AD-A077 482 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. MONGAUP FALLS DAM (INVENTORY NUMBE--ETC(U)
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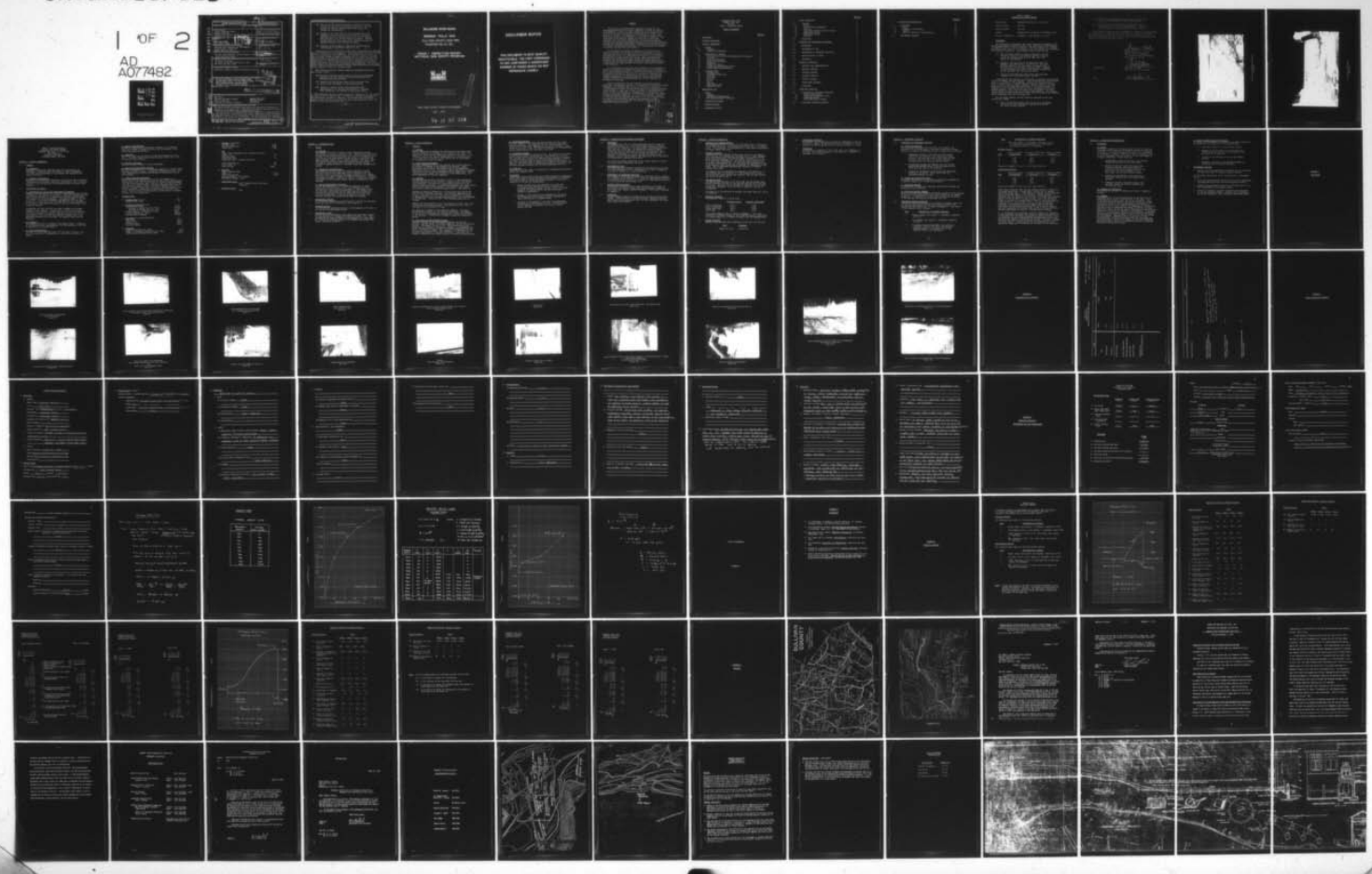

AD A077482

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
Mongaup Falls Dam
Delaware River Basin, Sullivan County, New York
Inventory No. 321

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

6. PERFORMING ORG. REPORT NUMBER

LEVEL II

7. AUTHOR(s)
George Koch, P.E.

8. CONTRACT OR GRANT NUMBER(s)
DACW-51-79-C-0001

9. PERFORMING ORGANIZATION NAME AND ADDRESS
New York State Department of Environmental Conservation/ 50 Wolf Road
Albany, New York 12233

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
12 167

11. CONTROLLING OFFICE NAME AND ADDRESS
New York State Department of Environmental Conservation/ 50 Wolf Road
Albany, New York 12233

12. REPORT DATE
24 Sep[illegible]79

13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)
Department of the Army
26 Federal Plaza/ New York District, CofE
New York, New York 10007

15. SECURITY CLASS. (of this report)
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)
National Dam Safety Program, Mongaup Falls Dam (Inventory Number NY 321), Delaware River Basin, Mongaup River, Sullivan County, New York. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES
ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

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
Mongaup Falls Dam
Sullivan County
Forestburg

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.

The examination of documents and visual inspection of Mongaup Falls Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. ~~These problem areas are as follows:~~ cont.

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(1) The structural stability analysis indicates that the factors of safety for the spillway section of the dam during the Probable Maximum Flood (PMF) and ½ PMF events are unacceptable.

(2) Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake walls of the gate house, and the non-overflow section. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.

(3) Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, the following: Installation and monitoring of weirs or other devices to measure seepage, concrete coring of the gate house structure, and subsurface exploration of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. Drill holes may also serve to determine the uplift forces beneath the dam to aid in stability investigations. The investigations should be initiated within 6 months from notification and remedial action completed within the following year.

The following remedial actions should be completed within this construction season:

(4) Trim the vegetative growth noted on the earth embankment portion up to and including the vegetation noted near the south spillway buttress.

(5) Backfill the depressions noted on the upstream side of the earth embankment in the original grade.

(6) Initiate a program of periodic inspections and maintenance of the dam and appurtenances. Document this information and develop an operations manual.

The discharge capacity of the spillway is inadequate for all floods in excess of 79% of the PMF (PMF = 38,000 CFS), without overtopping of the non-overflow portions of the dam. The maximum reservoir level during the PMF will be 2 feet over the top of dam and during the ½ PMF will be 3 feet below the top of dam.

DELAWARE RIVER BASIN

MONGAUP FALLS DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 321

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NEW YORK DISTRICT CORPS OF ENGINEERS

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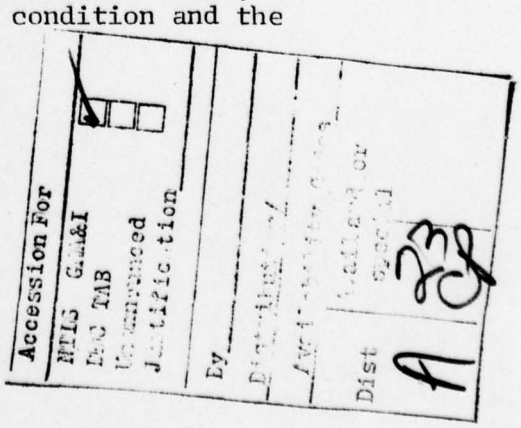
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



DELAWARE RIVER BASIN
MONGAUP FALLS DAM
NY 321
PHASE I INSPECTION REPORT

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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Mongaup Falls Dam (I.D. No. NY 321)
State Located:	New York
County Located:	Sullivan
Stream:	Mongaup River (tributary of Delaware River)
Dates of Inspection:	November 8, 1978 and April 20, 1979

ASSESSMENT

The examination of documents and visual inspection of Mongaup Falls Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of problem areas, which if not remedied, have the potential for developing into hazardous conditions. These problem areas are as follows:

(1) The structural stability analysis indicates that the factors of safety for the spillway section of the dam during the Probable Maximum Flood (PMF) and ½ PMF events are unacceptable.

(2) Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake walls of the gate house, and the non-overflow section. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.

(3) Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.

Investigations are required in these areas to ascertain the type and extent of remedial measures required. These investigations should include, but not be limited to, the following: Installation and monitoring of weirs or other devices to measure seepage, concrete coring of the gate house structure, and subsurface exploration of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. Drill holes may also serve to determine the uplift forces beneath the dam to aid in stability investigations. The investigations should be initiated within 6 months from notification and remedial action completed within the following year.

The following remedial actions should be completed within this construction season:

(4) Trim the vegetative growth noted on the earth embankment portion up to and including the vegetation noted near the south spillway buttress.

(5) Backfill the depressions noted on the upstream side of the earth embankment in the original grade.

(6) Initiate a program of periodic inspections and maintenance of the dam and appurtenances. Document this information and develop an operations manual.

The discharge capacity of the spillway is inadequate for all floods in excess of 79% of the PMF (PMF = 38,000 CFS), without overtopping of the non-overflow portions of the dam. The maximum reservoir level during the PMF will be 2 feet over the top of dam and during the ½ PMF will be 3 feet below the top of dam.

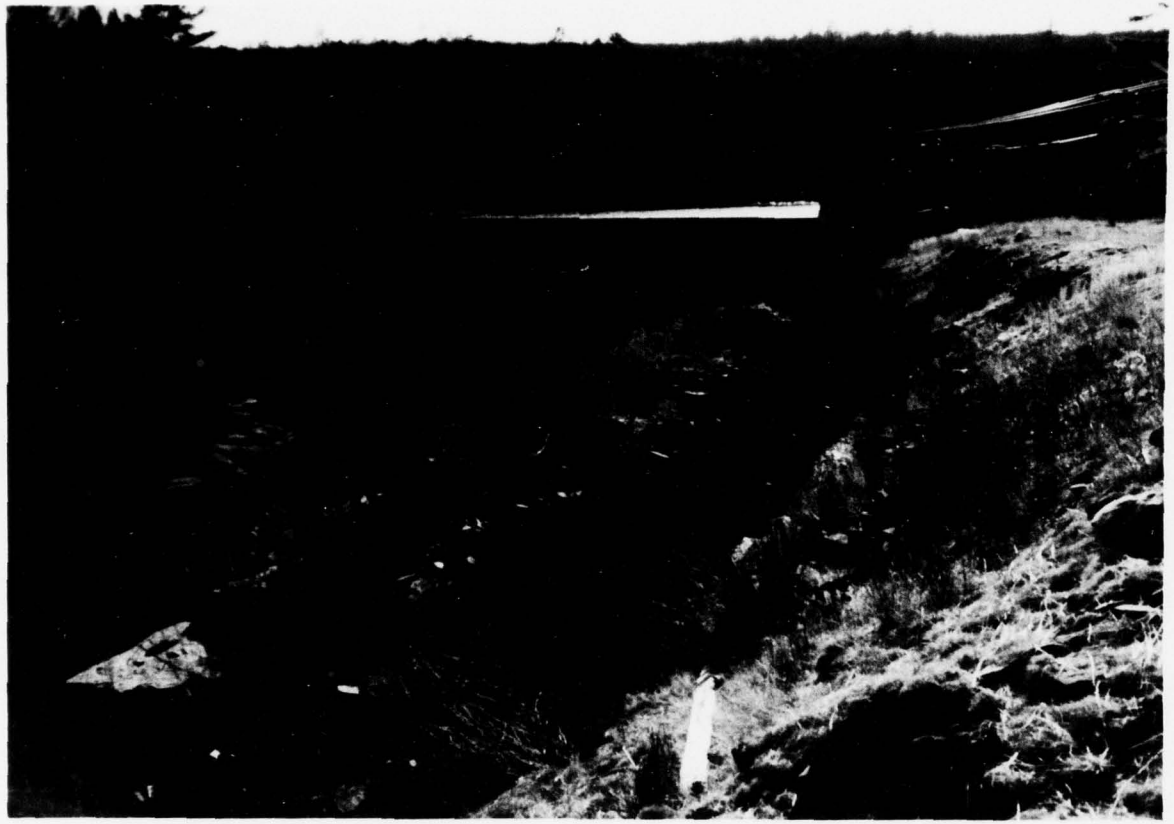
George Koch

George Koch
Chief, Dam Safety Section
New York State Department
of Environmental Conservation
NY License No. 45937

Clark H. Benn

Approved By: Col Clark H. Benn
New York District Engineer

Date: 27 September 79



Overview of Mongaup Falls Dam
Photo #1

Overview of Spillway
Photo #2

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
MONGAUP FALLS DAM, I.D. NO. NY 321
DEC #148D-130
DELAWARE RIVER BASIN
SULLIVAN COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of the Dam and Appurtenant Structures

Mongaup Falls Dam consists of a 155 foot long concrete ogee spillway, buttresses at each end of the spillway, a concrete retaining section north of the spillway, and a concrete non-overflow section keyed into bedrock at the south abutment. The maximum height of the dam is 60 feet. A low earth embankment approximately 200 feet long serves as a closure dike and is located about 150 feet southwest of the spillway. The concrete portions of the dam are founded on and keyed into bedrock.

Flashboards 4.8 feet in height are used to augment the storage capacity of the reservoir. A gate house, located at the north abutment of the spillway, controls the flow to the 8-foot diameter wood stave penstock. A vertical slide gate controls the flow to the penstock. The 2800-foot long penstock provides flow to the generating station east of the dam. No reservoir drain was constructed.

b. Location

The Mongaup Falls Dam is located on the Mongaup River, a tributary of the Delaware River, approximately 10 miles southwest of the City of Monticello in Sullivan County.

c. Size Classification

The dam is 60 feet high and stores 1607 acre-feet of water. The dam is classified as "intermediate" in size (40 to 100 feet in height).

d. Hazard Classification

The dam is classified as high hazard, because of its location above the Village of Mongaup (8 miles) and the presence of one other high hazard dam below it.

e. Ownership

The dam is owned and operated by Orange and Rockland Utilities, Inc., 1 Blue Hill Plaza, Pearl River, New York 10965, Tel: (914) 627-2410 or (914) 343-0621.

f. Purpose of the Dam

The dam provides storage for power development.

g. Design and Construction History

The dam was designed by R. R. Livingston Engineers, 2 Rector Street, New York, New York in 1922. The dam was constructed in 1923. No other engineering information pertaining to construction history was available.

h. Normal Operating Procedures

Water stored in the reservoir is used for the generation of electricity by the turbines housed in the power plant approximately 2800 feet below the dam. Water from the reservoir passes through a screen to the intake chamber, located in the gate house near the north spillway abutment, then to an 8-foot diameter wood stave penstock, through a surge tank, and then to the power house. Flow to the turbines is distributed by hydraulically operated wicket gates. Flow not used in the generation of electricity is allowed to spill over the flashboards.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	160
Height of dam (feet)	60
b. Discharge at Dam Site (cfs)	
Maximum known Flood	12,100
Spillway at Design Pool (El. 942.0	21,500
Spillway at Maximum Pool (El. 945)	30,200
Maximum Capacity of Reservoir drains	None
Total Discharge, Max. Pool	30,200
Average Daily Discharge	Unknown
c. Elevation (ft. above MSL-Datum)	
Top of Dam	945.0
Design Pool	942.0
Spillway Crest	930.0
Tailrace Channel	890.0
d. Reservoir	
Length of maximum Pool, miles	2.35
Length of Shoreline (Spillway Crest) miles	4.88
Surface area (Spillway Crest) acres	140.0

e. Storage, (Acre-feet)

Spillway Crest	1,200
Maximum Design Pool	3,000
Top of Dam	3,500

f. Dam

Type: Earth embankment with concrete core wall

Length (ft.)	218
Upstream slope	-
Downstream slope	31

Impervious Core: Concrete core wall

Crest elevation, ft.	945
Crest Width, ft.	12
Grout curtain	None

g. Spillway

Type: Concrete Ogee

Length, ft.	155.0
Crest Elevation MSL	930.0

Upstream Channel: Not Visible

Downstream Channel: Rock

h. Regulating Outlet

One 8' diameter wood stave pipe (Penstock)

i. Reservoir Drain

None

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Geology

The Mongaup Falls Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (northern extreme of the Appalachian Plateau) was formed by dissection of the uplifted but flat lying sandstones and shales of the middle and upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occurs in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally south or southwest toward the Delaware River system.

b. Subsurface Investigations

The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station indicates that the surficial soils are Lordstown and Oquaga of glacial till origin. These soils have good internal drainage characteristics. Boulders are common and depth to bedrock is variable. Bedrock was observed outcropping in the spillway channel and at the abutments of the spillway.

c. Dam and Appurtenant Structures

The dam was designed by R. R. Livingston Engineers, 2 Rector Street, New York, New York in 1922. All drawings which are available have been included in Appendix G. The design of the dam includes a buttressed concrete ogee spillway, abutted by 2 concrete non-overflow sections at either end of the spillway. A low closure embankment is located southwest of the dam. All concrete sections are founded on and keyed into bedrock.

2.2 CONSTRUCTION RECORDS

No information regarding the construction of the dam was available other than the year of completion, that being 1923.

2.3 OPERATION RECORD

All information concerning operation and maintenance of the dam is on file with the maintenance staff.

2.4 EVALUATION OF DATA

Some of the data presented in this report has been made available by representatives of Orange and Rockland Utilities, Inc. This information has been invaluable in the preparation of this report. All information gathered appears to be adequate and reliable for Phase 1 Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Mongaup Falls Dam and the surrounding watershed was conducted on November 8, 1978 and April 20, 1979. The weather was clear and the temperature ranged in the fifties. The reservoir level at the time of inspection was at elevation 930.5 or 0.5 feet above the crest of the spillway due to the presence of flashboards 4.8 feet in height.

b. Earth Closure Embankment

The earth embankment south of the spillway was in good condition. No evidence of seepage or misalignment was observed. Three depressions were noted on the upstream side of the embankment. (See photos #19,20, & 21) The cause of these depressions is unknown. The distance from the earth embankment and the height above normal reservoir levels warrent only filling of these depressions. The earth embankment was heavily vegetated.

c. Spillway

The spillway was treated with gunite in 1975-76, thus masking any detailed inspection of the concrete. Numerous small face drains were installed in the gunite to avoid pressure build up at the concrete-gunite interface. No seepage was apparent from these drains. Some moss and debris were observed. Calcification was evident particularly along the horizontal gunite joints. (See photo #4)

Seepage was observed flowing from a 6-inch drain pipe protruding from the north spillway buttress. This flow was estimated to be 25 gpm. (See photos #7 & 8) This flow is believed to be caused by seepage from the rock outcrop and gate house at the north abutment of the spillway. (See photo #16) The remaining pipes were not flowing.

Seepage was also observed at the south spillway buttress and at the rock outcrop behind the buttress. (See photos #5 & 10) Flow is estimated to be in excess of 15 gpm.

The spillway is founded on and keyed into bedrock. The outlet and downstream channel are also bedrock controlled. The bedrock at the toe of the spillway was rock-bolted to insure the stability of the spillway. A rock bolt is evident in photo #8, right foreground.

d. Gate House and Non-Overflow Section

Concrete surfaces are deteriorated particularly at the north buttress, the gate house, the intake wingwalls, and the non-overflow section. (See photos #7,11,12, & 16) While deterioration was extensive, no evidence of settlement, movement, or misalignment was noted. Seepage was observed above the penstock eminating from the east wall of the gate house. This seepage is an indication of the concrete deterioration of the gate house wall. (See photo #16) Extensive vegetation was evident south of the south spillway buttress.

e. Regulating Outlets

An 8-foot diameter wood stave penstock provides the only outlet from the reservoir. This penstock and the vertical slide gate located in the gate tower appeared to be in good condition. (See photos #1,13,14,15, & 18) The penstock terminates at the generating station approximately 2800 feet east of the dam.

f. Downstream Channel

The downstream channel is bedrock formed. The bedrock has extensive joints, both vertical and horizontal. (See photos #2,6,8 & 17) This jointing was of sufficient magnitude that the owner conducted a program of rock bolting to insure the sliding stability of the dam. The consulting firm of Ralph Smith initiated this action. In addition, 400 cubic yards of concrete was placed at the base of the spillway and gunite placed over the entire spillway (1975-76).

g. Reservoir

There are no visible signs of instability or sedimentation problems within the reservoir area.

3.2 EVALUATION

Three significant problem areas were evident during the inspections. These areas require further engineering investigation to determine the need and type of corrective action necessary to insure the stability of the dam and appurtenances.

1. Seepage evident above the penstock on the east wall of the gate house and deterioration of concrete at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section is significant.

2. Seepage at the north and south abutments of the spillway necessitate installation of weirs, measurement of flows, and analysis of seepage forces.

3. Jointing of the bedrock in the outlet and downstream channels may extend beneath the dam. A boring program may be required to determine the extent of joints beneath the dam.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The Mongaup Falls Dam is a power generating dam for Orange and Rockland Utilities, Inc. An 8-foot diameter penstock carries water from the reservoir to the power plant located approximately 2800 feet east of the dam. An electrically operated remote controlled vertical slide gate located in the gate house north of the spillway controls the flow through the penstock. The penstock is connected to a surge tank near the power plant. In addition, flow at the entrance to the generators can be controlled by hydraulically operated wicket gates.

All valves are remote controlled by the systems operator located on Dolson Avenue, Middletown, New York.

4.2 MAINTENANCE OF DAM

The operating and maintenance records for the facility are on file with the maintenance staff. Maintenance of the dam is inadequate as noted in "Section 3: Visual Inspection".

4.3 MAINTENANCE OF OPERATING FACILITIES

Maintenance of generating equipment and associated valves, conduits, etc., appears to be adequate. All valves are reported operational. No operations manual is on file. A record of maintenance operations is on file with the maintenance staff.

4.4 WARNING SYSTEM IN EFFECT

An excellent warning system has been developed by the owner, in accordance with Federal Energy Regulating Commission standards. This system was recently updated (December 7, 1978) and is included in Appendix G.

4.5 EVALUATION

Certain remedial measures are required to provide the proper maintenance. Deterioration of concrete surfaces, vegetation removal, and backfilling of depressions near the earth embankment are areas which require maintenance.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Mongaup Falls Dam is located on the Mongaup River, a tributary of the Delaware River. The drainage area at the dam is 160 square miles. The topography is characterized by steep slopes interspersed by swamps, ponds, and lakes.

5.2 ANALYSIS CRITERIA

Information on the Standard Project Flood (SPF) for the Mongaup Falls Dam and its watershed was obtained from the "Upper Delaware River Basin Hydrologic Flood Routing Model" prepared in 1976 by Water Resources Engineers, Inc. for the New York District of the U.S. Army Corps of Engineers. The rainfall runoff mathematical model HEC-1 developed by the U.S. Army Corps of Engineers was used to reconstitute major floods and to simulate SPF considered in the study. SPF is considered approximately one-half of Probable Maximum Flood (PMF).

The Mongaup Falls Dam watershed is composed of sub-basins 49, 50, and northern part of sub-basin 51 of the Delaware River Basin. The inflow was routed through the reservoir, and the peak outflow was 19,000 cfs due to SPF.

5.3 SPILLWAY CAPACITY

The ungated ogee spillway is 155 feet long, and the maximum head possible between the crest of the spillway and the top of the dam is 15 feet. The crest of the spillway is topped by 4.8-foot high flashboards designed to fail at 2 feet of head over the top of flashborads.

The capacity of the spillway at maximum high water level (EL. 945.0) is 30200 cfs.

5.4 RESERVOIR CAPACITY

The reservoir capacity is given below:

	Elevation (feet)	Capacity (acre-feet)
Crest of spillway	930.0	1,200
Top of flashboards	934.8	1,650
Design High Water	942.0	3,000
Top of dam	945.0	3,500

The storage capacity curve is shown in Appendix C. The curve indicates a surcharge storage of 2300 acre-feet which is equivalent to a runoff depth of 0.27 inches of runoff over the drainage area.

5.5 FLOODS OF RECORD

Maximum flood recorded since completion of the dam is as follows:

DATE	DISCHARGE
August 19, 1955	12,000 cfs

5.6 OVERTOPPING POTENTIAL

The capacity of the spillway is 30,200 cfs compared to a SPF of 19,000 cfs. Hence, the spillway can pass 159 percent of the SPF. However, the PMF of 38,000 cfs will overtop the dam by 1.5 feet.

5.7 EVALUATION

The spillway is adequate to pass ½ PMF (SPF), but inadequate to pass PMF. The maximum capacity of the spillway is adequate to discharge 79% of the PMF.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The following conditions were observed, which indicate the potential for the development of hazardous conditions although they do not indicate an immediate hazard to human life or property:

1. Seepage was evident on the east wall of the gate house above the penstock, and considerable deterioration of concrete was noted at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section.

2. Considerable seepage was apparent from the exposed bedrock and through drains in the buttresses at the north and south ends of the spillway.

3. Jointing of the bedrock in the outlet and downstream channels is extensive. These joints may have progressed beneath the dam.

b. Design and Construction Data

No design computations or construction information regarding the structural stability of the dam are available.

c. Operating Records

No operational problems were reported, which would influence the stability of the structure.

d. Post-Construction Changes

Ralph Smith Consulting Engineers initiated a program of rock bolting at the toe of the spillway to insure the integrity of the bedrock foundation. In addition, 400 cubic yards of concrete was placed at the toe and the spillway was gunited (1975-76).

6.2 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted on Mongaup Falls Dam for the spillway section and the non-overflow section. The information and analysis are included in Appendix F. The results of this analysis are as follows:

Case	Description of Loading Conditions
1	Normal Loading, full uplift, 3' tailwater, reservoir at 933.0;
2	Ice Loading, full uplift, 3' tailwater, reservoir at 928.0;
3	½ Probable Maximum Flood (PMF), full uplift, 3' tailwater, reservoir at 942.0 (12 feet above spillway crest or 3 feet below top of non-overflow section w/no tailwater);

Case	Description of Loading Conditions
4	PMF, full uplift, 3' tailwater, reservoir at 947.0 (17 feet above spillway crest, or 2 feet above non-overflow section w/no tailwater).

Spillway Section

Case	Factor of Safety Overturning	Location of Resultant from Toe	Factor of Safety Sliding
1	1.92	25.6	3.57
2	1.91	25.6	4.10
3	1.41	18.3	2.54
4	1.26	14.0	2.17

Location of middle 1/3 is 16.7 to 33.4 feet from toe.

Non-Overflow Section

Case	Factor of Safety Overturning	Location of Resultant from Toe	Factor of Safety Sliding
1	2.97	16.4	44.4
2	2.37	14.3	22.8
3	1.96	12.1	12.0
4	1.62	10.5	8.6

Location of middle 1/3 is 6.3 to 12.7 feet from toe.

These results indicate that the non-overflow section is stable for all design conditions. The spillway is stable for all design conditions except Case 4 - PMF, where the location of the resultant falls outside the middle 1/3 of the base. Further analysis indicates that for any storm less than 65% of the PMF, the resultant remains within the middle 1/3 of the base. Also, the factors of safety of sliding for the spillway section fall below the recommended value of 3.0 for Cases 3 and 4. This is not believed to be a problem, since rock bolting at the toe of the spillway was conducted to strengthen the passive wedge formed at the base. This factor was not taken into account in the stability program and would significantly increase these values to levels above the minimum requirements for factors of safety against sliding.

It is recommended that additional stability analyses be conducted to more accurately determine the factors of safety and location of the resultant for all cases concerning the spillway section. This investigation should be conducted in conjunction with the investigation of the bedrock jointing beneath the dam. The dam is located in seismic zone 1. Seismic forces are not considered to be of significant magnitude to influence the stability of the structure.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase 1 Inspection of Mongaup Falls Dam did not indicate conditions which constitute an immediate hazard to human life or property. The earth embankment portion is not considered to be unstable. However, there are a number of problem areas if not investigated have the potential for the development of hazardous conditions. These areas are:

1. Unacceptable factors of safety for the spillway section during the PMF and ½ PMF events.

2. Seepage on the east wall of the gate house above the penstock, and deterioration of concrete at the north spillway buttress, the gate house, the intake wingwalls of the gate house, and the non-overflow section.

3. Jointing of the bedrock in the outlet and downstream channels which may extend beneath the dam.

4. Seepage at the north and south ends of the spillway through the bedrock abutments and the buttress walls.

b. Adequacy of Information

The information reviewed is adequate for Phase 1 Inspection purposes.

c. Urgency

Investigation of the four problem areas listed above must be completed within 1 year of notification to the owner. The investigations should include, but not be limited to, coring of the gate house structure to determine the integrity of the concrete and cause of the observed seepage, and subsurface explanation of the outlet channel and foundation of the spillway with drill holes to determine the extent of bedrock jointing. These drill holes may also be used to determine the uplift forces beneath the dam to aid in stability investigations. In addition, weirs or other monitoring devices must be installed immediately and measurements taken bi-weekly to monitor the flow of seepage at all locations. Remedial action, as a result of these investigations, should be completed within the following construction season. Vegetative trimming of the earth embankment and backfilling of the near by depressions should be completed during this construction season.

d. Need for Additional Investigations

To prevent the development of potentially hazardous conditions, investigations are required in the following areas:

1. Structural stability of the spillway section.

2. Seepage on the east wall of the gate house and deterioration of concrete on all elements of the dam north of the spillway.

3. Jointing of the bedrock at the toe and beneath the dam.

4. Seepage at each end of the spillway through the buttresses and the bedrock abutments.

7.2 RECOMMENDED MEASURES

a. Results of the aforementioned investigations will determine the type and extent of remedial measures required.

The following improvements can be accomplished by maintenance forces:

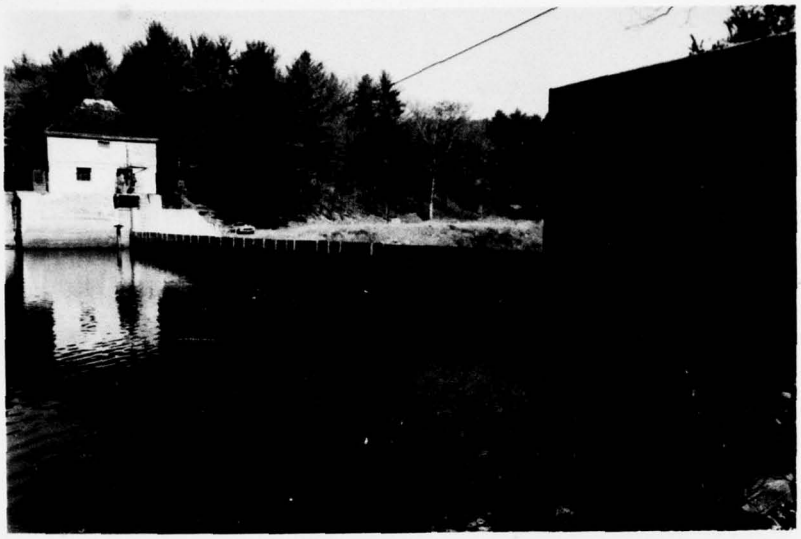
b. Trim the vegetative growth observed on the earth embankment, including that noted near the south spillway buttress.

c. Backfill the depressions noted on the upstream side of the earth embankment in the original grade.

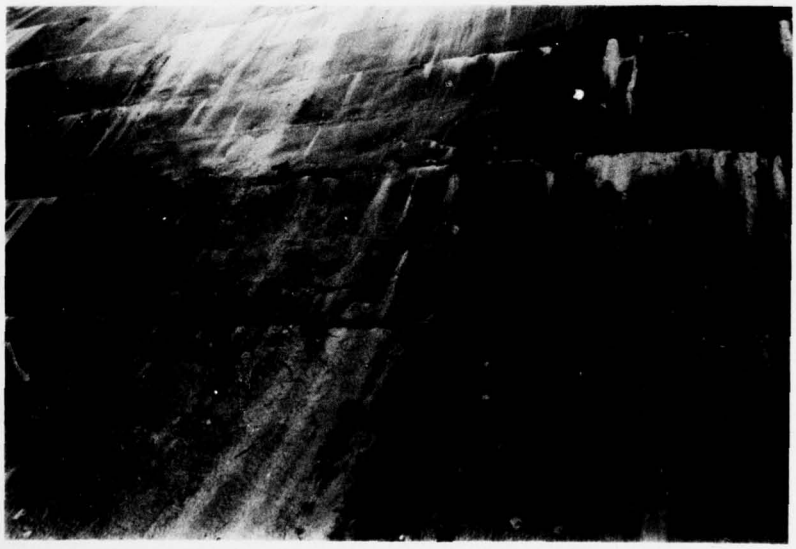
d. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also, develop an operations manual.

APPENDIX A

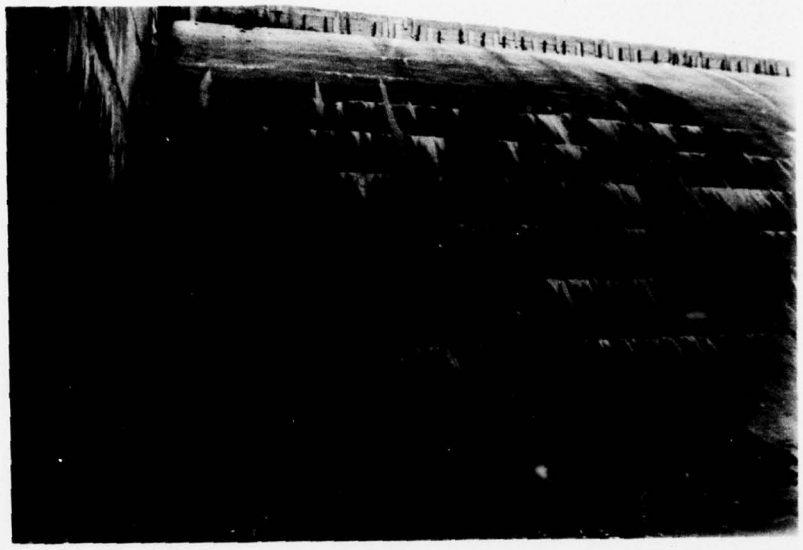
PHOTOGRAPHS



Spillway Viewed from Upstream
Note Flashboards
Photo #3

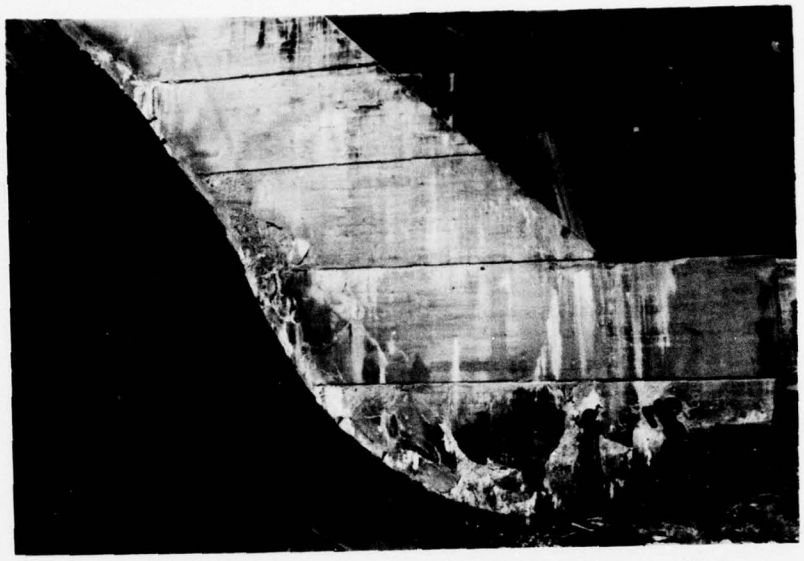


Face Drains Through Gunite Treated Spillway
Photo #4



South Abutment Wall and Spillway Viewed from Downstream
Note Deterioration and Calcification
Photo #5

Spillway Viewed from Downstream
Note Poured Concrete at the Toe of Spillway
and
Water Pool on the Right Corner
Photo #6



North Abutment Wall and Spillway
Note Seepage and Deterioration
Photo #7

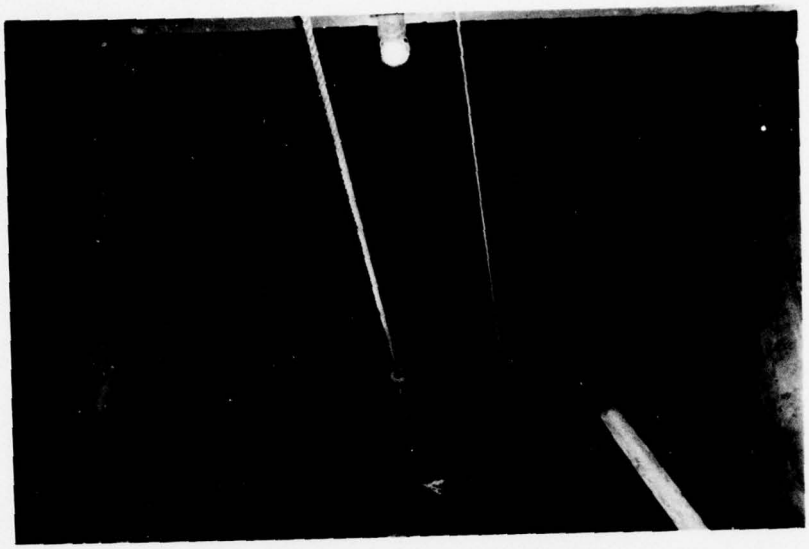
Closeup View of Seepage on Photo #7
Photo #8

South Abutment Wall
Note Cracks on Top
Photo #9

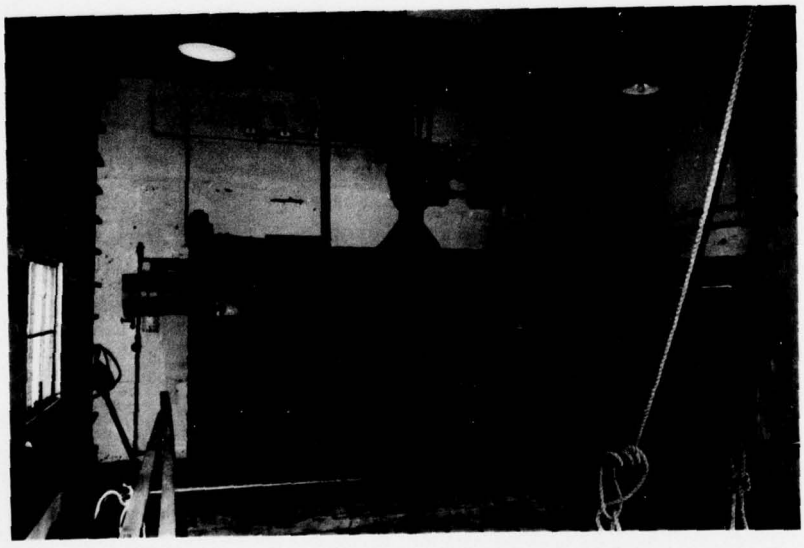
Seepage Near South Abutment
Photo #10

Concrete Retaining Wall and Gate House Viewed from Upstream
Note Concrete Deterioration
Photo #11

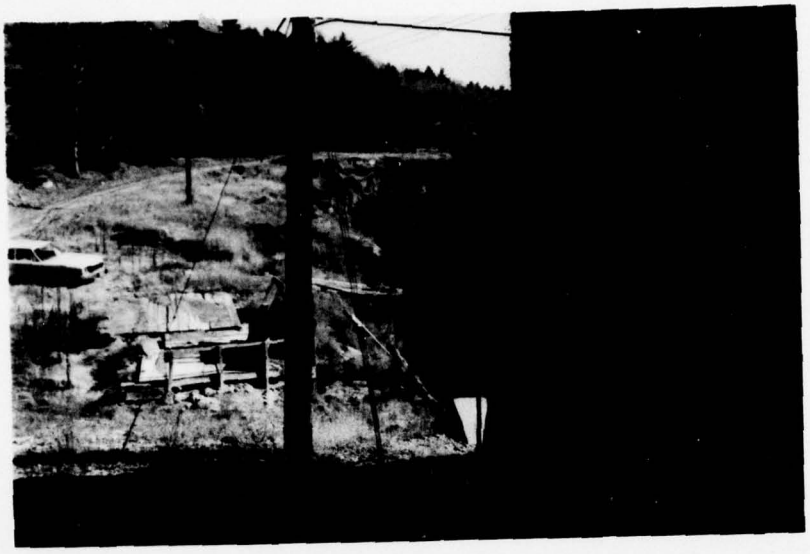
Intake
Note Concrete Deterioration
Photo #12



Intake Well
Photo #13

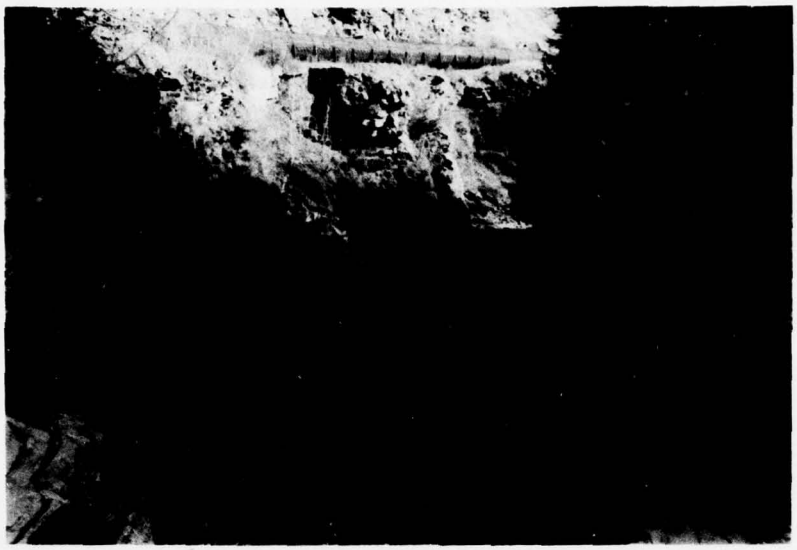


Vertical Slide Gate at Intake
Photo #14



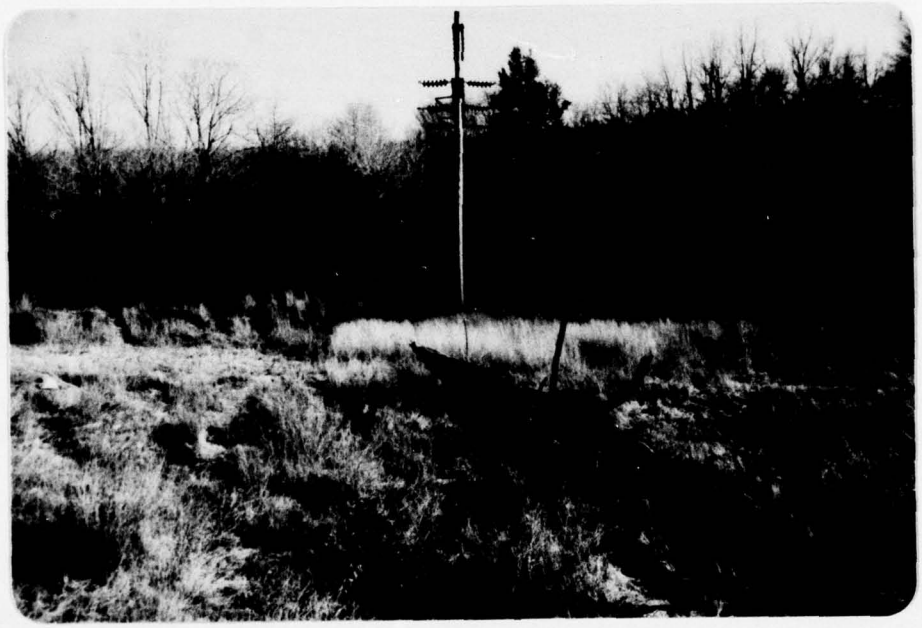
Gate House, Wood Stave Pipe (Penstock), and Access Road
Photo #15

North Abutment (left), Gate House (center), and Retaining Wall (right)
Viewed from Downstream
Note Concrete Deterioration
Photo #16

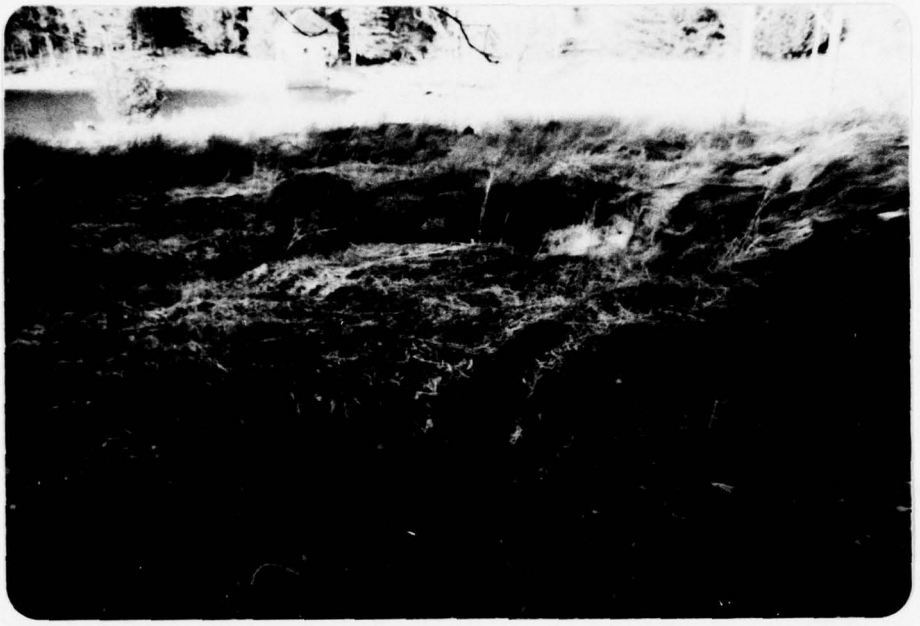


Downstream Channel Viewed from Spillway Top
Photo #17

Tailrace Channel and Penstock
Photo #18



Earth Embankment (Closure Dike) in the Background
Southwest of Spillway
Photo #19



Depression on Upstream Side of the Earth Embankment
Photo #20

Pool of Water on Upstream Side of Earth Embankment
Photo #21

APPENDIX B

ENGINEERING DATA CHECKLIST

Check List
Engineering Data
Design Construction Operation

Name of Dam Mongaup Falls

I.D. # NY 321

Item	Remarks		
	Plans	Details	Typical Sections
Dam			
Spillway(s)	YES	NO	YES
Outlet(s)	YES	NO	YES
Design Reports	NONE		
Design Computations	NONE		
Discharge Rating Curves	NONE		
Dam Stability			
Seepage Studies	NONE		
Subsurface and Materials Investigations	NONE		

Item	Remarks
Construction History	NONE
Surveys, Modifications, Post-Construction Engineering Studies and Reports	Ralph Smith Consulting Engrs initiated program of rock bolting at spillway toe & 900 cy of concrete to insure stability of rock boundation. Also spillway gunited in (1975-76)
Accidents or Failure of Dam Description, Reports	NONE
Operation and Maintenance Records Operation Manual	YES

APPENDIX C

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam MONGAUP FALLS

I.D. # N.Y. 321

Location: Town FOREST BURG & LUMBERLAND County SULLIVAN

Stream Name MANGAUP RIVER

Tributary of DELAWARE RIVER

Longitude (W), Latitude (N) 74° 46' 20", 41° 32' 15'

Hazard Category C

Date(s) of Inspection NOV. 8, 1978, Apr 20, 1979

Weather Conditions 40's CLEAR, SUNNY

b. Inspection Personnel ROBERT McCARTY, MUHAMMAD ISLAM, KENNETH FIELD.

c. Persons Contacted KENNETH FIELD. (914) 627-2410
ROBERT STUBER (914) 429-3061

d. History:

Date Constructed JUNE 20, 1923

Owner ORANGE AND ROCKLAND UTILITIES INC.

Designer R.R. LIVINGSTON, 2 RECTOR ST. NYC

Constructed by —

2) Technical Data

Type of Dam CONCRETE ABUTMENT, EARTH EMBANKMENT WITH CONCRETE CORE WALL

Drainage Area 160 SQUARE MILES

Height 60 FT. Length 218 FT.

Upstream Slope vertical Downstream Slope 3:1

YJ

2) Technical Data (Cont'd.)

External Drains: on Downstream Face NONE OTHER THAN FACE DRAINS IN SPILLWAY. @ Downstream Toe NONE

Internal Components:

Impervious Core CONCRETE CORE WALLS ON BOTH SIDES OF SPILLWAY.

Drains NONE

Cutoff Type CONCRETE CUTOFF WALLS UNDER SPILLWAY AND CORE WALLS.

Grout Curtain NONE

3) Embankment

Earth dike on south of spillway.

a. Crest

(1) Vertical Alignment Good

(2) Horizontal Alignment Good

(3) Surface Cracks None observed

(4) Miscellaneous –

b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows Heavy weeds. Should be trimmed and mowed.

(2) Sloughing, Subsidence or Depressions 3 depressions on upstream side of dike. Source or reason unknown.

(3) Slope Protection None

(4) Surface Cracks or Movement at Toe None observed

(5) Seepage

(6) Condition Around Outlet Structure No outlet other than penstock.

c. Abutments

(1) Erosion at Embankment and Abutment Contact

None

(2) Seepage along Contact of Embankment and Abutment

None

(3) Seepage at toe or along downstream face

None

d. Downstream Area - below embankment

Good

(1) Subsidence, Depressions, etc.

None

(2) Seepage, unusual growth None

(3) Evidence of surface movement beyond embankment toe

None

(4) Miscellaneous

—

e. Drainage System

NONE

(1) Condition of relief wells, drains, etc. None

(2) Discharge from Drainage System None

4) Instrumentation

(1) Monumentation/Surveys NONE

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

(5) Other AUTOMATIC WATEL LEVEL RECORDING GAGE

5) Reservoir

a. Slopes O.K.

b. Sedimentation NONE REPORTED

6) Spillway(s) (including tail race channel)

a. General The spillway was treated with gunite in 1975-76. Numerous small face drains were installed on the spillway to avoid pressure buildup between concrete of spillway and gunite.

b. Principle Spillway moss and dirt buildup was observed. Calcification, especially along horizonal gunite joints was obvious. Some debris was noticed at the base of spillway and on the joint of spillway and north abutment.

c. Emergency or Auxiliary Spillway None

d. Condition of Tail race channel Good

e. Stability of Channel side/slopes Channel floor and sides in rock. Stable

7) Downstream Channel

a. Condition (debris, etc.) clean.

b. Slopes channel in rock. Slopes almost vertical. No problems observed.

c. Approximate number of homes

8) Miscellaneous Flow through a 6" drain pipe was approximately 25 gpm. This was was collected from hills north of spillway. The 2 other pipes were dry. All three pipe came through the wingwall north of spillway. Flow through a pipe south of south (abutment) wing wall was approximately 15 gmp. This water was collected from the hills south & west of spillway.
Water ponded below the spillway near the south end.

9) Structural

a. Concrete Surfaces Concrete surfaces deteriorated and spalled in many places especially around the gate house, wing walls, abutments, non-overflow section and joints.

b. Structural Cracking There were a vertical and a horizontal crack on the south wing wall. Some small cracks on north wingwall and on non-overflow section north of spillway.

c. Movement - Horizontal & Vertical Alignment (Settlement) None observed.

d. Junctions with Abutments or Embankments Concrete deteriorated and spalled at junctions of spillway and abutments, and abutment and wing walls.

e. Drains - Foundation, Joint, Face None

f. Water passages, conduits, sluices None. only one wooden penstock.

g. Seepage or Leakage Water was leaking through penstock. It could not be determined if the spillway was leaking too.
Seepage evident on east wall of gate house above penstock should be investigated.

h. Joints - Construction, etc. Significant calcification at granite joints.

i. Foundation The dam is founded on solid rock. No problem anticipated.

j. Abutments Concrete deteriorated and spalled.

k. Control Gates A vertical gate controls the flow to the penstock. The gate is operated from time to time but the penstock is not closed completely. The gate operated electrically.

l. Approach & Outlet Channels Approach channel is under water; not visible. Outlet channel is clean and stable.

m. Energy Dissipators (plunge pool, etc.) None

n. Intake Structures Intake structure is located in the gate house. Some deterioration of concrete was observed in the tower. There was severe deterioration of concrete around the outside of gate house.

o. Stability A structural stability analysis was done by Ralph Smith Consulting Engineering firm. It was found that stability was low against sliding. Subsequently, 400 cubic yeard of concrete was placed at the base of the spillway.

p. ~~Miscellaneous~~

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	945	170	3500
2) Design High Water (Max. Design Pool)	942	160	3000
3) Auxiliary Spillway Crest	-	-	-
4) Pool Level with Flashboards			
5) Service Spillway Crest	930	140	1200

DISCHARGES

	Volume (cfs)
1) Average Daily	Unknown
2) Spillway @ Maximum High Water	21,500
3) Spillway @ Design High Water	21,500
4) Spillway @ Auxiliary Spillway Crest Elevation	-
5) Low Level Outlet	-
6) Total (of all facilities) @ Maximum High Water	21,500
7) Maximum Known Flood	Unknown

CREST: ELEVATION: 945

Type: CONCRETE ABUTMENT, EARTH EMBANKMENT WITH CONCRETE CORE WALLS.

Width: _____ Length: 218 FT.

Spillover CONCRETE OGEE

Location SOUTH OF SERVICE ROAD AND GATE HOUSE

SPILLWAY:

PRINCIPAL		EMERGENCY
930	Elevation	N/A
OGEE	Type	
155.2 FEET	Width	
	Type of Control	
YES	Uncontrolled	
	~~Controlled:~~	
4.8' HIGH FLASHBOARDS	Type (Flashboards; gate)	
Collapsible at 2' of water over flashboards		
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
-	Chute Length	
40 FEET	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate _____ Sluice _____ Conduit _____ Penstock Yes

Shape : CIRCULAR

Size: 8 FEET DIAMETER WOOD STAVE PIPE (PENSTOCK)

Elevations: Entrance Invert 901

Exit Invert 829.5

Tailrace Channel: Elevation 890

HYDROMETEROLOGICAL GAGES:

Type : NONE

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

_____

Method of Controlled Releases (mechanisms):

ONLY THROUGH PENSTOCK. ELECTRICALLY OPERATED GATE IN GATE HOUSE CAN SHUT OFF SUPPLY TO PENSTOCK.

DRAINAGE AREA: 160 SQUARE MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: _____

Terrain - Relief: _____

Surface - Soil: _____

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: _____

Elevation: _____

Reservoir:

Length @ Maximum Pool 2.35 (Miles)

Length of Shoreline (@ Spillway Crest) 4.88 (Miles)

Mongaup Falls Dam

Drainage area = 160 square miles

From "Upper Delaware River Basin Hydrologic flood Routing Model" Study, Subbasin 51 (49+50+51); page T8 to F7: (→ Station 4335.00 Mongaup River near Mongaup)

Area of Station 4335.00 = 202 sq. mi.

Drainage area of Mongaup Falls Dam consists of subbasin 49, 50 and upper part of 51.

Modified Standard Project flood (MSPF) = ½ PMF

MSPF = 22,820 cfs (Node 123; Sta. 4335; D.A. 202 sq.)

$PMF_1 = 2 \times 22820 = 45,640$ cfs

$$\frac{PMF_1}{PMF_2} = \left(\frac{A_1}{A_2}\right)^{3/4} \quad \text{or} \quad \frac{45,640}{PMF_2} = \left(\frac{202}{160}\right)^{3/4}$$

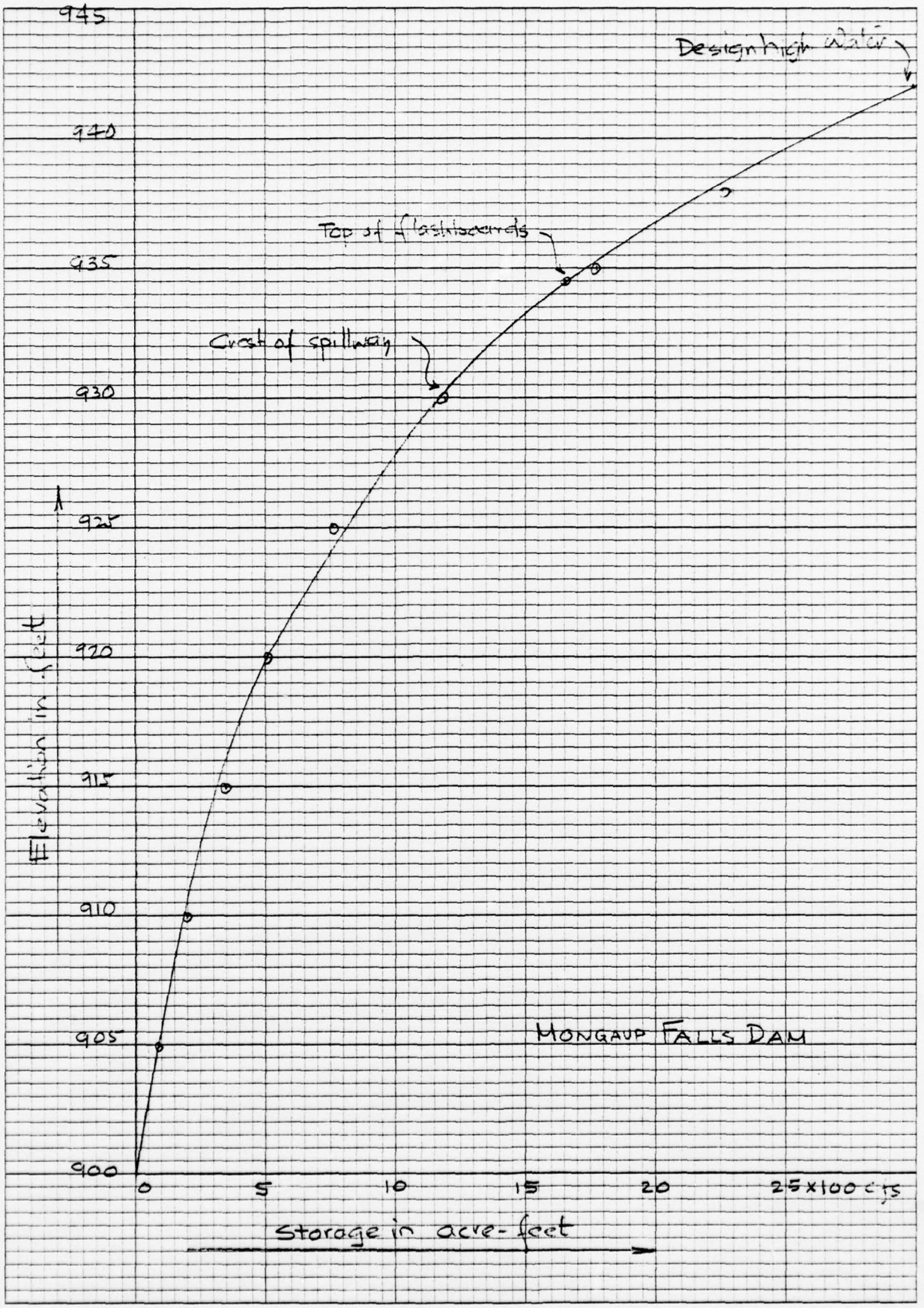
$PMF_2 = 38,320 \approx 38,000$ cfs

½ PMF = 19,000 cfs

MONCAP FALLS

STORAGE CAPACITY CURVE

Elevation (feet)	storage (acre-feet)
900	0
905	92
910	196
915	345
920	506
925	759
930	1196
935	1783
938	2266
942	3000



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SPILLWAY RATING CURVE

MONGAUP FALLS

$C = 3.27 + 0.4 \frac{H}{h}$ where C = Coefficient of discharge

H = Head over spillway

h = Height of spillway

$L = L' - 0.1NH$ L = Crest length of spillway

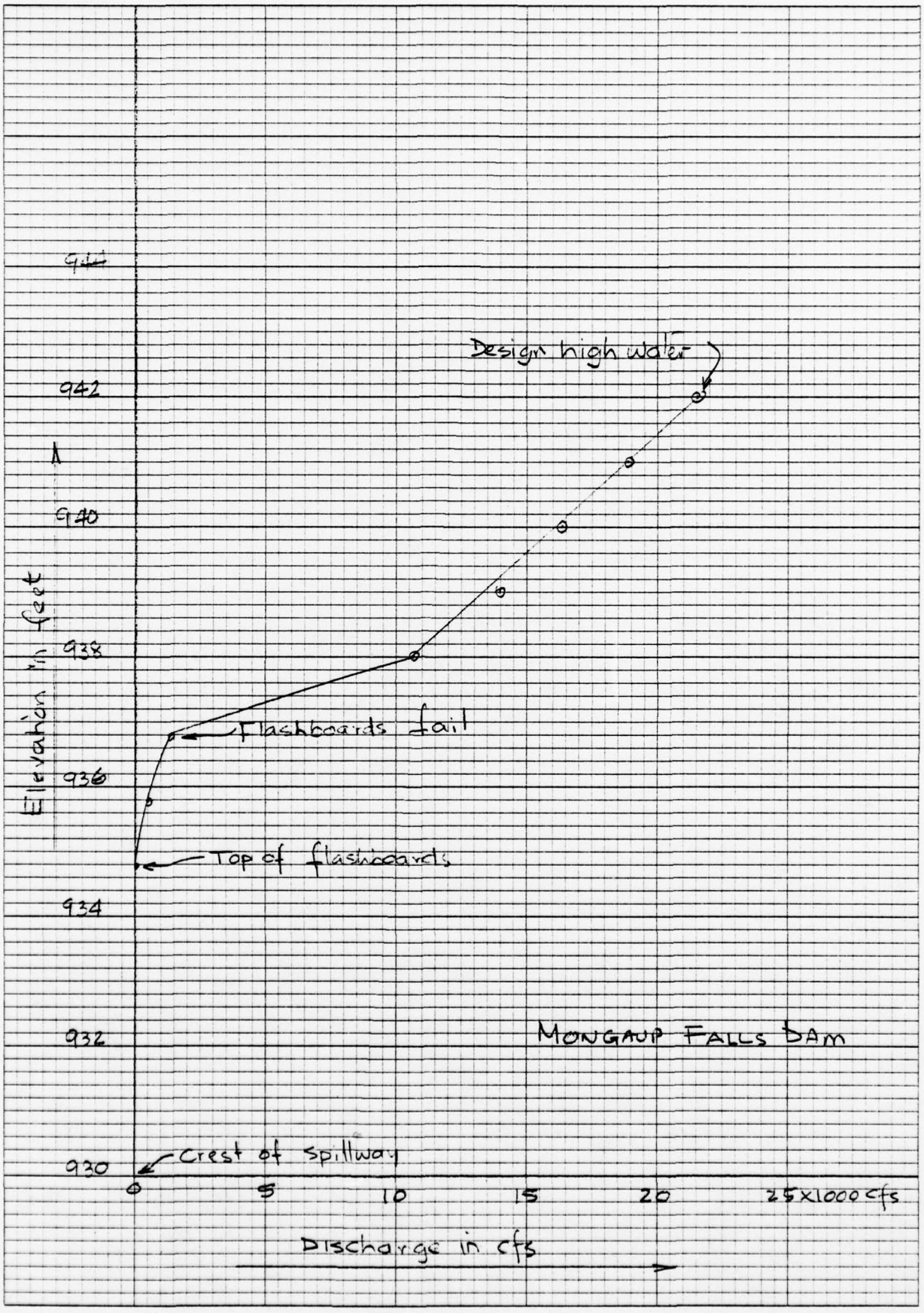
L' = Measured length of spillway

$Q = CLH^{3/2}$ N = No. of end contractions

H' = Head over flashboards

$L' = 155.2$ feet, $N = 2$

Elevation (feet)	H (feet)	H' (feet)	h (feet)	C	L (feet)	Q (cfs)	Remarks
931.0	1.0	0	44.8			0	
932.0	2.0	0	44.8			0	
933.0	3.0	0	44.8			0	
934.0	4.0	0	44.8			0	
934.8	4.8	0	44.8			0	
935.8	5.8	1	44.8	3.28	155	508	
936.8	6.8	2	44.8	3.29	154.8	1,440	Flashboards Collapse
938.0	8.0	No flash-boards.	40.0	3.35	153.6	11,643	
939.0	9.0	↓	40.0	3.36	153.4	13,916	
940.0	10.0		40.0	3.37	153.2	16,326	
941.0	11.0		40.0	3.38	153.0	18,867	
942.0	12.0		40.8	3.39	152.8	21,533	
945.0	15.0		40.0	3.42	152.2	30,240	



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10 X 10 TO THE INCH • 7 X 10 INCHES
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Overtopping

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

$$38{,}000 = \underset{①}{3.39 \times 155 \times H^{3/2}} + \underset{②}{3.3 \times 500 \times (H-15)^{3/2}}$$

$$= 525.45\, H^{3/2} + 1650\,(H-15)^{3/2}$$

$H = 16.5$ feet

or 1.5 feet above top of dam

① = Spillway Section

② = Embankment Section

Q = Discharge in cfs

C = Coefficient of discharge

L = Length (ft.)

H = Head (ft.)

LIST OF REFERENCES

APPENDIX E

APPENDIX E

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX F

STABILITY ANALYSES

MONGAUP FALLS
STABILITY ANALYSIS

A stability analysis was performed on the subject dam with the use of a Texas Instruments Model #TI-59 Programmable calculator. A listing of the program may be obtained upon request.

Spillway Section

The following cases apply for the spillway section:

Case	Description of Loading
1	Normal loads, full uplift, 3' tailwater, reservoir at 933.
2	Ice loading (5 K/ft.), full uplife, 3' tailwater, ice at 928.
3	½ PMF, reservoir at 942, 12 ft. over crest, full uplift, 3' tailwater.
4	PMF, reservoir at 947, 17 ft. over crest, full uplift, 3' tailwater.

Non-Overflow Section

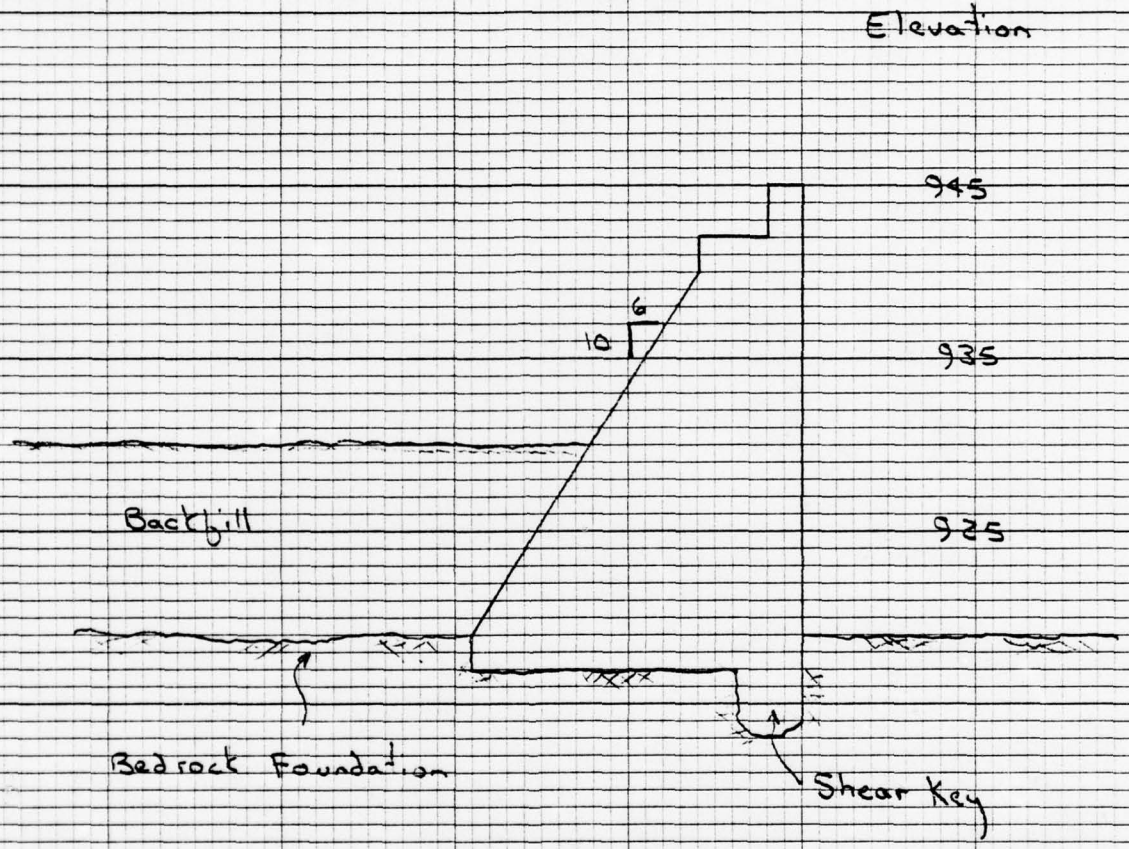
The following cases apply for the non-overflow section:

Case	Description of Loading
1	Normal loads, full uplift, no tailwater, reservoir at 933.
2	Ice load (5 K/ft.), full uplift, no tailwater, ice at 933.
3	½ PMF, reservoir at 942, 3.0 feet below top of dam, full uplift, no tailwater.
4	PMF, reservoir at 947, 2.0 feet over top of dam, full uplift, no tailwater.

NOTE: A shear key located at the heel of the dam contributes to the sliding resistance of the dam. The stability analysis does not include this option. Therefore, the additional calculations below the computed factors of safety are shown to account for the benefit of the shear key.

Mongaup Falls Dam

Non-Overflow Section



Scale 1" = 10'

middle 1/3 of base ranges

from 6.3' to 12.7'

46 0700
10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

INPUT FOR STABILITY ANALYSIS PROGRAM

Input Parameter		Value			
		Case 1	Case 2	Case 3	Case 4
0	Unit Weight of Dam ($K/ft.^3$)	.15	.15	.15	.15
1	Area of Segment #1 ($ft.^2$)	56	56	56	56
2	Location of Center of Gravity from toe (ft.) Segment #1	18.0	18.0	18.0	18.0
3	Area of Segment #2 ($ft.^2$)	112	112	112	112
4	Location of CG from toe, Seg. #2 (ft.)	15.0	15.0	15.0	15.0
5	Area of Segment #3 ($ft.^2$)	150	150	150	150
6	Location of CG from toe, Seg. #3 (ft.)	8.7	8.7	8.7	8.7
7	Total Base Width of Dam (ft.)	19.0	19.0	19.0	19.0
8	Height of Dam (ft.)	28.0	28.0	28.0	28.0
9	Ice Loading (K/L.F.)	0	5.0	0	0
10	Coefficient of Sliding	.6	.6	.6	.6
11	Unit Weight of Soil ($K/ft.^3$)	.17	.17	.17	.17
12	Coefficient of Active Soil Pressure - Ka	0	0	0	0
13	Coefficient of Passive Soil Pressure - Kp	3.5	3.5	3.5	3.5
14	Height of Water over Top of Dam (ft.)	0	0	0	2.0
15	Height of Soil for Active Pressure (ft.)	0	0	0	0
16	Height of Soil for Passive Pressure (ft.)	13.0	13.0	13.0	13.0
17	Height of Water in Tailrace Channel (ft.)	0	0	0	0

INPUT FOR STABILITY ANALYSIS PROGRAM

Input Parameter		Value			
		Case 1	Case 2	Case 3	Case 4
18	Unit Weight of Water ($K/ft.^3$)	0.0624	0.0624	0.0624	0.0624
19	Area of Segment #4 ($ft.^2$)	0	0	0	0
20	Location of CG from toe, Seg. #4 (ft.)	0	0	0	0
46	Height of Ice Load or Active Water	13	13	25	28

Mongaup Falls Dam
Stability Analysis
Non-Overflow Section

Case 1 Normal Loading

(a) 2.966304529
(b) 16.40352265
(d) 11.66891429

4.	×	Width of Shear Key (ft.)
1.	×	Depth of Section (ft.)
144.	×	Inches 2/foot^2
300.	÷	Shear strength of concrete (psi)
1000.	=	Pounds/kip
172.8		
172.8	+	Shear Resistance of key (kips)
172.8	RCL 45	
61.50096		Sum of Resisting forces for
61.50096	=	sliding (kips)
234.30096		
234.30096	÷	
234.30096	(	
234.30096	RCL 29	Driving force of water (kips)
5.2728		triangular distribution
5.2728	+	
5.2728	RCL 31	Driving force of water (kips)
0.		Rectangular distribution for
0.	+	height above dam
5.2728	RCL 9	Driving force of ice (kips)
0.		
0.	+	
5.2728	RCL 31	Driving force of Active Soil (kips) on upstream side of dam
0.		
0.	)	
5.2728		
5.2728	=	Sum of driving forces for sliding (kips)

(d) 44.43677606

F.S. Sliding for Shear Key

Case 2 Ice Loading

(a) 2.372054791
(b) 14.31359801
(c) 5.986174691

172.8	RCL 45
61.50096	
61.50096	=
234.30096	
234.30096	÷
234.30096	(
234.30096	RCL 29
5.2728	
5.2728	+
5.2728	RCL 31
0.	
0.	+
5.2728	RCL 9
5.	
5.	+
10.2728	RCL 36
0.	
0.	)
10.2728	
10.2728	=

(d) 22.80789858

F.S. Sliding

Mongaup Falls Dam
Stability Analysis
Non-Overflow Section

Case 3 - ½ PMF

(a) 1.962121258
(b) 12.13405741
(c) ~~2.150396385~~

↓

172.8	+
172.8	RCL
	45
61.50096	
61.50096	=
234.30096	
234.30096	÷
234.30096	(
234.30096	RCL
	29
19.5	
19.5	+
19.5	RCL
	31
0.	
0.	+
19.5	RCL
	9
0.	
0.	+
19.5	RCL
	36
0.	
0.	)
19.5	
19.5	=

(d) 12.01543385

F.S. 1.5 Sliding

Case 4 PMF

(a) 1.624211455
(b) 10.48461581
(c) ~~2.440587092~~

↓

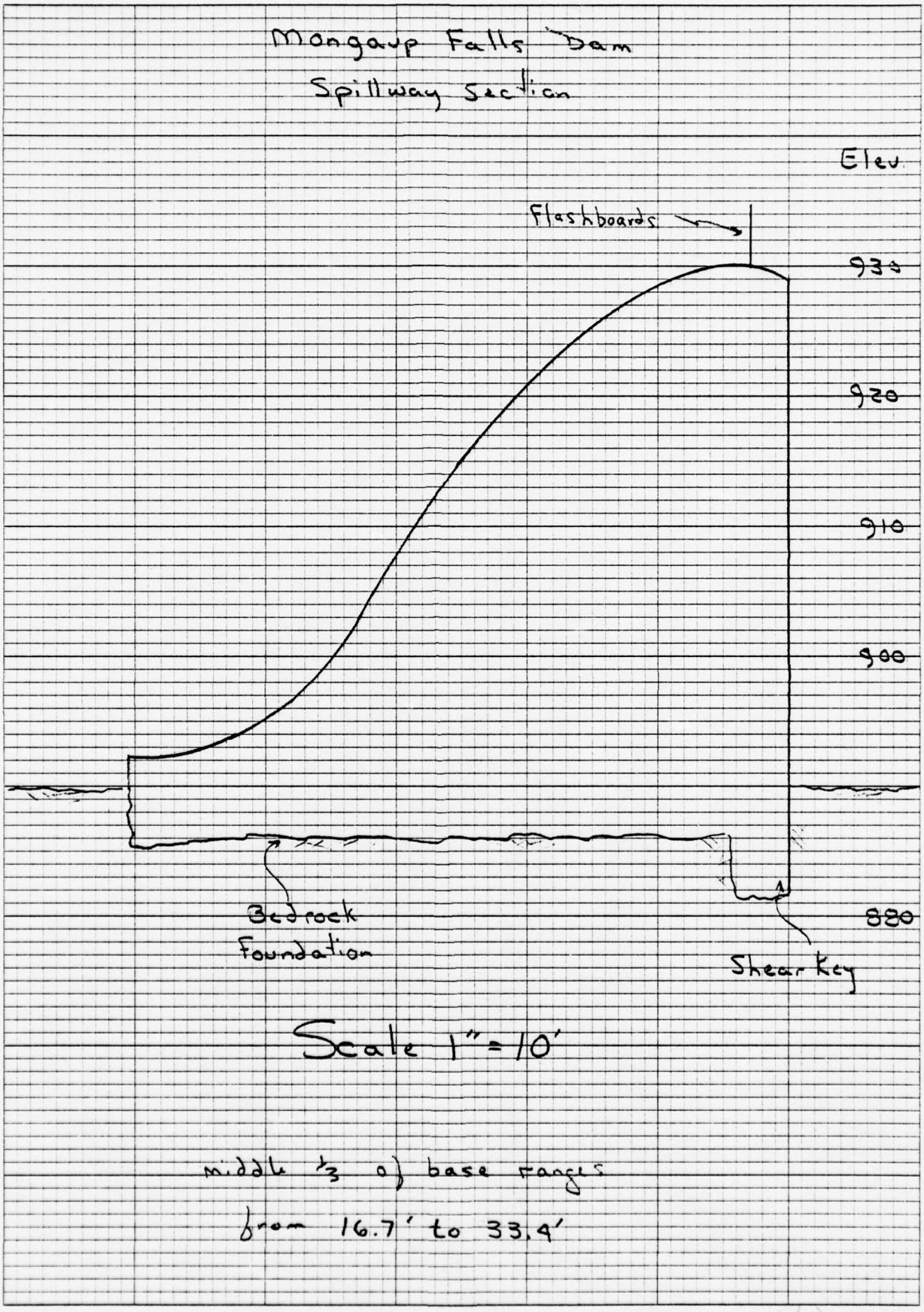
172.8	+
172.8	RCL
	45
68.2271	
68.2271	=
241.0271	
241.0271	÷
241.0271	(
241.0271	RCL
	29
24.4608	
24.4608	+
24.4608	RCL
	31
3.4944	
3.4944	+
27.9552	RCL
	9
0.	
0.	+
27.9552	RCL
	36
0.	
0.	)
27.9552	
27.9552	=
8.621905764	
8.621905764	PRT

(d)

F.S. 1.5 Sliding

46 0700
K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO MADE IN U.S.A.

Mongaup Falls Dam
Spillway Section



Scale 1" = 10'

middle 1/3 of base ranges
from 16.7' to 33.4'

INPUT FOR STABILITY ANALYSIS PROGRAM

Input Parameter		Value			
		Case 1	Case 2	Case 3	Case 4
0	Unit Weight of Dam ($K/ft.^3$)	0.15	0.15	0.15	0.15
1	Area of Segment #1 ($ft.^2$)	1338	1338	1338	1338
2	Location of Center of Gravity from toe (ft.) Segment #1	33.45	33.45	33.45	33.45
3	Area of Segment #2 ($ft.^2$)	0	0	0	0
4	Location of CG from toe, Seg. #2 (ft.)	0	0	0	0
5	Area of Segment #3 ($ft.^2$)	0	0	0	0
6	Location of CG from toe, Seg. #3 (ft.)	0	0	0	0
7	Total Base Width of Dam (ft.)	50.17	50.17	50.17	50.17
8	Height of Dam (ft.)	45.0	45.0	45.0	45.0
9	Ice Loading (K/L.F.)	0	5.0	0	0
10	Coefficient of Sliding	0.6	0.6	0.6	0.6
11	Unit Weight of Soil ($K/ft.^3$)	.17	.17	.17	.17
12	Coefficient of Active Soil Pressure - Ka	0	0	0	0
13	Coefficient of Passive Soil Pressure - Kp	4.0	4.0	4.0	4.0
14	Height of Water over Top of Dam (ft.)	0	0	12.0	17.0
15	Height of Soil for Active Pressure (ft.)	0	0	0	0
16	Height of Soil for Passive Pressure (ft.)	5.0	5.0	5.0	5.0
17	Height of Water in Tailrace Channel (ft.)	3.0	3.0	3.0	3.0

INPUT FOR STABILITY ANALYSIS PROGRAM

	Input Parameter	Value			
		Case 1	Case 2	Case 3	Case 4
18	Unit Weight of Water ($K/ft.^3$)	0.0624	0.0624	0.0624	0.0624
19	Area of Segment #4 ($ft.^2$)	0	0	0	0
20	Location of CG from toe, Seg. #4 (ft.)	0	0	0	0
46	Height of Ice Load or Active Water	48	43	45	45

NOTE: On the suceeding pages the following notation will be used:

(a) is the factor of safety for overturning;

(b) is the location of the resultant from the toe;

(c) is the factor of safety for sliding without the benefit of resistance from the shear key;

(d) is the factor of safety for sliding with the benefit of resistance from the shear key.

Mongaup Falls Dam
Stability Analysis
Spillway Section

Case 1 Normal Loads

(a)	1.9152273536	
(b)	25.6051421	
(c)	~~1.17[illegible]~~	
	172.8	+
	172.8	RCL
		45
	84.1200448	
	84.1200448	=
	256.9200448	
	256.9200448	÷
	256.9200448	(
	256.9200448	RCL
		29
	71.8848	
	71.8848	+
	71.8848	RCL
		31
	0.	
	0.	+
	71.8848	RCL
		9
	0.	
	0.	+
	71.8848	RCL
		36
	0.	
	0.	)
	71.8848	
	71.8848	=
(d)	3.5740052439	

F.S. Sliding for Shear Key

Case 2 Ice Loading

(a)	1.9141511008	
(b)	25.58873631	
(c)	1.[illegible]	
	172.8	+
	172.8	RCL
		45
	84.1200448	
	84.1200448	=
	256.9200448	
	256.9200448	÷
	256.9200448	(
	256.9200448	RCL
		29
	57.6888	
	57.6888	+
	57.6888	RCL
		31
	0.	
	0.	+
	57.6888	RCL
		9
	5.	
	5.	+
	62.6888	RCL
		36
	0.	
	0.	)
	62.6888	
	62.6888	=
(d)	4.090034045	

F.S. Sliding

Mongaup Falls Dam
Stability Analysis
Spillway Section

Case 3 - ½ PMF

(a) 1.410073129
(b) 18.34046795
(c) .7[illegible]1

172.8	+
172.8	RCL
	45
72.849856	
72.849856	=
245.649856	
245.649856	÷
245.649856	(
245.649856	RCL
	29
63.18	
63.18	+
63.18	RCL
	31
33.696	
33.696	+
96.876	RCL
	9
0.	
0.	+
96.876	RCL
	36
0.	
0.	)
96.876	
96.876	=

(d) 2.535714274

F.S. Sliding

Case 4 PMF

(a) 1.258426044
(b) 13.96197[illegible]61
(c) .[illegible]57

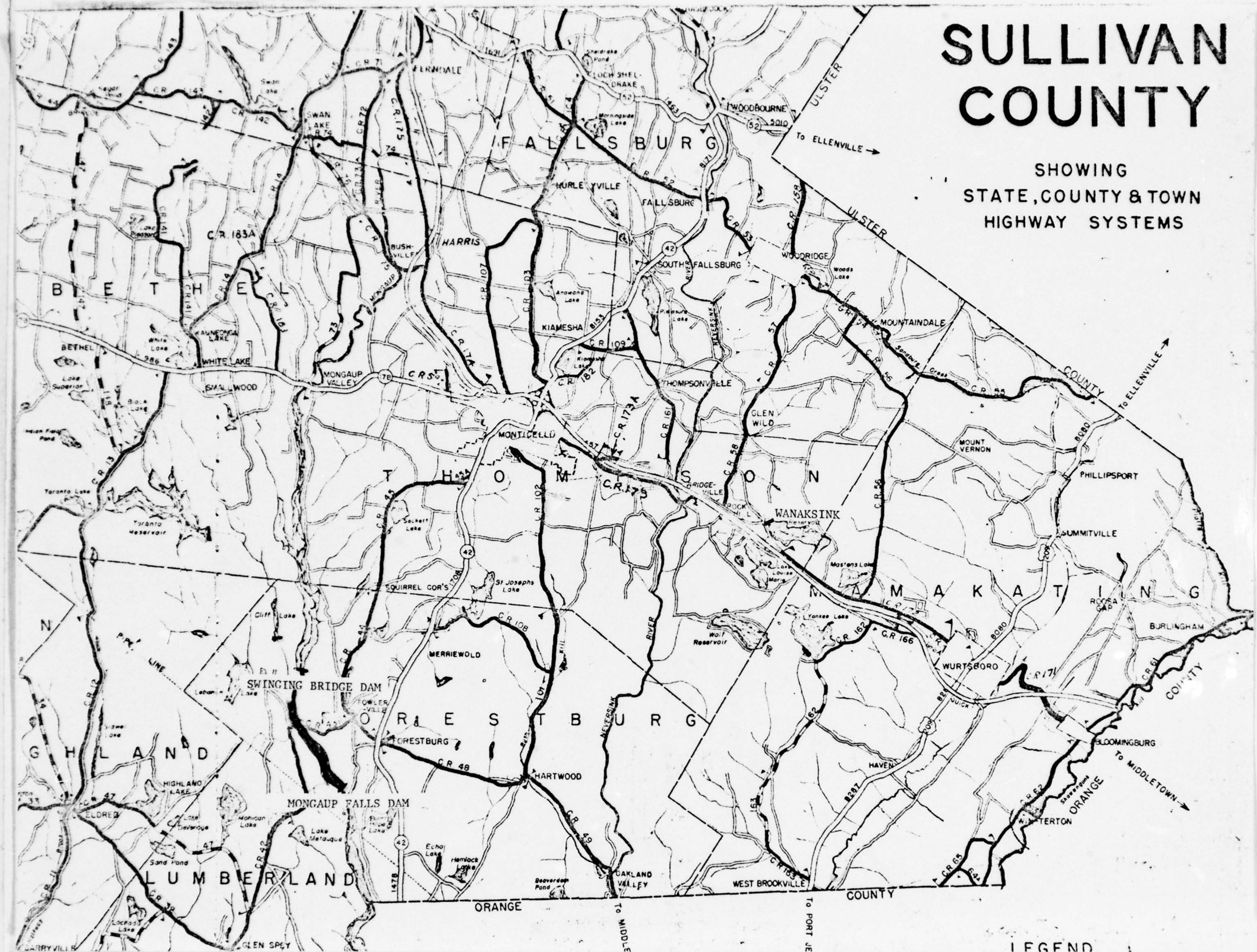
172.8	+
172.8	RCL
	45
68.153944	
68.153944	=
240.953944	
240.953944	÷
240.953944	(
240.953944	RCL
	29
63.18	
63.18	+
63.18	RCL
	31
47.736	
47.736	+
110.916	RCL
	9
0.	
0.	+
110.916	RCL
	36
0.	
0.	)
110.916	
110.916	=

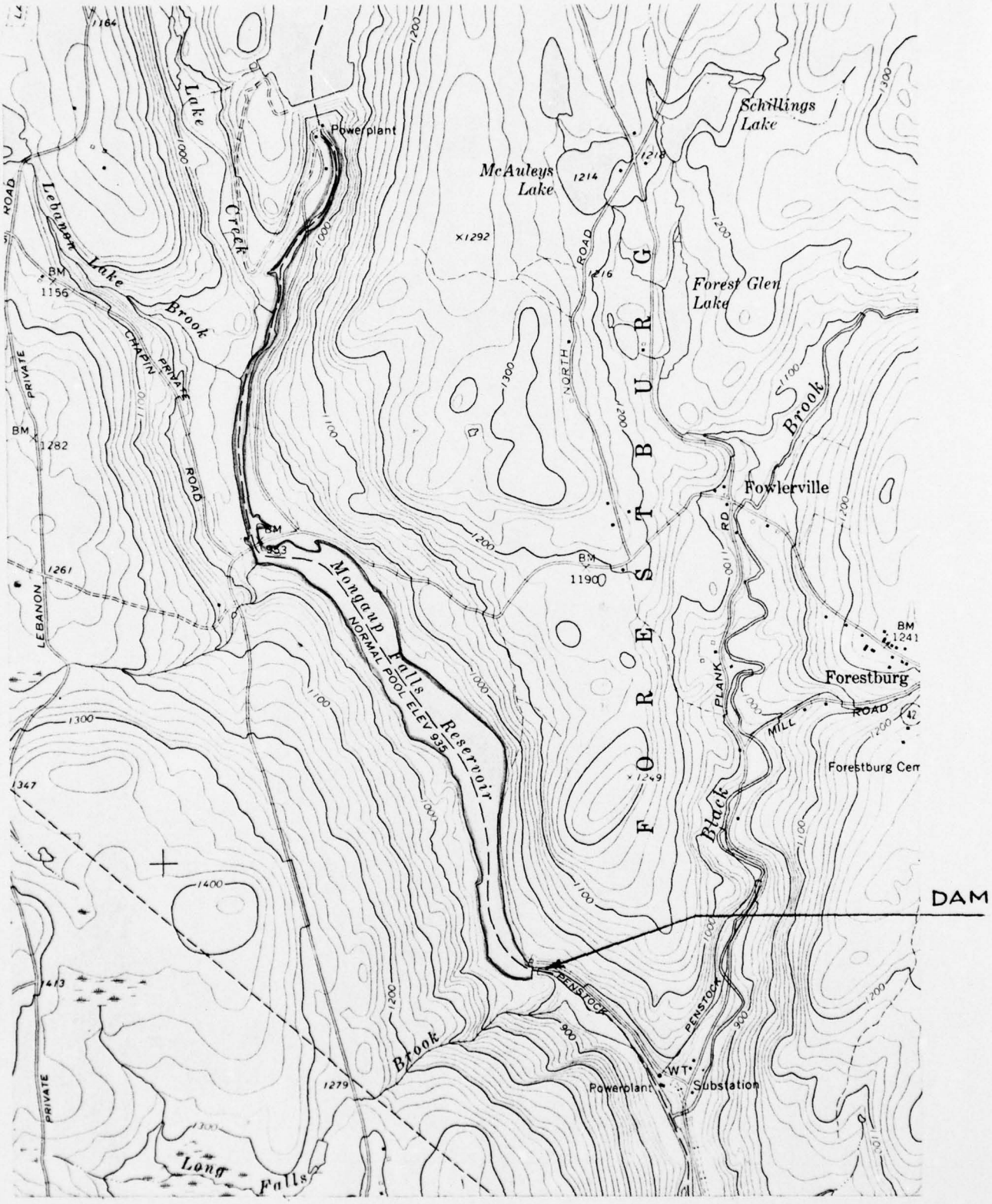
(d) 2.172400331

F.S. Sliding

APPENDIX G

DRAWINGS


SULLIVAN COUNTY
SHOWING
STATE, COUNTY & TOWN
HIGHWAY SYSTEMS
LEGEND
FALLSBURG
BETHEL
THOMPSON
MAMAKATING
FORESTBURG
HIGHLAND
LUMBERLAND
ULSTER
COUNTY
ORANGE
To ELLENVILLE
To MIDDLETOWN
To MIDDLE
To PORT JE
SWINGING BRIDGE DAM
MONGAUP FALLS DAM
MONTICELLO
WOODBOURNE
LOCH SHELDRAKE
HURLEYVILLE
FALLSBURG
SOUTH FALLSBURG
WOODRIDGE
MOUNTAINDALE
KIAMESHA
THOMPSONVILLE
GLEN WILD
MOUNT VERNON
PHILLIPSPORT
SUMMITVILLE
WANAKSINK
ROCK HILL
BRIDGEVILLE
WURTSBORO
BLOOMINGBURG
BURLINGHAM
ROCKA GAP
HAVEN
WEST BROOKVILLE
OAKLAND VALLEY
HARTWOOD
FORESTBURG
MERRIEWOLD
SQUIRREL COR'S
FOWLER VILLE
SWAN LAKE
FERNDALE
HARRIS
BUSHVILLE
MONGAUP VALLEY
WHITE LAKE
KAUNEONGA LAKE
SMALLWOOD
BETHEL
ELDRED
HIGHLAND LAKE
GLEN SPEY
BARRYVILLE
C.R. 175
C.R. 183A
C.R. 141
C.R. 48
C.R. 49
C.R. 166
C.R. 162
C.R. 108
C.R. 102
C.R. 107
C.R. 103
C.R. 52
C.R. 53
C.R. 55
C.R. 56
C.R. 57
C.R. 58
C.R. 158
C.R. 161
C.R. 173A
C.R. 17A
C.R. 171



TOPOGRAPHIC MAP

K. C. Stuber

ORANGE AND ROCKLAND UTILITIES, INC.

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number 914-627-2420

December 7, 1978

Mr. James D. Hebson, Regional Engineer
New York Regional Office
Federal Energy Regulatory Commission
26 Federal Plaza
New York, New York 10007

Subject: Emergency Action Plan in the
Event of Dam Failure at
Project Nos. 2578, 2592 and 2605

Dear Mr. Hebson:

In accordance with your letter dated October 16, 1978, enclosed are three (3) copies of our revised "Monitoring and Emergency Action Plan, Mongaup River Hydroelectric Facilities." The plan provides a detailed procedure for notification of the proper authorities in the event of an emergency, including a list of telephone numbers of persons to be contacted. A contingency plan for alternate means of communication as well as documentation of correspondence with the New York State Police are also attached.

The Company Duty Officer changes each week and a copy of the Duty Officer schedule is provided to the System Operator's office. By copy of this letter the revised Emergency Action Plan is being transmitted to the Superintendent-Hydro Maintenance for immediate posting in his office. All subsequent revisions shall be likewise forwarded to him.

The revised plan includes a list of parties to be notified in the event of an emergency with the State Police having the primary responsibility and authority to effect any orderly evacuation of the areas of potential flooding. Since Orange and Rockland Utilities is the only operator of water-related facilities along the Mongaup River subject to potential flooding in the event of dam failure, the notification of other such operators is not applicable.

The Company's rigid inspection program, which is summarized in the Emergency Action Plan, affords us the opportunity to determine where repairs are required well in advance of their reaching the critical stage. Materials necessary to effect such repairs on a

timely basis are on hand or are readily available in the area. Therefore, we do not feel the necessity to stockpile additional materials for emergency repairs.

Coordination of flows based on weather forecasts is included in instructions to System Operators. This flow coordination is designed to reduce the risk and amount of potential flooding in the downstream areas.

If we can be of further assistance to you regarding this matter, please do not hesitate to contact us.

Very truly yours,

Frank E. Fischer
Vice President

BZBjr/ct
Atts.

cc: B. Muthig, Capt. (NYS Police)

bcc: T. A. Griffin, Jr.
K. B. Field
B. Z. Baxter, Jr.
F. J. Kiernan (4 copies for distribution)
J. F. Kragh
W. H. Smith
J. O. Trudeau
K. D. Archer

ORANGE AND ROCKLAND UTILITIES, INC.

MONITORING AND EMERGENCY ACTION PLAN

MONGAUP RIVER HYDROELECTRIC FACILITIES

(Revised December 1, 1978)

Inspection Procedures Used To Monitor Condition Of Dams

Swinging Bridge, Mongaup and Rio dams are inspected daily by attendant-operators.

Toronto, Cliff Lake and Lebanon dams are inspected on Monday, Wednesday and Friday of each week by Hydro Maintenance crew members.

Each dam will be inspected once a year by a licensed Civil Engineer.

All dams are inspected every five years by consulting engineers representing the Company Bond Holders.

Other Monitoring Procedures

Pond elevations at Swinging Bridge, Mongaup and Rio are recorded by operators at these plants and relayed to Orange and Rockland System Operators at least every 4 hours during normal working hours and 24 hours per day during times of severe floods. When the new Energy Control Center goes into service in mid-1979, these elevations will be monitored continuously and automatically logged hourly at the System Operator's office in Spring Valley, New York.

Instructions to System Operators and Superintendent-Hydro Maintenance

In case of major floods (over 4 inches of rain in 24 hours or 6 inches in 48 hours), or when the in-flow at Swinging Bridge exceeds 2,000 c.f.s., Superintendent-Hydro Maintenance is instructed to close Toronto reservoir gates (if open) and start opening Swinging Bridge

flood gates at a rate which will hold the Swinging Bridge pond elevation at Elev. 1070 or less.

If the Swinging Bridge pond water elevation rises to Elev. 1071, the top 1.2 feet of flashboards will release over the 125 foot length of boards. When this condition occurs the Superintendent-Hydro Maintenance shall notify the System Operator. The System Operator shall notify the New York State Police that a possible emergency condition is imminent and request that Police stand by, but take no action until further notice. If this release by the top 1.2 feet of flashboards does not cause a drop in the elevation of the Swinging Bridge pond, or if the pond again rises to Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the houses in Mongaup Village at the lower end of the Mongaup River. The System Operator shall notify the Company Duty Officer, Manager-Electric Production, and Security Manager of the emergency condition and the action taken. The System Operator shall notify the New York Regional Engineer of the Federal Energy Regulatory Commission or his alternate.

If Swinging Bridge pond level continues to rise to above Elev. 1072, the remaining 5.0 feet of flashboards will be released and the maximum spillway capacity will then be available. The sill of this spillway is at Elev. 1065.

The operation of the entire flashboard system with all gates wide open should control the Swinging Bridge pond level for any anticipated flood. If after the operation of the entire flashboard system the pond level does not drop below Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the remaining endangered properties located immediately down-

stream of the Mongaup dam and the Rio recreation area. Notification of the Duty Officer, Manager-Electric Production, Corporate Communications, and Security Manager shall also be accomplished.

In the event, during an emergency condition, the Superintendent-Hydro Maintenance cannot make telephone contact with the System Operator, he shall use the Company two-way radio system. If the System Operator cannot make telephone contact with the State Police, he shall request a messenger with a radio vehicle be immediately dispatched from the Company's Western Division Operations Center in Middletown, New York to go directly to the State Police headquarters, also located in Middletown, to notify them of the emergency condition. The messenger shall remain at police headquarters to maintain direct radio contact between the Superintendent-Hydro Maintenance, System Operator, and the State Police.

MONGAUP RIVER HYDROELECTRIC FACILITIES

EMERGENCY ACTION PLAN

NOTIFICATION LIST

New York State Police		(914) 343-1424
Superintendent-Hydro Maintenance Joseph B. Case	Office: Home:	(914) 856-2109 (914) 754-8271
Manager-Electric Production Frank J. Kiernan	Office: Home:	(914) 352-6000, X-441 (914) 342-0521
Security Manager John F. Kragh	Office: Home:	(914) 352-6000, X-558 (914) 496-4964
Corporate Communications John P. Murphy	Office: Home:	(914) 627-2473 (914) 942-0246
Federal Energy Regulatory Commission New York Regional Engineer James Hebson	Office: Home:	(212) 264-3687 (201) 998-2845
Chief Civil Engineer (Alternate) Martin Inwald	Office: Home:	(212) 264-3687 (516) 285-5964
Operations Duty Officer		(See Operations Duty Officer Schedule and Guidelines)

12/1/78

In answering this, please use the same subject heading as on this letter

Subject Monitoring and Emergency Action Plan

To FILE

From B. Z. Baxter, Jr.

cc: Mr. F. E. Fischer
Mr. J. Kragh
Mr. K. B. Field

July 14, 1978

On July 7, 1978 a meeting was held at the New York State Police Headquarters, Troop F, in Middletown, New York to review our June 30, 1978 submittal of subject plan to the Federal Energy Regulatory Commission. Attendees were J. Kragh (O&R), B. Z. Baxter, Jr. (O&R), B. Muthig, Capt. (NYS Police) and J. McMahon, Lt. (NYS Police).

Since we had forwarded a copy of the plan to the NYS Police prior to the meeting, only a short discussion as to the purpose of the plan and the function of the State Police was required. We advised that they were the only group being asked to coordinate this Emergency Action Plan in the event implementation was necessary and we would forward them a list of residences not controlled by O&R that would be affected in the Mongaup Village area. The State Police felt that since there were few residences involved, notification would not be difficult.

They were informed that any changes in the Emergency Action Plan would be forwarded to them as they occurred.

The meeting was highly productive since we will be able to obtain their cooperation.

B. Z Baxter Jr.

BZBjr/ct B. Z. Baxter, Jr.

914-627-2609

July 17, 1978

Blake Muthig, Captain
New York State Police
Troop F
Middletown, New York 10940

Subject: Monitoring and Emergency Action Plan
Mongaup River Hydroelectric Facilities

Dear Captain Muthig:

As agreed during our July 7, 1978 meeting, attached is a list of residences in the Mongaup Village area not controlled by Orange and Rockland which could be flooded due to upstream dam failure. We also attach a drawing showing location of the homes with respect to the expected area of flooding.

In the event of any changes in the Emergency Action Plan, you will be promptly notified.

Very truly yours,

B. Z. Baxter, Jr.

BZBjr/ct
Atts.

B. Z. Baxter, Jr.
Assistant Vice President

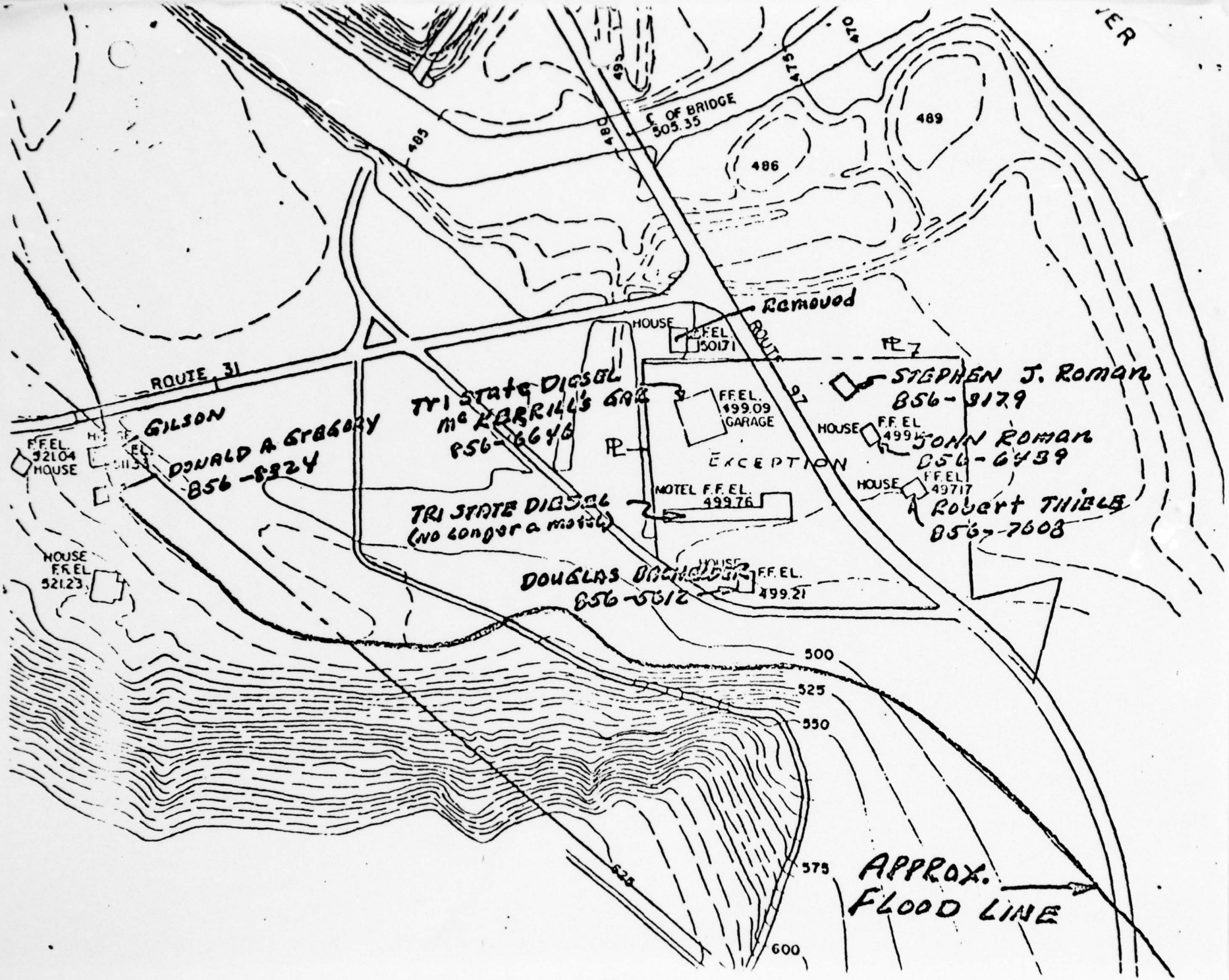
cc: Mr. J. Kragh

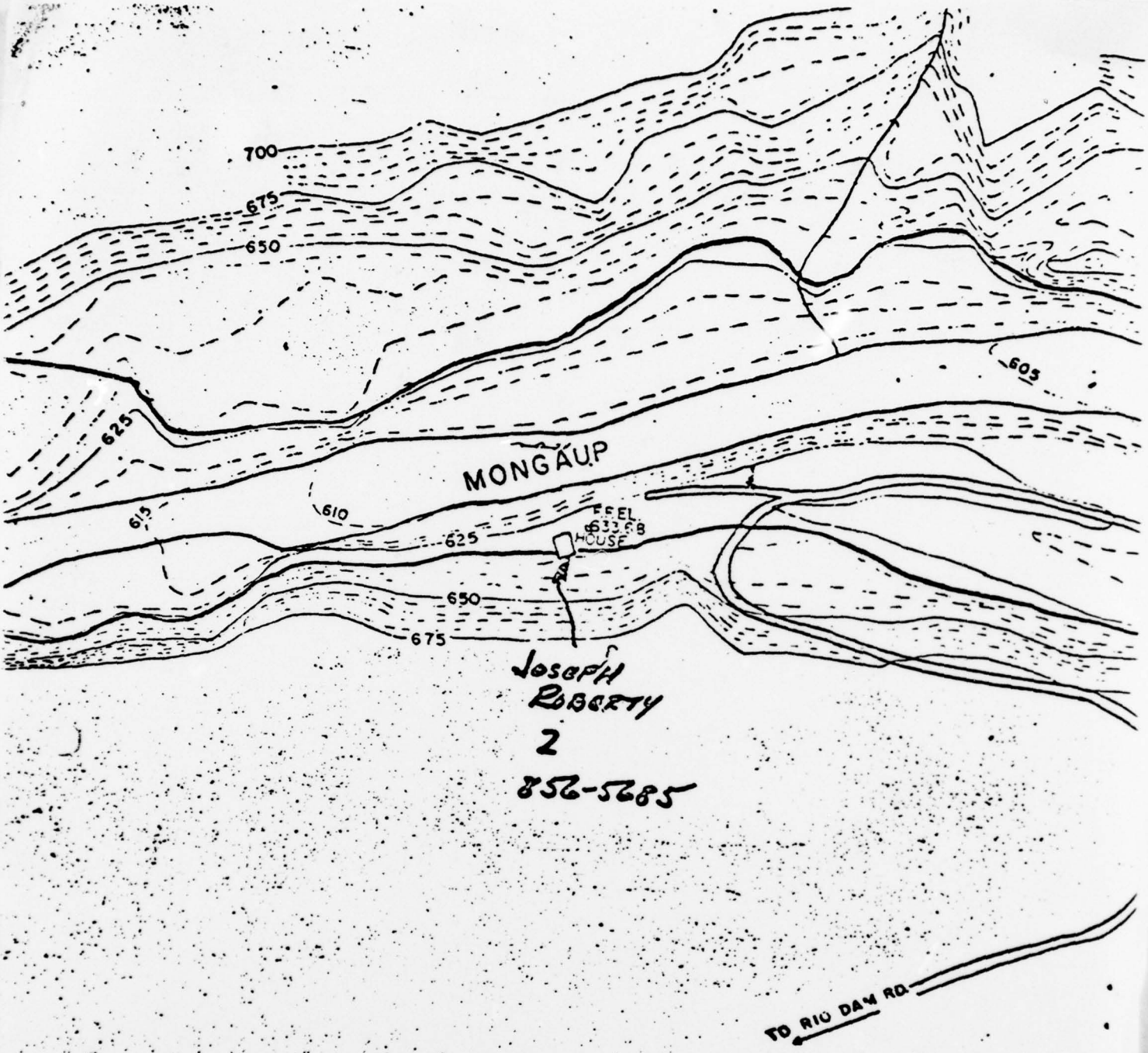
bcc: Mr. F. E. Fischer
Mr. K. B. Field

Mongaup Village Residences

Not Controlled By O&R

Donald A. Gregory	856-8324
Tri State Diesel McKerrill's Garage	856-6646
Gilson	No Phone Listed
Douglas Bachelder	856-5612
Stephen J. Roman	856-3179
John Roman	856-6439
Robert Thiele	856-7608
Joseph Roberty	856-5685


ROUTE 31
ROUTE 9
℄ OF BRIDGE 505.35
485
486
489
490
480
475
470
HOUSE F.F.EL. 501.71
Removed
GILSON
DONALD A GREGORY 856-8324
F.F.EL. 521.04 HOUSE
TRI STATE DIESEL McLARRIL'S GAS 856-6646
F.F.EL. 499.09 GARAGE
EXCEPTION
MOTEL F.F.EL. 499.76
TRI STATE DIESEL (NO LONGER A MOTEL)
HOUSE F.F.EL. 521.23
DOUGLAS [illegible] 856-5512
HOUSE F.F.EL. 499.21
STEPHEN J. ROMAN 856-9179
HOUSE F.F.EL. 499.5
JOHN ROMAN 856-6439
HOUSE F.F.EL. 497.17
ROBERT THIELE 856-7608
500
525
550
575
600
APPROX. FLOOD LINE


700
675
650
625
605
MONGAUP
610
615
625
650
675
F.F.EL.
633.68
HOUSE
Joseph
Roberty
2
852-5285
TO RIO DAM RD.

COMPANY OPERATIONS
DUTY OFFICER
GENERAL GUIDELINES

PURPOSE

To provide for the availability of a person of sufficient rank to act in the capacity of Company spokesman and provide high level management direction, if required in the event of an incident or accident within the Company which would have a significant impact in terms of our customers, the general public, regulatory agencies, news media and other interested publics. This is consistent with our Company Policy of providing continuous service to our customers in a safe and efficient manner.

To provide an equitable distribution of Operating Department responsibilities during those periods outside of the normal business hours.

To provide the opportunity for the exposure of the Duty Officer to all facets of operations, thereby developing understanding, appreciation and flexibility of personnel within the Company.

GENERAL GUIDELINES

1. Copies of the Duty Officer Schedule for Company operations will be made available to the Service Operator Supervisor and Service Operators to facilitate contacting the appropriate person when an incident or accident occurs which may have a significant impact on the Company.

2. Persons scheduled for duty may change with other parties on the Duty Officer Schedule and will be obligated to inform the Service Operator Supervisor of such change.

3. The availability of the Duty Officer will be required during the entire week that the person is scheduled. Availability is not construed to mean that the person must stay at home by the telephone. However, it does mean that the person may be contacted in a timely fashion.

4. The person designated as Duty Officer for the week will act as the Company spokesman concerning any incident or accident that occurs during that week, until such time as another appropriate individual becomes available to act as the Company spokesman.

5. The availability of a Duty Officer will not supersede or change established procedures for emergency notification of functionally responsible Officers or other personnel.

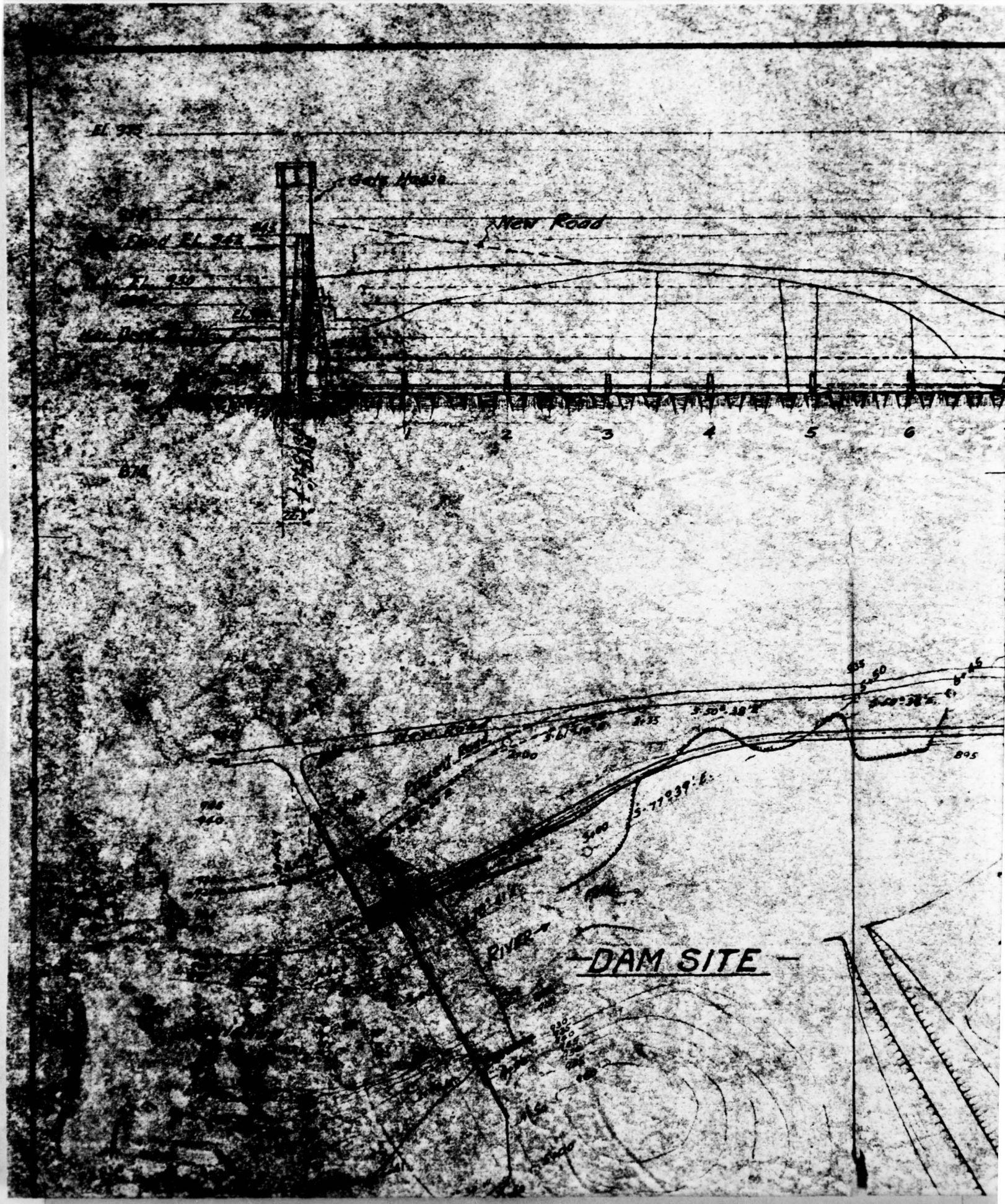
GENERAL GUIDELINES - (Continued)

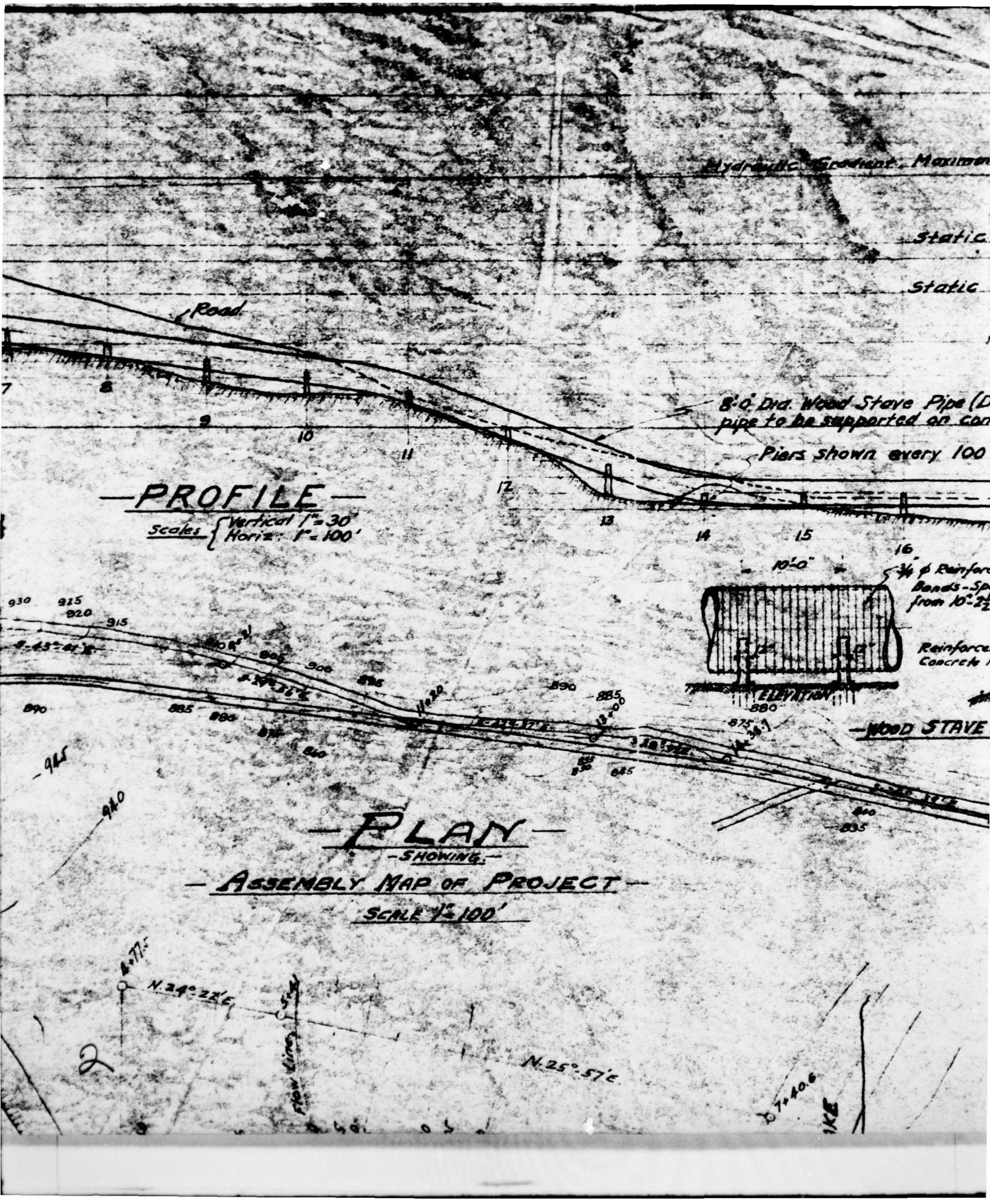
6. The Duty Officer shall act as the liaison authority across all departments, such as Transportation, Stores, etc. during the period outside of normal business hours. Problems which may develop after the standard Operating Procedures have been exhausted at lower levels of management, concerning the coordination of support services will be resolved by the Duty Officer.

7. Included with the Duty Officer Schedule are Emergency Procedures that are to be followed either by the Standby Duty Supervisor and/or persons within the operating departments in compliance with established requirements. It shall be the responsibility of the Duty Officer to ensure that these requirements are accomplished in a timely manner.

List of Drawings
Mongaup Falls

DESCRIPTION	DRAWING NO.
General Arrangement	374-4-A
Gate House	374-28
Gate House	374-29
Retaining Wall Section	374-34


Gate House
New Road
1
2
3
4
5
6
DAM SITE
RIVER


Hydraulic Gradient. Maximum
Static
Static
Road
8'-0" Dia. Wood Stave Pipe (D
pipe to be supported on con
Piers shown every 100
PROFILE
Scales { Vertical 1"=30'
Horiz. 1"=100'
10'-0"
¾" ϕ Reinforc
Bends - Sp
from 10"-2
Reinforce
Concrete
ELEVATION
WOOD STAVE
PLAN
SHOWING
ASSEMBLY MAP OF PROJECT
SCALE 1"=100'
N. 34° 22' E.
N. 25° 57' E.
Flow Line
Sta. 7+40.6

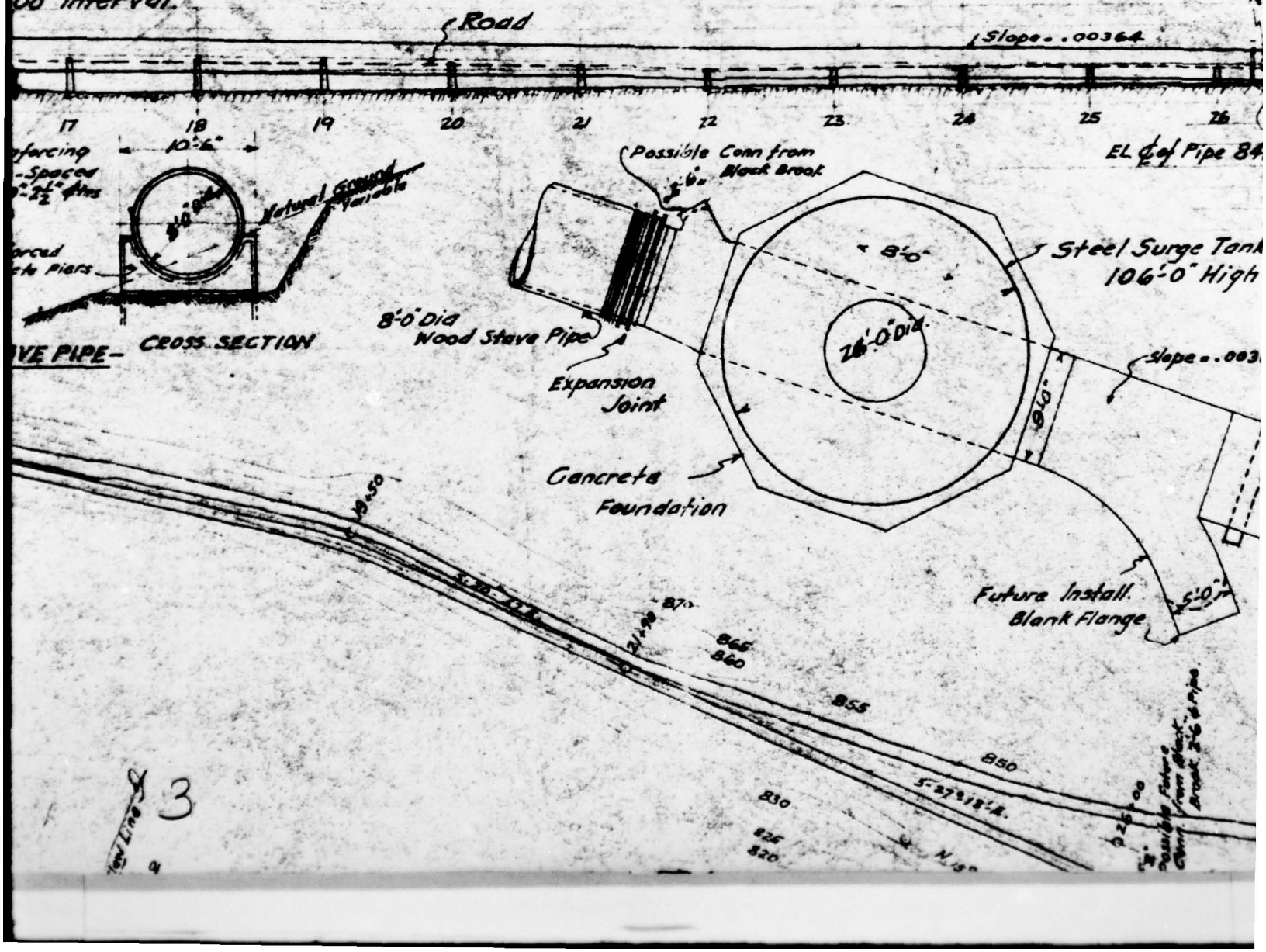
...rent Surge due to throwing off 3000 K.W.

...ic Level

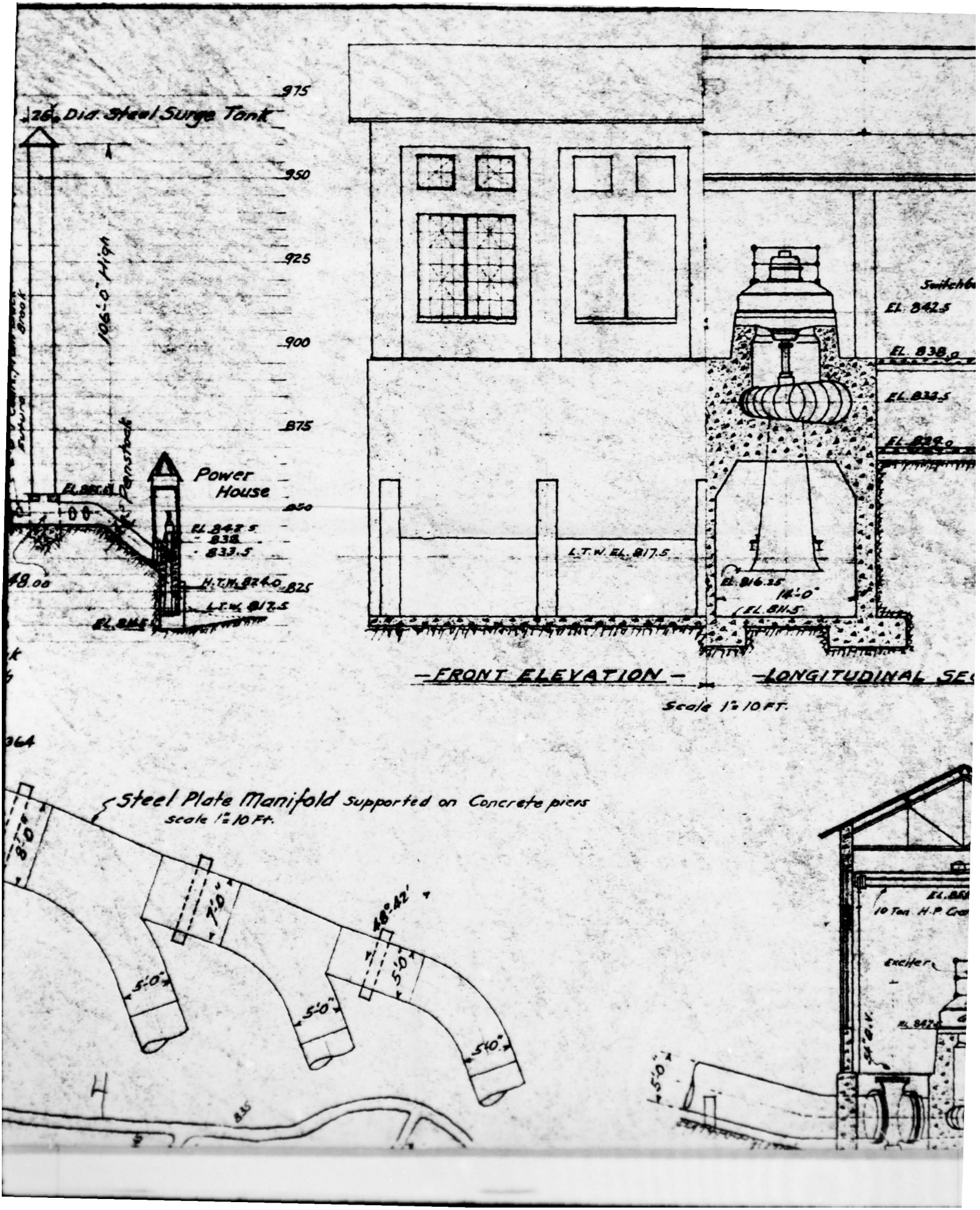
...ic Level

(Douglas Fir), 3½" Staves, reinforced with ¾" ϕ steel bands, spaced from 10" to 2½" on ctrs.
concrete piers, spaced 10' on ctrs.

00' interval.

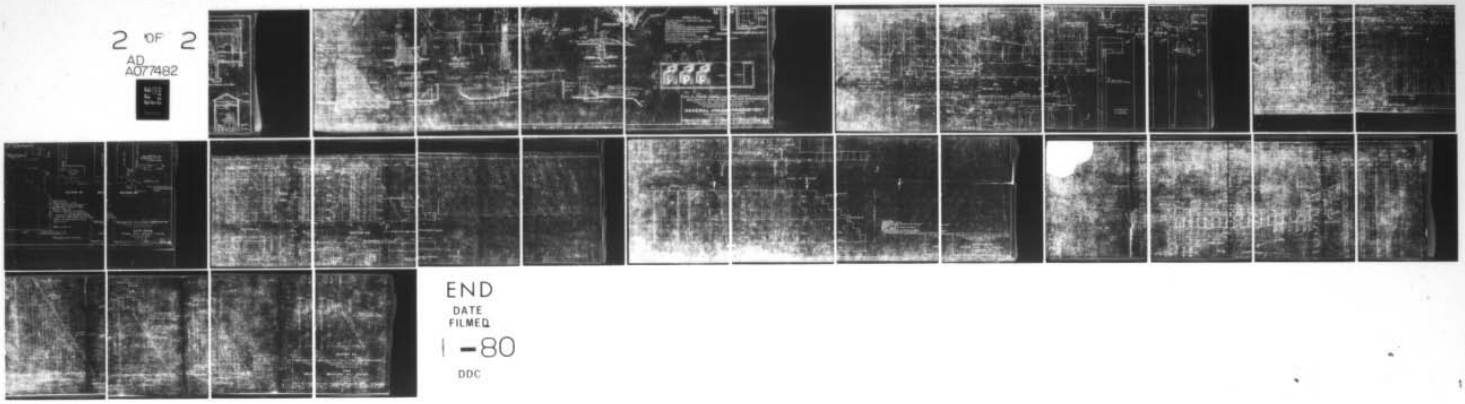


3

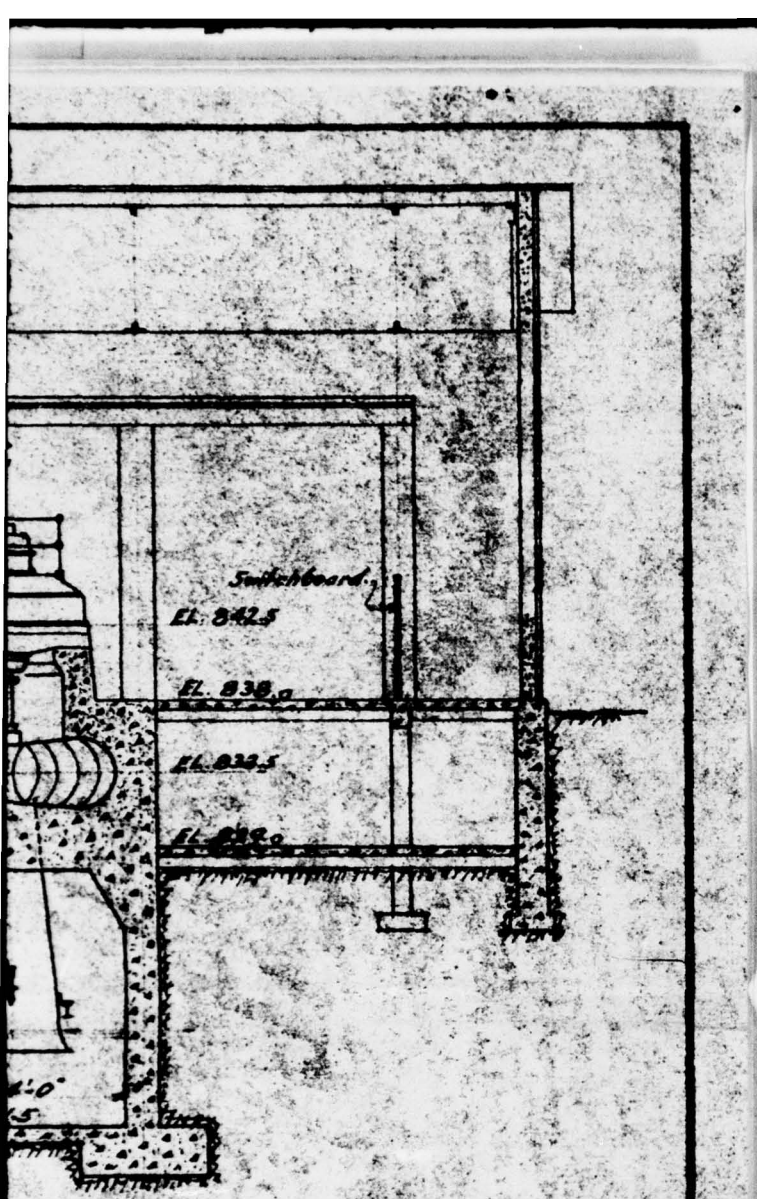

26' Dia. Steel Surge Tank
106'-0" High
975
950
925
900
875
850
825
Power House
Penstock
EL. 842.5
838
833.5
H.T.W. 824.0
L.T.W. 817.5
EL. 816.35
14'-0"
EL. 811.5
Switchb
EL. 842.5
EL. 838.0
EL. 833.5
EL. 829.0
-FRONT ELEVATION-
-LONGITUDINAL SE
Scale 1"=10 FT.
Steel Plate Manifold supported on Concrete piers
scale 1"=10 Ft.
8'-0"
7'-0"
5'-0"
5'-0"
5'-0"
5'-0"
48°-42'
5'-0"
10 Ton H.P. Cra
Exciter
EL. 842
EL. 816.35
5'-0"

AD-A077 482 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. MONGAUP FALLS DAM (INVENTORY NUMBE--ETC(U)
SEP 79 G KOCH DACW51-79-C-0001
UNCLASSIFIED NL

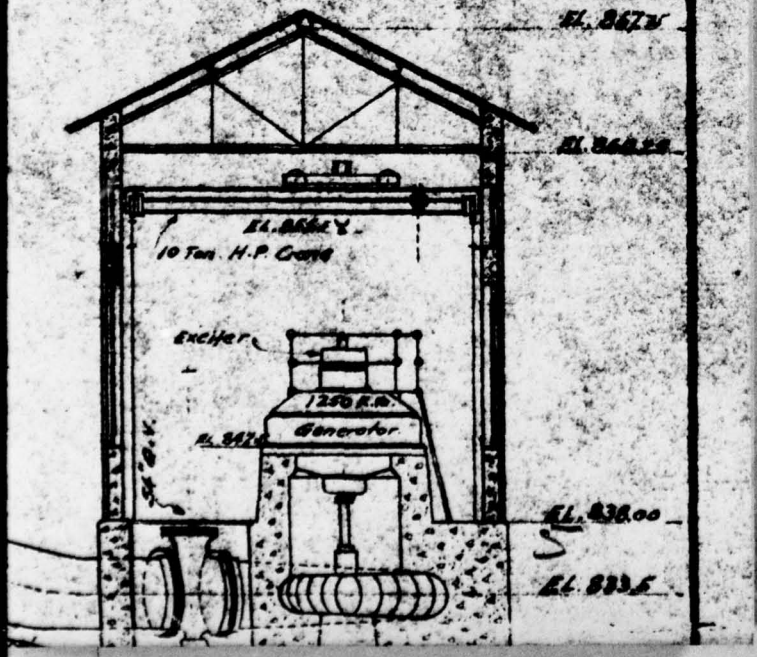
2 OF 2
AD
A077482

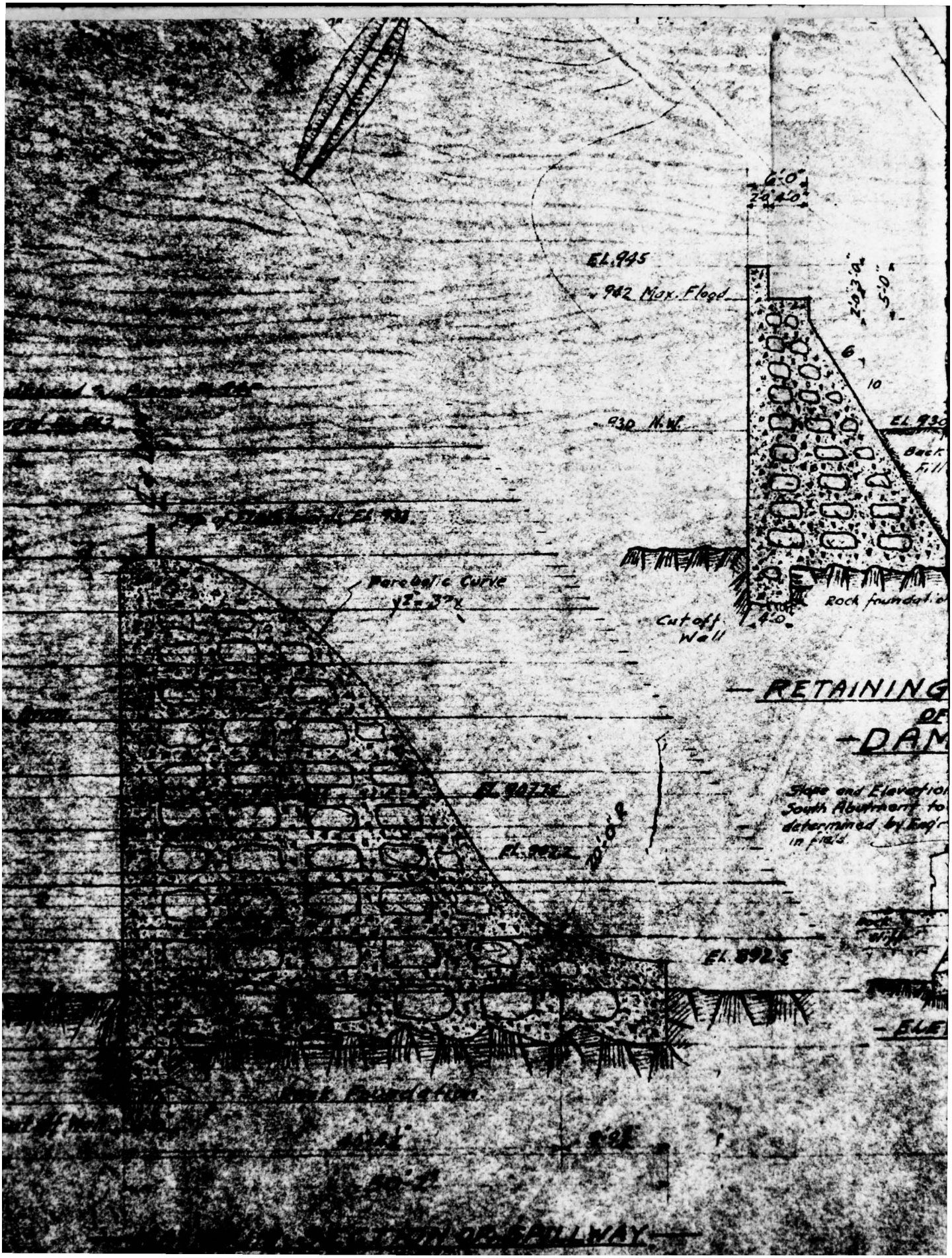


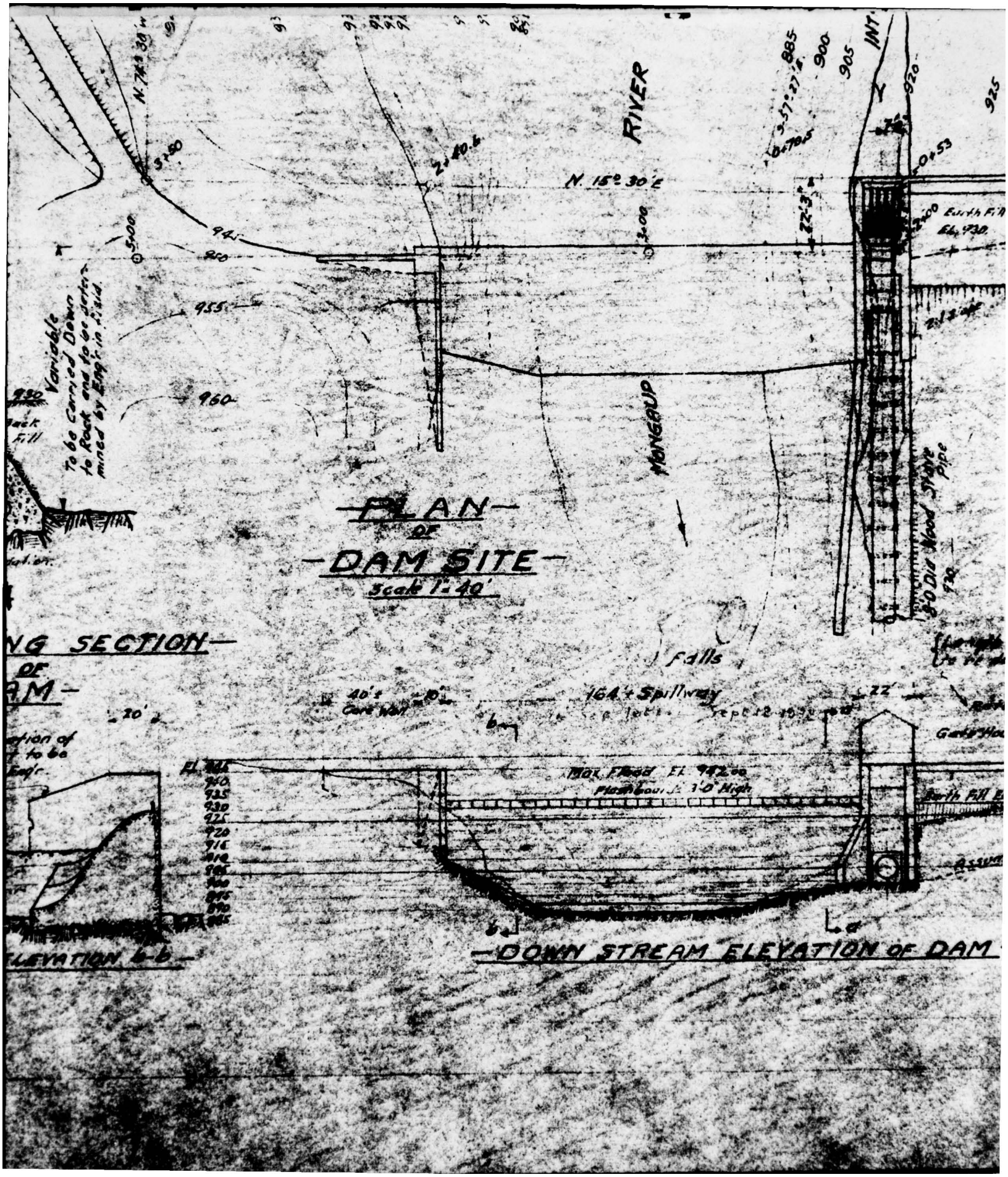
END
DATE
FILMED
1-80
DDC

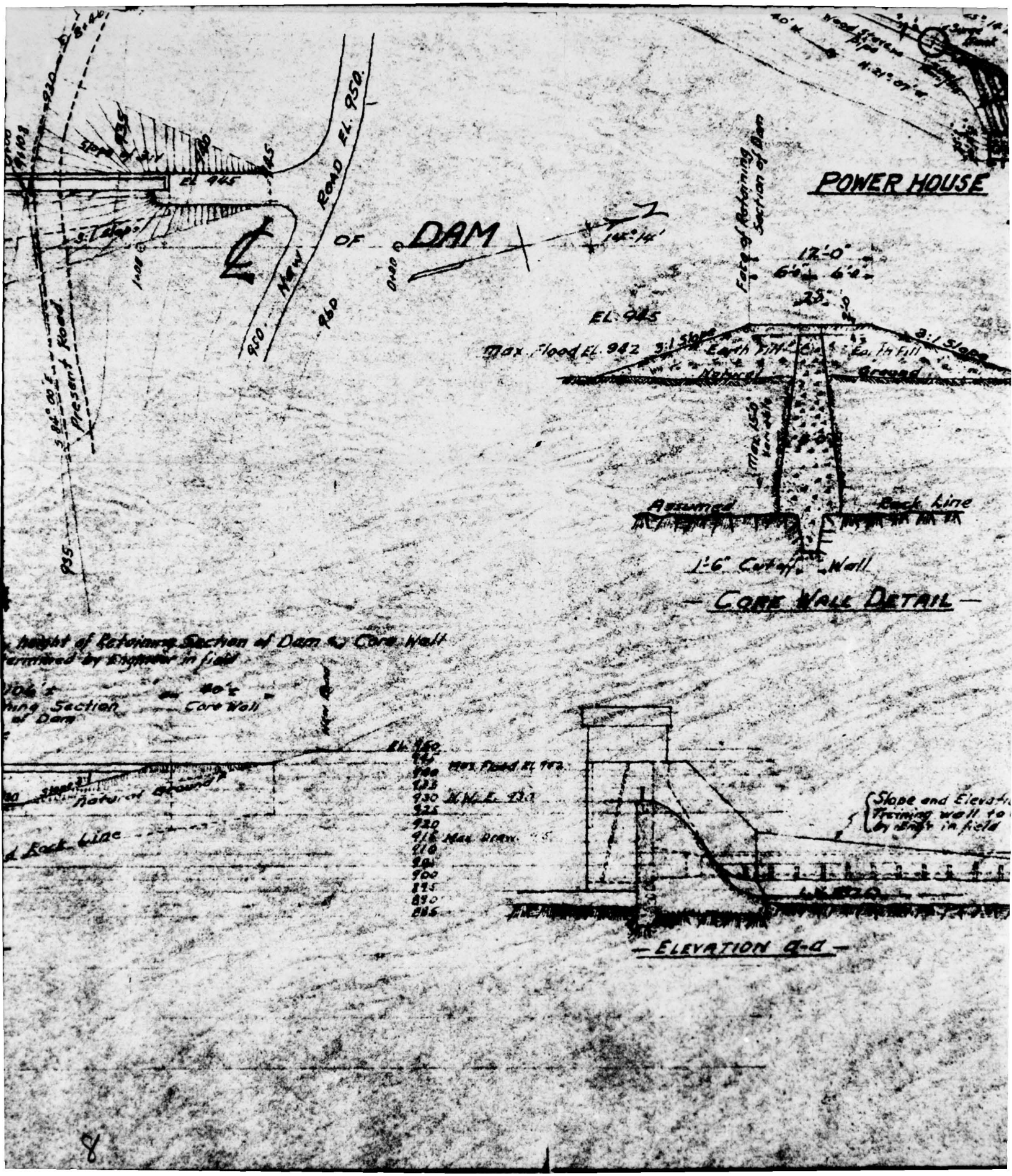


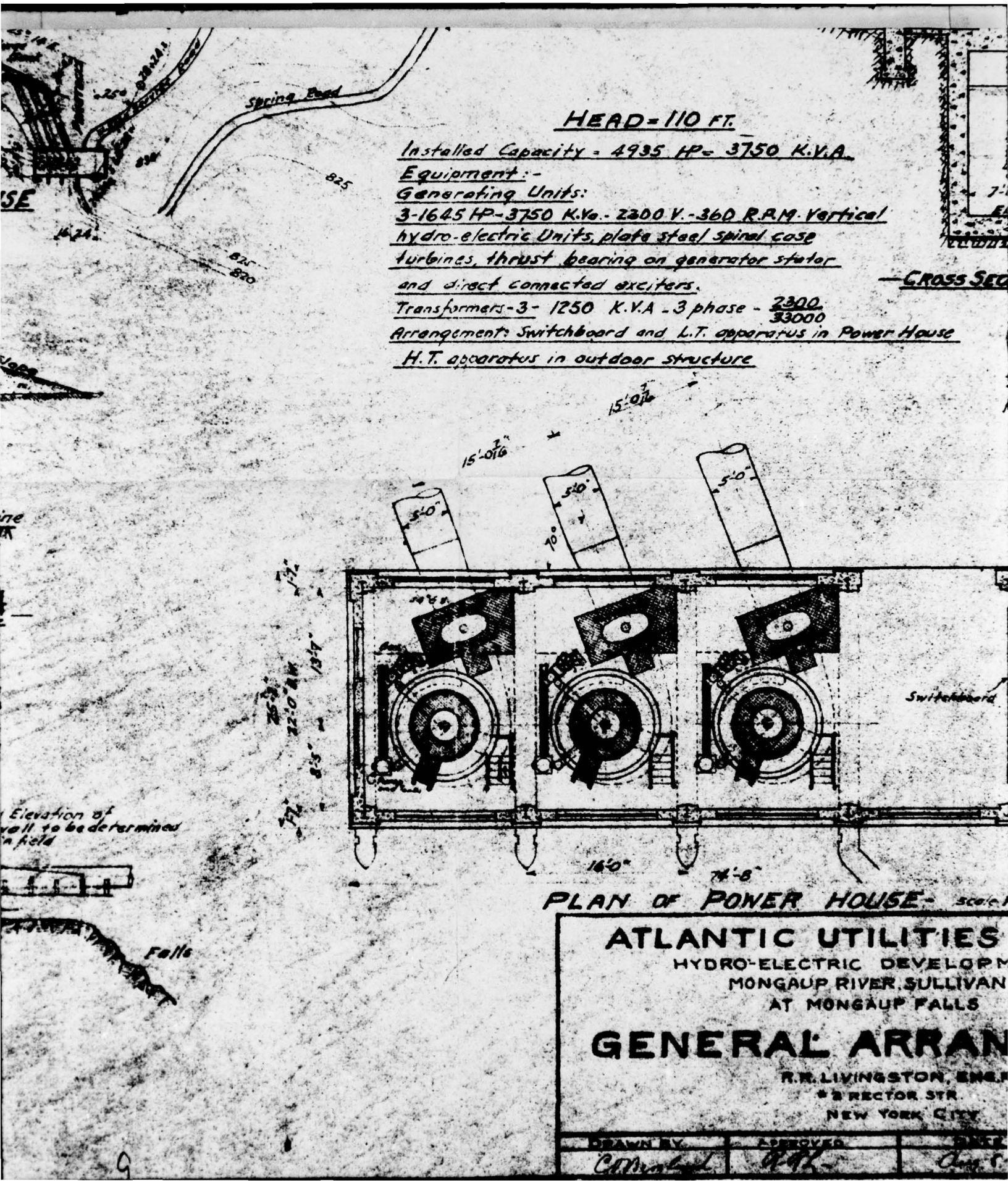
ONGITUDINAL SECTION-

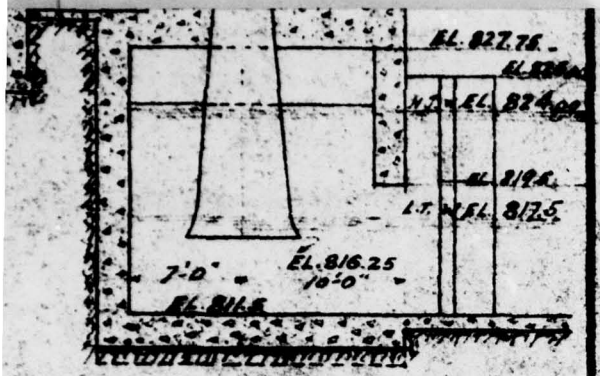



EL. 945
942 Max. Flood
930 N.W.
Parabolic Curve
Cut off Wall
RETAINING
DAM
Slope and Elevation
South Abutment to
determined by Eng'r
in field
EL. 892.5
EL. 930
Back
Fill
Rock foundation
6'-0"
10
10'-0"
5'-0"


RIVER
N. 15° 30' E
N. 74° 30' W
MANGRUP
Variable
To be Carried Down
to Rock and to be Determined by Engineer in Field.
PLAN
OF
DAM SITE
Scale 1:40'
Falls
164'± Spillway
40's
Core Wall
Mor. Flood El. 942.00
Flashboards 3'0" High
Gate House
ELEVATION b-b
DOWN STREAM ELEVATION OF DAM


POWER HOUSE
DAM
Road El. 950
New
Present Road
EL. 945
3:1 slope
Max. Flood El. 982
Earth Fill
Natural Ground
Assumed Rock Line
1'-6" Cut off Wall
CORE WALL DETAIL
Core Wall
Natural Ground
Rock Line
ELEVATION A-A


Spring Road
825
820
16'24"
HEAD = 110 FT.
Installed Capacity = 4935 HP = 3750 K.V.A.
Equipment:-
Generating Units:
3-1645 HP-3750 K.Vo.-2300 V.-360 R.P.M. Vertical hydro-electric Units, plate steel spiral case turbines, thrust bearing on generator stator and direct connected exciters.
Transformers-3- 1250 K.V.A.-3 phase - 2300/33000
Arrangement: Switchboard and L.T. apparatus in Power House
H.T. apparatus in outdoor structure
CROSS SEC
15'-0 1/16"
5'-0"
10°
Switchboard
16'0"
74'-8"
PLAN OF POWER HOUSE- scale
Elevation of ... to be determined ... field
Falls
ATLANTIC UTILITIES
HYDRO-ELECTRIC DEVELOPM
MONGAUP RIVER, SULLIVAN
AT MONGAUP FALLS
GENERAL ARRAN
R.R. LIVINGSTON, ENG.
#2 RECTOR STR.
NEW YORK CITY
DRAWN BY
APPROVED
DATE



CROSS SECTION OF POWER HOUSE

House

ISE - scale 1"=10 FT.

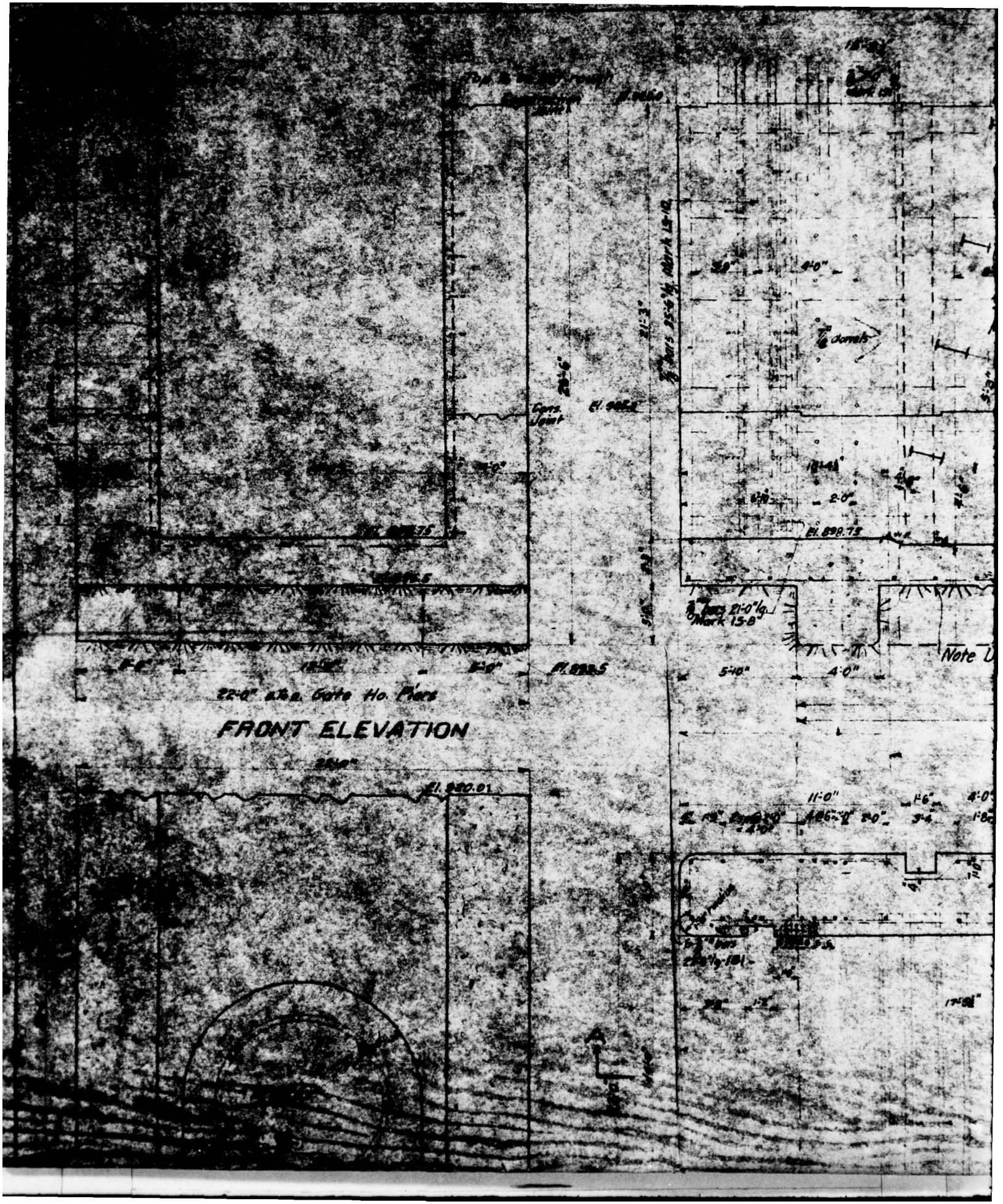
LITIES CORPORATION
DEVELOPMENT ON
R. SULLIVAN CO.
UP FALLS

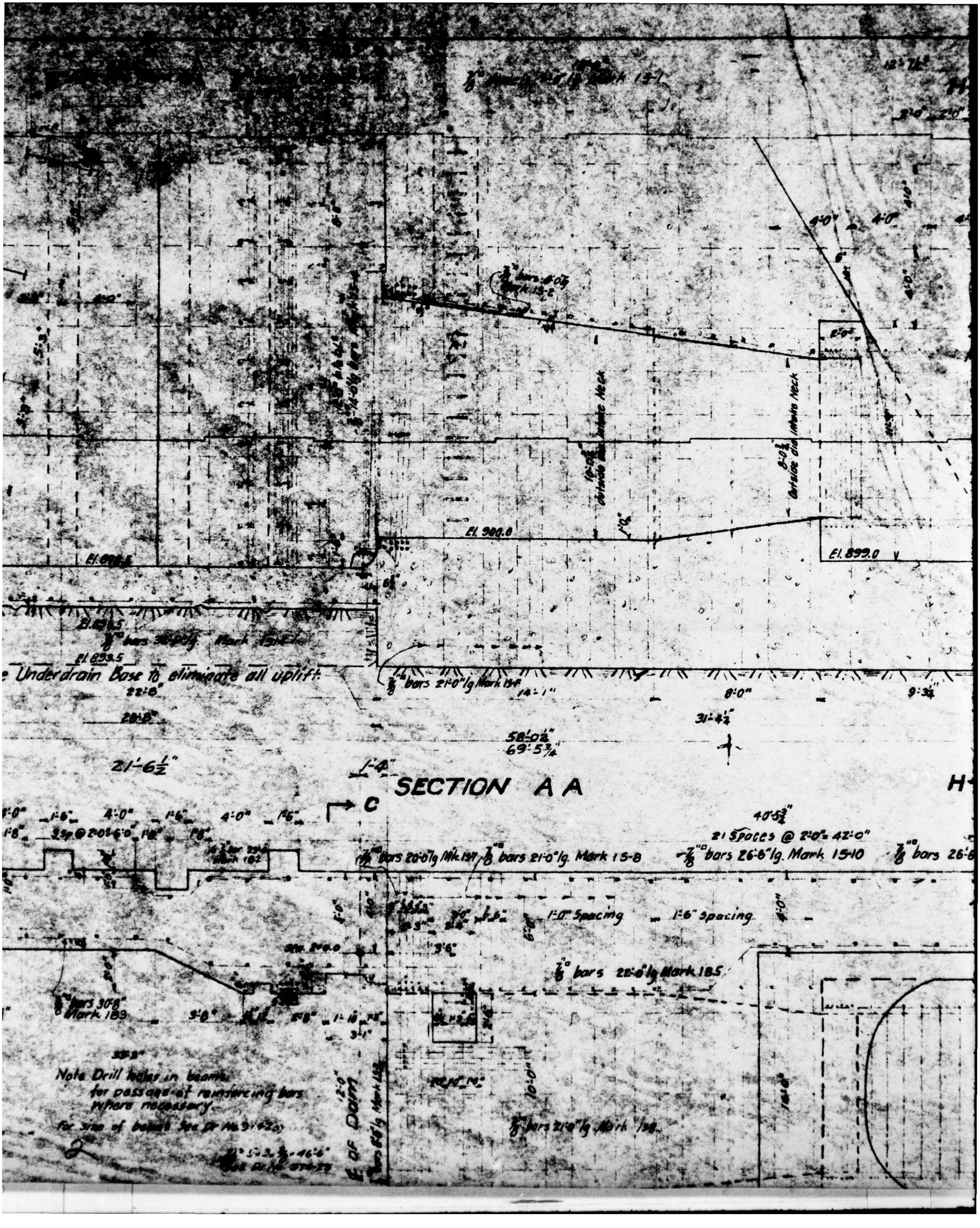
RRANGEMENT

ASTON, ENG.R
CTOR STR.
YORK CITY

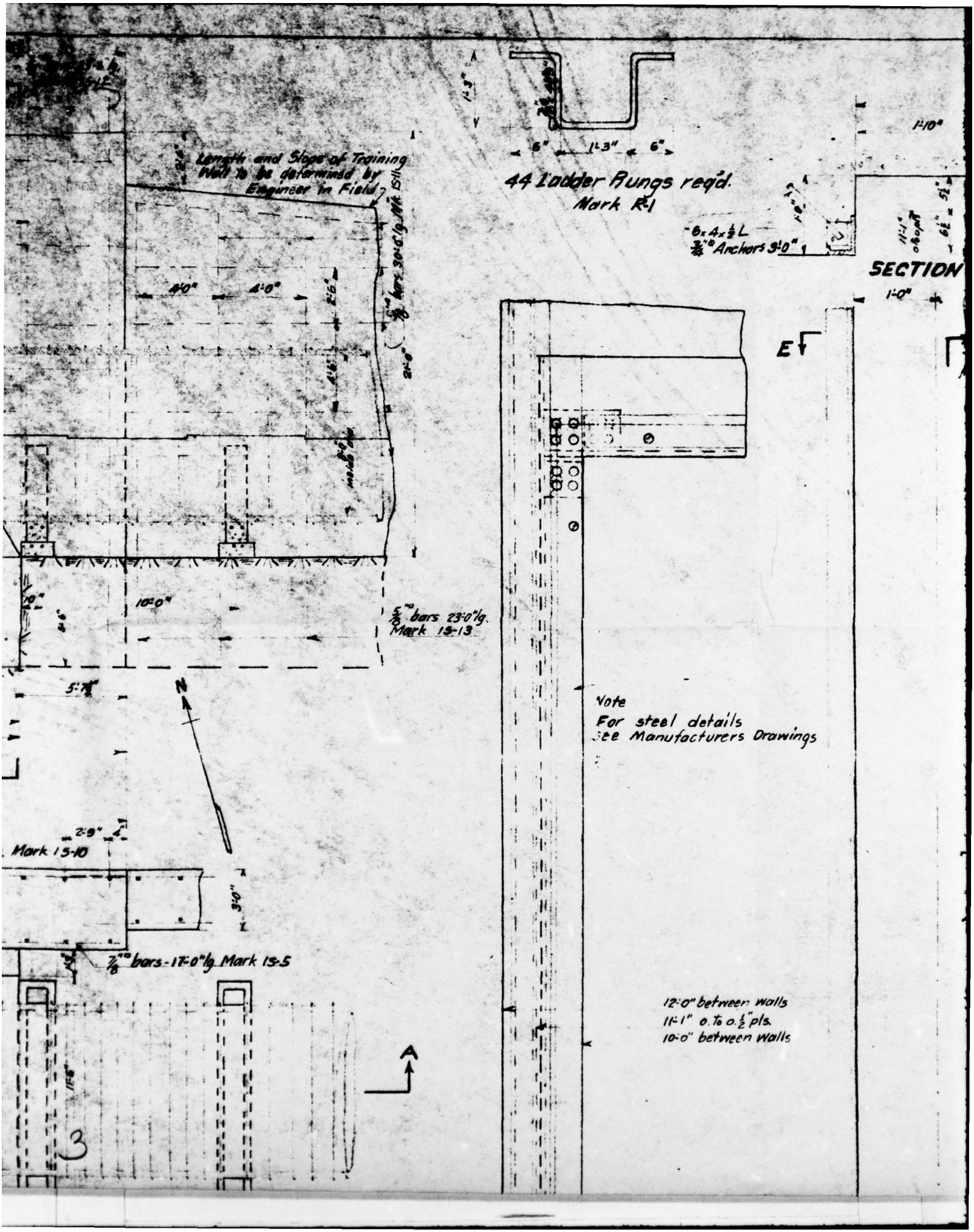
10

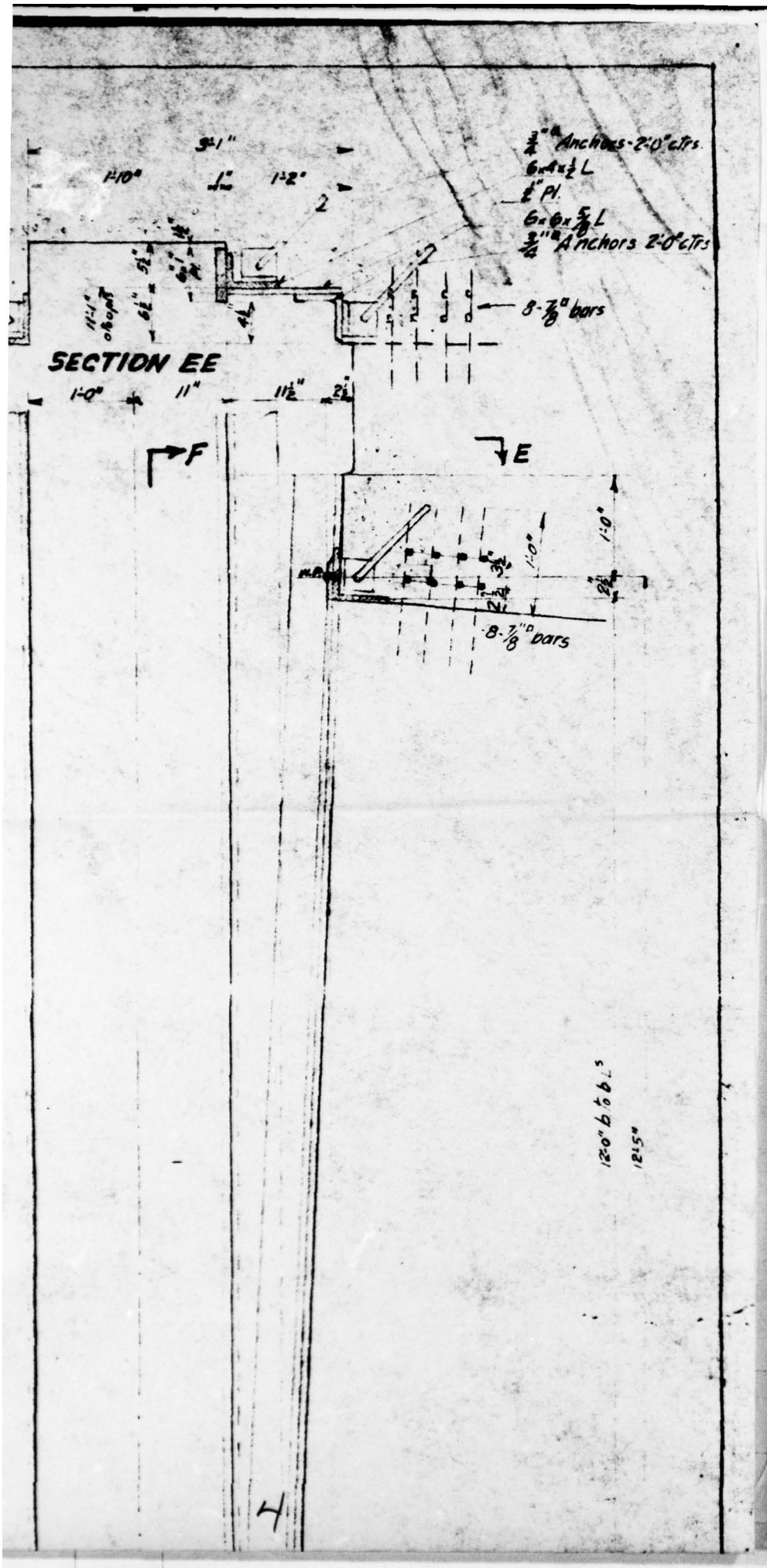
374-4A

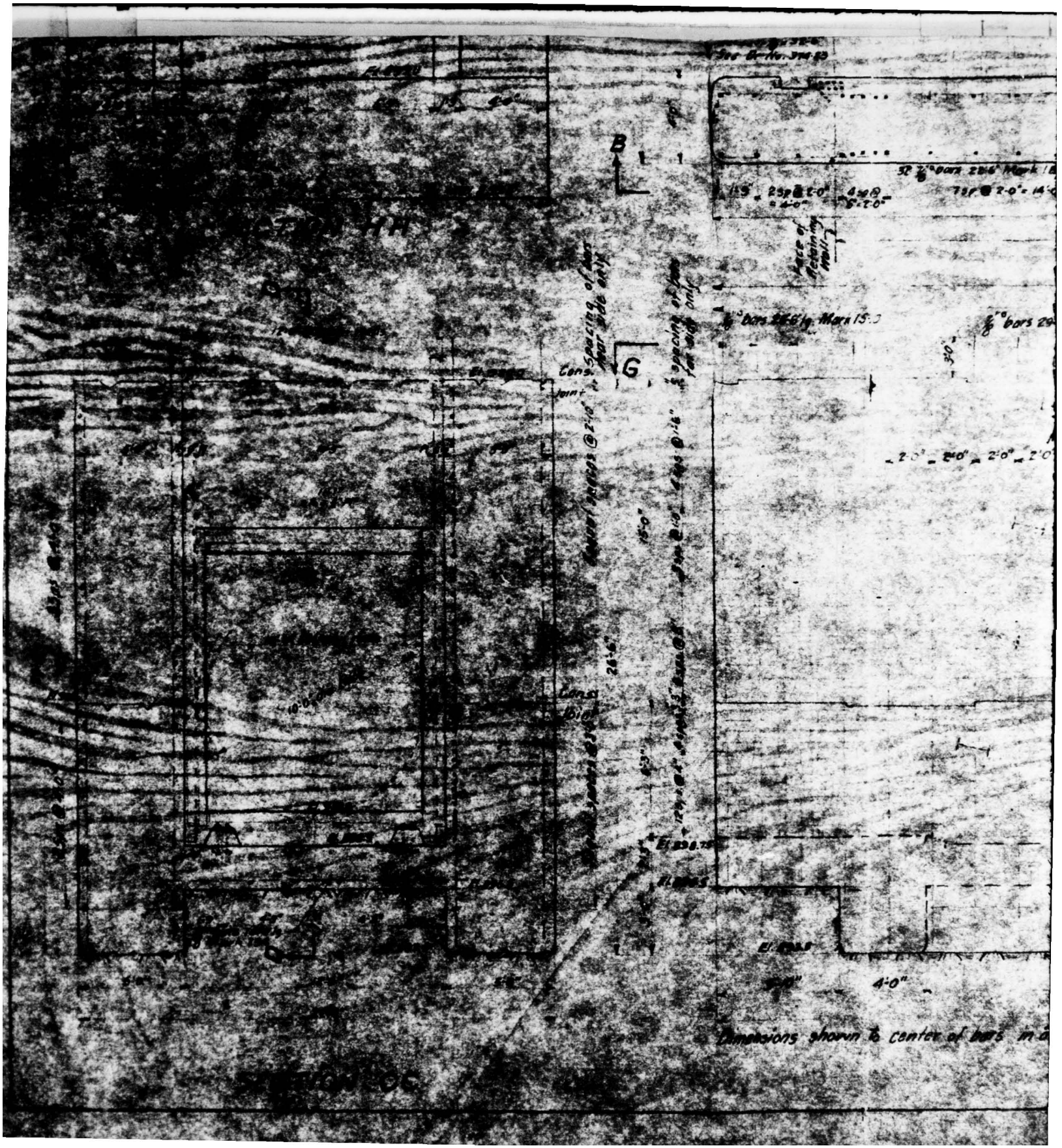

Const. Joint
Const. Joint
El. 898.75
El. 898.75
22'-0" c/to c. Gate Ho. Piers
FRONT ELEVATION
El. 920.01
Note U
A
A

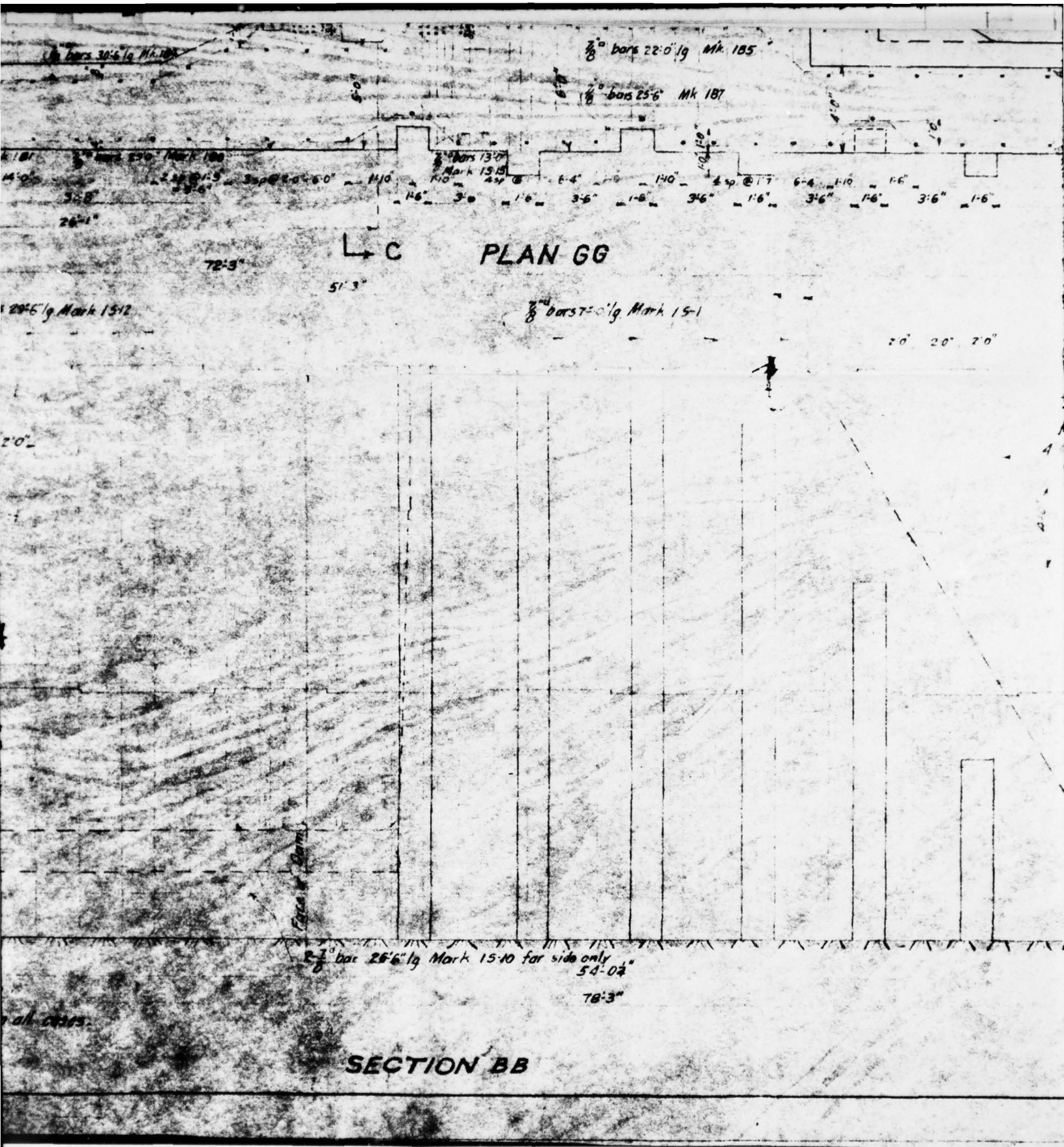


SECTION AA
C
El. 900.0
El. 899.0
El. 893.5
Outside dia. intake Neck
Underdrain Base to eliminate all uplift
7/8" bars 21'-0" lg. Mark 15-4
14'-1"
8'-0"
31'-4 1/2"
58'-0 1/2"
69'-5 3/4"
21'-6 1/2"
1'-4"
40'-5 3/4"
21 Spaces @ 2'-0" = 42'-0"
7/8" bars 20'-0" lg. Mk. 15-7
7/8" bars 21'-0" lg. Mark 15-8
7/8" bars 26'-6" lg. Mark 15-10
1'-0" Spacing
1'-6" Spacing
7/8" bars 22'-0" lg. Mark 18-5
Note Drill holes in beams for passage of reinforcing bars where necessary.
℄ OF Dam
7/8" bars 21'-0" lg. Mark 18-

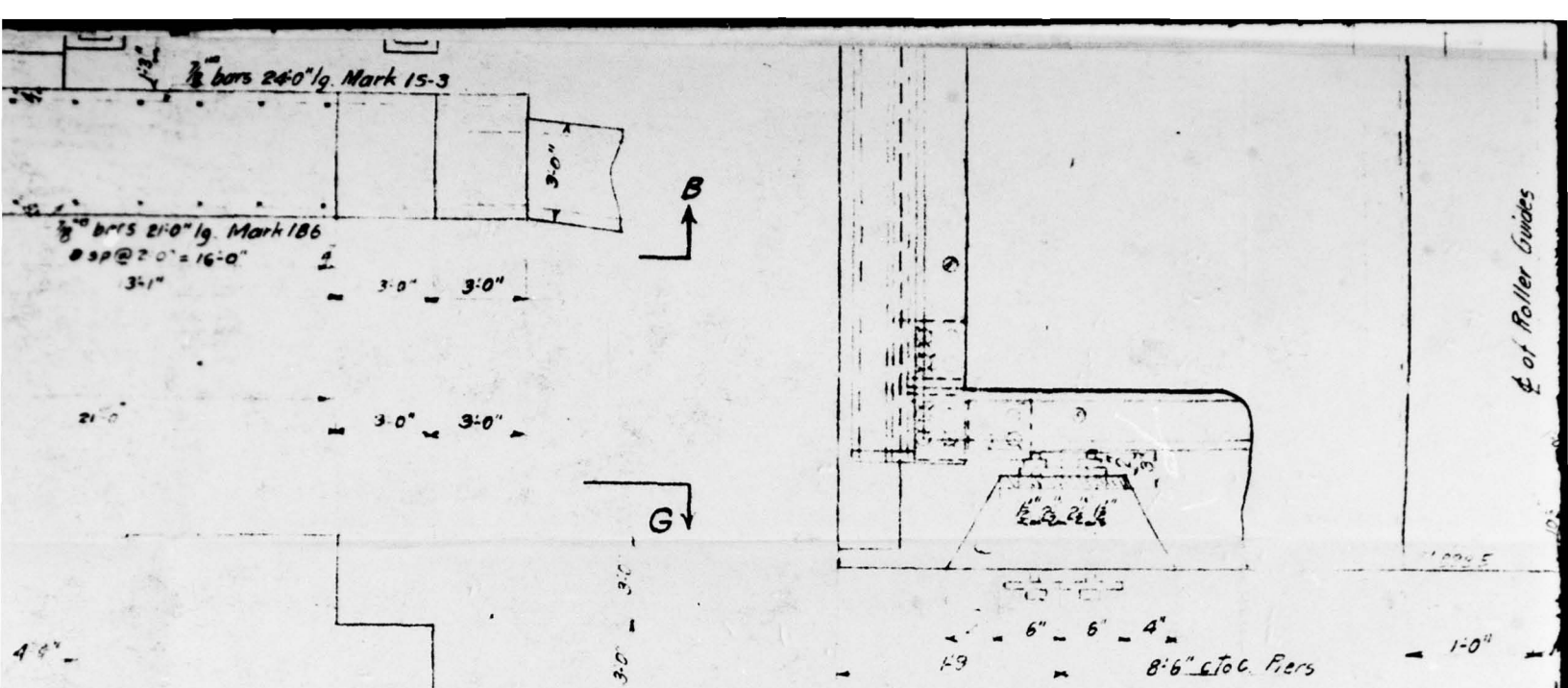

Length and Slope of Training Wall to be determined by Engineer in Field
44 Ladder Rungs reqd.
Mark R-1
6 x 4 x ½ L
¾" ø Anchors 3'-0"
SECTION
1'-0"
E
Note
For steel details
See Manufacturers Drawings
12'-0" between walls
11'-1" 0. to 0. ½" pls.
10'-0" between walls
4'-0"
4'-0"
10'-0"
⅝" ø bars 23'-0" lg.
Mark 15-13
⅝" ø bars - 17'-0" lg. Mark 15-5
Mark 15-10
N
A
A
3


3'-1"
1'-10"
1'-2"
2
¾" ø Anchors - 2'-0" c/trs
6 x 4 x ½ L
8" Pl.
6 x 6 x 5/16 L
¾" ø Anchors 2'-0" c/trs
8 - 7/8" ø bars
SECTION EE
1'-0"
11"
11½"
2½"
F
E
1'-0"
1'-0"
3½"
2½"
8 - 7/8" ø bars
120' 6 6 6 5
121' 5"
4


B
G
Face of Retaining Wall
Const. joint
Const. joint
4'-0"
4'-0"
Dimensions shown to center of bars in c


7/8" bars 22'0" lg Mk 185
1 1/8" bars 25'6" Mk 187
7/8" bars 13'0" Mark 15.15
72'-3"
51'-3"
PLAN GG
7/8" bars 7'-0" lg Mark 15-1
2'0" 2'0" 2'0"
Face of Beam
1 1/8" bar 25'6" lg Mark 15.10 for side only
54'-0"
78'-3"
SECTION BB

6



SECTION FF

SECT

General Notes
All concrete to be 1:3:5 Mix.
Integral Waterproofing requirements to be determined by Engineer in Field
Reference Drawings
For detail of Neck see Dr. No. 374-21
" " " Pipe Piers see Dr No 374-17
" Top Portion - Intake Pier see Dr No 374-29
" details of reinforcing bars see Dr No. 374-30
For Intake Steel Details, Screens and Frames See Dr. No 374-23

5/8" bars 17'-0" lg Mark 15-6

Length and slope of Training Wall to be determined by Engineer in Field.

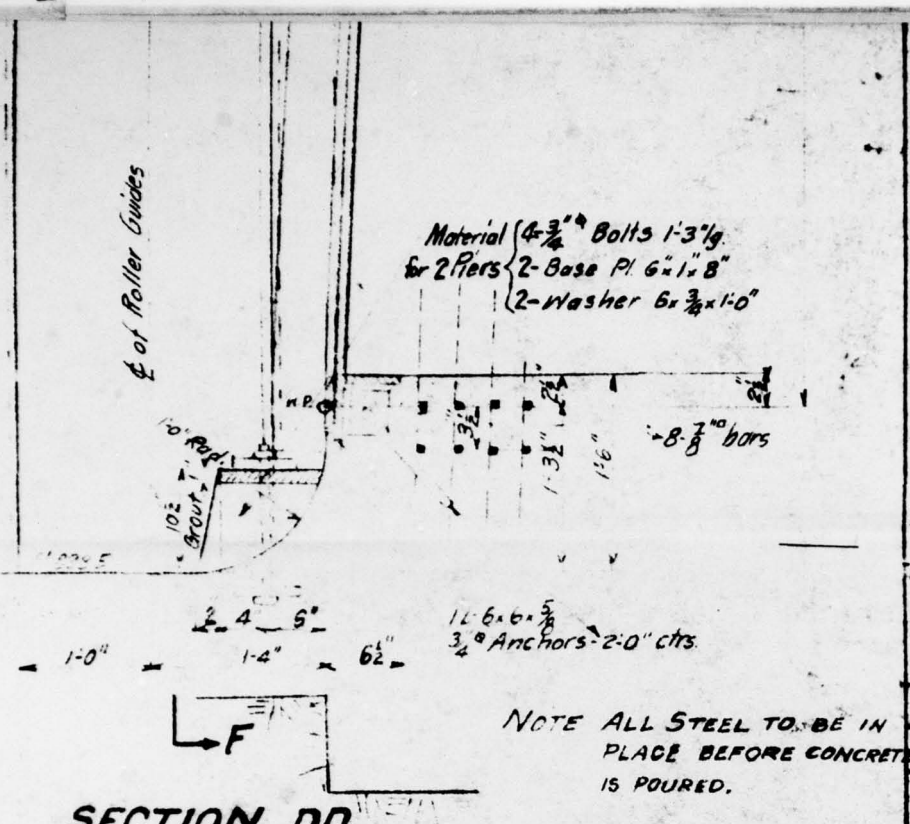
Revised Oct 30 22 Marking of bars revised
" Nov 15-22 [illegible]

ATLAN
HYDR

INTA

DRAWN BY
A.D.S

7



SECTION DD

SCALE 1"=1'0"

NOTE ALL STEEL TO BE IN PLACE BEFORE CONCRETE IS POURED.

c. Piers

s to

374-17
No 374-29
g No. 374-30
nes

ATLANTIC UTILITIES CORPORATION

HYDRO-ELECTRIC DEVELOPMENT ON
MONGAUP RIVER SULLIVAN CO
AT MONGAUP FALLS

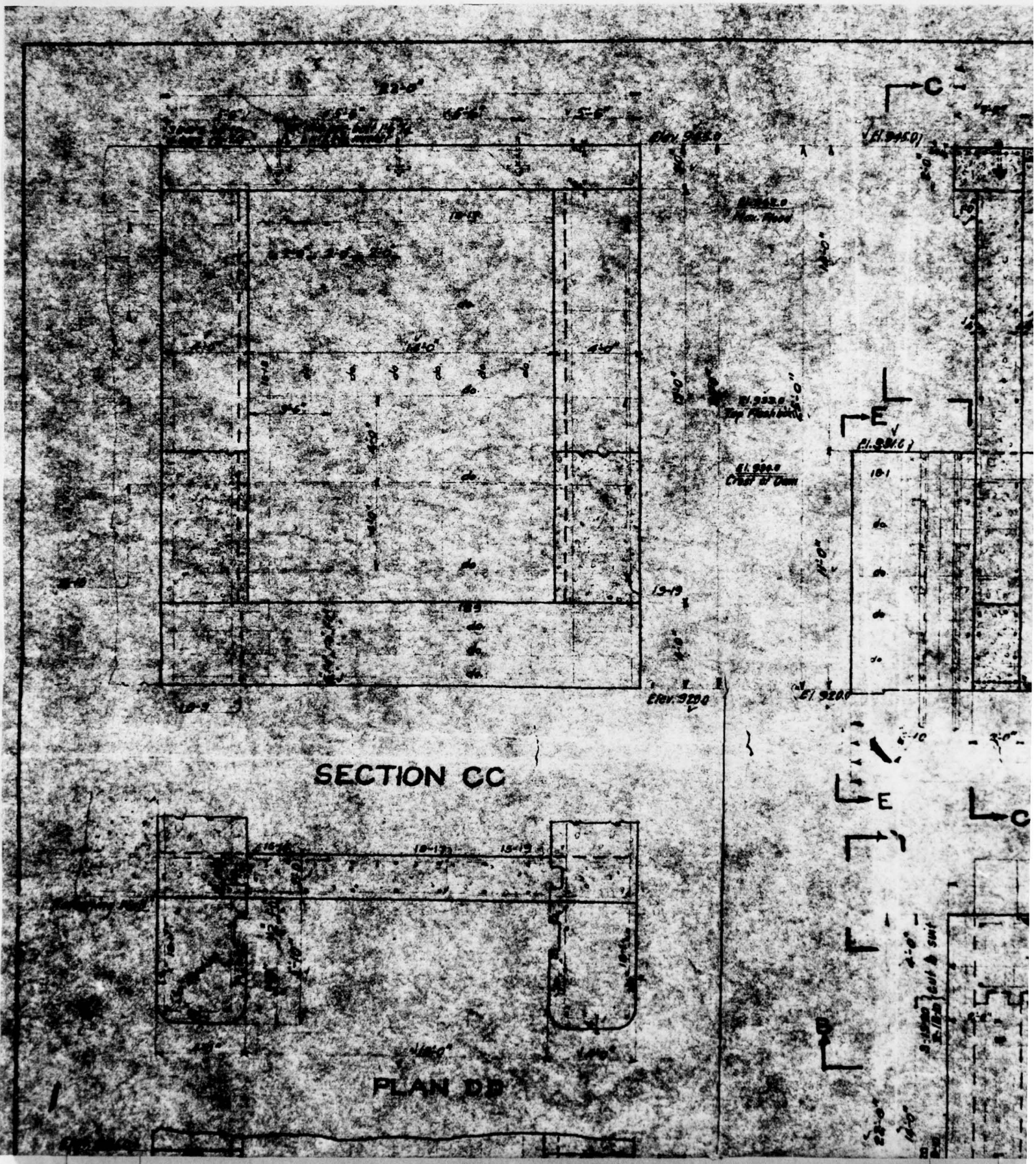
GATE HOUSE

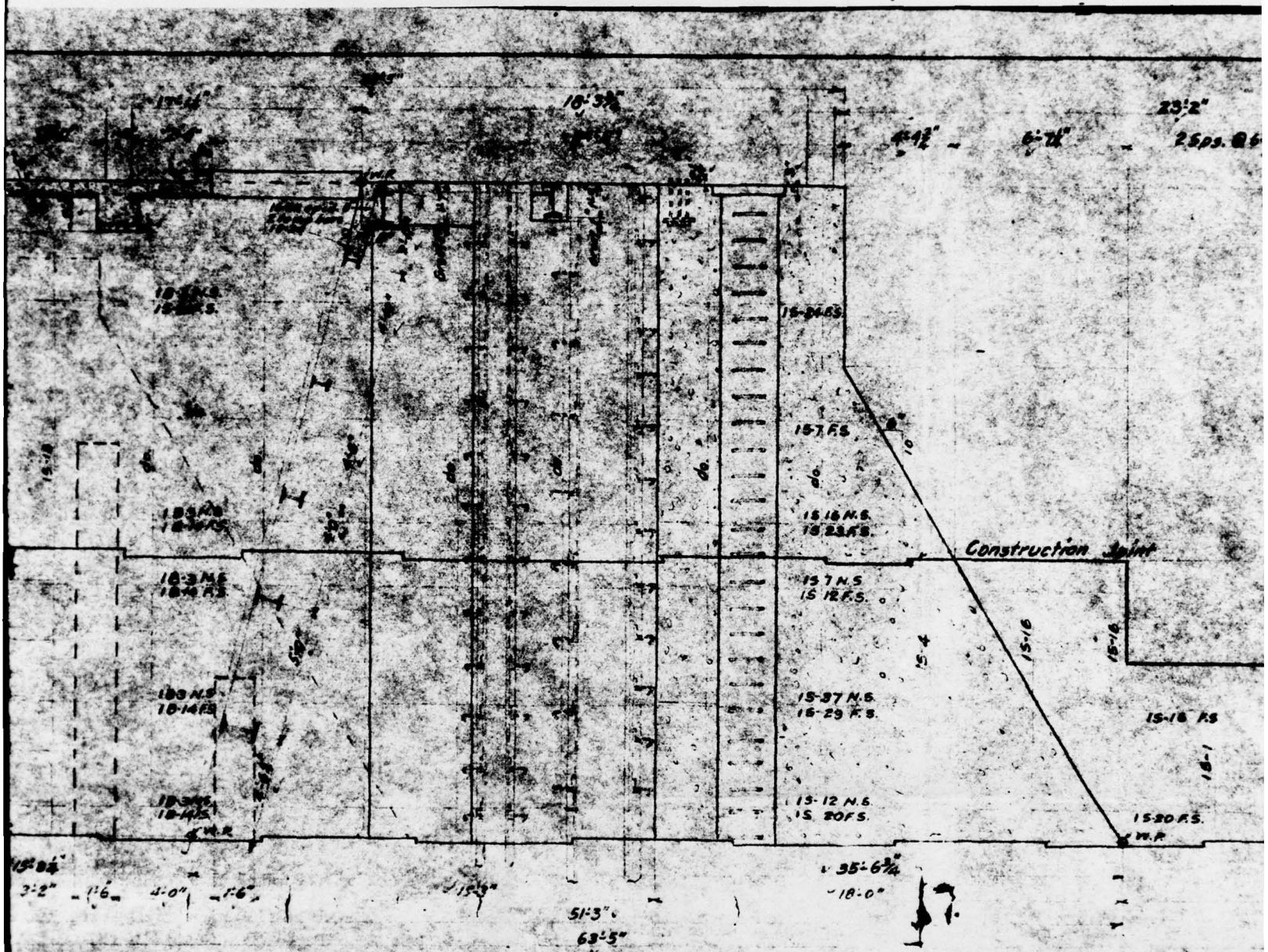
INTAKE PIER - BOTTOM PORTION

R. W. LIVINGSTON, ENGR.
"J" RECTOR ST
NEW YORK CITY

DRAWN BY	CHECKED BY	APPROVED BY	DATE	374-28
A.D.S				

8

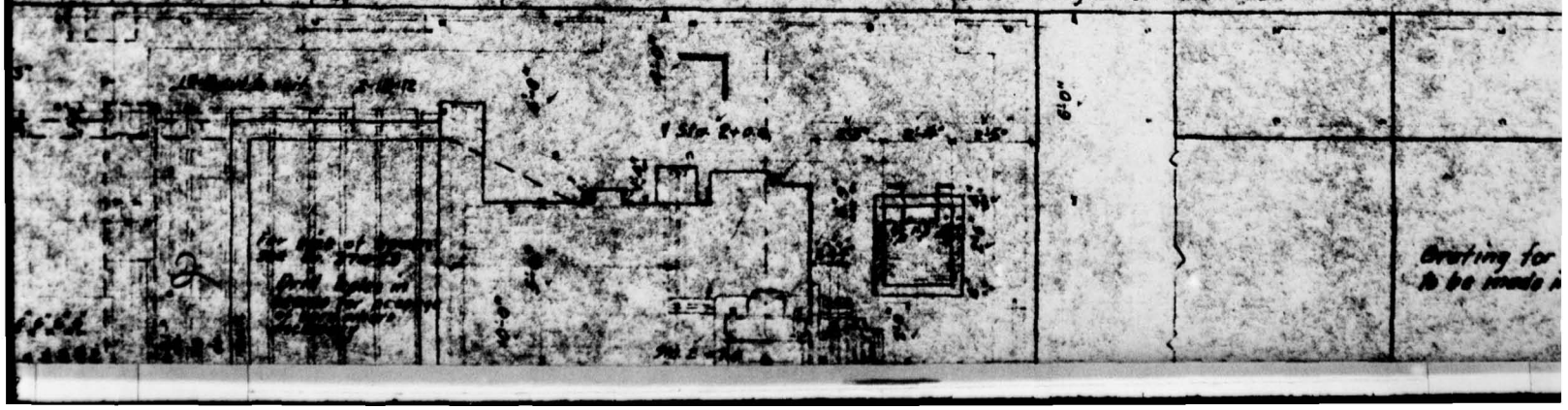

SECTION CC
PLAN DD

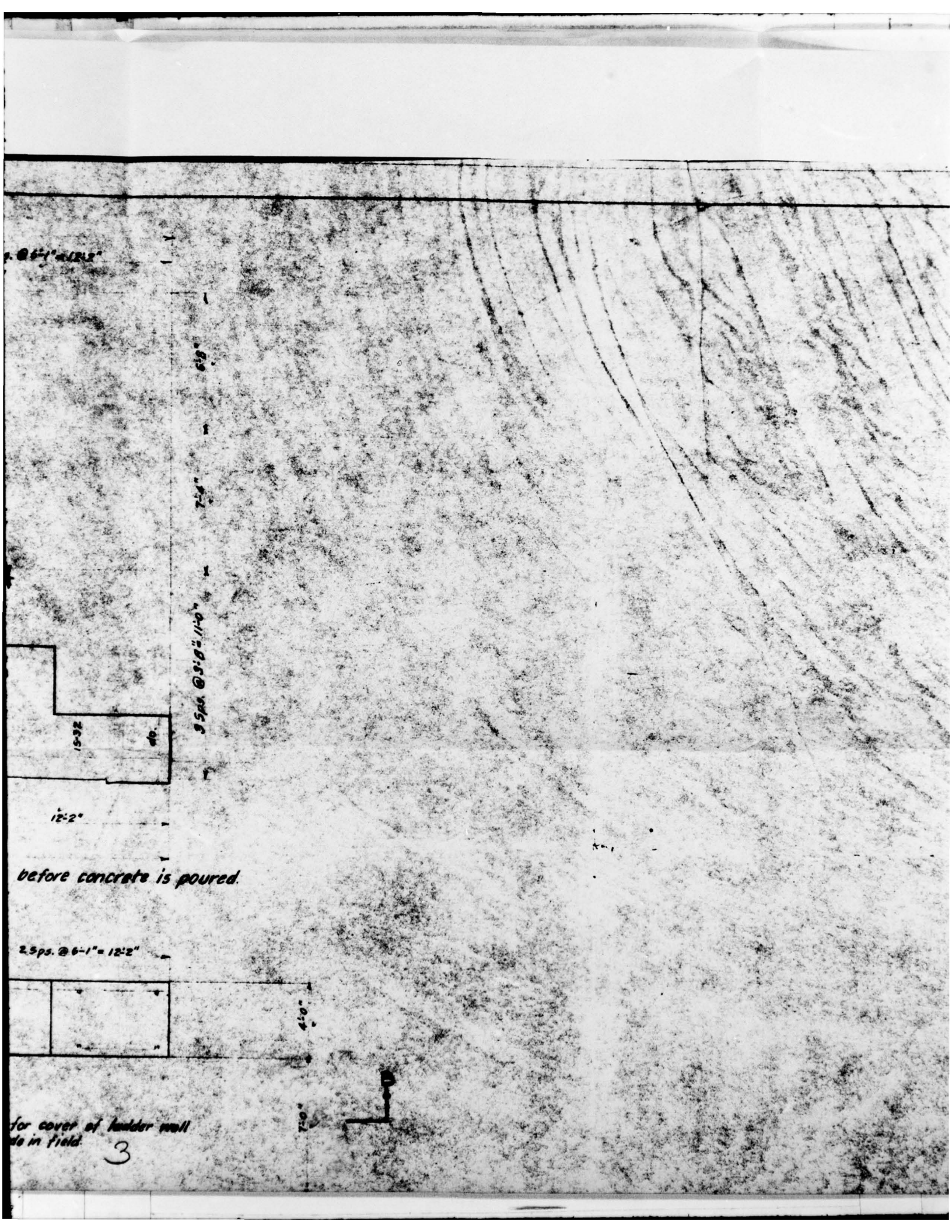


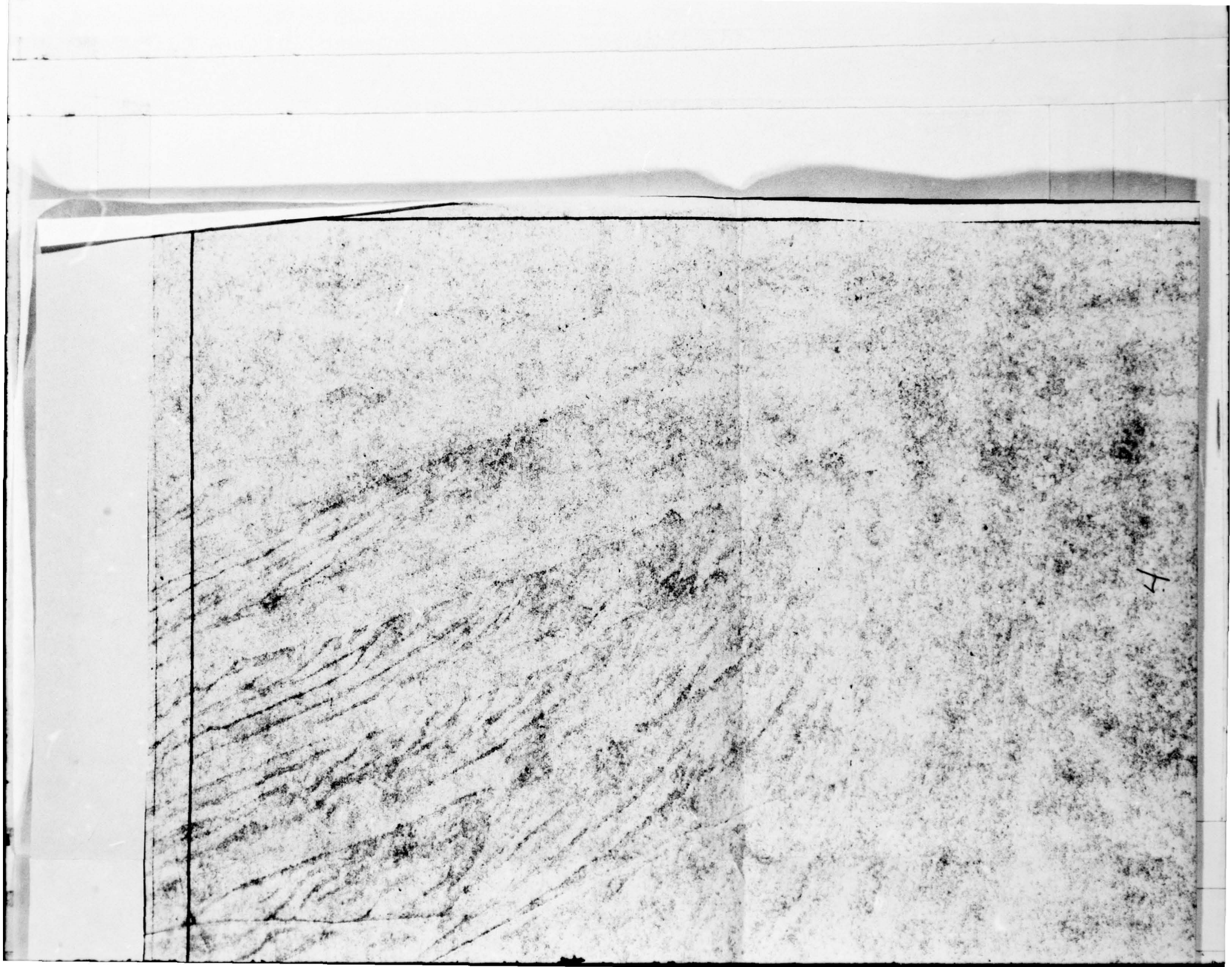
SECTION BB

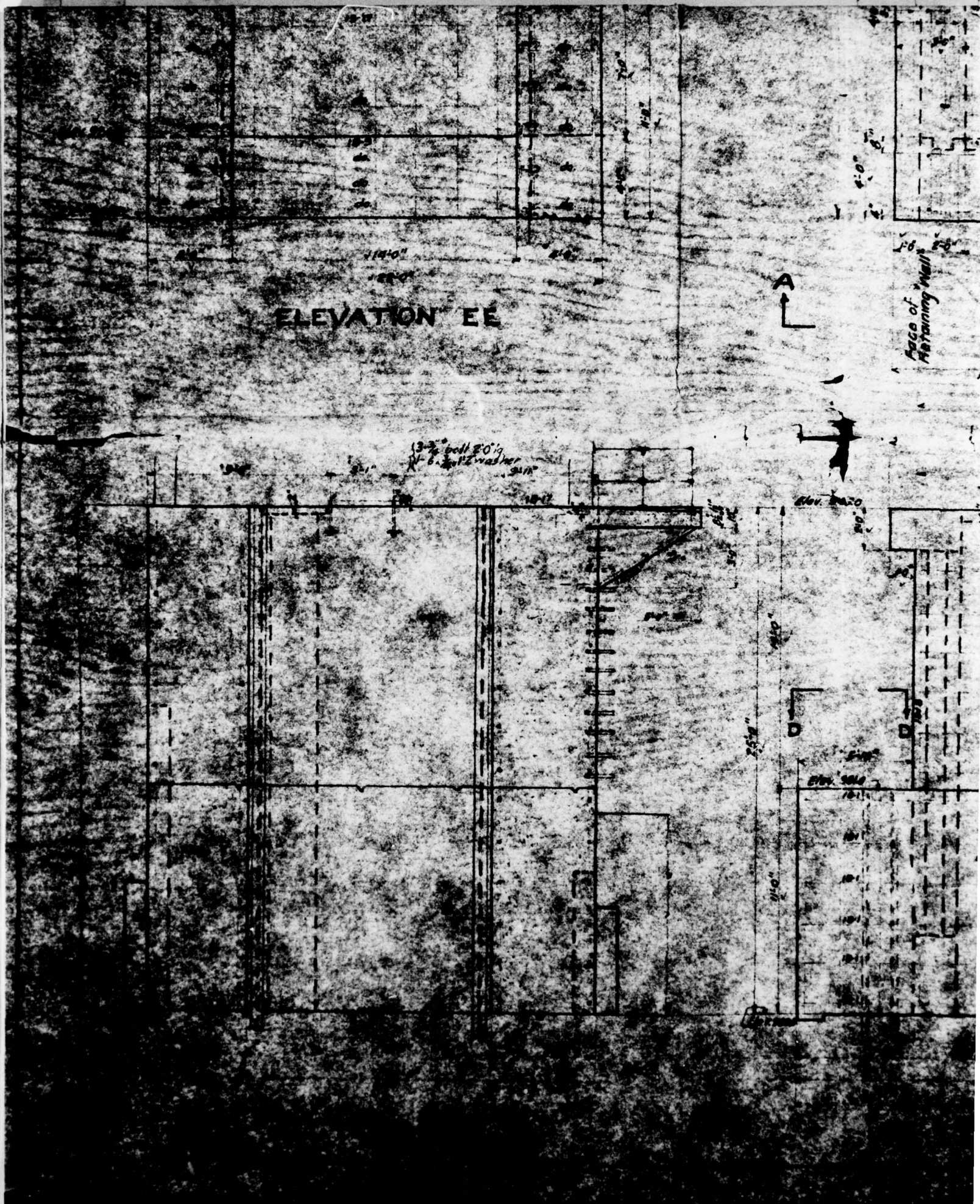
Note: All steel to be in place be

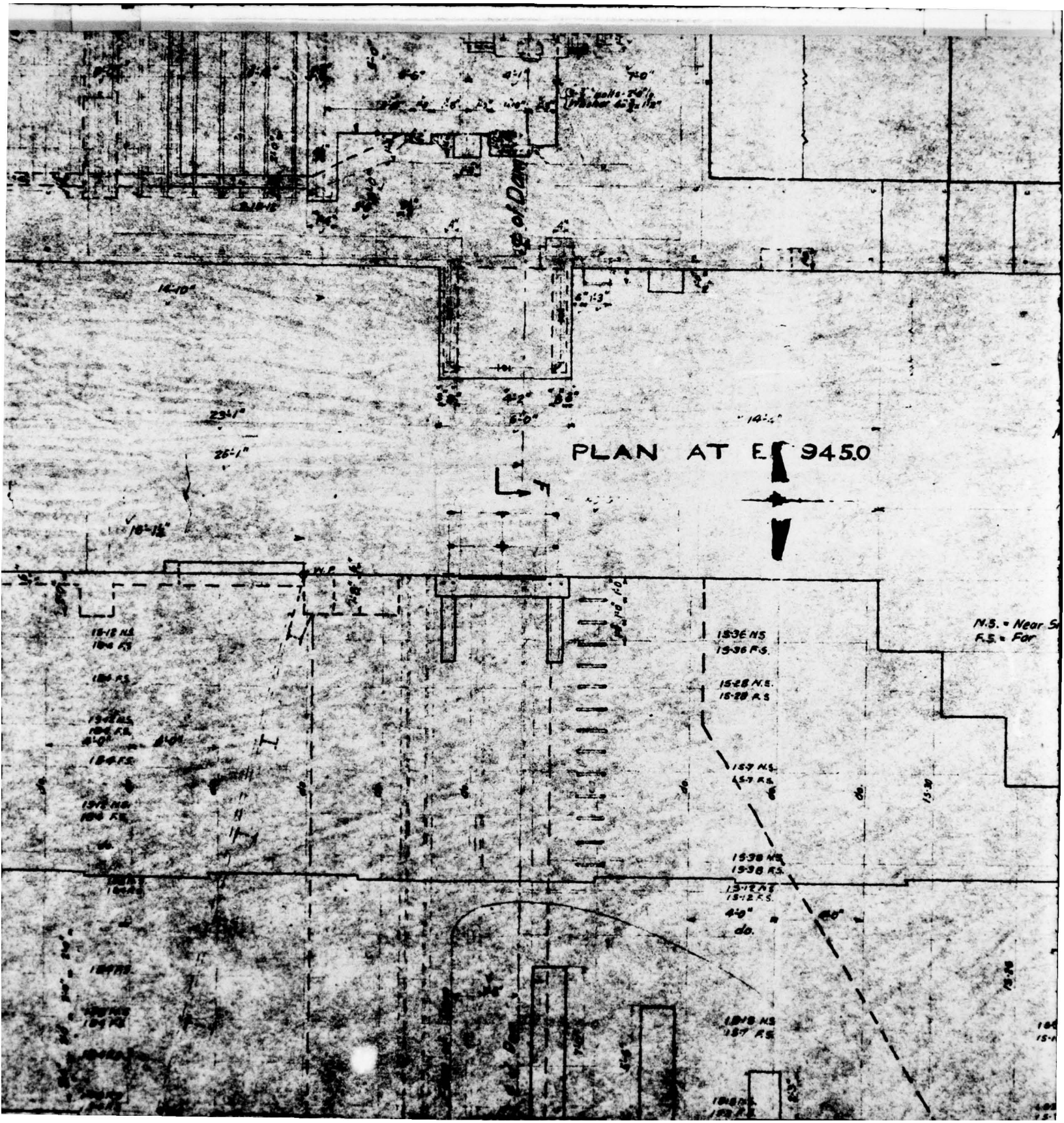
for size of beams see Maine Electric Co. Drawings M3816 and M3817

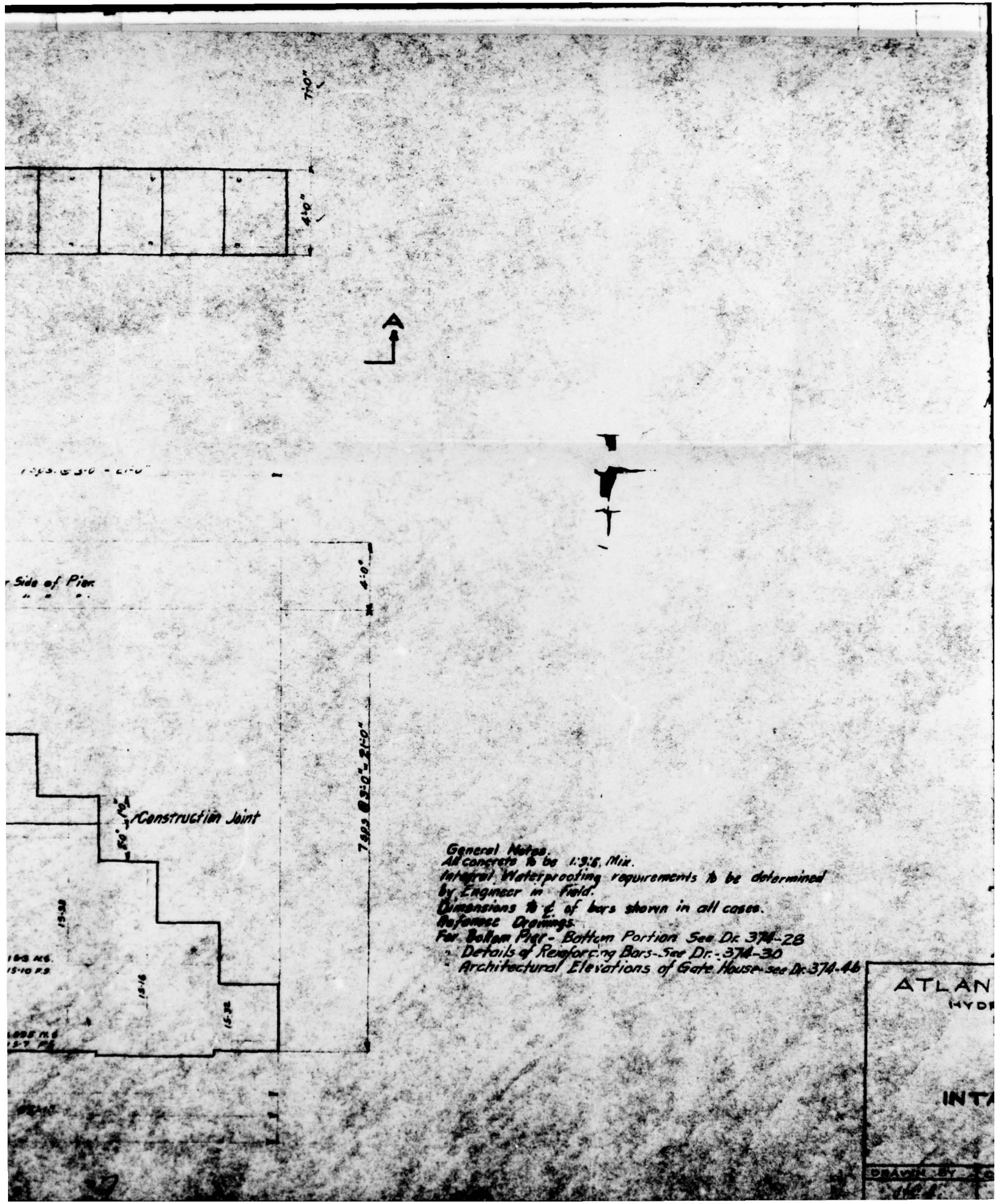



@ 6'-1" = 12'-2"
6'-8"
7'-4"
9 Spa. @ 9'-0" = 11'-0"
15-32
do.
12'-2"
before concrete is poured.
2.5ps. @ 6'-1" = 12'-2"
4'-0"
7'-0"
for cover of ladder well
de in field.
3




ELEVATION EE
A
D
D
Retaining Wall


PLAN AT E 945.0
N.S. = Near S
F.S. = Far



General Notes.
All concrete to be 1:3:6, Mix.
Integral Waterproofing requirements to be determined by Engineer in field.
Dimensions to ℄ of bars shown in all cases.
Reference Drawings.
For Bottom Pier - Bottom Portion See Dr. 374-28
" Details of Reinforcing Bars - See Dr. - 374-30
" Architectural Elevations of Gate House - see Dr. 374-46

ATLAN
HYDR

INTA

DRAWN BY

ATLANTIC UTILITIES CORPORATION

HYDRO-ELECTRIC DEVELOPMENT ON
MONGAUP RIVER SULLIVAN CO.
AT MONGAUP FALLS

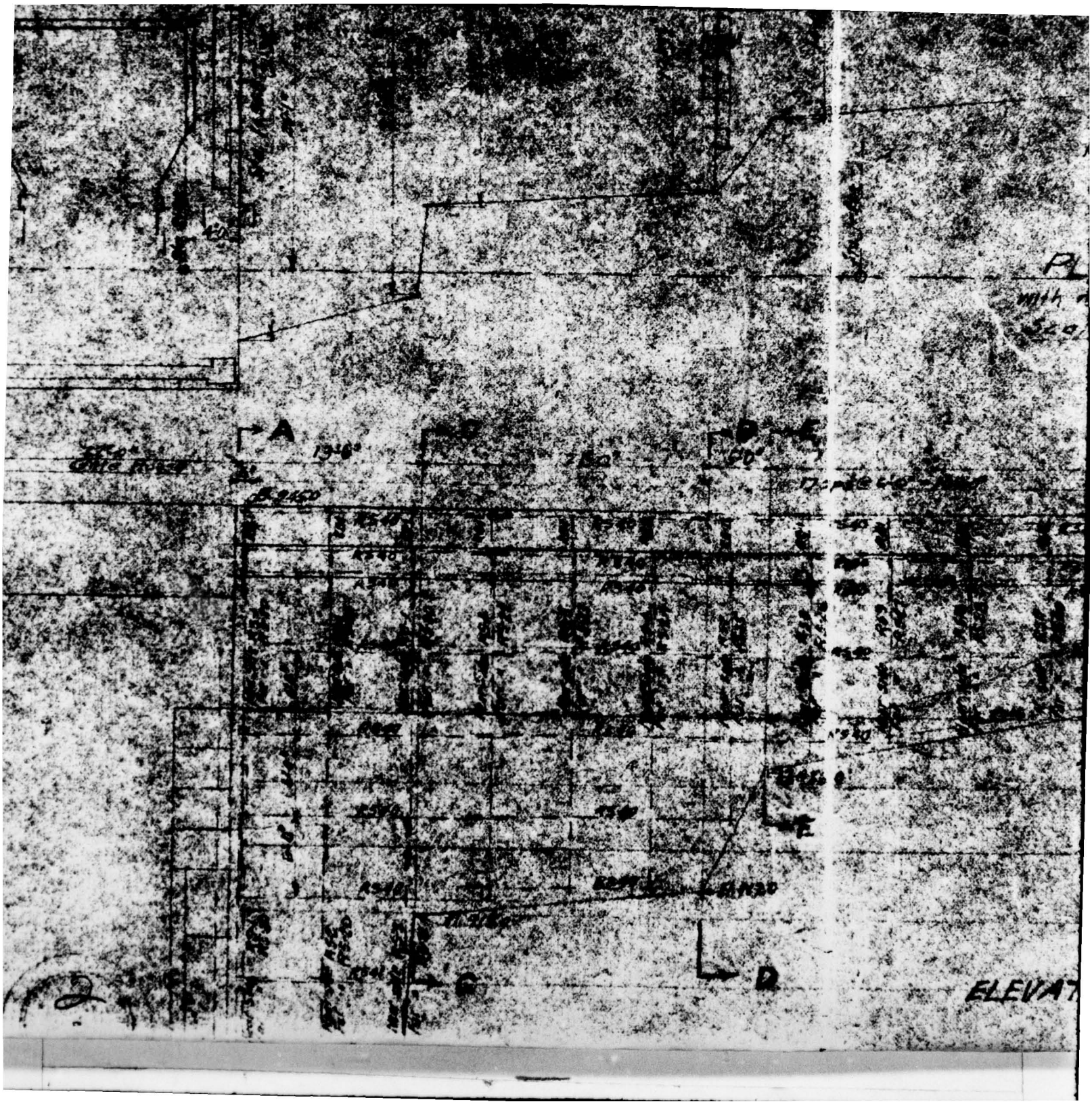
GATE HOUSE

INTAKE PIER - TOP PORTION

R. R. LIVINGSTON ENGR.
[illegible] VICTOR ST.
NEW YORK CITY

DRAWN BY	CHECKED BY	ARRANGEMENT	DATE	374-29
[illegible]	[illegible]	[illegible]	[illegible]	

SECTION BB

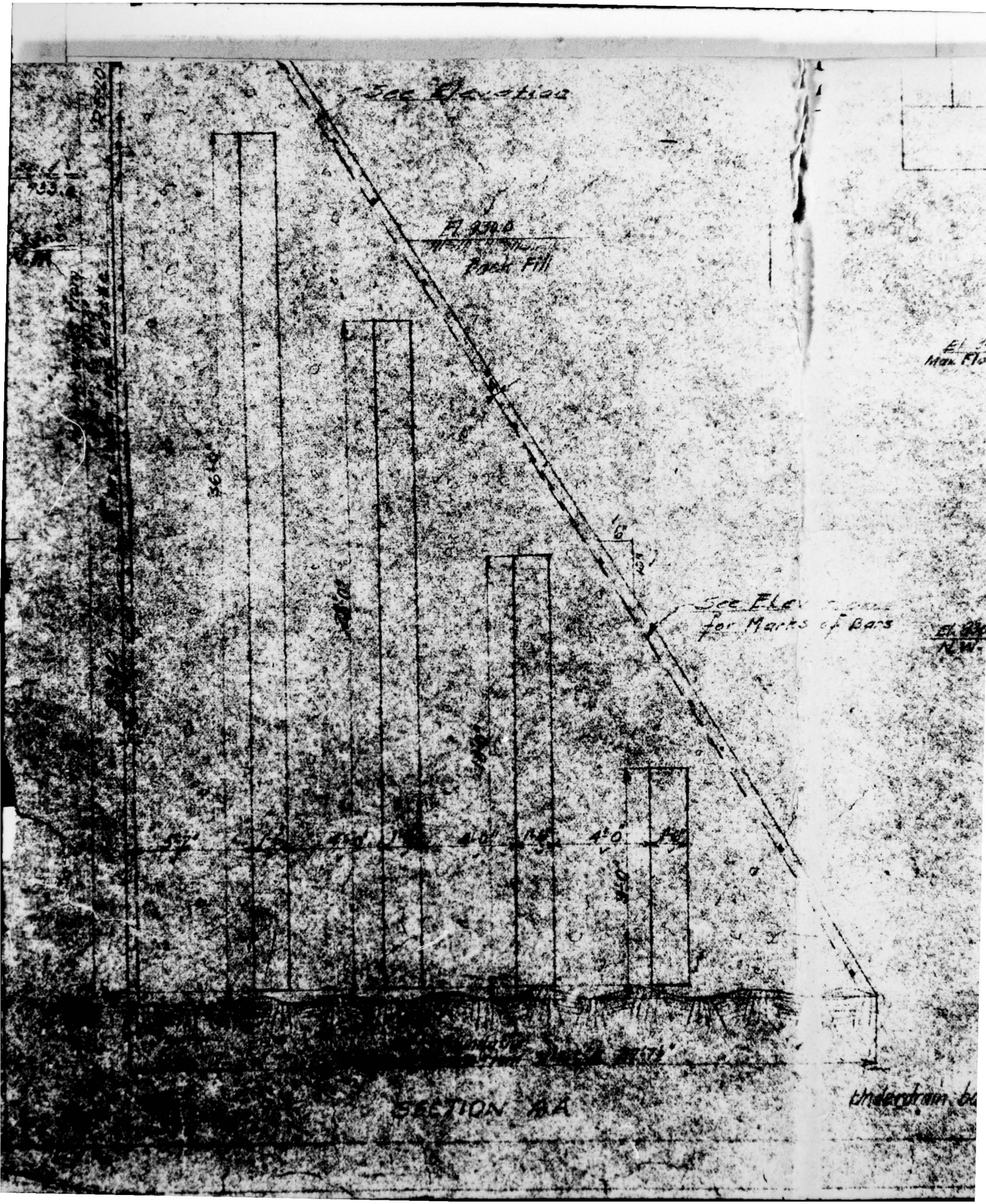

A
D
ELEVAT

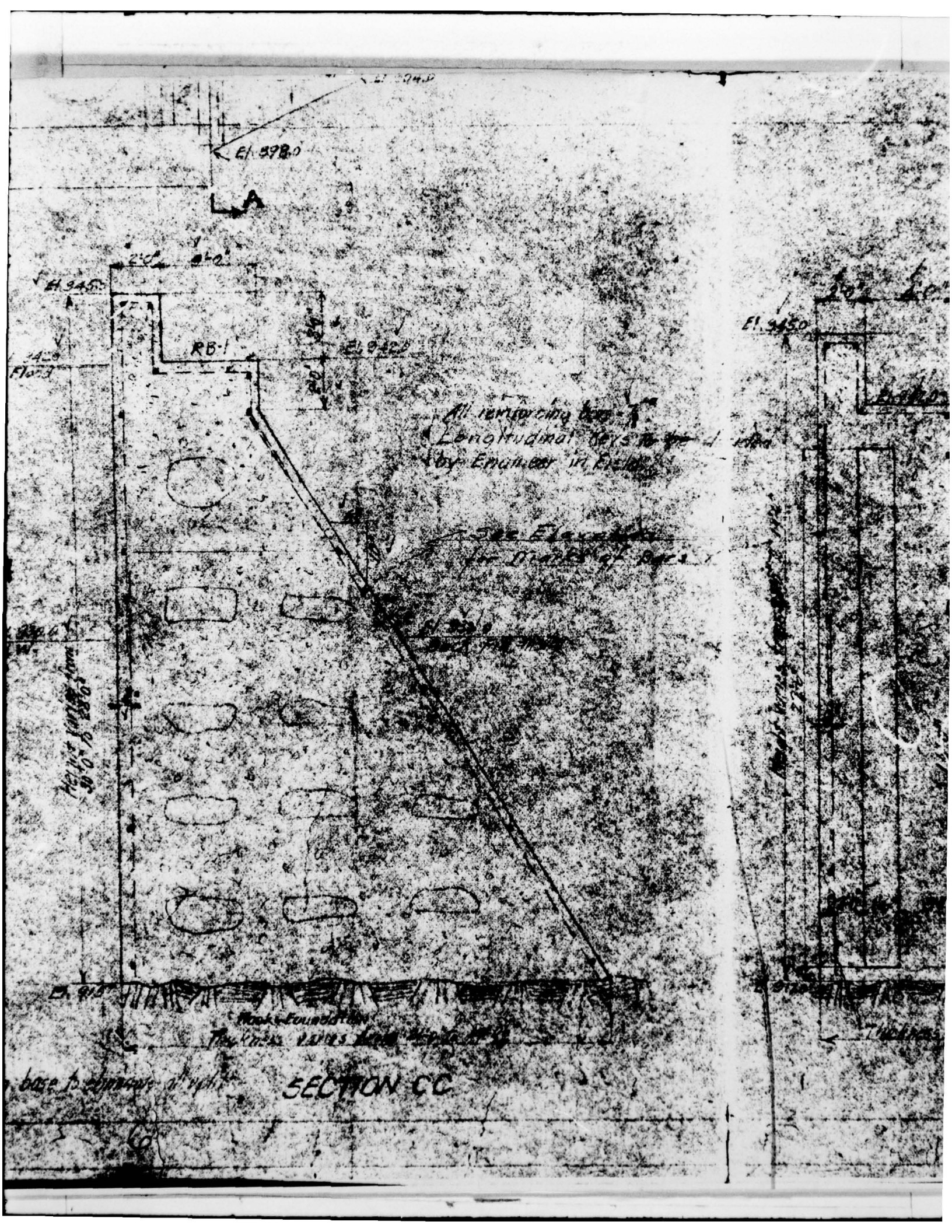
Mark	No.
RB-1	201
RS-1	4
RS-2	1
RS-3	1
RS-4	1
RS-5	1
RS-6	1
RS-7	1
RS-8	1
RS-9	1
RS-10	1
RS-11	1
RS-12	1
RS-13	1
RS-14	1
RS-15	1
RS-16	1
RS-17	1
RS-18	1
RS-19	1
RS-20	5
RS-21	1
RS-22	1
RS-23	1
RS-24	1
RS-25	1
RS-26	1
RS-27	1
RS-28	1
RS-29	1
RS-30	1
RS-31	1
RS-32	1
RS-33	1
RS-34	1
RS-35	1
RS-36	1

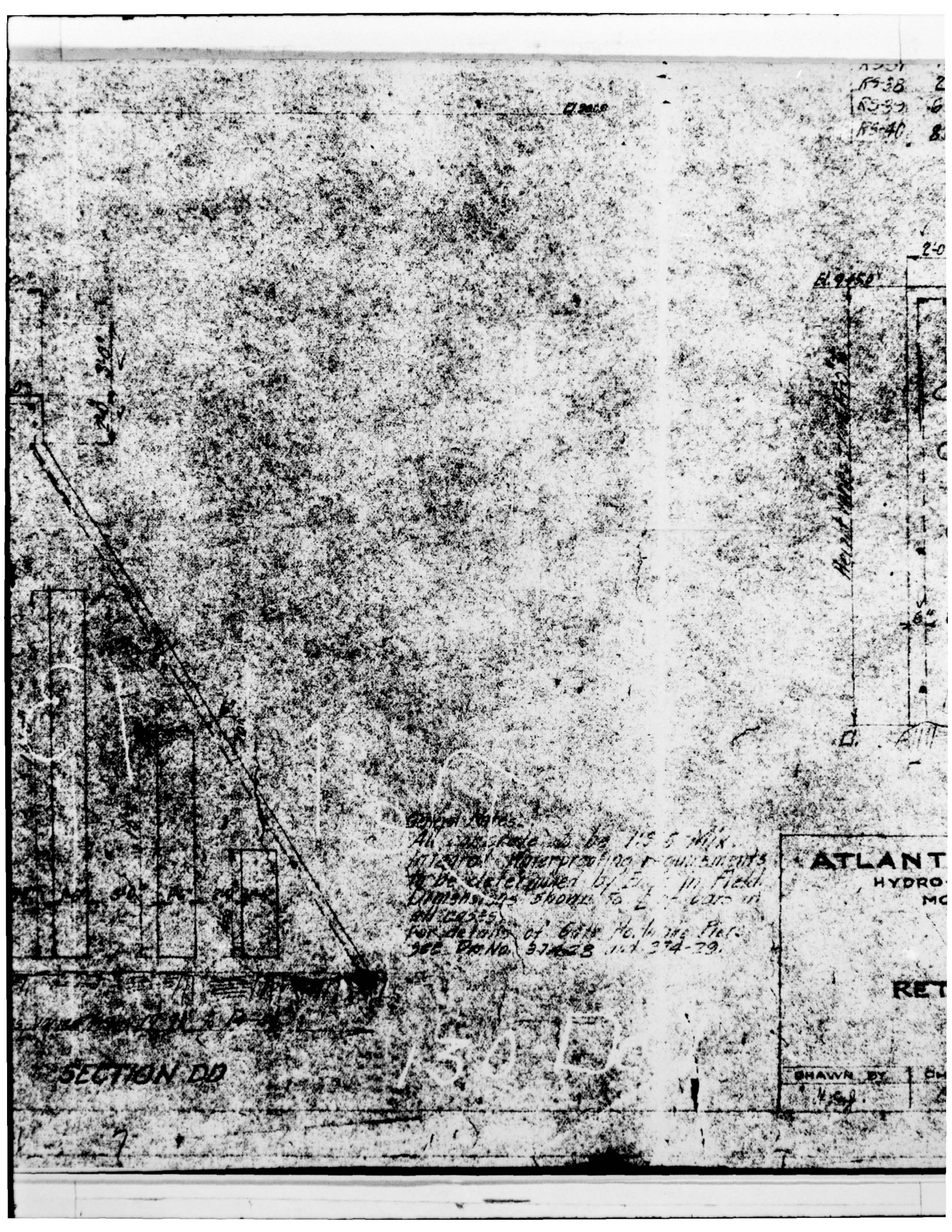
List of Reinforcing Bars

Retaining Wall

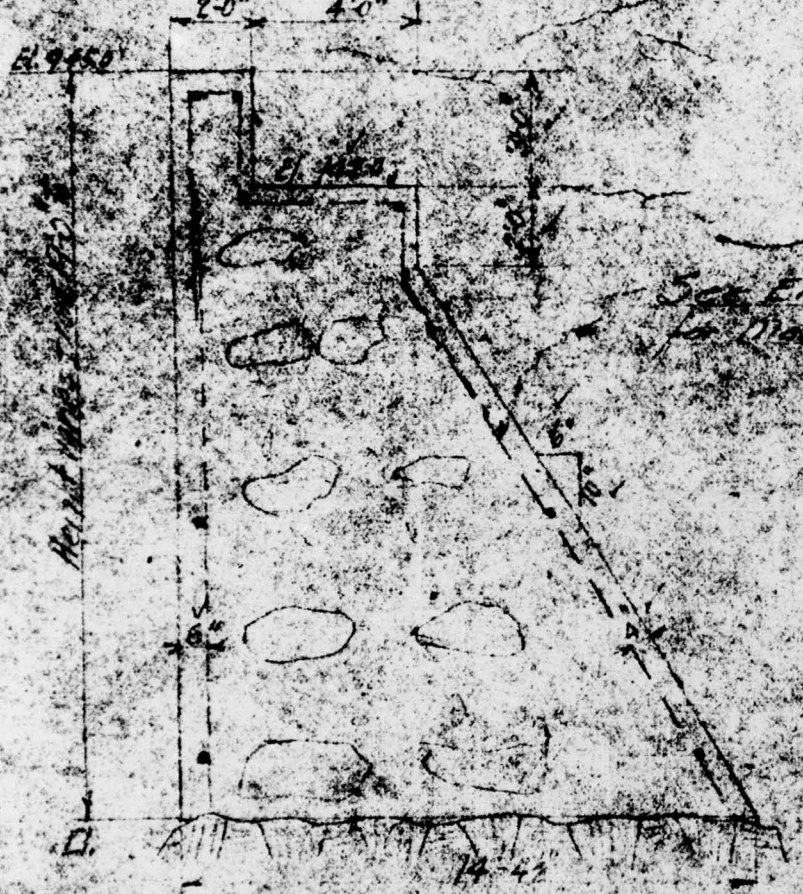
Mark	No.	Size	Length	Diagram
RB-1	28	7/8"	19'-0"	
RS-1	4	7/8"	20'-5"	Straight
RS-2	1	7/8"	20'-0"	Straight
RS-3	1	7/8"	19'-3"	Straight
RS-4	1	7/8"	28'-6"	Straight
RS-5	1	7/8"	28'-2"	Straight
RS-6	1	7/8"	27'-8"	Straight
RS-7	1	7/8"	21'-6"	Straight
RS-8	1	7/8"	19'-9"	Straight
RS-9	1	7/8"	17'-6"	Straight
RS-10	1	7/8"	17'-3"	Straight
RS-11	1	7/8"	16'-6"	Straight
RS-12	1	7/8"	16'-0"	Straight
RS-13	1	7/8"	14'-0"	Straight
RS-14	1	7/8"	13'-0"	Straight
RS-15	1	7/8"	12'-4"	Straight
RS-16	1	7/8"	11'-0"	Straight
RS-17	1	7/8"	6'-6"	Straight
RS-18	1	7/8"	4'-9"	Straight
RS-19	1	7/8"	4'-0"	Straight
RS-20	5	7/8"	23'-8"	Straight
RS-21	1	7/8"	22'-0"	Straight
RS-22	4	7/8"	20'-5"	Straight
RS-23	1	7/8"	16'-0"	Straight
RS-24	1	7/8"	25'-6"	Straight
RS-25	1	7/8"	25'-6"	Straight
RS-26	1	7/8"	19'-6"	Straight
RS-27	1	7/8"	19'-0"	Straight
RS-28	1	7/8"	18'-0"	Straight
RS-29	1	7/8"	17'-0"	Straight
RS-30	1	7/8"	16'-3"	Straight
RS-31	1	7/8"	16'-9"	Straight
RS-32	1	7/8"	15'-3"	Straight
RS-33	1	7/8"	14'-5"	Straight
RS-34	1	7/8"	13'-3"	Straight
RS-35	1	7/8"	12'-0"	Straight
RS-36	1	7/8"	11'-3"	Straight


See Elevation
El. 933.0
El. 930.0
Rock Fill
See Elevation
for Marks of Bars
4'-0"
4'-0"
SECTION AA


El 948.0
El 939.0
LA
El 945.0
RB-1
El 942.0
All reinforcing bars
Longitudinal bars
by Engineer in Field
See Elevation
for Details of Bars
El 915.0
Rock Foundation
SECTION CC
base to remain at right
60


El. 9.50'
6"
SECTION DD
General Notes.
ATLANT
HYDRO
RET
DRAWN BY

RS-38	2		20'-0"
RS-39	6		
RS-40	80		20'-0"



SECTION EE

ATLANTIC UTILITIES CORPORATION

HYDRO-ELECTRIC DEVELOPMENT ON
MONGAUP RIVER SULLIVAN CO. N.Y.
AT MONGAUP FALLS

DAM

RETAINING WALL SECTION

R.R. LIVINGSTON, ENGR.
74 RECTOR ST.
NEW YORK CITY

DRAWN BY	CHECKED BY	APPROVED BY	DATE	
H.C.J.			Oct. 29	37-434

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