Project Final Report

Bare Hill Pond Noxious Plant Reduction
03-05/319

Dates: 2004-2007

Town of Harvard, MA

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PREPARED FOR:

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AND

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REGION 1

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Glenn Haas, Director

A. Project Snapshot

Project Number and Title: 03-05/319 Bare Hill Pond Noxious Plant Reduction

A1. Project start date: March 16, 2004

A2. Date closed: June 30, 2007

A3. Basin and HUC 12 subwatershed: Nashua River Basin; HUC ID: 010700040205, Nashua River – Catacoonamug Brook to Squannacook River

A4. Segment and/or waterbody number(s): Bare Hill Pond, MA81007

A5. Status of waterbody (Category 5, etc.): Category 5

A6. Priority Pollutant(s) targeted: Noxious aquatic plants
Phosphorus

A7. Estimated Annual Pollutant removal
N:
P: TBD pending ENSR final measurements and analysis 9/2007
Sediment:
Bacteria:
Other: Noxious aquatic plants – TBD pending ENSR final measurements and analysis 9/2007

Method of Determination:
Phosphorus: 2007 comparison to 2004 measurements of total and dissolved phosphorus at two sampling points within Bare Hill Pond, and at four sampling points that feed Bare Hill Pond (two tributaries and two stormwater drainage locations)
Noxious aquatic plants: 2007 comparison to 1998, 2001, and 2004 measurements of plant cover, biovolume, and taxonomic composition of the aquatic vegetation at 52 points along 5 established transects.

A8. BMPs installed, number and type:
- Installed a fully automated pumping system to lower the water level of Bare Hill Pond below its natural gravity-based drawdown limit, exposing a significantly greater area of invasive weeds to the effects of winter kill. This prototype design can be replicated at other water bodies across the state that have downstream obstacles in the protected wetlands that preclude effective gravity drawdowns.
- Developed a DEP-approved permitting template for pumped drawdowns, incorporating GEIR guidelines for drawdown execution and impact monitoring.

Descriptive Project Summary

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

SECTION 319 NPS PROJECT 03-05/319

PROJECT TITLE: Bare Hill Pond Noxious Plant Reduction
NPS CATEGORY: Implementation: 4A waters
INVESTIGATOR: Town of Harvard Bare Hill Pond Watershed Management Committee
LOCATION: Bare Hill Pond
TARGETED POLLUTANTS: Noxious aquatic plants

DESCRIPTION:

Given the Town of Harvard's recognition that Bare Hill Pond is an extremely important natural resource of the community, the Bare Hill Pond Watershed Management Committee has been active over four decades in trying to maintain the quality of this resource. The TMDL, as well as 1998 and 2002 ENSR reports on the quality of the water and aquatic plant growth in the pond, find that the pond suffers from extensive growths of invasive plants such as variable milfoil, waterchestnuts, water lilies, fanwort, smartweed, and pondweed. The pond has elevated nutrient levels, particularly in terms of phosphorous concentrations and macrophyte growth. The excessive growth of invasive species has been due to shallow water depths, bottom sediment rich in nutrients from macrophyte growth and historical uses, and sustained nutrient enrichment from the pond's watershed. Attempts to control the noxious plants through gravity-induced drawdowns have met limited success because the downstream topography constrains these drawdowns to a shallow depth of less than 4 feet.

The objectives of this project are to address the Water Quality Standards violations documented in the Bare Hill Pond TDML by:
(1) reducing the existing biomass of noxious aquatic plants; and
(2) reducing the current levels of NPS phosphorus pollution.
This project also proposes, as a technology transfer, the development of an automated pumping system and a set of DEP-approved operating guidelines for pumped drawdowns that can be replicated across the state for water bodies like Bare Hill Pond that have limited ability to do effective gravity drawdowns.

These objectives will be accomplished by:
1- Utilizing gravity drawdowns, weed harvesting and manual weed pulls to continue attacking the biomass of invasive weeds in shallow areas
2- Developing in parallel an automated pumping system to enable deeper drawdowns (up to 8') than is currently possible through gravity. This pump will be operated throughout a complete deep drawdown cycle at the end of the project to prove its design and measure its efficacy.
3- Educating the abutters and town residents as to the impact of their activities on the level of nutrients in the pond, with specific recommendations for reducing external phosphorus loading.
4- Conducting a watershed survey to identify opportunities for further reductions in NPS phosphorus pollution

RESULTS: The resulting reductions of phosphorus loading and noxious aquatic plant biomass will be measured by ENSR 9/2007

PROJECT COST: $ 418,368 (spending to date; does not include estimated cost of $23,450 for ENSR final measurements and analysis)

FUNDING: $ 195,000 by the US EPA (Assumes MassDEP reimburses 10% grant retainage)
$ 223,368 by the Town of Harvard

PROJECT COMPLETE: June 30, 2007
DURATION: 2004 – 2007

C. BMPs. Repeat this information as many times as required to report on each BMP implemented. Refer to the Key to learn more about the information that is required.

Automated Drawdown Pumping System

C1. Type of BMP: Pumping system and procedures to achieve a deep drawdown for noxious plant control in water bodies with gravity-based drawdown limitations
C2. Date of implementation: Completed 9/30/2006 and operated during the 2006/2007 winter drawdown
C3. Size of treatment area: Exposed approximately
C4. Pollutant load removed: TBD pending ENSR measurement and analysis 9/2007
C5. Method of pollutant load removal determination: 2007 comparison to 1998, 2001, and 2004 measurements of plant cover, biovolume, and taxonomic composition of the aquatic vegetation at 52 points along 5 established transects
C6. Percentage of pollutant removed from the 12-digit HUC (for N, P, fecal coliform, and sediment only): N/A

DEP-approved permitting template for pumped drawdowns

C1. Type of BMP: First implementation of GEIR recommendations for drawdown execution and impact monitoring in an approved Order of Conditions
C2. Date of implementation: Completed and approved 7/07/2005
C3. Size of treatment area: N/A
C4. Pollutant load removed: N/A
C5. Method of pollutant load removal determination: N/A
C6. Percentage of pollutant removed from the 12-digit HUC (for N, P, fecal coliform, and sediment only): N/A

D. Lessons Learned

1. There is no design precedent for a small-scale constrained-cost pumping system that can achieve the high flow-rate pumping characteristics needed for deep drawdowns of a Great Pond. We had to design this from scratch ourselves. What we have now will help others.
2. The most difficult part of pre-determining pumping capacity requirements is estimating average and worst-case inflows. We hired a firm to model the watershed and its characteristics with historical precipitation data, and also conducted our own measurements of pond outflows while maintaining constant level to derive this estimation. Our experience shows that these estimates were overly conservative.
3. Despite its small size, we were able to find within the Town of Harvard the unique expertises we needed in marine construction, cutting edge pump system design, control system design, and commercial-style construction to achieve this unique result. We were also able to martial significant volunteer resources within Harvard to do virtually all the construction without contractor cost. This saved the town approximately $.4M in total project cost.
4. National Grid was a difficult organization to work with. They overpromised and underdelivered on the type of electrical service they would offer, and on the installation schedule. Plan and budget accordingly.
5. We spent a lot of time educating and listening to Town officials, abutters, and the general public. As such, we sailed through the formal review processes of the Conservation Commission and Zoning Board for permits, and the Finance

Committee, Community Preservation Committee, and Town Meeting itself for financial support.

6. Our annual monitoring indicates that the impact of a drawdown following GEIR guidelines has not been adverse. Native plant and animal species appear to be thriving.
7. The hard freeze this winter of exposed plants not only killed the targeted milfoil, but also caused uprooting of waterchestnuts, that as seed-bearing plants would not normally be affected by a drawdown.
8. The NPS Watershed Survey identified a number of opportunities to implement future BMPs.
9. There is a great resource to found in the schools to engage students and teachers in watershed protection education and activities.

E. Attachments

E1. Maps

- Locus map showing Bare Hill Pond watershed
- Design and siting of drawdown pumping system
- ENSR vegetation survey locations
- ENSR in-lake water sampling locations
- ENSR tributary/stormwater sampling locations
- ENSR sediment sampling locations

E2. Deliverables

- Deliverable 1A: Quality Assurance Project Plan
- Deliverable 1B: To be provided 9/2007 after final ENSR measurements
- Deliverable 2A: Pump System Design Documents
- Deliverable 2B: Photographs of pump construction and operation
- Deliverable 3A: DEP-approved drawdown permit
- Deliverable 3B: To be included with Deliverable 1B on 9/2007 after final ENSR measurements
- Deliverable 3C: Post-operation analysis of pump's effectiveness
- Deliverable 3D: Yearly drawdown and manual weed pull impact reports
- Deliverable 4A: To be included with Deliverable 1B on 9/2007 after final ENSR measurements
- Deliverable 5A: Bare Hill Pond Watershed Survey
- Deliverable 6A: Report of outreach and education activities