

APPENDIX A

Project Area Photographs
& Figures

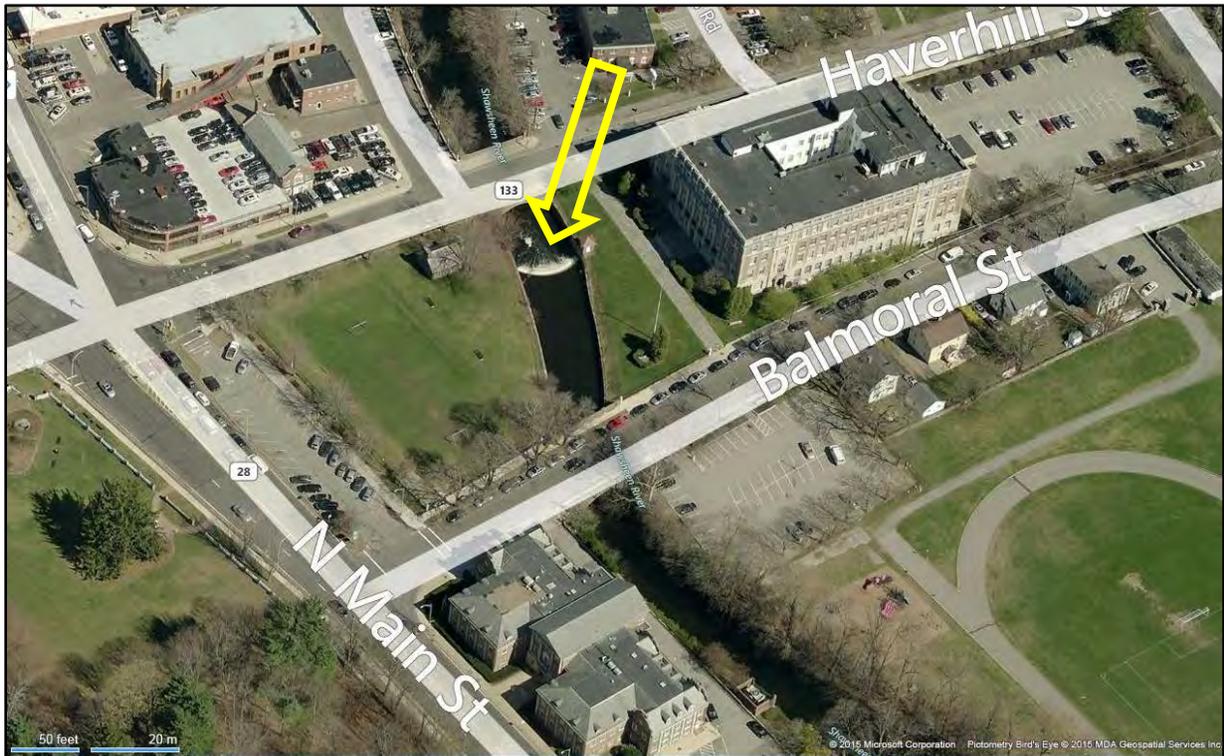


Figure 1 Aerial photo with arrow pointing at Balmoral Dam (Bing Maps accessed 7/15/15).



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).

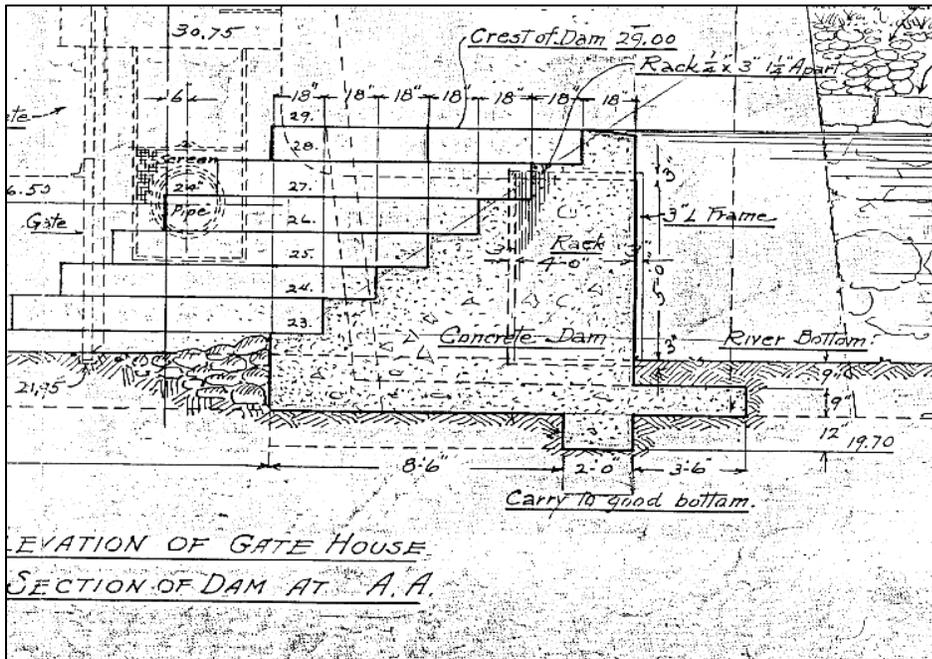


Figure 7 Cross section of the Balmoral Dam proposed design plan (American Woolen Mills Co. 1920).



Figure 8 Shawsheen River looking upstream of recreational fields south of Balmoral Dam in June 2015.

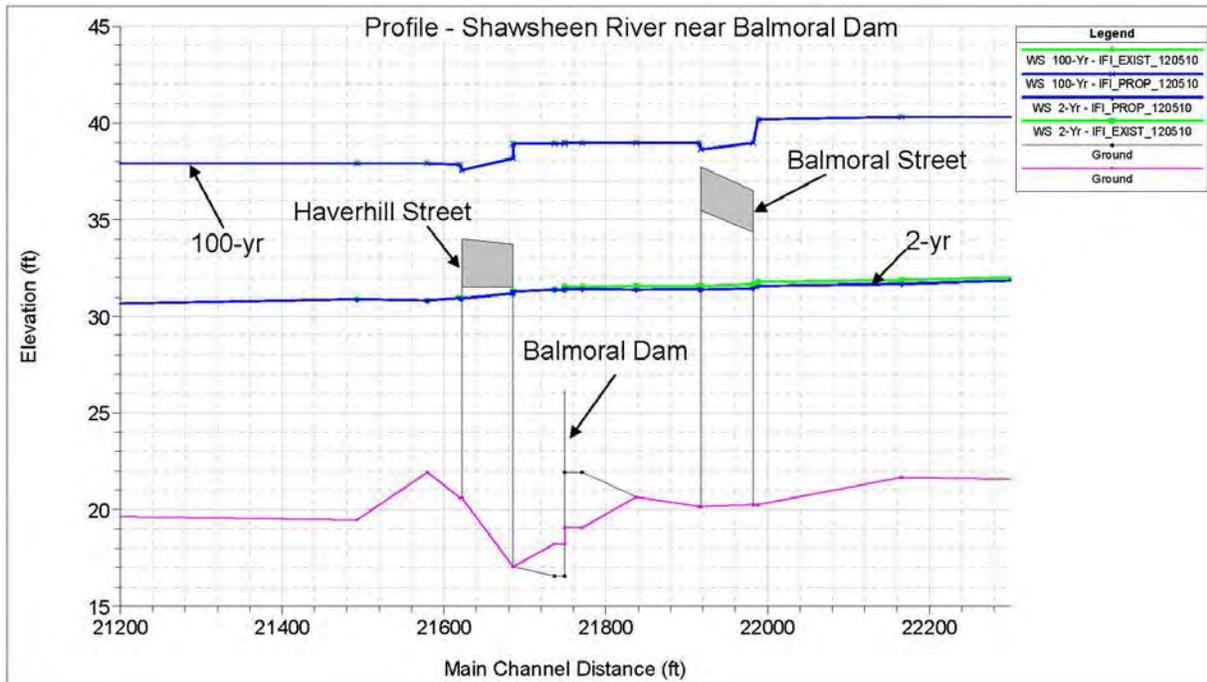
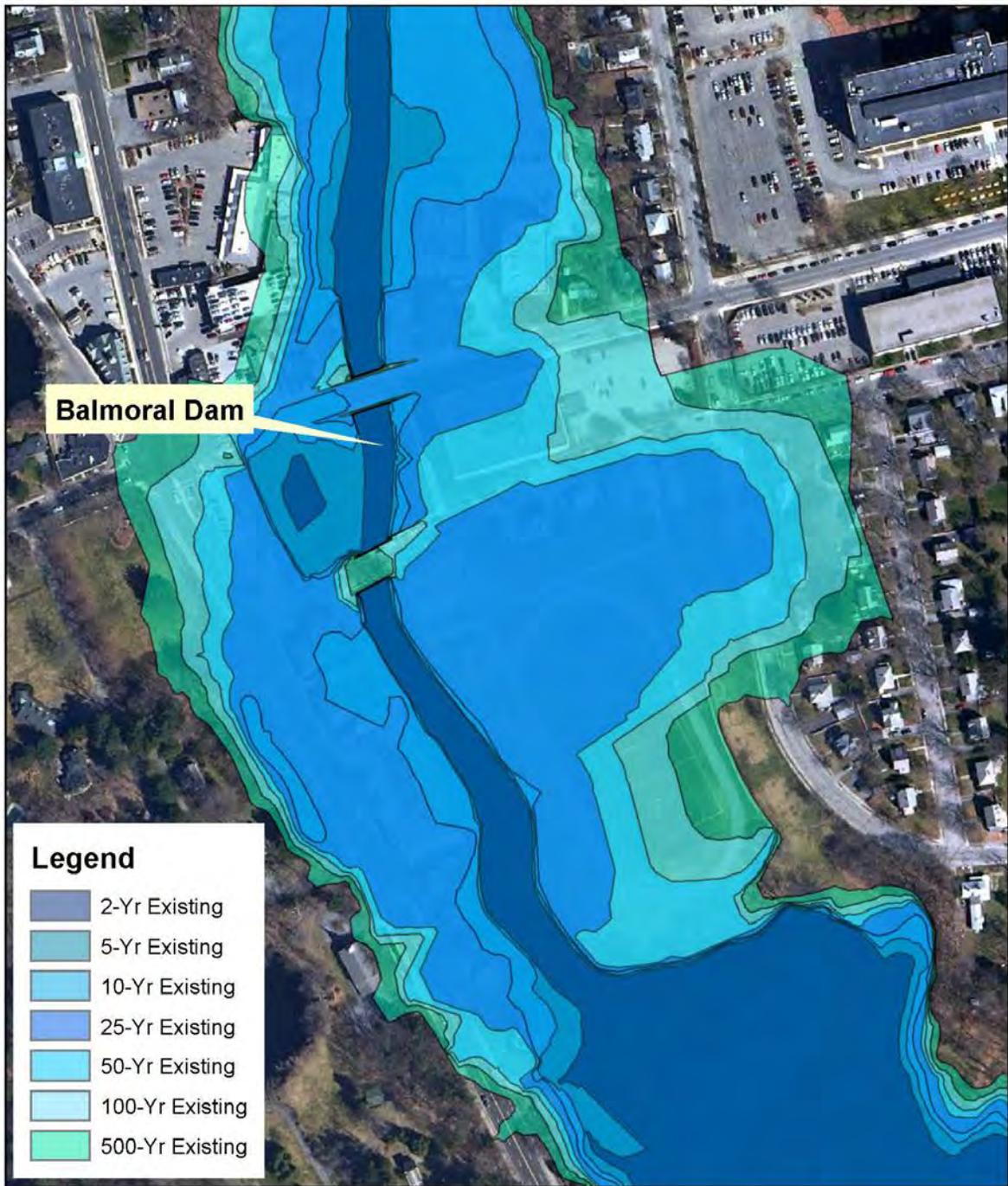


Figure 9 Longitudinal profile of the Shawsheen River near Balmoral Dam showing the existing (green lines) and proposed (blue lines) flood elevations for the 2-yr and 100-yr floods (Stewart et. al 2011).



**Balmoral Dam Existing Conditions
Inundation Map 2-Yr to 500-Yr**

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

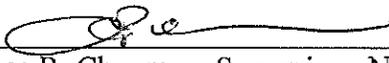
- A. This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

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: 21 July, 2016
Thomas R. Chapman, Supervisor, New England Field Office
Achy

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

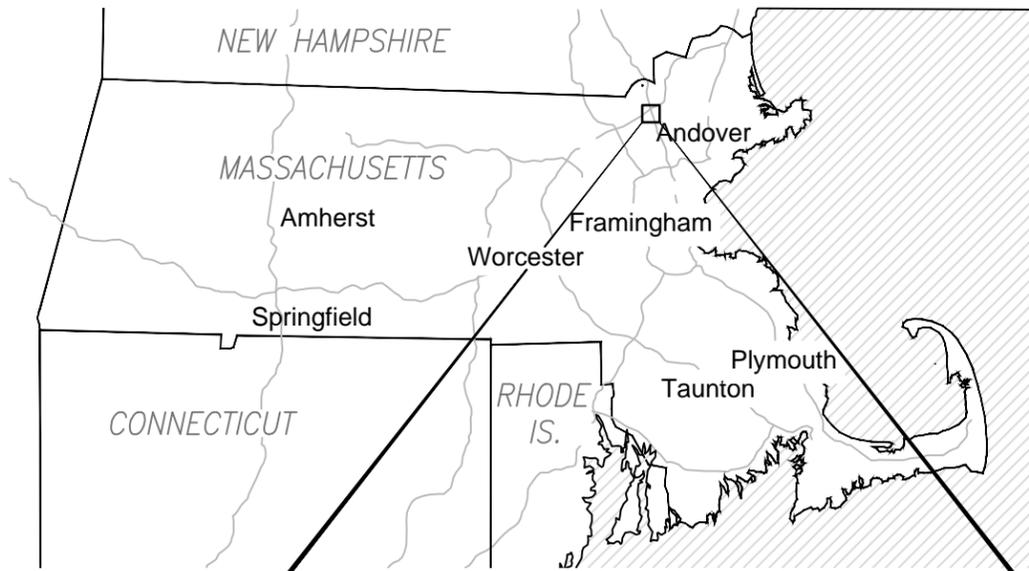
By: _____ Date: _____
Signatory Not Determined

APPENDIX A

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

APPENDIX C

Proposed Project Engineering Designs



LOCATION MAP
STATE OF MASSACHUSETTS

SHAWSHEEN RIVER RESTORATION BALMORAL DAM REMOVAL ANDOVER, MA 100% DRAWINGS

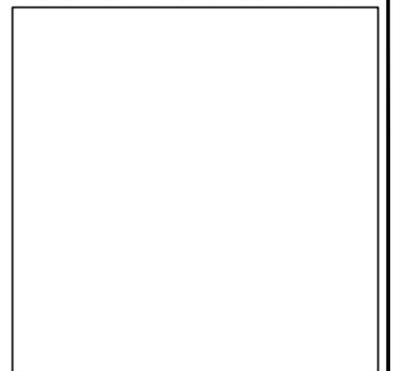
SHEET INDEX

1. PROJECT LOCATION AND SHEET INDEX
2. EXISTING CONDITIONS & CONSTRUCTION STAGING PLAN
3. PROPOSED GRADING PLAN AND PROFILE
4. PROPOSED TREATMENT PLAN
5. CROSS SECTIONS
6. TYPICAL CROSS SECTIONS AND DETAILS
7. VEGETATION PLAN
8. PERMITTING SHEET
9. PERMITTING SHEET
10. PERMITTING SHEET



SITE MAP

"RESERVED FOR ENGINEER'S STAMP"



NO.	DATE	REVISION DESCRIPTION

SJ,BL,RP	BL,NN	BN
DRAWN	DESIGNED	CHECKED
BN	12-23-2015	15-05-04
APPROVED	DATE	PROJECT

Shawsheen River
Balmoral Dam Removal
Andover, MA

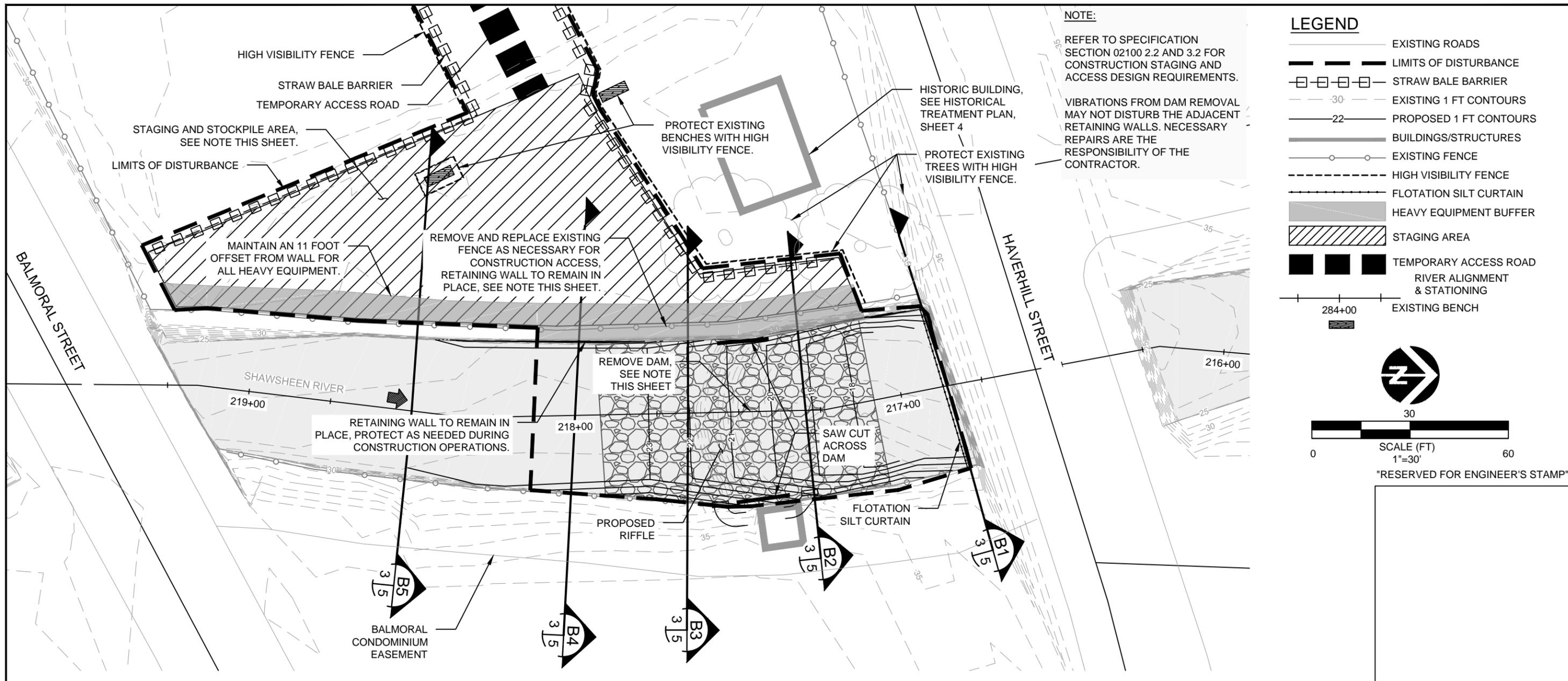


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Project Location
and Sheet Index

SHEET

1 OF 10



NOTE:
 REFER TO SPECIFICATION SECTION 02100 2.2 AND 3.2 FOR CONSTRUCTION STAGING AND ACCESS DESIGN REQUIREMENTS.
 VIBRATIONS FROM DAM REMOVAL MAY NOT DISTURB THE ADJACENT RETAINING WALLS. NECESSARY REPAIRS ARE THE RESPONSIBILITY OF THE CONTRACTOR.

LEGEND

- EXISTING ROADS
- LIMITS OF DISTURBANCE
- □ □ □ STRAW BALE BARRIER
- - - 30 - - - EXISTING 1 FT CONTOURS
- - - 22 - - - PROPOSED 1 FT CONTOURS
- ▭ BUILDINGS/STRUCTURES
- ○ ○ ○ EXISTING FENCE
- - - - - HIGH VISIBILITY FENCE
- - - - - FLOTATION SILT CURTAIN
- ▨ HEAVY EQUIPMENT BUFFER
- ▨ STAGING AREA
- ▭ TEMPORARY ACCESS ROAD
- RIVER ALIGNMENT & STATIONING
- ▨ EXISTING BENCH

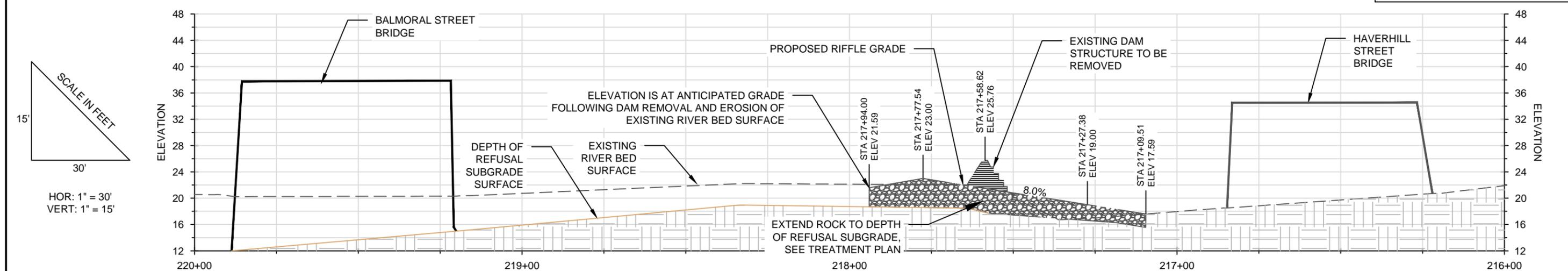
284+00 216+00

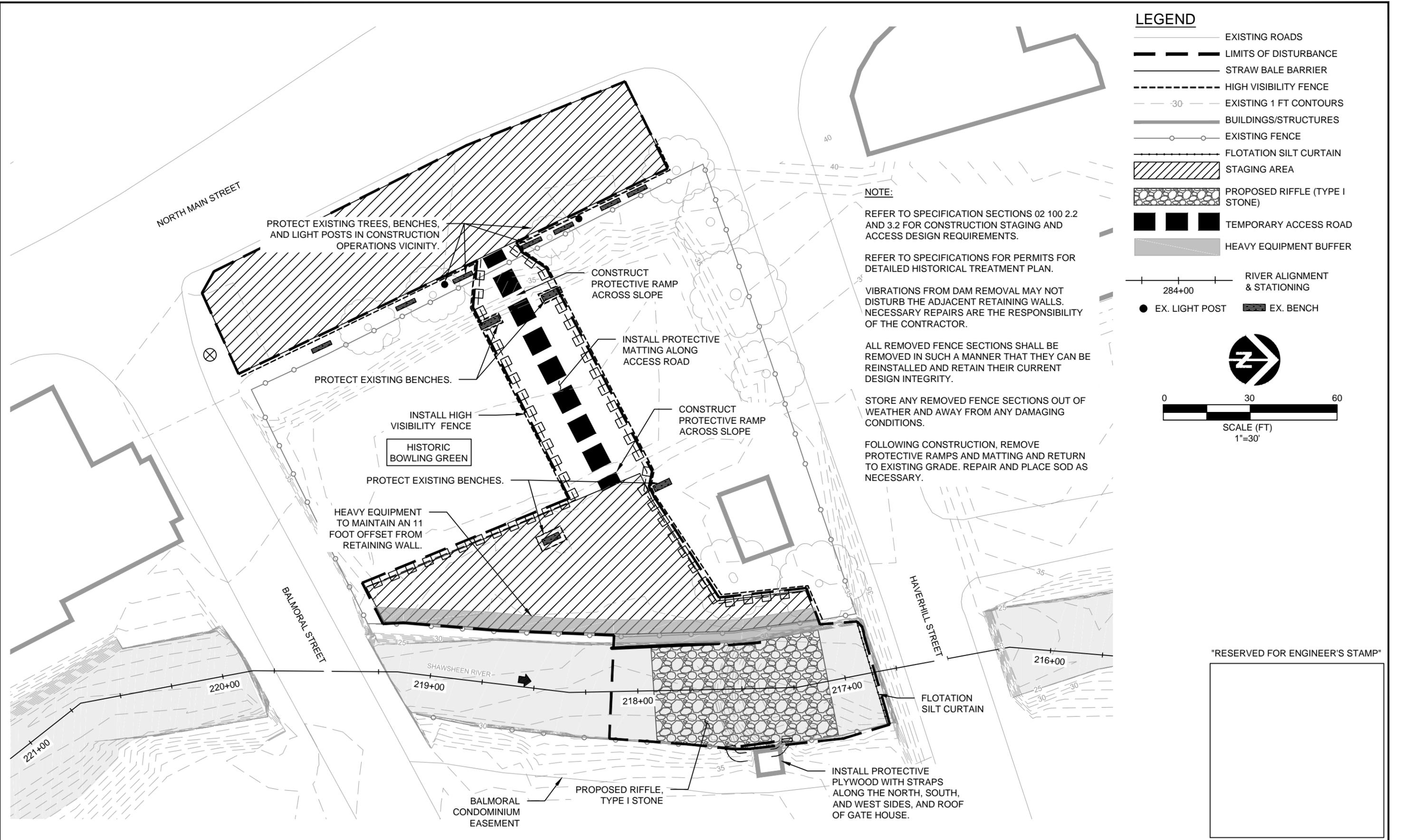
30

SCALE (FT)
1"=30'

0 60

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- LEGEND**
- EXISTING ROADS
 - LIMITS OF DISTURBANCE
 - STRAW BALE BARRIER
 - - - HIGH VISIBILITY FENCE
 - - - -30- EXISTING 1 FT CONTOURS
 - BUILDINGS/STRUCTURES
 - EXISTING FENCE
 - FLOTATION SILT CURTAIN
 - ▨ STAGING AREA
 - ▨ PROPOSED RIFFLE (TYPE I STONE)
 - TEMPORARY ACCESS ROAD
 - HEAVY EQUIPMENT BUFFER

NOTE:

REFER TO SPECIFICATION SECTIONS 02 100 2.2 AND 3.2 FOR CONSTRUCTION STAGING AND ACCESS DESIGN REQUIREMENTS.

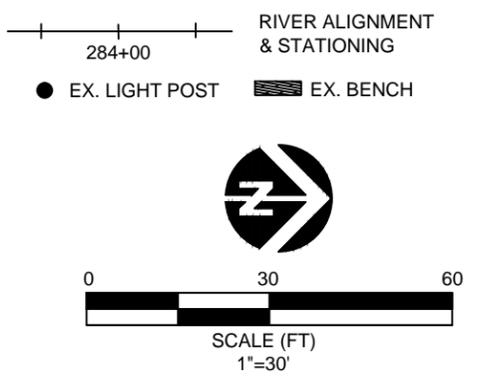
REFER TO SPECIFICATIONS FOR PERMITS FOR DETAILED HISTORICAL TREATMENT PLAN.

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.



"RESERVED FOR ENGINEER'S STAMP"

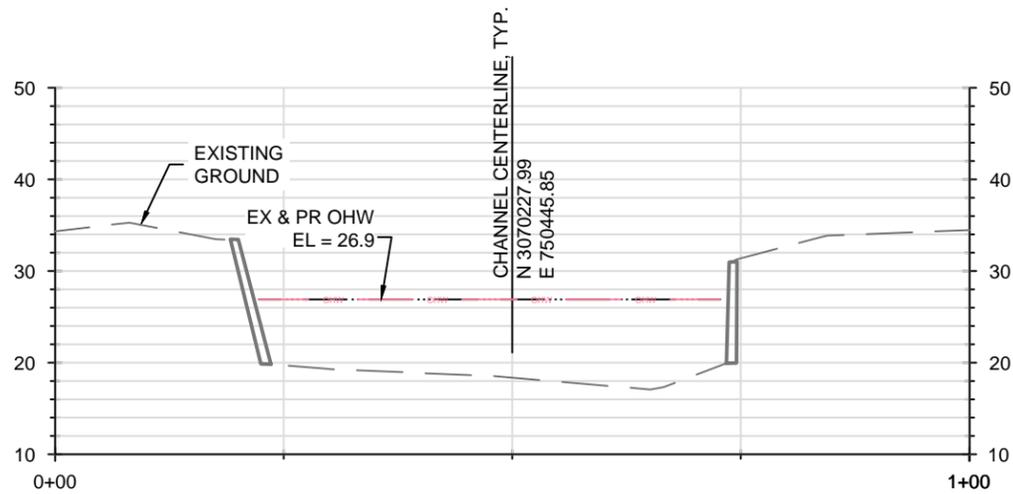
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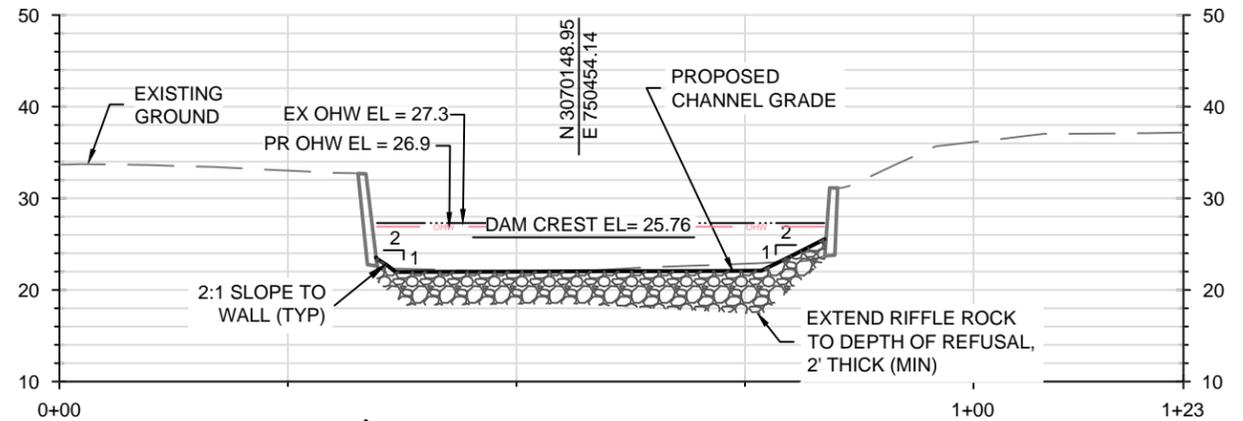
Shawsheen River
Balmoral Dam Removal
Andover, MA

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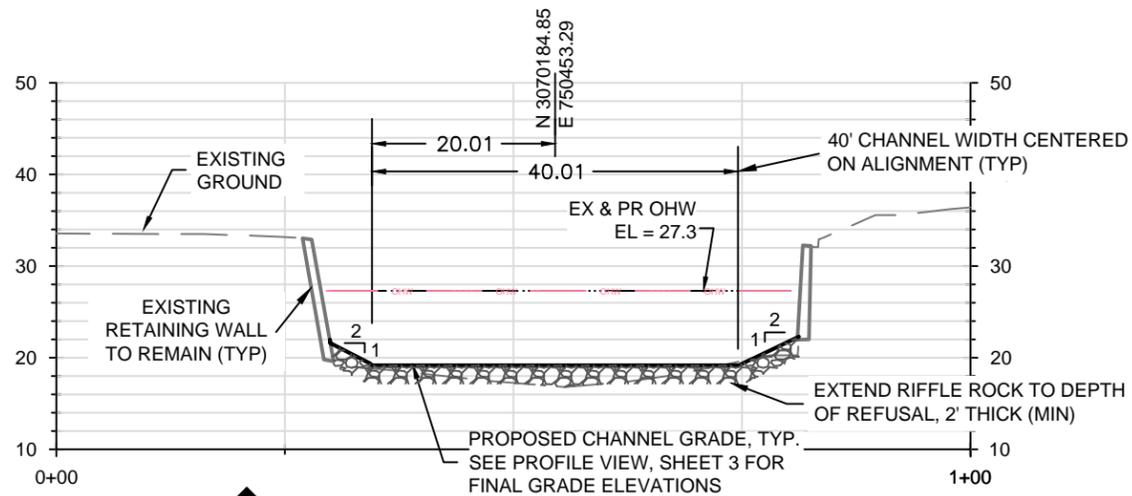
Balmoral Dam
Historical Treatment Plan



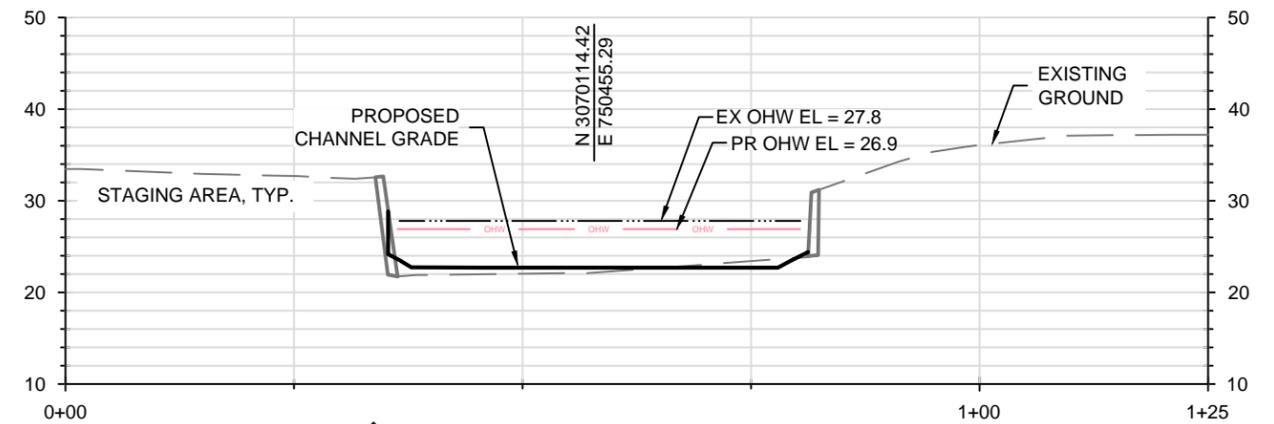
B1 CONSTRUCTION SECTION
3 | 5 BALMORAL STA 216+85.38



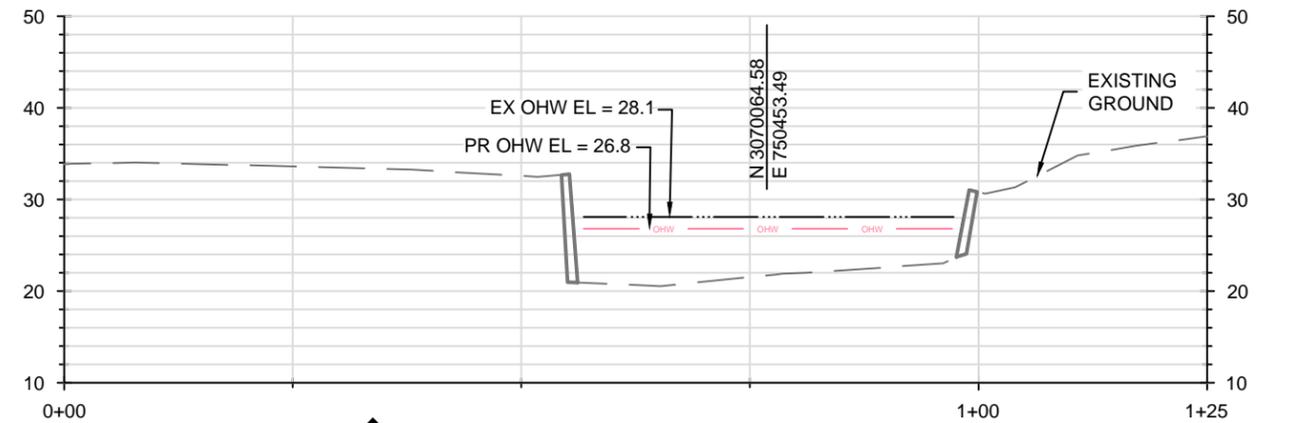
B3 CONSTRUCTION SECTION
3 | 5 BALMORAL STA 217+65.50



B2 CONSTRUCTION SECTION
3 | 5 BALMORAL STA 217+30.00

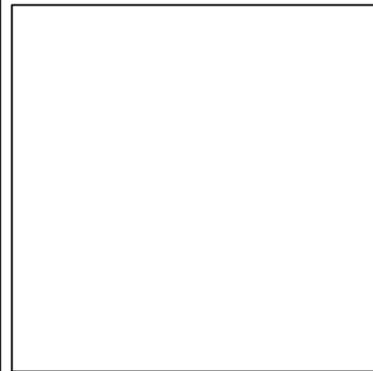


B4 CONSTRUCTION SECTION
3 | 5 BALMORAL STA 218+00.00



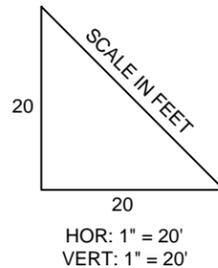
B5 CONSTRUCTION SECTION
3 | 5 BALMORAL STA 218+50.00

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NOTES:

- CROSS SECTIONS FACE DOWNSTREAM.
- EXISTING RETAINING WALLS AT DAM SHALL NOT BE DISTURBED OR DAMAGED. SHOWN HERE FOR SCHEMATIC REPRESENTATION ONLY.



BN

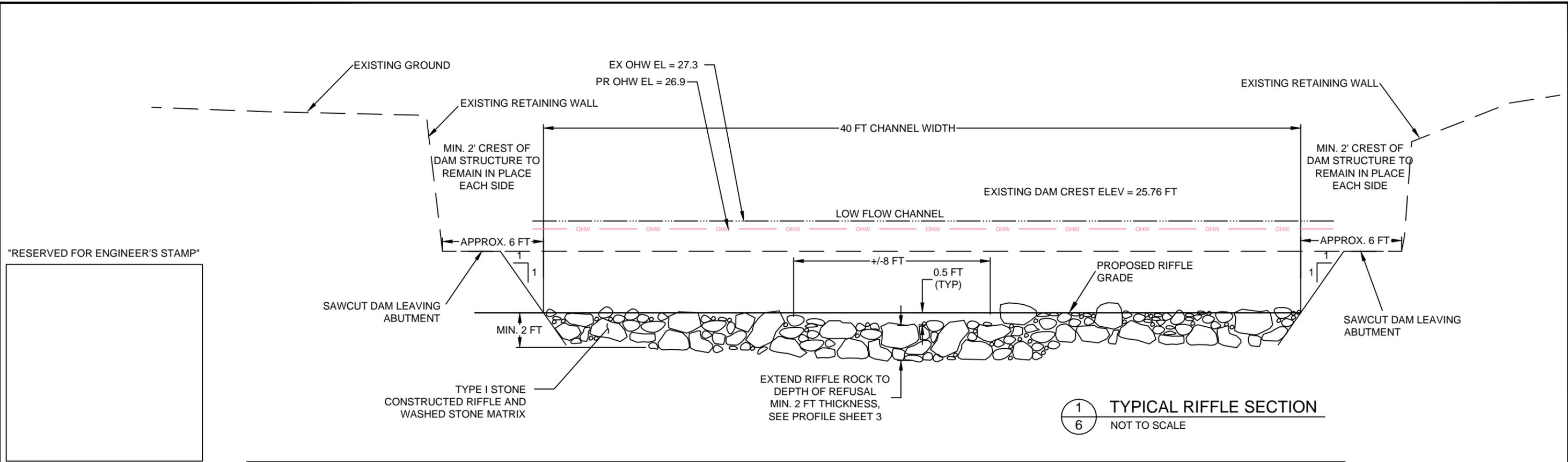
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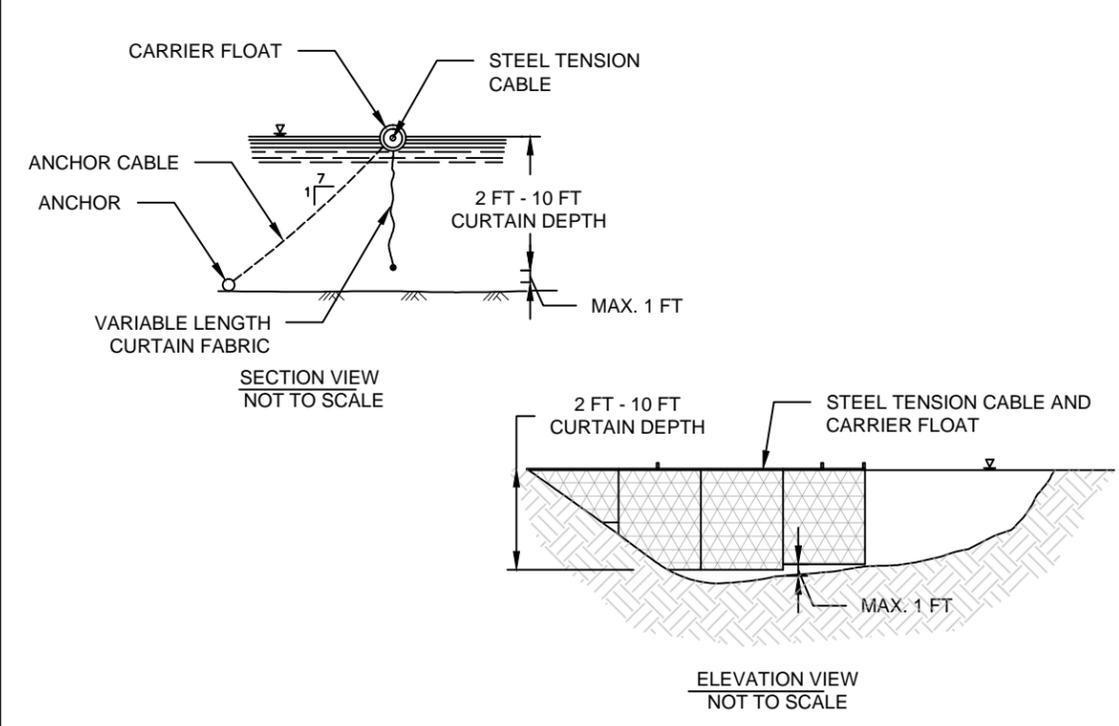
Shawsheen River
Balmoral Dam Removal
Andover, MA



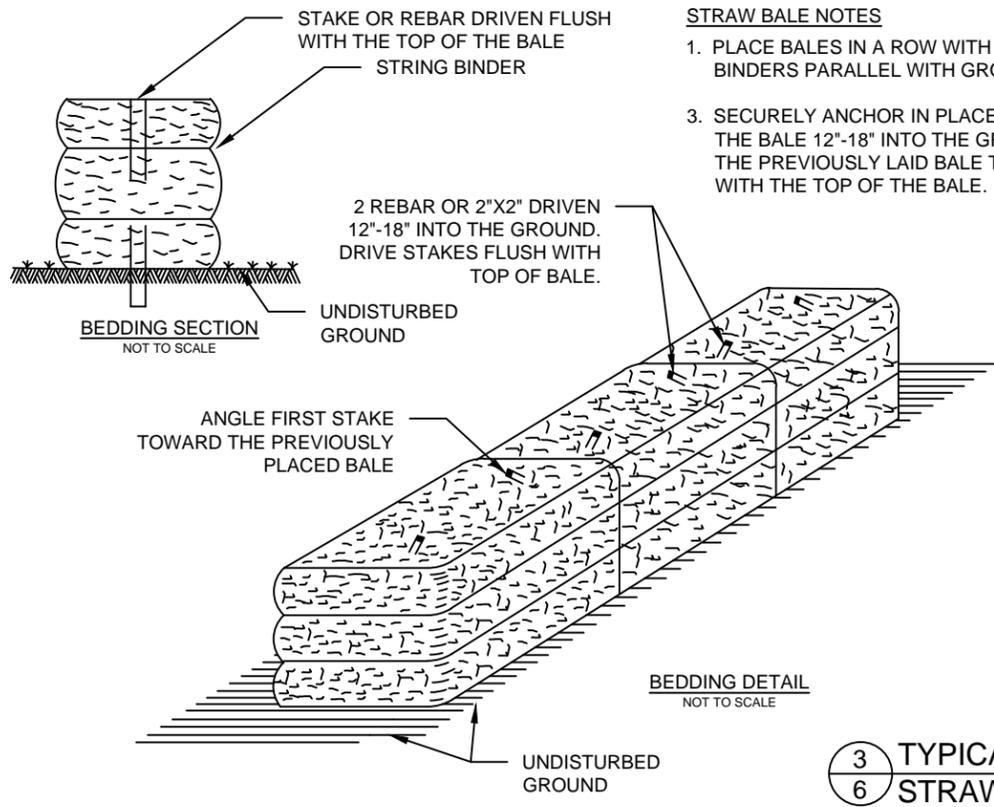
Balmoral Dam
Cross Sections



1 TYPICAL RIFFLE SECTION
6 NOT TO SCALE



2 TYPICAL DETAIL
6 FLOTATION SILT CURTAIN
NOT TO SCALE



STRAW BALE NOTES

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 BALE TO FORCE THE BALES TOGETHER. DRIVE STAKES FLUSH WITH THE TOP OF THE BALE.

3 TYPICAL DETAIL
6 STRAW BALE BARRIER
NOT TO SCALE

NO.	DATE	REVISION DESCRIPTION

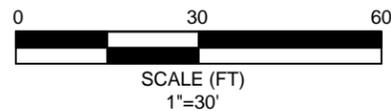
SJ,BL,RP	BL,NN	BN
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Shawsheen River
Balmoral Dam Removal
Andover, MA

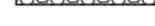
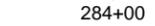


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Balmoral Dam
Typical Cross Sections and Details

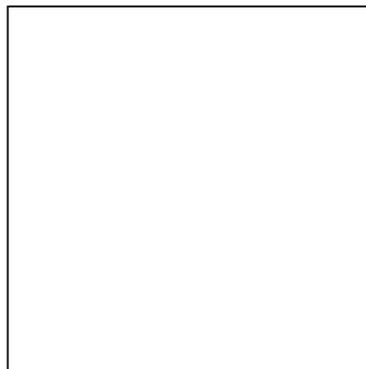


LEGEND

-  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



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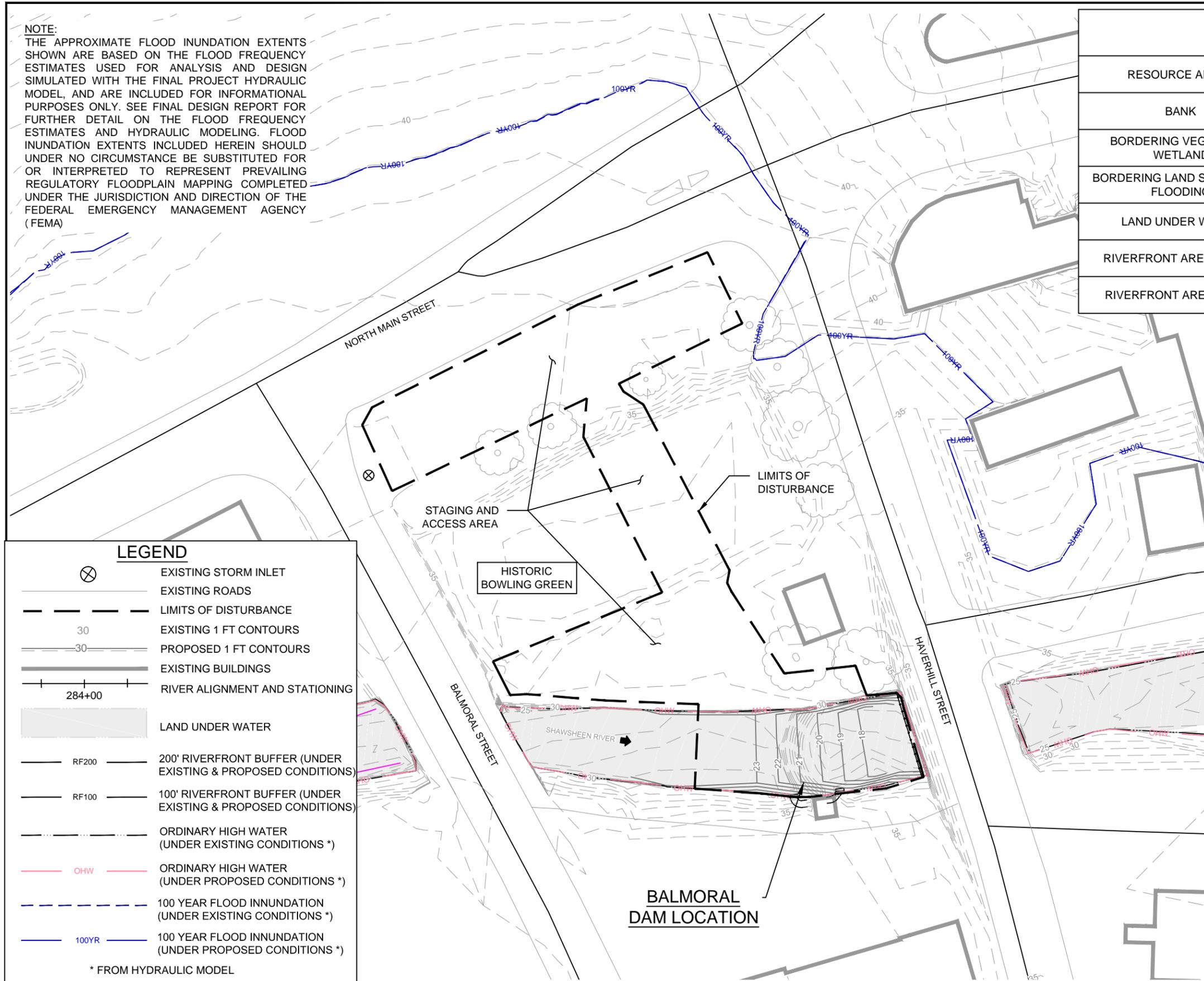


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Balmoral Dam
Vegetation Plan

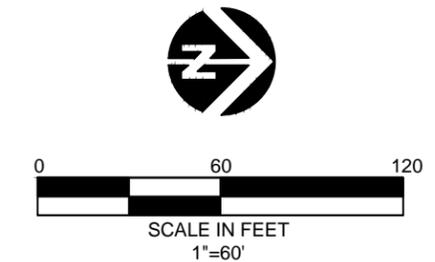
NOTE:
 THE APPROXIMATE FLOOD INUNDATION EXTENTS SHOWN ARE BASED ON THE FLOOD FREQUENCY ESTIMATES USED FOR ANALYSIS AND DESIGN SIMULATED WITH THE FINAL PROJECT HYDRAULIC MODEL, AND ARE INCLUDED FOR INFORMATIONAL PURPOSES ONLY. SEE FINAL DESIGN REPORT FOR FURTHER DETAIL ON THE FLOOD FREQUENCY ESTIMATES AND HYDRAULIC MODELING. FLOOD INUNDATION EXTENTS INCLUDED 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)

RESOURCE AREA IMPACTS		
RESOURCE AREAS	PROPOSED MAXIMUM DISTURBANCE	PERMANENT CHANGES
BANK	30 LF	-0-
BORDERING VEGETATED WETLAND	-0-	-0-
BORDERING LAND SUBJECT TO FLOODING	26,130 SF	-0-
LAND UNDER WATER	5350 SF	-0-
RIVERFRONT AREA - 200 FT	17,860 SF	-0-
RIVERFRONT AREA -100 FT	10,200 SF	-0-

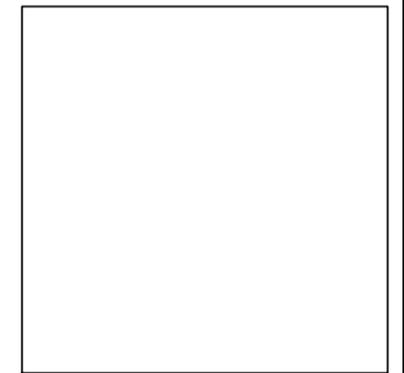


LEGEND

- EXISTING STORM INLET
 - EXISTING ROADS
 - LIMITS OF DISTURBANCE
 - EXISTING 1 FT CONTOURS
 - PROPOSED 1 FT CONTOURS
 - EXISTING BUILDINGS
 - RIVER ALIGNMENT AND STATIONING
 - LAND UNDER WATER
 - 200' RIVERFRONT BUFFER (UNDER EXISTING & PROPOSED CONDITIONS)
 - 100' RIVERFRONT BUFFER (UNDER EXISTING & PROPOSED CONDITIONS)
 - ORDINARY HIGH WATER (UNDER EXISTING CONDITIONS *)
 - ORDINARY HIGH WATER (UNDER PROPOSED CONDITIONS *)
 - 100 YEAR FLOOD INNUNDATION (UNDER EXISTING CONDITIONS *)
 - 100 YEAR FLOOD INNUNDATION (UNDER PROPOSED CONDITIONS *)
- * FROM HYDRAULIC MODEL



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Shawsheen River
Balmoral Dam Removal - Permitting Information
Andover, MA

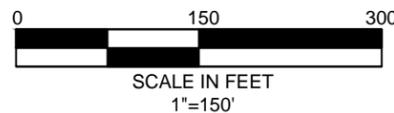


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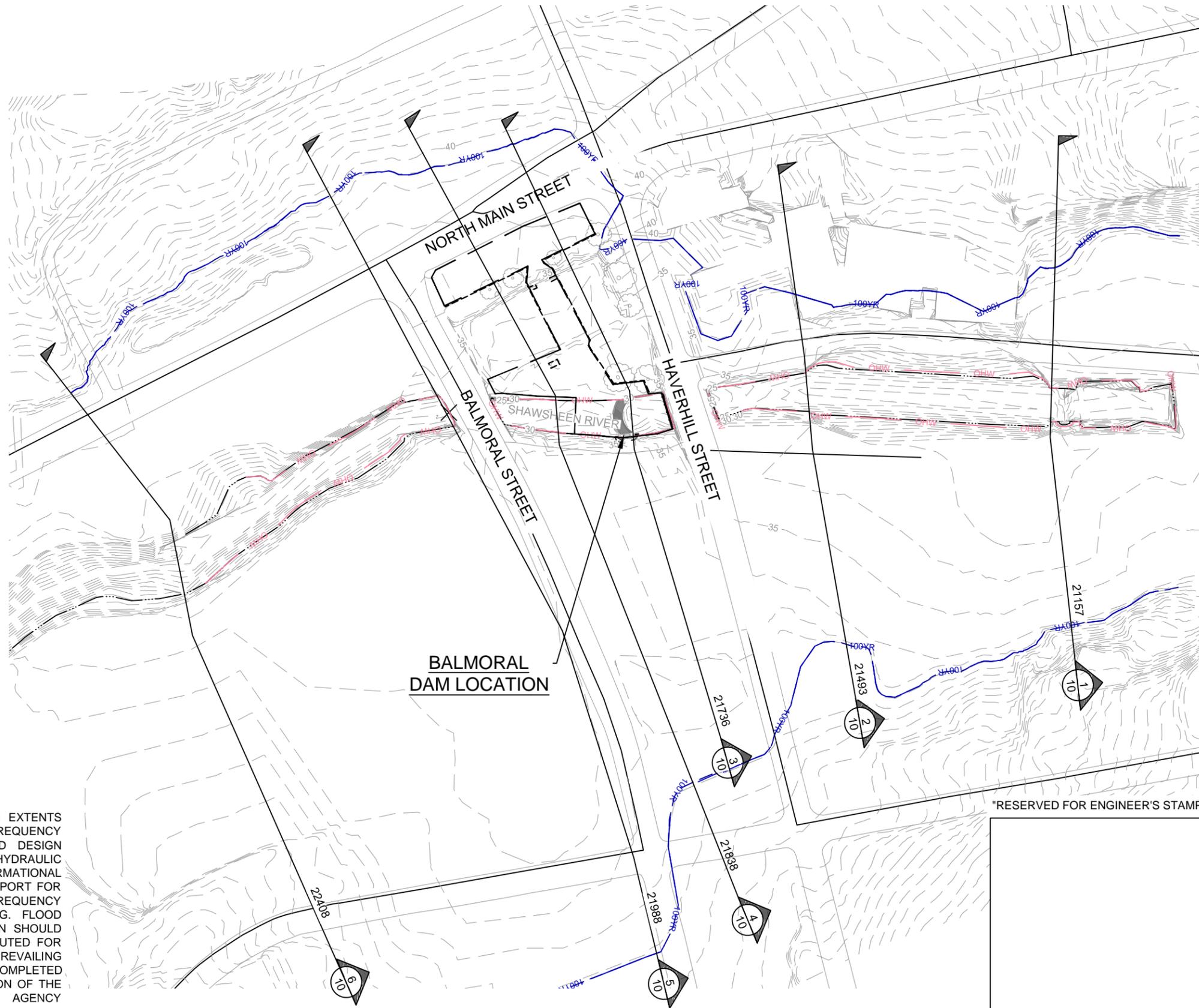
Resource Area Impacts

LEGEND

-  EXISTING 1 FT CONTOURS
 -  EXISTING ROADS
 -  RIVER ALIGNMENT AND STATIONING
 -  PROPOSED LIMITS OF DISTURBANCE
 -  200' RIVERFRONT BUFFER
 -  100' RIVERFRONT BUFFER
 -  ORDINARY HIGH WATER (UNDER EXISTING CONDITIONS *)
 -  OHW ORDINARY HIGH WATER (UNDER PROPOSED CONDITIONS *)
 -  APPROX. 100 YEAR FLOOD INNUNDATION (UNDER EXISTING CONDITIONS *)
 -  100YR APPROX. 100 YEAR FLOOD INNUNDATION (UNDER PROPOSED CONDITIONS *)
- * FROM HYDRAULIC MODEL



NOTE:
 THE APPROXIMATE FLOOD INNUNDATION 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 INNUNDATION EXTENTS INCLUDED 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)



"RESERVED FOR ENGINEER'S STAMP"

NO.	DATE	REVISION DESCRIPTION

SJ, BL, RP	BL, NN	BN
DRAWN	DESIGNED	CHECKED
BN	12/23/2015	15-05-04
APPROVED	DATE	PROJECT

**Shawsheen River
 Balmoral Dam Removal - Permitting Information
 Andover, MA**



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 Cambridge, MA 02138
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Flood Inundation

SHEET
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