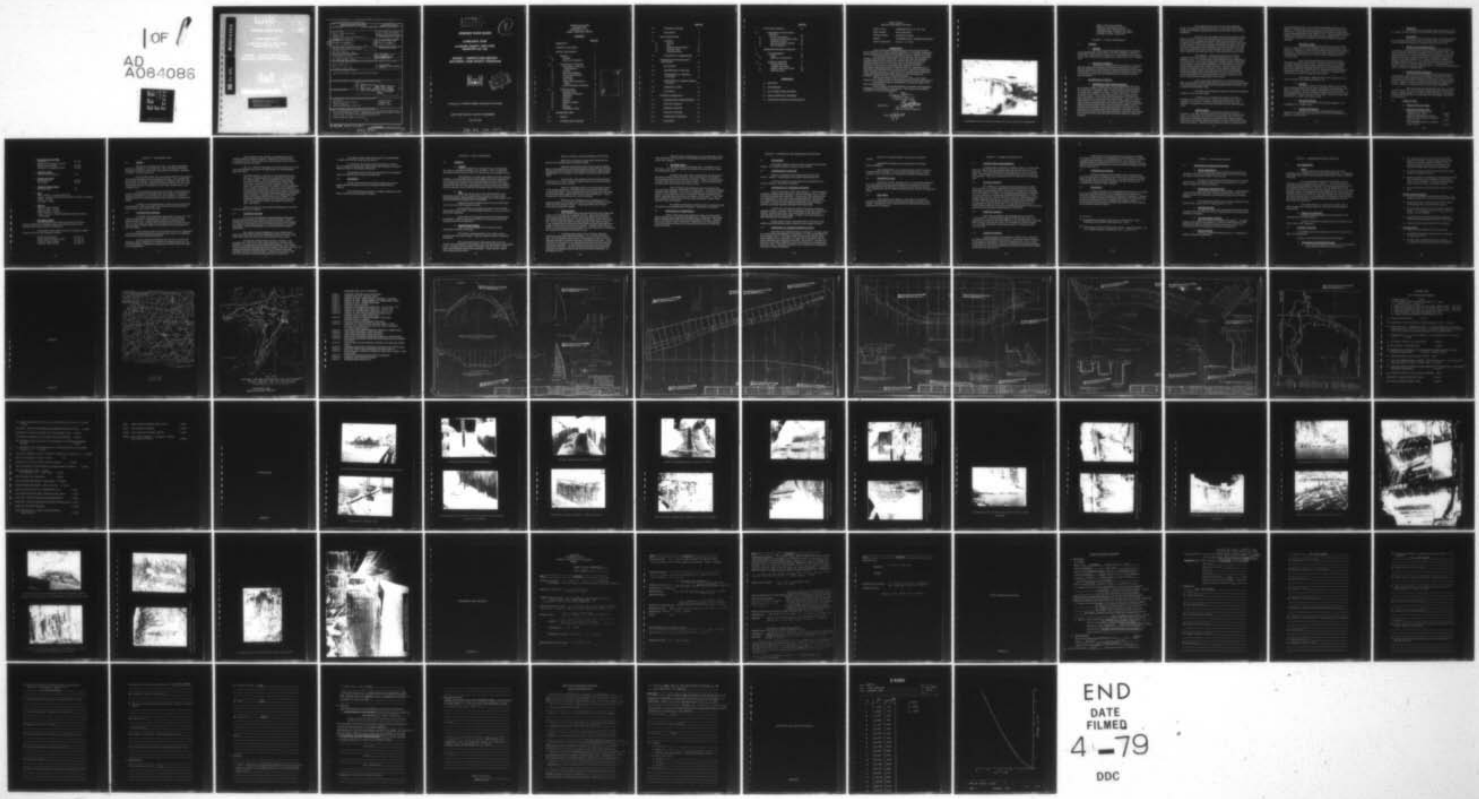
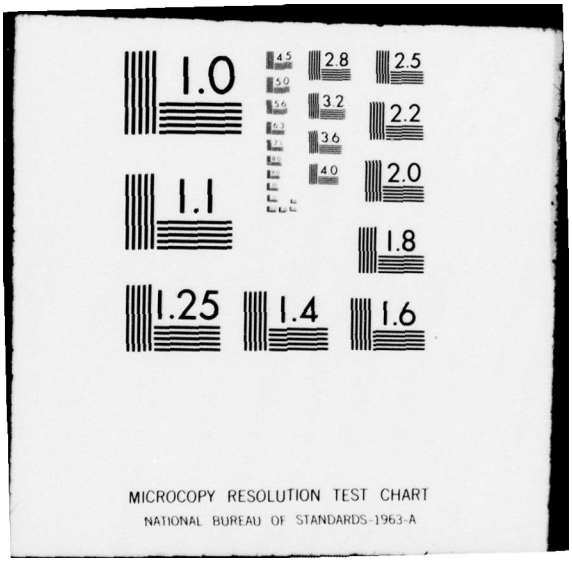
AD-A064 086 TIPPETTS-ABBETT-MCCARTHY-STRATTON NEW YORK F/G 13/2
NATIONAL DAM SAFETY PROGRAM, CANEADEA DAM (NY 464), GENESEE RIV--ETC(U)
JUL 78 E O'BRIEN DACW51-78-C-0024
UNCLASSIFIED NL

1 OF 1
AD A064086



END
DATE FILMED
4-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

GENESEE RIVER BASIN

CANEADEA DAM

ALLEGANY COUNTY, NEW YORK
INVENTORY NO. 484

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE *(and Subtitle)*
Phase I Inspection Report
Caneadea Dam
Genesee River Basin, Allegany Co. N.Y.
Inventory No. N.Y. 464

5. TYPE OF REPORT & PERIOD COVERED
Phase I Inspection Report
National Dam Safety Program

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
(10) Eugene O'Brien ~~P.E.~~

8. CONTRACT OR GRANT NUMBER(s)
(15) DACW51-78-C-0024

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Tippetts-Abbett-McCarthy-Stratton
345 Park Avenue
New York, New York 10021

411 046

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
Department of the Army
26 Federal Plaza / New York District, CofE
New York, New York 10007

(11) 28 July 1978

12. REPORT DATE
~~13. NUMBER OF PAGES~~

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*
(12) 93 p.

15. SECURITY CLASS. *(of this report)*
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*
Approved for public release; Distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

(6) National Dam Safety Program. Caneadea Dam (NY 464), Genesee River Basin, Caneadea Creek, Allegany County, New York. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*
Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Allegany County
Caneadea Dam
Caneadea Creek

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Caneadea Dam was judged to be safe.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

411 046

LEVEL II

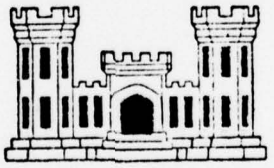
(4)

GENESEE RIVER BASIN

CANEADEA DAM

ALLEGANY COUNTY, NEW YORK
INVENTORY NO. 464

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



Prepared by: TIPPETTS-ABBETT-McCARTHY-STRATTON

NEW YORK DISTRICT CORPS OF ENGINEERS

JULY 26, 1978

GENESEE RIVER BASIN
CANEADEA DAM
INVENTORY NO. 464
PHASE I INSPECTION REPORT

CONTENTS

		Page No.
-	ASSESSMENT	-
-	OVERVIEW PHOTOGRAPH	-
1	PROJECT INFORMATION	1
1.1	GENERAL	1
a.	Authority	1
b.	Purpose of Inspection	1
1.2	DESCRIPTION OF PROJECT	1
a.	Description of Dam and Appurtenances	1
b.	Location	3
c.	Size Classification	3
d.	Hazard Classification	3
e.	Ownership	4
f.	Use of Dam	4
g.	Design and Construction History	4
h.	Normal Operating Procedures	4
1.3	PERTINENT DATA	4
a.	Drainage Areas	4
b.	Discharge at Damsite	4
c.	Elevation	5
d.	Reservoir	5
e.	Storage	5
f.	Reservoir Surface	5
g.	Dam	5
h.	Spillway	5
i.	Regulating Outlets	5
2	ENGINEERING DATA	6
2.1	DESIGN	6
2.2	CONSTRUCTION RECORDS	6

		Page No.
2.3	OPERATION RECORDS	7
2.4	EVALUATION	8
3	VISUAL INSPECTIONS	9
3.1	FINDINGS	9
a.	General	9
b.	Dam	9
c.	Concrete-lined Spillway	9
d.	Spillway Gates	10
e.	Regulating Gates	11
3.2	EVALUATION OF OBSERVATIONS	11
4	OPERATIONAL AND MAINTENANCE PROCEDURES	12
4.1	PROCEDURES	12
4.2	MAINTENANCE OF THE DAM	12
4.3	MAINTENANCE OF OPERATING FACILITIES	12
4.4	DESCRIPTION OF WARNING SYSTEM IN EFFECT	12
4.5	EMERGENCY POWER	13
4.6	EVALUATION	13
5	HYDRAULIC/HYDROLOGIC	14
5.1	DRAINAGE AREA CHARACTERISTICS	14
5.2	SPILLWAY CAPACITY	14
5.3	RESERVOIR CAPACITY	14
5.4	FLOODS OF RECORD	14
5.5	OVERTOPPING POTENTIAL	15
5.6	EVALUATION	15

		Page No.
6	STRUCTURAL STABILITY	16
6.1	EVALUATION OF STRUCTURAL STABILITY	16
a.	Visual Observations	16
b.	Design and Construction Data	16
c.	Operating Records	16
d.	Post-construction Changes	16
e.	Seismic Stability	16
7	ASSESSMENT/REMEDIAL MEASURES	17
7.1	DAM ASSESSMENT	17
a.	Safety	17
b.	Adequacy of Information	17
7.2	REMEDIAL MEASURES	17
a.	Concrete Dam and Spillway Structures	17
b.	Spillway Gates and Hoists	18
c.	Penstock Gates	18

APPENDICES

A. DRAWINGS

B. PHOTOGRAPHS

C. ENGINEERING DATA CHECKLIST

D. VISUAL INSPECTION CHECKLIST

E. HYDROLOGIC DATA AND COMPUTATIONS

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	CANEADEA DAM (I.D. NO. 464)
State Located:	NEW YORK STATE
County Located:	ALLEGANY COUNTY
Stream:	CANEADEA CREEK, GENESEE RIVER BASIN
Date of Inspection:	June 15 - 16, 1978

ASSESSMENT

Visual observations made during the course of the inspection did not indicate any severe structural deficiency or mechanical malfunction which would adversely affect the immediate safety or stability of the dam.

The total discharge capacity of the spillway and the regulating outlets is approximately 15,500 cfs. This is less than the estimated Probable Maximum Flood (PMF) of 95,000 cfs and also less than the Standard Project Flood of 47,500 cfs, both as determined using an envelope of PMF values in the Great Lakes region of New York. The project discharge capacity is therefore seriously inadequate from a hydrologic and hydraulic point of view; however, since the concrete arch dam is founded and abuts on sound rock it is considered that overtopping of the dam during the design flood would not adversely affect the stability of either the arch or the rock abutments.

The owner/operator of the dam has in effect a storm watch program and a warning system in connection with regulation of the reservoir.

No remedial measures are required to assure the safety of the dam at the present time.

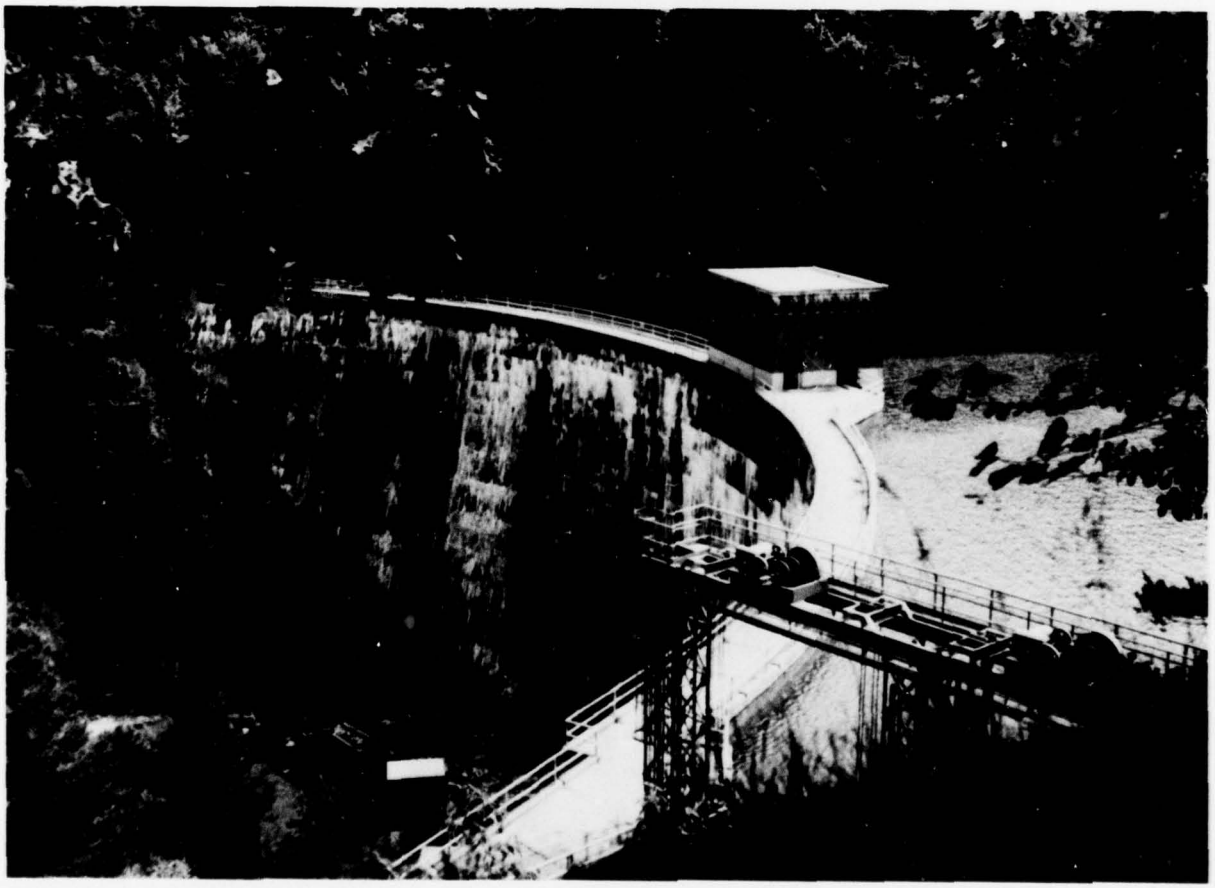
Some measures are recommended in connection with inspection, maintenance and monitoring of the project. The measures are included in Section 7 of the Inspection Report.

Eugene O'Brien, P.E.
New York No. 29823

Approved by:

Col. Clark H. Benn
New York District Engineer

Date: 28 July 1978



DOWNSTREAM FACE OF DAM AND RESERVOIR VIEWED FROM LEFT EMBANKMENT

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
CANEADEA DAM, INVENTORY NO. 464
CANEADEA CREEK, GENESEE RIVER BASIN
ALLEGANY COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the DEPARTMENT OF THE ARMY, NEW YORK DISTRICT, CORPS OF ENGINEERS by letter dated 31 March 1978, in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, 8 August 1972.

b. Purpose of Inspection

The purpose of this inspection and report is to investigate and evaluate the existing conditions of subject dam in order to: identify deficiencies and hazardous conditions; determine if they constitute hazards to human life or property; and notify the State of New York of these results along with recommendations for remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Caneadea Dam, of the constant angle arch type, has a maximum radius of 262 feet and a crest height of 140 feet above the stream bed of Caneadea Creek. At the base, the maximum section is 44 feet wide, tapering to a width of 5 feet at the crest. The arch is flanked on both sides of the steep gorge by two concrete gravity abutment sections. On the north side the abutment is 100 feet long and on the south side the abutment is 80 feet long. There is a 10-foot wide walkway on top of the dam. The dam is constructed of concrete faced upstream and downstream with paving brick to protect the concrete against frost and weather action and is composed of eleven 40-foot sections with contraction joints separating each of the sections. All contraction joints are provided with an asphaltum waterstop, running from the crest of the dam to the rock foundation, grout pipes and a metal grout stop; the joints were filled with grout after maximum contraction occurred.

The vitrified paving brick was laid with alternating header and stretcher in horizontal courses so that in the vertical plane headers and stretchers alternated from the top of the dam to the concrete foundation.

The brick was laid against wood forms for each five-foot lift in a 40-foot section of arch and after having been allowed to set for at least 24 hours, concrete was placed within the space formed by the upstream and downstream brick facing. All headers are keyed and bonded to the concrete. Both on the upstream and downstream sides of the dam the brick is terminated at the contraction joints so that there is an open joint in the facing from top to bottom between each section. The brick-work, including the contraction joints, was pointed with cement mortar.

The spillway, located at the north end of the dam adjacent to the north abutment, is concrete-lined and is cut almost entirely in rock. It is 48 feet wide, 20 feet deep and fully controlled at the upper end by two all-steel electrically operated vertical sluice gates 20 feet high by 20 feet wide supported by a concrete pier in the center. A hoist bridge is provided over the gate slots. Further control of the reservoir is effected by two low-level 54-inch diameter sluice pipes through the center section of the dam near the bottom and extending 80 feet downstream with a Howell-Bunger valve at the end of the line. A weir approximately 100 feet downstream of the dam maintains a low pool to submerge the Howell-Bunger valve outlets.

Above each sluice pipe there is a 6-foot penstock line that was installed to furnish water should a power plant be built downstream. Each penstock line has an inlet gate at the upstream face of the dam, and is open at the downstream face.

Drawings and photographs indicate a trashrack immediately upstream of the low level outlet.

A gatehouse is provided at top-of-dam level with a traveling hoist for the four gates. A traveling trashrack rake hoist is installed, but not used. A remote reading water level gage is also installed. A separate hoist house is provided over each Howell-Bunger valve.

Spillway Gates

Two vertical lift, tractor-type spillway gates are provided. Each gate is 20 feet wide by 20 feet high with upstream skin plates. The sills are at El 1420 and the top of gates are at El 1440. A rope hoist, provided for each gate, is mounted on an overhead bridge. Bottom seals are wooden timbers fastened to the gates and sealing against steel sill channels. Drawings show upstream J-seals but these have not

been installed and gates seal on greased downstream surfaces of end members. Spillway gates and hoists were manufactured by Philips and Davies, Inc. Hydraulic jacking mechanisms, for cracking and closing, and seal greasing systems were added in 1972. Hoist and jacking control stations are located at the north end of the hoist bridge column. Both gate hoists and jacking mechanisms also have provisions for manual operation.

Regulating Outlets

The two low-level 54-inch sluices each are provided with 7'-6" wide by 7'-8" high caterpillar gates above the inlets. The gates are suspended by links and chains that are dogged at the gatehouse floor level. The gate hoist is a 40-ton traveling gantry-type with an overhead rope hoist with hook to serve the two sluice gates and two penstock gates.

New 54-inch Howell-Bunger (H-B) valves regulate discharge from the two sluice lines. The H-B valves have motorized Limitorque operating stands mounted in separate hoist houses above the valves; operating stands have provisions for manual operation. These H-B valves were installed in 1972, replacing original hydraulic-operated Johnson-type valves. The H-B valves can be operated from the gatehouse or from the separate valve houses.

Sluice gates, penstock gates and the gatehouse hoist were manufactured by Philips and Davies, Inc.

b. Location

The dam is located on Caneadea Creek at its junction with the Genesee River and in a narrow gorge about 300 feet deep. The site is 1-1/2 miles from the village of Caneadea and about 60 miles south of Rochester. The gorge widens out rapidly above the dam forming Lake Rushford, 2 miles long and 12 miles wide, covering 800 acres and impounding 1.2 billion cubic feet of water.

c. Size Classification

The dam is more than 125 feet high; therefore, it is considered to be a "large" dam.

d. Hazard Classification

The dam is in the "high" hazard potential category. Failure of the dam would cause possible loss of life and destruction of property, including roads.

e. Ownership

The dam belongs to Caneadea Power Corporation, which is a wholly owned subsidiary of Rochester Gas and Electric Corporation.

f. Use of Dam

The dam is used to control the flow of the Genesee River and to impound water for the use of the power plants of the Rochester Gas and Electric Corporation in Rochester during the dry months.

g. Design and Construction History

The dam was built by the Caneadea Power Company, a subsidiary of the Rochester Gas and Electric Corporation (RGE). The design originated with and was patented by Lars Jorgensen. The plans were prepared by the engineering department of the Rochester Gas and Electric Corporation, and the construction was carried out under the direction of its chief engineer, E.R. Crofts, with Arthur Whitbeck as resident engineer on the job. The plans were checked and approved by the State of New York Conservation Commission. The contractor was Gannett, Seelye and Fleming, Engineers, Inc., of Harrisburg, Pennsylvania, with E.M. Kayser as superintendent.

h. Normal Operating Procedures

The water level in the lake is maintained near the top of the spillway gate, El 1440, from Memorial Day until shortly after Labor Day to accommodate waterfront activities on the lake. At other times the water is lowered, sometimes in the order of 60 feet below top of dam. Gates and valves are operated by the Genesee District staff of RGE according to instruction from the RGE central dispatchers.

The sluice gates are normally kept full open just above the sluice inlet, and may be lowered if required for work at the outlet valves. Howell-Bunger valves release water according to instructions from the RGE dispatchers to provide water for downstream hydro plants and condensers.

1.3 PERTINENT DATA

a. Drainage Areas (sq. miles)	61
b. Discharge at Damsite (cfs)	
Maximum known flood at site (September 28, 1967)	13,800
Maximum regulating gate outlets	1,900
Maximum gates spillway at maximum pool, El 1443	13,600
Total discharge capacity at maximum pool, El 1443	15,500

c. Elevation (ft above MSL)

Top of Dam	El 1443
Maximum pool design surcharge	
Spillway crest (gated)	El 1420
Streambed at centerline of dam	El 1315

d. Reservoir (miles)

Length of recreation pool	3.85

e. Storage (acre-feet)

Recreation pool	25,400
Top of Dam	27,000

f. Reservoir Surface (acres)

Recreation pool	578

g. Dam

Type - Gravity - constant angle arch
Length - 440-foot arch plus two abutments 180 feet = 620 feet
Height - 125 feet
Top Width - 5 feet

h. Spillway

Type - concrete channel
Length of Weir - 48 feet
Crest elevation - 1420 feet
Gates - 20-foot x 20-foot electrically operated vertical sluice gates

i. Regulating Outlets

Two low-level 54-inch sluices pass through the dam and are controlled by caterpillar gates above the inlets and 54-inch Howell-Bunger valves regulate the discharge.

The penstock intake gates, though not regulating outlets, are part of the low-level waterway complex.

Sluice Intake Centers	El 1317.75
Sluice Outlet (D/S face of dam)	El 1317.25
Penstock Intake Centers	El 1336.75
Penstock Outlet Centers	El 1327.92

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The dam is a constant angle arch. The design originated with and is patented by Lars Jorgensen. The plans were checked and approved by the State of New York Conservation Commission, assisted by Hugh L. Cooper of New York.

The "constant angle" type was chosen because of its economy in volume of concrete over the constant radius type. Two concrete arch dams similar in character and proportions, the Salmon Creek Dam built in Alaska in 1914 and the Kerkhoff Dam built in California in 1918, were serving their owners successfully for years before construction of the Caneadea Dam.

From the examples cited above and others, we conclude that the type and proportion of Caneadea Dam was in line with engineering practice at that time in this country for such structures. A number of prominent arch dam consulting engineers also reviewed and approved the design.

In design of the Caneadea Dam, arches are assumed to take full water load. This assumption is conservative since the cantilever action carries some portion of the load.

2.2 CONSTRUCTION RECORDS

An article in the Engineering News-Record of August 23, 1928, pages 268 through 272, describes the "Building (of) a Brick-Faced Concrete-Arch Dam". Another article in the same magazine dated May 14, 1936, page 699 states that after eight years of service the dam shows leaching on brick surface but no peeling or structural failure of the brick facing.

Some original spalling of the brickwork was due to deflections. It has been observed that the top of the dam near station 3+20 deflected about an inch in the downstream direction.

In some cases the downstream face and top of the dam are exposed to direct sunlight and are subject to temperature stresses, but the brick facing is practically an integral part of each section and cannot move independently.

Free movement of the structure is restrained by the two concrete (gravity section) abutments - therefore any movement due to stresses set up by forces acting upon the structure must be taken up by the arch section of the dam.

Mr. L.E. Jackson's inspection of the dam during May of 1947 gives the following report about the discoloration on the downstream face of the dam:

> The white deposit on the brick on the downstream face of the dam is an efflorescence to be expected on brick work in a damp location. Water absorbed by mortar between the bricks or from other sources dissolves certain salts in the lime or cement and upon evaporating, leaves these salts as a white deposit on the surface. This is particularly true of certain types of brick. The fact that the deposit is heaviest below certain brick joints may be due to water which has seeped through the dam along planes between successive lifts of concrete. Practically all of the deposit was made during the first year after the dam was completed. No seepage nor additional deposit has been noted since that time. The structure has been only slightly injured if at all by this action.

There is no record of any structural deficiencies in the dam or its foundation and abutments.

2.3 OPERATION RECORDS

In 1947 the measurement of water dispatched downstream was measured by means of a graphic pond level recorder. A chart showing the volume of water in the reservoir at any pond level enables the operator to determine the amount of water discharged by comparing the storage volumes corresponding to pond levels before and after discharging.

The volume of water discharged was also determined by means of a chart which showed the discharge through the valves in the sluice pipes below the dam for any pool level and valve opening.

The Genesee District Hydro Operation maintains a log including date, time of day, lake surface elevation, gate and valve operations, and pertinent data regarding the operations. Lake surface levels are recorded at the Genesee District office in Fillmore, and U.S.G.S. gaging stations, and maintained throughout the Genesee watershed including one for the Caneadea Creek. Records are also kept of gate and valve operations during periodic inspection by consultant.

The maximum water level ever reached was approximately 15 inches over the top of the dam (El 1444.2).

For some time the reservoir level was kept at El 1439.0 due to a previous problem with a flash flood which required some quick releases which caused damage downstream.

The reservoir level is now kept near the top of the spillway gates; the overflow helps keep the surface clean.

2.4 EVALUATION

Records and drawings were readily available at the RGE central office in Rochester and at the Genesee District office in Fillmore.

The available data reviewed is considered adequate for this Phase I inspection and evaluation of safety.

SECTION 3 - VISUAL INSPECTIONS

3.1 FINDINGS

a. General

A visual inspection of Caneadea Dam, near Caneadea, was made on Thursday and Friday, June 15 and 16, 1978. At that time the reservoir level was at El 1439.6 ± near the top of the spillway gates.

The gatehouse is usually kept locked to prevent malicious mischief. It was reported that the wood railings and stairs leading down to the spillway gate structure have been damaged more than once and had recently been repaired. The chain link fence at the end of the right abutment had been cut and needed repairs to prevent people from climbing onto the walkway on top of the dam and gaining access to the gatehouse.

b. Dam

There are numerous areas with white deposits on the downstream face of the dam; deposition of as much as 2 inches thick has been observed. Minor leakage on downstream face of dam appears to be along horizontal and vertical joints of brickwork.

Seepage was also observed coming from the downstream face of the north (left) concrete abutment.

The foundation rock at the lower level is thinly bedded shale which breaks easily. Rock immediately above the crest near the left abutment is sandstone.

Large areas of the downstream face of the left abutment have spalled. There is some grass growing out of both the vertical and horizontal joints of the brickwork.

c. Concrete-lined Spillway

There is general spalling of the concrete surface immediately upstream of the gates.

The spillway walls downstream of the gates and the spillway pier have been gunited. There are numerous cracks on the face of the pier.

The second weep hole on the interior face of the left channel wall downstream of the spillway gates was discharging approximately 4 gpm. The first hole downstream of the gates was dry at time of visit. There were additional weep holes downstream - some were dry, others were weeping small amounts.

There was debris in channel including one rock slab.

There was no leakage on chute walls except through the last two monoliths before the abrupt plunge.

There are exposed rebars and several sizable spalled areas on the exterior face of the right spillway chute wall and carbonate deposits near the vent holes in the spillway chute wall. There is also deterioration of the concrete on both sides of several vertical monolith joints.

The end slab of the spillway chute had been damaged and removed by a wave of water traveling down the chute leaving rebars of the former floor slab exposed.

There is substantial erosion on the downstream portion of the sloping chute floor. The flatter floor slab near the abrupt end is also badly eroded. At the downstream end of the high right wall where the chute slab drops sharply there is some local undermining - a chunk of concrete several cubic feet in volume is missing.

There was some seepage over an approximate 100 ft length downstream on the right side and 200 ft length downstream on the left side of the spillway channel. Water apparently comes through at the shale overburden contact.

d. Spillway Gates

Both spillway gates were closed and the lake surface was about 0.4 ft below the top of gate (El 1440.0). Side seals were tight. At the north gate there was a slight leak at the bottom of the north end and moderate leakage squirting just above the bottom corner of the south end. At the south gate there was light leakage at both bottom corners. It was reported that the north gate bottom timber had been replaced in the spring of 1978 and was thought to be warped. Upstream side J-seals as shown on the drawings were not installed, but were stored in the gatehouse. The visible gate surfaces had patches of rust.

No defects were noticed on the hoisting equipment except the ropes which needed lubrication, e.g. at south hoist drum. Also, all four thimbles were missing or disengaged at upper rope fixed terminals resulting in excessive bending and flattening of ropes. It was said that the ropes were to be replaced and that improved rope terminals were being considered. It was reported that the hoist motors had been rebuilt five years ago. The RGE General Maintenance had greased the machinery and replaced brake shoes during the annual inspection, in the spring of 1978.

The gate jacking mechanisms and seal lubricating systems were installed in 1972 and had no visible defects except some heavy rust on the jack cylinders.

e. Regulating Gates

The sluice gates were dogged open, immediately above the sluice. They had been lowered and raised at the time the H-B valves were installed in 1972.

Penstock inlet gates were in their normal closed position. The north penstock opening was dry. The south penstock was leaking a small amount judged to be in the order of 20 gpm. There is a small amount of weed growth at the invert of the south outlet. It was reported that the penstock gates were inspected by divers in 1972.

The H-B valves were closed and the record shows they have both been operated several times in recent years. Operating machinery appeared well lubricated. A low weir is maintained to submerge the valve outlets, but the pond level was at a level that resulted in freezing during winter, requiring sawing the ice in the vicinity of the valves. It was said that a simple low-level water line was being considered to keep valves operable during cold weather.

The gatehouse equipment including hoists, dogging devices and special tools appeared well maintained, serviceable and secured.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate any severe structure deficiency or mechanical malfunction which would adversely affect the immediate safety of the dam. However, there is continuous need of inspection, maintenance and repair programs to see that present problems do not become serious enough to affect the safety of the dam.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The Howell-Bunger valves are used to regulate the low-level outlets. The spillway regulates outflows above El 1420.

4.2 MAINTENANCE OF THE DAM

There is no operation and maintenance manual for the project. However, maintenance of the project appears adequate.

No regular maintenance procedures are established for the masonry structure, abutments or spillway.

4.3 MAINTENANCE OF OPERATING FACILITIES

With the exceptions noted under Section 3, visible equipment comprising spillway gates and hoists, and the regulating gates, valves and hoists appeared well maintained. Records show that spillway gates and regulating H-B valves have been operated frequently and recently. It is understood that five-year periodic inspections are conducted by a consultant, and that the RGE General Maintenance grease machinery annually, and repair operating equipment when requested.

In April 1978, the Genesee District formulated procedures regarding the dam, including weekly inspections of the dam and adjacent property, monthly alarm tests, and annual check of the water level recording chart in the Fillmore office. Further O and M procedures are being prepared and are in draft form.

During summer months, the water level is allowed to raise slightly above the spillway gates to clear the lake surface of debris.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

The water level behind the dam is monitored. The gage system is a bubbler-type manufactured by Honeywell. An alarm sounds when the level reaches 1440.8. The alarm system sounds at the Fillmore office during weekday hours of operation. At night and on weekends there are three dispatchers who alternate active duty - one week on, one week off; these men have alarms installed in their homes which are activated when they are on duty. The alarm connection to load dispatcher in Rochester is in process of being established.

The dam is inspected weekly; the alarms are checked monthly.

Standardized procedures to handle alarms are currently being established.

The load dispatcher is in constant contact with the National Weather Service at Buffalo. In event of an approaching storm a hydro operator is sent to the dam to be available to regulate the water levels.

4.5 EMERGENCY POWER

Conduits have been installed, and a 35 kVA portable generator was purchased for emergency power operation of equipment at the dam. It was reported that the generator had been brought to the dam and had been satisfactorily used to operate the spillway gates and the H-B regulating valves.

4.6 EVALUATION

There appears to be nothing in the present operational or maintenance procedures which would adversely affect the safety of the project. Maintenance of the Caneadea Dam and appurtenant features is considered to be adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Caneadea Dam is located on Caneadea Creek, 2.2 river miles above its junction with the Genesee River and about 60 miles south of Rochester. The total drainage area contributing to the dam is 61 square miles. The topography consists of low, rounded hills, most of which are well-forested. There are no important lakes or reservoirs in the drainage area.

5.2 SPILLWAY CAPACITY

The spillway is a rectangular concrete channel 48 ft wide and 20 ft deep. It is fully controlled at the upper end by two all-steel, electrically operated sluice gates, 20 by 20 ft, supported by a concrete pier in the center 8.0 ft wide. No head-discharge relation was available, so it was necessary to estimate the discharge characteristics. It was assumed that the flow, through the gates, would be supercritical and the spillway entrance would act as a broad-crested weir with a coefficient of 3.09. The computed spillway capacity at maximum head (23.0 ft), corresponding to the top of the dam, is 13,600 cfs (223 cfs/sq.mi.). The low-level outlets at the dam have a discharge capacity of about 1900 cfs making the total discharge capacity equal to 15,500 cfs.

5.3 RESERVOIR CAPACITY

The storage provided by the Caneadea Dam at El 1440 is 1,110 million cu. ft (8,300 million gallons or 25,500 acre-feet). Its capacity at the spillway crest (el 1420) is 23,600 acre-feet and 27,300 acre-feet at the top of the dam (El 1443), thus providing a surcharge storage of 3,700 acre-feet which is equivalent to about 4.7 inches of runoff over the basin.

5.4 FLOODS OF RECORD

A gaging station was operated from 1949 to 1968, inclusive, at a point 2 miles downstream from the dam. The maximum peak discharge for the period of record was 13,800 cfs on September 28, 1967. It will be noted that this discharge is 200 cfs greater than the estimated capacity of the spillway, and may be explained by the fact that the low-level outlets could pass more than 200 cfs.

Floods above the gaging station are significantly modified by storage in the reservoir, and therefore the record of floods is unlikely to indicate true frequency of the drainage area. From regional flood frequency relations established by the U.S. Geological Survey, the mean annual flood for this drainage area is 2900 cfs and the estimated 100-year flood is 7200 cfs. [1]

5.5 OVERTOPPING POTENTIAL

A Probable Maximum Flood (PMF) for the Caneadea Creek was determined from an envelope curve of PMF values in the Great Lakes region in New York to be 95,000 cfs. [2] From this discharge, the peak of the Standard Project Flood is estimated to be about 47,500 cfs or 3.06 times the computed outflow capacity.

5.6 EVALUATION

In view of the fact that the Standard Project Flood is 3.06 times the computed outflow capacity, it is considered that the spillway is seriously inadequate from a hydraulic and hydrologic viewpoint. However, to most accurately evaluate the probable outflow from the Standard Project Flood and the deficiency of the Caneadea Dam spillway capacity, it would be necessary to develop a complete hydrograph and route it through the substantial surcharge storage.

---

[1] Magnitude and Frequency of Floods in the United States, Part 4, Geological Survey Water Supply Paper 1677, 1965.

[2] Design Basis Floods for Nuclear Power Plants, Regulatory Guide 1.59, U.S. Nuclear Regulatory Commission, Rev. 2, August 1977.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual observations did not indicate either existing or potential conditions of the structure itself which would adversely affect the safety or structural stability of the arch dam.

Numerous minor problems were observed in the concrete-lined spillway, the spillway gates and their intermediate pier, none of which is expected to cause instability.

b. Design and Construction Data

Some design calculations are available. Correspondence of the Constant Angle Arch Dam Company reveals that the design was checked by the RGE Corporation and received the approval of the State Engineer.

Some construction data is found in the Engineering News-Record article, pages 268-272, dated August 23, 1978.

c. Operating Records

The maximum water level ever reached was approximately 15 inches over top of dam (El 1444.2), indicating that the dam can safely withstand overtopping.

d. Post-construction Changes

There have been some construction changes. An eroded spillway slab surface was repaired. In 1972 the Howell-Bunger valves replaced the original hydraulic-operated Johnson-type valves. The valve houses had to be enlarged to suit the new equipment.

e. Seismic Stability

The dam is located in Seismic Zone No. 2, therefore no seismic analyses are warranted.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Visual observations made during the course of the inspection did not indicate any severe structural deficiency or mechanical malfunction which would adversely affect the immediate safety or stability of the dam.

The total discharge capacity of the spillway and the regulating outlets is approximately 15,500 cfs. This is less than the estimated Probable Maximum Flood (PMF) of 95,000 cfs and also less than the Standard Project Flood of 47,500 cfs, both as determined using an envelope of PMF values in the Great Lakes region of New York. The project discharge capacity is therefore seriously inadequate from a hydrologic and hydraulic point of view; however, since the concrete arch dam is founded and abuts on sound rock it is considered that overtopping of the dam during the design flood would not adversely affect the stability of either the arch or the rock abutments.

The owner/operator of the dam has in effect a storm watch program and a warning system in connection with regulation of the reservoir.

b. Adequacy of Information

Adequate information and data were available for the performance of this investigation.

Records of previous inspections were not available at the time of this Phase I inspection.

7.2 REMEDIAL MEASURES

No remedial measures are required to assure the safety of the dam at the present time.

However, the following measures are recommended.

a. Concrete Dam and Spillway Structures

1) Grass and other vegetation growing out of the brickwork and concrete abutments should be removed.

2) The seepage coming from the left (north) abutment should be monitored. If the seepage remains insignificant no action is required. However, if the seepage gets worse and becomes significant, the need for remedial action should be investigated.

3) An attempt should be made to clean inoperative weep holes in the spillway channel.

4) Initiate a program of rehabilitation of concrete structures with exposed rebars and spalled or eroded surface areas of walls and slabs. Priorities for repair would depend upon the severity of damaged concrete.

5) Prepare Maintenance and Inspection Manuals for the dam.

b. Spillway Gates and Hoists

1) Prepare an Operation and Maintenance Manual. It is understood that such a manual is already in preparation.

2) Determine source of bottom leakage at south side of north spillway gate, and correct the problem.

3) Revise drawing 31430-73 to show as-built side seal details. It is understood that the J-seal, presently shown, was not installed.

4) Lubricate hoist ropes and improve fixed terminals where thimbles are presently missing or disengaged.

5) Clean and coat outside surface of jack cylinders.

c. Penstock Gates

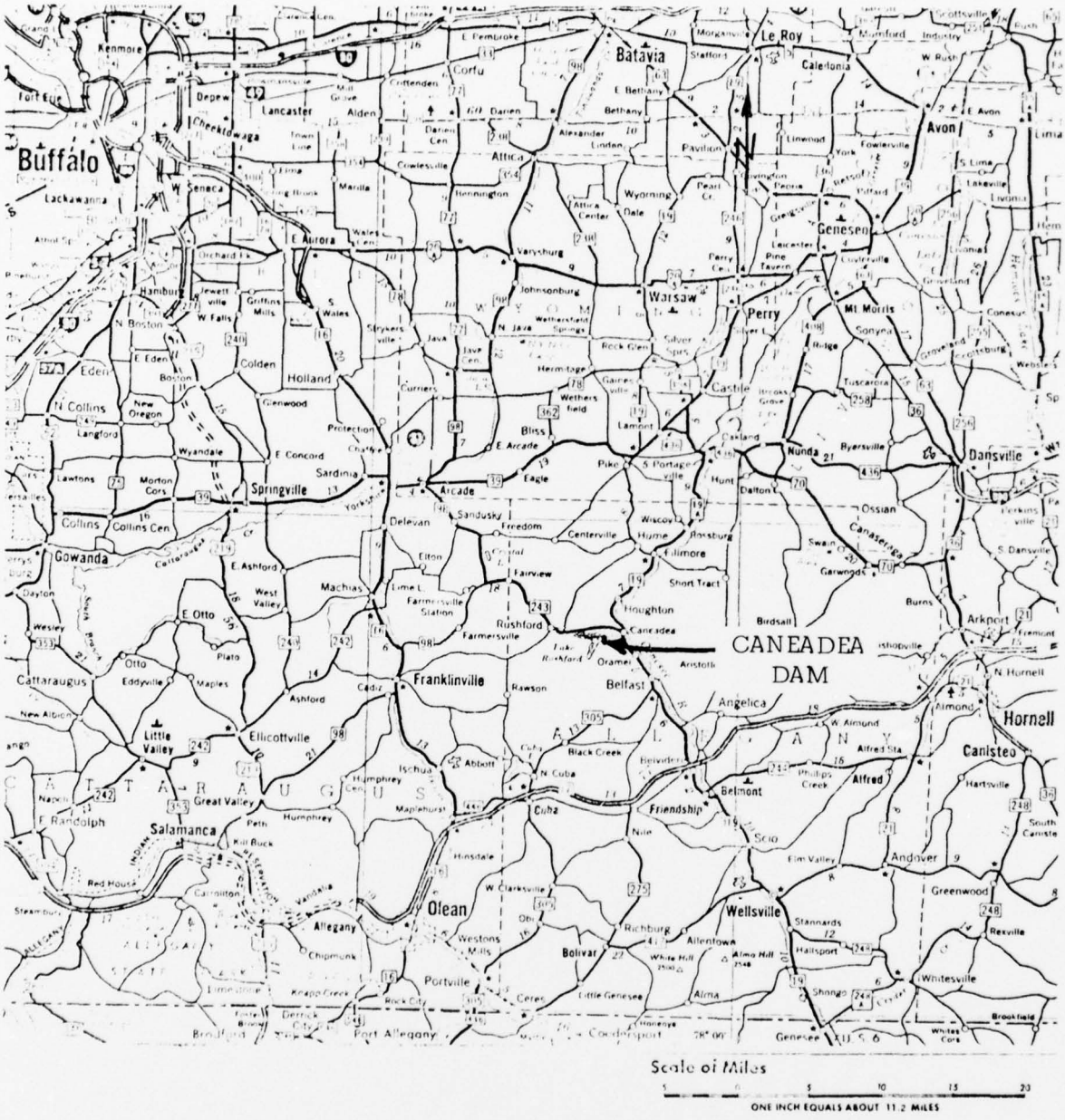
1) Clean out weed growth from south outlet pipe.

2) Periodically record flow rate from south outlet pipe, at least once a year.

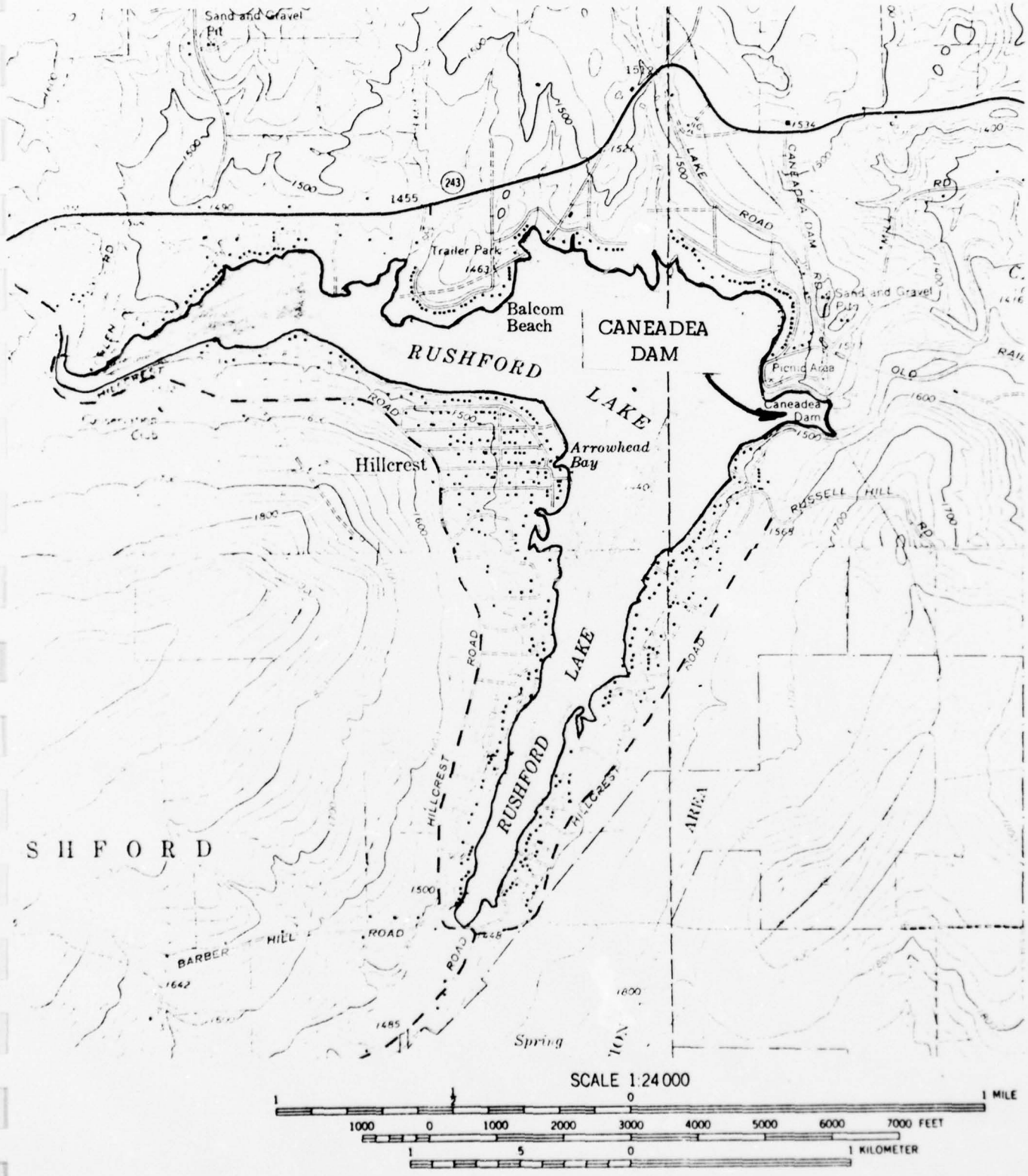
3) Provide means to prevent icing at H-B valves. It is understood this is presently under consideration.

DRAWINGS

APPENDIX A



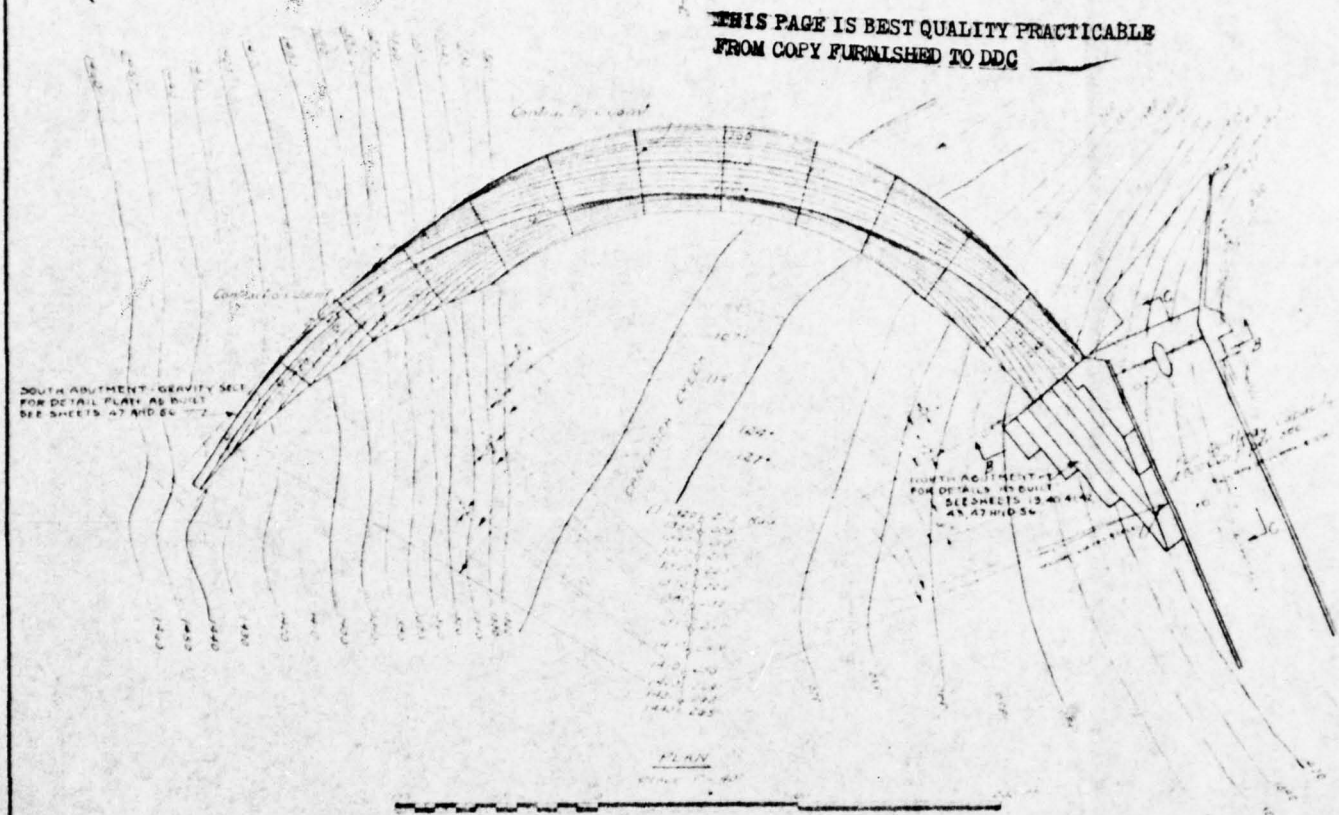
VICINITY MAP
CANEADEA DAM



TOPOGRAPHIC MAP
CANEADEA DAM AND RESERVOIR

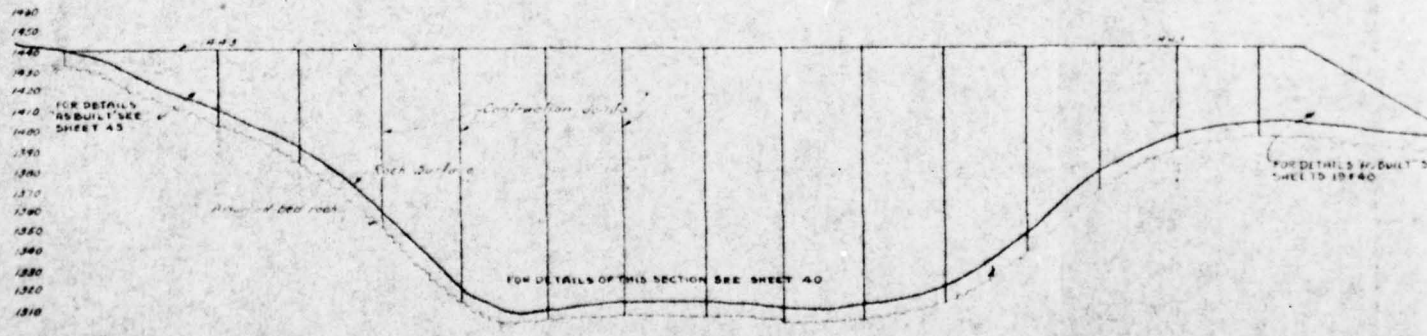
CANEADEA DAM LIST OF DRAWINGS

31430-1	PROPOSED CONSTANT ANGLE ARCH DAM
31430-2	GENERAL PLAN AND LOCATION MAPS
31430-3	DETAILS OF DAM - BRICK FACING, WALKWAY & RAILINGS
31430-4	DETAILS OF DAM - ARRANGEMENT OF CONTRACTION JOINTS
31430-5	DETAILS OF DAM - INTAKE STRUCTURE
31430-8	SPILLWAY PLAN & PROFILE
31430-13	DETAILS OF CONTRACTION JOINTS STA. -0+00 TO STA. 1+60
31430-14	DETAILS OF CONTRACTION JOINTS STA. 2+00 TO 3+20
31430-15	DETAILS OF CONTRACTION JOINTS STA. 3+60 TO 5+60
31430-16	DETAILS OF DAM-CROSS SECTION AT STATION 3+00 (CENTER LINE OF INTAKE STRUCTURE)
31430-19	REVISED DESIGN OF NORTH ABUTMENT & SPILLWAY ENTRANCE-PLAN & DETAILS
31430-36	PLAN OF SLUICES DOWNSTREAM FROM DAM
31430-40	ELEVATION OF DAM SHOWING ORIGINAL EARTH & ROCK PROFILE ON ℄ OF BASE & ℄ OF CUT-OFF WALL & LOCATION OF STEEL & GROUT HOLES
31430-41	DAM-NORTH ABUTMENT-ISOMETRIC DRAWING & STRESS SHEET
31430-42	DAM-NORTH ABUTMENT-CROSS SECTIONS
31430-43	DAM-NORTH ABUTMENT-CROSS SECTIONS
31430-44	DAM-SOUTH ABUTMENT-ISOMETRIC DRAWING & STRESS SHEET
31430-45	DAM-SOUTH ABUTMENT-CROSS SECTIONS SHOWING THE CENTERS OF GRAVITY
31430-47	PLAN OF BASE OF DAM SHOWING LOCATION OF STEEL AND GROUT HOLES
31430-56	CONSTANT ANGLE ARCH DAM-FIELD LOCATION AND LAYOUT PLAN
31430-57	DAM SITE-NORTH SIDE-CONSTRUCTION PLANT LAYOUT
31430-58	SPILLWAY PLAN & PROFILE & DETAILS OF END WALL & REINF. CONC. FLOOR SLABS
31430-59	DETAILS OF SPILLWAY WALLS-PLAN & ELEVATIONS
31430-69	CANEADEA DAM-SPILLWAY EROSION
31430-71	CANEADEA DAM-SECTION A-A



PLAN

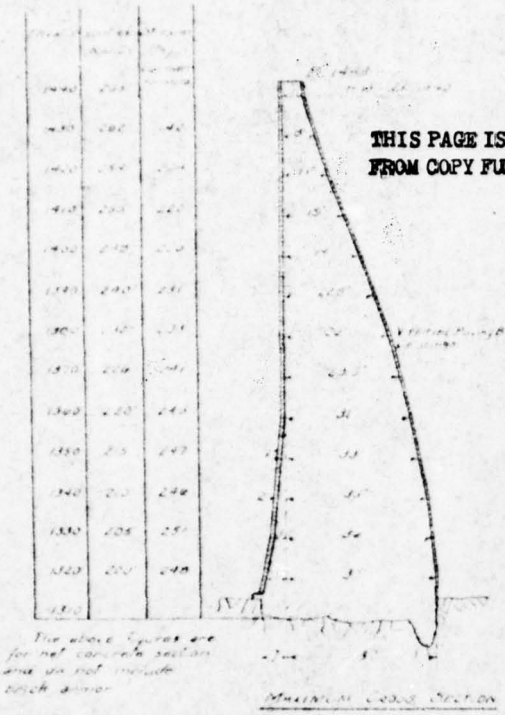
FOR DETAILS 'AS BUILT' SEE SHEETS
47 AND 56

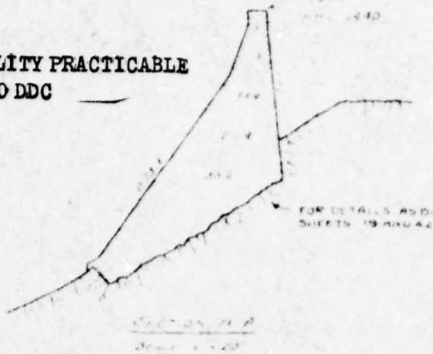


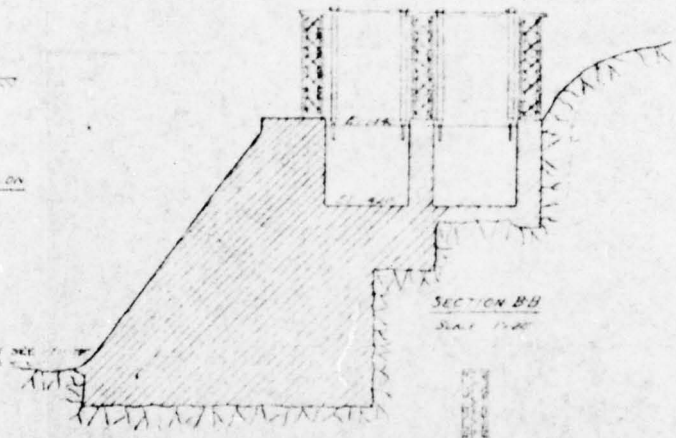
SECTION ALONG CENTER LINE OF DAM
SCALE 1" = 40'

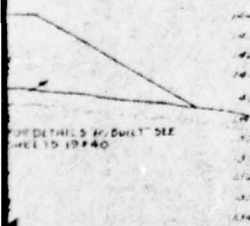
FOR DETAILS 'AS BUILT' SEE SHEETS
19,40,42,43 AND 45

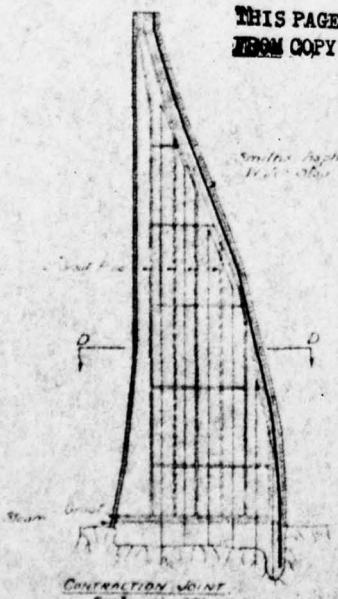
NOTICE REVISIONS — RETURN TO DRAFTING DEPARTMENT ALL PRINTS

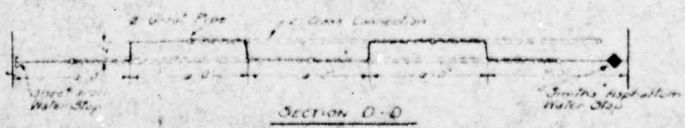












Quantities: Arch Dam 44821 C.Y.
Gravity Dam Spillway 678 C.Y.
TOTAL 45500 C.Y.

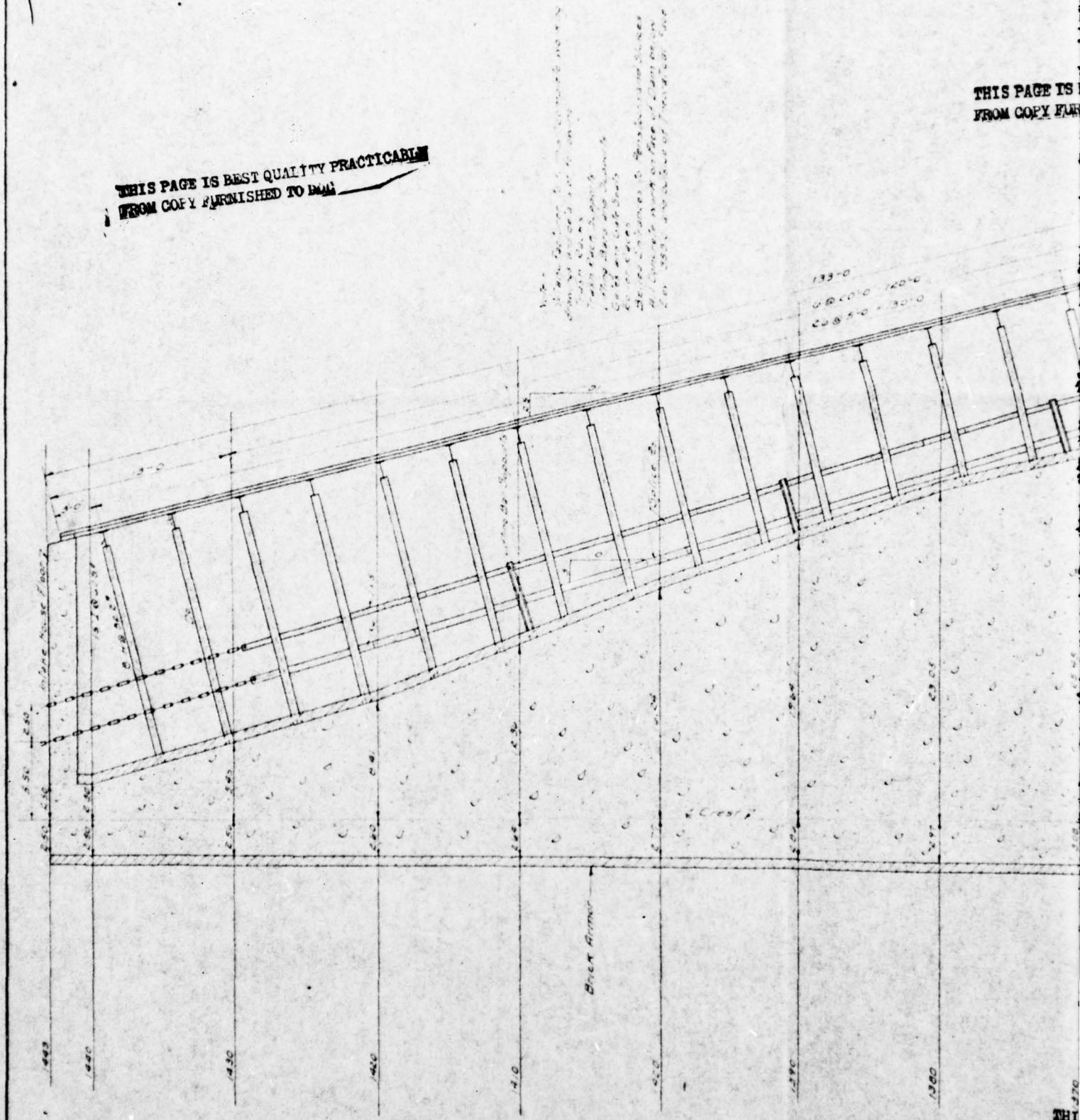
CANADEA POWER CORP
- CANEADEA DAM -
THE CONSTANT ANGLE ARCH DAM CO
SAN FRANCISCO CALIFORNIA
Scale 1" = 40'
Drawing No. 1002

REFERENCE DRAWINGS

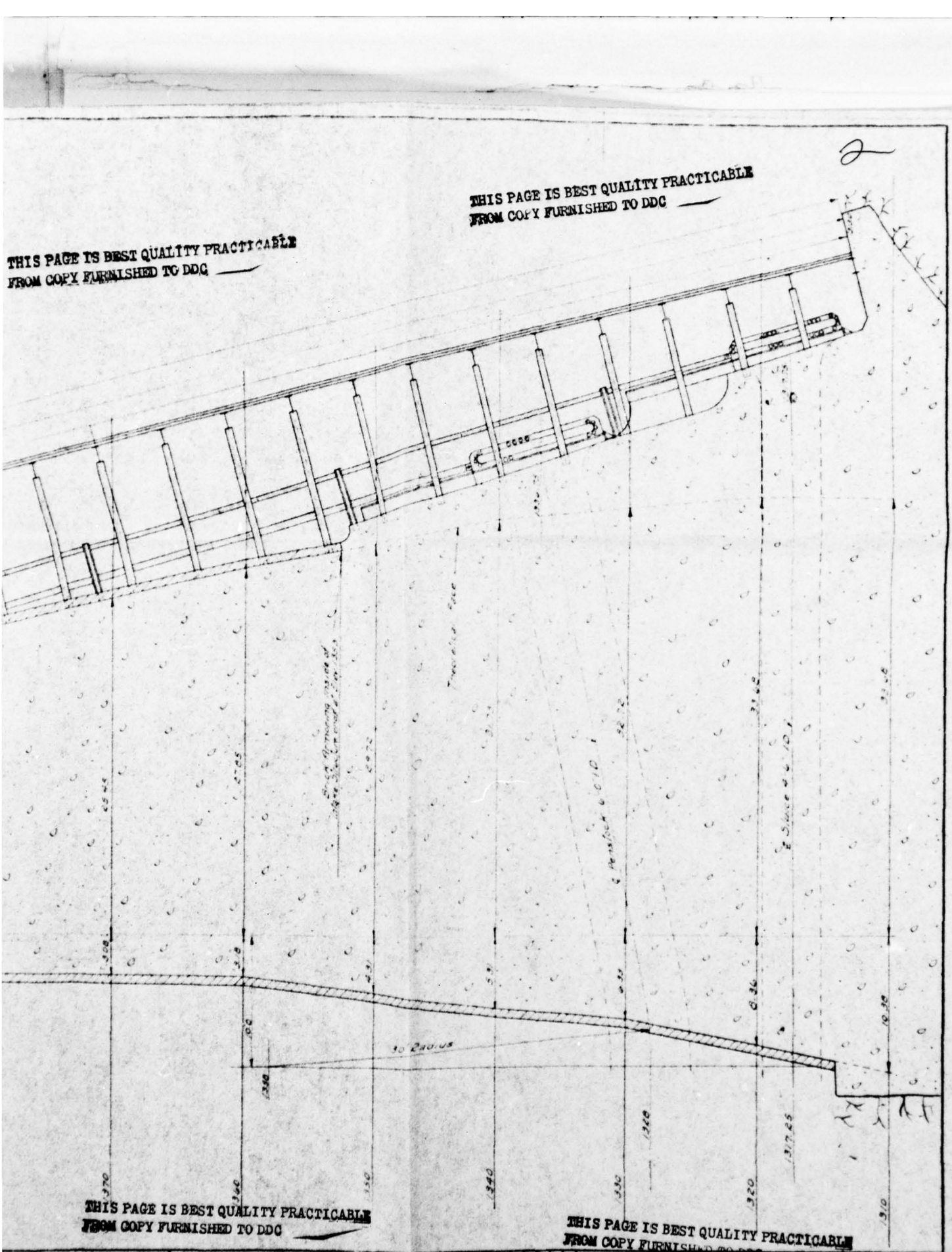
CANADEA POWER CORP

CANADEA CREEK DEVELOPMENT
PROPOSED
CONSTANT ANGLE ARCH DAM

PRINTED No. 31430-1



THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

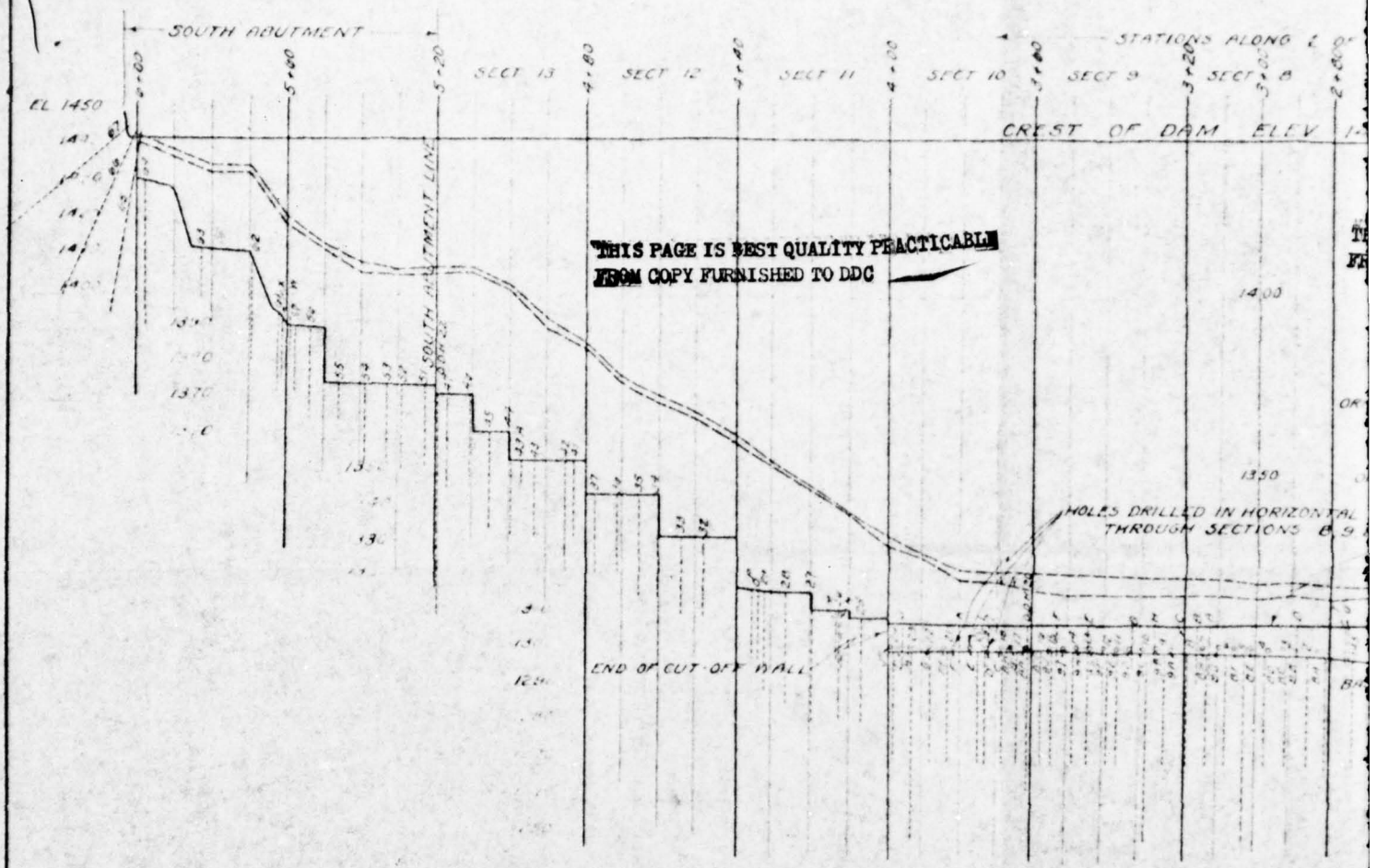


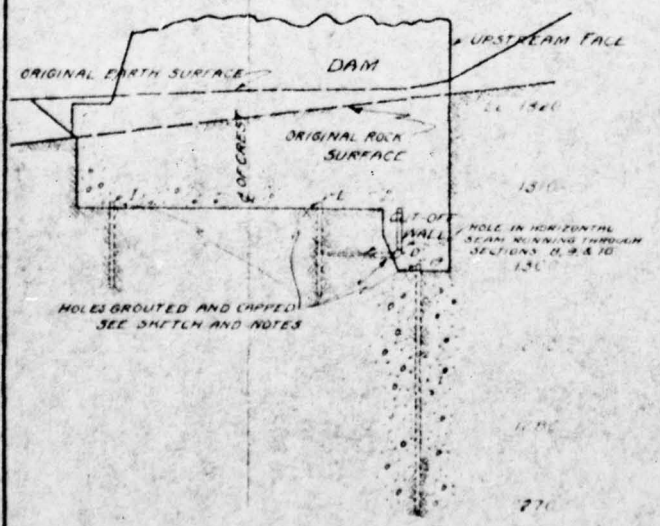
THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

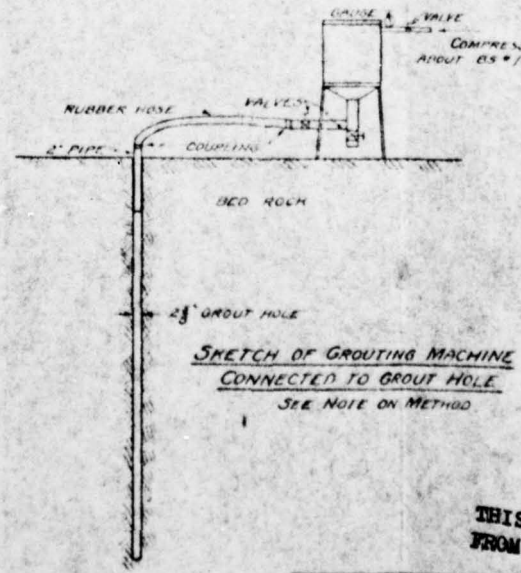
CHARLOTTE CREEK DEVELOPMENT
DETAILS OF DAM
CROSS SECTION AT STATION 3+00
(CENTER LINE OF INTAKE STRUCTURE)

NO. 31430-16





TYPICAL CROSS-SECTION OF DAM AT STA 3+73
SHOWING LOCATION OF GROUT HOLES
SCALE 1"-10'

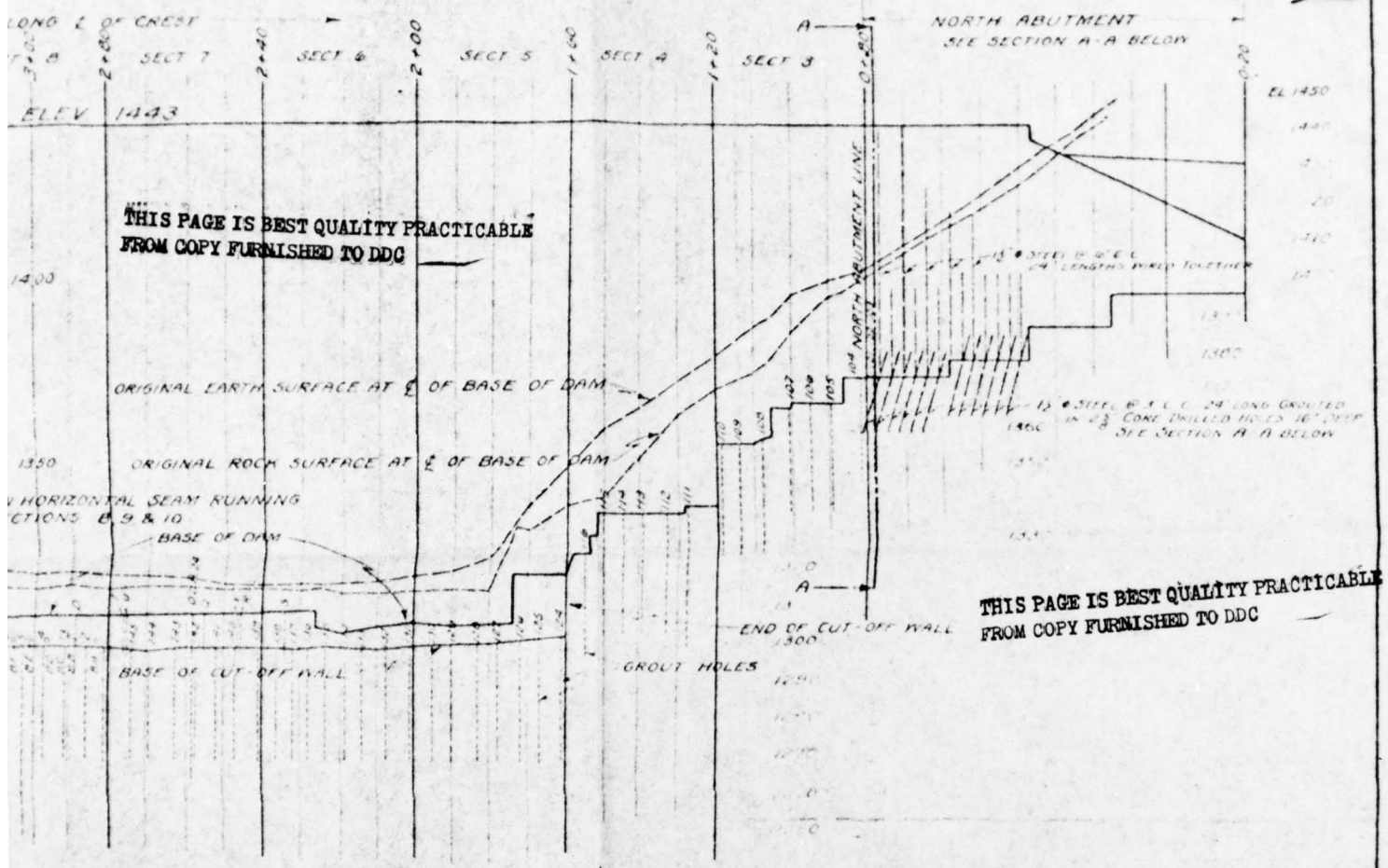


SKETCH OF GROUTING MACHINE
CONNECTED TO GROUT HOLE
SEE NOTE ON METHOD

NOTE - METHOD OF DRILL
1. DRILLING [illegible]
2. 2" PIPE INSERTED IN HO
3. HOLE WASHED OUT WITH
4. WATER FORCED OUT AT
5. COMPRESSED AIR ATTAC
6. WATER ATTACHED TO H
AT ELEVATION 1325, A
7. WATER FORCED OUT BY C
8. GROUTING MACHINE CON
UNDER ABOUT 85 #/
9. GROUTING MACHINE REM

NOTICE REVISIONS RETURN TO DRAFTING DEPARTMENT ALL PRINTS PRIOR TO LA

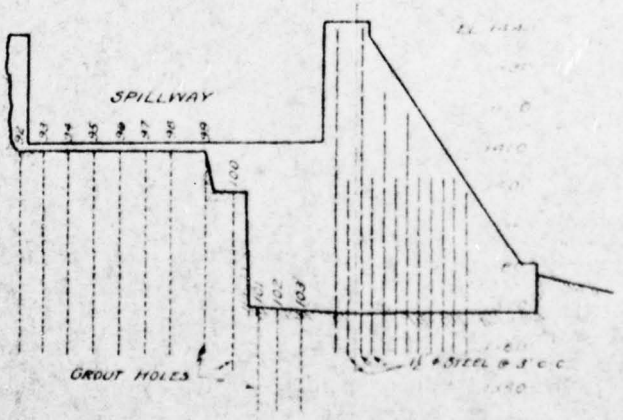
2



THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

℄ OF BASE OF DAM



METHOD OF DRILLING, TESTING AND GROUTING HOLES
DRILLING 2¾" DIAMETER HOLE
PIPE INSERTED IN HOLE AND GROUTED IN PLACE
HOLE WASHED OUT WITH WATER ABOUT 90 #/IN² PRESSURE
WATER FORCED OUT BY COMPRESSED AIR UNDER ABOUT 85 #/IN² PRESSURE
COMPRESSED AIR ATTACHED TO HOLE TO TEST FOR SEAM CONNECTIONS UNDER ABOUT 85 #/IN² PRESSURE
WATER ATTACHED TO HOLE TO TEST FOR SEAM CONNECTIONS PRESSURE FROM TANK OR TANK
OF ELEVATION 1525, ABOUT 80 #/IN² (MAXIMUM)
WATER FORCED OUT BY COMPRESSED AIR UNDER ABOUT 85 #/IN² PRESSURE
GROUTING MACHINE CONNECTED TO HOLE AND COMPRESSED AIR APPLIED TO FORCE GROUT IN HOLE
UNDER ABOUT 85 #/IN² PRESSURE
GROUTING MACHINE REMOVED AND CAP ATTACHED TO HOLE

Note:
Profiles plotted from tracings of final Cross-Sections, dated March 2, 1928 at the Field Office, Caneadea, N.Y.
Location of Grout Holes taken from Field Record and Drawing No 51,161
Location of the steel in North Abutment taken from Drawing No. 31430-19

SECTION "A-A"
CROSS SECTION OF NORTH ABUTMENT AND SPILLWAY
SHOWING LOCATION OF STEEL AND GROUT HOLES
SEE ELEVATION ABOVE

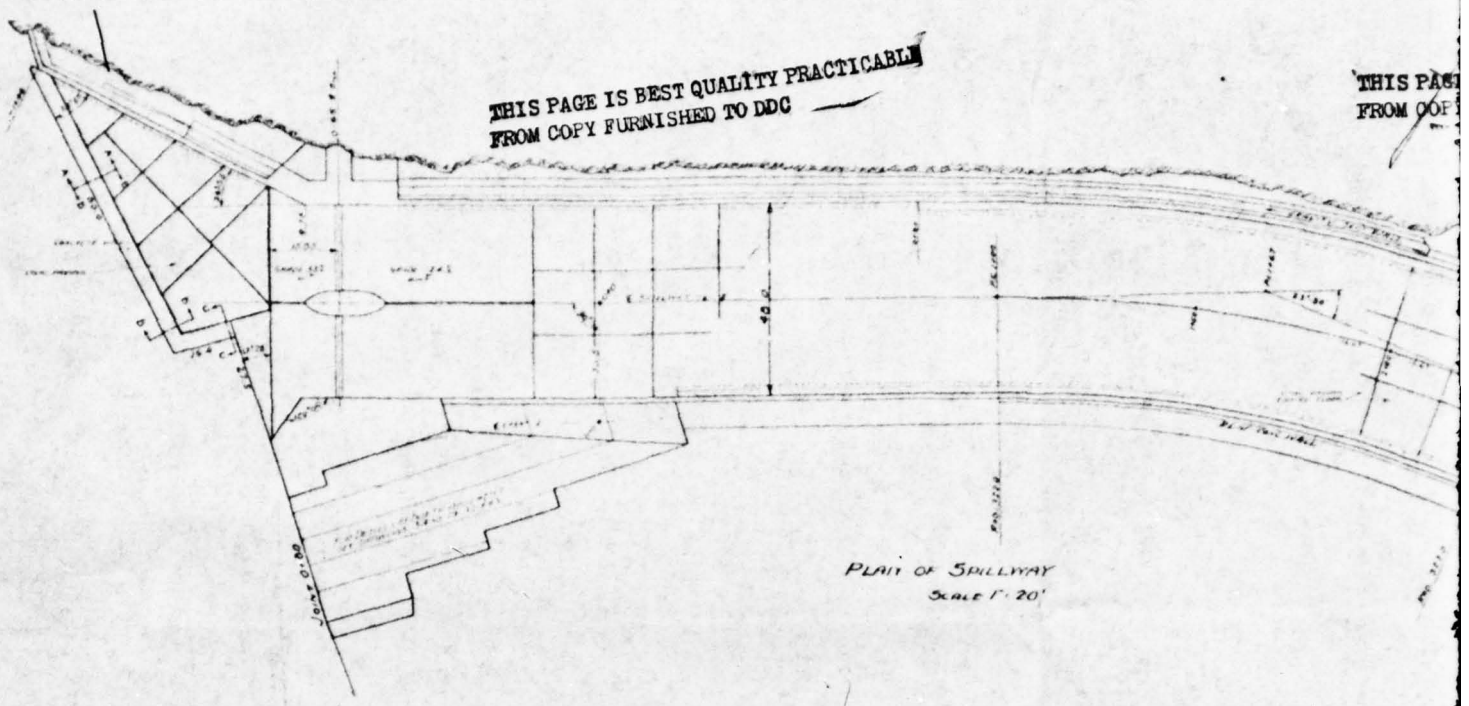
THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

FOR PLAN SEE DRAWING NO 31430-47
SHEET 1 OF 2

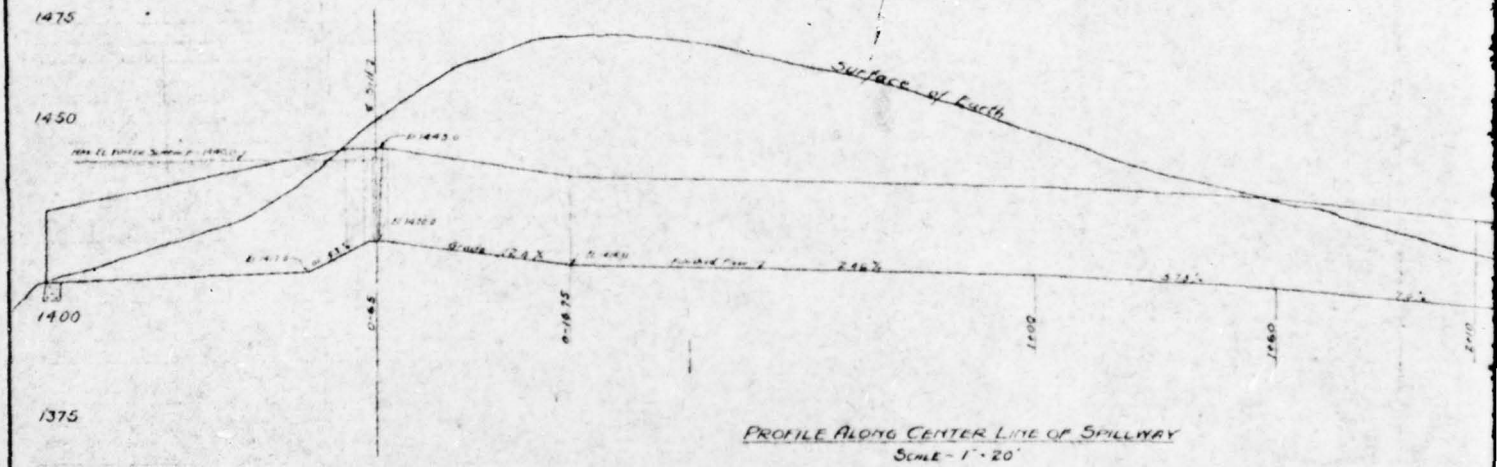
PRINTS PRIOR TO LAST REVISION	REFERENCE DRAWINGS		
A			
B			

SCALE	20
JOB NO	NO 31430-40

CANEADEA CREEK DEVELOPMENT
ELEVATION OF DAM SHOWING ORIGINAL EARTH AND ROCK PROFILE ON ℄ OF BASE AND ℄ OF CUT-OFF WALL & LOCATION OF STEEL & GROUT HOLES



PLAN OF SPILLWAY
SCALE 1" = 20'



PROFILE ALONG CENTER LINE OF SPILLWAY
SCALE - 1" = 20'

SECTION A-A

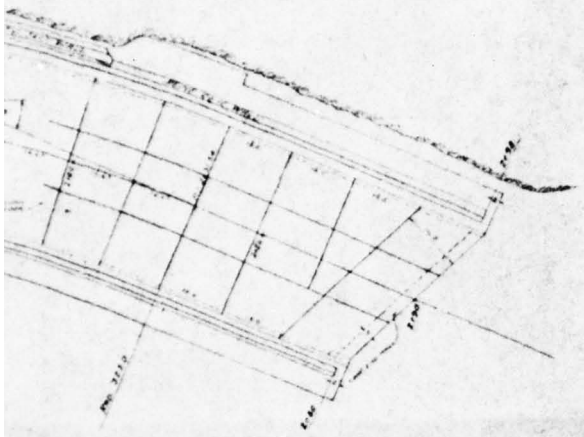
SECTION B-B

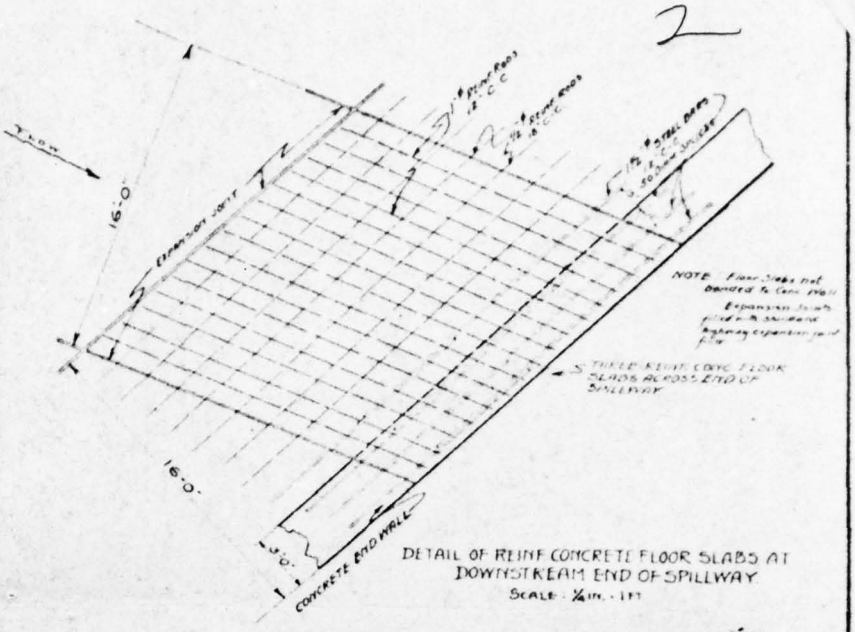
SECTION C-C

DETAIL OF CONCRETE WALL IN FOREBAY
AT ENTRANCE TO SPILLWAY.

SCALE ½ IN. = 1 FT.

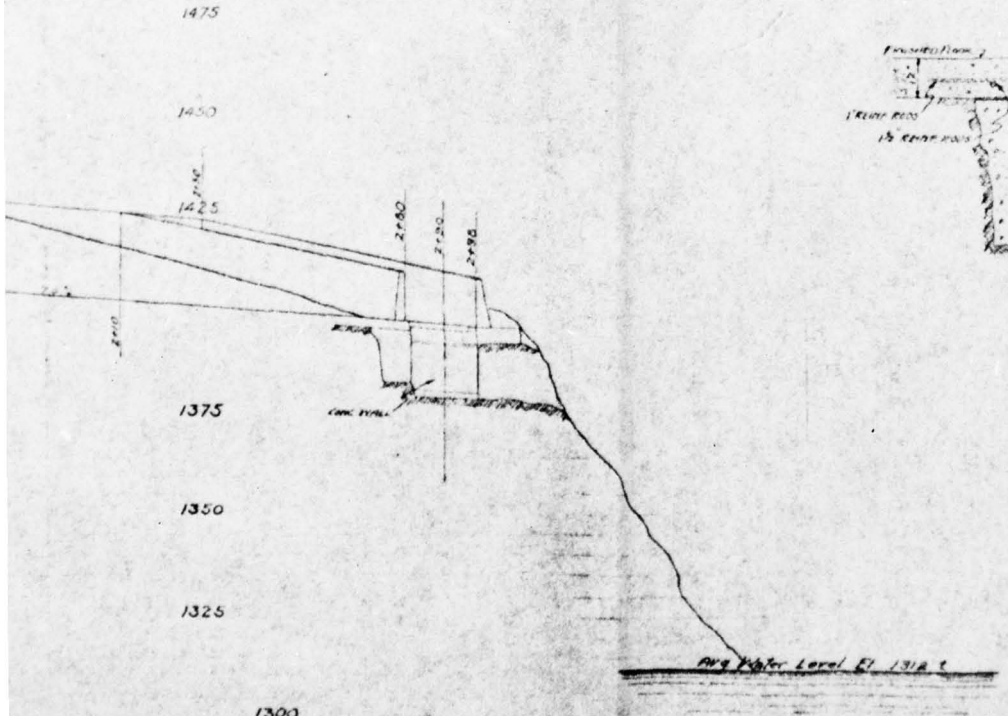
2

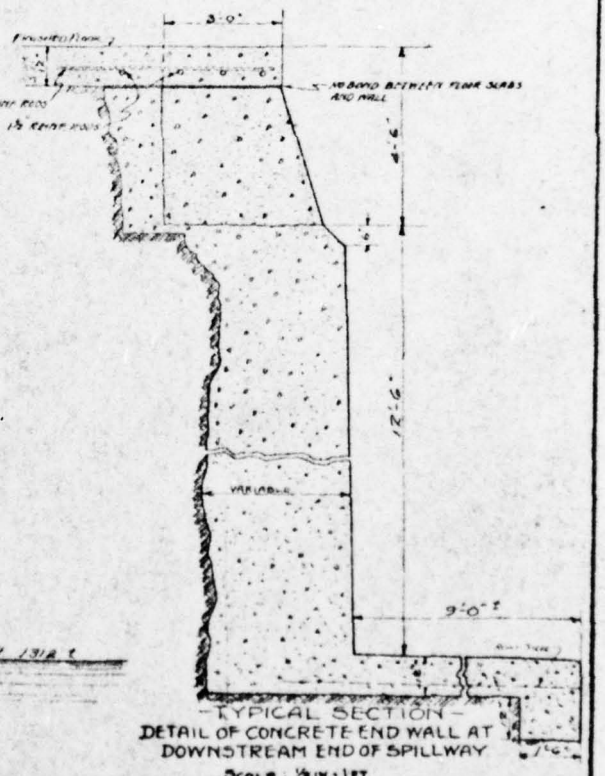




DETAIL OF REINF CONCRETE FLOOR SLABS AT DOWNSTREAM END OF SPILLWAY
SCALE: ½ IN. = 1 FT

NOTE - ALL STATIONS ARE WITH REFERENCE TO CENTER LINE DATA





- TYPICAL SECTION -
DETAIL OF CONCRETE END WALL AT DOWNSTREAM END OF SPILLWAY
SCALE: ½ IN. = 1 FT

NOTE - THIS DRAWING BASED ON CONSTRUCTION RECORDS AND SHOWS SPILLWAY AS BUILT.

SHEET 1 of 2

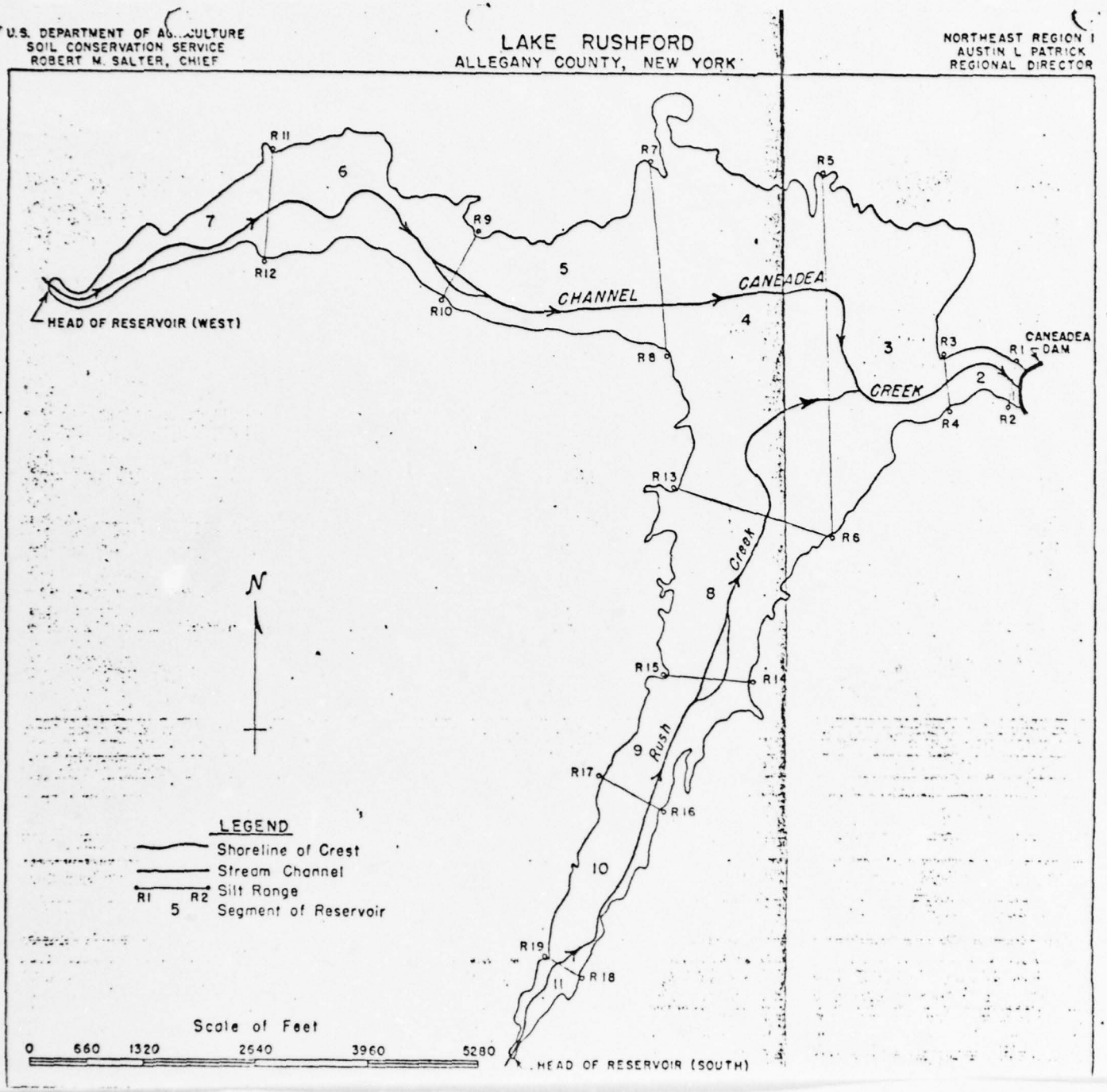
- SUPERSEDING No 31430-8 -

ALL PRINTS PRIOR TO LAST REVISION	REFERENCE DRAWINGS		ROCHESTER GAS & ELECTRIC CORP. ROCHESTER, NEW YORK	CANEADEA CREEK DEVELOPMENT
			DEPT.	SPILLWAY PLAN & PROFILE AND DETAILS OF END WALL & REINF. CONC. FLOOR SLABS
			FOLDER NO.	
			SCALE AS NOTED	JOB NO. NO. 31430-58

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ROBERT M. SALTER, CHIEF

LAKE RUSHFORD
ALLEGANY COUNTY, NEW YORK

NORTHEAST REGION I
AUSTIN L. PATRICK
REGIONAL DIRECTOR



CANEADEA DAM

LIST OF REFERENCE MATERIAL

I. Caneadea Dam Data 9 sheets
   1. Waste Gates, Johnson Valves, Trash Rack, etc. data
   2.,3. Hydraulic Data 1928-1977
   4. RG&E Load Dispatchers Office 20 year Average Inflow to Pond 1931-1950
   5. RG&E Load Dispatchers Office 10 year Average Inflow to Pond 1968-1977
   6. RG&E Load Dispatchers Office 47 year Average Inflow to Pond 1937-1977
   7. Total SFD Inflow - Caneadea Pond Monthly 1931-1977
   8,9 Totals SFD Inflow-Caneadea Pond Monthly 1931-1977

II. Laboratory Reports-Sand 3 sheets

III. Application for the Construction or Reconstruction of a Dam 4 sheets

IV. Letter to Mr. A. S. Whitbeck from Mr. C. C. Cooman Eng'g Dept. requesting comments to Dwgs. 31430-40 & 47 elev. of dam with original earth & rock profile on ℄ of base and ℄ of cut off wall-location of steel & grouting holes.

V. Seismology 29-1, 2, 3 & 4 plus TABLE 2.9-1 and epicentral location map Fig. 2.9-1 6 sheets

VI. Bore Holes, location, log & description 10 sheets

VII. Plan and Elev. of Caneadea Dam 2 sheets

VIII. Sedimentation Investigation of Rushford Lake Description Sediment, Tables, Statistics Location Plans (6 sheets - some two sides)

IX. Letter-Inspection of Dam-deposits on brick (one)

X. Value of Caneadea Storage - operation - 24 day draw down 30, 33 & 60 day draw down plus graph Avg. Head vs. Thous. KWH 11 sheets

XI. Suggested method of measuring future deflections of Caneadea Dam + Deformations measured by triangulation 6 sheets

XII. Estimate of Volume of water storage at Caneadea (one)

XIII. Letter - leakage of water plus record 2 sheets

XIV. Value of Caneadea Storage + Data 3 sheets

XV. Report on deflections in the Dam causing brick facing at Cont. Sts. to spall
8 sheets

XVI. Letter - character of foundation and suitability of gravel and sand 2 sheets

XVII. Report on Volume of Pondage (1927) plus pondage curves 6 sheets

XVIII. Record of Inspection of Foundation of Dam and Abutment 4 sheets

XIX. Preliminary report on Design and Construction by the Foundation Company and Plan 7 sheets

XX. Specifications for the construction of a constant angle Arch Dam and Appurtenances 3+27 30 sheets

XXI. Letters referring to design calculations, coefficients, drawings, etc. 10 sheets

XXII. Design properties of Dam x section one

XXIII. Value of Caneadea Storage varying drawdowns 11 sheets

XXIV. Calculations & Design Sheets by Constant Angle Arch Dam Co. 3 sheets

XXV. Caneadea Pond - Data 4 sheets
plus drawdown curve barge & KWH 7 sheets

XXVI. Caneadea Dam description 3 sheets

XXVII. Caneadea Development - Brief History 9 sheets

XXVIII. Sedimentation Report - Letter, data, etc. 11 sheets

XXIX. Discharge curve for 54" Howell'Bunger Valve 1 sheet

XXX. Profile of Genesee Valley, Rochester to Mt. Morris 1 sheet

XXXI. Dwg. 31430-72C Spillway Gate JackMechanism 1 sheet

XXXII. Dwg. 31430-73 Spillway Gate Jacking of Grease System 1 sheet

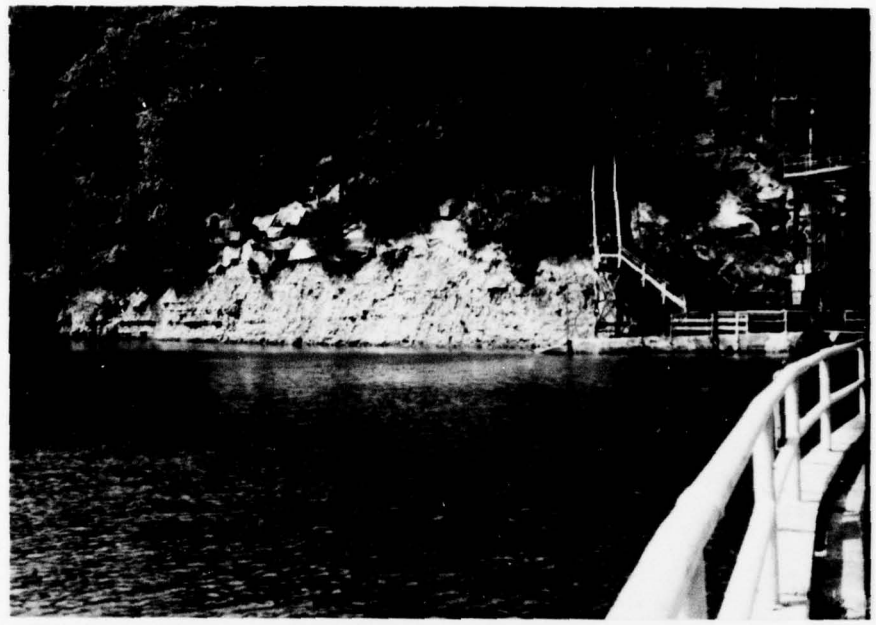
XXXIII. Genesee River Watershed 3 sheets

XXXIV. RGE ltr to Mr. L. White re O&M procedures,
dated 28 Apr 78 1 sheet

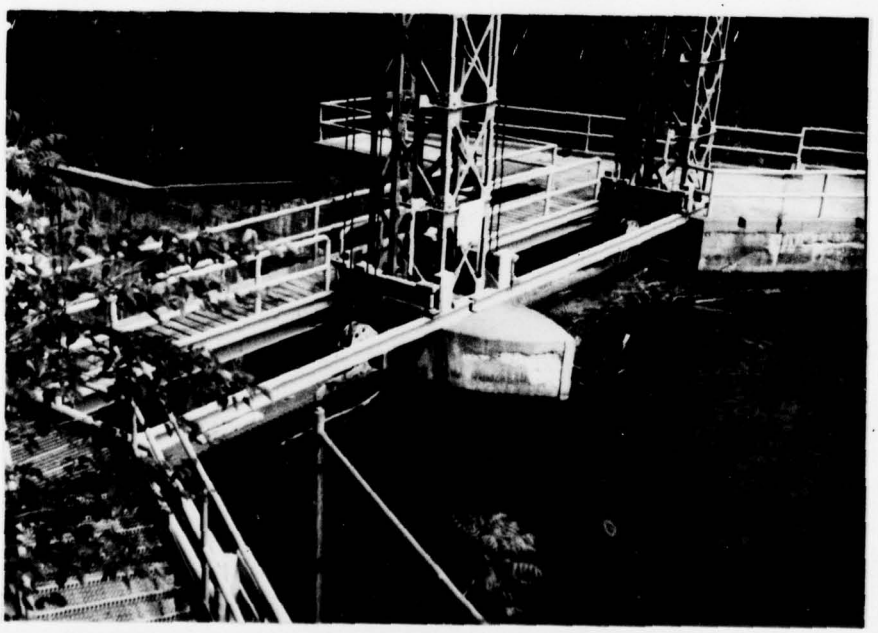
XXXV.	Sample weekly inspection sheet, 6/1/78	1 sheet
XXXVI.	Gate operator's log pages	4 sheets
XXXVII.	Curve at AV lake elevation, 1950-60	1 sheet
XXXVIII.	Log of valve openings, w. elevations, CFS and SFD, 12/6/72, 12/7/72	2 sheets

PHOTOGRAPHS

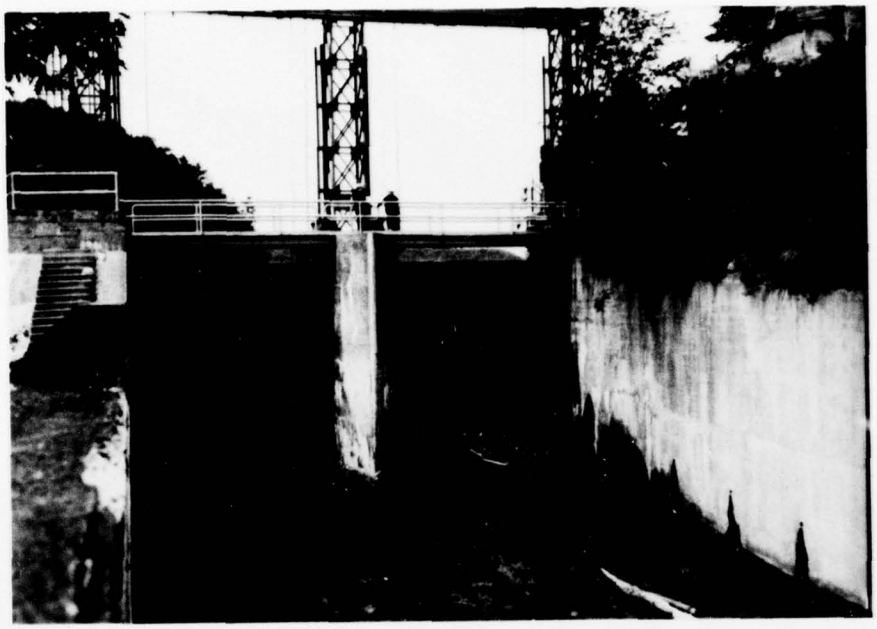
APPENDIX B



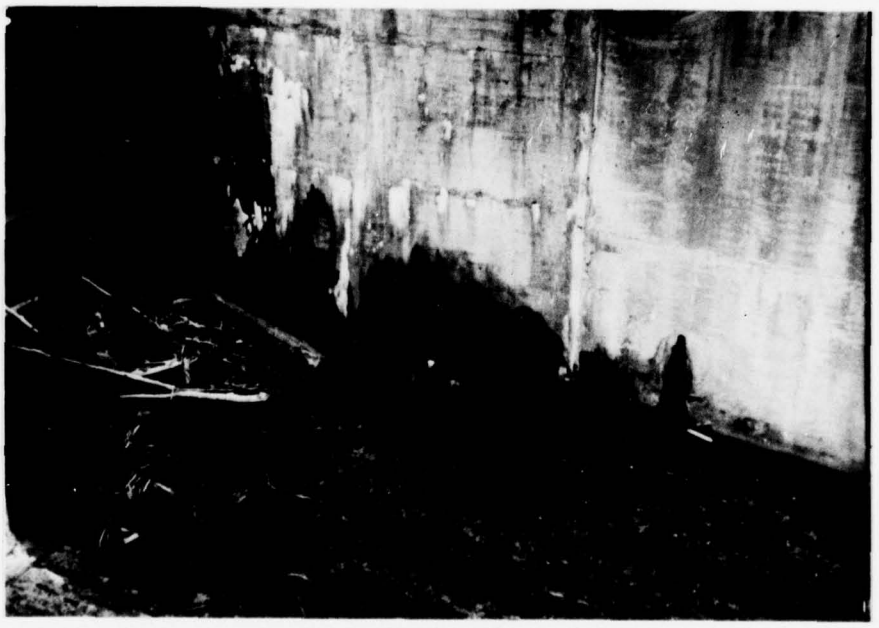
UPSTREAM RESERVOIR SIDE SLOPE ADJACENT TO SPILLWAY CHANNEL



AREA AT TOP OF SPILLWAY GATES



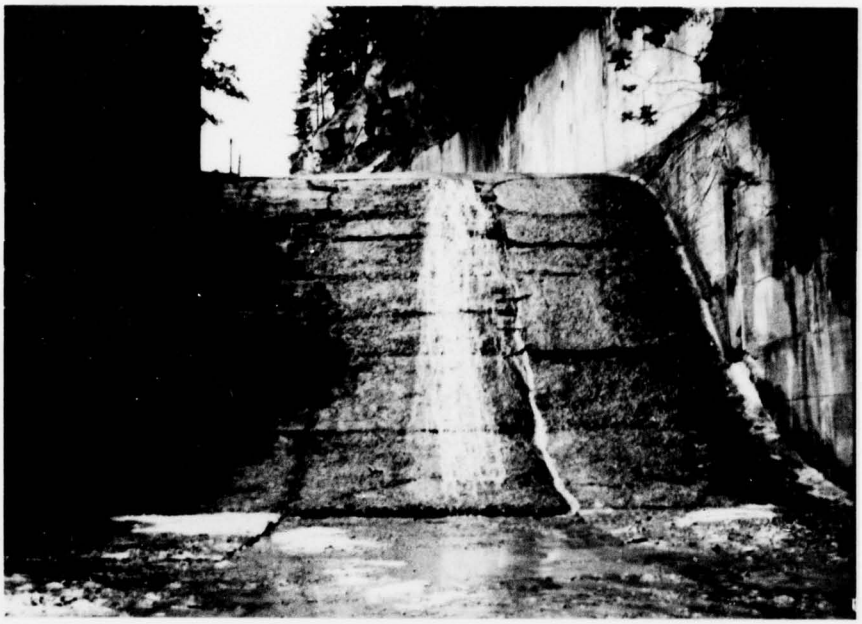
SPILLWAY GATES VIEWED FROM DOWNSTREAM



DOWNSTREAM VIEW AT BOTTOM OF LEFT SPILLWAY GATE INCLUDING WEEP HOLE DISCHARGE

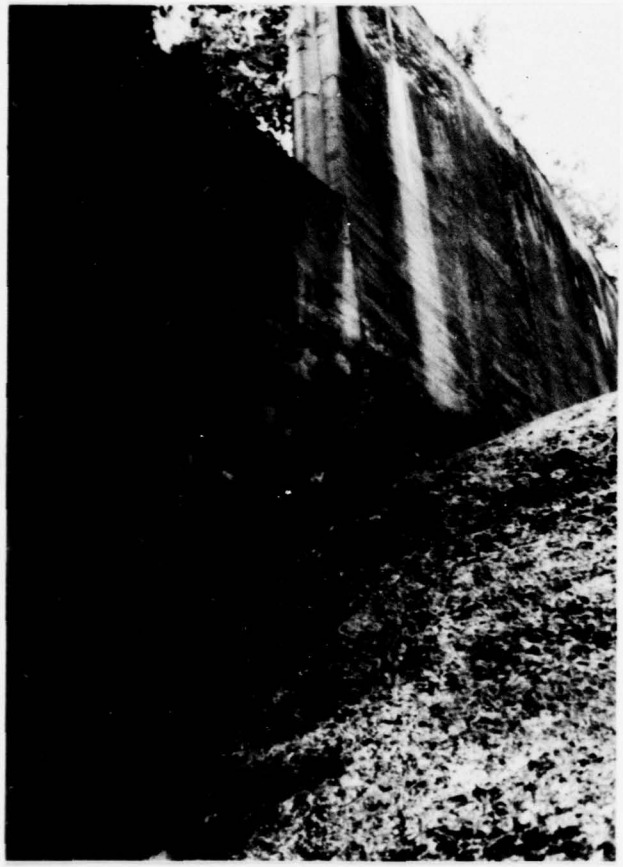
SPILLWAY CHANNEL VIEWED FROM GATE BRIDGE

RIGHT WALL, SPILLWAY CHANNEL, FROM GATE BRIDGE

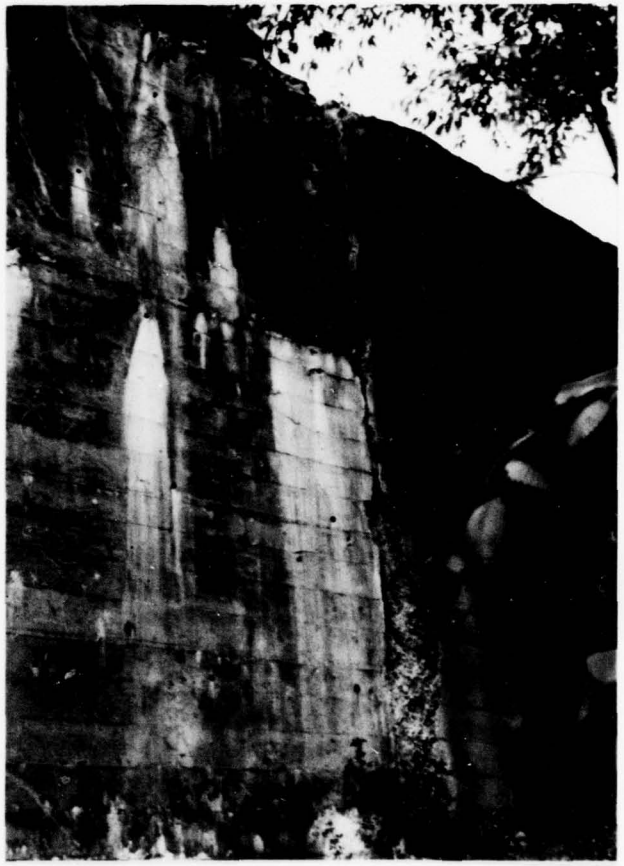


CHUTE AT DOWNSTREAM END OF SPILLWAY CHANNEL

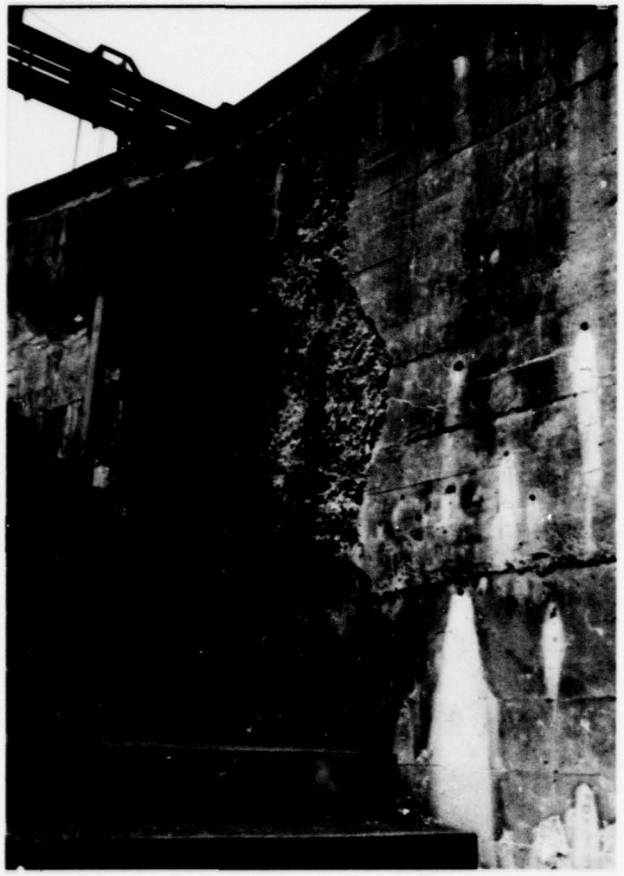
RIGHT SPILLWAY CHANNEL WALL EXTERIOR FACE, EXPOSED REBARS



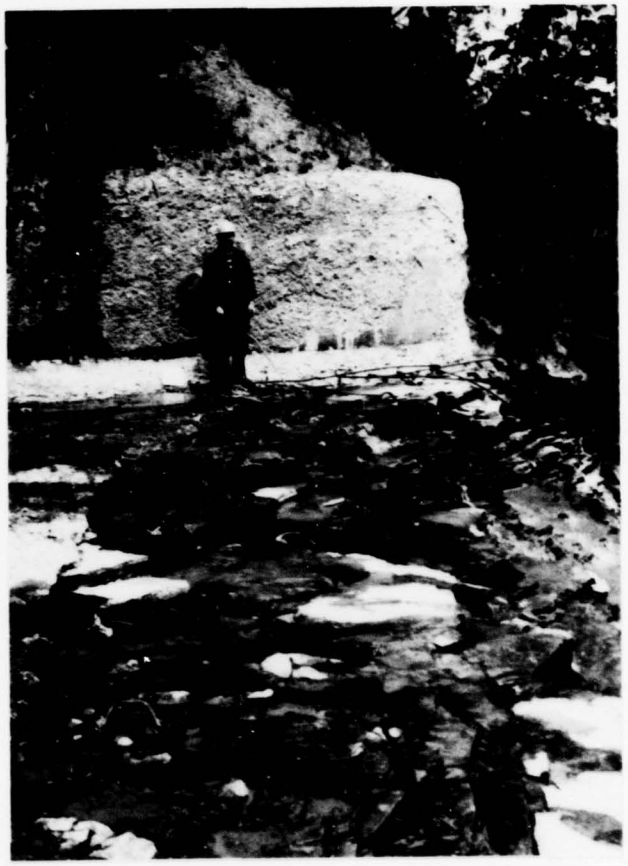
RIGHT CHANNEL WALL AT CHUTE SHOWING
UNDERCUT OF UPPER CHANNEL WALL



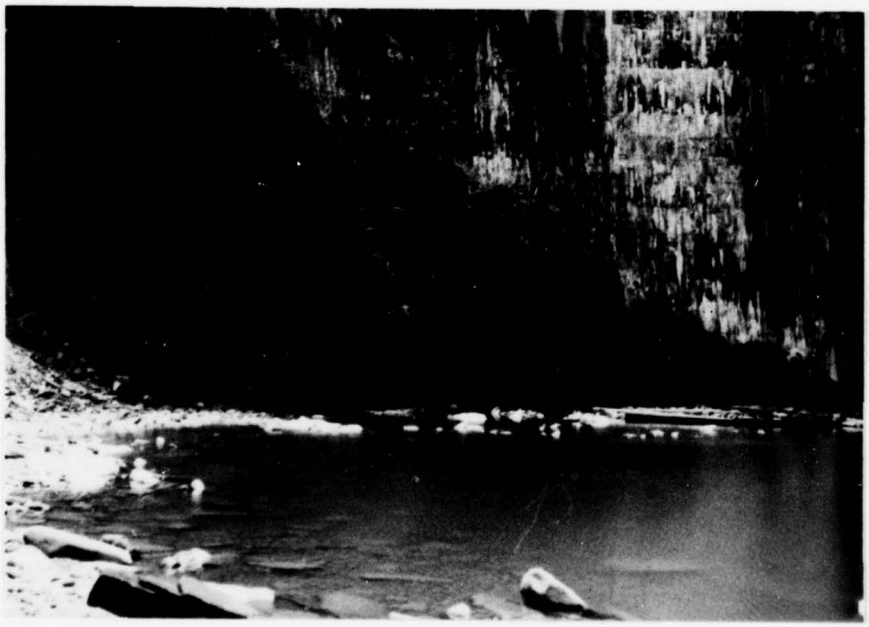
RIGHT SPILLWAY CHANNEL WALL EXTERIOR
FACE, MONOLITH JOINT



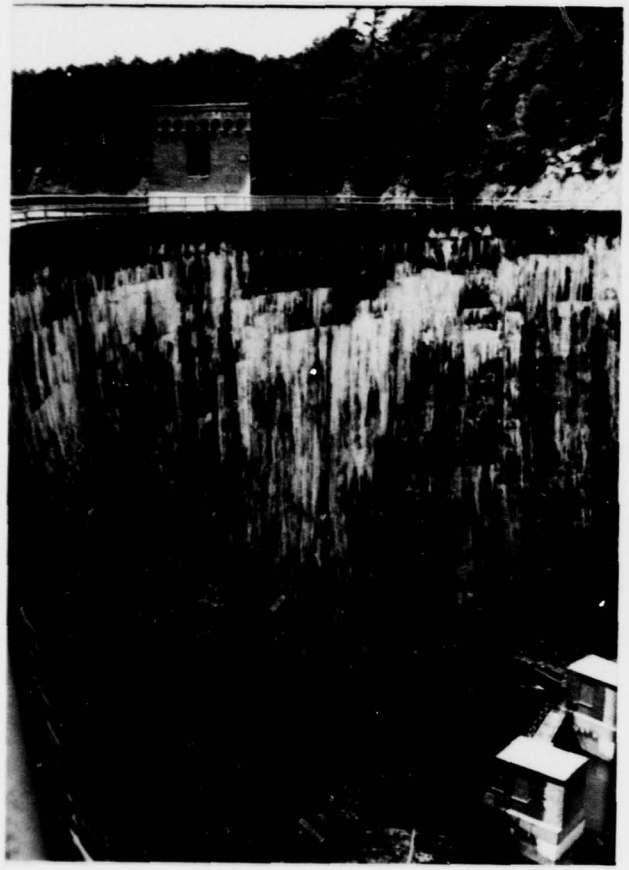
RIGHT SPILLWAY CHANNEL WALL EXTERIOR FACE, DOWNSTREAM OF GATES



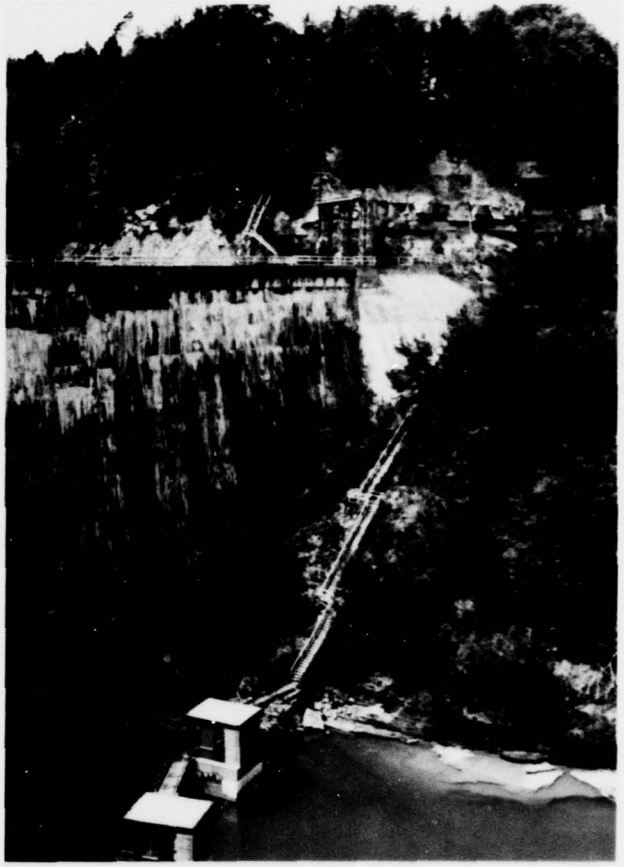
ABRUPT END OF SPILLWAY CHANNEL & LEFT WALL DOWNSTREAM OF OGEE SHOWING AREA WHEREIN CHANNEL WALL AND FLOOR SLAB WERE LOST DUE TO UNDERCUTTING



DOWNSTREAM FACE OF DAM, ROCK LEDGE AT BASE OF RIGHT ABUTMENT



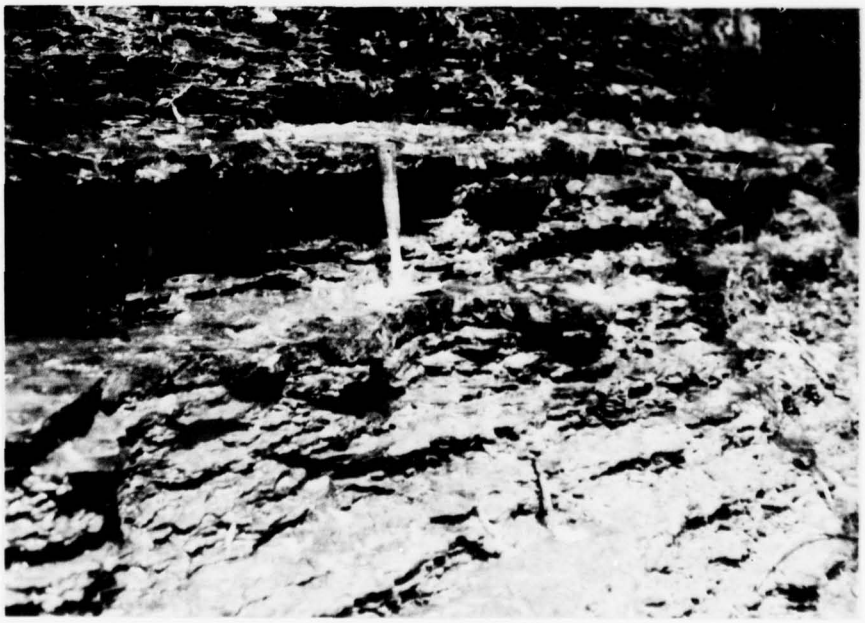
DOWNSTREAM FACE OF DAM AND GATE HOUSE, VIEW FROM TOP OF RIGHT ABUTMENT



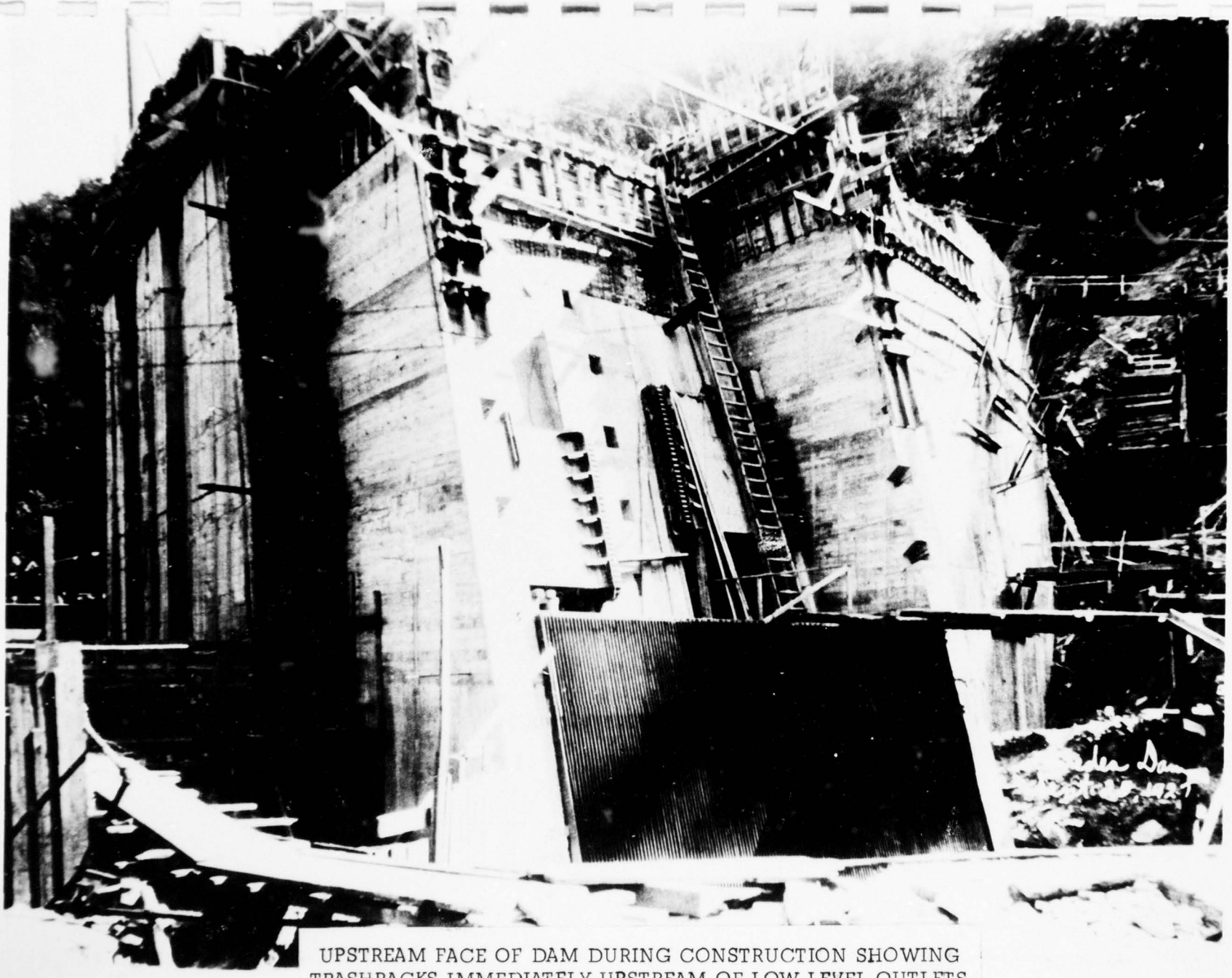
DOWNSTREAM FACE OF DAM, LEFT SIDE, AND REGULATING OUTLETS

DOWNSTREAM FACE OF DAM FROM DOWNSTREAM WEIR IN STREAM BED

AREA OF SEEPAGE ON LEFT SIDE DOWNSTREAM OF DAM



SEEPAGE FROM ROCK LEDGE SHOWN IN ABOVE PHOTO



UPSTREAM FACE OF DAM DURING CONSTRUCTION SHOWING
TRASHRACKS IMMEDIATELY UPSTREAM OF LOW LEVEL OUTLETS

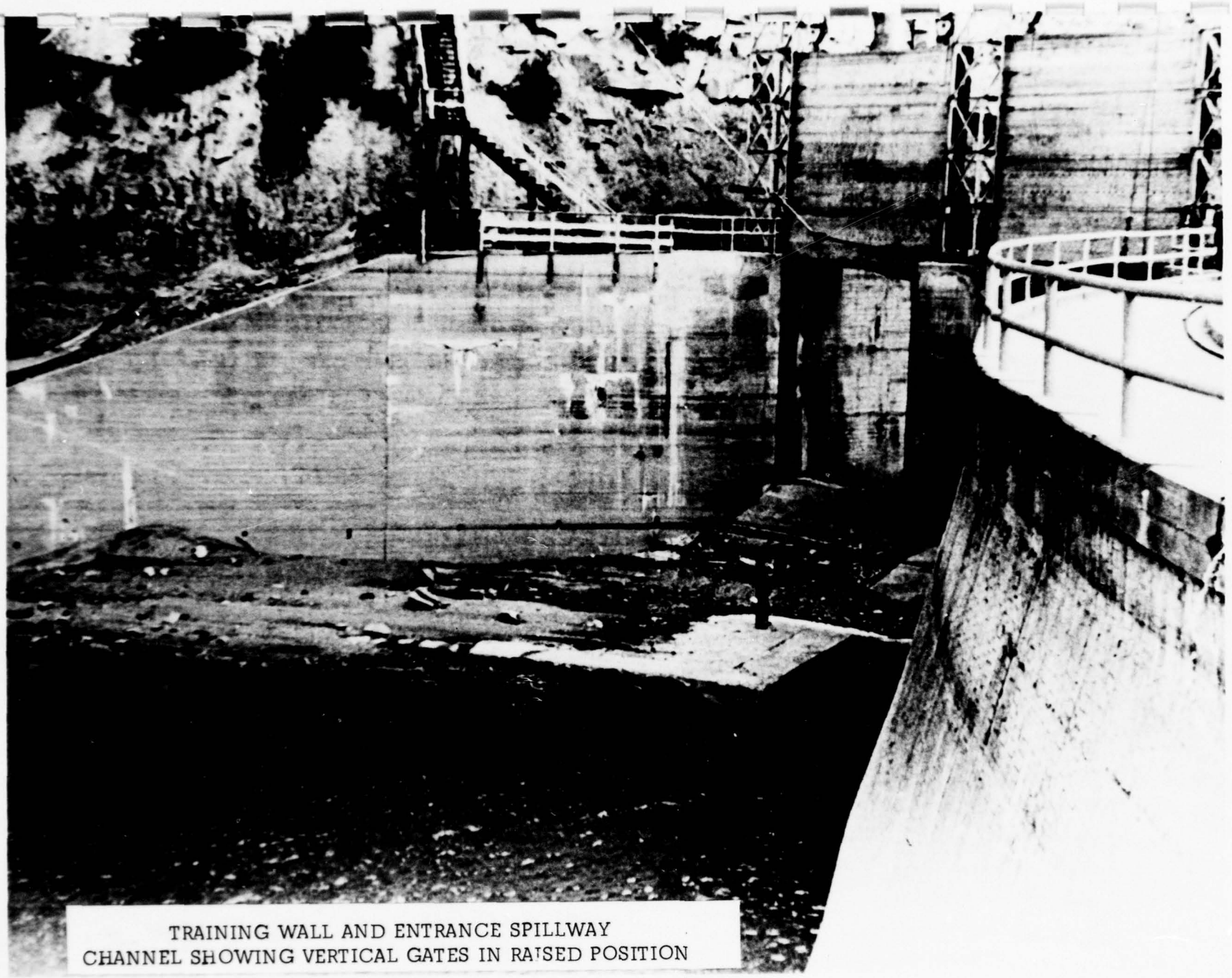
DOWNSTREAM FACE OF DAM VIEWED FROM TOP WALKWAY SHOWING BULGE DUE TO YIELDING OF CONCRETE FORMS DURING CONSTRUCTION

CLOSEUP OF BASE OF DOWNSTREAM FACE SHOWING BRICK FACING AND MINERAL DEPOSITION DUE TO SEEPAGE

OVERALL VIEW OF DOWNSTREAM FACE OF DAM SHOWING MINERAL DEPOSITION DUE TO SEEPAGE

DETAIL, SHOWING THICKNESS OF DEPOSITION ON DOWNSTREAM FACE OF DAM

DOWNSTREAM FACE OF DAM SHOWING LEAKAGE (DARK AREAS)



TRAINING WALL AND ENTRANCE SPILLWAY
CHANNEL SHOWING VERTICAL GATES IN RAISED POSITION

ENGINEERING DATA CHECKLIST

APPENDIX C

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM CANEADEA

ID # 464

ITEM	REMARKS
AS-BUILT DRAWINGS	SEE APPENDIX FOR LIST OF DRAWINGS AVAILABLE AND DRAWINGS SUBMITTED WITH INSPECTION REPORT.
REGIONAL VICINITY MAP	ANGELICA QUADRANGLE U.S. GEOLOGICAL SURVEY
CONSTRUCTION HISTORY	SEE ENGINEERING NEWS RECORD ARTICLE DATED AUG. 23, 1928 pages 268-272 AND PHOTOGRAPHS TAKEN DURING CONSTRUCTION
TYPICAL SECTIONS OF DAM	SEE CANEADEA CREEK DEVELOPMENT DRAWINGS NOS. 31430-1, 31430-16, 31430-42, 31430-43, 31430-45, 31430-55
OUTLETS-PLAN	FOR LOW LEVEL OUTLETS SEE DWGS. NOS. 31430-16, 31430-36 & 31430-71
-DETAILS	FOR SPILLWAY PLAN, PROFILE AND ELEVATIONS AND DETAILS OF WALLS AND FLOOR SLABS SEE DWGS. NOS. 31430-3, 31430-58 & 31430-59
-CONSTRAINTS	NONE CITED
-DISCHARGE RATINGS	NOT AVAILABLE FOR SPILLWAY
RAINFALL/RESERVOIR RECORDS	NONE AVAILABLE

ITEM	REMARKS
DESIGN REPORTS	SEE PRELIMINARY REPORT ON DESIGN AND CONSTRUCTION BY THE FOUNDATION COMPANY DATED 8/18/25
GEOLOGY REPORTS	SEE APPLICATION FOR THE CONSTRUCTION OF A DAM SENT TO STATE OF NEW YORK DEPARTMENT OF STATE ENGINEER AND SURVEYOR - ALBANY, N.Y.
DESIGN COMPUTATIONS	STRESS SHEETS FOR ABUTMENTS SEE DWGS. NOS. 31430-41 AND 31430-44; FOR ARCH DAM - BY CONSTANT ANGLE ARCH DAM Co. SEE COMPUTATIONS
HYDROLOGY & HYDRAULICS	
DAM STABILITY	SEE DESIGN COMPUTATIONS BY CONSTANT ANGLE ARCH DAM Co.
SEEPAGE STUDIES	
MATERIALS INVESTIGATIONS	HUGH L. COOPER & Co LETTER DATED 3/30/26 CHARACTER OF FOUNDATIONS AND SUITABILITY OF GRAVEL AND SAND DEPOSITS FOR USE IN THE DAM.
BORING RECORDS	BORE HOLES - LOCATION, LOG AND DESCRIPTION - 10 sheets
LABORATORY	REPORTS - SAND 3 Sheets
FIELD	NONE

POST-CONSTRUCTION SURVEYS OF DAM
U.S. DEPT OF AGRICULTURE SOIL CONSERVATION SERVICE 1/23/1952
SEDIMENTATION INVESTIGATIONS OF RUSHFORD LAKE.

BORROW SOURCES NOT APPLICABLE

ITEM	REMARKS
MONITORING SYSTEMS	THE WATER LEVEL BEHIND THE DAM IS MONITORED. THE GAGE SYSTEM IS A BUBBLER TYPE MANUFACTURED BY HONEYWELL. AN ALARM SOUNDS WHEN THE WATER LEVEL REACHES EL. 1440.8. THE ALARM SOUNDS AT THE FILLMORE OFFICE DURING WEEKDAY HOURS OF OPERATION. AT NIGHT AND ON WEEKENDS THE ALARM SOUNDS IN THE HOMES OF THE DISPATCHERS WHO ARE ON ACTIVE DUTY. THE LOAD DISPATCHER IS IN CONSTANT
MODIFICATIONS	CONTACT WITH THE NATIONAL WEATHER SERVICE. IN EVENT OF AN APPROACHING STORM A HYDRO OPERATOR IS SENT TO THE DAM. HOWELL-BUNGER VALVES REPLACED THE ORIGINAL JOHNSON-TYPE VALVES FOR REGULATION OF LOW LEVEL OUTLETS IN 1972
HIGH POOL RECORDS	RGE LOAD DISPATCHER'S OFFICE INFLOW TO POND
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS THE DAM HAS BEEN INSPECTED PERIODICALLY BY OUTSIDE CONSULTANTS.	CONDUITS HAVE BEEN INSTALLED AND A 35 KVA PORTABLE GENERATOR WAS BROUGHT TO THE DAM AND HAD BEEN SATISFACTORILY USED TO OPERATE THE SPILLWAY GATES AND THE H-B REGULATING VALVES FOR EMERGENCY SERVICE. THE H-B VALVES, WHICH CAN BE OPERATED FROM THE GATE HOUSE OR FROM THE SEPARATE VALVE HOUSES, WERE INSTALLED IN 1972 REPLACING ORIGINAL HYDRAULIC-OPERATED JOHNSON-TYPE VALVES. THE VALVE HOUSES HAD TO BE ENLARGED TO SUIT THE NEW EQUIPMENT
PRIOR ACCIDENTS OR FAILURE OF DAM	FAILURE OF END OF SPILLWAY
DESCRIPTION	FOR REPAIR OF SPILLWAY EROSION SEE DWG NO. 31430-69
REPORTS	REPORT ON DEFLECTIONS IN THE DAM CAUSING BRICK FACING AT CONTRACTION JOINTS TO SPALL - 3 sheets.
MAINTENANCE	THE DAM IS INSPECTED WEEKLY THE ALARMS ARE CHECKED MONTHLY.
OPERATION	THE WATER LEVEL IN THE LAKE IS MAINTAINED NEAR EL. 1440 FROM MEMORIAL DAY UNTIL SHORTLY AFTER LABOR DAY TO ACCOMMODATE WATER FRONT ACTIVITES ON THE LAKE. AT OTHER TIMES THE WATER IS LOWERED.
RECORDS	THE GENESEE DISTRICT HYDRO OPERATION MAINTAINS A LOG INCLUDING DATE, TIME OF DAY, LAKE SURFACE ELEVATION, GATE AND VALVE OPERATIONS, AND PERTINENT DATA REGARDING THE OPERATIONS. LAKE SURFACE LEVELS ARE RECORDED AT THE DISTRICT OFFICE IN FILLMORE. RECORDS ARE ALSO KEPT OF GATE AND VALVE OPERATIONS DURING PERIODIC INSPECTIONS BY RGE CONSULTANTS. THERE IS NO O&M MANUAL. MAINTENANCE IS PERFORMED AS DEEMED NECESSARY

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	SEE DWG. NO. 31430-58
DETAILS	
OPERATING EQUIPMENT	FOR SPILLWAY GATE JACK MECHANISM SEE DWGS. NOS. 31430-72 & 31430-73
PLANS & DETAILS	

DRAWINGS OF GATES NOT AVAILABLE

VISUAL INSPECTION CHECKLIST

APPENDIX D

VISUAL INSPECTION CHECKLIST

1. Basic Data

a. General

Name of Dam CANEADEA Hazard Category HIGH

County ALLEGANY ID# 464

Stream Name CANEADEA CREEK Tributary of GENESEE RIVER

Location ALLEGANY County Nearest Town (P.O.) CANEADEA

Longitude 78°9.5' ± Latitude 42°23± Other Directions

60 MILES SOUTH OF ROCHESTER

Date of Insp 6-14-78 6-15-78 Weather SUNNY Temperature 70°F

b. Inspection Personnel H.B. LEVENTHAL STRUCTURAL ENGINEER
J.S. BURDICK MECHANICAL ENGINEER } TAMS
P. ZACCHEO GEOTECHNICAL ENGINEER

TAMS ENGINEERS WERE ACCOMPANIED TO SITE BY MR. ELMER DAUBERT, SUPERVISOR HYDROELECTRIC GENERATION AND MR. BERNARD MILLS, HYDRO OPERATOR

c. Persons Contacted AT RGE - MR. JOHN A. ARTHUR, CHIEF ENGINEER
MR. JAMES N. COVEY, MANAGER CIVIL ENGINEERING
MR. ROBERT SMITH, ASSISTANT CHIEF ENGINEER
MR. EDWIN J. BAILEY, DISTRICT MANAGER - GENESEE DISTRICT

d. History: Date Constructed 1928 { SEE ENGINEERING NEWS RECORD ARTICLE PAGES 268-272 DATED AUG. 23, 1928

Present Owner DAM BELONGS TO CANEADEA POWER CORP. WHICH IS A WHOLLY OWNED SUBSIDIARY OF RGE

Designed by LARS JORGENSEN. PLANS CHECKED AND APPROVED BY STATE OF N.Y. CONSERVATION COMM.

Constructed by GANNETT, SEELYE & FLEMING, ENGINEERS, INC. CONTRACTOR LOCATED IN HARRISBURG, PA.

Recent History

2. Technical Data

Type of Dam CONSTANT ANGLE ARCH Drainage Area 61 SQ. MILES ~~Acres~~

Height 125 FEET Length 620 FEET

Upstream Slope VARIABLE SEE DWG NO. 31430-16 Downstream Slope VARIABLE

(T OF DAM) Crest Width 5 FEET Freeboard at Spillway Crest 23 FEET

TWO 54 INCH SLUICES - PROVIDED WITH CATERPILLAR GATES ABOVE THE INLETS.

Low Level Control: (Type and Size) 54 INCH HOWELL-BUNGER VALVES REGULATE DISCHARGE

Valve Condition GOOD. BOTH VALVES OPERATED SEVERAL TIMES IN RECENT YEARS

~~Emergency~~ Spillway Type (Material) REINFORCED CONCRETE Width 48 FEET

Side Slopes _____

Height (Crest to Top) 23 FT

Exit Slope _____

Exit Length _____

Ponded Surface Area 578 Acres

Capacity (Normal Level) 25,500 Acre Feet

Capacity Emergency Spillway Level ___ Acre Feet

3. Embankment

NOT APPLICABLE

a. Crest _____

(1) Vertical Alignment _____

(2) Horizontal Alignment _____

(3) Longitudinal Surface Cracks _____

(4) Transverse Surface Cracks _____

(5) General Condition of Surface _____

(6) Miscellaneous _____

b. Upstream Slope NOT APPLICABLE

(1) Undesirable Growth or Debris

(2) Sloughing, Subsidence, or Depressions

(3) Slope Protection

(a) Condition of Riprap

(b) Durability of Individual Stones

(c) Adequacy of Slope Protection Against Waves and Runoff

(d) Gradation of Slope Protection - Localized Areas of Fine Material

(4) Surface Cracks

c. Downstream Slope

(1) Undesirable Growth or Debris

(2) Sloughing, Subsidence, or Depressions; Abnormal Bulges or Non-Uniformity

NOT APPLICABLE

(3) Surface Cracks on Face of Slope

(4) Surface Cracks or Evidence of Heaving at Embankment Toe

(5) Wet of Saturated Areas or Other Evidence of Seepage on Face of Slope; Evidence of "Piping" or "Boils"

(6) Fill Contact with Outlet Structure

(7) Condition of Grass Slope Protection

d. Abutments

(1) Erosion of Contact of Embankment with Abutment from Surface Water Runoff, Upstream or Downstream

(2) Springs or Indications of Seepage Along Contact of Embankment with the Abutments

(3) Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

NOT APPLICABLE

e. Area Downstream of Embankment, Including Tailrace Channel

(1) Localized Subsidence, Depressions, Sinkholes, Etc.

(2) Evidence of "Piping" or "Boils"

(3) Unusual Presence of Lush Growth, such as Swamp Grass, etc.

(4) Unusual Muddy Water in Downstream Channel

(5) Sloughing or Erosion

(6) Surface Cracks or Evidence of Heaving Beyond Embankment, Toe

(7) Stability of Tailrace Channel Sideslopes NOT APPLICABLE

(8) Condition of Tailrace Channel Riprap

(9) Adequacy of Slope Protection Against Waves, Currents and Surface Runoff

(10) Miscellaneous

f. Drainage System

(1) Condition of Relief Wells, Drains and Appurtenances

(2) Unusual Increase or Decrease in Discharge from Relief Wells

4. Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

(Other)

5. Reservoir

a. Slopes PORTIONS OF RESERVOIR SLOPES VISIBLE FROM THE DAM SHOW NO SIGNS OF DISTRESS, INSTABILITY OR OTHER ADVERSE CONDITIONS.

b. Sedimentation NOT VISIBLE.

FOR SEDIMENTATION INVESTIGATION OF RUSHFORD LAKE SEE JAN. 23, 1952 FOR REPORT OF SOIL CONSERVATION SERVICE OF U.S. DEPT. OF AGRICULTURE

6. Spillways

FOR SPILLWAY PLAN, PROFILE & DETAILS SEE DWG. No. 31430-58

a. ~~Principal Spillway; Inlet Condition~~ FOR SPILLWAY EROSION & REPAIR ~~Pipe Condition~~ SEE DWG. No. 31430-69

General Remarks (include information such as recently repaired, potential for debris accumulation, special items of note, etc.)

SPALLING AND DETERIORATION OF SOME INTERIOR AND EXTERIOR WALL SURFACES HAS RESULTED IN EXPOSED REBARS.

PARTS OF THE END SLAB AND DOWNSTREAM CONCRETE STRUCTURE WERE DAMAGED AND REMOVED. WATER FLOWING OVER THE DOWNSTREAM END OF THE SPILLWAY TENDS TO ERODE THE ROCK BOTH AT THE CHANNEL SURFACE AND BELOW BEFORE FLOWING INTO CANEADEA CREEK

~~b. Emergency Spillway; General Condition~~

Tree Growth

Erosion

Other Observations

7. Structural (if required) See Attached Appendix

8. Downstream Channel

WATER FROM DAM FLOWS INTO CANEADEA CREEK, APPROXIMATELY 2 MILES ABOVE ITS JUNCTION WITH THE GENESEE RIVER.

a. Condition (obstructions, debris, etc.)

b. Slopes

c. Approximate No. Homes and Population THE VILLAGE OF CANEADEA WITH A SMALL POPULATION AND SEVERAL HOMES WOULD BE AFFECTED BY A FLOOD.

d. General

H. B. LEVENTHAL

TEAM CAPTAIN

STRUCTURAL INSPECTION CHECKLIST

PHASE I DAM INSPECTION

1. Concrete Surfaces UPSTREAM AND DOWNSTREAM FACES OF ARCH DAM ARE BRICK FACED. THERE ARE NUMEROUS AREAS WITH WHITE (EFFLORESCENCE) DEPOSITS ON THE DOWNSTREAM FACE OF DAM. SOME CRACKS AND SPALLING OF BRICK ARE VISIBLE.

2. Structural Cracking SOME MINOR CRACKS IN PIER BETWEEN SPILLWAY GATES AND IN WALLS OF SPILLWAY.

3. Movement - Horizontal and Vertical Alignment NONE NOTICEABLE

4. Junctions with Abutments or Embankments SOME GRASS AND VEGETATION GROWING ON FACE OF STRUCTURE AT JUNCTION.

5. Drains - Foundation, Joint, Face FOUNDATION DRAINS NOT VISIBLE. SOME DRAINS IN FACE OF SPILLWAY WALLS WERE NOT WORKING.

6. Water Passages, Conduits, Sluices LOW LEVEL OUTLETS - SLUICES AND HOWELL-BUNGER VALVES APPEAR IN GOOD CONDITION. SOME EROSION OF DOWNSTREAM SPILLWAY FLOOR SURFACES. SEVERE EROSION TO DOWNSTREAM END OF SPILLWAY EXPOSING ROCK SURFACE BELOW.

7. Seepage or Leakage MINOR LEAKAGE ON DOWNSTREAM FACE OF DAM APPEARS TO BE ALONG HORIZONTAL AND VERTICAL JOINTS OF BRICKWORK. SEEPAGE ALSO NOTED COMING FROM THE DOWNSTREAM FACE OF THE LEFT CONCRETE ABUTMENT.

8. Monolith Joints - Construction Joints CONTRACTION JOINTS EVERY 40 FT IN ARCH DAM. SOME SEEPAGE WAS IN VICINITY OF CONTRACTION JOINTS

9. Foundation THE FOUNDATION ROCK AT THE LOWER LEVEL IS THINLY BEDDED SHALE WHICH BREAKS EASILY. ROCK IMMEDIATELY ABOVE CREST NEAR LEFT ABUTMENT IS SANDSTONE.

10. Abutments LARGE AREA OF THE DOWNSTREAM SURFACE OF THE LEFT ABUTMENT HAS SPALLED.

SPILLWAY

11. Control Gates BOTH GATES CLOSED. LEFT GATE - SLIGHT LEAK AT BOTTOM OF LEFTEND AND MODERATE LEAKAGE SQUIRTING NEAR BOTTOM OF RIGHT END. AT RIGHT GATE THERE WAS LIGHT LEAKAGE AT BOTH BOTTOM CORNERS.

12. Approach and Outlet Channels PLUNGE POOL VISIBLE AT END OF SPILLWAY. A LOW WEIR IS LOCATED DOWNSTREAM OF DAM TO MAINTAIN LEVEL OF WATER SUFFICIENT TO SUBMERGE H-B VALVES.

13. Stilling Basin NONE

14. Intake Structure NOT VISIBLE.

15. Settlement NONE

16. Stability

a. Overturning –

b. Sliding –

c. Seismic NOT REQUIRED - SEISMIC ZONE No. 2

17. Instrumentation NONE

a. Alignment

b. Uplift

c. Seismic

18. Miscellaneous

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX E

TAMS

Job No. 1487-11 Sheet _____ of _____

Project DAM INSPECTION Date July 5, 1978

Subject CANEADEA DAM By M.G-G.

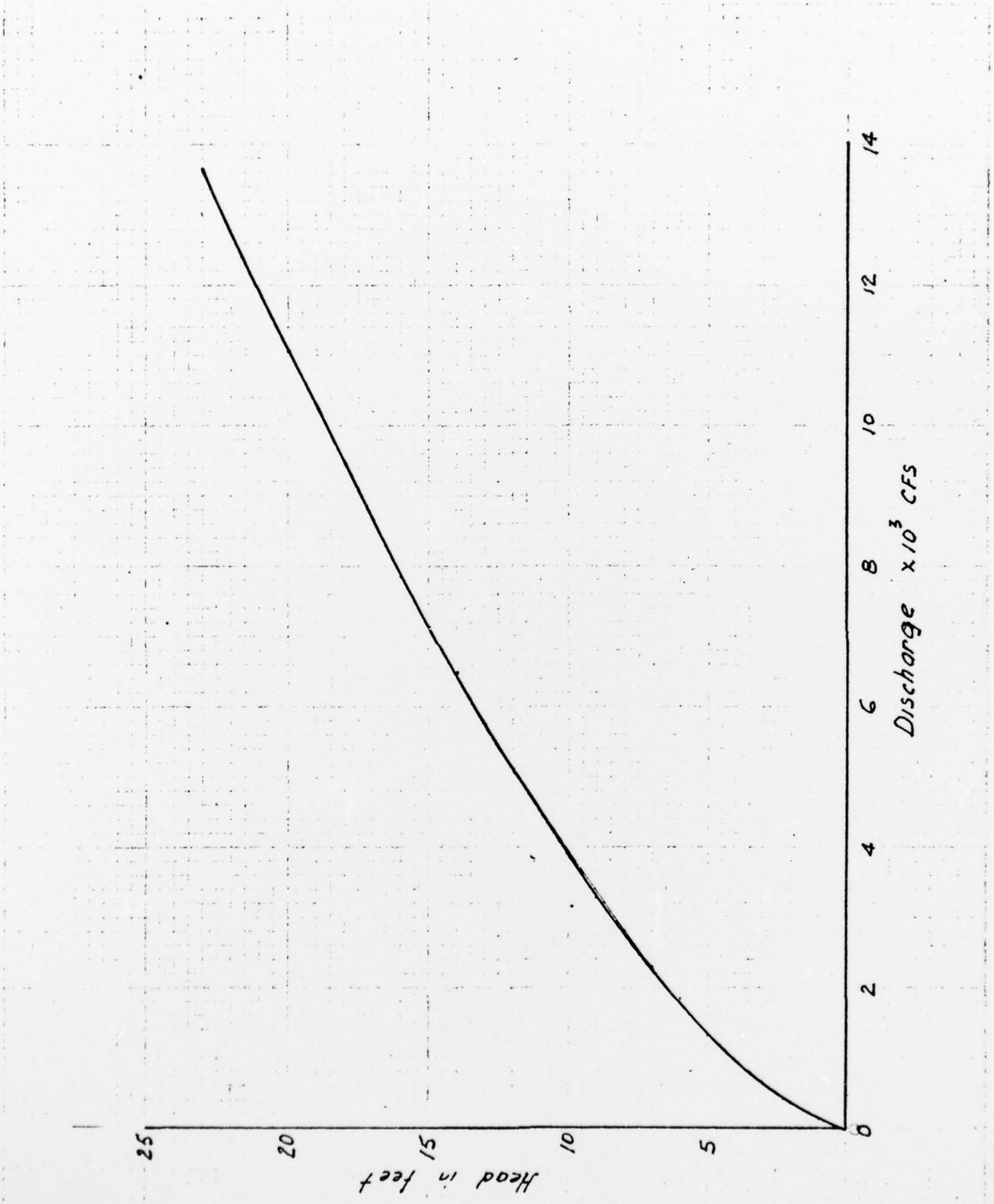
Ch'k. by _____

H	$H^{3/2}$	$Q = CLH^{3/2}$
1	1.000	120
2	2.828	350
3	5.196	640
4	8.000	990
5	11.180	1380
6	14.697	1820
7	18.520	2290
8	22.627	2800
9	27.000	3340
10	31.623	3900
11	36.483	4500
12	41.569	5140
13	46.872	5790
14	52.383	6480
15	58.095	7180
16	64.000	7910
17	70.093	8663
18	76.368	9440
19	82.819	10240
20	89.443	11060

$L = 40.0$

$C = 3.09$

$CL = 123.6$



SPILLWAY RATING CURVE		
1487-11	CANEADEA DAM.	D.L.C. 7.7.78