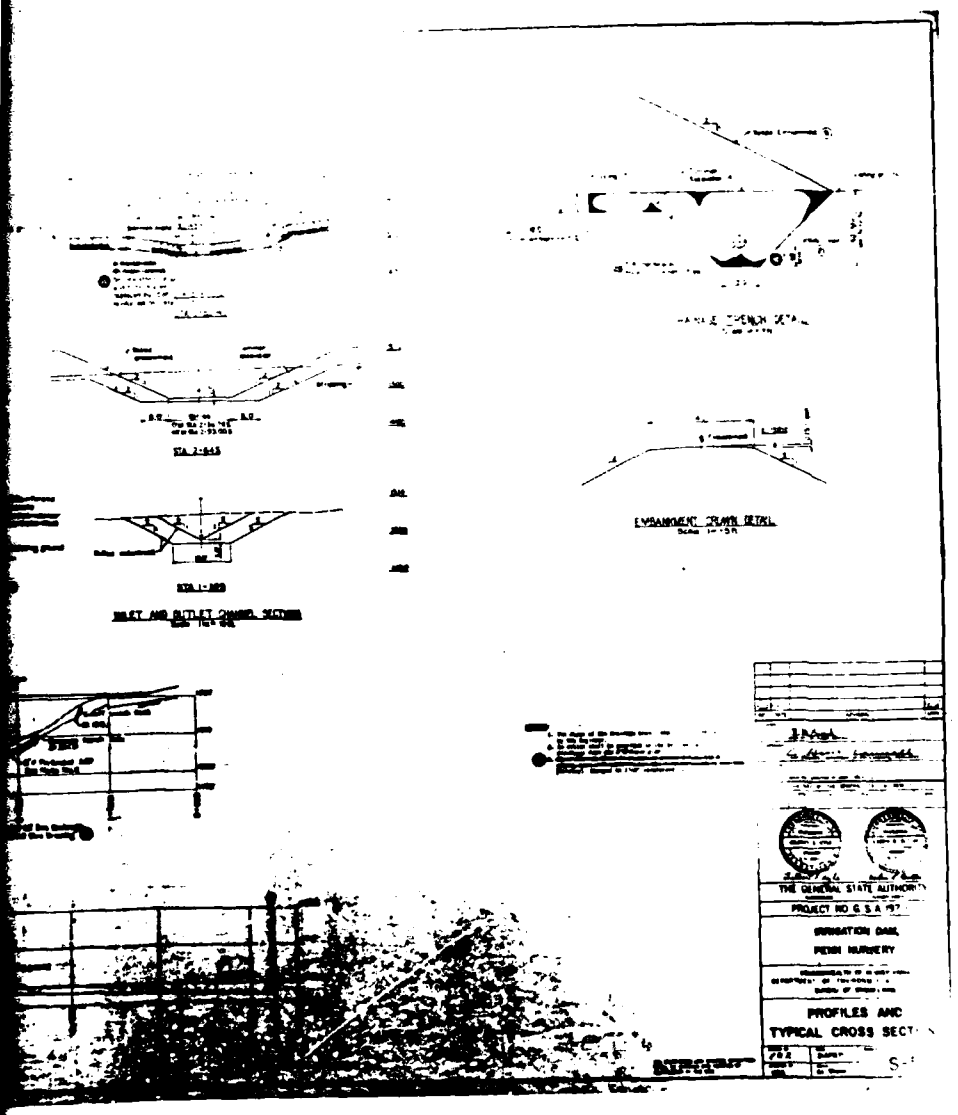


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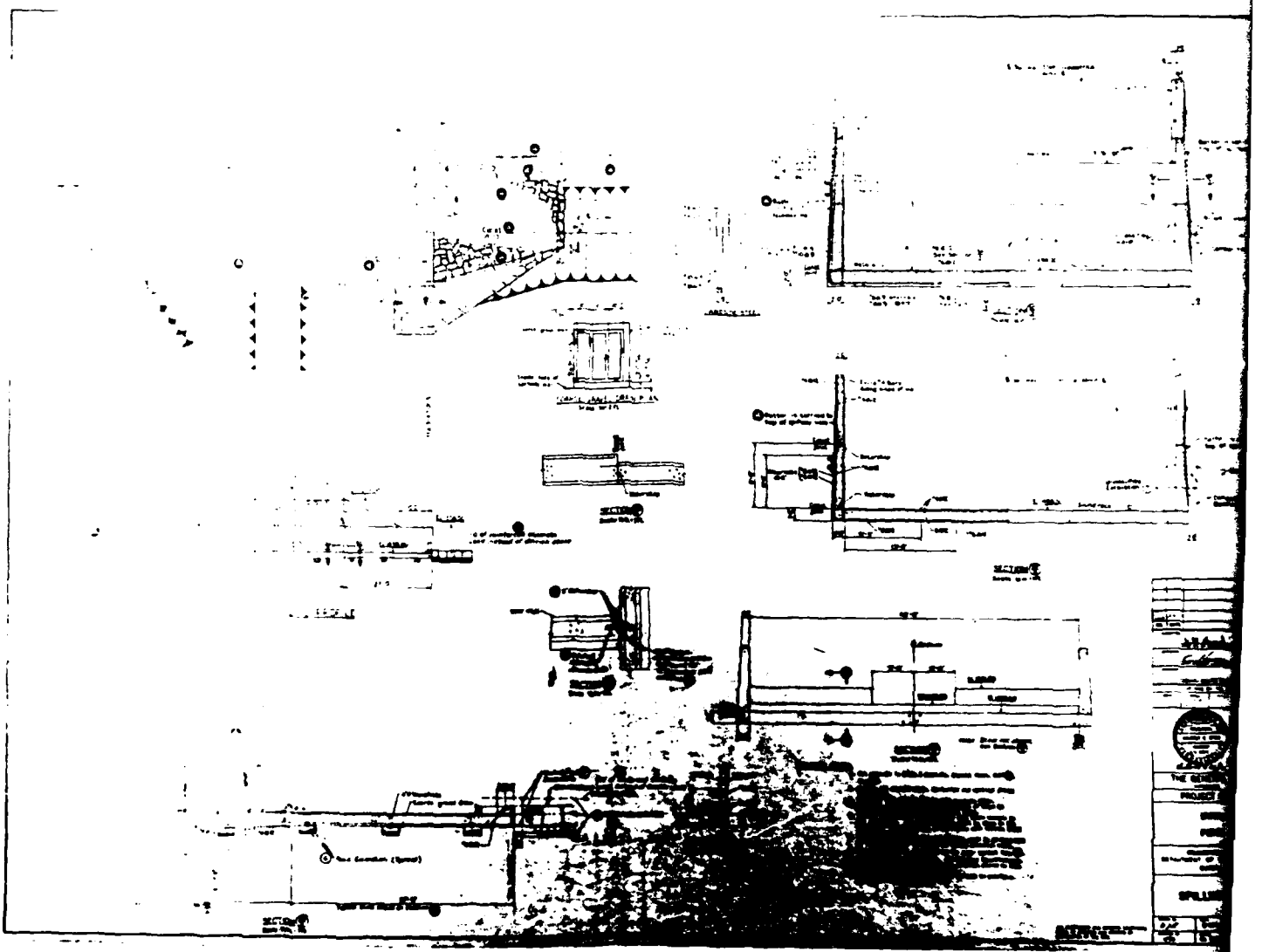
FIGURE 3



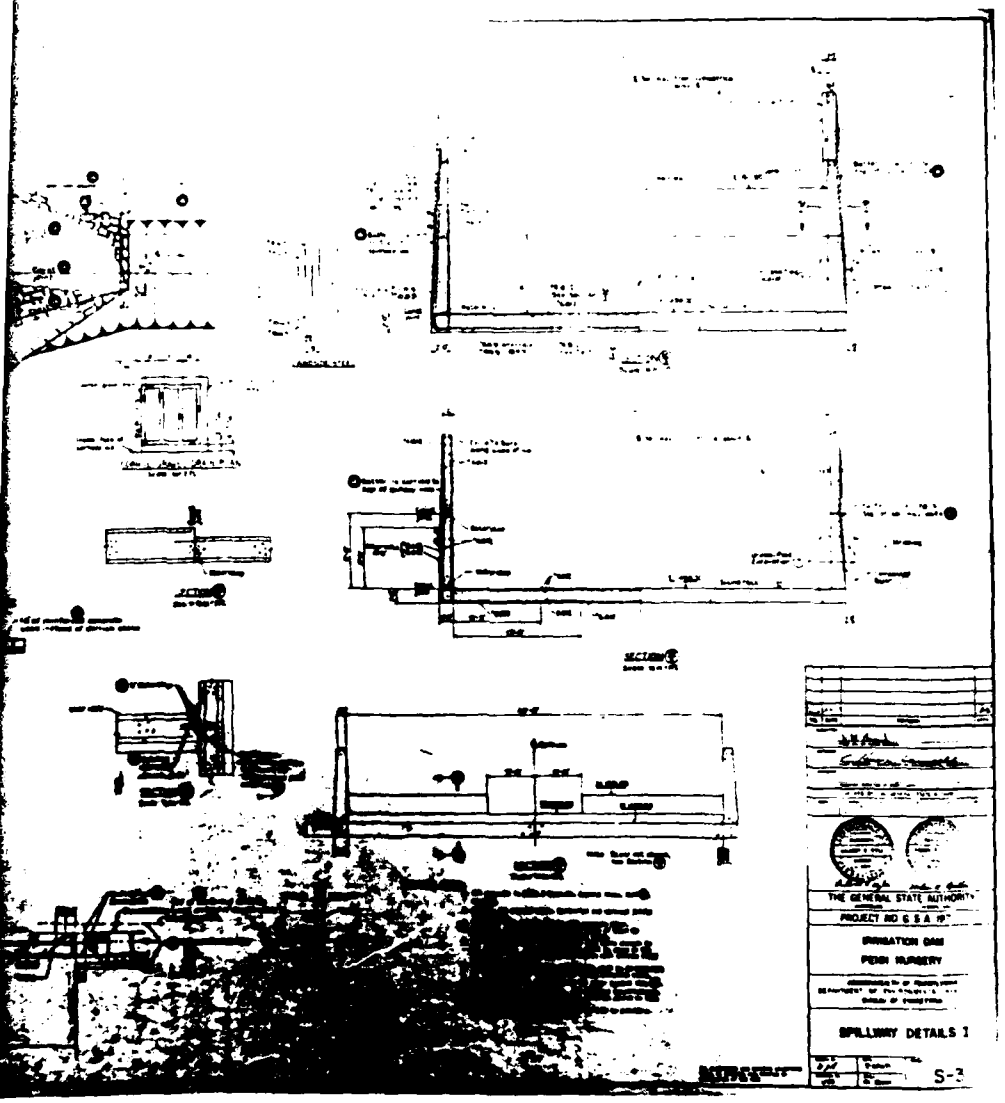


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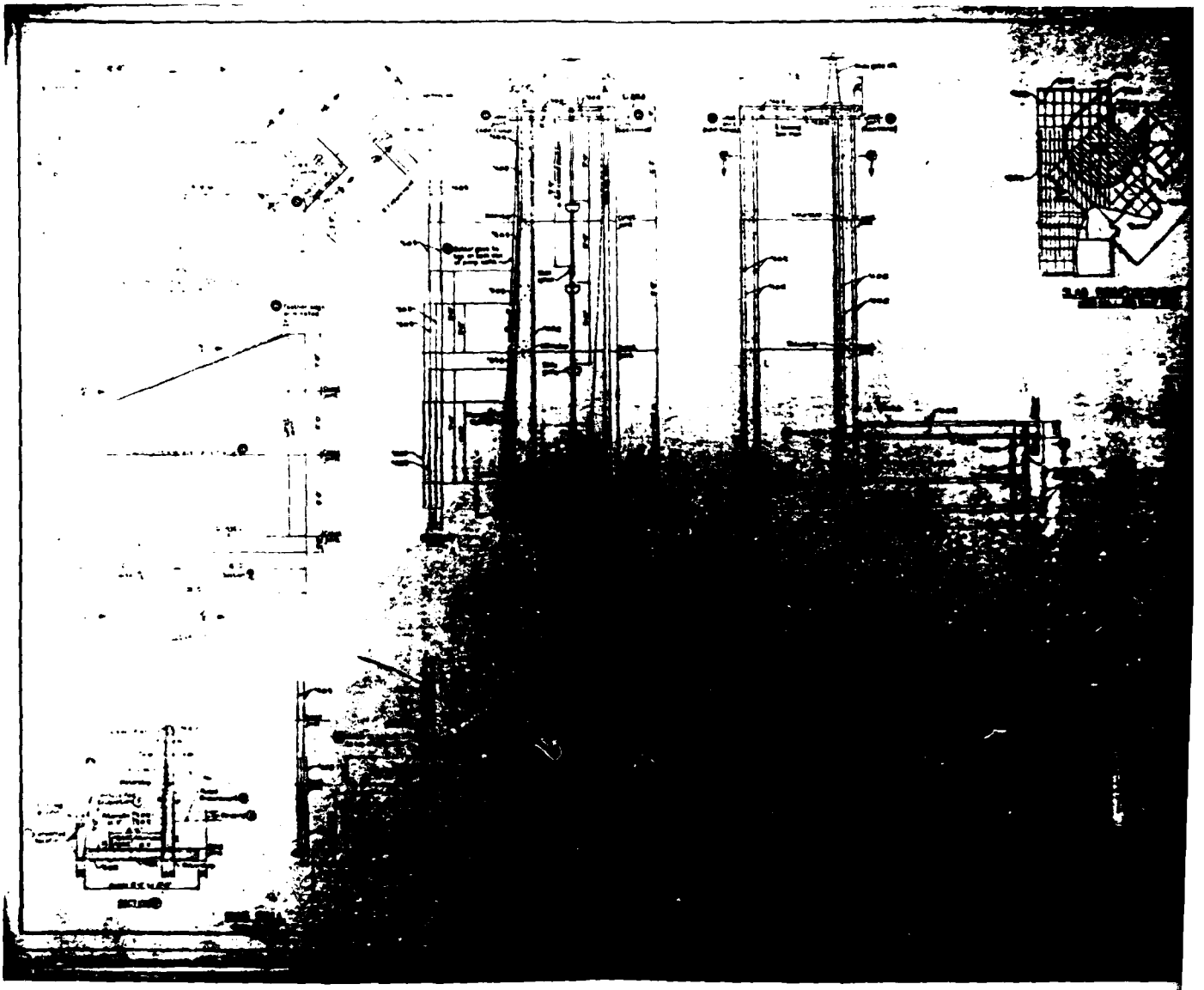
FIGURE 4



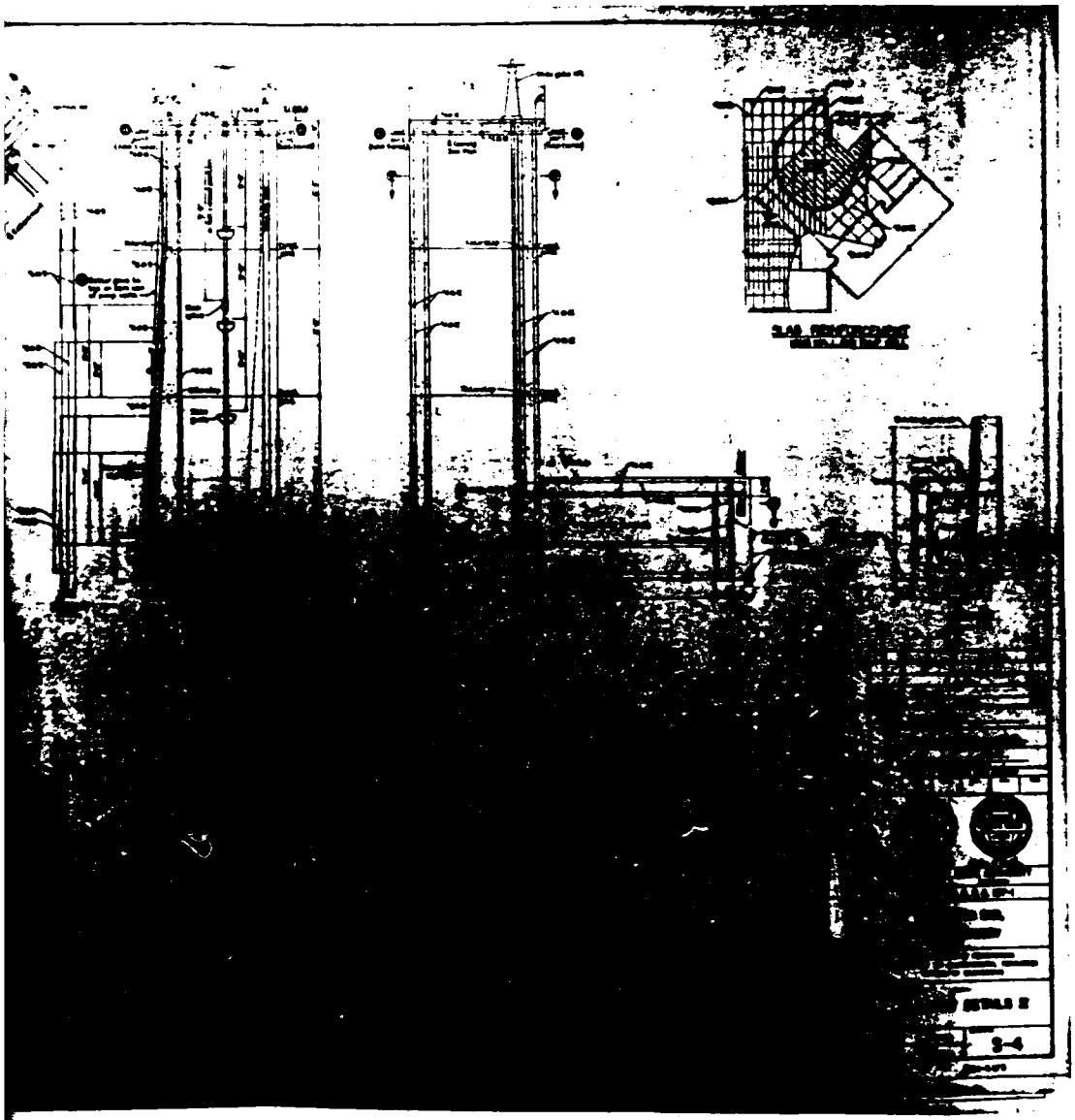


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FIGURE 5

APPENDIX F

GEOLOGY

Geology

Penn Nursery Dam is located in the Appalachian Mountain Section of the Valley and Ridge physiographic province of central Pennsylvania. This region is characterized by a series of northeast-southwest trending parallel mountains and intermontane valleys. Intense lateral compression from the southeast produced a series of high amplitude anticlines and synclines in the formerly flat lying strata. Folding of the rock strata was followed by uplift. Subsequent erosion cut valleys in the softer, less resistant beds and left the harder resistant strata as high mountain ridges.

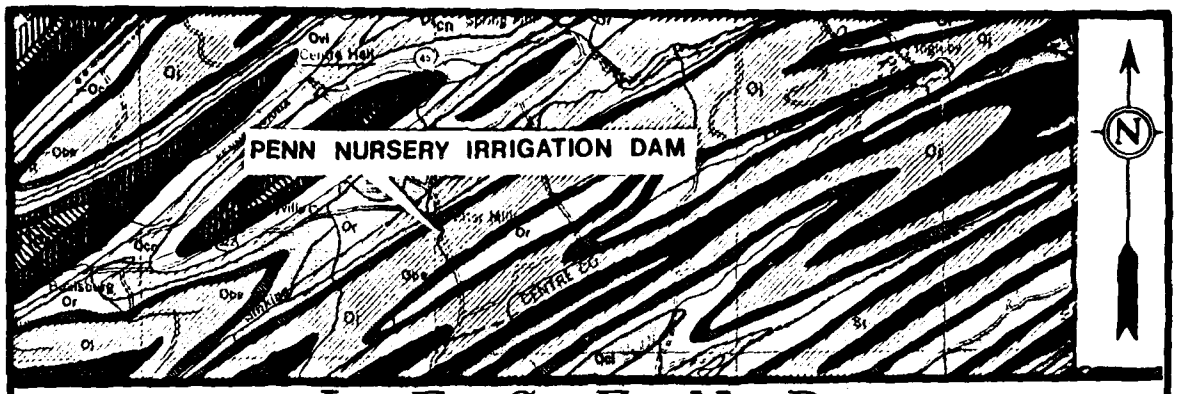
Penn Nursery Dam is located on Potter Run in Triester Valley which is flanked on the northwest by Triester Mountain and on the southeast by Sand Mountain. Structurally, the dam and reservoir are located in a tightly folded area with plunging syncline and anticline complexes.

Bedrock underlying the dam consists of "interbedded dark-gray, shale and thin gray sandstone beds" representing the Reedsville Formation of Ordovician age. Bedding dips approximately 15 degrees. Separations along bedding and cleavage, which dips at about 80 degrees are the dominant fracture planes. The upper 2 to 8 feet of rock is highly fractured with moderate fracturing occuring with depth. A weathered zone of fragmental shale, partly decomposed and ranging in thickness from 1 to 3 feet overlies the relatively fresh rock."

"Along the proposed dam axis and above a surface elevation of approximately 1,502 feet, the overburden consists predominantly of brown silty fine sand. In the lower, central part of the stream valley, along the dam axis, the overburden consists of layers of clayey silt, silty sand and gravel and clayey silt with gravel. These sediments represent floodplain deposits of Potter Run".

---

[1]Rose, C. W. et. al., "Subsurface Exploration, Penn Nursery Irrigation Dam, Potler Stream, Centre County, Pennsylvania".



L E G E N D

SILURIAN

Keyser Formation
Dark gray, highly fossiliferous, thick bedded, crystalline to nodular limestone, passes into Manlius, Rondout, and Decker Formations in the east

Skw

Tonoloway Formation
Gray, highly laminated, thin bedded, argillaceous limestone, passes into Bossardville and Pozono Island beds in the east

Wills Creek Formation
Greenish gray, thin bedded, fissile shale with local limestone and sandstone zones, contains red shale and siltstone in the lower part.

Bloomsburg Formation
Red, thin and thick bedded shale and siltstone with local units of sandstone and thin impure limestone, some green shale in places

Sc

Clinton Group
Predominantly Rose Hill Formation - Reddish purple to greenish gray, thin to medium bedded, fossiliferous shale with interlonguing "iron sandstones" and local gray, fossiliferous limestone; above the Rose Hill is brown to white quartzitic sandstone (Keefer) interbedded upward with dark gray shale (Rochester)

Tuscarora Formation
White to gray, medium to thick bedded, fine grained, quartzitic sandstone, conglomeratic in part.

ORDOVICIAN

CENTRAL PENNSYLVANIA

Oj

Juniata Formation
Red, fine grained to conglomeratic, quartzitic sandstone with well developed cross-bedding and with interbedded red shale in places.

Bald Eagle Formation
Gray to greenish gray, fine grained to conglomeratic, thick bedded sandstone; often iron-speckled and cross-bedded; some greenish gray shale in places.

Or

Reedsville Formation
Dark gray, olive weathering shale with thin silty to sandy interbeds; black shale of Antes Formation at the base

Coburn Formation
Dark gray to black, thin bedded limestone with black shale interbeds.

Salona Formation
Dark gray, thin bedded, dense limestone.

Ocn

Nealmont Formation
Bluish gray, finely crystalline, fossiliferous limestone, lower part grades laterally into Curtin Formation.

Osl

Curtin Formation
Gray, impure limestone, bluish gray, fine grained, high calcium limestone with some larger calcite grains (Valentine Member, Ovl at the top.

Benner Formation
Gray, mottled, dolomitic limestone and coarse granular limestone.

Ov

Ovl

Hatter Formation
Dark gray, impure, fossiliferous limestone

Loysburg Formation
Dense limestone over irregularly banded dolomitic limestone.

Bellefonte Formation
Gray, cream to tan weathering, medium bedded dense dolomite.

Scale

0 2 4 6 8 10 MILES

GEOLOGY MAP

REFERENCE:
GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL AFFAIRS, DATED 1960, SCALE 1" = 4 MILES

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