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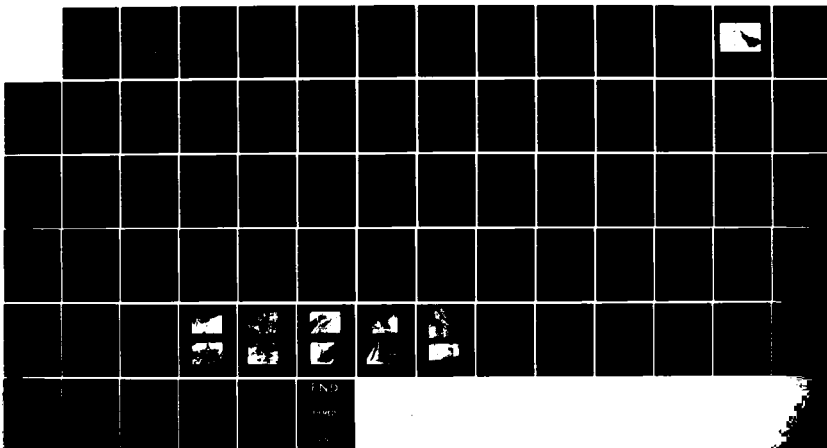
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
MOLLYMOCKET BROOK DAM. (U) CORPS OF ENGINEERS WALTHAM
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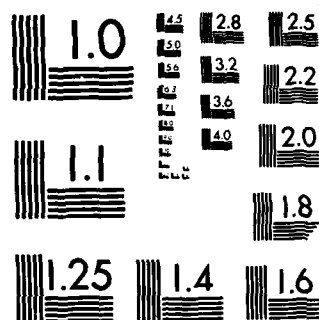
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MICROCOPY RESOLUTION TEST CHART
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ANDROSCOGGIN RIVER BASIN SUCCESS, NEW HAMPSHIRE

MOLLYWCKET BROOK DAM
N.H. 00076

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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JUL 08 1985
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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

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

REPLY TO
ATTENTION OF:
NEDED

JUN 25 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

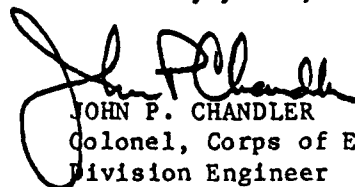
I am forwarding to you a copy of the Mollywocket Brook Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological 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 Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Berlin Water Department, City Hall, Berlin, New Hampshire 03570.

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 Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MOLLYWCKET BROOK DAM

NH 00076

SUCCESS, NEW HAMPSHIRE

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By	
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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No: NH00076
Name of Dam: Mollywocket Brook Dam
Town: Success
County and State: Coos, New Hampshire
Stream: Mollywocket Brook (Horne Brook)
Date of Inspection: November 15, 1978

BRIEF ASSESSMENT

The Mollywocket Brook Dam is a concrete core earth embankment dam, approximately 300 feet long and 29 feet high. The dam and reservoir are currently utilized as a standby source of potable water for the City of Berlin. A concrete spillway structure containing primary and emergency spillways controls the flow of water at the dam. The drainage area for the dam is 4.4 square miles with a normal impoundment of 8 acre-feet. Under normal operating conditions (no potable water withdrawal) the water level is controlled by the primary spillway.

The dam is classified as small and has a low hazard potential in the event of a dam failure. Based on size and hazard classifications, a 100-year flood of 2165 CFS was used as the test flood. Because of the limited storage volume the test flood inflow was equal to the test flood outflow. The spillway capacity of 1318 CFS is 60.9 percent of the test flood outflow. The 100-year test flood would overtop the dam by 0.7 feet.

The dam is judged to be in poor condition. The following significant findings were determined during the investigation:

1. A settlement failure has occurred to the right training wall producing a crack varying in width from 18" at the top to 4" at the bottom. The failure was caused by undermining due to the water flowing over the spillway and to water flow during a reported instance of dam overtopping.
2. The dam has been overtopped at least once since its original construction.
3. Spalling and cracking of the concrete spillway and training walls is extensive.
4. Significant undermining of both training walls and spillway is occurring due to the absence of an energy dissipating apron at the base of the spillway.

This Phase I Inspection Report on Mollywocket Brook 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.

Joseph W. Finegan
JOSEPH W. FINEGAN, JR., 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 aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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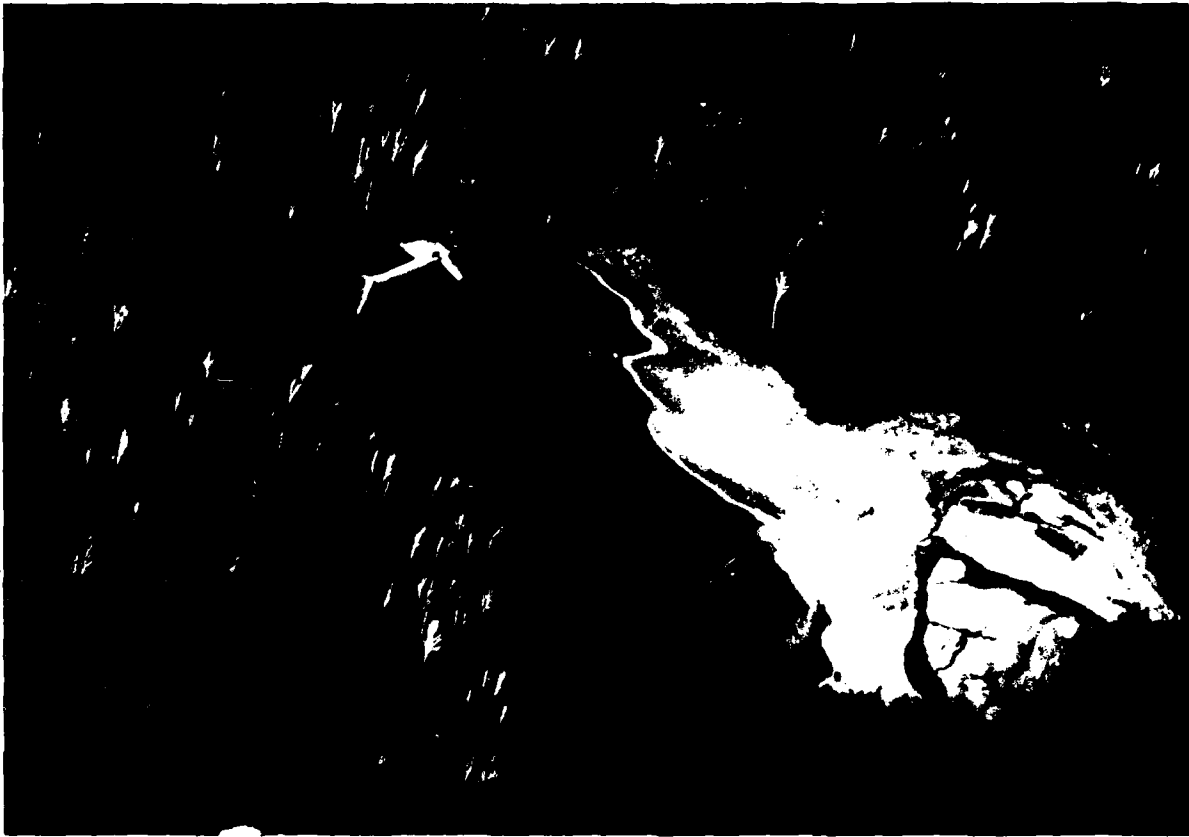
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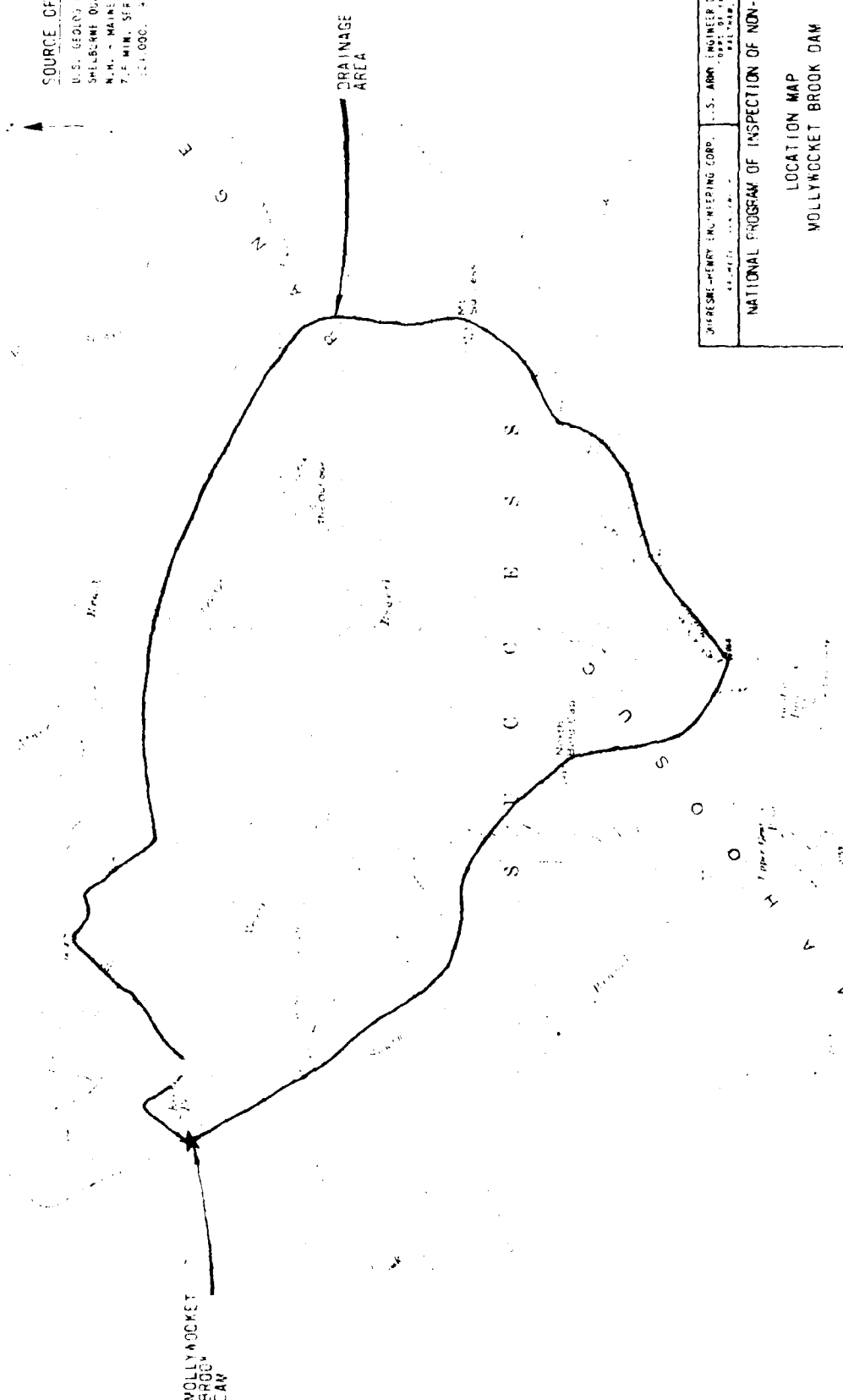
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OVERVIEW OF
MOLLYWCKET BROOK DAM
TOWN OF SUCCESS, NEW HAMPSHIRE

SOURCE OF MAP

U.S. GEOLOGICAL SURVEY
SHELBOURN QUADRANGLE
N.H. - MAINE
7.5 MIN. SERIES
1:250,000, 470



U.S. ARMY ENGINEERING CORP. NEW ENGLAND DISTRICT
MAINTENANCE DISTRICT
MAINTENANCE DISTRICT

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP
MOLLYOCKET BROOK DAM

SHEET NO. 04 0081 SCALE 1"=2000
NEW HAMPSHIRE

The water level is controlled by a concrete spillway structure consisting of a 21-foot high, 4-foot wide primary spillway (including 2-foot high stop logs) and a 25-foot high, 43-foot long emergency spillway. A 10-inch pipeline located in the left embankment (see plans in Appendix B) is also capable of withdrawing water from the reservoir. A gate valve located near the toe of the embankment controls this water line. At the time of inspection, the water level was 4 feet below the emergency spillway crest. The dam is located in a heavily wooded area approximately 3.2 miles from the City of Berlin, accessible by logging roads and trails. Mollywacket Brook is known as Horne Brook and the reservoir is known locally as Keene Reservoir.

c. Size Classification

The Mollywacket Brook Dam is approximately 29 feet high with a maximum storage of 31 acre-feet. United States Corps of Engineers (USCE) Guidelines place dams with a height between 25 and 40 feet and storage between 50 and 1000 acre-feet in the small category. Therefore the size classification of the Mollywacket Brook Dam is small.

d. Hazard Classification

A failure of the Mollywacket Brook Dam would route the resulting flood waters through approximately five miles of the natural channel of Horne Brook before encountering a culvert under Route 16A, approximately three miles north of the City of Berlin. The brook falls approximately 345 feet over the five mile distance for an average gradient of 1.3 percent. Any flood wave produced at the dam site would be nearly completely dissipated by the time it reached the culvert and minimal, if any, damage would result. The hazard classification is therefore low.

e. Ownership

The present owner of Mollywacket Brook Dam is:

Berlin Water Department
City Hall
Berlin, New Hampshire 03570
Telephone: 603-752-1677

f. Operator

Berlin Water Department.

g. Purpose

The Mollywacket Brook Reservoir was originally constructed as part of a surface reservoir water supply system for the City of Berlin. The water impounded at Mollywacket Reservoir is let

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: MOLLYWCKET BROOK

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. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.
- (2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The Mollywocket Brook Dam is located in northern New Hampshire, in the Town of Success, Coos County, and is in the Androscoggin River basin. The dam is located 3.2 miles east of the City of Berlin.

b. Description of Dam and Appurtenances

The Mollywocket Brook Dam is approximately 300 feet long and is 29 feet high. The dam is reported to be a concrete core, earth embankment dam set on impervious hardpan. The earth embankments, both upstream and downstream are completely covered with brush and small trees.

down to a lower reservoir via a 10-inch pipeline as needed. The City of Berlin has recently developed alternate water supplies and the utilization of the reservoir system has been greatly reduced. At the present time the pipeline is reported to be operational but is only used during emergency conditions.

h. Design and Construction History

Little information is available on the original design of the Mollywacket Brook Dam. It is reported to be a concrete core, earth embankment with concrete spillway, constructed in 1920. Correspondence on file with the New Hampshire Water Resources Board supplied some general dimensions and construction procedures but not enough information to perform a thorough structural analysis.

The original design assumed a ledge rock foundation, but upon excavating to a depth of 8 feet below the streambed, a hardpan material was encountered. The design was reviewed by the Public Service Commission on September 22, 1919 after an inspection of the construction then in progress. The reviewing engineer expressed some concern over the design of the spillway cross section in that the base width of the excavation (20 feet) was not enough to provide an apron at the base of the dam to prevent washout of the earth foundation. Instead of increasing the width of the spillway to account for the change in foundation material, an agreement was reached with the Berlin Water Company that rubble paving would be placed below the downstream face of the dam of sufficient size and strength to withstand the resulting wash from the overflow.

A subsequent inspection performed on December 1, 1920 noted that the concrete was completed but the rubble paving had not been placed at the base of the spillway as previously agreed upon. The report stressed the importance of this omission.

A letter dated December 24, 1920 from the Public Service Commission referenced a telephone call from the Berlin Water Company stating that "the downstream side of the dam had been paved with large derrick stones and concrete poured in along with the paving." There is no record of a follow-up inspection confirming the placement of the paving. The Public Service Commission closed their file on the dam on December 27, 1920.

The inspection performed on November 15, 1978 found no evidence of "large derrick stones" or the concrete mentioned in the preceding paragraph. The paving was either never placed or if placed was not of sufficient size or strength to resist the wash. The resulting wash has caused extensive undermining of the spillway and training walls, and is believed to have contributed to a failure of the right training wall (see Photo 6).

Since the dam was judged a nonmenace dam by the New Hampshire Public Service Commission, it received only minimal inspection subsequent to original construction. Therefore the date of the training wall failure is not known. The settlement failure produced a crack approximately 18 inches wide at the top and several inches at the bottom. The crack has been patched at least once since it occurred. Settlement has continued and the crack is approximately one inch wide between the original concrete and patch material.

With the exception of the repair to the right training wall, there are no indications of repairs, patching or new construction since the dam was originally built.

1. Normal Operating Procedures

Although the reservoir is reported to be operational, it is not being used at the present time. The Berlin Water Department has developed alternate water sources and the reservoir system, although still operational, is being maintained only as a standby supply.

The water level in the reservoir is being maintained by stop-logs in the primary spillway, at elevation 92.0, approximately 2 feet above the permanent primary crest and approximately 4 feet below the emergency spillway crest.

1.3 Pertinent Data

a. Drainage Area

The present drainage area above Mollywocket Brook reservoir contains 4.4 square miles of heavily wooded terrain ranging in elevation from 1480 at the reservoir to 3565 at the upper boundary. Originally, an adjacent watershed to the southwest was diverted to the reservoir via a diversion dam and pipeline. This additional area had increased the drainage area to 6.4 square miles. The diversion ditch and pipeline are completely silted in and no longer operational.

The main channel is approximately 3.2 miles long and varies in slope from 70 feet/mile to 1050 feet/mile in the upper reaches. Many sections of the watershed are logged for pulp wood.

b. Discharge at Dam Site

(1) Outlet Works

The pipeline running to the lower reservoir is reported to be operational, but is only utilized during emergency conditions. The invert elevation of the pipeline could not be measured.

The dam is also equipped with a 24" x 24" waste gate and conduit at the base of the dam, at elevation 71+. The operating shaft is located below water level and from the appearance of the conduit, the gate has not been operated for some time.

(2) Maximum Known Flood at Dam Site

There are no gauging stations or operating records for Mollywacket Brook Dam to determine the maximum known flood at the dam site. It has been reported that the dam has been overtopped at least once since the original construction but the date of the occurrence could not be recalled. During this event, a large section of the downstream embankment was washed out but the concrete core wall held and no breach occurred.

(3) Spillway Capacity

The Mollywacket Brook Dam contains two spillways, a primary and an emergency or overflow spillway. The primary spillway (see Figure 2) is four feet wide and six feet high and is equipped with stop logs which are two feet high at the present time. The primary spillway functions as a broad crested weir until the maximum height of six feet is reached, after which the spillway functions as an orifice. Under existing conditions with the stop logs in place, the maximum capacity of the primary spillway is 250 cfs. With the stop logs removed, the capacity would increase to 400 cfs. The emergency spillway capacity is 1070 cfs at maximum high water (top of dam). Therefore, the total spillway capacity is 1320 cfs under existing conditions (stop logs in place) and 1470 cfs under maximum conditions (stop logs removed). The test flood of 2165 cfs would exceed the total spillway capacity by approximately 60 percent (stop logs in place) and overtop the dam by 0.7 feet.

c. Elevations

The following elevations are based on an assumed elevation of 100.0 at the top of dam.

(1) Streambed at Centerline of Dam

71.0

(2) Maximum Tailwater

Could not be determined.

(3) Upstream Portal Invert Diversion Tunnel

Not applicable.

(4) Recreation Pool

92.0 - present conditions with stop logs.
90.0 - if stop logs were removed.

(5) Full Flood Control Pool

100.0

(6) Spillway Crest

92.0 - primary with stop logs.
90.0 - primary without stop logs.
96.0 - emergency spillway.

(7) Top of Dam

100.0

(8) Maximum Pool

100.0

(9) Test Flood Surcharge

100.7

d. Reservoir

(1) Length of Maximum Pool

675 feet.

(2) Length of Recreation Pool

473 feet.

(3) Length of Flood Control Pool

675 feet.

e. Storage (based on limited topographic information)

(1) Recreation Pool

8 acre-feet.

(2) Maximum Pool

31 acre-feet.

f. Reservoir Surface

(1) Recreation Pool

1.2 acres.

(2) Maximum Pool

3.1 acres.

(3) Top of Dam

3.1 acres.

g. Dam

(1) Type

Earth embankment, concrete core.

(2) Length

180 feet $\pm$.

(3) Height

29 feet (maximum).

25 feet (at emergency spillway crest).

(4) Top Width

50 feet (spillway structure).

(5) Side Slopes

Downstream slope - 2:1

Upstream slope - 4:1

(6) Zoning

None known.

(7) Impervious Core

Concrete core wall (dimensions not known).

(8) Cut Off

None known, foundation of core wall not known.

(9) Grout Curtain

None known.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

(1) Type

Concrete.

(2) Length

Primary - 4 feet.

Emergency - 43 feet.

(3) Crest Elevation

Primary - 92 with stop logs; 90 without stop logs.

Emergency - 96.

(4) Gates

2' x 2' waste gate at base of dam.

(5) Upstream Channel

Reservoir.

(6) Downstream Channel

Natural streambed 15-20 feet wide.

j. Regulating Outlets

The primary spillway is equipped with stop log channels. The logs and channel are in good condition and are presently maintaining a normal pool elevation of 92.0 approximately 2 feet above the permanent concrete crest.

The 10-inch pipeline located in the left abutment, adjacent to the spillway is controlled by a gate valve near the toe of the downstream embankment. The pipeline is reported to be operational, but is only used during emergency conditions.

The 2-foot by 2-foot waste gate, located at the left hand base of the spillway is controlled by a slide gate on the upstream face of the dam. The operating stem terminates below the water level and its operational status is not known.

SECTION 2 - ENGINEERING DATA

2.1 Design

There is no design data available for this dam.

2.2 Construction

According to records on file with the New Hampshire Water Resources Board the dam was completed in December 1920. The dam is a concrete core, earth embankment, constructed on hardpan foundation. The records indicate that the earth embankment was constructed of a variety of materials including boulders, gravel, loam and muck.

Some of the early correspondence from the Public Service Commission is worthy of note, especially in light of the current condition of the dam. An early memo dated September 22, 1919 from the Public Service Commission expressed some concern over the design base width of the concrete spillway (20 feet) especially with an earth (hardpan) foundation. The width was felt to be insufficient to allow an adequate apron to protect against washout. The design was approved contingent upon providing rubble paving below the spillway of sufficient size and strength to withstand the resulting wash from the overflow. A subsequent inspection report dated December 3, 1920 stated that the rubble paving had not been placed. The placement of the rubble paving was later reported in a telephone call from the Berlin Water Company on December 22, 1920, but apparently was not confirmed by inspection by the Public Service Commission who closed their file on this dam on December 27, 1920.

The inspection of the dam performed on November 15, 1978 found no evidence of large rubble paving as required in the early dam approval. The rubble was either never placed or if placed was not of a sufficient size or strength to resist washout. The absence of protection has led to the failure of the right training wall.

2.3 Operation

The water level at the Mollywocket Dam is controlled by stop logs placed in the primary spillway. The level is being maintained approximately 2 feet above the spillway crest and approximately 4 feet below the emergency spillway crest. The pipeline to the lower reservoir is reportedly closed at the valve located in the left embankment.

2.4 Evaluation

a. Availability

The design and construction drawings for this dam are not available, but construction procedures and general dimensions are

recorded in early correspondence from the New Hampshire Public Service Commission.

b. Adequacy

The lack of in-depth engineering data does not allow for an in-depth analysis of the dam. Therefore, the adequacy of the dam must be based on visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The on-site inspection of the Mollyrocket Brook Dam was performed on November 15, 1978. Weather conditions were clear and cool. The original construction road has become nearly impassable and the dam is accessible only by four-wheel drive vehicles or by foot. No emergency conditions were observed on the day of inspection.

b. Dam

The dam is an earth embankment with a concrete core wall. Both the upstream and downstream slopes were found covered with brush and trees varying in size from one to four inches in diameter. The top of the embankment is an open grass area which showed signs of trespassing. Several camp fires and discarded clothing indicate that the site is being used for camping and swimming.

An area of seeps and boils was observed about 4 feet downstream of the toe about 60 feet to the left of the spillway's left training wall. The area of boils is about 5 feet by 3 feet and is covered with brown silt and fine sand. The silt and sand are also evident further downstream where it is transported by the water from the seeps. A view of the area of boils is shown in Photo 2. A small hole excavated in the boils area disclosed a 3-inch layer of brown silt and sand with tree leaves. At the bottom of the 3-inch layer, a gravelly sand was exposed.

Surface erosion was noted on the downstream slope at both of the spillway training walls and at the access road. Some minor movement and sloughing were also observed on other areas of the downstream slope. The water line valve operating pit has been deflected by this movement (see Photos 3 and 7).

A review of correspondence on file with the State of New Hampshire indicated that a timber sheet pile retaining wall was constructed upstream of the dam and to the left of the intake in the waste gate. This retaining wall was visible approximately 3 feet below the water line and appeared to be in good condition.

c. Appurtenant Structures

The concrete spillway structure was found to be in very poor condition. Spalling and cracking of all exposed surfaces is extensive. At one location above the waste gate conduit the spalling has extended approximately one foot into the downstream face of the spillway. The spalling at this location has been intensified by seepage through the spillway with obvious freeze-thaw action speeding the surface spalling process (see Photos 5, 7, 8 and 9).

Major cracking of the spillway and training walls appears to be associated with the original construction jointing. A comparison of Photos 4 and 5, showing both upstream and downstream faces of the spillway, indicates that the observed cracks may extend through the full width of the spillway.

A major failure has occurred at the right spillway training wall. The failure produced a crack in the wall approximately 18" wide at the top and 4" wide at the bottom (see Photo 6). The crack was patched subsequent to the original failure but the downstream section of the wall has continued to settle, producing a one-inch crack between the patch and the original concrete.

The stream bed at the base of the spillway has been washed out by water flowing over the dam leaving a pool several feet deep. It appears that this washout has undermined both training walls and the spillway, and was a contributing factor to the failure of the right training wall (see Photos 6 and 8).

As mentioned in Section 1.2.h there is some question as to whether stone rubble was ever placed at the base of the spillway as requested by the original State design review. The material found at the base of the spillway during the November 1978 inspection was not of sufficient size to prevent the washout which was anticipated by the Public Service Commission's review. The material consists of small diameter rubble stones which appeared to be from the natural stream bed. There were no signs of any concrete or large derrick stones (see Photos 1 and 9).

d. Reservoir Area

The reservoir water level was approximately four feet below the emergency spillway crest during the inspection. This relatively low water level exposed a large area of sand deposition where Horne Brook enters the reservoir (see Overview Photo). From the aerial photograph it appears that the sand has filled in approximately 40-50 percent of the original reservoir volume.

During the inspection of the reservoir area, a 12-inch diameter wood stave pipeline was found entering the reservoir. The pipeline was traced 0.5 miles to its source, a small diversion dam on the South Branch of Horne Brook. The original purpose of the pipeline was to increase the watershed area of the reservoir. The diversion dam is completely silted over with sand and gravel and is no longer functional.

e. Downstream Channel

The downstream channel, beginning at the base of the spillway consists of a natural stone stream bed. The channel has been eroded at the base of the spillway creating a pool several feet deep. This erosion is believed to have contributed to the failure of the right training wall. The natural channel runs through dense forest for approximately five miles before encountering a culvert under Route 16A.

3.2 Evaluation

The visual inspection indicated that the dam is in poor condition. The following observations indicate potential safety problems:

- a. The area of sand boils immediately downstream of the earth embankment is transporting a small but clearly visible volume of soil particles. The amount of soil being transported would likely increase with higher reservoir levels.
- b. The general deteriorating condition of the concrete spillway is cause for concern. In particular, the condition of the right training wall and continued undermining at the base of the spillway could lead to eventual collapse.
- c. Growth of trees on both downstream and upstream slopes can result in seepage channels along decaying tree roots.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

None.

4.2 Maintenance of Dam

The existing maintenance of the dam consists of periodic inspections of the spillway to remove obstructions, especially in winter when ice jamming of the spillway becomes a problem.

4.3 Maintenance of Operating Facilities

The control valve for the pipeline to the lower reservoir is reported to be operational, but not in use at the present time. Operation is on an as-needed basis.

The waste gate operator is located below water level and could not be observed. The operational status of the gate is not known.

4.4 Description of Warning System in Effect

None exists for this dam.

4.5 Evaluation

The maintenance of the dam should be expanded to include removal of brush and trees on an annual or semiannual basis, and include the operation of the waste gate, to provide a means of dewatering the reservoir should problems develop. Detailed recommendations for improvements are presented in Section 7.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

There is no known design data concerning the hydraulic and hydrologic aspects of the Mollywacket Brook Dam.

b. Experience Data

During interviews with Water Department personnel, it was reported that the dam has been overtopped at least once since its original construction. The exact date of the occurrence could not be recalled.

c. Visual Observation

The primary spillway is a four-foot wide by six-foot high opening. It will function as a weir for water depths 0-6' above the spillway crest. Beyond the six-foot height the spillway will function as an orifice. At the present time the spillway is equipped with stop logs, raising the crest approximately two feet above the concrete crest. Because of its relatively narrow width, the spillway is subject to ice jamming, and as a result may become severely restricted during high spring runoff.

d. Test Flood Analysis

The dam is classified to be small size with a low hazard rating; therefore a 100-year exceedance interval flood was selected as the test flood. The computations of the test flood were carried out using a computer program of the procedures presented in Geological Survey Water-Supply Paper 1580-B, which is a study of the relation of annual peak discharges to hydrologic factors in New England. The input data computations and results are contained in Appendix D of this Report. The relatively small reservoir area offers insignificant flood regulation for the 4.4 square mile drainage area and therefore the test flood inflow equals the test flood outflow of 2165 CFS. Since the existing spillway capacity of 1318 CFS is only 60.9 percent of the test flood, the dam would be overtopped by 0.7 feet at a test flood elevation of 100.7.

e. Dam Failure Analysis

If the Mollywacket Brook Dam were to fail, a wave of water approximately 20 feet high would be released into the lower channel of Horne Brook. The wave would travel approximately

five miles through a densely wooded area before encountering a culvert under Route 16A north of Berlin. Assuming a 12 x 5 foot average cross section, the available storage within the natural channel will exceed the estimated maximum reservoir storage by 20 percent. The stream storage and low gradient of 1.3 percent would effectively reduce the flood wave to an insignificant height by the time it reached the culvert, and minimal, if any, damage would occur as a result of the failure. No dwellings will be impacted by this flood wave.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The visual observations indicated that the dam is marginally stable, based on the following findings:

1. The spillway right training wall has partially failed across a vertical crack along its full height. The failure is probably due to undermining of its foundation. Unless corrective measures are taken, a complete collapse of the wall can occur. Such a collapse would lead to instability of the spillway and to failure of the adjacent earth embankment.
2. An area of boils was observed near the toe of the earth embankment. The movement of soil from the foundation of the earth embankment is likely to increase in the future and can lead to failure by piping.

b. Design and Construction Data

Design data, sufficient to perform a thorough stability evaluation is not available for this dam. Some data, including rough dimensions and construction procedures, have been obtained through a review of correspondence on file with the New Hampshire Water Resources Board. This data, as explained in Section 1.2 h and 2.2 leaves considerable doubt as to the installation of an adequate apron at the base of the spillway to dissipate the energy of the overflowing water to prevent washout of the spillway and training wall foundations.

c. Operating Records for the Dam

There are no formal operating records for the dam. An interview with Water Department personnel confirmed that the dam was overtopped at least once since its original construction. During this incident a large portion of the downstream embankment was washed out, but the core wall held and no breaching occurred. It can be assumed that this washout was also a contributing factor in undermining the right training wall.

d. Post-Construction Changes

The only post-construction change evident during the visual inspection is the patch applied to the failure crack in the right training wall.

In addition, it was reported that a considerable portion of the downstream embankment was replaced subsequent to the overtopping and washout noted previously.

e. Seismic Stability

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

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Based on the records and visual observations this dam is in poor condition. The areas of major concern for the near future are:

1. The failure of the right training wall and on-going undermining of the spillway and training walls.
2. The area of seeps and boils downstream of the toe of slope.
3. The excessive spalling and cracking of the concrete structure.

b. Adequacy of Information

The lack of in-depth engineering design information does not allow for a definitive review and evaluation. Therefore the evaluation of this dam is based on visual observations, past performance history and sound hydraulic and hydrologic engineering judgment.

c. Urgency

The recommendations given in Section 7.2 should be carried out within one year after receipt of this report.

d. Need for Additional Investigation

The additional investigations described in Section 7.2 should be carried out.

7.2 Recommendations

It is recommended that an engineer qualified in the design of dams investigate and design remedial measures for the following:

1. Repair and stabilization of the right training wall.
2. Installation of an energy dissipating apron at the base of the dam.
3. Repair and/or replacement of the spalled concrete.
4. Seal of leakage through spillway above waste gate.

5. Repair or replacement of the waste gate.
6. Investigation of the embankment and foundation materials to ascertain the significance of the seep and boil area and the design of measures to prevent future piping.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

1. The trees and brush growing on the upstream and downstream slopes should be removed and the eroded areas should be repaired.
2. Slope protection should be placed on the upstream slope and grass grown on the downstream slope.
3. A program of annual periodic technical inspection should be established. Points of inspection should include the boil area, concrete spalling and operation of the waste gate.
4. In the interim, the waste gate should be opened and the reservoir drained.

7.4 Alternatives

The alternative to the above recommendations and remedial measures would be to breach the dam and permanently drain the reservoir.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

TIME 1:00 PM - 3:15 PM

WEATHER Cool, Cloudy

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

PARTY:

- | | | |
|-----------------------------------|------------|-----------|
| 1. <u>Jim Maynes</u> | <u>D-H</u> | 6. _____ |
| 2. <u>Jim Dohrman</u> | <u>D-H</u> | 7. _____ |
| 3. <u>Sherward Farnsworth</u> | <u>D-H</u> | 8. _____ |
| 4. <u>Gonzalo Castro</u> | <u>GEI</u> | 9. _____ |
| 5. <u>Ken Sterns - N.H. Water</u> | | 10. _____ |
| <u>Resources Board</u> | | |

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

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWOCKET BROOK DAM DATE November 15, 1978
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u> (EARTH)	
Crest Elevation	96.0 (Emergency Spillway).
Current Pool Elevation	92.0
Maximum Impoundment to Date	31 Acre-feet (estimated).
Surface Cracks	None observed.
Pavement Condition	Grass.
Movement or Settlement of Crest	Erosion near access road.
Lateral Movement	None observed.
Vertical Alignment	Irregular.
Horizontal Alignment	Irregular.
Condition at Abutment and at Concrete Structures	Erosion along spillway wingwalls on downstream slopes.
Indications of Movement of Structural Items on Slopes	Valve pit deflected by movement downslope.
Trespassing on Slopes	Minimal (swimming, camping).
Sloughing or Erosion of Slopes or Abutments	Sloughing on downstream slope particularly on right side of spillway.
Rock Slope Protection - Riprap Failures	None.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Area of seeps and boils located 60 feet left of spillway and 10 feet beyond the toe of downstream embankment.
Piping or Boils	
Foundation Drainage Features	None known.
Toe Drains	None known.
Instrumentation System	None.
Vegetation	Entire embankment above maximum water line.

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	NONE.
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General Condition of Concrete	Water supply line to a lower reservoir.
Rust or Staining on Concrete	Water line, left side through core wall.
Spalling	Intake not observed, under water
Erosion or Cavitation	Valve on down stream slope in 21" RCP
Cracking	pit. Pit is deflected by sloughing
Alignment of Monoliths	on slope.
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE</u> <u>AND OUTLET CHANNEL</u> General Condition of Concrete Rust or Staining Spalling Erosion or Cavitation Visible Reinforcing Any Seepage or Efflorescence Condition at Joints Drain Holes Channel Loose Rock or Trees Overhanging Channel Condition of Discharge Channel	NONE

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	None (reservoir).
General Condition	N.A.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	None.
b. Weir and Training Walls	
General Condition of Concrete	Very poor.
Rust or Staining	None observed.
Spalling	Major - freeze-thaw 1 foot into downstream face of spillway.
Any Visible Reinforcing	Yes, minimal.
Any Seepage or Efflorescence	Yes, extensive.
Drain Holes	None observed.
c. Discharge Channel	Natural channel.
General Condition	Poor (erosion at right wingwall)
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Channel	Natural channel.
Other Obstructions	Erosion at right training wall has caused settlement and failure. Attempted repair has not prevented subsequent movement. Footing material has been washed away by erosion

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	NONE
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM

DATE November 15, 1978

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u>	NONE
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

PERIODIC INSPECTION CHECK LIST

PROJECT MOLLYWCKET BROOK DAM DATE November 15, 1978
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>RESERVOIR</u>	
Stability of Shoreline	Good.
Sedimentation	Extensive sand and gravel deposition at reservoir inlet.
Changes in Watershed Runoff Potential	Diversion pipeline from adjacent watershed. Diversion dam and pipe are clogged with sand.
Upstream Hazards	None.
Downstream Hazards	None (five miles natural stream).
Alert Facilities	None.
Hydrometeorological Gages	None.
Operational and Maintenance Regulations	Water supply dam.

APPENDIX B

PROJECT RECORDS AND PLANS

FRANK A. GAY
CIVIL ENGINEER
OFFICE, 852 ELM ST.
ROOM 32

MANCHESTER, N. H., September 22, 1913.

John W. Storrs,

Chief Engineer, Public Service Commission,

Concord, N. H.

Dear Sir:

At your request on Tuesday and Wednesday, Sept. 16 and 17, I made a trip of inspection, in company with Mr. Moxon of your office, to Berlin, N. H. to the site of a proposed dam to be built by the Berlin Water Company of that city, for a reservoir of about ten million gallons capacity on a mountain brook about six miles from the city of Berlin.

The immediate cause of our journey was a desire on the part of the Water Company to have us pass on the sufficiency of the foundation for the dam for which excavation was in progress. This had reached a depth of about eight feet below the brook bed and revealed a clayey hard pan or marl with numerous boulders imbedded in it. This material is very hard and capable of sustaining large loads when dry and is also impenetrable to water.

There did not seem to be any question in my mind as to the quality of the foundation which the soil offered and I so advised the Water Company.

With regard to the design of the dam itself I was of the opinion however that it should be somewhat modified.

MANCHESTER, N. H., _____ 191

The cross section of the dam as submitted to your Commission by W. M. Gooding the Superintendent of the Water Company and the engineer in charge, seemed too light at the spillway crest (three feet in thickness) and showed also a square edge on the down stream side. The effect of this would be to cause the overflowing water to leave the down stream slope of the dam at the moment of its passing the spillway and to cause it to impinge on the dam again near the bottom of the slope, thus adding to its destruction effect at the base of the dam.

I was also of the opinion that an outward curve should be added to the down stream slope of the dam at the base so as to guide the water horizontally on leaving the dam and prevent its washing out and undermining the dam as the result of a vertical fall of nearly 25 feet on the unprotected soil.

I am enclosing a plan sketch which will show my ideas as explained above.

I was not able however to get the full ogee form of dam which I should have liked to design on account of the limited room developed by the foundation excavation already spoken of which was twenty one feet wide and fifty feet long.

The original dam was twenty feet thick on the bottom at the level of the base of excavation as made.

2.
FRANK A. GAY
CIVIL ENGINEER
OFFICE, 852 ELM ST.
ROOM 32

MANCHESTER, N. H., _____ 191

This excavation was strongly braced and served by pumps and derricks and it seemed an unnecessary hardship to the Water Company to ask them to pull out their bracing and sink a foot or two more in width on the down stream side, and there was also present the probability that if the bracing was pulled out the side would cave in and not afford so good a backing for the masonry as the original soil would do.

We were enabled however to effect a compromise, in that the Water Company agreed, and I believe on their own suggestion, to fill the entire excavation as made with concrete, which will make a solid mass twenty-one feet wide and eight feet thick under the whole length of the dam, which will in my judgment make the dam secure and provide an excellent base for the dam itself. This width of twenty-one feet as I have stated, is not sufficient to provide apron enough for a dam in earth foundation, and at my suggestion which as I understand it is agreed by the company, rubble paving below the down stream face of the dam is to be provided of sufficient size and strength to withstand the resulting wash from the overflow. It also seemed better to thicken top of the dam, for experience has shown that three feet is a little light for a spillway crest of a dam, accordingly as the design shows, I have increased the width to five feet. These points are all shown in the sketch submitted.

FRANK A. GAY
CIVIL ENGINEER
OFFICE, 852 ELM ST.
ROOM 312

4.

MANCHESTER, N. H., _____ 191

I should explain however that the design of parts other than the cross section of the dam should be considered merely tentative for sufficient data is lacking in the nature of lines and levels for a finished design, but it is possible that it may be of some use as a suggestion of what might be done.

Yours very truly,

Frank A. Gay, C.E.

PUBLIC SERVICE COMMISSION

WILLIAM T. GUNNISON, CHAIRMAN
THOMAS W. D. WORTHEN
JOHN W. STORRS
COMMISSIONERS

OF

NEW HAMPSHIRE

WALTER H. TIMM, CLERK
MISS MARY A. NAWN
ASSISTANT CL

CONCORD. December 3, 1920.

Hon. John W. Storrs, Commissioner,
Public Service Commission,
Concord, New Hampshire.

Dear Sir:-

On December 1 in company with Engineer Gay of Manchester I made an inspection of the dam which is being constructed by the Berlin Water Company at the outlet of Horne No. 2 reservoir. On the above date all the concrete work of the main dam was in place and the workmanship appeared very good. At that time work was being done on the fill behind the abutment wall.

I am now waiting for a report which Mr. Gay is preparing covering some additional work which we think is imperative. We informed Mr. Twitchell of the water company that the work had progressed nicely, but that we would insist that large rubble paving be carefully placed just below the spillway to resist the wash, and also that some kind of a core wall be extended from 25 to 30 feet beyond that point where the heavy abutment wall ended in order to insure a perfectly water-tight embankment.

We were told that both of these recommendations will be met, and with a reasonable amount of effort the remainder of the work should be completed and the pond ready to be filled by January 1, 1921.

Very truly yours,

B. H. Moxon.

Inspector.

BH:HWV

PUBLIC SERVICE COMMISSION

WILLIAM T. GUNNISON, CHAIRMAN
THOMAS W. D. WORTHEN
JOHN W. STORRS
COMMISSIONERS

OF

NEW HAMPSHIRE

WALTER H. TIMM, CLERK
MISS MARY A. NAWN
ASSISTANT

CONCORD. December 24, 1920.

Hon. John W. Storrs, Commissioner,
Public Service Commission,
Concord, New Hampshire.

Dear Sir:-

On December 22, Mr. Gerrish, manager of the Berlin Water Company, called at this office and personally advised that the work on the dam at Horne No. 2 reservoir was complete and the construction equipment was being removed from the site. He further stated that all additional work as suggested by Mr. Gay had been done, i.e., a double line of sheeting had been driven at the end of the abutment wall on the easterly side and that the downstream side of the dam had been paved with large derrick stones and concrete poured in along with the paving. The construction work on the dam is therefore complete.

Very truly yours,

B. H. Moxon,
Inspector.

HVV

PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE—DAM RECORD I-5381

TOWN	SUCOTEE	TOWN NO.	3	STATE NO.	633
RIVER STREAM	Wollyocket Brook (Keene Reservoir)				
DRAINAGE AREA	5.7 Sq. Mi.	POND AREA			
D/ TYPE	Gravity	FOUNDATION NATURE OF			
MATERIALS OF CONSTRUCTION	Stone				
PURPOSE OF DAM	POWER— CONSERVATION — DOMESTIC —RECREATION—TRANSPORTATION—PUBLIC UTILITY Water Supply				
HEIGHTS, TOP OF DAM TO END OF STREAM			TOP OF DAM TO SPILLWAY CRESTS		
SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM				LENGTH OF DAM	
FLASHBOARDS TYPE, HEIGHT ABOVE CREST					
OPERATING HEAD CREST TO N. T. W.			TOP OF FLASHBOARDS TO N. T. W.		
WHEELS, NUMBER KINDS & H. P.					
GENERATORS, NUMBER KINDS & K. W.					
H. P. 50 P. C. TIME 100 P. C. EFF.			H. P. 75 P. C. TIME 100 P. C. EFF.		
REFERENCES, CASES, PLANS, INSPECTIONS					
REMARKS					

OWNER: City of Berlin

CONDITION: ?

MENACE: No. Will not be subject to further inspection.

To the Public Service Commission:

The foregoing memorandum on the above dam is submitted covering inspection made Aug. 4, 1936, according to notification to owner dated July 25, 1936.

D. Waldo White
Chief Engineer

Aug. 11, 1936
Copy to Owner

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: Sucias Dam Number: 227.03

Name of Dam, Stream and/or Water Body: Nellysacket Br

Owner: Berlin WW Telephone Number: _____

Mailing Address: _____

Max. Height of Dam: _____ Pond Area: _____ Length of Dam: _____

FOUNDATION: Earth

OUTLET WORKS: Concrete overflow spillway
Stoplog sect.

ABUTMENTS: Concrete in fair shape some spalling

EMBANKMENT: Earth 2:1 slopes 17' wide Top trees on slopes

Give Sizing, Condition and detailed description for each item, if applicable.

Changes Since Construction or Last Inspection:

Tail Water Conditions:

Overall Condition of Dam: Fair

Contact With Owner:

Date of Inspection: 2 Dec 77

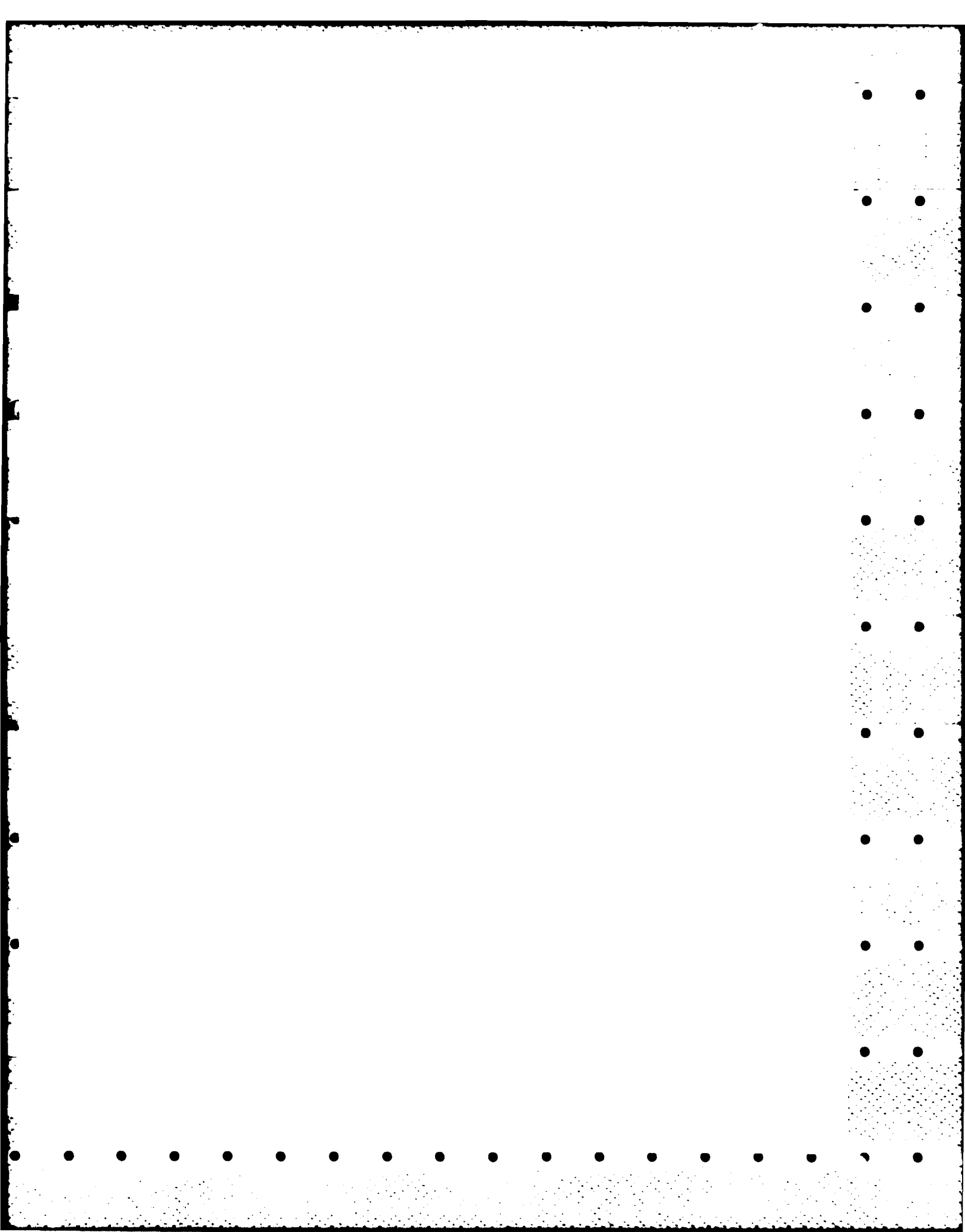
Suggested Reinspection Date

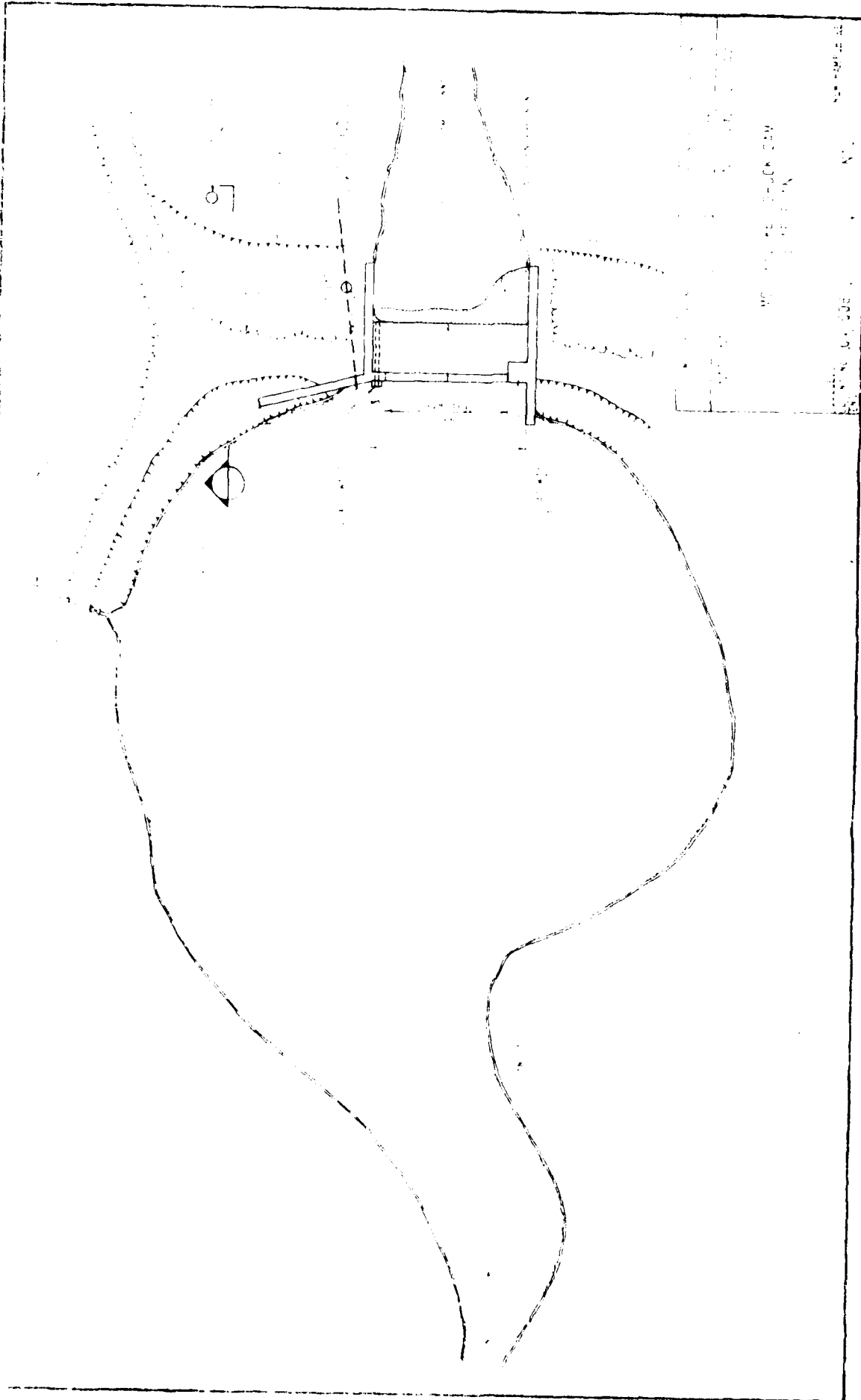
Class of Dam: Minor

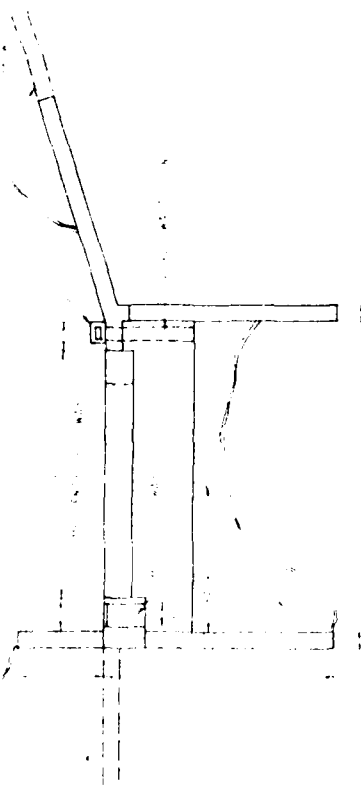
Signature

Date

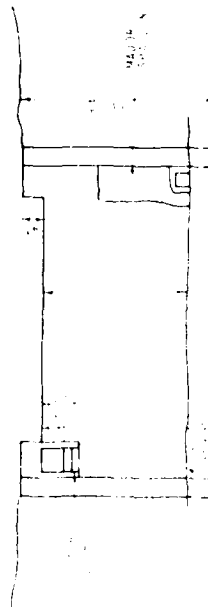
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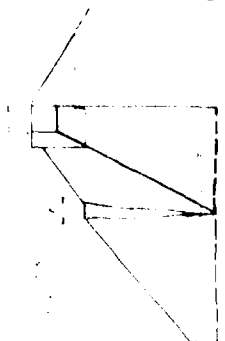




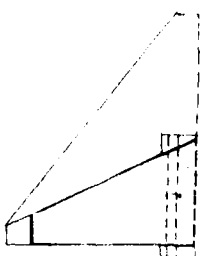
ELEVATION



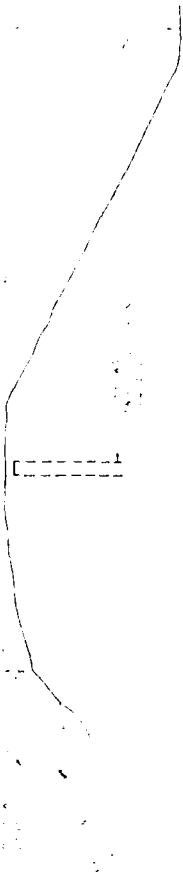
ELEVATION



RIGHT TRAINING WALL SECTION



LEFT TRAINING WALL SECTION



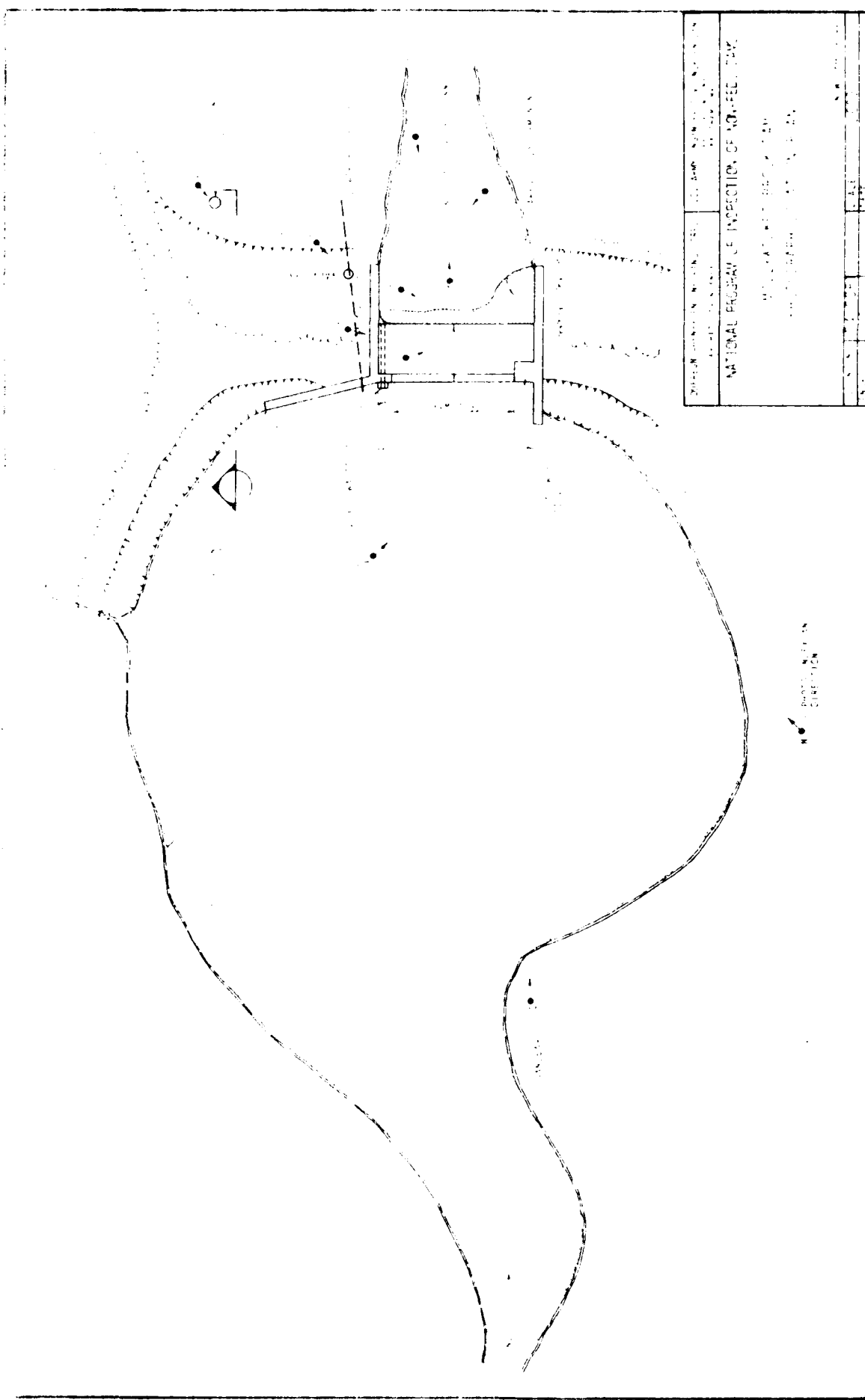
SECTION THROUGH AW (SEE SITE PLAN)

NO. 104-0001	DATE	BY	CHKD.	APP'D.
NO. 104-0001	11/12/50	J. H. B.		
VOLUNTARY BOARD				

APPENDIX C

PHOTOGRAPHS

NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946	
NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946	NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946 NATIONAL PROGRAM OF INSPECTION OF NOVAE, 1946





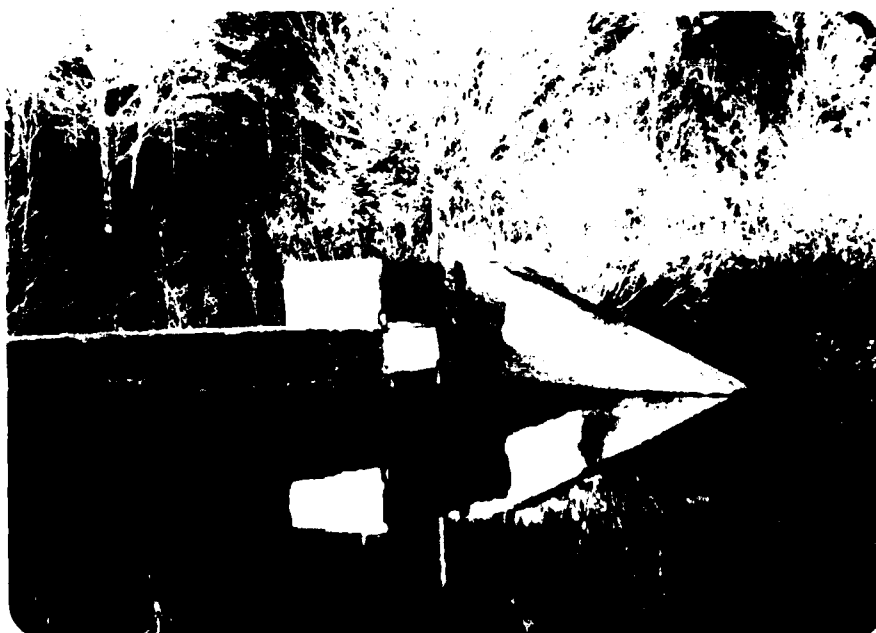
#1. VIEW OF DOWNSTREAM SPILLWAY FACE



#2. VIEW OF BOIL AND SEEP AREA



#3. VIEW OF VALVE OPERATOR PIT



#4. VIEW OF UPSTREAM SPILLWAY FACE



#5. VIEW OF DOWNSTREAM SPILLWAY FACE SHOWING
CRACKED AND SPALLING CONCRETE



#6. VIEW OF RIGHT TRAINING WALL SHOWING
SETTLEMENT CRACK



#7. VIEW OF LEFT TRAINING WALL SHOWING CRACKED AND SPALLING CONCRETE



#8. VIEW OF DOWNSTREAM SPILLWAY FACE SHOWING CRACKS, SPALLING CONCRETE AND UNREINFORCED



#9. VIEW OF DOWNSTREAM
CHANNEL



#10. VIEW OF RESERVOIR AREA

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

J. DOHRMAN
DATE 1-24-79

SUBJECT MOLLY LOCKET DFM
HYDRAULIC CALCULATIONS

SHEET NO. 1 OF 5
JOB NO. 04-0081

① DRAINAGE AREA (SEE FIGURE 1 FOR AREA BOUNDARY)

PRESENT AREA = 4.4 SQ. MI = 2816 ACRES

ORIGINAL AREA (INCLUDED DIVERSION FROM SOUTH
BRANCH OF HORNE BROOK)

= 4.4 + 2.0 = 6.4 SQ. MI = 4096 AC.

② RUNOFF (100 YEAR DESIGN STORM)

RAINFALL = 6.5 IN/24 HOURS

PEAK RUNOFF WAS CALCULATED ACCORDING TO
PROCEDURES PRESENTED IN "GEOLOGICAL SURVEY
WATER SUPPLY PAPER 1580-B"

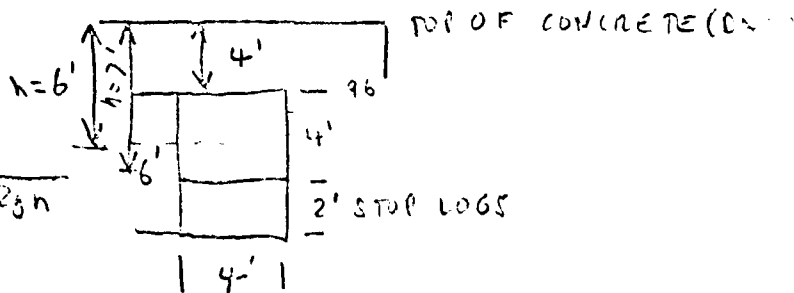
$$Q_{100} = 2165 \text{ CFS}$$

③ SPILLWAY CAPACITY

PRIMARY CAPACITY

$$\text{ORIFACE FLOW } Q = CAV\sqrt{2gh}$$

$$C = .80$$



WITH STOP LOGS ($A = 16 \text{ ft}^2$) ($h = 6'$)

$$Q = (.80)(16)\sqrt{64.4(6)} = 252 \text{ CFS}$$

WITHOUT STOP LOGS ($A = 24 \text{ ft}^2$) ($h = 7'$)

$$Q = (.80)(24)\sqrt{64.4(7)} = 377 \text{ CFS}$$

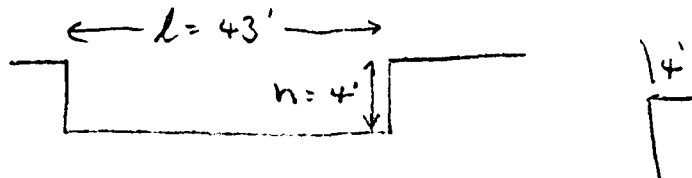
DUFRESNE-HENRY ENGINEERING CORPORATION

BY J. DOHRMAN
DATE 1-24-79

SUBJECT MOLLY WOCKETT DAM
HYDRAULIC CALCULATIONS

SHEET NO. 2 OF 5
JOB NO. 04-0081

EMERGENCY SPILLWAY - BROAD CRESTED WEIR



$$Q = C_w L h^{3/2} \quad C_w = 3.10$$

$$Q = (3.10)(43)(4^{3/2}) = \underline{1066 \text{ CFS}}$$

TOTAL SPILLWAY CAPACITY

WITH STOP LOGS $1066 + 252 =$
WITHOUT STOP LOGS $1066 + 407 =$

1318	CFS
1473	CFS

DUFRESNE-HENRY ENGINEERING CORPORATION

BY J. DORRMAN
DATE 1-24-79

SUBJECT MOUNTAIN CREEK DAM
HYDRAULIC COMPS

SHEET NO. 3 OF 5
JOB NO. 04-0081

FLOW STABILIZING

PRIMARY SPILLWAY WEIR FLOW $Q = C_w L h^{3/2}$

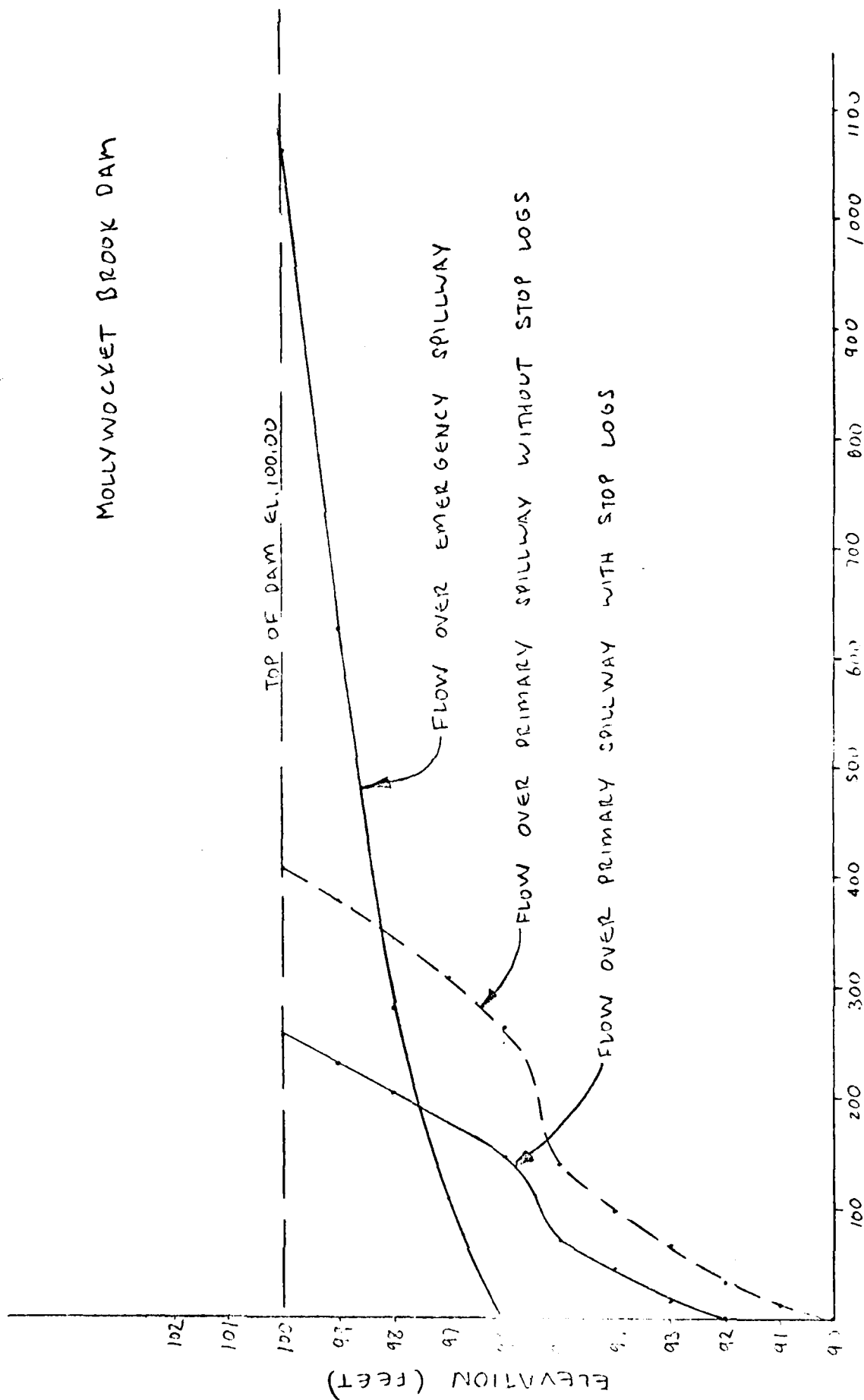
ORIFACE $Q = C A \sqrt{2 g h}$

ELEVATION	<u>w/o STOP LOGS</u>			<u>w/ STOP LOGS</u>		
	<u>h</u>	<u>C</u>	<u>Q(CFS)</u>	<u>h</u>	<u>C</u>	<u>Q(CFS)</u>
100	↑ 7	.80	407	↑ 6	.80	252
99	WE 6	.80	377	WE 5	.80	229
98	ORIFACE 5	.80	344	ORIFACE 4	.80	205
97	↓ 4	.80	308	↓ 3	.80	178
96	3	.80	266	2	.80	145
95	↑ 5	3.10	138	↑ 3	3.45	72
94	WE 4	2.80	89	WE 2	3.45	42
93	3	2.73	56	1	3.45	14
92	↓ 2	2.68	30			
91	1	2.67	10			

EMERGENCY SPILLWAY $Q = C_w L h^{3/2}$

<u>ELEVATION</u>	<u>h</u>	<u>C</u>	<u>Q(CFS)</u>
100	4	3.10	1066
99	3	2.80	625
98	2	2.73	
97	1	2.68	115

MOLLYWCKET BROOK DAM



FLOW IN CFS

DUFRESNE-HENRY ENGINEERING CORPORATION

BY J. DOHRMANN

SUBJECT MOLLY WOCKETT DAM

SHEET NO. 5 OF 5

DATE _____

JOB NO. _____

STORAGE DISCHARGE CALCULATION (WITH SPLOGE CREST)

SURFACE AREA AT NORMAL POOL (ELEV 92.0) = 1.2 ACRES
STORAGE AT NORMAL (ELEV 92.0) = 8 ACRE-Feet

SURFACE AREA AT MAX. POOL (ELEV 100) = 3.1 ACRES
STORAGE AT MAX. POOL (ELEV 100) = 31 ACRE-Feet

Δ STORAGE IS ASSUMED TO BE AN ADDITIONAL
2.9 ACRE-Feet PER FOOT OF WATER
SURFACE INCREASE.

<u>WATER SURFACE ELEVATION</u>	<u>STORAGE AC.FE</u>	<u>DISCHARGE (CFS)</u>
90	8	0
91	8	0
92	8	0
93	10.9	14
94	13.8	40
95	16.7	72
96	19.6	145
97	22.5	293
98	25.3	485
99	28.1	854
100	31.0	1318

STORAGE AREA / DRAINAGE AREA = $31 / 2816 = .011$

SINCE STORAGE EFFECT ON PEAK RUNOFF WILL BE
MINIMAL, FLOOD ROUTING CALCULATIONS ARE NOT REQ'D.

MOLLYCKET BROOK DAM
TOWN OF SUCCESS, NEW HAMPSHIRE

SUMMARY OF COMPUTED PEAK DISCHARGES

RECURRENCE INTERVAL (YRS)	NUMBER OF VARIABLES USED IN EQUATION					
	1	2	3	4	5	6
1.2	82	109	198	173	195	1
2.33	157	345	400	343	384	1
5	250	579	483	556	625	619
10	362	865	699	800	899	938
25	589	1479	1096	1203	1333	1448
50	932	2215	1377	1744	1845	1993
100	1103	2647	1533	1596	1259	2165
200	1506	4148	1600	1566	1	1
300	1702	6134	2391	5176	1	1

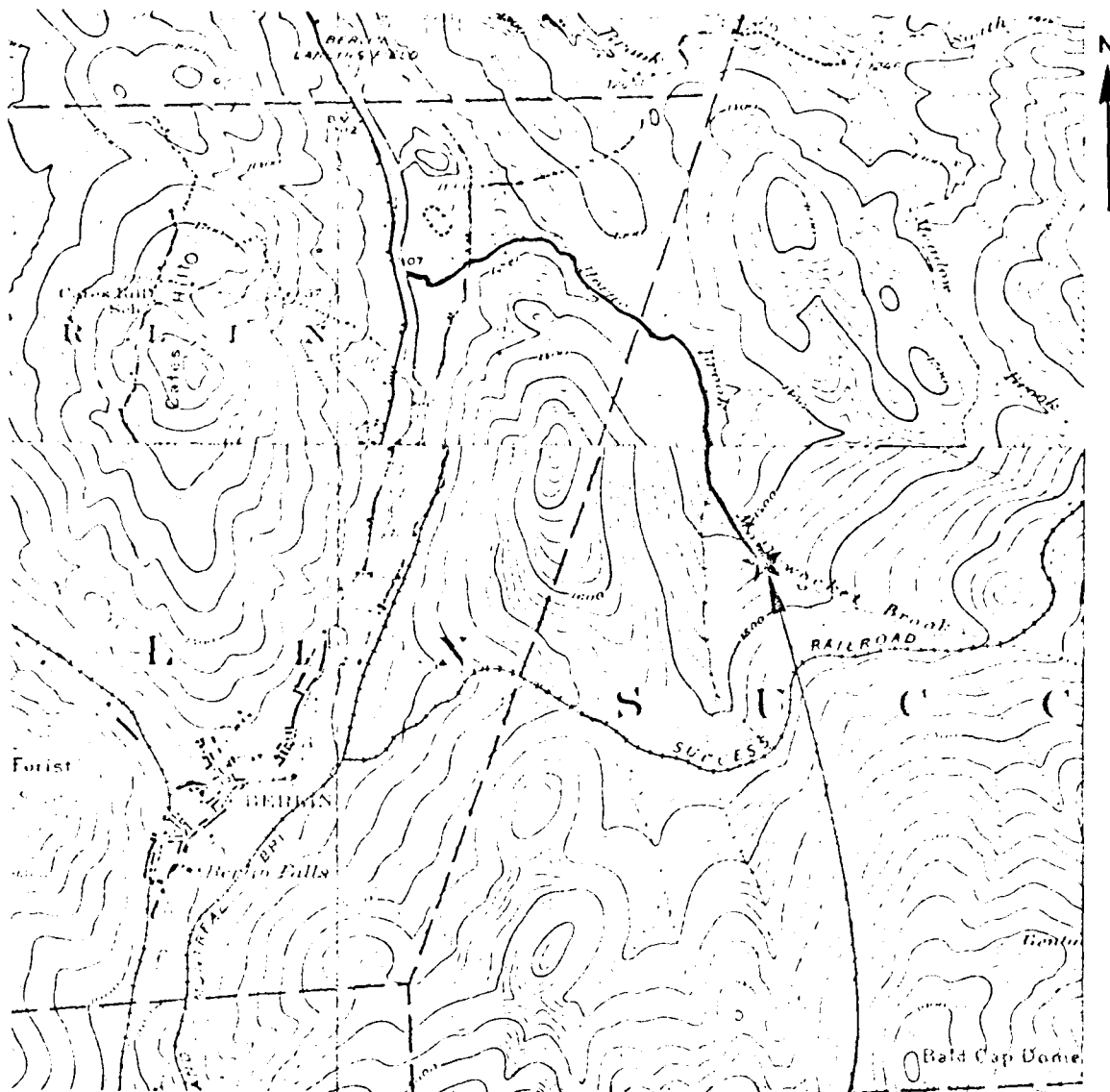
MOLLYWCKET BROOK DAM
 TOWN OF SUCESS, NEW HAMPSHIRE

A = DRAINAGE AREA = 4.40 SQ. MI.
 S = MAIN CHANNEL SLOPE = 428.00 FT./MI.
 ST = STORAGE INDEX = 0.50
 T = TEMPERATURE INDEX = 14
 O = OROGRAPHIC FACTOR = 1.00
 I = X-YEAR, 24-HOUR RAINFALL

RAINFALL DATA

RECURRENCE INTERVAL (YEARS)	24-HOUR RAINFALL (INCHES)
1.2	0.0
2.33	0.0
5	4.50
10	5.00
25	5.50
50	6.00
100	6.50
200	0.0
300	0.0

RECURRENCE INTERVAL (YRS)	NUMBER OF VARIABLES IN EQUATION	INDEPENDENT VARIABLES	PEAK DISCHARGE (CFD)
1.2	1	A	02
	2	A,S	169
	3	A,S,ST	198
	4	A,S,ST,O	173
	5	A,S,ST,O,T	195
	6	A,S,ST,O,T,I	-4
2.33	1	A	157
	2	A,S	345
	3	A,S,ST	400
	4	A,S,ST,O	343
	5	A,S,ST,O,T	369
	6	A,S,ST,O,T,I	-4
5	1	A	250
	2	A,S	512
	3	A,S,O	483
	4	A,S,O,ST	550
	5	A,S,O,ST,T	645
	6	A,S,O,ST,T,I	612
10	1	A	362
	2	A,S	865
	3	A,S,O	699
	4	A,S,O,ST	800
	5	A,S,O,ST,T	899
	6	A,S,O,ST,T,I	938
25	1	A	509
	2	A,S	1472
	3	A,S,O	1090
	4	A,S,O,ST	1203
	5	A,S,O,ST,T	1353
	6	A,S,O,ST,T,I	1440
50	1	A	922
	2	A,S	2245
	3	A,S,O	1377
	4	A,S,O,ST	1744
	5	A,S,O,ST,T	1845
	6	A,S,O,ST,T,I	1995
100	1	A	1103
	2	A,S	2647
	3	A,S,O	1533
	4	A,S,O,T	1590
	5	A,S,O,T,I	1259
	6	A,S,O,T,I,ST	2105
200	1	A	1500
	2	A,S	4140
	3	A,S,O	1600
	4	A,S,O,T	1500
	5	A,S,O,T,I	-4
	6	A,S,O,T,I,ST	-1
300	1	A	1500
	2	A,S	4140
	3	A,S,O	2371
	4	A,S,O,T	5170
	5	A,S,O,T,I	-1
	6	A,S,O,T,I,ST	-1



MOLLYWOCKET BROOK DAM

SOURCE OF MAP

U.S.G.S. QUADRANGLE
MILAN AND GORHAM, N.H.
1:62500, 1930 & 1891

DUFRESNE-HENRY ENGINEERING CORP.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTON, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

IMPACT AREA MAP MOLLYWOCKET BROOK DAM

SUCCESS
CLIENT NO. 04-0031
E.S.R. JAD

NEW HAMPSHIRE
1"=1 MILE

APPENDIX E

Information as Contained in the National Inventory of Dams

14-0000
11-23

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY	LOCATION	DATE	STATE	COUNTY	USE	NAME	LONGITUDE (WEST)	REPORT DATE
70	70	70	70	70	70	70	MOLLYBUCKET BROOK DAM	110.0	01-1-1970

POPULAR NAME		NAME OF IMPOUNDMENT	
MOLLYBUCKET BROOK		KEENE RESERVOIR	
NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	POPULATION		
BERLIN	15500		

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES (ACRE-FT)	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	POPULATION
CONCRETE	1920	50	29	29	51	BERLIN	15500

REMARKS									
1-11-122703 21-CONCRETE SPILLWAY 23-STANDBY 17-ALSO MURNE BROOK									
D/S HAS	SPILLWAY	MAXIMUM DISCHARGE (CFS)	VELOCITY (FPS)	POWER CAPACITY (KW)	INSTALLED	POWER CAPACITY (KW)	NAVIGATION LOCKS	LENGTH (FT)	WIDTH (FT)
5	500 U	47	1470						

OWNER	ENGINEERING BY	CONSTRUCTION BY
NEW HAMPSHIRE DEPARTMENT	M. M. GORDON	NEW HAMPSHIRE DEPARTMENT

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NEW HAMPSHIRE DEPT	NEW HAMPSHIRE DEPT	NEW HAMPSHIRE DEPT	NEW HAMPSHIRE DEPT

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
DUPRESNE MELNY EIC COMP	15-00-78	PUBLIC LAW 92-367 AUG 1972

REMARKS	
50-01A44.45M SADS, IAC	

END

FILMED

8-85

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