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NATIONAL DAM SAFETY PROGRAM. THOMAS W. KOON DAM (INVENTORY NUMB--ETC(U)
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LEVEL II

(1)

POTOMAC RIVER BASIN

THOMAS W. KOON DAM

COMMONWEALTH OF PENNSYLVANIA

BEDFORD COUNTY

INVENTORY NUMBER NDS 240

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-78-C-0044

(6) National Dam Safety Program. Thomas W. Koon Dam (Inventory Number NDS-240), Evitts Creek, Potomac River Basin, Bedford County, Commonwealth of Pennsylvania. Phase I Inspection Report.

Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland
by
BERGER ASSOCIATES, INC.
CONSULTING ENGINEERS
HARRISBURG, PA.

(12) 65p.

(11) JUN 78

411 003

LEVEL II

1

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	THOMAS W. KOON
State and State Number:	PENNSYLVANIA - 5-49
County Located:	BEDFORD
Stream:	EVITTS CREEK, POTOMAC RIVER BASIN
Date of Inspection:	April 25, 1978

Based on a visual inspection, past performance and available engineering data, the dam and its appurtenances appear to be in questionable condition. The following recommendations are made:

1. The flashboard base and pins on the spillway crest should be removed immediately.

2. Additional hydraulic studies should be performed to ascertain the adequacy of the spillway and to determine maximum expected pool level.

3. Structural stability should be investigated based on the hydraulic studies.

4. Further studies should be initiated to determine the cause of leakage adjacent to the spillway abutments and to investigate the possible danger to the structural integrity in case of a high pool level.

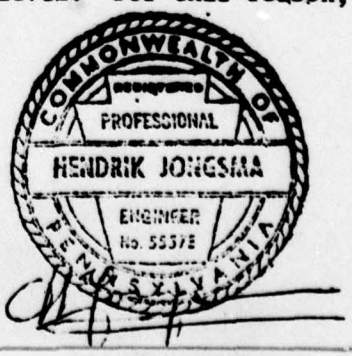
5. The cause of settlement on the eastern roadway slab should be determined and corrected.

The present spillway capacity will pass only 32 percent of the PMF with the pool surface at the level of the spring line of the roadway arches. This capacity can be increased to 39 percent by removing obstructions on the spillway crest. A larger capacity can be reached by increasing the design surcharge. Further studies will be required to determine the structural stability of the dam. Good practice requires that the spring line of the arches be above the maximum flood level. For this reason, the spillway is considered to be inadequate.

Submitted By:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

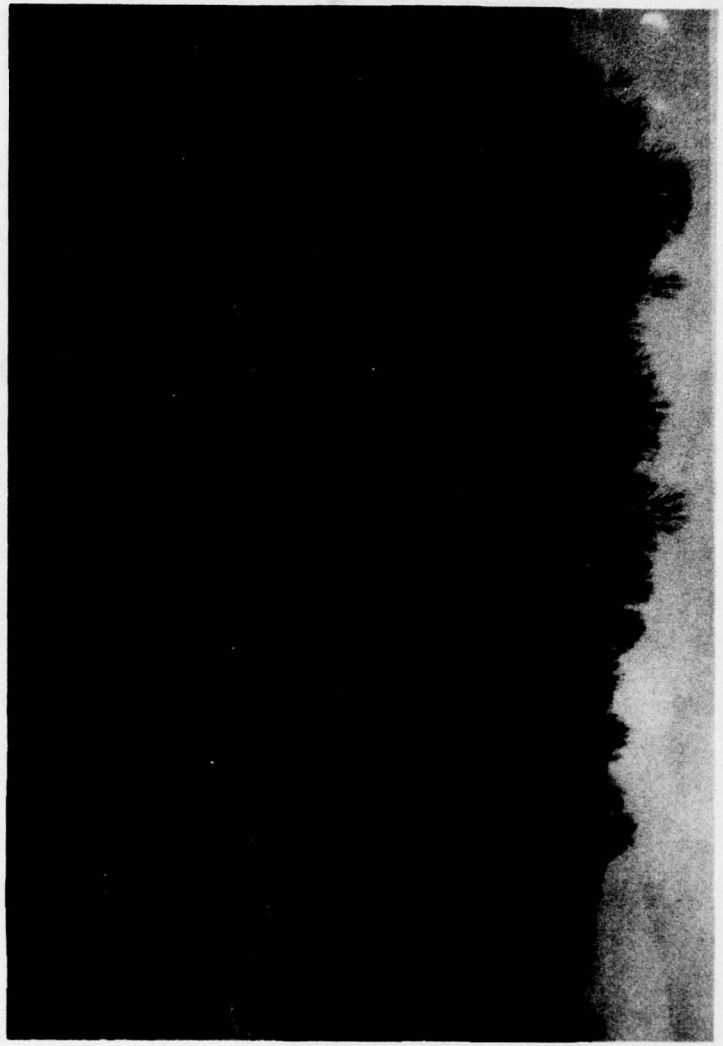
Date: May 23, 1978



APPROVED BY:

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

DATE: 27 Jun 78



OVERVIEW

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Dam Inspection Act, Public Law 92-237 (Appendix III) authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States. Phase I Inspection and Report is limited to a review of available data, a visual inspection of the dam site and the basic hydraulic calculations to determine the hydraulic adequacy of the spillway.

b. Purpose

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

1.2 DESCRIPTION OF PROJECT

a. Dam and Appurtenances

Thomas W. Koon Dam is a concrete gravity dam, constructed in monolithic sections. The dam carries a 22 foot wide state road (L.R.05006) with sidewalks on each side of the roadway. The total length of the bridge is 726 feet including 4 arch openings at 66 foot width each over the spillway. The gatehouse is located in the center of the dam. The crest of the spillway is at elevation 1017. The roadway grade is at elevation 1037.0 and the lowest foundation is at elevation 925.0. Low streambed elevation was at 945.0. See Appendix D, Plates IV through X for general elevations, typical sections and other information. This dam is situated 1.3± miles upstream from the Lake Gordon Dam. Refer to Dam No.242 on Plate II, Appendix D.

b.	Location;	Cumberland Valley Township, Bedford County U.S. Quadrangle, Hyndman, Pa. Latitude 39°46.6', Longitude 78°39.8' (Appendix D, Plates I and II)
c.	Size Classification:	Intermediate (12,400 acre-feet)
d.	Hazard Classification:	high (Section 3.1.d)
e.	Ownership:	City of Cumberland, Maryland City Hall, Box 1702 Cumberland, Maryland 21502
f.	Purpose of Dam:	Water Supply

g. Design and Construction History

The dam was designed by J. E. Greiner Company, Baltimore, Maryland, for the Evitts Creek Water Company and the City of Cumberland, Maryland. The construction drawings are dated May, 1931. Construction was started in June, 1931 by Vang Construction Company and completed in June, 1932. Impounding of the lake started in March, 1932. The Permit Application was approved in June, 1931.

h. Normal Operating Procedures

The dam is for domestic water supply and supplements the water supply reservoir downstream (Lake Gordon Dam). The actual water supply intake is located at the Lake Gordon Dam and when the flow over the spillway is not sufficient to keep Lake Gordon at spillway level, releases are made through valves located in the control tower at the Thomas W. Koon dam to satisfy the requirements downstream.

1.3 PERTINENT DATA

a. Drainage Area (square miles)

Computed for this report.	44.2

b. Discharge at Dam Site (cubic feet per second)
See Appendix B for hydraulic calculations

Maximum known flood, March 17, 1936 estimated on basis of record for upstream U.S.G.S. gaging station	7,100
Outlet works low-pool outlet at pool El. 960	50
Outlet works at pool level El. 1017.4 (spillway crest)	240
Spillway capacity at pool El. 1026.0 (maximum pool design surcharge)	19,900

c. Elevation (feet above mean sea level)

Top of roadway pavement	1037.0
Underside of center of arches	1033.2
Spring line of arches	1024.17
Spillway crest (top of plank)	1017.4

Upstream portal invert	955.5
Downstream portal invert (24 inch needle valve)	957
Streambed at centerline of dam	945
Maximum tailwater (Lake Gordon pool with water at level of top of dam)	959

d. Reservoir (miles)

Length of pool	2.2

e. Storage (acre-feet)

Spillway crests (El. 1017.4)	6,790
Spring line of arches (El. 1024.17)	8,480
Design pool (El. 1026)	8,980
Underside of arches (El. 1033.2)	11,200
Roadway Surface (El. 1037.0)	12,400

f. Reservoir Surface (acres)

Roadway Surface (El. 1037.0)	343
Underside of arches (El. 1033.2)	325
Design pool (El. 1026)	282
Spring line (El. 1024.17)	265
Spillway (El. 1017.4)	227

g. Dam

Type: Concrete Gravity

Length: 726 feet including bridge approaches

West Approach Length: 90'-10"

Spillway and Gatehouse Length: 298 feet

East Approach Length: 337'-2"

Roadway Elevation: 1037.0

Roadway Width: 22 feet plus 4 foot sidewalks on each side, plus parapets.

Lowest Foundation Elevation: 925.0 (as per plans)

Maximum Structural Height: 112 feet

A cutoff wall 6 feet wide is shown at the upstream end with varying depths. No grout curtain is indicated on the plans.

h. Outlet Facilities

Water is taken into the control tower through six 24-inch by 36-inch sluice gates. They are in pairs with centerline elevations of 957.0, 984.5, and 1012.0. After passing through a bar screen, water is carried in two 36-inch pipes to two 24-inch needle valves, which spray the water out to the channel downstream from the dam.

Access to the control tower operating floor is from the roadway on top of the dam.

Centerline elevation of the needle valves is 957.0.

i. Spillway

Type - Uncontrolled, modified ogee weir.

Length of weir - Four sections, each 59.5 feet long. Total effective length, 237 feet. The sections are separated by piers supporting a roadway.

Crest elevation - The original ogee design had a crest elevation of 1017.0. Over the years the crest has been built up with 1.5 inches of gunite and horizontal 3-inch by 8-inch planking has been bolted on top to support flashboards. Crest elevation is now calculated to be at 1017.4.

Upstream channel - The spillway is in the center of the dam at the deepest portion of the reservoir.

Downstream channel - The discharge from the spillway flows down the ogee section with some five-foot-high steps on the sides, and empties into the Lake Gordon pool which is ten to fifteen feet deep at the toe of the dam (Appendix D, Plate III, photographs).

j. Regulating Outlets

Twin 24-inch needle valves were provided for regulating low-flow releases from the reservoir. Over the years these valves have

become frozen in the open position. Regulating is now done with the back-up sluice gates but the water still flows out of the needle valves.

The removal of the planking would increase the efficiency of the spillway considerably. For instance, the discharge with a pool elevation of 1026 would change from 19,900 cfs to 23,900 cfs.

See Section 1.3.h for available means for making an emergency drawdown.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

a. Data Available

1. Hydrology and Hydraulics

A Permit Application Report was prepared by the Pennsylvania Department of Environmental Resources (PennDER) in June, 1931, for construction of this dam. This report states that the spillway capacity is as follows:

Elevation 1024.17	Q Discharge = 17,800 c.f.s.
Elevation 1025.0	Q Discharge = 21,000 c.f.s.
Elevation 1026.0	Q Discharge = 23,900 c.f.s.

This report also lists the lake area as 268 acres, the length of the lake as 2.2 miles and the storage capacity as 7,060 acre-feet.

2. Dam

A geological report was prepared by Charles Swartz of John Hopkins University. The report is dated March 7, 1931. The contract drawings show rock elevations as obtained from core borings (Appendix D, Plate V).

A small drawing in the file dated February, 1931, indicates the design assumptions and loading conditions as follows:

Design Assumptions:

Weight of masonry - 140 pounds per c.f.
Weight of water - 62.5 pounds per c.f.
Ice thrust acting at crest - 20,000 pounds per lineal foot.
Upward pressure, full head pressure at heel decreasing uniformly to 0 at the toe, acting over 2/3 the area.
Maximum head over spillway - 9 feet.
Surface of tail water 62 feet below crest.
No silt in reservoir.
No wind when reservoir is empty.

Assumed Conditions of Loading:

1. Weight of masonry.
2. Weight of masonry and full head pressure of water dam ful

3. Weight of masonry, full head pressure of water dam full and uplift.
4. Weight of masonry, full head pressure of water dam full, uplift and ice.
5. Weight of masonry and full head pressure of water 9 feet over crest.
6. Weight of masonry, full head pressure of water 9 feet over crest and uplift.

Graphs on the drawings indicate that the resultant of any of the loadings falls within the center third of the spillway section, except in the higher regions.

The concrete design strength of the dam is 2,500 psi.

3. Appurtenant Structures

Structural design analysis or criteria are not available for the gatehouse and bridge structure. The bridge is posted for 15 tons maximum weight. The concrete design strength for the bridge and gatehouse walls are indicated as 3,000 psi.

b. Design Features

1. Dam

The dam is constructed in monolithic sections with lengths varying from 30 feet to 77 feet. The monolyths are shown on the drawings separated by a 3/4 inch expansion joint. The center section, containing the spillway and gatehouse has only one expansion joint shown, but presumably has other joints over this length.

The main footings are set on rock with a cutoff wall at the upstream side of the dam. This wall is shown as 6'0" wide and with a varying depth. Minimum depth scales off as ten feet.

The maximum foundation pressures for the spillway section are shown as 5.32 tons/square foot at the toe and 7.3 tons/square foot at the heel. The dam has been designed for a maximum pool level of 1026 (9 feet over the spillway) and an ice pressure of 20 kips/linear foot or 1.66 kips per linear inch. Assuming that melting crushing pressure of ice is 400 psi, the ice depth would be 4.2 inches.

The gravity section of the dam starts at elevation 1027.0 and the normal dam section is stepped. The minimum base width is 32.0 feet, except at the ends of the approaches, where small reinforced concrete retaining walls have been used. The footings for these walls are not indicated to be set on rock. On the west abutment, the general elevation (Appendix D, Plate IV) indicates that a cutoff wall was to be

placed at the upstream side. Detail drawings in the file, however, do not indicate any cutoff walls. The footings at the west end are only 2'6" wide. The east abutment does not indicate the requirement for a cutoff wall and this was presumably not installed. Footing elevations here are well above spillway crest elevation.

The spillway chute is a gravity concrete ogee section forming a concrete slab excavated in rock at the toe with a length of approximately 35 feet (Appendix D, Plate VII). This toe of the spillway is also curved and stepped on the sides to direct the water towards the center of the stream. Only minimal reinforcement is placed in the top of the spillway section (#6 at 12 inches, length 50 feet) to allow for tension in this area due to ice pressure. The clear opening between the piers is 59.5 feet. There are four bays each. The bridge is carried by a reinforced concrete arch across each bay (Appendix D, Plate X).

In the center of the dam is the gatehouse or control tower, with two spillway bays on each side. The gatehouse projects about 22 feet on the upstream side and has an overall width of 34 feet. All gate controls are located on a floor at elevation 1027, except two 24 inch needle valves located at elevation 957. A spiral stairway is provided for access to this level (Appendix D, Plate IX).

2. Appurtenant Structures

All appurtenant structures are an integral part of this concrete gravity dam.

c. Design Data

1. Hydrology and Hydraulics

PennDER's permit application report states that the spillway discharges at elevations 1024.17, 1025.0 and 1026.0 are 17,800, 21,000 and 23,900 cfs, respectively. Stability design calculations are based on a maximum pool elevation of 1026.0. The PMF discharge of 61,900 cfs would cause a pool elevation of about 1037.0.

2. Dam

The design drawings indicate the top of rock profile on the centerline of dam and above and below the dam. These profiles are based upon test boring information. The boring results are not included in the plans. The type of overburden has not been identified. A geological report is also available in the files.

2.2 CONSTRUCTION

Construction data available for review consists of the original contract drawings and progress reports from June, 1931 to January, 1932. A report concerning the leakage, written June 30, 1932, states that grouting had taken place in the area between Station 5+00 and 5+75 to a depth of 30 feet to intercept the water carrying zone between the sandstone and shale. No other reference to grouting was found. Immediately after construction was completed, leakage occurred at both abutments.

2.3 OPERATION

No formal records of operation problems were available, except several statements concerning the leakage occurring at the abutments and some inspection reports. Mr. Nixon, Superintendent of the water company stated that leakage had reduced considerably since the flashboards (2 feet high) had been removed.

2.4 EVALUATION

a. Availability

The available design drawings were provided by Division of Dams and Encroachments, Pennsylvania Department of Environmental Resources.

b. Adequacy

1. Hydrology and Hydraulics

The hydrologic and hydraulic analysis for this dam is very limited. There were no records of rating curves for outlet works and spillway, frequency curves, design storm or flood hydrographs.

2. Dam

The construction drawings are the only available design data for this structure. These drawings included a spillway section indicating the loci of points of application of the resultant forces for various assumed loading conditions and a listing of design assumptions. No calculations of shear resistance were included and there were no design calculations for the reinforced sections of the gatehouse and bridge.

c. Operating Records

No formal operating records are available for review. Descriptions of leakage problems are in the file and were confirmed by the Superintendent. This leakage increases considerably with higher pool levels.

d. Post Construction Changes

When leakage occurred in June, 1932, a terra cotta drain was installed behind the low walls adjacent to the lower portion of the spillway and carried around the end of the walls into the downstream channel. According to records in the file, considerable turbidity existed in the discharge at that time.

e. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability with the normal safety factors is sufficient to withstand minor earthquake induced dynamic forces. No calculations or studies have been made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The general appearance of the dam and connected structures are good, except a few troublesome areas. The maintenance of the gates is excellent. A visual checklist is in Appendix A. Pool elevation at the time of inspection was 1017.1.

b. Dam

Some deterioration has occurred on the concrete surface and a large section had been gunited some years ago (no record). A small area of this gunite had again spalled, but it did not seem serious at the time of inspection.

The dam structure had very little cracking or spalling of the surfaces. The expansion joints were all open at the downstream side and presumably the copper waterstops at the upstream side are holding. There is a measurable amount of leakage at the left and right abutments. Rough measurements, using a stop watch and a container indicate flows of at least 20,000 gallons per day on the left side of the spillway and 40,000 gallons per day on the right side. All of the seepage could not be collected for measurement.

The gatehouse tunnel under the roadway has some stress cracks and some water is seeping through the joints. The roadway is not sealed properly and the salt water seeping through is causing large deposits of calcium and corrodes the steel structures rather seriously.

The two needle valves at elevation 957 are not operable, but the superintendent stated that they are scheduled for extensive repairs and maintenance this summer.

The flashboards were removed this spring and the supporting pins, according to the plant operator, will be removed this season. Leakage reduced considerably after removal of the two extra feet of head.

The easternmost section of the roadway and sidewalk had settled and is being repaired. This settlement could be caused by soil erosion from the leakage or from broken roadway gutters. The first condition could point to a serious problem.

c. Reservoir Area

The lake area is clean and well maintained. The reservoir banks do not indicate any special erosion problems. The approach to the spillway is the lake and it is clear of any obstructions. Fishing from the banks is permitted, but there is no boating or swimming. Little or no siltation has occurred near the dam according to the superintendent.

d. Downstream Channel

The downstream channel is the upstream end of the downstream reservoir (Lake Gordon) and is wide and clear. Failure of the Thomas W. Koon Dam would probably cause a failure at Lake Gordon Dam downstream. Failure of either dam would cause considerable loss of life and extensive economic loss in the downstream valley which is developed and has several small communities. Evitts Creek joins the North Branch of Potomac River in South Cumberland, Maryland, about 12 miles from this dam. The dam is considered to be in the High Hazard Classification.

3.2 EVALUATION

The observed physical condition of the dam and its appurtenant structures was reasonably good. However, a number of items were noted that indicate less than satisfactory conditions prevail. Points of concern include the apparent steady seepage at the right and left walls adjacent to the spillway; the information that seepage increases with increased pool elevations; the inoperable condition of the needle valves in the gatehouse; and the limited capacity of the spillway as determined by the hydraulic calculations.

Indications are that, in the event of a PMF, the Lake Gordon Dam, located downstream from this structure would fail first, thus reducing the impact of this dam on loss of life and property.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURE

An interview with Mr. Nixon, dam superintendent, indicated that there is not an established procedure for operating the dam, except to maintain a pool level of 950 at the downstream Lake Gordon. There is no pipeline between this dam and the filter plant located directly downstream of Lake Gordon. The needle valves are not operable and are in an open or partly open position. Releases are controlled by opening one of the six gates. Flashboards have been removed and according to the owner's representative will not be replaced.

4.2 MAINTENANCE OF DAM

The gates are all operated regularly and are well greased. Salt water seeping through the roadway is causing maintenance problems, but does not affect the operation of the gates. The City has requested the Department of Transportation to seal the deck. However, no action has been taken over the years. The bridge was constructed by the Evitts Water Company and the dam is owned by that company. There is probably a question as to who is responsible for the maintenance of the bridge.

4.3 MAINTENANCE OF OPERATING FACILITIES

The gates are operated regularly and are well greased. The needle valves are not operable, but will be repaired this summer according to the owner's representative.

4.4 EVALUATION

The general maintenance of the structure is good with the exception of the leakage at the abutments and the seepage through the roadway surface into the gatehouse.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

a. Design Data

The hydrologic and hydraulic analyses available from PennDER for T. W. Koon Dam were not very extensive. No area-capacity curve, frequency curve, unit hydrograph, nor flood routings were submitted by the designer to PennDER. There was a statement that the spillway would pass 17,800 cfs with the water level at the spring line of the arches (1024.17 feet).

Area-capacity curves and a spillway rating curve have been developed for this report using the information in the construction drawings and on U.S.G.S. topo sheets. Hydraulic computations made for this report are in Appendix B.

b. Experience Data

In the period that the dam has been in existence, from 1931 to the present, the maximum flood was that of March 17, 1936, when the flow was about 7,100 cfs. The spillway passed that flood without distress.

c. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event.

It was noted that the ogee spillway crest is obstructed by the remains of a former flashboard installation. These consist of horizontal 3-inch x 8-inch planks bolted to the crest and vertical steel pins set in holes in the spillway crest. These items catch drift and lessen the hydraulic efficiency of the spillway. It is recommended that they be removed.

d. Overtopping Potential

This dam has an overall height of 92 feet above streambed and a maximum storage capacity of approximately 12,000 acre feet, both calculated to roadway level. These dimensions indicate a Size Classification of "Intermediate".

The Hazard Classification is "High" (See Section 3.1.d).

The Recommended Spillway Design Flood (SDF) for a dam with the above classifications is the Probable Maximum Flood (PMF). The PMF for this site is 61,900 cfs but the spillway capacity at the design surcharge level (Elev. 1026.0) is about 19,900 cfs or 32 percent of PMF.

If the spillway crests are restored to their original condition, the PMF inflow, adjusted for the storage effect of the reservoir, would result in a maximum pool elevation of about 1037.0 (roadway surface). The pool elevation will be only a little higher if the crests are not restored, since at these high flows, each archway opening will be acting as an orifice rather than as an ogee weir (see Appendix B).

For a concrete gravity dam with superimposed highway bridge such as this structure, "overtopping" might be considered to occur when the pool level is even with the roadway surface. If this definition is accepted then calculations made for this investigation indicate that this dam will not be overtopped.

The ability of the dam and roadway bridge to resist the loads resulting from passing a PMF flow is discussed in Section 6.

e. Spillway Adequacy

If the dam and roadway bridge can withstand the stresses of passing a PMF flow, the spillway is considered to be adequate.

If the dam and roadway bridge can only stand the stresses associated with the design pool level (Elev. 1026.0, discharge 24,000 cfs or 39 percent of PMF) then the spillway is seriously inadequate.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The outside surfaces of the dam did not indicate by visual observation any undue cracking resulting from shrinkage or stresses and the general appearance was excellent. A point of concern was the settlement of roadway and sidewalk near Station 6+50, which could have been caused by roadway drainage through pavement cracks or underground seepage. Its cause should be thoroughly investigated. The spillway surface should be checked for deterioration after the pool level has dropped below the spillway crest.

b. Design and Construction Data

Design calculations for stability, sliding resistance or concrete stresses were not available. The design drawings indicate elevations for depth of foundations and cutoff walls, but there are no as-built drawings to review actual construction. Correspondence indicates that some grouting had taken place in 1932. Records concerning this action as to location, take, etc., were not found in the files. The loci of resultants for the spillway section indicates that the dam is designed within acceptable criteria for pool levels up to elevation 1026 (nine feet over spillway crest). The concrete used was supposed to be 2,500 psi concrete for mass pours and 3,000 psi for reinforced sections. The dam was not designed for silt accumulation on the upstream side, but according to the Superintendent little siltation has occurred. Ice has never been piled up against the dam.

c. Operating Records

Formal records are not maintained. The maximum discharge was recorded for 1936 and was about three feet above spillway crest. No specific problems could be recalled. The flashboards were installed, according to the superintendent, about six years ago and removed during the spring of 1978. Ice has never caused damage to the flashboards. The demand for water in this community has reduced over the years.

d. Post Construction Changes

Although some details for flashboard sockets are shown on the drawings, they were shown as plugged with oak plugs. The files do not indicate approval for flashboard installation.

The installation of a terra cotta pipe at the abutments to drain the leakage around the end of the lower spillway wall occurred one month after the construction of the dam had been completed.

In 1937, application was made to draw down the lake 40 feet to "catch turbid water of the spring freshets". No records or descriptions of actual construction are available in the files.

e. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

f. Structural Stability for Pool Levels Above Elevation 1026

Appendix D, Plate VI, indicates the loci for different loading conditions for a maximum pool elevation of 1026. In Appendix C, approximate calculations have been made for an assumed pool elevation of 1037, neglecting the pool influence at the downstream side and the weight of water on the spillway. The results indicate that the dam would be in danger of overturning or sliding. The resultant falls outside the middle third of the spillway section and this could cause additional uplift forces under the spillway.

The available information is not sufficient to determine the maximum pool level this dam could sustain without failure. Additional information is required on the rock foundation strata. The collection of this information and a detailed stability analysis should be a part of the additional investigations.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

a. Safety

The visual inspection and operational history indicates that the T. W. Koon Dam is functioning satisfactorily, with the exception that leakage occurs at both abutments and that this leakage increases considerably with higher pool levels. The efficiency of the spillway has been decreased by the installation of a row of boards on top of the weir crest. The dam was designed for a maximum pool level of 1026 and a discharge of 24,000 cfs. The Spillway Design Flood (SDF) for this location is 61,900 cfs and preliminary calculations indicates that this inflow could cause problems.

b. Adequacy of Information

The information that was available is considered sufficient to make a reasonable assessment of the project.

c. Urgency

It is considered important that the recommendations suggested in this section be implemented immediately.

d. Necessity for Additional Studies

It is considered necessary that the owner should initiate additional studies to investigate the following:

1. The cause of leakage increases with increased head and methods of reducing and controlling this leakage.

2. A detailed hydrology and hydraulic study to determine maximum safe pool level with the recommended spillway design flood in accordance with the guidelines.

3. Based on the results of an in-depth hydraulic analysis, review the structural adequacy of the dam and spillway.

4. The cause of settlement and preparation of future settlements in the easternmost section of the roadway on the dam.

7.2 RECOMMENDATIONS

a. Facilities

1. In order to improve the spillway capacity, the owner should immediately remove the obstructions on the spillway crest (pins and 3 inch x 8 inch boards).

2. Studies as outlined in Paragraph 7.1.d should be initiated as soon as practical.

3. Weirs should be installed at both abutments and daily readings of pool elevation and the amount of leakage should be recorded.

b. Operation and Maintenance Procedures

Although the dam and facilities are maintained in good condition, it is considered important that the following procedures be adopted.

1. To prevent further damage caused by salt water leakage through the roadway deck, the roadway should be sealed. Most of the damage is occurring on the circular steps leading to the needle valves and in an emergency, these should be accessible.

2. An around-the-clock surveillance during periods of high precipitation should be developed to allow detection of problems at an early stage. A formal downstream warning system should be implemented for emergencies.

APPENDIX A

VISUAL CHECKLIST

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 240

PA. ID # 5-49 NAME OF DAM T. W. Koon HAZARD CATEGORY High

TYPE OF DAM: Concrete Gravity

LOCATION: Cumberland Valley TOWNSHIP Bedford COUNTY, PENNSYLVANIA

INSPECTION DATE 4-25-78 WEATHER Cloudy TEMPERATURE 53°

INSPECTORS: H. Jongsma - R. Houseal
R. Steacy - A. Bartlett
C. Gray - R. Marion

Owner Representatives
Mr. Nixon
Mr. Stampf

NORMAL POOL ELEVATION: 1017 AT TIME OF INSPECTION:

BREAST ELEVATION: 1037 POOL ELEVATION: 1017.1

SPILLWAY ELEVATION: 1017 TAILWATER ELEVATION: 950

MAXIMUM RECORDED POOL ELEVATION: 3'± over spillway (1936)

GENERAL COMMENTS:

Two-lane roadway across top of dam
Six gates
Pins for flashboards. No flashboards, some debris on pins

DAM NO. NAD 240

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Gatehouse located between the 4 spillway sections. Some leakage at lower level.	
B. OUTLET STRUCTURE	Good condition. Some cracks at elevation 955 inside the structure.	
C. OUTLET CHANNEL	Stream below spillway 200' ± wide - quiet under normal flow. Part of Lake Gordon Dam located downstream	
D. GATES	All operable and in good condition.	Two needle valves in open position and not operable Will be repaired this summer.
E. EMERGENCY GATE	None	
F. OPERATION & CONTROL	Well maintained.	
G. BRIDGE (ACCESS)	None	

DAM NO. NAD 240

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	Lake	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	 Good - flashboard pegs No major Normal See geology - limestone	 Some gunite on lower part of spillway. Some deterioration, not serious
C. DISCHARGE CHANNEL Lining Cracks Spilling Basin	None	
D. BRIDGE & PIERS	Dam and bridge are integral	
E. GATES & OPERATION EQUIPMENT	None on spillway	
F. CONTROL & HISTORY	Maximum flood about 3'± in 1936	

DAM NO. NAD 240

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation	None	
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	Measures with steel tape for water depth	
RESERVOIR		
Slopes	Clean, no erosion	
Sedimentation	Very little	
DOWNSTREAM CHANNEL		
Condition	Good and clear	
Slopes	No erosion	
Approximate Population	Lake Gordon Dam downstream with filter plant	
No. Homes		

DAM NO. NAD 240

VISUAL INSPECTION

CONCRETE/MASONRY DAM	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SEEPAGE	Left abutment wall and right abutment	Increases if water level increases.
B. ABUTMENT JOINTS	Looks good. Roadway settlement at east abutment.	
C. DRAINS	None visible.	
D. WATER PASSAGE	Over spillway	
E. FOUNDATION	See Geologic Report	
F. CONCRETE SURFACE	Weathered - no major spalling on walls	
G. STRUCTURAL CRACKS	None evident There are expansion joints.	
H. HORIZONTAL & VERTICAL ALIGNMENTS	Good	
J. MONOLITH JOINTS	Observed right abutment No seepage	
K. STAFFGAGE & RECORDER	None	

APPENDIX B

HYDROLOGY/HYDRAULICS

PROJECT Dam Investigation SHEET NO. 1 OF 4

SUBJECT T. W. Kean Dam ID # 240

COMPUTED BY RES DATE 5-4-78 CHECKED BY JJPJr 5-9-78

Maximum known flood at damsite

USGS gaging station # 1603500, Evitts Creek near Centerville, PA. Drainage area 30.2 square miles. Record 1932 to present. Maximum Q 5,240 cfs 3-17-36.

To transpose to damsite

$$\left(\frac{44.2}{30.2}\right)^{0.8} \times 5,240 = 7,100 \text{ cfs}$$

Low-pool discharge - pool at 960 ft

Discharge is through two 24-inch needle valves. & at 957 ft.

Each valve $Q = Ca\sqrt{2gh}$

$Q = 0.65 \times 3.14 \times (64.3 \times 3)^{1/2}$

$= 28$ cfs. Use 25 cfs

Two valves = 50 cfs

$h = 3$ ft.

$a = \pi R^2$

$= \pi (1)^2$

$= 3.14$

$C = .65$

Outlet works discharge at pool elev. 1017.4 (spillway crest)

Each 24" needle valve

$Q = Ca\sqrt{2gh}$

$Q = 0.65 \times 3.14 \times (64.3 \times 60.4)^{1/2}$

$= 127$ cfs - Use 120 cfs

Two valves 240 cfs

$h = 1017.4 - 957$

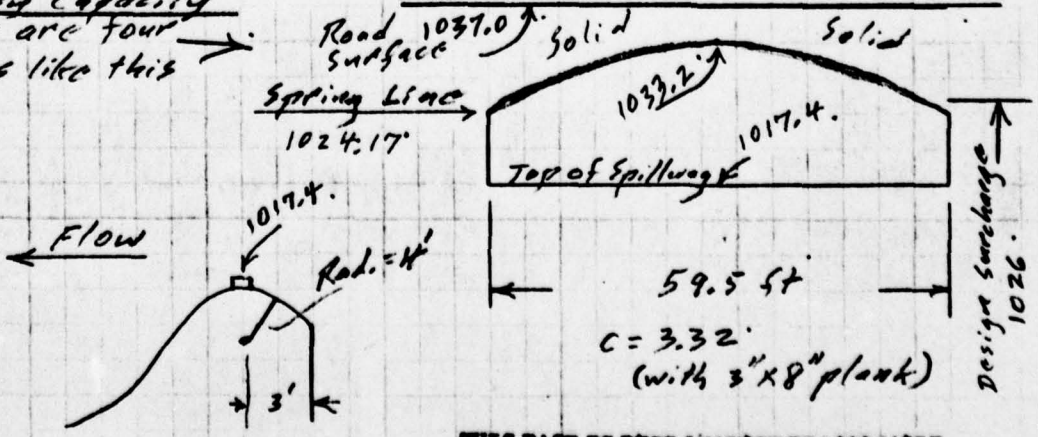
$= 60.4$ ft.

$C = 0.65$

$a = 3.14$ ft^2.

Spillway capacity

There are four openings like this →



PROJECT Dam Investigation SHEET NO. 2 OF 4

SUBJECT T.W. Koon Dam ID # 240

COMPUTED BY RES DATE 5-4-78 CHECKED BY JJPJr 5-9-78

Spillway Capacity (cont.)

Ungated spillway capacity at design pool Elevation 1026.0 feet.

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

$= 3.32 \times 59.5 \times (8.6)^{3/2}$

$= 4,980$ cfs each opening

$= 19,900$ cfs for 4 openings

$C = 3.32$

$L = 59.5$ ft.

$H = 1026.0 - 1017.4$

$= 8.6$ ft.

Ungated spillway capacity to spring line (1024.17)

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

$= 3.32 \times 59.5 \times (6.77)^{3/2}$

$= 3480$ cfs each opening.

$= 13,900$ cfs for 4 openings.

$C = 3.32$

$L = 59.5$

$H = 1024.17 - 1017.4$

$= 6.77$ ft.

Original designer computed 17,800 cfs
Difference is due to raising crest 0.4 ft and changing "C" from 3.88 to 3.32.

PMF Drainage Area 44.2 square miles
PMF = 1,400 cfsm } from curves furnished by
T = 74 hours } Balt. Dist. C of E.

PMF = $1,400 \times 44.2 = 61,900$ cfs

Vol. of Inflow = $61,900 \times \frac{74}{24} \div 2 = 95,430$ cfs-days

$= 189,300$ acre-ft.

$= 80.5$ inches runoff (too much)

Use 26 inches runoff

$= (26 \div 80.5) \times 189,300 = 61,100$ acre feet

$\frac{\text{Max Spillway Q}}{\text{Peak inflow}} = \frac{57,000^*}{61,900} = 0.92$

$\frac{\text{Req. Resv. Storage}}{\text{Vol. of Inflow}} = 0.08$ From Balt. Dist. C of E Short cut flood routing method.

Req. Resv. Storage = $0.08 \times 61,100 = 4,890$ acre feet

Storage available between elev. 1037 and 1017.4

$12,435 - 6,790 = 5,645$ acre feet.

Pool level should not go above elev. 1037.

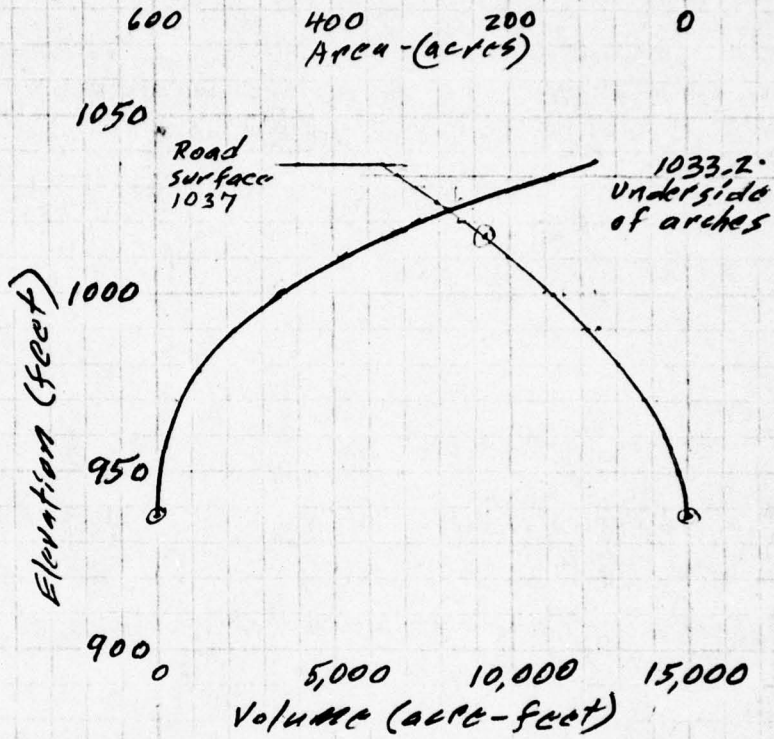
* Pool level at elev. 1037 (Road surface) Spillway crest restored.

PROJECT Dam Investigation SHEET NO. 3 OF 4

SUBJECT T. W. Hoon Dam ID # 240

COMPUTED BY RES DATE 5-3-78 CHECKED BY JJPJr 5-9-78

Area-Capacity curves



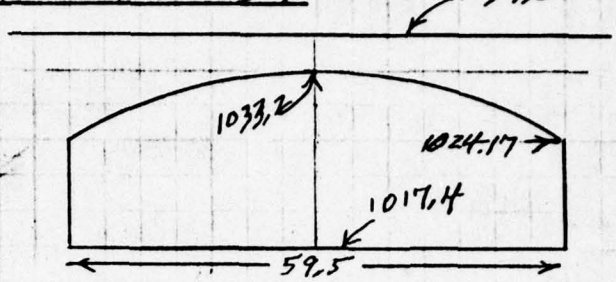
Elev.	Area (acres)	Vol. (ac. ft.)	cum. (ac. ft)	
938	0.	60.	0	
950	10.	160.	60	
960	22.	360.	220	
970	50.	640.	580	
980	78.	940.	1220	
990	110.	1300.	2160	
1000	150.	1750.	3460	
1010	200.	1580.	5210	
1017.4	227.	620.	6790	Spillway (7061)
1020	250.	1074.	7410	
1024.17	265.	500.	8484	Spring line
1026	282.	1174	8984	Design pool
1030	305.	1008	10158	
1033.2	325.	1269	11166	Underside of arch.
1037	343		12,435	Road surface.

PROJECT Dam Investigation SHEET NO. 4 OF 4

SUBJECT T. W. Koon Dam ID # 240

COMPUTED BY RES DATE 5-15-78 CHECKED BY JJPJr 5-15-78

Spillway capacity at Pool Elev. 1037



Assume pool at 1037.0
Compute discharge
using $Q = Ca\sqrt{2gh}$
(Orifice)

Increment	h	a	h x a
1017.4 to 1018	19.3	35.7	689
1018 to 1020	18.0	119	2142
1020 to 1022	16.0	119	1904
1022 to 1024	14.0	119	1666
1024 to 1026	12.0	114	1368
1026 to 1028	10.0	102	1020
1028 to 1030	8.0	88	704
1030 to 1032	6.0	52	312
1032 to 1033.2	4.4	9	40
		757.7	9845

$\frac{9845}{757.7} = 12.99$ ft.
= h to centroid

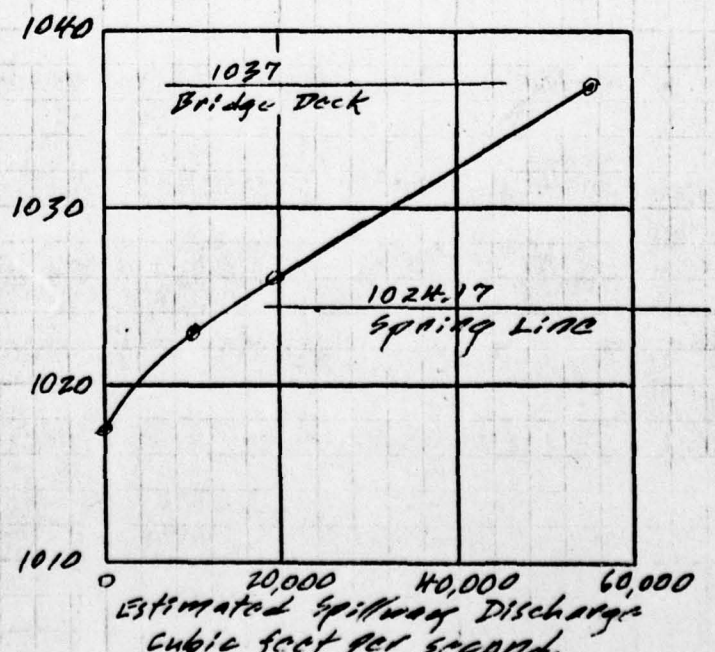
$c = 0.63$
$a = 757.7$

$Q = 0.63 \times 757.7 \times (64.3 \times 12.99)^{1/2}$
$= 13,796$ cfs per arch

4 arches = 55,184 cfs
Use 55,000

Spillway Capacity at Elev. 1023

$Q = CLH^{3/2}$
$Q = 3.32 \times 59.5 \times (5.6)^{3/2}$
$= 2620$ cfs
For 4 openings
$Q = 10,500$ cfs



PROJECT Dam Investigation SHEET NO. 5 OF
SUBJECT T. W. Keon Dam ID # 240
COMPUTED BY RES DATE 5-19-78 CHECKED BY JJP 5-19-78

Spillway discharge rating if ogee crest is restored to original shape.

See drawings and computations on sheets 1, 2, and 4.

New crest elevation 1017.0

New "C" 3.8 at 9.0 ft head

(Kings Handbook 6th Ed. fig. 5-16)

At design pool elev. = 1026.0 ft.

$c = 3.8$, $L = 59.5$ $H = 1026 - 1017 = 9.0$ ft.

$Q = CLH^{3/2} = 3.8 \times 59.5 \times (9.0)^{3/2}$

$= 6105$

$= 24{,}000$ cfs for 4 openings.

At pool elevation 1037.0 (parement level of bridge) c from Kings Handbook, 6th Ed Table 4-5

Increment	h	a	h x a
1017 to 1018	19.5	59.5	1160
1018 to 1020	18	119	2142
1020 to 1022	16	119	1904
1022 to 1024	14	119	1666
1024 to 1026	12	114	1368
1026 to 1028	10	102	1020
1028 to 1030	8	88	704
1030 to 1032	6	52	312
1032 to 1033.2	4.4	9	40
		781.5	10,316

h to centroid = $\frac{10316}{781.5} = 13.20$ ft.

$c = 0.63$

$a = 781.5$

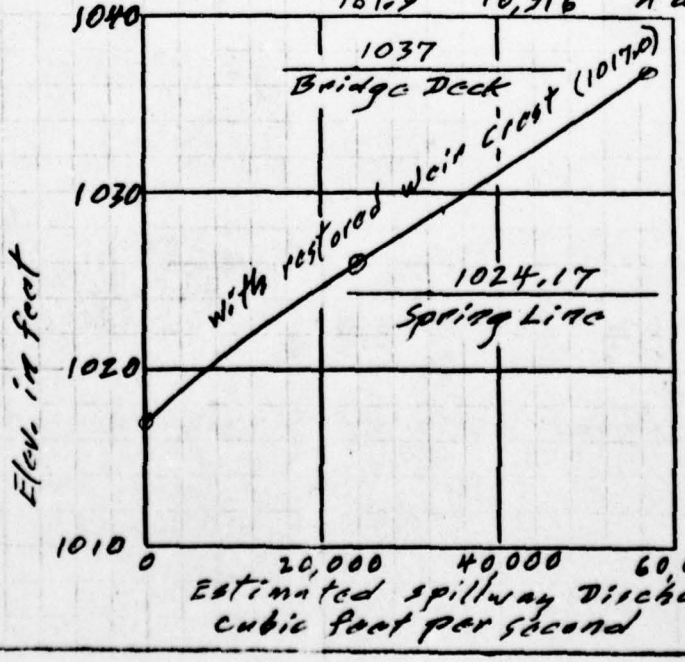
$Q = ca\sqrt{2gh}$

$= 0.63 \times 781.5 \times \sqrt{64.3 \times 13.2}$

$= 14{,}344$ per arch

4 arches $= 57{,}376$ cfs

Use 57,000



APPENDIX C

GEOLOGICAL REPORT
STRUCTURAL STABILITY

GEOLOGIC REPORT

Bedrock - Dam

Formation Names: Ridgely Sandstone and Needmore Shale.

Lithology: The Ridgely Sandstone is 150 feet thick, a medium gray to light bluish-gray sandstone, abundantly fossilliferous. It is composed of quartz and calcite grains cemented by calcite. Some beds are so calcareous that they could be called sandy or silty limestone. The Ridgely is thick bedded, beds being two to eight feet thick. The rock weathers to a light to dark brown, porous sandstone. Some beds completely disintegrate on weathering to loose yellow sand. The Needmore Shale is a soft, calcareous, dark brownish gray shale and mudstone, with some brownish black very thin bedded shale. The contact between the Needmore Shale and the Ridgely Sandstone outcrops under the left abutment of the dam. Its position, as determined by core borings, is shown on the longitudinal profile on line N 3+00.

Bedrock - Reservoir

Formation Names: The following formations are exposed on the shore of the reservoir: (listed from oldest to youngest) Wills Creek Formation, Tonoloway Limestone, Keyser Limestone, Mandata Formation, Shriver Formation, Ridgely Formation, Needmore Shale and Marcellus Shale.

Lithologies: The Wills Creek is composed of dark gray to greenish-gray calcareous shale and mudstone, about 500 feet thick. The Tonoloway is a very dark gray, laminated argillaceous limestone, about 550 feet thick. The Keyser is a gray to dark gray crystalline limestone, very fossilliferous, with some nodular chert. It is nearly 300 feet thick. The Mandata Formation is a thin unit, 20 feet thick, of light gray calcareous shale. The Shriver Formation (160 to 170 feet thick) is composed of gray to black, siltstone chert and shale. The upper part is very calcareous, essentially a silty, cherty limestone. The Ridgely Sandstone and Needmore Shale are described in the previous paragraph. The Marcellus Shale is a black, soft, carbonaceous shale.

Structure

The valley of Evitts Creek is a complex syncline, in which, the shales, sandstones and limestones described above have been folded

into sharp, tight folds. The T. W. Koon Dam is on the southeast limit of a small, assymetric anticline. The beds exposed at the foot of the dam strike N36°E and dip 25°SE. The attitude of joints in the bedrock were measured at several outcrops near the dam (see appendix). Figure 2 is a stereographic plot of the poles to the measured joint planes. Also, on this plot is the pole to the bedding, labeled B, and the pole to a vertical plane through the axis of the dam (D-D). As most of the joints have very high dip angles, their poles plot around the edge of the plot. For explanation of the shaded field, see discussion below.

Overburden

On the right side of Evitts Creek, the overburden is generally less than 20 feet, and consists of weathered Ridgely Sandstone. The foundation of the dam here is deep in fresh bedrock. On the left bank, the overburden is thicker and consists, in part, of colluvium, weathered rock, which has moved by gravity, down the slopes of Evitts Mountain. Fresh bedrock, in places, is 60 feet below the surface. The foundation of the dam appears to have been entirely cut into fresh bedrock.

Aquifer Characteristics

Where fresh and unweathered, the Ridgely Sandstone and Needmore Shale are composed of essentially impermeable rock, and the movement of groundwater is confined to bedding planes and fractures. However, most of the Ridgely Sandstone has carbonate cement, and some beds can even be considered to be a sandy limestone, therefore, the formation must be considered susceptible of solution by groundwater. Solution widens the openings on bedding planes and joints, and in some cases can remove enough cement to make the entire bed permeable. No enlarged joints or bedding planes were seen to carry groundwater near the T. W. Koon Dam. However, on the left bank of the creek, just below the dam, there is a three or four foot thick bed of sandstone with enough cement leached out to make the bed porous. A spring is fed from this bed.

Discussion

Brief consideration has been given to whether there are any surfaces present (bedding or joints) which could act as slippage planes and facilitate failure of the dam foundation. It was assumed that such surfaces would have a strike making an angle of 45°, or more, to

the axis of the dam, and dip toward the reservoir at angles of less than 45°, that is, slope up away from the dam. The shaded field on the stereographic projection of poles to joints would contain poles to all such planes. No points on the diagram fall close to the field. It is concluded, therefore, that there are no existing surfaces in the rock that would obviously facilitate failure of the foundation.

It is possible that the spring fed from the permeable bed described above derives its water from the reservoir. If the bed is continuously permeable far enough down dip and along strike, it could be carrying water under the dam. It appears unlikely, however, that there is any real likelihood of increased flow along this zone.

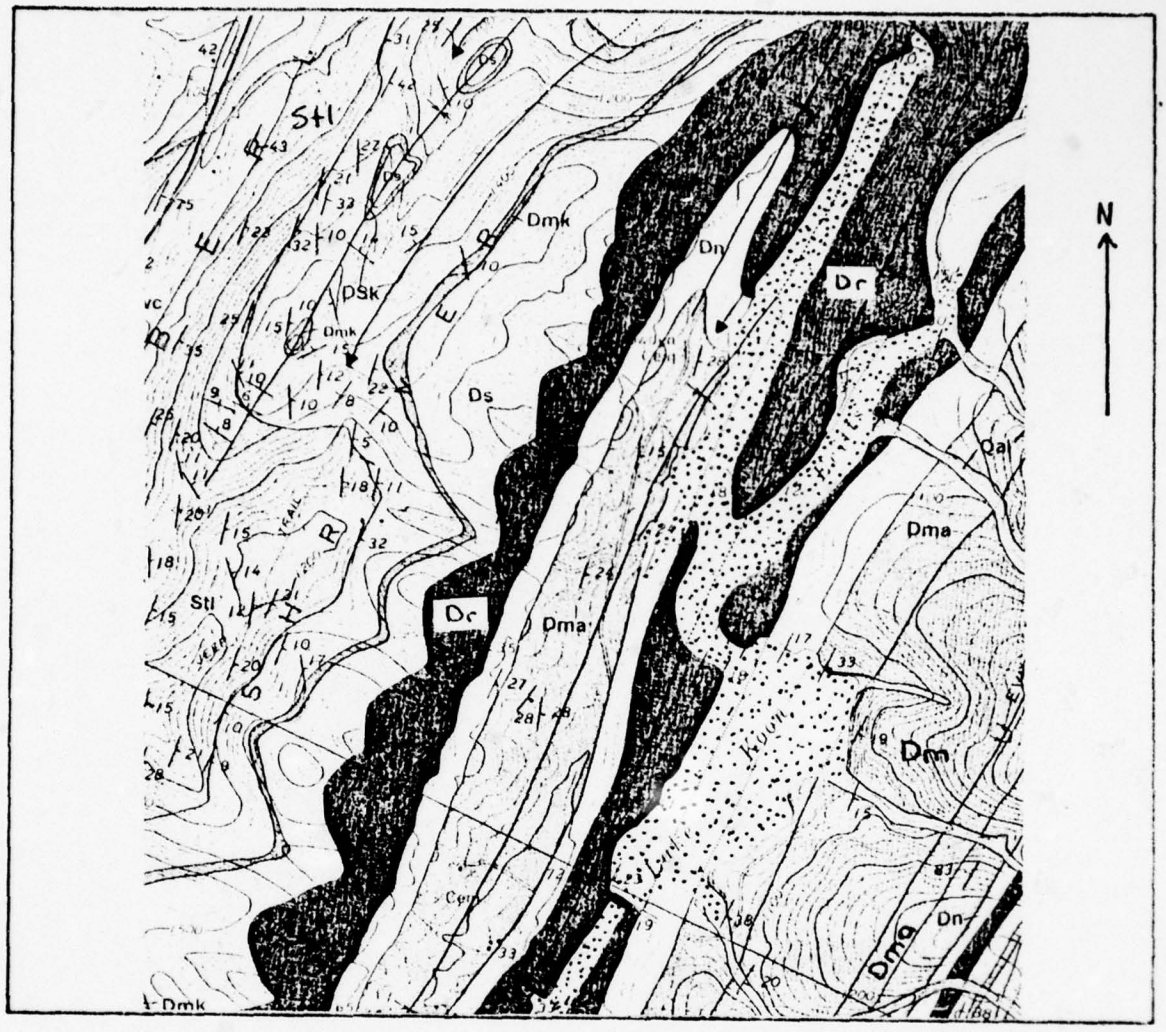
Source of Information

1. De Witt, Wallace "Geologic Map of the Beans Cove and Hyndman Quadrangles, Bedford County, Pa.". U.S. Geological Survey, Miscellaneous Investigations Series, Map I-801.

2. Air Photos, scale 1:24,000, dated 1966.

3. Plans, dated 1932.

Figure 1.



- LAKE LYON AREA

Qal	Alluvium	Ds	Shriver Formation
Dm	Mahantango Formation	Dmk	Landaff Formation
Dma	Marcellus Shale	DSk	Keyser Limestone
Dn	Needmore Shale		strike & dip of bedding
Dr	Ridgeley Sandstone		

(Geology from USGS Map I-501)

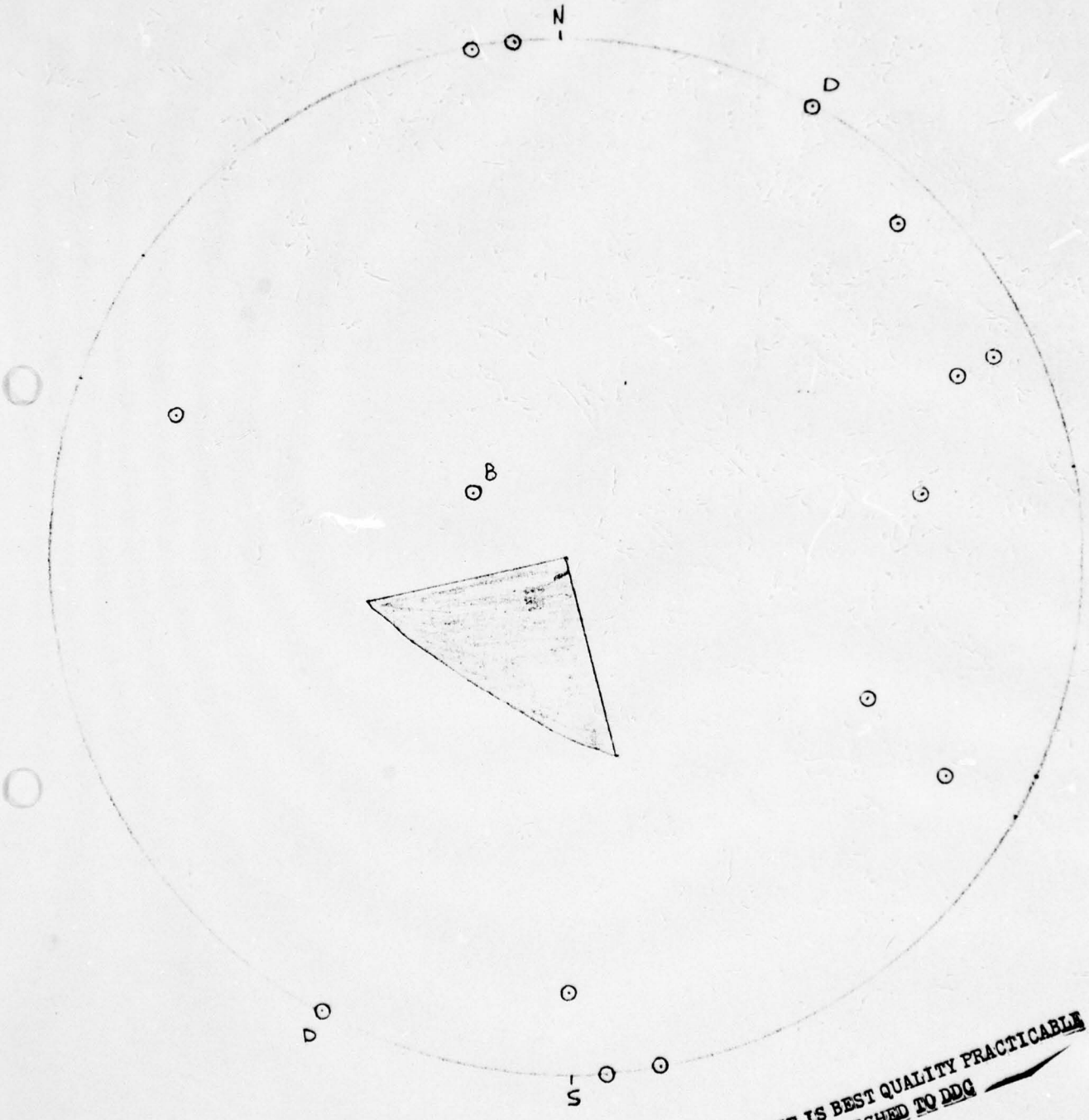


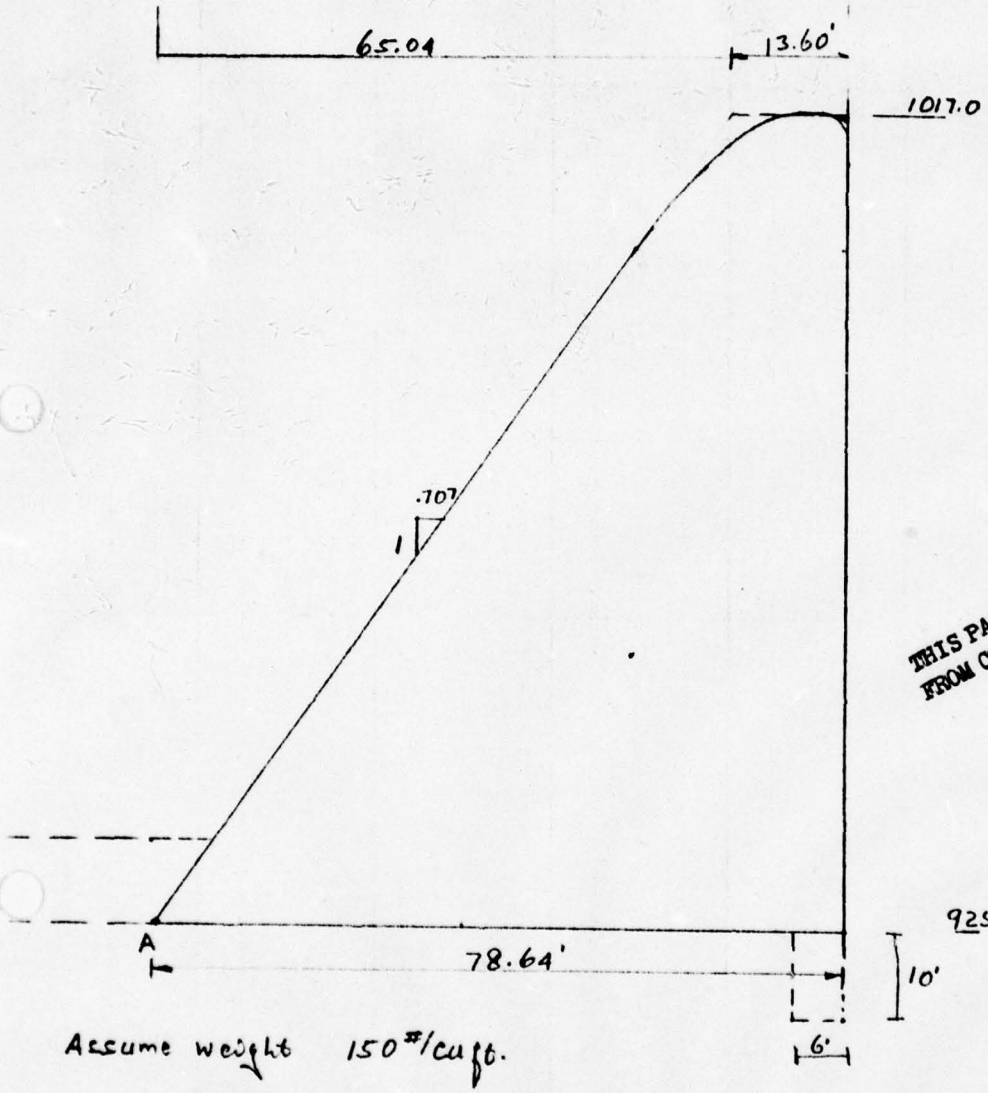
Figure 2.

T. W. KOON DAM

Stereographic Plot of Poles to Joints
(see text for explanation)

BY AIK DATE 6/78
CHKD. BY ____ DATE ____
SUBJECT T.W. KOON - #240

SHEET NO. 1 OF
PROJECT 07530



Assume weight 150#/cuft.

Concr. Spillway $\frac{1}{2} \times 65.04 \times 92 \times .150 = 448.7 \times 65.04 \times \frac{2}{3} = 19,469$

$13.60 \times 92 \times .150 = 187.7 \times (65.04 + 6.80) = 13,483$

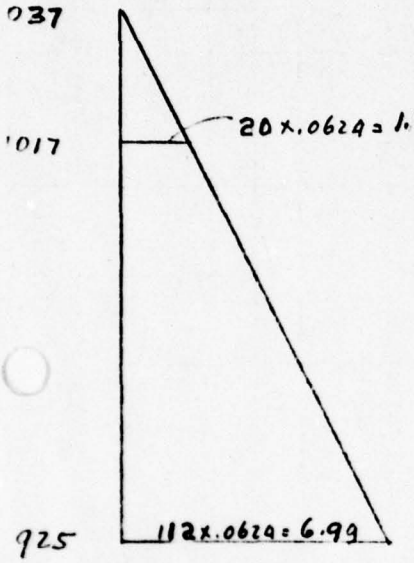
Weight bridge: Approx. $24 \times 3 \times .150 = 10.8 \times 66.64 = 720$

$647.2^{k} \times 52.03' = 33,672\ k'$

HKD. BY ____ DATE ____ SHEET NO. ____ OF ____

SUBJECT T.W. KOON - TL 240 PROJECT D7510

Assume Water to Elev 1037 (PMF)
Neglect hor water pressure on bridge.
Neglect water on spillway



Vertical: Spillway $647.2 \times 52.03 = 33,672$

Uplift: $78.64 \times 2.08 = -163.6 \times 39.32 = -6,432$

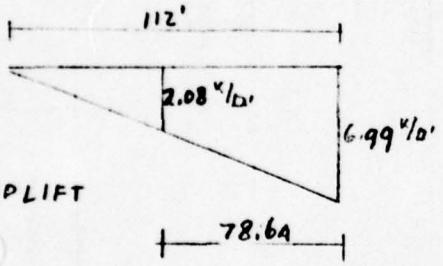
$\frac{1}{2} \times 78.64 \times 4.91 = -193.1 \times 52.42 = -10,120$

$290.5^{K} \times 58.93 \quad 17,120$

Hor: $1.25 \times 92 = 115 \times 46 = 5290$

$\frac{1}{2} \times 5.74 \times 92 = 264 \times 92/3 = 8097$

$379^{K} \quad 13,387$



F.O.S. against overturning: $\frac{17,120}{13,387} = 1.28$

$M = 13,387 - 290.5(58.93 - 39.32) = 7690^{K'}$ (56.97) $\quad e = \frac{7690}{290.5} = 26.47' > \frac{78.64}{6} = 13.10$

$L = (39.32 - 26.47)3 = 38.54' \quad p = \frac{2 \times 290.5}{38.54} = 15.07^{K}/D'$

Sliding resistance: $R = \Sigma V \operatorname{tg} \varphi + cA$

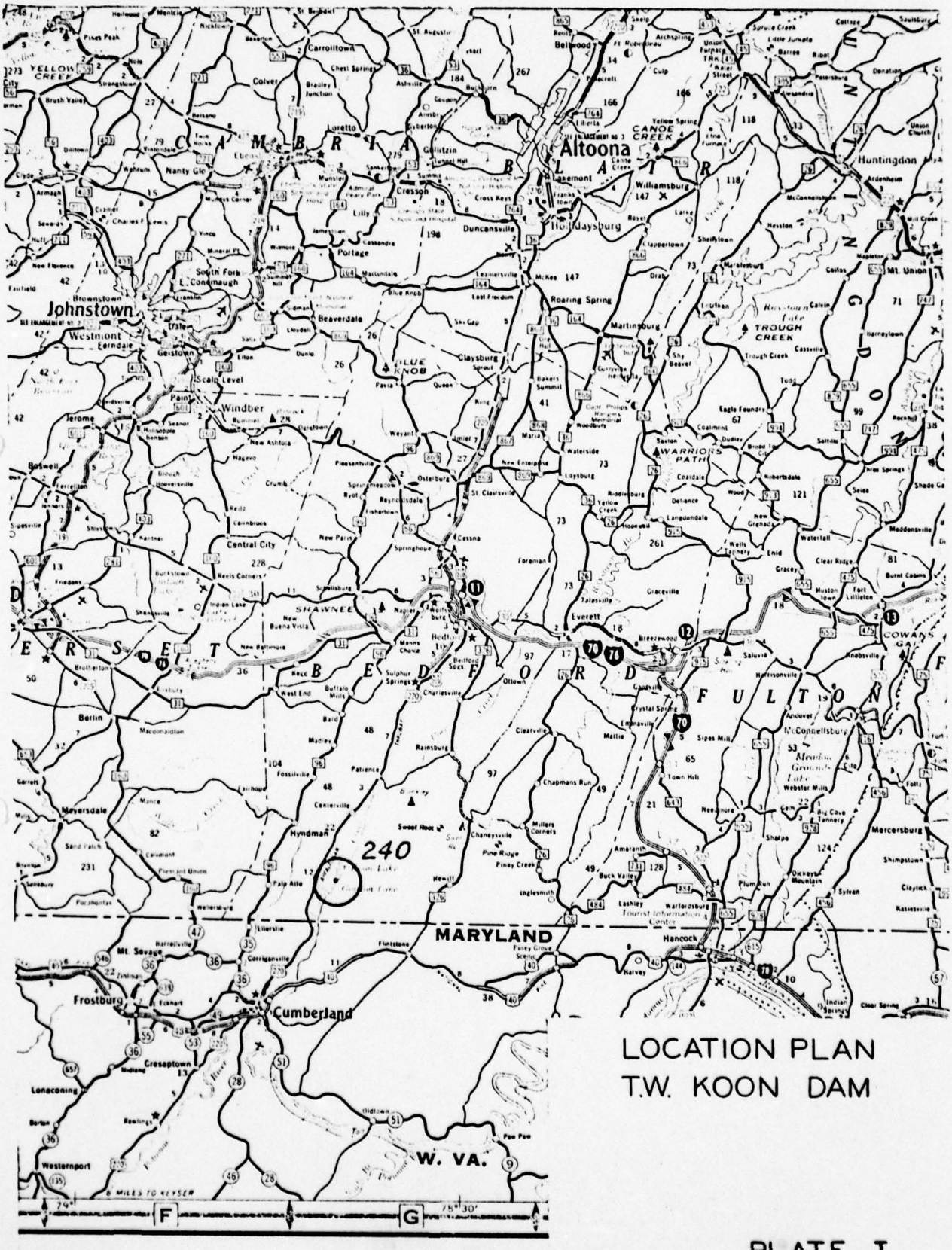
$R = 290.5 \operatorname{tg} 40^{\circ} + 1.5 \times 78 = 243^{K} + 117 = 360^{K}$

F.O.S. $\frac{360}{379} = .95$

$\varphi = 15^{\circ} \quad R = 408 \quad$ F.O.S. $= \frac{408}{379} = 1.08$

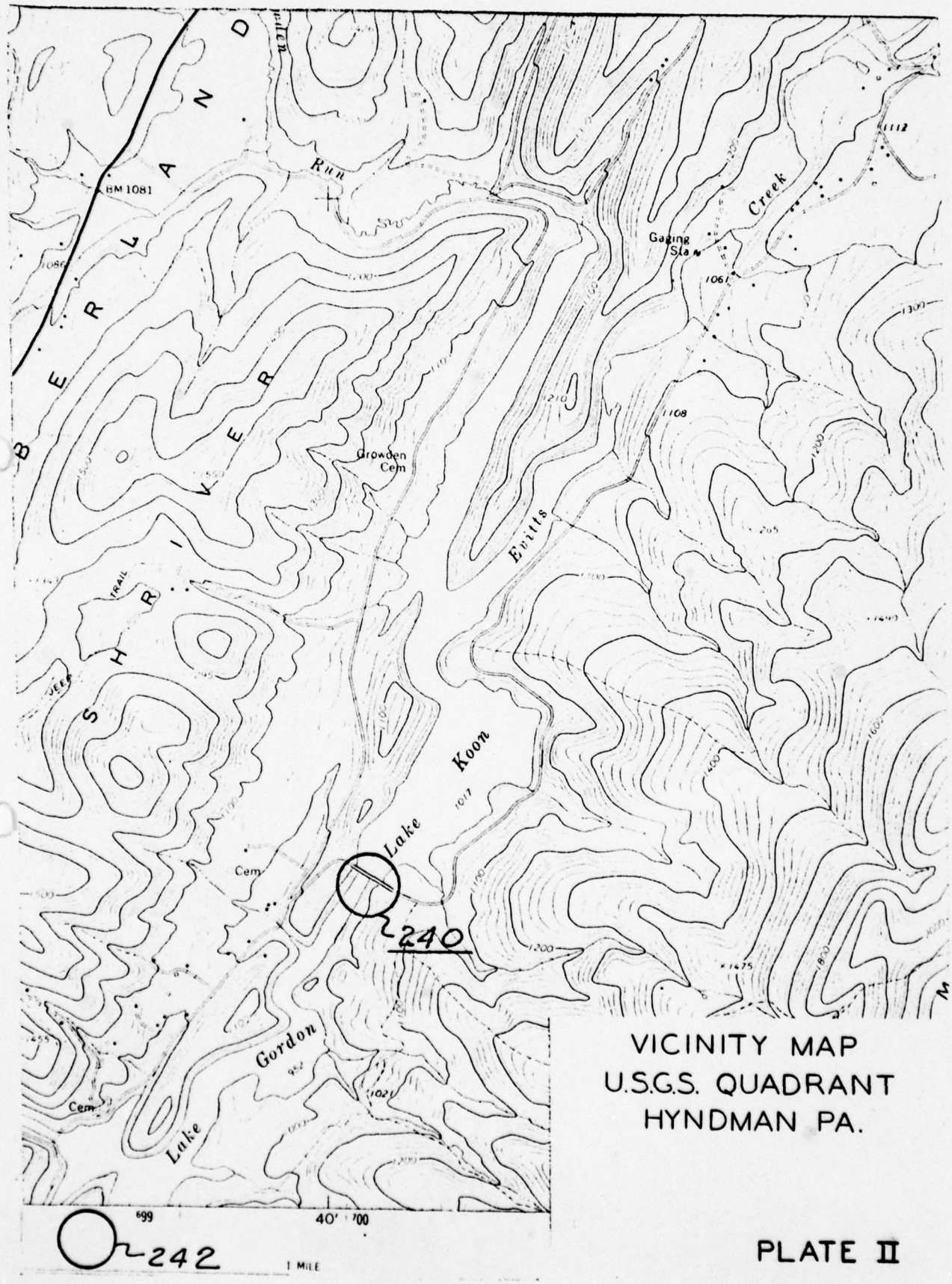
APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS



LOCATION PLAN
T.W. KOON DAM

PLATE I



VICINITY MAP
U.S.G.S. QUADRANT
HYNDMAN PA.

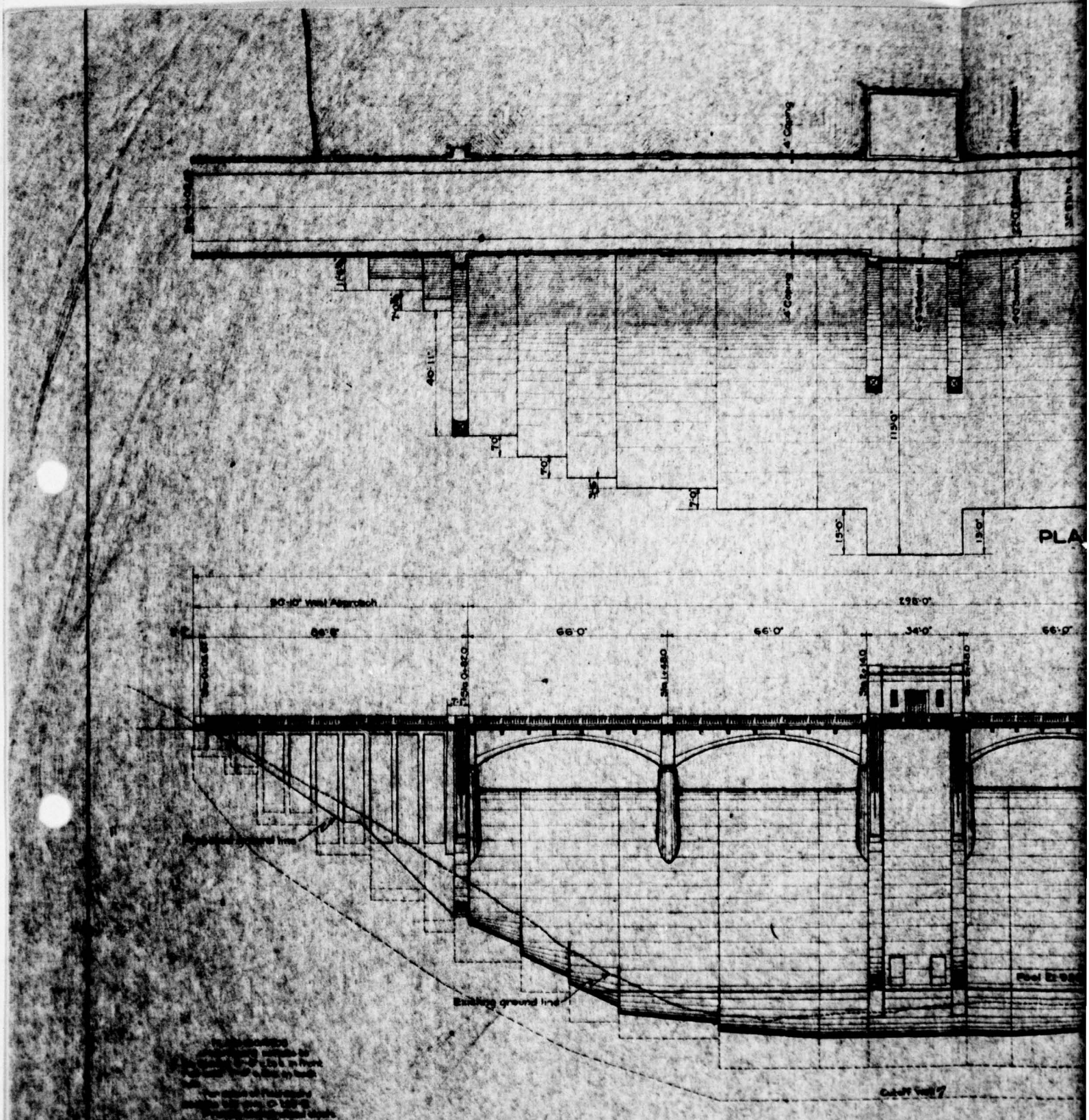
PLATE II

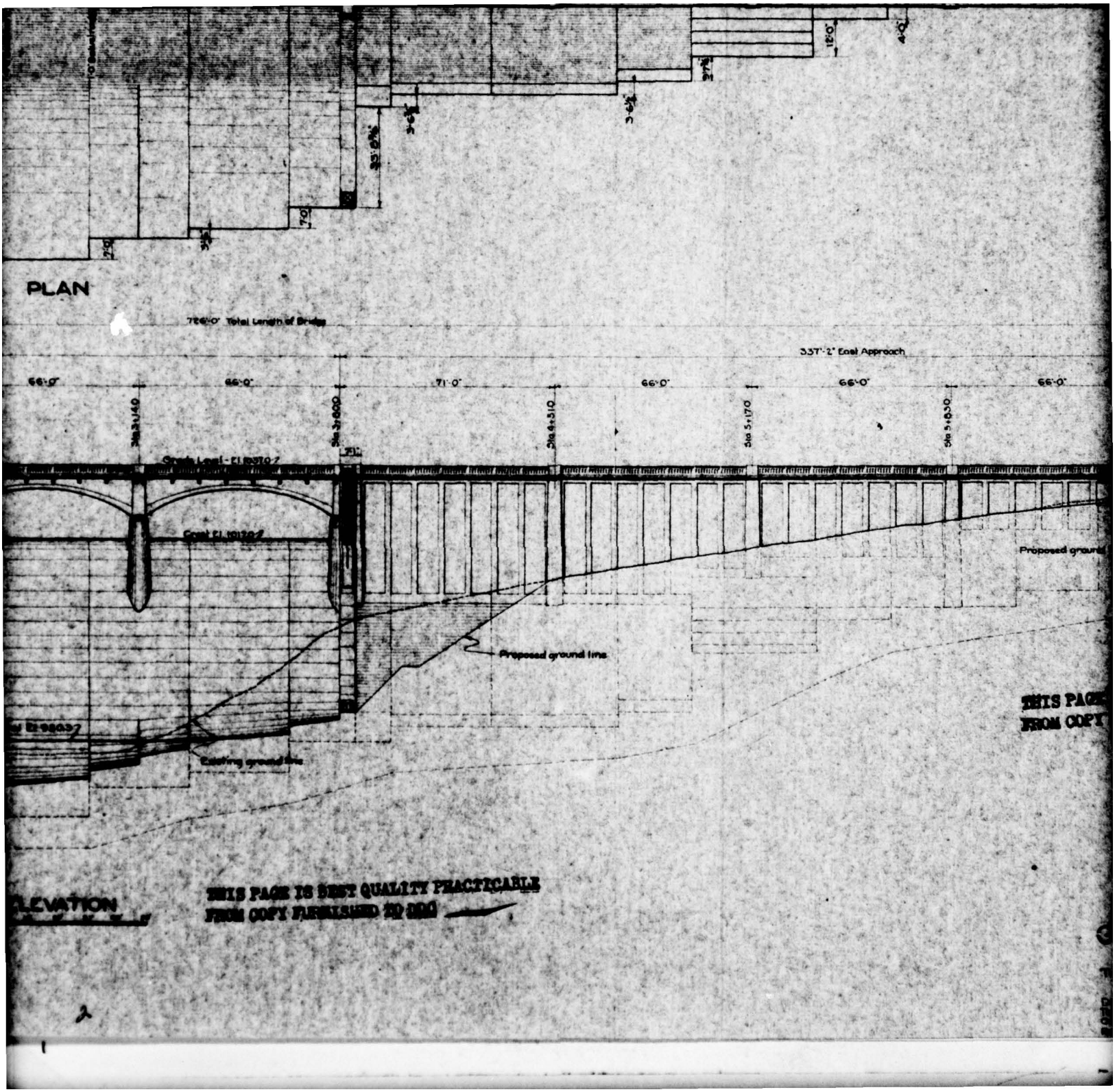
Upstream Face
Of Dam And
Gatehouse

Spillway

Upstream Lake

PLATE III




PLAN
726'-0" Total Length of Bridge
337'-2" East Approach
66'-0"
66'-0"
71'-0"
66'-0"
66'-0"
66'-0"
Sta 3+140
Sta 3+800
Sta 4+510
Sta 5+170
Sta 5+830
Grade Level - El 1021.0'
Crest El 1012.0'
Proposed ground line
Proposed ground
Existing ground line
ELEVATION
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FROM COPY FURNISHED TO DDC

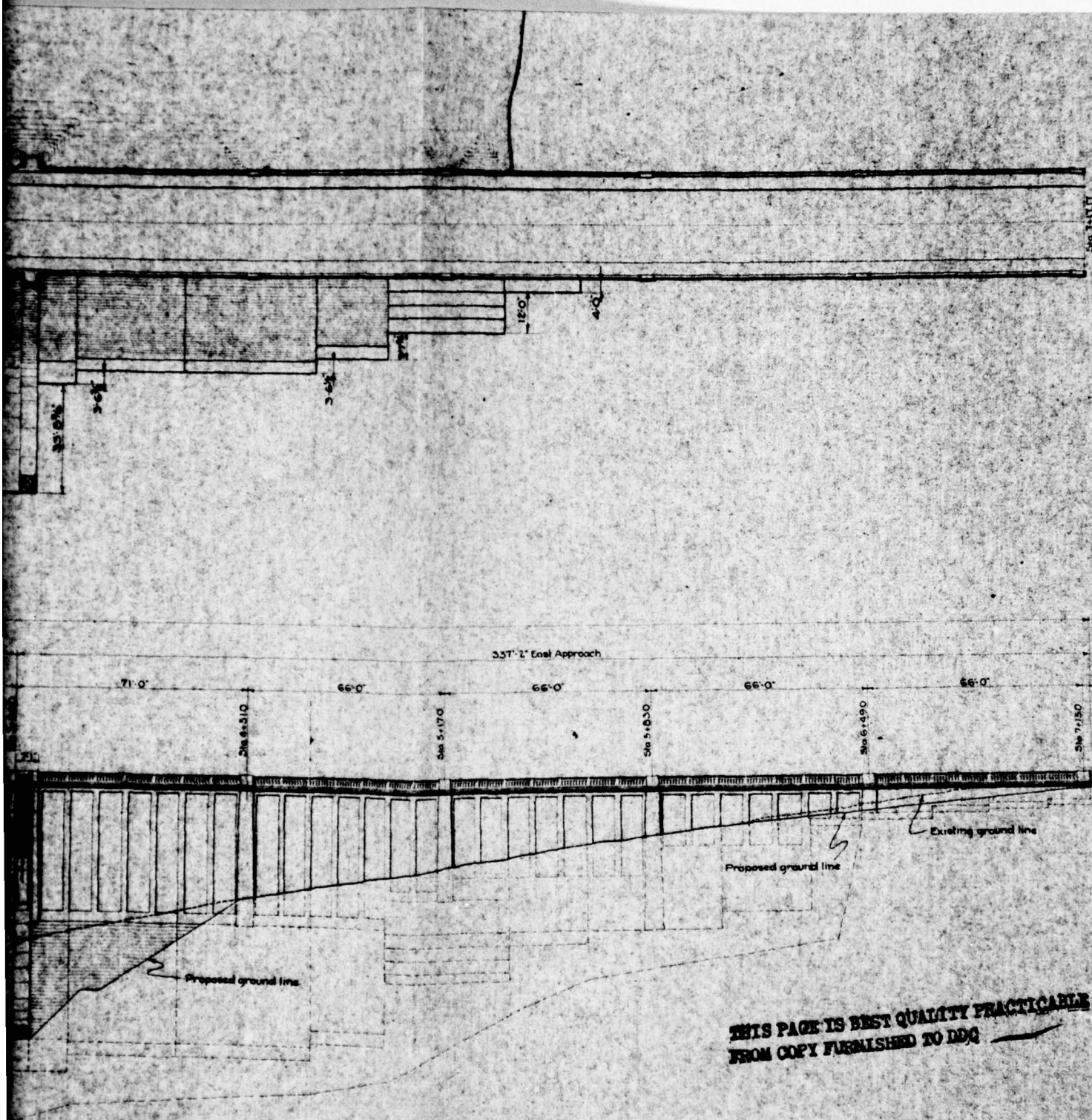


PLATE IV

CITY OF CUMBERLAND, MD.
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

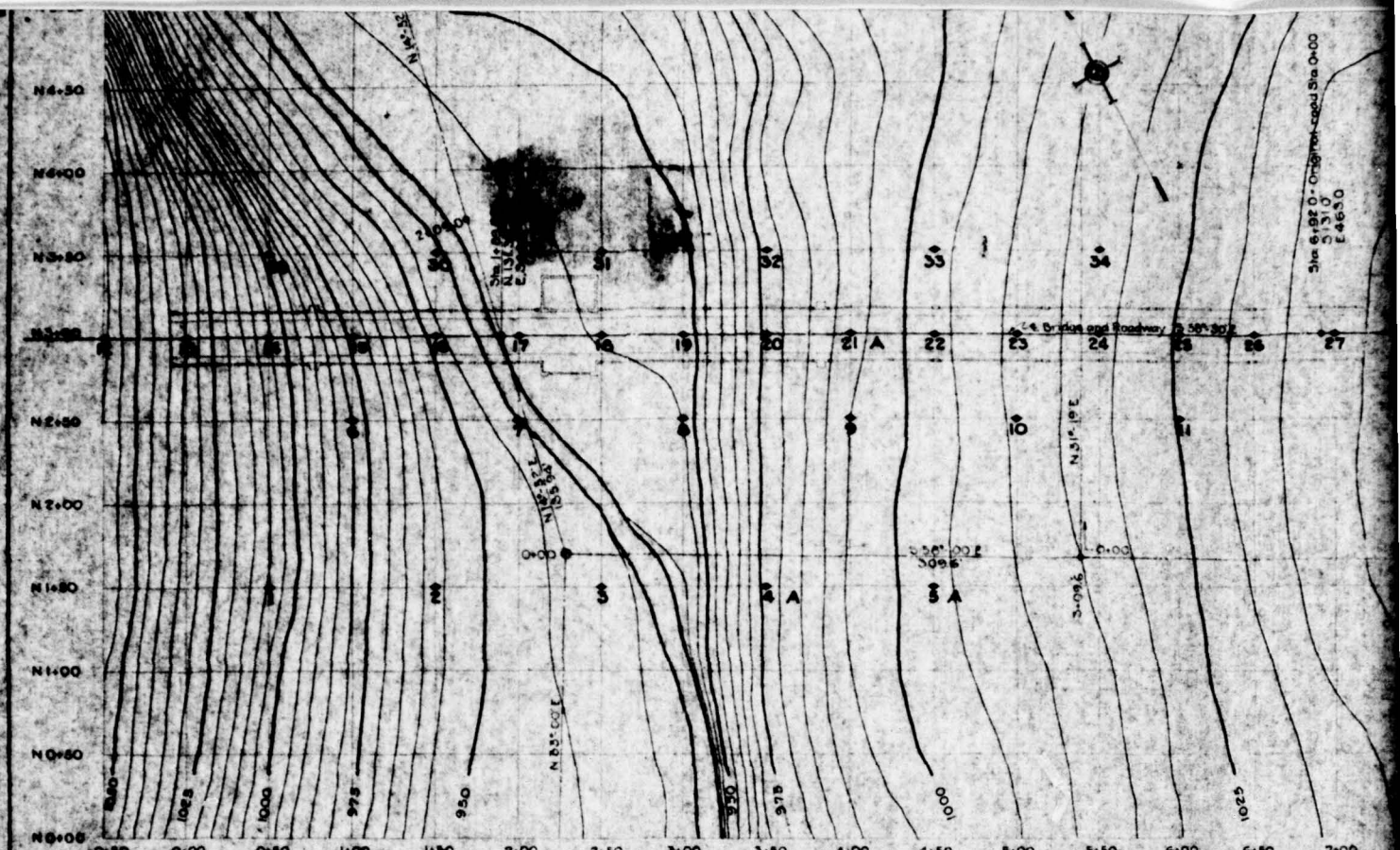
GENERAL PLAN AND ELEVATIO

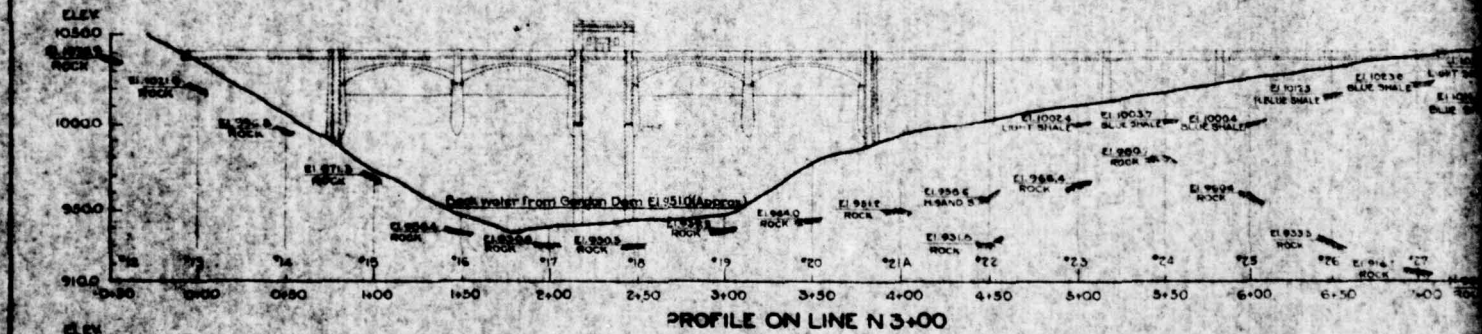
SCALE: 1"=20'

THE J. E. GREINER CO. CONSULTING ENGINEERS
BALTIMORE, MD. MAY 7, 1931

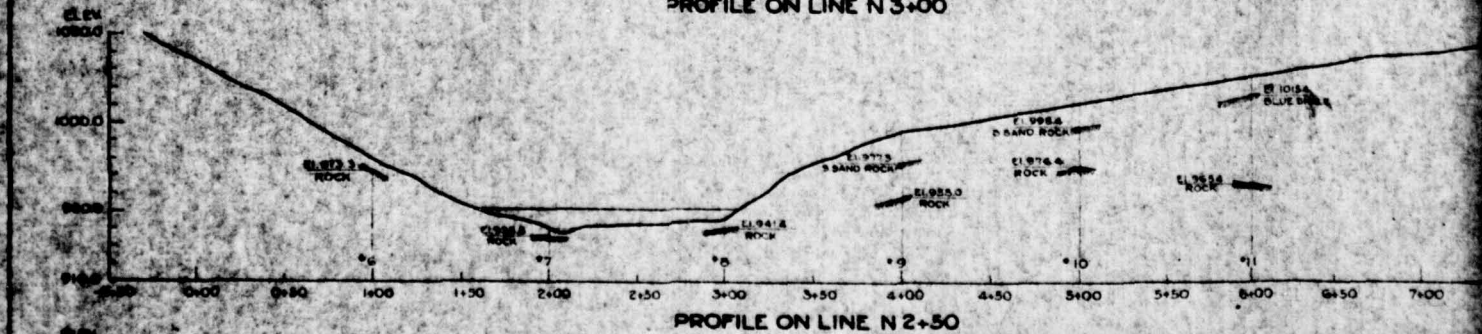
DRAWN BY: J.M.R.
TRACED BY: J.M.R.
CHECKED BY: W.W.
REVISED:

C-295-2
SHEET 2 OF 21

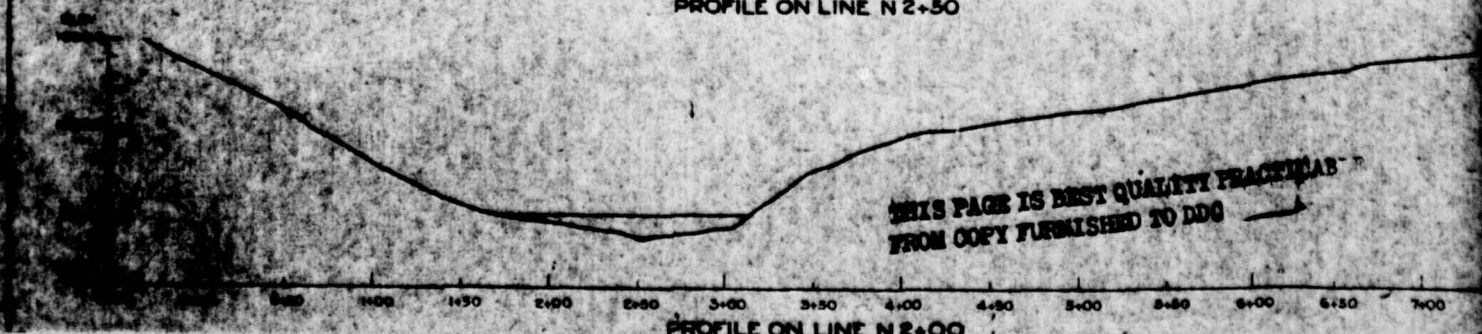




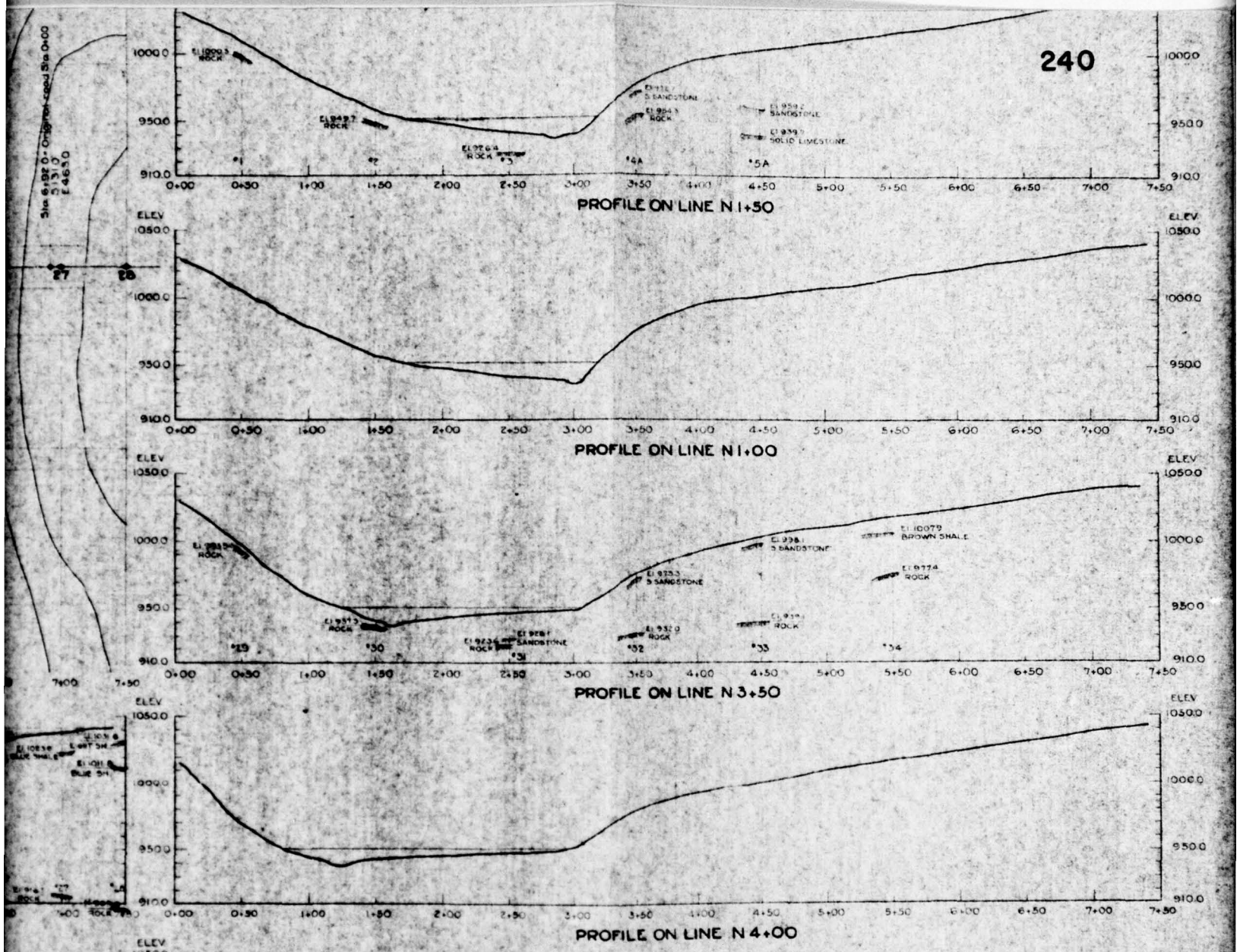
PROFILE ON LINE N 3+00



PROFILE ON LINE N 2+50



PROFILE ON LINE N 2+00



NOTE
The character and the location of the materials at the site of the foundations as obtained from borings and the record of same as shown on this drawing are not guaranteed.
Legend :- ◆ Indicates location of Borings

PLATE V

CITY OF CUMBERLAND, MD.
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

TOPOGRAPHY OF DAM SITE
TEST HOLE DATA

SCALE: 1"=50'

THE J. E. GREINER CO
BALTIMORE, MD

CONSULTING ENGINEERS
MAY 7, 1931

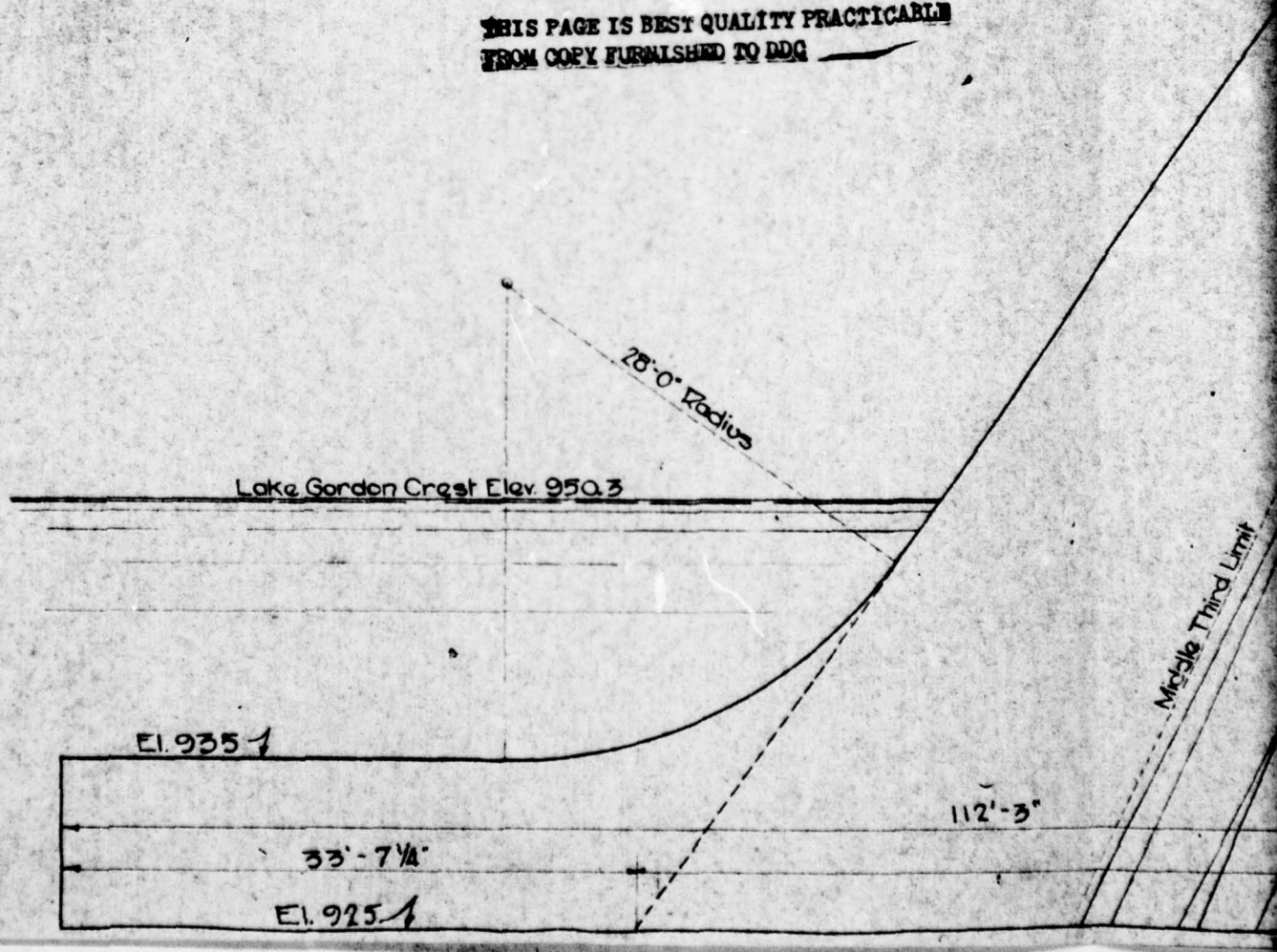
DRAWN BY: J.M.R.
TRACED BY: J.M.R.

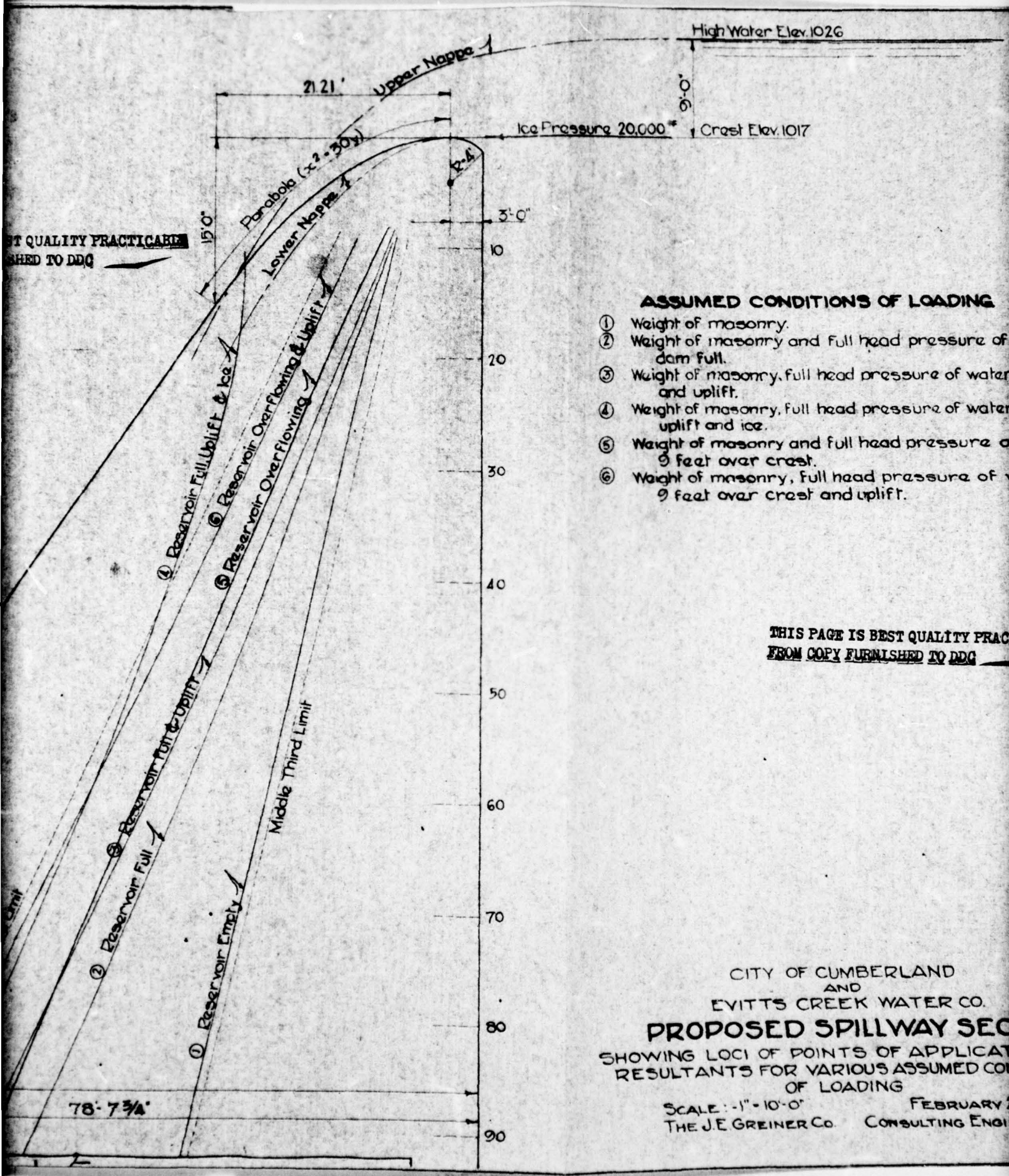
C-295-1

ASSUMPTIONS :

Weight of masonry = 140 lbs. per c.f.
Weight of water = 62.5 lbs. per c.f.
Ice thrust acting at crest = 20,000 lbs. per lin. ft.
Upward pressure, full head pressure at heel decreasing uniformly to 0 at the toe, acting over 2/3 the area.
Maximum head over spillway = 9 feet
Surface of tail water 62' below crest
No silt in reservoir
No wind when reservoir is empty

Maximum pressure at toe, joint 92; 5.32 tons per sq. ft.
Maximum pressure at heel, joint 92; 7.30 tons per sq ft.





ASSUMED CONDITIONS OF LOADING

1. Weight of masonry.
2. Weight of masonry and Full head pressure of dam full.
3. Weight of masonry, full head pressure of water and uplift.
4. Weight of masonry, full head pressure of water uplift and ice.
5. Weight of masonry and full head pressure of 9 feet over crest.
6. Weight of masonry, full head pressure of 9 feet over crest and uplift.

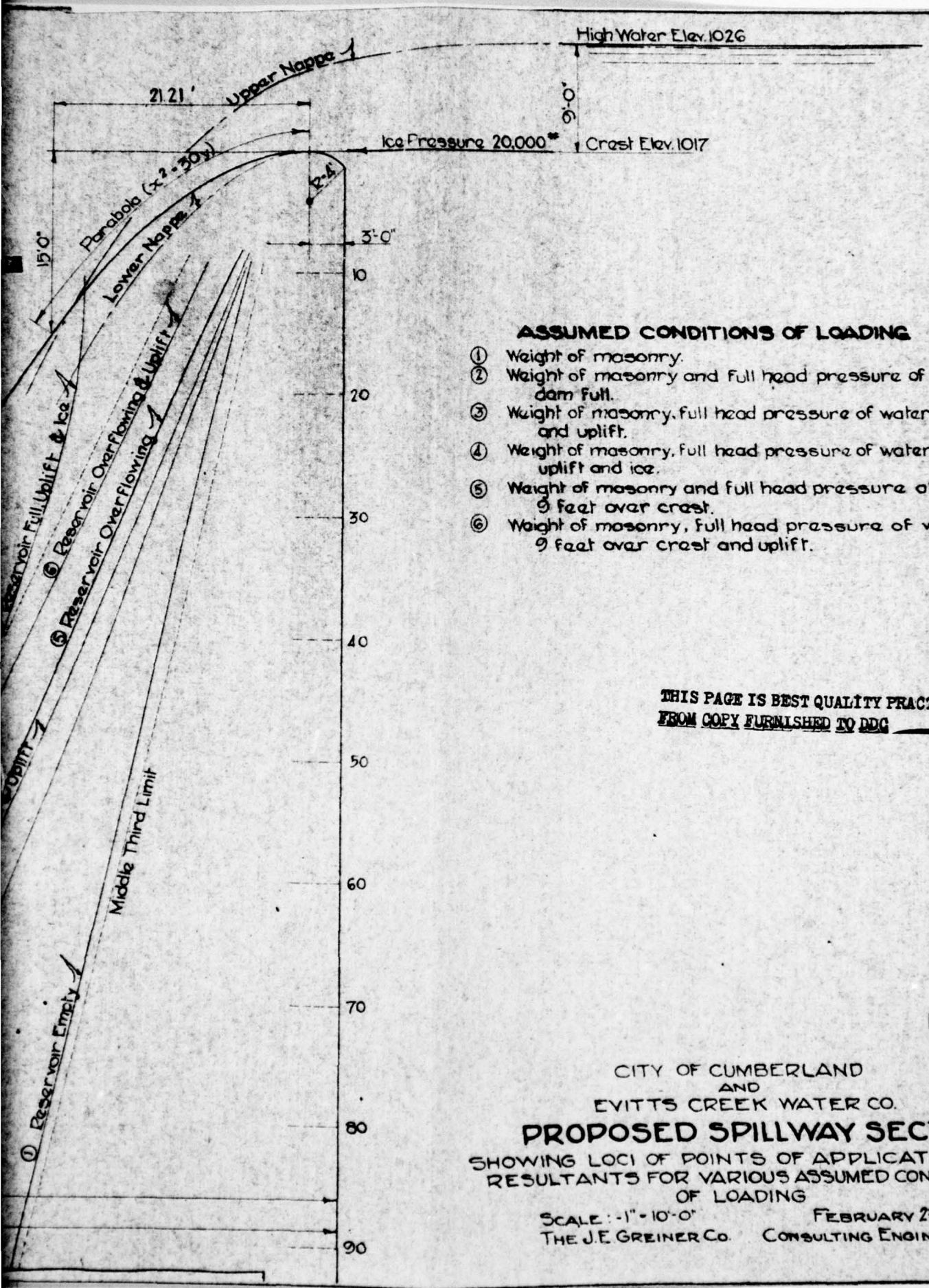
CITY OF CUMBERLAND
AND
EVITTS CREEK WATER CO.

PROPOSED SPILLWAY SEC

SHOWING LOCI OF POINTS OF APPLICAT
RESULTANTS FOR VARIOUS ASSUMED CON
OF LOADING

SCALE: - 1" = 10'-0"
THE J.E. GREINER Co.

FEBRUARY 2
CONSULTING ENGI



ASSUMED CONDITIONS OF LOADING

① Weight of masonry.
② Weight of masonry and Full head pressure of water dam Full.
③ Weight of masonry, Full head pressure of water dam full and uplift.
④ Weight of masonry, Full head pressure of water dam full uplift and ice.
⑤ Weight of masonry and full head pressure of water 9 feet over crest.
⑥ Weight of masonry, Full head pressure of water 9 feet over crest and uplift.

PLATE VI

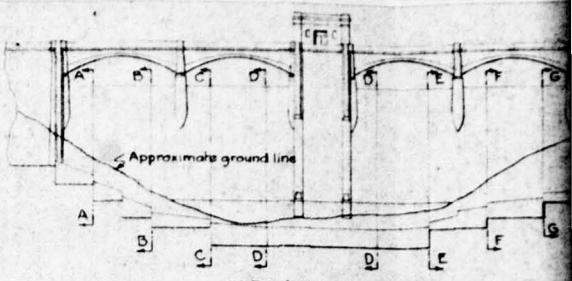
CITY OF CUMBERLAND
AND
EVITTS CREEK WATER CO.

PROPOSED SPILLWAY SECTION

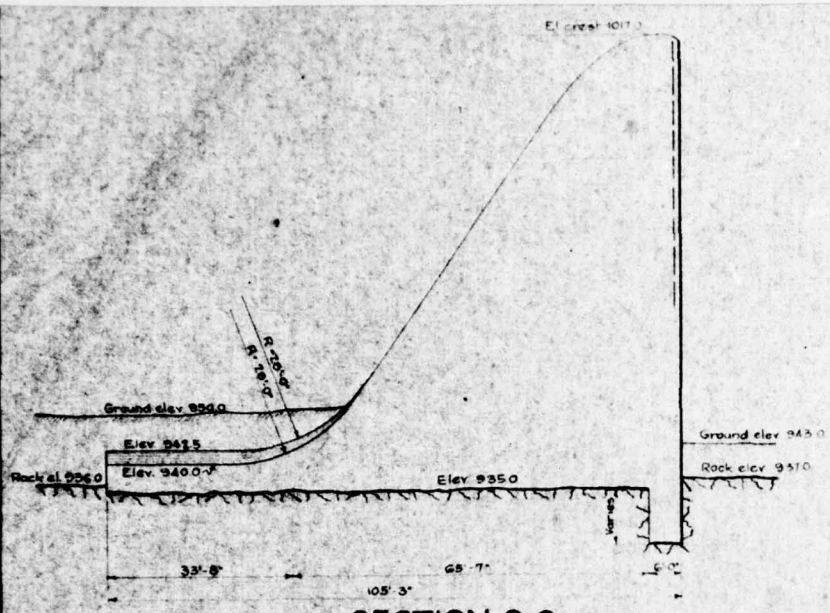
SHOWING LOCI OF POINTS OF APPLICATION OF THE RESULTANTS FOR VARIOUS ASSUMED CONDITIONS OF LOADING

SCALE: - 1" - 10'-0" FEBRUARY 23, 1931
THE J.E. GREINER Co. CONSULTING ENGINEERS

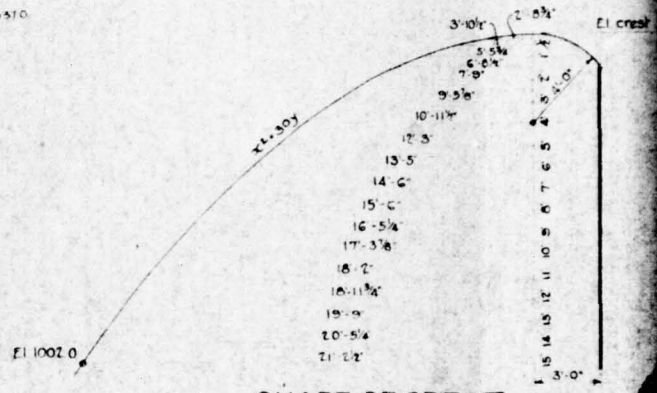
3



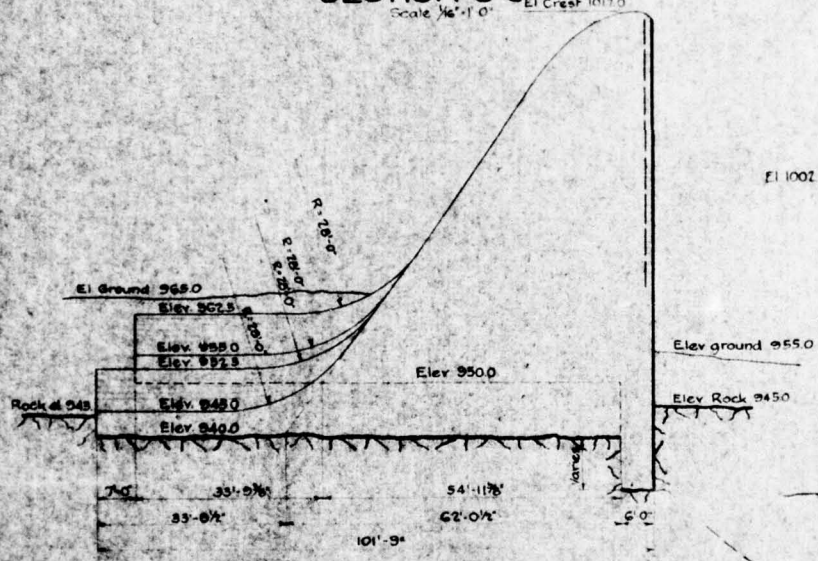
KEY ELEVATION
Scale 1"=50'-0"



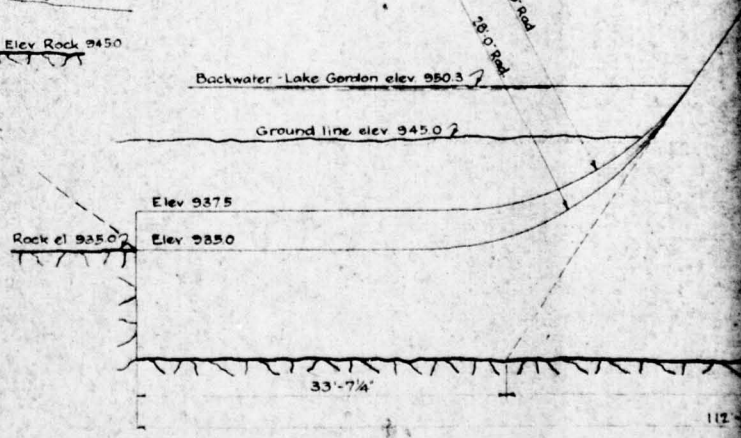
SECTION C-C
Scale 1/16"=1'-0"

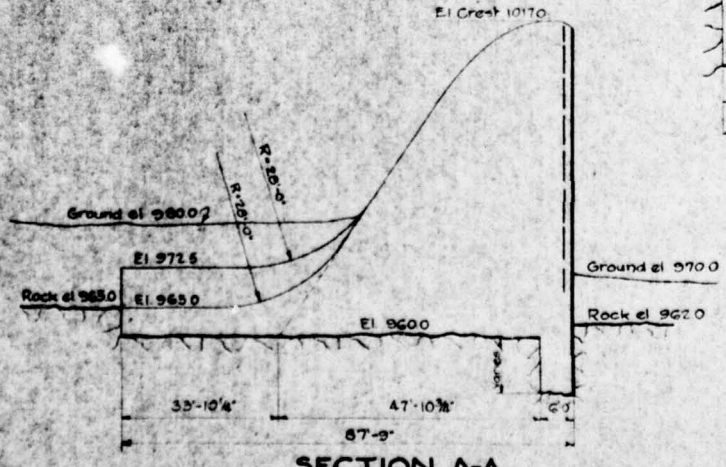


SHAPE OF CREST
Scale ½"=1'-0"

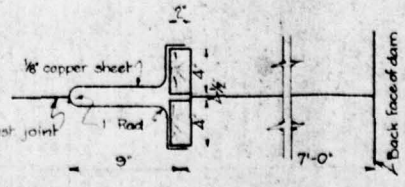


SECTION B-B
Scale 1/16"=1'-0"





SECTION A-A
Scale 1/16"=1'-0"



SECTION H-H
Scale 1½"=1'-0"

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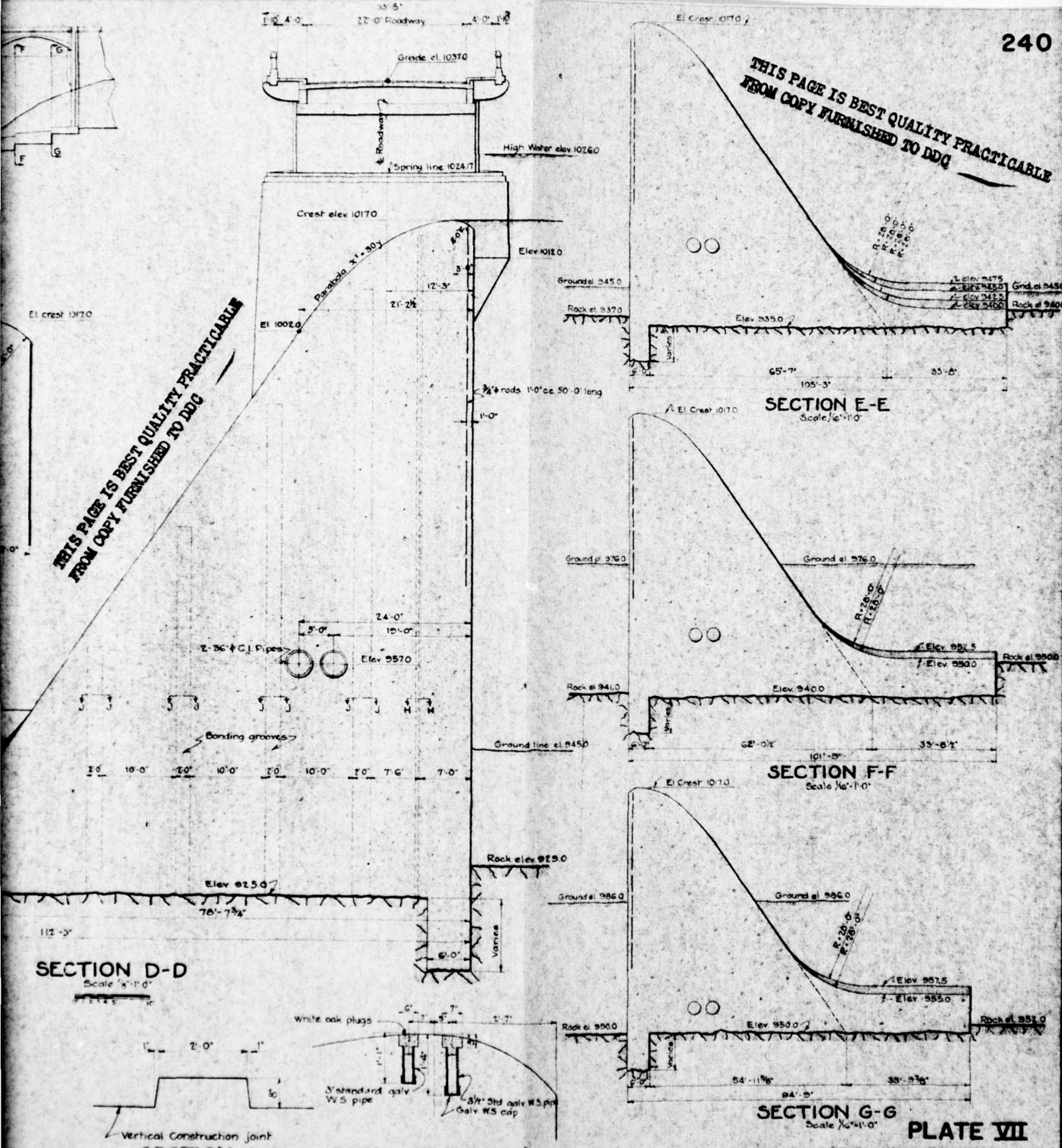


SECTION D-D
Scale 1/8"=1'-0"

SECTION J-J
Scale 3/4"=1'-0"

DETAIL OF SOCKETS
Scale 3/8"=1'-0"

SECTION E-E
Scale 1/8"=1'-0"

SECTION F-F
Scale 1/8"=1'-0"

SECTION G-G
Scale 1/8"=1'-0"

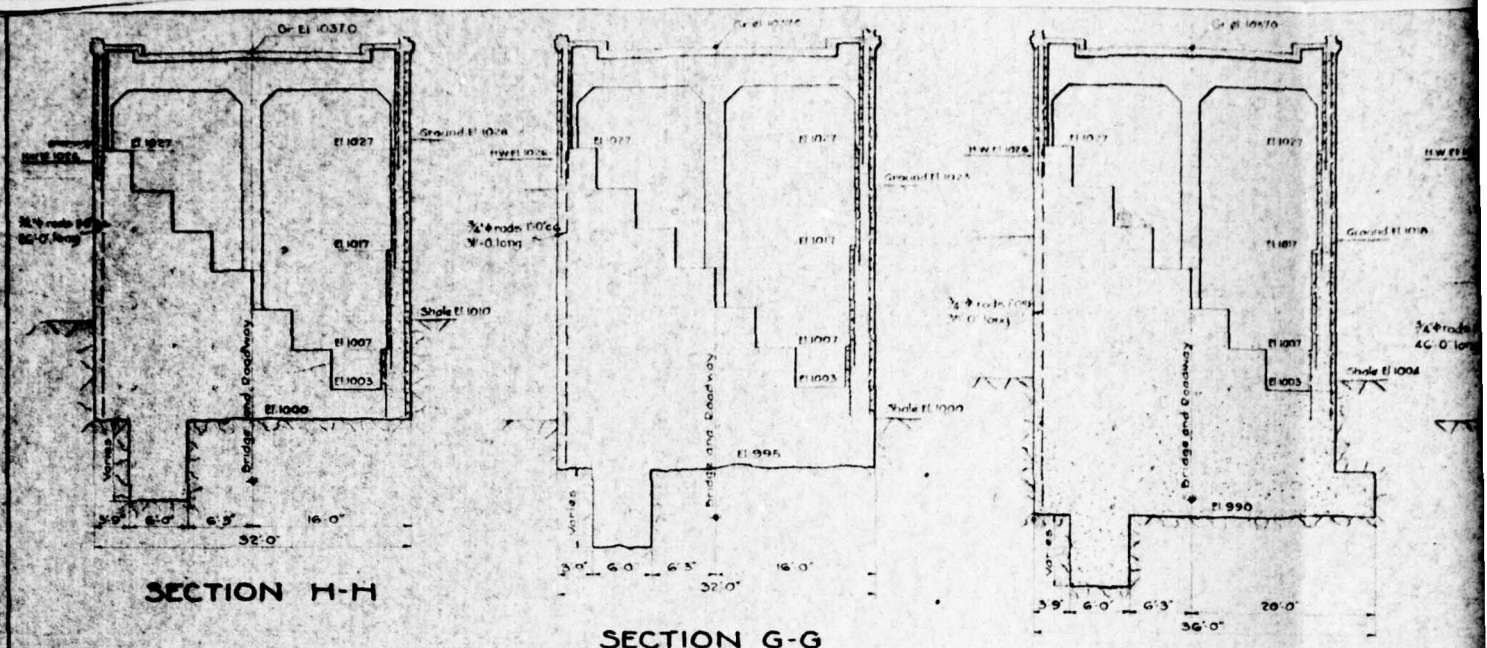
Notes:
2500# Concrete, maximum aggregate as spec, in dam section, apron and cut off walls

PLATE VII

CITY OF CUMBERLAND, MD.
AND
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

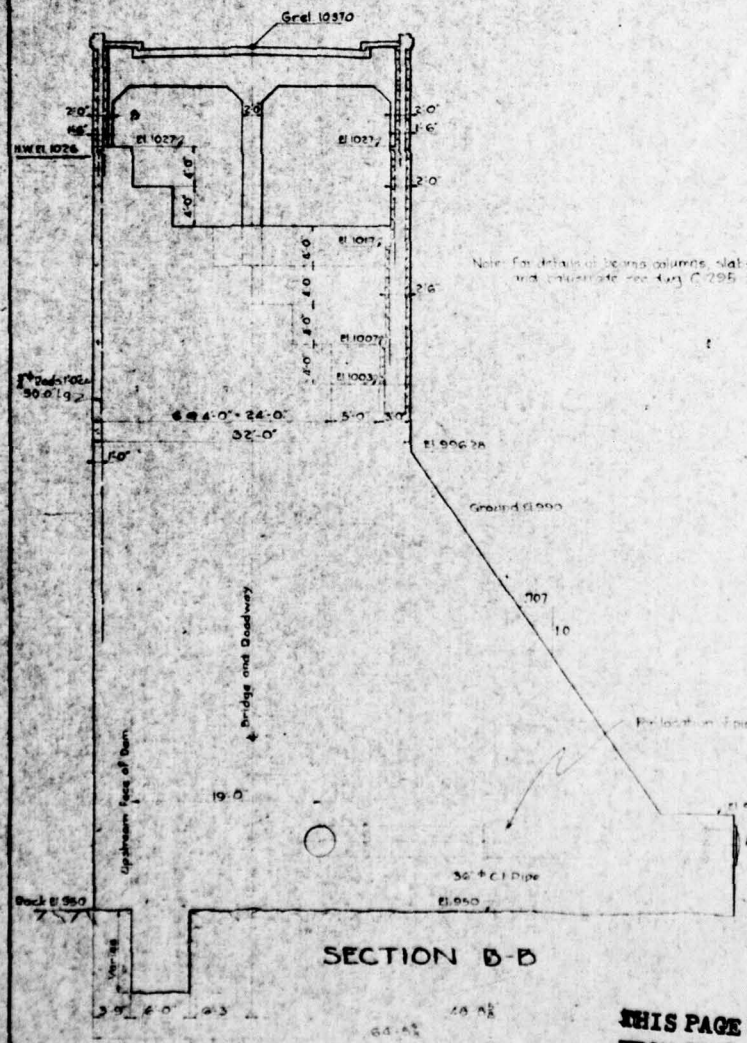
SPILLWAY SECTIONS



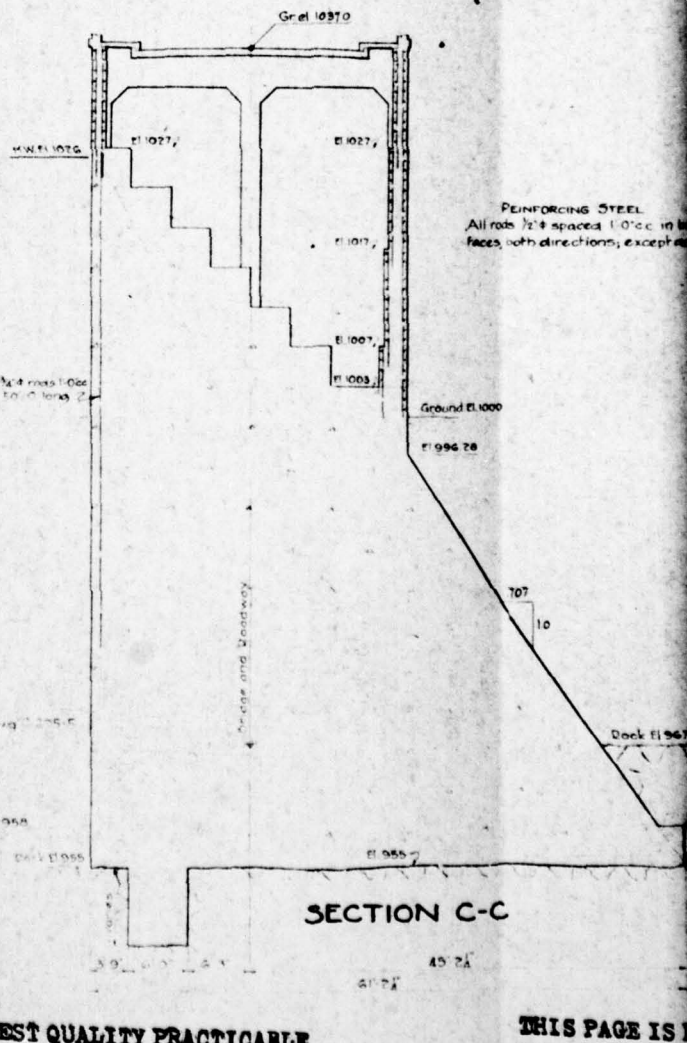
SECTION H-H

SECTION G-G

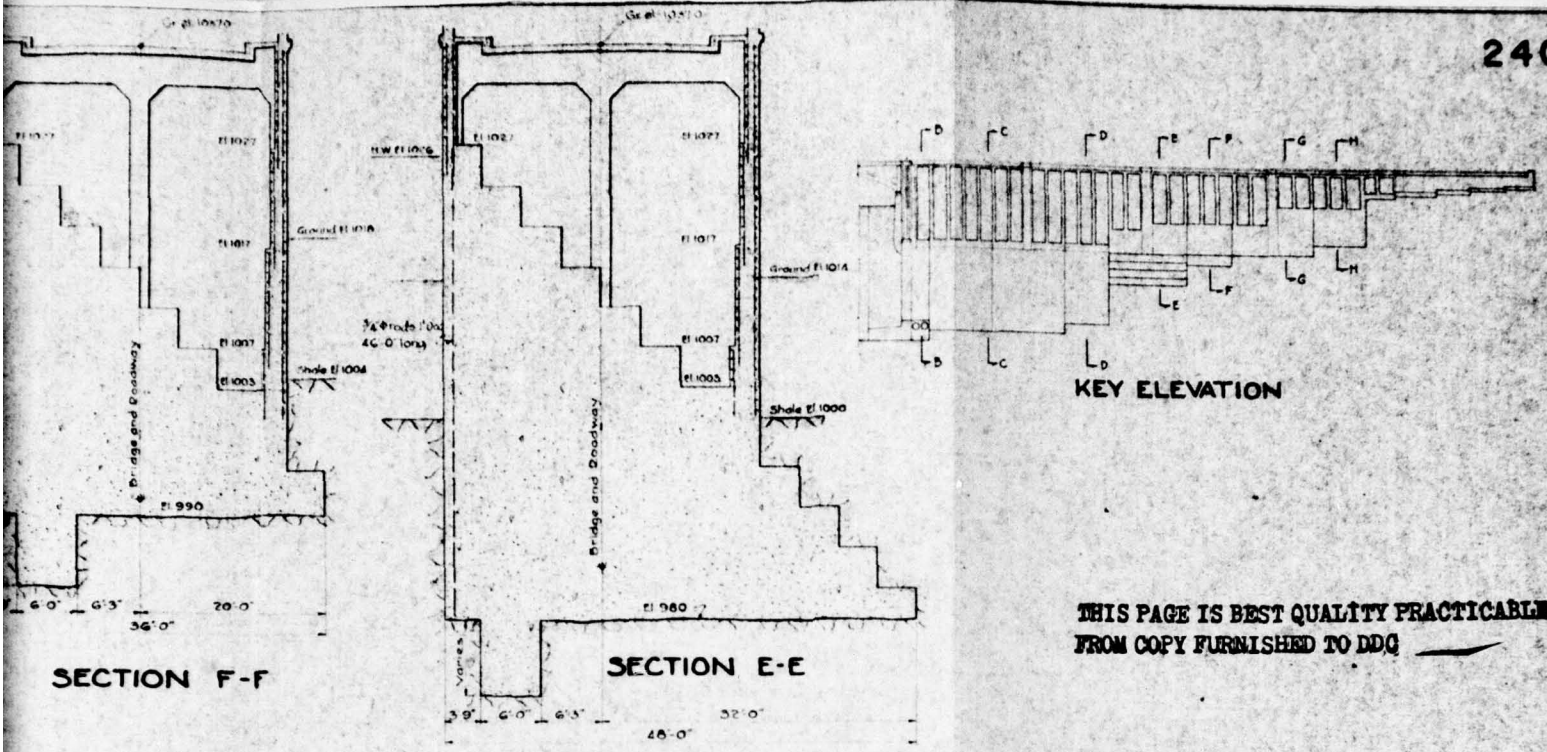
SECTION F-F



SECTION B-B



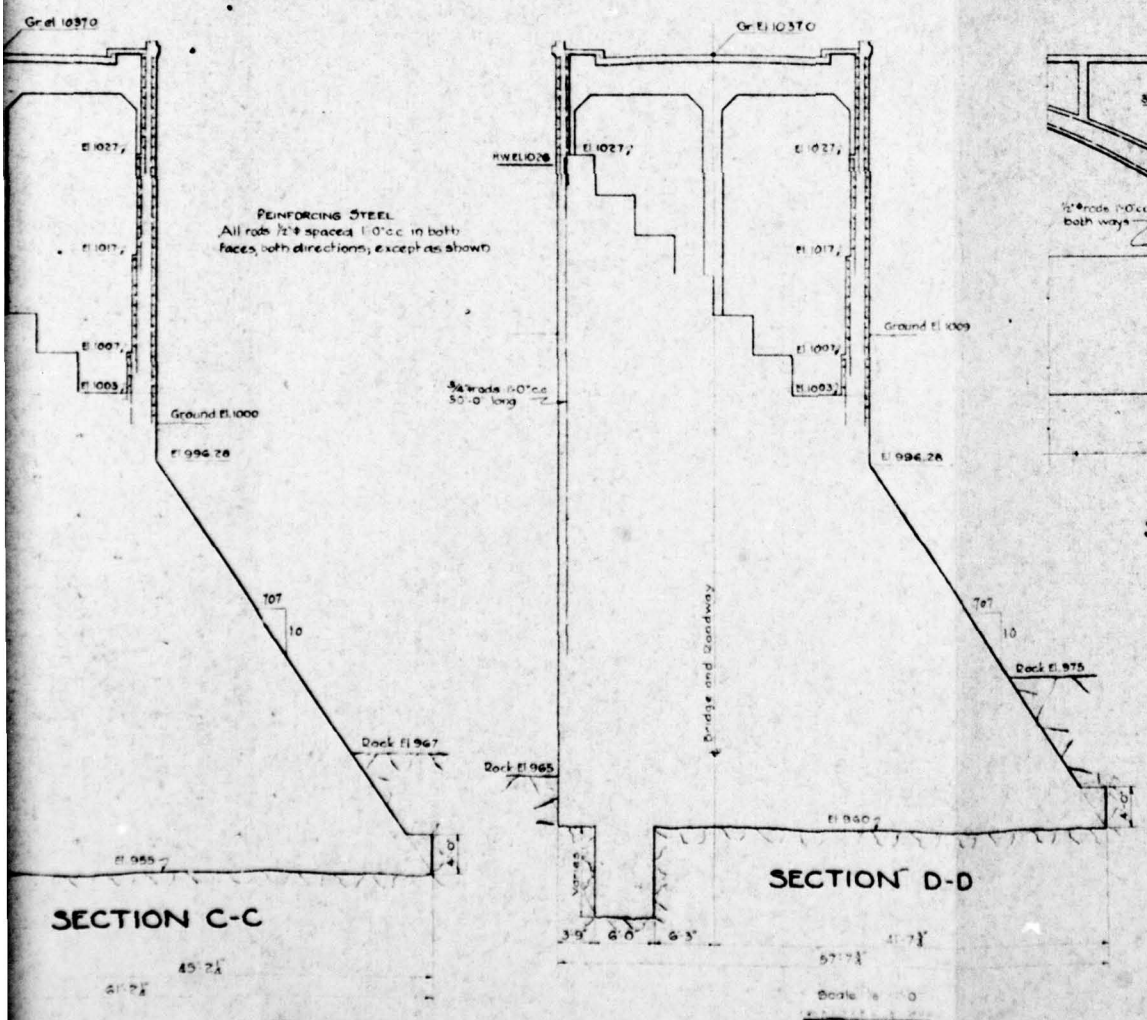
SECTION C-C



SECTION F-F

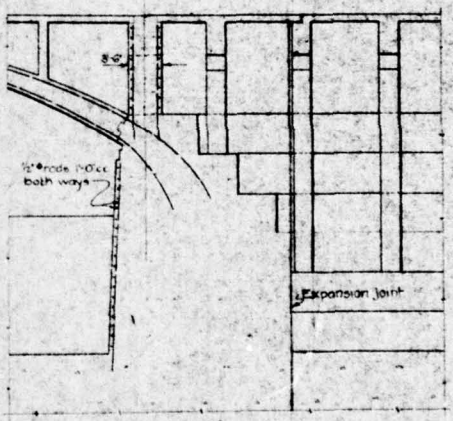
SECTION E-E

KEY ELEVATION



SECTION C-C

SECTION D-D



SECTION A-A

PLATE VIII

NOTE -
2500# concrete, aggregate as specified, in dam.
3000# concrete, maximum size aggregate, 1½", in walls, abutment, buttress, beams, columns, and roadway slab.
3500# concrete, maximum size aggregate ¾", in balustrade and sidewalk slab.
All elevations of ground, rock and foundations are approximate

CITY OF CUMBERLAND, MD.
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

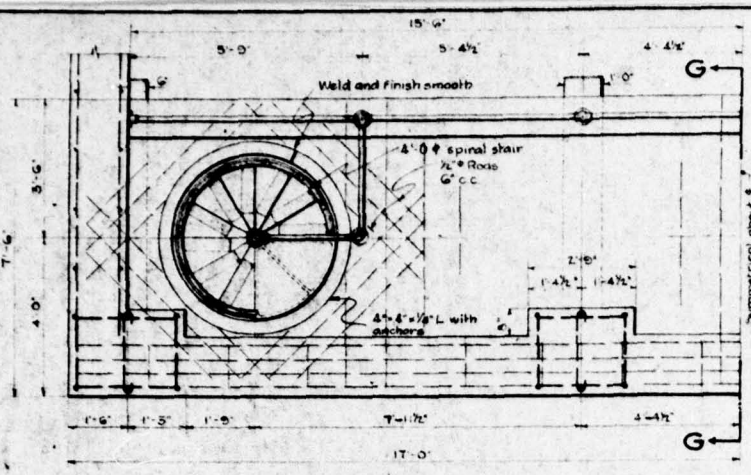
DAM AND BRIDGE APPROACH SECTIONS EAST OF SPILLWAY

SCALE: ⅛"=1'-0"

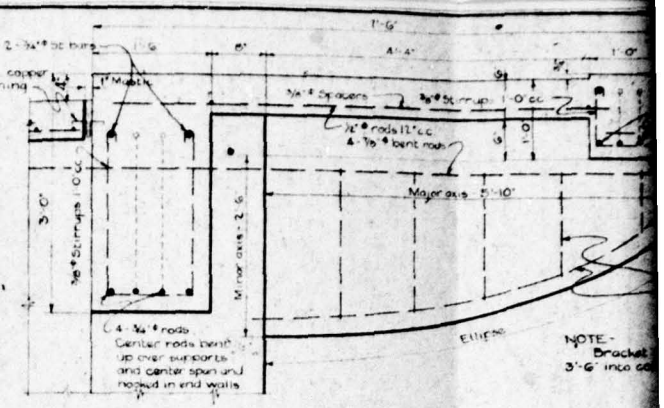
THE J. E. GREINER CO. BALTIMORE, MD.
CONSULTING ENGINEERS
MAY 7, 1931

DRAWN BY W.W.
TRACED BY E.A.M.
CHECKED BY W.W.
REVISED

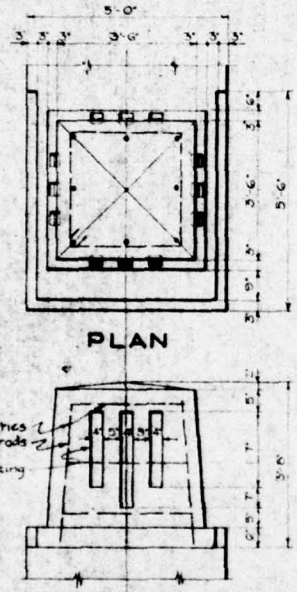
C-295-7
SHEET 1 OF 21



BALCONY PLAN
Scale ½"=1'-0"

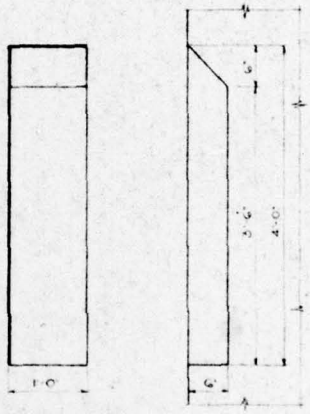


SECTION G-G
Scale 1"=1'-0"

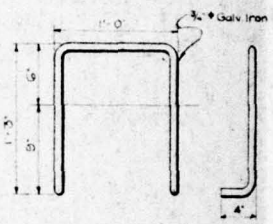


PLAN

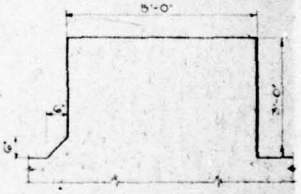
ELEVATION
BUTTRESS PEDESTAL
Scale ½"=1'-0"



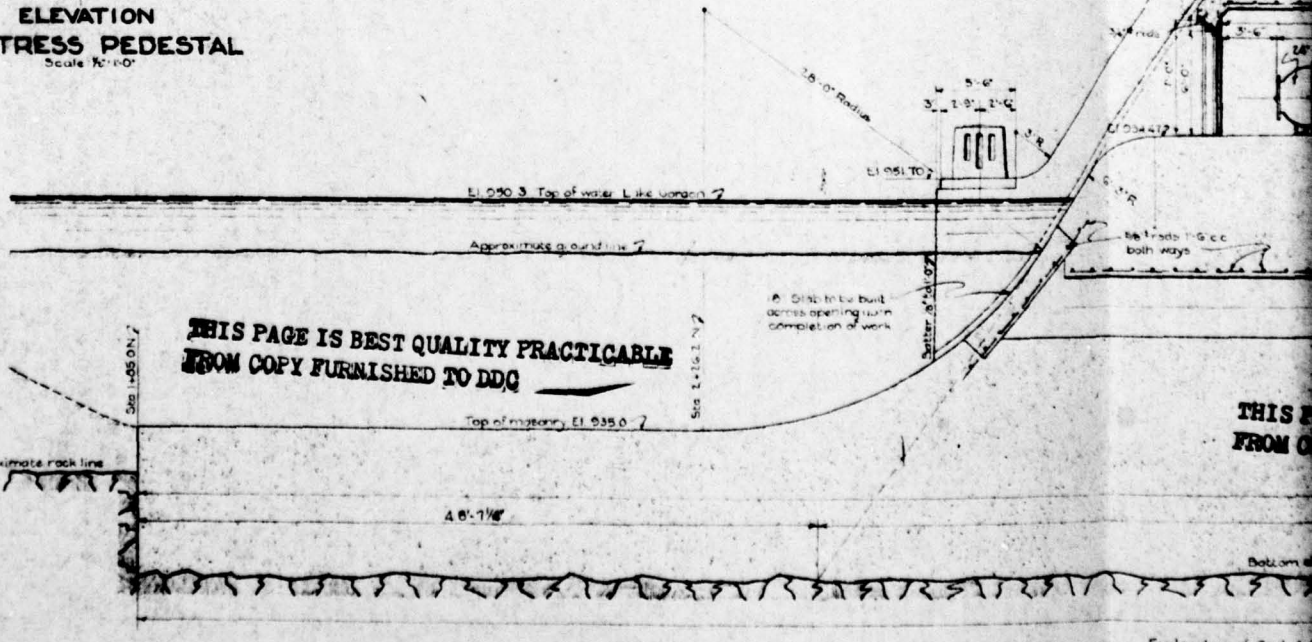
GROOVE DETAIL
Scale 1"=1'-0"



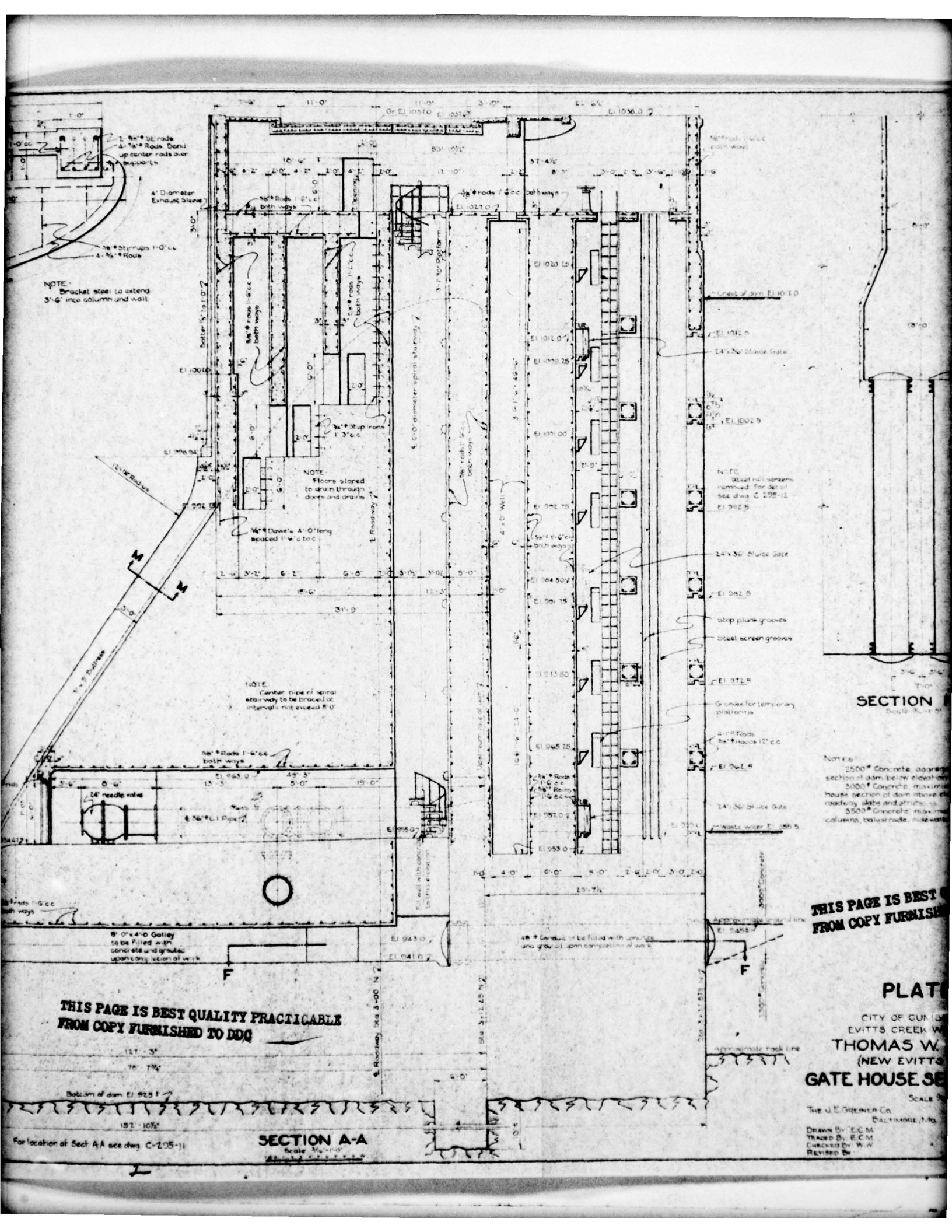
STEP IRON DETAIL
Scale 1½"=1'-0"



SECTION M-M
Scale ½"=1'-0"



For location of Sect A


NOTE:
Bracket steel to extend 3'-6" into column and wall
4" Diameter Exhaust Sleeve
NOTE
Floors sloped to drain through doors and drains
NOTE
Center pipe of spiral stairway to be braced at intervals not exceed 8'-0"
24" needle valve
8'-0" x 4'-0" Gatley to be Filled with concrete and grouted upon completion of work
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SECTION A-A
For location of Sect AA see dwg C-205-11
NOTE
Steel mill screens removed for detail see dwg C 205-12
24"x36" Sluice Gate
step plank grooves
Steel screen grooves
Grooves for temporary platforms
SECTION
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PLAT
CITY OF CUM
EVITTS CREEK W
THOMAS W.
(NEW EVITTS
GATE HOUSE SE
THE J. E. GREINER CO.
BALTIMORE, MD.
DRAWN BY E.C.M.
TRACED BY E.C.M.
CHECKED BY W.W.
REVISED BY

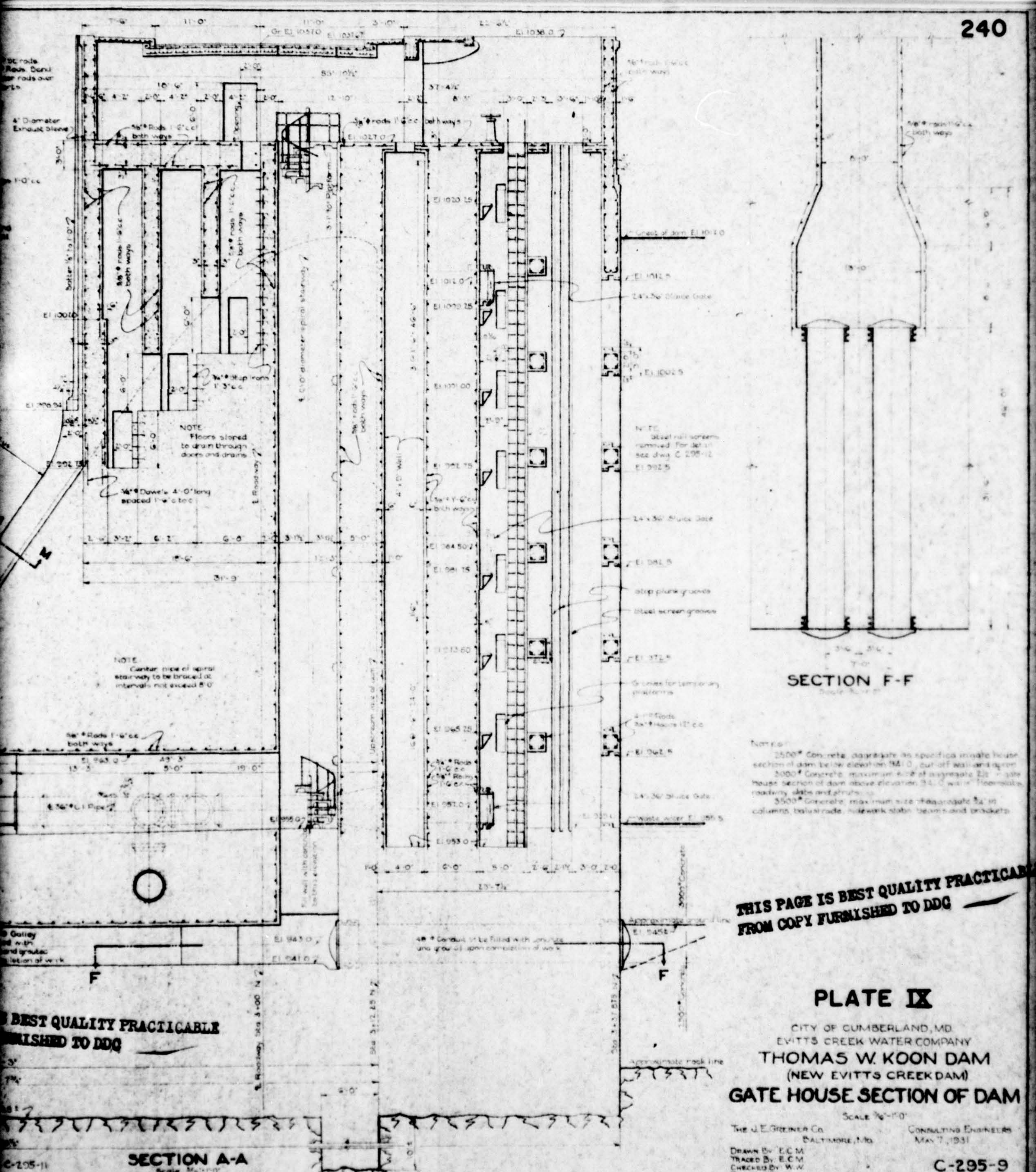


PLATE IX

CITY OF CUMBERLAND, MD.
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

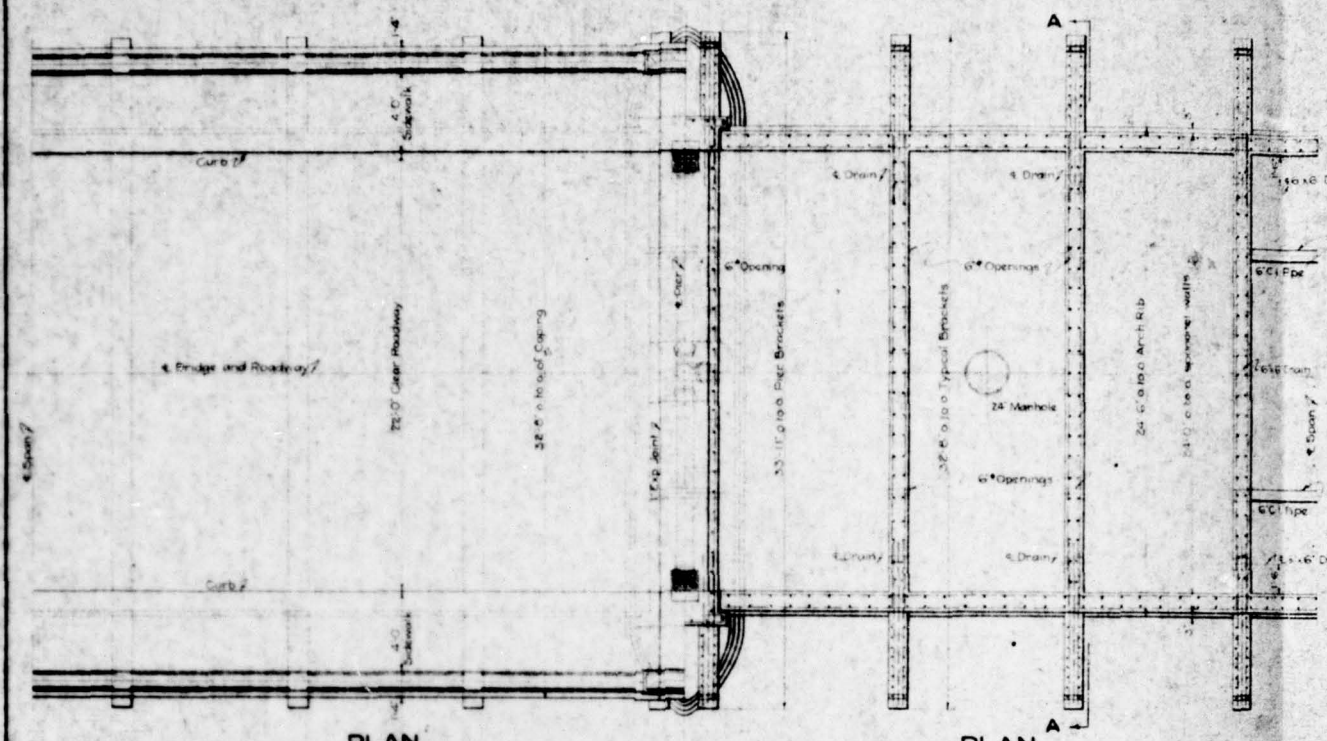
GATE HOUSE SECTION OF DAM

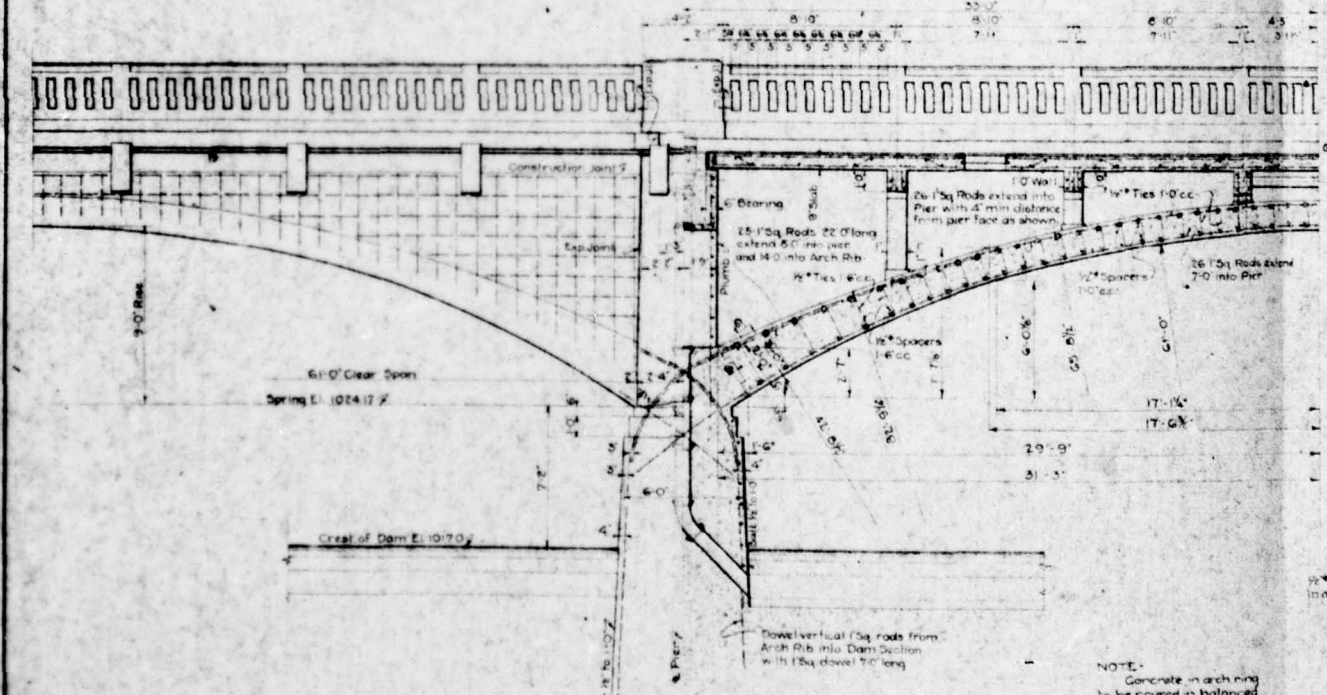
Scale 3/16"=1'-0"

THE J. E. GREINER CO. CONSULTING ENGINEERS
BALTIMORE, MD. MAY 7, 1931

DRAWN BY E.C.M.
TRACED BY E.C.M.
CHECKED BY W.W.
REVISED BY

C-295-9
SHEET 9 OF 21





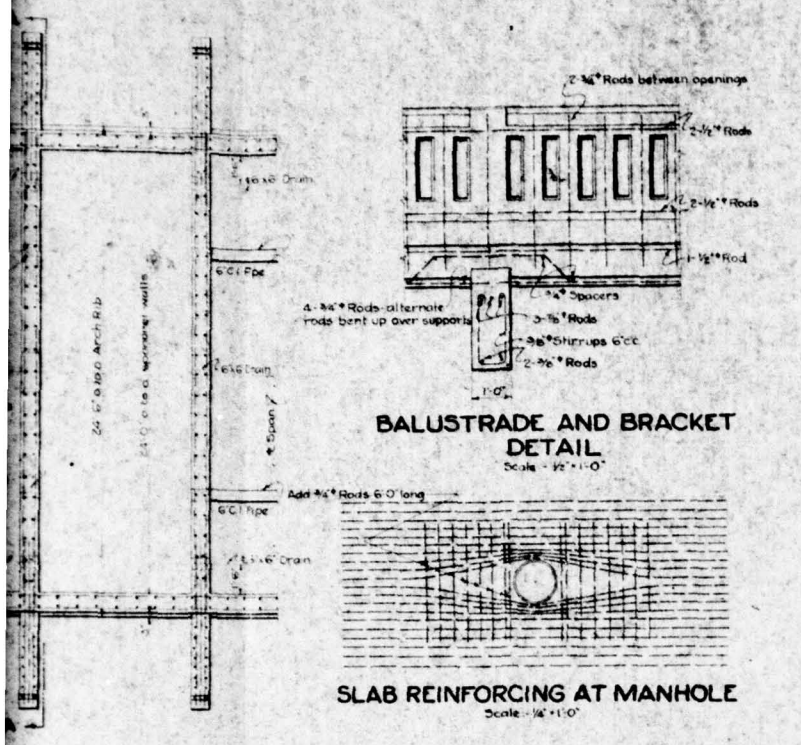
CONCRETE - MIXES

2000# Concrete, Maximum size aggregate 1 1/2" for Arch Ring, Spandrel and Cross Walls, Piers and Roadway Slab.

3500# Concrete, Maximum size aggregate 3/4" for Brackets, Balustrades and Sidewalk Slabs

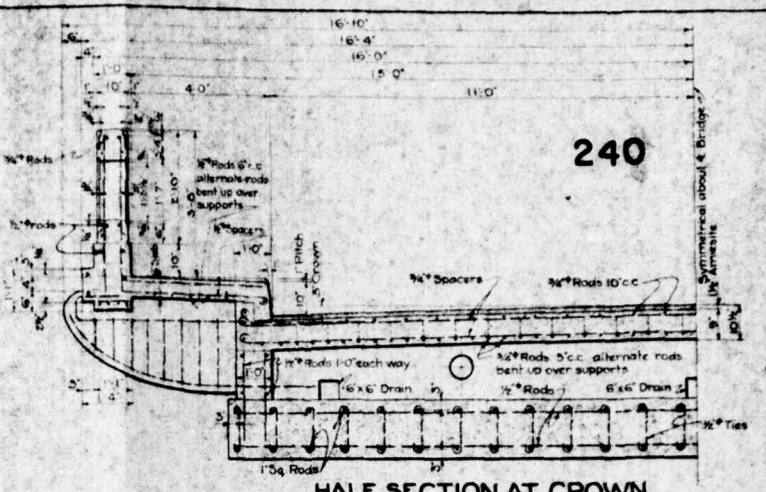
El 992.75

240

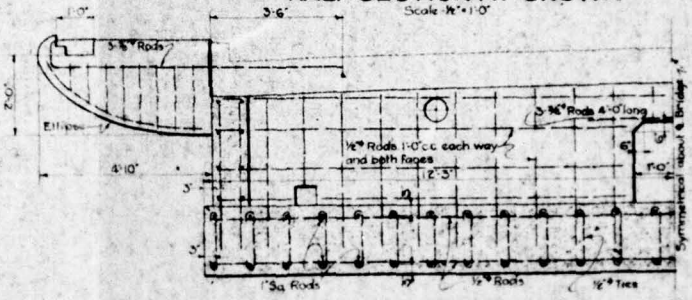


BALUSTRADE AND BRACKET DETAIL
Scale - ½" = 1'-0"

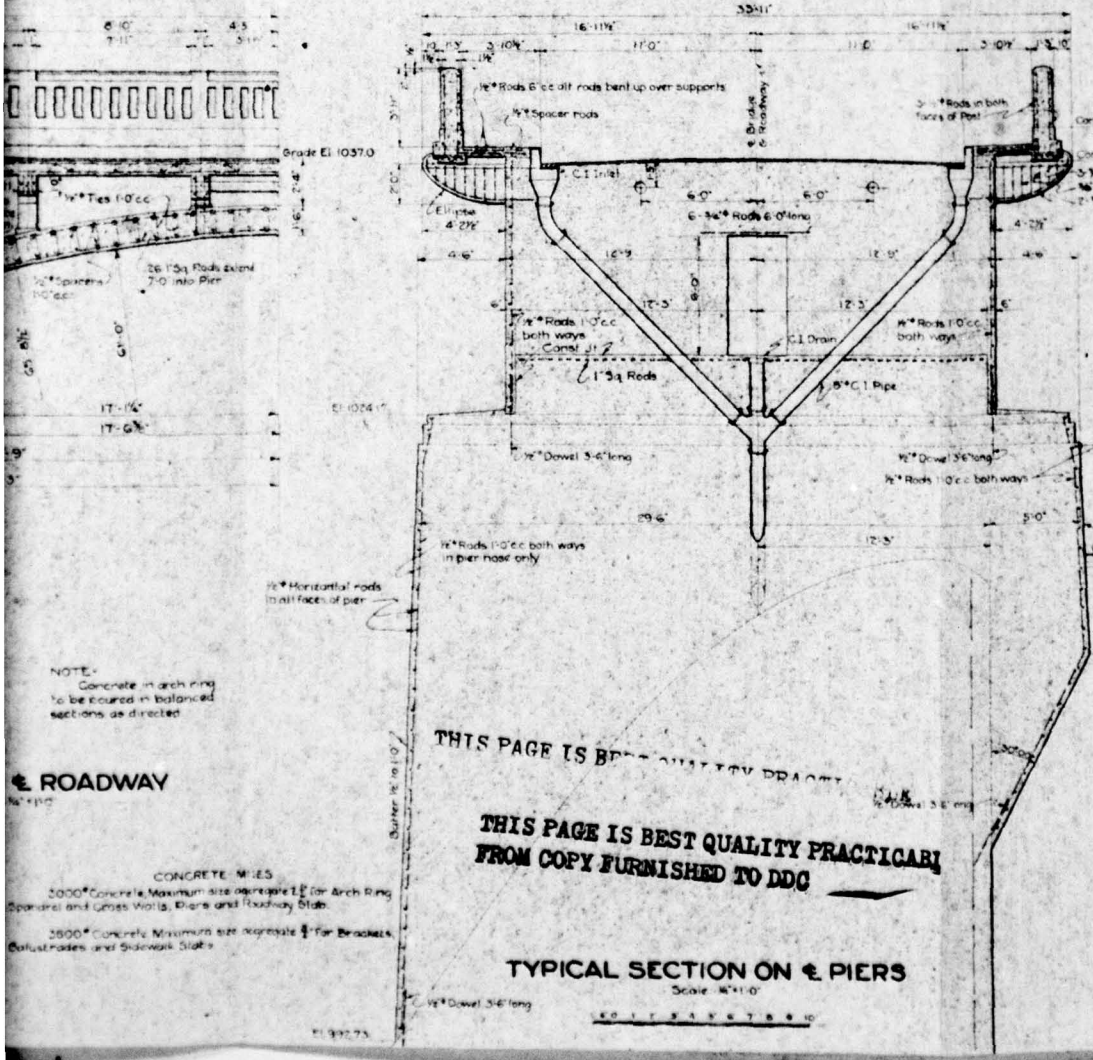
SLAB REINFORCING AT MANHOLE
Scale - ½" = 1'-0"



HALF SECTION AT CROWN
Scale - ½" = 1'-0"



HALF SECTION A-A
Scale - ½" = 1'-0"

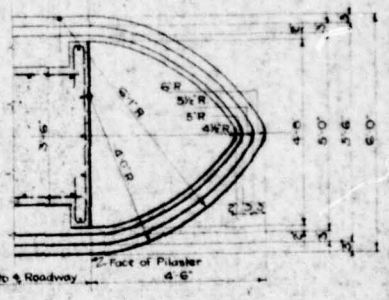


NOTE:
Concrete in arch ring to be poured in balanced sections as directed

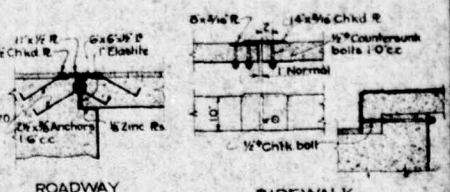
℄ ROADWAY

CONCRETE MIXES
3000# Concrete, Maximum size aggregate 1½" for Arch Ring, Spandrel and Cross Walls, Piers and Roadway Slab.
3500# Concrete, Maximum size aggregate ¾" for Brackets, Balustrades and Sidewalk Slabs

TYPICAL SECTION ON ℄ PIERS
Scale - ⅛" = 1'-0"



DETAIL OF PIER NOSE
Scale - ½" = 1'-0"



EXPANSION JOINT DETAILS
Scale - ½" = 1'-0"

PLATE X

CITY OF CUMBERLAND, MD.
AND
EVITTS CREEK WATER COMPANY

THOMAS W. KOON DAM
(NEW EVITTS CREEK DAM)

BRIDGE & PIER DETAILS

SCALE: AS NOTED

THE J. E. GREINER CO.
BALTIMORE, MD.

CONSULTING ENGINEERS
MAY 7, 1931

DRAWN BY: J.M.R.
TRACED BY: J.M.R.
CHECKED BY: W.W.
REVISED BY:

C-295-14
SHEET 14 OF 21