

The Baboosic Lake

Stormwater Improvement Project

A Final Report to

The New Hampshire Department of Environmental Services

Submitted by

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Executive Summary

The scope of this project is large and this grant was what we considered phase 2, a follow on award to phase 1 to begin to repair Baboosic Lake. Baboosic Lake has been experiencing more frequent algae blooms, specifically cyanobacteria algae blooms. Through studies conducted, it has been determined that the primary cause of this and the general water quality degradation can be attributed to excessive Phosphorus loading, mostly from direct runoff.

Proposal Outcome Statement:

The ultimate outcome or goal is to reduce watershed phosphorus loading in an effort to reduce algal blooms and eliminate Cyanobacteria blooms to meet state water quality standards.

This will be accomplished through site-specific stormwater BMP implementation. The purpose of the watershed-based plan was to prioritize phosphorus and sediment load locations and make recommendations on methods to reduce these pollutants. The purpose of designing and implementing the landscape / stormwater BMPs was to immediately engage in implementing watershed changes to reduce phosphorus and sediment loading.

We feel that our phase two BMP installations were very successful. Our execution period was from August 19, 2010 through September 30, 2012. The Baboosic Lake association consisting of just under 200 members and governed by the Board of Directors consisting of 12 individuals was the primary organization responsible for the development and success of the second phase of our program. The objective was to identify the most problematic sites where significant amounts of water runoff were occurring and design BMP's to implement that would resolve or mitigate these problem areas. Upon quoting our previous engineering firm, Geosyntec the BLA discovered that the firm would basically use all of our funding just in the proposed design of the BMP's. Unfortunately, at this point the BLA had no choice but to seek an alternative engineering firm. We issued requests for qualifications, sorted through responses, conducted interviews, reviewed ballpark proposals and finally Selected Comprehensive Engineering of Merrimack, NH as our new engineering firm.

Our initial funding for the project total was \$130,000.00, of which \$78,000.00 was the DES / Federal grant money and \$52,000.00 was the BLA required matching funds. The total expended of DES / Federal funds was just over \$56,000.00. The BLA matching funds procured were approximately \$55,000.00. Worthy of mention is that the BLA exceeded the required match, of which approximately \$3,000.00 has been documented and submitted with our closure documentation. This resulted in a total program completion cost of approximately \$111,000.00.

In closing we are pleased to report that we have met the targets as follows:

- a). Studied the identified sites and established the priority for implementation.***
- b). Negotiated and generated the new Statement of Work for the new Engineering firm.***
- c). Directed efforts of Comprehensive Engineering and coordinated the Design / Approval cycle with DES.***

d). Implemented all but two designs resulting in a total BMP installation of 18 sites.

e). In addition to successfully completing the grant requirement for BMP installation, and matching funds, through the hard work of the BLA, we came in \$22,000.00 under budget and returned the excess funds to the DES.

Introduction

Baboosic Lake is a 221.9-acre natural lake situated on the boundary between the towns of Amherst and Merrimack, New Hampshire, with its watershed of 1536 acres extending into both towns. Constant water quality monitoring for the past twenty-five plus years reveals a continuing deterioration in water quality and clarity. Baboosic Lake has experienced declines in water quality in recent years, and has been included on the Draft 2008 List of Threatened or Impaired Waters That Require a TMDL for nuisance blooms of Cyanobacteria (hepatoxic blue-green algae), elevated Chlorophyll-A concentrations, and elevated levels of the bacteria Escherichia coli.

The 2008 Watershed Plan reported that Phosphorus loading is the primary contributor to a decline in water quality. The Study's Phosphorus budget lists watershed inputs as: (in declining order of magnitude) septic/groundwater systems (43%), watershed runoff (46%), and atmospheric (11%).

As a result of excessive phosphorus loading through tributaries and direct runoff, algal blooms and more specifically Cyanobacteria blooms have become increasingly more frequent in recent years. Cyanobacteria blooms have led to Baboosic Lake as being impaired and not meeting state water quality standards.

Reducing Cyanobacteria blooms and Chlorophyll-A concentrations in Baboosic Lake will require reducing the amount of phosphorus entering the lake from sources such as septic systems and storm water runoff. In freshwater lakes, phosphorus is usually the most important nutrient determining the growth of algae and aquatic plants. As such, increases in phosphorus levels tend to be strongly correlated with decreased water clarity, increased algal abundance and other indicators of declining water quality. To reduce algal blooms and eliminate Cyanobacteria blooms phosphorus loading as a result of septic systems, gulls and stormwater runoff (tributaries and direct runoff) sites must be prioritized and addressed. With the completion of community septic system, loading from bad or old systems has been decreased substantially, and with the transition out of the Amherst dump, the gull population has been significantly reduced. Pollutant load allocation will occur through the implementation of the watershed-based plan. Phosphorus load allocation, if not assessed directly, will be assessed indirectly through analysis of sediment loads. In addition several shoreline properties will be selected for stormwater best management practice (BMP) implementation. Designs and implementation will be targeted at reducing stormwater runoff rates and volumes through infiltration. This will occur through native vegetation buffer plantings, stream bank stabilization, vegetated swales along lake roads, and stormwater detention/infiltration areas within the watershed. A byproduct of this will be sediment load and therefore phosphorus load reductions. The outcome verification will occur through modeling pollutant load reductions, improvement in the VLAP water quality results, reduction of algal blooms and elimination of Cyanobacteria algal blooms. It should be noted that outcome verification will be based on implementation of projects having the greatest ability and feasibility to reduce pollutant loadings.

In addition to the watershed based plan and BMP design and implementation the BLA has lead an education campaign targeting landowners within the watershed about their individual impact on the watershed, stormwater runoff and the lake. Education has been accomplished through development and distribution of a Waterfront and Watershed property owner's guide, landscaping methods to reduce and manage stormwater runoff and ongoing programs sponsored by the BLA.

About the Baboosic Lake Association

In 1982 Baboosic Lake started its own water quality testing and is working closely with the NH Lakes Lay Monitoring Program. In 1986 the Baboosic Lake Association was formed to help with lake issues, inform and educate waterfront and watershed residents and to help protect and preserve Baboosic Lake. The Baboosic Lake Association today consists of just under 200 members and is governed by a 12 person Board of Directors, all being watershed property owners of varied backgrounds. We have developed and maintain a very informative web site for the waterfront, watershed residents and the general public to use for information and guidance. We now have an email blast system in place to keep everyone abreast of current or urgent issues. We are also looking to supplement any state or federal funding we can get, with personal and corporate donations. The other factor, almost as important as funding itself, is that we are now focused on teaming with and are developing excellent relations with our towns. We have a new spirit of support and cooperation, which if nurtured, will prove to be very beneficial to Baboosic Lake. We also have negotiated discount rates for septic pumping with a local contractor to encourage people to keep their septic system pumped and maintained. We are currently negotiating with a couple of local hardware stores to obtain a discounted rate for phosphorous free fertilizer and to have the supplies delivered to the lake residents in early spring.

Project Goals and Objectives

The ultimate outcome or goal is to reduce watershed phosphorus loading in an effort to reduce algal blooms and eliminate Cyanobacteria blooms to meet state water quality standards. This will be accomplished through implementing the watershed based plan and site-specific stormwater BMP implementations. The purpose of the watershed-based plan is to prioritize phosphorus and sediment load locations and make recommendations on methods to reduce these pollutants. The purpose of designing and implementing the landscape / stormwater BMPs will be to immediately engage in implementing watershed changes to reduce phosphorus and sediment loading.

Site Location Map



Photo Documentation (See Attachment A)



Baboosic Lake Association
Amherst & Merrimack NH

Baboosic Lake Storm water Improvement Project

Photo Documentation

**Prepared by Greg Gendron, Baboosic Lake Assoc.
December 5, 2012**

Funding for this project was provided in part by a grant from the NH Department of Environmental Services with funding from the US Environmental Protection Agency under Section 319 of the Clean Water Act.



Baboosic Lake Watershed Restoration

Stormwater BMP Implementation Project Operations & Maintenance Plan

***Town of Merrimack, NH
Department of Public Works
Baboosic Lake Association***

December 2012



**Prepared by
Comprehensive Environmental, Inc.**

Pollutant Load and Reduction Estimates (See Attachment C)

Pollutant Loading & Removal Summary										
281-1 - Baboosic Lake s319 Grant - Phase 2 Watershed Restoration Project 2012										
BMP Summary			Total Pollutant Loading				Total Pollutant Removal			
Site Location	BMP Type	Area (acres) ¹	Annual Runoff (of)	Annual TSS Loading (lbs/yr)	Annual TP Loading (lbs/yr)	Annual TN Loading (lbs/yr)	Annual TSS Removed (lbs/yr)	Annual TP Removed (lbs/yr)	WMP Target TP Removal (lbs/yr)	Annual TN Removed (lbs/yr)
Site 5 (upper) - Greenwood Rd	Plunge Pools & Vegetated Swale	3.31	118,257	1,808	3.5	13.2	539	0.36	0.10	0.65
Site 5 (lower) - Greenwood Rd	Riprap Swale	0.24	16,998	500	0.5	1.5	265	0.04	0.10	0.04
Site 6 - Lakeside Rd	Riprap apron & Vegetated Swale (pavement removed)	0.63	11,542	71	0.2	1.5	20	0.03	0.10	0.17
Site 7 - Jebb Rd	Plunge Pool (pipes un-clogged & headwall stabilized)	8.00	149,301	949	2.9	18.5	237	0.23	0.10	0.56
Site 8 - Lakeside Rd	Forebay & Rain garden	4.55	105,165	1,035	2.5	12.6	221	0.33	0.50	1.53
Site 10 - N. Jebb Rd	Forebay & Rain garden	0.77	26,224	392	0.8	2.9	59	0.07	0.20	0.22
Site 10B - N. Jebb Rd	Forebay & Rain garden	1.32	43,074	625	1.2	4.8	277	0.31	0.20	1.02
Site 12 - Lakeside Rd	Forebay & Vegetated Swale	1.09	36,247	533	1.0	4.1	352	0.27	0.20	0.82
Site 14A - Miriam Rd	Plunge Pools & Vegetated Swale	5.64	167,574	2,136	4.7	19.9	792	0.67	0.10	1.83
Site 14B - Arnold Rd	Forebay & Rain garden	2.13	90,017	1,552	2.8	9.5	75	0.08	0.10	0.24
Site 14C - Carter Rd	Forebay & Rain garden	2.09	88,615	1,533	2.7	9.4	60	0.06	0.10	0.20
Site 16 - Shore Rd	Forebay & Rain garden	2.57	73,056	923	2.0	8.5	258	0.33	0.10	1.27
Site 16A - Shore Rd	Forebay & Rain garden	0.13	8,306	173	0.3	0.8	106	0.11	0.10	0.30
Site 16B - Longa Rd	Plunge Pool (pipes un-clogged & swale stabilized)	3.38	112,235	1,609	3.3	12.8	402	0.26	0.10	0.38
Project Totals		41.19	884,898	11,882	28.88	182.12	3,864	3.15	1.40	8.28
Percentage Totals							32%	13%	6%	9%
Project Totals			6,182	10.7	48.3	1,882	1.4	0.6		4.2



Completed Grant Accounting Spreadsheet (See Attachment D)

Baboosic Lake Storm water Project --Grant II Time spent & by whom

<u>Deliverable</u>	<u>Date</u>	<u>Where</u>	<u>Who</u>	<u>What</u>	<u>#people</u>	<u>time</u>	<u>total time</u>	<u>Rate</u>	<u>Cost</u>
1A	14-Jan-2009	BLA meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	26-Jan-2009	Special BLA meeting	Officers	Discuss status grant 2	4	2	8	20.85	\$166.80
1A	30-Jan-2009	Bernie's office	Bernie	Project Accounting	1	3	3	35.00	\$105.00
1A	11-Feb-2009	BLA meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	11-Mar-2009	BLA meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	8-Apr-2009	Greg's office	Greg	Telecom with Andy	1	1	1	20.85	\$20.85
1A	8-Apr-2009	BLA meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	2-May-2009	Greg's office	Greg and Richard	Grant review	2	2	4	20.85	\$83.40
1A	6-May-2009	BLA Meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	7-May-2009	Greg's office	Greg and Richard	Final Grant 2 Review	2	3	6	20.85	\$125.10
1A	11-May-2009	Greg's office	Greg	Telecom Andy Chapman	1	1	1	20.85	\$20.85
1A	21-May-2009	Boyd Insurance	Bernie	Obtain Insurance cert.	1	1	1	20.85	\$20.85
1A	26-May-2009	Sec. of state office	Bernie	Obtain cert of non Profit	1	4	4	20.85	\$83.40
1A	26-May-2009	"	Bernie	mileage		80 mile		\$.55 cents per	\$44.00
1A	3-Jun-2009	Richard's office	Richard	Summary for BLA vote	1	3	3	20.85	\$62.55
1A	10-Jun-2009	BLA meeting	Full board 10 mem.	Discuss status grant 2	10	1	10	20.85	\$208.50
1A	10-Jun-2009	Bernie's office	Bernie	Project accounting	1	1.5	1.5	35.00	\$52.50
1A	8-Jul-2009	BLA Meeting	Full board 10 member	Discuss status grant 2	10	1	10	20.85	\$208.50
BLA Matching Fund subtotal									\$2,244.80

Conclusions and Recommendations:

Based on having experienced the organization, administration and execution of Phase 2, along with our previous phases, and with the successes we have achieved, we can say that the BLA has learned a great deal. We are becoming more skilled at understanding the needs of the lake and how to present facts to people that make sense for the long term health of the lake. It is our opinion that by demonstrating how we care sets a positive example for others to follow. We are also very pleased that the majority of this work (Phase 2 BMP installations) was performed by volunteers of the BLA. Many of our members donated their time and efforts to the construction phases insuring our successful BMP installations.

During the phase 2 of this grant we set goals and we are pleased that we were able to accomplish them. As stated earlier, the goal to identify the sources of runoff, evaluate and prioritize them based on loading was accomplished. The Watershed Plan was developed, which detailed all of these sights, their estimated pollutant load and suggested schedule of priority. Upon completion of the Watershed plan came the decision process for sight selection, BMP design and implementation. In the middle of all of this we were forced to solicit bids for a new Engineering firm. RFP's were issued, interviews conducted and the BLA board of directors selected Comprehensive Engineering of Merrimack NH as our new Engineering firm. In addition to these successes we achieved a couple more that are more than worthy of mention. We have begun to develop a working relationship with the town of Amherst and Merrimack. We are now doing water testing with the town of Amherst at the town beach, which revealed that improper testing procedures by lifeguards were resulting in unnecessary beach closures and bad publicity for the lake. The BLA also had success in enlisting the Town of Merrimack as a working partner. The Town of Merrimack, through the Public Works Department supplied men and machinery for assistance on several sites in Phase 2. It was through the help of the Town and our many BLA volunteers that we were able to finish the total program under budget, and we were able to return over \$22,000.00 of unused funds to DES.

In addition to the above, the BLA has spent great time and effort to get qualified as a 501(c)3 organization. We are pleased to announce that we have achieved our certification as of February of 2012. We believe that this will be an additional door opener for the BLA to get corporate donations / funding for future lake improvement projects.

In conclusion, we would like to see the programs to improve Baboosic Lake continue. We are encouraged by homeowner and the town's receptiveness to the program and are confident that we can make great strides with our future efforts.