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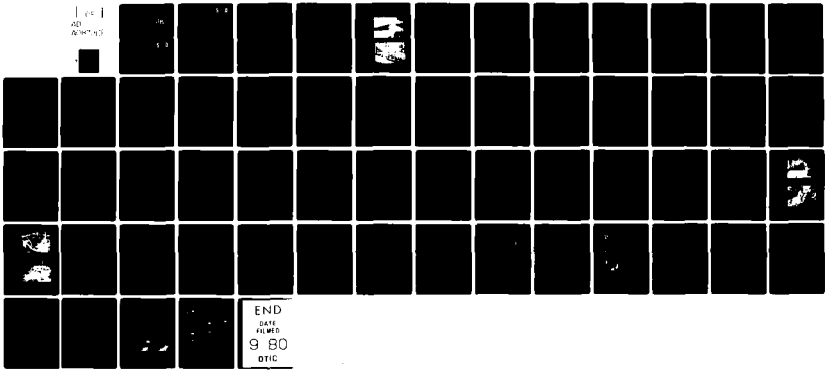

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OHIO RIVER BASIN
UNNAMED TRIBUTARY OF TWO LICK CREEK, INDIANA COUNTY

PENNSYLVANIA

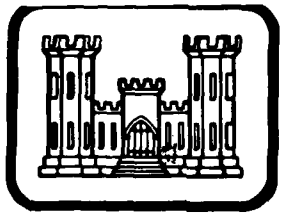
LEVEL II

GRACETON DAM

NDI I.D. NO: PA-00279
DER I.D. NO: 32-25

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

D'APPOLONIA CONSULTING ENGINEERS
DACW31-80-C-0022



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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

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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 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: Graceton Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Indiana
STREAM: An Unnamed Tributary of Two Lick Creek
SIZE CLASSIFICATION: Small
HAZARD CLASSIFICATION: Significant
OWNER: Lower Indiana County Municipal Authority
DATE OF INSPECTION: March 18, 1980 and March 19, 1980

ASSESSMENT: Based on the evaluation of the existing conditions, the condition of Graceton Dam is considered to be poor. A portion of the spillway discharge chute was collapsed, causing erosion on the embankment side of the spillway discharge channel. An active landslide on the abutment side of the spillway discharge channel is threatening to block the channel. Swampy areas and ponded water below the toe of the dam suggest the presence of underseepage through the embankment. The dam is overgrown with brush and trees up to 1-1/2 feet in diameter, and it appears that it is not being maintained. A portion of the downstream slope at the middle of the embankment near the toe level was found to have been excavated. The owner indicated that the excavation was done in an attempt to locate a blocked supply pipe through the embankment.

The flood discharge capacity of the dam was evaluated according to the recommended procedure and was found to pass 10 percent of the probable maximum flood (PMF) without overtopping the embankment. This capacity is less than the recommended spillway capacity range of 100-year flood to 50 percent PMF, the upper limit of which is considered to be applicable to the dam considering the height of the dam and downstream damage potential. Therefore, the flood discharge capacity is classified to be inadequate.

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

1. The owner should immediately retain an experienced professional engineer to prepare and execute plans for the repair and restoration of the embankment, spillway structures, and outlet facilities or to develop a procedure for orderly abandonment of the dam. Repairs and restoration should include, but not be limited to, the following work:

a. Conduct additional detailed hydrologic and hydraulic studies to more accurately ascertain the spillway capacity.

b. Take the necessary steps to prevent blockage of the spillway discharge channel by the active landslide located on the left abutment.

c. Provide an emergency drawdown facility.

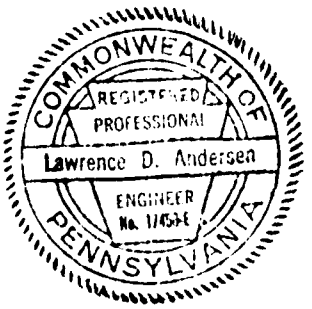
d. Backfill the excavated portion of the downstream slope of the embankment and the low areas on the crest of the dam.

e. Provide adequate surface drainage to the area below the toe of the dam.

f. Clear brush and trees on the embankment.

2. 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.

3. The dam and appurtenant structures should be inspected regularly and a formal maintenance manual should be developed for the future maintenance of the dam.



Lawrence D. Andersen, P.E.
Vice President

June 18, 1980
Date

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

11 July 1980
Date

GRACETON DAM
NDI I.D. PA-279
DER I.D. 32-25
MARCH 18, 1980

Upstream Face

Downstream Face

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
GRACETON DAM
NDI I.D. PA-279
DER I.D. 32-25

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. Graceton Dam consists of an earth embankment approximately 250 feet long with a maximum height of approximately 26 feet from the downstream toe. The crest width is approximately 10 feet. A 10-foot-wide berm is located on the downstream slope at about midheight of the embankment. The downstream slope of the embankment is approximately 1.5H to 1V above the berm and 2.5H to 1V below that level.

The flood discharge facilities for the reservoir consist of a concrete overflow structure located on the left abutment (looking downstream). The overflow section is approximately 15 feet wide and 3 feet deep and discharges onto an approximately 30-foot-long concrete chute.

According to the previous inspection reports, the outlet facilities consist of two cast-iron pipes 4 and 6 inches in diameter. The location of the pipes and the manner in which flow through these pipes is controlled is unknown. In the design drawings, flow through these pipes is shown to be controlled by valves located in a valve chamber on the downstream side of the dam. However, this valve chamber could not be located at the site during this inspection. As it presently exists, the dam has no functional emergency drawdown facilities.

b. Location. Graceton Dam is located on an unnamed tributary of Two Lick Creek approximately one mile east of Coral in Center

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Township, Indiana County, Pennsylvania. Plate 1 shows the location of the dam.

c. Size Classification. Small (based on 26-foot height and 21 acre-feet maximum storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. Below the dam for approximately 1000 feet, the stream flows through a narrow uninhabited valley. Then, the valley widens and the stream flows under U.S. Route 119 approximately one mile downstream from the dam. Residential areas of the town of Coral are located in the vicinity of the Route 119 underpass. It is estimated that failure of the dam may cause loss of a few lives and property damage in the residential areas of the town of Coral. It is estimated that flooding in the vicinity of Coral is likely to be shallow.

e. Ownership. Lower Indiana County Municipal Authority (address: Ms. Evelyn J. DeMarines, P.O. Box 444, Black Lick, Pennsylania 15716).

f. Purpose of Dam. The dam was built for industrial water supply. Presently, the dam is reportedly serving a single customer, a farm approximately 1000 feet downstream from the dam.

g. Design and Construction History. The dam was designed by C. W. Knight and Sons, engineers from Rome, New York, and built by the original owner, The Potter Coal and Coke Company, prior to 1917. In 1921, the dam was enlarged by the placement of additional fill on the downstream face of the dam.

h. Normal Operating Procedure. The reservoir is normally maintained at the crest level of the uncontrolled spillway. When the lake is at or above the spillway crest level, inflow is discharged through the uncontrolled spillway.

1.3 Pertinent Data. Elevations referred to in this and subsequent sections of the report were calculated based on field measurements assuming the spillway crest level (normal pool level) to be at Elevation 1129.2 (USGS Datum), which is indicated to be the normal pool elevation of the reservoir according to the design files and which generally agrees with the current USGS topographic maps. Elevations shown in Plate 2 are relative to an arbitrary sites datum which is not in conformance with the current USGS datum.

a. Drainage Area	0.65 square mile
b. Discharge at Dam Site (cfs)	
Maximum known flood at dam site	Unknown

Outlet conduit at maximum pool	Not applicable[1]
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	149
Total spillway capacity at maximum pool	149

c. Elevation (USGS Datum) (feet)

Top of Dam	1131.4 (measured low spot); 1132 (design elevation)
Maximum pool	1131.4
Normal pool	1129.2
Upstream invert outlet works	Unknown
Downstream invert outlet works	Unknown
Maximum tailwater	Unknown
Toe of Dam	1105±

d. Reservoir Length (feet)

Normal pool level	450
Maximum pool level	500±

e. Storage (acre-feet)

Normal pool level	12
Maximum pool level	21±

f. Reservoir Surface (acres)

Normal pool level	1.8
Maximum pool level	3.7±

g. Dam

Type	Earth
Length	250 feet
Height	26 feet
Top width	10 feet
Side slopes	Downstream: 1.5H:1V (above berm), 2.5H:1V (below berm); Upstream: 2H:1V
Zoning	Unknown

[1] The dam has no functional outlet facilities.

Impervious core	Unknown
Cutoff	Unknown
Grout Curtain	None

h. Regulating Outlet[1]

Type	6-inch cast-iron pipe
Length	Unknown
Closure	Unknown
Access	Inaccessible
Regulating facilities	None

i. Spillway

Type	Rectangular open channel
Length	15 feet, 2.8 feet deep
Crest elevation	1129.2
Upstream channel	Lake
Downstream channel	Earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available data consist of files provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), which contain design drawings, limited correspondence, and several past inspection reports.

(1) Hydrology and Hydraulics. The available information includes the design capacity of the spillway.

(2) Embankment. The available information consists of a design drawing and description of the embankment included in the past inspection reports.

(3) Appurtenant Structures. The available information consists of description of the appurtenant structures included in the previous inspection reports.

b. Design Features

(1) Embankment. As illustrated in Plate 2, the dam appears to be a homogeneous embankment. A Commonwealth report dated June 2, 1919, indicates that the dam was designed by C. W. Knight and Sons, engineers from Rome, New York prior to 1917. The same report indicates the embankment material consisted of clay mixed with sand and gravel excavated from the reservoir area. No other information was found relative to the design of the dam.

(2) Appurtenant Structures. The appurtenant structures consist of an open channel spillway located on the left abutment and an outlet works. The spillway consists of a rectangular overflow section approximately 15 feet wide and about 3 feet deep, discharging into a 30-foot-long concrete chute. The concrete chute in turn discharges into an earth channel. According to the 1919 Commonwealth report, the outlet facilities consist of two cast-iron pipes, 4 and 6 inches in diameter. No other information was found relative to the details of the outlet facilities.

c. Design Data

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

(2) Embankment. Other than a design drawing, no engineering data are available on the design of the embankment.

(3) Appurtenant Structures. No design data are available on the appurtenant structures.

2.2 Construction. Available records indicate the dam was constructed prior to 1917 by the original owner, The Potter Coal and Coke Company. The exact date of construction is unknown. In 1921, the downstream slope of the dam was flattened by the construction of a berm and a toe buttress to remedy a slope failure and seepage problem which existed prior to 1921.

2.3 Operation. There are no formal operating records maintained for the dam.

2.4 Other Investigations. None reported.

2.5 Evaluation

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

b. Adequacy

(1) Hydrology and Hydraulics. No design information is available to assess the adequacy of the spillway.

(2) Embankment. No information is available to assess the structural adequacy of the embankment.

(3) Appurtenant Structures. No information is available to assess the structural adequacy of the appurtenant structures.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Graceton Dam consisted of:

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

2. Visual examination of the spillway structures.

3. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 3.

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 poor. The embankment is overgrown with trees up to 1-1/2 feet in diameter. Swampy areas and ponded water below the toe of the dam suggest the presence of underseepage through the embankment. However, no isolated seepage points were identified. An excavated area was found on the downstream slope of the dam located at about the center of the dam at a level halfway between the berm and the toe level. The owner indicated that the excavation was done in an attempt to locate a blocked supply line through the embankment. The upstream slope of the dam was found to have no erosion protection, such as riprap.

The crest of the dam was surveyed relative to the spillway crest elevation and it was found to be on the order of 0.5 to 0.8 foot below the top of the spillway wall, which appears to be the design crest level for the embankment. The dam crest profile is illustrated in Plate 4. The downstream slope was surveyed and the slopes were found to be reasonably within the design slopes which are 1.5H to 1V above the berm and 2.5H to 1V below the berm level.

c. Appurtenant Structures. The spillway structures were examined for deterioration and other signs of distress and obstructions that would limit flow. The spillway structures were found to be in poor condition. A portion of the spillway chute was found to have collapsed, causing erosion along the toe of the dike which is

separating the spillway discharge channel from the embankment. An active landslide was observed on the left abutment side of the spillway discharge channel, threatening to block the spillway discharge channel. Two railroad rail sections were found installed in the spillway crest extending from the crest level to the top of the spillway wall. Apparently, these rails were installed with the intention of placing flashboards across the spillway. The presence of these steel sections in the overflow section is considered to pose a potential for the blockage of the spillway with debris in the event of a major flood.

No portions of the outlet works were visible for inspection.

d. Reservoir Area. A map review and visual observations indicate that the watershed is predominantly covered by woodlands; however, portions have been strip mined. No signs of landslide activity in the vicinity of the reservoir were found. A review of the regional geology is included in Appendix F.

e. Downstream Channel. Below the dam, the stream flows through an uninhabited valley for approximately one mile where it flows under U.S. Route 119 near the town of Coral. A further description of the downstream conditions is included in Section 1.2d.

3.2 Evaluation. The overall condition of the dam is considered to be poor. The embankment, spillway structures, and outlet facilities are in need of repair and restoration or orderly abandonment.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. There are no formal operating procedures for the dam. As it presently exists, the reservoir is normally maintained at the crest level of the uncontrolled spillway.

4.2 Maintenance of the Dam. The visual observations indicate that the dam has essentially been abandoned. Maintenance is nonexistent.

4.3 Maintenance of Operating Facilities. The dam has no visible operating facilities. According to the owner, a portion of the downstream slope of the dam has been recently excavated to locate and clean a blocked supply line through the embankment.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via a farm located about 1000 feet from the dam.

4.5 Evaluation. The visual observations indicate that the dam is essentially abandoned and is no longer maintained.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Graceton Dam has a watershed of 0.65 square mile and impounds a reservoir with a surface area of 1.8 acres at normal pool level. The flood discharge facilities consist of an open channel spillway located near the left abutment. The spillway is approximately 15 feet wide and 2.8 feet deep. The capacity of the spillway, based on the available 2.2 feet of freeboard relative to the low spot on the crest of the dam, was determined to be 149 cfs, as indicated in the computer output in Appendix D.

b. Experience Data. As previously stated, Graceton 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 from the 100-year flood to one-half PMF. In view of the downstream hazard potential, the upper limit of the recommended range is considered to be applicable to this dam.

The 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 717 cfs. The 100-year flood, calculated according to the recommended procedure, was found to have a peak flow of 773 cfs, which is in excess of the one-half PMF peak flow. It appears that due to the small watershed, the procedure used for calculating the PMF yields a low estimate for the peak discharge, causing the computed 100-year flood to be in excess of 50 percent of the computed PMF. Computer input and summary of computer output for the PMF analysis and the 100-year flood calculations are included in Appendix D.

c. Visual Observations. Although the presence of rail sections in the spillway overflow section was considered to pose a potential for blockage of the spillway by debris which would reduce the spillway discharge capacity, no reduction in the capacity was considered for the purpose of evaluating the adequacy of the spillway. Similarly, a potential for reduction in the capacity of the spillway exists in the event the spillway discharge channel is blocked by the progressing landslide on the left abutment. As it presently exists, the landslide is not affecting the capacity of the spillway.

d. Overtopping Potential. Various percentages of the PMF inflow hydrograph were routed through the reservoir, and it was found that the spillway can pass 10 percent of the PMF without overtopping the embankment. It was found that during the passage of 50 percent PMF, the dam would be overtopped for a duration of 9.5 hours with a maximum depth of 0.7 foot over the low spot on the crest of the dam.

e. Spillway Adequacy. The spillway was found to pass 10 percent of the PMF, which is less than the required spillway capacity of 50 percent PMF. Therefore, the spillway capacity 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 the overall condition of the embankment was considered to be poor, none of the observations were found to be serious relative to the overall stability of the dam at this time.

(2) Appurtenant Structures. The spillway structures were found to be in poor condition and partially collapsed. Ongoing erosion below the toe of the spillway chute is considered to be threatening the overall stability of the spillway structures. No portions of the outlet facilities were visible to assess their structural condition.

b. Design and Construction Data

(1) Embankment. The available information does not include any data to aid in the assessment of the structural stability of the dam. However, as previously noted, the deficiencies observed in the embankment were not considered to be serious relative to the overall stability of the dam at this time. Therefore, based on visual observations, the static stability of the dam is considered to be adequate.

(2) Appurtenant Structures. No information is available to assess the structural adequacy of the appurtenant structures.

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

d. Post-Construction Changes. In 1921, additional fill was placed on the downstream side of the dam, forming a 10-foot-wide berm at midheight of the embankment with a 2.5H to 1V slope below the berm level. This work was undertaken to remedy a slope failure and seepage problem that existed at the time.

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 hazard as a result of earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that Graceton Dam is in poor condition. The dam appears to have been abandoned and is no longer being maintained. The dam crest is irregular up to 0.8 foot below the design elevation. A portion of the downstream slope has been excavated. The spillway structures are in poor condition and have partially collapsed. An active landslide observed on the left abutment is threatening to block the spillway discharge channel. The reservoir has no functional emergency drawdown facilities.

In view of the above conditions, it is recommended that the overall condition of the dam be evaluated by a professional engineer to prepare plans to repair and restore the embankment, spillway structures, and outlet facilities or to develop a procedure for orderly abandonment. A spillway capacity of 10 percent of the PMF was found to be less than the recommended spillway capacity of 50 percent of the PMF. Therefore, the spillway is classified as inadequate.

b. Adequacy of Information. Available information, in conjunction with visual observations and the previous experience of the inspectors, is considered to be sufficient to make the following recommendations.

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

d. Necessity for Additional Data. In view of the conditions described above, the owner should retain a professional engineer to prepare and implement plans for restoration of the dam and to conduct additional hydrologic and hydraulic analyses to provide adequate spillway capacity or develop a procedure for orderly abandonment of the dam.

7.2 Recommendations/Remedial Measures. It is recommended that the following recommendations be implemented immediately or on a continuing basis:

1. The owner should immediately retain an experienced professional engineer to prepare and execute plans for the repair and restoration of the embankment, spillway structures, and outlet facilities or to develop a procedure for orderly abandonment of the

dam. Repairs and restoration should include, but not be limited to, the following work:

a. Conduct additional detailed hydrologic and hydraulic studies to more accurately ascertain the spillway capacity.

b. Take the necessary steps to prevent blockage of the spillway discharge channel by the active landslide located on the left abutment.

c. Provide an emergency drawdown facility.

d. Backfill the excavated portion of the downstream slope of the embankment and the low areas on the crest of the dam.

e. Provide adequate surface drainage to the area below the toe of the dam.

f. Clear brush and trees on the embankment.

2. 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.

3. The dam and appurtenant structures should be inspected regularly and a formal maintenance manual should be developed for future maintenance of the dam.

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Graceton Dam COUNTY Indiana STATE Pennsylvania ID# NDI I.D. PA-279 DER I.D. 32-25

TYPE OF DAM Earth HAZARD CATEGORY Significant

DATE(S) INSPECTION March 18, 1980 WEATHER Cloudy TEMPERATURE 30s

POOL ELEVATION AT TIME OF INSPECTION 1129.7 M.S.L. TAILWATER AT TIME OF INSPECTION 1105± M.S.L.

INSPECTION PERSONNEL:

B. Erel

W. T. Chan

REVIEW INSPECTION PERSONNEL:
(March 19, 1980)

E. D'Appolonia

J. H. Poellot

B. Erel

L. D. Andersen

OWNER'S REPRESENTATIVE:

None

B. 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	A portion of the downstream slope covering an area approximately 60 feet by 60 feet and located at the center of the embankment halfway between the berm and the toe level of the dam has been excavated to a depth of approximately 5 feet below the original slope surface (see Photograph No. 4).	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 4 for dam crest profile.	
RIPRAP FAILURES	The upstream slope has no erosion protection.	The upstream slope of the dam should be provided with adequate erosion protection.

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	There is an active landslide on the left abutment approximately 100 feet downstream from the dam which is threatening to block the spillway discharge channel.	Necessary steps should be taken to prevent blockage of the spillway discharge channel.
ANY NOTICEABLE SEEPAGE	There are swampy areas and ponded water below the toe of the dam. However, no isolated point of seepage was located.	
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	No portions of the outlet works were visible.	
INTAKE STRUCTURE	Submerged	
OUTLET STRUCTURE	Could not be located.	
OUTLET CHANNEL	None	
EMERGENCY GATE	None	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There are two railroad rail sections across the overflow weir that may pose a potential for blockage of the spillway by debris in the event of floods.	The railroad rail sections should be removed.
APPROACH CHANNEL	Lake	
DISCHARGE CHANNEL	Flow from the overflow section discharges into a concrete chute approximately 30 feet long. The right side (embankment side) has partially collapsed, causing water to erode the dike along the right side of the spillway discharge channel.	Spillway structures should be repaired. (See remarks above.)
BRIDGE AND PIERS	None	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable	
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE PIERS	Not applicable	
GATES AND OPERATION EQUIPMENT	Not applicable	

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	Moderately steep. No significant shoreline erosion was noted.	
SEDIMENTATION	The reservoir appears to be significantly silted.	
UPSTREAM RESERVOIRS	None	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	A landslide on the left abutment is threatening to block the spillway discharge channel.	
SLOPES	No features pertinent to the safety of the dam.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approximately three to six houses are located approximately one mile downstream from the dam and are likely to be in the potential flood plain. Population: aproximately 10 to 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 Graceton Dam

ID# NDI I.D. PA-279
DER I.D. 32-25

ITEM	REMARKS
AS-BUILT DRAWINGS	None available. A drawing available in the Commonwealth files illustrates repairs performed during 1921.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by C. W. Knight and Sons, engineers from Rome, New York, prior to 1917. The exact date of construction is unknown. The dam was constructed by the original owner, The Potter Coal and Coke Company.
TYPICAL SECTIONS OF DAM	See Plate 2.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	None available

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Not maintained
DESIGN REPORTS	None prepared
GEOLOGY REPORTS	None prepared
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not reported

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported
BORROW SOURCES	Unknown
MONITORING SYSTEMS	None
MODIFICATIONS	In 1921, additional fill was placed on the downstream slope to remedy a slope failure and seepage problem.
HIGH POOL RECORDS	Not recorded

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	Not available
OPERATING EQUIPMENT PLANS AND DETAILS	Not available

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 0.65 square mile

ELEVATION, TOP OF NORMAL POOL AND STORAGE CAPACITY: 1129 (12 acre-feet)

ELEVATION, TOP OF FLOOD CONTROL POOL AND STORAGE CAPACITY: 1131 (21 acre-feet)

ELEVATION, MAXIMUM DESIGN POOL: 1132

ELEVATION, TOP OF DAM: 1132 (as designed); 1131.4 (measured low spot)

SPILLWAY:

a. Elevation 1129.2

b. Type Concrete overflow section

c. Width 15 feet (perpendicular to flow)

d. Length Not applicable

e. Location Spillover Adjacent to spillway

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 6-inch cast-iron blow-off pipe

b. Location Unknown

c. Entrance Inverts Unknown

d. Exit Inverts Unknown

e. Emergency Drawdown Facilities Not functional at this time

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

c. Records None

MAXIMUM NONDAMAGING DISCHARGE: 150± cfs (existing spillway capacity)

APPENDIX C

PHOTOGRAPHS

LIST OF PHOTOGRAPHS
GRACETON DAM
NDI I.D. PA-279
DER I.D. 32-25
MARCH 18, 1980

PHOTOGRAPH NO.	DESCRIPTION
1	Crest (looking west).
2	Spillway.
3	Spillway discharge channel (looking upstream). Note tilting trees (landslide).
4	Downstream face (looking upstream). A recent excavation on the downstream face.

Photograph No. 1

Crest (looking west).

Photograph No. 2

Spillway.

Photograph No. 3

Spillway discharge channel (looking upstream). Note tilting trees (landslide).

Photograph No. 4

Downstream face (looking upstream). A recent [illegible] on the downstream face.

APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Graceton Dam (NDI I.D. PA-279)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.8 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	Lake	Dam			
Drainage Area (square miles)	0.6	-			
Cumulative Drainage Area (square miles)	0.6	0.6			
Adjustment of PMF for Drainage Area (%)[2]	(ZONE 7)				
6 Hours	102	-			
12 Hours	120	-			
24 Hours	130	-			
48 Hours	140	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone[3]	24	-			
C_p/C_t[4]	0.45/1.6	-			
L (miles)[5]	1.4	-			
L_{ca} (miles)[5]	0.8	-			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	1.66	-			
Spillway Data					
Crest Length (ft)	-	14.8			
Freeboard (ft)	-	2.8			
Discharge Coefficient	-	3.1[6]			
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.

[6] Assumed based on field observations.

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (ACRES)[1]	ΔVOLUME (ACRE-FEET)[2]	STORAGE (ACRE-FEET)
1129.2[3]	10.8	1.8	43.8	0
1140.0		3.7		43.8

[1] Planimetered from USGS maps.

[2] $\Delta Volume = \Delta H/3 \ (A_1 + A_2 + \sqrt{A_1 A_2})$.

[3] Normal pool elevation.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1       SNYDER UNIT HYDROGRAPH, FLOOD ROUTING AND DAM OVERTOPPING ANALYSES
    2                A2       GRACETON DAM, INDIANA COUNTY, NDI-I. D. PA 279          PROJECT NO. 79-543-16
    3                A3       FOR 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%,  AND 50% PMF
    4                B    300        0       10        0        0        0        0        0       -4        0
    5                B1     5
    6                J      1        9        1
    7                J1  0.05     0.10     0.15     0.20     0.25     0.30     0.35     0.40     0.50
    8                K      0        1                                                  1
    9                K1       CALCULATION OF SNYDER INFLOW HYDROGRAPH TO GRACETON DAM
   10                M      1        1     0.65             0.65                                      1
   11                P              23.8      102      120      130      140
   12                T                                                          1.0      .05             0.0047
   13                W   1.66     0.45
   14                X   -1.0    -0.05      2.0
   15                K      1        2                                          1
   16                K1       ROUTING FLOW THROUGH GRACETON DAM (NDI-I. D. PA. 279)
   17                Y                                          1        1
   18                Y1     1                                                -1129.2
   19                $A   1.8      3.7
   20                $E1129.2   1140.0
   21                $$1129.2     14 8     3.08      1.5
   22                $D1131.4     3.08      1.5    300.0
   23                $L 150.0    225.0    250.0    300.0
   24                $V1131.4   1131.5   1131.7   1131.9
   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 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .25	RATIO 6 .30	RATIO 7 .35	RATIO 8 .40	RATIO 9 .50
HYDROGRAPH AT	1	.65 (1.68)	1	72. (2.03)	143. (4.06)	215. (6.09)	287. (8.12)	359. (10.15)	430. (12.19)	502. (14.22)	574. (16.25)	717. (20.31)
ROUTED TO	2	.65 (1.68)	1	70. (1.98)	141. (3.98)	215. (6.09)	286. (8.11)	358. (10.14)	430. (12.18)	502. (14.21)	574. (16.24)	717. (20.30)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1129.20	1129.20	1131.40
STORAGE	0.	0.	4.
OUTFLOW	0.	0.	149.

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
.05	1130.53	0.00	3.	70.	0.00	41.67	0.00
.10	1131.32	0.00	4.	141.	0.00	41.67	0.00
.15	1131.58	.18	5.	215.	3.17	41.33	0.00
.20	1131.70	.30	5.	286.	4.50	41.33	0.00
.25	1131.79	.39	5.	358.	5.83	41.33	0.00
.30	1131.87	.47	5.	430.	6.83	41.33	0.00
.35	1131.95	.55	6.	502.	7.83	41.33	0.00
.40	1132.02	.62	6.	574.	8.50	41.33	0.00
.50	1132.14	.74	6.	717.	9.67	41.33	0.00

OVERTOPPING ANALYSIS SUMMARY

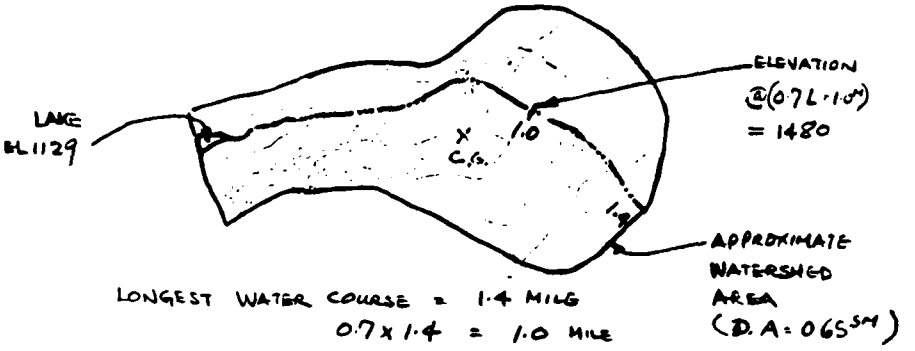
D'APPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 9/16/80 Subject GRACETON DAM Sheet No. 1 of 1
Chkd. By BE Date 4/23/80 100 YEAR FLOOD Proj. No. 79-543-16

100-YEAR FLOOD PEAK PER COE REGRESSION ANALYSIS

$$Q_{100,cfs} = 120.38 (DA \times S^{1/2})^{0.724}$$

where DA = DRAINAGE AREA, SQ.MI
S = SLOPE OF FIRST (0.7 x length) REACH IN FT/MILE



LONGEST WATER COURSE = 1.4 MILE
0.7 x 1.4 = 1.0 MILE
ELEVATION @ 1.0 MILE = 1480

$$\text{SLOPE} = \frac{1480 - 1129}{0.7L} = \frac{351}{1} = 351 \text{ FT/MILE}$$

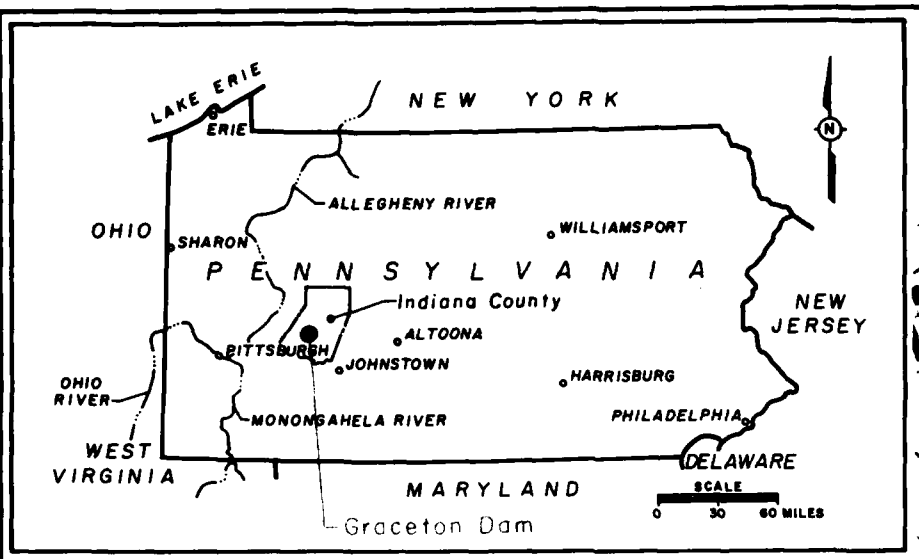
$$Q_{100} = 120.38 (0.65\sqrt{351})^{0.724}$$

$$= 773 \text{ cfs}$$

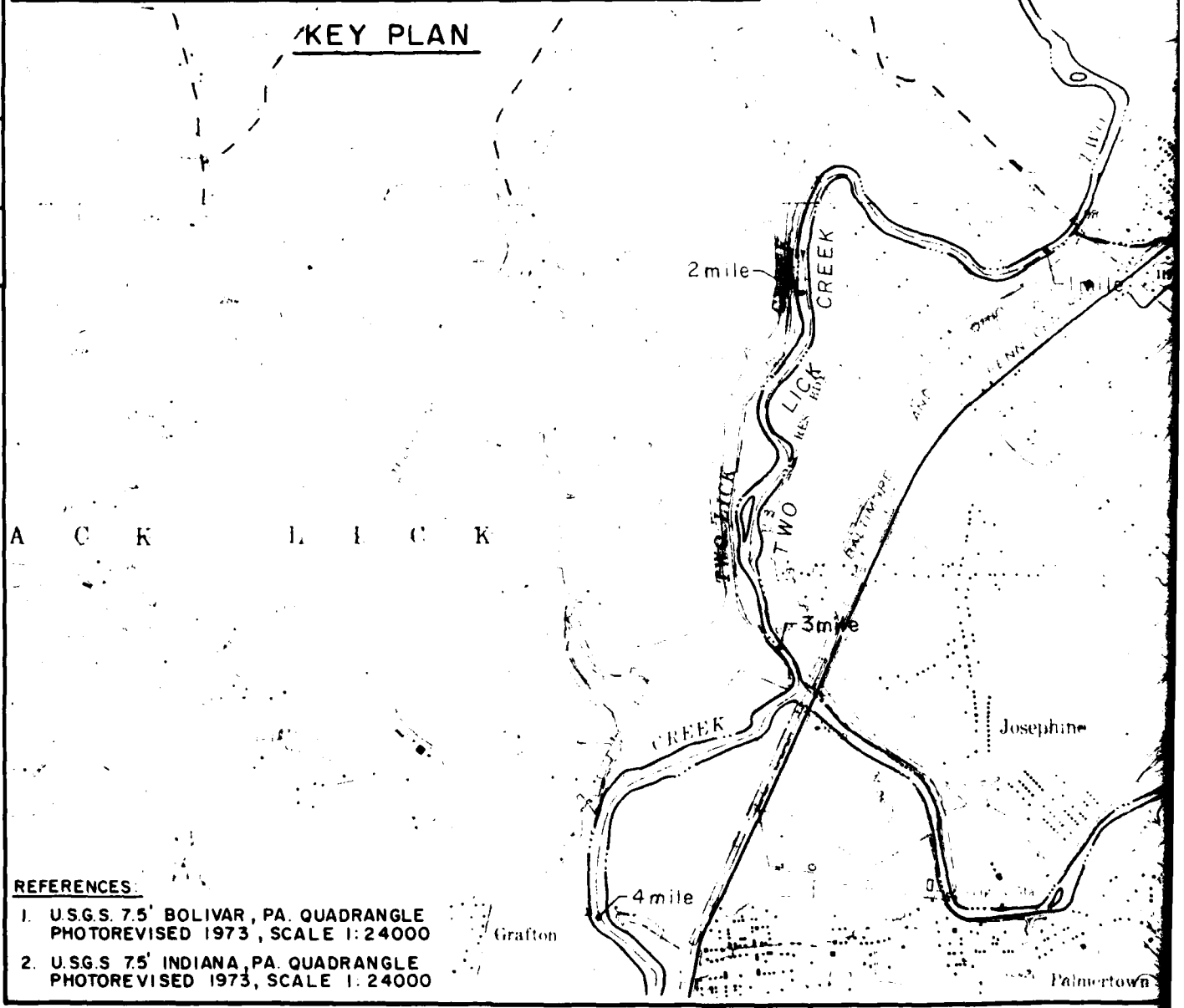
APPENDIX E

PLATES

DRAWN BY	ACS	CHECKED BY	JSC	DRAWING NUMBER	79-543-B62
	11-7-79	APPROVED BY	JAP		5-28-80



KEY PLAN



REFERENCES:

1. U.S.G.S. 7.5' BOLIVAR, PA. QUADRANGLE PHOTOREVISED 1973, SCALE 1:24000
2. U.S.G.S 7.5' INDIANA, PA. QUADRANGLE PHOTOREVISED 1973, SCALE 1:24000

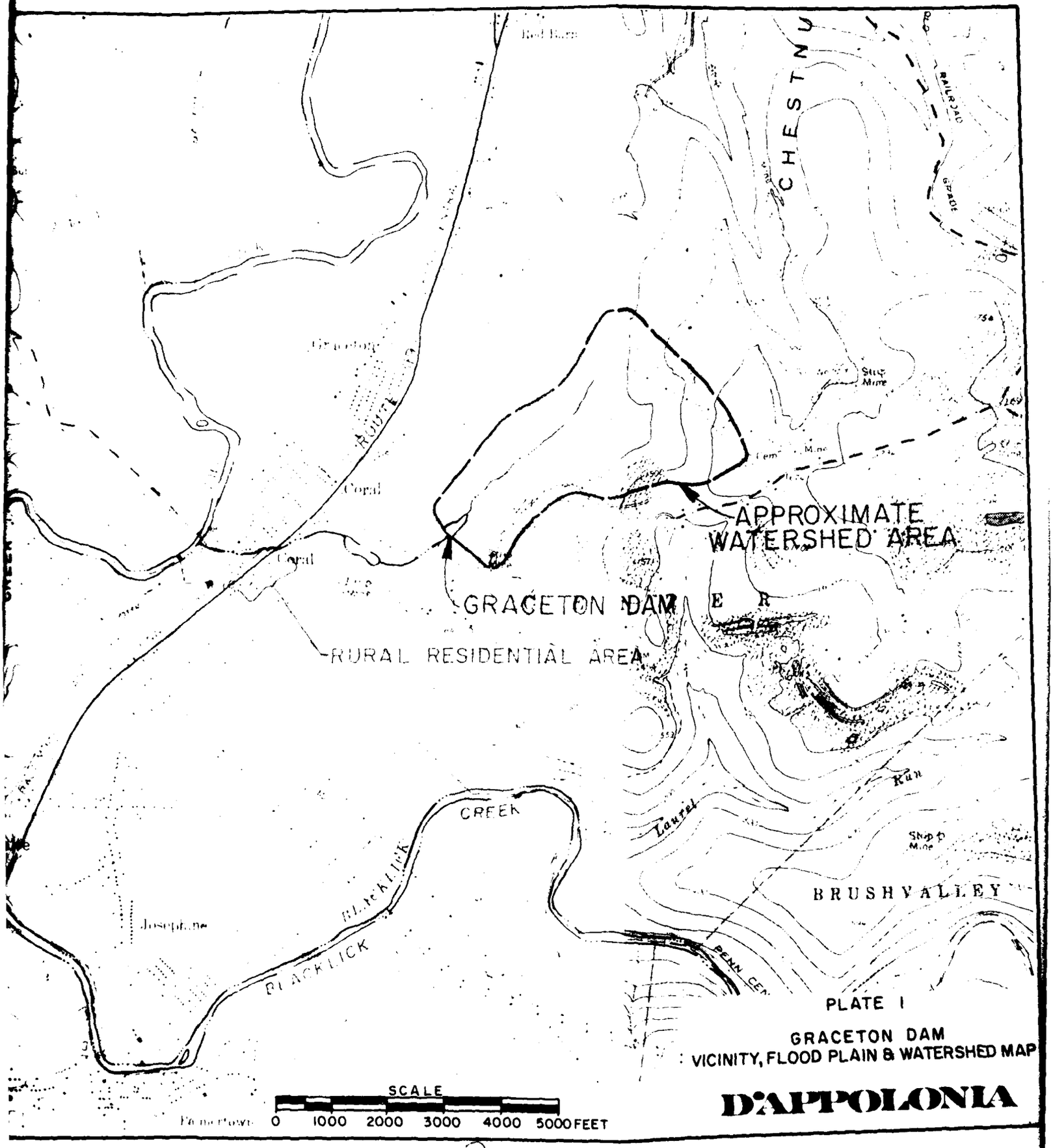
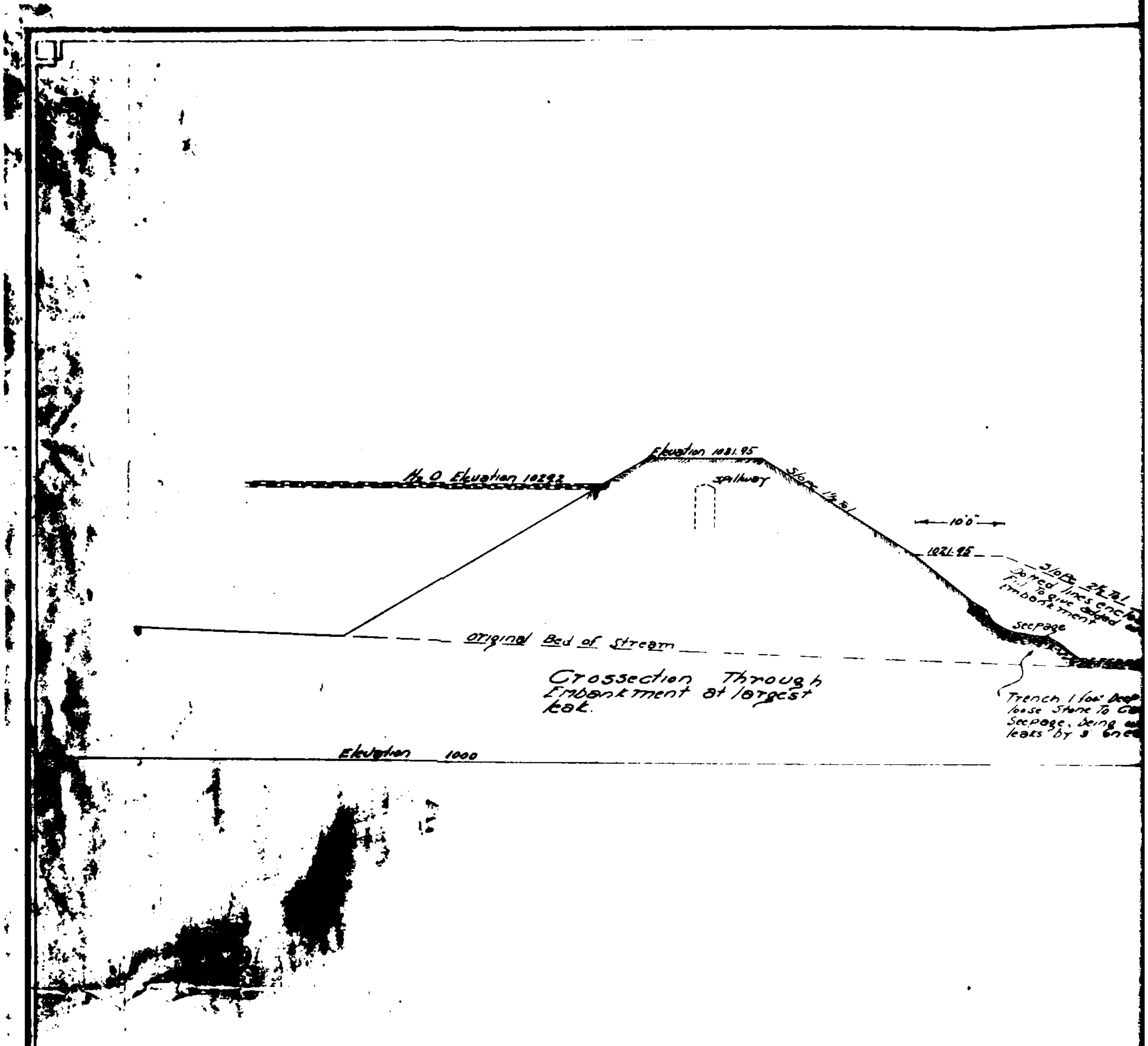


PLATE I

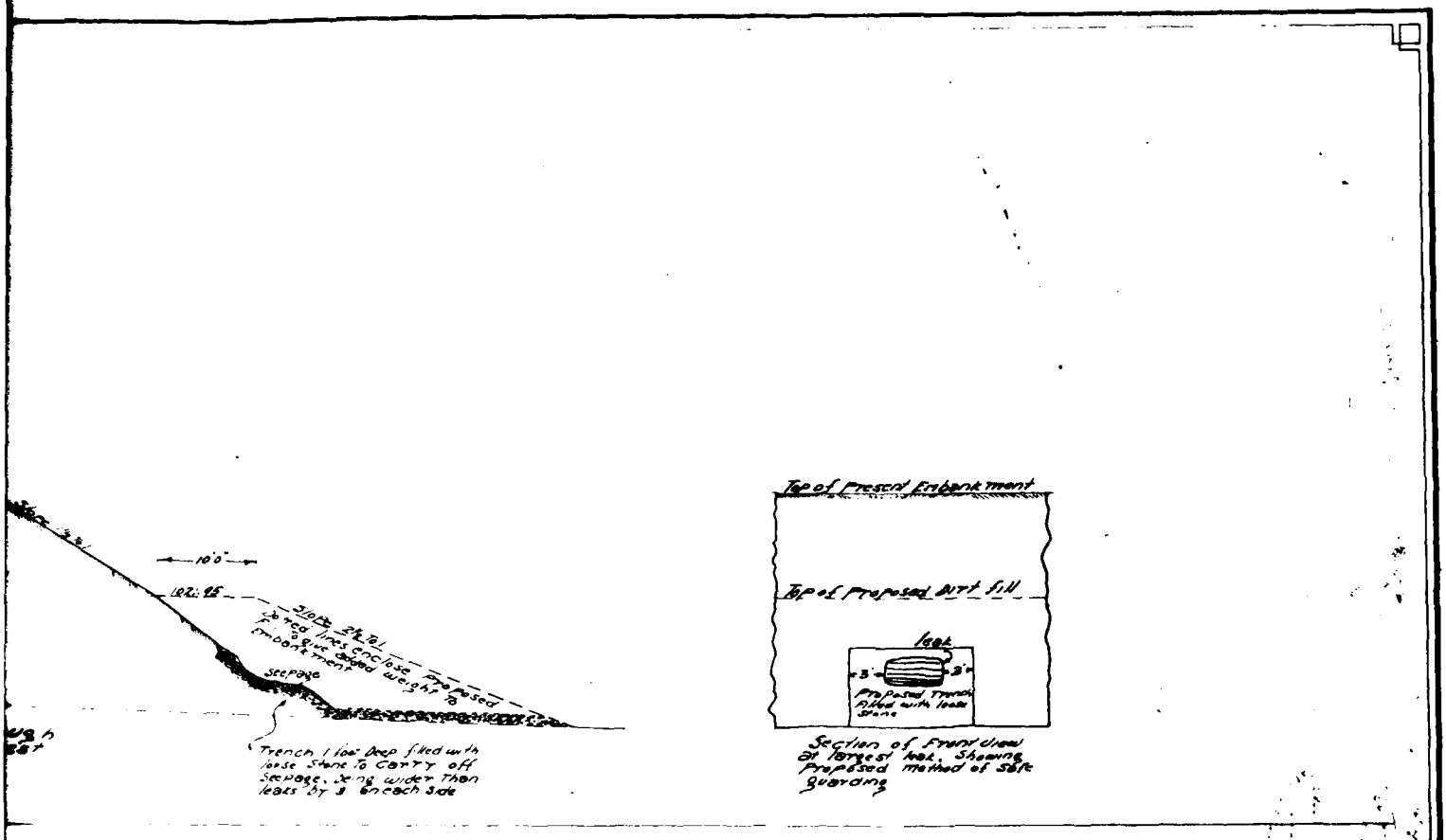
GRACETON DAM
VICINITY, FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY		DRAWING NUMBER
	5-28-80	APPROVED BY		79-543-B63



1



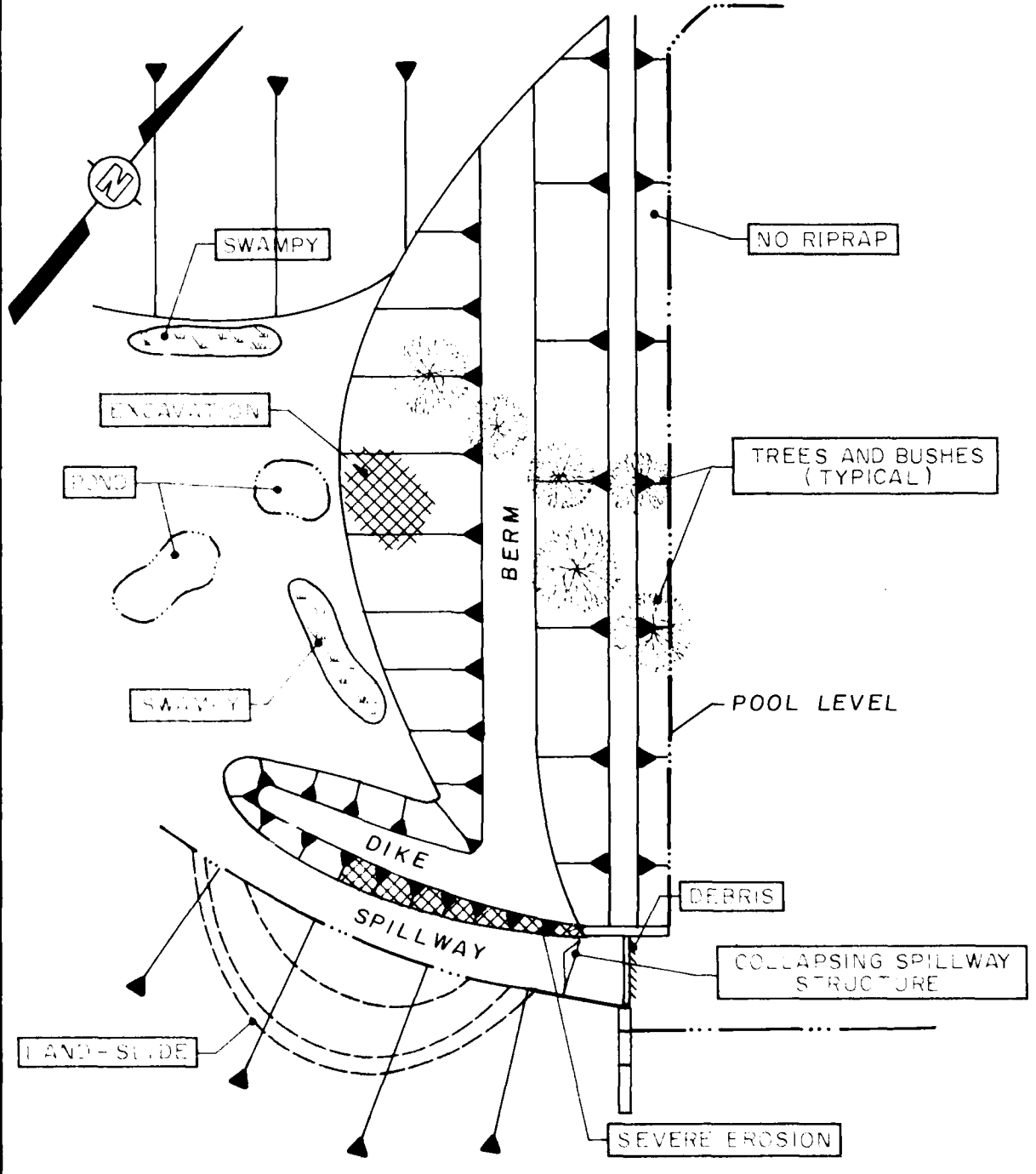
Water Supply Commission of Pa
Plan to accompany application of Potter Coal & Coke Co. for Permit To Repair Middle Reservoir at Coral Plant Scale 1/8"=1'
April 19 1921 Enter

Potter Coal & Coke Co
Coral, Pa.

PLATE 2

2

DRAWN BY	ACS	CHECKED BY	JSL	DRAWING NUMBER	79-043-A41
	5-20-80	APPROVED BY	JMP		



NOTES:

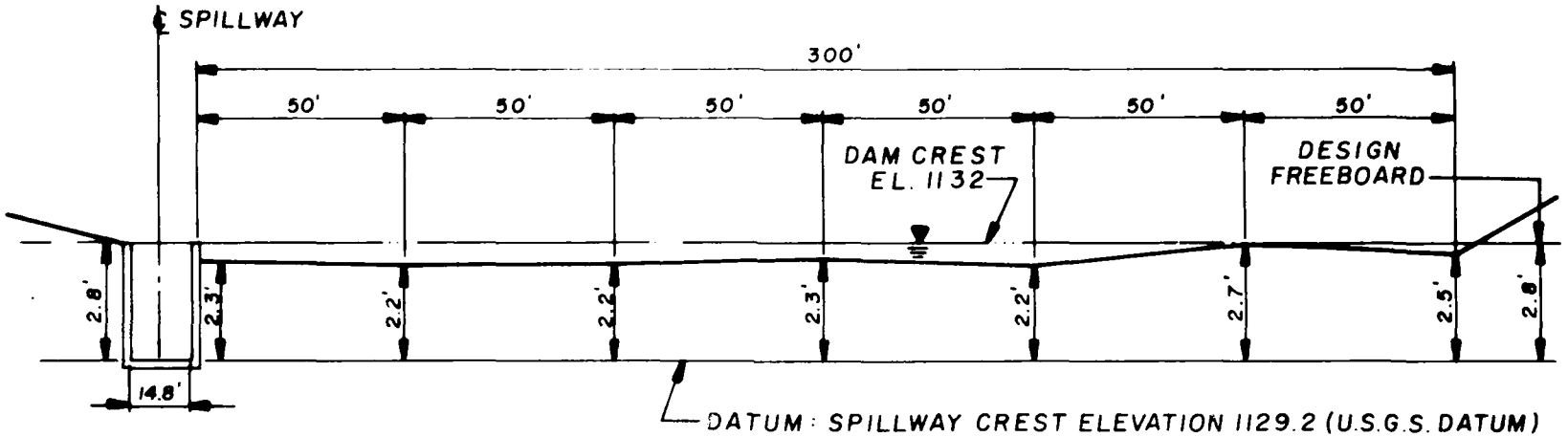
1. POOL LEVEL DATE OF INSPECTION: 0.5 FT. ABOVE SPILLWAY CREST

PLATE 3

GRACETON DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: MAR. 18, 1980

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	JSE	5-22-80	DRAWING NUMBER 79	3-A42
	5-21-80	APPROVED BY	JHS	5/28/80		



DAM CREST PROFILE
(LOOKING DOWNSTREAM)

NOTES:

1. DAM CREST IS SURVEYED RELATIVE TO SPILLWAY CREST LEVEL
2. DATUM ELEVATION PER AVAILABLE DESIGN DATA.

PLATE 4

GRACETON DAM
DAM CREST SURVEY
FIELD INSPECTION DATE: MAR. 18, 1980

DAMPOLAVA

APPENDIX F

REGIONAL GEOLOGY

APPENDIX F

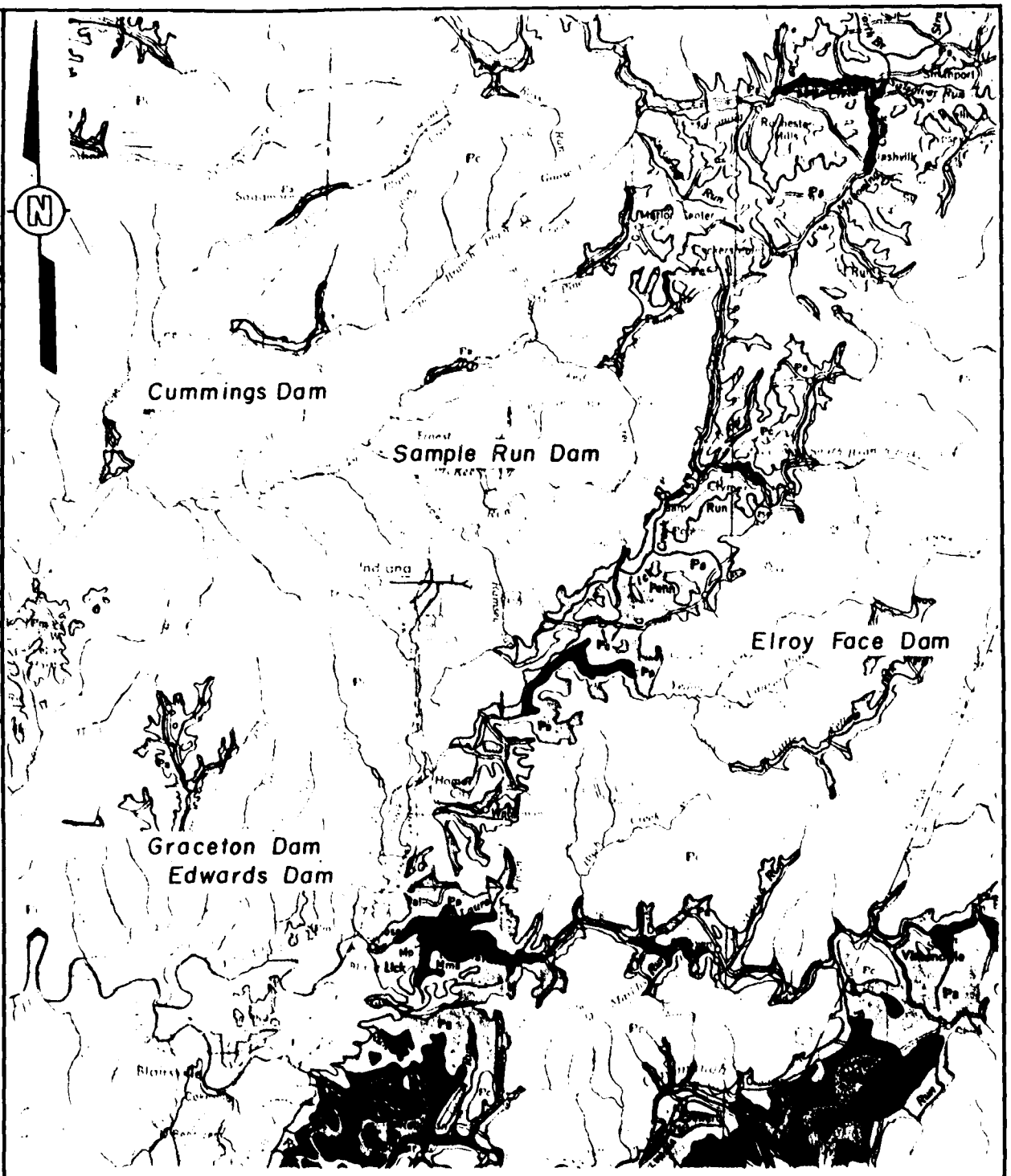
REGIONAL GEOLOGY
GRACETON DAM

Graceton Dam is located in the eastern area of the Appalachian Plateau Province which is characterized by broad, nearly level ridges and deep steep valleys. Strata east of the dam have been mildly folded to form the Chestnut Ridge Anticline which trends to the northeast. Strata dip away from the axis toward the northwest and southeast at about three to four degrees.

The dam lies near the contact of the Allegheny and Conemaugh groups, both of Pennsylvanian Age. The Allegheny is about 295 feet thick and is composed of massive sandstones and several beds of limestone and fire clay. It contains many coal beds, four of which are economically minable. The Conemaugh Group is about 650 feet thick and consists of shales of various colors interbedded with coarse sandstones, thin limestones, and several coal beds.

The Upper Freeport Coal has been strip mined extensively in the vicinity of the dam and to the east along the flanks of Chestnut Ridge.

DRAWN BY	ACS	CHECKED BY	
	12-29-79	APPROVED BY	
		DRAWING NUMBER	7[illegible] 43-A12



SCALE

0 2 4 6 8 10 miles

CUMMINGS, SAMPLE RUN, ELROY FACE, GRACETON AND EDWARDS DAMS

GEOLOGY MAP

REFERENCE

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

D'APPOLONIA

LEGEND

Pc

Conemaugh Formation

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals, massive Mahoning Sandstone commonly present at base. Ames Limestone present in middle of sections. Brush Creek Limestone in lower part of section

Pottsville Group

Light gray to white, coarse grained sandstones and conglomerates with some minable coal; includes Sharp Mountain, Schuylkill and Tumbling Run Formations

Allegheny Group

Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals; limestones thicken westward; Vanport Limestone in lower part of section; includes Freeport, Kittanning, and Clarion Formations

Clinton Group

Predominantly Rose Hill Formation - Reddish purple to greenish gray, thin to medium bedded, fossiliferous shale with interfingering "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).

Dm

Marine beds

Gray to olive brown shales, graywackes, and sandstones; contains "Chemung beds" and "Portage beds" including Burket, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base

Pocono Group

Predominantly gray, hard, massive, crossbedded conglomerate and sandstone with some shale; includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations; includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties.

Oriskany Formation

White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgeley) at the top; dark gray, cherty limestone with some interbedded shales and sandstones below (Shriver)

Tuscarora Formation

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

Marcellus Formation

Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.

Onondaga Formation

Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places; includes Selinsgrove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Esopus Shale in easternmost Pennsylvania; in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert

Dmo

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.

McKenzie Formation

Greenish gray, thin bedded shale interbedded with gray, thin bedded, fossiliferous limestone, shale predominant at the base; intraformational breccia in the lower part. Absent in Harrisburg quadrangle and to the east

Keyser Formation

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

Tonoloway Formation

Gray, highly laminated, thin bedded, argillaceous limestone; passes into Bossardville and Poxono Island beds in the east.

Dck

Catskill Formation

Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

REFERENCE:

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

GEOLOGY MAP LEGEND

D'APPOLONIA

DRAWN BY	ACS	12-31-79
CHECKED BY	[signature]	1/4/80
APPROVED BY	[signature]	1/4/80
DRAWING NUMBER	79-543-A18	