--TOWN OF BOLTON--

FYFESHIRE POND DAM

PHASE I

INSPECTION / EVALUATION REPORT

Dam Name:	Fyfeshire Dam, also known as Fish Pond Dam
State Dam ID#:	3-14-34-2
NID ID#:	MA01512
Owner:	Town of Bolton Conservation Commission
Owner Type:	Bolton, MA
Town:	Municipal
Consultant:	AMEC Earth & Environmental Inc.
Date of Inspection:	7/17/2008

EXECUTIVE SUMMARY

- ***Fyfeshire Dam (AKA Fish Pond Dam), Bolton, MA***
- ***July 17, 2008***
- ***AMEC Earth & Environmental, Inc.***
- ***Dam Condition: Unsafe***
- ***Major Deficiencies: Failing Spillway, Bulging Embankment, Lack of Documentation.***

In 1878 William E. Fyfe of Bolton owned the property where Fyfeshire Dam is currently located. He had built a Button Factory Mill, and the associated Fyfeshire Dam, with the latter impounding water to supply power for the Button Shop. In 1880, the Button Shop burned down and was not rebuilt. Currently the Dam is being used for recreational and conservatory purposes.

The dam is earth-filled between stacked-stone walls with a cast-in-place concrete spillway about midway along the dam's length. The downstream face of the dam is near-vertical stacked stone. The western end of the stacked stone downstream face has a noticeable bulge. A few large trees are growing at the toe of the downstream face. The upstream face of the dam is sloped approximately 2 (horizontal) to 1 (vertical) and covered with stone facing. The abutments and toe of the downstream embankment have large trees growing upon them.

The dam and spillway have a footpath crossing the crest and a steel walkway, with handrail, across the spillway. Within the last eight to ten years the spillway was modified by adding an approximately three feet high, concrete sill within the spillway. Likewise, two small concrete walls have been added on the left side of the spillway to slow erosion that is ongoing behind the left wall of the spillway. Both vertical walls of the spillway have horizontal cracks about ½ up from the floor. The cracks extend the full length of the spillway and appear to be completely through the spillway walls. There is significant deflection of the left (east) spillway wall toward the center of the spillway. The type and size of aggregate exposed in the crack and the lack of reinforcing steel appears to be consistent with concrete produced in the latter part of the 19th century.

The spillway is partially clogged with branches and mud that appear to have accumulated due to storm flows. In the past, the pond has been home to beavers; however, there is little fresh sign of beaver activity. A 15-inch diameter corrugated polyethylene pipe and screened inlet was installed from the pool in front of the dam extending slightly past the spillway, atop the concrete sill, to bypass the accumulated debris or beaver dam. The pipe and inlet were installed within the last three years according to the limited records.

In general, the overall condition of the Fyfeshire Dam (a.k.a. Fish Pond Dam) is Unsafe. The dam was found to have structural deficiencies in the embankments due to wall instability, large tree growth, and failing concrete spillway.

The spillway and embankments will require immediate replacement or significant repairs to remain in service.

Dam Evaluation Summary Detail Sheet

1. NID ID: MA01512	**2. Dam Name:** Fish Pond Dam (AKA Fyfeshire Dam)	**3. Dam Location:** Bolton, MA
4. Inspection Date: 7/17/2008	**5. Last Insp. Date:** unknown	**6. Next Inspection:** 7/16/2013
7. Inspector: D. E. Tate	**8. Consultant:** AMEC Earth & Environmental, Inc.	
9. Hazard Code: Significant (Class 2)	**10. Insp. Frequency:** Significant-5 Yrs.	**11. Insp. Condition:** Unsafe

E1. Design Methodology:	1	**E7. Low-Level Discharge Capacity:**	1
E2. Level of Maintenance:	2	**E8. Low-Level Outlet Physical Condition:**	1
E3. Emergency Action Plan:	2	**E9. Spillway Design Flood Capacity:**	
E4. Embankment Seepage:	3	**E10. Overall Physical Condition of the Dam:**	1
E5. Embankment Condition:	2	**E11. Estimated Repair Cost (in thousand $):**	
E6. Concrete Condition:	1		

Evaluation Description

E1: DESIGN METHODOLOGY
1. Unknown Design – no design records available
3. Some standard design features
5. State of the art design – design records available

E2: LEVEL OF MAINTENANCE
1. No evidence of maintenance, no O&M manual
2. Very little maintenance, no O&M manual
3. Some level of maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN
1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available and filed with MADCR

E4: EMBANKMENT SEEPAGE
1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Controlled seepage
5. No seepage or piping

E5: EMBANKMENT CONDITION
1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained healthy uniform grass cover

E6: CONCRETE CONDITION
1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW LEVEL OUTLET DISCHARGE CAPACITY
1. No low level outlet
2. Outlet with insufficient drawdown capacity
3. Inoperable gate with potentially sufficient drawdown capacity
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW LEVEL OUTLET PHYSICAL CONDITION
1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY
1. 0 - 20% of the SDF
2. 21- 40% of the SDF
3. 41- 60% of the SDF
4. 61- 80% of the SDF
5. 81- 100% of the SDF

E10: OVERALL PHYSICAL CONDITION OF THE DAM
1. *UNSAFE* – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. *POOR* - Significant structural, operation and maintenance deficiencies are clearly recognized under normal loading conditions
3. *FAIR* - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to. critical parameters
4. *SATISFACTORY* - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result In deficiencies.
5. *GOOD* - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST
Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Changes/Deviations to Database Information since last inspection

No previous inspection was available. Town records show that the spillway was inspected by an engineer (GOLDSMITH, PREST &: RINGWALL, INC.) in January, 1998, who recommended its replacement.
E9 Spillway Capacity - the capacity of the spillway relative to the design storm is unknown.

PREFACE

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 this report.

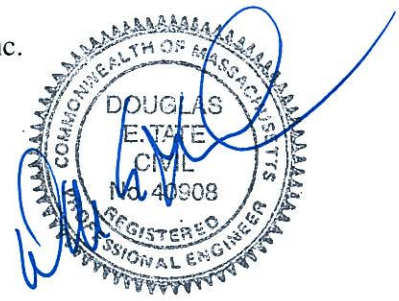
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases where an impoundment is lowered or drained prior to inspection, such action, while 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 critical to note that the condition of the 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.

Licensed Professional's Signature*

* 302 CMR 10.00 requires inspecting engineers to be Commonwealth of Massachusetts Registered Professional Engineers with a **Civil engineering license** with experience in dam safety inspections and engineering. The Department will also accept a Commonwealth of Massachusetts Registered Professional **Structural or Sanitary engineering license stamp**, provided the Registered Professional Engineer has experience in the field of dam engineering and inspection.

Douglas Tate, PE
Massachusetts License No.: 40908
Geotechnical Engineer
AMEC Earth and Environmental, Inc.



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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The Town of Bolton has retained AMEC Earth & Environmental to perform a visual inspection and develop a Phase I Report of conditions for the Fyfeshire Dam, also known as Fish Pond Dam, in Bolton, Massachusetts. This inspection and report were performed in accordance with MGL Chapter 253, Sections 44-50 of the Massachusetts General Laws as amended by Chapter 330 of the Acts of 2002.

1.1.2 Purpose of Work

The purpose of this investigation is to inspect and evaluate the present condition of the dam and appurtenant structures in accordance with 302 CMR10.07 to provide information that will assist in both prioritizing dam repair needs and planning/conducting maintenance and operation.

The investigation is divided into four parts: 1) obtain and review available reports, investigations, and data previously submitted to the owner pertaining to the dam and appurtenant structures; 2) perform a visual inspection of the site; 3) evaluate the status of an emergency action plan for the site and; 4) prepare and submit a final report presenting the evaluation of the structure, including recommendations and remedial actions, and opinion of probable costs.

1.1.3 Definitions

To provide the reader with a better understanding of the report, definitions of commonly used terms associated with dams are provided in Appendix D. Many of these terms may be included in this report. The terms are presented under common categories associated with dams which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; and 5) miscellaneous.

1.2 Description of Project

1.2.1 Location

The dam is located in the Fyfeshire Conservation Area, a property owned and maintained by the Town of Bolton Conservation Commission. It is located off of Watoquadoc Hill Road in the southwestern portion of Bolton, at latitude 42.41530, longitude -71.64902. The dam is on the south side of Fyfeshire Pond with the upstream face of the dam facing north.

1.2.2 Owner/Operator

	Dam Owner	Dam Caretaker
Name	Town of Bolton Conservation Commission	Town of Bolton Conservation Commission, CO Carol Gumbart
Mailing Address	Town Hall, 663 Main Street	Town Hall, 663 Main Street
Town	Bolton, MA 01740	Bolton, MA 01740
Daytime Phone	978-779-3304	508-877-2297
Emergency Phone		
Email Address	concom@townofbolton.com	concom@townofbolton.com

1.2.3 Purpose of the Dam

In 1878 William E. Fyfe of Bolton owned the property where Fyfeshire Dam is located. He had built The Button Factory Mill and rented it to McNeal, Plummer & Company. The Factory was very small and employed 3 people besides the owner. The Fyfeshire Dam was used as an energy source for the Button Shop. In 1880 the Button Shop burnt and was never rebuilt. Currently the Dam is being used for recreational and conservation purposes.

1.2.4 Description of the Dam and Appurtenances

The dam is earth-filled between stacked field-stone walls, with a cast-in-place concrete spillway about midway along the dam's length. The downstream face of the dam is near-vertical stacked stone with a few large trees growing at the toe and a noticeable bulge on the western portion of the stacked stone. The upstream face of the dam is sloped approximately 2 (horizontal) to 1 (vertical) and covered with stone facing. The abutments have large trees growing upon them.

The dam and spillway have a footpath crossing the crest, with a steel walkway across the spillway. The walkway consists of a steel beam (W36x135) laid on its side with wooden safety rails and steel posts. Steel angle irons brace the walkway beam in place against the spillway walls. The spillway has an inverted crane rail spanning the top of the spillway walls just behind the slots in the walls for the stop logs. Within the last eight to ten years the spillway was modified by adding an approximately three feet high, concrete sill within the spillway. Likewise, two small concrete walls have been added on the left side of the spillway to slow erosion that is ongoing behind the left wall of the spillway. Both vertical walls of the spillway have horizontal cracks about halfway up from the floor, which extend the full length of the spillway and completely through the spillway walls. There is significant deflection of the spillway walls toward the center of the spillway. The type and size of aggregate exposed in the crack and the lack of reinforcing steel appears to be consistent with concrete produced in the latter part of the 19th century.

The spillway is plugged with branches and mud. Although this mass of branches and mud appears similar to a beaver dam, close inspection suggests that it may be due to storm flows. In the past, the pond has been home to beavers; however, there is little fresh sign of beaver activity. A 15-inch diameter corrugated polyethylene pipe and screened inlet was installed from the pool in front of the dam extending slightly past the spillway, atop the concrete sill, to bypass the beaver dam. The pipe and inlet were installed within the last three years according to the limited records.

1.2.5 Operations and Maintenance

The Fyfeshire Pond is owned by The Conservation Commission of Bolton, MA, which is currently administered by Ms. Carol Gumbart. We understand that ongoing maintenance consists primarily of

maintaining the walking trail atop the dam, maintaining the hand rails crossing the channel spillway, and filling erosion features. Summer and winter operating procedures consists of periodic observation and filling of erosion features.

1.2.6 DCR Size Classification

Fyfeshire (Fish Pond) Dam has a maximum structural height of approximately 9 feet and a maximum storage capacity reported to be 46.2 acre-feet. Therefore, in accordance with Department of Conservation and Recreation Office of Dam Safety (DCR) classification, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Fyfeshire (Fish Pond) Dam is a small size structure.

1.2.7 DCR Hazard Classification

Fyfeshire (Fish Pond) Dam is located upstream of Lancaster Road in Berlin, MA. It appears that a failure of the dam at maximum pool will release between 23.8 and 46.2 acre-feet of water. Therefore, in accordance with Department of Conservation and Recreation classification procedures, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Fyfeshire (Fish Pond) Dam is classified as a significant hazard potential dam.

1.3 Pertinent Engineering Data

1.3.1 Drainage Area

The drainage area for Fyfeshire (Fish Pond) Dam is unknown and extends through the community of Bolton, Massachusetts. There are no records of the method used to determine drainage area of the dam which was constructed about 1878. There are several small ponds and wetlands shown on the USGS Quad Sheet upstream of the Fyfeshire (Fish Pond) Dam. The nature and characteristics of the watershed is unknown, but appears to be predominantly wooded, with some open farm/pasture and residential areas.

1.3.2 Reservoir

	Length (feet)	Width (feet)	Surface Area (acres)	Storage Volume (acre-feet)
Normal Pool				23.8*
Maximum Pool	N/A	N/A	N/A	46.2*
SDF Pool				

* From Jurisdictional Verification Form

1.3.3 Discharges at the Dam Site

There are no reported discharges or breaches from the Fyfeshire (Fish Pond) Dam, based on records and information provided by witnesses available at the time of inspection.

1.3.4 General Elevations (feet, measured from the bottom of the spillway)

A.	Top of Dam	8.58 ft
B.	Spillway Design Flood Pool	N/A
C.	Normal Pool	N/A
D.	Spillway Crest	3 ft
E.	Upstream Water at Time of Inspection	~2.5 ft
F.	Streambed at Toe of the Dam	0 ft
G.	Low Point along Toe of the Dam	0 ft

1.3.5 Main Spillway

A.	Type	Concrete
B.	Length	9.67 ft
C.	Invert Elevation	3 ft
D.	Upstream Channel	debris filled
E.	Downstream Channel	0 ft
F.	Downstream Water	0 ft

1.3.6 Other Information

The Impoundment is managed as a conservation area and reportedly is home to the endangered Blanding's Turtle.

1.3.7 Design or As-built (Record)

The records pertaining to the Fyfeshire (Fish Pond) Dam were obtained from the Town of Bolton and the Massachusetts, Department of Conservation and Recreation (DCR). The United States Army Corp of Engineers was queried for records, but none were available. No construction records are available for this dam.

1.3.8 Operating Records

Operational records consist of a few letters regarding minor erosion repairs, funding documents, invoices, wildlife control (beavers), and other miscellaneous records. Bolton Conservation Commission maintains and updates the available records.

SECTION 2

2.0 INSPECTION

2.1 Visual Inspection

Fyfeshire (Fish Pond) Dam was inspected on July 17, 2008. At the time of the inspection, the weather was clear with a very slight breeze. Temperature was approximately 80 degrees. No significant amount of rainfall had fallen previous to the inspection date. Photographs to document the current conditions of the dam were taken during the inspection and are included in Appendix A. The level of the impoundment was approximately +2.5 feet, measured from the bottom of the spillway. Underwater areas were not inspected. A copy of the inspection checklist is included in Appendix B.

2.1.1 General Findings

In general, Fyfeshire (Fish Pond) Dam was found to be in unsafe condition with the spillway and downstream walls as the major concerns. The specific concerns are identified in more detail in the sections below:

2.1.2 Dam

The Fyfeshire (Fish Pond) Dam is approximately 88 feet long with a crest width of approximately 12 feet. Based on available information and visual observations, the dam is constructed of dry-stack stone walls at the upstream and downstream faces with earth fill between them and a concrete spillway in the approximate center. The left side of the spillway is located 39 feet from the left abutment.

2.1.2.1 Abutments

The abutments on both the left and right sides of the dam appear to be solid and dry. There is thick grass along the top of abutments and crest of the dam and only a few trees nearby on either side. At the corner of the right abutment, a tree has fallen over, removing the root ball and exposing a spherical volume within the pond embankment. This area doesn't appear to have weakened the dam abutment, but could be a cause for concern with erosion. See Photos 10 & 11.

2.1.2.2 Upstream Face

The upstream face of the dam consists of a battered (sloped) wall of smooth flat rocks. The rock face of the dam is in satisfactory condition with little observable erosion or wear. Trees are present on the right side face. See Photos 8 & 9. The pond appears stagnant and the pool directly in front of the dam is heavily silted in. Therefore, the visual inspection can only verify the condition of the face of the dam to the mud line. At the time of the inspection the mud line was completely visible and only partially submerged.

2.1.2.3 Crest

The crest of the dam is currently part of a walking path in the conservation area. Both sides of the path are grass-covered. The left side of the dam has juniper bushes planted on the upstream side of the crest. Evidence of significant erosion is found on the left side of the dam at the point where the spillway wall and the earth dam structure meet. The area was recently repaired with small 2-foot tall, cast-in-place concrete walls, retaining the soil within the walking path. The right side of the crest appears in better condition, with no sign of notable erosion, and only grass along the crest. See Photos 1 & 2.

2.1.2.4 Downstream Face

The downstream face of the dam is a vertical dry-stacked stone wall on both sides of the spillway. The left side of the wall is straight and has no noticeable batter. There is a large tree at the base of the wall; see Photos 25 & 26 in Appendix A. The right side of the downstream face is the same construction; however, it is bulged and leaning significantly along its length. See Photo 27 in Appendix A. The downstream face of the dam appears dry and shows no evidence of seepage.

2.1.2.5 Drains

There is no evidence and no record of any drains for the dam.

2.1.2.6 Instrumentation

The Fyfeshire Dam has no instrumentation of any kind.

2.1.2.7 Access Roads and Gates

The dam is accessed by the public through the gate at 500 Watoquadoc Hill Road in Fyfeshire Conservation Area in Bolton. Fyfeshire Dam can only currently be accessed by a foot path from the small pond near the entrance to the park. Another access point was observed during the inspection, southeast of the dam, through the private residence downstream of the dam. This access point has a gate across it.

2.1.3 Appurtenant Structures

2.1.3.1 Primary Spillway

The spillway for the Fyfeshire Dam is located approximately in the center of the dam and is a rectangular opening about 9.67 feet wide. The earthen dam structure is retained with vertical concrete walls on the left and right of the spillway. See Photo 17.

The spillway walls are made of concrete with aggregate sizes as large as approximately 6 inches in diameter. The concrete is consistent with the concrete produced in the late 19th century. The right (west) wall appears to be straight and vertical with a horizontal crack extending from upstream to downstream. The left (east) wall of the spillway has a large horizontal crack, which appears to penetrate completely through the thickness of the wall and extends from upstream to downstream. The left wall of the spillway appears to be bulged or folded such that the horizontal crack projects toward the center of the spillway many inches and the portion above and below the crack is leaning significantly (estimated 10 degrees) away from the center of the spillway. See Photos 18 through 25 in Appendix A for the spillway walls.

The foot path crosses the spillway with a steel foot bridge 5.58 feet above the spillway weir. The foot bridge is a W36x135 steel beam laid on its side for use as a walking surface across the spillway. Welded to the under side of the beam are steel sections of 2.5 inch angle, bracing the spillway walls.

A concrete sill, approximately 3-feet high, was added inside the spillway channel between 8 and 10 years ago (Photos 18, 22, & 31). The spillway is currently partially choked above the sill with branches, mud, and sticks. A 15-inch corrugated polyethylene pipe is protruding through the debris and over the sill within the spillway. The pipe appears to be connected to an inlet about 30 feet upstream of the dam. The inlet is covered with a large metal screen and was partially visible on the day of the inspection. Due to the low water level, water was not flowing through the pipe. This structure was reportedly installed to discourage beavers from damming the spillway. See Photos 18 and 30 thru 32 for the spillway pipe.

The spillway for the dam has an inverted crane rail spanning the top of the spillway walls just behind the slots in the walls for the stop logs.

2.1.3.2 Low Level Outlets

The only outlet is the main spillway shown in the photos. At the time of inspection, water was not flowing from the outlet pipe, or over the concrete weir.

2.1.3.3 Auxiliary/Emergency Spillway

An auxiliary spillway has not been constructed on the Fyfeshire (Fish Pond) Dam.

2.1.4 Downstream Area

The downstream area beyond the Fyfeshire (Fish Pond) Dam is a gully approximately 90 feet wide and 9 feet deep with moderately sloped embankment and stream in the middle. There is no trail below the dam; however, access is not difficult on foot. The area is generally wooded with trees and brush. Approximately 300 feet downstream and left of the dam, a relatively new residence is present. The home appears to be above the elevation of the dam. See Photos 33 and 34.

The downstream face of the dam is covered with thick brush on the right side of the spillway, and mostly clear on the left side, except for a large tree approximately two feet in diameter located next to the dam wall. The small stream bed is lined with rocks ranging from cobbles to 3-foot diameter boulders. At the time of inspection the stream bed had standing water but no discernable flow. Also at the time of inspection there was no evidence of seepage from the dam walls. See Photo 17.

Further downstream, there is a wetland and heavily wooded stream with thick underbrush. The nearest bridge is about ±1,300 feet downstream, and the Lancaster Road crossing is about ±3,100 feet downstream of the dam.

2.1.5 Reservoir Area

The reservoir is Fyfeshire Pond, also known as Fish Pond. It has a surface area estimated from the GIS figures (See Figure 2) to be 9 acres. The pond is visibly shallow as the bottom can be seen in more clear areas, and the majority of the pond is covered by lilies. Most of the pond is surrounded by low areas, with gradually sloping banks. However, in the immediate vicinity of the dam the banks are steeper. The pond is entirely surrounded by woods, primarily deciduous but with a few areas of mixed deciduous and evergreens. See Photos 13 thru 16 in Appendix A

The Fyfeshire Dam is located at the south east corner of the pond, facing south going downstream. The dam and screened inlet is located in a small cove in the corner of the pond, as shown in Figures 1 and 2, and on Photo 4 in Appendix A.

2.2 Caretaker Interview

The interview with the caretaker of the dam occurred on July 17, 2008. Ms.Carol Gumbart, the Conservation Administrator of the Town of Bolton Conservation Department, is considered the caretaker for the purposes of the Phase I Assessment. Ms. Gumbart has been the administrator for the Conservation Commission for 8 years and is familiar with the Fyfeshire Dam.

The dam is used only for conservation, recreation, and hiking. No regular maintenance is done unless a problem arises, and up until recently there were no regular removal or placement of stop logs to control

water level. In the last few years, beaver have begun blocking the spillway; therefore, the outlet pipe was installed to keep the water levels at the spillway level. However, there is little evidence of recent beaver activity.

At the time of the interview, the Conservation Commission did not have an emergency action plan in place. Also, the Conservation Commission has no written policy or manual regarding the operation and maintenance of the dam.

Ms. Rona Balco, a Bolton resident and active volunteer in the Fyfeshire Conservation Area, was also invited to the visit. Ms. Balco had been the organizer for the few repairs on the Fyfeshire (Fish Pond) Dam in 1997, and has continued trail maintenance in the area. Her knowledge of the area, past repairs and inspections, and history of William E. Fyfe was very helpful in the site visit.

2.3 Operation and Maintenance Procedures

2.3.1 Operational Procedures

Since the Fyfeshire Conservation Area is used for recreation use only and the pond use is restricted to conservation, there is no scheduled operation of the facility.

2.3.2 Maintenance of Dam and Operating Facilities

Maintenance of the dam consists of leak repair, trail maintenance and erosion control. These have been done on an as-needed basis. The projects have been completed by volunteers and funded by the Conservation Commission. Some records have been kept for each improvement and inspection.

2.4 Emergency Warning System

No Emergency Warning System or Emergency Action Plan was available at the time of inspection for the Fyfeshire Dam.

2.5 Hydrologic/Hydraulic Data

No hydrologic and hydraulic analysis was available at the time of inspection for the Fyfeshire Dam.

2.6 Structural Stability/Overtopping Potential

2.6.1 Structural Stability

The structural stability of the Fyfeshire Dam appears to be in unsafe condition based upon the visual inspection. In particular, the downstream face on the right side and the cracked and broken left wall of the spillway contribute to the “Unsafe” designation. These two walls appear to be of concern and could have significant impacts to the entire structure if they fail.

No structural stability analysis of the Fyfeshire (Fish Pond) Dam was available at the time of inspection.

2.6.2 Overtopping Potential

No overtopping data or analysis for the Fyfeshire (Fish Pond) Dam was available at the time of the inspection..

SECTION 3

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

In general, the overall condition of Fish Pond Dam is Unsafe. The dam was found to have structural deficiencies in the embankments due to wall instability, large tree growth, and failing concrete spillway.

The following recommendations and remedial measures generally describe the recommended approach to address current deficiencies at the dam. Prior to undertaking recommended maintenance, repairs and remedial measure, the applicability of environmental permits needs to be determined prior to undertaking activities that may occur within resource areas under the jurisdiction of local conservation commissions, MADEP, or other regulatory agencies.

3.2 Studies and Analyses

We understand that the Bolton Conservation Commission desires to keep the Fyfeshire Dam and pond in operation for environmental and conservation purposes. To bring the dam up to a minimum safe condition, we recommend that the following studies should be completed to evaluate concerns and/or comply with current regulations:

A. Hydraulic & Hydrologic analyses;

B. Stability Analysis;

C. Seepage Evaluation.

D. Downstream Hazard Assessment

The facility should also have the following documents prepared so that future modifications and repairs can be made with dam safety in mind.

E. Operations and Maintenance (O & M) Manual;

F. Emergency Action Plan (EAP).

3.3 Yearly Recommendations

At a minimum, the spillway should be checked for accumulated debris, wood, mud, etc., and cleaned as needed. That should be done at least quarterly (every three months) and after every significant storm event. Other recommendations will require further study.

3.4 Recommendations, Maintenance, and Minor Repairs

Such recommendations will require further study.

3.5 Remedial Measures

Due to the unsafe condition of the dam, the dam will require significant remedial action. Such measures could include reconstruction, replacement, or breaching.

3.6 Alternatives

An alternative could include constructing a downstream buttress along with replacing the spillway.

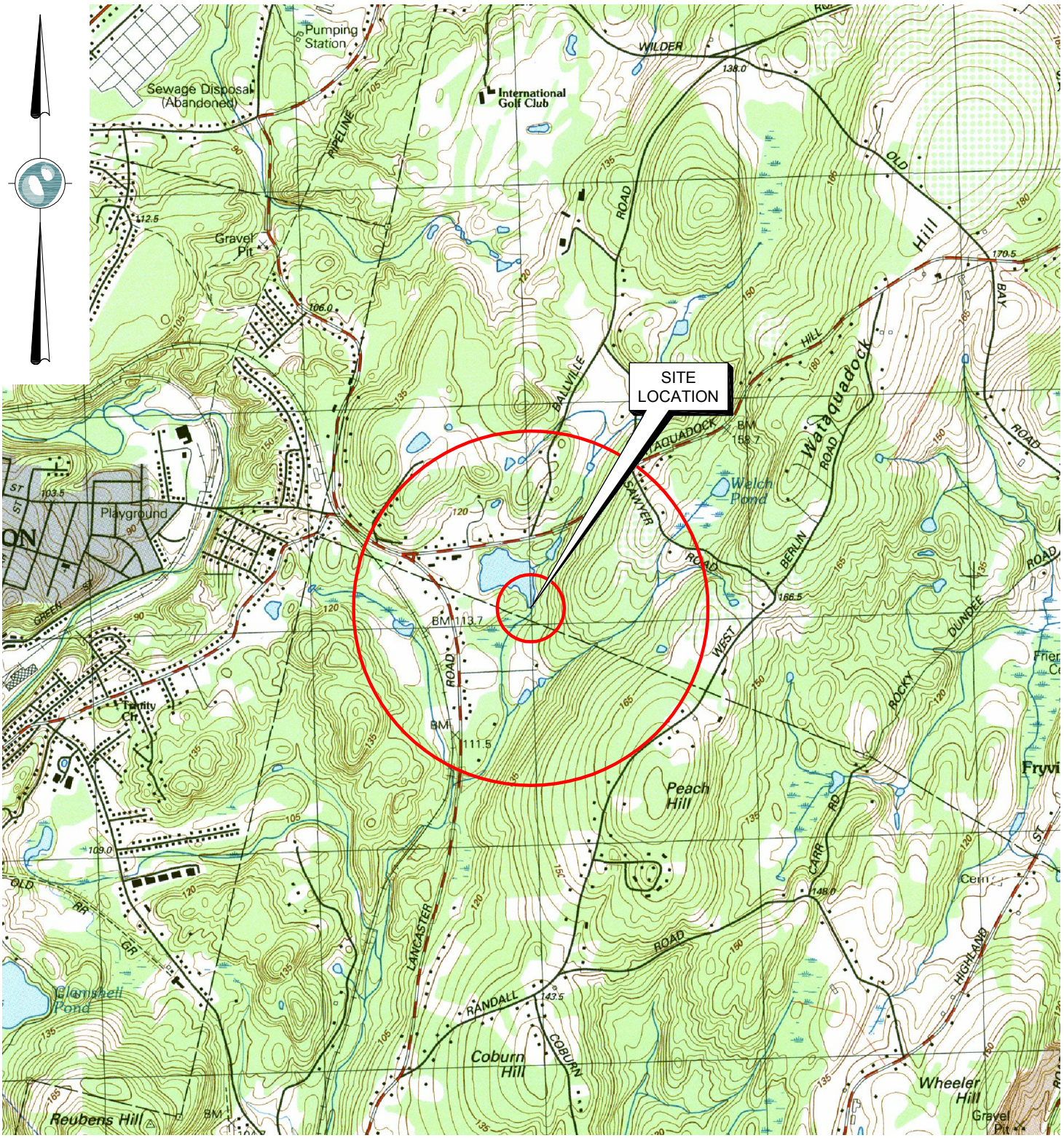
3.7 Opinion of Probable Construction Costs

Our opinion of the Probable Cost for implementing the recommendations and alternatives include:

A. Engineering and Permitting	$75,000 to $125,000
B. Operation and Maintenance Manual	$8,000 to $16,000
C. Emergency Action Plan	$8,000 to $16,000
D. 1. Construction	$150,000 to $250,000
2. Dam Breaching	$15,000 to $50,000
E. Annual Maintenance & Inspection	$8,000 to $16,000

This information is based upon published estimating guides, current market pricing, and manufacturer information where applicable and our opinion regarding the necessary remediation of the dam.

FIGURES



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1 : 25000

NOTES:

1. CIRLCLES INDICATE 500-FOOT AND 1/2-MILE RADII.
2. BASED ON USGS TOPOGRAPHIC QUADRANGLE MAPS FOR CLINTON AND HUDSON, MASSACHUSETTS, REVISED 1988.

AMEC Earth & Environmental
2 ROBBINS ROAD
WESTFORD, MASSACHUSETTS 01886

CLIENT LOGO		CLIENT	FISH POND DAM
NATIONAL I.D. NO.	MA01512	DWN BY: R. BOWMAN	DATUM: N/A / DATE: 12 JUNE 2008
TITLE	SITE LOCUS FYFESHIRE DAM (A.K.A. FISH POND DAM) BOLTON, MASSACHUSETTS	CHK'D BY: J. HOYT	REV. NO.: A / PROJECT NO: X-XXXX-XXXX
		PROJECTION: N/A	SCALE: AS SHOWN / FIGURE No. 1

P:\Bolton Dam Assessment\CAD\SITE LOCUS.dwg — Layout1 — Jun. 17, 2008 2:15pm — ron.bowman

CLIENT LOGO	CLIENT TOWN OF BOLTON, MASSACHUSETTS	DWN BY: R. BOWMAN	FYFESHIRE DAM (A.K.A. FISH POND DAM) NATIONAL I.D. NO. MA01512 BOLTON, MASSACHUSETTS	REV. NO.: A
		CHK'D BY: J. HOYT		DATE: 12 JUNE 2008
AMEC Earth & Environmental 2 ROBBINS ROAD WESTFORD, MASSACHUSETTS 01886	amec	DATUM: N/A	TITLE AERIAL SITE PLAN	PROJECT NO: 7-7699-0000
		PROJECTION: N/A		FIGURE No. 2
		SCALE: AS SHOWN		

P:\Bolton Dam Assessment\CAD\SITE AERIAL.dwg – Layout1 – Jun. 18, 2008 9:31am – ron.bowman

APPENDIX A

PHOTOGRAPHS

Photo #1: Taken from the left abutment (east facing west) facing dam, and cove upstream

Photo #2: Taken from left abutment (east facing west) of dam and downstream.

Photo #3 Upstream face of dam taken at left abutment (east facing west)

Photo #4: Screened inlet for spillway outlet pipe.

Photo #5: Upstream face, spillway and footbridge taken from right embankment.

Photo #6: Debris dam and sedimentation in upstream pool.

Photo #7: Debris dam and sedimentation in upstream pool.

Photo #8: Trees in upstream face (right side)

Photo #9: Trees in upstream face (right side)

Photo #10: Fallen tree upstream of the right side of abutment (view south).

Photo #11: Fallen tree upstream of the right side of abutment (view west).

Photo #12: Right side upsteram face, abutment and cove embankment

Photo #13: Fyfeshire Pond upstream of the dam, within the cove (view north)

Photo #14: Fyfeshire Pond upstream of the dam, within the cove (view NNE)

Photo #15: Fyfeshire lower Pond (Fish Pond) upstream of cove with dam.

Photo #16: Fyfeshire Pond to the right of the cove with the dam.

Photo #17: Downstream of spillway

Photo #18: Downstream of spillway facing the right (west) spillway wall and dam wall

Photo #19: Downstream of spillway facing the right (west) spillway wall and dam wall with grape vine

Photo #20: Major crack in left spillway wall and steel bracing

Photo #21: Deterioration of left, downstream spillway wall

Photo #22: Left side of spillway.

Photo #23: Major crack in the left spillwaywall downstream

Photo #24: Major crack in the left spillwaywall downstream

Photo #25: Major crack in left spillway wall ,upstream

Photo #26: Downstream face, left side

Photo #27: Downstream face, right side

Photo #28: Downstream face left side.

Photo #29: Repair section on left side of spillway

Photo #30: Debris dam at the spillway and pipe outlet.

Photo #31: Debris dam at the spillway and pipe outlet.

Photo #32: Evidence of old beaver activity

Photo #33: Stream Downstream facing south, closest residence in background

Photo #34: Residence downstream from Fyfeshire Dam.

APPENDIX B

INSPECTION CHECKLIST

Dam Evaluation Summary Detail Sheet

1. NID ID: MA01512	**2. Dam Name:** Fish Pond Dam (AKA Fyfeshire Dam)	**3. Dam Location:** Bolton, MA
4. Inspection Date: 7/17/2008	**5. Last Insp. Date:** unknown	**6. Next Inspection:** 7/16/2013
7. Inspector: D. E. Tate	**8. Consultant:** AMEC Earth & Environmental, Inc.	
9. Hazard Code: Significant (Class 2)	**10. Insp. Frequency:** Significant-5 Yrs.	**11. Insp. Condition:** Unsafe

E1. Design Methodology:	1	**E7. Low-Level Discharge Capacity:**	1
E2. Level of Maintenance:	2	**E8. Low-Level Outlet Physical Condition:**	1
E3. Emergency Action Plan:	2	**E9. Spillway Design Flood Capacity:**	
E4. Embankment Seepage:	3	**E10. Overall Physical Condition of the Dam:**	1
E5. Embankment Condition:	2	**E11. Estimated Repair Cost (in thousand $):**	
E6. Concrete Condition:	1		

Evaluation Description

E1: DESIGN METHODOLOGY
1. Unknown Design – no design records available
3. Some standard design features
5. State of the art design – design records available

E2: LEVEL OF MAINTENANCE
1. No evidence of maintenance, no O&M manual
2. Very little maintenance, no O&M manual
3. Some level of maintenance and standard procedures
4. Adequate level of maintenance and standard procedures
5. Detailed maintenance plan that is executed

E3: EMERGENCY ACTION PLAN
1. No plan or idea of what to do in the event of an emergency
2. Some idea but no written plan
3. No formal plan but well thought out
4. Available written plan that needs updating
5. Detailed, updated written plan available and filed with MADCR

E4: EMBANKMENT SEEPAGE
1. Severe piping and/or seepage with no monitoring
2. Evidence of monitored piping and seepage
3. No piping but uncontrolled seepage
4. Controlled seepage
5. No seepage or piping

E5: EMBANKMENT CONDITION
1. Severe erosion and/or large trees
2. Significant erosion or significant woody vegetation
3. Brush and exposed embankment soils, or moderate erosion
4. Unmaintained grass, rodent activity and maintainable erosion
5. Well maintained healthy uniform grass cover

E6: CONCRETE CONDITION
1. Major cracks, misalignment, discontinuities causing leaks, seepage or stability concerns
2. Cracks with misalignment inclusive of transverse cracks with no misalignment
3. Significant longitudinal cracking and minor transverse cracking
4. Spalling and minor surface cracking
5. No apparent deficiencies

E7: LOW LEVEL OUTLET DISCHARGE CAPACITY
1. No low level outlet
2. Outlet with insufficient drawdown capacity
3. Inoperable gate with potentially sufficient drawdown capacity
4. Operable gate with sufficient drawdown capacity
5. Operable gate with capacity greater than necessary

E8: LOW LEVEL OUTLET PHYSICAL CONDITION
1. Outlet inoperative needs replacement, non-existent or inaccessible
2. Outlet inoperative needs repair
3. Outlet operable but needs repair
4. Outlet operable but needs maintenance
5. Outlet and operator operable and well maintained

E9: SPILLWAY DESIGN FLOOD CAPACITY
1. 0 - 20% of the SDF
2. 21- 40% of the SDF
3. 41- 60% of the SDF
4. 61- 80% of the SDF
5. 81- 100% of the SDF

E10: OVERALL PHYSICAL CONDITION OF THE DAM
1. *UNSAFE* – Major structural, operational, and maintenance deficiencies exist under normal operating conditions
2. *POOR* - Significant structural, operation and maintenance deficiencies are clearly recognized under normal loading conditions
3. *FAIR* - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to. critical parameters
4. *SATISFACTORY* - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result In deficiencies.
5. *GOOD* - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF

E11: ESTIMATED REPAIR COST
Estimation of the total cost to address all identified structural, operational, maintenance deficiencies. Cost shall be developed utilizing standard estimating guides and procedures

Changes/Deviations to Database Information since last inspection

No previous inspection was available. Town records show that the spillway was inspected by an engineer (GOLDSMITH, PREST &: RINGWALL, INC.) in January, 1998, who recommended its replacement.
E9 Spillway Capacity - the capacity of the spillway relative to the design storm is unknown.

DAM SAFETY INSPECTION CHECKLIST

NAME OF DAM:	Fish Pond Dam	STATE ID #:	3-14-34-2
REGISTERED:	☑ YES ☐ NO	NID ID #:	MA01512
STATE SIZE CLASSIFICATION:	Small	STATE HAZARD CLASSIFICATION:	Significant

LOCATION INFORMATION

CITY/TOWN:	Bolton	COUNTY:	Worcester
DAM LOCATION:	Wattaquodoc Hill Road, Bolton MA	AKA NAME:	Lower Fyfeshire Pond Dam
USGS QUAD.:	Clinton and Hudson ?	LAT.: 42.14182	LONG.: -72.08502
DRAINAGE BASIN:		RIVER:	Fish Pond
IMPOUNDMENT NAME(S):	Fish Pond		

GENERAL DAM INFORMATION

TYPE OF DAM:	REPG	OVERALL LENGTH (FT):	?
PURPOSE OF DAM:	Recreational	NORMAL POOL STORAGE (ACRE-FT):	23.8
YEAR BUILT:	1940	MAXIMUM POOL STORAGE (ACRE-FT):	46.2
STRUCTURAL HEIGHT (FT):	9	EL. NORMAL POOL (FT):	?
HYDRAULIC HEIGHT (FT):	5.1	EL. MAXIMUM POOL (FT):	?

FOR INTERNAL MADCR USE ONLY

FOLLOW-UP INSPECTION REQUIRED: ☐ YES ☐ NO CONDITIONAL LETTER: ☐ YES ☐ NO

NAME OF DAM: Fish Pond Dam

STATE ID #: 3-14-34-2

NID ID #: MA01512

INSPECTION SUMMARY

DATE OF INSPECTION: 7.17.08

DATE OF PREVIOUS INSPECTION: UNKNOWN

TEMPERATURE/WEATHER: 80° CLEAR

ARMY CORP PHASE I: ☐ YES ☒ NO If YES, date

CONSULTANT: AMEC

PREVIOUS DCR PHASE I: ☐ YES ☒ NO If YES, date

BENCHMARK/DATUM:

OVERALL CONDITION:

DATE OF LAST REHABILITATION: UNKNOWN 1940?

EL. POOL DURING INSP.:

EL. TAILWATER DURING INSP.:

PERSONS PRESENT AT INSPECTION

NAME	TITLE/POSITION	REPRESENTING
Rona	Volenteer	~~Bolton Friend~~
Carol	Administrator	Bolton Con Com
Herb	Engineer	AMEC
Leo	Engineer	"
Doug	Engineer	"

EVALUATION INFORMATION

E1) TYPE OF DESIGN

E2) LEVEL OF MAINTENANCE

E3) EMERGENCY ACTION PLAN

E4) EMBANKMENT SEEPAGE

E5) EMBANKMENT CONDITION

E6) CONCRETE CONDITION

E7) LOW-LEVEL OUTLET CAP

E8) LOW-LEVEL OUTLET COND.

E9) SPILLWAY DESIGN FLOOD

E10) GENERAL CONDITIONS

E11) ESTIMATED REPAIR COST ($000)

ROADWAY OVER CREST ☐ YES ☐ NO

BRIDGE NEAR DAM ☐ YES ☐ NO

SIGNATURE OF INSPECTING ENGINEER:

NAME OF DAM: Fish Pond Dam			STATE ID #:	3-14-34-2	
			NID ID #:	MA01512	
OWNER:	ORGANIZATION	Town of Bolton Conservation Commison	CARETAKER:	ORGANIZATION	Town of Bolton
	NAME/TITLE	Town Hall		NAME/TITLE	
	STREET	663 Main Street		STREET	
	TOWN, STATE, ZIP	Bolton MA, 01740		TOWN, STATE, ZIP	Bolton MA 01740
	PHONE	978-779-3304		PHONE	508-877-2297
	FAX			FAX	
	EMAIL			EMAIL	
	OWNER TYPE				

PRIMARY SPILLWAY TYPE	Open Channel Concrete		
SPILLWAY LENGTH (FT)		SPILLWAY CAPACITY (CFS)	N/A
AUXILIARY SPILLWAY TYPE	N/A	AUX. SPILLWAY CAPACITY (CFS)	None
NUMBER OF OUTLETS	1	OUTLET(S) CAPACITY (CFS)	N/A
TYPE OF OUTLETS	Spillway	TOTAL DISCHARGE CAPACITY (CFS)	N/A
DRAINAGE AREQ (SQ MI)	N/A	SPILLWAY DESIGN FLOOD (PERIOD/CFS)	N/A
HAS DAM BEEN BREACHED OR OVERTOPPED	☐ YES ☒ NO	IF YES, PROVIDE DATE(S)	
FISH LADDER (LIST TYPE IF PRESENT)	None		
DOES CREST SUPPORT PUBLIC ROAD?	☐ YES ☒ NO	IF YES, ROAD NAME:	
PUBLIC BRIDGE WITHIN 50' OF DAM?	☑ YES ☐ NO	IF YES, ROAD/BRIDGE NAME:	Pedestrian Foot Bridge

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: 7/17/2008 NID ID #: MA01512

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
CREST	SURFACE TYPE	Soil			
	SURFACE CRACKING	None			
	SINKHOLES, ANIMAL BURROWS	Sinkhole / Erosion			
	VERTICAL ALIGNMENT (DEPRESSIONS)	Depression			
	HORIZONTAL ALIGNMENT	OK			
	RUTS AND/OR PUDDLES	Yes			
	VEGETATION (PRESENCE/CONDITION)	Grass, Juniper, Grape, Poison Ivy / Wood & Non Woody Shrubs			
	ABUTMENT CONTACT	OK - few trees			

ADDITIONAL COMMENTS:

Downstream Side

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: 7 NID ID #: MA01512

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S SLOPE	WET AREAS (NO FLOW)	No seeps			
	SEEPAGE	No seeps			
	SLIDE, SLOUGH, SCARP	West Embankment Bulge			
	EMB.-ABUTMENT CONTACT	Satisfactory			
	SINKHOLE/ANIMAL BURROWS	None			
	EROSION	East Embankment, with repair walls			
	UNUSUAL MOVEMENT	Bulging on West			
	VEGETATION (PRESENCE/CONDITION)	Woody & Non Woody Shrubs			

ADDITIONAL COMMENTS:

Upstream side

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S SLOPE	SLIDE, SLOUGH, SCARP	None			
	SLOPE PROTECTION TYPE AND COND.	Slope w/ Rock Face Slope is 2:1			
	SINKHOLE/ANIMAL BURROWS	East Em, Animal burrows			
	EMB.-ABUTMENT CONTACT	Satisfactory			
	EROSION	East Embankment @ bridge			
	UNUSUAL MOVEMENT	None			
	VEGETATION (PRESENCE/CONDITION)	Woody & Non Woody Shrubs			

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

EMBANKMENT

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
INSTR.	PIEZOMETERS	N/A			
	OBSERVATION WELLS	N/A			
	STAFF GAGE AND RECORDER	N/A			
	WEIRS	N/A			
	INCLINOMETERS	N/A			
	SURVEY MONUMENTS	N/A			
	DRAINS	N/A			
	FREQUENCY OF READINGS	N/A			
	LOCATION OF READINGS	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: _____ NID ID #: MA01512

UPSTREAM AND/OR DOWNSTREAM MASONRY WALLS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S WALLS	WALL TYPE	Concrete Spillway (East			
	WALL ALIGNMENT	Perpendicular to dam, midway			
	WALL CONDITION	Poor (East)			
	HEIGHT: TOP OF WALL TO MUDLINE	min: max: avg:			
	SEEPAGE OR LEAKAGE	None			
	ABUTMENT CONTACT	None			
	EROSION/SINKHOLES BEHIND WALL	Along crest of East Embankment, behind wall			
	ANIMAL BURROWS	None			
	UNUSUAL MOVEMENT	East Wall Cracked, leaning			
	WET AREAS AT TOE OF WALL	Spillway			

ADDITIONAL COMMENTS: _____

NAME OF DAM: Fish Pond Dam STAE ID #: 3-14-34-2

INSPECTION DATE: _____ NID ID #: MA01512

DOWNSTREAM AREA

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S AREA	ABUTMENT LEAKAGE	None			
	FOUNDATION SEEPAGE	None			
	SLIDE,SLOUGH,SCARP	West Embankment			
	WEIRS	N/A			
	DRAINAGE SYSTEM				
	INSTRUMENTATION				
	VEGETATION				
	ACCESSIBILITY				
	DOWNSTREAM HAZARD DESCRIPTION				
	DATE OF LAST EAP UPDATE				

ADDITIONAL COMMENTS: _____

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

MISCELLANEOUS

AREA INSPECTED	CONDITION	OBSERVATIONS		
MISC.	RESERVOIR DEPTH (AVG)	Unknown Reported 1'-3'		
	RESERVOIR SHORELINE	Wooded		
	RESERVOIR SLOPES	Flat		
	ACCESS ROADS	Foot path		
	SECURITY DEVICES	N/A		
	VANDALISM OR TRESPASS	YES: ☒	NO: ☐	WHAT:
	AVAILABILITY OF PLANS	YES: ☐	NO: ☒	DATE:
	AVAILABILITY OF DESIGN CALCS	YES: ☐	NO: ☒	DATE:
	AVAILABILITY OF EAP/LAST UPDATE	YES: ☐	NO: ☒	DATE:
	AVAILABILITY OF O&M MANUAL	YES: ☐	NO: ☒	DATE:
	CARETAKER/OWNER AVAILABLE	YES: ☒	NO: ☐	DATE: 7/17/2008
	CONFINED SPACE ENTRY REQUIRED	YES: ☐	NO: ☒	PURPOSE:

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

PRIMARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	Open channel concrete			
	WEIR TYPE	Concrete			
	SPILLWAY CONDITION	Poor			
	TRAINING WALLS	N/A			
	SPILLWAY CONTROLS AND CONDITION	15" PP to allow flow through beaver dam			
	UNUSUAL MOVEMENT	Spillway walls in poor condition See comment			
	APPROACH AREA	Beaver Dam Debris			
	DISCHARGE AREA	Beaver Dam Debris			
	DEBRIS	Beaver dam / Spill pipe			
	WATER LEVEL AT TIME OF INSPECTION				

ADDITIONAL COMMENTS: 15" ID Polyethylene Pipe
Boat Spillway wall is cracked & broken completely through

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: _____ NID ID #: MA01512

AUXILIARY SPILLWAY

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
SPILLWAY	SPILLWAY TYPE	N/A			
	WEIR TYPE				
	SPILLWAY CONDITION				
	TRAINING WALLS				
	SPILLWAY CONTROLS AND CONDITION				
	UNUSUAL MOVEMENT				
	APPROACH AREA				
	DISCHARGE AREA				
	DEBRIS				
	WATER LEVEL AT TIME OF INSPECTION				

ADDITIONAL COMMENTS: _____

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

OUTLET WORKS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
OUTLET WORKS	TYPE	N/A			
	INTAKE STRUCTURE				
	TRASHRACK				
	PRIMARY CLOSURE				
	SECONDARY CLOSURE				
	CONDUIT				
	OUTLET STRUCTURE/HEADWALL				
	EROSION ALONG TOE OF DAM	None			
	SEEPAGE/LEAKAGE	None			
	DEBRIS/BLOCKAGE	Beaver Dam			
	UNUSUAL MOVEMENT				
	DOWNSTREAM AREA	Small stream / Rock			
	MISCELLANEOUS				

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
GENERAL	TYPE	N/A			
	AVAILABILITY OF PLANS				
	AVAILABILITY OF DESIGN CALCS				
	PIEZOMETERS				
	OBSERVATION WELLS				
	INCLINOMETERS				
	SEEPAGE GALLERY				
	UNUSUAL MOVEMENT				

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
U/S FACE	TYPE	N/A			
	SURFACE CONDITIONS				
	CONDITIONS OF JOINTS				
	UNUSUAL MOVEMENT				
	ABUTMENT CONTACTS				

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS	NO ACTION	MONITOR	REPAIR
D/S FACE	TYPE SURFACE CONDITIONS CONDITIONS OF JOINTS UNUSUAL MOVEMENT ABUTMENT CONTACTS DRAINS LEAKAGE	N/A			

ADDITIONAL COMMENTS:

NAME OF DAM: Fish Pond Dam STATE ID #: 3-14-34-2

INSPECTION DATE: NID ID #: MA01512

CONCRETE/MASONRY DAMS

AREA INSPECTED	CONDITION	OBSERVATIONS
CREST	TYPE SURFACE CONDITIONS CONDITIONS OF JOINTS UNUSUAL MOVEMENT HORIZONTAL ALIGNMENT VERTICAL ALIGNMENT	N/A

ADDITIONAL COMMENTS:

APPENDIX C

PREVIOUS REPORTS AND REFERENCES

PREVIOUS REPORTS AND REFERENCES

The following is a list of reports that were located during the file review, or were referenced in previous reports.

Jurisdictional and Ownership Inspections, Tighe and Bond Engineers, Project #: P07-2441-X05, July 18, 2007

Tighe&Bond
Consulting Engineers
Environmental Specialists

M-0440-4-50
7/18/2007

JURISDICTIONAL
AT CLASS II
2/28

William C. Salomaa, Program Manager
Department of Conservation and Recreation
Office of Dam Safety
John Augustus Hall
180 Beaman Street
West Boylston, MA 01583

Re: Jurisdictional and Ownership Inspections
Project #P07-2441-X05
Nat. ID# MA01512
Dam Name: Fish Pond Dam

Town/City: Bolton

Dear Mr. Salomaa:

In accordance with the scope of engineering services for the Jurisdictional and Ownership Inspection Project, we are submitting to you herewith the following listed items for the above referenced dam:

1. Jurisdiction Verification Form.
2. Overview photos of dam.
3. Not to scale sketch of dam.
4. Locus map of dam.

We appreciate the opportunity to provide DCR with our engineering services. Should you have any questions, please contact the undersigned at 413-572-3235.

Very truly yours,

TIGHE & BOND, INC.

David M. Lenart

David M. Lenart, P.E.
Associate

J:\M\M0440\Data\DamReports.mdb

Commonwealth of Massachusetts
Department of Conservation and Recreation (DCR)
Office of Dam Safety (ODS)

For Office of Dam Safety Records - Jurisdiction Verification Form

Consultant Firm Name: Tighe&Bond, Inc. **Consultant Staff:** B. Raymond

Date: 6/28/2007 **Town:** Bolton **Name of dam:** Fish Pond Dam

National Dam ID Number: MA01512 **State ID Number:** 3-14-34-2

Structural Height of Dam: (measured vertical height of dam as measured from streambed at downstream toe to crest of dam) ..... 9 feet

Maximum Size of Impoundment: (estimated volume in acre feet of pool at top of dam elevation)..... 46.2 acre-feet

Hydraulic Height of Dam: (measured vertical height of normal pool impoundment from streambed at downstream toe to Spillway Crest..... 5.1 feet

Normal Pool Size of Impoundment: (estimated volume in acre feet of pool at spillway crest elevation)..... 23.8 acre-feet

Dam Location Lat. 42.41530 **Long.** -71.64902

Public Road On Crest: No **If Public Road, is there a Bridge Across the Spillway?** No

Consultant Recommendation:
Does the dam meet the definition of a jurisdictional dam in accordance with MGL Chapter 253 Section 44 – 48 and 302 CMR 10.00 Dam Safety Regulations? X Yes ___No Is the dam currently Jurisdictional? No

Suggested Hazard Potential Class: ___High X Significant ___Low Existing Hazard Potential Class: Low

Check here if this statement applies: √ The Suggested Hazard Potential Class is based upon a cursory review of the limited information available during this assignment. The suggested class is not intended to be an actual recommended classification of the structure. Additional study may be necessary to establish the record Hazard Potential Class. ODS will make the final determination.

Additional Comments: Significant Downstream Hazard - Failure of dam would likely result in damage to Collins Road (approximately 1200 feet downstream) and low lying homes along Lancaster Road.

Consultant Signature: David K. Lemont **Title:** Associate 7/18/2007 **Date**

For Office of Dam Safety Use

Name of ODS Staff Reviewing Recommendations: _____ **Date:** 7/08

Office Staff Review Concludes: (mark with X)
The Dam X **Does** _____ **Does Not Meet the Definition of a Jurisdictional Dam.**

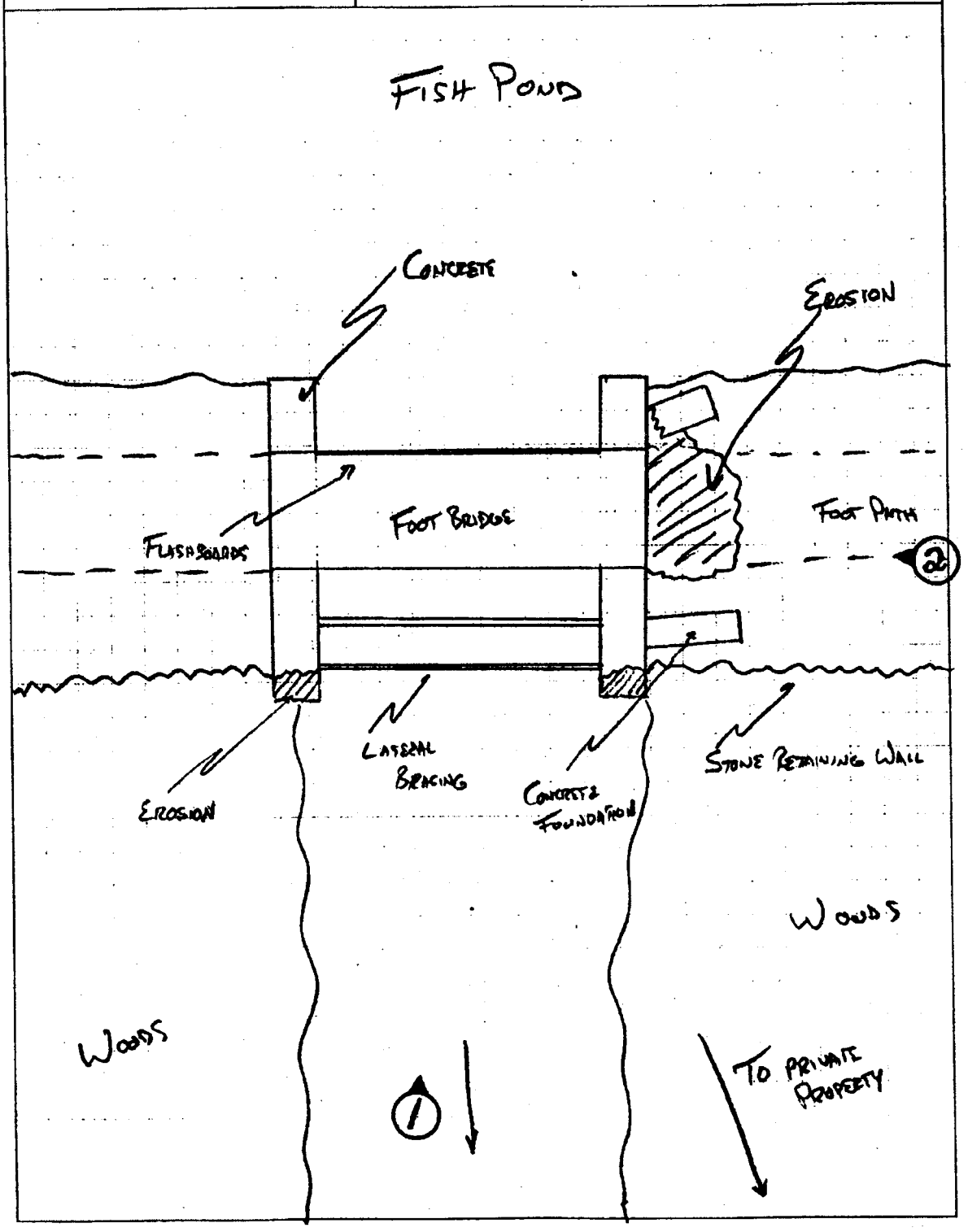
Data contained on this form was entered into the Office of Dam Safety Database on 7/08

Site Sketch:

Nat ID#: MA01512

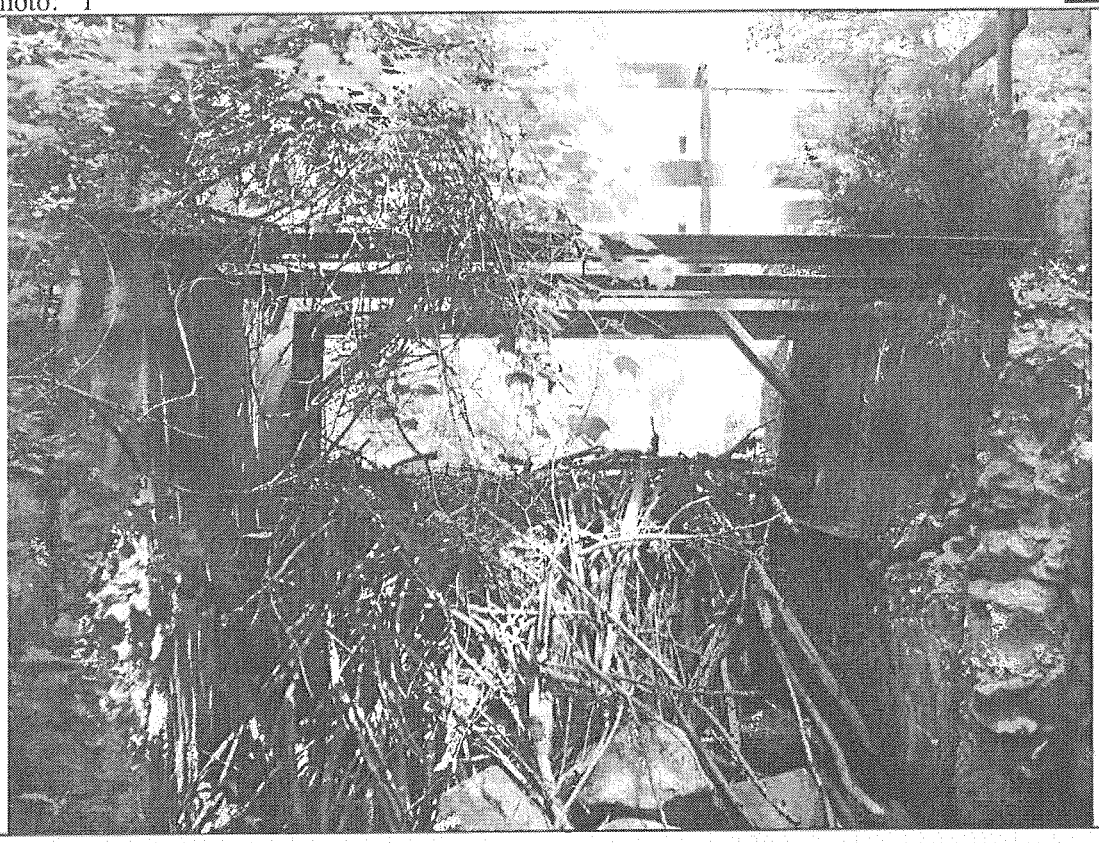
Tighe&Bond
Consulting Engineers
Environmental Specialists

JOB NO. M440-4-50 SHEET ____ OF ____
CLIENT Bolton, MA
SUBJECT MA01512 Fish Pond Dam
PREPARED BY BTR DATE 6/28/07 CHECKED BY ____ DATE ____

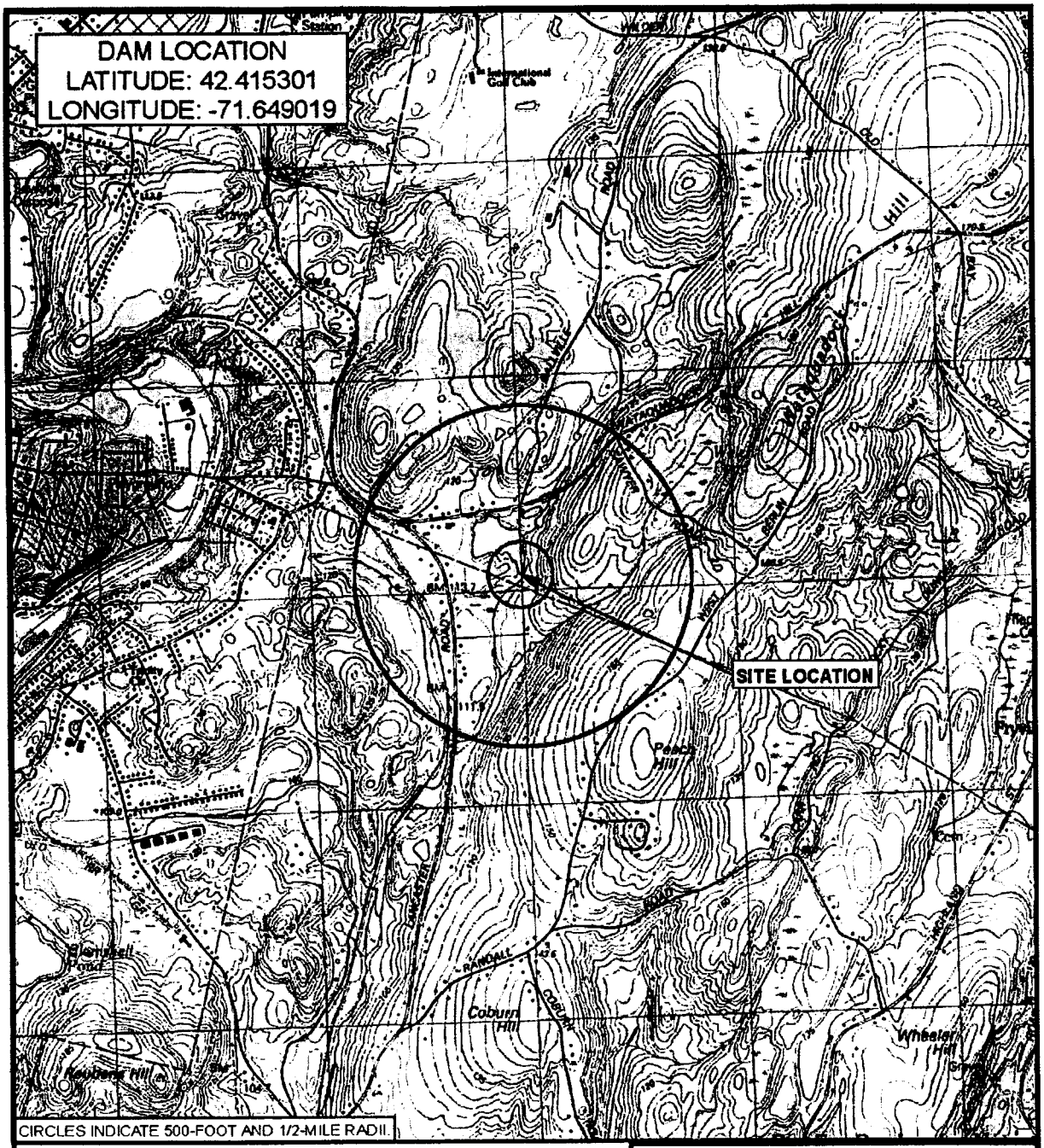


Site Photo: 1

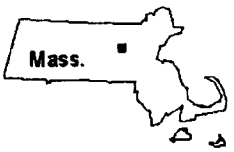
NatID: MA01512

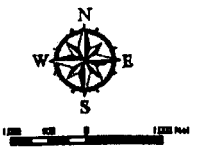


Site Photo: 2



BASED ON USGS TOPOGRAPHIC MAP FOR
CLINTON & HUDSON
MASSACHUSETTS QUADRANGLES
REVISED 1988
3-METER CONTOUR INTERVAL





SITE LOCUS

FISH POND DAM
BOLTON, MASSACHUSETTS
MA01512

Tighe&Bond

JULY 2007

V:\Projects\WM0440\MA01512usgs.mxd

Department of Conservation and Recreation DAM Detail

National ID: MA01512
Dam Location: Bolton
Dam Name: Fish Pond Dam
AKA Name: Lower Fyfeshire Pond Dam
District#: 3 **County#:** 14
Town#: 34 **DAM#:** 2
River:
IMP Name Fish Pond
AKA Name
Basin: 11 **Compliance:** N
Grant:
Grant Date:
Fish Ladder:

Size Class:
Dam Type:
Purpose:
Year Comp: 0
Struct Height (ft): 9
Hydro Height (ft): 5.1
Drain Area (Sq. mi): 0
Iml. Impoundment (acre-ft) 23.8
Max Impoundment (acre-ft): 46.2
Crest Length (ft): 0
Spill Type:
Spill Length (ft): 0
Spill Capacity (cfs): 0

USGA Quad:
Inspection Reg:
Conditional Letter: UN
Army Phase1 RPT: N
DCR Phase 1 RPT: N
Latitude: 42.4153
Longitude: -71.64902
Ferc lic: N
253 Permit Date:
Crest Public Road:
Crest Public Bridge:
Registered: N

Owner: Town of Bolton
Street: Town Hall - 663 Main St.
Town: Bolton, MA 01740
Phone: (978) 779-3304
Owner type: 20
FAX:
EMail:

Caretaker: Town of Bolton
Street: Town Hall - Main St.
Care. Town: Bolton, Ma 01740
Phone: (508) 877-2297
FAX:
Email:

Comment:

Last_date_Changed: 1/31/2008

JP enter 2/08: Dam falls under DCR jurisdiction as Class II based on T&B 7/18/07 VIF report, subject to possible hazard potential re-classification based on required Phase I inspection.

Owner updated 12/07 based on Tighe & Bond Ownership Report.

ODSREVIEW: **ORPSTATUS:** C **JDSTATUS:** F **DCRPH1Status:** **Jurisdictional Status:** Y

HC: S **Last Reg. Inspection Date** 01/01/1975 **Next Reg. Inspection Date:** 12/31/1979 **Inspection Frequency:** 5

Update Confirmation to file **DCR Initial:** JP **Date:** 1/2/08

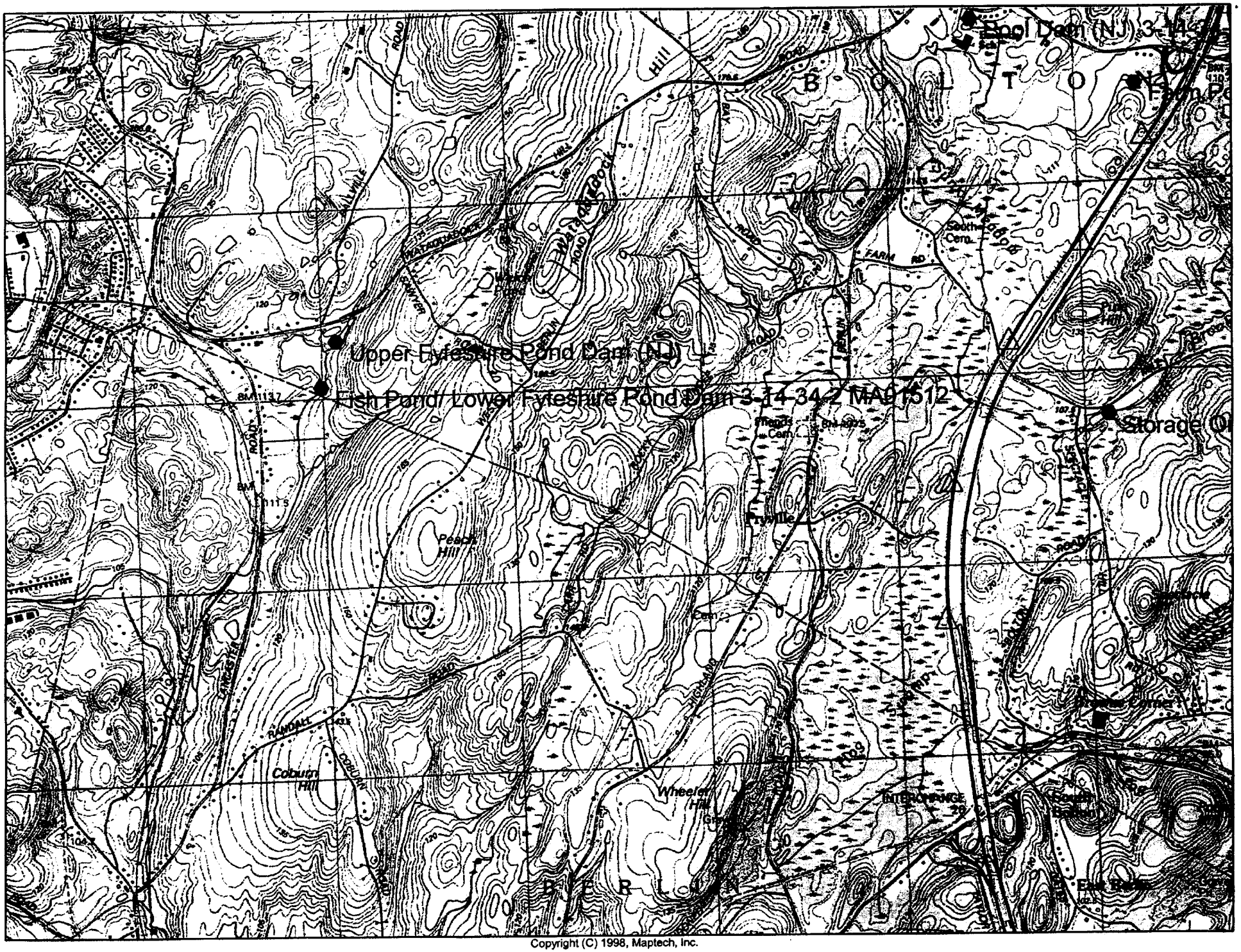
Department of Conservation and Recreation DAM Detail

National ID: MA01512

DCR Inspector	TCF	**DCR Date:**	**Consultant**	**Reg. Ins. Date**
		Inspection cond		
InspectionCompliance:		**Date Report Received:**	**Date Returned to Owner:**	

Design		**Concrete. Cond.**	
Maint. Level		**Lowlevel Capacity**	
Emerg Plan		**Outlet Cond.**	
Embank. Sepage		**% Capacity**	
Embank. Cond.		**DAM Condition**	
Est. Repair Cost	$0.00		

Comments



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APPENDIX D

DEFINITIONS

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to 302 CMR10.00 Dam Safety, or other reference published by FERC, Dept. of the Interior Bureau of Reclamation, or FEMA. Please note should discrepancies between definitions exits, those definitions included within 302 CMR 10.00 govern for dams located within the Commonwealth of Massachusetts.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate therefrom. including but not be limited to, spillways; reservoirs and their rims; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

Size Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.

Non-Jurisdictional – structure less than 6 feet in height or having a storage capacity of less than 15 acre-feet.

Hazard Classification

(as listed in Commonwealth of Massachusetts, 302 CMR 10.00 *Dam Safety*)

High Hazard (Class I) – Shall mean dams located where failure will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

Significant Hazard (Class II) – Shall mean dams located where failure may cause loss of life and damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s), or cause the interruption of the use or service of relatively important facilities.

Low Hazard (Class III) – Dams located where failure may cause minimal property damage to others. Loss of life is not expected.

General

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.

O & M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. On million U.S. gallons = 3.068 acre feet

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Condition Rating

Unsafe - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.

Poor - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

Fair - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

Satisfactory - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

Good - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.