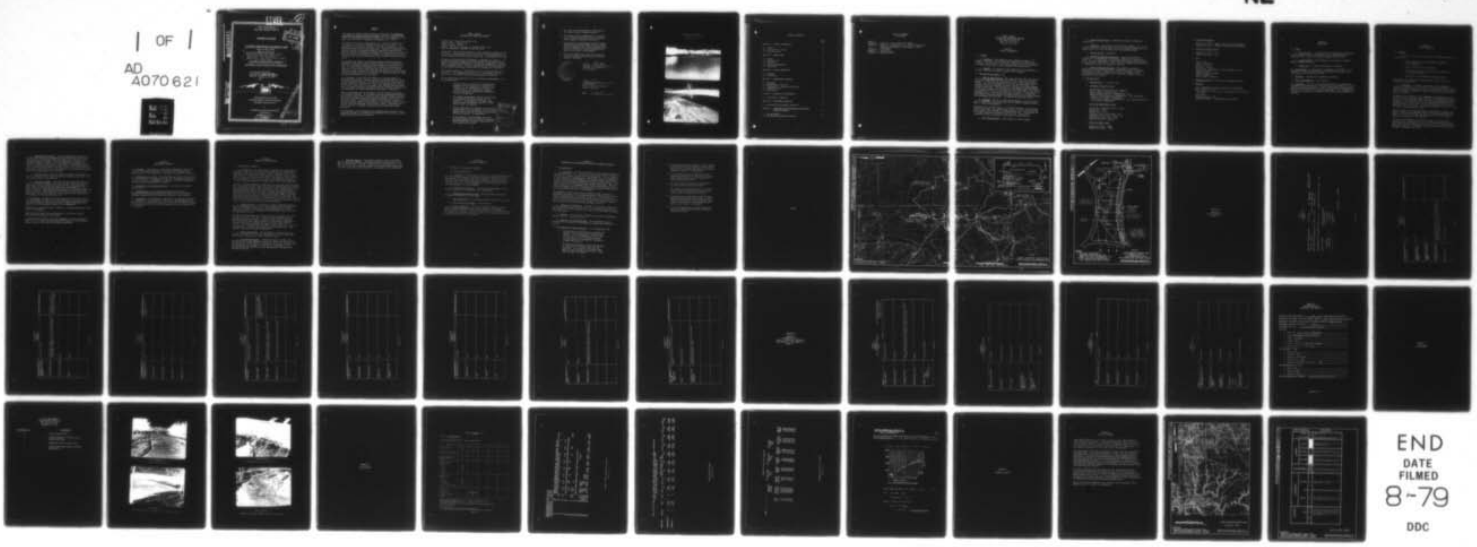
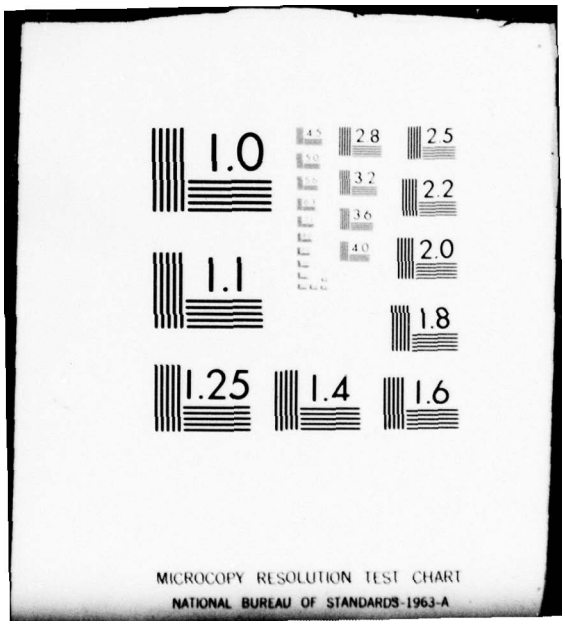
AD-A070 621 D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. LOWER HEREFORD MANOR DAM (NDI---ETC(U)
MAR 79 DACW31-79-C-0014

UNCLASSIFIED NL



END
DATE FILMED
8-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OHIO RIVER BASIN
DOE RUN, BEAVER COUNTY

PENNSYLVANIA

LOWER HEREFORD MANOR DAM

NDI I.D. NO: PA-261

DER I.D. NO: 4-47

(6) National Dam Inspection Program. Lower Hereford Manor Dam (NDI-ID-PA-261) (DER-ID-4-47). Ohio River Basin, Doe Run, Beaver County, Pennsylvania.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Distribution Unlimited
Approved for Public Release
Contract No. DACW31-79-C-0014
(15)

PREPARED FOR

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

BY

D'APPOLONIA CONSULTING ENGINEERS
10 DUFF ROAD
PITTSBURGH, PA. 15235

(11) MAR[illegible]79

(12) 53p.

4/11 001

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

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

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some 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.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Lower Hereford Manor Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Beaver
STREAM: Doe Run, a tributary of Conoquenessing Creek
DATE OF INSPECTION: December 12 and 28, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the overall condition of Lower Hereford Manor Dam is considered to be fair.

No design and construction information is available for this dam. It appears the dam was constructed in conjunction with strip-mine operations in the reservoir area and was not formally engineered. The dam has no low-level outlet. The only spillway of the dam is equpped with a fish screen, which poses a potential for blockage of the spillway.

The spillway capacity is in the range of 15 to 20 percent PMF and is classified to be inadequate according to the recommended criteria, based on size and hazard potential classification of the dam.

The following recommendations should be implemented immediately or on a continuing basis:

1. The dam should be evaluated by a professional engineer for the purpose of documenting the integrity of the embankment as a water retention structure. The investigation should include subsurface investigation, laboratory testing, and analysis.

2. The further investigation should develop means of installing a low-level outlet for the reservoir. In the interim, emergency pumps should be made available at the site to draw down the lake, if required.

3. Further hydrologic and hydraulic studies should be performed to more accurately assess spillway capacity and to provide the basis for providing additional capacity, if appropriate.

4. In the interim, the fish screen across the spillway should either be removed or necessary modifications made to prevent obstruction of flow through the spillway.

5. The crest of the dam should be surveyed and low spots filled to design elevation.

6. The seepage on the downstream face of the dam should be periodically observed and remedial action taken if conditions deteriorate.

7. Around-the-clock surveillance should be implemented during unusually heavy runoff to detect possible problems, and a formal warning system should be developed to alert downstream residents in the event of an emergency.

8. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

Lawrence D. Andersen, P.E.
Vice President

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE: 22 Apr 79

LOWER HEREFORD MANOR DAM
NDI I.D. NO. PA-261
DECEMBER 12, 1978

Upstream Face

Downstream Face

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
LOWER HEREFORD MANOR DAM
NDI I.D. NO. PA-261
DER I.D. NO. 4-47

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

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

1.2 Description of Project

a. Dam and Appurtenances. The Lower Hereford Manor Dam consists of an earth embankment approximately 1000 feet long with a maximum height of 37 feet from the downstream toe and a crest width of about 25 feet. The flood discharge facilities for the dam consist of a combined primary and emergency spillway located on the right abutment (looking downstream). The spillway is a rectangular concrete channel 17 feet wide, equipped with flashboards and a fish screen. The tops of the flashboards are at a level about two feet below the low spot on the embankment crest. The spillway discharge channel is a trapezoidal earth channel excavated across the drainage divide on the right abutment and discharging into Buck Run. The dam has no low-level outlet.

b. Location. The dam is located approximately 1-1/2 miles northeast of Zelienople along State Route 288 in Franklin Township, Beaver County, Pennsylvania (~~Plate~~ 1).

Downstream from the dam, there is no defined streambed. The discharge from the dam flows into numerous lakes formed by old strip-mined pits which appear to be connected to Conoquenessing Creek. State Route 288 is located immediately downstream from the dam. There are no structures within the potential flood plain of this reservoir.

c. Size Classification. Small (based on 37-foot height).

d. Hazard Classification. Significant (based on downstream conditions).

e. Ownership. Pennsylvania Fish Commission (address: Mr. E. Jon Grindall, Senior Project Engineer, Director of Bureau of Fisheries and Engineering, R.D. 3, Box 70, Bellefonte, Pennsylvania 16823).

f. Purpose of Dam. Recreation.

g. Design and Construction History. Based on undocumented information, it appears that the dam was constructed by the previous owner, Mr. J. H. Cunningham, in conjunction with strip mining operations in the reservoir area prior to 1958. Review of PennDER files indicates no construction permit was issued for this dam.

h. Normal Operating Procedure. The reservoir is normally maintained at the crest level of the flashboards across the spillway, leaving about 2 feet of freeboard to the top of the dam. Inflow occurring when the pool level is at or above the flashboard level is discharged to the spillway.

1.3 Pertinent Data

a. Drainage Area - 1.3 square miles

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - Unknown
Outlet conduit at maximum pool - N/A
Gated spillway capacity at maximum pool - N/A
Ungated spillway capacity at maximum pool - 167 (with flashboards); 337 (without flashboards)
Total spillway capacity at maximum pool - 167 (with flashboards); 337 (without flashboards)

c. Elevation (USGS Datum) (feet)

Top of dam - 936.8 (low spot on crest)
Maximum pool - 936.8
Normal pool - 934.7
Upstream invert outlet works - N/A
Downstream invert outlet works - N/A
Streambed at center line - 900±
Maximum tailwater - Unknown

d. Reservoir Length (feet)

Normal pool level - 2600±
Maximum pool level - 2700±

e. Storage (acre-feet)

Normal pool level - Unknown (400 acre-feet estimated)
Maximum pool level - Unknown (500 acre-feet estimated)

f. Reservoir Surface (acres)

Normal pool level - 44.6
Maximum pool level - 46±

g. Dam

Type - Earth
Length - 1000 feet
Height - 37 feet
Top width - 25 feet
Side slopes - Downstream: 4H:1V; Upstream: 1H:1V
Zoning - Unknown
Impervious core - Unknown
Cutoff - Unknown
Grout curtain - Unknown

h. Regulating Outlet - The dam has no regulating outlet.

i. Spillway

Type - Rectangular concrete channel with flashboards
Crest length - 17 feet
Crest elevation - 934.7 (top of flashboards); 933.0 (top of concrete)
Gate - None
Upstream channel - Lake
Downstream channel - Trapezoidal earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), and the Pennsylvania Fish Commission files include no design information for this dam.

b. Design Features. No information is available to document design features of the dam.

c. Design Data. No design information is available.

2.2 Construction. No construction information is available. It is presumed to have been constructed in conjunction with strip mining operations in the area prior to 1958.

2.3 Operation. The dam has no operational features.

2.4 Other Investigations. None reported.

2.5 Evaluation. There is no information available to document the conformance of design approach and construction techniques to currently accepted engineering practices. Based on undocumented information, it appears that the dam was not formally engineered. It is assumed that the dam was constructed in conjunction with strip mining operations in the area.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Lower Hereford Manor Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual inspection of the spillway.

3. Observation of factors affecting runoff potential of the drainage basin.

4. Evaluation of the downstream hazard potential.

The specific observations are illustrated in Plate 2 and in the photographs in Appendix C.

b. Embankment. In general, inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the embankment is considered to be fair. One wet area and a seepage point were found on the downstream face of the dam. The wet area was located near the left abutment approximately midheight of the downstream slope. No seepage flow appeared to be associated with this wet area. Seepage was found in a ditch on the downstream slope of the dam. The flow was estimated to be on the order of four to five gallons per minute.

While a portion of the upstream slope is protected by a masonry wall against erosion, the remaining portion of the upstream slope has no riprap. At certain sections, the upstream slope is steep (approximately one horizontal to one vertical).

The top of the embankment was surveyed relative to the spillway flashboard crest elevation (934.7). A 150-foot-long section of the crest near the left abutment was found to be 0.5 to 1.5 feet below the mean crest elevation. The lowest point was about two feet above the spillway flashboard crest level.

c. Appurtenant Structures. The only appurtenant structure of the dam, the spillway, was examined for deterioration or other signs of distress or obstructions that would limit flow. The fish screen, located immediately upstream of the flashboards, was found to be partially clogged by debris. The pool level of the upstream side of the fish screen was approximately eight inches higher than the water level on the downstream side of the fish screen. This condition clearly demonstrates the potential for obstruction of flow through the spillway by debris accumulating on the fish screen.

d. Reservoir Area. Reservoir slopes are gentle to moderate and are not likely to be susceptible to massive landslides which may affect the storage volume of the reservoir.

e. Downstream Channel. Flow from the Lower Hereford Manor Lake spillway discharges into Buck Run, which in turn flows into numerous ponds formed by strip-mined pits about 1000 feet downstream from the dam. These strip-mined pits are apparently interconnected to the present course of Conoquenessing Creek, which is located about 4000 feet south of the dam. Other than State Route 288, which is immediately downstream from the dam, there are no structures within the potential flood plain of Lower Hereford Manor Dam.

3.2 Evaluation. Although visual observations indicate that the dam is in fair condition, the lack of any design and construction information and indications that the dam was not formally engineered cause concern as to the continued integrity of the embankment.

The dam has no low-level outlet; therefore, it cannot be drained in the event of an emergency.

The fish screen across the only spillway of the reservoir poses a potential for blockage of the spillway.

A 150-foot-long section of the crest adjacent to the left abutment is about 0.5 to 1.5 feet below the mean crest elevation, and the lowest point is about 2 feet above the spillway flashboards.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. The reservoir is normally maintained at the crest level of the flashboards across the spillway, with excess inflow discharging over the flashboards. The dam has no operable facilities.

4.2 Maintenance of the Dam. The maintenance of the dam is considered to be satisfactory. It appears that the only maintenance operation at the dam is mowing the embankment as required. The dam is maintained by Pennsylvania Fish Commission personnel.

4.3 Maintenance of Operating Facilities. The dam has no operable appurtenances.

4.4 Warning System. No formal warning exists for the dam. A Pennsylvania Fish Commission employee resides at the dam site and telephone communication facilities are available at his residence.

4.5 Evaluation. The maintenance condition of the existing facilities are considered to be satisfactory. The dam and appurtenances should be periodically inspected with emphasis on the wet area and the seepage on the downstream face of the dam to document that the conditions are not changing.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. No design data is available for Lower Hereford Manor Dam. Data for this study were generated based on approximate field measurements and map studies. It was found that the dam has a watershed of 1.3 square miles and impounds a reservoir with a surface area of 44.6 acres at normal pool level. The capacity of the spillway was determined to be 167 cfs (as exists with flashboards) based on 2 feet of freeboard below the low spot on the crest of the embankment.

The dam is located immediately downstream from the Upper Hereford Manor Dam. The upper dam has a watershed of about 2 square miles and impounds a reservoir with a surface area of about 24 acres. Discharge from the upper dam spillway bypasses the lower dam via a diversion channel. It was estimated that within the range of floods less than the spillway capacity of the lower dam, the upper dam diversion channel would have sufficient discharge capacity to bypass the flows from the upper dam watershed without significantly overflowing into the lower lake. Therefore, in the following analysis, no flow from the upper dam wastershed was included in determining lower dam inflow hydrographs.

b. Experience Data. As previously stated, Lower Hereford Manor Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass a 100-year to half PMF flood flow.

The PMF inflow hydrograph for the reservoir was determined using the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer analysis are presented in Appendix D. The half PMF inflow hydrograph was found to have a peak flow of 1174 cfs. The 100-year flood was found to have a peak flow of 300 cfs, corresponding to slightly less than 15 percent PMF peak flow. The computer outputs are included in Appendix D.

c. Visual Observations. The presence of a fish screen across the only spillway of the reservoir is considered to pose significant potential for obstruction of flow through the valley.

d. Overtopping Potential. Various percentages of PMF inflow hydrograph were routed through the reservoir and it was found that the dam can pass 15 percent PMF with flashboards across the spillway without overtopping the embankment. Without the flashboards, it was determined that the spillway can pass approximately 20 percent PMF without overtopping.

e. Spillway Adequacy. The spillway capacity (15 to 20 percent PMF) is within the range of recommended spillway design floods of 100-year to one-half PMF. However, considering that the height of the dam (37 feet) is closer to the upper limit of the size classification range (25 to 40 feet), the spillway capacity is considered to be inadequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the dam at this time. However, in view of the lack of any design and construction information and based on the indications that the dam was not formally engineered, concern exists as to the continued integrity of the embankment.

(2) Appurtenant Structures. The structural performance of the spillway structures is considered to be satisfactory.

b. Design and Construction Data. No design and construction information is available for this dam.

c. Operating Records. No operating records are kept for the dam.

d. Post-Construction Changes. None reported.

e. Seismic Stability. The dam is located in Seismic Zone 1. Based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The overall condition of Lower Hereford Manor Dam is considered to be fair. The dam has no low-level outlet to permit draining the reservoir in the event of emergencies. The only spillway of the reservoir is equipped with a fish screen, which is considered to pose a potential for blockage of the spillway during major floods. No design and construction information is available for the dam. Indications are that the dam has not been formally engineered. Based on these concerns, it is recommended that further investigation be undertaken to document the type of foundation and embankment materials and to evaluate the stability of the embankment.

The capacity of the spillway (15 to 20 percent PMF) is found to be inadequate according to the recommended criteria based on the size and hazard classifications for the dam. Therefore, it is necessary to conduct additional hydrologic and hydraulic analyses to more accurately ascertain the spillway capacity and the nature and extent of improvements required to provide sufficient spillway capacity.

b. Adequacy of Information. Although no design and construction information is available for the dam, it is considered that a preliminary assessment of the condition of the dam can be made based on visual observations alone.

c. Urgency. The following recommendations should be implemented immediately or on a continuing basis.

d. Necessity for Additional Data. The recommended further investigation is required to more adequately assess the condition of the dam.

7.2 Recommendations/Remedial Measures. It is recommended that:

1. The dam should be evaluated by a professional engineer for the purpose of documenting the integrity of the embankment as a water retention structure. The investigation should include subsurface investigation, laboratory testing, and analysis.

2. The further investigation should develop means of installing a low-level outlet for the reservoir. In the interim, emergency pumps should be made available at the site to draw down the lake, if required.

3. Further hydrologic and hydraulic studies should be performed to more accurately assess spillway capacity and to provide the basis for providing additional capacity, if appropriate.

4. In the interim, the fish screen across the spillway should either be removed or necessary modifications made to prevent obstruction of flow through the spillway.

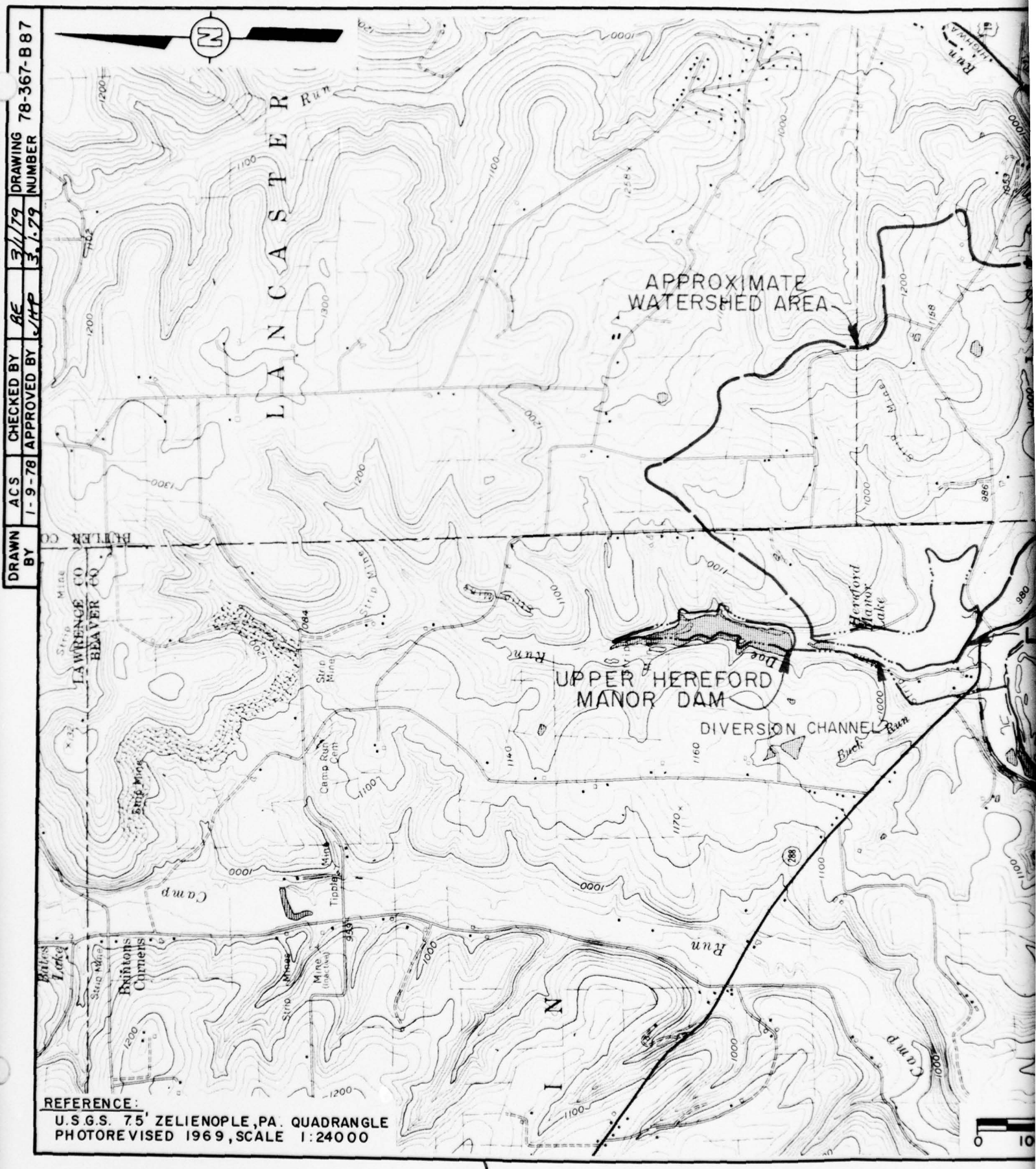
5. The crest of the dam should be surveyed and low spots filled to design elevation.

6. The seepage on the downstream face of the dam should be periodically observed and remedial action taken if conditions deteriorate.

7. Around-the-clock surveillance should be implemented during unusually heavy runoff to detect possible problems, and a formal warning system should be developed to alert downstream residents in the event of an emergency.

8. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

PLATES


DRAWN BY
ACS
1-9-78
CHECKED BY
APPROVED BY
DRAWING NUMBER
78-367-B87
LANCASTER
APPROXIMATE WATERSHED AREA
UPPER HEREFORD MANOR DAM
DIVERSION CHANNEL
Hereford Manor Lake
LAWRENCE CO
BEAVER CO
Brinkton Corners
Bells Lake
Camp Run
Buck Run
Run
REFERENCE:
U.S.G.S. 7.5' ZELIENOPLE, PA. QUADRANGLE
PHOTOREVISED 1969, SCALE 1:24000

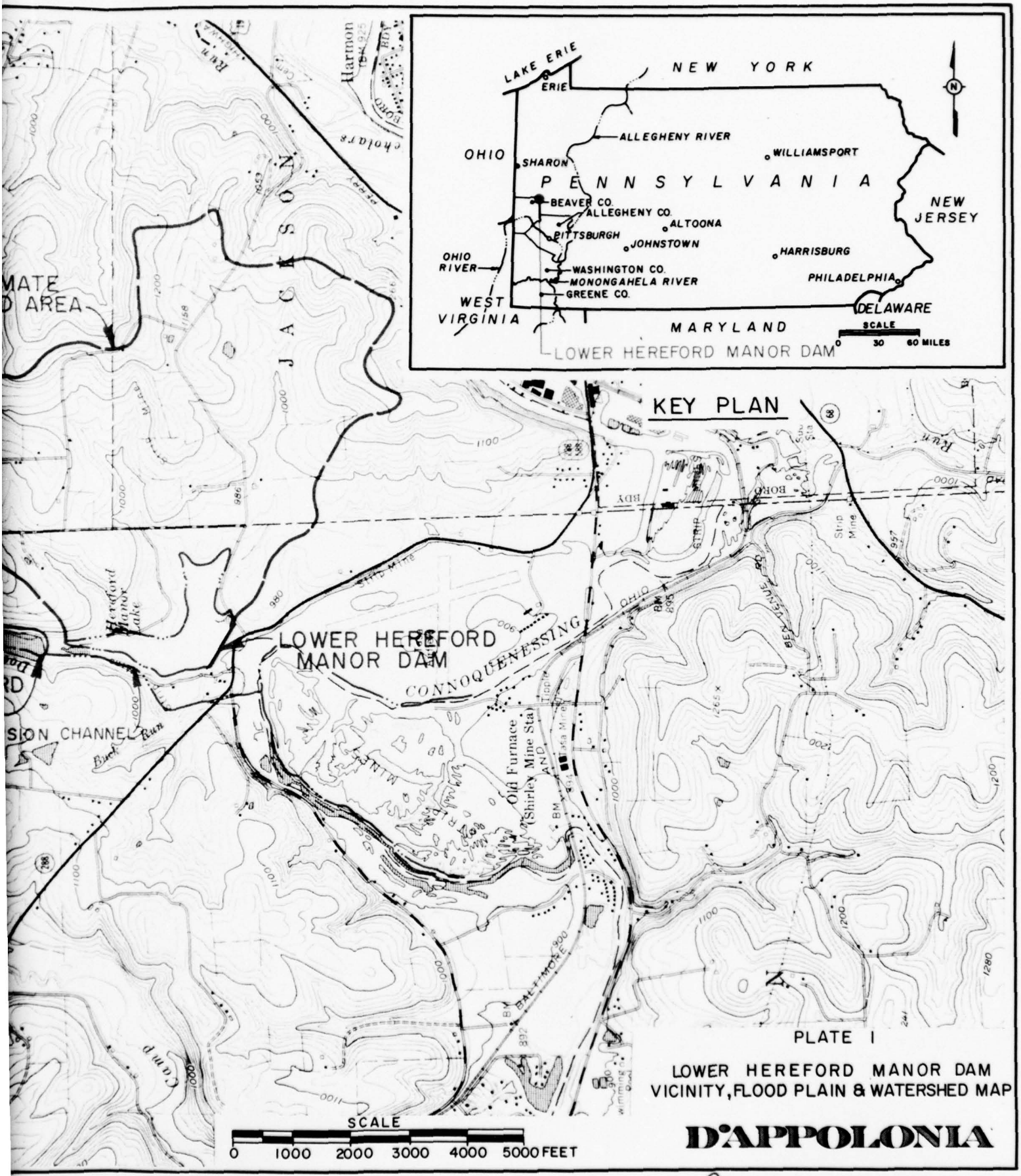


PLATE 1

LOWER HEREFORD MANOR DAM
VICINITY, FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

2

DRAWN BY	MBM	CHECKED BY	BE	3/1/79	DRAWING NUMBER 78-37-A13
	1-4-79	APPROVED BY	JHP	3.1.79	

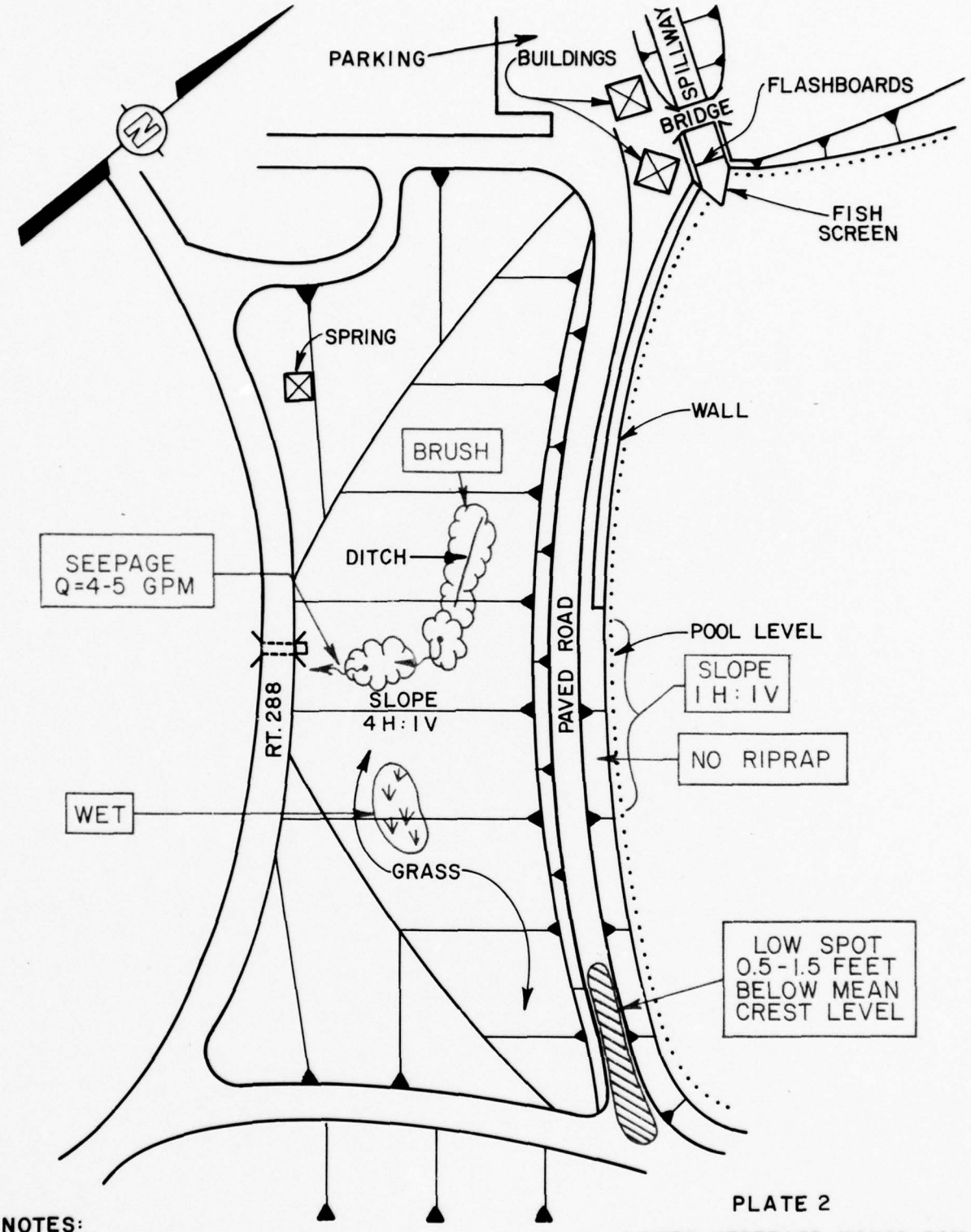


PLATE 2

LOWER HEREFORD MANOR DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: DEC. 12, 1978

NOTES:

1. SPILLWAY FREEBOARD (MEASURED FROM LOW SPOT ON CREST TO TOP OF FLASHBOARDS = 2 FT.
2. POOL LEVEL DATE OF INSPECTION: 1.3 FT. BELOW LOW SPOT IN CREST.

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Lower Hereford Manor COUNTY Beaver STATE Pennsylvania NDI I.D. NO. PA-261
ID# DER I.D. NO. 4-47

TYPE OF DAM Earth HAZARD CATEGORY Significant

DATE(S) INSPECTION December 12, 1978 WEATHER Cloudy TEMPERATURE 30s

POOL ELEVATION AT TIME OF INSPECTION 935.6 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

Bilgin Erel
Wah-Tak Chan

REVIEW INSPECTION PERSONNEL:
(December 20, 1978)

E. D'Appolonia
L. D. Andersen
J. H. Poellot
B. Erel

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Mean crest level is 3.0 feet to 3.5 feet above the spillway flashboard. There is a 150-foot-long low section near the left abutment. The lowest point is two feet above the spillway flashboard crest level.	
RIPRAP FAILURES	Poor, or nonexistent.	New riprap should be installed.

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	One wet area at midheight of the downstream slope near the left abutment. Seepage in the ditch on the downstream slope. Flow is 4 to 5 gpm.	These two areas should be regularly inspected to document if conditions are worsening.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

VISUAL INSPECTION
PHASE 1
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	There is no outlet works. N/A	Outlet works should be constructed.
INTAKE STRUCTURE	N/A	
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	N/A	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete is in fair condition. Weir is equipped with 1.7-foot-high flashboards.	
APPROACH CHANNEL	Lake. Approach channel is obstructed by fish screen.	Fish screen should be removed or modified to prevent obstruction of flow through the spillway.
DISCHARGE CHANNEL	Trapezoidal earth channel, flowing across the drainage divide into the valley west of the dam.	
BRIDGE AND PIERS	A single-span wooden bridge across the discharge channel.	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

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

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

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

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle.	
SEDIMENTATION	Unknown.	
UPSTREAM RESERVOIRS	Upper Hereford Manor Dam. Normal spillway flow from the upstream dam bypasses the lower lake via a diversion channel.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No apparent obstructions that would affect the spillway capacity.	
SLOPES	No apparent instability.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	No inhabitable structures. State Route 288 is located immediately downstream of the dam.	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lower Hereford Manor
ID# NDI I.D. NO. PA-261
DER I.D. NO. 4-47

ITEM	REMARKS
AS-BUILT DRAWINGS	Reportedly, none exist.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	Unknown. Based on undocumented information, the dam was built prior to 1958 (presumably in conjunction with strip mining activities in the area).
TYPICAL SECTIONS OF DAM	Unknown.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	There is no outlet works.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Not recorded.
DESIGN REPORTS	Reportedly, none exist.
GEOLOGY REPORTS	Reportedly, none exist.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Reportedly, none exist.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Reportedly, none exist.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	Not maintained.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	Not maintained.
SPILLWAY PLAN SECTIONS DETAILS	None exist.
OPERATING EQUIPMENT PLANS AND DETAILS	There is no operating equipment.

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 1.3 square miles (wood and pasture lands)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 935.4 (400 acre-feet, estimated)

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: Same as above.

ELEVATION; MAXIMUM DESIGN POOL: 937.5

ELEVATION; TOP DAM: 937.5 (low spot on crest)

SPILLWAY:

a. Elevation 935.4 (top of flashboards)

b. Type Rectangular concrete channel.

c. Width 17.2 feet

d. Length N/A

e. Location Spillover Near left abutment.

f. Number and Type of Gates None

OUTLET WORKS: (None)

a. Type N/A

b. Location N/A

c. Entrance Inverts N/A

d. Exit Inverts N/A

e. Emergency Draindown Facilities None

HYDROMETEOROLOGICAL GAGES:

a. Type N/A

b. Location N/A

c. Records N/A

MAXIMUM NONDAMAGING DISCHARGE: Spillway capacity (160± cfs)

APPENDIX C

PHOTOGRAPHS

LIST OF PHOTOGRAPHS
LOWER HEREFORD MANOR DAM
NDI I.D. NO. PA-261
DECEMBER 12, 1978

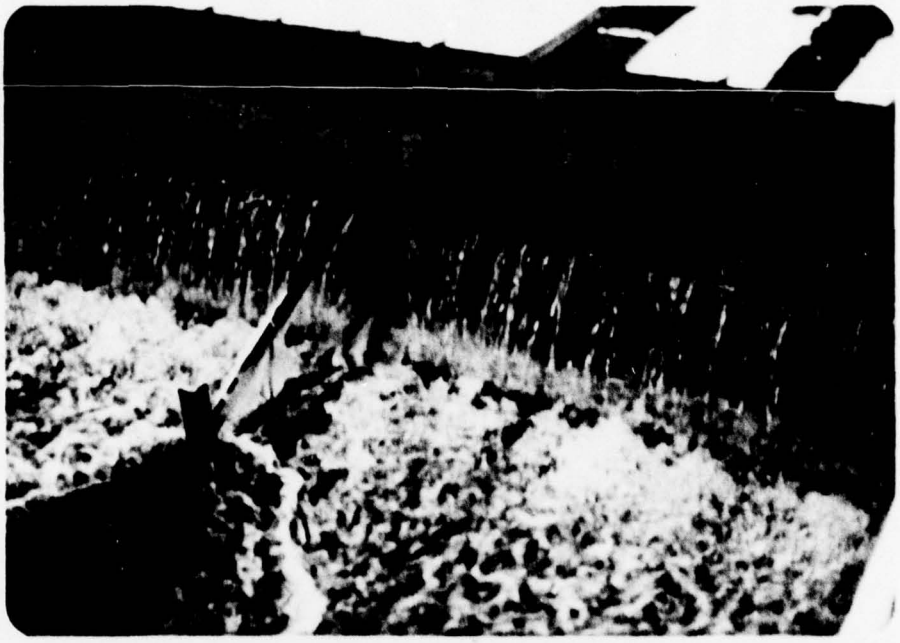
PHOTOGRAPH NO.	DESCRIPTION
1	Crest (looking west).
2	Spillway approach. Spillway crest behind wood fence.
3	Flashboard across spillway crest.
4	Spillway discharge channel (looking downstream).

Photograph No. 1

Crest (looking west).

Photograph No. 2

Spillway approach. Spillway crest behind wood fence.



Photograph No. 3

Flashboard across spillway crest.

Photograph No. 4

Spillway discharge channel (looking downstream).

APPENDIX D
CALCULATIONS

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Lower Hereford Manor
(NDI I.D. PA-261)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.9 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	Lake	Dam			
Drainage Area (square miles)	1.3	0			
Cumulative Drainage Area (square miles)	1.3	1.3			
Adjustment of PMF for Drainage Area (%)[2]					
6 Hours	102	-			
12 Hours	120	-			
24 Hours	130	-			
48 Hours	140	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone[3]	27	-			
C_p/C_t[4]	0.4/2.7	-			
L (miles)[5]	1.4	-			
L_{ca} (miles)[5]	0.3	-			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	2.1	-			
Spillway Data					
Crest Length (ft)	-	17.2			
Freeboard (ft)	-	2.1(w/flashboard)			
Discharge Coefficient		3.2			
Exponent		1.5			

(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.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  11 JAN 79
**********
    1                 A1       SNYDER UNIT HYDROGRAPH,FLOOD ROUTING   DAM OVERTOPPING ANALYSES
    2                 A2       HEREFORD MANOR DAM(LOWER),BEAVER COUNTY,NDI-ID.PA.261  PROJ.NO.78-367-13
    3                 A3       FOR 10%,15%,20%,30%,40%,50%,60%,80%,AND 100% PMF
    4                 B     300        0       15        0        0        0        0        0       -4        0
    5                 B1      5
    6                 J       1        9        1
    7                 J1   0.10     0.15     0.20     0.30     0.40     0.50     0.60     0.80     1.00
    8                 K       0        1                                          1
    9                 K1       CALCULATION OF INFLOW HYDROGRAPH TO HEREFORD MANOR DAM,NDI-ID.PA261
   10                 M       1        1      1.3                1.3                                1
   11                 P              23.9      102      120      130      140
   12                 T                                                    1.0      .05             0.055
   13                 W    2.08     0.40
   14                 X    -1.0    -0.05      2.0
   15                 K       1        2                                          1
   16                 K1       ROUTING FLOW THROUGH HEREFORD MANOR DAM,NDI-ID.PA.261
   17                 Y                                          1        1
   18                 Y1      1                                                      1000.0
   19                 $S    0.0   1000.0   1782.0
   20                 $E  900.0    933.0    950.0
   21                 $$  934.7    17.17     3.20      1.5
   22                 $D936.82     3.08      1.5   1050.0
   23                 $L   75.0     50.0     150.0     50.0    100.0    150.0    350.0     50.0     25.0     50.0
   24                 $V936.82   936.99   937.69   937.80   937.90   938.07   938.17   938.30   938.58   940.00
   25                 K      99
```

COMPUTER INPUT OVERTOPPING ANALYSIS

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .15	RATIO 3 .20	RATIO 4 .30	RATIO 5 .40	RATIO 6 .50	RATIO 7 .60	RATIO 8 .80	RATIO 9 1.00
HYDROGRAPH AT	1	1.30	1	235.	352.	470.	704.	939.	1174.	1409.	1878.	2348.
	(	3.37)	(	6.65)(	9.97)(	13.30)(	19.95)(	26.60)(	33.24)(	39.89)(	53.19)(	66.49)
ROUTED TO	2	1.30	1	62.	140.	261.	577.	870.	1142.	1390.	1864.	2334.
	(	3.37)	(	1.76)(	3.98)(	7.38)(	16.35)(	24.65)(	32.34)(	39.35)(	52.80)(	66.08)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

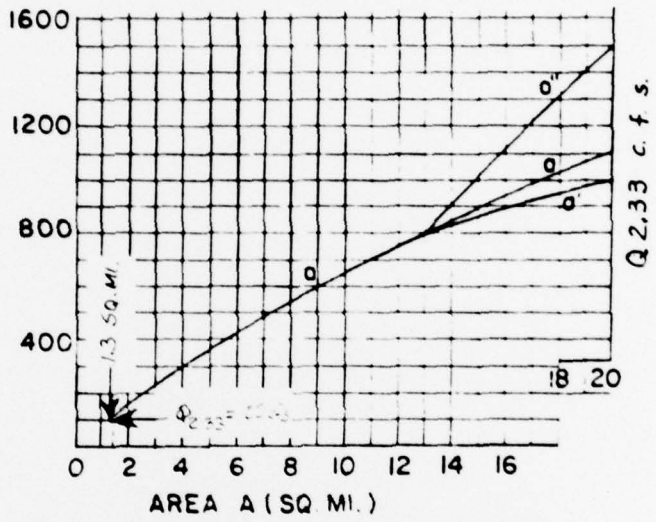
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	933.00	934.70	936.82
STORAGE	1000.	1078.	1176.
OUTFLOW	0.	0.	170.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	935.78	0.00	1128.	62.	0.00	48.75	0.00
.15	936.57	0.00	1164.	140.	0.00	46.75	0.00
.20	937.16	.34	1191.	261.	6.00	45.25	0.00
.30	937.74	.92	1218.	577.	9.75	43.75	0.00
.40	938.06	1.24	1233.	870.	11.75	43.00	0.00
.50	938.26	1.44	1242.	1162.	13.25	42.50	0.00
.60	938.40	1.58	1249.	1390.	14.75	42.25	0.00
.80	938.63	1.81	1259.	1864.	16.75	42.25	0.00
1.00	938.83	2.01	1268.	2334.	18.75	42.25	0.00

IDAHO DIVISION
CONSULTING ENGINEERS, INC

By EE Date 3/16/79 Subject LOWER HEREFORD MANOR DAM Sheet No 1 of 1
Chkd By MF Date 3/20/79 100-YEAR FLOOD Proj No [illegible]

100-YEAR FLOOD ACCORDING TO PENNDOT PROCEDURE



Curves for Estimating the 2 33 year Flood

LOWER HEREFORD MANOR DAM DRAINAGE AREA : [illegible] SQ. MILES

FROM THE ABOVE CHART

$Q_{2.33\ YEAR} \cong 100$ cfs.

RETURN PERIOD ADJUSTMENT.

$Q_{100} = 3.1 \times Q_{2.33}$

$= 310$ cfs SAY $Q_{100} = 300$ CFS

APPENDIX E

REGIONAL GEOLOGY

APPENDIX E
REGIONAL GEOLOGY

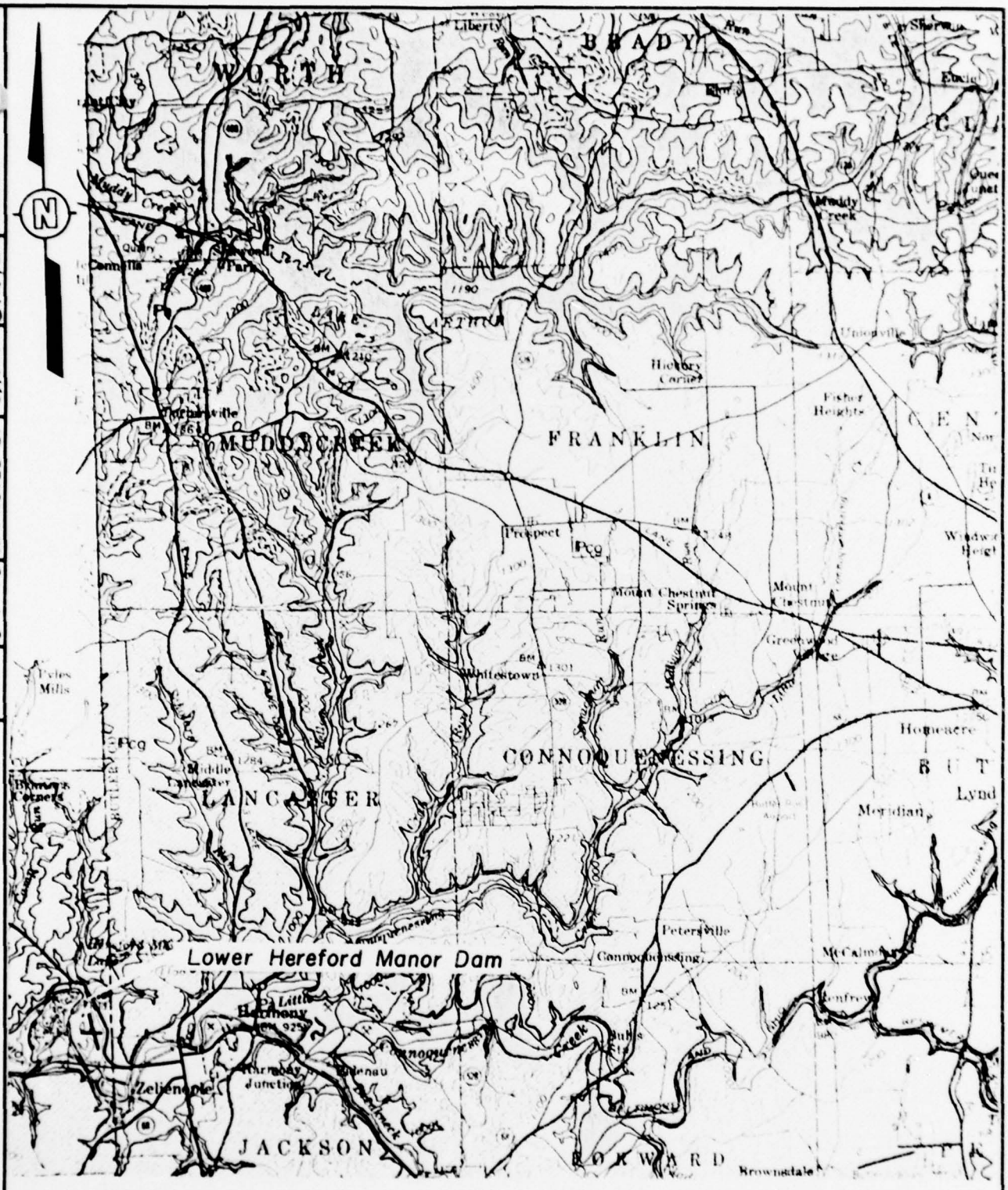
Lower Hereford Manor Dam is located on strata of the Lower Allegheny Group, consisting primarily of interbedded sandstone, shale, and economically valuable seams of coal and clay. The geologic structure consists of a series of small gentle domes and basins with the strata under the dam dipping approximately 40 feet per mile to the southeast.

The strata under the dam are predominantly shales with some interbedded sandstone seams. The Middle Kittanning coal seam crops just upstream along Doe Run, with the Lower Kittanning coal seam cropping along the west bank of the reservoir and downstream along Conoquenessing Creek. The Lower Kittanning coal seam is stratigraphically 35 feet below the Middle Kittanning coal seam. The Vanport Limestone, a 19-foot seam of limestone and interbedded shale, is approximately 100 feet below the dam. This limestone seam is susceptible to solutioning and open or clay-filled fractures should be expected.

The Lower Kittanning coal and underlying clay seams have been strip mined along the Conoquenessing Creek, as well as on the west banks of Hereford Manor Lake, while the Middle Kittanning coal seam has been strip mined upstream from the dam. The Vanport Limestone is mined at several locations in the region; however, no information was found indicating that the limestone has been mined under Hereford Manor Dam.

Due to the low slope gradient in the vicinity of the reservoir, there appears to be no potential for landslides.

DRAWN	CHECKED BY	DRAWING NUMBER
ACS 3-1-79	APPROVED BY	78 67-A23



SCALE

0 1 2 3 4 5miles

LOWER HEREFORD MANOR DAM

GEOLOGY MAP

REFERENCE

GREATER PITTSBURGH REGION GEOLOGIC MAP
COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN
AND J.A. HARPER, DATED 1975, SCALE 1:125000

DRAWN BY	ACS	CHECKED BY	BE	2-6-79	DRAWING NUMBER 78-67-A22
	2-5-79	APPROVED BY	JHP	2-8-79	

GROUP	FORMATION		DESCRIPTION
	Alluvium	Qt	Sand, gravel, clay.
	Terrace deposits		Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
DUNKARD	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
DUNKARD	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
MONONGAHELA		Pm	Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
P. CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
P. CONEMAUGH	Ames		
P. CONEMAUGH	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.
ALLEGHENY	Vanport		Cyclic sequences of shale, sandstone, limestone, and coal; contains Brookville coal at base and Upper Freeport coal at top; within group are the commercial Vanport limestone and Kittanning and Clarion coals.
ALLEGHENY		Pa	

GEOLOGY MAP LEGEND

REFERENCE:
GREATER PITTSBURGH REGION GEOLOGIC MAP
COMPILED BY W.R. WAGNER, J.L. CRAFT, L. HEYMAN
AND J.A. HARPER, DATED 1975, SCALE 1:125000

IDAHO