SUSQUEHANNA RIVER BASIN
TRIBUTARY TO BLACK CREEK
LUZERNE COUNTY

PENNSYLVANIA

LAKE IRENA DAM

NDI ID NO. PA-00179
DER ID NO. 40-215

HAZLE TOWNSHIP
BOARD OF SUPERVISORS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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

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Prepared By:

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

SEPTEMBER 1981

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 investigations; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

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

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

NDI ID No. PA 00179, DER ID No. 40-215

PHASE I INSPECTION REPORT

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESMENT OF GENERAL CONDITION
AND
RECOMMENDED ACTION

Name of Dam:	Lake Irena Dam NDI ID No. PA 00179 DER ID No. 40-215
Size:	Small (23.6 feet high; 156 acre-feet)
Hazard Classification:	Significant
Owner:	Hazle Township Board of Supervisors Hazleton, Pa.
State Located:	Pennsylvania
County Located:	Luzerne
Strea :	Tributary to Black Creek
Date of Inspection:	1 December 1980

The visual inspection and review of available design and construction data indicate that Lake Irena Dam is in fair condition. In accordance with the guidance provided, the spillway design flood (SDF) ranges between the 100 year flood and 1/2 the PMF. Based on the size and extent of downstream hazard for the dam, the SDF selected for this facility was the 100 year flood.

The hydrologic and hydraulic computations indicate that the spillway will pass the selected SDF prior to overtopping the embankment. Therefore, in accordance with the recommended criteria for Phase I inspections, the spillway for Lake Irena Dam is considered to be adequate.

It is recommended that the following actions be taken by the owner without delay:

1. The crest and downstream face to the embankment should be provided with erosion protection.

2. The seepage near the embankment side of the berm along the left side of the spillway channel should be monitored, and appropriate remedial measures taken should any significant changes in turbidity or flow rate be observed.

3. The right spillway wall should be repaired.

4. A conventional method for securing the manhole cover for the control valve should be developed, and the operational condition of the outlet works determined (including removal of all debris at the downstream end).

5. The area along the toe of the embankment should be regraded to provide proper drainage for runoff.

6. The embankment and spillway discharge channel should be cleared of trees and brush.

7. Make appropriate repairs to the spillway bridge to assure that no damage is done to the spillway by the passage of traffic.

8. A formal surveillance and downstream emergency warning system should be developed for use during periods of heavy or prolonged precipitation.

9. An operation and maintenance manual or plan should be prepared for use as a guide in the operation and maintenance of the dam during normal and emergency conditions.

10. A schedule of regular inspections by a qualified engineer should be developed.

Lake Irena Dam

Approved By:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineer
District Engineer

DATE: 18 Sept 1981

LAKE IRENA DAM

OVERVIEW

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 non-federal dams throughout the United States.

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

1.2 Description of Project.

a. Description of Dam and Appurtenances. Lake Irena Dam is an earthfill structure approximately 23.6 feet high and 690 feet in length (including spillway). The 27 foot wide spillway is an uncontrolled rectangular ogee weir located near the right abutment of the dam. The outlet works consist of a 24 inch diameter corrugated metal pipe through the embankment with a control valve located in a manhole near the centerline of the dam.

b. Location: Hazle Township, Luzerne County, Pennsylvania
U.S.G.S. Quadrangle - Hazleton, Pennsylvania
Latitude 40° 58.8'; Longitude 76° 00.2'
Refer to Plates E-I and E-II.

c. Size Classification: Small: Height - 23.6 feet,
Storage - 156 acre-feet.

d. Hazard Classification: Significant (Refer to sect 3.1.e)

e. Ownership: Hazle Township Board of Supervisors
Hazleton, Pennsylvania
c/o Mr. Frank Fay, Chairman

f. Purpose: Recreation.

g. Design and Construction History: The dam was designed in 1961 by Central Penn Engineering for the Greater Hazleton Community Park Association. A permit for construction was issued by PennDER on 17 July 1961. By letter dated 7 November 1963, the owner stated that the dam was completed. A PennDER inspection on 6 July 1965 found the dam to be in good condition.

h. Normal Operating Procedure. The reservoir is normally maintained at the level of the spillway crest. Large inflows are discharged through the spillway section.

1.3 Pertinent Data.

a. Drainage Area (square miles)

From files:	0.70
Computed for this report:	1.00
Use:	1.00

b. Discharge at Damsite (cubic feet per second)

Maximum known flood	unknown
Outlet works with maximum pool (El. 1520.4)	47
Spillway with maximum pool (El. 1520.4)	1320

c. Elevations (feet above mean sea level)

Top of Dam	
Design	1520.0
Existing	1520.4
Normal pool	1515.0
Spillway Crest	
Design	1515.0
Existing	1515.0
Outlet Works	
Upstream invert	1496.9
Downstream invert	1496.8
Streambed at toe	1496.8

d. Reservoir Length (Feet)

Normal pool (El. 1515.0)	1500
Maximum pool (El. 1520.4)	1700

e. Storage (acre-feet)

Normal pool (El. 1515.0)	62
Maximum pool (El. 1520.4)	156

f. Reservoir Surface (acres)

Normal pool (El. 1515.0)	13
Maximum pool (El. 1520.4)	24

g. Dam

Note: Refer to plates in Appendix E for plans and sections.

Type	Earthfill
Length	690 feet including spillway
Top Width	27 feet
Height	23.6 feet
Side Slopes	
Upstream	2.3H:1V
Downstream	2.5H:1V
Zoning	None
Cutoff	None
Grouting	None

h. Outlet Works.

Type	24 inch corrugated metal pipe.
Closure	Sluice gate.

i. Spillway

Type	Rectangular concrete ogee weir.
Location	Near right abutment
Length	27 feet
Crest Elevation	1515.0 MSL
Freeboard	5.4 feet
Approach Channel	Reservoir
Downstream Channel	Earth and rock lined
Bridge	Small bridge w/steel stringers and wood decking
Piers	None

SECTION 2

ENGINEERING DATA

2.1 Design.

The available data for Lake Irena Dam consist of files provided by PennDER. Information available includes a permit application report with a general description of the proposed design, construction progress reports, PennDER inspection reports, and various related correspondence. Design drawings, dated June 1961, showing plans, sections and details of the dam are also available.

2.2 Construction.

Data available for this dam indicate that it was completed as of 7 November 1963 essentially in accordance with the approved design. There were some questions raised by PennDER during construction concerning spillway blockage, which were satisfactorily resolved by the owners.

2.3 Operation

No formal records of operation or maintenance are known to exist.

The most recent PennDER inspection indicated that the dam was in good condition.

2.4 Evaluation

a. Availability. All available written information was contained in the permit files provided by PennDER.

b. Adequacy. The available data, including that collected during the recent detailed visual inspection, are considered to be adequate to make a reasonable assessment of the dam.

SECTION 3

VISUAL INSPECTION

3.1 Observations.

a. General. The overall appearance and general condition of Lake Irena Dam is fair. Noteworthy observations are described briefly below. The visual inspection checklist, field sketch and crest profile are provided in Appendix A. Photographs taken during the inspection are reproduced in Appendix C.

The initial inspection was performed 1 December 1980. A brief review inspection was made on 20 May 1981 to ascertain if any significant changes had occurred during the winter months. The only change noted was that the seepage near the junction of the dam and spillway had increased. In addition, the reservoir level was slightly higher, which resulted in an increase in spillway discharge. Representatives of the owner were interviewed during the inspection.

b. Embankment. The vertical alignment of the crest varied about 0.8 foot with a low point occurring approximately 150 feet to the right of the left abutment. No signs of horizontal movement of the crest were observed. Practically the entire 27 foot wide crest was devoid of vegetation. This was apparently due to heavy foot traffic, since the lake is located in a community park and is popular for fishermen. Minor erosion was occurring at the edges of the crest. The upstream face, which is protected by 18-24 inch riprap, has a slope of 1V:2.3H. This stone protection was in good condition and no areas of instability or erosion were observed. Numerous white birch trees are growing near the junction of the crest and upstream slope along the entire length of the dam. The downstream face slopes at 1V:2.5H. Although this face generally supported a good stand of grass, there were areas of localized surficial erosion. The cause was assumed to be the high volume of pedestrian traffic. Scattered trees and brush were growing on this face, mainly near the left and right abutments. Clear seepage was observed flowing from near the toe of a berm which was along the left side of the spillway discharge channel. This area of seepage was determined to be downstream of the junction of the embankment and natural ground. The type of vegetation in the area indicated that this condition has existed for some time. On the day of the review inspection the seepage flow had visibly increased. The location of this seepage with respect to the spillway and the direct correlation between spillway discharge and seepage flows indicates that this flow is caused by spillway discharge passing through the berm. Another wet area exists at and beyond the toe, adjacent to the left half of the dam. No movement or flow was evident in this area. According to photographs taken during construction, a large area downstream of the toe was filled and graded relatively flat. Ponding of surface runoff occurred a short time later.

c. Appurtenant Structures. The outlet works for this facility reportedly consists of a concrete encased 24-inch corrugated metal pipe with a sluice gate. The gate is housed in a manhole that is located immediately downstream of the dam centerline. On the day of this inspection, a large boulder was resting on top of the manhole cover. This obstruction prevented

inspection of the gate and gate control. The outlet end of the pipe was buried by earth up to within one foot of the top of the headwall. Therefore, the condition of the outlet works could not be determined.

The spillway, which is located at the right end of the dam, consisted of a concrete ogee weir with concrete walls. These walls extended 20 feet upstream and 25 feet downstream of the dam centerline. A concrete apron extended downstream to the end of the walls. All the concrete in the spillway was in good condition except for the downstream portion of the right wall. Sufficient deterioration has occurred that some reinforcing steel was exposed. A bridge which crosses the spillway was supported by steel beams which rest in notches in the top of the concrete walls. The structure was in fair condition, except that tread boards should be provided on the deck. At the end of the spillway slab there was a vertical drop of about two feet. The channel was rock lined for the first 100 feet. The right bank of this channel, which was natural ground, was steeply eroded. The left bank is an earth and rockfill berm protecting the toe of the embankment.

d. Reservoir Area. The reservoir slopes are wooded and relatively flat. The slopes appear stable and a massive slide is unlikely. A community recreation area is located adjacent to the right shoreline.

e. Downstream Channel. The channel downstream of Lake Irena Dam passes through a wooded and uninhabited area with a flat to moderate slope. Approximately 2,000 feet downstream of the dam, a branch of Conrail crosses the stream. Black Creek is joined 0.6 mile below the dam. Pennsylvania Route 93 passes over the stream via a bridge about 0.9 mile downstream. Below this structure, the floodplain widens and Black Creek flows through the center of Valmont Industrial Park and adjacent to a wastewater treatment plant which is approximately 1.2 miles below the dam. The first floor of one of the buildings in the industrial park is 9 feet above streambed. The treatment plant is approximately 10 feet above the streambed. Beyond this point, Black Creek passes under Interstate Route 81 and then adjacent to an uninhabited strip mine area. It is judged that failure of Lake Irena Dam would create a potential hazard for serious economic damage, property damage and the loss of a few lives. Therefore, a significant hazard classification is warranted for Lake Irena Dam.

f. Evaluation. The primary deficiencies at this dam are basically maintenance problems. The crest and downstream face should be protected from erosion. The spillway wall should be repaired to prevent further deterioration. In addition, a conventional method of securing the manhole cover to allow dependable access to the valve for maintenance and operation. The discharge end of the conduit should be cleared of all obstructions. The seepage should also be monitored for significant changes in flow or turbidity. The wet area at the downstream toe of the embankment should be regraded for proper drainage.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure. The lake is normally maintained at the level of the spillway crest, elevation 1515.0. Normal flow passes over the ogee spillway located near the right abutment. Large inflows would also be discharged over the spillway.

4.2 Maintenance of Dam. The condition of the dam and its appurtenances as observed by the inspection team was fair. The embankment has tree growth along the upstream face and small trees and shrubs on the downstream face. The emergency spillway crest, walls and weir are in good condition. The bridge spanning the spillway is in need of minor repair; however, this condition does not adversely impact on the spillway performance. The downstream end of the outlet works has been buried or covered in with earth, and no flow was observed. In addition, access to the gate valve has been prevented by the placing of a large rock (see Appendix C for photograph) on top of the manhole cover. The ability to operate the valve for normal maintenance or during an emergency situation is questionable. No formal maintenance manual exists.

4.3 Maintenance of Operating Facilities. See section 4.2 above.

4.4 Warning System. No formal warning system exists.

4.5 Evaluation. Maintenance of the facility appears to be insufficient at this time. The sluice gate operating mechanism should be made more accessible. Sediment or blockage at the downstream end of the outlet works should be removed to permit flow through the conduit. Trees and brush should be removed from the embankment and discharge channel of the spillway. Formal manuals of maintenance and operation should be developed to ensure all needed maintenance is identified and performed regularly. In addition, a formal warning system for the protection of downstream inhabitants should be developed. Included in the plan should be provision for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

Section 5
HYDRAULIC/HYDROLOGIC EVALUATION

5.1 Design Data. No formal design reports or calculations are known to exist for the facility. Two design drawings showing embankment, spillway, outlet works, and reservoir area details are located in the PennDER files and are shown in Appendix E of this report.

5.2 Experience Data. Records of reservoir levels and/or spillway discharges are not available.

5.3 Visual Observations. On the date of the inspection, the facility appeared that it would operate satisfactorily during a flood event. Minor deficiencies were noted in section 4.2, primarily the blockage of the downstream end of the outlet works. In addition, minor areas of the embankment have been eroded due to foot and bicycle traffic along the downstream face. These areas should be seeded. See field sketch in Appendix A and photographs in Appendix C for more detail of the facility.

5.4 Method of Analysis. The facility has been analyzed in accordance with the guidelines established by the U.S. Army Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the SDF for Lake Irena Dam ranges between the 100 year flood and one-half Probable Maximum Flood (PMF). This classification is based on the relative size of the dam (small) and the potential hazard of failure to downstream development (significant). Due to the small height and storage of Lake Irena Dam and the degree of downstream hazard, the selected SDF was the 100 year flood.

b. Results of Analysis.

The 100 year flood peak is derived by averaging the peak flow value obtained from two regression equations. The first regression equation is from Bulletin 13, Floods in Pennsylvania, Water Resources Bulletin. Guidelines are provided to determine the peak value by use of regional statistical data. The second regression equation is from the Hydrologic Study, Tropical Storm Agnes, North Atlantic Division, U.S. Army Corps of Engineers, 1975. Guidelines are provided to determine the flood peak by use of map coefficients and logarithmic equations. The following results are obtained.

100 year flood peak	CFS
Bulletin 13 -	438
North Atlantic Division, Tropical Storm Agnes -	1,191
Average 100 year flood peak -	815

To determine the adequacy of the spillway, the average value for the 100 year flood is compared against the maximum outflow at low point top of dam. If the maximum outflow exceeds the 100 year average peak value derived above, then the spillway is rated adequate. If, however, the 100 year average peak value exceeds the maximum outflow at low point top of dam, the spillway is rated inadequate. Results are as follows.

	CFS
Maximum outflow at top of dam -	1,320
Average 100 year flood peak -	815

5.6 Spillway Adequacy. Under existing conditions, Lake Irena Dam can pass the 100 year flood peak value. Since this structure can pass the selected SDF (100 year flood), the spillway is rated adequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) Embankment. Lake Irena Dam is an earth embankment that is in fair condition. The dam crest measures 27 feet wide while the upstream slope is 2.3H:1V and the downstream slope is 2.5H:1V. Erosion was noted along the crest, at either side of the spillway, and an area on the downstream slope used as a footpath. The upstream slope is protected with 18-24 inch riprap. No signs of sloughing or embankment instability were noted. The trees and brush on the dam should be removed, and the area adjacent to the downstream toe regraded to allow proper drainage, since this area stays wet. Seepage was observed near the embankment side of the berm along the left side of the spillway channel. Most, if not all, of this seepage is from spillway flow seeping through the berm, as the seepage intensity varies with the quantity of flow in the spillway channel. This condition should be monitored.

(2) Appurtenant Structures. The spillway is located at the right abutment. It is a concrete structure with an ogee crest. Generally, the spillway structure is in good condition, although the downstream right spillway wall is deteriorating and rebar is exposed. The bridge over the spillway appears to be in need of improvement. The approaches to the bridge should be raised to the height of decking. Tread boards are recommended, and the bridge should be classified for weight capacity and posted to prevent damage to the bridge and spillway. An outlet drain control is located approximately 90 feet from the right end of the dam. The closure for this drain is slightly downstream of the dam centerline. The outlet end of the drain could not be observed since it was silted in and only the top of the structure was visible.

b. Design and Construction Data.

(1) Embankment. Two design drawings were on file with PennDER. One drawing presented a plan view and the other provided a cross section and longitudinal section of the dam along with spillway sections and outlet drain information. The dam is a homogeneous earthfill structure with no cutoff. Six test pits were dug along the dam centerline during design which indicated that rock was approximately 7 feet below the base of the dam. The designed 20 foot wide embankment crest was widened and the 2H:1V slopes were flattened during construction.

(2) Appurtenant Structures. A design drawing for the spillway and drain is on file. The outlet drain is shown to be a concrete encased 24 inch CMP, with a sluice gate closure located at the downstream edge of the crest. Seepage collars were designed for the drain. A report pertaining to construction of the dam states that a 12 inch gate valve was used as the drain closure instead of a 24 inch sluice gate. Spillway data indicate that 10 foot

long seepage walls were constructed perpendicular to the spillway channel walls on each side. A seepage cutoff wall is also shown at the downstream end of the concrete slab below the ogee crest.

c. Operating Records. None.

d. Post Construction Changes. None.

e. Seismic Stability. The dam is located in Seismic Zone 1. From visual observations the dam is considered to be statically stable. Therefore, the seismic stability is considered adequate.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment.

a. Safety. The visual inspection and review of available design and construction data indicate that Lake Irena Dam is in fair condition. In accordance with the guidance provided, the spillway design flood (SDF) ranges between the 100 year flood and 1/2 the PMF. Based on the size and extent of downstream hazard for the dam, the SDF selected for this facility was the 100 year flood.

The hydrologic and hydraulic computations indicate that the spillway discharge capacity is sufficient to pass the selected SDF prior to overtopping the embankment. Therefore, in accordance with the criteria outlined and evaluated in section 5.5, the spillway for Lake Irena Dam is considered to be adequate.

b. Adequacy of Information. The design and construction data contained in PennDER files, in conjunction with data collected during the recent visual inspection, are considered to be adequate for making a reasonable assessment of this dam.

c. Urgency. The recommendations presented below should be implemented without delay.

d. Necessity for Additional Studies. The results of this inspection indicate no need for additional studies at this time.

7.2 Recommendations.

1. The crest and downstream face of the embankment should be provided with erosion protection.

2. The seepage near the embankment side of the berm along the left side of the spillway channel should be monitored, and appropriate remedial measures taken should any significant changes in turbidity or flow rate be observed.

3. The right spillway wall should be repaired.

4. A conventional method for securing the manhole cover for the control valve should be developed, and the operational condition of the outlet works determined (including removal of all debris at the downstream end).

5. The area along the toe of the embankment should be regraded to provide proper drainage for runoff.

6. The embankment and spillway discharge channel should be cleared of trees and brush.

7. Make appropriate repairs to the spillway bridge to assure that no damage is done to the spillway by the passage of traffic.

8. A formal surveillance and downstream emergency warning system should be developed for use during periods of heavy or prolonged precipitation.

9. An operation and maintenance manual or plan should be prepared for use as a guide in the operation and maintenance of the dam during normal and emergency conditions.

10. A schedule of regular inspection by a qualified engineer should be developed.

APPENDIX A

CHECKLIST - VISUAL INSPECTION

APPENDIX A

Check List
Visual Inspection
Phase 1

Name Dam Lake Lena Dam, DER I.D. No. 40-215 County Luzerne State Pennsylvania

Date(s) Inspection 1 Dec 80 Weather Cloudy Temperature 50°

Pool Elevation at Time of Inspection 1515.0 M.S.L. Tailwater at Time of Inspection 1496.9 M.S.L.

Inspection Personnel:

J. Bianco, C.O.E.
B. Cortright, C.O.E.
J. Evans, C.O.E.
E. Hecker, C.O.E.
Mr. Joe Belusko, Township Supervisor
Mr. Joe Synoski, Township Supervisor
B. Cortright Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS
Any Noticeable Seepage	20 gpm clear seepage 20 feet downstream of toe and left of spillway berm. (1 Dec 80)
Junction of Embankment with: Abutments Spillway	Abutments - Good. Spillway - Good.
Surface Cracks	None.
Crest Alignment Vertical Horizontal	Vertical - Varies 0.8 foot. Low spot near left end. Horizontal - Good; no signs of movement.
Unusual Movement or Cracking at or beyond the Toe	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS
Sloughing or Erosion: Embankment Crest/Slopes Abutment Slopes	Embankment - Minor surficial erosion of edges of crest and downstream face due to foot traffic. Abutments - None.
Riprap	18" - 24" stone up to crest on upstream face. Durable and stable
Staff Gage and Recorder	None.
Instrumentation	None.
Miscellaneous	Trees along upstream face at crest. Small trees and brush scattered on downstream slope.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS
Intake Structure	Submerged: not observed.
Outlet Conduit	Not observed.
Outlet Structure	Concrete endwall; buried to within one foot of top.
Emergency Gate	Located within manhole on crest; not observed.
Outlet Channel	Silted in and buried.

SPILLWAY

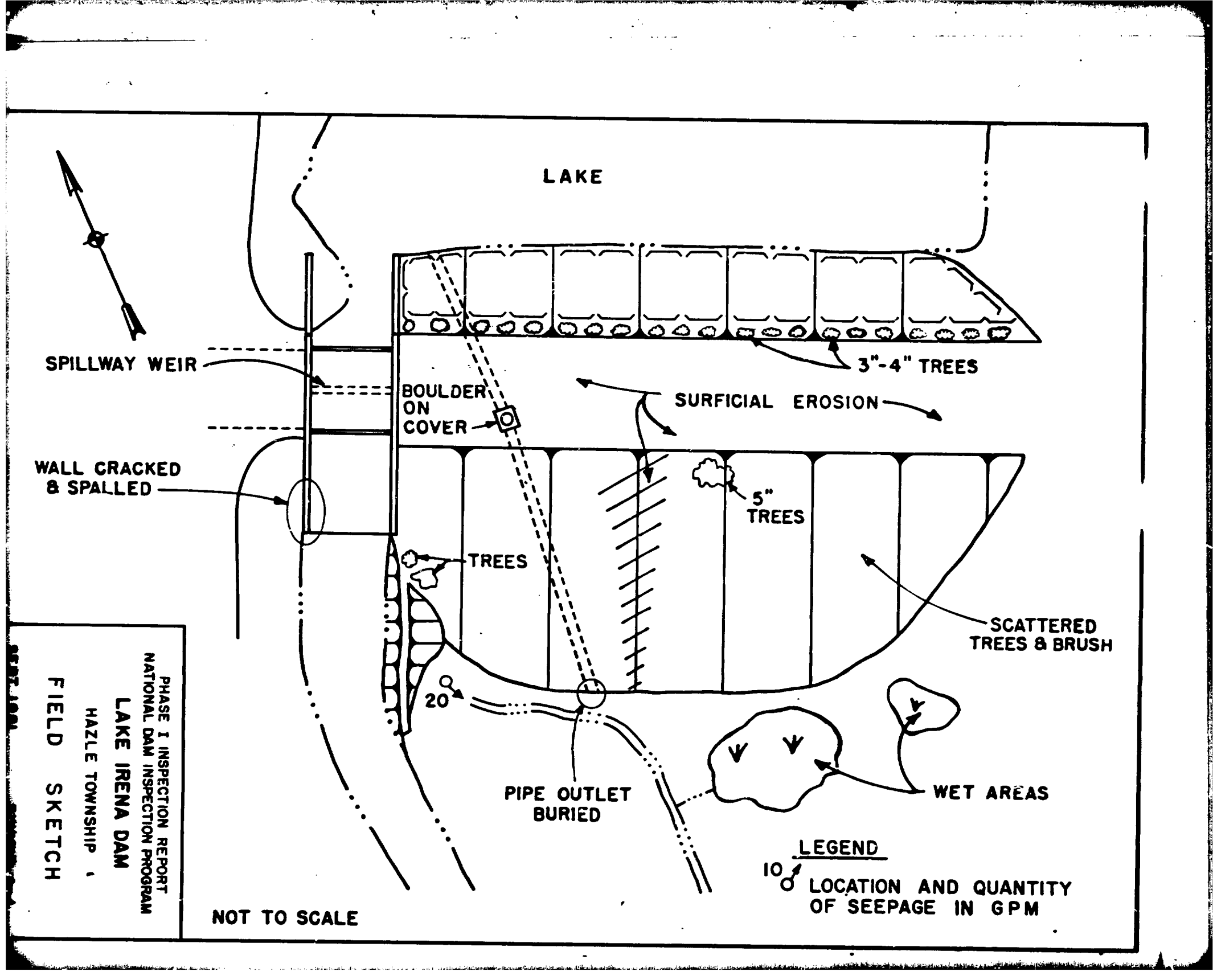
VISUAL EXAMINATION OF	OBSERVATIONS
Approach Channel	Reservoir, no obstructions.
Concrete Weir and Walls	Deterioration of right downstream wall; some rebar exposed.
Bridge and Piers	Wood decking over steel beam supports.
Discharge Channel	First 100 feet rock lined; then earth and rock. Right bank eroded.

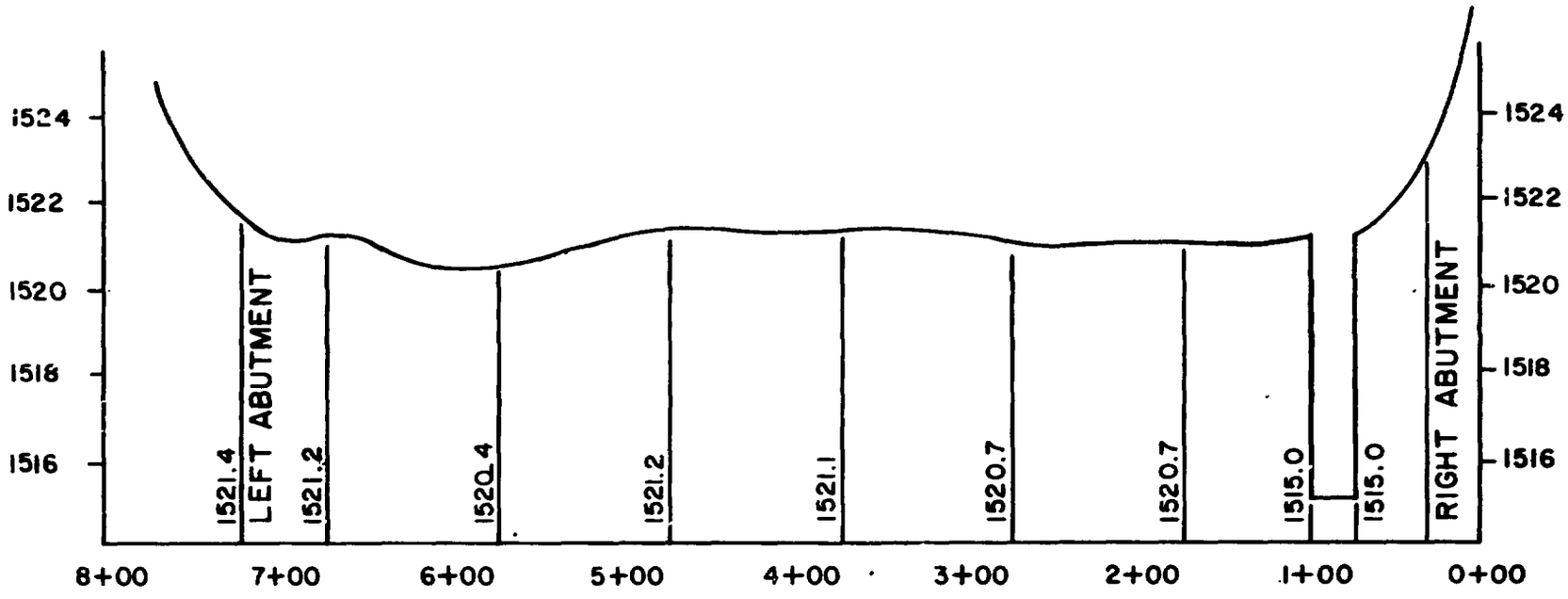
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS
Slopes	Wooded with flat slopes; appear stable. Community park on right bank.
Sedimentation	None observed or reported.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS
Condition: Obstructions, Debris, etc.	Well defined with rock bottom for 100 feet. Conrail bridge 2,000 feet downstream. Joins Black Creek 0.6 mile downstream. PA Route 93 at 0.9 mile from dam.
Slopes	Flat to moderate. Wooded until reaching Route 93.
Approximate Number of homes	One or two buildings in industrial park. Wastewater Treatment Plant. Possible loss of few lives.


LAKE
SPILLWAY WEIR
BOULDER ON COVER
3"-4" TREES
SURFICIAL EROSION
WALL CRACKED & SPALLED
5" TREES
TREES
SCATTERED TREES & BRUSH
20
PIPE OUTLET BURIED
WET AREAS
LEGEND
10
LOCATION AND QUANTITY OF SEEPAGE IN GPM
NOT TO SCALE
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE IRENA DAM
HAZLE TOWNSHIP
FIELD SKETCH



DISTANCE IN FEET

TOP OF DAM - PROFILE

SCALE - HORIZ 1 IN. = 100FT.
VERT. 1 IN = 4 FT.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE IRENA DAM

HAZLE TOWNSHIP

PROFILE

SEPT, 1981

EXHIBIT A-2

APPENDIX B

CHECKLIST - ENGINEERING DATA

APPENDIX B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

Dam Name Lake Irena Dam DER ID No. 40-215

ITEM	REMARKS
As-Built Drawings	None
Regional Vicinity Map	U.S.G.S. 7 1/2 minute guadrangle sheet; Hazleton, Pa. See Appendix E, plate E-II.
Construction History	Permit issued 17 July 1961. Completed by 7 November 1963.
Typical Sections of Dam	See drawing in Appendix E of this report.
Outlets - Plan	See drawing in Appendix E
Details	" " " "
Constraints	Unknown
Discharge Ratings	None

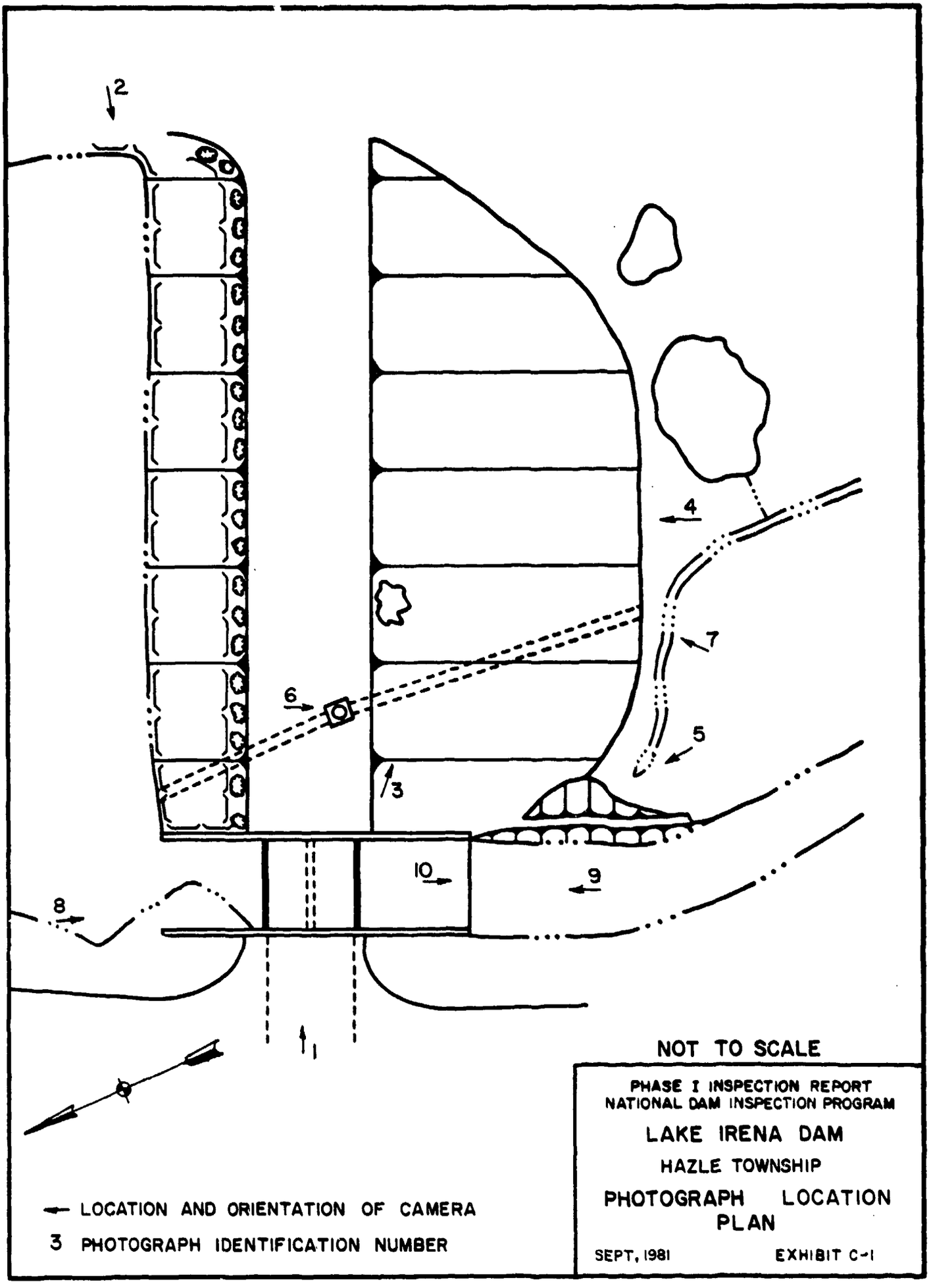
ITEM	REMARKS
Rainfall/Reservoir Records	None
Design Reports	None
Geology Reports	None
Design Computations: Hydrology & Hydraulics Dam Stability Seepage Studies	None
Materials Investigations: Boring Records Laboratory Field	Test pits shown on drawings in Appendix E.
Post Construction Surveys of Dam	None
Monitoring Systems	None

ITEM	RECORDS
Modifications	None
High Pool Records	None
Post-Construction Engineering Studies and Reports	None
Prior Accidents or Failure of Dam Description Reports	None
Maintenance Operation Records	None
Spillway Plan Sections Details	See drawings in Appendix E " " " "

ITEM	REMARKS
Operating Equipment	Value on outlet works shown on drawing in Appendix E
Specifications	None
Miscellaneous	PennDER inspection reports and photographs taken during construction and later are in PennDER files.
Previous Inspections	By PennDER during construction and in July 65.

APPENDIX C

PHOTOGRAPHS


2
4
7
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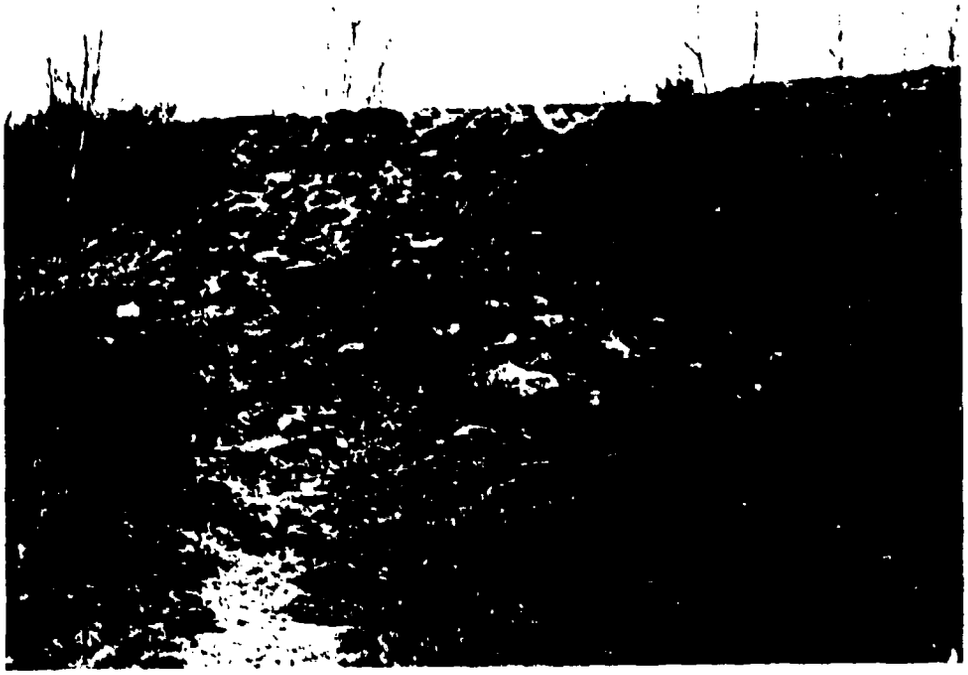
1
NOT TO SCALE
← LOCATION AND ORIENTATION OF CAMERA
3 PHOTOGRAPH IDENTIFICATION NUMBER
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE IRENA DAM
HAZLE TOWNSHIP
PHOTOGRAPH LOCATION PLAN
SEPT, 1981
EXHIBIT C-1

1. Overview of crest and left abutment with spillway in foreground.

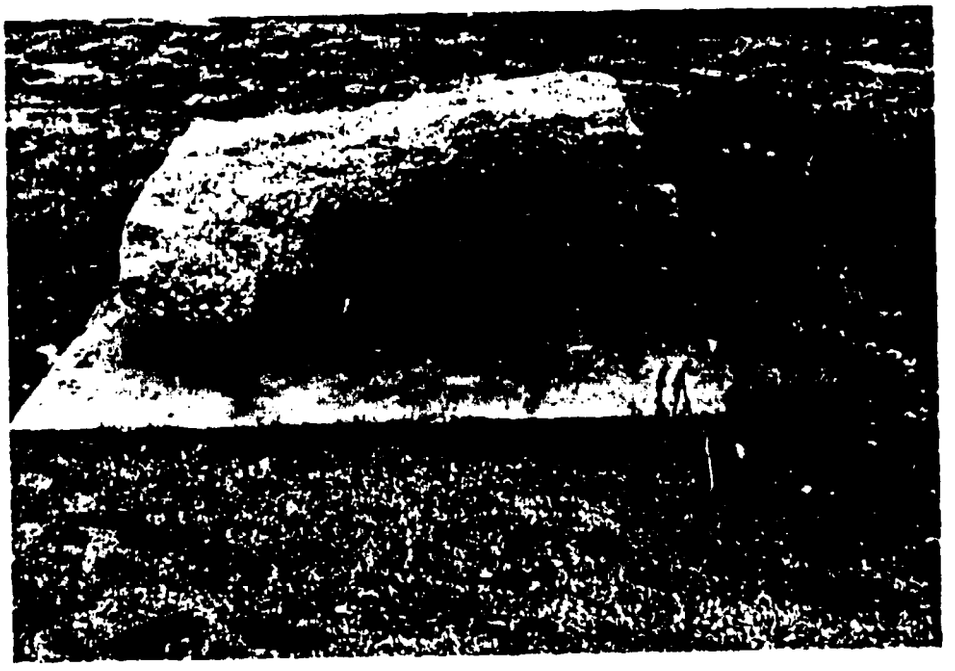
2. Upstream face and right abutment.

3. Downstream face and left abutment.



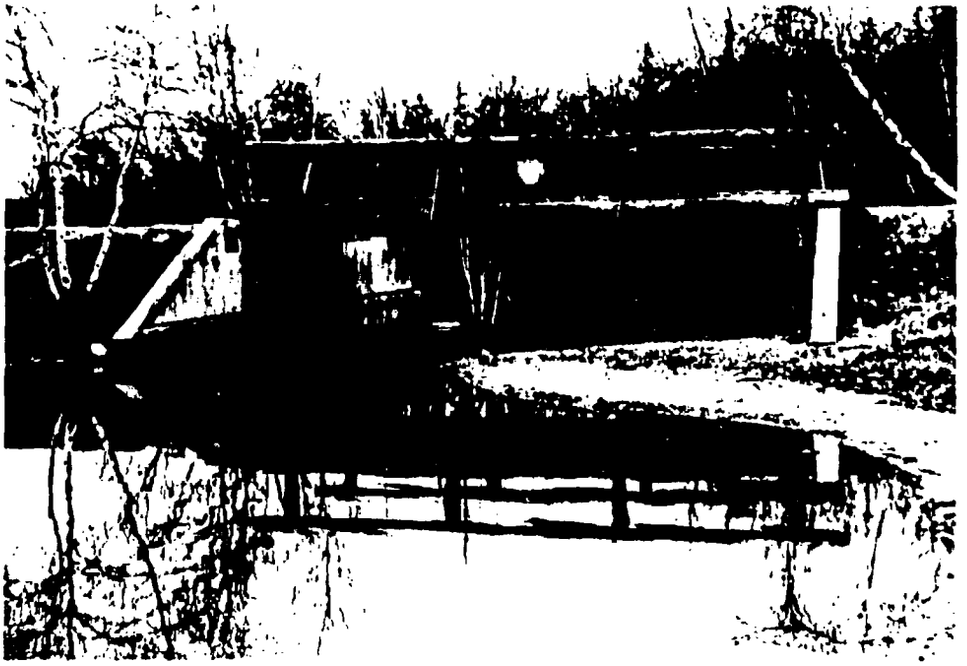
4. Minor erosion of downstream face due to foot traffic.

5. Seepage flowing from rock berm on left bank of spillway.

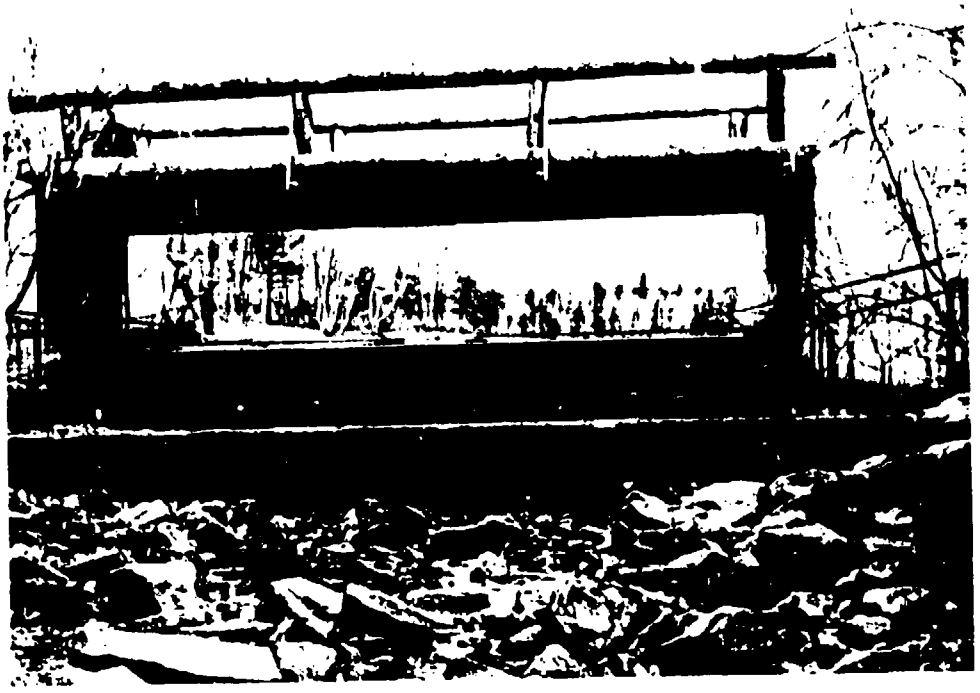


6. Manhole containing outlet works valve.

7. Headwall at discharge end of outlet works. Pipe not visible due to silt.



8. Spillway approach, walls and bridge.



9. Spillway bridge, weir and discharge channel.

10. Spillway discharge channel immediately downstream of slab.

APPENDIX D

HYDROLOGY AND HYDRAULICS

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 1 OF SHEETS

COMPUTED BY JMB CHECKED BY DATE 5-27-81

DAM CLASSIFICATION:

SIZE OF DAM - SMALL
HAZARD - SIGNIFICANT
REQUIRED SDF - 100 YEAR FLOOD TO ½ PMF

DAM STATISTICS.

HEIGHT OF DAM - 23.6 FEET
STORAGE AT NORMAL POOL - 62 AC:FT.
STORAGE AT TOP OF DAM - 156 AC:FT.
DRAINAGE AREA ABOVE DAMSITE - 1.00 mi^2

ELEVATIONS: (MSL)

TOP OF DAM LOW POINT (FIELD) - 1520.4
NORMAL POOL - 1515.0
SPILLWAY CREST - 1515.0
STREAMBED AT TOE - 1496.8

HYDROGRAPH PARAMETERS:

RIVER BASIN - SUSQUEHANNA RIVER BASIN
ZONE - 13
SYNDER COEFFICIENTS

$C_p = 0.50$

$C_t = 1.85$

MEASURED PARAMETERS*

L = LENGTH OF LONGEST WATERCOURSE — L = 7400 FT. 1.40 miles

L_{CA} = LENGTH OF LONGEST WATERCOURSE TO CENTROID OF BASIN — L_{CA} = 3600 FT. 0.682 miles

* FROM U.S.G.S. QUAD SHEET ENTITLED 7½ MINUTE SERIES, SCALE 1:24000

NOTE: ELEVATIONS ARE REFERENCED TO TOPOGRAPHIC DATA. NORMAL POOL WAS ASSUMED TO BE AT SPILLWAY CREST, ELEVATION 1515.0. ALL ELEVATIONS WERE REFERENCED TO THIS VALUE.

t_p = SNYDER BASIN LAGTIME, HOURS

$t_p = C_t(L L_{CA})^{0.3} = 1.85(1.40(0.682))^{0.3} = 1.82$ HOURS

$t_p = 1.82$ HOURS

RESERVOIR CAPACITY:

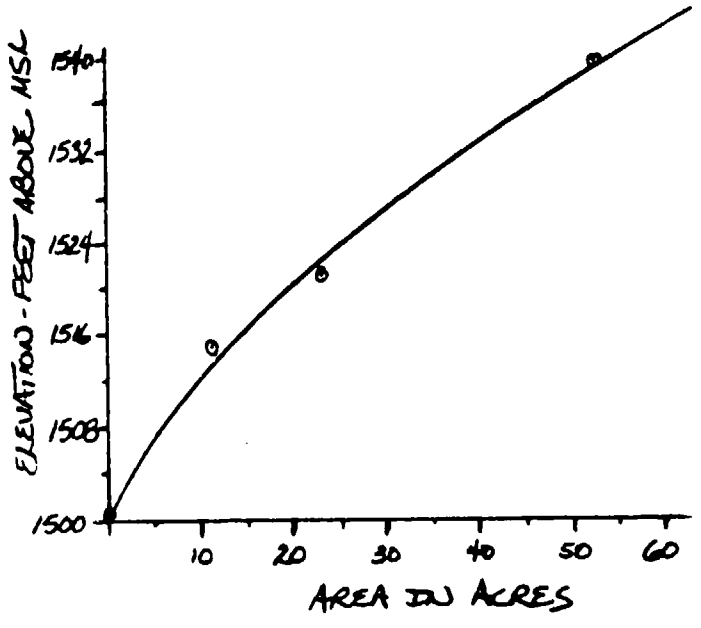
SURFACE AREA AT NORMAL POOL (EL 1515.0) - 13 ACRES
SURFACE AREA AT ELEVATION 1520.0 - 23 ACRES
SURFACE AREA AT ELEVATION 1540.0 - 50 ACRES

ASSUME CONICAL METHOD APPLIES TO FIND LOW POINT IN POOL, BELOW NORMAL POOL.

VOLUME AT NORMAL POOL - 62 AC-FT
(FROM DESIGN DATA IN PENNDER FILES)

$V = \frac{1}{3}AH$; $H = \frac{3V}{A} = \frac{3(62)\ \text{AC-FT}}{13\ \text{AC}} = 14.3$ FEET

∴ ZERO STORAGE AT ELEVATION 1500.7



FOR FLOOD ROUTING PURPOSES, ASSUME THE AVERAGE END AREA METHOD IS SUITABLE TO ELEVATIONS ABOVE STARTING POOL.

$\Delta V = \left(\frac{A_1 + A_2}{2}\right)\Delta H$

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 3 OF _____ SHEETS

COMPUTED BY JMB CHECKED BY _____ DATE 6-2-87

ELEVATION - STORAGE TABLE:

ELEVATION (MSL)	AREA (ACRES)	ΔH (FT)	$\Delta V = \left(\frac{A_1+A_2}{2}\right)\Delta H$ (AC-FT)	CUMULATIVE VOLUME (AC-FT)
1500.7	0	-	-	0
1515.0	13	-	62	62
1518.0	17	3.0	45	107
1520.0	23	2.0	40	147
1520.4 (TOD)*	24	0.4	9.4	156.4
1525.0	27	4.6	117.3	273.7
1530.0	35	5.0	155.0	428.7

NOTE: DRAINAGE AREA ABOVE DAM IS 1.00 mi^2

ELEVATION (MSL)	STORAGE (AC-FT)
1500.7	0
1515.0	62
1518.0	107
1520.0	147
1520.4	156
1525.0	274
1530.0	430

* T.O.D. - TOP OF DAM (LOW POINT, FROM FIELD INSPECTION)

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 4 OF _____ SHEETS

COMPUTED BY JPB CHECKED BY _____ DATE 5-27-81

SDF: BASED ON THE SMALL HEIGHT OF DAM AND THE SMALL STORAGE, THE SDF SELECTED FOR THIS POND WAS THE 100 YEAR FLOOD. THIS IS IN ACCORDANCE WITH THE GUIDANCE PROVIDED.

∴ USE SDF = 100 YEAR FLOOD.

PMP CALCULATION:

SINCE THE SDF SELECTED FOR THIS POND HAS BEEN THE 100 YEAR FLOOD, NO CALCULATIONS ARE NECESSARY TO COMPUTE THE PROBABLE MAXIMUM PRECIPITATION (PMF) OR PROBABLE MAXIMUM FLOOD (PM

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 5 OF SHEETS

COMPUTED BY JJB CHECKED BY DATE 6-2-81

EMERGENCY SPILLWAY CAPACITY:

THE SPILLWAY IS LOCATED NEAR THE RIGHT ABUTMENT, SEE FIELD SKETCH IN APPENDIX A, EXHIBIT 1, AND PHOTOGRAPHS IN APPENDIX C.

SPILLWAY DATA:

TYPE - RECTANGULAR OGEE WEIR CREST
LENGTH - 27 FEET
LOW POINT TOP OF DAM - 1520.4 MSL
SPILLWAY CREST ELEVATION - 1515.0 MSL
SPILLWAY FREEBOARD - 5.4 FEET
C VALUES SPILLWAY - VARIABLE; DEPENDENT ON HEAD ON CREST.

ASSUME DESIGN HEAD IS 5 FEET; $H_o = 5.0$ FEET.

∴ FROM DESIGN OF SMALL DAMS, PG. 378, FIGURES 249 & 250 WE FIND THAT: KNOWING $P = 3.5$ AND $H_o = 5.0$

$$\frac{P}{H_o} = \frac{3.5}{5.0} = 0.70; \quad C_o = 3.85 \text{ DESIGN "C"}$$

POOL ELEVATION (MSL)	H_e (A)	H_o (A)	$\frac{H_e}{H_o}$	$\frac{C}{C_o}$	C	$Q = CLH_e^{3/2}$
1515.0	0	5	0	-	-	0
1516.0	1	5	0.2	0.85	3.27	86.3
1517.0	2	5	0.4	0.90	3.47	264.9
1518.0	3	5	0.6	0.94	3.62	507.9
1519.0	4	5	0.8	0.97	3.73	805.7
1520.0	5	5	1.0	1.00	3.85	1162.2
1520.4	5.4	5	1.08	1.01	3.89	1318.0
1521.0	6	5	1.2	1.03	3.96	1571.4
1525.0	10	5	2.0	1.10	4.23	3611.6

* SEE DESIGN DRAWING IN APPENDIX E.

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 6 OF SHEETS

COMPUTED BY JPB CHECKED BY DATE 6-2-81

SPILLWAY RATING TABLE

POOL ELEVATION (MSL)	DISCHARGE (CFS)
1515.0	0
1516.0	90
1517.0	270
1518.0	510
1519.0	810
1520.0	1160
1520.4 *	1320
1521.0	1570
1525.0	3610

* MAXIMUM OUTFLOW AT TOP OF DAM IS 1320 CFS

NADB FORM 1233, 20 MAR 74

100 YEAR FLOOD ANALYSIS:

THE SELECTED SDF FOR LAKE IRENA DAM HAS BEEN THE 100 YEAR FLOOD. THIS IS BASED ON THE SIZE OF THE DAM AND THE HAZARD CATAGOREY OF THE DAM.

TO DEVELOP THE 100 YEAR FLOOD, TWO REGRESSION EQUATIONS WILL BE USED TO DETERMINE THE PEAK VALUE. THE AVERAGE OF THE TWO REGRESSION PEAKS WILL BE THE 100 YEAR FLOOD PEAK USED IN THIS ANALYSIS.

BULLENTIN 13 FLOOD PEAK:

FROM PLATE 1 - LAKE IRENA DAM IS IN REGION 5.

∴ THE REGRESSION EQUATION IS

$$Q_T = CA^X P_i^P$$

where:

Q_T = PEAK FLOW FOR RETURN PERIOD T, IN YEARS
C = REGRESSION CONSTANT
A = DRAINAGE AREA IN SQUARE MILES
X = REGRESSION COEFFICIENT
P_i = ANNUAL PRECIPITATION INDEX = AVERAGE ANNUAL EXCESS PRECIPITATION WHICH EQUALS AVERAGE ANNUAL PRECIPITATION MINUS ESTIMATED POTENTIAL ANNUAL EVAPOTRANSPIRATION
P = REGRESSION COEFFICIENT

FROM PLATE #2: AVERAGE ANNUAL PRECIPITATION = 49 INCHES
POTENTIAL ANNUAL EVAPOTRANSPIRATION = 25.8 INCHES

$$\therefore P_i = 49 - 25.8 = 23.2$$

RECALL DRAINAGE AREA = 1.00 mi.

FOR 100 YEAR ANALYSIS:

$C = 42.2$	$P_i = 23.2$
$X = 0.751$	$A = 1.00$
$P = 0.744$	$T = 100$

$$Q_T = cA^x P_i^p$$

$$Q_{100} = 42.2(1.00)^{0.751}(23.2)^{0.744} = 437.76 \text{ CFS}$$

$\therefore Q_{100} \approx 438$ CFS FROM BULLETIN 13

NOW, COMPUTE THE 100 YEAR FLOOD PEAK FROM HYDROLOGIC STUDY - TROPICAL STORM AGNES, NORTH ATLANTIC DIVISION, 1975.

$$\text{Log}(Q_m) = C_m + 0.75 \log(A)$$

where: C_m = a map coefficient for mean log of annual peaks

Q_m = geometric mean of annual flood peaks, IN CFS

A = DRAINAGE AREA IN SQUARE MILES

FROM FIGURE 21: $C_m = 2.05$

$\therefore \text{Log}(Q_m) = 2.05 + 0.75 \log(1.00)$

$$\log(Q_m) = 2.05$$

now, compute the standard deviation

$$S = C_S - 0.05 \log(A)$$

where: S = STANDARD DEVIATION

C_S = a map coefficient for standard deviation

FROM FIGURE 22; $C_S = 0.38$

$$S = 0.38 - 0.05 \log(1.00)$$

$$S = 0.38$$

now, compute the 100 year FLOOD PEAK from the following

$$\log(Q_{(p)}) = \log(Q_m) + K(P,g)S$$

where: $\log(Q_{(p)})$ = log of annual flood peaks for a given EXCEEDENCE FREQUENCY

$\text{Log}(Q_m)$ = mean logarithm of annual flood peaks

NADB FORM 1232, 28 MAR 74

$K(P,g)$ = STANDARD DEVIATE for a GIVEN EXCEEDENCE FREQUENCY (P) AND SKEW COEFFICIENT (g)

S = STANDARD DEVIATION, LOGS OF ANNUAL PEAKS

∴ WE NEED TO HAVE SKEW COEFFICIENT, FROM FIGURE 23

$$g = 0.50$$

$$\therefore K(P,g) = 2.70$$

$$\log(Q_{(p)}) = \log(q_m) + K(P,g)\,S$$

$$\log(Q_{100}) = 2.05 + (2.70)(0.38)$$

$$\log(Q_{100}) = 3.076$$

$$Q_{100} = 1191.2 \text{ CFS}$$

THEREFORE, $Q_{100} = 1191.2$ CFS FROM TROPICAL STORM AGNES REPORT NORTH ATLANTIC DIVISION.

NOW, Compute the 100 YEAR FLOOD PEAK BY AVERAGING THE TWO REGRESSION EQUATIONS.

$$\therefore Q_{100} = \frac{437.76 + 1191.2}{2} = 814.5 \text{ CFS}$$

$$\therefore Q_{100} \sim 815 \text{ CFS}$$

SPILLWAY ADEQUACY:

THE SPILLWAY IS CONSIDERED ADEQUATE IF THE MAXIMUM OUTFLOW THROUGH THE SPILLWAY AT LOW POINT TOP OF DAM IS GREATER THAN THE Q_{100} PEAK CALCULATED ABOVE. THEREFORE

MAXIMUM OUTFLOW AT TOP OF DAM = 1320 CFS
MAXIMUM INFLOW FOR 100 YEAR FLOOD = 815 CFS

SINCE, THE MAXIMUM OUTFLOW IS GREATER THAN THE MAXIMUM INFLOW, THE SPILLWAY IS RATED ADEQUATE.

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 10 OF _____ SHEETS

COMPUTED BY JPB CHECKED BY _____ DATE 5-28-81

OUTLET WORKS:

THE 24" CMP IS ENCASED IN CONCRETE. THE PIPE HAS A LENGTH OF 100 FEET AND A SLOPE OF 0.001 ft/ft. THE UPSTREAM INVERT IS AT ELEVATION 1496.9 AND THE DOWNSTREAM INVERT IS AT ELEVATION 1496.8.

THE OUTLET WORKS IS SHOWN IN APPENDIX E OF THIS REPORT. THE WALLS ARE PERPENDICULAR TO THE DIRECTION OF FLOW, AND A TRASH RACK WAS TO BE ATTACHED.

NOTE: PRESENTLY THE DOWNSTREAM END OF OUTLET WORKS IS BLOCKED. THIS ANALYSIS ASSUMES THAT THE DEBRIS IS REMOVED AND THAT THE GATE OPERATES SATISFACTORY.

ASSUMPTIONS:

ASSUME THAT THE DOWNSTREAM END OF THE OUTLET WORKS IS SUBMERGED BY ~ 1 FOOT OF WATER.

$\therefore$ TAILWATER IS $1496.8 + 2 + 1 = 1499.8$

$LS_o = 0.1$ feet $\quad \therefore H = HW - h_o + LS_o$

H = DIFFERENTIAL HEAD BETWEEN UPSTREAM POOL ELEVATION AND DOWNSTREAM TAILWATER - ASSUMED ELEV OF 1499.8

THE FOLLOWING DATA AND CHART CAN BE FOUND IN APPENDIX B OF HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS, U.S. DEPARTMENT OF COMMERCE, DEC. 1965. THIS ANALYSIS WILL ASSUME OUTLET CONTROL

$K_e = 0.5$

NADB FORM 1232, 28 MAR 74

BALTIMORE DISTRICT, CORPS OF ENGINEERS PAGE _____

SUBJECT DAM SAFETY ANALYSIS

COMPUTATIONS LAKE IRENA DAM SHEET 11 OF _____ SHEETS

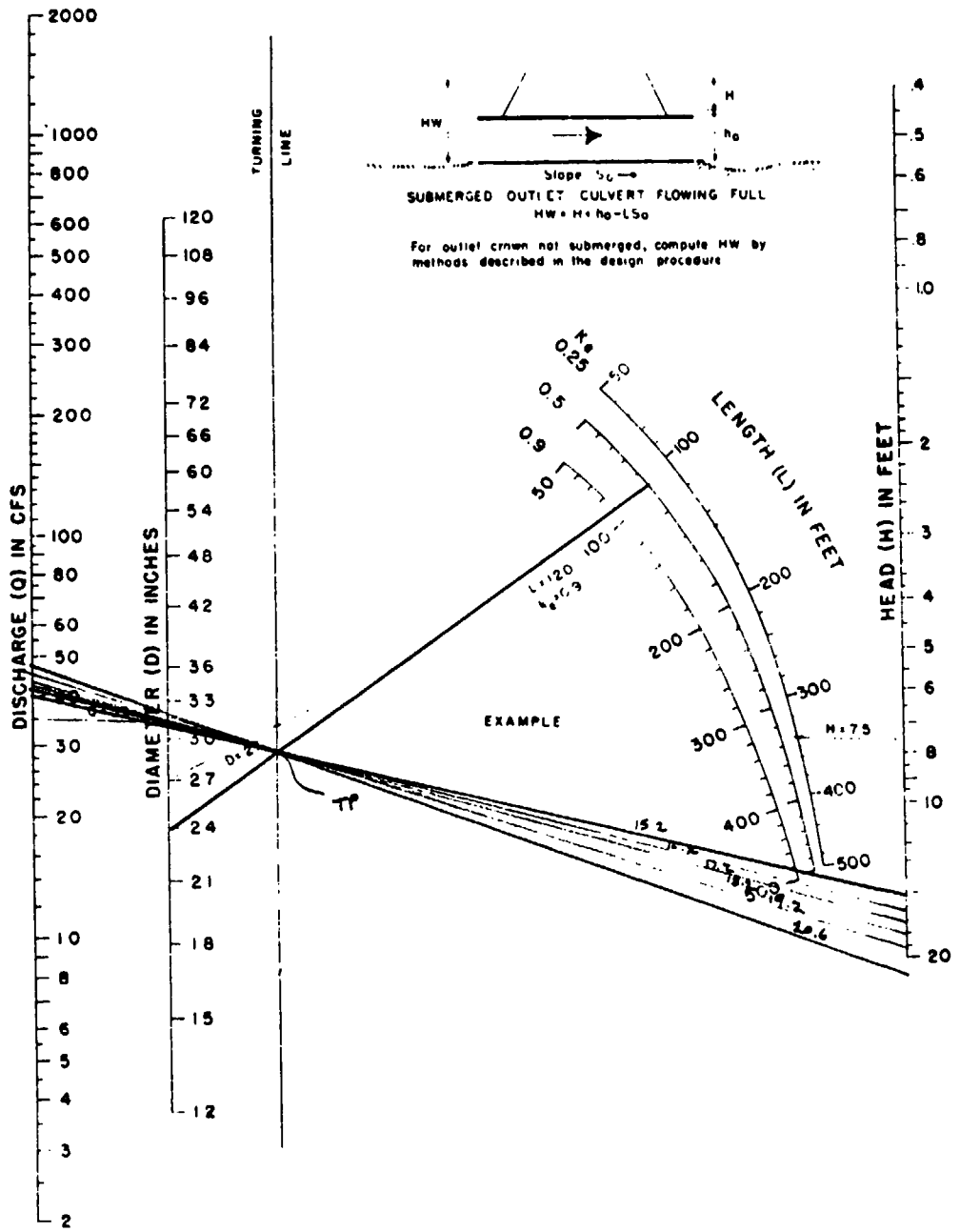
COMPUTED BY GPB CHECKED BY _____ DATE 5-28-81

POOL ELEVATION (MSL)	TAILWATER (MSL)	H (FEET)	Q (CFS)	REMARKS FOR OUTLET
1515.0	1499.8	15.2	40	SPILLWAY CREST
1516.0	1499.8	16.2	41	
1517.0	1499.8	17.2	42	
1518.0	1499.8	18.2	44	
1519.0	1499.8	19.2	45	
1520.4	1499.8	20.6	47	TOP OF DAM

SEE CHART 11 IN THIS APPENDIX FOR EXPLANATION.

NADB FORM 1232, 28 MAR 74

CHART 11



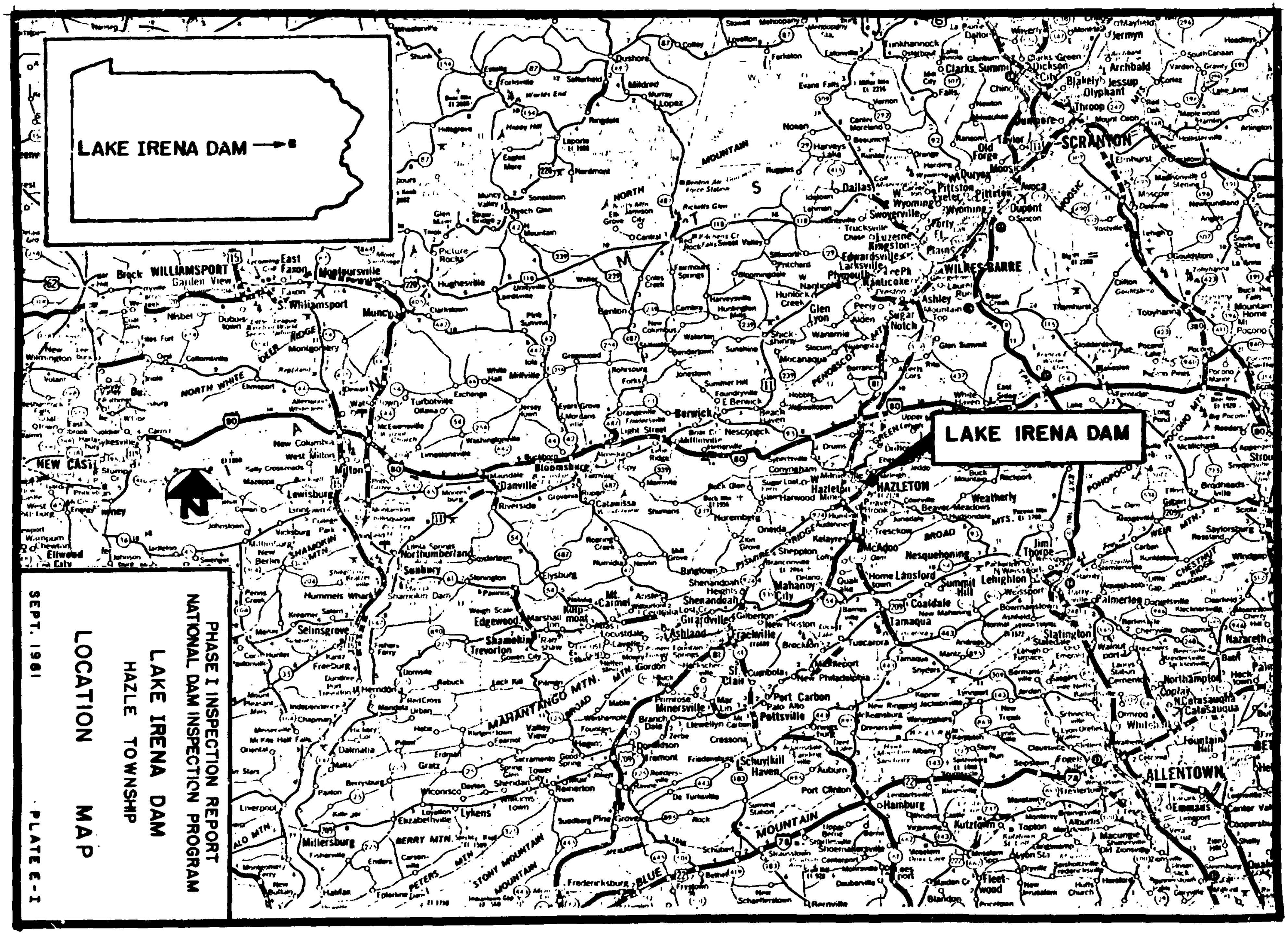
HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024

BUREAU OF PUBLIC ROADS JAN 1963

LAKE IRENA DAM

APPENDIX E

PLATES



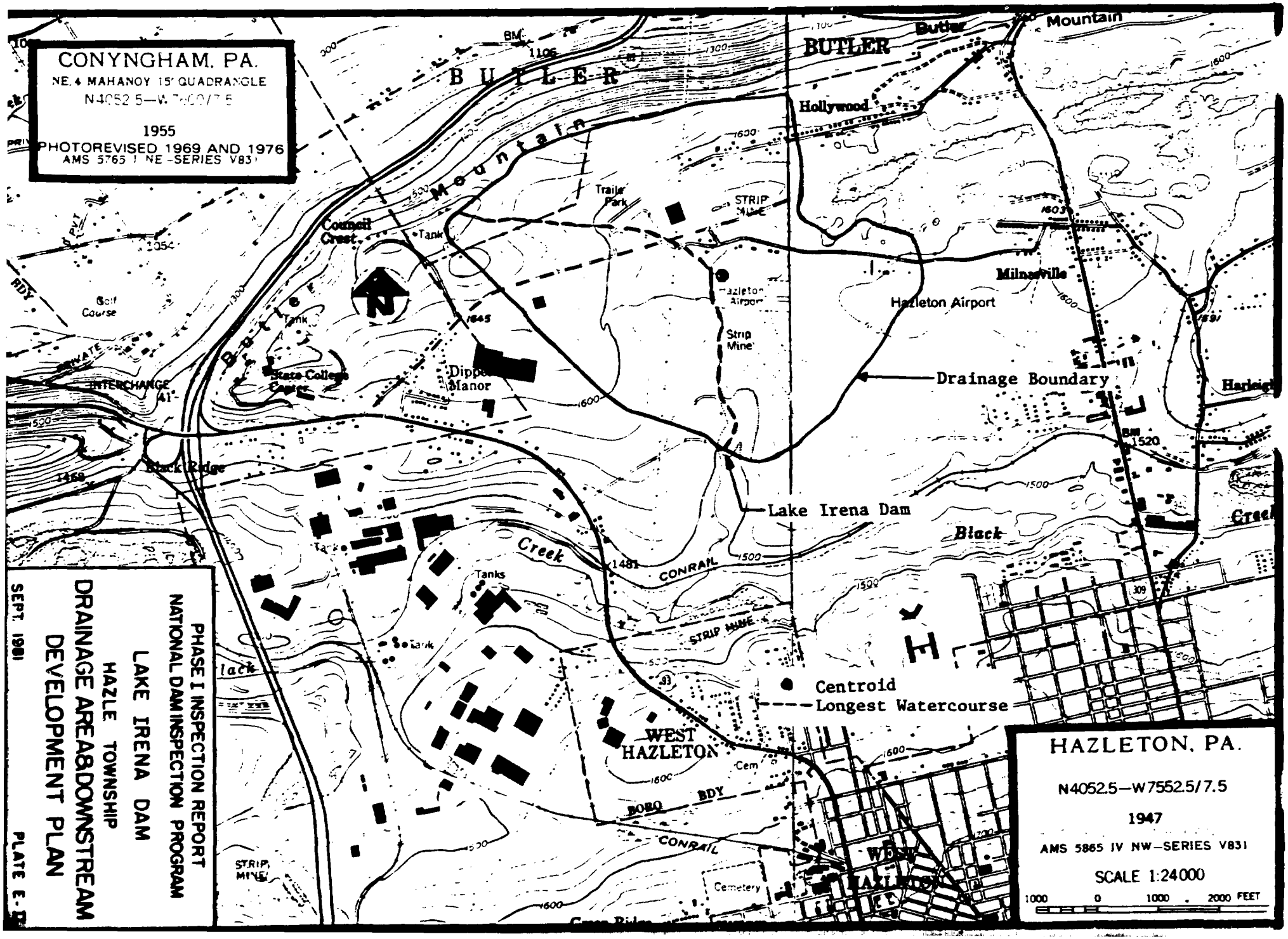
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

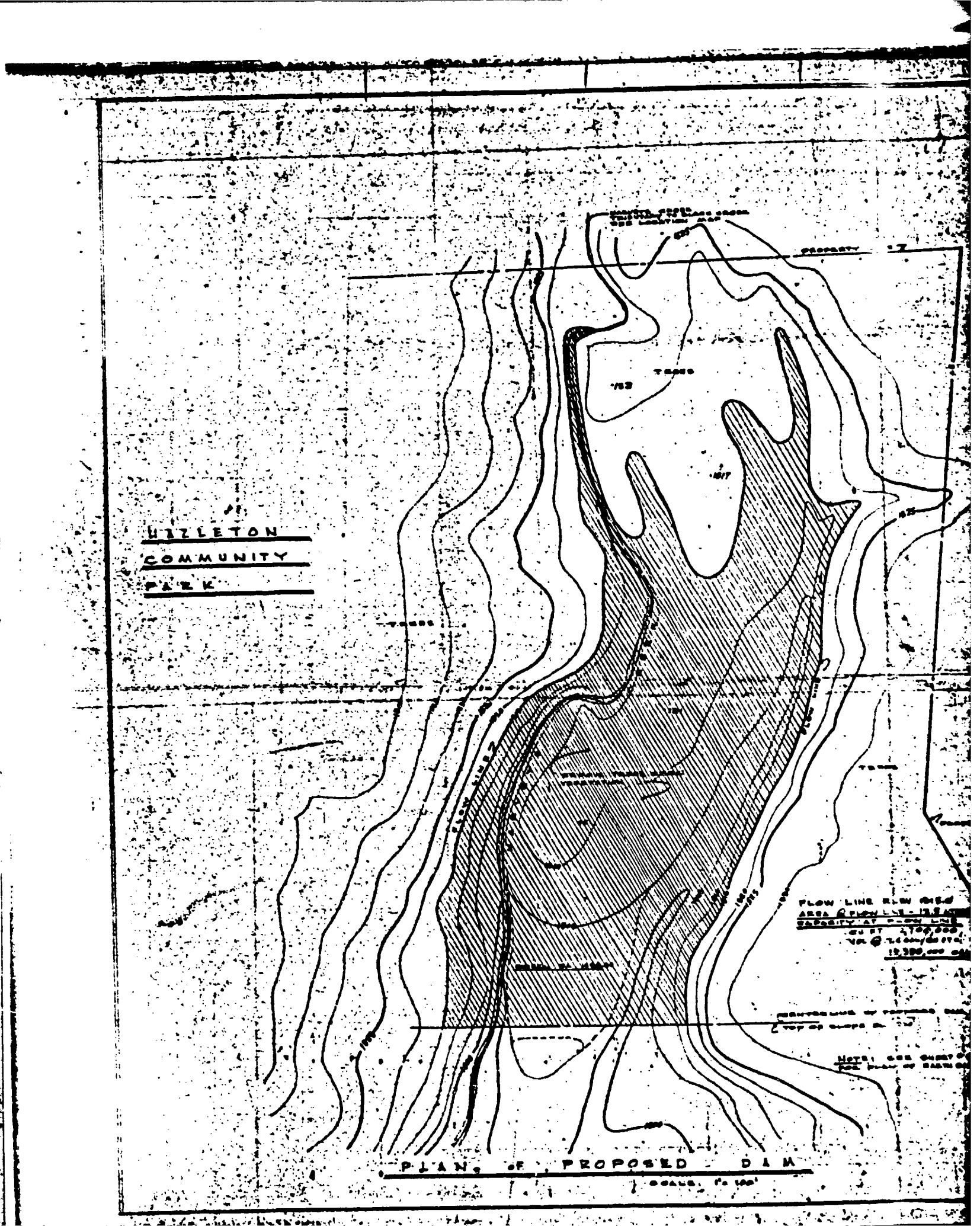
LAKE IRENA DAM
HAZLE TOWNSHIP

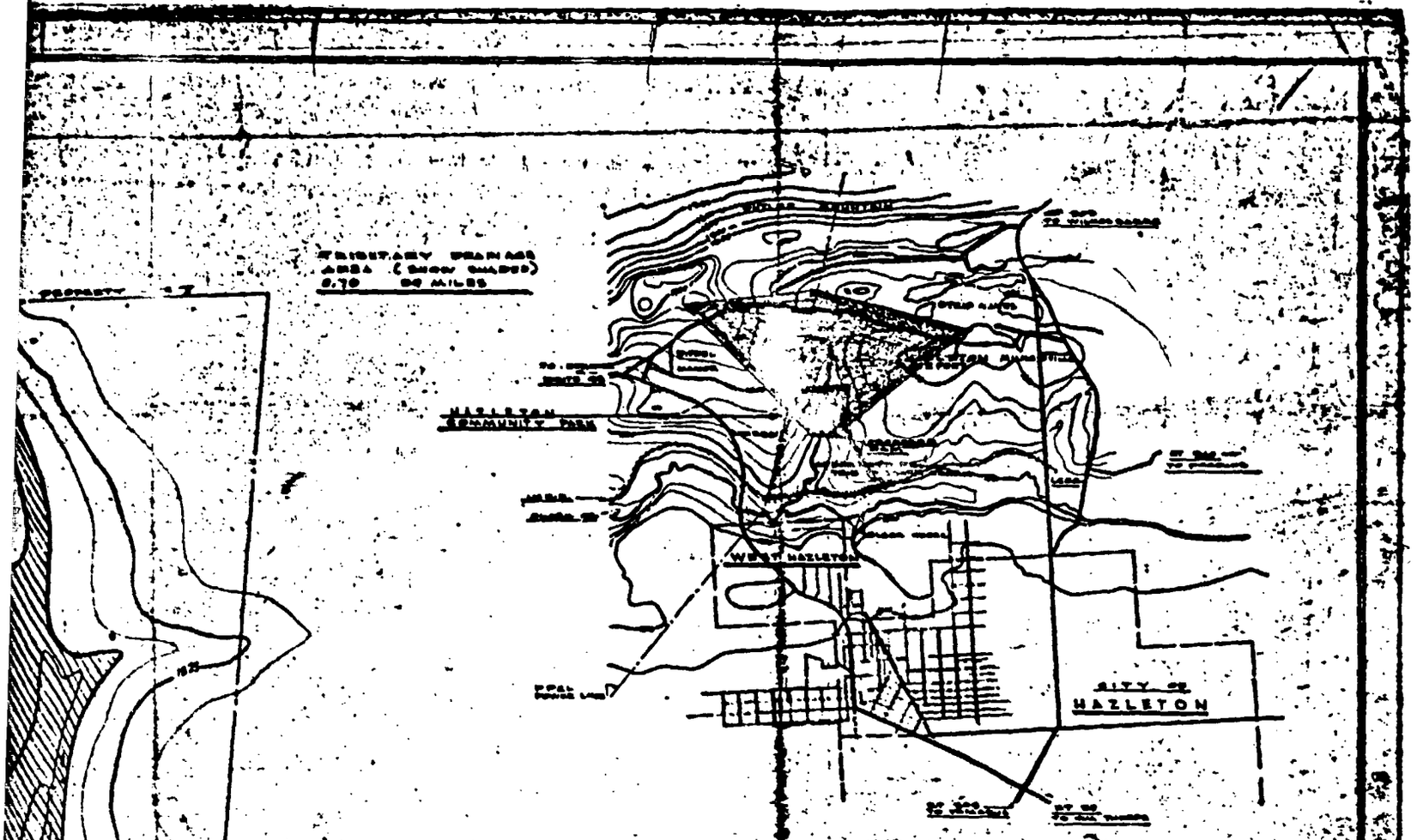
LOCATION MAP

SEPT. 1981

PLATE E-I


CONYNGHAM, PA.
NE 4 MAHANOY 15' QUADRANGLE
N4052.5—W7600/7.5
1955
PHOTOREVISED 1969 AND 1976
AMS 5765 I NE-SERIES V831
BUTLER
Butler Mountain
Hollywood
Council Crest
Trailer Park
STRIP MINE
Milnesville
Hazleton Airport
Golf Course
Tank
Dipper Manor
Strip Mine
Drainage Boundary
INTERCHANGE 41
Black Ridge
Lake Irena Dam
Creek
CONRAIL
Tanks
WEST HAZLETON
BORO BDY
Cemetery
Centroid
Longest Watercourse
HAZLETON, PA.
N4052.5—W7552.5/7.5
1947
AMS 5865 IV NW—SERIES V831
SCALE 1:24000
1000 0 1000 2000 FEET
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE IRENA DAM
HAZLE TOWNSHIP
DRAINAGE AREA&DOWNSTREAM DEVELOPMENT PLAN
SEPT. 1981
PLATE E-1


HAZLETON
COMMUNITY
PARK
PROPERTY
PLAN OF PROPOSED DAM



LOCATION PLAN

SCALE 1" = 2,000 FT

NOTE: MAP PREPARED FROM U.S. GEOLOGICAL SURVEY MAPS
1) NW/4 HAZLETON 15' QUADRANGLE - 1958 EDITION
2) NE/4 MAHANOY 15' QUADRANGLE - 1958 EDITION

40-215-1A
FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD - DEPARTMENT OF FORESTS & WATERS ON THIS DAY OF A.D. 19[illegible]

[illegible]

PROPOSED DAM

FOR THE

HAZLETON COMMUNITY PARK

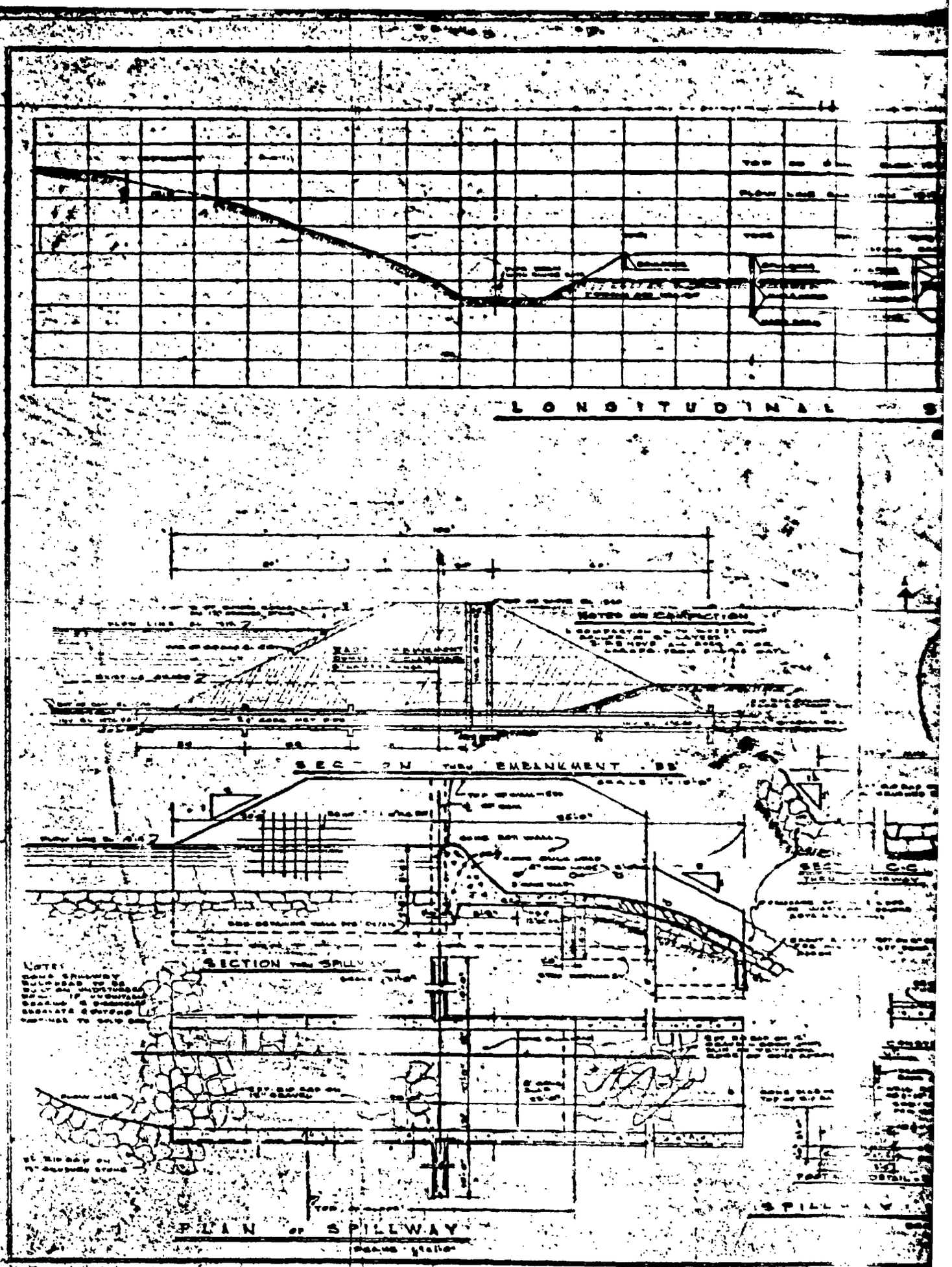
HAZLE TWP. - LUZERNE COUNTY, PENNSYLVANIA

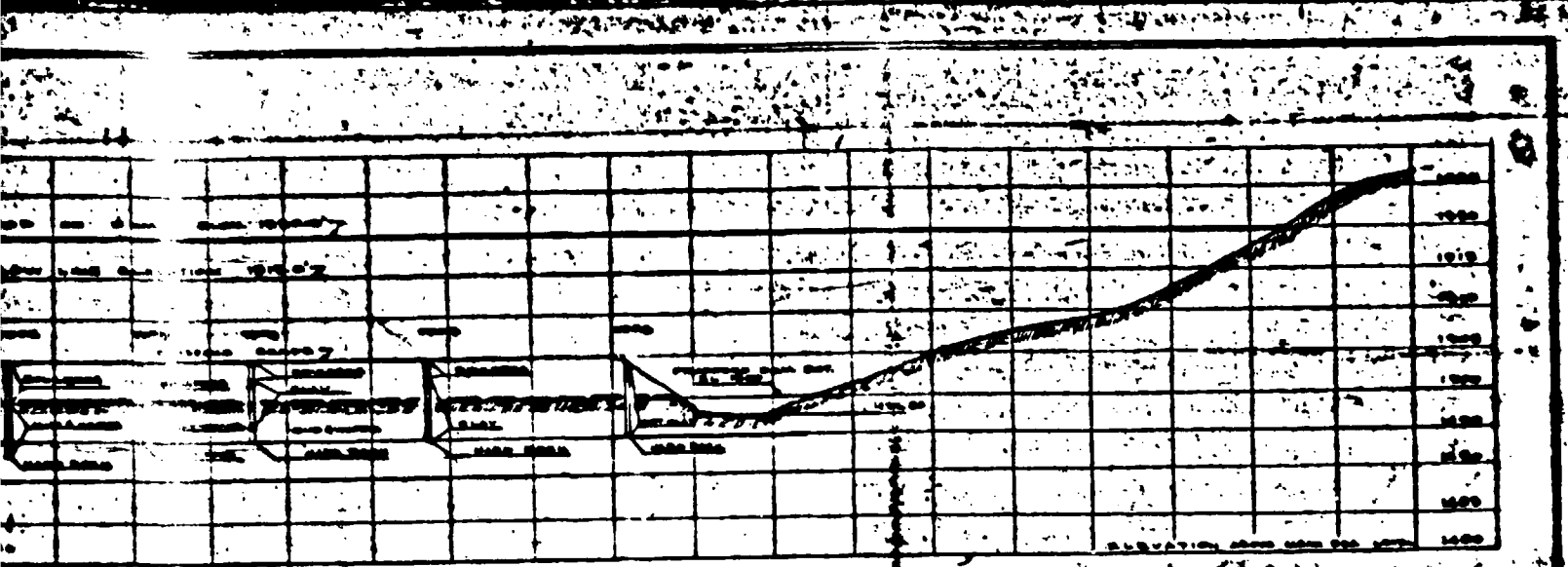
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE IRENA DAM
HAZLE TOWNSHIP

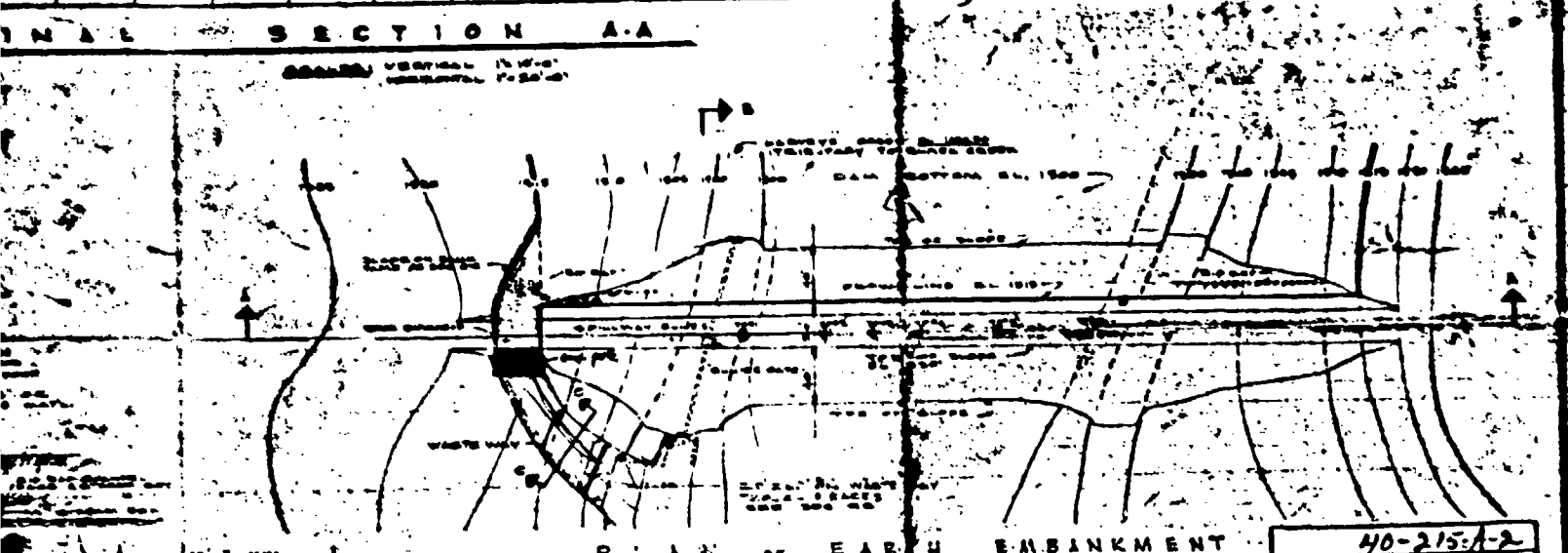
SEPT. 1981

PLATE E-III

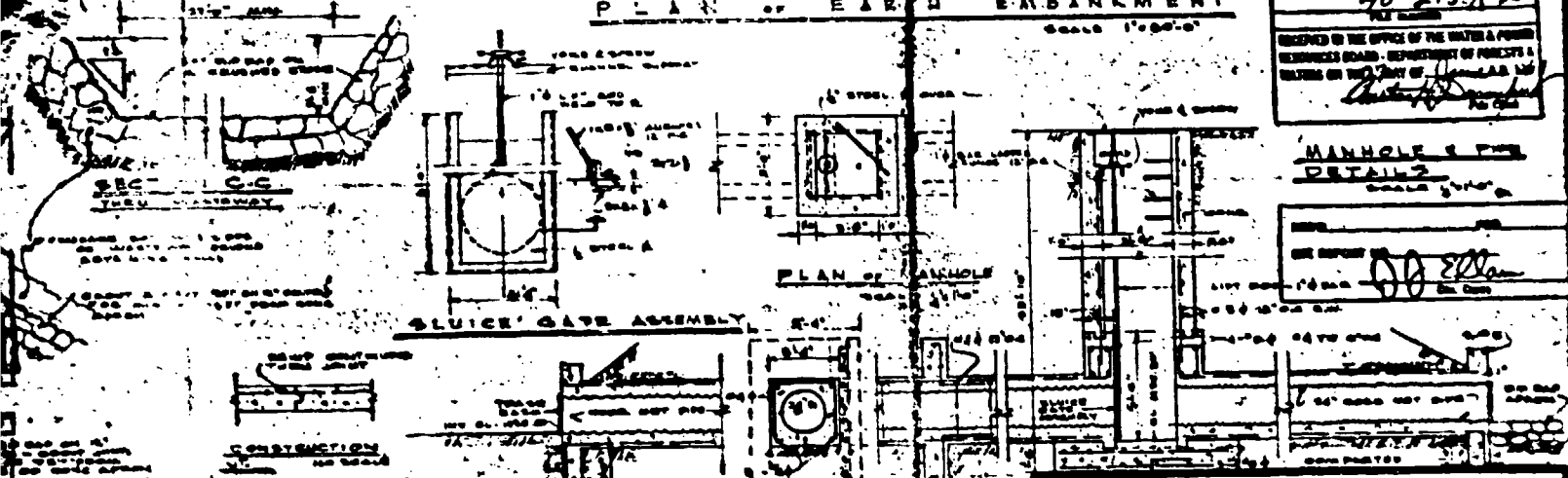

LONGITUDINAL
SECTION THRU EMBANKMENT
SECTION THRU SPILLWAY
PLAN OF SPILLWAY



INAL SECTION A-A



PLAN OF EARTH EMBANKMENT



SEC C-C THRU GATEWAY

SLUICE GATE ASSEMBLY

PLAN OF MANHOLE

MANHOLE & PIPE DETAILS

CONSTRUCTION

GENERAL NOTES

PROPOSED

HAZLETON CC

HAZLE TWP LUZ

DATE BY

SPILLWAY DETAILS

40-215.1-2

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD - DEPARTMENT OF FORESTS & WATERS ON THE 2nd DAY OF [illegible] A.D. 19[illegible]

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE IRENA DAM

HAZLE TOWNSHIP

SEPT. 1981

PLATE E-IV

APPENDIX F

GEOLOGY

GENERAL GEOLOGY

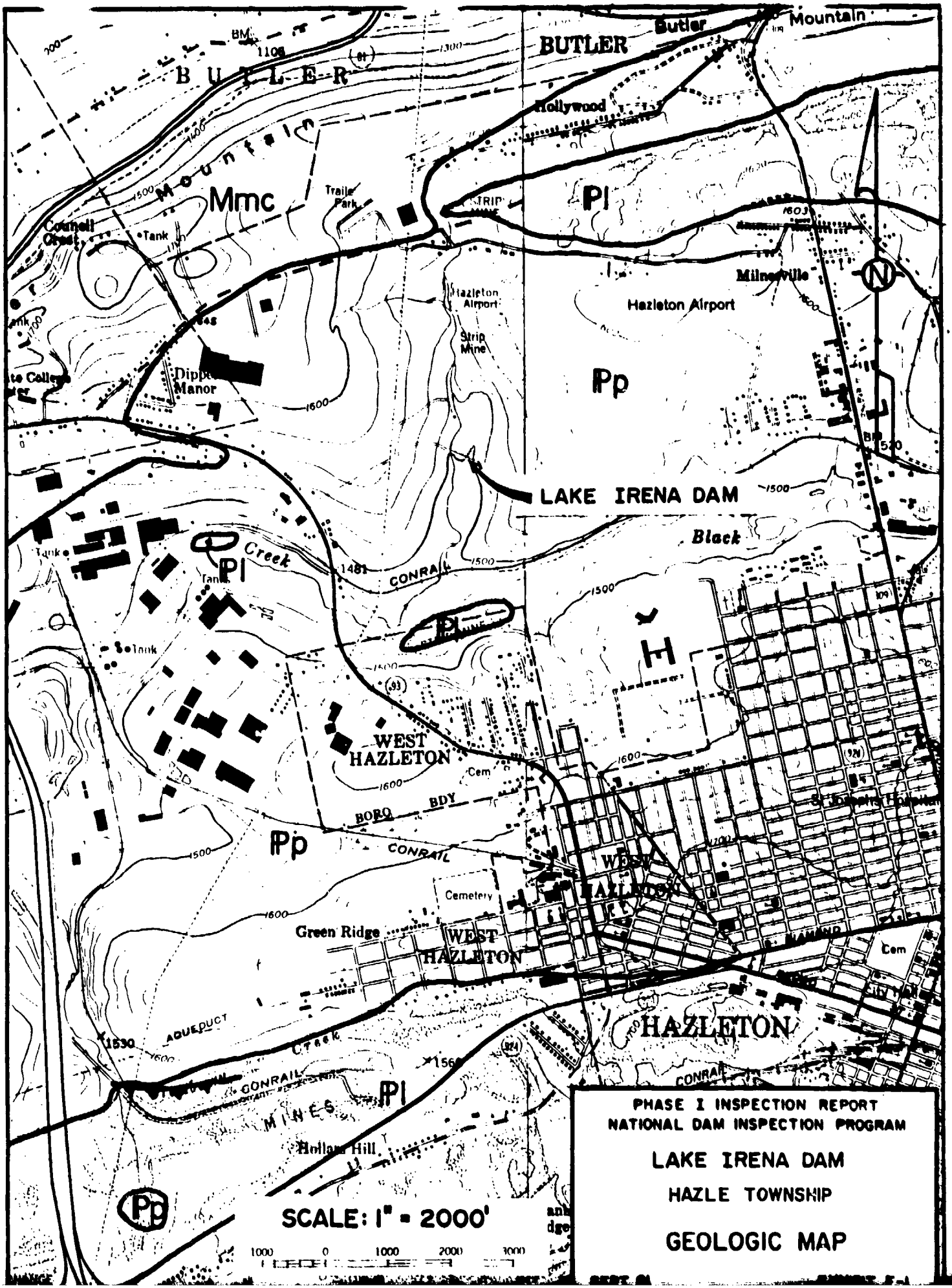
Bedrock at Lake Irena is of the Pottsville Group, which contains conglomerate, sandstone, siltstone, and shale. There may be some residual soil and some colluvial material in the area, but the thickness of these materials is probably less than 2 meters.

Legend
(Bedrock)

P_l LLEWELLYN FORMATION Gray, fine- to coarse-grained sandstone, siltstone, shale, conglomerate; and numerous anthracite coals in repetitive sequences.

P_p POTTSVILLE GROUP - Gray conglomerate, fine- to coarse-grained sandstone, siltstone, and shale containing minable anthracite coals. Includes three formations. In descending order: Sharp Mountain--conglomerate and conglomeratic sandstone; Schuylkill--sandstone and conglomeratic sandstone; Tumbling Run--conglomeratic sandstone and sandstone.

Mmc MAUCH CHUNK FORMATION - Grayish-red shale, siltstone, sandstone, and some conglomerate; some local nonred zones. Includes Loyalhanna Member--crossbedded, sandy limestone at base of south-central and southwestern Pennsylvania; also includes Greenbrier Limestone Member and Wymps Gap and Deer Valley Limestones, which are tongues of the Greenbrier. Along Allegheny Front from Blair County to Sullivan County, Loyalhanna Member is greenish-gray, calcareous, crossbedded sandstone.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE IRENA DAM

HAZLE TOWNSHIP

GEOLOGIC MAP