APPENDIX A

Project Area Photographs & Figures
Figure 1 Aerial photo with arrow pointing at Balmoral Dam (Bing Maps accessed 7/15/15).

Figure 2 Looking south from Haverhill Street Bridge toward Balmoral Dam and Gatehouse.
Figure 3 Looking downstream at Dam, Gatehouse, and Haverhill Street Bridge (Roberts and Donohue 2015).

Figure 4 Looking upstream at Balmoral Street Bridge (PAL 2010).

Figure 5 River wall west at Balmoral Dam’s attachment point (Roberts and Donohue 2015).
Figure 6 The Bowling Green and parkland adjacent to the Balmoral Dam (PAL 2010).

Figure 7 Cross section of the Balmoral Dam proposed design plan (American Woolen Mills Co. 1920).
Figure 8 Shawsheen River looking upstream of recreational fields south of Balmoral Dam in June 2015.

Figure 9 Longitudinal profile of the Shawsheen River near Balmoral Dam showing the existing (green lines) and proposed (blue lines) flood elevations for the 2-yr and 100-yr floods (Stewart et. al 2011).
Figure 10 Map of existing flood inundations output by HEC-RAS modeling software for the 2-year to the 500-year storm (Figure taken from Stewart et. al 2011).
Figure 11 Map of flood inundations predicted by HEC-RAS modeling software for the 2-year to the 500-year storm with Balmoral Dam removed (Figure taken from Stewart et. al 2011).
APPENDIX B

Section 106 of National Historic Preservation Act
MEMORANDUM OF AGREEMENT
AMONG THE
U.S. FISH AND WILDLIFE SERVICE,
THE MASSACHUSETTS HISTORICAL COMMISSION,
MASSACHUSETTS BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
AND THE
TOWN OF ANDOVER
FOR THE BAMORAL DAM REMOVAL PROJECT
IN ANDOVER, MASSACHUSETTS

WHEREAS, the Town of Andover (Town), the project proponent, is proposing the Balmoral Dam Removal Project (Project) in Andover, Massachusetts, consisting of removal of the dam and installation of a grade control riffle to restore riverine habitat and a free-flowing riverine system for migratory and resident fish passage ("the undertaking"); and

WHEREAS, the U.S. Fish and Wildlife Service (USFWS), as lead Federal agency for the Project, has determined that the undertaking will have an adverse effect on the Shawsheen Village Historic District (MHC #ANV.A), listed in the National Register of Historic Places (NRHP), and the Balmoral Dam and Gatehouse and the Shawsheen Recreational Landscape, which are eligible for listing in the NRHP as contributing resources of the National Register-listed Shawsheen Village Historic District; and

WHEREAS, the USFWS has consulted with the Massachusetts Historical Commission (MHC) pursuant to applicable regulations found in 36 CFR Part 800 implementing section 106 of the National Historic Preservation Act (16 U.S.C. 470f) and has provided documentation required by 36 CFR § 800.11 to them; and

WHEREAS, the USFWS has invited the Advisory Council on Historic Preservation (ACHP) to participate in the consultation process, and the ACHP has determined that its participation in the consultation to resolve adverse effects is not necessary; and

WHEREAS, the USFWS has solicited input from Tribal interests (Wampanoag Tribe of Gay Head and Mashpee Wampanoag Indian Tribal Council) to participate in this section 106 consultation process, but has received no responses; and

WHEREAS, the USFWS has consulted with the Massachusetts Board of Underwater Archaeological Resources (BUAR) and invited the BUAR to be a signatory of this Memorandum of Agreement (MOA) and BUAR accepted; and

WHEREAS, the USFWS and the Town have coordinated with and solicited input from the local and regional community interested in historic resources to participate in this section 106 consultation process; and
WHEREAS, The Andover Preservation Commission and Andover Historic Society have commented on the undertaking, and have been invited by USFWS to sign this MOA, but received no response; and

NOW THEREFORE, the USFWS and the MHC agree that the project undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties:

**Stipulations**

The USFWS shall ensure that the following measures are implemented:

I. Impact Avoidance of Identified Structures

   A. The USFWS and the Town will ensure construction avoids and protects the above- and below-ground archaeological and historic features as detailed in the agreed upon Historic Properties Treatment Plan shown in Appendix A. Field delineation and staking of the avoidance and protection areas will be conducted as indicated in the Historic Properties Treatment Plan and will be recorded on site maps and design sheets available to and for use by the construction contractor.

   B. A 36 CFR 61 qualified architectural historian will visually assess historic features before, during, and after demolition of the Balmoral Dam spillway as detailed in the agreed upon Historic Properties Treatment Plan shown in Appendix A. In the event impacts to other contributing historic resources are observed as a result of the Project, those historic resources will be rehabilitated and/or restored to the standard described in the Historic Properties Treatment Plan.

II. Documentation

   A. On behalf of the USFWS and the Town, a 36 CFR 61 qualified architectural/industrial historian will prepare full documentation with in-process photography of the dam removal process. The specific content of the state-level documentation will be determined in consultation with the MHC. The documentation will be submitted to and reviewed and approved by the MHC. If comments are not received within 30 days of submission, it will be assumed that the documentation is complete and acceptable.

   B. An original of the documentation will be provided to the Commonwealth of Massachusetts for the MHC files. Copies of this documentation will also be provided by the USFWS to appropriate local archives such as the Andover Preservation Commission, Andover Historical Society, and Andover Town Library, or as designated by the USFWS in consultation with the MHC.
III. Interpretation

A. The USFWS will work with the Town and in consultation with the MHC, Andover Historical Society, and Andover Preservation Commission to prepare a brass plaque or marker that disseminates information about the Balmoral Dam and the Shawsheen Village Recreation Landscape. The marker’s location and text will be determined by the USFWS, MHC and the Town and other parties as appropriate. The deadline for completing and installing the signage shall be two (2) years from the date of execution of this MOA. This deadline may be extended if mutually agreeable among the USFWS, BUAR, and the MHC.

IV. Post-Review Discoveries

A. The USFWS and the Town or their project consultants shall notify MHC and appropriate invited signatories and/or interested parties, if previously unidentified historic properties, including archaeological resources, are discovered during construction activities. Consultation among the signatories and invited signatories shall proceed pursuant to 36 CFR 800.13 and the USFWS and MHC shall apply the National Register criteria of eligibility (36 CFR 60). Signatories and appropriate invited signatories and/or interested parties shall develop and implement a plan to identify and evaluate, including protecting the discovery location, and to avoid, minimize, or mitigate any adverse effects to the historic or archaeological resource(s), consistent with applicable State and/or Federal regulations and the Massachusetts Board of Underwater Archaeological Resources Policy Guidance for the Discovery of Unanticipated Archaeological Resources.

V. Dispute Resolution

A. Should any signatory to this MOA object within thirty (30) days to any actions proposed or carried out pursuant to this MOA, the USFWS shall consult with the signatory to resolve the objection. If the USFWS determines that the objection cannot be resolved, the USFWS shall forward all documentation relevant to the dispute to the ACHP. Within thirty (30) days after receipt of all pertinent documentation, the ACHP will either:

1. provide the USFWS with recommendations which the USFWS will take into account in reaching a final decision regarding the dispute; or

2. notify the USFWS that it will comment pursuant to 36 CFR 800.6(b), and proceed to comment. Any recommendations or comment provided by the ACHP will be understood to pertain only to the subject of the dispute; the USFWS responsibility to carry out all actions under the MOA that are not subject of the dispute will remain unchanged.
B. If at any time during the implementation of the measures stipulated in this MOA, an objection should be raised by an interested member of the public or consulting parties, the USFWS will consult with the other parties to this MOA to determine the appropriate response.

VI. Duration

A. This MOA will expire if its terms are not carried out within three (3) years from the date of its execution. Prior to such time, the USFWS may consult with the other signatories to reconsider the terms of this MOA and amend it in accordance with Stipulation VIII below.

VII. Limitations and Assurances

A. This MOA is not a fiscal or fund obligating document and no funds are transferred hereunder. The USFWS will ensure that project partners gain best professional cost estimates for all activities proposed in this undertaking. The USFWS agrees not to proceed with the undertaking until the project partners have obtained adequate funding, based on best professional estimates, to fulfill the obligations under this MOA.

VIII. Amendments

A. This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

IX. Termination

A. If any signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties in an attempt to develop an amendment per the stipulation in Section VIII above. If, within thirty (30) days (or another time period agreed to by all signatories), an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories.

B. In the event the MOA is terminated, the USFWS will either execute an MOA with signatories pursuant to 36 CFR 800.6 (c), or request a written response from the ACHP under 36 CFR 800.7 (a).
Execution of this MOA by the USFWS, BUAR, and MHC, and its subsequent filing with the ACHP, and implementation of its terms evidences that the USFWS has afforded the ACHP an opportunity to comment on the Balmoral Dam Removal Project, and that the USFWS has taken into account the effects of the undertaking on historic properties.

U.S. FISH AND WILDLIFE SERVICE

By: ___________________________ Date: ____________
Thomas R. Chapman, Supervisor, New England Field Office

MASSACHUSETTS HISTORICAL COMMISSION

By: ___________________________ Date: ____________
Brona Simon, Executive Director, State Historic Preservation Officer, State Archaeologist

MASSACHUSETTS BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES

By: ___________________________ Date: ____________
Victor T. Mastone, Director

INVITED SIGNATORIES:

TOWN OF ANDOVER, MASSACHUSETTS

By: ___________________________ Date: ____________
Signatory Not Determined
APPENDIX A

HISTORIC PROPERTIES TREATMENT PLAN
AND DESIGN PROJECT PLAN SET
FOR THE
BALMORAL DAM REMOVAL PROJECT
APPENDIX C

Proposed Project Engineering Designs
Balmoral Dam Removal
Andover, MA

Shawsheen River

SUGGESTED SEQUENCING

1. PLACE TEMPORARY EROSION CONTROL AND PROTECTION MEASURES:
   - STRAW BALE BARRIER
   - STORM WATER INLET PROTECTION
   - CHAIN LINK CONSTRUCTION FENCING
   - FLOTATION SILT CURTAIN

2. REMOVE EXISTING FENCE, AS NECESSARY, BETWEEN STAGING AREA AND ACCESS ROAD

3. CONSTRUCT TEMPORARY CONSTRUCTION ACCESS ROADS

4. SAW CUT THE ENDS OF THE DAM

5. REMOVE DAM STRUCTURE

6. CONSTRUCT RIFFLE

7. REMOVE TEMPORARY CONSTRUCTION ACCESS ROADS

8. REPLACE IN KIND FENCE REMOVED FOR THE ACCESS ROADS

9. RE-VEGETATE DISTURBED AREAS

10. REMOVE EROSION CONTROL

NOTES:

PROTECTION REQUIRED AT ALL INLETS, SEE SPECIFICATIONS.

SURVEY PERFORMED BY INTER-FLUVE, INC. IN MAY, 2008 AND DECEMBER, 2012.

THE HORIZONTAL COORDINATE SYSTEM IS THE NORTH AMERICAN DATUM OF 1983, MASSACHUSETTS STATE PLANE, MAINLAND ZONE, US FEET.


SURVEY CONTROL

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<th>ELEVATION (FT)</th>
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<td>CP4</td>
<td>750402.62</td>
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LEGEND

- EXISTING ROADS
- EXISTING 1 FT CONTOURS
- SANITARY SEWER
- WATER DISTRIBUTION PIPES
- STORM DRAIN PIPE
- PROPERTY BOUNDARIES
- BUILDING OUTLINES
- EXISTING FENCE
- HIGH VISIBILITY FENCE
- STRAW BALE BARRIER
- LIMITS OF DISTURBANCE
- TEMPORARY CHAIN LINK CONSTRUCTION FENCE
- FLOTATION SILT CURTAIN
- TEMPORARY ACCESS ROAD

SCALE 1"=40'
NOTE:
REFER TO SPECIFICATION SECTIONS 02 100 2.2 AND 3.2 FOR CONSTRUCTION STAGING AND ACCESS DESIGN REQUIREMENTS.
REFER TO SPECIFICATIONS FOR PERMITS FOR DETAILED HISTORICAL TREATMENT PLAN.
VIBRATIONS FROM DAM REMOVAL MAY NOT DISTURB THE ADJACENT RETAINING WALLS. NECESSARY REPAIRS ARE THE RESPONSIBILITY OF THE CONTRACTOR.
ALL REMOVED FENCE SECTIONS SHALL BE REMOVED IN SUCH A MANNER THAT THEY CAN BE REINSTALLED AND RETAIN THEIR CURRENT DESIGN INTEGRITY.
STORE ANY REMOVED FENCE SECTIONS OUT OF WEATHER AND AWAY FROM ANY DAMAGING CONDITIONS.
FOLLOWING CONSTRUCTION, REMOVE PROTECTIVE RAMPS AND MATTING AND RETURN TO EXISTING GRADE. REPAIR AND PLACE SOD AS NECESSARY.

INSTALL HIGH VISIBILITY FENCE

HEAVY EQUIPMENT TO MAINTAIN AN 11 FOOT OFFSET FROM RETAINING WALL

CONSTRUCT PROTECTIVE RAMP ACROSS SLOPE

INSTALL PROTECTIVE MATTING ALONG ACCESS ROAD

CONSTRUCT PROTECTIVE RAMP ACROSS SLOPE

HEAVY EQUIPMENT BUFFER

PROPOSED RIFFLE (TYPE I STONE)

INSTALL PROTECTIVE PLYWOOD WITH STRAP TO MAINTAIN AN 11 FOOT OFFSET FROM RETAINING WALL

HEAVY EQUIPMENT TO MAINTAIN AN 11 FOOT OFFSET FROM RETAINING WALL

CONSTRUCT PROTECTIVE RAMP ACROSS SLOPE

INSTALL PROTECTIVE PLYWOOD WITH STRAP ALONG THE NORTH, SOUTH, AND WEST SIDES, AND ROOF OF GATE HOUSE

Balmoral Dam
Historical Treatment Plan
Andover, MA
NOTES:
1. CROSS SECTIONS FACE DOWNSTREAM.
2. EXISTING RETAINING WALLS AT DAM SHALL NOT BE DISTURBED OR DAMAGED. SHOWN HERE FOR SCHEMATIC REPRESENTATION ONLY.

*RESERVED FOR ENGINEER'S STAMP*
EXISTING GROUND

EXISTING DAM CREST ELEV = 25.76 FT

EXISTING RETAINING WALL

SAWCUT DAM LEAVING ABUTMENT

APPROX. 6 FT

APPROX. 6 FT

SAWCUT DAM LEAVING ABUTMENT

EXISTING RETAINING WALL

MIN. 2' CREST OF DAM STRUCTURE TO REMAIN IN PLACE EACH SIDE

17.8 FT

0.9 FT (TYP)

MIN. 2 FT

PROPOSED RIFFLE GRADE

EXTEND RIFFLE ROCK TO DEPTH OF REFUSAL MIN. 2 FT THICKNESS. SEE PROFILE SHEET 3

MIN. 2 FT

MIN. 2' CREST OF DAM STRUCTURE TO REMAIN IN PLACE EACH SIDE

TYPICAL RIFFLE SECTION

NOT TO SCALE

EXISTING RETAINING WALL

EXISTING DAM CREST ELEV = 25.76 FT

MIN. 2' CREST OF DAM STRUCTURE TO REMAIN IN PLACE EACH SIDE

40 FT CHANNEL WIDTH

LOW FLOW CHANNEL

EXISTING DAM CREST ELEV = 25.76 FT

1. PLACE BALES IN A ROW WITH THE ENDS TIGHTLY ABUTTING THE ADJACENT BALES, BINDERS PARALLEL WITH GROUND.

3. SECURELY ANCHOR IN PLACE BY EITHER TWO STAKES OR REBARS DRIVEN THROUGH THE BALE 12"-18" INTO THE GROUND. DRIVE THE FIRST STAKE AT AN ANGLE TOWARD THE PREVIOUSLY LAID BALES TO FORCE THE BALES TOGETHER. DRIVE STAKES FLUSH WITH THE TOP OF THE BALE.

STRAW BALE NOTES

TYPICAL DETAIL

FLOTATION SILT CURTAIN

NOT TO SCALE
LEGEND
- LIMITS OF DISTURBANCE
- EXISTING ROADS
- EXISTING 1 FT CONTOURS
- BUILDINGS/STRUCTURES
- EXISTING FENCE
- SOD
- PROPOSED RIFFLE
- EXISTING STORM INLET
- RIVER ALIGNMENT & STATIONING
- EX. LIGHT POST
- EX. BENCH

"RESERVED FOR ENGINEER'S STAMP"

SHAWSEEN RIVER
Balmoral Dam Removal
Andover, MA

HISTORIC BOWLING GREEN

REPAIR DAMAGED GRASS WITH SOD AS NEEDED, SEE SPECIFICATION.
NOTE: THE APPROXIMATE FLOOD INUNDATION EXTENTS SHOWN ARE BASED ON THE FLOOD FREQUENCY ESTIMATES USED FOR ANALYSIS AND DESIGN, SIMULATED WITH THE FINAL PROJECT HYDRAULIC MODEL, AND ARE INCLUDED FOR INFORMATIONAL PURPOSES ONLY. SEE FINAL DESIGN REPORT FOR FURTHER DETAIL ON THE FLOOD FREQUENCY ESTIMATES AND HYDRAULIC MODELING. FLOOD INUNDATION EXTENTS SHOWN HEREIN SHOULD UNDER NO CIRCUMSTANCE BE SUBSTITUTED FOR OR INTERPRETED TO REPRESENT PREVAILING REGULATORY FLOODPLAIN MAPPING COMPLETED UNDER THE JURISDICTION AND DIRECTION OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).

<table>
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<th>PERMANENT CHANGES</th>
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<td>BANK</td>
<td>30 LF</td>
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<tr>
<td>BORDERING VEGETATED WETLAND</td>
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<td>-</td>
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<tr>
<td>BORDERING LAND SUBJECT TO FLOODING</td>
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<tr>
<td>LAND UNDER WATER</td>
<td>5350 SF</td>
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<tr>
<td>RIVERFRONT AREA - 200 FT</td>
<td>17,860 SF</td>
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<tr>
<td>RIVERFRONT AREA - 100 FT</td>
<td>10,200 SF</td>
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NOTE: THE APPROXIMATE FLOOD INUNDATION EXTENTS SHOWN ARE BASED ON THE FLOOD FREQUENCY ESTIMATES USED FOR ANALYSIS AND DESIGN, SIMULATED WITH THE FINAL PROJECT HYDRAULIC MODEL, AND ARE INCLUDED FOR INFORMATIONAL PURPOSES ONLY. SEE FINAL DESIGN REPORT FOR FURTHER DETAIL ON THE FLOOD FREQUENCY ESTIMATES AND HYDRAULIC MODELING. FLOOD INUNDATION EXTENTS SHOWN HEREIN SHOULD UNDER NO CIRCUMSTANCE BE SUBSTITUTED FOR OR INTERPRETED TO REPRESENT PREVAILING REGULATORY FLOODPLAIN MAPPING COMPLETED UNDER THE JURISDICTION AND DIRECTION OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
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