

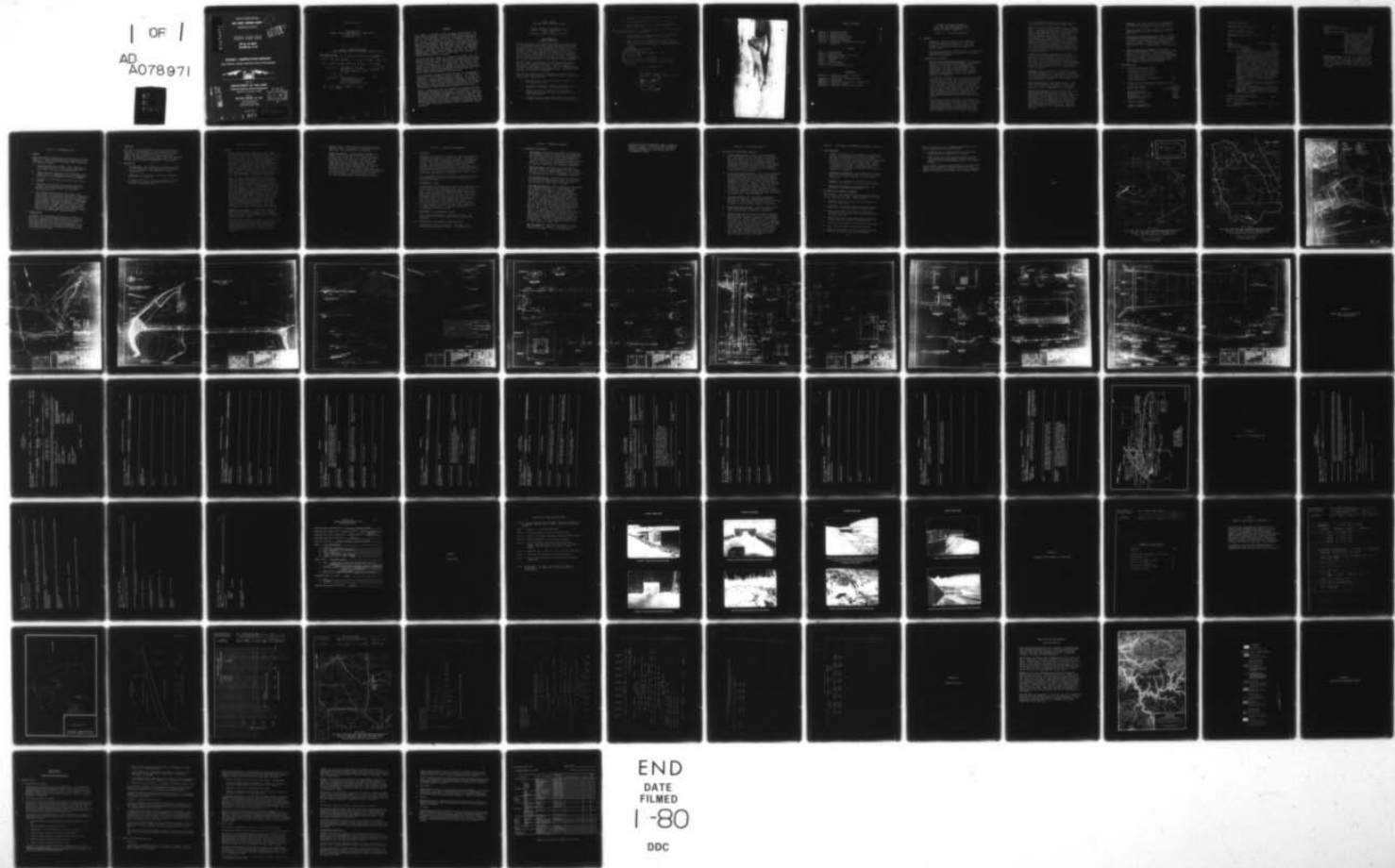
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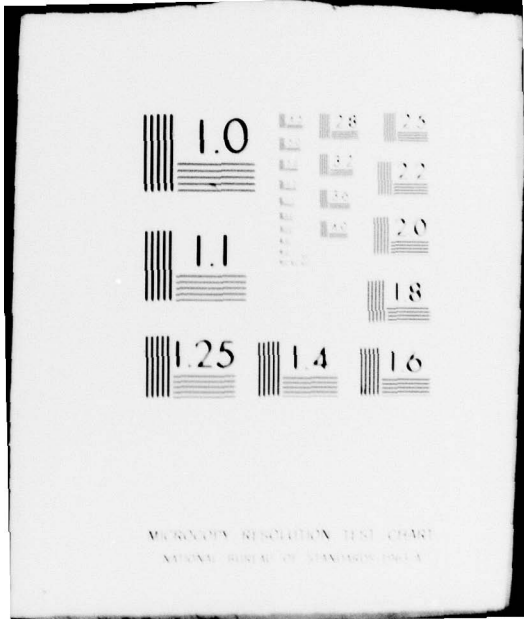
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OHIO RIVER BASIN  
MILL CREEK, VENANGO COUNTY  
PENNSYLVANIA

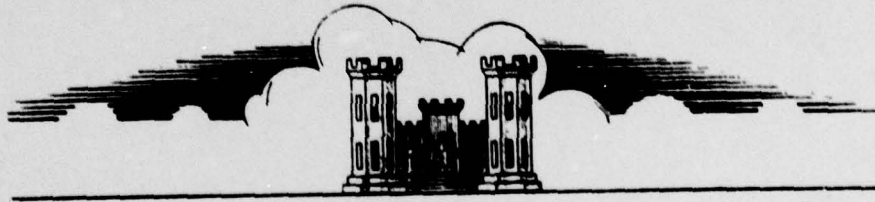


**LEVEL** 4

**KAHLE LAKE DAM**

NDI No. PA 00825  
PennDER No. 61-20

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



*prepared for*

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

*prepared by*

**MICHAEL BAKER, JR., INC.**  
Consulting Engineers  
4301 Dutch Ridge Road  
Beaver, Pennsylvania 15009

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AUGUST 1979

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OHIO RIVER BASIN

KAHLE LAKE DAM  
VENANGO COUNTY, COMMONWEALTH OF PENNSYLVANIA  
NDI No. PA 00825  
PennDER No. 61-20

Chuan Yuan/Chen

Number

(6) PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM • Kahle Lake

Dam (NDI PA-00825, PennDER 61-20), Ohio  
River Basin, Mill Creek, Venango County,  
Pennsylvania. Phase I Inspection

Report.

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

(11) Aug 79

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

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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 PROGRAM

Kahle Lake Dam (PA No Name No. 151)  
NDI No. PA 00825, PennDER No. 61-20  
Mill Creek  
Inspected 10 May 1979 and 28 June 1979

ASSESSMENT OF  
GENERAL CONDITIONS

Considering those items noted during the visual inspections and the information contained in the Pennsylvania Department of Environmental Resources (PennDER) and Pennsylvania Fish Commission files, the overall appraisal of Kahle Lake Dam is that the dam and its appurtenant structures are in fair condition. The dam is 45 feet high and has a total length of 1300 feet. The embankment is a zoned, earth structure with a compacted fill cut-off trench. The dam is owned and operated by the Pennsylvania Fish Commission and is categorized as a "Significant" hazard - "Intermediate" size impoundment.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, U.S. Army Corps of Engineers for Phase I Inspection Reports, revealed that the spillway will pass the 1/2 Probable Maximum Flood (1/2 PMF) without overtopping the dam. Therefore, the spillway is assessed as "adequate".

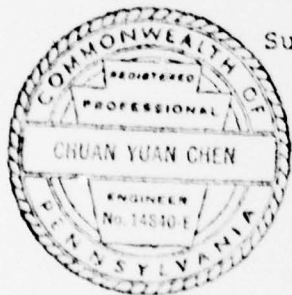
The inspection and review of information revealed certain items of work which should be performed as soon as practicable by the owner. These include:

- 1) Regrade, treat, and seed the erosion channel on the downstream slope.
- 2) Institute a program to monitor the quantity and turbidity of the water in the marshy area.
- 3) Repair the cracks in the walls of the outlet discharge basin and the concrete chute below the auxiliary spillway.
- 4) Regrade the area on the right side of the outlet discharge channel where the riprap has been undercut.

- 5) Regrade the low areas along the crest of the dam.
- 6) Clear the weep holes in the stilling basin.
- 7) Replace the joint filler where missing along the base of the overflow weir in the spillway.


The following items are recommended additions to the current emergency operation procedures:

- 1) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 2) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.



Submitted by:

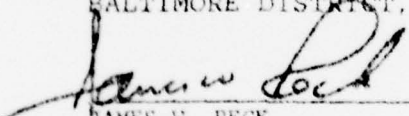
MICHAEL BAKER, JR., INC.

  
C. Y. Chen, Ph.D., P.E.  
Engineering Manager-Geotechnical

Date: 24 August 1979

Approved by:

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS

  
JAMES W. FECK  
Colonel, Corps of Engineers  
District Engineer

Date: 12 Sep 79

KAHLE LAKE DAM



Overall View

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Appendix B - Check List - Engineering Data
Appendix C - Photographs
Appendix D - Hydrologic and Hydraulic Computations
Appendix E - Regional Geology
Appendix F - Operation and Maintenance Manual

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
KAHLE LAKE DAM (PA NO NAME No. 151)  
NDI No. PA 00825, PennDER No. 61-20

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Kahle Lake Dam is a zoned, earthfill embankment with a maximum height of 45 feet and a total length between abutments of 1300 feet. The embankment has a crest width of 19 feet and side slopes of 3H:1V (Horizontal to Vertical) upstream and 2.5H:1V downstream. The upper 10 feet of the upstream slope is provided with 18 inch thick riprap for wave and ice protection.

The auxiliary spillway, located in the left abutment, consists of a concrete weir, a concrete chute, and a stilling basin. The weir has an overall length of 81 feet with the crest elevation 6 feet below the top of dam. Flow over the weir discharges into a reinforced concrete chute. The chute width varies from 81 feet at the weir to 60 feet at the stilling basin. The bottom of the chute has a slope of 5H:1V and an overall length of 144.33 feet. Reinforced concrete training walls are provided from the weir to the end of the stilling basin.

The stilling basin of the end of the chute is 60 feet long by 60 feet wide with a 4 foot high sill at the discharge end. Drainage from the stilling basin is provided by a 12 inch asbestos coated corrugated metal pipe that discharges into the outlet channel 130 feet downstream of the basin. The overflow from the stilling basin discharges

into a gabion and riprap-lined channel 150 feet long and 44 feet wide with 1H:1V side slopes.

The outlet works for the dam consist of a control tower, a concrete conduit, and an outlet discharge basin. The tower is constructed on the upstream face of the embankment and is of the wet-well and dry-well design. (The center of the tower is fitted with white oak stop logs thereby allowing the upstream half of the tower to fill with water while keeping the downstream half dry, permitting access to the gates at the lower end of the tower.) The outlet conduit is a reinforced concrete box culvert with inside dimensions of 4 foot square. A 36 inch slide gate is provided at the base of the tower to regulate the flow through the conduit. A 2 inch PVC pipe is also provided to maintain the minimum stream flow.

A reinforced concrete outlet discharge basin is located at the downstream end of the conduit. The basin is 40 feet long and 15.33 feet wide. The side walls for the outlet discharge basin are 3 feet high. Inserts are provided at the downstream end of the basin to permit stop logs to be installed to control the elevation and flow. This basin is also used for trapping fish for transportation to other locations.

- b. Location - Kahle Lake Dam is located across Mill Creek approximately 4.5 miles from its confluence with the Allegheny River. The structure is located in Richland Township, Venango County, Pennsylvania. The coordinates of the dam are Latitude N41° 14.1' and Longitude W79° 39.9'.
- c. Size Classification - The maximum height of the dam is 45 feet and the reservoir volume to the crest of the dam is 5800 acre-feet. The dam is therefore in the "Intermediate" size category.
- d. Hazard Classification - At the present time, there are no residential structures located in the downstream area that would be affected by excessive discharges from the reservoir. However, State Route 38 is located approximately 1000 feet below the embankment. In addition, five other bridge crossings are located between the dam and the confluence with the Allegheny River. Because of possible damage to these structures, Kahle Lake Dam is classified in the "Significant" hazard category.

- e. Ownership - The dam is owned by the Commonwealth of Pennsylvania, Pennsylvania Fish Commission, P.O. Box 1673, Harrisburg, Pennsylvania 17120.
- f. Purpose of Dam - The dam is used for recreation under the direction of the Pennsylvania Fish Commission.
- g. Design and Construction History - Kahle Lake Dam was designed by the Engineering Division, Bureau of Fisheries and Engineering, Pennsylvania Fish Commission, and constructed by the Keystone Construction Company, 90 Race Street, Meadville, Pennsylvania 16335 between August 1973 and October 1974.
- h. Normal Operational Procedures - The reservoir is typically maintained at the crest elevation of the auxiliary spillway weir. There has reportedly been no major flood since the dam was constructed. The dam is visited at least once every three weeks by a representative of the Pennsylvania Fish Commission; however, during the warmer months, a more frequent schedule is instituted.

1.3 PERTINENT DATA

- a. Drainage Area (square miles) - 4.5
- b. Discharge at Dam Site (c.f.s.) -
  - Outlet Works at Maximum Pool (El. 1383.0 ft.) - 290
  - Spillway Capacity at Maximum Pool (El. 1383.0 ft.) - 4550
- c. Elevation (feet above Mean Sea Level [M.S.L.]) -
  - Design Top of Dam - 1383.0
  - Actual Top of Dam - Varies from 1382.0 to 1383.8
  - Maximum Design Pool - 1383.0
  - Auxiliary Spillway Crest - 1377.0
  - Normal Pool - 1377.0
  - Streambed at Centerline - 1338+
  - Maximum Tailwater - Unknown
- d. Reservoir (miles) -
  - Length of Maximum Pool - 1.8
  - Length of Normal Pool - 1.7

e. Storage (acre-feet) -

Top of Dam (El. 1383.0 ft.) -	5800
Spillway Crest (El. 1377.0 ft.) -	4100

f. Reservoir Surface (acres) -

Spillway Crest (El. 1377.0 ft.) -	251
Maximum Pool (El. 1383.0 ft.) -	292.5

g. Dam -

Type -	Zoned earth embankment
Length (feet) -	1143
Maximum Height (feet) -	45
Side Slopes - Upstream -	3H:1V
Downstream -	2.5H:1V

Zoning - The embankment consists of 4 different zones. The upstream shell is constructed of Class "A" fill defined as selected semi-pervious and structurally sound material free from vegetable matter and rock greater than six inches in maximum dimensions. The cut-off core is made of select impervious fill with no rock greater than four inches in maximum dimensions. A Zone of Class "B" fill was placed against the downstream face of the impervious core section. Class "B" fill is defined as selected semi-pervious and structurally sound material free from vegetable matter, but may contain rock with a maximum dimension of twelve inches. The outside shell of the downstream portion of the embankment consists of selected pervious material.

Cut-off - A cut-off trench with a 12 foot wide bottom width is provided along the centerline of the embankment.

Drains - A two foot thick gravel filter drain is provided under the downstream portion of the embankment. A rock toe drain is also provided with collector pipes that exit into the fish catch basin.

h. Diversion and Regulating Tunnel - None

i. Auxiliary Spillway -

Type - Reinforced concrete weir discharging into reinforced concrete chute	
Width (feet) -	81

Length (feet) - 144.33  
Crest Elevation (feet M.S.L.) - 1377.0  
Gates - None  
Slope of Concrete Chute - 5H:1V  
Downstream Channel - Chute empties into a 60 foot square concrete stilling basin with a 4 foot high end sill. Beyond the sill is a 150 foot long, 44 foot wide gabion and riprap-lined channel. At the end of the channel is a 1.5 foot high gabion wall with a small opening near the right end to allow fish to enter into the downstream channel. Beyond the gabion wall lies the natural stream channel.

- j. Regulating Outlet - Consists of a reinforced concrete control tower and a 4 foot square concrete conduit with a 36 inch square slide gate. A 2 inch PVC line is provided to maintain a minimum flow to the downstream creek channel. The 2 inch line is fitted with a cut-off valve that is used if needed.

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

Kahle Lake Dam was designed by the Engineering Division, Bureau of Fisheries and Engineering, Pennsylvania Fish Commission. The following information was reviewed for the inspection report:

- 1) The design drawings entitled, "Mill Creek Dam Site" Project No. F.C.-230L (93916-1) designed by the Bureau of Fisheries and Engineering.
- 2) "Report Upon the Application of Pennsylvania Fish Commission" by a representative of the Pennsylvania Department of Environmental Resources (PennDER).
- 3) The Application and Permit for Construction from PennDER.
- 4) Pennsylvania Fish Commission Mineral Appraisal Proposed Mill Creek Dam Clarion and Venango Co's. by Gwin, Dobson and Foreman, Inc. Altoona, Pennsylvania, 1972.
- 5) The information contained in the files of the Pennsylvania Fish Commission, Bellefonte, Pennsylvania office which contained such information as construction documents, core boring logs, daily inspection logs, utility relocation information, job conference correspondence, engineering agreements, plans and specifications, equipment rental receipts, permits and resolutions, change orders, photographs, gas and oil well locations, subsurface investigations, design calculations, quantity calculations, monthly invoices, and embankment compaction tests.

### 2.2 CONSTRUCTION

In August 1973, the Keystone Construction Company of Meadville, Pennsylvania began construction of the dam. No unusual problems were noted during the construction. The final inspection was made on 23 October 1974. Inspection reports of the construction progress along with memoranda and black and white photographs of the contractors progress are available in the Pennsylvania Fish Commission's files.

### 2.3 OPERATION

The lake level is maintained at normal pool throughout the year. A representative of the Pennsylvania Fish Commission visits the dam at least once every three weeks with more frequent visits during the warmer months. No detailed records of these visits are available; however, an operation and maintenance manual has been adopted and is included as Appendix F of this report.

### 2.4 EVALUATION

- a. Availability - The information reviewed consisted of the Pennsylvania Fish Commission's file on the dam and information obtained from the owner's representative.
- b. Adequacy - The information available is adequate for a Phase I Inspection.
- c. Validity - There is no reason or indication at the present time to doubt the authenticity of the available engineering data.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

- a. General - The visual inspection of Kahle Lake Dam was accomplished on two separate dates 10 May 1979 and 28 June 1979. No unusual weather conditions existed at either time. A water elevation of 1377.1 feet on 10 May 1979 permitted approximately 0.1 foot of water to flow over the auxiliary spillway weir; on 28 June 1979, the water elevation was at 1376.8 feet and no water was flowing over the weir. The dam and its appurtenances are considered to be in fair condition as of the above dates. Noteworthy deficiencies observed during the inspections are described briefly in the following paragraphs. The visual inspection check list and field sketch are given in Appendix A.
- b. Dam - The deficiencies noted during the visual inspection of the embankment were for the most part of a superficial nature. On the downstream slope of the dam, several surface cracks were observed. These cracks are believed to be due to the fine material used for the embankment and the long, dry period prior to inspection. A minor erosion channel has formed on the downstream slope near the footpath leading to the riser unit. On the downstream side approximately 30 feet beyond the toe of the embankment, a marshy, wet area was encountered. This area is near the site of the original streambed. According to the drillers logs contained in the design plans, the areas where drilling was done along the stream had artesian flow from the bore holes. This may account for the wet area below the dam. Several low areas were noted along the crest of the dam.
- c. Appurtenant Structures - A few minor cracks were noted along the walls of the outlet discharge basin of the principal spillway. Also, a small ditch was noted to the right of the outlet channel undercutting the riprap.

The auxiliary spillway was observed to be in good overall condition with only minor deficiencies. A portion of the joint sealer at the base of the overflow weir was missing. Minor cracking was noted along the walls of the concrete chute. Several weep holes in the stilling basin were plugged.

- d. Reservoir Area - No problems were observed in the reservoir area. The reservoir slopes are primarily moderately sloping pastures and farmlands.
- e. Downstream Channel - A small beaver dam and State Route 38 are located approximately 1000 feet downstream from the dam. It is considered highly unlikely that those items could affect the flood discharge from the reservoir. The channel and slopes adjacent to the channel are fairly mild immediately downstream from the dam. As Mill Creek approaches the Allegheny River, the channel and side slopes become relatively steep. No residential structures are located downstream from the dam that would be affected by excessive discharges from the reservoir. Five other bridge crossings are located between the dam and the confluence with the Allegheny River, a distance of 4.5 miles.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

Appendix F of this report contains a copy of the Operation and Maintenance Manual for Kahle Lake Dam. The manual outlines the normal operating procedures, flood emergency operation procedure, drawdown for inspection and maintenance, and a section on inspection and maintenance of the dam. The emergency procedures require that a Venango County waterways patrolman or a deputy patrolman observe the structure during periods of heavy precipitation. During the observation period, if any of a list of conditions are observed, a roster of persons and offices included in the manual are notified.

It is recommended that the emergency operating procedures be prominently displayed and a copy furnished to all operating personnel.

### 4.2 MAINTENANCE OF DAM

The maintenance and upkeep of the dam is the responsibility of the Pennsylvania Fish Commission. No records are kept of the routine maintenance and inspections of the dam. It was learned from interviewing the Pennsylvania Fish Commission personnel that two or three years ago a depression approximately 32 inches deep and 6 feet wide had formed along the right side of the outlet basin. The exact cause of the depression was not determined at the time and the area was regraded and seeded. A marshy area exists to the right of this area; however, it was not possible by means of the visual inspection to assess whether the materials were piped from beneath to cause the depression. A monitoring program is recommended for the marshy area.

### 4.3 MAINTENANCE OF OPERATING FACILITIES

The operating equipment is inspected, operated, and lubricated twice a year by the state park maintenance personnel.

### 4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

An emergency warning procedure is contained in the operation and maintenance manual. (See Appendix F.)

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

- a. Design Data - Hydrologic and hydraulic design data were obtained from the Pennsylvania Fish Commission. The hydraulic design of the spillway was based on the requirements as set forth in the Pennsylvania "C" curve and was therefore required to have a capacity of 4545 c.f.s. Storage-discharge relationships for the reservoir and spillway, calculated by the Fish Commission, are included in Appendix D.
- b. Experience Data - According to representatives from the Pennsylvania Fish Commission, the maximum reservoir level was approximately six inches above the spillway crest. This corresponds to a discharge of approximately 100 c.f.s. through the spillway.
- c. Visual Observations - At the time of the inspection, no condition was observed that would indicate that the spillway and outlet works could not operate satisfactorily in the event of a flood.
- d. Overtopping Potential - Kahle Lake Dam is classified as a "Significant" hazard - "Intermediate" size dam required evaluation for a spillway design flood (SDF) in the range of the 1/2 Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF). Since the dam and reservoir are on the low end of the intermediate size category, the 1/2 PMF was chosen as the appropriate SDF. The hydrologic and hydraulic capabilities of the dam, reservoir, and spillway were evaluated by routing the 1/2 PMF through the reservoir with the aid of the U.S. Army Corps of Engineers Flood Hydrograph Package, HEC-1. The flood hydrograph developed as part of this analysis had a peak discharge of 3196 c.f.s. based on a total storm runoff of 12.9 inches. Storage-discharge data used in the analysis were taken from calculations performed by the Pennsylvania Fish Commission. The results of the flood routing indicate that the dam is capable of passing the 1/2 PMF with a maximum reservoir level of 1380.8 feet, 1.2 feet below the minimum crest of dam elevation of 1382.0 feet.
- e. Spillway Adequacy - The dam, as outlined in the above analysis, is capable of passing the 1/2 PMF without overtopping. In fact, the dam could

withstand a storm of magnitude equal to approximately 75 percent of the PMF without sustaining extensive damages. The spillway is therefore considered "adequate" in accordance with the recommended criteria.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations - No structural inadequacies were noted during the visual inspection of the dam. The depression near the toe of the dam which was previously filled in is thought to be the result of backfilling in the old streambed and subsequent settlement of the backfill. The seepage and marshy area below the dam is not considered to affect the structural stability of the dam but should be monitored for increases in the quantity or turbidity of the seepage.
- b. Design and Construction Data - The dam was designed by the Engineering Division, Bureau of Fisheries Engineering, Pennsylvania Fish Commission and was constructed by the Keystone Construction Company, Meadville, Pennsylvania. Design calculations of embankment slope and foundation stability were not available for review. However, due to the moderate height of the earthfill section of the dam, its substantial width, and moderate slopes, it is reasonable to assume that the dam could be shown to meet the stability criteria required. Therefore, no further stability assessments are deemed necessary for this Phase I Inspection Report.
- c. Operating Records - No operating records were available for the dam. Operating procedures, obtained by interviewing Pennsylvania Fish Commission personnel, do not indicate cause for concern relative to the structural stability of the dam.
- d. Post-Construction Changes - The modifications made after construction do not appear to adversely affect the structural stability of the dam.
- e. Seismic Stability - The dam is located in Seismic Zone 1 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of very low seismic activity. Experience indicates that dams in this zone will have adequate stability under seismic loading conditions provided static stability conditions are satisfied and conventional safety margins exist. As indicated in 6.1.b, Kahle Lake Dam could be shown to meet the conventional static stability requirements and, therefore, further consideration of the seismic stability is not warranted.

## SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

- a. Safety - According to the information reviewed and the observations made during the field inspections, the dam is considered to be in fair condition. According to the criteria set forth in the "Recommended Guidelines for Safety Inspection of Dams," Kahle Lake Dam is classified as a "Significant" hazard - "Intermediate" size dam. As presented in Section 5, the dam can withstand a flood equivalent to approximately 75 percent of the PMF and is therefore assessed as "adequate".
- b. Adequacy of Information - The information available and the observations made during the field investigation are considered adequate for this Phase I Inspection.
- c. Urgency - The owner should initiate the action discussed in paragraph 7.2 as soon as practicable.
- d. Necessity for Additional Data/Evaluation - No further investigation is necessary.

### 7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection and review of engineering data revealed certain items of work which should be performed as soon as practicable by the owner. These include:

- 1) Regrade, treat, and seed the erosion channel on the downstream slope.
- 2) Institute a program to monitor the quantity and turbidity of the water within the marshy area.
- 3) Repair the cracks in the walls of the outlet discharge basin and the concrete chute below the auxiliary spillway.
- 4) Regrade the area on the right side of the outlet channel where the riprap has been undercut.
- 5) Regrade the low areas along the crest of the dam.
- 6) Clear the weep holes in the stilling basin.
- 7) Replace the joint filler where missing along the base of the overflow weir in the spillway.

The following items are recommended additions to the current emergency operation procedures:

- 1) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 2) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

In the future, the owner should continue to periodically inspect the embankment and appurtenances and take appropriate action as necessary. It is also recommended that a log be kept of the inspections and repair work.

PLATES

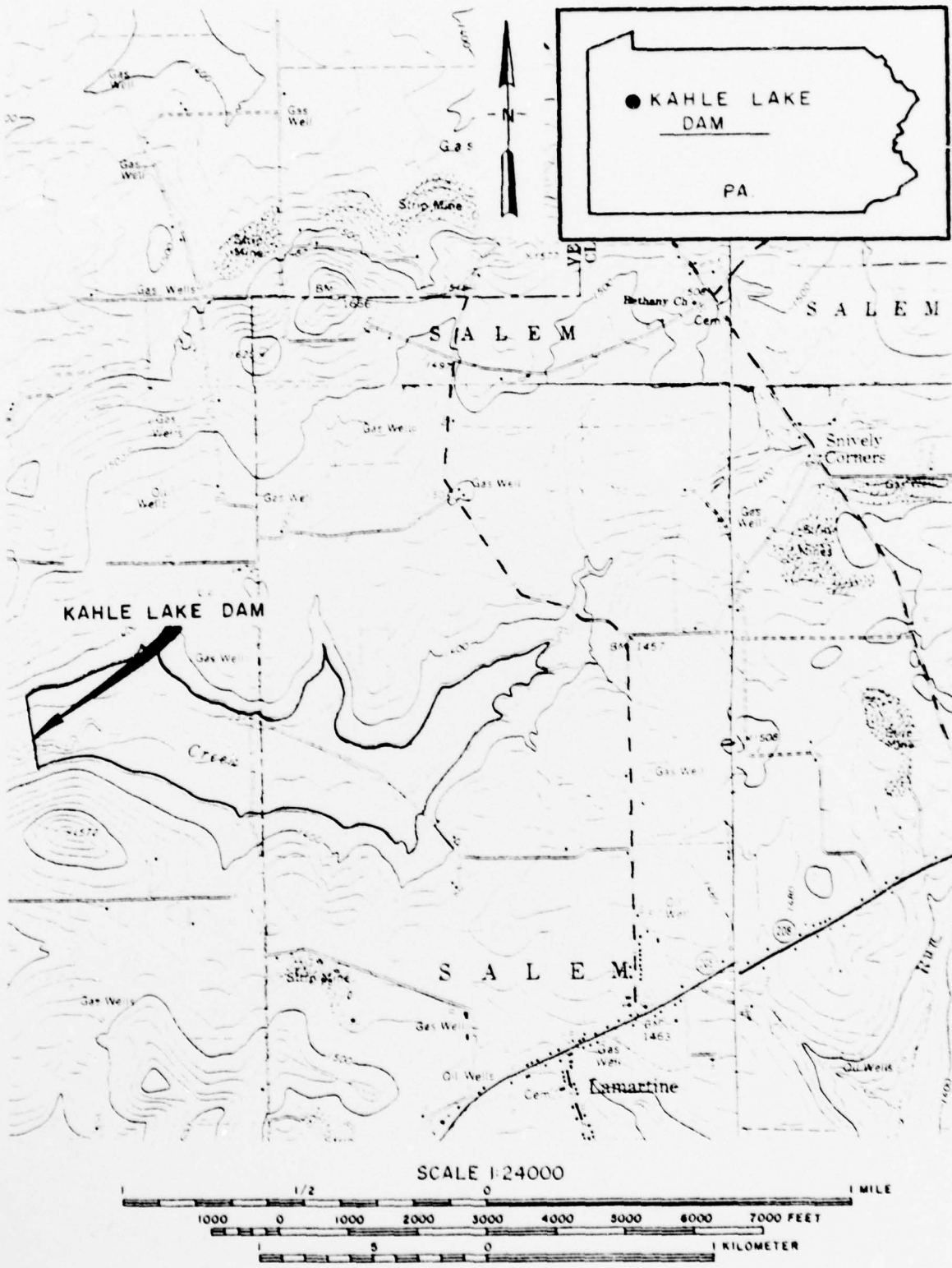


PLATE I LOCATION PLAN  
KAHLE LAKE DAM

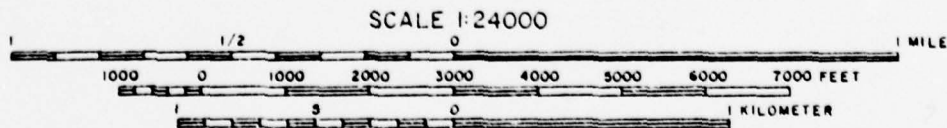
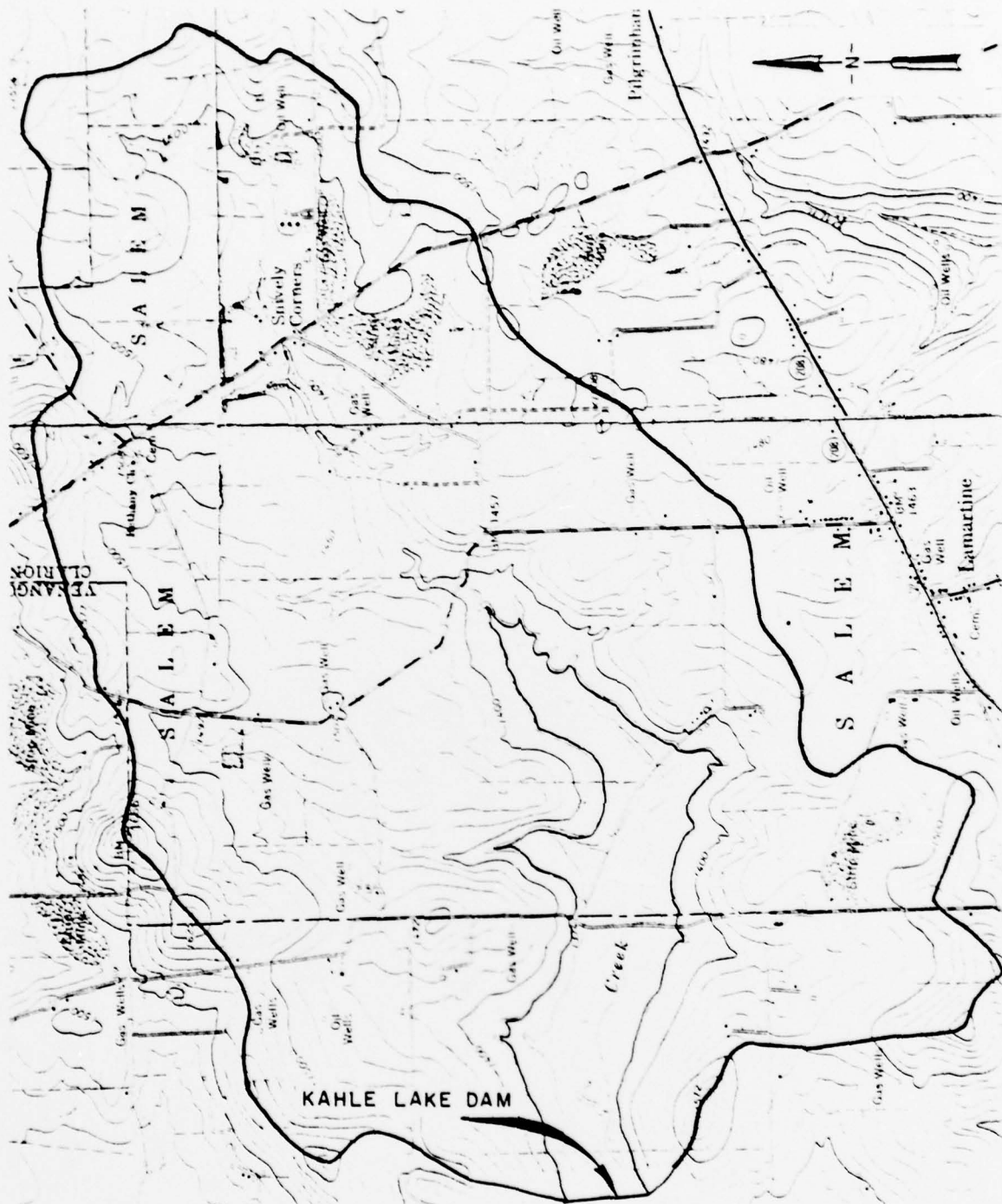


PLATE 2 WATERSHED MAP  
KAHLE LAKE DAM



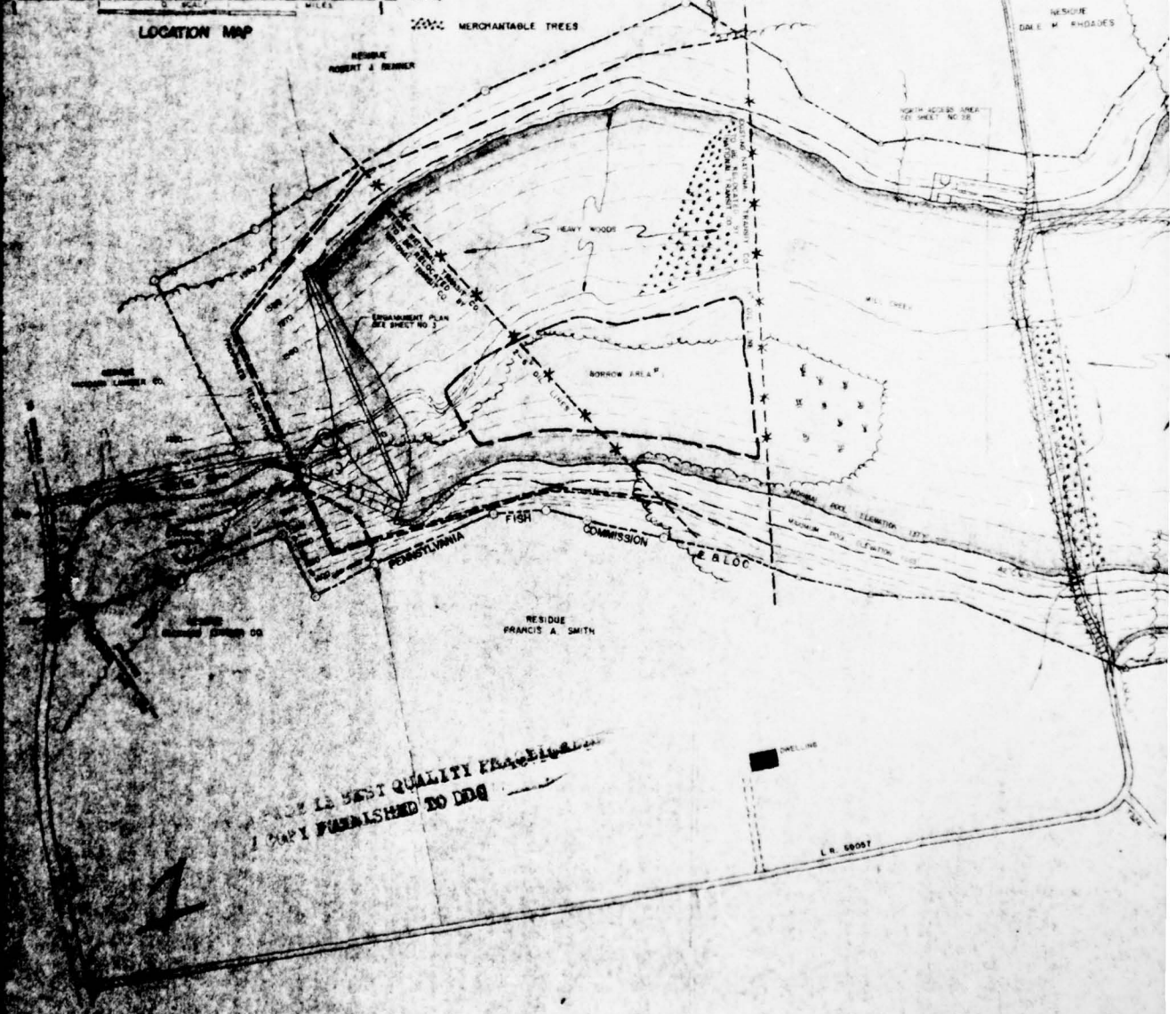
LOCATION MAP

**LEGEND**

- P.C. BRASS PINS & MARKINGS
- RAILS, BR SPINES, IRON PIPES, CONCRETE MONUMENTS, IRON PINS, & PORTS
- △ WOODEN HUBS
- Ⓡ REMOVAL OF STRUCTURE
- ⊞ SW of SW/4
- UTILITY POLE
- PROPERTY LINE
- COUNTY LINE
- LIMIT OF CONTRACT ON PUBLIC ROADS
- ⊞ MERCHANTABLE TREES

**ABBREVIATIONS**

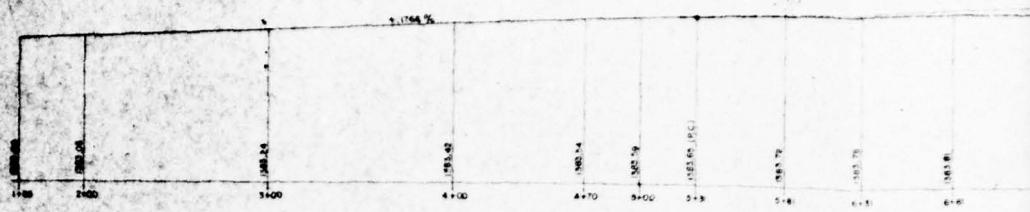
- TYP.—TYPICAL
- B.M.—BENCH MARK
- A.C.—ASBESTOS CEMENT
- C.M.P.—CORRUGATED METAL PIPE
- C.B.—CORE BORING
- ELEV.—ELEVATION
- L.O.C.—LIMIT OF CONTRACT
- A.C.E.M.P.—ASPHALT COATED CORRUGATED METAL PIPE
- PENN. DOT — PENNSYLVANIA DEPARTMENT OF TRANSPORTATION



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**GENERAL PLAN**  
SCALE: 1" = 300'

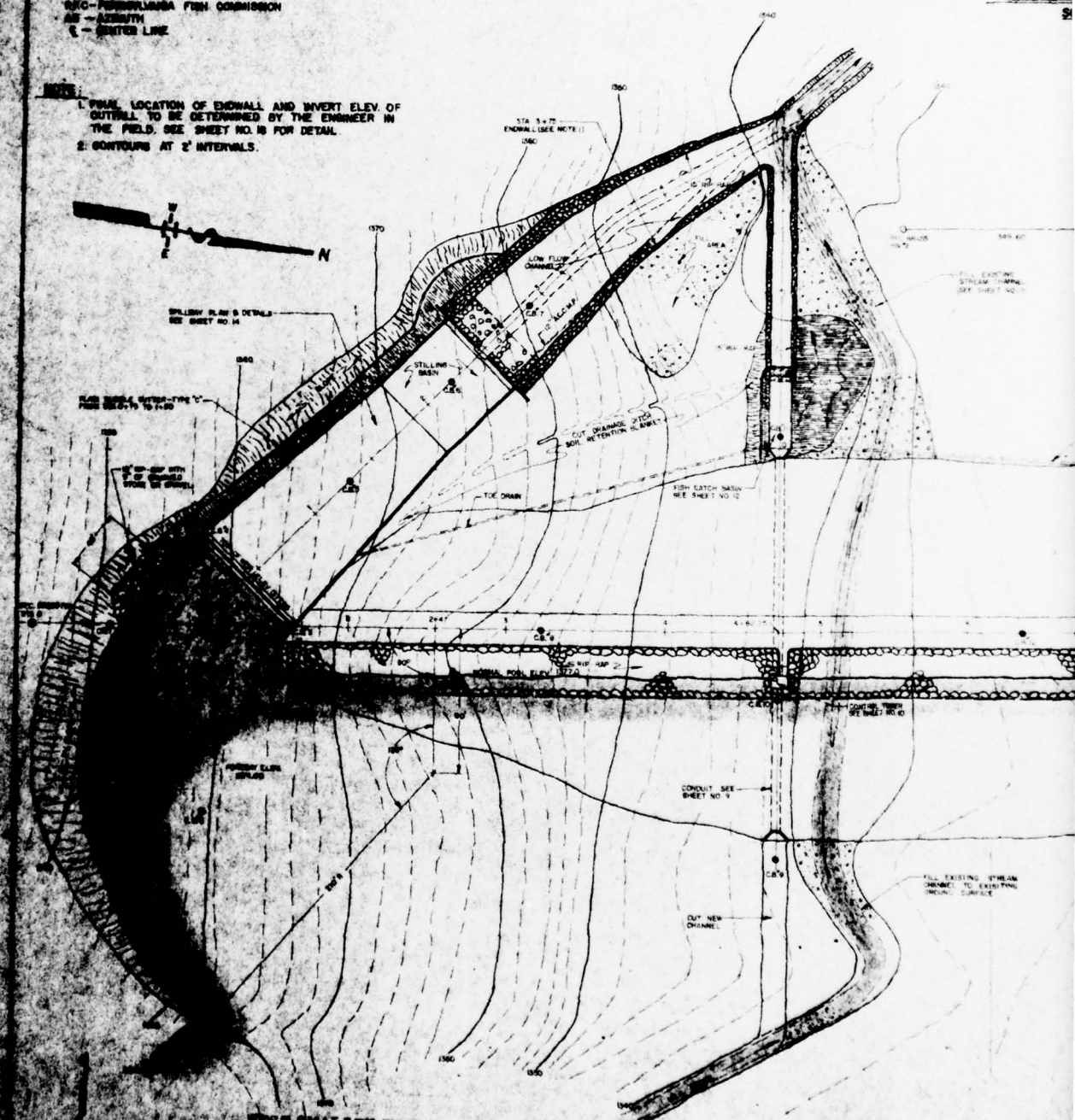




**LEGEND**  
 C. - CORE BORING  
 P.C. - POINT OF CURVATURE  
 A.C. - AXIS OF CURVATURE  
 C.L. - CENTER LINE

**EMBANK**

**NOTE:**  
 1. FINAL LOCATION OF EMBANK AND INVERT ELEV OF  
 OUTFALL TO BE DETERMINED BY THE ENGINEER IN  
 THE FIELD. SEE SHEET NO. 10 FOR DETAIL.  
 2. CONTOURS AT 2' INTERVALS.



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 WASHED TO 100

**EMBANKMENT PLAN**  
 SCALE: 1" = 40'

SEE DRAINAGE AND  
 EROSION AND  
 THE SITE

**EMBANKMENT VERTICAL CURVE**  
 SCALE: 1" = 40' (HOR.)  
 NO SCALE VERT.

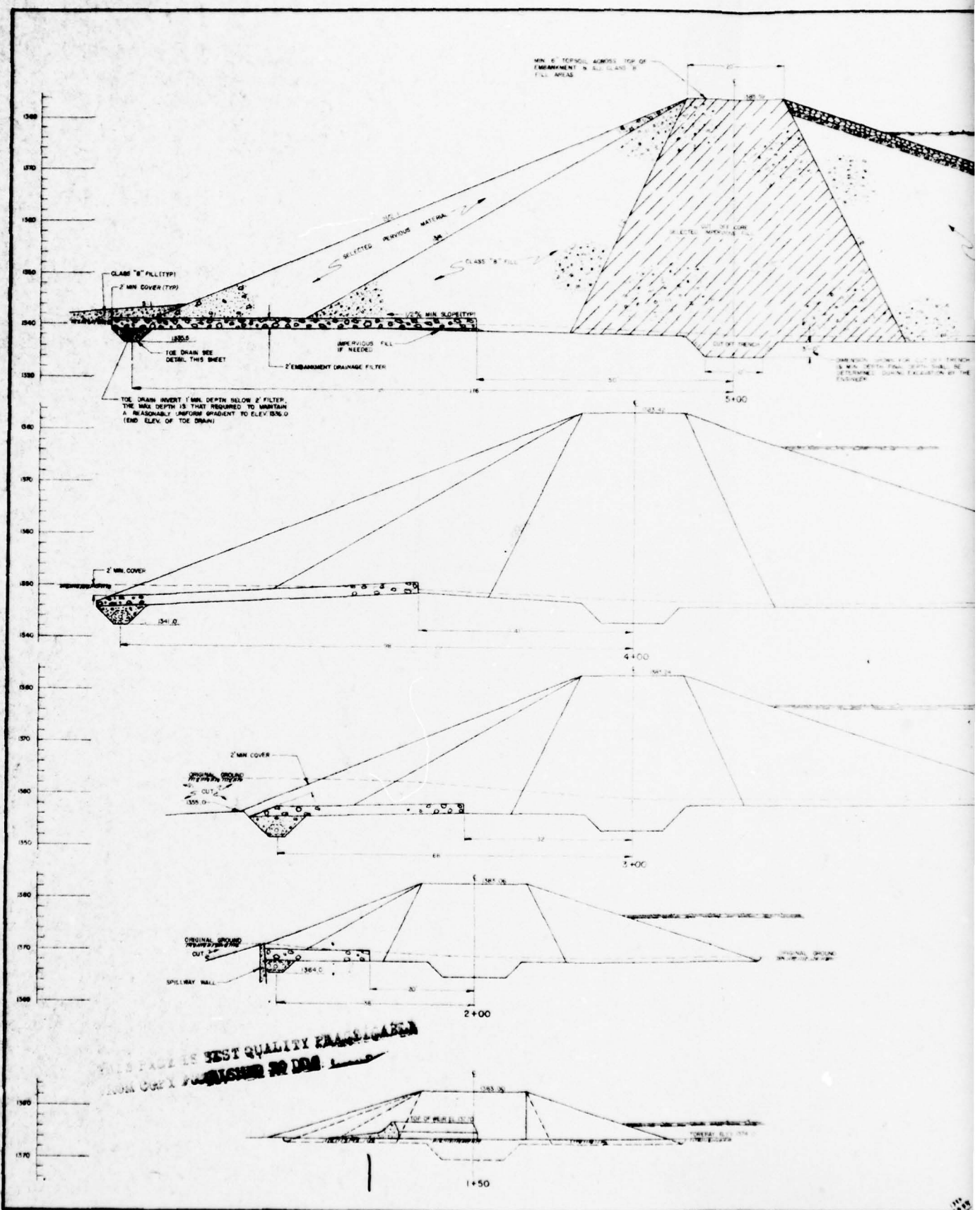
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 AND NOT FURNISHED TO YOU

**G DIAGRAM**  
 SCALE: 1" = 100'

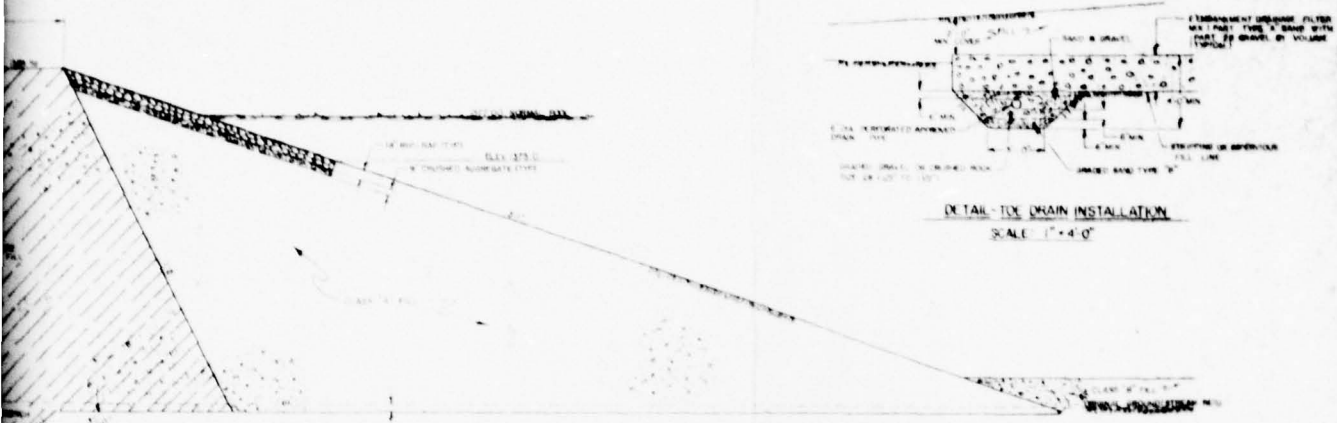
2  
**PLATE 4**

<b>SEAL</b>		<b>SEAL</b>		<b>REVISED</b>	<b>APPROVALS</b>
[Seal]		[Seal]			

NO. 172  
 ALL DIMENSIONS AND LOCATIONS SHALL BE  
 EXPANDED AND VERIFIED BY THE CONTRACTOR AT  
 HIS RISK



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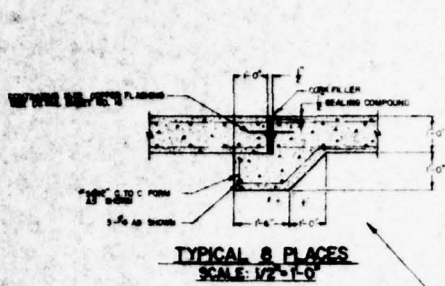
NOTES

1. SELECTED IMPERVIOUS FILL SHALL BE SELECTED IMPERVIOUS AND STRUCTURALLY SOUND MATERIAL FREE FROM VEGETABLE MATTER AND ROCK GREATER THAN FOUR (4) INCHES IN MAXIMUM DIMENSIONS.
2. CLASS "A" FILL SHALL BE SELECTED SEMI-IMPERVIOUS AND STRUCTURALLY SOUND MATERIAL FREE FROM VEGETABLE MATTER AND ROCK GREATER THAN SIXTY INCHES IN MAXIMUM DIMENSIONS.
3. CLASS "B" FILL SHALL BE SELECTED SEMI-IMPERVIOUS AND STRUCTURALLY SOUND MATERIAL FREE FROM VEGETABLE MATTER, BUT MAY CONTAIN ROCK WITH A MAXIMUM DIMENSION OF TWELVE (12) INCHES. NO POCKETS OR CONCENTRATION OF ROCK SHALL BE PERMITTED.
4. SELECTED PERVIOUS MATERIAL SHALL BE COMPOSED OF STRUCTURALLY SOUND MATERIAL SUFFICIENTLY PERVIOUS TO DRAIN THE EMBANKMENT AND FREE FROM VEGETABLE MATTER, BUT MAY CONTAIN ROCK WITH A MAXIMUM DIMENSION OF TWELVE (12) INCHES.
5. STONE RIP-RAP SIZE, TYPE AND LOCATION SEE DETAILS AND WRITTEN SPECIFICATIONS.
6. EMBANKMENT CONSTRUCTION DETAILS SEE WRITTEN SPECIFICATIONS AND CROSS SECTIONS.
7. DIMENSIONS SHOWN FOR CUT-OFF TRENCH ARE MINIMUM. FINAL DEPTH SHALL BE DETERMINED DURING EXCAVATION BY THE ENGINEER.
8. ALL DIMENSIONS AND MEASUREMENTS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE.

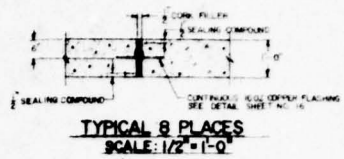
2

PLATE 5

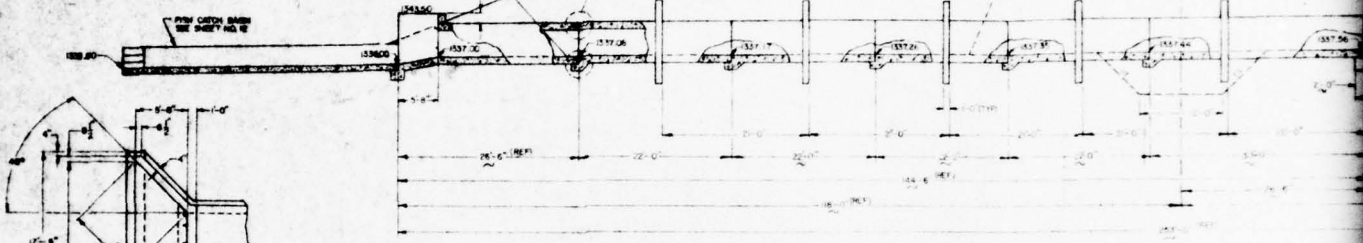
SEAL		SEAL		REVISED	APPROVALS	PROJECT NO. FC-2804 (2804)
[Seal]		[Seal]			APPROVED BY: <i>[Signature]</i> CHIEF ENGINEER	EMBANKMENT SYSTEMS
					SUBMITTED BY: <i>[Signature]</i> CHIEF ENGINEER	SHALL ONLY BE USED FOR THE PROJECT AND NOT FOR ANY OTHER PROJECT
					ACCEPTED BY: <i>[Signature]</i> CONTRACTOR	PENNSYLVANIA FISH COMMISSION
					DATE: 3-21-72	DIVISION OF CONSTRUCTION - BUREAU OF CONSTRUCTION
					CHECKED BY: KEM	COMMONWEALTH OF PENNSYLVANIA DEPT. OF TRANSPORTATION & DEVELOPMENT
					DATE: 3-22-72	PENNSYLVANIA FISH COMMISSION BUREAU OF FISH & BOAT CONTROL HARRISBURG - PENNSYLVANIA



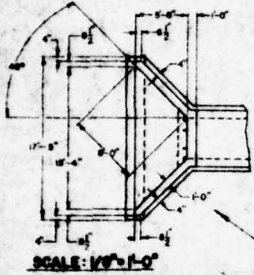
**TYPICAL JOINT PLACES**  
SCALE: 1/2" = 1'-0"



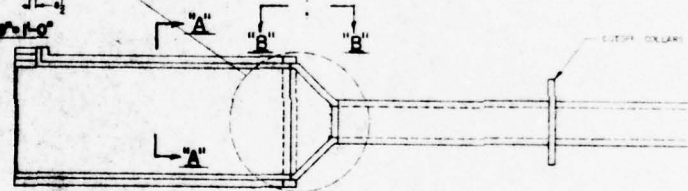
**TYPICAL JOINT PLACES**  
SCALE: 1/2" = 1'-0"



**CONDUIT PROFILE**  
SCALE: 3/32" = 1'-0"

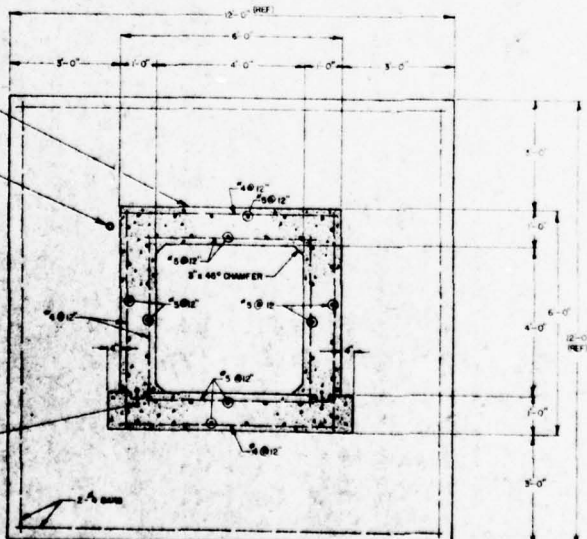


SCALE: 1/2" = 1'-0"

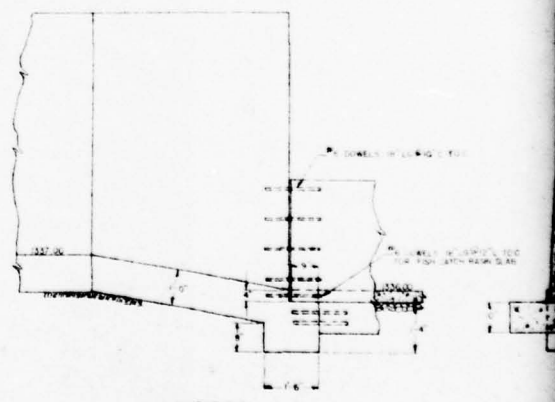


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NOT FURNISHED TO EDC

JOINT SURFACE WITH ADHESIVE FIBER  
GLASS REINFORCING FABRIC  
SEE SHEET NO. 10 VIEW "Y"

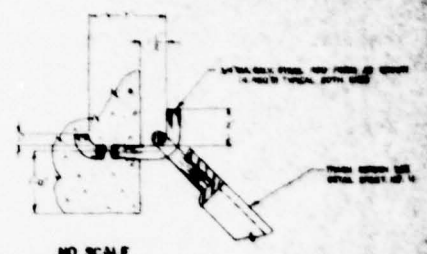
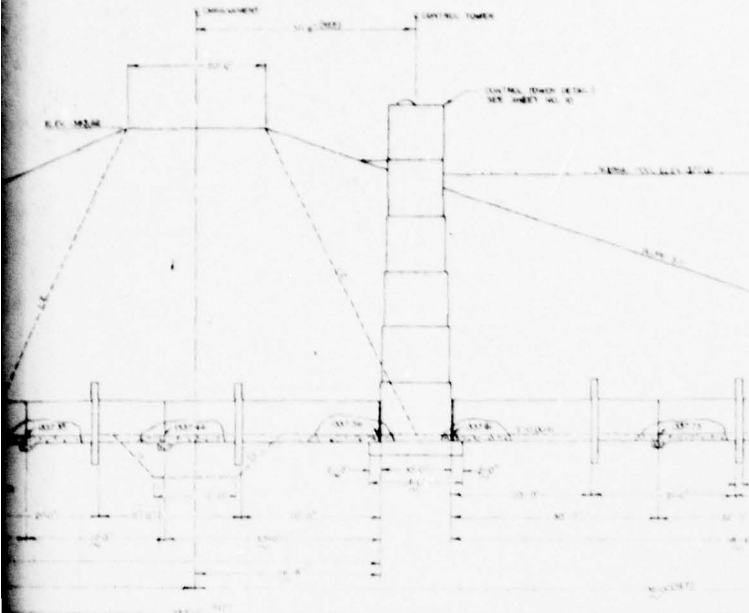


**SECTION "D"-D"**  
SCALE: 1/2" = 1'-0"



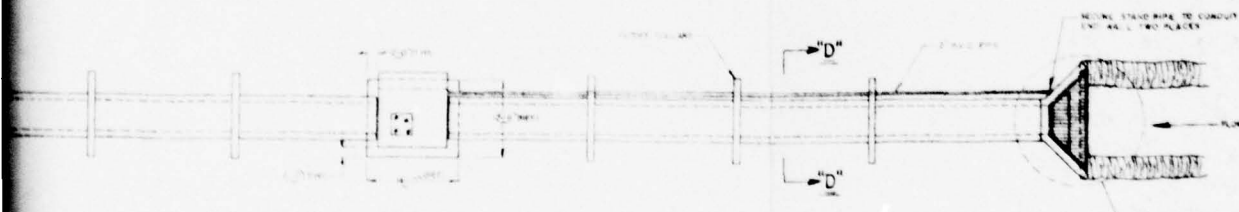
**VIEW "B"-B"**  
SCALE: 1/2" = 1'-0"

NOTE:  
ALL DIMENSIONS AND REQUIREMENTS SHALL BE  
CHECKED AND VERIFIED BY THE CONTRACTOR AT  
THE SITE.

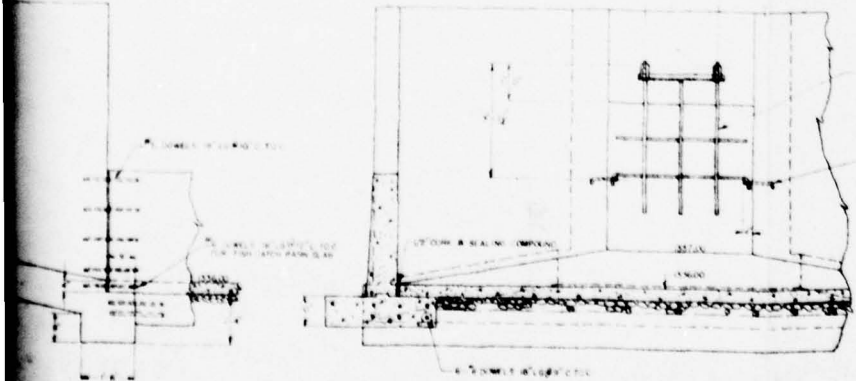


CONDUIT PROFILE  
SCALE 3/32" = 1'-0"

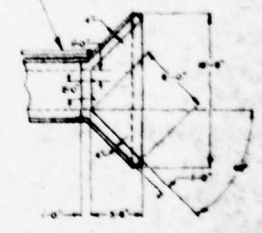
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CONDUIT PLAN  
SCALE 3/32" = 1'-0"



SECTION "A-A"  
SCALE 1/8" = 1'-0"



SCALE 1/8" = 1'-0"

2

PLATE 6

SEAL	SEAL

REVISED	APPROVALS
[REVISIONS]	[SIGNATURES]
[DATE]	[DATE]

PROJECT NO. FC-2894
[PROJECT DETAILS]

ALL DIMENSIONS AND REVISIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE



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FROM COPY FURNISHED TO DDC

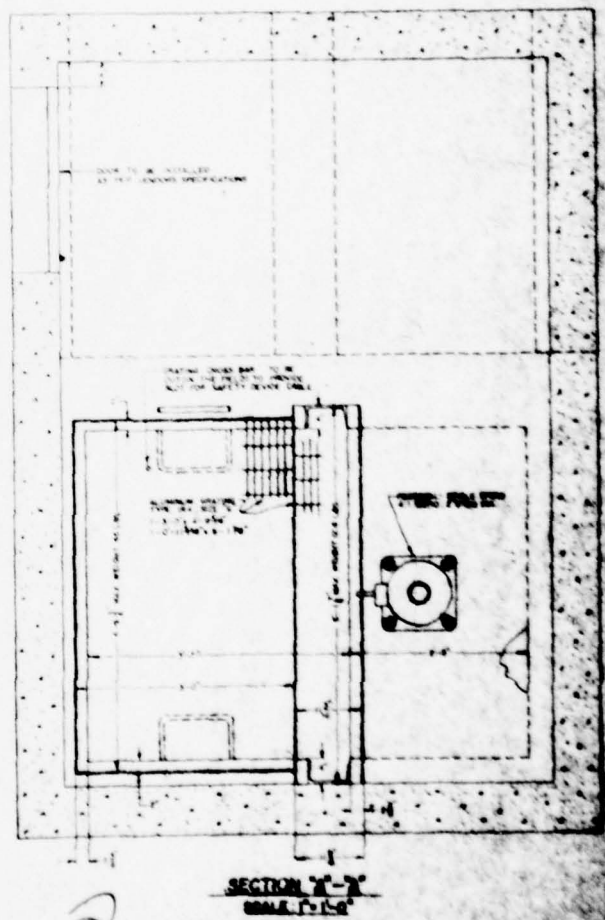
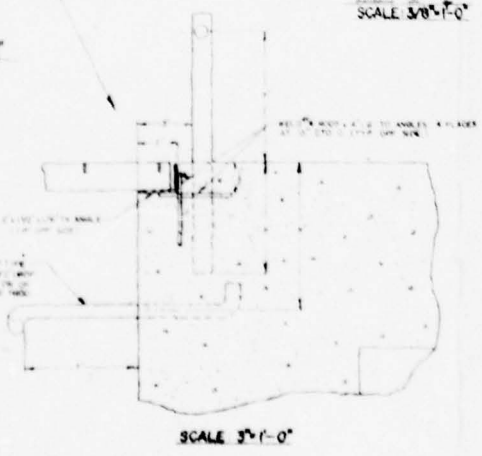
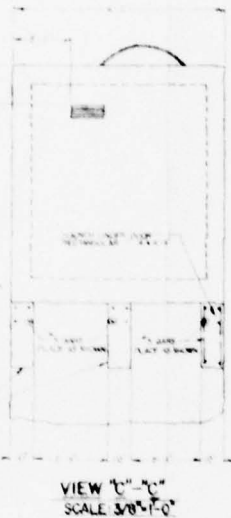
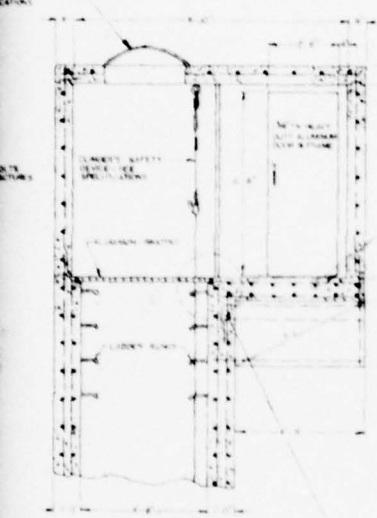
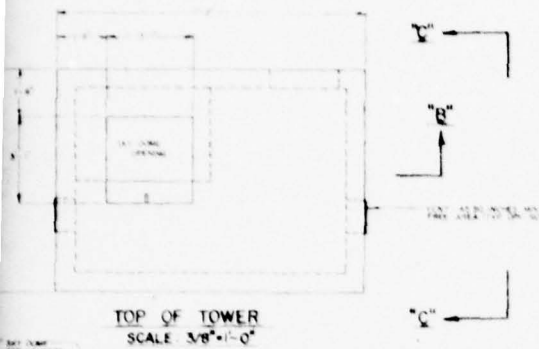


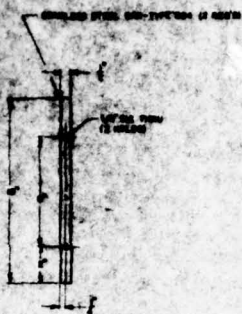
PLATE 7

NOTE: ALL DIMENSIONS AND ALIGNMENTS SHALL BE  
CHECKED AND VERIFIED BY THE CONTRACTOR AT  
THE SITE.

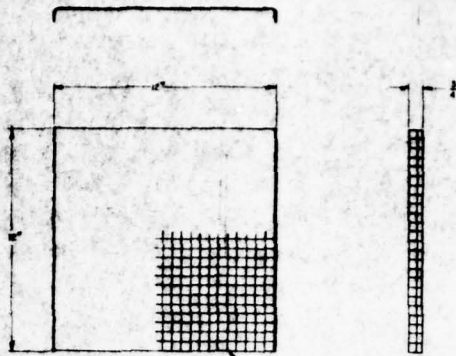
SEAL	SEAL

REVISED	APPROVALS
	<p>APPROVED BY: <i>[Signature]</i></p> <p>DATE: 2-24-70</p>
	<p>CHECKED BY: <i>[Signature]</i></p> <p>DATE: 2-24-70</p>

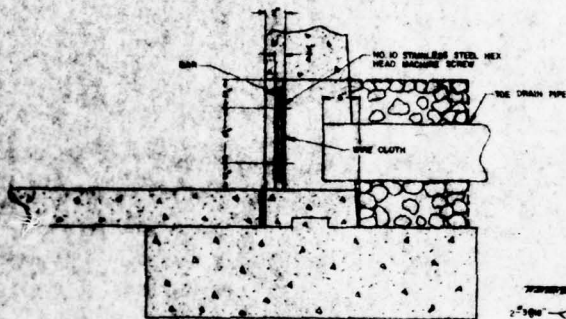
<p>PROJECT NO. PC-500-0000</p> <p>CONTROL: <i>[Signature]</i></p> <p>PERMITS: <i>[Signature]</i></p>
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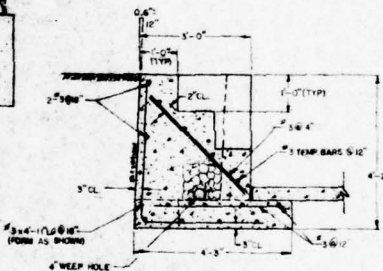
**BAR DETAIL**  
SCALE: 1/4" = 1"



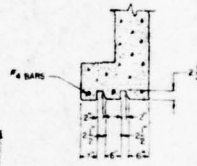
**WIRE CLOTH DETAIL**  
SCALE: 1/4" = 1"



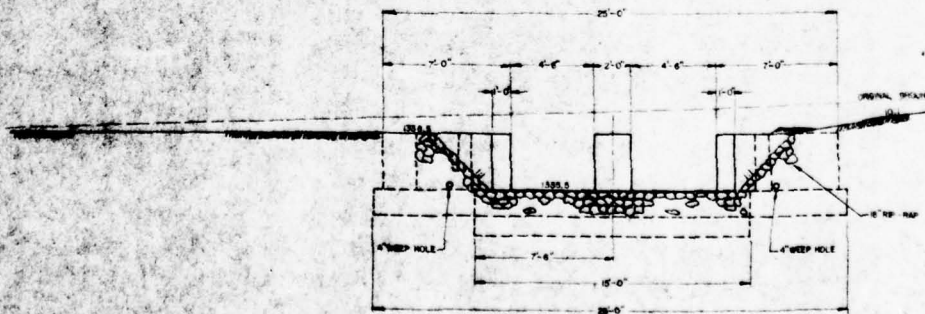
**RODENT BARRIER DETAIL**  
SCALE: 1/4" = 1"



**STAIR DETAIL**  
SCALE: 1/2" = 1'-0"



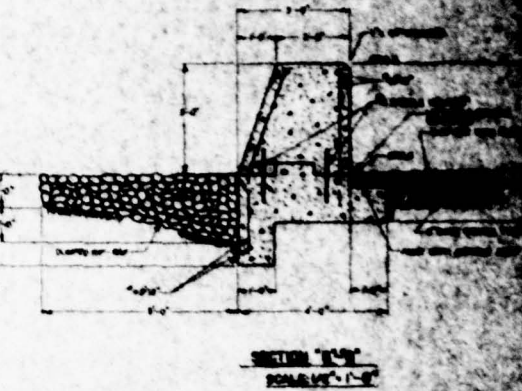
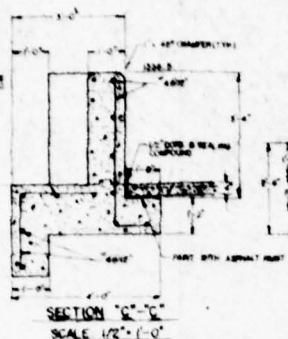
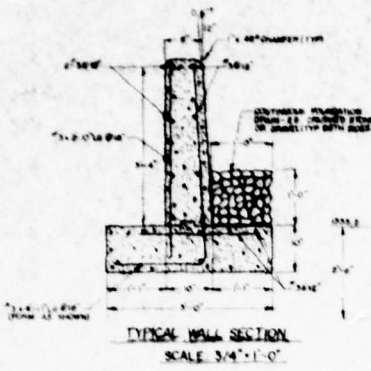
**TYP STOP PLANK GROOVE**  
SCALE 1/2" = 1'-0"



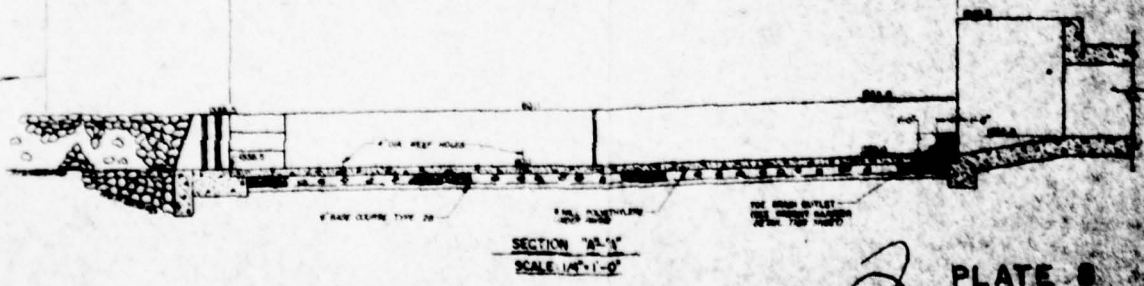
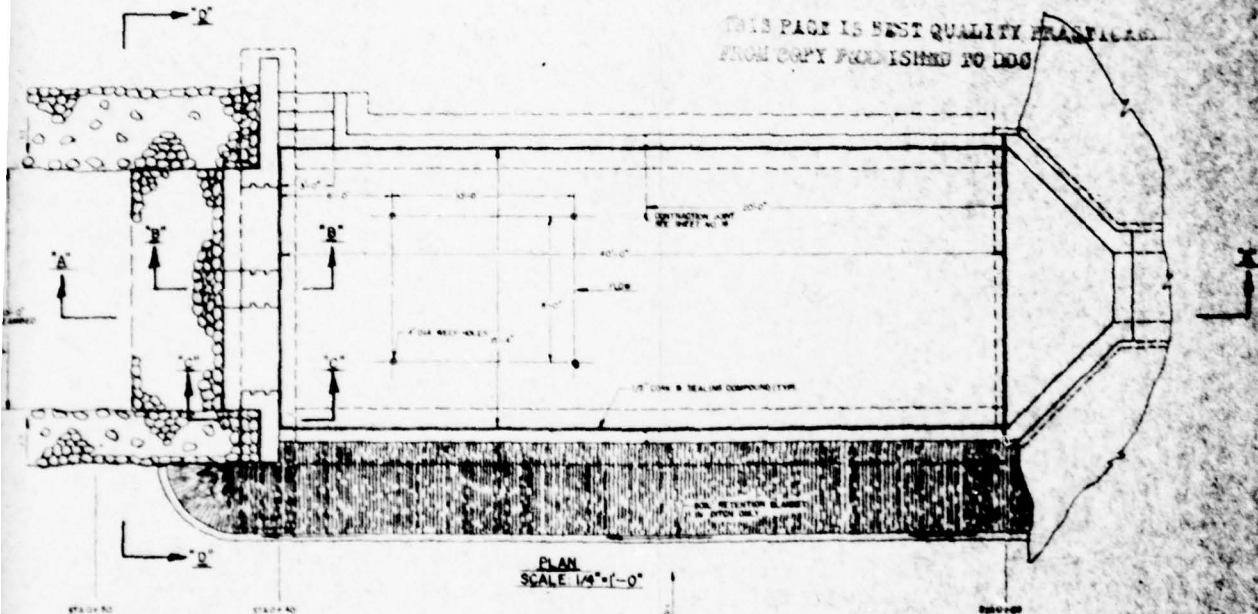
**SECTION D-D**  
SCALE: 1/4" = 1'-0"

13 PAGE TO BE REVISED TO SHOW CHANGES FROM RFI FORWARDED TO DDG

NOTE:  
ALL DIMENSIONS AND MEASUREMENTS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE.



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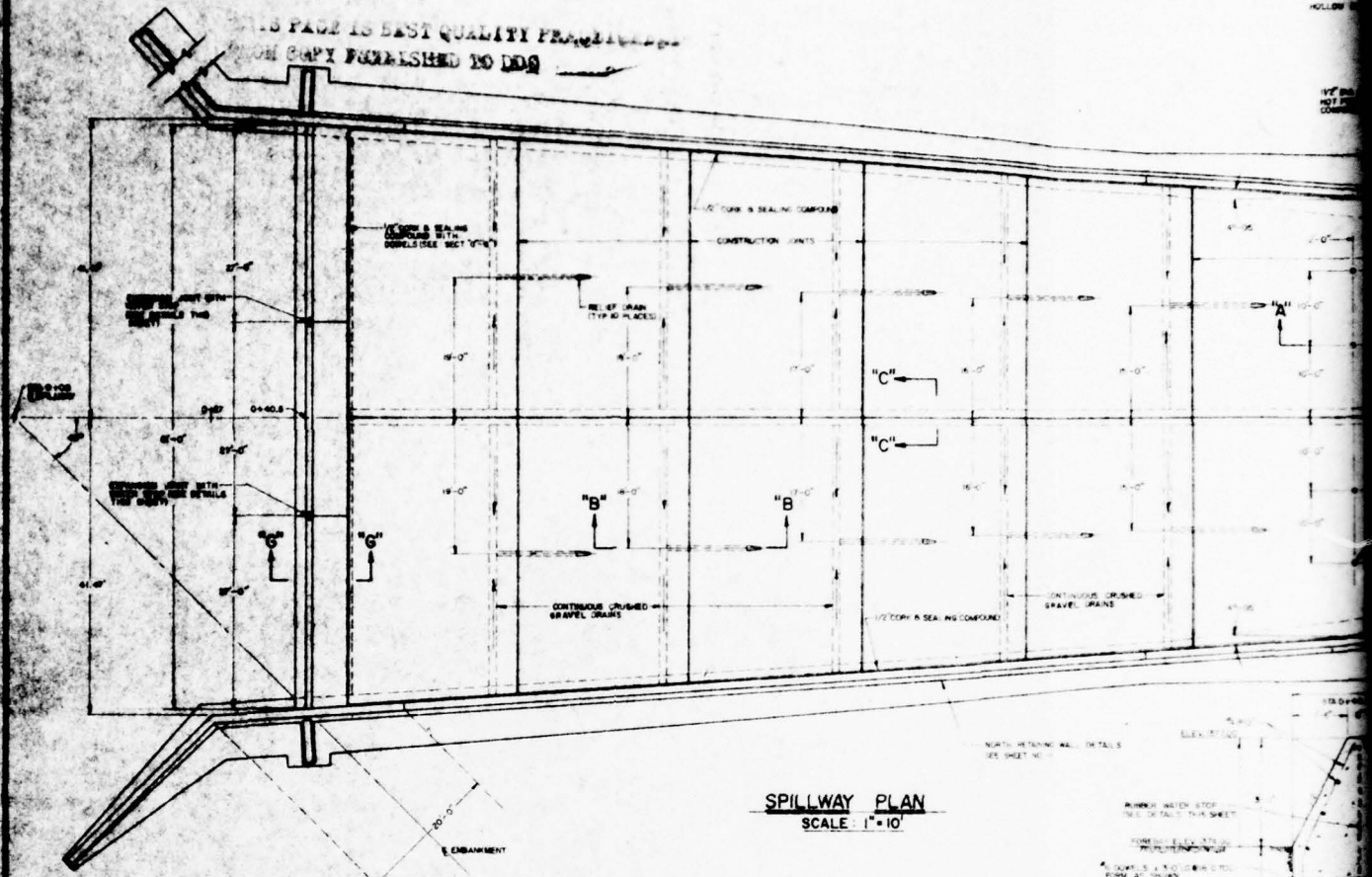


2 PLATE 8

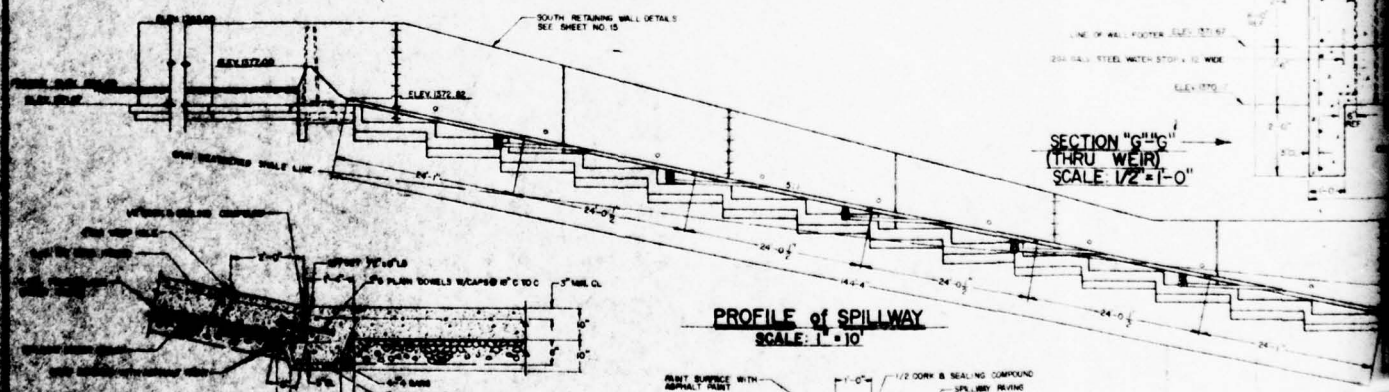
SEAL		SEAL		REVISED	
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[Empty]		[Empty]		[Empty]	
[Empty]		[Empty]		[Empty]	
[Empty]		[Empty]		[Empty]	

DESIGN AND DIMENSIONS SHALL BE AS SHOWN BY THE CONVENTION 27

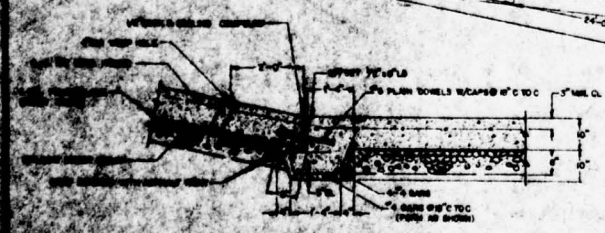
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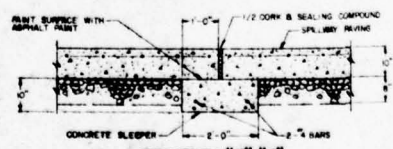
**SPILLWAY PLAN**  
SCALE: 1"=10'



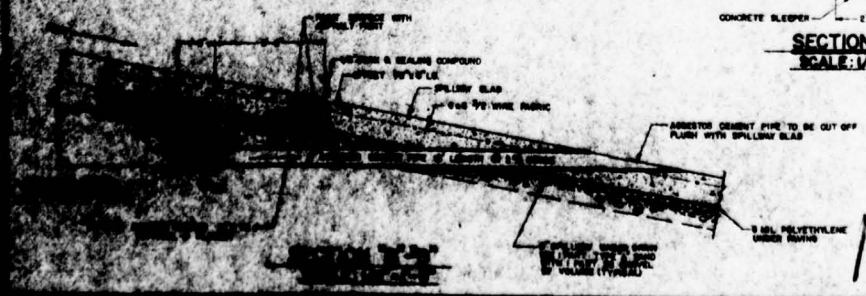
**PROFILE of SPILLWAY**  
SCALE: 1"=10'



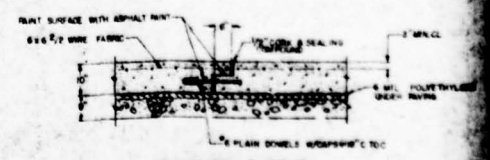
**SECTION A-A**  
SCALE: 1/2"=1'-0'



**SECTION C-C**  
SCALE: 1/2"=1'-0'



**SECTION B-B**  
SCALE: 1/2"=1'-0'



**SECTION D-D**  
SCALE: 1/2"=1'-0'



APPENDIX A

CHECK LIST - VISUAL INSPECTION  
AND FIELD SKETCH

Check List  
Visual Inspection  
Phase 1

Name of Dam Kahle Lake Dam County Venango State PA Coordinates Lat. N 41° 14.1'  
NDI # PA 00825 PennDER # 61-20 Long. W 79° 39.9'

Date(s) Inspection 10 May 1979 Weather Rain, mild Temperature 80°F.  
28 June 1979 Party cloudy, 70°F.  
rain in AM

Pool Elevation at Time of Inspection M.S.L.\* Tailwater at Time of Inspection M.S.L.  
10 May 1979 - 1377.1 M.S.L. 10 May 1979 - 1348.1 M.S.L.\*  
28 June 1979 - 1376.8 M.S.L. 28 June 1979 - Unknown

\*Elevations are based on the top of the reinforced concrete ogee weir, El. 1377.0 ft. M.S.L., according to the design plans of the Pennsylvania Fish Commission, Bureau of Fisheries and Engineering Division.

Inspection Personnel: Michael Baker, Jr., Inc.:  
10 May 1979  
Owner's Representatives:  
Pennsylvania Fish Commission  
10 May 1979

Rodney E. Holderbaum E. Jon Grindall  
James G. Ulinski Melvin Dinger

28 June 1979 PennDER  
10 May 1979

Rodney E. Holderbaum Lawrence Busack  
James G. Ulinski  
David Johns

David Johns Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

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

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

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

EMBANKMENT

Name of Dam: KAHLE LAKE DAM

NDI # PA 00825

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Some surface cracks were observed on the downstream slope of the embankment, however, these were shrinkage cracks due to the fine material used for the embankment and the long, dry period prior to inspection.	No action necessary
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	A minor erosion channel has formed on the downstream slope near the foot path leading to the riser unit.	Should be corrected during routine maintenance.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems observed	
RIPRAP FAILURES	No problems observed	



OUTLET WORKS  
(Principal Spillway)

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No problems observed	
INTAKE STRUCTURE	No problems observed	
OUTLET STRUCTURE	Some minor cracking in the walls of the stilling basin of the outlet conduit were observed.	These cracks should be repaired.
OUTLET CHANNEL	A small ditch was noted to the right of the outlet channel undercutting the riprap.	The area should be regraded and seeded to prevent further erosion.
EMERGENCY GATE	A 36 in. by 36. in. slide gate is provided at the base of the control tower.	

UNGATED SPILLWAY  
(Auxiliary Spillway)

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	<ol style="list-style-type: none"> <li>Concrete was in good overall condition. The joint sealer is missing at the base of the ogee section.</li> <li>Some minor cracking was noted along the walls of the concrete chute.</li> </ol>	<ol style="list-style-type: none"> <li>Recommend replacing the joint sealer.</li> <li>The cracking should be repaired, as necessary.</li> </ol>
APPROACH CHANNEL	Not Applicable	
DISCHARGE CHANNEL	<ol style="list-style-type: none"> <li>The discharge channel below the end sill is 150 ft. long and 44 ft. wide. The channel floor is grass-lined except for the center 20 ft. which has a gabion lining. The side slopes are 1H:1V and are covered with riprap. At the end of the lined channel is a 4.5 ft. high gabion wall with a small break near the right end to allow for passage of fish.</li> </ol>	<ol style="list-style-type: none"> <li>No action necessary.</li> </ol>
BRIDGE AND PIERS	None	<ol style="list-style-type: none"> <li>The weep holes should be unplugged.</li> </ol>

GATED SPILLWAY - Not Applicable

Name of Dam: KAHLE LAKE DAM

NDI # PA 00825

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

CONCRETE SILL

APPROACH CHANNEL

DISCHARGE CHANNEL

BRIDGE AND PIERS

GATES AND OPERATION  
EQUIPMENT



RESERVOIR

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SLOPES

The reservoir slopes are primarily moderately sloping pastures or farmlands.

SEDIMENTATION

Judging from the age of the reservoir and the watershed cover, sedimentation should be relatively minor.

DOWNSTREAM CHANNEL

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONDITION  
(OBSTRUCTIONS,  
DEBRIS, ETC.)

A small beaver dam and State Route 38 are located approximately 1000 ft. downstream from the dam.

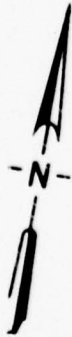
These structures would probably not affect flood discharges from the reservoir.

SLOPES

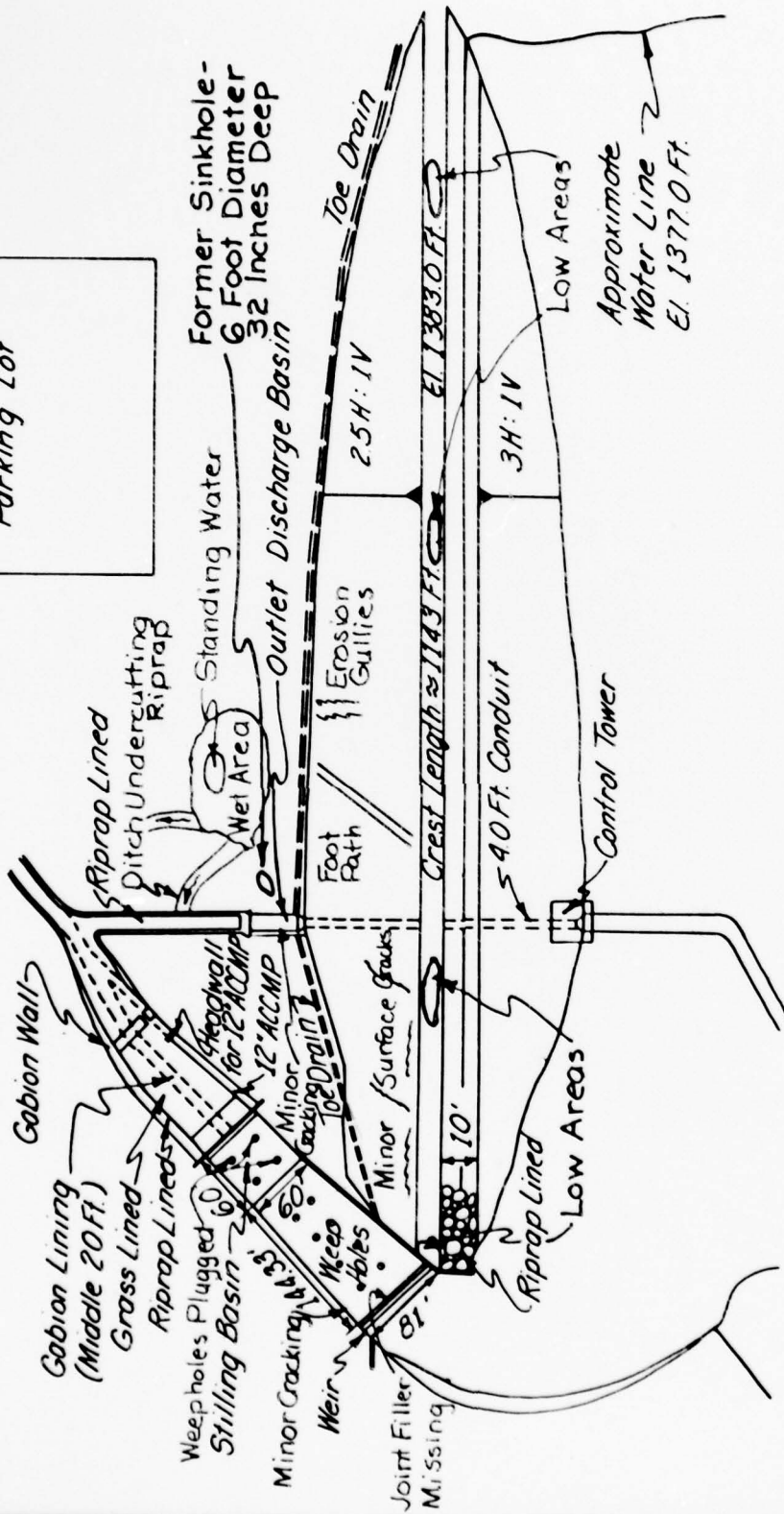
The channel and slopes adjacent to the channel are fairly mild immediately downstream from the dam. As Mill Creek approaches the Allegheny River, the channel and side slopes become relatively steep.

APPROXIMATE NO.  
OF HOMES AND  
POPULATION

No residential structures are located downstream from the dam that would be affected by excessive discharges from the reservoir. State Route 38 is located approximately 1000 ft. downstream from the dam. Five other bridge crossings are located between the dam and the confluence with the Allegheny River, a distance of approximately 4.5 mi.



Parking Lot



FIELD SKETCH  
 Kohle Lake Dam  
 NDI No. PA 00825  
 Penn DER No. 61-20

(Not to Scale)

APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

ITEM REMARKS

PLAN OF DAM See Plate 3.

REGIONAL VICINITY MAP A portion of the USGS 7.5 minute topographic quadrangle, Emlenton, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).

CONSTRUCTION HISTORY The dam was designed by the Engineering Division, Bureau of Fisheries Engineering, Pennsylvania Fish Commission and was constructed by the Keystone Construction Co. of Meadville, Pennsylvania between August 1973 and October 1974.

TYPICAL SECTIONS OF DAM See Plate 5, Typical Embankment Sections.

HYDROLOGIC/HYDRAULIC DATA The hydrologic/hydraulic data reviewed are available in the files of the Pennsylvania Fish Commission.

OUTLETS - PLAN See Plate 6.

- DETAILS See Plates 6 and 8.

- CONSTRAINTS One 36 in. by 36 in. slide gate located in the control tower.

- DISCHARGE RATINGS None available

RAINFALL/RESERVOIR RECORDS None available

Name of Dam: KAHLE LAKE DAM  
NDI # PA 00825

ITEM REMARKS

DESIGN REPORTS None available

GEOLOGY REPORTS A mineral appraisal done by Gwin, Dobson, and Foreman, Inc. Consulting Engineers, Altoona, Pennsylvania was available for review from the PennDER files.

DESIGN COMPUTATIONS The hydrologic/hydraulic design data are available in the files of the Pennsylvania  
HYDROLOGY & HYDRAULICS Fish Commission.  
DAM STABILITY  
SEEPAGE STUDIES

MATERIALS INVESTIGATIONS The boring logs, included in the design drawings, are located in the PennDER files.  
BORING RECORDS  
LABORATORY  
FIELD

POST-CONSTRUCTION SURVEYS OF DAM None available

BORROW SOURCES The borrow areas are shown on Plate 3-General Plan and Location Map.

Name of Dam: KAHLE LAKE DAM

B-3

NDI # PA 00825

ITEM REMARKS

MONITORING SYSTEMS None installed

MODIFICATIONS In 1976, the gabions were placed in the downstream outlet channel immediately below the auxiliary spillway end sill.

HIGH POOL RECORDS None available

POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS None

PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS None

MAINTENANCE OPERATION RECORDS No records are kept.

Name of Dam: KAHLE LAKE DAM  
MDI # PA 00825

B-4

ITEM	REMARKS
------	---------

SPIILLWAY PLAN ,

SECTIONS,  
and  
DETAILS

See Plate 9.

OPERATING EQUIPMENT  
PLANS & DETAILS

See Plate 7.

CHECK LIST  
HYDROLOGIC AND HYDRAULIC DATA  
ENGINEERING DATA

B-5

DRAINAGE AREA CHARACTERISTICS: 4.50 sq.mi. (primarily wooded)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1377.0 ft. (4100 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY) 1383.0 ft. (5800 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 1383.0 ft.

ELEVATION TOP DAM: 1383.0 ft. (design), 1382.0 ft. (minimum)

CREST: Auxiliary Spillway

a. Elevation 1377 ft.

b. Type Concrete weir and chute channel

c. Width 81 ft.

d. Length 144.33 ft.

e. Location Spillover Left abutment

f. Number and Type of Gates None

OUTLET WORKS: Principal Spillway

a. Type Concrete control tower with concrete conduit and a fish catch basin

b. Location 310 ft. to the right of emergency spillway on upstream face

c. Entrance inverts 4 ft. by 4 ft. concrete conduit - El. 1338.0 ft;

2 in. P.V.C. - El. 1362.0 ft.

d. Exit inverts El. 1336.0 ft. both

e. Emergency draindown facilities One 36 in. sq. slide gate

HYDROMETEOROLOGICAL GAGES: None

a. Type \_\_\_\_\_

b. Location \_\_\_\_\_

c. Records \_\_\_\_\_

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

APPENDIX C

PHOTOGRAPHS

H N V | C | C | O | IN | OUT | OUT | EME |

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam from Left Abutment: Auxiliary Spillway in Foreground, Control Tower to Right, and Fish Catch Basin to Left

Photo 1 - Control Tower on Upstream Slope

Photo 2 - Toe Drain Outlet at Outlet Discharge Basin

Photo 3 - Outlet of Principal Spillway (Outlet Discharge Basin)

Photo 4 - Downstream Channel of Principal Spillway

Photo 5 - View of Auxiliary Spillway Looking Upstream  
(Note: head wall for 12 inch A.C.C.M.P. to left of channel and gabion wall and lining to right of center.)

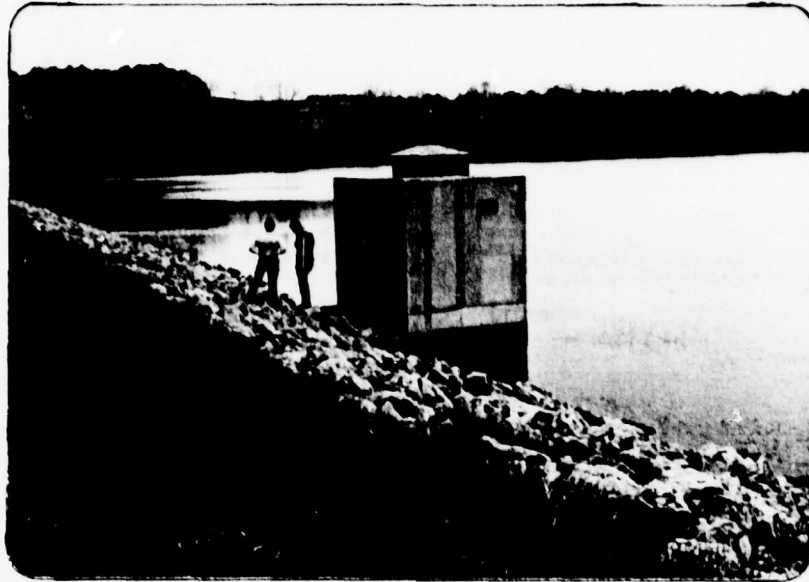
Photo 6 - Head Wall for 12 inch A.C.C.M.P. from Stilling Basin

Photo 7 - Concrete Weir Section of Auxiliary Spillway

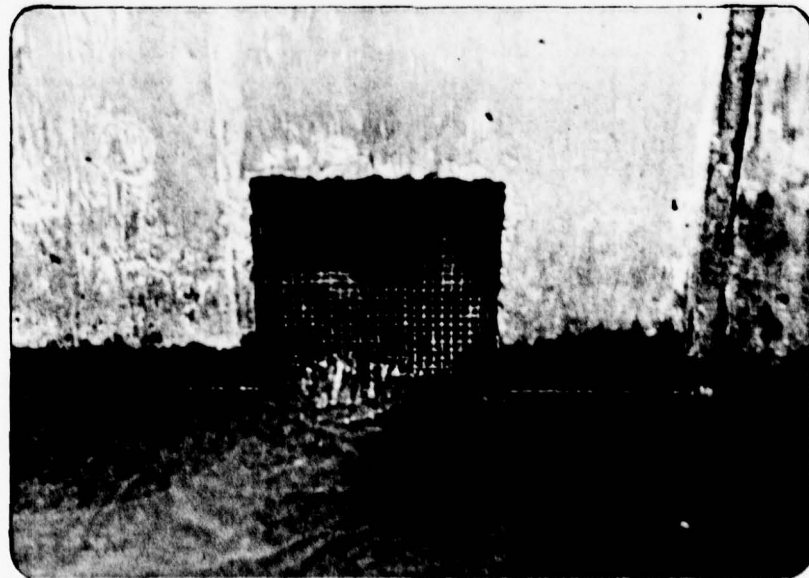
Photo 8 - View of Stilling Basin and Concrete Chute Looking Downstream

Note: Photographs 1 through 6 were taken on 10 May 1979; photographs 7, 8, and overall view were taken on 28 June 1979.

**KAHLE LAKE DAM**

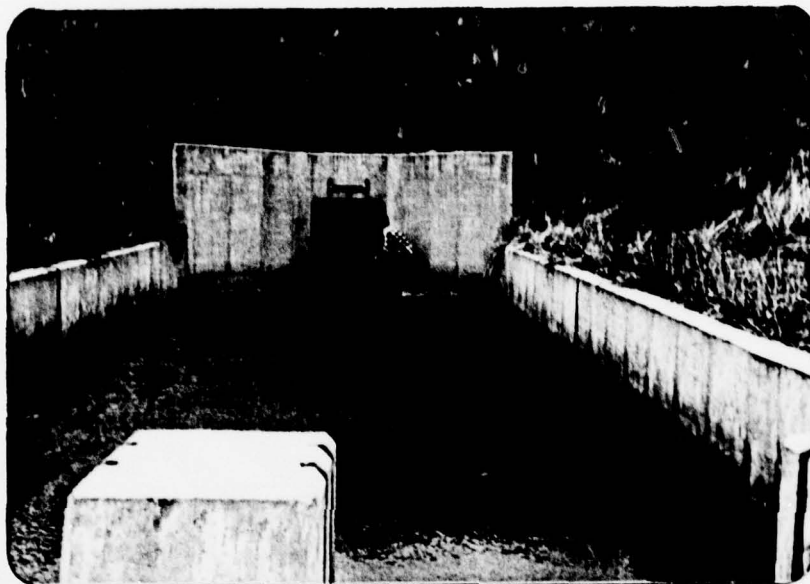


**PHOTO 1. Control Tower on Upstream Slope**



**PHOTO 2. Toe Drain Outlet at Outlet Discharge Basin**

**KAHLE LAKE DAM**



**PHOTO 3. Outlet of Principal Spillway (Outlet Discharge Basin)**



**PHOTO 4. Downstream Channel of Principal Spillway**

**KAHLE LAKE DAM**



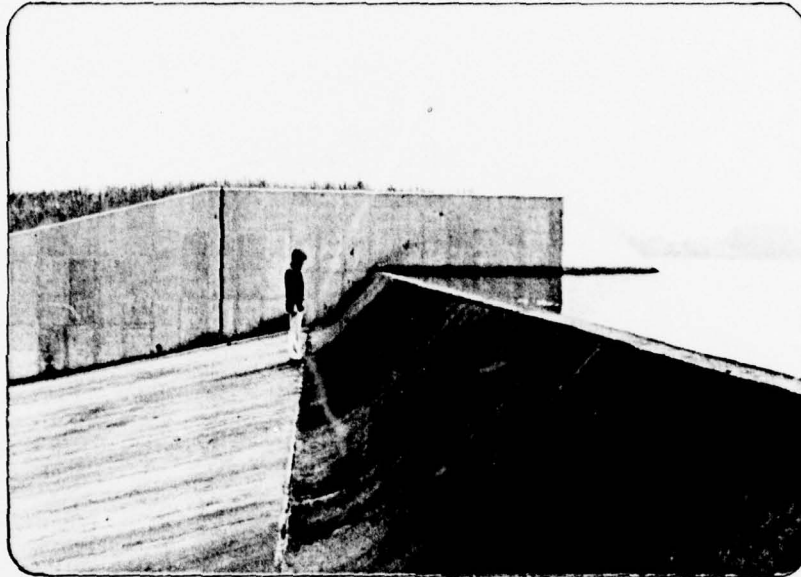
**PHOTO 5. View of Auxillary Spillway Looking Upstream (Note: head wall for 12 inch A.C.C.M.P. to left of channel and gablon wall and lining to right of center.)**



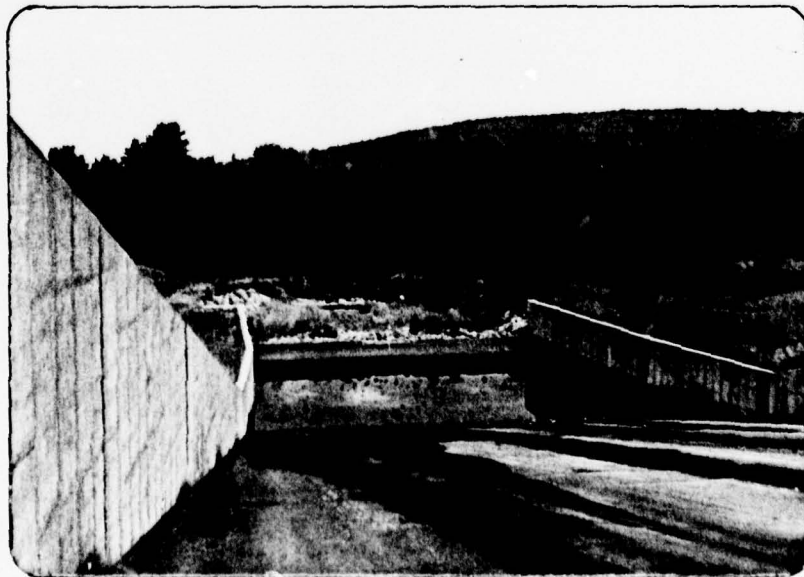
**PHOTO 6. Head Wall for 12 inch A.C.C.M.P. from Stilling Basin**

N N V S  
SE

**KAHLE LAKE DAM**



**PHOTO 7. Concrete Weir Section of Auxiliary Spillway**



**PHOTO 8. View of Stilling Basin and Concrete Chute Looking Downstream**

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Weep  
Still  
Minor  
We  
Joint Filling  
Missing

MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject Kahle Lake Dam S.O. No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Drawing No. \_\_\_\_\_  
Computed by \_\_\_\_\_ Checked by \_\_\_\_\_ Date \_\_\_\_\_

Table of Contents

<u>SUBJECT</u>	<u>PAGE</u>
PREFACE	1
RAINFALL AND HYDROGRAPH COEFFICIENTS	1
WATERSHED MAP	2
STORAGE VS. AREA CURVES	3
TOP OF DAM PROFILE	4
MAP OF DOWNSTREAM AREA	5
COMPUTER ANALYSIS	6

## PREFACE

### HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variation of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

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

MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject KAHLE LAKE DAM S.O. No. \_\_\_\_\_  
RAIN FALL & HYDROGRAPH Sheet No. 1 of 10  
COEFFICIENTS Drawing No. \_\_\_\_\_  
Computed by S.L.S. Checked by \_\_\_\_\_ Date 5-30-79

RAIN FALL (TAKEN FROM HMR-33)

ZONE 2 P.M.P.<sub>24HR.</sub> = 200 mi.<sup>2</sup> = 23.4 in.  
6 HR = 117% P.M.P.  
12 HR = 127% P.M.P.  
24 HR. = 141% P.M.P.  
48 HR. = 151% P.M.P.

HYDROGRAPH COEFFICIENTS (SNYDERS UNIT HYDROGRAPH)

ZONE 23 PLATE C (tp) Cp = 0.55

SINCE THE CENTROID OF THE WATERSHED FALLS WITHIN  
THE LAKE AREA:

$$t_p = C_T (L^{0.6})$$

$$t_p = 3.3 (2.14)^{0.6}$$

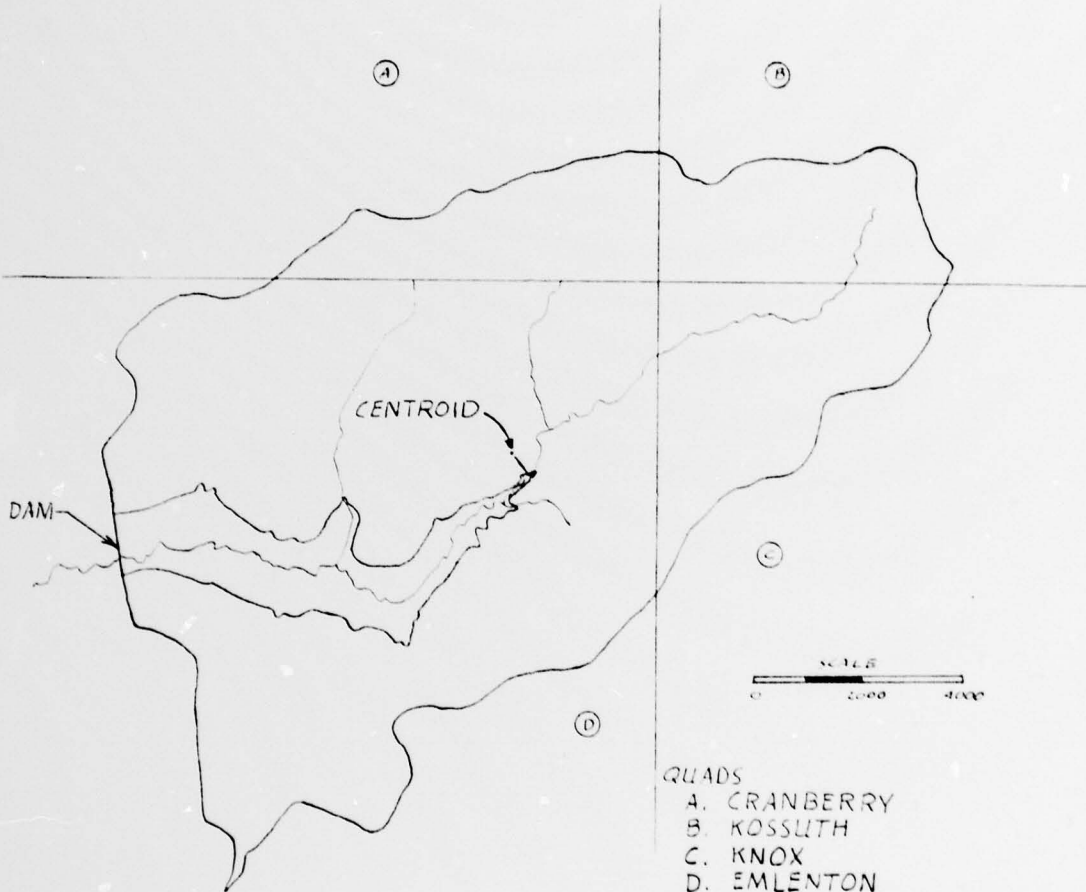
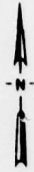
$$t_p = 5.21 \text{ HRS.}$$

$$t_r = \frac{5.21}{5.5} = 0.95 \text{ HR. USE } T_R = 20 \text{ MIN.}$$

$$t_{PR} = t_p + 0.25 (t_R - t_r)$$

$$t_{PR} = 5.21 + 0.25 (0.33 - 0.95)$$

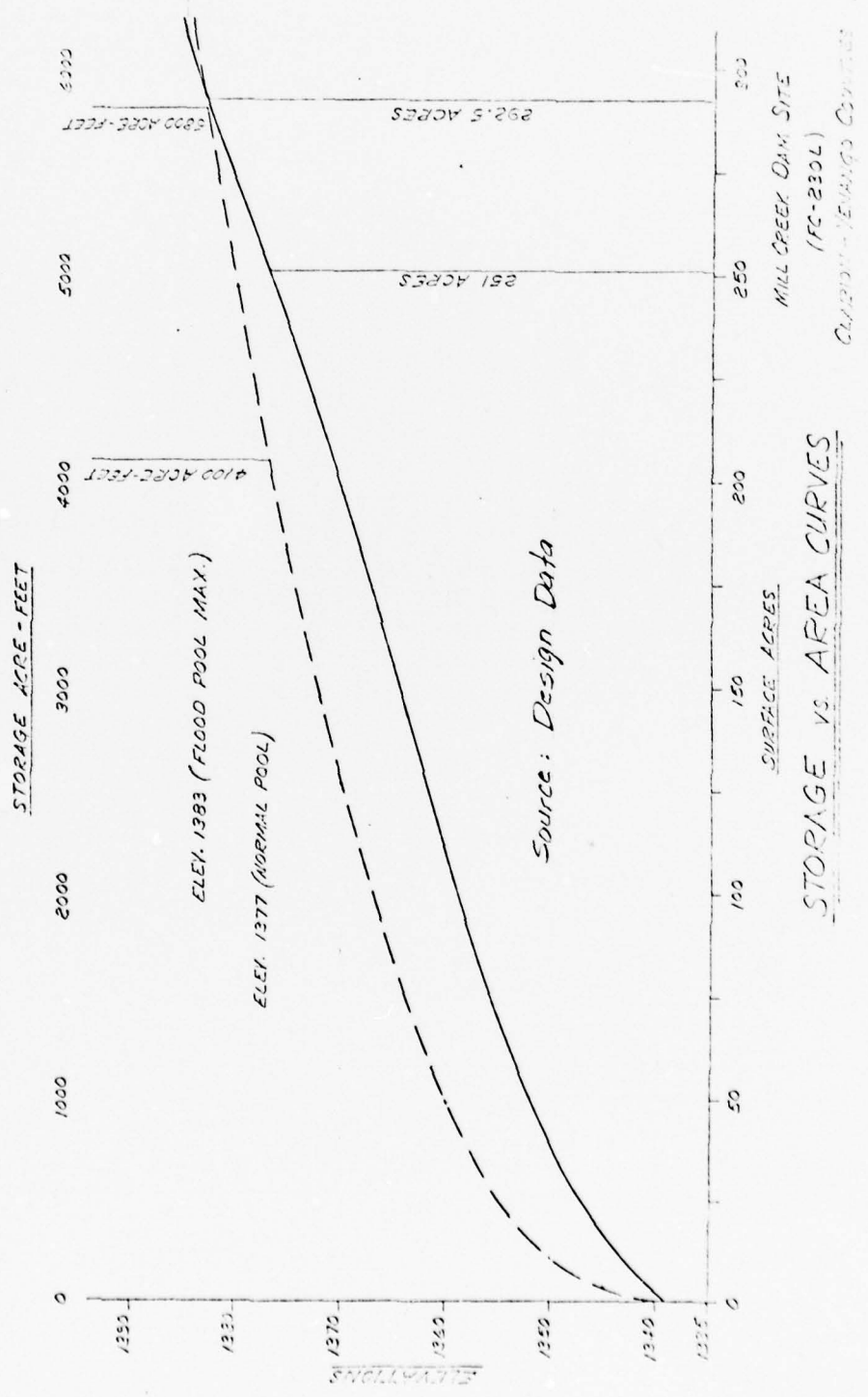
$$t_{PR} = 5.06 \text{ HRS.}$$



QUADS  
A. CRANBERRY  
B. KOSSUTH  
C. KNOX  
D. EMLENTON  
DRAINAGE AREA = 451 sq. mi.  
L = 2.14 mi

KAHLE LAKE DAM  
WATERSHED MAP

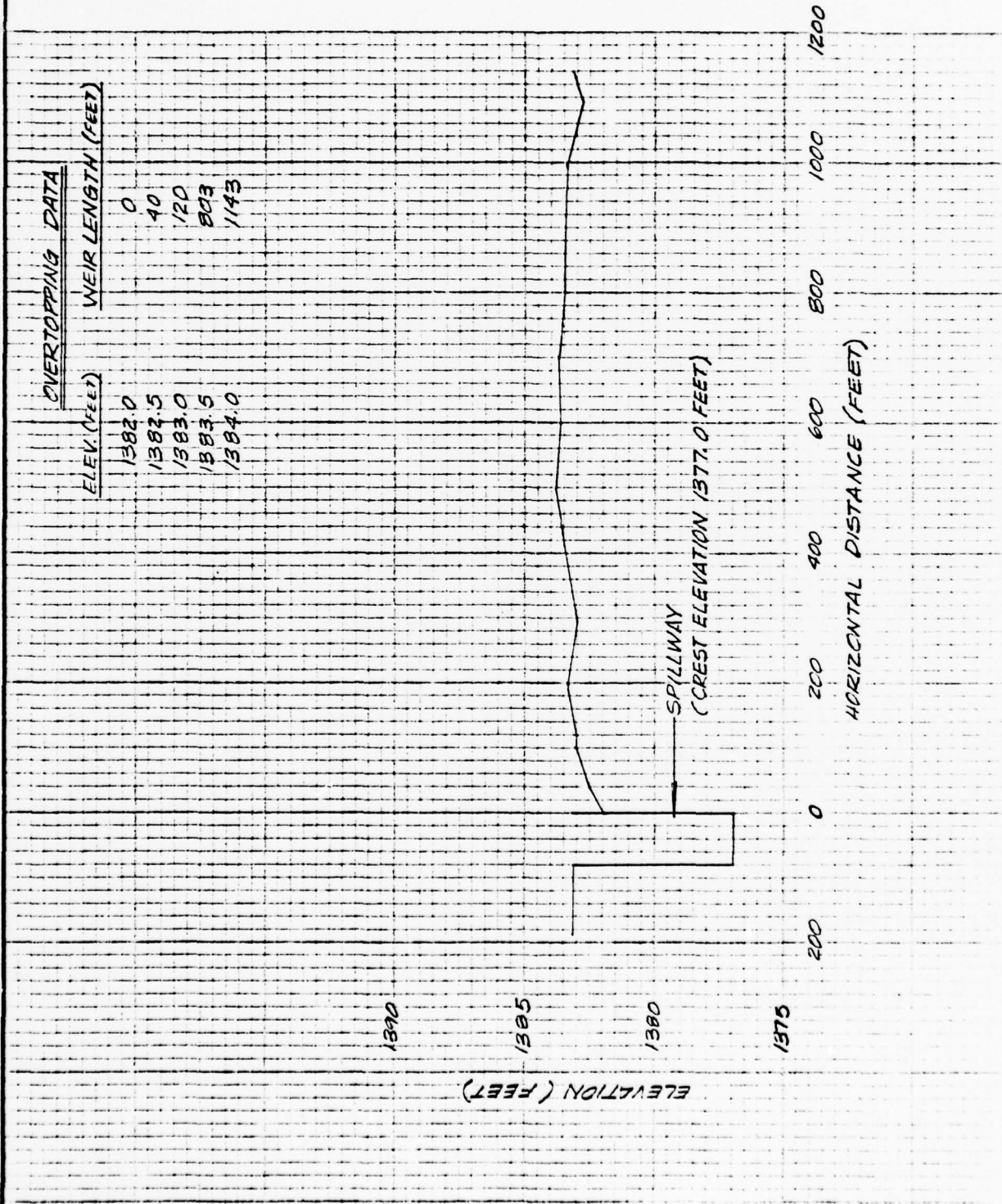
**MICHAEL BAKER JR. INC.**  
*Consulting Engineers & Surveyors*



MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

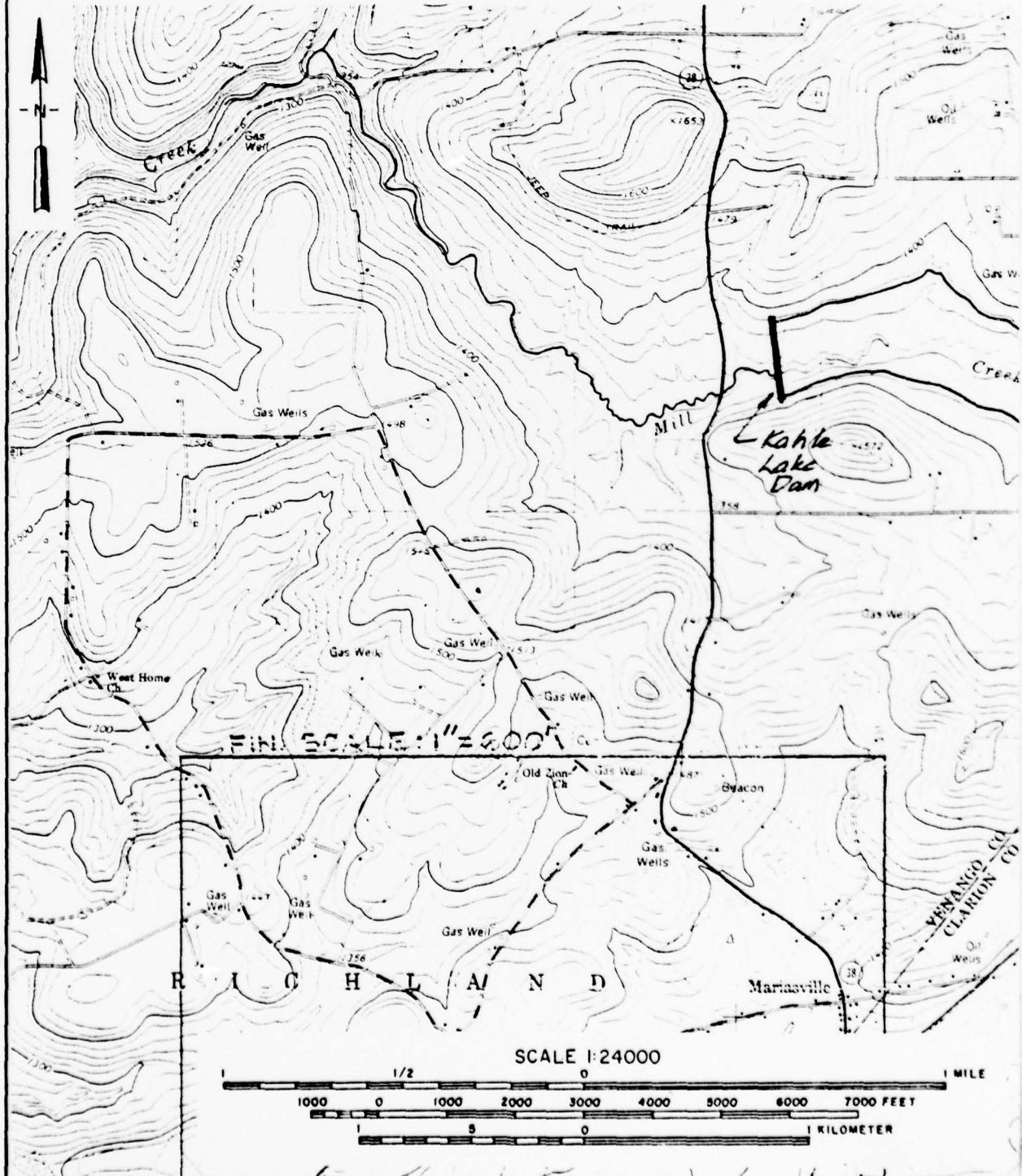
Subject KAHLE LAKE DAM S.O. No. \_\_\_\_\_  
TOP OF DAM PROFILE Sheet No. 4 of 10  
Drawing No. \_\_\_\_\_  
Computed by GAS. Checked by REH Date 5-30-79



MICHAEL BAKER, JR., INC.  
THE BAKER ENGINEERS

Box 280  
Beaver, Pa. 15009

Subject Kahle Lake Dam S.O. No. \_\_\_\_\_  
Map of Downstream Area Sheet No. 5 of 10  
Drawing No. \_\_\_\_\_  
Computed by SCB Checked by REH Date 7-10-79





\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HFC-11)  
 DAM SAFETY VERSION JULY 1976  
 LAST MODIFICATION 26 FEB 79  
 MSJ UPDATE 04 JUN 79  
 \*\*\*\*\*

RUN DATE 07/17/79  
 TIME 16.31

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF KAHE LAKE DAM 16  
 PROBABLE MAXIMUM FLOOD PAFUNIT GRAPH BY SNYDERS METHOD

JFH SPECIFICATION  
 NO NHP NMIN IDAY IMP IMIN METAC IPT IPAT NSTAN  
 300 0 23 0 0 0 0 0 0 0 0 0 0  
 JOPEP 5 0 0 0 0 0 0 0 0 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED  
 PLAN= 1 NP10= 3 LR10= 1  
 PT10= 1.00 0.75 0.50

\*\*\*\*\* SUB-AREA RUNOFF COMPUTATION \*\*\*\*\*

HYDROGRAPH DEVELOPMENT

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

HYDROGRAPH DATA

IHYDG	IUMG	TAREA	SRAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.51	0.0	4.51	0.0	0.0	0	0	0

PRECIP DATA

SPEE	PWS	P4	P12	P24	P48	P96
0.0	23.40	117.00	127.00	141.00	151.00	0.0

LOSS DATA

LRDPT	STKPB	OUTPR	PTID1	FRAIN	STPKS	RTI0K	STP1L	CRSTL	ALSNW	PTIMP
0	0.0	0.0	1.00	0.0	1.00	1.00	1.00	0.05	0.0	0.0

UNIT HYDROGRAPH DATA  
 TP= 5.06 CP=0.55 NIA= 0

RECESSION DATA  
 STP1Q= -1.50 PRCRN= -0.05 RTI0R= 2.00

UNIT HYDROGRAPH TO END-OF-PERIOD ORIGINATES, LAG= 5.07 HOURS, CP= 0.55 VOL= 0.99

5.	20.	60.	93.	123.	154.	187.	220.	250.
274.	295.	223.	210.	199.	188.	178.	168.	159.
274.	295.	223.	210.	199.	188.	178.	168.	159.

TOTAL COMPUTED BY THE PROGRAM IS 0.900

MO.DA HR.MN PERIOD MAIN EYCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EYCS LOSS COMP Q

END-OF-PERIOD FLOW  
 142. 135. 127. 120. 114. 108. 102. 96. 91. 86.  
 81. 77. 73. 65. 61. 58. 55. 52. 49.  
 46. 44. 42. 39. 37. 35. 33. 30. 28.  
 27. 25. 24. 22. 21. 20. 19. 18. 17.  
 15. 14. 13. 12. 11. 10. 10. 9.  
 9. 8. 7. 7. 7. 6. 6. 5.  
 5. 5. 4. 4. 4. 4. 4. 3. 3.

SUM 28.27 25.83 2.44 224873.  
 ( 718.)( 656.)( 62.)( 6367.70)

\*\*\*\*\*  
 HYDROGRAPH ROUTING  
 \*\*\*\*\*

ROUTING FOR KAHLE LAKE DAM  
 ISTAQ ICOMP IFCON ITAPE JPLT JPRT INAME ISTAGE IAUTO  
 2 1 0 0 0 0 0 1 0 0  
 ROUTING DATA  
 QLOSS CLOSS AVG IRES ISAME IDPT IPMP LSTR  
 0.0 0.0 0.0 1 1 0 0 0  
 NSTPS NSTDL LAG AMSKK X TSK STORA ISPRAT  
 0 0 0 0.0 0.0 0.0 -1377. 0

CAPACITY= 0. 65. 220. 500. 980. 1660. 2535. 3600. 4940. 6170.  
 ELEVATION= 1339. 1345. 1350. 1355. 1360. 1365. 1370. 1375. 1380. 1385.

CREST LENGTH 0. 40. 120. 803. 1143.  
 AT OR BELOW ELEVATION 1382.0 1382.5 1383.0 1383.5 1384.0  
 DAM DATA  
 TOPEL COQD EYMD DAMWID  
 1382.0 0.0 0.0 0.

PEAK OUTFLOW IS 522% AT TIME 46.67 HOURS  
 PEAK OUTFLOW IS 3631. AT TIME 47.33 HOURS  
 PEAK OUTFLOW IS 2268. AT TIME 47.67 HOURS

\*\*\*\*\*  
 SHEET 9 OF 10  
 \*\*\*\*\*

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 RATIOS APPLIED TO FLOWS  
 1.00 0.75 0.50

HYDROGRAPH AT 1 4.51 6352 4795 3150  
 ( 11.68) ( 131.03) ( 135.77) ( 90.51)

ROUTED TO 2 4.51 5224 3631 2268  
 ( 11.68) ( 147.93) ( 102.81) ( 64.24)

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SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

INITIAL VALUE      SPILLWAY CREST      *Minimum*  
 TOP OF DAM  
 1377.00      1377.00      1382.00  
 4136.      4136.      5432.  
 0.      0.      3459.

ELEVATION  
 STORAGE  
 OUTFLOW

RATIO      MAXIMUM      MAXIMUM      MAXIMUM      DURATION      TIME OF      TIME OF  
 OF      RESERVOIR      STORAGE      OUTFLOW      OVER TOP      MAX OUTFLOW      FAILURE  
 PMF      W.S.ELEV      AC-FT      CFS      HOURS      HOURS      HOURS

1.00      1383.31      5754.      5226.      8.00      46.67      0.0  
 0.75      1382.16      5472.      3631.      3.00      47.33      0.0  
 0.50      1280.77      5130.      2253.      0.0      47.67      0.0

SHEET 10 OF 10

APPENDIX E

REGIONAL GEOLOGY

## KAHLE LAKE DAM AND RESERVOIR

### REGIONAL GEOLOGY

Kahle Lake Dam and Reservoir are located in the Appalachian Plateaus Physiographic Province, along the boundary between the Allegheny High Plateaus section and the Pittsburgh section. The area has considerable relief, is maturely dissected, and has not been glaciated.

According to the Erosion and Sedimentation Control Plan, the dam is underlain by residual, alluvial, and colluvial soil types. Specifically, Cavode Series soils (residual) approximately 12 feet thick cover the slopes on the left side; Atkins Series deposits (alluvium) are approximately 25 feet thick along the center of the valley, on the right side, and in the spillway area. Brinkerton Series soils (colluvium) predominate and are approximately 15 feet thick.

Members of both the Allegheny and Pottsville Formations, Pennsylvania System are found beneath the soil cover in the dam and reservoir area, as shown on the following geologic map. The lower portion of the Allegheny Formation overlies the Pottsville and consists generally of shale, fine-grained to conglomeratic sandstone, and several valuable coal seams, specifically the Clarion coal in the area surrounding the reservoir. The Pottsville, present in the foundation of the dam, consists of gray shall with clay seams, with varying degrees of weathering. Typically however, the members of the Pottsville are coarse grained and massive conglomerates and shales.

Although there are gas and oil fields in the area, an appraisal made for the Fish Commission in 1972 concluded that there is no potential hazard from underlying mineral resources. This study also found that there are no mineable coal seams immediately below the site.



## PERMIAN



### Greene Formation

*Cyclic sequences of sandstone, shale, red beds, limestone and coal, base at the top of the Upper Washington Limestone.*

## PERMIAN AND PENNSYLVANIAN



### Washington Formation

*Cyclic sequences of sandstone, shale, limestone and coal, some red shale, some mineable coal, base at the top of the Waynesburg Coal.*

## PENNSYLVANIAN

### APPALACHIAN PLATEAU



### 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.*



### Conemaugh Formation

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



### Allegheny Group

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



### Pottsville Group

*Predominantly sandstones and conglomerates with thin shales and coals, some coals mineable locally.*

### ANTHRACITE REGION



### Post-Pottsville Formations

*Brown or gray sandstones and shales with some conglomerate and numerous mineable coals.*



### Pottsville Group

*Light gray to white, coarse grained sandstones and conglomerates with some mineable coal, includes Sharp Mountain, Skullkill, and Turning Run Formations.*

## MISSISSIPPIAN



### Mauch Chunk Formation

*Red shales with brown to greenish gray, blocky sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties, Loyalhanna Limestone at the base in southwestern Pennsylvania.*



### Pocono Group

*Predominantly gray, hard, massive, cross-bedded conglomerates and sandstones with some shale, includes in the Appalachian Plateau: Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations, includes part of Onango of M. L. Fuller in Potter and Tioga counties.*

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APPENDIX F  
OPERATION AND MAINTENANCE MANUAL

KAHLE LAKE DAM  
VENANGO COUNTY

OPERATION AND MAINTENANCE MANUAL

I. OPERATION OF DAM

A. Normal Operating Procedure

Kahle Lake Dam is designed to control flow automatically. The control tower is a rectangular shaped reinforced concrete vertical riser, 4'6" x 6'0" with stoplogs normally set at an elevation of 1377.0. During normal flows, a pool elevation of approximately 1377.0 will be automatically maintained. It is not possible to manually control flows through the spillway; therefore, a resident dam tender is unnecessary.

B. Flood Emergency Operation Procedure

During flood periods, the discharge is controlled by the flow through the spillway system. Discharge through the spillway system will increase with the rising pool elevation. When elevation 1377.0 is reached, the emergency spillway will come into use. Although Kahle Lake is not a flood control reservoir, some storage of floodwater is provided between elevations 1377.0 and 1383.0 (top of dam). Storage and discharge of flood waters will be automatically controlled by the spillway system, no manual control being possible.

The Venango County waterways patrolman or a deputy patrolman shall observe this structure during periods of heavy precipitation. Should any of the following conditions be observed:

1. Sliding of upstream or downstream slopes or abutments contiguous to the dam;
2. sudden subsidence of the crest of the dam;
3. longitudinal or transverse cracking of the crest of the dam;
4. unusual release of water from the face or toe of the dam;
5. any other unusual conditions at the downstream slope of the dam;
6. significant landslides in the reservoir area; or
7. unusual discharges through the spillway system

all of the following persons and offices should be notified stating that a potential dam emergency exists. If any of the named persons are not available, repeat that a potential dam emergency exists and ask that a representative of that office be sent to the site immediately.

1. Melvin W. Dinger, Pennsylvania Fish Commission Area Manager, Tionesta, Pennsylvania. Phone: 814-755-3524.
2. E. Jon Grindall, P.E., Pennsylvania Fish Commission, Division of Engineering, Bellefonte, Pennsylvania. Business Phone: 814-359-2754. Home Phone: 814-238-3646.
3. J. Leon Kean, Director, Venango County Civil Defense, Franklin, Pennsylvania. Business Phone: 814-437-6871, Extension 225. Home Phone: 814-374-4148.
4. DER Regional Office at Meadville. Telephone 814-724-8550, a 24-hour number.

Further action to be taken will be determined by the above personnel following their on-site investigation. After placing the four telephone calls, the patrolman should return to the site to explain the condition observed.

Although the waterways patrolmen have been assigned responsibility for emergency procedure, any PFC employee observing any of the above conditions should notify the personnel listed above.

#### C. Drawdown for Inspection and Maintenance

Prior to any drawdown, an application must be submitted to the Department of Environmental Resources who in turn may issue a permit for such action. Also, PFC Fisheries Management Section personnel should be consulted to determine if fish salvage operations will be required.

A drawdown conduit is provided at the upstream base of the embankment to allow for dewatering of the reservoir. The drawdown conduit is a 4' square concrete conduit having a metal trash rack along the top of the intake structure and discharging into the fish catch basin. A sluice gate is provided located at the bottom of the vertical riser. The gate is opened by a crank operated from a floor stand located in the vertical riser.

To prevent any internal movement of filter or material on or back of the filter layer, a drawdown rate of approximately one-half (1/2) inch per hour should be maintained. The rate of drawdown should at no time exceed one (1) inch per hour.

The maximum rate of discharge through the conduit is such that the total drawdown can only be accomplished during periods of extreme low inflow into the reservoir area.

## II. INSPECTION AND MAINTENANCE OF DAM

### A. Embankment

The embankment is described in Sections 1.3g and 2.1b1 of "Phase 1 Inspection Report" prepared by Michael Baker, Jr., Inc., Beaver, Pennsylvania, and hereinafter referred to as the "Report".

When inspecting the dam, it is vitally important to constantly watch for occurrences or indications affecting the stability of the embankment and to exercise prompt and effective action to correct such conditions. The following are examples of possible occurrences requiring prompt remedial measures:

1. Unusual settlement or loss of grade or cross section in the embankment.
2. Evidence of seepage through the embankment or foundation as indicated by soft, wet or spongy areas, boils or sloughing of fill materials.
3. Appearance of boils or springs downstream of the dam.
4. Increase in discharge or turbid effluent from the toe area, the conduit or occurrence of seepage in the downstream slopes.

A trapezoidal shaped drain is installed under the downstream toe to collect any seepage that may develop and to conduct this flow safely into the downstream channel. A 6-inch diameter perforated pipe drain runs parallel to the toe in the trench drain and intercepts the toe drain on each side of the outlet conduit, extending to and discharging into the fish catch basin at the termination of the outlet conduit. These two drains will normally be discharging water at all times; however, any increase in flows or evidence of turbidity should immediately be reported to the PFC Division of Engineering office.

Weeds, brush and trees must not be allowed to grow on the embankment. Tree growth must not be permitted to progress along the dam abutments. Rock facings should be inspected for any unusual subsidence and repairs accomplished when necessary. Burrowing animals shall be exterminated whenever found on the embankment and any damage should be immediately repaired. Repairs should be accomplished to the embankment crest as necessary, maintaining the crown to provide for free surface drainage.

#### B. Outlet System

This structure is described in Sections 1.3h and 2.1b2b of the "Report".

An access door provides a means of entrance to the riser for maintenance purposes.

The principal spillway system should be inspected annually; especially after each high velocity discharge has occurred. Inspection of the wet well part of the riser stem and the upstream part of the outlet conduit will necessitate complete drawdown of the lake or use of a diver. This operation can be accomplished only during low inflow into the reservoir area by opening the 36-inch square sluice gate provided for the drawdown purposes. Therefore, this inspection should be done only if the engineer has reason to suspect a problem.

Entrance into the dry part of the structure is possible by proceeding through the conduit from the downstream terminus or through the access manhole located in the top slab. This can be accomplished only when there is no water flowing over the stop logs and because of the normal leakage between the logs, a wet-suit is suggested, even then.

If the latter location is used, it will be necessary to employ a safety sling as a man descends the ladder rungs.

Inspection of the riser and conduit should include observation for spalls or cracks in the concrete walls; special attention should be given to the area of the 90 degree bend for signs of excessive wear of the concrete caused by high velocity flow. The reinforced concrete conduit should be checked for misalignment, settlement or joint failure.

Because of the location of the trash rack, little maintenance is possible or required. If the reservoir is drained for any reason, then maintenance of the trash rack and headwall should be promptly executed, including removal of all debris that has lodged on or inside the trash rack as well as anything that might slide or be washed into the rack as the dam refills. Special care must be taken to insure that all metal or other debris that might prevent complete closure of the sluice gate is removed.

When painting of the trash rack is required, first clean all surfaces thoroughly, then paint with a water resistant material such as Koppers No. 50 or an approved equal. Such coating should be applied cold. If the rack as a whole does not need painting, touch up the rust spots by cleaning thoroughly and painting. Make sure the area inside the trash rack is cleaned of all sand, silt and mud.

#### C. Spillway

The spillway is described in Section 1.3i and 2.1b2a of the "Report".

After each spillway discharge of more than a foot of water passing over the weir, the downstream channel, spillway chute and stilling basin should immediately be cleared of all rocks and debris and the necessary repairs accomplished. Any erosion of the downstream channel should immediately be repaired and reseeded. The reinforced concrete walls and slabs should be checked for spalls, cracks, misalignment, settlement or joint failure.

The downstream channel of the stilling basin and the existing creek channel should be inspected at intervals of not less than 6 months for a distance of not less than 500 yards below the pool. Trees, rubbish, brush, slides or other forms of blockage which will create a damming effect should be removed to prevent back-up of water.

#### D. Sluice Gate and Gate Control

Drawdown of the pool is provided by a 48-inch square concrete conduit which extends from the upstream embankment to the fish catch basin and is part of the outlet system. A 36-inch square sluice gate is mounted at the bottom of the riser under the stop logs. The sluice gate control is placed and may be operated from the operating floor of a room at the top of the riser.

All metal parts should be thoroughly inspected for rusting and corroding or any signs of failure. Metals should be thoroughly cleaned and painted as necessary.

The sluice gate control is supplied with high pressure grease fittings in the operating case and spur gear case. The gates and gate controls should be lubricated with a high-grade pressure grease impervious to water such as Mobile Grease #4 or an approved equal. Lubrication should be performed at intervals which do not exceed six (6) months.

The gate should be opened every six (6) months long enough to flush silt and debris from the conduit. No attempt to flush silt or debris from the reservoir should be made as this would violate the state water quality standards.

Control of the pool elevation is provided by the stop logs located in the vertical riser. Some leakage is to be expected; however, the stop logs should be reset if the leakage is excessive. The stop logs should be checked for rot, cracking or bowing and replaced if defective.

E. Rock Riprap

Riprap is used to prevent erosion and requires little maintenance. Cut all brush and growth in and at least 10 feet beyond the limits of riprapped areas to prevent eventual displacement of the rock, to prevent interference with drainage through the rock and to discourage animal habitation. Replace any displaced rock.

F. Seeding

Seeded areas should be inspected each spring for signs of erosion, bareness and excessive weed growth. These areas should be corrected by filling, mulching and reseeding as necessary.

G. Crownvetch

Crownvetch areas should be inspected each spring for signs of erosion, bareness, excessive weed growth and animal burrows. Excessive weed growth accompanied with lack of crownvetch usually indicates a seepage area. These areas should be corrected by filling, mulching, reseeding and locating the source of seepage as necessary. Crownvetch areas should be mowed at two to three year intervals to help control weed and brush growth and to permit more thorough inspection for burrows.

Maintenance Check List

Submitted by \_\_\_\_\_

Kahle Lake Dam

Date \_\_\_\_\_

Structure		Item to be Checked*	Required Frequency of Check	Description of Correction Required	Date Checked	Date Re-paired
Embankment	Crest, Slopes & Toe Area	Mow Grass	Bi-monthly			
		Mow Crownvetch	Annually			
		Settlement	When Mowed			
		Seepage	When Mowed			
		Boils	When Mowed			
		Burrows	When Mowed			
	Toe Drain	Cut Brush/Trees	As Needed			
		Inc. Discharge	When Mowed			
		Inc. Turbidity	When Mowed			
Crest	Crown	When Mowed				
Outlet System	Wet Well	Concrete	As Directed by Engineer			
		Trash Rack				
	Dry Well	Concrete	Annually			
Spillway	Downstream Channel, Chute & Basin	Rocks, Debris & Erosion	After Each Discharge or Annually			
	Chute & Basin	Concrete	"			
	Downstream & Existing Crk. Channel	Blockage	Bi-Annually			
Sluice Gate & Gate Control	All Metal Parts	Any sign of failure	Annually			
	Gate	Grease & Lub.	Bi-Annually			
	Controls	Open sluice gate	"			
	Stop Logs	Rot, cracking or bowing	"			
Rock Riprap		Cut Brush	Annually			
		Replace rock	As Needed			
Seeding & Crownvetch		Erosion	Each Spring			
		Bareness	"			
		Excessive weeds	"			

\*Refer to O & M Manual for complete instructions.