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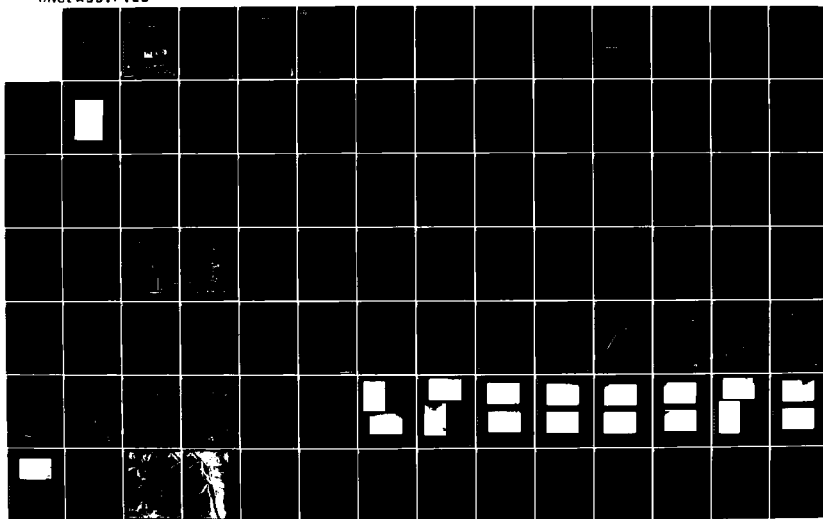
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
KENT POND DAM (VT 000) (U) CORPS OF ENGINEERS WALTHAM
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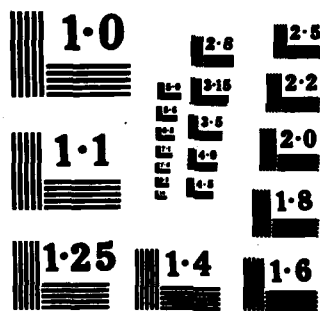
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AD-A156 744

CONNECTICUT RIVER BASIN
SHERBURNE, VERMONT

KENT POND DAM
VT 00071

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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JUL 17 1985
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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1981

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Sherburne, VT. Kent Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earthfill embankment about 1450 ft. long and 26.5 ft. high. The dam is considered to be in fair condition. It is intermediate in size with a significant hazard potential. The test flood is equal to $\frac{1}{4}$ the PMF. There are various recommendations which ~~must~~ ^{should} be implemented by the owner.		

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

AUG 06 1981

NEDED

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

Dear Governor Snelling:

Inclosed is a copy of the Kent Pond Dam (VT-00071) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve 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 vitally important.

Copies of this report have been forwarded to the Department of Environmental Management and to the owner, Department of Fish and Game, Agency of Environmental Conservation, Montpelier, VT. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Management for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

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CONNECTICUT RIVER BASIN

SHERBURNE, VERMONT

KENT POND DAM

VT 00071

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASSACHUSETTS 02154

FEBRUARY, 1981

LETTER OF TRANSMITTAL
FROM THE CORPS OF ENGINEERS TO THE STATE
TO BE SUPPLIED BY THE CORPS OF ENGINEERS

BRIEF ASSESSMENT
PHASE I INSPECTION REPORT
NATIONAL PROGRAM OF INSPECTION OF DAMS

Identification Number:	VT 00071
Name of Dam:	KENT POND DAM
Town:	SHERBURNE
County and State:	RUTLAND COUNTY, VERMONT
Stream:	KENT BROOK
Date of Inspection:	AUGUST 6, 1980

The dam, constructed in 1965, is an earthfill embankment approximately 1,450 feet long and 26.5 feet in height. The upstream and downstream slopes are inclined at 3 horizontal to 1 vertical. The dam contains no drainage blankets or toe drains. The outlet structure is a reinforced concrete box 10 feet square in plan by 22.5 feet deep. The upstream end is fitted with stoplogs to a depth of 6 feet below the top of the structure. The outlet pipe is a 36-inch reinforced concrete pipe; the pond drain is a 12-inch valved cast iron pipe. The remote reinforced concrete emergency overflow spillway is approximately 80 feet long with a crest elevation 1 foot above the normal crest of the service spillway stoplogs.

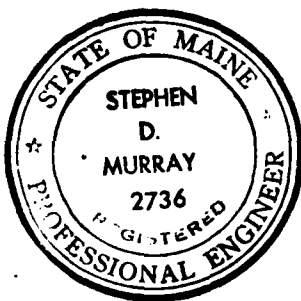
The dam impounds Kent Pond and the discharge flows in a northeasterly direction approximately 4,800 feet to its confluence with the Ottauquechee River. The pond is 2,800 feet in length with a surface area of 102 acres. Storage capacity at the top of the dam elevation is 1,160 acre-ft.

Based upon the visual inspection and the review of available data regarding this facility, the dam is considered to be in FAIR condition. No evidence of structural instability was observed, but three possible seepage areas were noted, the source of which could not be determined because of recent heavy rains.

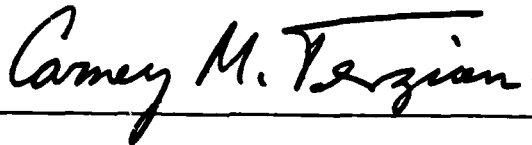
In accordance with the Corps of Engineers Guidelines and the size (INTERMEDIATE) and hazard (SIGNIFICANT) classification of the dam, the Test Flood selected was equivalent to one-half the Probable Maximum Flood (PMF). Peak inflow to Kent Pond is 4,200 cfs; routed peak outflow from the dam and remote emergency spillway is 2,900 cfs with the water elevation 0.2 feet above the dam crest. Total spillway and outlet capacity is 2,800 cfs, which is equivalent to 97% of the routed Test Flood outflow.

It is recommended that the owner engage a qualified, registered engineer to inspect the dam during dry weather to assess the significance of the wet areas observed downstream of the dam. This, and the remedial measures which are discussed in Section 7, should be instituted within one year of the owner's receipt of this report.

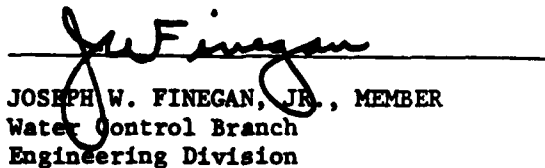

Stephen D. Murray, P.E.
Project Manager
James W. Sewall Company



This Phase I Inspection Report on Kent Pond Dam (VT-00071) 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 judgement and practice, and is hereby submitted for approval.



CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

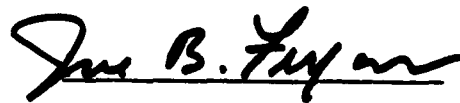


JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division



ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will 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.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

- a. General - No operating procedure, as such, is known to exist.
- b. Warning System - No warning system is known to exist.

4.2 MAINTENANCE PROCEDURES

- a. General - The dam receives no regular maintenance.
- b. Operating Facilities - The stoplogs on the control structure are replaced as they deteriorate. The existing stoplogs appear to be in good condition.

4.3 EVALUATION

The operation and maintenance procedures at this dam are minimal but do not appear to have resulted in any difficulties. Nevertheless, a formal program of operation and maintenance procedures should be developed, including documentation to provide complete records for future reference. In addition, a formal warning system for the primary impact area should be developed and established.

d. Reservoir Area - There are no indications of instability along the banks of the reservoir in the vicinity of the dam.

e. Downstream Channel - There are two downstream channels, one downstream from the outlet pipe from the control structure, and one downstream from the emergency spillway. The two downstream channels are referred to as the outlet channel and the spillway channel, respectively, in the following sections.

The floor of the outlet channel is covered with cobbles and boulders as shown in photo 14. The channel is unobstructed to about 35 ft. downstream from the outlet pipe. Downstream from this point small trees overhang the channel.

The spillway channel is lined with riprap consisting of boulders and pieces of blasted rock as shown in Photo 15. From the downstream end of the concrete spillway to 60 feet downstream of this point the riprap stones are concreted together. There has been displacement and settlement of some rocks of the riprap. This movement is not considered to pose a problem at this time, but the area should be inspected periodically and following major storm events. Fallen trees and other debris were observed at the end of the spillway channel.

About 3,000 feet downstream from the dam is a light duty roadway bridge as shown in Photo 16. Between this bridge and the house shown in Photo 17, the brook channel becomes increasingly steep, leveling abruptly at the Ottawaquechee River flood plain immediately downstream of the above house. Kent Brook enters the Ottawaquechee River about 4,800 feet downstream from the dam. The Ottawaquechee valley at this location is relatively flat, overgrown with bushes and shrubs, about 900 feet wide and nearly devoid of habitable structures. The river is little more than a brook at this location. Within 12,000 feet downstream of the confluence, three roadway bridges cross the Ottawaquechee River.

3.2 EVALUATION

On the basis of the results of the visual inspection, Kent Pond Dam is judged to be in fair condition.

If the small trees and bushes on the upstream slope are allowed to continue to grow, the resulting root systems could create seepage paths which could lead to internal erosion of the dam.

The trees overhanging the outlet channel and the debris at the downstream end of the spillway channel could restrict the flow of water discharged into the channels.

A significant amount of rain fell at the dam site about 12 hours prior to the inspection. It was therefore not possible to determine if the wet areas observed downstream of the downstream toe of the dam were mainly the result of the rain or the result of seepage beneath the dam. The dam should be inspected by qualified engineers during dry weather in order to determine the presence of seepage conditions that could affect the stability of the dam.

1. At the contact of the downstream toe with the left abutment to about 150 feet right of the contact, Photo 6. The wet area extends from the downstream toe of the dam to about 150 feet downstream of the downstream edge of the crest.
2. At about Sta. 7+00 to about Sta. 8+00, Photo 7. The wet area extends from about 80 feet downstream from the downstream edge of the crest to about 120 to 150 feet downstream from the downstream edge of the crest.
3. At about Sta. 9+00 to about Sta. 10+00, Photo 8. The wet area extends from about 100 feet downstream from the downstream edge of the crest to about 140 feet downstream from the downstream edge of the crest.

c. Appurtenant Structures

Emergency Spillway

A concrete emergency spillway is located at the north end of the reservoir, about 2000 feet north of the east end of the dam, Photo 9. Any flow over the emergency spillway bypasses Kent Brook and flows north and east down a separate natural drainageway and intermittent stream which enters the Ottawaquechee River about 3500 feet upstream of where Kent Brook joins the river.

The floor of the inlet channel to the spillway is covered with riprap. A concrete weir wall forms the 80-foot long crest of the spillway, as shown in Photo 10. There is a concrete slab 100 feet long forming the floor of the spillway, with concrete training walls on each side. The channel below the emergency spillway is rock riprap lined which for the first 60 feet has concrete mortar placed between the boulders. The sides of the emergency spillway channel are vegetated with grass and weeds. The natural slope above the channel is tree covered. The joints in the invert and sidewalls of the emergency spillway show no sign of difficulty. There are a few hairline vertical cracks in the vertical sidewalls from which there is a small amount of efflorescence but no indication of structural difficulty as shown in Photo 11.

Outlet Structure

The control structure is located on the upstream slope at about Sta. 4+30, Photo 12, and consists of a vertical concrete inlet shaft which leads to a 36-inch diameter outlet pipe. The rectangular shaft admits water on three sides. The side away from the dam is provided with stoplogs. The right and left sides have weirs to admit water. All visible concrete appears in good condition.

A gate valve and valve handle for the 12-inch pond drain are provided on the far side of this structure. The gate valve is reported to be operable. Access to the valve handle is along a 1½ inch galvanized pipe as seen in Photo 13, providing an insecure means of access, particularly during times of high water or freezing weather.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

At the time of inspection on August 6, 1980, the water level in Kent Pond, impounded by the dam, was 1 inch over the top of the stoplogs. The weather was warm, humid and overcast. The general condition of the dam is fair.

b. Dam - The dam is an earth embankment with approximately 3 horizontal to 1 vertical upstream and downstream slopes. Existing design drawings indicate the dam contains a reinforced concrete core wall along the centerline of the dam from about Sta. 2+00 to about Sta. 7+75. (The referenced station numbers were obtained from Haley and Ward, Drawing No. 2 - "Kent Pond Dam - General Plan of Proposed Dam", dated March 14, 1962). The plans indicate that the sections of the dam to the left and right of the concrete core wall section contain an impervious core along the centerline of the dam.

The dam is located at the southeast end of the reservoir. A reinforced concrete emergency spillway is located at the north end of the reservoir.

Upstream Slope

The upstream slope was covered with rip-rap full length to about elevation 1603 on the date of inspection, as shown in Photo 1. Above this level, the slope is grass-covered. Some bushes and small trees were observed on the upstream slope. There is a small quantity of accumulated debris along the shore. No animal burrows were noted.

Crest

The crest of the dam is about 20 feet wide with a 16-foot wide asphalt-paved roadway as shown in Photo 2. The remaining 4 feet of the crest is grass-covered. No erosion from storm runoff was noted.

Downstream Slope

The downstream slope is grass-covered as shown in Photo 3. The slope is separated into two sections by a knob of natural ground located at about Sta. 5+80. No animal burrows were noted.

The 36-inch diameter control structure outlet pipe passes from the control structure through the dam and exits at the downstream toe of the dam at about Sta. 4+30, Photo 4. As shown in Photo 5, a small rust-colored seepage area was observed adjacent to the left side of the outlet structure. This seepage did not appear to be the result of rain. The seepage was minor and of an undetermined quantity.

Wet, soggy areas with standing water and wetland flora were observed downstream of the downstream toe of the dam at the following locations:

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - Available data consists of three sheets by Haley and Ward Engineers, Boston, Massachusetts; Sheet 2 of 10 - General Plan of Proposed Dam, March 14, 1962; Sheet 6 of 10 - Plan of Spillway and Sections of Embankment, May 1962; and Sheet 7 of 10 - Control Structure, March 14, 1962. Also available was a sheet by DuBois and King, Randolph, Vermont; Sheet 2 of 5 - Emergency Spillway, September 1973.

b. Design Features - The drawings, computations and inspection reports indicate the design features stated in Section 1.

c. Design Data - Design data consists of information on the drawings by Haley and Ward and on the drawing by DuBois and King.

2.2 CONSTRUCTION

a. Available Data - Information as contained in any plans, drawings, or specifications previously listed in "Design Data" or Appendix B.

b. Construction Considerations - No construction data was available for review. The dam is reported to have been built in 1965.

2.3 OPERATION

Pond level readings are not taken on any regular schedule. It is reported that the operating procedure consists of annual winter drawdowns by removal of some of the stoplogs.

2.4 EVALUATION

a. Availability - Existing data was provided by the State of Vermont Agency of Environmental Conservation, (the owner).

b. Adequacy - Detailed hydrologic/hydraulic data were not available. Design data and field measurements were utilized in conjunction with New England Division - Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" to perform the computations of outflow capacity.

The detailed engineering data required to perform an in-depth stability analysis of the dam was not available. The final assessment of the dam, therefore, must be based primarily on visual inspection, performance history, and spillway capacity computations.

c. Validity - A comparison of records, data, and visual observations reveals no significant discrepancies, other than those noted above, between design and as-built dimensions.

	<u>Service</u>	<u>Emergency</u>
6. Downstream channel:	Original streambed	Rip-rap channel to streambed
7. General:	N/A	N/A
j. <u>Regulating Outlets</u>		
1. Invert:		1581.0
2. Size:		12" diameter
3. Description:		C.I. low level drain
4. Control mechanism		Manually operated gate valve
5. Other:		N/A

f. Reservoir Surface

- | | |
|------------------------|------------|
| 1. Normal pool: | 102 acres |
| 2. Flood control pool: | N/A |
| 3. Spillway crest: | 102+ acres |
| 4. Test flood pool: | 102+ acres |
| 5. Top of dam: | 102+ acres |

g. Dam

- | | |
|---------------------|---|
| 1. Type: | Homogeneous earthfill |
| 2. Length: | 1,450 ft |
| 3. Height: | 26.5 ft |
| 4. Top Width: | 20 ft |
| 5. Side Slopes: | 3H to 1V |
| 6. Zoning: | N/A |
| 7. Impervious Core: | 2 sections, one reinforced concrete, one clay |
| 8. Cutoff: | to ledge |
| 9. Grout Curtain: | N/A |
| 10. Other: | N/A |

h. Diversion and Regulating Tunnel

i. Spillway

- | | <u>Service</u> | <u>Emergency</u> |
|----------------------|-----------------------------|---------------------|
| 1. Type: | Stoplogs | Reinforced Concrete |
| 2. Length of weir: | 6 feet | 80 feet |
| 3. Crest el. | 1601.0
(top of stoplogs) | 1602.0 |
| 4. Gates: | N/A | N/A |
| 5. Upstream channel: | N/A | Earthen |

8. Total project discharge at top of dam el. 1606.5 : 2,840 cfs
 9. Total project discharge at test flood el. 1606.7 : 2,930 cfs
- c. Elevation (Feet, assumed datum)
Elevation 1601 assumed datum is between elevations 1536 and 1541 feet NGVD.
1. Streambed at toe of dam: 1580
 2. Bottom of cutoff: varies
 3. Maximum tailwater: N/A
 4. Recreation pool: 1601.0 +
 5. Full flood control pool: N/A
 6. Spillway crest (Ungated): 1601.0
 7. Design surcharge (original design): unknown
 8. Top of dam: 1606.5
 9. Test flood surcharge: 1606.7
- d. Reservoir
1. Length of normal pool: 2,800+ ft
 2. Length of flood control pool: N/A
 3. Length of spillway crest pool: 2,800+ ft
 4. Length of pool at top of dam: 2,800+ ft
 5. Length of test flood pool: 2,800+ ft
- e. Storage
1. Normal pool: 600 acre-ft
 2. Flood control pool: N/A
 3. Spillway crest pool: 600 acre-ft
 4. Top of dam: 1,160 acre-ft
 5. Test flood pool: 1,180 acre-ft

g. Purpose of Dam - Recreation

h. Design and Construction History - The following information is believed to be accurate based upon plans and correspondence available and from conversations with persons familiar with the history of the dam. The dam was designed in 1962 by Haley and Ward Engineers, Boston, Massachusetts, for the State of Vermont Fish and Game Service. A public hearing, as required by the state, was held April 8, 1961, and continued to April 26, 1962, after which a Hearing Order was issued July 12, 1962. Construction was completed in 1965. No unusual construction problems or conditions are known to have been encountered.

i. Normal Operational Procedures - It is reported that the pond level is drawn down up to a maximum of four feet during the winter months by removal of some of the stoplogs. Other than this, no operational procedures exist other than occasional checking.

1.3 PERTINENT DATA

a. Drainage Area - 3.64 square miles of steep, undeveloped terrain which is virtually 100% wooded.

b. Discharge at Dam Site - Discharge is from over the outlet structure and through the 36-inch outlet conduit. Additional discharge is from a remote emergency spillway at higher flows. Elevations are in feet referenced to an assumed datum as shown on the design drawings. Normal pool elevation 1601 feet assumed datum is between elevations 1536 and 1541 feet NGVD.

1. Outlet Works (conduits):

One 36" reinforced concrete pipe at invert elevation 1580.5	200 cfs
--	---------

2. Maximum known flood at dam site:

June 30, 1973. Magnitude unknown.	N/A
-----------------------------------	-----

3. Ungated spillway capacity at
top of dam el. 1606.5 :

2,640 cfs

4. Ungated spillway capacity at
test flood el. 1606.7 :

2,810 cfs

5. Gated spillway capacity at
normal pool el. 1601.0 :

N/A

6. Gated spillway capacity at test
flood el. 1606.7 :

N/A

7. Total spillway capacity at
test flood el. 1606.7 :

2,810 cfs

four sides under surcharge conditions. A 12-inch gated pond drain, controlled by a "T" handle at the operating level, enters the box at elevation 1581. The outlet pipe is 36-inch diameter reinforced concrete, installed at a slope of .005, with its upstream invert matching the bottom of the box.

An 80-foot long remote reinforced concrete emergency overflow spillway exists on the north end of the pond. Any flow over the emergency spillway bypasses Kent Brook and flows down a separate natural drainageway and intermittent stream which enters the Ottauquechee River about 3,500 feet upstream of where Kent Brook joins the river.

Elevations are in feet referenced to an assumed datum as shown on the design drawings for the dam. Normal pool elevation 1601 feet assumed datum is between elevations 1536 and 1541 feet NGVD.

No instrumentation exists at this dam.

c. Size Classification - INTERMEDIATE - The dam impounds 1,160 acre-ft of water with the pond level at the top of the dam, which at elevation 1606.5 is 26.5 feet above the original streambed. According to the Recommended Guidelines, the dam is classified as intermediate in size since its impoundment is between 1,000 acre-ft and 50,000 acre-ft.

d. Hazard Classification - SIGNIFICANT - If the dam were to be breached there is potential for considerable damage and possible loss of a few lives. There would be a sudden 19 foot increase in stage at a light duty road crossing about 3,000 feet downstream of the dam, which would inundate the crossing by 15 feet and destroy it. Further downstream, about 3,750 feet downstream of the dam, is a residential structure about 10 feet above the brook. The rapid increase in stage would flood this structure to a depth of nearly 13 feet. About 5,500 feet downstream of the dam and 1,000 feet downstream of the confluence of Kent Brook and the Ottauquechee River is a triple 7-foot diameter culvert which carries an unimproved roadway over the river. The road, about 9 feet above the streambed, would be overtopped nearly 17 feet by the breach flow. Further downstream on the Ottauquechee, about 12,500 feet from the dam, is a concrete bridge which carries a paved town road over the river. This road, about 14 feet above the streambed, would be overtopped by about 3.5 feet by the failure flood. About 300 feet downstream of this bridge is a mobile home with the floor about 6 feet above the streambed. The mobile home would be flooded to a depth of about 11 feet by the failure flow.

e. Ownership - Department of Fish and Game
Agency of Environmental Conservation
State of Vermont
Montpelier, Vermont 05602
(802) 828-3371

The dam was built by its present owner.

f. Operator - Department of Fish and Game
Agency of Environmental Conservation
State of Vermont
Montpelier, Vermont 05602
(802) 828-3371

PHASE I INSPECTION REPORT

KENT POND DAM

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James W. Sewall Company 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 James W. Sewall Company under a letter of April 2, 1980 from William E. Hodgson Jr., Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

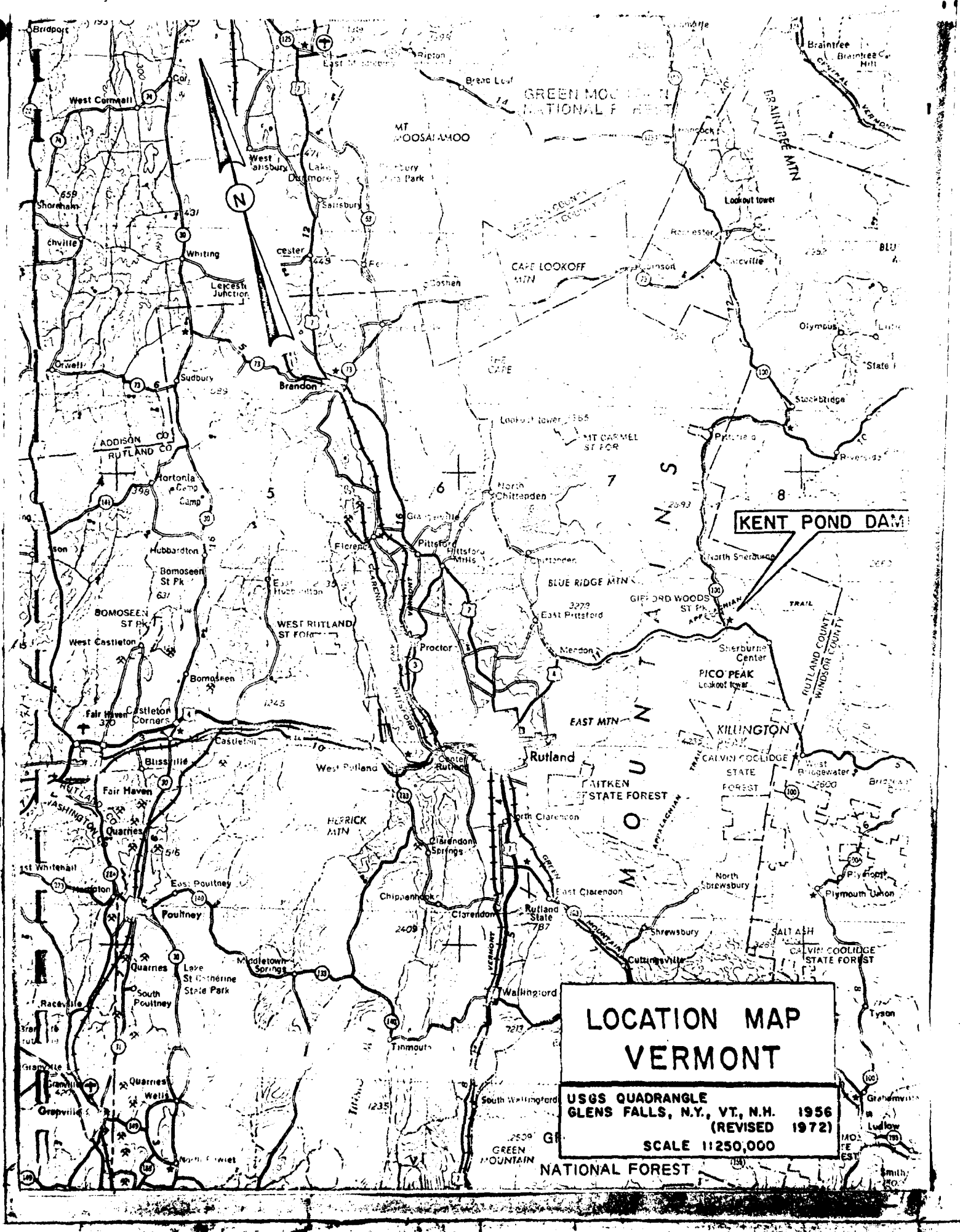
1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located at the outlet of Kent Pond in the Town of Sherburne, County of Rutland, State of Vermont. The dam is shown on the Pico Peak, Vt. 7.5 minute USGS Quadrangle Map having coordinates latitude N43° 40.5' and longitude W72° 48.1'.

b. Description of Dam and Appurtenances - The dam, completed in 1965, consists of a homogeneous earthfill embankment having a total length of approximately 1450 feet, including outlet works near the left end of the dam.

The embankment has a top elevation of approximately 1606.5, is 26.5 feet in height above the streambed and is 20 feet wide at the crest. The upstream slope is inclined at 3 horizontal to 1 vertical. The downstream slope is also inclined at 3 horizontal to 1 vertical and has no drainage blanket or toe drain.

The outlet structure consists of a reinforced concrete box 10 feet by 10 feet in plan with the bottom at elevation 1580.50 and the top at elevation 1603.0. Pond level control is achieved by two sets of 3-foot long stoplogs in the upstream end of the box. The four stoplog guides extend down six feet below the top of the structure to elevation 1597.0. For a normal pool elevation, stoplogs are inserted up to elevation 1601.0. A 5-foot long by 1.5' deep slot (down to elevation 1601.50) exists in each side of the structure, and the top of the box is open which allows for overflow into the box from all



KENT POND DAM

LOCATION MAP
VERMONT

USGS QUADRANGLE
GLENS FALLS, N.Y., VT, N.H. 1956
(REVISED 1972)

SCALE 1:250,000

GREEN MOUNTAIN
NATIONAL FOREST



OVERVIEW PHOTO

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

JAMES W. SEWELL COMPANY
CONSULTANTS
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM - VT 00071

SHERBURNE, VERMONT

APRIL 22, 1980

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SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The tributary watershed consists of 3.64 square miles of undeveloped steep terrain, virtually 100% wooded and containing no significant storage other than Kent and Pico Ponds. These ponds have a surface area of 110 acres constituting less than 5% of the total drainage area. Kent Pond Dam is an earth embankment equipped with a 6-foot long overflow service spillway and an 80-foot long emergency spillway crest 1 foot higher. The service spillway discharges to Kent Brook, which enters the Ottauquechee River about 4,500 feet downstream of the dam. The emergency spillway discharges to an adjacent un-named brook which also enters the Ottauquechee River. Total spillway discharge capacity is about 97% of the routed Test Flood outflow.

5.2 DESIGN DATA

No design data are known to exist for this project.

5.3 EXPERIENCE DATA

The maximum known flood at the dam site reportedly occurred June 30, 1973. No specific information concerning maximum discharge was located. This flood damaged the earthen channel and concrete weir wall of the overflow spillway, which was subsequently replaced with reinforced concrete. The dam was not overtopped.

5.4 TEST FLOOD ANALYSIS

The Test Flood for this significant hazard, intermediate size dam ranges from one-half of the Probable Maximum Flood (PMF) to the Probable Maximum Flood. One-half of the PMF was selected as the Test Flood since Kent Pond Dam is at the lower end of the intermediate size classification and poses a relatively low risk to the populated areas.

Peak inflow to Kent Pond is 4,241 cfs and was determined using the "Mountainous" guide curve of the "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978 which provides a cubic foot per second per square mile (CSM) for the PMF, which when applied to the watershed area, provides an estimated PMF in cubic feet per second. Peak outflow is 2,930 cfs with the water elevation 0.2 feet above the top of dam and the initial reservoir level assumed at the crest of the spillway (el. 1601.0 assumed datum). Based upon hydraulics computations, the maximum spillway and outlet capacity is 2,840 cfs, or approximately 97% of the routed Test Flood outflow.

5.5 DAM FAILURE ANALYSIS

Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow to Kent Brook with the pool initially at the top of the dam (el. 1606.5 assumed datum) would be approximately 110,100 cfs. Pre-failure flow, assumed to be the spillway discharge with the water level at the top of the dam, was 198 cfs. The hazard area includes the 4,500 foot length of Kent Brook downstream of the dam, and a 9,000 foot reach of the Ottauquechee River downstream from the mouth of Kent Brook. Routing of the failure flood resulted in an approximate 90% flow reduction in the above 13,500 ft. length, and the considerable flood plain storage available on the Ottauquechee below this point indicates little further hazard potential.

The failure flood would produce a sudden increase in stage of 16 feet immediately downstream of the dam, which would overtop a light duty roadway bridge about 3,000 feet downstream by about 14 feet, destroying the bridge and causing considerable roadway damage. Further downstream, about 3,750 feet from the dam, a residential structure with sill elevation about 10 feet above the stream bottom would be flooded to a depth of nearly 13 feet by the rapid increase in stage from 1.2 feet to 22.8 feet. About 5,500 feet from the dam and 1,000 feet downstream of the confluence of Kent Brook with the Ottauquechee River is a triple 7-foot diameter culvert which carries an unimproved roadway over the river. The road, about 9 feet above the streambed, would be overtopped nearly 17 feet by the breach flow. Further downstream on the Ottauquechee, about 12,500 feet from the dam, is a concrete bridge which carries a paved town road over the river. This road, about 14 feet above the streambed, would be overtopped by about 3.5 feet by the failure flood. About 300 feet downstream of this bridge is a mobile home with the floor about 6 feet above the streambed. The mobile home would be flooded to a depth of about 11 feet by the failure flow. There is potential for considerable property damage and loss of a few lives, thus Kent Pond Dam has been classified as a "Significant Hazard" dam.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION

The visual inspection did not disclose any immediate stability problems. However, the roots of the trees and bushes growing on the upstream slope and near the downstream toe of the dam could lead to internal erosion of the dam if continued growth of the trees is permitted. The trees overhanging the outlet channel and the debris at the downstream end of the spillway channel could restrict the flow of water discharged into the channels.

It was not possible to determine if the wet areas observed downstream of the dam were mainly the result of the rain which fell at the site about 12 hours prior to the inspection or the result of seepage beneath the dam. The dam should be inspected by qualified engineers during dry weather in order to determine the presence of seepage conditions that could affect the stability of the dam.

6.2 DESIGN AND CONSTRUCTION DATA

Due to the lack of in-depth and construction data for this dam, the assessment of safety is based on the results of the visual inspection and on engineering judgment.

6.3 POST-CONSTRUCTION CHANGES

When the dam was constructed in 1965 at the southeast end of Kent Pond, the separate emergency spillway was constructed in a saddle of land at the north end of the reservoir consisting of an 80-foot long concrete weir wall with stone paving on either side, together with an earthen downstream channel.

This emergency spillway received heavy damage during the passage of hurricane "Belle" in July, 1973. During the fall of 1973 the emergency spillway was reconstructed with a concrete slab 25 feet upstream of and 75 feet downstream of the weir wall, with concrete training walls forming the sides of the spillway. The discharge channel is covered with riprap.

6.4 SEISMIC STABILITY

The dam is located in Seismic Zone 2, and in accordance with the recommended Phase I guidelines does not warrant seismic investigation.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Condition - Based upon the visual inspection, the dam is judged to be in fair condition.
- b. Adequacy of Information - Due to the lack of design and construction data for this dam, the assessment of safety is based solely on the visual inspection.
- c. Urgency - The remedial measures and recommendations presented below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

7.2 RECOMMENDATIONS

The owner should engage a qualified registered engineer to undertake further investigations as follows:

- a. Inspect the dam during dry weather in order to determine if the wet areas observed downstream are due to seepage conditions that could affect the stability of the dam.
- b. Investigate the seepage at the left side of the outlet headwall and determine corrective measures.

The owner should implement all recommendations by the engineer.

7.3 REMEDIAL MEASURES

Operating and Maintenance Procedures

1. The trees on the upstream slope and within 20 feet of the downstream toe should be cut and later new growth cut every two years.
2. After the brush is removed, the trees overhanging the outlet channel should be cut and later new growth cut every two years.
3. The debris along the upstream slope of the dam, at the outlet structure and at the downstream end of the spillway channel should be removed periodically.
4. The grass embankment slopes should be mowed on a regular basis, at least once a year.
5. A safer and more secure means of access to the pond drain valve handle of the outlet control structure should be provided.

6. The dam should be monitored during periods of intense rainfall and a formal downstream warning system, to be implemented in the event of flood flow or imminent dam failure conditions, should be developed by the owner.
7. A formal program of operating and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.
8. A formal annual inspection of the dam and emergency overflow by qualified engineers should be provided. The emergency overflow should be inspected after each major storm event.

7.4 ALTERNATIVES

This study has identified no practical alternative to the above recommendations.

APPENDIX A
VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECKLIST PARTY ORGANIZATION

PROJECT Kent Pond Dam

DATE 9/10/69

TIME 9:00

WEATHER Clear, warm

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

PARTY:

- | | |
|--------------------------------------|--|
| 1. <u>Stephen D. Murphy S.D.M.</u> | 6. <u>A. Peter Barron P. A. Barron</u> |
| 2. <u>Robert L. Hargrove R.L.H.</u> | 7. _____ |
| 3. <u>Charles A. Hargrove C.A.H.</u> | 8. _____ |
| 4. <u>David P. LaGatta D.P.L.</u> | 9. _____ |
| 5. <u>Stephen L. Hargrove S.L.H.</u> | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam Structure</u>	<u>D.P.L. S.L.H. S.D.M. R.L.H. C.A.H.</u>	
2. <u>Appurtenant Structures</u>	<u>S.D.M. R.L.H. S.L.H.</u>	
3. <u>Outlet Works</u>	<u>D.P.L. S.L.H. S.D.M. R.L.H. C.A.H.</u>	
4. <u>Drainage</u> <u>Emergency Spillway</u>	<u>D.P.L. S.L.H. S.D.M. R.L.H. C.A.H.</u>	
5. <u>Approved Discharge Channel</u>	<u>D.P.L. S.L.H. S.D.M. R.L.H. C.A.H.</u>	
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

PROJECT Don Embankment DATE Aug. 6, 1950
 PROJECT FEATURE Don Embankment NAME _____
 DISCIPLINE Civil Engr. Co. NAME SAV. P. & C. Co.
Civil Technica, Engineers Inc. D.P.L. S. L.

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	Minor cracks to pavement on crest.
Pavement Condition	Good
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No misalignment observed
Horizontal Alignment	No misalignment observed
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	No evidence of trespassing
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	No failures observed
Unusual Movement or Cracking at or Near Toe	None observed
Unusual Embankment or Downstream Seepage	None wet areas downstream of downstream toe of dam.
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed
Vegetation	Some small bushes on upstream slope.

PERIODIC INSPECTION CHECKLIST

PROJECT West Pond Dam DATE 10/10/80
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE Geotechnical Engineering Inc. NAME John J. Smith

AREA EVALUATED	CONDITION
DIKE EMBANKMENT Crest Elevation Current Pool Elevation Maximum Impoundment to Date Surface Cracks Pavement Condition Movement or Settlement of Crest Lateral Movement Vertical Alignment Horizontal Alignment Condition at Abutment and at Concrete Structures Indications of Movement of Structural Items on Slopes Trespassing on Slopes Sloughing or Erosion of Slopes or Abutments Rock Slope Protection - Riprap Failures Unusual Movement or Cracking at or Near Toes Unusual Embankment or Downstream Seepage Piping or Boils Foundation Drainage Features Toe Drains Instrumentation System Vegetation	<i>Diagrams of dam cross-sections and plan view showing inspection points.</i>

PERIODIC INSPECTION CHECKLIST

PROJECT Port Pogo Dam DATE 11/15/2000
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE Geotechnical Engineering Inc. NAME John J. Smith

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u> a. Approach Channel Slope Conditions Bottom Conditions Rock Slides or Falls Log Boom Debris Condition of Concrete Lining Drains or Weep Holes b. Intake Structure Condition of Concrete Stop Logs and Slots	<i>Not observed - under water</i> <i>Not observed - under water</i>

PROJECT Bay BridgeDATE Aug. 3, 1987PROJECT FEATURE Approach Structure

NAME _____

DISCIPLINE Geotechnical EngineeringNAME John J. ...

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Control structure is a rectangular section concrete structure with a 36" outlet pipe at the bottom.
a. Concrete and Structural	Good
General Condition	Good
Condition of Joints	Good
Spalling	None observed
Visible Reinforcing	None observed
Rusting or Staining of Concrete	Minor staining
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None observed
Cracks	None observed
Rusting or Corrosion of Steel	None observed
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PROJECT 1000' Water Main DATE Aug. 1, 1960
 PROJECT FEATURE Outlet Pipe NAME _____
 DISCIPLINE Sanitary Engineering NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General Condition of Concrete	36" Diameter pipe from 10' to 12' structure, concrete appearing at downstream end
Rust or Staining on Concrete	Good
Spalling	Minor staining of concrete
Erosion or Cavitation	None visible
Cracking	None visible
Alignment of Monoliths	Not visible
Alignment of Joints	Not visible
Numbering of Monoliths	
	A small seepage area was visible at the left end of the transition.

PERIODIC INSPECTION CHECK

PROJECT Red Bank Dam DATE August 2, 1974
 PROJECT FEATURE Outlet Structure NAME
 DISCIPLINE NAME
Engineers Inc.

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u> General Condition of Concrete Rust or Staining Spalling Erosion or Cavitation Visible Reinforcing Any Seepage or Efflorescence Condition at Joints Drain holes Channel Loose Rock or Trees Overhanging Channel Condition of Discharge Channel	<i>None observed</i> <i>Good to 35' downstream of outlet pipe.</i> <i>Some trees overhanging channel.</i> <i>Good to 35' downstream of outlet pipe.</i> <i>Fair downstream from this point.</i>

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On the morning of September 10, 1973, John Scott of DuBois & King, Inc., met with Messrs. Rouleau, Manning and Spies of the Vermont Department of Water Resources to present a basis for final design. A verbal approval was given to proceed.

On September 12, 1973, DuBois & King, Inc. personnel discussed the basis of design further with Messrs. Manning and Rouleau of the Water Resources Department regarding the selection of the concrete alternative versus using riprap.

On September 17, 1973, written approval of the basis of design dated September 13th, 1973, was received by DuBois & King, Inc.

Preparation of final plans and specifications commenced on September 10th, 1973 and discussions between members of the Water Resources Department and DuBois & King, Inc. took place during the development of the final planning documents.

On the 21st of September, 1973, Messrs. Spies and Manning visited DuBois & King offices to review the status of the plans, to go over the details and to briefly review the specifications. No changes were indicated at that meeting and DuBois and King proceeded to finalize all plans and specifications ready for bidding on September 24th, 1973.

The preliminary notice to possible interested contractors was sent out on September 20th, 1973. This list was sent to 40 contractors. The project will be formally advertised in the Burlington Free Press and the Rutland Herald on September 24th, 1973 and October 1st, 1973.

Bids will be received at the DuBois & King offices at 2:00 p.m., daylight saving time on October 8, 1973. It is the intent to award the contract and authorization to proceed by October 12, 1973 and substantially complete concrete and riprap work in 65 days. Final grading, seeding, cleanup would be accomplished in the Spring and the entire job closed out by June 1, 1974.

Attached to this memorandum is a brief summary of the technical basis of design. Also attached is an engineer's estimate of the work as indicated in the proposal section of the contract document.

RED/jpb

Attachment

September 24, 1973

2. The uncertainties of obtaining suitable riprap, possible reluctance of contractors to bid, satisfactory riprap reconstruction and the necessity to shape a spillway to certain dimensions using heavy riprap were all discussed.
3. The second alternative was to use a concrete chute with limited riprap protection at the upstream end and at the exit appeared to be more desirable because of the assurance that the work would be performed satisfactorily and could be controlled. The channel could be shaped and concrete work might be installed faster and more satisfactorily in the short period of time remaining to construct the work prior to winter season.

The outcome of this meeting was that DuBois & King, Inc. was to finalize the quantities, prepare a project cost estimate and submit a report immediately summarizing the use of the concrete alternate.

It should be pointed out that at this point in time, the design work was to be confined to property owned by the Fish and Game Department and although work downstream in the channel, while desirable, was of questionable status because the property owner had not been contacted at that time. Therefore, the preliminary report submitted and discussed below did not contemplate substantial work beyond the concrete chute.

On July 26, 1973, a formal written preliminary report on the reconstruction of the spillway was submitted to Commissioner Kehoe. The construction costs were estimated (at that time) to be between \$86,000 and \$104,000 and the project cost was estimated to range between \$103,000 and \$122,000. The preliminary report indicated that if DuBois & King, Inc. were authorized to proceed with the final design by August 1, 1973 that the plans and specifications would be ready sometime during the week of August 15, 1973, thereby permitting early bidding and construction to be underway in early September and hopefully completed early in November, 1973.

On July 31, 1973, an inspection report on the entire Kent Pond Dam was submitted to Commissioner Kehoe. This report contained descriptions and photographs of damage that occurred at the emergency spillway and erosion at the outlet conduit through the main dam. It was recommended that riprap be placed at the outlet to arrest further erosion and restore the channel at this point to a satisfactory condition.

There was no activity on the project until about August 22, 1973 when Mr. LaRosa contacted Mr. DuBois to prepare formal contracts for the final design and other associated engineering services. These contracts were prepared and hand delivered to Mr. Brierley of the Vermont Department of Water Resources on August 24, 1973.

The contract between the Vermont Fish and Game Department and DuBois & King, Inc. is dated August 30th, 1973. These contracts were transmitted to DuBois & King on August 30th, 1973 and received on September 4th, 1973. Mr. Collins who transmitted the contracts indicated there would be a verbal approval to proceed within a few days. Mr. Collins called the DuBois & King office and gave a verbal approval to proceed on September 4th, 1973.

KENT POND EMERGENCY SPILLWAY
VERMONT DEPARTMENT OF FISH AND GAME
SUMMARY OF EVENTS AND CONCLUSIONS LEADING TO BASIS OF DESIGN

Background

On July 9, 1973, Ed Kehoe, Commissioner of the Vermont Fish and Game Department telephoned Mr. William Baumann, Vice President of DuBois & King, Inc., and indicated that he wanted DuBois & King, Inc. to do the preliminary and final design work for the repairs to the Kent Pond Dam Emergency Spillway in Sherburne, Vermont. This spillway was severely eroded during the July, 1973 flood.

On July 11, 1973, at 9:30 a.m., Richard E. DuBois, President of DuBois & King, Inc., met with Mr. Robert Collins, Maintenance Supervisor of the Vermont Fish and Game Department at the site of the emergency spillway. A general inspection of conditions took place together with discussions regarding property lines, rights of access and possible methods of repair.

On July 12, 1973, Mr. DuBois contacted Andy Rouleau of the Water Resources Department to discuss the project and Mr. Rouleau advised that some data was available in their files. Also, Mr. Rouleau requested an inspection of the entire dam to determine if other damage had occurred. DuBois & King, Inc. agreed to perform this inspection.

On July 12, 1973, Mr. DuBois wrote Commissioner Kehoe confirming his conversation with Mr. Baumann relative to performing the engineering services and indicating that the preliminary work would be ready for discussion no later than July 25, 1973.

On July 13, 1973, Mr. LaRosa called regarding contractual arrangements for the preliminary design work. Apparently up to \$2,000 was authorized for this portion of the work.

On the afternoon of July 25, 1973, Commissioner Kehoe and Mr. Collins of the Fish and Game Department met with Mr. DuBois at the DuBois & King offices to go over the preliminary schemes and cost estimates for the proposed reconstruction. At this meeting, a general discussion of two alternatives took place. It was the general consensus of those present that a concrete chute or concrete spillway would be more desirable than a riprap spillway. The reasons for this were:

1. Preliminary studies utilizing survey data obtained at the site indicated that the riprap would have to be placed on the sides of the spillway at a slope of 1 to 1 or greater because of topographic limitations. Serious concern was expressed by Mr. DuBois concerning the placing of the riprap and possible erosion and slippage because of the steep side banks, if this alternative were used.

DuBOIS & KING, INC.
Engineering and Environmental Services
RANDOLPH, VERMONT 05060

LETTER OF TRANSMITTAL

Phone (802) 728-3376 & 3377

Vermont Department of Water Resources

State Office Building

Montpelier, Vermont 05602

DATE	September 25, 1973	JOB NO	73114
ATTENTION	Andy Rouleau		
RE	Kent Pond		
	Sherburne, Vermont		

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

- ☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ Copies

COPIES	DATE	NO.	DESCRIPTION
1	Sept 25/73		Summary of Events and Conclusions Leading to Basis of Design
1	Oct 1/73		Engineer's Estimate
	Copy to B. Perkins Dec 2/73		

ROUTING		
GENERAL		
TO	NOTED	DATE
AJR	✓	7/27
Don	✓	9/28
D.S.		
SUBMITTED TO		
Resubmit _____ copies for approval		
Submit _____ copies for distribution		
Return _____ corrected prints		

THESE ARE TRANSMITTED as (checked below):

- ☐ For approval ☐ Approved as submitted ☐ Submit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Return _____ corrected prints
☐ As requested ☐ Returned for corrections
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS The basis of design was sent to you under separate cover.

Brief opening Oct 8 2 PM
Vote: Columbus Day!

COPY TO _____

Richard E. DuBois, P.E. President

SIGNED: *Richard E. DuBois*

If enclosures are not as noted, kindly notify us at once.

ROUTING		
GENERAL		
TO	NOTED	DATE
ar	✓	7/25
ds	DHS	7-25-75
~~DM~~	~~elgm~~	~~7/25/75~~
DM	elgm	7/25/75
SUSPEND TO		
FILE		

FILE COPY

MANAGEMENT & ENGINEERING DIVISION

July 25, 1975

MEMORANDUM

To: Edward F. Kehoe, Commissioner, Department of Fish and Game
 From: Donald H. Spies, Engineer, Department of Water Resources
 Re: Kent Pond Dam - Sherburne

I made an inspection of the subject structure on July 16, 1975. There is some tree growth on the upstream face which should be cut down. No cracking or erosion was found on the earth fill, however, along the downstream toe north of the spillway, an animal has been grubbing in the grass and has torn up sections of the sod. These areas should be regraded and reseeded. No leakage or seepage was found along the earth fill.

The principal spillway appears to be in good shape and the streambed at the outlet seems to be stable. The emergency spillway is also in good shape. The trench drain looks good and was working at the time of the inspection. A hair-line temperature crack was noted in the spillway's east wall; this is not a serious problem at the present, but should be monitored.

This dam is in good condition.

DHS/law

cc: William Sladyk

ROUTING		
TO	DATE	
CRB	2/26/78	
SUBMITTED TO		
FILE		

WATER QUALITY DIVISION

September 26, 1978

MEMORANDUM

To: Ed Kehoe, Commissioner of Fish & Game
 From: A. Peter Barranco, Jr., Environmental Engineer
 Subject: Kent Pond Dam - Sherburne

On September 18, while in the area, I made a brief inspection of the subject structure and found the dam to be in generally good condition.

The embankment was dry along the downstream slope except for a small wet area about 4' above the toe some 60' left of the outlet channel. This does not appear to be a problem but should be monitored periodically. There are two established (cattails, etc.) swampy areas downstream of the toe - one about 100' long to the left of the outlet channel and the other to the right of the outlet channel adjacent to the curve in the embankment. No boils were visible and these may be natural wet areas.

Although there was only a little brush growing on the upstream slope, both slopes should be mowed at least once a year to prevent future growth and to facilitate inspection for seepage, animal burrows, etc.

Some debris (logs and branches) were caught in the trash racks on the spillway (stop log structure) and should be removed.

v1

VERMONT DEPARTMENT OF WATER RESOURCES

INFORMATION SHEET

Name of Dam Kent Brook Town Sherburne
Owner Dept. of Fish and Game Name of Stream Kent Brook
Address Montpelier Classification _____
Vermont
U.S.G.S. Coordinates: Lat. 43° 45' - 32" Long. 72° 45' - 48" - 4"
U.S.G.S. Map # Pico Peak Aerial Photos VT-62-H 25-221, 222
U.S.G.S. Elev. @ Spillway _____
Total Length of Dam 1500' Crest Width of Emergency 80'
Spillway
Width of Top 20' Maximum Height 26.5 ft.
Spillway Capacity: Principal _____ Emergency _____
Pond Area 101.5 acres Drainage Area 3.64
3.5 sq miles
Pond Volume: Normal Water Level _____ Design High Water Level _____
Maximum Water Depth: Normal Water Level 21 ft. Design High Water Level _____
Level
Storage Before Emergency Spillway is Used _____
Use of Reservoir Recreation, fish propagation
Description of Dam: Earth fill w/ 3 on 1 slopes on each face
Description of Spillway(s): concrete weir w/ stone paving
Designed by Hale & Ward Eng. Boston Year Built 1965
Hoarding Date 11 April 8, 1961 Order Date July 12, 1962
21 April 14, 1962
Additional Remarks:
Plans in PF#6 "dams"

KENT POND DAM

SUMMARY OF DATA AND CORRESPONDENCE

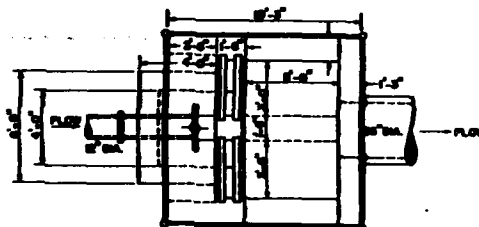
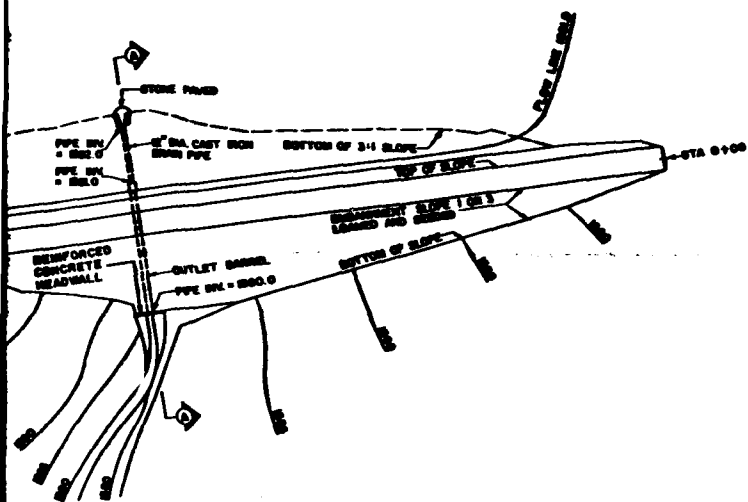
<u>Date</u>	<u>To</u>	<u>From</u>	<u>Subject</u>	<u>Page</u>
-	File	-	Vermont Dept. of Water Resources Information Sheet	B-4
9-26-78	Ed Kehoe, Comm. Fish & Game	Peter Barranco Environ. Eng.	Kent Pond Inspection	B-5
7-25-75	Ed Kehoe, Comm. Fish & Game	Donald Spies Engineer	Kent Pond Dam Inspection	B-7
9-25-73	Vt. Dept. of Water Resources	DuBois & King	Events & Conclu- sions Leading to Basis of Design	B-8
9-25-73	Vt. Dept. of Water Resources	DuBois & King	Basis of Design	B-14
7-24-73	Vt. Dept. of Water Resources	Richard DuBois	Inspection Report Kent Pond Dam	B-17
7-24-73	Vt. Dept. of Water Resources	-	Photos of Damage from Hurricane "Belle"	B-21
62,73	-	-	Design Plans - Reduced in Size	B-22

KENT POND DAM

EXISTING PLANS

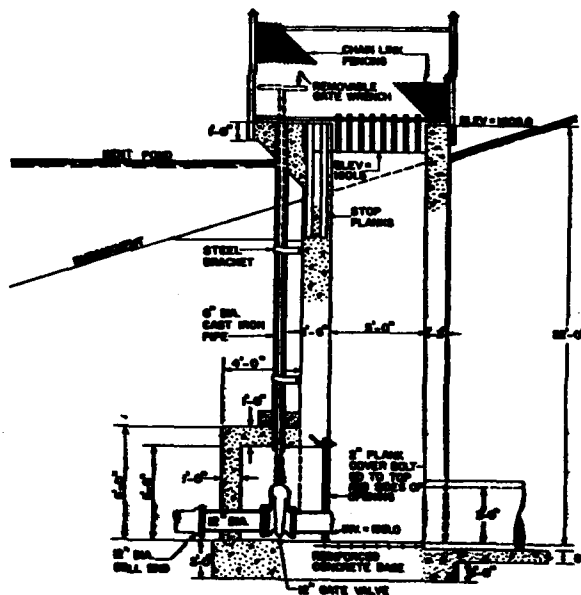
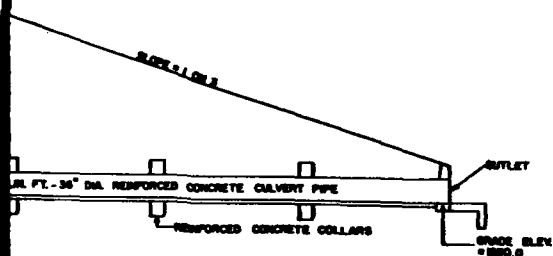
On file with the Vermont Department of Water Resources:

1. State of Vermont Fish and Game Service
Sherburne
Kent Brook Dam
Haley and Ward Engineers, Boston, Mass.
Dwg. 2 of 10 - General Plan of Proposed Dam, March 14, 1962
Dwg. 6 of 10 - Plan of Spillway and Sections of Embankment, May, 1962
Dwg. 7 of 10 - Control Structure, March 14, 1962
2. Vermont Department of Fish and Game
Kent Pond Emergency Spillway
DuBois and King, Randolph, Vermont
Sheet 2 of 5 - Structural Plans and Details, September, 1973



PLAN OF OUTLET CONTROL STRUCTURE

0 5 FEET 0



ELEVATION OF OUTLET CONTROL STRUCTURE

0 5 FEET 0

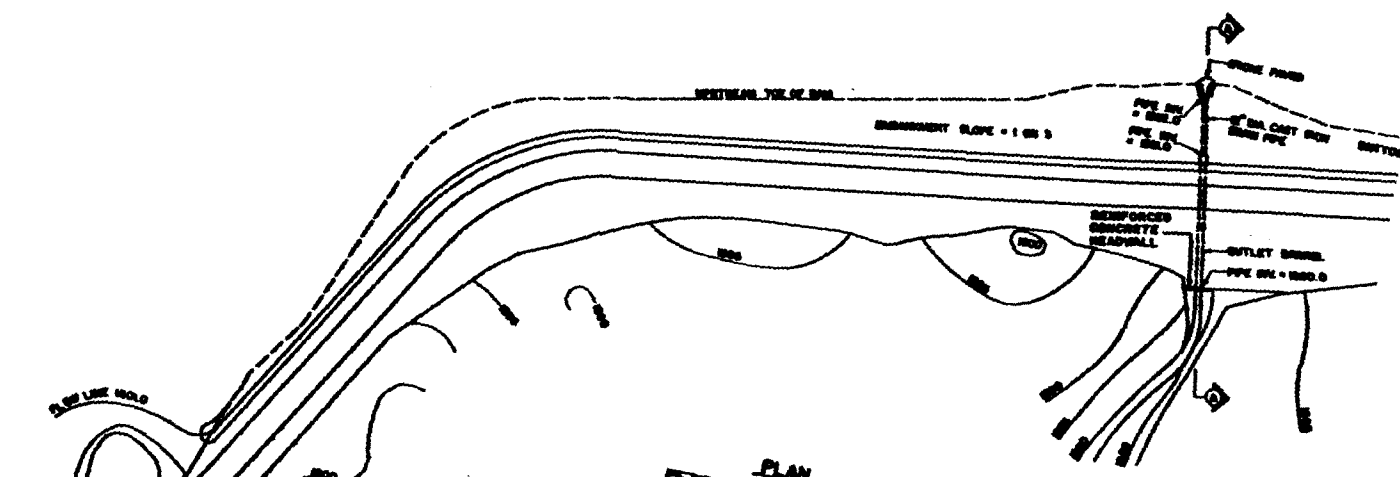
NOTE:
THIS PLAN COMPILED FROM ORIGINAL PLANS
FOR GAGE CONSTRUCTION IN 1932 BY HALEY
AND SON, ENGINEERS, AND MODIFIED AS
OBSERVED IN THE FIELD.
ELEVATIONS REFERENCED TO AN
ASSUMED DATUM

U.S. ARMY ENGINEER DISTRICT NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

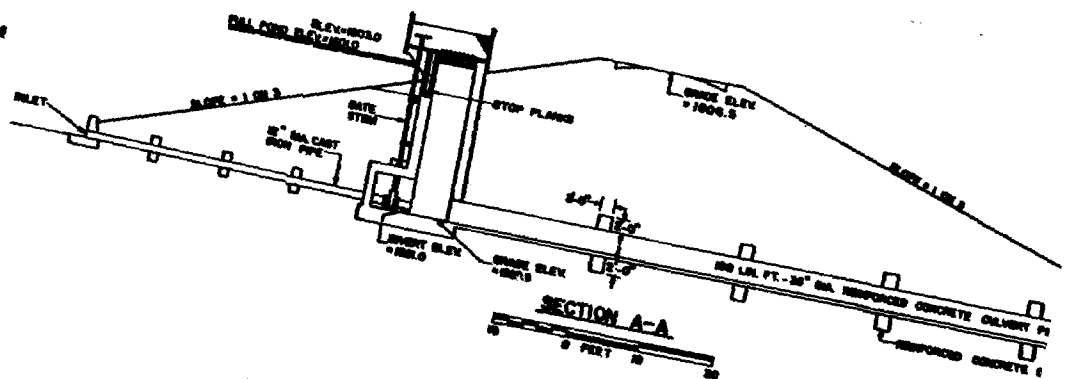
JAMES W. SEWELL CO.
CONSULTING ENGINEERS
147 CENTRE ST. OLD TOWN, ME.
TEL. 207-287-4450

OFFICIAL RECORD OF REPORTING OF NON-PERMANENT DAMAGE
VENT POND DAM
TO-1
SHELBY, VT.

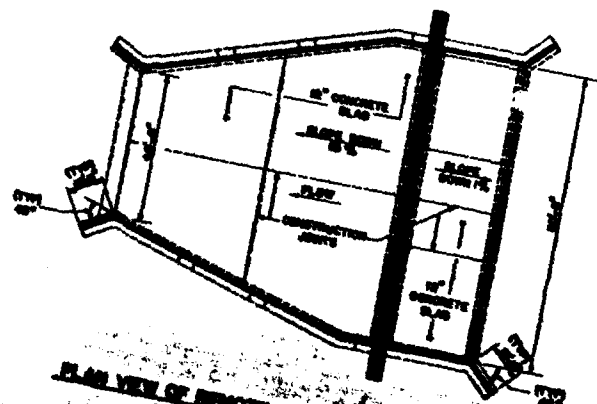
KENT POND



PLAN
0 FEET 50



SECTION A-A
0 FEET 50



PLAN VIEW OF REMOTE EMERGENCY SPILLWAY
0 FEET 50

SEE
FOR PLAN
AND ELEVATION
ELEVATION
SPILLWAY

APPENDIX B
ENGINEERING DATA

ENGINEER'S ESTIMATE

KENT POND EMERGENCY SPILLWAY

24 September 1973

DuBois & King, Inc.

ENR Index = 1930

Item No.	Estimated Quantity	Brief description; unit or lump sum price bid in both words and figures	Total in figures \$
1		Furnishing concrete poured in place and finished complete with all appurtenant materials and work.	
1a	400 Cu.Yd.	Reinforced Class A concrete, per cubic yard: One hundred fifty dollars and no cents (\$ 150.00)	\$ 60,000.00
1b	60 Cu.Yd.	Class B concrete fill, per cubic yard: One hundred thirty dollars and no cents (\$ 130.00)	\$ 7,800.00
2		Furnishing gravel in place, graded and compacted.	
2a	380 Cu.Yd.	Select Gravel, per cubic yard: Seven dollars and no cents (\$ 7.00)	\$ 2,660.00
2b	700 Cu.Yd.	Bank Run Gravel, per cubic yard: Five dollars and no cents (\$ 5.00)	\$ 3,500.00
3		Furnishing stone for riprap, emplaced and positioned.	
3a	360 Sq.Yd.	Type A Riprap, per square yard: Forty dollars and no cents (\$ 40.00)	\$ 14,400.00
3b	140 Sq.Yd.	Type B Riprap, per square yard: Fifteen dollars and no cents (\$ 15.00)	\$ 2,100.00
3c	50* Sq.Yd.	Type C Riprap, per square yard: Twenty-five dollars and no cents (\$ 25.00)	\$ 1,250.00
4	950 Cu.Yd.	Earth Excavation and disposal, per cubic yard: Three dollars and no cents (\$ 3.00)	\$ 2,850.00

For informal comparison only; not to be considered a part of this Proposal.
 *Indeterminate; quantity assumed for comparison of bids.

Item No.	Estimated Quantity	Brief description; unit or lump sum price bid in both words and figures	Total in Figures \$
5	10* Cu.Yd.	Rock Excavation and disposal, per cubic yard: <u>Fifty</u> dollars and <u>no</u> cents (\$ <u>50.00</u>)	\$ <u>500.00</u>
6	1200 Sq.Yd.	Loaming and Seeding, per square yard: <u>One</u> dollars and <u>fifty</u> cents (\$ <u>1.50</u>)	\$ <u>1,800.00</u>
7	Lump Sum	Handling flows during construction, the lump sum of: <u>Five hundred</u> dollars and <u>no</u> cents (\$ <u>500.00</u>)	\$ <u>500.00</u>
8	Lump Sum	Cleaning up, the lump sum of: <u>One Thousand</u> dollars and <u>No</u> cents (\$ <u>1,000.00</u>)	\$ <u>1,000.00</u>

Sub Total \$ 98,360.00

10% Contingencies 9,640.00

TOTAL ESTIMATED CONSTRUCTION COSTS \$108,000.00

Ø For informal comparison only; not to be considered a part of this Proposal.
 * Indeterminate; quantity assumed for comparison of bids.

BASIS OF DESIGN
EMERGENCY SPILLWAY
KENT POND DAM

LOCATION: Kent Pond Dam
Sherburne, Vermont
See attached map.

OWNER: Vermont Department of Fish and Game

WATERSHED CHARACTERISTICS:

Drainage area	-	3.64 square miles
Precipitous Terrain	-	Elevation 1600 USGS at Pond
	-	Elevation 3957 USGS Top of Pico Peak
Pondage	-	Limited amount in Pico Pond
		(No data available)
	-	Some in Kent Pond
		(No stage storage data available)

RUNOFF RECORDS:

. No data available on discharge through emergency spillway.

Gaging station data available for Kent Brook station located at Route 100 -- data record starts October 1963 and runs to current year.

Peak discharges at gaging station:

-	302 cfs March 23, 1968
-	1973 Flood - ?

Adequacy of Records - Neither considered long enough nor complete enough to utilize with statistical confidence to determine probable peak discharge.

DETERMINATION OF PEAK DESIGN DISCHARGE:

Recognizing there is some pondage in watershed, i.e., Pico Pond and Kent Pond, use attached unit runoff chart and scale down maximum curve slightly.

Note: A hydrograph and flood routing analysis is not being made because:

1. Insufficient data available.
2. Watershed relatively small.

3. Insufficient funds and time available to develop accurate stage storage curves.
4. A theoretical analysis is only as accurate as the basic raw data.

From attached Unit Runoff Chart:

- 580 cfs per square mile for 3.64 square mile watershed.

Scale down slightly for pondage and use 550 cfs/sq.mi.

Therefore, Peak Design Discharge is estimated to be:

$$- 550 \text{ cfs} \times 3.64 \text{ cfs/sq.mi.} = \underline{2000 \text{ cfs}}$$

GENERAL FEATURES OF EMERGENCY SPILLWAY:

Concrete chute of rectangular cross section extending 25 feet upstream and 75 feet downstream from present weir wall.

Slope of spillway = .133 (10 ft. drop in 75 ft.)

Vertical side walls, nominal 5 feet high.
See attached print.

Hydraulic profile information is tabulated below. Calculations (7 sheets) are attached.

FLOW, Q = 2000 cfs

<u>Location</u>	<u>Depth, Ft.</u>	<u>Velocity, fps.</u>
At weir crest	2.69	9.3
25' downstream of crest	1.30	19.2
50' downstream of crest	1.30	22.3
75' downstream of crest	1.36	25.3

Erosion protection to consist of heavy stone upstream and downstream of structure. Stone in area immediately below structure will be grouted in place. See detail on print.

A stilling basin with ogee-section dam crest was considered as a possible design, but was rejected for the following reasons:

1. It is unlikely that a contractor interested in a job of this size would be experienced in forming complex curves in concrete.
2. The extra work involved would double or triple the cost.
3. The steepness of the drainage course dictates supercritical flow through its entire length.

No man-made structure, therefore, can prevent rapid flow from occurring downstream. The sole benefit of a stilling basin would be to dissipate an insignificant amount of energy.

4. Most dry spillways of Corps of Engineers flood control dams do not have stilling basins.

INSPECTION REPORT

ON

KENT POND DAM

July 24, 1973

343

INSPECTION REPORT ON KENT POND DAM

General

On the morning of July 11, 1973, Richard E. DuBois, P.E. of DuBois & King, Inc. met with Mr. Robert Collins, Maintenance Supervisor of the Vermont Department of Fish and Game. The meeting consisted of a cursory inspection of the failure of the emergency spillway at the Kent Pond Dam located in Sherburne, Vermont.

On July 24th, 1973, Richard E. DuBois, P.E., again inspected the emergency spillway failure and made a detailed inspection of the entire Kent Pond Dam.

This report indicates the findings of the inspection of July 24th, 1973.

Photographs

A series of photographs taken on July 24th, 1973, are located in the appendix of this report.

Condition of Emergency Spillway

The emergency spillway containing a concrete weir wall approximately 80 feet long was subject to severe erosion and failure as a result of heavy precipitation occurring on June 30th, 1973, and/or July 4th, 1973.

Photograph No. 1 indicates the extent of the erosion on the downstream side of the concrete weir. Approximately 10 feet of fill material or existing ground was eroded away and carried downstream. Erosion occurred to the extent that water actually flowed beneath the concrete footings.

Photograph No. 2 and Photograph No. 3 indicates the extent of erosion in the immediate vicinity of the concrete weir wall.

DuBois & King, Inc. has been retained by the Vermont Department of Fish and Game to prepare preliminary proposals for restoration of this emergency

spillway. These have been prepared and submitted to the Fish and Game Department on July 25th, 1973.

Restoration of the emergency spillway should commence as soon as possible so that work can be completed prior to winter.

Earth Embankment Section of Dam

There appears to be little, if any, damage to the earth embankment section of the dam as a result of the early July floods.

Photographs 4, 5, and 6 indicate the general conditions of the earth embankment and rip rap protection on July 24th, 1973.

The water in the impoundment had been substantially lowered below the plank outlet structure. Water was discharging through the outlet pipe beneath the earth embankment to Kent Brook on the date of inspection.

Erosion Below Outlet

Photographs 7 and 8 indicate the area of erosion at the exit of the outlet tube downstream of the dam. This erosion appears to be a result of heavy discharges through the conduit. A section approximately 40 feet long and 8 to 10 feet in depth appears to be eroded away on the northerly side of Kent Brook. This erosion should be stopped by placing heavy dumped stone or rip rap along the eroded area.

Minor Maintenance Problems

During the inspection, it was noted that some metal work at the outlet structure should be painted with a protective coating. This included the beginnings of major corrosion on the metal sleeve housing the gate valve stem, particularly as indicated in Photo No. 9.

Other items of maintenance might include removal of minor debris and refuse along the shore line of the pond particularly along the face of the dam.

Consideration should be given to any necessity to replace stop plank pins at this time. A close inspection of the condition of the pins was not possible since they were in the locked enclosure.

Minor Seepage Under Dam

On the downstream side, at the toe of the embankment and beyond, it was noted that there are several areas of minor seepage. These seem to be insignificant and do not appear to presently jeopardize the structural integrity of the dam itself. Limited observations were made in respect to this seepage, but it appeared that with the water level in the pond being lower than normal, that such seepage had partially subsided. A typical seepage area is shown in Photo No. 10.

Downstream Damage

During the inspection, approximately 1/2 mile of drainage course was inspected below the emergency spillway. It was noted that several trees were undercut by the onrushing water and severe damage occurred to the adjacent land. Also deposits of sand, gravel, and debris were made outside the normal water course descending into the woodlands.

Recommendations

It is recommended that the emergency spillway be restored as soon as possible and hopefully prior to the forthcoming winter season.

It is recommended that the eroded area below the outlet be protected with dumped rip rap.

Minor maintenance items such as debris removal are optional, however, the corrosion on the valve stem sleeve should be steel brushed and painted with a suitable protective coating.

11-11-10-10 Dam
Sherburne

Damage to Emergency Spillway
from Hurricane "Belle"



MEADOW - EL.

SEE SHEET 10
PROFILE OF 1

EXISTING TUNNEL TO BE EXCAVATED

ENGAGEMENT

1st 3

Top of Ground

Top of Tunnel

Top of Slope

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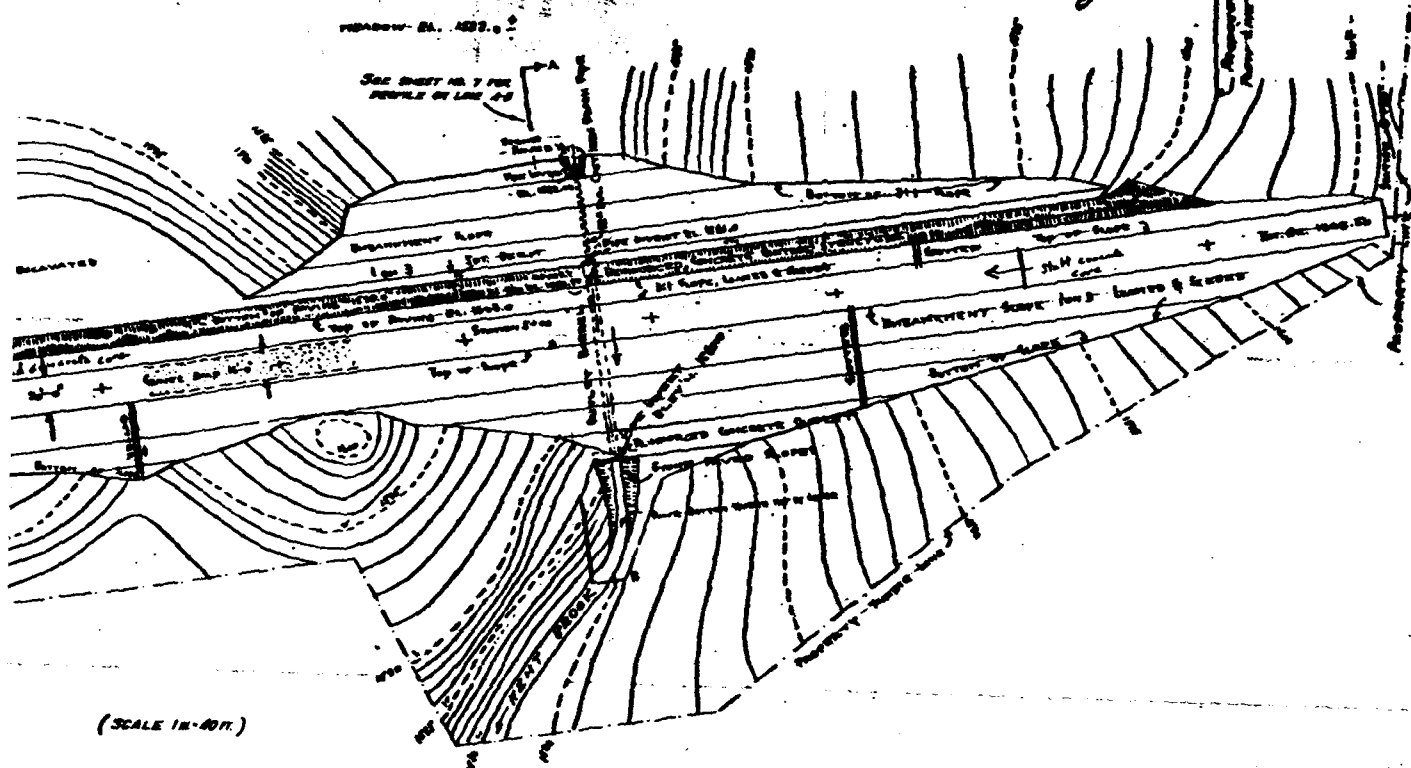
Top of Slope

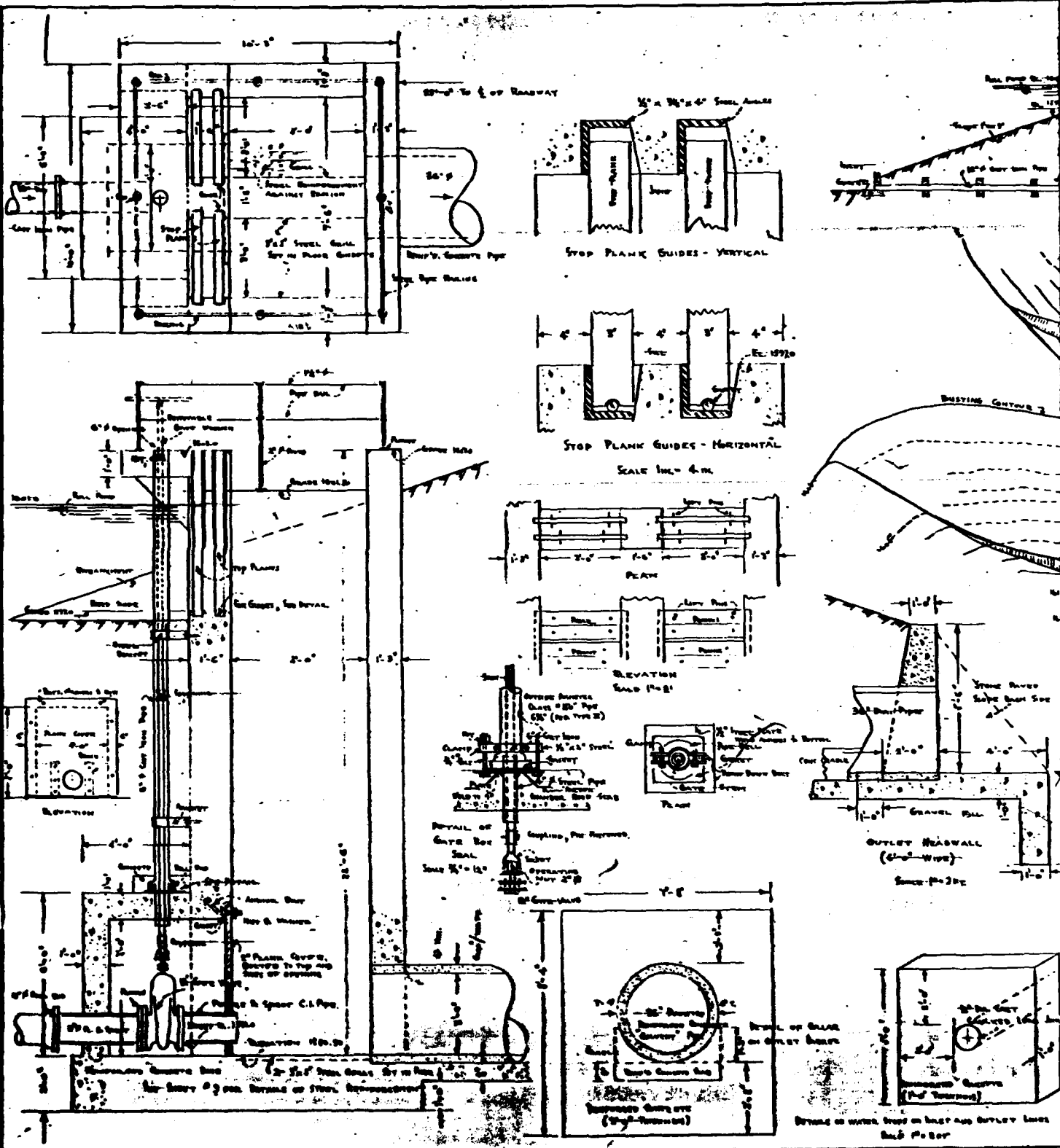
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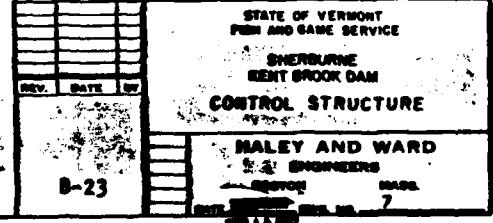
Top of Slope

(SCALE 1"=40')

2









(15) Emergency Spillway Channel



(16) Light Duty Roadway Bridge Over Kent Brook,
3,000 Feet Downstream of Dam

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

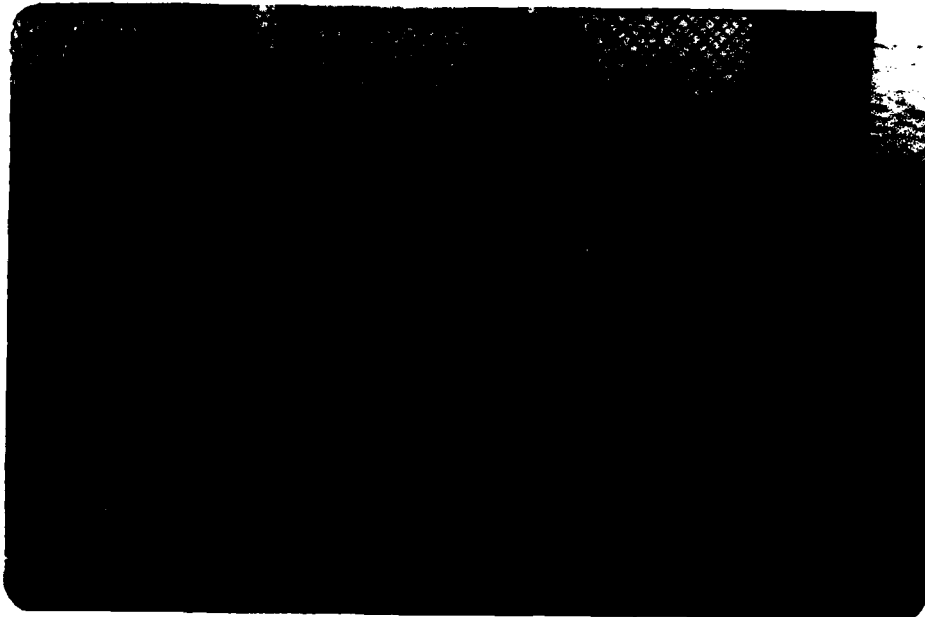
JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT

VT 00017
AUGUST 6, 1980

C-9



(13) Outlet Control Structure



(14) Downstream Channel from
Outlet Pipe Headwall

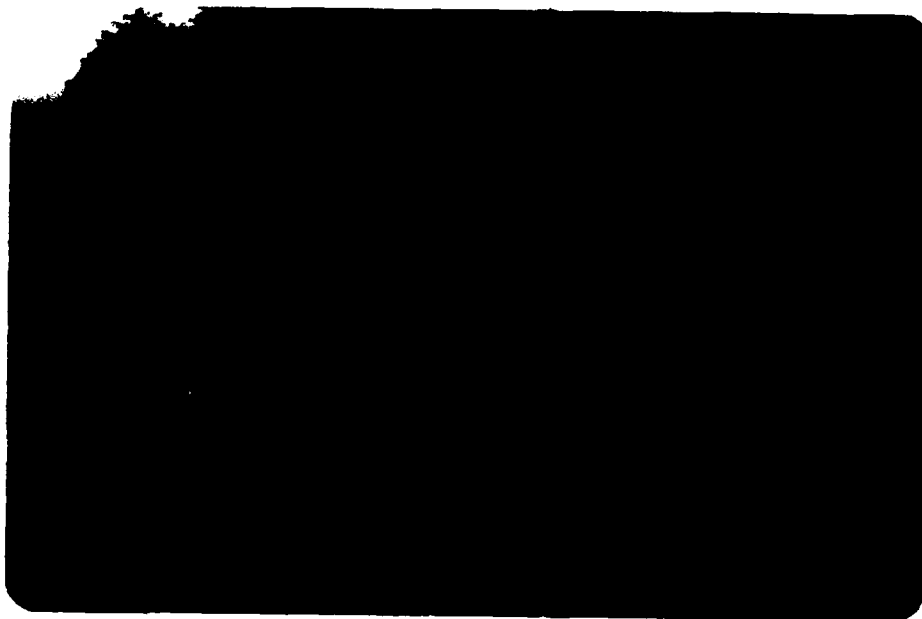
U.S. ARMY ENGINEER DIV, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

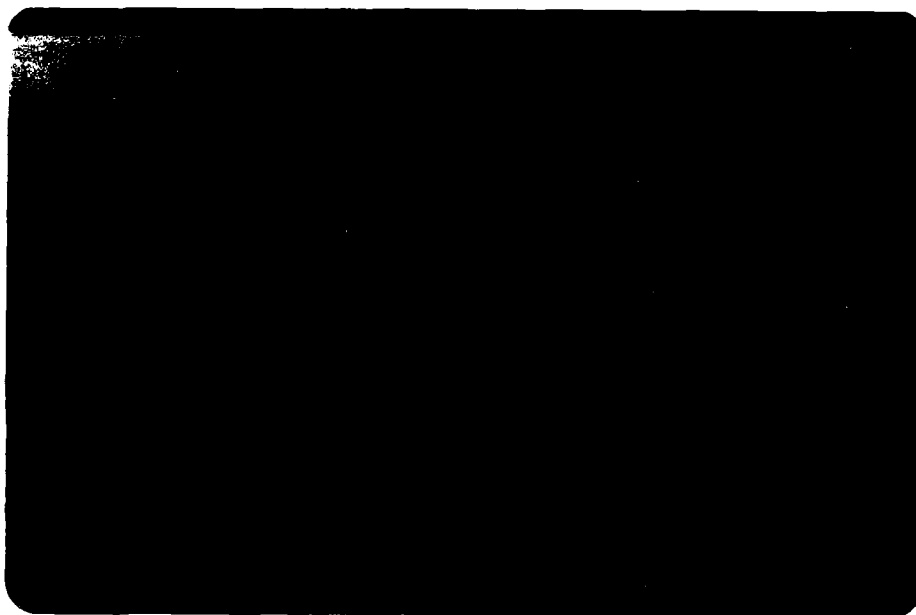
NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT
VT 00017
AUGUST 6, 1980

C-8



(11) Left Sidewall of Emergency Spillway



(12) Outlet Control Structure

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INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT

VT 00017
AUGUST 6, 1980

C-7



(9) Remote Emergency Spillway at North End of Reservoir



(10) Emergency Spillway Crest and Approach Channel

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OLD TOWN, MAINE

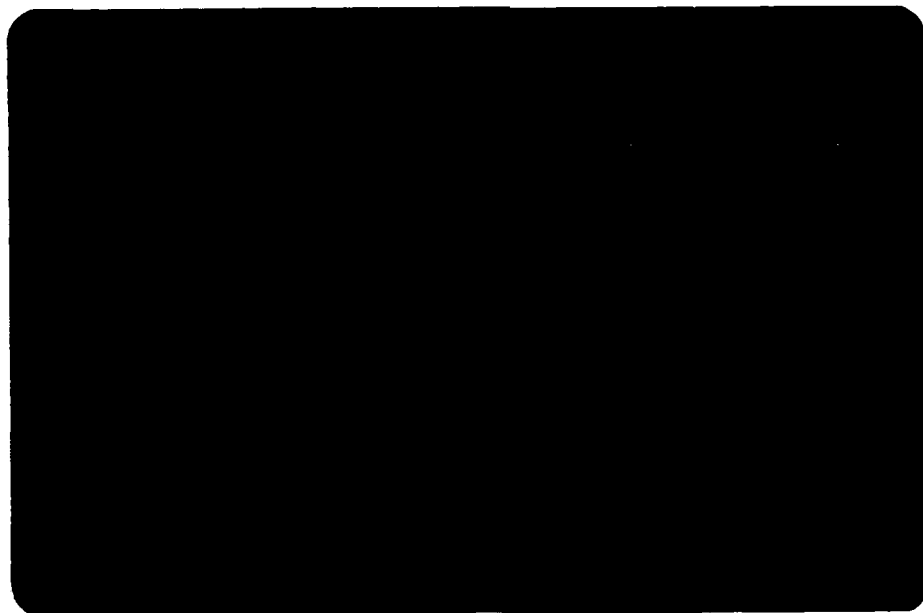
NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT
VT 00017
AUGUST 6, 1980

C-6



(7) Wet Area Downstream of Toe, Between Sta. 7+00 and Sta. 8+00



(8) Wet Area Downstream of Toe Near Bend Point of Dam

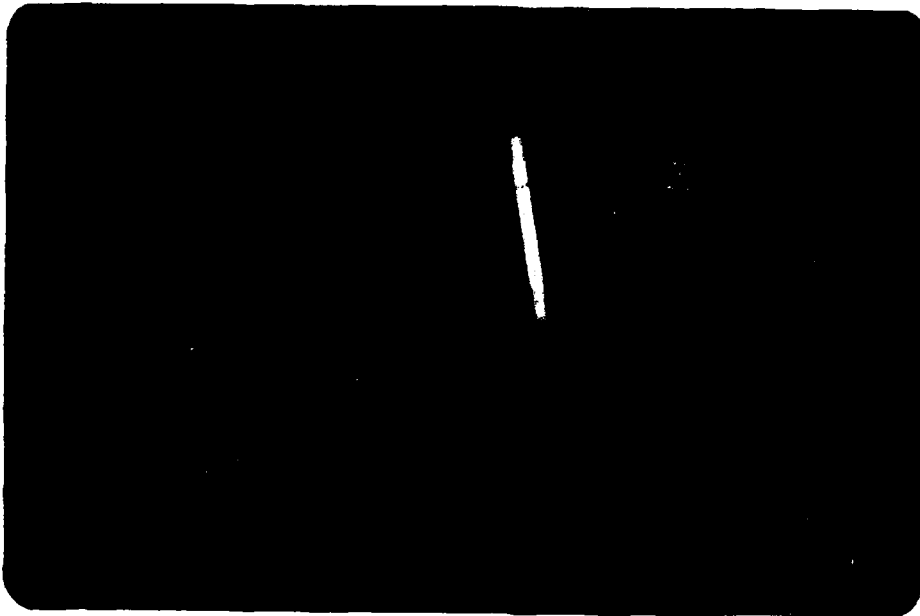
U.S. ARMY ENGINEER DIV, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

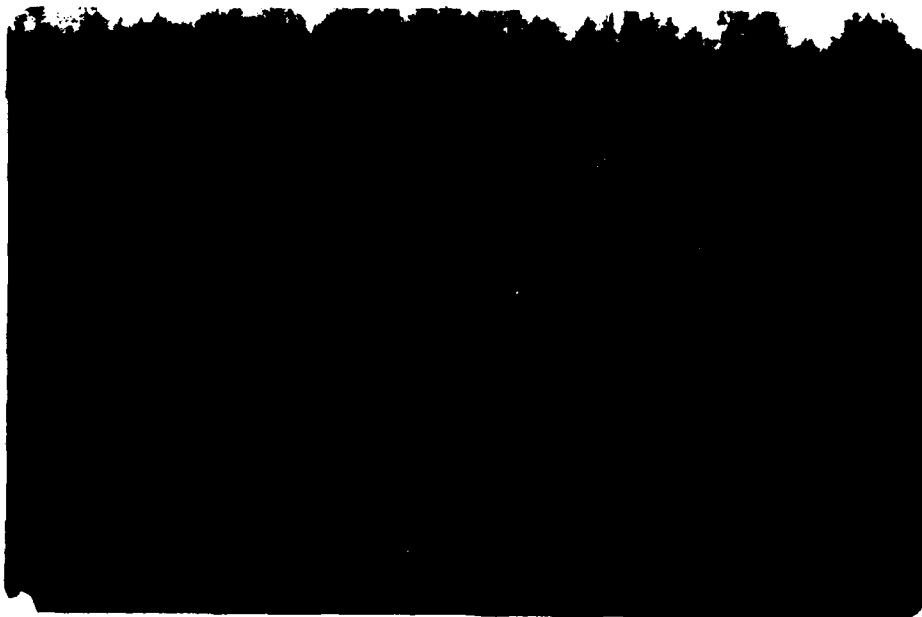
NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT
VT 00017
AUGUST 6, 1980

C-5

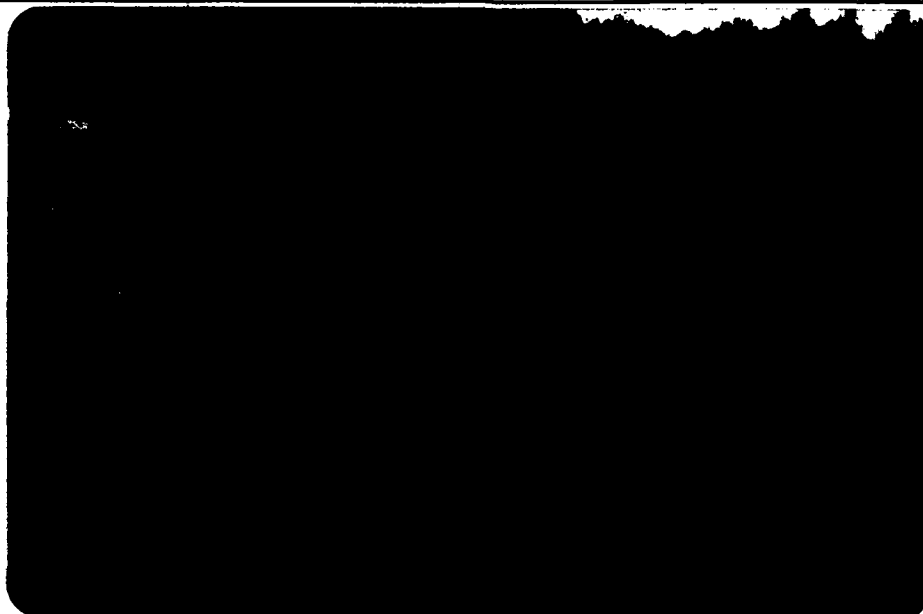


(5) Seepage at Left Side of Outlet Headwall



(6) Wet Area at Contact of Downstream Toe with Left Abutment

U.S. ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	KENT POND DAM
JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE		SHERBURNE, VERMONT
		VT 00017
		AUGUST 6, 1980
		C- 4



(3) Downstream Slope from Natural Knob of Ground,
Looking Toward Left Abutment



(4) 36" Diameter Outlet Pipe
from Control Structure

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OLD TOWN, MAINE

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT
VT 00017
AUGUST 6, 1980

C-3



(1) Grass Cover and Riprap on
Upstream Slope



(2) Paved Roadway on Crest of Dam

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NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

KENT POND DAM
SHERBURNE, VERMONT
VT 00017
AUGUST 6, 1980

C-2



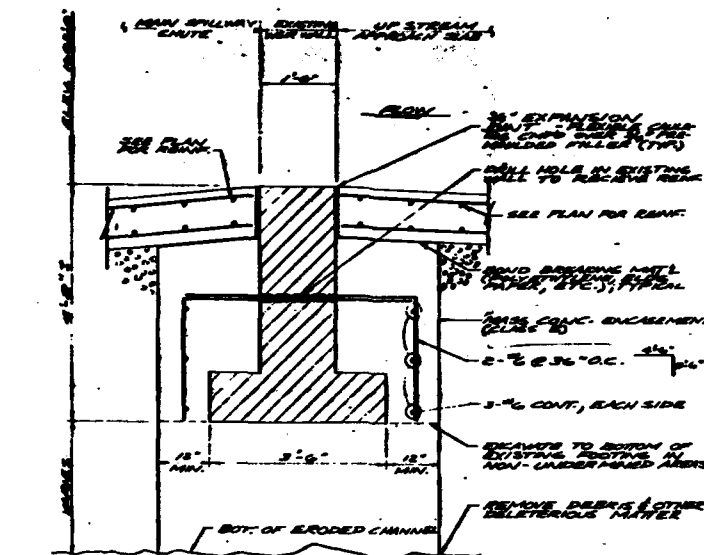
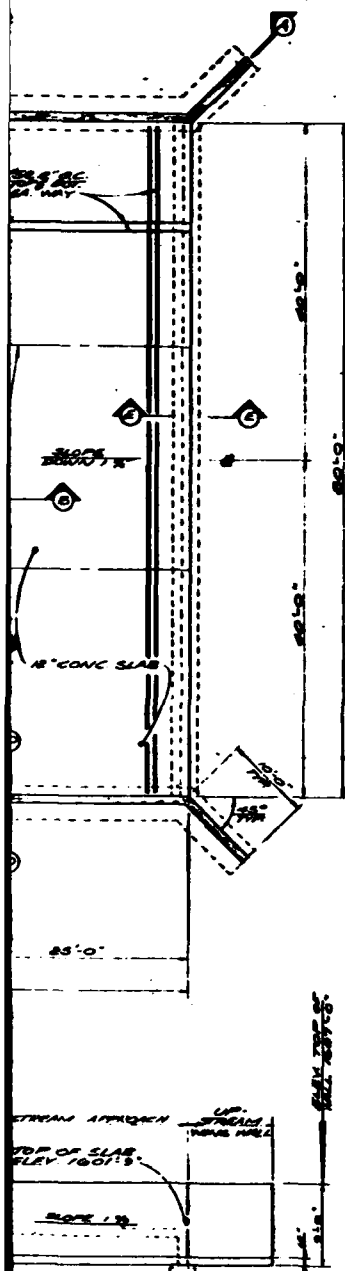
**TAKEN AT
REMOTE
EMERGENCY
SPILLWAY**

PHOTO
LOCATION
PLAN

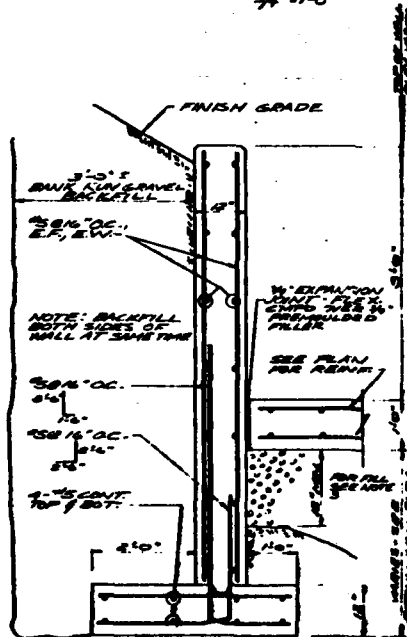
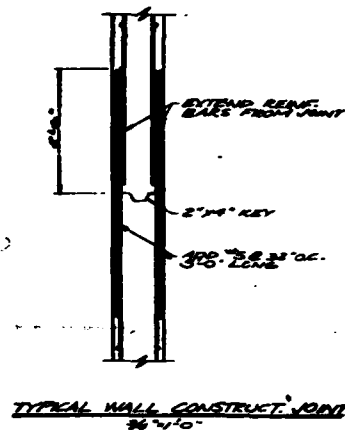


C-1

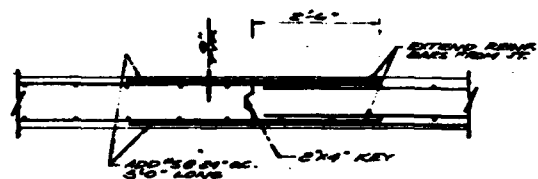
APPENDIX C
DETAIL PHOTOGRAPHS



SECTION B-E
TYPICAL CONCRETE ENCASUREMENT OF WEIR WALL
3/4" x 1'-0"



SECTION C-C
TYPICAL RETAINING WALL
3/4" x 1'-0"



TYPICAL FLOOR SLAB CONSTRUCT JOINT
3/4" x 1'-0"

NOTES

1. ALL CONCRETE SHALL DEVELOP A MIN. ULTIMATE COMPRESSIVE STRENGTH OF 3900 P.S.I. & 4000 P.S.I. CLASS A.
2. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, 40,000 P.S.I. YIELD STRENGTH, 60,000 P.S.I. TENSILE STRENGTH, 0.25% ELONGATION IN 2 INCHES.
3. COMPACTED FILL BENEATH THE BASE SLAB SHALL BE SELECT GRAVEL AS SPECIFIED IN THE SPECIFICATIONS. SELECT GRAVEL TO BE OF MAX. PARTICLE SIZE 3/4 INCH. ALL OTHER FILL SHALL BE EACH RUN GRAVEL AS SPECIFIED IN THE SPECIFICATIONS.
4. ALL WORK SHALL BE ACCOMPANIED BY A MEASUREMENT LOG MAINTAINED IN ACCORDANCE WITH ACD 210-570-100-100.
5. FINISH EXPOSED CONCRETE SURFACES AS FOLLOWS:
a. VERTICAL SURFACES - BROOM FINISH.
b. HORIZONTAL SURFACES - CURB FINISH.
c. ALL EXPOSED SURFACES SHALL BE FREE OF ALL OTHER EXPOSED AGGREGATE, OR OTHER IRREGULARITIES.
6. CHAMFER ALL EXPOSED CONCRETE EDGES 3/4"

7/24/73
PCLM.

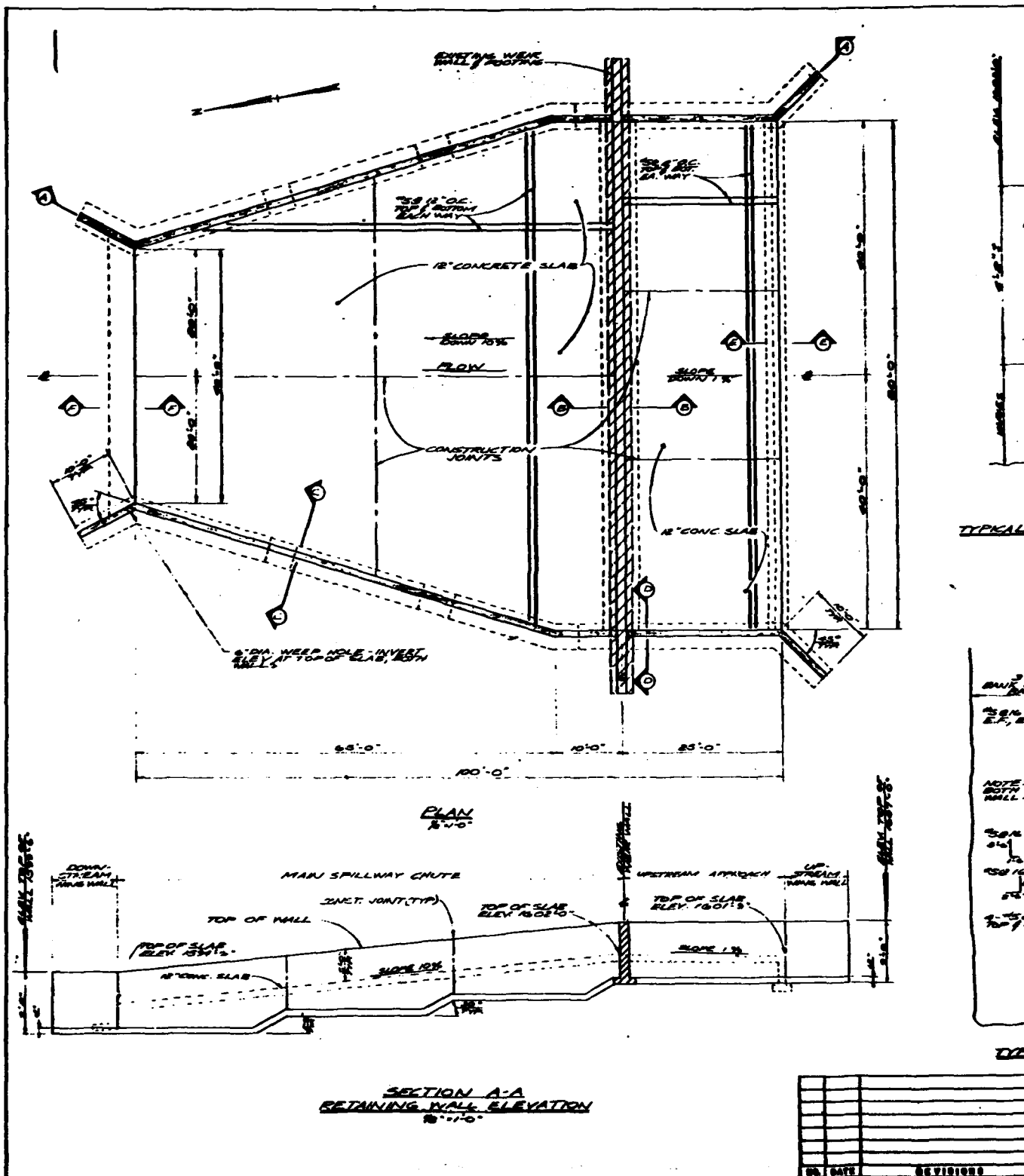
NO.	REVISION	DATE

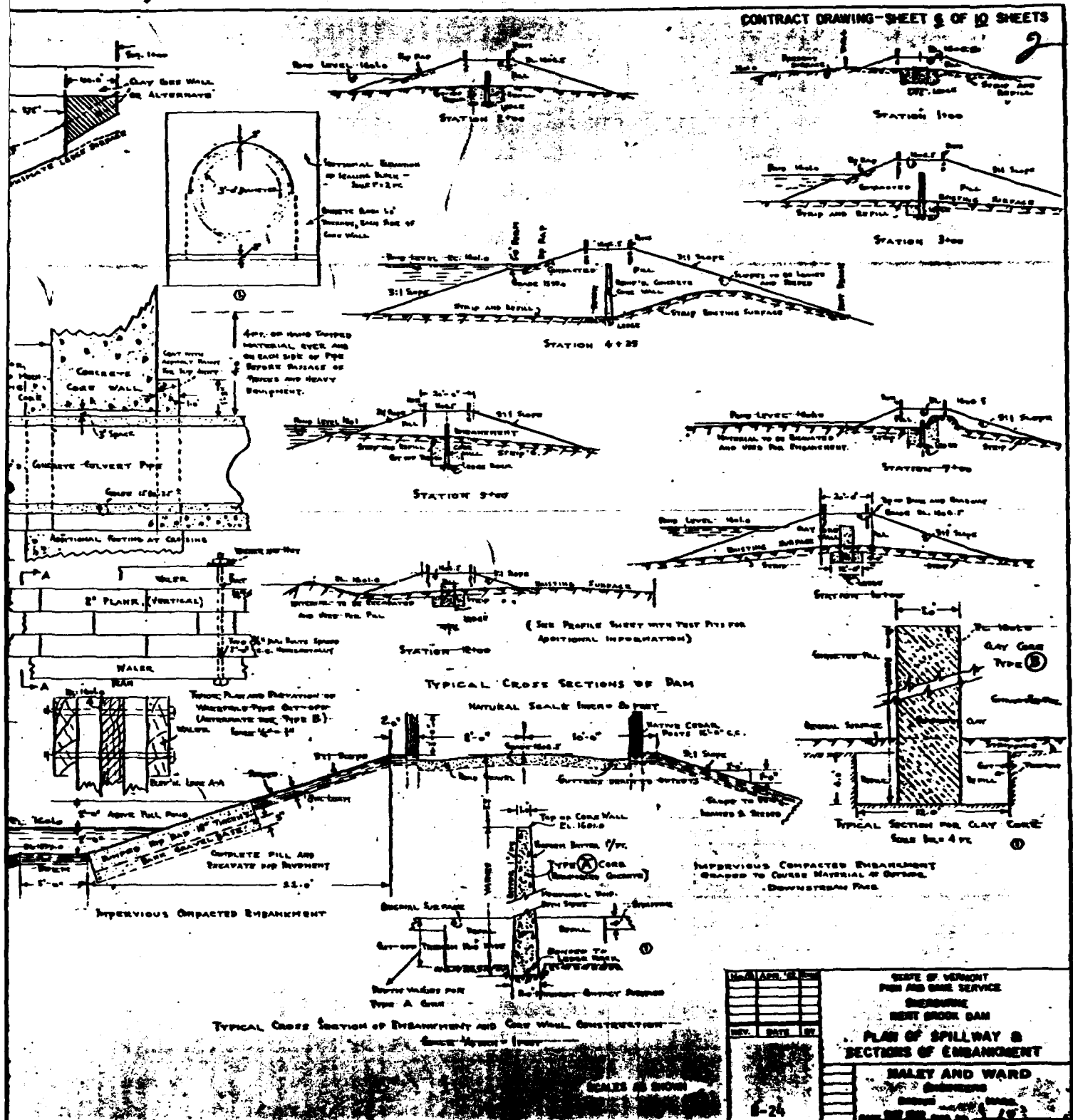
DUBOIS & KING, INC.
ENGINEERS AND ARCHITECTS, CHICAGO
BROADWAY, CHICAGO

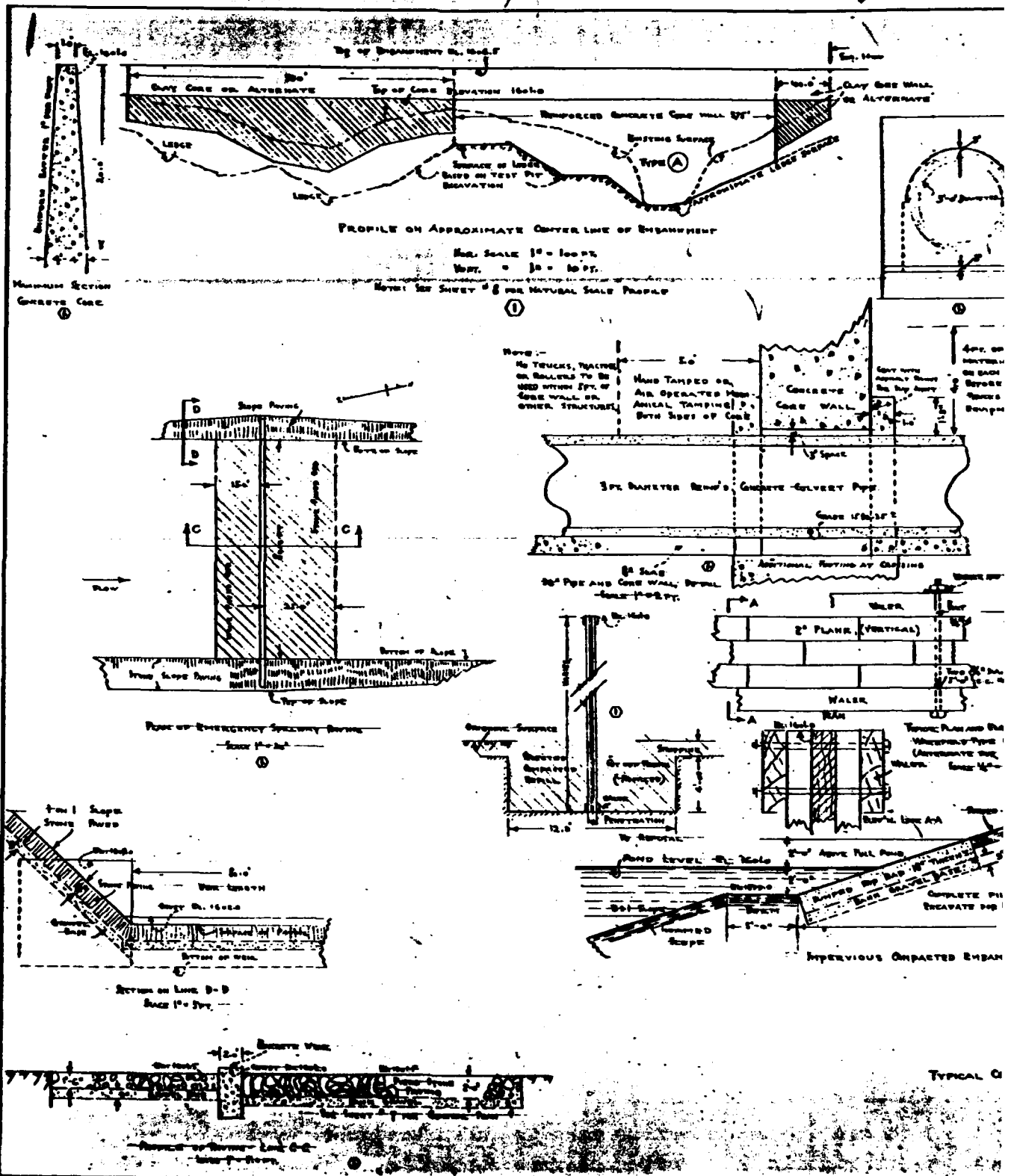
VERMONT DEPARTMENT OF FISH & GAME
WENT FISH HATCHERY SPILLWAY
STRUCTURAL PLAN AND DETAILS

B-25

DATE	BY
8.8.73	W.P.
8.8.73	W.P.
8.8.73	W.P.
8.8.73	W.P.
8.8.73	W.P.









(17) House and Concrete Training Wall Adjacent to Kent Brook,
3,750 Feet Downstream of Dam

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

JAMES W. SEWALL COMPANY
CONSULTANTS
OLD TOWN, MAINE

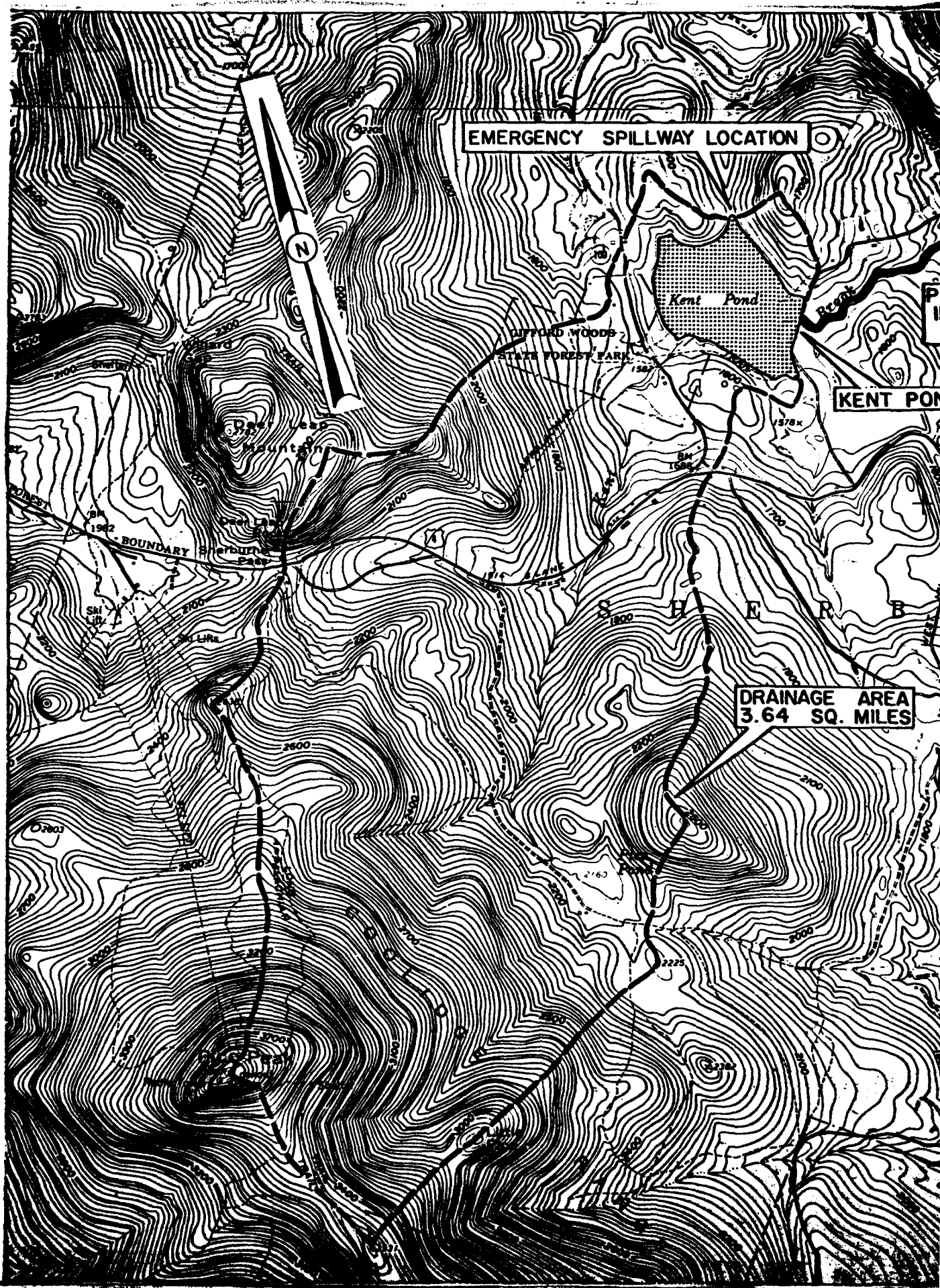
NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

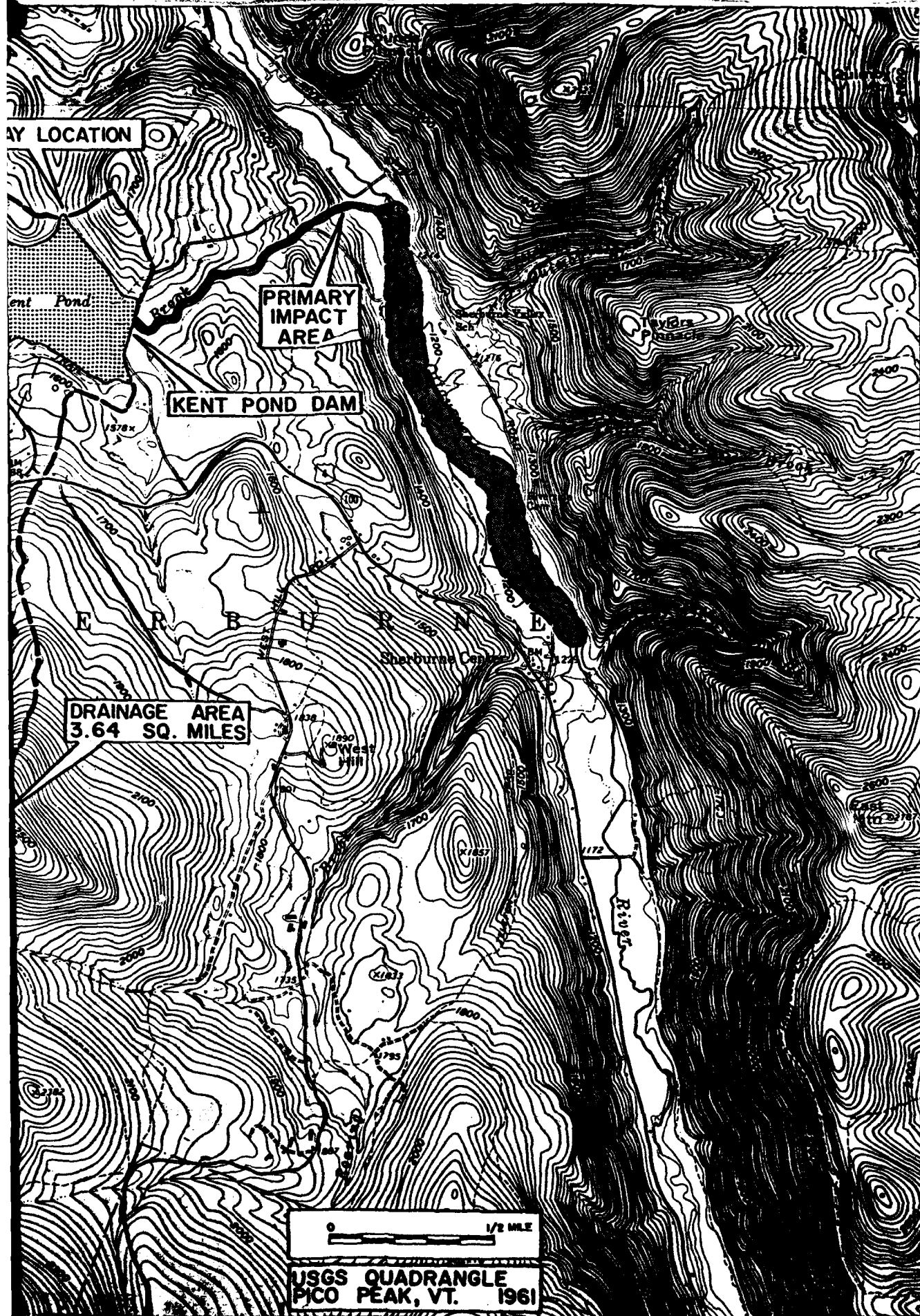
KENT POND DAM
SHERBURNE, VERMONT

VT 00017
AUGUST 6, 1980

C-10

APPENDIX D
HYDRAULIC/HYDROLOGIC COMPUTATIONS





Subject Inspection of non-failure dams

Computation Kent Pond Sherburne, VT

Job No. 953-05 I

Computed by WFB

Checked by SDM

Date 10-2-80

Hydrologic / Hydraulic Inspection

I Performance at Test Flood Conditions

1) Maximum Probable Flood

a) Watershed classified as "mountainous"

b) Watershed area = 3.64 square miles

c) From NED-AGE Preliminary Guidance for
Estimating Maximum Probable Discharges
Guide curve for PMF Peak Flow Rates:

$$PMF \approx 2330 \text{ cfs / square mile}$$

d) Peak Inflow

$$2330 \text{ cfs} \times 3.64 \text{ sq. miles} = 8481 \text{ cfs @ PMF}$$

$$\text{Similarly, } \approx 2311 \text{ cfs @ } 1/2 \text{ PMF}$$

$$100 \text{ yr. 1\% P} \approx 1/4 \text{ PMF} = 1636 \text{ cfs}$$

(NED-AGE Guide, T.R. 40, p. 58 - Ratio of Probable Maximum 6-hour Precip. for 10 Year 1% P to 100-yr 6-hour 1% P)

2) Test Flood

a) Classification of Dam: according to NED-AGE
Recommended Guidelines

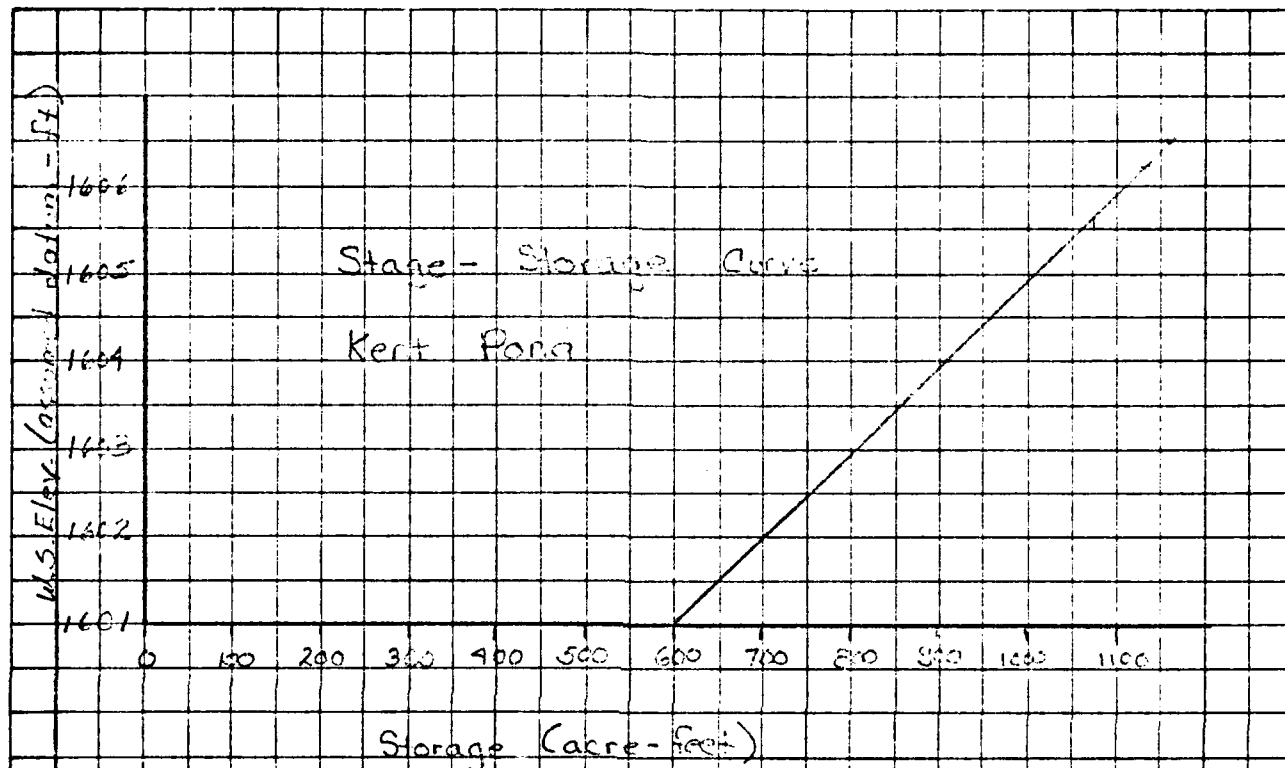
i) Size: Storage (max) = 1160 acre-ft

Height = 22.5 feet

Subject Inspection of non-federal dam

Computation Kert Pond Storage Volume Job No. 903-03

Computed by MEB Checked by SDH Date 11-2-80



Pond Area = 101.5 acres at summer pool level 1601.0

From Vt. Dept of Water Resources Tech Sheet

Assumed 100 acre-ft of storage @ 1601 - Vt Dept Water Res

1116.5 $\rightarrow (101.5 \times 10.0) + 600 = 1116.5$ acre-ft

(i) Hazard Potential:

There is no high-density housing and other hazards located on the flood plain. The dam is old and in poor condition. The dam is a significant hazard to the community. The dam is a significant hazard to the community.

(ii) Dam Condition:

Size: Intermediate
Type: Significant

Subject Inspection of pre-fabricated dam

Computation Kent Pond

Job No. 953-05 I

Computed by MEB

Checked by SDM

Date 10-13-80

b) Test Flood = 4200 cfs ✓

3) Surcharge at Peak Inflow

a) Test Flood = 3 1/2 PMF $Q_p = 4200$ cfs

b) Outflow Rating Curve

Primary Spillway

Side-sill $L=10$

Back-sill $L=7.5$

Stapleg Station

$Q = CLH^{3/2}$ $C=3.3$

$Q = CLH^{3/2}$ $C=3.3$

Stapleg Station

H	Q	WS EL
.5	12	1602
1.5	61	1603
2.5	130	1604
3.5	218	1605

H	Q	WS EL
1	25	1604
2	70	1605

part - bottom neglect
flow between staples
and bottom of dam
Weir flow over
concrete apron
applies since no bottom

Outlet Pipe 3' Diameter Invert EL = 1590.0

$H = h_{ext} + h_f + h_{ext}$

$h_f = f \frac{L}{D} \frac{V^2}{2g}$ $f = 1.49 \frac{K^2}{D^{4.75}}$ $K = 0.5$ $L = 100'$ $D = 3'$

$h_{ext} = 1.49 \frac{V^2}{2g}$ (entrance loss, flush inlet) $h_{ext} = 1.49 \frac{V^2}{2g}$

H	V	Q	WS EL
13	25.16	173	1602
20	25.81	182	1603
21	26.45	187	1604
22	27.17	191	1605
23	27.86	196	1605
24	28.53	200	1605
25	29.18	204	1605

Subject Inspection of non-feeders dam

Computation Kent Pond

Job No. 953-05 I

Computed by MFB

Checked by

Date 10-13-80

Outflow Rating Curve Kent

Emergency Spillway crest el. 1602 $L=82$ $C=3.2$ $Q=C L H^{3/2}$

H	Q	WS El	H	Q	WS El
1	256	1603	1.5	2444	1606.5
2	724	1604	5	2862	1607
3	1330	1605	5.5	3302	1607.5
4	2078	1606	6	3762	1608

Top of Dam crest el. 1606.5 $L=114.0$ left side 2:1 slope, right side 1.5:1 slope

H	Q	WS El	
.5	539	1607	$Q=C L H^{3/2}$ $C=1.0$ (friction)
1.0	1553	1607.5	
1.5	2912	1608	

Emergency Spillway sidewall el. 1607 left slope 1:2 right slope 1:6

H	Q	WS El	
.5	3	1607.5	$Q=C L H^{3/2}$ $C=1.0$
1.0	11	1608	

Rating Curve

WS El	Q	WS El	Q
1601	0	1605	1521
1602	12	1606	2244
1603	317	1607	3601
1604	904	1607.5	5060

The outflow rating curve is plotted on page 5

Subject Inspection of non-flooded dam

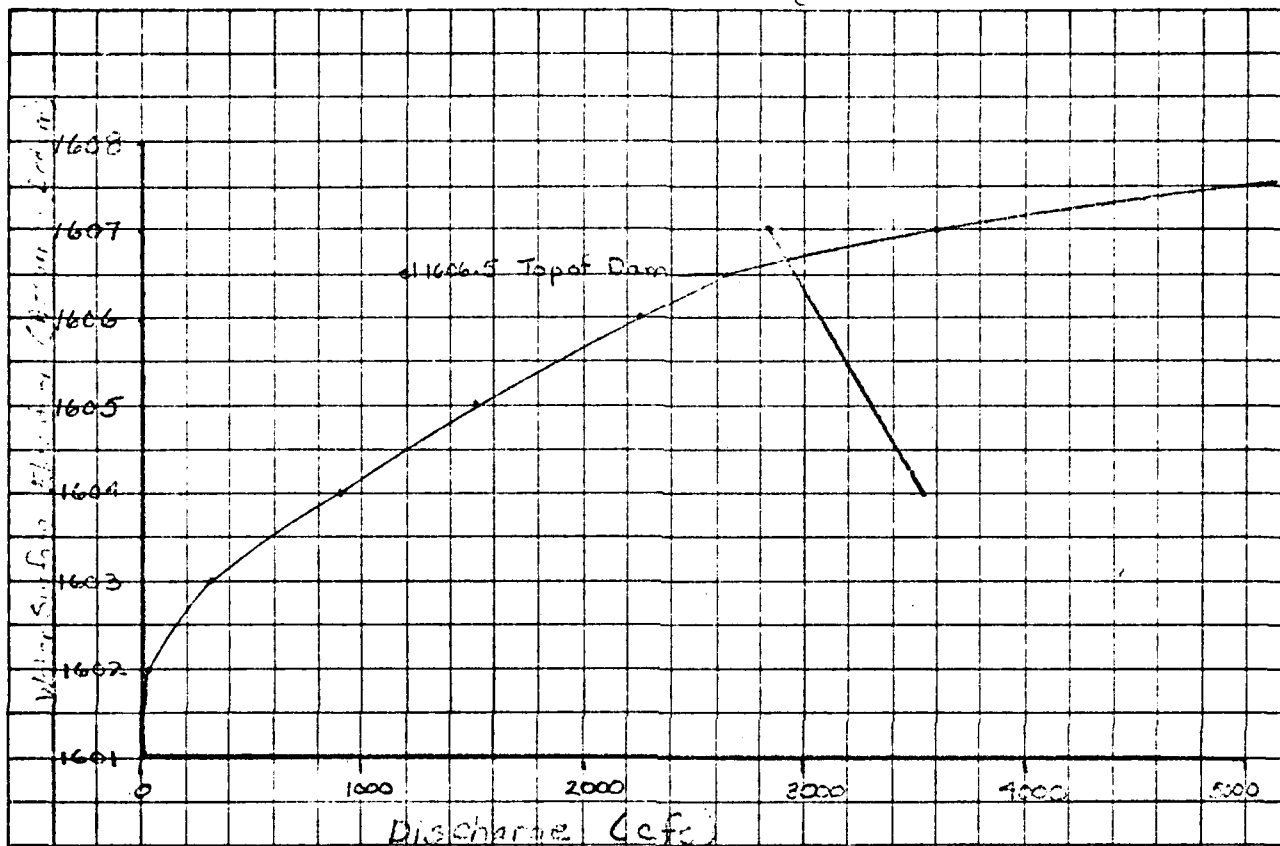
Computation Kent Pond

Job No. 253-253

Computed by MDM

Checked by SDM

Date 12-12-20



c) Spillway capacity to top of dam

$$\text{WS EL} = 1606.5 \quad Q \approx 2640 \text{ cfs} \approx 52\% Q_p$$

d) Surge height to pass Q_p

$$Q_p \approx 1/2 \text{ PMF} = 4291 \text{ cfs} \quad H = 6.25' \text{ (observed from 1601)}$$

e) Effect of Surge on max possible Discharge

$$\text{a) } \text{Leakage Flow Rate} \approx 151.5 \text{ cfs}$$

b) Assumes normal pool level at el. 1601

Subject Inspection of run-off in 1961

Computation 10-13-80

Job No. 953-05 I

Computed by WSE

Checked by SDM

Date 10-13-80

c) Watershed area = 3.64 mi^2

d) Discharge (Q_{p2}) at various surcharge elevations:

$H = 6' \quad V = 101.5 \text{ acres} \times 6' = 609 \text{ acre-ft}$
 $S = 609 / (53.3 \times 3.64) = 3.14''$

$H = 3' \quad V = 101.5 \text{ acres} \times 3' = 304.5 \text{ acre-ft}$
 $S = 304.5 / (53.3 \times 3.64) = 1.57''$

From Approximate Storage Routing Guidelines
(1971) (Max. Probable Rain in New England)

$Q_{p2} = Q_{p1} (1 - \frac{S}{3.5})$ for $Q_{p1} = 1/2 \text{ PMF}$ $Q_{p1} = 4241 \text{ cfs}$

$H = 6' \quad Q_{p2} = 2839 \text{ cfs}$

$H = 3' \quad Q_{p2} = 3537 \text{ cfs}$

e) Peak Outflow (Q_{p3})

Using NED-ACE Guidelines "Surcharge Storage
Routing" Alternate Method

$Q_{p3} = 2830 \text{ cfs} \quad H = 5.7' \quad \text{for } Q_{p1} = 1/2 \text{ PMF}$ ✓

f) Spillway capacity to outflow

$Q = 2640 = 90\% Q_{p3}$ ✓

Subject Inspection of non-federal dam

Computation Kent Pond

Job No. 953-05 I

Computed by MEB

Checked by SDM

Date 10-13-99

Summary

a) Peak Inflow

$$\text{Test Flood} = 1/2 \text{ PMF} = 4241 \text{ cfs}$$

b) Peak Outflow

$$Q_p = 2930 \text{ cfs @ } 1/2 \text{ PMF}$$

c) Spillway Max Capacity

$$Q_s = 2640 \text{ cfs}$$

At Test Flood = $1/2$ PMF, the dam is overtopped by 0.20 feet (WS @ 1606.7) or to an average surcharge above the max. height of stoppage (1612.6) of 5.7 feet.

Subject Inspection of non-federal dams

Computation Kent Pond

Job No. 953-05 I

Computed by MFB

Checked by SDH

Date 10-13-20

II Downstream Failure Hazard

1. Peak Failure Outflow

a) Breach Outflow

i) Mid-Height $E1 = 1606.5 - 26.5 = 1593.25$

ii) Approx mid-height length = 1200'

iii) Breach width

$b_1 = 0.9 \times 1200 = 480'$

iv) Assume shoulder to top of dam

$\therefore h_0 = 26.5'$

v) $Q_b = \frac{3}{27} W_b \sqrt{h_0} h_0^{3/2}$
 $= 110,100 \text{ cfs}$ ✓

b) Retaining Spillway, 200 ft

- Assume breach occurs in area of primary spillway
- Emergency spillway outflow $Q_e = 2444 \text{ cfs}$
bypasses Kent Pond and primary spillway
directly into downstream reservoir

c) Peak Failure Outflow = 110,100 cfs

Subject Inspection of ... dams

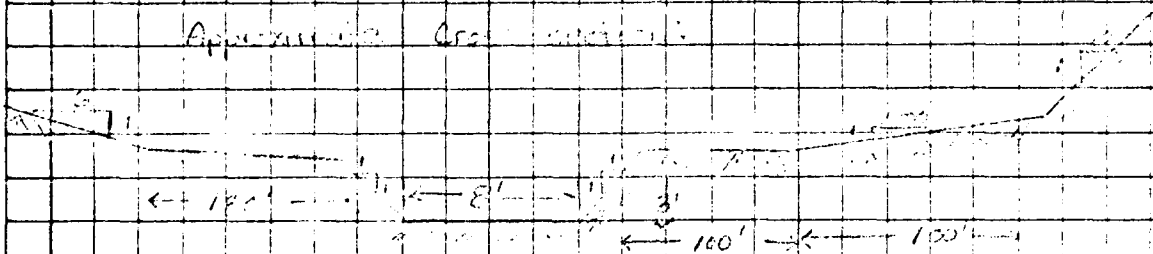
Computation done Job No. 953-05 I

Computed by MEE Checked by SDM Date 10-18-11

2. Downstream Bank Elevation - Peak Flood 4 Stage

a) 0 - 1500 ft Dls of Dam

Approximate Cross-section:



$$V = 1.45 R^{2.13} S^{1/4}$$

$$S = \frac{V^4}{R^{8.26}}$$

1500' = 1500' (100' x 15) / 100' = 1500'

Stage elevation

H	L	P	R	V	Q
1	3	16.53	.82	3.73	34
3	23	16.49	2.00	6.21	225
4	47	16.42	2.8	8.61	605
6	75	16.43	4.55	11.70	942
8	103	16.49	6.25	14.52	1437
10	131	16.42	7.95	17.33	2235
12	159	16.49	9.61	19.41	3057
14	187	16.49	11.34	21.77	4095
16	215	16.49	13.04	24.24	5104
18	243	16.49	14.74	25.77	6252
20	271	16.49	16.44	27.70	7506
22	299	16.49	17.99	29.31	8697
24	313	16.49	19.35	30.93	9851

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 10 of 31

Subject Topography of ...

Computation ...

Job No. 953-0015

Computed by ...

Checked by SDH

Date 10-13-20

Left Hand (L)					
1	2	3	4	5	6
1	188	1.2	2.1	3.2	4.1
6	117	123.25	2.83	3.05	1259
9	375	210.4	4.13	5.1	404
10	191	122.5	3.34	4.1	3232
12	171	123.75	1.77	2.2	1272
14	11	80.1	2.45	3.42	1712
16	227	211.5	3.2	3.71	2316
18	3375	11.2	3.2	3.10	3101
20	3127	211.9	3.2	3.2	3032
22	1513	211.7	15.25	10.53	1104
24	1113	11.2	16.25	11.2	1113
Right Hand (R)					
1	2	3	4	5	6
1	150	1.2	2.1	3.2	212
6	510	122.1	2.4	3.2	111
9	1020	243.3	4.20	4.52	4659
10	1220	212.3	5.15	5.58	8540
12	111	282.4	7.22	6.50	13450
14	211	311.5	8.30	7.31	13335
16	2170	322.6	10.25	9.05	26350
18	322	340.7	11.51	9.75	24524
20	111	311.3	12.53	1.21	43491
22	111	11.2	11.2	11.2	53107
24	111	11.2	11.2	11.2	40000

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NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
KENT POND DAM (VT 000... (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 81

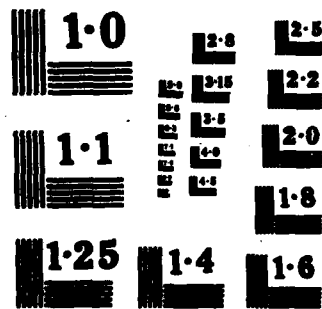
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Subject Inspection of non-federal dams

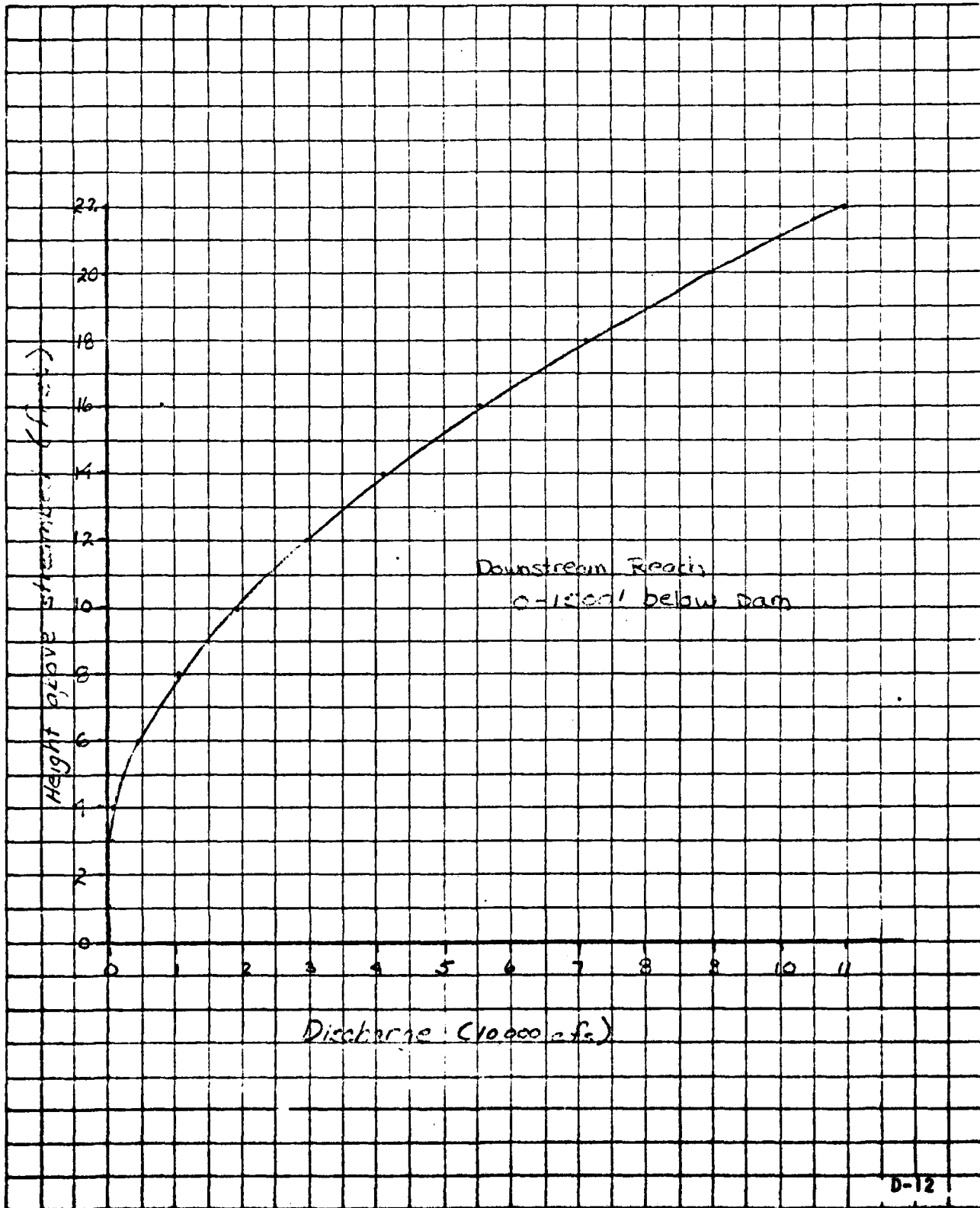
Computation Kent Pond

Job No. 953-05 I

Computed by MEB

Checked by SDM

Date 10-13-80



Subject Inspection of m-federal dam

Computation Part

Job No. 953-05 I

Computed by MSB

Checked by SDH

Date 10-13-83

Downstream Reach 0-1500' below dam

Reservoir storage at time of failure = 1160 acre-ft

Pre-failure stage = 18.8' H.C. (primary spillway only)
Overflowed spillway, does not discharge to Kent Brook

H = 2.7' V = 1 acre-ft

Failure flow = 110,100 cfs H = 22' V = 349 acre-ft

V available for storage = 349 - 1 = 348 acre-ft

$$\begin{aligned} Q_{p2} (Trial) &= Q_p \left(1 - \frac{V}{V_p}\right) \\ &= 110,100 \left(1 - \frac{348}{1160}\right) \\ &= 76375 \text{ cfs} \quad H = 18.5' \quad V = 267 - 1 = 266 \end{aligned}$$

$$\begin{aligned} Q_{p2} &= Q_p \left(1 - \frac{V_{av}}{V_p}\right) \\ &= 110,100 \left(1 - \frac{249 + 266}{1160}\right) \\ &= 80,900 \text{ cfs} \quad H = 19' \end{aligned}$$

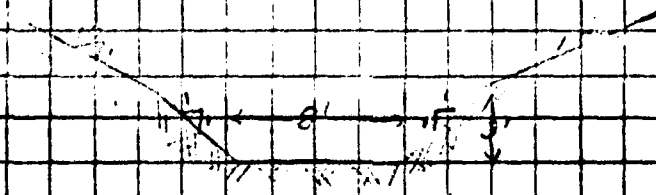
Pre-failure stage = 2.7'

Failure stage = 19.0'

Rise in stage = 16.3'

Downstream Reach 1500-3000' below dam

Approximate Cross-section:



$$V = 1.486 K^{1/3} S^{1/2}$$

$$S = 0.003$$

$$n = 0.10 \text{ for } n = 0.04 \text{ straight}$$

D-13

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 13 of 31

Subject Inspection of non-federal dam

Computation Kent Pond

Job No. 953-OS I

Computed by MRB

Checked by SDM

Date 10-14-80

Downstream Reach 1500-3000' below dam

Stream channel

H	A	P	R	V	Q
1	9	10.83	.83	9.62	78
3	33	16.49	2.00	15.22	511
4	47	"	2.85	19.62	922
6	75	"	4.55	26.80	2010
8	103	"	6.25	33.11	3410
10	131	"	7.95	39.37	5112
12	159	"	9.64	44.20	7125
14	187	"	11.34	49.26	9211
16	215	"	13.04	54.07	11635
18	243	"	14.74	58.67	14256
20	271	"	16.44	63.05	17099
22	299	"	18.14	67.36	20192
23	313	"	18.80	69.45	21739

Stream Bank

H	A	P	R	V	Q
4	10	20.1	.50	2.95	25
6	90	60.2	1.42	5.10	459
8	250	102.5	2.19	7.17	1792
10	490	140.7	3.48	9.17	4395
12	810	180.7	4.93	10.92	8529
14	1210	221.1	5.47	12.12	12167
16	1610	261.3	6.17	13.55	22900
18	2010	301.5	7.46	14.91	33640
20	2420	341.7	8.46	16.20	46329
22	2810	381.9	9.45	17.15	62778
23	3000	402.0	9.95	18.06	72232

Subject Inspection of non-federal dam

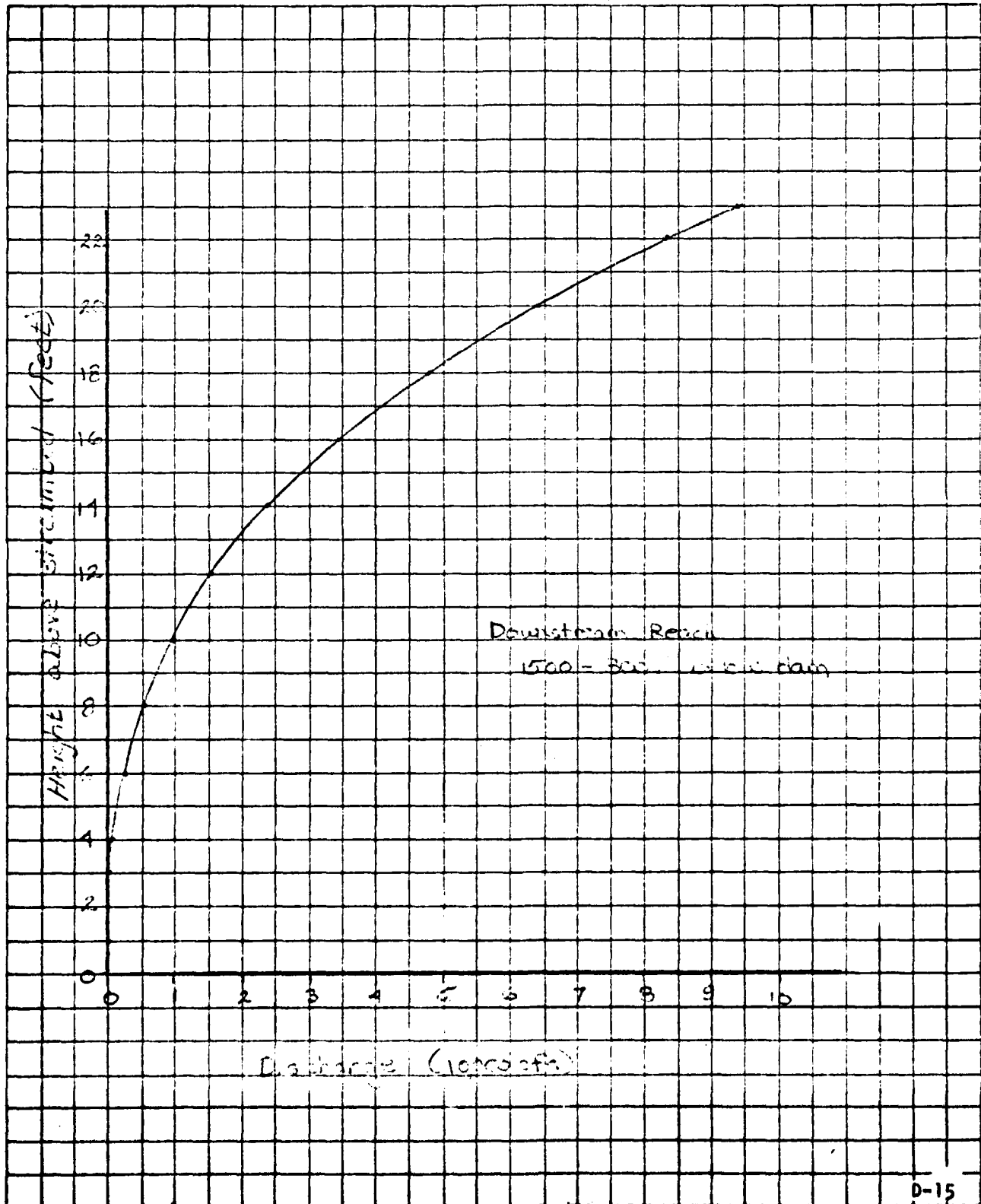
Computation Kent Pond

Job No. 953-05 I

Computed by mEB

Checked by SDA

Date 10-14-9



Subject Inspection of non-factory dam

Computation Kent Pond

Job No. 953-05 I

Computed by MFB

Checked by SDH

Date 10-14-30

Downstream Preen 1500 - 200' below dam

Reservoir Storage @ time of failure 1187 acre-ft

Pre-failure flow = 198 cfs $H = 1.6'$ $V = .5$ acre-ft

Failure flow = 20,000 cfs (from 0 - 500' below dam) $H = 21.7'$
 $V = 127.8$ acre-ft

V available for storage = $127.8 - .5 = 127.3$ acre-ft

$$Q_{p2}(\text{find}) = Q_{p1} \left(1 - \frac{V_1}{V_2}\right)$$

$$= 198 \left(1 - \frac{.5}{127.3}\right)$$

$$= 197.24 \text{ cfs} \quad H = 20.8' \quad V = 118.3 - .5 = 117.8$$

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_{p1}}{V_{p2}}\right)$$

$$= 198 \left(1 - \frac{.5}{117.8}\right)$$

$$= 197.24 \text{ cfs}$$

Pre-failure stage = 1.6'

Failure stage = 21.7'

Post-failure stage = 13.2'

There is a light duty road crossing at the downstream end of the reach. The bridge deck is approximately 5 feet above the streambed and would be destroyed in the event of a failure.

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 116 of 31

Subject Inspection of non-federal dams

Computation Kent Pond

Job No. 953-05 I

Computed by MSP

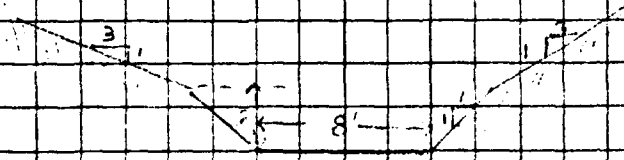
Checked by SDM

Date 10-14-21

Downstream Reach 300' - 315' 215' - 230'

Approximate Cross-section:

$$V = 1.486 R^{2/3} S^{1/2}$$



$$S = .25$$

05.04 stream bed

13.10 stream banks (for P)

Stream bed

H	A	P	R	V	Q
1	9	10.83	.93	14.69	132
3	33	16.49	2.00	26.50	371
4	47	"	2.93	32.40	1570
6	75	"	4.55	45.62	3421
8	103	"	6.25	56.56	5265
10	131	"	7.95	66.16	6667
12	159	"	9.64	75.23	11269
14	187	"	11.34	83.92	15625
16	215	"	13.04	92.65	19791
18	243	"	14.74	99.55	24870
20	271	"	16.44	107.41	29113
22	299	"	18.14	114.69	34292
24	327	"	19.84	121.74	39910
26	355	"	21.53	129.55	45653

Subject Inspection of non-federal dam

Computation Kent Pond

Job No. 953-05 I

Computed by MEB

Checked by SDM

Date 10-14-80

Downstream Reach 3000 - 3750' below dam

Stream Banks

H	A	P	R	V	Q
4	3	6.32	.47	1.04	12
6	27	18.37	1.42	3.41	227
8	75	31.62	2.37	11.82	896
10	147	44.27	3.32	14.72	2174
12	243	56.52	4.27	17.49	4250
14	363	68.37	5.22	19.99	7557
16	507	82.22	6.17	22.35	11330
18	675	94.87	7.12	24.58	16594
20	867	107.52	8.04	26.72	23149
22	1083	120.17	9.0	28.75	31167
24	1323	132.32	9.96	30.77	40704
26	1587	145.46	10.9	32.69	51979

Reservoir storage @ time of failure = 160 acre-ft

Pre-failure flow = 198 cfs $H = 1.2'$ $V = .2$ acre-ft

Failure flow = 72,200 cfs $H = 22.9'$ $V = 25.8$ acre-ft

V_1 available for storage = $25.8 - .2 = 25.6$ acre-ft

$$Q_{p2}(\text{Trial}) = Q_p \left(1 - \frac{V_1}{V}\right)$$

$$= 72,200 \left(1 - \frac{25.6}{1160}\right)$$

$$= 70,600 \text{ cfs} \quad H = 22.8' \quad V = 25.6 - .2 = 25.4$$

$$Q_{p2} = Q_p \left(1 - \frac{V_{\text{avr}}}{V}\right)$$

$$= 72,200 \left(1 - \frac{25.4}{1160}\right)$$

$$= 70,600 \text{ cfs} \quad H = 22.8'$$

The Kent Pond dam is a gravity dam with a spillway on the left side. The spillway is 10' above Kent Pond and may be flooded to a depth of almost 13' above the spill in the event of failure.

Subject Inspection of non-Federal dams

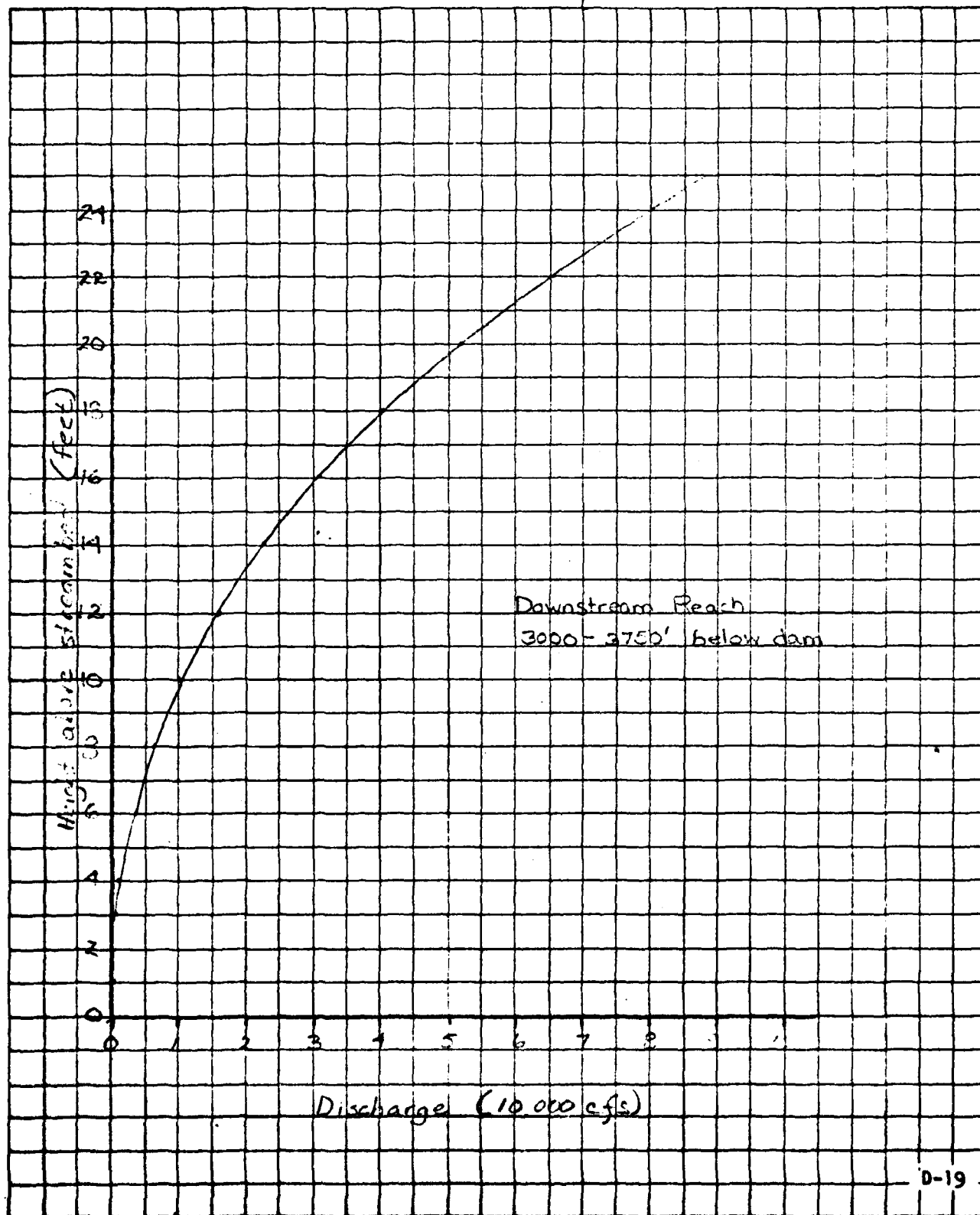
Computation Kert Port

Job No. 953-05I

Computed by M.E.P.

Checked by SDH

Date 10-14-80



Subject Inspection of more federal dams

Computation K. A. Bond

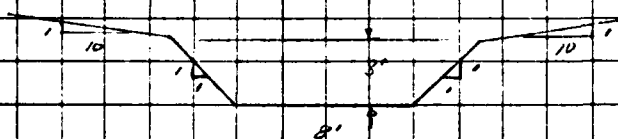
Job No. 953-05 I

Computed by SDM

Checked by

Date 3/26/81

Downstream reach 3750' - 4550' below dam
(to confluence of Ottaunuchee)



$$V = \frac{4.786}{R} R^{1/3} S^{1/2}$$

$$S = \frac{20}{840} = .025$$

$n = .04$ stream bed

$n = .10$ stream bank

Stream bed

H	A	P	R	V	Q	Storage
1	9	10.43	.83	5.18	47	.17
2	33	10.49	2.00	7.34	308	.61
4	47	"	2.85	11.85	557	.86
6	75	"	4.55	16.21	1216	1.38
8	103	"	6.24	22.0	2060	1.89
10	131	"	7.94	28.5	3029	2.41
12	158	"	9.58	34.70	4219	2.90
14	187	"	11.34	39.89	5589	3.43
16	215	"	13.04	44.82	7056	3.95
18	243	"	14.74	49.63	8658	4.46
20	271	"	16.48	54.32	10520	4.98
30	411	"	24.92	80.65	20,819	7.55

Subject Inspection of new - Federal dams

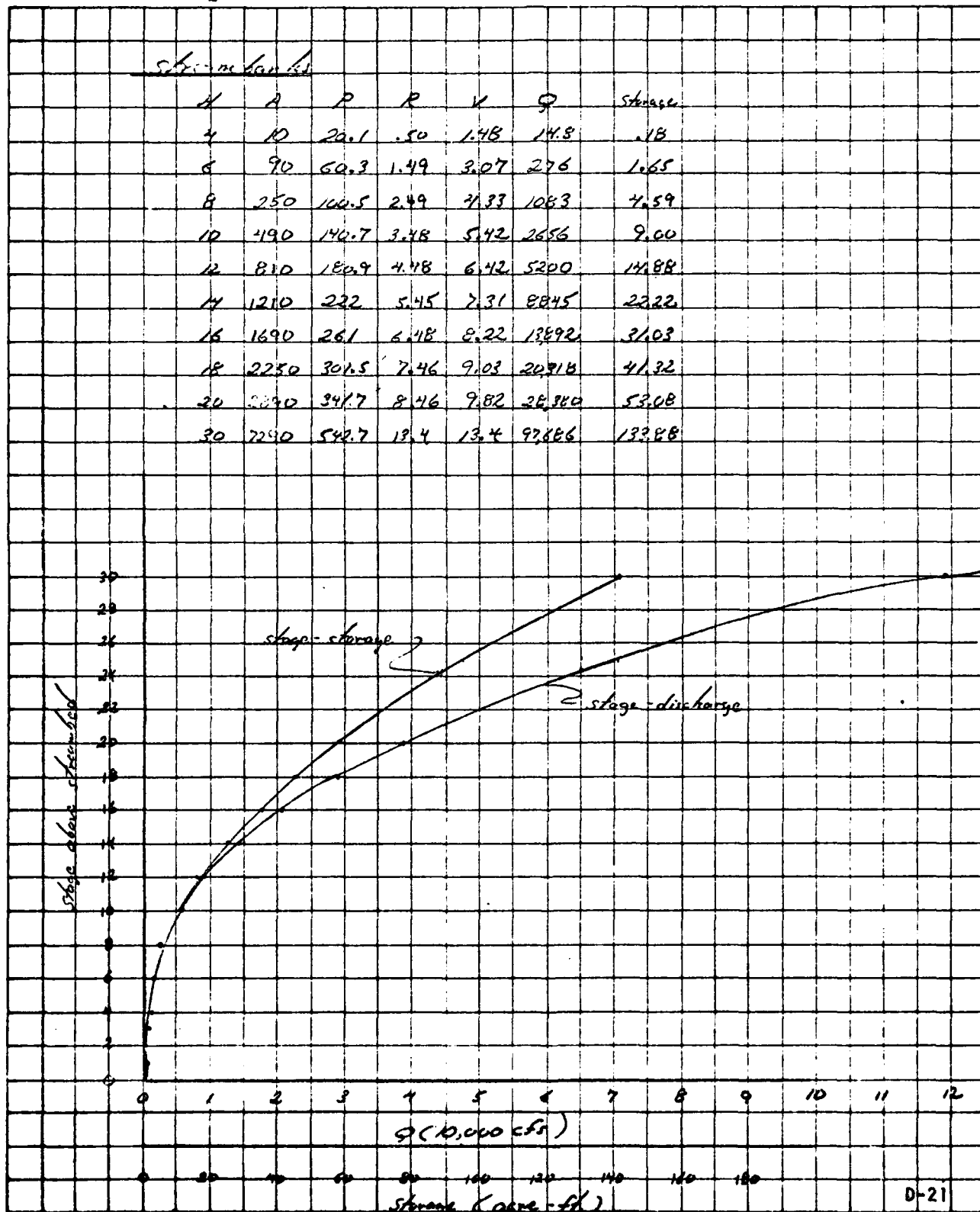
Computation Hand

Job No. 953-05 I

Computed by SDH

Checked by

Date 3/26/81



Subject Inspection of non-federal dams

Computation New Pond

Job No. 953-05 I

Computed by SDM

Checked by

Date 3/27/81

Reservoir Storage @ time of failure = 1180 acre-ft
Pre-failure flow = 198 cfs $H = 22'$ $V = .4$ acre-ft
Failure flow = 70,600 cfs (from 3000'-3750' reach)

$H = 25'$, $V = 90$ acre-ft

V available for storage = $90 - .4 = 89.6$ acre-ft

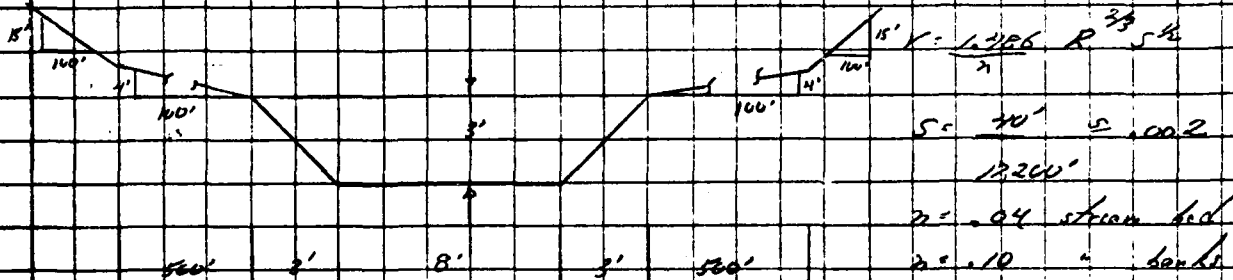
Q_R (trial) = $Q_P (1 - \frac{89.6}{1180}) = 65,147$ cfs

$H = 24.4'$, $V = 88$ acre-ft - $.4$ acre-ft = 87.6 acre-ft

$Q_R = Q_P (1 - \frac{87.6}{1180}) = 65,207$ cfs $H = 24.4'$

4550' - 12,150'

Dam to be built 4550' - 12,150' below dam
divide into 8 1000' reaches



Stream bed

H	N	P	R	V	Q	Storage
1	9	10.83	.83	1.46	13	.21
3	33	11.49	2.40	2.6	86	.76
7	47	"	2.85	3.35	157	1.1
6	75	"	3.55	7.58	344	1.7
8	103	"	6.24	5.66	589	2.4
10	131	"	7.94	6.65	871	3
12	158	"	9.58	7.55	1193	3.6
14	187	"	11.37	8.45	1590	4.3
16	215	"	13.04	9.28	1975	4.9
18	243	"	14.74	11.08	2449	5.6
20	271	"	16.41	11.84	2918	6.2

Subject Inspection of new-level dams

Computation New Pond

Job No. 953-05 I

Computed by SDY

Checked by

Date 4/7/81

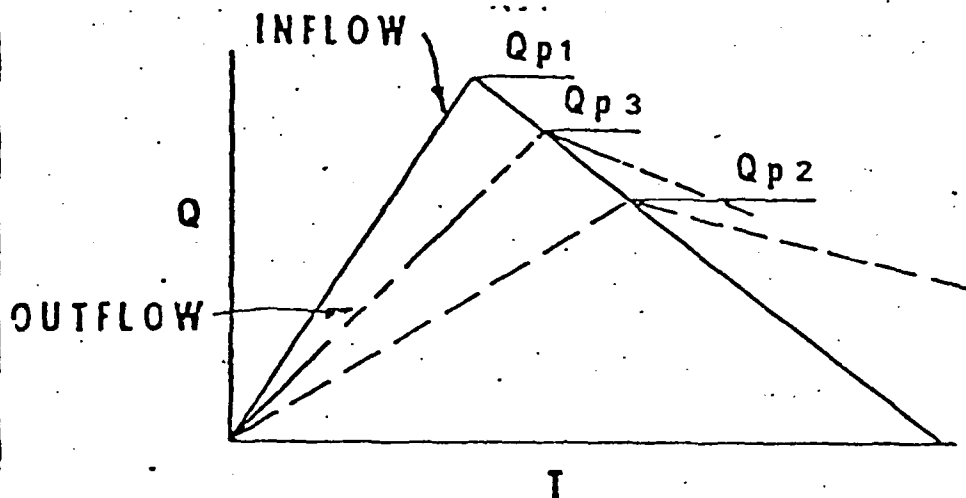
Stream bed (CFS/ft)

H	A	P	R	V	Q	Storage
28	313	1649	1898	1193	3724	7.2
26	355	"	2153	1299	4511	8.1
29	397	"	2408	1400	5559	9.1

Stream bank

H	A	P	R	V	Q	Storage
4	50	50	1	.87	33.5	1.1
6	225	150	15	.87	196	5.2
8	625	250	25	1.23	709	14.3
10	1225	350	35	1.54	1447	28.1
12	2025	450	45	1.92	2426	46
14	3025	550	55	2.28	3692	69
16	4225	650	65	2.32	9544	97
18	5625	750	75	2.56	14440	129
20	7225	850	85	2.79	20158	166
23	10,900	1041	10	3.11	31,140	230
25	13,462	1041	12.59	3.63	47,560	301
29	16,324	1082	15.09	4.10	66,947	375

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surchage Height To Pass " Q_{p1} ".

b. Determine Volume of Surchage ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surchage Height and " $STOR_2$ " To Pass " Q_{p2} "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surchage and Resulting Peak Outflow " Q_{p3} ".

D-36



MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES

X5 - NED DAM IDENTIFICATION
 07'- TWICE SPF AT INDICATED SITES

DEC. 1977.

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

<u>River</u>	<u>SPF</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

<u>Project</u>	<u>Q</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> cfs/sq. mi.
1. Hall Meadow Brook	26,600	17.2	1,546
2. East Branch	15,500	9.25	1,675
3. Thomaston	158,000	97.2	1,625
4. Northfield Brook	9,000	5.7	1,580
5. Black Rock	35,000	20.4	1,715
6. Hancock Brook	20,700	12.0	1,725
7. Hop Brook	26,400	16.4	1,610
8. Tully	47,000	50.0	940
9. Barre Falls	61,000	55.0	1,109
10. Conant Brook	11,900	7.8	1,525
11. Knightville	160,000	162.0	987
12. Littleville	98,000	52.3	1,870
13. Colebrook River	165,000	118.0	1,400
14. Mad River	30,000	18.2	1,650
15. Sucker Brook	6,500	3.43	1,895
16. Union Village	110,000	126.0	873
17. North Hartland	199,000	220.0	904
18. North Springfield	157,000	158.0	994
19. Ball Mountain	190,000	172.0	1,105
20. Townshend	228,000	106.0(278 total)	820
21. Surry Mountain	63,000	100.0	630
22. Otter Brook	45,000	47.0	957
23. Birch Hill	88,500	175.0	505
24. East Brimfield	73,900	67.5	1,095
25. Westville	38,400	99.5(32 net)	1,200
26. West Thompson	85,000	173.5(74 net)	1,150
27. Hodges Village	35,600	31.1	1,145
28. Buffumville	36,500	26.5	1,377
29. Mansfield Hollow	125,000	159.0	786
30. West Hill	26,000	28.0	928
31. Franklin Falls	210,000	1000.0	210
32. Blackwater	66,500	128.0	520
33. Hopkinton	135,000	426.0	316
34. Everett	68,000	64.0	1,062
35. MacDowell	36,300	44.0	825

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

Subject Inspection of non-federal dams

Computation Not Done

Job No. 953-05 E

Computed by SDM

Checked by

Date 7/14/81

Summary

a) Peak Failure Outflow

Q_P = 10,100 cfs flow to Kent Brook

Q_P = 2,444 cfs flow from emergency spillway

b) Approximate pre-failure stage

Just below dam 2.7'

3750' D/S 1.2' (at house)

4450' D/S 2.1' (at Ottanguesset)

5550' D/S 3.2' (at high barn (culvert))

12550' D/S 4.4' (at bridge)

12850' D/S 4.4' (at house trailer)

c) Approximate post-failure stage

structure el.
above river bed

Just below dam 19.0'

3750' D/S 22.8'

4450' D/S 24.4'

5550' D/S 25.5'

12550' D/S 17.5'

12850' D/S 17'

10'
-
9' ± Top of Dam
14' ± Top of RM
6' ±

d) Rise in Stage

Just below dam 20.2'

3750' D/S 20.7'

4450' D/S 21.2'

5550' D/S 22.3'

12550' D/S 19.1'

12850' D/S 19'

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 30 of 31

Subject Inspection of non-Federal dams

Computation New Pond

Job No. 953-05 I

Computed by SDY

Checked by

Date 4/14/81

Run 12550-13550

Failure flow = 14,500 cfs (from reach 12550-13550)

$H = 17.5'$, $V = 130$ acre-ft - 2.2 = 1278

QR (trial) = $QR (1 - \frac{1278}{1160}) = 12,924$ cfs

$H = 17'$, $V = 115$ acre-ft - 2.2 = 112.8

$QR = QR (1 - \frac{1278 + 112.8}{1160}) = 13,219$ cfs
say 13,000 cfs

$H = 17'$

Hence Trailer Spill at 6'±

Subject Inspection of non-federal dams

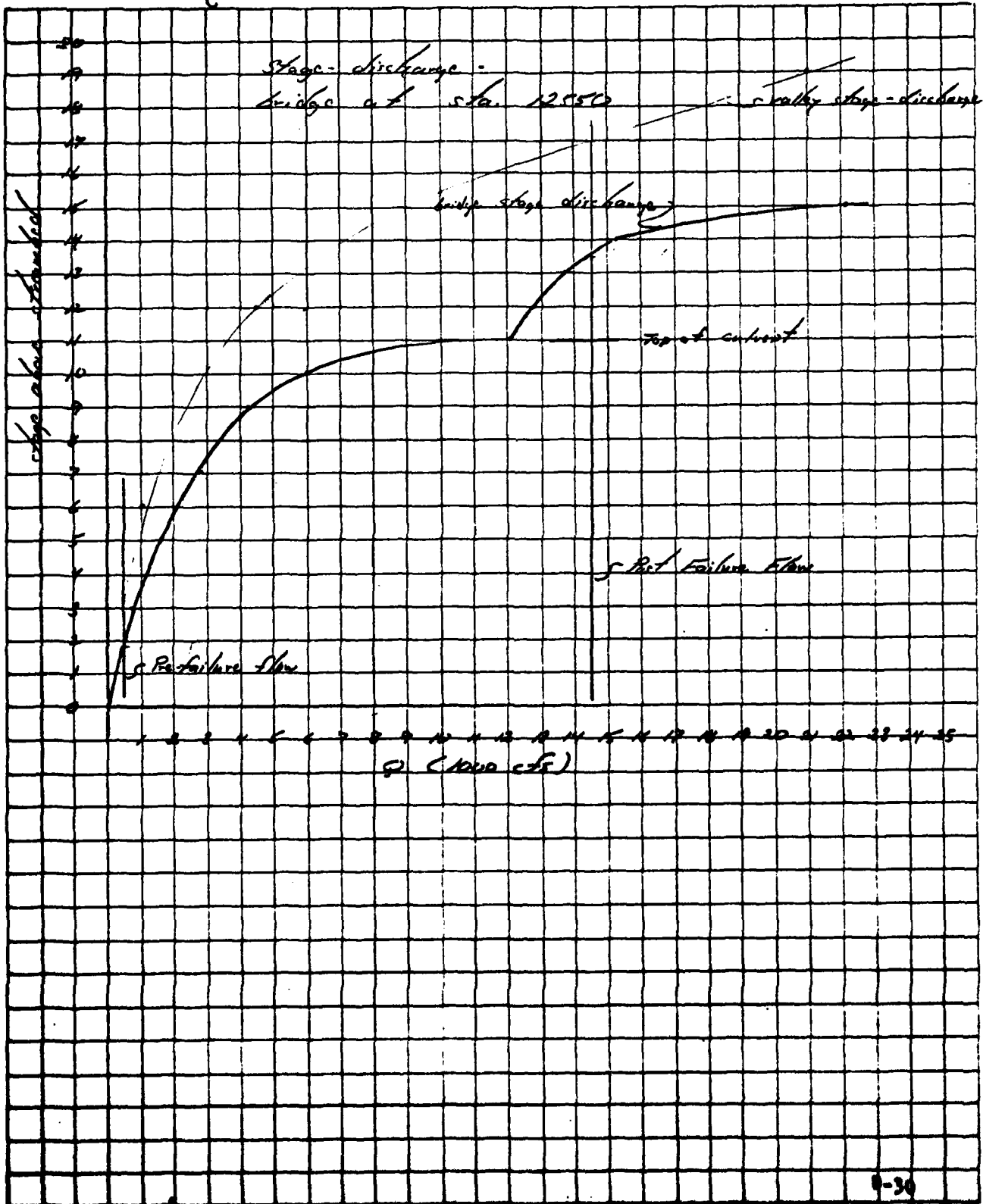
Computation New Pond

Job No. 953-051

Computed by SDH

Checked by

Date 7/17/81



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 28 of 31

Subject Inspection of dam - Federal dams

Computation Hand Pencil

Job No. 953-05 I

Computed by SDM

Checked by

Date 4/14/81

Highway Bridge @ Sta. 12550 (Cont'd)

Surcharge Flow

$$Q = CA \sqrt{2g \Delta h}$$

C = 1.8

multiplied for 45° angle = 1.1

H	A	Δh	Q
11	8.4	4.4	12,058
12	"	4.6	12,594
13	"	5.2	13,108
14	"	5.6	13,603
15	"	6	14,080
16	"	6.4	14,542
17	"	6.8	14,990

Main Flow

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

C = 2.5

H	A	Q	H	A	Q	H	A	Q	H	A	Q	EQ
2.1	.67	300	1.0									110
3	1.3	460										592
4	2	660										1032
5	3	900	1	74	185	.67	50	69	.67	100	187	8185
6	4	1200	2	7	523	1.34	100	388	1.34	260	776	13,587
7	5	1671	3	7	761	2.34	7	895	2.34	7	1790	20,417

Subject Inspection of non-Federal dams

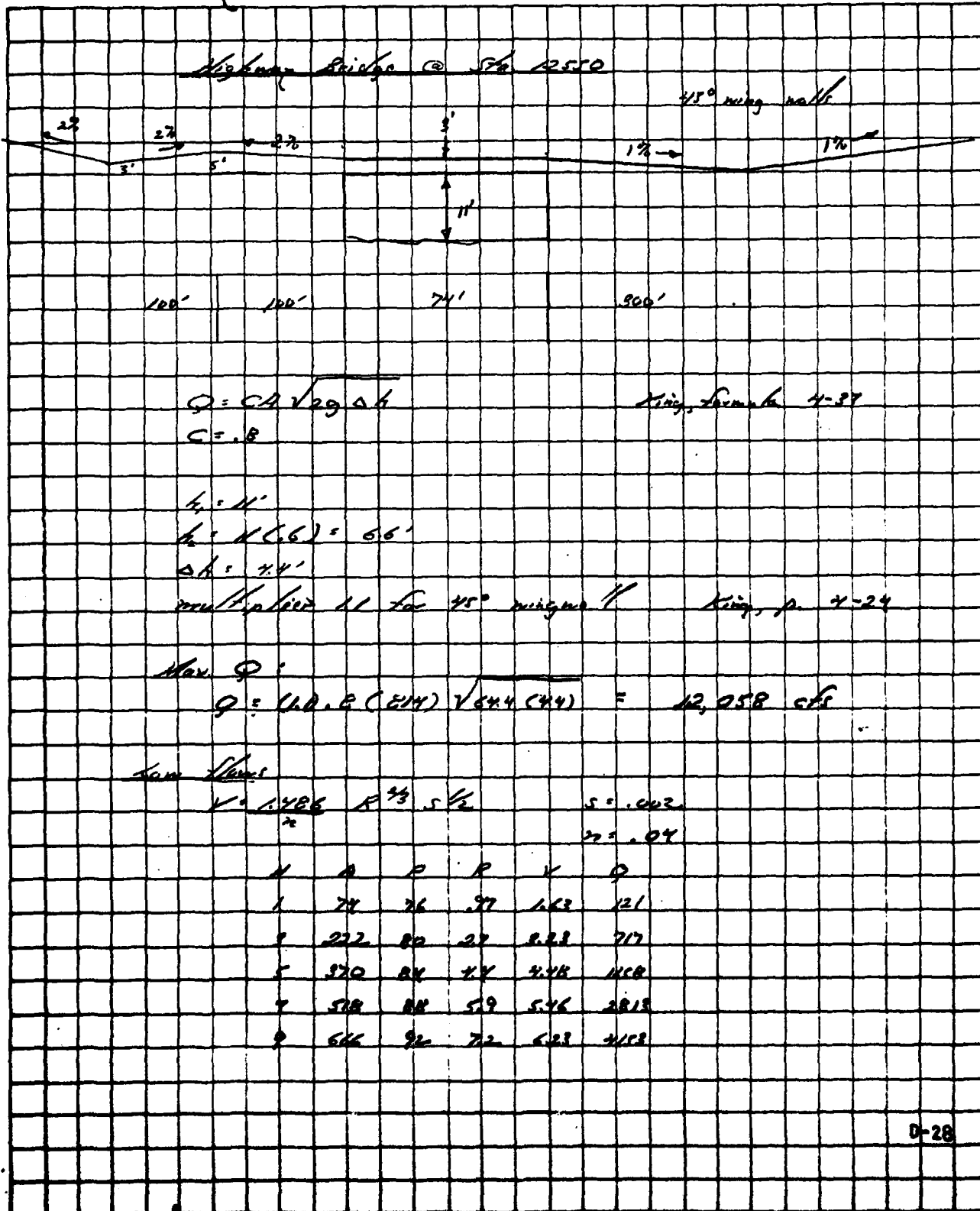
Computation Ken F. B.

Job No. 953-05 I

Computed by SDM

Checked by

Date 4/8/81



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet 26 of 31

Subject Inspection of non-federal dams

Computation Ken Paul

Job No. 953-052

Computed by SDH

Checked by

Date 4/7/81

Reach 9550-10550

Failure flow = 21,229 cfs (from reach 8550-9550)

$H = 19'$, $V = 150$ accel-ft $-2.2 = 147.8$

$Q_R (A_{12}) = Q_P \left(1 - \frac{147.8}{1160}\right) = 18,524$ cfs

$H = 18.5'$, $V = 145$ accel-ft $-2.2 = 142.8$

$Q_R = Q_P \left(1 - \frac{\frac{147.8 + 142.8}{2}}{1160}\right) = 18,570$ cfs

Reach 10550-11550

Failure flow = 18,570 cfs (from reach 9550-10550)

$H = 18.5'$, $V = 145$ accel-ft $-2.2 = 142.8$

$Q_R (A_{12}) = Q_P \left(1 - \frac{142.8}{1160}\right) = 16,284$ cfs

$H = 18'$, $V = 135$ accel-ft $-2.2 = 132.8$

$Q_R = Q_P \left(1 - \frac{\frac{142.8 + 132.8}{2}}{1160}\right) = 16,364$ cfs

Reach 11550-12550

Failure flow = 16,364 cfs (from reach 10550-11550)

$H = 18'$, $V = 135$ accel-ft $-2.2 = 132.8$

$Q_R (A_{12}) = Q_P \left(1 - \frac{132.8}{1160}\right) = 14,491$ cfs

$H = 17.5'$, $V = 130$ accel-ft $-2.2 = 127.8$

$Q_R = Q_P \left(1 - \frac{\frac{127.8 + 127.8}{2}}{1160}\right) = 14,525$ cfs

Step 14,500 cfs

Subject Inspection of non-federal dams

Computation Next Pond

Job No. 953-05 I

Computed by SDH

Checked by

Date 4/7/81

Pond 6550-7550

Failure flow = 36,975 cfs (from reach 5550-6550)

$H = 23.5'$, $V = 245$ acre-ft

V available for storage = $245 - 2.2 = 242.8$ acre-ft

$Q_R(\text{ch.1}) = Q_P \left(1 - \frac{242.8}{1160}\right) = 29,236$ cfs

$H = 26.5'$, $V = 205$ acre-ft - 2.2 = 199.8

$Q_R = Q_P \left(1 - \frac{242.8 + 199.8}{2 \cdot 1160}\right) = 29,921$ cfs

Pond 7550-8550

Failure flow = 29,921 cfs (from reach 6550-7550)

$H = 22'$, $V = 210$ acre-ft - 2.2 = 207.8

$Q_R(\text{ch.1}) = Q_P \left(1 - \frac{207.8}{1160}\right) = 24,561$ cfs

$H = 21'$, $V = 190$ acre-ft - 2.2 = 187.8

$Q_R = Q_P \left(1 - \frac{207.8 + 187.8}{2 \cdot 1160}\right) = 24,819$ cfs

Pond 8550-9550

Failure flow = 24,819 cfs (from reach 7550-8550)

$H = 21'$, $V = 190$ acre-ft - 2.2 = 187.8 acre-ft

$Q_R(\text{ch.1}) = Q_P \left(1 - \frac{187.8}{1160}\right) = 20,800$ cfs

$H = 19'$, $V = 150$ acre-ft - 2.2 = 147.8

$Q_R = Q_P \left(1 - \frac{187.8 + 147.8}{2 \cdot 1160}\right) = 21,229$ cfs

Subject Inspector at non-federal - dams

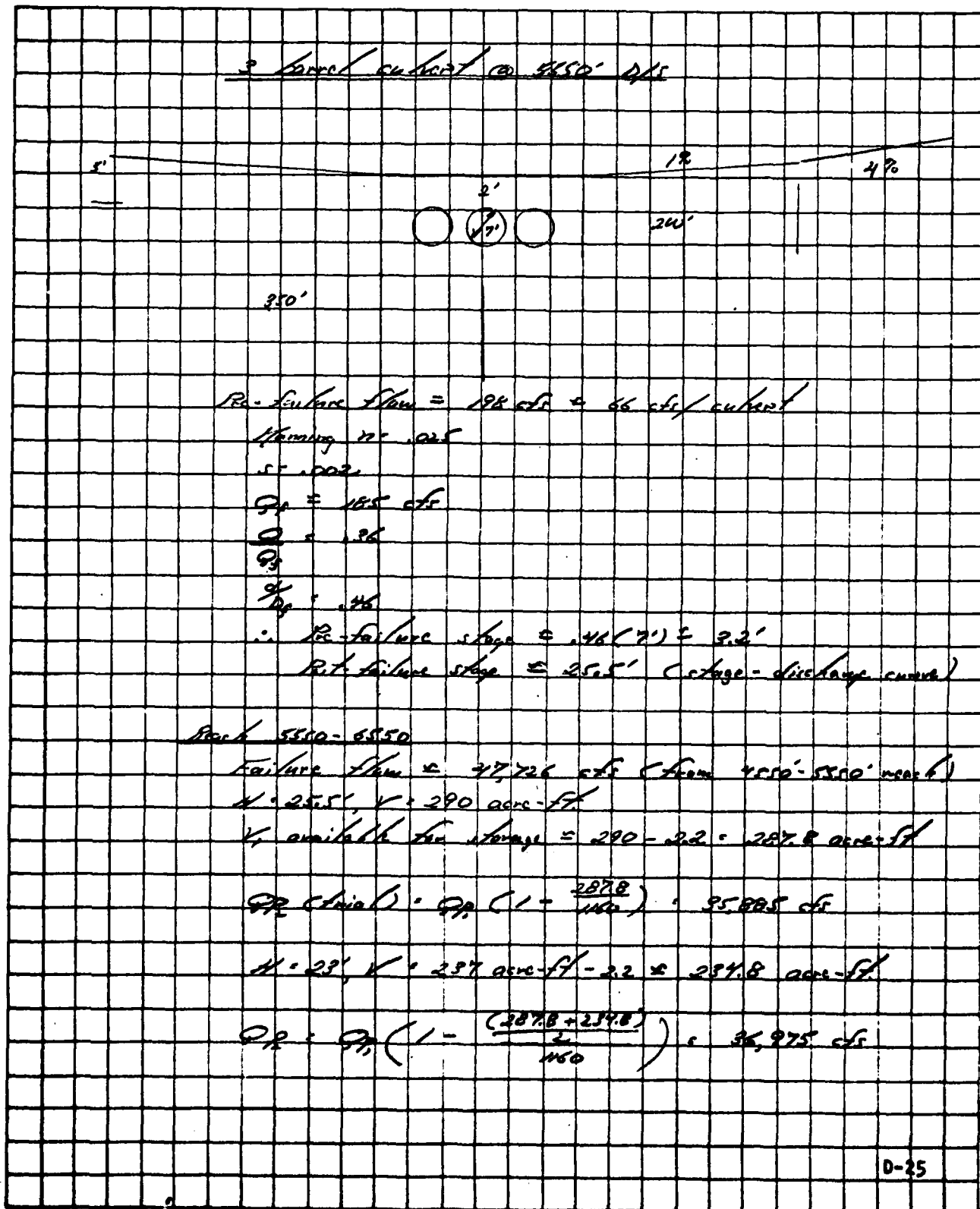
Computation West Pond

Job No. 953-05 I

Computed by SDC

Checked by

Date 4/7/81



Subject Inspection of non-federal dams

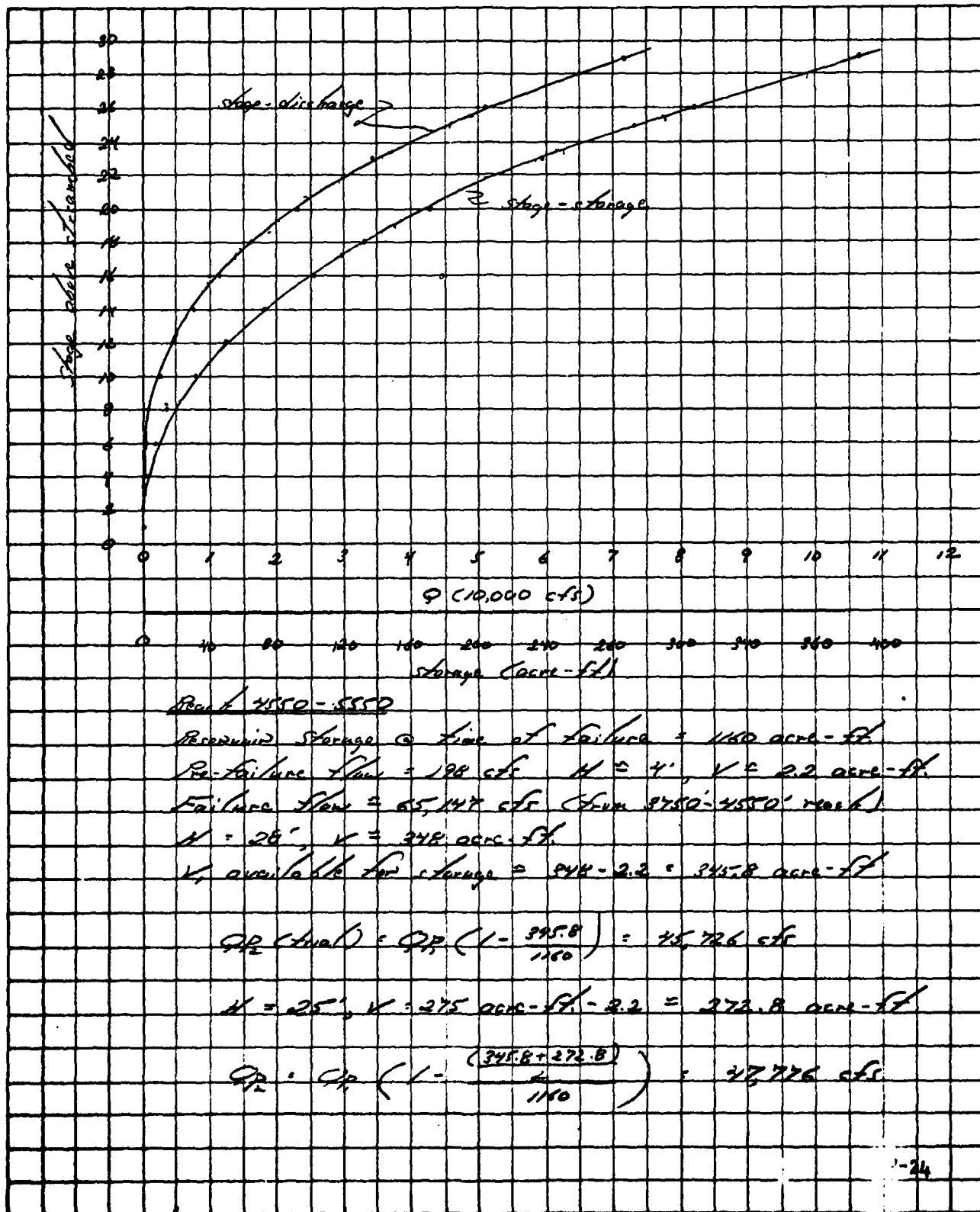
Computation West Pond

Job No. 85305 I

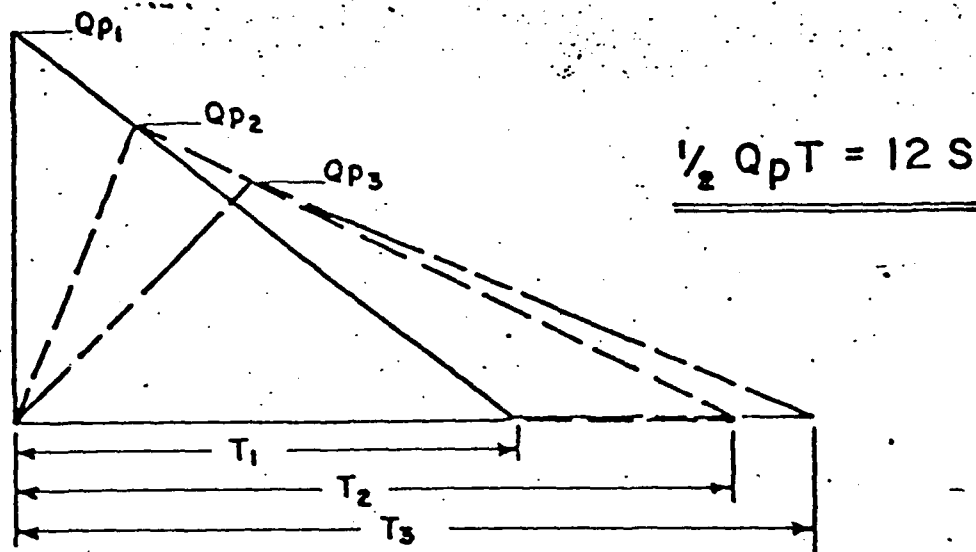
Computed by SDM

Checked by _____

Date 4/7/81



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} Y_0^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS $1/2$ OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2} :

$$Q_{p2}(\text{TRIAL}) = Q_{p1} (1 - \frac{V_1}{S})$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2} .

$$Q_{p2} = Q_{p1} (1 - \frac{V_{\text{avg}}}{S})$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

DATE
FILMED
- 8