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NATIONAL DAM SAFETY PROGRAM. BURT DAM (INVENTORY NUMBER N.Y. 74--ETC(U)

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LAKE ONTARIO BASIN

AD A105729

BURT DAM

**NIAGARA COUNTY, NEW YORK
INVENTORY No. N.Y. 745**

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



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AUGUST 1981

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety National Dam Safety Program Visual Inspection Hydrology, Structural Stability Burt Dam Niagara County Lake Ontario Basin		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Examination of available documents and a visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigation and remedial action.		

The hydrologic/hydraulic analysis performed indicates that the spillway does not have sufficient capacity to discharge the peak outflow from one-half the Probable Maximum Flood (PMF). However, spillway discharges occurring during large storm events will cause water surface elevations in the downstream hazard area to rise to flood levels. A dam failure resulting from overtopping would not significantly increase the hazard to loss of life from that which would exist just prior to an overtopping failure. Therefore, the spillway is assessed as inadequate.

Since the structural stability analysis performed by the dam's designer could not be located, an analysis was performed as part of this Phase I Investigation. It indicated that the sliding and overturning factors of safety, for normal operating conditions, are less than the recommended minimum values. In addition, the dam is located in Seismic Zone 3, and there is no record of a suitable seismic analysis being performed. Therefore, an additional investigation by a qualified registered professional engineer to evaluate the normal and seismic stability of the dam is recommended.

The investigation should be completed within 12 months of notification to the owner, and remedial actions resulting from the investigation completed in the subsequent 12 months.

The following remedial measures should be performed within 1 year of notification to owner:

- Replace the missing floor grating on the bridge across the spillway.
- Paint the bridge across the spillway.
- Install hand rails the full length of the dam crest.
- Repair the gate hoist controlling the reservoir drain gate.
- Install fencing at the east abutment and post warning signs at both abutments to discourage trespassers.
- Clean debris and vegetation from areas atop the downstream face of dam and from both abutments.
- Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks, and from upstream slopes.
- Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.
- Develop and maintain a program of biannual technical inspections.

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LAKE ONTARIO BASIN

BURT DAM

NIAGARA COUNTY, NEW YORK
INVENTORY No. N.Y. 745

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM.

Burt Dam (Inventory Number NY. 745),
Lake Ontario Basin, Niagara County,
New York. Phase I Inspection Report,



15) DACW51-81-C-0017

Robert J. Farrell

11) 27 Aug 81

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PREFACE

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

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

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

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

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Burt Dam
State Located: New York
County Located: Niagara
Stream: Eighteenmile Creek
Basin: Lake Ontario
Date of Inspection: May 19, 1981

ASSESSMENT

Examination of available documents and a visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigation and remedial action.

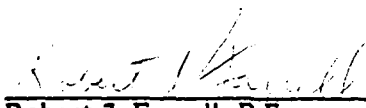
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Since the structural stability analysis performed by the dam's designer could not be located, an analysis was performed as part of this Phase I Investigation. It indicated that the sliding and overturning factors of safety, for normal operating conditions, are less than the recommended minimum values. In addition, the dam is located in Seismic Zone 3, and there is no record of a suitable seismic analysis being performed. Therefore, an additional investigation by a qualified registered professional engineer to evaluate the normal and seismic stability of the dam is recommended.

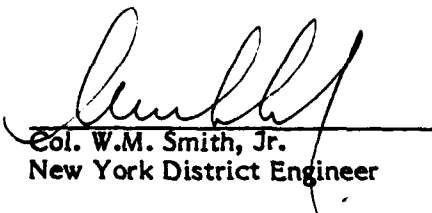
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- Clean debris and vegetation from areas atop the downstream face of dam and from both abutments.
- Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks, and from upstream slopes.
- Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.
- Develop and maintain a program of biannual technical inspections.


Robert J. Farrell, P.E.
New York No. 55983

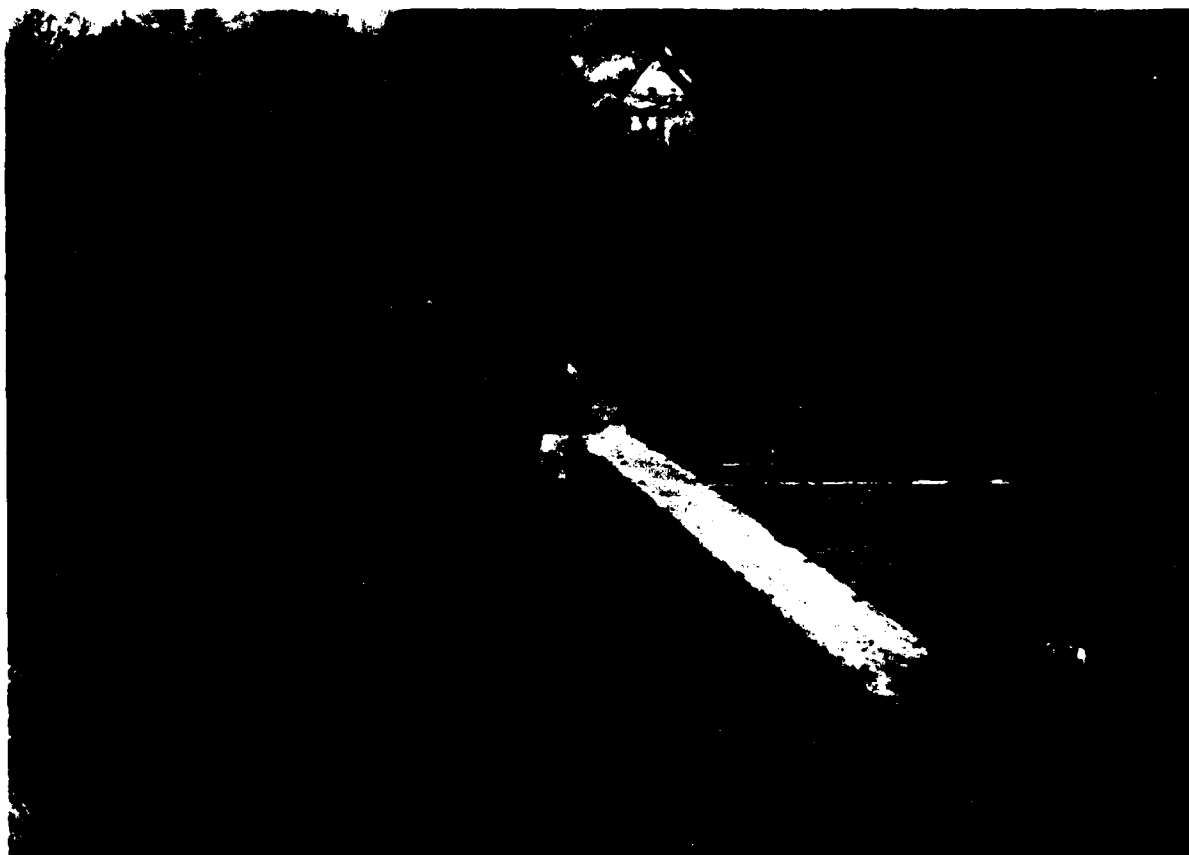
Approved by:


Col. W.M. Smith, Jr.
New York District Engineer

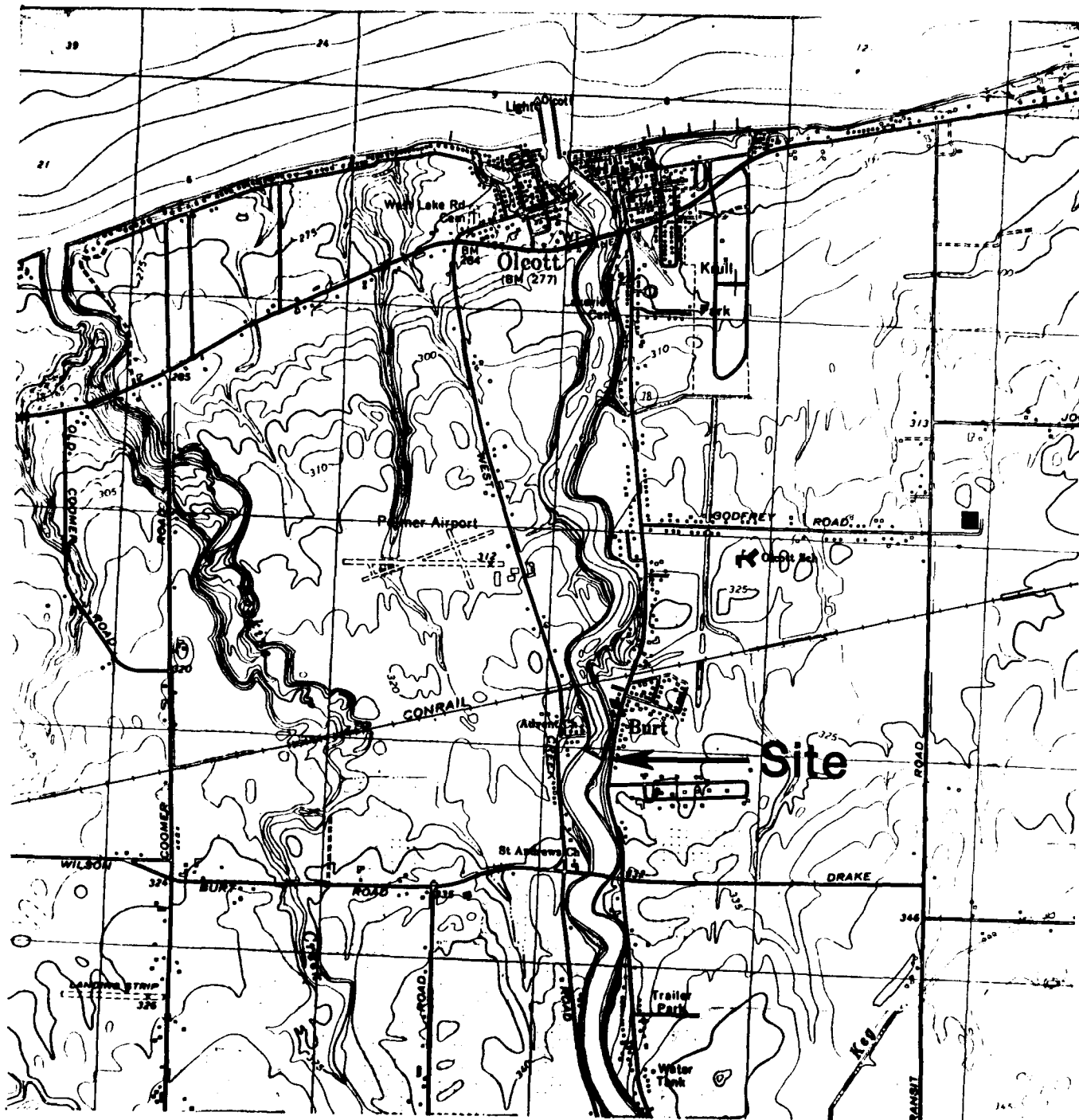
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Burt Dam



OVERVIEW



Burt Dam

LOCATION PLAN

Scale: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BURT DAM
I.D. NO. NY 745
D.E.C. NO.15C-272
LAKE ONTARIO BASIN
NIAGARA COUNTY, NEW YORK

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF THE PROJECT

a. Description of Dam and Appurtenances

Burt Dam is an unreinforced concrete gravity dam with an ogee spillway located near the west abutment. It is approximately 328 ft. long and has a maximum height of 54.5 ft. The crest width of the dam is 5 ft. The upstream face of the dam is vertical. The downstream face is vertical for the top 7.5 ft. below which the face slopes at approximately 1 ft. vertical to .77 ft. horizontal.

The principal ogee spillway is 75 ft. wide and 7.5 ft. deep. The reservoir drain consists of a 6 ft. conduit running through the east end of the spillway section. It is operated by a vertical lift sluice gate with a gate hoist positioned on the walkway above the spillway.

The dam contains three penstocks. According to the design calculations two measure 9 ft. by 14 ft. while the third is 11 ft. by 18 ft. The penstocks, located near the center of the dam, at one time carried flow to the turbines in the powerhouse on the downstream face of the dam. The flow into the penstocks was controlled by two vertical lift sluice gates per penstock.

b. Location

The dam is located on Eighteenmile Creek approximately 0.2 miles south of Burt, New York. The dam is approximately 1.5 miles south of the intersection of N.Y.S. Route 18 and 78.

c. Size Classification

The dam is 54.5 ft. high and the reservoir has a storage capacity of 2447 acre-ft. The dam is classified as "INTERMEDIATE" in size (40 to 100 ft. in height).

d. Hazard Classification

The hazard classification for this dam is HIGH because of the potential for loss of life and property 2.0 miles downstream in the event of dam failure.

e. Ownership

Burt Dam is owned by the Olcott Harbor Board of Trade, a local association of businessmen. No address or telephone is listed for this organization. An application for converting the dam to power generation is pending with the Federal Energy Regulatory Commission by:

J. W. Company
Jeffery Moon, President
55 Union Place
Manchester, Connecticut 06040
Tele: (207) 775-5401

f. Purpose of Dam

Burt Dam was originally constructed for hydroelectric power generation. It presently serves no useful purpose.

g. Design and Construction History

The dam was designed and constructed by McCarthy Brothers and Ford of Buffalo, New York in 1924. The original owner was Lockport and Newfane Power and Water Supply Co.; it was later sold to Niagara Mohawk Power Co. "As-built" dam drawings were obtained from the New York State Department of Environmental Conservation, Albany, New York.

h. Normal Operating Procedure

No regular procedure of operating the sluice gates at the dam presently exists. Normal flows pass over the ogee spillway.

1.3 PERTINENT DATA

a.	<u>Drainage Area</u>	77.4 sq. miles
b.	<u>Discharge at Damsite</u>	
	Maximum known flood at Damsite	Unknown
	Recent maximum discharge (from high water mark)	1867 cfs
	Principal Spillway	
	Maximum Pool	6116 cfs
	Total Spillway Capacity at Maximum Pool Elevation	6116 cfs
c.	<u>Elevation (U.S.G.S. Datum)</u>	
	Top of Dam	304.5 ft.
	Maximum Pool	304.5 ft.
	Normal Pool	297.0 ft.
	Principal Spillway Crest	297.0 ft.
d.	<u>Reservoir</u>	
	Length of Normal Pool	1050 ft.
	Length of Maximum Pool	1300 ft.
e.	<u>Storage</u>	
	Normal Pool	1488 acre-ft.
	Maximum Pool	2447 acre-ft.
f.	<u>Reservoir Surface</u>	
	Normal Pool	95 acres
	Maximum Pool	149 acres
g.	<u>Dam</u>	
	Type	Concrete Gravity
	Length	328 [±] ft.
	Maximum Height	54.5 [±] ft.
	Top Width	5 ft.
	Side Slopes (V:H)	
	Upstream	Vertical
	Downstream	Vertical to 1V:0.77H
h.	<u>Reservoir Drain</u>	
	Type	Conduit
	Dimensions	6 ft. x 6 ft.
	Closure	Vertical lift sluice gate
	Invert Elevation	252 ft.
i.	<u>Principal Spillway</u>	
	Type	Concrete Ogee
	Base Width	75 ft.
	Height	7.5 ft.
	Side Slopes	Vertical
	Location	Near west abutment

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

The stratigraphy in northern Niagara County consists of relatively undeformed flat-lying sedimentary rocks of upper Ordovician age (450-425 million years ago). The bedrock formation is red bedded, massive shales with some interbedded siltstones and silty dolomites of the Queenston Shale Formation. The shale rock is generally moderately soft, and tends to break down rapidly upon exposure. The siltstones and silty dolomites are generally moderately hard and tend to resist weathering. The rock forms a homocline which dips southward to southwestward at approximately 40 feet per mile. Only minor folding and faulting are found in the region with no major or active faults known to exist in the area.

The Village of Olcott and the Burt Dam are in a region classified as Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams.

Glaciations of the area was extensive. During the glacial period (Pleistocene Epoch), spanning about 1.5 million years, the area was over-ridden many times by a thick continental ice sheet moving southward over the region, from Quebec and Ontario, eroding the rock and changing drainage patterns. Soil deposits left by the glacier include lake silt, sand and clayey silts deposited as off-shore deposits of primitive lakes of the Lake Iroquois stage in the Ontario basin.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigations could be located for the dam.

2.3 DESIGN RECORDS

The records available for the project consist of 4 contract drawings which show plans, sections and details of the dam and powerhouse, the original "application for Construction of a Dam", and several sheets of correspondence, some of which discuss the selected design discharge.

2.4 CONSTRUCTION RECORDS

The only construction records available consist of correspondence between the dam's designer and various public agencies.

2.5 OPERATION RECORD

An effort to locate the operation record was unsuccessful.

2.6 EVALUATION OF DATA

The information presented was obtained primarily from NYSDEC files and appears adequate and reliable for Phase I inspection and evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

A visual inspection of Burt Dam was made on May 19, 1981. The weather was sunny, and the temperature was in the mid-seventies. The reservoir level at the time of the inspection was at elevation 297.5 MSL, 6 in. above the spillway crest.

b. Foundation

Foundation rock is generally competent and lightly weathered from the left abutment downstream. There is a horizontal clay seam (1/4 in. to 1/2 in. thick) approximately 6 ft. above the tailwater surface. Water exits this seam as a minor weep of approximately 2 GPM for its entire length. Scree covers the slope at the right abutment. Downstream of the dam (150 ft. to 200 ft.) is an outcrop of red, thin to medium bedded shale, which is moderately weathered. Slaking shale has been deposited downslope.

c. Dam

The dam is generally in good condition. However, several deficiencies and areas of deterioration were noted. These include:

1. Significant areas of eroded and spalled concrete were observed along the entire crest of the dam, as well as along both spillway sidewalls. In addition, cracks, significant spalls and effervescent stains were observed on the downstream face of the dam; although it was completely dry at the time of the inspection.
2. The gate hoist controlling the reservoir drain sluice gate is inoperative. The electric motor has been removed, and the electrical wiring has been disconnected and abandoned.
3. The wood stairs at the east abutment are seriously deteriorated.
4. Water seepage was observed along the west side of the west spillway sidewall.
5. Trees and vegetation were observed at both abutments and atop the downstream face of the dam.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the inspection did not indicate any serious problems which would adversely affect the adequacy of the dam. The following is a summary of the problem areas encountered, in order of importance, with the appropriate recommended action:

1. The missing floor grating on the bridge across the spillway should be replaced. The entire bridge should be painted.
2. Handrails should be installed the full length of the dam crest.
3. The stairs at the east abutment should be repaired or replaced.
4. The gate hoist controlling the reservoir drain sluice gate should be made operational. The gate should be exercised and lubricated annually.
5. The reservoir should be lowered below the spillway crest so that the spillway and downstream toe of the dam can be inspected.
6. Fencing should be installed at the east abutment and warning signs posted at both abutments to discourage trespassers.
7. The concrete cracks and spalls should be monitored.
8. Some debris has collected near the crest of the principal spillway. This debris should be removed on an annual basis.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

No written operation and maintenance procedures exist for the project. The normal operation of the project consists of allowing water to flow over the spillway section of the dam. It appears that the reservoir drain has not been used in many years.

4.2 MAINTENANCE OF DAM

The dam's owner, the Olcott Harbor Board of Trade, practices a policy of deferred maintenance.

4.3 WARNING SYSTEM IN EFFECT

No warning system is in effect or in preparation.

4.4 EVALUATION

The dam and appurtenances have not been maintained in satisfactory condition as noted in "Section 3: Visual Inspection".

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Burt Dam is located on Eighteenmile Creek in the Lake Ontario basin, and has a drainage area of 77.4 square miles. The dam is situated approximately 1200 ft. south of Burt, New York in the Town of Newfane. The topography of the watershed is gently northward sloping farmlands, with orchards and woodland.

5.2 DESIGN DATA

Burt Dam was constructed for the purpose of hydroelectric power generation, although power is not currently being generated. According to the application for construction of the dam, dated April 24, 1924, the design flow for the dam was 5,940 cfs (144 cfs/acre). This figure was computed by assuming a peak flow of 64 cfs/sq. mi. over an 85 square mile drainage basin plus 500 cfs overflow from the New York State Barge Canal. The combined discharges from the spillway, penstocks, and sluice gate of 5953 cfs produces a design high water of 302.0 ft. (MSL). The ogee spillway control cross section is 75 ft. wide with a crest elevation of 297.0 ft. (MSL). The dam crest elevation is 304.5 ft. (MSL).

5.3 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and the storage of the reservoir was performed using the Corps of Engineers HEC-1 Dam Safety Version computer model. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method. The drainage area for Burt Dam was divided into three smaller drainage areas: Eighteenmile Creek, East Branch Eighteenmile Creek, and the West Branch Eighteenmile Creek; and routed downstream by means of the Muskingum routing procedure. The three penstocks and the reservoir drain gate are inoperable and were excluded as factors in the hydraulic analysis as were the tailwater effects of Lake Ontario. The Probable Maximum Precipitation (PMP) was 21.8 in. (24 hours 200 sq. miles) from Hydrometeorological Report #33 in accordance with the Recommended Guidelines of the Corps of Engineers. The dam is 54.5 ft. high and impounds approximately 2447 acre-ft. at the top of the dam. The dam is classified as a HIGH hazard and INTERMEDIATE in size, according to the Recommended Guidelines of the Corps of Engineers. The spillway design flood is the Probable Maximum Flood (PMF). The floods selected for analysis were 20, 40, 50, 60, 80 and 100% of the PMF flows. The PMF inflow of 65,495 cfs was routed through the reservoir and the peak outflow was determined to be 65,687 cfs. The peak PMF elevation is 316.8 ft. (MSL) or 12.3 ft. above the top of dam. The maximum elevation for one half the PMF is 311.7 ft. (MSL) or 7.2 ft. above the top of the dam. The inflow and outflow for one half the PMF are 32,748 cfs and 32,785 cfs, respectively.

5.4 RESERVOIR CAPACITY

The reservoir capacities at the crest of the spillway and at the top of the dam are 1488 acre-ft. and 2447 acre-ft., respectively. Surcharge storage between the spillway crest and the top of the dam is equivalent to 0.23 in. of runoff from the drainage area.

5.5 EXPERIENCE DATA

There are no flood records for the dam site. However, during the field investigation evidence of recent high water was observed at elevation 300.4 ft. (MSL). This reservoir elevation corresponds to a peak outflow of 1867 cfs.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 6116 cfs which is less than the PMF peak outflow of 65,687 cfs. The dam is overtopped by the PMF, the peak elevation being 12.3 ft. above the top of the dam. The dam is also overtopped by half the PMF, the peak elevation being 7.2 ft. above the top of the dam. The dam will be overtopped by floods greater than 10% of the PMF.

5.7 ANALYSIS OF DOWNSTREAM IMPACTS

During the field investigation, dwellings and highways located downstream of the dam were identified and referenced to the channel invert. The cross section locations used in the downstream channel routing are shown on Page D-2, Appendix D. The impacts of the PMF on dwellings located downstream of the dam are shown in Table 5.1. For the purposes of this analysis, a danger of loss of life was assumed to exist if the computed PMF water surface was above the first floor elevation of a structure. This situation occurs at a substantial number of structures (Locations 7 & 8) as well as some small roads being overtopped at Location 8. The potential danger of loss of life and economic damage is substantial enough to warrant classification as a HIGH hazard dam.

5.8 EVALUATION

The spillway of Burt Dam will safely pass only 10% of the PMF without overtopping. The spillway, therefore, is assessed as inadequate.

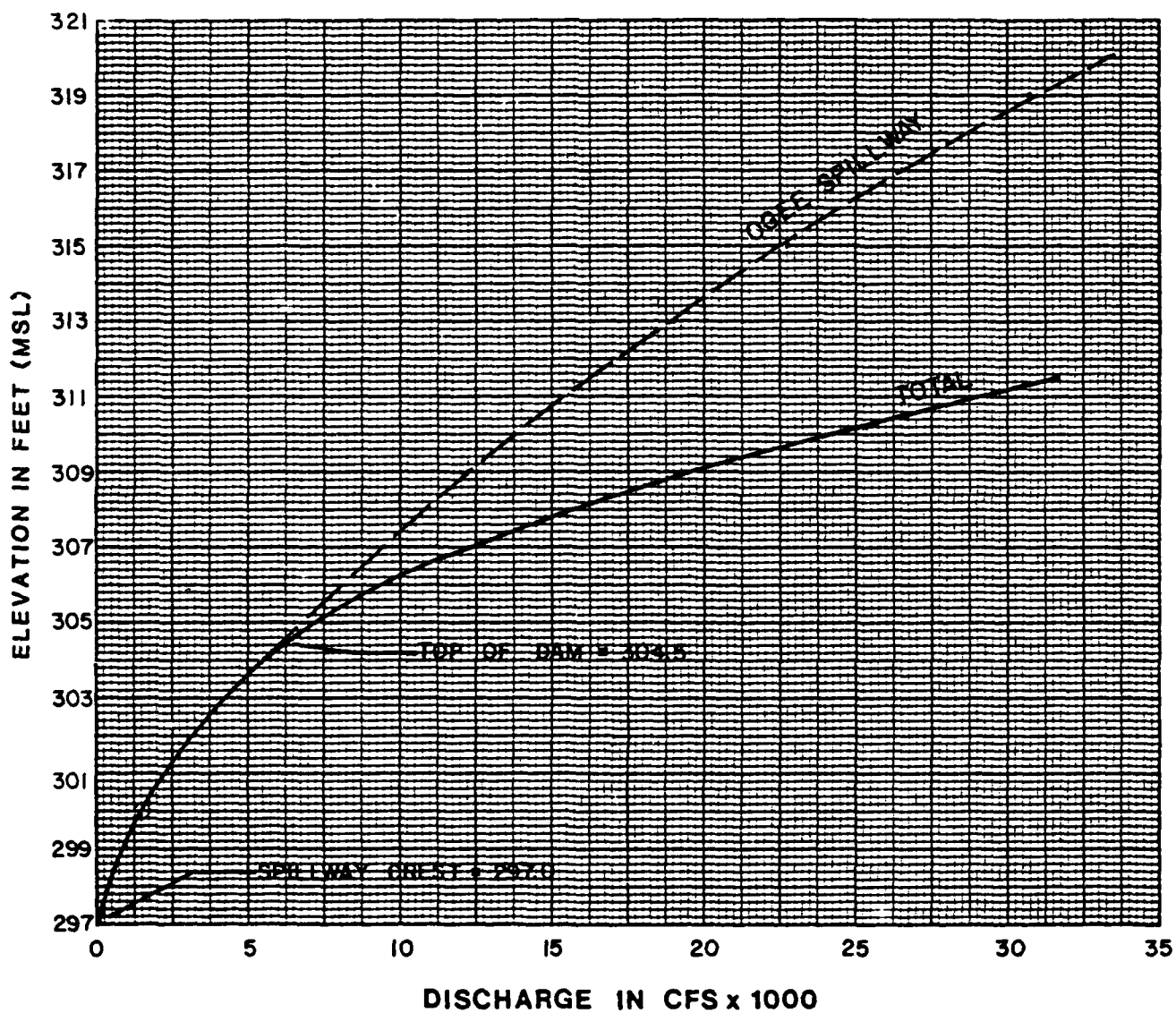
ETL 1110-2-234, Section 5, gives the basis for determining whether or not a spillway should be classified as seriously inadequate. The results of this investigation indicates that there would not be a significant increase in the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. This is illustrated by the elevation - discharge relationship shown in Figure 5.1. The increase in flow above elevation 304.5 ft. (MSL) does not appear to be significant, therefore the spillway is assessed as inadequate. Potential problems include:

- a) The danger of loss of life and economic damage in the harbor area (Locations 7 & 8) downstream of the dam for floods in the 1/2 PMF to PMF range.

TABLE 5.1
SUMMARY OF DOWNSTREAM IMPACTS FOR PMF

<u>Location #</u> (See pg. D-2, Appendix D)	<u>Location</u>	<u># of Dwellings</u>	<u>Structure Height Above Streambed (ft)</u>	<u>Peak Flow (cfs)</u>	<u>Peak (2) Stage (ft)</u>	<u>Comments</u>
-	At Dam	-	-	65,687	-	-
1	500' d/s of dam	-	-	65,662	34.7	-
2	800' d/s of Loc. 1	-	-	65,647	36.5	-
3	1300' d/s of Loc. 2	-	-	65,609	19.2	-
4	1100' d/s of Loc. 3	-	-	65,605	18.6	-
5	1800' d/s of Loc. 4	-	-	65,582	16.6	-
6	1700' d/s of Loc. 5	-	-	65,604	17.7	-
7	1600' d/s of Loc. 6 500' d/s of Loc. 7 " " "	1 boathouse 1 boathouse 1 house 1 house 1 house	11.5 13.0 17.6 14.3 15.7	65,612 65,612 65,612 65,612 65,612	16.4 15.2 15.2 15.2 15.2	Danger of loss of life
8	1400' d/s of Loc. 7	50 houses 1 yacht club 1 boat co. 1 commercial	13.4 14.4 14.9 15.1	65,622 65,622 65,622 65,622	14.0 14.0 14.0 14.0	Danger of loss of life Roads on the west side @ Loc 8 will be overtopped.

Notes: (1) Structure height above streambed is the difference in elevation of dwelling's 1st floor & channel invert.
(2) Tailwater effects of Lake Ontario were not considered in the analysis



BURT DAM (N.Y. 745)

RATING CURVE

PHASE I DAM INSPECTION REPORT

DATE: JULY, 1981

FIGURE 5.1

SECTION 6 - STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

Visual observations did not detect any settlement, displacement, tilting or distress of the dam or appurtenant structures with the reservoir at its present level. There are no adverse conditions which would affect the stability of the dam at the present time.

6.2 DESIGN AND CONSTRUCTION DATA

No information could be located regarding the structural stability of the dam.

6.3 OPERATING RECORD

No operating records could be located for the structure. The sluice gate for draining the reservoir cannot be operated in its present condition.

6.4 POST-CONSTRUCTION CHANGES

There have been no post-construction changes to the dam. However, two of the three turbines have been removed, and the powerhouse has been abandoned.

6.5 SEISMIC STABILITY

The dam is located in Seismic Zone 3 and, in accordance with the recommended Phase I guidelines, a seismic stability analysis is warranted. This should be accomplished by a qualified registered professional engineer and should be made a part of the record for this dam.

6.6 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted for the typical dam cross section. The results of the analysis are as follows:

<u>Case</u>	<u>Description of Loading Conditions</u>
1	Normal Operating Conditions, reservoir at elevation 297.0 MSL, full uplift, no tailwater.
2	Same as Case 1 plus 10 kips/L.F. ice load.
3	Water at 1/2 PMF elevation 311.53 MSL, uplift as in case 1, tailwater at elevation 280.7 MSL

<u>Case</u>	<u>Factor of Safety Overturning</u>	<u>Location of Resultant From Toe</u>	<u>Factor of Safety Sliding</u>
1	1.54	13.8	1.08
2	1.33	9.82	.96
3	.95	-3.10	.62

The location of the middle third of the dam foundation is 13.67 ft. to 27.33 ft. from the toe. A factor of safety of 1.5 for overturning, a resultant location within the middle third of the foundation, and a factor of safety of 3.0 for sliding is considered to be adequate by the Corps of Engineers guidelines. Therefore, it is recommended that an in-depth investigation of the structural stability of the dam be conducted. That investigation should include the following items:

1. The reservoir level should be lowered below the spillway crest elevation to permit an inspection of the ogee spillway and the rock at the toe of the dam.
2. The actual magnitude and distribution of hydrostatic uplift pressures under the dam should be determined by installing and monitoring piezometers.
3. Core samples of the dam and foundation rock should be taken to determine in-situ material properties.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of the Burt Dam did not reveal conditions which constitute an immediate hazard to the human life and property of the downstream residents.

From the available data the total spillway capacity is capable of discharging 10% of the PMF before overtopping of the dam occurs. This spillway is, therefore, judged to be inadequate.

The structural stability analysis performed as part of this investigation indicates the dam has safety factors against overturning and sliding below those recommended by the Corps of Engineers Guidelines.

b. Adequacy of Information

The information reviewed for this Phase I inspection is considered adequate.

c. Need for Additional Investigation

The following investigation is required to be performed by a qualified registered professional engineer:

1. Investigate the normal and seismic stability of the dam and spillway.

d. Urgency

All recommended investigations should be completed within 12 months of notification to owner, and remedial actions resulting from these investigations completed in the subsequent 12 months. The remedial measures or actions listed below should be completed within one year from notification to owner.

7.2 RECOMMENDED REMEDIAL MEASURES

1. Implement those remedial measures or actions resulting from the aforementioned investigation.
2. Replace the missing floor grating on the bridge across the spillway.
3. Paint the bridge across the spillway.

4. Install handrails the full length of the dam crest.
5. Repair the gate hoist controlling the reservoir drain gate.
6. Install fencing at the east abutment and post warning signs at both abutments to discourage trespassers.
7. Clear debris and vegetation from areas atop the downstream face of dam and from both abutments.
8. Implement a program of diligent and periodic maintenance including but not limited to: operation and lubrication of the reservoir drain, patching spalled and eroded concrete areas, and clearing debris and trash from trash racks and from upstream slopes.
9. Develop a formal written downstream warning system to alert the appropriate officials and residents in the event of an emergency.
10. Develop and maintain a program of biannual technical inspections.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Burt Dam
Fed. I.D. # 745 DEC Dam No. 15C-272
River Basin Lake Ontario
Location: Town Burt County Niagara
Stream Name Eighteenmile Creek
Tributary of _____
Latitude (N) 43° 18.8' Longitude (W) 78° 43.0'
Type of Dam Concrete Gravity
Hazard Category High
Date(s) of Inspection May 19, 1981
Weather Conditions Sunny, 70°
Reservoir Level at Time of Inspection Elevation 297.5, 6 in. on spillway

b. Inspection Personnel Jim Reynolds, Ray Kampff, Jeff Hardin, Ken Avery,
Bob Farrell, Rick Brown

c. Persons Contacted (including Address & Phone No.) Attempted unsuccessfully
to contact Olcott Harbor Board of Trade

d. History:
Date Constructed 1924 Date(s) Reconstructed _____
Designer McCarthy Brothers and Company
Constructed by Same as Designer
Owner Olcott Harbor Board of Trade

7) Embankment Not applicable

a. Characteristics

- (1) Embankment Material _____

- (2) Cutoff Type _____

- (3) Impervious Core _____

- (4) Internal Drainage System _____

- (5) Miscellaneous _____

b. Crest

- (1) Vertical Alignment _____

- (2) Horizontal Alignment _____

- (3) Surface Cracks _____

- (4) Miscellaneous _____

c. Upstream Slope

- (1) Slope (Estimate) (V:H) _____
- (2) Undesirable Growth or Debris, Animal Burrows _____

- (3) Sloughing, Subsidence or Depressions _____

(4) Slope Protection _____

(5) Surface Cracks or Movement at Toe _____

d. Downstream Slope

(1) Slope (Estimate - V:H) _____

(2) Undesirable Growth or Debris, Animal Burrows _____

(3) Sloughing, Subsidence, or Depressions _____

(4) Surface Cracks or Movement at Toe _____

(5) Seepage _____

(6) External Drainage System (Ditches, Trenches, Blanket) _____

(7) Condition Around Outlet Structure _____

(8) Seepage Beyond Toe _____

e. Abutments - Embankment Contact

(1) Erosion at Contact _____

(2) Seepage Along Contact _____

4) Drainage System

(a) Description of System None noted

(b) Condition of System _____

(c) Discharge from Drainage System _____

5) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, etc.) None noted

5) Reservoir

a. Slopes Generally good condition

b. Sedimentation Could not be observed

c. Unusual Conditions Which Affect Dam None

6) Area Downstream of Dam

a. Downstream Hazard (No. of homes, highways, etc) Many structures in Olcott, See Table 5.1 for Summary of Downstream Impacts.

b. Seepage, unusual growth Many trees in and along channel

c. Evidence of movement beyond toe of Dam None noted

d. Conditions of Downstream Channel Rock strewn, stable

7) Spillway(s) (including Discharge Conveyance Channel)

Spillway could not be inspected because of flow over it

a. General Side walls are spalled

b. Condition of Service Spillway Good based on what could be seen

c. Condition of Auxiliary Spillway Not applicable

d. Condition of Discharge Conveyance Channel

Reservoir Drain/Outlet

Type: Pipe _____ Conduit _____ Other 6' x 6' penetration thru spillway

Material: Concrete _____ Metal _____ Other _____

Size: 6' x 6' Length Approx 40'

Invert Elevations: Entrance 252 ft. Exit 252 ft.

Physical Condition (Describe): _____ Unobservable X

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate X Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable X Other _____

Present Condition (Describe): _____

9, Structural

- a. Concrete Surfaces Spalling significant on crest, spillway sidewalls and downstream face
- b. Structural Cracking Minor
- c. Movement - Horizontal & Vertical Alignment (Settlement) None observed
- d. Junctions with Abutments or Embankments Could not inspect
- e. Drains - Foundation, Joint, Face None
- f. Water Passages, Conduits, Sluices Could not inspect reservoir drain water passage
- g. Seepage or Leakage Seepage observed along west side of west spillway side wall.
May be ground water.
- h. Joints - Construction, etc. Effervescence observed along same construction joints.
No leakage.
- i. Foundation On rock. Could not inspect near dam due to high water.
- j. Abutments Covered with earth, trees and vegetation
- k. Control Gates Inoperative
- l. Approach & Outlet Channels Not applicable

m. Energy Dissipators (Plunge Pool, etc) None

n. Intake Structures Not applicable

o. Stability Good. No problems observed

p. Miscellaneous

10) Appurtenant Structures (Power House, Lock, Gatchouse, Other)

a. Description and Condition Power House abandoned but in good condition

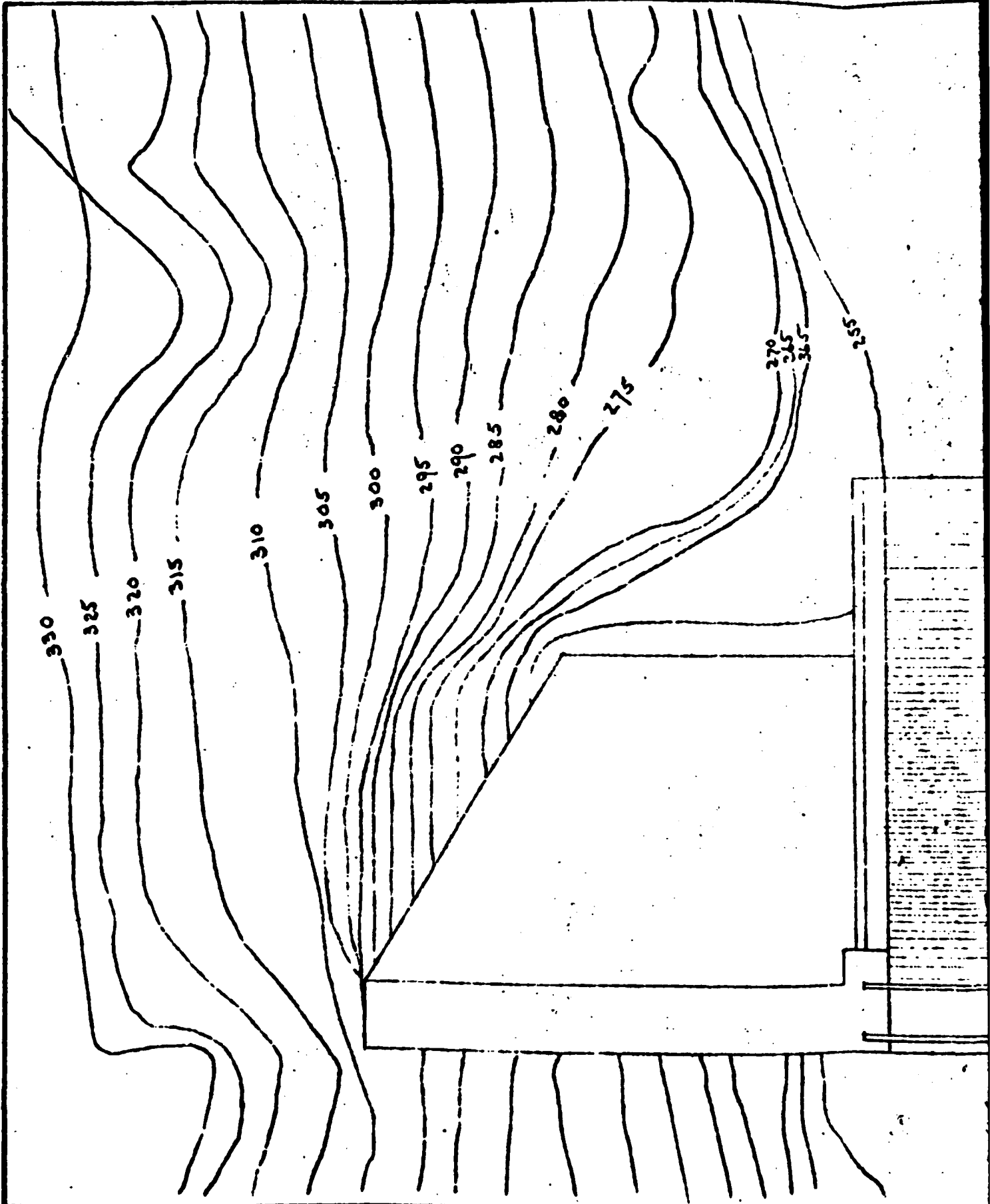
APPENDIX B

ENGINEERING DATA

APPENDIX B

<u>TITLE</u>	<u>PAGE</u>
Plot Plan	B-2
Dam Section, Upstream Elevation & Spillway Section	B-3

B-1



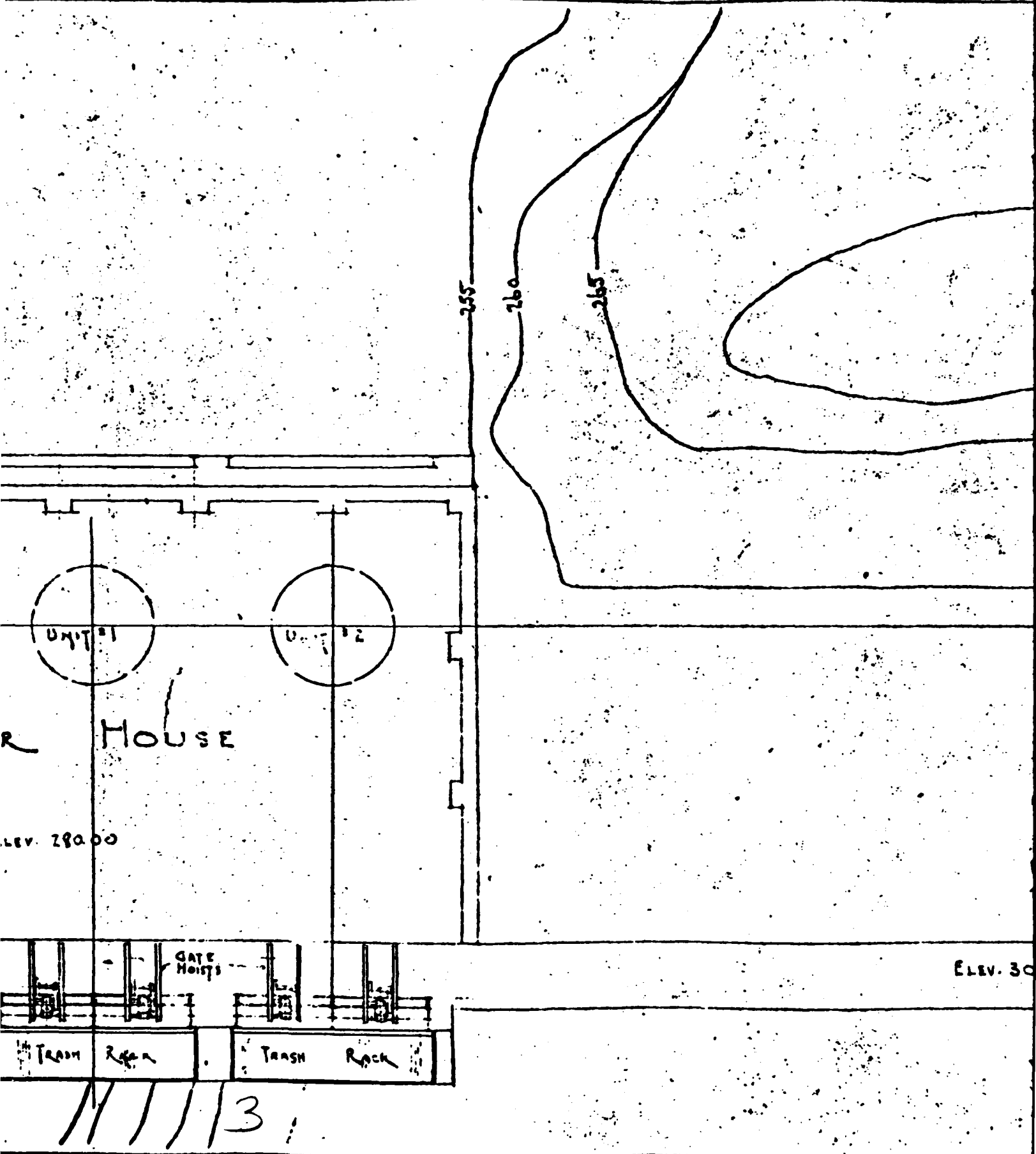
SPIELWAY

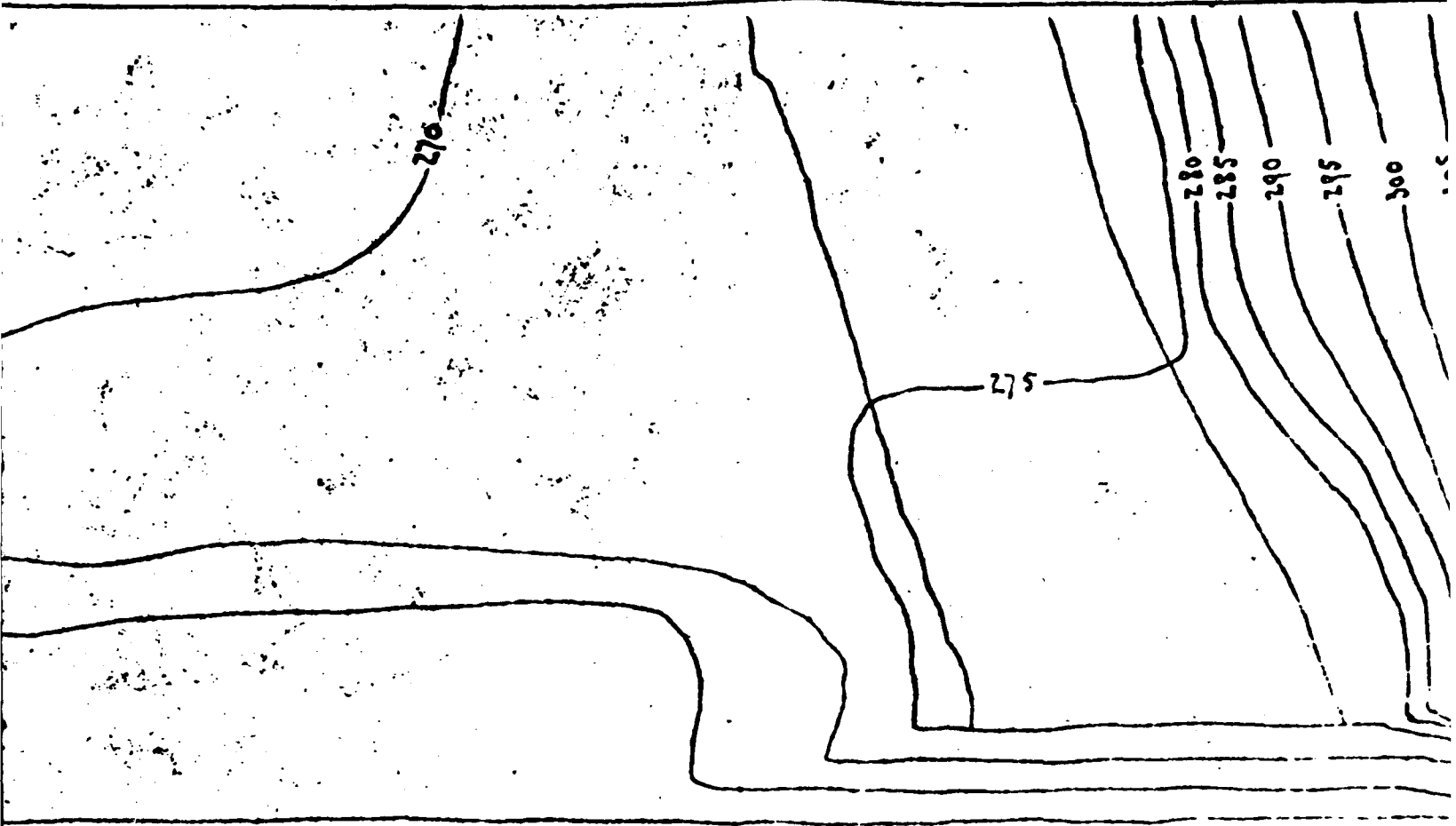
POWER

FLOOR ELEV

GATE MOI

2

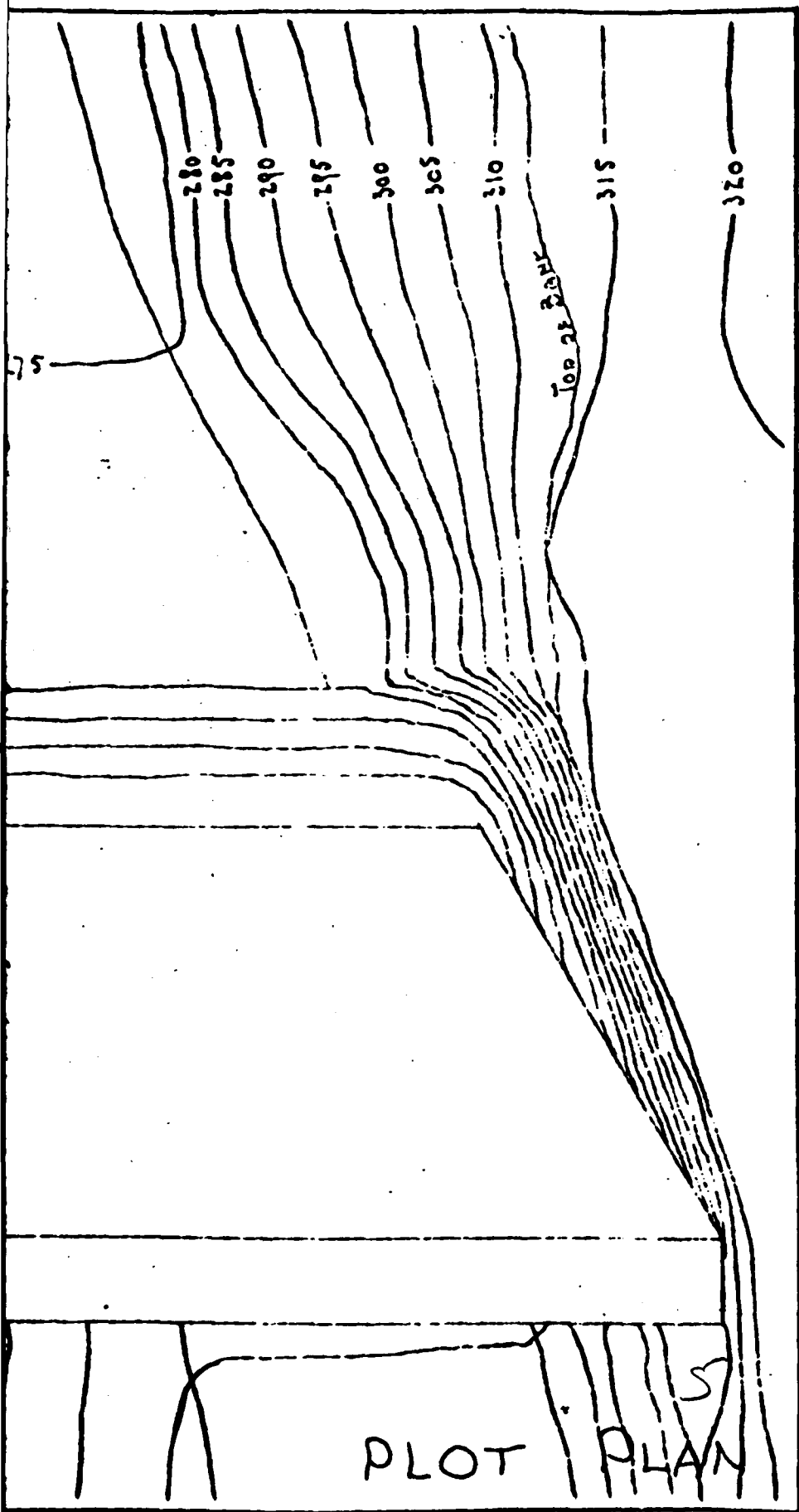




ELEV. 304.5

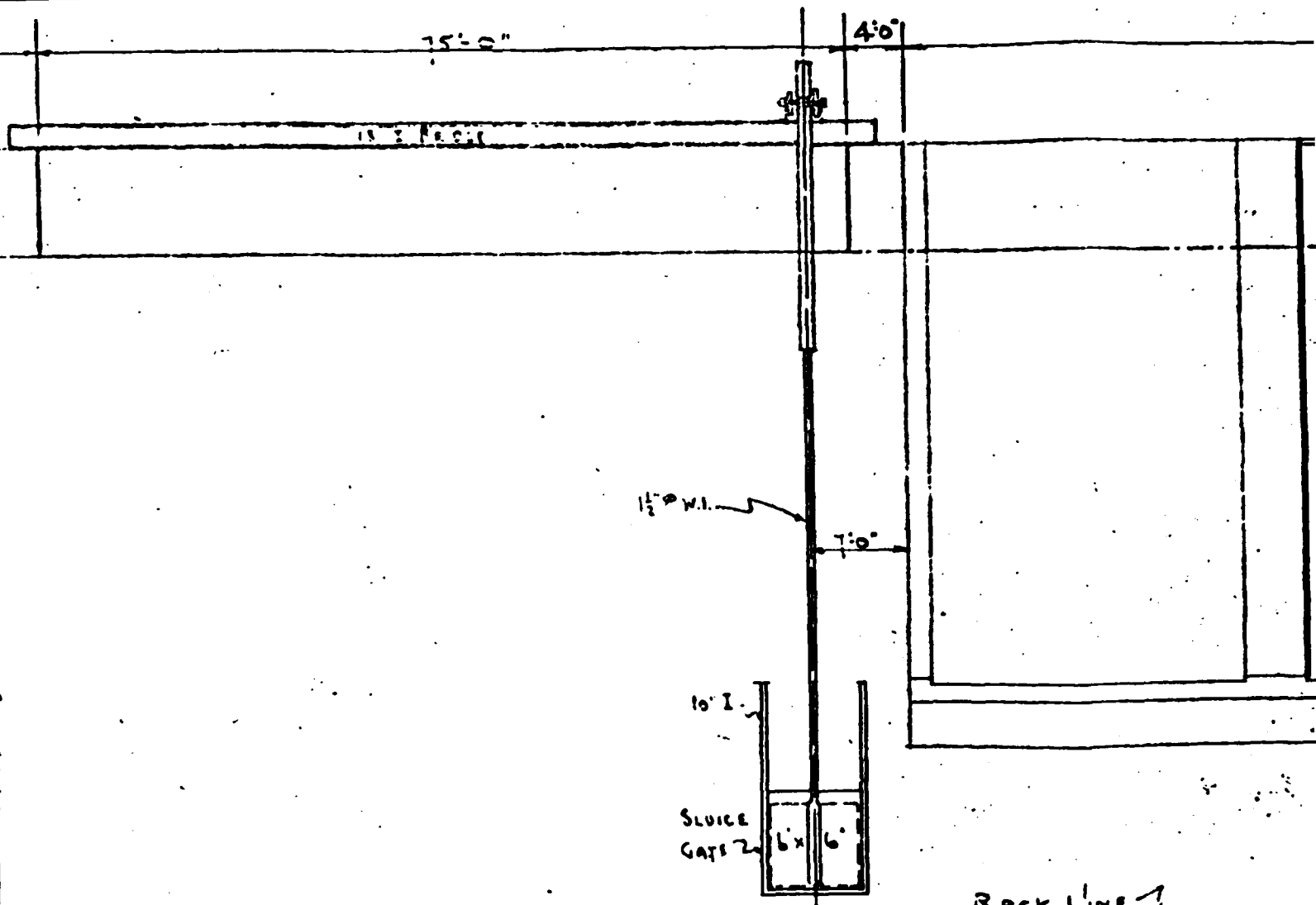
4

PL





SPILLWAY SECTION



2

UPSTREA

324:0'

68.0'

ELEV. 304.5

NORMAL WATER LEVEL ELEV. 297.00

GATE

GATE

PREPARED BY E. W. 7

3

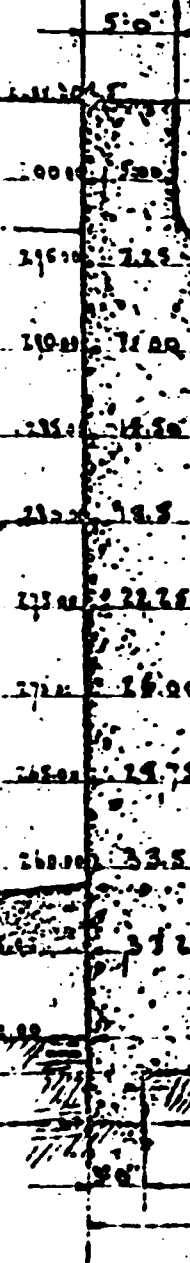
STREAM ELEVATION

131'-0"

NOTE

EXCAVATION TO BE CARRIED DOWN
TO SOUND ROCK, AND INTO BANKS TO
SOUND ROCK AS DIRECTED

59'-6"



DAM SECTION

CARRIED DOWN
INTO BANKS TO
LTD

REVISED 5-2-24 A-304-14
REVISED 4-15-24 A-304-8
REVISED 4-15-24 A-304-6
REVISED 4-15-24 A-304-4
REVISED 3-15-24 A-304-2
REVISED 4-15-24 A-304-1

PROPOSAL No. 3556

CONTRACT No.

MCCARTHY BROS & FORD
BUFFALO N.Y.

PLAN OF DAM

HYDROELECTRIC POWER DEVELOPMENT
LOCKPORT & NEWFANE POWER & WATER SUPPLY CO.
MIDDLEPORT N.Y.

DATE APRIL 3 '23 SCALE N.T.S.

CHECKED

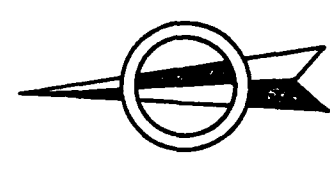
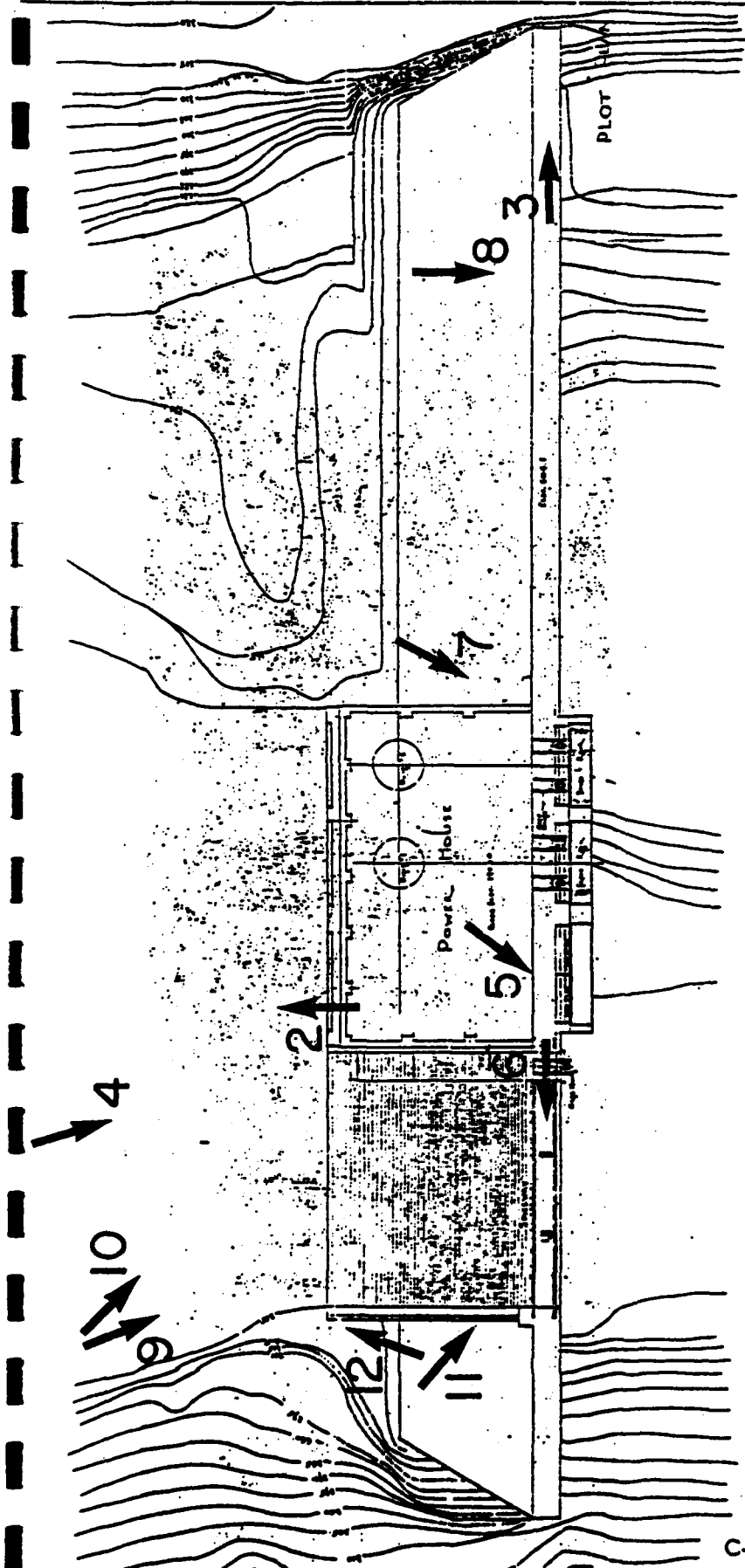
DRAWN

1332

E

APPENDIX C

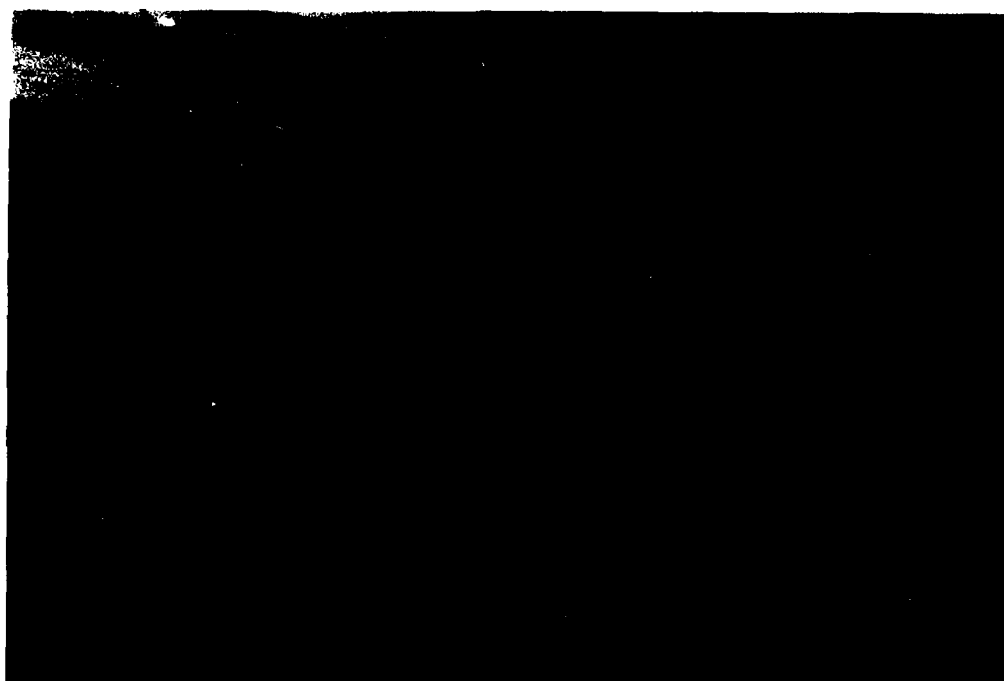
PHOTOGRAPHS



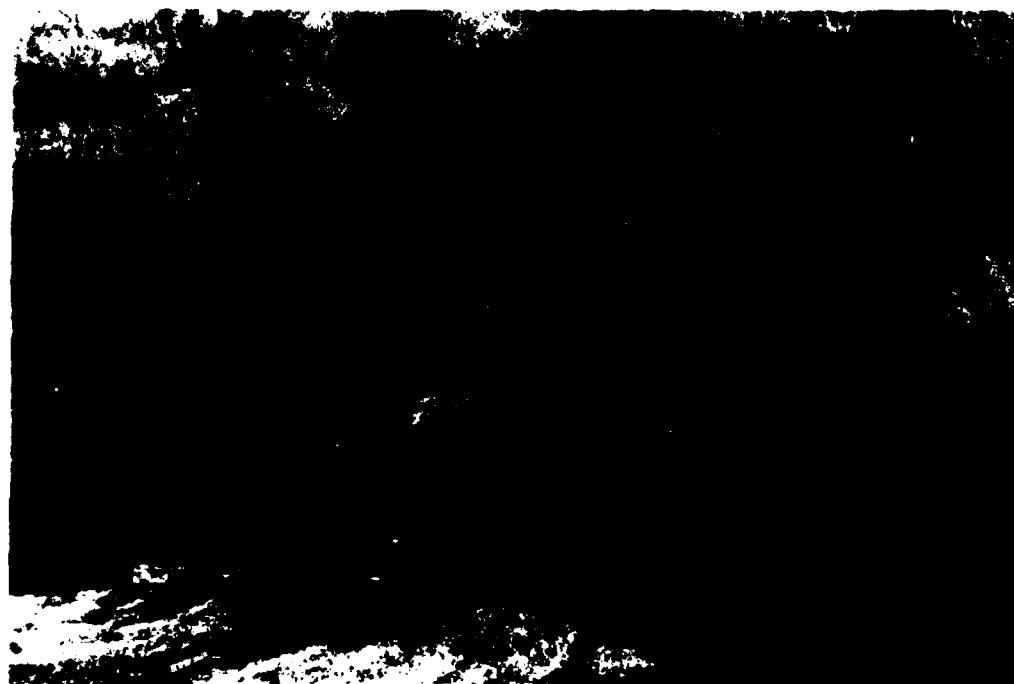
BURT DAM
NY00745

PHOTO ORIENTATION PLAN

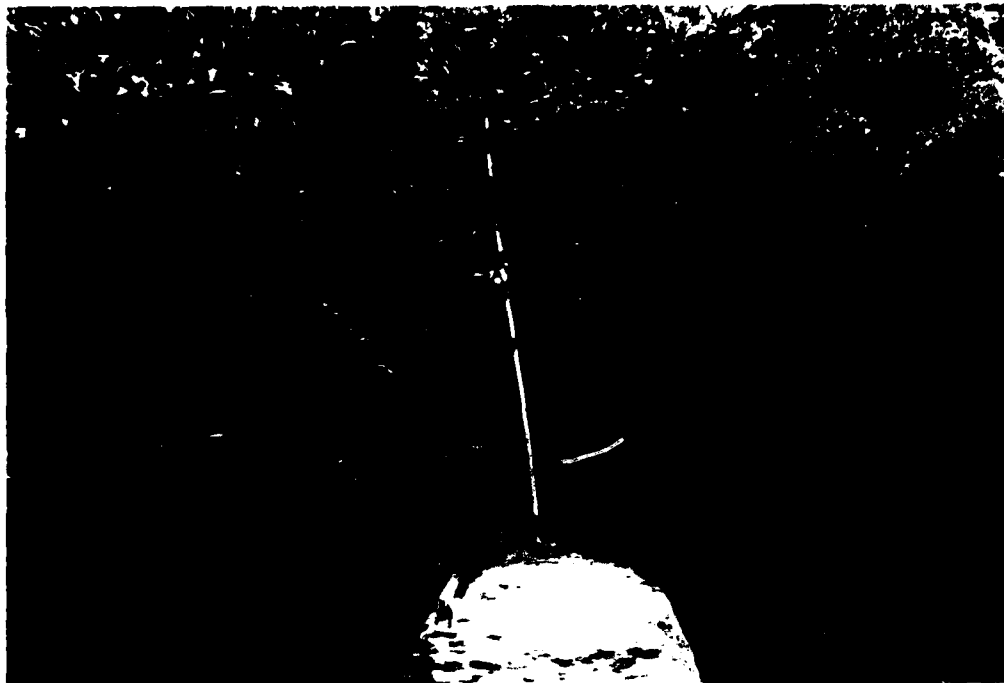
ENDMAN, ANTHONY, ASSOCIATES
CONSULTING ENGINEERS & PLANNERS
MAY 1961



1. Upstream impoundment



2. Downstream channel



3. Stairs at east abutment



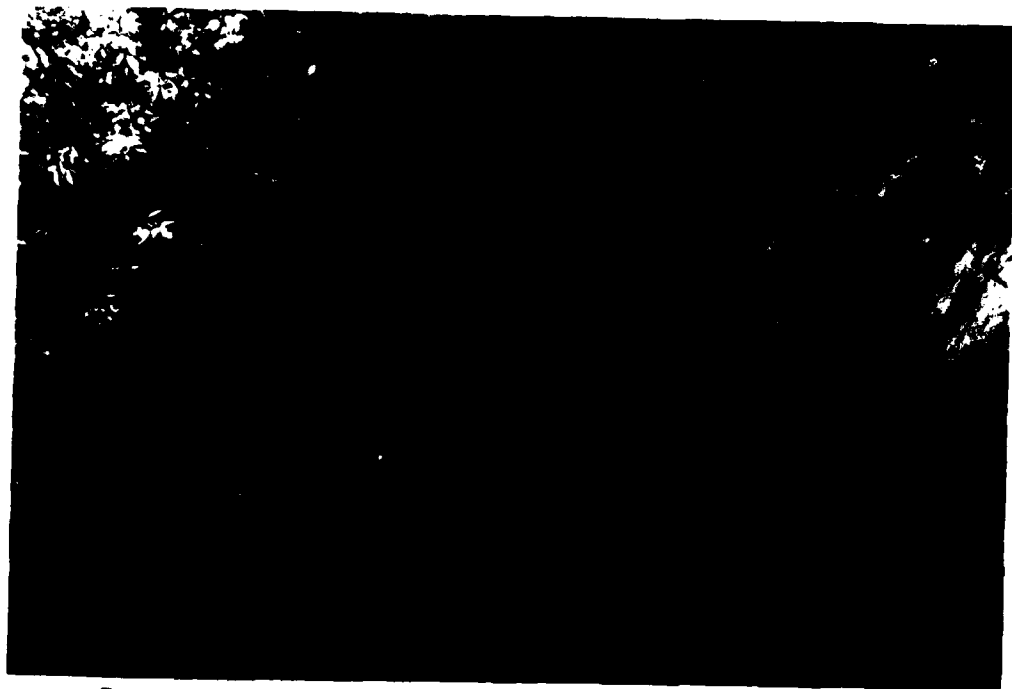
4. Abandoned powerhouse



5. Sluice gate mechanism for penstocks

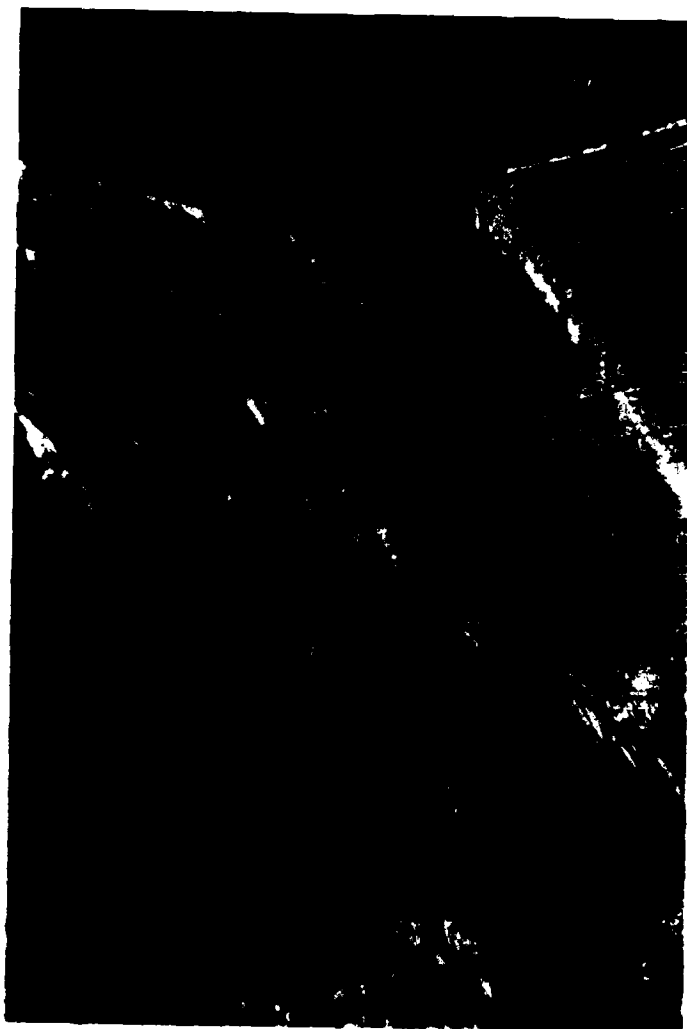


6. Bridge across spillway. Note missing grating.



7. Downstream face of dam near east abutment.
Note spalled concrete.

8. Downstream face of dam east
of abandoned powerhouse.
Note spalled concrete and
effervesce.

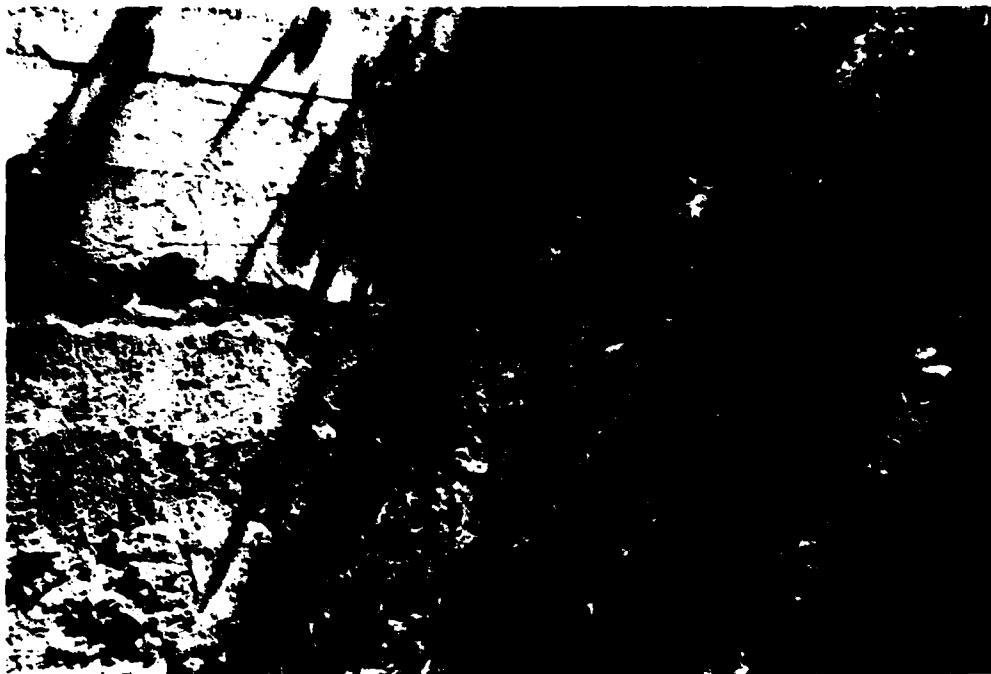




9. Spillway



10. Abandoned powerhouse



11. West face of west spillway wall. Note water trickling down face of dam.



12. West face of west spillway wall. Note spalled concrete.

APPENDIX D

HYDRAULIC AND HYDROLOGIC COMPUTATIONS

APPENDIX D

	<u>PAGE</u>
Cross Section Location Plan	D-2
HEC-1 Dam Safety Version Computer Program-Input	D-3
HEC-1 Dam Safety Version Computer Program-Output	D-5
Supporting Calculations	
• Hydrology	D-21
• Spillway Hydraulics	D-29
• Downstream Channel Routing	D-32
Checklist for Hydrologic and Hydraulic Engineering Data	D-34

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

B	180	1	0			0	-1	4
B1	5							
J	1	6	1					
J1	-2	-4	-5	-6	-8	1	0	0
K	1					0	1	0
K1								
M	1	39.22	77.4	0				1
P	0	21.8	91	181	112	125	1.	.1
T								0
V	9.29	.63						
V	2.	-.1	2.					
K	0	2						
K1								
M	1	20.						
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.31	0.63						
V	2.	-.1	2.					
K	2	A						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V	2.	-.1	2.					
K	2	E						
K1								
M	1	18.17	77.4	0				
P	0	21.8	91	181	112	125	1.	.1
T								0
V	5.64	0.63						
V								

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF

DAM NY 745

		1		2		3		4		5		6		7		8		9	
		CHANNEL ROUTING -MOD PULS REACH 1-2		CHANNEL ROUTING -MOD PULS REACH 2-3		CHANNEL ROUTING -MOD PULS REACH 3-4		CHANNEL ROUTING -MOD PULS REACH 4-5		CHANNEL ROUTING -MOD PULS REACH 5-6		CHANNEL ROUTING -MOD PULS REACH 6-7		CHANNEL ROUTING -MOD PULS REACH 7-8		CHANNEL ROUTING -MOD PULS REACH 8-9		CHANNEL ROUTING -MOD PULS REACH 9-10	
		1		1		1		1		1		1		1		1		1	
		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1	
		300		300		300		300		300		300		300		300		300	
		0.0022		0.0022		0.0022		0.0022		0.0022		0.0022		0.0022		0.0022		0.0022	
		400		400		400		400		400		400		400		400		400	
		300		300		300		300		300		300		300		300		300	
		401		401		401		401		401		401		401		401		401	
		300		300		300		300		300		300		300		300		300	
		510		510		510		510		510		510		510		510		510	
		251		251		251		251		251		251		251		251		251	
		249		249		249		249		249		249		249		249		249	
		520		520		520		520		520		520		520		520		520	
		245		245		245		245		245		245		245		245		245	
		505		505		505		505		505		505		505		505		505	
		241		241		241		241		241		241		241		241		241	
		550		550		550		550		550		550		550		550		550	
		238		238		238		238		238		238		238		238		238	
		1040		1040		1040		1040		1040		1040		1040		1040		1040	
		235		235		235		235		235		235		235		235		235	
		1800		1800		1800		1800		1800		1800		1800		1800		1800	
		250		250		250		250		250		250		250		250		250	

OK. SEG #HEC108

OK. SEG #HEC108
ENTER PROJECT NUMBER
88166-88-11
INPUT FILE 7 NY745
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

1
RUNOFF HYDROGRAPH AT 1
RUNOFF HYDROGRAPH AT 2
COMBINE 2 HYDROGRAPHS AT A
ROUTE HYDROGRAPH TO B
RUNOFF HYDROGRAPH AT 3
COMBINE 2 HYDROGRAPHS AT B
ROUTE HYDROGRAPH TO UTIFLOW
ROUTE HYDROGRAPH TO 1
ROUTE HYDROGRAPH TO 2
ROUTE HYDROGRAPH TO 3
ROUTE HYDROGRAPH TO 4
ROUTE HYDROGRAPH TO 5
ROUTE HYDROGRAPH TO 6
ROUTE HYDROGRAPH TO 7
ROUTE HYDROGRAPH TO 8
END OF NETWORK

1
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE: 8/11/
TIME: 1:54 PM

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BURT DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

DAM NY 745

JOB SPECIFICATION									
NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IFRT	INSTAN
100	1	0	0	0	0	0	-1	4	0
			JOPER	NUT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED

NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= 0.20 0.40 0.50 0.60 0.80 1.00

SUR-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FOR SUB-AREA 1
 ISTAQ ICOMP ILCON ITAPE JPLT JPRT INAPE ISTAGE IAUTO

HYDROGRAPH DATA
 IHDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 21.80 91.00 101.00 112.00 125.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA
 LROPT STRKR OLTKR RTIOL ERAIN STRKS RTIOK STRIL CNSTL ALSMX RTIMP

UNIT HYDROGRAPH DATA
 TP= 9.29 CP=0.63 NTA= 0

RECESSION DATA
 STRTO= 2.00 QRCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 9.23 HOURS, CP= 0.63 VOL= 1.00
 60. 223. 450. 710. 990. 1268. 1502. 1685. 1755. 1766.
 1668. 1496. 1327. 1177. 1044. 926. 821. 729. 646. 573.
 500. 451. 400. 355. 279. 248. 220. 195. 173. 155.
 133. 136. 121. 107. 95. 84. 75. 66. 55. 52.
 46. 36. 32. 29. 25. 23. 20. 18. 16.

MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q MO.DA HR.MN PERIOD RAIN EXCS LOSS CONF Q
 SUM 23.46 19.60 3.86 5068.62.
 (556.)(496.)(98.)(1487.65)

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FOR SUB-AREA 2
 ISTAQ ICOMP ILCON ITAPE JPLT JPRT INAPE ISTAGE IAUTO

HYDROGRAPH DATA
 IHDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 21.80 91.00 101.00 112.00 125.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.861

LOSS DATA

LROPT	STKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STATL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA
 TP= 5.31 CP=0.63 NTA= 0

RECESSION DATA
 STRIQ= 2.00 ORCSN= -0.10 RTIOR= 2.00

UNIT HYDROGRAPH 29 END-OF-PERIOD ORIGINATES, LAG= 5.34 HOURS, CP= 0.64 VOLE= 1.00

118.	401.	787.	1172.	1444.	1534.	1403.	1153.	932.	755.
611.	495.	401.	324.	262.	212.	172.	139.	113.	91.
74.	60.	48.	39.	32.	26.	21.	17.	14.	

MO-DA HR-MN PERIOD RAIN EXCS LOSS COMPO MO-DA HR-MN PERIOD RAIN EXCS LOSS COMPO

0	23.46	19.60	3.86	273626.
SUM	(596.)	(498.)	(98.)	(7748.22)

D-7

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS FROM SUB-AREAS 1 AND 2 AT POINT A

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INAVE	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTE THE COMBINED HYDROGRAPH FROM POINT A TO B BY MUSKINGUM METHOD

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INAVE	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

ROUTING DATA

GLSS	CLOSS	AVG	IRIS	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	0	1	0	0	0

INSTPS NSTDL LAG ANSKK X TSK STORA ISPRAT

1	0	1	0.150	0.200	0.000	-1.	0
---	---	---	-------	-------	-------	-----	---

SUB-AREA RUNOFF COMPUTATION

COMPUTE HYDROGRAPH FROM SUB-AREA 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INAVE	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

PROCESS COMPUTED BY THE PROGRAM IS 0.261

UNIT HYDROGRAPH DATA NTA= 0
CP= 5.64 CP=0.63

```

RECESSION DATA
OBSCN= -0.10
RTIOR= 2.00

```

UNIT	HYDROGRAPH	31	END-OF-PERIOD	ORDINATES	LAGE	5.65 HOURS	CP = 0.63	VOL = 1.00
89.	325.	641.	966.	1209.	1313.	1248.	1049.	864.
886.	482.	397.	327.	269.	221.	182.	150.	102.
	65.	57.	47.	38.	32.	26.	21.	15.
12.								

	END-OF-PERIOD FLOW												
	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HR.MN	PERIOD	RAIN	EXCS	LOSS	CONF Q
0													
MO.DA													
SUM				23.46	19.60	3.86							246782.
Avg				1.02	.82	.16							98.88

COMBINE HYDROGRAPHS

```

COMBINE ALL HYDROGRAPHS AT POINT B - INFLOW TO RESERVOIR
          ISTAQ      ICOMP      IECON      ITAPE      JPLT      JPRY      INAPE      INSTAGE      IAUTO
          0          0          0          0          0          0          0          0          0

```

HYDROGRAPH ROUTING

... CONTINUATION OF QUICKEST HYDROGRAPH FROM RESERVOIR

[illegible]

DATE	DESCRIPTION	AMOUNT	BALANCE
197.00		299.05	302.00
301.00		301.00	303.00
302.00		302.00	304.00
303.00		303.00	305.00
304.00		304.00	306.00
305.00		305.00	307.00
306.00		306.00	308.00
307.00		307.00	309.00
308.00		308.00	310.00
309.00		309.00	311.00
310.00		310.00	312.00
311.00		311.00	313.00
312.00		312.00	314.00
313.00		313.00	315.00
314.00		314.00	316.00
315.00		315.00	317.00
316.00		316.00	318.00
317.00		317.00	319.00
318.00		318.00	320.00
319.00		319.00	321.00
320.00		320.00	322.00
321.00		321.00	323.00
322.00		322.00	324.00
323.00		323.00	325.00
324.00		324.00	326.00
325.00		325.00	327.00
326.00		326.00	328.00
327.00		327.00	329.00
328.00		328.00	330.00
329.00		329.00	331.00
330.00		330.00	332.00
331.00		331.00	333.00
332.00		332.00	334.00
333.00		333.00	335.00
334.00		334.00	336.00
335.00		335.00	337.00
336.00		336.00	338.00
337.00		337.00	339.00
338.00		338.00	340.00
339.00		339.00	341.00
340.00		340.00	342.00
341.00		341.00	343.00
342.00		342.00	344.00
343.00		343.00	345.00
344.00		344.00	346.00
345.00		345.00	347.00
346.00		346.00	348.00
347.00		347.00	349.00
348.00		348.00	350.00
349.00		349.00	351.00
350.00		350.00	352.00
351.00		351.00	353.00
352.00		352.00	354.00
353.00		353.00	355.00
354.00		354.00	356.00
355.00		355.00	357.00
356.00		356.00	358.00
357.00		357.00	359.00
358.00		358.00	360.00
359.00		359.00	361.00
360.00		360.00	362.00
361.00		361.00	363.00
362.00		362.00	364.00
363.00		363.00	365.00
364.00		364.00	366.00
365.00		365.00	367.00
366.00		366.00	368.00
367.00		367.00	369.00
368.00		368.00	370.00
369.00		369.00	371.00
370.00		370.00	372.00
371.00		371.00	373.00
372.00		372.00	374.00
373.00		373.00	375.00
374.00		374.00	376.00
375.00		375.00	377.00
376.00		376.00	378.00
377.00		377.00	379.00
378.00		378.00	380.00
379.00		379.00	381.00
380.00		380.00	382.00
381.00		381.00	383.00
382.00		382.00	384.00
383.00		383.00	385.00
384.00			

OK. SEG #HECIDB

PAGE 0005

307.00 309.00 311.00 313.00 315.00 317.00 319.00 320.00
FLOW 0.00 298.00 842.00 1547.00 2382.00 3329.00 4376.00 5514.00 6737.00
9416.00 12377.00 15597.00 19056.00 22758.00 30725.00 32845.00 0.00

SURFACE AREA= 0. 95. 129. 174. 225.

CAPACITY= 0. 1408. 1823. 3332. 5322.

ELEVATION= 250. 297. 300. 310. 320.

CREL SPVID COBW EXPW ELEV COOL CAREA EXFL
297.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA
TOPEL COOD EXPD DAMWID
304.5 0.0 0.0 0.

CREST LENGTH 253. 315.
AT OR BELOW
ELEVATION 304.5 320.0

PEAK OUTFLOW IS 13055. AT TIME 47.00 HOURS
PEAK OUTFLOW IS 26210. AT TIME 47.00 HOURS
PEAK OUTFLOW IS 32785. AT TIME 47.00 HOURS
PEAK OUTFLOW IS 39351. AT TIME 47.00 HOURS
PEAK OUTFLOW IS 52648. AT TIME 47.00 HOURS
PEAK OUTFLOW IS 65687. AT TIME 47.00 HOURS

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS RESERVOIR - 1
ISTAO ICOMP IECON ITAPE JPLT JPRT INAPE ISTAGE IAUTO
1 1 0 0 0 0 0 0 0
ROUTING DATA
GROSS CLOSS AVG IRES ISARE IOPT IPMP LSTR
0.0 0.000 0.00 1 1 0 0 0
NSTPS NSTOL LAG AMSKK X TSK STORA ISPRAT
1 0 0 0.000 0.000 0.000 0.000 0.

NORMAL DEPTH CHANNEL ROUTING

QN(1) QN(2) QN(3) FLQVT ELMAX RLNTH SEL
0.1700 0.0450 0.1000 256.0 300.0 500. 0.00220

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	0.00	300.00	89.00	256.00	270.00	256.00	380.00	300.00	381.00	300.00
	382.00	300.00	300.00	383.00	380.00	384.00	300.00			

OUTFLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25218.81
	30681.13	36654.48	43177.70	50261.23	57915.95	66153.00	74981.77	84419.83	94472.84	105154.67

FLOW	0.00	550.08	1784.35	3582.54	5909.21	8750.48	12102.24	15965.71	20345.37	25247.81
	30681.13	36654.48	43177.70	50281.23	57915.95	66153.00	74983.77	84419.83	94477.84	105154.67

HAXIMUM STAGE IS 270.5

MAXIMUM STAGE IS 277.2

MAXIMUM STAGE IS 280.0

MAXIMUM STAGE IS 282.4

MAXIMUM STAGE IS 286.8

MAXIMUM STAGE IS 290.6

CHANNEL ROUTING -MOD PULS REACH 1-2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRY	INAVE	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA	
QLOSS	AVG
CLOSS	ISAME
IRES	

1	000.0
1	00.0

NSTPS	NSTDL	LAG	AMSKK
1	0	0	0.000

•
•
•
•
•

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	254.0	300.0	800.	0.00220

CROSS SECTION, COORDINATES>--STA,ELEV,STA,ELEV--ETC

DATE	DESCRIPTION	AMOUNT	BALANCE
01-01-2020	OPENING BALANCE	0.00	300.00
02-01-2020	PAYROLL	110.00	254.00
03-01-2020	RENT	254.00	240.00
04-01-2020	UTILITIES	240.00	400.00
05-01-2020	SALES	400.00	300.00
06-01-2020	PAYROLL	300.00	401.00
07-01-2020	RENT	401.00	300.00
08-01-2020	UTILITIES	300.00	401.00
09-01-2020	SALES	401.00	300.00
10-01-2020	PAYROLL	300.00	401.00
11-01-2020	RENT	401.00	300.00
12-01-2020	UTILITIES	300.00	401.00
12-31-2020	CLOSING BALANCE	401.00	300.00

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MAXIMUM STAGE IS	270.4
MAXIMUM STAGE IS	277.4
MAXIMUM STAGE IS	280.2
MAXIMUM STAGE IS	282.6
MAXIMUM STAGE IS	286.9
MAXIMUM STAGE IS	290.6

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 2-3

	ISAO	ICOMP	IENCON	ITAPE	JPLT	JPRP	INAPR	ISTAGE	IAUTO
	3	1	0	0	0	0	1	0	9
	CLOSS	AVG	ROUTING DATA						
	0.0	0.00	IRES	ISAME	IOPT	IPPP		LSTR	
			1	1	0	0			
	NSTPS	NSTDL	LAG	AMSK	X	TSK	STORA	ISPRT	
	1	0	0	0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1090	251.0	300.0	1300.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

SECTION	CONTRACT NO.	DATE	AMOUNT	PAID	BALANCE
0.00	300.00	151.00	260.00	210.00	251.00
500.00	300.00	501.00	300.00	502.00	300.00
					480.00
					251.00
					510.00
					260.00

STORAGE	0.00	21.77	45.53	71.21	98.24	126.08	154.67	184.00	214.08	244.90
	276.47	368.77	341.83	375.63	410.17	445.46	481.49	518.26	555.78	594.05

PAGE 008

明倫彙編 家範典 卷一百一十五

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 3-4

	ISSTAD	4	I	COMP	RECON	IAAPE	JPLT	JPRP	INAPR	ISTAGE	IAUTO
						ROUTING DATA					
						IRSES	IOPT	IPRP		LSTR	
	CLOSS	0.0	Avg	0.00	1	ISAME	1	0			
	NSTPS	1	NSTDL	0	LAG	AMSKK	X	TSK	STORA	ISPAT	
						0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	249.0	300.0	1100.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

[illegible]

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2
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STAGE	249.00	251.68	254.37	257.05	259.74	262.42	265.11	267.79	270.47	272.16
	275.84	278.53	281.21	283.89	286.58	289.26	291.95	294.63	297.32	300.00
FLOW	0.00	2518.29	8066.79	15998.30	26073.50	38190.63	52197.11	68010.63	85575.16	104845.22
	125801.81	148409.53	172655.00	198525.06	226010.69	255105.88	285806.75	318111.88	352021.56	387537.19
MAXIMUM STAGE IS	256.0									
MAXIMUM STAGE IS	259.8									
MAXIMUM STAGE IS	261.2									
MAXIMUM STAGE IS	262.7									
MAXIMUM STAGE IS	265.2									
MAXIMUM STAGE IS	267.4									

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 4-5

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	CLOSS	AVG	IRCS	ISAME	IOPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0		
NSTPS NSTDL LAG AMSKK X TSK STORA ISPRAT								
1	0	0	0	0.000	0.000	0.000	0.000	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	245.0	300.0	1800.0	0.00220

CROSS SECTION COORDINATES--STA+ELEV,STA+ELEV--ETC

0.00	300.00	100.00	250.00	105.00	245.00	500.00	245.00	505.00	250.00
630.00	300.00	631.00	300.00	632.00	300.00				

STORAGE	0.00	47.59	95.91	145.56	196.77	249.53	302.86	359.74	417.18	474.18
	536.73	598.84	662.52	727.75	794.53	862.88	932.79	1004.25	1077.27	1151.85
OUTFLOW	0.00	3606.99	11437.00	22459.17	36341.84	52869.69	71899.58	93329.88	117085.42	143105.47
	171358.41	201792.41	234403.81	269154.80	306036.50	345038.31	386152.69	429374.75	474703.06	521313.00
STAGE	245.00	247.89	250.79	253.68	256.58	259.47	262.37	265.26	268.16	271.05
	273.95	276.84	279.74	282.63	285.53	288.42	291.32	294.21	297.10	300.00
FLOW	0.00	3606.99	11437.00	22459.17	36341.84	52869.69	71899.58	93329.88	117085.42	143105.47

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171358.41 201798.41 234403.81 269154.88 306036.50 345038.31 386152.69 429374.75 474703.06 522131.00

MAXIMUM STAGE IS 251.2
MAXIMUM STAGE IS 254.4
MAXIMUM STAGE IS 255.8
MAXIMUM STAGE IS 257.1
MAXIMUM STAGE IS 259.4
MAXIMUM STAGE IS 261.4

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 5-6

ISTAO	ICOMP	JECON	ITAPE	JPLT	JPRT	INAPE	ISTAGE	IAUTO
6	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSTPS NSTOL LAG AMSKK X TSK STORA ISPRAT								
1	0	0	0.000	0.000	0.000	0.00	0	

NORMAL DEPTH CHANNEL ROUTING

QM(1)	QM(2)	QM(3)	ELNVT	ELMAX	RLNTH	SEL
0.1000	0.0450	0.1000	241.0	290.0	1700.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

STA	ELEV	STA	ELEV	STA	ELEV
0.00	290.00	105.00	250.00	210.00	241.00
630.00	290.00	631.00	290.00	632.00	290.00

STORAGE	0.00	33.15	70.19	111.12	155.60	201.60	248.80	297.20	346.80	391.60
	449.61	502.81	557.21	612.82	669.62	727.63	786.83	847.24	908.84	971.65
OUTFLOW	0.00	2376.16	7676.43	15352.24	25352.05	37530.88	51635.02	67571.52	85272.34	114685.80
	125772.02	148499.81	172844.34	198786.31	226310.22	255404.22	286055.31	318268.63	352027.25	387332.38
STAGE	241.00	243.58	246.16	248.74	251.32	253.89	256.47	259.05	261.63	264.21
	266.79	269.37	271.95	274.53	277.10	279.68	282.26	284.84	287.42	291.00
FLOW	0.00	2376.16	7676.43	15352.24	25352.05	37530.88	51635.02	67571.52	85272.34	114685.80
	125772.02	148499.81	172844.34	198786.31	226310.22	255404.22	286059.31	318268.63	352027.25	387332.38
MAXIMUM STAGE IS	247.9									

[illegible]

CHANNEL ROUTING -MOD PULS REACH 6-7

	QLOSS	CROSS	ISTAC	IComp	IECON	ITAPE	JPLT	JPRY	INAME	ISTAGE	IAUTO	
	0.0	0.000	7	1	0	0	0	0	1	0	0	
					ROUTING DATA							
		Avg			IRCS	ISAME	IOPT	IPKP		LSTR		
	0.0	0.00			1	1	0	0				
			NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRT		
			1	0	0	0.000	0.000	0.000	0.	0		

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0630	0.0450	0.0600	238.0	280.0	1600.	0.00220

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC			
0+00	270.00	450.00	260.00 600.00 250.00
1060+00	250.00	1590.00	280.00 1591.00 280.00

	0.00	32.19	65.43	99.71	135.04	171.42	205.63	253.26	302.75	351.11
STORAGE	419.33	489.36	570.64	663.17	766.94	880.86	995.86	1120.03	1244.37	1371.88
OUTFLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.80	61933.98	79197.67	10792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	45765.00
STAGE	238.00	240.21	242.42	244.63	246.84	249.05	251.26	253.47	255.68	257.89
	260.11	262.32	264.53	266.74	268.95	271.16	273.37	275.58	277.79	280.00
FLOW	0.00	2281.53	7276.31	14371.25	23331.31	34022.98	46840.80	61933.98	79197.67	10792.81
	120827.22	145121.00	172766.13	203992.53	239079.06	279445.38	325005.63	374613.44	428212.94	45765.00

MAXIMUM STAGE IS	244.2
MAXIMUM STAGE IS	247.4
MAXIMUM STAGE IS	248.6

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MAXIMUM STAGE IS 250.0
MAXIMUM STAGE IS 252.1
MAXIMUM STAGE IS 253.9

HYDROGRAPH ROUTING

CHANNEL ROUTING -MOD PULS REACH 7-8

ISTAQ ICOMP IECON ITAPE JPLY JPRT INAPE ISTAGE IAUTO
8 1 0 0 0 0 1 0
ROUTING DATA
GROSS CROSS AVG IRES ISAME IOPT IPMP LSTR
0.0 0.000 0.00 1 1 0 0
NSTPS NSTDL LAG AMSKK X TSK STORA ISPRAT
1 0 0 0.000 0.000 0.000 0

NORMAL DEPTH CHANNEL ROUTING

QN(1) QN(2) QN(3) ELNVT ELMAX RLNTH SEL
0.0600 0.0450 0.0600 235.0 270.0 1400. 0.00220

CROSS SECTION COORDINATES--STA+ELEV,STA+ELEV--ETC

0.00 270.00 80.00 250.00 1100.00 235.00 1300.00 235.00 1800.00 250.00
2300.00 260.00 2550.00 270.00 2551.00 270.00

STORAGE 0.00 17.37 45.78 85.25 135.78 197.35 265.97 353.65 442.37 551.26
662.08 777.79 899.40 1026.89 1160.02 1296.76 1436.66 1579.72 1725.95 1871.34
OUTFLOW 0.00 1039.68 3907.02 8908.19 16409.30 26766.31 40315.55 57394.49 78303.31 104465.47
135252.22 170525.06 210360.53 254845.94 307213.25 368515.75 424543.50 505271.69 580677.88 660742.63
STAGE 235.00 236.44 238.68 240.53 242.37 244.21 246.05 247.89 249.74 251.58
253.42 255.26 257.11 258.95 260.79 262.63 264.47 266.32 268.16 270.00
FLOW 0.00 1039.68 3907.02 8908.19 16409.30 26766.31 40315.55 57394.49 78303.31 104465.47
135252.22 170525.06 210360.53 254845.94 307213.25 368515.75 424543.50 505271.69 580677.88 660742.63

MAXIMUM STAGE IS 241.5
MAXIMUM STAGE IS 244.1
MAXIMUM STAGE IS 245.0
MAXIMUM STAGE IS 245.9
MAXIMUM STAGE IS 247.4

MAXIMUM STAGE IS 248.6

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
				0.20	0.40	0.50	0.60	0.80	1.60
HYDROGRAPH AT	1	39.22	1	5922.	11845.	14806.	17767.	23689.	29612.
	(	101.58)		(167.70)	(335.40)	(419.25)	(503.10)	(670.81)	(838.51)
HYDROGRAPH AT	2	20.00	1	4634.	9268.	11585.	13903.	18537.	23171.
	(	51.80)		(131.22)	(262.45)	(328.06)	(393.67)	(524.90)	(656.12)
2 COMBINED	A	59.22	1	9678.	19357.	24196.	29035.	38713.	48392.
	(	153.38)		(274.06)	(548.12)	(685.15)	(822.18)	(1096.24)	(1370.29)
ROUTED TO	B	59.22	1	9664.	19328.	24160.	28992.	38656.	48315.
	(	153.38)		(273.65)	(547.30)	(684.13)	(820.95)	(1094.60)	(1368.25)
HYDROGRAPH AT	3	18.17	1	4922.	8044.	10055.	12066.	16088.	20109.
	(	47.06)		(113.89)	(227.77)	(284.72)	(341.66)	(455.55)	(569.43)
2 COMBINED	P	77.39	1	13099.	26198.	32748.	39297.	52396.	65495.
	(	200.44)		(370.92)	(741.85)	(927.31)	(1112.77)	(1483.70)	(1854.62)
ROUTED TO	UTFLOW	77.39	1	13055.	26210.	32785.	39351.	52640.	65687.
	(	200.44)		(369.69)	(742.20)	(928.36)	(1114.30)	(1490.59)	(1860.04)
ROUTED TO	1	77.39	1	13953.	26192.	32815.	39377.	52619.	65662.
	(	200.44)		(369.61)	(741.67)	(929.22)	(1115.02)	(1490.01)	(1859.35)
ROUTED TO	2	77.39	1	13039.	26167.	32828.	39397.	52602.	65647.
	(	200.44)		(369.22)	(740.97)	(929.58)	(1115.60)	(1489.53)	(1858.91)
ROUTED TO	3	77.39	1	13011.	26132.	32835.	39382.	52617.	65609.
	(	200.44)		(368.43)	(739.98)	(929.79)	(1115.18)	(1489.93)	(1857.85)
ROUTED TO	4	77.39	1	13035.	26183.	32800.	39391.	52640.	65605.
	(	200.44)		(369.11)	(741.42)	(928.79)	(1115.42)	(1490.59)	(1857.73)
ROUTED TO	5	77.39	1	12989.	26103.	32841.	39384.	52649.	65582.
	(	200.44)		(367.82)	(739.15)	(929.94)	(1115.23)	(1490.85)	(1857.08)
ROUTED TO	6	77.39	1	12985.	26218.	32733.	39341.	52700.	65604.
	(	200.44)		(367.69)	(742.41)	(926.88)	(1114.02)	(1492.30)	(1857.70)
ROUTED TO	7	77.39	1	12975.	26252.	32705.	39277.	52763.	65612.

ROUTED TO (200.44) (367.41) (743.36) (926.11) (1112.20) (1492.38) (1857.91) (2200.44)
 8 77.39 1 13018. 26237. 32668. 39275. 52627. 65622.
 (200.44) (368.63) (742.96) (925.06) (1112.13) (1490.23) (1858.21) (2200.44)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1
 ELEVATION INITIAL VALUE SPILLWAY CREST TOF OF DAM
 STORAGE 297.00 297.00 304.50
 OUTFLOW 1488. 1488. 2447.
 0. 0. 6116.

RATIO OF PMF	MAXIMUM RESERVOIR U.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	307.15	2.65	2855.	13055.	12.00	47.00	0.00
0.40	310.40	5.90	3402.	26210.	19.00	47.00	0.00
0.50	311.74	7.24	3643.	32785.	22.00	47.00	0.00
0.60	312.99	8.49	3874.	39351.	24.00	47.00	0.00
0.80	315.20	10.70	4303.	52640.	28.00	47.00	0.00
1.00	316.75	12.25	4619.	65687.	30.00	47.00	0.00

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.20	13053.	270.5	47.00
0.40	26192.	277.2	47.00
0.50	32815.	280.0	47.00
0.60	39377.	282.4	47.00
0.80	52619.	286.8	47.00
1.00	65662.	290.6	47.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.20	13039.	270.4	47.00
0.40	26167.	277.4	47.00
0.50	32828.	280.2	47.00
0.60	39397.	282.6	47.00
0.80	52602.	286.9	47.00
1.00	65647.	290.6	47.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
0.20	13011.	258.6	47.00
0.40	26132.	262.5	47.00
0.50	32935.	264.0	47.00
0.60	39382.	265.4	47.00

0.80	52617.	268.0	47.00
1.00	65609.	270.4	47.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13835.	256.0	47.00
0.40	26103.	259.8	47.00
0.50	32800.	261.2	47.00
0.60	39391.	262.7	47.00
0.80	52648.	265.2	47.00
1.00	65605.	267.4	47.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12989.	251.2	47.00
0.40	26103.	254.4	47.00
0.50	32841.	255.8	47.00
0.60	39384.	257.1	47.00
0.80	52649.	259.4	47.00
1.00	65582.	261.4	47.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12985.	247.9	47.00
0.40	26218.	251.5	47.00
0.50	32733.	252.9	47.00
0.60	39341.	254.2	47.00
0.80	52700.	256.6	47.00
1.00	65694.	258.7	47.00

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	12975.	244.2	47.00
0.40	26252.	247.4	47.00
0.50	32705.	248.8	47.00
0.60	39277.	250.0	47.00
0.80	52703.	252.1	47.00
1.00	65612.	253.9	47.00

PLAN 1 STATION 8

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	13018.	241.5	40.00

OK, SEG #HEC100

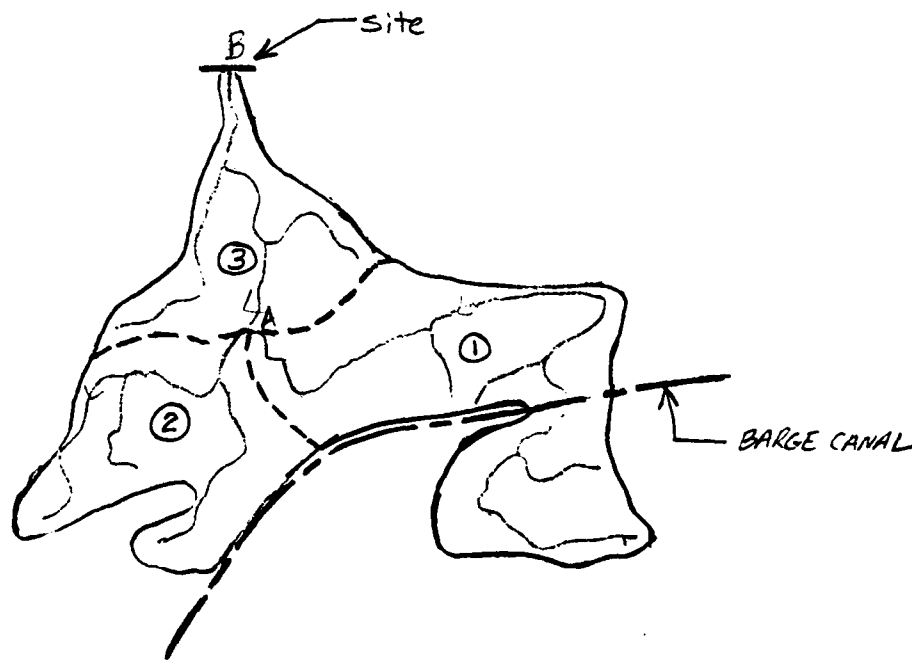
PAGE 0016

0.40	26237.	244.1	47.00
0.50	32668.	245.0	47.00
0.60	39275.	245.9	47.00
0.80	52627.	247.4	47.00
1.00	65622.	248.6	47.00

1.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
.....

Burt Dam Hydrology

The drainage area for Burt Dam is sub-divided into 3 smaller drainage areas as shown below.



Summary Of Required Data

Sub-Area No.	Drainage Area (mi ²)	L _c (ft.)	L _{ca} (ft.)	PMP Rainfall (Basin Avg.)	Reach Length (ft.)	Muskingum Coeff.	
						K	X
1	25,102 AC = 39.22 MI ²	125,400	39,600'	21.8	—	—	—
2	12,801 AC = 20 MI ²	52,100	13,800	21.8	—	—	—
3	11,629 AC. = 18.17 MI ²	36,800	24,000	21.8	36,000	0.15	0.2

TOTAL = 77.39 mi²

P.D.C.	DATE 5/20/81	ERDMAN, ANTHONY, ASSOCIATES	SHEET 2 OF 13
KD BR	DATE 5/20/81	SUBJECT DAM 745 - Hydrology	SUB-SHEET NO. 2
OWNER	PROJECT NAME DAM INSPECTION		80166-00.11

CURT DAM NY 745
SUR-SECTIONS 1, 2 & 3

LEFF. QUAD MAPS LOCKPORT, NEWFANE, CAMBRIA & GASPORT N.Y.
SCALE 1" = 2000' CONTOUR INT. 10 FT.

REACH MEAS. WITH A MAP WHEEL 1" = 2000'
DATA MEAS. ON CROSS SECTION GRID 1" = 2000' & WITH PLANIMETER

SUB-AREA NO 1

REACH LENGTH = 62.7 x 2000' = 125,400 ft. ✓

AREA IN ACRES = 25,101.92 AC. SEE CROSS SECT. SHEET NO 1 FOR COMPUTATIONS
✓

SUR-AREA NO 2

REACH LENGTH = 26.05 ✓ x 2000' = 52,100 ft. (EAST BRANCH EIGHTEEN MILE CREEK)

AREA IN ACRES = 12801 ✓ SEE CROSS SECT. SHEET NO 2 FOR COMPUTATIONS

SUB-AREA NO 3

REACH LENGTH = 18.4 x 2000' = 36,800 ft. (EIGHTEEN MILE CREEK)

AREA IN ACRES = 11,620.0 AC. SEE CROSS SECTION SHEET NO 3 COMPUTATIONS
✓

P.D.P. DATE 5/20/81 ERDMAN, ANTHONY, ASSOCIATES SHEET 3 OF 13
 RD B.R. DATE 5/21/81 SUBJECT Dam 745 - Hydrology SUB-SHEET NO. 3
 OWNER PROJECT NAME URM INSPECTION 80166-00.11

BURT DAM NY 745

L & LCA DISTANCE MEAS. WITH A MAP MEAS. WHEEL SCALE 1" = 2000'

SUB-AREA NO 1 REFF. QUAD MAPS NEWFANE & LOCKPORT, N.Y.

L DISTANCE = $62.7 \times 2000' = 125,400 \text{ ft.}$ ✓

LCA DISTANCE = $19.8 \times 2000' = 39,600 \text{ ft.}$ ✓

SUB-AREA NO 2 REFF. QUAD MAPS LOCKPORT & CAMERIA, N.Y.

L DISTANCE = $26.05 \times 2000' = 52,100 \text{ ft.}$ ✓

LCA DISTANCE = $6.90 \times 2000' = 13,800 \text{ ft.}$ ✓

SUB-AREA NO 3 REFF. QUAD MAPS LOCKPORT & GASPORT, N.Y.

L DISTANCE = 36,800

LCA DISTANCE = $12.0 \times 2000' = 24,000 \text{ ft}$

SLOPE CONTOUR EL. = 345

CONTOUR EL. AT DAM = 260

EL. h = 85'

REACH LENGTH = $18 \times 2000 = 36000'$

SLOPE = $85 / 36000 = 0.0024$

DETERMINATION OF SNYDER'S LAG TIME

SUB-AREA NO. 1

$$T_p = C_t (L_c L_{ca})^{0.3}$$

$$C_t = 2.00 \checkmark$$

$$C_p = 0.63 \checkmark$$

$$T_r = \frac{T_p}{5.5}$$

$$T_{PR} = T_p + 0.25 (T_R - T_r)$$

$$L_c = 125400 \text{ ft} \checkmark = \frac{125400}{5280} = 23.75 \text{ MILES} \checkmark$$

$$L_{ca} = 39600 \text{ ft} \checkmark = \frac{39600}{5280} = 7.50 \text{ MILES} \checkmark$$

$$T_p = 2 (23.75 \times 7.50)^{0.3} = 9.47 \text{ hrs} \checkmark$$

$$T_r = \frac{9.47}{5.5} = 1.72 \text{ hrs.} \rightarrow T_R = 1 \text{ hr} \checkmark$$

$$T_{PR} = 9.47 + 0.25 (1 - 1.72) = 9.29 \text{ hrs.} \checkmark$$

BY P.R. DATE 5/20/81 ERDMAN, ANTHONY, ASSOCIATES SHEET 5 OF 13
 NO 9/18A DATE 5/24/81 SUBJECT DAM 745 - Hydrology SUB-SHEET NO. 5
 OWNER PROJECT NAME Dam Inspection 40166-00-11 , NY745

SUB-AREA NO. 2

$$L_e = 52100 \text{ ft} \checkmark = \frac{52100}{5280} = 9.81 \text{ MILES} \checkmark$$

$$L_{ea} = 13800 \text{ ft} \checkmark = \frac{13800}{5280} = 2.61 \text{ MILES} \checkmark$$

$$\tau_p = 2 (L_e \times L_{ea})^{0.3} = 5.30 \text{ hrs.} \checkmark$$

$$\tau_r = \frac{5.30}{5.5} = 0.96 \rightarrow \tau_R = 1 \text{ hr.} \checkmark$$

$$\tau_{PR} = 5.30 + 0.25 (1 - 0.96) = 5.31 \text{ hrs.} \checkmark$$

SUB-AREA NO. 3

$$L_e = 36800' \checkmark = \frac{6.97}{7.0} \text{ MILES} \checkmark$$

$$L_{ea} = 24000' \checkmark = 4.55 \text{ MILES} \checkmark$$

$$\tau_p = 2 (L_e \times L_{ea})^{0.3} = \frac{5.64}{5.65} \text{ hrs.}$$

$$\tau_r = \frac{5.64}{5.5} = 1.03 \text{ hrs} \checkmark \rightarrow \tau_R = 1 \text{ hr} \checkmark$$

$$\tau_{PR} = 5.65 + 0.25 (1 - 1.03) = 5.64 \text{ hrs} \checkmark$$

DETERMINATION OF K FOR MUSKINGUM ROUTING

ASSUMPTIONS

$Q = 1.5 \text{ cfs/sec}$

$n = 0.06$

$R = y$ (HYDRAULIC RADIUS = CHANNEL DEPTH)

ASSUME RECTANGULAR CROSS SECTION OF LENGTH B

$Q = \frac{1.49}{n} A R^{2/3} S_0^{1/2}$

$Q = \frac{1.49}{n} B y y^{2/3} S_0^{1/2} = \frac{1.49}{n} B y^{5/3} S_0^{1/2}$

solve for y for y $y = \left[\frac{n Q}{1.49 S_0^{1/2} B} \right]^{3/5}$ ✓

$A = yB$

$V = \frac{Q}{A}$

$K = \tau = \frac{L}{V}$

$y = \left[\frac{n Q}{1.49 S_0^{1/2} B} \right]^{3/5}$

$n = 0.06$

$K = 0.146 L B^{\frac{2}{5}} Q^{-\frac{2}{5}} S_0^{-0.3}$ ✓

note: $K \approx$ Travel Time

BY L.R. DATE 5/20/81 ERDMAN, ANTHONY, ASSOCIATES SHEET 7 OF 13
 CKD RKA DATE 5/20/81 SUBJECT Drill 745 - Hydrology SUB-SHEET NO. 7
 OWNER PROJECT NAME Dam Inspection 70162-02-11, NY745

ROUTINE - MUSKINAUM METHOD

REACH A-B

$$K = 0.146 \ell^{\frac{2}{5}} Q^{\frac{2}{5}} S_o^{-0.3}$$

$$A = 25102 + 12801 = 37903 \text{ ac.}$$

$$\text{ASSUME } Q = 1.5 \text{ cfs/ac}$$

$$Q = 1.5 \times 37903 = 56854.5 \text{ cfs} \checkmark$$

$$\ell = 36000', \quad S_o = 0.0024$$

ASSUME AN AVERAGE OF 650' FOR B

$$K = 0.146 \times 3600^{0.4} \times 650^{-0.4} \times 56854.5^{-0.3} \times 0.0024$$

$$K = \frac{537}{5368} \text{ sec} = \frac{0.15 \text{ hrs}}{1.49} \text{ hrs.}$$

D-27

BY 2RA DATE 5/20/81 ERDMAN, ANTHONY, ASSOCIATES SHEET 8 OF 8
 ED BR DATE 6-11-81 SUBJECT DAM 745 - Hydrology SUB-SHEET NO. 8
 OWNER PROJECT NAME Dam Inspections C0166-00.11 NY 745

CHECK THE VALUE OF K

Assume $\Delta t = \frac{K}{1}$ $\Delta t = 0.15$ $X = 0.2$

$\frac{\Delta t}{2(1-X)} \leq K \leq \frac{\Delta t}{2X}$ (Ref HEC-1)

$\frac{0.15}{2(1-0.2)} \leq 0.15 \leq \frac{0.15}{2(0.2)}$

$0.094 \leq 0.15 \leq 0.375$ ✓

BY 16 DATE 5/24/71 ERDMAN, ANTHONY, ASSOCIATES SHEET 7 OF 13
 KD BR DATE 6/11/1981 SUBJECT 745 - Henderson SUB-SHEET NO. 1
 OWNER _____ PROJECT NAME 745 INSPECTIONS (20125-00.11)

Emergency Spillway

Open channel, 75 ft wide, crest elev = 297.50 75 ft wide for 0.00

The spillway $C = 3.97 L H_o^{3/2}$ will be used to determine the flow over the emergency spillway.

Sp. Henderson, Open Channel Sec. 79.181

$$C = 3.97 L H_o^{3/2} \rightarrow 3.97 (75') H_o^{3/2}$$

$$C = 297.75 - 1.72$$

Elev.	H_o	Q_c
297.0	0	0
298.0	1.0	298
299.0	2.0	842
300.0	3.0	1547
301.0	4.0	2382
302.0	5.0	3329
303.0	6.0	4376
304.0	7.0	5514
305.0	7.5	6116
306.0	8.0	6737
307.0	10.0	9416
307.0	2.0	12377
311.0	14.0	15597
313.0	16.0	19056
315.0	18.0	22738
317.0	20.0	26632
319.0	22.0	30725
320.0	25.0	32843

BY PJL DATE 6/2/71 ERDMAN, ANTHONY, ASSOCIATES SHEET 10 OF 13
 CKD ER DATE 6/11/71 SUBJECT CAM 7AL - Hydraulics SUB-SHEET NO. 2
 OWNER _____ PROJECT NAME CAM INSPECTION 30166-00-11

BURT DAM

\$A RATED RESEVOIR SURFACE AREA

REF. U.S. QUAD MAP NEWFARE NY SCALE 1"=2000'

$$\text{Eq. } n^2 \times \frac{2000^2 \text{ ft}^2}{\text{ft}^2} \times \frac{1 \text{ AC}}{43,560 \text{ ft}^2}$$

ELEV. 300

$$1.4 \times \frac{2000^2 \text{ ft}^2}{\text{ft}^2} \div \frac{1 \text{ AC}}{43,560} = 129.56 \text{ AC}$$

ELEV. 310

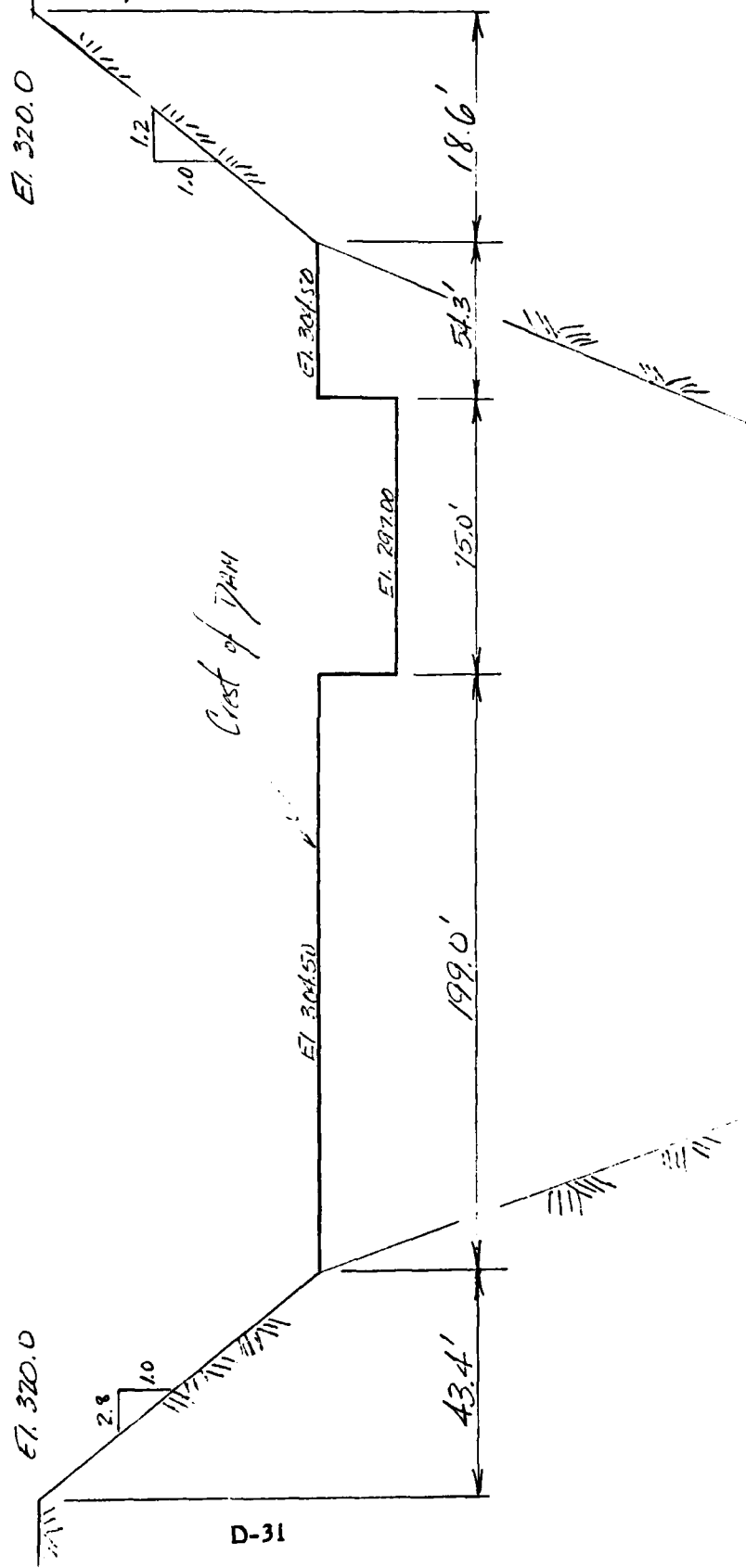
$$1.9 \times \frac{2000^2 \text{ ft}^2}{\text{ft}^2} \div \frac{1 \text{ AC}}{43,560} = 174.47 \text{ AC}$$

ELEV. 320

$$2.45 \times \frac{2000^2 \text{ ft}^2}{\text{ft}^2} \div \frac{1 \text{ AC}}{43,560} = 224.98 \text{ AC}$$

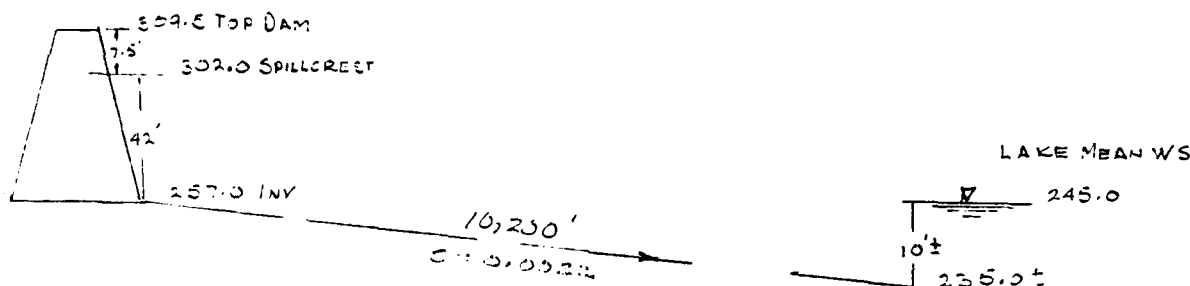
BY ERD DATE 5/25/11 ERDMAN, ANTHONY, ASSOCIATES SHEET 11 OF 13
 NO OR DATE 6/11/81 SUBJECT DAM #5 - Hydrology SUB-SHEET NO. 3
 OWNER _____ PROJECT NAME DAM INSPECTIONS (10150-00.11)

EXIST DAM (looking upstream)



CURT DAM

*
 Center of Section -
 Slope of the 60' to
 100' section



1. SLOPE = Dam INV. - LAKE INV. = $h \div L$
 $S = 257.0 - 235.0 = 22' \div 10,200 = 0.0022$

REACH 1 LENGTH = 500' ✓

SLOPE $500' \times 0.0022 = 1.1 - 257.0 = 255.9$ CREEK INV.

CROSS SECT.

$\frac{300}{0}$	$\frac{255.9}{80}$	$\frac{255.9}{270}$	$\frac{300}{330}$
-----------------	--------------------	---------------------	-------------------

REACH 2 LENGTH = 300' ✓

SLOPE $= 300' \times 0.0022 = 1.75 - 255.9 = 254.1$ CREEK INV.

CROSS SECT.

$\frac{300}{0}$	$\frac{254.1}{110}$	$\frac{254.1}{240}$	$\frac{300}{400}$
-----------------	---------------------	---------------------	-------------------

REACH 3 LENGTH = 1300' ✓

SLOPE $= 1300' \times 0.0022 = 2.86 - 254.1 = 251.2$ CREEK INV.

CROSS SECT

$\frac{300}{8}$	$\frac{251.2}{150}$	$\frac{251.2}{270}$	$\frac{251.2}{430}$	$\frac{251.2}{570}$	$\frac{300}{580}$
-----------------	---------------------	---------------------	---------------------	---------------------	-------------------

REACH 4 LENGTH = 1100' ✓

SLOPE $= 1100' \times 0.0022 = 2.42 - 251.2 = 248.8$ CREEK INV.

CROSS SECT.

$\frac{300}{0}$	$\frac{248.8}{120}$	$\frac{248.8}{140}$	$\frac{248.8}{530}$	$\frac{248.8}{570}$	$\frac{300}{600}$
-----------------	---------------------	---------------------	---------------------	---------------------	-------------------

BY PRP DATE 3/5/61 **ERDMAN, ANTHONY, ASSOCIATES** SHEET 13 OF 13
B.K. DATE 4/13/61 SUBJECT DAM 745 ROUTING SUB-SHEET NO. 2
 OWNER PROJECT NAME HEC-10R DAM INSPECTION 80166-00.11

REACH 5 LENGTH = 1300'

SLOPE = $1300' \times 0.0022 = 2.86 - 248.6 = 244.8$ CREEK INV.

CROSS SECT.	300	250	244.8	244.8	250	300
	0	100	100	500	500	400

REACH 6 LENGTH = 1700' ✓

SLOPE = $1700' \times 0.0022 = 3.74 - 244.8 = 241.0$ CREEK INV.

CROSS SECT.	290	250	241.0	241.0	250	290
	0	100	210	520	500	630

REACH 7 LENGTH = 1600' ✓

SLOPE = $1600' \times 0.0022 = 3.52 - 241.0 = 237.5$

CROSS SECT.	270	260	250	237.5	237.5	250	280
	0	450	400	650	1040	1060	1590

REACH 8 LENGTH = 1300'

SLOPE = $1300 \times 0.0022 = 2.86 - 237.5 = 234.6$ ✓

CROSS SECT.	270	250	234.6	234.6	250	260	270
	0	80	1100	1300	1300	2300	2550

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

1

(DAM NY 745)

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>304.5</u>	<u>149</u>	<u>2447</u>
2) Design High Water (Max. Design Pool)	<u>302.0</u>	<u>131</u>	<u>2127</u>
3) Auxiliary Spillway Crest	<u>N/A</u>	<u>-</u>	<u>-</u>
4) Pool Level with Flashboards	<u>N/A</u>	<u>-</u>	<u>-</u>
5) Service Spillway Crest	<u>297.0</u>	<u>95</u>	<u>1488</u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u>unknown</u>
2) Spillway @ Maximum High Water	<u>6116</u>
3) Spillway @ Design High Water	<u>5953</u>
4) Spillway @ Auxiliary Spillway Crest Elevation	<u>N/A</u>
5) Low Level Outlet (gated reservoir drain)	<u>0</u>
6) Total (of all facilities) @ Maximum High Water	<u>6116</u>
7) Maximum Known Flood (observed high water)	<u>1867</u>
8) At Time of Inspection	<u>250</u>

CREST:

ELEVATION:

304.5

Type:

Broad Crested Weir

Width:

5 ft.

Length

328 ft.

Spillover

Location

On Both Sides of the Spillway

SPILLWAY:

SERVICE

AUXILIARY

297.0

Elevation

NoneConcrete Ogee

Type

75 ft.

Width

Type of Control

✓

Uncontrolled

Controlled:

Type

(Flashboards; gate)

Number

Size/Length

Invert Material

Anticipated Length
of operating service

Chute Length

Height Between Spillway Crest
& Approach Channel Invert
(Weir Flow)

HYDROMETEROLOGICAL GAGES:

Type : None

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

None

DRAINAGE AREA:

77.4 sq. mi.

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type:

farmlands with orchards and woodlands

Terrain - Relief:

flat, northward sloping

Surface - Soil:

lake deposited sands and clays

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

None

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

None

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

None

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

Location:

None

Elevation:

Reservoir:

Length @ Maximum Pool

± 0.25

(Miles)

Length of Shoreline (@ Spillway Crest)

± 0.40

(Miles)

APPENDIX E

REFERENCES

APPENDIX E

REFERENCES

- 1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May, 1961.
- 2) F.M. Henderson, Open Channel Flow, Macmillian Publishing Co., Inc., 1966.
- 3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th Edition, McGraw-Hill, 1963.
- 4) T. W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1969.
- 5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.
- 6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.
- 7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.
- 8) U.S. Department of Commerce, Hydrometeorological Report No. 33, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas From 10 to 1000 Square Miles and Durations of 6, 12, 24, and 48 hours, April 1956.
- 9) U.S. Department of the Army, Engineering Manual 1110-2-1411, Standard Project Flood Determinations, March 1952.
- 10) U.S. Army Corps of Engineers, The Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations, September, 1978.

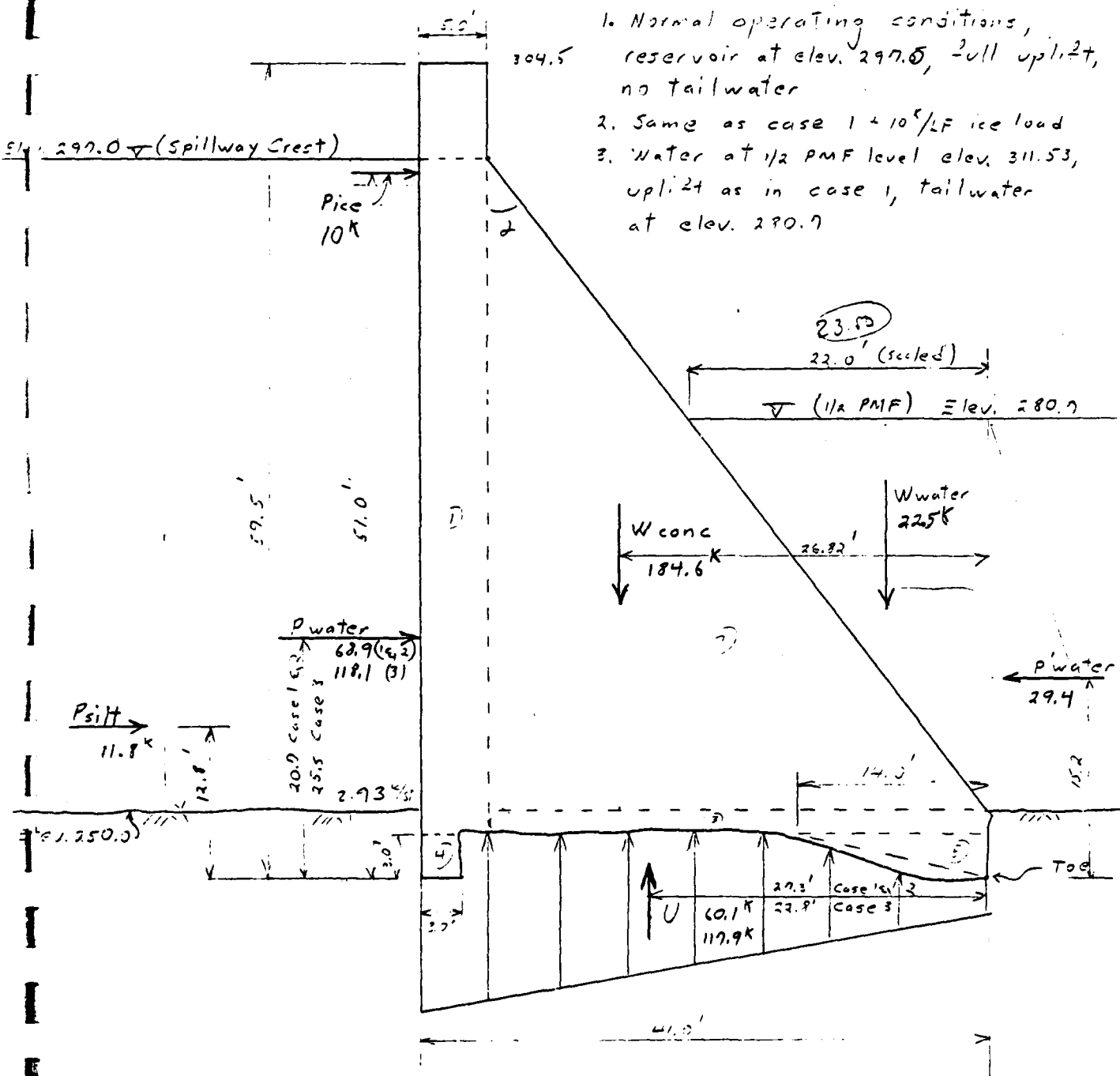
APPENDIX F

STABILITY ANALYSIS

lev. 311.53 ∇ (1/2 PMF)

Loadings Considered:

1. Normal operating conditions, reservoir at elev. 297.0, full upl. 2, no tailwater
2. Same as case 1 + 10⁶/LF ice load
3. Water at 1/2 PMF level elev. 311.53, upl. 2 as in case 1, tailwater at elev. 280.7



$$\tan \alpha = \frac{36}{47} = 0.766$$

$$0.766 \times (2207 - 250) = 23.50$$

DAM SECTION

AD-A105 729

ERDMAN ANTHONY ASSOCIATES ROCHESTER NY
NATIONAL DAM SAFETY PROGRAM. BURT DAM (INVENTORY NUMBER N.Y. 74--ETC(U)
AUG 81 R J FARRELL

F/0 13/13

DACW51-81-C-0017

NL

UNCLASSIFIED

2 2

2000



END
DATE
FBI
DTC

Weight of Concrete - Wconc.

			Dist from Toe	
Area: ①	5.0' x 56.5'	= 282.5'	x 38.5'	= 10876.25
②	36.0' x 42.0' x 1/2	= 746.0	x 24.0	= 20304.
③	2.0 x 36.0	= 72.0	x 18.0	= 1296.
④	3.0 x 3.0	= 9.0	x 39.5	= 355.5
⑤	3.0 x 14.0 x 1/2	= 21.0	x 4.67	= 98.07
		1230.5'		32929.82

$$W_{conc} = 1230.5' \times .15 \text{ K/ft} = 184.6 \text{ K/ft} \checkmark$$

$$\text{Resultant (from Toe)} = \frac{32929.82}{1230.5} = 26.76' \checkmark$$

Water Force Pwater on Upstream Face

Case 1 & 2

$$P_{water} = \frac{(297.0 - 250.0)^2 \times .0624}{2} = 68.9 \text{ K/ft} \checkmark$$

Case 3

$$P_{water} = \frac{(311.53 - 250.0)^2 \times .0624}{2} = 118.1 \text{ K/ft} \checkmark$$

Water Force P'water on Downstream Face

$$\text{Case 3 } P'_{water} = \frac{(290.7 - 250.0)^2 \times .0624}{2} = 29.4 \text{ K/ft} \checkmark$$

Silt Force Psilt on Upstream Face

Assume depth of silt equals 1/2 depth of water.

$$P_{silt} = \frac{(\frac{297.0 - 250.0}{2})^2 \times .085 \times .5}{2} = 11.8 \text{ K/ft} \quad \text{PCA "Small Concrete Dams" p.9} \quad \text{Assume } K = .5$$

Weight of Water Wwater

$$W_w = (290.7 - 250.0) \times \frac{23.5}{F-3} \times \frac{1}{2} \times .0624 = 22.5 \text{ K} \checkmark$$

Hydrostatic Uplift Force U

Case 1 & 2

$$U = (297.0 - 250.0) \times 41.0 \times \frac{1}{2} \times .0624 = 60.1 \text{ K/1} \quad \checkmark$$

$$\text{Resultant (from toe)} = (41) \times \frac{2}{3} = 27.3' \quad \checkmark$$

Case 3

$$U = \overset{30.7}{(280.7 - 250)} \times 41.0 \times .0624 + \overset{30.83}{(311.53 - 280.7)} \times 41.0 \times \frac{1}{2} \times .0624 \\ = 78.5 + 39.4 = 117.9 \text{ K/1} \quad \checkmark$$

$$\text{Resultant (from Toe)} = \frac{30.7 \times 41.0 \times \frac{41.0}{2} + 30.83 \times 41.0 \times \frac{1}{2} \times \frac{2}{3}}{30.7 \times 41.0 + 30.83 \times 41 \times \frac{1}{2}} \\ = 22.8' \quad \checkmark$$

Ice Force Pice

$$P_{ice} = 10 \text{ K/1}$$

$$\text{Resultant} = 51.0'$$

$$\text{arms: } \frac{47.0}{3} + 5.05 = 20.7' \\ \frac{2 \times 41}{3} = 27.3' \\ \frac{29.5}{3} + 5 = 12.8'$$

Stability Check

Case 1

$$\Sigma M \text{ overturning} = 60.1 \times 27.3' + 68.9 \times 20.7' + 11.8 \times 12.8' = 3218 \text{ K} \quad \checkmark$$

$$\Sigma M \text{ resisting} = 184.6 \times 26.76 = 4940 \text{ K}$$

$$\Sigma F_v = 184.6 - 60.1 = 124.5 \text{ K} \downarrow$$

$$\bar{x} = \frac{\Sigma M_o - \Sigma M_r}{\Sigma V} = \frac{4940 - 3218}{124.5} = 13.8' \quad \checkmark$$

$$F.S. = \frac{4940}{3218} = \frac{1.54}{1.53} \quad \checkmark$$

$$e = \frac{B}{2} - \bar{x} = \frac{41}{2} - 13.8 = 6.7'$$

$$B/6 = \frac{41}{6} = 6.8' > 6.7' \quad \checkmark$$

conc. on rock, some laminations
 PCA "Small Concrete Dams" p 12

$$S.F. \text{ sliding} = \frac{7 \times 124.5}{68.9 + 11.8} = 1.08 \text{ N.G.}$$

$$\text{No Uplift} = \frac{.7 \times 184.6}{68.9 + 11.8} = 1.60$$

BY 6-15-71 DATE 6-15-71 **ERDMAN, ANTHONY, ASSOCIATES** SHEET 7 OF 7
 CH H/K DATE 6-15-71 SUBJECT Stability Analysis SUB-SHEET NO.
 OWNER PROJECT NAME Burt Dam - Phase I Inspection

Case 2 $\Sigma M_o = 60.1^k \times 27.3' + 68.9 \times 20.7 + 11.8 \times 12.9 + 100 \times 51.0 = 3728.1^k$

$\Sigma R = 184.6 \times 26.82' = 4951^k$ ✓

$\Sigma V = 184.6 - 60.1 = 124.5^k \downarrow$ $F.S._{OT} = \frac{4951}{3728} = 1.33$

$\bar{x} = \frac{4951 - 3728}{124.5} = 9.82'$

$c = \frac{b}{2} - \bar{x} = \frac{41}{2} - 9.82 = 10.68' > 6.9 \text{ N.G.}$

$F.S._{sliding} = \frac{.7 \times 124.5}{68.9 + 11.8 + 10} = .96$

$\text{ans: } \frac{61.53}{3} + 5 = 20.5 + 5 = 25.5$

$30.7/3 + 5 = 10.2 + 5 = 15.2$

Case 3 $\Sigma M_o = 117.9 \times 22.8 + 118.1 \times 25.5 + 11.8 \times 12.8 = 5850.7$ ✓

$\Sigma R = 184.6 \times 26.82 + 22.5 \times \frac{23.5}{3} + 29.4 \times 15.2 = 5574.1$ ✓

$\Sigma V = 184.6 + 22.5 - 117.9 - 89.2^k$

$F.S._{OT} = \frac{5574.1}{5850.7} = .95$

$\bar{x} = \frac{5574.1 - 5850.7}{89.2} = -3.1$

$c = \frac{b}{2} - \bar{x} = \frac{41}{2} + 3.1 = 23.6 > 6.9 \text{ N.G.}$

$F.S._{sliding} = \frac{.7 \times 89.2}{118.1 + 11.8 + 29.4} = .62$

APPENDIX G

PREVIOUS INSPECTION REPORTS/
AVAILABLE DOCUMENTS

DAM INSPECTION REPORT
(By Visual Inspection)

15C 272

Dam Number	River Basin	Town	County	Hazard Class	Date & Inspector
272	W LAKONTARIO	NEWFANE	NIAGARA	C	9/77 BC

Stream - EIGHTEEN MILE CREEK Owner - NIAGARA MOHPARK - ?

Type of Construction

Use

- ☐ Earth w/Concrete Spillway
☐ Earth w/Drop Inlet Pipe
☐ Earth w/Stone or Riprap Spillway
☒ Concrete
☐ Stone
☐ Timber
☐ Other _____

- ☐ Water Supply
☐ Power
☐ Recreation - ☐ High Density
☐ Fish and Wildlife
☐ Farm Pond
☒ No Apparent Use-Abandoned
☐ Flood Control
☐ Other _____

Estimated Impoundment Size 95 Acres ### Estimated Height of Dam above Streambed 45 Ft.

Condition of Spillway

- ☒ Service satisfactory ☐ Auxiliary satisfactory
☐ In need of repair or maintenance ☐ In need of repair or maintenance

Explain: Small cracks in concrete - No leaks 1- 6'x16' sluice gate to
down in apron foot

Condition of Non-Overflow Section

- ☒ Satisfactory ☐ In need of repair or maintenance

Explain: _____

Condition of Mechanical Equipment

- ☐ Satisfactory ☐ In need of repair or maintenance

Explain: Not Generating any power 2-pansucks 9'x14' hooked off.
GENERATORS REMOVED

Siltation ☐ High ☐ Low

Explain: _____

Remarks: C. HAZARD - MARINA, HOUSES 2 MILES Downstream

Evaluation (From Visual Inspection)

- ☐ Repair req'd. beyond normal maint. ☒ No defects observed beyond normal maint.

THOS. J. MORRISON, Division Engineer

STATE OF NEW YORK

DWIGHT B. LA DU
STATE ENGINEER

M/L

DEPARTMENT OF STATE ENGINEER
WESTERN DIVISION

ARNOLD G. CHAPMAN
DEPUTY

Power dam at Eighteen Mile Creek, at Burt, N.Y. ROCHESTER

Sept. 12, 1924.

SUBJECT:

Hon. Dwight B. La Du,
State Engineer,
Albany, N. Y.

Dear Sir:-

Referring to the construction of the concrete power dam on Eighteen Mile creek, at Burt, N. Y., I have twice visited the site- once on August 13th, when a part of the foundation was ready for inspection, and again on August 28th, when the Contractors were ready to pour concrete.

At the time of my first visit a portion of the east end of the dam had been excavated and the trenches in the rock for the foundation made. The rock on the surface is rather soft red sandstone, which tends to disintegrate on exposure. Lower down the rock is considerably higher and appears to be quite free from seams. I suggested that a narrow trench be cut back into the side of the rocky cliff so as to key the dam more securely into the side. On my second visit a section about 40-feet long at the east end of the dam had been prepared for concreting, and the key that I had suggested on my former visit had been dug. The rock foundation was in very good shape to receive the concrete.

The Company is to notify me when another section of the foundation will be ready and when I am so notified I will inspect that.

Very truly yours,
Thos. J. Morrison,

Thos. J. Morrison
Division Engineer.

McCARTHY BROS. & FORD,

ELECTRICAL HEADQUARTERS

SUPPLIES-ENGINEERING-CONTRACTING-REPAIRS

75-79 WEST MONAWK ST.
BUFFALO, N.Y.

May 6 1924

OFFICE STAMPED
MAY 7 1924
REPT. to Mr. Kine
AND

Mr A R McKim
Dept of State Engineer & Surveyor
Albany New York

Subject Dam #272 W Ontario- Burt
Lockport & Newfane Water & Supply Co

Dear Sir:

With further reference to our telephone conversation today. After talking with you, I received your letter and find that the old print of Drawing 1330-E was sent you instead of the revised print. I am accordingly attaching two prints of revised Drawing 1330-E showing the revised section of the Dam thru the power house.

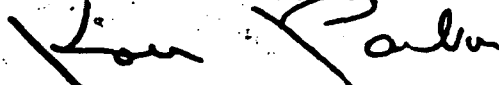
Also am attaching two prints of drawing 1332-E showing revised section of the spillway with steel re-inforcing as you suggest.

With reference to the application, advise that our pen stocks will at all times be capable of accommodating a flow of not less than 2141 CFS. As a matter of fact they will accommodate a still greater flow of water.

On the basis of the application which you have and the revised prints enclosed herewith, can you not let us have immediate approval of this Dam and oblige

Very truly yours,

MCCARTHY BROS & FORD



Engineering Manager.

Harr Parker-B

Note: Blue prints being sent under separate cover.

MC CARTHY BROS. & FORD,

ELECTRICAL HEADQUARTERS

SUPPLIES-ENGINEERING-CONTRACTING-REPAIRS

75-78 WEST MONAWK ST.
BUFFALO, N.Y.

April 25 1924

Arnold H Chapman, Deputy State Engineer
Telephone Building
Albany N Y

Attention Mr A R McKim.
Subject Lockport & Newfane Power & Water Supply Co.
Dam 272 W Ontario, Burt.

Gentlemen:

With further reference to the conference which I had with Mr McKim on the 22nd instant regarding the application of the Lockport and Newfane Power & Water Supply Co for the erection of a dam on Eighteen Mile Creek at Burt N Y, I have revised the application and plans in accordance with the agreement reached at this conference and am forwarding herewith.

EXHIBIT A Application for the construction of the dam.
This supercedes the previous application which was sent you.

EXHIBIT B Three prints of revised drawing 1330-E showing Power House plan and cross-section.

EXHIBIT C Three prints of SK 1019 showing graphically the forces in the dam, and three prints of Dwg 1332-E showing the dam.

You will note that we are providing for a maximum flow in accordance with your letter of the 16th instant. We point out that this flow is 12 times the normal flow of this stream and 5 times the greatest known flood and we believe that the maximum runoff which is being calculated is very much in excess of anything that it is necessary to provide for. However, in view of the fact that we have met your conditions, we would ask that you let us have your approval of the revised plans at the earliest possible date.

Work is already under way at the site of the dam and I appreciate very much Mr McKim's promise to give the revised application immediate attention and wish to thank him for courtesies extended to me while in Albany. In replying kindly address your communications to me and oblige

Very truly yours,

Karr Parker
Engineering Manager.

Karr Parker-B

STATE OF NEW YORK
DEPARTMENT OF

State Engineer and Surveyor

ALBANY

Received April 30 - 1924 Dam No. 272 W Ont Watershed
 Disposition Approved May 9 - 1924 Serial No. 568
 Foundation inspected _____
 Structure inspected _____

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked: 1330-E & 1332-E and Sheet #3 State Engineers
Map of Eighteen Mile Creek 1919 Report Vol.1. site Western N Y Water Co.

herewith submitted for the { construction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about October 1 1924
 (Date)

1. The dam will be on Eighteen Mile Creek flowing into Lake Ontario in the town of Newfane County of Niagara and 250 ft south of Highway Bridge at Burt N.Y. 1.9 miles from Olcott Light
 (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream) House.

2. The name and address of the owner is Lockport & Newfane Power & Water Supply Co.
Middleport N.Y.

3. The dam will be used for Generation of Electric Power.

4. Will any part of the dam be built upon or its pond flood any State lands? NO

5. The watershed at the proposed dam draining into the pond to be formed thereby is 85 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 95 acres and will impound 173,000,000 cubic feet of water.

7. The lowest part of the natural shore of the pond is 15 feet vertically above the spillcrest, and everywhere else the shore will be at least 20-42 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 1000-1200 cubic feet per second on Estimate no records. See State Engineers Report 1919 p. 227-241.

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam NO such possibility

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Limestone

11. The material of the right bank, in the direction with the current, is limestone, at the spillcrest elevation this material has a top slope of 14.4 inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of several miles, see Map feet, and the top surface extends for a vertical height of 30 feet above the spillcrest.

12. The material of the left bank is limestone, has a top slope of 34 inches to a foot horizontal, a thickness of several miles, see Map feet, and a height of 15 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity etc. Very hard and impervious

14. If the bed is in layers, are the layers horizontal or inclined? horizontal If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping

15. What is the thickness of the layers? 6-12 inches

16. Are there any porous seams or fissures? No

17. **WASTES.** The spillway of the above proposed dam will be 75 feet long in the clear; the waters will be held at the right end by a Dam the top of which will be 7.5 feet above the spillcrest, and have a top width of 5 feet; and at the left end by a dam, See Dwg 1330-E the top of which will be 7.5 feet above the spillcrest, and have a top width of 5 feet.

18. There will be also for flood discharge a pipe inches inside diameter and the bottom will be feet below the spillcrest, a sluice or gate 6 feet wide in the clear by 6 feet high, and the bottom will be 45 feet below the spillcrest.

19. **APRON.** Below the proposed dam there will be an apron built of Concrete, 75 feet long across the stream, 15 feet wide and 9-4 feet thick. The downstream side of the apron will have a thickness of 6 feet for a width of 3 feet. See details on Dwg 1332-E.

20. **PLANS.** Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. **SKETCHES.** For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. **ELEVATIONS.** Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. **SAMPLES.** When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over $\frac{1}{2}$ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. **INSPECTION.** State how inspection is to be provided for during construction. Regular
inspection by a Professional Engineer licensed in the State of New York.

25. **WATER SUPPLY.** Are the waters impounded by the above dam to be used for a public water supply? No.
Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?

Maximum flow to be provided or according to State Engineer's letter 4-15-24 is
 85 sq miles drainage on X64 CFS = 5440 CFS
 Maximum amount from Canal as per agreement
 with the State of New York 500 CFS
 Total 5940 CFS

In respect to Item A we submit that this figure is very much in excess of any floods which we have ever experienced on 18 Mile Creek, going back 20 years. Under chapter 425 Laws of 1918 the State Engineer made a careful survey of this stream, see pp 227-241 of 1919 Report and calculated that 307 acres of bottom land would be flooded if the flow was increased to 1000 CFS - as a matter of experience all this land has not been flooded as far back as local records go.

The above flow will be provided for as follows (See Dwg 1332-E)

2 - Penstocks 9' x 14' 690 CFS
 1 - " 11' x 18' 551 CFS
 1 - 6'x6' submerged sluice gate (h = 50') 1742 CFS

$$Q = CA \sqrt{2gh} = 0.85 \times 36 \sqrt{64.4 \times 50}$$

$$Q = 1742$$

Spillway 75' long x 5' max. depth of water 2970 CFS
 Total 5953 CFS

Spillway Discharge Calculation

Francis' Formula $Q = 3.33 l h^{3/2}$
 $l = 75', h = 5'$
 $Q = 3.33 \times 75 \times 5^{3/2} = 2970 \text{ CFS}$

It will be noted that the normal elevations of water on the dam is 297 and the maximum elevation under the above flood condition with 5 ft of water on the spillway would be 302. It will be further noted that the water cannot wash around the ends of the dam or overflow the banks and that no damage would be done if the non-overflow section should be over-topped - which latter condition we consider impossible as the maximum flow being provided for is 12 times the normal flow of the stream and 5 times the greatest known floods on this stream. Careful tests and records of other hydro-electric plants on this stream show, for the past 8 years, that the average flow is

Canal water 375 CFS
 Natural run off 75- 125 CFS
 Total Flow 500 CFS

The above information is correct to the best of my knowledge and belief.

Middleport, New York
 (Address of signer)

Lockport & Newfane Power & Water Supply Co

April 24 1924
 (Date)

F. S. Tracy Manager
 (A person signing for owner should indicate his title or authority)

Lockport and Newfane Power and Water Supply Co.

OFFICE 16 STATE STREET

MIDDLEPORT, N. Y.

April 14th, 1924.

Mr. Arnold Chapman,
Ass't. State Eng.
Albany, N. Y.

RECEIVED
OFFICE STATE ENG.
APR 15 1924
REFD TO
ANSO

Dear Sir:

I have your letter of recent date covering the proposed dam #272 at Newfane N. Y.

Since receiving your letter, I have noticed that we had the location as being 250 ft. south of the highway bridge below Newfane, N. Y. This location should have been 250 ft. south of the highway bridge at Burt, N. Y., or about 11,000 ft. north of the highway bridge at Newfane, N. Y. and approximately 1000 ft. south of the lake level in this Creek.

You also state that the maximum flow would overflow the complete dam and spillway approximately one foot. Kindly let me know the cubic flow you are taking as a maximum flow. We have measured the maximum flow that has been known as the maximum flow for the past twenty years and found that it would not exceed 1000 cu. ft. per second.

If you will give me this information as soon as possible, I will forward it to our engineer so that we may have a new set of plans sent to you at once.

Thanking you, we remain

Yours very truly,

LOCKPORT & NEWFANE POWER & WATER SUPPLY
CO.

FST:AL

By

J. H. Tracy

Mgr.

STATE OF NEW YORK

DEPARTMENT OF

State Engineer and Surveyor

ALBANY

Received March 25th 1924 Dam No. 272 W One Watershed
Disposition Not approved Serial No. 558
Site Inspected Lake application approved
Foundation Inspected
Structure Inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1917, Section 22 as amended, for the approval of specifications and detailed plans, marked 1330-E & 1332-E

Location Map Project N Y #15

herewith submitted for the ~~construction~~ ^{construction} of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam.

1. The dam will be on Eighteen Mile Creek branch of in the town of Newfane County of Niagara and 250 ft north of highway bridge below Newfane N. Y.

(Give exact distance and direction from a well-known bridge, dam, village, main cross-roads or mouth of a stream)

2. The name and address of the owner is Lockport & Newfane Power & Water Supply Co Middleport N. Y.

3. The dam will be used for Generation of Electric Power.

4. Will any part of the dam be built upon or its pond flood any State lands? No

5. The watershed at the proposed dam draining into the pond to be formed thereby is 85 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 95 acres and will impound 173,000,000 cubic feet of water.

7. The lowest part of the natural shore of the pond is 15 feet vertically above the spillcrest, and everywhere else the shore will be at least 20-42 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 800-1000 cubic feet per second on Estimate no records.

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam No such possibility

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Limestone

11. The material of the right bank, in the direction with the current, is limestone; at the spillcrest elevation this material has a top slope of 1 1/2 inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of 17 feet, and the top surface extends for a vertical height of 30 feet above the spillcrest. several miles, see Map.

12. The material of the left bank is limestone has a top slope of 3/4 inches to a foot horizontal, several miles, see map a thickness of 15 feet, and a height of 15 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Very hard and impervious.

14. If the bed is in layers, are the layers horizontal or inclined? horizontal If inclined what is the direction of the slope relative to the center line of the dam and the inches vertical to a foot horizontal?

15. What is the thickness of the layers? 6-12 inches

16. Are there any porous seams or fissures? No

17. WASTES. The spillway of the above proposed dam will be 45 feet long in the clear; the waters will be held at the right end by a Dam the top of which will be 4.5 feet above the spillcrest, and have a top width of 5 feet; and at the left end by a Dam, See Dwg 1330-E the top of which will be 4.5 feet above the spillcrest, and have a top width of 5 feet.

18. There will be also for flood discharge a pipe 6 inches in diameter and the bottom will be 6 feet below the spillcrest, a sluice or gate 6 feet wide in the clear by 6 feet high, and the bottom will be 4.5 feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of concrete 45 feet long, 15 feet wide and 9 feet thick. The downstream side of the apron will have a thickness of 6 feet for a width of 2 feet. See Details on Dwg 1332-E.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings of the proposed structure. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the plans any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer.

21. **SKETCHES.** For small and unimportant structures, if plans have not been made, on the back sheet of this application make a sketch to scale for each different cross-section at the highest point, showing the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; and the abutments by their top width and top lengths from the upstream face of the spillcrest and give the elevation of the top in reference to the spillcrest.

22. **ELEVATIONS.** Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at both ends of the spill; and of the spillcrest for the above proposed dam.

23. **SAMPLES.** When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand one-half a cubic foot is desired; for cement, three pints; and for the natural bed, twenty cubic inches.

24. **INSPECTION.** State how inspection is to be provided for during construction. Regular
inspection by a Professional Engineer licensed in the State of New York.

25. **WATER SUPPLY.** Are the waters impounded by the above dam to be used for a public water supply? no. Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y. ?

I have carefully checked over the matter of the maximum flow of water that can be expected in Eighteen Mile Creek and I am informed by some of the plant officials in Lockport who have had experience with this stream for many years, that 800 CFS has been considered to be a very great flood and that only once in the past 15 years did the flow ever reach 1000 CFS. This occasion was in the winter time. Very careful surveys have been made by the State Engineer showing the land which will be flooded if 1000 CFS is put down this Creek. Our estimate of the maximum floods that ever have obtained on this Creek is based on the known area of land which has been flooded at these times.

The spillway as proposed is ample to take care of more than 1000 CFS with all the turbine gates closed and in addition to that, there is of course, the sluice gate which can also be used. It must be kept in mind that practically all of the water coming down this Creek is discharged from the Canal and that the stream is short, the drainage there is small and it is relatively not subject to floods to anything like the extent that a stream would be if its entire volume was supplied from runoffs of a large drainage area.

See Column 1 page 227 of Report of New York State Engineer and Surveyor (1919) on Survey of Eighteen Mile Creek - note maps accompanying this report and showing site of proposed dam.

The above information is correct to the best of my knowledge and belief.

Middlebrook, N.Y.
(Address of signer)

The Lockport Water Supply Company
by E. H. Hays

March 24 - 1924.

Ray L. Wheeler, Secretary
(A person signing for a company should indicate his title or authority.)

DATE
ILME