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WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA  
NATIONAL DAM INSPECTION PROGRAM; SPRING MILL DAM (NDS I.D. NUMB--ETC(U)  
MAR 80 M F BECK, J H FREDERICK DACW31-80-C-0018

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DACW31-80-C-0018

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DELAWARE RIVER BASIN

SPRING CREEK

National Dam Inspection Program

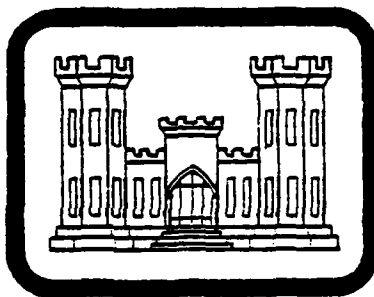
SPRING MILL DAM

LEHIGH COUNTY, PENNSYLVANIA

(NDS I.D. <sup>Number</sup> NO. PA 89785  
DER I.D. <sup>Number</sup> NO. 39-1), Delaware River

Passing Spring Creek, Lehigh County,  
Pennsylvania.

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM



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10 Mary F. / ~~John A.~~ Prepared by:

WOODWARD-CLYDE CONSULTANTS  
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WCDADWEL-80-0458

Submitted to:

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

11 March 1980

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J.E

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 the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to expeditiously identify 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 the need for more detailed studies.

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

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

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

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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Spring Mill Dam  
County Located: Lehigh County  
State Located: Pennsylvania  
Stream: Spring Creek  
Coordinates: Latitude 40° 42.0'  
Longitude 75° 31.1'  
Date of Inspection: November 16, 1979

Spring Mill Dam, built in 1889 and 1900, is owned by Northampton Borough Municipal Water Authority. The dam and reservoir are currently used as a secondary water supply for Northampton Borough, Pennsylvania.

The dam and its appurtenant facilities are considered to be in good condition. The dam is classified as a "Small" size structure with a "Significant" hazard classification, consistent with its appreciable economic loss and possible loss of life in the event of failure.

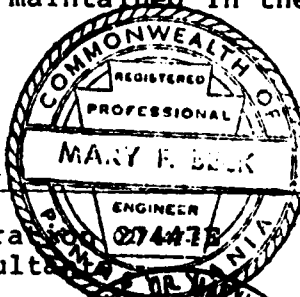
In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "Significant" hazard classification ranges from the 100 year event to 0.5 PMF (Probable Maximum Flood). As the height of this dam is near the lower limit for small size dams, and the total capacity is less than one-third the upper limit, the selected spillway design flood is the 100 year event. Hydrologic and hydraulic computations presented in Appendix D indicate that the structure will not pass the 100 year event without overtopping. It is further assessed that the 100 year event would not cause failure or significantly increase the potential for excessive property damage and loss of life downstream of the dam. Therefore, the spillway systems of this structure are considered to be "Inadequate" but not "Seriously Inadequate".

It is recommended that the following measures be undertaken as soon as practical.

1. All pond drain controls should be made operational.
2. The mortar joints in the bridge parapet wall and the spillway retaining wall should be repaired.
3. The flashboards, which reduce the spillway capacity, should be removed.

Because of the location of the dam and the potential for significant or appreciable property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning water treatment plant personnel if high flows are expected and provisions for evacuating these people in the event of an emergency. In addition, an operation and maintenance procedure should also be developed to insure that all pertinent items are carefully inspected on a regular basis and maintained in the best possible condition.

*Mary F. Beck*  
 Mary F. Beck, P.E.  
 Pennsylvania Registration No. 074478  
 Woodward-Clyde Consultants



*3/18/80*  
 Date

*John H. Frederick, Jr.*  
 John H. Frederick, Jr.  
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 Woodward-Clyde Consultants



*3/18/80*  
 Date

APPROVED BY:

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

*25 APR 80*  
 Date



OVERVIEW  
SPRING MILL DAM, LEHIGH COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
SPRING MILL DAM  
NATIONAL ID NO. PA 00785  
DER NO. 39-1

SECTION 1  
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

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

1.2 Description of Project.

a. Dam and Appurtenances. Spring Mill Dam is a masonry and earth/rock dam about 27 feet high and 235 feet long. Very limited data exists regarding the physical features of the dam. Blueprints in the Pennsylvania Department of Environmental Resources (DER) files were traced in 1914, from the original records obtained from C. D. Weirbach, the engineer in charge of construction, dated 1899 and 1900. The drawings indicate that the rubble masonry wall is 5.5 feet wide at the top. The upstream masonry slope is 1H:12V and the downstream masonry slope is 1H:2V. The cutoff wall appears to be up to 15 feet below the existing ground line or rock line. Rock or earth and rock fill on the downstream slope has a slope of 2.5H:1V, although a slope of 1.5H:1V is shown on the plans. A paved two lane road crosses over the breast of the dam.

An "L"-shaped broad crested weir forms the spillway at the left end of the dam. Spillway discharge flows over the stepped downstream face of the weir, under a stone arch bridge, and discharges over bedrock about 30 feet beyond the dam.

A masonry screen chamber, shown as 16 feet square on the blueprints, is located upstream of the dam at approximately its midpoint. Drawings show two intakes, 12 feet and 21.5 feet below the spillway crest, which admit water into the chamber from which the flow is carried through a 16 inch main to the water treatment plant downstream. A 30 inch cast iron

pond drain pipe is below the 16 inch main water supply line, 29 feet below the spillway crest. As shown in Photograph 5, there are three intakes on the right side of the structure, reportedly at about 8, 12 and 16 feet below the water surface.

b. Location. The dam is located across Spring Creek in North Whitehall Township, Lehigh County, Pennsylvania. The dam site is located approximately one mile north of Cementon, Pennsylvania. The dam site and reservoir are located on the USGS Quadrangle map entitled, "Cementon, Pennsylvania", at coordinates N 40° 42.0' W 75° 31.1'. A regional location plan of Spring Mill Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Small" size structure by virtue of its 27 foot height and estimated total capacity of 269 acre-feet.

d. Hazard Classification. A "Significant" hazard classification is assigned consistent with the dam's location above a water treatment plant and the potential to cause economic loss and possible loss of life downstream of the dam at the treatment plant.

e. Ownership. Spring Mill Dam is owned by the Northampton Borough Municipal Water Authority. All correspondence should be addressed to Mr. Richard Paul, Manager, Northampton Borough Municipal Water Authority, 1717 Main Street, Northampton, Pennsylvania 18067.

f. Purpose of Dam. The dam was built and is used as a water supply dam. It is currently used as a secondary source of water. The Lehigh River is the primary water supply source.

g. Design and Construction History. Information concerning the construction of the dam is limited to blueprints in DER files. The dam, known as Mill Creek Dam, was built in 1899 and 1900, for the Clear Springs Water Company. The present Water Authority was founded in 1940. No other state files were available for review.

h. Normal Operating Procedures. Water is drawn off as needed through the upper two intakes to the 16 inch pipe leading to the treatment plant located immediately downstream of the dam. Treated water is pumped to Cementon Reservoir for storage, as shown on Plate 1. Excess flow discharges over the stone spillway, flowing beside the treatment plant and entering the Lehigh River approximately 900 feet downstream of the dam.

### 1.3 Pertinent Data.

The summary of pertinent data for Spring Mill Dam is presented as follows.

a.	Drainage Area (square miles)	3.0
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood at Dam Site	Unknown
	At Top of Dam	960
c.	Elevation (feet above MSL)	
	Top of Dam	348.7
	Spillway Weir Crest <sup>(1)</sup>	345.0
	Water Supply Intakes	337, 333, 329
	Pond Drain Inlet	316.0
	Pond Drain Outlet Invert	312.1
	Downstream Toe	322.1
d.	Reservoir Length (feet)	
	Length at Normal Pool	1,400
e.	Storage (acre-feet)	
	To Spillway Crest (normal pool)	230
	To Top of Dam	269
f.	Reservoir Surface Area (acres)	
	Normal Pool	9.3
g.	Embankment Data	
	Type	Masonry and rock or earth and rock
	Volume	6,538 cu yds masonry 8,000 cu yds rock or earth/rock (est)
	Length	235 feet
	Height Above Downstream Toe	26.6 feet
	Top Width	28.5 feet
	Side Slopes	
	Upstream	1 H:12V
	Downstream	2.5H: 1V
	Cutoff	Masonry cutoff excavated up to 15 feet below ground line
	Grout Curtain	None

---

(1) Spillway crest elevation assumed to be 345.0 from USGS Quadrangle map. All other elevations are relative.

h.	Spillway	
	Type	"L"-shaped broad crested weir
	Weir Crest Elevation	345.0
	Pond Drain Inlet	316.0
	Pond Drain Outlet Invert	312.1
i.	Outlet Works	
	Type	Masonry screen cham- ber
	Water Supply	
	Intake Elevations	337, 333, 329
	Outlet	In downstream plant
	Pond Drain	
	Type	30 inch CIP
	Inlet Elevation	316.0
	Outlet Elevation	312.1

SECTION 2  
ENGINEERING DATA

2.1 Design.

a. Data Available. The only data available for review are the blueprints located in the Department of Environmental Resources (DER) files. There were no other records available for review. There is no record of any engineering analysis performed for this dam.

b. Design Features. The principal design features of Spring Mill Dam are illustrated on Plates 2 through 6, Appendix E. Data for these sections were obtained from the blueprints in the state files. A description of the design features is also described in Section 1.2, paragraph a, and pertinent data relative to the structure is presented in Section 1.3.

2.2 Construction.

Beyond the limited information given in Section 1.2, there are no data available concerning the construction history of this dam and reservoir.

2.3 Operational Data.

There are no operational records maintained.

2.4 Evaluation.

a. Availability. Information presented herein was obtained from the records located in DER files in Harrisburg, Pennsylvania, and from conversations with the Owner's representative.

b. Adequacy. The available data included in the state files together with the visual inspection are considered adequate to evaluate the design of the dam and appurtenant structures.

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

SECTION 3  
VISUAL INSPECTION

3.1 Findings.

a. General. Observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix A, and are summarized and evaluated in the following subsections. In general, the appearance of the facility indicates that the dam is in good condition. Plan and cross-sections of the dam are shown on Plates 2 and 3, Appendix E.

b. Dam. During the visual inspection, there were no indications of distortions in alignment or grade that would be indicative of movement of the dam or the foundation. The vertical alignment of the dam was checked and elevations are shown on sheet 5b, Appendix A. No discernible horizontal displacement or bulging was noted along the crest. The visible portion of the upstream face of the dam is the masonry wall, 5.5 feet wide at the top, which has been capped with a two foot wide concrete wall, and is shown on Photographs 7 and 9, Appendix C. The exposed masonry and concrete portion is generally in good condition. Near the right abutment, stone masonry was extended and soil placed on the upstream side of the wall. Some deterioration of the mortared joints has occurred in this area, and the concrete cap has been displaced up to four inches laterally; see Photograph 9. The exposed portion of the stone masonry is also damaged. It is undetermined whether the damage is limited to the exposed masonry or extends a significant distance underground. It is assessed that the damage is of a limited extent.

The crest of the dam is paved with a bituminous concrete pavement. The pavement is in generally good condition, but with a large area of alligator cracking near the left abutment. The cause of the cracking could not be determined. The downstream slope is rock, as shown in Photograph 8, which appears to have been dumped from the top of the dam. Larger pieces are towards the bottom of the slope. No woody vegetation was noted growing in the rock, although there are large patches of fairly high weeds. It is unknown whether the downstream portion of the dam is rock or rock overlying earth. No seepage was observed either at or beyond the toe of the downstream slope. A small gully was detected in the grass at the downstream toe; the gully was judged to be insignificant.

c. Appurtenant Structures.

1. Spillway. The spillway is "L"-shaped, as shown on sheet 5a, Appendix A, with the shorter leg perpendicular to the masonry dam. The longer leg is perpendicular to a retaining wall, which is parallel to the left abutment. Flashboards have been added to the spillway, as shown on Photograph 1. These flashboards are about 10 to 14 inches high and are held in place by pipes driven into the stone. It is assessed that these would fail during a large storm.

A bridge spans the area between the left abutment and the masonry dam, as shown on Photograph 2. The bridge and spillway are generally in good condition, but with some cracks and deterioration of the mortared joints noted in the bridge parapet walls and the retaining walls of the spillway, as shown in Photographs 10 and 11. The cracks appear to be limited to the parapet wall and do not extend to the bridge floor.

The spillway channel below the bridge, shown on Photographs 2 and 3, is assessed to be in good condition. Spillway discharge flows under the bridge and then over bedrock to a plunge pool located below the dam. The channel between the plunge pool and a downstream railroad culvert was rehabilitated in 1977.

2. Outlet Works. The exposed portions of the masonry screen chamber, shown in Photograph 5, were inspected and appear to be in good condition. The wooden top could not be removed to inspect the interior of the chamber. The upper two intakes were exercised; the lower intake is inoperable. The pond drain conduit is gated at the upstream end and at the downstream toe. The upstream gate is nonfunctional, and flow through the pond drain is controlled at the downstream valve. A small amount of water was flowing through the pond drain conduit at the time of the inspection, as shown in Photograph 6. The original cast iron conduit has been extended by reinforced concrete pipe, and this discharges into the stream channel about 135 feet beyond the dam. Two other valves at the toe of the dam control the flow of water between the treatment plant and the reservoir and tank on top of the hill. A third valve controls the drain line from the tank. The drain line from the tank can also draw off water from upstream of the dam. A schematic diagram, as reported by the plant operator, is included on sheet 5a.

d. Reservoir. The reservoir slopes are moderate to steep. A roadway parallels the north side of the reservoir, and a steep hill with trees and rock outcrops is on the south side of the reservoir. A considerable amount of sediment has been deposited at the upper end of the pool; however, this

should have little effect on flood water storage. There was very little debris noted along the reservoir side slopes.

e. Downstream Channel. Immediately below the dam, the spillway discharge falls over bedrock, as shown in Photograph 2, to a plunge pool. About 200 feet downstream of the dam is the treatment plant. The minimum channel section is located near the access bridge to the treatment plant. At this point, the channel is about 39 feet wide and 12 feet deep. About 500 feet downstream from the dam, the channel flows under a high concrete arch highway bridge, shown in Photograph 3. About 800 feet below the dam, the channel passes under Conrail tracks, through the culvert shown in Photograph 4, and then discharges into the Lehigh River. It is reported that the Lehigh River backs up to the access bridge in the plant area during large storms. The downstream damage center is limited to the treatment plant below the dam. Failure of the dam would result in the loss of a secondary water supply and possible damage to a treatment plant serving about 40,000 people, therefore causing an appreciable economic loss, and a significant hazard potential classification is justified.

### 3.2 Evaluation.

Inspection of the dam and appurtenant facilities disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam or spillway. Interior portions of the screen chamber could not be inspected. Not all pond drain controls are operational, which should be corrected. The dam and spillway systems are considered to be in good condition, as the extent of the damaged masonry is assessed to be of a limited extent. Items of preventive maintenance to be noted are the repair of mortared joints in the bridge parapet wall, the spillway retaining wall and the exposed portions of the right end of the dam. Also noted were weeds on the downstream face which should be cut on an annual basis.

SECTION 4  
OPERATIONAL PROCEDURES

4.1 Procedures.

Operation of the dam does not require a dam tender. Under normal conditions, water for treatment is drawn off through the upper two intakes in the screen chamber, as needed. Excess water is discharged over the spillway adjacent to the left abutment.

4.2 Maintenance of the Dam.

No routine maintenance procedures were reported beyond the cutting of weeds on the downstream slope. As the Water Authority owns the road crossing the dam, there is no confusion over responsibility for maintenance of the dam.

4.3 Maintenance of Operating Facilities.

No operating procedures were reported.

4.4 Warning Systems In Effect.

There is no written warning procedure in effect for this dam. The downstream damage center is the treatment plant located immediately below the dam, where at least one employee is always on duty.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a dam tender, is a realistic means of operating the relatively simple control facilities of Spring Mill Dam. In conclusion, it is noted that formal operational, maintenance and warning procedures should be developed and implemented as soon as practical. These procedures should include an inspection checklist, which would include a list of items that should be checked during each inspection and repaired as necessary to insure proper performance of the structure.

SECTION 5  
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. There is no original design or subsequent evaluation data available for this dam.

The watershed is about 2.9 miles long and averages less than a mile wide, having a total area of three square miles. Elevations within the watershed range from about 745 feet in the upper reaches to 345 feet at normal pool elevation. The watershed is approximately ten percent wooded and the rest is open land with scattered residential development.

In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "Significant" hazard classification ranges from the 100 year event to 0.5 PMF (Probable Maximum Flood). As the height of this dam is near the lower limit for small size dams, and the total capacity is less than one-third the upper limit, the selected spillway design flood is the 100 year event.

b. Experience Data. There are no records of reservoir levels or rainfall kept for this dam. There are no estimates or records of previous high water levels. It is reported that the dam was overtopped in 1945, but no other information about that event is available.

c. Visual Observations. On the date of the inspection, the only condition observed that would indicate a reduced spillway capacity is that flashboards have been added to the spillway. It is considered likely that these flashboards would fail in the event of a large storm. Other observations regarding the condition of the downstream channel, spillway and reservoir are presented in Appendix A and are discussed in greater detail in Section 3.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the HEC-1, Dam Safety Version, computer program. A brief description of the program is included in Appendix D. The selected spillway design storm for this dam is the 100 year event. The peak inflow rate calculated by the computer program is 1,425 cfs. This value was checked against the peak inflow value as determined according to procedures in the "Regional Frequency Study, Upper Delaware and Hudson River Basin, New York District" report prepared by the Hydrologic Engineering Center in

California. There was very good correlation between the two procedures. Calculations for this investigation indicate the maximum spillway capacity to be about 960 cfs with the water level at the minimum top of the dam. With the flashboards in place, the maximum spillway discharge is estimated to be only about 530 cfs. The computer program indicates that the 100 year event will overtop the embankment by about one-half foot without flashboards and about one foot with flashboards, although the flashboards would probably fail before the dam was overtopped by the full one foot.

e. Spillway Adequacy. A spillway that will not pass the spillway design flood without overtopping the dam is rated as "Seriously Inadequate" provided two other conditions are present. One is failure of the dam by overtopping. As this dam is assessed not to fail by overtopping, either with or without flashboards in place, the spillway system is considered to be "Inadequate" but not "Seriously Inadequate".

f. Downstream Conditions. About 200 feet downstream from the dam is the major downstream hazard center, the water treatment plant. About 500 feet beyond the dam, the channel flows under a large concrete arch highway bridge, as shown in Photograph 3. About 800 feet below the dam, the channel passes under Conrail tracks, through the culvert shown in Photograph 4, and then discharges into the Lehigh River. Sudden failure of the dam would flood the water treatment plant shown in Photograph 3, and could possibly damage the plant and cause loss of life, as well as result in loss of the secondary water supply serving about 40,000 people. Therefore, because of the appreciable potential economic loss, a "Significant" hazard potential classification is justified.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The only evidence of existing or impending dam or spillway instability detected by visual observations would be that the right end of the exposed masonry wall was damaged. Although the damage was assessed to be of a local nature, its extent should be verified by further detailed investigation.

b. Design and Construction Data. Design drawings and a stability analysis do not exist for this structure. Based on the dam's longevity and lack of visual signs of significant deterioration, it is qualitatively assessed that the stability of the dam is adequate.

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. A post-construction change noted was the addition of the concrete cap to the upstream masonry wall. This cap serves to increase the height of the dam by about 0.7 feet above the design crest elevation. In addition, the present three level water supply intake arrangement is different from what is shown on the 1917 blueprint and probably is a post-construction change.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally it is considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. As the dam is qualitatively assessed to be stable under static loading conditions, it can reasonably be assumed to be stable under seismic loading conditions.

SECTION 7  
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection indicates that the dam, foundation and spillway structures of Spring Mill Dam are in good condition.

In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "Significant" hazard classification ranges from the 100 year event to 0.5 PMF (Probable Maximum Flood). As the height of this dam is near the lower limit for small size dams, and the total capacity is less than one-third the upper limit, the selected spillway design flood is the 100 year event. Hydrologic and hydraulic computations presented in Appendix D indicate the structure will not pass the 100 year event without overtopping. It is further assessed that the 100 year event would not cause failure or significantly increase the potential for excessive property damage and loss of life downstream of the dam. Therefore, the spillway systems of this structure are considered to be "Inadequate" but not "Seriously Inadequate". The structure itself has a "Significant" hazard classification.

b. Adequacy of Information. The combined visual inspection, obvious performance history of the structure, and simplified calculations presented in Appendix D were sufficiently adequate to evaluate the structure.

c. Urgency. It is recommended that the measures presented in Section 7.2 be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken as soon as practical.

1. All pond drain controls should be made operational.
2. The mortar joints in the bridge parapet wall and the spillway retaining wall should be repaired.
3. The flashboards, which reduce the spillway capacity, should be removed.

b. Operation and Maintenance Procedures. Because of the location of the dam and the potential for significant or appreciable property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning water treatment plant personnel if high flows are expected and provisions for evacuating these people in the event of an emergency. In addition, an operation and maintenance procedure should also be developed to insure that all pertinent items are carefully inspected on a regular basis and maintained in the best possible condition.

**APPENDIX**

**A**

CHECK LIST  
VISUAL INSPECTION  
PHASE I

Sheet 1 of 11

Name Dam Spring Mill Dam County Lehigh State Pennsylvania National ID # PA 00785

Type of Dam Masonry & Rock/Earth Hazard Category Significant

Date(s) Inspection 11/16/1979 Weather Sunny Temperature 50's

Pool Elevation at Time of Inspection 345+ M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

Mary F. Beck (Hydrologist) Vincent McKeever (Hydrologist)

Arthur H. Dvinoff (Geotechnical/Civil)

Raymond S. Lambert (Geologist) Mary F. Beck Recorder

Remarks:

Mr. Robert Crawford, other Northampton Borough Water Authority Employees, and a nearby resident were on site and provided assistance to the inspection team.

CONCRETE/MASONRY DAMS

Sheet 2 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

ANY NOTICEABLE SEEPAGE

N/A

STRUCTURE TO  
ABUTMENT/EMBANKMENT  
JUNCTIONS

N/A

DRAINS

N/A

WATER PASSAGES

N/A

FOUNDATION

N/A

CONCRETE/MASONRY DAMS

Sheet 3 of 11

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

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SURFACE CRACKS

*The only cracking observed was of the bituminous concrete roadway over the crest of the dam near the bridge over the spillway channel. The cause of the cracking could not be determined.*

UNUSUAL MOVEMENT OR  
CRACKING AT OR BEYOND  
THE TOE

*None observed.*

SLOTTING OR EROSION OF  
EMBANKMENT AND ABUTMENT  
SLOPES

*None observed.*

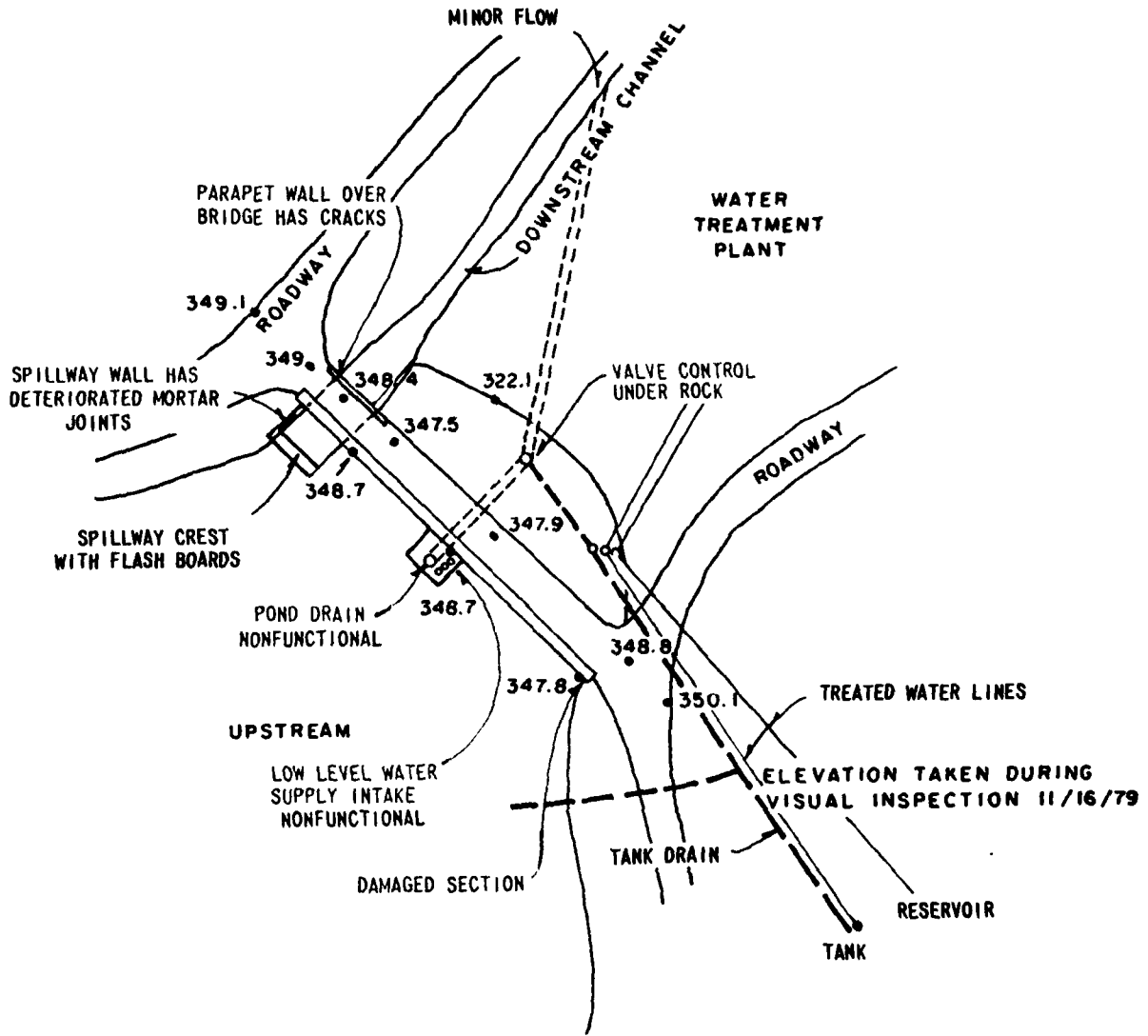
VERTICAL AND HORIZONTAL  
ALIGNMENT OF THE CREST

*Vertical and horizontal alignment were checked and found to be good, except for settlement of the concrete parapet wall near the right abutment; see Photograph No. 9, Appendix C.*

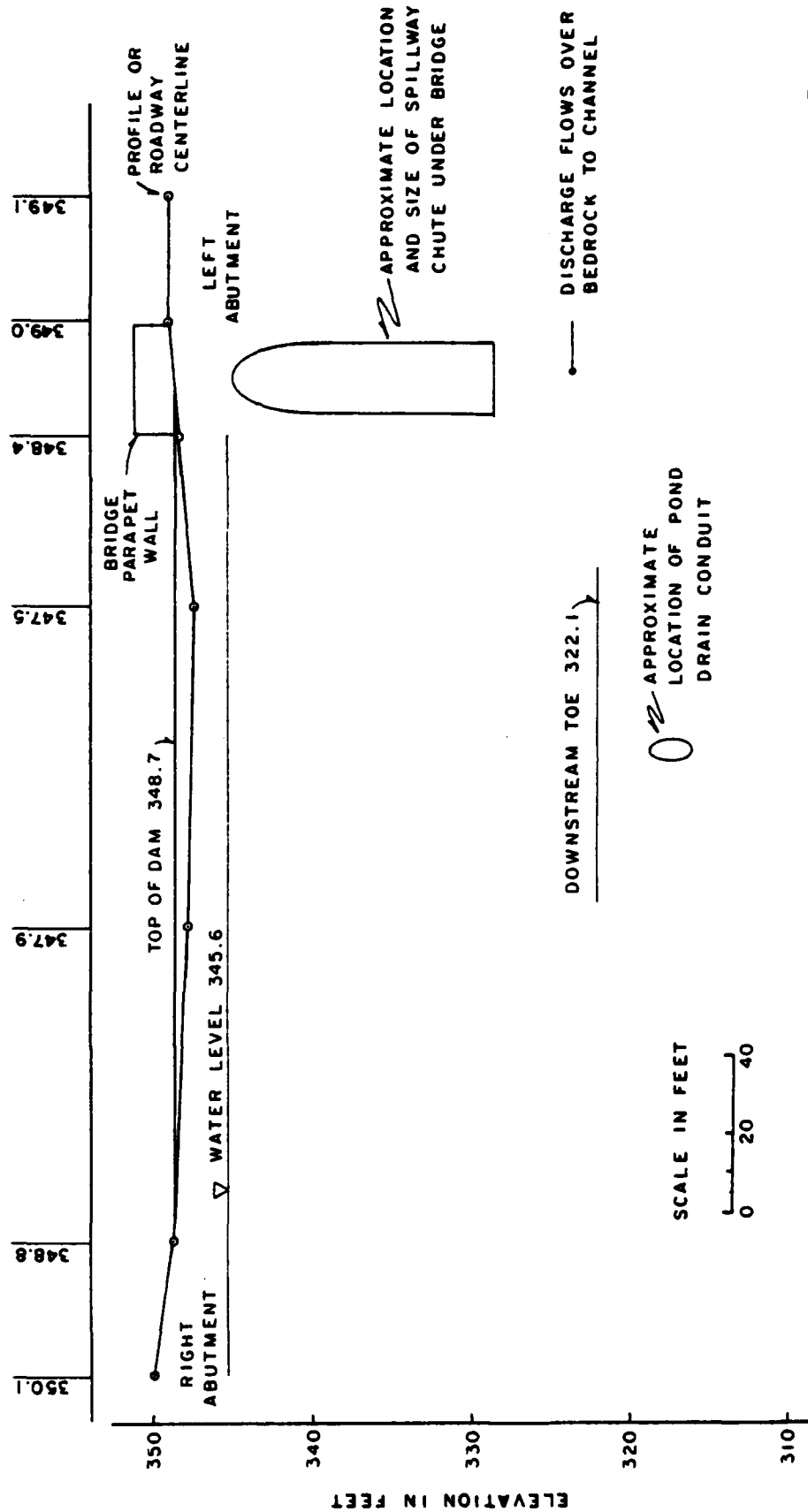
RIPRAP FAILURES

*None observed, the riprap appears to have been placed by dumping from the top of the dam, see Photograph No. 8, Appendix C.*





FIELD OBSERVATION PLAN  
 SPRING MILL DAM  
 SHEET 5A OF 11



FIELD OBSERVATION PROFILE  
 SPRING MILL DAM

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	<p>All conduits are under the dam and could not be inspected with the exception of the outlet of the 30-inch pond drain conduit, which appears in good condition.</p>	
INTAKE STRUCTURE	<p>The exterior of the stone masonry intake structure (above water) appears in good condition. The wooden cover over the interior could not be moved to inspect the interior.</p>	
OUTLET STRUCTURE	<p>None. Three pipes go directly to the treatment plant below the dam. The gate of the deepest intake can not be moved, the upper two gates operate.</p>	
OUTLET CHANNEL	<p>The pond drain gate is frozen open, flow is controlled by a valve at the downstream toe of the embankment.</p>	
EMERGENCY GATE	<p>The pond drain is reportedly controlled at upstream end.</p>	

UNIGATED SPILLWAY

Sheet 7 of 11

VISUAL EXAMINATION OF                      OBSERVATIONS                      REMARKS OR RECOMMENDATIONS

STONE WEIR

*The L-shaped weir (see Photographs, Appendix C) appears in good condition. Flashboards have been added to the top of the weir.*

APPROACH CHANNEL

N/A

DISCHARGE CHANNEL

*The channel under the bridge and immediately downstream of the bridge appears in good condition without excessive deterioration of the shale bedrock.*

BRIDGE AND PIERS

*The underside of the bridge over the spillway channel appears in fairly good condition with some deterioration of mortared joints; see Photograph No. 10 and 11, Appendix C.*

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION      OBSERVATIONS      REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

*None*

OBSERVATION WELLS

*None*

WEIRS

*None*

PIEZOMETERS

*None*

OTHER

*None*

RESERVOIR

Sheet 10 of 11

VISUAL EXAMINATION OF                      OBSERVATIONS                      REMARKS OR RECOMMENDATIONS

SLOPES

*Reservoir slopes are moderate to steep. A roadway parallels the north side of the reservoir and a steep hill with trees and rock outcrops are on the south side of the reservoir.*

SEDIMENTATION

*Sedimentation of the reservoir has no effect on flood water storage.*

DOWNSTREAM CHANNEL

Sheet 11 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CONDITION  
(OBSTRUCTIONS,  
DEBRIS, ETC.)

*The downstream channel appears in good condition, reportedly having been rehabilitated in 1978. About 350 feet downstream, an access road crosses the stream. About 800 feet downstream Conrail tracks cross the stream. The culvert under the railroad is a stone and brick arch about 8 feet wide and 6 feet high.*

SLOPES

*The valley gradient through the plant area is about 0.028.*

APPROXIMATE NO.  
OF HOMES AND  
POPULATION

*The Northampton Borough Water Treatment plant serving 40,000 people is located immediately below the dam. This plant is manned 24 hours per day.*

**APPENDIX**

**B**

NAME OF DAM Spring Mill Dam  
ID # PA 00785

CHECK LIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	See Appendix E.
REGIONAL VICINITY MAP	See Appendix E.
CONSTRUCTION HISTORY	Virtually unknown, see Section 1.2 paragraph 'g'.
TYPICAL SECTIONS OF DAM	See Appendix E.
OUTLETS - PLAN	}
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	See Appendix D.
RAINFALL/RESERVOIR RECORDS	None

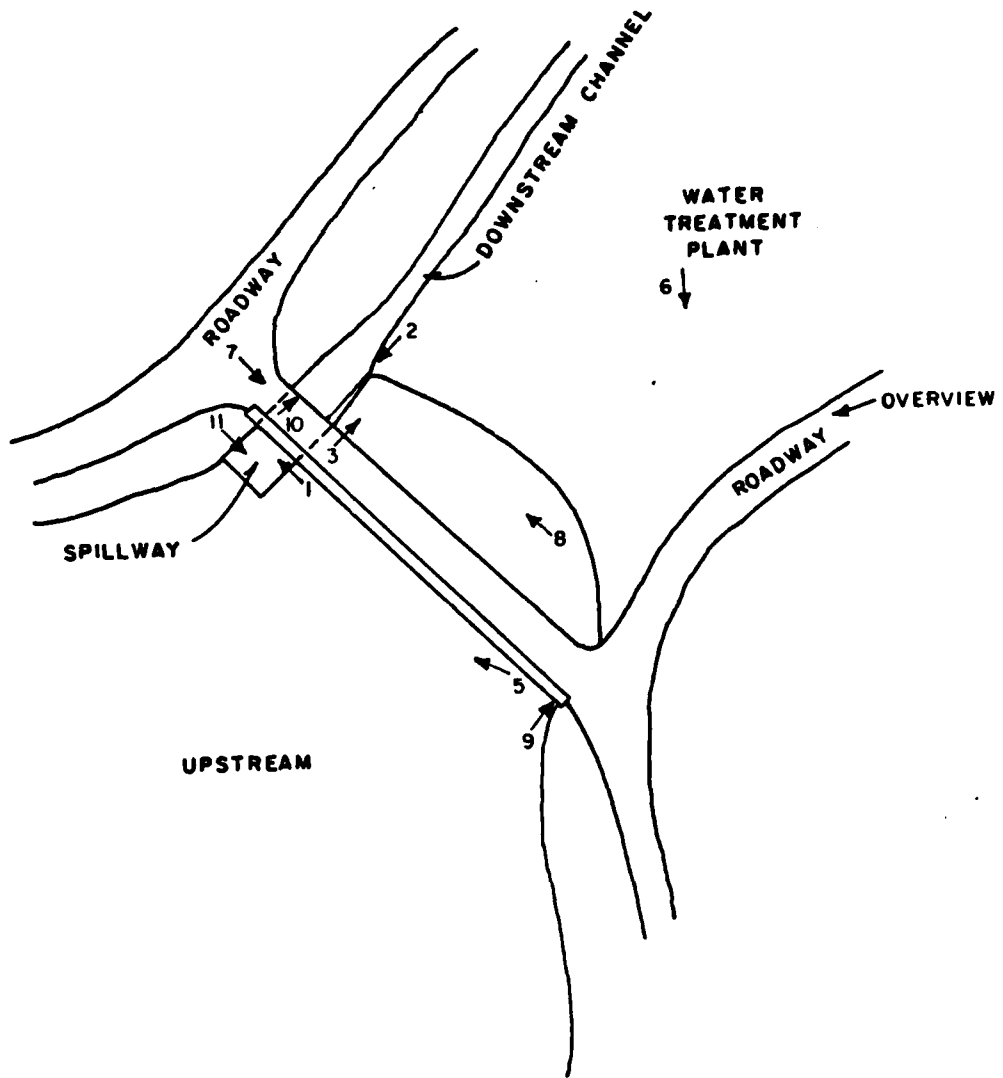
ITEM	REMARKS
DESIGN REPORTS	None
GEOLOGY REPORTS	See Appendix F.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No original computations or previous evaluations available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None
POST-CONSTRUCTION SURVEYS OF DAM	None known.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	<i>None</i>
MODIFICATIONS	<i>None known.</i>
HIGH POOL RECORDS	<i>None</i>
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	<i>None known.</i>
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	<i>Reported overtopping.</i>
MAINTENANCE OPERATION RECORDS	<i>None</i>

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS DETAILS	<i>See Appendix E.</i>
OPERATING EQUIPMENT PLANS & DETAILS	<i>None</i>
MISCELLANEOUS	<i>Blueprints in DER files.</i>

**APPENDIX**

**C**



PHOTOGRAPH LOCATION PLAN  
SPRING MILL DAM

PLATE C-1



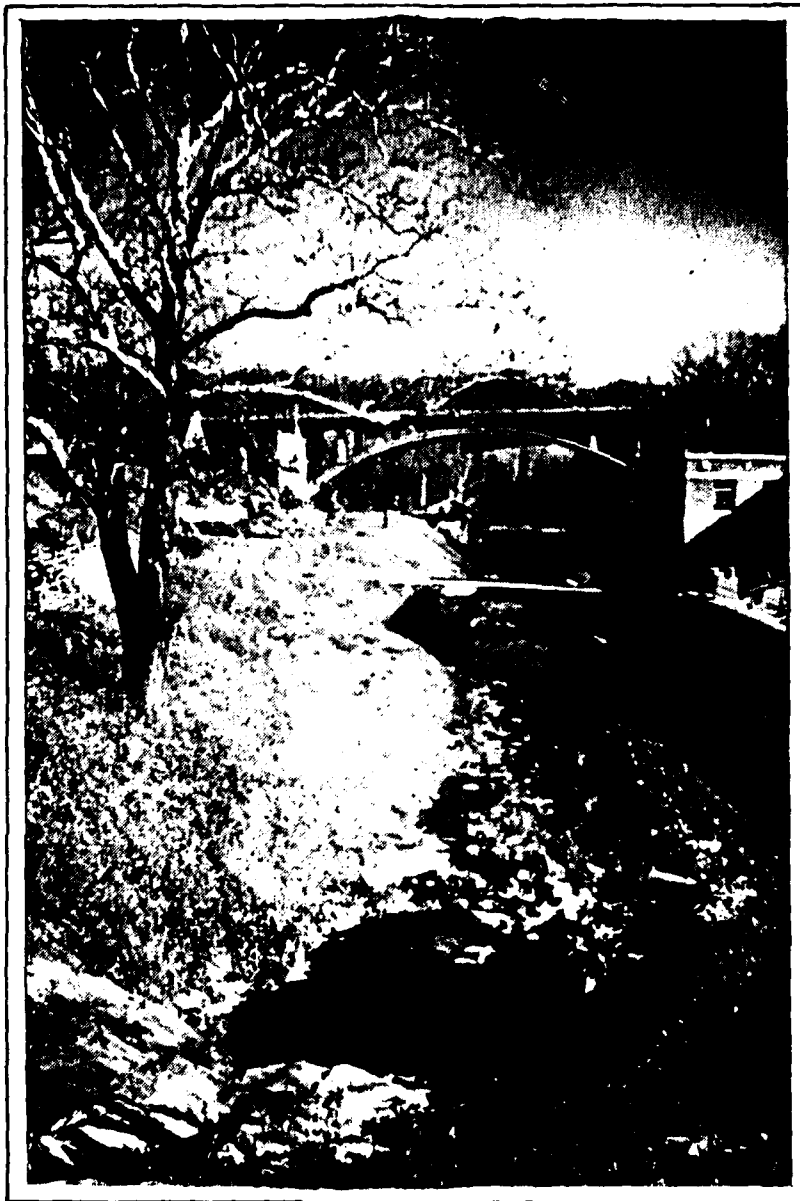
SPILLWAY WITH FLASHBOARDS.

PHOTOGRAPH NO. 1



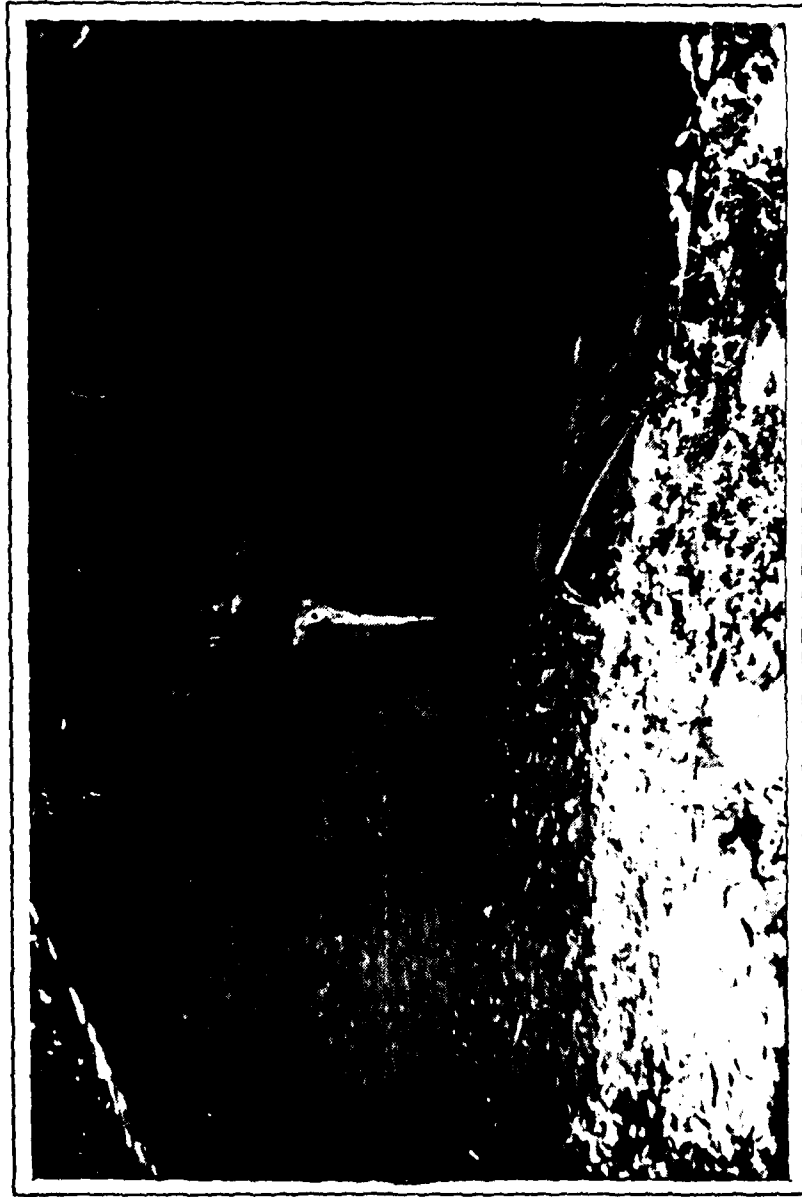
DOWNSTREAM SIDE OF SPILLWAY.

PHOTOGRAPH NO. 2



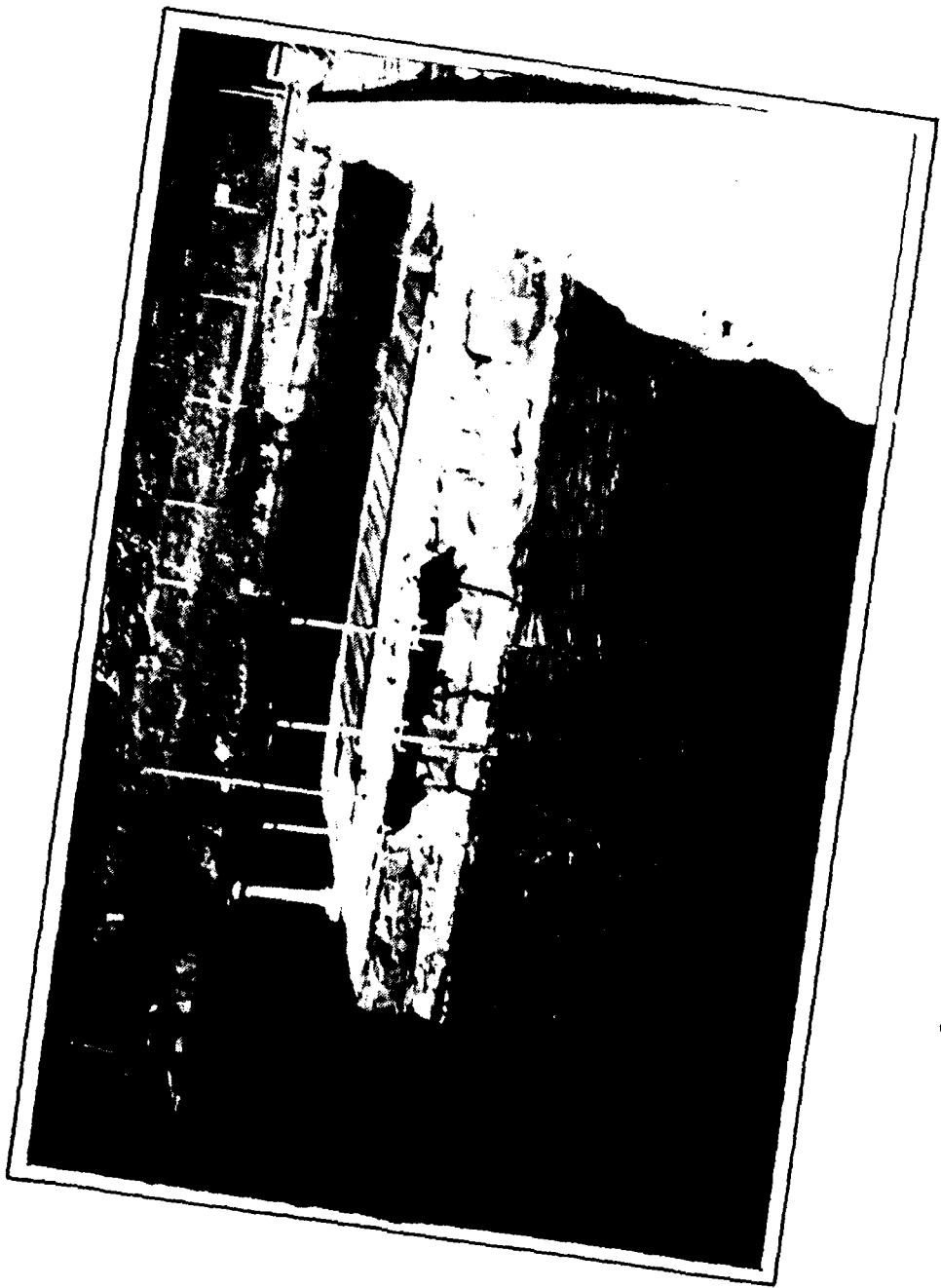
V I E W   O F   D O W N S T R E A M   C H A N N E L  
A N D   D A M A G E   C E N T E R .

P H O T O G R A P H   N O .   3



CULVERT UNDER RAILROAD TRACKS. THE  
CULVERT IS ABOUT 8 FEET WIDE AND 6  
FEET HIGH.

PHOTOGRAPH NO. 4



INTAKE STRUCTURE.

PHOTOGRAPH NO. 5



POND DRAIN OUTLET.

PHOTOGRAPH NO. 6



OVERALL VIEW OF CREST.

PHOTOGRAPH NO. 7



OVERALL VIEW OF DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 8



DAMAGE TO WALL NEAR RIGHT ABUTMENT.

PHOTOGRAPH NO. 9



CRACKING OF PARAPET WALL OF BRIDGE.

PHOTOGRAPH NO. 10



DETERIORATION OF MORTAR JOINTS ON  
OUTSIDE OF LEFT SPILLWAY WALL.

PHOTOGRAPH NO. 11

**APPENDIX**

**D**

SPRING MILL DAM  
CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominantly open with steep watershed slopes.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 345.0 feet. (230 Acre-Feet).

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 348.7 feet (269 Acre-Feet).

ELEVATION MAXIMUM DESIGN POOL: ---

ELEVATION TOP DAM: 348.7 feet.

SPILLWAY

a. Elevation 345.0 feet (elevation without flashboards).

b. Type Broad crest stone weir.

c. Width The downstream edge is 40'4" long.

d. Length N/A

e. Location Spillover Left abutment.

f. Number and Type of Gates None

OUTLET WORKS:

a. Type Stone "screen chamber" or intake tower.

b. Location Adjacent to upstream face of dam at midpoint.

c. Entrance inverts 8, 12 and 16 feet below water level.

d. Exit inverts N/A, line goes directly into water treatment plant.

e. Emergency draindown facilities 30" CI pipe through base of dam.

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: Not determined.

HYDROLOGIC AND HYDRAULIC  
BASE DATA

Sheet 2 of 11

DRAINAGE AREA: <sup>(1)</sup> 3.0 square miles

100 YEAR PRECIPITATION <sup>(2)</sup>

30 MINUTES	<u>2.3"</u>
1 Hours	<u>2.9"</u>
2 Hours	<u>3.6"</u>
3 Hours	<u>4.0"</u>
6 Hours	<u>4.8"</u>
12 Hours	<u>5.9"</u>
24 Hours	<u>6.9"</u>

SNYDER HYDROGRAPH PARAMETERS: <sup>(4)</sup>

Zone	<u>3</u>
C <sub>p</sub> , C <sub>t</sub>	<u>0.45, 1.45</u>
L <sup>(5)</sup>	<u>3.41 miles</u>
L <sub>ca</sub> <sup>(6)</sup>	<u>1.52 miles</u>
tp=C <sub>t</sub> (L·L <sub>ca</sub> ) <sup>0.3</sup>	<u>2.38</u>

SPILLWAY CAPACITY AT MAXIMUM

WATER LEVEL <sup>(7)</sup> 958 cfs without flashboards, 533 with flashboards.

- 
- (1) Measured from USGS maps.
  - (2) TP 40 - Rainfall Frequency Atlas of the United States
  - (4) Information received from Corps of Engineers, Baltimore District.
  - (5) Length of longest water course from outlet to basin divide, measured from USGS maps.
  - (6) Length of water course from outlet to point opposite the centroid of drainage area, (see Plate 1, Appendix E) measured from USGS maps.
  - (7) See Sheet 5 of this Appendix.

HEC-1, REVISED  
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quadrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputted and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 2/8/80 SUBJECT \_\_\_\_\_ SHEET 4 OF 11  
 CHKD. BY AHD DATE 2/20/80 Spring Mill Dam JOB No. \_\_\_\_\_  
Hydrology / Hydraulics

Classification (Ref. Recommended Guidelines for Safety Inspection of Dams)

1. The hazard classification is rated as "Significant" as there would be appreciable economic loss and possible loss of life in the event of failure.
2. The size classification is "Small" based on its 25 foot height and 26.9 Ac-Ft total capacity.
3. The selected spillway design flood, based on size and hazard classification, is the 100yr. event.

Hydrology and Hydraulic Analysis

1. Original Data. No original design data or subsequent evaluation data is known to exist.
2. Evaluation Data.  
 Rainfall and Snyder's Hydrograph parameters are shown on sheet 2. The value of the peak inflow value is checked against the peak 100yr inflow value ( $Q_{100}$ ) determined by procedures contained in "Regional Frequency Study, Upper Delaware and Hudson River Basins, New York District."

$$\log(Q_m) = C_m + 0.87 \log(D.A.)$$

where  $C_m = 1.75$  from fig. 2 ✓

$$\log(Q_m) = 2.165$$

$D.A. = 3.0$  sq. miles from sheet 2 ✓

$$S = C_s - 0.05 \log(D.A.)$$

where  $C_s = 0.403$  from fig. 3 ✓

$$S = 0.379$$

✓

$$g = +0.4$$

from fig. 5 ✓

$$\log(Q_{100}) = \log(Q_m) + k(P.g)S$$

where  $k(P.g) = 2.62$  from table ✓

$$\log(Q_{100}) = 2.165 + 2.62 \cdot 0.379$$

$$= 3.158$$

✓

$$Q_{100} = 14.39 \text{ cfs.}$$

✓

BY MFB DATE 2/11/80 SUBJECT \_\_\_\_\_ SHEET 5 OF 11  
 CHKD. BY AMD DATE 2/20/80 Spring Mill Dam JOB No. \_\_\_\_\_  
 \_\_\_\_\_ Hydrology / Hydraulics \_\_\_\_\_

Elevation - Storage Data. The reported normal storage is 75 mgal or 230 Ac.-Ft. Surface area measured from original reservoir drawing is 9.3 Ac., area within 350 contour measured from USGS is 11.9 Ac.

Elevation: Discharge Data.

Without flash boards - the downstream edge of weir is 40'4".

$$Q = C L H^{3/2}$$

C varies with H, Table 5-13, King & Brater Handbook of Hydraulics

Water Surface	H	C	L	Q	
345.	0			0	
346.	1.0	3.54	40.33'	143 cfs	✓
347	2.0	3.50	"	399 cfs	✓
348	3.0	3.27	"	685 cfs	✓
350.	5.0	3.25	"	1465 cfs	✓

With flashboards - their length is slightly longer, say 41.3'. Assume flash boards do not fail

346.2	0	3.1	41.3	0	
347.0	0.8	3.1	41.3	92 cfs	✓
348.0	1.8	3.1	41.3	309 cfs	✓
350.0	3.8	3.1	41.3	948 cfs	✓

3. Results of computer analysis. The peak inflow ( $Q_{100}$ ) calculated by the HEC-1 program is 1425 cfs, close to the value calculated on sheet 4. The program indicates the dam will be overtopped by the 100 yr event. The dam reportedly has not been overtopped since 1945. A need for a more detailed hydrologic/hydraulic analysis is indicated.

4. Spillway Adequacy - the spillway is considered "Inadequate" as it will not pass the selected spillway design storm without overtopping the dam. The spillway is not considered "seriously inadequate" as the dam is not assessed to fail by overtopping during the spillway design flood.

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

RUN DATE: 80/02/12.  
 TIME: 05.39.20.

SPRING HILL DAM  
 NAT ID NO. PA 00875 DER NO. 39-1  
 OVERTOPPING ANALYSIS

NO	NHR	MWIN	LWAY	JOB SPECIFICATION					
				HRK	IMIN	METRC	IPLI	IPRI	MSIHR
100	0	20	0	0	0	0	0	-4	0
			JOPER	RUT	LROPT	IRADE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED  
 #PLAN= 1 RATIO= 1 LRATIO= 1

RTIOS= 1.00



HIDROGRAPH ROUTING

OUTFLOW HYDROGRAPH

ISTAR	ICORP	TECON	ITAPE	JPLT	JPKI	ISAGE	ISTAGE	IAUD
OUT	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	CLOSS	AVG	ISAME	IUFT	IFMP	LSTR		
0.0	0.000	0.00	1	1	0	0		

NSIFS	RSTH	LAG	ANSKK	X	ISK	STOKA	ISPKAT
1	0	0	0.000	0.000	0.000	-345.	-1

*Without Flashboards*

STAGE 345.00 346.00 347.00 348.00 350.00

FLOW 0.00 143.00 399.00 685.00 1465.00

CAPACITY= 230. 283.

ELEVATION= 345. 350.

CREL	SPWID	COBU	EXPU	ELEVL	COBL	CAREA	EXPL
345.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA			
IOFEL	COOB	EXPD	DAMWID
348.7	0.0	0.0	0.

CREST LENGTH 190. 215. 280.  
 AT OR BELOW  
 ELEVATION 348.7 349.0 350.0

PEAK OUTFLOW IS 1417. AT TIME 18.00 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)

WITHOUT FLASHBOARDS

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1
				1.00
HYDROGRAPH AT	IN	3.00	1	1425.
	(	7.77)	(	40.35)(
ROUTED TO	OUT	3.00	1	1419.
	(	7.77)	(	40.19)(

SUMMARY OF DAM SAFETY ANALYSIS

RATIO OF PNF	MAXIMUM RESERVOIR N.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	SPILLWAY CREST	TOP OF DAM	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	349.24	.54	275.	345.00	348.70	3.33	1417.	18.00	0.00
				230.	269.				
				0.	958.				

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH

ISTAD	ICOMP	IECON	ITAPE	JPLI	JFRT	INAME	ISTAGE	IAUID
001	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	AVG	IRES	ISAME	IOPT	IFMP		LSTR	
0.0	0.00	1	1	0	0		0	
NSIFS	MSIDL	LAG	AMSKK	X	TSK	STORA	ISPRAT	
1	0	0	0.000	0.000	0.000	-345.	-1	

*With Flashboards*

STAGE	345.00	346.20	347.00	348.00	350.00
FLOW	0.00	0.00	92.90	309.00	948.00

CAPACITY= 230. 265.

ELEVATION= 345. 350.

CKEL	SFNU	CORW	EXFW	ELIPL	COOL	CAREA	EXFL
346.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DATA DATA

IOFEL	LOAD	EXFD	DAMWD
348.7	0.0	0.0	0.

CREST LENGTH 190. 215. 280.  
 AT OR BELOW ELEVATION 348.7 349.0 350.0

PEAK OUTFLOW IS 1421. AT TIME 18.00 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)

WITH FLASHBOARDS

RATIOS APPLIED TO FLOWS

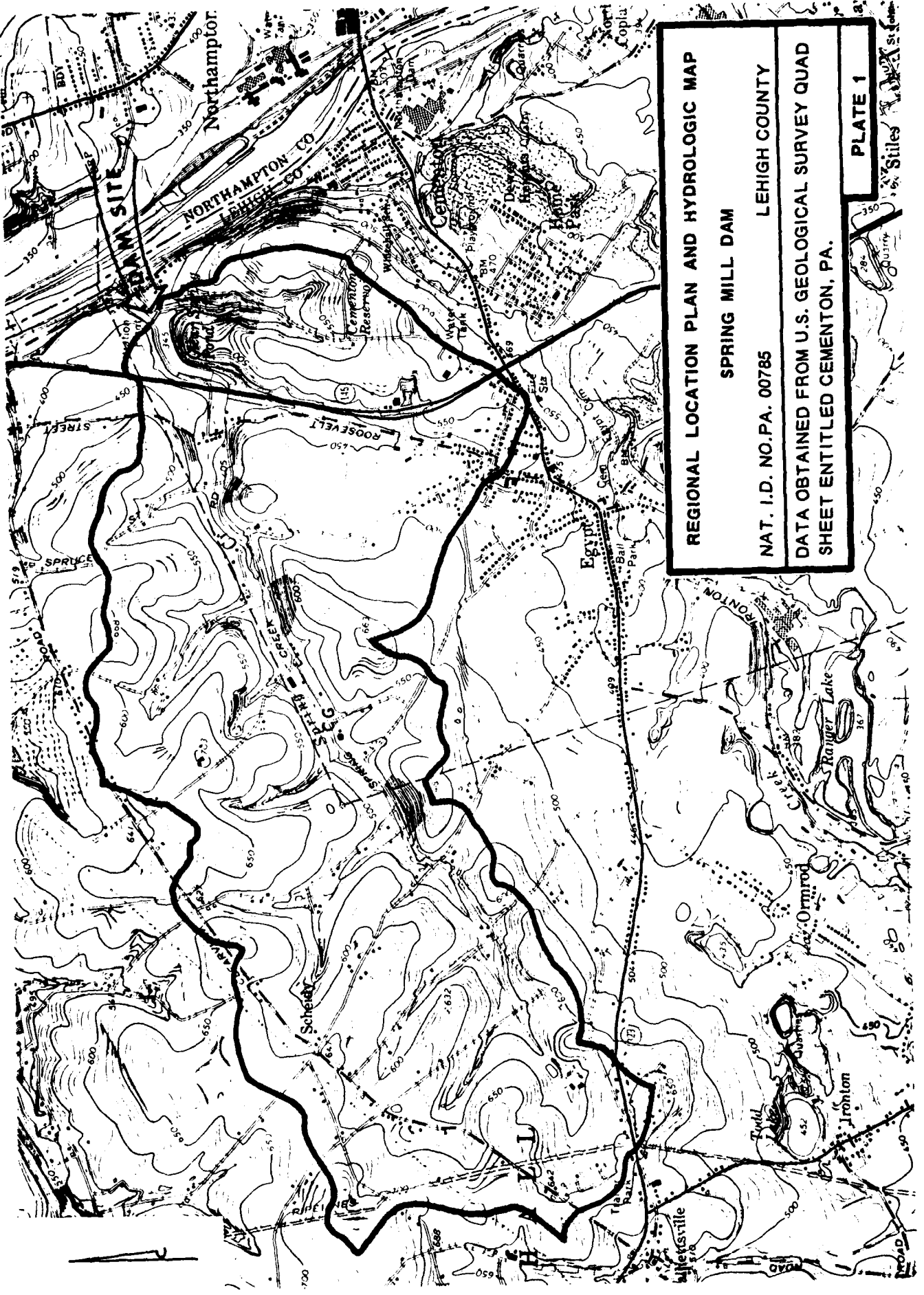
OPERATION	STATION	AREA	PLAN RATIO	1
HYDROGRAPH AT	IN	3.00	1	1425.
	(	7.77)	(	40.35)(
ROUTED TO	OUT	3.00	1	1421.
	(	7.77)	(	40.24)(

SUMMARY OF DAM SAFETY ANALYSIS

ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	DURATION OVER TOP	TIME OF MAX OUTFLOW	TIME OF FAILURE
	345.00	346.20	348.70	HOURS	HOURS	HOURS
	230.	243.	267.			
	0.	0.	533.			
RATIO OF PWF	MAXIMUM RESERVOIR U.S.ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	MAXIMUM DEPTH OVER DAM	MAXIMUM OUTFLOW HOURS	MAXIMUM FAILURE HOURS
1.00	349.62	279.	1421.	6.00	18.00	0.00

**APPENDIX**

**E**



**REGIONAL LOCATION PLAN AND HYDROLOGIC MAP**

**SPRING MILL DAM**

**LEHIGH COUNTY**

**NAT. I.D. NO. PA. 00785**

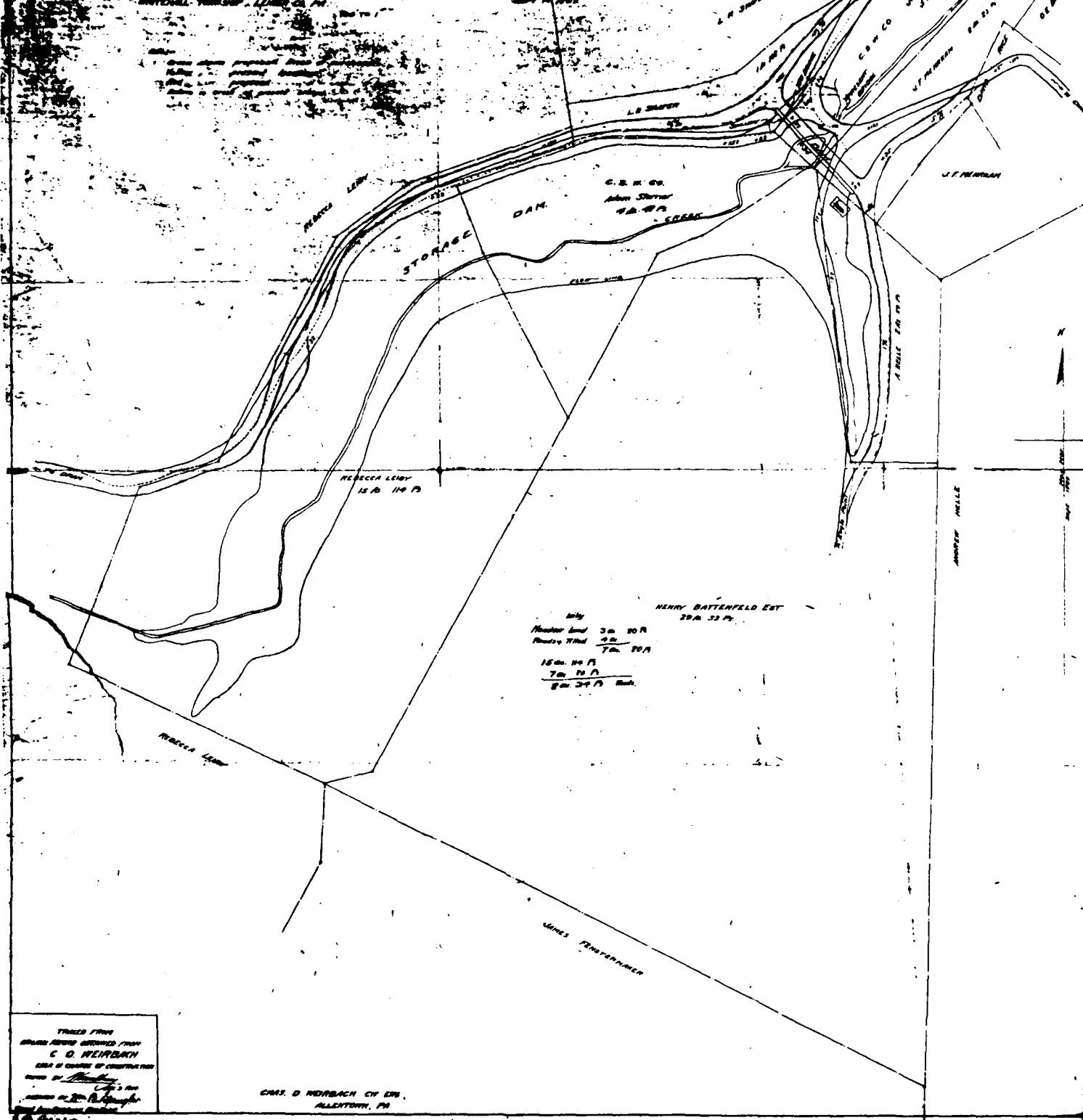
**DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED CEMENTON, PA.**

**PLATE 1**

Stiles

PLAN SHOWING LOCATION OF DAM OF THE CLEAR SPRINGS WATER CO  
 AND THE PRESENT AND PROPOSED LOCATION OF THE BRIDGE  
 OVER MILL CREEK AND THE PUBLIC ROADS  
 LEADING THERETO

WATKINS TOWNSHIP, LEHIGH CO., PA.



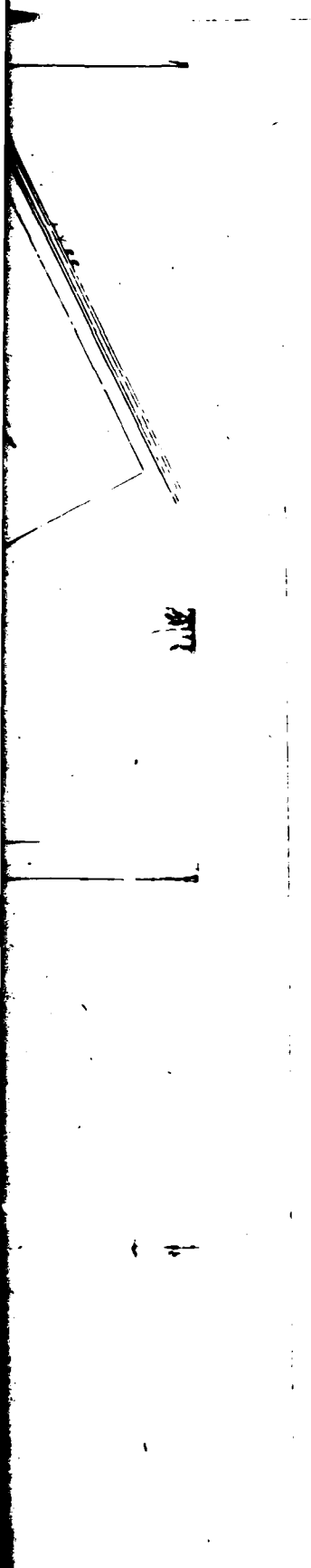
July  
 Flooded level 3m 30 ft  
 Roadway level 2m 70 ft  
 15m 14 ft  
 7m 12 ft  
 8m 24 ft. Max.

HENRY BATTENFELD EST  
 29m 33 ft.

REBECCA LEIBY  
 18 ft 110 ft

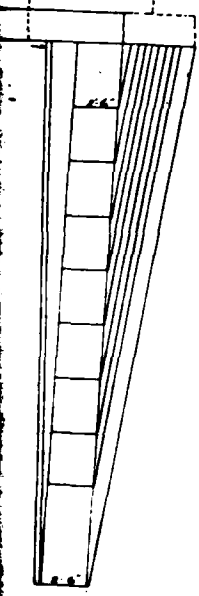
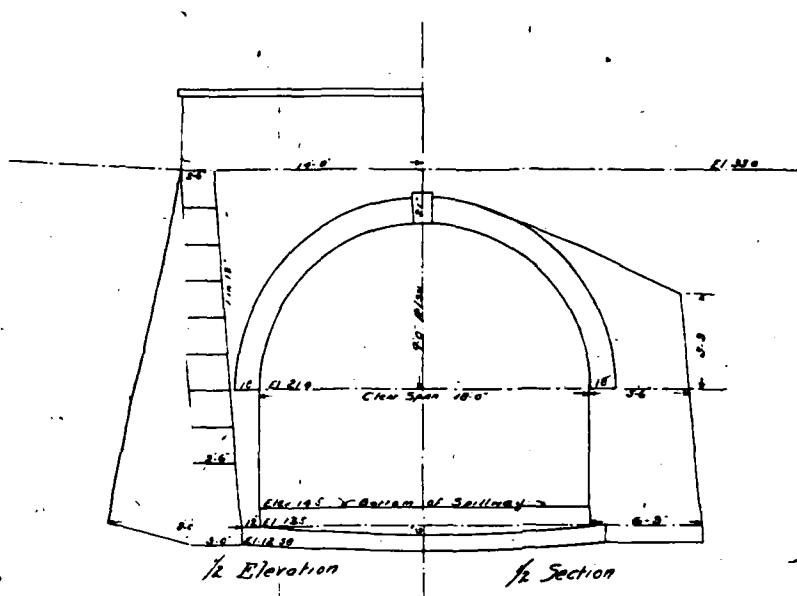
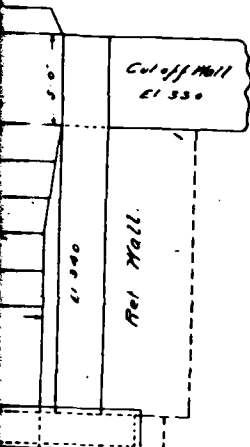
THREE FOUR  
 BRIDGE BEING DESIGNED FROM  
 C. O. WEIRBACH  
 CIVIL ENGINEER  
 DRAWN BY  
 J. H. B. S. S. S.

CHAS. D. NORBACH CIV. ENR.  
 ALLENTOWN, PA.



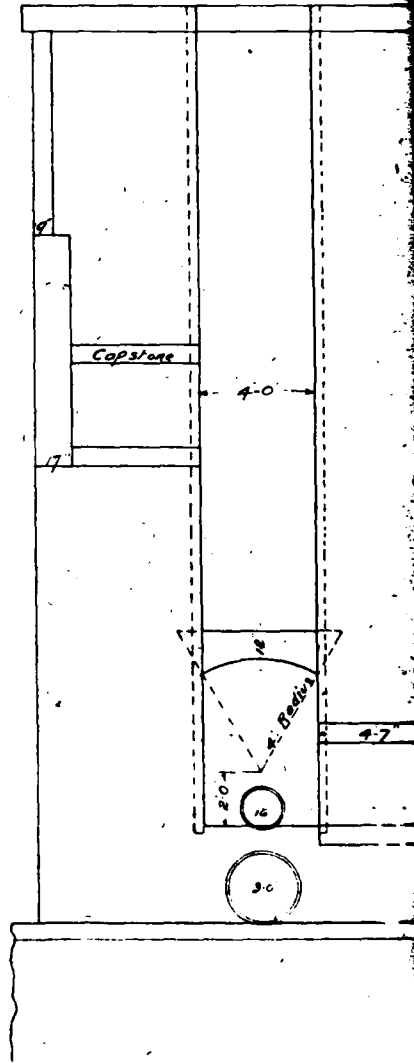
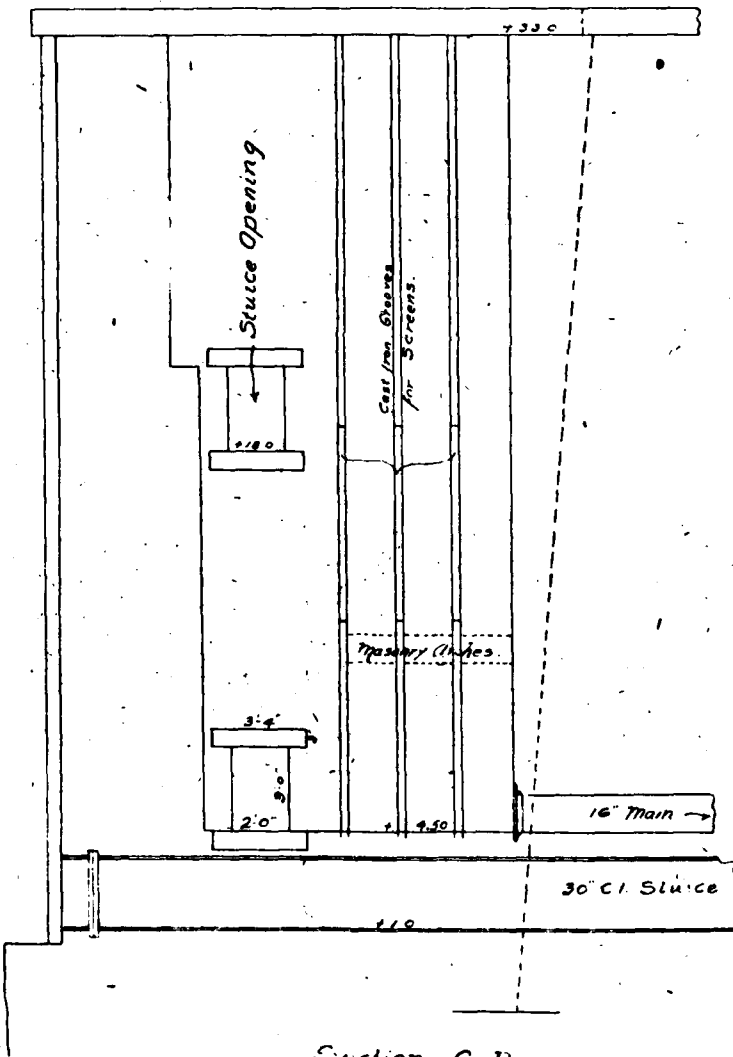
217





PLAN of SPILLWAY and BRIDGE over BYWASH  
 MILL CREEK DAM of the  
 CLEAR SPRINGS WATER CO  
 Scale 4ft to 1in  
 Apr 10 - 1900

2



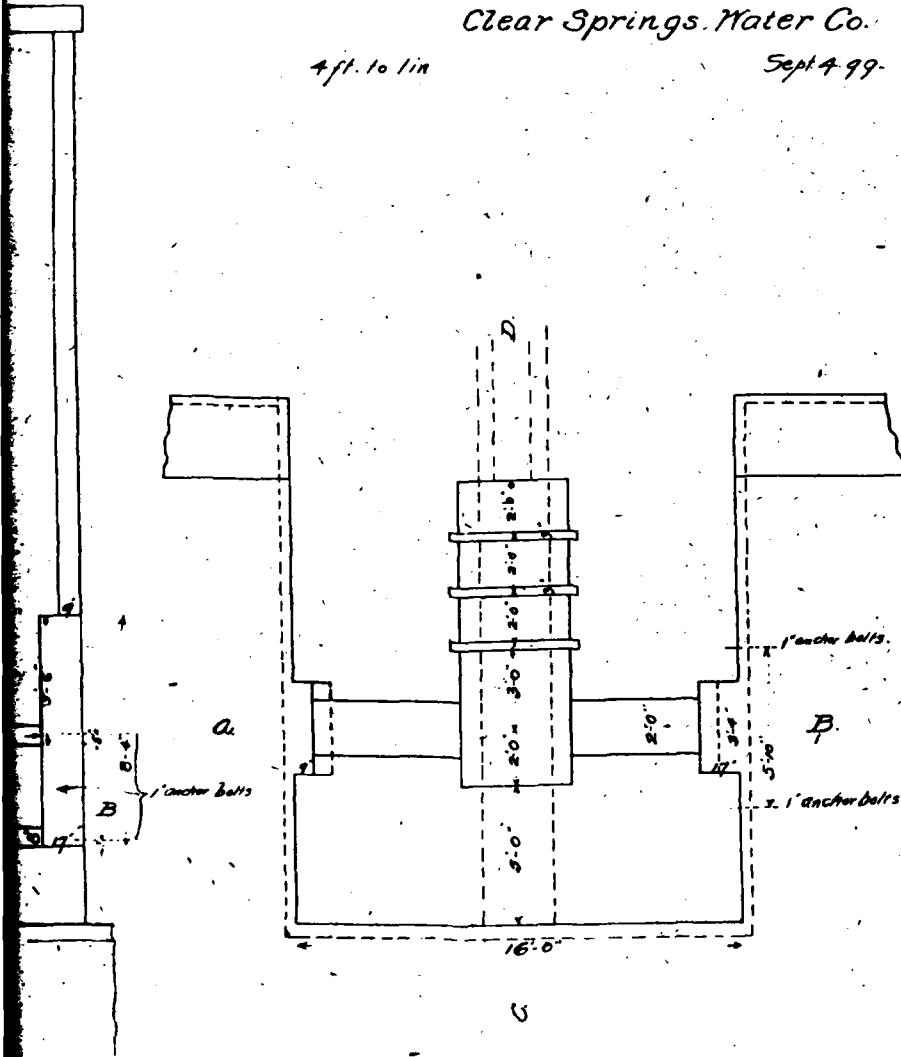
Section C-D

TRACED FROM  
 ORIGINAL RECORD OBTAINED FROM  
 C. D. WEIRBACH  
 ENGINEER IN CHARGE OF CONSTRUCTION OF  
 SLUICE AT ALL CLEVELAND  
 DRAWN BY W. B. Spangler

Plan of Screen Chamber.  
 Mill Creek Dam  
 Clear Springs Water Co.

4 ft. to 1 in.

Sept 4 99



2

2







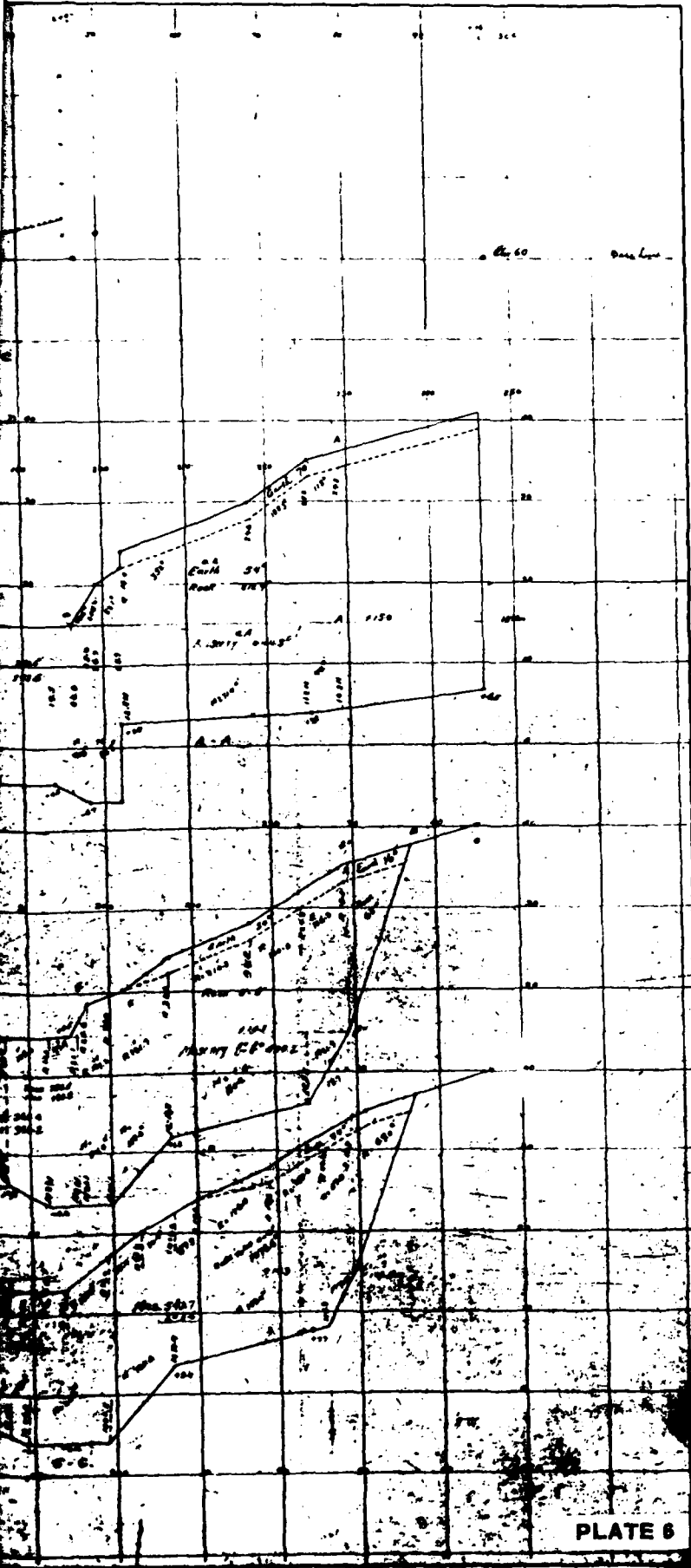


PLATE 6

**APPENDIX**

**F**

SITE GEOLOGY  
SPRING MILL DAM

Spring Mill Dam is located in the Great Valley Section of the Valley and Ridge Physiographic Province. As shown in Plate F-1, the dam is underlain by the Martinsburg Formation, which consists of Ordovician age claystone slate having siltstone interbeds. South of the dam area, carbonate bedrock predominates.

The strike and dip of bedding in rock exposures in the immediate dam area are variable; for example, bedding in the spillway channel strikes north-northwest, dipping 23 degrees to the southwest (upstream direction); bedding in the roadcut above the left abutment strikes north-northeast, dipping 21 degrees to the southeast. Near vertical rock jointing strikes east-northeast in the spillway channel area; elsewhere, jointing strikes to the northwest and northeast. Evidence of minor faulting was observed in the spillway channel and nearby roadcuts. Bedrock was observed in the spillway channel and nearby roadcuts. Bedrock related seepage should not be of concern due to the soundness of the rock and the upstream direction of the bedding dip. Minor seepage could be expected along select joint planes.



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