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NATIONAL DAM SAFETY PROGRAM. GLENDOLA RESERVOIR DAM (NJ 00096),--ETC(U)
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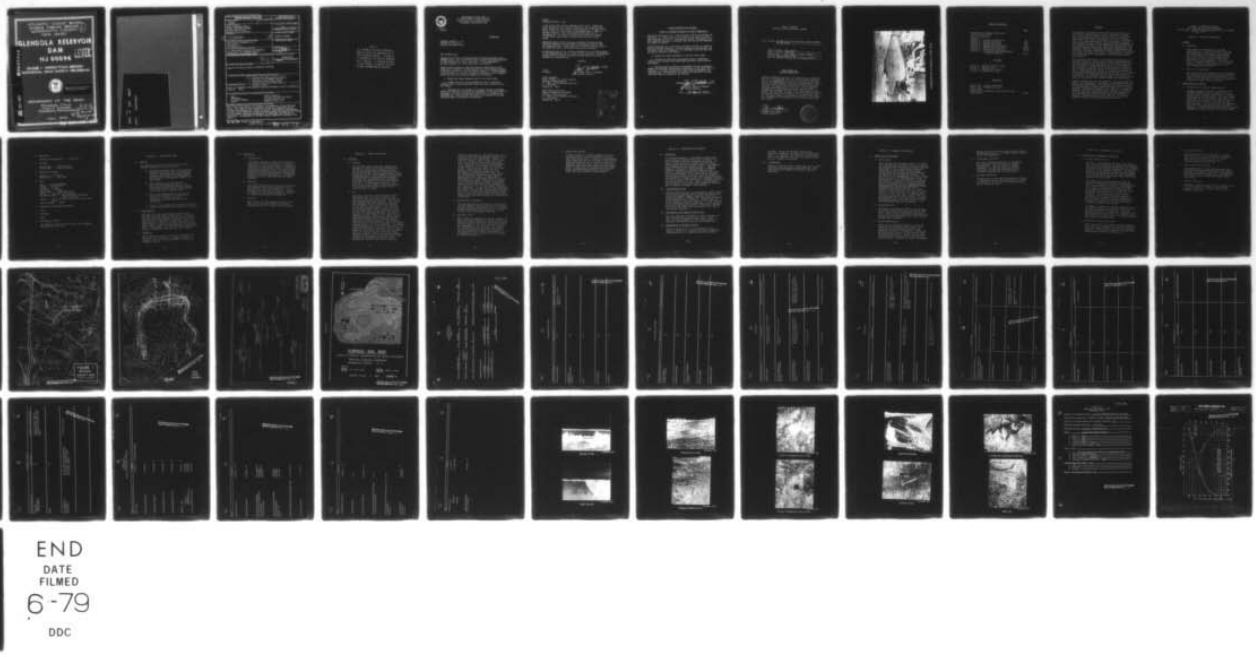

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ATLANTIC COAST BASIN
ROBINS SWAMP BROOK
MONMOUTH COUNTY
NEW JERSEY

GLENDOLA RESERVOIR DAM
NJ 00096

LEVEL II

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

April, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00096	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Phase I Inspection Report National Dam Safety Program Glendora Reservoir Dam Monmouth County, New Jersey	5. TYPE OF REPORT & PERIOD COVERED: (9) FINAL rept.
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7. AUTHOR(s): (10) F. Keith Jolls, PE	8. CONTRACT OR GRANT NUMBER(s): (15) DACW61-78-C-0124
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Louis Berger & Associates Inc. 100 Halsted St. East Orange, N. J.	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106	12. REPORT DATE: (11) April 1979 13. NUMBER OF PAGES: 53
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (12) 53p.	15. SECURITY CLASS. (of this report): Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

(6) National Dam Safety Program. Glendola Reservoir Dam (NJ ØØØ96), Atlantic Coast Basin, Robins Swamp Brook, Monmouth County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Structural Analysis
Safety
Visual Inspection
National Dam Safety Act Report
Glendora Reservoir Dam
Monmouth County, N.J.

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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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE--2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

12 APR 1979

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

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Glendola Reservoir Dam in Monmouth 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, Glendola Reservoir Dam, a high hazard potential structure, is judged to be in good overall condition. To insure adequacy of the structure, the following actions are recommended to be undertaken within one year from the date of approval of this report:

a. Regrade the eroded backslopes and fill the burrow holes.

b. Overseed the slopes with consideration given to supplying a different type of ground cover which might take better hold on the dry arid slopes.

c. Continue study and analysis of piezometer readings to evaluate whether the continued cleaning and/or backflushing of the relief wells is sufficient in the long-term aspects of controlling the seepage at the downstream toe. Quite possibly, new wells or an extension of the zone protection might be indicated in the analysis.

NAPEN-D
Honorable Brendan T. Byrne

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 James J. Howard of the Third District. Under the provisions 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 Safety 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.

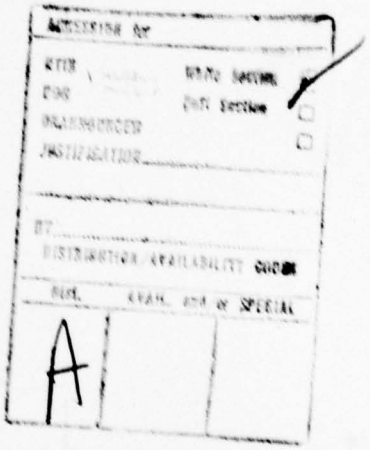
Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N. J. Dept. of Environmental Protection
P. O. Box CN029
Trenton, NJ 08625



GLENDOLA RESERVOIR DAM (NJ00096)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 15, 17 and 29 January 1979 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.

Glendola Reservoir Dam, a high hazard potential structure, is judged to be in good overall condition. To insure adequacy of the structure, the following actions are recommended to be undertaken within one year from the date of approval of this report:

a. Regrade the eroded backslopes and fill the burrow holes.

b. Overseed the slopes with consideration given to supplying a different type of ground cover which might take better hold on the dry arid slopes.

c. Continue study and analysis of piezometer readings to evaluate whether the continued cleaning and/or backflushing of the relief wells is sufficient in the long-term aspects of controlling the seepage at the downstream toe. Quite possibly, new wells or an extension of the zone protection might be indicated in the analysis.

APPROVED: Joel Kollerton LTC
JAMES G. TON
Colonel, Corps of Engineers
for District Engineer

DATE: 12 April 1979

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

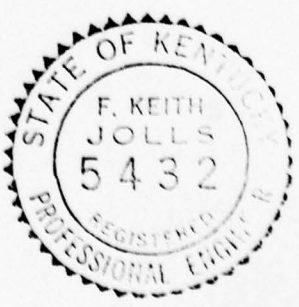
Name of Dam Glendola Reservoir Dam Fed. ID# NJ 00096, NJ ID# 29-50

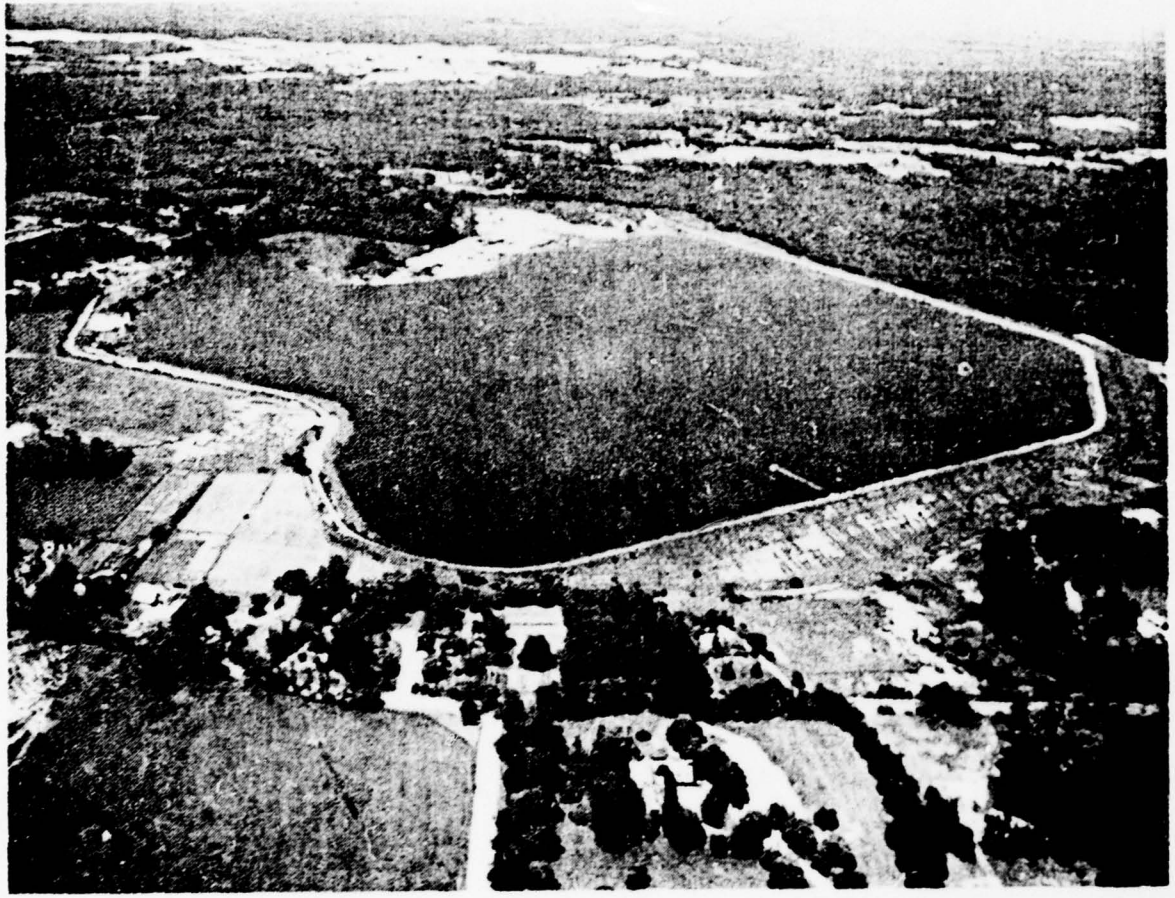
State Located New Jersey
County Located Monmouth
Coordinates Lat. 4011.7 - Long. 7404.8
Stream Robins Swamp Brook
Date of Inspections 15, 17, 29 January 1979

ASSESSMENT OF GENERAL CONDITIONS

Glendola Reservoir Dam is in a good overall condition, but it is recommended that its classification be maintained as high hazard as there are several residences and a road immediately below the main embankment, and a collapse would seriously endanger property loss and increase the danger to loss of life. No detrimental findings were uncovered to warrant further study. Recommended remedial actions to be undertaken in the future by the owner as part of his maintenance program include the repair and seeding of the backslopes and as a possible result of piezometer analysis, the cleaning, replacing, or extending of the relief wells and toe drains.

F. Keith Jolls P.E.
Project Manager





OVERVIEW OF GLENDOLA LAKE DAM

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FIGURES

APPENDIX

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

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

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: GLENDOLA RESERVOIR DAM FED ID# NJ 00096, NJ ID# 29-50

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 Engineer District, 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 Glendola Reservoir 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

Glendola Reservoir Dam is a 4,500 foot long horseshoe-shaped earth dike which forms a billion gallon storage reservoir in a pumped storage water supply system. The multi-zoned embankment is 20 feet wide at the crest, and rises over 65 feet above the natural terrain near the outlet works at the east end of the reservoir. At the west end, the embankment keys into the naturally surrounding higher terrain. A wetpool intake tower and 36" diameter transmission line function as an inlet/outlet

facility as there is no overflow spillway. The upstream face of the earth dike has 12" riprap overlying a 6" crushed stone base. Six-inch diameter toe drains empty into a collection well at the outside toe of the east face of the dike. Eleven relief wells on 50-foot centers are also located along the toe at the north end of the embankment structure.

b. Location

Glendola Reservoir is located about one-half mile northwest of the community of Glendola at the intersection of Belmar Boulevard and Gully Road in Monmouth County, New Jersey. The reservoir occupies an area previously known as Robins Swamp which lies due west of the Shark River Inlet and midway between the Garden State Parkway (Mile 98) and State Highway 18.

c. Size Classification

Glendola Reservoir Dam has a maximum height of 65 feet and a maximum storage capacity of 3,780 acre-feet. Based on the foregoing this dam is placed in the intermediate size category in accordance with the criteria promulgated in the Recommended Guidelines for the Safety Inspection of Dams (hgt. > 40 feet and storage > 1,000 acre-feet).

d. Hazard Classification

A collapse of the dam would, in all likelihood, result in water flow to the east along the Robins Swamp Brook. There are about a dozen homes on the flood plain immediately downstream (250' to 1,000') of the dam. Failure of the dam could severely damage these homes and endanger the occupants and could wash out Gully Road immediately to the east. Accordingly, this dam is classified as possessing a high hazard potential.

e. Ownership

Glendola Reservoir Dam is owned by the Monmouth Consolidated Water Company, 661 Shrewsbury Avenue, Shrewsbury, New Jersey, 07701.

f. Purpose of the Dam

The dam was constructed solely for the containment of pumped storage of the Monmouth Consolidated Water Company.

g. Design and Construction History

Glendola Reservoir was designed and erection started in 1961 by the American Water Works Service Company Inc., the owner's parent organization. This facility was designed as an integral part of the Shark River Pumped Storage Project. Extensive soil testing and borrow searching preceded design. The dam was almost entirely constructed from material available within the immediate vicinity of the project.

h. Normal Operating Procedures

Water is pumped from the Shark River to Glendola Reservoir where it is stored until such time as demands at the Jumping Brook Filter Plant necessitate releases (see Section 4).

1.3 PERTINENT DATA

a. Drainage Area:

0.3 square miles (reservoir and boundary area)

b. Discharge at Damsite

Maximum known flood at damsite - None
Water outlet at normal elevation - 260± cfs

c. Elevation (ft. above MSL)

Top Dam - +112
Normal Pool - +107
Streambed at centerline of dam - +50±

d. Reservoir

Length of maximum pool - 3,200 feet

e. Storage

Top of dam - 3,780 acre-feet
Normal pool - 3,155 acre-feet

f. Reservoir Surface

Top dam - 130 acres
Normal pool - 120 acres

g. Dam

Type - Earth embankment
Length - 4,500 feet
Height - 65 feet
Top Width - 20 feet
Side Slopes - 3H:1V and 2H:1V
Zoning - Two zones (2H:1V core)
Impervious Core - Semi-permeable compacted silty fine sand
Cutoff - 10' deep cutoff trench of silty fine sand
Grout curtain - None

h. Diversion and Regulating Tunnel

None

i. Spillway

None

j. Regulating Outlets

36" diameter concrete inlet/outlet pipe (pumped storage) Inv. El. 55.5

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information available for review for the Glendola Reservoir dam consisted of:

1) Dam Application No. 962, State Division of Water and Supply Policy (3 February 1958) for proposed water supply system together with various correspondence, specifications and approval thereof (up thru 1961).

2) Six drawings of the 1961 design; American Waterworks Service Co. Inc. Engineering Department Drawings 73-780, which depicted the overall construction of the dam in its present form.

3) Notes and computations by the owner's engineering personnel on subjects of hydrology, spillway capacity, inspection criteria and operational procedures.

4) Copy of Soils Report by Woodward Clyde and Sherard and Associates, Consulting Engineers.

2.2 CONSTRUCTION

The Davis Construction Company of Hicksville, New York were the General Contractors. From the various revisions indicated on the design plans, the work was substantially completed in late 1962 (the revisions indicated at that time were of a minor nature). There are no apparent major structural modifications but numerous minor repairs were made in 1964, 1966, 1974 and 1977 which consisted mainly of embankment repairs and tree removal.

2.3 OPERATION

The inspection revealed little of an operational nature as the reservoir is a pumped storage facility with no overflow spillway or emergency drawdown sluices.

2.4 EVALUATION

a. Availability

Sufficient engineering data was obtained to assess the structural stability. The data available to base an assessment of safety in regard to the embankment zones or foundation stability was delineated in the soils report prepared by Woodward, Clyde and Sherard and Associates (which analyzed all geotechnical aspects in considerable detail). Piezometer readings were also furnished by the Water Company.

b. Adequacy

The field inspection and review of the available design plans reveal that the dam is structurally sound and well-built. It is believed that the data available is adequate to render this assessment without recourse to gathering additional information.

c. Validity

The validity of the engineering data available is not challenged and is accepted without recourse to further investigations.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The on-site inspections were conducted on December 15 and 29, 1978 and revealed the dam to be in excellent condition except for the backslope seepage conditions noted below. All of the major elements were in true alignment and in a well-maintained condition. Conferences were held with Water Company personnel who delineated their operational programs and joined in the initial inspection tour. A subsequent inspection was held on 17 January 1979 in freezing weather to re-examine the seepage zones at the easterly toes of slope.

b. Dam

The major portion of the horseshoe-shaped embankment lies just west of Gully Road and is over 60 feet high in the vicinity of the Robins Swamp Brook channel. The embankment extends along the northeast side and the remainder of the reservoir is bounded by the natural high ground. The reservoir side slope varies between 2:1 and 3:1 and is protected with riprap, although only the top few feet could be observed. The riprap appears in good condition with only minor subgrade erosion. There is no riprap on the downstream slopes but concrete and macadam have been placed at the northwest corner, apparently to retard erosion. The dam crest is 20 feet wide and stabilized with a 6" gravel roadway which is in good condition. The embankment backslopes have a fairly uniform cover of grass and secondary growth near the toe, but in numerous areas where the grass has not taken, there are erosion gullies which are quite severely incised. There are numerous rodent burrows on the slopes and erosion gullies are scoured out immediately down the slope, apparently caused by the burrow openings.

There are wet zones at and beyond the toe in several areas and some seepage appears to be emanating from the embankment. There is a line of a dozen or more relief wells in the vicinity of Robins Swamp Brook that feed into a collection box located approximately at the midpoint. The outlets are several inches below grade and appear to be flowing freely. Additionally, there are also piezometers in and beyond the toe. At one water was flowing out of a hole at the top (through the rusted casing). The toe drains and relief wells are apparently functioning on a continuous basis to relieve the hydrostatic head. However, in certain areas, the significant seepage observed may indicate that either the relief structures are silting up, or, to some extent, the wells are inadequate. A berm area at the downstream toe forms a terrace that extends some 200 feet beyond the toe and then slopes abruptly down into a relatively large borrow area that most probably was excavated during the construction of the dam.

c. Appurtenant Structures

The only appurtenant structure is the 80-foot concrete wetpool intake tower in the reservoir for the 36-inch inlet/outlet pipe. The access bridge and working platform are in a satisfactory, well-maintained condition.

d. Reservoir Area

The off-stream reservoir is fed by pumping raw supply from the Shark River (about 2 miles to the east) and was formed by excavating several million yards of fill from the basin to form the embankments. The reservoir is located at a relatively high elevation with respect to the surrounding terrain but intercepts the upstream flow of Robins Swamp Brook. It is completely free of debris and is enclosed by security fencing.

e. Downstream Channel

A small release is legally mandated from the reservoir and is accomplished by a tap from the inlet/outlet main. A small pond apparently forms below the dam (to the west of Gully Road) during wet periods but no drainage pipe was observed under the road. About one-half mile eastward, the brook discharges into the Shark River. Except for the residences along Gully Road, the downstream reaches of the brook flood plain are presently undeveloped.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

As a major component of the pumped storage water supply system, Glendola Reservoir is subject to daily monitoring by Water Company personnel. In general, the operation requires that the Shark River Pumping Station provide water to the Jumping Brook Filtration and Treatment Plant. Pumping capacity in excess of water demands at Jumping Brook are diverted to Glendola Reservoir for storage. During periods of low flow in the Shark River (when demands at the filter plant exceeds the diversion rights from the river) the additional requirements are supplied from the Glendola facility. The water level in the reservoir is normally lowered during the months of July, August, and September and returned to the normal pool elevation (107 MSL) during October, November, and December.

4.2 MAINTENANCE OF DAM

Glendola Reservoir Dam is patrolled on a daily basis and formally inspected once a month and after heavy storms by trained company inspectors utilizing visual checklists. Defects are corrected as rapidly as warranted by their severity. Heavy brush and other growth are cut back 100 feet from the toe and on the embankment every second year. Light brush is cut during the summer months as required. Surface erosion on the back slope and crest of the dam is refilled as required.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating component at this reservoir is the inlet/outlet pipe and gate tower. Since this is a key component of the water system, it receives top priority service and maintenance.

4.4 DESCRIPTION OF WARNING SYSTEM

While no alarm system is in operation, daily patrols and periodic inspections greatly diminish the possibility of a failure occurring without

warning. During the monthly inspections, piezometer readings are taken at the observation wells. In addition, the discharge from relief wells are inspected for signs of material movement or changes in velocity.

4.5 EVALUATION

Glendola Reservoir Dam is considered to be a well monitored and adequately maintained dam. The maintenance and upkeep is extensive and well conceived.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Water enters the reservoir either as rainfall over the 192-acre catchment area or is fed by the transmission line which is pumped from the Shark River. Since the inflow is closely regulated, only rainfall and discharge capabilities were evaluated with respect to the adequacy of the hydraulic design. The reservoir is of intermediate size with a high hazard potential. A precipitation event equivalent to a PMF was selected to evaluate the hydraulic capacity of the 36" discharge pipe in accordance with the Recommended by Guidelines for the Safety Inspection of Dams. Precipitation data was obtained from Hydrometeorological Report No. 33. When applied to the reservoir, the rainfall would cause a rise in lake level of approximately 3.3 feet. Since the lake is maintained at a maximum elevation of 107.0, there is a minimum freeboard of 5 feet which could actually accommodate roughly one and one-half times the PMP without need for discharge.

b. Experience Data

No history of excessive flows or dangerously high water levels have been reported at this site. Water level is routinely maintained at or slightly below the design elevation and at the time of inspection, was 15 feet below maximum pool elevation.

c. Visual Observations

There are no discharge outlets at this dam. However, the toe drains which empty into a concrete collector basin were flowing freely at the time of inspection. Water was also emanating from all of the relief wells at the downstream toe. Flows from the wells and drains are discharged into the original stream channel. Despite the wells and drains,

seepage was noted at the ground surface along the downstream toe at the high easterly portion of the dam embankment.

d. Overtopping Potential

With all facilities operating as designed, the potential for overtopping is almost non-existent. The dam site and pumping equipment is monitored daily by trained personnel, so that the likelihood of an accidental overtopping is quite remote.

e. Drawdown Potential

Glendola Lake would take approximately 22 days to drawdown from its design elevation of 107.0 to the invert of the 36" reinforced concrete pipe (elevation 55.5).

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

In view of the relative age of the dam embankment, the well-designed and supervised construction and the continuous maintenance, the visible portions of the Glendola Reservoir Dam are deemed to be in a good overall condition. The upper zones of riprap protection show little evidence of subgrade subsidence and the main embankment crest and adjoining shallower dikes are at true design grade and slope.

The inspection team was concerned with the continual maintenance problem of backslope erosion and apparent seepage at the downstream toe. The relief wells and toe drains appear to be under a continuous artesian head due to seepage and percolation. Either the wells and drains are silting up (and are less effective) or the extent of their overall coverage is less than completely adequate. The surficial sloughing of the backslopes is not of major concern as the Water Company is presently formulating plans for undertaking corrective measures this spring.

In summary, nothing was visually noted to create or worsen a hazardous condition that cannot be readily maintained or corrected. The only drainage element not visible for inspection was the existence and condition of a drainage structure under Gully Road, which is actually outside the scope of the assessment.

b. Design and Construction Data

From the review of the soils report recommendations and contract plans for the 1962 construction, the design appears to be well-engineered, reflects a conservative approach, and employed conventional analytical techniques.

c. Operating Records

The performance of this structure has been satisfactory since its completion, although some concern is expressed for the future when the relief wells and toe drain systems may become clogged up.

d. Post Construction Changes

There have been no major modifications since the 1962 construction which affect the overall structural integrity of the dam. Information furnished by Water Company engineers indicates that repair work is undertaken practically every year.

e. Seismic Stability

Experience indicates that dams in Seismic Zone 1 will have adequate stability under dynamic loading conditions if stable under static loading conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ REMEDIAL ACTIONS

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, Glendola Reservoir Dam is judged to be in a good overall structural condition. Overtopping of the dam is a very remote possibility and no seriously detrimental conditions were observed. However, the dam is recommended to be retained in a high hazard condition due to the presence of several homes and a county road immediately below the main embankment.

b. Adequacy of Information

The information made available by the Water Company is deemed to be adequate regarding the analyses of safe operation and structural stability.

c. Urgency

No urgency is attached to implementing the remedial measures set forth below and it is recommended that they be undertaken sometime in the future.

d. Necessity for Further Study

In view of the overall condition of this dam and the fact that it is continually monitored by trained engineering personnel, additional inspections under the purview of P.L. 92-367 are deemed to be unnecessary. The Monmouth Consolidated Water Company has embarked on an internal system of periodic inspections and emergency action plans which basically reflects the requirements mandated under P.L. 92-367. Further, their continuity of action is not contingent upon external funding and bureaucratic considerations.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Alternatives

Under the Water Company's continual maintenance program, it is recommended that the following be taken under advisement in the future:

- Regrade the eroded backslopes and fill the burrow holes.
- Overseed the slopes with consideration given to supplying a different type of ground cover (such as crown vetch) which might take better hold on the dry arid slopes.
- Continue the study and analysis of the piezometer readings to evaluate whether the continued cleaning and/or backflushing of the relief wells is sufficient in the long-term aspects of controlling the seepage at the downstream toe. Quite possibly, new wells or an extension of the zone protection might be indicated in the analysis.

b. O&M Maintenance and Procedures

In view of the assessment contained herein, no additional procedures other than those presently in effect appear to be required.

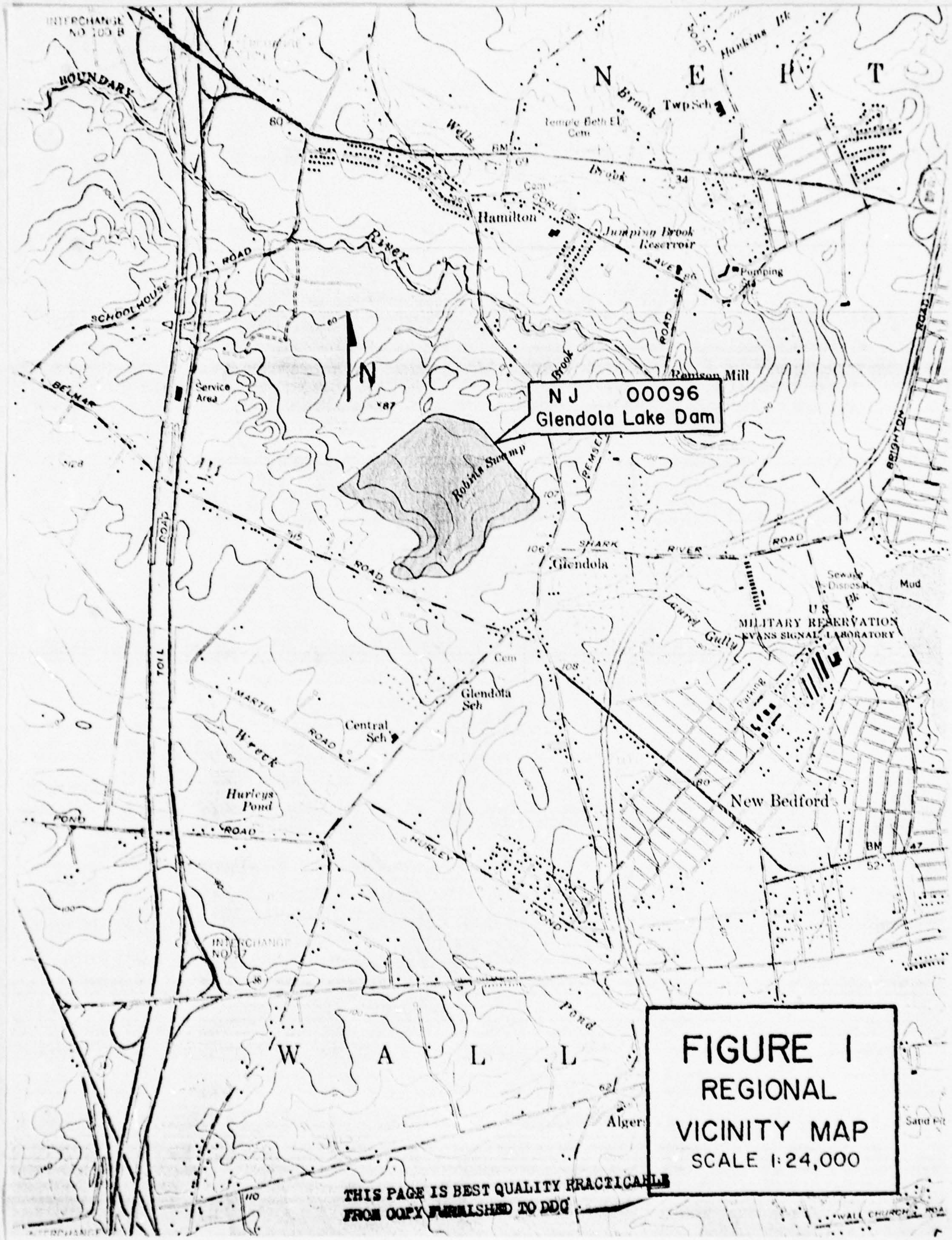
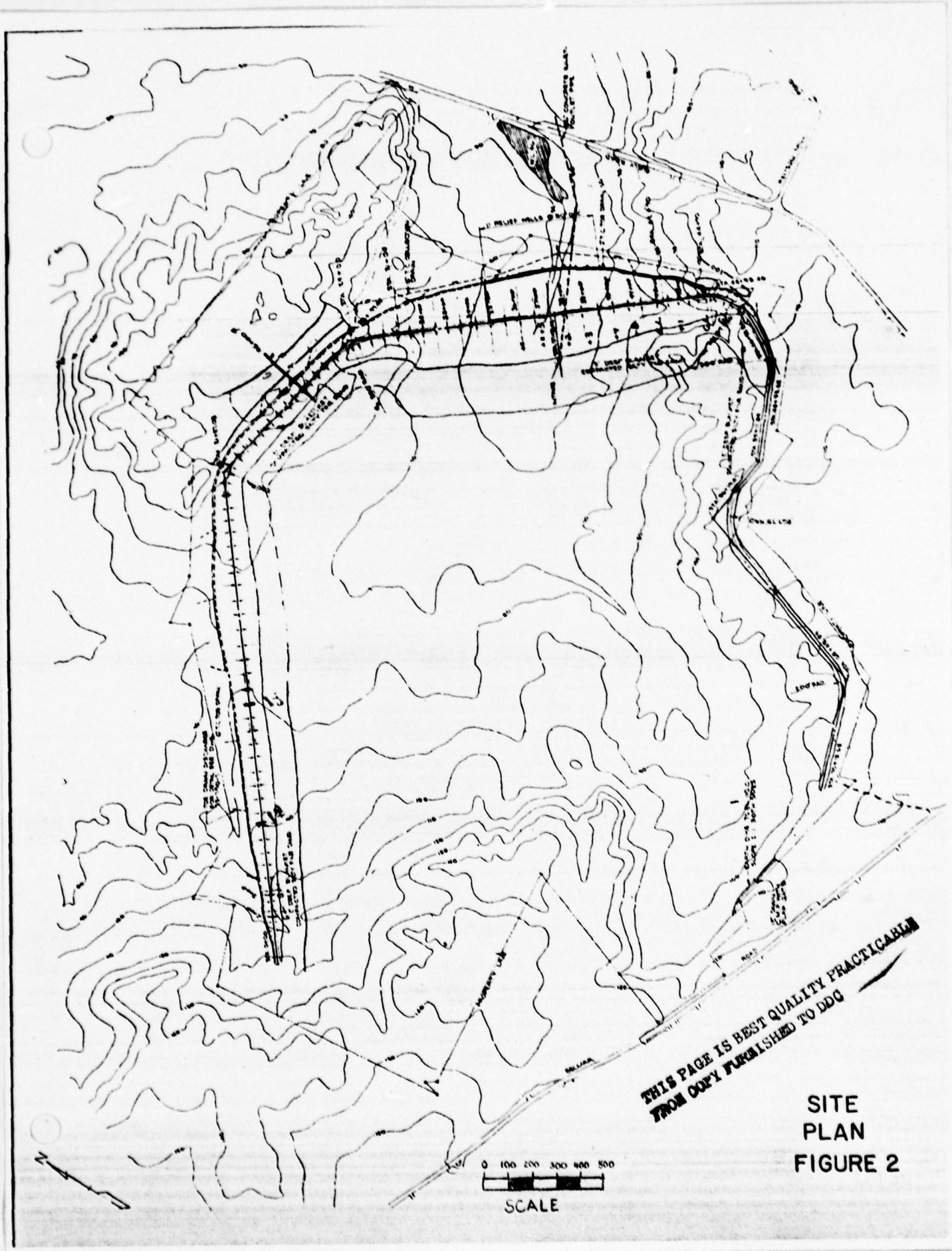
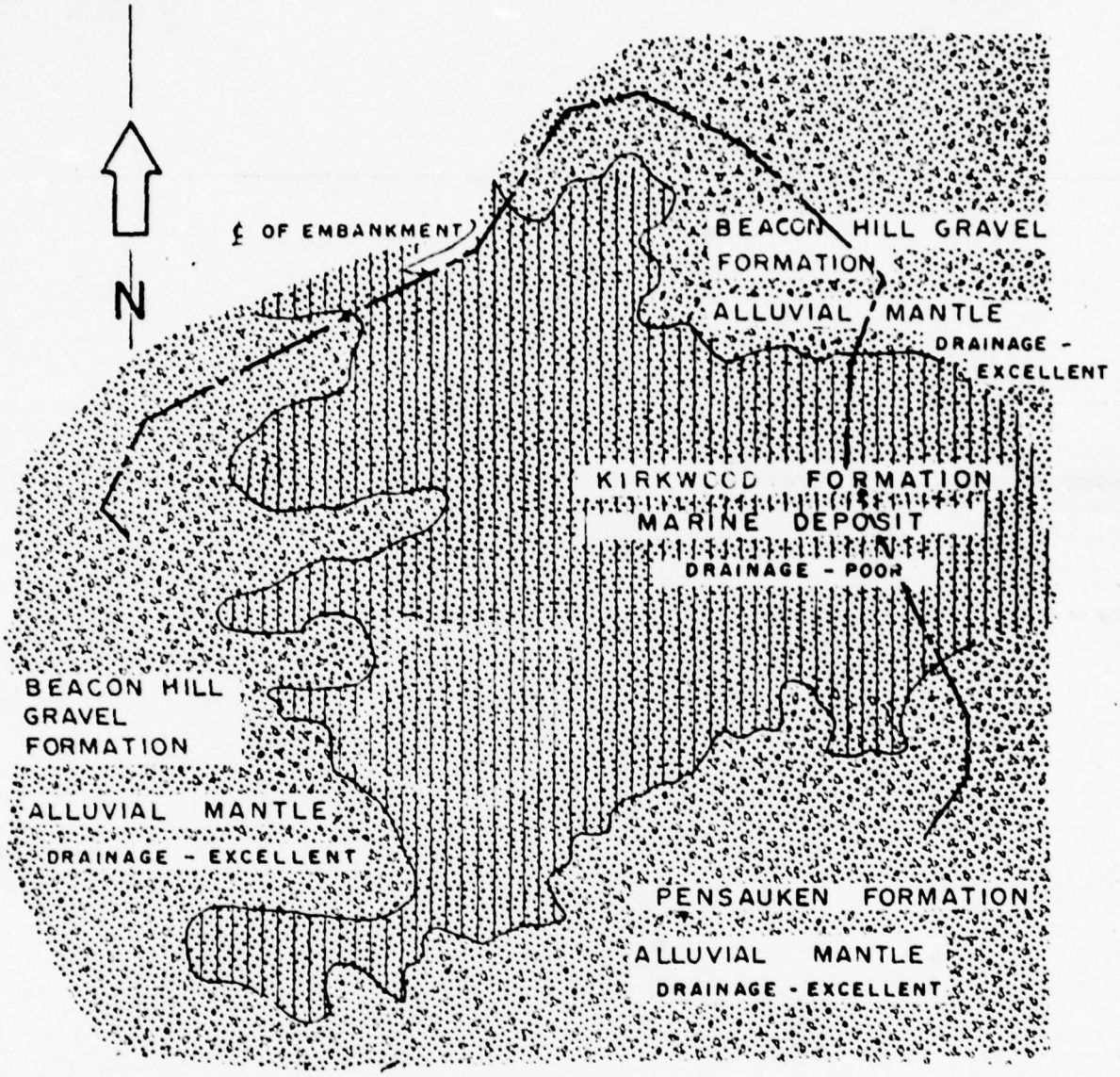


FIGURE 1
REGIONAL
VICINITY MAP
SCALE 1:24,000



SITE
PLAN
FIGURE 2

FIGURE 3



SURFACE SOIL MAP

(BASED ON AIRPHOTO INTERPRETATION AND GEOLOGIC REFERENCES)

PROPOSED GLENDOLA RESERVOIR

MONMOUTH COUNTY , N . J .

LEGEND :

SILTY FINE SANDS

GRAVELLY SANDS

APPROX. SCALE 1" = 600'

FIGURE 4

Check List
Visual Inspection
Phase 1

Name Dam Glendola Lake County Monmouth State New Jersey Coordinators NJDEP

Date(s) Inspection 12/15,29/78 1/17/79 Weather Partly Cloudy Temperature 40°F

Pool Elevation at Time of Inspection 97 M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

T. Chapter
A. Shearman (MCWC)
K. Jolls
L. Baines
D. Edwards (MCWC)
E. Simone
W. Pearce (MCWC)
M. Carter

L. Baines Recorder

Dam No. 00096

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE ON LEAKAGE	N/A	Entire dam is earth embankment
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Numerous sloughed areas observed on downstream slopes.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Erosion and sloughing, but no movement.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	At several localized areas of downstream face approximately 75' downslope of crest.	According to builder: newly sloughed out area right behind house under construction.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Minor undulation	
RIPRAP FAILURES	None observed	No riprap on downstream side.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	N/A	Pumped storage facility, no spillway outlet. Embankment grades into natural terrain.
ANY NOTICEABLE SEEPAGE	Seepage very evident - moist ground; seepage at toe.	Boiling occurred at a point approximately 100' from toe of westerly portion of embankment. Condition has been corrected.
STAFF GAGE AND RECORDER		
DRAINS	Toe drains - 4' below surface of toe. Collectors empty into collection well.	Steady flow out of toe drains.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit not observed.	
INTAKE STRUCTURE	No spalling. Appeared satisfactory.	
OUTLET STRUCTURE	None	New residence under construction at road below dam. Road would flood if there were a break.
OUTLET CHANNEL	None	
EMERGENCY GATE	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	N/A	No spillway
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	See piezometers	
WEIRS	None	
PIEZOMETERS	Every 100 ft. 20% of the piezometers are out of operation. Located at toe at 20' depth below toe. They are observed every month.	
OTHER Relief Wells	50' depth below toe.	Apparently becoming clogged.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steep 1½ to 1	
SEDIMENTATION	None observed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	N/A	Natural channel flows to North East under Gully Road. No drainage structure under road.
SLOPES	N/A	
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes immediately below dam on North East side west of Gully Road. Imminent danger should dam collapse.	No warning system.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available (* From MCWC records)
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Available (*)
TYPICAL SECTIONS OF DAM	Available (*)
HYDROLOGIC/HYDRAULIC DATA	Available (*)
OUTLETS - PLAN	Available (*)
- DETAILS	Available
-CONSTRAINTS	Available
-DISCHARGE RATINGS	Available
RAINFALL/RESERVOIR RECORDS	Available

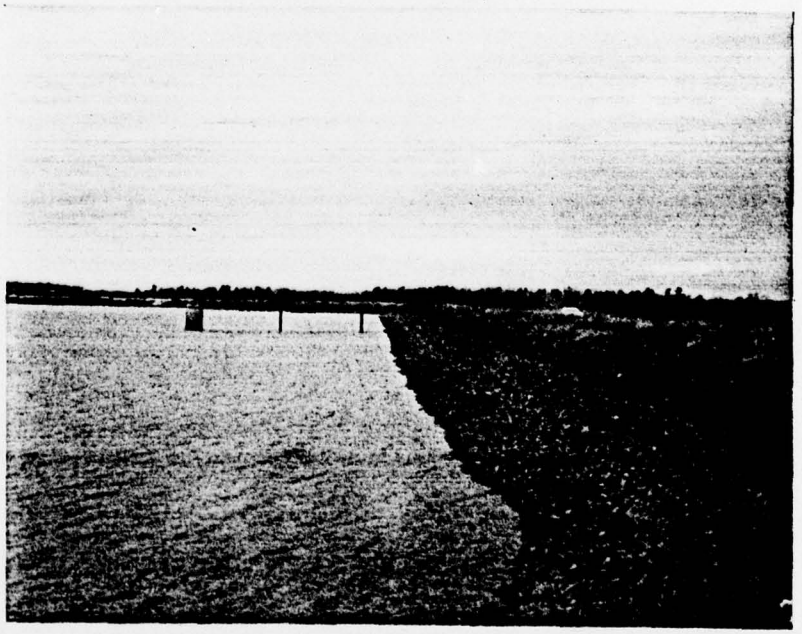
ITEM	REMARKS
DESIGN REPORTS	Available (*)
GEOLOGY REPORTS	Available (*)
DESIGN COMPUTATIONS	Not available
HYDROLOGY & HYDRAULICS	Available
DAM STABILITY	Not available
SEEPAGE STUDIES	Available
MATERIALS INVESTIGATIONS	Available
BORING RECORDS	Available
LABORATORY	Available
FIELD	Available
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES.	Not available

ITEM	REMARKS
MONITORING SYSTEMS	Available (*)
MODIFICATIONS	None
HIGH POOL RECORDS	Available (*)
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE	Available (*)
OPERATION	Available
RECORDS	

ITEM	REMARKS
SPILLWAY PLAN	No spillway
SECTIONS	Not applicable
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Available (*)

December, 1978

Overview of dam



December, 1978

Intake structure

December, 1978

Downstream toe of dam

December, 1978

Seepage at downstream toe

December, 1978

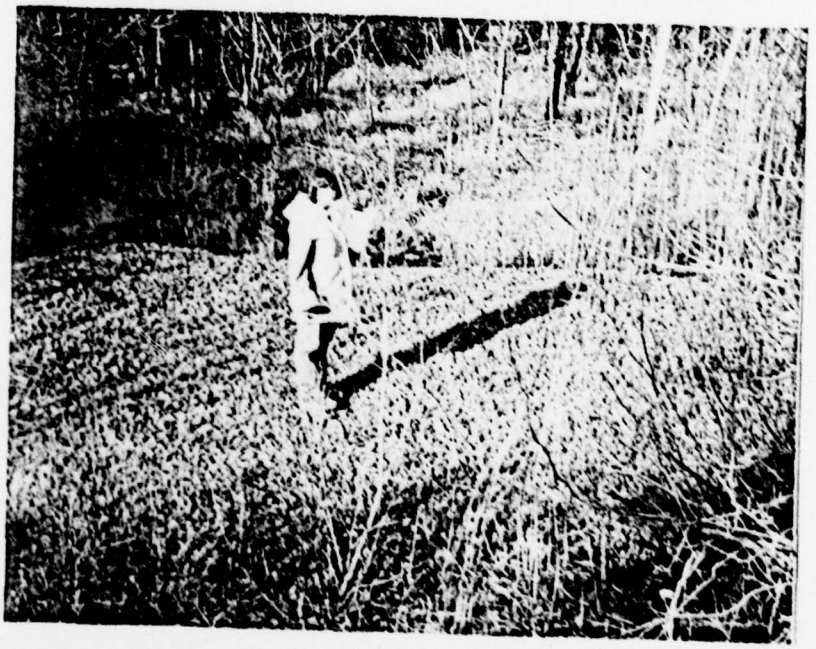
Erosion of downstream slope of dam

December, 1978

Erosion of downstream slope of dam

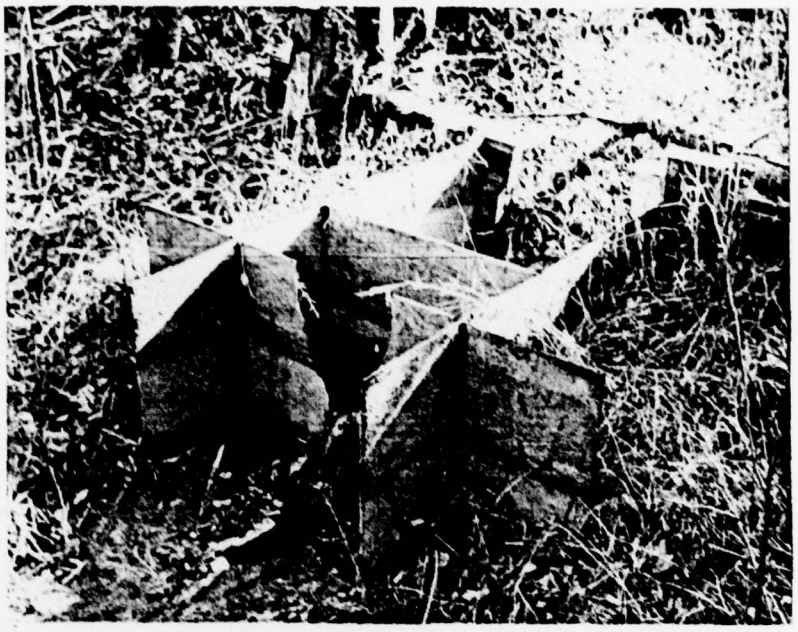
December, 1978

Repaired embankment



December, 1978

Location of boil



December, 1978

V-noched weir measuring toe drain flow

December, 1978

Relief well

Dam No. 00096

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.3 sq.mi. (Reservoir boundary area only)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 107 M.S.L. (3155 acre-feet)

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

ELEVATION MAXIMUM DESIGN POOL: 107 M.S.L.

ELEVATION TOP DAM: 112 M.S.L. (3780 acre-feet)

CREST: Earthen dam without spillway

a. Elevation N/A
b. Type N/A
c. Width N/A
d. Length N/A
e. Location Spillover N/A
f. Number and Type of Gates N/A

OUTLET WORKS:

a. Type Wet pool intake tower and 36" dia. inlet/outlet RCP
b. Location Station 37+81
c. Entrance inverts 55.5 M.S.L.
d. Exit inverts Unknown
e. Emergency draindown facilities Same

HYDROMETEOROLOGICAL GAGES: N/A

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: N/A

BY D. J. M. DATE 1-79

CHKD. BY _____ DATE _____

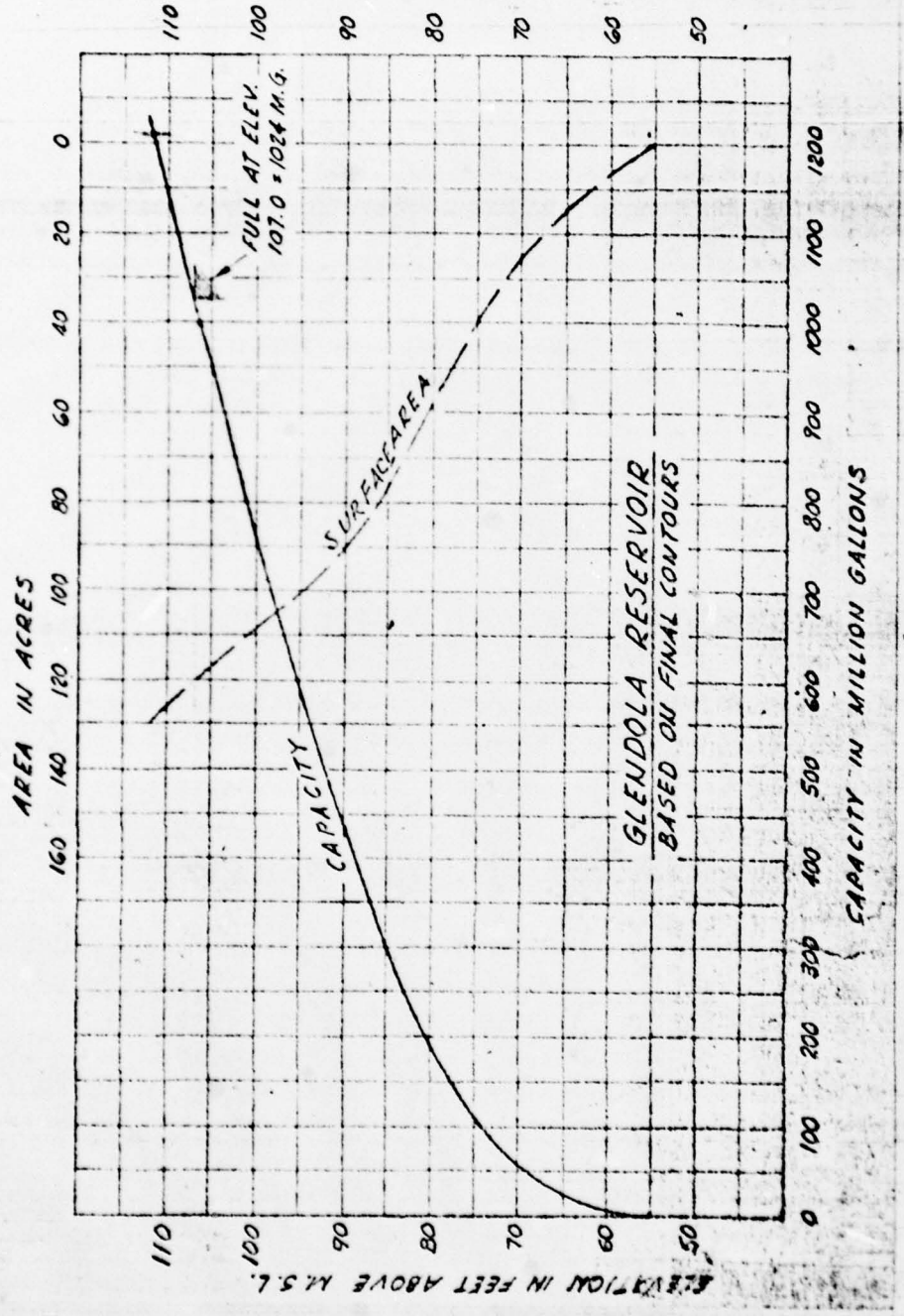
SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

GLENDOLA DAM INSPECTION

SHEET NO A1 OF

PROJECT C-227



BY D.J.M DATE 1-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A2 OF
CHKD. BY DATE GLENDALA DAM INSPECTION PROJECT C227
SUBJECT

Water surface elevation = 107.0
Invert of 36" pipe (entrance) = El 55.5
exit elevation = El 20.0
length of pipe = 6500 ft
area of lake = 130 acres
Top of dam Elev. = 112.0 area = 130 acre

PMF for 200 sq miles & 24 hours duration = 23"
48hr = 142% Hop Brook Factor = 0.8 ∴ rainfall = 26.1"

This when applied to the surface of the reservoir would produce
$\frac{26.1 \times 192}{12}$ = 417.6 acre feet of water
This would cause the water to rise to El. 110.3 in the reservoir assuming no water was being discharged — This is well below the top of the dam

APPROXIMATE DISCHARGE CALCULATIONS FOR DRAWDOWN

UNDER HEAD OF 74.13' (equation page 567 'Design of small Dams')

$$Q^2 = \frac{74.13 \times 100}{\left(\frac{2.5204(1.5)}{3^4} + \frac{466.18 \times 0.012^2 \times 6500}{3^{5.33}}\right)} = 5719$$

$Q = 76$ cfs

UNDER HEAD OF 48.38'

$$Q^2 = \frac{48.38 \times 100}{\left(\frac{2.5104(1.5)}{3^4} + \frac{466.18 \times 0.012^2 \times 6500}{3^{5.33}}\right)} = 3732$$

$Q = 61$ cfs

BY D.J.M DATE 1-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A3 OF
CHKD. BY DATE GLENDOLA DAM INSPECTION PROJECT C227
SUBJECT

Approximate Drawdown Calculations

Assuming Volume drawn down under head of 79.13'

= 1024 - 210 = 814 million gallons
= 109261745 ft^3

Time = $\frac{109261745}{76 \times 3600}$ = 400 hours

Volume drawn down under head of 98.38'

= 210 million gallons
= 28187919 ft^3

Time = $\frac{28187919}{61 \times 3600}$ = 128 hours

Σ time = 528 hours

= 22 days

In case of emergency, the lake can be drawn down. Drawdown is not controlled by water demand, as water can either overflow into wells brook from the water plant or through a 16" blowoff into the shark river