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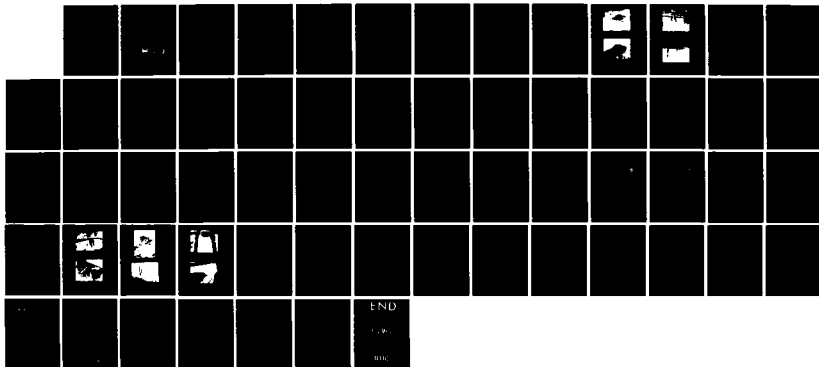
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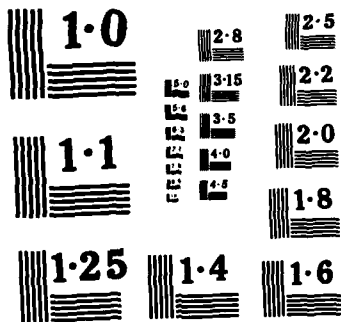
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AD-A155 805

PENOBSCOT RIVER BASIN
BUCKSPORT, MAINE
SILVER LAKE DAM
ME 00147

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Penobscot River Basin Bucksport Maine		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) -The dam is about 29 ft. high and about 470 ft. long. The lake is used to supply industrial water to Saint Regis Paper Co. and domestic water supply to the town of Bucksport. The dam is in fair condition. It is intermediate in size with a high hazard classification. Round the clock surveillance should be provided during periods of high precipitation.		



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

REPLY TO
ATTENTION OF:

JAN 26 1979

NEDED

Honorable Joseph E. Brennan
Governor of the State of Maine
State Capitol
Augusta, Maine 04330

Dear Governor Brennan:


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

A copy of this report has been forwarded to the Department of Agriculture and the Department of Transportation, cooperating agencies for the State of Maine. In addition, a copy of the report has also been furnished the owner, St. Regis Paper Company, Bucksport, Maine 04416, ATTN: Mr. Preston Robinson, Chief Engineer.

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

I wish to take this opportunity to thank you and the Department of Agriculture and the Department of Transportation for your cooperation in carrying out this program.

Sincerely yours,


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SILVERLAKE DAM

ME 00147

PENOBSCOT RIVER BASIN
BUCKSPORT, MAINE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT

Identification No.: ME00147
Name of Dam: Silver Lake Dam
Town: Bucksport
County and State: Hancock County, Maine
Stream: Unnamed
Date of Inspection: 15 Dec. 1977 and 31 May 1978

BRIEF ASSESSMENT

Silver Lake Dam is about 29 feet high, averages about 100 feet wide and is about 470 feet long. It is a composite dam consisting of an overflow concrete gravity spillway with flanking non-overflow dikes of earth construction. The concrete spillway is about 50 feet long. The concrete spillway weir is separated by a 6 foot wide stop log weir.

The lake is used to supply industrial water (pulp processing) to Saint Regis Paper Co. and domestic water supply to the town of Bucksport. The lake is nearly 2.5 miles long and has a surface area of about 670 acres.

The dam is about 48 years old and is in fair condition. The outlet works has limited ability to regulate the reservoir level and drain the lake. It has inadequate spillway discharge capacity to prevent overtopping during the test flood. Seepage of about 0.4 gpm was noted at the downstream toe of the right side embankment. The location and condition of an abandoned 10 inch pipe thru the foundation area of the dam embankment is unknown.

Based on its intermediate size and high hazard classification in accordance with the Corps' guidelines the test flood is the PMF. The spillway will pass only about 36 percent of the PMF test flood and is considered inadequate.

Round-the-clock surveillance should be provided during periods of high precipitation. The owner should develop a formal warning system. An operational procedure to follow in the event of an emergency should also be adopted.

Recommendations and remedial measures described in Section 7 should be implemented by the owner within two years after receipt of this Phase I Inspection Report.

John C. Hart

John C. Hart
Registered Professional Engineer
Commonwealth of Massachusetts
Registration Number 19456

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

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

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

Carney M. Terzian

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

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

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

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

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

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

CONTENTS

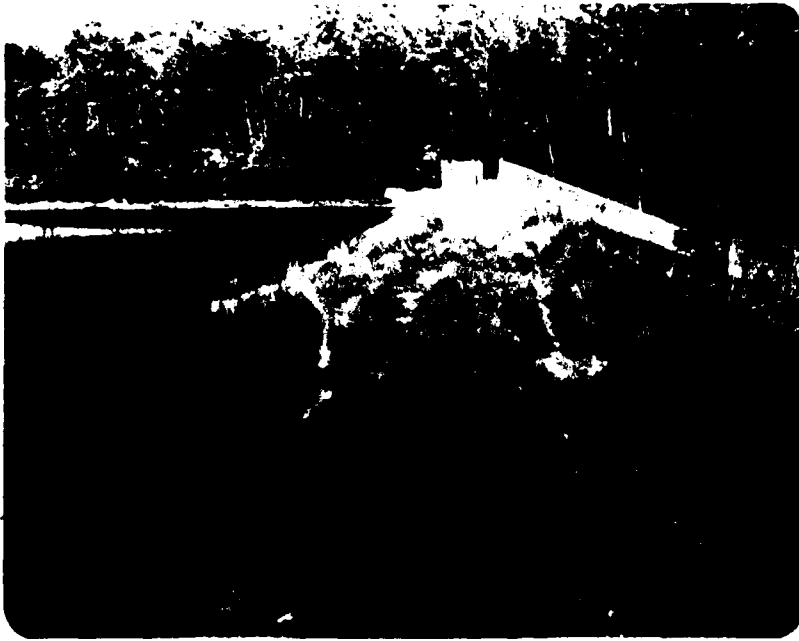
<u>Title</u>	<u>Page</u>
BRIEF ASSESSMENT	
REVIEW BOARD PAGE	
PREFACE	i
CONTENTS	ii
OVERVIEW PHOTOS	iii, iv
VICINITY MAP	v
TOPOGRAPHIC MAP	vi

REPORT

Section	
1 PROJECT INFORMATION	1
1.1 General	1
1.2 Description of Project	1
1.3 Pertinent Data	4
2 ENGINEERING DATA	7
2.1 Design and Construction	7
2.2 Operation	7
2.3 Evaluation	7
3 VISUAL INSPECTION	8
3.1 Findings	8
3.2 Evaluation	10
4 OPERATIONAL PROCEDURES	11
4.1 Procedures	11
4.2 Maintenance of Dam and Operating Facilities	11
4.3 Description of Any Warning System in Effect	11
4.4 Evaluation	11
5 HYDROLOGY AND HYDRAULIC ANALYSIS	12
5.1 Evaluation of Features	12
6 STRUCTURAL STABILITY	14
6.1 Evaluation of Structural Stability	14
7 ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES	16
7.1 Dam Assessment	16
7.2 Recommendations	16
7.3 Remedial Measures	17

APPENDICES

	<u>Designation</u>
CHECK LIST - VISUAL INSPECTION	A
INSPECTION REPORTS/SKETCHES	B
PHOTOGRAPHS (Figures)	C
HYDROLOGY/HYDRAULICS	D
INVENTORY DATA	E



No. 1 VIEW LOOKING EAST ALONG CREST OF DAM - NOTE FENCING
SURROUNDING SPILLWAY



No. 2 VIEW LOOKING WEST ALONG CREST AND DOWNSTREAM SLOPE
OF RIGHT SIDE EMBANKMENT



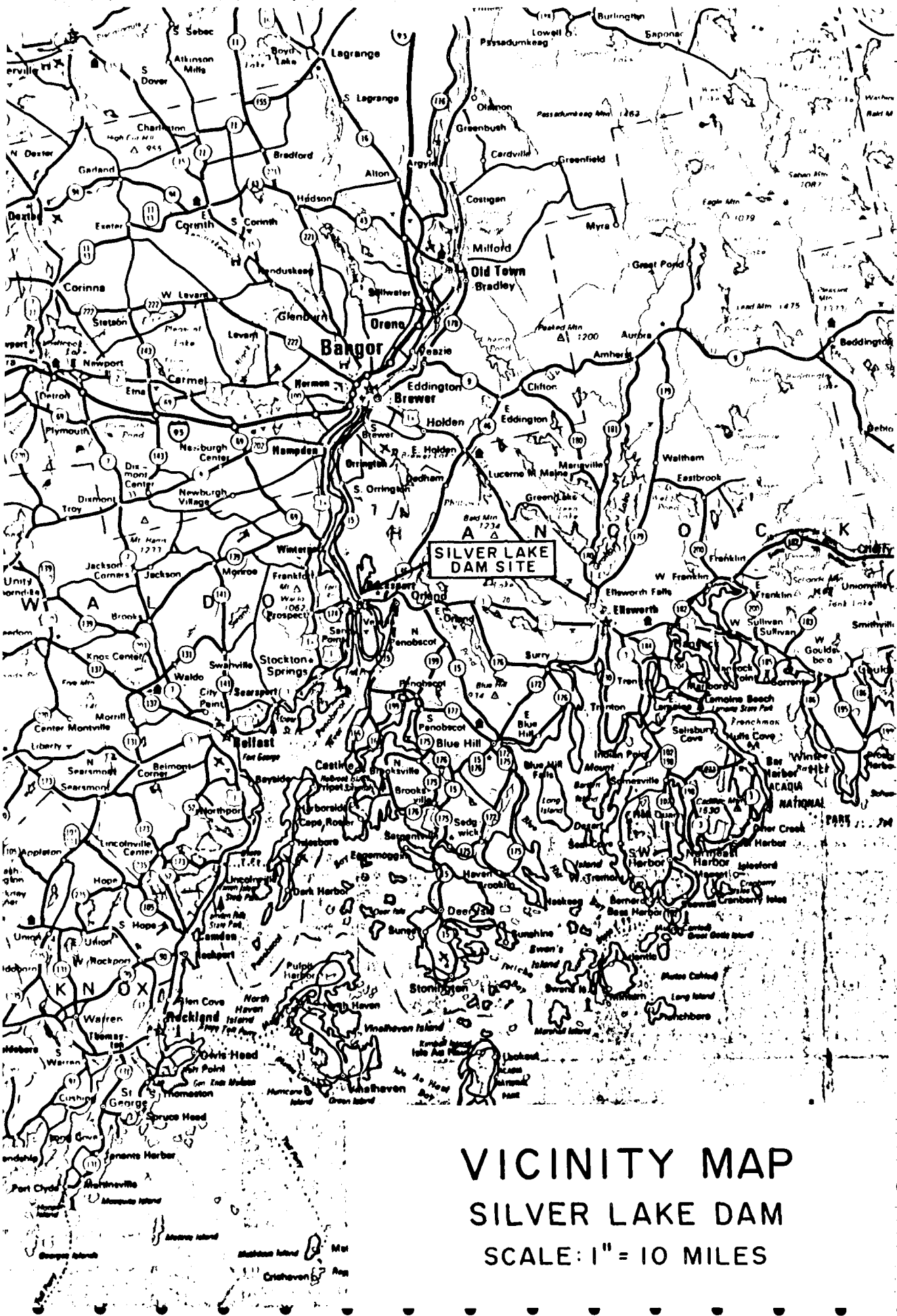
No. 3

VIEW OF SPILLWAY - LOOKING UPSTREAM FROM DOWNSTREAM
SIDE



No. 4

VIEW OF SPILLWAY - NOTE STOPLOG STRUCTURE AT CENTER
OF WEIR



SILVER LAKE
DAM SITE

VICINITY MAP
SILVER LAKE DAM
SCALE: 1" = 10 MILES

PHASE I INSPECTION REPORT
SILVER LAKE DAM, ME. 00147

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

b. Purpose:

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

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

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

1.2 Description of Project

a. Location. The dam is located in the town of Bucksport, Maine and about 19 miles south of the city of Bangor. The dam site is located on an unnamed stream about a mile upstream of the center of the town.

b. Description of Dam and Appurtenances

(1) General. Silver Lake Dam is a composite structure consisting of an overflow concrete gravity spillway with flanking, non-overflow dikes of earth construction. The overall length of the dam is about 470 feet. See Photo Nos. 1 thru 4..

c. Maintenance of Operating Facilities. The sluiceway and stop logs are in good condition and are functional even though the stop logs are operated manually. Although methods of removal of the logs is slow and cumbersome, they are not considered to affect the safety of the dam. The steel bulkheads are also in good condition and also show evidence of periodic maintenance. As previously described, the discharge channel walls have been gunited in order to control seepage through cracks and joints in the walls. Furthermore, there is no warning system in effect other than the 6 inspections per year.

d. Post Construction Changes. The major post construction change to the Silver Lake Dam was the addition of 3 ft. high steel flashboards (bulkheads) in 1952 and then increasing them to 5.5 ft. in 1965 in order to increase the storage capacity of the reservoir. Drawings have been obtained for the 1952 change but no drawings have been located for the later change nor have any computations been found relating to the effect of these changes on the stability of the structure. The additional overturning forces resulting from increasing the height of the flashboards, with no substantial addition of resisting forces, could have a significant effect on reducing the original Safety Factors for overturning and sliding of the spillway.

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

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) Dam Embankments. Visual inspection of the embankments indicate a favorable comparison with earth dams that have proven safe in service. Of the various observations made on the embankment, the seep at the downstream toe of the right side embankment is the most critical with regards to stability. Although it is considered that this seep presents no stability problem at this time, observations should be made in accordance with Section 7 to monitor for the continuing possibility of piping.

(2) Outlet Works. The previous mentioned spalling of the weir, surficial cracking of and seepage through the walls is not considered detrimental to its safety, although observation is recommended and may be accomplished by periodic comparative photographs and/or physical measurements. The 3 foot thick concrete slab at the downstream toe of the weir was not visible during the inspection. This slab should be uncovered and examined and its resistance to uplift pressures and scour determined.

b. Design and Construction Data.

(1) Dam Embankments. There are no known design records available other than the drawings shown in Appendix B. There is no known information on embankment materials used in the construction except that which is shown on the cross-sections. The type of foundation (earth or bedrock) upon which the embankment, corewall and spillway bear is not known. The presence of downstream seepage, the spillway upstream impervious blanket as well as the configuration of the weir and discharge slab suggest an earth foundation. The presence of the abandoned 10 inch pipe could be conducive to piping and eventual slope failure.

(2) Spillway. The original contract drawings for the dam and a 1952 drawing for the addition of 3 ft. flashboards have been located. The original drawings show the concrete weir and channel walls, but show no design for any bulkheads. They do, however, show that there were provisions for some type of flashboards; however, there was no indication to their height. The original drawings also show construction joints at various locations in the wall. They were not visible due to the gunite cover that has since been applied.

The second condition investigated was to determine the maximum height of flashboards that can be used without the dam overtopping under test flood inflows. It was determined that by limiting the height of flashboards to 4 foot (elevation 128), the spillway capacity is adequate to discharge the routed test flood outflow without overtopping the dam.

f. Dam Failure Analysis. The impact of failure of the dam with the pool elevator at the top of the dam was assessed using the "Rule of Thumb" guidance for estimating downstream dam failure hydrographs. The analysis covered the reach from the dam to the Central Street culvert. Failure of the Silver Lake Dam would result in a 12-foot wave in this reach of the river and would cause serious damage to about twenty homes and possible loss of life. Central Street would be overtopped and severed with the loss of important public utilities. Based on this estimate, the dam has been classified as high hazard.

SECTION 5

HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features.

a. General. The Silver Lake Dam is a composite structure consisting of an overflow concrete gravity spillway with flanking, non overflow dikes of earth construction. The appurtenant works consist of two outlet conduits and a 6-foot wide stop log weir which is located at the center of the spillway. The two very low capacity conduits are a 36-inch industrial water supply line to the Saint Regis Paper Company and a 12-inch domestic water supply line to the Bucksport Water Company. The dam is located on an unnamed tributary of the Penobscot River and was constructed for water supply purposes.

b. Design Data. The dam was designed by the New England Public Service Company which has now been absorbed by the Maine Central Power Company. The only hydraulic design data available is a stage-capacity curve which is included as Fig. 3 of Appendix D.

Silver Lake Dam with a maximum height of 29 feet and a maximum storage of 12,700 acre-feet is classified as being intermediate in size and high hazard. Under O.C.E. Guidelines for Safety Inspection of Dams, the recommended "Test Flood" is the Probable Maximum Flood (P.M.F.).

c. Experience Data. Maximum flood flows and elevations are unknown.

d. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

e. Overtopping Potential. As no detailed design information is available, hydraulic evaluation was performed using information gathered by field inspection, watershed size and an estimated test flood equal to the probable maximum flood. Based on a drainage area of 5.5 square miles, the estimated test flood inflow is 8,000 CFS.

The routed test flood outflow and resulting pool stage was determined for two conditions. Under the present conditions with the 5.5 foot flashboards (steel bulkheads) at a top elevation of 129.5, the routed outflow is 2625 CFS and the dam is overtopped by about 1 foot. Therefore the spillway capacity is inadequate (36% of outflow) to discharge the outflow without overtopping the dam. With a test flood equal to one-half the PMF, the spillway had adequate capacity and the dam is not overtopped.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures. Normal operation by St. Regis Paper Co. is aimed at maintaining the pool between elevations 124 and 127. The stoplogs are added or removed to regulate the water level. Water is withdrawn from the reservoir through the 36-inch water supply line to the Paper Co. and the 12-inch domestic water line to the town. Very little water appears to flow over the spillway.

4.2 Maintenance of the Dam and Operating Facilities. Maintenance of the dam is performed by the owners of St. Regis Paper Co. on a regular basis. There is a good growth of grass growing on the slopes despite the presence of numerous shrubs and some trees. There are also some shrubs and small trees growing in the discharge channel. The stoplogs and steel bulkhead are in good condition. The spillway walls were gunited in 1972.

4.3 Description of any Warning Systems in Effect. The dam is inspected six times a year by the Paper Co. This inspection provides the only warning system except cursory observations by occasional fishermen or hunters.

4.4 Evaluation. The spillway and outlet works appear to be well operated and maintained; however the embankments appear to be only fairly well maintained. Any distress occurring in the dam would only be discovered at periods of 2 months. This frequency is undesirable for a structure of this magnitude. St. Regis Paper Co. should also establish a warning system to follow in event of any emergencies.

e. Downstream Channel. Although not considered a major problem, it was observed that the channel was choked with vegetative growth (trees, shrubs) which constrict the waterway, thus reducing its design discharge capabilities. The first 3,000 feet of channel flows through a flat, wide swampy area with no inhabitable structures. The slope for this reach is approximately 0.75 percent. The next 2,000 feet of the channel is densely inhabited with single family homes and trailers located 5 to 10 feet above streambed. The streambed drops about 20 feet in this reach (1 percent slope). There is a difference of elevation of approximately 80 feet for the last 1,000 foot reach before the stream enters the Penobscot River. Single family residences are also located adjacent to the streambed in this reach. Through the middle reach, the river flows under approximately 3 roads and thru various size box culverts and pipes which appear inadequate in size to pass the test flood.

3.2 Evaluation.

a. General. The observed condition of the project is fair. With the exception of a few items, these structures are structurally sound and no immediate action to remedy any serious problems need be taken. The potential problems observed during the visual inspection are listed below.

b. Earth Embankments.

(1) Trees and shrubs growing on the embankments and within 10 feet of the toes should be cut and removed. The stumps should be removed to the extent practicable and the resulting excavation backfilled with a pervious gravel fill material.

(2) The location of the buried 10 inch pipe through the dike embankment foundation area should be determined. Eventual corrosion of this pipe could lead to the formation of a seepage path; therefore the pipe should be flushed, cleaned and then grouted.

(3) The two cases of seepage observed are not considered to have an adverse effect on the structural integrity of the dam at this time, but should be closely monitored for cloudiness or any increase or decrease in quantity relating to reservoir stage which could require prompt corrective action.

c. Spillway.

(1) The surficial cracking of the spillway wall mentioned previously is not uncommon and not considered hazardous to the structure, but should be monitored for any further deterioration.

(2) The limited ability to regulate the reservoir level is highly undesirable. Replacement of the stoplogs with some form of a more positive, lower level control such as a vertical lift sluice gate, bascule gate or similar device should be considered.

seepage water was very cold and was rust colored. The discoloration of the water in the pool and on the ground surface is caused by precipitation of iron minerals, (upon contact with air) from the seepage flows. The seepage emergence area overlaps the buried cast iron pipes. Some seepage could be following along these pipes. A lesser quantity of seepage was observed flowing from the left embankment toe at the intersection of the embankment and left discharge channel wall. This seepage was also flowing clear. No seepage was observed flowing from the embankments.

c. Appurtenant Structures.

(1) Visual inspection of the concrete spillway included checking for surface cracks; structural cracking; vertical and horizontal alignment; monolith and construction joints. The concrete weirs showed extensive signs of spalling in some areas, particularly the downstream side of west weir. Spalling had progressed to such a depth (2 inches) as to expose portions of the 2" x 2" wire mesh.

(2) The gravity type walls of both the approach and discharge channels exhibited numerous surficial cracks. The depths and lengths of the original cracks were difficult to determine since most of the wall surfaces had been gunited in 1972. Most of the cracks showed signs of seepage emergence as indicated by lime deposits that covered and filled these cracks. The only visible open structural crack was at the upstream corner of the west abutment wall. This structural crack was about 1/4 inch wide and was located above about elev. 129. Seven weep holes, consisting of about 1" pipe, were observed protruding from the east side discharge channel wall. According to Mr. Robinson, they were installed (about 6 inches into the wall) during the guniting to control seepage flowing thru cracks in the wall. Only two weep holes were bleeding at the time of inspection. The downstream concrete apron at the downstream toe of weir could not be observed because of the presence of 3 to 4 feet of soil, vegetation and rubble.

(3) The steel bulkheads were in good condition with only minor leakage from a 2.5 foot head (see Photo No. 10). The stop-logs in the sluiceway also appeared in good condition (see Photo No. 9).

(4) The intake for the 12 inch domestic water supply could not be observed as it is located at the upstream toe below permanent pool (Elev. 124 to 127). The location of the old 10 inch pipe could not be positively determined as the wood cover for the valve house was too heavy to be opened.

(5) The 36 inch industrial water supply line is reported by company officials to be in good condition.

d. Reservoir Area. The drainage area is relatively small, 5.06 square miles, while the topography is gently rolling with some swampy areas. Vegetative cover ranges from open agricultural land to densely wooded areas. No sloughing of the reservoir slopes was noted.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The first Phase I inspection was performed on 15 December 1977. Observations were limited by the depth of snow cover (6 to 12 inches); therefore another field inspection was conducted on 31 May 1978 after the snow cover had melted.

b. Earth Embankments.

(1) The dam, approximately 50 years old, showed no signs of sloughing or erosion of the embankment or the abutment slopes. The vertical as well as horizontal alignment of the crest showed no signs of distress and no cracks or unusual movement, including rip-rap failure and/or dislocations were visible. Some vehicle caused rutting (about 6" deep) was observed on the crest of the right side embankment. Shrubs were noted growing on the upstream and downstream slopes of both embankments while several large trees (up to 12" dia.) were noted on the downstream slopes. (See photo nos. 2 and 8).

(2) Rip-rap on the upstream slopes extends only to about elev. 129 (ref. photo no. 7). The remaining 4 feet (measured vertical) are topsoiled and seeded as are the downstream slopes. The downstream slope of the right side embankment has a layer of rip-rap extending 7 feet (vertical) above toe and about 150 feet horizontally extending from the west spillway wall.

(3) Seepage thru the embankment of the earth embankments is controlled by the concrete core wall located under the upstream edge of the Crest (top elev. 132). Portions of this wall are visible adjacent to both sides of the spillway. There are no records available that describe the type foundation (earth or rock) for the embankments, core wall or spillway. There are no visible outcrops in the foundation area of the structures, on the abutments or in the area downstream of the dam. The lack of visual evidence of outcrops, the configuration of the spillway keys, the presence of the spillway upstream clay blanket and downstream concrete apron suggest that the structures are resting on an earth foundation. About a 4 foot high windrow of earth and boulders were noted, located about 20 feet from and parallel to the downstream toe of the right embankment. The location and character of the materials suggests that they originated from stripping and excavating of the embankment foundation areas.

(4) Seepage emergence was noted near the downstream toe of the right embankment. The seepage was ponding in a shallow pool over a length of about 70 feet (see plate B-1 and photo no. 8). The seepage was flowing clear indicating that material piping was not occurring. The

SECTION 2
ENGINEERING DATA

2.1 Design. The dam was designed by New England Power Service Co. (NEPSC) about 1930. This company has now been absorbed by Maine Central Power Co. A telephone call to this company's Augusta office revealed that there are no known design records available other than the storage capacity curve (Fig. 3) and some plans which are now incorporated into Appendix B. St. Regis Co. furnished the design plans, plus some sketches on modifications to the spillway bulkheads.

2.2 Construction. There are no known construction records available.

2.3 Operation. All available engineering operational data is included in other sections of this report.

2.4 Evaluation.

a. Availability. The available data were reviewed by members of the inspection team and were found to be accurate.

b. Adequacy. The lack of in depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. The visual inspection is generally consistent with the available plans for the exposed portions of the dam.

h. Earthfill Dikes (cont.)

- | | |
|---------------------|--|
| (3) Top Width | 8 feet |
| (4) Side Slopes | U/S and D/S, 1V on 2.5H |
| (5) Zoning | Central impervious zone with gravel shells |
| (6) Impervious Core | Concrete core wall |
| (7) Cutoff | Unknown |
| (8) Grout Curtain | None |

i. Spillway

- | | |
|---------------------|--|
| (1) Type | Overflow concrete gravity ogee type |
| (2) Length | 2 weir sections ea. 20.5 ft. = 41 feet |
| (3) Crest Elevation | 124 |
| (4) Gates | 5.5 feet high permanent steel bulkhead - Top elev. 129.5 |
| (5) U/S Channel | Concrete retaining walls bottom lined with clay blanket and riprap |
| (6) D/S Channel | Concrete retaining walls bottom lined with concrete and riprap |
| (7) Other | Spillway has 6-foot wide center sluice section with stoplogs |

j. Regulating Outlets. Regulating facilities consist of the 6-foot wide stoplog controlled weir with invert at elev. 120 or 13 feet below top of dam. Sluiceway regulation is accomplished by manually adding or removing stoplogs through use of a chainfall and makeshift support system.

- | | |
|-----------------------------------|---------|
| (7) Stoplog weir invert | 120 |
| (8) Streambed @ centerline of dam | 104 |
| (9) Maximum tailwater | Unknown |
- d. Reservoir (miles)
- | | |
|----------------------------------|-----|
| (1) Length of maximum pool | 2.5 |
| (2) Length of water supply pool | 2.5 |
| (3) Length of flood control pool | 2.5 |
- e. Storage (acre-foot) (Gross)
- | | |
|------------------------|---------|
| (1) Water Supply Pool | 7,700 |
| (2) Flood Control Pool | 9,400 |
| (3) Design Surcharge | Unknown |
| (4) Top of Dam | 12,700 |
- f. Reservoir Surface (acres)
- | | |
|------------------------|---------|
| (1) Top Dam | 700 |
| (2) Maximum pool | Unknown |
| (3) Flood-Control pool | 670 |
| (4) Water Supply pool | 670 |
| (5) Spillway Crest | 670 |
- g. Dam
- | | |
|--|--|
| (1) Type - composite structure
consisting of overflow concrete
gravity spillway with flanking
non-overflow earthfill dikes. | |
|--|--|
- h. Earthfill Dikes
- | | |
|------------|---|
| (1) Length | left side 150 feet
right side 260 feet |
| (2) Height | 28 feet |

1.3 Pertinent Data. The only available data was acquired through the visual inspection, the use of USCGS topographic map, St. Regis Paper Co. and Maine Central Power Co. Using these sources and sound engineering judgement, the following pertinent data was derived.

a. Drainage Area. Based on a watershed delineation using the 1955 USGS Bucksport Quadrangle (scale 1:62,500) the drainage area was determined to be 5.5 square miles. The watershed topography is gently rolling, with a high proportion of natural storage.

b. Discharge at Damsite.

(1) Outlet Works. The primary outlet at the dam is a 6-foot wide stoplog weir with invert at Elev. 120. A 12-inch cast iron water line is located under right embankment. The intake for the water line is located near the upstream toe while the valve house is located about 30 feet downstream of the landside toe. The capacity of the outlet weir is 875 CFS with the pool at the top of the dam. The 36 inch line has a capacity of about 30 CFS.

(2) The maximum flood at the dam site is unknown.

(3) Ungated spillway capacity at maximum pool elevation is 4,600 cfs @ elev. 133.

(4) Gated spillway capacity at normal pool elevation is 0 cfs @ elev. 129.5.

(5) Gated spillway capacity at maximum pool elevation is 940 cfs @ elev. 133.

(6) Total spillway capacity at maximum pool elevation is 940 cfs @ elev. 133.

c. Elevation (ft. above MSL) based upon elevations shown on drawings furnished by St. Regis Co.

(1) Top of Dam	133
(2) Maximum pool test flood	134
(3) Full Flood Control Pool	129.5
(4) Water Supply Pool	124 to 127
(5) Spillway Crest (gated)	129.5
(6) Upstream invert industrial water supply conduit (3 ft. dia.)	112

c. Size Classification. Intermediate (Hydraulic height - 29 feet, Storage - 12,700 acre-feet), based on storage (\approx 1000 to $<$ 50,000 acre-feet) as given in OCE Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. High hazard. A major breach in the dam would probably result in serious damage to about twenty homes, important public utilities and at least four roads.

e. Ownership. The dam is currently owned by the Saint Regis Paper Company.

f. Operator. The dam is operated by St. Regis Paper Co. The Chief Engineer, Mr. Preston Robinson, is in charge of operations and maintenance. His telephone number is 207-469-3131. The address is St. Regis Co., Bucksport, ME 04416.

g. Purpose of Dam. The dam was constructed to supply industrial water (pulp processing) to Saint Regis Paper Company and domestic water to the town of Bucksport.

h. Design and Construction History. The dam was originally designed for St. Regis Paper Co. by New England Public Service Co. (NEPSC) about 1930. This company has now been absorbed by Maine Central Power Co. Some design information was available at the offices of these two companies. This available information (plates 1, 2 and 3 and graph ^{F₁}) is included in this report. There is no data as to the type of earth and rock materials used to construct the dam or to the location of the borrow areas, other than the information shown on the drawings. The types of foundations (earth or bedrock) that the dam rests upon is not known nor is the name of the construction company that built the dam. Modifications to the dam consisted of the addition of 3 foot high steel flashboards (in 1952) to the spillway and then replacing these in 1965 with a 5.5 foot permanent type steel bulkhead in order to increase the storage capacity of the reservoir.

i. Normal Operating Procedures. Normal operation by the St. Regis Co. is aimed at maintaining the water supply pool between elevations 124 and 127 msl. The stoplogs in the sluiceway are added or removed to regulate the water level, if necessary. The 36-inch industrial water supply line to the Paper Co. (invert elev. 112) discharges about an average of 22 mgd to the plant. It is not known how much water is withdrawn thru the 12-inch domestic water line or how much discharges over the weir. To augment the normal runoff over the small watershed, water is pumped into Silver Lake through an aqueduct from nearby Alamoosook Lake. The average inflow from the aqueduct is about 6 to 7 mgd (10 cfs) with a maximum of 20 mgd. Pumping thru the aqueduct is required on the average of 10 months per year.

(2) Dike Embankments. The right side flanking dike is about 260 feet long while the left side is about 150 feet in length. The dikes reach a maximum height of about 28 feet. The side slopes are about 1 vertical on 2.5 horizontal and the crest is about 8 feet wide. The crest and downstream slopes are grass-covered except for the downstream right side which is partially riprapped. This riprap extends about 7 feet vertically above the toe. The reservoir side slopes are riprapped to about Elev. 129 or about 4 feet from top of dam. According to plans furnished by St. Regis Paper Co., seepage through the embankment is controlled by a centrally located concrete core wall (visible at upstream side of crest adjacent to spillway) and a downstream gravel toe. As described above, portions of this gravel toe are protected by riprap.

(3) Spillway. Between the dikes, at the location of the original streambed, there is an overflow concrete gravity spillway about 50 feet long (see Photo Nos. 3 and 4). The concrete weir consists of two elements, each 20.5 feet in length. Its crest is at elev. 124; however, two permanently attached steel flashboards bolted to concrete wall (see Photo No. 10) increase the effective spillway crest to elev. 129.5. The overflow weir stands about 20 feet above the discharge channel. The weir is separated by a 6-foot wide stoplog weir (see Photo No. 2) with invert at elev. 120 msl or 13 feet below top of dam. This weir is the primary flood control outlet. There are concrete retaining walls on each side of the approach and discharge channels for the full length of the channels. According to the plans, a concrete apron extends 23 feet downstream from the bottom of the spillway weir.

(4) Outlet Works. There are three outlet conduits for this reservoir, two of which are very low capacity - a 36 inch industrial water supply line to Saint Regis Paper Company and a 12 inch domestic water supply line to Bucksport Water Company (owned by St. Regis). The primary flood control outlet is a 6-foot wide stoplog weir with invert located 16 feet above discharge channel grade. Regulation for the stoplog weir is done manually by adding or removing individual stoplogs. The control tower for the 36-inch water line is located 800 feet due west of the dam adjacent to the McDonald St. Highway embankment. The invert for this pipe is at Elev. 112 msl. The lake between Elevations 104 and 112 cannot be drained. According to the St. Regis Co. officials, an old 10 inch cast iron pipe exists under the right side embankment. This pipe was constructed in the early 1900s and carried domestic water supply from an older and lower dam which was located just upstream of the existing dam. According to company officials, this pipe has now been abandoned, but has not been grouted. The new 12 inch cast iron pipe was placed in 1930 when the new dam was constructed. The 12 inch pipe now carries water downstream for use by the town of Bucksport as domestic water.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Condition. The visual inspection indicates that Silver Lake Dam is in fair condition. The major concerns that may affect the long-term integrity of the dam are as follows:

- (1) Overtopping potential
- (2) The limited ability to regulate the reservoir level and drain the lake.
- (3) The effects of raising the height of the bulkheads on the stability of the spillway.
- (4) The location and condition of the 10 inch pipe through the dike embankment foundation area.

b. Adequacy of Information. The lack of in depth engineering data did not allow for definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within two years after receipt of this Phase I Inspection Report.

d. Need for Additional Investigations. The information available from the visual inspections is adequate to identify the potential problems which are: overtopping, limited ability to regulate the reservoir level, stability of the spillway, seepage and the condition of the abandoned 10 inch ter line. These problems require the attention of a registered professional engineer who will have to make additional studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to instability of the structure.

7.2 Recommendations. The Saint Regis Paper Company should retain the services of a registered professional engineer to:

a. Evaluate further the potential for reducing the height of the steel bulkheads to a 4 foot height (crest at elev. 128) or lower in order to prevent overtopping of the earth embankments during the Probable Maximum Flood and provide an acceptable factor of safety for stability.

b. Evaluate the possibilities of replacing the stoplogs with a faster and more positive regulation control such as a vertical lift sluice gate, bascule gate, or similar device.

c. Determine the feasibility of constructing a low-level controlled outlet in the spillway section in order to rapidly drain the entire reservoir during periods of emergency. A well-designed low-level outlet could eliminate the need for stop logs or similar devices as recommended in paragraph 7.2.b above.

d. Perform a stability analysis of the spillway weir with permanent bulkheads in place as to better assess the performance of this structure. In order to accomplish this analysis, the foundation materials will have to be identified as well as the uplift pressures under the weir and downstream concrete apron.

e. Perform seepage studies of the seepage emergence at the toe of the embankments. This seepage should be monitored. Two weir ponds with V-notch weirs to measure increases or decreases in flow should be installed and periodic measurements made relating seepage flow to reservoir stage and rainfall.

7.3 Remedial Measures.

a. Operating and Maintenance Procedures.

(1) The location and condition of the 10 inch pipe through the foundation of the left side earth embankment should be determined. Eventual corrosion of the pipe could lead to the formation of a seepage path and an eventual piping failure. The pipe should be cleaned and then grouted for its full length under the embankment.

(2) All trees and shrubs growing on the embankments, in the discharge channel, and within 10 feet of the toes of these features should be cut and removed. The stumps and roots should be removed to the extent practicable and the resulting holes backfilled with a compacted pervious fill.

(3) The debris, vegetation, mud and sand in the stilling basin should be cleaned out and hauled away.

(4) The surficial cracking of the discharge channel walls should be monitored for any further deterioration. This can be accomplished by periodic comparative photographs and/or physical measurements.

(5) The rip-rap (with underlying gravel bedding layer) on the upstream slope should be extended to the top of dam.

(6) Institute a program of bi-annual periodic technical inspections.

(7) The owner should develop a written operational procedure to follow in the event of flood flow conditions or imminent dam failure. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

b. Alternates. The Saint Regis Paper Company should consider as an alternate pending implementation and results of the recommendations above that the reservoir be operated at a lower level during the year so as to provide more storage for extreme flood conditions and to provide an acceptable factor of safety for stability of the spillway.

APPENDIX A
CHECK LIST - VISUAL INSPECTION

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT Silverlake Dam, Maine

DATE May 31, 1978

TIME 2:30 P.M.

WEATHER Sunny, warm

W.S. ELEV. 126.5 U.S. DN.S.

PARTY:

- | | | | |
|----------------------------|--------------------------------|----------------------|------------------|
| 1. <u>John Hart</u> | <u>Corps of Engineers</u> | 6. <u>Phil Libby</u> | <u>Maine DOT</u> |
| 2. <u>Tsy Katz-Hyman</u> | <u>Corps of Engineers</u> | 7. _____ | _____ |
| 3. <u>Tom Feeney</u> | <u>Corps of Engineers</u> | 8. _____ | _____ |
| 4. <u>Wm. Mullen</u> | <u>Corps of Engineers</u> | 9. _____ | _____ |
| 5. <u>Preston Robinson</u> | <u>St. Regis
Paper Co.</u> | 10. _____ | _____ |

<u>PROJECT FEATURE</u>	<u>INSPECTED BY</u>	<u>REMARKS</u>
1. <u>Dam Embankment</u>	<u>J. Hart</u>	_____
2. <u>Spillway</u>	<u>Katz-Hyman, Feeney, Mullen</u>	_____
3. <u>Discharge Channel</u>	<u>Hart, Katz-Hyman, Feeney</u>	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

PERIODIC INSPECTION CHECK LIST

PROJECT Silverlake Dam, Maine DATE May 31, 1978
 PROJECT FEATURE Earth Embankments NAME John Hart
 DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	133.0
Current Pool Elevation	126.5
Maximum Impoundment to Date	127 (according to St. Regis Co. Officials)
Surface Cracks	None observed
Pavement Condition	None
Movement or Settlement of Crest	None observed - Some rutting from vehicle traffic
Lateral Movement	None observed
Vertical Alignment	No visible change in vertical or horizontal alignment has occurred.
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	Satisfactory - some erosion earth slope on reservoir side.
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Ruts on top dam by vehicles
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	See narrative report
Piping or Boils	None observed
Foundation Drainage Features	Downstream stone protection at toe of right side dam
Toe Drains	None
Instrumentation System	None according to St. Regis Paper Co. Official

PROJECT Silverlake Dam, Maine
 PROJECT FEATURE Spillway
 DISCIPLINE Geotechnical, Structural

DATE May 31, 1978
 NAME _____
 NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u></p> <p>a. Approach Channel</p> <p> General Condition</p> <p> Loose Rock Overhanging Channel</p> <p> Trees Overhanging Channel</p> <p> Floor of Approach Channel</p> <p>b. Weir and Training Walls</p> <p> General Condition of Concrete</p> <p> Rust or Staining</p> <p> Spalling</p> <p> Any Visible Reinforcing</p> <p> Any Seepage or Efflorescence</p> <p> Drain Holes</p> <p>c. Discharge Channel</p> <p> General Condition</p> <p> Loose Rock Overhanging Channel</p> <p> Trees Overhanging Channel</p> <p> Floor of Channel</p> <p> Other Observations</p> <p> Seepage Efflorescence</p>	<p>Good - some efflorescence</p> <p>No bedrock visible</p> <p>None observed</p> <p>Not visible - water too deep</p> <p>Fair to good - some cracking</p> <p>None, steel bulkheads in good condition</p> <p>Both weirs</p> <p>Wire mesh exposed on west weir</p> <p>None observed</p> <p>None observed</p> <p>Fair to good - guniting in 1972</p> <p>No bedrock observed</p> <p>Some small saplings and bushes</p> <p>Concrete apron buried with approx. 3 ft. of riprap, sand, silt and debris</p> <p>See narrative</p>

PERIODIC INSPECTION CHECK LIST

PROJECT Silverlake Dam, Maine

DATE May 31, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - TRANSITION AND CONDUIT</u></p> <p>General Condition of Concrete</p> <p>Rust or Staining on Concrete</p> <p>Spalling</p> <p>Erosion or Cavitation</p> <p>Cracking</p> <p>Alignment of Monoliths</p> <p>Alignment of Joints</p> <p>Numbering of Monoliths</p> <p>Water Supply Pipes 10 inch Cast Iron 12 inch Cast Iron</p> <p>Valve House</p> <p>Aquaduck to St. Regis Paper Co.</p>	<p>See narrative</p> <p>Abandoned but not grouted</p> <p>Not visible (see narrative)</p> <p>Good - concrete walls with flat wood deck</p> <p>Good - according to St. Regis Co. Officials</p>

PERIODIC INSPECTION CHECK LIST

PROJECT Silverlake Dam, Maine

DATE May 31, 1978

PROJECT FEATURE Spillway Bridge

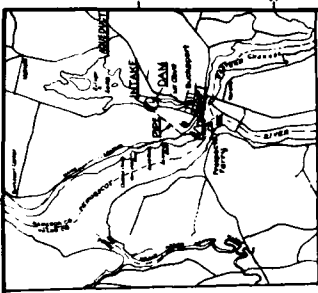
NAME Tsy Katz-Hyman

DISCIPLINE _____

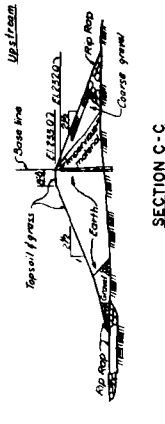
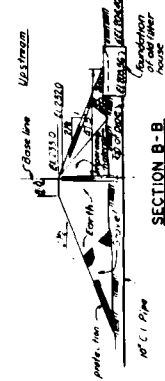
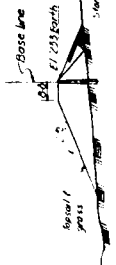
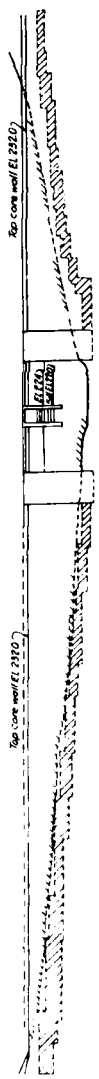
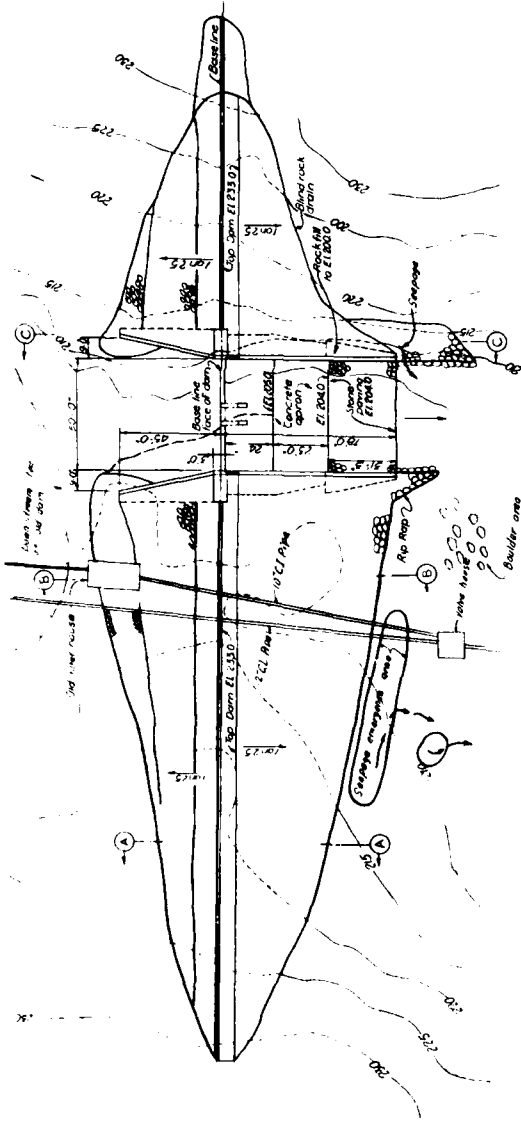
NAME: _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SERVICE BRIDGE</u></p> <p>a. Super Structure</p> <ul style="list-style-type: none"> Bearings Anchor Bolts Bridge Seat Longitudinal Members Under Side of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint <p>b. Abutment & Piers</p> <ul style="list-style-type: none"> General Condition of Concrete Alignment of Abutment Approach to Bridge Condition of Seat & Backwall 	<p>General condition was good with some spalling of concrete deck. Structural members were in good condition.</p>

APPENDIX B
INSPECTION REPORTS/SKETCHES

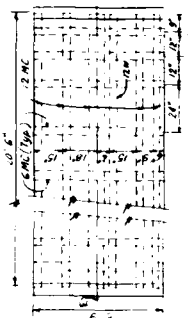


LOCATION MAP SCALE 1:62500

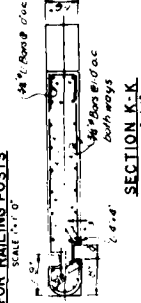


NOTE
From Sections and Details shown here are copies from original drawings by New England Public Service dated 6/26/1900

SILVER LAKE DAM	
DATE	1900
BY	W. H. ...
CHECKED BY	...
APPROVED BY	...
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	

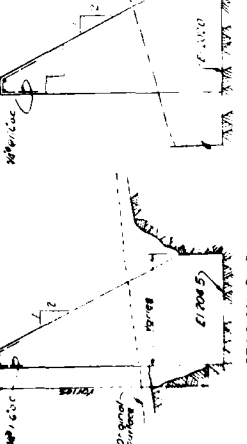
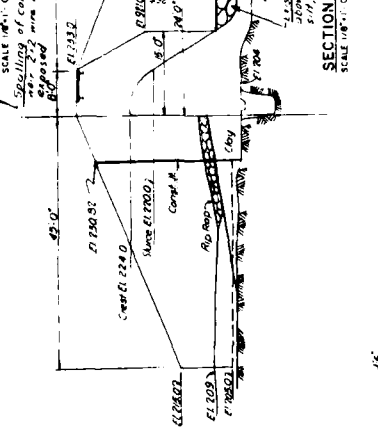
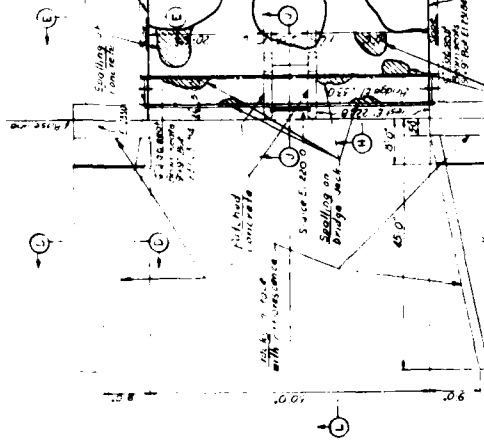
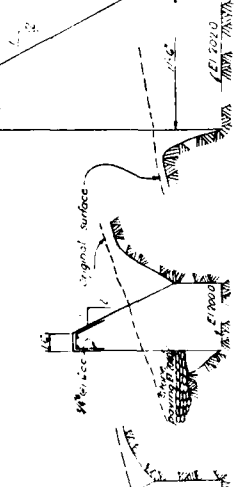
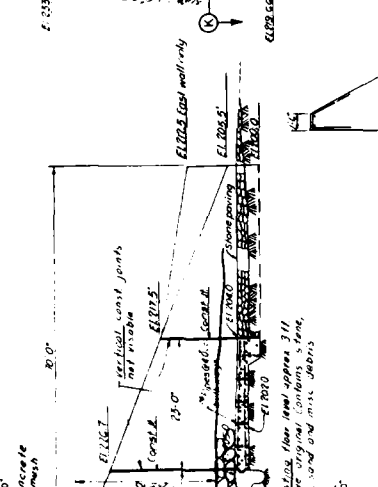
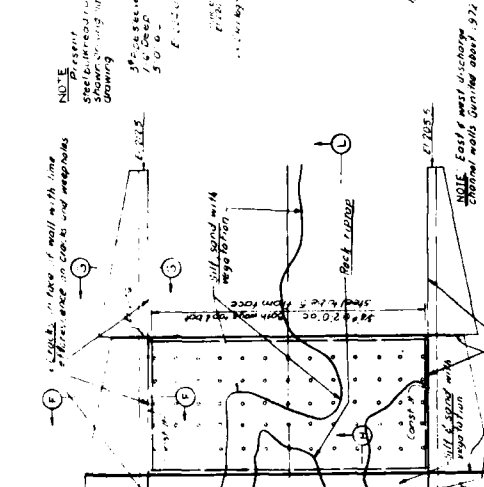
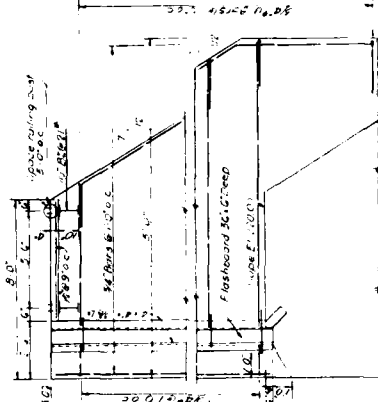
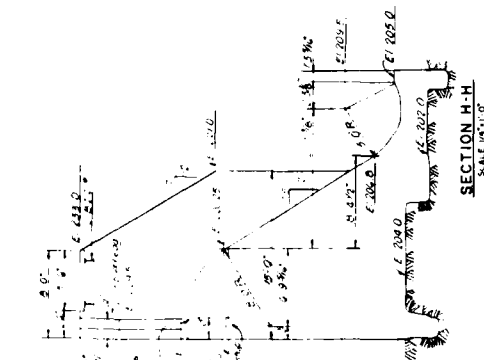


ANCHOR BOLT DETAIL FOR RAILING POSTS

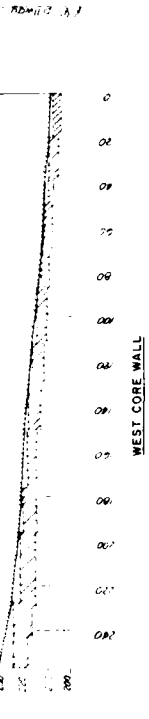
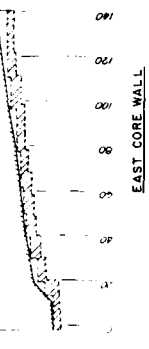
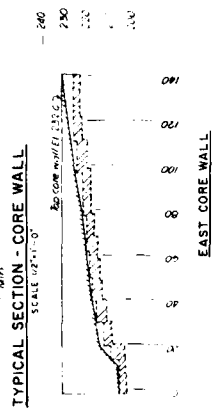
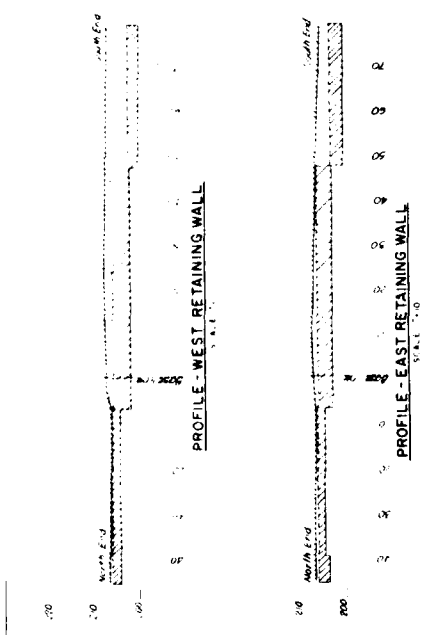


NOTE
Plan Sections and Detail shown here are copies from original drawings by New England Public Service Co. and are shown for information only. Note as to condition of structure and inspection records are from the May 1978 inspection.

SILVER LAKE DAM



SILVER LAKE DAM



PROFILE CORE WALLS
SCALE 1/2" = 1'-0"

Legend:
 --- Concrete
 --- Surface

NOTE
 Profiles and Section shown here are based from
 data for 1958 New City and Public Service.



SAFETY PLANS
 NATIONAL PROGRAM OF INSPECTION OF NON-FLOODING
 SILVER LAKE DAM
 PLATE 63

APPENDIX C

SELECTED GROUP OF PHOTOGRAPHS SHOWING DAM AND PERTINENT FEATURES

PHOTOGRAPHS NOS. 5 - 10

SILVER LAKE DAM - BUCKSPORT, MAINE

LOCATION DOWNSTREAM DAM FAILURE HYDROGRAPH

DESIGNED BY TME

CHECKED BY

DATE 22 JUNE 78

$$(3) \text{ STA. } 5+50 \quad A = \frac{(100 + 334)}{2} \times 13.4 = 2908 \text{ SF}$$

$$\text{VOL.} = \frac{4978 + 2908}{2} \times \frac{150}{43560} = 13.6 \text{ AF}$$

$$(4) \text{ STA. } 10+50 \quad A = \frac{1}{2} \times 315 \times 12.6 = 1984 \text{ SF}$$

$$\text{VOL.} = \frac{2908 + 1984}{2} \times \frac{500}{43560} = 2.8 \text{ AF}$$

$$(5) \text{ STA. } 15+50 \quad A = \frac{1}{2} \times 266 \times 11.8 = 1569 \text{ SF}$$

$$\text{VOL.} = \frac{1984 + 1569}{2} \times \frac{500}{43560} = 20.4 \text{ AF}$$

$$(6) \text{ STA. } 20+50 \quad A = \frac{1}{2} \times 165 \times 11.0 = 908 \text{ SF}$$

$$\text{VOL.} = \frac{1569 + 908}{2} \times \frac{500}{43560} = 14.2 \text{ AF}$$

$$(7) \text{ STA. } 20+50 \text{ TO } 31+00$$

$$\text{VOL} \approx 35 \text{ AF}$$

$$\text{TOTAL VOLUME} \approx 150 \text{ AF}$$

$$Q_{P2} (\text{TRIAL}) = Q_{P1} (1 - V_1/S)$$

$$Q_{P2} = 4982 (1 - 0.01) = 4982 = Q_{P1}$$

NO STORAGE AVAILABLE

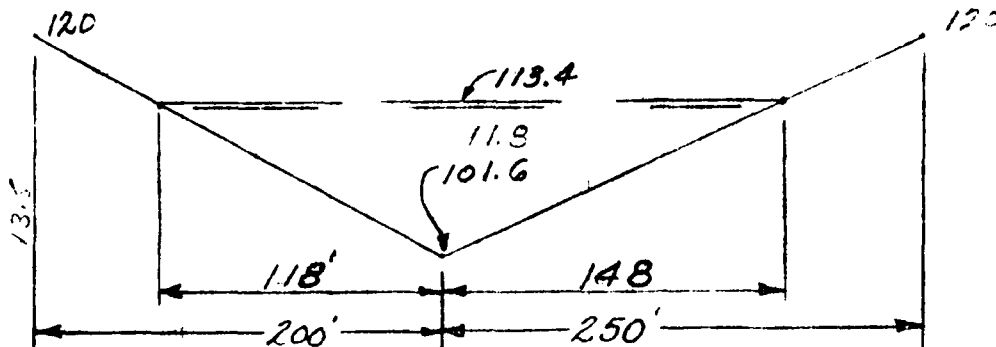
SILVER LAKE DAM - BUCKSPORT, MAINE

STATION DOWNSTREAM DAM FAILURE HYDROGRAPH

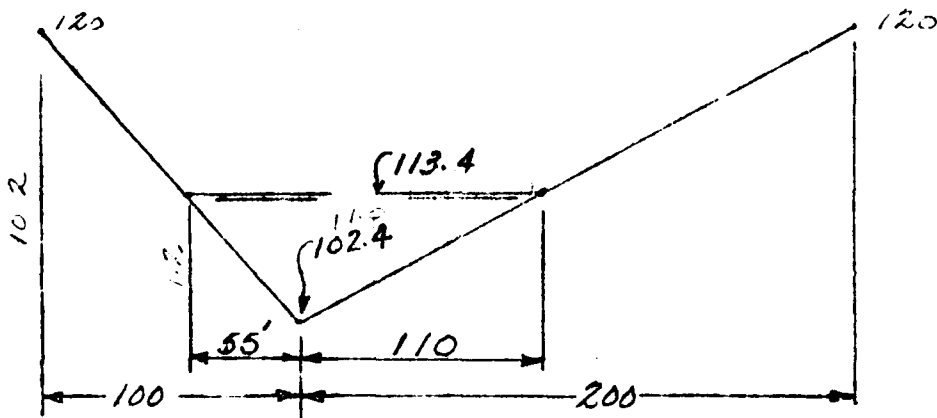
DESIGNED BY TMF

CHECKED BY

DATE 21 JUNE '78



STATION 15+50



STATION 20+50

AREA & VOL.

(1) STA. 0+00 $A = \frac{(200 + 256)}{2} (14.2) = 3237.6 \text{ SF}$

(2) STA 4+00 $A = \frac{1}{2} (200) (6.2) + \frac{(200 + 540)}{2} (13.4) = 4978 \text{ SF}$

$\text{Vol.} = \frac{(3237.6 + 4978) (400)}{2} = \frac{37.7 \text{ AF}}{(43560)}$

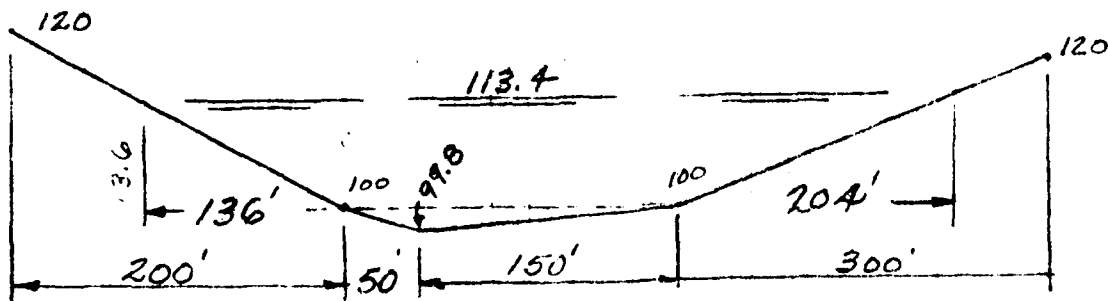
PROJECT SILVER LAKE DAM - BUCKSPORT, MAINE

PURPOSE DOWNSTREAM DAM FAILURE HYDROGRAPH

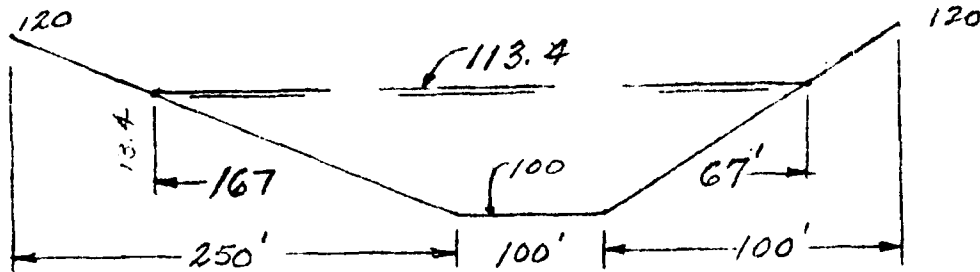
DESIGNED BY TME

CHECKED BY

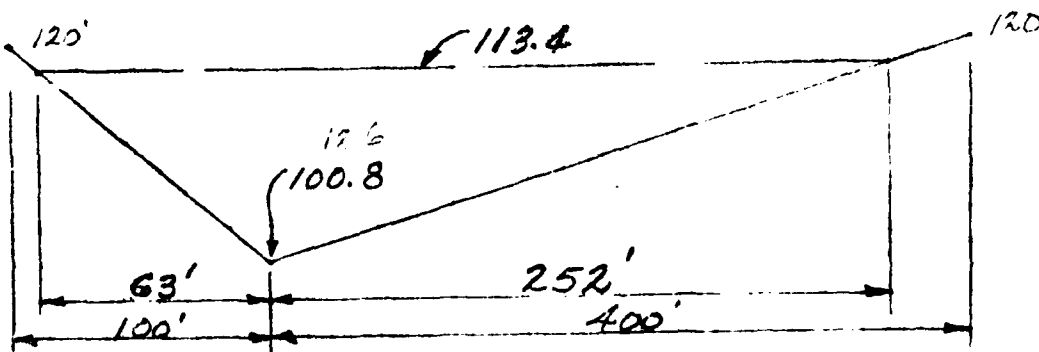
DATE 21 JUNE 78



STATION 4+00



STATION 5+50



STATION 10+50

ELI SILVER LAKE DAM - BUCKSPORT, MAINE

PUTATION DOWNSTREAM DAM FAILURE HYDROGRAPH

PUTED BY IMF

CHECKED BY

DATE 20 JUNE 1978

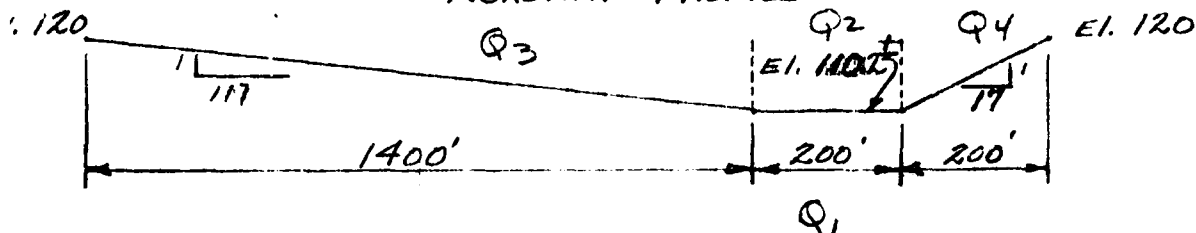
$$Q = 1250 \quad Q/b = 94 \quad dc = 6.5$$

$$h_0 = \frac{6.5 + 9.3}{2} = 7.9 \quad H = 2.8$$

$$HW = 7.9 + 2.8 + 0.1 = 10.8$$

STEP 4:

ROADWAY PROFILE



(A) Assume pressure flow $Q = 1750$ CFS

$$Q/b = 1750/13.3 = 131 \quad dc = 8.2$$

$$h_0 = \frac{8.2 + 9.3}{2} = 8.75$$

$$HW = h_0 + H + S_0L = 8.75 + 5.35 + 0.1 = 14.2 \text{ FT}$$

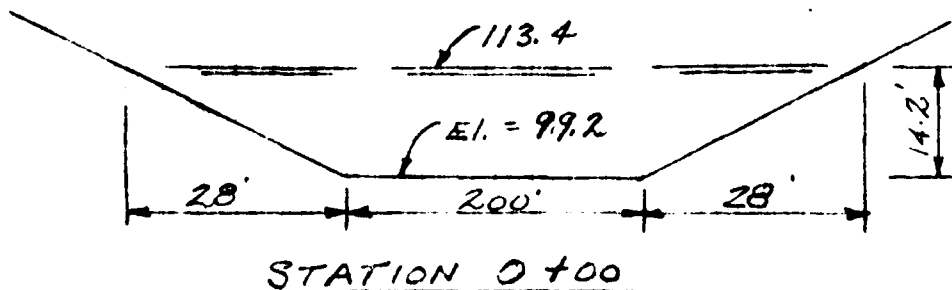
Depth of flow over roadway = 3.2 FT

$$Q_2 = CLH^{3/2} = 2.8 \times 200 \times (3.2)^{3/2} = 3200 \text{ CFS}$$

$$Q_3 = C \tan \frac{\theta}{2} H^{2.5} = 45 \text{ CFS}$$

$$Q_1 + Q_2 + Q_3 + Q_4 = 4990 \approx 4982 \text{ OK.}$$

(B) Determine volume (V_i) in reach:



SUBJECT SILVER LAKE DAM - BUCKSPORT, MAINE

COMPUTATION DOWNSTREAM DAM FAILURE HYDROGRAPH

COMPUTED BY TME

CHECKED BY

DATE 19 JUNE 1978

(B) ASSUME OUTLET CONTROL:

Stream gradient $S = \frac{5}{3100} = 0.16$ Ft per 100'

$H'W = h_0 + H + S_0 L$ Assume $L = 50'$

$h_0 = \frac{d_c + D}{2}$ $d_c = 5.4$ Ref. Plate 1-21

$h_0 = \frac{5.4 + 9.3}{2} = 7.35$

$H = 1.62'$ REF. Plate 1-15

$S_0 L = 0.08'$

$H'W = 9.1$ Ft.

INV. ELEV.:

$100 - 5(0.16) = 98.2$

\therefore Outlet Controls

{ $H'W = 11.0$ $Q = 1350$ CFS }
 { WATER SURFACE UP TO ROADWAY. }

II DAM FAILURE ANALYSIS

(A) STEP 1:

RES. STORAGE $S = 13,100$ AF (SEE FIG. 3)

STEP 2:

$Q.P. = \frac{8}{27} W_b \sqrt{9} (Y_0)^{3/2}$ $W_b \approx 20'$

$Q.P. = \frac{8}{27} (20) \sqrt{9} (28)^{3/2}$ $Y_0 \approx 28'$

$Q.P. = 4982$ CFS

STEP 3:

Flows above 1250 CFS is a combination of pressure flow & weir flow over the road.

Length of roadway up to contour 120 is 1800 Ft.

27 Sept 49

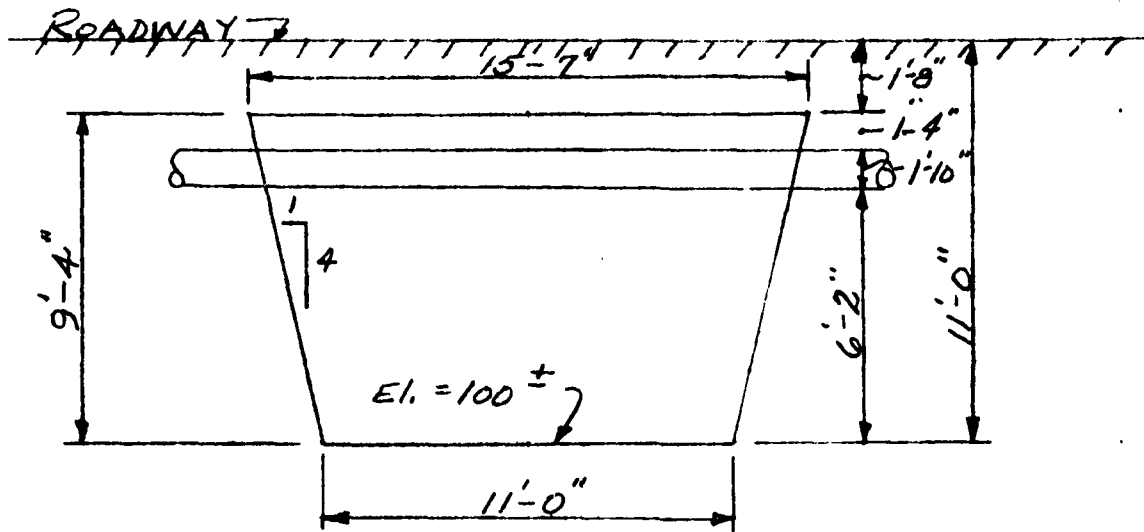
CORPS OF ENGINEERS, U. S. ARMY

SUBJECT SILVER LAKE DAM - BUCKSPORT, MAINE

COMPUTATION DOWNSTREAM DAM FAILURE HYDROGRAPHS

COMPUTED BY TME CHECKED BY _____ DATE 19 JUNE 78

CENTRAL ST. CULVERT



Information obtained by Preston Robinson
(St. Regis Paper Co.). Rec'd by Tel. on 16 Jun '78.

Analysis of max. spillway discharge

$Q = 950 \text{ CFS}$ Refer to EM 1110-345-284

(A) Assume Inlet Control:

Avg. Width = $\frac{15.58 + 11.00}{2} = 13.3'$

$q = 950 / 13.3 = 71.4 \text{ CFS}$

REF. PLATE 1-6 HW/D = 0.9

HW = $0.9 \times 9.33 = 8.4 \text{ FT}$

SUBJECT Silver Lake Dam
COMPUTATION Single spillway Rating curve (w/o "Flash board" bulkhead)
COMPUTED BY Nelson CHECKED BY _____ DATE 1/6/73

Rating curve for a single 20.5' long spillway w/
crest @ el. 124' USL

$$Q = C L H^{3/2} \quad (\text{disregard approach velocity})$$

use $C = 4.0$ for conservative estimate:

<u>W.S. el.</u>	<u>"H"</u>	<u>Q (cfs, a single spillway)</u>
124	—	—
5	1	82
6	2	232
7	3	426
8	4	656
9	5	917
130	6	1205
1	7	1518
2	8	1855

Total Q for 2 flashboard bulkheads removed +
out flow from sluiceway w/ top @ el. 120

<u>el.</u>	<u>Q_{TOT}</u>
129	1854
130	2466
131	3139
132	3870

SUBJECT Silver Lake Dam

COMPUTATION

COMPUTED BY Mattson

CHECKED BY RJD

17 Jan

DATE 12/29/77

2. Consider storage:

From Area - Capacity curve, 3200 Acre-ft.
in going from el. 127.5 to 133 -

$$STO = \frac{(3200 \text{ Acre-ft})(43,560 \frac{\text{ft}^2}{\text{Acre}})}{(3600 \frac{\text{ft}^3}{\text{CFS-HR}})} = 38,700 \text{ CFS-HR}$$

$$\begin{array}{r} \text{Total Inflow} = 57,600 \text{ CFS-HR} \\ - \text{STO} = 38,700 \\ \hline \end{array}$$

18,900 CFS-HR = OVERFLOW

$$Q_{MOD} = \frac{18,900}{\frac{1}{2}(14.4)} = 2625 \checkmark \text{ CFS}$$

From rating curve, depth of flow over entire dam is ~1.0' during F.M.F.

Note: there is an assumption inherent in this analysis that the flash boards (steel bulkheads) do not fail. If they fail, there is 3 feet of storage from spillway crest to top of dam; 18" of runoff would require 7.5' storage (not counting outflow).

Consider Reduced Flash board ht. to el. 127'

$$STO = \frac{(4950 \text{ Acre-ft})(43560)}{3600} = 59,900 \text{ CFS-HR}$$

∴ STORAGE CAPACITY exceeds total inflow and the dam is not overtopped.

Try el. 128'

$$STO = \frac{(12,300 - 8,300)(43560)}{3600} = 48,400$$

$$Q_{MOD} = \frac{57,600 - 48,400}{\frac{1}{2}(14.4)} = 1300 \checkmark \text{ CFS}$$

A check on Fig. 4 shows $Q_{allow} \approx 1600 \checkmark \text{ CFS}$ ∴ OK

SUBJECT Silver Lake Dam - Buckport, ME.

COMPUTATION Hydrologic Analysis

COMPUTED BY Mattson

CHECKED BY RJD 17 Jan

DATE 12/29/77

Determination of PMF:

ref 1: Manley charts CFS vs D.A.
for D.A. = 5 S.M., PMF \approx 1600 CFS/SM

$\rightarrow Q_{max} = 8000 \text{ CFS}$

ref 2: Geological Survey Paper 1887

$\rightarrow Q_{max} = 11,000 \text{ CFS (Region 1)}$

As the watershed topography is gently rolling, with a high proportion of natural storage, it seems that the lower value of $Q_{max} = 8,000 \text{ CFS}$ is the more realistic.

Because the reservoir storage capacity is significant, we cannot assume peak inflow = peak outflow. Therefore, develop triangular hydrograph and include storage effect.

Triangular Hydrograph:

$Q_{max} = 8000 \text{ CFS}$, determine base time:

1. Assume 18" of runoff -

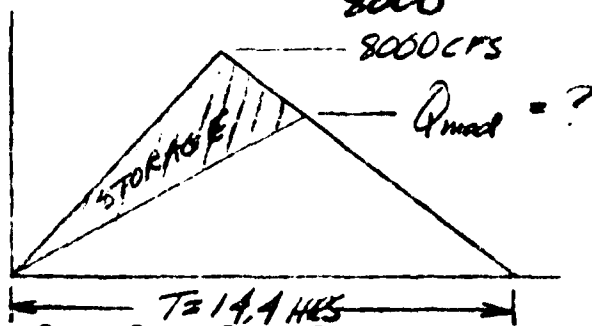
1 in/hr. precip. = 640 CFS-HR per S.M.

Tot. Vol. = $\left(\frac{640 \text{ CFS-HR}}{\text{SM}}\right)(18)(5 \text{ SM}) = 57,600 \text{ CFS-HR}$

Tot. Vol. = $\frac{1}{2} (Q_{max})(T)$

$T = 2(\text{Tot Vol}) / Q_{max}$

$= \frac{57,600(2)}{8000} = 14.4 \text{ HRS.}$

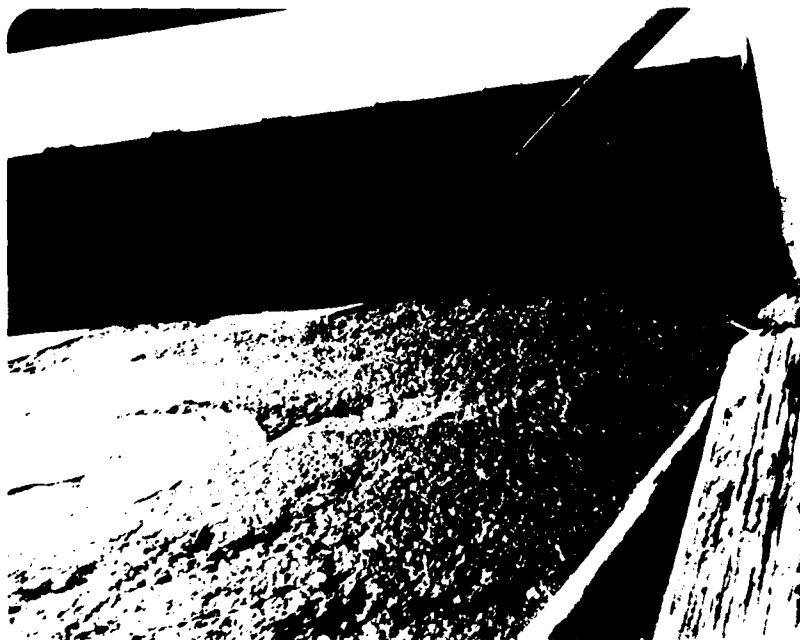


APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS



No. 9

VIEW OF SLUICWAY AND STOPLOGS FROM DOWNSTREAM SIDE



No. 10

VIEW OF PERMANENT BULKHEAD AND CONCRETE WEIR FROM
DOWNSTREAM SIDE



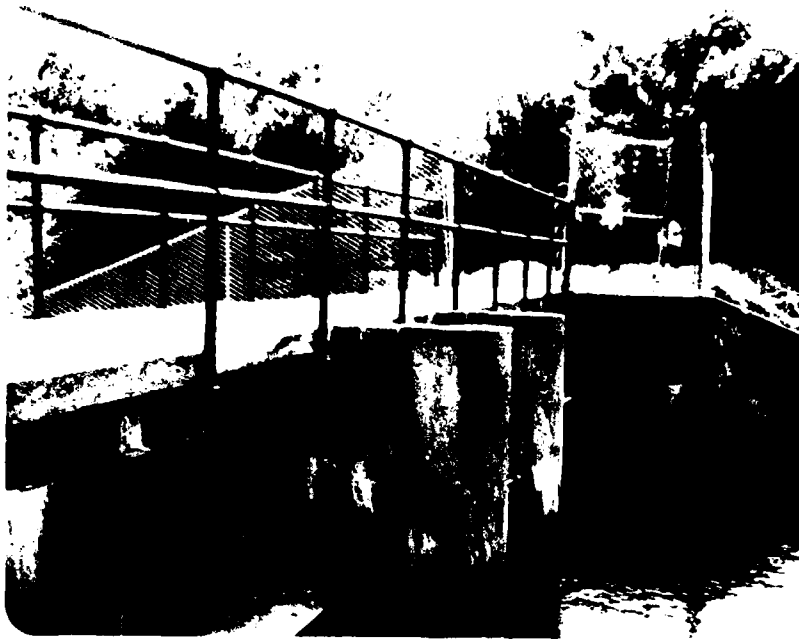
No. 7

VIEW LOOKING EAST ALONG UPSTREAM SLOPE
OF DAM EMBANKMENT



No. 8

FOUNDATION SEEPAGE (ORANGE COLORED) AT DOWNSTREAM
TOE OF RIGHT SIDE EMBANKMENT



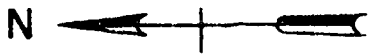
No. 5

VIEW LOOKING WEST AT UPSTREAM SIDE OF SPILLWAY &
SERVICE BRIDGE



No. 6

VIEW OF DISCHARGE CHANNEL WALL (LEFT SIDE) - NOTE
CRACKING EFFLORESCENCE AND SEEPAGE ON WALL

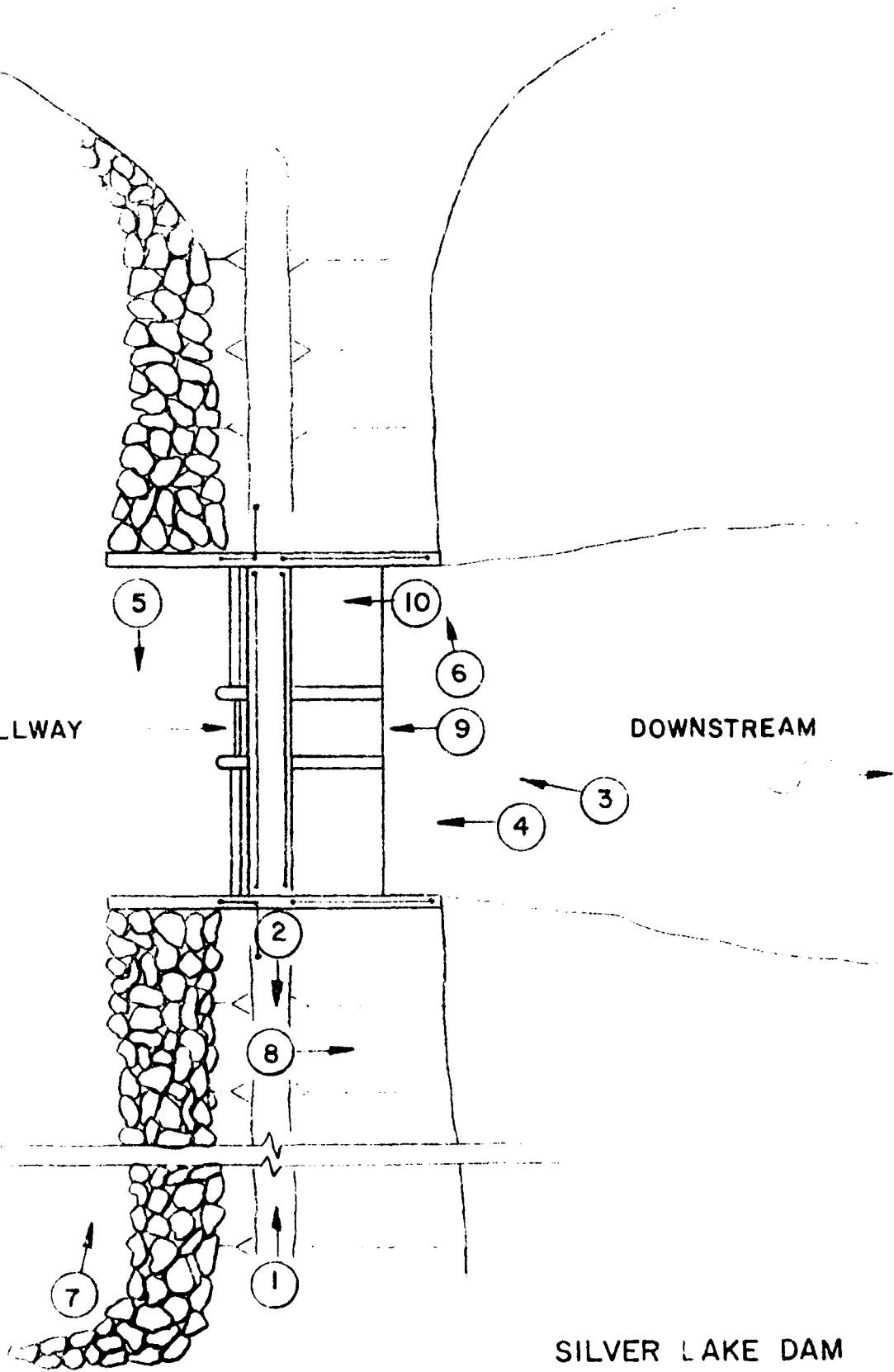


SILVER

SPILLWAY

DOWNSTREAM

LAKE



SILVER LAKE DAM
PHOTOGRAPH INDEX MAP

RED FORM 222
27 Sept 49

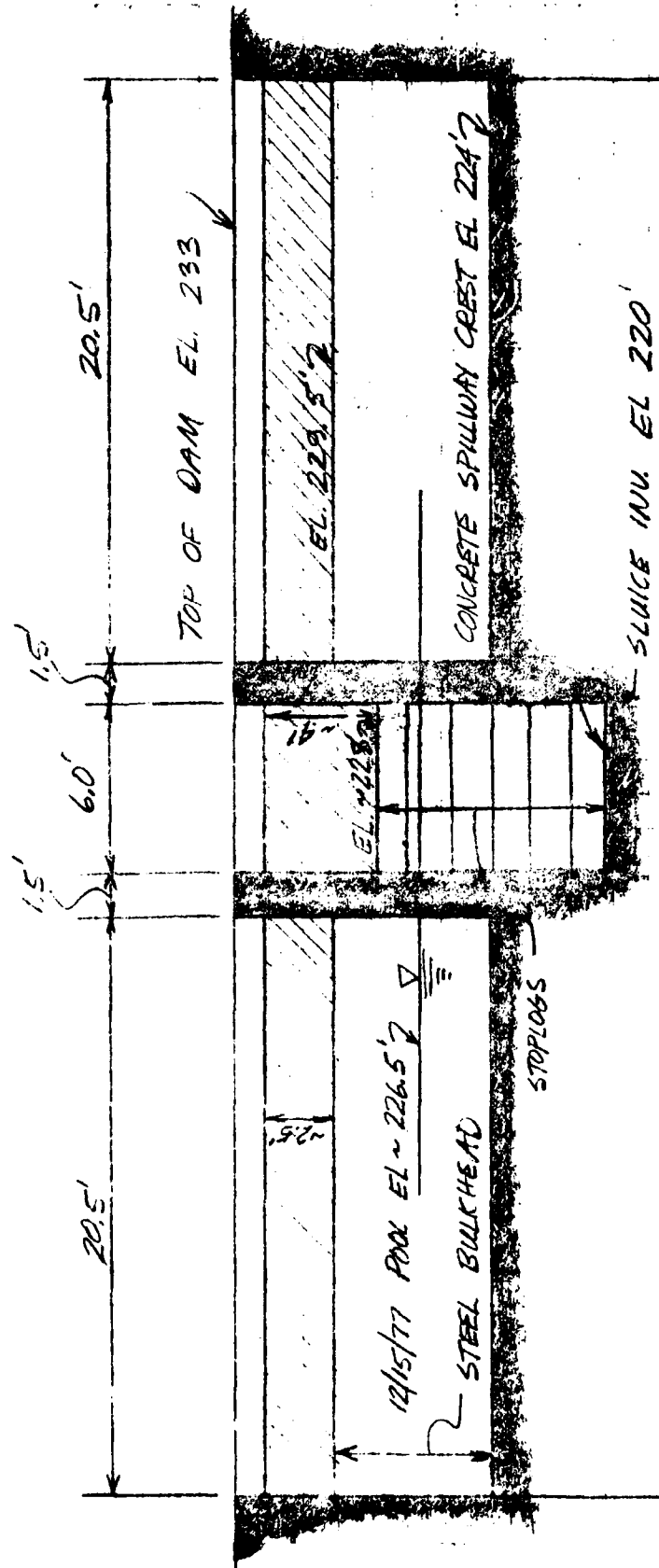
NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U.S. ARMY

PAGE _____

SUBJECT SILVER LAKE DAM INSPECTION - BUCKSPORT, ME

COMPUTATION SPILLWAY GEOMETRY

COMPUTED BY Mattson CHECKED BY _____ DATE 12/21/77



Area available for spillway
discharge to be overtopping
occurs to shaded area

*Note: elevations shown are 100.0' higher than MSL Datum.

FIG. 1

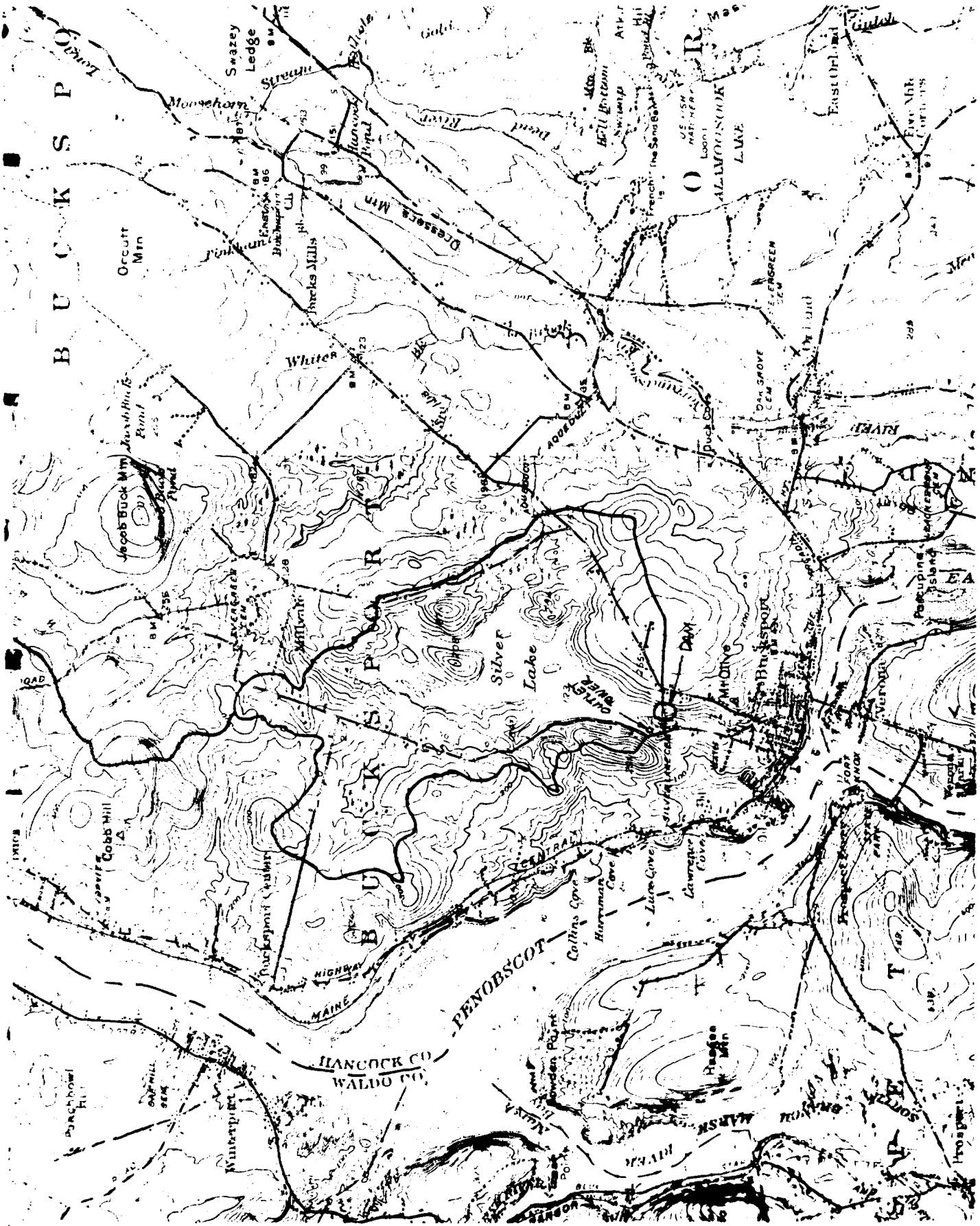


FIG 2

SILVER LAKE DAM
 BUCKSPORT, ME
 * STORAGE CAPACITY CURVE
 Matteson 11/17/78

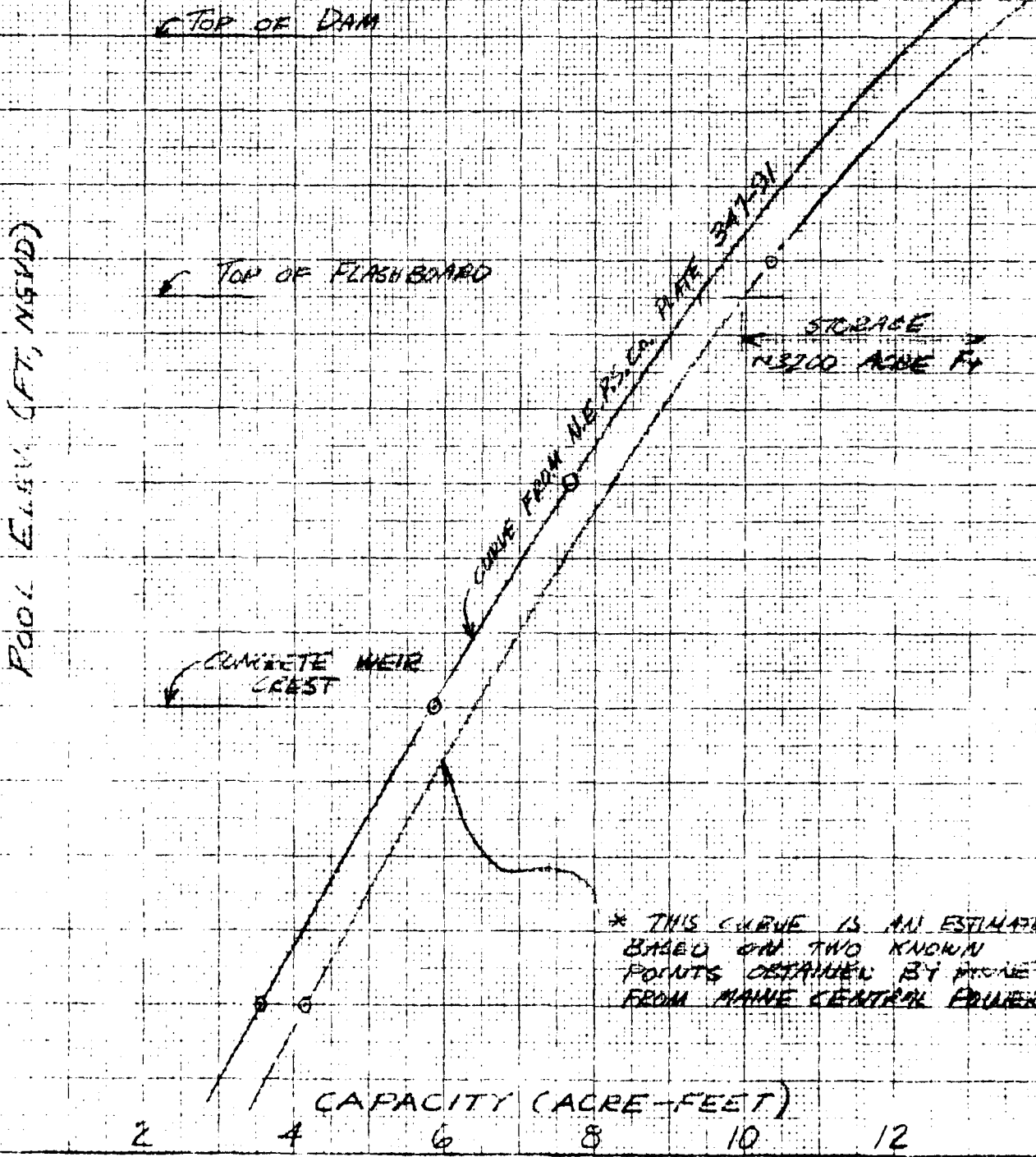
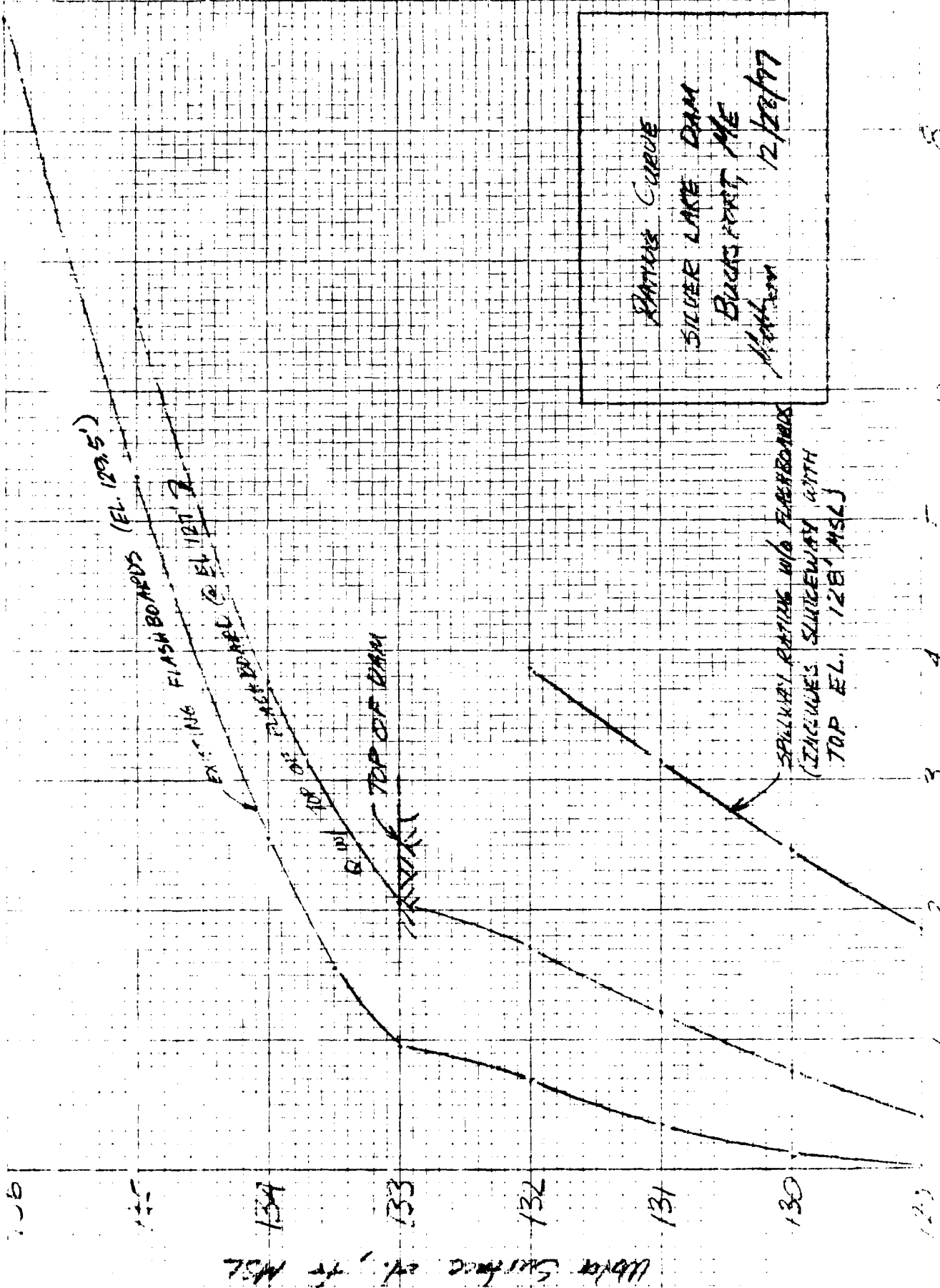


FIG. 3



RATING CURVE
SILVER LAKE DAM
BUCKLEBERRY, ME
12/20/77
M. H. HARRIS

FIG 4

APPENDIX E

Information is contained in the
National Inventory of Dams

STATE
ME 147 RFD

INVENTORY OF DAMS IN THE UNITED STATES

FEDERAL DISTRICT		COUNTY		STATE		CITY		COM.		NAME		LATITUDE (NORTH)		LONGITUDE (WEST)		REPORT DATE	
ME	147	RFD								SILVER LAKE DAM	4435.2	6847.4	DAY	MO	YR		
													05	JAN	79		

POPULAR NAME		NAME OF IMPOUNDMENT	
RIVER OR STREAM		SILVER LAKE	
REGION BASIN	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 02	TANNERY BROOK TH-PENOBSCOT R BUCKSPORT	1	3000

TYPE OF DAM	YEAR COMPLETED	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY (MW)	IMPOUNDING CAPACITIES	
					STRAIGHT (FT.)	HYDRAULIC (FT.)
REFLECTING	1930 S	4600	39500	29	29	12700
						7700

REMARKS	

DIS HAS	SPILLWAY	TYPE	WIDTH (FT.)	LENGTH (FT.)	INSTALLED	PROPOSED	NAVIGATION LOCKS	
							NO.	LENGTH (FT.)
1	470	U	50	4600				

OWNER	ENGINEERING BY	CONSTRUCTION BY
ST. REGIS PA-LR CO.	N.F. PUBLIC SERVICE CO.	

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
NEW ENG. DIV.	31 MAY 78	PL. 92-367

REMARKS	

DIST OWN FED R PRV/FED SCS A VER/DATE
N N N N N N 15 JAN 79

END

FILMED

8-85

DTIC