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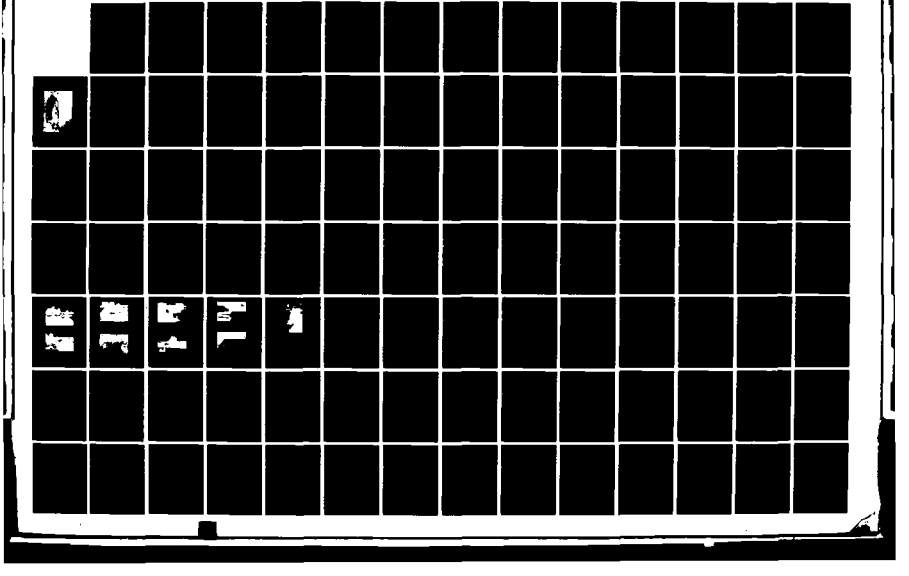

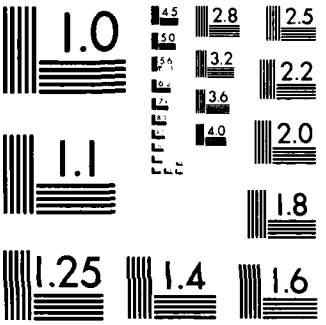

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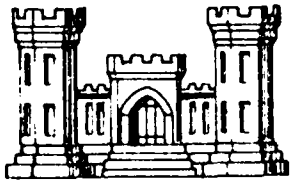
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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

AUGUST 1978

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Whitingham, VT.
Tributary to Lake Whitingham

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

The dam is an earthfill dam about 10 ft. high, 400 ft. long. It is intermediate in size with a significant hazard potential. The main embankment is in good condition. Regular maintenance is required in the form of control of vegetation, repair of rip rap, and roo t removal. Annual maintenance inspectio inspections and bi-annual technical inspections should be instituted.

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LAKE SADAWGA

VT00012

WHITINGHAM, VERMONT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: VT00012
Name of Dam: Lake Sadawga Dam
Town: Whitingham
County and State: Windham, Vermont
Stream: Tributary to Lake Whitingham
Date of Inspection: June 16, 1978

BRIEF ASSESSMENT

GENERAL

Lake Sadawga Dam is an earthfill dam about 10 feet high, 400 feet long, a crest width of about 10 feet, and side slopes of 2 to 2.5H:1V. It contains a 60-foot-long masonry, control section with a height of 13.5 feet. There is one earthfill saddle dike, referred to as the West Dike, which is about 10 feet high, 265 feet long, has a crest width of 4 feet, and side slopes of about 1.5H:1V. The impounded water is used for recreation and to feed a sprinkler system in a factory downstream.

The dam is classed as "intermediate" in size, based on storage, and its hazard classification is "significant".

The drainage area is about 2800 acres and the reservoir surface area is 202 acres. The length of the reservoir is about 5700 feet and it contains 808 acre feet of water in the normal recreation pool. The water may be drained from the reservoir through a 24 foot diameter pipe by removing stoplogs. The upstream invert of the stoplog structure is about 16.2 feet below the top of the dam.

A flood equal to 50% of the PMF will overtop the main embankment by about 1.5 feet and the West Dike by about 0.5 feet.

The main embankment is in good condition. Regular maintenance is required in the form of control of vegetation, repair of riprap, and root removal.

The West Dike has steep side slopes and a narrow crest. If the water rises to within two feet from the top of this dike, which occurs in a flood about 15% of the PMF, it may become unstable. Hence its stability should be checked and the dike should be redesigned so that it will be equivalent to the main embankment.

A portion of the concrete cap on the spillway section is severely cracked and is in only fair condition. A monitoring system

should be established to determine whether this portion is settling and an engineer should be retained to make necessary recommendations for repair of this control section.

Annual maintenance inspections and bi-annual technical inspections should be instituted. In addition, a flood warning system for downstream residents should be developed and implemented.

STATEMENT OF SIGNIFICANT FINDINGS

The following significant conditions were observed:

1. A large section of the original spillway shows cracking which may indicate settlement of this section of spillway.

2. Large trees are growing on the right end of the embankment, and vegetation is growing profusely on the upstream slope, on the left embankment and on the West Dike.

3. The West Dike has a very narrow crest width together with steep side slopes.

4. The spillway capacity is inadequate to pass the design flood of 3800 cfs.

5. The embankment is wave cut at lake level due to erosion of fines from the embankment.

STATEMENT OF RECOMMENDED ACTION

An engineer qualified in dam design should be engaged to redesign the West Dike to be safe when the maximum flood occurs, and to analyze alternatives and recommend a method for increasing the spillway capacity. In addition the cracking on the old spillway should be monitored to see if an ongoing settlement condition exists.

The large trees and roots on the right embankment should be removed and the holes repaired properly. The riprap on the upstream face of the embankment should be repaired. A maintenance program should be developed to insure that brush is removed annually from all parts of the dam and dike. Refer to Section 7 for detailed findings and recommendations.

John K. Spurr

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

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

TABLE OF CONTENTS

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

None

4.2 Maintenance of Dam

The Vermont Department of Fish and Game maintain the dam by cutting brush and mowing both the dam, and the West Dike.

4.3 Maintenance of Operating Facilities

There is no routine maintenance of the operating facilities.

4.4 Description of Warning System in Effect

None for this dam.

4.5 Evaluation

The mowing program is effective in keeping brush from growing on the dam. The section of the dam west of the spillway structure has not been mowed for several years, and should be included in order for the maintenance program to be complete.

d. Reservoir Area

Lake Sadawga has a large "floating island" which consists of bog vegetation that floats in the central part of the lake. The lake level on June 16, 1978 was at the crest of the service weir, elevation 96.2, as is required by the rules and regulations for the surface level of Sadawga Pond as amended 18 September 1964.

e. Downstream Channel

The channel rapidly falls away from the Route 100 bridge at a 3.6 per cent slope. The channel averages 20 feet in width and water, flowing out of bank, can rise to stages of about 10 feet without flooding homes. The channel is composed of ledge outcrops and has been riprapped on the downstream side of the bridge. Water will probably overtop the bridge for the Spillway Design Flood but not at elevations which will significantly impede the flow out of Lake Sadawga. The bridge has a hydraulic opening of about 180 square feet and the top of road is at about elevation 95.4.

3.2 Evaluation

Based on visual examination, the embankments of the main dam are in good condition. The riprap needs repair, trees and shrubs must be cut, and the roots must be eliminated as a possible path of seepage.

Due to its steep side slopes and narrow crest width the West Dike appears to be only marginally adequate if the lake rises to within two feet below the top, as has been anticipated in the records available.

A portion of the concrete cap is in fair condition, since it is severely cracked and shows signs of settlement. It should be monitored to determine whether settlement is occurring. It is also recommended that the condition of the penstock where it penetrates the wall be determined.

The concrete cap shows evidence of deterioration in the form of light scaling and medium surface cracks. A portion of the cap just to the right of the control section (see Photo 8 in Appendix C) approximately 4 feet x 8 feet in plan appears to have settled and cracked. This portion of the cap is located directly over the old 3.9-foot diameter penstock where it penetrates the masonry wall.

The control section in the spillway is approximately 9 feet long. It appears to be constructed in accordance with the plans entitled "Proposed Spillway, Sadawga Pond, Whitingham, Vermont" by Howard M. Turner, Consulting Engineer, 1957.

There is provision in the control section for stop planks, which if installed, would raise the lake level to the height of the original spillway.

The concrete in the control section, including the training walls appears relatively new and is in good condition.

The regulating outlet consists of a 6.3 feet by 8.4 feet drop inlet. The upstream face of the inlet is formed by two rows of stop planks which fit into steel channel sections imbedded in concrete. The drop inlet, flows into the remains of a 3.9 foot penstock which penetrates the masonry wall. This structure is in generally good condition. The condition of the old penstock, within the masonry wall is unknown.

On the left side of the control section is a control gate for an 8-inch penstock which is used by a small wood product factory. The gate is operated by a handwheel which is in a gate house on top of the spillway. The actual penetration of the masonry wall is accomplished by a 30-inch boiler section, which is filled with concrete on the downstream side of the wall in order to accomplish the transition to 8-inch cast-iron pipe.

Just to the right of the right spillway training wall a path has been formed by pedestrians who climb to the top of the spillway structure.

Left Embankment - The embankment to the left of the spillway section is entirely overgrown with low trees to 15 feet high and with wild roses, on both upstream and downstream sides and on the crest.

No erosion was noted, except that a wave cut zone exists at lake level. The riprap appears in good condition. No filter material was evident beneath the riprap.

There was no seepage observed downstream of this embankment, which is arched downstream, in plain view, as it turns to meet the left abutment.

Spillway Structure Foundation - The spillway structure is founded on bedrock which is relatively flat-lying. One measurement showed a strike of N75E with a dip of 14° N. It appears that bedrock is shallow in the vicinity and that the embankment may be founded thereon.

West Dike - The west dike has very steep slopes (about 1.4H:1V) and a 3 or 4-foot-wide crest. The lake level is about 3 feet higher than the downstream toe and the freeboard is about 7 feet, which means that the top of the dike is about one foot higher than the dam embankment.

This dike is overgrown with shrubs and small trees. The records indicate that about 20 years ago this growth had been cut back.

A swampy zone exists for a distance of at least 100 feet downstream in a rather flat saddle that is shown on the USGS topographic map. There was no seepage evident from the downstream toe of the dike.

c. Appurtenant Structures

The concrete and masonry spillway, with the drop inlet regulating outlet, and the gated 8-inch penstock constitute the appurtenant structures of this dam.

The original spillway section is approximately 46 feet long. This spillway section is capped with old concrete. There is steel bar and masonry block embedded in the concrete. The purpose of the steel and masonry is unknown.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The on-site inspection of Lake Sadawga Dam was performed on June 16, 1978. Weather conditions were ideal for the inspection; clear, temperatures in the 70s. Runoff in the streams was considered normal for that time of year. No emergency conditions were observed on the day of the inspection.

The condition of the embankment was found to be good, and the spillway concrete was found to be in fair condition. The West Dike has steep slopes.

b. Dam

Figure 1 shows an approximate cross section, which was taken at a location about 73 feet right of the right spillway training wall. The freeboard is nearly 6 feet and the lake is quite shallow at this location. There is a head of only 2.6 feet across the embankment. The head is several feet high growing from the riprap.

At the lake level this riprap is wave cut slightly. No filter material appears to be present under the riprap. At one location about 56 feet right of the right spillway training wall, a zone about 10 feet wide along the upstream lake shore is eroded partway up the slope. At this location the embankment is arched upstream. This zone of erosion is at the location of minimum radius of curvature in plan view of the embankment.

Seepage was observed emanating from the downstream toeline along nearly the entire 300 foot length. Specific seeps were not observed, but the entire zone was wet downstream and a small channel had been dug to carry the water to an outlet. The wet zone is shown in Photo No. 3 in Appendix C. The dark green grass grows in the wetter areas.

SECTION 2: ENGINEERING DATA

2.1 Design

There is no design data available for this dam.

2.2 Construction

There is no construction data available for this dam.

2.3 Operation

There is no operation associated with this dam.

2.4 Evaluation

a. Availability

There are no data.

b. Adequacy

Not applicable.

c. Validity

Not applicable.

5. Side slopes: 1.5H:1V upstream
2H:1V downstream

6. Zoning - none known

7. Impervious Core - none known

8. Cutoff - none known

9. Grout Curtain - none known

i. Spillway

1. Type: concrete and cut stone masonry

2. Length of Weir: 45.5 feet main weir
9 feet service weir

3. Crest elevation: 98.9 main weir
96.2 service weir

4. Gates: none

5. Upstream channel: pond

6. Downstream channel: Bridge at Route 100 approximately 10 feet downstream 19 x 9.5 foot opening above elevation 84.4

j. Regulating Outlets

1. Invert: 85.2

2. Size: 4' diameter with 3.9' diameter outlet (see photo).

3. Description: Boiler tube modified for outlet service

4. Control Mechanism: Stop log structure 8.4 feet from dam x 6.3 feet wide - concrete 1.5 feet thick.

f. Reservoir Surface (acres)

1.	Top dam	202
2.	Maximum pool[2]	202
3.	Flood-Control pool[2]	202
4.	Recreation Pool[2]	202
5.	Spillway crest[2]	202

g. Main Dam

1. Type

Earth dam embankments with concrete and cut-stone masonry spillway section.

2. Length - 400 feet ± including spillway

3. Height - 9 feet

4. Top width - 10 feet

5. Side Slopes - 2H:1V upstream
2.5H:1V downstream

6. Zoning - None known

7. Impervious Core - None known

8. Cutoff - None known

9. Grout Curtain - None known

West Dike

1. Type - Earth Embankment

2. Length - 265 feet (approx.)

3. Height - 10 feet

4. Top width - 4 feet

---

[2] Estimated due to lack of topographic data.

b. Discharge at Dam Site

1. The outlet works consist of a 3.9' diameter boiler tube which is regulated by a stop-log structure at its inlet and a 30-inch boiler tube which is gated and reduced down to make a transition to an 8-inch cast iron pipe.

2. There is no record of estimated or known maximum floods at the dam site.

3. The ungated spillway capacity at the full reservoir level is 1050 cfs.

4. There is no gated spillway.

c. Elevation (local datum)

1.	Top dam	101.8
2.	Maximum pool - design surcharge[1]	99.4
3.	Full flood control pool	101.8
4.	Recreation pool	96.2
5.	Spillway crest	98.9
6.	Upstream invert 4-foot diameter conduit	85.2
7.	Streambed at centerline of dam	82.7
8.	Maximum tailwater[1]	88.7

d. Reservoir

1.	Length of maximum pool	5700 feet

e. Storage (acre-feet)

1.	Recreation pool	808
2.	Flood control pool	1939
3.	Design surcharge[1]	1455
4.	Top of dam	1939

---

[1]Results of Howard M. Turner Report dated June 20, 1957.

f. Operator

The dam is operated by the Vermont Department of Fish and Game, Contact:

Mr. Ray Harwood, Regional Supervisor
Telephone: 802-773-2657

g. Purpose

Lake Sadawga Dam is presently maintained for recreational purposes. One 8-inch pipe feeds a sprinkler system for a building downstream.

The dam was originally constructed to impound and control water for hydropower purposes.

h. Design and Construction History

No information is available on the design or construction history of this dam.

i. Normal Operation Procedures

There are no normal operational procedures associated with this dam.

1.3 Pertinent Data

a. Drainage Area

The drainage area is 4.33 square miles of rolling hills surrounding Lake Sadawga, including the drainage area of Lake Clara. The drainage is from hills which rise 430 feet above normal pond level. They are predominantly covered with soils described as glacial till with a hard-pan or bed rock commonly within three feet of the surface.

The watercourses into the pond vary in characteristic from a well-defined 1.9 square mile basin formed north of Route 100 and the town highway just south of Route 100 to several smaller tributaries flowing from the hills immediately surrounding Lake Sadawga. The northern watercourse has an average slope of 130 feet per mile and is about 2.3 miles long while the smaller tributaries are about 0.8 mile long with slopes of roughly 440 feet per mile.

b. Description of Dam and Appurtenances

Lake Sadawga Dam is an earth dam with a concrete and masonry spillway section.

The level in the lake is maintained by a control section in the spillway. There is also a drop inlet, in which the invert elevation may be varied by use of stop planks. The drop inlet is connected to an abandoned 3.9' penstock which penetrates the masonry wall of the spillway on the east side. There is an 8-inch penstock on the west side which is still in service. Water in this penstock is maintained by a gate constructed in the concrete and masonry portion of the dam.

At the far west end of the lake is a dike, apparently constructed of earth and rock, which prevents water from outletting at that spot.

c. Size Classification

Lake Sadawga is a 202-acre impoundment. The dam is between 9 and 17 feet in height. The maximum storage potential of the lake is estimated at 1939 acre-feet. The Corps of Engineers recommends that dams which have a height greater than 40 feet but less than 100 feet, or have a storage volume greater than 1000 acre-feet but less than 50,000 acre-feet be classified as intermediate in size. The storage volume therefore governs, and results in a size classification of intermediate for this dam.

d. Hazard Classification

A failure of Lake Sadawga Dam would route the resulting flood through Whitingham Village to Lake Whitingham, (see map in Appendix B). It is estimated that three or four lives might be endangered in the event of a dam failure, and that one building, State Route 100 and several town roads would suffer serious damage. The hazard category of Lake Sadawga Dam is therefore significant.

e. Ownership

The present owner of Lake Sadawga Dam is:

The Vermont Dept. of Fish and Game
Montpelier, Vermont 05602
Commissioner, Edward Kehoe

Reportedly the previous owner of the dam was Mr. Houghton Sawyer of Whitingham.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: LAKE SADAWGA

SECTION I: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of May 26, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0341 has been assigned by the Corps of Engineers for this work.

b. Purpose

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

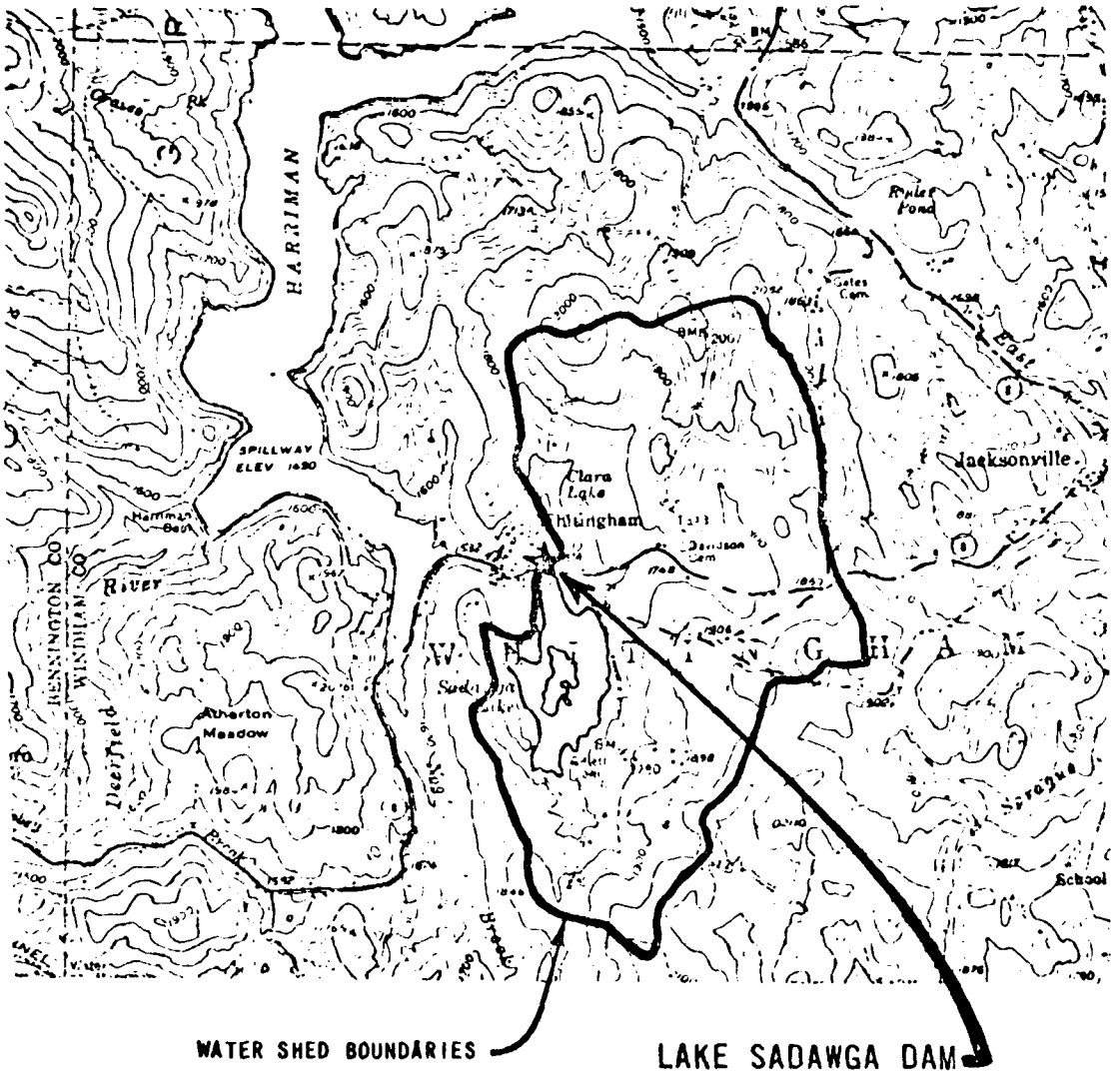
2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

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

1.2 Description of Project

a. Location

Lake Sadawga Dam is located in the Town of Whitingham, Windham County, Vermont. More specifically the dam is located approximately 0.25 miles southeast of Whitingham Village on Route 100.



SOURCE OF MAP:

U.S. GEOLOGICAL SURVEY
WILMINGTON QUADRANGLE,
VERMONT, 15 MIN. SERIES
1"=62500', 1954

CLIENT NO.	22-0555
ENGINEER	JRS
DRAWN BY	LGF
DATE	7-11-78

DUFRESNE-HENRY ENGINEERING CORP.

LOCATION MAP
LAKE SADAWGA DAM

WHITINGHAM VERMONT

A

OVERVIEW OF LAKE SADAWGA DAM
WHITINGHAM, VERMONT

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The only data available is contained in the report by Howard M. Turner in 1957. In this report he was proposing modification to the spillway section to its present form. In his analysis he makes reference to a "rare flood" of 1680 cfs which is reduced by pond storage to an outflow of 540 cfs. This outflow would result in a stage of 99.4 in the pond based on his supporting computations.

One-half of the Probable Maximum Flood (1/2 PMF) has been selected as the Test Flood for this impoundment. This flood was computed using hydrograph methods via the Generalized Computer Program HEC-1. The results of the current hydrograph analysis show that the inflow would be on the order of 7500 cfs and the outflow would be about 3800 cfs. Consequently the previously existing data does not conform to the present design criteria.

b. Experience Data

There are no accounts of overtopping or significantly high water levels in Lake Sadawga.

c. Visual Observations

The impoundment is being operated in accordance with the rules and regulations for the surface level of Sadawga Pond as amended 18 September 1964. The stop log structure is in serviceable condition and could be used to draw the lake down in the event of an emergency.

d. Overtopping Potential

The Test Flood of 1/2 PMF will overtop the earth embankment near the spillway by about 1.5 feet and the West Dike by about 0.5 feet.

e. Results of Dam Failure

(1) Main Dam

A wave of water about 11 feet high would flow down the existing channel away from Lake Sadawga. This would not be high enough to cause serious damage as there is channel capacity to at least 10 feet above the stream bed.

(2) West Dike

A wave of water about 7 feet high would flow through the woods and swamp area to the west of Lake Sadawga. Its height would be somewhat diminished when it reached the Village area but still could sustain considerable damage to a church and possibly Route 100.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Based on visual observations there appears to be little cause for concern currently about the stability of this dam. However, large trees are growing near the right abutment, which will lead eventually to rotting roots and possible paths for internal erosion. Similarly shrubs and low trees are being allowed to grow on the upstream side of the right embankment and over the entire left embankment and West Dike.

The riprap is wave cut, probably due to continual plucking of fines from the embankment through the voids between stones.

The West Dike has a crest width of only a few feet. In the records it appears that for a "rare storm" (1640 cfs inflow, 11% of PMF) the freeboard will drop to only 2 feet. Under these conditions the West Dike will be in substantial danger of eroding through due to only minor wave action, because the crest is narrow and the slopes are steep.

See Section 3.1.c. for comments on the cracking of the concrete cap of the spillway.

b. Design and Construction Data

There are no design or construction data available on which to base an analysis of the stability of this dam.

c. Operating Records

There are no operating records available that relate to the structural stability of this dam.

d. Post-Construction Changes

There are no data available concerning post-construction changes. From the appearance of the concrete, and the June 20, 1957 letter from Mr. Turner to Mr. Thieme, it would seem that changes have been made at the control section. In particular, a 9 foot section of the spillway was lowered 2.7 feet to prevent overtopping during a "rare" storm.

e. Seismic Stability

This dam is in Seismic Zone 2 and therefore need not be analyzed for seismic forces, according to the guidelines for Phase I inspection.

SECTION 7: ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Based on the records and visual observations, there are no significant concerns about the structural stability of this dam. The wave cut riprap and the large trees on the embankment could ultimately lead to difficulties if not repaired.

The West Dike has such a narrow crest and steep slopes that it would be subject to washout if the freeboard were ever reduced from its present value of 6 feet to only 2 feet, which would occur during a "rare" flood (equivalent to 11% of the PMF).

The concrete cap on a portion of the control section is in fair condition. It contains large cracks and may be settling.

b. Adequacy of Information

The assessment of the condition of the dam was based primarily on the visual inspection.

c. Urgency

The recommendations given in Sections 7.2 and 7.3 should be carried out within 12 months in the control section and within two to four years for the balance of the work.

d. Necessity for Additional Information

Additional information needed to carry out the recommendations in Sections 7.2 and 7.3 should be obtained.

7.2 Recommendations

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

1. Redesign and rebuild the West Dike to make it equivalent to the dam.

2. Monitor settlement of the cracked portion of the control section and redesign this structure as necessary.

3. Investigate the condition of the penstock that penetrates the control section and make any necessary recommendations.

4. Develop a procedure for removing roots of large deciduous trees in the dam without endangering the dam.

7.3 Remedial Measures

a. Alternatives

Not applicable.

b. Operating and Maintenance Procedures

1. Make an annual maintenance inspection of the dam.

2. Make a bi-annual technical inspection of the dam.

3. Repair the riprap that has been wave cut.

4. Repair eroded spots in embankment.

5. Cut all vegetation and maintain it cut, for both the main dam and the West Dike.

6. Repair spalled and cracked concrete.

7. Develop and test regularly a flood warning system for the downstream residents.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT SADAWGA DAM

DATE June 16, 1978

TIME 1410

WEATHER Clear, sunny

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

PARTY:

1. Walter A. Henry	D-H	6.	
2. John R. Spencer	D-H	7.	
3. Morris J. Root	D-H	8.	
4. Steve Poulos	GEI	9.	
5.		10.	

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

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME

DISCIPLINE Geotechnical NAME S. J. Poulos

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	Grassed to right of spillway, choke-cherries and rose shrubs to 15 feet and grass to left of spillway.
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	Condition of abutments is good. Seepage exits from spillway structure along entire downstream face from about 3 feet above invert of outlet conduit. One seep 2 feet below spillway.
Indications of Movement of Structural Items on Slopes	None observed.
Trespassing on Slopes	Free access. Only one path exists at right of spillway structure.
Sloughing or Erosion of Slopes or Abutments	One slough or erosion patch 56 feet to right of structure.
Rock Slope Protection - Riprap Failures	Wave cut at water level. No filter observed. 100-300 lb. stone.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Seepage at toeline of entire embankment to right of spillway. Not unusual.
Piping or Boils	None observed.
Foundation Drainage Features	None apparent.
Toe Drains	None apparent.
Instrumentation System	None apparent
Vegetation	Right abutment: Trees to 10 in. Shrubs to 5 ft. on remainder of embankment upstream only. Downstream grass. Left abutment overgrown. Not mowed.

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME

DISCIPLINE Geotechnical NAME S. J. Poulos

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None observed.
Pavement Condition	None. Grass.
Movement or Settlement of Crest	Half-foot deep dip in middle 50 ft. of dike.
Lateral Movement	None observed.
Vertical Alignment Horizontal Alignment)	Fairly straight or curved very slightly upstream.
Condition at Abutment and at Concrete Structures	No structures. No seepage or other deleterious features observed at abutments.
Indications of Movement of Structural Items on Slopes	No structures.
Trespassing on Slopes	Free access. No paths eroded.
Sloughing or Erosion of Slopes or Abutments	None observed.
Rock Slope Protection - Riprap Failures	None present.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Swampy downstream in saddle area to at least 100 feet downstream.
Piping or Boils	None observed.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.
Vegetation	Trees and shrubs on downstream; shrubs on upstream side.

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME

DISCIPLINE Geotechnical NAME S. J. Poulos

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions Bottom Conditions)	Can see 3-4 feet deep. Sandy, gravelly silt on bottom.
Rock Slides or Falls	None.
Log Boom	None.
Debris	Not observable.
Condition of Concrete Lining	
Drains or Weep Holes	None.
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	At least 4 stop planks, 8" x 4", 2-slot guides; no planks in second slot.

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE Outlet Structures NAME Steve Poulos

DISCIPLINE NAME John Spencer

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Mill Outlet
a. Concrete and Structural	N/A
General Condition	Good (see notes).
Condition of Joints	None.
Spalling	No significant.
Visible Reinforcing	None (bent anchor bars).
Rusting or Staining of Concrete	None.
Any Seepage or Efflorescence	None.
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate Chamber	No gate. None
Cracks	See notes.
Rusting or Corrosion of Steel	None.
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates (Stop planks maybe)	Hand wheel operated 28" diameter sluice gate
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME J. R. Spencer

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Conduit 4' pipe with 3' diameter opening. Other 10" pipe, grouted in 2'-6" opening (concrete)
Rust or Staining on Concrete	
Spalling	N/A
Erosion or Cavitation	N/A
Cracking	N/A
Alignment of Monoliths	N/A
Alignment of Joints	N/A
Numbering of Monoliths	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME J. R. Spencer

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	(See notes) OK.
Rust or Staining	None.
Spalling	Minor surface spalling on west spillway section.
Erosion or Cavitation	No.
Visible Reinforcing	No. Some exposed bars.
Any Seepage or Efflorescence	No.
Condition at Joints	No joints.
Drain Holes	No.
Channel	See weir discharge channel.
Loose Rock or Trees Overhanging Channel	See weir discharge channel.
Condition of Discharge Channel	See weir discharge channel.

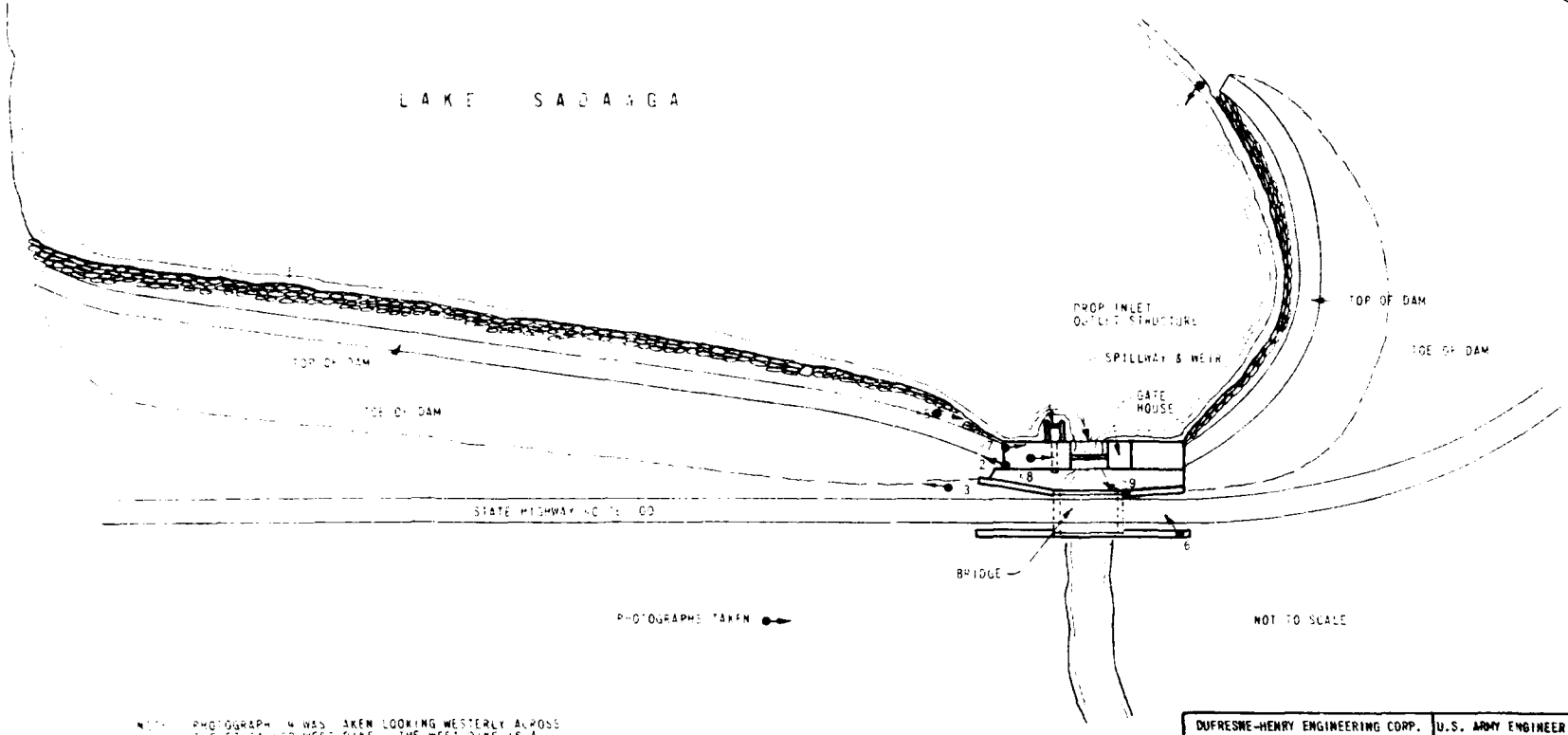
PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME J. R. Spencer

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanging Channel	No.
Trees Overhanging Channel	No.
Floor of Approach Channel	Concrete.
b. Weir and Training Walls	
General Condition of Concrete	Good.
Rust or Staining	No.
Spalling	No.
Any Visible Reinforcing	No. (4" x 6" channels for stop planks)
Any Seepage or Efflorescence	No.
Drain Holes	No.
c. Discharge Channel	
General Condition	Good.
Loose Rock Overhanging Channel	No.
Trees Overhanging Channel	No.
Floor of Channel	Concrete.
Other Obstructions	None.



NOTE: PHOTOGRAPH 4 WAS TAKEN LOOKING WESTERLY ACROSS THE SO-CALLED WEST DIKE. THE WEST DIKE IS A SMALL DAM LOCATED AT THE END OF A BAY ON THE WESTERLY SIDE OF THE LAKE APPROXIMATELY 2,400 FEET SOUTHERLY FROM THE MAIN DAM

DUFRESNE-HENRY ENGINEERING CORP. ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SADAWGA DAM

LOCATIONS OF PHOTOGRAPHS

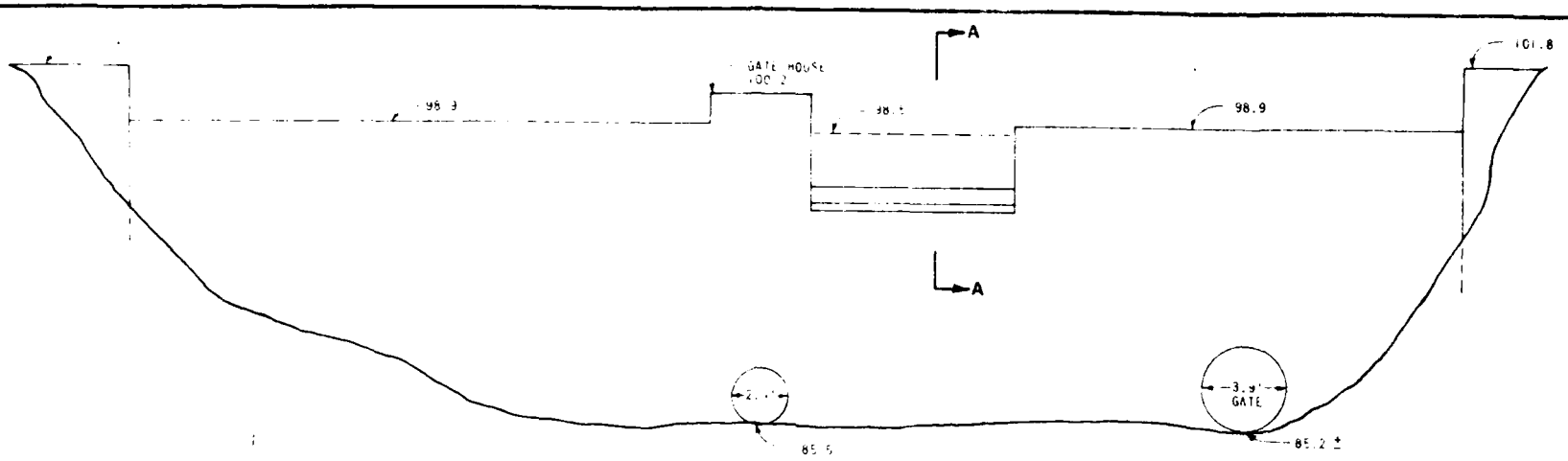
TAKEN 6 16 1978

WHITINGHAM VERMONT

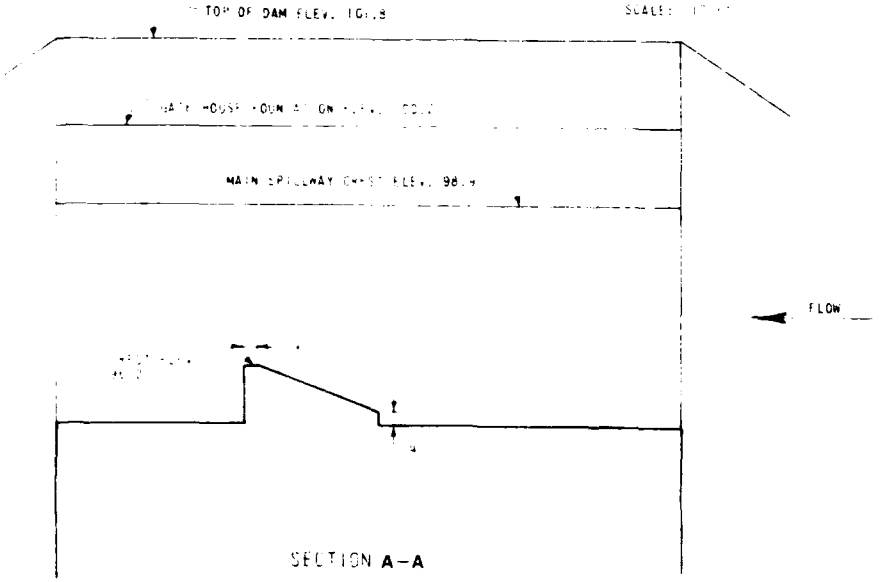
APPENDIX C

PHOTOGRAPHS

1. Upstream of Lake Sadawga Dam, Looking at Spillway Section.
2. Right Embankment, From Spillway Looking East.
3. Toe of Right Embankment.
4. West Dike.
5. Spillway, Drop-Inlet and Gatehouse.
6. Spillway, Gatehouse from Downstream.
7. Drop Inlet, Also Note Cracked Concrete.
8. View of Cracked Concrete on Spillway.
9. Outlet From Drop-Inlet, and View of Masonry Wall.



UPSTREAM ELEVATION



SECTION A–A

NOTE: THIS SECTION TRACED FROM DRAWING BY HOWARD M. TURNER, CONSULTING ENGINEER, ENTITLED "PROPOSED SPILLWAY SADAWGA POND" DATED JUNE 1967.

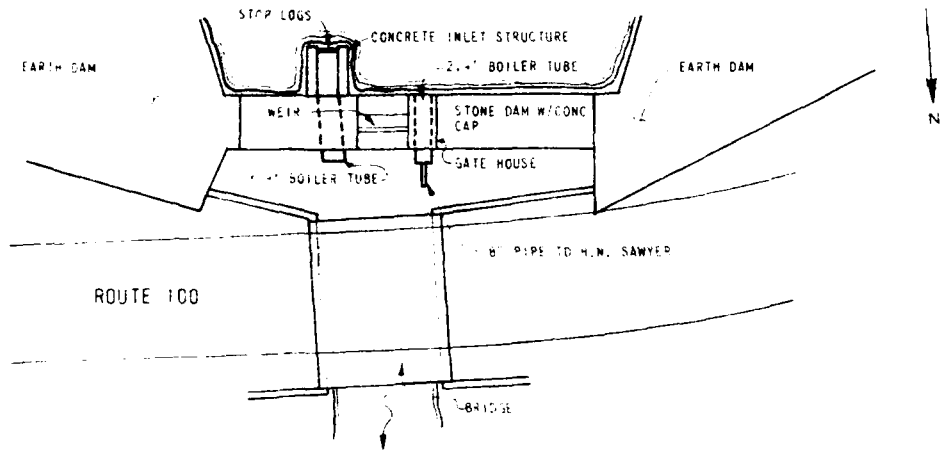
FIGURE 2

DUFRESNE-HENRY ENGINEERING CORP.	U.S. ARMY ENGINEER DIV. NEW ENGLAND

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SADAWGA DAM

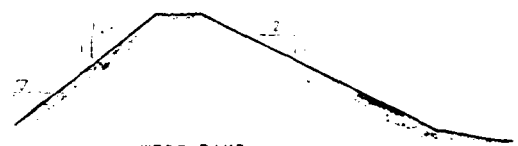
WHITTINGHAM VERMONT



PLAN VIEW

SCALE: 1" = 10'

SADAWGA DAM



WEST DIKE
TYPICAL SECTION

SCALE: 1" = 10'

FIGURE 1

DUFRESNE-HENRY ENGINEERING CORP. ARCH. TECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SADAWGA DAM

WHITINGHAM VERMONT

FILE COPY

State of Vermont

t of Fish and Game
t of Forests and Parks
t of Water Resources
ıtal Board
Environmental Protection
Recreation
Planning
sources Conservation Council

ROUTING		
GENERAL		
TO	NOTED	DATE
DHS	DHS	9-30-75
DJM	JJM	9/30/75
ASR	ASR	9/30
SUSPEND TO		
FILE		

AGENCY OF ENVIRONMENTAL CONSERVATION

MARTIN L. JOHNSON, Secretary

Montpelier, Vermont 05602

DEPARTMENT OF WATER RESOURCES

MANAGEMENT & ENGINEERING DIVISION

September 30, 1975

M E M O R A N D U M

To: File

From: Donald H. Spies

Subject: Lake Sadawga Dam - Whitingham

On August 25, 1975, the writer made an inspection of the subject structure. The right embankment appears to be in good condition. Some water was noted along the toe, but it was not determined whether the water was from seepage or local drainage. It was also noted the upstream face is heavily overgrown with brush which should be brought under control.

The spillway section also seemed to be in good condition. Some small trees are growing on the downstream face and should be removed before the root systems damage the stone work. There is some leakage through the stones, but doesn't appear to be a problem at the present. This condition should be observed periodically to detect changes.

The left embankment is quite overgrown with brush which should be cut and removed.

The dike on the northwest bay seems to be stable. Some of the brush and trees are starting to grow and should be cut back. Water was noted at the toe but appears to be an accumulation from local drainage and not seepage.

DHS/vdl

Edward F. Kehoe, Commissioner, Fish & Game

Donald H. Spies

Lake Sadawga Dams - Whitingham

October 28, 1971

Main Dam

On October 4, 1971, the writer inspected the subject structure. The dam is essentially a concrete and masonry structure with an earth fill wing wall on each end. Overall, the dam was in fairly good shape. However, the masonry is leaking in quite a few places. The west wing wall is heavily overgrown with brush and small trees. There is some growth on the east embankment and a little in the masonry portion.

The door to the gatehouse has been removed and it was noted that there was no lock on the gate wheel. Also, the penstock leaks quite badly.

West Dam

The subject dam was inspected by the writer on October 4, 1971. It is an earth fill dam with no spillway. The purpose of this structure apparently is to prevent the lake waters from flowing out a low area. The width of the dam is quite narrow (about 3' at the top) and the slopes are quite steep (almost 1 on 1). However, the dam appears to be holding up quite well and there was no noticeable leakage. It was noted that the brush had been cut down some time ago, but it is starting to come back. Possibly, something could be sprayed on the brush to retard its growth.

cc: Robert Collins, Maintenance Supervisor
Richard Sears, Land Negotiator

ROUTING

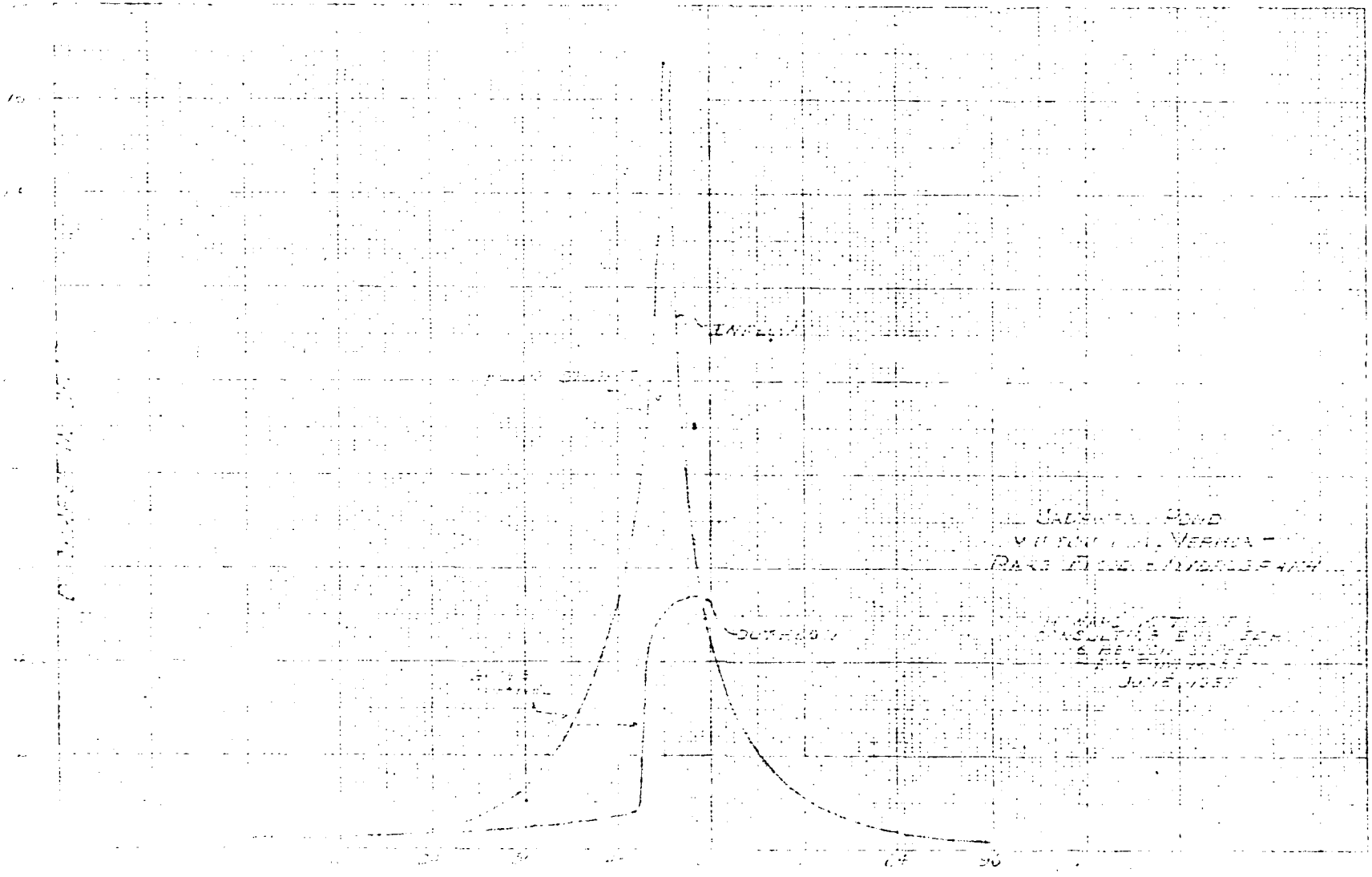
GENERAL

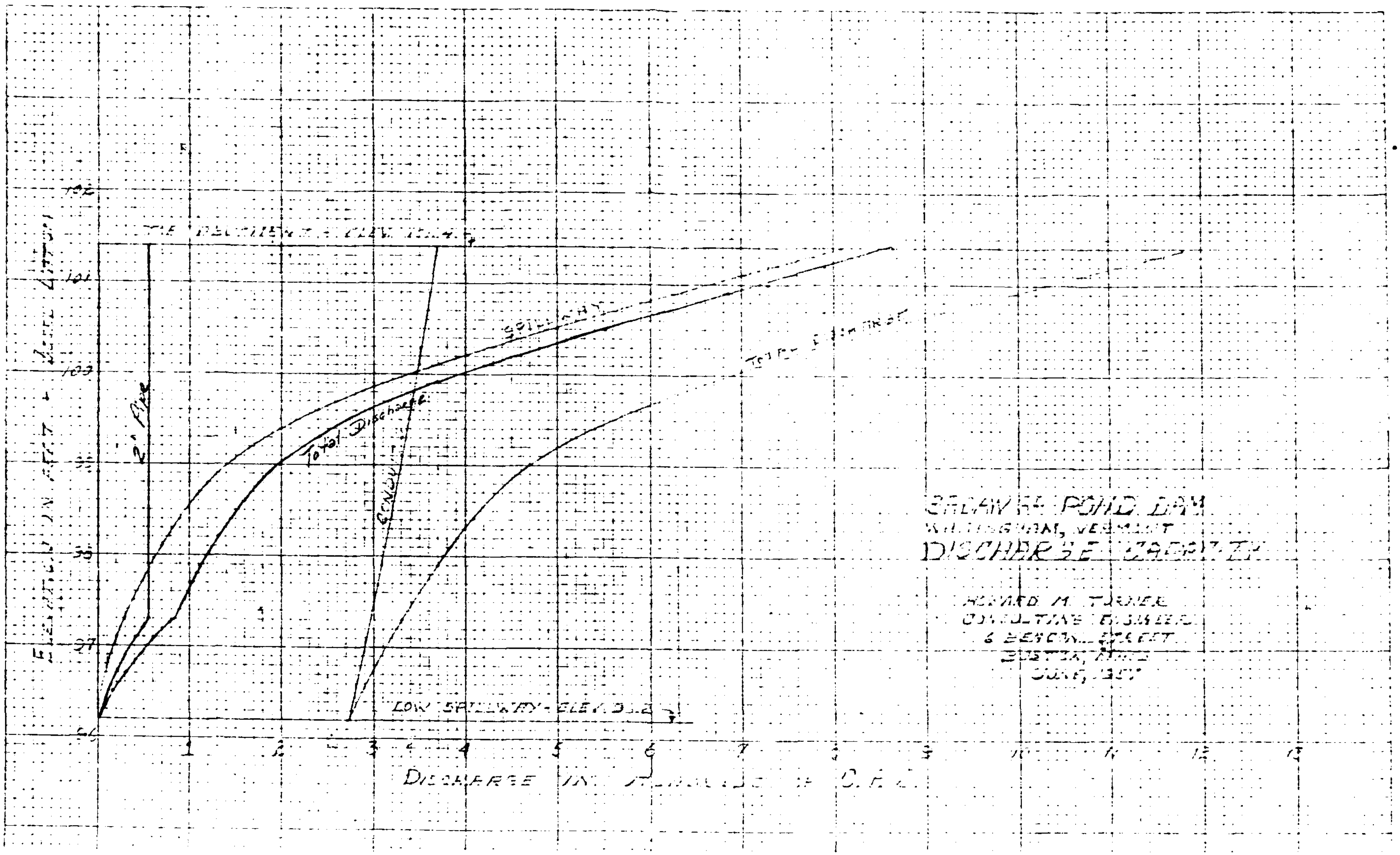
TO	NOTED	DATE
JFC		
Dits	Ehls	10-28-71

STOPPED TO

FILE

Dam





BELLAW POND DAM
DISCHARGE CAPACITY
HOWARD M. TURNER
CONSULTING ENGINEER
6 BEACON STREET
BOSTON, MASS
Total Discharge
Spillway
2" Pipe
LOW SPILLWAY - ELEV.
DISCHARGE IN

with the level 1.2 ft. below the top of the abutments. This is too low for safety when wave action is considered, but the fact may be of interest.

I recommend the following:

(1) That the present 4 ft. penstock opening below the dam be put in shape with an adequate flood gate at its entrance so that this can be used during times of high flood to reduce the height of the water over the dam, and that the gate to the small pipe be put in suitable operating condition.

(2) That the low spillway be reduced 2.3' in height with the remaining 1' of this wall shaped as shown.

Yours very truly,

Howard M. Turner

HMT/sb

HOWARD M. TURNER
CONSULTING ENGINEER
6 BEACON STREET
BOSTON 8, MASS.

June 20, 1957

Mr. Reinhold W. Thieme, Commissioner
Water Conservation Board
Montpelier, Vermont

Dear Sir:

Last December, I made a study of the flood conditions of Sadawga Pond. This was figured on a drainage area, taken from the maps then existing, of 5.2 sq. miles and a pond area of 179 acres. You have given me new figures on these, from maps as yet unpublished from the United States Geological Survey which show that the drainage area of Sadawga Pond including Lake Clara is 4.33 sq. miles and the area of the pond is 202 acres. This, of course, materially changes the basis of flood discharge. This report is written using these revised figures.

At the recent hearing, it was suggested that if the old spillway area 9' wide by 3.3' high be opened again, it would be safe for flood purposes. I have been through this and have estimated the "rare" flood with the revised drainage areas, to be 1680 c.f.s. (cubic feet per second).

I have found that sufficient flood capacity can be obtained with the gates and the spillway lowered 2.3 ft. The low wall 1' high across this 9' spillway should be shaped as shown to give a good discharge coefficient.

With this spillway, assuming that the pond is full to the new crest of the spillway when the flood starts and that the gates are opened when the water is about two feet over the spillway, the storage of the pond above the dam , 28,200,000 cu. ft., will reduce the flood to an outflow of 540 c.f.s. with the water level 3.2' over the new low crest of the spillway and 0.5' over the long, main crest. This maximum water level will be two feet from the top of the abutment and embankment on both sides of the dam which is a satisfactory margin. I enclose a hydrograph of this flood showing the outflow over the spillway.

It may be of interest to know that if for any reason, the gates fail to be opened, the spillway proposed will handle the flow of a rare flood

APPENDIX B

A. Listing of Design and Construction Records

None

B. Copies of Past Inspection Reports

1. "Sadawga Dam, Whitingham, Vt.," Howard M. Turner, Consulting Engineer. Boston, Mass. June 20, 1957.

2. Inspection Memorandum, Donald H. Spies, Oct. 28, 1971.

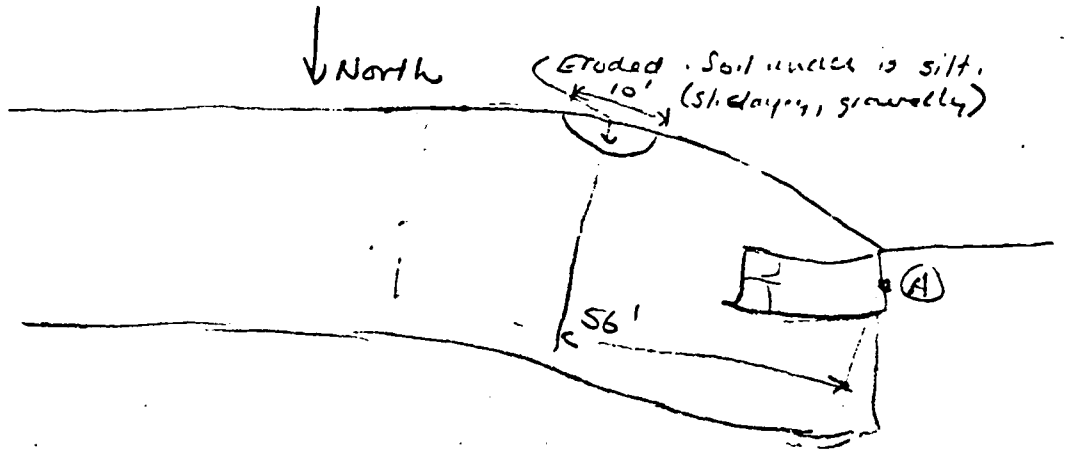
3. Inspection Memorandum, Donald H. Spies, September 30, 1975.

C. Listing of Plans

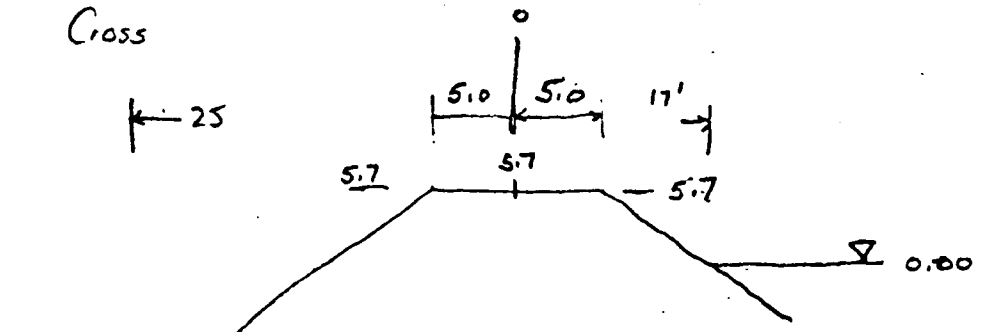
Fig. 1 - Plan and Section Views of Dam

Fig. 2 - Sections of Spillway

Erosion upstream to right of structure as shown.



Cross



11.1 Water
5.4 HI
Water level is at crest of spillway weier

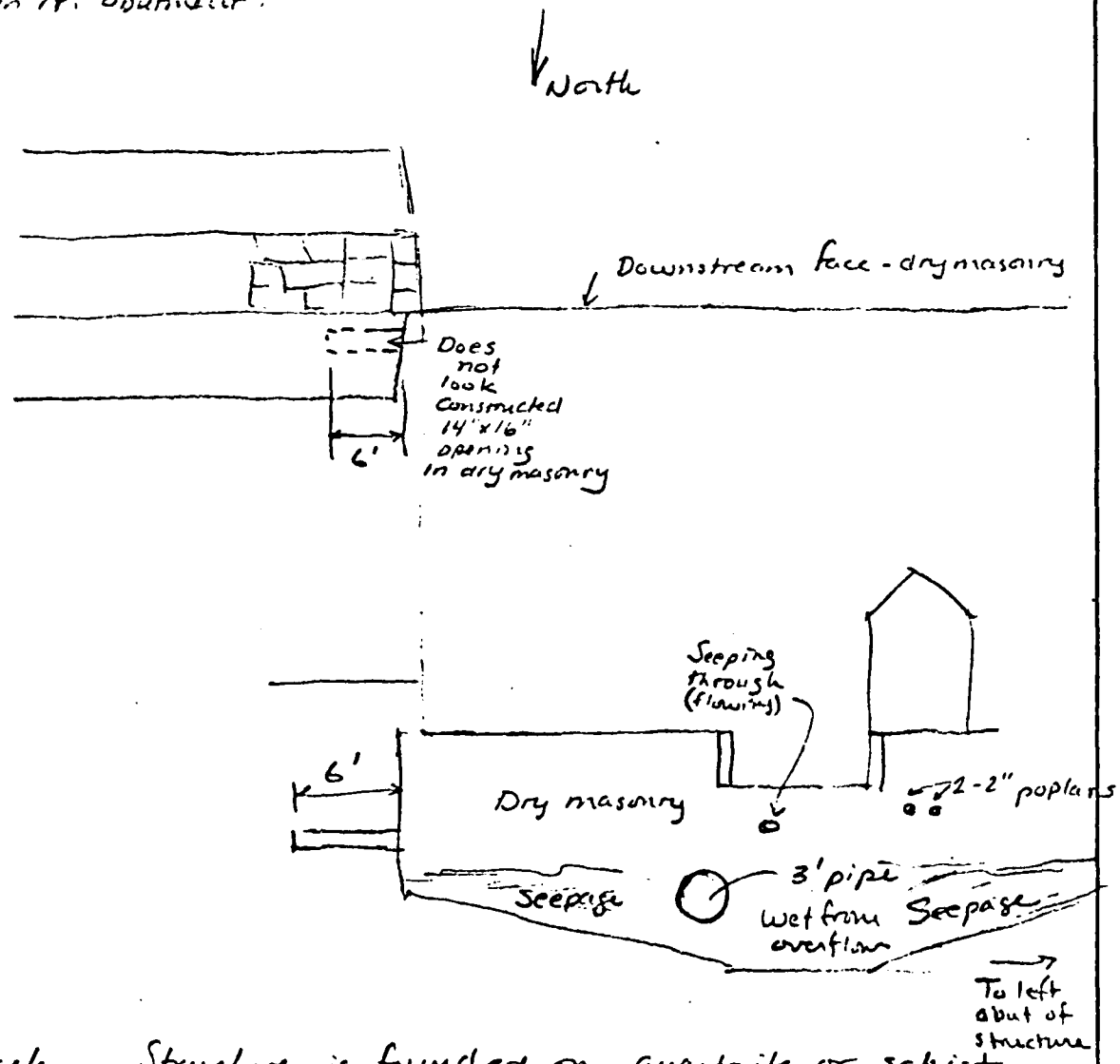
13.7
5.4
8.3

Sta alongstraight line 73 ft to right of right side of structure wall (pt A)

GEOTECHNICAL ENGINEERS INC.

	Project	Page	1
Client Dufresne & Henry	Date June 11, 73	By	LSH
Subject Saratoga Dam	Checked	By	
	Approved	By	

Hole in rt. abutment.



Bedrock. Structure is founded on quartzite or schist bedrock dipping 14° N Striking N75E

PERIODIC INSPECTION CHECK LIST

PROJECT SADAWGA DAM DATE June 16, 1978

PROJECT FEATURE NAME J. R. Spencer

DISCIPLINE NAME

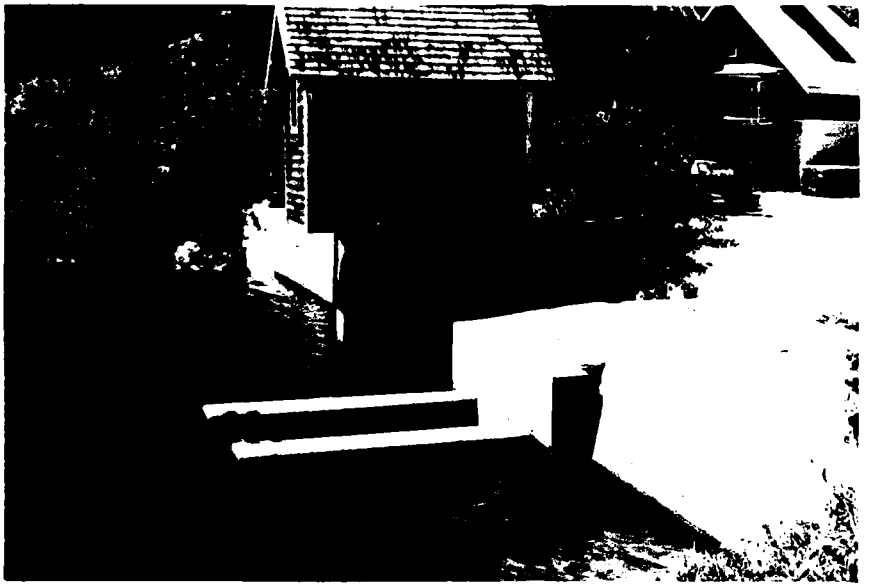
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure Bearings Anchor Bolts Bridge Seat Longitudinal Members Under Side of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint	Not applicable.
b. Abutment & Piers General Condition of Concrete Alignment of Abutment Approach to Bridge Condition of Seat & Backwall	

#1 UPSTREAM OF LAKE SADAWGA DAM, LOOKING AT SPILLWAY SECTION

#2 RIGHT EMBANKMENT, FROM SPILLWAY LOOKING EAST

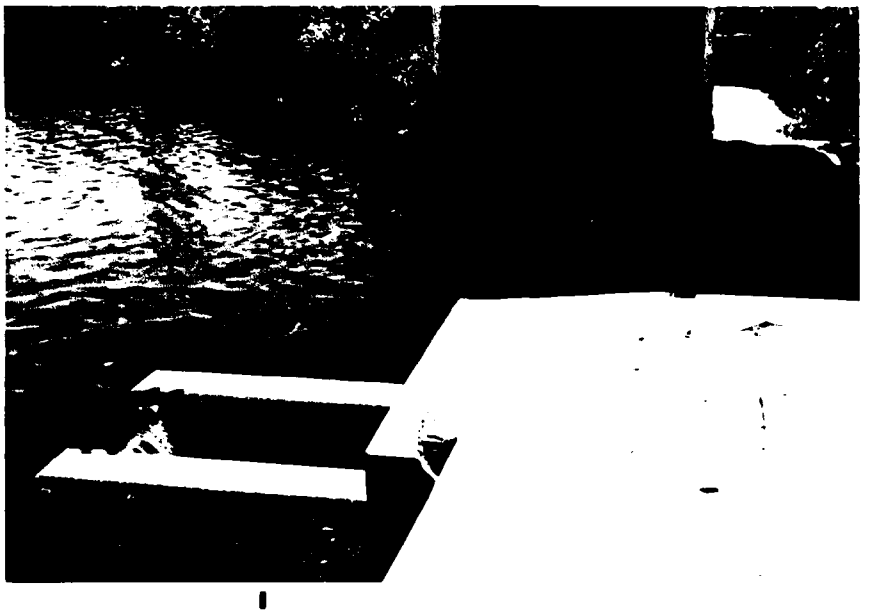
#3 TOE OF RIGHT EMBANKMENT

#4 WEST DIKE

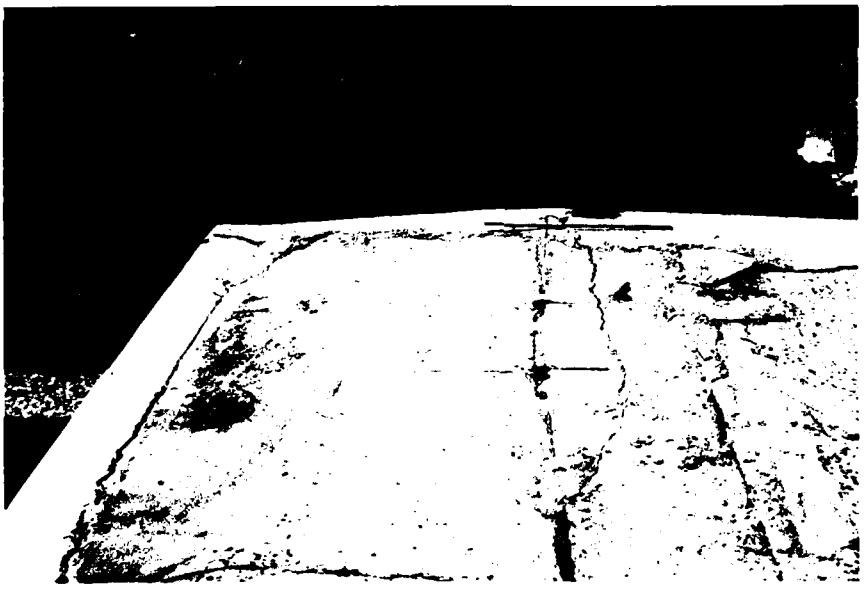


#5 SPILLWAY, DROP-INLET AND GATEHOUSE

#6 SPILLWAY, GATEHOUSE FROM DOWNSTREAM



#7 DROP INLET, ALSO NOTE CRACKED CONCRETE



#8 VIEW OF CRACKED CONCRETE ON SPILLWAY

#9 OUTLET FROM DROP-INLET, AND VIEW OF MASONRY WALL

APPENDIX D

HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

DATE _____ SUBJECT Lake Sadawga Hydrology and Hydraulics SHEET NO. ____ OF ____ JOB NO. _____

Index to computations

Lake Sadawga Dam

Drainage Area

4.31 square miles → 4.33 sq. mi. = state of Vt.

8.81
13.24 4.43
17.67 4.43

Break $Y_w = \frac{2}{3} Y_o = \frac{2}{3}(17\pm) = 11'\pm$ / channel is 10'± deep !

Channel Capacity Route 100 Bridge - 19' wide x 9.5' deep + 1.5' top of road
$S = (984.6 - 981)/100 \doteq 3.6\%$ ∴ Use inlet control as first approximation
∴ VHD Assumed datum 500 = 98.9 H. M. Turner Report
(-401.1)

Size Classification :

By Storage (gives larger size category)

Max. Ac-ft by Vt. DWR 1820 Ac-ft. > 1000 Ac-ft
Normal Ac-ft 808 Ac-ft

∴ SIZE ≡ Intermediate

Hazard Classification :

Few, if any homes
Possible, but not likely, road damage

∴ HAZARD ≡ Significant

Significant Intermediate Dam — use 1/2 PMF as SDF

it watershed :

Tribs from Lake Clara 0.7+ sq. mi
complete W.S. N. of Route 100 ≈ 2.6 sq. mi.
E, TH S of Route 100

1.7 sq. mi hillsides around pond to South

) $(2100 - 1670^{\pm}) = 430'$ rise

ks L = 2.3 miles - N $\hat{L}_c = .6L = 1.38$ $T_p = 2.2\left(\frac{L L_c}{\sqrt{S}}\right)^{.37} = 1.4$ hr

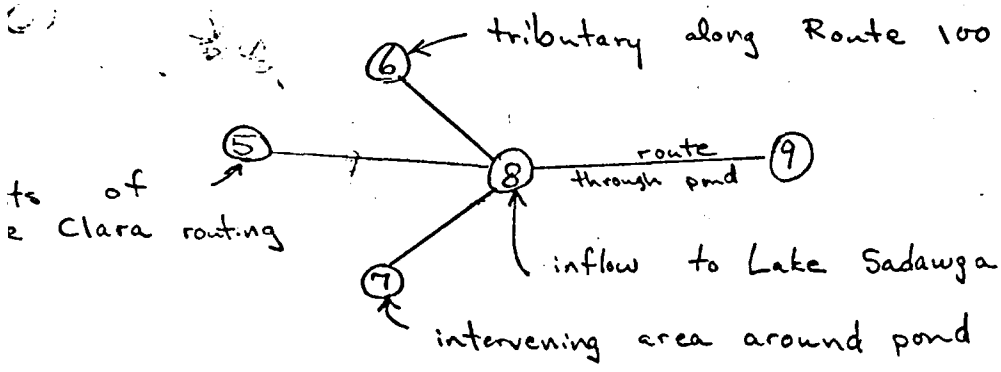
$S = \frac{(99\% \ 1690)}{1.73} = 127'/\text{mile}$ $C_p = .75$; ie. $640 C_p = 480$

ide
ical L = .8 mile $\hat{L}_c = .6L = .48$ mile $T_p = .5$ hr

$\frac{(1940 - 1675)}{.6} = 441'/\text{mile}$ $C_p = .75$

d area = 202 Acres normal water level - DWR/NERBC

ting Diagram for HEC-1



ts of
e Clara routing

CHANGE NO. 01

Lake Sadanga

FLOOD ROUTING THROUGH LAKE SADAWGA , WHITINGHAM , VERMONT

PREPARED FOR USE IN DAM SAFETY EVALUATION PHASE I

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
144	0	10	1	0	0	0	2	0	0

JOPER 3 NWT 0

SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH FOR TRIBUTARY NUMBER 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.20	0.0	0.0	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	RT2	R96
0.0	18.00	110.00	122.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.33	0.07	0.0	0.0

UNIT HYDROGRAPH DATA

TP# 0.50 CP#0.75 NTA# 0

RECESSION DATA

STRTQ# 2.00 QRCSN# -0.10 RTIOR# 1.50

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 4.08 AND R# 1.53 INTERVALS

UNIT HYDROGRAPH 11 END-OF-PERIOD ORDINATES, LAG# 0.50 HOURS, CP# 0.75 VOL# 1.00

33. 109. 176. 187. 132. 68. 34. 18. 9. 5.
2.

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	2.
1	0 20	0.02	0.00	2.
1	0 30	0.02	0.00	2.
1	0 40	0.02	0.00	2.
1	0 50	0.02	0.00	2.
1	0 60	0.02	0.00	2.
1	1 10	0.02	0.00	2.
1	1 20	0.02	0.00	1.
1	1 30	0.02	0.00	1.
1	1 40	0.02	0.00	1.
1	1 50	0.02	0.00	1.
1	1 60	0.02	0.00	1.
1	2 10	0.02	0.00	1.

MOORE BUSINESS FORMS, INC. NO. PRINTED IN U.S.A.

1	2	20	0.02	0.00	1.
1	2	30	0.02	0.00	1.
1	2	40	0.02	0.00	1.
1	2	50	0.02	0.00	1.
1	2	60	0.02	0.01	2.
1	3	10	0.02	0.01	3.
1	3	20	0.02	0.01	4.
1	3	30	0.02	0.01	6.
1	3	40	0.02	0.01	6.
1	3	50	0.02	0.01	7.
1	3	60	0.02	0.01	7.
1	4	10	0.02	0.01	7.
1	4	20	0.02	0.01	7.
1	4	30	0.02	0.01	7.
1	4	40	0.02	0.01	7.
1	4	50	0.02	0.01	7.
1	4	60	0.02	0.01	7.
1	5	10	0.02	0.01	7.
1	5	20	0.02	0.01	7.
1	5	30	0.02	0.01	7.
1	5	40	0.02	0.01	7.
1	5	50	0.02	0.01	7.
1	5	60	0.02	0.01	7.
1	6	10	0.06	0.05	8.
1	6	20	0.06	0.05	13.
1	6	30	0.06	0.05	20.
1	6	40	0.06	0.05	27.
1	6	50	0.06	0.05	32.
1	6	60	0.06	0.05	35.
1	7	10	0.06	0.05	36.
1	7	20	0.06	0.05	37.
1	7	30	0.06	0.05	37.
1	7	40	0.06	0.05	38.
1	7	50	0.06	0.05	38.
1	7	60	0.06	0.05	38.
1	8	10	0.06	0.05	38.
1	8	20	0.06	0.05	38.
1	8	30	0.06	0.05	38.
1	8	40	0.06	0.05	38.
1	8	50	0.06	0.05	38.
1	8	60	0.06	0.05	38.
1	9	10	0.06	0.05	38.
1	9	20	0.06	0.05	38.
1	9	30	0.06	0.05	37.
1	9	40	0.06	0.05	37.
1	9	50	0.06	0.05	37.
1	9	60	0.06	0.05	37.
1	10	10	0.06	0.05	37.
1	10	20	0.06	0.05	37.
1	10	30	0.06	0.05	37.
1	10	40	0.06	0.05	37.
1	10	50	0.06	0.05	37.
1	10	60	0.06	0.05	37.
1	11	10	0.06	0.05	37.
1	11	20	0.06	0.05	37.
1	11	30	0.06	0.05	37.
1	11	40	0.06	0.05	37.
1	11	50	0.06	0.05	37.
1	11	60	0.06	0.05	37.
1	12	10	0.33	0.32	46.
1	12	20	0.33	0.32	76.
1	12	30	0.33	0.32	123.
1	12	40	0.33	0.32	174.
1	12	50	0.33	0.32	209.
1	12	60	0.33	0.32	227.
1	13	10	0.40	0.39	239.

MOORE BUSINESS FORMS INC HQ PRINTED IN USA

1	13	20	0.40	0.38	251.
1	13	30	0.40	0.38	265.
1	13	40	0.40	0.38	278.
1	13	50	0.40	0.38	288.
1	13	60	0.40	0.38	292.
1	14	10	0.49	0.48	298.
1	14	20	0.49	0.48	310.
1	14	30	0.49	0.48	329.
1	14	40	0.49	0.48	346.
1	14	50	0.49	0.48	360.
1	14	60	0.49	0.48	366.
1	15	10	1.25	1.24	394.
1	15	20	1.25	1.24	479.
1	15	30	1.25	1.24	613.
1	15	40	1.25	1.24	756.
1	15	50	1.25	1.24	856.
1	15	60	1.25	1.24	907.
1	16	10	0.46	0.45	908.
1	16	20	0.46	0.45	835.
1	16	30	0.46	0.45	702.
1	16	40	0.46	0.45	557.
1	16	50	0.46	0.45	455.
1	16	60	0.46	0.45	401.
1	17	10	0.36	0.35	371.
1	17	20	0.36	0.35	346.
1	17	30	0.36	0.35	321.
1	17	40	0.36	0.35	299.
1	17	50	0.36	0.35	285.
1	17	60	0.36	0.35	278.
1	18	10	0.03	0.02	264.
1	18	20	0.03	0.02	226.
1	18	30	0.03	0.02	166.
1	18	40	0.03	0.02	103.
1	18	50	0.03	0.02	88.
1	18	60	0.03	0.02	85.
1	19	10	0.03	0.02	81.
1	19	20	0.03	0.02	78.
1	19	30	0.03	0.02	75.
1	19	40	0.03	0.02	72.
1	19	50	0.03	0.02	69.
1	19	60	0.03	0.02	66.
1	20	10	0.03	0.02	64.
1	20	20	0.03	0.02	61.
1	20	30	0.03	0.02	59.
1	20	40	0.03	0.02	56.
1	20	50	0.03	0.02	54.
1	20	60	0.03	0.02	52.
1	21	10	0.03	0.02	50.
1	21	20	0.03	0.02	48.
1	21	30	0.03	0.02	46.
1	21	40	0.03	0.02	44.
1	21	50	0.03	0.02	43.
1	21	60	0.03	0.02	41.
1	22	10	0.03	0.02	39.
1	22	20	0.03	0.02	38.
1	22	30	0.03	0.02	36.
1	22	40	0.03	0.02	35.
1	22	50	0.03	0.02	33.
1	22	60	0.03	0.02	32.
1	23	10	0.03	0.02	31.
1	23	20	0.03	0.02	30.
1	23	30	0.03	0.02	28.
1	23	40	0.03	0.02	27.
1	23	50	0.03	0.02	26.
1	23	60	0.03	0.02	25.

MOORE BUSINESS FORMS INC. (NO) PRINTED IN USA

SUM 23.70 22.03 18008.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	908.	407.	125.	125.	13009.
INCHES		18.92	23.27	23.27	23.27
AC-FT		202.	248.	248.	248.

OVN

RUNOFF MULTIPLIED BY 0.50

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
3.	3.	3.	3.	4.	4.	4.	4.	4.	4.
3.	3.	3.	3.	3.	3.	4.	6.	10.	14.
16.	17.	18.	19.	19.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	19.	19.	19.	19.
19.	19.	23.	38.	62.	87.	105.	114.	119.	125.
132.	139.	144.	146.	149.	155.	164.	173.	180.	183.
197.	239.	307.	378.	428.	454.	454.	417.	351.	279.
227.	201.	185.	173.	161.	150.	142.	139.	132.	113.
83.	52.	44.	42.	41.	39.	37.	36.	35.	33.
32.	31.	29.	28.	27.	26.	25.	24.	23.	22.
21.	20.	20.	19.	18.	17.	17.	16.	15.	15.
14.	14.	13.	13.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	454.	203.	63.	63.	9035.
INCHES		9.46	11.63	11.63	11.63
AC-FT		101.	124.	124.	124.

MOORE BUSINESS FORMS, INC. NO. 22

1	15	20	1.25	1.24	2998.	
1	15	30	1.25	1.24	3256.	
1	15	40	1.25	1.24	3587.	
1	15	50	1.25	1.24	3990.	
1	15	60	1.25	1.24	4460.	
1	16	10	0.46	0.45	4955.	
1	16	20	0.46	0.45	5416.	
1	16	30	0.46	0.45	5798.	
1	16	40	0.46	0.45	6070.	
1	16	50	0.46	0.45	6195.	
1	16	60	0.46	0.45	6159.	
1	17	10	0.36	0.35	5986.	
1	17	20	0.36	0.35	5713.	
1	17	30	0.36	0.35	5375.	
1	17	40	0.36	0.35	5004.	
1	17	50	0.36	0.35	4646.	
1	17	60	0.36	0.35	4328.	
1	18	10	0.03	0.02	4042.	
1	18	20	0.03	0.02	3766.	
1	18	30	0.03	0.02	3488.	
1	18	40	0.03	0.02	3202.	
1	18	50	0.03	0.02	2908.	
1	18	60	0.03	0.02	2605.	
1	19	10	0.03	0.02	2299.	
1	19	20	0.03	0.02	1997.	
1	19	30	0.03	0.02	1706.	
1	19	40	0.03	0.02	1435.	
1	19	50	0.03	0.02	1198.	
1	19	60	0.03	0.02	1001.	
1	20	10	0.03	0.02	840.	
1	20	20	0.03	0.02	708.	
1	20	30	0.03	0.02	615.	
1	20	40	0.03	0.02	591.	
1	20	50	0.03	0.02	567.	
1	20	60	0.03	0.02	545.	
1	21	10	0.03	0.02	523.	
1	21	20	0.03	0.02	502.	
1	21	30	0.03	0.02	482.	
1	21	40	0.03	0.02	463.	
1	21	50	0.03	0.02	445.	
1	21	60	0.03	0.02	427.	
1	22	10	0.03	0.02	410.	
1	22	20	0.03	0.02	394.	
1	22	30	0.03	0.02	378.	
1	22	40	0.03	0.02	363.	
1	22	50	0.03	0.02	349.	
1	22	60	0.03	0.02	335.	
1	23	10	0.03	0.02	322.	
1	23	20	0.03	0.02	309.	
1	23	30	0.03	0.02	297.	
1	23	40	0.03	0.02	285.	
1	23	50	0.03	0.02	273.	
1	23	60	0.03	0.02	263.	
		SUM	23.70	22.03	163430.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6195.	3665.	1135.	1135.	163426.
INCHES		17.95	22.23	22.23	22.23
AC-FT		1815.	2252.	2252.	2252.

MOORE BUSINESS FORMS INC. NO PRINTED IN USA '77

1	4	20	0.02	0.01	33.
1	4	30	0.02	0.01	38.
1	4	40	0.02	0.01	42.
1	4	50	0.02	0.01	46.
1	4	60	0.02	0.01	49.
1	5	10	0.02	0.01	51.
1	5	20	0.02	0.01	53.
1	5	30	0.02	0.01	55.
1	5	40	0.02	0.01	56.
1	5	50	0.02	0.01	57.
1	5	60	0.02	0.01	58.
1	6	10	0.06	0.05	60.
1	6	20	0.06	0.05	64.
1	6	30	0.06	0.05	73.
1	6	40	0.06	0.05	86.
1	6	50	0.06	0.05	103.
1	6	60	0.06	0.05	124.
1	7	10	0.06	0.05	149.
1	7	20	0.06	0.05	175.
1	7	30	0.06	0.05	202.
1	7	40	0.06	0.05	228.
1	7	50	0.06	0.05	251.
1	7	60	0.06	0.05	270.
1	8	10	0.06	0.05	286.
1	8	20	0.06	0.05	298.
1	8	30	0.06	0.05	309.
1	8	40	0.06	0.05	317.
1	8	50	0.06	0.05	324.
1	8	60	0.06	0.05	330.
1	9	10	0.06	0.05	335.
1	9	20	0.06	0.05	338.
1	9	30	0.06	0.05	341.
1	9	40	0.06	0.05	344.
1	9	50	0.06	0.05	346.
1	9	60	0.06	0.05	348.
1	10	10	0.06	0.05	349.
1	10	20	0.06	0.05	350.
1	10	30	0.06	0.05	351.
1	10	40	0.06	0.05	352.
1	10	50	0.06	0.05	353.
1	10	60	0.06	0.05	353.
1	11	10	0.06	0.05	353.
1	11	20	0.06	0.05	354.
1	11	30	0.06	0.05	354.
1	11	40	0.06	0.05	354.
1	11	50	0.06	0.05	354.
1	11	60	0.06	0.05	354.
1	12	10	0.33	0.32	362.
1	12	20	0.33	0.32	389.
1	12	30	0.33	0.32	444.
1	12	40	0.33	0.32	528.
1	12	50	0.33	0.32	642.
1	12	60	0.33	0.32	785.
1	13	10	0.40	0.38	951.
1	13	20	0.40	0.38	1135.
1	13	30	0.40	0.38	1328.
1	13	40	0.40	0.38	1522.
1	13	50	0.40	0.38	1705.
1	13	60	0.40	0.38	1869.
1	14	10	0.49	0.48	2017.
1	14	20	0.49	0.48	2156.
1	14	30	0.49	0.48	2290.
1	14	40	0.49	0.48	2421.
1	14	50	0.49	0.48	2548.
1	14	60	0.49	0.48	2669.

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SUB-AREA RUNOFF COMPUTATION

LARGE TRIBUTARY FROM NORTH SIDE OF ROUTE 100

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
6	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.90	0.0	0.0	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	18.00	110.00	122.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.33	0.07	0.0	0.0

UNIT HYDROGRAPH DATA

TP= 1.40 CP=0.75 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= -0.10 RTIOR= 1.50

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=10.43 AND R= 4.97 INTERVALS

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 1.40 HOURS, CP= 0.75 VOL= 1.00

28.	103.	202.	311.	423.	529.	609.	654.	666.	643.
574.	477.	390.	319.	260.	213.	174.	142.	116.	95.
78.	63.	52.	42.	35.	28.	23.	19.	15.	13.
10.	8.	7.							

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	2.
1	0 20	0.02	0.00	2.
1	0 30	0.02	0.00	2.
1	0 40	0.02	0.00	2.
1	0 50	0.02	0.00	2.
1	0 60	0.02	0.00	2.
1	1 10	0.02	0.00	2.
1	1 20	0.02	0.00	1.
1	1 30	0.02	0.00	1.
1	1 40	0.02	0.00	1.
1	1 50	0.02	0.00	1.
1	1 60	0.02	0.00	1.
1	2 10	0.02	0.00	1.
1	2 20	0.02	0.00	1.
1	2 30	0.02	0.00	1.
1	2 40	0.02	0.00	1.
1	2 50	0.02	0.00	1.
1	2 60	0.02	0.01	2.
1	3 10	0.02	0.01	3.
1	3 20	0.02	0.01	5.
1	3 30	0.02	0.01	8.
1	3 40	0.02	0.01	12.
1	3 50	0.02	0.01	17.
1	3 60	0.02	0.01	22.
1	4 10	0.02	0.01	27.

MOORE BUSINESS FORMS, INC. NO. PRINTED IN U.S.A. 22

1	18	10	47.	548.	598.
1	18	20	46.	510.	564.
1	18	30	45.	480.	525.
1	18	40	44.	394.	475.
1	18	50	42.	321.	416.
1	18	60	40.	253.	354.
1	19	10	38.	196.	295.
1	19	20	37.	162.	255.
1	19	30	36.	149.	223.
1	19	40	35.	142.	198.
1	19	50	34.	135.	179.
1	19	60	33.	129.	164.
1	20	10	33.	123.	152.
1	20	20	32.	118.	141.
1	20	30	32.	113.	133.
1	20	40	32.	108.	125.
1	20	50	32.	104.	119.
1	20	60	31.	101.	113.
1	21	10	31.	98.	109.
1	21	20	31.	95.	105.
1	21	30	31.	92.	101.
1	21	40	31.	89.	99.
1	21	50	31.	87.	98.
1	21	60	30.	84.	96.
1	22	10	30.	82.	94.
1	22	20	30.	79.	92.
1	22	30	30.	77.	91.
1	22	40	30.	74.	89.
1	22	50	29.	72.	87.
1	22	60	29.	70.	85.
1	23	10	29.	68.	83.
1	23	20	29.	66.	81.
1	23	30	28.	64.	79.
1	23	40	28.	62.	77.
1	23	50	28.	60.	75.
1	23	60	28.	58.	73.
		SUM			28149.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1347.	672.	195.	195.	28149.
INCHES		8.93	10.39	10.39	10.39
AC-FT		333.	388.	388.	388.

MOORE & BRUSS FORMS, INC. CHINO, CALIF. Printed in U.S.A.

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1	7	10	3.	36.	4.	
1	7	20	4.	41.	4.	
1	7	30	4.	44.	4.	
1	7	40	5.	46.	5.	
1	7	50	6.	47.	5.	
1	7	60	6.	48.	6.	
1	8	10	7.	49.	6.	
1	8	20	7.	50.	7.	
1	8	30	8.	51.	8.	
1	8	40	9.	51.	8.	
1	8	50	9.	51.	9.	
1	8	60	10.	52.	10.	
1	9	10	10.	52.	10.	
1	9	20	11.	53.	11.	
1	9	30	11.	53.	12.	
1	9	40	12.	53.	13.	
1	9	50	13.	54.	13.	
1	9	60	13.	54.	14.	
1	10	10	14.	54.	15.	
1	10	20	14.	54.	16.	
1	10	30	15.	55.	16.	
1	10	40	15.	55.	17.	
1	10	50	16.	55.	18.	
1	10	60	16.	55.	18.	
1	11	10	17.	56.	19.	
1	11	20	17.	56.	20.	
1	11	30	18.	56.	21.	
1	11	40	18.	56.	22.	
1	11	50	19.	57.	23.	
1	11	60	19.	57.	25.	
1	12	10	20.	59.	26.	
1	12	20	20.	68.	28.	
1	12	30	21.	88.	30.	
1	12	40	22.	119.	34.	
1	12	50	24.	159.	39.	
1	12	60	26.	201.	56.	
1	13	10	28.	239.	78.	
1	13	20	31.	271.	102.	
1	13	30	33.	298.	161.	
1	13	40	35.	323.	210.	
1	13	50	37.	355.	254.	
1	13	60	38.	397.	298.	
1	14	10	40.	436.	350.	
1	14	20	41.	469.	395.	
1	14	30	42.	499.	434.	
1	14	40	43.	528.	470.	
1	14	50	44.	556.	503.	
1	14	60	45.	582.	533.	
1	15	10	46.	610.	562.	
1	15	20	47.	657.	598.	
1	15	30	49.	743.	667.	
1	15	40	51.	877.	767.	
1	15	50	54.	1043.	899.	
1	15	60	57.	1211.	1047.	
1	16	10	60.	1345.	1190.	
1	16	20	63.	1416.	1297.	
1	16	30	64.	1402.	1347.	
1	16	40	63.	1316.	1332.	
1	16	50	62.	1183.	1261.	
1	16	60	59.	1037.	1154.	
1	17	10	57.	909.	1038.	
1	17	20	55.	812.	930.	
1	17	30	53.	739.	839.	
1	17	40	51.	678.	762.	

MOORE BUSINESS FORMS, INC. NO. PRINTED IN U.S.A. 27

HYDROGRAPH ROUTING

ROUTE THROUGH EAST POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
5	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE#	0.	6.	10.	18.	24.	29.	31.	39.	47.	56.
OUTFLOW#	2.	5.	10.	20.	40.	80.	100.	300.	600.	1000.

	TIME	EOP STOR	AVG IN	EOP OUT
1	0 10	0.	2.	2.
1	0 20	0.	2.	2.
1	0 30	0.	3.	2.
1	0 40	0.	3.	2.
1	0 50	0.	3.	2.
1	0 60	0.	3.	2.
1	1 10	0.	3.	2.
1	1 20	0.	3.	2.
1	1 30	0.	3.	2.
1	1 40	0.	3.	2.
1	1 50	0.	3.	2.
1	1 60	0.	2.	2.
1	2 10	0.	2.	2.
1	2 20	0.	2.	2.
1	2 30	0.	2.	2.
1	2 40	0.	2.	2.
1	2 50	0.	2.	2.
1	2 60	0.	2.	2.
1	3 10	0.	3.	2.
1	3 20	0.	4.	2.
1	3 30	0.	5.	2.
1	3 40	0.	6.	2.
1	3 50	0.	7.	2.
1	3 60	0.	8.	2.
1	4 10	0.	9.	2.
1	4 20	1.	9.	2.
1	4 30	1.	9.	2.
1	4 40	1.	10.	2.
1	4 50	1.	10.	2.
1	4 60	1.	10.	3.
1	5 10	1.	10.	3.
1	5 20	1.	10.	3.
1	5 30	1.	10.	3.
1	5 40	1.	10.	3.
1	5 50	1.	10.	3.
1	5 60	2.	10.	3.
1	6 10	2.	11.	3.
1	6 20	2.	12.	3.
1	6 30	2.	15.	3.
1	6 40	2.	19.	3.
1	6 50	3.	25.	3.
1	6 60	3.	31.	4.

MOORE BUSINESS FORMS INC MO PRINTED IN USA 22

•OVN•

•••••••••• •••••••••• •••••••••• •••••••••• ••••••••••

COMBINE HYDROGRAPHS

COMBINE INFLOW FROM WEST POND WITH TRIBUTARY NO. 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	0	0	1

SUM OF 2 HYDROGRAPHS AT 4

2.	3.	3.	3.	3.	3.	3.	3.	3.	3.
2.	2.	2.	2.	2.	2.	2.	3.	3.	4.
5.	6.	7.	8.	9.	9.	10.	10.	10.	10.
10.	10.	10.	10.	10.	10.	11.	13.	17.	22.
28.	34.	39.	42.	45.	47.	48.	49.	50.	50.
51.	51.	52.	52.	53.	53.	53.	53.	54.	54.
54.	55.	55.	55.	55.	56.	56.	56.	56.	56.
57.	57.	61.	75.	101.	138.	180.	222.	256.	285.
311.	335.	376.	418.	453.	484.	513.	542.	570.	594.
626.	688.	797.	956.	1131.	1290.	1401.	1430.	1374.	1257.
1109.	966.	853.	772.	706.	650.	602.	565.	531.	489.
430.	357.	285.	221.	171.	153.	145.	138.	132.	126.
120.	115.	110.	106.	102.	99.	96.	94.	91.	88.
85.	83.	80.	78.	75.	73.	71.	69.	67.	65.
63.	61.	59.	57.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1430.	684.	209.	209.	30158.
INCHES		9.09	11.13	11.13	11.13
AC-FT		339.	416.	416.	416.

MOORE BUSINESS FORMS INC. PRINTED IN USA 22

•OVN•

RUNOFF MULTIPLIED BY 0.50

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
3.	5.	6.	6.	7.	7.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	9.	11.	14.	20.	20.
26.	31.	36.	39.	41.	43.	44.	45.	45.	45.	46.	46.
46.	46.	46.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	47.	47.	47.	47.	47.	47.	47.	47.	47.	47.
47.	47.	50.	64.	89.	124.	164.	203.	234.	259.	259.	259.
281.	300.	318.	333.	345.	358.	373.	390.	408.	424.	424.	424.
447.	493.	569.	673.	789.	900.	976.	999.	970.	897.	897.	897.
801.	704.	624.	564.	515.	474.	439.	411.	385.	353.	353.	353.
310.	259.	203.	152.	111.	98.	94.	90.	86.	83.	83.	83.
80.	77.	73.	71.	68.	65.	62.	60.	58.	55.	55.	55.
53.	51.	49.	47.	45.	43.	42.	40.	38.	37.	37.	37.
35.	34.	33.	31.								

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	999.	499.	153.	153.	22039.
INCHES		9.29	11.39	11.39	11.39
AC-FT		248.	304.	304.	304.

MOORE BUSINESS FORMS, INC. NO. PRINTED IN USA 22

1 15 40	1.25	1.24	1346.
1 15 50	1.25	1.24	1579.
1 15 60	1.25	1.24	1800.
1 16 10	0.46	0.45	1952.
1 16 20	0.46	0.45	1999.
1 16 30	0.46	0.45	1940.
1 16 40	0.46	0.45	1795.
1 16 50	0.46	0.45	1602.
1 16 60	0.46	0.45	1408.
1 17 10	0.36	0.35	1248.
1 17 20	0.36	0.35	1127.
1 17 30	0.36	0.35	1029.
1 17 40	0.36	0.35	947.
1 17 50	0.36	0.35	878.
1 17 60	0.36	0.35	822.
1 18 10	0.03	0.02	770.
1 18 20	0.03	0.02	705.
1 18 30	0.03	0.02	621.
1 18 40	0.03	0.02	517.
1 18 50	0.03	0.02	406.
1 18 60	0.03	0.02	303.
1 19 10	0.03	0.02	222.
1 19 20	0.03	0.02	195.
1 19 30	0.03	0.02	187.
1 19 40	0.03	0.02	180.
1 19 50	0.03	0.02	173.
1 19 60	0.03	0.02	166.
1 20 10	0.03	0.02	159.
1 20 20	0.03	0.02	153.
1 20 30	0.03	0.02	147.
1 20 40	0.03	0.02	141.
1 20 50	0.03	0.02	135.
1 20 60	0.03	0.02	130.
1 21 10	0.03	0.02	125.
1 21 20	0.03	0.02	120.
1 21 30	0.03	0.02	115.
1 21 40	0.03	0.02	111.
1 21 50	0.03	0.02	106.
1 21 60	0.03	0.02	102.
1 22 10	0.03	0.02	98.
1 22 20	0.03	0.02	94.
1 22 30	0.03	0.02	90.
1 22 40	0.03	0.02	87.
1 22 50	0.03	0.02	83.
1 22 60	0.03	0.02	80.
1 23 10	0.03	0.02	77.
1 23 20	0.03	0.02	74.
1 23 30	0.03	0.02	71.
1 23 40	0.03	0.02	68.
1 23 50	0.03	0.02	65.
1 23 60	0.03	0.02	63.
SUM	23.70	22.03	44072.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1999.	999.	305.	306.	44078.
INCHES		18.58	22.78	22.78	22.78
AC-FT		496.	607.	607.	607.

MOORE BUSINESS FORMS, INC. OH PRINTED IN USA 32

1	4	40	0.02	0.01	16.
1	4	50	0.02	0.01	16.
1	4	60	0.02	0.01	16.
1	5	10	0.02	0.01	16.
1	5	20	0.02	0.01	16.
1	5	30	0.02	0.01	16.
1	5	40	0.02	0.01	17.
1	5	50	0.02	0.01	17.
1	5	60	0.02	0.01	17.
1	6	10	0.05	0.05	18.
1	6	20	0.06	0.05	22.
1	6	30	0.06	0.05	29.
1	6	40	0.06	0.05	39.
1	6	50	0.06	0.05	51.
1	6	60	0.06	0.05	63.
1	7	10	0.06	0.05	72.
1	7	20	0.06	0.05	78.
1	7	30	0.06	0.05	83.
1	7	40	0.06	0.05	86.
1	7	50	0.06	0.05	88.
1	7	60	0.06	0.05	90.
1	8	10	0.06	0.05	91.
1	8	20	0.06	0.05	92.
1	8	30	0.06	0.05	92.
1	8	40	0.06	0.05	93.
1	8	50	0.06	0.05	93.
1	8	60	0.06	0.05	93.
1	9	10	0.06	0.05	93.
1	9	20	0.06	0.05	93.
1	9	30	0.06	0.05	93.
1	9	40	0.06	0.05	93.
1	9	50	0.06	0.05	93.
1	9	60	0.06	0.05	93.
1	10	10	0.06	0.05	93.
1	10	20	0.06	0.05	93.
1	10	30	0.06	0.05	93.
1	10	40	0.06	0.05	93.
1	10	50	0.06	0.05	93.
1	10	60	0.06	0.05	93.
1	11	10	0.06	0.05	93.
1	11	20	0.06	0.05	93.
1	11	30	0.06	0.05	93.
1	11	40	0.06	0.05	93.
1	11	50	0.06	0.05	93.
1	11	60	0.06	0.05	93.
1	12	10	0.33	0.32	101.
1	12	20	0.33	0.32	127.
1	12	30	0.33	0.32	177.
1	12	40	0.33	0.32	248.
1	12	50	0.33	0.32	328.
1	12	60	0.33	0.32	405.
1	13	10	0.40	0.38	468.
1	13	20	0.40	0.38	518.
1	13	30	0.40	0.38	561.
1	13	40	0.40	0.38	600.
1	13	50	0.40	0.38	635.
1	13	60	0.40	0.38	665.
1	14	10	0.49	0.48	691.
1	14	20	0.49	0.48	716.
1	14	30	0.49	0.48	746.
1	14	40	0.49	0.48	780.
1	14	50	0.49	0.48	816.
1	14	60	0.49	0.48	848.
1	15	10	1.25	1.24	894.
1	15	20	1.25	1.24	936.

P. 12-1

MOORE BUSINESSFORMS INC NU PRINTED IN U.S.A. 22

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SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH FOR TRIBUTARY NUMBER 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.50	0.0	0.0	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	18.00	110.00	122.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.33	0.07	0.0	0.0

UNIT HYDROGRAPH DATA

TP# 0.80 CP#0.75 NTA# 0

RECESSION DATA

STRTQ# 2.00 QRCSN# -0.10 RTIOR# 1.50

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 5.91 AND R# 2.94 INTERVALS

UNIT HYDROGRAPH 19 END-OF-PERIOD ORDINATES, LAG# 0.80 HOURS, CP# 0.74 VOL# 1.00

28.	98.	186.	262.	299.	285.	226.	160.	114.	81.
57.	41.	29.	20.	15.	10.	7.	5.	4.	

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	2.
1	0 20	0.02	0.00	2.
1	0 30	0.02	0.00	2.
1	0 40	0.02	0.00	2.
1	0 50	0.02	0.00	2.
1	0 60	0.02	0.00	2.
1	1 10	0.02	0.00	2.
1	1 20	0.02	0.00	1.
1	1 30	0.02	0.00	1.
1	1 40	0.02	0.00	1.
1	1 50	0.02	0.00	1.
1	1 60	0.02	0.00	1.
1	2 10	0.02	0.00	1.
1	2 20	0.02	0.00	1.
1	2 30	0.02	0.00	1.
1	2 40	0.02	0.00	1.
1	2 50	0.02	0.00	1.
1	2 60	0.02	0.01	2.
1	3 10	0.02	0.01	3.
1	3 20	0.02	0.01	5.
1	3 30	0.02	0.01	7.
1	3 40	0.02	0.01	9.
1	3 50	0.02	0.01	11.
1	3 60	0.02	0.01	13.
1	4 10	0.02	0.01	14.
1	4 20	0.02	0.01	15.
1	4 30	0.02	0.01	15.

1 18 10	19.	135.	146.	
1 18 20	19.	122.	136.	
1 18 30	19.	98.	120.	
1 18 40	18.	67.	98.	
1 18 50	18.	48.	82.	
1 18 60	17.	43.	69.	
1 19 10	17.	41.	60.	
1 19 20	17.	40.	56.	
1 19 30	16.	38.	52.	
1 19 40	16.	37.	49.	
1 19 50	16.	35.	46.	
1 19 60	16.	34.	43.	
1 20 10	16.	33.	41.	
1 20 20	16.	31.	39.	
1 20 30	15.	30.	37.	
1 20 40	15.	29.	35.	
1 20 50	15.	28.	35.	
1 20 60	15.	27.	34.	
1 21 10	15.	26.	34.	
1 21 20	15.	24.	34.	
1 21 30	15.	24.	33.	
1 21 40	15.	23.	33.	
1 21 50	15.	22.	32.	
1 21 60	14.	21.	32.	
1 22 10	14.	20.	31.	
1 22 20	14.	19.	31.	
1 22 30	14.	18.	30.	
1 22 40	14.	18.	30.	
1 22 50	14.	17.	29.	
1 22 60	13.	16.	29.	
1 23 10	13.	16.	28.	
1 23 20	13.	15.	28.	
1 23 30	13.	14.	27.	
1 23 40	13.	14.	27.	
1 23 50	12.	13.	26.	
1 23 60	12.	13.	25.	
SUM			8119.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	431.	189.	56.	56.	8119.
INCHES		8.78	10.49	10.49	10.49
AC-FT		94.	112.	112.	112.

MOORE BUSINESS FORMS INC. NO. PRINTED IN USA 22

1 7 10	1.	18.	3.	
1 7 20	1.	18.	3.	
1 7 30	1.	19.	3.	
1 7 40	2.	19.	4.	
1 7 50	2.	19.	4.	
1 7 60	2.	19.	4.	
1 8 10	2.	19.	4.	
1 8 20	2.	19.	5.	
1 8 30	3.	19.	5.	
1 8 40	3.	19.	5.	
1 8 50	3.	19.	5.	
1 8 60	3.	19.	6.	
1 9 10	3.	19.	6.	
1 9 20	3.	19.	6.	
1 9 30	4.	19.	6.	
1 9 40	4.	19.	7.	
1 9 50	4.	19.	7.	
1 9 60	4.	19.	7.	
1 10 10	4.	19.	8.	
1 10 20	4.	19.	8.	
1 10 30	5.	19.	8.	
1 10 40	5.	19.	8.	
1 10 50	5.	19.	9.	
1 10 60	5.	19.	9.	
1 11 10	5.	19.	9.	
1 11 20	5.	19.	9.	
1 11 30	5.	19.	10.	
1 11 40	6.	19.	10.	
1 11 50	6.	19.	10.	
1 11 60	6.	19.	10.	
1 12 10	6.	21.	11.	
1 12 20	6.	30.	11.	
1 12 30	7.	50.	12.	
1 12 40	8.	74.	14.	
1 12 50	9.	96.	16.	
1 12 60	10.	109.	19.	
1 13 10	11.	117.	22.	
1 13 20	13.	122.	26.	
1 13 30	14.	129.	31.	
1 13 40	15.	136.	35.	
1 13 50	17.	142.	58.	
1 13 60	18.	145.	86.	
1 14 10	18.	147.	108.	
1 14 20	19.	152.	126.	
1 14 30	19.	159.	140.	
1 14 40	20.	169.	152.	
1 14 50	20.	176.	162.	
1 14 60	20.	181.	170.	
1 15 10	20.	190.	179.	
1 15 20	21.	218.	195.	
1 15 30	22.	273.	228.	
1 15 40	23.	342.	283.	
1 15 50	24.	403.	342.	
1 15 60	25.	441.	390.	
1 16 10	26.	454.	425.	
1 16 20	26.	436.	431.	
1 16 30	25.	384.	404.	
1 16 40	24.	315.	360.	
1 16 50	23.	253.	308.	
1 16 60	22.	214.	262.	
1 17 10	22.	193.	229.	
1 17 20	21.	179.	208.	
1 17 30	21.	167.	191.	
1 17 40	20.	155.	176.	
1 17 50	20.	146.	163.	

MOORE BUSINESS FORMS, INC. NO. PRINTED IN U.S.A. 27°

HYDROGRAPH ROUTING

ROUTING THROUGH WEST POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE#	0.	3.	6.	11.	15.	17.	18.	22.	25.	29.
OUTFLOW#	2.	5.	10.	20.	35.	60.	100.	235.	400.	600.

		TIME	EOP STOR	AVG IN	EOP OUT
1	0	10	0.	1.	1.
1	0	20	-0.	1.	2.
1	0	30	-0.	1.	2.
1	0	40	-0.	1.	2.
1	0	50	-0.	1.	2.
1	0	60	-0.	1.	2.
1	1	10	-0.	1.	2.
1	1	20	-0.	1.	2.
1	1	30	-0.	1.	2.
1	1	40	-0.	1.	2.
1	1	50	-0.	1.	2.
1	1	60	-0.	1.	2.
1	2	10	-0.	1.	2.
1	2	20	-0.	1.	2.
1	2	30	-0.	1.	2.
1	2	40	-0.	1.	2.
1	2	50	-0.	1.	2.
1	2	60	-0.	1.	2.
1	3	10	-0.	1.	2.
1	3	20	-0.	2.	2.
1	3	30	-0.	2.	2.
1	3	40	-0.	3.	2.
1	3	50	-0.	3.	2.
1	3	60	-0.	3.	2.
1	4	10	-0.	4.	2.
1	4	20	-0.	4.	2.
1	4	30	-0.	4.	2.
1	4	40	-0.	4.	2.
1	4	50	-0.	4.	2.
1	4	60	-0.	4.	2.
1	5	10	-0.	4.	2.
1	5	20	-0.	3.	2.
1	5	30	0.	3.	2.
1	5	40	0.	3.	2.
1	5	50	0.	3.	2.
1	5	60	0.	3.	2.
1	6	10	0.	4.	2.
1	6	20	0.	5.	2.
1	6	30	0.	8.	2.
1	6	40	0.	12.	2.
1	6	50	1.	15.	3.
1	6	60	1.	17.	3.

MOORE-BURNESS SWAN INC. OHIO PRINTED IN USA 22

DVN

RUNOFF MULTIPLIED BY 0.50

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
4.	6.	8.	11.	14.	16.	19.	21.	23.	24.
26.	27.	27.	28.	28.	29.	30.	32.	36.	43.
51.	62.	74.	88.	101.	114.	125.	135.	143.	149.
154.	159.	162.	165.	167.	169.	171.	172.	173.	174.
175.	175.	176.	176.	176.	177.	177.	177.	177.	177.
177.	177.	181.	195.	222.	264.	321.	392.	476.	567.
664.	761.	852.	934.	1008.	1078.	1145.	1211.	1274.	1335.
1404.	1499.	1628.	1793.	1995.	2230.	2478.	2708.	2899.	3035.
30	3080.	2993.	2857.	2687.	2502.	2323.	2164.	2021.	1883.
1744.	1601.	1454.	1303.	1150.	998.	853.	718.	599.	500.
420.	354.	308.	295.	284.	272.	262.	251.	241.	232.
222.	214.	205.	197.	189.	182.	174.	167.	161.	154.
148.	142.	137.	131.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3098.	1833.	567.	567.	81713.
INCHES		8.97	11.11	11.11	11.11
AC-FT		909.	1126.	1126.	1126.

MOORE BUSINESS FORMS, INC. NO. PRINTED IN USA 22

RUN

SUB-AREA RUNOFF COMPUTATION

REMAINING INTERVENING AREAS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
7	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.70	0.0	0.0	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	18.00	110.00	122.00	132.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.33	0.07	0.0	0.0

UNIT HYDROGRAPH DATA

TP# 0.50 CP#0.75 NTA# 0

RECESSION DATA

STRTQ# 2.00 QRCSN# -0.10 RTIOR# 1.50

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC# 4.08 AND R# 1.53 INTERVALS

UNIT HYDROGRAPH 11 END-OF-PERIOD ORDINATES, LAG# 0.50 HOURS, CP# 0.75 VOL# 1.00

277. 925. 1498. 1588. 1120. 576. 293. 149. 76. 38.
20.

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	2.
1	0 20	0.02	0.00	2.
1	0 30	0.02	0.00	2.
1	0 40	0.02	0.00	2.
1	0 50	0.02	0.00	2.
1	0 60	0.02	0.00	2.
1	1 10	0.02	0.00	2.
1	1 20	0.02	0.00	1.
1	1 30	0.02	0.00	1.
1	1 40	0.02	0.00	1.
1	1 50	0.02	0.00	1.
1	1 60	0.02	0.00	1.
1	2 10	0.02	0.00	1.
1	2 20	0.02	0.00	1.
1	2 30	0.02	0.00	1.
1	2 40	0.02	0.00	1.
1	2 50	0.02	0.00	2.
1	2 60	0.02	0.01	7.
1	3 10	0.02	0.01	17.
1	3 20	0.02	0.01	30.
1	3 30	0.02	0.01	41.
1	3 40	0.02	0.01	48.
1	3 50	0.02	0.01	52.
1	3 60	0.02	0.01	54.
1	4 10	0.02	0.01	55.
1	4 20	0.02	0.01	55.
1	4 30	0.02	0.01	55.

MOORE ENGINEERING, INC. PRINTED IN USA 22

1	4	40	0.02	0.01	55.
1	4	50	0.02	0.01	55.
1	4	60	0.02	0.01	55.
1	5	10	0.02	0.01	55.
1	5	20	0.02	0.01	55.
1	5	30	0.02	0.01	55.
1	5	40	0.02	0.01	55.
1	5	50	0.02	0.01	55.
1	5	60	0.02	0.01	55.
1	6	10	0.06	0.05	66.
1	6	20	0.06	0.05	103.
1	6	30	0.06	0.05	163.
1	6	40	0.06	0.05	227.
1	6	50	0.06	0.05	271.
1	6	60	0.06	0.05	294.
1	7	10	0.06	0.05	306.
1	7	20	0.06	0.05	312.
1	7	30	0.06	0.05	315.
1	7	40	0.06	0.05	317.
1	7	50	0.06	0.05	317.
1	7	60	0.06	0.05	317.
1	8	10	0.06	0.05	317.
1	8	20	0.06	0.05	317.
1	8	30	0.06	0.05	317.
1	8	40	0.06	0.05	317.
1	8	50	0.06	0.05	317.
1	8	60	0.06	0.05	317.
1	9	10	0.06	0.05	317.
1	9	20	0.06	0.05	317.
1	9	30	0.06	0.05	317.
1	9	40	0.06	0.05	317.
1	9	50	0.06	0.05	317.
1	9	60	0.06	0.05	317.
1	10	10	0.06	0.05	317.
1	10	20	0.06	0.05	317.
1	10	30	0.06	0.05	317.
1	10	40	0.06	0.05	317.
1	10	50	0.06	0.05	317.
1	10	60	0.06	0.05	317.
1	11	10	0.06	0.05	317.
1	11	20	0.06	0.05	317.
1	11	30	0.06	0.05	317.
1	11	40	0.06	0.05	317.
1	11	50	0.06	0.05	317.
1	11	60	0.06	0.05	317.
1	12	10	0.33	0.32	392.
1	12	20	0.33	0.32	642.
1	12	30	0.33	0.32	1046.
1	12	40	0.33	0.32	1475.
1	12	50	0.33	0.32	1777.
1	12	60	0.33	0.32	1933.
1	13	10	0.40	0.38	2030.
1	13	20	0.40	0.38	2131.
1	13	30	0.40	0.38	2250.
1	13	40	0.40	0.38	2366.
1	13	50	0.40	0.38	2445.
1	13	60	0.40	0.38	2483.
1	14	10	0.49	0.48	2530.
1	14	20	0.49	0.48	2631.
1	14	30	0.49	0.48	2784.
1	14	40	0.49	0.48	2944.
1	14	50	0.49	0.48	3056.
1	14	60	0.49	0.48	3113.
1	15	10	1.25	1.24	3353.
1	15	20	1.25	1.24	4069.
1	15	30	1.25	1.24	5213.

MOORE BUSINESS FORMS, INC. HO PRINTED IN USA 77

1 15 40	1.25	1.24	6422.	
1 15 50	1.25	1.24	7274.	
1 15 60	1.25	1.24	7712.	
1 16 10	0.46	0.45	7714.	
1 16 20	0.46	0.45	7095.	
1 16 30	0.46	0.45	5966.	
1 16 40	0.46	0.45	4738.	
1 16 50	0.46	0.45	3866.	
1 16 60	0.46	0.45	3409.	
1 17 10	0.36	0.35	3150.	
1 17 20	0.36	0.35	2941.	
1 17 30	0.36	0.35	2732.	
1 17 40	0.36	0.35	2545.	
1 17 50	0.36	0.35	2418.	
1 17 60	0.36	0.35	2361.	
1 18 10	0.03	0.02	2240.	
1 18 20	0.03	0.02	1917.	
1 18 30	0.03	0.02	1411.	
1 18 40	0.03	0.02	879.	
1 18 50	0.03	0.02	750.	
1 18 60	0.03	0.02	720.	
1 19 10	0.03	0.02	691.	
1 19 20	0.03	0.02	664.	
1 19 30	0.03	0.02	637.	
1 19 40	0.03	0.02	612.	
1 19 50	0.03	0.02	588.	
1 19 60	0.03	0.02	564.	
1 20 10	0.03	0.02	542.	
1 20 20	0.03	0.02	520.	
1 20 30	0.03	0.02	500.	
1 20 40	0.03	0.02	480.	
1 20 50	0.03	0.02	461.	
1 20 60	0.03	0.02	442.	
1 21 10	0.03	0.02	425.	
1 21 20	0.03	0.02	408.	
1 21 30	0.03	0.02	392.	
1 21 40	0.03	0.02	376.	
1 21 50	0.03	0.02	361.	
1 21 60	0.03	0.02	347.	
1 22 10	0.03	0.02	333.	
1 22 20	0.03	0.02	320.	
1 22 30	0.03	0.02	307.	
1 22 40	0.03	0.02	295.	
1 22 50	0.03	0.02	283.	
1 22 60	0.03	0.02	272.	
1 23 10	0.03	0.02	261.	
1 23 20	0.03	0.02	251.	
1 23 30	0.03	0.02	241.	
1 23 40	0.03	0.02	231.	
1 23 50	0.03	0.02	222.	
1 23 60	0.03	0.02	213.	
SUM	23.70	22.03	152712.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7714.	3458.	1061.	1061.	152717.
INCHES		18.92	23.21	23.21	23.21
AC-FT		1716.	2105.	2105.	2105.

OVN

RUNOFF MULTIPLIED BY 0.50.

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	4.	9.	15.
21.	24.	26.	27.	27.	28.	28.	28.	28.	28.
28.	28.	28.	28.	28.	28.	33.	52.	82.	113.
136.	147.	153.	156.	158.	158.	159.	159.	159.	159.
159.	159.	159.	159.	159.	159.	159.	159.	159.	159.
159.	159.	159.	159.	159.	159.	159.	159.	159.	159.
159.	159.	196.	321.	523.	737.	889.	966.	1015.	1066.
1125.	1183.	1222.	1241.	1265.	1315.	1392.	1472.	1528.	1557.
1676.	2035.	2607.	3211.	3637.	3856.	3857.	3547.	2983.	2369.
1933.	1705.	1575.	1470.	1366.	1272.	1209.	1181.	1120.	959.
706.	439.	375.	360.	346.	332.	319.	306.	294.	282.
271.	260.	250.	243.	230.	221.	212.	204.	196.	188.
181.	173.	167.	160.	154.	147.	142.	136.	131.	125.
120.	116.	111.	107.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3857.	1729.	530.	530.	76358.
INCHES		9.46	11.61	11.61	11.61
AC-FT		858.	1052.	1052.	1052.

MOORE BUSINESS FORMS INC. NO. PRINTED IN USA 22

OVN

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE ALL INFLOW HYDROGRAPHS.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
8	3	0	0	0	0	1

SUM OF 3 HYDROGRAPHS AT 8

4.	4.	4.	4.	4.	4.	4.	3.	3.	3.
3.	3.	3.	3.	3.	3.	4.	6.	12.	20.
27.	32.	36.	40.	43.	46.	49.	51.	53.	54.
56.	57.	58.	58.	59.	59.	66.	87.	121.	159.
190.	213.	231.	248.	263.	277.	289.	299.	308.	315.
321.	326.	330.	333.	336.	339.	341.	343.	345.	347.
348.	349.	350.	351.	352.	353.	354.	355.	356.	358.
359.	360.	403.	543.	775.	1035.	1249.	1415.	1569.	1735.
1951.	2154.	2329.	2473.	2623.	2788.	2972.	3152.	3305.	3424.
3643.	4132.	4901.	5771.	6531.	7133.	7524.	7553.	7229.	6736.
6292.	5939.	5606.	5257.	4892.	4536.	4229.	3988.	3739.	3406.
2974.	2515.	2245.	2017.	1790.	1585.	1395.	1222.	1072.	946.
842.	756.	690.	660.	633.	607.	583.	560.	538.	519.
501.	483.	466.	449.	433.	418.	403.	388.	374.	360.
347.	335.	322.	311.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7553.	4152.	1293.	1293.	186221.
INCHES		8.98	11.19	11.19	11.19
AC-FT		2060.	2566.	2566.	2566.

MOORE BUSINESS FORMS INC MO PRINTED IN USA 777

HYDROGRAPH ROUTING

ROUTE THROUGH LAKE SADAWGA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
9	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
1	0	3	0.0	0.0	0.0	-1.

STORAGE=	0.	202.	404.	545.	747.	848.	1050.	1131.	1232.	1333.
OUTFLOW=	4.	70.	214.	361.	581.	733.	1098.	1267.	1750.	2535.

	TIME	EOP STOR	AVG IN	EOP OUT
1	0 10	0.	4.	4.
1	0 20	0.	4.	4.
1	0 30	-0.	4.	4.
1	0 40	-0.	4.	4.
1	0 50	-0.	4.	4.
1	0 60	-0.	4.	4.
1	1 10	-0.	4.	4.
1	1 20	-0.	4.	4.
1	1 30	-0.	3.	4.
1	1 40	-0.	3.	4.
1	1 50	-0.	3.	4.
1	1 60	-0.	3.	4.
1	2 10	-0.	3.	4.
1	2 20	-0.	3.	4.
1	2 30	-0.	3.	4.
1	2 40	-0.	3.	4.
1	2 50	-0.	3.	4.
1	2 60	-0.	5.	4.
1	3 10	-0.	9.	4.
1	3 20	0.	16.	4.
1	3 30	0.	23.	4.
1	3 40	1.	29.	4.
1	3 50	1.	34.	4.
1	3 60	2.	38.	5.
1	4 10	2.	42.	5.
1	4 20	3.	45.	5.
1	4 30	3.	48.	5.
1	4 40	4.	50.	5.
1	4 50	5.	52.	5.
1	4 60	5.	54.	6.
1	5 10	6.	55.	6.
1	5 20	7.	56.	6.
1	5 30	7.	57.	6.
1	5 40	8.	58.	7.
1	5 50	9.	59.	7.
1	5 60	9.	59.	7.
1	6 10	10.	63.	7.
1	6 20	11.	76.	8.
1	6 30	12.	104.	8.
1	6 40	14.	140.	9.
1	6 50	17.	175.	9.
1	6 60	19.	202.	10.

MOORE BUSINESS FORMS, INC. NO. [illegible] PRINTED IN U.S.A.

HYDROGRAPH ROUTING

ROUTE THROUGH LAKE SADAWGA

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
9	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE#	0.	202.	404.	545.	747.	848.	1050.	1131.	1232.	1333.
OUTFLOW#	4.	70.	214.	361.	581.	733.	1098.	1267.	1750.	2535.

	TIME	EOP STOR	AVG IN	EOP OUT
1	0 10	0.	4.	4.
1	0 20	0.	4.	4.
1	0 30	-0.	4.	4.
1	0 40	-0.	4.	4.
1	0 50	-0.	4.	4.
1	0 60	-0.	4.	4.
1	1 10	-0.	4.	4.
1	1 20	-0.	4.	4.
1	1 30	-0.	3.	4.
1	1 40	-0.	3.	4.
1	1 50	-0.	3.	4.
1	1 60	-0.	3.	4.
1	2 10	-0.	3.	4.
1	2 20	-0.	3.	4.
1	2 30	-0.	3.	4.
1	2 40	-0.	3.	4.
1	2 50	-0.	3.	4.
1	2 60	-0.	5.	4.
1	3 10	-0.	9.	4.
1	3 20	0.	16.	4.
1	3 30	0.	23.	4.
1	3 40	1.	29.	4.
1	3 50	1.	34.	4.
1	3 60	2.	38.	5.
1	4 10	2.	42.	5.
1	4 20	3.	45.	5.
1	4 30	3.	48.	5.
1	4 40	4.	50.	5.
1	4 50	5.	52.	5.
1	4 60	5.	54.	6.
1	5 10	6.	55.	6.
1	5 20	7.	56.	6.
1	5 30	7.	57.	6.
1	5 40	8.	58.	7.
1	5 50	9.	59.	7.
1	5 60	9.	59.	7.
1	6 10	10.	63.	7.
1	6 20	11.	76.	8.
1	6 30	12.	104.	8.
1	6 40	14.	140.	9.
1	6 50	17.	175.	9.
1	6 60	19.	202.	10.

MOORE BUSINESS FORMS, INC. HO PRINTED IN U.S.A. 22

1	7	10	22.	222.	11.
1	7	20	25.	239.	12.
1	7	30	29.	255.	13.
1	7	40	32.	270.	14.
1	7	50	36.	283.	16.
1	7	60	40.	294.	17.
1	8	10	44.	304.	18.
1	8	20	48.	311.	20.
1	8	30	52.	318.	21.
1	8	40	56.	323.	22.
1	8	50	60.	328.	24.
1	8	60	64.	332.	25.
1	9	10	69.	335.	26.
1	9	20	73.	338.	28.
1	9	30	77.	340.	29.
1	9	40	81.	342.	31.
1	9	50	86.	344.	32.
1	9	60	90.	346.	33.
1	10	10	94.	347.	35.
1	10	20	99.	349.	36.
1	10	30	103.	350.	38.
1	10	40	107.	351.	39.
1	10	50	112.	352.	40.
1	10	60	116.	353.	42.
1	11	10	120.	354.	43.
1	11	20	124.	355.	45.
1	11	30	129.	356.	46.
1	11	40	133.	357.	47.
1	11	50	137.	358.	49.
1	11	60	142.	360.	50.
1	12	10	146.	382.	52.
1	12	20	152.	473.	54.
1	12	30	160.	659.	56.
1	12	40	172.	905.	60.
1	12	50	187.	1142.	65.
1	12	60	204.	1332.	72.
1	13	10	224.	1492.	85.
1	13	20	245.	1652.	101.
1	13	30	269.	1843.	118.
1	13	40	295.	2052.	137.
1	13	50	324.	2242.	157.
1	13	60	355.	2401.	179.
1	14	10	388.	2548.	202.
1	14	20	422.	2706.	233.
1	14	30	458.	2880.	270.
1	14	40	496.	3062.	310.
1	14	50	536.	3228.	352.
1	14	60	577.	3365.	396.
1	15	10	620.	3534.	443.
1	15	20	667.	3887.	494.
1	15	30	722.	4517.	554.
1	15	40	788.	5336.	642.
1	15	50	863.	6151.	759.
1	15	60	945.	6832.	909.
1	16	10	1033.	7329.	1067.
1	16	20	1120.	7539.	1245.
1	16	30	1203.	7391.	1610.
1	16	40	1273.	6983.	2072.
1	16	50	1332.	6514.	2524.
1	16	60	1378.	6115.	2889.
1	17	10	1416.	5772.	3182.
1	17	20	1446.	5431.	3410.
1	17	30	1467.	5075.	3579.
1	17	40	1482.	4714.	3695.
1	17	50	1491.	4383.	3765.

MOORE BUSINESS FORMS, INC. NO. PRINTED IN U.S.A. 22

1	18	10	1497.	3863.	3806.			
1	18	20	1493.	3573.	3782.			
1	18	30	1486.	3190.	3722.			
1	18	40	1473.	2745.	3623.			
1	18	50	1457.	2380.	3496.			
1	18	60	1439.	2131.	3358.			
1	19	10	1420.	1906.	3210.			
1	19	20	1400.	1688.	3055.			
1	19	30	1379.	1490.	2896.			
1	19	40	1359.	1308.	2735.			
1	19	50	1338.	1147.	2573.			
1	19	60	1317.	1009.	2414.			
1	20	10	1298.	894.	2260.			
1	20	20	1279.	799.	2112.			
1	20	30	1260.	723.	1970.			
1	20	40	1243.	675.	1839.			
1	20	50	1228.	647.	1730.			
1	20	60	1213.	620.	1659.			
1	21	10	1199.	595.	1591.			
1	21	20	1185.	571.	1526.			
1	21	30	1172.	549.	1464.			
1	21	40	1160.	528.	1404.			
1	21	50	1148.	510.	1347.			
1	21	60	1136.	492.	1292.			
1	22	10	1125.	474.	1255.			
1	22	20	1114.	458.	1233.			
1	22	30	1104.	441.	1210.			
1	22	40	1093.	426.	1188.			
1	22	50	1083.	410.	1166.			
1	22	60	1072.	395.	1144.			
1	23	10	1062.	381.	1122.			
1	23	20	1051.	367.	1101.			
1	23	30	1041.	354.	1082.			
1	23	40	1031.	341.	1064.			
1	23	50	1021.	329.	1046.			
1	23	60	1011.	316.	1028.			
			SUM		113160.			

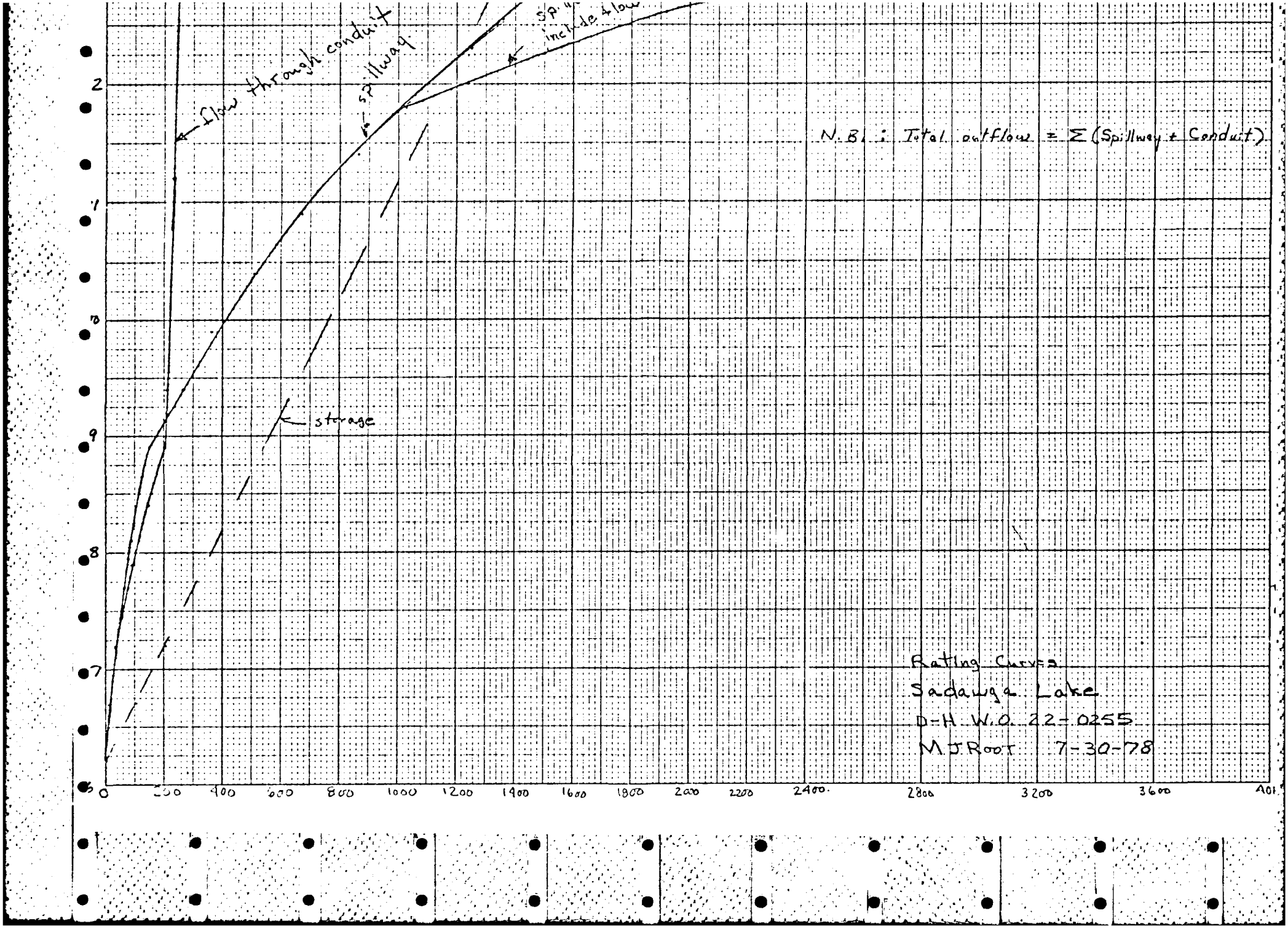
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3806.	2552.	786.	786.	113160.
INCHES		5.52	6.80	6.80	6.80
AC-FT		1266.	1559.	1559.	1559.

MOORE BUSINESS FORMS, INC. NO. 8881 PRINTED IN U.S.A.

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	2	454.	203.	63.	63.	0.20
ROUTED TO	3	431.	189.	56.	56.	0.20
HYDROGRAPH AT	1	999.	499.	153.	153.	0.50
2 COMBINED	4	1430.	684.	209.	209.	0.70
ROUTED TO	5	1347.	672.	195.	195.	0.70
HYDROGRAPH AT	6	3098.	1833.	567.	567.	1.90
HYDROGRAPH AT	7	3857.	1729.	530.	530.	1.70
3 COMBINED	8	7553.	4152.	1293.	1293.	4.30
ROUTED TO	9	3806.	2552.	786.	786.	4.30

MOORE BUSINESS FORMS INC NO PRINTED IN USA


flow through conduit
spillway
sp. + inlet flow
storage
N.B.: Total outflow = Σ (Spillway + Conduit)
Rating Curves
Sadawga Lake
D-H W.O. 22-0255
MJRoot 7-30-78
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2800
3200
3600
2
1
9
8
7

1, crest elevation 96.2', 1-foot rise, 1:3 slope ream face
$H^{3/2}$; where C = 3.85 by King, Table 5-11, p 5-50
Discharge = $(3.64)(9)(101.8-96.2)^{3/2}$ = ~~434~~ cfs

2, crest elevation 98.9', 9-foot width, level stone
$H^{3/2}$; where C = 2.64 by King, Table 5-3, p. 5-46
Discharge = $(2.64)(45.5)(101.8-98.9)^{3/2}$ = 593 cfs

gated Spillway Capacity = 1052 cfs say 1050 cfs

Rating for Spillway

H_1	C_1	$L_1 = 9'$	Q_1	H_2	C_2	$L_2 = 45.5$	Q_2	Q_T	Storage Ac-ft
0	0		0	0	0	0	—	0	
0.5	3.85		12				—	12	101
1.0	3.85		35				—	35	202
1.5	3.82		63				—	63	303
2	3.79		96				—	96	404
2.7	3.77		151	0	0		—	151	545
3.2	3.75		193	0.5	2.7		43	236	646
3.7	3.73		239	1.0	2.68		122	361	747
4.2	3.70		287	1.5	2.64		221	508	848
4.7	3.67		337	2.0			340	677	949
5.2	3.64		388	2.5			475	863	1050
5.6	3.64		434	2.9	2.64		593	1027	1131
6.1	3.64*		493	3.4	2.64		753	1246	1232
6.6	3.64		555 619	3.9	2.64		925 1108	1480 1728	1333
th dam, L = 300' ±									
0.5	2.48		264					1550	
1.0	2.68		804 ← @top of "West Dike"					2285	
1.5	2.64		1455					3183	
e 150' long spur									
1.5	2.49		132						

SDF = 3800 cfs

lls over weir 1.5' wide with effective length of 17.1'
.9 ~ approx.)
n flows outlet 4' ø pipe obstructed w/ 3' ø orifice

pipe ≃ 85.2', Compute rating for full pipe for TW = $\frac{D_c + D}{2}$

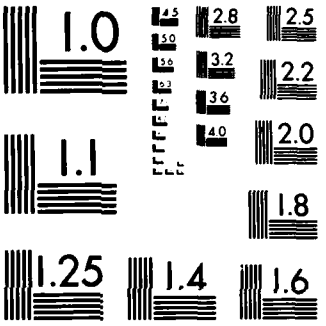
orifice ≃ 85.7'
ce ÷ 4'-ø pipe

D_c	H	Hw/D	Hw	stage	
25					
75	low-flow				
.9					
.0		1.2	4.8'	90.0	Pipe flow by inlet control
–		2.0	8.0	93.2	
–		3.0	12.0'	97.2'	
		4.0	16.0'	101.2'	
		3.5	14.0	99.2'	

w H	C	Q	
~	~	0	
.5	2.64	16	
.0	2.75	47	
.5	3.00	94	
.0	3.03	196	
.0	3.32	295	~ outlet limited to ≃ 210 cfs

AD-A156 259 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
LAKE SADAWGA (VT 0001. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV AUG 78

UNCLASSIFIED F/G 13/13 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

DUFRESNE-HENRY ENGINEERING CORPORATION

M. Root — SUBJECT outflow vs flood storage surcharge — SHEET NO. 35 OF 36

DATE 7-30-78 — JOB NO. 22-0555

Assume rec. pond @ 96.2

Q	Ac-ft	
A	0	96.2+
35+35 = 70	202	97.2
96+118 = 214	404	98.2
151+210 = 361	545	98.9
361+220 = 581	747	99.9
508+225 = 733	848	100.4
863+235 = 1098	1050	101.4
1027+240 = 1267	1131	101.8
1510+240 = 1750	1232	102.3
2285+250 = 2535	1333	102.8

DUFRESNE-HENRY ENGINEERING CORPORATION

BY MJR | SUBJECT Route 100 Bridge | SHEET NO. 36 OF 36
DATE 7-26-78 | Inlet Control | JOB NO. 22-0555

Inlet control, bridge is 19' wide x 9.5' deep, invert 485.5 = 84.4

	Q	HW/D	HW	WSEL
cfs ("rare flood" by HMT)	28.4 cfs/ft	.45	4.28	88.7
cfs (Q_p)	121.6 cfs/ft	1.4	13.3	97.7 (on the 2' around)
cfs	200 cfs/ft	2.5	19+	
cfs	105 cfs/ft	1.16	← low estimate for flow thru	

cfs over road run through town down Route 100 and channel

weir control – est. 100' effective length, C = 3.03

$(1800) = (3.03)(100) H^{3/2}$

$H^{3/2} = 5.94$

$H = 3.3'$ / max. stage $\simeq 84.4 + 11 + 3.3 = 98.7'$

WSEL behind dam 103.3±

∴ submergence is minor

4.33 sq. mi. water shed

minimum flow $(4.33/6.4)(.06) = .04$ cfs min. day

average flow $(4.33/6.4)(15.7) = 10.6$ cfs average annual

maximum flow $(4.33/6.4)^{.75}(1170) = 873$ cfs 1976 flood

$(4.33/39)^{.75}$ 8,950 = 1721
9,980 = 1919
8,450 = 1625

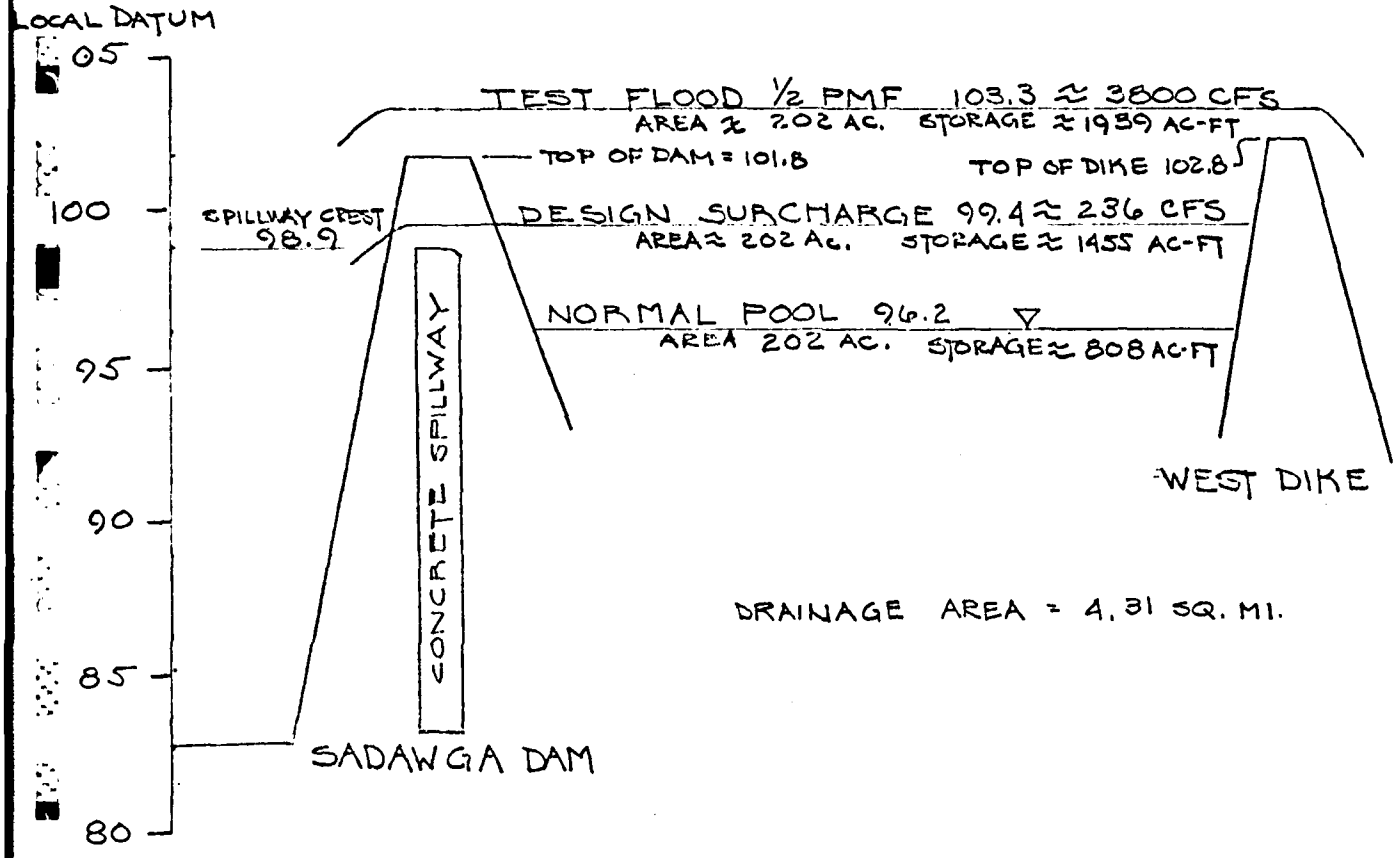
1534 cfs average est. max. inflow

767 cfs max. outflow

DUFRESNE-HENRY ENGINEERING CORPORATION

BY J.R. SPENCER SUBJECT LAKE SADAWGA DAM SHEET NO. 37 OF 37
DATE 10-2-78 JOB NO. VT 00012

HYDROLOGIC CHARACTERISTICS



DRAINAGE AREA = 4.31 SQ. MI.

CAPACITIES

% OF ½ PMF	WATER ELEV. FT	OUTLET	CAPACITY C.F.S.
4%	98.9	STOP LOG OUTLET	151
6%	99.4	DESIGN SURCHARGE	236
27%	101.8	TOP OF DAM	1027
60%	102.8	TOP OF WEST DIKE	2285
100%	103.3	OVERTOP	≈ 3800

APPENDIX E

Information as Contained in the National Inventory of Dams

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
VT	12	NED	VT	025	01				LAKE SADAWGA DAM	4247.2	7252.9	08	SEP	78

POPULAR NAME	NAME OF IMPOUNDMENT
	LAKE SADAWGA

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	TR-LAKE WHITINGHAM	WHITINGHAM	0	100

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1880	R	10	9	1939	808	NED	N	N	N	N	15AUG78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	455	U	55	1050	2700											

OWNER	ENGINEERING BY	CONSTRUCTION BY
VT DEPT OF FISH + GAME		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
DUFRESNE-HENRY ENG CORP	16	JUN	78	PL 92-367

REMARKS

END

FILMED

8-85

DTIC