OHIO RIVER BASIN

MILLER RUN, WESTMORELAND COUNTY

PENNSYLVANIA

LEVEL II

DERRY ROD AND GUN CLUB DAM

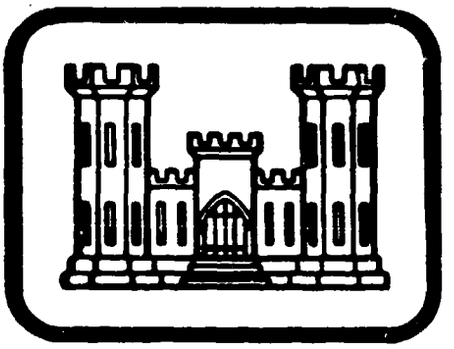
NDI ID NO. PA-518

DER ID NO. 65-143

DERRY ROD AND GUN CLUB

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



Prepared By

L. ROBERT KIMBALL & ASSOCIATES

CONSULTING ENGINEERS & ARCHITECTS

EBENSBURG, PENNSYLVANIA

15931

FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT CORPS OF ENGINEERS

BALTIMORE, MARYLAND

21203

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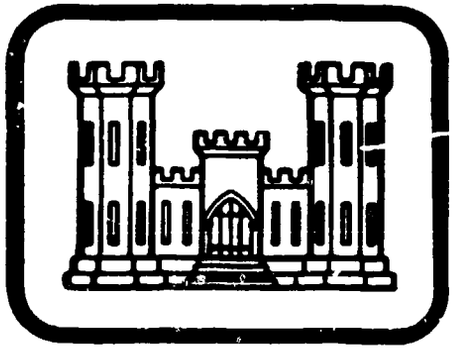

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Contract DACW31-81-C-0012

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PREFACE

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

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

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

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

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Derry Rod and Gun Club Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Westmoreland
STREAM	Miller Run
DATES OF INSPECTION	March 26, 1981 and May 12, 1981
COORDINATES	Lat: 40° 18.2' Long: 79° 18.4'

ASSESSMENT

The assessment of Derry Rod and Gun Club Dam is based upon visual observations made at the time of inspection, interviews with members of the Rod and Gun Club, hydraulic and hydrologic computations and past operational performance.

The Derry Rod and Gun Club Dam appears to be in fair condition, with the condition of the operating facilities being considered as poor. The maintenance of the dam and operating facilities is considered poor. The condition of the principal spillway discharge line is in a visibly deteriorating condition at the outlet. The condition of the pipe through the embankment is unknown. It is unknown as to whether cutoffs were provided for the line.

A wet area was observed on the downstream slope of the dam. The condition of the wet area did not appear to pose an immediate problem relative to the stability of the structure. Groundwater and surface runoff near the right abutment has caused erosion gullies along the toe of the dam, adjacent to the right abutment contact. The erosion could potentially erode the toe of the dam, and the runoff should be diverted away from the toe of the dam. A low spot was noted during the inspection, and the top of dam should be filled to an elevation consistent with the top of slope at the emergency spillway at the left abutment. Based on information provided by the members of the Derry Rod and Gun Club, it was reported that the drainline valve has not been operated in several years. The control stem for the valve reportedly is located in the reservoir, but the stem was not visible during the inspection period.

The Derry Rod and Gun Club Dam is a high hazard-small size dam. The recommended Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. Since the Derry Rod and Gun Club Dam just meets the minimum size criteria; and since the dam is located in a rural area suggesting only appreciable economic loss; compliance with current practice of the Baltimore District Corps of Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF). The spillway and reservoir are capable of controlling approximately 19% of the PMF without overtopping the

embankment low spot. Based on criteria established by the Corps of Engineers, the spillway is termed inadequate, but not seriously inadequate.

The following recommendations and remedial measures should be instituted immediately.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledegable in dam design and construction to increase the spillway capacity.

2. The wet area on the downstream slope of the dam should be monitored. If the wet area increases in size or flow is observed from the wet area an analysis should be made as to the effect of the seepage on the stability of the embankment. Seepage monitoring should be conducted at the direction of a registered professional engineer knowledgeable in dam design and analysis.

3. It should be ascertained whether the drainline valve reported on the upstream end of the drainline is capable of operation. If it is determined whether the valve is operable, it should be operated and lubricated on a regular basis. If it is determined that the valve is not operable, it should be made operable or some other method devised to drain the reservoir.

4. The condition of the pipe through the embankment should be determined. Deteriorated portions of the pipe through the embankment should be repaired or replaced. Erosion control measures should be implemented at the outlet of the pipe to prevent erosion at the outlet.

5. Groundwater and surface runoff near the right abutment should be diverted away from the toe of the dam.

6. The top of dam should be filled to an elevation consistent with the top of slope at the emergency spillway as a temporary measure until the owner determines what permanent modifications will be made.

7. A regularly scheduled operation and maintenance plan should be prepared and implemented to insure the continued safe operation of the structure. The operation and maintenance plan should include the regular operation and lubrication of the drainline valve.

8. A warning system should be developed to warn the downstream residents of imminent failure of the dam.

9. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

DERRY ROD AND GUN CLUB DAM
PA 518

SUBMITTED BY: L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

June 15, 1981
Date

R. Jeffrey Kimball, P.E.

APPROVED BY:

7 July 81
Date

JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

Overview of Derry Rod and Gun Club Dam.

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PHASE I
NATIONAL DAM INSPECTION PROGRAM

DERRY ROD AND GUN CLUB DAM
NDI. I.D. NO. PA 518
DER I.D. NO. 65-143

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. The Derry Rod and Gun Club Dam is an earthfill dam, 480 feet long and 24 feet high. The crest width of the dam is 15 feet. The upstream slope of the dam is 4H:1V to 5H:1V. The downstream slope of the dam is 3H:1V. The crest and downstream slope of the dam are grass covered.

The principal spillway for the structure consists of an 8" to 10" cast iron pipe riser. Inflow to the principal spillway is discharged through a 12" diameter bituminous coated corrugated metal pipe. An emergency spillway for the structure is located at the left abutment, and consists of a trapezoidal shaped spillway with a concrete weir at the crest. The crest width at the bottom of the trapezoidal channel is 28 feet long. The sideslopes of the trapezoidal channel are approximately 1H:1V.

b. Location. The dam is located on Miller Run, which is a tributary to the Loyalhanna Creek, approximately 2 miles south of the Borough of Derry, Derry Township, Westmoreland County, Pennsylvania. The Derry Rod and Gun Club Dam can be located on the Derry, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. The Derry Rod and Gun Club Dam is a small size dam (24 feet high, 54 acre-feet).

d. Hazard Classification. The Derry Rod and Gun Club Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives is probable should the structure fail. Approximately five homes are located approximately 2 miles downstream of the dam.

The Kennametal Dam is located 1 mile downstream of the dam. The approximate elevation of the homes located on reach cross-section number 2 is elevation 1240.

e. Ownership. The Derry Rod and Gun Club Dam is owned by The Derry Rod and Gun Club. Correspondence should be addressed to:

The Derry Rod and Gun Club
East 2nd Street
Derry, Pennsylvania 15627
412/694-9960

f. Purpose of Dam. The dam was constructed for the purpose of recreation.

g. Design and Construction History. No information is available regarding the design and construction of the structure. The dam was built around 1952 by Graver Construction of Ligonier, Pennsylvania. No design drawings were available for review, and no construction data are known to exist.

h. Normal Operating Procedures. No operating procedures are known to exist for this structure. It was reported by members of the Rod and Gun Club who accompanied the inspection team that the drainline valve has not been operated in several years.

1.3 Pertinent Data.

a. Drainage Area. 0.40 square mile

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Unknown
Spillway capacity at top of dam	260

c. Elevation (M.S.L.) (feet). - Field survey based on an assumed pool elevation, 1925 interpolated from U.S.G.S. quadrangle.

Top of dam - low point	1927.1
Top of dam - design height	Unknown
Pool at time of inspection	1925.0
Spillway crest	1925.0
Maximum pool - design surcharge	Unknown
Normal pool	1925.0
Upstream portal - 12" drainline	Unknown
Downstream portal - 12" drainline	1905.0
Maximum tailwater	Unknown
Toe of dam	1903.4

d. Reservoir (feet).

Length of maximum pool	1000
Length of normal pool	900

e. Storage (acre-feet).

Normal pool (spillway crest)	41
Top of dam	54

f. Reservoir Surface (acres).

Top of dam	7
Normal pool	6.4
Spillway crest	6.4

g. Dam.

Type	Earthfill
Length (including spillway)	480 feet
Height	24 feet
Top width	15 feet
Side slopes - upstream	4H:1V to 5H:1V
- downstream	3H:1V
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Reservoir Drain.

Type	12" diameter bituminous coated corrugated metal pipe
Length	100 feet
Closure	Valve on upstream end of pipe
Access	Valve stem reported to be on upstream slope in reservoir. Unobserved during inspection.
Regulating facilities	Valve stem Unobserved during inspection

i. Spillway.

Type	Trapezoidal with concrete ogee crest.
Length (bottom width)	28 feet
Crest elevation	1925
Upstream channel	Lake (unrestricted)
Downstream channel	Miller Run

SECTION 2
ENGINEERING DATA

2.1 Design. No information was available relative to the design of the dam.

2.2 Construction. No information exists regarding the construction of the dam. The dam was reportedly constructed by the Graver Construction Company of Ligonier.

2.3 Operation. No operations are conducted at the dam. No operating records are maintained.

2.4 Evaluation.

a. Availability. No engineering data were available from the PennDER, Bureau of Dams and Waterways Management. Two members of the Derry Rod and Gun Club Dam accompanied the inspection team during the inspection and were interviewed to obtain data regarding the operation and maintenance of the dam. The only information the representatives of the club were able to give the inspection team was in regards to the approximate date of construction (1952), and that the principal spillway riser was approximately 8" to 10" in diameter.

b. Adequacy. This Phase I Report is based on the visual inspection, hydrologic and hydraulic analysis, and reports of past operational performance. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Derry Rod and Gun Club Dam was conducted by personnel of L. Robert Kimball and Associates, accompanied by two members of the Derry Rod and Gun Club, on March 26, 1981, and May 12, 1981. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
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. From a brief survey conducted during the inspection, it was noted that a low spot exists on the crest of the dam approximately 300 feet right of the spillway. No riprap was observed on the upstream slope of the dam. The slopes and crest of the dam are grass covered. The upstream slope of the dam was measured to be 4H:1V to 5H:1V, and the downstream slope was measured to be 3H:1V. A wet area was observed on the downstream slope of the dam, and the location of the wet area can be seen in Appendix A, on page A-12. No flow was visible from the wet area. No change was noted in the wet area during the second inspection from that which existed during the earlier inspection.

Groundwater and surface runoff near the right abutment has caused a small erosion gully to form near the downstream toe of the dam. Surface drainage from this area ultimately discharges into the drainline discharge channel beyond the toe of the dam. The runoff has the potential to enlarge the erosion gully and ultimately erode part of the toe of the dam.

c. Appurtenant Structures. The spillway for the dam is located at the left abutment of the structure. The spillway is trapezoidal in shape, with a concrete weir at the control section of the structure. The side slopes of the discharge channel in the area of the control section were estimated to be 1H:1V. The emergency spillway extends around the junction of the left abutment and the flow is discharged into the natural stream below the dam. No obstructions were visible in the spillway approach or discharge channel during either the March 26 or May 12, 1981 inspections.

The intake for the principal spillway was barely visible during the inspection. It was noted during the March 26, 1981 inspection that the intake was surging due to the reservoir pool elevation at the

time of inspection. During both inspection dates, it was observed that flow was discharging from the principal spillway. The discharge pipe for the principal spillway and drainline consists of a 12" bituminous coated corrugated metal pipe. The pipe outlet is in a deteriorating condition. A major portion of the pipe at the outlet has rusted away, and flow discharges from the entire length of the exposed portion of the pipe. Discharges from the principal spillway and the surface runoff from the right abutment combine and flow in a stream channel which ultimately converges with the spillway discharge channel into Miller Run. It was reported by members of the Derry Rod and Gun Club that a drainline valve exists at the upstream entrance to the principal spillway and discharge drainline. The valve is reportedly operated by a valve stem on the upstream slope in the reservoir area. The valve stem was not observed during the inspection. It was also reported by members of the club that the valve has not been operated in several years.

d. Reservoir Area. The watershed is covered almost entirely with open fields. A small wooded area does exist at the headwaters of the watershed. The reservoir slopes are gentle to moderate and do not appear to be susceptible to landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel of the Derry Rod and Gun Club consists of Miller Run. A small unidentified dam exists downstream of the Derry Rod and Gun Club Dam, and the Kennametal Reservoir (PA 482) is located approximately 1 mile downstream of the Derry Rod and Gun Club Dam. A Phase I inspection of the Kennametal Dam was completed by Ackenheil and Associates of Pittsburgh, Pennsylvania, around April, 1980. Five homes are located approximately 1 mile downstream of the Kennametal Dam, and two miles downstream of the Derry Rod and Gun Club Dam. The population of the five homes is estimated at 20 people.

3.2 Evaluation. In general, the dam appears to be in fair condition. Maintenance of the dam and operating facilities is considered poor. It was reported by members of the Derry Rod and Gun Club that the drainline has not been operated in several years. The control facilities for the drainline were not observed during the inspection.

The wet area on the downstream slope of the dam should be monitored and if seepage becomes excessive in the area, its effects on the stability of the structure should be ascertained.

The principal spillway and drainline discharge pipe was visibly deteriorated along the visible portion of the exposed pipe. The condition of the pipe through the embankment is unknown and should be investigated, and the deteriorated portions of the pipe replaced. The area around the outlet for the drainline should be protected with riprap to prevent erosion at the outlet.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the principal spillway crest during normal inflow to the reservoir. Excessive inflow to the reservoir is discharged through the emergency spillway at the left abutment. No operational procedures are conducted at the dam. It was reported that the drainline valve has not been operated in several years.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the dam. Maintenance of the dam is performed on an unscheduled, as-needed basis by club members. Maintenance includes mowing grass on the crest and slopes.

4.3 Maintenance of Operating Facilities. No maintenance of operating facilities is conducted at the dam.

4.4 Warning System in Effect. There is no warning system 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 fair, and maintenance of the operating facilities is considered poor. The drainline valve reportedly has not been operated in several years. The lack of maintenance of the operating facilities has allowed the deterioration of the principal spillway discharge line to deteriorate extensively at the outlet. The emergency spillway appears to be in fair condition.

An emergency action plan should be available for every dam in the high and significant hazard category. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency, and should include an effective warning system. No emergency action plan has been developed, and the owner should develop such an action plan.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No design data relative to the hydraulic and hydrologic design of the dam were available for review.

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

c. Visual Observations. The principal spillway reportedly consists of an 8" to 10" diameter riser pipe. The entrance to the principal spillway is unprotected and was disregarded during the hydraulic and hydrologic analysis.

The emergency spillway appeared to be in fair condition. No obstructions were observed at the entrance to the spillway or in the spillway discharge channel. The emergency spillway was observed to be trapezoidal in shape, with a concrete weir at the control. The emergency spillway was considered as providing the only discharge during periods of excessive inflow to the reservoir.

The low spot on the embankment crest was observed to be near mid embankment. The low spot was considered to be the top of dam elevation in the hydraulic and hydrologic analysis.

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 completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The emergency spillway crest elevation was assumed to be at elevation 1925.0.

2. The pool elevation in the reservoir prior to the storm was considered to be at the spillway crest elevation.

3. The top of dam was considered to be the low spot elevation on the crest, 1927.1.

4. The emergency spillway was considered as exhibiting the properties of a trapezoidal channel.

5. The principal spillway was not considered during the analysis.

6. The Kennametal Dam located downstream of the Derry Rod and Gun Club Dam was assumed to fail during the breach analysis for the Derry Rod and Gun Club Dam. The failure conditions utilized for the Kennametal Dam were consistent with data provided in the Phase I dam report for the Kennametal Dam.

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

Peak inflow (PMF)	1480 cfs
Peak inflow (1/2 PMF)	740 cfs
Spillway capacity	260 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood for a dam of this size and hazard classification is in the range of 1/2 PMF to PMF.

No definitive criteria exists to assist the evaluating engineer in selecting a SDF within the given range. The current practice adopted by the Baltimore District Corps of Engineers relates the selection of a Spillway Design Flood to the size and storage potential of the dam.

The Baltimore District Corps of Engineers has determined that the SDF be selected at the lesser value (1/2 PMF) of the 1/2 PMF to PMF range for high hazard dams which barely meet the minimum storage or height criteria (size classification), and which are located in rural areas.

Since the Derry Rod and Gun Club Dam just meets the minimum size criteria; and since the dam is located in a rural area suggesting only appreciable economic loss; compliance with current practice of the Baltimore District Corps of Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF).

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 - All high hazard dams which do not pass the Spillway Design Flood (1/2 PMF), and where the downstream routing of the flood wave does not significantly increase the downstream hazard potential from that which existed just prior to failure of the dam.

The spillway and reservoir are capable of controlling approximately 19% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF (based on our analysis), it was necessary to perform the dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure. A pool elevation of 1927.7 (0.6 foot of overtopping) was considered sufficient to cause failure of the dam due to overtopping.

The flood wave was routed through the Kennametal Reservoir located approximately 1 mile downstream of the Derry Rod and Gun Club Dam, and was assumed to cause failure of the Kenemental Dam. The flood wave from the Derry Rod and Gun Club Dam and Kennametal Dam was routed downstream. The failure criteria associated with the Kennametal Dam was consistent with information supplied as part of the Phase I report for the Kennametal Dam.

The results of the dam breach analysis indicate that the downstream potential for loss of life and property is not significantly increased by dam failure. Therefore, the spillway is rated as inadequate, but not seriously inadequate. Details of the downstream routing of the flood wave are included in Appendix D.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No major visible deficiencies were observed on the embankment which could be considered as having an immediate effect on the stability of the structure. No major erosion areas were observed on the crest or downstream slope of the dam. No seepage was observed during the inspection, although a wet area was observed on the downstream slope of the dam. No visible flow was discharging from the wet area during either the March 26, 1981 or May 12, 1981 inspections.

Surface runoff was observed from the right abutment of the structure. The source of flow was determined to be groundwater from the right abutment. Flow from the area discharges through an erosion channel near the right downstream toe of the dam. The flow ultimately joins discharges from the principal spillway discharge pipe. It was noted during the inspection that the surface runoff should be diverted away from the toe of the dam.

b. Design and Construction Data. No information regarding the design and construction of the dam were available. It was reported that the dam was constructed by the Graver Construction Company of Ligonier, Pennsylvania. No stability analyses have been conducted.

c. Operating Records. No operating records exist for the dam.

d. Post Construction Changes. No post construction changes are known to have occurred at the structure.

e. Evaluation. No obvious deficiencies were observed during the inspection which were considered as having an immediate effect upon the static stability of the structure. Therefore, the dam is assumed to be safe for static loading conditions.

f. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses have 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 earthquake loading. The dam is assumed safe for expected earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in fair condition and poorly maintained. The condition of the spillway discharge and reservoir drainline is questionable. The exposed portion of the pipe at the outlet was visibly deteriorated.

No major erosion areas were observed on the crest or downstream slope of the dam. A wet area was observed on the downstream slope and extended for almost the entire length of the downstream slope between the spillway discharge pipe and the left abutment. The effect of the wet area on the stability of the structure is unknown. No flow was observed discharging from the area. The wet area should be monitored. If the wet area increases in size or flow begins to discharge on the area, an analysis of the affects of the wet area on the stability of the dam should be completed.

Erosion exists along the toe of the dam near the right abutment contact. Erosion is due to groundwater and surface runoff. The runoff has the potential to erode the area adjacent to the toe of the dam.

The drainline pipe for the reservoir and principal spillway discharge line is in a deteriorating condition. Discharges from the pipe were observed along the entire length of the exposed portion of the pipe. The condition of the line through the embankment is questionable. The condition of the pipe through the embankment should be ascertained. Deteriorated portions of the pipe through the embankment should be repaired or replaced. The existence of cutoff collars on the pipe is unknown.

The Derry Rod and Gun Club Dam is a high hazard-small size dam. The recommended Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. Since the Derry Rod and Gun Club Dam just meets the minimum size criteria and since the dam is located in a rural area suggesting only appreciable economic loss, compliance with current practice of the Baltimore District Corps of Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF).

The visual observations, review of available data, hydraulic and hydrologic calculations, and past operational operational performance indicate that the Derry Rod and Gun Club Dam is capable of controlling approximately 19% of the PMF. The spillway is termed inadequate, but not seriously inadequate.

b. Adequacy of Information. Sufficient information is available to complete a Phase I report.

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

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledegable in dam design and construction to increase the spillway capacity.

2. The wet area on the downstream slope of the dam should be monitored. If the wet area increases in size or flow is observed from the wet area an analysis should be made as to the effect of the seepage on the stability of the embankment. Seepage monitoring should be conducted at the direction of a registered professional engineer knowledgeable in dam design and analysis.

3. It should be ascertained whether the drainline valve reported on the upstream end of the drainline is capable of operation. If it is determined whether the valve is operable, it should be operated and lubricated on a regular basis. If it is determined that the valve is not operable, it should be made operable or some other method devised to drain the reservoir.

4. The condition of the pipe through the embankment should be determined. Deteriorated portions of the pipe through the embankment should be repaired or replaced. Erosion control measures should be implemented at the outlet of the pipe to prevent erosion at the outlet.

5. Groundwater and surface runoff near the right abutment should be diverted away from the toe of the dam.

6. The top of dam should be filled to an elevation consistent with the top of slope at the emergency spillway as a temporary measure until the owner determines what permanent modifications will be made.

7. A regularly scheduled operation and maintenance plan should be prepared and implemented to insure the continued safe operation of the structure. The operation and maintenance plan should include the regular operation and lubrication of the drainline valve.

8. A warning system should be developed to warn the downstream residents of imminent failure of the dam.

9. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Derry Rod and Gun Club Dam COUNTY Westmoreland STATE Pennsylvania ID# PA 518

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION March 26, 1981 WEATHER Overcast and cold TEMPERATURE 40°
May 12, 1981 Clear and sunny 65°

POOL ELEVATION AT TIME OF INSPECTION 1925 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

A-1

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

H.P. McGinnis - Derry Rod and Gun Club
John Geary - Derry Rod and Gun Club

Mr. Thomas D'Alphsono - Department of Environmental Resources

O.T. McConnell RECORDER

EMBANKMENT

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	None noted.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appears to be all right.	
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Slopes and crest are grass covered.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appear to be all right, except for surface runoff from the right abutment. An erosion gully has formed and the potential exist to erode the toe.	The surface runoff should be diverted away from the toe.
ANY NOTICEABLE SEEPAGE	No seepage observed. A wet area was observed on the downstream slope of the dam. No flow was visible from the area.	The seepage area should be monitored.
STAFF GAUGE AND RECORDER	None.	
DRAINS	None observed.	

CONCRETE/MASONRY DAMS

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

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not observed.	
OUTLET STRUCTURE	18" bituminous coated corrugated metal pipe protrudes from the embankment at the toe. The pipe is in a visibly deteriorated condition.	The condition of the pipe through the embankment should be ascertained. Deteriorated portions of the pipe should be repaired or removed.
OUTLET CHANNEL	Unobstructed.	
EMERGENCY GATE	Valve reportedly on upstream end of drainline.	It should be ascertained as to whether the valve is operable.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Emergency spillway is trapezoidal in shape. Concrete weir at control appeared to be in fair condition.	
APPROACH CHANNEL	Lake [unrestricted].	
DISCHARGE CHANNEL	Flows discharge around the left abutment contact and outlets beyond the toe into Miller Run.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

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

DOWNSTREAM CHANNEL

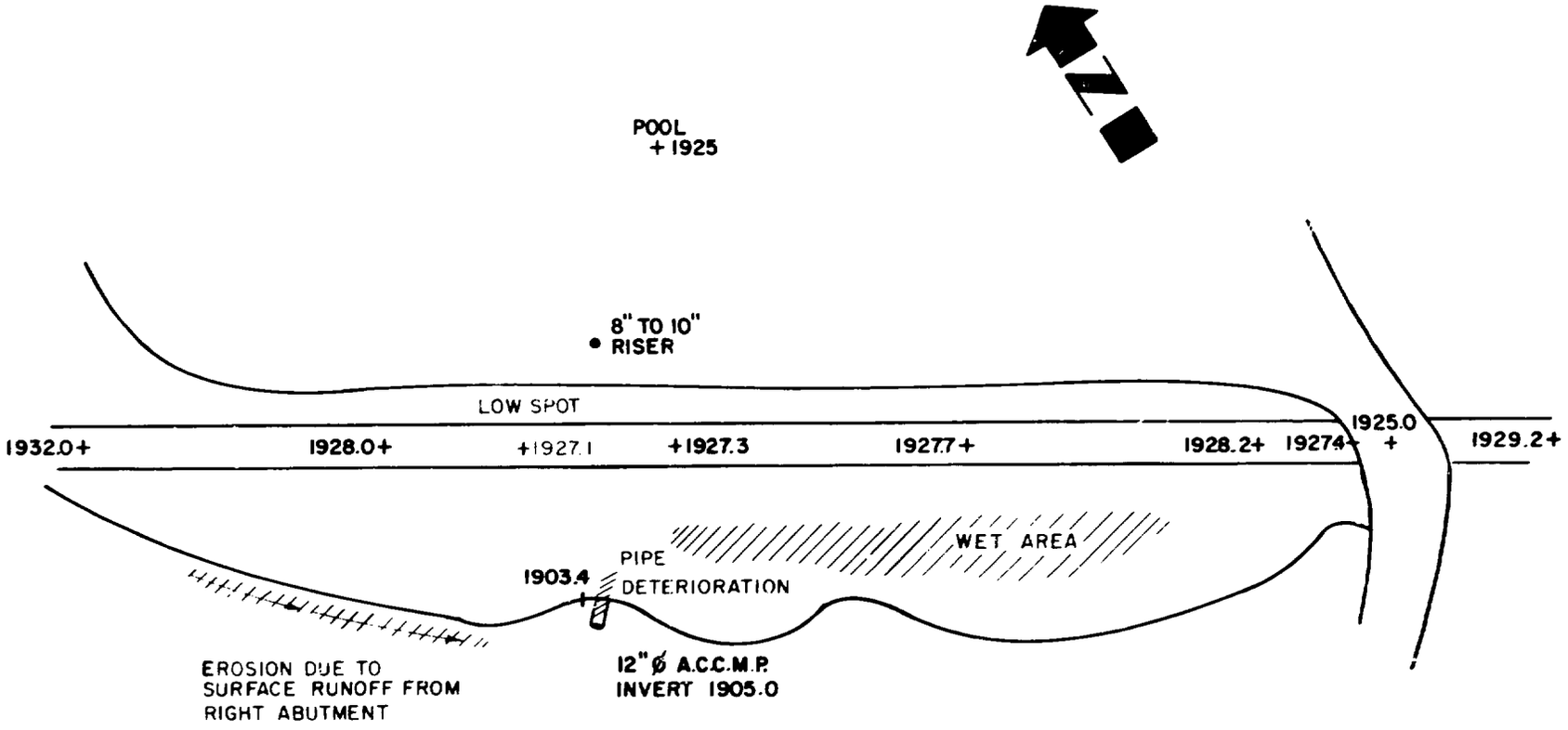
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The discharge channel for the Derry Rod and Gun Club consists of Miller Run. A small unidentified dam and the Kennemetal Dam [PA 482] are located downstream of the Derry Rod and Gun Club Dam.	The Kennametal Dam was included in the Derry Rod and Gun Club Dam breach analysis.
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 5 homes are located, adjacent to Miller Run, approximately 2 miles downstream of the Derry Rod and Gun Club Dam. The population of the homes is estimated at 6 to 10 people.	Homes at reach location no. 2 are approximately on the 1240 contour.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate, and appear stable.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

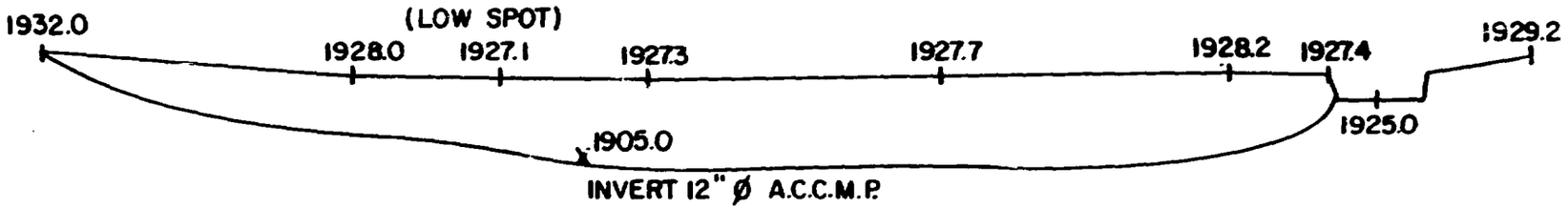
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



A-12

DERRY ROD & GUN CLUB DAM

SCALE: 1" = 60'



PROFILE
LOOKING UPSTREAM
SCALE: 1"=60'

DERRY ROD & GUN CLUB DAM

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

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Derry Rod and Gun Club Dam

ID# PA 518

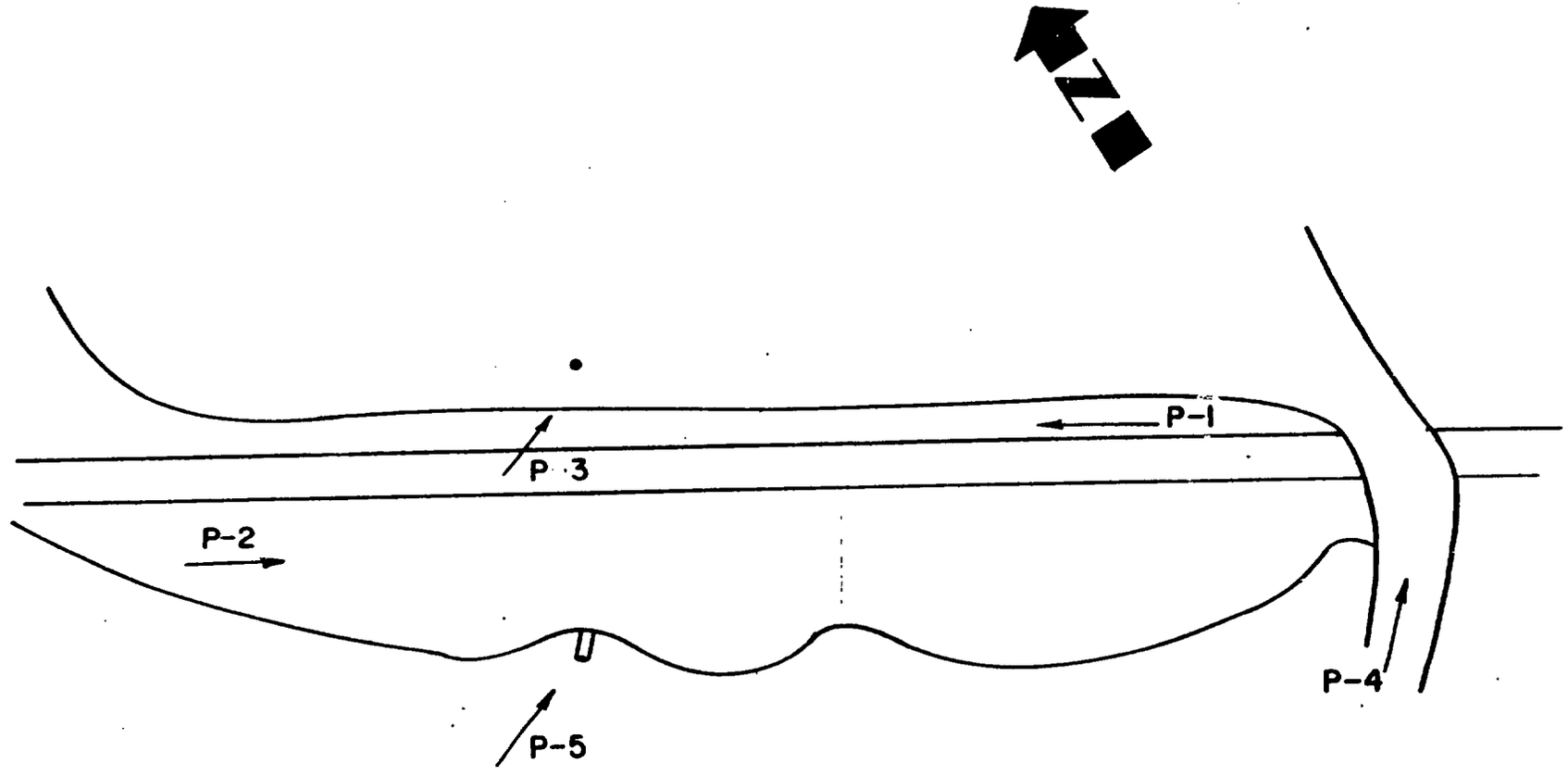
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	None available.
TYPICAL SECTIONS OF DAM	None available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

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

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

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



C-1

DERRY ROD & GUN CLUB DAM
PHOTO INDEX

P-INDICATES PHOTO LOCATION

DERRY ROD AND GUN CLUB DAM
PA 518

Sheet 1

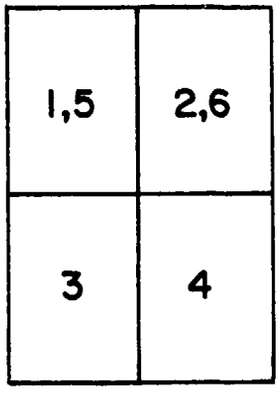
Front

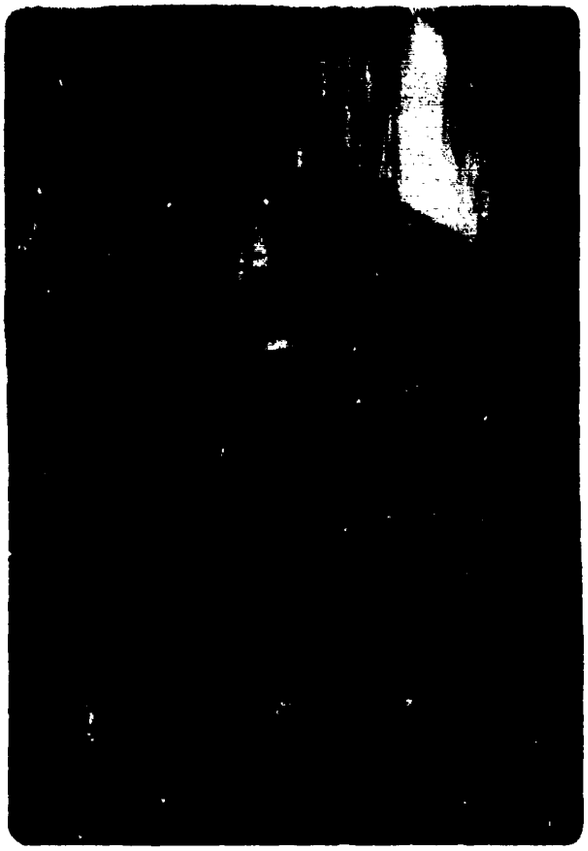
1. Upper left - View of upstream slope, crest, and right abutment.
2. Upper right - View of downstream slope. View towards left abutment.
3. Lower left - Principal spillway intake.
4. Lower right - Emergency spillway approach, and control section. View towards the reservoir.

Sheet 1

Back

5. Upper left - Spillway discharge line. Note deterioration of pipe.
6. Upper right - Downstream exposure.





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. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be 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 topgraphic
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: Derry Rod and Gun Club Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.0 inches

STATION	1	2	3
Station Description	Derry Rod and Gun Club Dam		
Drainage Area (square miles)	0.40		
Cumulative Drainage Area (square miles)	0.40		
Adjustment of PMF for Drainage Area (%)(1)	(Zone 7)		
6 hours	102		
12 hours	120		
24 hours	130		
48 hours	140		
72 hours	N/A		
Snyder Hydrograph Parameters			
Zone (2)	24		
Cp (3)	0.45		
Ct (3)	1.6		
L (miles) (4)	0.95		
Lca (miles) (4)	0.2		
tp = Ct(LxLca) 0.3 hrs.	0.97		
Spillway Data			
Crest Length (ft)	28 (bottom width)		
Freeboard (ft)	2.1		
Discharge Coefficient	C'=0.95		
Exponent	N/A		

(1) Hydrometeorological Report 33 (Figure 1), U.S. Weather Bureau and U.S. Army Corps of Engineers, 1956.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.40 sq.mi. [open fields, moderate slopes]

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1925 [41 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1927.10 [54 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1927.1 [low spot]

SPILLWAY CREST:

a. Elevation 1925.0
b. Type Trapezoidal with concrete weir
c. Width Bottom width = 28 feet
d. Length Not applicable
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 12" diameter bituminous coated corrugated metal pipe
b. Location Maximum section
c. Entrance inverts Unknown
d. Exit inverts 1905.0
e. Emergency drawdown facilities 12" diameter bituminous coated corrugated metal pipe

HYDROMETEOROLOGICAL GAUGES:

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

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

NOTE: All elevations are referenced to M.S.L.

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME Derry Rod & Gun Dam
NUMBER PA-518
SHEET NO. 1 OF 4
BY OTM DATE MAY, 81

Loss Rate and Base Flow Parameters

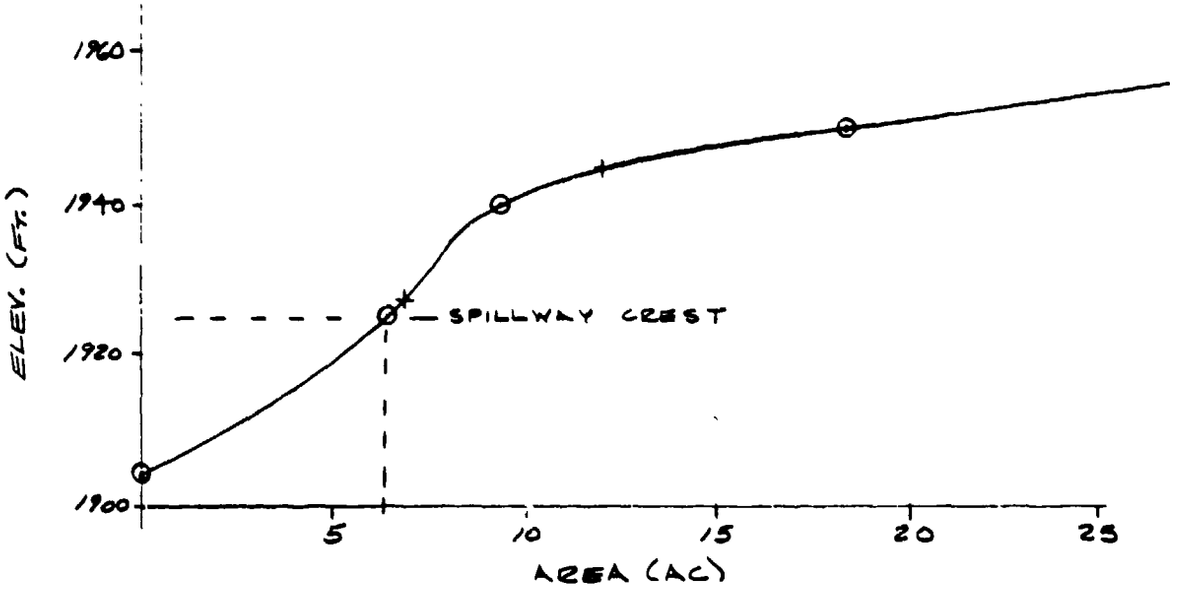
STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

As Recommended By The Baltimore District Corps of Engineers.

Elevation-Area-Capacity Relationships

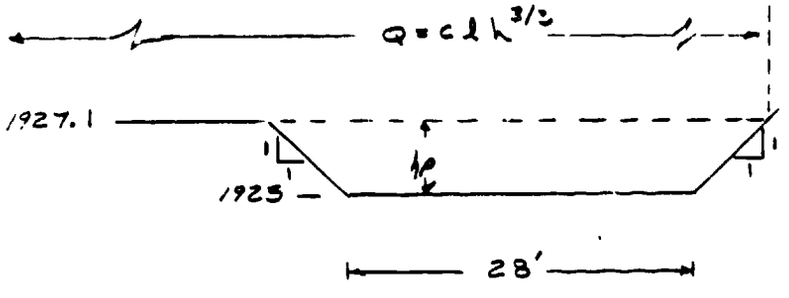
From USGS. 7.5-minute quadrangle and field inspection data.

Assume Spillway Crest Elevation = 1925
Assume Zero Storage at Elevation = 1906
At elev. 1925, area = 6.4 acres
At elev. 1940, area = 9.2 acres
At elev. 1950, area = 18.4 acres
At elev. 1960, area = 32.1 acres



AREA (Ac)	0	6.4	6.9	9.2	12	18.4
ELEV. (FT)	1906	1925	1927.1	1940	1945	1950

DISCHARGE RATING



B = 28 FT.
Z = 1
c' = 0.95

FROM: $Q = 8.03\, c'\, h_v^{1/2} (h_p - h_v) \left[B + \tfrac{1}{2}(h_p - h_v)\right]$

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

WATER AND WASTEWATER ENGINEERING, (11-14) & (11-15)
BY FAIR, GEYER & OKUM, 1966

LOW DAMS, EQ (7) & (8)
BY NATIONAL RESOURCES COMMITTEE,
WASHINGTON, D.C., 1938

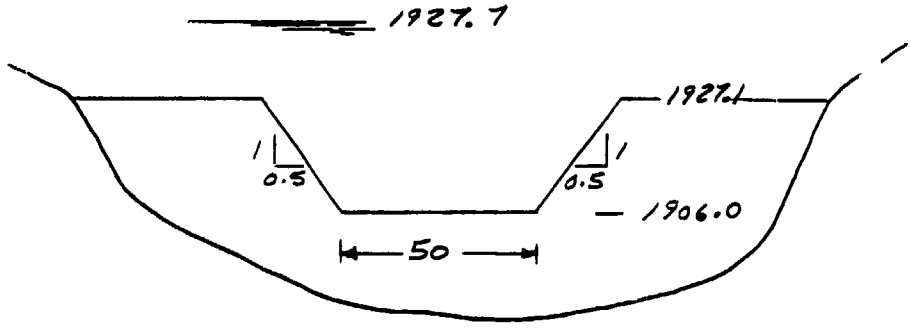
FOR FLOW THROUGH THE EMERGENCY SPILLWAY ABOVE ELEVATION 1927.1, AND EMBANKMENT OVERTOPPING;

USE $Q = c l h^{3/2}$

WHERE $c = 2.9$
l VARIES WITH h

ELEV. (FT)	EMER. S.W. hp (FT)	EMER. S.W. Q (cfs)	OVERTOPPING h (FT)	OVERTOPPING l (FT)	OVERTOPPING Q (cfs)	DISCHARGE Q (cfs)
1925.0	0	0				0
1925.5	0.6	30				30
1926.0	1.0	85				85
1926.5	1.5	155				155
1927.1	2.1	260				260
1927.5			0.4	130	95	355
1928.0			0.9	250	620	880
1928.5			1.4	345	1660	1920
1929.0			1.9	410	3115	3375
1930.0			2.9	450	6445	6700

DAM BREACH AND FLOOD ROUTING



BREWID = 50 FT
Z = 0.5
ELBM = 1906.0
TFAIL = 3 HRS
WSEL = 1925.0
FAILEL = 1927.7

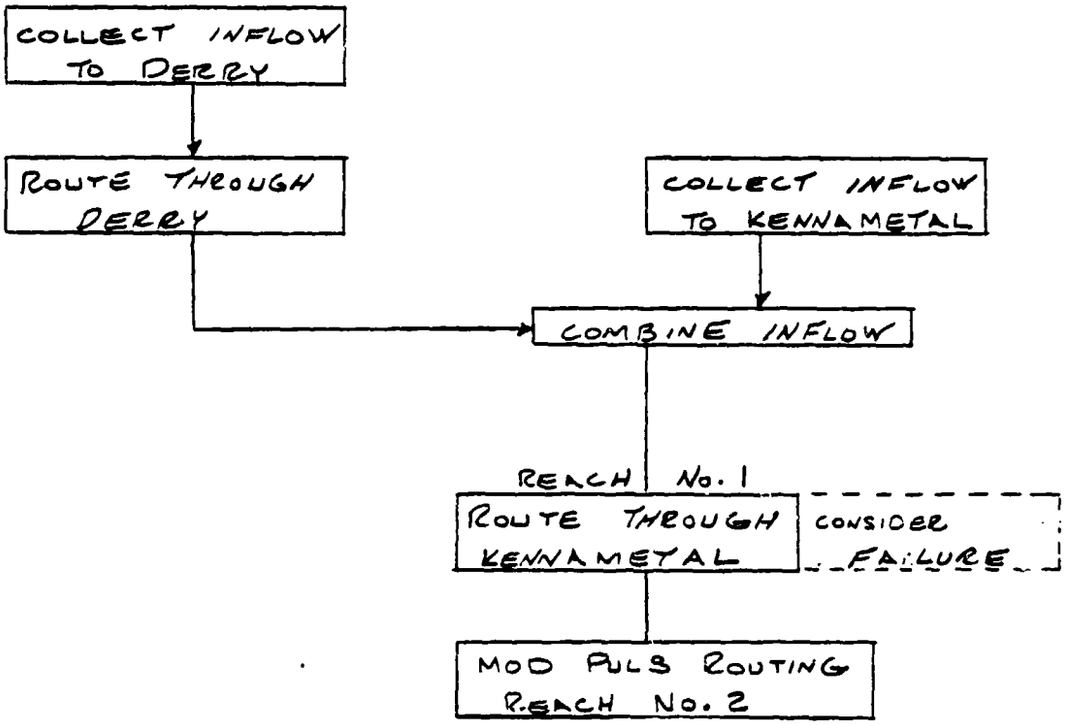
CONSIDER 0.60 FT OR 7.2 IN. SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE DUE TO OVERTOPPING. DURATION OF OVERTOPPING EQUALS APPROX. 4 HRS.

RATIO OF P.M.F. ≃ 0.40

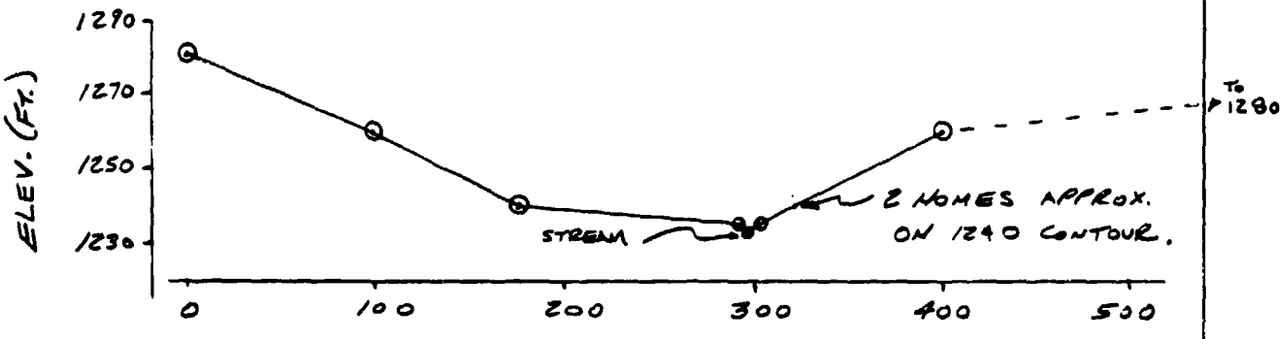
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-518
SHEET NO. 4 OF 4
BY OTM DATE MAY, 1981

PROGRAM SCHEDULE



REACH No. 2 PROFILE:



VIEWING DOWNSTREAM

MANNING'S CHANNEL (n) = 0.05
MANNING'S OVERBANK (n) = 0.06
REACH LENGTH = 5,500 FT.
AVERAGE SLOPE = 0.04

```
********* **********************
FLOOD H   OGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
*****************************
```

```
    1                A1      ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
    2                A2      HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF DERRY ROD & GUN CLUB DAM
    3                A3      RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-518)
    4                B   288       0      10       0       0       0       0       0      -4       0
    5                B1    5
    6                J     1       5       1
    7                J1  0.1     0.2     0.3     0.4       1
    8                K     0       1                                       1
    9                K1      INFLOW
   10                M     1       1     0.4                       1                               1
   11                P            24     102     120     130     140
   12                T                                                  1.0    0.05
   13                W  0.97    0.45
   14                X  -1.5     .05     2.0
   15                K     1       2                                       1
   16                K1      ROUTE
   17                Y                                     1       1
   18                Y1    1                                                -1925      -1
   19                Y4 1925  1925.5    1926  1926.5  1927.1  1927.5    1928  1928.5    1929    1930
   20                Y5    0      30      85     155     260     355     880    1920    3378    6700
   21                SA    0     6.4     6.9     9.2      12    18.4
   22                SE 1906    1925  1927.1    1940    1945    1950
   23                SS 1925
   24                $D1927.1
   25                K    99
```

```
********  ********************
FLOOD H.  JGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
********************************

RUN  DATE= 81/05/19.
     TIME= 09.31.07.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF DERRY ROD & GUN CLUB DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-518)

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS= .10 .20 .30 .40 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.40	0.00	.40	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	102.00	120.00	130.00	140.00	0.00	0.00

3/12

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	CK	STRTL	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= .97 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 53 END-OF-PERIOD ORDINATES, LAG= .98 HOURS, CP= .45 VOL= 1.00

7.	27.	55.	85.	108.	120.	116.	105.	94.	85.
76.	68.	61.	55.	49.	44.	40.	36.	32.	29.
26.	23.	21.	19.	17.	15.	14.	12.	11.	10.
9.	8.	7.	6.	6.	5.	5.	4.	4.	3.

3. 3. 2. 2. 2. 2. 1. 1. 1.
1. 1. 1.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	33.60	31.12	2.48	47281.
										(853.)(	790.)(	63.)(	1338.85)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

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

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1925.	-1

STAGE	1925.00	1925.50	1926.00	1926.50	1927.10	1927.50	1928.00	1928.50	1929.00
//1930.00									
FLOW	0.00	30.00	85.00	155.00	260.00	355.00	880.00	1920.00	3375.00
//6700.00									
SURFACE AREA=	0.	6.	7.	9.	12.	18.			
CAPACITY=	0.	41.	54.	158.	211.	286.			
ELEVATION=	1906.	1925.	1927.	1940.	1945.	1950.			

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1925.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1927.1	0.0	0.0	0.

PEAK OUTFLOW IS 130. AT TIME 41.17 HOURS

PEAK OUTFLOW IS 269. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 443. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 589. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 1476. AT TIME 40.67 HOURS

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 1.00
HYDROGRAPH AT	1	.40	1	148.	296.	444.	592.	1479.
	(	1.04)	(	4.19)(	8.38)(	12.56)(	16.75)(	41.88)(
ROUTED TO	2	.40	1	130.	269.	443.	589.	1476.
	(	1.04)	(	3.69)(	7.63)(	12.54)(	16.69)(	41.80)(

SUMMARY OF DA SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1925.00	1925.00	1927.10
STORAGE	41.	41.	54.
OUTFLOW	0.	0.	260.

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	1926.32	0.00	49.	130.	0.00	41.17	0.00
.20	1927.14	.04	55.	269.	.67	41.00	0.00
.30	1927.58	.48	58.	443.	2.83	40.67	0.00
.40	1927.72	.62	59.	589.	4.17	40.67	0.00
1.00	1928.29	1.19	63.	1476.	7.83	40.67	0.00

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAF     VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
     1          A1       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
     2          A2       DOWNSTREAM CONDITION DUE TO OVERTOPPING OF DERRY ROD & GUN CLUB DAM
     3          A3       PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH (PA-518)
     4          B    288       0       10        0        0        0        0        0        0
     5          B1     5
     6          J      2       1        1
     7          J1   0.4
     8          K      0       1                                   1
     9          K1       INFLOW
    10          M      1       1      0.4                          1                        1
    11          P              24      102      120      130      140
    12          T                                                        1.0     0.05
    13          W   0.97    0.45
    14          X   -1.5    -.05     2.0
    15          K      1       2                                   1
    16          K1       ROUTE
    17          Y                                       1        1
    18          Y1     1                                                -1925      -1
    19          Y4  1925  1925.5    1926    1926.5   1927.1   1927.5     1928   1928.5     1929     1930
    20          Y5     0      30      85      155      260      355      880     1920     3375     6700
    21          SA     0     6.4     6.9      9.2       12     18.4
    22          SE  1906    1928  1927.1     1940     1945     1950
    23          SS  1925
    24          SO1927.1
    25          SB    50      .5    1906        3     1925   1927.7
    26          SB    50      .5    1906        3     1925     1930
    27          K      0       3                                   1
    28          K1       INFLOW TO KENNAMETAL
    29          M      1       1      1.2                          1                        1
    30          P              24      102      120      130      140
    31          T                                                        1.0     0.05
    32          W   1.91    0.45
    33          X   0.15    -.05     2.0
    34          K      2       4                                   1
    36          K1       COMBINE
    36          K      1       4                                   1
    37          K1       ROUTE COMBINE FLOW THROUGH KENNAMETAL (REACH NO. 1)
    38          Y                                       1        1
    39          Y1     1                                                -1496.8    -1
    40          Y41496.8    1497  1497.2   1497.4   1497.6   1497.8     1498   1498.2   1498.4   1498.6
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41  Y41498.8  1499.3  1499.8  1500.3  1500.8  1501.3  1501.8  1502.3
42  Y5     0    9.7    27.8      53    85.3    1  2   168.3   217.3     268   318.7
43  Y5 374.5  524.9     690   869.6  1062.4   12.  7  1484.7  1712.9
44  $A     0    0.9      11    16.5
45  $E1464.3    1495    1520    1540
46  $$1496.8
47  $D1498.6     3.1     1.5     210
48  $L    40      60     160     220     230
49  $V1498.6    1499    1500  1501.4    1510
50  $B   180     0.5  1478.6       2  1496.8  1499.6

51  $B   180     0.5  1478.6       2  1496.8    1502
52  K     1       5
53  K1      BEACH NO. 2
54  Y                                    1       1
55  Y1    1
56  Y6 0.06    0.05    0.06    1233    1280    5500    0.04
57  Y7     0    1280     100    1260     175    1240     295    1235     300    1233
58  Y7   305    1235     525    1240     600    1260
59  K    99
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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	RATIOS APPLIED TO FLOWS RATIO 1 .40
HYDROGRAPH AT	1	.40 (1.04)	1	592. (16.75)(
			2	592. (16.75)(
ROUTED TO	2	.40 (1.04)	1	1071. (30.32)(
			2	589. (16.69)(
HYDROGRAPH AT	3	1.20 (3.11)	1	1247. (35.32)(
			2	1247. (35.32)(
2 COMBINED	4	1.60 (4.14)	1	2303. (65.23)(
			2	1749. (49.52)(
ROUTED TO	4	1.60 (4.14)	1	2291. (64.87)(
			2	1748. (49.51)(
ROUTED TO	5	1.60 (4.14)	1	2273. (64.36)(
			2	1746. (49.44)(

SUMMARY OF DAM SAFETY ANALYSIS (Inflow Point 4 Only)

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1925.00	1925.00	1927.10
STORAGE	41.	41.	54.
OUTFLOW	0.	0.	260.

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
.40	1927.72	.62	59.	1071.	1.09	41.83	40.50

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1925.00	1925.00	1927.10
STORAGE	41.	41.	54.
OUTFLOW	0.	0.	260.

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
.40	1927.72	.62	59.	589.	4.17	40.67	0.00

SUMMARY OF DAM SAFETY ANALYSIS (KENNAMETAL)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1496.80	1496.80	1498.60
STORAGE	11.	11.	14.
OUTFLOW	0.	0.	319.

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
.40	1499.64	1.04	16.	2291.	2.71	41.83	39.50

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1496.80	1496.80	1498.60
STORAGE	11.	11.	14.
OUTFLOW	0.	0.	319.

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
.40	1500.52	1.92	17.	1748.	10.67	41.33	0.00

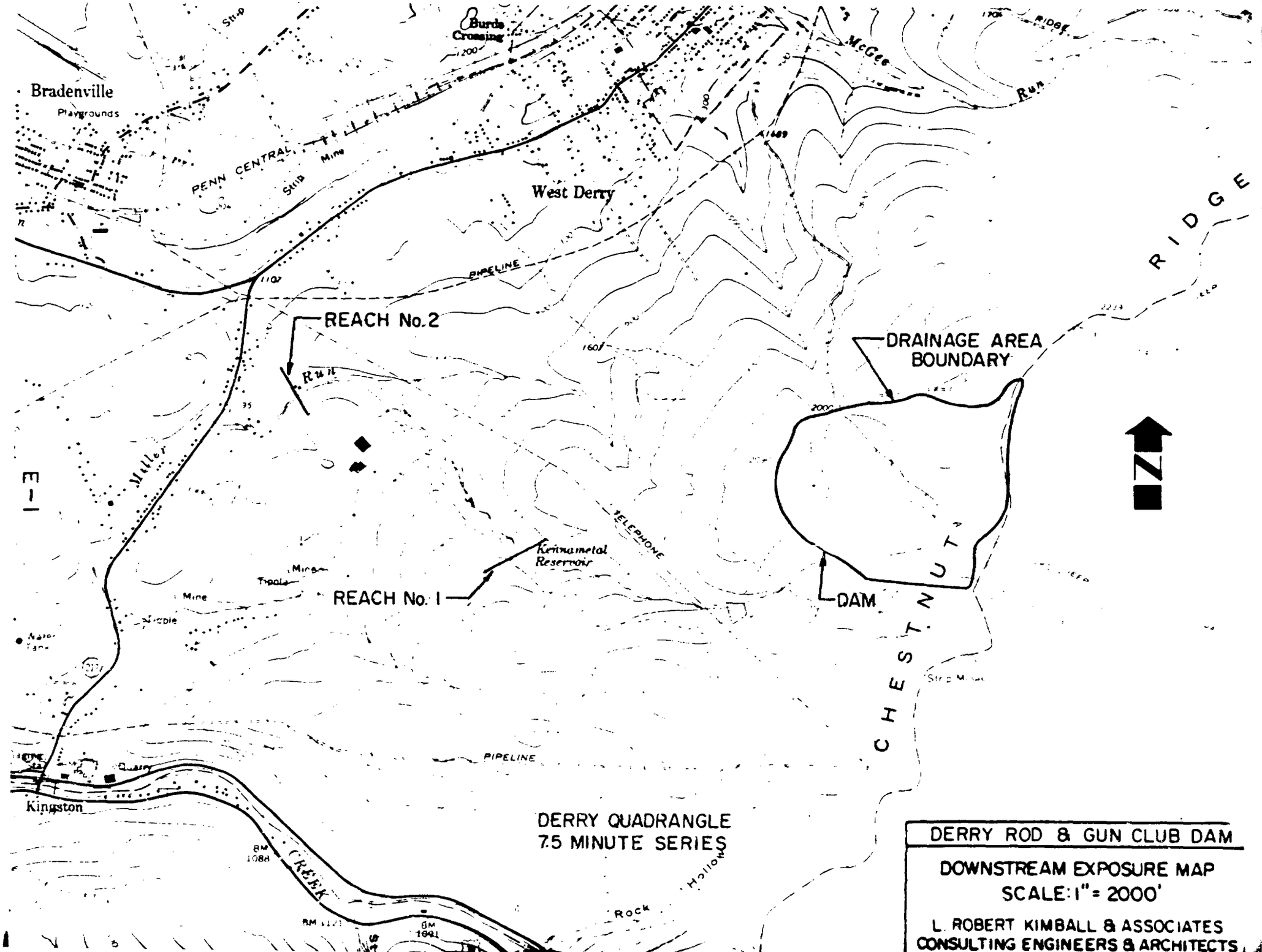
PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	2273.	1238.4	42.00

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.40	1746.	1238.2	41.50

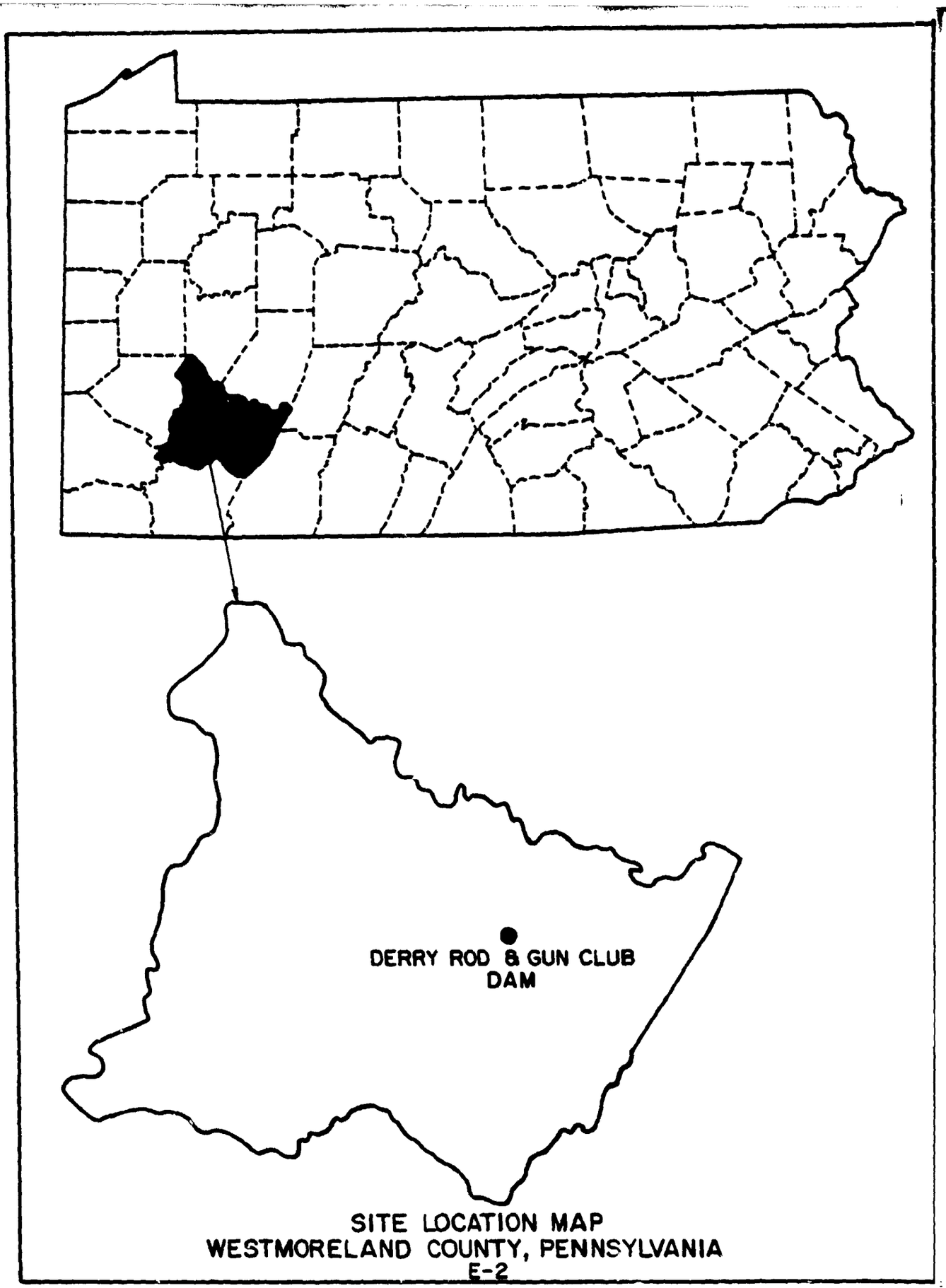
APPENDIX E
DRAWINGS



DERRY ROD & GUN CLUB DAM

DOWNSTREAM EXPOSURE MAP
SCALE: 1" = 2000'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



SITE LOCATION MAP
WESTMORELAND COUNTY, PENNSYLVANIA
E-2

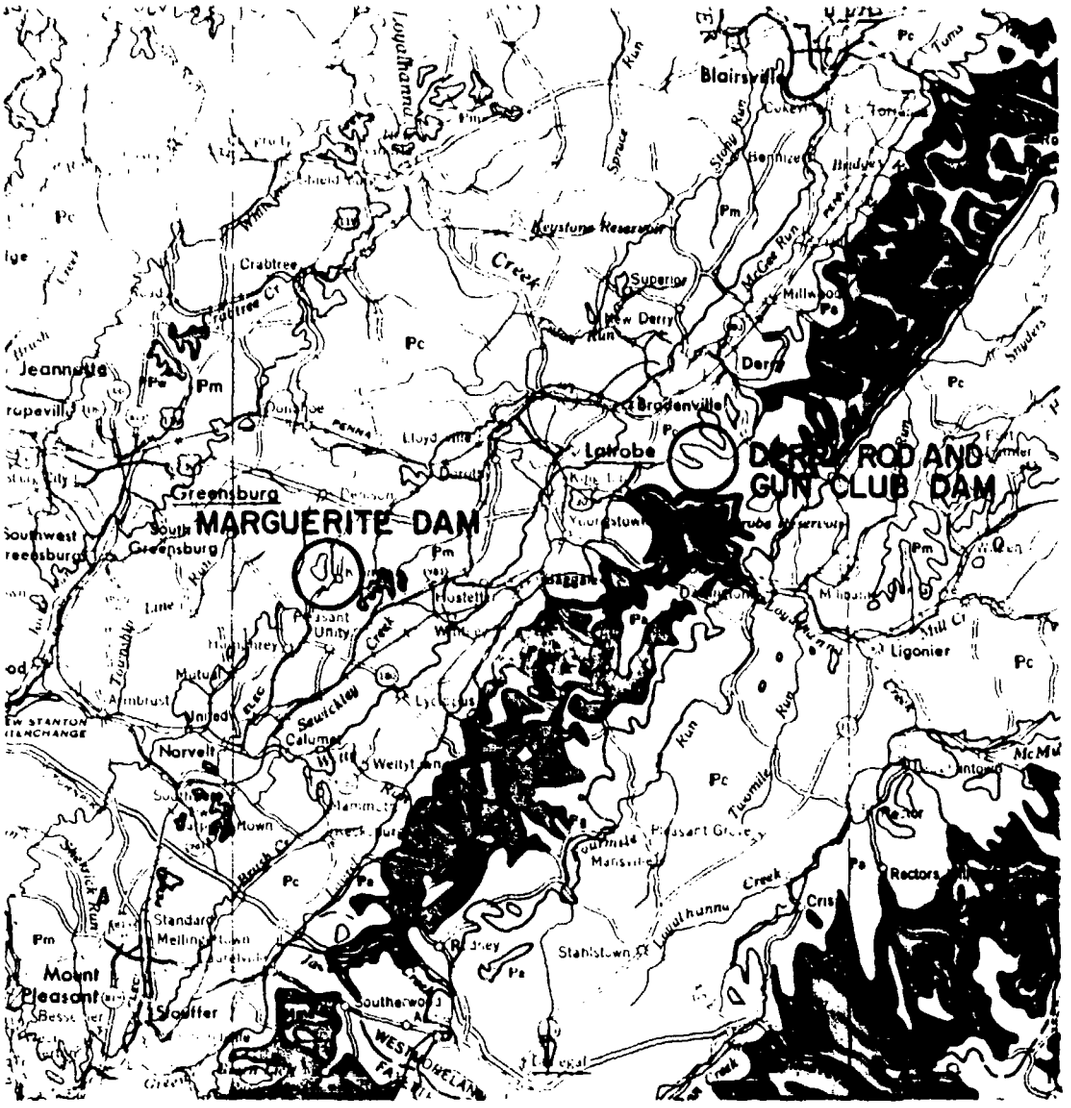
APPENDIX F
GEOLOGY

General Geology

The Derry Rod and Gun Club Dam is located in the Pittsburgh Plateaus Section one half mile from Chestnut Ridge, which acts as the division between this section and the Allegheny Mountain Section of the Appalachian Plateau Province. The surface is composed of more or less elevated plateaus, broken by a few ridges where broad folds have affected the strata. The rocks are deformed by several sub-parallel secondary folds which are superimposed upon a broad, flat canoe-shaped trough of first magnitude. The axes of these folds trend northeast, plunging gently southward. The dam lies on the common limb of the Chestnut Ridge Anticline and the Latrobe Syncline to the west. The strata beneath and outcropping near the dam strike about N43°E and dip about 5° to the northwest. No major faulting is evident in the vicinity of the Derry Rod and Gun Club Dam.

The bedrock underlying the dam consists of shales, sandstones and clays with several workable coal beds. These belong to the Allegheny Formation of Pennsylvanian Age which extends from the Upper Freeport coal bed at the top to the Brookville-Clarion coal seam at the bottom.

The dam is located in the Main Bituminous Coal Field, of which the Allegheny Formation is characteristic due to the seven coal beds it carries. From the uppermost member to the lowest, these coal seams are: the Upper Freeport; Lower Freeport; Upper, Middle, and Lower Kittanning; Clarion; and Brookville. The rocks which crop out near the dam are located stratigraphically at the Kittanning coal horizon. Of the Kittanning group of coal beds, the lower is the most important due to its good quality and fairly consistent thickness, between 3 and 4 feet. The Clarion and Brookville coals are generally too thin to be of commercial importance. Data obtained prior to 1974 indicates no mining of any of these coal seams to have taken place in the vicinity of the Derry Rod and Gun Club Dam.



GEOLOGIC MAP OF THE AREA AROUND MARGUERITE DAM, AND THE DERRY ROD AND GUN CLUB DAM

SCALE 1:250,000

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm — **Monongahela Formation**

Cyclic sequences of sandstone, shale, limestone and coal. Limestone prominent in northern outcrop areas; shale and sandstone increase southward, commercial coals present base at the bottom of the Pittsburgh Coal

Pc — **Conemaugh Formation**

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

Pa — **Allegheny Group**

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

Pp — **Pottsville Group**

Predominantly sandstones and conglomerates with thin shale and coals; some are minable in area