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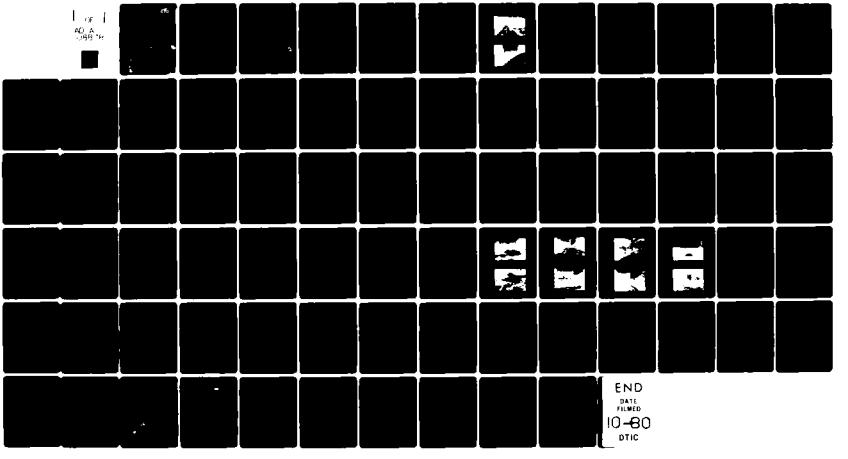

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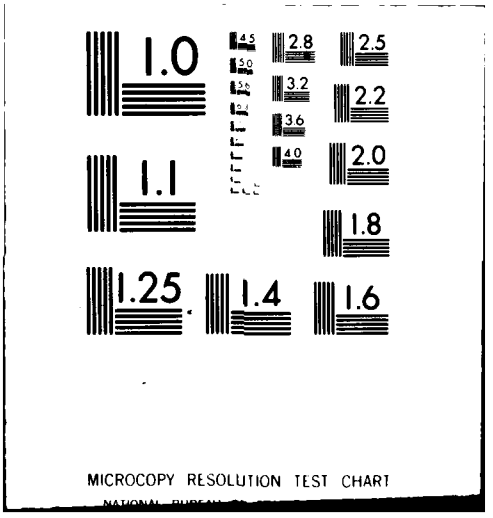
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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DACW31-80-C-0025

DEPARTMENT OF THE ARMY

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SMITH RESERVOIR DAM
ERIE COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00017
PennDER No. 25-28

(6) PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Smith Reservoir Dam. NDI number-PA-00017. PennDER Number-25-28. Lake Erie Basin. West Branch of Sixteen Mile Creek, Erie County, Pennsylvania. Phase I Inspection Report.

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

Prepared by: MICHAEL BAKER, JR., INC.
Consulting Engineers
4301 Dutch Ridge Road
Beaver, Pennsylvania 15009

(10) John A. Dziubek (11) Jul 80

(12) 77

(15) DACW21-80-C-0033

4/10/95

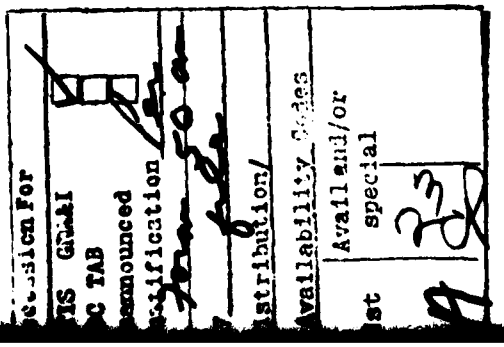
PREFACE

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

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

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

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Smith Reservoir Dam, Erie County, Pennsylvania
NDI No. PA 00017, PennDER No. 25-28
West Branch of Sixteen Mile Creek
Inspected 12 May 1980

ASSESSMENT OF GENERAL CONDITIONS

Smith Reservoir Dam is owned and operated by the Borough of North East and is classified as a "Significant" hazard - "Small" size dam. The dam and appurtenent structures were found to be in fair condition at the time of the inspection.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillway will pass the 100-year flood without overtopping the dam. A spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF) is required for Smith Reservoir Dam. The 100-year flood was chosen because the dam is on the low side of the "Small" size category according to storage capacity. The spillway is therefore considered "adequate".

The inspection and review of information revealed certain items of work which should be performed immediately by the owner. Items 1-5 below should be completed under the guidance of a licensed qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures. These include:

1) Investigate the source and cause of seepage exiting the left side of the valve house and take appropriate remedial action as necessary. The area should be examined in future inspections for turbidity or an increase in the volume of flow and the condition recorded.

2) The seepage at the downstream toe of the right abutment should be examined in future inspections for turbidity or an increase in flow and the observed conditions should be recorded.

3) Slope protection should be installed on the upstream face of the embankment at the normal pool level to protect it from scour and erosion.

5) Upstream closure (i.e. gate valves) for the two outlet pipes should be installed to protect the embankment in the event of a pipe rupture and for periodic inspection and maintenance of the pipes.

In order to correct the operational, maintenance, and repair deficiencies, the owner should perform the following items:

1) The undercutting of the left side of the spillway channel slightly downstream of the centerline of the embankment should be repaired.

2) The rodent holes in the protective dike should be filled and compacted.

3) The right blow-off pipe should be opened periodically to check its condition.

4) It is also recommended that the "Warning and Evacuation Plan" be revised in Part II, A, 2 to indicate that North East Borough Police be notified when water flowing in the emergency spillway is something less than 100 percent capacity (i.e., 90 percent or within one foot of the crest of the dam).

It is recommended that formal maintenance, operation, and inspection procedures and records be developed and implemented.

Submitted by:

MICHAEL BAKER, JR., INC.

John A. Dziubek

John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 10 July 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 11 August 80

SMITH RESERVOIR DAM

Overall View of Dam from the Left Abutment

Overall View of the Downstream Slope from the Left Abutment

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APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SMITH RESERVOIR DAM
NDI No. PA 00017, PennDER 25-28

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

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

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

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances - Smith Reservoir Dam was originally designed (1924) as a 35 foot high earth dam with an emergency spillway excavated in shale in the right abutment. In 1935, the spillway channel was excavated one foot lower and a 2 foot high concrete weir was added to the spillway crest. At the same time the embankment was raised 3 feet. The dam was built for water supply, for which it is still used today.

The spillway is located at the right abutment of the dam and is separated from the dam and reservoir by a protective earth dike. It is an open channel excavated in shale with a 32.5 foot bottom width and average side slopes of 1.5H:1V (Horizontal to Vertical). A concrete weir, 2 feet high by 9 feet long, is located in the spillway channel approximately 73 feet upstream from the centerline of the dam.

The outlet works consist of two 12 inch cast-iron pipes through the embankment. A valve house is located on the downstream side of the embankment. Both 12 inch pipes can function as blow-offs or supply water into a 24 inch steel pipe leading to the water treatment plant downstream.

b. Location - Smith Reservoir Dam is located on the West Branch of Sixteen Mile Creek in the Township of North East, Erie County, Pennsylvania. The coordinates of the dam are N 42° 10.3' and W 79°

48.8'. The dam and reservoir can be located on the USGS 7.5 minute topographic quadrangle, North East, Pennsylvania.

c. Size Classification - The maximum height of the dam from the minimum top of dam to the toe of the downstream slope is 34 feet. The reservoir volume to the top of dam, Elevation 1296.1 feet Mean Sea Level (M.S.L.), is 155 acre-feet. The dam is therefore in the "Small" size category.

d. Hazard Classification - Property damage to a residential structure located 2.5 miles downstream of the dam is likely but loss of life due to failure of the dam is believed to be unlikely. The possible economic damage combined with the loss of the reservoir as a source of water supply for the Borough of North East places the dam in the "Significant" hazard category.

e. Ownership The dam and reservoir are owned by the Borough of North East, 58 East Main Street, North East, Pennsylvania 16428.

f. Purpose of Dam - The reservoir is used as the primary water supply source for the Borough of North East, Pennsylvania.

g. Design and Construction History - The dam was originally designed in February 1923 and the permit to construct the dam was issued on 8 March 1923 by The Water Supply Commission of Pennsylvania. The plans were revised in January 1924 and construction of the dam was begun in the fall of 1924 and finished in the spring of 1925. The dam was designed by Hill and Hill Engineers of Erie, Pennsylvania.

h. Normal Operational Procedures - The spillway is uncontrolled and the reservoir is typically at the spillway crest elevation (Elevation 1290.0 feet M.S.L.) except during periods of low rainfall and high water consumption. During normal operations the dam is inspected twice weekly. During periods of inclement weather, the dam is checked daily.

1.3 PERTINENT DATA

a. Drainage Area (square mile) - 2.37

b. Discharge at Dam Site (c.f.s.) -

Maximum Flood of Record -	1490
Spillway Capacity (El. 1296.1 ft. M.S.L.) -	3100

c. Elevation (feet above M.S.L.)[1] -

Minimum Top of Dam -	1296.1
Spillway Crest -	1290.0
Toe of Dam -	1262±
Maximum Tailwater of Record -	Unknown

d. Reservoir (feet) -

Length of Maximum Pool (El. 1296.1 ft. M.S.L.) -	2650
Length of Normal Pool (El. 1290.0 ft. M.S.L.) -	2100

e. Storage (acre-feet) -

Top of Dam (El. 1296.1 ft. M.S.L.) -	155
Spillway Crest (El. 1290.0 ft. M.S.L.) -	74

f. Reservoir Surface (acres) -

Top of Dam (El. 1296.1 ft. M.S.L.) -	18.0
Spillway Crest (El. 1290.0 ft. M.S.L.) -	9.8

g. Dam -

Type -	Earthfill
Length (feet) -	365
Height (feet) - Field -	34
Design -	38
Top Width (feet) -	30
Side Slopes - Upstream - Design -	3H:1V
Downstream - Design -	2H:1V
Upstream - Field - (above pool level)	2H:1V
Downstream - Field -	2.16H:1V

Zoning - A rectangular clay puddle 20 feet wide extends from 3 feet below the top of dam to 6 feet below existing ground for the entire length of the embankment.

[1]All elevations are referenced to the crest of the spillway weir, El. 1290.0 ft. M.S.L., as determined from USGS 7.5 minute topographic quadrangle, North East, Pennsylvania. The original design elevations are based upon a local datum used at the time, which is approximately 1209 feet lower.

Cut-off - The clay puddle core extends 6 feet into the foundation.
Grout Curtain - None
Drains - None

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Trapezoidal rock cut open channel at the right abutment.
Bottom Width (feet) - Design - 30
Field - 32.5
Length (along centerline, feet) - 380
Crest Elevation (feet M.S.L.) - 1290.0
Gates - None
Upstream Channel - Trapezoidal shaped in clay and shale with a 2 percent grade up to the crest.
Downstream Channel - Trapezoidal shaped in clay and shale with a 1 percent grade down from crest.

j. Regulating Outlets - There are two 12 inch cast-iron pipes serving as the outlet works for the reservoir. These pipes were originally controlled by two 12 inch gate valves located in a valve house at the downstream toe of the dam. In 1958, an addition to the valve house was constructed. At this time, a 24 inch water supply line and four 12 inch gate valves were installed (see field sketch for schematic). The two original gate valves are typically kept open. Two of the additional gate valves function as "blow-offs" and the remaining two control flow into the 24 inch water supply line. The water supply line leads to the water treatment plant for the Borough of North East, located approximately 1.5 miles north of the dam site.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The Pennsylvania Department of Environmental Resources (PennDER) File No. 25-28 was reviewed for this dam. The following information is contained in the file:

1) Original design drawings dated 5 February 1923 (revised drawings dated 10 January 1924) prepared by Hill and Hill Engineers, Erie, Pennsylvania.

2) Various inspection reports from 21 August 1925 to 19 September 1967 by an engineer of the Water and Power Resources Board.

3) Photographs taken during the inspections. Two photographs dated 5 August 1925, two photographs dated 5 June 1935, and four photographs dated 19 September 1967.

4) Application to and permit from the Water Supply Commission of Pennsylvania for the Borough of North East to construct a dam, including revisions in dam design.

5) Miscellaneous correspondence between the Water Supply Commission of Pennsylvania and the Borough of North East about the condition of the dam from December 1928 to March 1949.

2.2 CONSTRUCTION

Smith Reservoir Dam was constructed in the fall of 1924 and spring of 1925. Modifications performed to the dam as determined from the PennDER file include:

1) Revisions to the design of the dam dated 9 January 1924 which consisted of substituting two 12 inch cast-iron pipes for a single 20 inch cast-iron pipe as the outlet works for the dam. The location of the controls for the outlet works was also changed from a reinforced concrete valve tower placed on the upstream side of the embankment to a valve house located at the downstream toe of the dam.

2) In 1935 the embankment was raised 3 feet and the spillway crest was raised 2 feet by

constructing a concrete weir across the spillway 73 feet upstream of the centerline of the dam. There were no plans submitted for this construction.

3) In 1940, flashboards with a total height of 1 foot were placed across the spillway crest. Upon request of the Water and Power Resources Board the flashboards were removed in that same year.

4) In 1958 an addition was constructed to the valve house. A water supply line, consisting of a 24 inch steel pipe, was installed from the valve house to the water treatment plant. Additional valves were also installed on the two 12 inch outlet pipes for "blow-off" purposes.

2.3 OPERATION

The operation of Smith Reservoir Dam is the responsibility of the North East Borough Water Department. During normal operations, the dam is inspected twice a week. During periods of inclement weather the dam is inspected daily for the following conditions:

1) Wet areas or seepage around the downstream embankment, toe, and abutments.

2) Seepage around the spillway structure.

3) Possible damage to the downstream embankment due to high velocity discharge through the spillway channel.

4) As flow in the spillway continues to rise, determine whether the embankment might be overtopped.

5) Visible movement of the structure.

2.4 EVALUATION

a. Availability - The information reviewed is readily available from PennDER's File No. 25-28. Additional information was obtained by interviewing the owner's personnel; however, this information is limited to the time period for which the personnel have been working for the owner.

b. Adequacy - The information available from the PennDER file and that collected during the field inspection is adequate for a Phase I Inspection of the dam.

c. Validity - There is no reason at the present time to doubt the validity of the available information.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The visual inspection of Smith Reservoir Dam was performed on 12 May 1980. The pool at the time of inspection was at Elevation 1287.9 feet M.S.L. or approximately 2.1 feet below the normal pool level. No unusual weather conditions were experienced at the time of inspection. The dam and appurtenant structures were considered to be in fair condition at the time of inspection. Noteworthy deficiencies observed during the inspection are described briefly in the following paragraphs. The visual inspection checklist, field sketch, top of dam profile, and typical cross-section are given in Appendix A.

b. Dam - The owner had cleared the small diameter trees and brush from the embankment and spillway channel prior to the inspection; however, some larger diameter trees immediately downstream of the right abutment/embankment junction need to be removed. The major root system of these trees should also be removed and replaced with well-graded, pervious fill. Seepage was observed at the downstream toe of the right abutment. This clear seepage (approximate flow 0.5 g.p.m.) may be from the spillway channel. (Note: A small pool was present in the channel near this location at the time of inspection). Seepage was also observed exiting from the left side of the valve house (flow less than 0.5 g.p.m.). The source of this seepage could not be determined at the time of inspection; however, it was noted that the seepage was originating from inside that portion of the valve house constructed circa 1923.

Some erosion of the upstream face of the embankment at the normal pool level has occurred. Some minor erosion on the downstream face has occurred at a low area (approximate Station 2+10) on the downstream crest of the dam. Some rodent holes were observed in the protective dike between the embankment and the entrance to the spillway.

c. Appurtenant Structures - The inspectable portion of the outlet works appeared to be in reasonable condition. The left blow-off pipe is checked approximately 8 times a year. The right blow-off pipe has not been checked in the recent past and

some accumulation of sediment has occurred at the outlet end of the pipe. The intakes of the pipes were submerged and could not be observed. No upstream closure is provided for these pipes.

The left side of the spillway channel approximately 30 feet downstream from the centerline of the dam, is being undercut to a small degree. This undercut area may be contributing to the seepage observed at the downstream toe of the right abutment. The undercutting is not threatening the stability of the spillway wall at the present time.

The protective earth dike extending upstream from the centerline of the dam along the spillway channel was constructed using a sandy loam material. It appeared that the transition from the constructed earth dike to in situ materials was located approximately 25 feet upstream from the centerline of the dam.

The small concrete weir constructed in the spillway has undergone some deterioration, primarily spalling of a majority of the exposed concrete surfaces. However, because of the mild slope and 380 foot length of the spillway channel, this weir has only a minor importance in the hydraulic performance of the dam. Flow in the channel is only influenced by the weir at very low dicharges; during flood events the weir would be completely submerged and flow in the spillway channel would be controlled by normal depth. For this reason, repair of the spalling on the weir is not considered necessary to insure that the spillway functions properly.

The spillway channel bottom has been cut and eroded in many areas. As a result, pools of standing water have formed along the length of the channel. This water may be contributing to the seepage observed at the downstream toe of the right abutment. This cutting and erosion of the channel bottom has increased the roughness of the channel, thereby reducing the capability of the spillway to efficiently pass water. However, as analysis presented in Section 5 indicates, this condition has not reduced the capacity of the spillway to the point where it cannot pass the required spillway design flood.

d. Reservoir Area - The reservoir and watershed area have moderate to mild slopes. The area is primarily forests with some low-density residential development.

Information collected during the field inspection indicated that sedimentation is not a major problem in the reservoir.

e. Downstream Channel - The downstream channel has relatively steep slopes and passes through a narrow valley. The channel passes under Cole Road approximately 2500 feet downstream from the dam. Flow under the road is carried by a 10 foot high by 25 foot wide corrugated metal arch culvert. There is a residential structure approximately 2.5 miles downstream from the dam which would likely suffer economic damage if the dam were to fail.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The two 12 inch cast-iron pipes that pass through the embankment to the valve house are connected to a 24 inch steel pipe which is used for water supply. In addition, two 12 inch pipes are connected to the outlet works and are used as blow-off pipes. One blow-off pipe is opened approximately 8 times a year. There are no formal, written operating procedures.

4.2 MAINTENANCE OF DAM

The maintenance of the dam is the responsibility of the North East Borough Water Department. There are no formal, written maintenance procedures for the dam.

4.3 MAINTENANCE OF OPERATING FACILITIES

The North East Borough Water Department is responsible for maintenance of operating facilities. There are no formal written procedures for maintenance of operating facilities.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

In case of an emergency, a warning and evacuation system has been devised for Smith Reservoir Dam. A copy of the "Warning and Evacuation Plan" was provided to the inspection team.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

Generally, the maintenance of the dam and appurtenant structures is considered adequate; however, it is recommended that the alternate blow-off pipe be checked periodically. In addition, it is advisable that formal written maintenance and inspection procedures be prepared and implemented.

It is also recommended that the "Warning and Evacuation Plan" be revised in Part II, A, 2 to indicate that North East Borough Police be notified when water flowing in the emergency spillway is something less than 100 percent capacity (i.e., 90 percent or within one foot of the crest of the dam).

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - No hydrologic or hydraulic design calculations are available for Smith Reservoir Dam.

b. Experience Data - According to owners of the dam in response to inquiries made by the Water and Power Resources Board, a storm which occurred in March 1936 resulted in flow 14 inches deep in the spillway. This corresponds to a discharge of 150 c.f.s. It was also reported that during a storm in March 1942, water rose to a depth of 4 feet in the spillway. This corresponds to a discharge of 1490 c.f.s.

c. Visual Observation - At the time of the inspection, no conditions were observed which would seriously affect the functioning of the spillway or dam during a flood event. There is one low spot on the dam crest (Station 2+50) which is approximately 0.2 foot below the average crest elevation.

d. Overtopping Potential - Smith Reservoir Dam is a "Small" size -"Significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Because the dam is on the low end of the "Small" size category according to the storage capacity, the 100-year flood was selected as the SDF.

Using regression equations developed by the Pittsburgh District of the Corps of Engineers, the peak inflow to the impoundment for the 100-year flood was calculated to be 980 c.f.s. The spillway is capable of passing a flow of 3100 c.f.s. before the dam is overtopped. Because the spillway capacity is greater than the maximum inflow to the impoundment during the SDF, the dam and spillway are capable of passing the SDF without overtopping.

e. Spillway Adequacy - The dam and spillway, as outlined above, are capable of passing the required SDF without overtopping. The spillway is therefore considered to be "adequate".

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The clear seepage at the downstream toe of the right abutment does not appear to adversely affect the structural stability at the present time. It is recommended that the area be periodically observed for turbidity or an increase in flow. The origin of the seepage exiting from the valve house should be determined and remedial action, if necessary, should be performed. No evidence of distress or additional areas of seepage were observed during the visual inspection.

Because of the upstream face being constructed of a loam material, wave action has caused some erosion at the normal pool level. Also, the protective dike on the left side of the spillway approach channel is constructed of an erodible loam material and may suffer some damage during excessively heavy flows in the spillway. However, this area could be repaired after the erosion occurs and does not necessarily need to be riprapped at the present time. The downstream slope is slightly flatter than 2H:1V and is constructed of a clayey sand with various size rock fragments. The upstream slope on the design plans is shown at 3H:1V. During the inspection, the upstream slope above the pool was measured and found to be approximately 2H:1V. This discrepancy may be the result of the raising of the top of dam by 3 feet and the occurrence of erosion on the upstream face. (Note: The constructed slope below the water level is probably the design 3H:1V slope.)

b. Design and Construction Data - Design calculations were not available for review. It is estimated for this dam, with its history of satisfactory performance of the slopes and the fact that no instability was observed during the field inspection, that further assessments of the stability are not necessary for this Phase I Inspection Report. Should future inspections observe signs of distress or conditions which would affect the structural stability of the embankment, additional evaluations and corrective measures may become necessary.

c. Operating Records - Nothing in the operational information indicates concern relative to the structural stability of the dam.

d. Post-Construction Changes - The raising of the embankment by 3 feet and the modifications to the valve house have not adversely affected the structural stability of the dam.

e. Seismic Stability - The dam is located in Zone 2 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of moderate seismic activity. Experience has shown that if the dam has adequate static stability in this zone then seismic stability is not a problem. As indicated in paragraph 6.1.b., Smith Reservoir Dam is considered to have adequate static stability, and therefore further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - Smith Reservoir Dam was found to be in fair overall condition at the time of inspection. Smith Reservoir Dam is a "Significant" hazard - "Small" size dam requiring a spillway capacity in the range of the 100-year flood to 1/2 PMF. The 100-year flood was chosen as the SDF because the dam is on the low side of the "Small" size category according to the volume of storage. As presented in Section 5, the spillway and reservoir are adequate to pass the 100-year flood without overtopping the dam. Therefore, the spillway is considered "adequate".

The seepage at the downstream toe of the right abutment is not considered to adversely affect the structural stability of the embankment or abutment. However, this area should be observed in future inspections and the condition recorded.

The seepage exiting the valve house should be further investigated to determine the source and cause of the seepage and the appropriate remedial action taken.

b. Adequacy of Information - The information available and the observations and measurements made during the field inspection are considered sufficient for this Phase I Inspection Report.

c. Urgency - The owner should immediately initiate the action discussed in paragraph 7.2.

d. Necessity of Additional Data/Evaluation - The inspection of this dam has indicated the need for further evaluation of the source and cause of the seepage exiting from the left side of the valve house. The owner should have a professional engineer experienced in the design and construction of earth dams and appurtenances determine the source and cause of the seepage.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection and review of information revealed certain items of work which should be performed immediately by the owner. Items 1-5 below should be completed under the guidance of a licensed qualified

professional engineer experienced in the design and construction of earth dams and appurtenant structures. These include:

1) Investigate the source and cause of the seepage exiting the left side of the valve house and take the appropriate remedial action as necessary. The area should be examined in future inspections for turbidity or an increase in the volume of flow and the condition recorded.

2) The seepage at the downstream toe of the right abutment should be examined in future inspections for turbidity or an increase in flow and the observed conditions should be recorded.

3) Slope protection should be installed on the upstream face of the embankment at the normal pool level to protect it from scour and erosion.

4) The trees at the right embankment/abutment junction should be removed. Their major root system should also be removed and replaced with well-graded, pervious fill.

5) Upstream closure (i.e. gate valve) for the two outlet pipes should be installed to protect the embankment in the event of a pipe rupture and for periodic inspection and maintenance of the pipes.

In order to correct operational, maintenance, and repair deficiencies, the owner should perform the following items:

1) The undercutting of the left side of the spillway channel slightly downstream of the centerline of the embankment should be repaired.

2) The rodent holes in the protective dike should be filled and compacted.

3) The right blow-off pipe should be opened periodically to check its condition.

4) It is also recommended that the "Warning and Evacuation Plan" be revised in Part II, A, 2 to indicate that North East Borough Police be notified when water flowing in the emergency

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH, TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Phase 1
Visual Inspection
Check List

Name of Dam Smith Reservoir Dam County Erie State PA Coordinates Lat. N 42°10.3'

NDI # PA 00017
PennDER # 25-28

Long. W 79°48.8'

Date of Inspection 12 May 1980 Weather Overcast Temperature 50° F.

Pool Elevation at Time of Inspection 1287.9 ft.* M.S.L. Tailwater at Time of Inspection 1251.0 ft.* M.S.L.

*All elevations are referenced to the crest of the spillway weir, El. 1290.0 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Wayne D. Lasch
Terry S. Hawk

Field Review (10 June 1980):

John A. Dziubek
James G. Ulinski

Owner's Representatives:

Borough of North East

Herb Mallick, Borough Engineer
Clarence E. Hutchinson, Water Department Superintendent

James G. Ulinski Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: SMITH RESERVOIR DAM
NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

EMBANKMENT

Name of Dam SMITH RESERVOIR DAM
NDI # PA 00017

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	There is some erosion at the normal pool level on the upstream face of the embankment. Some minor erosion has occurred on the downstream face at the low point on the crest of the dam.	The upstream face should be provided with slope protection at the pool level. The erosion on the downstream face and the low area on the top of dam should be filled.

EMBANKMENT

Name of Dam SMITH RESERVOIR DAM

NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The horizontal and vertical alignment of the crest is satisfactory.	
RIPRAP FAILURES	No riprap has been used on the dam.	The upper section of the upstream face of the embankment should be provided with some type of slope protection to prevent scour and erosion of the embankment.
VEGETATION	The trees and brush on the embankment and in the spillway channel were removed prior to inspection. Some additional large diameter trees should be removed at the junction of the embankment and right abutment.	The trees and their major root systems at the junction of the embankment and right downstream abutment should be removed and replaced with well-graded pervious fill.

EMBANKMENT

Name of Dam SMITH RESERVOIR DAM
NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junction of the embankment and left abutment is in good condition.	
ANY NOTICEABLE SEEPAGE	Clear seepage flowing at an approximate rate of 0.5 g.p.m. was observed at the right downstream toe of the abutment. It is estimated that this seepage may be passing through the jointed rock from the spillway channel. Additional seepage (flow less than 0.5 g.p.m.) was observed exiting on the left side of the valve house. The cause of the seepage was not determined during the inspection.	The seepage at the right abutment toe should be periodically examined for turbidity or increase in flow. The seepage at the valve house should be further investigated to determine the cause, i.e. leaky valve, seepage along the conduit, and appropriate remedial action taken.
STAFF GAGE AND RECORDER	None	
DRAINS	None	
RODENT HOLES	Several rodent holes are present in the protective dike.	These rodent holes should be filled and compacted.

OUTLET WORKS

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The outlet conduit was submerged and could not be observed.	
INTAKE STRUCTURE	The intake is submerged and could not be observed. No upstream closure is provided for the outlet conduits.	Upstream closure should be installed.
OUTLET STRUCTURE	The outlet conduits and valves in the valve house addition (circa 1958) were in good condition. The outlet end of the two 12 in. pipes were in good condition except for sediment accumulation in the right conduit.	The right blow-off should be checked occasionally. This will solve the sediment problem.
OUTLET CHANNEL	The outlet channel is in reasonable condition and free of blockages.	
EMERGENCY GATE	The left blow-off is checked frequently (8 times a year). The right blow-off should be opened periodically. The condition of the original valves should be examined for leaks in connection with the seepage discussed on page A-5.	

UNGATED SPILLWAY

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There is a small concrete weir in the spillway channel approximately 73 ft. upstream from the centerline of the dam. Some spalling of the exposed concrete surfaces has taken place.	Because of its low height, the weir is only important to the hydraulic performance of the dam during very low flows. At high flow depths, the weir will be completely submerged and flow will be controlled by the spillway channel. While the weir should be maintained in good condition, its relative importance in the overall safety of the dam is small.
APPROACH CHANNEL	The approach channel was satisfactory; no blockages or other restrictions were observed. The protective dike on the left side is constructed of loam and may be erodible during high flows.	Examine the dike after extremely high flows in the spillway for the necessity of repairs.
DISCHARGE CHANNEL	Some undercutting on the left side of the channel has occurred.	The undercutting should be repaired.
BRIDGE AND PIERS	None	

GATED SPILLWAY - None

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

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

INSTRUMENTATION - None

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER		

RESERVOIR

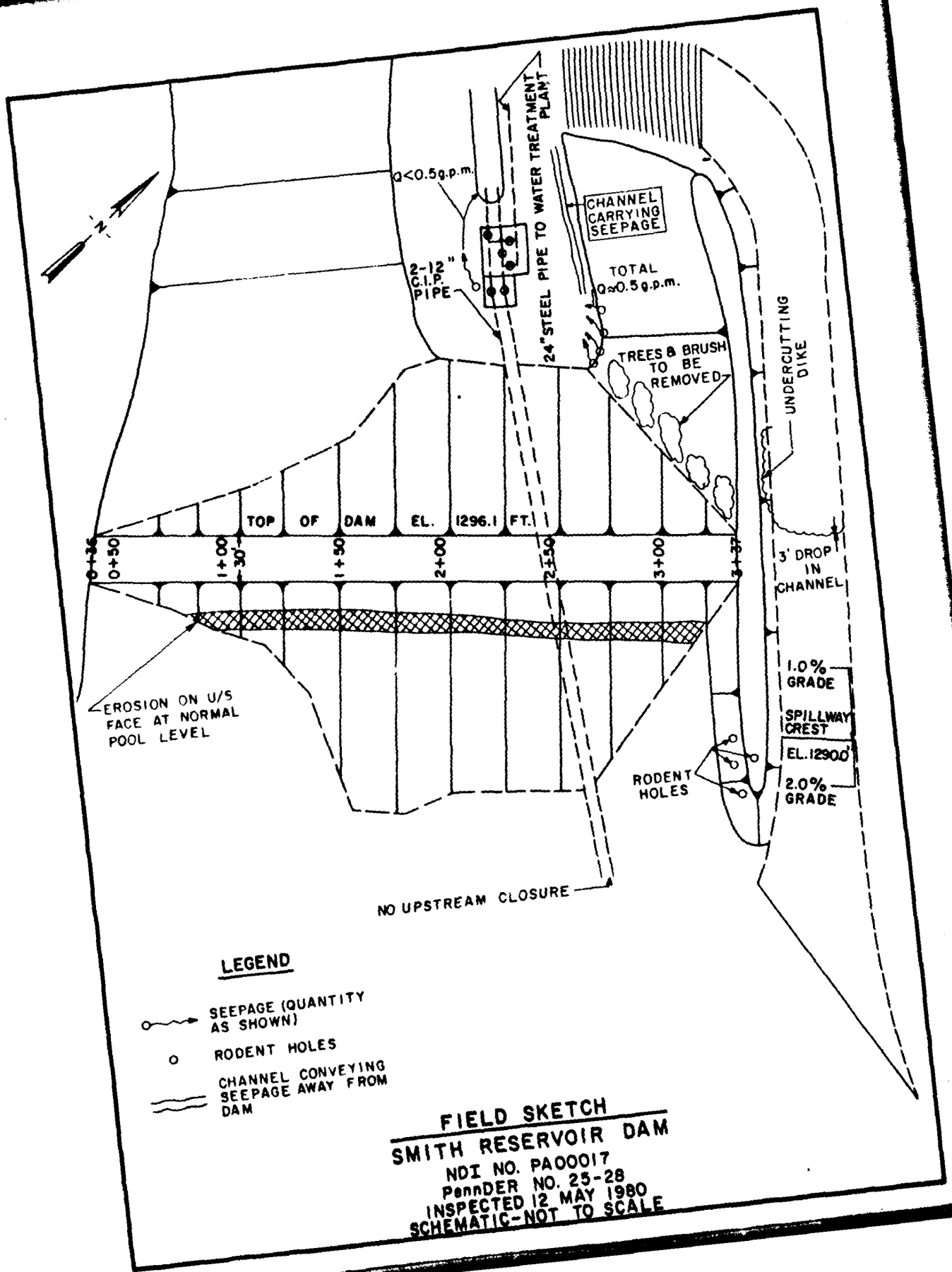
Name of Dam: SMITH RESERVOIR DAM
NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir and watershed slopes are moderate to mild. The area is primarily forests with some low density residential development.	
SEDIMENTATION	There was no evidence at the time of the inspection that sedimentation is a significant problem in the reservoir.	

DOWNSTREAM CHANNEL

Name of Dam: SMITH RESERVOIR DAM
NDI # PA 00017

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel lies in a relatively narrow valley with densely vegetated overbanks. There are some fallen trees in the channel approximately 750 ft. downstream from the dam, but they do not seriously restrict flow in the channel.	
SLOPES	The slope of the channel is relatively steep.	
APPROXIMATE NO. OF HOMES AND POPULATION	The nearest home that would be affected by a dam failure is approximately 2.5 mi. downstream from the dam.	



FIELD SKETCH
SMITH RESERVOIR DAM
NDI NO. PA00017
PennDER NO. 25-28
INSPECTED 12 MAY 1980
SCHEMATIC-NOT TO SCALE

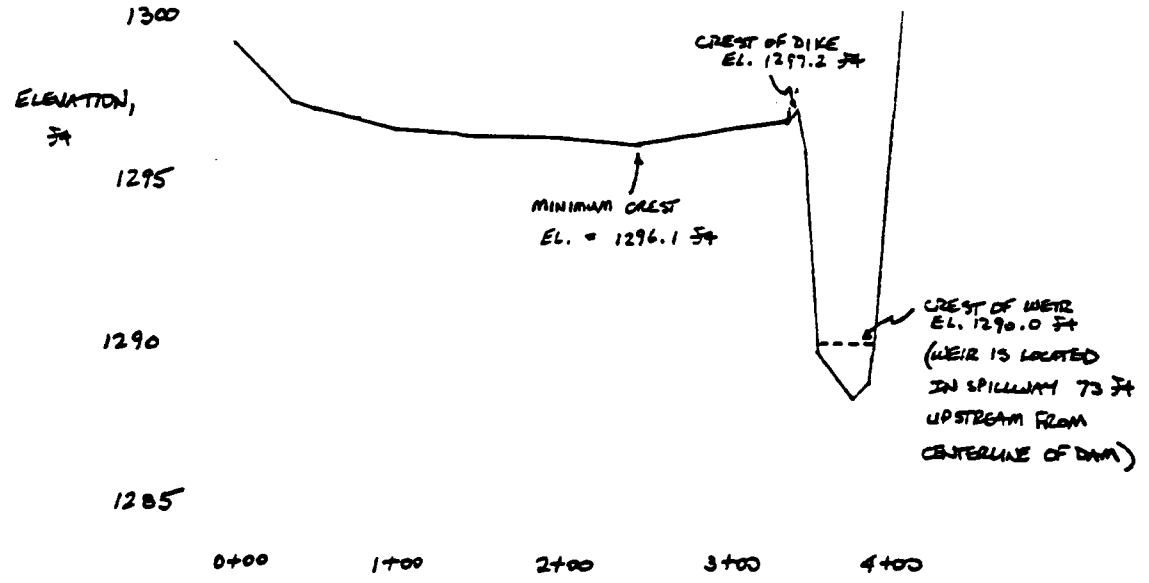
MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS
30 May 1980
Box 280
Beaver, Pa. 15009

SMITH RESERVOIR DAM

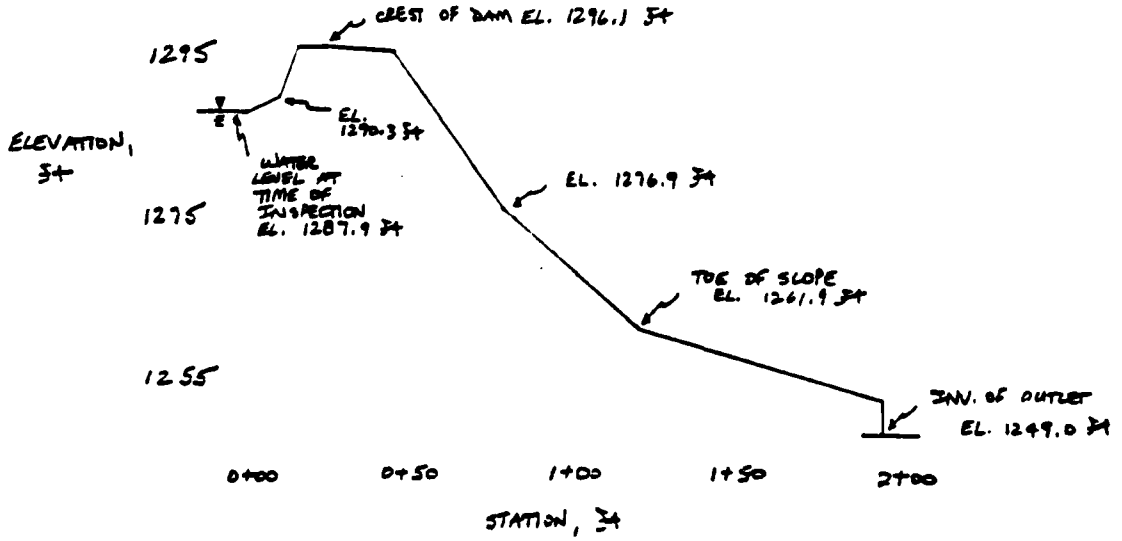
TOP OF DAM PROFILE
TYPICAL CROSS-SECTION

DATE OF INSPECTION - 12 May 1980

TOP OF DAM PROFILE



CROSS-SECTION AT STATION 2+50



APPENDIX B

ENGINEERING DATA CHECK LIST

ENGINEERING DATA
CHECK LIST
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: SMITH RESERVOIR DAM
NDI # PA 00017

ITEM	REMARKS
PLAN OF DAM	See Plate 3 and field sketch in this report.
REGIONAL VICINITY MAP	A USGS 7.5 minute topographic quadrangle, North East, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as the location Plan (Plate 1).
CONSTRUCTION HISTORY	See Section 2 for detailed description of construction history.
TYPICAL SECTIONS OF DAM	An original design drawing cross-section is shown on Plate 4 of this report. A typical cross-section, measured during the visual inspection, is included in Appendix A.
HYDROLOGIC/HYDRAULIC DATA	No information available
OUTLETS - PLAN and DETAILS	See Plates 3 and 4 and the field sketch of this report.
- CONSTRAINTS	None
- DISCHARGE RATINGS	No information available
RAINFALL/RESERVOIR RECORDS	Rainfall is recorded at the water treatment plant. Reservoir records are not currently maintained.

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	The regional geology has been included in this report as Appendix F.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	No information was available.

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	In 1935 a 2 ft. high spillway weir was installed after the channel was excavated 1 ft. lower. At the same time the top of dam was raised by 3 ft. In 1958 a 24 in. steel pipe was installed from the valve house to the water treatment plant. At the same time the valve house was enlarged and new valves installed on the two 12 in. blow-off pipes.
HIGH POOL RECORDS	No information available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None available

Name of Dam: SMITH RESERVOIR DAM

NDI # PA 00017

ITEM	REMARKS
SPILLWAY PLAN and SECTIONS and - DETAILS	See Plates 3 and 4 and the field sketch of this report. None
OPERATING EQUIPMENT PLANS & DETAILS	No information was available. See field sketch for schematic layout.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.37 sq.mi. (Primarily forested)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1290.0 ft. M.S.L. (74 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1296.1 ft. M.S.L. (155 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1296.1 ft. M.S.L. (minimum)

SPILLWAY: Principal Spillway

a. Crest Elevation 1290.0 ft. M.S.L.
b. Type Trapezoidal channel cut into rock
c. Bottom Width of Channel (Perpendicular to Flow) 32.5 ft.
d. Length of Channel along Centerline (Parallel to Flow) 380 ft.
e. Location Spillover Right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type Two 12 in. C.I.P.'s
b. Location Approximately at the center of the embankment
c. Entrance Inverts Unknown
d. Exit Inverts El. 1250.0 ft. M.S.L.
e. Emergency Drawdown Facilities Two 12 in. blow-off pipes serve as drawdown facilities

HYDROMETEOROLOGICAL GAGES:

a. Type Rain gauge
b. Location At the water treatment plant, 1.5 mi. north of the dam site
c. Records Records of major storms in the recent past are available

MAXIMUM KNOWN NON-DAMAGING DISCHARGE 1490 c.f.s.

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam

Top Photo - (OV-T) Overall View of Dam from the Left Abutment

Bottom Photo - (OV-B) Overall View of the Downstream Slope from the Left Abutment

Photograph Location Plan

Photo 1 - View of the Entrance to the Spillway

Photo 2 - View of the Low Flow Control Sill in the Spillway

Photo 3 - View of the Spillway Channel Looking Downstream from the Control Sill

Photo 4 - View of the Spillway Overflow from Downstream Looking Upstream

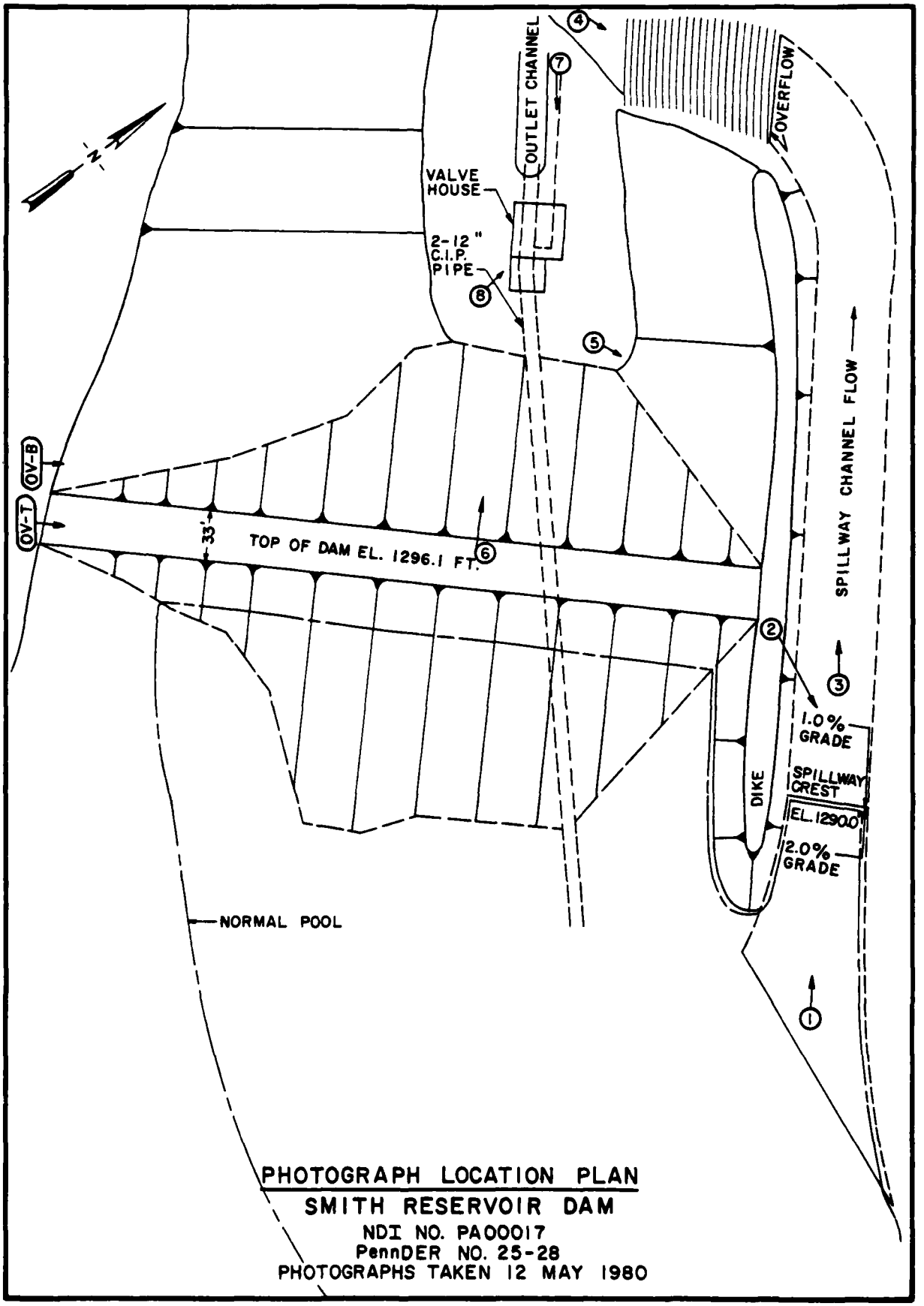
Photo 5 - View of Seepage Area at the Right Downstream Toe and Abutment Junction

Photo 6 - View of the Downstream Area (from the dam) and the Drainage Channel Provided for the Right Abutment Seepage

Photo 7 - View Looking Upstream at the Downstream Slope and Valve House

Photo 8 - View of Seepage Exiting from Left Side of Valve House

Note: Photographs were taken on 12 May 1980.



PHOTOGRAPH LOCATION PLAN

SMITH RESERVOIR DAM

NDI NO. PA00017

PennDER NO. 25-28

PHOTOGRAPHS TAKEN 12 MAY 1980

SMITH RESERVOIR DAM

PHOTO 1. View of the Entrance to the Spillway

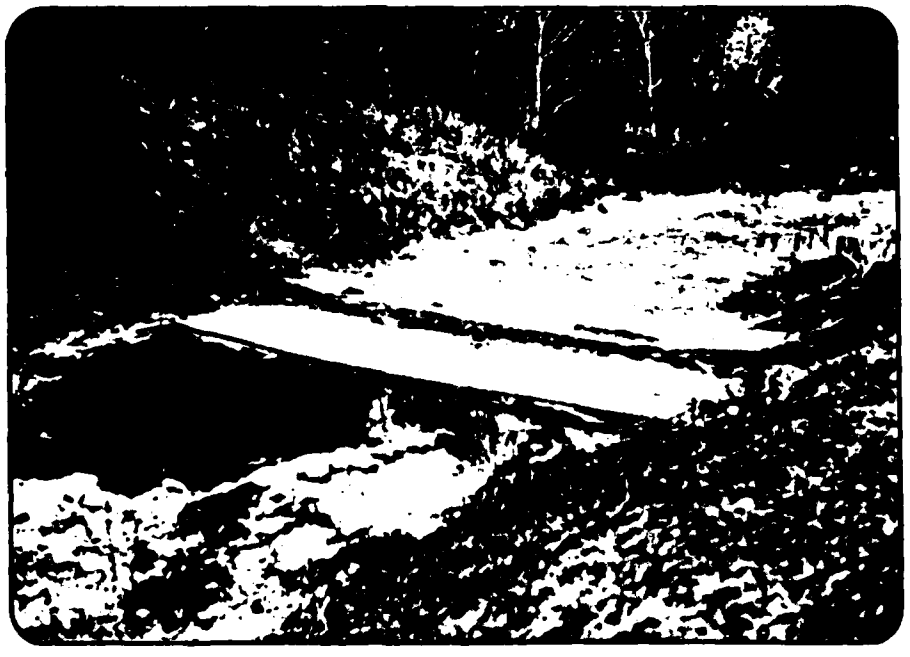


PHOTO 2. View of the Low Flow Control Sill in the Spillway

PHOTO 3. View of the Spillway Channel Looking Downstream from the *Control* Sill

PHOTO 4. View of the Spillway Overflow from Downstream Looking Upstream

PHOTO 5. View of Seepage Area at the Right Downstream Toe and Abutment Junction

PHOTO 6. View of the Downstream Area (from the dam) and the Drainage Channel Provided for the Right Abutment Seepage

PHOTO 7. View Looking Upstream at the Downstream Slope and Valve House

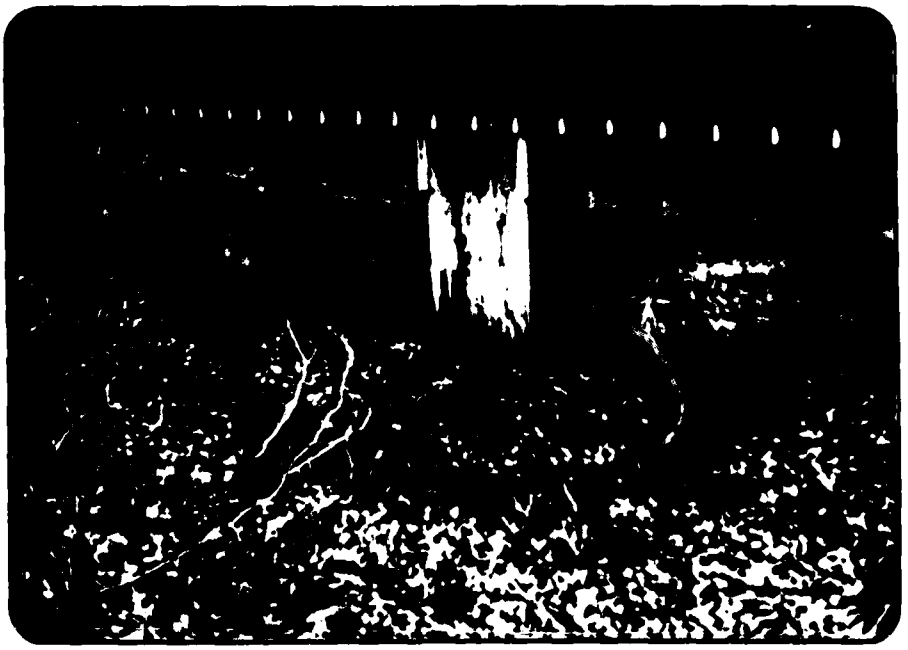


PHOTO 8. View of Seepage Exiting from Left Side of Valve House

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject SMITH RESERVOIR DAM, S.O. No.
APPENDIX D - HYDROLOGIC AND Sheet No. of
HYDRAULIC CALCULATIONS Drawing No.
Computed by Checked by Date

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: SMITH RESERVOIR DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.8 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	SMITH RESERVOIR DAM				
Drainage Area (square miles)	2.37				
Cumulative Drainage Area (square miles)	2.37				
Adjustment of PMF for Drainage Area (%)[2]	Zone 2				
6 Hours	117				
12 Hours	127				
24 Hours	141				
48 Hours	151				
72 Hours	-				
Snyder Hydrograph Parameters					
Zone [3]	26				
C_p/C_t [4]	0.78/1.16				
L (miles) [5]	2.25				
L_{ca} (miles)[5]	0.98				
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	1.47				
Spillway Data					
Crest Length (ft)	32.5				
Freeboard (ft)					
Discharge Coefficient	(Rating curve developed on sheet 4)				
Exponent					

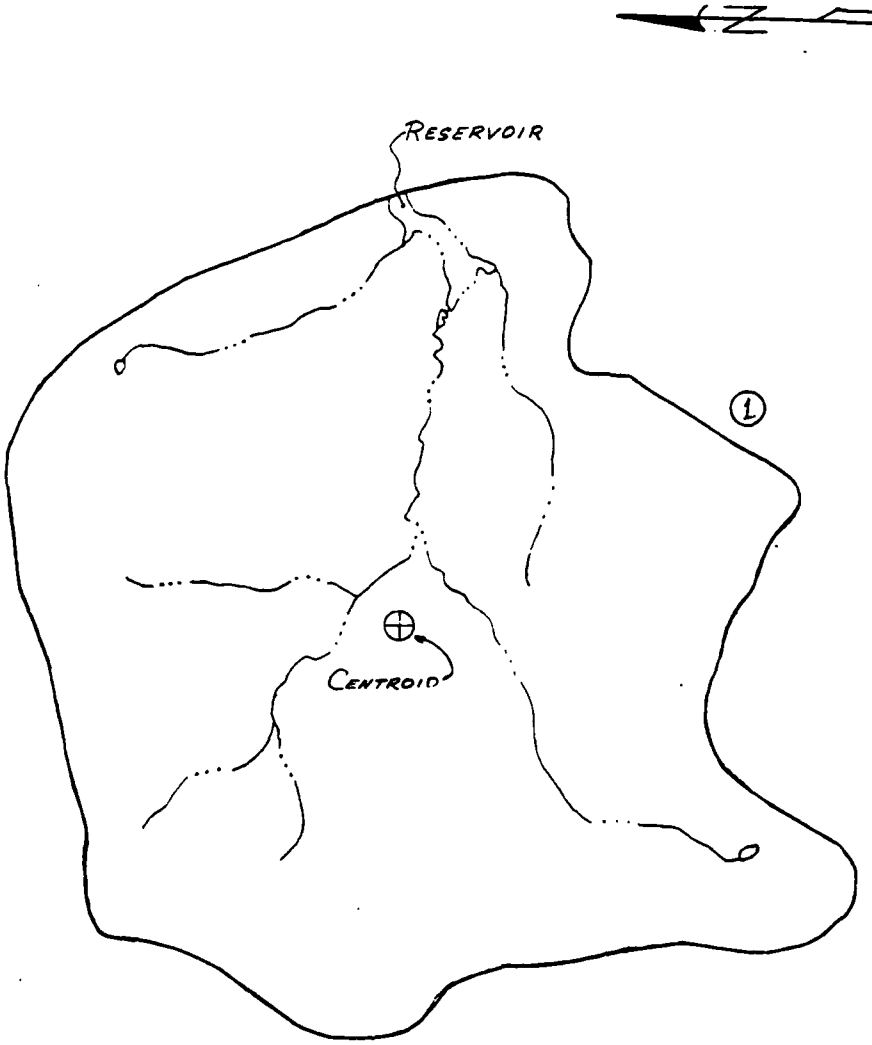
[1] Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

[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.



DRAINAGE BASIN MAP
SMITH RESERVOIR

QUADS:
1. NORTH EAST.

2000 0 2000 4000

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject 100-YEAR FLOOD FLOW CALCULATION S.O. No. _____ Sheet No. 3 of 5 Drawing No. _____

Computed by WDL Checked by LAD Date _____

USING ANALYSIS COMPLETED BY THE PITTSBURGH DISTRICT, CORPS OF ENGINEERS, THE PEAK INFLOW TO SMITH RESERVOIR FOR THE 100-YEAR FLOW IS CALCULATED AS FOLLOWS:

$$Q_{100} = 120.38 \left(D.A. \times S^{1/2}\right)^{0.744099}$$

D.A. = DRAINAGE AREA = 2.37 Mi^2

S = CHANNEL SLOPE IN THE LOWER 0.7 OF THE WATERSHED

S = 50 Ft/Mi

$$Q_{100} = 120.38 \left([2.37]\,[50]^{1/2}\right)^{0.744099}$$

$$\underline{Q_{100} = 980 \text{ C.F.S}}$$

THE ABOVE PROCEDURE IS APPLICABLE IN THE OHIO RIVER BASIN WHICH IS ADJACENT TO THE BASIN IN WHICH SMITH RESERVOIR DAM IS LOCATED, THE LAKE ERIE BASIN.

AS A CHECK ON THIS FLOW, PA. BULLETIN NO. 13, "FLOODS IN PENNSYLVANIA", WAS USED TO OBTAIN ANOTHER METHOD FOR CALCULATING THE 100-YEAR FLOOD FLOW. ACCORDING TO THIS PUBLICATION, THE PEAK 100-YEAR FLOW CAN BE COMPUTED AS FOLLOWS:

$$Q_{100} = 42.2\, A^{0.751}\, P_i^{0.744}$$

A = DRAINAGE AREA = 2.37 Mi^2

P_c = ANNUAL PRECIPITATION INDEX FROM PLATE 2, BULLETIN NO 13

P_i = 17

$$Q_{100} = 42.2\,(2.37)^{0.751}\,(17)^{0.744}$$

$$\underline{Q_{100} = 665 \text{ CFS}}$$

BOTH OF THESE FLOWS ARE MUCH LESS THAN THE SPILLWAY CAPACITY, 3100 C.F.S AS A RESULT, THE DAM AND SPILLWAY ARE CAPABLE OF PASSING THE SDF WITHOUT OVERTOPPING.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

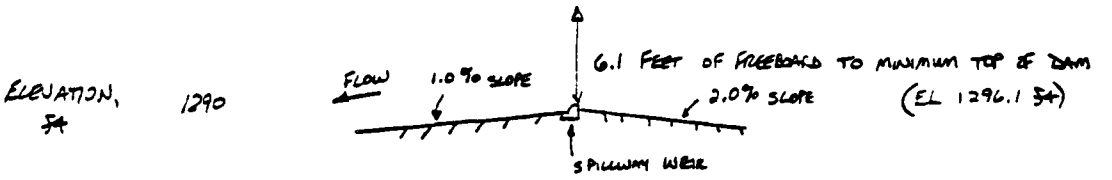
Subject SPILLWAY DISCHARGE RATING S.O. No.

Sheet No. 4 of 5

Drawing No.

Computed by LAD Checked by WDL Date

SPILLWAY PROFILE :



THE RELATIVELY SMALL HEIGHT OF THE WEIR COMBINED WITH THE MILD SLOPE OF THE SPILLWAY CHANNEL MAKES THE WEIR HYDRAULICALLY INSIGNIFICANT EXCEPT FOR SMALL FLOW DEPTHS. FOR LARGE FLOW DEPTHS, FLOW RATE WILL DEPEND UPON THE CHARACTERISTICS OF THE SPILLWAY CHANNEL (SLOPE, ROUGHNESS, GEOMETRY).

MANNING'S EQUATION IS USED TO CALCULATE THE SPILLWAY CAPACITY AS FOLLOWS :

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$ (CHOW, OPEN CHANNEL FLOW)

$n = 0.035$

$S = 0.01$

R = HYDRAULIC RADIUS

A = FLOW AREA

ELEVATION, Ft	DISCHARGE, cfs
1290.0	0
1291.0	143
1292.0	457
1293.0	904
1294.0	1492
1296.0	3029
1297.0	4107

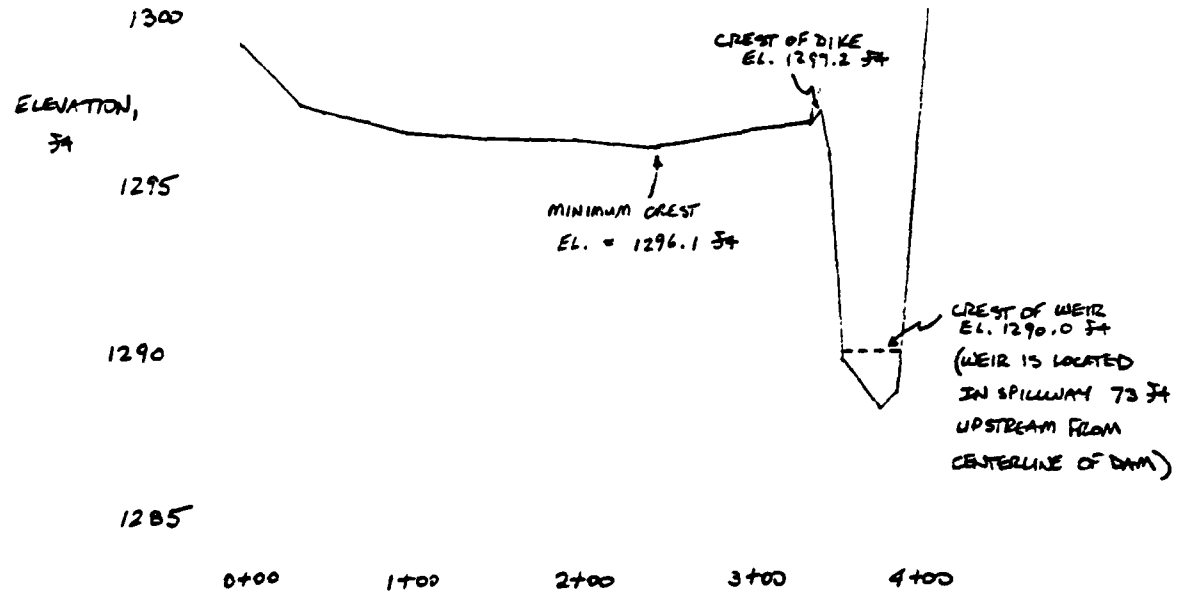
SPILLWAY CAPACITY AT MINIMUM TOP OF DAM, EL. 1296.1 Ft, IS 3100 C.F.S.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

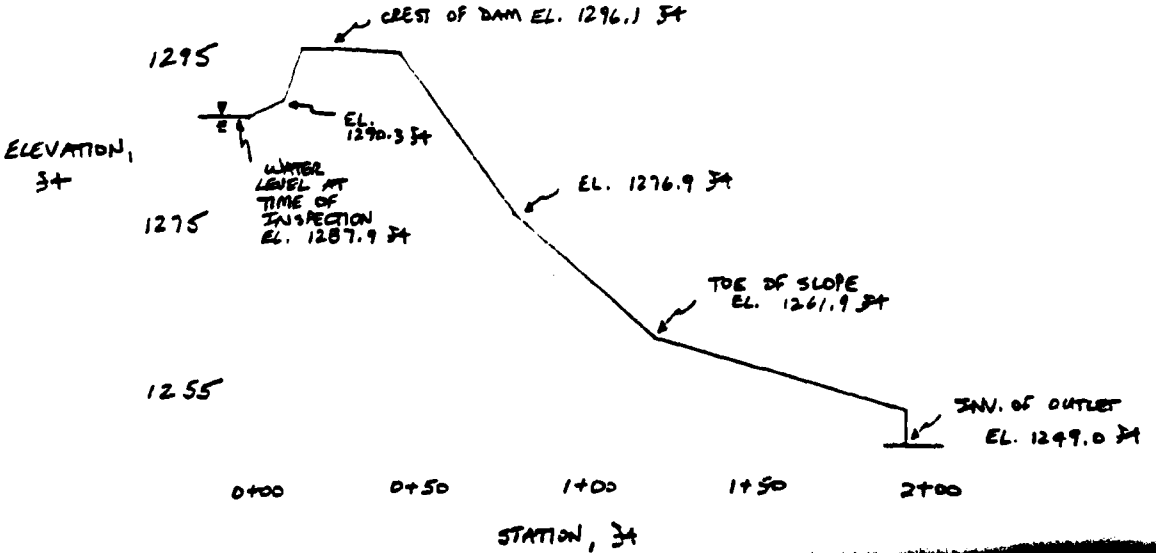
Box 280
Beaver, Pa. 15009

Subject SMITH RESERVOIR DAM — S.O. No.
TOP OF DAM PROFILE AND TYPICAL — Sheet No. 5 of 5
CROSS SECTION — Drawing No.
Computed by WDL — Checked by — Date 5-30-80

TOP OF DAM PROFILE



CROSS-SECTION AT STATION 2+50



APPENDIX E

PLATES

CONTENTS

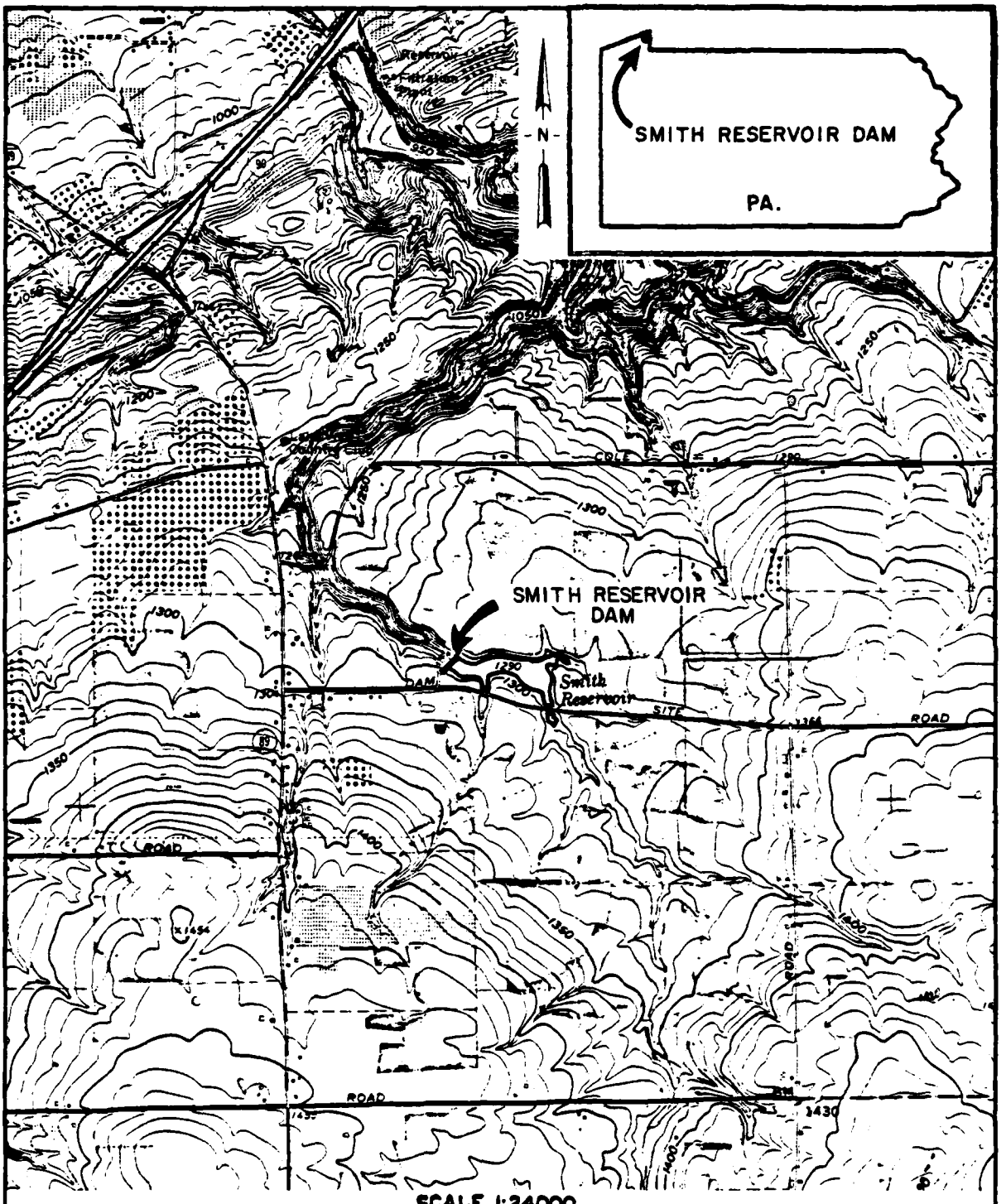
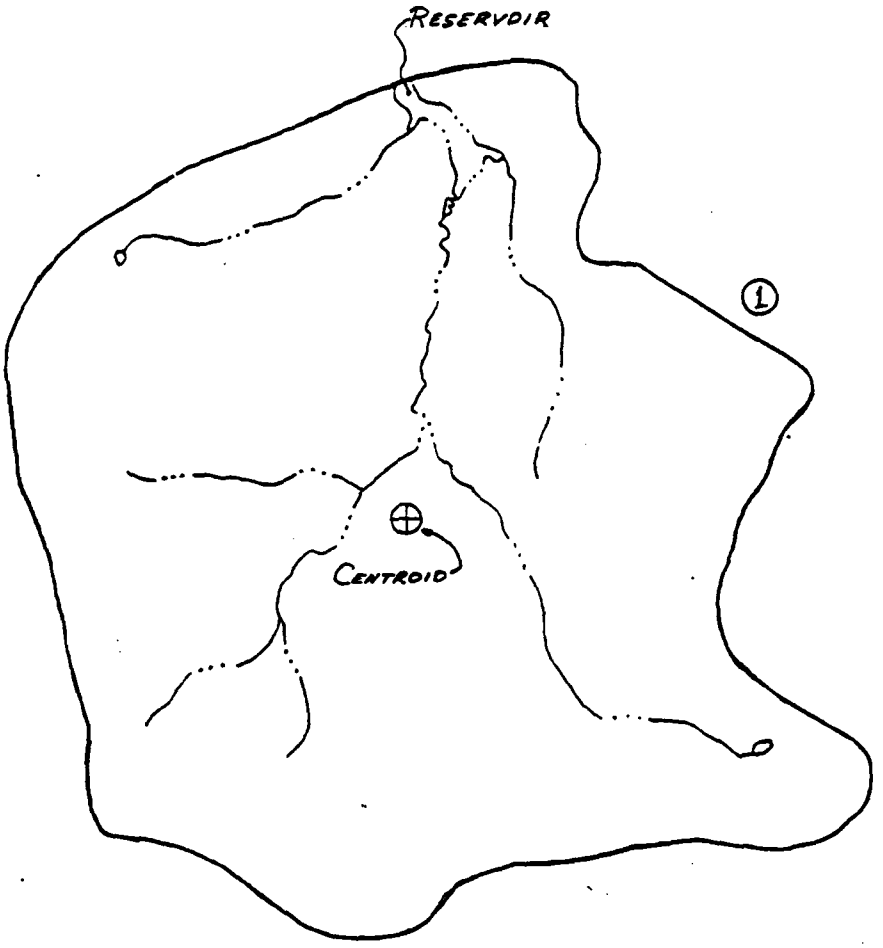


PLATE 1 LOCATION PLAN
SMITH RESERVOIR DAM



DRAINAGE BASIN MAP
SMITH RESERVOIR

QUADS:
1. NORTH EAST.

2000 0 2000 4000

PLATE 2 - WATERSHED MAP

SMITH RESERVOIR DAM

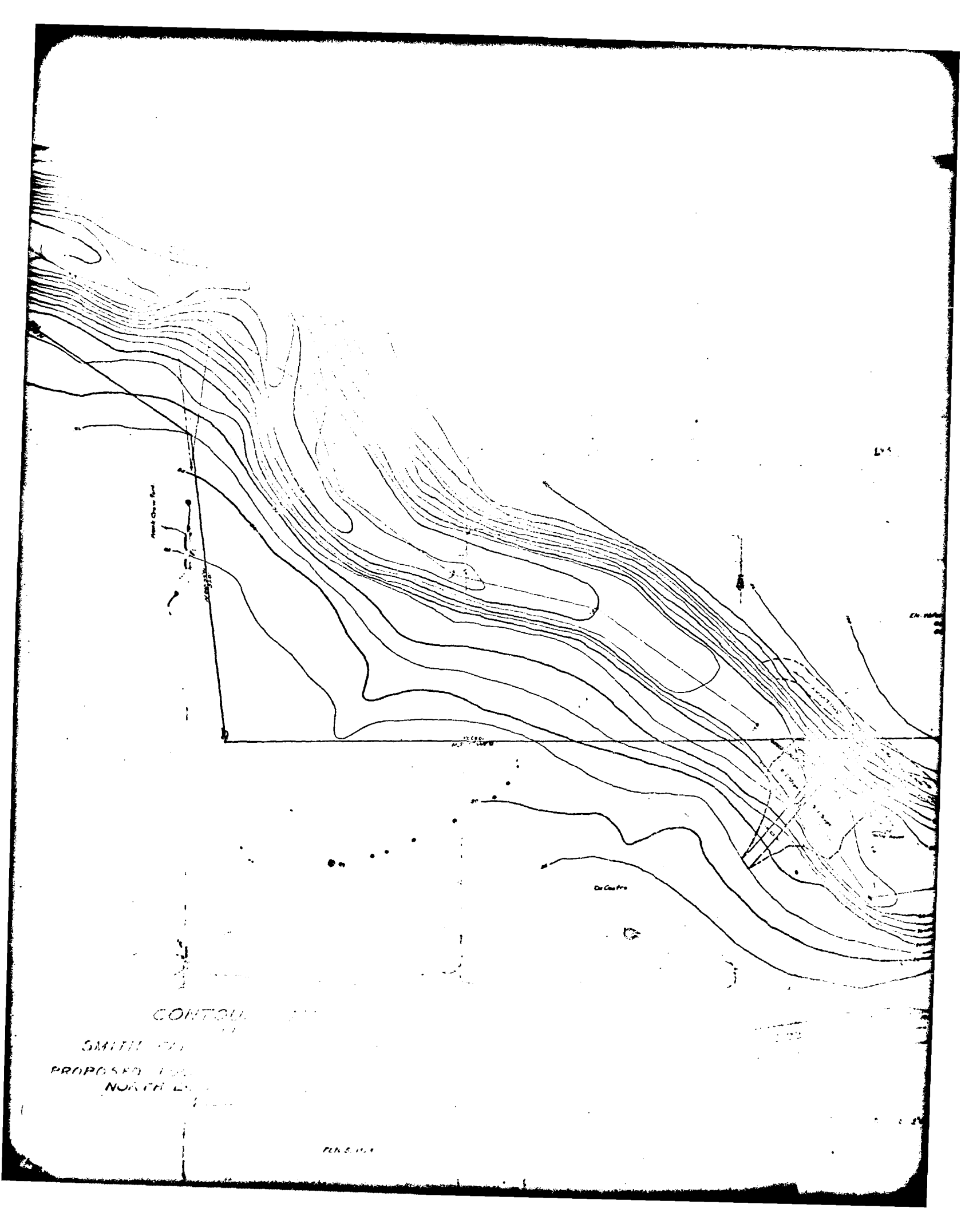
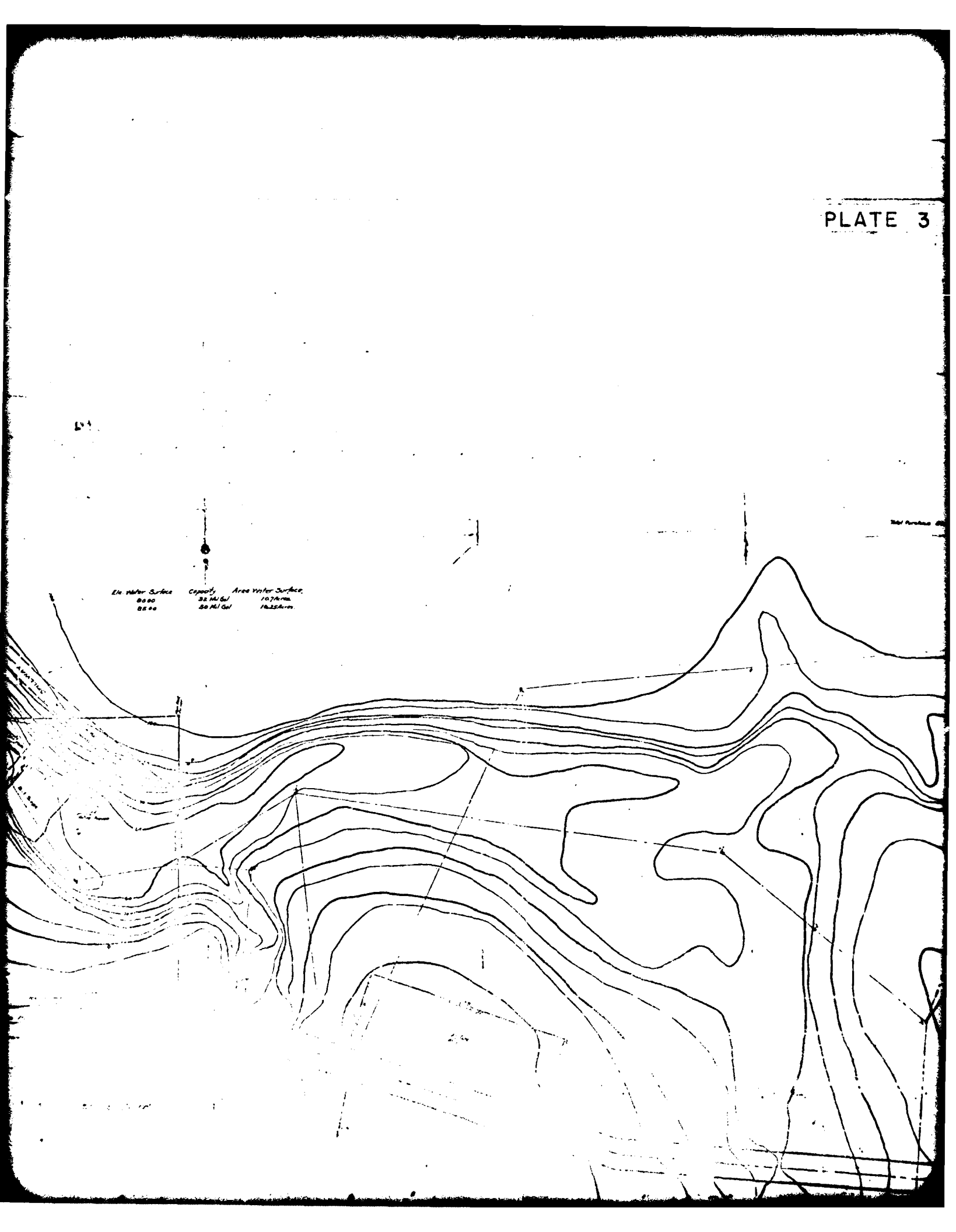
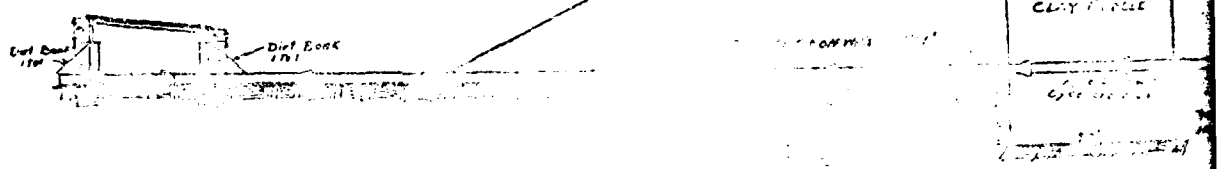
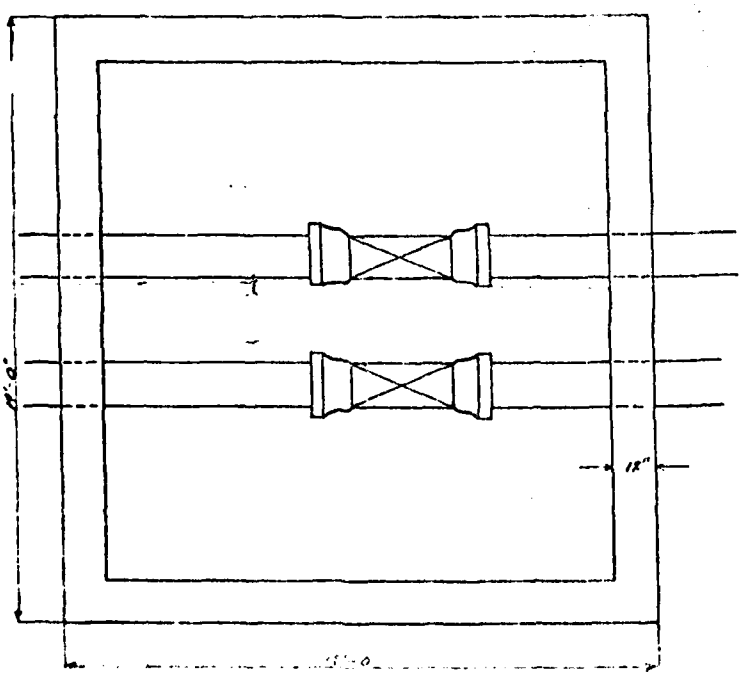
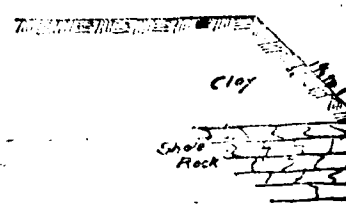


PLATE 3

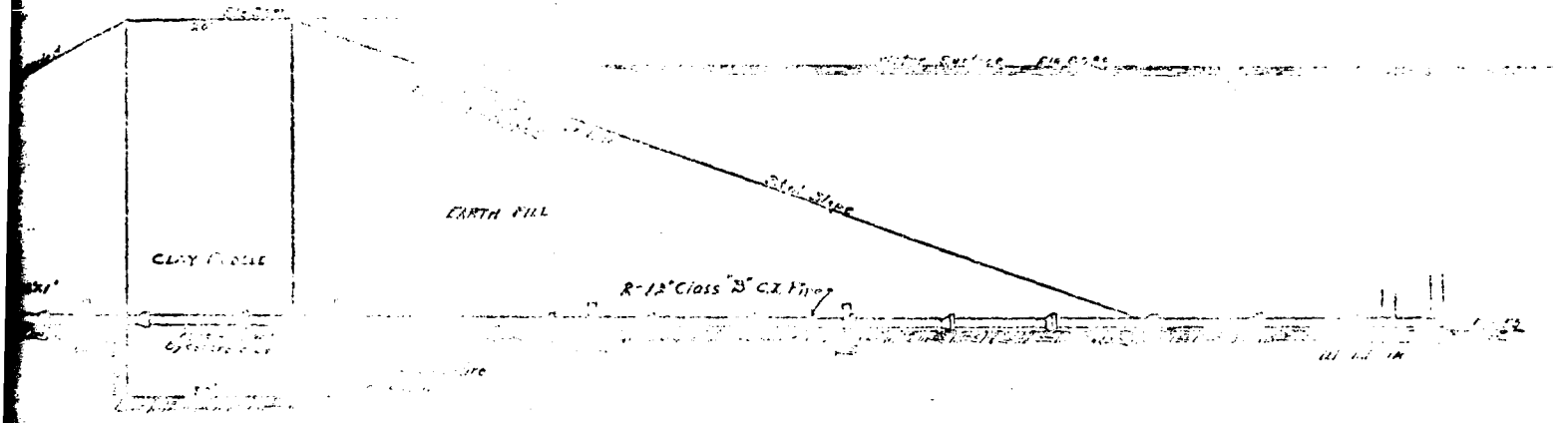

Ele. Water Surface
Capacity
Area Water Surface
8060
32 Mil Gal
10.7 Acres
8500
50 Mil Gal
18.25 Acres



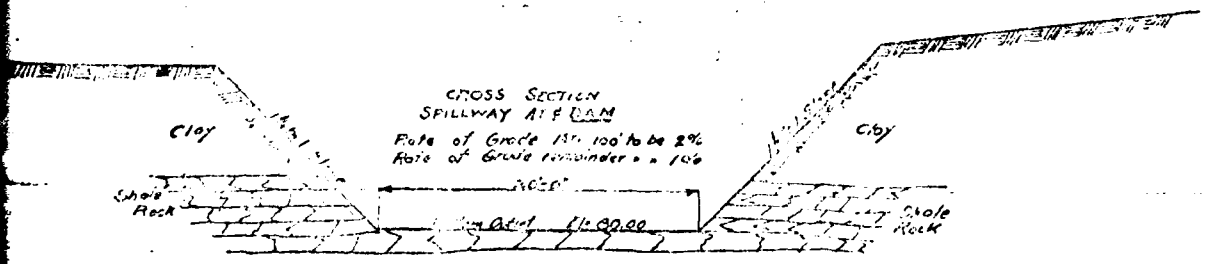




Details of Valve House
Scale 1/8" = 1'



CROSS SECTION
OF
DAM
Scale 1"=10'



CROSS SECTION
OF
SPILLWAY
Scale ⅛"=1'

PLATE 4

DETAILS
OF
DAM & CONTROL
SMITH FARM RESERVOIR
NORTH EAST WATER WORKS
NORTH EAST PA.

HILL & HILL
ENGINEERS

APPENDIX F

REGIONAL GEOLOGY

SMITH RESERVOIR DAM
NDI No. PA 00017, PennDER No. 25-28

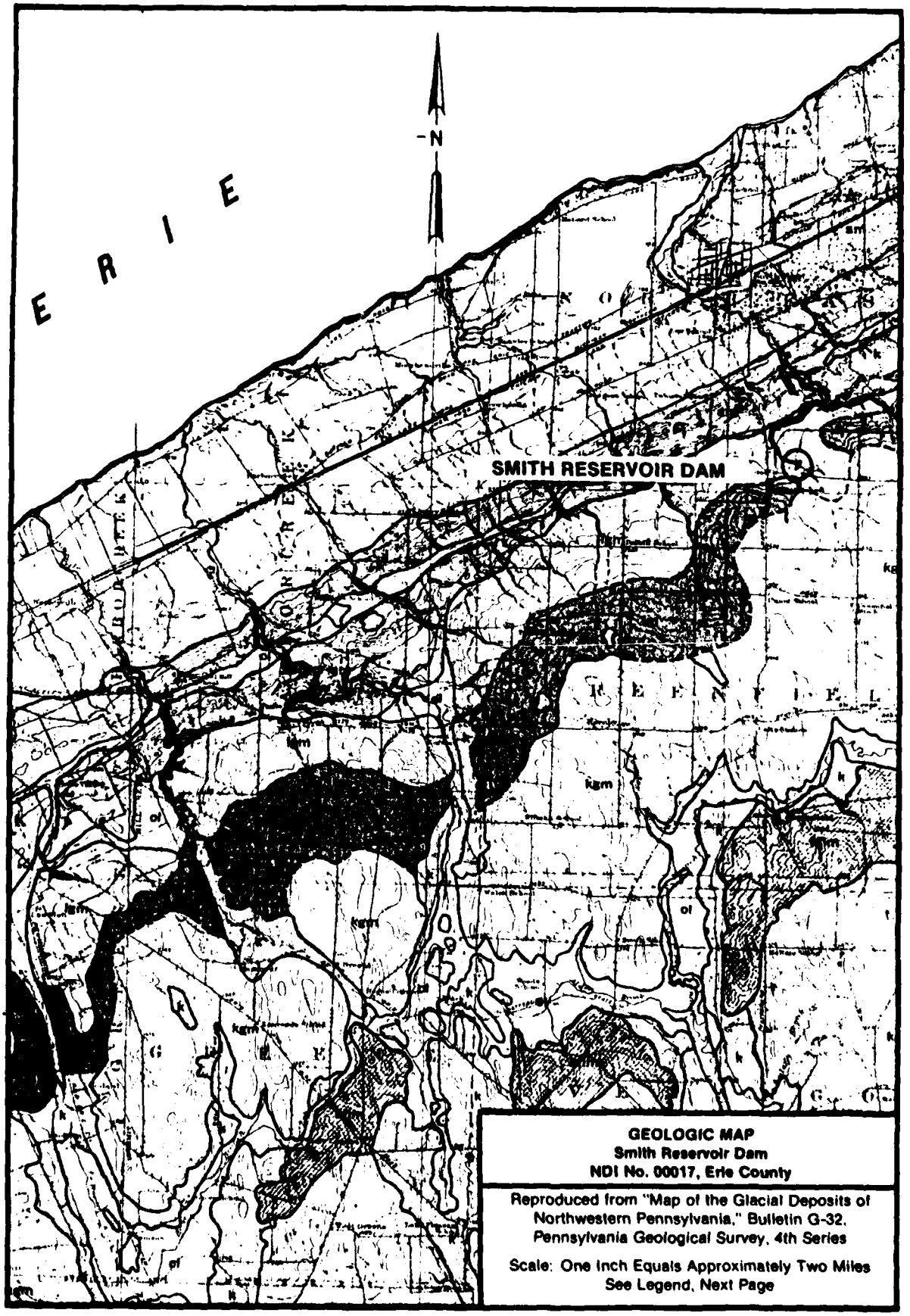
REGIONAL GEOLOGY

Smith Reservoir Dam is located in the glaciated section of the Appalachian Plateaus physiographic province, approximately 5 miles southeast of Lake Erie. The normal pool of the reservoir is approximately 728 feet above mean lake level of Lake Erie.

According to the "Geologic Map of Pennsylvania," (1960) the bedrock units in the vicinity of the dam are members of the Conneaut group, Devonian system. These units are alternating gray, brown, greenish, and purplish shales and siltstones; including the "Chemung" and "Girard" formations of northwestern Pennsylvania. The dam and abutments are located in the "Chemung" formation which forms the upper 325 feet of the Conneaut group.

The geologic map on the following page indicates the overburden in the vicinity of the dam is part of the Lavery Till ground moraine. The ground moraine of the Lavery advance consists primarily of silty till. The thickness of the ground moraine has been estimated to be 10 to 30 feet thick. Locally at the dam site the overburden on the right abutment appeared to be thin (estimated 10 feet maximum) and on the left abutment the overburden appeared to be thicker (estimate 25 feet). No information concerning the source of borrow was available; however, the material along the upstream slope above normal pool level and the material from which the protective dike along the spillway channel entrance is constructed is a sandy loam. This type of material is more commonly found in areas of the Kent Moraine deposits. The material comprising the downstream slope is a silty, clayey sand with sandstone and shale rock fragments.

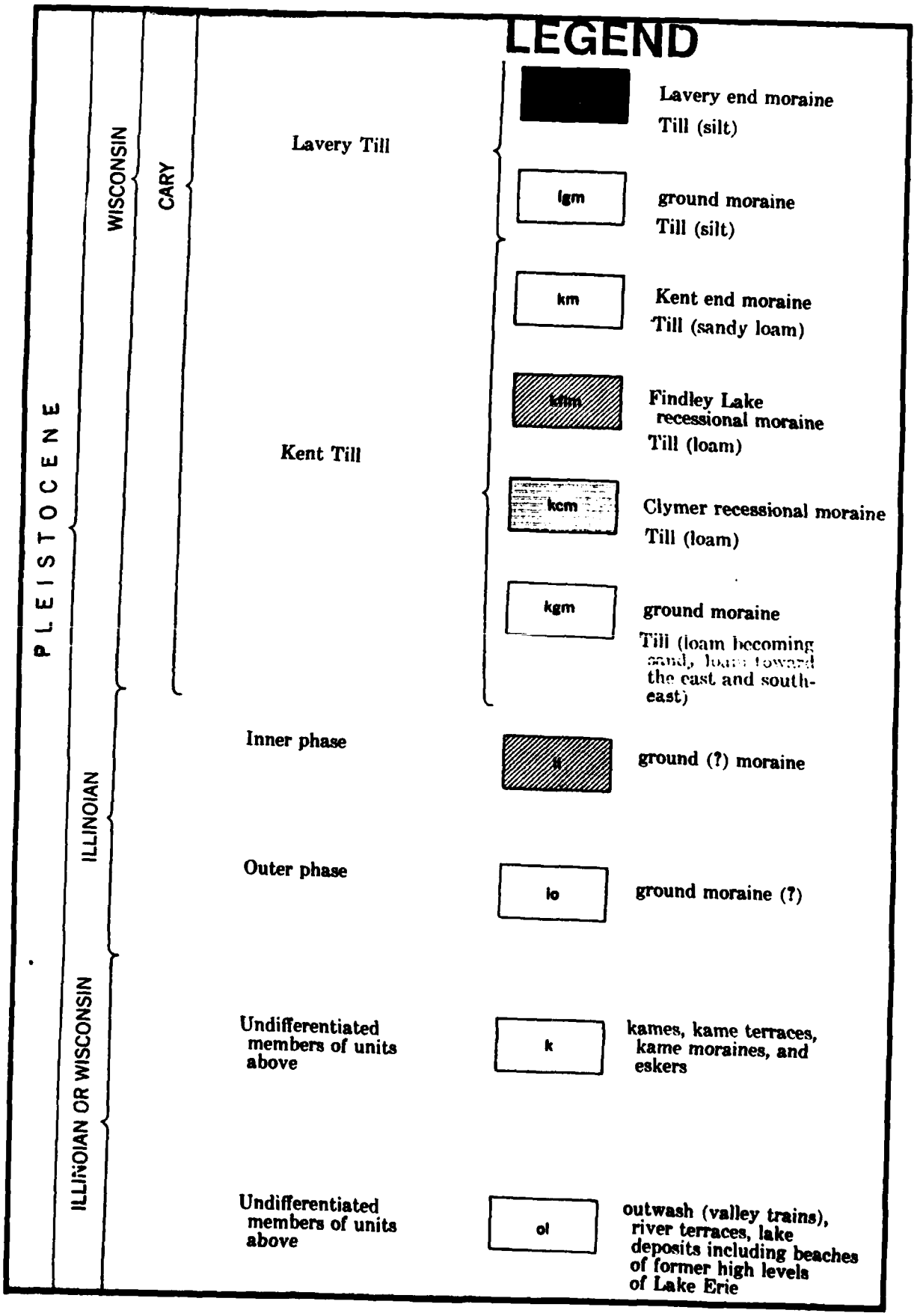
The geologic map and legend are presented on the following pages.



GEOLOGIC MAP
Smith Reservoir Dam
NDI No. 00017, Erie County

Reproduced from "Map of the Glacial Deposits of Northwestern Pennsylvania," Bulletin G-32, Pennsylvania Geological Survey, 4th Series

Scale: One Inch Equals Approximately Two Miles
See Legend, Next Page


LEGEND
PLEISTOCENE
WISCONSIN
CARY
ILLINOIAN
ILLINOIAN OR WISCONSIN
Lavery Till
Lavery end moraine
Till (silt)
lgm
ground moraine
Till (silt)
km
Kent end moraine
Till (sandy loam)
kfm
Findley Lake
recessional moraine
Till (loam)
Kent Till
kcm
Clymer recessional moraine
Till (loam)
kgm
ground moraine
Till (loam becoming
sand, loam toward
the east and south-
east)
Inner phase
ii
ground (?) moraine
Outer phase
io
ground moraine (?)
Undifferentiated
members of units
above
k
kames, kame terraces,
kame moraines, and
eskers
Undifferentiated
members of units
above
ol
outwash (valley trains),
river terraces, lake
deposits including beaches
of former high levels
of Lake Erie

APPENDIX G

WARNING AND EVACUATION PLAN

ERIE COUNTY

SMITH AND GRAHAMVILLE RESERVOIR DAMS

WARNING AND EVACUATION PLAN

April 1980

The Smith and Grahamville Reservoir Dams are owned by North East Borough. They are operated and maintained by the North East Borough Water Department.

PART I. GENERAL INFORMATION

A. Purpose

The purpose of this plan is to provide an effective public flood warning and evacuation system for use in the event of a severe flood or assumed failure of either the Smith or Grahamville Reservoirs.

B. Responsibility

The Water Department is responsible for maintaining surveillance of the dams and initiating the operating procedures to be implemented by the persons and organizations designated in Part II, following.

C. Basis for Establishing Alerts

Alerts will be based on information received from the Water Authority.

D. Governing Principle

There are no dwellings downstream from either dam that would be affected by a dam failure. Only Oxbow Road and Cole Road would be affected if a complete failure of the Grahamville Reservoir or Smith Reservoir, respectively, occurred.

E. Operating Conditions

1. During normal operations, the dams are inspected twice weekly.

2. During periods of inclement weather, the dams are inspected daily for any of the following conditions:

   a. Wet areas or seepage around the downstream embankment, toe and abutments;

   b. Seepage around spillway structures;

   c. Possible damage to the downstream embankment due to high velocity discharge through either spillway channel;

   d. As flow over the spillways continues to rise, determine whether the embankments might, or actually be overtopped;

   e. Visible movement of either structure.

PART II. OPERATING PROCEDURES

A. Action by the Water Department

1. When water is measured to be flowing through the emergency spillways at 50% of its capacity, notify the following:

   a. Water Department Superintendent

   b. Water Department Assistant Superintendent

   c. Borough Engineer

2. When water is measured to be flowing through either emergency spillway at 100% of its capacity, or when one of the conditions in Part I, Section E exist at either dam, notify the North East Borough Police. (SEE ATTACHMENT 1)

B. Action by the North East Borough Police

1. When advised that either dam is experiencing emergency conditions, notify the following:
   a. North East Fire Department (ACTIVATE SIREN)
   b. North East Emergency Management Coordinator
2. Dispatch vehicles to the appropriate dam to establish the necessary roadblocks. (SEE ATTACHMENT 2)

C. Action by the North East Borough Fire Department

Assist the Borough Police in the establishment of roadblocks.

D. Action by the Borough Emergency Management Coordinator

Coordinate the activities of the local police and fire departments.

E. Action by the Public

When informed, follow the instructions issued by the police and fire departments.

F. Contingency Actions

A copy of this plan will be furnished to all concerned, for use in the event that any unforeseeable development, such as breakdown of communications, prevents its orderly implementation. In that event, every effort through alternative means of communications, etc., will be taken to ensure its implementation.

CONCURRENCES

North East Borough Water Department	Date 5-16-80
North East Borough Police	Date 5/2/80
North East Borough Fire Department	Date 5/2/80
Emergency Management Coordinator	Date 5/5/80

ATTACHMENT #1 FOR

NORTH EAST BOROUGH RESERVOIR WARNING PLAN

The following is the list of telephone numbers for the Radio Operator's use in carrying out procedures outlined in the warning plan.

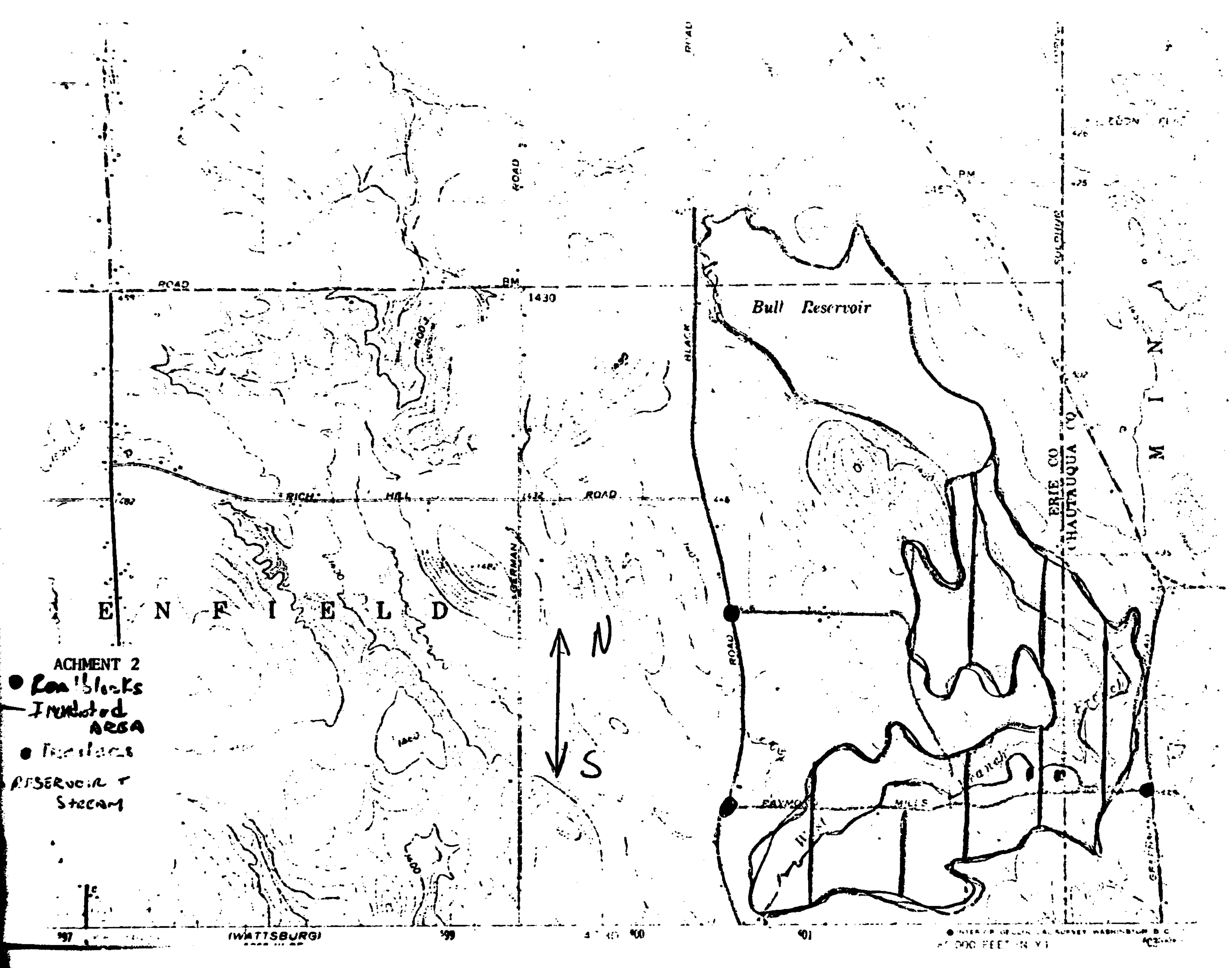
NAME	TITLE	PHONE NO.
Clarence Hutchinson	Water Dept. Superintendent	725-1143
F. David Montgomery	Asst. Water Dept. Superintendent	725-4181
H. L. Mallick	Borough Engineer	725-4666
James A. Ciminnisi	Borough Chief of Police	725-3612
Thomas Huber	North East Fire Chief	725-9233
Lonzo Newcome	Greenfield Fire Chief	725-1651
Donald Youngs	Civil Defense Director	725-1125
Penna. State Police		898-1641

Also in case emergency conditions exist notify:

DER Regional Office
Carnegie, Pa. (412) 276-1111

and

Division of Dam Safety
DER
Harrisburg, Pa. (717) 787-4467
(717) 783-8150


ACHMENT 2
Bull Reservoir
ERIE CO
CHAUTAUQUA CO
E N F I E L D
M I N A
RICH HILL ROAD
ROAD
BLACK
BM
1430
GERMAN
MILLS
(WATTSBURG)
N
S