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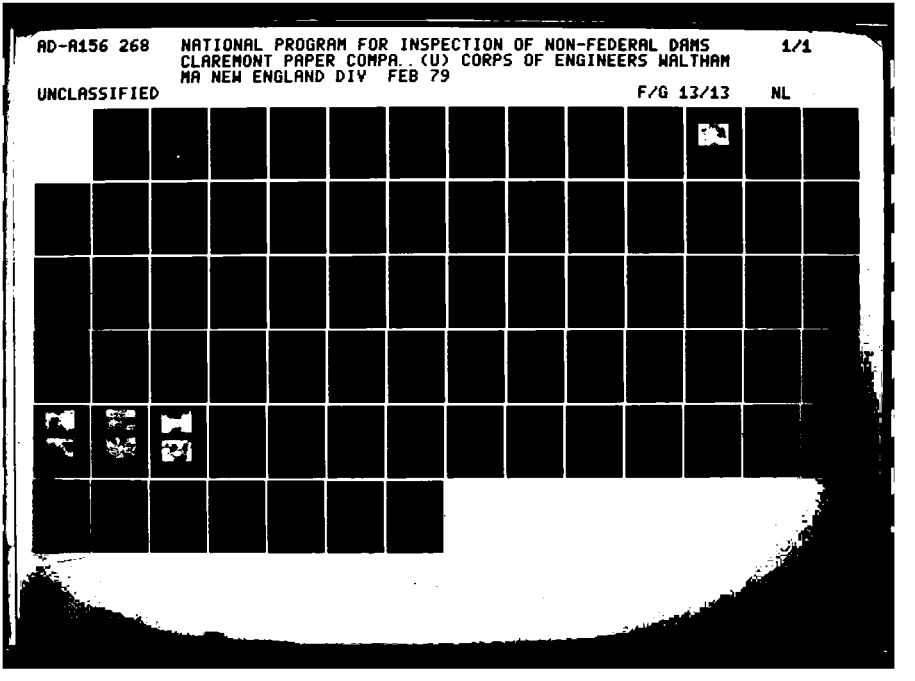

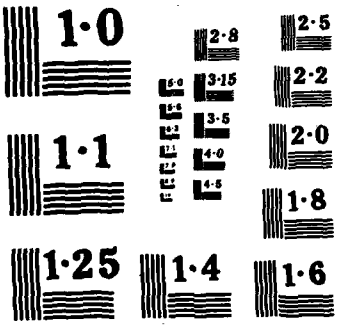

NATIONAL BUREAU OF STANDARDS
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CONNECTICUT RIVER BASIN
CLAREMONT, NEW HAMPSHIRE

CLAREMONT PAPER COMPANY DAM
NH 00139

STATE NO 47.06

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

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Claremont, New Hampshire
Sugar River

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The dam has a hydraulic height of 34 ft. and is 145 ft. long. It is a run of the river concrete gravity dam with an ogee-shaped spillway 91 ft. long. The damis in good condition. It is small in size with a high hazard classification. The test flood is ½ of the PMF. A major breach at top of dam would resulr in the loss of 50 or more lives and extensive property damage.

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REPLY TO
ATTENTION OF:
NEDED

JUL 16 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Claremont Paper Company Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Claremont Paper Mill, 131 Sullivan Street, Claremont, New Hampshire 03743.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00139
Name of Dam:	Claremont Paper Company Dam
City:	Claremont
County and State:	Sullivan County, New Hampshire
River:	Sugar River
Date of Inspection:	November 21, 1978

BRIEF ASSESSMENT

Claremont Paper Company Dam has a hydraulic height of 34 feet, is of varied topwidth, and is 145 feet long. It is a run-of-the-river concrete gravity dam with an ogee-shaped spillway 91 feet long. It has over-under trash and sluice gates for draining and two head gates to control industrial use. The dam spans a reach of the Sugar River and is located in west-central New Hampshire. Maximum storage capacity is about 24 acre-feet. Claremont Paper Company Dam is used for industrial process water as well as for hydroelectric purposes. The pond ranges from 450 to 850 feet in length with a surface area of about 2 acres.

The dam is in good condition. Major concern is the amount of overtopping of the dam and spillway under test flood conditions and the effect this would have on the stability of the dam, especially the powerhouse which comprises the south abutment. Minor concerns are: inability to inspect the concrete face of the overflow spillway, the spalled concrete on the gate structure, and lack of written operational and maintenance procedures including downstream warning system in event of severe flooding or imminent dam failure.

Based on small size and high hazard classification in accordance with Corps guidelines, the test flood is ½ Probable Maximum Flood (PMF). A test flood outflow of 36,685 cfs (180 csm) would overtop the dam by about 12.5 feet (20.1 feet over spillway crest); therefore, the spillway is considered inadequate. The spillway will pass 7,245 cfs or about 20 percent of the test flood before overtopping the abutments. Because the dam is of concrete on bedrock, it would likely withstand some overtopping before damage to the dam, as evidenced by the 1936 flood when abutments were overtopped by 4 feet, with no reported ill effect. A major breach at top of dam would result in the loss of 50 or more lives and extensive property damage.

The owner, Claremont Paper Mill, should implement the results of the recommendations given in Section 7.2 at the July 1979 drawdown period or within two years after receipt of this Phase I inspection report. The operating and maintenance measures recommended in Subsection 7.3 a should be developed and implemented within two years after receipt of this Phase I inspection report.

Warren A. Guinan
Project Manager
N.H. P.E. 2339

This Phase I Inspection Report on Claremont Paper Company Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

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 continued care and inspection can there be any chance that unsafe conditions be detected.

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.

TABLE OF CONTENTS

Title	Page
LETTER OF TRANSMITTAL	
BRIEF ASSESSMENT	
REVIEW BOARD PAGE	
PREFACE	v
TABLE OF CONTENTS	vi
OVERVIEW PHOTO	vii
LOCATION MAP	viii

REPORT

Section		
1	PROJECT INFORMATION	1-1
	1.1 General	1-1
	1.2 Description of Project	1-1
	1.3 Pertinent Data	1-3
2	ENGINEERING DATA	2-1
	2.1 Design	2-1
	2.2 Construction	2-1
	2.3 Operation	2-1
	2.4 Evaluation	2-1
3	VISUAL INSPECTION	3-1
	3.1 Findings	3-1
	3.2 Evaluation	3-4
4	OPERATIONAL PROCEDURES	4-1
	4.2 Procedures	4-1
	4.2 Maintenance of Dam	4-1
	4.3 Maintenance of Operating Facilities	4-1
	4.4 Description of Any Warning System in Effect	4-1
	4.5 Evaluation	4-1
5	HYDROLOGIC/HYDRAULIC	5-1
	5.1 Evaluation of Features	5-1
6	STRUCTURAL STABILITY	6-1
	6.1 Evaluation of Structural Stability	6-1
7	ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES	7-1
	7.1 Dam Assessment	7-1
	7.2 Recommendations	7-1
	7.3 Remedial Measures	7-2
	7.4 Alternatives	7-2

APPENDICES

	Designation
VISUAL INSPECTION CHECKLIST	A
ENGINEERING DATA	B
PHOTOGRAPHS	C
HYDROLOGIC AND HYDRAULIC COMPUTATIONS	D
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	E

Figure 1 - Overview of the Claremont Paper Company Dam.

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SCALE IN MILES

0 5 10

MAP BASED ON STATE OF NEW HAMPSHIRE OFFICIAL HIGHWAY MAP

Anderson-Nichols & Co, Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CLAREMONT PAPER COMPANY DAM LOCATION MAP

SUGAR RIVER NEW HAMPSHIRE

			SCALE: SEE BAR SCALE
			DATE: FEBRUARY 1979

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CLAREMONT PAPER COMPANY DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0009 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Claremont Paper Company Dam is located in Claremont, New Hampshire and is a run-of-the-river dam spanning the Sugar River. After discharging over the dam, the Sugar River flows northwesterly for a distance of 5 miles before becoming confluent with the Connecticut River. The Sugar River is a major tributary in the Connecticut River Basin. Claremont Paper Company Dam is shown on U.S.G.S. Quadrangle, Claremont, New Hampshire with coordinates approximately at N 43° 22' 26", W 72° 20' 48", Sullivan County, New Hampshire. (See Location Map page viii.)

b. Description of Dam and Appurtenances. Claremont Paper Company Dam is a concrete gravity dam on bedrock about 145 feet in length and about 34 feet in height. The concrete ogee spillway is 91 feet long and comprises the northern section of the dam. One timber trash gate (5' x 5') and one low-level timber sluice gate (5' x 5') are located at the southern end of the spillway. The operating mechanisms are located directly above the gates on the concrete service platform which is accessible through the powerhouse. The trash gate is mechanically operated; the low-level sluice gate is electrically operated. The southern abutment of the dam is hidden beneath the powerhouse of the Claremont Paper Company plant. Available plans indicate two timber head gates 10.5' H x 16' W. These gates are electrically operated and pass discharge into 400 KW capacity generators with vertical axis turbines for use in power generation. The plant buildings are adjacent to the powerhouse.

c. Size Classification. Small (hydraulic height - 34 feet; storage - 24 acre-feet) based on a hydraulic height and storage ($\geq$25 to $<$40 feet and $<$1000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. High Hazard. A major breach would probably result in the loss of 50 or more lives and extensive property damage. (See Section 5.1 f.)

e. Ownership. The Claremont Paper Company Dam was originally constructed by the Claremont Paper Company, Inc. This ownership has remained unchanged throughout the years. The Company at some unknown date changed the name to the Claremont Paper Mill (CPM). CPM presently owns, maintains, and controls the dam.

f. Operator. The current owner and operator of the Claremont Paper Company Dam is the Claremont Paper Mill, 131 Sullivan Street, Claremont, New Hampshire 03743. Phone: (603) 542-2592.

g. Purpose of Dam. The purpose for the construction of the dam was to create an industrial water storage for use in generating hydroelectric power as well as industrial process water. The power is utilized in the paper processing plant.

h. Design and Construction History. Little information was disclosed regarding the design and construction of the original timber-crib dam, which was the predecessor of the existing concrete dam. In 1920, a concrete dam with an ogee spillway was built to replace the timber-crib dam. The relative location between the two dams can be seen in Appendix B. The 1920 reconstruction was engineered by H.S. Ferguson

Engineers, 200 Fifth Avenue, New York. The construction was performed by Fred T. Ley & Co., Contractors, Springfield, Massachusetts. No construction records were disclosed.

i. Normal Operating Procedures. No written operational procedures were disclosed for Claremont Paper Company Dam. During the inspection members of the CPM staff stated that the reservoir is drained by means of the trash and deep sluices each summer during an annual two-week shutdown of the plant. At this time all sediment which has built up behind the dam is released into the downstream channel. This yearly opening of the gates also is a check to insure the gate operating facilities are functional.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 252 square miles (161,280 acres) of varied terrain. Numerous storage areas are present in the upstream watershed.

b. Discharge at Damsite

(1) Outlet works (conduits) - Trash gate 5' x 5' @ invert elevation 446' msl. Gate capacity at top of dam is 420 cfs @ 457.5' MSL. Deep sluice gate 5' x 5' @ invert elevation 424.5' MSL. Gate capacity at top of dam is 775 cfs @ 457.5' MSL. Two head gates 10.5' H x 16' W @ invert elevation 434' MSL. Capacity is controlled by the turbines in the powerhouse. Turbine capacity at maximum efficiency with a head of 26 feet was reported to be 185 cfs.

(2) The maximum discharge at damsite is unknown. However, there is a U.S.G.S. gaging station on the Sugar River with a drainage area of 269 square miles. Maximum known discharge at this gage with 48 years of record is 14,000 cfs during the March 1936 flood. The estimated maximum discharge at the dam itself can be interpolated to be approximately 13,500 cfs.

(3) Ungated Spillway capacity @ top of dam - 7,245 cfs @ 457.5' MSL.

(4) Ungated Spillway capacity @ test flood elevation - 31,162 cfs @ 470.0' MSL.

(5) Cated Spillway capacity @ top of dam elevation - not applicable

(6) Gated Spillway capacity @ test flood elevation - not applicable

(7) Total Spillway capacity @ test flood elevation - 31,162 cfs @ 470.0' MSL.

(8) Total project discharge @ test flood elevation - 36,685 @ 470.0' MSL.

c. Elevation (ft. above MSL)

(1) Streambed at centerline of dam - 423.5 (at downstream toe)

(2) Maximum tailwater - estimated 429 from approximate March 1936 discharge.

(3) Upstream portal invert low-level sluice - 424.5
Upstream portal invert trash gate - 446

(4) Recreation pool - not applicable

(5) Full Flood control pool - not applicable

(6) Spillway crest - 449.9

(7) Design surcharge (Original Design)- unknown

(8) Top of dam - 457.5

(9) Test flood pool - 470.0

d. Reservoir (feet)

(1) Length of maximum pool - 850

(2) Length of pool at spillway crest - 450

(3) Length of flood control pool - not applicable

e. Storage (acre-feet)

(1) Recreation pool - not applicable

(2) Flood control pool - not applicable

(3) Spillway crest pool - 8 (approximate)

(4) Top of dam - 24 (approximate)

(5) Test flood pool - 110 (approximate)

f. Reservoir Surface (acres)

(1) Recreation pool - not applicable

(2) Flood control pool - not applicable

(3) Spillway crest - 2 (approximate)

(4) Test flood pool - 4 (approximate)

(5) Top of dam - 2 (approximate)

g. Dam

(1) Type - concrete gravity dam on ledge with an ogee spillway.

(2) Length - 145'

(3) Height - 34' (structural height)

(4) Top Width - varied

(5) Side Slopes - Batter of ½"H:12"V on upstream face (flattening to 3½"H:12"V near crest) and ogee downstream.

(6) Zoning - not applicable

(7) Impervious core - not applicable

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - not applicable (See j.)

i. Spillway

(1) Type - concrete ogee

(2) Length of weir - 91'

(3) Crest elevation - 449.9' MSL

(4) Gates - none

(5) U/S Channel - The approach channel to the dam consists of the Sugar River about 70 feet in width. The banks are lined with brush and some small trees. The Main Street crossing is located about 450 feet upstream of the dam.

(6) D/S Channel - The channel immediately downstream of the dam is broader than it is at the dam itself. The valley sides are primarily of bedrock, with a thin veneer of soil and some small trees. Parts of the Claremont Paper Company plant are located at tailwater level on the left side of the valley immediately downstream of the dam. Other mills and a sluiceway are located at tailwater level on the right side of the valley. The Dartmouth Woolen Mill Dam and plant are located about 850 feet downstream of the dam. A developed area located about 1½ miles downstream of the dam contains about 20 inhabited structures including a 19-unit motel.

j. Regulating Outlets. A 5' x 5' trash gate is located adjacent to the south abutment of the spillway. Its invert is at elevation 446' MSL. A 5' x 5' low-level sluice is located just below the trash gate and has its invert at 424.5' MSL. Both gates are controlled by mechanisms on the concrete service bridge located above these outlets. The trash gate is mechanically operated; the low-level sluice gate has a motor operated mechanism.

Two 10.5' H x 16' W head gates at invert elevation 434' MSL are located in the power plant which contains the south abutment of the dam. These gates are both electrically operated.

SECTION 2
ENGINEERING DATA

2.1 Design

No design data were disclosed for the original timber dam. A discharge rating curve, dated April 1921 and compiled by H.S. Ferguson Engineers, was found in the files of the New Hampshire Water Resources Board (NHWRB). This apparently was the design rating curve for the concrete dam constructed in 1920. It demonstrates the differences in discharges between the old and new dams. (See Appendix B.) Obtained from the owner was a discharge curve for turbine capacity at 26 feet of head.

2.2 Construction

A plan was found in the files of the NHWRB that was compiled by H.S. Ferguson Engineers and dated March 31, 1921. This plan shows the relative location between the old timber dam and the new concrete structure. The dimensions shown on this plan conform with measurements made February 19, 1921. The original construction plans were disclosed by a member of the Claremont Paper Company staff. He stated that these plans were bought from H.S. Ferguson Engineers when they went out of business at some unknown date.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Limited engineering data were available for the Claremont Paper Company Dam. A search of the files of the NHWRB revealed only a limited amount of recorded information. The complete set of plans for the new concrete dam designed by H.S. Ferguson Engineers was obtained from a staff member of the Claremont Paper Company.

b. Adequacy. The final assessments and recommendations of this investigation are based on the plans of the dam obtained, the visual inspection, and the hydrologic and hydraulic calculations.

c. Validity. Because of the flow over the dam at the time of inspection, field measurements could not be taken to validate the reported dimensions and elevations.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Claremont Paper Company Dam is a run-of-the-river, low concrete dam which impounds a reservoir of small size. At the time of the inspection water was flowing over the dam so that it was not possible to inspect the condition of the concrete in the dam itself. The northwest abutment is a steeply sloping rock surface, with a short concrete retaining wall at the abutment perpendicular to the axis of the dam, and was not accessible on foot; it could be seen from the south abutment which is about 100 feet away. The south abutment is hidden from view beneath the Claremont Paper Company plant and contains the head gate intakes for use in hydroelectric power generation.

b. Dam. Claremont Paper Company Dam is a concrete gravity dam 145 feet in total length with an ogee downstream face, about 34 feet high, 28 feet wide at the base, and 91 feet long at the crest. (See Appendix C - Figure 2.) At the time of the inspection, several inches of water were flowing over the crest of the dam. (See Appendix C - Figure 3.) To the extent that the downstream face of the dam was visible beneath the overflowing water, no obvious defects were observed in the concrete. Drawings of the dam show that the upstream face is nearly vertical, but could not be verified from the visual inspection because of the water flowing over the dam. Recent photos in the Claremont Paper files of the upstream face taken when the dam was drained do not indicate any obvious defects.

The dam is located at the downstream end of a rock gorge about 150 feet wide at reservoir level. The surface of the rock in the vicinity of the northwest abutment is estimated to slope at about 45° toward the reservoir on the basis of visual observation from the south abutment. The rock appears to be foliated and the exposed rock surface appears to have developed along the foliations. A vertical concrete wall founded on bedrock has been constructed at the northwest abutment perpendicular to the axis of the dam. The wall has a total length of 42 feet (scaled from a drawing of the dam), extending from about 10 feet downstream of the crest to about 25 feet upstream of the crest. There are four weep holes in the wall at a height of about 4 feet above the crest of the dam, as estimated by visual inspection from the south abutment. No water was

discharging from the weep holes at the time of the inspection, but staining of the concrete below the two weep holes farthest downstream indicate that water has discharged from those weep holes sometime in the past. (See Appendix C - Figure 4.) The concrete in the wall appears to be in good condition. That part of the abutment which was visible above the water surface appeared to be in good condition.

The south abutment is hidden beneath the Claremont Paper Company plant and was not accessible for visual inspection. The rock exposed in a vertical face of the valley wall a short distance upstream of the dam was observed from the dam and appears to be more massive and less foliated than the rock in the northwest abutment.

The foundation of the dam, which appears to be on rock, could not be observed because of the water in the reservoir on the upstream side of the dam and the tailwater on the downstream side of the dam. A couple of logs were lodged on the crest of the dam at the time of the inspection, but were not significantly obstructing the flow of water over the dam.

Available drawings indicate that there is a trash gate 5' x 5' in cross section, with a sill elevation 3.4 feet below the crest of the spillway. This gate was observed during the inspection. Available drawings also indicate a low-level sluice, approximately 5' x 5' with a sill elevation 25.4 feet below the crest of the spillway. This sluice could not be seen since the reservoir was full of water.

c. Appurtenant Structures. To the extent the appurtenant structures of the dam were visible, none exhibited any obvious defects.

(1) Powerhouse Building. The south abutment of the ogee concrete dam is the powerhouse structure, inlet gates, trash rack and wheel housings. The reinforced concrete structure extends approximately 44 feet to match the existing paper mill buildings and subsurface foundations. Available design drawings of the powerhouse indicate the upstream face to be concrete with two 16' x 10.5' head-gate openings to the powerhouse. Both gates are operated by one motor. Each gate has a belt to an extended motor shaft. The belts are in fair condition; the motor is in good condition. Plans indicate two 6' x 6' low-level gates that open to the tail race. According to plans these were to be concreted in after completion of the dam. The visual inspection could not confirm whether they still exist. The upstream face and gates could not be inspected due to the impounded water in the reservoir. Visual inspection of the interior of the powerhouse revealed

the structure to be in good condition. The powerhouse contains two 400 KW capacity generators with vertical axis turbines which were operational and in good condition. Some efflorescence was observed from a distance on the downstream face of the powerhouse building in the vicinity of the wheel pits. (See Appendix C - Figure 2.) Because of the inaccessibility, detailed close-up field inspection of the downstream face could not be accomplished.

(2) Concrete Service Bridge. The concrete service bridge, which supports the gate operating mechanisms for the trash gate and low-level sluice outlet, was observed to be in good condition. The support piers at the water level revealed some surface deterioration to a maximum depth of three inches. The railings appear in good condition with no evidence of significant corrosion.

The gate mechanisms were covered with ice and snow but appeared to be in good condition. (See Appendix C - Figure 5.) The trash gate is mechanically operated by a wheel. The low-level sluice gate is electrically operated and the motor was in good condition.

d. Reservoir Area. Claremont Paper Company Dam and its reservoir are located in the middle of the City of Claremont. The drainage area above the dam is rolling, and is generally forested, except for the area in the City of Claremont itself and in the broad valley bottom and some of the flatter adjacent slopes for a distance of a few miles upstream from Claremont. About 450 feet upstream of the dam is the Main Street crossing. (See Appendix C - Figure 6.)

Members of the Claremont Paper Company staff stated at the time of the inspection that the reservoir is drained each summer during an annual two-week vacation shutdown of the plant. The purpose of draining the reservoir is to wash away silt that collects behind the dam. Photos in the Claremont Paper Company files show the reservoir area when the water behind the dam is drained. The photos show the remnants of an old, low timber dam which was the predecessor of the present dam and it is located immediately upstream of the present dam.

e. Downstream Channel. The channel immediately downstream of the dam is broader than it is at the dam itself. The valley sides are primarily bedrock, with a thin veneer of soil and some small trees. (See Appendix C - Figure 7.) Parts of the Claremont Paper Company plant are located at tailwater level on the south side of the valley immediately downstream of the dam. Other mills and a sluiceway are located at tailwater level on the north side of the valley immediately downstream of the dam. The channel itself is wide and unobstructed.

3.2 Evaluation

Based on the visual inspection, the Claremont Paper Company Dam appears to be in good condition.

To the extent that it was visible beneath the overflowing water, the concrete dam itself exhibited no obvious defects and appeared to be in good condition. This tentative evaluation should be verified by an inspection of the dam during one of the annxal drawdowns of the reservoir.

The northwest abutment, to the extent that it is visible above the water flowing over the dam, also appears to be in good condition.

The south abutment is hidden from view beneath the Claremont Paper Company Plant, but there was no external visual evidence to indicate any problems with that abutment.

Some concrete spalling was observed around the gate structures at the south end of the dam and some efflorescence was observed on downstream face of the power house. The spalling and efflorescence do not pose any immediate problems, but should be repaired as part of the routine maintenance program.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures were disclosed for Claremont Paper Company Dam. The discharge is utilized for power generation for use in the paper processing when sufficient discharges over the dam occur. Each summer, during the annual two-week shutdown of the plant, the reservoir is drained. This allows all accumulated sediment built up behind the dam to be released into the downstream channel. This also enables the testing of the gate operating facilities.

4.2 Maintenance of Dam

Claremont Paper Mill (CPM) is responsible for the maintenance of Claremont Paper Company Dam.

4.3 Maintenance of Operating Facilities

The annual releasing of the sediment through the trash and low-level sluice enables the testing of the operating facilities to insure that they are functional. No formal maintenance program was disclosed.

4.4 Description of Any Warning System in Effect

No written warning system was disclosed for Claremont Paper Company Dam. However, during times of high flow, sandbagging is done to protect generators. The waste and trash gates are opened to pass the maximum discharge.

4.5 Evaluation

The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in the event of floodflow conditions or imminent dam failure.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. General. Claremont Paper Company Dam is a run-of-the-river, low concrete gravity dam which impounds a reservoir of small size. The total length of the dam is 145 feet of which 91 feet consists of an ogee spillway. The dam has 7.6 feet of freeboard available before overtopping would occur. Because the dam is of concrete on bedrock it would likely withstand some overtopping before damage to the dam as evidenced by the 1936 flood when abutments were overtopped by 4 feet.

b. Design Data. The only hydrologic and hydraulic design data disclosed was a rating curve comparing the old and the new dam. This curve was calculated by H.S. Ferguson, Engineers in April 1921.

c. Experience Data. In a New Hampshire Water Resources Board (NHWRB) inspection report of September 14, 1938, it was reported that in 1927 about 2 feet of water was flowing over the abutments. It also stated that in the flood of 1936, approximately 4 feet of water was flowing over the abutments. During the 1936 flood the plant was shut down due to flooding from backup of high tailwater. The motors had to be removed from the basement level of the plant.

d. Visual Observations. At the time of inspection, no visual evidence was noted of damage to any portions of the concrete structure caused by excessive discharges.

e. Test Flood Analysis. Claremont Paper Company Dam is classified as being small in size having a height of 34 feet and a maximum storage capacity of 24 acre-feet; the dam was determined to have a High Hazard classification. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood was determined to be ½ PMF.

Using the ½ PMF, the test flood discharge was determined to be 36,685 cfs. The overtopping analysis indicates that the dam would be overtopped by 12.5 feet during the test flood. The maximum spillway capacity at top of dam is 7,245 cfs which is only 20 percent of the test flood discharge. However, because the spillway presently spans the entire width of the river, enlarging the spillway is not a viable alternative. As stated previously, because the dam is concrete on bedrock it would likely withstand considerable overtopping before damage would result.

f. Dam Failure Analysis. The impact of failure of the dam at normal flow conditions and at top of dam were assessed using the Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to a developed area consisting of about 20 inhabited structures including a motel with 19 units on the left bank of the Sugar River about 1½ miles downstream of the dam. It was determined that a breach at top of dam would create the greater downstream hazard. A breach at top of dam would increase the stage by 4.2 feet above the already high tailwater conditions damaging the Claremont Paper Mill building, the Dartmouth Woolen Buildings, and the housing development located 1.5 miles downstream of the dam. The potential for loss of life is high (50 or more), especially if the breach occurred during peak working hours.

One should note because of the lack of storage behind the dam, that test flood flows discharging over the dam, assuming the dam did not fail, would have nearly the same effects on the downstream hazard.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. To the extent that the downstream face of the dam was visible beneath the overflowing water, the concrete itself exhibited no obvious defects. The northwest abutment of the dam is bedrock and that part which is visible above the overflowing water appears to be in good condition. The south abutment of the dam is hidden beneath the Claremont Paper Company plant and was not accessible for visual inspection. Some of the concrete on the gate structures is spalled and some efflorescence was observed on the downstream face of the powerhouse. The spalling and efflorescence do not pose any immediate structural problems, but should be repaired as part of the routine maintenance program.

b. Design and Construction Data. Design and construction drawings by H.S. Ferguson dated 1920 are available for the powerhouse and dam. No calculations or detailed sursurface data were found. One drawing dated 1939 which shows a cross section through the centerline of the dam is also available. The numerous drawings indi ate that the dam is founded on "ledge" at a depth below the crest of the dam which varies from about 5 feet at the northwest abutment to about 29 feet near the south abutment.

c. Operating Records. The only operating record pertinent to the structural stability of the dam was provided orally by the members of the Claremont Paper Company staff, who stated that the reservoir is drained once each year for the purpose of washing downstream any silt that accumulates behind the dam.

d. Post-construction Changes. There is no record of any post-construction changes.

e. Seismic Stability. This dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection indicates that Claremont Paper Company Dam is in good condition. Some spalling of the concrete in the gate structures and efflorescence on the powerhouse walls was observed. The amount of overtopping of the spillway by the test flood and its effect on the stability of the dam, especially the powerhouse section, is a major concern.

b. Adequacy of Information. The information available is such that the assessment must be based on results of the visual inspection. Since this is a run-of-the-river dam and water was flowing over the dam at the time of the inspection, it is recommended below that the assessment be verified by an inspection of the dam when the reservoir is routinely drained during the two-week summer shutdown of the Claremont Paper Company plant.

c. Urgency. The recommendation made in 7.2 below should be implemented during the July 1979 shutdown period or within 2 years. The operating and maintenance procedures recommended in 7.2a below should be implemented by the owner within 2 years after receipt of this Phase I report.

d. Need for Additional Investigation. Additional investigations required for this dam are the inspection of the concrete dam itself when the reservoir is drained and a structural stability analysis as recommended in 7.2 below.

7.2 Recommendations

The owner should engage a Registered Professional Engineer to inspect the concrete dam when the reservoir is routinely drained during the two-week shutdown of the Claremont Paper Company plant, and to evaluate further the source and potential impact of the efflorescence on the downstream face of the powerhouse. In addition, the engineer should evaluate further the structural stability of the dam under the test flood and any other critical flow conditions because of the high flow anticipated for ½ PMF relative to the height of the dam.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

(1) Repair the spalled concrete on the gate structures.

(2) Remove the debris that lodges on the crest of the dam.

(3) Establish a surveillance and warning program to follow in the event of floodflow conditions or imminent dam failure.

(4) Establish a written operating procedure that would include opening all gates in time of flood events and generate maximum power to assist in passage of flood flows. However, when the flood elevation reaches top of dam (457.5' MSL) the head gates should be closed to stop flow to the turbines and cease power generation.

(5) Have the dam inspected by a Registered Professional Engineer once every two years.

(6) Make periodic observation of the dam (by owner or his representative) to note any changes of cinditions.

7.4 Alternatives

None.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Claremont Paper Company Dam

DATE November 21, 1978

TIME 2:00 P.M.

WEATHER Cloudy, cool

W.S. ELEV. 450.2 U.S. 423 DN.S.

PARTY:

1. Warren Guinan
2. Stephen Gilman
3. Leslie Williams
4. Robert Ojendyk
5. Ronald Hirschfeld
6. Lin Hall
7. Harold Wilcox (1/3/79)
8. John Falcione (1/3/79)
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrology/Hydraulics	W. Guinan/L. Williams	
2.	Structural Stability	S. Gilman	
3.	Soils & Geology	R. Hirschfeld	
4.	Mechanical	J. Falcione	
5.	Electrical	H. Wilcox	
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT Claremont Paper Company Dam DATE November 21, 1978

PROJECT FEATURE Intake Channel & Structure NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Sugar River
Slope Conditions	Good
Bottom Conditions	Not visible beneath surface of reservoir.
Rock Slides or Falls	None apparent
Log Boom	None
Debris	Not visible
Condition of Concrete Lining	Not visible
Drains or Weep Holes	None apparent
b. Intake Structure	
Condition of Concrete	Leading edges deteriorated
Stop Logs and Slots	Not applicable

PERIODIC INSPECTION CHECK LIST

PROJECT Claremont Paper Company Dam DATE November 21, 1978

PROJECT FEATURE Control Tower NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good. Visible portions indicate only surface erosion where in contact with water.
Condition of Joints	None visible
Spalling	Minor, limited to leading edges of piers
Visible Reinforcing	None visible
Rusting or Staining of Concrete	None visible
Any Seepage or Efflorescence	None visible
Joint Alignment	Good, no apparent movement
Unusual Seepage or Leaks in Gate Chamber	None visible
Cracks	None visible
Rusting or Corrosion of Steel	None visible
b. Mechanical and Electrical	The timber trash gate is mechanically operated by a wheel. The mechanism appeared to be in good condition. The low-level timber sluice gate is electrically operated. The motor was found to be in good condition. The two timber head gates are electrically operated by one motor. Each gate has a belt to an extended motor shaft. The belts are in fair condition; the motor is in good condition.
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECKLIST

PROJECT Claremont Paper Company Dam DATE November 21, 1978

PROJECT FEATURE Outlet Works NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	
Rust or Staining	See Outlet Works - Control Tower
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	None apparent
Channel	
Loose Rock or Trees Overhanging Channel	Some overhanging trees, but channel is wide and unobstructed
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Claremont Paper Company Dam DATE November 21, 1978

PROJECT FEATURE Spillway Weir NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None apparent
Trees Overhanging Channel	Some trees overhanging channel, but channel is wide and unobstructed.
Floor of Approach Channel	Not visible beneath surface of reservoir.
b. Weir and Training Walls	
General Condition of Concrete	Good. Visible portions indicate general erosion of surface with loss of approximately 1 inch.
Rust or Staining	Staining when in contact with water
Spalling	Minor. Limited to leading edges of concrete piers and low-level outlet.
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Little on downstream face of Power House.
Drain Holes	Four drain holes in retaining wall at northwest abutment appear to be functioning.
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None apparent
Trees Overhanging Channel	Some overhanging trees, but channel is wide and unobstructed.
Floor of Channel	Bedrock
Other Obstructions	None

PERIODIC INSPECTION CHECKLIST

PROJECT Claremont Paper Company Dam DATE November 21, 1978

PROJECT FEATURE Service Bridge NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	
Anchor Bolts	Not applicable
Bridge Seat	Not applicable
Longitudinal Members	Not applicable
Underside of Deck	Not visible
Secondary Bracing	Not applicable
Deck	Concrete, visible portions good condition.
Drainage System	
Railings	Steel painted
Expansion Joints	None
Paint	Good
b. Abutment & Piers	
General Condition of Concrete	Good
Alignment of Abutment	Not applicable
Approach to Bridge	Not applicable
Condition of Seat & Backwall	Not applicable

PROJECT Claremont Paper Co. Dam DATE November 21, 1978

PROJECT FEATURE Reservoir NAME R. Langen

AREA EVALUATED	REMARKS
Stability of Shoreline	Good
Sedimentation	Considerable; removed annually by opening flood gates in July
Changes in Watershed Runoff Potential	None
Upstream Hazards	Main Street Bridge 450' upstream of dam
Downstream Hazards	Downstream Woolen Mill Dam and plant; 20 inhabited structures 1.5 miles d/s.
Alert Facilities	None
Hydrometeorological Gages	None
Operational & Maintenance Regulations	None

APPENDIX B

ENGINEERING DATA

7204

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. .....

Town .....: County .....

Stream .....

Basin-Primary .....: Secondary .....

Local Name .....

Coordinates—Lat. .....: Long. .....

GENERAL DATA

Drainage area: Controlled ..... Sq. Mi.: Uncontrolled ..... Sq. Mi.: Total ..... Sq. Mi.

Overall length of dam ..... ft.: Date of Construction .....

Height: Stream bed to highest elev. ..... ft.: Max. Structure ..... ft.

Cost—Dam .....: Reservoir .....

DESCRIPTION Concrete- O Gate Free-- Ledge Foundation

Waste Gates

Type .....

Number .....: Size ..... ft. high x ..... ft. wide

Elevation Invert .....: Total Area ..... sq. ft.

Hoist .....

Waste Gates Conduit

Number .....: Materials .....

Size ..... ft.: Length ..... ft.: Area ..... sq. ft.

Embankment

Type .....

Height—Max. ..... ft.: Min. ..... ft.

Top—Width .....: Elev. ..... ft.

Slopes—Upstream ..... on .....: Downstream ..... on .....

Length—Right of Spillway .....: Left of Spillway .....

Spillway

Materials of Construction .....

Length—Total ..... ft.: Net ..... ft.

Height of permanent section—max. ..... ft.: Min. ..... ft.

Flashboards—Type .....: Height ..... ft.

Elevation—Permanent Crest .....: Top of Flashboard .....

Flood Capacity ..... cfs.: ..... cfs/sq. mi.

Abutments

Materials: .....

Freeboard: Max. .....ft.: Min. ..... ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER .....

REMARKS .....

Tabulation By .....: Date .....

7266

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON WATER POWER DEVELOPMENTS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 7.06

Town Claremont : County Sullivan

Stream Sugar River

Basin-Primary Conn R. : Secondary Sugar R

Local Name

GENERAL DATA

Head-~~Max.~~ ft.: ~~Min.~~ ft.: ~~Ave.~~ 26 ft.

Date of Construction 1901 : Use of Power Jon. Paper Co.

Pondage ac. ft.: Storage ac. ft.

DESCRIPTION

Racks

Size of Rack Opening

Size of Bar : Material

Area: Gross Sq. Ft.: Net sq. ft.

Head Gates

Type

Number : Size ft. high x ft. wide

Elevation of Invert : Total Area sq. ft.

Hoist

Penstock

Number : Material

Size : Length

Turbines 38" Rodney Hunt Vertical

Number 2 : Makers 36" Leffel Vertical

Rating HP. per unit : Total Capacity 250 HP.

Max. Dement C.F.S., per unit : Total cfs.

Drive

Type

Generator

Number 2

Make (2 3) (1-440 V.) (1-60 V.)

Rating KW., per unit ~~2.2~~ ~~200~~ ; Total Capacity ~~222~~ 1100 K. W.

Exciter

Number : Make

Rating-per unit : Total Capacity K. W.

OUTPUT—KWHRS

19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	

OWNER

Tabulation By [illegible] Date [illegible]

Form 280

NEW HAMPSHIRE WATER RESOURCES BOARD

QUESTIONNAIRE

WATER POWERS OF NEW HAMPSHIRE

Claremont Paper Company
Claremont
New Hampshire

Gentlemen:

We maintain in this office a list of the water power installations in New Hampshire. In recent months we have had several inquiries concerning the water power installations in the State and have found that our information is in some cases out of date.

We are, therefore, bringing this information up to date and request your cooperation by filling in the questionnaire below with data on your development, and return it to us in the enclosed stamped envelope.

Very truly yours,

RSH:GMB
Encl.

Richard S. Holmgren
Chief Engineer

Dam No. 47.06 : Location: Sugar River at Claremont

1. Will you please check or correct:

	Our Data	Your Corrections
Drainage Area - Sq.Mi.	251 ok	
Head - feet	26 ok	
Capacity	330 ok	
Wheel - H.P.	750	
Generator - K.W.	1000	

2. Is the power plant now in operation? Yes

3. If not, is the equipment in operable condition? _____

4. Is the dam in good repair? Yes

(Signed) Claremont Paper Co Inc
W. A. Parish Treasurer

Date July 14, 1942

FORM CE 5555

NEW HAMPSHIRE
WATER RESOURCES
BOARD
CONCORD, N. H.

PROJECT

SUBJECT

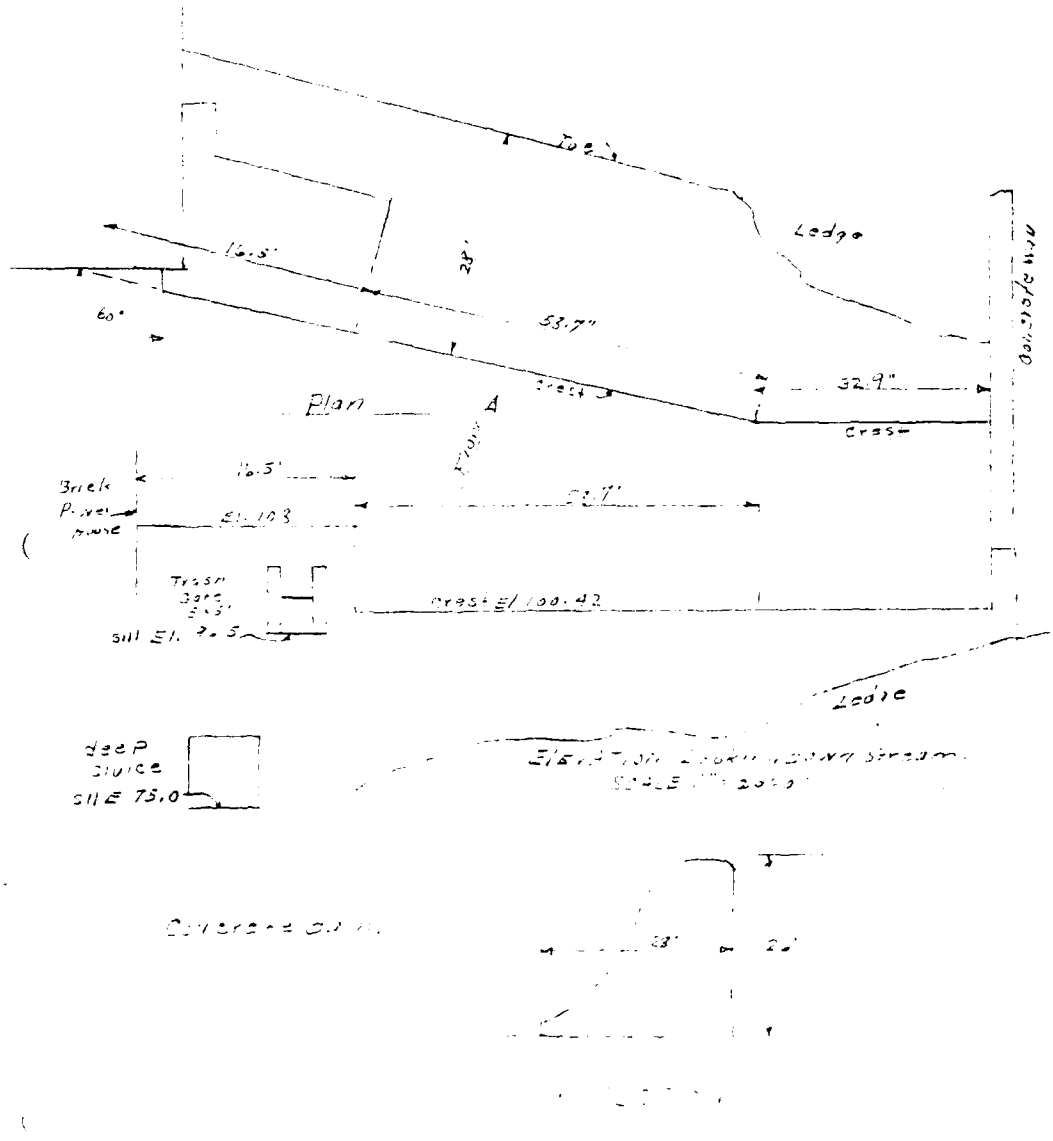
COMPUTER CHECKER

COMP FROM ACC | COMP ON ACC | SUMMARY ON ACC

FILE 47.06

ACC

DATE 2-5-73



NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Connecticut NO. 6 47.06 — 4510 USGS

RIVER Sugar MILES FROM MOUTH 4.9 D.A.SQ.MI 259 NDAE

TOWN Claremont OWNER Claremont Paper Co. Inc 1921 in Vermont

LOCAL NAME OF DAM (Succeeded Sugar R. Paper Co.) 1929 in NH

BUILT 1866 DESCRIPTION Concrete

Concrete dam built 1921

POND AREA-ACRES DRAWDOWN FT. POND CAPACITY-ACRE FT.

HEIGHT-TOP TO BED OF STREAM-FT. 24 MAX. MIN.

OVERALL LENGTH OF DAM-FT. 108 MAX. FLOOD HEIGHT ABOVE CREST-FT.

PERMANENT CREST ELEV U.S.G.S. 449.9 LOCAL GAGE 100.22

TAILWATER ELEV U.S.G.S. 423.1 LOCAL GAGE 73.62

SPILLWAY LENGTHS-FT 91 FREEBOARD-FT. 7.5 El 108.

FLASHBOARDS-TYPE, HEIGHT None

WASTE GATES-NO WIDTH MAX. OPENING DEPTH SILL BELOW CREST

WASTE GATES-NO	WIDTH	MAX. OPENING	DEPTH SILL BELOW CREST	
1	5	5	25.22	El 75
1	5	5	3.92	El 96.5

REMARKS Condition Good 1936 - 4' over

2H Discharge [illegible]

turbines [illegible]

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE
	~~400~~	~~26~~			
	~~1000~~				
	~~[illegible]~~	~~26.5~~			
				rated [illegible]	36" Rodney Hunt horizontal
1	400	26		gen 200	rope drive to G.E. gen 440V
1	530	26		400	33" Leffel vertical direct con. G.E. gen 600A 480V 200 RPM.

USE Power for Paper Co.

REMARKS Primary HP 90% time 4 H H.S. Ferguson 200 E. [illegible] Ave. N.Y.City

[illegible] concrete dam. Have Steam auxiliary + buy [illegible] power also.

Talked to Mr Dawson, Pres. and Wm. A. Kirn, Gen Supt.

DATE 1925 [illegible]

9/1/37 [illegible] JNS

Dams and Water Locations in Town of Claremont N.H.

No.	Location River, Brook, Pond or Lake	Condition Ruins or Operable	Ht.	Owner	Present Use
1.	Sugar River	Operable	[illegible]	Monadnock Mill Corp.	Claremont
2.	Sugar River	Operable	[illegible]	Sullivan Machine Co.	Claremont
3.	Sugar River	Operable	5'	Claremont Waste Mfg.Co.	Claremont
4.	Sugar River	Operable	6	Claremont Paper Co	Claremont
5.	Sugar River	Ruins	5'7	Dartmouth Woolen Co.	Claremont
6.	Sugar River	Operable	10	Coy Paper Co.	Claremont
7.	Red Water Brook	Operable	[illegible]	Gaffney Lumber Co	ClaremontRFD
8.	Municipal Water Works	Operable	[illegible]	Town of Claremont	Claremont
9.					
10.					
11.					
12.					
13.					
14.					

8/2/37

Claremont (Sullivan) Inspected July 1, 1930.
Page 1 #6

Dam owned by Claremont Paper Company. Concrete dam built in 1920. No changes since 1925. The gates and rack house are in covered housing. The apron needs some attention. Gates work mechanically O. K. and recently repainted. Interviewed Mr. W. A. Cairn, Manager. There are a few small leaks which could be stopped. About 800 to 900 horse power. General conditions are good.

DIVI-85.

Claremont - General

CLAREMONT, Dams in

1.	Monadnock Mills	Claremont, N.H.
2.	"	"
3.	Sullivan Machinery Co. I-1935 D-1409	"
5.	Frost & Pierce	"
	Claremont Waste Co.	
6.	Claremont Paper Co. Plan D-1336 in Folder"	
7.	Claremont Power Co.	"
8.	Dartmouth Woolen	"
9.	"	
10.	Jarvis Paper Mills) I-1283 Plan D-40	"
	Coy Paper Company)	
11.	Claremont Water Co. (I-1362)	"
12.	A. F. Gaffney	"
13.	Town of Claremont	"
14.	"	"
15.	"	"
16.	"	"
17.	"	"

Town No. 6 Town Claremont No. 33

Data by L.W.B. File

Owner ~~Claremont Paper Company~~ (Claremont Paper Co.)

River or Stream ~~Sugar River~~

Public Utility No Drainage area 259 sq. mi.

Wheel Capacity H. P. 460 (Primary H. P. / 90% time) 411

Type of Construction Concrete

Height ~~24~~ ft. Operating Head 26 ft.

Length ~~108~~ ft. Spillway Length (No. 1) ~~91~~ ft. (No. 2) ft.

Would Failure of Dam do Harm? No

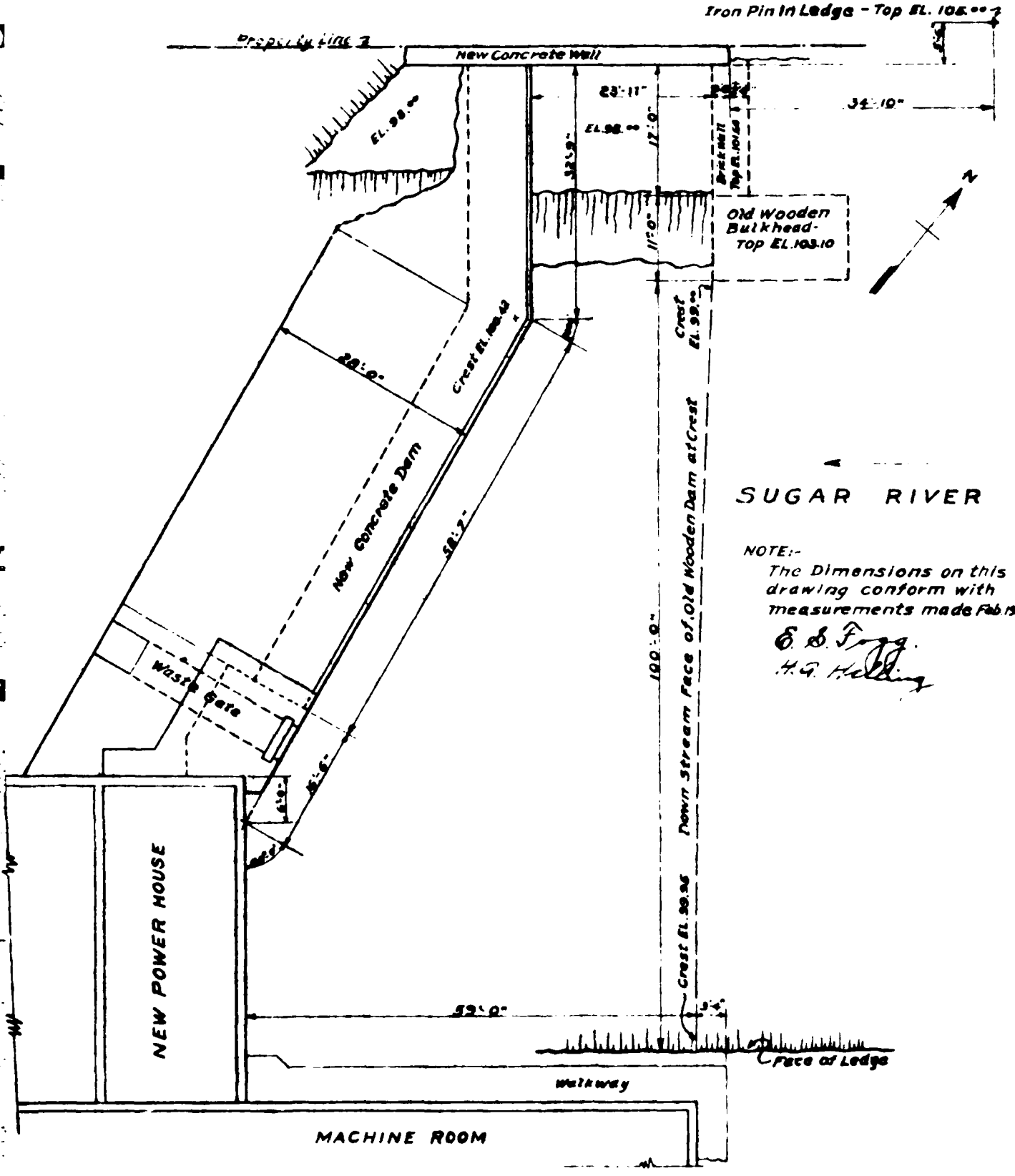
Present Condition Good Date 1925

rm. LWB Aug 25

H. S. FERGUSON CONSULTING ENGINEER
900 FIFTH AVE. NEW YORK, N. Y.

Job No 193-43 Filing No S-1466
Made by G.E.H. Scale 1/16" = 1'-0"
Checked By Date March-April E.S.F.

For CLAREMONT PAPER CO.
Project HYDRO-ELECTRIC DEVELOPMENT Location CLAREMONT, NEW HAMPSHIRE
Subject RELATIVE LOCATION BETWEEN OLD WOODEN DAM AND NEW STRUCTURES



File No. Washington 33

Field N. H. 1125.

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

REPORT ON DEVELOPED WATER POWER

1. Name of stream on which power is located--Sugar River

2. Location of plant:------¼ Sec.------, T.------, R.------

Town or City---Claremont----------, County Sullivan, State--N. H.

3. Location of point of diversion---Claremont

-------Fifth dam above mouth of river

4. Name and address of owner or operator--Claremont Paper Co., Inc.--

Claremont, N. H.

5. Operating head, fore bay to tailrace---24--------feet.

6. Water wheels:

No.	Kind	Make	Size	Rated capacity, horsepower (total)
1	Twin	Hunt-McCormick	33"	460

7. How many and what wheels are operated during the low-water [illegible]

One

8. What is the ordinary length of such low-water season?--varies

9. Generators: No.--1------ Total rated capacity (~~kw~~) 400 H. P.

10. Use of power--Paper mill

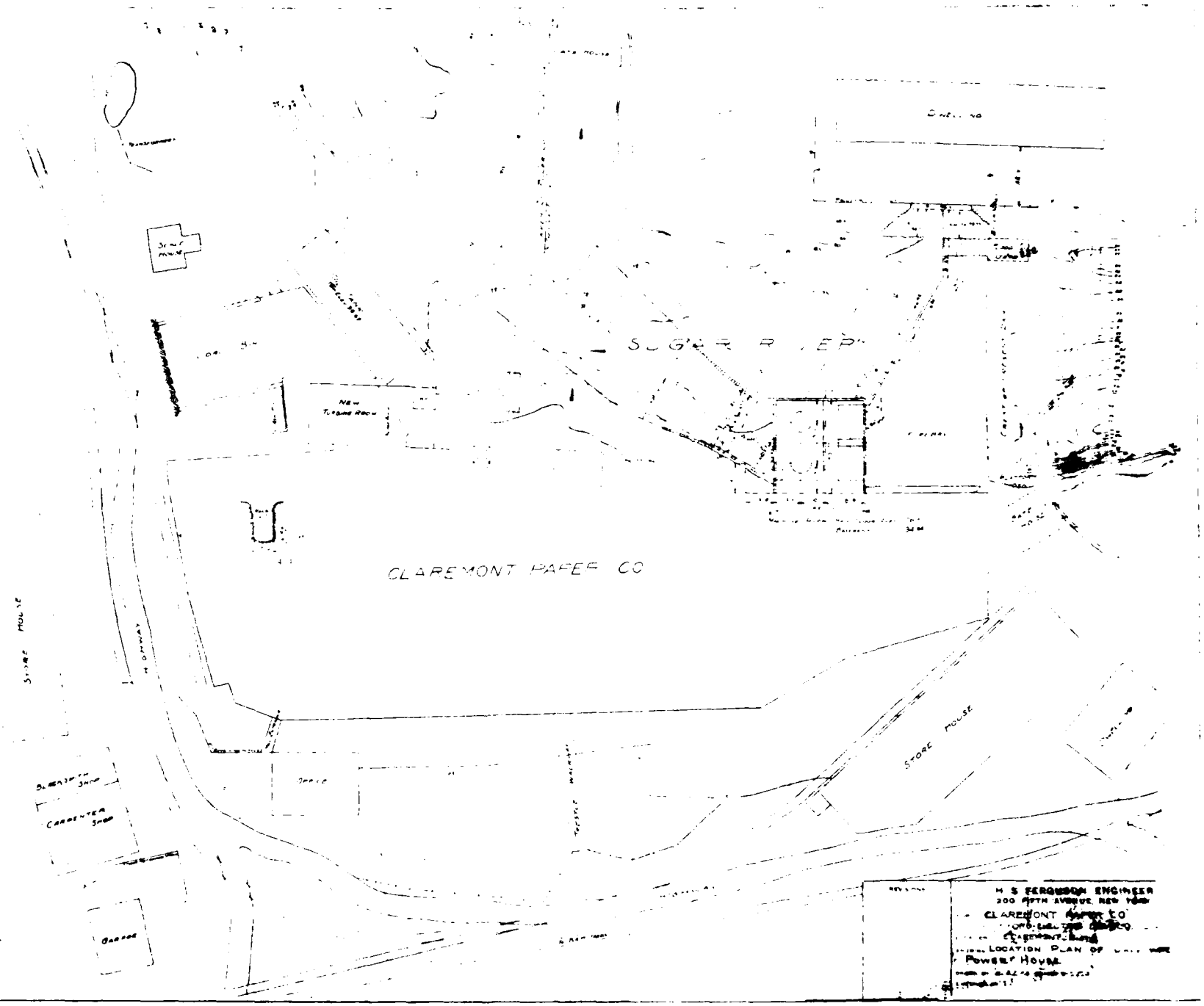
11. Average number of hours per day plant runs---24------

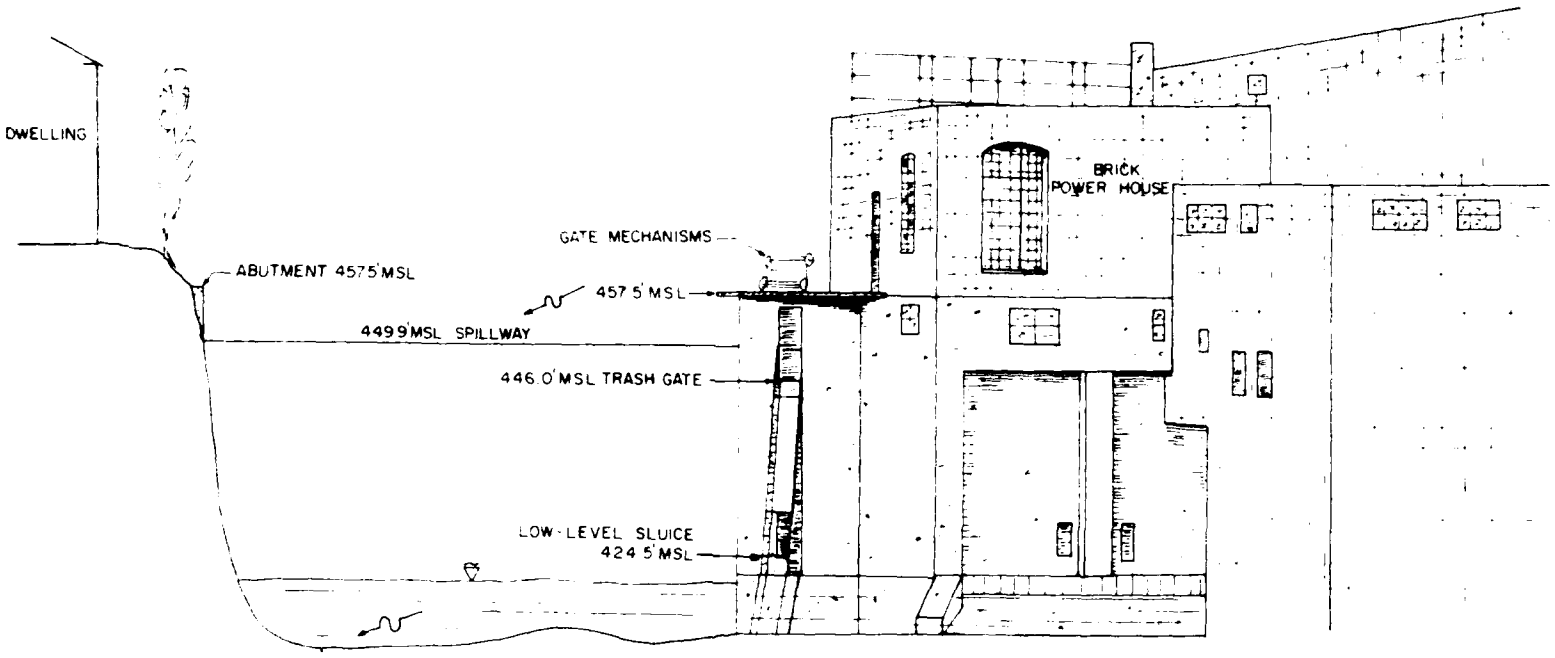
12. Auxiliary power--1,600 H. P. steam

13. Storage [illegible]

[illegible] 3 [illegible] 1.9 billion cu. ft.

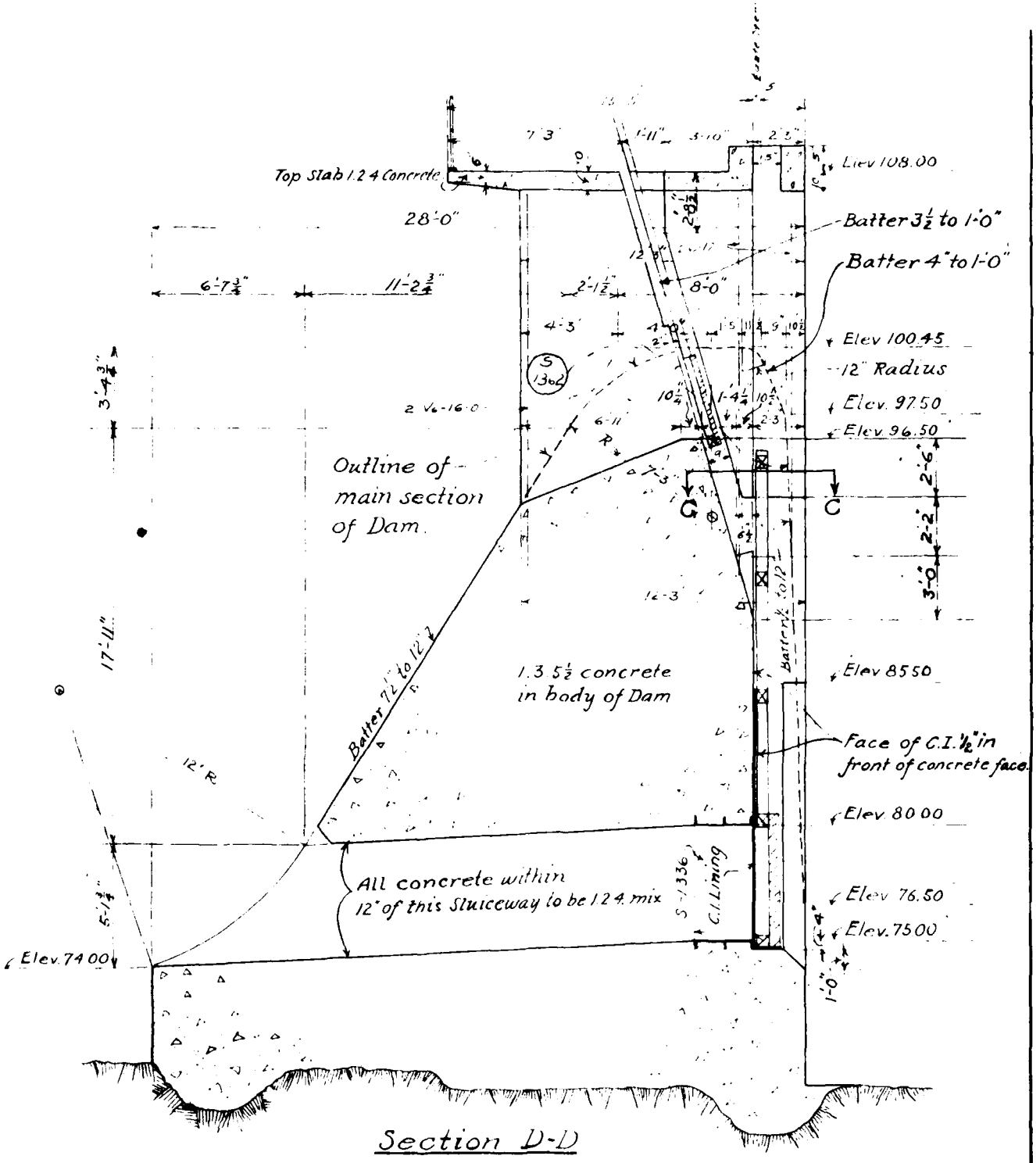
Date ~~July 10, 1919~~ July 2, 1919 [illegible] B. L. Bigwood





ELEVATION

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
CLAREMONT PAPER COMPANY DAM	
SUGAR RIVER	NEW HAMPSHIRE
	SCALE NOT TO SCALE
	DATE FEBRUARY 1979

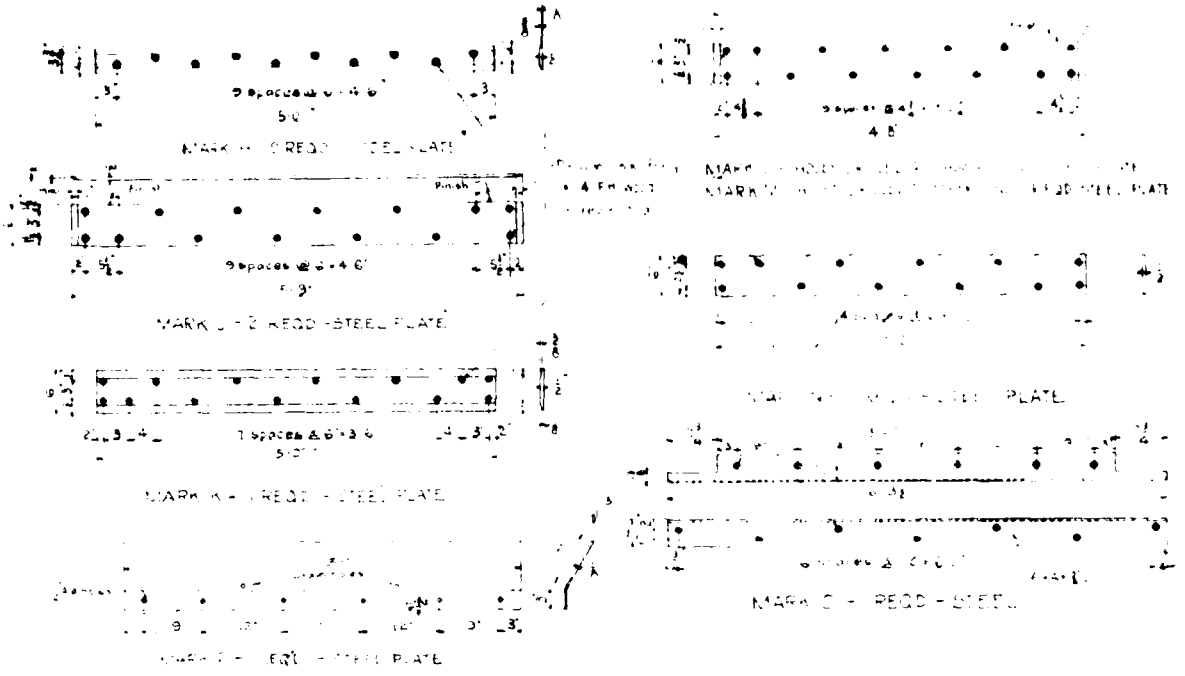


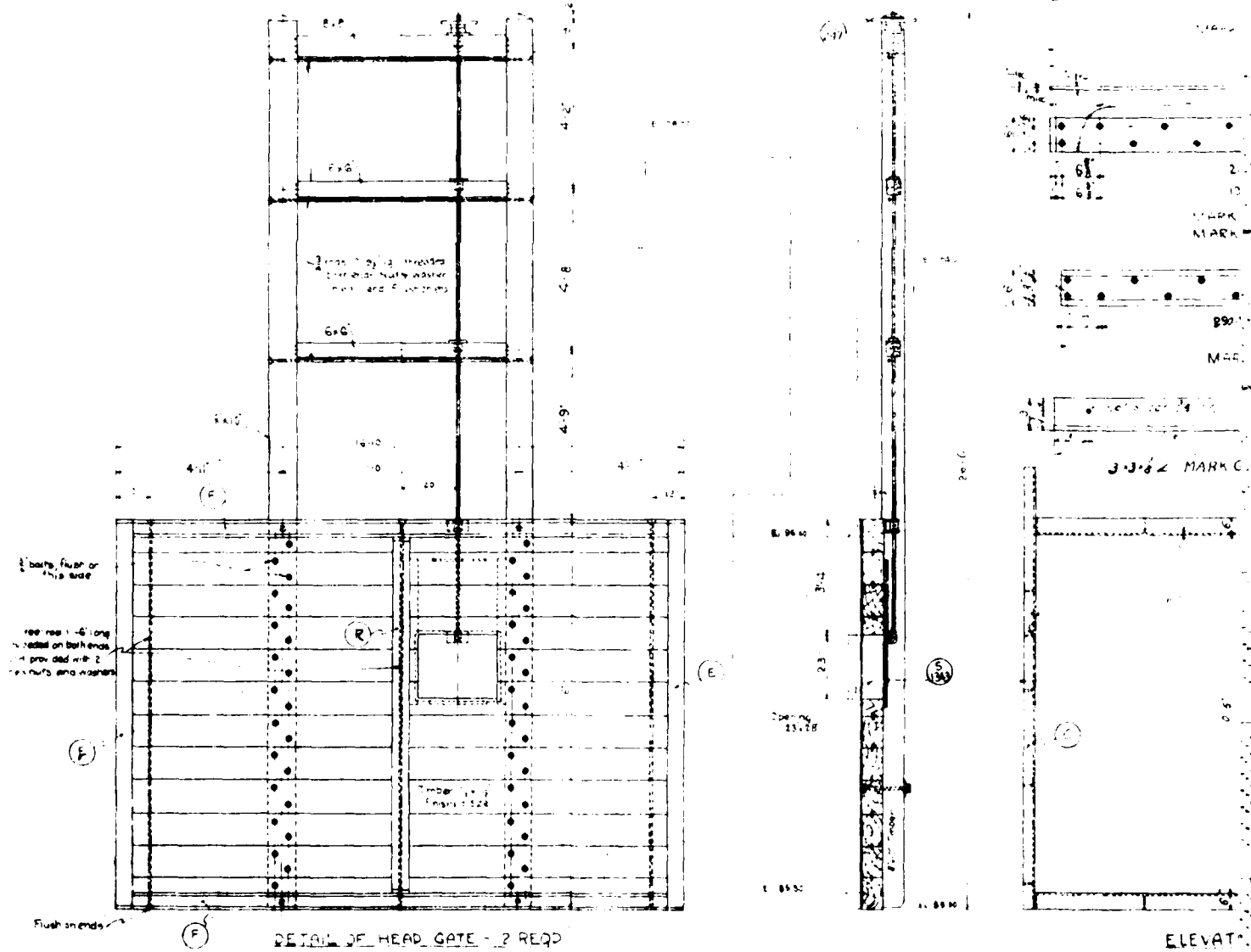
REVISIONS
8. Gate Slots. Anchor bars for Gate Hoist. 11-9-20. LEH 9. 43 Sluice Gate Stem to face of Concrete 5". 1-18-20. LEH

H. S. FERGUSON ENGINEER
200 FIFTH AVENUE, NEW YORK

FOR CLAREMONT PAPER CO.
PROJECT HYDRO ELECTRIC DEVELOPMENT
LOCATION CLAREMONT, NEW HAMPSHIRE
SHOWING CONCRETE DETAILS OF STAIRS, SCREEN CHAMBER AND DAM POWER HOUSE.

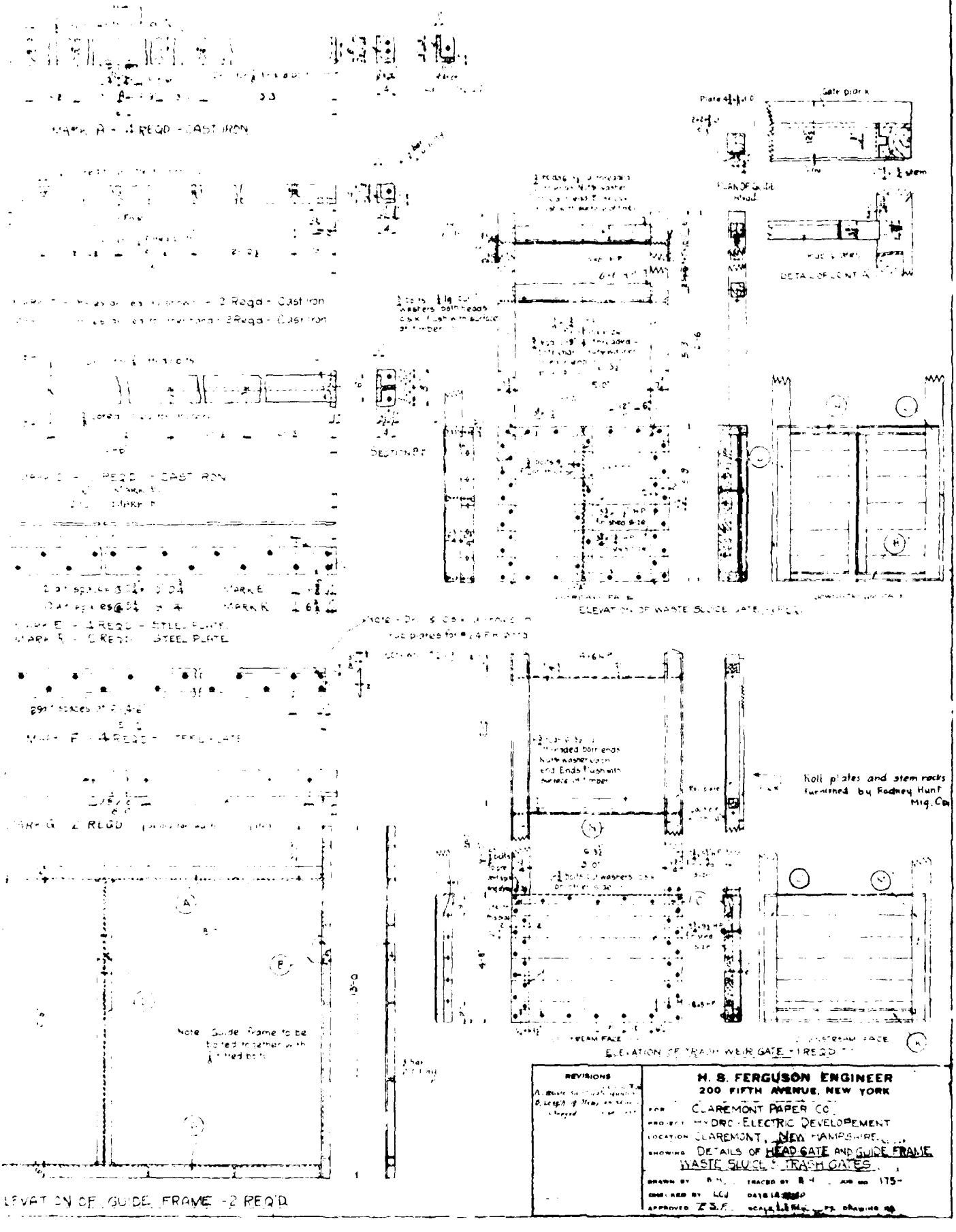
DRAWN BY J.B.-W.H. TRACED BY W.H. JOB NO 175-25
CHECKED BY E.G.J. DATE 10-6-20
APPROVED E.S.F. SCALE ½" IN. / FT. DRAWING NO B 1501





DETAIL OF HEAD GATE - 2 REQD

ELEVAT



REVISIONS
A. Details of Head Gate and Guide Frame changed
B. Details of Waste Sluice Gate changed

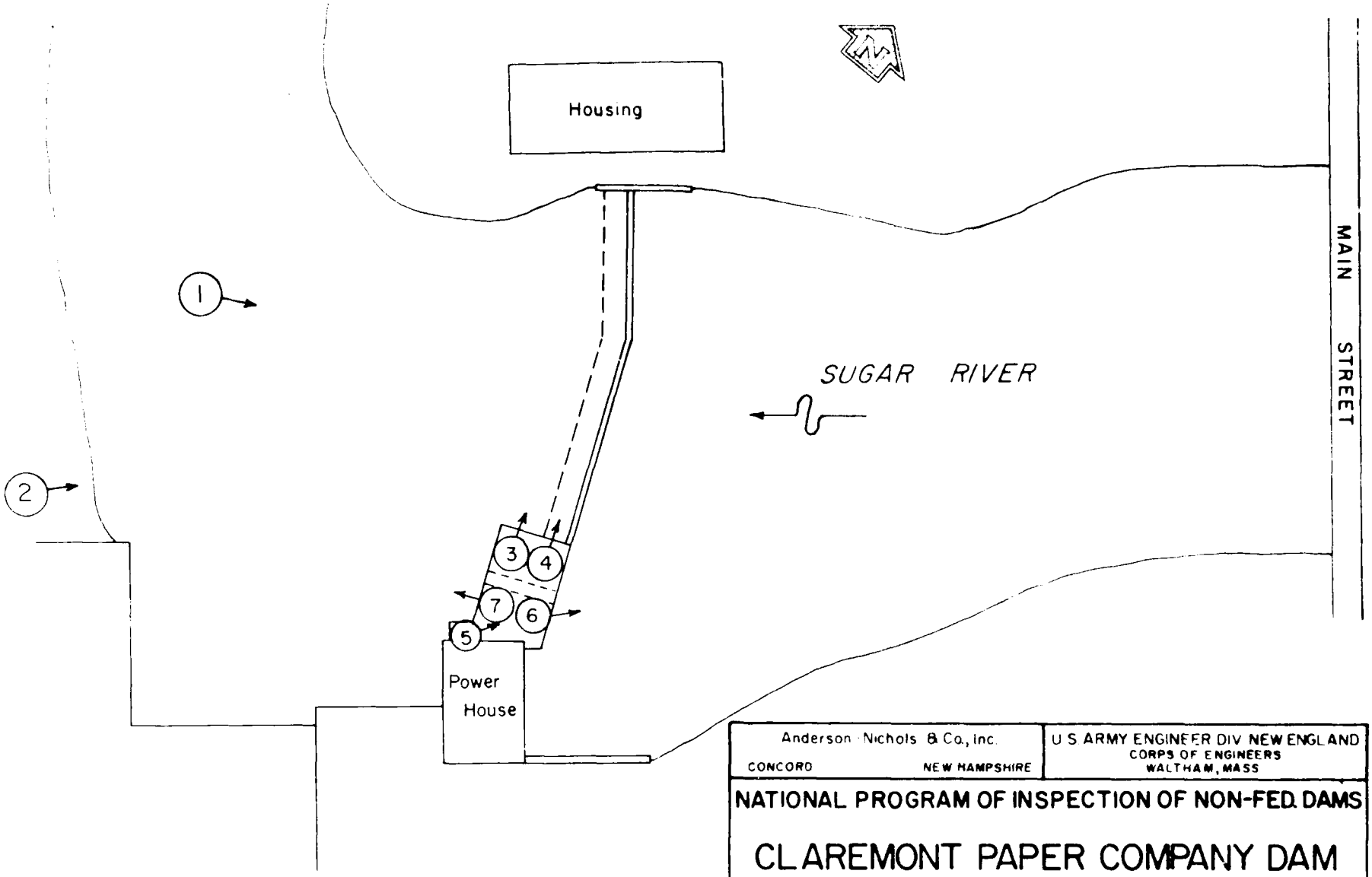
H. S. FERGUSON ENGINEER
200 FIFTH AVENUE, NEW YORK

FOR CLAREMONT PAPER CO.
PROJECT HYDRO-ELECTRIC DEVELOPEMENT
LOCATION CLAREMONT, NEW HAMPSHIRE.
SHOWING DETAILS OF HEAD GATE AND GUIDE FRAME WASTE SLUICE & TRASH GATES.
DRAWN BY B.H. TRACED BY B.H. JOB NO. 175-
CHECKED BY LCJ DATE 12-8-30
APPROVED H.S.F. SCALE 1 1/2" = 1'-0" DRAWING NO.

2

APPENDIX C

PHOTOGRAPHS



Anderson Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CLAREMONT PAPER COMPANY DAM
PHOTO INDEX

SUGAR RIVER NEW HAMPSHIRE

			SCALE: NOT TO SCALE
			DATE: FEBRUARY 1979

Figure 2 - Looking northeast at the downstream face of the dam and power house.

Figure 3 - Looking northwest across the concrete ogee weir from the service bridge.

Figure 4 - Looking at the four weep holes in the northwest abutment of the dam. Note housing adjacent to the abutment.

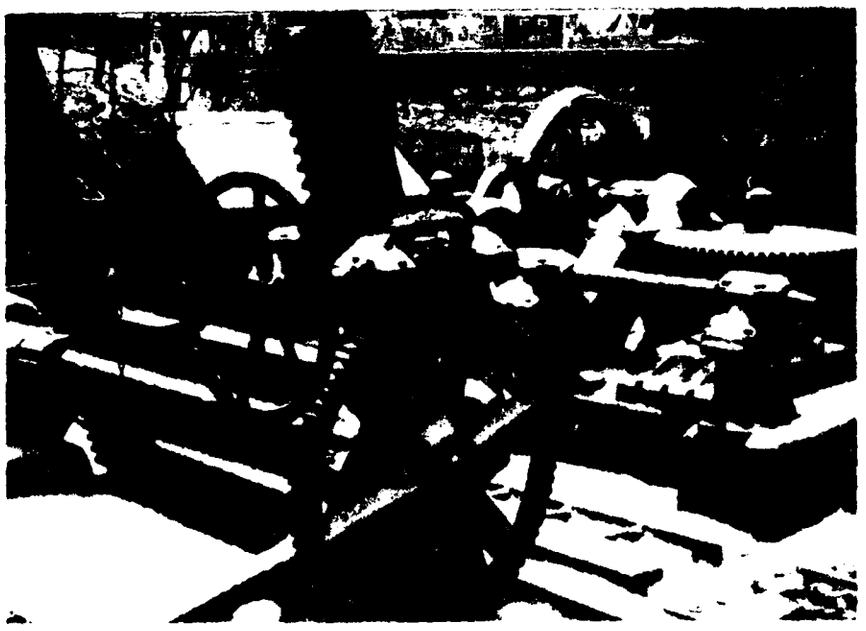


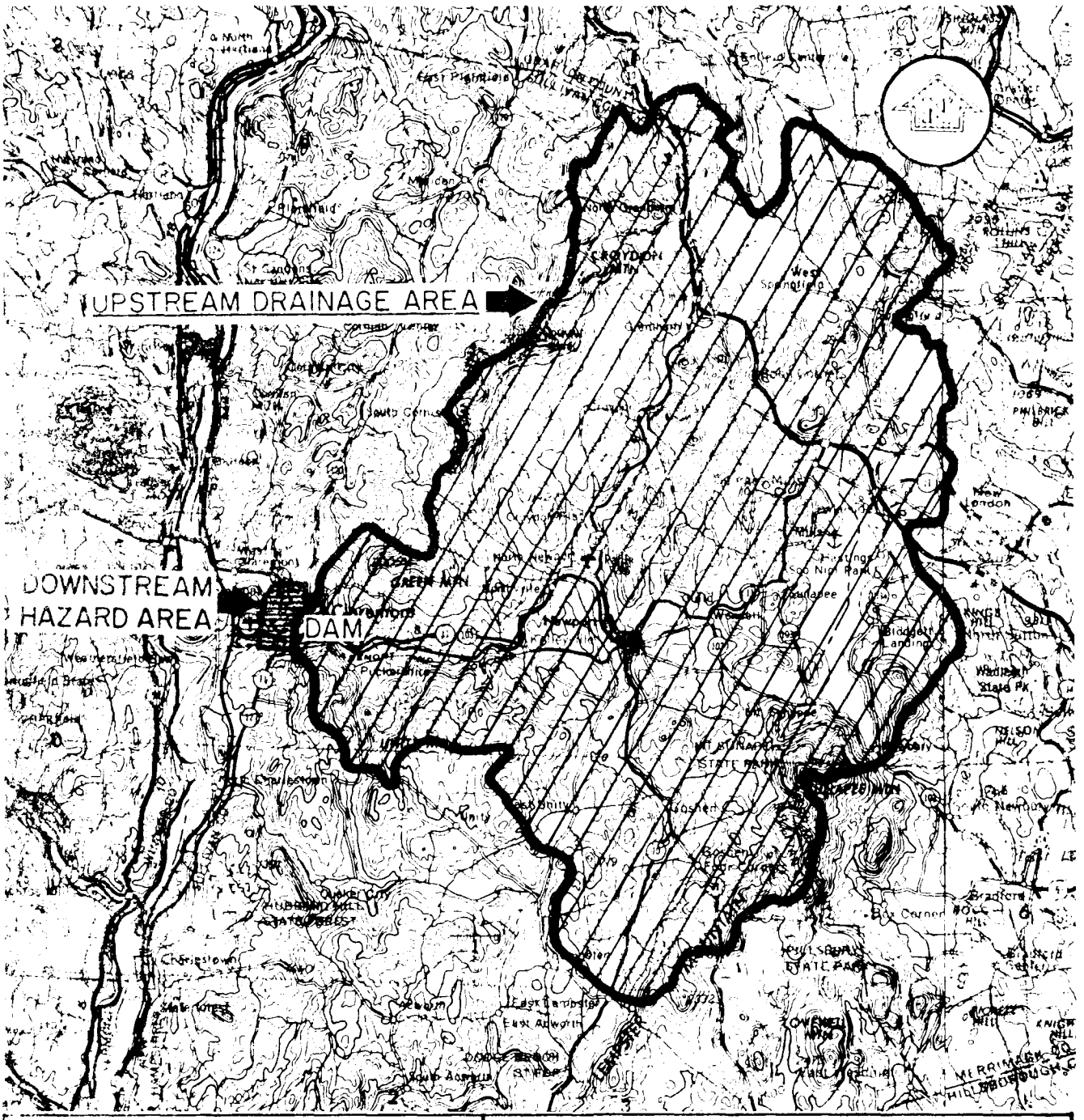
Figure 5 - Looking at the gate mechanisms on the service bridge.

Figure 6 - Looking at the Main Street crossing located approximately 450 feet upstream of the dam.

Figure 7 - View of the downstream channel from the service bridge.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



NATIONAL PROGRAM OF INSPECTION
OF NON-FED. DAMS

CLAREMONT PAPER COMPANY DAM
CLAREMONT, NEW HAMPSHIRE

REGIONAL VICINITY MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

ANDERSON-NICHOLS & CO., INC. CONCORD, NH

SCALE IN MILES

0 5 10

MAP BASED ON U.S.G.S. 1:250,000 SERIES TOPOGRAPHIC MAPPING. GLENS FALLS, NY, VT, NH. 1956. REVISED 1972. PORTLAND, ME, NH. 1956, REVISED 1972

1/13
1/19 LJW

Claremont Paper Company Dam

DA = 253 mi^2
Size Classification = Small
Hazard Classification = High
Test Flood = ½ PMF

Calculate PMF using "Preliminary Guidance For Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations, March 1978.

Slope of watershed is ≈ 32 FT/MI Because of Lake Sunapee and numerous other smaller storage areas, the 'Flat and Costal' curve was used to determine the CSM value for PMF. @ DA = 253 mi^2 a CSM value of 290 will be used to compute the PMF discharge.

253 mi^2 × 290 CSM = 73,370 cfs

½ PMF (TEST FLOOD) = 36,685 cfs

Develop a dam discharge rating curve using the weir cross section shown on page 4.

Assumptions:

* 'C' = 3.8 (spillway); C' = 3.0 abutments)
  Gates are closed
  Spillway @ Elev. 449.9' MSL (L = 91')
  Normal Storage = 8 AC-FT
  DA ≈ 253 mi^2
* King & Brater ref above was used to determine proper 'C' values.

Trial #1 @ 449.9' MSL Spillway Crest
$Q = 0$ cfs

Trial #2 @ 451.0' MSL
$Q = 3.8(91)(1.1)^{3/2}$
$= 398$ cfs

Trial #3 @ 452.0' MSL
$Q = 3.8(91)(2.1)^{3/2}$
$= 1052$ cfs

Trial #4 @ 453.0' MSL
$Q = 3.8(91)(3.1)^{3/2}$
$= 1887$ cfs

Trial #5 @ 454.0' MSL
$Q = 3.8(91)(4.1)^{3/2}$
$= 2871$ cfs

Trial #6 @ 456.0' MSL
$Q = 3.8(91)(6.1)^{3/2}$
$= 5210$ cfs

Trial #7 @ 457.5' MSL (MAXIMUM POOL)
$Q = 3.8(91)(7.6)^{3/2}$
$= 7245$ cfs

Trial #8 @ 459.0' MSL
$Q = 3.8(91)(9.1)^{3/2} + 3.0(16.5)(1.5)^{3/2} +$
$3.0(214)(1.5)^{3/2}$
$= 9493 + 91 + 39 = 9623$ cfs

Trial #9 @ 460.0' MSL
$Q = 3.8(91)(10.1)^{3/2} + 3.0(16.5)(4.5)^{3/2} +$
$3.0(214)(2.5)^{3/2} + 3.0(30)(2.5)^{3/2}$
$= 14555 + 473 + 541 + 874 = 15443$ cfs

3/13 -
1/79 L.W

Trial #10 @ 465.0' MSL

$Q = 3.8(91)(15.1)^{3/2} + 3.0(16.5)(7.5)^{3/2} + 3.0(\frac{1}{2}14)(2.0)^{3/2} + 3.0(30)(5.5)^{3/2}$

$= 20290 + 1017 + 59 + 1161$

$= 22527$ cfs

Trial #11 @ 470.0' MSL

$Q = 3.8(91)(20.1)^{3/2} + 3.0(16.5)(12.5)^{3/2} + 3.0(30)(10.5)^{3/2} + 3.0(\frac{1}{2}14)(2.0)^{3/2}$

$= 31,162 + 2188 + 3062 + 59$

$= 36,471$ cfs

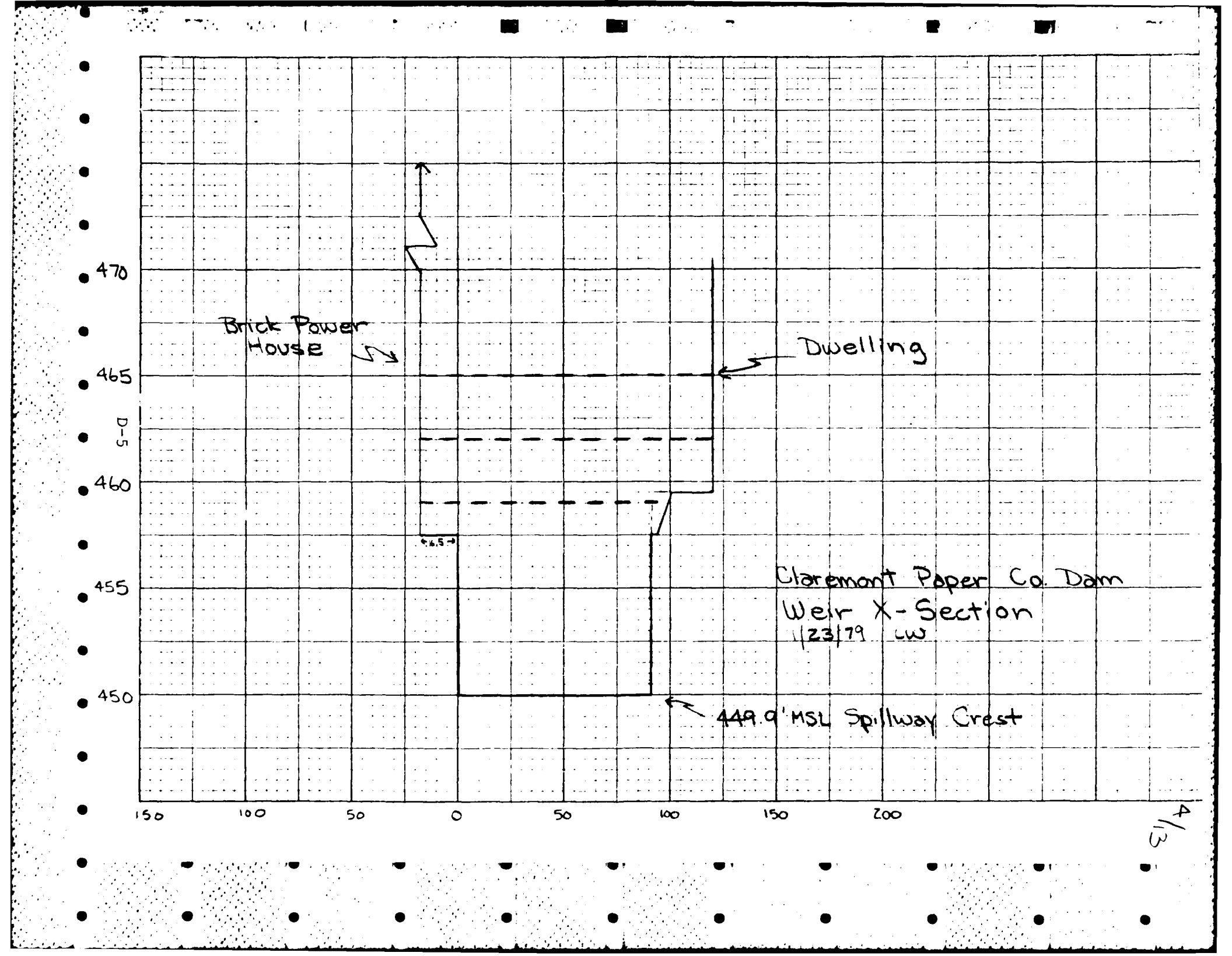
TEST FLOOD = 36,685 cfs

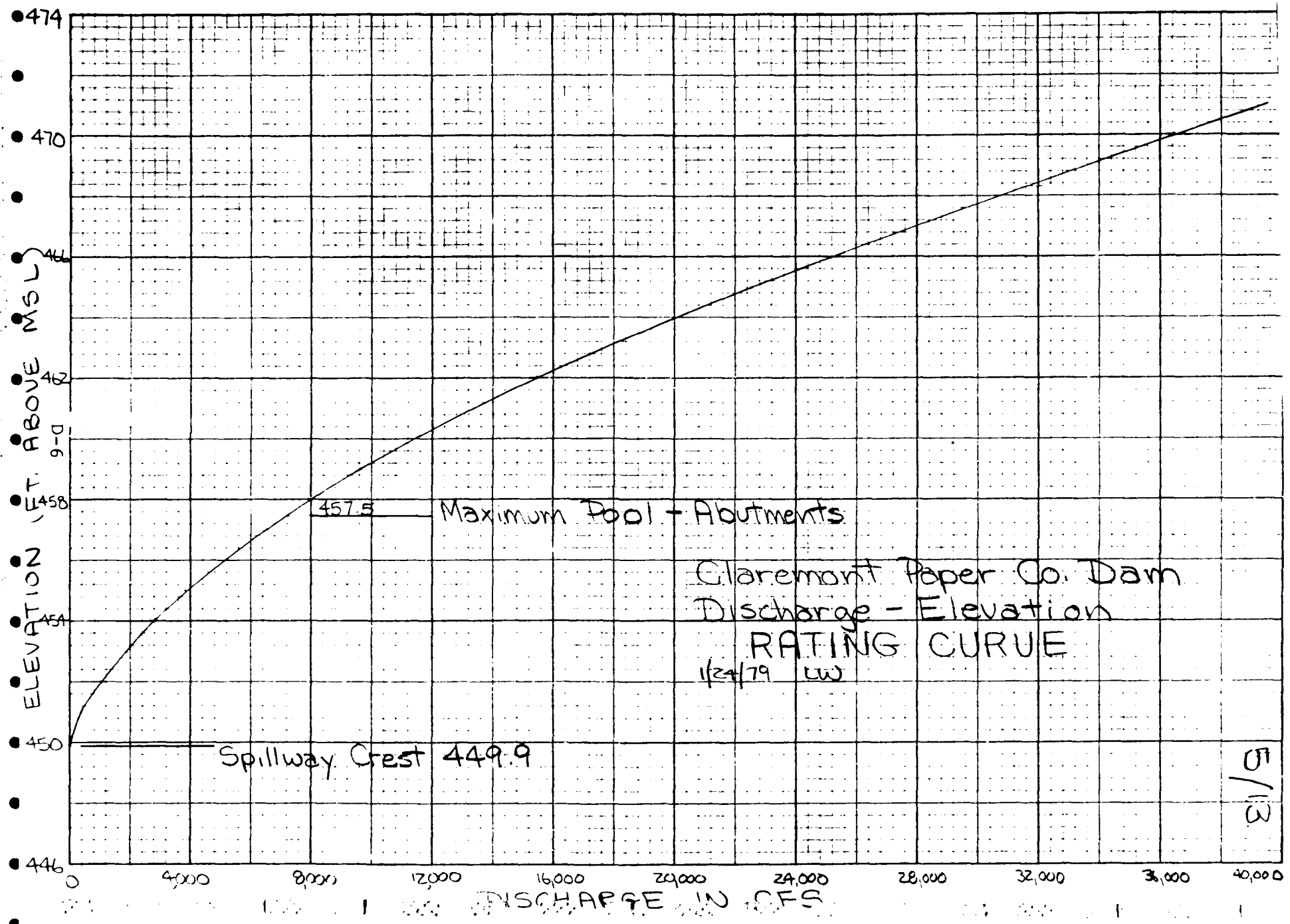
Refer to rating curve established from the above trials (p. 5).

With a Q = 36,685 cfs an elevation of 470.0' MSL can be read.

Spillway Crest = 449.9' MSL
Maximum Pool = 457.5' MSL

The water depth over the spillway during ½ PMF would be about 20.1 feet. The dam would be overtopped by 12.5 feet during ½ PMF.


470
465
460
455
450
Brick Power House
Dwelling
Claremont Paper Co. Dam
Weir X-Section
1/23/79 CW
449.9' MSL Spillway Crest
150
100
50
0
50
100
150
200
D-5
4/13


474
470
466
462
458
454
450
446
ELEVATION FT. ABOVE MSL
D-6
457.5
Maximum Pool - Abutments
Spillway Crest 449.9
Claremont Paper Co. Dam
Discharge - Elevation
RATING CURUE
1/24/79 LW
0
4,000
8,000
12,000
16,000
20,000
24,000
28,000
32,000
36,000
40,000
DISCHARGE IN CFS
11/17

Claremont Paper Co. Dam - BREACH ANALYSIS to determine downstream hazard. 6/13

Using Water Resources Data for New Hampshire and Vermont, Water Year 1976, U.S. Geological Survey Water-Data Report NH-VT-76-1, August 1977: Gage on Sugar River, DA = 269 mi^2, Mean Annual Flow = 660 cfs or 2.45 CSM. The DA = 253 mi^2 @ Claremont Paper Co. Dam Therefore, Mean annual flow over dam is approximately $253 \times 2.45 = 620$ cfs or 1.4' depth over spillway (451.3' MSL).

$Q_{p_1} = \frac{8}{27} W_b \sqrt{g}\, y_o^{3/2}$

W_b = breach width
$g = 32.2\ ft/sec^2$
y_o = pool elev. − u/s river bed

@ Claremont Paper Co. Dam:

$W_b = 58'$
$g = 32.2\ ft/sec^2$
$y_o = 451.3 - 424 = 27.3'$
424 → u/s river bed was used. Every year all sedimentation built up over the year is flushed out. This elevation corresponds to the invert of the deep sluice used to release sedimentation.

From above equation: Q = 13,910 cfs
Determine Q going over dam that is not breached: Q = 208 cfs
Total Breach Q = 14,118 cfs (NORMAL Flow Conditions)

Use a typical cross section along the downstream reach from the dam to the housing development 1/2 miles downstream. Develop discharge rating curve using the following Mannings Equation:

$Q = \frac{1.49}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$

n = composite 'n' value
A = area of section (ft^2)
R = A/wp (wetted perimeter)
S = slope of reach

Length of reach - 1.5 miles = 7920 feet
Elev. @ o/s toe - 432
Elev. @ end reach - 364
Slope .007
Composite 'n' - 0.05

The trials below refer to the d/s hazard cross section shown on page 11.

Trial # 1 Assume top 2'

$$\text{Area}_{TPZD} = \tfrac{1}{2} \text{height} \times (\text{base}_1 + \text{base}_2)$$
$$= \tfrac{1}{2}\, 2(100 + 130)$$
$$= 230 \text{ ft}^2$$

$WP = 100 + 40 = 140$
$R = A/WP = 230/140 = 1.64$

$$Q = \frac{1.49}{.05} \cdot 230 \cdot 1.64^{2/3} \cdot .007^{1/2}$$
$$= \underline{799 \text{ cfs}}$$

Trial #2 Assume top 5'

$$\text{Area} = \tfrac{1}{2}\, 5(100 + 175)$$
$$= 687.5$$

$WP = 100 + 75 = 175$
$R = \frac{687.5}{175} = 3.93$

$$Q = \frac{1.49}{.05} \cdot 687.5 \cdot 3.93^{2/3} \cdot .007^{1/2}$$
$$= \underline{4289 \text{ cfs}}$$

Trial #3 Assume stage 10'

Area = ½ 10 (100 + 250)
= 1750

WP = 100 + 150 = 250

R = A/WP = 1750/250 = 7.0

$Q = \frac{1.49}{.05} \cdot 1750 \cdot 7.0^{2/3} \cdot .001^{1/2}$

= 16,070 cfs

Trial #4 Assume stage 15'

Area = ½ 15 (100 + 325)
= 3187.5

WP = 100 + 225 = 325

R = A/WP = 3187.5/325 = 9.81

$Q = \frac{1.49}{.05} \cdot 3187.5 \cdot 9.81^{2/3} \cdot .001^{1/2}$

= 36,697 cfs

Trial #5 Assume stage 17'

Area = ½ 17 (100 + 345)
= 3782.5

WP = 100 + 245 = 345

R = A/WP = 3782.5/345 = 10.96

$Q = \frac{1.49}{.05} \cdot 3782.5 \cdot 10.96^{2/3} \cdot .001^{1/2}$

= 46,905 cfs

BREACH @ NORMAL FLOW CONDITIONS

Total Breach Q(normal) = 14,118 cfs

Stage = 9 feet (refer to d/s hazard rating curve)

Antecedent discharge:

Q over dam @ 451.3' MSL

$Q = 3.8 \cdot 91 \cdot 1.4^{3/2}$

$= 573$ cfs

Stage @ 573 cfs ≈ 1.3'

Therefore, increase in stage would be 9.0 - 1.3 = 7.7 feet

BREACH @ TOP OF DAM 457.5' MSL

$Q_p = {}^{8}/_{27}\, W_b \sqrt{g}\, y_o^{3/2}$

W_b = breach width = 58'

$g = 32.2$ ft/sec^2

$y_o = 457.5 - 424 = 33.5$

$Q = 18{,}908$ cfs

Q over spillway that is not breached:

$Q = 2627$ cfs

Total Breach Q = 21,535 cfs

Stage = 10.7 feet (refer to d/s hazard rating curve)

Antecedent discharge:

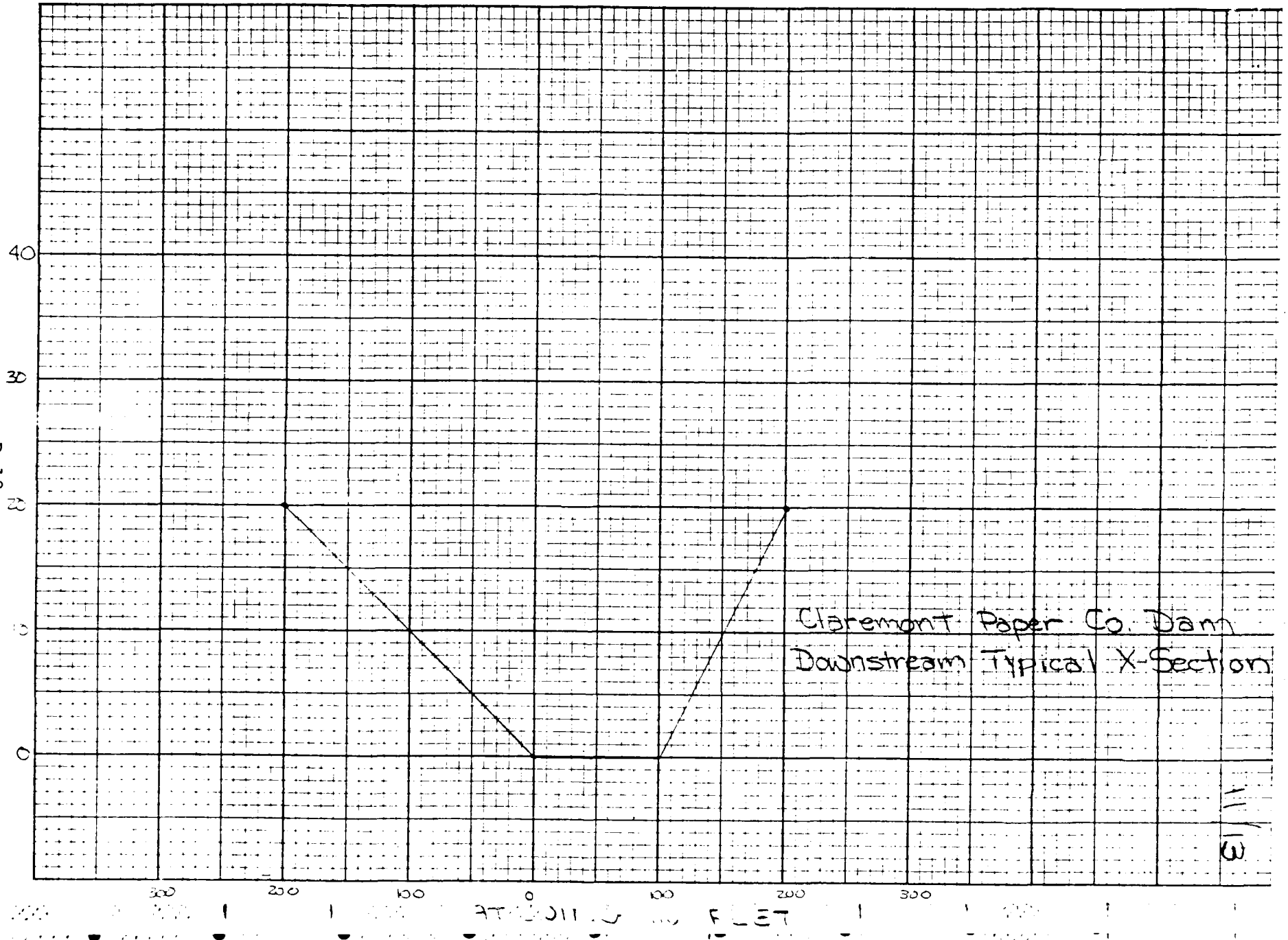
$Q = 3.8 \cdot 91 \cdot 7.6^{3/2}$

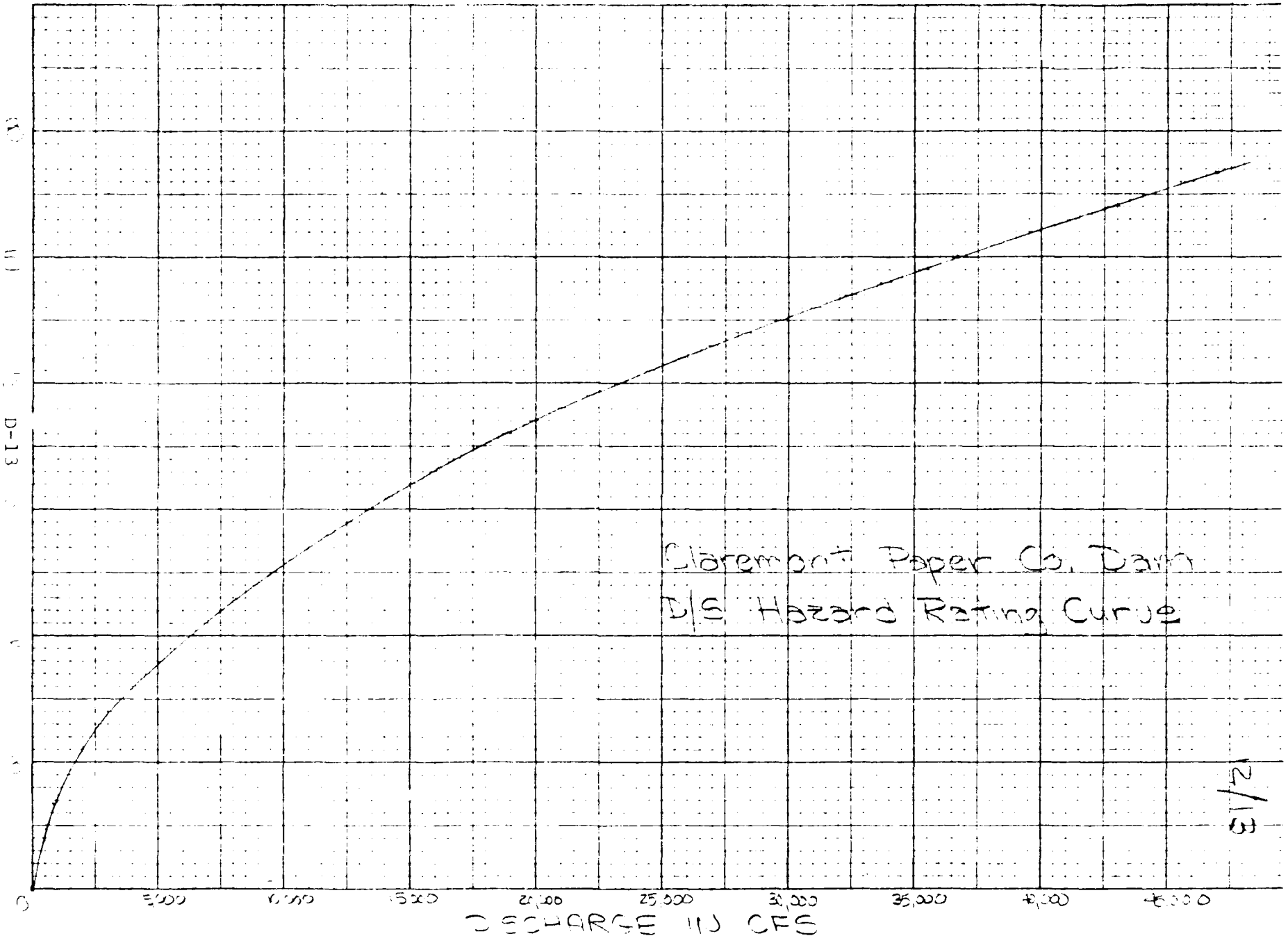
$= 7245$ cfs

Stage @ 7245 cfs = 6.5 feet

Therefore, increase in stage would be 10.7 - 6.5 = 4.2 feet

10/13


STAGE HEIGHT IN FEET
40
30
20
0
300
200
100
0
100
200
300
Claremont Paper Co. Dam
Downstream Typical X-Section


Claremont Paper Co. Dam
D/S Hazard Rating Curve
D-13
DISCHARGE IN CFS

GATE CAPACITIES

Determine approximate discharge capacities of gates @ top dam 457.5' MSL.

Trash Gate

5' x 5' or 25 ft²
Invert of gate - 446.0' MSL
Center line of gate - 448.5' MSL

Capacity @ top dam 457.5' MSL
$Q = CA\sqrt{2gh}$ ORIFICE EQUATION
$Q = (0.7)(25)\sqrt{(64.4 \times 9)}$
$= 420$ cfs

Low-level Sluice

5' x 5' or 25 ft²
Invert of gate - 424.5' MSL
Centerline of gate - 427' MSL

Capacity @ top dam 457.5' MSL
$Q = CA\sqrt{2gh}$ ORIFICE EQUATION
$Q = (0.7)(25)\sqrt{(64.4 \times 30.5)}$
$= 775$ cfs

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
NH	139	NED	NH	019	02				CLAREMONT PAPER CO DAM	4322.4	7220.8	15	FEB	79

POPULAR NAME	NAME OF IMPOUNDMENT
CLAREMONT PAPER COMPANY DAM	SUGAR RIVER

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	SUGAR RIVER	CLAREMONT	0	14221

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC. (FEET)	HYDRAU. (FEET)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	NORMAL (ACRE–FT.)
CTPG	1921	HS	34	34	24	8

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	N	07MAR79

REMARKS
1-NH04706 20-1970 21-CONCRETE RUN OF RIVER 22-REBUILT

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	145	U	91	7245		.8										

OWNER	ENGINEERING BY	CONSTRUCTION BY
CLAREMONT PAPER MILL	H S FERGUSON	FRED T LEY + CO

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BOARD	NHWRB	NHWRB	NHWRB

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
ANDERSON-NICHOLS + COMPANY INC	21	NOV	78	PL 92-367

REMARKS

END

FILMED

8-85

DTIC