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KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA  
NATIONAL DAM INSPECTION PROGRAM. KEHLY RUN DAM NUMBER 5 (NDS ID--ETC(U)  
MAR 80 R J KIMBALL

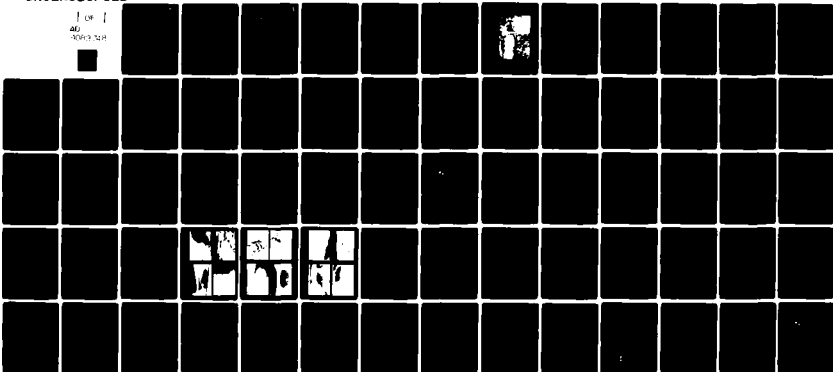
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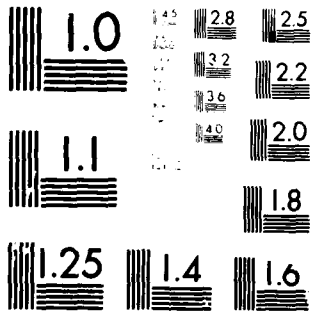


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SUSQUEHANNA RIVER BASIN  
KEHLY RUN, SCHUYLKILL COUNTY

PENNSYLVANIA

# KEHLY RUN DAM NO. 5

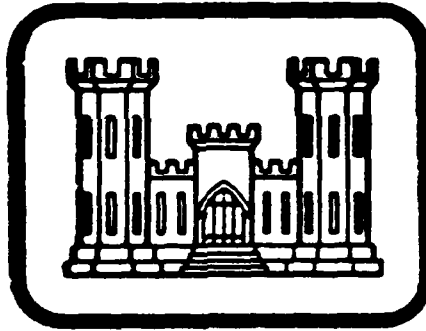
NDS ID NO. PA-658

DER ID NO. 54-7

SHENANDOAH MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



**LEVEL**

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Prepared By

**L. ROBERT KIMBALL & ASSOCIATES**  
CONSULTING ENGINEERS & ARCHITECTS  
EBENSBURG, PENNSYLVANIA  
15931

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FOR

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

MARCH, 1980

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SUSQUEHANNA RIVER BASIN  
KEHLY RUN, SCHUYLKILL COUNTY

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6 National Dam Inspection Program  
**KEHLY RUN DAM NO. 5**

(NDS ID NO. PA-658

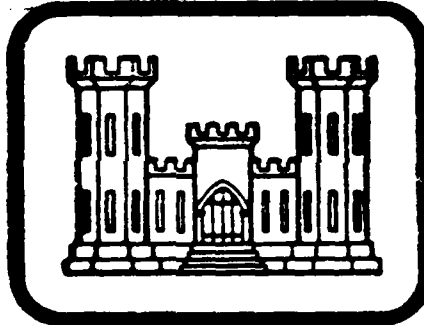
DER ID NO. 54-7)

Susquehanna River Basin, Kehly Run, Schuylkill

**SHENANDOAH MUNICIPAL AUTHORITY**  
County, Pennsylvania

**PHASE I INSPECTION REPORT,**  
**NATIONAL DAM INSPECTION PROGRAM**

By: F. J. [unclear] / Kimball



15) DACW 31-88-C-2488

Prepared By

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15931

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FOP

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

11) ~~MARCH 1980~~

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JOB

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.

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PHASE I REPORT  
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Kehly Run Dam No. 5
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Schuylkill
STREAM	Kehly Run
DATE OF INSPECTION	November 7 and 16, 1979

ASSESSMENT

The assessment of Kehly Run Dam No. 5 is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

Kehly Run Dam No. 5 is a high hazard-small size dam. The spillway design flood was selected as the PMF. The spillway and reservoir are capable of controlling approximately 75% of the PMF without overtopping the earth embankment. Based on criteria established by the Corps of Engineers, this spillway is termed inadequate. The long term affect of the seepage and wet areas on the abutments, and erosion of the slopes should be evaluated. Heavy growth of vegetation on the slopes should be selectively removed.

The following recommendation and remedial measures should be instituted immediately.

1. A detailed hydrologic and hydraulic study should be conducted by a professional engineer knowledgeable in dam design to increase spillway capacity. All dams in the Kehly Run system which have inadequate spillways should have their spillway capacities increased.
2. A stability analysis of the embankment should be conducted by a registered professional engineer knowledgeable in dam design and construction because of the steep downstream slope, erosion of both slopes and crest, seepage and past history of slope failure.
3. The brush and trees on the upstream and downstream slopes should be removed under the direction of a professional engineer knowledgeable in dam design and construction.
4. All wet and seepage areas should be monitored at regular intervals. Readings should be periodically evaluated by a professional engineer knowledgeable in dam design.
5. Positive drainage should be provided at the toe of dam to eliminate ponded areas on each abutment.

6. Some means of positive closure of the drainline should be developed in case of emergencies.

7. All valves should be exercised and lubricated at regular intervals.

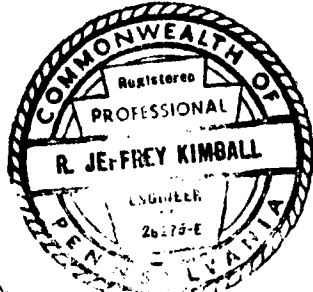
8. A subsidence investigation should be conducted by the owner or his engineer to determine the effects of past and present mining beneath the reservoir.

9. A warning system should be instituted to warn downstream residents of high water levels or imminent failure of the dam.

10. Regular safety inspections should be conducted in accordance with the provisions stipulated by the Commonwealth of Pennsylvania regarding inspection of dams.

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES  
CONSULTING ENGINEERS AND ARCHITECTS



March 18, 1980  
Date

R. Jeffrey Kimball  
R. Jeffrey Kimball, P.E.

APPROVED BY:

25 March 1980  
Date

James W. Peck  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer





Overview of Kehly Run Dam No. 5. Kehly Run Dam No. 6 upstream (upper left corner)  
and Kehly Run Dam No. 4 downstream (lower right corner).

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PHASE I  
NATIONAL DAM INSPECTION PROGRAM  
KEHLY RUN DAM NO. 5  
NDI. I.D. NO. PA 658  
DER I.D. NO. 54-19

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The National 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. 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. Dam and Appurtenances. Kehly Run Dam No. 5 is an earthfill dam which is semi-circular in plan and convex in the downstream direction. The embankment is 1,050 feet long and 25 feet high. The upstream slope is 1H:1V and the downstream slope is 1.5H:1V. The crest width varies from 15 feet to 25 feet wide. The lower part of the downstream slope of the embankment consists of hand placed stone. The upper portion of the downstream slope consists of an earthfill.

The reservoir drain conduit consists of one 6" cast iron pipe. Flow through the outlet conduit is controlled by a valve chamber located at the toe of the dam below the tailwater.

The spillway is located on the left abutment and consists of a stonelined chute. This stonelined chute has five concrete cutoff walls located beneath the stone masonry. The spillway weir consists of a concrete wall 2 feet thick and 5 1/2 feet high. The spillway is 39 feet long with 4H:1V sideslopes. The spillway discharge channel extends 625 feet downstream of the weir and bypasses Kehly Run Dam No. 4.

Immediately upstream of Kehly Dam No. 5 is Kehly Run Dam No. 6. This dam is an earthfill dam approximately 1200 feet long and 25 feet high.

b. Location. The dam is located on Kehly Run, 1 mile north of Shenandoah, Schuylkill County, Pennsylvania. Kehly Run Dam No. 5 can be located on the Shenandoah, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Kehly Run Dam No. 5 is a small size structure (25 feet high, 82 acre-feet).

d. Hazard Classification. Kehly Run Dam No. 5 is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail. Immediately downstream of Kehly Run Dam No. 5 are two more reservoirs in a steep, narrow, confined valley. Before the valley discharges into the town of Shenandoah.

e. Ownership. Kehly Run Dam No. 5 is owned by The Shenandoah Municipal Authority. Correspondence should be addressed to:

Shenandoah Municipal Authority  
26 West Lloyd Street  
Shenandoah, PA 17976  
Attention: Charles Dallazia, Manager  
717-462-1904

f. Purpose of Dam. Kehly Run Dam No. 5 is used for water supply.

g. Design and Construction History. The dam was reportedly constructed in 1882. No information is available on the design or construction history. In 1946 the spillway located on the left abutment was reconstructed and enlarged. At this time the dual spillways located on each abutment were abandoned.

h. Normal Operating Procedure. Fetter Pond is located upstream of Kehly Run Dam No. 5. Fetter Pond is a strip mine pond with a natural outlet. During dry periods water is pumped into Fetter Pond for storage. Downstream of Fetter Pond is Kehly Run Dam No. 6. Kehly Run Dam No. 6 has two spillways (one located on each abutment). Kehly Run Dam No. 6 is used as a holding pond for the downstream reservoirs. Water discharges through the spillways into Kehly Run Dam No. 5. Downstream of Kehly Run Dam No. 5 are Kehly Run Dams No. 4 and No. 3. Water is drawn off Kehly Run Dam No. 3 into the water system.

### 1.3 Pertinent Data.

a. Drainage Area. 0.4 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Emergency spillway capacity at top of dam	766

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on spillway crest given as 1660 on construction drawings.

Top of dam - low point	1663.1
Top of dam - design height	Unknown
Maximum pool - PMF	1663.2
Normal pool	1660
Spillway crest	1660
Tailwater on day of inspection	1643.3
Toe of dam	Submerged

d. Reservoir (feet).

Length of maximum pool (PMF)	1200'
Length of normal pool	1000'

e. Storage (acre-feet).

Normal pool	54
Top of dam	82

f. Reservoir Surface (acres).

Top of dam	10.5
Normal pool	9
Spillway crest	9

g. Dam.

Type	Earthfill
Length	1050'
Height	25'
Top width	Varies (15 to 25')
Side slopes - upstream	1H:1V
- downstream	1.5H:1V

SECTION 2  
ENGINEERING DATA

2.1 Design. Review of information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources and the owner's files revealed one construction drawing of the spillway modification, inspection reports, permit, photographs and correspondence were available for review. No detailed information on the design and original construction of the dam were available for review. All information available was reviewed for this study.

2.2 Construction. No information is available on the original dam construction.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterways Management and by the owner. The manager of the Municipal Authority was interviewed on operation and maintenance of the dam. The owner did not provide any information on past deep mining activities in the areas of the dam and reservoir.

b. Adequacy. A detailed study cannot be performed on this structure because of the lack of design and construction data. The Phase I Report is based upon visual inspection, review of available data, and the hydrologic and hydraulic analyses.

SECTION 3  
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Kehly Run Dam No. 5 was conducted by personnel of L. Robert Kimball and Associates on November 7 and 16, 1979. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and sections of toe not submerged.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in fair condition. The dam embankment is shaped in a semi-circle. From a brief survey conducted during inspection, it was noted that the dam crest elevation is fairly consistent. The upstream slope is 1H:1V with riprap missing throughout most of the embankment length. The crest width varies from 15 feet to 25 feet wide. The lower portion of the downstream slope consists of hand placed stone and is near vertical. The upper portion of the downstream slope consists of an earth embankment. The average slope on the downstream is 1.5H:1V. Both the upstream and downstream slopes and the crest are covered with trees and small brush. Many wet areas are located along the downstream toe of the dam (See page A-12). Along the left abutment beyond the toe of dam several seepage areas were noted. Seepage in this area was estimated at 2 gallons per minute. In addition, a wet area was noted at the toe of dam to the right of the tailwater. On the right abutment beyond the toe of dam is an extensive swampy area. An auxiliary spillway was located in this area prior to reconstruction of the new spillway. A diversion ditch is located along the right abutment. This diversion ditch formally acted as a spillway exit channel.

c. Appurtenant Structures. The 39 foot wide bottom width trapezoidal shaped spillway is located on the left abutment. The spillway and spillway exit channel are 625 feet long and bypass Kehly Run Dam No. 4. The spillway and spillway exit channel are lined with hand placed stone masonry in very good condition. The weir consists of a concrete wall approximately 5 1/2 feet high. The concrete is in good condition.



The outlet works consist of one 6" cast iron pipe through the embankment. Flow is controlled by a valve chamber located at the toe of dam. No upstream shut off is provided on this pipe. The pipe was unobserved during the inspection.

d. Reservoir Area. The watershed consists mostly of woodland and Kehly Run Dam No. 6. The reservoir slopes are gentle and are not susceptible to massive landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water. However, failure of Kehly Run Dam No. 6 probably would cause overtopping of Kehly Run Dam No. 5.

e. Downstream Channel. The downstream channel of Kehly Run is rather narrow and steep. Kehly Run Dams No. 4 and No. 3 are located downstream of the dam. Kehly Run discharges into the borough of Shenandoah.

3.2 Evaluation. In general, the embankment and appurtenant structures appear to be in fair condition. The seepage areas at the toe of dam should be monitored at regular intervals.

SECTION 4  
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the spillway crest elevation 1660.0. Excess inflow discharges over the spillway crest. The drainline is reportedly opened at regular intervals.

4.2 Maintenance of the Dam. No planned maintenance schedule exists. Maintenance of the dam has been lacking. Maintenance of the dam is considered poor.

4.3 Maintenance of Operating Facilities. The owner reported that the reservoir drain is opened at regular intervals. Maintenance of the operating facilities is considered fair.

4.4 Warning System in Effect. At the time of inspection no system was in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam is considered poor. Maintenance of the operating facilities is considered fair. There is no warning system in effect to warn downstream residents.

SECTION 5  
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No calculations or design data pertaining to hydrology were available.

b. Experience Data. No rainfall, runoff or reservoir data were available. The spillway has reportedly functioned in the past.

c. Visual Observations. The spillway appeared to be in good condition. The concrete control section is trapezoidal shaped with sideslopes equal to 4H:1V and the entrance is unrestricted.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The initial water level before the flood is elevation 1660 feet.

2. For the overtopping analysis the top of dam elevation of 1663.1 feet was assumed for the entire length of the crest of 1150 feet.

3. The flood was routed through Kehly Run Dam No. 6.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	1012 cfs
Spillway capacity	766 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for this dam is the PMF. The SDF is based on the hazard and size classification of the dam. Based on the following definition provided by the Corps of Engineers, the spillway is rated as inadequate as a result of our hydrologic analysis.

Inadequate - For all high hazard dams which do not safely pass the SDF (PMF).

The spillway and reservoir are capable of controlling 75% of PMF without overtopping the embankment. The computer printout of the hydrology is included in Appendix D.

5.4 Summary of Dam Breach Analysis. As the subject dam can satisfactorily pass 50% of the PMF without failure (based on our analysis) it was not necessary to perform a breach analysis and downstream routing of flood wave.

Special Note: Because failure of any dam in the Kehly Run system could result in failure of any downstream dam, the spillway capacity of all dams with inadequate spillways, should be increased.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The top part of the earth embankment consists of a sandy material which has eroded on the crest, upstream and downstream slopes. The upper portion of these slopes have eroded so that they are flatter than the downstream portions of the slopes. Trees and brush are growing on both the upstream and downstream slopes and the crest. Seepage is exiting from the left abutment and several locations on the right abutment (See page A-12). The downstream slope is very steep and appears to be bulging. Tailwater obscured close examination of the toe.

b. Design and Construction Data. No stability analyses are on record for this dam. No data are available on the design or construction of the dam. An inspection report prepared in 1920 indicated that a large slump on the upstream slope of the dam was present. This slump went unrepaired for several years. The correspondence and inspection reports do not indicate when or if this slump was repaired. The slide or slump area was not noted during the inspection.

c. Operating Records. No operating records are maintained.

d. Post Construction Changes. In 1946 the spillway located on the right abutment was abandoned and the spillway on the left abutment was enlarged and repaired. No other information is available on any post construction changes.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected loading.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in fair condition. The heavy growth of trees and vegetation, seepage and wet spots and erosion indicate that the dam is in need of repair and maintenance. The visual observations, review of available information, hydrologic and hydraulic calculations and past operational performance indicate that Kehly Run Dam No. 5 spillway is adequate. The spillway is capable of controlling 75% of the PMF without overtopping. According to the Corps of Engineers definitions the spillway is termed inadequate. All dams in the Kehly Run system which have inadequate spillways should have their spillway capacities increased. No adequate stability analyses have been performed for this structure. The long term effect of the seepage is unknown. Because of the very steep downstream slope; erosion on the upstream, downstream and crest; seepage areas, past history of slope failure, bulging of downstream slope, and tailwater condition, it is recommended that a stability analysis be conducted.

b. Adequacy of Information. The information available is not sufficient to complete the detailed report. The Phase I report is based upon visual observations, hydrologic and hydraulic calculations, and available information.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. To complete some of the recommendations/remedial measures outlined below, additional investigations are required.

7.2 Recommendations/Remedial Measures.

1. A detailed hydraulic and hydrologic study should be conducted by a professional engineer knowledgeable in dam design to increase spillway capacity. All dams in the Kehly Run system which have inadequate spillways should have their spillway capacities increased.

2. A stability analysis of the embankment should be conducted by a registered professional engineer knowledgeable in dam design and construction because of the steep downstream slope, erosion of both slopes and crest, seepage and past history of slope failure.

3. The brush and trees on the upstream and downstream slopes should be removed under the direction of a professional engineer knowledgeable in dam design and construction.

4. All wet and seepage areas should be monitored at regular intervals. Readings should be periodically evaluated by a professional engineer knowledgeable in dam design.

5. Positive drainage should be provided at the toe of dam to eliminate ponded areas.

6. Some means of positive closure of the drainline should be developed in case of emergencies.

7. All valves should be exercised and lubricated at regular intervals.

8. A subsidence investigation should be conducted by the owner or his engineer to determine the effects of past and present mining beneath the reservoir.

9. A warning system should be instituted to warn downstream residents of high water levels or imminent failure of the dam.

10. Regular safety inspections should be conducted in accordance with the provisions stipulated by the Commonwealth of Pennsylvania regarding inspection of dams.

APPENDIX A  
CHECKLIST, VISUAL INSPECTION, PHASE I



CHECK LIST  
VISUAL INSPECTION  
PHASE I

NAME OF DAM Kehly Run Dam No. 5 COUNTY Schuylkill STATE Pennsylvania ID# PA 658  
TYPE OF DAM Earth and rock fill HAZARD CATEGORY High  
DATE(S) INSPECTION Nov. 7, 15, 1979 WEATHER Cloudy, warm TEMPERATURE 50°

POOL ELEVATION AT TIME OF INSPECTION 1660.0 M.S.L. TAILWATER AT TIME OF INSPECTION 1643.3 M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates  
James T. Hockensmith - L. Robert Kimball and Associates  
O.T. McConnell - L. Robert Kimball and Associates  
\_\_\_\_\_  
\_\_\_\_\_

James T. Hockensmith \_\_\_\_\_ RECORDER

**EMBRANKMENT**

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The upper portions of the upstream and downstream slopes have eroded.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical alignment is fairly consistent. Any deflections of the horizontal alignment of the dam is difficult to determine because of the shape of the dam.	
RIPRAP FAILURES	Extensive areas of the upstream slope do not have riprap and are eroding.	

**EMBANKMENT**

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
<b>VEGETATION</b>	Trees and brush are located on both the upstream and downstream slopes and the crest.	
<b>JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM</b>	Appear to be good with the exception of seepage as indicated below.	
<b>ANY NOTICEABLE SEEPAGE</b>	Seepage is located on each abutment and near the toe of dam - See page A-12 for location and quantities.	
<b>STAFF GAUGE AND RECORDER</b>	None.	
<b>DRAINS</b>	None.	

**CONCRETE/MASONRY DAMS**

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
<b>ANY NOTICEABLE SEEPAGE</b>	Not applicable.	
<b>STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS</b>	Not applicable.	
<b>DRAINS</b>	Not applicable.	
<b>WATER PASSAGES</b>	Not applicable.	
<b>FOUNDATION</b>	Not applicable.	

**CONCRETE/MASONRY DAMS**

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

**OUTLET WORKS**

<b>VISUAL EXAMINATION OF</b>	<b>OBSERVATIONS</b>	<b>REMARKS OR RECOMMENDATIONS</b>
<b>CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT</b>	Outlet conduit unobserved. Reportedly one 6" cast iron pipe.	
<b>INTAKE STRUCTURE</b>	Unobserved.	
<b>OUTLET STRUCTURE</b>	Discharges below tailwater into Kehly Run Dam No. 4. Top portion of valve chamber visible in tailwater. Condition is partly deteriorated.	
<b>OUTLET CHANNEL</b>	None.	
<b>EMERGENCY GATE</b>	In valve chamber beneath tailwater.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	In good condition.	
APPROACH CHANNEL	Lake.	
DISCHARGE CHANNEL	Hand placed masonry in good condition.	
BRIDGE AND PIERS	None.	

**GATED SPILLWAY**

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



**DOWNSTREAM CHANNEL**

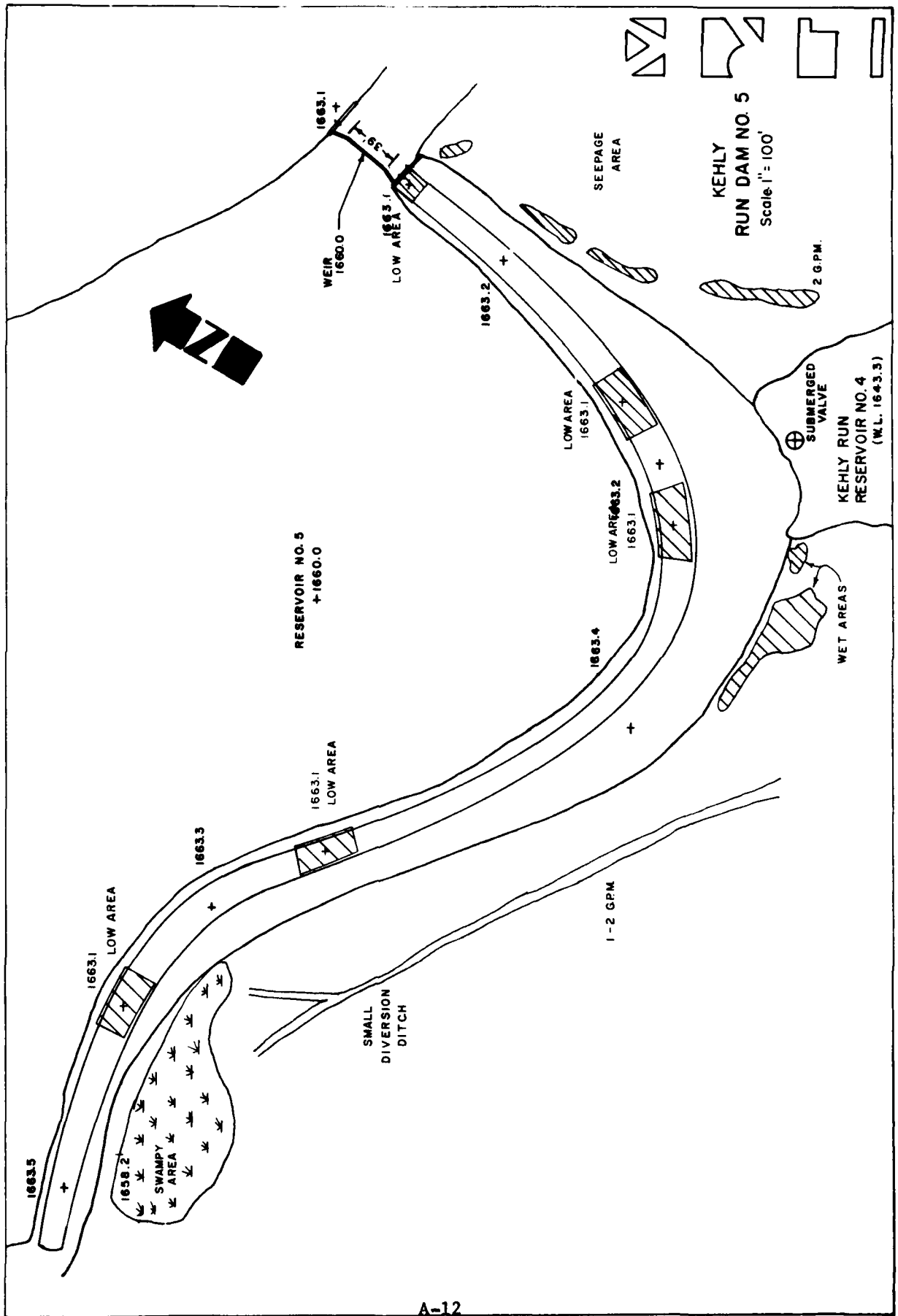
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
<p style="text-align: center;"><b>CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)</b></p>	<p>Kehly Run downstream of Kehly Run Dam No. 5 narrow and confined with several reservoirs before widening out in Shenandoah Borough.</p>	
<p style="text-align: center;"><b>SLOPES</b></p>	<p>Appear to be stable.</p>	
<p style="text-align: center;"><b>APPROXIMATE NO. OF HOMES AND POPULATION</b></p>	<p>Approximately 400 homes - 1,600 people.</p>	

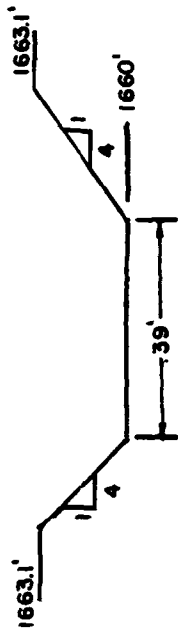
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate. Appear to be stable.	
SEDIMENTATION	Does not appear to be excessive because of Kehly Run Dam No. 6 upstream.	

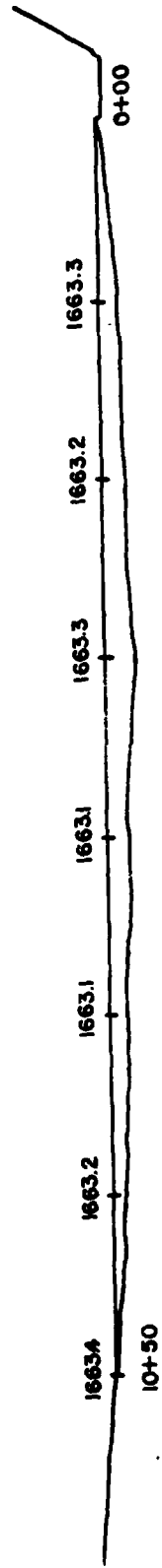
**INSTRUMENTATION**

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





**SPILLWAY PROFILE**  
(Not to Scale)



**PROFILE**  
**LOOKING UPSTREAM**

**KEHLY RUN NO. 5**  
Scale 1"=150'



APPENDIX B  
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION,  
PHASE I

**CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I**

NAME OF DAM Kehly Run Dam No. 5

ID# PA 658

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	None.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

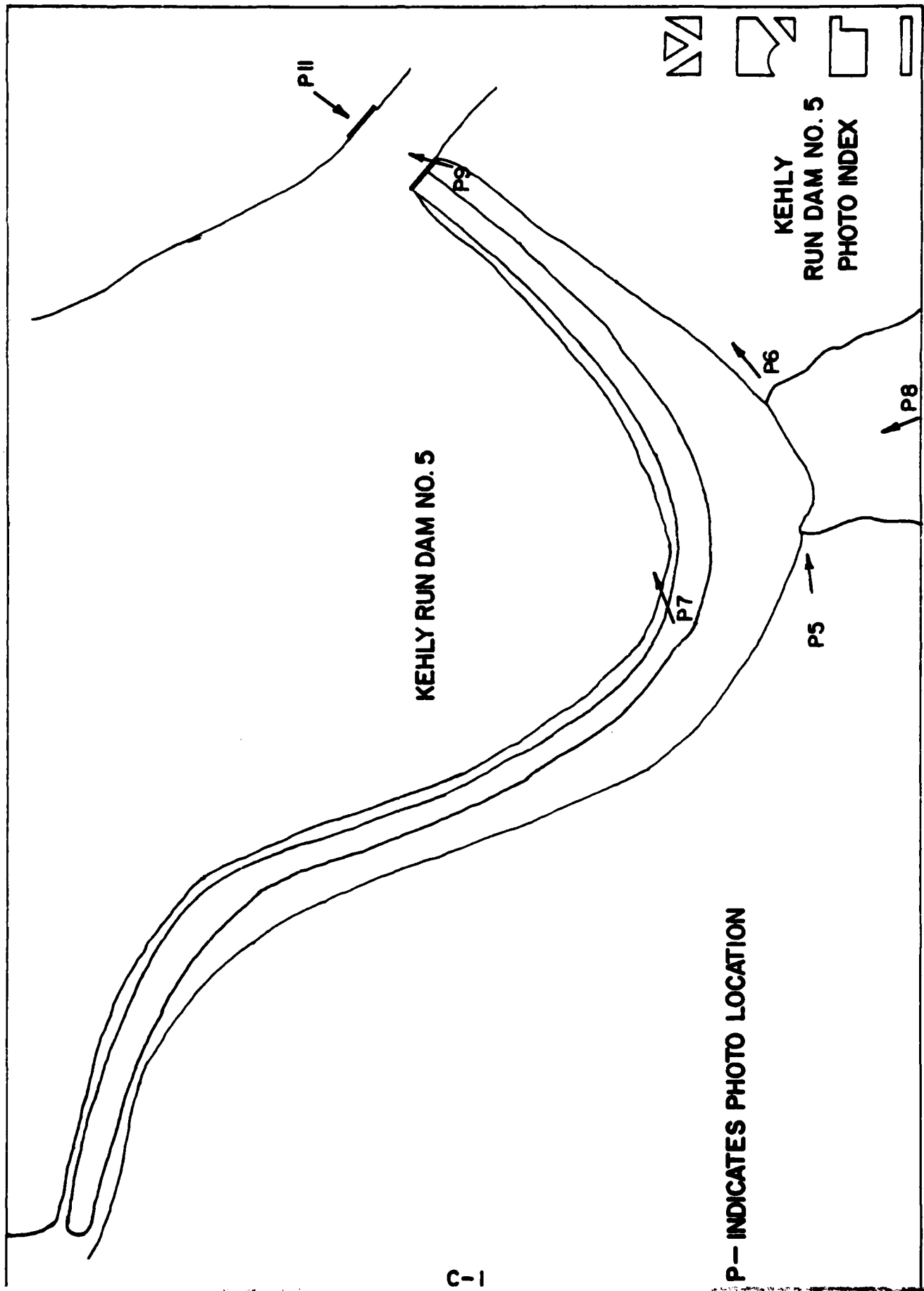
ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	Unknown.
BORROW SOURCES	Unknown.



ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Unknown.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Drawings on spillway modification.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C  
PHOTOGRAPHS



KEHLY RUN DAM NO. 5

KEHLY  
RUN DAM NO. 5  
PHOTO INDEX

P - INDICATES PHOTO LOCATION

C-1

KEHLY RUN DAM NO. 5

Photograph Descriptions

Sheet 1. Front

- (1) Upper left - Left spillway entrance and upstream slope of Kehly Run Dam No. 6.
- (2) Upper right - Kehly Run Dam No. 5. Spillway located on left abutment.
- (3) Lower left - Fetters Pond located upstream of Kehly Run Dam No. 5.
- (4) Lower right - Right spillway of Kehly Run Dam No. 6.

Sheet 1. Back

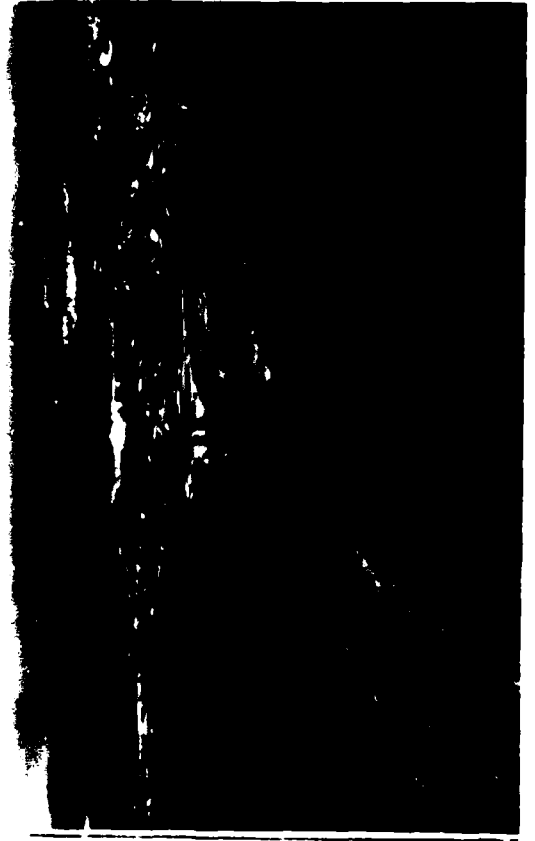
- (5) Upper left - Downstream slope of Kehly Run Dam No. 5 at maximum section. Tailwater of Kehly Run Dam No. 4 on right.
- (6) Upper right - Downstream slope of dam with heavy vegetation and wet areas at toe.
- (7) Lower left - Upstream slope of Kehly Run Dam No. 5.
- (8) Lower right - Downstream slope of Kehly Run Dam No. 5 viewed from Kehly Run Dam No. 4.

Sheet 2. Front

- (9) Upper left - Spillway weir.
- (10) Upper right - Downstream exposure (Shenandoah Borough) below Kehly Run Dam No. 3. Coal refuse embankment on right.
- (11) Lower left - Spillway and crest viewed from left abutment.
- (12) Lower right - Overview of Kehly Run Dam Nos. 4,5,6.









**APPENDIX D**  
**HYDROLOGY AND HYDRAULICS**

APPENDIX D  
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topographic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

\*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS  
DATA BASE

NAME OF DAM: Kehly Run Dam No. 5

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (1.005) = 22.3"

STATION	1	2	3
Station Description	Kehly Run No. 6		Kehly Run No. 5
Drainage Area (square miles)	0.29	0.11	
Cumulative Drainage Area (square miles)	0.29	0.40	
Adjustment of PMF for Drainage Area (%) <sup>(1)</sup>			
6 hours	117	117	
12 hours	127	127	
24 hours	136	136	
48 hours	143	143	
72 hours	145	145	
Snyder Hydrograph Parameters			
Zone <sup>(2)</sup>	13	13	
C <sub>p</sub> <sup>(3)</sup>	0.50	0.50	
C <sub>t</sub> <sup>(3)</sup>	1.85	1.85	
L (miles) <sup>(4)</sup>	0.4	0.4	
L <sub>ca</sub> (miles) <sup>(4)</sup>	0.2	0.2	
t <sub>p</sub> = C <sub>t</sub> (L <sub>x</sub> L <sub>ca</sub> ) 0.3 hrs.	0.87	0.87	
Spillway Data	Lt.	Rt.	
Crest Length (ft)	9	26	39
Freeboard (ft)	3.5		3.1
Discharge Coefficient	3.1	C'=0.95	C'=0.95
Exponent	1.5	N/A	N/A

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C<sub>p</sub> and C<sub>t</sub>).

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide.  
L<sub>ca</sub>=Length of water course from outlet to point opposite the centroid of drainage area.

**CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA**

**DRAINAGE AREA CHARACTERISTICS:** Drainage Area - 0.4 mi Wooded mild slopes

**ELEVATION TOP NORMAL POOL (STORAGE CAPACITY):** 42 ac.ft

**ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY):** 143 ac.ft

**ELEVATION MAXIMUM DESIGN POOL:** Unknown

**ELEVATION TOP DAM:** 1663.1 feet

**SPILLWAY CREST:**

- a. Elevation 1660.0 feet
- b. Type Trapezoidal
- c. Width 39 feet - bottom
- d. Length Unknown
- e. Location Spillover Left abutment
- f. Number and Type of Gates None

**OUTLET WORKS:**

- a. Type 6" CIP
- b. Location Maximum Section - embankment
- c. Entrance inverts Unknown
- d. Exit inverts Unknown
- e. Emergency draindown facilities 6" CIP

**HYDROMETEOROLOGICAL GAUGES:**

- a. Type None
- b. Location None
- c. Records None

**MAXIMUM NON-DAMAGING DISCHARGE:** Unknown



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EBENSBURG PENNSYLVANIA

DAM NAME KEHLY RUN No. 5

I.D. NUMBER 54-19

SHEET NO. 1 OF 4

BY OTM DATE 1-25-80

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY CORPS OF ENGINEERS,  
BALTIMORE DISTRICT.

STRTL = 1 INCH

CNSTL = 0.05 IN/HR

STRTO = 1.5 CFS/MI<sup>2</sup>

QRCSN = 0.05 (5% OF PEAK FLOW)

RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS

FROM USGS 7.5-MIN. QUAD., DER FILES AND  
FIELD INSPECTION DATA.

AT SPILLWAY CREST ELEVATION = 1660'

INITIAL STORAGE = 54 AC.FT

POND SURFACE AREA = 8 AC

AT ELEV. 1680, AREA = 23 ACRES

FROM CONIC METHOD FOR RESERVOIR VOLUME,  
FLOOD HYDROGRAPH PACKAGE (HEC-1), DAM  
SAFETY VERSION (USERS MANUAL).

$$\begin{aligned} H &= 3V/A \\ &= 3(54)/8 \\ &= 162/8 \\ &= 20.3' \end{aligned}$$

ELEVATION WHERE AREA EQUALS ZERO;

$$1660' - 20.3' = 1639.7'$$

AREA	8A	0	8	23	
ELEV.	8E	1639.7	1660	1680	



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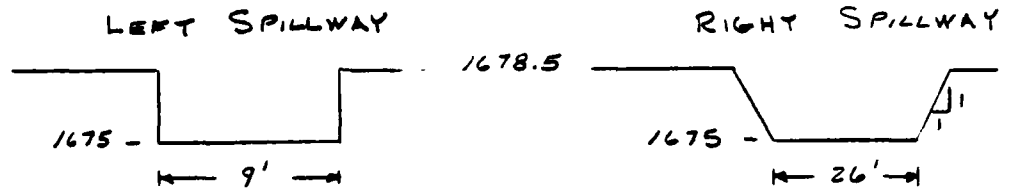
DAM NAME KEHLY RUN No. 5

I.D. NUMBER 54-19

SHEET NO. 2 OF 4

BY OTM DATE 2-25-80

DISCHARGE RATING CURVE (KEHLY RUN No. 6)



(NOT TO SCALE)

ELEV. (FT.)	LEFT C=3.1 l=9'		RIGHT C'=0.95, B=26', Z=1		DISCHARGE *Q (cfs)
	h (FT.)	Q <sub>1</sub> (cfs)	h <sub>p</sub> (FT.)	Q <sub>2</sub> (cfs)	
1675	0	0	0	0	0
1676	1	28	1	78	110
1677	2	79	2	227	310
1678	3	145	3	428	570
1678.5	3.5	183	3.5	545	730
1679	4	223	4	674	900
1680	5	312	5	965	1280
1685	10	882	10	3053	3940
1690	15	1621	15	6213	7830

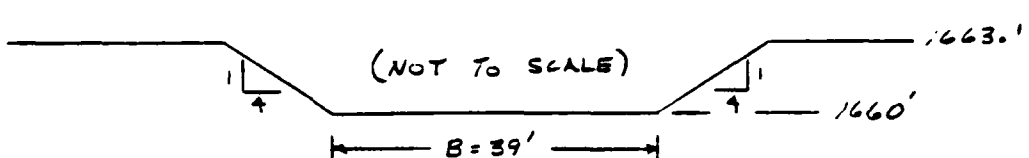
\* VALUES ROUNDED TO NEAREST 10 cfs.



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EBENSBURG PENNSYLVANIA

DAM NAME KEHLY RUN No. 5  
I.D. NUMBER 54-19  
SHEET NO. 3 OF 4  
BY OTM DATE 1-25-80

DISCHARGE RATING CURVE (KEHLY RUN No. 5)



ELEV. (FT.)	h <sub>p</sub> (FT.)	*Q (CFS)
1660	0	0
1660.5	.5	40
1661	1	120
1661.5	1.5	230
1662	2	370
1662.5	2.5	530
1663	3	720
1664	4	1180
1665	5	1740
1670	10	6240

\*VALUES ROUNDED TO  
NEAREST 10 CFS.

B = 39'  
Z = 4  
C' = 0.95'

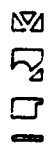
FROM:  $Q = 8.03 C' h_v^{1/2} (h_p - h_v) [B + Z (h_p - h_v)]$

WHERE  $h_v = \frac{3(2Z h_p + B) - (16Z^2 h_p^2 + 16Z B h_p + 9B^2)^{1/2}}{10Z}$

SOURCE: WATER AND WASTEWATER ENGINEERING  
BY FAIR, GEYER & OKUM 1966 p. (11-1A) & (11-15)

LOW DAMS  
BY NATIONAL RESOURCES COMMITTEE WASH. DC.  
1938 Eg. (7) & (8)





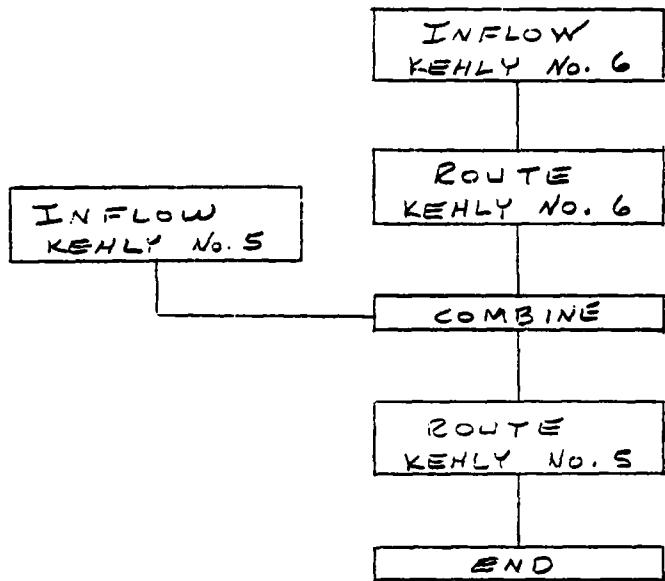
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DAM NAME KEHLY RUN No. 5  
I.D. NUMBER 54-19  
SHEET NO. 4 OF 4  
BY OTM DATE 1-25-80

OVERTOP PARAMETERS

TOP OF DAM ELEV. (LOW SPOT) = 1663.1'  
LENGTH OF DAM (EXCLUDING SPILLWAY) = 1150'  
COEFFICIENT OF DISCHARGE (C) = 3.0 (BROAD CREST)

PROGRAM SCHEDULE



18

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (FHC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 \*\*\*\*\*

A1 ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF  
 A2 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF KEHLY RUN NO. 5  
 A3 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA. 54-19

4	B	288	0	15	0	0	0	0	0	0
5	B1	5								
6	J	1	6	1						
7	J1	.1	.2	.3	.4	.5	1			
8	K	0	1				1			
9	K1									
10	M	1	1	0.29						
11	P		22.3	117	127	136	143	145	145	1
12	T								150	0.009
13	W	0.87	0.50							
14	X	-1.5	-0.5	2.0						
15	K	1	7							
16	K									
17	Y									
18	V1	5							1675	1
19	Y4	1675	6676	1677	1678	1678.5	1679	1680	1685	1690
20	Y5	0	110	310	570	730	500	1280	3940	7830
21	SA	0	21	46	92					
22	SE	1669	1675	1680	1700					
23	SS	1675								
24	SD1678.5	3.0		1.5	1200					
25	K	0	3							
26	K1									
27	M	1	1	0.11						
28	P		22.3	117	127	136	143	145	145	1
29	T								1.0	.05
30	W	0.87	0.50							
31	X	-1.5	-0.5	2.0						
32	K	2	4							
33	K1									
34	K	1	5							
35	K1									
36	Y									
37	V1	1	1						-1660	-1
38	Y4	1660	1660.5	1661	1661.5	1662	1662.5	1663	1664	1665
39	Y5	0	40	120	230	370	530	720	1180	1740
40	SA	0	8	23						
41	SE1639.7	1660	1680							
42	SS	1660								
43	SD1663.1	3.0	1.5	1150						
44	K	95								

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 26 FEB 79  
 \*\*\*\*\*

RUN DATE 80/01/15  
 TIME 07.35.36

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF  
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF KEHLY RUN NO. 5  
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA. 58-19

JOB SPECIFICATION

NO	NRH	NRIN	JDAY	JRR	IRIN	WEIR	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0
		JOPER	NWT	LROPT	TRACE				
		3	0	0	0				

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= .10 .20 .30 .40 .50 1.00  
 NPLANE= 1 NR110= 6 LR110= 1

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR NO. 6

JSTAG	JCOMP	TECON	ITRPE	JPLT	JPKT	ITMME	ITSTROE	TACTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.29	0.00	.29	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STHR	DLTKM	RTIUL	EXPN	STNKS	RTIOK	SIRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= .87 CP= .50 NFA= 0

RECESSION DATA

STRIO= -1.50 ORCSN= .05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVLI SNEYDER CP AND TP ARE TC= 3.67 AND R= 4.76 INTERVALS

UNIT HYDROGRAPH 28 ENL-01 -PERIOD ORDINATES. LAG= .87 HOURS. CP= .50 VOL= 1.00  
 1% 37% 91% 105% 75% 61% 49% 32%

HYDROGRAPH ROUTING

ROUTE THRU KEHLY NO. 6

ISTAO ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO  
 2 1 0 0 0 0 0 0 0 0 0 0 0 0

ROUTING DATA

LOSS	CLOSS	AVG	IREP	ISAME	IOPT	IMP	LSTR
0.0	0.000	0.00	1	1	0	0	0
STAGE	1675.00	1676.00	1678.00	1678.50	1679.00	1685.00	1690.00
FLOW	0.00	110.00	570.00	730.00	900.00	1280.00	3940.00

NSIPS	NSTD	LAG	ANSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1675	0
SURFACE AREA	0.	21.	46.	92.			
CAPACITY	0.	42.	205.	1559.			
ELEVATION	1669.	1675.	1680.	1700.			

CREL	SPWID	COOR	EXP	ELEV	COOL	CRK	EXP
1675.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DAM DATA							
TOPEL	1678.5	3.0	1.5	1200.			

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR NO, 5

✓ 98

ISTAG 3 TCOMP 0 TECON 0 ITAPE 0 JPLT 0 JPRT 0 TNAME 1 ISTAGE 0 TAUTO 0

HYDROGRAPH DATA

JHYDQ 1 JUNG 1 TAREA .11 SNAP 0.00 TRSDA .11 TRSPC 0.00 RATIO 0.000 ISNOW 0 ISAME 1 LOCAL 0

PHECIP DATA

SPFE 0.00 PMS 22.30 K6 117.00 R12 127.00 R24 136.00 R48 143.00 R72 149.00 R96 0.00

TRSPC COMPUTED BY THE PROGRAM IS .900

LUGS DATA

LROPT 0 STRKR 0.00 DLTKR 0.00 RTIOL 1.00 ERATN 0.00 STRKS 0.00 RTIOK 1.00 SINTL 1.00 CNSL .05 ALSMX 0.00 RTIMP 0.00

UNIT HYDROGRAPH DATA

TP = .87 CP = .50 NTA = 0

RECESSION DATA

STRIO = -1.50 URCSNs = .05 RTIOR = 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC = 3.67 AND N = 4.76 INTERVALS

UNIT HYDROGRAPH 28	END-OF-PERIOD ORDINATE	LAG	.87 HOURS	CP	.50	VOL
5.	20.	34.	40.	35.	28.	12.
10.	8.	6.	5.	4.	3.	15.
1.	1.	1.	1.	1.	0.	2.
						0.

END-OF-PERIOD FLOW

0

HYDROGRAPH ROUTING

ROUTE THRU RESERVOIR NO. 5

STAG	ICOMP	IECON	ITAPE	JPLT	JFRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0
ROUTING DATA								
LOSS	AVG	INES	ISAME	IOPT	IPMP	LSTR		
0.0	0.00	1	1	0	0	0		
HSTPS	HSTDL	LAG	AMSK	X	TSK	STORA	ISPRAT	
1	0	0	0.000	0.000	0.000	-1660.	-1	
STAGE	1660.00	1661.50	1662.00	1662.50	1663.00	1664.00	1665.00	
FLOW	5.00	120.00	230.00	370.00	530.00	720.00	1180.00	1740.00
ELEVATION								

SURFACE AREA = 0. 8. 23.

CAPACITY = 0. 96. 351.

ELEVATION = 1660. 1660.

CREL	SPWID	CONW	EXPW	FLEVL	CONL	CAREA	EXPL
1660.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA  
 TOSEL 166.01  
 COND 3.0  
 EXPD 1.5  
 DAMMED 1150.

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

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
				102	204	306	408	511	1021
HYDROGRAPH AT	1	0.29	1	2.89	5.78	8.67	11.57	14.46	28.92
				120	240	360	480	600	1200
ROOFTED TO	2	0.79	1	1.71	3.42	5.13	6.84	8.55	17.10
				170	340	510	680	850	1700
HYDROGRAPH AT	3	0.11	1	1.10	2.19	3.28	4.37	5.46	10.92
				170	340	510	680	850	1700
ROOFTED TO	4	1.04	1	2.47	4.91	7.35	9.79	12.23	24.46
				170	340	510	680	850	1700
HYDROGRAPH AT	5	1.04	1	2.37	4.82	7.27	9.72	12.17	24.34
				170	340	510	680	850	1700
ROOFTED TO	6	1.04	1	2.37	4.82	7.27	9.72	12.17	24.34

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..... INITIAL VALUE      SPILLWAY CREST      TOP OF DAM  
 ELEVATION      1675.00      1675.50  
 STORAGE      42      143  
 OUTFLOW      0      730

RATIO OF PAF	MAXIMUM RESERVOIR ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1675.55	0.00	54	60	0.00	42.75	0.00
.20	1676.06	0.00	67	123	0.00	42.75	0.00
.30	1676.42	0.00	77	199	0.00	42.00	0.00
.50	1676.80	0.00	87	270	0.00	41.75	0.00
.75	1677.13	0.00	97	344	0.00	41.75	0.00
1.00	1678.46	0.00	141	717	0.00	41.75	0.00



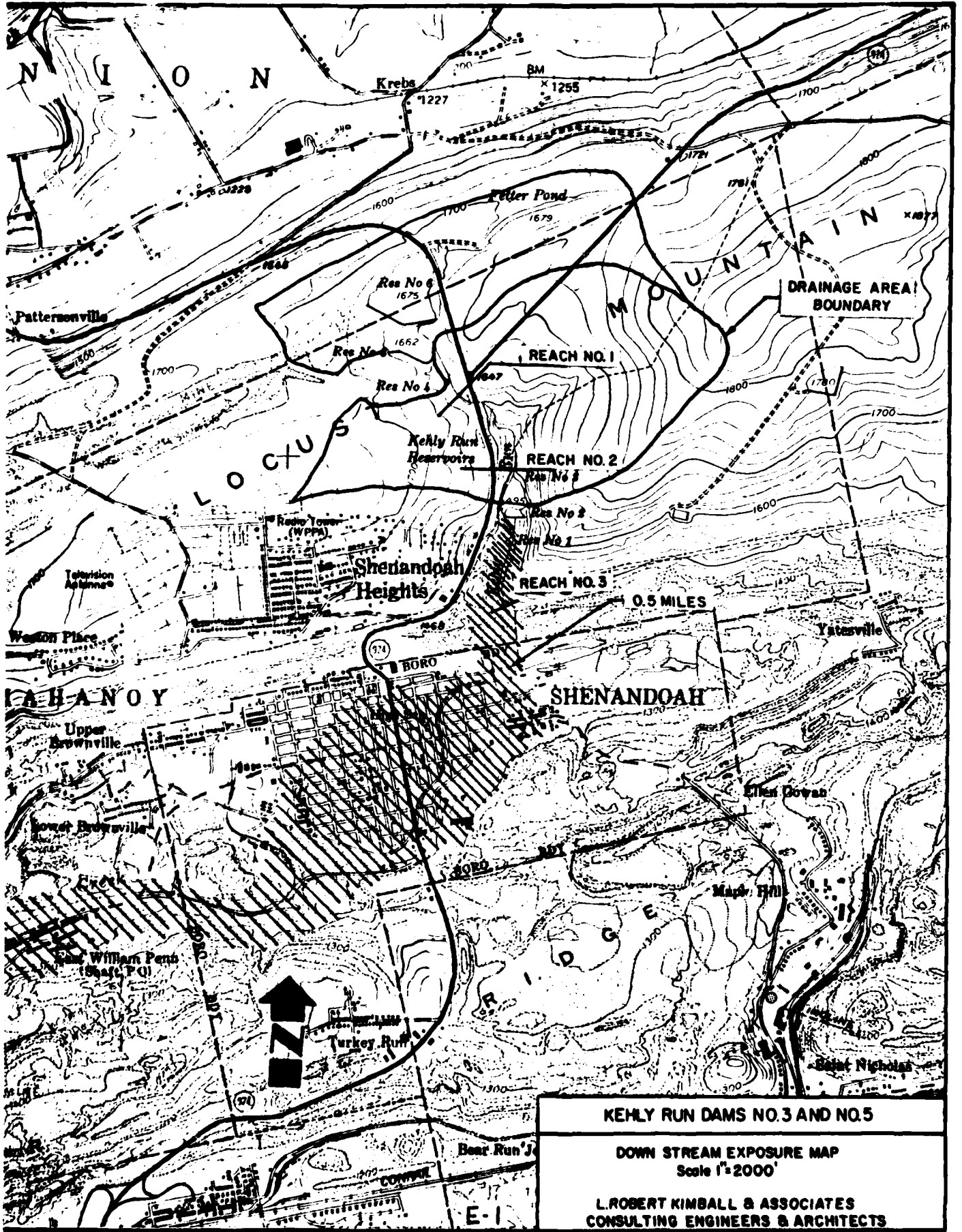
8/4

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..... INITIAL VALUE      SPILLWAY CREST      TOP OF DAM  
 ELEVATION      1650.00      1650.00      1653.10  
 STORAGE      54.      54.      82.  
 OUTFLOW      0.      0.      766.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1650.77	0.00	60.	84.	0.00	42.25	0.00
.20	1661.23	0.00	64.	170.	0.00	42.00	0.00
.30	1661.66	0.00	68.	276.	0.00	41.75	0.00
.40	1662.02	0.00	71.	377.	0.00	41.75	0.00
.50	1662.34	0.00	74.	478.	0.00	41.75	0.00
1.00	1663.24	.14	83.	1012.	2.75	41.25	0.00

**APPENDIX E  
DRAWINGS**



**KEHLY RUN DAMS NO.3 AND NO.5**  
**DOWN STREAM EXPOSURE MAP**  
 Scale 1"=2000'  
**L.ROBERT KIMBALL & ASSOCIATES**  
**CONSULTING ENGINEERS & ARCHITECTS**

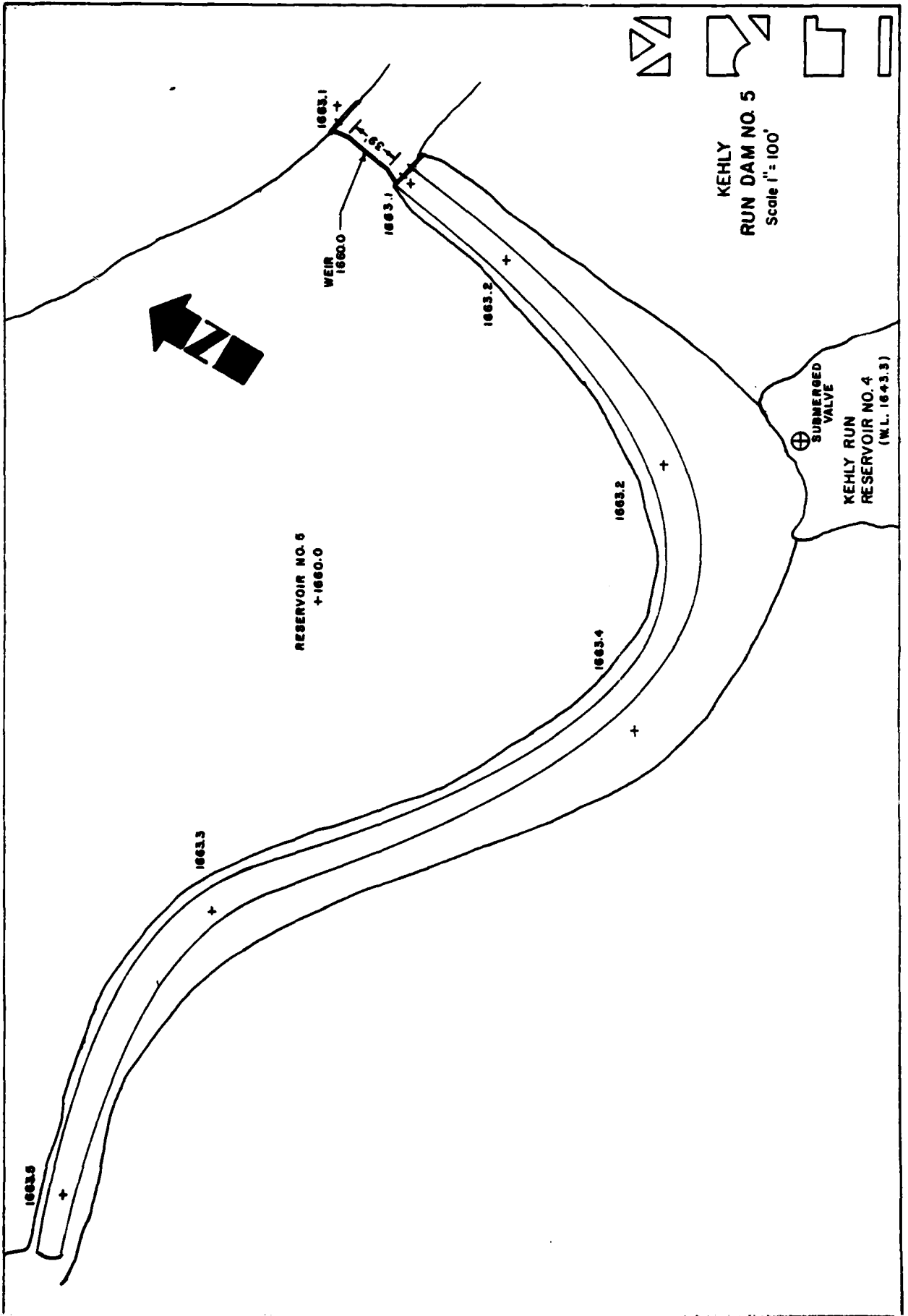
APPENDIX F  
GEOLOGY

## Kehly Run Dam No. 5 - General Geology

Kehly Run Dam No. 5 is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. This province is typified by numerous synclinal and anticlinal features. Some minor faulting is indicated to the south of the reservoir. The bedrock underlying the dam consists of the Pennsylvanian aged Pottsville Group. This unit consists of light to dark gray, fine grained to conglomeratic sandstone, with lesser amounts of shale, siltstone, limestone, coal and underclay. The bedding is generally well developed with the sandstones and siltstones often cross-bedded. Joints are usually regular and moderately well formed.

Both deep mining and surface mining of anthracite coal has taken place in the vicinity of this dam. The extent of any deep mining is unknown without extensive research.

X





**GEOLOGIC MAP OF THE AREA SURROUNDING  
 RAVEN RUN DAMS NO. 2 AND 3,  
 KEHLY RUN DAMS NO. 3 AND 5,  
 BRANDONVILLE PUMPING STATION RESERVOIR**

- Pp** Pottsville Group  
*Predominantly sandstones and conglomerates with thin shales and coals, some with variable quality.*
- ANTHRACITE REGION**
- Ppp** Post-Pottsville Formations  
*Blocky, quartz sandstones and shales with some conglomerates and numerous small coals.*
- Pp** Pottsville Group  
*Light gray to white, coarse grained, quartz sandstones and shales with some conglomerates and numerous small coals. See Schuchkell and Landis, U.S. Geol. Surv. Prof. Paper 100, 1905.*
- MISSISSIPPIAN**
- Mmc** Mauch Chunk Formation  
*Dark shales and shaly sandstones with thin layers of limestone. Limestone is locally abundant at the base and in the middle of the formation.*