TIPPETTS-ABBETT-MCCARTHY-STRATTON NEW YORK
NATIONAL DAM SAFETY PROGRAM. STILL LAKE DAM (INVENTORY NUMBER N--ETC(U))
AUG 81 E O'BRIEN
DACWS1-81-C-0008

UNCLASSIFIED
LONG ISLAND BASIN

STILL LAKE DAM

WESTCHESTER COUNTY, NEW YORK
INVENTORY NO. N.Y. 1266

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

JULY 1981
**Phase I Inspection Report**

Still Lake Dam

Long Island Basin, Westchester County, NY

**Inventory No. 1266**

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- Hydrology, Structural Stability

**Supplementary Notes:**

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Phase I investigation of Still Lake Dam did not indicate conditions which constitute an immediate hazard to human life or property. The project, however, does have inadequacies and deficiencies which, if not remedied, have the potential for developing into hazardous conditions.
Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the spillway is inadequate for all floods in excess of 4 percent of the Probable Maximum Flood (PMF). Overtopping of the dam would significantly increase the hazard to loss of life and property, and therefore, the spillway is adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

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

Structural stability analyses based on available information and the visual inspection indicates that the stability of the spillway section against overturning is inadequate for all loading conditions except earthquake, whereas sliding is inadequate for all loading conditions.

The seepage condition which exists on the surfaces and downstream of the earth buttress should be investigated to determine its cause, the stability of the structure under the seepage forces, and to provide remedial measures.
LONG ISLAND BASIN

STILL LAKE DAM

WESTCHESTER COUNTY, NEW YORK
INVENTORY NO. N.Y. 1266

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS
JULY 1981
PREFACE

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

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

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

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.
# PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
STILL LAKE DAM
I.D. NO. N.Y. 01266
DEC. NO. 214B-819
HUDSON RIVER BASIN
WESTCHESTER COUNTY, N.Y.

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Phase I investigation of Still Lake Dam did not indicate conditions which constitute an immediate hazard to human life or property. The project, however, does have inadequacies and deficiencies which, if not remedied, have the potential for developing into hazardous conditions.

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the spillway is inadequate for all floods in excess of 4 percent of the Probable Maximum Flood (PMF). Overtopping of the dam would significantly increase the hazard to loss of life and property, and therefore, the spillway is adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

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computations, there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream of the dam.

Structural stability analyses based on available information and the visual inspection indicates that the stability of the spillway section against overturning is inadequate for all loading conditions except earthquake, whereas sliding is inadequate for all loading conditions.

The seepage condition which exists on the surfaces and downstream of the earth buttress should be investigated to determine its cause, the stability of the structure under the seepage forces, and to provide remedial measures.

It is therefore recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the one-half (1/2) PMF event. Within 12 months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of studies, should have been completed. At the same time, a detailed investigation of the structural stability of the spillway and the seepage condition and subsequent analysis should be performed. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has other problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within one year. These areas are:

1. Monitor at biweekly intervals with the aid of weirs and/or other measuring devices, the seepage occurring on the surfaces and downstream of the earth buttress.

2. Remove heavy brush, shrubs, trees and debris from the surfaces of the downstream earth buttress. Provide a program of periodic cutting and mowing of all embankment surfaces.
3. Place riprap or boulders at the toe of the spillway chute to provide proper energy dissipation and prevent erosion and undermining.

4. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain and its control facilities. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

Approved by: 

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

Date: 05 AUG 1981
SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority
The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers Contract No. DACW 51-81-C-0008 in a letter dated 14 December 1980 in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.

b. Purpose
This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF THE PROJECT

a. Description of the Dam and Appurtenant Structures
Still Lake Dam is a stone/masonry gravity structure with upstream and downstream earth buttresses. The combined crest width of the gravity structure and the downstream earth buttress is 10.5 feet. The top of the upstream buttress is 3.5 feet below the gravity crest, and is of unknown width and shape. The maximum structural height of the dam is 16 feet.

The dam is about 540 feet long and consists of three linear segments: the right, the center and the left segment. The length of each segment is 200 feet, 20 feet and 320 feet, respectively. The segments are connected and form a "dog-leg" type configuration.

The downstream earth buttress has a grassed downstream slope, approximately 1V:2H (vertical to horizontal). The upstream buttress is unprotected and has an approximate 1V:6H slope extending an unknown distance upstream of the centerline.

The overflow section of the dam is an uncontrolled stone masonry structure about 15 feet in height located about 60 feet from the right abutment contact. The top of the spillway is a broad-crested concrete sill, 9.5 feet long and 3.5 feet wide.
Above the sill is a thin concrete arched bridge; at its maximum point, the bottom of the arch is 1.5 feet above the sill crest. The downstream face of the spillway consists of 12 steps, each approximately one foot high and wide. A concrete chute, approximately 30 feet long, is located at downstream edge of the structure.

A 24-inch steel pipe serves as a reservoir drain for the project. The drain is located beneath the spillway structure and is controlled by a valve located about two feet upstream of the crest of the dam and operated by a rotating T-bar control.

Discharge over the spillway and through the drain enter into the same downstream discharge channel. The channel is located at downstream edge of the chute, and extends perpendicular to the dam for its first 200 feet, wherein it follows a circuitous path.

b. Location
The dam is located in Ossining, Westchester County, New York. The dam is located approximately four miles north-east of the City of Ossining.

c. Size Classification
The dam has a structural height of 16 feet and a reservoir storage capacity of 150 acre-feet. The dam is classified as "small" in size (50 to 1,000 acre-feet).

d. Hazard Classification
The dam is classified as "high" hazard due to the number of homes located downstream; two of these homes are less than 200 feet downstream of the dam.

e. Ownership
The dam is owned and operated by the Still Water Lake Association. The President of the Association is Mr. Barry Shainman, Adams Road, Ossining, New York, 10562, Telephone No. (914) 762-118C.

f. Purpose
Still Lake Dam creates a recreational pool for use by members of the Association.

g. Design and Construction History
The dam was constructed about 1930. No information is available regarding its design and construction history.

h. Normal Operating Procedure
Water release from the lake is uncontrolled through the broad-crested sill. According to Mr. Saltzman, the Association representative who was present during this inspection,
the reservoir drain is operated when the need arises, and usually in the fall to allow for collection of spring runoff.

1.3 **PERTINENT DATA**

a. **Drainage Area, Square Miles** 0.22

b. **Discharge at Damsite, cfs**
   - Maximum Known Flood at Damsite Unknown
   - Spillway: Maximum Pool 30
   - Reservoir Drain: Maximum Pool (Top of Dam) Unknown

c. **Elevation, USGS Datum (MSL)**
   - Maximum Pool 487 feet
   - Normal Pool 486 feet
   - Spillway Concrete Sill 486 feet

d. **Reservoir**
   - Length of Maximum Pool 1600+ feet
   - Length of Normal Pool 1600 feet

e. **Storage**
   - Maximum Pool 177 acre-feet
   - Normal Pool 150 acre-feet

f. **Reservoir Surface**
   - Maximum Pool 26.2 acres
   - Normal Pool 24.3 acres

g. **Dam Type**
   - Gravity Structure with Upstream and Downstream Earth Buttresses

   - Length 540
   - Height 16 feet
   - Crest Width: Total 10.5 feet
     - Concrete 2.5 feet
     - Downstream Earth Buttress 8 feet
   - Earth Buttress Slopes:
     - Downstream, (V:H) 1:2
     - Upstream Unknown

h. **Reservoir Drain Type**
   - Steel Pipe
   - Diameter 24-Inch
   - Closure Valve
i. **Spillway**

Type Uncontrolled, Stone/Masonry Stepped Structure with Broad-Crested Sill

Height 16 feet

Width 3.5 feet

Location 60 feet from Right Abutment Contact

Side Walls Stone/Masonry
SECTION 2- ENGINEERING DATA

2.1 GEOLOGY

Still Lake Dam is located in the New England Upland Section of the New England Maritime Physiographic Province. The bedrock in this section consists of metamorphic, igneous and sedimentary rocks which have undergone a complex sequence of deposition, folding, faulting and erosion. In the vicinity of the damsite, the rock comprises schistose gneiss of Precambrian Age. The local relief is that of a maturity dissected peneplain modified by continental glaciation.

2.2 SUBSURFACE INVESTIGATIONS

No subsurface information is available for the project. The soil deposits which exist in the vicinity of the damsite are primarily glacial tills deposited during the Late Pleistocene Age. The till is composed primarily of gravels, silts and sands.

2.3 DESIGN RECORDS

No design records are available for the project.

2.4 CONSTRUCTION RECORDS

No construction records are available for the project.

2.5 OPERATION RECORDS

No operation records exist for the project.

2.6 EVALUATION OF DATA

There are neither design records nor construction records, however information obtained from personal interviews and observation made during the visual inspection are considered adequate for Phase I inspection.
SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General
A visual inspection of Still Lake Dam was made on 17 March 1981. The weather was clear and sunny and the temperature was in the mid-fifties (°F). At the time of this inspection, the reservoir level was approximately two feet below the crest of the dam.

b. Dam
The exposed concrete surfaces of the dam appear to be in good condition; no structural cracking or deterioration was observed (See OVERVIEW). The vertical and horizontal alignment of the gravity crest and the downstream earth buttress crest are good. The alignment of the submerged upstream buttress crest could not be determined.

The surfaces of the downstream buttress contain debris, boulders, fallen trees and vegetation consisting of small bramble bushes to trees of large diameter (24-inch) (See PHOTOGRAPH 1). No surface cracking, movement at the toe or other signs of instability were observed along these surfaces.

The crest of the upstream earth buttress was, at the measured locations, 3.5 feet below the gravity crest. The submerged upstream slope was about 1V:6H, up to 15 feet from the exposed vertical upstream face of the gravity structure. According to Mr. Saltzman, there is a sharp drop in the lake bottom (or upstream buttress slope) approximately 20 feet upstream of the gravity crest.

Swamp-like vegetation and wet ground were observed along the surfaces of the downstream earth buttress and up to 40 feet downstream of the buttress toe. This condition appeared to occur along the entire length of the dam (See PHOTOGRAPHS 2, 3 and 4). In addition, an approximate 15 foot wide by 40 foot long wet area was observed near the right abutment contact. Channels have been constructed along the downstream toe by local residents to collect the seepage. In addition, a 4-inch diameter vitrified clay pipe was installed along the toe of the right buttress (to the right of the spillway section) to collect seepage in that area. This pipe discharges into the downstream spillway channel; the flow was measured to be 1+ gpm and the water was clear. No boils or other evidence of high water pressures were observed.

There is no emergency action plan for the project.
c. Spillway Section
The condition of the stone/masonry downstream steps and concrete chute is good (See PHOTOGRAPHS 6 and 7). There has been little to no deterioration; the stone appears durable and resistant to erosion and weathering. No leaks were observed through the structure. The spillway concrete sill and arch show minor signs of distress (See PHOTOGRAPH 8). The upstream surface of the spillway section could not be observed due to the existence of the upstream earth buttress. The downstream stone/masonry sidewalls appear to be in good condition (See PHOTOGRAPH 6).

d. Appurtenant Structures
The reservoir drain was not operated during this inspection, since Mr. Saltzman was unfamiliar with the valve operation. It is reported, however, that this valve is operational. No maintenance of the drain control facilities were reported.

The exposed downstream portion of the reservoir drain appears to be in good condition. The downstream channel contains small-size riprap along its sides and some vegetation (See PHOTOGRAPH 7). The area adjacent to the channel is relatively flat. Two homes exist along the banks of the channel within its first 200 feet downstream of the dam. Little or no riprap exists within the channel at the downstream edge of the spillway apron (See PHOTOGRAPH 9).

e. Reservoir
Still Lake is bordered by the Taconic State Parkway to the east and Pines Bridge Road to the south.

There are no visible signs of instability or sedimentation problems in the reservoir area.

f. Abutments
A relatively large wet area, as previously reported, was located near the right abutment contact.

3.2 EVALUATION OF OBSERVATIONS

The seepage condition which was observed requires immediate investigation to determine the extent of corrective action which is required. The following summarizes this condition as well as those previously reported, in order of importance, along with appropriate remedial action:

1. The seepage occurring along the downstream slope, at the toe and downstream of the toe, and near the left abutment contact, must be investigated immediately. Construction of weirs and monitoring of flow at biweekly intervals should be performed to determine the nature and extent of this seepage.
2. Heavy brush, shrubs, trees and debris should be cut and/or removed from the surfaces of the downstream earth buttress. A program of periodic cutting and mowing should be initiated. Inspections should be made to determine if removal and/or cutting of vegetation will adversely affect the condition of the dam.

3. Riprap or boulders should be placed at the toe of the spillway chute.

4. The reservoir drain and its control facilities should be inspected and maintained on a yearly basis. This information should be documented for future reference.

5. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain at its control facilities. Document this information for future reference. Develop an emergency action plan.
SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

No written operation and maintenance procedures exist for the project. It is reported that the reservoir drain is operated when the need arises, and usually in the fall to allow for storage or spring runoff.

4.2 MAINTENANCE OF DAM

It is reported that the dam is not maintained on a regular basis. No formal maintenance program or manual exists for the project.

4.3 WARNING SYSTEM IN EFFECT

No warning system is either in effect or preparation.

4.4 EVALUATION

The dam and appurtenances have not been adequately maintained, as evidenced by the seepage problems reported in "SECTION 3 - VISUAL INSPECTION".
SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Still Lake Dam is located northeast of Ossining in New Castle Township, Westchester County, New York (Hydrologic Unit Code 02030101) at the intersection of the Taconic Parkway and Pines Bridge Road. The drainage area contributing to the lake is 140.5 acres (0.22 square miles) of wooded gently sloping terrain with relatively little development. The lake occupies approximately 17 percent of the drainage area.

5.2 ANALYSIS CRITERIA

The analysis of the capacity of the service spillway was performed using the HEC-1DB computer program(1). A unit hydrograph was developed using Snyders coefficient of $C_T = 2$ and $640 \ C_p = 325$. The all season Probable Maximum Precipitation for 200 square miles in 24 hours of 22 inches was obtained from the Weather Bureau's Hydro-meteorological Report No. 33 and distributed over 48 hours(2). In accordance with the "Recommended Guidelines for Safety Inspection of Dams"(3), the adequacy of the spillway was analyzed using the Probable Maximum Flood (PMF).

5.3 SPILLWAY CAPACITY

The principal spillway of Still Lake Dam is 9.5 feet in length with a crest elevation of 486, 1.0 feet below the top of the dam. The spillway is assumed to act as a broad-crested weir and the computed maximum discharge with a head of 1.0 feet is 30 cfs.

5.4 RESERVOIR CAPACITY

The normal capacity of Still Lake is listed as 150 acre-feet with 27 acre-feet of surcharge storage, which is equivalent to about 2.3 inches of runoff over the entire basin.

5.5 FLOODS OF RECORD

There are no records available of floods or maximum lake elevations; however, it is reported that the dam has never been overtopped.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated on the basis of the spillway discharge capacity and the available surcharge storage to meet the selected design flood inflows.
The computed PMF, routed through the lake resulted in a maximum lake elevation of 487.54 feet, 0.54 feet above the top of the dam. Duration of flow over the dam was 12.3 hours, and the peak outflow was 718 cfs. One-half (1/2) the PMF raised the lake elevation to 487.32 feet with a peak discharge of 351 cfs. Lake elevation was assumed to be 486 (spillway crest elevation) at the start of the flood event.

A summary of the HEC-1DB multi-plan analysis is listed below.

<table>
<thead>
<tr>
<th>RATIO OF PMF</th>
<th>PEAK INFLOW (cfs)</th>
<th>PEAK OUTFLOW (cfs)</th>
<th>MAXIMUM DEPTH OVER DAM (ft)</th>
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<td>718</td>
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<td>0.50</td>
<td>364</td>
<td>351</td>
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<tr>
<td>0.25</td>
<td>182</td>
<td>133</td>
<td>0.15</td>
</tr>
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</table>

5.7 EVALUATION

The Still Lake Dam spillway is capable of discharging only 4 percent of the PMF without the dam being overtopped. The overtopping could cause the failure of the dam thus significantly increasing the hazard to the loss of life downstream. Therefore, the spillway is assessed as being "seriously inadequate".
SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations
   Visual observations did not indicate conditions which are an immediate hazard to life and property. However, the seepage condition which exists on the surfaces and downstream of the downstream earth buttress should be investigated to determine its cause, the stability of the dam and to provide remedial action. Although it is not an immediate hazard to life and property, if left uncorrected, this condition is potentially hazardous to life and property downstream of the dam.

b. Design and Construction Records
   No design drawings, construction records or other pertinent project information is available for the project.

c. Operating Records
   No operating records are kept for the project.

d. Post-Construction Changes
   No post-construction changes have been reported.

e. Seismic Stability
   In accordance with recommended Phase I guidelines, the dam is located in Seismic Risk Zone 1. However, based on local seismic experience, the New York State Geological Survey recommends that the damsite is to be considered in Zone 2. Therefore, the stability of the spillway was determined using a seismic coefficient of 0.05g.

6.2 STRUCTURAL STABILITY ANALYSIS

Since there are no design drawings for the project, the geometry of the spillway section for stability analyses was based on visual observations and engineering judgment. In addition the analysis was performed in accordance with the Corps of Engineers guidelines (Ref. 3). A detailed sketch along with stability computations is presented in Appendix E. A description of the cases examined and a summary of the results of the analyses are presented below.

<table>
<thead>
<tr>
<th>Case</th>
<th>Description of Loading Conditions</th>
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<tbody>
<tr>
<td>1</td>
<td>Normal Loading, Lake Level at El 486, No Tailwater, Full Uplift</td>
</tr>
<tr>
<td>2</td>
<td>Same as Case 1, with 5 K/LF, Ice Load</td>
</tr>
<tr>
<td>3</td>
<td>Unusual Loading, 1/2 PMF, Lake Level at 486.32, Tailwater 1.7 Feet.</td>
</tr>
</tbody>
</table>
Case Description of Loading Conditions

4 Extreme Loading, Full PMF, Lake Level at 486.52, Tailwater 2.4 Feet

5 Unusual Loading, Case 1 with Earthquake Loading (Zone 1, n = 0.05)

SUMMARY OF RESULTS

<table>
<thead>
<tr>
<th>Case</th>
<th>Location of Resultant</th>
<th>Sliding Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.34ft Outside Middle Third</td>
<td>1.63</td>
</tr>
<tr>
<td>2</td>
<td>6.77ft Outside Middle Third</td>
<td>1.13</td>
</tr>
<tr>
<td>3</td>
<td>1.53ft Outside Middle Third</td>
<td>1.43</td>
</tr>
<tr>
<td>4</td>
<td>1.77ft Outside Middle Third</td>
<td>1.40</td>
</tr>
<tr>
<td>5</td>
<td>Within Base</td>
<td>1.37</td>
</tr>
</tbody>
</table>

The results of the stability analysis indicate that the stability of the section analyzed is inadequate in overturning except for earthquake loading, and inadequate in sliding for all loading conditions. The configuration of the gravity spillway structure and the upstream earth buttress should be determined to more accurately evaluate the stability of the structure. After obtaining this information, an in-depth structural stability analysis should be conducted.
7.1 **ASSESSMENT**

a. **Safety**

Phase I investigation of Still Lake Dam does not indicate conditions which constitute an immediate hazard to human life or property. Based on engineering judgment and the performance of the dam, the project appears to be in fair condition. The project, however, does have inadequacies and deficiencies which, if not remedied, have the potential for developing into hazardous conditions.

Using the Corps of Engineers screening criteria for initial review of spillway adequacy, it has been determined that the spillway is inadequate for all floods in excess of 4 percent of the Probable Maximum Flood. Overtopping of the dam would significantly increase the hazard to loss of life and property, and therefore, the spillway is adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

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

Structural stability analyses based on available information and the visual inspection indicates that the stability of the spillway section against overturning is inadequate for all loading conditions except earthquake, whereas sliding is inadequate for all loading conditions.

b. **Adequacy of Information**

The lack of in-depth engineering data did not allow for a definitive assessment. Therefore, the adequacy of the dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. **Need for Additional Investigations**

The following investigations are required to be performed by a licensed engineer experienced in dam engineering:

1. Investigate the site specific characteristics of the watershed to more accurately determine the hydrologic/hydraulic capabilities of the dam and watershed. Conduct studies to determine what measures are necessary to improve discharge capacities.
2. Determine the exact geometry of the gravity structure and the material properties of the downstream and upstream earth buttress and foundation. Perform an in-depth structural stability analysis.

3. Investigate the seepage condition which exists along the surfaces of the downstream earth buttress, downstream of the buttress, and near the right abutment contact, and to recommend measures to eliminate these conditions.

d. Urgency
The additional required investigations described above must be initiated within 3 months from the date of notification. Within one year of notification, remedial measures as a result of this investigation must be initiated, with completion of these measures during the following year. In the interim, develop an emergency action plan for notification of downstream residents and proper governmental authorities in the event of overtopping and provide around-the-clock surveillance of the dam during periods of extreme runoff. The other deficiencies as reported below must be corrected within one year of notification.

7.2 RECOMMENDED MEASURES

1. The results of the aforementioned in-depth investigations will determine the appropriate remedial measures required.

2. Monitor at biweekly intervals with the aid of weirs and/or other measuring devices, the seepage through and under the dam.

3. Remove vegetation and debris from the surfaces of the downstream earth buttress. Provide a program of periodic cutting and mowing of all embankment surfaces. Inspections should be made to determine if removal and/or cutting of vegetation will adversely affect the condition of the dam.

4. Place riprap or boulders at the toe of the spillway chute to provide proper energy dissipation and prevent erosion and undermining.

5. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of the reservoir drain valve and its control facilities. Document this information for future reference. The emergency action plan described in Section 7.1(d) should be maintained and updated periodically during the life of the structure.
TOPOGRAPHIC MAP
STILL LAKE DAM

PLATE 2
PHOTOGRAPH 1. CONDITION OF DOWNSTREAM SLOPE OF EARTH BUTTRESS (OBSERVE DEBRIS AND VEGETATION)

PHOTOGRAPH 2. SEEPAGE THROUGH DAM (OBSERVE SWAMP-LIKE VEGETATION AT TOE)
PHOTOGRAPH 3. WET GROUND APPROXIMATELY 40 FEET DOWNSTREAM OF DAM

PHOTOGRAPH 4. SEEPAGE DOWNSTREAM OF DAM
PHOTOGRAPH 5. CHANNEL DOWNSTREAM AND PARALLEL TO DAM TO COLLECT SEEPAGE

PHOTOGRAPH 6. SPILLWAY
PHOTOGRAPH 7. CONDITION OF SPILLWAY CHUTE AND DOWNSTREAM CHANNEL

PHOTOGRAPH 8. CONDITION OF BROAD-CRESTED CONCRETE SILL
PHOTOGRAPH 9. AREA DOWNSTREAM OF DAM
VISUAL INSPECTION CHECKLIST

APPENDIX C
VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam: Still Lake Dam
Fed. I.D. #: NY01266
DEC Dam No.: Unknown
River Basin: Lower Hudson River
Location: Town: Ossining, County: Westchester
Stream Name: None
Tributary of: New Croton Reservoir
Latitude (N): 41°12.2'
Longitude (W): 73°48.6'
Type of Dam: Masonry-Earthfill Buttress
Hazard Category: High
Date(s) of Inspection: 17 March 81
Weather Conditions: Sunny, 55°F
Reservoir Level at Time of Inspection: 2.25 ft below dam crest

b. Inspection Personnel: Mr. Harvey Feldman and Mr. Albert DiBernardo

c. Persons Contacted (Including Address & Phone No.): Mr. Irv Saltzman (914) 762-0041

Ossining, New York 10562

Mr. Barry Shainman (914) 762-1180
Adams Road, Ossining, New York 10562

d. History:

Date Constructed: 1930
Date(s) Reconstructed: Not

Designer: Unknown

Constructed By: Unknown

Owner: Still Water Lake Association

Sheet 1
2) Embankment

a. Characteristics

(1) Embankment Material Earthfill material, has consistency of a
silt or sandy silt

(2) Cutoff Type Unknown, however there is believed to be none

(3) Impervious Core None

(4) Internal Drainage System A vitrified clay pipe extends along
the downstream toe to the right of the spillway section (Facing d/s)

(5) Miscellaneous No drawings for the dam exist. It appears that the
cement structure is buttressed by an upstream earth buttress as well as
downstream earth buttress; however, the upstream buttress could not
be inspected because it was submerged.

b. Crest

(1) Vertical Alignment i.e. vertical alignment of the concrete wall
and the d/s earth buttress is good with no sags or depressions

(2) Horizontal Alignment The dam contains a dog leg approximately
200 ft from the right abutment contact

(3) Surface Cracks None were observed along the embankment crest
nor the concrete crest

(4) Miscellaneous None

c. Upstream Slope (Upstream Earth Buttress)

(1) Slope (Estimate) (V:1I) 1:6 (very approx due to submergence)

(2) Undesirable Growth or Debris, Animal Burrows None was observed.

(3) Sloughing, Subsidence or Depressions Could not be determined
due to submergence, at the slope
(4) Slope Protection  None was visible

(5) Surface Cracks or Movement at Toe  Unknown

d. Downstream Slope

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

(2) Undesirable Growth or Debris, Animal Burrows  Trees up to 2', small saplings and brush and some debris exist

(3) Sloughing, Subsidence or Depressions  None observed

(4) Surface Cracks or Movement at Toe  None observed

(5) Seepage  Seepage exists along the entire length of the dam, with some locations worse than others. The seepage areas are generally located 20 to 40 ft from the embankment toe. No seepage was observed through the embankment

(6) External Drainage System (Ditches, Trenches; Blanket)  Ditches exist however they were installed by the local landowner to channel the seepage

(7) Condition Around Outlet Structure  Generally in good condition with only minor situtation at invert of outlet pipe

(8) Seepage Beyond Toe  See note No. 5) directly above. Also it was reported that one house just 1/2 of the dam has a continuous wet basement

c. Abutments - Embankment Contact

Appear to be free of leaks and does not show signs of instability
(1) Erosion at Contact None

(2) Seepage Along Contact None

3) Drainage System
   a. Description of System A vitrified clay pipe (12" Ø) collects seepage
      through the dam to the right of the spillway. The pipe was
      flowing and appeared to be unobstructed. It is unknown whether
      an internal drainage system exists.
   b. Condition of System See (a.)
   c. Discharge from Drainage System A small quantity of flow was
      recorded exiting the vitrified clay pipe.

4) Instrumentation (Documentation/Surveys, Observation Wells, Weirs,
   Piezometers, Etc.) None

Sheet 4
5) Reservoir
   a. Slopes The Taconic Parkway Embankment bounds the lake to
      the west. All slopes appear stable.
   b. Sedimentation The water was relatively clear. Sedimentation does not
      appear to be a problem.
   c. Unusual Conditions Which Affect Dam None

6) Area Downstream of Dam
   a. Downstream Hazard (No. of Homes, Highways, etc.) A number of summer
      and year-round homes exist downstream of the dam.
   b. Seepage, Unusual Growth Seepage was observed along the entire length of
      typically 20 to 40 feet from the toe.
   c. Evidence of Movement Beyond Toe of Dam None
   d. Condition of Downstream Channel The downstream channel is straight for
      the first 150 ft (approx) of the spillway chute and then is diverted
      through a constructed stone structure.

7) Spillway(8) (Including Discharge Conveyance Channel)
   a. General The spillway consists of a broad crested weir with an
      arched concrete top, i.e. \[ y = \frac{3}{2} x \] where \( y = 1.5 \text{ ft} \), \( x = 9.5 \text{ ft} \)
      The water flows through the weir down an approximate 12 step structure
      constructed of boulder masonry. Prior to entering the channel, flows
      channelled down a concave upward masonry chute.
   b. Condition of Service Spillway The spillway appears to be in good condition, however, construction
      at each side of the weir exist. The surface of the masonry
      chute was very irregular, either due to erosion or poor construction
      techniques.
c. Condition of Auxiliary Spillway  

Not Applicable

---

d. Condition of Discharge Conveyance Channel  
The downstream channel is clear of obstructions and in generally good condition. It is approx. 6 ft wide and 3 ft deep and has rock protected side slopes. The channel is relatively straight for the first 150 ft (approx) d/s of the dam.

---

3) Reservoir Drain/Outlet

Type:  

- Pipe  
- Conduit  
- Other

Material:  

- Concrete  
- Metal  
- Other

Size:  

- 2 feet  
- Length  
- Unknown

Invert Elevations:  

- Entrance  
- Exit  
- Unknown

Physical Condition (Describe):  

Unobservable

Material:  

- Steel, appeared to be in good condition at the outlet

Joints:  

- Unknown  
- Alignment  
- Unknown

Structural Integrity:  

Flow through the pipe was not permitted since no one could operate the regulating valve.

Hydraulic Capability:  

Unknown (See above)

Means of Control:  

- Gate  
- Valve  
- Uncontrolled

Operation:  

- Operable  
- Inoperable  
- Other  
- Unknown

Present Condition (Describe):  

Unknown

* However, according to Mr. Saltzman, the drain has been operated in the past.

Sheet 6
a. Concrete Surfaces  The concrete surfaces appeared to be in good 
condition with minor bulging occurring at a few locations 
along the upstream face.

b. Structural Cracking  No major structural cracks were observed.

c. Movement - Horizontal & Vertical Alignment (Settlement)  The vertical 
and horizontal alignment appear good.

d. Junctions with Abutments or Embankments  The earth buttress(es) appear 
to be in good contact with the concrete wall.

e. Drains - Foundation, Joint, Face  None located except for that which 
was previously mentioned.

f. Water Passages, Conduits, Sluices  None except for the low level 
outlet previously described.

g. Seepage or Leakage  None

Sheet 7
h. Joints - Construction, etc. Joints were in good condition, with no observable erosion, deterioration, spalling or leakage occurring.

i. Foundation Unknown

j. Abutments Not Applicable

k. Control Gates Not Applicable

l. Approach & Outlet Channels See previous description on Sheet 5

m. Energy Dissipators (Plunge Pool, etc.) A 12 step structure for dissipation of flow and masonry chute as previously described.

n. Intake Structures Not Applicable

o. Stability Appears to be stable

p. Miscellaneous None
10) **Appurtenant Structures** (Powerhouse, Lock, Gatehouse, Other)
   
a. Description and Condition
   
   There are no powerhouse, lock, gatehouse, or other appurtenant structures located at the dam site.
## AREA-CAPACITY DATA:

<table>
<thead>
<tr>
<th>Description</th>
<th>Elevation</th>
<th>Surface Area</th>
<th>Storage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of Dam</td>
<td>487</td>
<td>26.3</td>
<td>177 acre-ft</td>
</tr>
<tr>
<td>Design High Water (Max. Design Pool)</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Auxiliary Spillway Crest</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Pool Level with Flashboards</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Service Spillway Crest</td>
<td>486</td>
<td>24.3</td>
<td>150 acre-ft</td>
</tr>
</tbody>
</table>

## DISCHARGES

<table>
<thead>
<tr>
<th>Description</th>
<th>Volume (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily</td>
<td>Unknown</td>
</tr>
<tr>
<td>Spillway @ Maximum High Water</td>
<td>30 cfs</td>
</tr>
<tr>
<td>Spillway @ Design High Water</td>
<td>Unknown</td>
</tr>
<tr>
<td>Spillway @ Auxiliary Spillway Crest Elevation</td>
<td>None</td>
</tr>
<tr>
<td>Low Level Outlet</td>
<td>Unknown</td>
</tr>
<tr>
<td>Total (of all facilities) @ Maximum High Water</td>
<td>30+ cfs</td>
</tr>
<tr>
<td>Maximum Known Flood</td>
<td>Unknown</td>
</tr>
<tr>
<td>At Time of Inspection</td>
<td>None</td>
</tr>
</tbody>
</table>
### Crest:

<table>
<thead>
<tr>
<th>Type</th>
<th>6A c/741 9.5 feet (Sill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spillover</td>
<td>Broad-crested sill</td>
</tr>
<tr>
<td>Location</td>
<td>60 feet from left abutment</td>
</tr>
</tbody>
</table>

### Spillway:

<table>
<thead>
<tr>
<th></th>
<th>Service</th>
<th>Auxiliary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>486</td>
<td>Not Applicable (N.A.)</td>
</tr>
<tr>
<td>Type</td>
<td>Unknown</td>
<td>N.A.</td>
</tr>
<tr>
<td>Width</td>
<td>Unknown</td>
<td>N.A.</td>
</tr>
<tr>
<td>Type of Control</td>
<td>Uncontrolled concrete sill</td>
<td>N.A.</td>
</tr>
<tr>
<td>Controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>N.A.</td>
<td>(Flashboards; gate)</td>
</tr>
<tr>
<td>Number</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>Size/Length</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>Invert Material</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>Anticipated Length of operating service</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>30 feet (+)</td>
<td>Chute Length</td>
<td>N.A.</td>
</tr>
<tr>
<td>Not Applicable</td>
<td>Height Between Spillway Crest &amp; Approach Channel Invert (Weir Flow)</td>
<td>N.A.</td>
</tr>
</tbody>
</table>
HYDROMETEOROLOGICAL GAGES:

Type: None
Location: Not Applicable (NA)
Records:
  Date: N.A.
  Max. Reading: N.A.

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):
  Valve and 24" reservoir drain
DRAINAGE AREA: 0.22 square miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

<table>
<thead>
<tr>
<th>Land Use - Type</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain - Relief</td>
<td>Hilly</td>
</tr>
<tr>
<td>Surface - Soil</td>
<td>Glacial Tills</td>
</tr>
</tbody>
</table>

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

Unknown

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

Appear to be none

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

Unknown

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

Location: None

Elevation: Not Applicable

Reservoir:

Length @ Maximum Pool 1600 + feet

Length of Shoreline (at Spillway Crest) 1 mile
Smythos Coef: $640 \text{ CP} \sim 375$

$C_T \sim 2$, $C_p = 0.59$

$L = 1.2'' \times 2600' \sim 0.19$ mile

$L_m = 5'' \times 1000 \sim 0.19$ mile

$T_p = 2 \{1.40(0.19)\}^{0.3} \sim 0.98$ \quad Use $T_p = 0.233$

$T_{PR} = 0.9811 + 0.250(0.3333 - 0.1784) = 0.9811 + 0.0387 = 1.02$ hrs

From Hypoten 33.

All seasons 200 sq mile 24 hour PMP \sim 22 miles Zone 5

10 sq mile (point transfer) percent values:

6 hour 411
12 hour 523
24 hour 133
48 hour 142

Initial Loss 20''

Constant Loss 0.1

Lake Area AS $\% = \frac{\text{CSFL}}{\text{Lake Area}} \times (\frac{\text{CP}}{140.5}) \times 120 = 17\%$

<table>
<thead>
<tr>
<th>EL</th>
<th>LB Base</th>
<th>RB Dist 350 Yr 500ft</th>
<th>3/5 Data</th>
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</thead>
<tbody>
<tr>
<td>500</td>
<td>100</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>480</td>
<td>270</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>474</td>
<td>420</td>
<td>440</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td>430</td>
<td>430</td>
<td></td>
</tr>
</tbody>
</table>
Spillway Division

Width 9.5'

Ht below arched walkway
- at ends 0.5' at center 1.5

Max Q at 1.0' = 30 cfs.

DAM dimensions

Top of dam elevation 487. C= 3.09, (rev: 2.5)

Width 540'

Surcharge STORACE COMPUTATION:

<table>
<thead>
<tr>
<th>Fl. A</th>
<th>Ave. Mill. Area</th>
<th>Ave. Volume</th>
<th>Surcharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(ft²)</td>
<td>(ft³)</td>
<td>(ft³)</td>
</tr>
<tr>
<td>486</td>
<td>37.3</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>4</td>
<td>27.3</td>
<td>109.2</td>
<td></td>
</tr>
<tr>
<td>490</td>
<td>39.3</td>
<td>109.2</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>39.6</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>458</td>
<td></td>
<td>658</td>
<td></td>
</tr>
</tbody>
</table>

Rating for Spillway - Assume walkway II washed out.

<table>
<thead>
<tr>
<th>Fl. A</th>
<th>C</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>486</td>
<td></td>
<td></td>
</tr>
<tr>
<td>487</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td>488</td>
<td>3</td>
<td>89</td>
</tr>
<tr>
<td>490</td>
<td>2</td>
<td>51</td>
</tr>
</tbody>
</table>
TAMS

Job No. 1579-16
Project STILL LAKE DAM.
Subject HYDROLOGIC/HYDRAULIC COMPUTATIONS

This water elevation at section 300 ft down stream of Dam:
Steam invert = 470.
Max water level = 472 + 3/8 in.
471 7/8 in.

Distance water surface slope same as initial slope.
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|

**STILL LIFE FOR FEMALE 1**

**INSPECTION**

**SPECIFICATIONS**

**1.**

**MULTIPLE ANALYSIS TO BE PERFORMED**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>7.63</th>
<th>7.55</th>
<th>7.72</th>
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**1. BAIN RECLUSE**

**SPECIFICATIONS**

<table>
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<tr>
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<th>7.53</th>
<th>7.63</th>
<th>7.73</th>
<th>7.83</th>
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**ABSORPTION DATA**

<table>
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<tr>
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<th>7.93</th>
<th>8.03</th>
<th>8.13</th>
<th>8.23</th>
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</table>

**TESTED BY THE PROJECT**

<table>
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<tr>
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<th>7.33</th>
<th>7.43</th>
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<th>7.63</th>
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**ABSORPTION DATA**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>7.03</th>
<th>7.13</th>
<th>7.23</th>
<th>7.33</th>
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</table>

**TESTED BY THE PROJ**

<table>
<thead>
<tr>
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<th>7.73</th>
<th>7.83</th>
<th>7.93</th>
<th>8.03</th>
</tr>
</thead>
</table>

**APPROXIMATE CLAY COEFFICIENTS FROM GIVEN DATA**

<table>
<thead>
<tr>
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<th>7.53</th>
<th>7.63</th>
<th>7.73</th>
<th>7.83</th>
</tr>
</thead>
</table>

**APPROXIMATE HYDROGRAPH TO EXCEPT-PERIOD RESULTS TO BE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>7.93</th>
<th>8.03</th>
<th>8.13</th>
<th>8.23</th>
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**APPROXIMATE HYDROGRAPH TO EXCEPT-PERIOD RESULTS TO BE**

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</table>

**APPROXIMATE HYDROGRAPH TO EXCEPT-PERIOD RESULTS TO BE**

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<th>7.03</th>
<th>7.13</th>
<th>7.23</th>
<th>7.33</th>
</tr>
</thead>
</table>

**STUDY TO BE**

<table>
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<tr>
<th>ITEM</th>
<th>7.73</th>
<th>7.83</th>
<th>7.93</th>
<th>8.03</th>
</tr>
</thead>
</table>
STABILITY ANALYSIS

APPENDIX E
### Loading Conditions

<table>
<thead>
<tr>
<th>Case</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal Loading - Lake Level at Overflow Section Crest Elevation (EL 486)</td>
</tr>
<tr>
<td>II</td>
<td>Normal Loading as in Case I, with an additional Ice Loading of 5 kips/lf. at 0.5 feet below crest</td>
</tr>
<tr>
<td>III</td>
<td>Unusual Loading, Lake Level at 1/2 PMF (EL 487.52)</td>
</tr>
<tr>
<td>IV</td>
<td>Extreme Loading, Lake Level at Full PMF (EL 487.52)</td>
</tr>
<tr>
<td>V</td>
<td>Unusual Loading, Lake Level as in Case I, with additional Earthquake loadings for Zone 2 criterion (n = 0.05)</td>
</tr>
</tbody>
</table>

### Stability and Overturning Criteria

<table>
<thead>
<tr>
<th>Case</th>
<th>Location of Resultant</th>
<th>Shear Friction Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>middle third</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>II</td>
<td>middle third</td>
<td>&gt; 8.0</td>
</tr>
<tr>
<td>III</td>
<td>middle third</td>
<td>&gt; 3.0</td>
</tr>
<tr>
<td>IV</td>
<td>middle third</td>
<td>&gt; 3.0</td>
</tr>
<tr>
<td>V</td>
<td>within base</td>
<td>&gt; 1.5</td>
</tr>
</tbody>
</table>
ASSUMED GEOMETRY AND MATERIAL PROPERTIES

1. The configuration of the spillway section is, as shown, on Figure 1. For stability, the 90° face of the gravity structure was assumed to be 0.711 to IV.

2. The upstream earth buttress was assumed to have a IV: 6H slope to a distance of 15 ft from the dam and a IV: 1H slope thereafter. (See configuration for Case I).

3. The dam was assumed to be founded on a soil foundation. The shearing resistance between the soil and gravity base is tan φ, and φ was assumed to be 25° with a C = 1.6y.

4. The unit weights of the materials were assumed as follows:
   - Stone/Masonry: 2.4 y w or 150 lbs/ft²
   - Saturated Earth Backfill: 2 y w or 125 lbs/ft²

Also, the lateral earth pressure coefficient was assumed to be 0.5 for the upstream earth buttress. No passive resistance was assumed at the toe.

5. The arched concrete structure above the overflow crest was excluded from this analysis.

6. Refer to Figure 1 for Assumed Typical Cross Section and Assumed Values of Material Properties.

7. Stability analyses criteria in accordance with Corps of Engineers recommended guidelines.
TAMS

Job No. 1579-16
Project Still Lake Dam, Phase I Inspection
Subject Stability Analysis

ASSUMED TYPICAL CROSS-SECTION
OF OVERFLOW SECTION

Crest of Spillway

Assumed D/S Face of Gravity Structure

Assumed Upstream Slope (NTS)
(See note 2) 15'

\[ \gamma_{sat} = 20 \text{ ksf} \]
\[ K_{fr} = 0.5 \]

\[ \delta_w = 0.062 + K/10^9 \]
\[ \delta_{sat} = \text{saturated unit weight of soil} \]
\[ \delta_c = \text{unit weight of concrete} \]

\[ \delta = 2.4 \delta_w \]

\[ \phi = 25^\circ + \gamma \]

Foundation (soil): \[ \gamma = 26 \text{ ksf} \]

SCALE 1 inch = 4 feet

Figure 1
NTS = Not to Scale (when stated)
COMPUTATION OF STRUCTURE CENTER OF GRAVITY (CofG)

--- Weight Computations ---

<table>
<thead>
<tr>
<th>Section</th>
<th>$F'(1)$</th>
<th>$F'(2)$</th>
<th>$B$</th>
<th>$H$</th>
<th>$F'FBHv_w$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$W_1$</td>
<td>1.0</td>
<td>2.4</td>
<td>3.5</td>
<td>15</td>
<td>126 $v_w$ (Total Weight: 238.36 $v_w$)</td>
</tr>
<tr>
<td>$W_2$</td>
<td>0.5</td>
<td>2.4</td>
<td>9.4</td>
<td>13.5</td>
<td>152.3 $v_w$</td>
</tr>
</tbody>
</table>

Note: (1) $F'$ is a geometric factor, i.e., for a triangle $F' = 0.5$, for a rectangle $F' = 2.0$

(2) $F_{mi}$ is a coefficient multiplied by $v_w$ (62.9 pcf) to obtain unit weight

Determine Moment Weights About Point O:

(a) $\bar{x} = \frac{W_1 X_1 + W_2 X_2}{W_1 + W_2}$  
where $X_i$ = distance to C of E of Section in x-direction

$\bar{x} = \frac{126 v_w \left( \frac{3.5}{2} \right) + 152.3 v_w \left( 3.5 + \frac{9.5}{3} \right)}{126 v_w + 152.3 v_w + 0}$

$\bar{x} = 4.44$ feet

(b) $\bar{y} = \frac{W_1 y_1 + W_2 y_2 + W_3 y_3}{W_1 + W_2}$  
where $y_i$ = distance to C of E of Section in y-direction

$\bar{y} = \frac{126 v_w \left( \frac{15}{2} \right) + 152.3 v_w \left( 15 - \frac{15}{2} \right)}{126 v_w + 152.3 v_w + 0}$

$\bar{y} = 5.86$ feet
**TAMS**

**Job No.** 1579-16  
**Project** Still Lake Dam: Phase I Inspection  
**Subject** Stability Analyses: Normal Loading Condition (Lake level at Spillway Crest)

**Case 1: Normal Loading Condition**  
(Lake level at Spillway Crest)

---

**ASSUMED TYPICAL CROSS SECTION**

**SCALE:** 1 inch = 5 feet

<table>
<thead>
<tr>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>10ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
<td>Q</td>
</tr>
</tbody>
</table>

**(Pressure Distributions Not to Scale)**

**Definitions**

- **W**: Total Weight of Structure
- **E**: At Rest Earth (Water) Force Along Upstream Face (Ignore Effects of IV.6H slope)
- **U**: Uplift Force Beneath Spillway

---

**Forces (Kips/LE)**

- **Pw**: 
  \[ P_w = 0.5(486 - 471)^2 \delta_w = 112.5 \delta_w \rightarrow \]
- **Pe**: 
  \[ P_e = 0.5(482.5 - 471)(13 - \delta_w) = 66.1 \delta_w \rightarrow \]
- **ΣFh**: 
  \[ ΣF_h = 128.6 \delta_w \rightarrow \]
- **W**: 
  \[ W = 278.3 \delta_w \rightarrow \]
- **U**: 
  \[ U = 0.5(13)(486 - 471)\delta_w = 97.5 \delta_w \rightarrow \]
- **ΣFv**: 
  \[ ΣF_v = 160.88 \delta_w \rightarrow \]

---

**Moment About A (Kip - Feet/LE)**

- **Pw**: 
  \[ P_w = (112.5 \delta_w)(5) = 562.5 \delta_w \]
- **Pe**: 
  \[ P_e = (66.1 \delta_w)(3.83) = 253.2 \delta_w \]
- **W**: 
  \[ W = 278.3 \delta_w(13 - 444) = 2382.2 \delta_w \]
- **U**: 
  \[ U = 97.5 \delta_w(13 - 4.33) = 845.3 \delta_w \]
From Previous Table:

\[ \Sigma F_H = 178.6 \, \delta w \rightarrow (K/LF) \]
\[ \Sigma F_V = 180.8 \, \delta w \downarrow (K/LF) \]
\[ \Sigma M_{\text{resisting}} = \frac{W_T}{(K-H/LF)} = 2.9822 \delta w \left( \frac{K-F/LF}{K-H/LF} \right) \]  
\[ \Sigma M_{\text{opposing}} = P_H + P_T + \delta w = 1661 \delta w \left( \frac{K-H/LF}{K-H/LF} \right) \]

\[ \Sigma M_{\text{resisting}} = \Sigma M_r \]
\[ \Sigma M_{\text{opposing}} = \Sigma M_o \]

Location of Resultant at Base

\[ \overline{x}_{\text{Result}} = \frac{\Delta (M_r-M_o)}{\Sigma F_V} = \frac{721.2 \delta w}{180.8 \delta w} - \frac{13}{3} \]
\[ \overline{x}_{\text{Result}} = -0.34 \text{ ft outside middle third} \]

Shear Factor of Safety:

\[ S.F.F.S. = \frac{\Sigma F_V \tan \phi + cA}{\Sigma F_H} = \frac{(180.8 \delta w) \tan 25 + 1 \times (13)}{178.6 \delta w} \]
\[ S.F.F.S. = 1.63 < 3.0 \text{ (No Good)} \]
CASE II - NORMAL LOADING (Lake Level at Spillway Crest) WITH ICE LOAD

ASSUMED TYPICAL CROSS SECTION

SCALE: inch = 5 feet

Pressure Distribution: Not to Scale

Definitions:

\( W_t \) = Total Weight of Structure
\( P_e(w) \) = At Rest Earth (Water) Force
\( U \) = Uplift Force Beneath Spillway
\( P_i \) = Ice load = 5,000 lbs/ft. or 80.18 lbs.

\( P_e = 80.18 \times (486 - 0.5 - 47) = 1161.9 \) lbs.

From Page 6 of 17, the summation of forces and moments follows:

\[ \Sigma F_H = \Sigma F_H (pg \text{ lot of 17}) + \vec{P}_i = 178.6 \text{ lbs} + 80.18 \text{ lbs} = 258.7 \text{ lbs} \]  

\[ \Sigma F_V = \Sigma F_V (pg \text{ lot of 17}) = 180.8 \text{ lbs} \]  

\[ \Sigma M \text{ resisting} = \Sigma M \text{ resisting (pg lot of 17)} = 2382 \text{ lbs} \]  

\[ \Sigma M \text{ opposing} = \Sigma M \text{ opposing (pg lot of 17)} = 2823 \text{ lbs} \]  

\[ \Sigma F \text{ resisting} = \]  

\[ \Sigma F \text{ opposing} = \]
Resultant Location:

\[
\overline{X}_{\text{result}} = \frac{E(M_r - M_0)}{EF_Y} - \frac{B}{3}
\]

\[
= \frac{(2382 - 2823) kN}{180.8 kN/m} - \frac{13}{3}
\]

\[
\overline{X}_{\text{result}} = -6.77 \text{ feet (outside middle third)}
\]

Shear Factor of Safety:

\[
S.F.F.C = \frac{EF_Y + tan \phi CA}{EF_H} = \frac{180.8 kN/m \tan 25^\circ + 1(13)}{258.7 kN/m}
\]

\[
= 1.18 < 3.0 \text{ (No Good)}
\]
CASE III: UNUSUAL LOADING (½ PMF)

ASSUMED TYPICAL CROSS SECTION

SCALE: Inch = 5 Feet

(Pressure Distributions Not to Scale)

Definitions:

\[ W = \text{Total Weight of Structure} \]

\[ P_w = \text{At Rest Earth (Water) Force Alone Upstream Face} \]

\[ U = \text{Uplift Force Force-o-Mom} \]

\[ Y_w = \text{YM} \]

\[ \bar{X}_w = \frac{555.4 Y_w}{117.1 Y_w} = \frac{555.4 Y_w}{117.1 Y_w} \]

Determine Uplift Force, Location (\( \bar{X}_w \)) and Moment:

\[ u_1 = (487.32 - 471) Y_w = 16.32 Y_w \]

\[ u_2 = (472.7 - 471) Y_w = 1.7 Y_w \]

\[ U = \frac{u_1 + u_2}{2} (13) = 117.1 Y_w \]

Location:

\[ \bar{X}_w = 1.7 Y_w \left( \frac{13}{2} \right) + Y_w (16.32 - 1.7) \left( \frac{13}{3} \right) \]

\[ \bar{X}_w = 4.74 \text{ feet} \]
TAMS

Determine $P_w$ Force, Location ($\bar{y}_{pw}$) and Moment:

Force:

$$P_w = \gamma_w (487.92 - 486) = 1.32 \gamma_w$$
$$P_w = \gamma_w (487.32 - 471) = 16.32 \gamma_w$$

$$P_w = \frac{\left[1.32 \gamma_w + 16.32 \gamma_w\right]}{2} (486 - 471)$$

$$P_w = 132.3 \gamma_w \rightarrow (k/LF)$$

Location:

$$\bar{y}_{pw} = \frac{\gamma_w (486-471) \left\{1.32 (486-471) + \frac{1}{2} (16.32-1.32) (486-471)\right\}}{\gamma_w (486-471) \left\{(1.32) + \frac{1}{2} (16.32-132)\right\}}$$

$$\bar{y}_{pw} = 5.37 \text{ feet}$$

Moment: $P_w \times \bar{y}_{pw} = 710.5 \gamma_w^2 \rightarrow (k-ft/LF)$

Determine $P'_w$ Force, Location ($\bar{y}_{pw}'$) and Moment $P'_w$:

Force:

$$P'_w = 0.6 \left\{(0.5)(472.7-471)^2 \gamma_w \right\}$$

$$P'_w = 0.87 \gamma_w \rightarrow (k/LF)$$

Location:

$$\bar{y}_{pw}' = \frac{1}{3} (472.7-471)$$

$$\bar{y}_{pw}' = 0.57 \text{ ft.}$$

Moment: $P'_w \times \bar{y}_{pw}' = 0.50 \gamma_w^2 \rightarrow (k-ft/LF)$
TAMS

Subject: Stability Analysis: Unusual Loading (1/2 PMF)

Summation of Forces and Moments:

1. \( \Sigma F_H: \ \bar{P}_W + \bar{P}_E - \bar{P}_W = 132.3 \gamma_w + 66.1 \gamma_w - 0.87 \gamma_w \)
   \( \Sigma F_H: \ 197.5 \gamma_w \rightarrow (K/LF) \)

2. \( \Sigma F_V: \ \omega_T - \omega_T = 278.3 \delta_w - 117.1 \gamma_w \)
   \( \Sigma F_V: \ 161.2 \delta_w \rightarrow (K/LF) \)

3. \( \Sigma M_{resisting} (about o): \ \omega_T + \bar{P}_W = 2382 \delta_w + 0.5 \delta_w \)
   \( \Sigma M_{resisting} : \ 2382.5 \delta_w \) (K-ft/LF)

4. \( \Sigma M_{resisting} (about o): \ \bar{P}_W + \bar{P}_E + \omega_T = 710.5 \delta_w + 253.2 \delta_w + 967.2 \gamma_w \)
   \( \Sigma M_{resisting} : \ 1931 \gamma_w \) (K-ft/LF)

Resultant Location:

\( \bar{x}_{result} = \frac{2382.5 \delta_w - 1931 \gamma_w}{161.2 \delta_w} - \frac{13}{3} \)

\( \bar{x}_{result} = -1.53 \) ft (outside middle third)

Shear Friction Factor of Safety:

\( S.F.F.S = \frac{\Sigma F_V \tan \phi + cA}{\Sigma F_H} \)

\( S.F.F.S = \frac{161.2 \gamma_w \tan 25^\circ + 1(13)}{197.5 \gamma_w} \)

\( S.F.F.S = 1.43 < 3.0 \) (No Good)
**CASE IV: EXTREME LOADING (PMF)**

**ASSUMED TYPICAL CROSS SECTION**

**SCALE:** Inch = 5 feet

<table>
<thead>
<tr>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
</table>

(Pressure Distributions Not to Scale)

**Definitions:**

- \( W_t \): Total Weight of Structure
- \( P_{E(w)} \): At. Rest Earth (Water) Force
- \( U \): Uplift Force Beneath Spillway

**Determine Uplift Force, Location \( \bar{x}_w \) and Moment \( \bar{M} \):**

**Force:**

\[
U_1 = (487.52 - 471) y_w = 16.52 y_w \\
U_2 = (473.4 - 471) y_w = 2.4 y_w \\
U = \left( \frac{U_1 + U_2}{2} \right) (13) = 123 y_w \uparrow (K-14/CF)
\]

**Location:**

\[
\bar{x}_w = \frac{13 y_w \left( \frac{2.4}{2} \right)^{13}}{13y_w \{ 2.4 + 0.5 \left( 16.52 - 2.4 \right) \}} \\
\bar{x}_w = 4.2 \text{ ft}
\]
Moment (about O): \( U(13 - \bar{y}_w) = 998.8 \delta_w \)

Determine \( P_w \) Force, Location \( (\bar{y}_{pw}) \) and Moment:

Force:
\[
P_{w1} = 6 \delta_w (487.2 - 486) = 1.52 \delta_w \\
P_{w2} = 6 \delta_w (487.2 - 471) = 16.52 \delta_w \\
P_w = \left( \frac{P_{w1} + P_{w2}}{2} \right) (486 - 471) \\
P_w = 135.3 \delta_w \rightarrow (K/LF)
\]

Location:
\[
\bar{y}_{pw} = \frac{6 \delta_w (486 - 471) \left\{ 1.52 \left( \frac{486 - 471}{2} \right) + \frac{1}{2} \left( 16.52 - 1.52 \right) \right\}}{6 \delta_w (486 - 471) \left\{ 1.52 + \frac{1}{2} (16.52 - 1.52) \right\}} \\
\bar{y}_{pw} = 54.2 \text{ feet}
\]

Moment: \( P_w (\bar{y}_{pw}) = 733.3 \delta_w \rightarrow (K\cdot ft/LF) \)

Determine \( P_{w'} \) Force, Location \( (\bar{y}_{pw'}) \) and Moment:

Force:
\[
P_{w'} = 0.6 \left( 0.5 \left( 473.4 - 471 \right)^2 \delta_w \right) \\
P_{w'} = 1.7 \delta_w \rightarrow (K/LF)
\]

Location:
\[
\bar{y}_{pw'} = \frac{1}{2} (2.4) = 0.8 \text{ feet} \\
\text{Moment: } P_{w'} (\bar{y}_{pw'}) = 14 \delta_w \rightarrow (K\cdot ft/LF) \]
SUMMATION OF FORCES AND MOMENTS:

1. $\Sigma F_H: \vec{P}_W + \vec{P}_E - \vec{P}_f = 155.3 \gamma_w + 66.1 \gamma_w - 1.7 \gamma_w$
   $\Sigma F_H = 199.7 \gamma_w \rightarrow (k/LF)$

2. $\Sigma F_V: W - V - U_t = 278.3 \delta_w - 123 \delta_w$
   $\Sigma F_V = 155.3 \delta_w (k/LF)$

3. $\Sigma M_{resisting (about 0)}: \vec{W}_T + \vec{P}_W = 2382 \delta_w + 1.9 \gamma_w$
   $\Sigma M_r = 2583 \delta_w (k-ft/LF)$

4. $\Sigma M_{opposing (about 0)}: \vec{P}_W + \vec{P}_E + \vec{U}_t = 735.3 \delta_w + 253 \delta_w$
   $\Sigma M_o = 1985.3 \delta_w (k-ft/LF)$

Location of Resultant:

$R_{result} = \frac{\Sigma (M_r - M_o)}{\Sigma F_V} = \frac{399.1 \gamma_w}{155.3 \delta_w} \rightarrow \frac{3}{4}$

$X_{result} = -0.69 \text{ ft. (outside middle half)}$

Shear

Friction Factor of Safety

$S_{FFS} = \frac{\Sigma F_V \tan \phi + cA}{\Sigma F_H} = \frac{155.3 \delta_w \tan 25^\circ + 1(13)}{199.7 \gamma_w}$

$S_{FFS} = 1.40 < 3.0 \quad \text{(No Good)}$
CASE V: UNUSUAL LOADING: NORMAL POOL WITH EARTHQUAKE

ASSUMED TYPICAL CROSS SECTION
SCALE: 1inch = 5feet

Definition:

- $W_T$: Total weight of structure
- $P_e(w)$: Act. Pos. Earth (Water) Force
  Along Up-Stream Face
  (Ignore Effects of IV 6H:33= U = Uplift Force Beneath Spillway)
- $U$: Spillway

Determine Dynamic Force
Water Force ($P_{eq}$)
Zone 2, $n = 0.05$

- Zanger's Coefficient $C = 0.726$ when $B = 0$
- $P_{eq} = 0.726 \times 0.05 \times \gamma_w \times (486 - 482.5)^2 = 0.44 \gamma_w \rightarrow (k/ft)$
- $M_{eq}$ (about Pt. 0): $P_{eq} \times \frac{(482.5 - 471) + 0.4(486 - 482.5)}{2} = 5.78 \gamma_w$ (ft-

Inertia Force ($nW_T$)

- $\frac{nW_T}{W_T} = 0.05(238.3\gamma_w) = 13.9 \gamma_w \rightarrow (k/ft)$
- $M_{nW_T} = 13.9 \gamma_w (5.86) = 81.5 \gamma_w \rightarrow (k-f/ft)$
Determine Inertia Force of Upstream slope Assuming Following Geometry of slope.

COMPUTATION OF WEIGHTS

<table>
<thead>
<tr>
<th>Section</th>
<th>( F' )</th>
<th>( F'_y )</th>
<th>( B )</th>
<th>( H )</th>
<th>( F'_F )</th>
<th>( B H )</th>
<th>( \delta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>2.0</td>
<td>15</td>
<td>25</td>
<td>38 ( \delta )</td>
<td>( \delta )</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>2.0</td>
<td>15</td>
<td>9</td>
<td>270 ( \delta )</td>
<td>( \delta )</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.5</td>
<td>2.0</td>
<td>9</td>
<td>9</td>
<td>81 ( \delta )</td>
<td>( \delta )</td>
<td></td>
</tr>
</tbody>
</table>

Find location of C o t E. of \( W_s \) Earth Butress:

\[
\bar{y} = \frac{38 \delta (9 + \frac{2}{3}) + 270 \delta (9/2) + 81 \delta (9/3)}{38 \delta + 270 \delta + 81 \delta} = 4.71 \text{ feet}
\]

\( M_{tot} = n WTE(\bar{y}) = (19.5 \delta)(4.71) = 91.8 \delta \)
TAMS

Job No. 1579-16

Sheet 17 of 17

Still Lake Dam: Phase I Inspection

Date 24 April 81

Stability Analysis: (Unusual Loading - Normal Pool)

With Earthquake

By A.D.

Chk. by

---

Summation of Forces and Moments

1. \( EF_H : 1786 \delta w + \vec{P_{eq}} + n \vec{W_T} + n \vec{w_T} = 212.4 \delta w \rightarrow (K/LF) \)

2. \( EF_V : 180.8 \delta w \downarrow \) (From pg. 5 of 17) \((K/LF)\)

3. \( EM \text{ resist} : 2382 \delta w \uparrow \) (From pg. 5 of 17) \((K-ft/LF)\)

4. \( EM \text{ opps} : 1661 \delta w + \vec{M_{PEQ}} + M_{wT} + M_{wT} \)

\[ m_{opp} = 1840 \delta w \downarrow \) \((K-ft/LF)\)

Location of Resultant:

\[ \bar{x}_r = \frac{\sum (M_r - M_0) \cdot B}{EF_V} \]

\[ \bar{x}_r = 542 \delta w \]

\[ \bar{x}_r = 2.99 \text{ within base. OK} \]

Shear Friction Factor of Safety:

\[ SF\text{FFS} = \frac{EF_v \tan \phi + cA}{EF_H} = \frac{180.8 \delta w \tan 25 + 1(15)}{212.4 \delta w} \]

\[ SF\text{FFS} = 1.37 < 1.5 \text{ MG} \]
REFERENCES


2. "Seasonal Variation of the Probable Maximum Precipitation, East of the 105th Meridian for Areas from 10 to 1,000 Square Miles, and Durations of 6, 12, 24 and 48 Hours", Hydrometeorological Report No. 33. Weather Bureau, U.S. Department of Commerce, April 1956.


4. "How to Read Topo Maps", Internal Report, Civil Engineering, Purdue University, West Lafayette, Indiana.
