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NATIONAL DAM INSPECTION PROGRAM. TUSCARORA LAKE DAM (NDI I.D. P--E
1981 DACW31-81-C-0014

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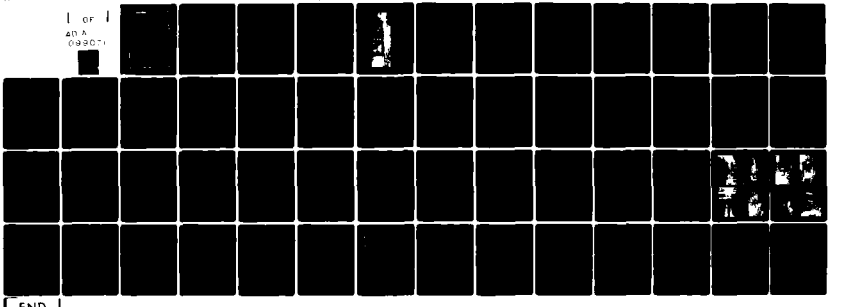

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SUSQUEHANNA RIVER BASIN
TUSCARORA CREEK, SUSQUEHANNA COUNTY

PENNSYLVANIA

(6) National Dam Inspection Program.

TUSCARORA LAKE DAM

(NDI I.D. PA-00049
DER I.D. 058-027)

~~OWNER: JAYNE C. ORCHARDS~~

Susquehanna River Basin, Tuscarora Creek, Susquehanna County, Pennsylvania.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(12) 54

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

PREPARED FOR

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

BY

(15) DACW31-81-C-0014

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

(11) 1981

411001

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.

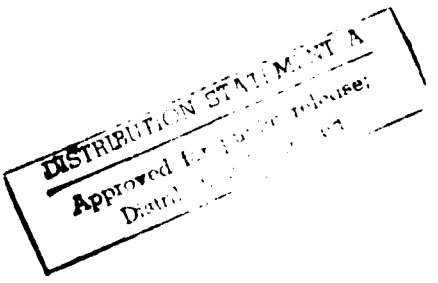
The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic 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: Tuscarora Lake Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Susquehanna
STREAM: Tuscarora Creek, tributary of Susquehanna River
SIZE CLASSIFICATION: Small
HAZARD CLASSIFICATION: Significant
OWNER: Jayne's Orchards
DATE OF INSPECTION: November 14, 1980 and February 5, 1981

ASSESSMENT: Based on the evaluation of the existing conditions, the condition of Tuscarora Lake Dam is considered to be fair. Although some deficiencies were observed such as seepage from the toe and lack of upstream erosion protection, none were considered to be significant relative to the overall stability of the dam at this time. Periodic inspection and evaluation of the seepage conditions are recommended. It was found that the dam has no low level outlet facilities.

The flood discharge capacity of the dam was evaluated according to the recommended criteria and the spillway was found to pass 10 percent of the PMF without overtopping the low spot of the embankment. This capacity is less than the recommended spillway capacity of 50 percent of the PMF which was based on the size and downstream hazard classification of the dam. Therefore, the spillway capacity is classified to be inadequate.

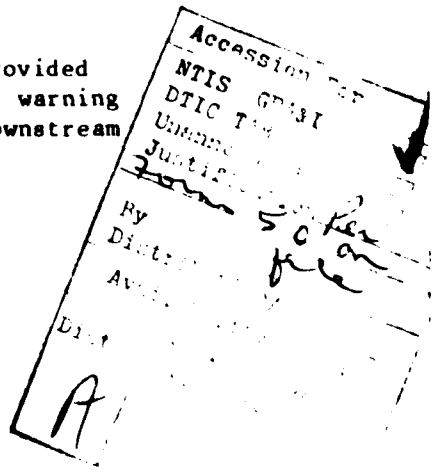
The following recommendations should be implemented as soon as possible or on a continuing basis:

1. The owner should determine the nature and extent of improvements required to provide adequate spillway capacity.

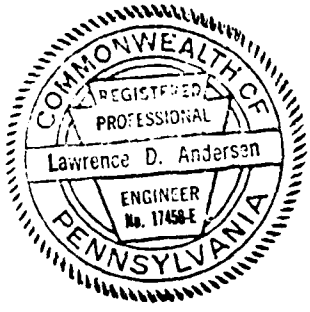
2. In conjunction with the above work, means should be developed to draw down the reservoir when required.

3. Seepages along the toe of the dam should be periodically observed and evaluated to assess changes in quantity or turbidity.

4. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.



5. The owner should develop a formal operation and maintenance plan, inspect the dam regularly, and perform necessary maintenance.



Lawrence D. Andersen, P.E.
Vice President

March 19, 1981
Date

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 22 APR 81

TUSCARORA LAKE DAM
NDI I.D. PA-00069
DER I.D. 058-017
NOVEMBER 4, 1981

Overview

Looking Downstream

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
TUSCARORA LAKE DAM
NDI I.D. PA-0049
DER I.D. 058-027

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. Tuscarora Lake Dam consists of an earth embankment approximately 250 feet long with a maximum height of approximately 12 feet from the downstream toe. The crest width of the dam is irregular, varying from 12 to 20 feet. The lower five- to six-foot height of the downstream side of the dam consists of a vertical dry stone wall. Above the wall, the face of the dam is irregular, generally with a slope of 3 horizontal to 1 vertical. The upstream face of the dam is irregular and covered with grass. The flood discharge facilities for the dam consist of a four-foot-wide open channel spillway located at the center of the embankment. The spillway channel is constructed of railroad ties forming the sides over a concrete slab. Discharge from the spillway plunges onto a mound of stones. The dam does not appear to have a low level outlet facility.

It appears that this dam was constructed at the outlet of a natural lake to raise the lake level.

b. Location. The dam is located (N 41° 44.3', W76° 05.6') on Tuscarora Creek, a primary tributary of the Susquehanna River, approximately 9 miles upstream from its confluence with the Susquehanna River in Auburn Township, Susquehanna County, Pennsylvania. Plate 1 illustrates the location of the dam.

c. Size Classification. Small (based on 12-foot height and 295 acre-feet maximum storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. The stream below the dam flows through an

uninhabited valley for approximately 1.0 mile, where Beaver Meadow Creek joins Tuscarora Creek. In this reach, the stream flows under State Route 367. Approximately 3,000 feet downstream from this confluence, Tuscarora Creek flows through West Auburn. It is estimated that a failure of this dam might damage State Route 367 and cause property damage in West Auburn. Loss of a few lives is considered possible in this area.

e. Ownership. Jayne's Orchards (address: Mr. David Jayne, R.D. #1, Laceyville, Pennsylvania 18623).

f. Purpose of Dam. Recreation.

g. Design and Construction History. No reference was found to indicate when the dam was constructed. The dam was first inspected by the Commonwealth of Pennsylvania in 1919.

h. Normal Operating Procedure. Under normal operating conditions, the reservoir is maintained at the level of the uncontrolled spillway crest. The dam has no other outlet facility.

1.3 Pertinent Data. Elevations referred to in this section and subsequent sections of the report were calculated based on field measurements, assuming the normal pool level to be at Elevation 1161 (USGS Datum), which is shown to be the lake elevation on the USGS 7.5-minute, Auburn Center quadrangle.

a. Drainage Area	0.95 square miles[1]
b. Discharge at Dam Site (cfs)	
Maximum known flood at dam site	Unknown
Outlet conduit at maximum pool	Not applicable
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	16
Total spillway capacity at maximum pool	16
c. Elevation (USGS Datum) (feet)	
Top of dam	1162.6 (measured low spot)
Maximum pool	1162.6
Normal pool	1161.0
Upstream invert outlet works	Not applicable
Downstream invert outlet works	Not applicable
Streambed at downstream toe	1151±
Maximum tailwater	Unknown

(1) Planimetered from USGS topographic map. State records indicate the drainage area to be 1.3 square miles.

d. Reservoir Length (feet)

Normal pool level	3500
Maximum pool level	3500+

e. Storage (acre-feet)

Normal pool level	211
Maximum pool level	295+

f. Reservoir Surface (acres)

Normal pool level	69
Maximum pool level	72+

g. Dam

Type	Earth with stone masonry toe wall
Length	250 feet
Height	12 feet
Top width	12 to 20 feet
Side slopes	Upstream: 3H:1V; (above pool level) Downstream: 3H:1V (above stone wall)
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Regulating Outlet

The dam has no regulating facilities.

i. Spillway (Emergency)

Type	Open channel
Length	4 feet
Crest elevation	1161
Upstream channel	Lake
Downstream channel	Railroad tie sidewalls, concrete bottom

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available information was provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER). The information includes correspondence, state inspection reports, and inspection photographs.

(1) Hydrology and Hydraulics. No design information is available.

(2) Embankment. No design information is available.

(3) Appurtenant Structures. No design information is available.

b. Design Features

(1) Embankment. No information is available on the design of the dam. It appears that the dam is a homogeneous embankment with a five- to six-foot-high dry stone wall along the downstream toe.

(2) Appurtenant Structures. No design information is available for the appurtenant structures. As noted in Paragraph 1.2 a, an overflow spillway is the only appurtenant structure.

c. Design Data.

(1) Hydrology and Hydraulics. No design data are available.

(2) Embankment. No engineering data are available on the design of the embankment.

(3) Appurtenant Structures. The dam has no low level regulating facilities.

2.2 Construction. No design information is available to indicate the manner in which the embankment was constructed. Available records indicate that the dam was completed before 1919.

2.3 Operation. No operating records have been kept for the dam. However, the state inspection records indicate that the dam might have been overtopped in the past.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. The available information was provided by PennDER.

b. Adequacy. The available information, which consists of past inspection reports and some photographs, includes no design information to assess the hydrologic, hydraulic, and structural adequacy of the dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The onsite inspection of Tuscarora Lake Dam consisted of:

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

2. Visual examination of the emergency spillway and the downstream discharge channel.

3. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 2.

b. Embankment. The 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. Two seepage points were found along the toe of the downstream stone wall. Total discharge from the seepages was estimated to be about 10 to 20 gallons per minute. Other than this seepage condition, no additional signs of distress were noted. The upstream shoreline was irregular and lacked erosion protection; however, no significant shoreline erosion was observed.

The crest of the dam was surveyed relative to the spillway crest elevation, and the crest profile is illustrated in Plate 3. A 30- to 50-foot section of the embankment on each side of the spillway was found to be lower than the remaining portions of the dam.

c. Appurtenant Structures. The spillway channel is constructed of railroad ties forming walls above a concrete slab. Concern exists due to both the size and the manner of construction of the spillway. Because of the small size of the spillway channel, about 4 feet wide and 2.5 feet deep, it is considered vulnerable to blockage by debris during storms, which could result in overtopping of the embankment. It appears that the railroad tie walls could be washed out during storms, initiating a breach through the dam.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered with woodlands and pastures. A review of the regional geology is included in Appendix F.

e. Downstream Channel. A description of the downstream channel is included in Section 1.2 d.

3.2 Evaluation. The overall condition of the embankment is considered to be fair. Installation of a structurally and hydraulically adequate spillway is required. In conjunction with this work, means should be developed to draw down the lake, and the need for providing erosion protection along the upstream face should be evaluated.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. There is no formal operating procedure for the dam. The reservoir is normally maintained at the uncontrolled spillway crest level with excess inflow discharging over the spillway.

4.2 Maintenance of the Dam. The maintenance of the dam is poor. It does not appear that attempts have been made to fill the low spots on the dam, to provide shoreline protection, or to maintain the spillway structures.

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

4.4 Warning System. No formal warning system exists for the dam. The dam is readily accessible from a state highway.

4.5 Evaluation. The maintenance condition of the dam is poor. It is recommended that the owner prepare a formal plan for maintenance and operation of the dam and perform necessary maintenance.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Tuscarora Lake Dam has a watershed of 0.95 square mile and impounds a reservoir with a surface area of 69 acres at normal pool level. The flood discharge facilities for the dam consist of an open channel spillway located at the center of the dam. The capacity of the spillway is estimated to be 16 cfs, based on the available head relative to the low spot on the crest of the dam.

b. Experience Data. As previously stated, Tuscarora Lake Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating spillway discharge capacity, such impoundments are required to pass from the 100-year flood to one-half of the Probable Maximum Flood (PMF). In view of the downstream conditions, the one-half PMF is selected as the spillway design flood.

The one-half PMF inflow hydrograph for the reservoir was determined utilizing 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 one-half PMF inflow hydrograph was found to have a peak flow of 1290 cfs. The computer input and a summary of computer output are also included in Appendix D.

c. Visual Observations. Due to the small size of the spillway channel (about 4 feet wide and 2.5 feet deep), the spillway is considered to be vulnerable to blockage by debris during storms. However, for the purpose of assessing the overtopping potential, a reduction in the spillway capacity due to possible blockage was not considered.

d. Overtopping Potential. Various percentages of the PMF inflow hydrograph were routed through the reservoir and it was found that the spillway can pass about 10 percent of the PMF without overtopping the embankment. For 50 percent of the PMF, the dam would be overtopped for a duration of 10.5 hours with a maximum depth of approximately 1.7 feet.

e. Spillway Adequacy. Because the spillway cannot pass the recommended spillway design flood of 50 percent of the PMF without overtopping the dam, the spillway is classified to be inadequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, although some deficiencies were noted, none were considered to be serious relative to the overall stability of the dam at this time.

(2) Appurtenant Structures. The structural condition of the spillway structures is considered to be poor, requiring restoration or replacement.

b. Design and Construction Data

(1) Embankment. No information is available to aid in the assessment of the structural stability of the dam. Further, no detailed information is available on the manner in which the dam was constructed. However, as noted previously, no conditions were observed at this time that would significantly affect the stability of the dam. Nevertheless, it is advisable that the structural condition of the dam be evaluated by a professional engineer in conjunction with the evaluation of the spillway facilities which were found to be inadequate according to the recommended spillway capacity criteria.

(2) Appurtenant Structures. As discussed in Section 3.1 c, the structural adequacy of the spillway is considered to be questionable during flows in excess of the capacity of the spillway.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Postconstruction Changes. None reported.

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

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that Tuscarora Dam is in fair condition. Although some deficiencies were observed, such as seepage from the toe and lack of upstream erosion protection, none were considered to be significant relative to the overall stability of the dam at this time. Periodic inspection and evaluation of the seepage conditions are recommended. It was noted that the dam does not appear to have a low level outlet facility.

The flood discharge capacity of the dam was evaluated according to the recommended criteria and was found to pass 10 percent of the PMF without overtopping the low spot of the embankment. This capacity is less than the recommended spillway capacity of 50 percent of the PMF which was based on the size and downstream hazard classification of the dam. Therefore, the spillway capacity is classified to be inadequate.

b. Adequacy of Information. The available information, in conjunction with the visual observations, is considered to be sufficient to make a Phase I evaluation.

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

d. Necessity for Additional Investigations. In view of the conditions described above, the owner should determine the extent of the improvements required to provide adequate spillway capacity, restore and rehabilitate the spillway, install an outlet structure, and inspect and reevaluate the condition of the embankment.

7.2 Recommendations/Remedial Measures.

It is recommended that the following recommendations be implemented immediately or on a continuing basis:

1. The owner should determine the nature and extent of improvements required to provide adequate spillway capacity.

2. In conjunction with the above work, means should be developed to draw down the reservoir when required.

3. Seepages along the toe of the dam should be periodically observed and evaluated to assess changes in quantity or turbidity.

4. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.

5. The owner should develop a formal operation and maintenance plan, inspect the dam regularly, and perform necessary maintenance.

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Tuscarora Lake COUNTY Susquehanna STATE Pennsylvania ID# NDI: PA-0049 DER: 058-027

TYPE OF DAM Earth HAZARD CATEGORY Significant

DATE(S) INSPECTION November 14, 1980 WEATHER Cloudy TEMPERATURE 40's

POOL ELEVATION AT TIME OF INSPECTION 1160.7 M.S.L. TAILWATER AT TIME OF INSPECTION No Tail-water M.S.L.

INSPECTION PERSONNEL:	REVIEW INSPECTION PERSONNEL: (February 4, 1981)
Douglas Cosler	Lawrence D. Andersen
Arthur Smith	James H. Poellot
Bilgin Erel	Bilgin Erel

Owner's Representative: None

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 3 for dam crest profile.	
RIPRAP FAILURES	Upstream slope has no riprap protection.	Adequate erosion protection (e.g., riprap) should be provided along the upstream slope of the dam.

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed.	
ANY NOTICEABLE SEEPAGE	Seepage under the dam was observed along the downstream toe. See Plate 2 for seepage location.	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The dam has no outlet facilities.	The owner should provide for installation of outlet facilities or prepare plans for draining the lake in case of emergency.
INTAKE STRUCTURE	N/A	
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	N/A	See above remarks.

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Four-foot-wide rectangular channel consisting of railroad ties for walls and a concrete base. Appears to be in satisfactory condition.	
APPROACH CHANNEL	Lake	
DISCHARGE CHANNEL	Earth channel. No problems observed.	
BRIDGE AND PIERS	None	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	The dam has no gated spillway.	
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	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle slopes. No problems observed.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	None	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No problems observed.	
SLOPES	No problems observed.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approximately four to five homes in West Auburn. (Population = approximately 20)	

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 Tuscarora Lake

ID# NDI: PA-0049
DER: 058-027

ITEM	REMARKS
AS-BUILT DRAWINGS	None available.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	Unknown
TYPICAL SECTIONS OF DAM	See Plate 2 (a sketch according to field observations).
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	No existing outlet facilities.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None reported.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	No information reported.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown
MONITORING SYSTEMS	No existing monitoring systems.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	No records available.

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	None available.
SPILLWAY PLAN SECTIONS DETAILS	See Plate 2 (defined by field measurements).
OPERATING EQUIPMENT PLANS AND DETAILS	No operating equipment.

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 0.95 square mile (wooded)

ELEVATION, TOP OF NORMAL POOL AND STORAGE CAPACITY: 1161.0 (211 acre-feet)

ELEVATION, TOP OF FLOOD CONTROL POOL AND STORAGE CAPACITY: 1162.6 (295 acre-feet)

ELEVATION, MAXIMUM DESIGN POOL: Unknown

ELEVATION, TOP OF DAM: 1162.6

SPILLWAY:

a. Elevation 1161.0

b. Type Rectangular channel with concrete paved bottom and railroad tie walls

c. Width 4 feet (perpendicular to flow)

d. Length 30 feet

e. Location Spillover None observed

f. Number and Type of Gates None

OUTLET WORKS:

a. Type Dam has no outlet facilities

b. Location N/A

c. Entrance Inverts N/A

d. Exit Inverts N/A

e. Emergency Drawdown Facilities None

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location N/A

c. Records None

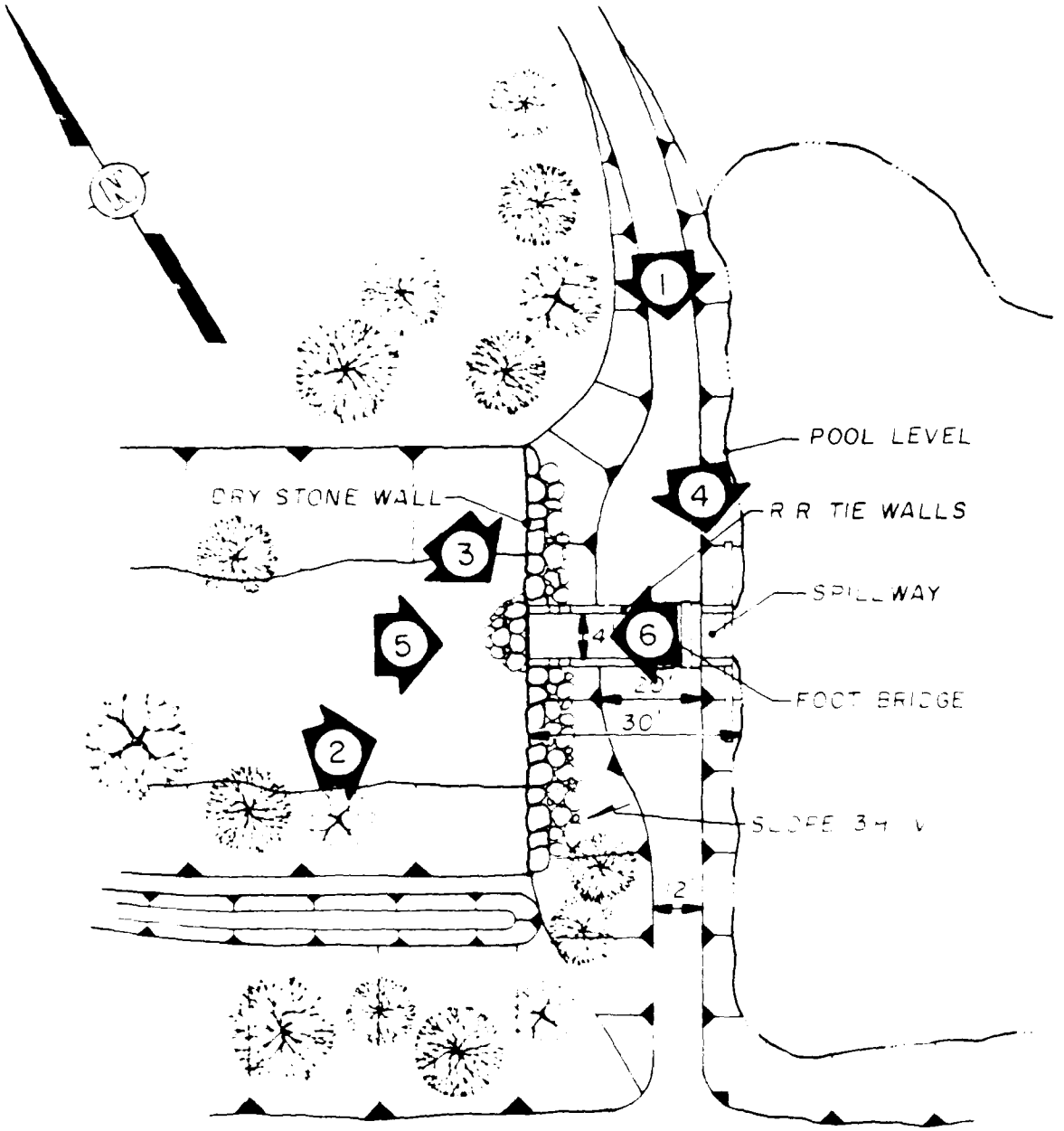
MAXIMUM NONDAMAGING DISCHARGE: Spillway discharge capacity - 16 cfs

APPENDIX C

PHOTOGRAPHS

LIST OF PHOTOGRAPHS
TUSCARORA LAKE DAM
NDI I.D. NO. PA-0049
NOVEMBER 14, 1980

PHOTOGRAPH NO.	DESCRIPTION
1	Crest (looking south).
2	Downstream face of dam.
3	Spillway (downstream end).
4	Spillway (upstream end).
5	Downstream face and spillway.
6	Spillway discharge channel.
7	Houses - West Auburn (mile 1.5).
8	House - West Auburn (mile 1.5).



LEGEND

2 — INDICATES DIRECTION IN WHICH PHOTOGRAPH WAS TAKEN

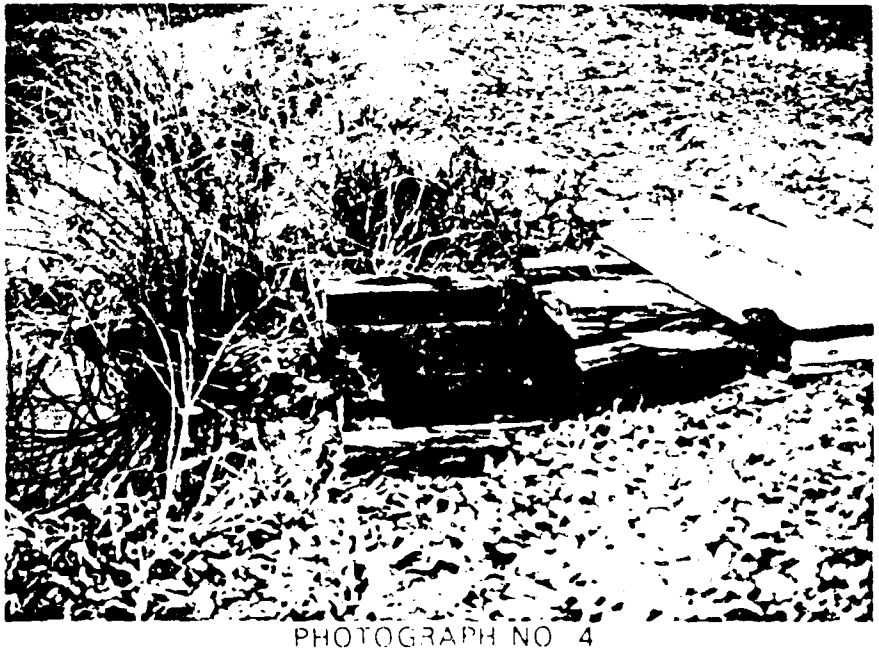
TUSCARORA LAKE DAM
KEY PLAN OF PHOTOGRAPHS
FIELD INSPECTION DATE NOV 4, 19[illegible]

DIAPPOLONIA

PHOTOGRAPH NO 1

PHOTOGRAPH NO 2

PHOTOGRAPH NO 3



PHOTOGRAPH NO 4

PHOTOGRAPH NO. 5

PHOTOGRAPH NO. 6

PHOTOGRAPH NO. 7

PHOTOGRAPH NO. 8

APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Tuscarora Lake Dam

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

STATION	1	2	3	4	5
Station Description	Tuscarora Lake	Tuscarora Lake Dam			
Drainage Area (square miles)	0.95	-			
Cumulative Drainage Area (square miles)	0.95	0.95			
Adjustment of PMF for Drainage Area (%)(1)	95%				
6 Hours	117	-			
12 Hours	127	-			
24 Hours	136	-			
48 Hours	145	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone(2)	11	-			
C_p/C_t(3)	0.62/1.5	-			
L (miles)(4)	1.33	-			
L_{ca} (miles)(4)	0.66	-			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	1.44	-			
Spillway Data					
Crest Length (ft)	-	4			
Freeboard (ft)	-	1.2			
Discharge Coefficient	-	3.1			
Exponent	-	1.5			

(1) Hydrometeorological Report 40, U.S. weather Bureau, 1965.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (acres)(1)	ΔVOLUME (acre-feet)(2)	STORAGE (acre-feet)
1161 (Spillway Crest El.)		68.9		0
	19		1734.6	
1180		115.7		1734.6
	20		2664.0	
1200		151.5		4398.6

(1) Planimetered from USGS maps.
(2) $\Delta Volume = \Delta H/3 \ (A_1 + A_2 + \sqrt{A_1 A_2})$.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  21 APR 80
**********
    1                A1       SNYDER UNIT HYDROGRAPH, SPILLWAY AND DAM OVERTOPPING ANALYSES
    2                A2       TUSCARORA LAKE,(DER 58-27),SUSQUEHANNA COUNTY,  PROJECT NO.80-556-08
    3                A3       FOR 10%,20%,30%,40%,50%,60%,70%,80%,AND 100% PROBABLE MAXIMUM FLOOD(PMF)
    4                H     300        0       10        0        0        0        0        0       -4        0
    5                B1      5
    6                J       1        9        1
    7                J1   0.10     0.20     0.30     0.40     0.50     0.60     0.70     0.80     1.00
    8                K       0        1                                           1
    9                K1       CALCULATION OF SNYDER INFLOW HYDROGRAPH TO TUSCARORA LAKE,(DER 58-27)
   10                M       1        1     0.95              0.95                                    1
   11                P                21.1      117      127      136      145
   12                T                                                     1.0      0.5           0.1137
   13                W    1.44     0.62
   14                X    -1.5    -0.05      2.0
   15                K       1        2                                           1
   16                K1       ROUTING FLOW THROUGH TUSCARORA LAKE,(DER 58-27)
   17                Y                                        1        1
   18                Y1      1                                                -1161.0
   19                $A   68.9    115.7    151.5
   20                $E 1161.0  1180.0   1200.0
   21                $S 1161.0     4.0     3.08      1.5
   22                $D 1162.2     2.65     1.5    335.0
   23                $L   50.0    100.0    200.0    250.0    295.0    320.0    335.0
   24                $V 1162.2  1162.9   1163.1   1163.7   1164.1   1165.9   1167.4
   25                K      99
```

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .60	RATIO 7 .70	RATIO 8 .80	RATIO 9 1.00
HYDROGRAPH AT	1	.95 (2.46)	1	258. (7.31)	516. (14.61)	774. (21.92)	1032. (29.22)	1290. (36.53)	1548. (43.84)	1806. (51.14)	2064. (58.45)	2580. (73.06)
ROUTED TO	2	.95 (2.46)	1	15. (.44)	161. (4.56)	412. (11.68)	680. (19.27)	951. (26.93)	1223. (34.62)	1495. (42.33)	1765. (49.97)	2288. (64.79)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

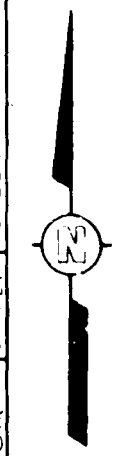
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1161.00	1161.00	1162.20
STORAGE	0.	0.	84.
OUTFLOW	0.	0.	16.

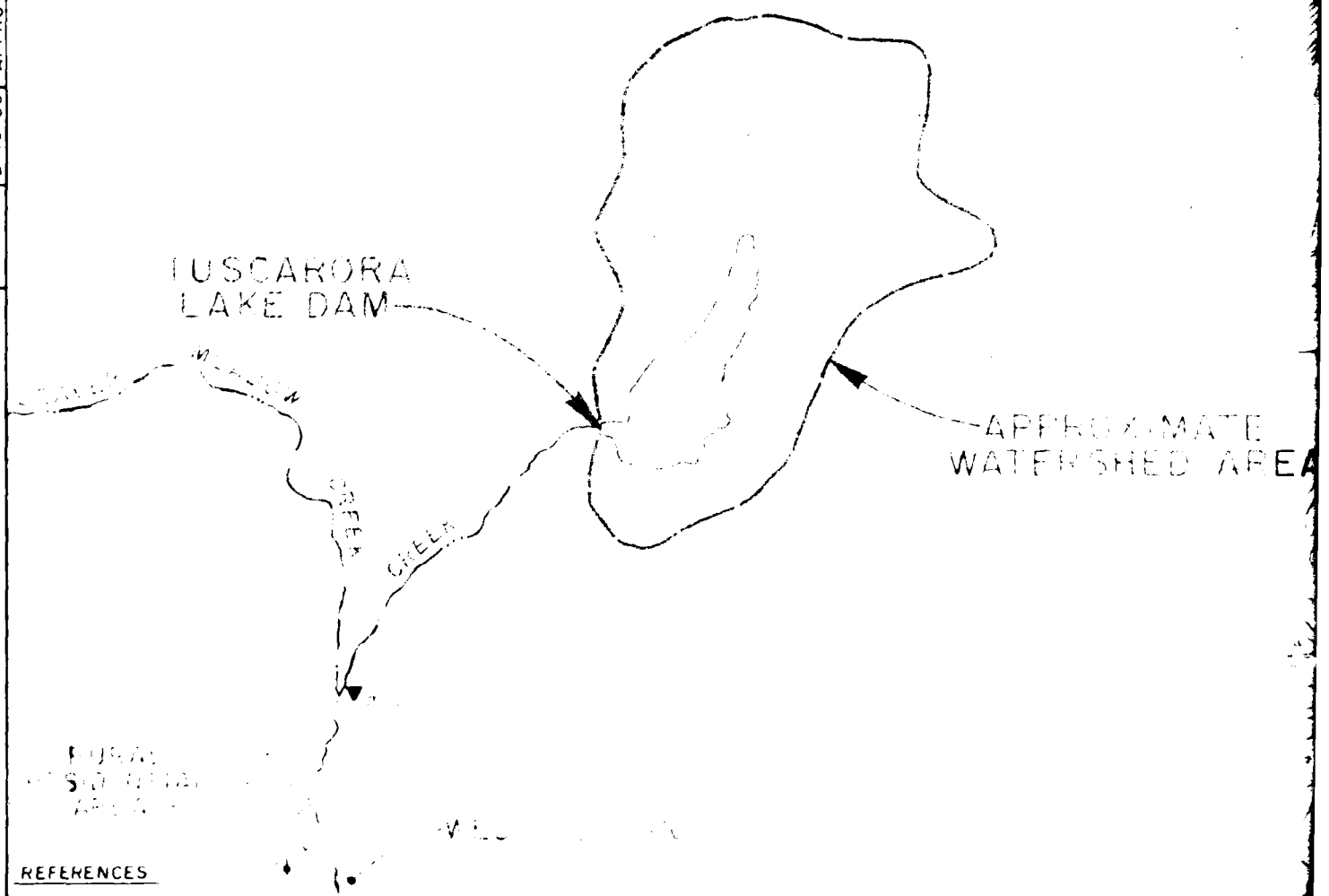
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1162.16	0.00	81.	15.	0.00	46.00	0.00
.20	1162.91	.71	136.	161.	9.00	43.83	0.00
.30	1163.35	1.15	168.	412.	9.67	43.00	0.00
.40	1163.65	1.45	190.	680.	10.17	42.50	0.00
.50	1163.89	1.69	208.	951.	10.50	42.17	0.00
.60	1164.09	1.89	224.	1223.	10.83	42.00	0.00
.70	1164.28	2.08	238.	1495.	11.00	41.83	0.00
.80	1164.45	2.25	251.	1765.	11.17	41.67	0.00
1.00	1164.75	2.55	274.	2288.	11.50	41.50	0.00

APPENDIX E

PLATES

DRAWN BY	ACS	CHECKED BY	BE	2-17-81	DRAWING NUMBER 80-556-B4
	12-15-80	APPROVED BY	CHK	2 17 81	



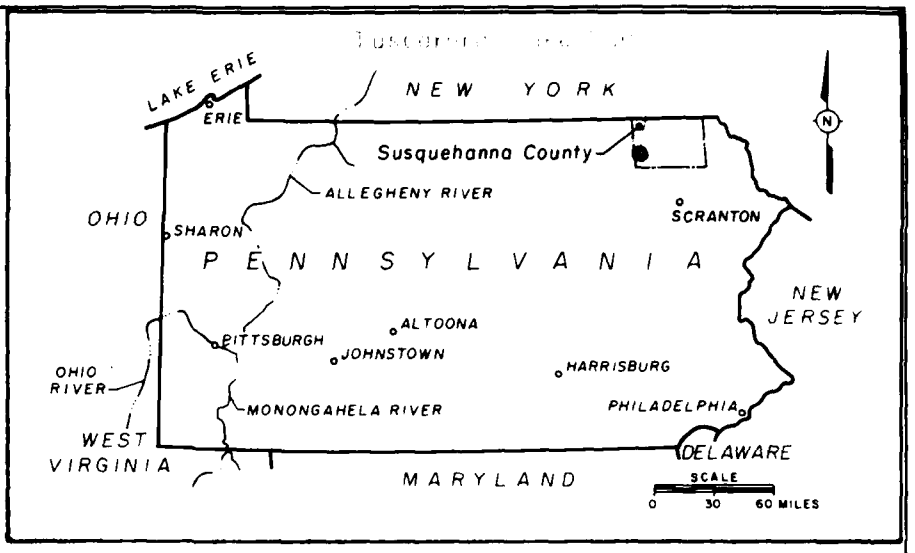


REFERENCES

1 U S G S AUBURN CENTER, PA QUADRANLE
PHOTOREVISED 1969, SCALE 1 24000

2 U S G S LAWTON, PA QUADRANGLE
PHOTOREVISED 1978, SCALE 1 24000

0



KEY PLAN

PPROXIMATE
TERSHED AREA

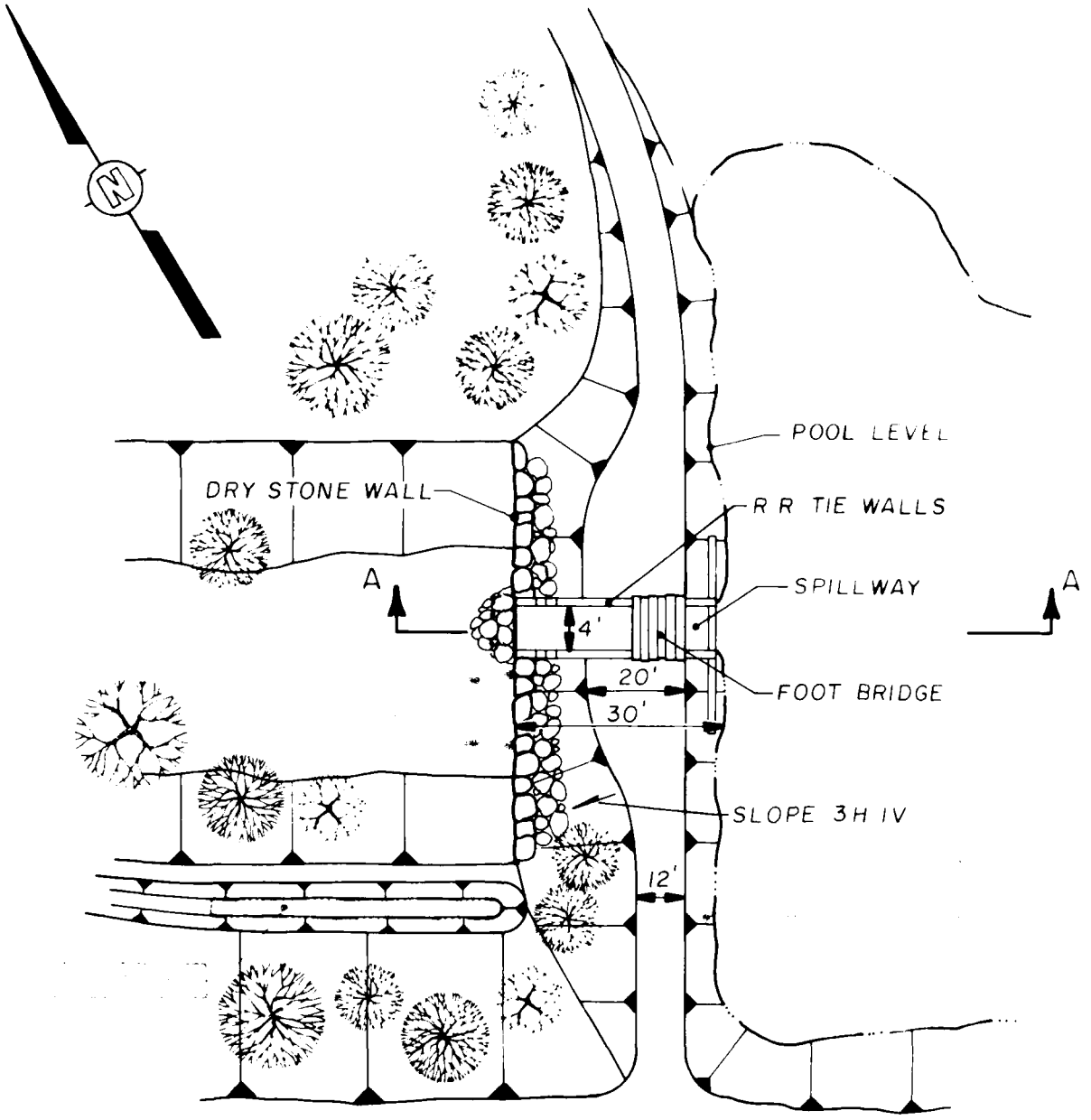
PLATE I

TUSCARORA LAKE DAM
VICINITY FLOOD PLAIN & WATERSHED MAP

SCALE
0 2000 4000 6000 FEET

DIAPOLONIA

DRAWN BY	ACS	CHECKED BY	JE	2-17-81	DRAWING NUMBER 80-556-A11
	11-21-80	APPROVED BY	JHD	2-17-81	



NOTE

POOL LEVEL AT DATE OF INSPECTION
~4" BELOW SPILLWAY CREST

SECTION A-A

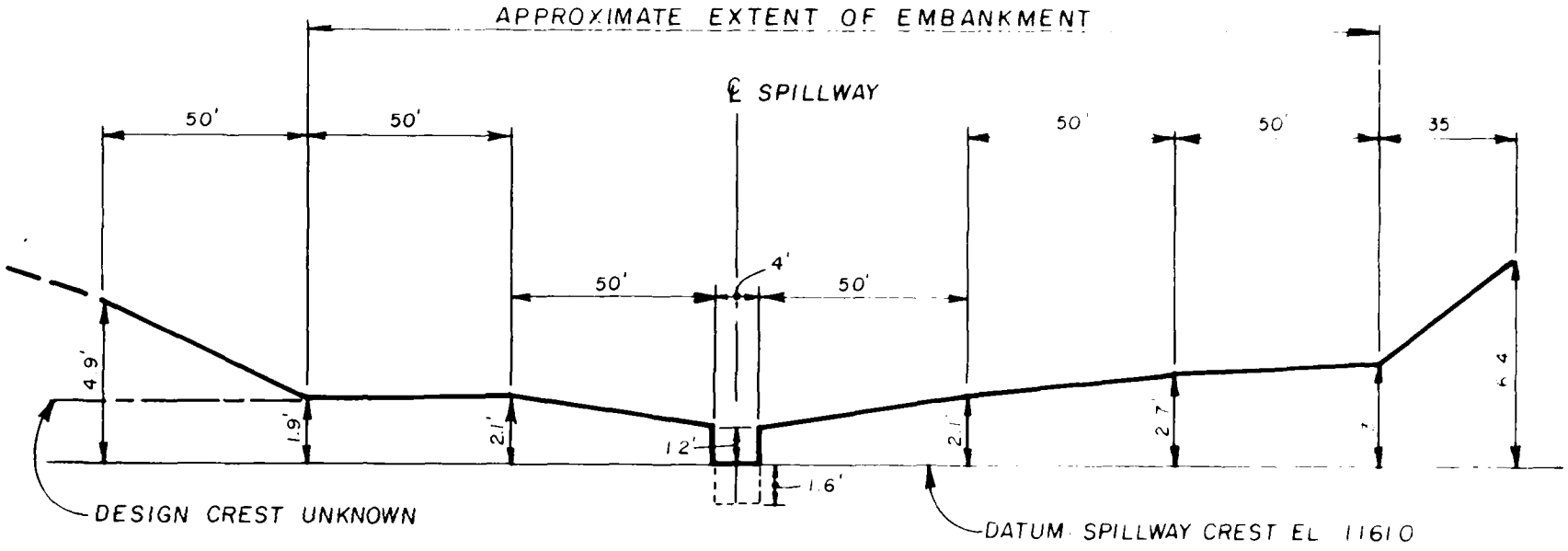
NOT TO SCALE

PLATE 2

TUSCARORA LAKE DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE NOV 14,1980

DAPOLONIA

DRAWN BY	MBM	CHECKED BY			DRAWING NUMBER	80 556 A12
	12 26 80	APPROVED BY				



DAM CREST PROFILE
(LOOKING DOWNSTREAM)

NOTES

1 DAM CREST WAS SURVEYED RELATIVE TO SPILLWAY CREST LEVEL

2 DATUM ELEVATION PER USGS MAP

PLATE 3

TUSCARORA LAKE DAM
DAM CREST SURVEY
FIELD INSPECTION DATE NOV 26, 1980

APPENDIX F

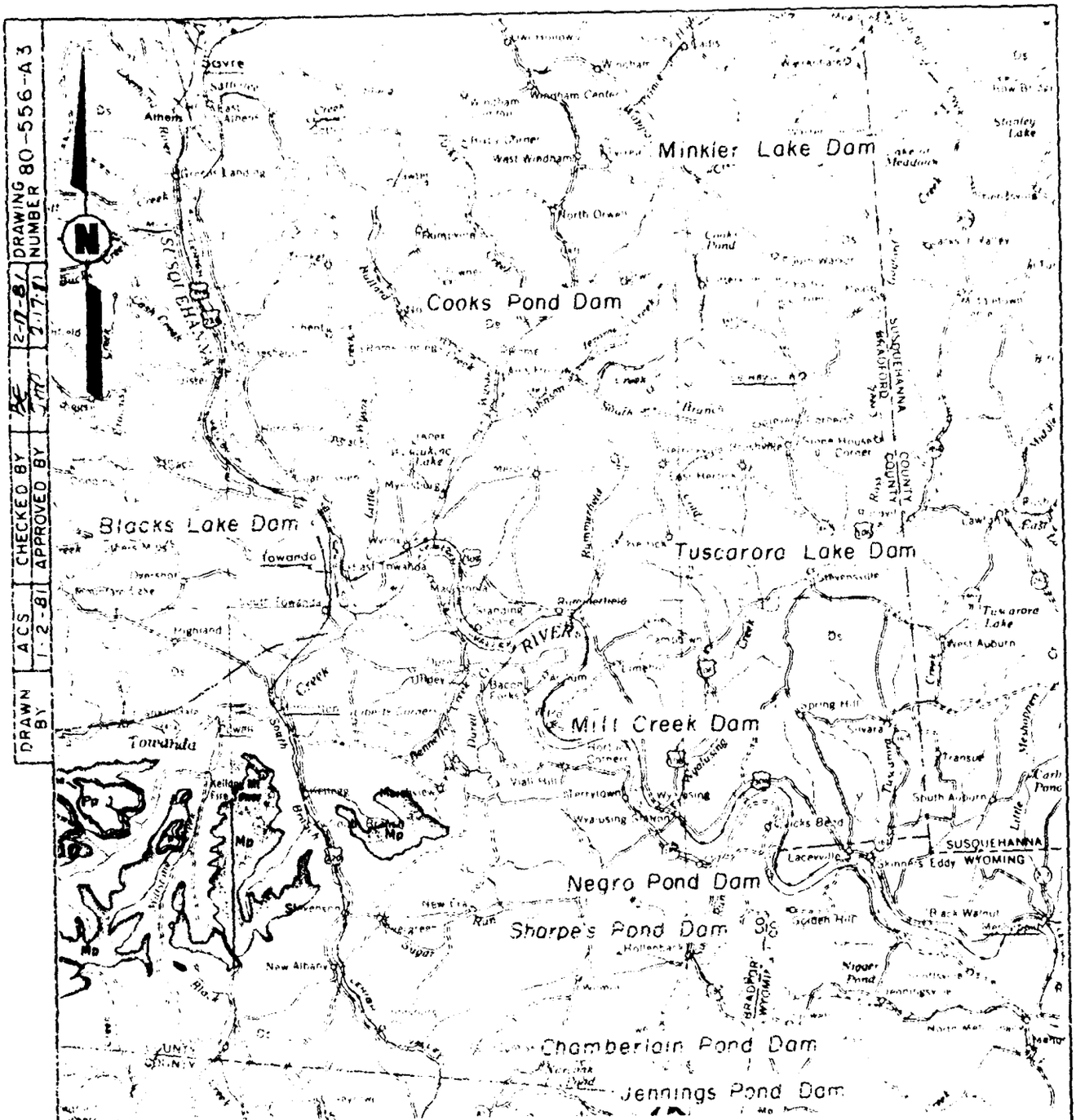
REGIONAL GEOLOGY

REGIONAL GEOLOGY
TUSCARORA LAKE DAM

The Tuscarora Lake Dam is located in the glaciated low plateaus section of the Appalachian Plateau physiographic province, characterized as a mature glaciated plateau of moderate relief.

The geologic structure consists of a series of northeast trending folds (approximately N20°E) which plunge gently to the southwest. The dip of the limbs of the folds in the vicinity of the Tuscarora Lake Dam is less than two degrees, with the southeast limb steeper than the northwest limb. The dam is located on the axis of a small syncline located between the Wilmot Anticline to the south and the Towanda Anticline to the north. In general, the discontinuity trends are northeast and northwest.

The stratigraphy consists of glacial till which will range in thickness from very thin to approximately 200 feet. The glacial till is underlain by the Devonian Catskill Formation, which is approximately 1,800 feet thick in this area. The Catskill Formation is continental in origin, consisting of red shale, cross-bedded red and green sandstone and siltstone, with a few thin layers of conglomerates and coal. The shale strata tend to weather rapidly when exposed.


Minkler Lake Dam
Cooks Pond Dam
Blacks Lake Dam
Tuscarora Lake Dam
Mill Creek Dam
Negro Pond Dam
Sharpe's Pond Dam
Chamberlain Pond Dam
Jennings Pond Dam
Towanda
Athens
Sayre
SUSQUEHANNA
WYOMING
SCALE
0 2 4 6 8 10 miles
GEOLOGY MAP
REFERENCE
GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPARTMENT OF ENVIRONMENTAL RESOURCES DATED 1980
SCALE 1:250,000
DRAWING NUMBER 80-556-A3
CHECKED BY
APPROVED BY
ACS 1-2-81
DRAWN BY
DAMPOLONIA

DRAWN BY	ACS 1-2-81	CHECKED BY	2-17-81	DRAWING NUMBER 80-556-A4
		APPROVED BY	2-17-81	

PENNSYLVANIAN

APPALACHIAN PLATEAUS

Pa

Allegheny Group

Pd

Dunkard Group

CENTRAL AND EASTERN PENNSYLVANIA

Pu

MISSISSIPPIAN

Mmc

Mauch Chunk Formation

Mp

Pocono Formation

DEVONIAN

UPPER

CENTRAL AND EASTERN PENNSYLVANIA

Dhc

Oswayo Formation

Dk

Catskill Formation

Mahantango Shale

Dc

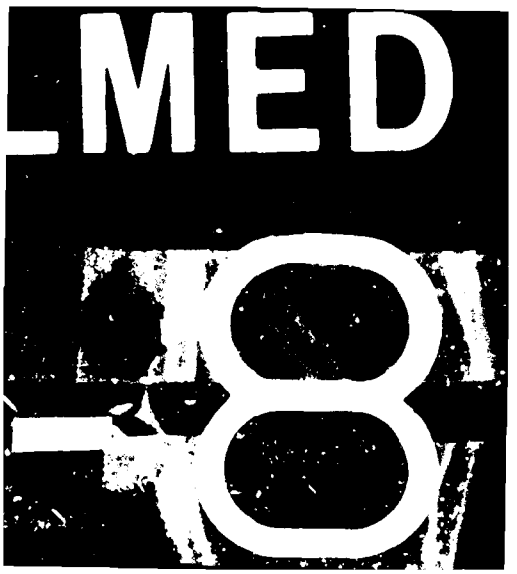
Onondaga Limestone

GEOLOGY MAP LEGEND

REFERENCE

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPARTMENT OF ENVIRONMENTAL RESOURCES DATED 1980
SCALE 1:250,000

D'APPOLONIA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