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**UNCLASSIFIED**
CONNECTICUT RIVER BASIN
HOLYOKE, MASSACHUSETTS

McLEAN RESERVOIR
MA 00539

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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

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MARCH 1979

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**Title:** McLean Reservoir

**Type of Report & Period Covered:** Inspection Report

**Performing Org. Report Number:**

**Author(s):**

U.S. Army Corps of Engineers
New England Division

**Perfoming Organization Name and Address:**

DEPT. OF THE ARMY, CORPS OF ENGINEERS
NEW ENGLAND DIVISION, NEDED
424 TRAPELO ROAD, WALTHAM, MA. 02254

**Report Date:**

March 1979

**Number of Pages:**

53

**Abstract:**

The dam is comprised of a 700 ft. long, 35 ft. high earthfill embankment and a 920 ft. long, 15 ft. high earthfill dike. The dam is generally in fair condition. It has a size classification of intermediate and a hazard classification of low. Remedial measures consist of removal of all brush and trees from the downstream slope of the main dam and spillway channel and repair of spalled and deteriorated concrete on the emergency spillway.
DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.
Honorable Edward J. King  
Governor of the Commonwealth of 
Massachusetts  
State House  
Boston, Massachusetts 02133  

Dear Governor King:  

I am forwarding to you a copy of the McLean Reservoir Phase I 
Inspection Report, which was prepared under the National Program for 
Inspection of Non-Federal Dams. This report is presented for your use 
and is based upon a visual inspection, a review of the past performance 
and a brief hydrological study of the dam. A brief assessment is in-
cluded at the beginning of the report. I have approved the report and 
support the findings and recommendations described in Section 7 and ask 
that you keep me informed of the actions taken to implement them. This 
follow-up action is a vitally important part of this program. 

A copy of this report has been forwarded to the Department of Environ-
mental Quality Engineering, the cooperating agency for the Commonwealth 
of Massachusetts. In addition, a copy of the report has also been 
furnished the owner, City of Holyoke, Board of Water Commissioners, 
Holyoke, Massachusetts 01040. 

Copies of this report will be made available to the public, upon 
request, by this office under the Freedom of Information Act. In the 
case of this report the release date will be thirty days from the date 
of this letter. 

I wish to take this opportunity to thank you and the Department of 
Environmental Quality Engineering for your cooperation in carrying out 
this program. 

Sincerely yours,  

[Signature]  

John P. Chandler  
Colonel, Corps of Engineers  
Division Engineer
NATIONAL DAM INSPECTION PROGRAM
PHASE I INVESTIGATION REPORT

Identification No: MA 00539
Name of Dam: McLean Reservoir
City: Holyoke
County and State: Hampden County, Massachusetts
Stream: McLean Reservoir
Date of Inspection: December 6, 1978

The dam is comprised of a 700± foot, 35 foot high earthfill embankment dam and a 920± foot long, 15± foot high earthfill dike, a gatehouse with outlet controls and a 10 foot wide concrete arch emergency spillway. The reservoir is fed by a 20 inch line from the Tighe Carmody Reservoir and the drainage area. Discharge through the gatehouse enters the Holyoke Water Department Supply System. Construction of the dam was completed in 1903. The dam's purpose has always been water supply. The facility has always been owned, operated and maintained by the Holyoke Water Department.

Visual inspection indicated that the dam is in generally fair condition.

The dam has a size classification of intermediate and a hazard classification of low. According to Corps guidelines, the test flood would be the 100 year storm. The inflow would be 375 cfs. With the water level assumed to spillway crest at time of test flood, spillway discharge of about 30 cfs would occur. The reservoir would be surcharged to elevation 433, four feet above the spillway crest and two feet below the dam crest. The dam will not be
overtopped. There were no indepth engineering data available and therefore, the adequacy of the dam was evaluated based primarily on visual inspection, past performance history, and engineering judgement.

The dam is generally in fair condition. Remedial measures consist of removal of all brush and trees from the downstream slope of the main dam and spillway channel and repair of spalled and deteriorated concrete on the emergency spillway. It is further recommended that the owner engage a qualified engineer to investigate the seepage conditions at the downstream toe. These recommendations and remedial measures should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

Ronald H. Cheney, P.E.
Associate
Hayden, Harding & Buchanan, Inc.
Boston, Massachusetts
This Phase I Inspection Report on McLean Reservoir has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division
PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.
It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an 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.
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PHASE I
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: McLEAN RESERVOIR

SECTION 1
PROJECT INFORMATION

1.1 General
   a. Authority

   Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Hayden, Harding & Buchanan, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued Hayden, Harding & Buchanan, Inc. under a letter of 28 November 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-79-C-0012 has been assigned by the Corps of Engineers for this work.
b. **Purpose**

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 **Description of Project**

a. **Location**

The dam, McLean Reservoir is located in the City of Holyoke, in Hampden County, Massachusetts. The reservoir is formed by the drainage from the north central portion of East Mountain. The dam is located along the southeastern shore of the reservoir. McLean Reservoir is shown on the Mount Tom Quadrangle, Massachusetts and has the approximate coordinates of North 42° 10' 30" West 72° 40' 12"

b. **Description of Dam and Appurtenances**

The dam is comprised of an earthfill embankment, a gatehouse, with outlet controls, an earthfill dike, and an emergency spillway. The embankment has a maximum fill height of 35 feet, a plan length of 700 feet and an average crest width of about 24 feet. The central portion of the embankment contains a mortared masonry core wall founded on ledge. The upstream embankment face is partially...
ripraped and sloped at 2\(\frac{1}{2}\) horizontal to 1 vertical. The
downstream face has a 3:1 slope and is lined with turf,
rockfill, brush and trees. The dike has a plan length of
about 920 feet, a maximum fill height of about 15 feet and
also contains a mortared masonry core wall founded on
ledge. The typical crest width is 12 feet. A gravel
access road traverses both the dam and dike. The dikes
upstream face is stone paved and sloped at 2 horizontal to
1 vertical. The downstream area in front of the dike is
filled in with spoil material removed from the basin of the
reservoir. The emergency spillway is located near the dam and
dike interface and is a 3.75 foot high by 10 foot wide concrete
arch culvert. The base of the spillway is founded 6 feet
below the crest of the dam and is lined with unmortared
stone. The fieldstone masonry gatehouse is located at the
center of the earth embankment. It contains the manual
controls for a 30 inch diameter outlet pipe and a 20 inch
diameter inlet pipe. The intake structure for the 30 inch
outlet pipe is located about 100 feet upstream of the gate-
house and the outlet pipe feeds to a chlorinating station
at Ashley and eventually into the Holyoke Water Systsem.
The 20 inch inlet pipe feeds water to the reservoir from
the upstream Tighe Carmody Dam. This line is controlled
at the gatehouse and has its outlet located at the toe of
the embankment approximately 50 feet upstream and about 50
feet to the east of the gatehouse. Prior to 1963 these 2
lines were both used as outlets for the McLean Reservoir.
However, due to the reservoir's low recharge capability, this original system could easily drain the pond.

The present system of operation is with the inlet pipe normally open and the outlet pipe feeding between 3 and 5 million gallons a day into the Holyoke Water System.

c. **Size Classification**
   The dam is classified as intermediate according to its impoundment capacity of 1240 acre feet and height of 35 feet.

d. **Hazard Classification**
   McLean Reservoir is classified as low hazard. Land below the dam is owned by the City of Holyoke for use by the Water Department. The land is wooded and undeveloped and it is unlikely to be developed. Ashley Pond (part of the water supply system) is about 2000 feet downstream.

e. **Ownership**
   The dam is owned by the City of Holyoke Board of Water Commissioners and has always been part of their water system.

f. **Operator**
   The designated caretaker of the dam is Mr. Edward Welsh, Superintendent of the Holyoke Water Department, 20 Commercial Street, Holyoke, Massachusetts 01040.
   Telephone (413) 536-0442

g. **Purpose of Dam**
   The purpose of the dam has always been water supply.
h. **Design and Construction History**

The original design plans were prepared by J.L. Tighe and dated 1899 through 1903. The dam was constructed in 1903. Subsequent repairs were performed on the corewall of the dike in 1939, when seepage through several corewall cracks were sealed. The original outlet pipes system consisting of two 20-inch lines was modified to one 30-inch line in 1963.

i. **Normal Operational Procedures**

There is nominal operational procedure for this dam. The level of the reservoir and quantity of outlet water is dependant on the demand of the system. The reservoir has additional water feed to it via a 20-inch inlet from the Tighe Carmody Reservoir. This 20-inch line is controlled at the gatehouse and is normally left open. There is a 30-inch outlet line which is controlled at the gatehouse and normally drains 3 to 5 million gallons of water per day into the Holyoke Water System.

1.3 **Pertinent Data**

a. **Drainage Area**

The drainage area (301 acres - 0.47 s.m.) is comprised of wooded hills sloping towards the reservoir, and flat to hilly land immediately around and to the north of the impoundment. Runoff drains directly into the reservoir or from a swampy area to the north.

Development within the drainage area is limited to the U.S. Route 202 crossing, and several improved and unimproved roads throughout the area.
No residential buildings are located between the outlet for the emergency spillway and Ashley Pond, which would receive its discharge. A culvert under Westfield Road and utility lines are the only structures located below the dam.

The dam has always been used for water supply. The water level is typically well below the spillway level. The small drainage area does not provide adequate runoff into the dam to be useful for water supply. As such, a 20-inch pipe brings water from the Tighe Carmody Reservoir to maintain the reservoir's water level. Daily flows normally vary between 3 to 5 million gallons.

b. Discharge at Dam Site

This dam has a 30-inch CI pipe located near the central portion of the earth embankment, which is used as a water supply intake. Flow through the pipe is controlled manually at a fieldstone masonry gatehouse with the intake structure located about 100 feet upstream of the house. The intake pipe invert is at elevation 411.0ft.

The spillway is comprised of a 3.75' x 10' arched culvert. A 3' high overflow weir was installed in the outlet channel approximately 15 feet downstream of the arch. This weir reduces any flow through the culvert. With water at the top of dam, flow through the culvert would be about 36 cfs.

Specific information pertaining to maximum flood discharges at this site is not available. According to personnel
of the Holyoke Water Department, the dam was not overtopped by the 1955 flood and the emergency spillway has only been used once in the last 10 years. The crest elevation of the emergency spillway is 429.

For the 100 year flood the emergency spillway outflow is 30 cfs at elevation 433.0, with the water level at elevation 429 just prior to the storm.

c. Elevation (ft. above MSL)
(1) Streambed at centerline of dam------------------------400±
(2) Maximum tailwater---------spillway discharges to steep channel D.S.; backwater minimal
(3) Upstream portal invert diversion tunnel----------none
(4) Recreation pool----------(Water Supply Reservoir)----------N/A
(5) Full flood control pool--(Water Supply Reservoir)----------N/A
(6) Spillway crest-(weir elevation432.)------(ungated) 429
(7) Design surcharge (Original Design)------------------unknown
(8) Top Dam ------------------------------------------435
(9) Test flood design surcharge---------- 433.0 (100 yr.) (assuming 429 for a base elevation)

d. Reservoir
(1) Length of maximum pool--------------------- 2000' (100 yr.)
(2) Length of recreation pool------------------none (water supply) normal pool:2000'
(3) Length of flood control pool---------- N/A (water supply)
e. **Storage (acre feet)**

1. Recreation pool-------------------(water supply) N/A
2. Flood control pool-------------------(water supply) N/A
3. Spillway crest pool----(elevation 429)--------960±
4. Test flood pool------------------------1200
5. Top of dam---------------------------------1240

f. **Reservoir Surface (acres)**

1. Flood control pool----------------------------N/A
2. Recreation pool---none (water supply) normal pool 43±
3. Spillway crest-------------------------------46±
4. Test flood pool-------------------------------59±
5. Top of dam---------------------------------72±

g. **Dam**

1. Type-------------------Gravity, earth embankment and dike
2. Length------- 700'±(dam section) 920'± (dike section)
3. Height-------------------35'(dam) 15' (dike)
4. Top Width------- 24' (dam section) 12' (dike section)
5. Side Slopes-------------------2½:1 riprap U.S. 3:1 turf D.S.
6. Zoning-------------------------------none
7. Impervious Core-mortared masonry wall founded on ledge
8. Cutoff-------------------------------core wall 3' into ledge
9. Grout curtain-------------------------------none

h. **Diversion and Regulating Tunnel**----------------------------------none
i. **Spillway**

(1) Type—— concrete arch culvert with overflow weir  
(see photos 2,3 and Appendix B plans)

(2) Length of weir--------------------------10'

(3) Crest elevation---------------------culvert 429, weir 432

(4) Gates --------------------------------- none

(5) U/S Channel-----10' wide rock lined with concrete side walls

(6) D/S Channel-----10' wide rock lined with concrete side walls, weir

(7) General--------weir and arch restrict flow through outlet channel

j. **Regulating Outlets**

The regulating outlets for this dam consist of a 30" C.I. outlet pipe for water supply (City of Holyoke Water Department) and the 10' wide concrete arch culvert emergency spillway. The outlet pipe is operated manually from controls located within a fieldstone-masonry gatehouse at the center of the earth embankment. Its intake structure is located approximately 100' upstream of the gatehouse and has an invert elevation of 411±. The 30" pipe feeds to a chlorination facility and eventually to the Holyoke Water Supply system.

As previously described, the emergency spillway (shown by photos 2,3 & 4) is lined with unmortared stone and has concrete sidewalls. The crest invert of the culvert is at elevation 429. The arched culvert is 3 to 3.75 feet high. The crest of the overflow weir is at elevation 432. The effective outlet is very small, having a low discharge rate.
SECTION 2
ENGINEERING DATA

2.1 **Design**

The dam was designed by J.L. Tighe in 1899 to 1903. Design plans dated 1899 through 1903 were located at the Holyoke Water Department. Design plans outlining corewall leakage in 1939 were also located. No indepth engineering design calculations were located.

2.2 **Construction**

The dam was built in 1903. Plans were found at Holyoke Water Department dated 1903, outlining cross sections used for construction estimates and cement tests. No other construction data was located.

2.3 **Operation**

No engineering operational data was located.

2.4 **Evaluation**

a. **Availability**

The original plans and 1939 plans were made available at the Holyoke Water Department, Holyoke, Massachusetts. State Inspection Reports from 1974 and 1977 along with some correspondence were made available at the Department of Environmental Quality Engineering, Division of Waterways, Boston office.
b. **Adequacy**

The lack of in-depth engineering data does not allow for a definitive review. Therefore the adequacy of this dam structurally and hydraulically, can not be assessed from the standpoint of review of design calculation, but must be based primarily on the visual inspection, past performance history, and sound engineering judgement.

c. **Validity**

The visual inspection of this facility showed no reason to question the validity of the information supplied.
SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General

McLean Reservoir Dam was inspected on December 6, 1978. At that time there was no water flowing over the spillway and the reservoir was frozen just upstream of the embankment. The outlet gate was open during the inspection.

b. Dam

The dam consists of a main embankment section with a maximum height of about 35 feet. The main embankment is about 700 feet long. An embankment dike extends beyond the right abutment of the main dam. This dike is approximately 920 feet long and has a maximum height of about 15 feet. Photo 1 shows the crest and upstream slope of the main dam in the foreground and the dike in the background.

A spillway structure is on the right abutment passing through the embankment and forms the boundary between the main embankment section and the dike.

Upstream Slope

The upstream face of the dam is on a slope of 2.5:1. The upper 10½ feet of the upstream slope was above the reservoir and available for inspection. The riprap slope protection extended from the water surface to within about 4 feet of the dam crest, photo 1. Above the riprap the upstream surface is covered with grass.

The riprap is in good condition and no slumping or slides were observed above the reservoir level.
Crest

The crest of the dam is about 24 feet wide and grass covered. No evidence of cracking or misalignment of the crest was observed.

Downstream Slope

The downstream face of the dam is on a slope of 3:1. The downstream slope is overgrown with grass, bushes, brambles, and small trees. The overgrown condition of the slope is shown in photos 4 and 12. This dense growth makes inspection of the downstream face very difficult.

There are numerous bedrock outcrops at the toe of the downstream slope as shown in photos 7 and 9. The observation is consistent with early drawings of the dam which indicate it is founded on bedrock.

Photo 7 shows the numerous small trees which have grown along the downstream toe of the dam.

Standing water was observed at the toe of the slope between the spillway on the right abutment and a point opposite the gatehouse. At the time of inspection the water surface was covered with leaves, but in some places the water was 4 inches deep. Photo 8 shows a wet area about 30 feet from the spillway. At this point the ground is so soft and wet that a stick could be inserted easily below the water surface a distance of about 18 inches.
Seepage at the downstream toe has been noted during previous inspections, and during an inspection performed on January 24, 1974, it was noted that visible seepage was exiting from a rock fill at the toe of the dam. This previously noted seepage was not observed during this inspection but water was exiting along rock joints above the toe of the dam near the right abutment, as shown in photo 9. A rock fill has been placed at the downstream toe in about the central one third of the dam. The slope of this fill is shown in photo 11. Previous inspection reports indicate that this rock fill was placed because of excessive seepage in this area. Details of when the rock fill was placed and the type of materials used in the fill were not available.

c. Appurtenant Structures

The spillway, which is located in the right abutment area, is 10 feet wide. The approach channel to the control weir passes through the embankment. This approach section is shown in photo 2. The floor of the channel is paved with boulders. The left training wall of the spillway, which retains the embankment, is in poor condition. Photo 3 shows the control weir and the concrete lined discharge channel immediately downstream. The concrete is placed on bedrock, and

McLean Reservoir
there are numerous bedrock outcrops along the discharge channel, as indicated by photo 6. The fieldstone masonry gatehouse is in good condition with no signs of needed repairs. The gate feeding the water system was open during the inspection. The outlet from the gatehouse feeds water into the Holyoke Water System through a 30-inch pipe. A 20-inch diameter pipe feeds water to this reservoir from the Tighe Carmody reservoir. The gate for this pipe was also open during the inspection. Both pipes are located beneath the surface and could not be observed during the inspection. The emergency spillway according the City personnel has only received water once in the last 10 years.

d. Reservoir Area

The reservoir area slopes are relatively steep and contain no houses. A more detailed description of the drainage area is included in Section 1.3.a of this report. The amount of siltation within the reservoir is unknown.

e. Downstream Channel

The spillway discharges into a poorly defined channel at the base of the right abutment. Bedrock outcrops immediately opposite the discharge channel form a wall about 6 feet high. There are numerous trees growing in and adjacent to the channel.

3.2 Evaluation

Visual inspection indicates that the dam is in fair condition. Seepage was observed over a large portion of the downstream toe. A rock fill berm has been placed after
initial construction presumably to arrest damage to the embankment due to excessive seepage. The details of the construction of this berm were not available.

Excessive growth of grass, bushes, and trees on the downstream slope prevent a thorough examination of this slope.

The spillway was observed to be in poor condition with excessive spalling and deterioration.
SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The major purpose of the McLean Reservoir Dam is for water supply for the City of Holyoke. The normal operating procedure is for the 30-inch outlet line to be left open to feed water to the Ashley Chlorinating Station and then into the City water system. The controls for the outlet line are located in the gatehouse and are regulated according to demand by the Holyoke Water Department. The 20-inch inlet line normally feeds water to the reservoir from the Tighe Carmody Reservoir. A further description of these lines is given in Section 1.2.b.

4.2 Maintenance of Dam

The dam is maintained by the Holyoke Water Department. They are responsible for reviewing the State Inspection Reports and instituting the necessary repairs. Heavy brush was found on the downstream face during this inspection.

4.3 Maintenance of Operating Facilities

The gate valves which operate the intake and supply pipes are operated regularly by the City.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

Since the gates are operated on a regular basis no formal operating procedure appears to be necessary. With the exception of the poor condition of the emergency spillway,
the heavy growth on the downstream face and the possible
toe seepage discussed in Section 3.1, the dam appears to
be in good condition. However, due to the aforementioned
conditions the overall condition of the dam is considered
to be fair. This dam should be inspected yearly by qualified
personnel who can identify any areas of concern which could
in time lead to serious deficiencies.
5.1 Evaluation of Features

a. General

The dam was designed and is used as a water supply reservoir. It is a 35 foot high earth fill structure with a storage capacity of 1240 a-f. The surrounding drainage area (300 acres) is undeveloped wooded land. Below the dam there is no development except for Westfield Road. East of Westfield Road are Ashley Pond, Wright Pond and Connor Reservoir. All are part of the Holyoke Water Supply System.

b. Design Data

The dam was designed from 1899 to 1903. Construction was completed in 1903. No design calculations were located. The dam has always been used for water supply and is maintained by the City of Holyoke.

c. Experience Data

Discussions with Water Works employees indicated that the dam has never been overtopped. During the August 19, 1955 hurricane, the Holyoke area received about 18 to 19 inches of rainfall. The water level is usually several feet below the spillway elevation.

d. Visual Observations

The dam shows no evidence of having been overtopped. There is no defined outlet channel below the spillway. Visual observations of the drainage area and general vicinity.
show it to be generally as indicated on the U.S.G.S. map. This is described in Section 1.3 of this report.

e. **Overtopping Potential**

   Due to the dam's size and hazard potential, the test flood chosen was the 100 year storm. The peak inflow is 375 cfs from the 300 acre drainage area. The water level is normally well below the spillway elevation of 429. The storage capacity is large enough to retain the runoff without water reaching elevation 429, spillway crest, except after periods of very prolonged rainfall conditions.

   The outlet culvert has an arched top and an overflow weir (see photos 2 and 3 and Appendix B plans). The top of the weir is 0.7 feet below the arch. The actual flow channel is very small and restricted.

   If the water level were assumed at elevation 429, the pond could retain the 100 year inflow of 375 cfs and be surcharged to elevation 433. The outflow through the small arch opening would be about 30 cfs. With the water level below elevation 429 there will be no outflow as the storage capacity exceeds the volume of runoff.

f. **Dam Failure Analysis**

   Assuming the dam failed, about 60,000 cfs of water would be released. There are no homes or developed areas below the dam. Sections of Westfield Road, a gravel
road serving only the reservoir, could be washed out or blocked by floodwater. The released waters would flow overland into the lower ponds. At Westfield Road, the flood stage at elevation 327± would cover the road with about 7 feet of water.
SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The visual observation did not disclose any immediate stability problems. However, the left training wall of the spillway approach channel which also acts as a retaining wall for the embankment is badly deteriorated. Failure of this wall would expose the embankment to spillway flows.

Significant seepage was found at the downstream toe of the main dam, and the exit points of this seepage could not be delineated at the time of the inspection.

b. Design and Construction Data

According to drawings dated 1903, the main dam and the dike have a mortared masonry core wall. The drawings indicate that the main dam was built on bedrock. The most impervious fill available during construction was placed upstream of the core wall and "rolled in 4 inch layers." Debris taken from the reservoir cleaning operation was placed on the gravel downstream slope.

The dike was constructed with gravel upstream and downstream of its central core wall. The downstream surface of the dike was used as a disposal area for waste material removed from clearing of the reservoir.

A 24 inch diameter intake pipe leading to a 30 inch diameter feed pipe downstream of the gatehouse passes through the main dam above the bedrock foundation. A 20 inch diameter pipe now used as a feed to this reservoir from the Tighe Carmody McLean Reservoir.
reservoir is located in a trench excavated in the bedrock. Details of the construction of these pipes were not available. Since they are located beneath the surface, they could not be observed during this inspection.

c. Operating Records

No operating manual was available for this dam.

d. Post-Construction Changes

At an undetermined time after initial construction, a rock fill berm was placed over a portion of the downstream toe. The available information did not indicate why the rock fill had been placed, but it is located in the area of seepage along the toe and may have been placed because of excess seepage in the area. In 1939, repairs were made to the core wall of the dike to correct observed seepage.

In 1963, the inlet-outlet system was modified so that a 20 inch inlet line from the upstream Tighe Carmody reservoir feeds this reservoir. The gate on this line is normally left open. The 30 inch outlet line drains 3 to 5 million gallons per day into the City water system. Prior to 1963, both lines were used as outlets.

e. Seismic Stability

The dam is located in Seismic Zone 2, and according to the USCE guidelines, it is assumed that there is no hazard from earthquake loading.
SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual examination indicates the dam is in generally fair condition. There were observed indications of seepage on the downstream face of the dam embankment and the spillway was observed to be in poor condition with excessive spalling and deterioration.

b. Adequacy of Information

The information made available, along with the visual inspection, are adequate for a Phase I investigation.

c. Urgency

The recommendations made in Section 7.2 and the remedial measures suggested in Section 7.3 should be implemented within one year after receipt of this Phase I Inspection Report by the owner.

d. Need for Additional Investigation

No additional investigation is needed to complete the Phase I inspection.

7.2 Recommendations

1. It is recommended that the owner engage a qualified engineer to investigate the seepage conditions at the downstream toe and design a seepage collection and monitoring system.
2. Analysis of the test flood (100 year) under normal conditions, indicated the reservoir to have sufficient storage so that no discharge would occur at the spillway. However, the spillway has an extremely low discharge capacity and its weir configuration results in an unusually high potential for blockage. Under periods of extreme prolonged rainfall, or if the reservoir had to be operated at an unusually high storage level, the spillway would be incapable of passing more than minimal additional outflow and the dam would be vulnerable to overtopping. Considering the aforementioned poor condition of the spillway and its low flow capacity, it is recommended that the owner engage a qualified engineer to further investigate this structure in order to design a new structure or repair and/or modify the existing structure.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

1. The owner should remove all brush debris and trees from the downstream slope of the main dam and spillway discharge channel.

2. If in accordance with recommendation 7.2.2 of this report, the existing spillway is to remain in place, the owner should repair all spalled and deteriorated concrete and masonry in the spillway walls and arch culvert.

3. The dam should be inspected yearly by qualified personnel who can identify any areas of concern which could in time lead to serious deficiencies.
7.4 Alternatives

Not applicable to this dam.
APPENDIX A

INSPECTION CHECKLIST
VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT: McLean Reservoir

DATE: Dec. 6, 1978
TIME: 10:30 a.m.
WEATHER: Clear 45
W.S. ELEV.: 420+ U.S. D.N.S.

PARTY:
1. Ronald H. Cheney - HH&B
2. David B. Vine. - HH&B
3. Daniel P. LaGatta - GEI
5. 
6. 
7. 
8. 
9. 
10. 

PROJECT FEATURE
1. Embankment Dam & Dike
2. Gatehouse
3. Spillway
4. 
5. 
6. 
7. 
8. 
9. 
10. 

INSPECTED BY: Daniel L. LaGatta
REMARKS:

Ronald H. Cheney

Ronald H. Cheney
## PERIODIC INSPECTION CHECKLIST

**PROJECT**  McLean Reservoir  
**DATE**  Dec. 6, 1978  
**PROJECT FEATURE**  Embankment Dam  
**NAME**  D. P. LaGatta  
**DISCIPLINE**  Geotechnical engineers  
**NAME**  R. H. Cheney

### AREA EVALUATED

<table>
<thead>
<tr>
<th>DAM EMBANKMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<p>| CREST ELEVATION | 435± |
| CURRENT POOL ELEVATION | 420 ± |
| MAXIMUM IMPOUNDMENT TO DATE | Unknown |
| SURFACE CRACKS | None observed. |
| PAVEMENT CONDITION | No pavement. |
| MOVEMENT OR SETTLEMENT OF CREST | None observed. |
| LATERAL MOVEMENT | None observed. |
| VERTICAL ALIGNMENT | No misalignment observed. |
| HORIZONTAL ALIGNMENT | Conditions at abutment good. Spillway training wall badly deteriorated. |
| CONDITION AT ABUTMENT AND AT CONCRETE STRUCTURES | None observed. |
| INDICATIONS OF MOVEMENT OF STRUCTURAL ITEMS ON SLOPES | None observed. |
| TRESPASSING ON SLOPES | None observed. |
| SLoughING OR EROSION OF SLOPES OR ABUTMENTS | None observed. |
| ROCK SLOPE PROTECTION - RIPRAP FAILURES | Riprap in good condition. |
| UNUSUAL MOVEMENT OR CRACKING AT OR NEAR TOE | No movement observed. |
| UNUSUAL EMBANKMENT OR DOWNSTREAM SEEPAGE | Area at toe of dam between spillway on right abutment and gatehouse very wet and swampy. No piping or boils observed. |
| PIPING OR BOILS | None. |
| FOUNDATION DRAINAGE FEATURES | None. |
| TOE DRAINS | None. |
| INSTRUMENTATION SYSTEM | None. |
| VEGETATION | Downstream face and toe overgrown. |</p>
<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dike Embankment</td>
<td></td>
</tr>
<tr>
<td>Crest Elevation</td>
<td>Dike is extension of main dam along right abutment shoreline beyond spill-way.</td>
</tr>
<tr>
<td>Current Pool Elevation</td>
<td>Unknown</td>
</tr>
<tr>
<td>Maximum Impoundment to Date</td>
<td>None observed.</td>
</tr>
<tr>
<td>Surface Cracks</td>
<td></td>
</tr>
<tr>
<td>Pavement Condition</td>
<td></td>
</tr>
<tr>
<td>Movement or Settlement of Crest</td>
<td>None observed.</td>
</tr>
<tr>
<td>Lateral Movement</td>
<td></td>
</tr>
<tr>
<td>Vertical Alignment</td>
<td></td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td></td>
</tr>
<tr>
<td>Condition at Abutment and at Concrete</td>
<td></td>
</tr>
<tr>
<td>Structures</td>
<td></td>
</tr>
<tr>
<td>Indications of Movement of Structural</td>
<td></td>
</tr>
<tr>
<td>Items on Slopes</td>
<td></td>
</tr>
<tr>
<td>Trespassing on Slopes</td>
<td></td>
</tr>
<tr>
<td>Sloughing or Erosion of Slopes or</td>
<td></td>
</tr>
<tr>
<td>Abutments</td>
<td></td>
</tr>
<tr>
<td>Rock Slope Protection - Riprap Failures</td>
<td></td>
</tr>
<tr>
<td>Unusual Movement or Cracking at or</td>
<td></td>
</tr>
<tr>
<td>Near Toes</td>
<td></td>
</tr>
<tr>
<td>Unusual Embankment or Downstream</td>
<td></td>
</tr>
<tr>
<td>Seepage</td>
<td></td>
</tr>
<tr>
<td>Piping or Boils</td>
<td></td>
</tr>
<tr>
<td>Foundation Drainage Features</td>
<td></td>
</tr>
<tr>
<td>Toe Drains</td>
<td></td>
</tr>
<tr>
<td>Instrumentation System</td>
<td></td>
</tr>
<tr>
<td>Vegetation</td>
<td></td>
</tr>
<tr>
<td>Area downstream of dike is heavily</td>
<td></td>
</tr>
<tr>
<td>wooded.</td>
<td></td>
</tr>
<tr>
<td>AREA EVALUATED</td>
<td>CONDITIONS</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>a. Approach Channel</strong></td>
<td></td>
</tr>
<tr>
<td>Slope Conditions</td>
<td>There is no Approach Channel for this facility.</td>
</tr>
<tr>
<td>Bottom Conditions</td>
<td></td>
</tr>
<tr>
<td>Rock Slides or Falls</td>
<td></td>
</tr>
<tr>
<td>Log Boom</td>
<td></td>
</tr>
<tr>
<td>Debris</td>
<td></td>
</tr>
<tr>
<td>Condition of Concrete Lining</td>
<td></td>
</tr>
<tr>
<td>Drains or Weep Holes</td>
<td></td>
</tr>
<tr>
<td><strong>b. Intake Structure</strong></td>
<td></td>
</tr>
<tr>
<td>Condition of Concrete</td>
<td>The Intake Structure is located approximately 100 feet upstream of the Gatehouse. It is a 24 inch diameter supply pipe with manual controls located in the Gatehouse. The structure could not be visually inspected as it was under water.</td>
</tr>
<tr>
<td>Stop Logs and Slots</td>
<td></td>
</tr>
</tbody>
</table>
## PERIODIC INSPECTION CHECK LIST

<table>
<thead>
<tr>
<th>PROJECT FEATURE</th>
<th>Gatehouse &amp; Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT</td>
<td>McLean Reservoir</td>
</tr>
<tr>
<td>DISCIPLINE</td>
<td>Geotechnical Engineer</td>
</tr>
<tr>
<td></td>
<td>Structural Engineer</td>
</tr>
<tr>
<td>NAME</td>
<td>D. P. LaGatta</td>
</tr>
<tr>
<td></td>
<td>R. H. Cheney</td>
</tr>
</tbody>
</table>

### OUTLET WORKS - CONTROL TOWER

<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Concrete and Structural</td>
<td>There is no control tower for this facility, however, there is a gatehouse located at the center of the embankment. The Gatehouse is of fieldstone masonry, having a wood roof and concrete floor. The structure is in good condition with no apparent defects.</td>
</tr>
<tr>
<td>General Condition</td>
<td></td>
</tr>
<tr>
<td>Condition of Joints</td>
<td></td>
</tr>
<tr>
<td>Spalling</td>
<td></td>
</tr>
<tr>
<td>Visible Reinforcing</td>
<td></td>
</tr>
<tr>
<td>Rusting or Staining of Concrete</td>
<td></td>
</tr>
<tr>
<td>Any Seepage or Efflorescence</td>
<td></td>
</tr>
<tr>
<td>Joint Alignment</td>
<td></td>
</tr>
<tr>
<td>Unusual Seepage or Leaks in Gate Chamber</td>
<td></td>
</tr>
<tr>
<td>Cracks</td>
<td></td>
</tr>
<tr>
<td>Rusting or Corrosion of Steel</td>
<td></td>
</tr>
<tr>
<td>b. Mechanical and Electrical</td>
<td></td>
</tr>
<tr>
<td>Air Vents</td>
<td></td>
</tr>
<tr>
<td>Float Wells</td>
<td></td>
</tr>
<tr>
<td>Crane Hoist</td>
<td></td>
</tr>
<tr>
<td>Elevator</td>
<td></td>
</tr>
<tr>
<td>Hydraulic System</td>
<td></td>
</tr>
<tr>
<td>Service Gates</td>
<td></td>
</tr>
<tr>
<td>Emergency Gates</td>
<td></td>
</tr>
<tr>
<td>Lightning Protection System</td>
<td></td>
</tr>
<tr>
<td>Emergency Power System</td>
<td></td>
</tr>
<tr>
<td>Wiring and Lighting System in Gate Chamber</td>
<td></td>
</tr>
</tbody>
</table>
PERIODIC INSPECTION CHECK LIST

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>McLean Reservoir</th>
<th>DATE</th>
<th>Dec. 6. 1978</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT FEATURE</td>
<td>Transition and Conduit</td>
<td>NAME</td>
<td>D. P. LaGatta</td>
</tr>
<tr>
<td>DISCIPLINE</td>
<td>Geotechnical Engineer</td>
<td>NAME</td>
<td>R. H. Cheney</td>
</tr>
<tr>
<td></td>
<td>Structural Engineer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA EVALUATED</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTLET WORKS - TRANSITION AND CONDUIT</td>
<td>There is a 30 inch outlet pipe which runs from the Gatehouse to the Ashley</td>
</tr>
<tr>
<td>General Condition of Concrete</td>
<td>Chlorinating Station to the water system. This line is underground and</td>
</tr>
<tr>
<td>Rust or Staining on Concrete</td>
<td>could not be visually inspected.</td>
</tr>
<tr>
<td>Spalling</td>
<td></td>
</tr>
<tr>
<td>Erosion or Cavitation</td>
<td></td>
</tr>
<tr>
<td>Cracking</td>
<td></td>
</tr>
<tr>
<td>Alignment of Monoliths</td>
<td></td>
</tr>
<tr>
<td>Alignment of Joints</td>
<td></td>
</tr>
<tr>
<td>Numbering of Monoliths</td>
<td></td>
</tr>
</tbody>
</table>
### PROJECT
McLean Reservoir

### DATE
Dec. 6, 1978

### PROJECT FEATURE
Embankment Dam

### DISCIPLINE
Geotechnical Engineer

### NAME
R. H. Cheney

#### AREA EVALUATED

<table>
<thead>
<tr>
<th>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Approach Channel</td>
<td></td>
</tr>
<tr>
<td>General Condition</td>
<td>Good.</td>
</tr>
<tr>
<td>Loose Rock Overhanging Channel</td>
<td>None.</td>
</tr>
<tr>
<td>Trees Overhanging Channel</td>
<td>None.</td>
</tr>
<tr>
<td>Floor of Approach Channel</td>
<td>Paved with boulders - good condition.</td>
</tr>
<tr>
<td>b. Weir and Training Walls</td>
<td></td>
</tr>
<tr>
<td>General Condition of Concrete</td>
<td></td>
</tr>
<tr>
<td>Rust or Staining</td>
<td></td>
</tr>
<tr>
<td>Spalling</td>
<td></td>
</tr>
<tr>
<td>Any Visible Reinforcing</td>
<td></td>
</tr>
<tr>
<td>Any seepage or Efflorescence</td>
<td></td>
</tr>
<tr>
<td>Drain Holes</td>
<td></td>
</tr>
<tr>
<td>c. Discharge Channel</td>
<td></td>
</tr>
<tr>
<td>General Condition</td>
<td></td>
</tr>
<tr>
<td>Loose Rock Overhanging Channel</td>
<td></td>
</tr>
<tr>
<td>Trees Overhanging Channel</td>
<td></td>
</tr>
<tr>
<td>Floor of Channel</td>
<td></td>
</tr>
<tr>
<td>Other Obstructions</td>
<td></td>
</tr>
<tr>
<td>The concrete is in poor condition with some spalling &amp; deterioration.</td>
<td>None.</td>
</tr>
<tr>
<td>6-8 trees 6-in. diameter</td>
<td></td>
</tr>
<tr>
<td>Numerous rock outcrops.</td>
<td></td>
</tr>
<tr>
<td>Very narrow channel with some vegetation.</td>
<td></td>
</tr>
<tr>
<td>AREA EVALUATED</td>
<td>CONDITIONS</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>OUTLET WORKS - OUTLET STRUCTURE AND</td>
<td>The inlet-outlet structure is the 24 inch supply line running through the</td>
</tr>
<tr>
<td>OUTLET CHANNEL</td>
<td>embankment under the gatehouse. This line is eventually converted to a</td>
</tr>
<tr>
<td>General Condition of Concrete</td>
<td>30 inch line feeding the water system.</td>
</tr>
<tr>
<td>Rust or Staining</td>
<td></td>
</tr>
<tr>
<td>Spalling</td>
<td></td>
</tr>
<tr>
<td>Erosion or Cavitation</td>
<td></td>
</tr>
<tr>
<td>Visible Reinforcing</td>
<td></td>
</tr>
<tr>
<td>Any Seepage or Efflorescence</td>
<td></td>
</tr>
<tr>
<td>Condition at Joints</td>
<td></td>
</tr>
<tr>
<td>Drain Holes</td>
<td></td>
</tr>
<tr>
<td>Channel</td>
<td></td>
</tr>
<tr>
<td>Loose Rock or Trees Overhanging</td>
<td>There is no definitive outlet channel for this facility.</td>
</tr>
<tr>
<td>Channel</td>
<td></td>
</tr>
<tr>
<td>Condition of Discharge Channel</td>
<td></td>
</tr>
<tr>
<td>AREA EVALUATED</td>
<td>CONDITIONS</td>
</tr>
<tr>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>OUTLET WORKS - SERVICE BRIDGE</td>
<td>There is no service bridge for this facility.</td>
</tr>
<tr>
<td>a. Super Structure</td>
<td></td>
</tr>
<tr>
<td>- Bearings</td>
<td></td>
</tr>
<tr>
<td>- Anchor Bolts</td>
<td></td>
</tr>
<tr>
<td>- Bridge Seat</td>
<td></td>
</tr>
<tr>
<td>- Longitudinal Members</td>
<td></td>
</tr>
<tr>
<td>- Under Side of Deck</td>
<td></td>
</tr>
<tr>
<td>- Secondary Bracing</td>
<td></td>
</tr>
<tr>
<td>- Deck</td>
<td></td>
</tr>
<tr>
<td>- Drainage System</td>
<td></td>
</tr>
<tr>
<td>- Railings</td>
<td></td>
</tr>
<tr>
<td>- Expansion Joints</td>
<td></td>
</tr>
<tr>
<td>- Paint</td>
<td></td>
</tr>
<tr>
<td>b. Abutment and Piers</td>
<td></td>
</tr>
<tr>
<td>- General Condition of Concrete</td>
<td></td>
</tr>
<tr>
<td>- Alignment of Abutment</td>
<td></td>
</tr>
<tr>
<td>- Approach to Bridge</td>
<td></td>
</tr>
<tr>
<td>- Condition of Seat and Backwall</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

ENGINEERING DATA

B-1
LIST OF ENGINEERING DATA

1. Plans dated 1899 to 1903 outlining original construction
2. Plans dated 1939 outlining corewall repairs to the dike

Location: Holyoke Water Department
20 Commercial Street
Holyoke, Massachusetts 01040

No design calculations were located
City of Holyoke
Board of Water Commissioners
20 Commercial Street
Holyoke, Ma.

Dear Sir:

On April 23, 1976, an Engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam. Our records indicate the owner to be Board of Water Commissioners - City of Holyoke. If this information is incorrect, will you please notify this office.

The inspection was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dams Safety Act). Chapter 706 of the Acts of 1975 transferred the jurisdiction of the so-called "Dams Safety Program" to the Commissioner of the Department of Environmental Quality Engineering.

The results of the inspection indicate that this dam is not safe. The following conditions were noted that require attention:

- The spillway structure has deteriorated slightly more, with cracks in side walls more pronounced - this should be corrected.
- Brush growth on downstream slope should be removed.
- Dam appears safe, routine maintenance necessary.

We call these conditions to your attention before they become serious and more expensive to correct. With any correspondence please include the number of the dam as indicated above.

Very truly yours,

John F. Hanlon, F.E.
Chief Engineer

City: Holyoke 2-16-77

E. Disty
LOCATION:
City/Town: Holyoke County: Hampden Dam No.: 2-7-137-7
Name of Dam: McLean Reservoir Dam
Topo Sheet No.: 12A Coordinates: N 430,200, E 282,300

Inspected by: Harold T. Shumway, On April 23, 1976

Last Inspection: 1-24-74

CARETAKER: As of April 23, 1976

City of Holyoke
1. Board of Water Commissioners, 20 Commercial Street, Holyoke, Mass.
   Name: __________________ St. & No.: __________________ City/Town: Holyoke State: Mass. Tel. No.: ______

2. __________________ St. & No.: __________________ City/Town: Holyoke State: Mass. Tel. No.: ______

3. __________________ St. & No.: __________________ City/Town: Holyoke State: Mass. Tel. No.: ______

CARETAKER: (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.
Mr. Charles Moran
Name: __________________ St. & No.: __________________ City/Town: Holyoke State: Mass. Tel. No.: ______

DATA:
No. of Pictures Taken: None Sketches: See description of Dam
Plans, Where: None located

DEGREE OF HAZARD: (if dam should fail completely)*

1. Minor
2. Moderate X
3. Severe
4. Disastrous

Comments: Most of impoundment should be accommodated in Ashley Pond just below.
This rating may change as land use changes (future development).
<table>
<thead>
<tr>
<th>OUTLETS: OUTLET CONTROLS AND DRAWDOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southerly end of main dam-concrete and ledge chute spillway.</td>
</tr>
<tr>
<td>No. 1 Location and Type: 8' to 10' W.-chute carried through embankment by 10'X4'H. concrete arch culvert-invert 6' below top of embankment.</td>
</tr>
<tr>
<td>Controls Yes, TYPE: A concrete weir or baffle 2.7'H across chute 15' downstream of arch culvert.</td>
</tr>
<tr>
<td>Automatic Manual Operative Yes, No.</td>
</tr>
<tr>
<td>Comments: Minor spalling and cracks in side walls.</td>
</tr>
<tr>
<td>Through gate house near center of dam-20&quot;C.I. pipe water intake.</td>
</tr>
<tr>
<td>No. 2 Location and Type: leading to Holyoke water system and to Ashley Reservoir.</td>
</tr>
<tr>
<td>Controls Yes, Type: Valve gates.</td>
</tr>
<tr>
<td>Comments:</td>
</tr>
<tr>
<td>No. 3 Location and Type:</td>
</tr>
<tr>
<td>Controls_, Type:</td>
</tr>
<tr>
<td>Automatic Manual Operative Yes, No.</td>
</tr>
<tr>
<td>Comments:</td>
</tr>
<tr>
<td>Drawdown present Yes X, No. Operative Yes X, No.</td>
</tr>
<tr>
<td>Comments: See No. 2 above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DAM UPSTREAM FACE: Slope 3:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Water at Dam 30' to 35'.</td>
</tr>
<tr>
<td>Material: Turf Brush &amp; Trees Rock fill Masonry Wood Other Top 4' of slopes turf-remaining surface rock paving.</td>
</tr>
<tr>
<td>Comments: Minor erosion from vehicular traffic along top of dam.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DAM DOWNSTREAM FACE: Slope 3:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material: Turf Brush &amp; Trees Rock Fill Masonry Wood Other Rock toe fill near center of dam.</td>
</tr>
<tr>
<td>Comments: Erosion from bike trails on slope-gully 8&quot; to 10&quot; deep and 2' to 3' wide extends from top to toe of slopes on down stream side.</td>
</tr>
</tbody>
</table>
Present chute spillway has been adequate for many years.

Height Above Normal Water: 4\(\frac{1}{2}\) Ft.

Width 10 Ft. Height 4.5 Ft. Material concrete and ledge.

Condition:
1. Good
2. Minor Repairs X
3. Major Repairs
4. Urgent Repairs

Comments: Concrete side walls badly cracked and spalled.

WATER LEVEL AT TIME OF INSPECTION: 7\(\frac{1}{2}\) Ft. Above X Below X.

Top Dam X F.L. Principal Spillway X

Other X From invert of emergency spillway to top of embankment.

SUMMARY OF DEFICIENCIES NOTED:

Growth (Trees and Brush) on Embankment Yes—moderate growth of brush on downstream slope.

Animal Burrows and Washouts None found.

Damage to Slopes or Top of Dam Yes—see item #8 comments, also item #7 comments.

Cracked or Damaged Masonry Yes—side walls of spillway cracked and settled.

Evidence of Seepage Seepage flow noted from rock fill at top of slope.

Evidence of Piping None found.

Leaks None found.

Erosion See item #7 and #8.

Trash and/or Debris Impeding Flow None found.

Clogged or Blocked Spillway None found.

Other
OVERALL CONDITION:

1. Safe

2. Minor repairs needed

3. Conditionally safe - major repairs needed

4. Unsafe

5. Reservoir impoundment no longer exists (explain)

Recommend removal from inspection list

MARKS AND RECOMMENDATIONS: (Fully Explain)

Mr. Charles Moran, Supt. of Holyoke Water Dept., and Mr. Philip Sheridan, Chief Eng for Tighe and Bond Div. of S.C.I., were both present during this inspection. Conditions at the dam were found to be much the same as at last inspection of 1-24-74. The spillway structure has deteriorated slightly more with cracks in side walls more pronounced. Brush growth on down stream slope is evident. The seepage flow at toe of slope appeared to be the same as at last inspection and appears normal for this type of dam.

Dam appears safe with mostly routine maintenance repairs needed.
INSPECTION REPORT - DAMS AND RESERVOIRS

1. LOCATION:
   City: Holyoke        County: Hampden        Dam No.: 2-7-137-7
   Name of Dam: McLean Reservoir Dam
   Topo Sheet No.: 12A  Coordinates: N 430,200, E 282,300
   Last Inspection: 1969

2. OWNER/S: As of Jan. 24, 1974
   per: Assessors, Reg. of Deeds, Prev. Insp., Per. Contact

   City of Holyoke
   1. Board of Water Commissioners - Room 8, City Hall, Holyoke, Mass.
      Name                          St. & No.  City/Town State Tel. No.
   2. Name                          St. & No.  City/Town State Tel. No.
   3. Name                          St. & No.  City/Town State Tel. No.

3. CARETAKER: (if any) e.g. superintendent, plant manager, appointed by
   absentee owner, appointed by multi owners.
   Mr. Anthony Canon
   Supt. of Water Dept., 20 Commercial Street, Holyoke, Mass.
      Name                          St. & No.  City/Town State Tel. No.

4. DATA:
   No. of Pictures Taken: None  Sketches: See description of Dam.
   Plans: Where: No comprehensive plans found

5. DEGREE OF HAZARD: (if dam should fail completely)*
   1. Minor
   2. Moderate X
   3. Severe
   4. Disastrous

   Comments: Most of runoff should be accommodated in Ashley Pond just below.

   *This rating may change as land use changes (future development).
OUTLETS: OUTLET CONTROLS AND DRAWDOWN

Southerly end main dam concrete and ledge chute spillway -
No. 1 Location and Type: 8' to 10' wide - chute carried through embankment by 10' wide high concrete arch culvert - flow line 6' below top of embankment.

Controls Yes, TYPE: A concrete weir or baffle 2.7 ft. high across chute 15' downstream of culvert.

Automatic____, Manual____, Operative Yes____, No____.

Comments: Some spalling and deterioration of concrete spillway side walls - also some cracks.

No. 2 Location and Type: Through gate house near center of dam water intake - 20' CI pipe to Holyoke water distribution system and to Ashley

Controls Yes, Type: Reservoir, Gates

Automatic____, Manual X, Operative Yes X, No____. Per Water Dept. personnel.

Comments: ___________________________________________________________________________

No. 3 Location and Type:

Controls____, Type:

Automatic____, Manual____, Operative Yes____, No____.

Comments: ___________________________________________________________________________

Drawdown present Yes X, No____. Operative Yes____, No____.

Comments: ___________________________________________________________________________

DAM UPSTREAM FACE: Slope 3:1____, Depth Water at Dam 20 ft. plus

Material: Turf X, Brush & Trees____, Rock Fill X, Masonry____, Wood____.

Other____ Top 4 ft. turf - remaining surface rock paving or fill____.


Comments: Stump of some small trees visible on slope. Cut since County inspection in 1969.

DAM DOWNSTREAM FACE: Slope 3:1____.

Material: Turf X, Brush & Trees X, Rock Fill X, Masonry____, Wood____.

Miscellaneous brush and trees growing on slope - a rock toe fill near center of main dam apparently placed since construction. Has seepage.


Comments: Seepage should be watched. District recommends that the owner install a seepage weir or other means of measuring amount of seepage.
9. **EMERGENCY SPILLWAY**: Available **Yes**. Needed **No**. Present chute spillway has been adequate for many years.

Height Above Normal Water **4.7 Ft.** at time of inspection.

Width **10 Ft.** Height **4.5 Ft.** Material **Concrete and ledge**

2. Minor Repairs **X**  4. Urgent Repairs

Comments: Concrete sidewalls spalled and cracked.

---

10. **WATER LEVEL AT TIME OF INSPECTION**: **10 Ft. Above** **Below **

Top Dam **X** F.L. Principal Spillway

Other

Normal Freeboard **7 Ft.** From flow line emergency spillway to top of embankment.

---

11. **SUMMARY OF DEFICIENCIES NOTED**: Yes - See Item 8 above. Also some overspreading.

Growth (Trees and Brush) on Embankment ornamental bushes on crest

Animal Burrows and Washouts **None found**

Damage to Slopes or Top of Dam **None found**

Cracked or Damaged Masonry Spalling and cracking overflow spillway masonry

Evidence of Seepage Visible seepage from rock fill at toe of main dam

Evidence of Piping **None noted**

Leaks **None noted**

Erosion **None found**

Trash and/or Debris Impeding Flow **None**

Clogged or Blocked Spillway

Other
OVERALL CONDITION:

1. Safe
2. Minor repairs needed X
3. Conditionally safe - major repairs needed
4. Unsafe
5. Reservoir impoundment no longer exists (explain)

Recommend removal from inspection list

REMARKS AND RECOMMENDATIONS: (Fully Explain)

This reservoir was established around 1900 to provide water to the area west of Beech Street and we were told by various Water Department employees that some of the water impounded in the reservoir is pumped up from the Ashley Reservoir or from the Manhan Reservoir in Southampton. The information on the construction and internal structure of the embankment was indefinite but there was some indication that the embankment is built over and around a rather massive concrete wall with a sheet piling water stop in the base. Also, the exact nature of the pipes through the embankment and the controls in the gate house was not clear.

At the time of the inspection the embankments, both the main dam and the dike at the southerly end, were satisfactory as to alignment and grade. The roadway along the top showed no evidence of settlement and both slopes showed no signs of slumping or sliding. Brush on the upstream slope had been cut as recommended by the County Engineer but the stumps were still there. On the downstream slope brush and brambles are still growing and should be cleared and the slope mowed regularly. The stone paving or fill on the upstream slope was in satisfactory condition.

There is a rock fill at the downstream toe which in places appears to have been placed since the dam was constructed. Considerable seepage flow was visible here. This seepage appears to be of sufficient quantity so that a close watch should be kept on it and perhaps a seepage collection ditch and weir or some other means of measuring the amount of seepage should be installed.

The masonry sidewalls of the chute overflow spillway were badly spalled and cracked in places. Repairs should be made to prevent more serious deterioration.

HCS/jc/vk
## DISTRICT 2

Submitted by R. C. Salls, P.E.  
Dam No. 2-7-137-7

Date January 24, 1974  
City Holyoke

Name of Dam McLean Reservoir Dam

### 1. Location
- Topo Sheet No. 12A  
- Coordinates N 430,200 E 282,300

Provide 8 1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.

On Paukatuck Brook - access via a private road southerly from Rte. 202 along shore of Reservoir - road about 1 mile westerly from intersection of Rte. 202 and Homestead Avenue.

### 2. Date on Gate house
- Year built 1903  
- Year/s of subsequent repairs Unknown

### 3. Purpose of Dam
- Water Supply X  
- Recreational
- Flood Control  
- Irrigation  
- Other

### 4. Drainage Area
- 0.47 sq. mi.  
- 39 acres
  
- Type: City, Bus. & Ind. X  
- Dense Res.  
- Suburban  
- Rural, Farm
- Wood & Scrub Land X  
- Slope: Steep X  
- Med.  
- Slight

Reservoir also receives water from Ashley and Manhan Reservoirs.

### 5. Normal Ponding Area
- 64 Acres  
- Ave. Depth Say 14 to 15 ft.
  

Silted in: Yes X  
- No  
- Approx. Amount Storage Area

### 6. No. and type of dwellings located adjacent to pond or reservoir
- None
  
i.e. summer homes etc.

### 7. Dimensions of Dam
- Length 1620'  
- Max. Height 35'

- Freesboard 4.6 ft. to flow line overflow spillway

- Slopes: 
  - Upstream Face 3:1 - stone paved
  - Downstream Face 3:1 - turf - rock fill at toe in places

- Width across top 24 except for widening at gate house
8. Classification of Dam by Material:

- Earth
- Conc. Masonry
- Stone
- Timber
- Rockfill
- Other

9. Dam Type:

- Gravity
- Straight
- Curved, Arched
- Other

- Overflow
- Non-overflow

Main dam straight - dike curves with contours.

9. A. Description of present land usage downstream of dam:

- 100% rural; 0% urban

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure? Yes X No

C. Character Downstream Valley: Narrow _____ Wide X Developed _____

- Rural
- 100*
- Urban

Ashley Pond below.

11. Risk to life and property in event of complete failure.

- No. of people: None
- No. of homes: None
- No. of businesses: None
- No. of industries: None
- No. of utilities: 2
- Type: Holyoke Water Supply - Telephone
- Type: trunk line
- Railroads: None
- Other dams: Ashley Reservoir Dam No. 2-7-137-9
- Other: Above evaluation of risk assumes that released water is held in Ashley Reservoir.

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

RC3/vk
Attachments
Locus Plan
Sketches
SKETCHES NOT TO SCALE

DATE 12/7/1941
McLean Reservoir Dam

NOTE: SOME EVIDENCE IN WATER DEPT. FILES MAIN DAM
HAS CONCRETE CORE & SHEET PILING IN BASE

TYPICAL X SECTION MAIN DAM "AA"

X SECTION BS" THROUGH CHUTE OVERFLOW
SPILLWAY AT 3'LY END MAIN DAM
APPENDIX C

PHOTOGRAPHS
PHOTO NO. 1 - Crest and upstream face of dam.

PHOTO NO. 2 - Approach channel of spillway weir.
PHOTO NO. 3 - Spillway weir and outlet channel.

PHOTO NO. 4 - Downstream face of embankment viewed from spillway channel toward left abutment.
PHOTO NO. 5 - Outlet channel viewed from crest of weir.

PHOTO NO. 6 - Outlet channel viewed from bottom of channel looking up to top of dam.
PHOTO NO. 7 - Toe of embankment viewed from bottom of spillway channel toward left abutment.

PHOTO NO. 8 - Wet area at toe of dam about 30 feet from spillway channel toward left abutment.
PHOTO NO. 9 - Bedrock outcrop at toe of dam above wet area shown in PHOTO 8. Water is leaking from joints.

PHOTO NO. 10 - Downstream face of dam from top of "berm" above toe of dam.
PHOTO NO. 11 - Toe of berm at a point 100 feet right of gatehouse. Wet, swampy area in lower right hand corner of photograph.

PHOTO NO. 12 - Downstream face of dam below gatehouse.
PHOTO NO. 13 - View of crest and upstream face of dam taken from spillway

PHOTO NO. 14 - Left training wall of spillway.
PHOTO NO. 15 - View of McLean Reservoir.
McLaren Reservoir Dam

Hydraulic Data from COE Inventory of Dams in the US. Sheet Inspection

Crest length = 1620' Drainage area = 447 sq mi
Spillway width = 10'
Impounded Cap (Estimated)

\[ \text{Normal} = 950 \text{ cfs} \]
\[ \text{Max} = 1240 \text{ cfs} \]

Structural Height = 42'
Height to Fill = 35'

Hydraulic Data from Field Investigation

Spillway width = 10'
Impounded Cap

\[ \text{Normal} = 987932 \text{ cfs} = \frac{1}{20} \text{ cfs/ft} \]

Site Classification

\[ \text{Height} = 35' \]

Hydraulic Cap = 1240 cfs

Use Intermediate Site Classification

Hazards Potential Classification

\[ \text{Height} = 35' \text{ - minor cap - proceeded downstream dams held} \]
\[ \text{Erosion - minimal - one must examine.} \]
Determine Test Flood

For Low Hazard & Intermediate Site:
Range 100yr to 1/2 PMF

Test flood = 100yr storm

No development down stream, water depth, flow, and very small drainage area. Flow controlled by water depth in-out by water mains & demand normal level 427 - sometimes much lower.

\[ A = \frac{1274,000}{4000} \text{ sq ft} \times \text{ HRSD} \text{ zone} \text{ Stat.} \]

\[ R_1 = 3.44 \text{ ft} \text{, } P_1 = 3.47 \text{ ft} \text{, } R_2 = 3.46 \text{ ft} \text{, } R_3 = 3.74 \text{ ft} \]

\[ A = \frac{1274000 \times 3.46}{4000} \text{ sq ft} = 317.1 \text{ sq ft} = 0.496 \text{ sq m.} \]

Say 300 acres

Peak Flow:

\[ A_1 < 2 \text{ sq m.} \text{ use } PMF = 3000 \text{ cfs/sq.m.} \]

\[ PMF \text{ for } A_0 = \frac{3000 \text{ cfs}}{\frac{300}{50}} = 500 \text{ cfs} \]

Test flood = \( \frac{1}{4} \times 1500 = 375 \text{ cfs} \)

100yr = 375 cfs
Outlets

"1. 24" C.I.P. Inc. In elev = 411.0 - Water Supply Pipe (from plan "Section thru Gate House")
   Assume inlet gate closed during flood, i.e. ignore pipe.

"2. Spillway - 10' wide; control at arch culvert.

From Plans & Field Recon Sketch:

Arch Culvert:

![Diagrams of outlet structures]

Approx 13.5' depression at culvert

Width: 10' 2 1/2"

Crest elev = 430\frac{1}{2}' above dam.

Effect of weir on flow through arch culvert significant (see pg 12).

Discharge controlled by weir.
Flow over weir \( Q = C + H^{3/2} \)

<table>
<thead>
<tr>
<th>( H )</th>
<th>( D )</th>
<th>( C )</th>
<th>( L )</th>
<th>( Q )</th>
</tr>
</thead>
<tbody>
<tr>
<td>434</td>
<td>125</td>
<td>3.10</td>
<td>10</td>
<td>3.3</td>
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<tr>
<td>433</td>
<td>120</td>
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<td>3.31</td>
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<td>482</td>
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<td>&quot;</td>
<td>6</td>
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</table>

Culvert Flow

\( Q, cfs \)

<table>
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<tr>
<th>( Q, cfs )</th>
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<tbody>
<tr>
<td>433</td>
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</tbody>
</table>

\( Q, cfs \) from head loss

Culvert Flow

Weir

\( Q, cfs \)
Flow Area \( w \) in channel

Flow Area = \( \frac{1}{2} (2)(10) = 15\) ft² @ \( D = 3'\).

\[ V = \frac{1.46 \times 10^{15}}{0.15} \left( \frac{1.2}{2} \right)^{1.2} \]

\[ Q = \frac{V A}{A} \]

\[ 12^{2/3} = \frac{V}{12.1} = \frac{12}{12.1} \]

\[ Q = p^{2/3} \times 12.1 \times A \]

**will not interfere**

Flow from weir

- 5.4
- 15
- 14
- 1.64
- 187

- 8
- 11
- 9.86
- 89

- 3.4
- 6
- 0.61
- 25

- 1
- 3.5
- 0.45
- 5.12
\[ Q_{P1} = 375 \text{ cfs} \quad E_{11} = 435.35 \quad e_{11} = 1245 - 1090 = 155 \text{ or } 6.2" \\
6.2" > 4.75" = 19/4 \text{ for } 100 \text{ yr storm} \\
\text{let } St = \frac{155}{2} = 78.5 \text{ or } 3.12" \]

\[ Q_{P2} = 375 \left( 1 - \frac{4.75}{4.75} \right) = 130 \text{ cfs} \quad E_{22} = 435.1 \\
St_{22} = 1245 - 1090 = 155 \quad St_{22} = \frac{155 + 78.5}{2} = 116.5 \text{ or } 4.66" \]

\[ Q_{P3} = 375 \left( 1 - \frac{4.66}{4.75} \right) = 71 \text{ cfs} \quad E_{33} = 432.35 \\
St_{33} = 1185 - 1090 = 95 \quad St_{33} = \frac{116.5 + 95}{2} = 105.75 \text{ or } 4.23" \]

\[ Q_{P4} = 375 \left( 1 - \frac{4.23}{4.75} \right) = 41 \text{ cfs} \quad E_{44} = 433.6 \\
St_{44} = 1240 - 1090 = 120 \quad St_{44} = \frac{120 + 105.75}{2} = 112.9 \text{ or } 9.52" \]

\[ Q_{P5} = 375 \left( 1 - \frac{4.75}{4.75} \right) = 18.6 \text{ cfs} \quad E_{55} = 432.65 \\
St_{55} = 97 \quad St_{55} = \frac{97 + 112.9}{2} = 105 \text{ or } 4.2" \]

\[ Q_{P6} = 375 \left( 1 - \frac{4.12}{4.75} \right) = 43.6 \quad E_{66} = 433.8 \\
St_{66} = 1215 - 1090 = 125 \quad St_{66} = \frac{105 + 112.9}{2} = 115 \text{ or } 9.6" \]

\[ Q_{P7} = 375 \left( 1 - \frac{4.6}{4.75} \right) = 11.8 \quad E_{77} = 432.5 \\
St_{77} = 1190 - 1090 = 100 \quad St_{77} = \frac{100 + 115}{2} = 107.5 \text{ or } 4.3" \]

\[ Q_{P8} = 375 \left( 1 - \frac{4.2}{4.75} \right) = 35.5 \quad E_{88} = 433.3 \quad St_{88} = 115 \quad 4.45" \]

\[ Q_{P9} = 375 \left( 1 - \frac{4.45}{4.75} \right) = 23.7 \text{ cfs} \quad E_{99} = 432.75 \quad \frac{1195}{2} = 107.5 \text{ or } 4.3" \]

\[ Q_{P10} = 375 \left( 1 - \frac{4.33}{4.75} \right) = 33 \quad E_{10} = 433.3 \quad St_{10} = 115 \text{ or } 112 \text{ or } 4.46" \]

\[ Q_{P11} = 375 \left( 1 - \frac{4.44}{4.75} \right) = 23 \quad E_{11} = 432.8 \quad St_{11} = 105 \quad St_{11} = 109 \text{ or } 4.34" \]

\[ Q_{P12} = 375 \left( 1 - \frac{4.34}{4.75} \right) = 32 \quad E_{12} = 433.2 \]

Let \( E_{mov} = 4.33 \) \( Q_{out} = 30 \text{ cfs} \)
Determine weir flow over top of dam:

Assume flow only on "dam crest" - not on dike length $L = 650'$ with $w = 10'$

Assume have broad crested weir

Use weir formula: $Q = CLH^{3/2}$

$L = 650'$, $H$ - varies, $C$ - varies with $H$
$C$ - values obtained from Fig. 8, "Handbook of Hydraulics."

<table>
<thead>
<tr>
<th>$C$</th>
<th>$L$</th>
<th>$H^{3/2}$</th>
<th>$Q$</th>
<th>$Q_{act}$</th>
</tr>
</thead>
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<tr>
<td>0.2</td>
<td>1.5</td>
<td>0.089</td>
<td>194.9 - 195.0</td>
<td>208</td>
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<tr>
<td>0.4</td>
<td>2.2</td>
<td>0.253</td>
<td>471.0 - 472.0</td>
<td>485</td>
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<td>2.9</td>
<td>0.465</td>
<td>815.6 - 816.5</td>
<td>873</td>
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<td>1251.1 - 1250.0</td>
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<tr>
<td>1.0</td>
<td>2.5</td>
<td>0.70</td>
<td>1742 - 1740</td>
<td>873</td>
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</tbody>
</table>

For flow under 150 cfs, see pg 4 chart.
Assume Dam Fails

Peak storage = 1240 ac-ft

Height at failure = 35 ft

Width at mid-height = 430' (measured from plan)

Peak failure outflow = \( Q_p = \frac{6}{27} W_b \sqrt{2g} y_0^{3/2} \)

with \( W_b = 14 \text{ (ft)} = 14 \times 430 = 6,020 \)

\( y_0 = 35' \)

\( Q_p = \frac{6}{27} \times 6,020 \times \sqrt{2g} \times (35)^{3/2} = 5,788,000 \text{ cfs} \)

1st reach: Determine storage capacity in reach

\[ \begin{align*}
\text{Use } \eta &= 0.625 \\
S &= \frac{w}{n} = \frac{416}{0.625} = 0.15
\end{align*} \]

\( @ H = 9' \) 

\[ \begin{align*}
A &= \frac{1}{2} (3 \times 90) = 135 \text{ ft}^2 \\
P &= 2 \times 40.5 = 81 \text{ ft}
\end{align*} \]

\( i = 4.91 \)

\[ Q = \frac{1}{2} \times (491)^{1/2} (4.91) \times (15)^{3/2} \times 1600 = 40,500 \text{ cfs, } < 51,800 \]

\( @ H = 15' \) 

\[ \begin{align*}
A &= \frac{1}{2} (50 + 150) \times 15 = 1500 \text{ ft}^2 \\
P &= (50 + 150) \times 7.5 = 787.5 \\
R &= 7.37
\end{align*} \]
\[ Q = \frac{1}{2} \times (7.31)^{2/3} \times (5.05)^{1/2} \times 15 = 121.36 \text{ cfs} > 59,580 \text{ cfs} \]

\[ H_0 = 11' \]

\[ A_0 = \frac{1}{2} (36 + 11) \times 11 = 406.9 \text{ ft}^2 \]

\[ P = \frac{32.2 + 111.5}{2} = 144.9 \]

\[ R = 5.42 \]

\[ A = \frac{11^{3/2} \times (5.17)^{2/3} \times 0.15}{1075} = 57670 \text{ cfs} \]

Foot height @ 300' be. = same dam ~ just over 11 ft.

Reach Storage Capacity: 0.66 of Live Capacity

\[ V_L = \frac{807 \times 200}{12} = 13,370 \text{ cfs} \]

Trial \( Q \) to 100 = \( Q_{p,2} = Q_{p1} \left( 1 - \frac{V}{V_L} \right) \)

\[ 100 = 57670 \left( 1 - \frac{57670}{13370} \right) \]

use \( Q_{p1} = 0.66 \) Q_L

**Reaching:** 1200' downstream

\[ X = 0.39, L = 200 \]

\[ \frac{5}{10} = 0.05 \]

\[ \frac{5}{100} = 0.05 \]

\[ \frac{5}{10} = 0.05 \]

\[ 5 = 0.05 \times 100 \]

\[ H = 10' \]

\[ A = \frac{1}{2} (50 + 7.5) \times 10 \times 10 = 500 \text{ ft}^2 \]

\[ \rho = 50 \]

\[ H = 5.0 \]
\[ Q = \frac{1.49 \times 15 \times 0.03}{60} \times 1500 \times 5000 = 192,116 \text{ cfs} < 57,900 \]

\( Q = \frac{1.49 \times 2.5^{1.5} \times 1.07^{1.5} \times 1500}{1.85} = 30,256 \text{ cfs} < 59,940 \)

\( Q = \frac{1.49 \times 2.5^{1.5} \times 1.07^{1.5} \times 2000}{1.85} = 74,215 \text{ cfs} < 59,940 \)

Flood Width @ 1200' downstream 100' 6.6' ±

Depressing open culvert size under road, one elevation of road, assuming top Westfield Road.
Storage Capacity of Mears Reservoir

E Elev = 427 (end of spillway) Volume = 950 ac-ft
E Elev = 430 Volume = 1130 ac-ft
E Elev = 435 (max. height) Volume = 1240 ac-ft

Potential Spillway Capacity if Weir Removed

<table>
<thead>
<tr>
<th>Elev.</th>
<th>Height in Feet</th>
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<tbody>
<tr>
<td>30</td>
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<tr>
<td>31</td>
<td>2.0</td>
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<tr>
<td>32</td>
<td>3.0</td>
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<tr>
<td>32.5</td>
<td>4.0</td>
</tr>
<tr>
<td>33</td>
<td>5.0</td>
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Graph showing flow rates and volumes.
DRAINAGE AREA

DAM LOCATION

DAM FAILURE IMPACT AREA

McLEAN RESERVOIR

HOLYOKE, MASSACHUSETTS

SCALE: 1" = 2000'

DATE FEBRUARY, 1979

HAYDEN, HARDING & BUCHANAN, INC.
CONSULTING ENGINEERS
BOSTON, MASSACHUSETTS

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

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
## INVENTORY OF DAMS IN THE UNITED STATES

<table>
<thead>
<tr>
<th>STATE</th>
<th>IDENTITY NUMBER</th>
<th>DIVISION</th>
<th>STATE</th>
<th>COUNTY</th>
<th>CONG. DISTRICT</th>
<th>STATE</th>
<th>COUNTY</th>
<th>CONG. DISTRICT</th>
<th>NAME</th>
<th>LATITUDE (NORTH)</th>
<th>LONGITUDE (WEST)</th>
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<tr>
<td>MA</td>
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<td>ND</td>
<td>MA</td>
<td>01</td>
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<td>410.5</td>
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**Popular Name** | **Name of Impoundment**
--- | ---

<table>
<thead>
<tr>
<th>REGION</th>
<th>RIVER OR STREAM</th>
<th>NEAREST DOWNSTREAM CITY-TOWN-VILLAGE</th>
<th>DIST FROM DAM (MILES)</th>
<th>POPULATION</th>
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<tr>
<td>03</td>
<td>20TH OUTFALL TN ASHLEY POND</td>
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<tr>
<th>TYPE OF DAM</th>
<th>YEAR COMPLETED</th>
<th>PURPOSES</th>
<th>MAXIMUM DISCHARGE</th>
<th>POWER CAPACITY</th>
<th>NAVIGATION LOCKS</th>
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<tr>
<td></td>
<td>1905</td>
<td>3</td>
<td>34</td>
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**REMARKS**

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<tr>
<th>SPILLWAY</th>
<th>MAXIMUM DISCHARGE</th>
<th>VOLUME OF DAM (CY)</th>
<th>POWER CAPACITY</th>
<th>NAVIGATION LOCKS</th>
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<tr>
<td></td>
<td>310</td>
<td>116</td>
<td>Installed</td>
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**OWNER** | **ENGINEERING BY** | **CONSTRUCTION BY**
--- | --- | ---
| CITY OF HOLYOKE  | J. L. HILGHE  |  

**REGULATORY AGENCY**

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**INSPECTION BY**

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<th>AUTHORITY FOR INSPECTION</th>
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<td>01FEB78</td>
<td>PUBLIC LAW 62-567</td>
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**REMARKS**
APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS
APPENDIX E

INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS
END
FILMED
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