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NATIONAL DAM INSPECTION PROGRAM. LAKE ONEIDA DAM, NDI NUMBER PA--ETC(U)
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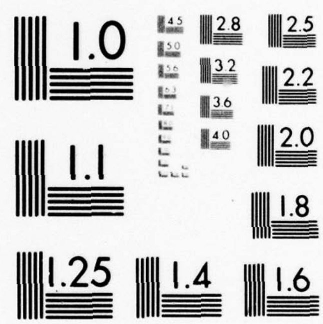

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OHIO RIVER BASIN
CONNOQUESNESSING CREEK, BUTLER COUNTY
PENNSYLVANIA

LAKE ONEIDA DAM
NDI No. PA - 272

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Lake Oneida Dam, NDI Number PA-272.
Ohio River Basin, Connoquesnessing Creek,
Butler County, Pennsylvania. Phase I Inspection Report.

Distribution Unlimited
Approved for Public Release
Contract No. DACW31-78-C-0052

PREPARED FOR

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

93 p.

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

SEPTEMBER 1978

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DISCLAIMER NOTICE

PHASE I REPORT
National Dam Inspection Program

Lake Oneida Dam

Pennsylvania

Butler County

Connoquenessing Creek

30 August 1978 (visual inspection)

Inspection Team - GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

The visual inspection, records of past performance, and hydraulic and hydrologic analysis indicate that the facility is in need of remedial repair and further engineering evaluation. The facility on the whole is considered in fair condition.

Hydraulic and hydrologic calculations indicate that the project is not capable of passing and/or storing 50 percent of the flow resulting from a storm of the PMF magnitude and the spillway is deemed seriously inadequate.

Portions of the concrete paving in the spillway outlet channel have become dislodged exposing erodable materials within 50 feet of the embankment toe. The owners representatives reported that parts of the spillway have required repair and replacement at various times in the past following large spillway discharges.

Saturated conditions were observed in a few locations along the toe of the embankment. Seepage flow could not be measured; however, the condition warrants further investigation.

The gates on the inlet end of the supply line, passing beneath the embankment, are left open and discharge is controlled at the treatment facility. In addition, the blow-off line has reportedly not been operated in years. According to representatives of the water company, no regular maintenance is performed on the outlet controls, and their operability was not determined at the time of inspection.

Based on the above mentioned considerations, it is recommended that the owner:

1. Enlist the services of a registered professional engineer experienced in the design and construction of earth dams to:

i. More accurately assess the adequacy of the outlet works and make any modifications deemed necessary to insure that the facility is hydraulically adequate under PMF conditions. This investigation should also include an analysis of the effects of the Boydstown Dam facility located just upstream.

ii. Investigate and determine the cause of the seepage observed at the downstream toe of the embankment, the piping potential, and to recommend remedial measures if necessary.

iii. Inspect the facility on an annual basis and report on hazardous conditions that might develop. Results of these inspections should be transmitted to the Pennsylvania Department of Environmental Resources, Division of Dams and Encroachments, for review.

2. Immediately take measures to repair and/or replace the deteriorated portions of the spillway outlet channel and eroded area adjacent to the spillway outlet channel just downstream of the dam and make any modifications necessary to preclude the possibility of the spillway slabs becoming dislodged in the future.

3. Develop an operations and maintenance manual for the facility.

4. Ascertain the operability of the valve controls on both the supply and blow-off lines and maintain the systems in working order.

5. Revise the water company plan for maintaining a safe potable water supply to include provisions for warning downstream residents should emergency conditions develop. The plan should include provisions for round-the-clock surveillance of the facility during periods of high pool levels.

GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Approved by:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date 27 Sept 78

Date 28 Sep 78

OVERVIEW PHOTOGRAPH OF ONEIDA DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE ONEIDA DAM
NDI# PA-272, PENNDER# 10-11

SECTION 1
GENERAL INFORMATION

1.0 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.

1.1 Purpose.

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

ABSTRACT

1.2 Description of Project.

a. Dam and Appurtenances. Lake Oneida Dam is an earthfill embankment with a concrete corewall and a steel sheetpile cutoff. The overall length of the embankment is approximately 830 feet and its maximum height is approximately 38 feet. The facility is equipped with a concrete spillway at the right abutment and 30-inch diameter blow-off and supply lines encased in concrete beneath the embankment. The lines are gated in a control tower located within the upstream slope near the embankment center. Access to the gate house is provided by a foot bridge. ← ABSTRACT

b. Location. Lake Oneida Dam is located just downstream of Boydstown Reservoir along the Connoquenessing Creek in Oakland Township, Butler County, Pennsylvania, about 5-1/2 miles north of Butler, Pennsylvania. PA Route 38 is located adjacent to the north shore of the reservoir. Dam, reservoir, and watershed are contained within the East Butler and Mount Chestnut U.S.G.S. 7.5 minute quadrangles (see Appendix G). The coordinates of the dam are N40° 55.4' and W79° 52.8'.

c. Size Classification. Intermediate (38 feet high, 3,350 acre-feet to the top of the dam).

d. Hazard Classification. High (see Section 3.1.c.4).

e. Ownership. Western Pennsylvania Water Company
Butler District
105 Lincoln Avenue
Butler, Pennsylvania 16001

f. Purpose of Dam. Water supply with limited recreational use permitted.

g. Historical Data. Records available in PennDER's files indicate that construction of the facility was initiated in 1910. After completing the sheetpile installation, construction was terminated due to lack of capital. Contract drawings and specifications were apparently resubmitted in 1916 for permit application by the Butler Water Company and the project was taken to completion by mid-1918. Design and construction of the facility was apparently performed by Butler Water Company personnel.

Monthly progress reports by the Water Supply Commission of Pennsylvania indicate only minor problems with winter construction and flooding.

1.3 Pertinent Data.

a. Drainage Area. 16.6 square miles.

b. Discharge at Dam Site. Discharge records compiled daily and records from the last 6 to 7 years are available at the Butler District Office. The maximum discharge (as per recollection of production superintendent) occurred in 1954 with a flow estimated at 58 inches over the spillway crest. (estimated flow ≃ 4000 cfs).

Outlet Works Conduit - Discharge curves not available for blow-off and supply lines.

Spillway Capacity at Maximum Pool ≃ 5000 cfs (assuming spillway acts as broad-crested weir with length of 58.5 feet).

c. Elevation (feet above mean sea level).

Top of Dam ≃ 1067.5.

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record ≃ 1063.6.

Normal Pool (spillway crest) ≃ 1058.8.

Upstream Portal Invert Outlet Conduit (blow-off) ≃ 1028.6.

Downstream Portal Invert Outlet Conduit ≃ 1028.3.

Streambed at Centerline of Dam ≈ 1028 (estimated).

Maximum Tailwater - Not known.

d. Reservoir.

Length of Maximum Pool (1067.5) ≈ 1.8 mile.

Length of Normal Pool (1058.8) ≈ 1.7 mile.

e. Storage (acre-feet).

Spillway Crest ≈ 1760.

Top of Dam ≈ 3350.

Design Surcharge - Not known.

f. Reservoir Surface (acres).

Spillway Crest ≈ 155

Top of Dam ≈ 210

Design Surcharge - Not known.

g. Dam.

Type - Earthfill with concrete corewall and sheetpile cutoff.

Length - 830 feet.

Height - 38 feet.

Top Width - 13 feet.

Side Slopes - upstream: 2H:1V
downstream: 2H:1V

Zoning - Lake Oneida Dam is a homogeneous earthfill dam with a thin reinforced concrete corewall and steel sheetpile cutoff. Drawings and correspondence indicate that the embankment contains four 18- x 18-inch lateral drains (blind drains filled with stone) that extend from the corewall to the downstream toe.

Cutoff - Contract documents indicate that interlocking steel sheetpile were driven from the base of the corewall trench to depths of about 20 feet (apparently into underlying "blue clay").

Grout Curtain - None.

h. Outlet Conduit.

Blow-off Line

Type - 30-inch steel blow-off line encased in concrete within embankment. At the downstream toe the line becomes a 30-inch CIP.

Length ≈ 465 feet.

Closure ≈ Sliding gate within intake tower.

Access - Foot bridge to gate house atop intake tower. Rung ladder to gate.

Supply Line

Type - 30-inch steel main encased in concrete within embankment. Reduced to 24-inch CIP near downstream toe.

Length - Approximately 140 feet to 24-inch reducer.

Closure - Gate valves within intake tower.

Access - Foot bridge to gate house. Rung ladders to valves.

Regulating Facilities - Outflow through supply line is controlled at the treatment plant. Blow-off sluice gate is closed. All other valves are kept open at the gate house.

i. Spillway.

Type - Concrete broad-crested weir projecting into reservoir resulting in side channel spillway effect at low heads (see Figure 4).

Crest Length - 129.5 feet at low flow (See Discussion
58.5 feet at high flow Section 5).

Channel Length - 360 feet.

Crest Elevation ≈ 1058.8.

Upstream Channel - Riprap lined approach channel.

Downstream Channel - Trapezoidal channel cut into Natural soil below stilling basin which extends to old stream channel.

j. Regulating Outlets. Blow-off line and supply line with inlets located at gate house (see Section h, above).

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. No design calculations are available. Correspondence relative to spillway analysis and hydrologic requirements are available in PennDER files.

2. Embankment. No design calculations are available. Embankment and subsurface details are indicated on drawings available from PennDER and owner's files.

3. Appurtenant Structures. No design calculations are available. Structural details are shown on drawings available from PennDER and owner's files.

b. Design Features.

1. Embankment. Contract drawings, specifications, and inspection reports (all available in PennDER files) indicate the embankment is a rolled earthfill structure containing a reinforced concrete corewall underlain by interlocking steel sheetpiling. Contract drawings and the visual inspection indicate that the upstream and downstream faces are sloped at 2H:1V. Drawings and specifications indicate that four 18- x 18-inch stonefilled drainage laterals were constructed from the corewall to the downstream toe. Field inspection indicates that these drains may be directed into drain tile that discharges into the natural stream channel. Contract drawings indicate that the steel piling extends about 20 feet below the base of the corewall, probably penetrating the clay strata indicated by the geologic cross section. (See Figure 7).

2. Appurtenant Structures. The spillway is a modified concrete chute with a broad-crested weir section projecting into the reservoir (see Figure 4). Contract drawings indicate the weir section is underlain by a sheetpile cutoff similar to the embankment. The spillway continues as a curved rectangular channel for about 150 feet from the crest where it discharges into a concrete-lined trapezoidal channel. This channel empties into a rock-lined stilling basin another 210 feet downstream.

The outlet works consists of a gate house, control tower, and two 30-inch diameter discharge lines (a blow-off and a supply line). The gate house and tower are located on the upstream slope near the embankment center and are accessible from the embankment crest via a foot bridge. Both blow-off and supply lines are steel and encased in concrete beneath the embankment. Contract drawings indicate that they both connect to cast iron pipes outside the embankment toe. The blow-off line terminates at the old stream channel approximately 240 feet from the embankment toe.

c. Design Data and Procedures.

1. Hydrology and Hydraulics. No design calculations are available. A review conducted by the Water Supply Commission in 1916 indicated that the spillway should be sized for a peak flow of 4,730 cfs based on experience with similar watersheds. Later reports in 1936 and 1949 indicate a required spillway capacity of 8300 cfs and 16,300 cfs based on experience and revised criteria.

2. Embankment. No design data are available.

3. Appurtenant Structures. No design data are available.

2.2 Construction.

Contract drawings, specifications, and construction inspection reports are available in PennDER files. Specifications are detailed with respect to piling; reinforcing steel; concrete mixes, placement, forming, and finishing; soil placement; and selection.

2.3 Operational Records.

Daily rainfall (from nearby Thorn Run watershed) and discharge records are available for the last six to seven years at the Butler office, of Western Pennsylvania Water Company.

2.4 Other Investigations.

PennDER files indicate periodic inspections were performed through 1964. The owner has initiated yearly inspection since 1977 for insurance requirements.

2.5 Evaluation.

a. Availability. General engineering data in the form of contract drawings, specifications, and correspondence are available in PennDER files. No specific design calculations are available.

b. Adequacy of Data. Sufficient data are available to make an accurate general assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the structure and the related appurtenances suggests that the dam is in fair condition.

b. Embankment. The embankment is in general conformance with the lines and grades shown on the drawings supplied by PennDER. No signs of slope distress were noted at the time of inspection; however, a few areas of minor seepage were observed along the toe of the embankment. Seepage flow could not be measured although portions of the toe were saturated (see Figure 1 for location of seepage areas). All of the seepage areas were previously reported in various PennDER reports over the years. The consensus was that the seepage presented no threat to the integrity of the structure. It should be pointed out that a system of blind stone drains were provided at 170-foot intervals downstream of the corewall (see Figure 2). At the time of inspection, a clay tile drain was found discharging water into the old stream valley approximately 130 feet downstream of the dam toe. It is conceivable that this tile drain is connected to the blind drains; however, this is entirely conjecture since no mention of a tile drain is made on the drawings.

The downstream face and crest of Lake Oneida Dam are covered with grassy vegetation; whereas, the upstream slope is mantled with a 12-inch thick layer of durable sandstone riprap. Both the upstream and downstream faces are sloped at 2H:1V and the crest is approximately 13 feet wide.

c. Appurtenant Structures.

1. Gate House, Blow-off, and Supply Line. Lake Oneida Dam is provided with two 30-inch diameter steel pipes encased in concrete beneath the dam. Both lines change to cast iron construction just downstream of the dam. One of the pipes serves as a blow-off line which discharges into the original stream channel approximately 300 feet downstream of the centerline of the dam. The other, a 30-inch diameter line serves as the supply line to the water distribution system. This line reduces to 24 inches at a wye just downstream of the dam (see Figure 2).

The blow-off and supply lines are gated within a masonry gate house located near the center of the embankment. Discharge can be controlled via a system of gate valves and sluice gates at the operating floor of the gate house (see Figure 9). According to a water company representative, all the valves on the supply line are open and the flow is regulated at the treatment plant. The blow-off line is reportedly opened very infrequently and it is not known if it is currently operable.

2. Spillway. The spillway at Lake Oneida Dam is a broad-crested weir which partially projects into the reservoir affording increased surface area for discharge at low pool levels (see Figure 4 and Photograph 2). Discharge is carried through a rectangular concrete channel to a point approximately 150 feet downstream of the spillway crest where flow enters a concrete-lined trapezoidal channel before entering a trapezoidal channel cut in earth (see Figure 2).

At a point just downstream of the rectangular concrete spillway chute (180 feet downstream of spillway crest), severe erosion has occurred which has resulted in the removal of the concrete paving in the spillway outlet channel (see Photographs 5, 6 and 7). As a result, there has been significant erosion of the alluvial materials just downstream of the dam and encroachment of an erosional scarp toward the toe of the dam. At the time of inspection, the edge of the erosional scarp was 50 feet from the dam.

According to water company personnel, several of the concrete slabs within the spillway outlet channel were removed in 1954 during high flow associated with hurricane "Hazel".

In general, the spillway is in good condition in the rectangular section of the outlet channel; however, the trapezoidal portion of the channel is in a state of disrepair and requires considerable remedial work (see Photographs 5, 6, and 7).

3. Reservoir Area. The slopes adjoining Lake Oneida Reservoir are generally moderate to steep and primarily wooded. No signs of slope distress were observed at the time of inspection.

4. Downstream Channel. The area immediately downstream of Lake Oneida Dam is characterized as a sparsely wooded floodplain (600 to 1,000 feet wide) containing the sluggish flowing waters of Connoquenessing Creek (gradient 10 to 15 feet/mile). More than 20 homes, with an estimated population of 60 to 80 people, are located on the floodplain within two miles of the dam. The city of Butler, Pennsylvania, is located approximately 5.5 miles downstream. Included within this 5.5 mile interval are primary and secondary road bridges as well as other improvements such as commercial establishments and rail yards. Because of the above mentioned considerations, the dam was placed in a "high" hazard category.

3.2 Evaluation.

Areas of seepage were located along the toe of the embankment requiring additional investigation. The concrete-lined trapezoidal portion of the spillway outlet channel is deteriorated and requires immediate attention. The condition or operability of the supply and blow-off lines is suspect since they have reportedly not been operated in years.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to representatives of the water company, there are no formal operational procedures detailed in manual form. Rather, discharge to the supply system is regulated at the treatment facility located about four miles downstream of the dam. Excess inflow passes over the spillway and enters the Connoquenessing Creek drainage.

4.2 Maintenance of Dam.

There are no formal maintenance procedures at the dam. Grass is mowed and brush cleared on an as-needed basis.

4.3 Maintenance of Operating Facilities.

As best as could be determined, there is no maintenance of the operating facilities at the dam site. The valves are left full open at the reservoir and flow is regulated at the treatment plant.

4.4 Warning System.

There is no formal warning system in effect at the site; however, Western Pennsylvania Water Company has, an emergency plan for maintaining a potable water supply that can be readily adapted for this use.

4.5 Evaluation.

No formal operational procedures are available in written form from the owner. The embankment slopes are reportedly mowed on an as-needed basis; however, there is apparently no other regular maintenance program.

The inlet end of the supply pipe is opened at the dam and flow is regulated at the treatment facility located approximately four miles downstream. According to the owners representative, the blow-off line has not been operated in years and its operability is unknown.

A formal warning system to protect downstream residents should be established.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No hydrologic or hydraulic design reports are available. An informative discussion of the weir design at Lake Oneida Dam is available from PennDER files in the form of a memorandum dated April 6, 1949. It was apparently written by a hydraulic engineer (name not ledgible) working for the Water Resources Commission (predecessor of PennDER). The report discusses the results of a crude model test (1/120 scale) performed on the weir at Lake Oneida Dam.

The results of the test indicated that at low flow the spillway behaved normally but exhibited severe contractions in the overflow section at both abutments and at the reentrant angles. These contractions along with crossing nappes at the interior angles of the weir caused a loss in efficiency although no estimate of the loss was possible. At high heads the above mentioned conditions persisted. The principal change occurring at high heads was that on the weir walls extending upstream the flow is no longer normal to the axis of the weirs but is tending to cross at an angle which approached parallel flow to the axis of the dam. This behavior indicated that at high heads the discharge approached that of a simple weir having a length equal to the channel opening.

The memorandum closed by recommending that a controlled model test be made of the spillway and spillway channel to determine their adequacy. The report noted that the owners claimed a capacity of 8,300 cfs for this design. It was believed that at maximum head, the actual discharge will be less than this figure. Furthermore, the design discharge of 8,300 cfs did not meet the Water Supply Commission requirement of 16,300 cfs supplied to the owner in 1946.

5.2 Experience Data.

Rainfall and reservoir pool levels reportedly are recorded daily and kept on file at the treatment plant located downsteam. Apparently over the years the owners have had problems when discharge through the spillway has dislodged portions of the concrete paving on the apron and channel sidewalls. This problem is evidenced by the damage (mentioned in previous sections) currently visible in the spillway outlet channel.

5.3 Visual Observations.

It was obvious from the condition of the lower spillway on the date of inspection that the spillway channel will not function satisfactorily during a flood event. In fact, it would be expected that such an event would result in more extensive damage. No other conditions were observed that would indicate the remaining appurtenant structures could not function properly.

5.4 Overtopping Potential.

Three separate analyses were performed on the spillway at Lake Oneida Dam. First, the spillway discharge was calculated assuming 129.5 feet of weir (full weir length). Secondly, an effective weir length of 58.5 feet (width of the channel at the weir) was used. The third case involved calculating the capability of the facility to pass the PMF based on a spillway capacity of 8,300 cfs as per the memorandum April, 1949, discussed in Section 5.1.

The ratio "PMF Peak Flow/Drainage Area" was determined from an empirical curve supplied by the Corps of Engineers, Baltimore District. The curve used was the Ohio River Basin curve. Based on this curve and a drainage area of 16.6 square miles, Peak PMF Q/A ≈ 1290 cfs/sq. mi., and Peak PMF Q ≈ 21,400 cfs. The size category is "intermediate" and the hazard rating "high". Consequently, the SDF is the PMF.

Calculations were performed to evaluate the overtopping potential using spillway and storage capacities during the PMF (see Appendix C).

Based on weir lengths of 129.5 feet and 58.5 feet, the maximum spillway discharge was calculated to equal approximately 11,000 cfs and 5,000 cfs, respectively. Comparing discharge (11,000 cfs and 5,000 cfs) to maximum inflow (Peak PMF Q ≈21,400 cfs) reveals the need for substantial storage volume. It was found for both cases that the storage required (11,000 acre-feet and 17,700 acre-feet) greatly exceeded the storage available 1,600 acre-feet). It was found that under conditions of the first case, approximately 59 percent of the PMF is discharged and/or stored; whereas, under conditions of the second case, approximately 30 percent of the PMF is discharged and/or stored.

The memorandum of April 6, 1949 (discussed in Section 5.1) suggests that the results of the second case are more probable than the results of the first case.

As a further check, a similar analysis was performed based on a spillway capacity of 8,300 cfs (claimed by the owner to be the maximum spillway capacity; see Section 5.1). In this the third case, the required reservoir storage (14,000 acre-feet) was also found to exceed the storage available 1,600 acre-feet). It was ultimately found that under conditions of the third case approximately 46 percent of the PMF is passed and/or contained.

Finally, the effects of the upstream dam at Boydstown Reservoir, which is contained within the watershed for Lake Oneida Dam, were considered as part of the overall analysis of Lake Oneida Dam. Based on a drainage area of 13.6 square miles, Peak PMF Q ≈ 18,800 cfs. The maximum spillway discharge was calculated to approximately equal 4,500 cfs. Once again, inflow (18,800 cfs) exceeds discharge (4,500 cfs). Thereby suggesting a need for substantial storage. The calculated storage required (14,300 acre-feet) is found to be much greater than the storage available (307 acre-feet). The end result is that the dam at Boydstown Reservoir will pass and/or contain approximately 26 percent of the flow resulting from the PMF. Consequently, this structure will have no retarding effects relative to the PMF inflow into the reservior at Lake Onida Dam and could, if it fails, contribute its normal pool storage (221 acre-feet) as additional inflow to Lake Oneida Reservoir during a PMF event.

In summary, the entire analysis suggests that Lake Oneida Dam is capable of passing and/or containing runoff resulting from a storm of magnitude between 30 and 59 percent of the PMF, neglecting the possible adverse effects of a failure of the upstream dam at Boydstown Reservoir and minor crest settlement or deviations. The maximum spillway discharge would more closely approximate the former percentage; consequently, this number will be used to assess the spillway adequacy.

5.5 Spillway Adequacy.

The facility at Lake Oneida Dam is capable of passing and/or containing a storm of approximately 30 percent of the PMF.

Since overtopping is expected to cause embankment failure and since numerous homes are located at various levels above the floodplain, overtopping would significantly increase the potential hazard to residents downstream from that which would exist just prior to failure. Consequently, the spillway is deemed seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Areas of minor seepage were observed at the toe of the embankment. A spring is located on the left abutment adjacent to the old Connoquenessing Creek channel. These items are well documented in PennDER files and flow emanating from these areas is considered insignificant. Contract drawings indicate that four blind stone drains were provided downstream of the concrete cutoff wall. The inspection team located a tile drain discharging into the old stream channel 130 feet downstream of the dam toe and it is conceivable that this drain pipe is connected to the stone drains, although no mention of the tile drain is made on available drawings.

b. Appurtenant Structures.

1. Spillway. The weir and rectangular concrete portion of the spillway outlet channel appeared in good condition. However, from the point where the outlet channel becomes a concrete trapezoidal channel ($\approx$ 150 feet downstream of the weir) the structure is severely deteriorated and in need of repair (see Photographs 5, 6, and 7). Some of the concrete sidewall slabs have become dislodged exposing erodable materials within 50 feet of the toe of the dam (see Figure 1 and Photographs 5 and 6). If the condition is allowed to persist, it is possible that lateral encroachment by erosion could transgress to the point where it could eventually affect the stability of the embankment.

2. Outlet Works. According to representatives of the water company, the blow-off pipe has not been operated in years. The valves that control discharge through the 30-inch supply pipe are kept open at the gate house and flow is controlled at the treatment plant located about four miles downstream. Although this is a common mode of operation, it is desirable to have the ability to control flow at the inlet end of all piping systems passing through or beneath earthen embankments. The gate controls should therefore be kept in working order.

6.2 Design and Construction Techniques.

Actual design data, design computations, or reports were not available for any aspect of the facility.

6.3 Past Performance.

Reservoir level records are available at the owner's Butler office for the last six or seven years. The owners representative reported that during the rains associated with Hurricane Hazel in 1954 portions of the spillway slabs were dislodged and moved downstream. It is not known, however, if provisions have since been made to anchor the slabs and prevent a recurrence of the problem.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and it is thought that the static stability of the structure is sufficient to withstand minor earthquake induced dynamic forces; however, no calculations, investigations, etc., were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, past performance, and available engineering data suggest that the dam is in fair condition, requires additional analysis and some immediate remedial repair.

Hydraulic and hydrologic calculations indicate that the facility is capable of discharging and/or storing approximately 30 percent of the PMF neglecting the possible adverse effects of a failure of the upstream dam at Boydstown Reservoir. The hazard rating for the facility is high and failure due to overtopping would significantly increase the hazard to downstream residents from that which would exist prior to overtopping. Therefore, the spillway is considered seriously inadequate.

Additional problems are encountered when one considers the adequacy of the outlet works at Boydstown Reservoir, located just upstream of Lake Oneida. Brief calculations show that the Boydstown spillway is also seriously inadequate since the facility is capable of passing and/or storing only 26 percent of the PMF. This suggests the possibility of Boydstown Reservoir Dam overtopping and failing prior to or concurrent with the overtopping of Lake Oneida Dam.

The spillway outlet channel in the concrete-lined trapezodial section is severely deteriorated. Large portions of the concrete paving have been removed and erosion has progressed toward the toe of the dam. This condition should be remedied immediately.

Saturated conditions were observed at the toe of the dam in a few areas (see Figure 1). These areas of seepage have been noted in PennDER files since shortly after the embankment was constructed. Flow could not be measured; however, the condition warrants further investigation by a geotechnical engineering experienced in dam design.

The blowoff pipe has not been operated in years. The valves controlling discharge through the supply line are kept open at the dam and flow is regulated at the treatment facility. The condition or operability of the valve controls is not known.

b. Adequacy of Inspection. The available data was thought to be sufficient to make an accurate Phase I assessment of the facility.

c. Urgency. It is suggested that the recommendations listed below be implemented immediately.

d. Necessity for Additional Investigations. Additional investigations, as listed below, are considered necessary.

7.2 Recommendations/Remedial Measures.

a. Facilities. It is recommended that the owner:

1. Enlist the services of a professional engineer experienced in the design and construction of earth dams to:

i. Make a detailed hydraulic and hydrologic analysis in order to more accurately ascertain the adequacy of the outlet works and to insure that the facility is hydraulically adequate under PMF conditions. This investigation should include an analysis of the effects of the Dam at Boydstown Reservoir (also owned by Western Pennsylvania Water Company) located just upstream.

ii. To investigate and determine the cause of the seepage observed at the downstream toe of the embankment, its effect on the overall stability of the embankment, as well as the piping potential, and recommend remedial measures if necessary.

iii. Inspect the facility on an annual basis. The results of these inspections should be transmitted, in report form, to the PennDER, Division of Dams and Encroaching for their review.

2. Take measures to repair and/or replace the deteriorated portions of the spillway outlet channel and eroded area adjacent to the spillway channel just downstream of the dam and provide a means to ensure that the replaced concrete spillway slabs cannot be dislodged during future flood events.

b. Maintenance and Operating Procedures. It is recommended that the owner:

1. Develop an operations and maintenance manual for the facility.

2. Assess the operability of the valve controls for the supply and blow-off lines and maintain the controls in working order.

3. Revise their plan to maintain a safe potable water supply to include provisions for the warning of downstream residents should emergency conditions develop. The plan should include round-the-clock surveillance of the facility during periods of high water levels.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Lake Oneida Dam

ID # NDI# PA-272; PennDER# 10-11

ITEM	REMARKS
	SHEET 1

AS-BUILT DRAWINGS

1. Ten drawings dated 1910 and approved by Water Supply Commission of PA in 1916 in PennDER files.
2. Topo Map (1909) of Little Connoquenessing Valley (scale 1" = 100') in PennDER files.
3. Eight miscellaneous drawings in PennDER files showing weir & spillway repairs and various proposals.
4. Two originals from owner showing 1968 spillway repairs.

REGIONAL VICINITY MAP

Dam, reservoir, and watershed on East Butler, PA, 7.5 minute quadrangle map.
Construction Drawing No. 30036 in PennDER files.

CONSTRUCTION HISTORY

Permit, some correspondence, specifications, and inspection reports on microfiche in PennDER files.

TYPICAL SECTIONS OF DAM

Construction Drawing No. 30039 - Butler, PA, Lake Oneida Dam, Cross-sections.

OUTLETS - PLAN Construction Drawing 30036 - General Plan, Lake Oneida Dam.

- DETAILS Construction Drawing 30041 - Spillway and Weir; also plans and details for subsequent revisions.
Construction Drawing 30044 - Gate house.

- DISCHARGE RATINGS Untitled 8-1/2 x 11 graph with approximate discharge, depth of flow, and year measured.

RAINFALL/RESERVOIR RECORDS Rainfall gage at nearby Thorn Run Reservoir - Read daily (6 to 7 years of records are available at Butler office of WPW Co.).
Reservoir level measured daily (records also at Butler office).

DESIGN REPORTS

None. A 12-page report dated 1916 which reviews the design drawings, specifications, etc., is available in PennDER files.

GEOLOGY REPORTS

None.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS None available.
DAM STABILITY None available.
SEEPAGE STUDIES None available.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY None
FIELD None

Construction Drawings 30016 and 30034 show subsurface profile based on apparent borings and test pits.

POST-CONSTRUCTION SURVEYS OF DAM
A survey was conducted in 1969 for remedial work on the spillway.

BORROW SOURCES

Not known - probably from within reservoir.

MONITORING SYSTEMS

None.

MODIFICATIONS

Drawings and correspondence indicate spillway was repaired in 1931, 1936, and 1969.

HIGH POOL RECORDS

Mr. Ray Black (production superintendent) recalls a storm in 1954 passing about 58 inches over the spillway crest.

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

1. Several inspections by predecessors of PennDER from 1919 to 1964 in files.
2. A model study by predecessors of PennDER to evaluate spillway capacity also in files.
3. Owner conduting inspection since 1977 for insurance application. Copy of 1977 report reviewed by GAI.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

Corewall overtopped during construction as per PennDER records. Minimal damage.
According to water company personnel, several of the concrete slabs within the spillway outlet channel were removed in 1954 during high flow associated with hurricane "Hazel".

MAINTENANCE
OPERATION
RECORDS

No formal manuals. Embankment is mowed regularly. Caretaker and helper police area daily (limited recreational use).
Facility basically self-regulating. All valves are opened at dam and flow is regulated at treatment plant. Can pump from Allegheny River into watershed of Oneida for storage.

ITEM	REMARKS
SPILLWAY PLAN	Construction Drawing 30041.
SECTIONS	Construction Drawing 30041.
DETAILS	Construction Drawing 30041.

OPERATING EQUIPMENT
PLANS & DETAILS

Construction Drawing 30044 and 30047 (gate house).
Construction Drawing 30037-H and 30040-H - Steel pipe and CI Fittings for Lake Oneida Dam (contained within PennDER files).

A publication entitled, "Contingency Emergency Plan to Maintain Safe Potable Water Delivery to Consumers of Western Pennsylvania Water Company - Butler District", is available at Butler office. This plan contains complete telephone listing for local supervisory personnel, radio, DER, police, fire department, etc.

NDI# PA-272

CHECK LIST ID # PennDER# 10-11

HYDROLOGIC AND HYDRAULIC

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 75% woodlands; 25% residential/cultivated

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1058.8 (1760 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not applicable

ELEVATION MAXIMUM DESIGN POOL: Not known

ELEVATION TOP DAM: 1067.5 (3350 acre-feet)

SPILLWAY DATA:

a. Crest Elevation 1058.8 MLS
b. Type Modified side channel with broad-crested weir
c. Weir Length 129.5 feet, measured
d. Channel Length approximately 350 feet
e. Location Spillover right abutment
f. Number and Type of Gates ungated

OUTLET WORKS:

a. Type a. 30-inch steel, concrete enacted, main supply line to water treatment plant. b. 30-inch steel blow-off encased in concrete
b. Location Entrance at gate house; blowoff exit about 300' d/w ~~of crest in old stream~~
c. Entrance Inverts 1028.6
d. Exit Inverts 1028.3 (blow-off)
e. Emergency Draindown Facilities 30-inch sluice valve operated from gate house.

HYDROMETEOROLOGICAL GAGES:

a. Type Rain gage
b. Location Thorn Run Reservoir (nearby)
c. Records Last 6 to 7 years available at Butler Office (WPWG)

MAXIMUM NON-DAMAGING DISCHARGE: 58 inches over crest in 1954

Note: All elevations are field measured based on the spillway crest (1058.8) supplied by the Owner.

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

DAM NAME Lake Oneida Dam   COUNTY Butler   STATE PA   NDI# PA-272
ID # PennDER# 10-11

TYPE OF DAM Earth   HAZARD CATEGORY High

DATE(S) INSPECTION 30 August 78   WEATHER Overcast w/ light rain   TEMPERATURE 70°-75°

POOL ELEVATION AT TIME OF INSPECTION 1058.7 M.S.L.   TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL:

GAI	WPW Co.	PennDER
B. Mihalcin	W. H. McAdams	
J. P. Nairn	R. Black	L. Busack
D. Bonk	A. Reeder	
E. Mannella		
S. R. Michalski		

B. Mihalcin RECORDER

EMBANKMENT ID# PA-272 Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS None observed.		
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE None observed.		
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES None observed.		
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST The horizontal alignment appears to be good however, minor settlement deviates the vertical alignment by a maximum of one foot.		
RIPRAP FAILURES None observed.		

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM

Good condition.

ANY NOTICEABLE SEEPAGE

Slight seepage at toe near center of embankment - possibly from toe drain or drain laterals. Terra-cotta (t.c.) drain tiles were located in the flat beyond the toe and a t.c. exit was found at the old stream location about 110 feet from the embankment toe.

STAFF GAGE AND RECORDER

None observed. There is a bench mark (painted yellow) indicated on the top of the left wingall to the spillway.

DRAINS

1. Square terra-cotta tiles are evident in flat beyond toe of dam. They probably connect into toe drain laterals. An exit was located in the natural streambed about 130 feet from the toe. Flow was minimal, less than 1 gpm.
2. Evidence of a t.c. drain was noted near the left abutment approximately 45 feet from the toe of the dam and 27 feet below the crest. Correspondence indicates old spring location.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Single crack visible at discharge end of 30-inch cast iron pipe (outlet conduit) located in downstream channel adjacent to left abutment.	
INTAKE STRUCTURE	Intake submerged. Masonry gate house in need of structural repair due to cracking. Access bridge in good condition.	
OUTLET STRUCTURE	No outlet structures.	
OUTLET CHANNEL	Blow-off (30-inch CIP) exits into pool at natural stream channel. About 400 feet downstream of embankment, channel is densely wooded.	
EMERGENCY GATE	Manual valve controls observed within gate house appeared in good condition. 30-inch blow-off has sliding gate. Supply line has gate valves. Supply line reportedly has 6-inch blow-off connected - not observed. The condition and operability of the lines and their controls is suspect since they have reportedly not been operated in years and were not operated in the presence of the inspection team.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

CONCRETE WEIR

Good condition. Minor to moderate scaling of weir walls. Could use surface treatment.

APPROACH CHANNEL

Submerged. Riprap lined on right abutment.

DISCHARGE CHANNEL

a. From weir to downstream access bridge (about 150 feet) - apron in good condition; minor cracking in wingwalls; little efflorescence; construction joints o.k.; access bridge in good condition.

b. From access bridge to end of spillway channel - Poor condition; 70-foot diameter erosional depression immediately downstream of bridge; 60-foot from toe of embankment.

BRIDGE AND PIERS

Foot bridge across spillway in good condition.

GATED SPILLWAY ID # PA-272 SHEET 5

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

INSTRUMENTATION ID # PA-272 SHEET 6

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

Bench mark (yellow paint mark) on top of left wingwall to spillway.

OBSERVATION WELLS

None.

WEIRS

None.

PIEZOMETERS

None.

OTHERS

None.

RESERVOIR ID # PA-272 SHEET 7

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate to steep. Cleared to top of dam elevation around reservoir, otherwise, heavily wooded.	
SEDIMENTATION	Some apparent in approach channel, particularly along right abutment.	

DOWNSTREAM CHANNEL ID # PA-272 SHEET 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Natural stream with brushy overgrowth. Broad valley with meandering stream.	
SLOPES	Gentle along valley bottom. Steep side slopes. Valley bottom approximately 600 to 1000 feet wide.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approxiamtely 20 structures within two miles of dam. Estimated population 60 to 80.	

APPENDIX C

HYDRAULICS/HYDROLOGY

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272

CHKD. BY EJM DATE 9-13-78 SHEET NO. 1 OF 20

GAI CONSULTANTS, INC.
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DAM STATISTICS

MAXIMUM HEIGHT - 38 FEET (REF 1: pg 99)

DRAINAGE AREA - 16.6 SQ. MI " "

STORAGE CAPACITY ≈ 3350 AC-FT @ TOP OF DAM (SHEET)

SIZE CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 2: TABLE 1)

HAZARD RATING - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 2: TABLE 3)

REFERENCES

1 "DAMS, RESERVOIRS, AND NATURAL LAKES," WATER RESOURCES BULLETIN, BUREAU OF ENGINEERING, HARRISBURG (1970)

2 "RECOMMEND GUIDELINES FOR SAFETY INSPECTION OF DAMS" DEPT. OF THE ARMY - OFFICE OF CHEIF ENGINEER, APPENDIX D

3 STANDARD HANDBOOK FOR CIVIL ENGINEERS, F. S. MERRITT, McGRAW-HILL, INC., NEW YORK (1976)

4 "SIMULATION OF FLOW THROUGH BROAD CREST NAVIGATION DAMS WITH RADIAL GATES," R.W. SCHMITT, U.S. ARMY CORPS OF ENGINEERS, PITTSBURGH DISTRICT

PMF (PEAK FLOW)/AREA = 1290 CFS/SQ.MI. (REF: C OF E CURVE, OHIO RIVER BASIN)

PMF = (1290 CFS/SQ.MI.)(16.6 SQ.MI.) = 21,414 CFS (ROUNDED TO 21,400 CFS)

PEAK PMF Q = 21,414 CFS = Q_{IMAX}

VOLUME OF INFLOW HYDROGRAPH

V = 1/2 (Q_{IMAX})(TIME)

DURATION TIME = 54 HRS (REF: C OF E CURVE, OHIO RIVER BASIN)

V = 1/2 (21,414 CFS)(54 HRS)(3600 SEC/HR)(1 ACRE/43,560 SQ.FT.)

= 47783 AC-FT

DETERMINE THE AVERAGE RUNOFF REQUIRED TO PRODUCE THE ABOVE VOLUME OF INFLOW.

(47,783 AC-FT)(1 SQ.MI/640 ACRES)(12 IN/FT)/(16.6 SQ.MI) = 54.0 INCHES

VOLUMES PRODUCED BY RUNOFF IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER BOUND.

(26 INCHES)(16.6 SQ.MI)(640 ACRES/SQ.MI)(1 FT/12 IN) = 23,019 AC-FT

VOLUME OF INFLOW (RECALCULATED) = 23,019 AC-FT

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272

CHKD. BY EJM DATE 9-13-78 SHEET NO. 3 OF 20

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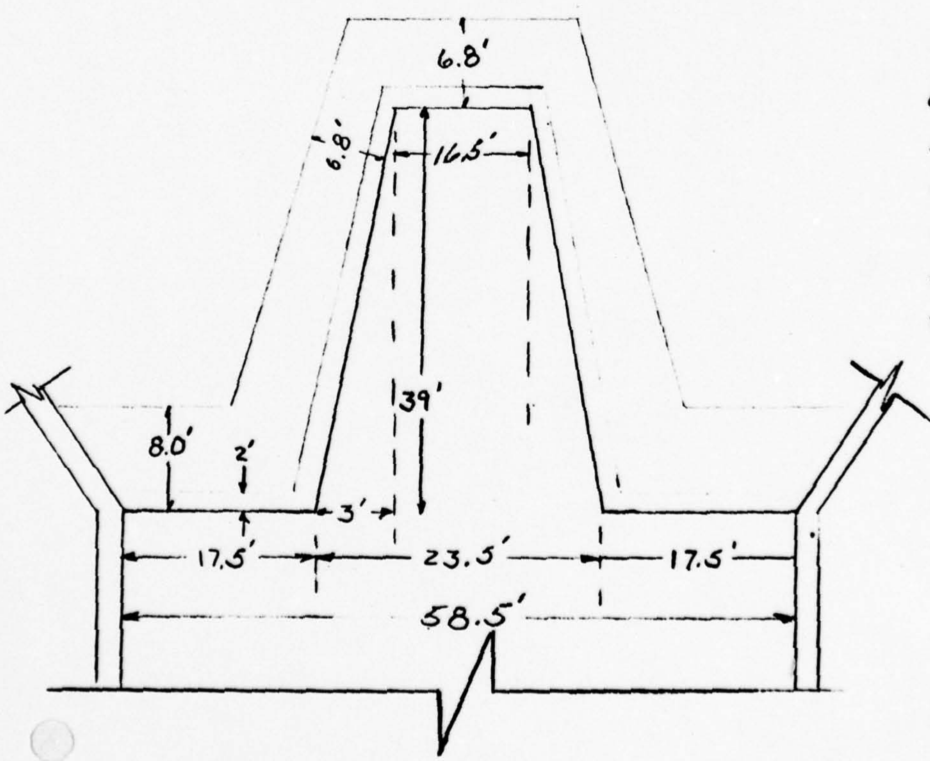
NOTE : $Q_{I MAX}$ REMAINS CONSTANT.
DURATION TIME DECREASES IN ACCORDANCE WITH THE DECREASE IN INFLOW VOLUME.

$$\text{EQUIVALENT DURATION TIME} = \frac{(23{,}019 \text{ AC-FT})(2)(43{,}560 \text{ SQ.FT/ACRE})}{(21{,}414 \text{ CFS})(3600 \text{ SEC/HR})}$$

$$= 26.0 \text{ HRS}$$

SPILLWAY CAPACITY



NOTE : DIMENSIONS ARE BASED ON DESIGN DRAWING TITLED "LAKE ONEIDA DAM, SPILLWAY & WEIR" REVISED ON JULY 15, 1910. FIELD VERIFIED DIMENSIONS DIFFER SLIGHTLY FROM FROM THOSE ON THE DRAWINGS

DIMENSIONS SHOWN ON THIS SECTION ARE FIELD MEASURED

SUBJECT: DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY: DLB DATE: 9-1-78 PROJ. NO. 78-501-272
CHKD. BY: EJM DATE: 9-13-78 SHEET NO. 4 OF 20

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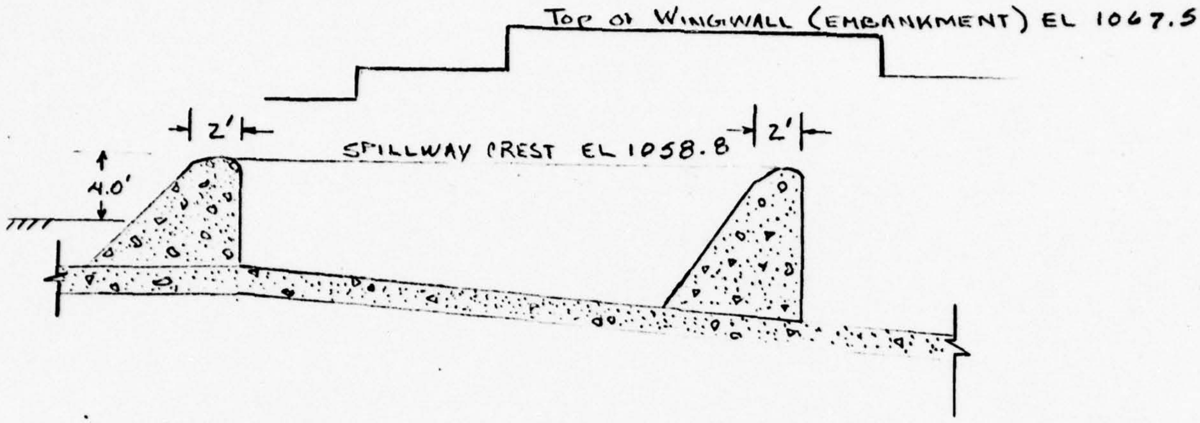

NOTE - ALL ELEVATIONS ARE FIELD MEASURED AND BASED ON THE ELEVATION OF THE SPILLWAY CREST 1058.8 SUPPLIED BY THE OWNER. ASSUMED MINOR CREST SETTLEMENTS RESTORED TO PROPER GRADE [MAXIMUM MEASURED EMBANKMENT SETTLEMENT APPROXIMATELY EQUALS 0.7 FEET].

$Q = C L H^{3/2}$ (REF 3, EQ 21-121)

L = LENGTH OF WEIR ≈ 129.5 FEET   (SHEET 3)

H = MAXIMUM HEAD OVER SPILLWAY CREST = 1067.5 - 1058.8 = 8.7 FT.

C = COEFFICIENT OF DISCHARGE

(FROM REF 3, TABLE 21-15)

BREADTH OF CREST OF WEIR = 2 FT

$C \approx 3.32$

$Q \approx (3.32)(129.5)(8.7)^{3/2} \approx 11033$ CFS   (ROUNDED TO 11,000 CFS)

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (11,000 CFS)

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 5 OF 20

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CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{11{,}033 \text{ CFS}}{21{,}414 \text{ CFS}}$$ (SHEET 4) (SHEET 2)

P = 0.52

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = 0.48$$

REQUIRED RESERVOIR STORAGE = (0.48)(23,019 AC-FT) (SHEET 2)
= 11,049 AC-FT (ROUNDED TO 11,000 AC-FT)

CALCULATE STORAGE AVAILABLE

RESERVOIR SURFACE (@ NORMAL POOL) ≃ 155 ACRES (PLANIMETERED OFF U.S.G.S 7.5 MINUTE MAP)

RESERVOIR SURFACE (@ TOP OF DAM) ≃ 210 ACRES " "

AVAILABLE FREEBOARD = 8.7 FEET (SHEET 4)

AVAILABLE STORAGE = [(210+155) ACRES / 2] (8.7 FT) ≃ 1588 AC-FT (ROUNDED TO 1600 AC-FT)

AVAILABLE STORAGE (1600 AC-FT) < REQUIRED STORAGE (11,000 AC-FT)

BJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

DATE 9-1-78 PROJ. NO. 78-501-272

KD. BY EJM DATE 9-13-78 SHEET NO. 6 OF 20

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ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED BASED ON THE ASSUMPTIONS AND CRITERIA ON THE PREVIOUS FIVE PAGES.

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588 \text{ AC-FT}}{(1/2)(Q_{IMAX})(26 \text{ HRS})(3600 \text{ SEC/HR})(1 \text{ AC}/43,560 \text{ FT}^2)}$$

$$P = \frac{11,033 \text{ CFS}}{Q_{IMAX}}$$

$$\therefore 1 - \frac{11,033}{Q_{IMAX}} = \frac{1588}{1.07 Q_{IMAX}}$$

$$1.07 Q_{IMAX} - 11805 = 1588$$

$$Q_{IMAX} = 12,517 \text{ CFS}$$

PEAK PMF Q = 21,414 CFS (SHEET 2)

Q_{IMAX} = 58.5% PEAK PMF Q

CONSIDER THE SPILLWAY TO DISCHARGE AS A SIMPLE WEIR WITH AN EFFECTIVE LENGTH EQUIVALENT TO THE CHANNEL OPENING (58.5 FT) UNDER HIGH HEADS.

$Q = CLH^{3/2}$ (REF 3, EQ 21-121)

L = LENGTH OF WEIR ≃ 58.5 FT (SHEET 3)
H = 8.7 FT (SHEET 4)

C ≈ 3.32 (SHEET 4)

$Q \approx (3.32)(58.5)(8.7)^{3/2} \simeq 4984$ CFS (ROUNDED TO 5000 CFS)

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (5000 CFS)

CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD

$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF Q}} = \frac{4984 \text{ CFS}}{21{,}414 \text{ CFS}}$ (SHEET 7)

P = 0.23

$(1-P) = \frac{\text{REQUIRED STORAGE}}{\text{INFLOW VOLUME}} = 0.77$

REQUIRED STORAGE = (0.77)(23,019 AC-FT) (SHEET 2)

REQUIRED STORAGE = 17,725 AC-FT (ROUNDED TO 17,700 AC-FT)

REQUIRED STORAGE (17,700 AC-FT) > AVAILABLE STORAGE (1600 AC-FT)

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ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED BASED ON THE ASSUMPTIONS AND CRITERIA ON SHEET 7.

$$P = \frac{4984 \text{ CFS}}{Q_{IMAX}}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588}{1.07 Q_{IMAX}}$$

(SHEET 5)
(SHEET 6)

$$\therefore \quad 1 - \frac{4984}{Q_{IMAX}} = \frac{1588}{1.07 Q_{IMAX}}$$

$$1.07 Q_{IMAX} - 5,333 = 1588$$

$$Q_{IMAX} = 6468 \text{ CFS}$$

PEAK PMF $Q = 21,414$ CFS (SHEET 2)

$Q_{IMAX} = 30.2$ % PEAK PMF Q

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 9 OF 28

A MEMORANDUM CONTAINED WITHIN PENNDER FILES AND DATED 6 APRIL 1949 STATES THAT THE OWNER CLAIMS THE SPILLWAY AT LAKE ONEIDA DAM HAS A CAPACITY OF APPROXIMATELY 8300 CFS.

DETERMINE WHAT PERCENT PMF IS PASSED AND/OR CONTAINED WHEN THE SPILLWAY IS ASSUMED TO HAVE A CAPACITY EQUIVALENT TO 8300 CFS.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{8300 \text{ CFS}}{21{,}414 \text{ CFS}} \quad \text{(SHEET 2)}$$

$$P = 0.39$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = (1-0.39) = 0.61$$

INFLOW VOLUME = 23,019 AC-FT (SHEET 2)

REQUIRED STORAGE = 14049 AC-FT (ROUNDED TO 14,000 AC-FT) (SHEET 5)

STORAGE AVAILABLE = 1600 AC-FT (SHEET 5)

REQUIRED STORAGE (14000 AC-FT) > AVAILABLE STORAGE (1600 AC-FT)

$$P = \frac{8300 \text{ CFS}}{Q_{IMAX}} = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q}$$

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1588}{1.07\, Q_{IMAX}} \quad \begin{matrix}\text{(SHEET 5)}\\ \text{(SHEET 6)}\end{matrix}$$

SUBJECT Dam Safety Inspection
Lake Oneida Dam

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 10 OF 20

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$$\therefore 1 - \frac{8300 \text{ cfs}}{Q_{I_{MAX}}} = \frac{1588}{1.07\, Q_{I_{MAX}}}$$

$$1.07\, Q_{I_{MAX}} - 8881 = 1588$$

$$Q_{I_{MAX}} = 9{,}784 \text{ cfs}$$

$$\text{Peak PMF } Q = 21{,}414 \text{ cfs}$$

$$Q_{I_{MAX}} = 45.7\% \text{ Peak PMF } Q$$

CONSIDER THE AFFECTS OF UPSTREAM RESERVOIR

BOYDSTOWN RESERVOIR

DAM STATISTICS

MAXIMUM HEIGHT	- 28 FEET	(REF 1: pg 99)
DRAINAGE AREA	- 13.6 SQ. MI.	" "
STORAGE CAPACITY	- 528 ACRE-FEET @ TOP OF DAM	

SIZE CLASSIFICATIONS

DAM SIZE	- SMALL	(REF 2: TABLE 1)
HAZARD RATING	- HIGH	(FIELD OBSERVATION)
REQUIRED SDF	- 1/2 PMF TO PMF	(REF 2: TABLE 3)

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PMF (PEAK FLOW)/AREA = 1380 CFS/SQ. MI. (REF: C OF E CURVE, OHIO RIVER BASIN)

PMF = (1380 CFS/SQ. MI.)(13.6 SQ. MI.) = 18768 CFS (ROUNDED TO 18,800 CFS)

PEAK PMF Q = 18,768 CFS = Q_{IMAX}

VOLUME OF INFLOW HYDROGRAPH

$V = 1/2\,(Q_{IMAX})(TIME)$

DURATION TIME = 51 HRS

V = 1/2 (18,768 CFS)(51 HRS)(3600 SEC/HR)(1 ACRE/43,560 SQ. FT)

V = 39,552 AC-FT

DETERMINE THE AVERAGE RUNOFF REQUIRED TO PRODUCE THE ABOVE VOLUME OF INFLOW

(39,552 AC-FT)(1 SQ. MI./640 ACRES)(12 IN/FT)/(13.6 SQ. MI.) = 54.5 INCHES

VOLUMES PRODUCED BY RUNOFF IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER BOUND.

(26 INCHES)(13.6 SQ. MI.)(640 ACRES/SQ. MI.)(1 FT/12 IN) = 18,859 AC-FT

VOLUME OF INFLOW (RECALCULATED) = 18,859 AC-FT

BOYDSTOWN RESERVOIR

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272

CHKD. BY EJM DATE 9-13-78 SHEET NO. 13 OF 20

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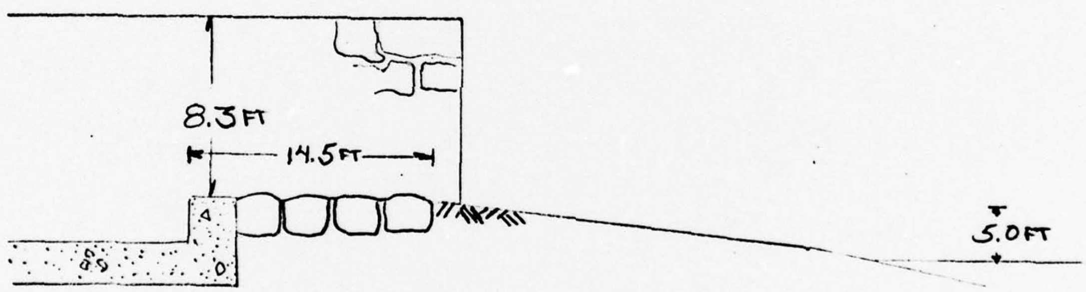
NOTE: $Q_{I\,MAX}$ REMAINS CONSTANT.
DURATION TIME DECREASES IN ACCORDANCE WITH THE DECREASE IN INFLOW VOLUME.

$$\text{EQUIVALENT DURATION TIME} = \frac{(18{,}859\ \text{AC-FT})(2)(43{,}560\ \text{SQ.FT./ACRE})}{(18{,}768\ \text{CFS})(3600\ \text{SEC/HR})}$$

$$= 24.3\ \text{HRS}$$

SPILLWAY CAPACITY



BROAD-CRESTED WEIR

$$Q = CLH^{3/2}$$

L = LENGTH OF WEIR
H = MAXIMUM HEAD OVER SPILLWAY CREST
C = COEFFICIENT OF DISCHARGE

NOTE: THE ABOVE DIMENSIONS ARE BASED ON FIELD MEASUREMENTS. EMBANKMENT SETTLEMENT WAS NOT MEASURED.

BOYDSTOWN RESERVOIR

SUBJECT: DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY: DLB DATE: 9-1-78 PROJ. NO. 78-501-272

CHKD. BY: EJM DATE: 9-13-78 SHEET NO. 14 OF 20

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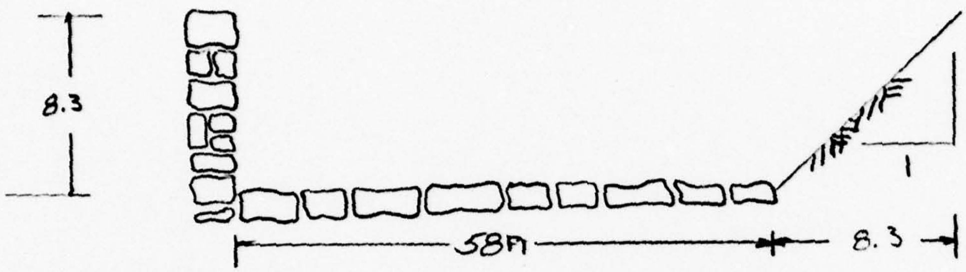
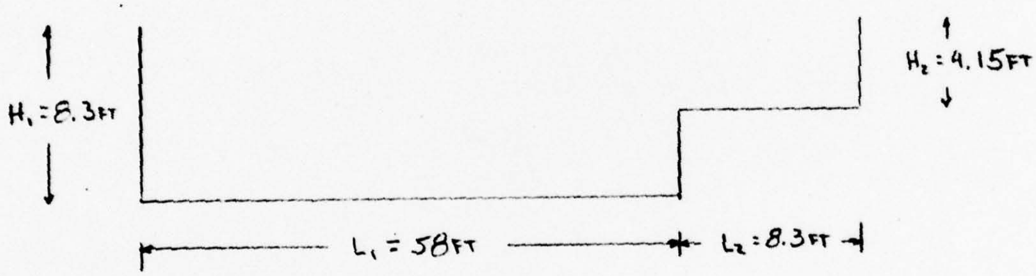


ASSUMED SLOPE BASED ON FIELD OBSERVATIONS



$Q_1 = C_1 L_1 H_1^{3/2}$

$Q_2 = C_2 L_2 H_2^{3/2}$

ASSUME $C_1 = C_2$

BASED ON $\frac{H_{\text{GROSS HEAD}}}{L_{\text{BREADTH}}} = \frac{8.3\text{FT}}{14.5\text{FT}} = 0.57$

$C = 3.1$ (REF 4, FIG 3)

BOYDSTOWN RESERVOIR

SUBJECT Dam Safety Inspection
Lake Oneida Dam

BY DLB DATE 9-1-78 PROJ. NO. 78-501-272
CHKD. BY EJM DATE 9-13-78 SHEET NO. 15 OF 20

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$Q_1 = (3.1)(58)(8.3)^{3/2} = 4299$ CFS

$Q_2 = (3.1)(8.3)(4.15)^{3/2} = 218$ CFS

$Q_1 + Q_2 = 4517$ CFS (Rounded to 4500 CFS)

Peak PMF Q (18,800 CFS) > Maximum Discharge (4500 CFS)

Consider inflow relative to both outflow and storage

$$P = \frac{\text{Maximum Discharge}}{\text{Peak PMF Q}} = \frac{4517 \text{ CFS}}{18{,}768 \text{ CFS}} = 0.24$$

$$(1-P) = \frac{\text{Required Storage}}{\text{Inflow Volume}} = (1-0.24) = 0.76$$

Required Storage = (0.76)(18,859 AC-FT) ← (Sheet 12)

Required Storage = 14,333 AC-FT (Rounded to 14,300 AC-FT)

Storage Available ≃ 307 AC-FT (See note on page 16)

Required Storage (14,300 AC-FT) >> Available Storage (307 AC-FT)

Boydstown Reservoir

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NOTE: STORAGE AVAILABLE IS GIVEN WITHIN THE TEXT OF A MEMORANDUM DATED 3 MAY 1949 AND CONTAINED WITHIN PENNDER FILES

ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED BY BOYDSTOWN RESERVOIR DAM BASED ON THE ASSUMPTIONS AND CRITERIA DEVELOPED ON THE PREVIOUS PAGES.

$$P = \frac{\text{MAXIMUMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{4517 \text{ CFS}}{Q_{IMAX}}$$ (SHEET 15)

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{307 \text{ AC-FT}}{1.07\, Q_{IMAX}}$$ (SHEET 15) (SHEET 6)

$$\therefore 1 - \frac{4517}{Q_{IMAX}} = \frac{307}{1.07\, Q_{IMAX}}$$

$$1.07\, Q_{IMAX} - 4833 = 307$$

$$Q_{IMAX} = 4804 \text{ CFS}$$

$$\text{PEAK PMF } Q = 18768 \text{ CFS}$$ (SHEET 12)

$$Q_{IMAX} = 25.6\%$$

NOTE: AVAILABLE STORAGE ABOVE THE SPILLWAY CREST IS TAKEN FROM A MEMORANDUM CONTAINED IN PENN DER FILES DATED 3 MAY 1949.

SUBJECT	DAM SAFETY INSPECTION LAKE ONEIDA DAM		
BY DLB	DATE 9-25-78	PROJ. NO. 78-501-272	
CHKD. BY JPW	DATE 9-26-78	SHEET NO. 17 OF 20	

GAI CONSULTANTS, INC.
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CONSIDER THE OVERALL LOSS IN SPILLWAY EFFICIENCY DUE TO THE MEASURED CREST SETTLEMENT OF APPROXIMATELY 0.7 FEET AS PREVIOUSLY STATED ON SHEET 4.

SPILLWAY CAPACITY (SEE SHEETS 4 & 7)

$Q = CLH^{3/2}$

L = 129.5 FEET OR 58.5 FEET

NOTE: THE PERCENTAGE DECREASE IN OVERALL EFFICIENCY WILL NOT BE THE SAME FOR BOTH THE ABOVE CASES (129.5 FT AND/OR 58.5 FT). CONSEQUENTLY, BOTH CASES MUST BE CONSIDERED INDIVIDUALLY.

H = MAXIMUM HEAD OVER SPILLWAY CREST = 8.0 FEET

$C \simeq 3.32$

$Q \simeq (3.32)(129.5)(8.0)^{3/2} \simeq 9728$ CFS (ROUNDED TO 9700 CFS)

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (9700 CFS)

SUBJECT: Dam Safety Inspection
Lake Oneida Dam

BY: DLB DATE: 9-25-78 PROJ. NO. 78-501-272
CHKD. BY: JTW DATE: 9-26-78 SHEET NO. 18 OF 20

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Environmental Specialists

CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING THE SHORT CUT METHOD AS RECOMMENDED BY NAD.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PEAK PMF } Q} = \frac{9728 \text{ CFS}}{21{,}414 \text{ CFS}}$$ (SHEET 17) (SHEET 2)

$P = 0.45$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{INFLOW VOLUME}} = 0.55$$

REQUIRED RESERVOIR STORAGE = (0.55)(23,019 AC-FT) ← (SHEET 2)

= 12,660 AC-FT

BASED ON COMPUTED STORAGE (SHEET 5) OF 1588 AC-FT AT TOP OF DAM ELEVATION 1067.5, THE STORAGE AVAILABLE AT ELEVATION 1066.8 IS ESTIMATED TO APPROXIMATELY EQUAL 1450 AC-FT

REQUIRED STORAGE (12,660 AC-FT) > AVAILABLE STORAGE (1450 AC-FT)

ESTABLISH WHAT PERCENT PMF IS PASSED AND/OR CONTAINED BASED ON THE ASSUMPTIONS AND CRITERIA FROM PAGES 17 & 18.

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1450}{1.07 Q_{IMAX}}$$ — (SHEET 18) (SHEET 6)

SUBJECT DAM SAFETY INSPECTION
LAKE ONEIDA DAM

BY DLB DATE 9-25-78 PROJ. NO. 78-501-272

CHKD. BY JPH DATE 9-26-78 SHEET NO. 19 OF 20

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$$P = \frac{\text{MAXIMUM DISCHARGE}}{Q_{IMAX}} = \frac{9728 \text{ cfs}}{Q_{IMAX}}$$ (SHEET 17)

$$\therefore \; 1 - \frac{9728}{Q_{IMAX}} = \frac{1450}{1.07\, Q_{IMAX}}$$

$1.07\, Q_{IMAX} = 11,859$

$Q_{IMAX} = 11,083$ cfs

PEAK PMF Q = 21,414 CFS (SHEET 2)

Q_{IMAX} = 51.7 % PEAK PMF Q (CONSIDERING SETTLEMENT, L = 129.5 FT)
Q_{IMAX} = 58.5 % PEAK PMF Q (NEGLECTING SETTLEMENT, " ") SHEET 6

TOTAL LOSS OF EFFICIENCY (58.5 - 51.7) = 6.8 %

$Q = CLH^{3/2}$

$L = 58.5$ FT

$Q \approx (3.32)(58.5)(8.0)^{3/2}$

$Q \approx 4395$ CFS (ROUNDED TO 4400 CFS)

PEAK PMF Q (21,400 CFS) > MAXIMUM DISCHARGE (4400 CFS)

$P = \frac{\text{MAXIMUM DISCHARGE}}{Q_{IMAX}} = \frac{4395}{Q_{IMAX}}$

$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{INFLOW VOLUME}} = \frac{1450}{1.07\,Q_{IMAX}}$ (SHEET 18) (SHEET 6)

$\therefore\ 1 - \frac{4395}{Q_{IMAX}} = \frac{1450}{1.07\,Q_{IMAX}}$

$1.07\,Q_{IMAX} = 6153$

$Q_{IMAX} = 5750$ CFS

PEAK PMF Q = 21,414 CFS

$Q_{IMAX} = 26.8\%$ PEAK PMF Q (CONSIDERING SETTLEMENT, L = 58.5 FT)

$Q_{IMAX} = 30.2\%$ PEAK PMF Q (NEGLECTING SETTLEMENT, L = 58.5 FT)

TOTAL LOSS OF EFFICIENCY = (30.2 - 26.8) = 3.4%

APPENDIX D

PHOTOGRAPHS

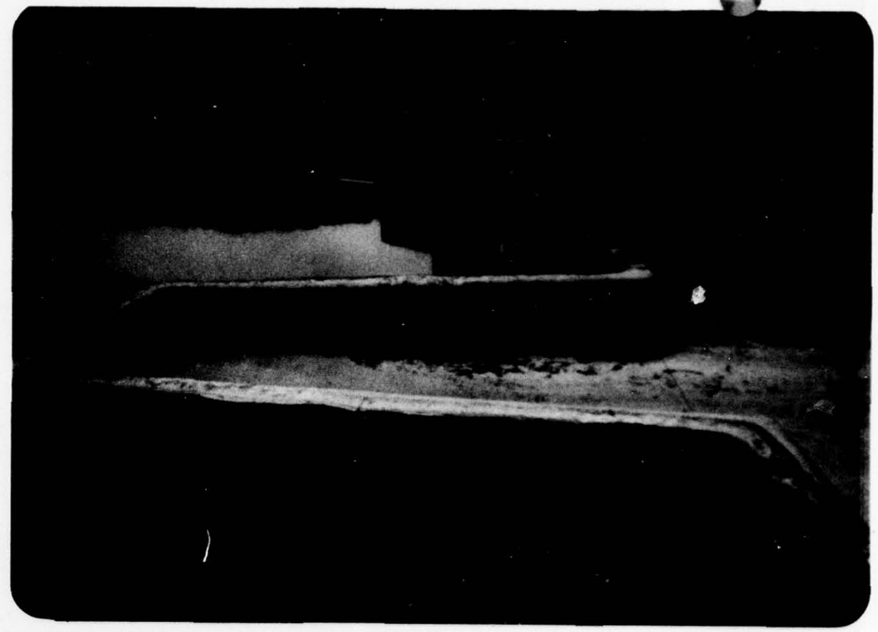
PHOTOGRAPH 1 View of Oneida Dam and spillway as seen from the right abutment.

PHOTOGRAPH 2 Detailed view of spillway weir.

PHOTOGRAPH 3 View downstream of the spillway weir.

PHOTOGRAPH 4 View of the upper spillway channel and spillway weir. The reservoir is visible in the background.

1



2

3

4

PHOTOGRAPH 5 This view shows the severe erosion of the raceway channel after failure of the concrete channel lining. The top of the erosion scarp in the upper right is 60 feet from the downstream toe of the embankment.

PHOTOGRAPH 6 This view is similar to the previous view and shows severe erosion on both sides of the raceway.

PHOTOGRAPH 7 This view shows the lower end of the lined portion of the raceway. The severe erosion shown in the previous two views can be seen in the upper left corner of the photograph. Note the dislodged concrete slabs in the foreground.

PHOTOGRAPH 8 This view shows the outlet of the 30-inch blow-off pipe.

5

6

7

8

PHOTOGRAPH 9 This view is looking east along the abandoned Connoquenessing Creek channel just downstream of the embankment (center background). The low flow noted in the channel is primarily drainage from the downstream toe tile drains.

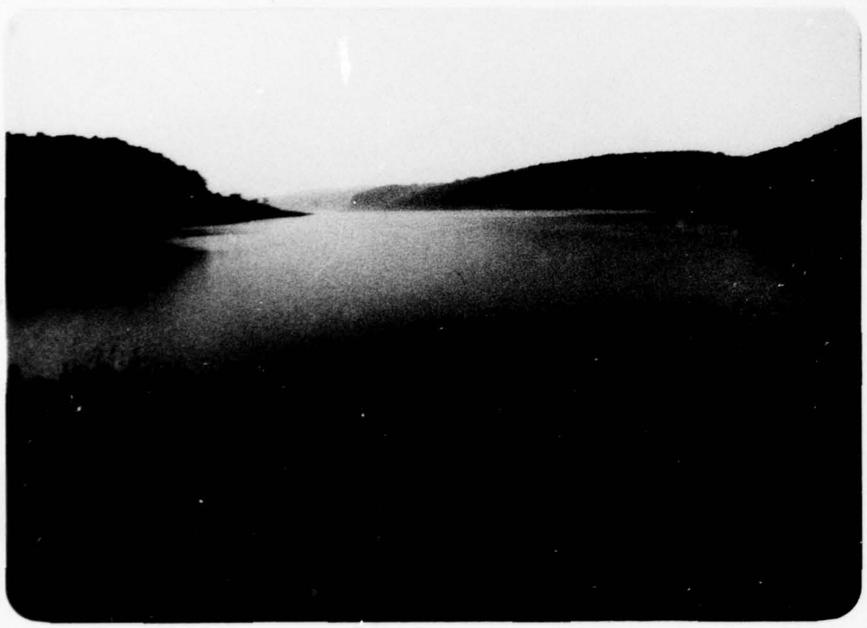
PHOTOGRAPH 10 View of Oneida Dam from the left abutment.

PHOTOGRAPH 11 This view is looking northeast over Lake Oneida.

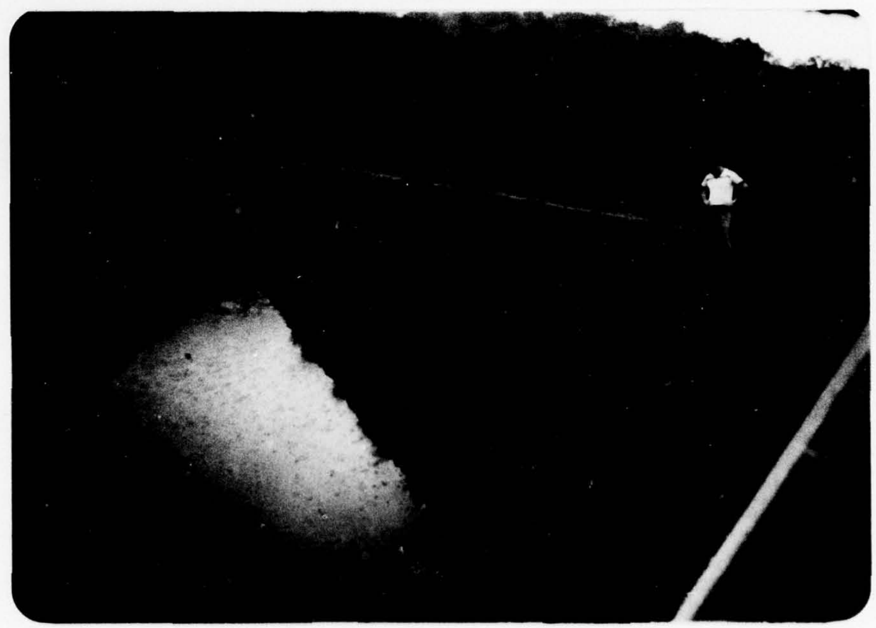
PHOTOGRAPH 12 View of the hand-placed riprap on the upstream slope of the embankment.

9

10



11



12

PHOTOGRAPH 13 This view is looking southwest at the area immediately downstream of the dam.

PHOTOGRAPH 14 Detail showing the condition of the gate controls.

PHOTOGRAPH 15 This view is looking northeast or upstream in the Connoquenessing Creek channel at a point approximately 3,000 feet downstream of Lake Oneida.

PHOTOGRAPH 16 Overview of the Boydstown Dam which lies immediately upstream of Lake Oneida. Discharge from the blow-off outlet can be seen just left of center. The spillway is located in the foreground.

13

14

15

16

APPENDIX E

GEOLOGY

GEOLOGY

The site of the Oneida Dam and Reservoir is located in the Pittsburgh Plateaus Section of the Appalachian Plateau Province. The structural geology of the area is characterized as nearly horizontal beds gently dipping to the southwest.

The strata occupying the hilltop above the reservoir consist of sandstone, shale, limestone, and few thin coal seams of the Conemaugh Formation. The strata in the valley walls and underlying the reservoir and embankment consist of sandstone, shale, and several workable coal seams of the Allegheny Formation. The consolidated sediments of the Allegheny and Conemaugh Formations were deposited during the latter half of the Pennsylvanian age.

APPENDIX F

FIGURES

SUBJECT Oneida Dam

BY SRM DATE 9-12-78 PROJ. NO. 78-501-272

CHKD. BY BMM DATE 9-13-78 SHEET NO. 1 OF 1

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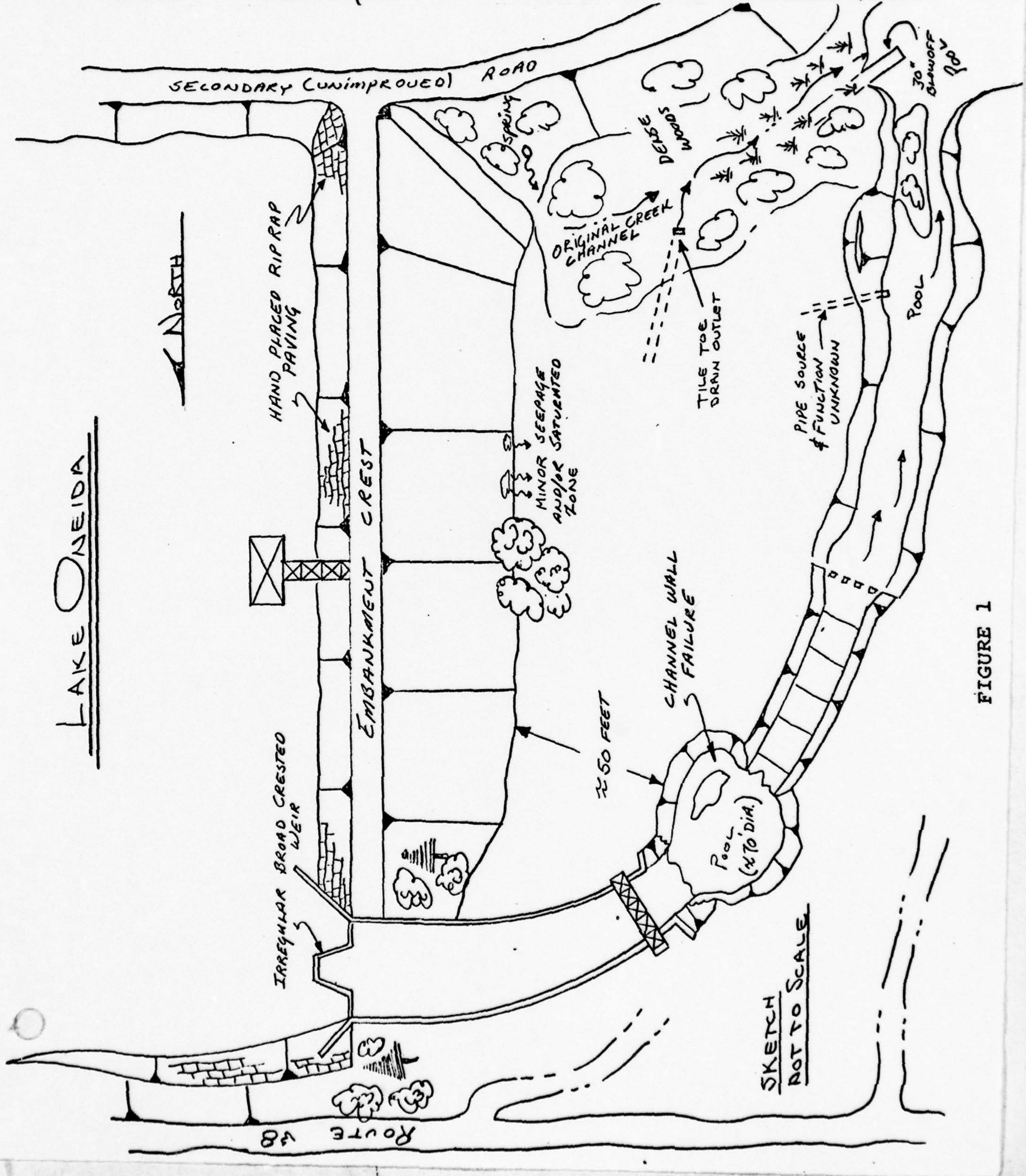
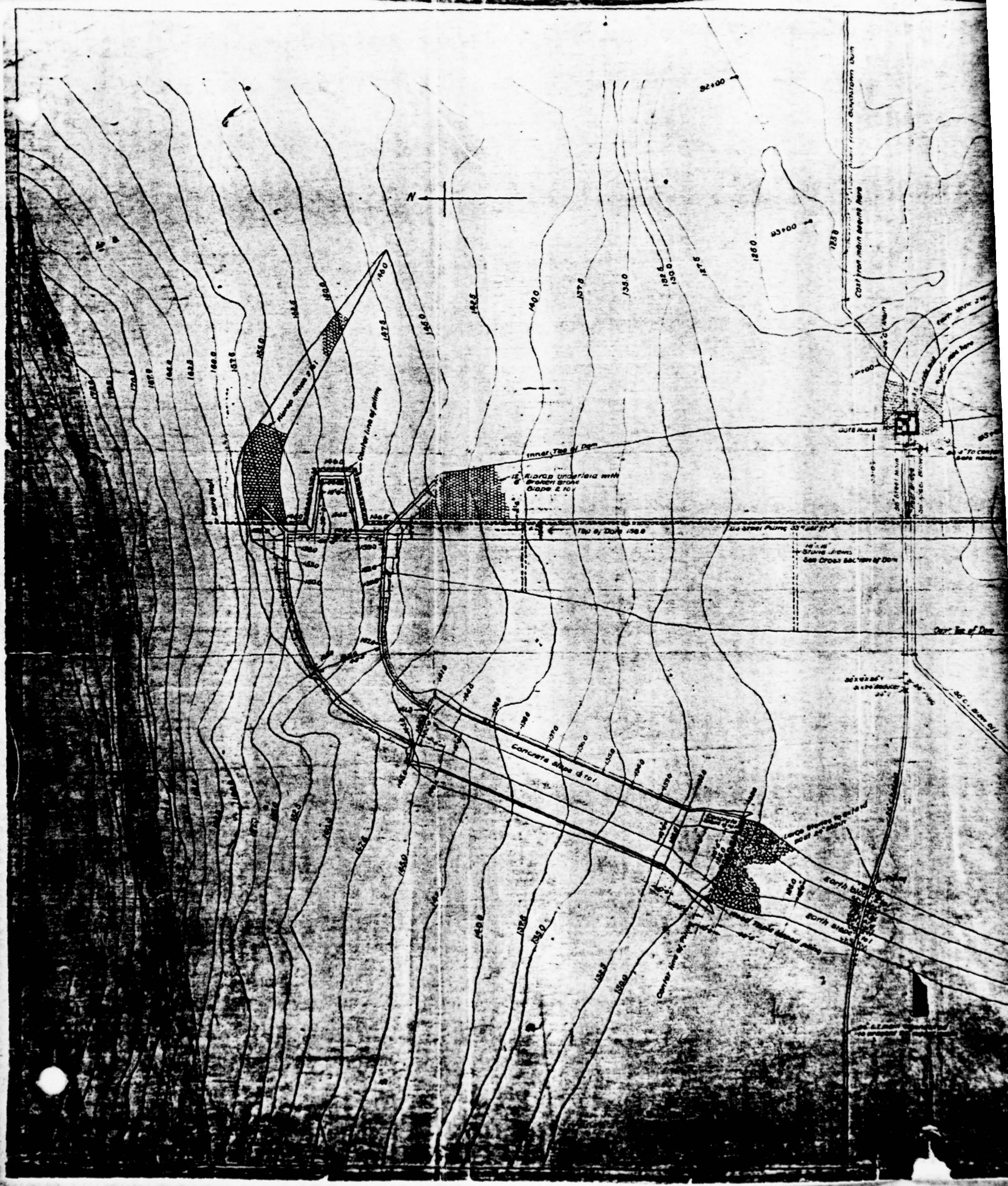
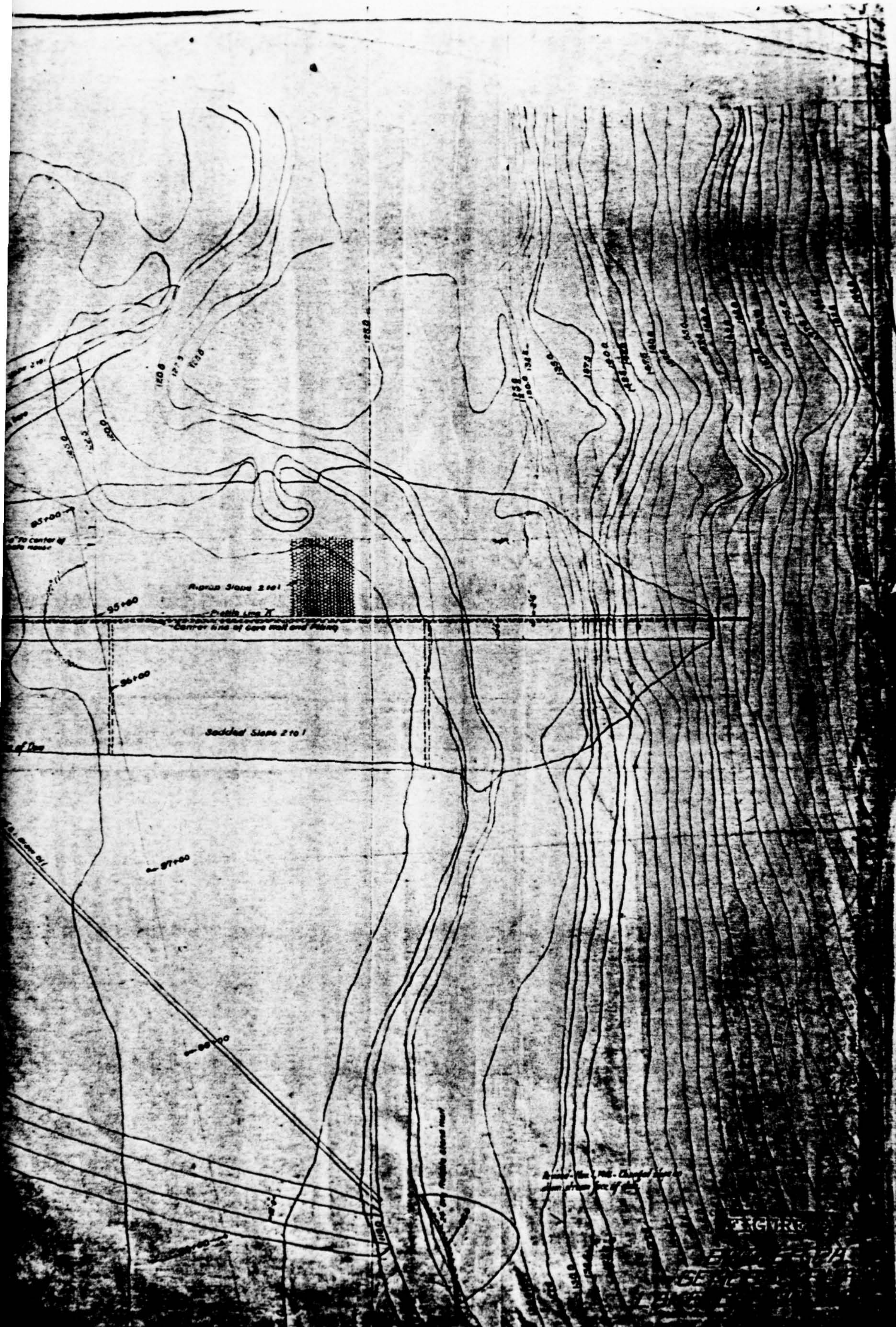


FIGURE 1

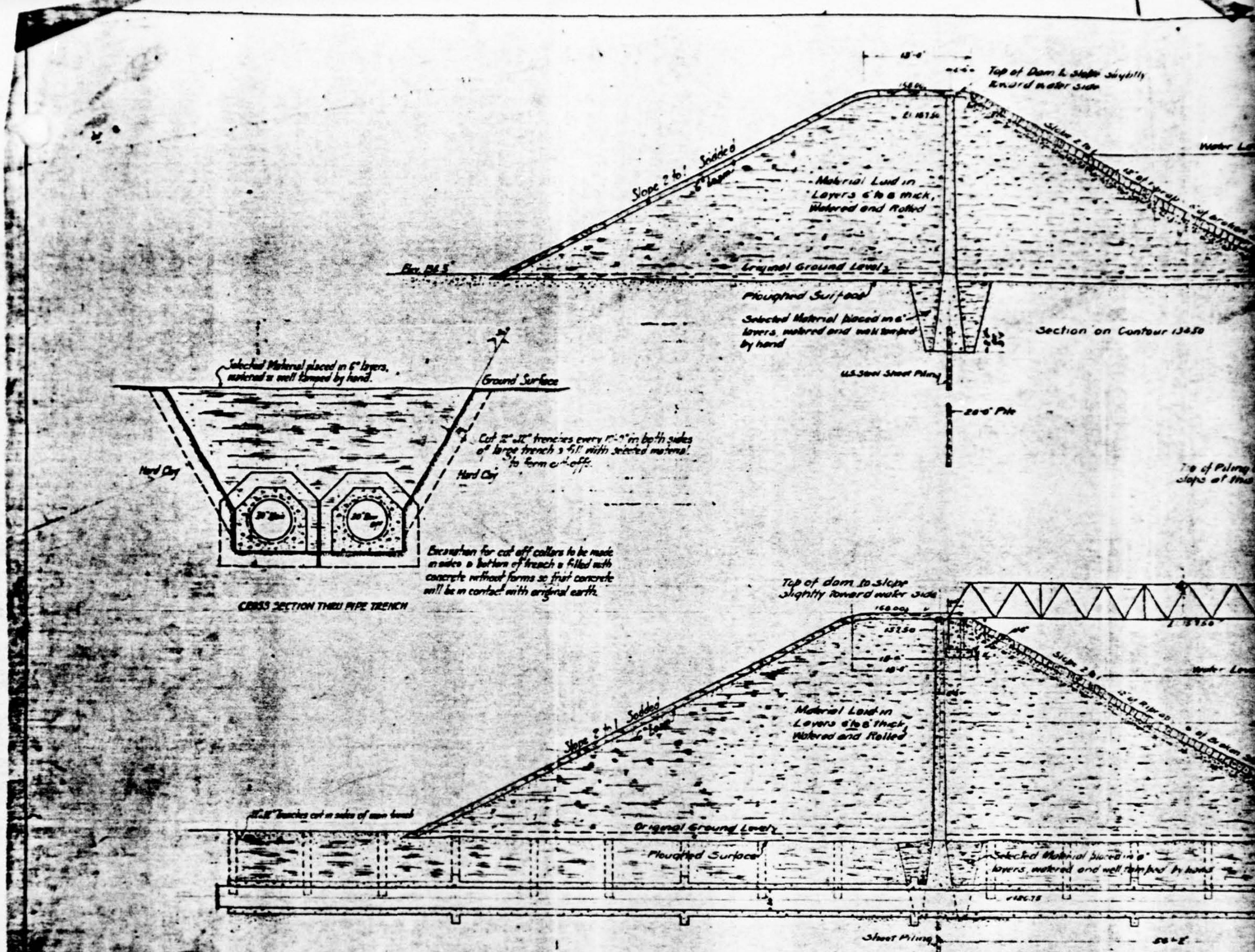


N
Inner Toe of Dam
Riprap underlaid with Broken Stone Slope 2 to 1
Top of Dam
Stone Slopes See Cross Section of Dam
Outer Toe of Dam
Concrete Slope 4 to 1
Center line of Spillway
Earth Slope
Cast Iron main begins here
Gate House

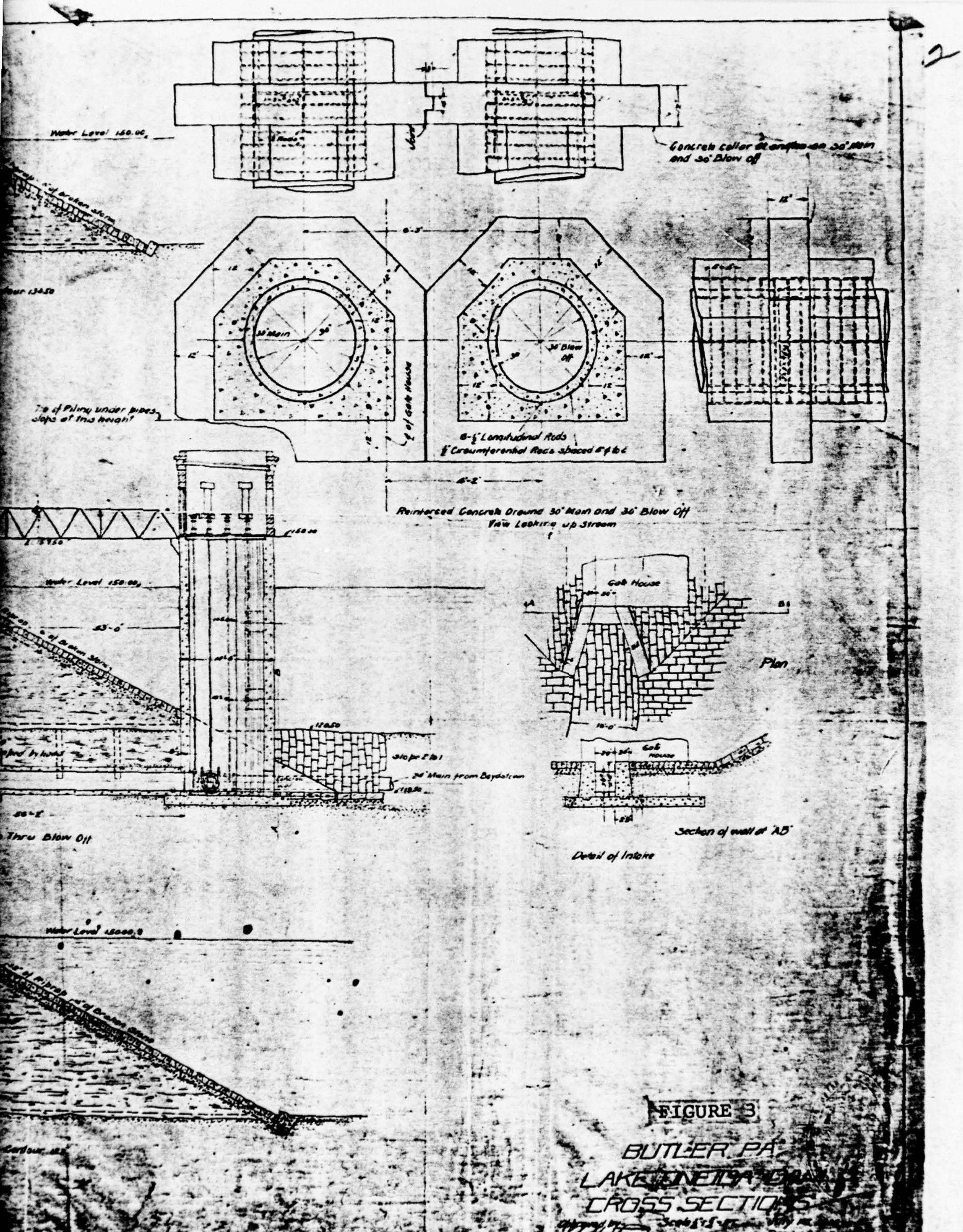
2

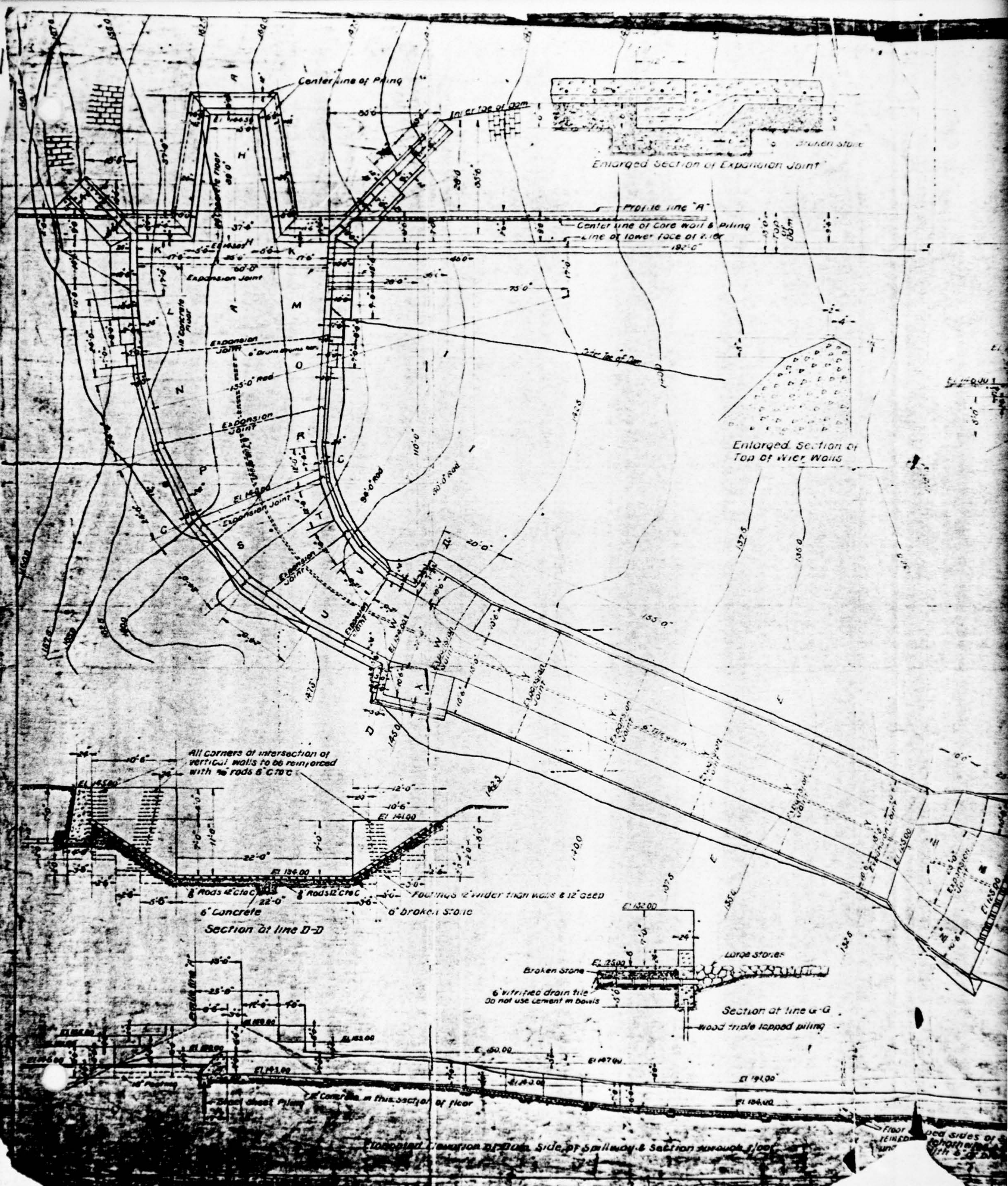


95+00
Riprap Slope 2 to 1
Profile Line X
Center Line of Core Wall and Piling
96+00
Sodded Slope 2 to 1
97+00



Top of Dam & Slope slightly toward water side
Water Level
Slope 2 to 1 Sodded
Material Laid in Layers 6" to 8" thick, Watered and Rolled
Original Ground Level
Ploughed Surface
Selected Material placed in 6" layers, watered and well tamped by hand
Section on Contour 134.50
U.S. Steel Sheet Piling
20'-0" Pile
Selected Material placed in 6" layers, watered & well tamped by hand.
Ground Surface
Hard Clay
Hard Clay
Excavation for cut off collars to be made in sides & bottom of trench & filled with concrete without forms so that concrete will be in contact with original earth.
CROSS SECTION THRU PIPE TRENCH
Top of dam to slope slightly toward water side
Water Level
Slope 2 to 1 Sodded
Material Laid in Layers 6" to 8" thick, Watered and Rolled
Original Ground Level
Ploughed Surface
Sheet Piling
Section Thru Blow Off
Top of Dam to slope slightly toward water side
Water Level
Slope 2 to 1 Sodded
Material Laid in Layers 6" to 8" thick Watered and Rolled
Ploughed Surface
Selected Material placed in 6" layers, watered and well tamped by hand
U.S. Steel Sheet Piling


Water Level 150.00
Concrete collar at angles on 30" Main and 30" Blow off
Toe of Piling under pipes stops at this height
30" Main
30" Blow Off
Gate House
6-½" Longitudinal Rods
½" Circumferential Rods spaced 6" c to c
Reinforced Concrete Around 30" Main and 30" Blow Off
View Looking up Stream
Water Level 150.00
Gate House
Plan
Slope 2 to 1
24" Main from Boydstown
Section of wall at "AB"
Detail of Intake
Thru Blow Off
Water Level 150.00
FIGURE 3
BUTLER PA
CROSS SECTIONS


Center line of Piling
Inner face of dam
Broken Stone
Enlarged Section of Expansion Joint
Profile line "A"
Center line of Core wall & Piling
Line of lower face of wier
Expansion Joint
Enlarged Section of Top of Wier Walls
All corners at intersection of vertical walls to be reinforced with rods 6" C to C
Footings 12" wider than walls & 12" deep
6" Concrete
6" broken stone
Section at line D-D
Broken Stone
Large stones
6" vitrified drain tile
Do not use cement in bowls
Section at line G-G
Wood triple lapped piling

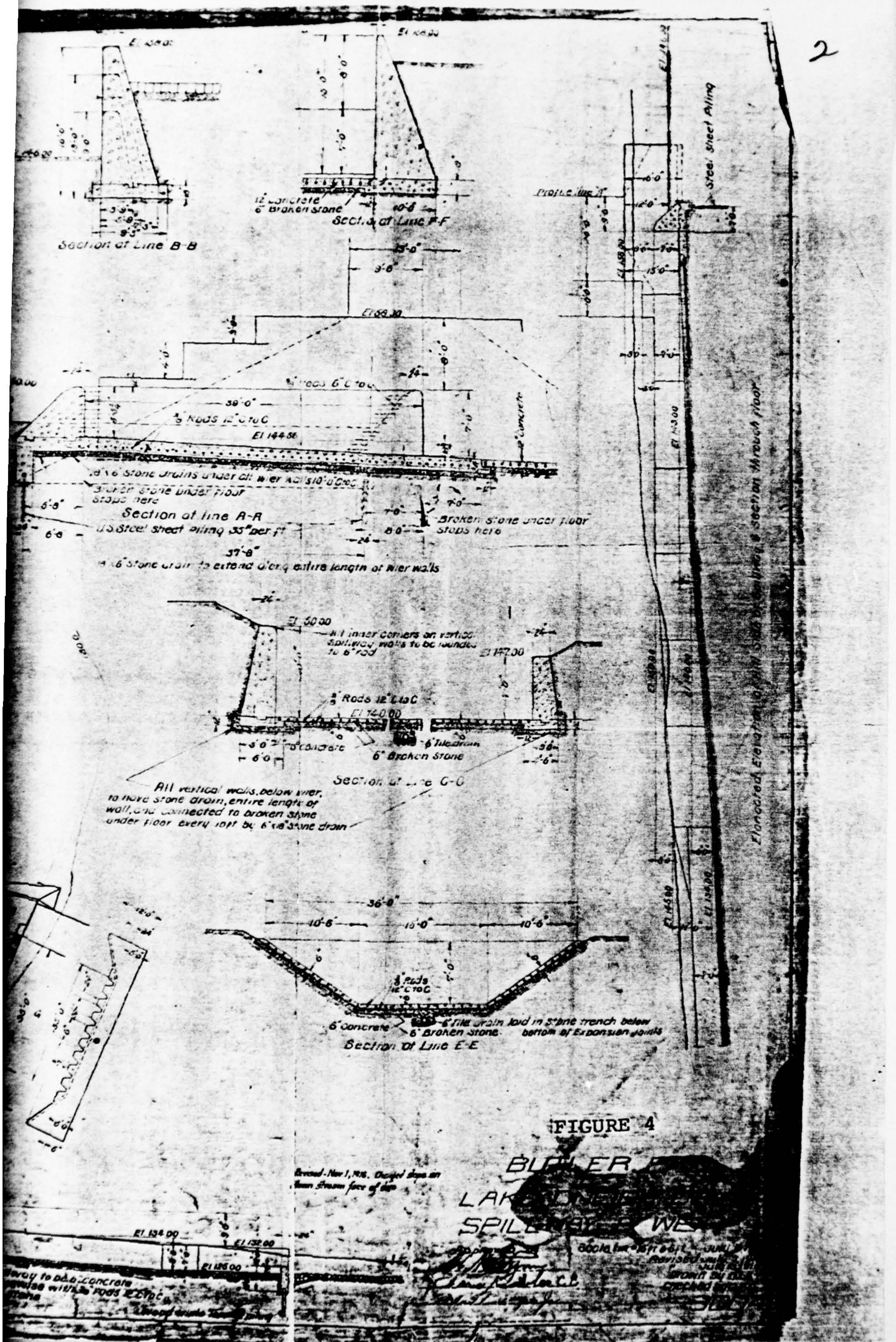
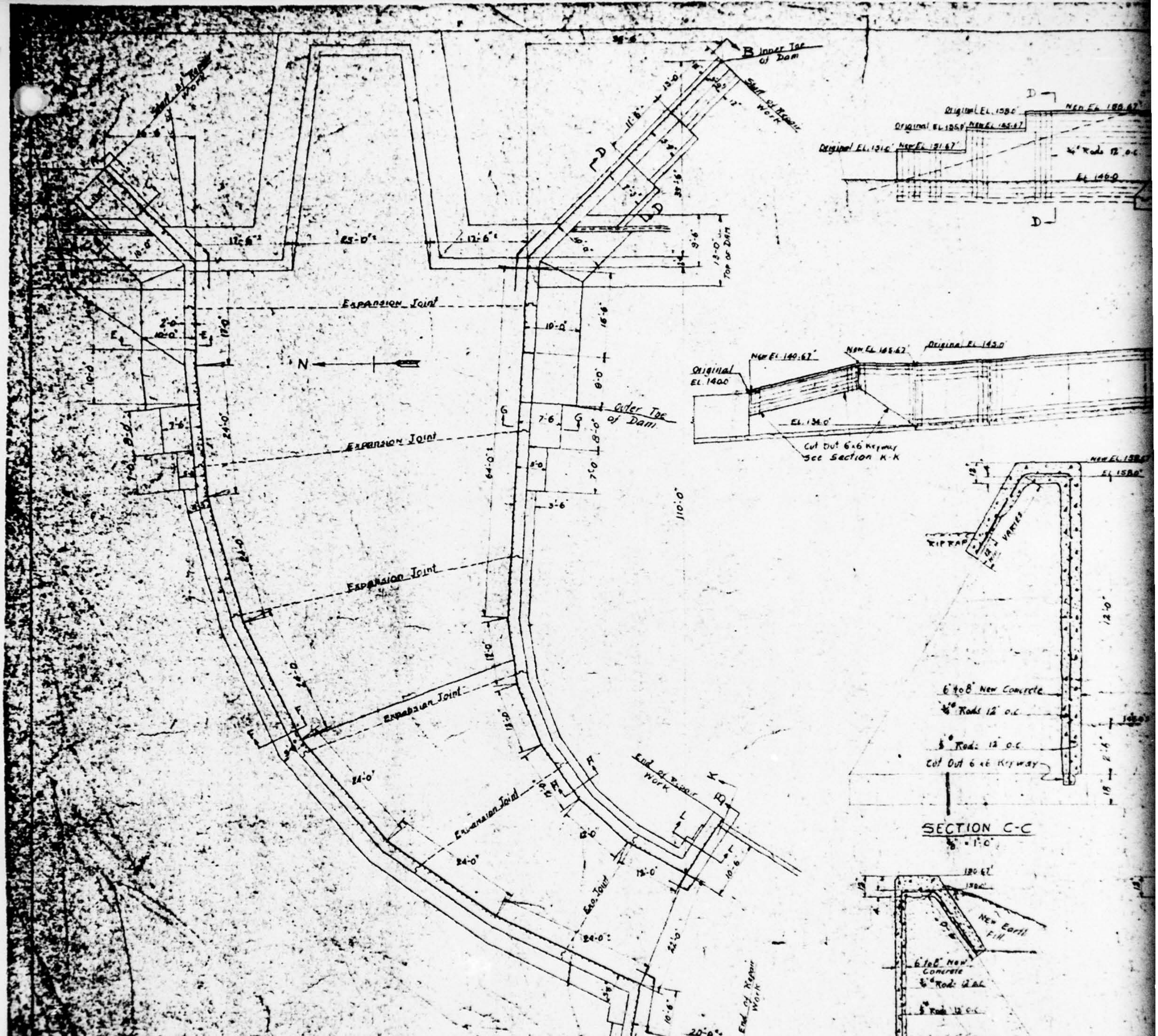
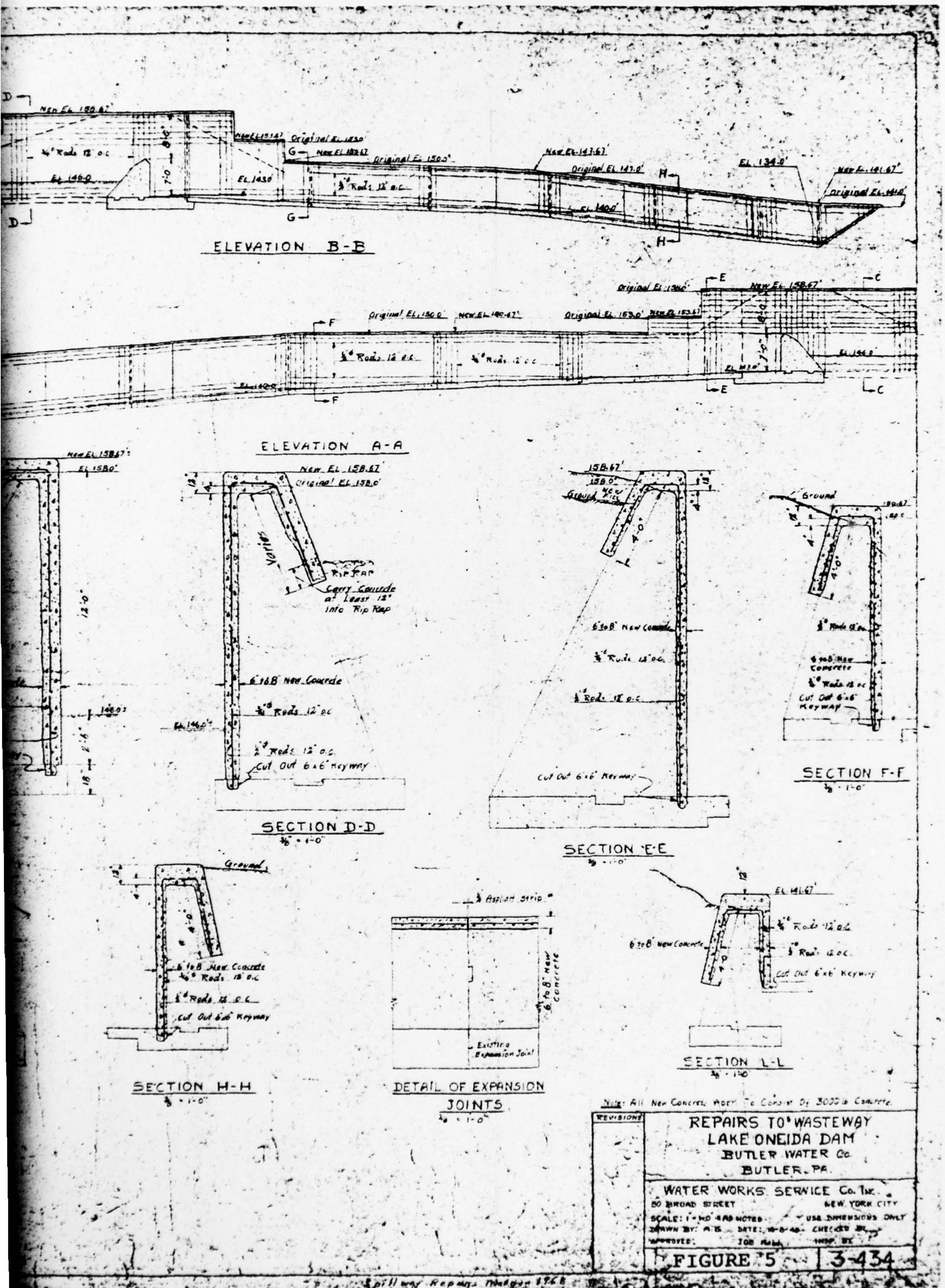
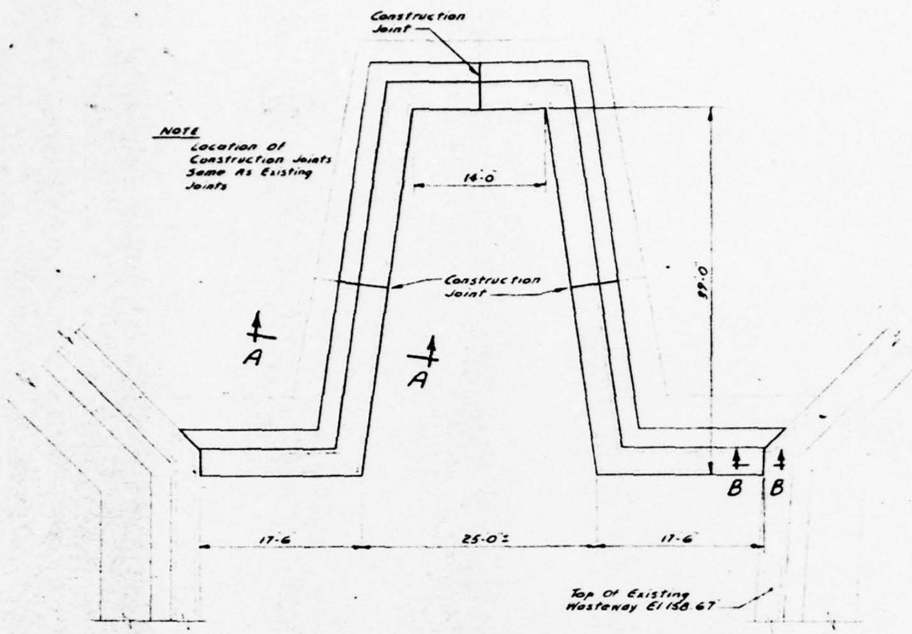

2
Section at Line B-B
12" Concrete
6" Broken Stone
Sect. at Line F-F
Profile line "A"
Steel Sheet Piling
El 144.56
Section at line A-A
U.S. Steel Sheet Piling 35# per ft
Broken stone under floor stops here
6"x6" Stone drain to extend along entire length of wier walls
All inner corners on vertical spillway walls to be rounded to 6" rad
El 147.00
El 140.00
6" Concrete
6" Tile drain
6" Broken Stone
Section at Line C-C
All vertical walls, below wier, to have stone drain, entire length of wall, and connected to broken stone under floor every 10ft by 6"x6" stone drain
36'-0"
10'-6"
15'-0"
6" Concrete
6" Broken Stone
6" Tile drain laid in stone trench below bottom of Expansion Joints
Section at Line E-E
Elongated Elevation of ... Section through floor
El 134.00
El 132.00
El 126.00

FIGURE 4

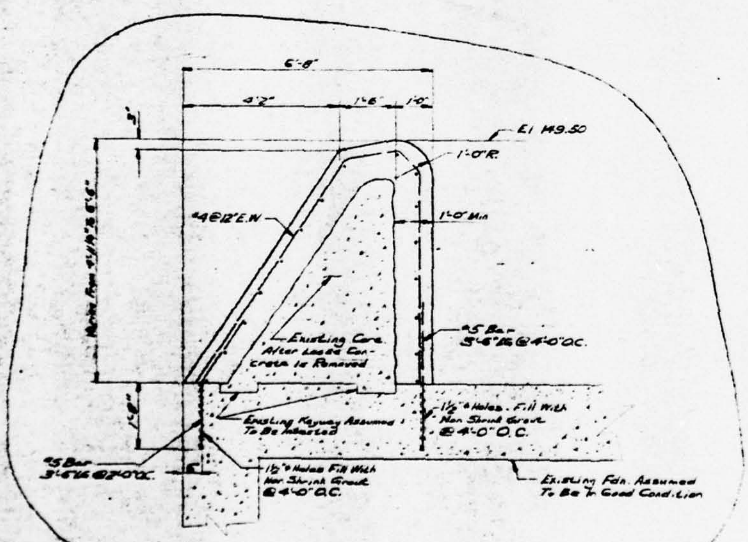

B Inner Toe of Dam
Start of Repair Work
Top of Dam
Expansion Joint
N
Outer Toe of Dam
End of Riprap Work
End of Repair Work
Original EL 140.0
New EL 140.67'
EL 134.0'
Cut Out 6"x6" Keyway
See Section K-K
Riprap
Varies
6" to 8" New Concrete
Cut Out 6"x6" Keyway
SECTION C-C
New Earth Fill
SECTION G-G
6"x6" Keyway
EL 134.0
SECTION K-K

2

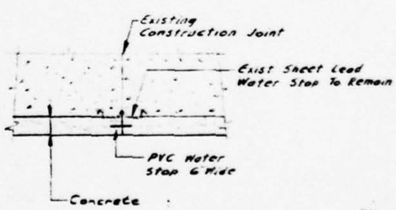

ELEVATION B-B
ELEVATION A-A
SECTION D-D
SECTION E-E
SECTION F-F
SECTION H-H
SECTION L-L
DETAIL OF EXPANSION JOINTS
New El. 158.67'
Original El. 158.0'
6 to 8" New Concrete
3/4" Rods 12" o.c.
Cut Out 6 x 6" Keyway
Rip Rap
Carry Concrete at Least 12" Into Rip Rap
Varies
Ground
Asphalt strip
Existing Expansion Joint
Note: All New Concrete Work To Consist Of 3000 lb Concrete.
REVISIONS
REPAIRS TO WASTEWAY
LAKE ONEIDA DAM
BUTLER WATER Co.
BUTLER, PA.
WATER WORKS SERVICE Co. Inc.
50 BROAD STREET
NEW YORK CITY
FIGURE 5
3-434



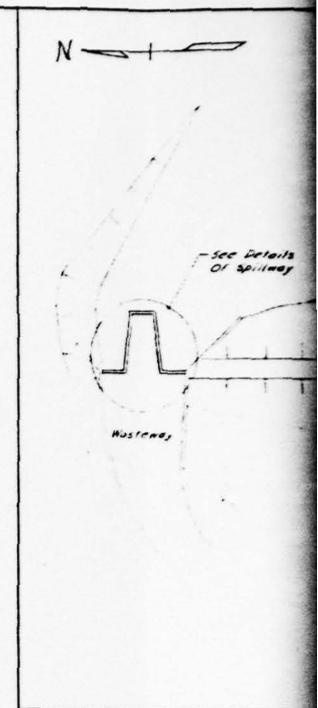
PLAN
Scale 1/8"=1'-0"



SECTION "A-A"
Scale ½"=1'-0"

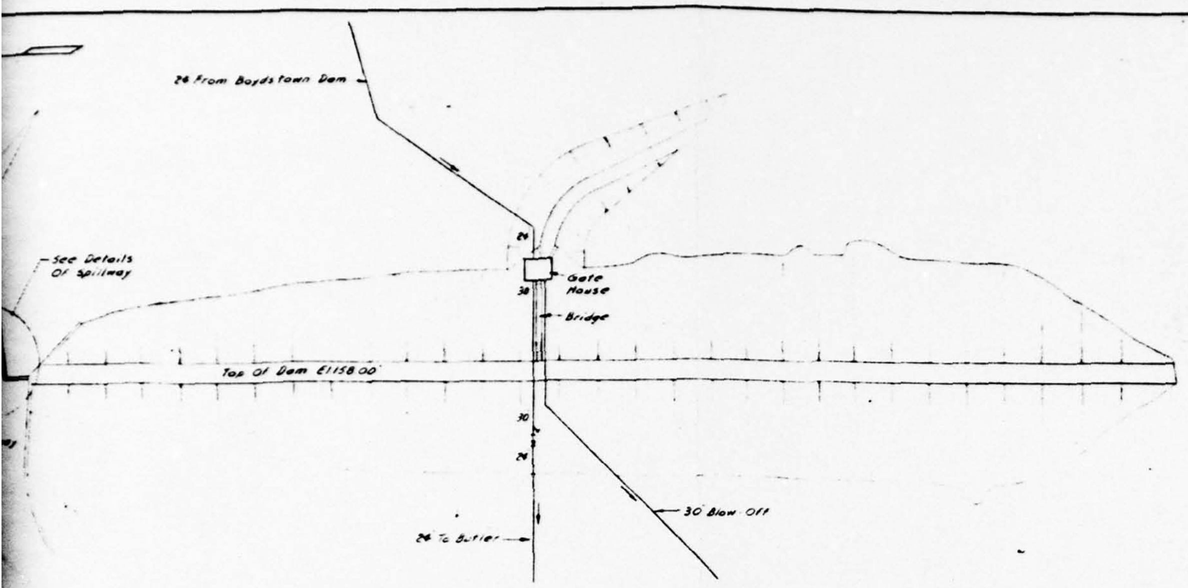


CONSTRUCTION JOINT DETAIL
Scale ½"=1'-0"



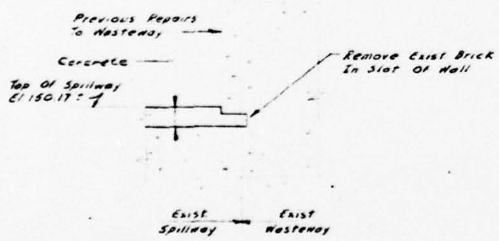
DETAILS OF SPILLWAY

2



LOCATION PLAN

Scale 1" = 50'-0"



SECTION B-B

Scale 1/2" = 1'-0"

REFERENCE DRAWINGS

- #30034
- #30036
- #3-296 H

NOTE

Concrete Shall Develop 3,000 P.S.I. Compressive Strength At 28 Days

Reinforcing Bars Shall Conform To A.S.T.M. Specification A-432

Deformations Shall Conform To A.S.T.M. Specification A-305

FIGURE 6

REVISIONS

As Built Revisions 8-5-69

LAKE ONEIDA DAM

REPAIRS TO SPILLWAY

PLANS SECTIONS & DETAILS

BUTLER WATER COMPANY

BUTLER, PA

AMERICAN WATER WORKS SERVICE COMPANY, INC.

THREE PENN CENTER PLAZA — PHILADELPHIA, PA. 19103

SCALE: AS NOTED

DRAWN BY J.M.M.

APPROVED

DATE: 6-12-68

PROJECT

USE DIMENSIONS ONLY

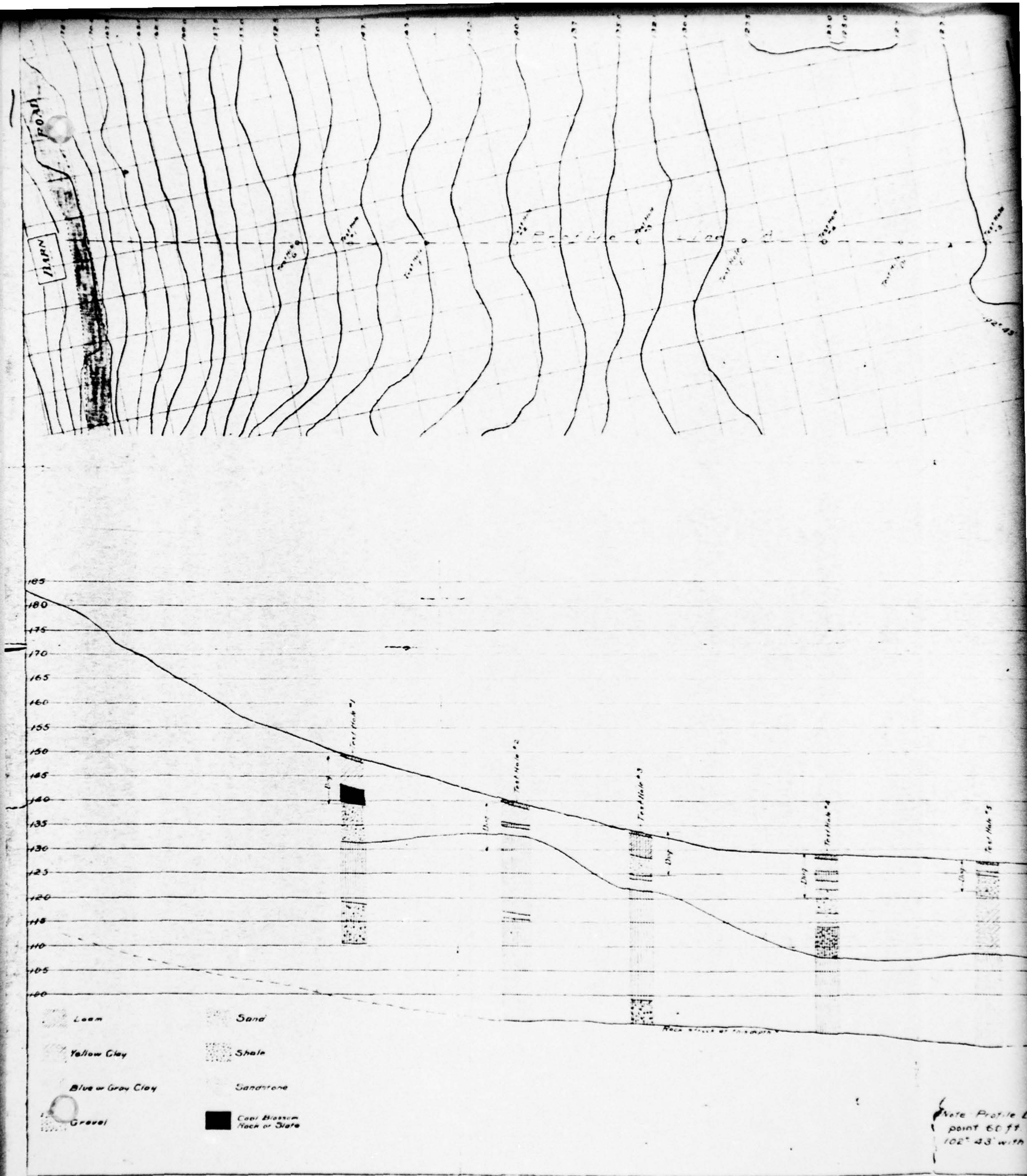
CHECKED BY

INSP. BY

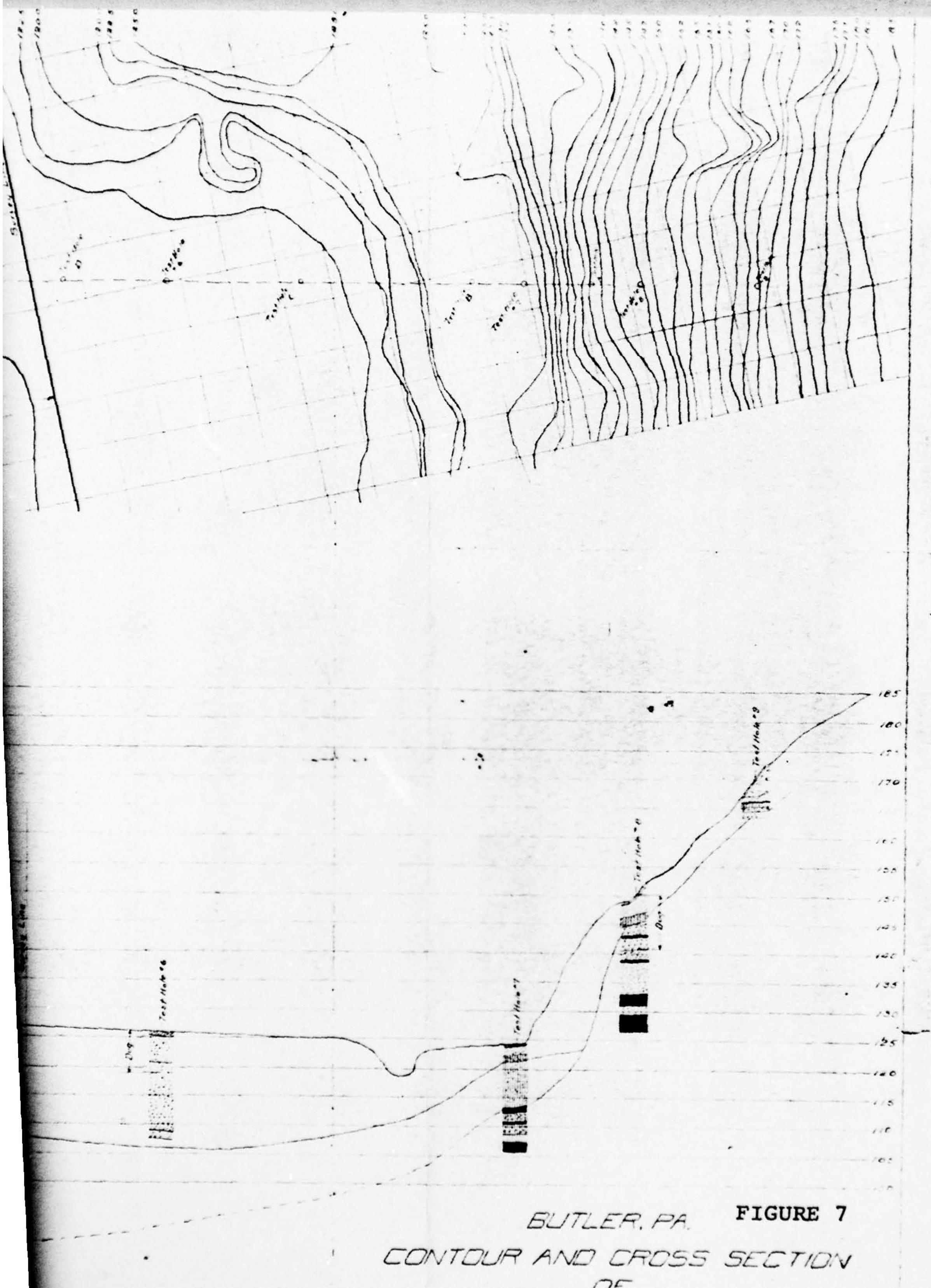
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

3-532

COMMONWEALTH OF PENNSYLVANIA — PROFESSIONAL ENGINEER — HOWARD J. CARLOCK — No. 8990



ROAD
BARN
Test Hole #1
Test Hole #2
Test Hole #3
Test Hole #4
Test Hole #5
Dug
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
Loam
Sand
Yellow Clay
Shale
Blue or Gray Clay
Sandstone
Gravel
Coal Blossom Rock or Slate



BUTLER, PA. **FIGURE 7**

CONTOUR AND CROSS SECTION

OF

LAKE ONEIDA DAM

..." crosses Base Line of Survey at a ... of Sta 95+00, making an angle of ... Line

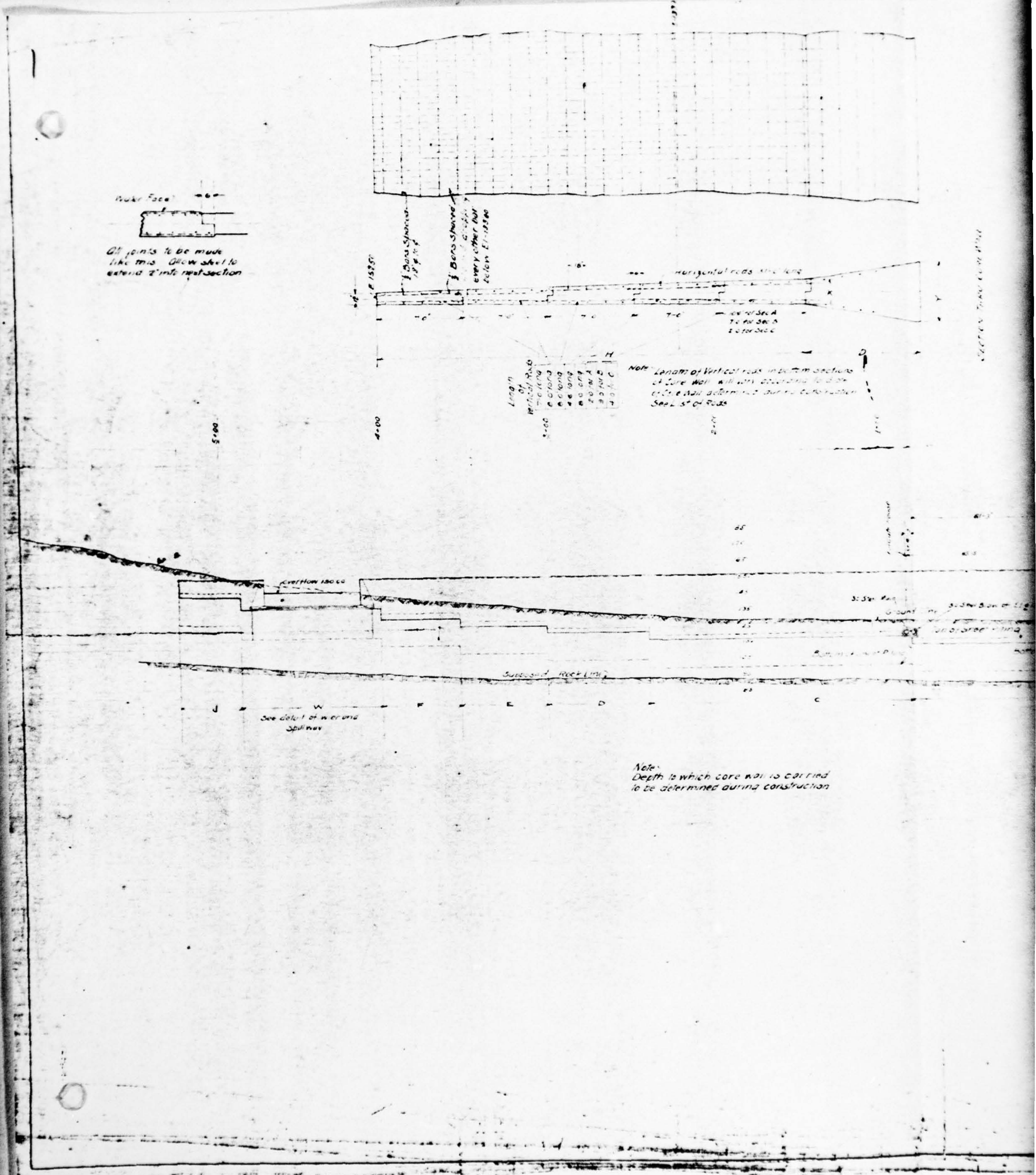
Scale: Hor. 1"=30', Vert. 1"=10'

June 14, 1910

Drawn by JHC

Checked by

30034


Water Face
All joints to be made like this. Allow steel to extend 2" into next section
Horizontal rods
Note: Length of Vertical rods in bottom sections of Core Wall will vary according to depth of Core Wall determined during construction. See List of Rods
Length of Vertical Rods
5+00
4+00
Overflow
Ground Line
Top of Sheet Piling
Subsoil Rock Line
See detail of weir and Spillway
Note: Depth to which core wall is carried to be determined during construction

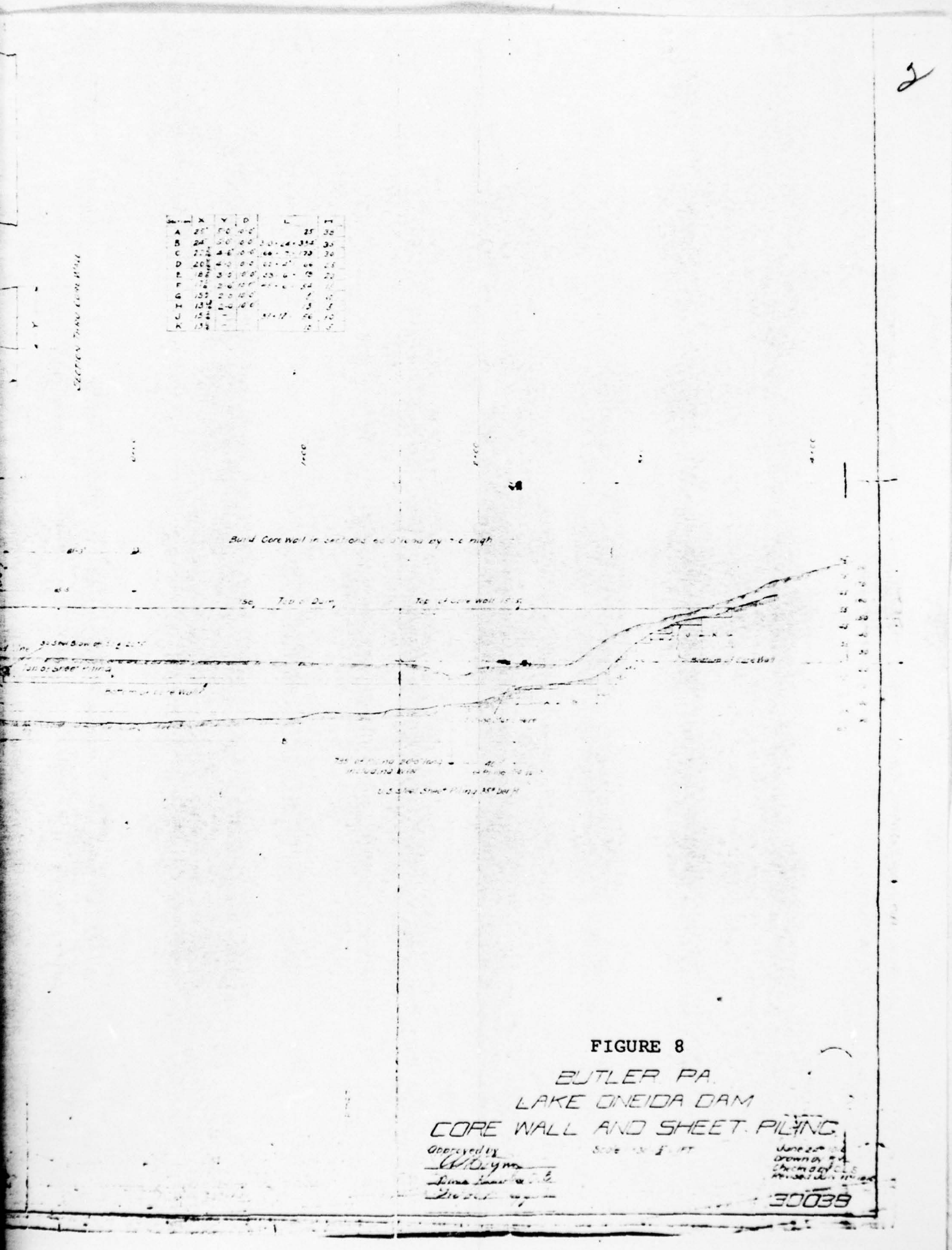
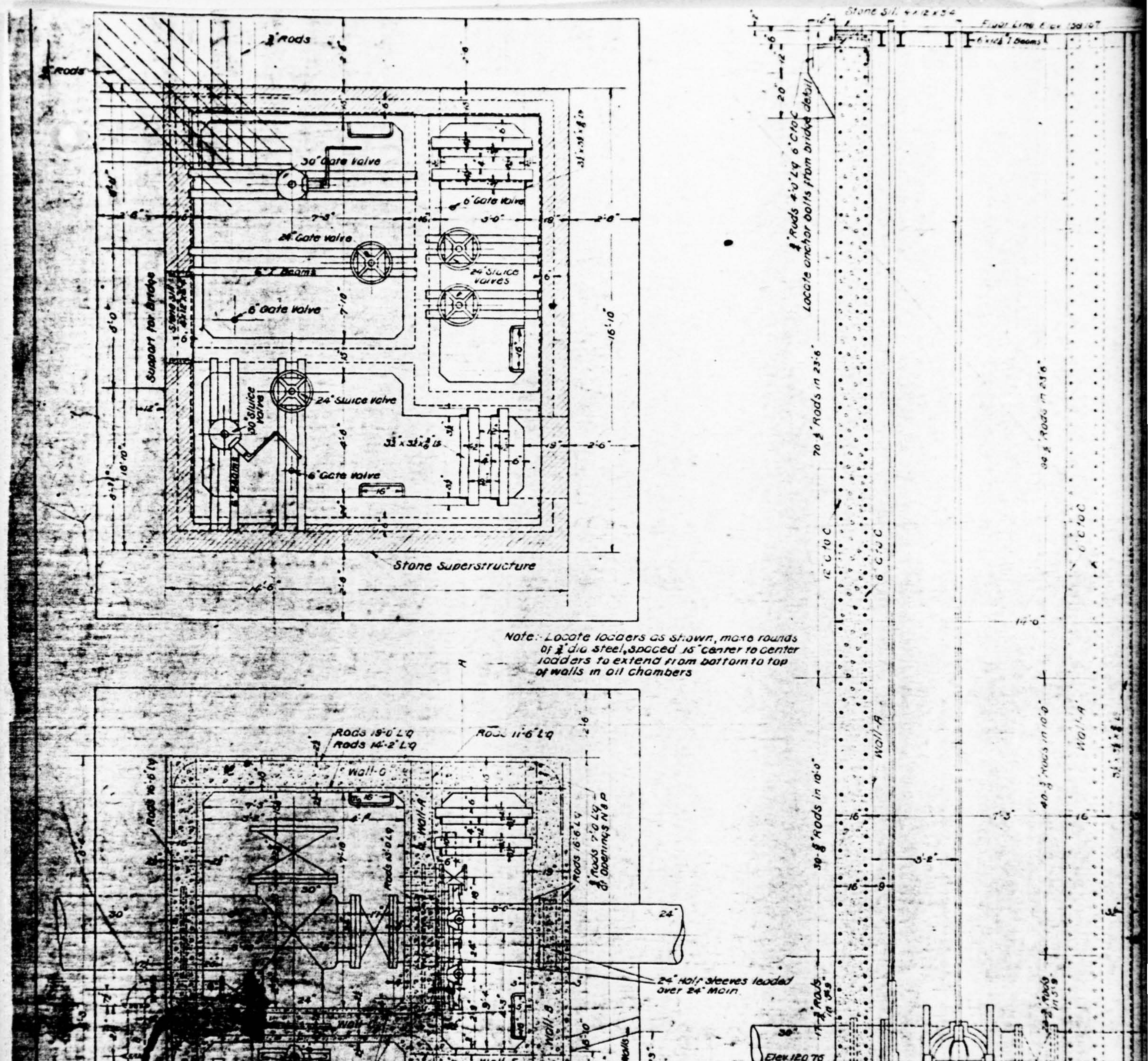


FIGURE 8



30" Gate Valve
6" Gate Valve
24" Gate Valve
24" Sluice Valves
6" I Beams
6" Gate Valve
Support for Bridge
24" Sluice Valve
30" Sluice Valve
6" Gate Valve
Stone Superstructure
Note:- Locate ladders as shown, make rounds of ¾" dia steel, spaced 15" center to center ladders to extend from bottom to top of walls in oil chambers
Rods 19'-0" Lg
Rods 14'-2" Lg
Rods 11'-6" Lg
Wall-C
Wall-A
Wall-B
Wall-E
Wall-D
24" Half Sleeves leaded over 24" Main
Rods 11'-0" Lg
Rods 14'-2" Lg
Rods 19'-0" Lg
Grading for Retaining Walls
Locate anchor bolts from bridge detail
Wall-A
Elev 120.75
Section at Line B-B

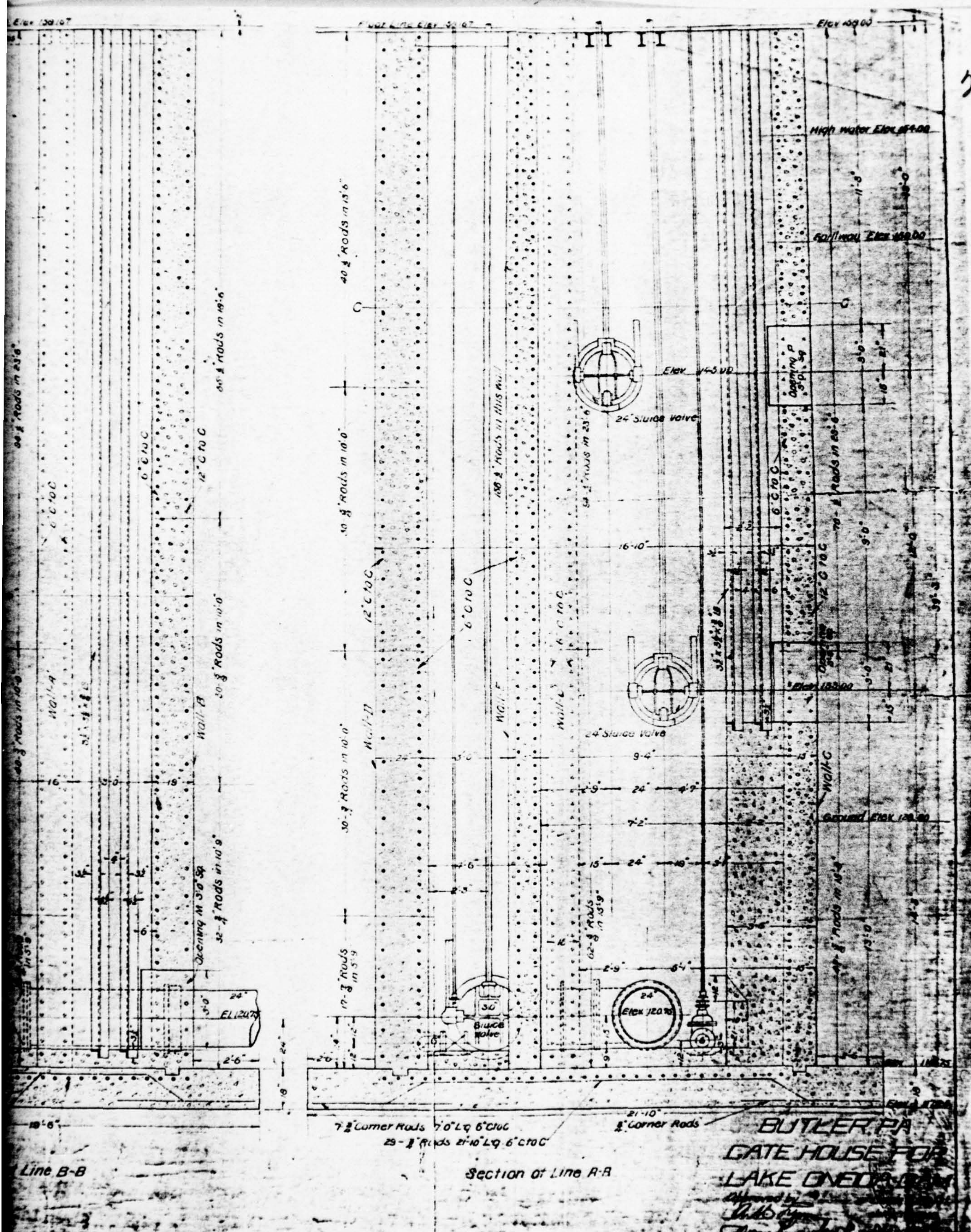
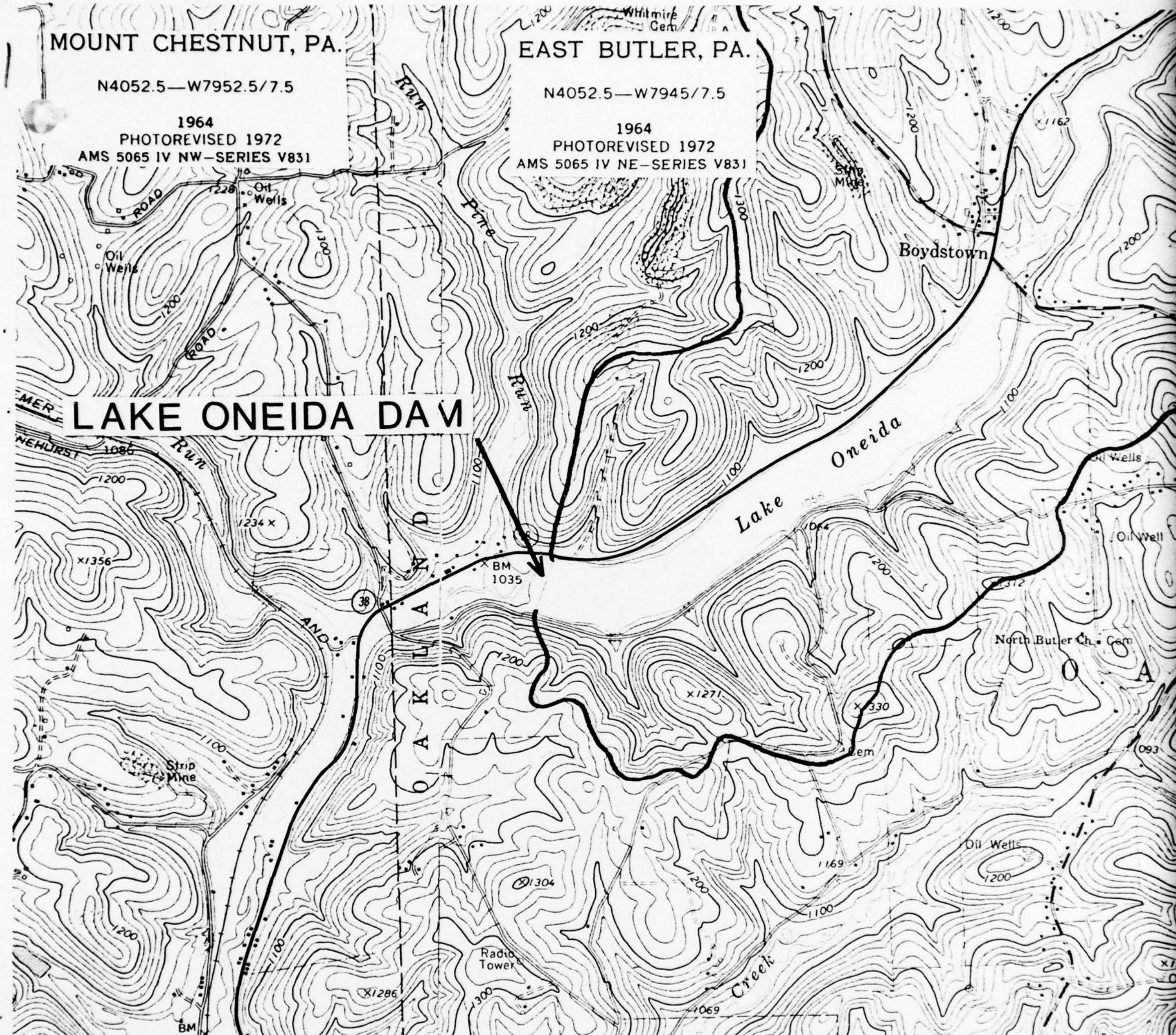
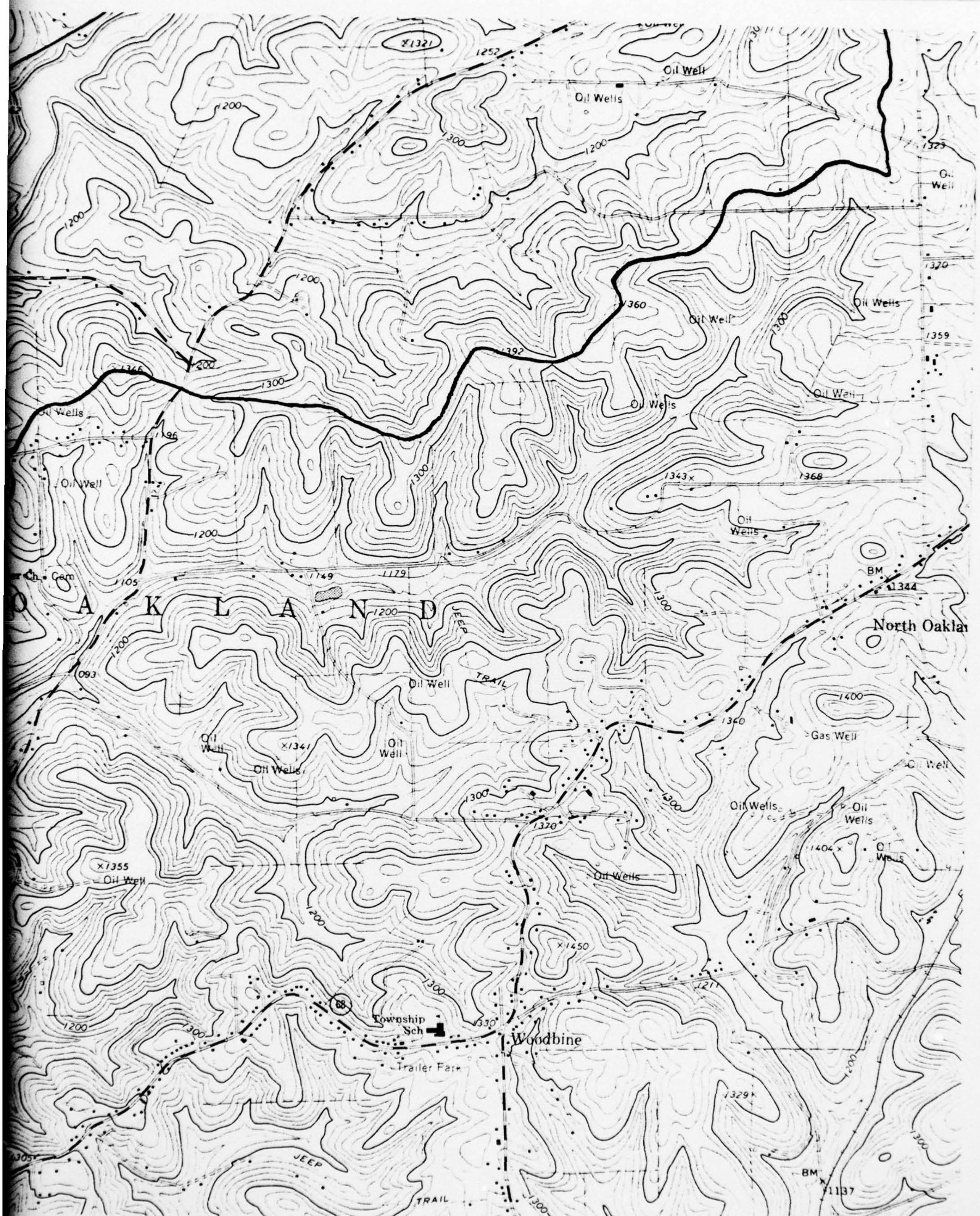

High water Elev 154.00
Spillway Elev 150.00
24" Sluice Valve
24" Sluice Valve
Wall C
Ground Elev 128.00
Wall A
Wall B
Wall D
Wall E
Wall F
Elev 120.75
7-½" Corner Rods 7'0" Lg 6" C to C
29-⅞" Rods 21'10" Lg 6" C to C
⅞" Corner Rods
Line B-B
Section at Line A-A
BUTLER, PA
GATE HOUSE FOR
LAKE ONEIDA DAM

FIGURE 9

APPENDIX G

REGIONAL VICINITY MAP


MOUNT CHESTNUT, PA.
N4052.5—W7952.5/7.5
1964
PHOTOREVISED 1972
AMS 5065 IV NW—SERIES V831
EAST BUTLER, PA.
N4052.5—W7945/7.5
1964
PHOTOREVISED 1972
AMS 5065 IV NE—SERIES V831
LAKE ONEIDA DAM
Lake Oneida
Boydstown
Pine Run
Oil Wells
Strip Mine
BM 1035
BM 1020
Oneida
Radio Tower
North Butler Ch. Cem
Creek
Connoquenessing
LAKE ERIE
Thorn Reservoir



Oil Well
Oil Wells
Oil Wells
Oil Well
Oil Wells
Oil Well
Oil Wells
Oil Well
O A K L A N D
JEEP
TRAIL
North Oakla
Oil Well
Gas Well
Oil Well
Oil Well
Oil Wells
Oil Wells
Oil Wells
Oil Well
Oil Wells
Township Sch
Woodbine
Trailer Park
JEEP
TRAIL
BM
Ch. Cem

2