PENOBSCOT RIVER BASIN
BUCKSPORT, MAINE
SILVER LAKE DAM
ME 00147

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

OCTOBER 1978
Silver Lake Dam

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION

DEPT. OF THE ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION, NEEDED
424 TRAPELO ROAD, WALTHAM, MA. 02254

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.
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
SILVERLAKE DAM

ME 00147

PENOBSCOT RIVER BASIN
BUCKSPORT, MAINE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
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
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, MEMBER
Water Control Branch
Engineering Division

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

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

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division
PREFACE

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

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

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


(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 elevation 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 PMP, 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 feet 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 ½ 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 7,706
   (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 USGS 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 ($\geq 1000$ to $\leq 50,000$ 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 $F^{x^2}$) 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 pipe 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. John Hart Corps of Engineers
2. Tsy Katz-Hyman Corps of Engineers
3. Tom Feeney Corps of Engineers
4. Wm. Mullen Corps of Engineers
5. Preston Robinson St. Regis Paper Co.

INSPECTED BY

1. Dam Embankment J. Hart
2. Spillway Katz-Hyman, Feeney, Mullen
3. Discharge Channel Hart, Katz-Hyman, Feeney

4. 
5. 
6. 
7. 
8. 
9. 
10. 

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

**PROJECT** Silverlake Dam, Maine

**DATE** May 31, 1978

**PROJECT FEATURE** Earth Embankments

**NAME** John Hart

**DISCIPLINE** Geotechnical

**AREA EVALUATED**

**CONDITIONS**

1. Crest Elevation
2. Current Pool Elevation
3. Maximum Impoundment to Date
4. Surface Cracks
5. Pavement Condition
6. Movement or Settlement of Crest
7. Lateral Movement
8. Vertical Alignment
9. Horizontal Alignment
10. Condition at Abutment and at Concrete Structures
11. Indications of Movement of Structural Items on Slopes
12. Trespassing on Slopes
13. Sloughing or Erosion of Slopes or Abutments
14. Rock Slope Protection - Riprap Failures
15. Unusual Movement or Cracking at or near Toes
16. Unusual Embankment or Downstream Seepage
17. Piping or Boils
18. Foundation Drainage Features
19. Toe Drains
20. Instrumentation System
**PROJECT**  Silverlake Dam, Maine  
**DATE**  May 31, 1978  
**PROJECT FEATURE**  Spillway  
**DISCIPLINE**  Geotechnical, Structural

### AREA EVALUATED

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

PROJECT  Silverlake Dam, Maine  DATE  May 31, 1978
PROJECT FEATURE  
DISCIPLINE  

AREA EVALUATED  
OUTLET WORKS - TRANSITION AND CONDUIT

| General Condition of Concrete |  |
| Rust or Staining on Concrete |  |
| Spalling |  |
| Erosion or Cavitation |  |
| Cracking |  |
| Alignment of Monoliths |  |
| Alignment of Joints |  |
| Numbering of Monoliths |  |
| Water Supply Pipes | See narrative |
| 10 inch Cast Iron | Abandoned but not grouted |
| 12 inch Cast Iron | Not visible (see narrative) |
| Valve House | Good - concrete walls with flat wood deck |
| Aquaduck to St. Regis Paper Co. | Good - according to St. Regis Co. Officials |
**PERIODIC INSPECTION CHECK LIST**

**PROJECT** Silverlake Dam, Maine  
**DATE** May 31, 1978  
**PROJECT FEATURE** Spillway Bridge  
**NAME** Tsy Katz-Hyman  

<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUTLET WORKS - SERVICE BRIDGE</strong></td>
<td>General condition was good with some spalling of concrete deck. Structural members were in good condition.</td>
</tr>
<tr>
<td>a. Super Structure</td>
<td></td>
</tr>
<tr>
<td>Bearsings</td>
<td></td>
</tr>
<tr>
<td>Anchor Bolts</td>
<td></td>
</tr>
<tr>
<td>Bridge Seat</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Members</td>
<td></td>
</tr>
<tr>
<td>Under Side of Deck</td>
<td></td>
</tr>
<tr>
<td>Secondary Bracing</td>
<td></td>
</tr>
<tr>
<td>Deck</td>
<td></td>
</tr>
<tr>
<td>Drainage System</td>
<td></td>
</tr>
<tr>
<td>Railings</td>
<td></td>
</tr>
<tr>
<td>Expansion Joints</td>
<td></td>
</tr>
<tr>
<td>Paint</td>
<td></td>
</tr>
<tr>
<td>b. Abutment &amp; Piers</td>
<td></td>
</tr>
<tr>
<td>General Condition of Concrete</td>
<td></td>
</tr>
<tr>
<td>Alignment of Abutment</td>
<td></td>
</tr>
<tr>
<td>Approach to Bridge</td>
<td></td>
</tr>
<tr>
<td>Condition of Seat &amp; Backwall</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C

SELECTED GROUP OF PHOTOGRAPHS SHOWING DAM AND PERTINENT FEATURES

PHOTOGRAPHS NOS. 5 - 10
NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U.S. ARMY

SILVER LAKE DAM - BUCKSPORT, MAINE
STATION DOWNSTREAM DAM FAILURE HYDROGRAPH

PAGE 1/2

ED BY CME CHECKED BY DATE 27 JUNE 75

(3) STA. 5+50 \[ A = \frac{(100 + 334)}{2} \times 13.4 = 2908 \text{ SF} \]
Vol. \[ = \frac{4978 + 2908 \times 150}{43560} = 13.6 \text{ AF} \]

(4) STA. 10+50 \[ A = \frac{1}{2} \times 315 \times 12.6 = 1984 \text{ SF} \]
Vol. \[ = \frac{2908 + 1984 \times 500}{43560} = 28 \text{ AF} \]

(5) STA. 15+50 \[ A = \frac{1}{2} \times 266 \times 11.8 = 1569 \text{ SF} \]
Vol. \[ = \frac{1984 + 1569 \times 500}{43560} = 20.4 \text{ AF} \]

(6) STA. 20+50 \[ A = \frac{1}{2} \times 165 \times 11.0 = 908 \text{ SF} \]
Vol. \[ = \frac{1569 + 908 \times 500}{43560} = 14.2 \text{ AF} \]

(7) STA. 20+50 to 31+00
Vol. \approx 35 \text{ AF}
Total Volume \approx 150 \text{ AF}

Q_{P_{2}} (TRIAL) = Q_{P_{1}} (1 - V/5)
Q_{P_{2}} = 4982 (1 - 0.01) = 4982 = Q_{P_{1}}
No storage available
A R E A S & V O L .

(1) STA. 0+00
\[ A = \frac{(200 + 256)(14.2)}{2} = 3237.6 \text{ sq ft} \]

(2) STA 4+00
\[ A = \frac{1}{2}(200)(1.4) + \frac{(200 + 540)(13.4)}{2} = 49.78 \text{ sq ft} \]

\[ \text{Vol.} = \frac{(3237.6 + 49.78)(400)}{2} = 37.7 \text{ AF} \]
\[ Q = 1250 \quad \theta_b = 94 \quad dc = 6.5 \]

\[ h_0 = 6.5 + 9.3 = 7.9 \quad H = 2.8 \]

\[ HW = 7.9 + 2.8 + 0.1 = 10.8 \]

**STEP 4:**

**(A) Assume pressure flow**

\[ Q = 1750 \text{ cfs} \]

\[ \theta_b = \frac{1750}{13.3} = 131 \quad dc = 8.2 \]

\[ h_0 = \frac{(8.2 + 9.3)}{2} = 8.75 \]

\[ HW = h_0 + H + S_0L = 8.75 + 5.35 + 0.1 = 14.2 \text{ ft} \]

Depth of flow over roadway = 3.2 ft

\[ Q_2 = CEH^{3/2} = 2.9 \times 200 \times (3.2)^{3/2} = 3200 \text{ cfs} \]

\[ Q_3 = C \tan \theta \frac{H^{2.5}}{2} = 45 \text{ cfs} \]

\[ Q_1 + Q_2 + Q_3 + Q_4 = 4990 \times 4982 \text{ OK} \]

**(B) Determine volume \((V_1)\) in reach:**

\[ \text{STATION 0+00} \]
(B) Assume Outlet Control:

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

\[ H'W = h_0 + H + S \cdot L \]  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

\[ S \cdot L = 0.08' \]

\[ HW = 9.1 \text{ Ft.} \]

\[ \text{INV. ELEV.} \]

\[ 100 - 5(0.16) = 98.2 \]

Outlet Controls

\[ \begin{cases} 
HW = 11.0 \\ 
Q = 1350 \text{ CFS} \\
\text{WATER SURFACE UP TO ROADWAY.}
\end{cases} \]

II. DAM FAILURE ANALYSIS

(A) Step 1:

Res. Storage \( S = 13,100 \text{ AF} \) (see Fig. 3)

Step 2:

\[ Q_P = \frac{8}{27} W_0 \sqrt{9} (Y_0^{3/2}) \]

\[ W_0 = 20' \]

\[ Y_0 \approx 28 \]

\[ Q_P = 4982 \text{ CFS} \]

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.
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

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

(A) Assume Inlet Control:

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

$Q = \frac{950}{13.3} = 71.4 \text{ cfs}$

Ref. Plate 1-6  $\frac{H}{W} = 0.9$

$H = 0.9 \times 4.33 = 8.4' +$
Rating curve for a single, 20.5' long spillway at crest @ el 124' NSL.

\[ Q = C L H^{3/2} \] (disregard approach velocity)

Use \( C = 4.0 \) for conservative estimate:

<table>
<thead>
<tr>
<th>W.S. el.</th>
<th>&quot;H&quot;</th>
<th>( Q ) (crs, a single spillway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>125</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>126</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>127</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>128</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>129</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>130</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>131</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>132</td>
<td>13</td>
<td>9</td>
</tr>
</tbody>
</table>

Total \( Q \) for 2 flashboard bulkheads removed + outflow from sluiceway w/ top @ el 128:

<table>
<thead>
<tr>
<th>el.</th>
<th>( Q_{tot} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
<td>1859</td>
</tr>
<tr>
<td>130</td>
<td>2466</td>
</tr>
<tr>
<td>131</td>
<td>3139</td>
</tr>
<tr>
<td>132</td>
<td>3870</td>
</tr>
</tbody>
</table>
2. Consider storage:

From Area-Capacity curve, 3200 Acre-ft.
   in going from 81, 127.5 to 133 -
   \[ S_{10} = \frac{(3200 \text{ Acre-ft})(43,560 \text{ ft}^2)}{3600 \text{ ft}^3 \text{/ CFS-HR}} = 38,700 \text{ CFS-HR} \]

Total Inflow = 57,600 CFS-HR
   - S_{10} = 38,700
   18,900 CFS-HR = OVERFLOW

\[ Q_{\text{runoff}} = \frac{18,900}{2/14.4} = 2625 \text{ CFS} \]

From rating curve, depth of flow over entire dam 9/16 = 1.0' during FMF.

Note: there is an assumption inherent in this analysis that the flash boards (steel bulkheads) do not fail. If they fail, there is 9 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 height to el. 127'.

\[ S_{10} = \frac{(4950 \text{ Acre-ft})(43,560)}{3600} = 59,900 \text{ CFS-HR} \]

\[ Q_{\text{runoff}} = \frac{59,600 - 48,400}{2/14.4} = 1300 \text{ CFS} \]

\[ A \text{ check on Fig. 4 shows flow \approx 1600 \text{ CFS} \Rightarrow OK} \]
Determination of PMF:

ref 1: Manley charts, CFS vs. D.A.,
    for D.A. = 5 s.m., PMF = 1600 CFS/s.m.
    \( Q_{\text{max}} = 8000 \text{ CFS} \)

ref 2: Geological Survey Paper 1887
    \( Q_{\text{max}} = 11,000 \text{ CFS} \) (Region 1)

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

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

1. Assume 18" of runoff -
   1 in/hr. precip. = 640 CFS-HR per s.m.
   Tot. Vol. = \( \frac{640 \text{ CFS-HR}}{\text{s.m.}} \times 18 \times 5 \text{ s.m.} = 57,600 \text{ CFS-HR} \)
   Tot. Vol. = \( \frac{1}{2} (Q_{\text{max}})(T) \)
   \( T = \frac{2 \times (\text{Tot Vol})}{Q_{\text{max}}} \)
   \( T = \frac{57,600}{8000} = 7.2 \text{ hrs.} \)

\( Q_{\text{max}} = 8000 \text{ CFS} \)
APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS
No. 9  VIEW OF SLUICEWAY 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 LAKE DAM
PHOTOGRAPH INDEX MAP
FIG. 1

Area available for spillway discharge occurs at SL 122.00 higher than MSL Datum.
APPENDIX E

Information is contained in the National Inventory of Dams
## INVENTORY OF DAMS IN THE UNITED STATES

| (1) STATE | (2) COUNTY | (4) NAME | (5) POPULAR NAME | (6) LATITUDE DEG | (7) LONGITUDE DEC | (8) REPORT DATE | (9) DIST OWN | (10) FED R | (11) PRIV/FED |
|---|---|---|---|---|---|---|---|
| ME | AE | SILVER LAKE | SILVER LAKE | 4435.2 | 48.7 | 05JAN79 | N | N | N |

### DAM DETAIL

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<th>(12) REGION</th>
<th>(13) BASIN</th>
<th>(14) RIVER OR STREAM</th>
<th>(15) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE</th>
<th>(16) POPULATION</th>
<th>(17) TYPE OF DAM</th>
<th>(18) YEAR COMPLETED</th>
<th>(19) PURPOSES</th>
<th>(20) VOLUME OF DAM (ACRES)</th>
<th>(21) POWER CAPACITY UTILIZED (KW)</th>
<th>(22) NAVIGATION LOCKS</th>
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### REMARKS

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<th>(28) CONSTRUCTION BY</th>
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| (29) REGULATORY AGENCY | (30) DESIGN | (31) CONSTRUCTION | (32) OPERATION | (33) MAINTENANCE |
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