

AD-A156 737

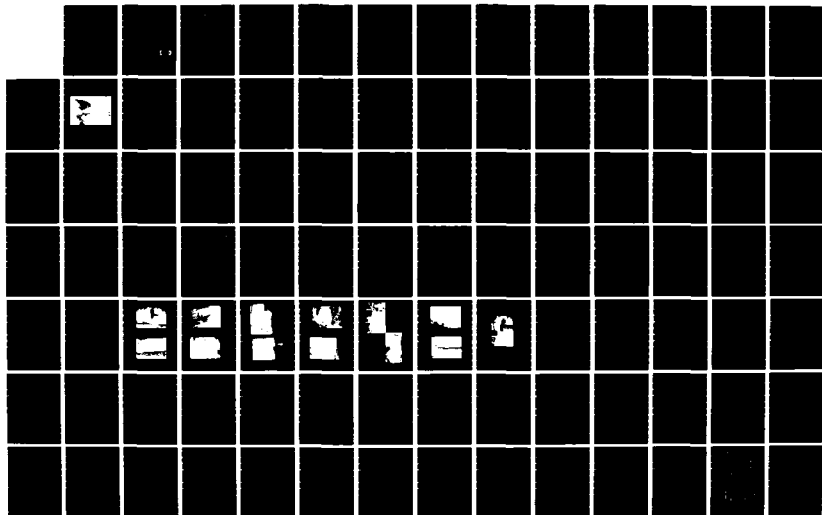
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
MONTPELIER NUMBER 4 (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV FEB 79

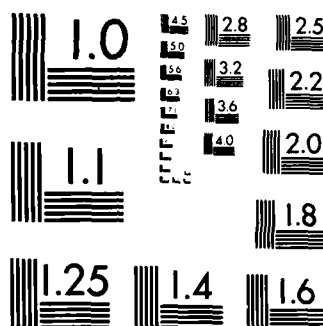
1/2

UNCLASSIFIED

F/G 13/13

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD A 156 737

**RICHELIEU RIVER BASIN
EAST MONTPELIER**

**MONTPELIER NO. 4
VT. 00048**

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**



**DTIC
ELECTE
JUL 17 1985
S D G**

DTIC FILE COPY

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

FEBRUARY 1979

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

85 6 28 002

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DTIC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER VT 00048	2. GOVT ACCESSION NO. ADA 156 737	3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Montpelier No. 4 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT	
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER	
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)	
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE February 1979	
		13. NUMBER OF PAGES 45	
		15. SECURITY CLASS. (of this report) UNCLASSIFIED	
		18a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED			
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)			
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.			
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Richelieu River Basin East Montpelier, Vermont Winooski River			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is a concrete gravity dam with an overall length of 152 ft. and a height of 21 ft. The dam is classified as small and has a low hazard potential in the event of a dam failure. The dam is in poor condition. The lack of maintenance during the last 15-20 years may have rendered the dam economically unsalvageable. To avoid substantial costs to rehabilitate this dam, it is recommended that the dam be breached. A program of annual periodic technical inspections should be instituted.			

DISPOSITION FORM

For use of this form, see AR 340-15, the component agency is TAGCEN.

REFERENCE OR OFFICE SYMBOL

SUBJECT

HEDED-E

Dam Inspection Final Report

TO

FROM

DATE 27 Apr 1979 CMT 1

Chief, Design Branch
Chief, F & M Branch
Chief, Water Control Branch

Chairman,
Dam Safety Review Board

1. Attached is a single copy of the final report for
Thontpelier No. 4 Dam, Identity No. VT00048.
2. Please ascertain that the report is acceptable in accordance with your Branch comments or instructions given to the Architect-Engineer at the Review Board Meeting.
3. If acceptable, retain the copy for your files and be prepared to sign the (master) approval sheet on 4 May.
4. If the report requires further work or correction, notify the undersigned as soon as the determination is made.
5. The cost code for this review is ABA060700000000.

Terzian
TERZIAN



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
VERMONT

JUN 12 1975

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

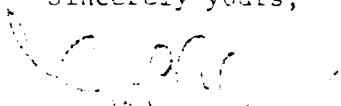
I am forwarding to you a copy of the Montpelier No. 4 Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological 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 Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Green Mountain Power Corporation, Montpelier, Vermont 05602.

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 Department of Water Resources for your cooperation in carrying out this program.

Sincerely yours,


John P. O'Connell
Colonel, Corps of Engineers
Division Engineer

MONTPELIER NO. 4 DAM

VT. 00048

EAST MONTPELIER, VERMONT

Accession For		
NTIS GRA&I ☒		
DTIC TAB ☐		
Unannounced ☐		
Justification		
By		
Distribution/		
Availability Codes		
Dist	Avail and/or Special	
A/		23



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No: VT 00048
Name of Dam: Montpelier No. 4
Town: East Montpelier
County and State: Washington County, Vermont
Stream: Winooski River
Date of Inspection: November 21, 1978

BRIEF ASSESSMENT

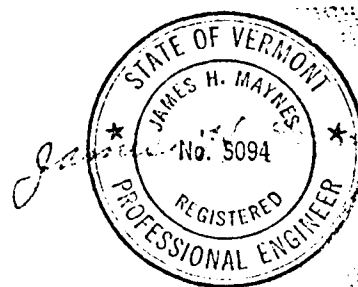
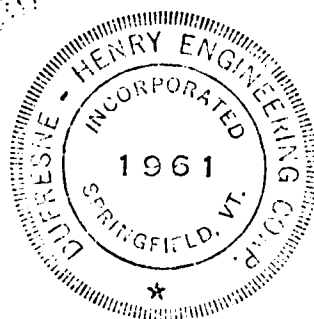
This dam is a concrete gravity dam with an overall length of 152 feet, a basal spillway width at the concrete/bedrock interface at the gate house abutment of 11 feet and a structural height of 21 feet. This dam was constructed by Cory, Devitt and Frost, Inc. for the former Montpelier and Barre Light and Power Company. At the right abutment there is a concrete structure housing the forebay and gates. This structure formerly diverted water to a penstock for use at a downstream power house. Green Mountain Power Corporation now owns the facility; however, its function as a low-head hydroelectric facility was discontinued around 1960.

The dam is classified as small and has a low hazard potential in the event of dam failure. The dam is designed to overtop continuously without structural damage. The dam is anchored directly into existing channel bedrock. The gate house formerly abutted the downstream portion of a bend in the river. This bend was overtopped by river flows, partially eroded away, and subsequently backfilled with soil fines to construct the present access road.

Based on size and hazard classification and in accordance with Corps Guidelines, the test flood is the 100-year flood. The test flood outflow of 17,000 CFS (85 CSM) overtops the dam by 9.1 feet. With water level at the top of the dam (elevation 616.2 feet MSL) the spillway will pass 8,700 CFS which is 50 percent of the test flood.

The dam is in poor condition. The lack of maintenance during the last 15-20 years may have rendered the dam economically unsalvageable. The downstream portion of the soils to the right of the gate house appear to be highly susceptible to erosion, and the upstream portion is of unknown composition. In addition, the concrete overflow weir may be unstable against overturning and horizontal sliding under high water conditions, particularly since silt behind the weir practically reaches to its crest. To avoid substantial costs to rehabilitate this dam, it is recommended that the dam be breached. Alternatively, the stability of the dam and the right abutment must be checked in detail. The following items require immediate attention:

1. The waste gate and penstock gates should be opened permanently to maintain lower upstream water levels during normal flows. Prior to opening either gate, the Vermont Division of Water Resources should be contacted to specify necessary measures to control the release of silt build-up.
2. The forebay cover should be renovated to prevent unauthorized access and hazard to trespassers.
3. The gate house should be disassembled and removed from the site.
4. The trees that are growing on the embankment to the right and upstream from the gate house should be cut annually.
5. The downstream slope of the embankment to the right of the gate house should be kept free of debris and trees so that any seepage through the embankment will be observable.
6. All deteriorated concrete at the dam and abutments must either be repaired or replaced if the dam is to remain in use.
7. A program of annual periodic technical inspections should be instituted.



This Phase I Inspection Report on Montpelier Number Four 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
JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar
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 aid 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

<u>Section</u>	<u>Page</u>
Letter of Transmittal	
Brief Assessment	
Review Board Page	
Preface	i
Table of Contents	ii-iv
Overview Photo	v
Location Map	vi

REPORT

1. PROJECT INFORMATION

1.1 General	1-1
a. Authority	1-1
b. Purpose	1-1
1.2 Description of Project	1-1
a. Location	1-1
b. Description of Dam and Appurtenances	1-2
c. Size Classification	1-2
d. Hazard Classification	1-2
e. Ownership	1-2
f. Operator	1-2
g. Purpose of Dam	1-3
h. Design and Construction History	1-3
i. Normal Operational Procedures	1-3
1.3 Pertinent Data	1-3
a. Drainage Area	1-3
b. Discharge at Dam Site	1-3
c. Elevation Data	1-4
d. Reservoir Dam	1-5
e. Storage Data	1-5
f. Reservoir Surface Area	1-5
g. Dam	1-5
h. Diversion and Regulating Tunnel	1-6
i. Spillway	1-6
j. Regulating Structures	1-6

<u>Section</u>	<u>Page</u>
2. ENGINEERING DATA	
2.1 Design Data	2-1
2.2 Construction Data	2-1
2.3 Operation Data	2-2
2.4 Evaluation of Data	2-2
a. Availability	2-2
b. Adequacy	2-2
c. Validity	2-2
3. VISUAL INSPECTION	
3.1 Findings	3-1
a. General	3-1
b. Dam	3-1
c. Appurtenant Structures	3-2
d. Reservoir Area	3-3
e. Downstream Channel	3-3
3.2 Evaluation	3-3
4. OPERATIONAL PROCEDURES	
4.1 Procedures	4-1
4.2 Maintenance of the Dam	4-1
4.3 Maintenance of the Operating Facilities	4-1
4.4 Description of Any Warning System in Effect	4-1
4.5 Evaluation	4-1
5. HYDRAULIC/HYDROLOGIC	
5.1 Evaluation of Features	5-1
a. General	5-1
b. Design Data	5-1
c. Experience Data	5-1
d. Visual Observations	5-1
e. Test Flood Analysis	5-1
f. Dam Failure Analysis	5-2
6. STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	6-1
a. Visual Observations	6-1
b. Design and Construction Data	6-1
c. Operating Records	6-1
d. Post-Construction Changes	6-1
e. Seismic Stability	6-1

d. Reservoir Area

The reservoir area consists of approximately 4 acres when the water level is at spillway crest elevation, 610.6 feet MSL. This area was 7 acres in 1910 and has decreased due to heavy siltation.

e. Downstream Channel

The downstream channel is in good condition. There is very little debris or overhanging vegetation in or near the channel. There are several homes on the left side of the channel; however these homes are located above flood hazard levels. U.S. Route 2 crosses the Winooski River approximately 1 mile east of the dam, prior to the confluence of the Winooski River and Stevens Brook.

3.2 Evaluation

Montpelier No. 4 Dam has gradually deteriorated to a point such that renovation is not considered reasonable. The concrete has so severely spalled and cracked that actual replacement of the entire gate house and foundation would be necessary. Years without maintenance have rendered both the gate house and forebay cover unsalvageable.

The sluice gates and conduit equipment at the dam itself are no longer operable. The two sluice gates are not only inoperable but also beyond the point of repair. The penstock itself has been severed at the right abutment and has been completely removed downstream of the dam.

Based on the condition of the dam and the right abutment, it appears that this structure may be on the verge of incipient failure. However, the potential for destruction is extremely low due to the small volume of water behind the dam relative to the size of the downstream channel.

Based on the visual observations and the verbal information provided, it appears that the right abutment of this dam is uncompacted silt and trash fill that was not built as a dam but only as a road to access the gate house. Furthermore, no information is available on the character of the natural materials upstream from this access road. Therefore, it is not known whether these materials form an adequate dam. If the river overtops the right abutment again, it should be assumed that a washout will occur.

The left abutment of the dam appears to be composed of bedrock which appears to be competent.

the downstream side of the bend and worked upstream toward the headwater of the ice jam. Apparently a channel was not formed through the entire abutment. It is not known whether the upstream portion of the bend is controlled by a shallow ledge, or whether the water did not flow over the top long enough to cut all the way through.

At the time of inspection an embankment about 100 feet long at elevation 618.2 feet MSL existed between the gate house and the natural hill further to the right. The exposed portion of the downstream face of this embankment is composed of silt, fine sand and trash. The zone downstream from this embankment has been used for dumping trash. The surfaces of the embankment are generally grassed or forested. The shortest distance from the downstream crestline of this embankment to the upstream crestline (i.e. the top of the river bank on the upstream side of the dam) was about 200 feet at the time of inspection.

The material downstream of the left abutment also has been eroded during a previous overtopping. However, since this wall was anchored directly to bedrock, the eroded material was not required for support of the dam or abutment.

c. Appurtenant Structures

The discharge channel immediately downstream of the dam has exposed bedrock at both left and right banks. The channel has a cobble bottom and is clear and unobstructed.

The dam, constructed as a "run-of-the-river dam" has no intake channel. However, the quiescent conditions of the impoundment have allowed significant siltation to occur upstream of the dam. This siltation has severely limited both the maximum usable volume and surface area of the impoundment.

The intake channel into the forebay has significant silt deposits upstream from the bar racks. This silt has deposited upstream of the waste gate to a level near the top of the gate. The waste gate seemed to be nearly watertight. However, flow channels have developed in the waste gate discharge passageway as recorded in Photo 8 in Appendix C.

There is a flow of 10-20 GPM passing through the penstock sluice gate. This flow is recorded in Photo 7, Appendix C.

The forebay was covered, which prevented visual inspection.

The wood frame control building has deteriorated significantly. Its concrete footing serving as part of the dam is spalled and cracked beyond economical repair.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

In general, the Montpelier No. 4 Dam is in very poor condition. The concrete has spalled severely both on the dam and abutment structures. In 1949, Stephen H. Haybrook, hydraulic engineer, noted that "surface disintegration has reduced its section and is further reducing the structure to incipient failure." The dam has weathered an additional 30 years with no apparent maintenance since that evaluation.

b. Dam

The dam consists of a concrete overflow spillway. On the day of inspection the water surface was slightly above the spillway crest (elevation 610.2 feet MSL). The downstream face of the dam has weathered significantly (see Photo 6, Appendix C). The concrete overflow spillway and gate house structure have been anchored directly to the bedrock existing throughout the entire length of the flow channel. Inspection for possible seeps at the base of the dam was not possible due to the continuous overflow. However, there was no visible seepage at the bedrock-concrete interface at the left or right abutment walls.

A wet area was observed to the extreme right of the dam. A stream carrying less than 3 GPM collects flow and rejoins the Winooski River channel downstream of the dam. It is not known whether this water is seepage through the embankment from the river, or runoff and ground water from the adjacent natural land. The water in this stream is discolored with a rusty stain on the downstream end, and is relatively stagnant on the upstream end.

There has been extensive fill (sandy silt with wood trash) placed upstream of the wet area to the right of the dam. This fill seems to have been placed to repair the access road which was eroded during a previous overtopping.

Mr. Raymond C. DeForge, Vice President of Operations and Engineering, Green Mountain Power Corporation, has indicated that the natural materials in the abutments have been overtopped in the past due to an ice jam upstream from the dam.

As a result of that overtopping the soil that comprised the right abutment, which is the mass that forms the bend in the river at this location, was eroded away. Erosion started on

2.3 Operation Data

The dam was attended during the period of time it was in operation as a low-head hydro facility (1908-1960). During the last 20 years there has not been any program of operation in effect at Montpelier No. 4 Dam.

2.4 Evaluation of Data

a. Availability

The original power license application plans for Montpelier No. 4 Dam are stored in the archives at the Montpelier office of the Green Mountain Power Corporation. There are no design calculations relating to structural or hydraulic aspects of the dam itself.

b. Adequacy

Based on the visual inspection and the available engineering data (Figures 1 and 2, Appendix B), the information is sufficient for the Phase I inspection.

c. Validity

The available engineering data are considered valid on the basis of the visual inspection.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

There are no design drawings or calculations available other than the "as built" drawings included in Appendix B, Figures 1 and 2. These drawings were part of the Green Mountain Power Corporation license application dated June 30, 1966.

A letter report, prepared in 1949 by Stephen H. Haybrook, contains a complete evaluation of the dam at that time. This report made reference to a report by Barker and Wheeler prepared in 1926. This report was not available for evaluation.

2.2 Construction Data

The dam was constructed in 1908 by Cory, Devitt and Frost, Inc. According to Green Mountain Power Corporation there has been little or no maintenance work on either the dam or related structures since construction.

There is no evidence of the dam being raised from its initial constructed elevation of approximately 610.2 feet MSL.

The concrete dam has been anchored into the existing bedrock as shown in Appendix B, Figure 2. In cross section, the concrete dam has faces symmetrical about the centerline and formed at an average slope of 4H:21V. There are flashboard support holes set into the crest of the dam at 15-foot intervals. The flashboards and supports are no longer in place.

The gate house footing and concrete penstock intake structure rest directly on the bedrock. A concrete training wall extends upstream about 75 feet from the gate house. This wall is shown in Appendix B, Figure 2, as not extending into bedrock.

The covering of the forebay is of wood construction with a tarpaper covering. The gatehouse is a single story wood frame building located directly over the air and gate shafts.

The 7-foot diameter steel penstock passing under the right end of the dam forms the forebay outlet and is hydraulically controlled by a sluice gate located at the penstock intake.

Also passing through the right end of the dam is a waste gate discharge passageway. This outlet is controlled at the upstream end by a wooden sluice gate. This structure provides a method of draining the impoundment for maintenance procedures.

(5) Side Slope

Upstream - approximately 4H:21V.

Downstream - approximately 4H:21V.

(6) Zoning

Not applicable.

(7) Impervious Core

Not applicable.

(8) Cutoff

Concrete to bedrock of stream channel.

(9) Grout Curtain

None known.

(10) Other

No other aspects known.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

The spillway consists of a modified ogee spillway 152 feet in length. The crest of the weir is about 3 feet wide and its upstream and downstream faces are sloped at about 4H:21V. The spillway is anchored directly into bedrock. The maximum height of the structure is about 21 feet.

j. Regulating Structures

The water level can be affected by opening or closing either the waste gate or penstock intake gate. Otherwise the impoundment level remains at or above the spillway crest elevation of 610.2 feet above MSL. Both gates are controlled by wooden sluice gates, now inoperable. The invert elevation of the 7' x 10' waste gate passageway is 592 feet MSL. The 7-foot diameter penstock also has an invert elevation of 592.0 feet MSL.

	<u>Elevation (feet above MSL)</u>
Spillway Crest	610.2
Normal Pool	610.4
Upstream Invert of Waste Gate Passageway	592
Streambed at Centerline of Dam	592
d. <u>Reservoir Dam</u>	<u>Feet</u>
Length of Test Flood Pool	1000
Length of Normal Pool	1000
e. <u>Storage Data</u>	<u>Acre-Feet</u>
Test Flood (100-year)	51.6
Top of Dam (at left abutment)	39.2
Normal Pool	16
f. <u>Reservoir Surface Area</u>	<u>Acres</u>
Test Flood (100-year)	4
Top of Dam (at left abutment)	4
Normal Pool	4
g. <u>Dam</u>	
(1) <u>Type</u>	
The dam is a concrete gravity dam.	
(2) <u>Length</u>	
The overall length is about 227 feet; the weir length is 152 feet.	
(3) <u>Height</u>	
The maximum height is 26.2 feet.	
(4) <u>Top Width</u>	
A level section through the top of the rounded weir is about 3 feet.	

waste gate passageway is a 10' x 7' outlet controlled by a sluice gate which is presently inoperable. The intake into the forebay is controlled by another sluice gate. Invert elevations for both conduits are at approximately 592.25 feet MSL. Silt has essentially clogged the upstream side of these gates.

(2) Maximum Known Flood at Dam Site

There are no records available regarding major flooding at the dam site. Green Mountain Power Corporation personnel indicate that ice jams at the dam cause a much higher water level than a 100-year frequency flood.

(3) Spillway Capacity

The capacity of the spillway at elevation 618.2 feet MSL is about 13,400 CFS.

(4) Ungated Spillway Capacity During Test Flood

The ungated spillway capacity at the 100-year test flood elevation 619.3 feet MSL is approximately 16,000 CFS.

(5) Gated Spillway Capacity at Normal Pool Elevation

Not applicable.

(6) Gated Spillway Capacity at Test Flood Elevation

Not applicable.

(7) Total Spillway Capacity at Test Flood Elevation

16,000 CFS at elevation 619.3 feet MSL.

(8) Total Project Discharge at Test Flood Elevation

17,000 CFS at 619.3 elevation.

c. Elevation Data

Elevation (feet
above MSL)

Top of Dam (Maximum) (at gatehouse and access road)	618.2
Top of Dam (Minimum) (at left abutment)	616.2
Top of Flashboards (no longer used)	612.7
Test Flood (100-year)	619.3

g. Purpose of Dam

The dam was designed solely to provide an intake basin from which water could be withdrawn and transported to a power generation station located downstream. The impounded water entered the forebay through a bar rack structure and passed to a 7-foot diameter penstock. The penstock carried water approximately 0.53 miles westerly along the river to the Number 4 power station.

h. Design and Construction History

The dam was constructed in 1908 by Cory, Devitt and Frost, Inc. Design records are not available. There are two plans prepared for Federal Power Commission licensing available which seem to be in agreement with observations made during the visual inspection.

i. Normal Operational Procedures

The dam has not been operated during the past 15 years.

1.3 Pertinent Data

a. Drainage Area

The drainage area at the Montpelier No. 4 Dam is 201 square miles. The flow at this site is regulated by Peacham Pond and Mollys Falls Reservoir (combined usable capacity 11,295 acre-feet). The Winooski River is located in the central portion of the physiographic region of Vermont known as the Vermont Piedmont. The river flows westerly into Lake Champlain and has an average slope upstream of the site of 13 feet per mile. The soils within the watershed are predominantly well drained loamy silty soils on gently sloping to steep hills.

The river channel in the vicinity of the dam is principally a calcareous sandstone known as the Waites Formation. Exposures of a nearly-vertically foliated graphitic phyllite and pegmatite intrusions are both present in the vicinity. The upstream side of the bend in the river that forms the right abutment of the dam is composed of glacial till. The thickness of this till is not known.

b. Discharge at Dam Site

(1) Outlet Works

The spillway is designed for continuous overtopping and thus provides the major outlet at Montpelier No. 4. In addition, there have been two other structures designed into the dam to function as outlets. The waste gate and

b. Description of Dam and Appurtenances

The Montpelier No. 4 Dam is a concrete gravity dam with an overall length of 152 feet, a basal spillway width of 11 feet and a structural height of 21 feet.

The modified ogee spillway is anchored directly into the channel bedrock. The left abutment is bedrock and the right abutment consists of soil.

There are two low level outlets built into the dam, both controlled by wooden sluice gates. The waste gate passageway is a 10' x 7' outlet at invert elevation 592.25 feet MSL. The other outlet conduit was initially designed as the 7-foot diameter penstock intake at invert elevation 592.00 feet MSL. The penstock has been severed at the downstream gate house abutment.

The downstream channel is clear of debris and overhanging forestation and slopes at approximately 3 feet per 1000 feet.

c. Size Classification

The Montpelier No. 4 Dam has a size classification of small. The dam impounds about 700,000 cubic feet (16 acre-feet) at a normal water surface of 610.4 feet MSL. The storage with a water surface at the top of the dam (elevation 618.25) is about 48 acre-feet. A dam with a maximum storage volume of less than 1000 acre-feet or a height of greater than 25 feet but less than 40 feet is classified as small. In this case both criteria apply.

d. Hazard Classification

The potential for hazard in the event of failure of this dam is low. Homes in the area affected are above the flood wave.

e. Ownership

The dam is owned by the Green Mountain Power Corporation, Montpelier, Vermont.

f. Operator

Montpelier No. 4 Dam has no one individual responsible for the day-to-day operation of the facility. Questions regarding operational procedures should be addressed to Green Mountain Power Corporation, telephone 802-223-5235.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: MONTPELIER NO. 4

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. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

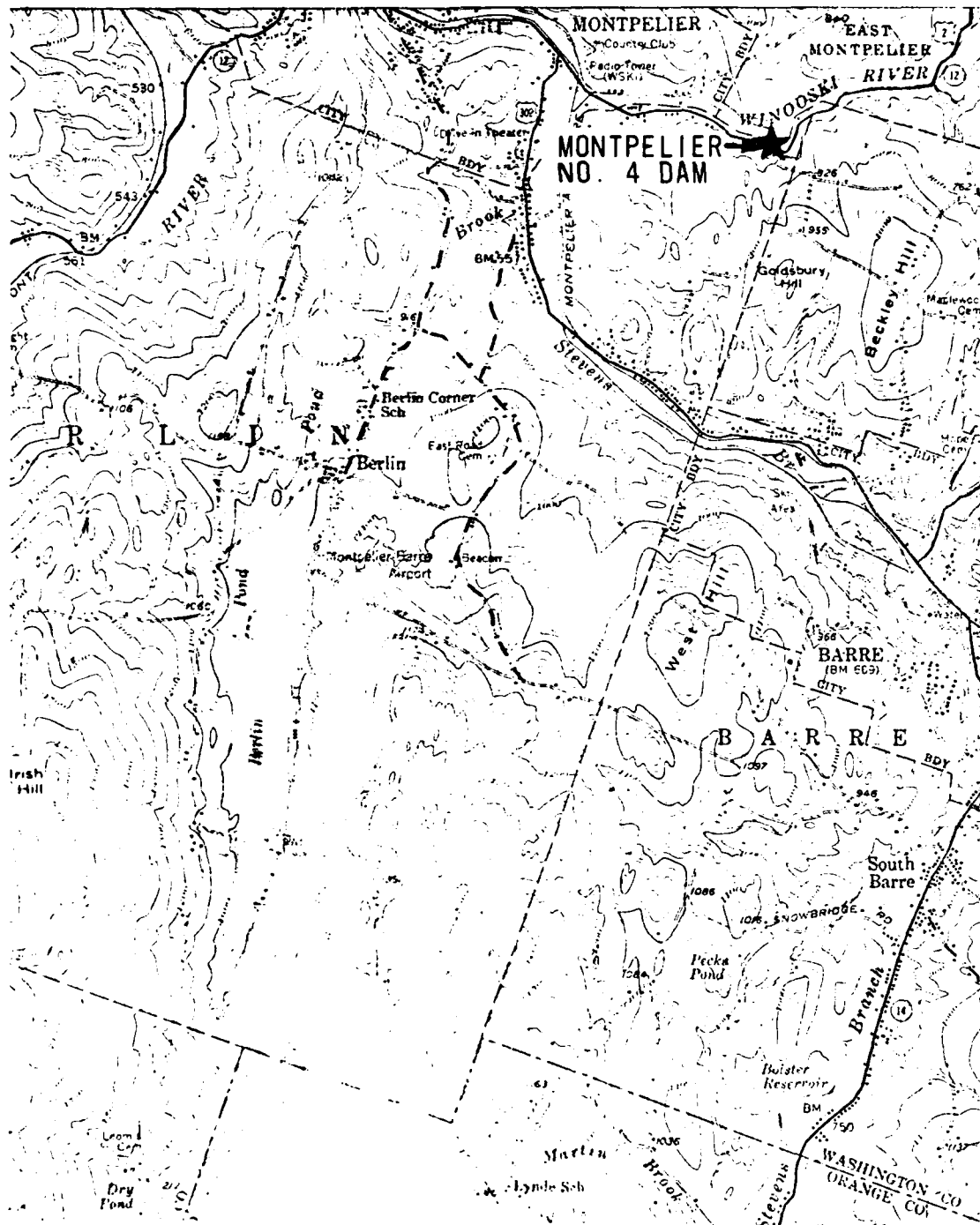
- (1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.
- (2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Montpelier No. 4 Dam is located partially in the Towns of Berlin and East Montpelier, Washington County, Vermont.

The site is located on the Winooski River which empties into Lake Champlain and is approximately 7,400 feet upstream from the confluence of the Winooski River and Stevens Brook.



SOURCE:
USGS QUADRANGLE
"BARRE" 1922-57
1:62,500

DUFRESNE-HENRY ENGINEERING CORP.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP MONTPELIER NO. 4 DAM

EAST MONTPELIER

VERMONT

CLIENT NO. 04-0096

SCALE 1"=1 MILE

ENGR. RED

DATE DECEMBER 19, 1978



OVERVIEW OF
MONTPELIER NO. 4 DAM
EAST MONTPELIER, VERMONT

<u>Section</u>	<u>Page</u>
7. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES	
7.1 Dam Assessment	7-1
a. Condition	7-1
b. Adequacy of Information	7-1
c. Urgency	7-1
d. Need for Additional Investigation	7-1
7.2 Recommendations	7-1
7.3 Remedial Measures	7-2
a. Operation and Maintenance Procedures	7-2
7.4 Alternatives	7-2

APPENDICES

APPENDIX A - VISUAL INSPECTION CHECK LIST	A-1
APPENDIX B - PROJECT RECORDS AND PLANS	B-1
APPENDIX C - PHOTOGRAPHS	C-1
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	D-1
APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS	E-1

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The dam has not been operated for the past 15 to 20 years.

4.2 Maintenance of the Dam

During the time of operation, routine maintenance was necessary to remain economical as a low-head hydro intake facility. However, during the past 15-20 years the dam has not been used and therefore not maintained.

4.3 Maintenance of the Operating Facilities

There is no maintenance provided.

4.4 Description of any Warning System in Effect

There is no warning system in effect.

4.5 Evaluation

There have been little or no operation or maintenance procedures during the past 15-20 years.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The Montpelier No. 4 Dam is a concrete gravity dam of the run of the river type. It is basically a low surcharge storage-high spillage dam designed for continual overtopping.

b. Design Data

No design data for the structures at Montpelier No. 4 are available.

c. Experience Data

There is no written record of overtopping at Montpelier No. 4. It experienced the November 1927 flood without significant damage even though Montpelier No. 5 upstream of this site was severely damaged during the flood. There is some possibility that Mollys Falls Reservoir moderated the peak flow, but hydrologic analyses indicate that the dam must have been overtopped in 1927.

Green Mountain Power Company representatives indicate that an ice jam occurred in the mid-1930s which caused the overtopping that eroded substantial portions of the embankment on the right abutment. There are also positive signs of overtopping on the left abutment. This may have occurred either in 1927 or probably 1936.

d. Visual Observations

The continual overtopping of the Montpelier No. 4 Dam may continue for many years without failure. However, the flow channels through the concrete dam indicate significant internal deterioration. Spalling on the downstream side of the spillway has significantly reduced the effective dam section. The deteriorated condition of the concrete coupled with inadequate earthen dike on the right upstream river bank render the future of Montpelier No. 4 Dam precarious.

e. Test Flood Analysis

The test flood was selected as the 100-year flood using data provided by a Flood Insurance Study prepared by the Federal Insurance Administration by the New York District, Corps of Engineers in May 1975. The 100-year flood at the dam site is approximately 17,000 CFS (85 CSM) and under this condition the dam would be surcharged by 9.1 feet of water. This flow was not adjusted for surcharge storage as this is a run-of-the-river impoundment with low storage capacity.

f. Dam Failure Analysis

Under normal conditions, if the Montpelier No. 4 Dam were to fail due to the excessive deterioration of the concrete, a section approximately 20 feet wide near the spillway would fail first. This failure would release approximately 3500 CFS of water. Under the test flood conditions, if the dam were to fail approximately 5800 CFS additional flow would be released. Under these same conditions, if the dam held and the earthen dike on the right bank were to fail, 2600 CFS of water would escape. However, regardless of failure of either structure during the test flood, the City of Montpelier for the 100-year flood would already be under water. Therefore, the failure of either the dam or the erosion of the dike would have minimal additional impact on the City of Montpelier. Failure of either a 20-foot section of the concrete spillway or 60 feet of the earth embankment will cause a 1-foot or less rise in the 100-year flood level along the Winooski River upstream of the North Branch-Winooski River.

Sixty (60) feet of the concrete spillway failing with normal water levels would release a peak rate of 10,540 CFS and releasing 16 acre-feet of impounded water. This would create a wave of water about 9 feet high based on section backwater at the site. At this depth the Winooski River impounds about 20 acre-feet over an 845-foot reach. This impoundment capacity along the reach of the river would rapidly reduce the flood wave so that it would not overtop the river banks which are generally 15 feet or more above the stream bed.

For the water to be at the top of dam, elevation 618.2, the Winooski River would have to be discharging approximately 13,400 CFS. A 60-foot breach forming in the dam with water at this stage would release an additional 8,300 CFS for a total flow in the river of 21,700 CFS at the instant of failure. The surcharge storage lost as a result of this breach would be about 36 acre-feet. From rating curves plotted for cross sections 67 and 68 of the Winooski River near the Montpelier City line, there is 12 acre-feet of active storage available per 845-foot reach length to attenuate this additional flood flow resulting from the breach formation. From flood routing, this peak will decay approximately 30 percent per 845 foot reach so that there will be little difference between the flood stages for the flood before and after the case of the dam failing with the water level at the top of dam. In the first 3000-foot reach of the river where most of the flood attenuation takes place the flood will be within the river banks inundating an area not to exceed 300 feet in width.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual inspection did not disclose any findings which would indicate instability of the foundation of the structures.

b. Design and Construction Data

The available design and construction data are insufficient to formally evaluate the stability of the dam. However, the height of the concrete weir is known at two cross sections, as shown on Exhibit L of the Green Mountain Power license application dated June 30, 1966. At the higher of these two cross sections the weir is about 20 feet high from crest to bedrock along the centerline. In the field it was observed that the upstream side of the weir has been filled in with river silt almost up to the crest, in the vicinity of the right end of the weir. Further, Mr. DeForge of Green Mountain Power Corporation has indicated that overtopping of the right abutment has occurred, which means that the water level has been at least 10 feet above the crest of the weir.

Given the cross sections of the weir as shown on Exhibit L and the above loading conditions, and further assuming that the tailwater is 10 feet above the base, the stability of the weir against overturning and horizontal sliding is questionable. Therefore, it is important that the stability of this weir be evaluated in detail if the dam will continue to impound water.

c. Operating Records

None of the available records indicate that foundation stability problems have developed since the dam was constructed in 1908.

d. Post-Construction Changes

There are no known post-construction changes with the exception of the access road reconstruction and the silting-in behind the spillway weir which were mentioned previously in Sections 6.1b and 3.1 b and c.

e. Seismic Stability

The dam is in Seismic Zone 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

This dam is considered to be in poor condition because the character of the materials in the embankment to the right of the gate house are in part susceptible to internal erosion and in part unknown. Also, the combination of a heavy silt load on the upstream side of the spillway and high water levels that apparently have been reached in the past indicate that the stability of this weir against overturning and horizontal sliding is questionable.

The actual concrete in the dam and abutment structures has undergone significant deterioration. Abundant cracking and spalling are visible along most of the dam and right abutment. In addition, the internal concrete, visible inside the waste gate passageway, has developed flow channels (see Photo 8).

b. Adequacy of Information

The data available were sufficient to bring out potential defects in this structure but are not sufficient to evaluate the seriousness of those potential defects. The Phase I inspection was based principally on visual observations, verbal history and two drawings submitted in 1966 by Green Mountain Power for license application and engineering judgment.

c. Urgency

The recommendations given in Section 7.2 should be carried out within one year after receipt of this report.

d. Need for Additional Investigation

The additional investigations described in Section 7.2 should be carried out.

7.2 Recommendations

An engineer qualified in the design of dams should be engaged to:

1. Investigate the stability of the concrete overflow weir and make recommendations relative to the need for alterations.

2. Investigate the composition and stability, particularly against internal erosion, of the embankment to the right of the gate house, including the entire cross section upstream to the start of the bend in the river.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

1. The waste gate and penstock gates should be opened permanently to maintain lower upstream water levels during normal flows. Prior to opening either gate, the Vermont Division of Water Resources should be contacted to specify necessary measures to control the release of silt build-up.
2. The forebay cover should be renovated to prevent unauthorized access and hazard to trespassers.
3. The gate house should be disassembled and removed from the site.
4. The trees that are growing on the embankment to the right and upstream from the gate house should be cut annually.
5. The downstream slope of the embankment to the right of the gate house should be kept free of debris and trees so that any seepage through the embankment will be observable.
6. All deteriorated concrete at the dam and abutments must either be repaired or replaced if the dam is to remain in use.
7. A program of annual periodic technical inspections should be instituted.

7.4 Alternatives

As an alternative to carrying out the recommendations in Section 7.2 above, the dam could be breached to eliminate any potential flood hazards of this dam. Hazards to trespassers should also be eliminated if the dam is breached. However, the dam's capacity to retain ice and prevent severe ice jams in the City of Montpelier should be evaluated before a decision is reached to breach the structure. In addition, the Vermont Division of Water Resources will require proper controls to prohibit the sudden release of siltation deposits downstream.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT MONTPELIER No. 4 DAM

DATE November 21, 1978

TIME 12:30

WEATHER 70 % cloudy, 30° F at
12:40

W.S. ELEV. _____ U.S. _____ DN.S.

PARTY:

1. <u>James H. Maynes</u>	<u>D-H</u>	6. _____
2. <u>Morris J. Root</u>	<u>D-H</u>	7. _____
3. <u>Robert E. Dufresne</u>	<u>D-H</u>	8. _____
4. <u>Steve J. Poulos</u>	<u>GEI</u>	9. _____
5. <u>Kenneth Hadd</u>	<u>GMP</u>	10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

PERIODIC INSPECTION CHECK LIST

A-2

PROJECT Montpelier No. 4 DamDATE November 21, 1978

PROJECT FEATURE _____

NAME S. J. PoulosDISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u> (Earth fill zone to right of right abutment)	
Crest Elevation	618.25 USGS
Current Pool Elevation	610.25 USGS
Maximum Impoundment to Date	Foundation of concrete dam-spillway is bedrock
Surface Cracks	None observed
Pavement Condition	None
Movement or Settlement of Crest	Not observable
Lateral Movement	Not observable
Vertical Alignment	Not observable
Horizontal Alignment	Not observable
Condition at Abutment and at Concrete Structures	Left abutment - over wash has scoured soil to bedrock on downstream side and has scoured rock. Right abutment - no seepage at concrete bedrock interface.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Locked gate gives access. There seems to be no trespassing.
Sloughing or Erosion of Slopes or Abutments	During a past flood river has flowed over embankment to right of right abutment. Probably also dredge spoil has been placed to repair access road to gate house and to widen embankment. Fill is silt and miscellaneous wood trash.
Rock Slope Protection - Riprap Failures	Upstream face on right side is thick concrete wall; on left, channel is in bedrock.
Unusual Movement or Cracking at or Near Toe	None observed.
Unusual Embankment or Downstream Seepage	A small stream (<3GPM) is present downstream of right abutment contact with natural ground. Not known whether this is seepage from river or a natural stream. No other seepage observed downstream.
Piping or Boils	None observed.

PERIODIC INSPECTION CHECK LIST

A-3

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

PROJECT FEATURE _____

NAME S. J. Poulos

DISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u> (Earth fill zone to right of right abutment)	
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None
Vegetation	Fully forested with trees on downstream side up to about 16" diameter.

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	The comments below refer to the intake channel just upstream from the gate house intake screens.
a. Approach Channel	
Slope Conditions	The intake screens are almost totally silted in with river silt that has deposited just upstream.
Bottom Conditions	Not visible.
Rock Slides or Falls	None
Log Boom	None
Debris	
Condition of Concrete Lining	None - river is approach
Drains or Weep Holes	None
b. Intake Structure	
Condition of Concrete	Poor - spalled and cracked
Stop Logs and Slots	Trash screen - covered by silt at intake to penstock. 1 - outlet - flood gate. 1 - outlet - penstock. 2 inlet screens.

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Poor - dangerous.
Condition of Joints	Too irregular to judge.
Spalling	Much visible evidence on all concrete structures.
Visible Reinforcing	Wire mesh only.
Rusting or Staining of Concrete	Along cracks.
Any seepage or Efflorescence	Some seepage in flood gate conduit through concrete.
Joint Alignment	Seems to be OK
Unusual Seepage or Leaks in Gate Chamber	Gates are closed tightly. Significant seepage through flow channels in penstock sluice gate.
Cracks	Several small cracks.
Rusting or Corrosion of Structural Steel	None.
b. Mechanical and Electrical	
Air Vents	None.
Float Wells	None.
Crane Hoist	None.
Elevator	None.
Hydraulic System	None.
Service Gates	1 - rack and pinion on flood gate (7' x 10')
	1 - gear and screw on penstock (7' diameter pipe) sluice gate
Emergency Gates	
Lightning Protection System	None.
Emergency Power System	None.
Wiring and Lighting System	None.

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION</u> <u>AND CONDUIT</u> - EMERGENCY FLOOD GATE	
General Condition of Concrete	Poor.
Rust or Staining on Concrete	Most of the concrete is stained.
Spalling	Large chunks falling off.
Erosion or Cavitation	Severe erosion.
Cracking	The concrete on all three outlet works show prolific cracking.
Alignment of Monoliths	Too irregular to judge.
Alignment of Joints	Too irregular to judge.
Numbering of Monoliths	Too irregular to judge.

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

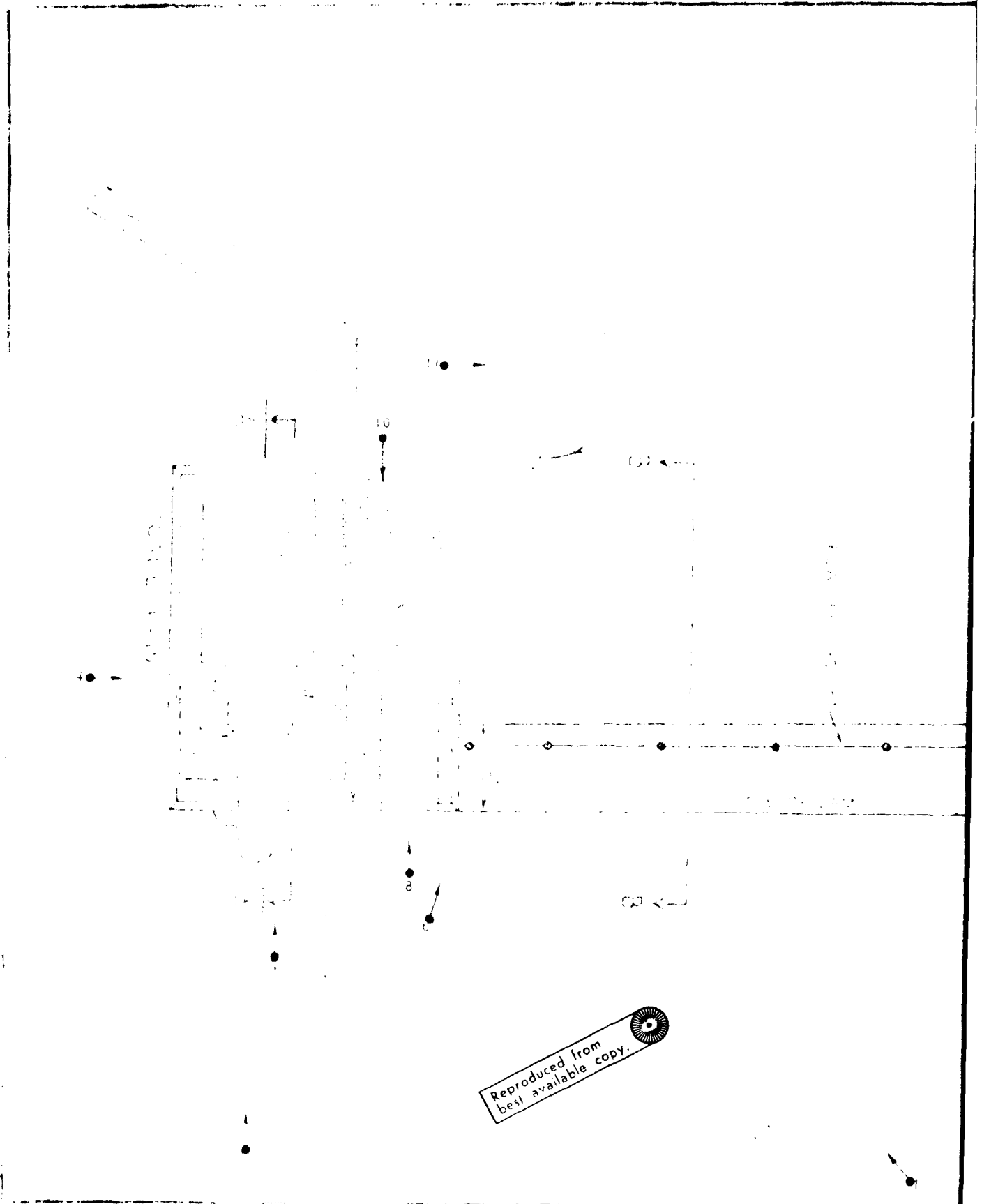
PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	See Conduit
Rust or Staining	" "
Spalling	" "
Erosion or Cavitation	" "
Visible Reinforcing	" "
Any Seepage or Efflorescence	" "
Condition at Joints	" "
Drain Holes	None
Channel	Natural bedrock.
Loose Rock or Trees Overhanging Channel	Plenty of loose rock and trees but form no impediments.
Condition of Discharge Channel	Hydraulically OK.

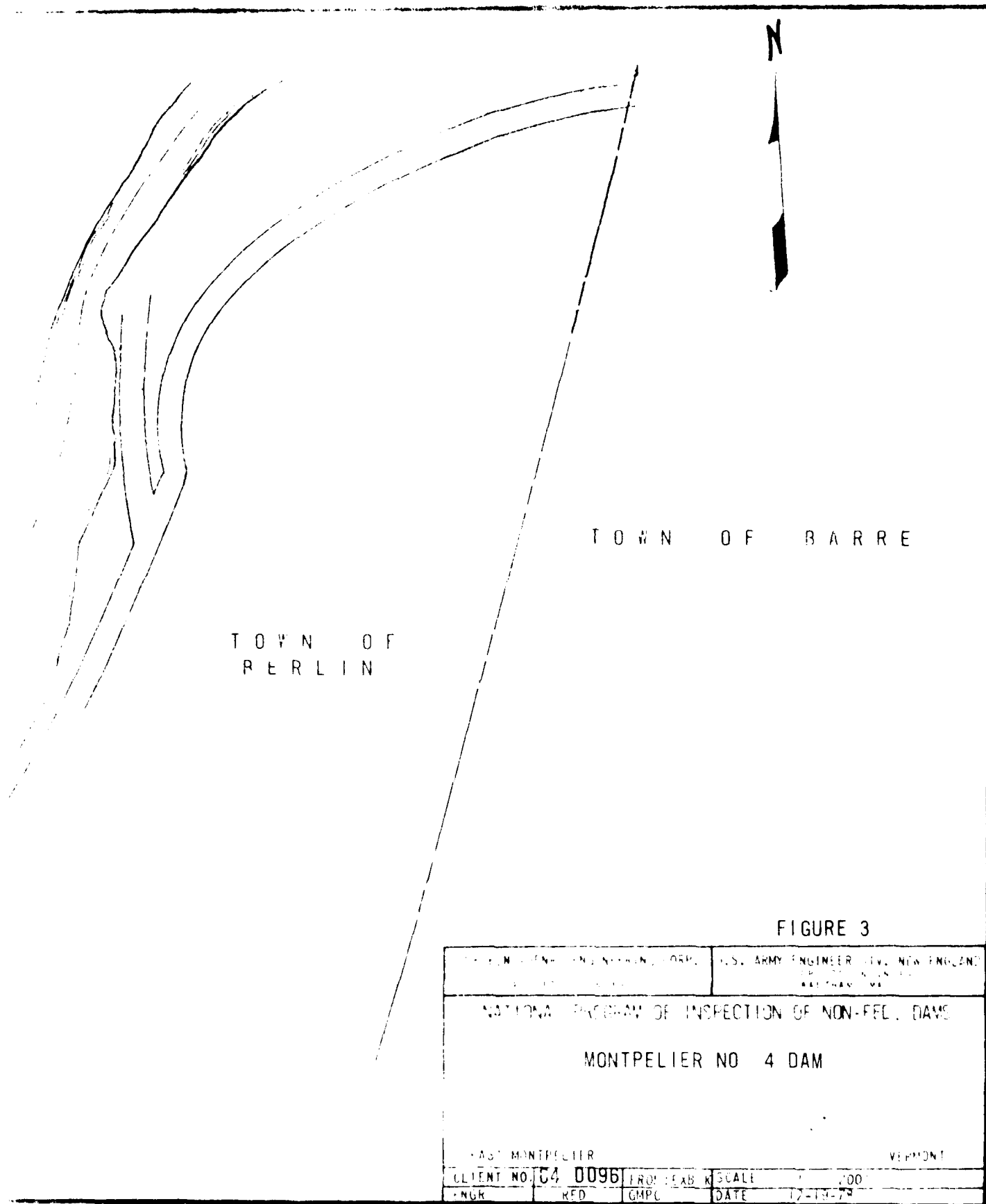


10/2

APPENDIX C

PHOTOGRAPHS AND LOCATION KEY

1. View of Gate House and Severed Penstock
2. View of Dam Spillway
3. View of Left Abutment and Dam Spillway
4. View of Right Side of Gate House
5. Downstream View of Gate House, Penstock and Waste Gate Passageway
6. View of Spalling at Right Downstream Abutment
7. View of Severed Penstock
8. View of Waste Gate Passageway
9. Downstream View of Left Abutment
10. View of Silt Deposit Upstream of Waste Gate
11. View of Bedrock on Left Side of Impoundment
12. View of Siltation on Right Side of Impoundment
13. View of Spillway Crest



3082

TOWN OF
EAST MONTPELIER

MONTPELIER NO. 4 DAM

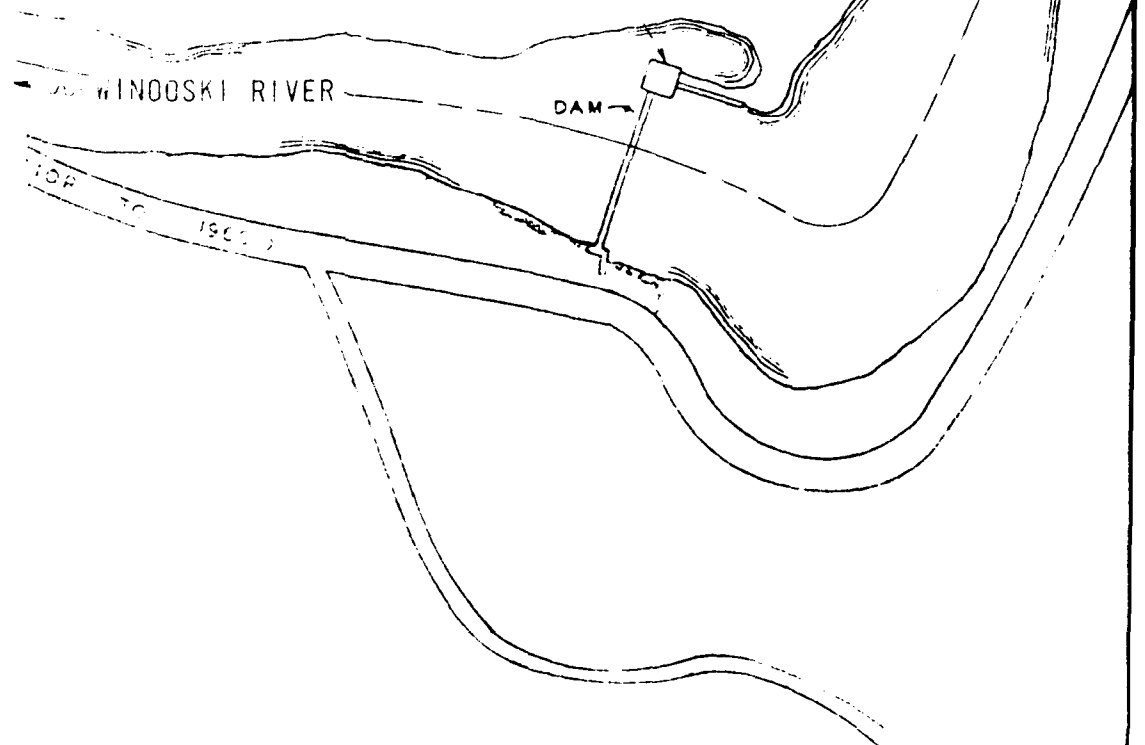
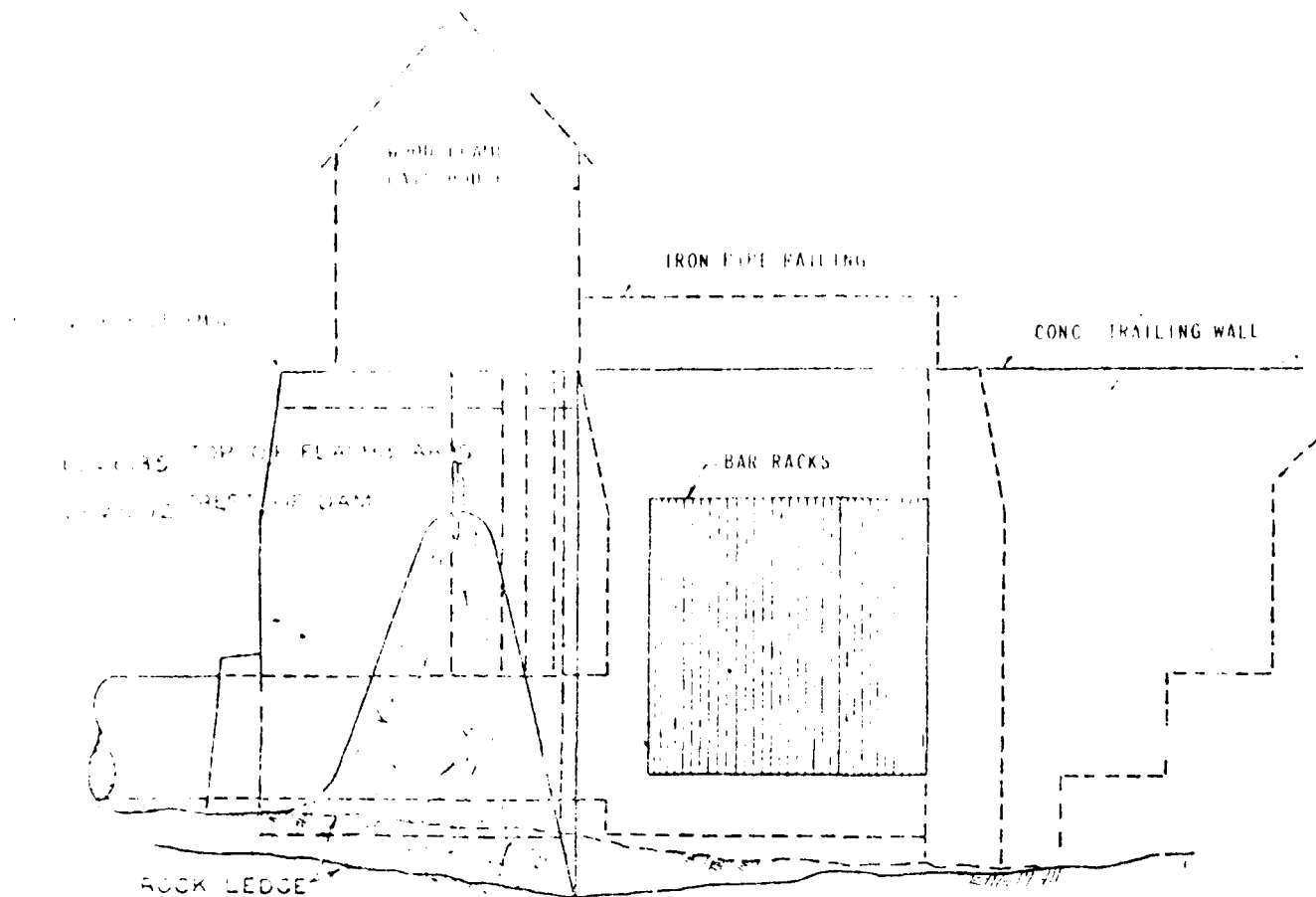


FIG 3

1 of 2



SECTION B-B

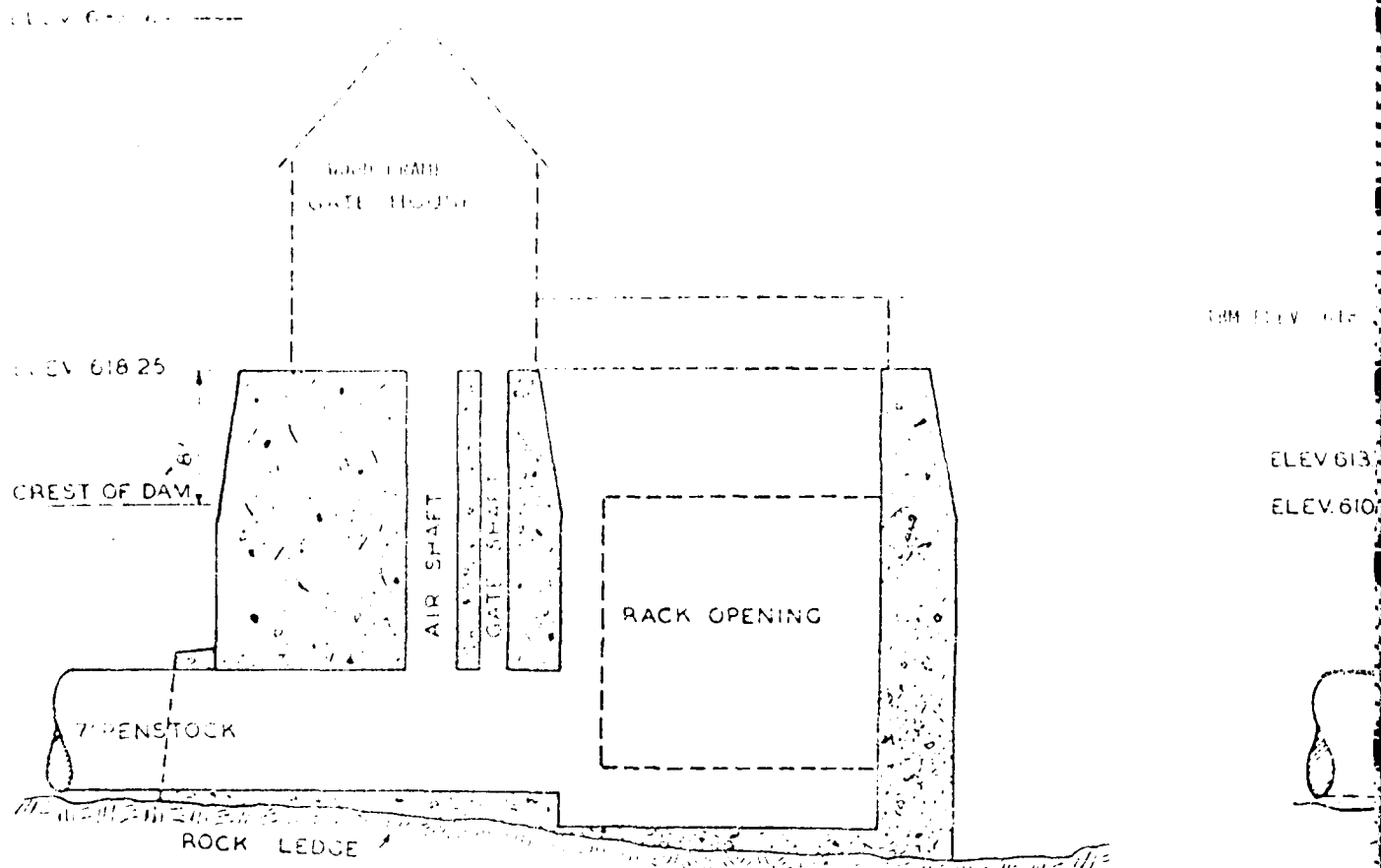
SCALE: 1" = 10' APPROX

FIGURE 2

DUPRESNE-HENRY ENGINEERING CORP. ARCHITECTS AND ENGINEERS		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS BALTIMORE, MARYLAND	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS MONTPELIER NO. 4 DAM			
EAST MONTPELIER		VERMONT	
CLIENT NO.	04-0096	FROM: EXB.L	SCALE AS SHOWN
ENGR	RED	GMPC	DATE 12-19-78

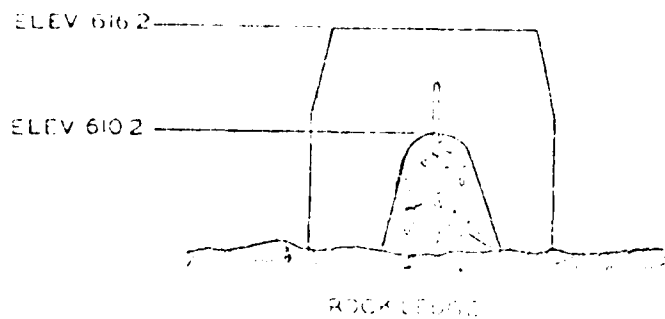
SEE PLAN OF FIGURE 1

20/2



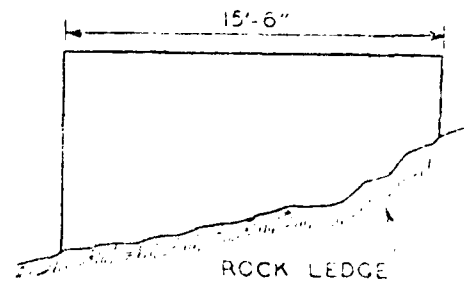
SECTION A-A

SCALE: 1" = 10'



SECTION C-C

SCALE: 1" = 10'



SECTION D-D

N.T.S.

NOTE: FOR PLAN SEE

7-6-2

10-2

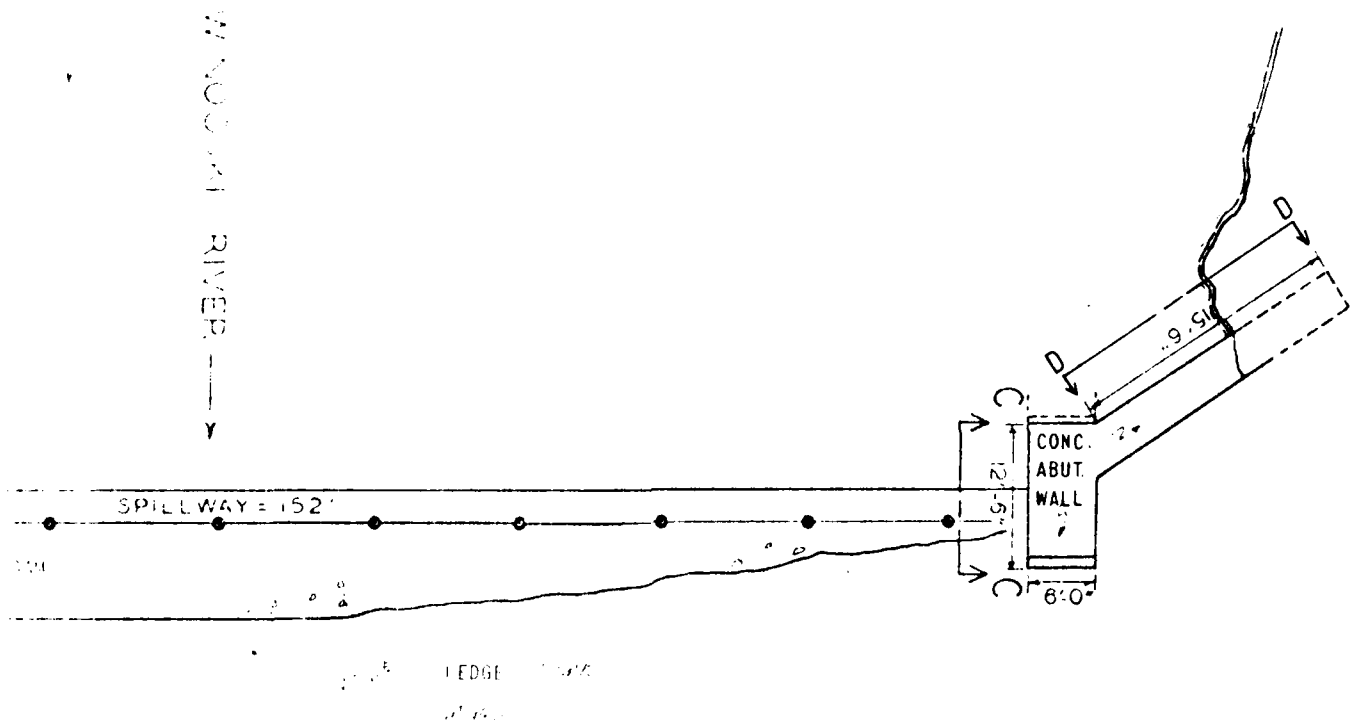


FIGURE 1

DIERESNE-HENRY ENGINEERING CORP.		U.S. ARMY ENGINEER DIV. NEW ENGLAND	
ARCHITECTS		CORP. OF ENGINEERS	
		BALTIMORE, MD.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
MONTPELIER NO. 4 DAM - PLAN			
EAST MONTPELIER		VERMONT	
CLIENT NO. 04-0096	FROM: EXB L	SCALE	1" = 15'
ENGR.	RED	GMPC PLAN	DATE 12-19-78

FOR SECTIONS SEE FIGURE 2

3 of 2

27
but for the existing weakened conditions undue damage to the structure is possible.

Conclusions:

According to the writer's observation of this dam, surface disintegration has reduced its section and is further reducing the structure to incipient failure. As indicated herein the intake section is in the poorest condition. Because of the small storage capacity, under ordinary conditions damage due to a dam failure would be limited.

Nevertheless, rehabilitation work is needed for this dam and should be accomplished soon.

Stephen H. Haybrock
STEPHEN H. HAYBROCK
HYDRAULIC ENGINEER

Public Service Commission
Montpelier, Vermont
December 9, 1949

Report No. 102

has sustained a surface failure, i. e., surface scaling and disintegration.

The spillway section, shown in Figure 1 has not been badly affected on its downstream face. The condition is more pronounced on the upstream face, especially at the upper elevation.

As shown in Figure 2, the intake section is in the worst condition. Besides the loss in section due to disintegration there is leakage in a number of places around its perimeter. Because of the leakage, alternate cycles of freezing and thawing can further disintegrate the concrete mass.

Miscellaneous Comments:

No major repairs have been made to this dam since its construction. Because of the almost complete silt conditions in the reservoir, the owner is skeptical about the relative worth of rehabilitating the structure.

In reviewing the discharge capacity of this dam it

In reviewing the discharge capacity of this dam, it was found to be inadequate as far as the maximum probable flood is concerned. Ordinarily, the dam could stand some overtopping,

- 2 -

B-2

cut off pg
Reproduced from
best available copy.

D. W. B. 10/26/62

REPORT ON MONTPELIER #4 DAM OF THE
GREEN MOUNTAIN POWER CORPORATION

Crooked Pg

Reproduced from
best available copy.

Introduction:

Montpelier #4 dam is one of the developments on the Wincoski River belonging to the Green Mountain Power Corporation. It is located at the Berlin, East Montpelier town line about 3 miles upstream from the city of Montpelier, Vermont. Built in 1908, it is operated in conjunction with a low head hydro-electric plant.

The dam creates a pond having a surface area of about 5 acres at flashboard height. Under present silt conditions, the useable volume impounded by the dam is about 700,000 cu. ft. The drainage area is about 201 sq. mi.

General Description:

This dam is described in detail in Barker & Wheeler's 1926 appraisal report of the property, then operated by the defunct Montpelier & Barre Light and Power Company. In general, it consists of the following:

A spillway section, about 152 ft. long is built on ledge rock and spanning the river channel. At the maximum section it is about 21 ft. high, 3 ft. wide at the crest and 19 ft. wide at the base. Both faces are sloped. The spillway crest is 6 ft. below the top of the dam. Flashboards are provided on the crest to a height of 2.5 ft.

North of the spillway, and adjacent to it, is an intake section containing the usual complement of trash racks

APPENDIX B

PROJECT RECORDS AND PLANS

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
----------------	-----------

OUTLET WORKS - SERVICE BRIDGE

Not Applicable

a. Super Structure

Bearings

Anchor Bolts

Bridge Seat

Longitudinal Members

Underside of Deck

Secondary Bracing

Deck

Drainage System

Railings

Expansion Joints

Paint

b. Abutment & Piers

General Condition of Concrete

Alignment of Abutment

Approach to Bridge

Condition of Seat & Backwall

PERIODIC INSPECTION CHECK LIST

PROJECT Montpelier No. 4 Dam

DATE November 21, 1978

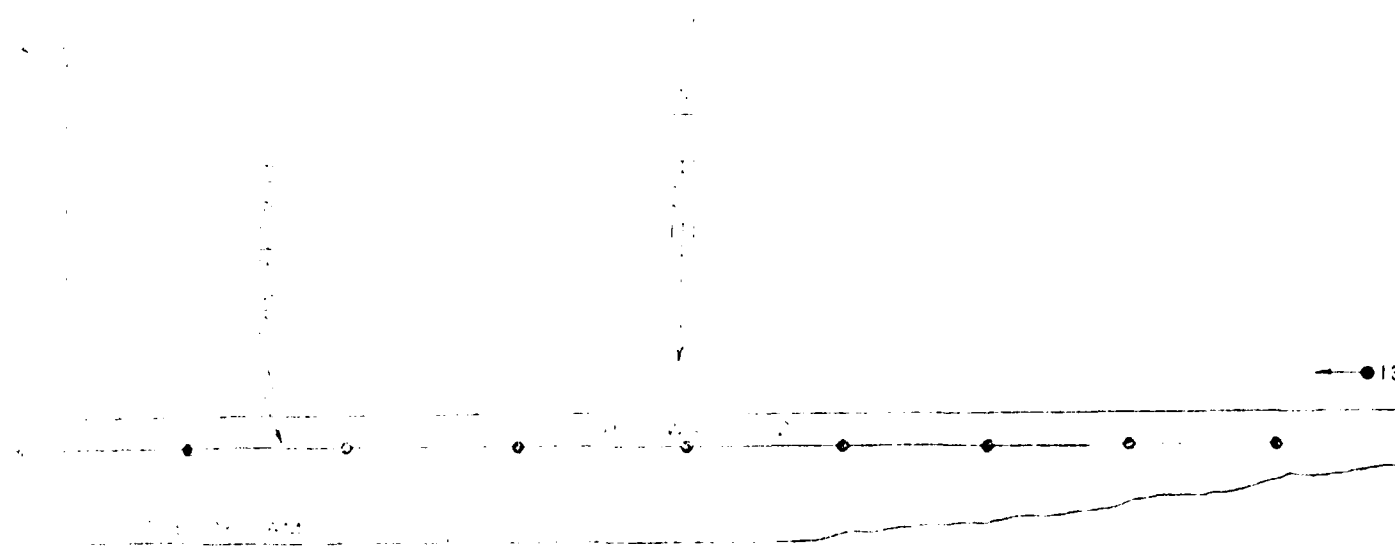
PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	River - mostly open with some silt.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	River bottom - bedrock not visible, may be silted behind spillway.
b. Weir and Training Walls	
General Condition of Concrete	Dam appears to be poor - irregularity of slope to spillway. Concrete poured on original ground as left abutment/ground.
Rust or Staining	None
Spalling	Spalling on downstream and at left training wall.
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Not visible.
Drain Holes	Not visible.
c. Discharge Channel	
General Condition	OK
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Lined with forested slopes.
Floor of Channel	River channel bedrock.
Other Obstructions	None



2

3

• PHOTO NO. AND
VIEW DIRECTION

DUFRESNE-HENRY ENGINEERING COR
ARCHITECT-ENGINEER

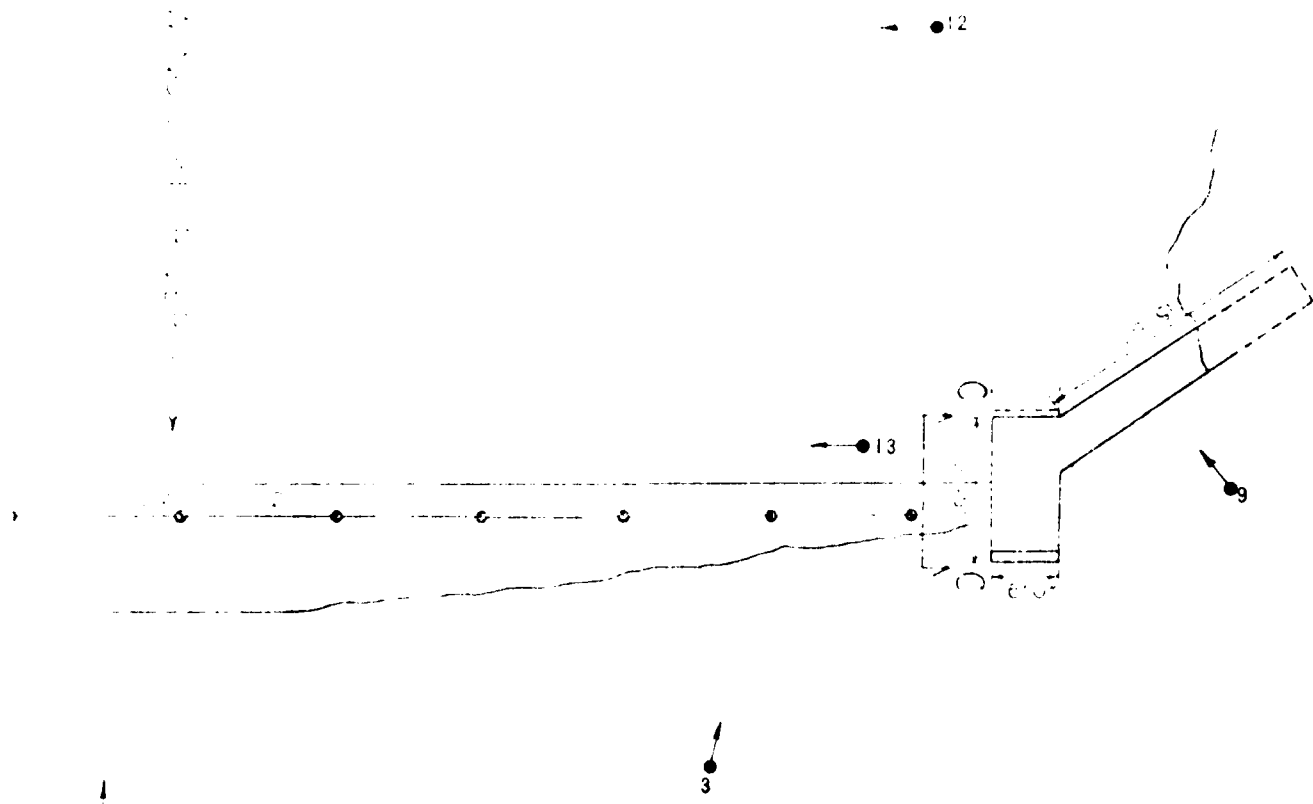
NATIONAL PROGRAM OF

PHOTO
LOCATIONS
MONTPELIER

E. MONTPELIER

CLIENT NO. 04-0096
ENGR. RED

20/3



1
2

3

● PHOTO NO. AND
VIEW DIRECTION

DUFRESNE-HENRY ENGINEERING CORP. ARCHITECT-ENGINEER		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
PHOTOGRAPH LOCATION KEY MONTPELIER NO. 4			
F. MONTPELIER		VERMONT	
CLIENT NO.	04-0096	SCALE	NTS
ENGR.	RED	DATE	1-23-79

32/3



1. VIEW OF GATE HOUSE AND SEVERED PENSTOCK



2. VIEW OF DAM SPILLWAY



3. VIEW OF LEFT ABUTMENT AND DAM SPILLWAY



4. VIEW OF RIGHT SIDE OF GATE HOUSE



5. DOWNSTREAM VIEW OF
GATE HOUSE, PENSTOCK
AND WASTE GATE
PASSAGEWAY



6. VIEW OF SPALLING AT RIGHT DOWNSTREAM
ABUTMENT



7. VIEW OF SEVERED PENSTOCK



8. VIEW OF WASTE GATE PASSAGEWAY



9. DOWNSTREAM VIEW
OF LEFT ABUTMENT



10. VIEW OF SILT
DEPOSIT UPSTREAM
OF WASTE GATE



11. VIEW OF BEDROCK ON LEFT SIDE OF
IMPOUNDMENT



12. VIEW OF SILTATION ON RIGHT SIDE OF
IMPOUNDMENT



13. VIEW OF SPILLWAY CREST

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

BY _____ SUBJECT _____ SHEET NO. _____ OF _____
DATE _____ JOB NO. _____

Appendix D

Hydrologic / Hydraulic Computations

Test Flood	D-1
Storage Routing	D-1
Rating Curve	D-2
Discharge Capacity Comps.	D-3
Failure Analysis	D-4
HEC-2 For Dam Failure	D-11
Drainage Area Map	

DUFRESNE-HENRY ENGINEERING CORPORATION

BY _____ SUBJECT _____
DATE _____

SHEET NO. D-1 OF _____
JOB NO. 7-0096

Test Flood

size: 16 Ac-ft; H 222 feet $\Rightarrow$ small

Hazard: failure poses no threat to life $\Rightarrow$ Low

Low Hazard, small size $\Rightarrow$ 50 to 100-yr frequency

From Flood Insurance Study for City of Montpelier, flow
in Winooski River above Stevens Branch $\Rightarrow$ 17,000 cfs
for Q_{100} .

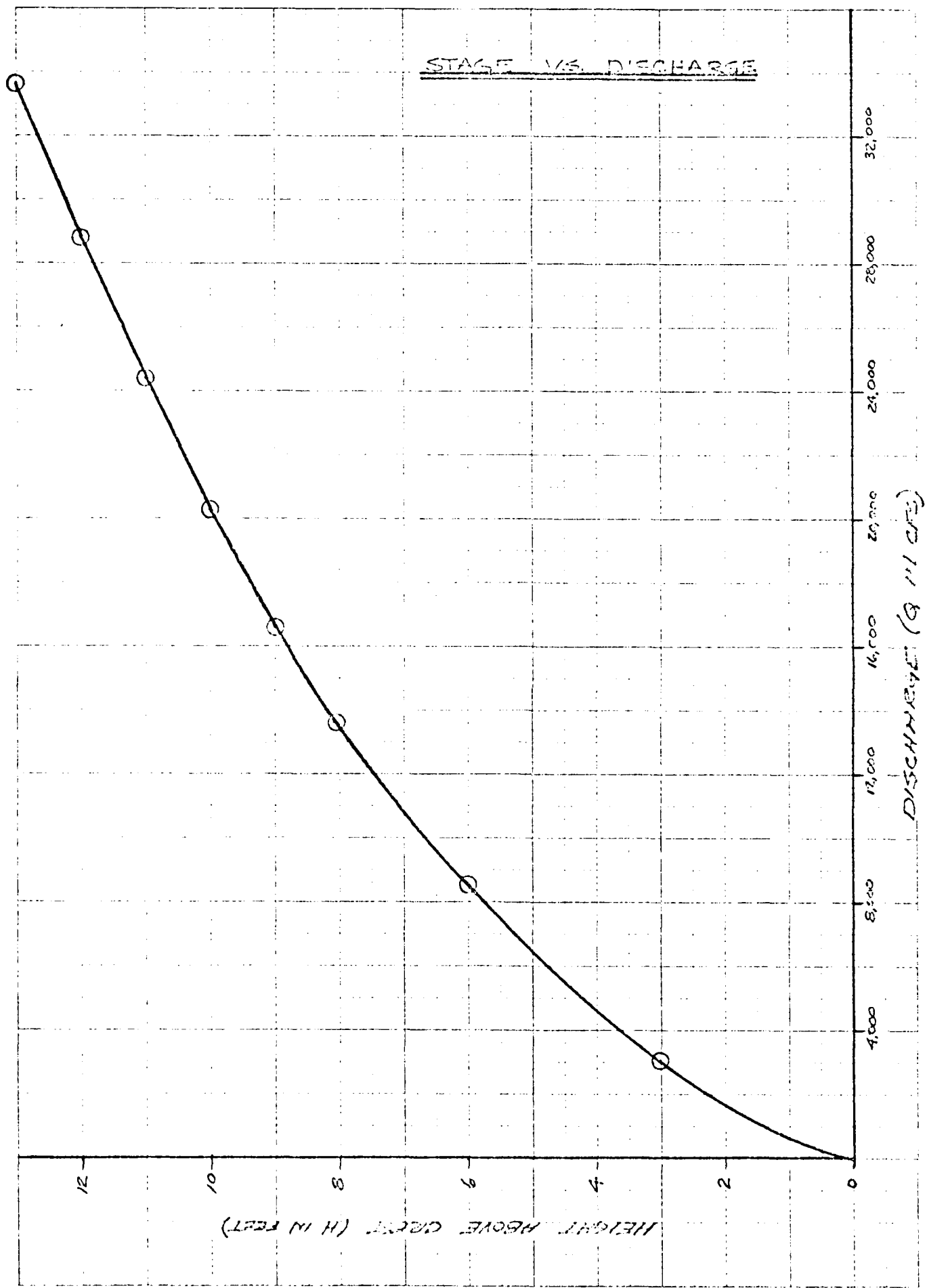
Storage Routing

Pond Surface Area = 4-5 Acres

Drainage Area = 201 square miles

Storage is "run-of-river"; therefore, routing would produce
insignificant reduction peak flood flows. No capacity curves
are developed or routing performed. Test Flood = 17,000 cfs

STAGE VS. DISCHARGE



DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.H. Duff SUBJECT Spillway Discharge Capacity SHEET NO. D-3 OF 1
DATE 3/1/50 APPRVD _____ JOB NO. 11-0076

Note: $Q = 11.17$

11.17 $Q = 610.2$

11.17 $Q = 616.2$

11.17 $Q = 612.05$

LENGTH 152'

ASSUME C FOR DAM = 3.83

$$h = 3' \quad Q = 3.83(152)(3)^{3/2} = \underline{3,064} \text{ cfs}$$

$$h = 6' \quad Q = 3.83(152)(6)^{3/2} = \underline{8,623.3}$$

$$h = 8.05' \quad Q = 3.83(152)(8.05)^{3/2} = 12,279$$

$$+ 2.5(21.5)(2.2)^{3/2} = 159$$

$$Q = \underline{12,438}$$

$$h = 9' \quad Q = 3.83(152)(9)^{3/2} = 15,924$$

$$+ 2.5(21.5)(3)^{3/2} = 279$$

$$+ 2.5(130)(.95)^{3/2} = 417$$

$$16,620$$

$$Q = \underline{16,620} \text{ cfs}$$

$$h = 10' \quad Q = 3.83(152)(10)^{3/2} = 18,650$$

$$+ 2.5(21.5)(4)^{3/2} = 430$$

$$+ 2.5(130)(1.9)^{3/2} = 1225$$

$$20305$$

$$Q = \underline{20,305} \text{ cfs}$$

$$h = 11' \quad Q = 3.83(152)(11)^{3/2} = 21,516$$

$$+ 2.5(21.5)(5)^{3/2} = 601$$

$$+ 2.5(130)(2.95)^{3/2} = 2280$$

$$24,397$$

$$Q = \underline{24,397} \text{ cfs}$$

$$h = 12' \quad Q = 3.83(152)(12)^{3/2} = 24,516$$

$$+ 2.5(21.5)(6)^{3/2} = 792$$

$$+ 2.5(130)(3.95)^{3/2} = 2523$$

$$28,839$$

$$Q = \underline{28,839} \text{ cfs}$$

$$h = 13' \quad Q = 3.83(152)(13)^{3/2} = 27,643$$

$$+ 2.5(21.5)(7)^{3/2} = 995$$

$$+ 2.5(130)(4.95)^{3/2} = 4,956$$

$$33,594$$

$$Q = \underline{33,594} \text{ cfs}$$

SUMMARY PRINTOUT FOR MULTIPLE PROFILES

MINNESOTA R. BR. TO TOWN

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF BRANCH	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE SCFS	CASEL	CRWS	EG	TOPMIN	ADRS	TIME	VEL
212.05	0.0	0.0	0.0	506.80	10540.00	513.24	513.24	516.33	130.73	91.40	0.0	0.0
212.05	0.0	0.0	0.0	506.80	31000.00	513.71	513.71	525.76	140.72	75.02	0.0	0.0
212.05	0.0	0.0	0.0	506.80	33600.00	520.52	520.52	528.74	156.34	21.45	0.0	0.0
212.05	0.0	0.0	0.0	506.80	48700.00	525.22	525.22	531.57	166.51	52.04	0.0	0.0
222.07	110.00	0.0	0.0	503.60	10540.00	516.32	0.0	516.79	145.49	7.62	0.01	3.51
222.07	110.00	0.0	0.0	503.60	31000.00	525.28	0.0	526.47	166.04	8.98	0.00	6.72
222.07	110.00	0.0	0.0	503.60	33600.00	526.19	0.0	527.46	166.46	9.04	0.00	7.08
222.07	110.00	0.0	0.0	503.60	48700.00	530.42	0.0	532.24	240.76	10.20	0.00	9.36
232.09	100.00	0.0	0.0	503.00	10540.00	516.25	0.0	516.92	157.41	10.03	0.01	7.73
232.09	100.00	0.0	0.0	503.00	31000.00	524.66	0.0	526.48	174.76	12.15	0.01	14.51
232.09	100.00	0.0	0.0	503.00	33600.00	525.84	0.0	527.67	162.97	12.52	0.01	15.25
232.09	100.00	0.0	0.0	503.00	48700.00	530.15	0.0	532.45	222.50	12.82	0.01	20.17
242.10	80.00	0.0	0.0	506.70	10540.00	515.79	0.0	517.18	154.78	35.45	0.01	9.66
242.10	80.00	0.0	0.0	506.70	31000.00	524.66	0.0	526.93	174.68	21.76	0.01	14.40
242.10	80.00	0.0	0.0	506.70	33600.00	525.83	0.0	527.62	172.81	21.14	0.01	14.31
242.10	80.00	0.0	0.0	506.70	48700.00	529.31	0.0	532.74	182.28	22.19	0.01	25.80
242.10	10.00	516.10	501.50	504.50	10540.00	516.89	0.0	518.33	149.29	60.81	0.01	9.50
242.10	10.00	516.10	504.50	504.50	31000.00	525.25	0.0	530.80	173.09	32.01	0.01	14.05
242.10	10.00	516.10	504.50	504.50	33600.00	527.48	0.0	531.33	174.62	32.03	0.01	20.05
242.10	10.00	516.10	504.50	504.50	48700.00	531.76	0.0	534.62	252.00	33.70	0.01	26.67
252.11	10.00	0.0	0.0	501.50	10540.00	516.72	0.0	518.94	144.86	76.16	0.01	10.11
252.11	10.00	0.0	0.0	501.50	31000.00	528.87	0.0	530.93	166.08	19.73	0.01	14.76
252.11	10.00	0.0	0.0	501.50	33600.00	529.19	0.0	531.49	170.14	21.64	0.01	20.77
252.11	10.00	0.0	0.0	501.50	48700.00	530.45	0.0	534.39	201.29	34.66	0.01	27.56
262.12	100.00	0.0	0.0	511.60	10540.00	518.74	518.74	521.72	152.26	96.11	0.01	12.00
262.12	100.00	0.0	0.0	511.60	31000.00	527.70	0.0	531.35	141.95	38.19	0.01	25.18
262.12	100.00	0.0	0.0	511.60	33600.00	527.72	0.0	532.23	141.95	44.66	0.01	26.54
262.12	100.00	0.0	0.0	511.60	48700.00	530.51	530.51	536.93	166.23	51.72	0.01	36.52
262.12	100.00	0.0	0.0	511.60	10540.00	519.23	0.0	521.78	133.62	72.98	0.02	12.75
262.12	100.00	0.0	0.0	511.60	31000.00	528.98	0.0	532.71	149.26	28.67	0.01	27.38
262.12	100.00	0.0	0.0	511.60	33600.00	528.95	0.0	532.77	147.30	34.20	0.01	28.55
262.12	100.00	0.0	0.0	511.60	48700.00	530.67	0.0	536.98	156.74	49.94	0.01	37.03
272.15	130.00	0.0	0.0	513.20	10540.00	521.39	0.0	522.49	141.20	29.31	0.02	15.68
272.15	130.00	0.0	0.0	513.20	31000.00	531.01	0.0	531.63	297.03	13.65	0.01	15.56
272.15	130.00	0.0	0.0	513.20	33600.00	531.47	0.0	533.25	305.53	14.71	0.01	16.90
272.15	130.00	0.0	0.0	513.20	48700.00	535.55	0.0	537.66	331.95	18.76	0.01	47.94
282.17	100.00	0.0	0.0	513.40	10540.00	521.77	0.0	522.79	149.99	29.32	0.02	16.81
282.17	100.00	0.0	0.0	513.40	31000.00	531.69	0.0	532.60	195.09	10.89	0.02	43.99
282.17	100.00	0.0	0.0	513.40	33600.00	532.25	0.0	533.44	195.09	11.14	0.02	45.76
282.17	100.00	0.0	0.0	513.40	48700.00	536.57	0.0	537.85	399.88	9.37	0.01	60.36

RI	6.921	52.000	1381.000	1461.000	543.000	543.000	543.000	0.0	0.0	0.0
GR	543.400	0.0	543.200	50.000	571.400	150.000	572.900	213.000	544.500	365.000
GR	545.400	470.000	545.100	475.000	546.000	500.000	546.200	574.000	547.200	601.000
GR	546.000	670.000	546.000	700.000	546.300	479.000	551.200	900.000	554.500	420.000
GR	556.000	1050.000	556.100	1225.000	553.400	1275.000	554.500	1375.000	549.100	1375.000
GR	555.000	1381.000	555.100	1587.000	555.100	1196.000	555.200	1405.000	556.400	1414.000
GR	556.000	1424.000	556.200	1634.000	555.100	1452.000	556.000	1461.000	556.400	1469.000
GR	559.000	1470.000	559.200	1670.000	553.000	1475.000	552.800	1525.000	555.000	1605.000
GR	559.000	1815.000	547.500	1945.000	544.800	1480.000	546.000	1945.000	545.400	2005.000
GR	549.000	2315.000	546.100	2015.000	545.200	2040.000	544.800	2045.000	545.800	2046.000
GR	549.200	2170.000	549.200	2180.000	549.100	2230.000	551.200	2290.000	551.800	2330.000
GR	551.400	2350.000	576.700	2450.000	0.0	0.0	0.0	0.0	0.0	0.0
RI	4.921	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
BT	2.000	1375.010	554.500	549.100	1470.000	554.500	549.100	0.0	0.0	0.0
RI	6.930	0.0	0.0	0.0	35.000	35.000	35.000	0.0	0.0	0.0
AZ	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
RI	6.930	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
RM	3.000	0.070	1161.000	0.035	1260.000	0.070	1500.000	0.0	0.0	0.0
NC	0.070	0.070	0.035	0.0	0.500	0.0	0.0	0.0	0.0	0.0
RI	655.030	31.000	1255.000	1257.000	528.000	528.000	528.000	0.0	0.0	0.0
GR	571.950	0.0	552.900	65.000	548.500	215.000	545.400	120.000	545.100	323.000
GR	546.000	350.000	546.200	429.000	547.400	513.000	544.900	520.000	546.400	550.000
GR	546.300	670.000	551.200	750.000	550.500	770.000	550.800	810.000	546.100	841.000
GR	546.700	849.000	549.700	1011.000	550.000	1090.000	541.700	1120.000	540.500	1161.000
GR	549.700	1205.000	551.800	1271.000	540.500	1251.000	543.700	1280.000	549.200	1275.000
GR	562.700	1585.000	551.800	1284.000	551.400	1310.000	551.800	1350.000	562.300	1370.000
GR	570.300	1500.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.030	0.030	0.035	0.0	0.500	0.0	0.0	0.0	0.0	0.0
RI	665.190	17.000	551.000	605.000	645.000	645.000	645.000	0.0	0.0	0.0
GR	549.000	0.0	557.100	51.000	557.300	240.000	558.800	395.000	556.800	409.000
GR	554.000	411.000	552.700	521.000	547.000	533.000	547.000	605.000	547.000	675.000
GR	556.100	645.000	552.900	625.000	560.800	655.000	560.800	665.000	561.800	701.000
GR	561.000	1135.000	560.500	1241.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.080	0.035	0.0	0.500	0.0	0.0	0.0	0.0	0.0
RI	675.340	11.000	270.000	360.000	645.000	645.000	645.000	0.0	0.0	0.0
GR	540.000	0.0	567.000	57.000	566.600	230.000	569.100	270.000	550.700	316.000
GR	548.700	712.000	552.700	360.000	554.100	374.000	565.500	470.000	546.100	479.000
GR	574.500	501.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.080	0.040	0.0	0.500	0.0	0.0	0.0	0.0	0.0
RI	685.510	19.000	460.000	510.000	645.000	645.000	645.000	0.0	0.0	0.0
GR	596.000	0.0	545.000	30.000	594.800	70.000	592.800	40.000	590.500	230.000
GR	571.000	250.000	575.200	272.000	577.700	296.000	577.600	310.000	574.400	337.000
GR	565.000	394.000	560.300	610.000	558.000	480.000	553.000	510.000	570.000	560.000
GR	575.000	570.000	560.000	585.000	585.000	595.000	595.000	605.000	0.0	0.0
RI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
X1	574.190	15.000	58.000	102.000	525.000	525.000	525.000	0.0	0.0	0.0
GA	570.000	0.0	558.700	0.100	557.800	72.000	535.000	5.000	529.600	58.000
GB	573.600	78.000	577.000	102.000	577.800	160.000	538.900	174.000	536.000	231.000
GC	536.100	308.000	537.000	365.000	540.000	168.100	550.000	566.200	570.000	368.300
X1	584.270	19.000	100.000	156.000	420.000	420.000	420.000	0.0	0.0	0.0
GA	570.000	0.0	576.000	0.100	556.000	16.000	555.000	25.000	545.000	41.000
GB	596.800	57.000	577.000	71.000	528.600	100.000	525.000	419.000	526.000	125.000
GC	576.000	156.000	577.000	209.000	536.000	233.000	538.000	336.000	538.000	425.000
GC	536.800	420.100	545.000	422.200	550.000	420.000	570.000	926.400	0.0	0.0
NC	0.050	0.040	0.035	0.100	0.200	0.0	0.0	0.0	0.0	0.0
X1	594.360	50.000	386.000	439.100	470.000	470.000	470.000	0.0	0.0	0.0
GA	570.000	0.0	565.000	10.000	550.000	30.000	555.000	46.000	555.000	65.000
GB	596.800	166.000	576.000	195.000	577.800	266.000	529.200	324.000	528.000	349.000
GC	576.000	180.000	576.000	407.000	577.500	434.000	537.300	444.000	526.000	519.000
GC	576.000	365.000	576.000	455.000	576.800	755.000	537.000	644.000	560.000	625.000
GC	544.000	1649.000	542.000	143.000	545.000	1805.000	550.000	1625.000	555.000	1635.000
GC	555.000	1845.000	555.000	1845.000	560.000	1885.000	565.000	1915.000	570.000	1950.000
GC	6.000	1696.000	1700.000	1980.000	1676.000	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.040	0.035	0.100	0.200	0.0	0.0	0.0	0.0	0.0
X1	6.568	35.000	250.000	296.000	1020.000	1020.000	1020.000	0.0	0.0	0.0
GA	576.000	0.0	570.000	14.000	565.000	28.000	550.000	68.000	545.000	78.000
GB	560.000	86.000	545.000	118.000	545.000	158.000	546.000	226.000	526.500	230.000
GC	576.000	218.000	570.000	263.000	571.700	250.000	525.400	258.000	525.000	287.000
GC	576.000	275.000	576.000	283.000	533.100	289.000	536.000	296.000	536.000	302.000
GC	576.000	306.000	577.000	319.000	535.700	322.000	546.000	324.000	546.000	327.000
GC	561.000	1014.000	562.000	1039.000	565.000	1564.000	550.000	1576.000	555.000	1584.000
GC	555.000	1646.000	555.000	1769.000	560.000	1836.000	565.000	1866.000	570.000	1886.000
X1	6.568	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
BT	2.000	22.000	366.610	537.600	326.000	546.410	539.400	0.0	0.0	0.0
X1	614.550	0.0	0.0	0.0	20.000	20.000	20.000	0.0	0.0	0.0
X2	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
X1	6.551	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
NC	0.050	0.040	0.035	0.0	0.500	0.0	0.0	0.0	0.0	0.0
GC	5.000	0.050	119.000	0.035	250.000	0.000	770.000	0.035	872.000	0.000
GC	1672.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	676.710	57.000	762.000	847.000	950.000	950.000	950.000	0.0	0.0	0.0
GA	570.000	0.0	565.000	20.000	560.000	35.000	555.000	50.000	550.000	65.000
GB	565.000	79.000	540.000	107.000	575.000	115.000	578.000	151.000	578.000	180.000
GC	528.000	201.000	527.000	276.000	536.000	250.000	537.000	335.000	537.200	300.000
GC	576.610	566.000	576.000	576.000	577.000	655.000	577.700	766.000	575.900	756.000
GC	576.000	770.000	576.000	762.000	577.400	812.000	578.000	849.000	576.000	856.000
GC	576.000	872.000	576.000	945.000	580.000	1000.000	594.000	1116.000	596.000	1230.000
GC	566.000	1319.000	566.000	1317.000	566.000	1361.000	556.100	1466.000	569.300	1519.000
GC	566.000	1556.000	565.000	1672.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	676.820	50.000	806.000	962.000	476.000	476.000	476.000	0.0	0.0	0.0
GA	570.000	0.0	565.000	15.000	560.000	40.000	555.000	60.000	552.000	103.000
GB	565.000	131.000	565.000	151.000	543.100	170.000	539.100	187.000	539.000	221.000
GC	531.000	225.000	526.000	268.000	535.500	504.000	531.000	515.000	531.000	517.000
GC	572.700	573.000	573.100	574.000	575.300	645.000	538.500	735.000	538.000	763.000
GC	576.000	835.000	577.000	855.000	577.500	946.000	577.700	946.000	576.000	965.000
GC	577.000	1075.000	577.000	1085.000	575.000	1095.000	586.000	1165.000	586.000	1165.000
GC	565.700	1275.000	566.000	1364.000	566.000	1365.000	567.000	1396.000	567.000	1440.000
GC	566.000	1455.000	566.000	1466.000	565.000	1506.000	565.400	1505.000	566.100	1510.000
GC	565.000	1615.000	565.000	1626.000	565.000	1681.000	565.200	1680.000	569.200	1675.000
GC	566.700	1725.000	566.000	1745.000	566.000	1825.000	567.400	1825.000	576.700	1845.000
NC	0.050	0.040	0.035	0.0	0.500	0.0	0.0	0.0	0.0	0.0

GR	528.300	444.000	533.600	444.000	534.200	444.000	539.400	502.000	545.600	514.000
GR	546.400	542.000	543.200	551.000	570.000	570.000	567.000	0.0	0.0	0.0
NC	0.050	0.050	0.055	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	50.352	18.000	278.000	336.000	540.000	540.000	540.000	0.0	0.0	0.0
GR	570.000	0.0	554.000	0.100	554.000	18.000	549.000	40.000	545.000	86.000
GR	542.400	148.000	522.000	162.000	526.200	166.000	525.200	222.000	525.800	278.000
GR	575.400	336.000	532.400	339.000	534.000	358.000	533.000	401.000	542.400	426.000
GR	546.000	460.000	550.000	502.000	570.000	652.000	0.0	0.0	0.0	0.0
NC	0.050	0.050	0.055	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	515.652	17.000	264.000	266.000	680.000	680.000	680.000	0.0	0.0	0.0
GR	570.000	0.0	554.000	22.000	552.000	75.000	547.000	75.100	546.400	106.000
GR	573.800	134.000	535.000	167.000	524.800	177.000	525.400	246.000	526.400	254.000
GR	520.000	503.000	526.800	322.000	534.000	360.000	534.000	360.000	544.400	573.000
GR	549.400	405.000	570.000	445.000	0.0	0.0	0.0	0.0	0.0	0.0
RI	523.800	22.000	467.000	541.000	790.000	790.000	790.000	0.0	0.0	0.0
GR	570.000	0.0	562.000	22.000	551.000	34.000	553.000	77.000	552.200	115.000
GR	551.200	138.000	545.100	167.000	545.400	147.000	546.400	241.000	546.000	313.000
GR	542.400	445.000	522.000	447.000	522.800	553.000	524.000	574.000	532.400	574.000
GR	541.000	541.000	545.000	615.000	552.000	621.000	552.000	604.000	555.000	647.000
GR	560.000	674.000	570.000	687.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.055	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	533.920	24.000	523.000	562.000	660.000	660.000	660.000	0.0	0.0	0.0
GR	570.000	0.0	562.000	34.000	545.600	103.000	546.000	214.000	546.000	236.000
GR	545.200	264.000	541.000	346.000	543.200	440.000	542.000	442.000	535.000	548.000
GR	533.200	518.000	522.200	520.000	524.200	532.000	526.400	540.000	526.400	632.000
GR	528.000	643.000	533.200	453.000	562.000	690.000	542.000	702.000	546.000	712.000
GR	554.000	715.000	555.000	723.000	560.000	730.000	570.000	764.000	546.000	0.0
NC	0.050	0.050	0.055	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	53.100	17.000	203.000	326.000	543.000	540.000	540.000	0.0	0.0	0.0
GR	570.000	0.0	564.000	36.000	544.000	160.000	546.800	194.000	540.000	199.000
GR	534.600	263.000	525.000	272.100	524.000	229.000	525.000	276.000	525.100	328.000
GR	525.700	342.000	534.600	546.000	546.000	371.000	544.800	351.100	546.400	503.000
GR	550.000	500.100	573.000	502.200	0.0	0.0	0.0	0.0	0.0	0.0
RI	53.200	0.0	0.0	0.0	5.000	5.000	5.000	0.0	0.0	0.0
BT	2.000	129.100	544.600	543.200	351.000	544.800	560.200	0.0	0.0	0.0
RI	53.100	0.0	0.0	0.0	15.000	15.000	15.000	0.0	0.0	0.0
RI	0.0	0.0	0.0	0.0	0.0	0.0	16.000	0.0	0.0	0.0
RI	544.020	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
RI	54.100	16.000	162.400	238.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	570.000	0.0	543.200	0.100	544.000	142.000	538.000	142.100	538.400	106.000
GR	510.600	146.100	527.100	144.000	525.800	162.600	544.500	206.000	527.000	238.000
GR	518.400	274.100	534.800	242.000	544.000	246.000	544.000	254.000	546.400	342.000
GR	570.000	542.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI	54.200	0.0	0.0	0.0	5.000	5.000	5.000	0.0	0.0	0.0
BT	2.000	102.100	544.000	539.400	242.000	544.000	539.000	0.0	0.0	0.0
RI	54.300	0.0	0.0	0.0	25.000	25.000	25.000	0.0	0.0	0.0
RI	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
RI	554.050	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
RI	544.050	19.000	285.000	320.000	211.000	211.000	211.000	0.0	0.0	0.0
GR	570.000	0.0	563.000	10.000	542.200	30.000	541.200	42.000	542.000	43.000
GR	540.000	102.000	538.400	160.000	524.500	175.000	527.400	221.000	526.400	255.000
GR	526.000	285.000	524.000	118.000	543.800	320.000	546.000	337.000	545.600	346.000
GR	546.000	384.000	545.600	410.000	550.000	410.100	570.000	414.200	0.0	0.0

11	10.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GR	560.000	0.0	543.300	81.000	537.400	120.000	536.000	162.000	535.800	190.000
GR	535.400	208.000	534.200	525.000	532.600	382.000	520.000	445.000	515.800	506.000
GR	515.400	500.000	520.800	560.000	526.200	576.000	512.000	586.000	536.600	547.000
GR	538.700	604.000	527.000	642.000	527.000	676.000	520.200	700.000	532.500	738.000
GR	535.200	745.000	537.900	893.000	538.300	920.000	540.000	920.100	545.000	920.200
GR	550.000	920.500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	45.000	14.000	63.000	158.000	130.000	430.000	150.000	0.0	0.0	0.0
GR	570.000	0.0	553.000	0.100	533.000	0.200	533.000	0.000	527.400	4.100
GR	522.200	32.000	517.000	61.000	517.400	153.000	522.200	190.000	525.800	206.100
GR	532.700	213.000	532.700	221.000	530.000	221.100	570.000	221.200	0.0	0.0
11	45.100	20.000	71.100	151.000	5.000	5.000	5.000	0.0	0.0	0.0
GR	0.0	0.0	0.0	535.200	538.800	0.0	0.0	0.0	0.0	0.0
GR	570.000	0.0	550.300	0.100	533.000	0.200	533.000	0.000	527.400	4.100
GR	517.400	61.000	515.200	61.000	535.200	71.000	517.400	71.100	518.600	112.000
GR	517.400	142.000	515.200	142.000	535.200	153.000	517.400	153.000	522.200	190.000
GR	525.800	206.000	532.700	213.000	532.700	221.000	530.000	221.100	570.000	221.200
11	45.200	0.0	0.0	0.0	25.000	25.000	25.000	0.0	0.0	0.0
GR	0.0	0.0	0.0	535.200	538.800	0.0	0.0	0.0	0.0	0.0
11	45.300	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
GR	0.000	0.000	0.000	0.100	0.200	0.0	0.0	0.0	0.0	0.0
11	46.100	22.000	687.000	710.000	235.000	235.000	235.000	0.0	0.0	0.0
GR	570.000	0.0	547.300	182.000	543.800	360.000	537.500	381.000	537.500	419.000
GR	516.700	402.000	532.500	670.000	532.700	525.000	521.800	540.000	519.100	610.000
GR	516.600	687.000	516.100	710.000	519.400	735.000	520.400	746.000	528.400	785.000
GR	537.700	870.000	536.800	855.000	535.000	648.000	536.000	640.000	541.200	672.000
GR	545.000	985.000	570.000	1070.000	0.0	0.0	0.0	0.0	0.0	0.0
11	47.300	21.000	627.000	481.000	555.000	555.000	555.000	0.0	0.0	0.0
GR	570.000	0.0	557.600	1.000	557.500	22.000	565.000	40.000	538.000	160.000
GR	516.800	176.000	535.800	262.000	536.000	318.000	521.200	340.000	520.000	340.000
GR	516.600	335.000	515.600	427.000	517.500	455.000	516.800	460.000	525.000	449.000
GR	516.000	407.000	535.300	529.000	538.200	576.000	563.200	587.000	543.500	615.000
GR	570.000	706.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GR	0.000	0.000	0.000	0.100	0.200	0.0	0.0	0.0	0.0	0.0
11	48.500	26.000	819.000	193.000	230.000	230.000	230.000	0.0	0.0	0.0
GR	570.000	0.0	542.200	103.000	540.800	167.000	540.900	310.000	539.400	310.100
GR	517.400	310.200	535.400	411.000	533.500	415.100	533.500	316.000	430.700	316.100
GR	517.700	348.000	517.800	316.100	518.800	339.000	517.000	362.000	517.400	393.000
GR	522.800	470.000	526.000	448.000	532.000	448.100	532.000	449.000	533.400	449.100
GR	516.400	471.000	539.800	432.100	527.000	497.000	545.000	520.000	547.900	553.000
GR	570.000	560.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GR	0.000	0.000	0.000	0.100	0.200	0.0	0.0	0.0	0.0	0.0
11	48.100	0.0	0.0	0.0	5.000	5.000	5.000	0.0	0.0	0.0
GR	2.000	310.200	540.900	535.500	452.000	539.400	534.000	0.0	0.0	0.0
11	48.200	0.0	0.0	0.0	25.000	25.000	25.000	0.0	0.0	0.0
GR	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
11	48.250	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
GR	0.000	0.000	0.000	0.100	0.200	0.0	0.0	0.0	0.0	0.0
11	48.300	0.0	0.0	0.0	620.000	620.000	620.000	0.0	0.0	0.0
GR	0.000	0.000	0.000	0.100	0.200	0.0	0.0	0.0	0.0	0.0
11	49.100	21.000	273.000	246.100	10.000	10.000	10.000	0.0	0.0	0.0
GR	570.000	0.0	557.000	15.000	550.400	67.000	567.000	140.000	546.400	151.000
GR	517.200	182.000	541.800	276.000	539.400	270.000	536.000	273.000	534.000	273.100
GR	521.400	273.200	521.400	279.000	534.000	290.100	534.000	290.000	528.300	290.100

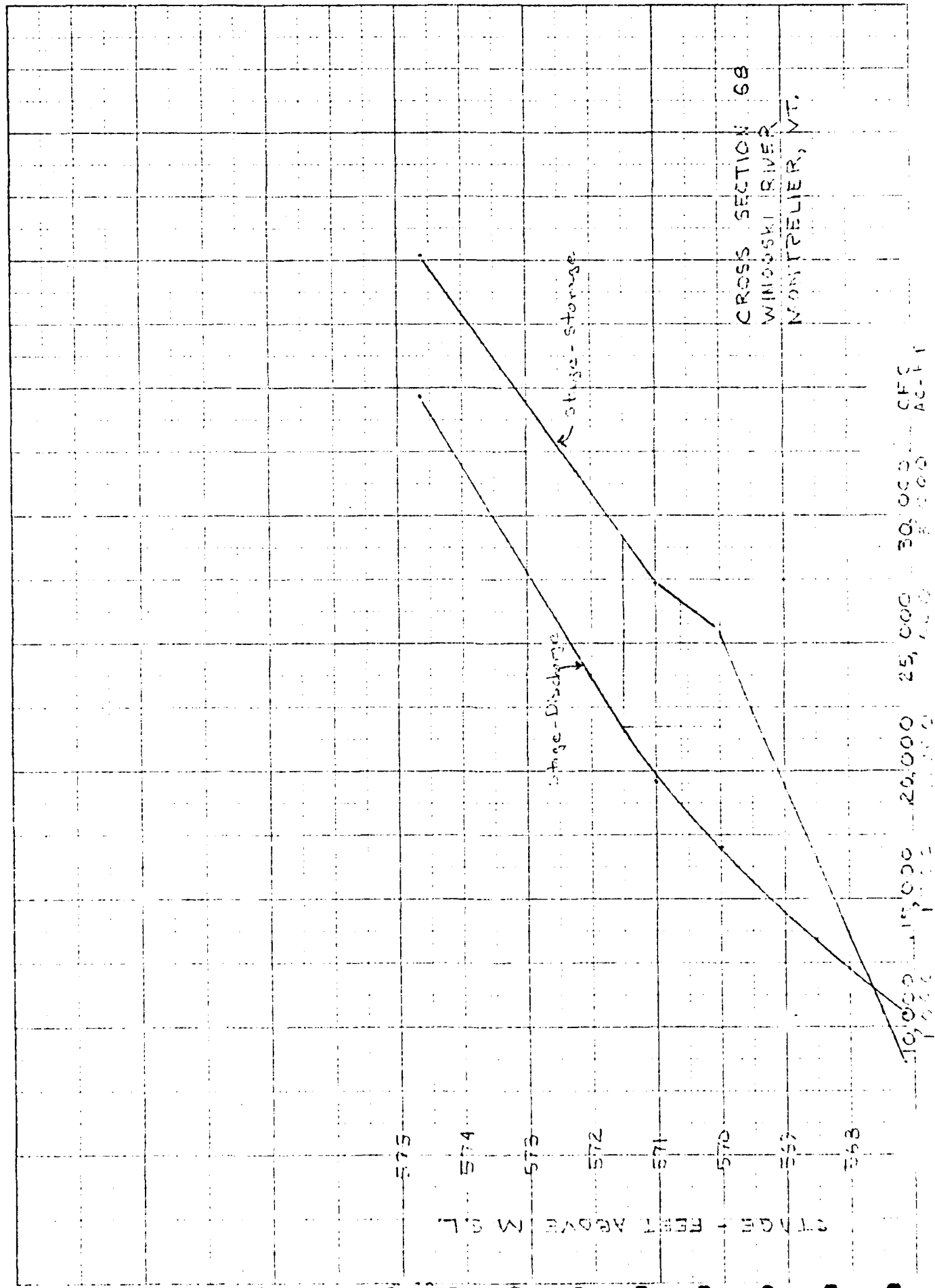
CA	532.000	193.000	530.000	189.000	529.200	195.000	519.800	204.000	519.000	209.000
CB	511.000	222.000	515.000	237.000	515.200	308.000	515.000	340.000	519.000	377.000
CC	528.000	385.000	530.000	395.000	530.000	408.000	530.700	510.000	511.000	516.000
CD	511.000	578.000	510.700	580.000	538.100	832.000	541.000	674.000	547.200	806.000
CE	547.700	829.000	550.000	836.000	560.000	846.000	0.0	0.0	0.0	0.0
CF	0.060	0.060	0.085	0.100	0.200	0.0	0.0	0.0	0.0	0.0
CG	582.540	31.000	152.000	338.000	500.000	500.000	500.000	0.0	0.0	0.0
CH	500.000	3.0	550.000	16.000	550.800	16.000	550.000	20.000	548.000	61.000
CI	515.000	101.000	531.000	111.000	531.200	115.000	531.000	157.000	530.900	169.000
CJ	514.000	152.000	527.200	157.000	544.500	108.000	514.200	108.000	514.400	208.000
CK	519.800	229.000	515.000	248.000	518.500	299.000	519.800	310.000	523.800	374.000
CL	529.500	118.000	531.000	418.000	510.700	477.000	530.300	545.000	532.100	605.000
CM	514.800	719.000	540.300	748.000	540.500	874.600	547.400	887.000	553.000	883.000
CN	560.000	943.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO	0.060	0.060	0.085	0.100	0.200	0.0	0.0	0.0	0.0	0.0
CP	392.650	20.000	18.000	293.000	650.000	650.000	650.000	0.0	0.0	0.0
CQ	540.700	0.0	550.000	0.100	519.000	0.200	533.000	50.000	531.200	74.000
CR	523.700	91.000	521.000	103.000	516.100	112.000	516.000	270.000	521.800	265.000
CS	529.300	285.000	531.200	291.000	511.200	384.000	529.000	670.000	530.700	595.000
CT	533.900	628.000	536.000	713.000	536.800	736.000	550.000	730.100	560.000	734.200
CU	39.000	0.0	0.0	0.0	10.000	10.000	10.000	0.0	0.0	0.0
CV	6.000	96.000	535.200	533.000	78.000	535.200	531.200	292.000	535.200	531.200
CW	324.000	531.210	531.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CX	39.200	0.0	0.0	0.0	10.000	10.000	10.000	0.0	0.0	0.0
CY	0.0	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0
CZ	39.300	0.0	0.0	0.0	1.000	1.000	1.000	0.0	0.0	0.0
DA	607.750	23.000	137.000	289.000	360.000	360.000	360.000	0.0	0.0	0.0
DB	500.000	0.0	546.200	28.000	537.800	84.000	534.200	80.000	537.800	114.000
DC	517.200	118.000	520.200	137.000	517.200	179.000	517.600	202.000	520.000	269.000
DD	529.000	307.000	531.200	244.000	532.800	379.000	532.000	619.000	532.500	646.000
DE	531.000	516.000	530.800	615.000	533.400	626.000	535.000	689.000	536.000	717.000
DF	540.200	717.100	550.000	729.000	560.000	770.000	0.0	0.0	0.0	0.0
DG	0.060	0.060	0.085	0.100	0.200	0.0	0.0	0.0	0.0	0.0
DH	617.830	28.000	185.000	326.000	510.000	510.000	510.000	0.0	0.0	0.0
DI	580.000	0.0	540.300	71.000	531.800	94.000	530.000	121.000	533.200	129.000
DJ	512.000	157.000	515.000	172.000	519.000	181.000	519.000	185.000	520.400	198.000
DK	518.000	210.000	519.000	245.000	517.200	272.000	519.000	326.000	525.200	338.000
DL	527.500	184.000	510.200	400.000	518.000	514.000	518.000	502.000	524.200	535.000
DM	532.000	545.000	530.500	685.000	539.800	685.000	539.800	645.000	550.000	699.000
DN	540.000	729.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DO	0.060	0.060	0.085	0.100	0.200	0.0	0.0	0.0	0.0	0.0
DP	627.910	24.000	122.000	269.000	605.000	605.000	605.000	0.0	0.0	0.0
DQ	580.000	0.0	538.000	35.000	537.000	76.000	536.200	80.000	530.000	93.000
DR	520.000	44.000	520.000	105.000	520.000	121.000	518.000	160.000	517.000	216.000
DS	519.800	269.000	526.000	262.000	528.000	334.000	518.000	387.000	529.800	617.000
DT	531.200	680.000	532.700	546.000	540.200	646.000	537.000	649.000	537.000	662.000
DU	536.000	689.000	540.300	700.000	550.000	722.000	560.000	750.000	0.0	0.0
DV	0.060	0.060	0.085	0.100	0.200	0.0	0.0	0.0	0.0	0.0
DW	632.990	24.000	291.000	407.000	625.000	625.000	625.000	0.0	0.0	0.0
DX	580.000	0.0	551.000	18.000	545.200	89.000	547.000	100.000	536.100	133.000
DY	536.100	199.000	533.000	261.000	527.000	273.000	522.000	281.000	517.200	332.000
DZ	516.800	381.000	519.000	427.000	521.000	639.000	527.000	667.000	526.000	690.000
EA	528.000	515.000	527.000	575.000	530.200	609.000	525.000	639.000	516.000	670.000
EB	537.000	879.000	538.800	651.000	540.800	821.000	542.800	869.000	550.000	914.000
EC	580.000	986.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ED	643.070	26.000	445.000	560.000	630.000	630.000	630.000	0.0	0.0	0.0

BA	510.500	143.000	508.500	187.000	509.800	228.000	512.300	248.000	514.800	271.000
GR	528.000	273.000	528.800	323.000	527.800	380.000	528.900	453.000	528.800	478.000
RI	252.110	19.000	127.000	272.200	10.000	10.000	10.000	0.0	0.0	0.0
GR	560.000	0.0	510.500	24.000	510.500	58.000	510.800	78.000	528.000	127.000
GR	522.800	127.100	511.500	127.200	513.200	183.000	508.500	187.000	509.400	227.000
GR	512.400	247.000	514.800	272.000	520.800	272.100	518.000	272.200	528.800	321.000
GR	527.700	380.000	528.800	453.000	528.700	478.000	580.000	480.000	0.0	0.0
RI	262.170	21.000	443.000	564.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	560.000	0.0	550.000	11.000	541.800	51.000	528.800	217.000	531.900	244.000
GR	530.200	359.000	530.200	408.000	530.400	443.000	530.000	443.100	519.300	443.200
GR	511.700	441.100	511.800	458.000	512.200	504.000	514.300	568.000	514.300	577.000
GR	522.000	58.000	530.000	585.100	529.500	592.000	528.800	657.000	528.300	685.000
GR	560.000	685.100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SB	0.900	1.580	2.500	0.0	141.600	3.000	2115.000	0.010	511.600	511.600
RI	28.300	0.0	0.0	0.0	41.000	41.000	41.000	0.0	0.0	0.0
RI	0.0	0.0	1.000	528.800	531.500	0.0	0.0	0.0	0.0	0.0
BT	11.000	11.000	538.800	0.0	249.000	531.500	0.0	359.000	530.200	0.0
BT	408.000	530.200	0.0	443.000	531.500	0.0	508.500	530.200	0.0	589.000
BT	532.300	0.0	522.000	529.500	0.0	657.000	528.800	0.0	685.000	528.300
BT	0.0	685.100	538.800	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI	272.150	21.000	143.000	220.000	130.000	130.000	130.000	0.0	0.0	0.0
GR	560.000	0.0	550.000	0.100	532.800	0.200	528.800	78.000	529.200	98.000
GR	528.800	118.000	529.300	127.000	528.800	131.000	519.300	244.000	511.600	118.000
GR	514.300	172.000	513.200	213.600	513.200	255.000	514.300	287.000	511.600	320.000
GR	519.300	324.000	528.800	324.000	527.500	322.310	524.300	330.100	550.000	322.200
GR	580.000	332.300	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	262.170	21.000	45.100	299.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	560.000	0.0	550.000	0.100	528.800	0.200	527.800	61.000	527.400	71.000
GR	527.800	60.100	528.200	89.000	527.100	95.000	528.900	95.100	520.000	101.000
GR	519.300	108.000	513.000	138.000	513.000	171.000	513.900	208.000	514.000	249.000
GR	518.700	289.000	517.100	290.000	528.900	299.000	527.000	400.000	550.000	400.000
GR	580.000	400.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	312.230	21.000	130.000	349.000	300.000	300.000	300.000	0.0	0.0	0.0
GR	560.000	0.0	550.000	0.100	528.800	0.200	527.800	69.000	528.600	100.000
GR	528.800	119.000	528.700	130.000	528.100	137.000	514.300	141.000	514.200	168.000
GR	514.300	207.000	516.600	250.000	515.300	202.000	518.800	238.000	514.300	335.000
GR	528.700	345.000	527.400	348.000	527.200	385.000	527.300	480.000	550.000	485.100
GR	560.000	485.200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.080	0.080	0.035	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	352.310	21.000	118.000	329.200	400.000	400.000	400.000	0.0	0.0	0.0
GR	560.000	0.0	529.400	14.000	528.800	34.000	527.800	89.000	527.600	103.000
GR	528.200	118.000	525.400	124.000	519.300	137.000	518.800	189.000	515.800	220.000
GR	518.000	281.000	517.400	329.000	519.300	324.100	528.200	324.200	527.800	324.300
GR	529.000	373.000	525.000	402.000	528.800	408.000	527.800	459.000	529.200	522.000
GR	532.100	593.000	532.900	627.000	580.000	627.100	0.0	0.0	0.0	0.0
RI	362.340	27.000	147.000	388.000	430.000	430.000	430.000	0.0	0.0	0.0
GR	560.000	0.0	550.000	25.000	543.100	36.000	531.900	80.000	532.100	97.000
GR	529.400	145.000	529.100	154.000	529.300	175.000	529.100	191.000	527.300	197.000
GR	520.000	259.000	519.300	213.000	519.400	238.000	515.800	277.000	515.500	317.000
GR	515.500	348.000	519.300	348.000	519.700	357.000	529.500	393.000	529.900	455.000
GR	530.100	498.000	530.500	523.000	531.100	572.000	534.000	608.000	543.300	659.000
GR	550.000	711.000	560.000	761.000	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.060	0.060	0.035	0.100	0.200	0.0	0.0	0.0	0.0	0.0
RI	372.440	28.000	209.000	377.000	500.000	500.000	500.000	0.0	0.0	0.0
GR	560.000	0.0	588.800	73.000	537.800	61.000	534.500	100.000	534.400	128.000

 MEC2 VERSION UPDATED JAN 1975
 ERROR CORRECTIONS 01.02.03.04.05.06.07.08
 MODIFICATIONS 52.53.54.55.56.57.58

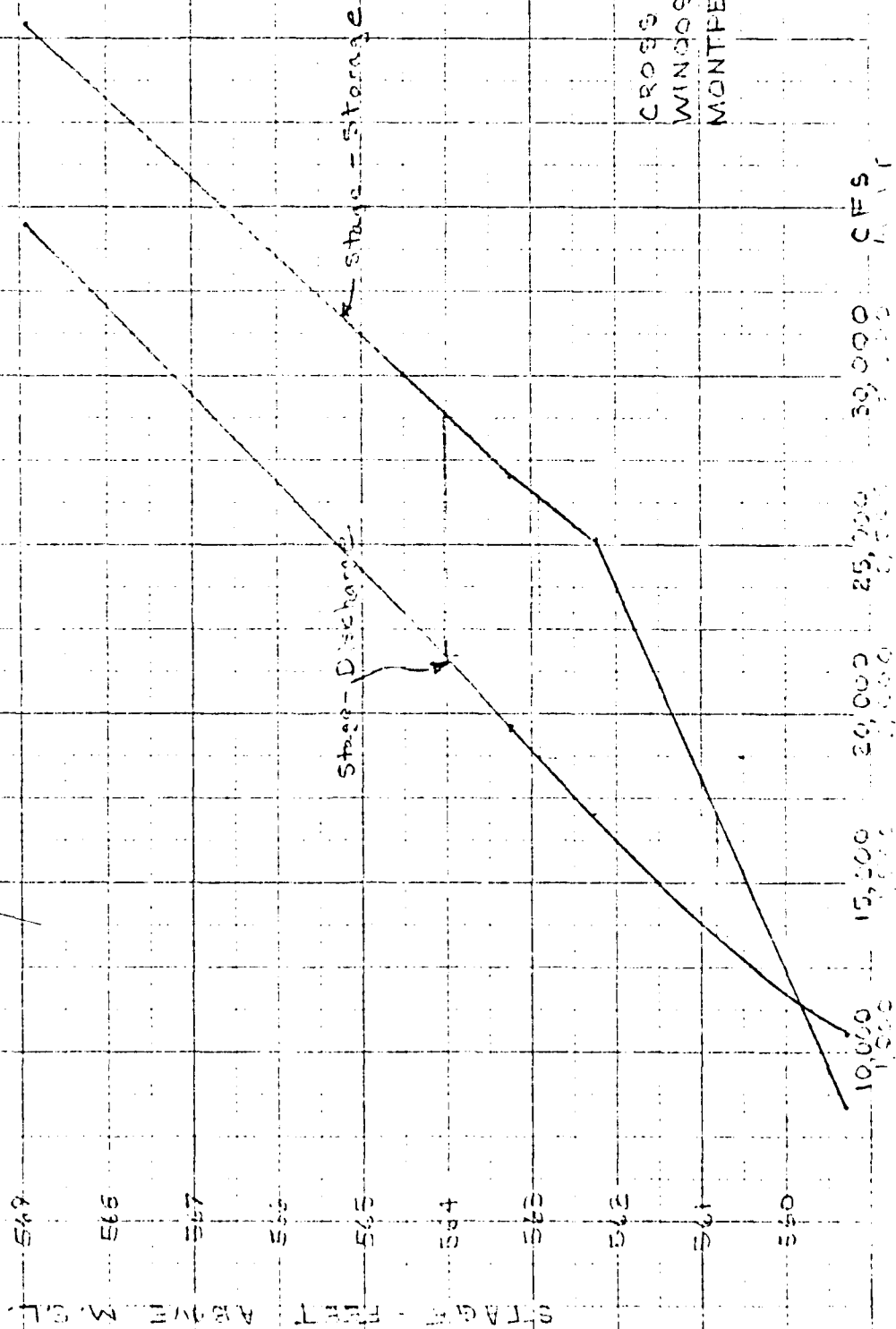
T1 FLOODWAY ANALYSIS FOR THE CITY OF MONTPELIER, VERMONT
 T2 EXISTING CONDITIONS WITH DAM FAILURE
 T3 WINDOOSKI R. BR TO TOWN LINE

J1	ICHECK	INC	MINV	DIR	STAT	METRIC	WVINS	Q	MSL	FO
	0.	2.	0.	0.	-1.000000	0.0	0.0	0.	506.805	0.0
J2	APPROF	IPLOT	PREVS	ASECH	KSECH	FM	ALLDC	16W	CHWIM	ITRACE
	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QT	6.000	16540.000	31000.000	33400.000	48700.000	0.0	0.0	0.0	0.0	0.0
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
AI	212.050	16.000	178.000	202.000	0.0	0.0	0.0	0.0	0.0	0.0
GR	500.000	0.0	529.000	500.000	528.000	0.0	0.0	520.000	140.000	519.000
GR	511.700	159.100	507.000	178.000	506.000	200.000	506.000	506.000	507.000	420.000
GR	506.000	271.000	507.000	282.000	523.000	300.000	520.000	520.000	520.000	520.000
GR	500.000	427.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NC	0.005	0.005	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
AI	222.070	20.000	136.000	247.000	110.000	110.000	110.000	0.0	0.0	0.0
GR	500.000	0.0	550.000	0.000	529.000	500.000	500.000	0.0	530.000	490.000
GR	510.000	127.000	526.000	191.000	508.000	110.000	507.000	110.000	506.000	152.000
GR	504.000	159.000	503.000	178.000	506.000	247.000	507.000	240.000	505.000	249.000
GR	506.000	304.000	506.000	319.000	530.000	319.000	550.000	319.000	500.000	259.000
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
AI	217.090	23.000	137.000	257.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	490.000	0.0	550.000	0.000	510.000	0.000	510.000	0.000	500.000	490.000
GR	510.100	80.000	508.000	0.000	520.000	110.000	500.000	110.000	500.000	110.000
GR	506.000	129.000	506.000	187.000	500.000	190.000	500.000	190.000	510.000	457.000
GR	508.000	250.000	509.000	280.000	520.000	290.000	520.000	270.000	520.000	470.000
GR	520.500	490.000	550.000	0.000	500.000	0.000	0.0	0.0	0.0	0.0
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
AI	242.100	19.000	120.000	271.000	60.000	60.000	60.000	0.0	0.0	0.0
GR	500.000	0.0	550.000	0.000	530.000	0.000	530.000	0.000	510.000	490.000
GR	510.100	80.000	510.000	117.000	510.000	110.000	510.000	120.000	506.000	120.000
GR	508.700	167.000	500.000	202.000	507.000	240.000	507.000	240.000	512.000	471.000
GR	510.100	280.000	530.000	0.000	550.000	480.000	500.000	480.000	0.0	0.0
NC	0.050	0.050	0.050	0.100	0.200	0.0	0.0	0.0	0.0	0.0
SB	0.0	0.0	2.000	0.0	145.000	0.000	0.000	0.000	510.000	510.000
AI	24.100	15.000	122.100	475.000	10.000	10.000	10.000	0.0	0.0	0.0
AI	0.0	0.0	0.000	500.000	510.000	0.0	0.0	0.0	0.0	0.0
AS	1.000	516.800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BT	15.000	5.000	130.000	0.0	51.000	530.000	0.0	100.000	520.000	0.0
BT	103.100	514.100	0.0	122.100	510.100	0.0	140.000	510.100	0.0	107.000
BT	516.100	0.0	220.000	510.100	0.0	240.000	510.100	0.0	240.100	520.000
BT	0.0	240.000	520.000	0.0	380.000	520.000	0.0	450.000	520.000	0.0
BT	470.000	527.000	0.0	585.000	527.000	0.0	0.0	0.0	0.0	0.0
BA	530.200	24.000	530.000	50.000	530.000	70.000	520.000	122.000	513.200	122.100



CROSS SECTION 68
 WINOOSKI RIVER
 MONTPELIER, VT.

CROSS SECTION 67
WINDOSKI RIVER
MONTPELIER, VT.



DUFRESNE-HENRY ENGINEERING CORPORATION

BY M. R. T.
DATE 4/26/19

SUBJECT Dam Failure Analysis
for water at "Top" of dam.

SHEET NO. D-7 OF
JOB NO. 04-0096

trial No. 2
Parameters of $(13,400 + 5,300 = 18,700 \text{ cfs})$

	stage	storage	Active storage = $22 - 12 = 10 \text{ Ac-ft}$
XS - 68	570.6	2662	
XS - 67	562.9	2640	$V_{AVG} = (10 + 13) / 2 = 11.5$
		22 Ac-ft	

$$22 - 12 = 10$$

$$Q_{P2} = 8,300 \left(1 - \frac{11.5}{36}\right) = 5,650 \text{ cfs}$$

$$Q_{Total} = 13,400 + 5,650 = 19,050 \text{ cfs}$$

$$4Q < 2\% \therefore \text{use } Q_{P2}$$

Conclude: $Q_{failure} = 8,300 \text{ cfs}$ at 36 Ac-ft will be reduced approximately 32% per 845 foot reach subject to asymptotic decay. Therefore, Q at first highway bridge, U.S. Route 2, (XS 64 to 65) 1 mile downstream of dam will be very close to Q prior to failure, 13,400 cfs. Q at first location for over bank flooding, 3,000 feet downstream of dam, will also be about the same as that prior to failure. The impact of the dam failing is minor by comparison to the flood conditions which would exist prior to the dam failing. The flood within this first 3,000 foot reach will be within banks inundating an area not to exceed 300 feet in width.

DUFRESNE-HENRY ENGINEERING CORPORATION

BY M. Root

SUBJECT Dam Failure Analysis

SHEET NO. D-6 OF

DATE 4/2/77

for water at "Top" of dam

JOB NO. 34-0096

Dam Failure

Failure at top of dam - concrete spillway failing

Stage = 613.25 at top of dam $\frac{V}{S} = 26.22$

Crest of dam = 610.2

Length of spillway = 152'

width of breach = $(.4)(152) = 60.8'$

Discharge required for water to be at top of dam = 13,400 cfs

Discharge on remaining dam = $CLH^{3/2} = 3.88(91.2)(9)^{3/2} = 8000$ cfs

Discharge through breach = $\frac{8}{27} W_L \sqrt{g} H^{3/2} = \frac{8}{27} (60.8)(5.37)(26.2)^{3/2} = 13700$ cfs

Total failure flow = 13700 cfs + 8000 cfs = 21,700 cfs

Increase due to failure = 8,300 cfs $\leftarrow (Q_p)$

Volume behind dam at failure = 16 Ac-ft + 3(4) = 48 Ac-ft

Hydraulic Capacity of Breach = $Q = (3.05)(60.8)(17.2)^{3/2} = 13,400$ cfs

$$H = \left(\frac{13400}{(187.26)} \right)^{2/3} = 17.2'$$

Stage behind dam drops to $(592 + 17.2) = 609.23'$

Volume Retained at instant of failure = 48 - 4(4) = 12 Ac-ft

Volume Released = 48 - 12 = 36 Ac-ft $\leftarrow$ Volume Released (S)

Rating - Rating table for HEC-2 output

Stage City of Maitpeter $\frac{V}{S} \times S$ 6.8 for 21,700 cfs = 571.5
 $\times 0.97$ for 21,700 cfs = 564.0

<u>21,700 cfs</u>		<u>13,400 cfs</u>	
Change at 571.5	2925	568.5	1137
564.0	<u>2900</u>	560.8	<u>1675</u>
25 Ac-ft 4.1		12 Ac-ft	

Difference (Active to Stud-wave rating) = 25 - 12 = 13 Ac-ft (V_1)

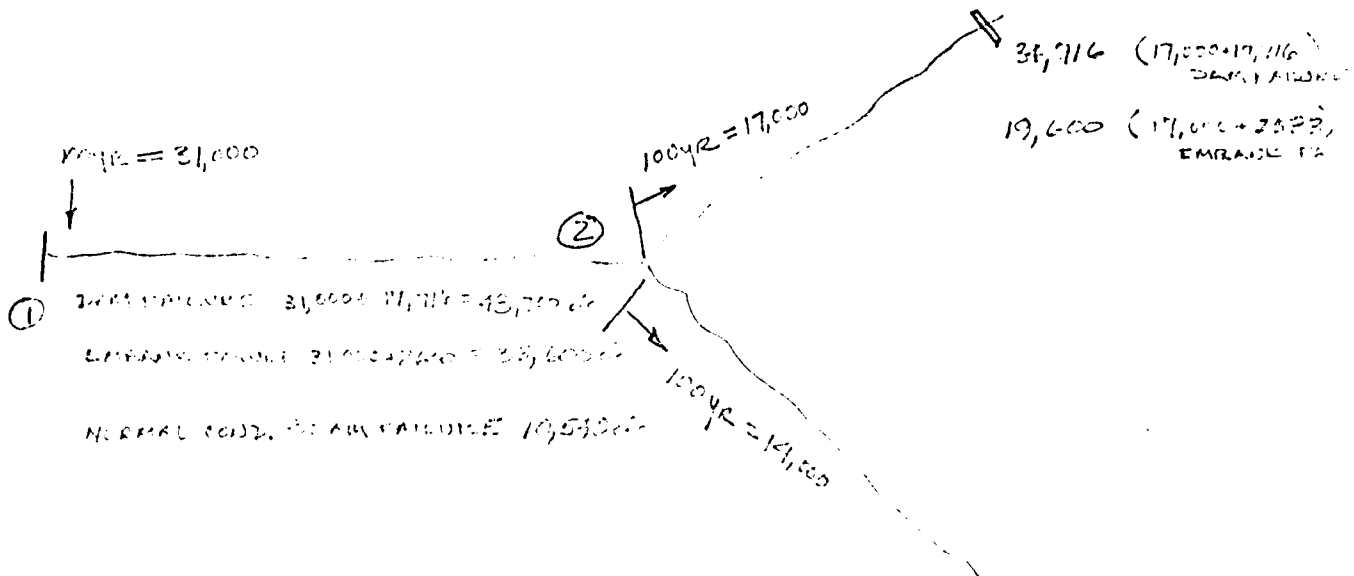
$$Q_{P_2} = Q_{P_1} \left(1 - \frac{V_1}{S} \right) = 8,300 \left(1 - \frac{13}{26} \right) = 5300 \text{ cfs}$$

DUFRESNE-HENRY ENGINEERING CORPORATION

BY N.A. LORING
DATE 7/5/79

SUBJECT MONTPELIER #4 DAM
REHEADING FOR COT CARRIES

SHEET NO. D-5 OF
JOB NO. 67-0006



①	NORMAL CONDITIONS - DAM FAILURE	10,540 cfs
	100 yr FLOOD CONDITIONS	31,000 cfs
	100 yr FLOOD WITH EMBANKMENT FAILURE	33,600 cfs
	100 yr FLOOD WITH DAM FAILURE	48,100 cfs

②	NORMAL CONDITIONS - DAM FAILURE	10,540 cfs
	100 yr FLOOD CONDITIONS	17,000 cfs
	100 yr FLOOD WITH EMBANKMENT FAILURE	19,600 cfs
	100 yr FLOOD WITH DAM FAILURE	31,700 cfs

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.A. Leonard
DATE 4/2/75

SUBJECT Failure Analysis

SHEET NO. D-1 OF 1
JOB NO. 100-100

$$\frac{100 \text{ ft} \times 100 \text{ ft}}{\text{FROM GRAPH}} = \frac{100 \text{ ft} \times 100 \text{ ft}}{100 \text{ ft} \times 100 \text{ ft}} = 9.1'$$

$$W_{SE} = 9.1 + 610.2 = \underline{\underline{619.3}}$$

FOR DAM FAILURE UNDER NORMAL FLOOD CONDITIONS:

① ASSUME .4 OF DAM FAILS

$$Q_1 = \frac{8}{27} W_L \sqrt{g} Y_0^{3/2}$$

$$Q_1 = \frac{8}{27} (.4)(152)(5.67)(2)^{3/2} = \underline{\underline{10,510 \text{ cfs}}}$$

FOR A 20' SECTION OF DAM FAILING $\Rightarrow Q_2 = \frac{8}{27} (20)(5.67)(2)^{3/2} = \underline{\underline{34,151 \text{ cfs}}}$

FOR DAM FAILURE UNDER NORMAL FLOOD CONDITIONS:

$$Q_{TOTAL} = Q_{KWIK} + Q_{FAILURE}$$

$$Q_{FAILURE} = \frac{8}{27} W_L \sqrt{g} Y_0^{3/2}$$

$$Q_{F1} = \frac{8}{27} (.4)(152)(5.67)(1.1)^{3/2} = 19,716 \text{ cfs}$$

$$Q_{F2} = \frac{8}{27} (20)(5.67)(3.11)^{3/2} = 5,827 \text{ cfs}$$

$$Q_{TOTAL1} = 17,000 + 19,716 \Rightarrow \underline{\underline{36,716 \text{ cfs}}}$$

$$Q_{TOTAL2} = 17,000 + 5,827 = \underline{\underline{22,827 \text{ cfs}}}$$

FOR DAM FAILURE UNDER FLOOD CONDITIONS:

ASSUME CREST LEVEL BEHIND EMBANKMENT IS AT CREST LEVEL OF DAM.

$$Q_{TOTAL} = Q_{KWIK} + Q_{FAILURE}$$

$$Q_{FAILURE} = \frac{8}{27} W_L \sqrt{g} Y_0^{3/2}$$

$$Q_{F1} = \frac{8}{27} (.4)(140)(5.67)(2.1)^{3/2} = 20,583 \text{ cfs}$$

$$Q_{TOTAL} = 17,000 + 20,583 \Rightarrow \underline{\underline{37,583 \text{ cfs}}}$$

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CURVE	MIN EL OF GRADING	DISCHARGE CFS	CWSEL	CR1s	EG	TOPG	10Ks	TIME	VOL
312.23	300.00	0.0	0.0	514.20	10540.00	522.74	0.0	523.56	199.66	21.26	0.03	28.29
312.23	300.00	0.0	0.0	514.20	31000.00	532.22	0.0	533.12	464.66	9.12	0.03	74.60
312.23	300.00	0.0	0.0	514.20	33600.00	537.69	0.0	538.76	464.66	9.18	0.03	76.17
312.23	300.00	0.0	0.0	514.20	46700.00	557.17	0.0	558.13	464.66	7.39	0.03	103.97
352.31	400.00	0.0	0.0	514.60	10540.00	523.40	0.0	524.40	197.65	21.13	0.05	41.88
352.31	400.00	0.0	0.0	514.60	31000.00	537.52	0.0	538.54	418.62	13.95	0.04	118.64
352.31	400.00	0.0	0.0	514.60	33600.00	543.13	0.0	544.19	418.62	10.93	0.04	124.64
352.31	400.00	0.0	0.0	514.60	46700.00	567.45	0.0	568.45	418.62	8.26	0.04	176.45
362.39	430.00	0.0	0.0	515.40	10540.00	524.40	0.0	525.23	189.60	17.45	0.07	56.30
362.39	430.00	0.0	0.0	515.40	31000.00	537.76	0.0	538.13	503.56	13.59	0.06	166.25
362.39	430.00	0.0	0.0	515.40	33600.00	543.32	0.0	544.79	514.75	13.11	0.05	170.21
362.39	430.00	0.0	0.0	515.40	46700.00	567.48	0.0	568.95	567.17	10.68	0.05	244.45
372.44	300.00	0.0	0.0	515.00	10540.00	524.90	0.0	525.70	186.60	13.91	0.08	66.97
372.44	300.00	0.0	0.0	515.00	31000.00	537.64	0.0	538.56	490.59	13.00	0.06	166.76
372.44	300.00	0.0	0.0	515.00	33600.00	543.61	0.0	545.21	494.60	13.10	0.06	170.12
372.44	300.00	0.0	0.0	515.00	46700.00	567.61	0.0	569.25	548.13	11.98	0.06	288.63
382.56	500.00	0.0	0.0	516.20	10540.00	525.67	0.0	526.44	164.66	15.22	0.10	84.58
382.56	500.00	0.0	0.0	516.20	31000.00	537.84	0.0	538.22	594.66	13.75	0.06	230.99
382.56	500.00	0.0	0.0	516.20	33600.00	543.50	0.0	545.90	609.56	13.17	0.08	246.56
382.56	500.00	0.0	0.0	516.20	46700.00	567.67	0.0	569.45	694.66	10.20	0.08	361.95
392.65	650.00	0.0	0.0	516.00	10540.00	526.74	0.0	527.18	194.64	15.38	0.13	108.65
392.65	650.00	0.0	0.0	516.00	31000.00	537.68	0.0	538.60	430.66	9.53	0.10	259.11
392.65	650.00	0.0	0.0	516.00	33600.00	543.73	0.0	545.47	457.66	9.42	0.10	320.72
392.65	650.00	0.0	0.0	516.00	46700.00	569.61	0.0	570.56	733.66	7.78	0.10	476.90
39.10	10.00	511.21	513.00	516.00	10540.00	526.74	0.0	527.18	194.64	15.38	0.13	108.65
39.10	10.00	511.21	513.00	516.00	31000.00	537.68	0.0	538.60	430.66	9.53	0.10	259.11
39.10	10.00	511.21	513.00	516.00	33600.00	543.73	0.0	545.47	457.66	9.42	0.10	320.72
39.10	10.00	511.21	513.00	516.00	46700.00	569.61	0.0	570.56	733.66	7.78	0.10	476.90
39.20	10.00	511.21	513.00	516.00	10540.00	526.74	0.0	527.18	194.64	15.38	0.13	108.65
39.20	10.00	511.21	513.00	516.00	31000.00	537.68	0.0	538.60	430.66	9.53	0.10	259.11
39.20	10.00	511.21	513.00	516.00	33600.00	543.73	0.0	545.47	457.66	9.42	0.10	320.72
39.20	10.00	511.21	513.00	516.00	46700.00	569.61	0.0	570.56	733.66	7.78	0.10	476.90
39.30	1.00	0.0	0.0	516.00	10540.00	526.74	0.0	527.18	194.64	15.38	0.13	108.65
39.30	1.00	0.0	0.0	516.00	31000.00	537.68	0.0	538.60	430.66	9.53	0.10	259.11
39.30	1.00	0.0	0.0	516.00	33600.00	543.73	0.0	545.47	457.66	9.42	0.10	320.72
39.30	1.00	0.0	0.0	516.00	46700.00	569.61	0.0	570.56	733.66	7.78	0.10	476.90
402.73	360.00	0.0	0.0	517.20	10540.00	527.13	0.0	527.57	177.64	15.76	0.14	121.83
402.73	360.00	0.0	0.0	517.20	31000.00	537.27	0.0	538.66	609.66	12.86	0.12	260.40
402.73	360.00	0.0	0.0	517.20	33600.00	543.86	0.0	547.14	637.26	12.73	0.11	305.31
402.73	360.00	0.0	0.0	517.20	46700.00	569.67	0.0	570.66	661.13	10.61	0.11	564.38

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHURC	MIN EL OF GROUND	DISCHARGE CFS	CASEL	CRWS	EG	TOPWID	LOKOS	TIME	VOL
412.83	510.00	0.0	0.0	514.40	10540.00	527.92	0.0	528.71	160.92	13.47	0.16	139.50
412.83	510.00	0.0	0.0	514.40	31600.00	536.30	0.0	537.29	574.92	9.07	0.13	396.78
412.83	510.00	0.0	0.0	514.40	31600.00	536.93	0.0	537.92	577.76	9.77	0.13	429.68
412.83	510.00	0.0	0.0	514.40	48700.00	540.48	0.0	541.80	616.87	9.20	0.13	631.93
422.91	405.00	0.0	0.0	518.10	10540.00	528.62	0.0	529.17	261.90	8.50	0.16	154.65
422.91	405.00	0.0	0.0	518.10	31600.00	536.81	0.0	537.80	574.92	7.98	0.15	447.89
422.91	405.00	0.0	0.0	518.10	31600.00	537.41	0.0	538.29	616.87	7.61	0.15	480.99
422.91	405.00	0.0	0.0	518.10	48700.00	540.97	0.0	541.95	616.87	7.65	0.15	738.88
432.99	425.00	0.0	0.0	518.80	10540.00	528.94	0.0	529.62	322.99	12.08	0.20	174.18
432.99	425.00	0.0	0.0	518.80	31600.00	537.04	0.0	538.04	574.92	9.87	0.17	506.15
432.99	425.00	0.0	0.0	518.80	31600.00	537.65	0.0	538.69	574.92	9.61	0.16	536.53
432.99	425.00	0.0	0.0	518.80	48700.00	541.28	0.0	542.21	780.92	8.95	0.16	788.25
443.07	435.00	0.0	0.0	515.40	10540.00	524.39	0.0	530.40	254.91	10.16	0.22	197.33
443.07	435.00	0.0	0.0	515.40	31600.00	532.37	0.0	538.49	574.92	9.97	0.18	531.26
443.07	435.00	0.0	0.0	515.40	31600.00	532.99	0.0	539.16	574.92	9.79	0.18	562.16
443.07	435.00	0.0	0.0	515.40	48700.00	541.81	0.0	542.70	664.92	8.76	0.18	612.32
453.09	130.00	0.0	0.0	517.00	10540.00	524.70	0.0	530.26	205.94	8.37	0.22	194.17
453.09	130.00	0.0	0.0	517.00	31600.00	532.22	0.0	538.71	274.97	12.93	0.18	504.49
453.09	130.00	0.0	0.0	517.00	31600.00	532.75	0.0	539.39	274.97	13.62	0.18	604.37
453.09	130.00	0.0	0.0	517.00	48700.00	540.63	0.0	543.16	274.97	18.03	0.18	691.56
45.10	5.00	518.80	535.20	517.00	10540.00	524.55	0.0	530.29	184.97	20.66	0.22	198.38
45.10	5.00	518.80	535.20	517.00	31600.00	532.57	0.0	538.49	274.97	17.05	0.18	564.88
45.10	5.00	518.80	535.20	517.00	31600.00	532.90	0.0	539.62	274.97	17.01	0.18	604.75
45.10	5.00	518.80	535.20	517.00	48700.00	538.09	0.0	543.80	274.97	23.92	0.18	692.37
45.20	25.00	518.40	535.20	517.00	10540.00	524.81	0.0	530.34	184.97	20.25	0.22	199.36
45.20	25.00	518.40	535.20	517.00	31600.00	532.81	0.0	539.13	274.97	17.05	0.19	566.68
45.20	25.00	518.40	535.20	517.00	31600.00	532.16	0.0	539.90	274.97	17.01	0.18	604.35
45.20	25.00	518.40	535.20	517.00	48700.00	538.88	0.0	543.90	274.97	23.92	0.18	691.97
45.30	1.00	0.0	0.0	517.00	10540.00	524.61	0.0	530.34	184.97	20.24	0.22	199.40
45.30	1.00	0.0	0.0	517.00	31600.00	532.73	0.0	539.22	274.97	17.06	0.19	566.53
45.30	1.00	0.0	0.0	517.00	31600.00	532.62	0.0	540.02	274.97	17.04	0.18	604.43
45.30	1.00	0.0	0.0	517.00	48700.00	542.69	0.0	544.77	274.97	26.23	0.18	694.06
463.14	235.00	0.0	0.0	518.10	10540.00	530.04	0.0	530.78	204.74	16.87	0.23	204.91
463.14	235.00	0.0	0.0	518.10	31600.00	538.09	0.0	539.72	574.92	14.01	0.20	569.92
463.14	235.00	0.0	0.0	518.10	31600.00	539.69	0.0	540.53	574.92	13.44	0.19	631.54
463.14	235.00	0.0	0.0	518.10	48700.00	544.54	0.0	545.26	661.93	9.89	0.19	679.73
473.25	555.00	0.0	0.0	517.54	10540.00	530.91	0.0	531.56	173.49	11.77	0.26	232.52
473.25	555.00	0.0	0.0	517.54	31600.00	539.77	0.0	546.00	447.99	14.45	0.21	651.88
473.25	555.00	0.0	0.0	517.54	31600.00	540.04	0.0	546.40	455.48	14.37	0.21	700.60
473.25	555.00	0.0	0.0	517.54	48700.00	544.66	0.0	549.79	559.96	12.11	0.21	1030.51

SECTION NUMBER	CHANNEL LENGTH	PEN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL OF GROUND	DISCHARGE SCFS	CHSEL	CRIBS	EG	TOPWID	104+5	TIME	VOL
483.29	230.00	0.0	0.0	517.00	10540.00	530.86	0.0	531.97	131.57	16.70	0.27	261.37
483.29	230.00	0.0	0.0	517.00	31000.00	530.12	0.0	541.47	166.22	29.55	0.22	669.73
483.29	230.00	0.0	0.0	517.00	33600.00	530.66	0.0	542.39	177.60	31.55	0.21	719.82
483.29	230.00	0.0	0.0	517.00	48700.00	542.43	536.18	547.10	413.97	36.57	0.21	1058.51
48.10	5.00	539.40	535.50	517.00	10540.00	530.87	0.0	531.98	131.57	16.67	0.27	261.53
48.10	5.00	539.40	535.50	517.00	31000.00	530.18	0.0	541.48	166.22	29.59	0.22	669.99
48.10	5.00	539.40	535.50	517.00	33600.00	530.76	0.0	542.40	177.60	31.60	0.21	720.09
48.10	5.00	539.40	535.50	517.00	48700.00	535.97	536.66	548.76	161.60	36.75	0.21	1058.89
48.20	25.00	539.40	535.50	517.00	10540.00	530.92	0.0	532.02	131.97	16.66	0.27	262.31
48.20	25.00	539.40	535.50	517.00	31000.00	537.07	0.0	542.21	167.50	29.64	0.22	671.12
48.20	25.00	539.40	535.50	517.00	33600.00	537.16	0.0	543.26	165.74	30.54	0.21	721.22
48.20	25.00	539.40	535.50	517.00	48700.00	538.84	536.14	549.83	161.60	36.75	0.21	1060.42
48.25	1.00	0.0	0.0	517.00	10540.00	530.93	0.0	532.02	131.97	16.65	0.27	262.41
48.25	1.00	0.0	0.0	517.00	31000.00	537.74	0.0	542.66	166.89	29.62	0.22	671.18
48.25	1.00	0.0	0.0	517.00	33600.00	547.71	0.0	543.50	167.74	29.74	0.21	721.28
48.25	1.00	0.0	0.0	517.00	48700.00	547.09	536.16	550.74	167.25	30.82	0.21	1060.12
48.30	620.00	0.0	0.0	517.00	10540.00	532.01	0.0	532.02	132.95	12.35	0.29	264.26
48.30	620.00	0.0	0.0	517.00	31000.00	541.54	0.0	543.70	178.48	18.42	0.23	713.62
48.30	620.00	0.0	0.0	517.00	33600.00	542.68	0.0	546.61	165.09	15.72	0.23	768.84
48.30	620.00	0.0	0.0	517.00	48700.00	549.88	0.0	551.29	163.60	9.46	0.23	1155.91
493.62	10.00	0.0	0.0	521.60	10540.00	532.87	532.87	535.12	182.20	176.76	0.29	264.55
493.62	10.00	0.0	0.0	521.60	31000.00	542.11	0.0	541.78	207.00	31.76	0.23	714.54
493.62	10.00	0.0	0.0	521.60	33600.00	543.29	0.0	546.85	164.34	15.82	0.23	769.46
493.62	10.00	0.0	0.0	521.60	48700.00	550.78	0.0	551.44	176.75	16.01	0.23	1157.41
50.35	540.00	0.0	0.0	525.10	10540.00	536.33	0.0	536.84	257.50	11.24	0.32	263.03
50.35	540.00	0.0	0.0	525.10	31000.00	541.50	0.0	546.98	128.06	12.87	0.25	757.21
50.35	540.00	0.0	0.0	525.10	33600.00	546.91	0.0	549.99	157.06	12.26	0.25	818.44
50.35	540.00	0.0	0.0	525.10	48700.00	551.12	0.0	552.05	170.99	8.13	0.25	1235.76
513.65	680.00	0.0	0.0	525.80	10540.00	537.22	0.0	537.87	238.41	19.75	0.35	312.55
513.65	680.00	0.0	0.0	525.80	31000.00	546.88	0.0	546.08	276.04	19.83	0.27	800.94
513.65	680.00	0.0	0.0	525.80	33600.00	545.78	0.0	547.05	269.20	18.81	0.27	884.43
513.65	680.00	0.0	0.0	525.80	48700.00	551.58	0.0	552.81	166.23	13.39	0.28	1340.66
523.60	740.00	0.0	0.0	522.80	10540.00	538.28	0.0	538.76	319.60	6.49	0.39	349.74
523.60	740.00	0.0	0.0	522.80	31000.00	548.23	0.0	546.99	671.19	6.96	0.31	942.52
523.60	740.00	0.0	0.0	522.80	33600.00	547.16	0.0	547.93	675.28	6.89	0.30	973.65
523.60	740.00	0.0	0.0	522.80	48700.00	552.75	0.0	553.42	575.74	4.95	0.31	1671.30
533.92	660.00	0.0	0.0	524.20	10540.00	538.62	0.0	539.42	174.98	13.12	0.42	380.29
533.92	660.00	0.0	0.0	524.20	31000.00	548.10	0.0	547.91	470.86	18.52	0.33	972.89
533.92	660.00	0.0	0.0	524.20	33600.00	547.05	0.0	548.80	511.93	17.45	0.32	1050.32
533.92	660.00	0.0	0.0	524.20	48700.00	552.81	0.0	554.02	614.97	10.48	0.33	1595.88

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF CHORD	MIN EL OF GROUND	DISCHARGE COEFF	CUSEC	CR165	EG	TOPWID	LOK95	TIME	VOL
53.10	540.00	0.0	0.0	525.00	10540.00	539.65	0.0	539.96	142.96	6.98	0.44	402.66
53.10	540.00	0.0	0.0	525.00	31000.00	547.42	0.0	546.70	499.97	10.63	0.34	1022.93
53.10	540.00	0.0	0.0	525.00	31600.00	548.29	0.0	549.56	495.99	10.31	0.34	1106.62
53.10	540.00	0.0	0.0	525.00	48700.00	553.40	0.0	554.51	500.00	7.74	0.35	1688.92
53.20	5.00	544.80	543.20	525.00	10540.00	539.44	0.0	537.96	142.96	6.97	0.44	402.67
53.20	5.00	544.80	543.20	525.00	31000.00	547.11	0.0	546.80	499.98	61.76	0.34	1023.36
53.20	5.00	544.80	543.20	525.00	31600.00	548.18	0.0	549.60	495.98	65.18	0.34	1106.50
53.20	5.00	544.80	543.20	525.00	48700.00	553.66	0.0	554.54	500.00	27.48	0.35	1687.71
53.30	15.00	544.80	543.20	525.00	10540.00	539.47	0.0	539.97	142.96	6.95	0.44	403.52
53.30	15.00	544.80	543.20	525.00	31000.00	547.14	0.0	546.53	499.97	73.91	0.34	1024.53
53.30	15.00	544.80	543.20	525.00	31600.00	548.35	0.0	549.70	495.99	61.36	0.34	1107.84
53.30	15.00	544.80	543.20	525.00	48700.00	553.71	0.0	554.59	500.00	26.80	0.35	1691.99
544.32	1.00	0.0	0.0	525.00	10540.00	539.67	0.0	539.97	142.96	6.95	0.44	403.57
544.32	1.00	0.0	0.0	525.00	31000.00	547.76	0.0	546.96	499.97	9.66	0.34	1024.62
544.32	1.00	0.0	0.0	525.00	31600.00	548.69	0.0	549.72	495.99	9.87	0.34	1107.99
544.32	1.00	0.0	0.0	525.00	48700.00	553.54	0.0	554.63	500.00	7.95	0.35	1692.14
54.10	100.00	0.0	0.0	524.50	10540.00	539.19	0.0	540.09	140.96	8.91	0.45	407.66
54.10	100.00	0.0	0.0	524.50	31000.00	547.36	0.0	547.21	313.99	14.19	0.35	1033.44
54.10	100.00	0.0	0.0	524.50	31600.00	548.02	0.0	549.98	325.96	14.65	0.34	1117.41
54.10	100.00	0.0	0.0	524.50	48700.00	552.88	0.0	554.92	341.95	12.72	0.36	1704.41
54.20	5.00	544.00	539.40	524.50	10540.00	539.19	0.0	540.09	140.96	8.90	0.45	407.66
54.20	5.00	544.00	539.40	524.50	31000.00	547.76	539.44	549.63	243.27	193.65	0.35	1033.75
54.20	5.00	544.00	539.40	524.50	31600.00	548.76	0.0	550.82	306.99	167.61	0.34	1117.74
54.20	5.00	544.00	539.40	524.50	48700.00	552.98	0.0	554.94	341.96	84.13	0.36	1705.97
54.30	25.00	544.00	539.40	524.50	10540.00	539.63	0.0	540.13	140.96	22.36	0.45	408.83
54.30	25.00	544.00	539.40	524.50	31000.00	547.76	0.0	550.14	320.99	146.02	0.35	1035.19
54.30	25.00	544.00	539.40	524.50	31600.00	548.30	0.0	550.76	310.91	106.12	0.34	1119.33
54.30	25.00	544.00	539.40	524.50	48700.00	553.22	0.0	555.10	341.98	80.08	0.36	1709.62
554.05	1.00	0.0	0.0	524.50	10540.00	539.43	0.0	540.13	140.96	8.84	0.45	408.67
554.05	1.00	0.0	0.0	524.50	31000.00	546.72	0.0	550.22	318.96	10.92	0.35	1035.26
554.05	1.00	0.0	0.0	524.50	31600.00	547.19	0.0	550.86	301.96	11.72	0.34	1119.61
554.05	1.00	0.0	0.0	524.50	48700.00	553.15	0.0	555.12	301.96	12.17	0.36	1709.76
564.09	211.00	0.0	0.0	524.80	10540.00	539.67	0.0	540.15	204.96	9.91	0.46	417.60
564.09	211.00	0.0	0.0	524.80	31000.00	549.66	0.0	552.51	308.96	6.08	0.36	1057.18
564.09	211.00	0.0	0.0	524.80	31600.00	550.45	0.0	551.16	309.96	6.98	0.35	1192.46
564.09	211.00	0.0	0.0	524.80	48700.00	554.54	0.0	555.44	309.00	8.53	0.36	1730.80
574.19	525.00	0.0	0.0	523.80	10540.00	540.36	0.0	540.84	323.96	8.97	0.46	444.03
574.19	525.00	0.0	0.0	523.80	31000.00	550.77	0.0	550.88	316.99	6.26	0.36	1122.68
574.19	525.00	0.0	0.0	523.80	31600.00	550.87	0.0	551.54	317.91	6.99	0.36	1210.54
574.19	525.00	0.0	0.0	523.80	48700.00	554.98	0.0	555.80	302.00	7.13	0.36	1826.30

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHINA	MIN EL CROSSING	DISCHARGE CFS	CHSEL	CR105	EG	TOPWID	10K95	TIME	VOL
586.27	420.00	0.0	0.0	525.60	10560.00	540.85	0.0	541.12	171.62	6.36	0.52	470.90
586.27	420.00	0.0	0.0	525.60	11000.00	540.72	0.0	541.10	169.71	3.75	0.40	1183.57
586.27	420.00	0.0	0.0	525.60	13600.00	541.66	0.0	541.77	150.66	3.92	0.40	1273.60
586.27	420.00	0.0	0.0	525.60	46700.00	555.55	0.0	556.12	404.60	6.36	0.40	1903.93
596.36	470.00	0.0	0.0	526.60	10560.00	541.13	0.0	541.10	167.21	3.33	0.56	510.40
596.36	470.00	0.0	0.0	526.60	11000.00	541.15	0.0	541.20	1642.12	6.76	0.47	1315.97
596.36	470.00	0.0	0.0	526.60	11600.00	541.62	0.0	541.64	1506.64	6.76	0.47	1412.56
596.36	470.00	0.0	0.0	526.60	46700.00	556.17	0.0	556.23	1809.00	6.62	0.47	1899.66
6.55	1020.00	0.0	0.0	520.70	10560.00	540.81	0.0	542.25	106.19	20.67	0.59	572.04
6.55	1020.00	0.0	0.0	520.70	11000.00	541.74	0.0	541.28	1511.78	0.57	0.66	1676.66
6.55	1020.00	0.0	0.0	520.70	11600.00	541.91	0.0	541.95	1514.92	0.61	0.66	1796.45
6.55	1020.00	0.0	0.0	520.70	34700.00	556.25	0.0	556.29	1752.62	0.56	0.66	2636.13
6.55	1.00	544.41	519.40	520.70	10560.00	540.50	0.0	542.33	101.66	12.15	0.59	572.06
6.55	1.00	544.41	519.40	520.70	11000.00	541.25	0.0	541.28	1511.78	0.76	0.66	1676.66
6.55	1.00	544.41	519.40	520.70	11600.00	541.92	0.0	541.95	1514.92	0.99	0.66	1797.18
6.55	1.00	544.41	519.40	520.70	34700.00	556.25	0.0	556.29	1752.62	0.75	0.66	2636.01
616.55	20.00	544.41	519.40	520.70	10560.00	540.64	0.0	542.67	102.92	12.12	0.59	572.53
616.55	20.00	544.41	519.40	520.70	11000.00	541.25	0.0	541.28	1511.78	0.66	0.66	1662.61
616.55	20.00	544.41	519.40	520.70	11600.00	541.92	0.0	541.95	1514.92	0.89	0.66	1803.69
616.55	20.00	544.41	519.40	520.70	34700.00	556.25	0.0	556.29	1752.62	0.75	0.66	2646.08
6.55	1.00	0.0	0.0	520.70	10560.00	541.18	0.0	542.53	107.53	18.48	0.59	572.56
6.55	1.00	0.0	0.0	520.70	11000.00	541.25	0.0	541.28	1511.78	0.57	0.66	1673.11
6.55	1.00	0.0	0.0	520.70	11600.00	541.91	0.0	541.95	1514.92	0.61	0.66	1803.61
6.55	1.00	0.0	0.0	520.70	34700.00	556.25	0.0	556.30	1752.62	0.58	0.66	2646.56
626.73	950.00	0.0	0.0	527.40	10560.00	542.85	0.0	542.90	102.12	0.96	0.75	658.70
626.73	950.00	0.0	0.0	527.40	11000.00	541.29	0.0	541.31	1663.06	7.16	0.96	2017.09
626.73	950.00	0.0	0.0	527.40	11600.00	541.97	0.0	541.99	1666.76	0.21	0.96	2163.59
626.73	950.00	0.0	0.0	527.40	34700.00	556.30	0.0	556.33	1690.67	0.27	0.82	3141.96
636.82	476.00	0.0	0.0	531.00	10560.00	542.91	0.0	542.96	107.97	1.41	0.63	129.63
636.82	476.00	0.0	0.0	531.00	11000.00	541.30	0.0	541.32	1681.67	0.20	1.06	2212.31
636.82	476.00	0.0	0.0	531.00	11600.00	541.98	0.0	542.04	1717.61	0.23	1.09	2366.48
636.82	476.00	0.0	0.0	531.00	34700.00	556.32	0.0	556.35	1771.76	0.27	0.92	3630.35
6.92	543.00	0.0	0.0	536.40	10560.00	542.79	542.79	546.56	91.76	118.77	0.64	172.56
6.92	543.00	0.0	0.0	536.40	11000.00	541.11	0.0	541.40	1200.00	5.96	1.12	2356.05
6.92	543.00	0.0	0.0	536.40	11600.00	541.62	0.0	542.08	1230.67	5.53	1.07	2526.76
6.92	543.00	0.0	0.0	536.40	34700.00	556.27	0.0	556.40	2126.03	2.50	0.98	3682.43
6.92	1.00	556.50	549.10	536.40	10560.00	541.33	0.0	546.61	92.04	93.92	0.64	172.60
6.92	1.00	556.50	549.10	536.40	11000.00	541.23	0.0	541.41	1216.05	9.66	1.12	2356.17
6.92	1.00	556.50	549.10	536.40	11600.00	541.91	0.0	542.09	1230.67	8.87	1.07	2526.92
6.92	1.00	556.50	549.10	536.40	34700.00	556.29	0.0	556.40	2126.03	3.61	0.98	3682.73

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF C+RD	MIN EL OF JUNC	DISCHARGE SCFS	C+SEL	CRHS	EG	TOPWD	FORPS	TIME	VOL
844.93	35.00	554.50	549.10	536.40	10540.00	546.40	0.0	546.95	95.47	42.24	0.84	773.23
844.93	35.00	554.50	549.10	536.40	10540.00	551.27	0.0	551.45	1218.46	9.53	1.12	2362.36
844.93	35.00	554.50	549.10	536.40	10540.00	551.95	0.0	552.42	1108.71	8.75	1.07	2500.75
844.93	35.00	554.50	549.10	536.40	10540.00	556.31	0.0	556.42	2120.22	2.40	0.98	3693.31
4.93	1.00	0.0	0.0	536.40	10540.00	546.43	0.0	546.94	96.47	41.25	0.84	773.25
4.93	1.00	0.0	0.0	536.40	10540.00	551.20	0.0	551.47	1209.02	5.72	1.12	2362.48
4.93	1.00	0.0	0.0	536.40	10540.00	551.49	0.0	552.14	1108.19	5.36	1.07	2500.69
4.93	1.00	0.0	0.0	536.40	10540.00	556.29	0.0	556.42	2120.20	2.47	0.98	3693.62
855.03	528.00	0.0	0.0	539.40	10540.00	546.60	0.0	549.60	446.94	37.24	0.86	791.05
855.03	528.00	0.0	0.0	539.40	10540.00	551.49	0.0	552.01	1108.14	17.95	1.15	2511.73
855.03	528.00	0.0	0.0	539.40	10540.00	552.15	0.0	552.45	1153.01	16.99	1.10	2601.08
855.03	528.00	0.0	0.0	539.40	10540.00	556.36	0.0	556.48	1246.59	9.20	1.02	3091.67
865.19	845.00	0.0	0.0	547.00	10540.00	552.81	0.0	556.42	251.55	100.29	0.88	822.28
865.19	845.00	0.0	0.0	547.00	10540.00	556.19	556.19	556.47	294.92	117.05	1.17	2496.92
865.19	845.00	0.0	0.0	547.00	10540.00	556.82	556.82	557.78	322.47	112.67	1.12	2611.15
865.19	845.00	0.0	0.0	547.00	10540.00	556.50	556.50	561.26	294.94	66.94	1.06	3974.55
875.35	845.00	0.0	0.0	548.70	10540.00	559.30	559.30	567.82	151.29	86.37	0.90	851.51
875.35	845.00	0.0	0.0	548.70	10540.00	562.26	562.26	566.55	160.26	81.11	1.18	2511.74
875.35	845.00	0.0	0.0	548.70	10540.00	563.24	563.24	567.41	170.65	83.08	1.13	2701.70
875.35	845.00	0.0	0.0	548.70	10540.00	566.95	566.95	573.04	228.86	54.44	1.05	4041.62
885.51	845.00	0.0	0.0	556.00	10540.00	567.13	0.0	566.59	194.44	51.79	0.92	861.44
885.51	845.00	0.0	0.0	556.00	10540.00	571.01	0.0	571.77	213.17	44.53	1.20	2591.71
885.51	845.00	0.0	0.0	556.00	10540.00	571.63	0.0	571.68	213.44	42.11	1.18	2713.21
885.51	845.00	0.0	0.0	556.00	10540.00	576.68	0.0	577.52	261.45	48.78	1.07	4056.55
SECTION NUMBER	DISCHARGE CFS	C+SEL	C+SEL DIFF EACH S	C+SEL DIFF EACH SECTION	C+SEL-BS+L	TOPWD	T+D DIFF	LENGTH				
212.050	10540.000	513.733	0.0	0.0	0.0	130.924	0.0	0.0				
212.050	51100.763	514.733	0.070	0.0	0.0	140.924	-9.996	0.0				
212.050	31600.000	513.523	0.814	0.0	0.0	158.345	-24.819	0.0				
212.050	48700.000	525.222	0.895	0.0	0.0	304.313	-126.588	0.0				
222.070	10540.000	516.324	0.0	1.487	0.0	185.493	0.0	110.000				
222.070	31600.000	525.284	0.960	5.573	0.0	166.036	-19.555	110.000				
222.070	31600.000	526.145	0.601	5.462	0.0	166.480	-4.444	110.000				
222.070	48700.000	530.114	4.233	5.196	0.0	280.977	-114.486	110.000				
232.090	10540.000	516.250	0.0	-0.073	0.0	197.408	0.0	100.000				
232.090	31600.000	526.966	4.713	-0.320	0.0	174.783	-22.625	100.000				
232.090	31600.000	525.343	3.477	-0.345	0.0	162.972	-11.811	100.000				
232.090	48700.000	530.453	4.213	-0.264	0.0	422.697	-264.549	100.000				
242.100	10540.000	515.745	0.0	-0.464	0.0	156.762	0.0	60.000				
242.100	31600.000	526.460	0.075	-0.504	0.0	174.670	-17.908	60.000				
242.100	31600.000	525.329	0.669	-0.511	0.0	177.804	-22.474	60.000				
242.100	48700.000	529.310	3.981	-0.643	0.0	192.178	-37.866	60.000				
26.100	10540.000	516.440	0.0	1.104	0.0	144.244	0.0	10.000				
26.100	31600.000	529.254	12.344	0.794	0.0	371.087	-226.843	10.000				
26.100	31600.000	529.534	0.420	0.355	0.0	379.615	-230.374	10.000				
26.100	48700.000	531.756	2.073	2.444	0.0	452.000	-302.754	10.000				
252.110	10540.000	516.720	0.0	-0.170	0.0	144.878	0.0	10.000				
252.110	31600.000	526.664	12.148	-0.386	0.0	364.464	-219.586	10.000				
252.110	31600.000	529.184	3.320	-0.496	0.0	370.137	-226.754	10.000				
252.110	48700.000	530.452	1.265	-1.304	0.0	401.291	-250.833	10.000				

262.120	10540.000	518.708	0.0	1.989	0.0	132.256	0.0	100.000
262.120	31000.000	527.700	8.992	-1.468	0.0	141.950	-9.696	100.000
262.120	33800.000	527.718	0.018	-1.470	0.0	141.950	-9.696	100.000
262.120	48700.000	533.581	2.753	0.058	0.0	346.433	-219.877	100.000
26.300	10540.000	519.231	0.0	0.523	0.0	131.422	0.0	41.000
26.300	31000.000	529.990	9.760	1.260	0.0	149.256	-59.834	41.000
26.300	33800.000	529.996	-2.034	1.228	0.0	147.305	-59.862	41.000
26.300	48700.000	533.671	1.725	0.160	0.0	356.773	-222.151	41.000
272.150	10540.000	521.388	0.0	2.155	0.0	161.206	0.0	130.000
272.150	31000.000	531.310	9.922	2.110	0.0	247.036	-145.831	130.000
272.150	33800.000	531.472	0.162	2.126	0.0	105.518	-124.310	130.000
272.150	48700.000	535.596	4.076	9.875	0.0	331.945	-159.341	130.000
282.170	10540.000	521.771	0.0	0.384	0.0	193.441	0.0	100.000
282.170	31000.000	531.644	9.874	0.674	0.0	379.836	-206.395	100.000
282.170	33800.000	532.751	0.567	0.779	0.0	395.841	-206.399	100.000
282.170	48700.000	536.572	6.321	1.628	0.0	379.679	-206.438	100.000
312.230	10540.000	522.716	0.0	0.567	0.0	199.680	0.0	300.000
312.230	31000.000	532.244	9.528	0.540	0.0	484.819	-285.158	300.000
312.230	33800.000	532.627	0.609	0.376	0.0	495.694	-285.165	300.000
312.230	48700.000	537.170	6.363	0.598	0.0	484.863	-285.203	300.000
352.310	10540.000	523.596	0.0	0.858	0.0	197.450	0.0	400.000
352.310	31000.000	532.517	8.920	0.291	0.0	618.416	-420.968	400.000
352.310	33800.000	533.126	0.610	0.299	0.0	618.720	-420.970	400.000
352.310	48700.000	537.955	4.329	0.285	0.0	619.450	-420.990	400.000
362.390	10540.000	524.459	0.0	0.463	0.0	189.896	0.0	430.000
362.390	31000.000	532.717	8.277	0.220	0.0	503.525	-313.628	430.000
362.390	33800.000	533.318	0.561	0.192	0.0	518.353	-328.457	430.000
362.390	48700.000	537.491	4.163	0.626	0.0	507.770	-313.633	430.000
372.440	10540.000	526.980	0.0	0.521	0.0	186.595	0.0	300.000
372.440	31000.000	533.119	6.059	0.303	0.0	440.549	-253.956	300.000
372.440	33800.000	533.617	0.574	0.294	0.0	444.595	-253.950	300.000
372.440	48700.000	537.946	3.955	0.126	0.0	528.735	-342.840	300.000
382.540	10540.000	525.610	0.0	0.689	0.0	188.065	0.0	500.000
382.540	31000.000	533.844	8.234	0.404	0.0	594.401	-420.718	500.000
382.540	33800.000	534.446	0.632	0.195	0.0	609.577	-443.512	500.000
382.540	48700.000	538.665	4.168	1.039	0.0	604.988	-528.921	500.000
392.650	10540.000	526.744	0.0	1.074	0.0	194.444	0.0	650.000
392.650	31000.000	535.078	8.333	1.234	0.0	630.034	-433.596	650.000
392.650	33800.000	535.726	0.648	1.229	0.0	637.316	-446.672	650.000
392.650	48700.000	539.613	3.867	0.940	0.0	733.813	-539.164	650.000
39.100	10540.000	526.760	0.0	0.016	0.0	194.512	0.0	10.000
39.100	31000.000	534.791	8.031	-0.287	0.0	617.912	-422.199	10.000
39.100	33800.000	535.612	0.821	-0.114	0.0	632.447	-437.955	10.000
39.100	48700.000	539.767	4.153	0.154	0.0	733.815	-539.303	10.000
39.200	10540.000	526.775	0.0	0.015	0.0	194.576	0.0	10.000
39.200	31000.000	534.638	8.083	0.067	0.0	620.740	-420.104	10.000
39.200	33800.000	535.722	0.444	0.111	0.0	637.120	-446.544	10.000
39.200	48700.000	539.813	4.041	0.067	0.0	733.816	-539.740	10.000
39.300	10540.000	526.776	0.0	0.001	0.0	194.583	0.0	1.000
39.300	31000.000	535.312	8.535	0.454	0.0	639.442	-445.598	1.000
39.300	33800.000	535.997	0.598	0.185	0.0	644.862	-470.299	1.000
39.300	48700.000	539.721	3.814	-0.042	0.0	733.816	-539.232	1.000

402.730	10540.C00	527.131	0.0	0.355	0.0	177.237	0.0	340.000
402.740	31000.C00	535.268	4.136	-0.044	0.0	609.599	-432.362	360.000
402.750	31600.C00	535.957	0.590	-0.050	0.0	637.780	-600.563	360.000
402.760	48700.C00	539.868	3.816	-0.053	0.0	861.132	-883.895	360.000
412.830	10540.C00	527.915	0.0	0.784	0.0	180.923	0.0	510.000
412.840	31000.C00	530.274	4.281	1.028	0.0	574.415	-393.492	510.000
412.850	31600.C00	530.949	0.667	1.042	0.0	577.756	-390.833	510.000
412.860	48700.C00	540.464	3.565	0.817	0.0	818.867	-833.744	510.000
422.910	10540.C00	528.622	0.0	0.767	0.0	261.301	0.0	605.000
422.920	31000.C00	536.810	4.188	0.514	0.0	574.809	-512.308	605.000
422.930	31600.C00	537.416	0.604	0.515	0.0	614.536	-552.218	605.000
422.940	48700.C00	540.971	3.558	0.486	0.0	871.300	-810.000	605.000
432.990	10540.C00	528.835	0.0	0.313	0.0	322.941	0.0	425.000
432.995	31000.C00	537.039	4.104	0.229	0.0	739.888	-418.495	425.000
432.999	31600.C00	537.454	0.615	0.240	0.0	755.355	-431.364	425.000
432.999	48700.C00	541.258	3.804	0.287	0.0	100.425	-457.433	425.000
443.070	10540.C00	529.390	0.0	0.455	0.0	258.308	0.0	430.000
443.070	31000.C00	537.167	2.971	0.327	0.0	740.794	-462.486	430.000
443.070	31600.C00	537.936	0.827	0.340	0.0	761.014	-522.708	430.000
443.070	48700.C00	541.613	3.619	0.355	0.0	846.524	-586.216	430.000
453.090	10540.C00	527.697	0.0	0.307	0.0	205.939	0.0	130.000
453.090	31000.C00	537.225	7.522	-0.142	0.0	220.451	-14.912	130.000
453.090	31600.C00	537.750	0.546	-0.243	0.0	220.457	-14.918	130.000
453.090	48700.C00	540.627	2.877	-0.966	0.0	220.490	-14.951	130.000
45.100	10540.C00	529.548	0.0	-0.149	0.0	184.203	0.0	5.000
45.100	31000.C00	536.572	7.023	-0.653	0.0	220.463	-30.140	5.000
45.100	31600.C00	536.698	0.328	-0.853	0.0	220.467	-30.144	5.000
45.100	48700.C00	538.066	1.188	-2.561	0.0	220.461	-30.158	5.000
45.200	10540.C00	527.611	0.0	0.043	0.0	184.748	0.0	25.000
45.200	31000.C00	536.514	7.203	0.242	0.0	220.464	-30.078	25.000
45.200	31600.C00	537.143	0.369	0.245	0.0	220.450	-30.082	25.000
45.200	48700.C00	538.635	1.502	0.599	0.0	220.468	-30.100	25.000
45.300	10540.C00	529.513	0.0	0.002	0.0	184.770	0.0	1.000
45.300	31000.C00	537.732	4.119	0.918	0.0	220.457	-30.187	1.000
45.300	31600.C00	538.676	0.692	1.241	0.0	220.465	-30.094	1.000
45.300	48700.C00	542.689	4.205	0.006	0.0	220.915	-30.164	1.000
463.140	10540.C00	530.036	0.0	0.475	0.0	204.725	0.0	235.000
463.140	31000.C00	535.360	8.823	1.128	0.0	505.167	-380.422	235.000
463.140	31600.C00	539.630	0.826	1.262	0.0	591.573	-380.853	235.000
463.140	48700.C00	544.542	4.855	1.853	0.0	681.533	-450.808	235.000
473.250	10540.C00	530.906	0.0	0.869	0.0	173.488	0.0	555.000
473.250	31000.C00	537.249	4.144	0.409	0.0	442.444	-284.176	555.000
473.250	31600.C00	540.042	0.773	0.356	0.0	455.477	-284.989	555.000
473.250	48700.C00	544.664	4.622	0.422	0.0	559.959	-380.471	555.000
483.290	10540.C00	530.882	0.0	-0.045	0.0	131.968	0.0	230.000
483.290	31000.C00	533.119	7.257	-1.150	0.0	166.118	-34.150	230.000
483.290	31600.C00	538.658	0.540	-1.383	0.0	177.796	-45.828	230.000
483.290	48700.C00	542.435	3.776	-2.229	0.0	413.470	-281.502	230.000
48.100	10540.C00	530.872	0.0	0.010	0.0	131.969	0.0	5.000
48.100	31000.C00	536.679	5.807	-1.440	0.0	141.887	-34.918	5.000
48.100	31600.C00	538.764	0.085	-1.845	0.0	141.490	-34.922	5.000
48.100	48700.C00	535.975	-0.789	-0.459	0.0	141.857	-34.649	5.000
48.200	10540.C00	530.923	0.0	0.051	0.0	131.972	0.0	25.000

48.200	31000.000	537.031	6.108	0.352	0.0	182.581	-100.604	25.000
48.200	31600.000	537.173	3.197	0.416	0.0	185.766	-13.772	25.000
48.200	48700.000	538.366	-0.334	0.269	0.0	181.894	-74.922	25.000
48.250	10540.000	530.925	0.0	0.002	0.0	131.572	0.0	1.000
48.250	31000.000	539.732	4.776	2.670	0.0	194.688	-62.717	1.000
48.250	31600.000	540.731	1.030	3.553	0.0	197.121	-65.749	1.000
48.250	48700.000	549.044	4.313	12.201	0.0	479.251	-347.280	1.000
48.300	10540.000	532.013	0.0	1.088	0.0	132.948	0.0	620.000
48.300	31000.000	541.535	4.522	1.434	0.0	378.483	-245.535	620.000
48.300	31600.000	542.677	1.142	1.948	0.0	415.094	-242.146	620.000
48.300	48700.000	547.878	7.201	0.434	0.0	448.398	-850.650	620.000
493.420	10540.000	537.867	0.0	0.454	0.0	182.198	0.0	10.000
493.420	31000.000	547.112	6.245	0.577	0.0	237.227	-105.429	10.000
493.420	31600.000	548.243	1.181	0.616	0.0	304.336	-122.139	10.000
493.420	48700.000	550.301	7.088	0.483	0.0	476.752	-294.555	10.000
50.352	10540.000	536.336	0.0	3.488	0.0	257.560	0.0	540.000
50.352	31000.000	543.878	7.563	1.786	0.0	326.878	-69.115	540.000
50.352	31600.000	546.937	1.009	1.416	0.0	357.467	-95.942	540.000
50.352	48700.000	551.115	6.208	0.754	0.0	470.638	-212.378	540.000
513.650	10540.000	537.716	0.0	0.884	0.0	235.306	0.0	680.000
513.650	31000.000	546.833	7.815	0.535	0.0	274.008	-131.700	680.000
513.650	31600.000	547.740	3.547	0.873	0.0	289.198	-53.492	680.000
513.650	48700.000	550.543	5.804	0.468	0.0	334.231	-94.925	680.000
523.800	10540.000	538.278	0.0	1.061	0.0	319.405	0.0	790.000
523.800	31000.000	546.226	7.948	1.355	0.0	471.167	-151.182	790.000
523.800	31600.000	547.163	0.937	1.380	0.0	475.283	-155.678	790.000
523.800	48700.000	552.768	3.584	1.463	0.0	575.717	-254.312	790.000
533.920	10540.000	538.625	0.0	0.346	0.0	174.958	0.0	660.000
533.920	31000.000	546.126	7.479	-0.123	0.0	471.881	-295.923	660.000
533.920	31600.000	547.048	0.545	-0.114	0.0	531.934	-350.976	660.000
533.920	48700.000	552.416	3.788	0.657	0.0	634.972	-460.114	660.000
53.100	10540.000	539.454	0.0	0.430	0.0	147.457	0.0	540.000
53.100	31000.000	547.623	7.564	1.320	0.0	494.967	-157.008	540.000
53.100	31600.000	548.265	0.867	1.237	0.0	499.905	-157.028	540.000
53.100	48700.000	553.396	3.181	0.582	0.0	500.052	-157.095	540.000
53.200	10540.000	539.454	0.0	0.604	0.0	142.959	0.0	5.000
53.200	31000.000	547.147	7.648	-0.316	0.0	499.960	-157.001	5.000
53.200	31600.000	548.102	1.075	-0.103	0.0	499.983	-157.024	5.000
53.200	48700.000	553.565	3.483	0.289	0.0	500.055	-157.098	5.000
53.300	10540.000	539.469	0.0	3.011	0.0	142.962	0.0	15.000
53.300	31000.000	547.592	7.913	0.275	0.0	499.966	-157.004	15.000
53.300	31600.000	548.359	3.472	0.172	0.0	499.987	-157.025	15.000
53.300	48700.000	553.712	3.356	0.048	0.0	500.055	-157.094	15.000
544.020	10540.000	539.670	0.0	0.001	0.0	142.962	0.0	1.000
544.020	31000.000	547.766	8.294	0.382	0.0	499.976	-157.012	1.000
544.020	31600.000	548.486	0.722	0.132	0.0	499.990	-157.024	1.000
544.020	48700.000	553.536	3.050	-0.176	0.0	500.053	-157.092	1.000
54.100	10540.000	539.388	0.0	-0.082	0.0	140.366	0.0	100.000
54.100	31000.000	547.165	7.476	-0.400	0.0	313.189	-173.025	100.000
54.100	31600.000	548.217	0.651	-0.449	0.0	325.579	-185.215	100.000
54.100	48700.000	552.880	6.863	-0.656	0.0	341.955	-201.591	100.000
54.200	10540.000	539.393	0.0	0.005	0.0	140.367	0.0	5.000
54.200	31000.000	545.756	6.383	-1.608	0.0	283.292	-140.924	5.000

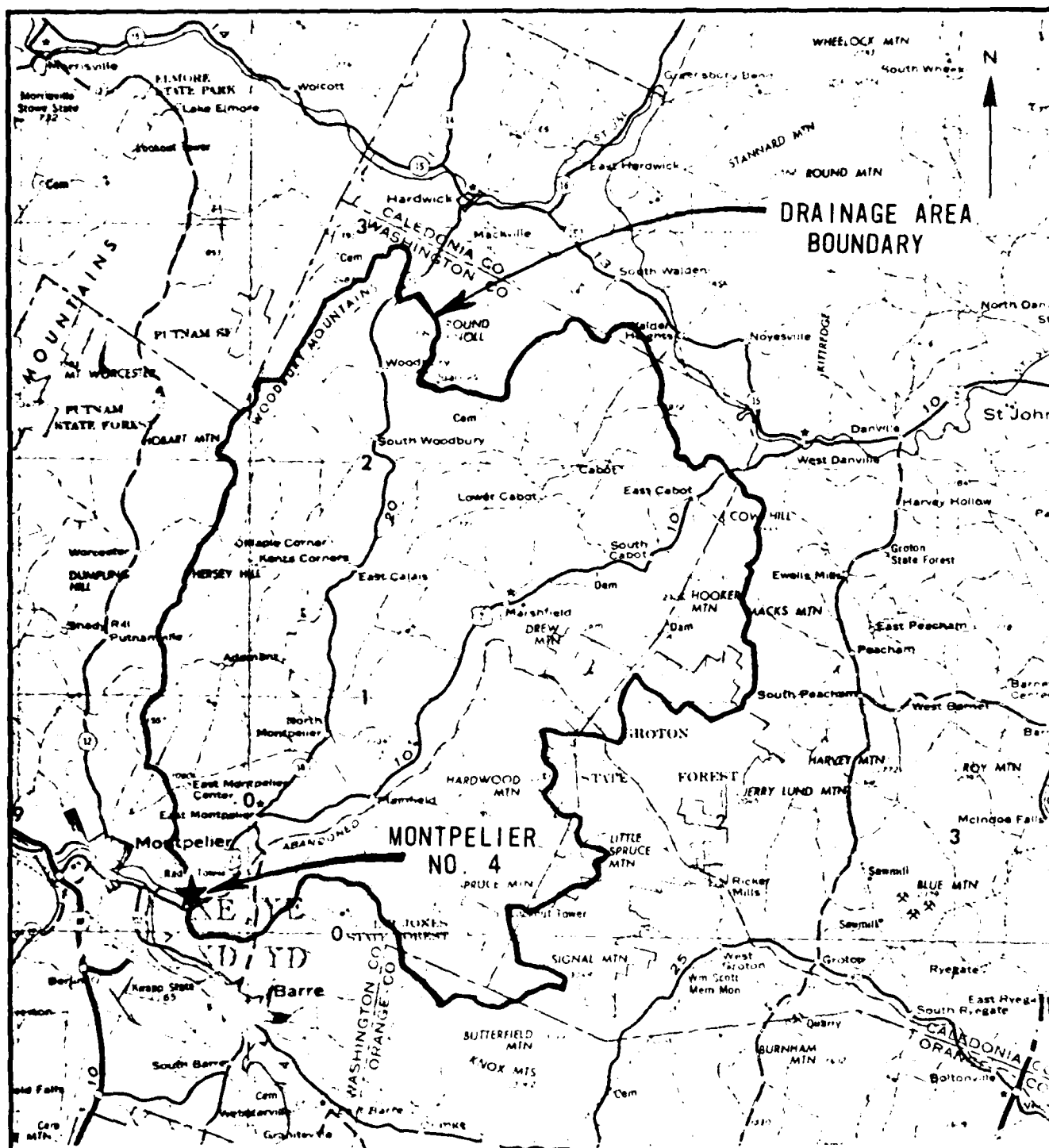
54.200	33600.000	546.760	1.004	-1.257	0.0	301.988	-161.618	5.000
54.200	48700.000	552.977	6.216	0.097	0.0	361.955	-201.568	5.000
54.300	10540.000	539.428	0.0	0.034	0.0	140.390	0.0	25.000
54.300	31600.000	567.755	8.331	2.002	0.0	320.598	-180.208	25.000
54.300	33600.000	564.306	0.546	1.544	0.0	360.812	-190.422	25.000
54.300	48700.000	553.218	4.914	0.241	0.0	361.958	-201.567	25.000
554.050	10540.000	539.432	0.0	0.004	0.0	140.391	0.0	1.000
554.050	31600.000	566.716	9.267	0.560	0.0	320.595	-180.194	1.000
554.050	33600.000	564.194	0.476	0.650	0.0	361.953	-201.532	1.000
554.050	48700.000	553.152	3.958	-0.665	0.0	361.957	-201.566	1.000
564.090	10540.000	539.866	0.0	0.435	0.0	204.543	0.0	211.000
564.090	31600.000	567.860	9.593	1.141	0.0	368.705	-180.120	211.000
564.090	33600.000	553.445	0.545	1.251	0.0	369.357	-190.776	211.000
564.090	48700.000	550.568	4.143	1.446	0.0	394.045	-186.462	211.000
574.190	10540.000	540.358	0.0	0.462	0.0	323.701	0.0	525.000
574.190	31600.000	550.271	8.912	0.411	0.0	336.510	-12.879	525.000
574.190	33600.000	552.672	0.602	0.47	0.0	337.506	-13.605	525.000
574.190	48700.000	554.976	4.104	0.388	0.0	362.598	-14.697	525.000
584.270	10540.000	540.855	0.0	0.527	0.0	371.122	0.0	420.000
584.270	31600.000	550.722	9.837	0.452	0.0	369.708	-10.586	420.000
584.270	33600.000	551.336	0.634	0.464	0.0	390.463	-10.742	420.000
584.270	48700.000	555.356	4.146	0.578	0.0	404.101	-12.474	420.000
594.360	10540.000	541.110	0.0	0.245	0.0	407.206	0.0	670.000
594.360	31600.000	551.148	10.018	0.426	0.0	402.714	-66.515	670.000
594.360	33600.000	551.516	0.470	0.680	0.0	450.412	-69.206	670.000
594.360	48700.000	550.167	4.351	0.612	0.0	469.601	-100.795	670.000
6.548	10540.000	540.811	0.0	-0.319	0.0	104.395	0.0	1020.000
6.548	17600.000	552.242	10.410	0.095	0.0	251.792	-140.737	1.200.000
6.548	19600.000	551.411	0.470	0.695	0.0	451.417	-141.524	1070.000
6.548	36700.000	556.245	4.334	0.074	0.0	1752.617	-164.222	1020.000
6.549	10540.000	540.478	0.0	-0.313	0.0	104.861	0.0	1.000
6.549	17600.000	551.267	10.751	0.008	0.0	1511.732	-141.132	1.000
6.549	19600.000	551.419	0.669	0.008	0.0	1514.917	-141.257	1.000
6.549	36700.000	556.269	4.330	0.003	0.0	1752.617	-165.957	1.000
614.550	10540.000	540.644	0.0	0.146	0.0	102.916	0.0	20.000
614.550	17600.000	551.751	10.803	0.002	0.0	1511.799	-140.883	20.000
614.550	19600.000	551.920	0.669	0.002	0.0	1514.925	-141.009	20.000
614.550	36700.000	556.250	4.330	0.001	0.0	1752.632	-164.716	20.000
6.551	10540.000	541.176	0.0	0.532	0.0	107.533	0.0	1.000
6.551	17600.000	551.265	10.069	-0.006	0.0	1511.799	-140.261	1.000
6.551	19600.000	551.724	0.669	-0.006	0.0	1514.925	-141.192	1.000
6.551	36700.000	556.267	4.333	-0.003	0.0	1752.632	-164.100	1.000
624.710	10540.000	542.851	0.0	1.075	0.0	1023.259	0.0	950.000
624.710	17600.000	551.293	8.442	0.148	0.0	1461.040	-434.161	950.000
624.710	19600.000	551.906	0.673	0.052	0.0	1666.786	-443.525	950.000
624.710	36700.000	556.279	4.333	0.052	0.0	1690.875	-467.618	950.000
634.870	10540.000	542.910	0.0	0.080	0.0	1075.274	0.0	476.000
634.870	17600.000	551.605	8.394	0.012	0.0	1680.274	-605.000	476.000
634.870	19600.000	551.777	0.675	0.014	0.0	1717.414	-642.339	476.000
634.870	36700.000	556.319	4.339	0.020	0.0	1771.758	-650.484	476.000
6.923	10540.000	542.792	0.0	-0.119	0.0	91.735	0.0	543.000
6.923	17600.000	551.127	8.315	-0.178	0.0	1200.377	-110.642	543.000
6.923	19600.000	551.822	0.695	-0.158	0.0	1298.809	-1207.134	543.000

4.923	34700.000	556.269	4.442	-0.050	0.0	2126.031	-2036.295	543.000
4.923	10540.000	543.333	0.0	0.341	0.0	92.011	0.0	1.000
4.923	17000.000	551.234	7.401	0.107	0.0	1214.050	-1122.040	1.000
4.923	19600.000	551.914	0.046	0.043	0.0	1306.803	-1214.594	1.000
4.923	34700.000	556.293	4.379	0.025	0.0	2126.230	-2036.219	1.000
644.910	10540.000	544.401	0.0	1.068	0.0	95.667	0.0	35.000
644.910	17000.000	551.270	6.865	0.036	0.0	1218.081	-1122.194	35.000
644.920	19600.000	551.947	0.078	0.033	0.0	1308.710	-1214.844	35.000
644.930	34700.000	556.306	4.356	0.013	0.0	2126.316	-2036.449	35.000
4.930	10540.000	544.435	0.0	0.034	0.0	96.073	0.0	1.000
4.930	17000.000	551.199	8.765	-0.070	0.0	1209.022	-1112.949	1.000
4.930	19600.000	551.890	0.044	-0.062	0.0	1304.194	-1200.121	1.000
4.930	34700.000	556.269	4.404	-0.017	0.0	2126.260	-2036.187	1.000
655.030	10540.000	544.605	0.0	4.170	0.0	646.976	0.0	528.000
655.030	17000.000	551.493	2.488	0.293	0.0	1104.137	-919.161	528.000
655.030	19600.000	552.151	0.658	0.246	0.0	1153.806	-960.630	528.000
655.030	34700.000	556.306	4.213	0.675	0.0	1266.536	-999.560	528.000
665.190	10540.000	552.813	0.0	4.208	0.0	251.555	0.0	645.000
665.190	17000.000	554.193	1.377	2.696	0.0	299.918	-94.363	645.000
665.190	19600.000	554.818	0.429	2.468	0.0	322.213	-104.716	645.000
665.190	34700.000	556.472	3.680	2.135	0.0	346.962	-94.367	645.000
675.350	10540.000	554.132	0.0	8.486	0.0	131.353	0.0	845.000
675.350	17000.000	562.240	2.936	8.650	0.0	160.966	-24.209	845.000
675.350	19600.000	563.235	0.195	8.416	0.0	170.452	-34.017	845.000
675.350	34700.000	566.952	5.111	10.453	0.0	426.878	-697.523	845.000
685.510	10540.000	567.129	0.0	7.828	0.0	194.175	0.0	845.000
685.510	17000.000	574.007	2.874	7.167	0.0	213.171	-14.196	845.000
685.510	19600.000	574.009	1.121	7.194	0.0	214.898	-24.920	845.000
685.510	34700.000	576.675	3.686	5.123	0.0	261.350	-86.515	845.000

DATA FOR LAST CROSS SECTION
PROFILE TYPE ENC

TARGET TOP WIDTH
AREA-AC4ES TOP WIDTH
AREA-DIPP

1	0.0	0.0	126.288	0.0
2	0.0	0.0	217.977	146.709
3	0.0	0.0	284.563	156.275
4	0.0	0.0	337.059	210.191



DUFRESNE-HENRY ENGINEERING CORP.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

ARCHITECT-ENGINEER

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MONTPELIER NO. 4

DRAINAGE AREA

SOURCE OF MAP

U. S. GEOLOGICAL SURVEY

LAKE CHAMPLAIN

N. Y. . . . N. H. . . . AN.

10-115-01

12-0 000 1472

EAST MONTPELIER

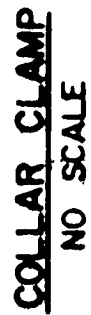
VERMONT

CLIENT NO.	04-0096
------------	---------

SCALE 1" 4 MILES

ENGR.	WAL
-------	-----

DATE FEBRUARY, 1979



**U.S. ARMY ENGINEER DIVISION
NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.**

APPENDIX E

Information as contained in the National Inventory of Dams

AD-A156 737

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
MONTPELIER NUMBER 4 (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV FEB 79

22

UNCLASSIFIED

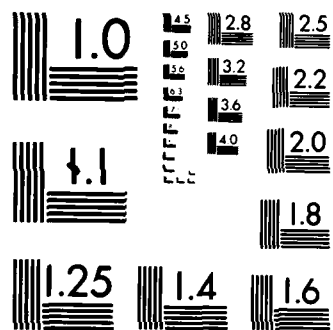
F/G 13/13

NL

END

FILED

ENC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

12-70
FEMA

INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY		DIVISION		STATE		COUNTY		CONGR		NAME		LATITUDE		LONGITUDE		REPORT DATE																																					
STATE	NUMBER	DIST	CONGR	DIST	CONGR	DIST	CONGR	DIST	CONGR	DIST	CONGR	DIST	CONGR	DIST	CONGR	DIST	CONGR																																				
VT	44	CU		VT	123	U1					MONTPELIER NUMBER FOUR	44 10.5	72 31.5				2-1-67																																				
<table border="1"> <thead> <tr> <th colspan="2">POPULAR NAME</th> <th colspan="2">NAME OF IMPOUNDMENT</th> </tr> </thead> <tbody> <tr> <td colspan="2"></td> <td colspan="2"></td> </tr> </tbody> </table>																		POPULAR NAME		NAME OF IMPOUNDMENT																																	
POPULAR NAME		NAME OF IMPOUNDMENT																																																			
<table border="1"> <thead> <tr> <th colspan="2">REGION</th> <th colspan="2">RIVER OR STREAM</th> <th colspan="2">NEAREST DOWNSTREAM CITY - TOWN - VILLAGE</th> <th colspan="2">POPULATION</th> </tr> </thead> <tbody> <tr> <td colspan="2">631</td> <td colspan="2">MONTPELIER RIVER</td> <td colspan="2">MONTPELIER</td> <td colspan="2">6600</td> </tr> </tbody> </table>																		REGION		RIVER OR STREAM		NEAREST DOWNSTREAM CITY - TOWN - VILLAGE		POPULATION		631		MONTPELIER RIVER		MONTPELIER		6600																					
REGION		RIVER OR STREAM		NEAREST DOWNSTREAM CITY - TOWN - VILLAGE		POPULATION																																															
631		MONTPELIER RIVER		MONTPELIER		6600																																															
<table border="1"> <thead> <tr> <th rowspan="2">TYPE OF DAM</th> <th rowspan="2">YEAR COMPLETED</th> <th rowspan="2">PURPOSES</th> <th rowspan="2">STRUCTURAL HEIGHT (FT)</th> <th rowspan="2">HYDRAULIC HEIGHT (FT)</th> <th colspan="2">IMPOUNDING CAPACITIES</th> <th rowspan="2">DIST FROM DAM (MI.)</th> <th rowspan="2">POPULATION</th> </tr> <tr> <th>MAXIMUM (ACRE-FT)</th> <th>NORMAL (ACRE-FT)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1904</td> <td>M</td> <td>26</td> <td>26</td> <td>54</td> <td>16</td> <td>2</td> <td>6600</td> </tr> </tbody> </table>																		TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES		DIST FROM DAM (MI.)	POPULATION	MAXIMUM (ACRE-FT)	NORMAL (ACRE-FT)	1	1904	M	26	26	54	16	2	6600																
TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES		DIST FROM DAM (MI.)	POPULATION																																													
					MAXIMUM (ACRE-FT)	NORMAL (ACRE-FT)																																															
1	1904	M	26	26	54	16	2	6600																																													
<table border="1"> <thead> <tr> <th colspan="18">REMARKS</th> </tr> </thead> <tbody> <tr> <td colspan="18">1ST CAN FLOW M PRV/PED SLS A VEN/LAIE</td> </tr> </tbody> </table>																		REMARKS																		1ST CAN FLOW M PRV/PED SLS A VEN/LAIE																	
REMARKS																																																					
1ST CAN FLOW M PRV/PED SLS A VEN/LAIE																																																					
<table border="1"> <thead> <tr> <th rowspan="2">SPILLWAY</th> <th rowspan="2">MAXIMUM DISCHARGE (CFS)</th> <th rowspan="2">VOLUME OF DAM (CUY)</th> <th rowspan="2">POWER CAPACITY (KW)</th> <th rowspan="2">INSTALLED PROPOSED</th> <th rowspan="2">LENGTH OF DAM (FT)</th> <th rowspan="2">WIDTH OF DAM (FT)</th> <th rowspan="2">HEIGHT OF DAM (FT)</th> <th rowspan="2">LENGTH OF DAM (FT)</th> <th rowspan="2">WIDTH OF DAM (FT)</th> <th rowspan="2">HEIGHT OF DAM (FT)</th> <th rowspan="2">LENGTH OF DAM (FT)</th> <th rowspan="2">WIDTH OF DAM (FT)</th> <th rowspan="2">HEIGHT OF DAM (FT)</th> <th rowspan="2">LENGTH OF DAM (FT)</th> <th rowspan="2">WIDTH OF DAM (FT)</th> <th rowspan="2">HEIGHT OF DAM (FT)</th> <th rowspan="2">LENGTH OF DAM (FT)</th> </tr> </thead> <tbody> <tr> <td colspan="18"></td> </tr> </tbody> </table>																		SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CUY)	POWER CAPACITY (KW)	INSTALLED PROPOSED	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)																		
SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CUY)	POWER CAPACITY (KW)	INSTALLED PROPOSED	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)	WIDTH OF DAM (FT)	HEIGHT OF DAM (FT)	LENGTH OF DAM (FT)																																				
<table border="1"> <thead> <tr> <th colspan="2">OWNER</th> <th colspan="2">ENGINEERING BY</th> <th colspan="2">CONSTRUCTION BY</th> </tr> </thead> <tbody> <tr> <td colspan="2">MONTPELIER POWER CO.</td> <td colspan="2">UNKNOWN</td> <td colspan="2">CONY, DEVELL AND PRUST</td> </tr> </tbody> </table>																		OWNER		ENGINEERING BY		CONSTRUCTION BY		MONTPELIER POWER CO.		UNKNOWN		CONY, DEVELL AND PRUST																									
OWNER		ENGINEERING BY		CONSTRUCTION BY																																																	
MONTPELIER POWER CO.		UNKNOWN		CONY, DEVELL AND PRUST																																																	
<table border="1"> <thead> <tr> <th colspan="2">DESIGN</th> <th colspan="2">CONSTRUCTION</th> <th colspan="2">OPERATION</th> <th colspan="2">MAINTENANCE</th> </tr> </thead> <tbody> <tr> <td colspan="2">PUBLIC SERVICE BD</td> <td colspan="2">PUBLIC SERVICE BD</td> <td colspan="2">PUBLIC SERVICE BD</td> <td colspan="2">PUBLIC SERVICE BD</td> </tr> </tbody> </table>																		DESIGN		CONSTRUCTION		OPERATION		MAINTENANCE		PUBLIC SERVICE BD		PUBLIC SERVICE BD		PUBLIC SERVICE BD		PUBLIC SERVICE BD																					
DESIGN		CONSTRUCTION		OPERATION		MAINTENANCE																																															
PUBLIC SERVICE BD		PUBLIC SERVICE BD		PUBLIC SERVICE BD		PUBLIC SERVICE BD																																															
<table border="1"> <thead> <tr> <th colspan="2">INSPECTION BY</th> <th colspan="2">INSPECTION DATE</th> <th colspan="2">AUTHORITY FOR INSPECTION</th> </tr> </thead> <tbody> <tr> <td colspan="2">MONTPELIER POWER CO.</td> <td colspan="2">21 NOV 78</td> <td colspan="2">PUBLIC LAW 92-307</td> </tr> </tbody> </table>																		INSPECTION BY		INSPECTION DATE		AUTHORITY FOR INSPECTION		MONTPELIER POWER CO.		21 NOV 78		PUBLIC LAW 92-307																									
INSPECTION BY		INSPECTION DATE		AUTHORITY FOR INSPECTION																																																	
MONTPELIER POWER CO.		21 NOV 78		PUBLIC LAW 92-307																																																	
<table border="1"> <thead> <tr> <th colspan="2">REMARKS</th> </tr> </thead> <tbody> <tr> <td colspan="2">55-ABANDONED, UNOPERABLE</td> </tr> </tbody> </table>																		REMARKS		55-ABANDONED, UNOPERABLE																																	
REMARKS																																																					
55-ABANDONED, UNOPERABLE																																																					



INVENTORY OF DAMS IN THE UNITED STATES

STATE VT	IDENTITY NUMBER 20	DIVISION	COUNTY DIST.	CONGR COUNTY DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE	
								DAY	MO YR
					MONTPELIER NUMBER FOUR	4414.5	7231.5	20	FEB 79

POPULAR NAME		NAME OF IMPOUNDMENT	
RIVER OR STREAM		NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	
MONTPELIER RIVER		MONTPELIER	
DIST FROM DAM (MI.)		POPULATION	
2		6600	

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES		DIST FROM DAM (MI.)	POPULATION
					MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)		
ROLL	1909	M	20	20	59	10	2	6600

REMARKS									
1ST DAM FED M PRIVIED SIS A VEH/DAL									
N N N 20 FEB 79									

TYPE OF DAM	SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CV)	POWER CAPACITY (KW)	INSTALLED PROPOSED (KW)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
S	27 U	13400	1000								

OWNER	ENGINEERING BY	CONSTRUCTION BY
VERMONT POWER CO.	VERMONT POWER CO.	CONY, DEVILL AND PRIST

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
PUBLIC SERVICE BD	PUBLIC SERVICE BD	PUBLIC SERVICE BD	PUBLIC SERVICE BD

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
VERMONT POWER CO.	21 NOV 78	PUBLIC LAW 92-507 AUG 1972

REMARKS	
STANDARDIZED, UNIFORMABLE	



INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY DIVISION		STATE COUNTY DIST		CONGR		NAME		LATITUDE		LONGITUDE		REPORT DATE							
NUMBER								(N)		(W)		(DAY MO YR)							
VT	CU	VI	125	VI			MONTPELIER NUMBER FOUR	44° 05'	72° 31' 05"			2 FEB 74							
POPULAR NAME				NAME OF IMPONDMENT															
RIVER OR STREAM				NEAREST DOWNSTREAM CITY - TOWN - VILLAGE				DIST FROM DAM (MI.)		POPULATION									
MONTPELIER RIVER				MONTPELIER				2		6000									
TYPE OF DAM		YEAR COMPLETED		PURPOSES		STRUCTURE HEIGHT (FEET)		HYDRAULIC HEAD (FEET)		IMPOUNDING CAPACITIES (ACRE-FT.)		FIRST CAN FEED M		PAY/FEED SLS A		VEN/DAIL			
271 U		1969		M		20		20		34		10		N		N		2 FEB 74	
REMARKS																			
SPILLWAY		MAXIMUM DISCHARGE (CFS)		VOLUME OF DAM (CU YD)		POWER CAPACITY (MW)		INSTALLED PROPOSED (MW)		LENGTH (FEET)		WIDTH (FEET)		HEIGHT (FEET)		WIDTH (FEET)			
271 U		15410		1000															
OWNER		ENGINEERING BY		CONSTRUCTION BY															
GREEN MOUNTAIN POWER CO.		GREEN MOUNTAIN POWER CO.		GREEN MOUNTAIN POWER CO.															
DESIGN		CONSTRUCTION		OPERATION															
PUBLIC SERVICE BD		PUBLIC SERVICE BD		PUBLIC SERVICE BD															
INSPECTION BY		INSPECTION DATE DAY MO YR		AUTHORITY FOR INSPECTION															
CORPESNE MECH ENG CORP		21 NOV 74		PUBLIC LAW 92-361 AUG 14 72															
REMARKS																			
SS-ADAMUNE UNOPERABLE																			

100-100
100-100

INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	DIVISION	CONGR. DIST.	STATE	COUNTY	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
VT 400	ED	VT 125	VT	ED	MUNIPPELLIEN NUMBER FOUR	44 14.5	72 33.5	6 26 79

POPULAR NAME	NAME OF IMPONDMENT
RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE
	MUNIPPELLIEN
DIST. FROM DAM (MI.)	POPULATION
2	6000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCT. HEIGHT (FEET)	HYDRAUL. HEIGHT (FEET)	IMPONDING CAPACITIES (ACRES)	1ST CAN FED M	NAV/PED	SUS A	VEN/DATE
1	1904	20	20	20	34	10	10	N	6 26 79

REMARKS

SPILLWAY TYPE	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CU YD)	POWER CAPACITY (KW)	INSTALLED PROPOSED	NO. OF LOCKS	NAVIGATION LOCKS	WIDTH (FEET)	LENGTH (FEET)	DEPTH (FEET)
1	1500	1000	1000	1000	1000	1000	1000	1000	1000

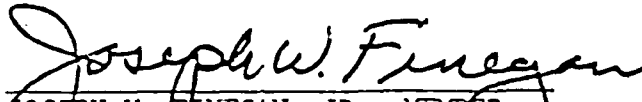
OWNER	ENGINEERING BY	CONSTRUCTION BY
STATE MOUNTAIN POWER CO.	UNKNOWN	CUMY, DEVLIN AND PRUST

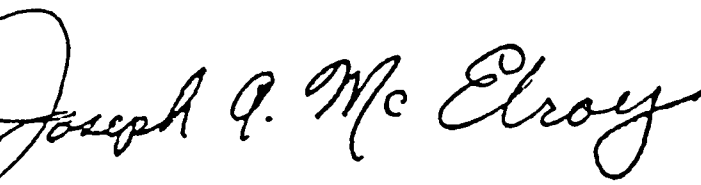
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
PUBLIC SERVICE BD	PUBLIC SERVICE BD	PUBLIC SERVICE BD	PUBLIC SERVICE BD

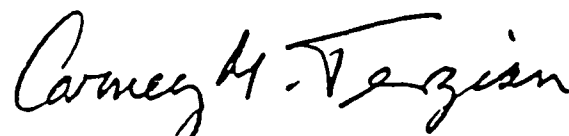
INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
JOHNESNE MEYER ENG CORP	21 NOV 78	PUBLIC LAW 92-307 AUG 1972

REMARKS
35-ABANDONED, UNOPERABLE

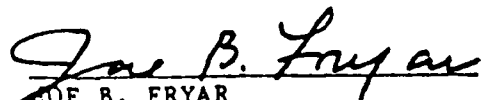
This Phase I Inspection Report on Montpelier Number Four has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment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


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


JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division

This Phase I Inspection Report on Montpelier Number Four 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
JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

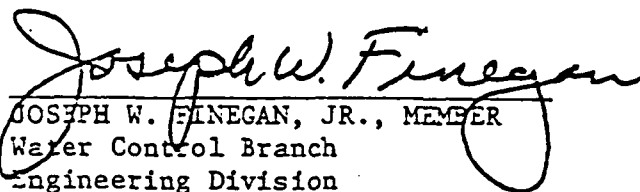
Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

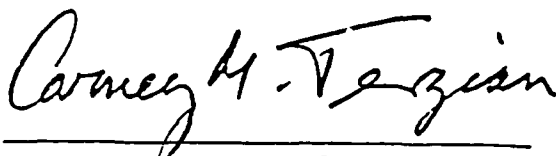
Joe B. Fryar
JOE B. FRYAR
Chief, Engineering Division

This Phase I Inspection Report on Montpelier Number Four 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

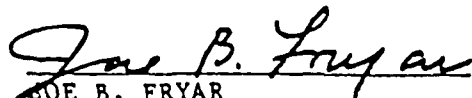


JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division



CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEED-E

JUN 13 1971

Green Mountain Power Corporation
Montpelier
Vermont 05602

Gentlemen:

Forwarded herewith for your information and use is a copy of the Inspection Report on the Montpelier No. 4 Dam. This inspection was made under the authority of Public Law 92-367 by the firm of Dufresne-Henry Engineering Corporation, North Springfield, Vermont under the direction and supervision of the Corps of Engineers. A copy of the finished report has been forwarded to the Governor and the Department of Water Resources, the cooperating agency for the State of Vermont.

Section 7 of the report contains an evaluation and recommendations. If you have any questions concerning this report, contact the Department of Water Resources first. Then, if there are further questions contact the Project Management Branch, Engineering Division of this office. We thank you for your cooperation and assistance in carrying out this program.

Sincerely yours,

JOE B. FRYAR
Chief, Engineering Division

Incl
As Stated



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NATED-R

33 11 879

Green Mountain Power Corporation
Montpelier
Vermont 05602

Gentlemen:

Forwarded herewith for your information and use is a copy of the Inspection Report on the Montpelier No. 4 Dam. This inspection was made under the authority of Public Law 92-367 by the firm of Dufresne-Henry Engineering Corporation, North Springfield, Vermont under the direction and supervision of the Corps of Engineers. A copy of the finished report has been forwarded to the Governor and the Department of Water Resources, the cooperating agency for the State of Vermont.

Section 7 of the report contains an evaluation and recommendations. If you have any questions concerning this report, contact the Department of Water Resources first. Then, if there are further questions contact the Project Management Branch, Engineering Division of this office. We thank you for your cooperation and assistance in carrying out this program.

Sincerely yours,

JOE B. FRYAR
Chief, Engineering Division

Incl
As Stated



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION ON OF:
NEEDS-E

Mr. Cardinal A. LaRosa, Acting Commissioner
Department of Water Resources
State of Vermont
Montpelier, Vermont 05602

Dear Mr. LaRosa:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on Montpelier No. 4 Dam. This inspection was performed in accordance with Public Law 92-367 under the direction of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the owner. We thank you for your cooperation and assistance in carrying out this program and hope this report will help you to develop an effective dam safety program.

Sincerely yours,

JOE B. FRYAR
Chief, Engineering Division

Incl
As stated



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION: 451
NEEDS-2

Mr. Ronald A. LaRosa, Acting Commissioner
Department of Water Resources
State of Vermont
Montpelier, Vermont 05602

Mr. LaRosa:

Forwarded herewith for your information and use is a copy of the Phase I Inspection Report on Montpelier No. 4 Dam. This inspection was performed in accordance with Public Law 92-367 under the direction of the Corps of Engineers. Copies of the finished report have been forwarded to the Governor and the owner. We thank you for your cooperation and assistance in carrying out this program and hope this report will help you to develop an effective dam safety program.

Sincerely yours,

JOE S. FRANK
Chief, Engineering Division

cc:1
As stated



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

RECEIVED
JUN 11 1974

JUN 11 1974

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

I am forwarding to you a copy of the Montpelier No. 4 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 Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Green Mountain Power Corporation, Montpelier, Vermont 05602.

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 Department of Water Resources for your cooperation in carrying out this program.

Sincerely yours,

John P. Thurston
John P. Thurston
Colonel, Corps of Engineers
Division Engineer



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
WEDED

JUN 14 1977

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

I am forwarding to you a copy of the Montpelier No. 4 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 Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Green Mountain Power Corporation, Montpelier, Vermont 05602.

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 Department of Water Resources for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CRANTLER
Colonel, Corps of Engineers
Division Engineer

Incl
as stated

END

FILMED

9-85

DTIC