

**LEVEL II**

①

AD A109100

**SUSQUEHANNA RIVER BASIN  
BRANCH OF BLACKWATER RUN, SULLIVAN COUNTY  
PENNSYLVANIA**

**MAPLE LAKE DAM**

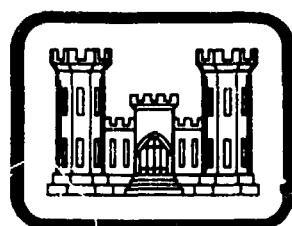
**NDI ID NO. PA-01026  
DER ID NO. 57-38**

**DTIC  
ELECTE  
DEC 31 1981**

**RUSSELL E. HOUK**

**E**

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



Original contains color  
plates: All DTIC reproduct-  
ions will be in black and  
white

Prepared by  
Geo-Technical Services, Inc.  
CONSULTING ENGINEERS & GEOLOGISTS  
851 S. 19th Street  
Harrisburg, Pennsylvania 17104

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

**AUGUST 1981**

DTIC FILE COPY

This document has been approved  
for public release and sale; its  
distribution is unlimited.

**81 12 28 187**

SUSQUEHANNA RIVER BASIN  
BRANCH OF BLACKWATER RUN, SULLIVAN COUNTY  
PENNSYLVANIA

MAPLE LAKE DAM  
NDI ID NO. PA-01026  
DER ID NO. 57-38

RUSSELL E. HOUK

|                    |                                     |
|--------------------|-------------------------------------|
| Accession For      |                                     |
| NTIS GRA&I         | <input checked="" type="checkbox"/> |
| DTIC TAB           | <input type="checkbox"/>            |
| Unannounced        | <input type="checkbox"/>            |
| Justification      | <i>in on file</i>                   |
| By                 |                                     |
| Distribution/      |                                     |
| Availability Codes |                                     |
| Dist               | Special                             |
| A                  |                                     |

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

*DACW31-81-C-0019*

Prepared by  
GEO-Technical Services, Inc.  
Consulting Engineers & Geologists  
851 S. 19th Street  
Harrisburg, Pennsylvania 17104

For  
Department of the Army  
Baltimore District, Corps of Engineers  
Baltimore, Maryland 21203

August 1981

*412431*

## 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 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 reasonable 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.

## TABLE OF CONTENTS

|                                                                              | <u>PAGE</u> |
|------------------------------------------------------------------------------|-------------|
| PREFACE . . . . .                                                            | i           |
| TABLE OF CONTENTS . . . . .                                                  | ii          |
| BRIEF ASSESSMENT OF GENERAL CONDITION AND RECOMMENDED ACTION. .              | iii         |
| OVERVIEW OF MAPLE LAKE DAM . . . . .                                         | vi          |
| <br>                                                                         |             |
| SECTION 1 - GENERAL INFORMATION . . . . .                                    | 1           |
| SECTION 2 - ENGINEERING DATA . . . . .                                       | 5           |
| SECTION 3 - VISUAL INSPECTION . . . . .                                      | 8           |
| SECTION 4 - OPERATIONAL PROCEDURES . . . . .                                 | 11          |
| SECTION 5 - HYDROLOGY AND HYDRAULICS . . . . .                               | 12          |
| SECTION 6 - EVALUATION OF STRUCTURAL STABILITY . . . . .                     | 15          |
| SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL<br>MEASURES. . . . . | 16          |

### APPENDICES

|                                                       |
|-------------------------------------------------------|
| APPENDIX A - VISUAL INSPECTION - CHECKLIST & EXHIBITS |
| APPENDIX B - ENGINEERING DATA - CHECKLIST             |
| APPENDIX C - PHOTOGRAPHS                              |
| APPENDIX D - HYDROLOGY AND HYDRAULICS                 |
| APPENDIX E - EXHIBITS                                 |
| APPENDIX F - GEOLOGY                                  |

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
BRIEF ASSESSMENT OF GENERAL CONDITION  
AND  
RECOMMENDED ACTION

Name of Dam: Maple Lake Dam  
NDI ID No. PA-01026  
DER ID No. 57-38

Size: Small (14.4 feet high; 126.5 acre-feet)

Hazard Classification: High

Owner: Russell E. Houk  
605 Country Club Drive  
Bloomsburg, Pennsylvania 17815

State Located: Pennsylvania

County Located: Sullivan

Stream: Branch of Blackwater Run

Date of Inspection: July 14, 1981

Based on visual inspection, the Maple Lake Dam is judged to be in good condition. Based on the size and the hazard classification of the dam, the recommended Spillway Design Flood (SDF) varies from 1/2 PMF (one-half of the Probable Maximum Flood) to the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam. Under the present conditions, the spillway will pass approximately 37 percent of the PMF. Should the top of the dam be restored to its design elevation, the spillway could pass the SDF without overtopping the dam. Overtopping depth of 0.47 foot and overtopping duration of 2.5 hours were calculated for a flood magnitude of 1/2 PMF. It was judged that Maple Lake Dam could withstand the depth and duration of overtopping for the selected SDF without failure. Nevertheless, continuous overtopping of the dam beyond the present spillway capacity and during flood magnitudes that are larger than the 1/2 PMF could cause severe embankment erosion that may affect the integrity of the embankment. Therefore, the spillway is rated as inadequate but not seriously inadequate.

Although the embankment appears to be in good condition, the displaced riprap on the upstream face of the dam and the brush and trees in the spillway outlet channel on the lower downstream slope and at the toe of the dam indicate that these deficiencies should be remedied and included within the maintenance program for the dam.

The following investigations and remedial measures are recommended for immediate implementation by the owner.

- (1) Raise the top of the dam to its design elevation, so that the capacity of the spillway can be increased to pass the SDF without overtopping the dam.
- (2) Fill in the isolated scarps on the upstream face of the dam with appropriate filter material and replace the dislodged riprap at these locations.
- (3) Remove trees and brush from the spillway outlet channel, the lower downstream slope and the toe of the dam.
- (4) Monitor the rate and clarity of seepage flow at the toe of the dam, as well as the horizontal and vertical extent of the wet area on each side of the outlet pipe. Take appropriate action as required.

All monitoring programs, design, and supervision of remedial measures should be performed by a Professional Engineer, experienced in the design and construction of dams.

In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

- (1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.
- (2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.
- (3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER,

MAPLE LAKE DAM

the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.



Submitted by:

GEO-TECHNICAL SERVICES, INC.

*Gideon Yachin*  
GIDEON YACHIN, P.E.

Date: August 31, 1981

Approved by:

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS

*James W. Peck*  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer  
Date: 10 Sep 81

MAPLE LAKE DAM ( PA-01026 )  
( SPILLWAY AT ARROW )



OVERVIEW

PHASE 1 INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

MAPLE LAKE DAM  
NDI# PA-01026, PENNDER# 57-38

SECTION 1  
GENERAL INFORMATION

1.1 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.

1.2 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.3 Description of Project.

a. Dam and Appurtenances: Maple Lake Dam is an earthfill embankment 14.4 feet high and 283 feet long, excluding spillway. The emergency spillway is located at the left abutment, consisting of an earth channel having a trapezoidal cross section. The bottom width of the spillway at the reservoir outlet is 56 feet. A service spillway, consisting of a 12-inch riser pipe and an 8-inch diameter outlet pipe, is located approximately 100 feet from the right abutment. The outlet works was reported to consist of an 8-inch diameter asbestos cement pipe, extending upstream of the riser pipe to the reservoir and terminating with two sections of an 8-inch diameter vitrified clay pipe, having a concrete plug at the inlet.

b. Location: Maple Lake Dam is located on a branch of Blackwater Run in Elkland Township, Sullivan County, 0.7 mile northeast of State Route 154 at Estella, Pennsylvania. The dam and reservoir are contained within the Overton, Pennsylvania 7.5 Minute Series USGS Quadrangle Map, at Latitude N41°31'07" and Longitude W76°36'55". A Location Map is shown in Exhibit E-1.

c. Size Classification: Small (14.4 feet high, 126.5 acre-feet storage capacity at top of dam).

d. Hazard Classification: High (see paragraph 3.1e).

e. Ownership: Russell E. Houk, 605 Country Club Drive, Bloomsburg, Pennsylvania 17815.

f. Purpose of Dam: Recreation and fire protection.

g. Design and Construction History: Maple Lake Dam was designed by W.R. Stepp, Registered Professional Engineer of Laporte, Pennsylvania. Exhibits E-2, E-3 and E-4 indicate the final revised plans for which a construction permit was issued to Baumunk Lumber Company (the original owner) by the Pennsylvania Water and Power Resources Board on September 9, 1953. Construction started in 1953 under the direction of the design engineer and was completed in August 1954. Although "as-built" drawings are not available, construction specifications, observed deviations from the original design and pertinent correspondence are on file with the Pennsylvania Department of Environmental Resources (PENNDER).

h. Normal Operational Procedure: The pool is maintained at the service spillway crest elevation with excess inflow discharging over the service and emergency spillways into a Branch of Blackwater Run.

1.4 Pertinent Data.

- a. Drainage Area: (square miles) 0.62
- b. Discharge at Damsite: (cfs)
- |                                                      |           |
|------------------------------------------------------|-----------|
| Maximum known flood at damsite since construction    | Not Known |
| Outlet works at normal pool elevation, when operable | 4         |
| Spillway capacity at maximum pool elevation          |           |
| Design Conditions                                    | Not Known |
| Existing Conditions                                  | 624       |
- c. Elevation: (feet above msl) See paragraph 3.1a for Datum
- |                                            |           |
|--------------------------------------------|-----------|
| Top of dam                                 |           |
| Design Conditions                          | 1578.6    |
| Existing Conditions                        | 1578.0    |
| Maximum Pool                               |           |
| Design Conditions                          | 1578.6    |
| Existing Conditions                        | 1578.0    |
| Normal Pool (at crest of service spillway) | 1575.6    |
| Upstream invert outlet works               | Not Known |
| Downstream invert outlet works             | 1563.6    |
| Streambed at toe of dam                    | 1563.6    |
- d. Reservoir Length: (feet)
- |                              |      |
|------------------------------|------|
| Normal Pool                  | 1460 |
| Maximum Pool (at top of dam) | 1560 |
- e. Storage: (acre-feet)
- |                     |           |
|---------------------|-----------|
| Normal Pool         | 76.7      |
| Maximum Pool        |           |
| Design Conditions   | Not Known |
| Existing Conditions | 126.5     |

- f. Reservoir Surface: (acres)
- |                     |           |
|---------------------|-----------|
| Normal Pool         | 16        |
| Maximum Pool        |           |
| Design Conditions   | Not Known |
| Existing Conditions | 17.2      |
- g. Dam:
- Type - Earthfill Embankment
- |                                                                                               |      |
|-----------------------------------------------------------------------------------------------|------|
| Length - (feet) - excluding spillway                                                          | 283  |
| Height (feet)                                                                                 | 14.4 |
| Top Width (feet)                                                                              |      |
| Design Conditions                                                                             | 8.0  |
| Existing Conditions - (varies from 7.5' at the right abutment to 15' near the left abutment). |      |
- Side Slopes
- |                   |         |
|-------------------|---------|
| Design Conditions |         |
| Upstream          | 1V:2.5H |
| Downstream        | 1V:2H   |
- Existing Conditions
- Upstream - Vary from 1V:2H near the right abutment to 1V:3H near the left abutment.
- Downstream - Vary from 1V:3H at the right abutment to 1V:4.5H at the left abutment.
- Zoning - Homogeneous earthfill embankment.
- Cutoff - 6' wide trench, having 1V:1H side slopes and excavated to impervious foundations under the entire length of the embankment.
- Impervious Core
- Foundations - Compacted backfill within cut-off trench.
- Embankment - See Zoning
- Grout Curtain
- |  |      |
|--|------|
|  | None |
|--|------|
- h. Diversion and Regulating Tunnel:
- |  |      |
|--|------|
|  | None |
|--|------|
- i. Spillway:
- Type
- Service Spillway - 12" diameter riser pipe and 8" diameter outlet pipe.
- Emergency Spillway - An earth channel, having a trapezoidal cross sectional area.
- Crest Elevation
- |                                               |        |
|-----------------------------------------------|--------|
| Service Spillway - Top of riser pipe          | 1575.6 |
| Emergency Spillway - At outlet from reservoir | 1575.8 |
| At spillway bridge section                    | 1574.7 |
- Length of Crest (feet)
- |                                                |     |
|------------------------------------------------|-----|
| Service Spillway - circumference of riser pipe | 3.1 |
| Emergency Spillway                             | 56  |

i. (spillway - continued)

Upstream Channel - Bottom slope 3% (upstream of bridge).

Downstream Channel - 3% along the first 18 feet (downstream of bridge), steepening to 8% downstream of the embankment.

j. Outlet Works:

Type - 8-inch diameter transite pipe, extending into the reservoir from the bottom of the riser pipe and terminating with two sections of vitrified clay pipe.

Length (feet)

80

Closure and Regulating Facilities - a concrete plug at the pipe inlet. Release of water by breaking the clay pipe.

Access - From boat (by probing), or by diving.

## SECTION 2

### ENGINEERING DATA

#### 2.1 Design.

a. Data Available: Design data available for review consist of the 1953 drawings, specifications, inspection reports, correspondence and photographs obtained from PENNDER files. Design drawings and photographs depicting conditions during and after construction of the facility are presented in Appendix E.

#### b. Design Features:

(1) Embankment: The dam was designed as a homogeneous earthfill embankment with 1V:2.5H (1 Vertical on 2.5 Horizontal) upstream slope and 1V:2H downstream slope. A cut-off trench with a 6-foot bottom width and 1V:1H side slopes was to be excavated to impervious foundations under the entire length of the embankment and backfilled with compacted earthfill from unspecified borrow sources. Earthfill was to be placed on the cleared, grubbed and stripped embankment foundations in 6-inch lifts and compacted with at least 10 passes of a sheeps foot roller, having a tooth pressure of not less than 500 pounds per square inch, to the required density. Three-inch lifts were to be placed in areas inaccessible by a roller and to be compacted with pneumatic tampers. The upstream slope was to be protected by a minimum of 12-inch riprap, from the top of the embankment crest to a 6-foot vertical distance below the crest, or to a 3-foot vertical distance below the normal pool. The downstream slope was to be seeded. The width of the embankment crest was to be 8 feet.

#### (2) Appurtenant Structures:

(a) Service Spillway: The spillway was to consist of a 12-inch diameter transite pipe riser with crest elevation 3 feet below the top of the dam. An 8-inch diameter transite pipe was to convey spillway discharges into the streambed.

(b) Emergency Spillway: The spillway was to be excavated into hard shale on the left abutment and to consist of a trapezoidal cross sectional area, having a 60-foot wide bottom with a crest elevation at the reservoir outlet being 2.5 feet below the crest of the embankment. The spillway outlet channel was to have a curved alignment with a 60-foot bottom width and a 2% slope, terminating approximately 80 feet from the left bank of the stream and 9 feet above the streambed.

(c) Outlet Works: The outlet works was to consist of an 8-inch diameter transite pipe, extending from the bottom of the service spillway riser pipe into the reservoir for an approximate distance of 27 feet. The entire length of the 8-inch diameter outlet pipe, both upstream and downstream of the riser pipe, was to be encased in 6-inches of concrete. Two anti-seep collars, 8 inches thick and extending 2 feet from the concrete

encasement, were to be located downstream of the cut-off trench. The outlet works inlet was to consist of two sections of VCP (Vitrified Clay Pipe), protruding upstream of the concrete encasement and having a concrete plug.

c. Specific Design Criteria: The emergency spillway design criteria was based on peak discharge of 950 cubic feet per second (cfs) per square-mile drainage area. For the 0.6 square-mile drainage area upstream of the dam, the minimum required spillway discharge capacity was 570 cfs.

## 2.2 Construction Records.

Review of the inspection reports and correspondence indicates that the bottom of the emergency spillway did not terminate in hard shale. The concrete encasement for the 8-inch diameter outlet pipe was limited to that portion of the pipe between the riser and the downstream anti-seep collar. The balance of the pipe was reported to be placed on top of bed-rock. The earth embankment was reported to consist largely of red and yellow clay, intermixed with some sand and gravel. *By carefully controlling the travel of the construction equipment over the embankment and the manner of placing the material, an embankment was produced varying between 91 and 97 percent of the maximum density as determined by the Modified Proctor Density Test.* Due to heavy rains during construction, the reservoir was impounded to approximately 85 percent of its storage capacity on two occasions. Careful examination of downstream conditions by the design engineer failed to disclose any seepage along the outlet pipe or through the embankment.

## 2.3 Operational Records.

There are no formal operational records for the dam.

## 2.4 Other Investigations.

Inspection of the dam on July 6, 1965 indicated a growth of trees and brush on the downstream slope and the toe of the embankment. The trees were removed by the present owner prior to September 1965, as indicated in Exhibit E-6, Appendix E. Assignment of the permit for the dam to the present owners was approved by the Pennsylvania Water and Power Resources Board on October 29, 1965.

## 2.5 Evaluation.

a. Availability of Data: Although "as-built" plans for the dam and appurtenant structures are not available, data obtained from PENNDER files provide information relative to the chronology of construction and deviations of construction features from the original design.

b. Adequacy: In the absence of "as-built" plans and formal construction records, assessment of the structural integrity of the dam and its

safety must be based on the combination of available cited data, visual inspection, performance history, as well as hydrologic and hydraulic analysis (see Section 5).

c. Validity: There is no reason to question the validity of the available data.

### SECTION 3

#### VISUAL INSPECTION

##### 3.1 Observations.

a. General: The overall appearance of the dam is good. Deficiencies observed during the field inspection are noted on the General Plan, Exhibit A-1, and are described in the subsequent paragraphs. The profile and typical sections of the dam are presented in Exhibits A-2, A-3 and A-4 and are based on field survey made on the day of the inspection. The survey datum for this inspection is based on interpolation of the USGS contour map, presented in Exhibit E-1, Appendix E. The elevations shown on the design drawings (Exhibits E-2, E-3 and E-4) are based on a different datum than that of the USGS map. Therefore, to convert the elevations shown on the appended design drawings to the elevations used in this report, it is necessary to add 20 feet to the elevations shown on the appended drawings. On the inspection date (7/14/1981), the lake level was at normal pool which is the crest of the service spillway (elevation 1575.6 above mean sea level). Visible features of the dam and appurtenant structures are depicted in photographs, presented in Appendix C.

b. Embankment: Observations made during the field inspection indicate that the embankment is in good condition. The upstream slope above the normal pool varies from 1V:2H (1 Vertical on 2 Horizontal) near the right abutment to 1V:3H near the left abutment (see Photographs 3, 4, 5, 6, and 8, Appendix C). The downstream slope varies from 1V:3H at the right abutment to 1V:4.5H at the left abutment (see Photographs 5 and 9, Appendix C). The top width of the dam varies from 7.5 feet at the right abutment to 15 feet near the left abutment (see Typical Dam Sections, Exhibit E-3, and Photographs 4, 5, and 9, Appendix C). The top of dam elevation is 1578, which is 2.4 feet higher than the normal pool. Hand placed riprap on the upstream face was reported to extend three feet below the normal pool elevation (see paragraph 2.1b (1)). The riprap is generally in good condition except for 5 limited erosion scarps (12" to 18" high and 24" to 36" wide) where large riprap boulders were displaced. The upper limit of the riprap terminates below the crest of the dam, as shown in Exhibit A-2 and Photograph 8, Appendix C. The visible portion of the upstream slope, the crest of the embankment and most of its downstream slope are grassed and well maintained. Trees and brush are located on the lower slope of the dam and at the toe between the left bank of the stream and the left abutment (see Exhibit A-1 and Photographs 7 and 9, Appendix C). A wet area is located on the lower downstream slope of the dam, extending approximately 10 feet to the left and to the right of the outlet pipe. The upper limit of this wet area forms a near horizontal line on the downstream slope, approximately 1.5 feet above the outlet works invert (see Photograph 7, Appendix C). The total estimated seepage flow from the wet area was 1 GPM (Gallons per Minute). Rock outcrops are visible in the streambed and along the right abutment (see Appendix F).

c. Appurtenant Structures:

(1) Emergency Spillway: The overall appearance of the spillway is good, except for the growth of brush and small trees (up to 8" diameter) downstream of the spillway bridge (see Photograph 5, Appendix C). Spillway design features are described in paragraph 2.1b(2)b and shown in Exhibit E-3, Appendix E. The observed features vary from the design features. The bottom width of the trapezoidal channel at the lake's outlet is 56 feet, rather than the 60-foot width shown in the design drawings. The bottom slope of the channel is 3% along the first 60 feet of its length, steepening to 8% slope, downstream of the embankment (see Exhibit A-4, Appendix A). The appended design drawings indicate a 2% bottom slope along the entire alignment of the spillway. The bottom width of the spillway narrows to a 7-foot wide outlet channel, approximately 70 feet downstream of the aforementioned break in the channel bottom slope. An arch shaped bridge, having a wooden deck over steel beams and supported by 8-inch diameter wooden piles, is located along the dam axis and across the spillway channel (see Exhibit A-2, Appendix A and Appendix D). The bottom of the spillway channel is lined with riprap for a distance of 35 feet upstream of the break in the spillway channel slope (see Exhibit A-4). The crest elevation of the spillway channel at the lake's outlet is 0.2-foot above the normal pool level, which is 2.2 feet below the lowest crest elevation of the dam.

(2) Service Spillway: The design features of this facility are described in paragraph 2.1b(2)(a), and are shown in Exhibit E-4, Appendix E. The existing conditions are presented in Exhibit A-4, Appendix A. There was virtually no flow through the service spillway on the day of the inspection. A trash rack, consisting of steel rods, is located on the top of the riser pipe (see Photograph 6, Appendix C). The outlet pipe and the tailwater at the toe of the dam are shown in Photograph 7, Appendix C. A large number of small (2-inch long) dead fish was found within the first 50-foot stretch downstream of the outlet pipe. It was reported that the lake was stocked with fish just prior to the inspection date. Rainfall on July 13, 1981 raised the lake level above the normal pool, resulting in the transport of the fish through the service spillway into the stream.

(3) Outlet Works: The outlet works design features are described in paragraph 2.1b(2)(c) and are shown in Exhibit E-4, Appendix E. The inlet is reported plugged with concrete. Release of water through the outlet works is by breaking the 8-inch diameter vitrified clay pipe that protrudes from the concrete encasement at the bottom of the reservoir.

d. Reservoir Area: Approximately 50 percent of the 0.6 square mile watershed is wooded. The right abutment is moderately steep, rising from the normal pool level (elevation 1575.6) to elevation 1600 along a distance of 200 feet. The left abutment across the emergency spillway channel does not exceed elevation 1580 for a distance of approximately 200 feet and has a slight depression whose low point is at elevation 1578.2 (see Exhibits A-1 and A-2, Appendix A and Photograph 4, Appendix C). Approximately one acre of ground to the left of the spillway bridge appears to be graded and presumed to result from borrow excavation during the construction of the embankment.

Upstream of Maple Lake Dam an impoundment owned by Keith McCarty is located at the northern part of the watershed (see Exhibit E-1, Appendix E and Photograph 10, Appendix C). McCarty Lake has a surface area of 6.5 acres at normal pool, which is 2 feet below the crest of the dam. The dam is 18 feet high and 600 feet long, excluding spillway. The spillway channel has been filled in and the present spillway capacity is limited to a flow through a 24-inch diameter CMP culvert under the spillway fill. The invert of this culvert is but 0.5-foot above the normal pool. A slotted 6-inch diameter PVC Riser Pipe maintains the normal pool level in the lake. The earthfill dam has steep upstream and downstream slopes (1V:1.5H). The upstream slope has riprap protection and the downstream slope is seeded. The crest of the dam is located immediately upstream of a road, shown in Exhibit E-1 and Photograph 10. Discharges from the dam cross beneath the road through a 24-inch diameter CMP culvert. The low point on the top of the road is approximately 11 feet below the top of the dam. It has been reported (Mrs. Lejedal of the Village of Estella, Telephone (717) 924-3938) that the dam overtopped during the 1972 flood, causing great concern in the Village of Estella.

e. Downstream Channel: The average slope of the stream along the first 1000 feet downstream of Maple Lake Dam is 5.7%. A service road owned by the Maple Lake Camp crosses the stream. The stream crossing consists of a loose rockfill, instead of an open culvert to pass stream flows. From the service road to the confluence with Blackwater Run, the average slope of the stream channel is 5%. The average slope of Blackwater Run below the confluence is 2.5%. At least 10 residences and business establishments are located between the dam and the confluence of Blackwater Run with Kings Creek (see Exhibit E-1 and Photographs 11, 12 and 13, Appendix C).

Survey of the downstream conditions indicates that more than a few lives can be lost and a significant property damage incurred should the dam fail. Consequently, the Maple Lake Dam is classified as a high hazard structure.

## SECTION 4

### OPERATIONAL PROCEDURES

#### 4.1 Normal Operating Procedure.

The reservoir is maintained at normal pool level with the excess inflow discharging over the service spillway into the downstream channel. The upstream control for the outlet pipe is operable by breaking a section of vitrified clay pipe, located at the bottom of the Lake (see also paragraph 2.1b(2)(c)).

#### 4.2 Maintenance of Dam.

The earth embankment is well maintained (see Photographs 5, 6, 8 and 9, Appendix C), except for displaced riprap in five locations on the upstream slope (see paragraph 3.1b) and the trees and brush on the bottom of the downstream slope and at the toe of the embankment. Trees and brush in the spillway outlet channel indicate that the spillway is not properly maintained.

#### 4.3 Maintenance of Operating Facilities.

There are no mechanically operating facilities for the dam. The method of operating the outlet works is described in paragraph 4.1.

#### 4.4 Warning System in Effect.

There is no emergency operation and warning system in effect at the present time.

#### 4.5 Evaluation.

The overall appearance of the dam is good. The maintenance of the spillway outlet channel is inadequate. The owner should institute regularly scheduled maintenance inspections. Findings and subsequent maintenance and repair work should be documented. An emergency operation and warning system and a plan to evacuate downstream population should be instituted by the owner to prevent loss of life resulting from a dam failure. The warning system should account for the off-season periods when the facility is unattended.

## SECTION 5

### HYDROLOGY AND HYDRAULICS

#### 5.1 Design Data.

The permit given by the Pennsylvania Water and Power Resources Board stipulates that the spillway design meets the criteria to pass 950 cfs (cubic feet per second) per square mile of the drainage area above the dam. Consequently, the spillway design capacity for the 0.6-square mile drainage area above the dam was 570 cfs. The drainage area above the dam was verified to be 0.6 square mile.

#### 5.2 Experience Data.

The probable flood of record in Plackwater Run is the June 1972 flood. Flood stages or flow records at the damsite are not available. No records are available on the maximum stage of the reservoir nor to indicate past overtopping of the Maple Lake Dam. Mrs. Russell E. Houk, the owner's wife, stated that during the June 1972 flood, the depth of water in the emergency spillway was approximately 6 inches. Flood marks from the 1972 flood have been reported for the Village of Estella, 1.2 miles downstream of the dam (see paragraph 3.1e).

#### 5.3 Visual Observations.

Based on the visual inspection and field survey, described in Section 3 of this report, the observations relevant to hydrology and hydraulics are evaluated below:

a. Embankment: The present low point on top of the dam is at elevation 1578.0, or 0.6-foot below the design elevation for the top of the dam.

b. Service Spillway: The crest of the 12-inch diameter riser pipe service spillway is at elevation 1575.6. Flow over the riser pipe discharges through an 8-inch diameter outflow pipe into the streambed at the toe of the dam.

c. Emergency Spillway: The crest of the emergency spillway at the reservoir outlet is at elevation 1575.8, or 0.2-foot higher than the normal pool elevation. The emergency spillway crest length is 56 feet, which is the bottom width of the trapezoidal shaped earth channel spillway, having a curved alignment. The bottom slope of the channel is 3% along the first 60 feet of its length, steepening to 8% and terminating 9 feet above the streambed on the left bank of the stream. A bridge spans the spillway along the axis of the dam. The cross section of the spillway channel upstream of the bridge is irregular and the bottom width of the channel is narrower than the length of the spillway crest.

d. Reservoir Area: An upstream impoundment (McCarty Lake) is located at the upper reach of the Maple Lake watershed. McCarty Lake has a surface area of 6.5 acres at normal pool that is maintained by a 6-inch diameter riser pipe. The present spillway consists of a 24-inch diameter corrugated metal pipe whose invert elevation is 0.5-foot above the normal pool. The 650-foot long earthfill dam (including a filled-in spillway channel) is 18 feet high. McCarty Dam was reported to overtop during the 1972 flood. Should this dam fail by overtopping during floods, the outflow resulting from the breached dam would add to the peak inflow into Maple Lake. There are no visible indications to suggest drastic change in the prevailing watershed land use to significantly alter the rate of inflow into Maple Lake during extreme floods.

e. Downstream Conditions: The spillway capacity is not affected by tailwater conditions. Flood stages in the Village of Estella may be affected by the confluence of Blackwater Run with Kings Creek (see paragraph 3.1e). Based on guidelines established for these studies, no consideration was given to the effect of the confluence on the flood stages within the hazard area.

#### 5.4 Method of Analysis.

Hydrologic and hydraulic evaluation was made in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, Phase I Safety Inspection of Dams. The analysis has been performed utilizing the HEC-1DB program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. A brief description of program capabilities, as well as the input and output data used specifically for this analysis, is presented in Appendix D.

#### 5.5 Summary of Analysis.

a. Spillway Design Flood (SDF): According to criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (small) and hazard potential (high) of the Maple Lake Dam is between the one-half Probable Maximum Flood (1/2 PMF) and the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam.

b. Results of Analysis: Pertinent results are tabulated in Appendix D. The analysis reveals that under the prevailing top of dam elevations, the spillway discharge is 624 cfs when the water surface in the reservoir reaches the low point on the dam crest. This condition is equivalent to a flood magnitude of approximately 37 percent of the PMF. Should the top of the dam be restored to its design elevation, the spillway could pass the SDF without overtopping the dam. The maximum rates of inflow and outflow from the reservoir, corresponding to a flood magnitude of PMF, are 1893 and 1884 cfs, respectively. For a flood magnitude of 1/2 PMF, the derived inflow and outflow peak rates are 946 cfs and 878 cfs, respectively. The dam is overtopped by 0.12-foot and 0.47-foot during peak outflow resulting from flood magnitudes of 40% and 50% of the PMF. The duration of overtopping that corresponds to the aforementioned floods is 1 and 2.5 hours, respectively.

#### 5.6 Spillway Adequacy.

It was judged that Maple Lake Dam could withstand the overtopping depth and duration, resulting from the selected SDF, without failure. Therefore, the present spillway capacity is rated as inadequate, but not seriously inadequate.

## SECTION 6

### EVALUATION OF STRUCTURAL STABILITY

#### 6.1 Visual Observations.

The visual inspection of Maple Lake Dam is described in Section 3. Observations that are relevant to the structural stability of the dam and appurtenant structures are evaluated below.

a. Embankment: The downstream slope and the visible part of the upstream slope are stable. The displaced riprap, resulting in five erosion scarps on the upstream slope of the dam, should be repaired to prevent progressive erosion of the slope. The 1 GPM clear seepage, emanating from the wet area at the toe of the dam, does not appear to be detrimental to the stability of the embankment. Should the extent of the wet area and the rate of seepage be increased in the future, additional investigation will have to be made and corrective measures taken, if required.

b. Emergency Spillway: Despite the steep slope of the spillway outlet channel, there is no evidence of erosion on the bottom of the channel, that in time, can undermine the toe of the dam.

c. Service Spillway and Outlet Works: Although computed outlet pipe velocities exceed 10 feet per second, there is no erosion in the streambed that can, in time, undermine the toe of the dam.

#### 6.2 Design and Construction Data.

Available design and construction data are inadequate to assess the present stability of the dam; thus, the evaluation is based on visual inspection.

#### 6.3 Past Performance.

The available data do not indicate any previous occurrences of structural problems in the dam and appurtenances.

#### 6.4 Seismic Stability.

The dam is located in Seismic Zone 1 and may be subject to minor dynamic forces induced by earthquakes. Normally, it can be considered that if a dam is stable under static loading conditions, it can be assumed safe to withstand minor earthquake loading. Although Maple Lake Dam is judged to be structurally stable under the prevailing conditions, no computations were made to evaluate this condition.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety:

(1) Based on visual inspection, the Maple Lake Dam is judged to be in good condition. Based on the size and the hazard classification of the dam, the recommended Spillway Design Flood (SDF) varies from 1/2 PMF (one-half of the Probable Maximum Flood) to the full PMF. Because of the small storage capacity of the reservoir, the 1/2 PMF is selected as the SDF for the Maple Lake Dam. Under the present conditions, the spillway will pass approximately 37 percent of the PMF. If the top of the dam is restored to its design elevation, the spillway could pass the SDF without overtopping the dam. Overtopping depth of 0.47-foot and overtopping duration of 2.5 hours were calculated for a flood magnitude of 1/2 PMF. It was judged that Maple Lake Dam could withstand the depth and duration of overtopping for the selected SDF without failure. Nevertheless, continuous overtopping of the dam beyond the present spillway capacity and during flood magnitudes that are larger than the 1/2 PMF could cause severe embankment erosion that may affect the integrity of the embankment. Therefore, the spillway is rated as inadequate, but not seriously inadequate.

(2) Although the embankment appears to be in good condition, the displaced riprap on the upstream face of the dam and the brush and trees in the spillway outlet channel on the lower downstream slope and at the toe of the dam indicate that these deficiencies should be remedied and included within the maintenance program for the dam.

(3) There is no warning system and evacuation plan in effect at the present time.

b. Adequacy of Information. The data collected from previously cited dam inspection reports, past performance, visual inspection and computations performed as part of this study are sufficient for the Phase I safety assessment, delineated in sub-paragraph a., above.

c. Urgency: The recommendations in Paragraph 7.2 should be implemented as soon as practical or as dictated by the recommended additional investigations that follow.

d. Necessity for Further Investigations: In order to accomplish some of the remedial measures outlined in paragraph 7.2, further investigations will be necessary.

7.2 Recommendations and Remedial Measures.

a. The following investigations and remedial measures are recommended

for immediate implementation by the owner.

(1) Raise the top of the dam to its design elevation so that the capacity of the spillway can be increased to pass the SDF without overtopping the dam.

(2) Fill in the isolated scarps on the upstream face of the dam with appropriate filter material and replace the dislodged riprap at these locations.

(3) Remove trees and brush from the spillway outlet channel, the lower downstream slope and the toe of the dam.

(4) Monitor the rate and clarity of seepage flow at the toe of the dam, as well as the horizontal and vertical extent of the wet area on each side of the outlet pipe. Take appropriate action as required.

All monitoring programs, design, and supervision of remedial measures should be performed by a Professional Engineer, experienced in the design and construction of dams.

b. In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

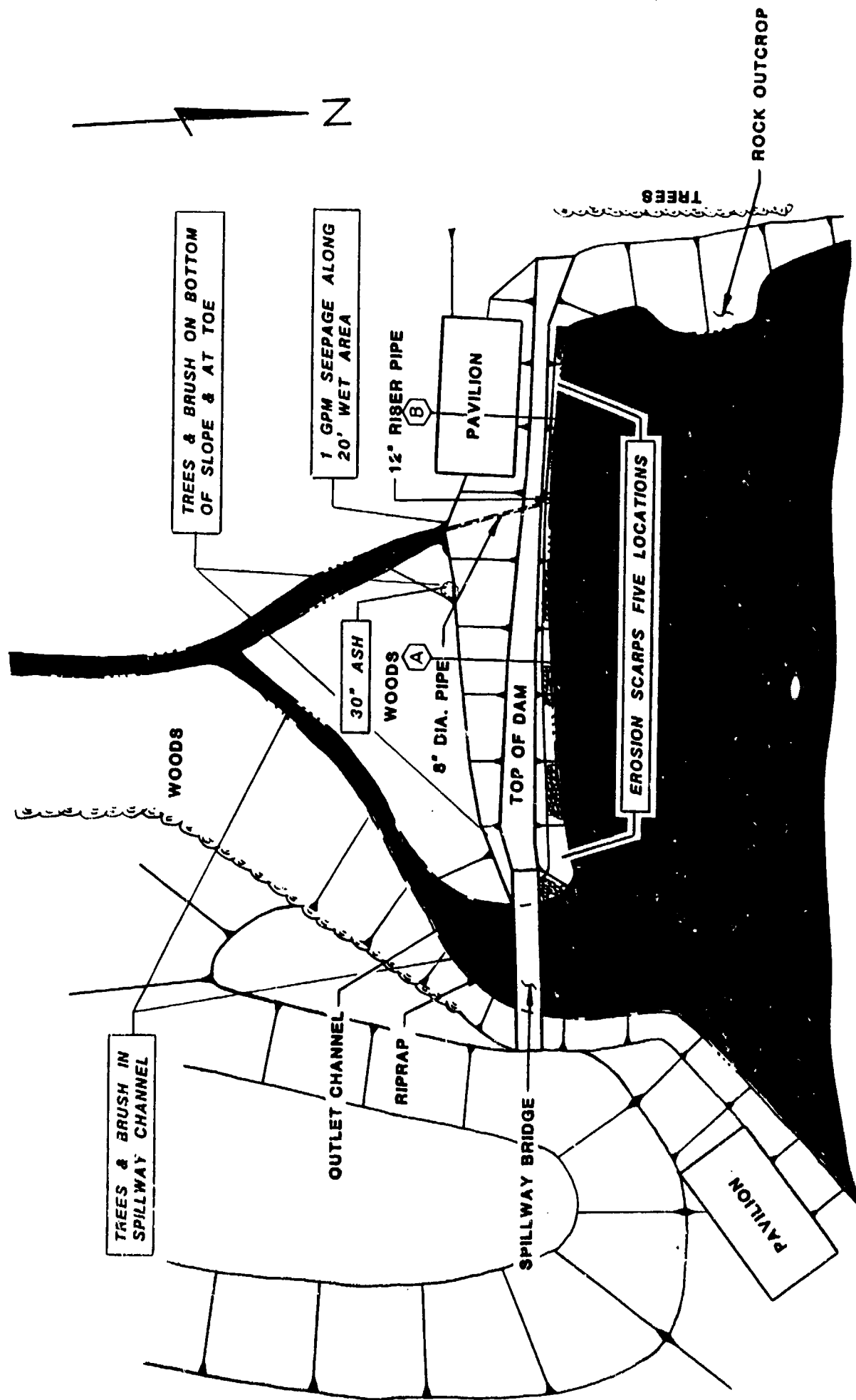
(1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.

(2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.

(3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER, the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.

## **APPENDIX A**

### **VISUAL INSPECTION - CHECKLIST AND FIELD SKETCHES**



MAPLE LAKE DAM  
GENERAL PLAN - FIELD INSPECTION NOTES

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

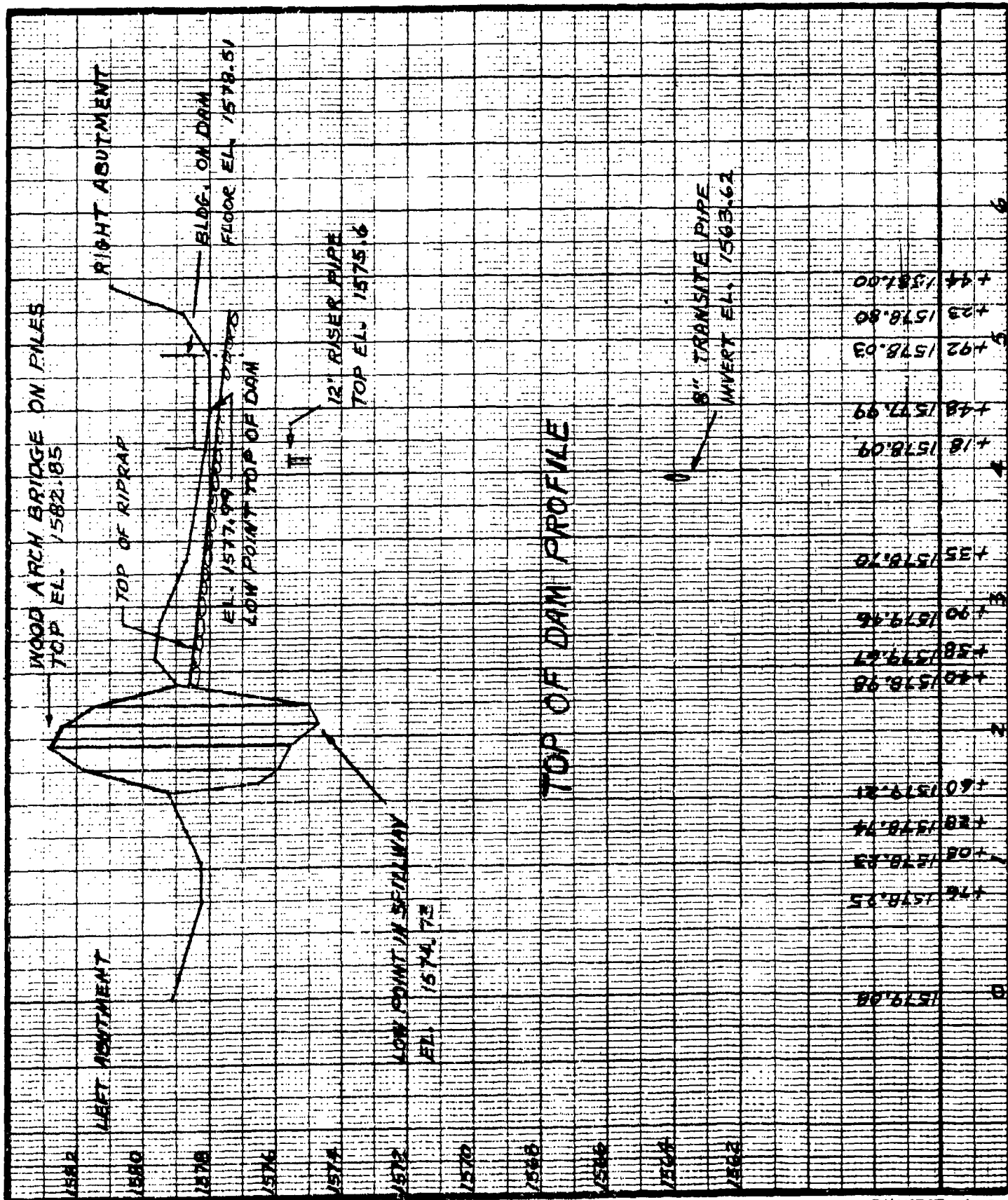
JOB MIDDLE LAKE

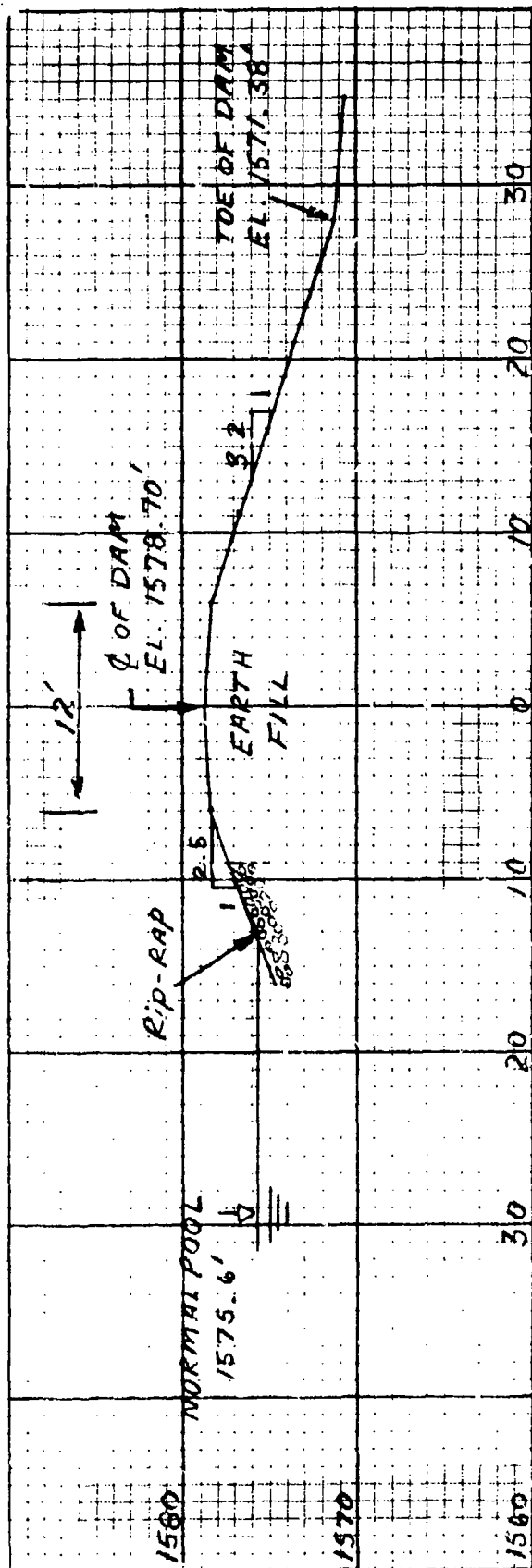
SHEET NO 1 OF 1

CALCULATED BY RJM DATE 7-20-81

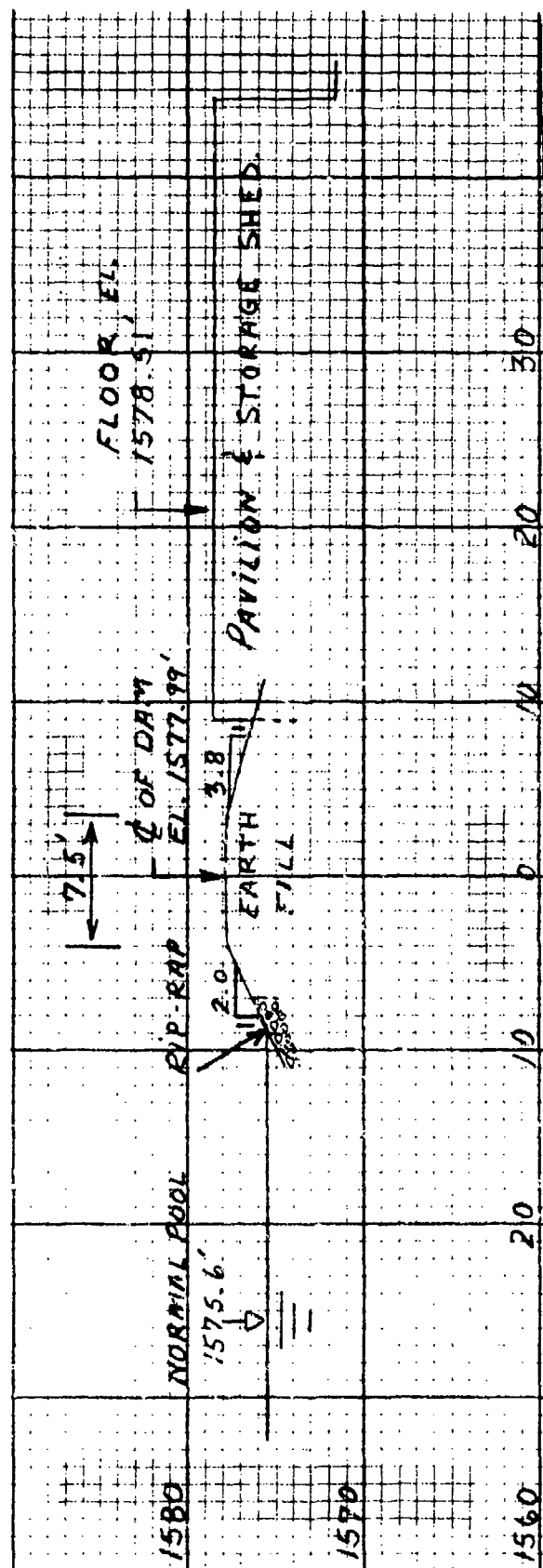
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SCALE HORZ. 1"=100' VERT. 1"=4'



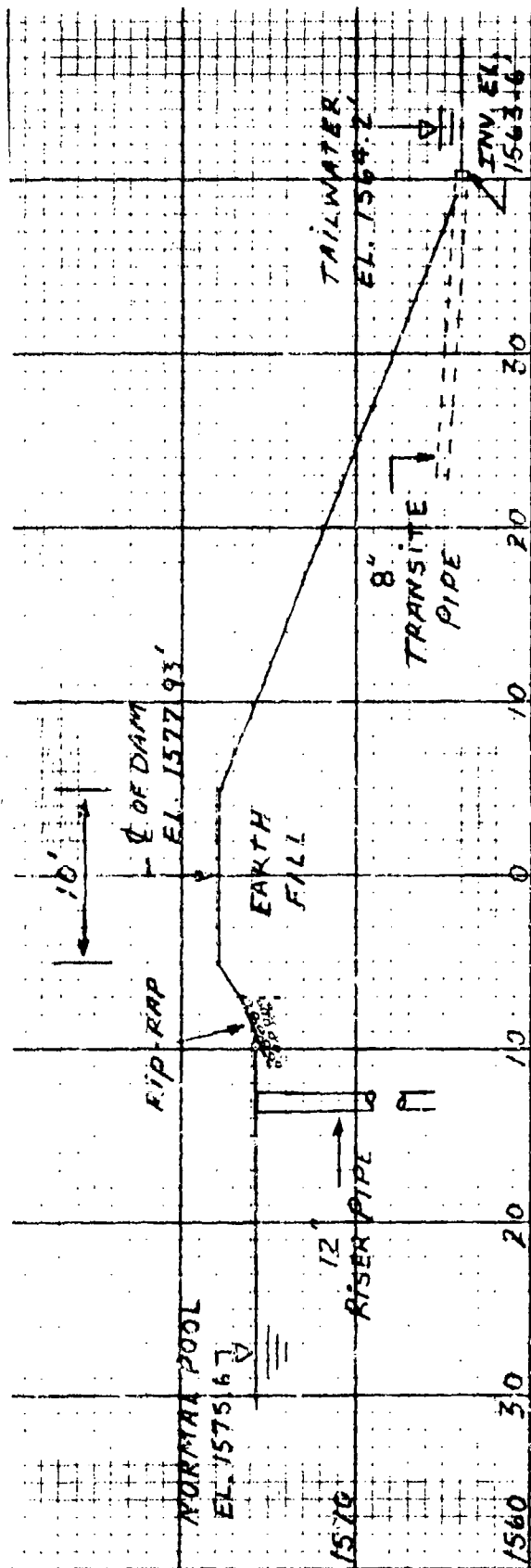


SECTION A

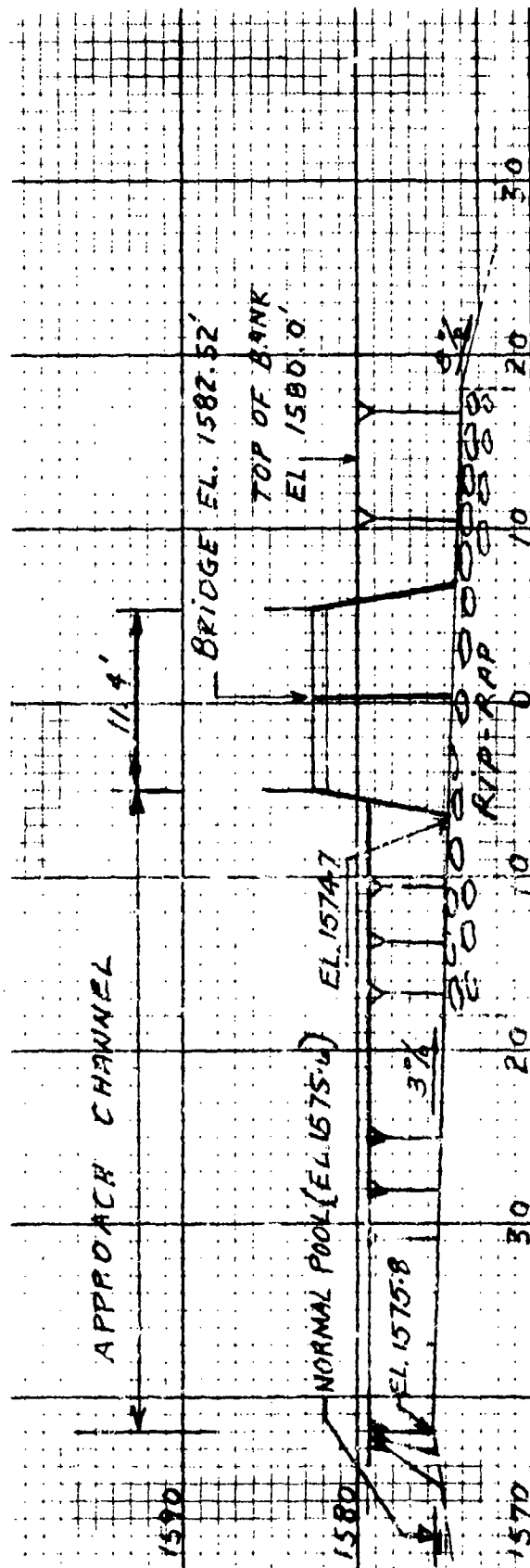


SECTION B

# TYPICAL DAM SECTIONS



### OUTLET WORKS



### SPILLWAY SECTION

# CHECK LIST VISUAL INSPECTION PHASE 1

NAME OF DAM Maple Lake Dam STATE Pennsylvania COUNTY Sullivan

NDI # PA - 01026 PENNDEL # 57-38

TYPE OF DAM Earth Fill SIZE Small HAZARD CATEGORY High

DATE(S) INSPECTION July 14, 1981 WEATHER Partly cloudy TEMPERATURE 26°C @ 11 AM

POOL ELEVATION AT TIME OF INSPECTION 1575.6 M.S.L.

TAILWATER AT TIME OF INSPECTION 1564.2 M.S.L.

## INSPECTION PERSONNEL

J. Diaz, Geologist

G. Yachin, Engineer

R. Mather, Surveyor

## OWNER REPRESENTATIVES

Mrs. Russel E. Houk

## OTHERS

RECORDED BY J. Diaz

# EMBANKMENT

| ITEM                                                   | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                    | NDIN# PA - 01026 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|
| SURFACE CRACKS                                         | None.                                                                                                                                   |                  |
| UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE      | None.                                                                                                                                   |                  |
| SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES | None.                                                                                                                                   |                  |
| VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST         | Good horizontal alignment. For vertical alignment, see Exhibit A-2.                                                                     |                  |
| RIPRAP FAILURES                                        | Riprap in good condition except for five limited erosion scarps (12" - 18" H x 24" - 36" W) where large riprap boulders were displaced. |                  |
| JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM  | Good. No erosion or leakage.                                                                                                            |                  |

# EMBANKMENT

| ITEM                                                     | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                                                                                                                                                                                                                              | NDI# PA - 01026 |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| DAMP AREAS<br>IRREGULAR VEGETATION (LUSH OR DEAD PLANTS) | None.                                                                                                                                                                                                                                                                                                                                             |                 |
| ANY NOTICEABLE<br>SEEPAGE                                | About 10' Right and 10' Left of 8" outlet pipe and 12 to 18" above invert is a horizontal seepage zone (total flow about 1 GPM).                                                                                                                                                                                                                  |                 |
| STAFF GAGE AND<br>RECORDER                               | None.                                                                                                                                                                                                                                                                                                                                             |                 |
| DRAINS                                                   | None.                                                                                                                                                                                                                                                                                                                                             |                 |
| ROCK OUTCROPS                                            | Right Abutment 50-75' Dwnstrm.- at Ground surf. Red shale strike N30-40°W 5-10°SW.<br>" " 50-75' Upstrm.- at Ground surf. Red shale strike NS Dip 10°W.<br>" " 50-75' & 150-200' Upstrm. 6-10' Cliffs of Red shale and fine sandstone strike N 30-40°W Dip 10-15°SW.<br>About 10' Left of outlet pipe, horizontal red shale exposed in creek bed. |                 |
| VEGETATION                                               | Brush and small trees along Lower downstream slope & toe.<br>One 30" Ash Tree at toe 15' Left of outlet pipe.                                                                                                                                                                                                                                     |                 |

# OUTLET WORKS

| ITEM                                                                   | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                                             | NDI# PA - 01026 |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| INTAKE STRUCTURE                                                       | Not visible. Reported to be 8" TC pipe plugged with concrete.                                                                                                    |                 |
| OUTLET CONDUIT<br>(CRACKING AND<br>SPALLING OF CON-<br>CRETE SURFACES) | 8" Dia. Transite pipe. Outlet end is <sup>3</sup> / <sub>4</sub> submerged (no end wall or concrete encasement). Total discharge including seeps is about 2 GPM. |                 |
| OUTLET STRUCTURE                                                       | None.                                                                                                                                                            |                 |
| OUTLET CHANNEL                                                         | Natural wooded stream channel.                                                                                                                                   |                 |
| GATE(S) AND OPER-<br>ATIONAL EQUIPMENT                                 | None.                                                                                                                                                            |                 |
|                                                                        |                                                                                                                                                                  |                 |

# EMERGENCY SPILLWAY

| ITEM                             | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                                                                        | NDI# PA - 01026 |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TYPE AND CONDITION               | Excavated earth channel with dumped stone bottom (50'+ W x 35' L) and earth slopes. Good condition except for growth of brush and small trees to 8" Dia. downstream of spillway bridge.     |                 |
| APPROACH CHANNEL                 | Grass and weed filled channel widens from about 50' at dam centerline to about 60' wide 20' upstream.                                                                                       |                 |
| SPILLWAY CHANNEL AND SIDEWALLS   | Earth slopes (1 V on 3 H) covered with brush, weeds and small trees to 8" Dia.                                                                                                              |                 |
| STILLING BASIN PLUNGE POOL       | None.                                                                                                                                                                                       |                 |
| DISCHARGE CHANNEL                | Excavated earth channel with dumped stone bottom narrowing from 50' to about 10' wide in a distance 70' downstream of dam centerline. Dense brush and trees to 8" dia. in channel & slopes. |                 |
| BRIDGE AND PIERS EMERGENCY GATES | An arched wooden bridge (Four 8" Dia. wood piers upstream and downstream, 12" wide plank deck, 8" H steel I beams) Clearance 5.5-6.0'. Top of deck is about 4' above top of dam.            |                 |

# **SERVICE SPILLWAY**

| ITEM               | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                                               | NDIN PA - 01026 |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| TYPE AND CONDITION | A 12" Dia. Transite riser pipe near center of dam (see Exhibit A-1) with 3/4" steel rod grating connected to 8" Dia. Transite outlet pipe. Both in good condition. |                 |
| APPROACH CHANNEL   | None.                                                                                                                                                              |                 |
| OUTLET STRUCTURE   | None.                                                                                                                                                              |                 |
| DISCHARGE CHANNEL  | Natural wooded stream channel.                                                                                                                                     |                 |
|                    |                                                                                                                                                                    |                 |
|                    |                                                                                                                                                                    |                 |

# INSTRUMENTATION

| ITEM                     | OBSERVATIONS/REMARKS/RECOMMENDATIONS | NDI# PA - 01026 |
|--------------------------|--------------------------------------|-----------------|
| MONUMENTATION<br>SURVEYS | None.                                |                 |
| OBSERVATION WELLS        | None.                                |                 |
| WEIRS                    | None.                                |                 |
| PIEZOMETERS              | None.                                |                 |
| OTHERS                   |                                      |                 |
|                          |                                      |                 |

# RESERVOIR AREA AND DOWNSTREAM CHANNEL

| ITEM                                                  | OBSERVATIONS/REMARKS/RECOMMENDATIONS                                                                                                                                                         | NDH PA - 01026 |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| SLOPES:<br>RESERVOIR                                  | Right side: steep wooded slopes with near horizontal bedrock outcrops.<br>Left side & Upstream: wooded gentle slopes. There are no slope conditions that could affect the safety of the dam. |                |
| SEDIMENTATION                                         | None.                                                                                                                                                                                        |                |
| DOWNSTREAM CHANNEL<br>(OBSTRUCTIONS,<br>DEBRIS, ETC.) | Natural wooded channel.                                                                                                                                                                      |                |
| SLOPES:<br>CHANNEL<br>VALLEY                          | Moderate slopes (1V on 3H) in natural wooded channel.                                                                                                                                        |                |
| APPROXIMATE NUMBER<br>OF HOMES AND<br>POPULATION      | About 10 residences, a sawmill, a repair shop and a nursing home.<br>(see table on the following sheet).                                                                                     |                |
|                                                       |                                                                                                                                                                                              |                |

### DESCRIPTION OF DOWNSTREAM HAZARD

| <u>DISTANCE<br/>DOWNSTREAM<br/>OF DAM (FT)</u> | <u>DESCRIPTION OF BUILDINGS</u>                          | <u>PROXIMITY TO STREAM</u> |                                   |
|------------------------------------------------|----------------------------------------------------------|----------------------------|-----------------------------------|
|                                                |                                                          | <u>DISTANCE<br/>FEET</u>   | <u>HEIGHT ABOVE<br/>STREAMBED</u> |
| 5000                                           | Mobile Home                                              | 200 Left                   | 4'                                |
| 6100                                           | 2-Story Green Residence                                  | 20 Right                   | 9.8'                              |
| 6200                                           | * L & H Lumber Co. - Main Bldg.                          | 50 Left                    | 7.0'                              |
| 6200                                           | 2-Story White Dwelling                                   | 50 Right                   | 7.0'                              |
| 6500                                           | * 1½ Story Green Dwelling                                | 30 Right                   | 9.5'                              |
| 6650                                           | 1½ Story Repair Shop                                     | 30 Right                   | 8.0'                              |
| 6700                                           | Mobile Home                                              | 30 Right                   | 6.5'                              |
| 6700 - 6900                                    | 3 Homes                                                  | 50 to 150 Right            | 10.0'±                            |
| 7000                                           | Darway Nursing Home below<br>confluence with Kings Creek | 160 Right                  | 15.0'±                            |

\* Reported to be flooded in the 1972 flood.

## **APPENDIX B**

### **ENGINEERING DATA - CHECKLIST**

**CHECK LIST  
ENGINEERING DATA  
PHASE I**

NAME OF DAM Maple Lake Dam

| ITEM                                            | REMARKS                                                                                                                                                                     | NDIN PA - 01026 |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| PERSONS INTERVIEWED<br>AND TITLE                | Mrs. Russel E. Houk, Owner's wife                                                                                                                                           |                 |
| REGIONAL VICINITY<br>MAP                        | See Exhibit E-1, Appendix E                                                                                                                                                 |                 |
| CONSTRUCTION<br>HISTORY                         | Designed by W.R. Stepp, Registered Professional Engineer, in 1952.<br>Construction started in 1953 under the direction of the design<br>engineer and was completed in 1954. |                 |
| AVAILABLE DRAWINGS                              | See Exhibits E-2, E-3 and E-4, Appendix E                                                                                                                                   |                 |
| TYPICAL DAM<br>SECTIONS                         | For typical sections obtained by survey (7/14/1981), see Appendix A                                                                                                         |                 |
| OUTLETS<br>PLAN<br>DETAILS<br>DISCHARGE RATINGS | For design drawings, see Appendix E. For existing conditions,<br>see Appendix A                                                                                             |                 |

**CHECK LIST  
ENGINEERING DATA  
PHASE I  
(CONTINUED)**

| ITEM                                                                                          | REMARKS                                                                                                               | NDIN PA 01026 |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------|
| SPILLWAY<br>PLAN<br>SECTION<br>DETAILS                                                        | For design drawings see Appendix E. For existing conditions, see Appendix A.                                          |               |
| OPERATING EQUIP<br>MENT PLANS AND<br>DETAILS                                                  | Not applicable (no operating equipment)                                                                               |               |
| DESIGN REPORTS                                                                                | None available                                                                                                        |               |
| GEOLOGY REPORTS                                                                               | None available. For general geologic description of the dam site, see Appendix F.                                     |               |
| DESIGN COMPUTATIONS:<br>HYDROLOGY AND<br>HYDRAULICS<br>STABILITY ANALYSES<br>SEEPAGE ANALYSES | None available other than noted. 1952 design criteria reported as 950 cfs per square mile of drainage area above dam. |               |
| MATERIAL<br>INVESTIGATIONS:<br>BORING RECORDS<br>LABORATORY TESTING<br>FIELD TESTING          | None available                                                                                                        |               |

**CHECK LIST  
ENGINEERING DATA  
PHASE I  
(CONTINUED)**

| ITEM                                                       | REMARKS                                                                                                           | NDIN PA - 01026 |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------|
| BORROW SOURCES                                             | Not known. Approximately one acre on the left abutment appears to be graded, indicating possible borrow source.   |                 |
| POST CONSTRUCTION<br>DAM SURVEYS                           | None available prior to 1981. For conditions on 7/14/81, see top of dam profile and typical sections, Appendix A. |                 |
| POST CONSTRUCTION<br>ENGINEERING<br>STUDIES AND<br>REPORTS | 1965 dam inspection report                                                                                        |                 |
| HIGH POOL RECORDS                                          | No formal records are available                                                                                   |                 |
| MONITORING SYSTEMS                                         | None                                                                                                              |                 |
| MODIFICATIONS                                              | None since construction. For reported design deviations, see paragraph 2.2, Section 2.                            |                 |

**CHECK LIST  
ENGINEERING DATA  
PHASE I  
(CONTINUED)**

| ITEM                                                    | REMARKS                                                                                 | NDIR PA - 01026 |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------|
| PRIOR ACCIDENTS OR<br>FAILURES                          | Not reported                                                                            |                 |
| MAINTENANCE<br>RECORDS<br>MANUAL                        | None available                                                                          |                 |
| OPERATION<br>RECORDS<br>MANUAL                          | None available                                                                          |                 |
| OPERATIONAL<br>PROCEDURES                               | Self-regulating.                                                                        |                 |
| WARNING SYSTEM<br>AND/OR<br>COMMUNICATION<br>FACILITIES | Not provided                                                                            |                 |
| MISCELLANEOUS                                           | Overtopping of an upstream dam (McCourtly Dam) was reported during the June 1972 flood. |                 |

**CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA**

NDI ID # PA-01026  
PENNER ID # 57-38

SIZE OF DRAINAGE AREA: 0.62 square mile  
ELEVATION TOP NORMAL POOL 1575.6 STORAGE CAPACITY 76.7 acre-feet  
ELEVATION TOP FLOOD CONTROL POOL NA STORAGE CAPACITY NA  
ELEVATION MAXIMUM DESIGN POOL 1578.6 STORAGE CAPACITY Unknown  
ELEVATION TOP DAM: 1578.0 STORAGE CAPACITY: 126.5 acre-feet

| SPILLWAY DATA             | SERVICE SPILLWAY             | EMERGENCY SPILLWAY                 |
|---------------------------|------------------------------|------------------------------------|
| CREST ELEVATION:          | <u>1575.6</u>                | <u>1575.8</u>                      |
| TYPE:                     | <u>12" Dia. Riser Pipe</u>   | <u>Trapezoidal Earth Channel</u>   |
| CREST LENGTH:             | <u>3.14' (circumference)</u> | <u>56 feet</u>                     |
| CHANNEL LENGTH:           | <u>45' of 8" Dia. Pipe</u>   | <u>140' approx. (Total Length)</u> |
| SPILLOVER LOCATION:       | <u>Near right abutment</u>   | <u>Left abutment</u>               |
| NUMBER AND TYPE OF GATES: | <u>None</u>                  |                                    |

**OUTLET WORKS**

TYPE: 8" diameter transite pipe  
LOCATION Extending upstream of riser pipe  
ENTRANCE INVERTS: Not known  
EXIT INVERTS: Elevation 1563.6  
EMERGENCY DRAWDOWN FACILITIES: Two sections of 8" dia. VCP, plugged at inlet. Operable by breaking.

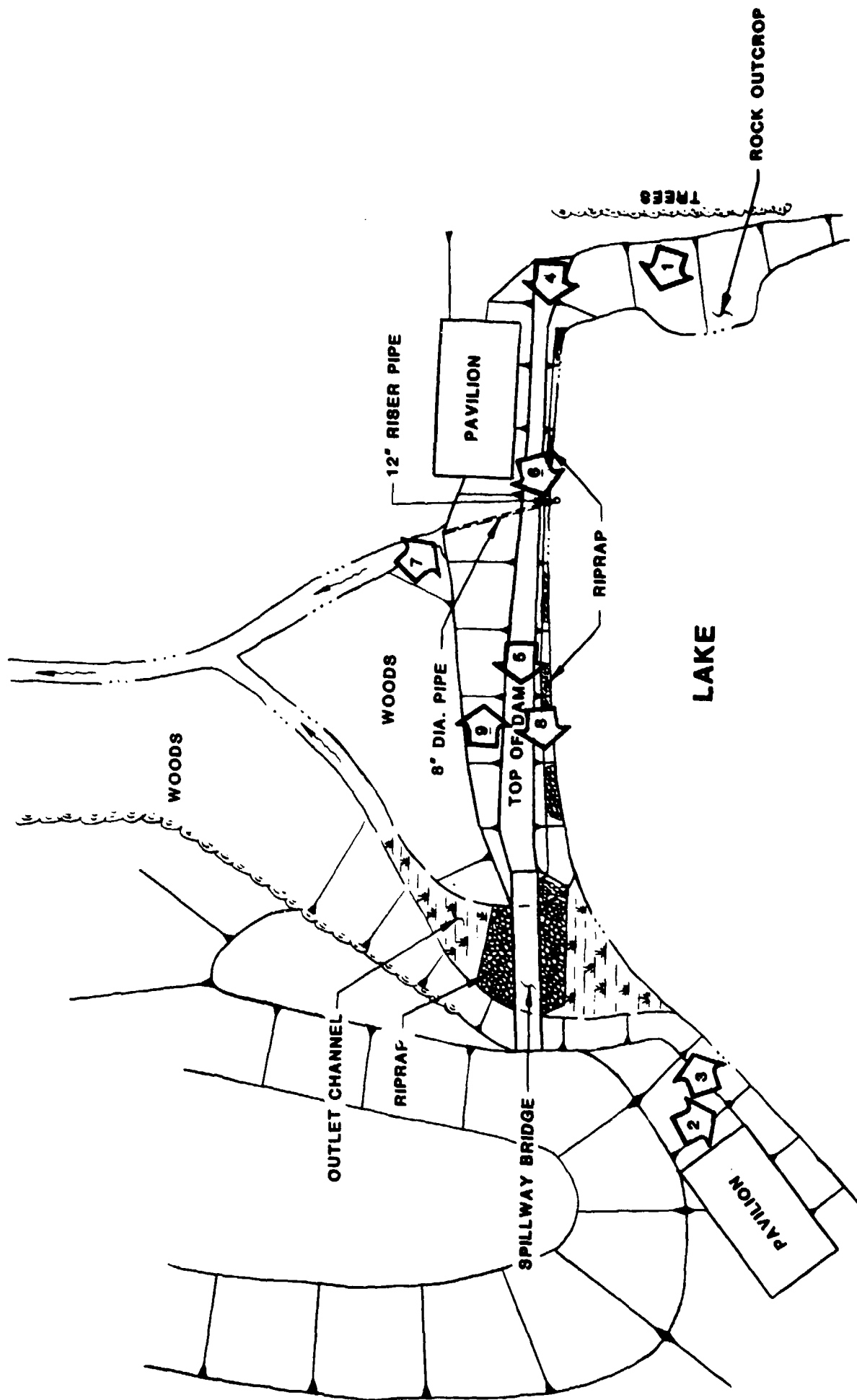
**HYDROMETEOROLOGICAL GAGES**

TYPE: None  
LOCATION: NA  
RECORDS: NA

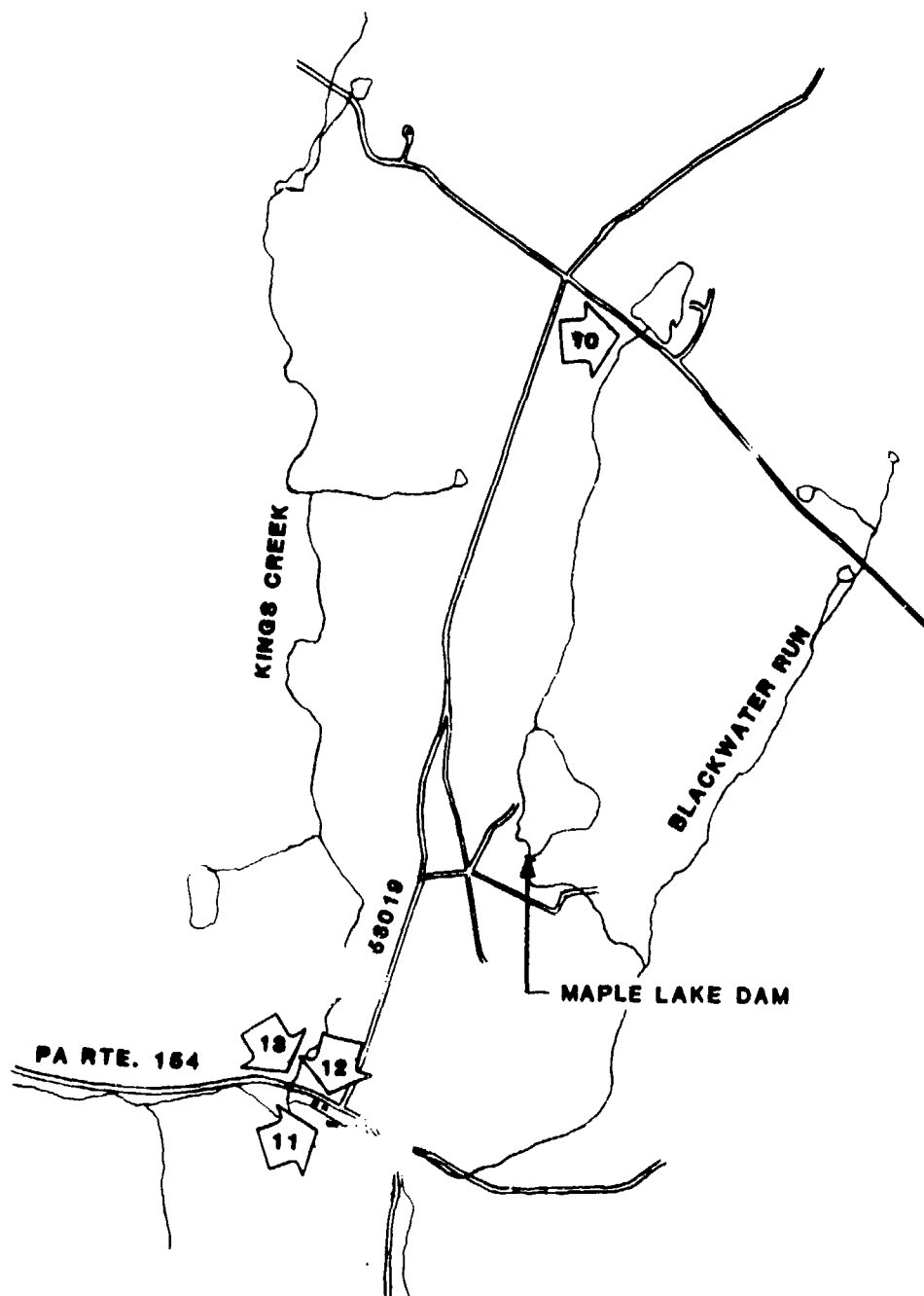
MAXIMUM NON-DAMAGING DISCHARGE: 624 cfs

**APPENDIX C**

**PHOTOGRAPHS**



**MAPLE LAKE DAM  
PHOTOGRAPHS LOCATION MAP**



**MAPLE LAKE DAM  
UPSTREAM & DOWNSTREAM PHOTOGRAPHS LOCATION MAP**



SPILLWAY BRIDGE

TOP OF RISER PIPE

SPILLWAY OUTLET CHANNEL

BLACKWATER RUN

1. AERIAL VIEW OF DAM (12/01/1980)



2. UPSTREAM VIEW OF MAPLE LAKE (7/14/1981)



3. UPSTREAM FACE OF DAM (SHOWING SEASONAL USE OF LAKE)



5. SPILLWAY BRIDGE WITH TREE CHOKED OUTLET ON RIGHT



4. VIEW OF DAM FROM RIGHT ABUTMENT

EMERGENCY SPILLWAY

SERVICE SPILLWAY  
(TOP OF 12" DIA. RISER)



6. UPSTREAM SLOPE OF DAM (FACING LEFT ABUTMENT)



8" DIA. PIPE

7. DOWNSTREAM EMBANKMENT SLOPE  
OUTLET WORKS IN FOREGROUND  
(WET AREA 20' LONG & 1.5' ABOVE INVERT)

EMERGENCY SPILLWAY



8. UPSTREAM SLOPE OF DAM  
(SHOWING UPPER LIMIT OF RIPRAP)



9. DOWNSTREAM SLOPE OF MAPLE LAKE DAM  
(FACING RIGHT ABUTMENT)



10. McCARTY LAKE AND DAM  
UPSTREAM VIEW FROM LEFT ABUTMENT  
(THIS DAM IS LOCATED UPSTREAM OF MAPLE LAKE)

| PHOTO<br>NO. | DOWNSTREAM HAZARD    |                           |
|--------------|----------------------|---------------------------|
|              | DISTANCE<br>FROM DAM | HEIGHT ABOVE<br>STREAMBED |
| 11.          | 6,200'               | 7'                        |
| 12.          | 6,700'               | 6.5' - 9.5'               |
| 13.          | 6,900'               | 10' - 11'                 |



11. L & H LUMBER CO., FACING UPSTREAM  
(LUMBER STACKS ON LEFT STREAM, HOMES  
IN BACKGROUND ARE ON THE RIGHT BANK)



12. VILLAGE OF ESTELLA (STREAM IS  
BEHIND TRAILER, RIGHT OF PHOTO)



13. VILLAGE OF ESTELLA (DOWNSTREAM OF  
PHOTO 12; STREAM IS 150' RIGHT OF HOME)

**APPENDIX D**

**HYDROLOGY AND HYDRAULICS**

SUMMARY DESCRIPTION  
OF  
FLOOD HYDROGRAPH PACKAGE (HEC-1)  
DAM SAFETY INVESTIGATIONS

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the over-topping potential of the dam, and (2) estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam over-topping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would over-top the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

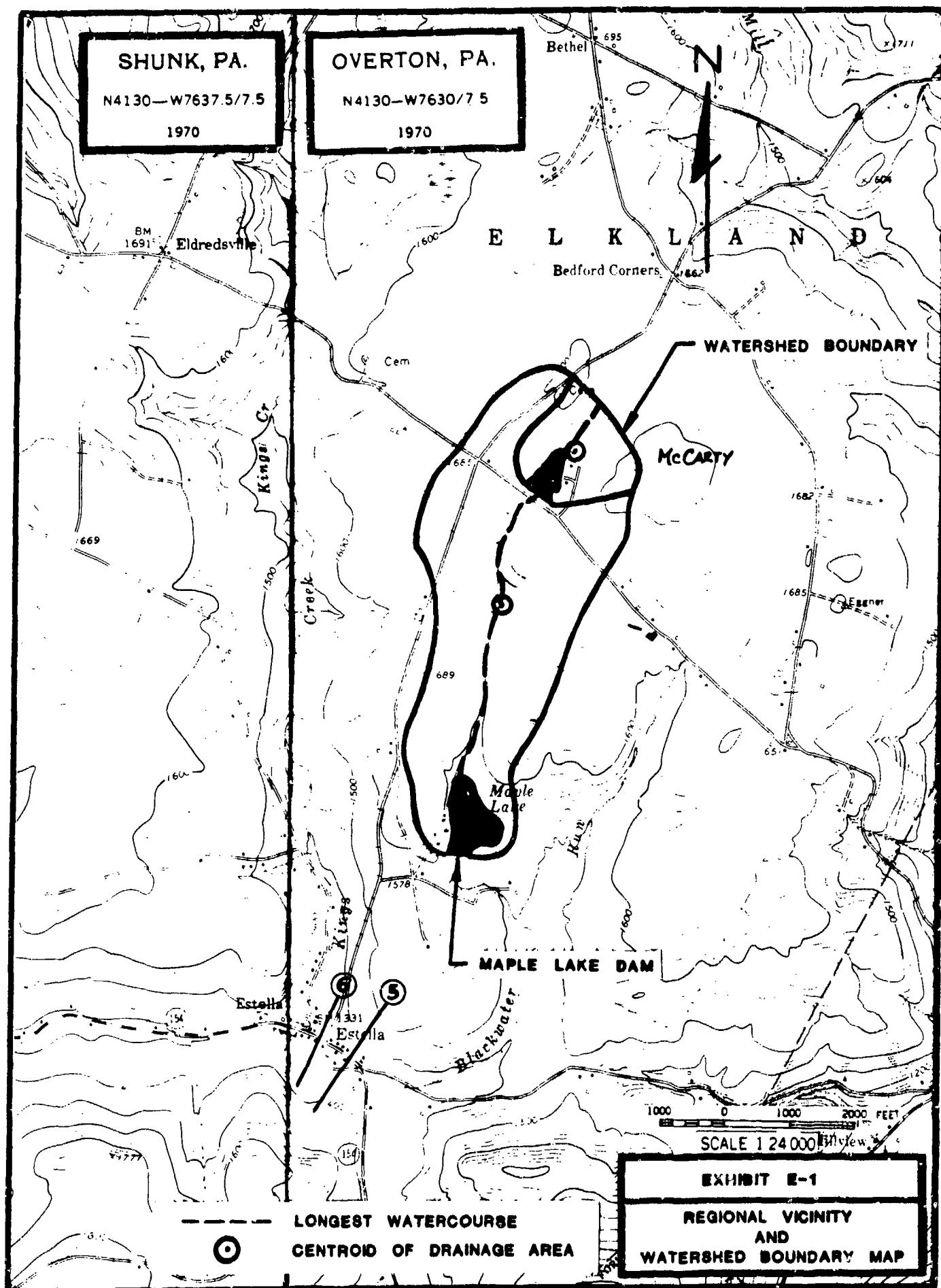
The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program, refer to the Users Manual for the Flood Hydrograph Package (HEC-1), Dam Safety Investigations prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB MAPLE LAKE TA-1026  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY WEH DATE 7/22/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

- 1.) GENERATE HYDROGRAPH FOR MCCARTY LAKE (SUB-AREA 1)
- 2.) ROUTE THRU MCCARTY LAKE
- 3.) ROUTE TO MAPLE LAKE
- 4.) GENERATE HYDROGRAPH FOR SUB-AREA 2
- 5.) COMBINE HYDROGRAPHS
- 6.) ROUTE THRU MAPLE LAKE



**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY sfm DATE 5/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

**GENERAL DATA - MAPLE LAKE DAM**

|               |                |
|---------------|----------------|
| RIVER BASIN   | SESQUEHANNA    |
| STREAM NAME   | BLACKWATER RUN |
| NDI I.D. NO   | PA - 1026      |
| DER I.D. NO   | 57-038         |
| OWNER         | R.E. HOUK      |
| LOCATION      | ELKLAND TWP.   |
| CO.           | SULLIVAN       |
| QUAD.         | OVERTON        |
| LAT.          | 41° 31' 07"    |
| LONG.         | 76° 36' 55"    |
| SIZE          | SMALL          |
| HAZARD        | HIGH           |
| DRAINAGE AREA | 0.62 Sq. Mi.   |

**Watershed Features**

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB MAPLE LAKE PA.-1026  
SHEET NO \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY WEH DATE 7/28/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

MAPLE LAKE DAM

DRAINAGE BASIN & UNIT HYDROGRAPH DATA

DRAINAGE AREA 0.53 Sq. Mi.

SNYDER UNIT HYDROGRAPH COEFFICIENTS  
AS SUPPLIED BY BALT. DIST. COE (SUSQUEHANNA BASIN ZONE 17)

$$C_p = 0.05$$

$$C_t = 1.13$$

$$\text{LAG TIME} = T_p = C_t (L \times L_{cr})^{0.3}$$

$$L = 1.13 \text{ mi.}$$

RESERVOIR OUTLET TO DRAINAGE DIVIDE

$$L_{cr} = 0.76 \text{ mi}$$

RESERVOIR OUTLET TO CENTROID

$$\therefore T_p = 1.13 (1.13 \times 0.76)^{0.3} = 1.08 \text{ HRS}$$

RAINFALL DATA

PER HYDROMETEOROLOGICAL REPORT No. 40

PMF RAINFALL = 22.2" (24 HR & 200 Sq. Mi.)

GEOGRAPHIC ADJUSTMENT FACTOR = 0.99

$$\therefore \text{PMP} = 22.2 \times 0.99 = \underline{22.0"} \underline{\underline{\quad}}$$

RAINFALL DISTRIBUTION

|       |      |
|-------|------|
| 6 HR  | 118% |
| 12 HR | 127% |
| 24 HR | 136% |
| 48 HR | 142% |

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB MAPLE LAKE TA-1026  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY WEH DATE 7/28/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

MAPLE LAKE (CONT.)

DAM DATA

TOP OF DAM ELEV. (LOW POINT) 1578.0  
DAM LENGTH (INC. SPILLWAY) 370'  
DAM HEIGHT 14.4'  
DAM WIDTH VARIES

NON-LEVEL DAM

| LENGTH<br>OF DAM | BELOW<br>ELEV. |
|------------------|----------------|
| 0'               | 1578.0         |
| 42'              | 1578.1         |
| 185'             | 1578.7         |
| 205'             | 1579.0         |
| 253'             | 1579.4         |
| 292'             | 1579.6         |
| 295'             | 1580           |
| 303'             | 1581           |

SPILLWAY DATA

COMPUTE RATING CURVE & INPUT DIRECTLY

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY G.Y. DATE 7/23/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

MAPLE LAKE DAM

SPILLWAY RATING TABLE

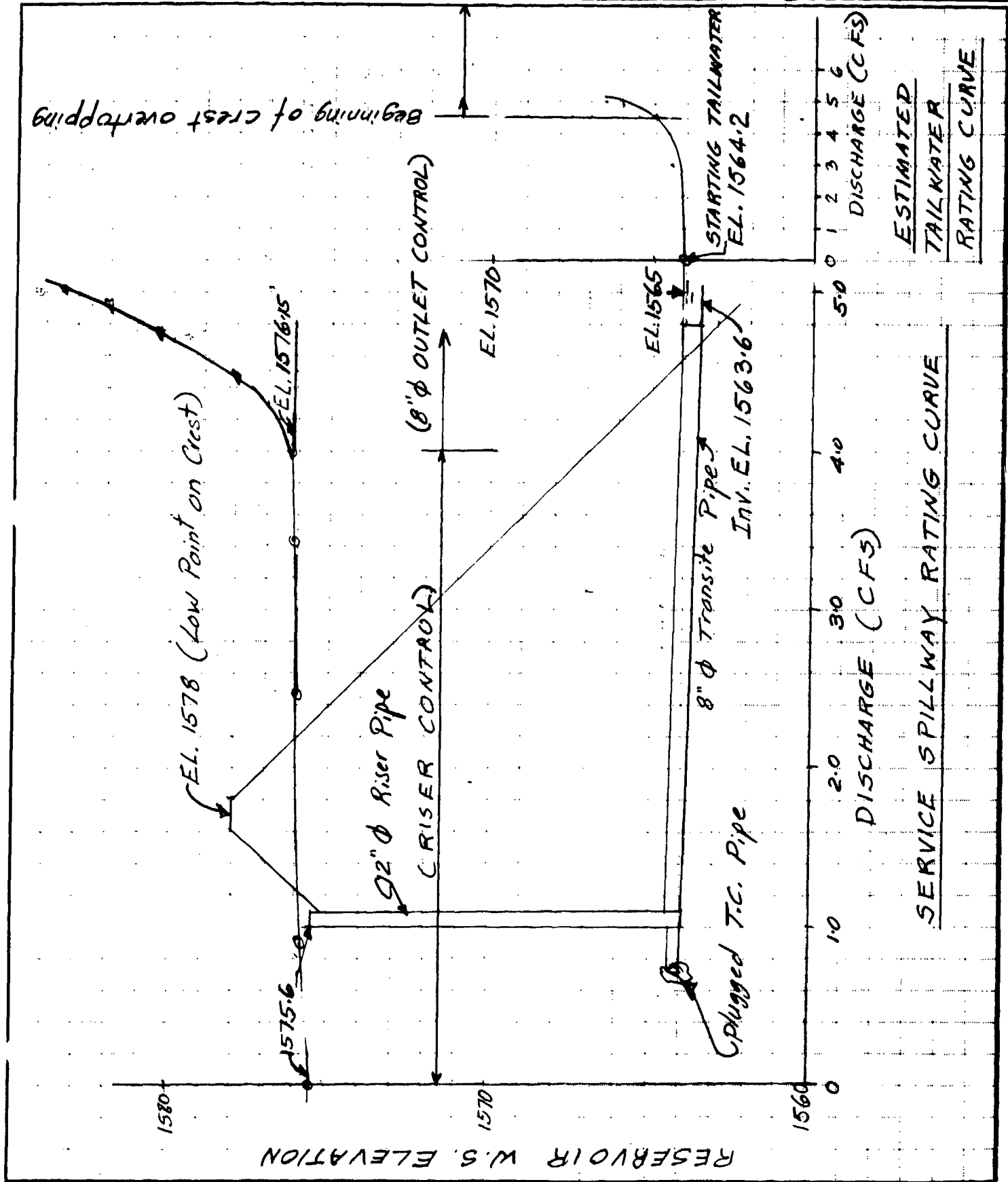
| RESERVOIR<br>W.S. ELEV.<br>(FEET) | DISCHARGE (CFS)     |                       |                  |       |
|-----------------------------------|---------------------|-----------------------|------------------|-------|
|                                   | SERVICE<br>SPILLWAY | EMERGENCY<br>SPILLWAY | BANK<br>OVERFLOW | TOTAL |
| 1575.60                           | 0                   | 0                     | 0                | 0     |
| 1575.80                           | 0.9                 | 0                     | 0                | 0.9   |
| 1576.10                           | 3.5                 | 28.5                  | 0                | 32    |
| 1576.40                           | 4.2                 | 81.4                  | 0                | 85    |
| 1577.00                           | 4.3                 | 259.8                 | 0                | 264   |
| * 1578.00                         | 4.4                 | 619.6                 | 0                | 624   |
| 1578.20                           | 4.5                 | 649.6                 | 0                | 704   |
| 1578.80                           | 4.6                 | 899.5                 | 53               | 957   |
| 1579.00                           | 4.6                 | 1130.5                | 120              | 1255  |
| 1580.00                           | 4.7                 | 1340.5                | 1820             | 2145  |
| 1581.00                           | 4.8                 | 1505.5                | 2300             | 3810  |
| 1582.00                           | 4.9                 | 2251.4                | 4700             | 6956  |

\* Begin overtopping of dam crest

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY G.Y. DATE 7/24/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

MAPLE LAKE DAM



**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY G.Y. DATE 7/24/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

MAPLE LAKE DAM

SERVICE SPILLWAY RATING CURVE

Pertinent Data:

Top of 12"  $\phi$  Riser Pipe, EL. 1575.6

Invert EL. of 8"  $\phi$  Outlet Pipe 1563.6

Starting Tailwater Elev. (by Survey) 1564.2

a. Flow Controlled by 8"  $\phi$  Asbestos Cement outlet pipe

Ref. Handbook of Concrete Culvert Pipe Hydraulics, Portland Cement Assoc. 1964

$$\text{Head Loss in pipe } H = \left[ \frac{2.5204(1+K_e)}{D^5} + \frac{466.18n^2L}{D^{4/3}} \right] \left( \frac{Q}{10} \right)^2$$

Where  $K_e$  is the Entrance loss coefficient  
 $n$  is the pipe roughness coefficient  
 $D$  is the pipe diameter, in feet  
 $L$  is Length of pipe, in feet  
 $Q$  is the discharge, in cfs

For  $D = 0.667'$ ;  $K_e = 0.5$ ;  $n = 0.015$  and  $L = 53'$

$$H = 67.4 \left( \frac{Q}{10} \right)^2 ; Q = \sqrt{\frac{100H}{67.4}} = 1.22 \sqrt{H}$$

| H<br>feet | Q<br>cfs | TAILWATER<br>ELEVATION | W. S. ELEVATION |               |
|-----------|----------|------------------------|-----------------|---------------|
|           |          |                        | IN RISER        | IN RESERVOIR* |
| 1.5       | 1.49     | 1564.2                 | 1565.7          | 1575.88       |
| 2.0       | 1.73     | 1564.3                 | 1566.3          | 1575.92       |
| 2.5       | 1.93     | 1564.3                 | 1566.8          | 1575.94       |
| 3.0       | 2.11     | 1564.3                 | 1567.3          | 1575.96       |
| 3.5       | 2.28     | 1564.4                 | 1567.9          | 1575.98       |
| 4.0       | 2.44     | 1564.4                 | 1568.4          | 1576.00       |
| 6.0       | 2.99     | 1564.5                 | 1570.5          | 1576.05       |
| 8.0       | 3.45     | 1564.6                 | 1572.6          | 1576.10       |
| 11.0      | 4.05     | 1564.6                 | 1575.6**        | 1576.15       |
| 13.4      | 4.47     | 1564.6                 | 1578.0*         | 1578.0        |
| 15.0      | 4.73     | 1565.5                 | 1580.5          | 1580.5        |
| 16.0      | 4.88     | 1566.0                 | 1582.0          | 1582.0        |
| 17.0      | 5.03     | 1566.5                 | 1583.5          | 1583.5        |

\* See b. - Riser control \*\* Top of Riser

PIPE CONTROL RISER CONTROL

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY G.Y. DATE 7/24/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

MAPLE LAKE DAM

SERVICE SPILLWAY RATING CURVE (CONT.)

b. FLOW OVER CREST OF RISER PIPE

$$Q = 3.1 \pi D H^{3/2}$$

Where  $\pi D$  is the Length of spillway crest  
H is the head over the spillway crest

| <u>W.S. ELEV</u><br><u>IN RESERV.</u> | <u>HEAD</u><br><u>H (ft)</u> | <u>Q</u><br><u>CFS</u> | <u>CORRECTED</u><br><u>W.S. ELEV</u> | <u>REMARKS</u>                                                 |
|---------------------------------------|------------------------------|------------------------|--------------------------------------|----------------------------------------------------------------|
| 1575.6                                | 0                            | 0                      | 1575.6                               |                                                                |
| 1575.8                                | 0.2                          | 0.87                   | 1575.8                               | Flow controlled<br>by riser pipe                               |
| 1576.0                                | 0.4                          | 2.47                   | 1576.0                               |                                                                |
| 1576.1                                | 0.5                          | 3.45                   | 1576.1                               |                                                                |
| 1576.15                               | 0.55                         | 4.00                   | 1576.15                              |                                                                |
| 1576.2                                | 0.60                         | 4.47                   | 1578.0                               | Flow controlled<br>by 8" $\phi$ outlet pipe<br>(See Sheet D-9) |
| 1576.22                               | 0.62                         | 4.73                   | 1580.5                               |                                                                |
| 1576.23                               | 0.63                         | 4.88                   | 1582.0                               |                                                                |
| 1576.24                               | 0.64                         | 5.03                   | 1583.5                               |                                                                |

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY G.Y. DATE 7/23/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

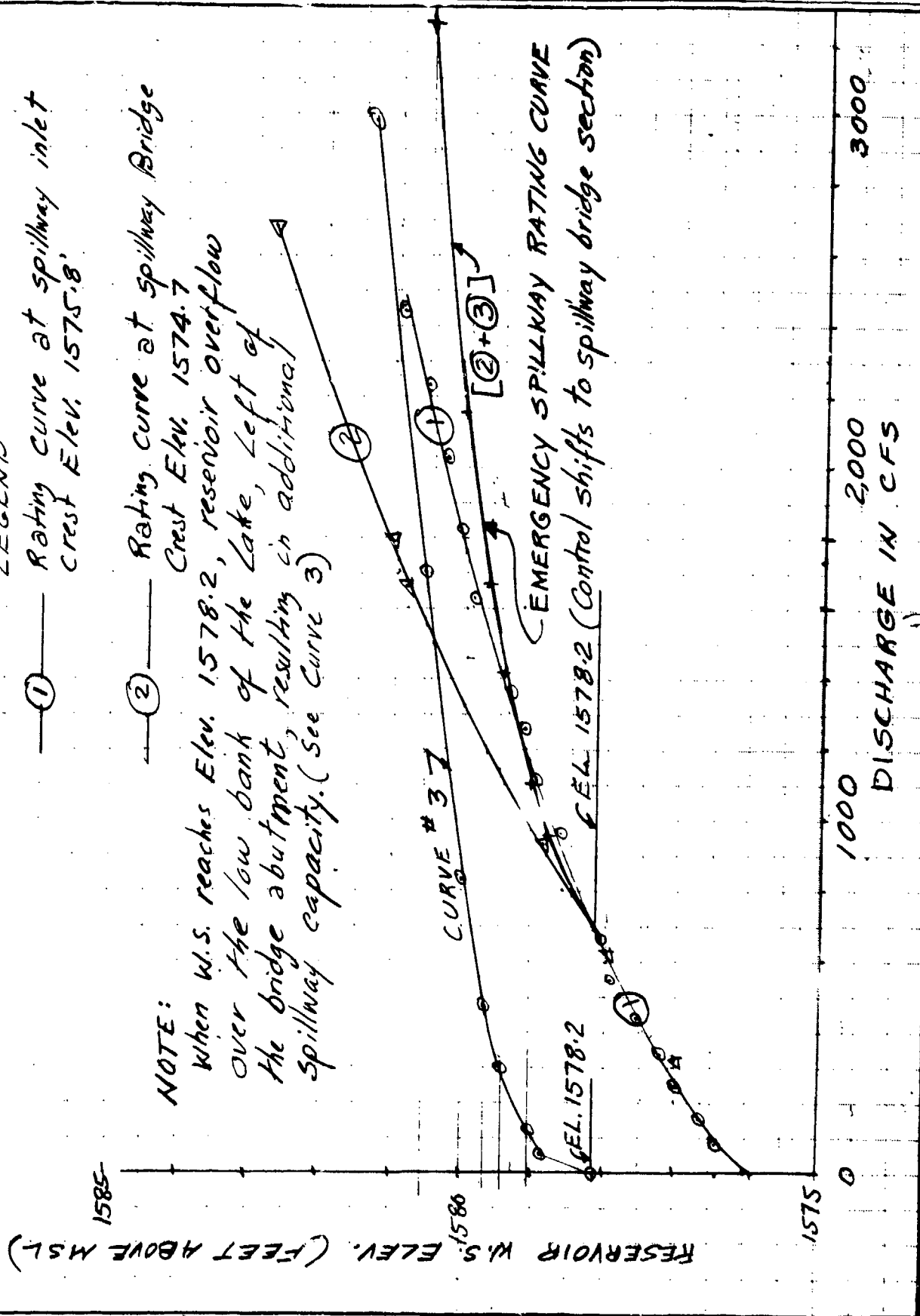
**MAPLE LAKE DAM**

RATING CURVES (Emergency spillway and overbank flow)

LEGEND  
① — Rating curve at spillway inlet  
Crest Elev. 1575.8'

② — Rating curve at spillway Bridge  
Crest Elev. 1574.7

NOTE:  
When W.S. reaches Elev. 1578.2, reservoir overflow  
over the low bank of the Lake, Left of  
the bridge abutment, resulting in additional  
spillway capacity. (See Curve 3)



**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_

SHEET NO. \_\_\_\_\_

OF \_\_\_\_\_

CALCULATED BY G.Y.

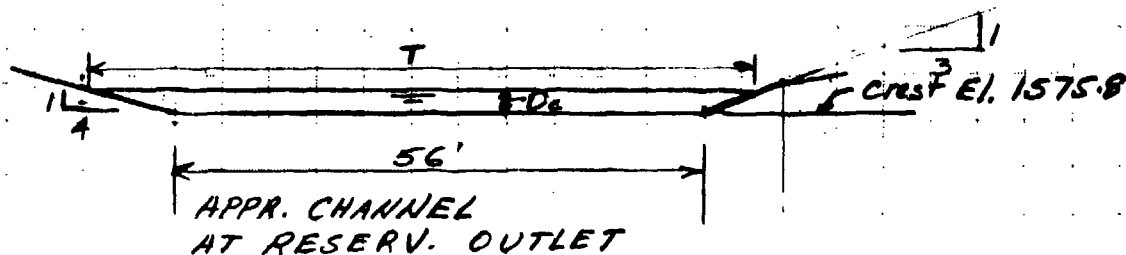
DATE 7/23/1981

CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

MAPLE LAKE DAM

SPILLWAY RATING CURVE



For Control section (at bridge - see sheet D-13)

For explanation of terms see also sheet D-15)

$T$  is Top width of water surface for a given critical depth  $D_c$   
 $a$  is the cross sectional area, for a given  $D_c$ , in  $ft^2$   
 $H_m = D_c + \frac{D_m}{2}$ ; W.S. Elev. =  $1575.8 + H_m$

| $D_c$ | $T$  | $a$    | $D_m = \frac{a}{T}$ | $Q \cdot a \sqrt{g D_m}$ | $H_m$ | W.S. ELEV. |
|-------|------|--------|---------------------|--------------------------|-------|------------|
| (1)   | (2)  | (3)    | (4)                 | (5)                      | (6)   | (7)        |
| 0.2   | 57.4 | 11.34  | 0.197               | 28.6                     | 0.30  | 1576.10    |
| 0.4   | 58.8 | 22.96  | 0.39                | 81.4                     | 0.60  | 1576.40    |
| 0.6   | 60.2 | 34.86  | 0.58                | 150.5                    | 0.89  | 1576.69    |
| 0.8   | 61.6 | 47.04  | 0.76                | 233.3                    | 1.18  | 1576.98    |
| 1.0   | 63   | 59.5   | 0.94                | 328.1                    | 1.47  | 1577.27    |
| 1.2   | 64.4 | 72.24  | 1.12                | 434                      | 1.76  | 1577.56    |
| 1.4   | 65.8 | 85.26  | 1.30                | 550.7                    | 2.05  | 1577.85    |
| 1.6   | 67.2 | 98.56  | 1.47                | 677.3                    | 2.33  | 1578.13    |
| 2.0   | 70.0 | 126.00 | 1.80                | 959.3                    | 2.90  | 1578.70    |
| 2.1   | 70.7 | 133.00 | 1.88                | 1036                     | 3.04  | 1578.84    |
| 2.2   | 71.4 | 140.14 | 1.96                | 1114                     | 3.18  | 1578.98    |

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_

SHEET NO \_\_\_\_\_

OF \_\_\_\_\_

CALCULATED BY GY

DATE 7/23/1981

CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

MAPLE LAKE DAM

SPILLWAY RATING CURVES (CONT.)

SPILLWAY AT BRIDGE SECTION (See cross section, sheet D-14)

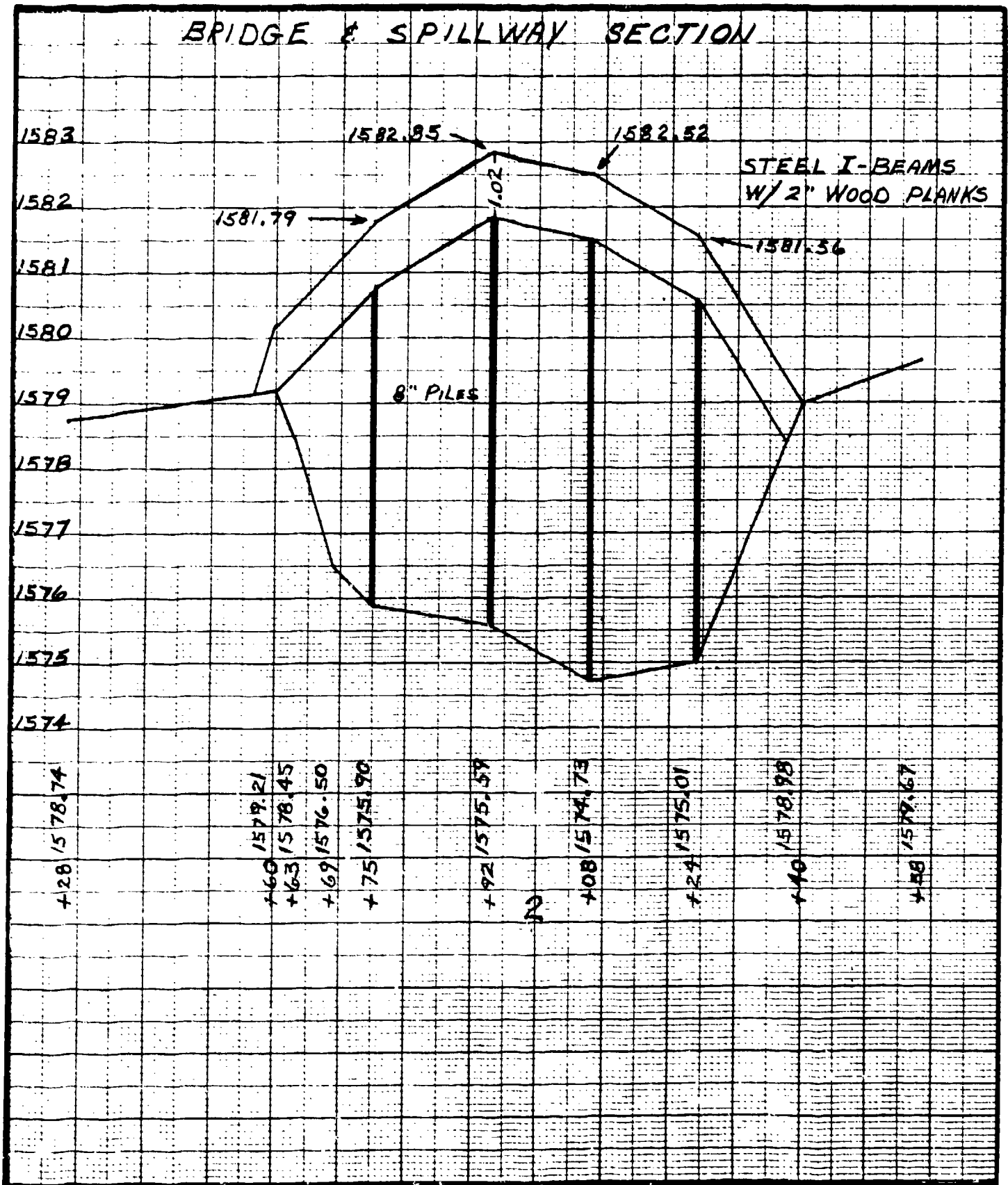
| EL.     | Dc   | AREA (a)<br>TOPWIDTH (T)                                            | Dm = $\frac{2}{3}H$ | Q       | Hm   | W.S.<br>ELEV* |
|---------|------|---------------------------------------------------------------------|---------------------|---------|------|---------------|
| 1574.7  | 0    |                                                                     |                     | 0       |      | 1574.70       |
| 1575.0  | 0.3  | $20.67 \times 0.3/2 = 3.10 \text{ ft}^2$                            | 0.15                | 6.8     | 0.38 | 1575.08       |
|         |      | $22 - 2 \times 0.667 = 20.67 \text{ ft}$                            |                     |         |      |               |
| 1575.4  | 0.7  | $3.10 + \frac{20.67 + 32}{2} \times 0.4 = 13.63 \text{ ft}^2$       | 0.43                | 50.72   | 0.92 | 1575.84       |
|         |      | $34 - 3 \times 0.667 = 32.0 \text{ ft}$                             |                     |         |      |               |
| 1575.9  | 1.2  | $13.63 + \frac{32 + 51}{2} \times 0.5 = 55.13 \text{ ft}^2$         | 1.08                | 325.26  | 1.74 | 1576.98       |
|         |      | $53 - 3 \times 0.667 = 51.0 \text{ ft}$                             |                     |         |      |               |
| 1576.5  | 1.8  | $55.13 + \frac{51.0 + 59.33}{2} \times 0.6 = 88.23 \text{ ft}^2$    | 1.49                | 610.54  | 2.55 | 1577.99       |
|         |      | $62 - 4 \times 0.667 = 59.33 \text{ ft}$                            |                     |         |      |               |
| 1577.0  | 2.3  | $88.23 + \frac{59.33 + 63.33}{2} \times 0.5 = 118.9 \text{ ft}^2$   | 1.88                | 924.5   | 3.24 | 1578.88       |
|         |      | $66 - 4 \times 0.667 = 63.33$                                       |                     |         |      |               |
| 1578.25 | 3.55 | $118.9 + \frac{63.33 + 71.33}{2} \times 0.95 = 182.86 \text{ ft}^2$ | 2.56                | 1,661.4 | 4.83 | 1580.81       |
|         |      | $74 - 4 \times 0.667 = 71.33 \text{ ft}$                            |                     |         |      |               |
| 1578.40 | 3.70 | $182.86 + \frac{71.33 + 72.33}{2} \times 0.15 = 193.63$             | 2.68                | 1,797.8 | 5.04 | 1581.08       |
|         |      | $75 - 4 \times 0.667 = 72.33 \text{ ft}$                            |                     |         |      |               |
| 1579.20 | 4.5  | $193.63 + \frac{72.33 + 70.33}{2} \times 0.8 = 250.69$              | 3.56                | 2,485.8 | 6.28 | 1582.76       |
|         |      | $73 - 4 \times 0.667 = 70.33$                                       |                     |         |      |               |

Note: To account for velocity head in approach channel (see spillway section, Exhibit A-4)  $\sqrt{3/2g}$ , assume  $V = Q/a$

\* W.S. ELEV = 1574.70 + Hm + Velocity head in approach channel

GEO-TECHNICAL SERVICES  
Consulting Engineers & Geologists

JOB 17116  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY RTM DATE 7-20-81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE HORZ. 1" = 20' VERT. 1" = 2'

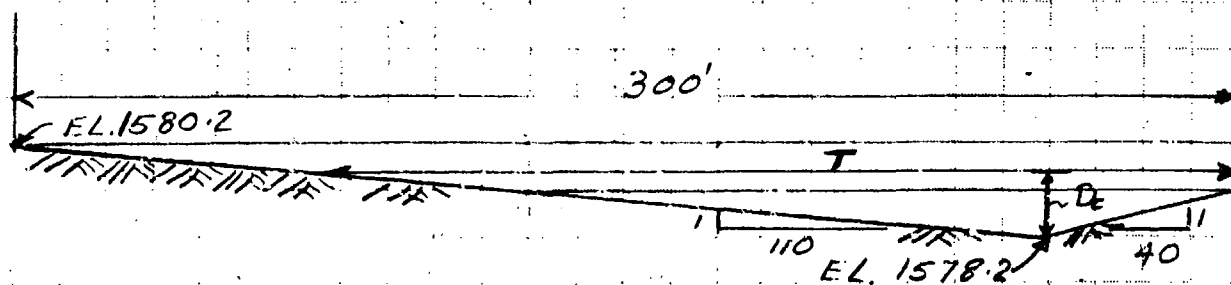


**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB \_\_\_\_\_  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY GY DATE 7/23/1981  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

**MAPLE LAKE DAM**

**FLOW OVER LOW LAKESHORE BANK, LEFT ABUTMENT**



| $D_c$ | $T$ | $a$    | $D_m = a/T$ | $Q = a\sqrt{gD_m}$ | $H_m$ | W.S. ELEV. |
|-------|-----|--------|-------------|--------------------|-------|------------|
| (1)   | (2) | (3)    | (4)         | (5)                | (6)   | (7)        |
| 0.5   | 75  | 18.75  | 0.25        | 53.2               | 0.63  | 1578.83    |
| 0.7   | 105 | 36.75  | 0.35        | 123.4              | 0.88  | 1579.08    |
| 1.0   | 150 | 75     | 0.50        | 301                | 1.25  | 1579.45    |
| 1.2   | 180 | 108    | 0.60        | 475                | 1.50  | 1579.70    |
| 1.5   | 225 | 168.75 | 0.75        | 829                | 1.88  | 1580.08    |
| 2.0   | 300 | 300    | 1.00        | 1702               | 2.50  | 1580.70    |
| 2.5   | 375 | 468.75 | 1.25        | 2974               | 3.13  | 1581.33    |
| 3.0   | 450 | 675    | 1.50        | 4691               | 3.75  | 1581.95    |

(2) for  $0 < D_c < 2.0$   $T = 150 \times D_c$ ; For  $D_c > 2.0$   $T = 300'$

(3)  $a = \text{area (ft}^2\text{)}$

for  $0 < D_c < 2.0$   $a = T \times D_c / 2 \text{ ft}^2$

for  $D_c > 2.0$   $a = 300 + (D_c - 2.0) \times T$

(6)  $H_m = D_c + \frac{D_m}{2}$ ; (7) W.S. ELEV. = 1578.2 +  $H_m$

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

PROJECT MAPLE LAKE

SHEET NO. 1

OF 1

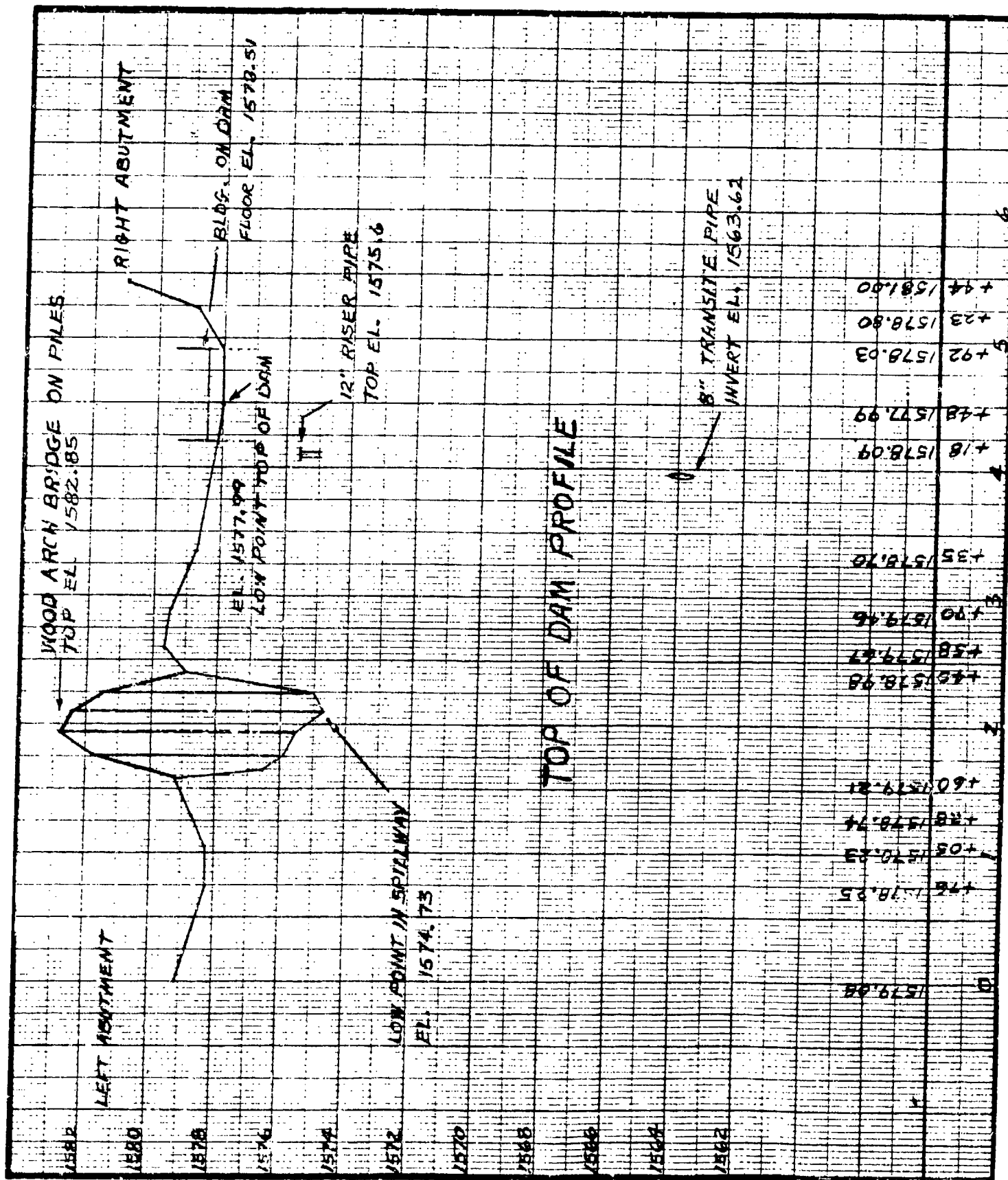
CALCULATED BY PJM

DATE 7-20-81

CHECKED BY \_\_\_\_\_

DATE \_\_\_\_\_

SCALE HORZ. 1"=100' VERT. 1"=4'



**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB

SHEET NO

OF

CALCULATED BY

G.Y

DATE

7/24/1981

CHECKED BY

DATE

SCALE

MAPLE LAKE DAM

RESERVOIR STORAGE

| <u>W.S.<br/>ELEV.</u> | <u>AREA<br/>ACRES</u> | <u>STORAGE<br/>AC-FT</u> | <u>REMARKS</u>                           |
|-----------------------|-----------------------|--------------------------|------------------------------------------|
| 1561.2*               | 0                     | 0                        | From Computations<br>by the Conic Method |
| 1575.6                | 16.0**                | 76.7**                   | Normal pool Elev. **                     |
| 1578.0                | 17.2                  | 126.5***                 | Low point on crest                       |
| 1580.0                | 18                    |                          | by planimeter of contour                 |
| 1590.0                | 27                    |                          | by planimeter of contour                 |

\* Bottom elevation of truncated cone (for HEC-1 DB)  
 $1575.6 - \frac{3 \times 76.7}{16} = 1575.6 - 14.4 \text{ EL. } 1561.2$

\*\* From 1953 Design Dwg's (Note: EL 1575.6, Existing  
 Condition  $\equiv$  EL. 1555.6 of design drawings) and  
 revised as per permit application. Also, as reported in Bulletin No. 5.

\*\*\* EL. 1575.6  $< \Delta V <$  EL 1578;  $\Delta V = \frac{2.4}{3} (16.0 \times 17.2 + \sqrt{16.0 \times 17.2}) = 49.8 \text{ ac-ft}$   
 Storage at EL. 1578 =  $76.7 + 49.8 = 126.5 \text{ ac-ft}$

GEO-TECHNICAL SERVICES  
Consulting Engineers & Geologists

JOB MAPLE LAKE

TA-1000

SHEET NO

OF

CALCULATED BY

WEH

DATE

7/29/81

CHECKED BY

DATE

SCALE

MC CARTY LAKE (UPSTREAM OF MAPLE LAKE)

DRAINAGE BASIN & UNIT HYDROGRAPH DATA

DRAINAGE AREA

0.09 Sq. Mi.

SNYDER UNIT HYDROGRAPH COEFFICIENTS

AS SUPPLIED BY BALT. DIST. COE (SUSQUEHANNA BASIN ZONE 17)

$C_p = 0.45$

$C_t = 1.13$

$$\text{LAG TIME} = T_p = C_t (L \times L_c)^{0.3}$$

$L = 0.33$  mi. RESERVOIR OUTLET TO DRAINAGE DIVIDE

$L_c = 0.17$  mi. RESERVOIR OUTLET TO CENTROID

$$\therefore T_p = 1.13 (0.33 \times 0.17)^{0.3} = 0.45 \text{ HRS}$$

RAINFALL DATA

SAME AS MAPLE LAKE

RAINFALL DISTRIBUTION

SAME AS MAPLE LAKE

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB McCarty Lake PA-1026  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY WEH DATE 7/22/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

MCCARTY LAKE (CONT.)

DAM DATA

TOP OF DAM ELEV. (LOW POINT) 1663.0  
DAM LENGTH (INC. FILLED SPILLWAY) 650'  
"C" VALUE - DAM 2.7  
NON-LEVEL DAM

| LENGTH<br>OF DAM | BELOW<br>ELEV. |
|------------------|----------------|
| 0'               | 1663.0         |
| 300'             | 1663.1         |
| 650'             | 1665.1         |
| 1200'            | 1680.0         |

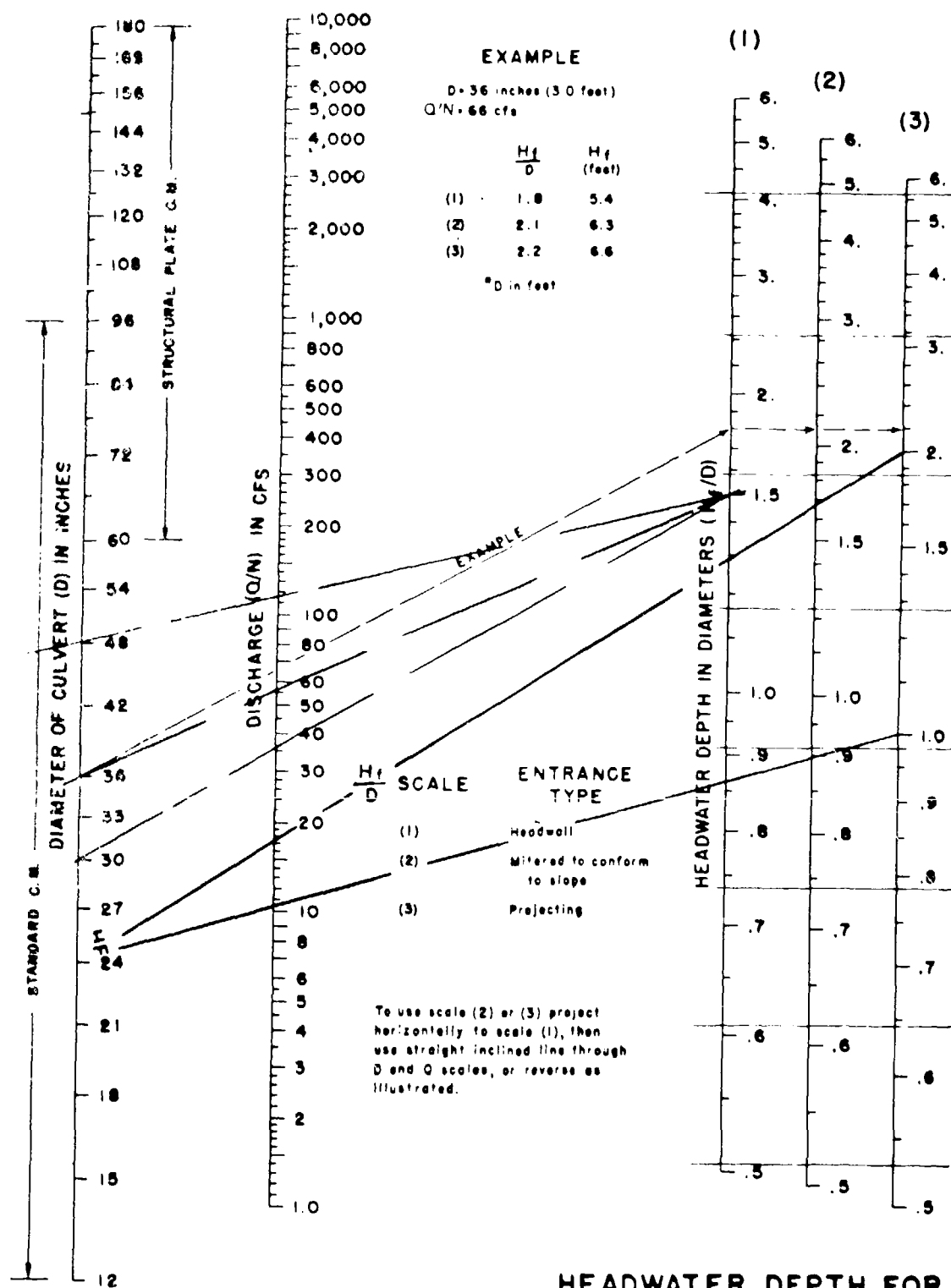
SPILLWAY DATA

ORIGINAL EMERGENCY SPILLWAY HAS BEEN BACK FILLED  
& REPLACED WITH A 24"  $\phi$  CMP  
ASSUME INLET CONTROL

| HW   | HW/<br>D | Q*     |              |
|------|----------|--------|--------------|
| 0    | 0        | 0 cfs  | ELEV. 1661.5 |
| 2'   | 1        | 10 cfs | 1663.5       |
| 4.1' | 2        | 17 cfs | 1665.6       |

\* See Sheet D-20

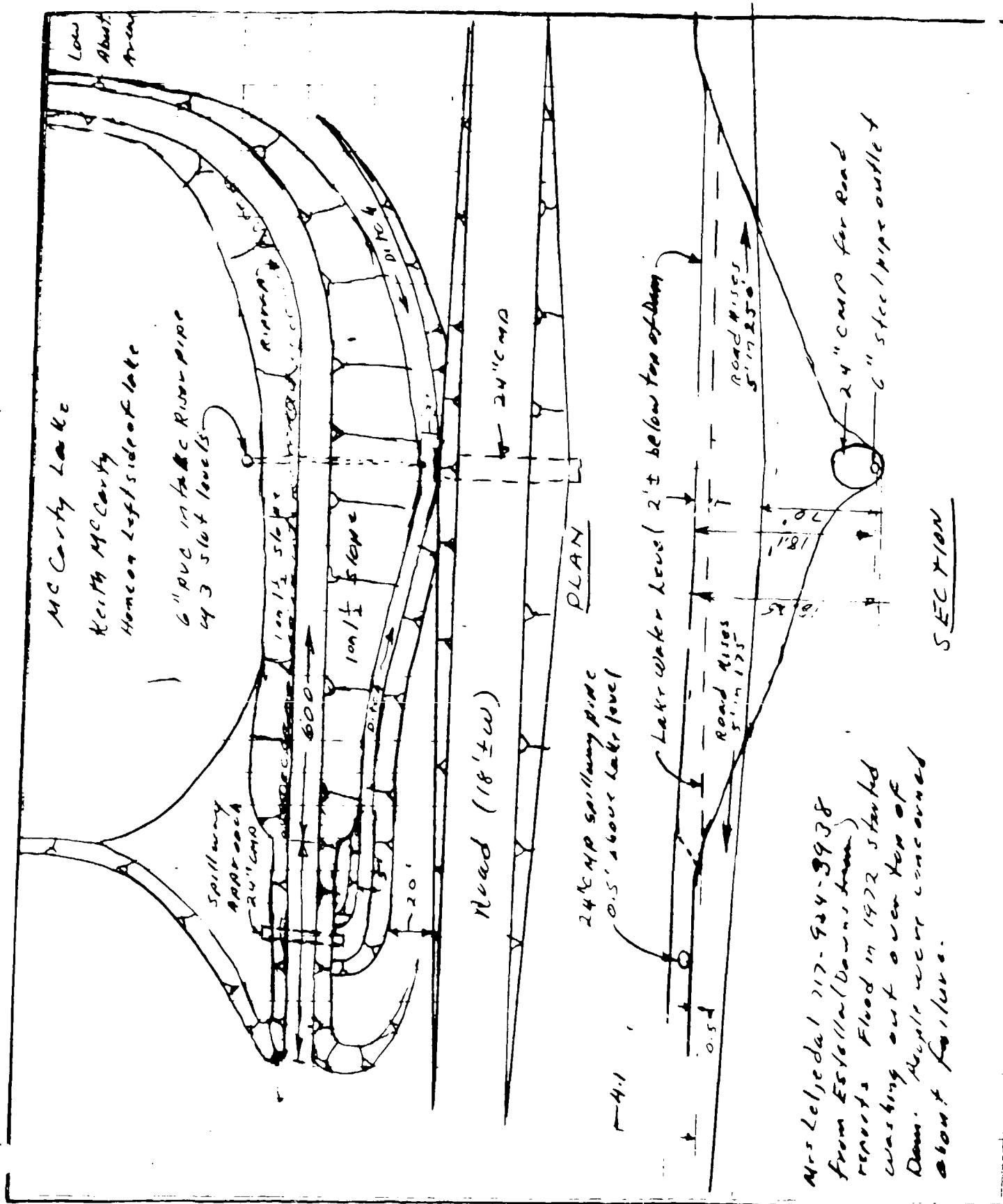
Chart 12



FEDERAL HIGHWAY ADMINISTRATION  
 MAY 1973

13-76

HEADWATER DEPTH FOR  
 C. M. PIPE CULVERTS  
 WITH INLET CONTROL



SKETCH OF McCARTY DAM

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB McCarty Lake PA-1000

SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_

CALCULATED BY WEH DATE 7/29/81

CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SCALE \_\_\_\_\_

McCARTY LAKE (CONT.)

ASSUME BOTTOM @ ELEV. 1645.0

AREA @ NORMAL POOL = 6.5 Ac (ELEV. 1661)

AREA @ 1680 CONTOUR = 21.1 Ac

∴ AREA @ LOW POINT =  $6.5 + (14.6/19)(2) = 8.0 \text{ Ac}$

| ELEV.  | AREA |                      |
|--------|------|----------------------|
| 1645.0 | 0    | BOTTOM RESERVOIR     |
| 1661.0 | 6.5  | NORMAL               |
| 1663.0 | 8.0  | LOW POINT TOP OF DAM |
| 1680.0 | 21.1 | CONTOUR              |

**GEO-TECHNICAL SERVICES**  
Consulting Engineers & Geologists

JOB MAPLE LAKE PA-1026  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY WJH DATE 7/22/81  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

*TYPICAL SECTION FOR ROUTING McCARTY LAKE OUTFLOW  
TO MAPLE LAKE.*

| <i>STA.</i> | <i>ELEV.</i>  |
|-------------|---------------|
| <i>0</i>    | <i>1586.3</i> |
| <i>50</i>   | <i>1583.0</i> |
| <i>100</i>  | <i>1579.6</i> |
| <i>103</i>  | <i>1575.6</i> |
| <i>107</i>  | <i>1575.6</i> |
| <i>110</i>  | <i>1579.6</i> |
| <i>160</i>  | <i>1583.0</i> |
| <i>210</i>  | <i>1586.3</i> |

*REACH LENGTH = 4600'*  
*SLOPE = 0.0151 %*

[illegible]

|    |          |     |        |        |        |        |      |      |   |   |
|----|----------|-----|--------|--------|--------|--------|------|------|---|---|
| 51 | SA       | 0   | 14.0   | 17.0   | 14     | 27     | 0    | 0    | 0 | 0 |
| 52 | SI1561.2 | 0   | 1575.6 | 1578.0 | 1580.0 | 1590.0 | 0    | 0    | 0 | 0 |
| 53 | SI1575.6 | 0   | 0      | 0      | 0      | 0      | 0    | 0    | 0 | 0 |
| 54 | SD1578.0 | 2.7 | 2.7    | 1.5    | 280    | 0      | 0    | 0    | 0 | 0 |
| 55 | SL       | 0   | 42     | 145    | 205    | 253    | 0    | 0    | 0 | 0 |
| 56 | SV1578.0 | 0   | 1578.1 | 1578.7 | 1579.0 | 1579.4 | 295  | 303  | 0 | 0 |
| 57 | K        | 9c  | 0      | 0      | 0      | 1579.6 | 1580 | 1581 | 0 | 0 |

\*\*\*\*\*  
 FLOOD HYDROGRAPH PACKAGE (HEC-1)  
 DAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 01 APR 80  
 \*\*\*\*\*

RUN DATE: 81/07/31.  
 TIME: 07.46.10.

NAT: VAL DAM INSPECTION PROGRAM  
 MA: E LAKE--PA1026 (OVERTOPPING ANALYSIS)  
 ELKLAND TWP, SULLIVAN CO, PA

JOB SPECIFICATION

| NO  | NHR | NMIN | IDAY  | IHR | IMIN  | METRC | IPLT | IPRT | NSTAN |
|-----|-----|------|-------|-----|-------|-------|------|------|-------|
| 150 | 0   | 15   | 0     | 0   | 0     | 0     | 0    | -4   | 0     |
|     |     |      | JOPER | NWT | LROPT | TRACE |      |      |       |
|     |     |      | 5     | 0   | 0     | 0     |      |      |       |

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= .10 .20 .30 .40 .50 .75 1.00  
 NPLAN= 1 NRTIO= 7 LRTIO= 1

SUP-AREA RUNOFF COMPUTATION

INFLOW TO MCCARTY LAKE (SUP-AREA 1)

| ISTAQ | ICOM? | IFCON | ITAPE | JPLT | JPRT | INAME | ISTAGE | IAUTO |
|-------|-------|-------|-------|------|------|-------|--------|-------|
| 1     | 0     | 0     | 0     | 0    | 0    | 1     | 0      | 0     |

HYDROGRAPH DATA

| IMYDG | IUNG | TAREA | SNAP | TRSDA | TRSPC | RATIO | ISNOW | ISAME | LOCAL |
|-------|------|-------|------|-------|-------|-------|-------|-------|-------|
| 1     | 1    | .09   | 0.00 | .62   | 0.00  | 0.000 | 0     | 1     | 0     |

PRECIP DATA

| SPFE | PMS   | R5     | R12    | R24    | R48    | R72  | R96  |
|------|-------|--------|--------|--------|--------|------|------|
| 0.00 | 22.00 | 118.00 | 127.00 | 136.00 | 142.00 | 0.00 | 0.00 |

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

| LROPT | STAKR | OLTKR | RTIOL | ERAIN | STKRS | RTIOK | 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= .48 CPE= .45 NTA= 0

RECESSION DATA

STRIO= -1.50 ORCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 16 END-OF-PERIOD ORDINATES, LAGE= .48 HOURS, CPE= .45 VOL= 1.00  
 18. 47. 50. 35. 24. 17. 12. 8. 4. 6. 4.  
 3. 2. 1. 1. 1. 0. 0. 0. 0. 0.

MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP G E.O-OF-PERIOD FLOW MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 24.99 22.74 2.25 5288.  
( 635.3)( 578.3)( 57.3)( 149.74)

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

POUTF THRU MCCARTY LAKE

| STAGE         | 1661.50 | 1663.50 | 1665.60 |
|---------------|---------|---------|---------|
| FLOW          | 0.00    | 10.00   | 17.00   |
| SURFACE AREA= | 0.      | 7.      | 8.      |
| CAPACITY=     | 0.      | 35.     | 49.     |
| ELEVATION=    | 1645.   | 1661.   | 1663.   |

| ISTAG | ICOMP | IECON | ITAPE        | JPLT  | JPRT  | INAME  | ISTAGE | IAUTO |
|-------|-------|-------|--------------|-------|-------|--------|--------|-------|
| 2     | 1     | 0     | 0            | 0     | 0     | 1      | 6      | 0     |
| QLOSS | CLOSS | AVG   | ROUTING DATA |       |       |        |        |       |
| 0.0   | 0.000 | 0.00  | 1            | 0     | 0     |        | LSTR   | 0     |
|       |       |       | ISAME        | IOPT  | IPMP  |        |        |       |
|       |       |       | 1            | 0     | 0     |        |        |       |
| NSTPS | NSTDL | LAG   | AMSKK        | X     | TSK   | STORA  | ISPRAT |       |
| 1     | 0     | 0     | 0.000        | 0.000 | 0.000 | -1661. | -1     |       |

DAM DATA  
TOPEL COGD EXPD DAMUJD  
1663.0 2.7 1.5 646.

CREST LENGTH  
AT OR BELOW  
ELEVATION

0. 309. 650. 1200.  
1663.0 1663.1 1665.1 1680.0

PEAK OUTFLOW IS 4. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 36. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 102. AT TIME 40.50 HOURS

PEAK OUTFLOW IS 158. AT TIME 40.25 HOURS

PEAK OUTFLOW IS 199. AT TIME 40.25 HOURS

PEAK OUTFLOW IS 202. AT TIME 49.25 HOURS  
PEAK OUTFLOW IS 404. AT TIME 40.25 HOURS

HYDROGRAPH ROUTING

ROUTE TO MAPLE LAKE

|                                          |       |       |       |       |       |       |        |       |
|------------------------------------------|-------|-------|-------|-------|-------|-------|--------|-------|
| ICSTAQ                                   | ICOMP | IECON | ITAPE | JPLT  | JPRT  | INAME | ISTAGE | IAUTO |
| 3                                        | 1     | 0     | 0     | 0     | 0     | 1     | 0      | 0     |
| ROUTING DATA                             |       |       |       |       |       |       |        |       |
| GROSS                                    | CROSS | AVG   | IRRES | 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 | 0.000 | 0      |       |

NORMAL DEPTH CHANNEL ROUTING

|        |        |        |        |        |       |        |
|--------|--------|--------|--------|--------|-------|--------|
| QNI(1) | QNI(2) | QNI(3) | ELNVT  | ELMAX  | RLNTH | SEL    |
| .0800  | .0400  | .0800  | 1575.5 | 1600.0 | 4600. | .01510 |

CROSS SECTION COORDINATES--STA+ELEV,STA+ELEV--ETC  
0.00 1586.30 50.00 1583.00 100.00 1579.60 103.00 1575.60 107.00 1575.60  
110.00 1579.60 160.00 1583.00 210.00 1586.30

|         |         |          |          |          |          |          |          |          |          |          |
|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| STORAGE | 0.00    | .67      | 1.61     | 2.80     | 6.16     | 14.62    | 28.19    | 47.01    | 71.09    | 99.28    |
|         | 127.76  | 156.24   | 184.72   | 213.20   | 241.68   | 270.16   | 298.64   | 327.11   | 355.59   | 384.07   |
| OUTFLOW | 0.00    | 26.87    | 89.69    | 189.45   | 388.82   | 798.46   | 1524.19  | 2656.48  | 4282.11  | 6763.37  |
|         | 9941.98 | 13626.58 | 17783.48 | 22386.61 | 27414.88 | 32850.77 | 38679.33 | 44887.61 | 51464.24 | 58399.09 |
| STAGE   | 1575.60 | 1576.86  | 1578.17  | 1579.45  | 1580.74  | 1582.02  | 1583.31  | 1584.59  | 1585.87  | 1587.16  |
|         | 1588.44 | 1589.73  | 1591.01  | 1592.29  | 1593.58  | 1594.86  | 1596.15  | 1597.43  | 1598.72  | 1600.00  |
| FLOW    | 0.00    | 26.87    | 89.69    | 189.45   | 388.82   | 798.46   | 1524.19  | 2656.48  | 4282.11  | 6763.37  |
|         | 9941.98 | 13626.58 | 17783.48 | 22386.61 | 27414.88 | 32850.77 | 38679.33 | 44887.61 | 51464.24 | 58399.09 |

MAXIMUM STAGE IS 1575.8  
MAXIMUM STAGE IS 1577.0  
MAXIMUM STAGE IS 1578.2  
MAXIMUM STAGE IS 1579.0

MAXIMUM STAGE IS 1579.5  
MAXIMUM STAGE IS 1580.0  
MAXIMUM STAGE IS 1580.6

\*\*\*\*\*

SUP-AREA RUNOFF COMPUTATION

INFLOW FROM SUB-AREA 2

ISTAQ ICOMP IECON ITAPE JPLT JPRY INAME ISTAGE IAUTO  
5 0 0 0 0 0 1 0 0

HYDROGRAPH DATA

IM' .UHG TAREA SJAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
1 1 .53 0.00 .62 0.00 0.000 0 1 0

PRECIP DATA

SPFF PMS R5 R12 P24 R72 R96  
0.00 22.00 118.00 127.00 136.00 142.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS .200

LOSS DATA

LROPT STRKR DLTKR RTIOL ERAIN STRKS RTIOK STRYL CNSTL ALSHX 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= 1.08 CP= .45 NTA= 0

RECESSION DATA

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

UNIT HYDROGRAPH 40 END-OF-PERIOD ORIGINATES, LAG= 1.08 HOURS, CP= .45 VOL= 1.00

| MO.DA | HR.MN | PERIOD | RAIN | EXCS | LOSS | COMP Q |
|-------|-------|--------|------|------|------|--------|
| 13.   | 49.   | 94.    | 130. | 139. | 127. | 110.   |
| 62.   | 53.   | 46.    | 40.  | 34.  | 30.  | 26.    |
| 14.   | 13.   | 11.    | 9.   | 8.   | 7.   | 6.     |
| 3.    | 3.    | 3.     | 2.   | 2.   | 2.   | 1.     |

MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 24.99 22.74 2.25 30462.  
( 635.)( 578.)( 57.)( 862.59)

\*\*\*\*\*

COMBINE HYDROGRAPHS

INFLOW TO MAPLE LAKE

ISTAG ICOMP IECON ITAPE JPLT JPRY INAME ISTAGE IAUTO  
3 2 0 0 0 0 1 0 0

\*\*\*\*\*

# HYDROGRAPH ROUTING

## ROUTE THRU MAPLE LAKE

| ISTAG        | ICOMP | IECON | ITAPE | JPLT  | JPRT  | INAME  | ISYGE  | IAUTO |
|--------------|-------|-------|-------|-------|-------|--------|--------|-------|
| 4            | 1     | 0     | 0     | 0     | 0     | 1      | 0      | 0     |
| ROUTING DATA |       |       |       |       |       |        |        |       |
| QLOSS        | CLOSS | AVG   | IRRES | ISAME | IOPT  | IPMP   | LSTR   |       |
| 0.0          | 0.000 | 0.00  | 1     | 1     | 0     | 0      | 0      |       |
| NSTPS NSTDL  |       |       |       |       |       |        |        |       |
| 1            | 0     | LAG   | AMSKK | X     | TSK   | STORA  | ISPRAT |       |
|              |       | 0     | 0.000 | 0.000 | 0.000 | -1576. | -1     |       |

|       |         |         |         |         |         |         |         |         |         |         |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| STAGE | 1575.60 | 1575.60 | 1576.10 | 1576.40 | 1577.00 | 1578.00 | 1578.20 | 1578.80 | 1579.00 | 1580.00 |
|       | 1581.00 | 1582.00 |         |         |         |         |         |         |         |         |
| FLOW  | 0.00    | 0.00    | 32.00   | 85.00   | 264.00  | 624.00  | 704.00  | 957.00  | 1255.00 | 2145.00 |
|       | 3810.00 | 6956.00 |         |         |         |         |         |         |         |         |

SURFACE AREA= 0. 16. 17. 18. 27.

CAPACITY= 0. 77. 117. 152. 375.

ELEVATION= 1561. 1576. 1578. 1580. 1590.

| CREL   | SPWID | COGW | EXPW | ELEV | COQL | CAREA | EXPL |
|--------|-------|------|------|------|------|-------|------|
| 1575.6 | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0   | 0.0  |

### DAM DATA

| TOPEL  | COQD | EXPD | DAMWID |
|--------|------|------|--------|
| 1578.0 | 2.7  | 1.5  | 280.   |

|              |        |        |        |        |        |        |        |        |
|--------------|--------|--------|--------|--------|--------|--------|--------|--------|
| CREST LENGTH | 0.     | 42.    | 145.   | 205.   | 253.   | 292.   | 295.   | 303.   |
| AT CR BELOW  |        |        |        |        |        |        |        |        |
| ELEVATION    | 1578.0 | 1578.1 | 1578.7 | 1575.0 | 1579.4 | 1579.6 | 1580.0 | 1581.0 |

PEAK OUTFLOW IS 136. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 287. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 489. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 674. AT TIME 41.25 HOURS

PEAK OUTFLOW IS 878. AT TIME 41.00 HOURS

PEAK OUTFLOW IS 1430. AT TIME 40.75 HOURS

PEAK OUTFLOW IS 1894. AT TIME 40.75 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                 | RATIO 2        | RATIO 3         | RATIO 4         | RATIO 5         | RATIO 6          | RATIO 7          |
|               |         |               |      | .10                     | .20            | .30             | .40             | .50             | .75              | 1.00             |
| HYDROGRAPH AT | 1       | .09<br>(.23)  | 1    | 40.<br>(1.13)           | 80.<br>(2.26)  | 120.<br>(3.39)  | 160.<br>(4.52)  | 200.<br>(5.65)  | 299.<br>(8.43)   | 399.<br>(11.30)  |
|               | 2       | .09<br>(.23)  | 1    | 4.<br>(.12)             | 36.<br>(1.01)  | 102.<br>(2.89)  | 158.<br>(4.46)  | 199.<br>(5.64)  | 302.<br>(8.54)   | 404.<br>(11.45)  |
| ROUTED TO     | 3       | .09<br>(.23)  | 1    | 4.<br>(.12)             | 34.<br>(.96)   | 92.<br>(2.61)   | 151.<br>(4.27)  | 190.<br>(5.38)  | 281.<br>(7.95)   | 375.<br>(10.63)  |
|               | 3       | .53<br>(1.37) | 1    | 155.<br>(4.39)          | 310.<br>(8.79) | 465.<br>(13.18) | 621.<br>(17.57) | 776.<br>(21.97) | 1164.<br>(32.93) | 1552.<br>(43.93) |
| HYDROGRAPH AT | 3       | .62<br>(1.61) | 1    | 157.<br>(4.45)          | 316.<br>(8.96) | 558.<br>(15.79) | 758.<br>(21.45) | 946.<br>(26.79) | 1421.<br>(40.25) | 1892.<br>(53.62) |
|               | 4       | .62<br>(1.61) | 1    | 136.<br>(3.85)          | 287.<br>(8.12) | 489.<br>(13.84) | 674.<br>(19.10) | 878.<br>(24.86) | 1430.<br>(40.50) | 1884.<br>(53.35) |

# SUMMARY OF DAM SAFETY ANALYSIS

| PLAN 1 ..... | RATIO<br>OF<br>PMF | ELEVATION<br>STOPAGE<br>OUTFLOW | INITIAL VALUE<br>1661.00<br>35.<br>0. | SPILLWAY CREST<br>1661.50<br>38.<br>0. | TOP OF DAM<br>1663.00<br>49.<br>8. | MAXIMUM<br>RESERVOIR<br>W.S.ELEV | MAXIMUM<br>DEPTH<br>OVER DAM | MAXIMUM<br>STORAGE<br>AC-FT | MAXIMUM<br>OUTFLOW<br>CFS | DURATION<br>OVER TOP<br>HOURS | TIME OF<br>MAX OUTFLOW<br>HOURS | TIME OF<br>FAILURE<br>HOURS |
|--------------|--------------------|---------------------------------|---------------------------------------|----------------------------------------|------------------------------------|----------------------------------|------------------------------|-----------------------------|---------------------------|-------------------------------|---------------------------------|-----------------------------|
|              |                    |                                 |                                       |                                        |                                    |                                  |                              |                             |                           |                               |                                 |                             |
|              | .10                | 1662.34                         | 0.00                                  | 44.                                    | 4.                                 | 0.00                             | 0.00                         | 43.25                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | .20                | 1663.15                         | .15                                   | 50.                                    | 36.                                | 4.00                             | 4.00                         | 41.75                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | .30                | 1663.26                         | .26                                   | 51.                                    | 102.                               | 5.25                             | 5.25                         | 40.50                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | .40                | 1663.34                         | .34                                   | 52.                                    | 158.                               | 6.50                             | 6.50                         | 40.25                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | .50                | 1663.39                         | .39                                   | 52.                                    | 199.                               | 8.00                             | 8.00                         | 40.25                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | .75                | 1663.49                         | .49                                   | 53.                                    | 302.                               | 10.00                            | 10.00                        | 40.25                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |
|              | 1.00               | 1663.58                         | .58                                   | 54.                                    | 404.                               | 10.50                            | 10.50                        | 40.25                       | 0.00                      | 0.00                          | 0.00                            | 0.00                        |

## PLAN 1 STATION 3

| RATIO | MAXIMUM<br>FLOW,CFS | MAXIMUM<br>STAGE,FT | TIME<br>HOURS |
|-------|---------------------|---------------------|---------------|
| .10   | 4.                  | 1575.8              | 43.50         |
| .20   | 34.                 | 1577.0              | 42.00         |
| .30   | 92.                 | 1578.2              | 40.75         |
| .40   | 151.                | 1579.0              | 40.50         |
| .50   | 190.                | 1579.5              | 40.50         |
| .75   | 281.                | 1580.0              | 40.50         |
| 1.00  | 375.                | 1580.6              | 40.50         |

# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

| RATIO<br>OF<br>PMF | MAXIMUM<br>RESERVOIR<br>W.S.ELEV | ELEVATION<br>STORAGE<br>OUTFLOW | INITIAL VALUE<br>1575.60<br>77.<br>0. | SPILLWAY CREST<br>1575.60<br>77.<br>0. | TOP OF DAM<br>1578.00<br>117.<br>624. | MAXIMUM<br>STORAGE<br>AC-FT | MAXIMUM<br>OUTFLOW<br>CFS | DURATION<br>OVER TOP<br>HOURS | TIME OF<br>MAX OUTFLOW<br>HOURS | TIME OF<br>FAILURE<br>HOURS |
|--------------------|----------------------------------|---------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|-----------------------------|---------------------------|-------------------------------|---------------------------------|-----------------------------|
|                    |                                  |                                 |                                       |                                        |                                       |                             |                           |                               |                                 |                             |
| .10                | 1576.57                          |                                 |                                       |                                        |                                       | 93.                         | 136.                      | 0.00                          | 41.75                           | 0.00                        |
| .20                | 1577.06                          |                                 |                                       |                                        |                                       | 101.                        | 287.                      | 0.00                          | 41.75                           | 0.00                        |
| .30                | 1577.62                          |                                 |                                       |                                        |                                       | 110.                        | 489.                      | 0.00                          | 41.50                           | 0.00                        |
| .40                | 1578.12                          |                                 |                                       |                                        |                                       | 119.                        | 674.                      | 1.00                          | 41.25                           | 0.00                        |
| .50                | 1578.47                          |                                 |                                       |                                        |                                       | 125.                        | 878.                      | 2.50                          | 41.00                           | 0.00                        |
| .75                | 1578.93                          |                                 |                                       |                                        |                                       | 133.                        | 1430.                     | 4.00                          | 40.75                           | 0.00                        |
| 1.00               | 1579.18                          |                                 |                                       |                                        |                                       | 137.                        | 1884.                     | 5.25                          | 40.75                           | 0.00                        |

**APPENDIX E**

**EXHIBITS**

**1970**

1970

1691 v. Eldredsville

E L K L | A N D

Bedford Corners 3466

**WATERSHED BOUNDARY**

## MAPLE LAKE DAM

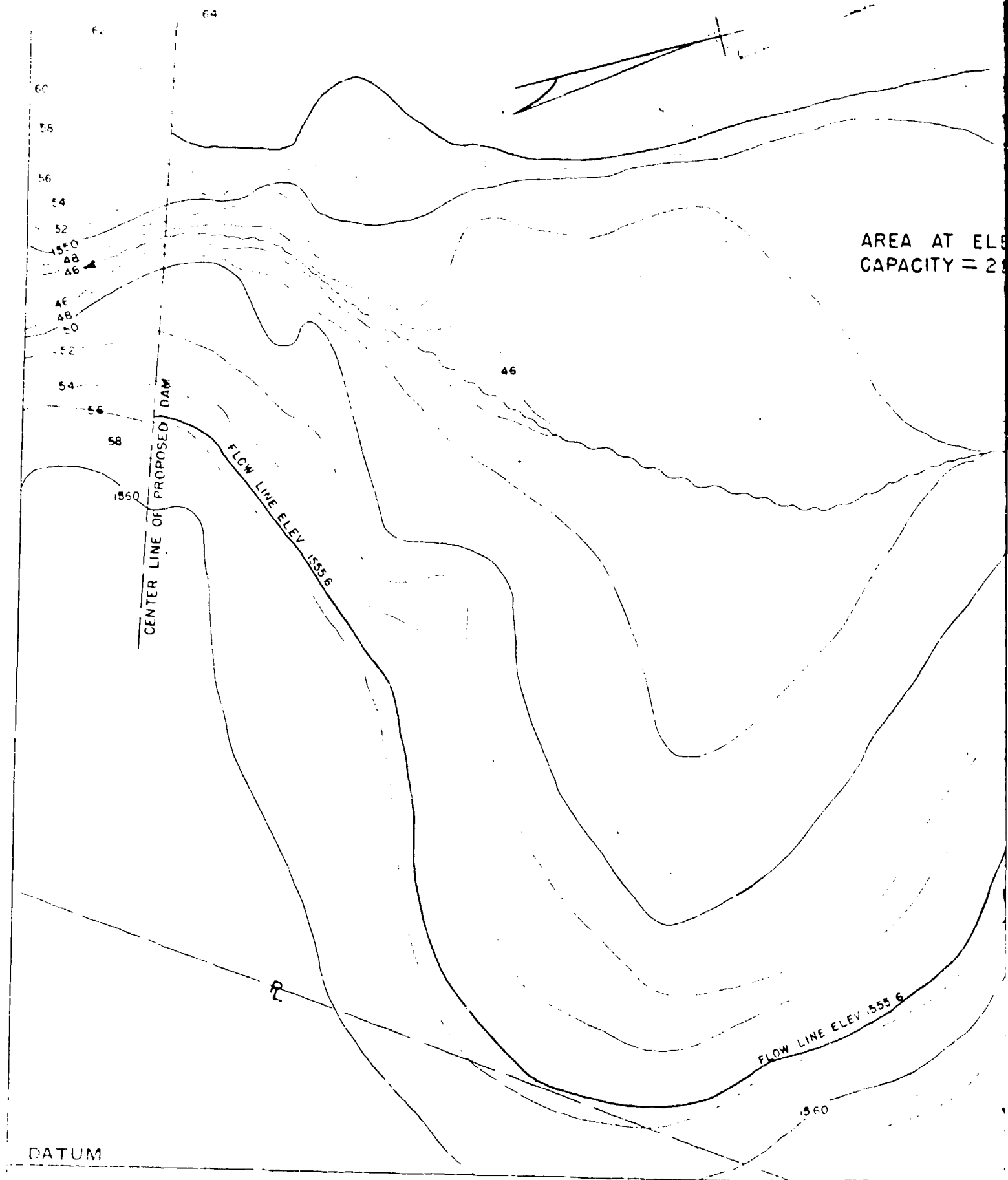
## Estella

**Estella**

**LONGEST WATERCOURSE**  
**CENTROID OF DRAINAGE AREA**

**EXHIBIT E-1**

## REGIONAL VICINITY AND WATERSHED BOUNDARY MAP

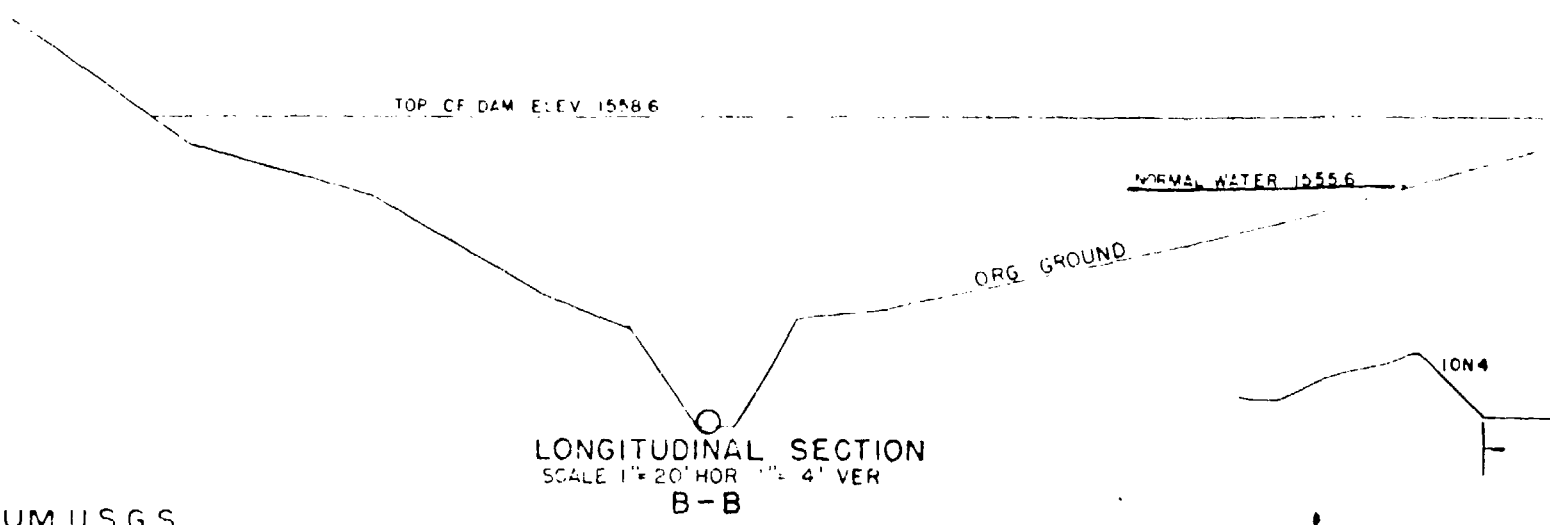
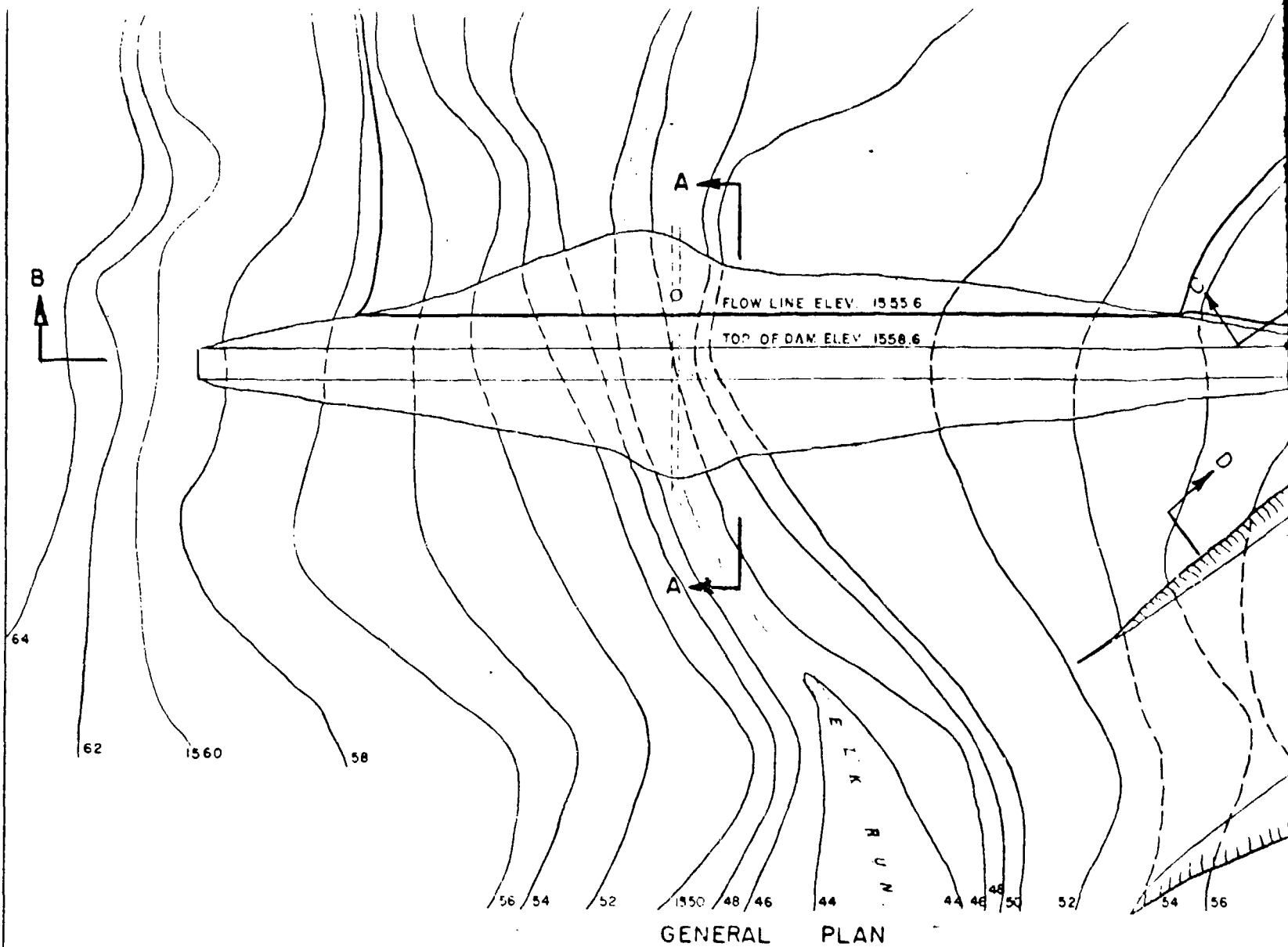


AREA AT ELEV 1555.6 = 157 ACRES  
CAPACITY = 22,000,000 GALLONS

PROPOSED  
MAPLE LAKE  
BAUMUNK LUMBER CO.  
ELKLAND TWP SULL CO PENN.  
W R STEPP, LA PORTE, PA.  
REG ENG PA LIC 5152  
SCALE 1" = 50'  
MAY 1953  
SHEET 1 OF 4  
PLAN

REV-1-AUG. 1953

EXHIBIT E-2



DATUM U S G S

APPROACH TO SPILLWAY  
EXCAVATED TO 1555.0 ELEV

SPILLWAY ELEV 1556.1

2.0%

1562

1558.6

1560

1555.0

VARIABLE  
60' MINIMUM  
C-C

ORG. SURFACE

ORG. SURFACE

1 ON 4

1 ON 4

SPILLWAY ELEV 1556.1

60'

1555.6

ORG. SURFACE

1 ON 4

1 ON 4

60'

D-D

# PROPOSED MAPLE LAKE

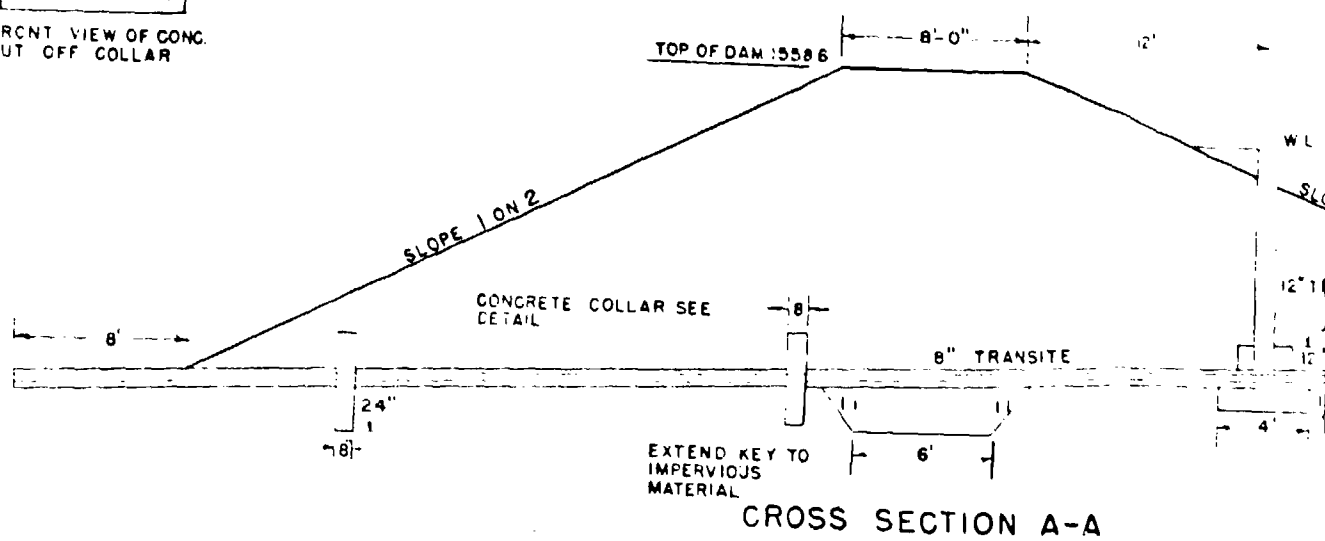
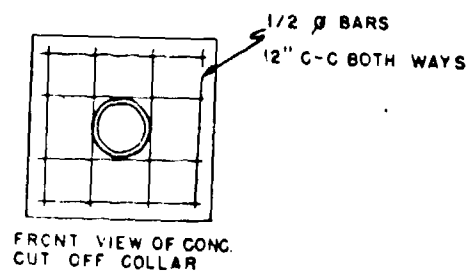
BAUMUNK LUMBER CO.  
ELKLAND TWP SULL CO PENN.  
W R STEPP LAPORTE PA.  
REG. ENG. PA LIC. 5152

SCALE 1" = 20'  
MAY 1953  
SHEET 2 OF 4

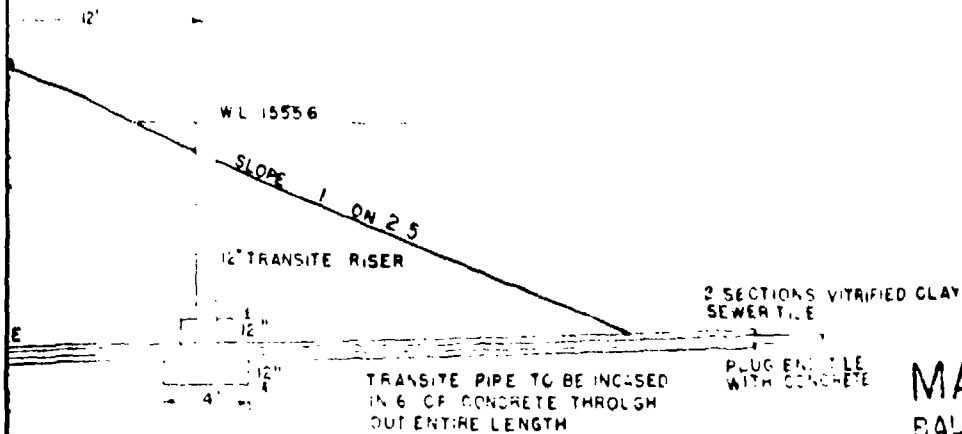
PA-1-116 1753

EXHIBIT E-8

2



DATUM



PROPOSED  
**MAPLE LAKE**  
 BAUMUNK LUMBER CO.  
 ELKLAND TWP SULL CO PENN.  
 W R STEPP LAPORTE, PA  
 REG ENG PA LIC. 5152  
 SCALE 1" = 4'  
 MAY 1953  
 SHEET 3 OF 4

REV-1 - AUG 1953

EXHIBIT E-4

2

W.S.(8/10/1954), PRIOR  
TO PLUGGING INLET

12" DIA. RISER PIPE



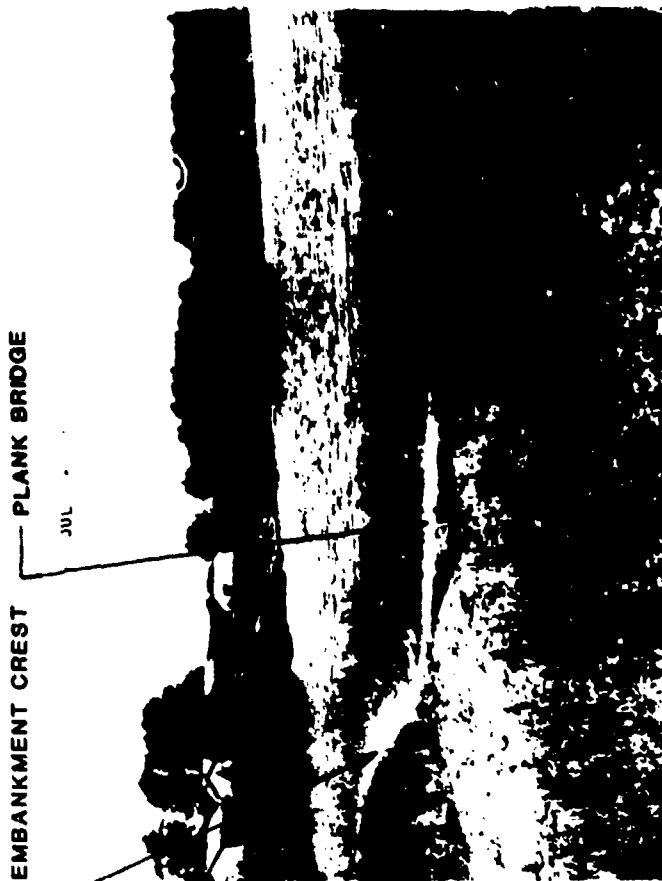
VIEW FROM RIGHT ABUTMENT



TOP OF RISER PIPE



UPSTREAM FACE AT NORMAL POOL (7/6/1965)  
EMBANKMENT CREST — PLANK BRIDGE



VIEW FROM LEFT ABUTMENT UPSTREAM FACE OF DAM (AUG. 1954)

UPSTREAM VIEW OF EMERGENCY SPILLWAY CONDITIONS IN JULY, 1965

JUL

PLANK BRIDGE



UPSTREAM VIEW OF LAKE (7/06/1966)  
EMERGENCY SPILLWAY LEFT BANK IN FOREGROUND



AFTER REMOVAL OF TREES (9/23/1966)

EXCAVATED EMERGENCY SPILLWAY (8/10/1964)

JUL



PRIOR REMOVAL OF TREES (7/06/1966)

## **APPENDIX F**

### **GEOLOGY**

## MAPLE LAKE DAM

### APPENDIX F

#### GEOLOGY

The Maple Lake Dam and reservoir area are located within the Glaciated Allegheny Plateau Section of the Appalachian Plateau Physiographic Province. Except where bedrock is exposed, deposits of glacial drift of variable thickness cover much of the area. The drift was deposited by the Wisconsin Ice Sheet during the Pleistocene period of geologic time.

The glacial drift is composed primarily of till which is a reddish-brown, unsorted, compact mixture of clay, silt, sand, gravel, and cobbles with occasional boulder sized pieces. The stone pieces are sub-angular to rounded and consist mainly of sandstone and siltstone derived from the Catskill Formation, the dominant rock formation in the area. The clay content and compact nature of the till makes it a relatively impervious soil type.

Some deposits of glacial outwash and Kame terraces are also found in the area. These deposits are composed of loose, poorly sorted to stratified deposits of silt, sand and gravel. The Kame and outwash deposits are generally very pervious.

Other loose, pervious soils in the area are recent deposits of alluvial silt, sand, and gravel with some clay. These soils are localized and limited to streambeds and flood plain areas.

The bedrock underlying the entire dam and reservoir area is the Catskill Formation of the Susquehanna Group. This group of formations is of Upper Devonian age. The Catskill strata generally consists of well indurated red shale, siltstone and fine sandstone with some gray, green and brown shale, siltstone and sandstone layers. Occasional conglomeratic layers are encountered. The red shales are the dominant lithology and the residual soils derived from this rock are usually high in clay and silt and contain numerous flaky and angular fragments and flat, slabby boulders. The dam was constructed with residual soils from a borrow area on the left abutment.

The regional structure of the bedrock in the area indicates that the bedrock underlying the dam and reservoir area is gently folded. Surface exposures of red shale bedrock about 75 feet downstream of the dam on the right abutment strike N30°-40°W and dip 5°-10°SW. Red shale is also exposed 75 feet upstream of the dam on the right abutment where it strikes NS and dips 10°W. Red shale and fine grained sandstone, exposed in six to ten foot cliffs 200 feet upstream of the dam on the right abutment, strike N20°-40°W and dip 10°-15°SW. The right end of the dam is probably founded on bedrock.

Ref.: *Ground Water of Northeastern Pennsylvania*, Stanley W. Lohman, 1937; *Bulletin W-4, Pennsylvania Geologic Survey*.



0 1 2 3 4 5 10 MILES

SCALE: 1" = 4 MILES

## LEGEND

### PENNSYLVANIAN

#### 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, Schuylkill, and Tumbling Run Formations.

### MISSISSIPPIAN



**Mauch Chunk Formation**  
Red shales with brown to greenish gray thin sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and Adams Counties; Logan Limestone at the base in southwestern Pennsylvania.



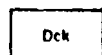
**Pocahontas Group**  
Predominantly gray, hard, massive, conglutinated conglomerates and sandstones with some shale, includes in the Appalachian Plateau: Burgoon, Shenandoah, Cayahoga, Cussewago, Corry, and Knapp Formations; includes part of "Onondaga" of M. J. Fuller in Potter and Tioga counties.

### DEVONIAN

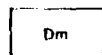
#### UPPER



**Onondaga Formation**  
Brownish and greenish gray, fine and medium grained sandstones with some shale and scattered calcareous lenses, includes red shales which become more numerous eastward. Relation to type Onondaga not proved.

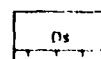


**Catskill Formation**  
Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Howardsville, Shohola, and Delaware River in the east.



**Marine beds**  
Gray to olive brown shales, graywackes and sandstones, contains "Chemung" beds and "Potage" beds including Bucklet, Brallier, Havell, and Trimmers Rock Tully Limestone at base.

#### CENTRAL AND EASTERN PENNSYLVANIA



**Susquehanna Group**  
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey. County reports barbs on "Chemung" side of line.

#### NOTE:

GEOLOGIC MAP AND LEGEND  
OBTAINED FROM GEOLOGIC MAP  
OF PENNSYLVANIA BY PA.  
TOPOGRAPHIC AND GEOLOGIC  
SURVEY, DAT: 1960

#### PHASE 1 INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

### MAPLE LAKE DAM GEOLOGIC MAP

GEO - Technical Services, Inc.  
HARRISBURG, PA

AUGUST, 1981

EXHIBIT F