

DRAFT Site Reconnaissance, Preliminary Evaluation, and Opinion of Probable Cost for Dam Removal

Bartlett Pond Dam
Lancaster, Massachusetts

June 2011



Former Powerhouse Structure and Turbines, Bartlett Pond Dam

Prepared for

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PREFACE

Bartlett Pond Dam is located on Wickapickit Brook, which discharges to the North Nashua River in the Town of Lancaster, Massachusetts. The Nashua River watershed has been the focus of ongoing efforts to restore fisheries habitat, continuity of instream and riparian habitats, and improvements to water quality in Worcester and Middlesex Counties.

Stantec Consulting Services Inc. (Stantec) performed preliminary site reconnaissance work to evaluate the potential for removal of Bartlett Pond Dam. Emphasis was placed on identifying potential beneficial and adverse impacts and challenges associated with the removal of this dam and relative costs of dam repair and removal. This work was performed by Stantec under contract to the Commonwealth of Massachusetts Department of Fish and Game Division of Ecological Restoration (DER). Project work included review of information provided to Stantec by DER and observations and discussions during a site visit by Stantec on June 9, 2011.

1.0 SITE CONDITIONS AT BARTLETT POND DAM

This report presents preliminary information relevant to the potential for removal of Bartlett Pond Dam (State ID 3-14-147-4, National ID No. MA 01561) on Wickapickit Brook in the Town of Lancaster, Massachusetts, and owned by the Town of Lancaster. The June 9, 2011, site visit was attended by Town Administrator Orlando Pacheco, Alex Hackman of DER, and Michael Chelminski of Stantec.

Photos 1 – 14 in Appendix A are of the dam, the dam impoundment, and other features on and adjacent to the project site.

Information presented in this report was obtained from observations by Stantec during the site visit and information presented in a Draft Phase I Inspection/Evaluation Report for this dam prepared by PARE Corporation (PARE) dated June 29, 2009 (PARE Phase I Report [Appendix B]) and the Draft Phase II Inspection/Evaluation Report for this dam prepared by PARE dated February 2011 (PARE Phase II Report [Appendix C]). These reports were provided to Stantec by Orlando Pacheco and were prepared by PARE in accordance with requirements of the Massachusetts Department of Conservation and Recreation (DCR) Office of Dam Safety (ODS). Other information that was provided to and reviewed by Stantec for this report included a letter from PARE to ODS dated November 15, 2010, addressing a poor conditions follow-up inspection of this dam (not attached to this report) and a spreadsheet of results obtained from laboratory analysis of a single sediment sample from the impoundment (Appendix D).

Information on the dam presented in this report was obtained from the referenced PARE reports unless otherwise noted.

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1.1.1 Bartlett Pond Dam

Bartlett Pond Dam is comprised of four sections and has an overall length of approximately 180 feet (ft), a hydraulic height of approximately 10 ft, and a structural height of approximately 13 ft. The left¹ section of the dam is comprised of an approximately 60-ft-long earthen embankment that abuts an 84-ft-long concrete and masonry overflow spillway section in the middle of the dam. A 25-ft-long, non-overflow section of the dam is located between the overflow spillway and the primary spillway, which is approximately 8.5 ft long. The right abutment of the dam is immediately to the right of the primary spillway and is comprised of a masonry wall that extends upstream and downstream from the dam. Immediately downstream from the primary spillway, two non-functioning power turbines are located on the base of a concrete apron in a deteriorated powerhouse with concrete walls on the sides and remnants of a concrete wall on the downstream face; the bottom of the downstream wall has substantially failed. Overtopping of a low-lying area and gravel parking lot to the left of the dam has apparently occurred during high flow events.

The observed hydraulic height of the dam during the June 9, 2011, site visit was approximately 6 ft. All of the water passing downstream from the dam during the visit was flowing over stoplogs installed in the primary spillway except for observed seepage through the masonry retaining wall that forms the right abutment of the dam and minor seepage along the downstream face of the non-overflow section of the dam adjacent to the primary spillway and the overflow spillway.

The dam is classified in accordance with DCR ODS regulations as a “Small” size structure with a “Significant” (Class 2) hazard potential and in “Poor” condition. The assigned hazard potential was determined based on the close proximity of the Route 17/Main Street Bridge approximately 80 ft downstream from the dam. Stability analyses presented in the PARE Phase II Report indicate that portions of the dam do not meet DCR ODS requirements.

1.1.2 Impoundment

The dam impoundment has a normal pool surface area of approximately 5 acres and normal and maximum (100-year flood event) impoundment volumes of approximately 25 and 50 acre-feet, respectively. Emergent aquatic vegetation was observed along the margins and upstream end of the impoundment during the site visit. Water clarity in the impoundment was generally good during the site visit, and observed substrates included sand, gravel, and organic muck. Maximum depths of water are estimated to be approximately 6 to 7 ft, and the average depth of water is estimated to be approximately 3 to 4 ft.

¹ Directionals “right” and “left” in this report are oriented looking downstream.

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The impoundment is the centerpiece of the Robert Frommer Conservation Area at Bartlett Pond, which is comprised of a gravel parking area adjacent to Route 17/Main Street, approximately 1 acre of mowed lawn along the west (left) and north sides of the impoundment, picnic benches, and an interpretive sign describing the legacy of Mr. Robert Frommer. According to the interpretive sign, Mr. Frommer served on the Lancaster Conservation Commission for 25 years and was a respected and dedicated member of the local community.

Based on discussions during the site visit, the impoundment provides the basis for multiple recreational and aesthetic uses, is annually stocked with trout, is the basis for a seasonal open-water recreational fishery and is also the location of an annual ice fishing tournament. Poor water quality during warm weather apparently results in rapid die-off of stocked trout during the spring. Other recreational use may include small boating, although the small size of the impoundment may diminish local interest in this use. A review of aerial photographs indicates that land to the west (left) of the impoundment is largely undeveloped and that a few residential properties are located along the east (right) side of the impoundment.

1.1.3 Upstream and Downstream Riverine/Riparian Corridors

The tributary drainage area of Wickapickit Brook upstream from the dam is approximately 11.4 square miles. This area includes forested land, residential parcels, and some agricultural land, including a farm with approximately 80 acres of cleared land approximately 0.25 miles upstream from the impoundment. The confluence of Wickapickit Brook with the North Nashua River is located approximately 0.3 miles downstream from the dam.

2.0 RESTORATION OPPORTUNITIES AND CONSTRAINTS

This section presents information on apparent opportunities and constraints on removal of this dam based on visual and semi-qualitative observations and experience from other, similar projects. The order of the constraints presented here is based on the apparent magnitude of their respective need for additional study as part of ongoing studies for removal of this dam in decreasing order. Brief discussions of potential constraints on dam repair are included where deemed relevant.

2.1.1 Aesthetic and Socio-Economic Factors and Community-Outreach

Aesthetic and socio-economic factors may represent the most substantial challenge to dam removal at this site because of public use of the Robert Frommer Conservation Area at Bartlett Pond. A suggested approach for outreach to the local communities includes 1) provide relevant information on dam removal to the Town of Lancaster, including the local Conservation Commission; and 2) hold public meetings to present the rationale for considering dam removal as a long-term approach for sustainable infrastructure management at this site, including the financial and legal liabilities that can adversely encumber dam

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owners. It is suggested that all such interactions include presentation of ongoing river restoration efforts in Massachusetts, including ongoing work on Town Brook in the Town of Plymouth.

2.1.2 Ecological Resources

Removal of the dam would restore free-flowing riverine conditions and reduce water quality problems (e.g., increased temperature and lower dissolved oxygen concentrations that may result from the impounded reach upstream from the dam). Ecological impacts resulting from removal of the dam would be similar to those on other small dam removal projects in Massachusetts, resulting in loss of open water habitat and conversion of habitat types. Such impacts would need to be well characterized as part of local, state, and federal permitting processes. Resource area delineation and mapping and coordination with regulatory agencies (e.g., Massachusetts Natural Heritage and Endangered Species Program [NHESP]) regarding potential project impacts to rare species would need to be performed in the future for dam removal permitting.

2.1.3 Impoundment Sediments

Impoundment sediments will need to be evaluated for potential contaminants and for mobility following dam removal. Limited field observations suggest that some of the sediments may consist of relatively fine-grained materials (i.e., passing the No. 200 sieve), and review of aerial photographs suggests the presence of a depositional feature at the upstream end of the impoundment.

Results of a laboratory analysis of a single sediment sample collected by PARE are included in Appendix D of this Report; all of the evaluated constituent concentrations were below the Massachusetts Contingency Plan (MCP) S1 and GW1 screening benchmark criteria values and only one of the evaluated constituent (Arsenic) concentrations exceeded the reported Threshold Effects Level (TEC) criteria values.

Recent dam removal projects in Massachusetts and elsewhere in New England indicate that “instream management” (e.g., natural scour and downstream repositioning) of sediments can be an acceptable strategy for management of sediments as part of dam removal projects. Instream sediment management appears to be a potentially appropriate approach at this site pending 1) the evaluation of the amount of material that would be remobilized following dam removal; and 2) the presence of contaminated materials. This approach would necessitate review of existing information and collection and analysis of sediment samples to evaluate the nature and extent of potential contaminants. The number and location of sediment samples would need to be determined in consultation with relevant regulatory agencies.

Recommended evaluations include a due-diligence review of potential sources of contamination in the upstream watershed (to inform development of a sediment sampling plan), field measurements to estimate impounded sediment volume, and sampling and laboratory analyses of sediment in the impoundment and in the downstream reach of the brook.

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2.1.4 Historic Resources

The absence of buildings on or adjacent to the dam suggests that historic resources may not represent a substantial constraint to removal of this dam. Appropriate coordination with state and local historical agencies is, nonetheless, recommended for the determination of an appropriate and acceptable dam removal approach.

2.1.5 Changes in Hydraulic Regime

Removal of this dam would likely improve water quality in the former impoundment and downstream in Wickapickit Brook and have little effect on downstream peak flows, as the dam is not operated or maintained as a flood control structure.

2.1.6 Infrastructure

No existing infrastructure was observed adjacent to the dam other than the Route 17/Main Street Bridge downstream from the dam. Note that shallow (e.g., dug) wells in close proximity to the impoundment could be affected by removal of the dam.

3.0 DAM REMOVAL AND APPROACH

This section presents a conceptual approach for removal of the Bartlett Pond Dam. The proposed conceptual approaches are based on information presented in Sections 1.0 and 2.0 of this report. The primary constraints for dam removal were determined to be aesthetic and socio-economic issues associated with the presence and use of the Robert Frommer Conservation Area at Bartlett Pond, and are considered in the conceptual dam removal approach presented here. A suggested approach to address current uses of the conservation area is to remove a sufficient portion of the dam to render it a non-jurisdictional structure while maintaining a (smaller) pool within the area occupied by the existing impoundment. Coordinated with ODS prior to initiation of project design is recommended to determine regulatory requirements for this approach.

3.1 Conceptual Dam Removal Approach

The conceptual dam removal approach presented here follows on information presented in the two reports prepared by PARE that are included as Appendices B and C to this report. The dam is in poor condition and all of the four sections of the dam require substantial repair or could be removed as part of dam removal. An apparent physical constraint on dam removal is the apparently poor condition of the masonry retaining wall that forms the right abutment of the dam and potential issues related to safety if that wall were left in place following dam removal.

The presence of an eroded channel between the overflow spillway and Wickapickit Brook immediately downstream from the dam suggests that removal of the overflow spillway may be sufficient to effectively remove the dam and provide for free-flowing conditions in the brook and restoration of upstream passage

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for fish. This approach would need to consider whether the sharp bend where the eroded channel joins the brook immediately downstream from the dam could result in erosion of the right bank of the brook adjacent to the Route 17/Main Street Bridge. The noted potential for erosion suggests that a larger portion of the dam should be removed to better align flow into the downstream reach of the brook. The suggested approach is therefore to remove the overflow spillway, the non-overflow section of the dam between the overflow spillway and the primary spillway, and some or all of the primary spillway and former powerhouse structure. The extent of removal of the primary spillway and former powerhouse structure would depend on the results of an evaluation of the masonry retaining wall. As previously noted, this wall represents an apparent safety hazard due to its height and poor condition, and removal of the former powerhouse structure is expected to decrease the stability of the wall. If it were determined that the wall should remain in place, consideration should be given to placing rock fill against the base of the wall as part of dam removal construction.

The left embankment section of the dam could be removed or remain in place as part of dam removal, as it is expected that removal of the adjacent sections of the dam would be sufficient to provide hydraulic conveyance through the site of the former dam. Retaining this section of the dam and installation of appropriate signage could serve as a reminder to the history of the dam and the conservation area, particularly if clearing of vegetation would result in improved public access to areas immediately adjacent to the dam.

Construction equipment staging and access for dam removal would be from the gravel parking lot adjacent to Route 17/Main Street in the conservation area immediately. Access to the dam would require some clearing of vegetation between the parking lot and the dam; selective tree cutting with preservation of larger trees may be appropriate to preserve some of the aesthetic integrity of the conservation area during and after dam removal.

Drawing down of the impoundment prior to dam removal construction could be substantially performed by removing stoplog boards from the primary spillway. Water diversion during construction could be managed through much of the construction period by continuing to route water through the spillway, but this would likely require installation of a temporary coffer dam (e.g., large sandbags) if the dam is removed below the elevation of the concrete apron below the primary spillway.

Site restoration work would necessarily include restoration of areas disturbed during project construction. Given that the conservation area is well used by the community, it is suggested that grubbing, placement of topsoil, and seeding of areas disturbed by project construction would be appropriate. Dewatered portions of the impoundment that abut existing lawns in the conservation area may provide opportunities to increase the area of lawn at this site where allowed by local, state, and federal natural resource agencies. It is suggested that initial planning for this site include some coordination with relevant agencies to determine the potential types and extents of actions intended to enhance public use of this site.

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3.2 Proceeding Directly To Preliminary Design for Dam Removal

Proceeding directly to preliminary design for dam removal may be an appropriate approach at this site given the poor condition of the dam and the apparent need for public input to address what would result in substantial alteration of public perceptions of the Robert Frommer Conservation Area at Bartlett Pond. Given the current use of the site by the local community, it is recommended that the Town of Lancaster hold a public meeting to present its rationale for dam removal at this site prior to initiating further studies. The suggested approach is for preparation of conceptual renderings of the project area depicting dam removal and possible opportunities to increase public space in the conservation area and to present the conceptual renderings at a public meeting. It is recommended that the sketch renderings be prepared by a landscape architect and that topographic maps presented in the PARE reports be evaluated for suitability for conceptual-level design of dam removal.

4.0 RESTORATION EVALUATION, SCOPE, AND PROCESS

Removal of the dam would eliminate liability associated with owning, repairing, and maintaining the dam. Restoration of riverine conditions at and upstream from the site of the dam would remove an anthropogenic impediment to upstream movement of resident fishes and other aquatic fauna in Wickapickit Brook. Dam removal could restore riverine and riparian conditions in the existing impoundment, eliminate or reduce potential adverse impacts to water quality resulting from the impoundment, and potentially increase land for recreational activities in the Robert Frommer Conservation Area at Bartlett Pond.

The suggested approach to removal of the dam emphasizes stakeholder outreach, elimination of financial and legal liabilities associated with owning the dam, and evaluation of potential beneficial and adverse impacts to regulated resources.

The proposed course of action is as follows:

- I. Overall Project Management;
- II. Development of Dam Removal Design;
- III. Regulatory Coordination and Permitting ; and
- IV. Dam Removal.

The following items provide brief descriptions of general and specific items of work associated with dam removal planning and implementation

4.1 Overall Project Management

The suggested approach for project management is to have the Town of Lancaster collaborate with local and/or regional groups, such as DER, to coordinate project management. The general approach to project management is consistent with other dam removal projects where use of the impoundment by

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abutters and the potential presence of contaminated materials pose constraints on dam removal. Public outreach should emphasize potential cost-benefits of dam removal relative to reconstruction of the dam.

4.1.1 Community Outreach Approach

Community outreach appears to be appropriate and necessary prior to initiation of regulatory processes given the extent of public use of the conservation area, and it is suggested that these efforts be initiated prior to submittal of a project Expanded Environmental Notification Form (ENF) and subsequent project permit applications. The objectives of public outreach efforts would be to present information on financial obligations associated with ownership of the dam; present conceptual plans for dam removal, site restoration, and continued public use of the conservation area following dam removal; and building stakeholder support for the selected action at this site. The suggested approach to community outreach is to present dam removal as a practical, feasible, and cost-effective alternative to dam rehabilitation, including the benefits of continued public use and access.

4.2 Data Collection and Preliminary Design

This section presents a conceptual approach for removal of Bartlett Pond Dam. This approach is based on conditions observed by Stantec during the June 9, 2011, site visit and experience with similar projects.

4.2.1 Sediment Data Review, Testing and Characterization

Sediment mapping should be performed on sediment to determine representative depths and composition of sediments in multiple areas of the impoundment using manual probing. Characterization of sediments, including laboratory analyses, should initially be performed at a limited number of locations to provide for a screening-level analysis of potential contamination and to determine with this material is comprised of fine-grained material and/or organic detritus. Sediment characterization would be required for permitting purposes and should include analyses for potential contaminants and grain size. Collection of “background” samples in the upstream and downstream reach of the brook may also be appropriate. The number of samples used for laboratory analyses should be determined based on regulatory consultation.

4.2.2 Delineation of Regulated Natural Resources

The impoundment limit and adjacent natural resources must be delineated along with a review of existing natural resources mapped by the state (e.g., NHESP). It is expected that these surveys would need to be performed in an area of approximately 3 acres.

4.2.3 Surveying and Mapping

Topographic surveys of the dam and appurtenances would be required for project design and permitting. Topographic survey maps presented in the PARE reports should be reviewed for their potential suitability for use as part of dam removal design prior to obtaining additional topographic survey work. A

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bathymetric survey of the impoundment would be necessary and could be performed using a boat-mounted acoustic depth sounder.

4.2.4 Hydrology and Hydraulics

Recommended hydrologic and hydraulic studies include development of base- and peak-flow hydrologic statistics and numerical hydraulic models. The purpose of this work is to provide information for use in evaluating potential sediment mobility following dam removal and changes in upstream water surface elevations that could affect regulated resources. Hydrologic statistics could be performed using regional regression equations or from previously developed reports. Hydraulic modeling could be performed using a relatively simple, one-dimensional numerical hydraulic model (e.g., HEC-RAS).

4.2.5 Historic Resources

While evaluation of historic resources does not appear to represent a critical path issue for removal of the spillway section of this dam, coordination with relevant local, state, and federal resource agencies is recommended.

4.2.6 Adjacent Infrastructure

Surveys are recommended to determine whether there are shallow (e.g., dug) drinking water wells in close proximity to the impoundment. Potential impacts to the Route 17/Main Street Bridge would need to be evaluated.

4.2.7 Preliminary Landscape Design and Engineering Plans

This work would include preparation of conceptual landscape and preliminary engineering design plans depicting construction access, dam removal, and site restoration. It is suggested that these materials be prepared in a manner suitable for use as part of the initial stakeholder outreach process.

4.2.8 Final Landscape Design and Engineering Plans

Suggested final landscape design and engineering plans and documents include erosion and sediment control management; construction access, staging and storage; existing and proposed conditions, and post dam-removal site restoration plans.

4.2.9 Agency Coordination and Permitting

Preliminary coordination with local, state, and federal regulatory agencies is recommended prior to the submittal of permit applications. It is suggested that such coordination be initiated as part of community and stakeholder outreach efforts.

Permitting requirements for this site would be similar to those encountered during other dam removal projects in Massachusetts, and include local, state, and federal permits. Initial coordination with the Town of Lancaster Conservation Commission during the stakeholder outreach process would be appropriate to

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foster local consensus. Likely required submittals/approvals include an Expanded Environmental Notification Form (EENF) under the Massachusetts Environmental Policy Act (MEPA); Notices of Intent (NOIs) under the Massachusetts Wetlands Protection Act and Lancaster Wetlands Protection Bylaw; applications for 401 and 404 permits to Massachusetts Department of Environmental Protection (DEP) and the Army Corp of Engineers, respectively; a Project Notification Form submitted to the Massachusetts Historical Commission; a Chapter 253 permit application to the ODS; and a Chapter 91 Waterways Permit application to the DEP.

5.0 PROJECT SCHEDULE, AND OPINION OF PROBABLE COST

Table 1 provides conceptual approaches, schedules, and opinion of probable of cost for dam removal and site restoration, including the development of design materials, permitting, and construction. Note that the opinion of probable of cost presented here assumes that permits are received for in-stream sediment management and that issues related to the presence and management of contaminated materials could substantially increase the cost of dam removal. The conceptual schedule assumes that funding for project studies and implementation is available immediately.

The opinion of probable cost presented in Table 1 was developed based on experience with similar projects, professional judgment, and reference to the opinion of probable cost presented in the PARE PHASE II Report. Note that the total recommended opinion of probable cost in the PARE Phase II Report for repair of the dam is \$606,000 to \$680,000.

Table 1: Project Timeline and Opinion of Probable Cost for Dam Removal

Dam Removal Work Item	Year/Quarter												Costs				
	Year 1				Year 2				Year 3								
	1	2	3	4	1	2	3	4	1	2	3	4	Coordination and Design	Construction	Construction Oversight		
I: Overall Project Management Project Management													\$10,000				
II: Development of Dam Removal Design Sediment Mapping, Characterization, and Testing													\$12,000				
Delineation of Regulated Natural Resources													\$10,000				
Surveying and Mapping													\$10,000				
Hydrology and Hydraulics													\$10,000				
Historic Resources.													\$2,000				
Preliminary Design Plans													\$20,000				
Final Design Plans													\$30,000				
III: Regulatory Coordination and Permitting Agency Coordination													\$10,000				
Permit Application Preparation													\$30,000				
IV: Dam Removal Construction Bidding																	
Dam Removal and Site Restoration													\$250,000	\$40,000			
	Subtotals:												\$144,000	\$255,000	\$40,000		
Grand Total: \$439,000																	

APPENDIX A

Site Photographs

Photo 1: Interpretive Sign



Photo 2: Plaque on Garnet Boulder



Photo 3: Impoundment from Dam



Photo 4: Primary Spillway from Left Side of Impoundment



Photo 5: Former Powerhouse Structure and Turbines Downstream from Primary Spillway



Photo 6: Primary Spillway Stoplog Bay



Photo 7: Primary Spillway from Upstream



Photo 8: Right Abutment Retaining Wall Upstream from Primary Spillway



Photo 9: Upstream Face of Overflow Spillway



Photo 10: Overflow Spillway (flow is from left to right)



Photo 11: Downstream Face of Overflow Spillway



Photo 12: Eroded Channel Downstream from Overflow Spillway



Photo 13: Right Eng of Left Section of Dam



Photo 14: Route 17/Main Street Bridge Downstream from Dam



APPENDIX B
PARE Phase I Report

APPENDIX C

PARE Phase II Report

APPENDIX D

Sediment Data