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NATIONAL DAM SAFETY PROGRAM. ROBERT L. BISHOP DAM (INVENTORY NU--ETC(U)

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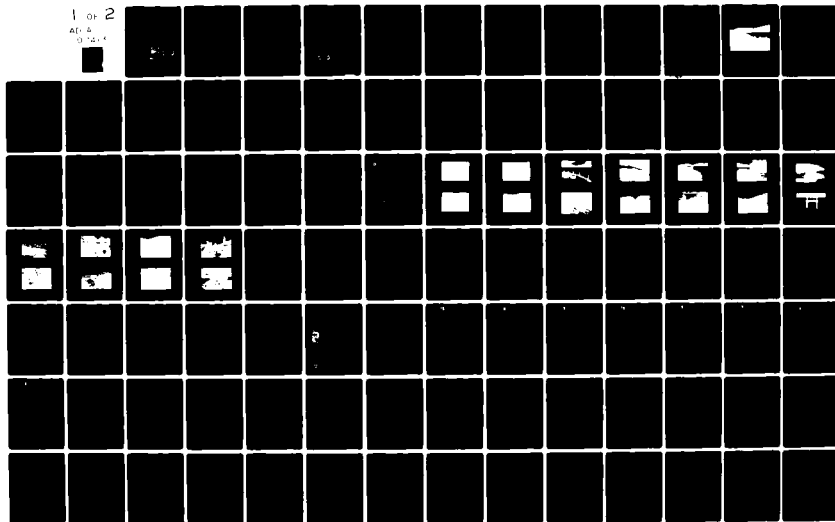
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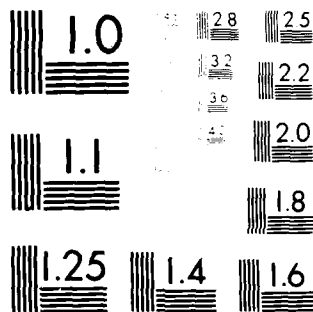
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DELAWARE RIVER BASIN

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ROBERT L. BISHOP DAM

DELAWARE COUNTY, NEW YORK
INVENTORY No. NY 534

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Examination of available documents and visual inspections of the dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies that need to be evaluated and remedied.		

Using the Corps of Engineers' screening criteria for the initial review of spillway adequacy, it has been determined that the embankment would be overtopped by the outflow resulting from all storms exceeding 18 percent of the Probable Maximum Flood (PMF). Dam overtopping, the resulting erosion of the embankment and hence, dam breaching would cause water surface levels downstream to reach depths which would pose significant danger to residents. Therefore, the spillway is adjudged to be seriously inadequate and the dam is assessed as unsafe, nonemergency.

The classification "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to life downstream from the dam.

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PREFACE

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

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

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

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

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ROBERT L. BISHOP DAM
INVENTORY NO. NY 534
DELAWARE RIVER BASIN
DELAWARE COUNTY, NEW YORK

TABLE OF CONTENTS

	<u>PAGE NO.</u>
ASSESSMENT	-
OVERVIEW PHOTOGRAPH	-
LOCATION MAP	i
1 - PROJECT INFORMATION	1
1.1 GENERAL	1
1.2 DESCRIPTION OF PROJECT	1
1.3 PERTINENT DATA	3
2 - ENGINEERING DATA	6
2.1 GEOTECHNICAL DATA	6
2.2 DESIGN RECORDS	6
2.3 CONSTRUCTION RECORDS	7
2.4 OPERATION RECORDS	7
2.5 EVALUATION OF DATA	7
3 - VISUAL INSPECTION	8
3.1 FINDINGS	8
3.2 EVALUATION OF OBSERVATIONS	10
4 - OPERATION AND MAINTENANCE PROCEDURES	12
4.1 PROCEDURE	12
4.2 MAINTENANCE OF DAM	12
4.3 WARNING SYSTEM	12
4.4 EVALUATION	12

5 - HYDROLOGIC/HYDRAULIC	13
5.1 DRAINAGE AREA CHARACTERISTICS	13
5.2 ANALYSIS CRITERIA	13
5.3 SPILLWAY CAPACITY	13
5.4 RESERVOIR CAPACITY	14
5.5 FLOODS OF RECORD	15
5.6 OVERTOPPING POTENTIAL	15
5.7 EVALUATION	15
6 - STRUCTURAL STABILITY	16
6.1 EVALUATION OF STRUCTURAL STABILITY	16
7 - ASSESSMENT/RECOMMENDATIONS	18
7.1 ASSESSMENT	18
7.2 RECOMMENDED MEASURES	18

APPENDICES

- A. PHOTOGRAPHS
- B. VISUAL INSPECTION CHECKLIST
- C. HYDROLOGIC/HYDRAULIC ENGINEERING DATA AND COMPUTATIONS
- D. PREVIOUS INSPECTION REPORTS/AVAILABLE DOCUMENTS
- E. REFERENCES
- F. DRAWINGS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Robert L. Bishop Dam
State Located: New York
County: Delaware
Watershed: Delaware River Basin
Stream: Skunk Hollow Brook
Dates of Inspection: March 12 and 14, 1981

✓ ASSESSMENT

Examination of available documents and visual inspections of the dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies that need to be evaluated and remedied.

Using the Corps of Engineers' screening criteria for the initial review of spillway adequacy, it has been determined that the embankment would be overtopped by the outflow resulting from all storms exceeding 18 percent of the Probable Maximum Flood (PMF). Dam overtopping, the resulting erosion of the embankment and hence, dam breaching would cause water surface levels downstream to reach depths which would pose significant danger to residents. Therefore, the spillway is adjudged to be seriously inadequate and the dam is assessed as unsafe, nonemergency.

✓ The classification "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to life downstream from the dam.

It is recommended that the following additional investigation be performed by a registered professional engineer engaged by the owner:

1. Conduct a detailed hydrologic and hydraulic analysis to determine the need for and methods of increasing the discharge capacity of the dam. This would include investigating the adequacy of the principal and emergency spillways and their respective discharge channels.
- A

It is recommended that within 3 months of the final approval date of this report, the hydrologic investigation of the structure should be initiated and any resulting remedial measures should be completed within 18 months of the final approval.

The following remedial measures should be completed within 12 months to correct existing deficiencies:

1. Monitor the seepage and wet areas on the left side of the downstream slope and toe and in the emergency spillway channel bottom to determine if the observed conditions are seasonal or continuous. If the seepage at the embankment toe of slope is found to be continuous and is becoming more severe with time, determine the source of the seepage (i.e. through the foundation or embankment or between the embankment and abutment) and recommend corrective measures.
2. Provide riprap protection with an adequate filter zone in the gully at the downstream toe of slope between the outlet pipe and the seepage area to prevent or minimize the ongoing erosion into the slope from drainage of the wet area.
3. If the seepage conditions are found to occur continuously throughout the year, provide a means for collecting and draining water from the wet areas along the downstream toe of slope. Such methods may include stone drainage ditches or an additional toe drain system at a higher elevation with an appropriate filter to prevent the erosion of fines from the embankment. If a new drain is installed, it should be designed to discharge into the principal spillway outlet area to eliminate maintenance of the riprap required in Item 2. above.
4. Regrade the bottom and provide riprap protection in the relatively steep exit channel of the emergency spillway where it enters the principal spillway discharge channel.
5. Regrade the emergency spillway channel bottom to remove ruts and pockets and permit surface runoff without concentrated flow. After regrading, the area should be reseeded and mulched. Future traffic should be kept off this area.
6. Clear the brush and trees from the embankment slopes and the spillway channel. Remove and backfill all stumps less than 6 inches in diameter; however, cut all stumps 6 inches or more in diameter flush to the ground. Equipment and procedures for these operations should be such as to avoid damage to existing riprap, grass or weed cover on the slopes. All backfilled areas, or areas damaged by equipment or traffic should be reseeded and mulched.

7. Fill in the animal burrows on the embankment slopes.
8. Develop and implement a flood warning and emergency evacuation plan to alert downstream residents in the event conditions occur which could result in failure of the dam.

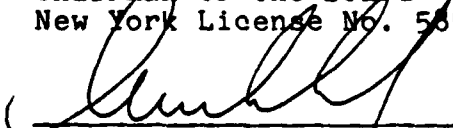
Submitted by:

FLAHERTY GIAVARA ASSOCIATES, P.C.



Hugh C. Flaherty, P.E. & L.S.
Chairman of the Board
New York License No. 58508

Approved by:



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

Date:

3 Aug 81



PHOTO #1: Overview of
Robert L. Bishop Dam
Inventory No. NY 534

NATIONAL DAM SAFETY PROGRAM
PHASE I INSPECTION REPORT
ROBERT L. BISHOP DAM
INVENTORY NO. NY 534
D.E.C. NO. 146B-3568
DELAWARE RIVER BASIN
DELAWARE COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367. Flaherty Giavara Associates, P.C. has been retained by the New York District to inspect and report on selected dams in the State of New York. Authorization and notice to proceed was issued to Flaherty Giavara Associates, P.C. under a letter of December 24, 1980 from W. M. Smith, Jr. Colonel, Corps of Engineers. Contract No. DACW 51-81-C-0006 has been assigned by the Corps of Engineers for this work.

b. Purpose

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Robert L. Bishop Dam consists of an earthen embankment with a corrugated metal pipe principal spillway under the central portion of the embankment and a vegetated emergency spillway excavated into natural ground at the left abutment. Plans, profiles and sections prepared for the project by Baldwin-Kalmus Associates of Oneonta, New York are shown on drawings in Appendix F.

The dam embankment is approximately 410 feet long, 34 feet high and has an upstream slope of 3 horizontal to 1 vertical and a downstream slope of 2 to 1. The crest of the dam is 20 feet in width and its elevation is 115.0 (Assumed Datum). The embankment has a cross section consisting primarily of compacted glacial till and a 10 foot

wide cutoff of the same material extending 3 feet below the original ground surface. The downstream slope is provided with grass cover for erosion protection, whereas the upstream slope has a two foot thick layer of rockfill extending approximately thirty feet down the slope from the dam crest. Some loose riprap is in place around the principal spillway outlet. The embankment has internal drainage embedded in filter material near the downstream toe of the slope for its entire length. Two 6 inch diameter perforated bituminous-coated corrugated metal pipes join and then discharge adjacent to the principal spillway outlet.

The principal spillway is a drop inlet structure consisting of a 30 inch diameter corrugated metal pipe (CMP) riser and a 24 inch diameter corrugated metal pipe conduit with a stilling basin 150± feet downstream of the outlet.

The emergency spillway is a 250 foot long by 10+ foot wide channel cut into earth at the left abutment (originally, the plans indicated the channel was to be 20 feet wide and excavated into the right abutment as shown on the drawings in Appendix F). It runs initially perpendicular to the embankment then curves gently to the right and intersects the discharge channel downstream of the principal spillway outlet. The right side of the spillway is formed by a 1 to 2 foot high earthen berm extending downstream from the left end of the dam crest. The left side slope is cut into natural earth at a slope of about 3 to 1. The channel side slope of the berm forming the right side of the spillway is about 6 to 1. The emergency spillway channel is about 3.0 feet below the embankment crest at the left end of the dam.

b. Location

The Robert L. Bishop Dam is located off Skunk Hollow Road approximately one half mile northeast of its intersection with Fall Clove Road in the Town of Andes, New York. The dam is located at latitude north 42°-10.1' and longitude west 74°-51.9' on the U.S. Geological Survey 7.5 minute series topographic map "Andes, New York". The Location Map on page i indicates where the dam is situated.

c. Size Classification

The maximum height of the dam is 34 feet and the maximum storage capacity is 154 acre-feet at the top of the dam. Therefore, the Robert L. Bishop Dam is classified as a "Small" dam as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

There are approximately 5 dwellings within the dam failure flood hazard area. Barnes Hill Road and Bussey Hollow Road are located downstream of the dam. Therefore, the dam is in the "High" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by Robert and Lucille Bishop. Their address and telephone number is as follows:

Owner

Contact: Robert and Lucille Bishop
120 Main Street
Delhi, New York 13753

Telephone: (607) 746-2624

f. Purpose

The primary purpose of this dam is to maintain the water level of the lake for recreational use.

g. Design and Construction History

The dam was designed by Baldwin-Kalmus Associates in 1966. It was constructed by I. and O. A. Slutzki, Contractors of Hunter, New York in 1967. No major post construction modifications have been made to the dam.

h. Normal Operating Procedure

The intake riser is always open; therefore, the water level is maintained at the elevation of the crest of the intake riser for normal flows. There are no regular operating procedures.

1.3 PERTINENT DATA

a. <u>Drainage Area (Square Miles)</u>	0.88
b. <u>Discharge at Dam Site (CFS)</u>	
- Top of Dam	365
- Crest of Emergency Spillway	36
- Crest of Riser	13
- Reservoir Drain Inlet	-

c. Elevations (Assumed Datum)

- Top of Dam	115.0
- Design High Water Level	113.5
- Crest of Emergency Spillway	112.0
- Crest of Riser	110.0
- Reservoir Drain Inlet	86.0

d. Reservoir Surface Area (Acres)

- Top of Dam	12.3
- Design High Water Level	11.8
- Crest of Emergency Spillway	11.1
- Crest of Riser	10.1

e. Storage (Acre-Feet)

- Top of Dam	154
- Design High Water Level	136
- Crest of Emergency Spillway	118
- Crest of Riser	97

f. Dam

- Type: Compacted glacial till with a glacial till cutoff	
- Length (Feet)	410
- Upstream Slope (H:V)	3:1
- Downstream Slope (H:V)	2:1
- Crest Width (Feet)	20

g. Emergency Spillway

- Type: Excavated earthen channel at left side of dam embankment	
- Length (Feet)	250
- Bottom Width (Feet)	10+
- Side Slopes (H:V)	
left	3:1
right	6:1
- Channel Bottom Slopes (Feet/Foot)	
upstream	0.333
downstream	0.083

- Control: None

h. Principal Spillway

- Type: Drop inlet structure consisting of a 30 inch diameter corrugated metal pipe (CMP) riser and a 24 inch diameter corrugated metal pipe conduit (153

feet long) with a stilling basin 150+ feet downstream from its outlet

- Control: None

i. Reservoir Drain

- Type: 24 inch diameter corrugated metal pipe (26 feet long)

- Control: 24 inch diameter slide gate located at the inlet to the principal spillway

j. Toe Drain

- Type: Two 6 inch diameter perforated bituminous-coated corrugated metal pipes in pervious fill

- Control: None

SECTION 2 - ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. Geology

The Robert L. Bishop Dam is located on a southerly flowing tributary to the Delaware River in the Catskill Mountain subprovince of the Allegheny Plateau physiographic province in New York State.

The topography in the area ranges from elevation 1740 at the tributary to about elevation 2200 to 2400 at the summits surrounding the reservoir.

The underlying bedrock is the Upper Walton Formation belonging to the Upper Devonian West Falls group. This formation is the terrestrial deposit of the Catskill Delta and consists of a medium to coarse-grained, red, silty sandstone and conglomerate containing minor amounts of red silty shale. It was derived from a combination of tributary channel, floodplain and beach deposits.

Above the bedrock, the valley bottom and side slopes are mantled by a heterogeneous mixture of clay, silt, sand and rock fragments. This soil is known as glacial till, and was deposited as the glacial ice melted back past the site some 13,000 to 14,000 years ago. Thin strata or beds of red clay occur overlying or within the glacial till. These beds probably developed in temporary lakes or ponds created during the retreat of the glaciers. Minor readvancements of the glaciers may have occurred in some areas, leading to additional deposition of glacial till over the clays at a later time.

b. Subsurface Investigations

Four test holes (apparently test pits) were excavated in the vicinity of the dam. The test pits encountered topsoil, sandy blue clay or sandy to silty gravel with clay in the upper 0.5 to 3.0 feet. Below 3 feet, the test holes, which terminated at depths of 9 feet without reaching bedrock, disclosed interbedded layers of red clay and apparent glacial till consisting of sandy clays to silty sands with stones. Sections of these test holes are shown on Sheet 7 of the drawings.

2.2 DESIGN RECORDS

This dam was designed by Baldwin-Kalmus Associates in 1966. As part of the design process, a design report and soils investigations were completed for the site. The soils data is included in Appendix F.

2.3 CONSTRUCTION RECORDS

This dam was constructed in 1967 by I. and O. A. Slutzki, Contractors of Hunter, New York. The contract drawings which were prepared by Baldwin-Kalmus Associates are included in Appendix F.

2.4 OPERATION RECORDS

There were no operation records available for this dam.

2.5 EVALUATION OF DATA

The data presented herein was obtained primarily from the files of the New York State Department of Environmental Conservation (DEC). This information appears to be reliable and adequate for the purposes of a Phase I Inspection Report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspections of the Robert L. Bishop Dam were conducted on March 12 and 14, 1981. The weather was mostly sunny and the temperature was 40⁺₈ F. At the time of these inspections, there were patches of snow on the ground and water was flowing in the principal spillway outlet pipe (See Photo No. 13).

b. Dam

The earthfill embankment of the dam is generally in fair condition. The crest of the dam is grass covered and is in fair condition (See Photo No. 3). There was no visible evidence of lateral movement, major seepage or erosion, significant settlement or other serious defects.

The following specific items were noted:

1. Wet ground apparently from seepage was noted at the toe of the downstream slope between the left abutment and the principal spillway outlet. Wet areas were also noted in the emergency spillway channel approximately adjacent to wet areas noted above (See Photos No. 16 and 17).
2. An erosion channel about 1 to 2 feet wide and several inches deep was noted to the left of the principal spillway outlet pipe at the toe of the downstream slope. This channel is being created by active flow from the wet area noted in Item 1 above.
3. Vehicle rutting was observed in the emergency spillway channel. Water from wet areas in the spillway channel near the downstream toe and left abutment was flowing along and through these ruts.
4. Erosion channels up to 1 to 2 foot wide and several inches to a foot deep were noted in the emergency spillway where it slopes into the main discharge channel. This area is displaced or undermined, leaving several areas unprotected (See Construction Photo No. 2 and Photos No. 18 and 19).
5. Both the riprapped upstream slope (above the reservoir level) and the grassed downstream slope have a minor cover of thick brush and small trees throughout (See Construction Photo No. 1 and Photos No. 4, 5, 6 and 7). Occasional small diameter animal burrows

were noted on the downstream slope.

6. The emergency spillway channel has localized areas of sparse brush and weed growth, as well as small pine trees which were planted on the side slopes (See Photos No. 8 and 9).

c. Principal Spillway

1. Drop Inlet Structure

The drop inlet is a 30 inch corrugated metal pipe (CMP) with an anti-vortex baffle plate. The drop inlet structure appeared to be in good condition at the time of the inspection; however, it has rusted somewhat (See Photo No. 10). The gate stem for the low level reservoir drain was observed but not operated during the inspection (See Photo No. 11).

2. Principal Spillway Conduit

The 24 inch diameter corrugated metal pipe (CMP) is in good condition where visible (See Photo No. 12). Some rust was noted on the inside of the pipe at the principal spillway outlet (See Photo No. 13).

3. Principal Spillway Outlet

The 24 inch diameter CMP conduit discharges into a stilling basin approximately 150 feet downstream of the principal spillway outlet. The stilling basin appeared to be stable and in fair condition (See Photo No. 15).

4. Principal Spillway Discharge Channel

The riprap-lined channel has an initial width of approximately 10 feet, and narrows slightly in the downstream direction. The side slopes are moderately steep, and typically 4 to 6 feet high. The banks are wooded and have no significant erosion (See Photo No. 14).

d. Emergency Spillway

The dam has a 10+ foot wide earthen spillway excavated into the left end of the dam embankment, having approach and discharge channels with a heavy, unmowed (18+ inches high) grass cover. The crest of the spillway at the centerline of the dam was bare earth with no grass protection. The crest of the dam and the crest of the emergency spillway are apparently used as accessways for "Jeep Trails" located in the eastern portion of the watershed

(See Photo No. 3).

The original construction plans indicate the emergency spillway was to be 20 feet wide and constructed on the right side of the dam; however, it was built 10+ feet wide on the left side. These plans also indicate grouted riprap was to be placed on the embankment side of the emergency spillway. Although the riprap was placed, apparently it was not grouted which was documented in the State of New York, Department of Public Works' inspection report dated July 26, 1967 included in Appendix D (See Construction Photo No. 3).

The discharge channel is separated from the embankment by an earthen berm (See Construction Photo No. 4) which is in good condition. The discharge channel has not been mowed (See Photo No. 9) and erosion is occurring at the end of the channel where it discharges into the principal spillway discharge channel (See Photos No. 18 and 19).

e. Downstream Channel

The natural channel downstream of the dam site has a width of 10 to 20 feet. The streambed consists of a gravel material with gradations ranging from medium to coarse and currently appears stable.

f. Reservoir - Storage Pool Area

The reservoir area is bordered by moderately to steeply sloping woodlands (See Photo No. 2). There are no visible signs of instability or sedimentation problems in the reservoir area. There is no significant probability of landslides into the storage pool affecting the safety of the dam.

3.2 EVALUATION OF OBSERVATIONS

The visual inspections revealed several deficiencies. The following observations were made:

- a. Apparent seepage was noted at the toe of the downstream slope and in the emergency spillway channel.
- b. Erosion channels were observed to the immediate left of the principal spillway outlet pipe and at the exit to the emergency spillway.
- c. Vehicle rutting was evident in the emergency spillway channel.
- d. Both the upstream and downstream slopes had a minor cover of thick brush and small trees.

- e. The emergency spillway channel had localized areas of sparse brush and weed growth, as well as landscaped pine trees.
- f. Rust was observed at the entrance to the drop inlet and at the outlet of the principal spillway conduit.
- g. The emergency spillway crest was lacking any type of erosion protection.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The normal water surface level is maintained by the CMP riser of the drop inlet structure at elevation 110.0 (Assumed Datum). No operational procedures are in effect at this time.

4.2 MAINTENANCE OF DAM

It appears that the only maintenance procedures in effect include mowing of the dam embankment crest and emergency spillway bottom.

4.3 WARNING SYSTEM

No warning system is presently in effect.

4.4 EVALUATION

Presently, there are no operation or maintenance procedures in effect for this dam or its appurtenances. Therefore, regular operation and maintenance procedures should be implemented.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

The dam is located in Andes on Skunk Hollow Brook, 5400+ feet upstream of Clove Hollow Brook. Four and a half miles further downstream, Clove Hollow Brook flows into Pepacton Reservoir (East Branch Delaware River) at a point which is approximately seven miles northeast of Downsville, New York.

The watershed (shown on the Watershed Map on Page C-5 in Appendix C) consists of 565 acres (0.88 square miles) of hilly uplands with typical slopes of 20 percent. Land within the watershed is largely undeveloped with extensive woodlands and scattered open fields. There are no significant waterbodies or wetlands upstream of the dam.

The watercourse upon which the dam is located is a small perennial stream with a typical flow width of 10 to 15 feet and a typical flow depth of 6 inches.

5.2 ANALYSIS CRITERIA

The purpose of the hydrologic/hydraulic analysis is to evaluate the spillway capacity and the potential for overtopping. The analysis of the spillway capacity of the dam and storage of the reservoir was performed using the Corps of Engineers' HEC-1 Computer Model - Dam Safety Version. The procedure included determining the Probable Maximum Flood (PMF) runoff from the watershed and routing the inflow hydrograph through the impoundment to determine the outflow hydrograph. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method, and the Modified Puls routing procedure was incorporated.

The initial rainfall loss was assumed to be 1.0 inches, and the uniform rainfall loss was assumed to be 0.1 inches per hour. In accordance with recommended guidelines of the Corps of Engineers, the Probable Maximum Precipitation (PMP) was 20.1 inches (24 hour duration, 200 square mile area).

The analysis was conducted for both the full PMF and for several fractional PMF conditions. The PMF inflow of 2548 CFS was routed through the reservoir and the peak outflow was determined to be 2527 CFS.

5.3 SPILLWAY CAPACITY

The total outlet capacity is the sum of discharges from the principal spillway and the emergency spillway.

The principal spillway consists of a drop inlet and conduit. The drop inlet is a 30 inch diameter corrugated metal pipe

(CMP) that acts as a weir or an orifice depending on the elevation head at the inlet. The initial one foot of head on the structure produces a weir condition while stages from 111.5 feet to 113.5 feet produce an orifice condition. The final factor in analyzing this drop inlet structure is the flow conveyed in the 24 inch diameter CMP principal spillway conduit.

The emergency spillway is a 10+ foot wide, trapezoidal-shaped vegetated channel. The original design information indicates the emergency spillway was designed to be used only by a flood event with an average return frequency of more than 50 years. However, since the emergency spillway that was actually constructed has a bottom width 10+ feet less than the one designed, its frequency of use would be less than every 50 years.

The stage discharge curve for the combined principal and emergency spillways is as tabulated below:

Stage (Feet)	Discharge Capacity (CFS)	Element of Structure
110.0	0	Normal Water Level
110.5	8	--
111.0	25	--
111.5	31	--
112.0	36	Emergency Spillway Crest
112.5	51	--
113.0	82	--
113.5	129	Design High Water Level
114.0	192	--
115.0	365	Top of Dam

The total spillway capacity at the top of dam is 365 CFS.

The principal spillway can pass the peak outflow from a flood equal to approximately 5 percent of the PMF before use of the emergency spillway would be required.

The average flow velocity in the emergency spillway discharge channel would be 9.7 feet per second (FPS).

5.4 RESERVOIR CAPACITY

The storage capacity of the reservoir was obtained from design information and from supplementary calculations, as indicated below:

<u>Stage (Feet)</u>	<u>Storage (Acre-Feet)</u>	<u>Storage (Inches of Runoff)</u>
110.0	97	2.06
112.0	118	2.51
113.5	136	2.89
115.0	154	3.27

5.5 FLOODS OF RECORD

No data regarding flood records was obtained for the Robert L. Bishop Dam.

5.6 OVERTOPPING POTENTIAL

The results of the HEC-1 DB computer analysis indicate that the crest of the dam is overtopped by all storms exceeding 18 percent of the outflow from the the PMF event. The PMF discharge rate of 2537 cfs would occur at a peak flood stage of 116.4 feet, which is 1.4 feet above the crest of the dam.

The results of the analysis are tabulated below:

<u>Flood Condition</u>	<u>Peak Inflow (CFS)</u>	<u>Peak Outflow (CFS)</u>	<u>Maximum Stage Elevation (Assumed Datum)</u>
0.5 PMF	1274	1258	115.7
1.0 PMF	2548	2527	116.4

5.7 EVALUATION

Using the Corps of Engineers' screening criteria for the initial review of spillway adequacy, it has been determined that the combined capacity of the principal and emergency spillways is not adequate to pass either the full PMF or one half the PMF; only approximately 18 percent of the outflow from the PMF can be safely passed before overtopping will occur. The PMF event would overtop the dam for a duration of 8.5 hours and the maximum depth of flow over the crest would be 1.4 feet. It is estimated that as a result of overtopping, breaching of the dam would cause water surface levels downstream to reach depths which would pose significant danger to residents. Therefore, the spillway is adjudged to be seriously inadequate and the dam is assessed as unsafe, nonemergency.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

There was no visible evidence of major settlement, lateral movement or other signs of overall structural instability of the dam during the site examinations. Based on the conditions that were observed, there is no reason to question the static structural stability of the dam unless subsequent investigations recommended in Section 7.1c reveal the downstream toe seepage is coming through the embankment and is becoming progressively more severe with time.

b. Design and Construction Data

Baldwin-Kalmus Associates drawings for the "Dam and Lake for Robert L. Bishop" (see Appendix F) show a configuration for the embankment and emergency spillway that generally corresponds to the conditions observed on March 12 and 14, 1981, with the following exceptions:

1. The emergency spillway was constructed on the left side of the dam embankment instead of on the right side, as shown on these drawings.
2. No footbridge was constructed to the drop inlet and the reservoir drain.

Both of these exceptions were noted in the State of New York Department of Public Works' (DPW) Inspection Reports dated May 5 and July 26, 1967.

According to the drawings, the toe drain discharges into the riprap of the principal spillway outlet below the outlet pipe; however, construction photographs (No. 64-12 and 64-13 on page D-13 in Appendix D) taken on July 11, 1967 during one of the DPW inspections indicate the toe drain was actually installed 6+ feet to the left of the outlet pipe. At the time of the site visits, the water level was several inches above the invert of the principal spillway; therefore, the outlet of the toe drain could not be observed.

There is no construction data to confirm the actual physical properties and configuration of earthfill in the embankments. However, the dam proportions are considered to be reasonable for the soils that were available at the site and the dam would be expected to have adequate safety margins with respect to stability under static loading conditions.

c. Seismic Stability

The Robert L. Bishop Dam is located in Seismic Zone 1, and in accordance with recommended Phase I guidelines does not require seismic analysis.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Condition

On the basis of the visual examinations, the Robert L. Bishop Dam is considered to be in fair condition. There were no signs of impending structural failure or other conditions which would warrant urgent remedial action, but a number of deficiencies were noted.

b. Adequacy of Information

The evaluation of this dam is based primarily on visual examinations, reference to the available Baldwin-Kalmus Associates' plans, approximate hydraulic and hydrologic computations, and application of engineering judgement. The visual examinations were somewhat hampered by patches of snow; however, the available information that was obtained is adequate for the purposes of a Phase I assessment.

c. Need for Additional Investigations

It is recommended the following additional investigation be performed for this dam by a registered professional engineer engaged by the owner:

1. Conduct a detailed hydrologic and hydraulic analysis to determine the need for and methods of increasing the discharge capacity of the dam. This would include investigating the adequacy of the principal and emergency spillways and their respective discharge channels.

d. Urgency

The additional investigation recommended in Section 7.1c should be initiated within 3 months and appropriate remedial measures completed within 18 months of the final approval date of this report. The recommended measures presented in Section 7.2 should be completed by the owner within 12 months of the final approval.

7.2 RECOMMENDED MEASURES

It is considered important that the following items be accomplished in addition to carrying out any remedial measures resulting from the investigation recommended in Section 7.1c:

- a. Monitor the seepage and wet areas on the left side of the downstream slope and toe in the emergency spillway chan-

nel bottom to determine if the observed conditions are seasonal or continuous. If the seepage at the embankment toe is found to be continuous and is becoming more severe with time, determine the source of the seepage (i.e. through the foundation or embankment or between the embankment and abutment) to determine if corrective measures are required.

- b. Provide riprap protection with an adequate filter zone in the gully at the downstream toe of slope between the outlet pipe and the seepage area to prevent or minimize the ongoing erosion into the slope from drainage of the wet area.
- c. If the seepage conditions are found to occur continuously throughout the year, provide a means for collecting and draining water from the wet areas along the downstream toe of the slope. Such methods may include stone drainage ditches or an additional toe drain system at a higher elevation with an appropriate filter to prevent the erosion of fines from the embankment. If a new drain is installed, it should be designed to discharge into the principal spillway outlet area to eliminate maintenance of the riprap required in Item b. above.
- d. Regrade the bottom and provide riprap protection in the relatively steep exit channel in the emergency spillway where it enters the principal spillway discharge channel.
- e. Regrade the emergency spillway channel bottom to remove ruts and pockets and permit surface runoff without concentrated flow. After regrading, the area should be reseeded and mulched. Future traffic should be kept off this area.
- f. Clear the brush and trees from the embankment slopes and the spillway channel. Remove and backfill all stumps less than 6 inches in diameter; however, cut all stumps 6 inches or more in diameter flush to the ground. Equipment and procedures for these operations should be such as to avoid damage to existing riprap, grass or weed cover on slopes. All backfilled areas, or areas damaged by equipment or traffic should be reseeded and mulched.
- g. Fill in the animal burrows on the embankment slopes.
- h. Develop and implement a flood warning and emergency evacuation plan to alert downstream residents in the event conditions occur which could result in the failure of the dam.

APPENDIX A
PHOTOGRAPHS

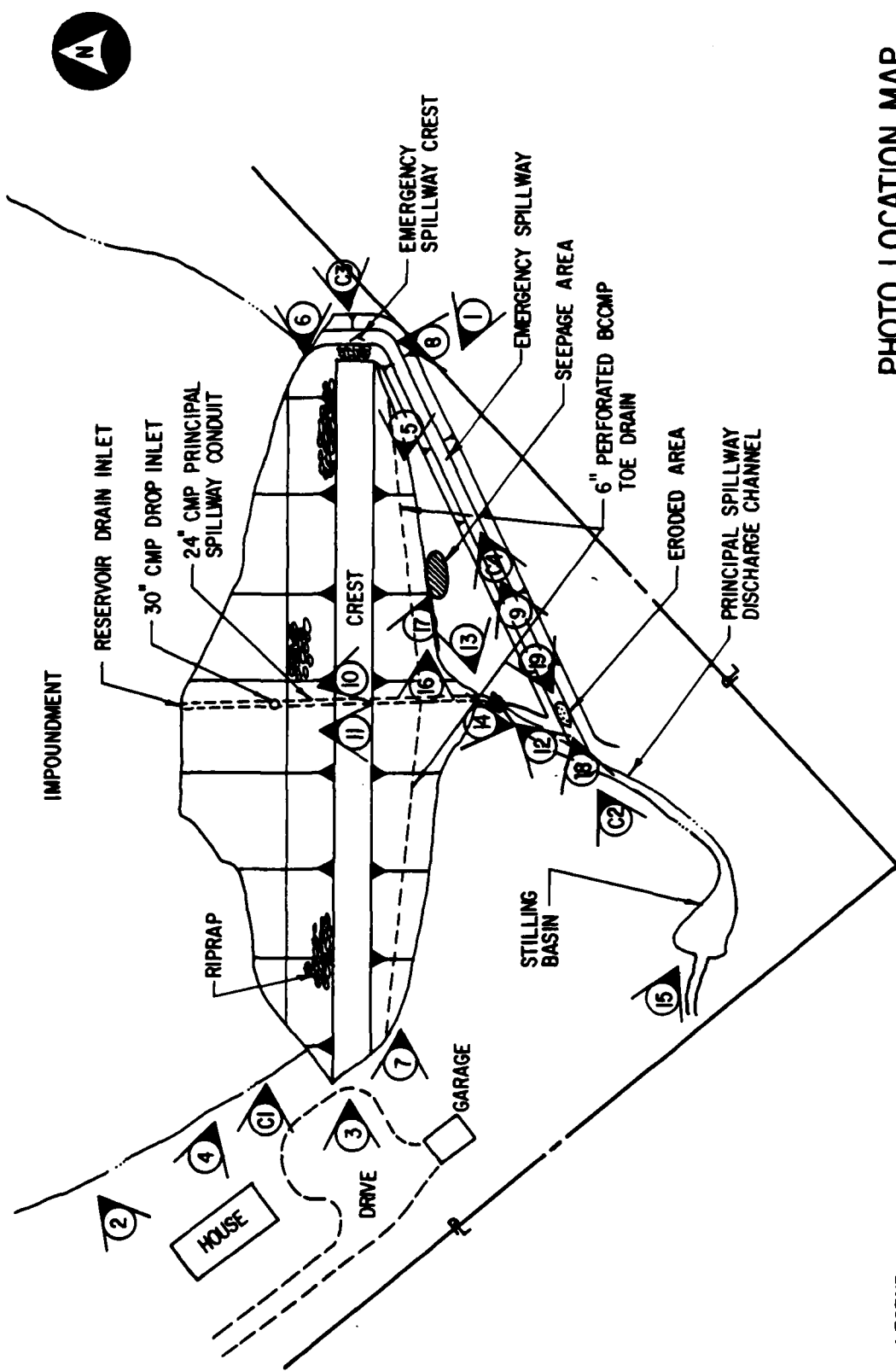


PHOTO LOCATION MAP

ROBERT L. BISHOP DAM
INVENTORY No. NY 534
DELAWARE COUNTY
ANDES, NEW YORK

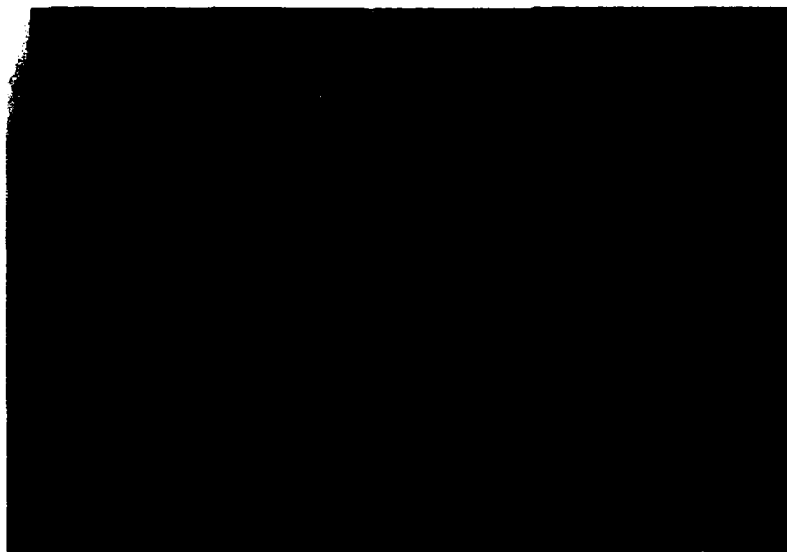
LEGEND

- Number refers to caption.
- Arrow indicates direction of photograph. "C" refers to construction photograph.



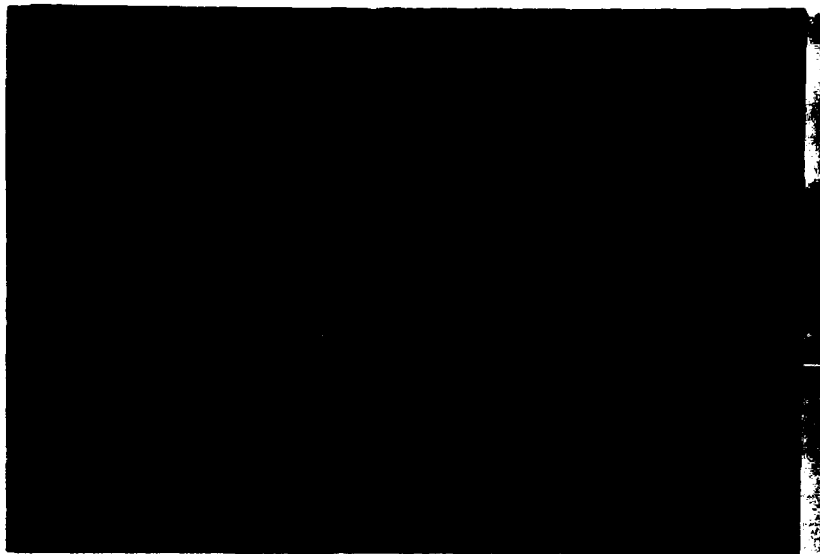
18 • 84V

CONSTRUCTION PHOTO #1: Upstream face of dam
(April 20, 1967)



19 • 84V

CONSTRUCTION PHOTO #2: Emergency spillway outlet
looking upstream; partial
impoundment (April 20, 1967)



10 - 84V

CONSTRUCTION PHOTO #3: Crest of dam and riprap
at emergency spillway
(July 11, 1967)



10 - 84V

CONSTRUCTION PHOTO #4: Emergency spillway looking
upstream; full impoundment
(July 11, 1967)



PHOTO #2: Overview of impoundment



PHOTO #3: Crest of dam looking toward
left abutment



PHOTO #4: Overview of upstream face of dam



PHOTO #5: Overview of downstream face of dam



PHOTO #6: Upstream face of dam



PHOTO #7: Downstream face of dam



PHOTO #8: Emergency spillway looking
toward impoundment



PHOTO #9: Emergency spillway looking upstream



PHOTO #10: Principal spillway drop inlet
structure - 30" corrugated metal pipe
(CMP) riser



PHOTO #11: Impoundment drain operating gate



PHOTO #12: Principal spillway outlet pipe -
24" CMP

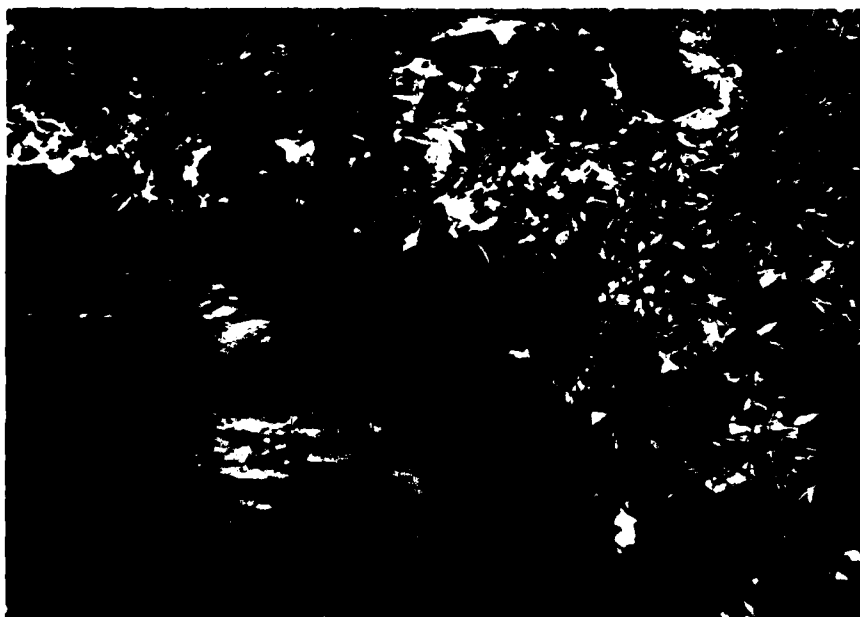


PHOTO #13: Riprap surrounding principal
spillway outlet pipe



PHOTO #14: Downstream channel conditions



PHOTO #15: Stilling basin



PHOTO #16: Seepage of downstream toe of slope

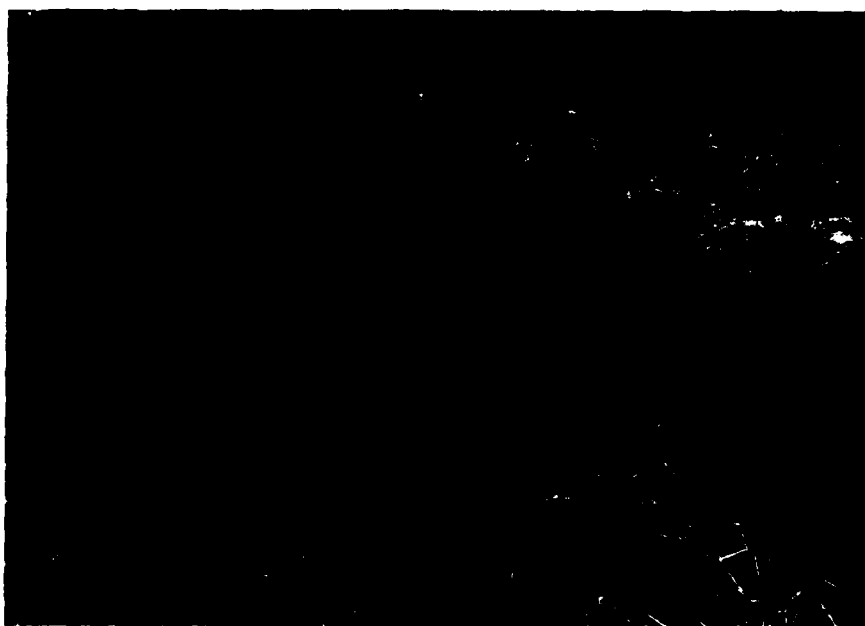


PHOTO #17: Closeup of seepage



PHOTO #18: Erosion at emergency spillway
outlet (looking upstream)

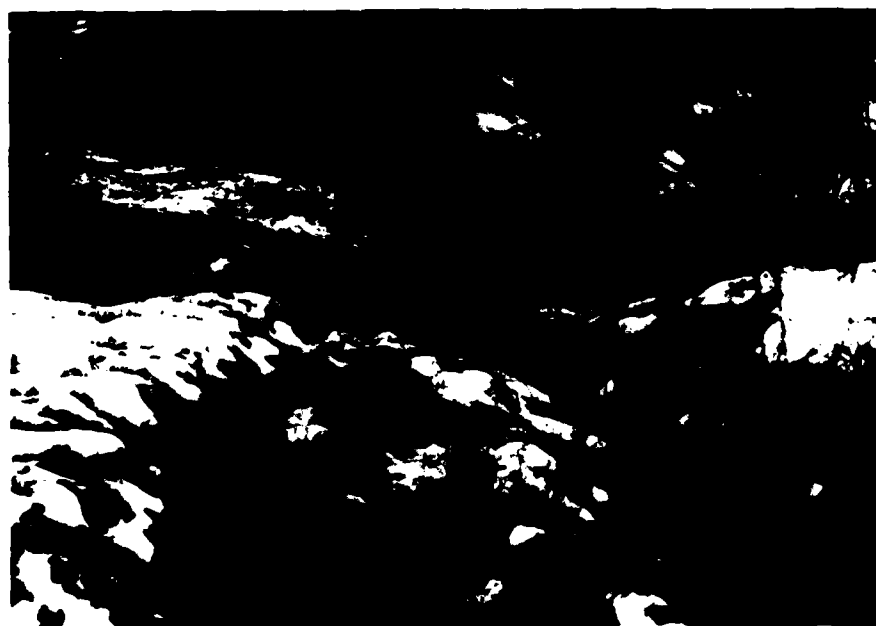


PHOTO #19: Erosion at emergency spillway
outlet (looking downstream)

APPENDIX B
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Robert L. Bishop Dam
Fed. I.D. # NY 534 DEC Dam No. 146B-3568
River Basin Delaware
Location: Town Andes County Delaware
Stream Name Skunk Hollow Brook
Tributary of Clove Hollow Brook
Latitude (N) 42°-10.1' Longitude (W) 74°-51.9'
Type of Dam Earthen embankment
Hazard Category High
Date(s) of Inspection March 12 and 14, 1981
Weather Conditions Mostly sunny, 40°+ F.
Reservoir Level at Time of Inspection Elevation 110.1 (Assumed Datum)

b. Inspection Personnel R.C. Smith, T.L. Ward & R.A. Criscuolo of Flaherty Giavara Associates, P.C.; P.L. LeCount & J.J. Rixner of Haley & Aldrich, Inc.; E. Thomas of Salmon Associates

c. Persons Contacted (Including Address & Phone No.)
Robert L. Bishop
120 Main Street
Delhi, NY 13753
(607) 746-2624

d. History:

Date Constructed 1967 Date(s) Reconstructed Never

Designer Baldwin-Kalmus Associates

Constructed By I. and O.A. Slutzki, Contractors

Owner Robert and Lucille Bishop

2) Embankment

a. Characteristics

- (1) Embankment Material Compacted glacial till
- (2) Cutoff Type Compacted glacial till
- (3) Impervious Core None
- (4) Internal Drainage System Two 6 inch diameter perforated BCCMP toe drains join and then discharge to the left of the principal spillway outlet.
- (5) Miscellaneous No comments

b. Crest

- (1) Vertical Alignment Excellent; substantially level
- (2) Horizontal Alignment Excellent; substantially straight
- (3) Surface Cracks None evident
- (4) Miscellaneous Mowed grass cover

c. Upstream Slope

- (1) Slope (Estimate - V:H) 1:3
- (2) Undesirable Growth or Debris, Animal Burrows Minor cover of thick brush and small trees
- (3) Sloughing, Subsidence or Depressions None observed

(4) Slope Protection Sparse grass and weeds; some small trees; layer of riprap
extending almost to the crest

(5) Surface Cracks or Movement at Toe None evident

d. Downstream Slope

(1) Slope (Estimate - V:H) 1:2

(2) Undesirable Growth or Debris, Animal Burrows Several small diameter
(1 to 2 inch) holes observed

(3) Sloughing, Subsidence, or Depressions None evident

(4) Surface Cracks or Movement at Toe None evident

(5) Seepage Seepage and wet area (very soft and muddy) noted at the downstream
toe of slope between the left abutment and the principal spillway outlet.
Seepage flows along the toe and forms an erosion gully as it empties into the
principal spillway discharge channel adjacent to the outlet.

(6) External Drainage System (Ditches, Trenches, Blanket) None observed

(7) Condition Around Outlet Structure Some riprap surrounds the outlet of the
principal spillway; an erosion gully has formed to the left of the outlet
as described in (5) above.

(8) Seepage Beyond Toe None observed

e. Abutments - Embankment Contact

Right: good condition

Left: fair condition

(1) **Erosion at Contact** Erosion noted at the left abutment due to vehicle
travel on the dam crest, spillway slopes and bottom and abutment slope.

(2) **Seepage Along Contact** _____
None observed

3) **Drainage System**

a. **Description of System** Drop inlet structure consisting of a 30 inch diameter
corrugated metal pipe (CMP) riser and a 24 inch diameter CMP conduit, a riprap-
lined discharge channel and a stilling basin.

b. **Condition of System** Good; however, rust was noted on the crest of the drop
inlet riser and on the inside of the principal spillway conduit.

c. **Discharge from Drainage System** Riprap-lined discharge channel and stilling basin

4) **Instrumentation** (Monumentation/Surveys, Observation Wells, Weirs, Peizometers, Etc.)

None observed

5) Reservoir

- a. Slopes Moderately to steeply sloping woodlands
- b. Sedimentation No apparent problems
- c. Unusual Conditions Which Affect Dam Low normal pool level

6) Area Downstream of Dam

- a. Downstream Hazard (No. of Homes, Highways, etc.) Approximately 5 dwellings as well as Bussey Hollow Road and Barnes Hill Road are within the dam failure flood hazard area
- b. Seepage, Unusual Growth None observed
- c. Evidence of Movement Beyond Toe of Dam None observed
- d. Condition of Downstream Channel Good; no aggradation or degradation

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

Principal spillway, emergency spillway and discharge conveyance channel

- a. General Principal spillway and discharge conveyance channel handle normal flows, while the emergency spillway conveys flood events with average return frequencies greater than 50 years (from Baldwin-Kalmus Associates design data)
- b. Condition of Principal Spillway Good; however, rust was noted as previously described in 3) b.

c. Condition of Emergency Spillway Fair; exposed soil in some areas of the
approach channel, but it is essentially grass covered; there are small
trees and brush on slopes, wheel ruts on channel bottom and 12 to 18 inch
deep erosion gullies in the discharge channel as it exits into the discharge
conveyance channel

d. Condition of Discharge Conveyance Channel Good; the bed is riprap-lined and the banks appear stable.

8) Reservoir Drain/Outlet

Type: Pipe X Conduit Other

Material: Concrete - Metal X Other -

Size: 24 inch corrugated metal pipe (CMP) Length 179 feet

Invert Elevations: Entrance 86.0 Exit 81.9

Physical Condition (Describe): Unobservable X

Material: Generally good; however, some rust has formed on the inside of the pipe outlet.

Joints: Unobservable Alignment Unobservable

Structural Integrity: Appears to be good

Hydraulic Capability: Good

Means of Control: Gate Slide Gate Valve Uncontrolled

Operation: Operable Inoperable Uncontrolled

Present Condition (Describe): Good; however, the slide gate was not operated
during the inspection.

9) Structural

a. Concrete Surfaces No concrete surfaces were observed

b. Structural Cracking Not applicable

c. Movement - Horizontal & Vertical Alignment (Settlement) Not applicable

d. Junctions with Abutments or Embankments Not applicable

e. Drains - Foundation, Joint, Face Not applicable

f. Water Passages, Conduits, Sluices Not applicable

g. Seepage or Leakage Not applicable

- h. Joints - Construction, etc., Not applicable
- i. Foundation Not Applicable
- j. Abutments Not applicable
- k. Control Gates 24 inch slide gate on the reservoir drain at its inlet
- l. Approach & Outlet Channels Not applicable
- m. Energy Dissipators (Plunge Pool, etc.) Stilling basin 150 feet downstream of the principal spillway outlet
- n. Intake Structures Inaccessible
- o. Stability Not applicable
- p. Miscellaneous No comments

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

a. Description and Condition _____

None

APPENDIX C.

HYDROLOGIC/HYDRAULIC ENGINEERING DATA AND COMPUTATIONS

**CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA**

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>115.0</u>	<u>12.3</u>	<u>154</u>
2) Design High Water (Max. Design Pool)	<u>113.5</u>	<u>11.8</u>	<u>136</u>
3) Emergency Spillway Crest	<u>112.0</u>	<u>11.1</u>	<u>118</u>
4) Pool Level with Flashboards	<u>--</u>	<u>--</u>	<u>--</u>
5) Principal Spillway Crest	<u>110.0</u>	<u>10.1</u>	<u>97</u>

DISCHARGES:

	<u>Volume</u> (cfs)
1) Average Daily	<u>Unknown</u>
2) Emergency Spillway @ Maximum High Water (Top of Dam)	<u>315</u>
3) Emergency Spillway @ Design High Water	<u>82</u>
4) Principal Spillway @ Emergency Spillway Crest	<u>36</u>
5) Low Level Outlet @ Principal Spillway Crest	<u>13</u>
6) Total (of all facilities) @ Maximum High Water	<u>365</u>
7) Maximum Known Flood	<u>Unknown</u>
8) At Time of Inspection	<u>5+</u>

CREST:

ELEVATION: 115.0

Type Vegetated earthen embankment
 Width 20 feet Length 410 feet
 Spillover Vegetated emergency spillway
 Location Left abutment

SPILLWAY:

PRINCIPAL		EMERGENCY	
<u>110.0</u>	<u>Elevation</u>	<u>112.0</u>	
<u>Drop inlet structure</u>	<u>Type</u>	<u>Earth excavated</u>	
<u>30 inch CMP drop inlet and 24 inch Width CMP conduit</u>		<u>10± feet</u>	
	<u>Type of Control</u>		
<u>Weir</u>	<u>Uncontrolled</u>	<u>Weir</u>	
<u>--</u>	<u>Controlled</u>	<u>--</u>	
<u>--</u>	<u>Type:</u> <u>(Flashboards; gate)</u>	<u>--</u>	
<u>One</u>	<u>Number</u>	<u>One</u>	
<u>30 inch and 24 inch/179 feet</u>	<u>Size/Length</u>	<u>10± feet/250 feet</u>	
<u>Corrugated metal</u>	<u>Invert Material</u>	<u>Vegetated cover on earth</u>	
<u>Continuously</u>	<u>Anticipated Length of Operating Service</u>	<u>Unknown</u>	
<u>Not applicable</u>	<u>Chute Length</u>	<u>250 feet</u>	
<u>Not applicable</u>	<u>Height Between Spillway Crest & Approach Channel Invert (Weir Flow)</u>	<u>Not applicable</u>	

Type: _____

Location: _____

Records:

Date _____ Unknown _____

Max. Reading _____ Unknown _____

FLOOD WATER CONTROL SYSTEM:

Warning System _____ None in effect _____

Method of Controlled Releases (mechanisms) _____ Manually controlled slide gate
to drain the impoundment _____

DRAINAGE AREA: 565 acres = 0.88 square miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type Rural, agriculture

Terrain - Relief Moderate to steep slopes

Surface - Soil Glacial till

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

Moderate to high due to rolling to steep uplands; glacial till soils;
average watershed slope is 20 percent.

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

Potential surface erosion from agricultural fields

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

None

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

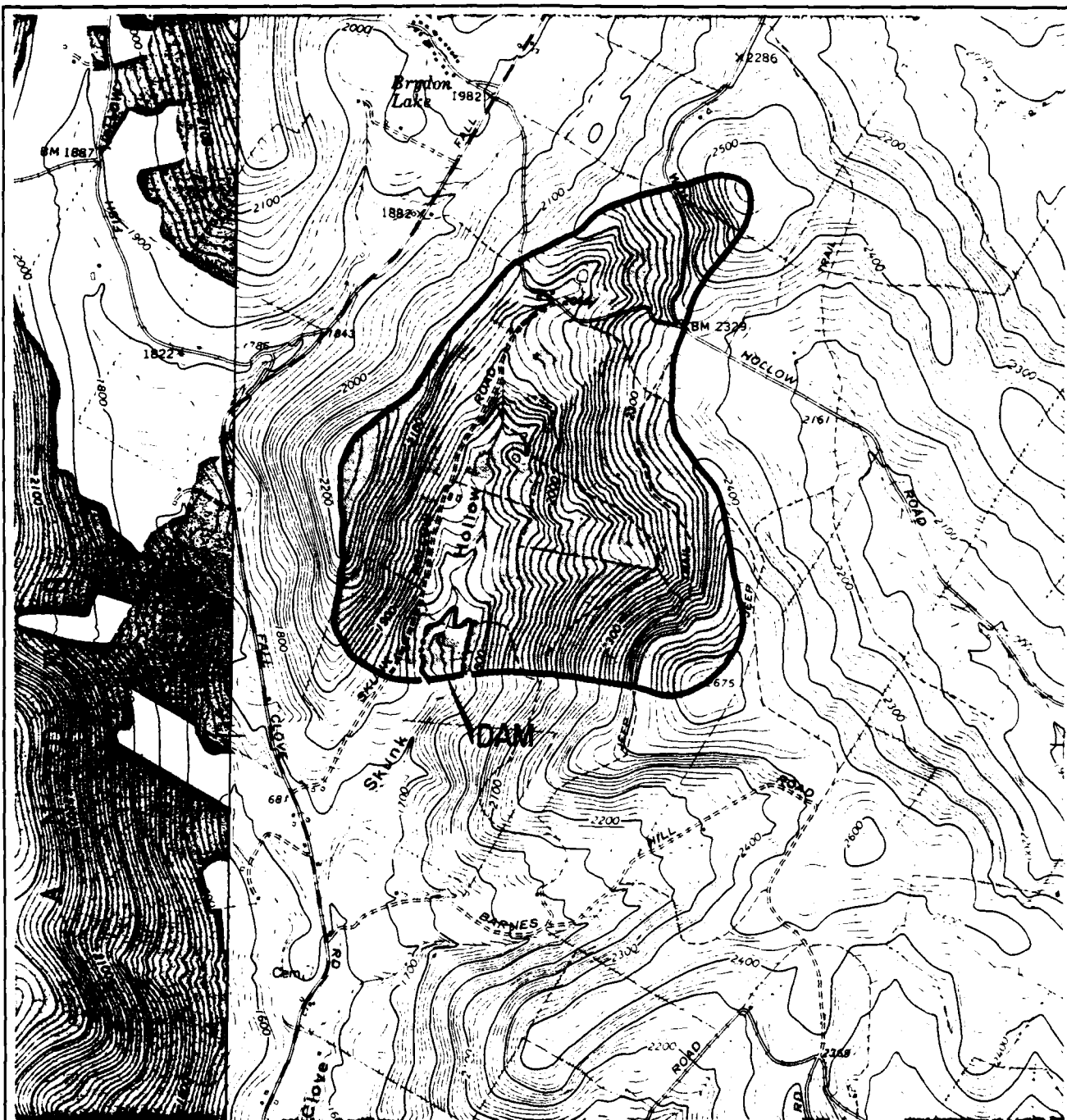
Location: None

Elevation: _____

Reservoir:

Length @ Maximum Pool 1050+ feet = 0.2 miles (Miles)

Length of Shoreline (@ Spillway Crest) 2700+ feet = 0.5 miles (Miles)



WATERSHED MAP

ROBERT L. BISHOP DAM
INVENTORY No. NY 534

DELAWARE RIVER BASIN
DELAWARE COUNTY
ANDES, NEW YORK



0 2000 4000
SCALE IN FEET

FLAHERTY • GIAVARA ASSOCIATES, P.C.

CALCULATIONS



WATERSHED DATA FOR HEC-1 SNYDER HYDROGRAPH

1) TIME TO PEAK

$$L = 9000 \text{ ft} = 1.70 \text{ miles}$$

$$L_c = 3500 \text{ ft} = 0.66 \text{ miles}$$

$C_t = 1.8$ basin has steep slopes

$$T_p = 1.8 (1.70 \times 0.66)^{0.3} = 1.86 \text{ hours}$$

$$t_p = \frac{L_p}{5.5} = \frac{1.86}{5.5} = 0.34 \quad \text{USE } t_R = 0.5$$

$$\begin{aligned} t_{pR} &= t_p + 0.25(t_R - t_p) \\ &= 1.86 + 0.25(0.5 - 0.34) \\ &= 1.90 \text{ HOURS} \end{aligned}$$

2) SNYDER'S PEAKING COEFFICIENT (CP) = 0.63 for HIGHLANDS

3) % IMPERVIOUS

$$\text{ROADS } 2500' \times 25' = 62,500 \text{ ft}^2$$

$$\text{HOUSES } 5 \times 1000 = 5,000 \text{ ft}^2$$

$$67,500 \text{ ft}^2$$

$$67,500 \text{ ft}^2 = 1.55 \text{ acres}$$

$$\frac{1.55 \text{ AC}}{565 \text{ AC}} = 0.27\% \text{ of watershed}$$

$$\text{SAY } 0.3\%$$

4) WATERSHED AREA

$$565 \text{ acres} / 640 = 0.88 \text{ sq. miles.}$$

PROJECT CORPS Dams
NY 534



FLAHERTY-GIAVARA ASSOCIATES
 ENVIRONMENTAL DESIGN CONSULTANTS
 ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/788-1280

SHEET NO. 2 OF 8
 BY RAC DATE 3-25-81
 CHK'D. BY TLW DATE 4-28-81

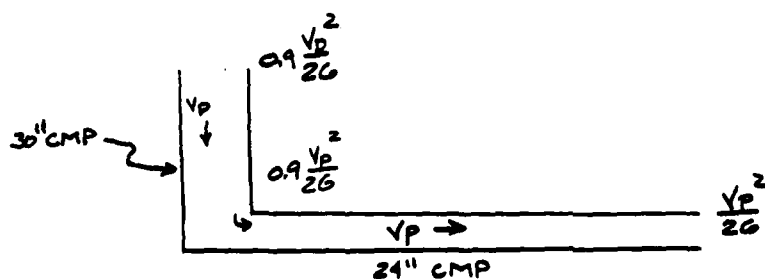
5) Rainfall Data (From Hydrometeorological Report No. 33)

24 Hour Duration PMP = 20.1 inches
 for 200 square miles

<u>Duration Hrs</u>	<u>Adj Factor %</u>
6	111
12	122
24	133
48	143

Stage Discharge Data

Weir - Orifice - Pipe flows from principal spillway



Weir Flow controls from stages 110.0' to 111.0'

$$Q = CLH^{1.5}$$

<u>Stage</u>	<u>Discharge</u>
1100	0
110.5	8.5
111.0	25.0

PROJECT Camps Dams
NY 534



FLAHERTY-GIAVARA ASSOCIATES
 ENVIRONMENTAL DESIGN CONSULTANTS
 ONE COLUMBUS PLAZA, NEW HAVEN, CONN 06510/203/760-1200

SHEET NO. 3 OF 8
 BY RAC DATE 3-25-81
 CHK'D. BY TLW DATE 4-28-81

ORFICE Flow Controls for Stages 111.5' - 113.5'

$$Q = CA \sqrt{2G} (H^{1/2})$$

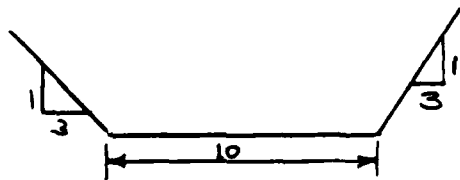
<u>Stage</u>	<u>Discharge</u>
111.5	30.5
112.0	35.5
112.5	39.5
113.0	43.0
113.5	46.5

PIPE Flow Controls for Stages > 114.0

$$EH = \left(0.9 \frac{V_D^2}{64.4} \right) + \left(0.9 \frac{V_P^2}{64.4} \right) + L_P S_F + \frac{V_P^2}{64.4}$$

<u>Stage</u>	<u>Discharge</u>
114.0	50.0
115.0	50.0
117.21	51.0

Flow From Emergency Spillway Starts at Stages
 > 112.0



$$Q = \frac{1.49}{n} R_h^{2/3} S^{1/2} A$$

$$n = 0.03$$

$$S = 0.5\%$$

PROJECT CORPS Dams
NY 534



FLAHERTY-GIAVARA ASSOCIATES
 ENVIRONMENTAL DESIGN CONSULTANTS
 ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/788-1280

SHEET NO. 4 OF 8
 BY RAC DATE 3-25-81
 CHK'D. BY TLW DATE 4-28-81

<u>STAGE</u>	<u>Discharge</u>
112.0	0
112.5	11.7
113.0	39.3
113.5	82.4
114.0	142.0
115.0	314.6
117.21	996.8

Discharge over top of dam starts @ 115.0

$$Q = CLH^{1.5}$$

$$= 2.5(120)(2.2)^{1.5} = 3449.7 \text{ CFS}$$

Cumulative Stage Discharge Data

<u>STAGE (ft)</u>	<u>Discharge (CFS)</u>
110.0	0
110.5	8.5
111.0	25.0
111.5	30.5
112.0	35.5
112.5	51.2
113.0	82.3
113.5	128.9
114.0	192.0
115.0	364.6
117.21	1047.8 (4497.5 w/ Top of Dam)

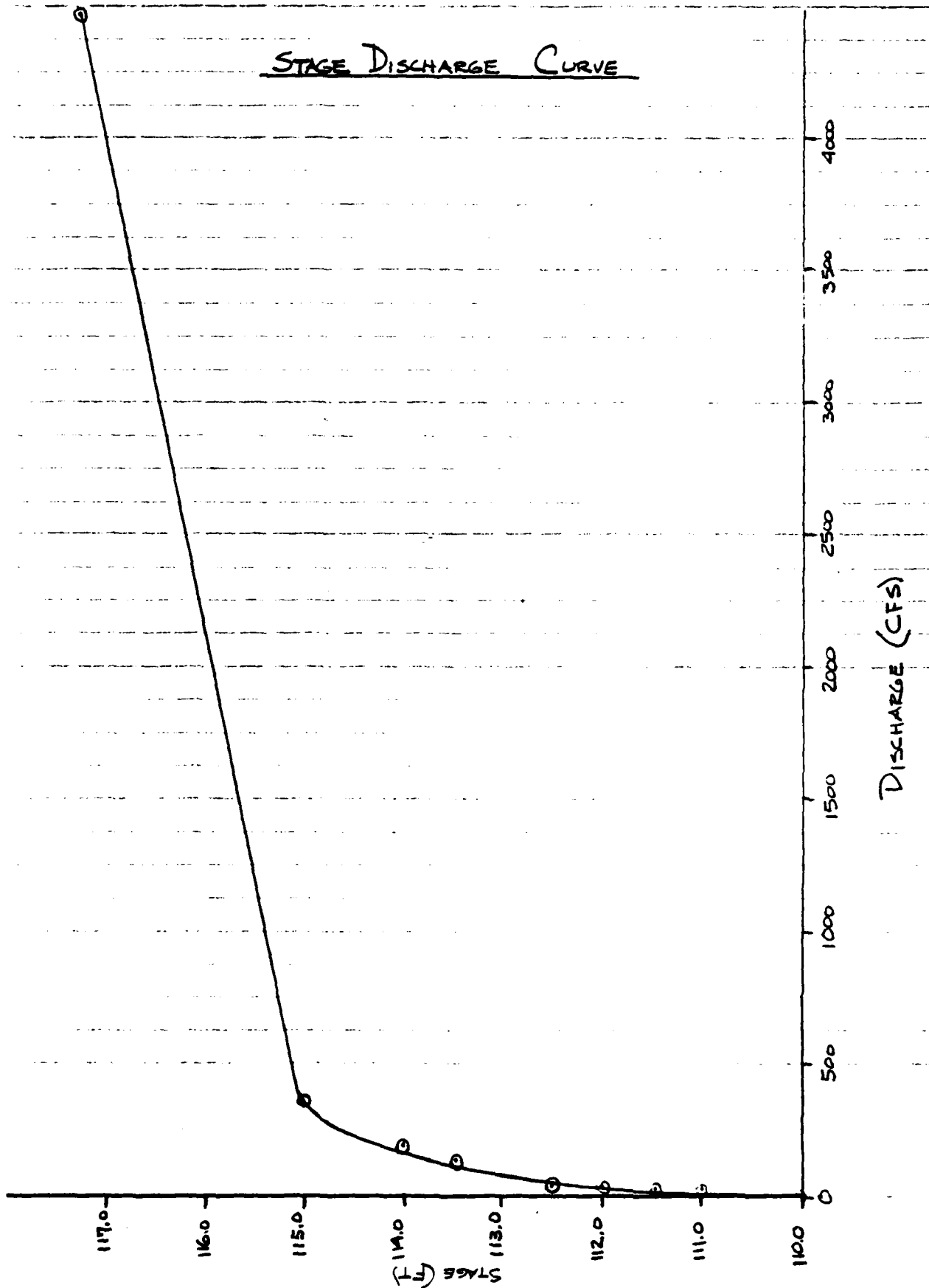
PROJECT NY 534



FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/788-1280

SHEET NO. 5 OF 8
BY RAC DATE 4-23-81
CHK'D. BY TLW DATE 4-28-81

STAGE DISCHARGE CURVE




EMERGENCY SPILLWAY DISCHARGE CHANNEL

$$b = 10$$

$$Z = 3:1$$

$$S = 0.5\% \text{ @ Dam Section}$$

$$N = 0.03$$

$$Q = 2787 \text{ (PMF - Principal Spillway Discharge)}$$

FIND D, A, V

$$Q = \frac{K'}{N} b^{8/3} S^{1/2} \text{ (KING'S HANDBOOK Table 7-11)}$$

$$K' = \frac{(2787)(0.03)}{(10)^{2.67} (0.005)^{1/2}} = 2.55$$

$$\frac{.83 - .82}{2.58 - 2.51} = \frac{x}{2.55 - 2.51} \quad x = 0.0057$$

$$\frac{D}{b} = 0.82 + 0.0057 = 0.8257$$

$$D = 0.8257 \times 10 = 8.26'$$

$$A = (10 \times 8.26) + (8.26 \times 3 \times 8.26) = 287.3 \text{ ft}^2$$

$$V = \frac{Q}{A} = \frac{2787}{287.3} = 9.70 \text{ ft/sec}$$



CHECK CRITICAL DEPTH

$$K'_L = \frac{Q}{b^{5/2}} = \frac{2787}{10^{5/2}} = 8.81 \quad (\text{KING'S HANDBOOK TABLE 8-5})$$

$$\frac{8.94 - 8.69}{.74 - .73} = \frac{8.81 - 8.69}{x} \quad x = 0.0048$$

$$\frac{D_c}{b} = 0.0048 + 0.73 = 0.7348$$

$$D_c = 10 \times 0.7348 = 7.35'$$

$D_c < D_N \therefore$ Subcritical flow occurs
@ DAM SECTION

EMERGENCY Spillway @ Discharge to Plunge Pool

$$b = 10$$

$$Z = 3:1$$

$$S = 8.3\%$$

$$N = 0.03$$

$$Q = 2787 \quad (\text{PMF - PRINCIPAL Spillway Discharge})$$

FIND D, A, V

$$Q = \frac{K'}{N} b^{8/3} S^{1/2} \quad (\text{KING'S HANDBOOK TABLE 7-11})$$

$$K' = \frac{(2787)(0.03)}{(10)^{2.67} (0.083)^{1/2}} = 0.6252$$

$$\frac{0.633 - 0.603}{.44 - .43} = \frac{.6252 - .603}{x} \quad x = 0.0074$$

$$\frac{D}{b} = 0.0074 + 0.43 = 0.4374$$

PROJECT NY 534



FLAHERTY-GIAVARA ASSOCIATES
ENVIRONMENTAL DESIGN CONSULTANTS
ONE COLUMBUS PLAZA, NEW HAVEN, CONN. 06510/203/788-1280

SHEET NO. 8 OF 6
BY RAC DATE 4-23-81
CHK'D. BY TLW DATE 4-28-81

$$D = 0.4374 \times 10 = 4.37'$$

$$A = (10 \times 4.37) + (4.37 \times 3 \times 4.37) = 101.0$$

$$V = \frac{Q}{A} = \frac{2787}{101} = 27.6 \text{ ft/sec} \therefore \text{EROSION WILL OCCUR}$$

@ EMERGENCY SPILLWAY EXIT

$$D_c = 7.35'$$

@ END $D_c > D_N \therefore$ supercritical flow exists.

HEC-1 FLOOD HYDROGRAPH COMPUTATIONS

FLAHERTY GIAVARA ASSOCIATES, P. C.

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

1 A1 NATIONAL DAM INSPECTION PROGRAM, PHASE I REPORT, CORPS OF ENGINEERS - NEW YORK DISTRICT
 2 A2 DAM INVENTORY NO. NY 534, ROBERT L. BISHOP DAM, DELAWARE COUNTY, NEW YORK, JUNE 26, 1981
 3 A3 PREPARED BY FLAHERTY GIAVARA ASSOCIATES, P. C., ONE COLUMBUS PLAZA, NEW HAVEN, CONNECTICUT
 4 B 120 0 30 0 0 0 2 0 0
 5 B1 3
 6 J1 0 1 0 2 0 3 0 4 0 5 0 6 0 7 0 8 1 0
 7 K1 INFLOW HYDROGRAPH, SNYDER METHOD
 8 M 1 1 0 88 0 1 0
 9 P 0 20 1 111 122 133 143 1
 10 T 1 90 0 63
 11 W -2.0 -0.10 1.5
 12 X K1 RESERVOIR ROUTING MODIFIED PLUS METHOD
 13 Y 1
 14 Y1 110.0 111.0 111.5 112.0 112.5 113.0 113.5 114.0 115.0
 15 Y4 116.5 117.21
 16 Y5 779.0 1047.8
 17 Y6 10.1
 18 Y7 110.0 112.0 116.0 118.0 120.0
 19 Y8 115.0 2.5 1.5 420.0
 20 Y9
 21
 22
 23
 24
 25
 26
 27

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
 RUNOFF HYDROGRAPH AT
 ROUTE HYDROGRAPH TO
 END OF NETWORK

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

RUN DATE: 6/26/
 TIME: 12.25 PM

NATIONAL DAM INSPECTION PROGRAM, PHASE I REPORT, CORPS OF ENGINEERS - NEW YORK DISTRICT
 DAM INVENTORY NO. NY 534, ROBERT L. BISHOP DAM, DELAWARE COUNTY, NEW YORK, JUNE 26, 1981
 PREPARED BY FLAHERTY GIAVARA ASSOCIATES, P. C., ONE COLUMBUS PLAZA, NEW HAVEN, CONNECTICUT

NG	NHR	NMIN	IDAY	JOPER	JOB SPECIFICATION	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
120	0	30	0	5	0	0	0	TRACE	2	0	0
					NMT	LROPT					
					0	0					

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 1.00
 NPLAN=1 NRTIO=9 LRTIO=1

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH, SNYDER METHOD
 ISTAG ICOMP IECON ITAPE JPLT JPRT INAME ISTAGE IAUTO
 1 0 0 0 0 0 1 0 0

HYDROGRAPH DATA
 INHYDQ 1 IUDQ TAREA SNAP TRSDA TRSPC RATIO ISNDW ISAME LOCAL
 1 1 0.88 0.00 0.88 1.00 0.000 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 20.10 111.00 122.00 133.00 143.00 0.00 0.00

LOSS DATA
 LROPT STRKR DLTKR RTIOL ERAIN STRKS RTIOL STRTL CNSTL ALSMX RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 0.10 0.00 0.00

UNIT HYDROGRAPH DATA
 TP= 1.90 CP=0.63 NTA= 0

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 4.35 AND R= 3.38 INTERVALS
 STRTG= -2.00 GRCSN= -0.10 RTIOR= 1.50
 23. 81. 148. 187. 173. 134. 100. 74. 53. 41. 2.
 30. 23. 17. 12. 9. 7. 5. 4. 3. 2.

UNIT HYDROGRAPH 21 END-OF-PERIOD ORDINATES, LAG= 1.88 HOURS, CP= 0.63 VOL= 1.00
 23. 81. 148. 187. 173. 134. 100. 74. 53. 41. 2.
 30. 23. 17. 12. 9. 7. 5. 4. 3. 2.

MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW	MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW	MO DA	HR MN	PERIOD	RAIN	EXCS	LOSS	COMP G
1 01	0 30	1	0 01	0 00	0 01	1 02	6 30	61	0 18	0 13	0 03	0 03	0 03	1 01	0 30	1	0 01	0 00	0 01	29
1 01	1 00	2	0 01	0 00	0 01	1 02	7 30	62	0 18	0 13	0 03	0 03	0 03	1 01	1 00	2	0 01	0 00	0 01	38
1 01	1 30	3	0 01	0 00	0 01	1 02	8 30	63	0 18	0 13	0 03	0 03	0 03	1 01	1 30	3	0 01	0 00	0 01	54
1 01	2 00	4	0 01	0 00	0 01	1 02	9 30	64	0 18	0 13	0 03	0 03	0 03	1 01	2 00	4	0 01	0 00	0 01	73
1 01	2 30	5	0 01	0 00	0 01	1 02	10 30	65	0 18	0 13	0 03	0 03	0 03	1 01	2 30	5	0 01	0 00	0 01	95
1 01	3 00	6	0 01	0 00	0 01	1 02	11 30	66	0 18	0 13	0 03	0 03	0 03	1 01	3 00	6	0 01	0 00	0 01	110
1 01	3 30	7	0 01	0 00	0 01	1 02	12 30	67	0 18	0 13	0 03	0 03	0 03	1 01	3 30	7	0 01	0 00	0 01	121
1 01	4 00	8	0 01	0 00	0 01	1 02	13 30	68	0 18	0 13	0 03	0 03	0 03	1 01	4 00	8	0 01	0 00	0 01	129
1 01	4 30	9	0 01	0 00	0 01	1 02	14 30	69	0 18	0 13	0 03	0 03	0 03	1 01	4 30	9	0 01	0 00	0 01	140
1 01	5 00	10	0 01	0 00	0 01	1 02	15 30	70	0 18	0 13	0 03	0 03	0 03	1 01	5 00	10	0 01	0 00	0 01	143
1 01	5 30	11	0 01	0 00	0 01	1 02	16 30	71	0 18	0 13	0 03	0 03	0 03	1 01	5 30	11	0 01	0 00	0 01	148
1 01	6 00	12	0 01	0 00	0 01	1 02	17 30	72	0 18	0 13	0 03	0 03	0 03	1 01	6 00	12	0 01	0 00	0 01	168
1 01	6 30	13	0 01	0 00	0 01	1 02	18 30	73	0 18	0 13	0 03	0 03	0 03	1 01	6 30	13	0 01	0 00	0 01	243
1 01	7 00	14	0 01	0 00	0 01	1 02	19 30	74	0 18	0 13	0 03	0 03	0 03	1 01	7 00	14	0 01	0 00	0 01	382
1 01	7 30	15	0 01	0 00	0 01	1 02	20 30	75	0 18	0 13	0 03	0 03	0 03	1 01	7 30	15	0 01	0 00	0 01	582
1 01	8 00	16	0 01	0 00	0 01	1 02	21 30	76	0 18	0 13	0 03	0 03	0 03	1 01	8 00	16	0 01	0 00	0 01	786
1 01	8 30	17	0 01	0 00	0 01	1 02	22 30	77	0 18	0 13	0 03	0 03	0 03	1 01	8 30	17	0 01	0 00	0 01	

[illegible]

QDV

C-1.7

PAGE 0005

FLAHERTY GIAVARA ASSOCIATES, P.C.

3 30 55 I
4 30 56 I
5 30 57 I
6 30 58 I
7 30 59 I
8 30 60 I
9 30 61 I
10 30 62 I
11 30 63 I
12 30 64 I
13 30 65 I
14 30 66 I
15 30 67 I
16 30 68 I
17 30 69 I
18 30 70 I
19 30 71 I
20 30 72 I
21 30 73 I
22 30 74 I
23 30 75 I
24 30 76 I
25 30 77 I
26 30 78 I
27 30 79 I
28 30 80 I
29 30 81 I
30 30 82 I
31 30 83 I
32 30 84 I
33 30 85 I
34 30 86 I
35 30 87 I
36 30 88 I
37 30 89 I
38 30 90 I
39 30 91 I
40 30 92 I
41 30 93 I
42 30 94 I
43 30 95 I
44 30 96 I
45 30 97 I
46 30 98 I
47 30 99 I
48 30 100 I
49 30 101 I
50 30 102 I
51 30 103 I
52 30 104 I
53 30 105 I
54 30 106 I
55 30 107 I
56 30 108 I
57 30 109 I
58 30 110 I
59 30 111 I
60 30 112 I

8	30	113	I	I	I	I	I
9	00	114					
4	00	115					
	30	116					
10	00	117					
11	00	118					
11	30	119					
12	00	120					

#N/D#

[illegible][illegible]

[illegible]

[illegible][illegible][illegible]

[illegible]

```
*****  
*****  
*****  
HYDROGRAPH ROUTING  
*****  
*****  
RESERVOIR ROUTING    MODIFIED PLUS METHOD      JPLI   IATA   I AUTO  
                     ISTAQ     ICOMT          0       0       0  
                     IRECON     ITAPE          0       1       0  
                     ROUTING DATA              IPMP   LSTR  
GROSS                AVG        IOPT           0       0  
0.0                  0.00         0       1  
0.0                  0.00         0       1  
0.0
```

DAM DATA			
TOPEL	COGD	EXPD	DAMWID
115.0	2.5	1.5	420

STATION 1, PLAN 1, RATIO 1
END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

[illegible]

[illegible]

PEAK OUTFLOW IS 197. AT TIME 43.00 HOURS

CFS
CMS
INCHES
MM
AC-FT
THOUS CU M

	24-HOUR	72-HOUR	TOTAL	VOLUME
137	38	24	2912	83
4	58	1	37	25
145	247	257	4522	120
3684	4268	6522	120	149
68	116	149	149	
84	143			

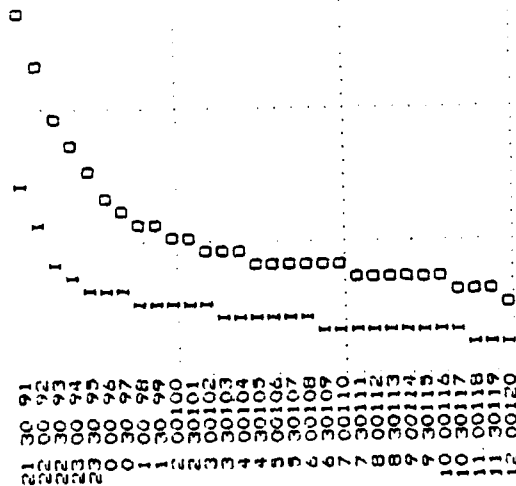
1000000

STATION 11

INFLOW(I),	OUTFLOW(O)	OBSERVED FLOW(*)
80	120	200
40	160	240

[illegible]

16 30 3301
 17 00 340 I
 18 00 350 I
 19 00 360 I
 20 00 37 01
 21 00 38 01
 22 00 39 01
 23 00 40 I
 24 00 41 I
 25 00 42 I
 26 00 43 I
 27 00 4410
 28 00 4510
 29 00 4610
 30 00 4710
 31 00 4810
 32 00 4910
 33 00 5010
 34 00 5110
 35 00 5210
 36 00 5310
 37 00 5410
 38 00 55 I
 39 00 56 I
 40 00 57 I
 41 00 58 I
 42 00 59 I
 43 00 60 I
 44 00 61 I
 45 00 62 I
 46 00 63 I
 47 00 64 I
 48 00 65 01
 49 00 66 01
 50 00 67 01
 51 00 68 01
 52 00 69 01
 53 00 70 01
 54 00 71 01
 55 00 72 01
 56 00 73 01
 57 00 74 01
 58 00 75 01
 59 00 76 01
 60 00 77 01
 61 00 78 01
 62 00 79 01
 63 00 80 01
 64 00 81 01
 65 00 82 01
 66 00 83 01
 67 00 84 01
 68 00 85 01
 69 00 86 01
 70 00 87 01
 71 00 88 01
 72 00 89 01
 73 00 90 01



140VN*

STATION 1, PLAN 1, RATIO 2
END-OF-PERIOD HYDROGRAPH ORDINATES

[illegible]

PEAK OUTFLOW IS 320. AT TIME 42.00 HOURS

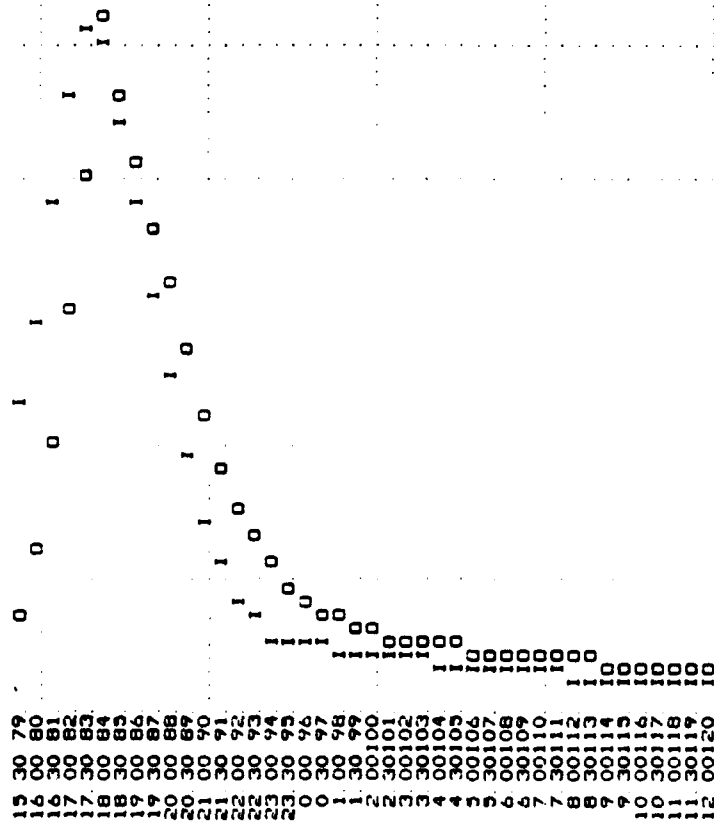
C-27

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
520	316	117	49	5859	166
15	9	3	1	5	16
	334	495	516	13109	242
	8473	12579	13109	299	299
	156	332	242	299	299
		287	299		

1 #OVF#

STATION	INFLOW(1), 400	OUTFLOW(1), 500	AND OBSERVED FLOW(1), 600
0	30	11	0
1	11	21	0
2	11	31	0
3	11	41	0
4	11	51	0
5	11	61	0
6	11	71	0
7	11	81	0
8	11	91	0
9	11	101	0
10	11	111	0
11	11	121	0
12	11	131	0
13	11	141	0
14	11	151	0
15	11	161	0
16	11	171	0
17	11	181	0
18	11	191	0
19	11	201	0
20	11	211	0
21	11	221	0
22	11	231	0
23	11	241	0
24	11	251	0
25	11	261	0
26	11	271	0
27	11	281	0
28	11	291	0
29	11	301	0
30	11	311	0
31	11	321	0
32	11	331	0
33	11	341	0
34	11	351	0
35	11	361	0
36	11	371	0
37	11	381	0
38	11	391	0
39	11	401	0
40	11	411	0
41	11	421	0
42	11	431	0
43	11	441	0
44	11	451	0
45	11	461	0
46	11	471	0
47	11	481	0
48	11	491	0
49	11	501	0
50	11	511	0
51	11	521	0
52	11	531	0
53	11	541	0
54	11	551	0
55	11	561	0
56	11	571	0
57	11	581	0
58	11	591	0
59	11	601	0
60	11	611	0
61	11	621	0
62	11	631	0
63	11	641	0
64	11	651	0
65	11	661	0
66	11	671	0
67	11	681	0
68	11	691	0
69	11	701	0
70	11	711	0
71	11	721	0
72	11	731	0
73	11	741	0
74	11	751	0
75	11	761	0
76	11	771	0
77	11	781	0
78	11	791	0
79	11	801	0
80	11	811	0
81	11	821	0
82	11	831	0
83	11	841	0
84	11	851	0
85	11	861	0
86	11	871	0
87	11	881	0
88	11	891	0
89	11	901	0
90	11	911	0
91	11	921	0
92	11	931	0
93	11	941	0
94	11	951	0
95	11	961	0
96	11	971	0
97	11	981	0
98	11	991	0
99	11	1001	0
100	11	1011	0
101	11	1021	0
102	11	1031	0
103	11	1041	0
104	11	1051	0
105	11	1061	0
106	11	1071	0
107	11	1081	0
108	11	1091	0
109	11	1101	0
110	11	1111	0
111	11	1121	0
112	11	1131	0
113	11	1141	0
114	11	1151	0
115	11	1161	0
116	11	1171	0
117	11	1181	0
118	11	1191	0
119	11	1201	0
120	11	1211	0

10 30 211
11 00 221
11 30 231
12 00 241
12 30 251
13 00 261
13 30 271
14 00 281
14 30 291
15 00 301
15 30 311
16 00 321
16 30 3301
17 00 3401
17 30 350 I
18 00 360 I
18 30 370 I
19 00 38 01
19 30 39 I
20 00 40 I
20 30 41 I
21 00 42 I
21 30 4310
22 00 4410
22 30 4510
23 00 4610
23 30 4710
0 00 4810
0 30 4910
1 00 501
1 30 511
2 00 521
2 30 531
3 00 541
3 30 551
4 00 561
4 30 571
5 00 581
5 30 591
6 00 601
6 30 6101
7 00 6201
7 30 6301
8 00 64 01
8 30 65 01
9 00 66 01
9 30 67 01
10 00 68 01
10 30 69 01
11 00 70 01
11 30 71 01
12 00 72 01
12 30 73 01
13 00 74 01
13 30 75 01
14 00 76 01
14 30 77 01
15 00 78 01



#DIV#

STATION 1, PLAN 1, RATIO 3
END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

[illegible]

[illegible]

100VF

STATION 1 1

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

[illegible]

FLAHERTY GIAVARA ASSOCIATES, P. C.

4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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9 30 67 0 1
 10 30 68 0 1
 11 30 69 0 1
 12 30 70 0 1
 13 30 71 0 1
 14 30 72 0 1
 15 30 73 0 1
 16 30 74 0 1
 17 30 75 0 1
 18 30 76 0 1
 19 30 77 0 1
 20 30 78 0 1
 21 30 79 0 1
 22 30 80 0 1
 23 30 81 0 1
 24 30 82 0 1
 25 30 83 0 1
 26 30 84 0 1
 27 30 85 0 1
 28 30 86 0 1
 29 30 87 0 1
 30 30 88 0 1
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 35 30 93 0 1
 36 30 94 0 1
 37 30 95 0 1
 38 30 96 0 1
 39 30 97 0 1
 40 30 98 0 1
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 54 30 112 0 1
 55 30 113 0 1
 56 30 114 0 1
 57 30 115 0 1
 58 30 116 0 1
 59 30 117 0 1
 60 30 118 0 1
 61 30 119 0 1
 62 30 120 0 1

0 1
 1 0

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1 0
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1 0
 1 0

1 0
 1 0

1 0
 1 0

1 0
 1 0

1 0
 1 0

1 0
 1 0

STATION 1

	200.	400.	600.	800.	1000.	1200.	0.	0.	0.	0.	0.	0.
0. 11												
1. 30												
2. 30												
3. 30												
4. 30												
5. 30												
6. 30												
7. 30												
8. 30												
9. 30												
10. 30												
11. 30												
12. 30												
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16. 30												
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19. 30												
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21. 30												
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FLAHERTY O'AVARA ASSOCIATES, P. C.

C-35

8 30113 10
 9 30114 10
 10 30115 10
 11 30116 10
 12 30117 10
 13 30118 10
 14 30119 10
 15 30120 10

1*OVN*

STATION 1, PLAN 1, RATIO 5
 END-OF-PERIOD HYDROGRAPH ORDINATES

STATION	1	PLAN 1	RATIO 5	END-OF-PERIOD HYDROGRAPH ORDINATES
8	30113	10	0	0
9	30114	10	0	0
10	30115	10	0	0
11	30116	10	0	0
12	30117	10	0	0
13	30118	10	0	0
14	30119	10	0	0
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19	30124	10	0	0
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21	30126	10	0	0
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23	30128	10	0	0
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26	30131	10	0	0
27	30132	10	0	0
28	30133	10	0	0
29	30134	10	0	0
30	30135	10	0	0
31	30136	10	0	0
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34	30139	10	0	0
35	30140	10	0	0
36	30141	10	0	0
37	30142	10	0	0
38	30143	10	0	0
39	30144	10	0	0
40	30145	10	0	0
41	30146	10	0	0
42	30147	10	0	0
43	30148	10	0	0
44	30149	10	0	0
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246	30351	10	0	0
247	30352	10	0	0
248	30353	10	0	0
249	30354	10	0	0
250	30355	10	0	0
251	30356	10	0	0
252	30357	10	0	0
253	30358	10		

PEAK OUTFLOW IS 125B. AT TIME 41 50 HOURS

CFS
CMS
INCHES
MM
AC-FT
THOUS CU M

TOTAL VOLUME
15026.
425.
13.24
336.21
621.
766.

72-HOUR
125.
4.
13.24
336.21
621.
766.

24-HOUR
300.
9.
12. 70
322. 52
596.
735.

6--HOUR
846.
24
8.95
227.24
420.
518.

PEAK
1258
36.

1001

STATION 11

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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21	30	43	1
22	30	44	0
23	30	45	0
24	30	46	0
25	30	47	0
26	30	48	0
27	30	49	0
28	30	50	0
29	30	51	0
30	30	52	0
31	30	53	0
32	30	54	0
33	30	55	0
34	30	56	0
35	30	57	0
36	30	58	0
37	30	59	0
38	30	60	0
39	30	61	0
40	30	62	0
41	30	63	0
42	30	64	0
43	30	65	0
44	30	66	0
45	30	67	0
46	30	68	0
47	30	69	0
48	30	70	0
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55	30	77	0
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57	30	79	0
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74	30	96	0
75	30	97	0
76	30	98	0
77	30	99	0
78	30	00	0

AD-A107 413

FLAHERTY-GIAVARA ASSOCIATES NEW HAVEN CT

F/G 13/13

NATIONAL DAM SAFETY PROGRAM. ROBERT L. BISHOP DAM (INVENTORY NU--ETC(U)

AUG 81 H C FLAHERTY

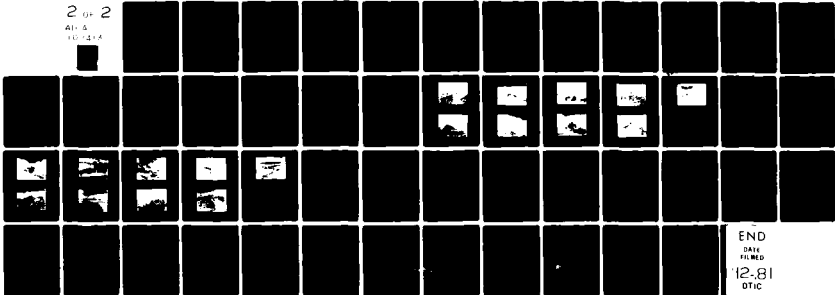
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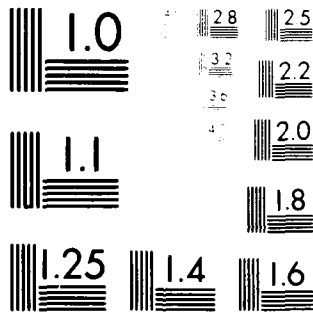
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2 OF 2

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DATE
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MICROCOPY RESOLUTION TEST CHART
NAT. BUREAU OF STANDARDS-1963-A

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PEAK OUTFLOW IS 1514. AT TIME 41.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CFS	1514	1027	362	151		1811B
CMS	43	29	10	4		513
INCHES		10.86	15.32	15.96		15.96
MM		273.78	389.10	403.40		403.40
CU-FT		509	719	749		749
THOUS. CU M		628	886	924		924

1 * Q V F *

STATION 11

INFLOW(I),	OUTFLOW(O)	AND OBSERVED FLOW(*)
600.	800.	1000.
		1200.

q.

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Q.

Q.

 $\dot{O}$

o.

Ek.

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C-40

15	30	311
16	30	321
17	30	3301
18	30	340
19	30	350
20	30	360
21	30	370
22	30	380
23	30	390
24	30	400
25	30	410
26	30	420
27	30	430
28	30	440
29	30	450
30	30	460
31	30	470
32	30	480
33	30	490
34	30	500
35	30	510
36	30	520
37	30	530
38	30	540
39	30	550
40	30	560
41	30	570
42	30	580
43	30	590
44	30	600
45	30	610
46	30	620
47	30	630
48	30	640
49	30	650
50	30	660
51	30	670
52	30	680
53	30	690
54	30	700
55	30	710
56	30	720
57	30	730
58	30	740
59	30	750
60	30	760
61	30	770
62	30	780
63	30	790
64	30	800
65	30	810
66	30	820
67	30	830
68	30	840
69	30	850
70	30	860
71	30	870
72	30	880

PEAK OUTFLOW IS 1767. AT TIME 41.30 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CFS	1767	1202	424	177	21214	601
CMS	50	34	12	5		18 69
INCHES		12 71	17 94	47 66		18 69
MM		322 85	453 60	174 66		474 66
AC-FT		841	877	877		877
THOUS CU M		735	1038	1081		1081

1. DVF *

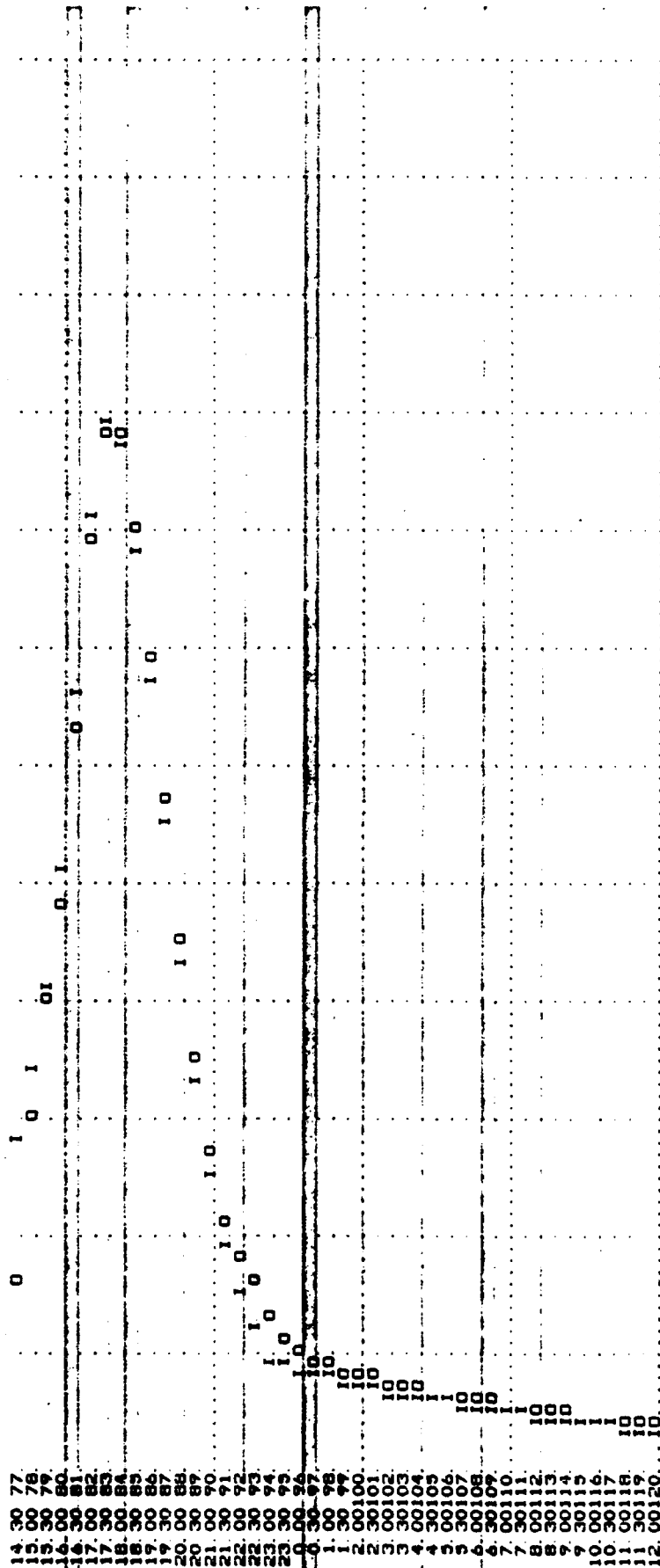
STATION 1

[illegible]

PAGE 0031

FLAHERTY GIAVARA ASSOCIATES, P C

9 30 191
10 00 201
11 00 211
12 00 221
13 00 231
14 00 241
15 00 251
16 00 261
17 00 271
18 00 281
19 00 291
20 00 301
21 00 311
22 00 321
23 00 3301
24 00 340
25 00 350
26 00 360
27 00 370
28 00 380
29 00 390
30 00 400
31 00 410
32 00 420
33 00 430
34 00 440
35 00 450
36 00 460
37 00 470
38 00 480
39 00 490
40 00 500
41 00 510
42 00 520
43 00 530
44 00 540
45 00 550
46 00 560
47 00 570
48 00 580
49 00 590
50 00 600
51 00 610
52 00 620
53 00 630
54 00 640
55 00 650
56 00 660
57 00 670
58 00 680
59 00 690
60 00 700
61 00 710
62 00 720
63 00 730
64 00 740
65 00 750
66 00 760
67 00 770
68 00 780
69 00 790
70 00 800
71 00 810
72 00 820
73 00 830
74 00 840
75 00 850
76 00 860
77 00 870
78 00 880
79 00 890
80 00 900
81 00 910
82 00 920
83 00 930
84 00 940
85 00 950
86 00 960
87 00 970
88 00 980
89 00 990
90 00 1000



1*OVN*

STATION 1, PLAN 1, RATIO 8
END-OF-PERIOD HYDROGRAPH ORDINATES

STATION	1	2	3	4	5	6	7	8	9	10	11	12
OUTFLOW	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1
	0	1	1	1	1	1	1	1	1	1	1	1

PEAK OUTFLOW IS 2019. AT TIME 41.30 HOURS

#31,000

STATION 1 1

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

	400	800	1200	1600	2000	2400
INFLUENT, OUTFLOW, AND OBSERVED FLOW (L)						
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0
25	0	0	0	0	0	0
26	0	0	0	0	0	0
27	0	0	0	0	0	0
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
32	0	0	0	0	0	0
33	0	0	0	0	0	0
34	0	0	0	0	0	0
35	0	0	0	0	0	0
36	0	0	0	0	0	0
37	0	0	0	0	0	0
38	0	0	0	0	0	0
39	0	0	0	0	0	0
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41	0	0	0	0	0	0
42	0	0	0	0	0	0
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44	0	0	0	0	0	0
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65	0	0	0	0	0	0
66	0	0	0	0	0	0
67	0	0	0	0	0	0
68	0	0	0	0	0	0
69	0	0	0</			

31	30	71
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5	50	91
6	50	101
7	50	111
8	50	121
9	50	131
10	50	141
11	50	151
12	50	161
13	50	171
14	50	181
15	50	191
16	50	201
17	50	211
18	50	221
19	50	231
20	50	241
21	50	251
22	50	261
23	50	271
24	50	281
25	50	291
26	50	301
27	50	311
28	50	321
29	50	3301
30	50	3401
31	50	3501
32	50	3601
33	50	3701
34	50	3801
35	50	3901
36	50	4001
37	50	4101
38	50	4201
39	50	4301
40	50	4401
41	50	4501
42	50	4601
43	50	4701
44	50	4801
45	50	4901
46	50	5001
47	50	5101
48	50	5201
49	50	5301
50	50	5401
51	50	5501
52	50	5601
53	50	5701
54	50	5801
55	50	5901
56	50	6001
57	50	6101
58	50	6201
59	50	6301
60	50	6401

8 30 65 01
 9 30 66 01
 10 30 67 01
 11 30 68 01
 12 30 69 01
 13 30 70 01
 14 30 71 01
 15 30 72 01
 16 30 73 01
 17 30 74 01
 18 30 75 01
 19 30 76 01
 20 30 77 01
 21 30 78 01
 22 30 79 01
 23 30 80 01
 24 30 81 01
 25 30 82 01
 26 30 83 01
 27 30 84 01
 28 30 85 01
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 41 30 98 01
 42 30 99 01
 43 30 100 01
 44 30 101 01
 45 30 102 01
 46 30 103 01
 47 30 104 01
 48 30 105 01
 49 30 106 01
 50 30 107 01
 51 30 108 01
 52 30 109 01
 53 30 110 01
 54 30 111 01
 55 30 112 01
 56 30 113 01
 57 30 114 01
 58 30 115 01
 59 30 116 01
 60 30 117 01
 61 30 118 01
 62 30 119 01
 63 30 120 01

1#QVN#

STATION 1, PLAN 1, RATIO 9
END-OF-PERIOD HYDROGRAPH ORDINATES

[illegible]

STATION 1

INFLOW(I),	OUTFLOW(O)	AND OBSERVED FLOW(*)
800.	1200.	2000.
800.	1600.	2400.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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 580 11011

PAGE 0040

FLAHERTY GIAVARA ASSOCIATES, P C

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

APPENDIX D

PREVIOUS INSPECTION REPORTS/AVAILABLE DOCUMENTS

PREVIOUS INSPECTION REPORTS



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

J. BURCH McMORRAN
SUPERINTENDENT

JOSEPH C. FEDERICK, DIST. ENG.
71 FREDERICK STREET, BINGHAMTON, N. Y. 13902

COUNTIES
IN 8TH DISTRICT

BROOME
CHENANGO
DELAWARE
OTSEGO
SCHENARIE
SULLIVAN

BINGHAMTON, N. Y.,

May 5, 1967

STATE OF NEW YORK
WATER RESOURCES

MAY 11 1967

COMMISSION
RECEIVED

RE: Dam 146-3568
Town of Andes
County of Delaware
Robert Bishop, Owner

Mr. J. R. Stellato, Acting Ass't. Supt.
Division of Operation & Maintenance (Canals)
New York State Department of Public Works
State Campus, 1220 Washington Avenue
Albany, New York

ATTENTION: Mr. E. Rowan

RECEIVED
ASST. SUPT.
OPER. AND MAINT.
WATERWAY SUBDIVISION

Forwarded to:

Construction
Control

Office

Files

Files

Files

Dear Sir:

On April 20, 1967 Mr. C. DeJean and our photographer, Mr. Gerald Whalen, inspected the construction of the above mentioned dam; and Mr. DeJean makes the following report.

The dam appears to be well constructed of suitable material and about 90 per cent complete. The work still to be performed is as follows:

1. Distribute gravel over the top of the dam and compact it. The gravel is now wind-rowed on top of the dam and appears in Photos 30-4, 30-5, 30-6, and 30-7.
2. Place grouted rip-rap in the emergency spillway.
3. Place grouted rip-rap at the outlet of the trickle tube.
4. Fine grade the down stream side of the dam and also the stilling basin and the outlet of the emergency spillway.

The only deviation to date from the approved plans was the construction of the emergency spillway on the east side of the dam at the approved elevation instead of on the west side.

THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY
THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY

Mr. J. R. Stellato

Attention: Mr. E. Rowan

Page: Two

May 5, 1967

This is the end of Mr. DeJean's report.

We are enclosing nine photos of the construction.

Very truly yours,

Joseph C. Federick
JOSEPH C. FEDERICK *co*
District Engineer

CLD:esg
Enclosures

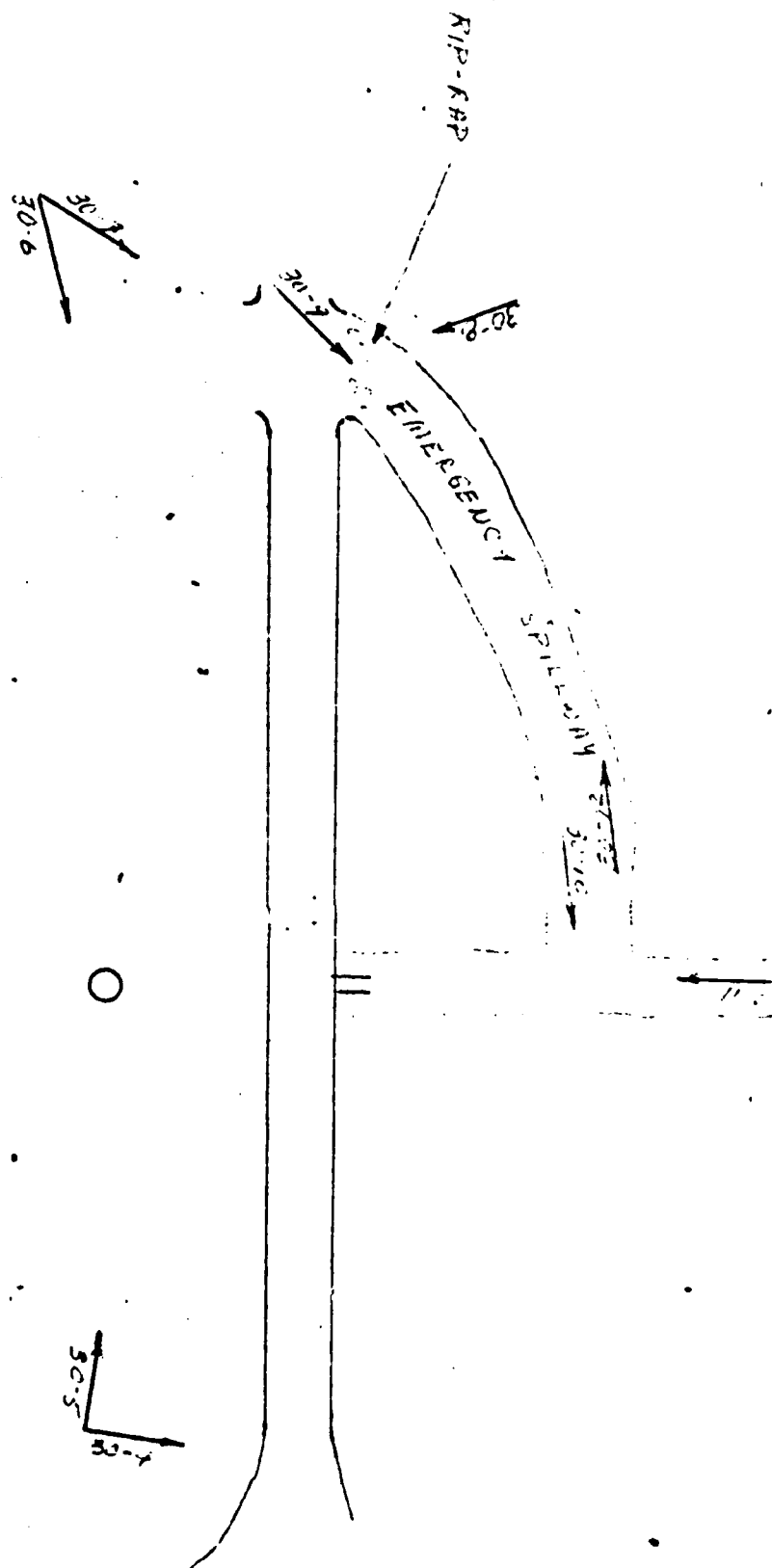
Clatsop County

Start L. Bishop (Cannon)

Town of Andes

Dam # 146-3568

4/20/64



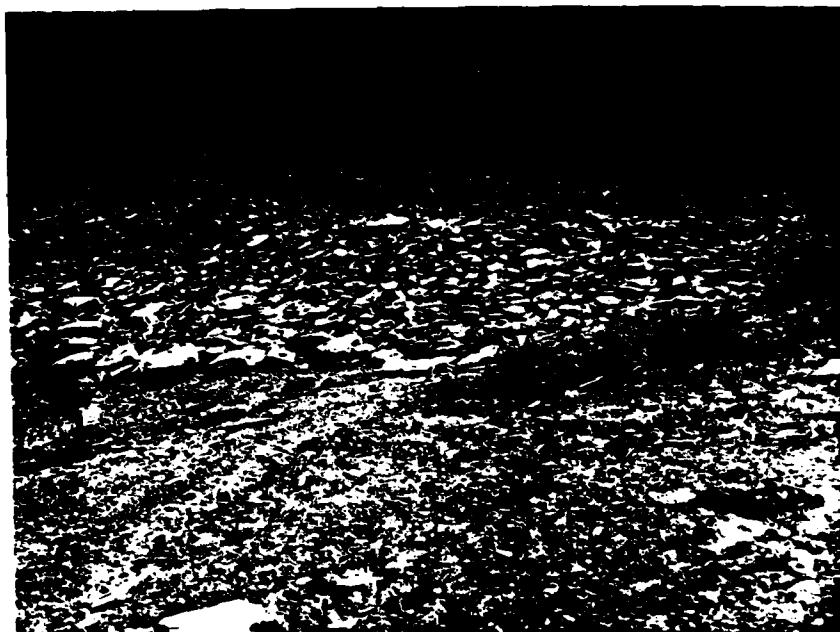


PHOTO #30-4



PHOTO #30-5



PHOTO #30-6



PHOTO #30-7



PHOTO #30-8



PHOTO #30-9



PHOTO #30-10

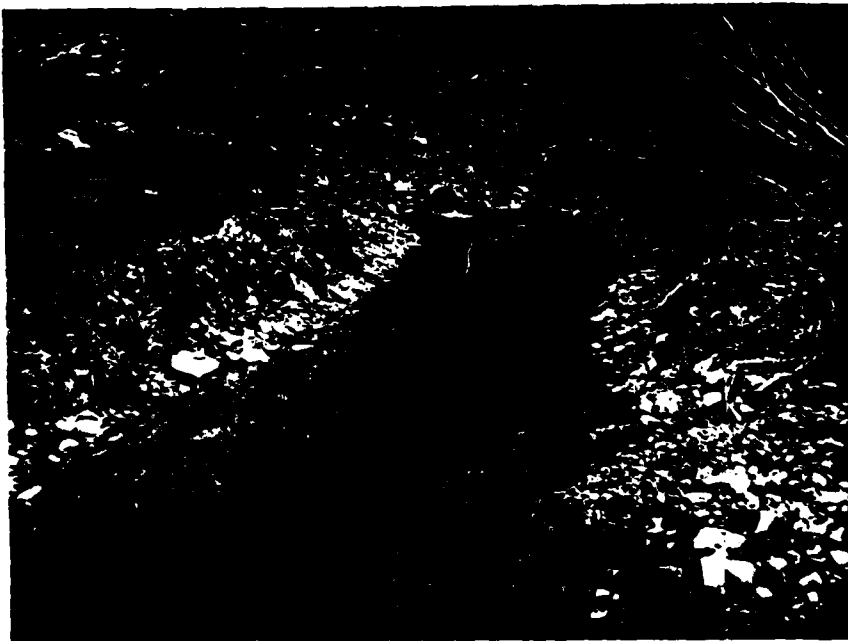


PHOTO #30-11

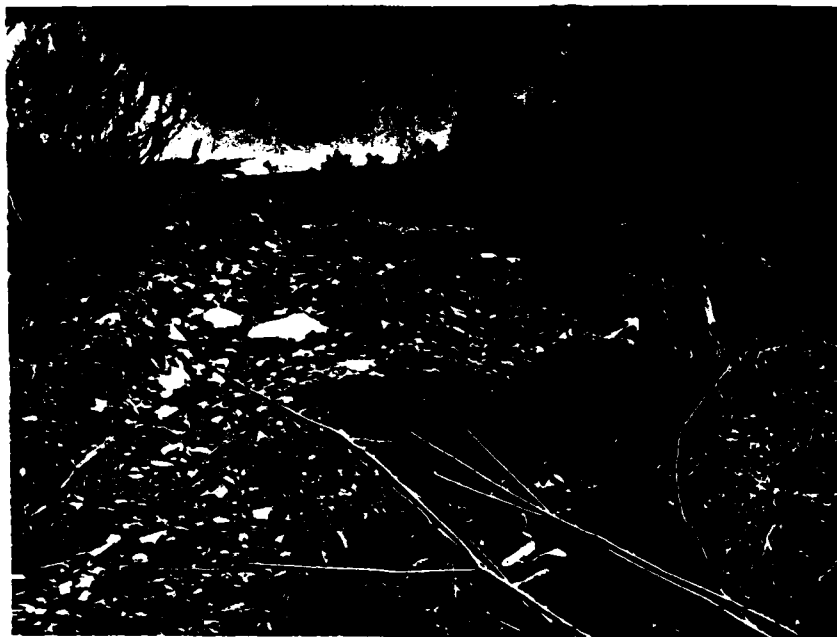


PHOTO #30-12



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

J. BURCH McMORRAN
SUPERINTENDENT

JOSEPH C. FEDERICK, DIST. ENGR.
71 FREDERICK STREET, BINGHAMTON, N. Y. 13902

COUNTIES
IN 8TH DISTRICT

BROOME
CHENANGO
DELAWARE
OTSEGO
SCHENECTADY
SULLIVAN

RE: Dam # 146-3568
Town of Andes
Delaware County
Robert Bishop - Owner

BINGHAMTON, N. Y.

July 26, 1967

RECEIVED
ASST. SUPT.
OPER. AND MAINT.
WATERWAY SUBDIVISION

5 JUL 28 1967
Reference to:

Mr. J. R. Stallato
Acting Asst. Supt. of Construction
New York State Dept. of Public Works
State Campus
1220 Washington Ave.
Albany, New York
Canal Traffic
Shore & Floating Plant
Canal Permits
Head Clerk
File

Mr. J. R. Stallato
Acting Asst. Supt. of Operations & Maintenance (Canals)
New York State Dept. of Public Works
State Campus
1220 Washington Ave.
Albany, New York

ATTENTION: Mr. E. Rowan

Dear Sir:

We are enclosing nine photos taken on July 11, 1967 by Mr. Gerald Whalen of the above noted dam. Mr. DeJean made an inspection of the dam on July 25, 1967 and makes the following report.

The dam appears to be well constructed with satisfactory material according to the approved plans with the following exceptions.

The emergency spillway was constructed on the east side of the dam instead of on the west side. It discharges into the brook about 50 feet down stream from the outlet end of the trickle tube.

Additional clean up work should be done at the outlet end of the trickle tube and the grouted rip-rap should be placed that is called for in the plans.

The emergency spillway varies in width from 12 to 16 feet instead of the 20 feet called for in the plans. The stone rip-rap should be continued through the section of spillway that passes through the top section of the dam and this section should be grouted. The last section of spillway as it enters the stream is on a steep grade and should be rip-raped as erosion has already started. There is approximately 20 feet in this section. * See Back.

It would appear that the board walk to the water control sluice gate would not be built. However, a boat is available and a ladder has been installed to the platform on which the operating mechanism is installed.

The top of the dam and down stream slope has been seeded and the growth is now well started.

This was the end of Mr. DeJeans report.

Very truly yours,

Joseph C. Federick
JOSEPH C. FEDERICK Dist. Engr.

CLD:wco
THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY
THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY THINK HIGHWAY SAFETY

2000-07-11

11/11/11

Town of Arles
Delaware County
Robert L Bishop (owner)
7-11-67

North

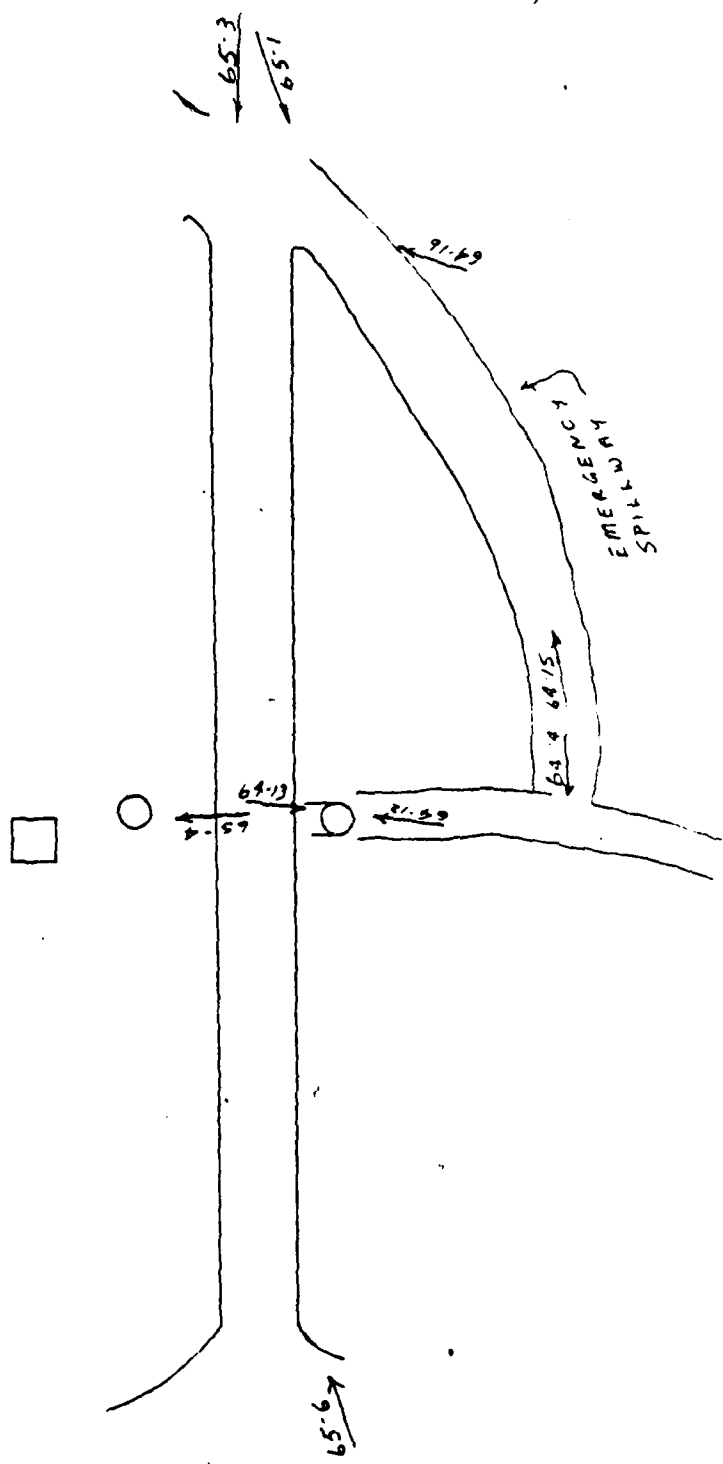




PHOTO #65-1



PHOTO #65-3

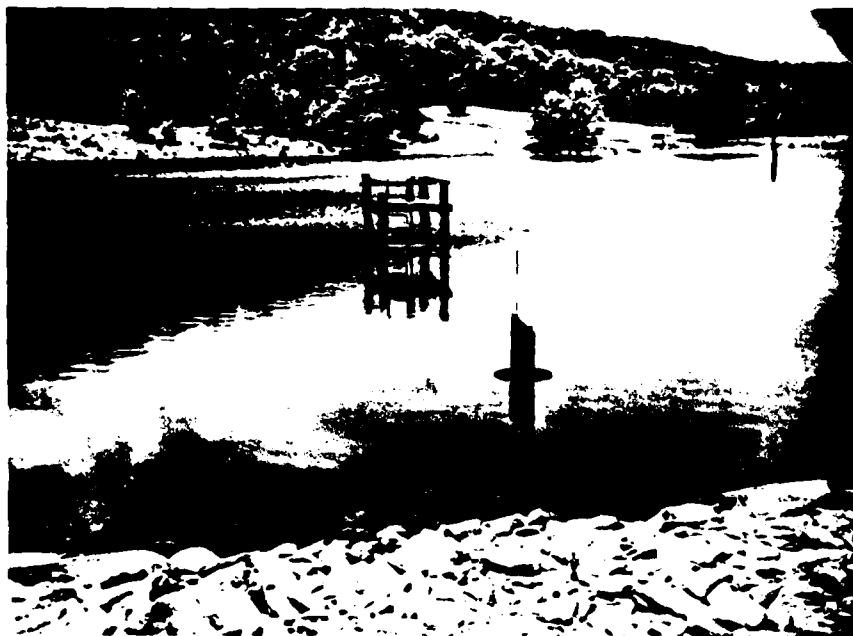


PHOTO #65-4



PHOTO #65-6



PHOTO #64-12



PHOTO #64-13



PHOTO #64-14



PHOTO #64-15



PHOTO #64-16

DAM CONSTRUCTION PERMIT APPLICATION

STATE OF NEW YORK
WATER RESOURCES COMMISSION
CONSERVATION DEPARTMENT
ALBANY, N.Y. 12226

WRC FORM #2 1/66

Do Not Write in This Box

Appl. No. 7D-36-66
Permit No. _____

Dam No. 146-3568
Watershed 7D-36-66 Delaware River

Application for a Permit for the Construction, Reconstruction or Repair of a Dam
or Other Impoundment Structure under Conservation Law, Section 429(c).

INSTRUCTIONS

1. Type or print in ink.
2. All papers must be filed in quadruplicate.
3. The completed application relating to construction, reconstruction or repair of a dam must include the following information:
 - (a) A topographical plan (with contours) of the impounded area drawn to a suitable scale.
 - (b) A profile and transverse section of the impounded area showing the proposed excavation, the normal water and possible high water elevations. A 1'-0" minimum of freeboard is to be provided between the top of the dam and the possible high water.
 - (c) A longitudinal elevation and transverse section of the dam with all the necessary details of the related appurtenances, spillways, drains, etc.
 - (d) A log of the soil information. Samples of the materials to be used in the dam and of the material upon which the dam is to be founded may be asked for, but need not be furnished unless requested.
4. No work of construction, reconstruction or repairs of the structure or structures shall be started until a permit therefor has been issued by the New York State Water Resources Commission.
5. The design, preparation of plans, estimates and specifications and the supervision of the erection, reconstruction and repair of all the structures herein applied for shall be done by a licensed professional engineer, or in the case of farm ponds by an engineer or conservationist employed by a governmental agency cooperating with a soil conservation district, or by an engineer employed by the Conservation Department.
6. A "Notice of Application" must be published by the applicant. The form of notice and instructions for publication will be furnished to the applicant by the Local Permit Agent to whom the application is delivered.

APPLICATION

Application is hereby made by Lucille S. and Robert L. Bishop
to the Conservation Department acting on behalf of the Water Resources Commission, pursuant to the provisions of Conservation Law, Section 429(c) for a permit to (construct) (~~reconstruct~~) (~~repair~~) a dam or impoundment structure substantially as shown on plans and specifications marked Dam & Lake for Robert L. Bishop herewith submitted and described.

It is intended to commence the work covered by the application
about August 1, 1966 and complete it about October 1, 1966
(Date) (Date)

1. The dam will be on Clove Hollow Brook flowing into Fall Clove
in the town of Andes County of Delaware and

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

2. Location of dam is shown on the attached map or overlay of the Andes quadrangle of the United States Geological Survey at latitude N 42° 10' 10" longitude W 74° 51' 53"
3. The impounded water will be used for recreation
4. Will any part of the dam be built upon or its pond flood any State lands? No
5. The area draining into the proposed pond or lake is 568 acres; 0.88 square miles.
6. The computed 50 year peak rate of runoff used in the design is 288 cu. ft. per sec. State criterion or method used in determining the peak rate of runoff rational formula c=0.30

1-250/t+27 (50 yrs. frequency)

7. The maximum height of the proposed dam above the bed of the stream will be 33 feet 0 inches.
8. The designed maximum high water elevation above the spillcrest is computed to be 1 feet 6 inches; the designed freeboard as measured from the maximum high water elevation to the top of the proposed dam will be 1 feet 6 inches. (One foot minimum)
9. The open spillway of the proposed dam that will control the designed flood flow will be of

vegetated earth

(State type, such as: vegetated earth, concrete, masonry, timber, rock filled crib, etc.)

The width of the control section of the spillway, measured normal to the flow of water at the crest, will be 20 feet 0 inches in the clear; facing down stream, the waters will be held at the right end by a cut bank the top of which will be - feet - inches above the spillcrest, and have a top width of - feet - inches; and at the left end by a riprapped bank of dam the top of which will be 3 feet 0 inches above the spillcrest and have a top width of 20 feet 0 inches. The slope of the sides of the spillway will be 1 ft. vert. on 3 ft. horiz. (left) 1 ft. vert. on 3 ft. horiz. (right).

10. The spillway is designed to safely discharge 233 cu. ft. per sec.
11. The surface area of the proposed pond or lake will be 10.1 acres at the normal water elevation and 11.1 acres at the spillcrest elevation; the volume of the water impounded in the pond or lake will be 31.7 m.g. gallons at the normal water elevation and 38.6 m.g. gallons at the spillcrest elevation.
12. The normal water elevation of the proposed pond or lake will be 2 feet 0 inches below the spillway crest, and will be maintained by means of a trickle tube; the pond or lake will be drained by means of a slide gate; provision will be made for supplying water to riparian owners downstream, during dry seasons, by means of a slide gate.
13. The maximum discharge through the spillway that controls the normal water elevation will be 54.8 cu. ft. per sec, during maximum high water.

14. If flashboards are to be used to control flood flow they must be of the automatic or self-tilting type, designed to fail or otherwise permit full discharge through the spillway when the flood waters reach a height of _____ feet _____ inches above the spillcrest.

15. If an overfall structure is used as a spillway, it shall be provided with an apron constructed of _____; the thickness of the _____ will be _____ feet _____ inches, the width _____ feet _____ inches across the stream and the length _____ feet _____ inches parallel to the stream.

16. Facing downstream, what is the nature of material composing the right bank? clay & hard pan

17. Facing downstream, what is the nature of the material composing the left bank? clay & hard pan

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

19. Are there any porous seams or fissures beneath the foundation of the proposed dam? Yes. This will be sealed by cork wall & clay mantle wherever exposed during excavation.

20. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. The character of the bed and banks is hard impervious hardpan & clay.

21. Was the above soil information obtained from soil borings? _____; test pits? X

22. State the height above the spillcrest elevation of the lowest part of the immediate upstream adjoining property or properties, 7 feet 0 inches. Flooding easements have been obtained, copy attached.

23. Does this proposed pond or lake constitute any part of a public water supply? no If not, where is the nearest downstream public water supply intake located? Downville Dam on Papacton Reservoir

24. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam none

25. The design, plans and specifications have been prepared under the supervision of S. Lawrence Baldwin or P.E. License No. 36732

(Authorized Agency)

Address Baldwin-Kalmus Associates Title Partner
418 Chestnut St. Oneonta, NY

26. The _____ will be under the supervision of
(State which: Erection, Reconstruction or Repairs)

_____ or P.E. License No. _____

(Authorized Agency)

Address Baldwin-Kalmus Associates

Title _____

27. Name and address of official newspaper of the town or city in which the proposed works are to be located,

Delaware Republican Express, Delhi

Att: Henry Hovemeyer, Editor

All provisions of law will be complied with in the erection and maintenance of the proposed dam or impoundment structure. The construction will be carried out substantially in accordance with the approved plans and specifications.

If the applicant is other than the owner, the applicant certifies that he has been duly authorized by the owner to make the application and to carry out the project described herein.

The applicant certifies the truth of the above statements and agrees that the issuance of the permit is based on the accuracy thereof. As a condition to the issuance of a permit, the applicant accepts full legal responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agrees to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from the said project.

Superior L. Bishop & Robert L. Bishop, Owners

By _____, authorized agent of owner.

Address of owner _____

Address of signer _____

(If other than owner)

Date _____

NOTE: Acceptance of a permit subjects permittee to restrictions, regulations or obligations stated in application and permit.

APPENDIX E
REFERENCES

REFERENCES

1. Chow, Ven Te, Editor - Handbook of Applied Hydrology. McGraw-Hill Book Company, New York, New York, 1964.
2. Hydrologic Engineering Center, U.S. Army Corps of Engineers, HEC-1 Flood Hydrograph Package, Users Manual. Davis, California, January 1973.
3. Hydrologic Engineering Center, U.S. Army Corps of Engineers, Flood Hydrograph Package (HEC-1), Users Manual for Dam Safety Investigations, Davis, California, September 1978.
4. King, Horace and Brater, Ernest. Handbook of Hydraulics, 5th Edition. McGraw-Hill Book Company, New York, New York, 1963.
5. Riedel, J.T., Appleby, J.F. and Schloemer, R.W. Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1000 Square Miles and Durations of 6, 12, 24, and 48 Hours (Hydrometeorological Report No. 33) U.S. Department of Commerce - Weather Bureau and U.S. Department of the Army - Corps of Engineers, Washington, D.C., April 1956
6. U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, Second Edition, Washington, D.C., 1973.

APPENDIX F

DRAWINGS

DAM AND LAKE FOR ROBERT

TOWN OF ANDES, COUNTY OF DELAWARE, STATE

SCALE: AS INDICATED

BALDWIN-KALMUS ASSOCIATES

ONEONT

S. LAWRENCE BALDWIN

146-363 D

HYDRAULIC DATA

TYPE	EARTH
LOCATION	LAT. 42°10' LONG. 74°32'
QUADRANGLE	ANDES
DAM HEIGHT	33 FT.
VOLUME	31.7 M.B. @ EL. 110
VOLUME	38.6 M.B. @ EL. 112
AREA	101 ACRES @ EL. 110
AREA	111 ACRES @ EL. 112
DRAINAGE AREA	365 ACRES
DRAINAGE AREA	0.88 SQUARE MILES

DR ROBERT L. BISHOP

OF DELAWARE, STATE OF NEW YORK

JUNE, 1966

ES ONEONTA, NEW YORK

P.E. 36732

146-368 DEL

HYDRAULIC DATA

WOODS	40%
PASTURE	50%
BRUSHY	10%
QUANTITY OF FLOW	182.4 CFS. MAX.
EMERGENCY SPILLWAY	300 AND RIP RAP
EMERGENCY SPILLWAY	36.7 SF WATERWAY
EMERGENCY SPILLWAY	148.0 CFS. @ EL. 113.5
MECHANICAL SPILLWAY	54.5 CFS. @ EL. 113.5
FREEBOARD	1.5 FEET
RAINFALL FREQUENCY	50 YEARS

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
SUBDIVISION OF WATERWAY OPERATION
AND MAINTENANCE
ALBANY, N. Y. 12212

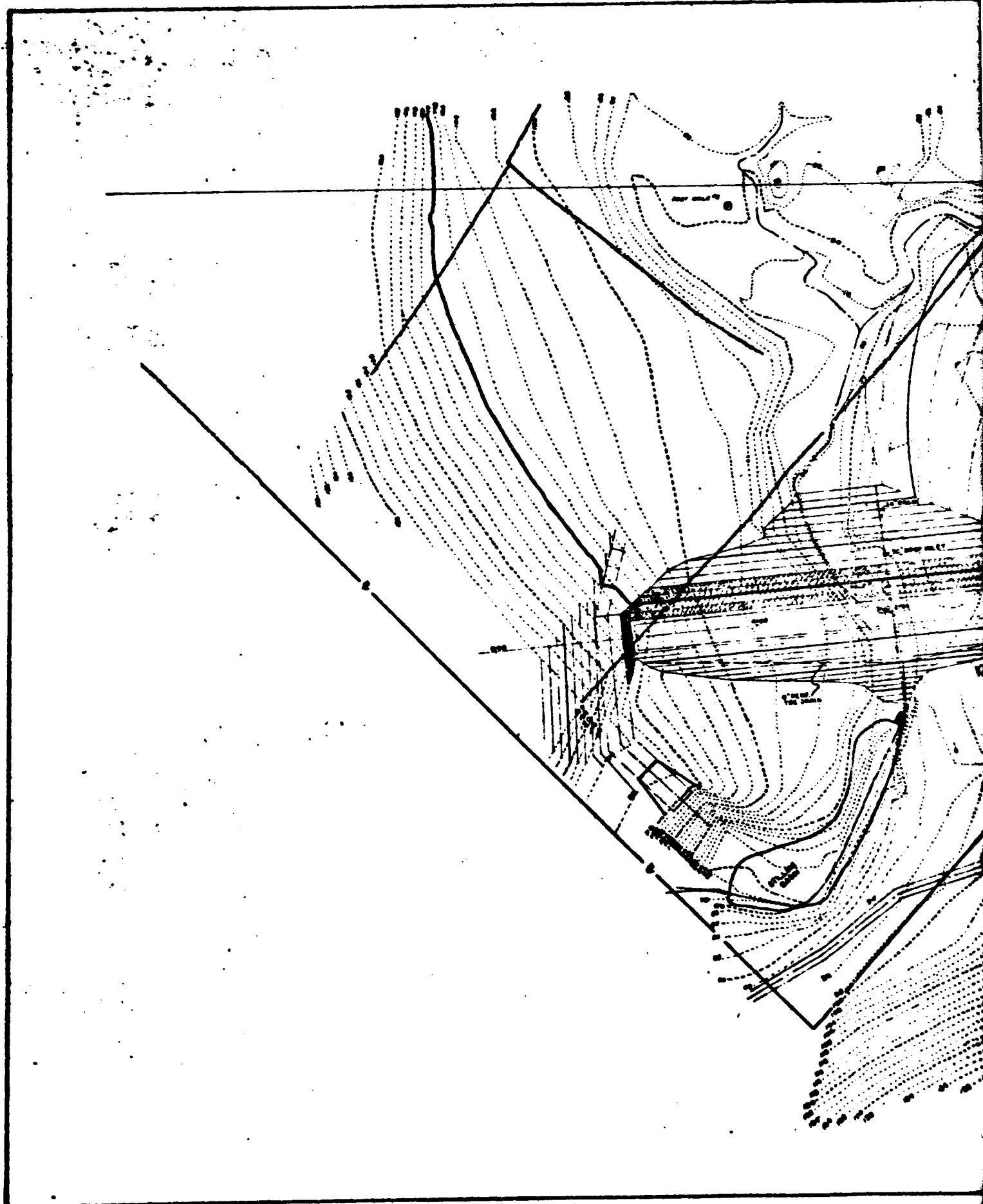
DESIGNATION NO. 146-368

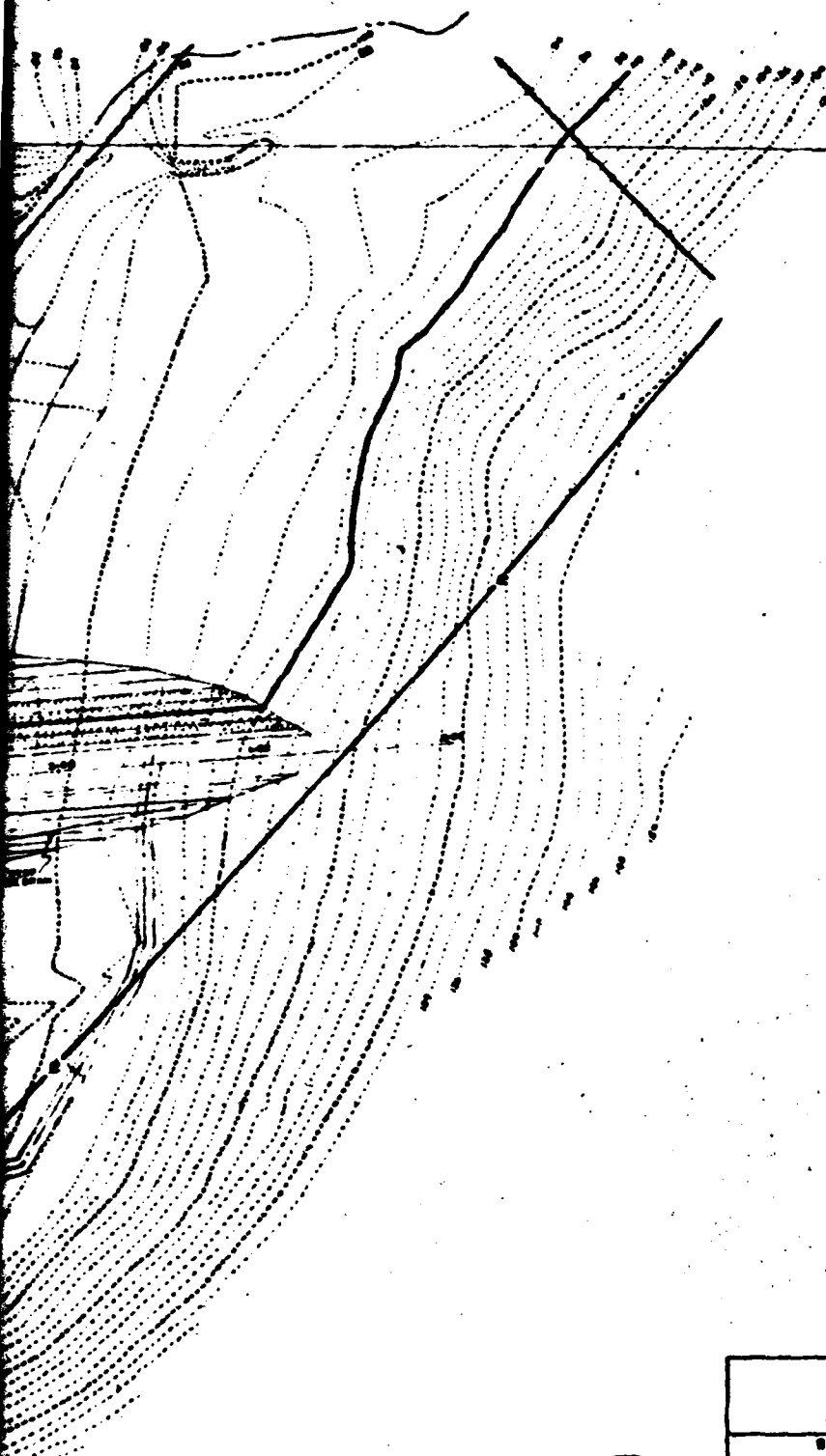
WATERWAY Delaware River
Pursuant to the provisions of Section 47 of the Conservation
Law, the design, details and specifications for the
construction of the structure shown on these plans are hereby
approved. Date August 1, 1966

Designed by Robert L. Bishop
Chief Civil Engineer

APPROVED BY R. C. McNeill
Assistant Commissioner

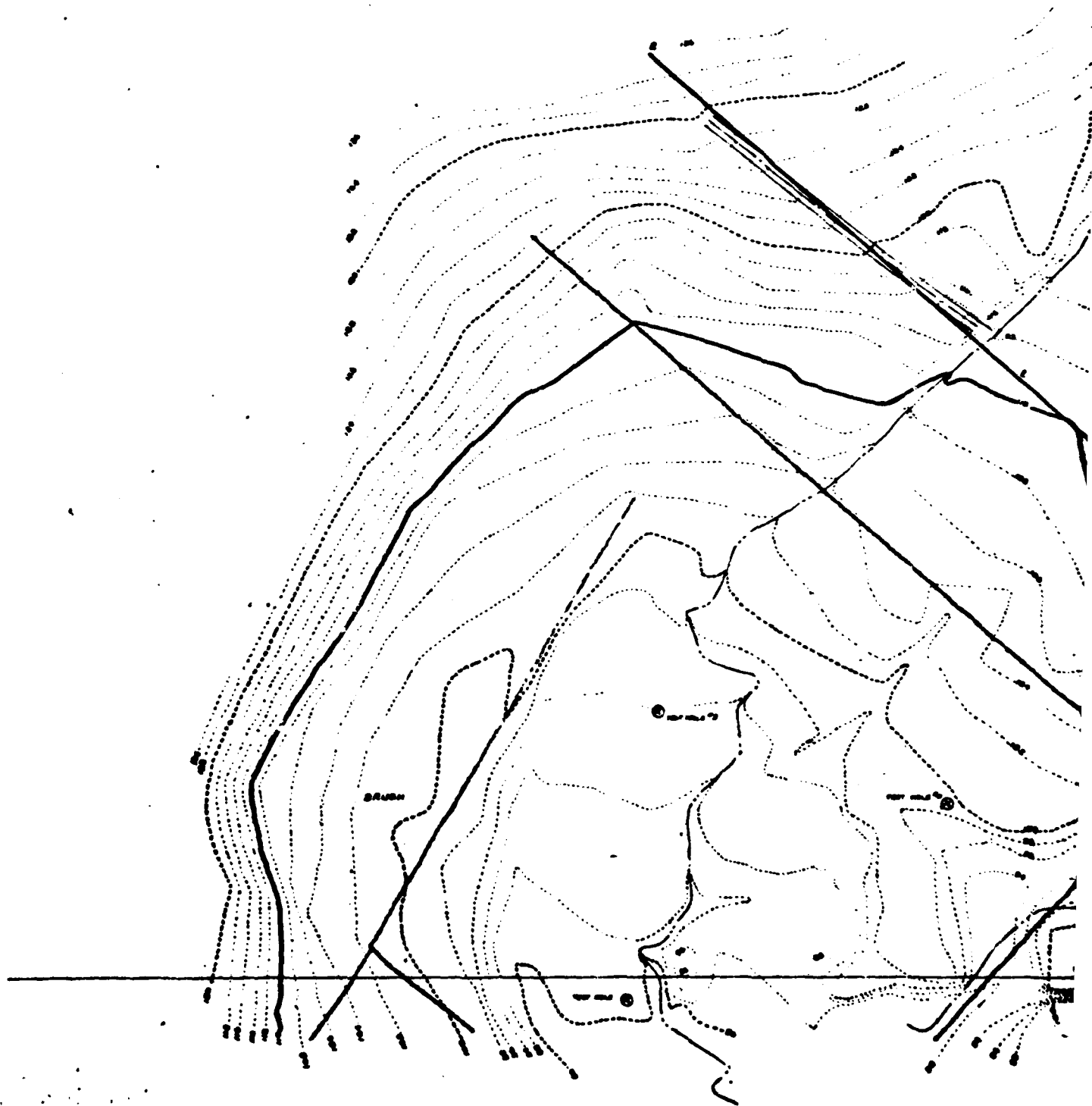


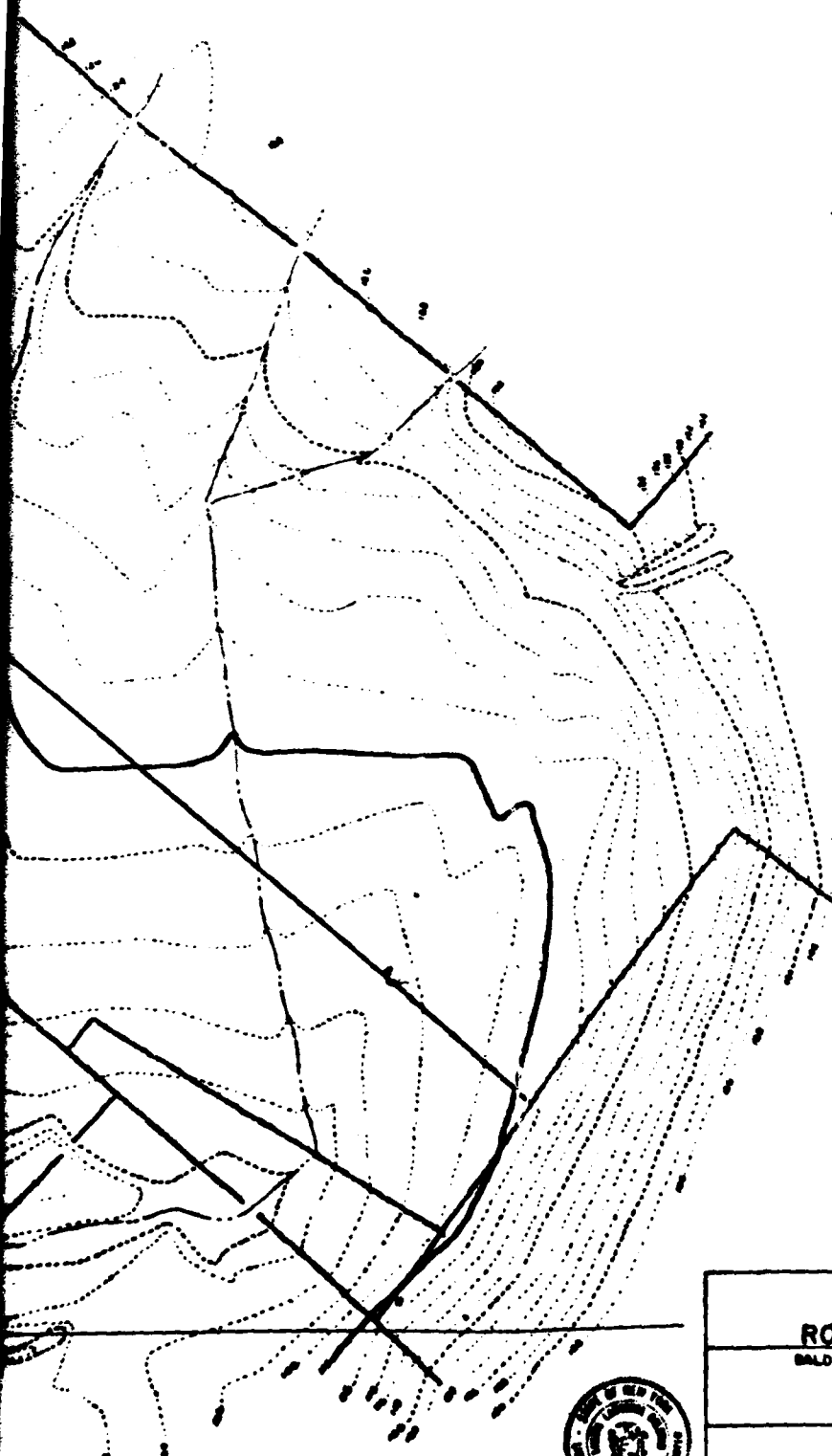




NO. 1000
EXPIRES 12/31/64
SEE 1000

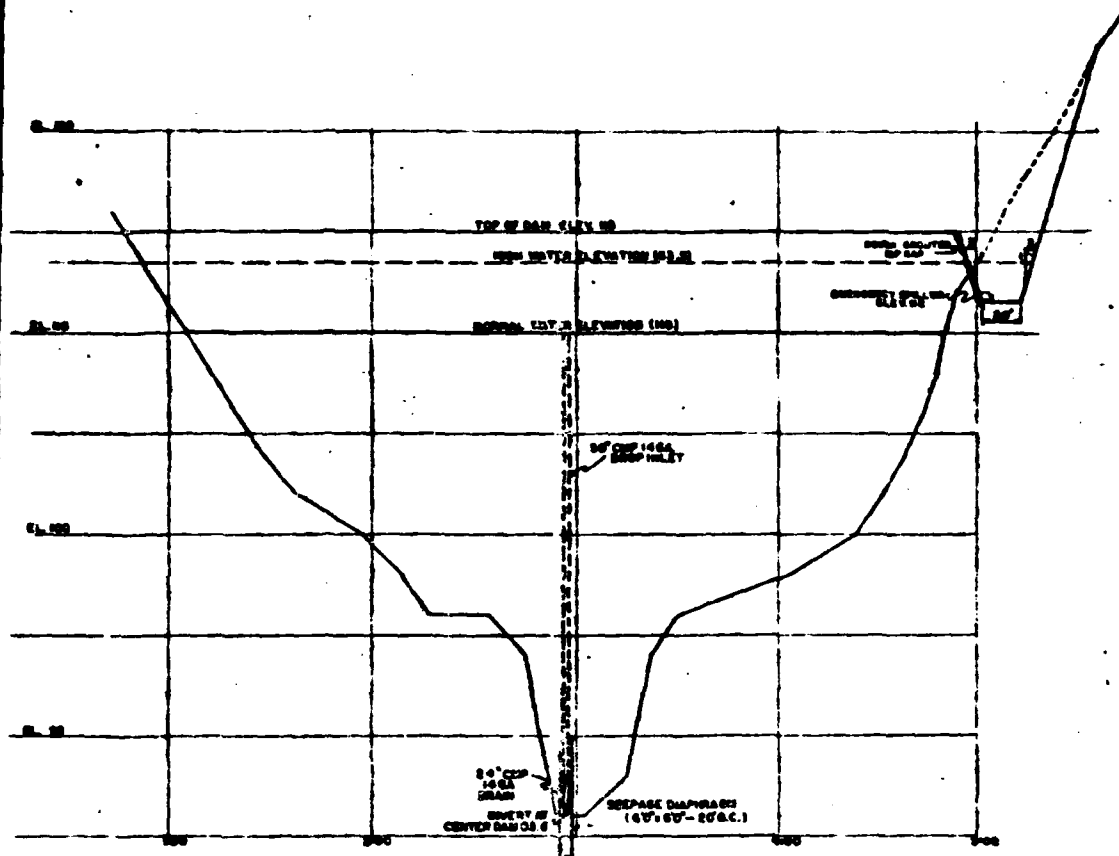
DAM & LAKE FOR ROBERT L BISHOP BALDWIN - KALMUS ASSOCIATES ENGINEER - SURVEYOR 8 CHESTNUT ST ONEONTA, N.Y. 13820		
TOPOGRAPHIC PLAN		DATE JUNE 1964 SHEET NO. 222-2
SCALE 1" = 40'	DRAWN BY E. V.	CHECKED BY S. L. B.



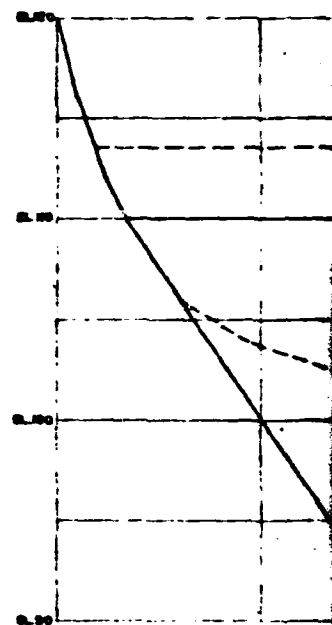


2/2/66

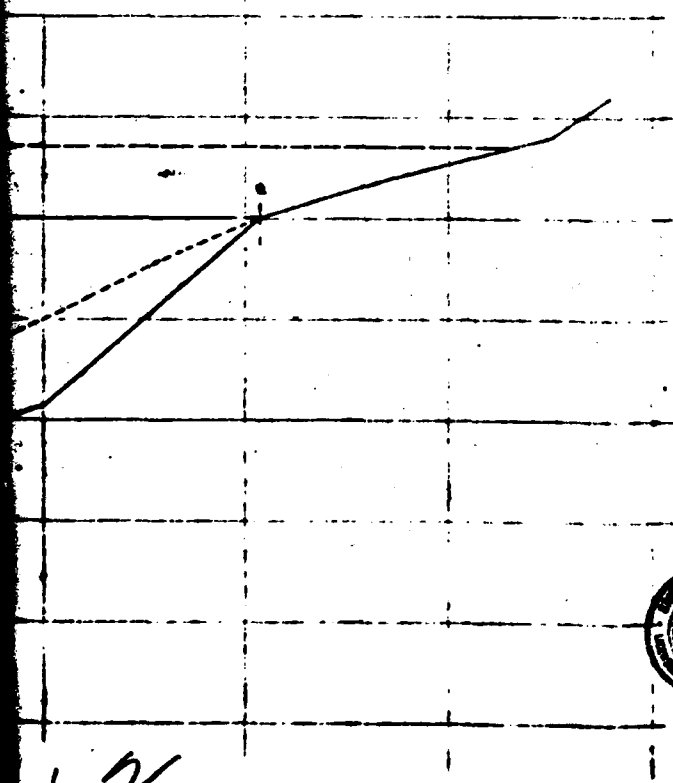
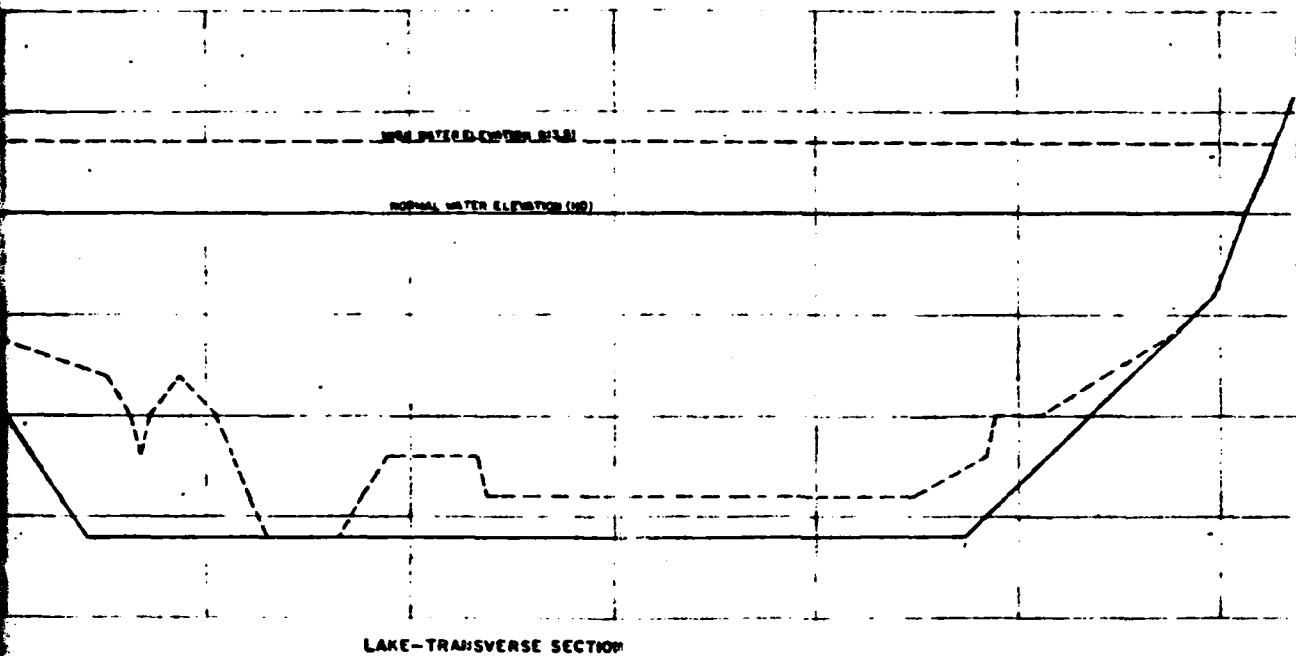
DAM & LAKE FOR ROBERT L. BISHOP BALDWIN - KALPUS ASSOCIATES ENGINEER SURVEYOR 400 CHESTNUT ST. ONE CITY, N.Y. 10006		
TOPOGRAPHIC PLAN		DATE JUNE 1966 DRAWING NO. H33-3
SCALE 1" = 40'	DRAWN BY E.V.	CHECKED BY S.L.B.



DAM-LONGITUDINAL SECTION

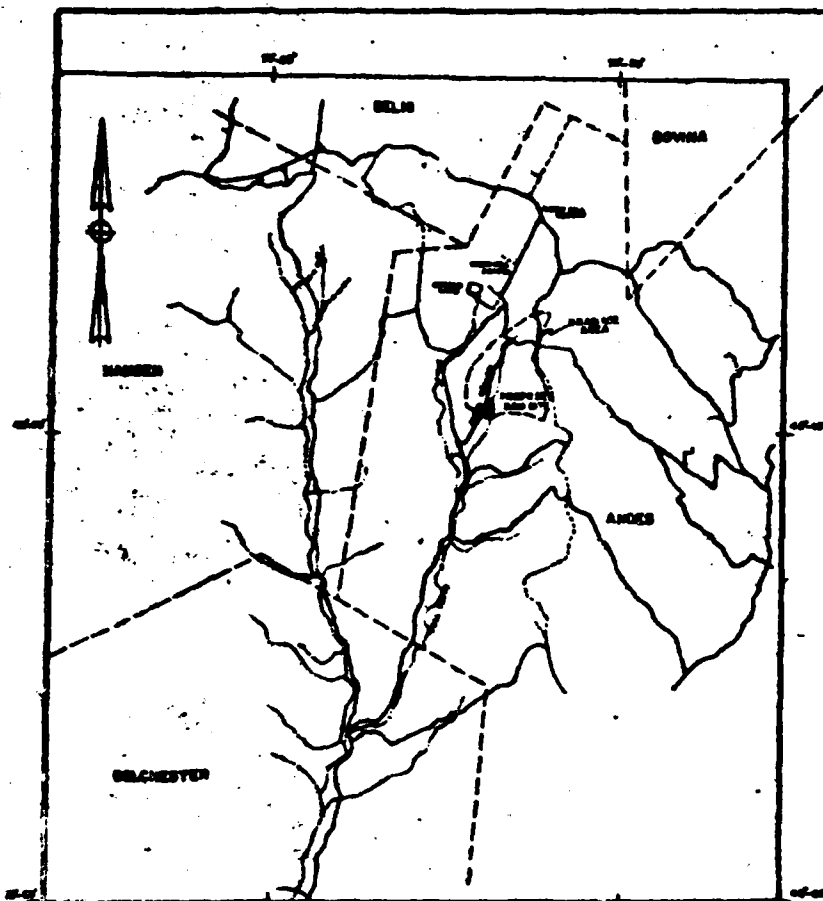


LAKE-LONGITUDINAL SECTION

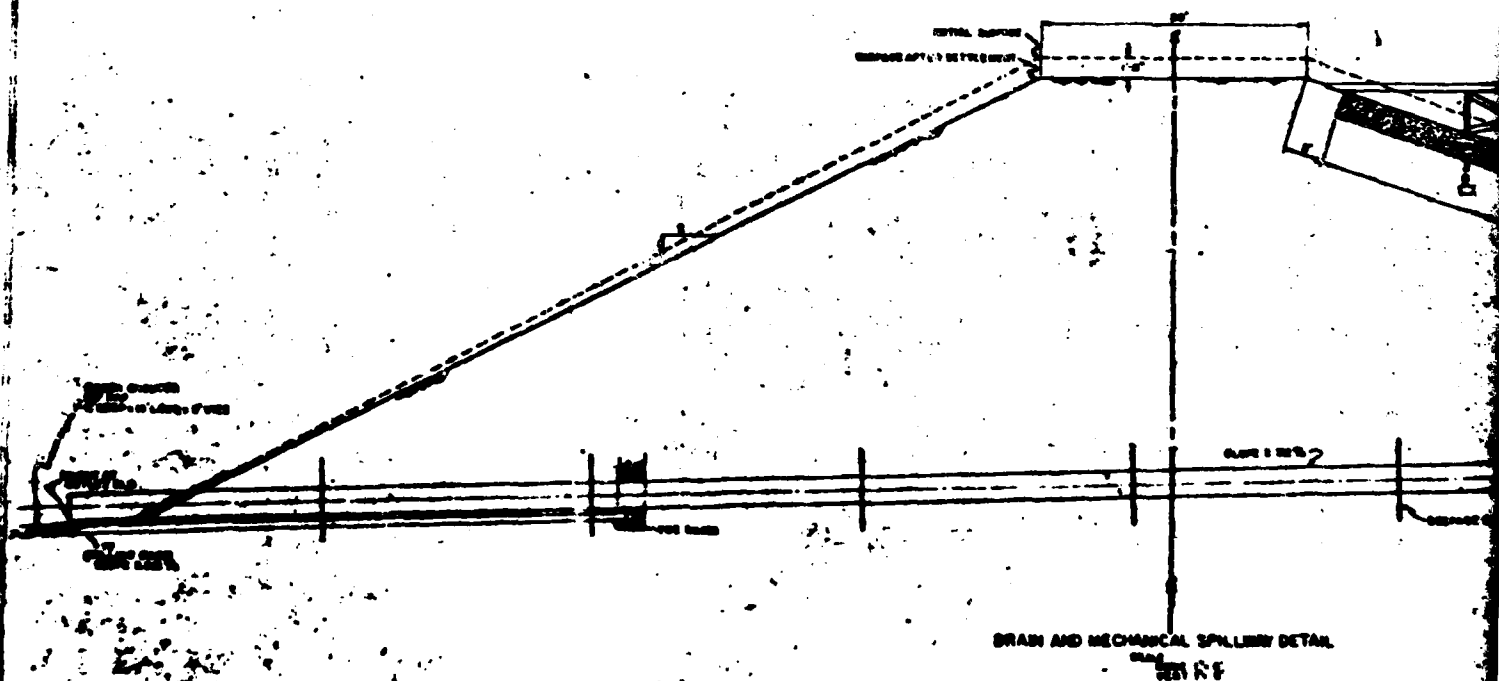
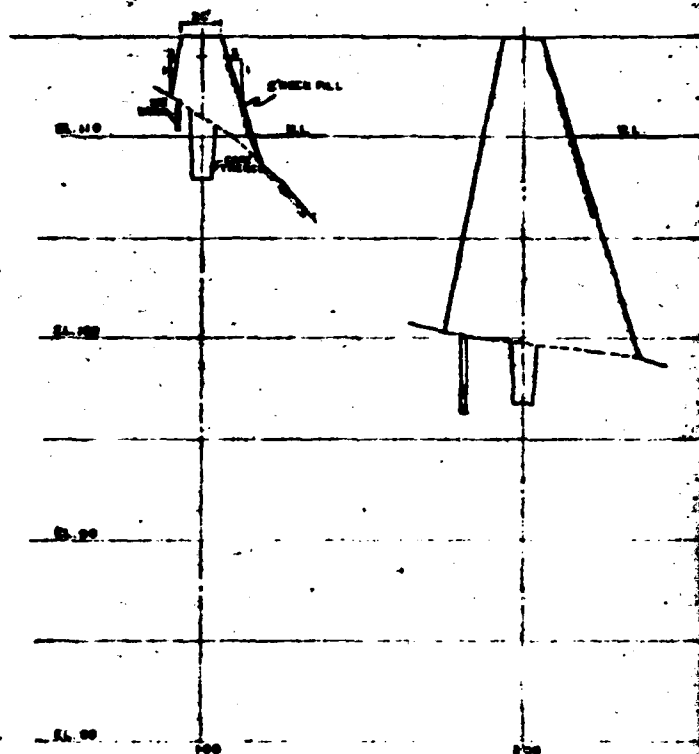


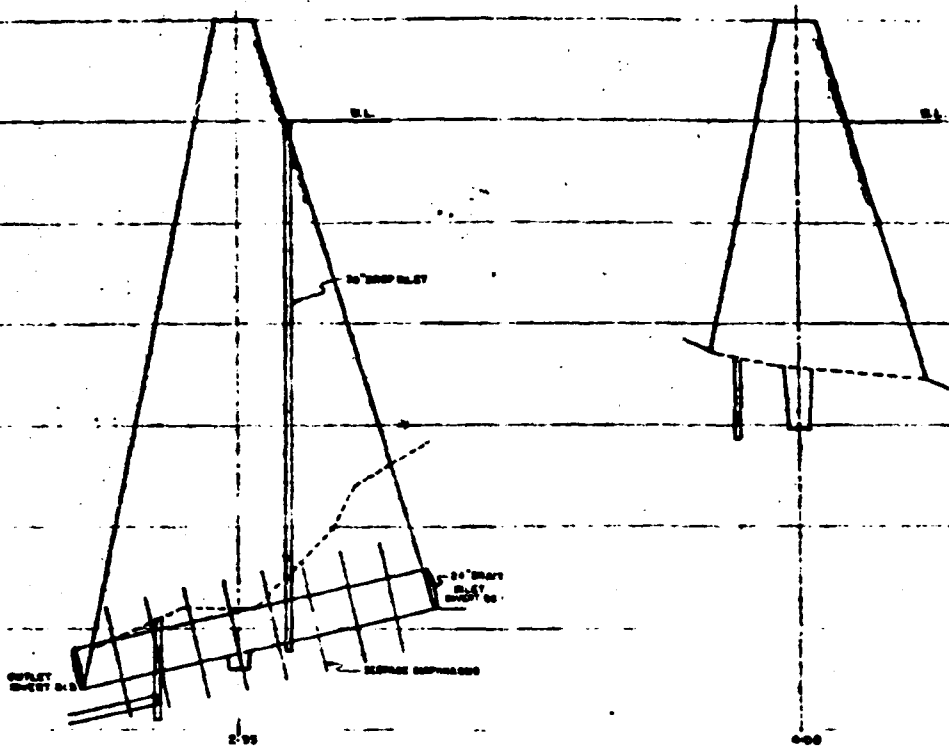
DAM & LAKE FOR ROBERT L. BISHOP BALDWIN - KALMUS ASSOCIATES ENGINEER SURVEYOR 410 CHESTNUT ST. ORCHARD, NY 13020		
CONSTRUCTION DETAILS		DATE JUNE 1968 DRAWING NO. 102-4
SCALE 1" = 100'	DRAWN BY E. V.	CHECKED BY E. L. B.

1.26



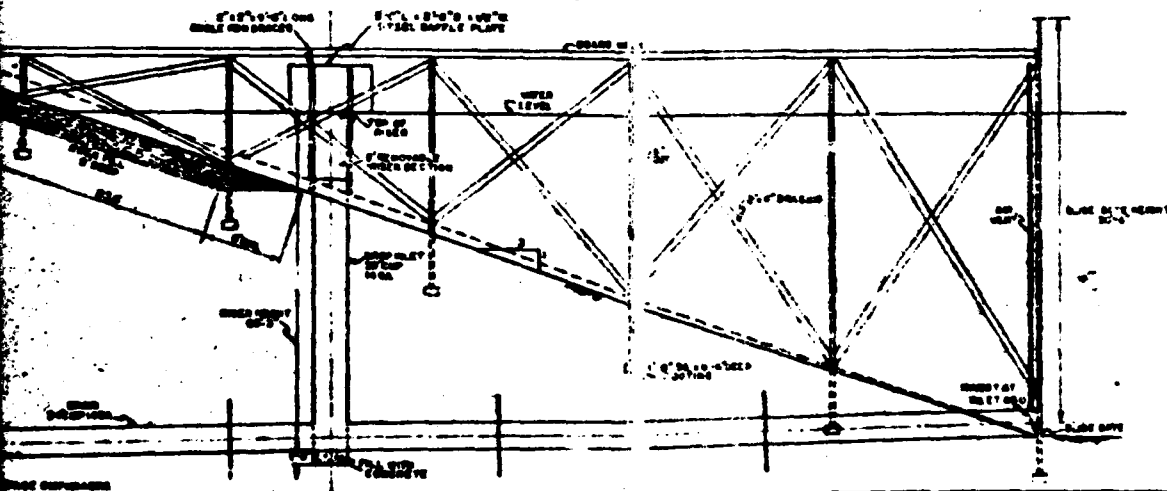
KEY LOCATION MAP
ANDER BRISTOL
SCALE 1:1000





DAM CROSS SECTIONS

SCALE
1/4\"/>



NOTES
1. ALL DIMENSIONS ARE IN FEET
2. ALL DIMENSIONS ARE TO BE TREATED AS APPROXIMATE
3. ALL DIMENSIONS ARE TO BE TREATED AS APPROXIMATE
4. ALL DIMENSIONS ARE TO BE TREATED AS APPROXIMATE



DESIGNED
BY R. L. BISHOP
DATE 6/1/60

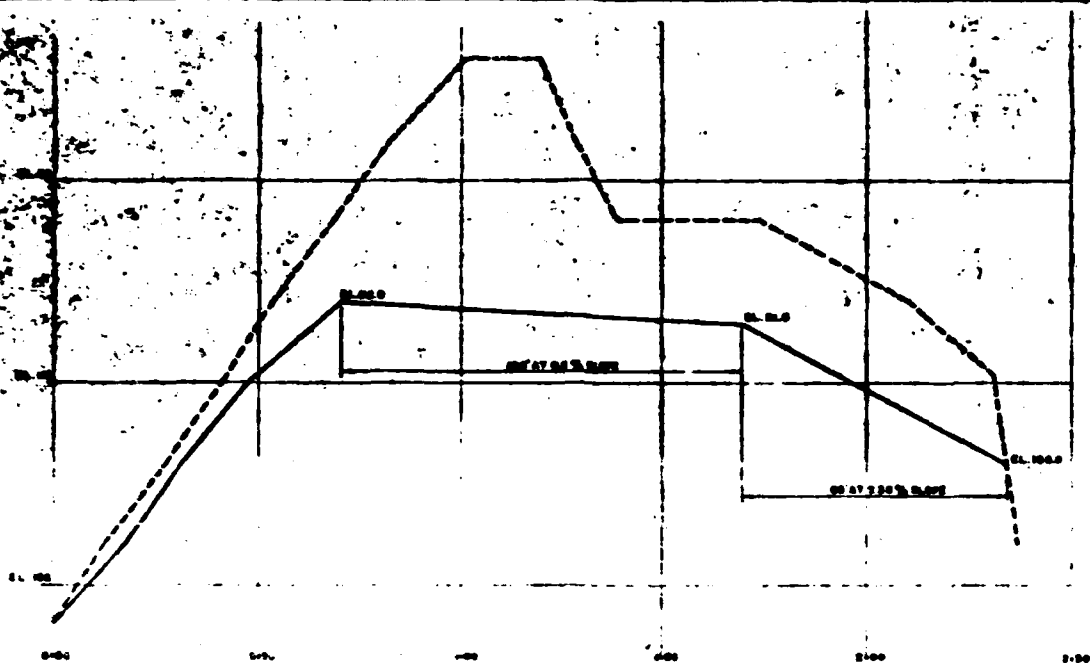
DAM & LAKE FOR ROBERT L. BISHOP

BALDWIN - KALMUS ASSOCIATES
ENGINEER SURVEYOR
418 CHESTNUT ST.
CHICAGO, ILL. 60602

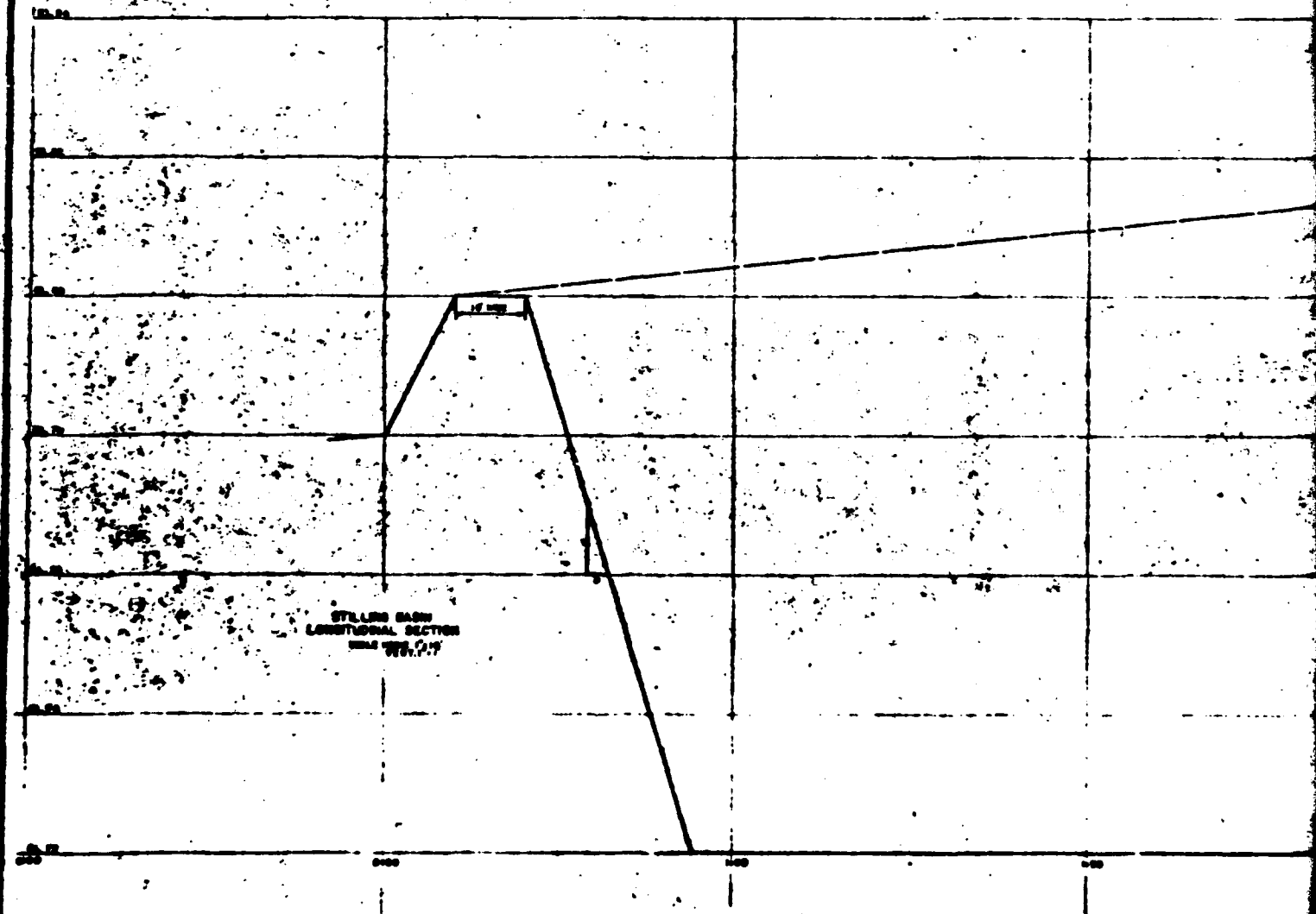
KEY LOCATION MAP AND CONSTRUCTION DETAILS

SCALE AS SHOWN DRAWN BY E. V. CHECKED BY S. L. B.

DATE
JUNE 1960
DRAWN BY
E. V.
CHECKED BY
S. L. B.



EMERGENCY SPILLWAY - LONGITUDINAL SECTION
SCALE 1" = 100'

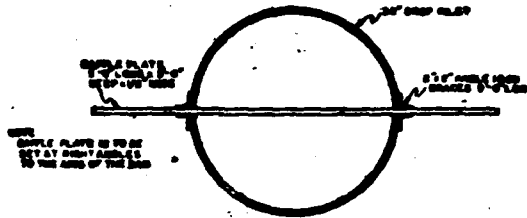


STILLING BASIN
LONGITUDINAL SECTION
SCALE 1" = 100'

CROSS SECTION OF
EMERGENCY SPILLWAY
SCALE 1"=20'



TOP VIEW OF
MECHANICAL SPILLWAY
SCALE 1"=1'

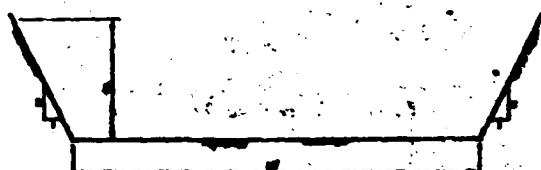


7'-0" DEEP x 10'-0" WIDE
AT THE END OF THE DAM
SCALE 1"=10'

8'-0" DEEP x 10'-0" WIDE
AT THE END OF THE DAM
SCALE 1"=10'

8'-0" DEEP
SCALE 1"=10'

CROSS SECTION DETAIL
SCALE 1"=1'



DAM & LAKE
FOR
ROBERT L. BISHOP

BALDWIN - KALBUS ASSOCIATES
ENGINEER SURVEYOR
440 CHESTNUT ST.
CHICAGO, ILL. 60620

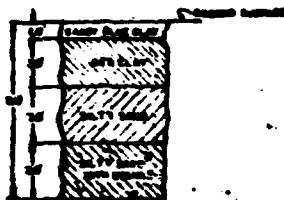
CONSTRUCTION DETAILS

DATE
JUNE 1965
DRAWN BY
TMS-G

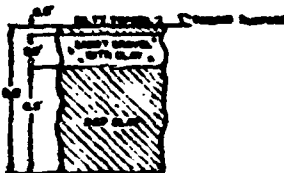
DATE
AS SHOWN
SCALE
1"=1'

2

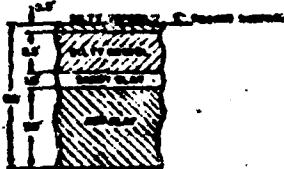
TEST HOLE NO. 1



TEST HOLE NO. 2



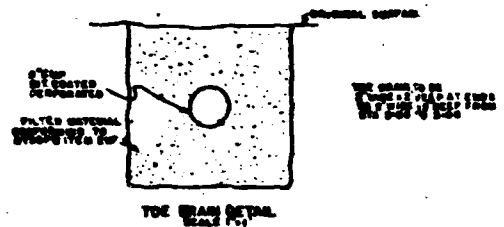
TEST HOLE NO. 3

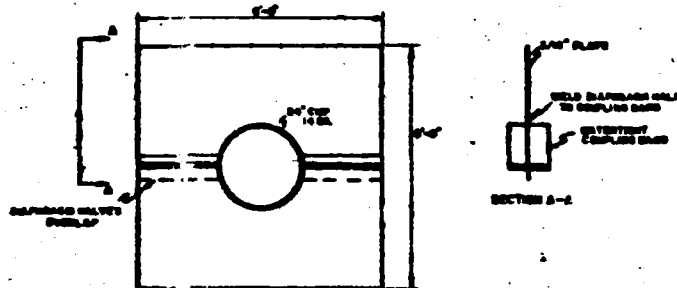


TEST HOLE NO. 4



SECTIONS OF TEST HOLES
SCALE 1/4" = 10'





SEE THE DIAPHRAGM DETAILS
SCALE 1/2\"



DROP INLET DETAIL

SCALE 1/2\"

SEE THE DAM & LAKE CONSTRUCTION
1 - 100-7



SEVEN
200 0.000

DAM & LAKE	
F.P.D.	
ROBERT L. BISHOP	
BALDWIN - KALMUS ASSOCIATES ENGINEER SURVEYOR 600 CHESTNUT ST. NEW YORK, N.Y. 10036	
CONSTRUCTION DETAILS	DATE JUNE 1966
	REVISION NO. 1000-7
TOTAL AS SHOWN	REVISION BY E.C.
CHECKED BY S.A.S.	