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ELECTRIC BROOK, MORRIS COUNTY,
NEW JERSEY.

National Dam Safety Program

GEORGE LAKE DAM

(NJ 00825)

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**PHASE 1 INSPECTION REPORT,
NATIONAL DAM SAFETY PROGRAM**

(15) DACW 61-79-C-0011

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DEPARTMENT OF THE ARMY

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

12 MAY 1981

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for George Lake Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, George Lake Dam initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in satisfactory overall condition. The dam's spillway is considered inadequate because a flow equivalent to 33 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial actions should be initiated:

(1) Selective removal of trees and brush on the upstream and downstream embankment slopes to lessen the piping potential.

(2) Repair of spalled concrete and repointing of masonry at the spillway.

(3) Removal of silt from the upstream face of the spillway and dam.

c. Periodic inspection of the dam and appurtenant structures should be included in the existing maintenance program.

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Honorable Brendan T. Byrne

d. Surface creep on the downstream slope should continue to be monitored and corrected when necessary.

e. The blow-off valve should be opened periodically to ensure proper functioning and to keep the intake area free of excessive siltation.

f. An emergency action plan and downstream warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:

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GEORGE LAKE DAM (NJ00825)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 21 August 1980 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

George Lake Dam initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in satisfactory overall condition. The dam's spillway is considered inadequate because a flow equivalent to 33 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial actions should be initiated:

(1) Selective removal of trees and brush on the upstream and downstream embankment slopes to lessen the piping potential.

(2) Repair of spalled concrete and repointing of masonry at the spillway.

(3) Removal of silt from the upstream face of the spillway and dam.

c. Periodic inspection of the dam and appurtenant structures should be included in the existing maintenance program.

d. Surface creep on the downstream slope should continue to be monitored and corrected when necessary.

e. The blow-off valve should be opened periodically to ensure proper functioning and to keep the intake area free of excessive siltation.

f. An emergency action plan and downstream warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: *James G. Ton*

JAMES G. TON

Colonel, Corps of Engineers
District Engineer

DATE: *8 May 1981*

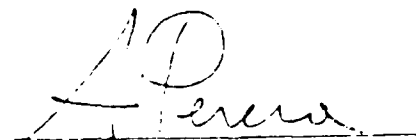
PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam George Lake Dam Fed ID# NJ 00825
and NJ ID# 127

State Located New Jersey
County Located Morris
Coordinates Lat. 4047.9 - Long. 7447.1
Stream Electric Brook a.k.a. Stony Brook
Date of Inspection 21 August, 1980

ASSESSMENT OF
GENERAL CONDITIONS

George Lake Dam is assessed to be in satisfactory overall condition. The discharge capacity of the main and auxiliary spillways is inadequate, however, being able to accommodate only 32% of the 100-year frequency design storm, and overtopping could occur. However, while overtopping would cause considerable damage to the dam and some downstream property, it is improbable that loss of life would result. It is therefore recommended that this dam be downgraded to the significant hazard category. Remedial actions to be undertaken in the near future include repair of main spillway concrete and masonry, removal of trees from the embankment, and removal of silt from the upstream face of the dam. It is further recommended that more precise H&H studies be performed and that the owner develop (1) written periodic maintenance plans and operating procedures, (2) an emergency action plan, and (3) a downstream warning system.


Abraham Perera P.E.
Project Manager



OVERVIEW OF GEORGE LAKE DAM
AUGUST, 1980

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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 can be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I investigations is to identify expeditiously those dams that may pose hazards to human life or property. The assessment of the general condition of the dam is based on 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 the review of 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. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway test flood is based on the estimated "probable maximum flood" for the region (greatest reasonable possible storm runoff) or fractions thereof. 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 INSPECTION PROGRAM
NAME OF DAM: George Lake Dam FED #NJ 00825
AND NJ ID # 127

SECTION 1 PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The state, in turn, is under agreement with the U.S. Army Corps of Engineers, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the George Lake Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

George Lake Dam, a.k.a. Camp Washington Dam, is a 230-foot-long earth structure with a masonry corewall and a 50-foot-long narrow-crested concrete spillway at the right abutment. This ogee-type structure constricts to about 26 feet about 30 feet downslope. At the constriction, the gradient steepens from 15 to about 38 degrees. An 8-foot-long horizontal apron is located at the toe of the structure. The embankment, which has a maximum height of about 29.5 feet, is 9 feet wide at the crest with 2H:IV and 1.5H:IV slopes upstream and downstream respectively. A slight saddle located at the junction of the dam crest and left abutment appears to have been designed as an auxiliary spillway. A 24-inch-diameter CI drain is located about 125 feet from the left abutment. This outlet presumably has a drop inlet

structure located below the lake level elevation and is controlled from a valve chamber located in the center of the dam crest. The outlet structure consists of a 4.75-foot-high headwall with 4-foot-long wingwalls on the downstream toe of the embankment.

b. Location

George Lake Dam is located on Electric Brook about one mile upstream from its confluence with the South Branch Raritan River. The site is 300 feet east of Camp Washington Road at a point about 2,200 feet north of the junction of that road with Route 24 in the town of Long Valley, Morris County, New Jersey.

c. Size Classification

George Lake Dam is approximately 29.5 feet high and impounds an estimated 88 acre-feet of water at maximum pool elevation. Based on the Recommended Guidelines for Safety Inspection of Dams, this dam is in the small size category.

d. Hazard Classification

George Lake Dam is located in a sparsely populated area of Morris County, New Jersey. Immediately below the dam, the stream descends through a rocky gorge dropping about 300 feet in half a mile. At the foot of the gorge, the valley widens rapidly into the main valley of the South Branch of the Raritan River, where nine homes are located within 300 feet of the stream. The dam experienced failures of varying degrees of intensity on four occasions between its original construction in 1908-09 and August 1942. Although none of the failures resulted in very serious damage to dwellings in the downstream valley, it is believed that new construction in the valley and people using the hiking trails downstream of the dam could be endangered in the event of a sudden failure. In order to verify the hazard classification, a breach analysis was performed assuming a 15-foot-wide break developing within one hour. A maximum flood stage of 4 feet within the stream was developed immediately below the dam and dissipated to 2.2 feet in the area of the

homes 3,000 feet downstream. Accordingly, it is recommended that the dam be downgraded to a significant hazard classification.

e. Ownership

George Lake Dam is currently owned by the Morris County Park Commission, Court House, Morristown, New Jersey, 07960.

f. Purpose of Dam

George Lake Dam is utilized solely for recreational purposes.

g. Design and Construction History

The dam was originally built by the Kennedy Electric Company in 1908-09 under the supervision of the New Jersey Engineering and Construction Company of Morristown, New Jersey. The original dam, which was a 2,100-foot-long timber-crib rock fill structure with a concrete corewall, failed in October 1927, and the existing dam was constructed in 1928. The dam was overtopped in 1940, motivating a one foot increase in the height of the dam to provide additional freeboard. The dam was again overtopped in 1942, prompting the state to request construction of an auxiliary spillway at the left abutment.

h. Normal Operational Procedures

The only regulating device at George Lake Dam is the 24-inch CI drain located near the center of the dam. This is utilized to regulate the elevation of the lake during the recreational summer months and to lower the lake level, if necessary, to prevent ice damage during the winter.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area for George Lake Dam is 2.9 square miles, which consists primarily of undeveloped woodlands with a few small, isolated residential developments.

- b. Discharge at Damsite
Maximum known flood at damsite - 1,850 cfs (1942)
Spillway capacity (at maximum pool elevation) - 1,175 cfs
- c. Elevation (ft. above MSL)
Top dam - +925.5
Recreation pool - +922.0
Spillway crest - +922.0
Streambed at centerline of dam - 876±
- d. Reservoir
Length of maximum pool - 990 feet
Length of recreation pool - 775 feet
- e. Storage
Recreation pool - 45± acre-feet
Top of dam - 88± acre-feet
- f. Reservoir Surface
Top dam (max. pool) - 9.1 acres
Recreation pool - 4.6 acres
- g. Dam
Type - Earth embankment with a concrete spillway
Length - 230 feet
Height - 29.5 feet
Top width - 9 feet
Side slopes - 2H:IV, 1.5H:1V
Zoning - Unknown
Impervious core - Unknown
Cutoff - Masonry corewall to bedrock or impervious till
Grout curtain - None recorded
- h. Diversion and Regulating Tunnel
None

i. Spillway

Type - concrete ogee-type weir
Total length of weir - 50 feet
Crest elevation - +922.0
U/S channel - None
D/S channel - Natural stream

j. Regulating Outlets

24-inch CI drain at approximately exit invert
elevation 898.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No plans, design drawings, or calculations were available for the evaluation of George Lake Dam. However, several pages of specifications detailed the manner in which the dam was to be constructed. Additionally, the Report on Dam Application prepared by the State Department of Conservation and Development provided pertinent data with respect to dimensions and features of the dam, although some of the information therein was found to be erroneous due to subsequent repairs and modifications.

2.2 CONSTRUCTION

As indicated previously, construction specifications were available for review by the inspection team, as were construction inspection reports prepared by an engineer from the State Department of Conservation and Development. In addition, subsequent inspection reports and modifications to the dam provide a continuity of construction events at the dam from 1928 to 1948. Inspection reports pertaining to the dam's construction in 1928 indicate that the corewall rests on the Precambrian gneiss bedrock from the east abutment to a point 90 feet to the west, where glacial till provides the footing until the west abutment is reached. The gneiss is a hard and durable gray to white granitoid basement rock prevalent in northern New Jersey. The glacial ground moraine is a dense, pre-consolidated heterogeneous mixture of earth and stone resembling, in some areas, a natural, semi-lithified concrete.

2.3 OPERATION

No records of formal operations at the dam were located. Communication with representatives of the present owner indicates that Morris County Park Commission personnel do regulate water levels at the lake and are available all year around for this function, although no codification of this operation exists at the present time.

2.4 EVALUATION

a. Availability

While none of the dam design, construction, drawings, or calculations were available, inspection reports and construction specifications reviewed in conjunction with, and confirmed by, visual inspection, aided in performing an analysis of the hydraulic capacity and structural integrity of the dam.

b. Adequacy

Assuming the validity of information available for review by the inspection team, the data are considered adequate to perform a cogent assessment of the dam's existing condition and capacity.

c. Validity

While the field investigation substantiates the accuracy of most of the available engineering data, some uncertainties exist with respect to elevations and configurations of some of the dam's features. Correspondence dated 1972 put the elevation of the spillway crest at 902, which would make the dam crest 905.5. Correspondence from the 1920s indicates that the dam crest is about at elevation 915. This latter figure is substantiated by the U.S.G.S. quadrangle map, which shows the 920-foot contour terminating in the vicinity of the dam. Subsequent construction raised the dam crest to the existing elevation. Other correspondence indicates that the auxiliary spillway channel crest elevation would be 3 inches higher than the principal spillway crest (i.e., 3.25 feet below dam crest elevation). However, the saddle at the left abutment, if it actually is an auxiliary spillway, appears to be on the order of only 1 to 1 1/2 feet below dam crest elevation. The drop inlet was not seen by the inspection team. Consequently, no data are available with respect to the opening dimensions. While the "Report on Dam Application" indicates that both embankment slopes are 2H:IV, field measurements indicate that the downstream slope

is about 1.5H:1V. Inspection reports indicate that this slope was built a little steeper than it was designed, and later modifications, consisting of raising and widening the dam crest, would accentuate the slope gradient.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of George Lake Dam took place on August 21, 1980. At the time of the inspection, about 2 inches of water was passing over the spillway weir. The state of the dam and appurtenant structures was found to be generally fair with no seriously detrimental conditions noted.

b. Dam

The embankment extends approximately 180 feet from the spillway to the relatively steep valley wall forming the left abutment. Modifications to the dam included raising and widening the dam crest slightly, which resulted in a somewhat steeper downstream slope than originally designed. However, vegetation and the use of heavy stone riprap at the toe seems to have mitigated the effects of erosion due to higher velocity runoff. Two exceptions were noted in the area directly above the 24-inch CI drain and adjacent to the spillway's left sidewall. However, while both these areas are devoid of vegetation, the earth is well compacted and erosive forces are not cutting at a very rapid pace. Consequently, it is believed the erosion is due primarily to foot traffic rather than surface runoff. Surface cover on both slopes consists of brush and of trees up to 12 inches in diameter with little substantial grass cover. The dam crest has, with the exception of a slight saddle at the left abutment, a fairly uniform horizontal and vertical alignment and is covered with gravel, providing a path across the valley. The heavy stone riprap at the toe seems to offer excellent stability to the embankment. No seepage or slumping was noted, although the growth angle of some trees on the downstream slope indicates that creep has been, and continues to be, a local on-going, although not critical, process.

c. Appurtenant Structures

The spillway appears to be in fairly good alignment and condition. Light surface spalling of the overflow slab was noted on the steeper portion of the spillway where flow velocities, and consequently cavitation effects, are greater. The masonry sidewalls, concrete caps, and sidewall/spillway-slab junction all appear to be in good condition with the exception of the footwall on the right side of the spillway apron, where more severe concrete deterioration has taken place. However, since this wall is footed on, abuts, and is towered over by a massive bedrock outcrop, the deterioration is of none but aesthetic consequence. The footbridge over the spillway is supported on the sidewalls and one narrow pier, offering little constriction to flows prior to a dam overtopping. The gate valve to the 24-inch CI drain could not be inspected since the access cover to the manhole was bolted shut. However, this unit is believed to be in good operable condition since the lake level is reportedly regulated periodically during the year. Water level at the outfall covered two-thirds of the outlet pipe, but it is not certain if this flow was emanating from the pipe or was seeping laterally through the riprap from the principal spillway outlet located about 60 feet to the right of this channel. The portion of the masonry headwall visible appeared in fairly sound condition.

d. Reservoir

The upstream (northwest) area of the lake has a gently wooded slope, whereas the valley walls on both sides of the lake are somewhat steeper and form a gorge in the area of the dam. With the exception of a few buildings and recreational facilities belonging to the Morris County Park Commission, the area immediately around the lake is undeveloped and heavily wooded. Sedimentation in the vicinity of the spillway has filled the lake to within two feet of the spillway crest. Correspondence indicates that heavy siltation has been a problem in the past since the owner requested state permission to use dynamite in an attempt to loosen silt from around the inlet structure for the 24-inch drain.

e. Downstream Channel

The downstream channel follows a narrow, deep, steep-sided gorge to the South Branch Raritan River Valley. The gorge is heavily wooded and boulder strewn along the stream channel. The floor of the gorge averages about 50 feet in width and is from 80 to 180 feet deep, while the slopes of the valley sidewalls range from 1.5H:IV to 2H:IV. About 3,500 feet downstream, the channel passes under Fairview Avenue, where the river enters the South Branch Raritan River Valley.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal operational procedures in effect at George Lake Dam at this time. While there are generally caretaker personnel of the Morris County Park Commission available in the park area on a full-time basis, no set procedures other than upkeep are employed at the dam. When the elevation of the lake water level is regulated, it is in response to specific needs, such as protection from ice, supplementation of low downstream flows, and repair and cleaning of recreational facilities.

4.2 MAINTENANCE OF DAM

Aside from light surface erosion and concrete spalling, the satisfactory nature of the dam condition indicates an adequate caretaking operation. The grounds surrounding the dam were well manicured, and apart from the large trees, the dam itself was clear and well maintained.

4.3 MAINTENANCE OF OPERATING FACILITIES

As indicated in Paragraph 4.1 above, the lake is regulated periodically using the 24-inch drain at the center of the dam. In conjunction with regulation of the lake, the operating controls are routinely inspected, tested, and repaired when necessary.

4.4 DESCRIPTION OF WARNING SYSTEM

There is no formal monitoring system in effect at the lake at present, although camp and park personnel are at the site on a full-time basis and would notify downstream authorities in the event of an emergency situation.

4.5 EVALUATION

The lack of formalized operational procedures at this dam is not considered a serious deficiency since operations and maintenance are performed by attendant personnel on an "as-needed" basis. However, in view

of this dam's past history of overtopping, it is believed that park employees should be instructed to lower the lake level during extended periods of rainfall and a formal set of notification procedures established whereby downstream civil defense authorities or local police would be alerted in the event of impending dam failure or overtopping.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, George Lake Dam is small in size and is placed in the significant hazard category. Accordingly, a 100-year frequency event was selected as the design storm and an inflow hydrograph calculated using precipitation data from Technical Paper 40 and NOAA Technical Memorandum NWS Hydro-35. Inflow to the reservoir was calculated with the HEC-1 computer program to be 3,771 cfs. The routed discharge was computed to be a peak of 3,640 cfs. Combined capacity of the principal and auxiliary spillways is 1,175 cfs and is, therefore, able to accommodate 32 percent of the design flood.

b. Experience Data

The dam has a history of failure and overtopping (see Section 2). Since 1941, after the dam was increased in height by 1 foot and an auxiliary spillway was provided, no further overtopping was recorded. The calculated maximum capacity of discharge before overtopping was indicated as being 1,880 cfs on design documents, but reduction of the auxiliary spillway width reduced this figure to about 1,175 cfs.

c. Visual Observations

The lake level at the time of inspection was a few inches above the spillway crest. The depression next to the left abutment was measured and found to be approximately 30 feet long and 1.5 feet deep. No evidence was noted that would indicate damage caused by hydraulic or hydrologic action or events.

d. Overtopping Potential

The appended hydraulic analysis indicates that a considerable potential exists for overtopping, primarily because of the limited spillway capacity. The design flood would overtop the dam crest by approximately 1.93 feet.

e. Drawdown Potential

Using the 24-inch-diameter CI pipe in the dam embankment, it would take approximately 15.5 hours to lower the lake to elevation 907.0.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation

Based on the field inspection, the structural stability of the dam is considered adequate, although further deterioration of the spillway surfaces can be expected in the future unless the deteriorated concrete surfaces are repaired. In particular, heavy spalling was noted on the right sidewall near the bottom of the spillway. Along both sidewalls, several separations were noted in the joints of the masonry underlying the concrete. While these defects are not a cause for immediate concern regarding the structural stability of the dam, they should not be left unattended in the future.

b. Design and Construction Data

The available official correspondence on this dam and the present inspection indicate that the dam was reconstructed following its failure in 1927 and that it overtopped in 1940 and 1942 with considerable damage caused each time. Since 1942, following the increase in the height of the dam and provision of an auxiliary spillway, no further overtopping has been recorded, although in 1949 the dam required the removal of silt at the upstream end of the outlet and repairs because of leakage and cracks in the spillway.

c. Operating Records

Written operating records are non-existent.

d. Post Construction Changes

According to available documentation of the dam, several modifications and repairs were undertaken at this site up to 1942. Although no engineering plans, with exception of one sketch of the dam cross section, were available to describe the construction changes made, sufficient written description is given in the past correspondence on the dam to indicate, with adequate detail for the purposes of this inspection, the changes that were made.

e. Seismic Stability

The dam is located in Seismic Zone 1, and because of its embankment height-width ratio, it is negligibly vulnerable to earthquake loading intensities as it is statically stable. Experience indicates that dams in Zone 1 will be adequately stable under dynamic loadings if they are stable under static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/
PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, George Lake Dam is classified as being in fair overall structural condition, although the spillways are incapable of passing the design flood. On the basis of available information, the dam embankment is believed to be sufficiently impervious to withstand normal hydraulic heads. The present spillway capacity does not meet the requirements of the Recommended Guidelines for Safety Inspection of Dams, as it is able to accommodate only 32 percent of the design flood as calculated by Corps of Engineers criteria. The calculated spillway design flood would overtop the dam by 1.93 feet, causing damage primarily to the downstream face.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the structural stability of the dam.

c. Urgency

It is recommended that the remedial measures enumerated below be undertaken in the near future.

d. Necessity for Further Study

Since the spillway capacity is inadequate, it is recommended that more precise H&H studies be undertaken. Should modifications to increase the spillway capacity of the dam be contemplated, additional engineering studies would also be required.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

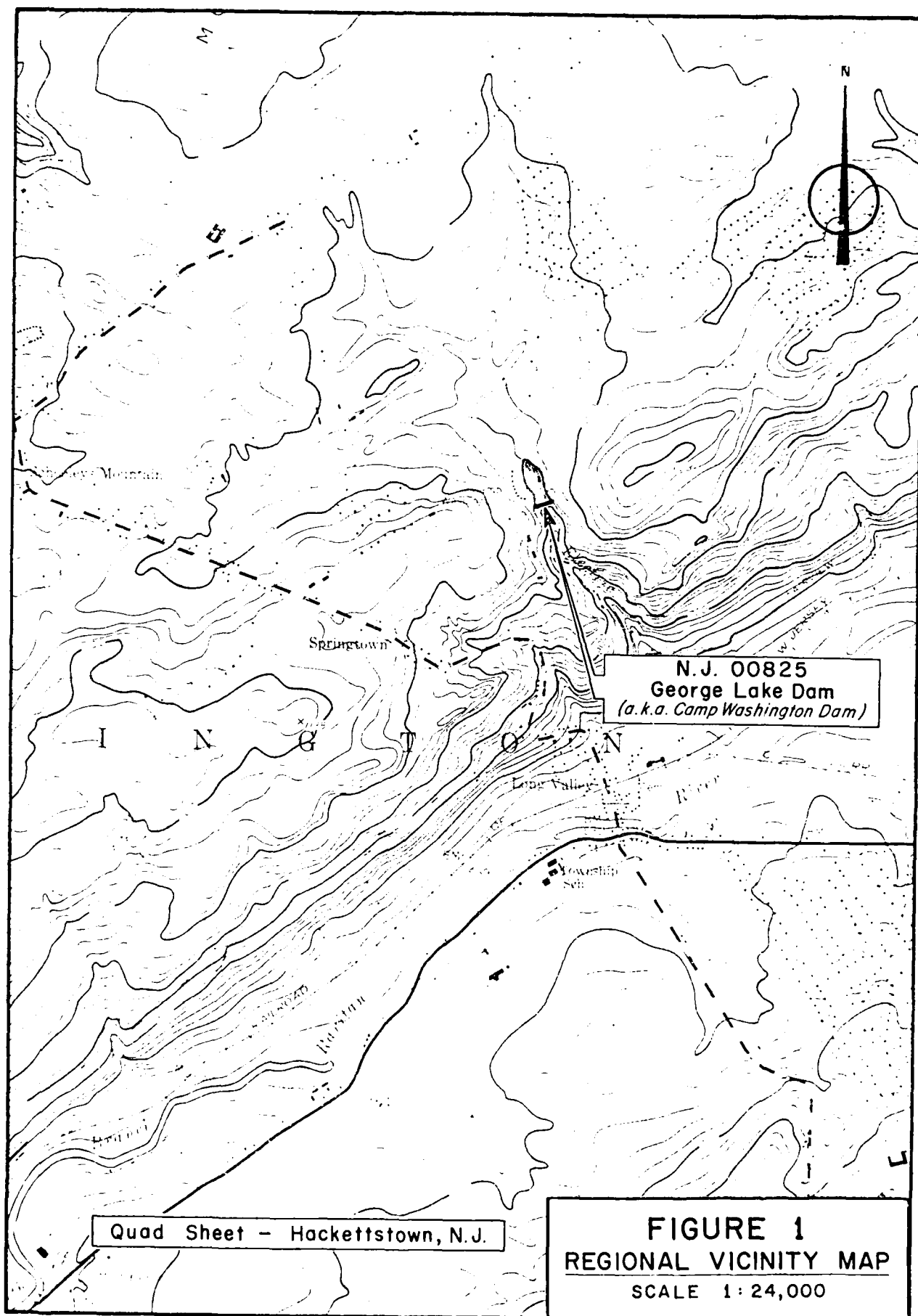
a. Recommendations

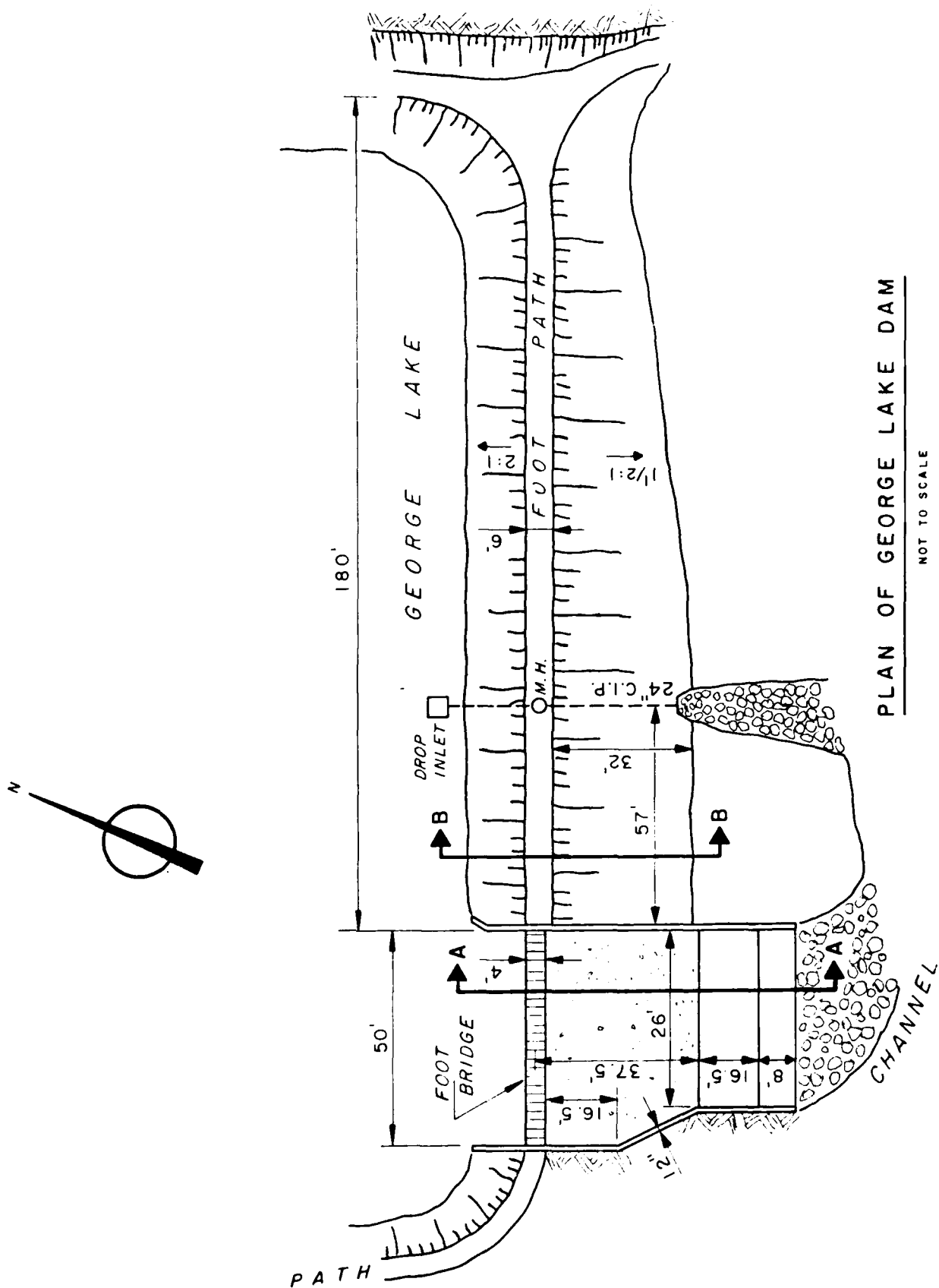
Remedial measures that should be considered as being part of the normal maintenance of the dam and implemented in the near future include:

1. Selective removal of trees and brush on the upstream and downstream embankment slopes to lessen piping potential.
2. Repair of spalled concrete and repointing of masonry at the spillway.
3. Removal of silt from the upstream face of the spillway and dam.

b. O&M Maintenance and Procedures

The present maintenance program is considered satisfactory within the limits of the program. However, periodic inspection of the dam and appurtenant structures should be included in the program. In this respect, the surface creep on the downstream slope and the spillway deterioration should continue to be monitored and corrected when deemed necessary. It is recommended that the blow-off valve be opened periodically to ensure its proper functioning and to keep the intake area free of excessive siltation. It is further recommended that the owner of the dam develop an emergency action plan (EAP) and warning system to minimize the potential for flood damage downstream. As a minimum, the EAP should include the release of water through the blow-off in anticipation of, or during, severe storms and excessive runoff.





PLAN OF GEORGE LAKE DAM

NOT TO SCALE

FIGURE 2

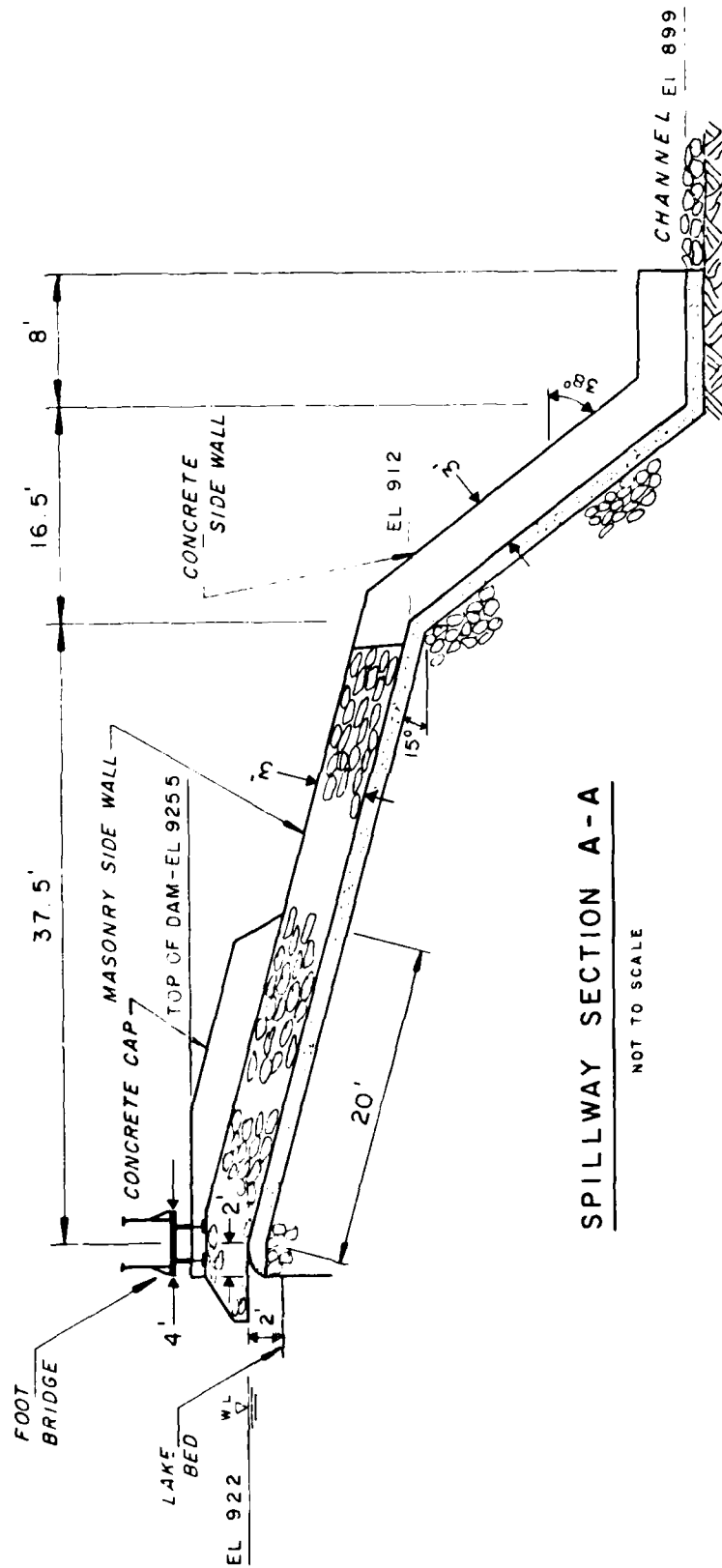
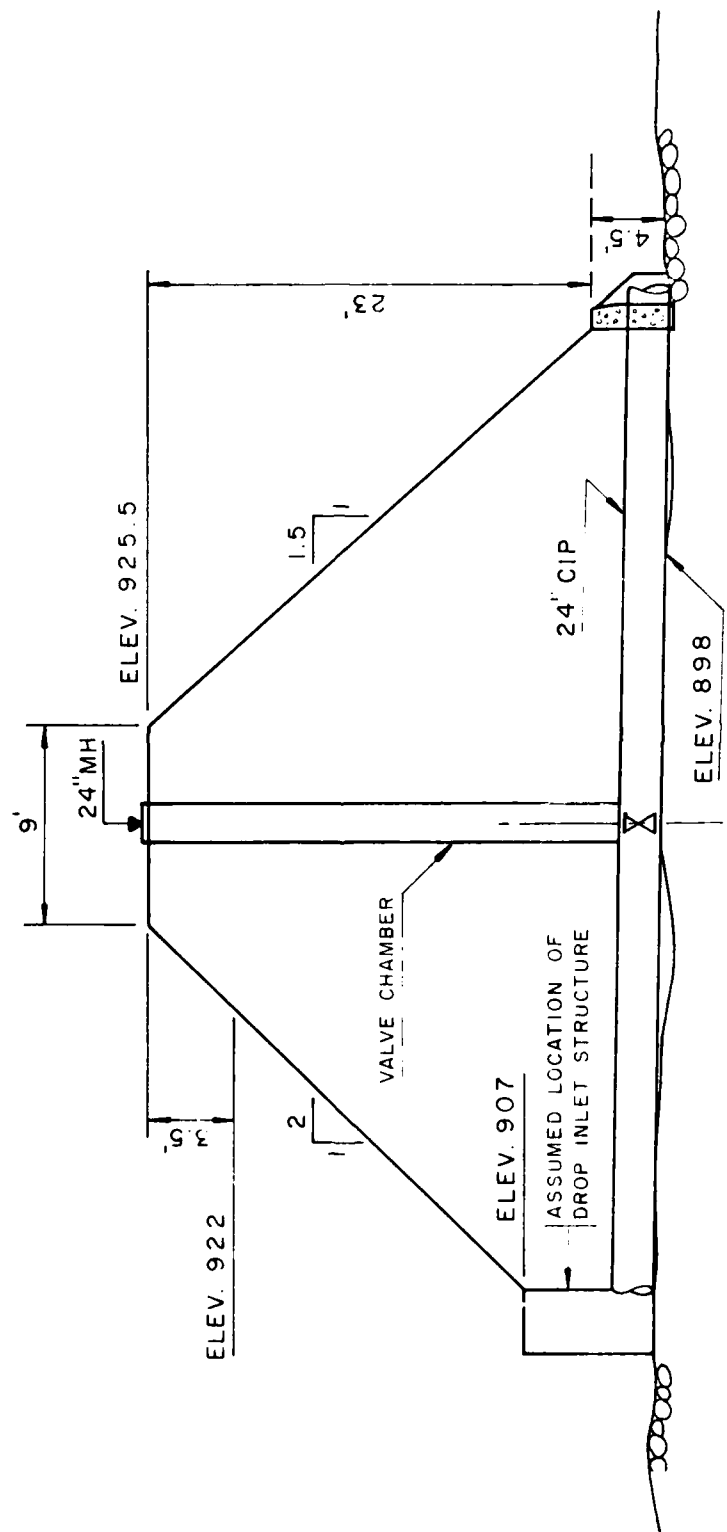


FIGURE 3



TYPICAL DAM SECTION B - B

SHOWN SCHEMATICALLY (NOT TO SCALE)

FIGURE 4

Check List
Visual Inspection
Phase I

Name Dam George Lake Dam County Morris State New Jersey Coordinates N.J.D.E.P.

Date(s) Inspection 21 Aug. 1980 Weather Clear Temperature 80°

Pool Elevation at Time of Inspection 902.1 M.S.L. Tailwater at Time of Inspection 879 M.S.L.

Inspection Personnel:

A. Perera T. Chapter

J. Greenstein

R. Lang

T. Chapter Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ADJACENT SLOPES	Some erosion in area of outlet pipe and left sidewall of spillway. Angle of tree growth indicates some localized creep has occurred in past and may still be in progress.	Very large stone on bottom half of slope and toe appear to have been placed to stop erosion or sloughing. Embankment has stabilized. Creep is so slow as to be insignificant.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment is satisfactory. Slight saddle at left abutment appears to be auxiliary spillway. Vertical alignment satisfactory. Slopes are 4:1 m. No distortion noted.	Later conversation with caretaker confirms crest saddle is auxiliary spillway.
RUPRAP FAILURES	4/3	ii

EMBANKMENT

VISUAL EXAMINATION OF CONSTRUCTION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	Brush and trees up to 12 inches in diameter on both slopes. Grass cover is spotty.	Heavy growth should be cleared and thicker more durable grass cover established.
SECTION OF EMBANKMENT AND ALLEVIANT, SPILLWAY AND DAM	Satisfactory - No cracking, separation or detrimental conditions noted with exception of spillway left footwall and embankment toe where toe/channel transition is rather sharp.	More stone should be placed along toe at the left side of the head of the spillway channel.
ANY NOTICEABLE SEEPAGE	No noticeable seepage on slopes or along toe. However, runoff from the spillway channel may be moving laterally through stone at toe to the outlet pipe channel.	Lateral water movement at toe is not considered significant if it exists. Outlet pipe is jammed partially open. Material causing jam later removed by flushing.
STAFF GAGE AND RECORDER	None	
REMARKS	Unknown	

OUTLET WORKS

TYPE AND EXTENT OF DAMAGE	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit not observed.	
INTAKE STRUCTURE	Not observed. Below lake level about 50 feet upstream from crest.	
OUTLET STRUCTURE	Masonry head and wingwalls. Satisfactory condition. Outlet pipe and channel about 2/3 full of water. Light erosion around wingwalls.	Valve was determined to be partially open. Condition subsequently corrected.
OUTLET CHANNEL	Well defined, very stony bottom with gentle stone covered side slopes and considerable vegetation on valley floor. Some bank erosion.	Channel condition is satisfactory.
EMERGENCY GATE	Not observed. Gate valve located in sealed manhole.	Reportedly operated periodically during the year.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good alignment. No appreciable concrete deterioration at crest. Steeper portion of spillway slab exhibits light cavitation spalling. Foot of right sidewall shows greater concrete deterioration.	Sidewall abuts bedrock so concrete patching only necessary for aesthetics. Spillway slab should be monitored for additional wear but repair is unnecessary at this time.
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Well defined, very stony channel follows right side of valley. Vertical bedrock wall on right changing to steep rocky, vegetated slope downstream. Joined by outlet channel about 200 feet downstream.	
BRIDGE AND PIERS	Footbridge over crest with narrow pier in center.	Bottom of bridge soffit is at crest elevation of dam. Bridge would not restrict flow until dam is overtopped. Pier is about 1 foot wide. Only slight restriction to flow.
	v	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gently sloping wooded area to northwest of lake. Northwest and southwest side of lake somewhat steeper. Undeveloped park area. Beach and bathhouse on shore.	
SEDIMENTATION	Lake silted up to within 2 feet of spillway crest at this location.	When lake is next lowered, the silt in front of the spillway should be removed to reduce the load on that structure.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Very rocky, narrow, deep gorge extends from dam to Long Valley. Drops about 300 feet in elevation in half a mile.	
SLOPES	Steep sided, heavily wooded, uninhabited valley side slopes.	
APPROXIMATE NO. OF HOMES AND POPULATION	Nine homes are located within 300 feet of Electric Brook in Long Valley. These homes are situated 1000 feet downstream of the Schooley Mountain gorge in an area where the stream is flowing across a broad valley enroute to its confluence with the South Branch Raritan River. A flood wave exiting the gorge would be attenuated by the broad valley floor.	Some cellar flooding reported as result of previous dam break.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Not Available
REGIONAL VICINITY MAP	Available - U.S.G.S. Quad Sheet - Hackettstown, New Jersey
CONSTRUCTION HISTORY	Available - microfilm, N.J.D.E.P., Prospect Street, Trenton, N.J.
TYPICAL SECTIONS OF DAM	Not Available
HYDROLOGIC/HYDRAULIC DATA	Not Available
OUTLETS - PLAN	Not Available
- DETAILS	Not Available
- CONSTRAINTS	Not Available
- DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available

ITEM	REMARKS
SPILLWAY PLAN	Not Available
SECTIONS	Not Available
DETAILS	Not Available
OPERATING EQUIPMENT PLANS & DETAILS	Not Available

ITEM	REMARKS
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DESIGN REPORTS

Not Available

GEOLOGY REPORTS

Available - Rutgers Engineering Soil Survey

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Not Available
Not Available
Not Available
Not Available

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Not Available
Not Available
Not Available
Not Available

POST-CONSTRUCTION SURVEYS OF DAM

Not Available

BORROW SOURCES

Not Available

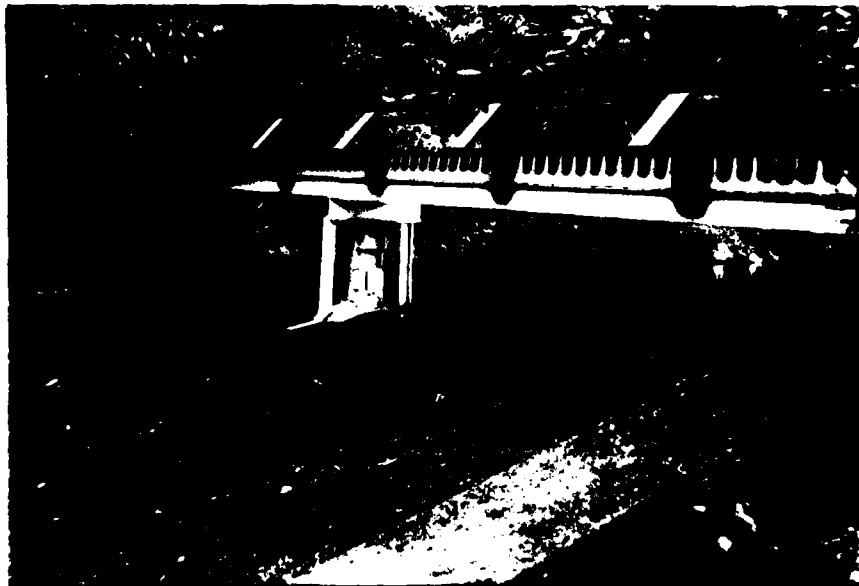
x

ITEM	REMARKS
MONITORING SYSTEMS	None Available
MODIFICATIONS	Available - Described in N.J.D.E.P. microfilm
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Available - Described on N.J.D.E.P. microfilm Available - Described on N.J.D.E.P. microfilm Available - Described on N.J.D.E.P. microfilm
MAINTENANCE OPERATION RECORDS	Available - Described by owner's representative Available - Described by owner's representative Not Available



View of Principal Spillway

August, 1980



View of Spillway Crest

August, 1980



August, 1980

View of Dam Crest from Principal Spillway



August, 1980

View of Downstream Face of Dam



August, 1980
View of 24" C.I.P. Outlet Structure



August, 1980
View of Downstream Channel

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.9 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): +922 MSL (45 acre ft)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: +925.5 MSL (88 acre feet)

CREST: _____

- a. Elevation +922 MSL
- b. Type Ogee-type, concrete spillway
- c. Width 68 foot long spillway slab and apron
- d. Length 50 foot overflow weir
- e. Location Spillover Right Abutment
- f. Number and Type of Gates None

OUTLET WORKS: _____

- a. Type 24 inch diameter CIP
- b. Location 57 feet left of spillway
- c. Entrance inverts Unknown
- d. Exit inverts Approximately 898 MSL
- e. Emergency draindown facilities Same

HYDROMETEROROLOGICAL GAGES: None

- a. Type _____
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE 1,175 cfs

BY _____ DATE _____
 CHKD. BY _____ DATE _____
 SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 42
 PROJECT _____

1. *100% WATERBURN*
 2. *100% WATERBURN*
 3. *100% WATERBURN*
 4. *100% WATERBURN*

5. *100% WATERBURN*

$$L = 100 \text{ ft} \times \frac{100}{100} = 100 \text{ ft}$$

6. *100% WATERBURN*

$$L = 100 \text{ ft} \times \frac{100}{100} = 100 \text{ ft}$$

7. *100% WATERBURN* (WATERBURN HYDROLOG/ FOR SMALL WATERBURN)
 TECHNICAL RELEASE NO. 55

8. *100% WATERBURN* $L = 100 \text{ ft}$

9. *100% WATERBURN* $L = 100 \text{ ft}$

10. *100% WATERBURN* $L = 100 \text{ ft}$

11. *100% WATERBURN* $L = 100 \text{ ft}$

12. *100% WATERBURN* $L = 100 \text{ ft}$

13. *100% WATERBURN* $L = 100 \text{ ft}$

14. *100% WATERBURN* $L = 100 \text{ ft}$

15. *100% WATERBURN* $L = 100 \text{ ft}$

RE
CHECKED BY
SUBJECT

DATE
DATE

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 1
PROJECT

1	2	3	4
1.00	0.01	0.009	10
1.25	0.02	0.021	300
1.50	0.03	0.035	1000
1.75	0.04	0.049	1000
2.00	0.05	0.072	1000
2.25	0.06	0.095	1000
2.50	0.07	0.118	510
2.75	0.08	0.141	510
3.00	0.09	0.164	445
3.25	0.10	0.187	300
3.50	0.11	0.210	300
3.75	0.12	0.233	240
4.00	0.13	0.256	130
4.25	0.14	0.279	130
4.50	0.15	0.302	70
4.75	0.16	0.325	70
5.00	0.17	0.348	50
5.25	0.18	0.371	50
5.50	0.19	0.394	50
5.75	0.20	0.417	50
6.00	0.21	0.440	50
6.25	0.22	0.463	50
6.50	0.23	0.486	50
6.75	0.24	0.509	50
7.00	0.25	0.532	50
7.25	0.26	0.555	50
7.50	0.27	0.578	50
7.75	0.28	0.601	50
8.00	0.29	0.624	50
8.25	0.30	0.647	50
8.50	0.31	0.670	50
8.75	0.32	0.693	50
9.00	0.33	0.716	50
9.25	0.34	0.739	50
9.50	0.35	0.762	50
9.75	0.36	0.785	50
10.00	0.37	0.808	50
10.25	0.38	0.831	50
10.50	0.39	0.854	50
10.75	0.40	0.877	50
11.00	0.41	0.900	50
11.25	0.42	0.923	50
11.50	0.43	0.946	50
11.75	0.44	0.969	50
12.00	0.45	0.992	50
12.25	0.46	1.015	50
12.50	0.47	1.038	50
12.75	0.48	1.061	50
13.00	0.49	1.084	50
13.25	0.50	1.107	50
13.50	0.51	1.130	50
13.75	0.52	1.153	50
14.00	0.53	1.176	50
14.25	0.54	1.199	50
14.50	0.55	1.222	50
14.75	0.56	1.245	50
15.00	0.57	1.268	50
15.25	0.58	1.291	50
15.50	0.59	1.314	50
15.75	0.60	1.337	50
16.00	0.61	1.360	50
16.25	0.62	1.383	50
16.50	0.63	1.406	50
16.75	0.64	1.429	50
17.00	0.65	1.452	50
17.25	0.66	1.475	50
17.50	0.67	1.498	50
17.75	0.68	1.521	50
18.00	0.69	1.544	50
18.25	0.70	1.567	50
18.50	0.71	1.590	50
18.75	0.72	1.613	50
19.00	0.73	1.636	50
19.25	0.74	1.659	50
19.50	0.75	1.682	50
19.75	0.76	1.705	50
20.00	0.77	1.728	50
20.25	0.78	1.751	50
20.50	0.79	1.774	50
20.75	0.80	1.797	50
21.00	0.81	1.820	50
21.25	0.82	1.843	50
21.50	0.83	1.866	50
21.75	0.84	1.889	50
22.00	0.85	1.912	50
22.25	0.86	1.935	50
22.50	0.87	1.958	50
22.75	0.88	1.981	50
23.00	0.89	2.004	50
23.25	0.90	2.027	50
23.50	0.91	2.050	50
23.75	0.92	2.073	50
24.00	0.93	2.096	50
24.25	0.94	2.119	50
24.50	0.95	2.142	50
24.75	0.96	2.165	50
25.00	0.97	2.188	50
25.25	0.98	2.211	50
25.50	0.99	2.234	50
25.75	1.00	2.257	50
26.00	1.01	2.280	50
26.25	1.02	2.303	50
26.50	1.03	2.326	50
26.75	1.04	2.349	50
27.00	1.05	2.372	50
27.25	1.06	2.395	50
27.50	1.07	2.418	50
27.75	1.08	2.441	50
28.00	1.09	2.464	50
28.25	1.10	2.487	50
28.50	1.11	2.510	50
28.75	1.12	2.533	50
29.00	1.13	2.556	50
29.25	1.14	2.579	50
29.50	1.15	2.602	50
29.75	1.16	2.625	50
30.00	1.17	2.648	50
30.25	1.18	2.671	50
30.50	1.19	2.694	50
30.75	1.20	2.717	50
31.00	1.21	2.740	50
31.25	1.22	2.763	50
31.50	1.23	2.786	50
31.75	1.24	2.809	50
32.00	1.25	2.832	50
32.25	1.26	2.855	50
32.50	1.27	2.878	50
32.75	1.28	2.901	50
33.00	1.29	2.924	50
33.25	1.30	2.947	50
33.50	1.31	2.970	50
33.75	1.32	2.993	50
34.00	1.33	3.016	50
34.25	1.34	3.039	50
34.50	1.35	3.062	50
34.75	1.36	3.085	50
35.00	1.37	3.108	50
35.25	1.38	3.131	50
35.50	1.39	3.154	50
35.75	1.40	3.177	50
36.00	1.41	3.200	50
36.25	1.42	3.223	50
36.50	1.43	3.246	50
36.75	1.44	3.269	50
37.00	1.45	3.292	50
37.25	1.46	3.315	50
37.50	1.47	3.338	50
37.75	1.48	3.361	50
38.00	1.49	3.384	50
38.25	1.50	3.407	50
38.50	1.51	3.430	50
38.75	1.52	3.453	50
39.00	1.53	3.476	50
39.25	1.54	3.499	50
39.50	1.55	3.522	50
39.75	1.56	3.545	50
40.00	1.57	3.568	50
40.25	1.58	3.591	50
40.50	1.59	3.614	50
40.75	1.60	3.637	50
41.00	1.61	3.660	50
41.25	1.62	3.683	50
41.50	1.63	3.706	50
41.75	1.64	3.729	50
42.00	1.65	3.752	50
42.25	1.66	3.775	50
42.50	1.67	3.798	50
42.75	1.68	3.821	50
43.00	1.69	3.844	50
43.25	1.70	3.867	50
43.50	1.71	3.890	50
43.75	1.72	3.913	50
44.00	1.73	3.936	50
44.25	1.74	3.959	50
44.50	1.75	3.982	50
44.75	1.76	4.005	50
45.00	1.77	4.028	50
45.25	1.78	4.051	50
45.50	1.79	4.074	50
45.75	1.80	4.097	50
46.00	1.81	4.120	50
46.25	1.82	4.143	50
46.50	1.83	4.166	50
46.75	1.84	4.189	50
47.00	1.85	4.212	50
47.25	1.86	4.235	50
47.50	1.87	4.258	50
47.75	1.88	4.281	50
48.00	1.89	4.304	50
48.25	1.90	4.327	50
48.50	1.91	4.350	50
48.75	1.92	4.373	50
49.00	1.93	4.396	50
49.25	1.94	4.419	50
49.50	1.95	4.442	50
49.75	1.96	4.465	50
50.00	1.97	4.488	50
50.25	1.98	4.511	50
50.50	1.99	4.534	50
50.75	2.00	4.557	50
51.00	2.01	4.580	50
51.25	2.02	4.603	50
51.50	2.03	4.626	50
51.75	2.04	4.649	50
52.00	2.05	4.672	50
52.25	2.06	4.695	50
52.50	2.07	4.718	50
52.75	2.08	4.741	50
53.00	2.09	4.764	50
53.25	2.10	4.787	50
53.50	2.11	4.810	50
53.75	2.12	4.833	50
54.00	2.13	4.856	50
54.25	2.14	4.879	50
54.50	2.15	4.902	50
54.75	2.16	4.925	50
55.00	2.17	4.948	50
55.25	2.18	4.971	50
55.50	2.19	4.994	50
55.75	2.20	5.017	50
56.00	2.21	5.040	50
56.25	2.22	5.063	50
56.50	2.23	5.086	50
56.75	2.24	5.109	50
57.00	2.25	5.132	50
57.25	2.26	5.155	50
57.50	2.27	5.178	50
57.75	2.28	5.201	50
58.00	2.29	5.224	50
58.25	2.30	5.247	50
58.50	2.31	5.270	50
58.75	2.32	5.293	50
59.00	2.33	5.316	50
59.25	2.34	5.339	50
59.50	2.35	5.362	50
59.75	2.36	5.385	50
60.00	2.37	5.408	50
60.25	2.38	5.431	50
60.50	2.39	5.454	50
60.75	2.40	5.477	50
61.00	2.41	5.500	50
61.25	2.42	5.523	50
61.50	2.43	5.546	50
61.75	2.44	5.569	50
62.00	2.45	5.592	50
62.25	2.46	5.615	50
62.50	2.47	5.638	50
62.75	2.48	5.661	50
63.00	2.49	5.684	50
63.25	2.50	5.707	50
63.50	2.51	5.730	50
63.75	2.52	5.753	50
64.00	2.53	5.776	50
64.25	2.54	5.799	50
64.50	2.55	5.822	50
64.75	2.56	5.845	50
65.00	2.57	5.868	50
65.25	2.58	5.891	50
65.50	2.59	5.914	50
65.75	2.60	5.937	50
66.00	2.61	5.960	50
66.25	2.62	5.983	50
66.50	2.63	6.006	50
66.75	2.64	6.029	50
67.00	2.65	6.052	50
67.25	2.66	6.075	50
67.50	2.67	6.098	50
67.75	2.68	6.121	50
68.00	2.69	6.144	50
68.25	2.70	6.167	50
68.50	2.71	6.190	50
68.75	2.72	6.213	50
69.00	2.73	6.236	50
69.25	2.74	6.259	50
69.50	2.75	6.282	50
69.75	2.76	6.305	50
70.00	2.77	6.328	50
70.25	2.78	6.351	50
70.50	2.79	6.374	50
70.75	2.80	6.397	50
71.00	2.81	6.420	50
71.25	2.82	6.443	50
71.50	2.83	6.466	50
71.75	2.84	6.489	50
72.00	2.85	6.512	50
72.25	2.86	6.535	50
72.50	2.87	6.558	50
72.75	2.88	6.581	50
73.00	2.89	6.604	50
73.25	2		

BY
CHECKED BY
SUBJECT

DATE
DATE

LOUIS BERGER & ASSOCIATES INC.

1000 West 10th Street
Tulsa, Oklahoma 74103

PROJECT NO. 1000
PROJECT NAME

Final Report - 1000 West 10th Street, Tulsa, Oklahoma
Memorandum NWD Hydrant 30

Time	1000 West 10th Street	1000 West 10th Street	1000 West 10th Street
0.15	0.7	0.7	0.7
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1.0	2.8	0.7	0.7
1.5	3.7	0.7	0.7
2.0	3.7	0.7	0.7
2.5	3.7	0.7	0.7
3.0	3.7	0.7	0.7
3.5	3.7	0.7	0.7
4.0	4.0	0.7	0.7
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4.50	4.22	0.7	0.7
4.75	4.31	0.7	0.7
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5.50	4.57	0.7	0.7
5.75	4.64	0.7	0.7
6.00	4.71	0.7	0.7
6.25	4.78	0.7	0.7
6.50	4.84	0.7	0.7
6.75	4.90	0.7	0.7
7.00	4.96	0.7	0.7
7.25	5.02	0.7	0.7
7.50	5.08	0.7	0.7
7.75	5.14	0.7	0.7
8.00	5.20	0.7	0.7

DATA

1000
 1000

SHEET NO. 44 OF 47
PROJECT 2nd Flr.
15/01/2014

[illegible]

1944

100

— *Chrysomelidae* (100%)

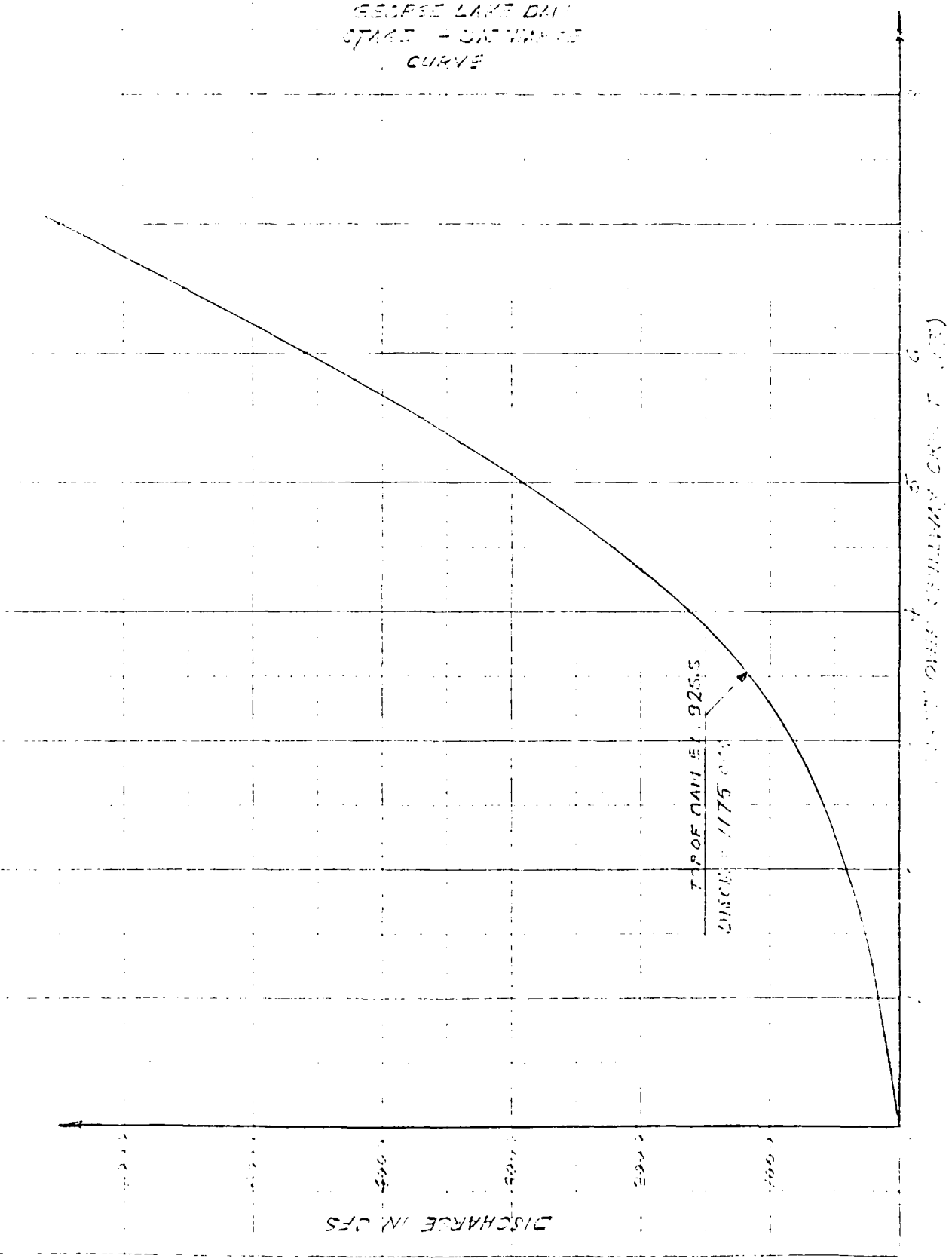
153

503-7253

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GEORGE LAKE DAM STAGE - DISCHARGE CURVE

45 1/2



BY DATE

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 116 OF 117

CHKD. BY DATE

RECEIVED L.H.B. 1/10/60

PROJECT C 242

SUBJECT

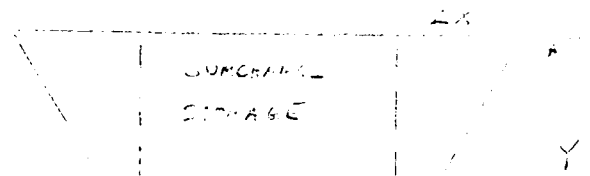
CONCRETE TRENCH AT THE

TREASURY

AREA AT BOTTOM OF TRENCH AT EL 95.75 = 1.4 AC

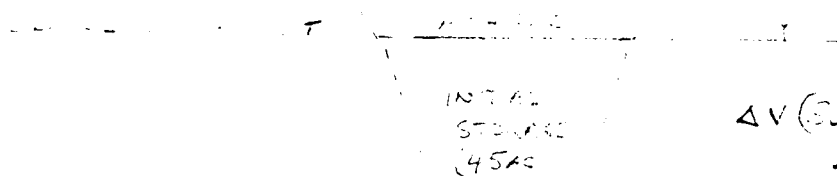
AREA OF LHM AT FINISH GRADE EL 102 = 4.6 AC

AREA AT 240' ELEVATION = 53.2 AC



$$\Delta X = \frac{53.2 - 4.6}{18} = \frac{48.6}{18}$$

$$\Delta X = 1.35 AC$$

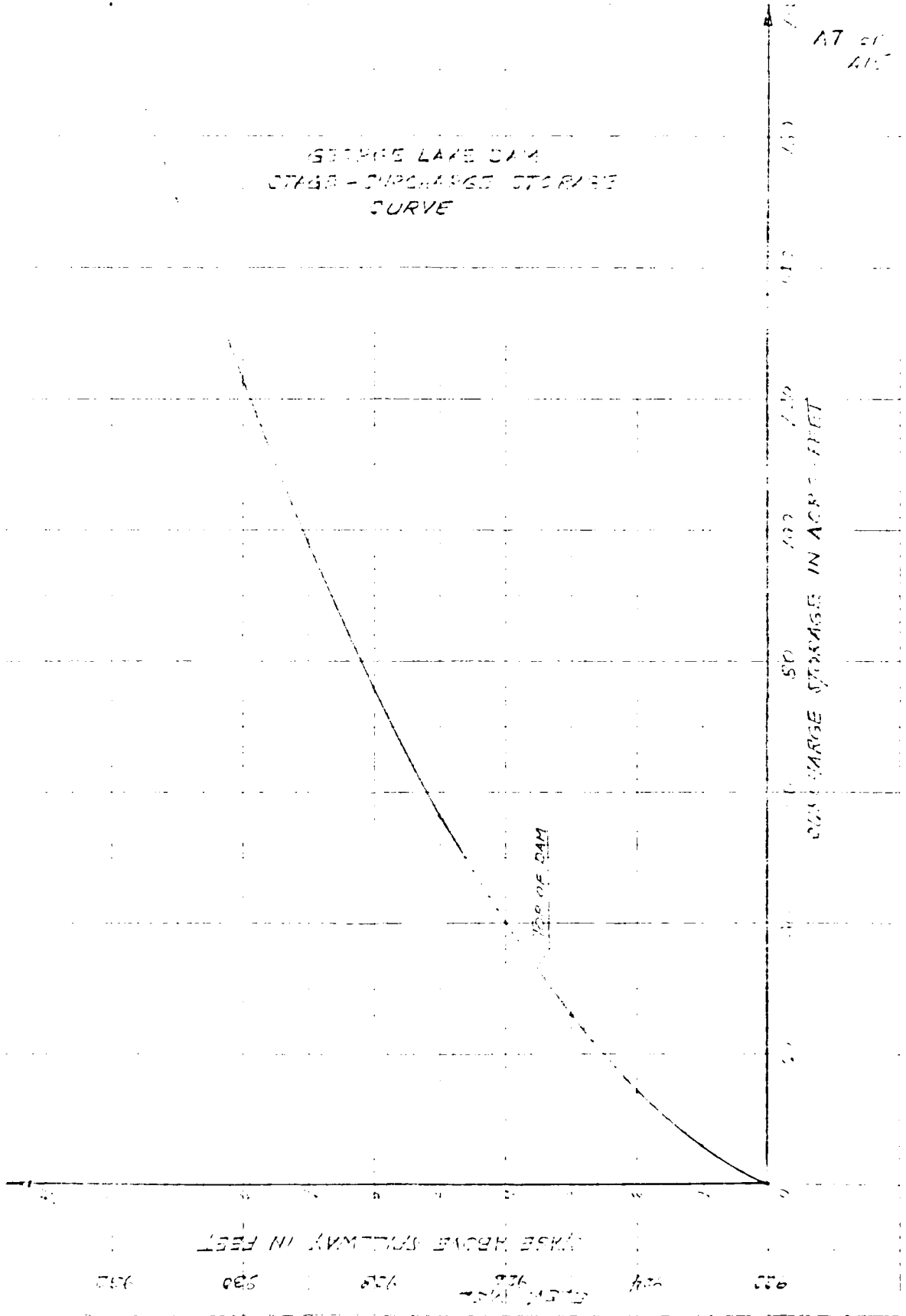


$$\Delta V (\text{SURCHARGE STORAGE}) = \Delta V = Y (X + \Delta X)$$

SECTION OF TRENCH EL 95.75

ELEV.	Y	X + ΔX	INITIAL	SURCHARGE	TOTAL
		AREA (AC)	STORAGE	STORAGE	STORAGE
			(AC-FT)	AC-FT	AC-FT
95.75	0	46	0	0	0
100	0	46	45	0	45
102	1	53.6		53.6	53.6
104	2	58		58	58
106	3	62		62	62
108	4	66		66	66
110	5	70		70	70
112	6	74		74	74
114	7	78		78	78
116	8	82		82	82
118	9	86		86	86
120	10	90		90	90
122	11	94		94	94
124	12	98		98	98
126	13	102		102	102
128	14	106		106	106
130	15	110		110	110
132	16	114		114	114
134	17	118		118	118
136	18	122		122	122
138	19	126		126	126
140	20	130		130	130
142	21	134		134	134
144	22	138		138	138
146	23	142		142	142
148	24	146		146	146
150	25	150		150	150
152	26	154		154	154
154	27	158		158	158
156	28	162		162	162
158	29	166		166	166
160	30	170		170	170
162	31	174		174	174
164	32	178		178	178
166	33	182		182	182
168	34	186		186	186
170	35	190		190	190
172	36	194		194	194
174	37	198		198	198
176	38	202		202	202
178	39	206		206	206
180	40	210		210	210
182	41	214		214	214
184	42	218		218	218
186	43	222		222	222
188	44	226		226	226
190	45	230		230	230
192	46	234		234	234
194	47	238		238	238
196	48	242		242	242
198	49	246		246	246
200	50	250		250	250
202	51	254		254	254
204	52	258		258	258
206	53	262		262	262
208	54	266		266	266
210	55	270		270	270
212	56	274		274	274
214	57	278		278	278
216	58	282		282	282
218	59	286		286	286
220	60	290		290	290
222	61	294		294	294
224	62	298		298	298
226	63	302		302	302
228	64	306		306	306
230	65	310		310	310
232	66	314		314	314
234	67	318		318	318
236	68	322		322	322
238	69	326		326	326
240	70	330		330	330
242	71	334		334	334
244	72	338		338	338
246	73	342		342	342
248	74	346		346	346
250	75	350		350	350
252	76	354		354	354
254	77	358		358	358
256	78	362		362	362
258	79	366		366	366
260	80	370		370	370
262	81	374		374	374
264	82	378		378	378
266	83	382		382	382
268	84	386		386	386
270	85	390		390	390
272	86	394		394	394
274	87	398		398	398
276	88	402		402	402
278	89	406		406	406
280	90	410		410	410
282	91	414		414	414
284	92	418		418	418
286	93	422		422	422
288	94	426		426	426
290	95	430		430	430
292	96	434		434	434
294	97	438		438	438
296	98	442		442	442
298	99	446		446	446
300	100	450		450	450

GEORGE LAKE DAM STAGE-SURCHARGE STORAGE CURVE



BY _____ DATE _____
 CHKD. BY _____ DATE _____
 SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 42 OF 42
 PROJECT 3
 REV 02-77

LINE	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
100	100	100	100	100
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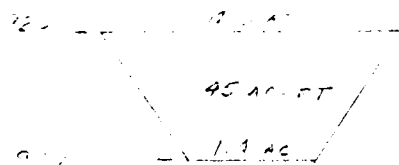
BY: DATE:
CHKD. BY: DATE:
SUBJECT:

LOUIS BERGER & ASSOCIATES INC.

DIAMOND LAKE DAM
DIAMOND LAKE

SHEET NO. 45 OF 5
PROJECT 2352
12/1/77

DIAMOND LAKE 24" P. 15 PIPE
FROM BOTTOM OF ELEV. 920.0 TO DAM INLET CREST 907.0
FLOW INLET OF 3 IPS 1 IPS / 10 MI
WATER FLOWING IN DRAINAGE THAT CREST EL 921.1 ABOVE 911



$$Q = CA \sqrt{H}$$

$$C = 0.57$$

$$A = 3.14$$

$$H_{avg} = 7.5$$

$$Q = 0.57 \times 3.14 \times \sqrt{7.5}$$

$$Q = 39.015 - 3672$$

$$TIME = \frac{45 AC-FT \times 43,560 FT^2/AC}{36 \times 3600 SEC/Hr} = 15.16 Hr. \text{ SAY } 15.5 HRS$$

TO DRAINAGE TO
ELEV. 907

BY DATE 7/27/77
 CHKD. BY DATE
 SUBJECT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO 1 OF 1
 PROJECT

A1	RHM - DOWNSTREAM CONSEQUENCES OF ASSUMED DAM BREAKS									
A2	GEORGE LAKE DAM RECH-1 DB									
A3	J CERAVOLO JAN 28 1981									
B	200	0	15	0	0	0	0	0	0	0
B1	5									
J	1	1	1							
J1	1									
K	0	1								
K1	INFLOW HYDROGRAPH TO RESERVOIR									
M	0	-1	2.9		2.9				1	
O	24	0								
O1	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.11	0.14	0.13
O1	0.3	0.7	1.7	0.4	0.3	0.16	0.11	0.09	0.09	0.07
O1	0.07	0.06	0.06	0.06						
T							0.5	0.1		
U	17									
U1	98	363	762	1069	1161	1030	814	598	445	327
U1	249	181	131	98	76	57	41			
X	0	0	1							
K	1	2								
K1	ROUTED FLOWS THROUGH RESERVOIR									
Y			1		1					
Y1	1						45	-1		
Y4	922	923	924	925	925.5	926	927	928	929	930
Y5	0	155	438	827	1175	1639	2928	4575	6456	8652
\$S	0	45	51	59.6	71	85	101.8	121.2	168.2	195.8
\$E	907	922	923	924	925	926	927	928	930	931
\$S	922									
\$D	925.5									
K	99									

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NFTAN
200	0	15	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

INFLOW HYDROGRAPH TO RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	IPLT	IPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDS	IUHS	TAREA	SNAP	TREDA	TREPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	2.90	0.00	2.90	0.00	0.000	0	1	0
PRECIP PATTERN									
0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.11	0.14	0.13
0.30	0.70	1.70	0.40	0.30	0.16	0.11	0.09	0.09	0.07
0.07	0.06	0.06	0.06						

LOSS DATA

LROPT	STRKR	DLTRR	RTIOL	ERAIN	STRKS	RTICK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

SHEET NO. 11 OF 41
PROJECT. 11-11-11

DATE	HR	MIN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD-FLOW COMP G	MO	DA	HR	MIN	PERIOD	RAIN	EXCS	LOSS	COMP
101	0	15	1	0.05	0.00	0.00	0	1	02	1	15	101	0.00	0.00	0.00	0
101	0	30	2	0.06	0.00	0.00	0	1	02	1	30	102	0.00	0.00	0.00	0
101	0	45	3	0.06	0.00	0.00	0	1	02	1	45	101	0.00	0.00	0.00	0
101	1	00	4	0.06	0.00	0.00	0	1	02	2	00	104	0.00	0.00	0.00	0
101	1	15	5	0.07	0.00	0.00	0	1	02	2	15	105	0.00	0.00	0.00	0
101	1	30	6	0.03	0.00	0.00	0	1	02	2	30	106	0.00	0.00	0.00	0
101	1	45	7	0.09	0.00	0.00	0	1	02	2	45	107	0.00	0.00	0.00	0
101	2	00	8	0.11	0.00	0.00	7	1	02	3	00	103	0.00	0.00	0.00	0
101	2	15	9	0.14	0.11	0.03	37	1	02	3	15	109	0.00	0.00	0.00	0
101	2	30	10	0.30	0.27	0.03	122	1	02	3	30	110	0.00	0.00	0.00	0
101	2	45	11	0.00	0.21	0.03	289	1	02	3	45	111	0.00	0.00	0.00	0
101	3	00	12	0.70	0.67	0.03	579	1	02	4	00	112	0.00	0.00	0.00	0
101	3	15	13	1.70	1.67	0.03	1118	1	02	4	15	113	0.00	0.00	0.00	0
101	3	30	14	0.40	0.37	0.03	1947	1	02	4	30	114	0.00	0.00	0.00	0
101	3	45	15	0.30	0.27	0.03	2999	1	02	4	45	115	0.00	0.00	0.00	0
101	4	00	16	0.16	0.13	0.03	3580	1	02	5	00	116	0.00	0.00	0.00	0
101	4	15	17	0.11	0.09	0.03	3771	1	02	5	15	117	0.00	0.00	0.00	0
101	4	30	18	0.09	0.06	0.03	3487	1	02	5	30	118	0.00	0.00	0.00	0
101	4	45	19	0.09	0.06	0.03	2968	1	02	5	45	119	0.00	0.00	0.00	0
101	5	00	20	0.07	0.04	0.02	2407	1	02	6	00	120	0.00	0.00	0.00	0
101	5	15	21	0.07	0.04	0.02	1939	1	02	6	15	121	0.00	0.00	0.00	0
101	5	30	22	0.05	0.03	0.02	1563	1	02	6	30	122	0.00	0.00	0.00	0
101	5	45	23	0.06	0.03	0.02	1255	1	02	6	45	123	0.00	0.00	0.00	0
101	6	00	24	0.06	0.03	0.03	1009	1	02	7	00	124	0.00	0.00	0.00	0
101	6	15	25	0.00	0.00	0.00	814	1	02	7	15	125	0.00	0.00	0.00	0
101	6	30	26	0.00	0.00	0.00	659	1	02	7	30	126	0.00	0.00	0.00	0
101	6	45	27	0.00	0.00	0.00	524	1	02	8	00	127	0.00	0.00	0.00	0
101	7	00	28	0.00	0.00	0.00	403	1	02	8	00	128	0.00	0.00	0.00	0
101	7	15	29	0.00	0.00	0.00	284	1	02	8	15	129	0.00	0.00	0.00	0
101	7	30	30	0.00	0.00	0.00	161	1	02	8	30	130	0.00	0.00	0.00	0
101	7	45	31	0.00	0.00	0.00	106	1	02	8	45	131	0.00	0.00	0.00	0
101	8	00	32	0.00	0.00	0.00	72	1	02	9	00	132	0.00	0.00	0.00	0
101	8	15	33	0.00	0.00	0.00	49	1	02	9	15	133	0.00	0.00	0.00	0
101	8	30	34	0.00	0.00	0.00	24	1	02	9	30	134	0.00	0.00	0.00	0
101	8	45	35	0.00	0.00	0.00	23	1	02	9	45	135	0.00	0.00	0.00	0
101	9	00	36	0.00	0.00	0.00	15	1	02	10	00	136	0.00	0.00	0.00	0
101	9	15	37	0.00	0.00	0.00	10	1	02	10	15	137	0.00	0.00	0.00	0
101	9	30	38	0.00	0.00	0.00	6	1	02	10	30	139	0.00	0.00	0.00	0
101	9	45	39	0.00	0.00	0.00	3	1	02	10	45	139	0.00	0.00	0.00	0
101	10	00	40	0.00	0.00	0.00	1	1	02	11	00	140	0.00	0.00	0.00	0
101	10	15	41	0.00	0.00	0.00	0	1	02	11	15	141	0.00	0.00	0.00	0
101	10	30	42	0.00	0.00	0.00	0	1	02	11	30	142	0.00	0.00	0.00	0
101	10	45	43	0.00	0.00	0.00	0	1	02	11	45	143	0.00	0.00	0.00	0
101	11	00	44	0.00	0.00	0.00	0	1	02	12	00	144	0.00	0.00	0.00	0
101	11	15	45	0.00	0.00	0.00	0	1	02	12	15	145	0.00	0.00	0.00	0
101	11	30	46	0.00	0.00	0.00	0	1	02	12	30	146	0.00	0.00	0.00	0
101	11	45	47	0.00	0.00	0.00	0	1	02	12	45	147	0.00	0.00	0.00	0
101	12	00	48	0.00	0.00	0.00	0	1	02	13	00	148	0.00	0.00	0.00	0
101	12	15	49	0.00	0.00	0.00	0	1	02	13	15	149	0.00	0.00	0.00	0
101	12	30	50	0.00	0.00	0.00	0	1	02	13	30	150	0.00	0.00	0.00	0
101	12	45	51	0.00	0.00	0.00	0	1	02	13	45	151	0.00	0.00	0.00	0
101	13	00	52	0.00	0.00	0.00	0	1	02	14	00	152	0.00	0.00	0.00	0
101	13	15	53	0.00	0.00	0.00	0	1	02	14	15	153	0.00	0.00	0.00	0
101	13	30	54	0.00	0.00	0.00	0	1	02	14	30	154	0.00	0.00	0.00	0
101	13	45	55	0.00	0.00	0.00	0	1	02	14	45	155	0.00	0.00	0.00	0
101	14	00	56	0.00	0.00	0.00	0	1	02	15	00	156	0.00	0.00	0.00	0
101	14	15	57	0.00	0.00	0.00	0	1	02	15	15	157	0.00	0.00	0.00	0
101	14	30	58	0.00	0.00	0.00	0	1	02	15	30	158	0.00	0.00	0.00	0
101	14	45	59	0.00	0.00	0.00	0	1	02	15	45	159	0.00	0.00	0.00	0

LOUIS BERGER & ASSOCIATES INC

SHEET NO. 111 OF 112
PROJECT

101	14 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
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BY _____ DATE 7/7
 CHKD. BY _____ DATE _____
 SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO 102 OF 107
 PROJECT HO-1

ROUTED FLOWS THROUGH RESERVOIR

STAGE	922.00	923.00	924.00	925.00	926.00	927.00	928.00	929.00
FLOW	0.00	155.00	433.00	829.00	1175.00	1629.00	2028.00	2475.00
CAPACITY=	0	45	51	60	71	85	102	121
ELEVATION=	907	922	923	924	925	926	927	928

CREL	SPWID	CGGW	EXPW	ELEV	COOL	CAREA	EXPL
922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COGD	EXPD	DAMWID
925.5	0.0	0.0	0.0

STATION 2: PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORIGINATES

MO	DA	HR	MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1	01	0	15	1	0.25	0	0	45	922.0
1	01	0	30	2	0.50	0	0	45	922.0
1	01	0	45	3	0.75	0	0	45	922.0
1	01	1	00	4	1.00	0	0	45	922.0
1	01	1	15	5	1.25	0	0	45	922.0
1	01	1	30	6	1.50	0	0	45	922.0
1	01	1	45	7	1.75	0	0	45	922.0
1	01	2	00	8	2.00	7	1	45	922.0
1	01	2	15	9	2.25	37	10	45	922.1
1	01	2	30	10	2.50	102	29	47	922.1
1	01	2	45	11	2.75	259	109	48	922.1
1	01	3	00	12	3.00	579	265	54	922.1
1	01	3	15	13	3.25	1118	355	63	922.1
1	01	3	30	14	3.50	1947	1140	77	922.1
1	01	3	45	15	3.75	2899	2121	93	922.1
1	01	4	00	16	4.00	3580	3136	104	922.1
1	01	4	15	17	4.25	3771	3640	110	922.1
1	01	4	30	18	4.50	3487	3629	110	922.1
1	01	4	45	19	4.75	2960	3274	106	922.1
1	01	5	00	20	5.00	2407	2774	99	922.1
1	01	5	15	21	5.25	1939	2335	93	922.1
1	01	5	30	22	5.50	1563	1905	87	922.1
1	01	5	45	23	5.75	1255	1470	83	922.1
1	01	6	00	24	6.00	1009	1198	78	922.1
1	01	6	15	25	6.25	614	1001	74	922.1
1	01	6	30	26	6.50	659	824	71	922.1
1	01	6	45	27	6.75	534	730	57	922.1

BY DATE

LOUIS BERGER & ASSOCIATES INC.

SHEET NO 411 OF 415

CHKD. BY DATE

PROJECT

SUBJECT

HEC-1 # 0.100

1 01	7 00	28	7 00	402	577	54	924 4
1 01	7 15	29	7 25	264	454	60	924 0
1 01	7 30	30	7 50	161	336	57	923 6
1 01	7 45	31	7 75	108	234	53	923 3
1 01	8 00	32	8 00	72	161	51	923 0
1 01	8 15	33	8 25	49	119	50	922 8
1 01	8 30	34	8 50	34	86	48	922 4
1 01	8 45	35	8 75	23	61	47	922 4
1 01	9 00	36	9 00	15	44	47	922 3
1 01	9 15	37	9 25	10	30	46	922 2
1 01	9 30	38	9 50	6	21	46	922 1
1 01	9 45	39	9 75	3	14	46	922 1
1 01	10 00	40	10 00	1	7	45	922 1
1 01	10 15	41	10 25	0	6	45	922 0
1 01	10 30	42	10 50	0	3	45	922 0
1 01	10 45	43	10 75	0	2	45	922 0
1 01	11 00	44	11 00	0	1	45	922 0
1 01	11 15	45	11 25	0	1	45	922 0
1 01	11 30	46	11 50	0	0	45	922 0
1 01	11 45	47	11 75	0	0	45	922 0
1 01	12 00	48	12 00	0	0	45	922 0
1 01	12 15	49	12 25	0	0	45	922 0
1 01	12 30	50	12 50	0	0	45	922 0
1 01	12 45	51	12 75	0	0	45	922 0
1 01	13 00	52	13 00	0	0	45	922 0
1 01	13 15	53	13 25	0	0	45	922 0
1 01	13 30	54	13 50	0	0	45	922 0
1 01	13 45	55	13 75	0	0	45	922 0
1 01	14 00	56	14 00	0	0	45	922 0
1 01	14 15	57	14 25	0	0	45	922 0
1 01	14 30	58	14 50	0	0	45	922 0
1 01	14 45	59	14 75	0	0	45	922 0
1 01	15 00	60	15 00	0	0	45	922 0
1 01	15 15	61	15 25	0	0	45	922 0
1 01	15 30	62	15 50	0	0	45	922 0
1 01	15 45	63	15 75	0	0	45	922 0
1 01	16 00	64	16 00	0	0	45	922 0
1 01	16 15	65	16 25	0	0	45	922 0
1 01	16 30	66	16 50	0	0	45	922 0
1 01	16 45	67	16 75	0	0	45	922 0
1 01	17 00	68	17 00	0	0	45	922 0
1 01	17 15	69	17 25	0	0	45	922 0
1 01	17 30	70	17 50	0	0	45	922 0
1 01	17 45	71	17 75	0	0	45	922 0
1 01	18 00	72	18 00	0	0	45	922 0
1 01	18 15	73	18 25	0	0	45	922 0
1 01	18 30	74	18 50	0	0	45	922 0
1 01	18 45	75	18 75	0	0	45	922 0
1 01	19 00	76	19 00	0	0	45	922 0
1 01	19 15	77	19 25	0	0	45	922 0
1 01	19 30	78	19 50	0	0	45	922 0
1 01	19 45	79	19 75	0	0	45	922 0
1 01	20 00	80	20 00	0	0	45	922 0
1 01	20 15	81	20 25	0	0	45	922 0
1 01	20 30	82	20 50	0	0	45	922 0
1 01	20 45	83	20 75	0	0	45	922 0
1 01	21 00	84	21 00	0	0	45	922 0
1 01	21 15	85	21 25	0	0	45	922 0
1 01	21 30	86	21 50	0	0	45	922 0
1 01	21 45	87	21 75	0	0	45	922 0
1 01	22 00	88	22 00	0	0	45	922 0
1 01	22 15	89	22 25	0	0	45	922 0
1 01	22 30	90	22 50	0	0	45	922 0
1 01	22 45	91	22 75	0	0	45	922 0
1 01	23 00	92	23 00	0	0	45	922 0
1 01	23 15	93	23 25	0	0	45	922 0
1 01	23 30	94	23 50	0	0	45	922 0
1 01	23 45	95	23 75	0	0	45	922 0
1 02	0 00	96	24 00	0	0	45	922 0
1 02	0 15	97	24 25	0	0	45	922 0
1 02	0 30	98	24 50	0	0	45	922 0
1 02	0 45	99	24 75	0	0	45	922 0
1 02	1 00	100	25 00	0	0	45	922 0

PEAK OUTFLOW IS 3640 AT TIME 4 25 HOURS

CFS	3640	1328	335	161	32139
CMS	103	38	9	5	910
INCHES		4 26	4 20	4 30	4 30
MM		108 20	104 10	109 10	109 10
AC-FT		679	664	664	664
THOUS CU FT		812	814	819	819

BY DATE
 CHKD. BY DATE
 SUBJECT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 105 OF 111
 PROJECT

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

OPERATION	STATION	AREA	PLAN RATIO	RATIOS APPLIED TO FLOWS	
				1	1.00
HYDROGRAPH AT	1	2.90	1	3771	
	(7.51)		(105.77)		
ROUTED TO	2	2.90	1	3640	
	(7.51)		(103.07)		

SUMMARY OF DAM SAFETY ANALYSIS

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM			
ELEVATION		922.00	922.00	925.50			
STORAGE		45.	45.	78			
OUTFLOW		0.	0	1175			
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF
OF	RESERVOIR	DEPTH	STORAGE	OUTFLOW	OVER TOP	MAX OUTFLOW	FAILURE
PMF	W.S. ELEV	OVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS
1.00	927.43	1.93	110.	3640	2.50	4.23	10.00

END

DATE
FILMED

6-81

DTIC