Appendix G

Presentations and Public Comments

ENSR | AECOM

presented by David Mitchell, PhD

ENSR Corporation

February 15, 2007

File name

ENSR | AECOM

Presentation Overview

- Introduction to ENSR and Project Team
- Project Tasks and Schedule
- Defining the Problem
  - Available Data and Information
  - Defining Management Objectives
- Potential Pond Management Options
  - Dredging
  - Circulation/Aeration
  - Nutrient Inactivation
- Next steps

File name

ENSR | AECOM

ENSR Corporation – Lake Management

- Working in New England lakes and ponds for 20+ years
  - Conducted 250+ Diagnostic/Feasibility (D/F) Studies
  - Four Certified Lake Managers (CLM) on Staff
  - Published and presented extensively
- Have worked with MA agencies on Lake Management Issues
  - EOEA "*Final Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in MA*"
  - MA DEP guidance for rapid response for aquatic invasive species
- Familiar with Cape Cod lakes and ponds:
  - Long Pond (Harwich), Ashumet Pond (Mashee/Falmouth), Hamblin Pond (Barnstable), Great Pond, Herring Pond (Eastham)
  - Many other waterbodies as well

File name

ENSR | AECOM

Lovers Lake/Stillwater Pond Project Team

- David F. Mitchell, PhD, CLM – Project Manager
- Ken Wagner, PhD, CLM – Senior Technical Reviewer
- Wendy Gendron, CLM – Limnology Field Support
- Matt Kennedy, PE – Project Engineer
- Teresa McGovern PE – Engineering Support

File name

ENSR | AECOM

Chatham Ponds Project Tasks – Phase 1

- Evaluate available water quality data, reports and other relevant information to assess nutrient stations
  - identify critical data gaps
  - coordinate any needed sampling.
- Develop hydrologic (water) budget for two Ponds
- Develop nutrient budget for two Ponds
  - investigate internal nutrient recycling
  - compare with other potential watershed sources
- Characterize biota of Ponds
  - macrophyte community
  - fish (herring)

File name

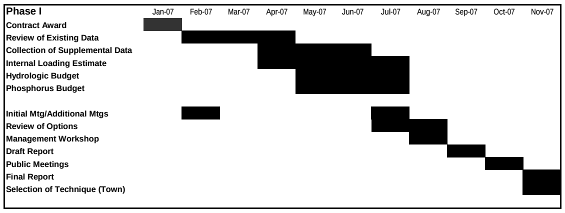
ENSR | AECOM

Chatham Ponds Project Tasks – Phase 2

- Evaluate potential lake management options
  - dredging
  - circulation
  - aeration
  - nutrient inactivation (alum treatment).
- Select management options to alleviate eutrophication, considering:
  - technical feasibility
  - expected water quality or recreational improvements
  - longevity
  - cost-effectiveness
  - permitting issues
- For recommended option, develop specifications, permits and detailed cost estimates
- Identify funding sources for implementation

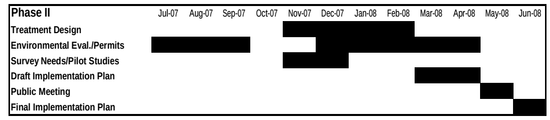
ENSR | AECOM

PROJECT SCHEDULE – PHASE 1 TASKS



ENSR | AECOM

PROJECT SCHEDULE – PHASE 2 TASKS



ENSR | AECOM

Data Evaluation for Lovers Lake & Stillwater Pond

- Describe physical attributes of the two ponds
  - Basin shape and bathymetry
  - Watershed size and land use
  - Flow characteristics
- Characterize current water quality
  - recent water chemistry results
  - secchi disk observations
  - observations of temperature and dissolved oxygen (DO) profiles
- Characterize biota
  - plankton (algae and zooplankton)
  - macrophyte and shoreline vegetation
  - wildlife (fish and waterfowl)

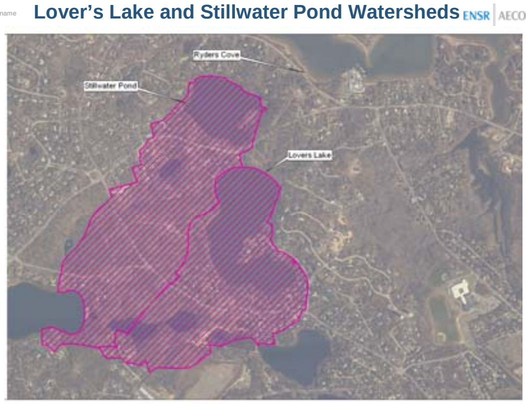
ENSR | AECOM

Data Sources for Lovers Lake and Stillwater Pond

- Pond and Lake Stewards (PALS) volunteer monitoring data. 2000-06.
- Horsley and Witten, Inc. 2003. *A Qualitative Survey of Pond Shoreline Vegetation and Anthropogenic Threats at Eleven Freshwater Ponds in the Pleasant Bay Area of Critical Environmental Concern*. February 2003
- Cape Cod Commission. 2003. *Cape Cod Pond and Lake Atlas -* section on Chatham ponds. May 2003
- Ecologic, LLC. 2003. *Action Plan for Town of Chatham Ponds*. November 2003.
- Massachusetts Estuaries Project (MEP) *Linked Watershed-Embayment Model to Determine Critical Nitrogen Thresholds for Pleasant Bay System*. May 2006.
- Massachusetts Natural Heritage Endangered Species/Habitat maps
- Additional Town files and data from watershed groups

Lover's Lake and Stillwater Pond Watersheds

ENSR | AECOM



ENSR | AECOM

General characteristics of Lovers Lake and Stillwater Pond

LOVERS LAKE

- Kettlehole Pond; MA-designated Great Pond
- Size is 37.7 acres
- Maximum depth about 32 feet
- Connected to Stillwater Pond and Frost Fish Creek
- No public access to pond
- Recreational uses
  - swimming, boating, fishing
  - passive recreational
- Herring run present

STILLWATER POND

- Kettlehole Pond; MA-designated Great Pond
- Size 18.7 acres
- Maximum depth about 46 feet
- Connected to Lovers Lake and Ryders Cove
- Unimproved boat launch
- Recreational uses
  - swimming, boating, fishing
  - passive recreational
- Herring run present

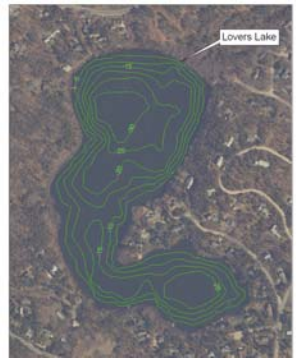
File name

What is the significance of being a kettlehole pond ?

- Formed by retreat of glacial ice sheet and remnant block of ice in sandy basin
- Deep central basin, often subject to thermal stratification
- Restricted number of tributaries and often only seasonal outflow
- Groundwater is most important portion of hydrologic budget
- Flushing rate is slow, nutrients are retained and promote growth
- Typically have diverse biotic communities

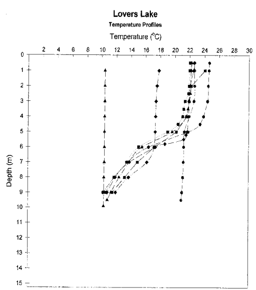
File name

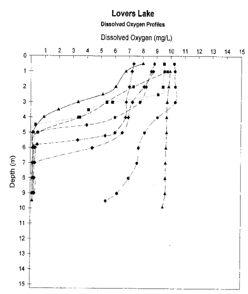
Lovers Lake Basin Bathymetry



File name

Lovers Lake Temperature and DO Profiles



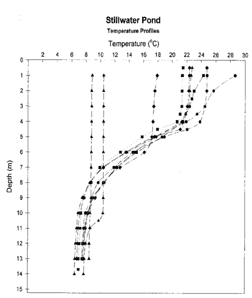


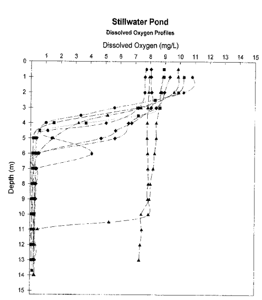
File name

Stillwater Pond Basin Bathymetry

File name

Stillwater Pond Temperature and DO Profiles





File name

What is Eutrophication and why do we want to mitigate it?

- Eutrophication is caused by an overabundance of nutrients
  - High levels of organic production – phytoplankton and macrophytes
  - Low water transparency
  - Large variation in DO over day and from top to bottom
  - Undesirable appearance, tastes, and odors
- Results of Eutrophication
  - Impaired water quality
  - Shift in biotic community
    - Loss of sensitive species
    - Potential fishkills
  - Impacted recreational uses
  - Unaesthetic conditions

Current water quality in Lovers Lake and Stillwater Pond

LOVERS LAKE

- Surface total phosphorus (TP) levels about 38.9 ug/L; bottom TP is approximately 125 ug/L
- Secchi disk transparency (SDT) depth ranges from 1.5 to 5.6 ft
- Summer chlorophyll a ranges from 5.4 to 73.3 ug/L with average of 32,2 ug/L
- Anoxic conditions below 12-15 ft in late summer
- Water quality conditions are consistent with eutrophic classification

STILLWATER POND

- Surface total phosphorus (TP) levels about 25 ug/L; bottom TP is approximately 312 ug/L
- Secchi disk transparency (SDT) depth ranges from 2.2 to 10 ft
- Summer chlorophyll a ranges from 4.3 to 56.1 ug/L with average of 21.6 ug/L
- Anoxic conditions below 15-18 ft in late summer
- Water quality conditions are consistent with eutrophic classification

Evidence of Internal Phosphorus Recycling

– Strongly anoxic hypolimnion, lack of oxygen in bottom releases phosphorus from iron-complex into overlying water

– Observations of elevated amounts of TP in bottom water - difference most profound in late season observations

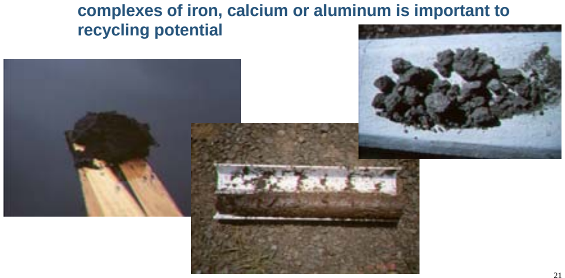
– Lack of significant surface tributaries or obvious overland routes

– Persistent phosphorus levels despite watershed management BMPs

– Nutrient control is the key to long-term control of algae problems; watershed management has top priority, but in-lake controls may be expedient and/or necessary.

Internal Phosphorus Recycling

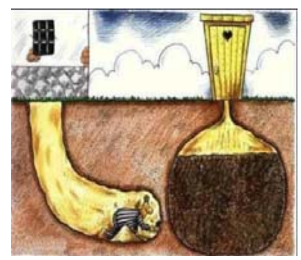
Phosphorus from past loadings can pass through the lake or become part of the sediment base; whether the P accumulating as sediment is bound as organic matter or complexes of iron, calcium or aluminum is important to recycling potential



Internal Phosphorus Recycling

It is critical to know where you are going to avoid unpleasant surprises:

- **How much of total P load is internally generated?**
- **Does available P reach the photic zone during summer?**
- **Which P binder is dominant?**
- **How and where are algae utilizing available P?**

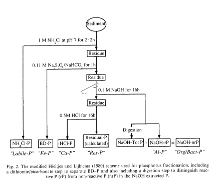


Evaluating internal loading via sediment sampling/analysis :

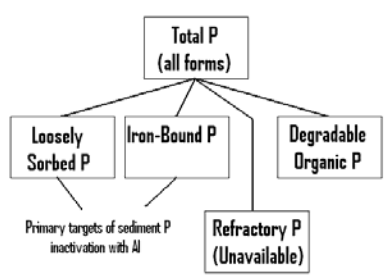
– **Measure P near the bottom and top, and preferably in between, to look for gradients**

– **Measure P over time to detect accumulation in bottom or surface waters**

– **Measure forms of P in the sediments; evaluate potential releases**



Available Sediment P Determination:



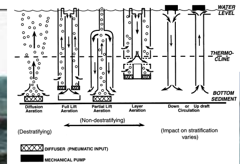
File name

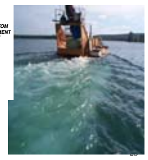
ENSR | AECOM

Internal P Recycling – Potential Restoration Approaches

Different methods to reduce internal loading:

- Dredging removes nutrient reserves
- Aluminum treatments bind P most permanently; iron or calcium may be appropriate in some cases
- Aeration will limit release by iron; mixing (circulation) may help too





File name

Internal Phosphorus Recycling - Dredging

ENSR | AECOM

Dredging:

- Dry (conventional)
- Wet (bucket/dragline)
- Hydraulic (piped)

- Removes nutrient reserves
- Removes “seed” bank
- Potential mat control

File name

Internal Phosphorus Recycling - Dredging

ENSR | AECOM

Dredging:

- Essential to remove all nutrient-rich sediment for maximum effect

File name

Internal Phosphorus Recycling - Dredging

ENSR | AECOM

Information Needs in Planning to Dredge:

- Sediment quality – controls disposal
- Sediment quantity – affects cost and method
- Flow control – affects method
- Disposal site features – affects method and rate
- Affected resources – controls mitigation needs
- Equipment access – affects method
- Relation to lake uses – affects timing and interference

File name

Internal Phosphorus Recycling – Aeration/Mixing

ENSR | AECOM

Aeration/mixing can work by:

- Adding oxygen and facilitating P binding while minimizing release from sediments
- Physical mixing that disrupts growth cycles of some algae
- Alteration of pH and related water chemistry that favors less obnoxious algal forms
- Turbulence that neutralizes advantages conveyed by buoyancy mechanisms
- Creation of suitable zooplankton refuges and enhancement of grazing potential

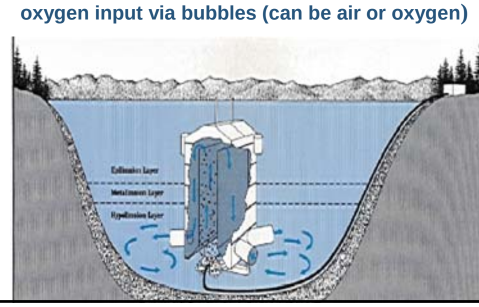
File name

Internal Phosphorus Recycling – Aeration/Mixing

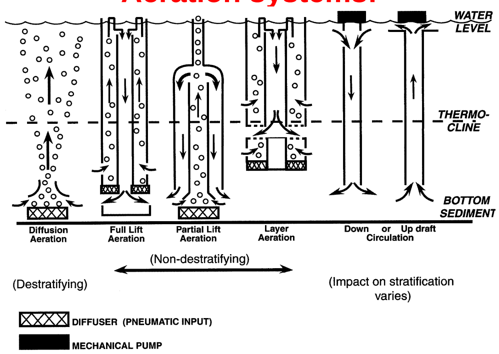
ENSR | AECOM

Non-destratifying aeration:

Bottom layer is aerated, but top layer is unaffected; oxygen input via bubbles (can be air or oxygen)



Aeration systems:

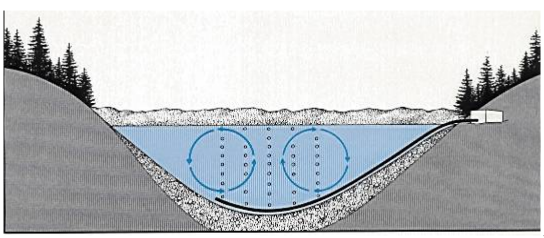


Key factors in aeration:

- Adding enough oxygen to counter the demand in the lake (usually about 75% from sediment) and distributing it where needed in the lake
- Maintaining oxygen levels suitable for target aquatic fauna (fish and invertebrates)
- Having enough of a P binder present to inactivate P in presence of oxygen
- Not breaking stratification if part of goal is to maintain natural summer layering of the lake

Destratifying aeration/mixing:

Lake is mixed, top to bottom, input of oxygen comes from bubbles and interaction with lake surface



Mixing systems:

Key factors in mixing:

- Moving enough water to prevent stagnation; may mix whole lake or just the top layer (if any)
- Fostering greater homogeneity in mixed zone and greater interaction with the atmosphere (oxygen and pH effects may be large)
- Getting enough motion or change in water quality to disrupt target algal species; moving algae to dark zone helps, but may be possible to disrupt with only surface layer mixing

Info needs for aeration/mixing:

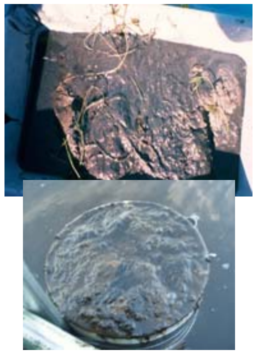
- Oxygen demand and its component parts (sources)
- Bathymetry and light penetration
- P binder forms and abundance
- Energy necessary to destratify
- Forms of algae and zooplankton
- Potentially sensitive biological receptors
- Power availability
- Nearby land availability

Lake Sediment Treatment:

Reduce P release from sediment; can control P in lake if sediment is the major source

Normally planned to react with upper 2-4 inches of sediment, more if very loose

Dose usually 25-100 g/m^2 – based on amount and form in which P is bound in sediment



Phosphorus Inactivators:

Aluminum - Most permanent binder, works well at all DO levels and best at an initial pH range of 6.0-8.0

Iron - Most common natural binder, works well at high DO and moderate to high pH (>6.0)

Calcium - Precipitates at elevated concentrations at high pH (>8.0), not greatly affected by DO

Organic complexes - Most common at low pH (<6.0), may inactivate or chelate P

Synthetic polymers - May capture and inactivate P as part of flocculation process

When to Use Aluminum:

- **Internal P load is high relative to external load, or external load is pulsed such that one treatment covers much of the annual load**
- **Detention time is high**
- **pH is 6-8 and alkalinity (buffer capacity) is high (>20 ppm, preferably >40ppm)**
- **Potentially sensitive receptors are few, or avoidable, or impacts are acceptable**
- **Rooted plant density in the targeted area at the time of treatment is low**

Conclusions for Lake Sediment Treatments:

Effective inactivation of sediment P achievable with Al

Necessary dose should be determined from the mobile sediment P fraction (loosely sorbed and Fe-P) and expected stoichiometry of Al-P binding (10-100:1) or measured dose response curve; buffer treatment as necessary

Short-lived benefits are usually a function of continued large external P load or insufficient Al addition

Where sediment P is inactivated, internal P loading has declined by 50-90% and chl has declined proportionally

Benefits of proper treatment tend to last about 10 years in shallow lakes and 15-20 years in deep lakes

Extra data may be needed to evaluate choices

- Lake volume and flushing rate estimates
- Water quality over season – spring TP concentrations
- DO concentrations in hypolimnion from spring turnover until mid-stratified period to document DO loss rate for estimate of aeration
- Sediment quality – to evaluate amount of desorbable phosphorus and calculate amount of alum inactivation
- Sediment characteristics to evaluate volume, handling, and disposal options for dredging
- Information on herring fishery, T/E species, any other special considerations

Selection of the appropriate pond restoration method requires clearly-defined objectives

- What are current uses of pond and the desired endpoints.
  - Boating, swimming, fishing
  - Other types of uses ?
- What level of water quality improvement is needed to:
  - improve aesthetic appearance ?
  - meet all water quality standards
  - promote ecological health or biological diversity ?
  - enhance recreation ?
- How we will measure success ?
  - Increase SDT to allow swimming all summer ?
  - Decrease number and frequency of algal blooms ?
  - Property values increase ?

Next Steps Forward

– Review available pond and watershed data
– Conduct sediment sampling (late April) and coordinate with Town regarding additional pond observations of Tº/DO
– Finalize diagnostic data and develop evaluation of various pond management options. Report back to Town with recommendations
– Public meeting to discuss and select pond management option
– Conduct Phase II design and permitting tasks

Town of Chatham

Department of Health and Environment

Health (508) 945-5165 Water Quality Laboratory (508) 945-5188 Conservation (508) 945-5164

TOWN ANNEX 261 GEORGE RYDER ROAD CHATHAM, MA 02633
FAX (508) 945-5163

Memorandum

TO: Lovers Lake/Stillwater Pond Review Group
Dave Mitchell, ENSR
File

CC:

FROM: Robert Duncanson, Ph.D.
Director of Health & Environment

DATE: February 16, 2007

RE: Meeting Notes
Public Meeting 02-15-07
Lovers Lake/Stillwater Pond Eutrophication Mitigation Plan

1. Comment - about Stillwater Pond being "spring-fed".
    a. Follow-up comment about area within Stillwater Pond that tends to freeze last.
    b. Question - Does depth of water have an impact on areas that freeze last?

2. Comment – lake should be an asset to neighborhood/town, not a detriment.

3. Comment - restoration goal should be bringing back the wildlife; 20-30 years ago first sign of decline in lake quality was loss of frogs.

4. Comment – more important to restore natural condition.

5. Comment/question – affect of condition on the herring.

6. Comment/question – about reverse layering.

7. Question – is it possible there might be different solutions for Lovers Lake versus Stillwater Pond?

8. Question – how much of the problem is attributable to runoff?

9. Question – how much might fixing the problem cost? General comments about funding;

several comments that abutters/watershed could/should raise funds rather than wait for town.

10. Comment – concern about "continuing' studies. Why not move forward with nutrient inactivation (i.e. alum)? Concern about length of time necessary to reach implementation.

11. Comment – ensure neighborhood associations are contacted/involved: Great Hill, Northgate, Stillwater P.

12. Comment – no public access makes selling additional funds to town difficult; concern about increased public access; make case that restoration benefits town overall; impact on property values.

13. Question – why is Lovers Lake more impacted when WQ data shows higher TP values at depth in Stillwater? Why does Stillwater P. have better transparency values with higher TP values at depth?

Lovers Lake and Stillwater Pond Eutrophication Mitigation Plan Report Presentation

ENSR Corporation

April 19, 2008

Presentation Agenda

- Project Overview
- Review of Watershed Characteristics & Historic Data
- Results from 2007 Field and Lab Work
- Hydrologic Budgets & Phosphorus Budgets
- Pond Diagnostic Summary
- Potential Pond Management Option Evaluations
  - Dredging
  - Circulation
  - Aeration
  - Nutrient Inactivation
- Recommended Pond Management Options

Lovers Lake/Stillwater Pond Project

- **ENSR Corporation, Westford, MA**
  - David F. Mitchell, PhD, CLM – Project Manager
  - Ken Wagner, PhD, CLM – Senior Technical Reviewer
  - Sarah MacDougall – Modeling and Analyses
  - Kate Dunlap – Limnology Field Support
- **Town of Chatham (CDH&E)**
  - Robert Duncanson, Ph.D.
  - Shannon Cook
- **Technical Committee**
  - Bruce Beane
  - Fred Jensen
  - Paul Grifo (Great Hills Association)

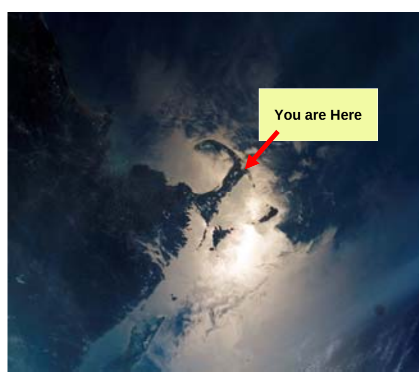
Chatham Ponds Project Tasks – Phase 1

- Evaluate available water quality data, reports and other relevant information to assess nutrient stations
  - identify critical data gaps
  - coordinate any needed sampling.
- Characterize biota of Ponds
- Develop hydrologic (water) budget for two Ponds
- Develop nutrient budget for two Ponds
  - investigate internal nutrient recycling
  - compare with other potential watershed sources

Chatham Ponds Project Tasks – Phase 2

- Evaluate potential lake management options
  - dredging
  - circulation
  - hypolimnetic aeration
  - nutrient inactivation (alum treatment).
- Select management options to alleviate eutrophication, considering:
  - technical feasibility
  - expected water quality or recreational improvements
  - longevity
  - cost-effectiveness
  - permitting issues
- For recommended option, develop specifications, permits and detailed cost estimates

---



ENSR | AECOM

Lovers Lake and Stillwater Pond Characteristics

Table 2-1. Characteristics of Lovers Lake and Stillwater Pond, Chatham, MA

	Lovers Lake	Stillwater Pond
Lake Surface Area (SA)(ac	37.7	18.7
Mean depth (ft)	15.1	21.8
Maximum depth (ft)	36	51
Lake Classification	Temperate dimictic	Temperate dimictic
Watershed area (WA) without lake (ac)	86.3	128.3
WA:SA Ratio	2.3	6.9
Hydrologic Connections	Stillwater Pond and formerly Frost Fish Creek	Lovers Lake and Ryders Cove
Recreational Uses	Swimming, boating, fishing	Swimming, boating, fishing

ENSR | AECOM

Lovers Lake / Stillwater Pond Watershed Characteristics

ENSR | AECOM

Lovers Lake / Stillwater Pond Watershed Characteristics

Lovers Lake	Current Conditions				Build-out Conditions			
LAND USE CATEGORY	Area in Watershed (ha)	% Watershed Area	Area in 300 ft Buffer (ha)	% Area in Buffer	Area in Watershed (ha)	% Watershed Area	Area in 300 ft Buffer (ha)	% Area in Buffer
Residential	13.81	39	8.68	61	15.92	45	8.98	63
Roads	2.69	8	0.96	7	2.69	8	0.96	7
Open Land	2.20	6	0.00	0	2.14	6	0	0
Cranberry Bog	1.65	5	0.00	0	1.65	5	0	0
Forest	12.08	34	4.66	33	10.04	28	4.36	30
Water/Wetlands	3.20	9	0.00	0	3.20	9	0	0
# of Residences	62		40		66		41	
Total	**35.64**		**14.29**		**35.64**		**14.29**	

Stillwater Pond	Current Conditions				Build-out Conditions			
LAND USE CATEGORY	Area in Watershed (ha)	% Watershed Area	Area in 300 ft Buffer (ha)	% Area in Buffer	Area in Watershed (ha)	% Watershed Area	Area in 300 ft Buffer (ha)	% Area in Buffer
Residential	17.77	34	3.16	57	18.66	36	3.16	57
Roads	3.71	7	0.94	17	3.71	7	0.94	17
Forest	28.77	55	1.41	26	27.22	52	0.74	13
Water/Wetlands	1.85	4	0	0	1.85	4	0.00	0
Municipal Developed	0.00	0	0	0	0.66	1	0.67	12
# of Residences	58		23		61		23	
Total	**52.10**		**5.50**		**52.10**		**5.50**	

ENSR | AECOM

Lovers Lake / Stillwater Pond Natural Habitat Mapping

ENSR | AECOM

Historic water quality in Lovers Lake and Stillwater Pond

LOVERS LAKE

- Surface total phosphorus (TP) levels about 38.9 ug/L; bottom TP is approximately 125 ug/L
- Secchi disk transparency (SDT) depth ranges from 1.5 to 5.6 ft
- Summer chlorophyll a ranges from 5.4 to 73.3 ug/L with average of 32,2 ug/L
- Anoxic conditions below 12-15 ft in late summer
- Water quality conditions are consistent with eutrophic classification

STILLWATER POND

- Surface total phosphorus (TP) levels about 25 ug/L; bottom TP is approximately 312 ug/L
- Secchi disk transparency (SDT) depth ranges from 2.2 to 10 ft
- Summer chlorophyll a ranges from 4.3 to 56.1 ug/L with average of 21.6 ug/L
- Anoxic conditions below 15-18 ft in late summer
- Water quality conditions are consistent with eutrophic classification

ENSR | AECOM

Fish Reported in Lovers Lake or Stillwater Pond

Common Name	Scientific Name
American eel	*Anguilla rostrata*
Chain pickerel	*Esox niger*
Smallmouth bass	*Micropterus dolomieui*
Largemouth bass	*Micropterus salmoides*
Yellow perch	*Perca flavescens*
White perch	*Morone americana*
Brown bullhead	*Ameiurus nebulosus*
Alewife	*Alosa spp.*
Bridle shiner	*Notropis bifrenatus*
Golden shiner	*Notemigonus crysoleucas*
Killifish	*Fundulus diaphanus*
Sticklebacks	*Gasterosteus spp.*

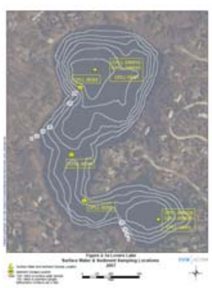
Lovers Lake and Stillwater Pond Herring (Alewife) Run

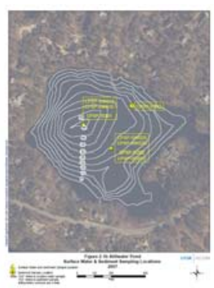
- Water levels maintained and released in 4 periods over year
- Alewife populations not well quantified locally or by MADFW
- Water level maintenance may:
  - improve WQ in early summer
  - impair WQ in mid-late summer
- Presence of alewife in SP may explain differences in SDT with LL in early summer
- Possible effect of alewife migration on nutrient dynamics

Field Measurements and Water Quality Sampling - 2007

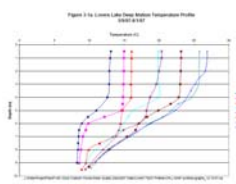
- Sixteen temperature and DO depth profiles taken from early May to December 2007
- Five water quality samples taken: 5/9/07; 6/5/07; 7/3/07; 8/2/07; and 8/30/07
- Water Quality Parameters:
  - Nutrients: TP, DP, NO_3-N, NO_2-N, NH_3-N, TKN
  - General: pH, alkalinity, hardness, TSS
  - Other: Cl, Fe, SO_4
- Secchi Disk Transparency depth

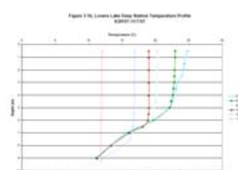
Lovers Lake and Stillwater Pond 2007 Survey Locations



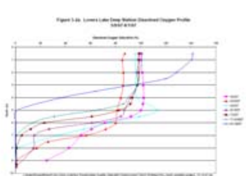


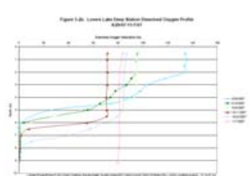
Lovers Lake Thermal Profiles: May – November 2007



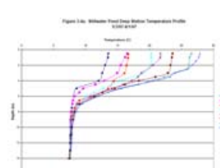


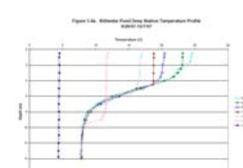
Lovers Lake DO Profiles: May – November 2007





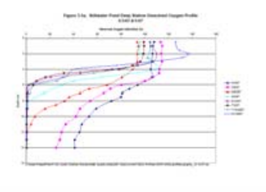
Stillwater Pond Thermal Profiles: May – December 2007

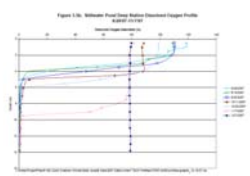




ENSR | AECOM

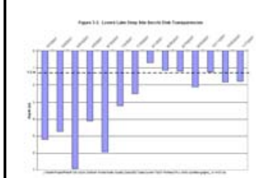
Stillwater Pond DO Profiles: May – December 2007

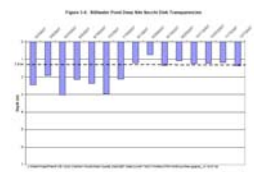




ENSR | AECOM

Lovers Lake and Stillwater Pond SDT depths - 2007





ENSR | AECOM

2007 water quality in Lovers Lake and Stillwater Pond

LOVERS LAKE

- Surface total phosphorus (TP) levels range from 32-38 ug/L; bottom TP averaged 64 ug/L
- Secchi disk transparency (SDT) depth ranges from 1.1 to 5.9 m; average of 3 m
- Modeled summer chlorophyll a estimated at 17 ug/L
- Anoxic conditions below 4-4.5 m in late summer
- Water quality conditions are consistent with eutrophic classification

STILLWATER POND

- Surface total phosphorus (TP) levels range from 40-43 ug/L; bottom TP averaged 288 ug/L
- Secchi disk transparency (SDT) depth ranges from 1.1 to 3 m
- Modeled summer chlorophyll a estimated at 18 ug/L
- Anoxic conditions below 5-6 m in late summer
- Water quality conditions are consistent with eutrophic classification

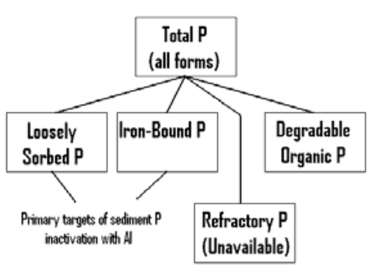
ENSR | AECOM

Lovers Lake & Stillwater Pond Sediment Characterization

- Collected 5 LL sediment samples and 3 SP sediment samples at various locations and depths within the basins
- Selectively sampled the top 6" and sent to analytical laboratory (Spectrum)
- Analyzed for grain size, % solids, iron, aluminum, and various phosphorus fractions
- Will be further tested for alum dose determination

ENSR | AECOM

Available Sediment Phosphorus Determination



ENSR | AECOM

Lovers Lake and Stillwater Pond Sediment Data

2007 Lovers Lake Sediment Data

Station	% Solids	Iron (mg/kg)	Total Phosphorus (mg/kg)	Iron Bound Phosphorus (mg/kg)	Loosely Sorbed Phosphorus (mg/kg)	Total Available Phosphorus (mg/kg)*	Minimum Available Phosphorus (g/m2)**	Maximum Available Phosphorus (g/m2)**
CPLL-SD-01	14.7	88,200	3,260	1810.0	BRL	1,811	43.5	86.9
CPLL-SD-02	15.5	123,000	6,360	1490.0	BRL	1,491	35.8	71.5
CPLL-SD-03	17.0	71,700	3,520	1380.0	BRL	1,381	33.1	66.3
CPLL-SD-04	28.9	31,700	587	116.0	BRL	117	2.8	5.6
CPLL-SD-05	13.8	68,700	2,740	1750.0	5.26	1,755	42.1	84.3

2007 Stillwater Pond Sediment Data

Station	% Solids	Iron (mg/kg)	Total Phosphorus (mg/kg)	Iron Bound Phosphorus (mg/kg)	Loosely Sorbed Phosphorus (mg/kg)	Total Available Phosphorus (mg/kg)*	Minimum Available Phosphorus (g/m2)**	Maximum Available Phosphorus (g/m2)**
CPSP-SD-01	11.1	65,300	4060.0	1,490	3.79	1494	35.9	71.7
CPSP-SD-02	19.3	43,100	976.0	179	BRL	180	4.3	8.6
CPSP-SD-02D	23.0	38,900	919.0	219	BRL	220	5.3	10.5
CPSP-SD-03	12.8	38,100	1570.0	1,070	BRL	1071	25.7	51.4

BRL- Below Reporting Limit

* = Reporting limits ranged from 0.8 to 2.26 mg/kg depending on the solids content. For purposes of calculation, a RL = 1.5 mg/kg was assumed with 1/2 RL (0.5 mg/kg) used to estimate LSP concentration.

** = Minimum available P based on active contributing sediment depth of 1 cm, maximum P based on a 4 cm depth.

Lovers Lake Hydrologic Budget

Input Source	Water (Million ft^3/yr)	% of Total water
Groundwater in-seepage	8.46	55
Direct Precipitation	6.06	39
Riparian Zone Runoff	0.76	5
Septic Discharge	0.13	1
Total	15.41	100
Output Source		
Surface Water Outflow	13.9	78
Evaporation	3.83	22
Groundwater Out-seepage	0	0
Total	17.7	100

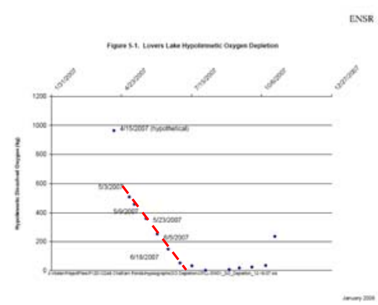
Stillwater Pond Hydrologic Budget

Input Source	Water (Million ft^3/yr)	% of Total water
Surface Water Tributary	13.9	60
Groundwater in-seepage	5.82	25
Direct Precipitation	3.01	13
Riparian Zone Runoff	0.41	2
Septic Discharge	0.07	≤1
Total	23.2	100
Output Source		
Surface Water Outflow	11	48
Evaporation	1.9	8
Groundwater Out-seepage	10.3	44
Total	23.2	100

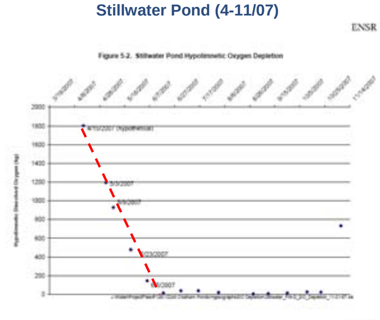
Herring Run – Water Elevation Changes

- **Stage 1 Early Fall – Early Winter** – free-flowing (juvenile alewife leave ponds) condition during period of moderate precipitation and slowly increasing groundwater tables. Ponds are fully mixing and entire two pond system is well flushed;
- **Stage 2. Early Winter – Early Spring** – storage of water during period of high precipitation and elevated groundwater tables. Ponds fully mixing but warming;
- **Stage 3. Early Spring – Mid-Summer** – free flowing conditions (adult alewife enter, spawn and leave), groundwater tables peak and begin to decline. Ponds stratify over this period; and
- **Stage 4. Mid-Summer – Early Fall** – storage of water during period of high evapotranspiration, groundwater tables are declining; recharge of groundwater maximized. Ponds well-stratified over this period; but eventually turnover and the system returns to Stage 1.

Hypolimnetic Oxygen Depletion Trends Lovers Lake (4-10/07)



Hypolimnetic Oxygen Depletion Trends Stillwater Pond (4-11/07)



Estimating Potential Phosphorus Inputs

- Watershed
  - Overland Flow (Runoff)
  - Groundwater Flow
- Other Potential Sources
  - Atmospheric
  - Water Fowl
  - Septic System
  - Internal Phosphorus Recycling

Overland Flow Watershed Phosphorus Load

- Estimated Watershed inputs using ShedMod – a Land Use Export Coefficient model developed by ENSR
- Calculated current land use areas in 300 ft buffer zone
- Multiplied each land use by reference runoff coefficient (Reckhow et al. 1980)
- Will consider potential implications of future build-out scenarios

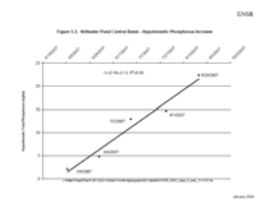
Groundwater Phosphorus Load

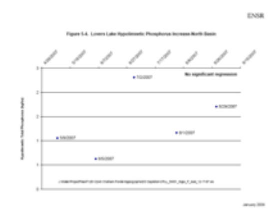
- Calculated land use areas within entire watershed
- Multiplied each land use by reference runoff coefficient (Reckhow et al. 1980)
- Will consider potential implications of future build-out scenarios

Additional TP Inputs

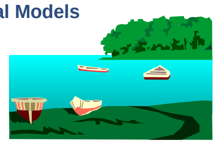
- Atmospheric
  - Lake Area X Reference Coefficient
- Waterfowl
  - Number of "bird-years" X Reference Coefficient
- Septic System
  - Number of households in 300 ft buffer X Reference Coefficient
- Internal Loading
  - Mass Balance Approach

Internal Phosphorus Regeneration Rate Calculations





Use of In-lake Empirical Models



- Inputs
  - Total Phosphorus Load
  - Hydrologic Inputs
  - Various in-lake processes
    - Phosphorus retention and settling
    - Lake flushing rates
- Output
  - Predicted In-lake Phosphorus and Chlorophyll Concentrations and Secchi Disk Depths
  - Also used to estimate internal loading when other TP sources are accounted for

Lovers Lake Phosphorus Budget

Input Source	TP Load (kg/yr)	% of TP
Atmospheric	3.8	9
Internal Recycling	18.3	43
Waterfowl	4	9
Septic Systems	4.6	11
Watershed GW Load	0.3	1
Watershed Runoff Load	11.5	27
Total	42.5	100
Output Source		
Surface Water Outflow	15	35
Out-seepage (assumed)	0	0
Storage	27.5	65
Total	42.5	100

ENSR | AECOM

Stillwater Pond Phosphorus Budget

Input Source	TP Load (kg/yr)	% of TP
Tributary (LL outlet)	**15**	**31**
Internal Recycling	**27**	**55**
Atmospheric	**1.9**	**4**
Waterfowl	**2**	**4**
Septic Systems	**2.6**	**5**
Watershed GW Load	**0.002**	**<0.01**
Watershed Runoff Load	**0.4**	**1**
Total	**48.5**	**100**
Output Source		
Surface Water Outflow	**15**	**26**
Out-seepage (assumed)	**0**	**0**
Storage	**27.5**	**74**
Total	**48.5**	**100**

ENSR | AECOM

Selection of the appropriate pond restoration method requires clearly-defined objectives

- What are current uses of pond and the desired endpoints.
  - Boating, swimming, fishing
  - Other types of uses ?
- What level of water quality improvement is needed to:
  - improve aesthetic appearance ?
  - meet all water quality standards
  - promote ecological health or biological diversity ?
  - enhance recreation ?
- How we will measure success ?
  - Increase SDT to allow swimming all summer ?
  - Decrease number and frequency of algal blooms ?
  - Property values increase ?

ENSR | AECOM

Lovers Lake Trophic State & Restoration Objectives

Description	Total P Load (kg/yr)	Mean In-lake P (ug/L)	Mean In-lake chl a (ug/L)	Mean SDT (m)	Probability of bloom> 10 ug/L (%)
Observed Conditions (2007):	-	38.0	-	3.0	-
Current Modeled Conditions:	42.5	38.2	17.1	1.4	79.5
Build-out Conditions	42.8	38.5	17.3	1.4	80.0
Hypothetical Critical Load:	53.0	46.4	21.9	1.2	90.7
Modeled Permissible Load:	26.0	23.4	9.1	2.1	33.3
Modeled CCC Criteria:	11.0	9.9	2.9	4.0	0.3

ENSR | AECOM

Stillwater Pond Trophic State & Restoration Objectives

Description	Total P Load (kg/yr)	Mean In-lake P (ug/L)	Mean In-lake chl a (ug/L)	Mean SDT (m)	Probability of bloom> 10 ug/L (%)
Observed Conditions (2007):	-	40.0	-	1.8	-
Current Modeled Conditions:	48.5	40.4	18.4	1.4	83.3
Build-out Conditions:	48.8	40.4	18.4	1.4	83.4
Hypothetical Critical Load:	44.0	36.9	16.4	1.5	76.9
Modeled Permissible Load:	22.0	18.4	6.7	2.5	14.5
Modeled CCC Criteria:	12.0	10.0	3.0	3.9	0.4

ENSR | AECOM

Evaluation of Potential Pond Treatment Options

- Justification of candidate management options not selected documented in report
- Most rejected because they do not address internal recycling of phosphorus from sediments
- Candidate management options
  - **Dredging**
  - **Artificial Circulation**
  - **Hypolimnetic Aeration**
  - **Nutrient Inactivation**
- Watershed best management practices (BMPs) and riparian zone management also appropriate

ENSR | AECOM

Dredging

Dredging of Lovers Lake or Stillwater Pond

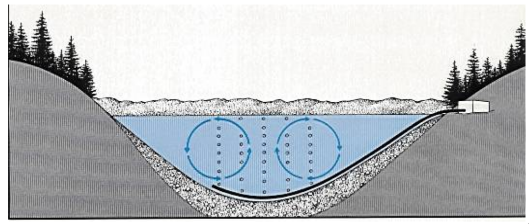
- Removal of top layer (2 ft) of nutrient rich sediments > 20 ft
  - Lovers Lake – 32,850 CY
  - Stillwater Pond – 28,500 CY
- Optimistic estimate of 50% reduction in internal P recycling; would reduce TP budgets by 26-28%
- Would require additional testing of deeper sediments to make sure clean layer underneath
- Increase volume of the ponds; greater hypolimnetic zone

Applicability of Method to Lovers Lake and Stillwater Pond

- Technically very difficult due to:
  - depth of sediments involved
  - would require clam-shell type dredge and workbarge(s)
- No easy location for dredged material dewatering and final disposal concerns
- Extensive permitting involved, timing of activity to avoid the herring run
- Preliminary cost estimate of $1.45M
- Method not recommended for LL or SP

Artificial Circulation

Lake is mixed, top to bottom, input of oxygen comes from bubbles and interaction with lake surface



Applicability of Method to Lovers Lake and Stillwater Pond

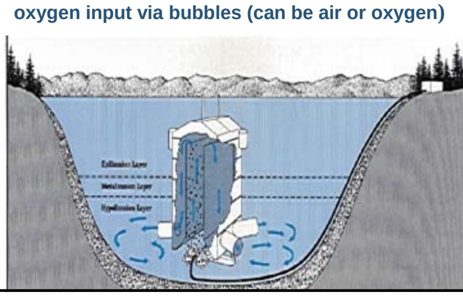
- Pumping and release of compressed air into bottom waters to keep entire waterbody circulating during summer
  - Counteracts DO demand and reduces/eliminates anoxia of bottom waters (>1.3 ft^3 /min/ acre);
  - Both Ponds contain sufficient iron to bind phosphorus when aerated; reduces internal P loading by est. 60%
  - Increases the amount of habitat by increase [DO] at depth
  - Tends to discourage development of BGA blooms
- Involves installation of a shore-based compressor and extension of piping into each of the deep basins (LL-2; SP-1)
- Small capital costs but annual Operation and Maintenance costs. System effective as long as the aeration continues

Applicability of Method to Lovers Lake and Stillwater Pond

- Artificial circulation more conducive for Lovers Lake due
  - less stable thermocline, more anoxia in shallower depths
  - relative Osgood Index suggests better vertical transport
- Estimated internal P reduction conservatively at 60% and should also reduce BGA blooms in LL
- Estimated cost for 15 years of operation in LL is $180,000
- Permitting should be relatively simple (NOI, Chapt.91)
- Potential concerns
  - need two locations (installation of pads) near basins
  - electrical power access (3-phase voltage) and noise/aesthetic issues
  - price of electricity in future and difficulty of annual funding

Hypolimnetic Aeration:

Bottom layer is aerated, but top layer is unaffected; oxygen input via bubbles (can be air or oxygen)



Applicability of Method to Lovers Lake and Stillwater Pond

- Pumping and release of compressed air into hypolimnion
  - Puts oxygenated layer to reduce benthic phosphorus release; reduces internal P loading by est. 70% (both ponds have good [Fe])
  - Increases the amount of habitat by increase [DO] at depth
- Involves installation of a shore-based compressor and large (16-20 ft tall) anchored device at bottom of pond
- Submerged device does not impact pond aesthetics
- Small capital costs but annual Operation and Maintenance costs. System effective as long as the aeration continues

ENSR | AECOM

Applicability of Method to Lovers Lake and Stillwater Pond

– Hypolimnetic aeration more conducive for Stillwater due
  - very stable thermocline; has little chance of destratification
  - deep hypolimnion (allows DO transfer) in single basin
– Estimated internal P reduction conservatively at 70%
– Estimated cost for 15 years of operation in LL is $165,000
– Permitting should be relatively simple (NOI, Chapt.91)
– Potential concerns
  - location with access to 3-phase voltage and noise/aesthetic issues;
  - access for installation of big device; higher annual maintenance
  - price of electricity in future and difficulty of annual funding

ENSR | AECOM

Nutrient Inactivation

Alum Application

– Application of an alum-sodium aluminate mixture (2:1)
– Has immediate reduction in water column TP, but longer effect is sharply reducing benthic recycling
– Has successfully and safely been conducted on ponds on Cape Cod with similar water chemistry
– Single application with no annual O&M costs; very good longevity
– Range of phosphorus reduction is 60-90%; ENSR estimated 75% for the two Ponds

ENSR | AECOM

Applicability of Method to Lovers Lake and Stillwater Pond

– Applicable to both ponds due to high sediment phosphorus
– Target deeper sediments: (LL > 4 m; SP > 6 m)
– Estimated cost for LL is $132,000; for SP is $82,000
– Permitting will be more involved (NHESP, MADFW) and there will be substantial monitoring
– Potential concerns
  - mobilization and operational access of big equipment;
  - treatment based on 2 doses of 50 g/m^2, additional sediment P may not be bound
  - cost of alum is rising and potential public concern over chemicals

ENSR | AECOM

Comparison of In-Pond Restoration Options – Lovers Lake

Feature	Artificial Circulation	Nutrient Inactivation
Capital costs (equipment site prep, installation, permit)	**$68,000**	**$122,500 - $141,000**
Operational Costs	**$6,900/yr**	**$0**
Maintenance Costs	**$500/yr**	**$0**
Total Costs / 15 years	**$180,000**	**$132,000**
Area of Pond Treated	**37.7 acres (100%)**	**19 acres (51%)**
Internal P load reduction	**60%**	**60-90%**
Hypolimnetic DO Increase	**2-7 mg/L**	**0-4 mg/L**
Potential toxicity	**None**	**Possible short-term Al^{++} toxicity if pH is < 6 or >8**

ENSR | AECOM

Comparison of In-Pond Restoration Options – Stillwater

Feature	Hypolimnetic Aeration	Nutrient Inactivation
Capital costs (equipment site prep, installation, permit)	**$68,000**	**$78,900 - $87500**
Operational Costs	**$3,500/yr**	**$0**
Maintenance Costs	**$1,500/yr**	**$0**
Total Costs / 15 years	**$165,000**	**$82,000**
Area of Pond Treated	**9.25 acres (52%)**	**9.25 acres (52%)**
Internal P load reduction	**70%**	**60-90%**
Hypolimnetic DO Increase	**2-6 mg/L**	**0-4 mg/L**
Potential toxicity	**None**	**Possible short-term Al^{++} toxicity if pH is < 6 or >8**

ENSR | AECOM

Watershed-Based Phosphorus Load Reduction Options

– Town
  - Land Use Conversion
  - Zoning and Land Use Planning
  - Bank and Slope Stabilization
– Buffer Zone residents behavorial modifications
  - Shoreline Buffer Strips (Chatham requires a 50 ft "No Disturb Zone" and regulates up to 100 ft)
  - Waste water management (non-P detergents, pumping & maintain.)
  - Waterfowl Control (feeding of wild waterfowl is prohibited by the Chatham Board of Health under its Animal Regulation. Section 11)
– Effectiveness of TP reductions
  - Institution of BMPs and good practices can lead to 60% reduction
  - Septic system reduction may be on order of 50%
– Small TP load reduction possible but still important

ENSR | AECOM

Review of Potential Pond Restoration Options for LL/SP

#	Category	Specific Restoration Tasks	Est. ($)	Rationale for Selection
1	No-Action	No in-pond restoration	$0	Current conditions. Good chance of future degradation. Watershed BMPs included.
2	Maintenance Approach	LL: Install Artificial Circulation SP: No in-pond restoration	$180,000	Destratification in LL least costly means of reducing internal P recycling. Pond still provide but less BGA. Watershed BMPs included.
3a	Phased Approach Alternative 1	LL: Hypolimnetic alum treatment w/ monitoring SP: Hypolimnetic alum treatment w/ monitoring	$214,000	Large reduction in internal P recycling with significant improvements in DO and SDT. Possible 2-3 year delay in application of alum to SP depending on LL response. Watershed BMPs included.

ENSR | AECOM

Review of Potential Pond Restoration Options for LL/SP

#	Category	Specific Restoration Tasks	Est. ($)	Rationale for Selection
3b	Phased Approach Alternative 2	LL: Pond alum treatment w/ monitoring SP: Delayed (3 yr) installation of hypolimnetic aeration	$297,000	Large reduction in internal P recycling with significant improvements in DO and SDT. Possible 2-3 year delay in application of hypolimnetic aerator to SP depending on LL response. Watershed BMPs included.
4	Aggressive Approach	LL: Pond alum treatment w/ monitoring and installation of Artificial Circulation SP: Hypolimnetic alum treatment w/ monitoring	$474,000	Large reduction in internal P recycling with significant improvements in DO and SDT. Destratification in LL to maintain oxic conditions, maintain export of good water quality to SP. Watershed BMPs included.

ENSR | AECOM

Lovers Lake Restoration Option Phosphorus Reduction

	Current Conditions	Option #2		Option #3a		Option #3b		Option #4	
Phosphorus Inputs	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)
ATMOSPHERIC	3.8	0	3.8	0	3.8	0	3.8	0	3.8
INTERNAL	18.3	60	7.3	75	4.6	75	4.6	90	1.8
WATERFOWL	4.0	0	4.0	0	4.0	0	4.0	0	4.0
SEPTIC SYSTEM	4.6	50	2.3	50	2.3	50	2.3	50	2.3
GROUNDWATER LOAD	0.3	0	0.3	0	0.3	0	0.3	0	0.3
WATERSHED RUNOFF	11.5	60	4.6	60	4.6	60	4.6	60	4.6
TP Total Load:	42.5		22.3		19.6		19.6		16.8

ENSR | AECOM

Stillwater Pond Restoration Option Phosphorus Reduction

	Current Conditions	Option #2		Option# 3a		Option #3b		Option #4	
Phosphorus Inputs	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)	% TP Reduct.	TP Load (kg/yr)
ATMOSPHERIC	1.9	0	1.9	0	1.9	0	1.9	0	1.9
INTERNAL	26.6	0	26.6	75	6.7	70	8.0	75	6.7
WATERFOWL	2.0	0	2.0	0	2.0	0	2.0	0	2.0
SEPTIC SYSTEM	2.6	50	1.3	50	1.3	50	1.3	50	1.3
INLET (FROM LL)	15.0	48	7.9	54	6.9	54	6.9	60	5.9
GROUNDWATER LOAD	<0.01	0	<0.01	0	<0.01	0	<0.01	0	<0.01
WATERSHED RUNOFF	0.4	60	0.2	60	0.2	60	0.2	60	0.2
TP Total Load:	48.5		39.8		18.9		20.2		17.9

ENSR | AECOM

Lovers Lake Trophic Conditions after Restoration

Description	Total P Load (kg/yr)	Mean In-lake P (ug/L)	Mean In-lake chl a (ug/L)	Mean SDT (m)
Scenario 1: Current Modeled Conditions:	42.5	38.2	17.1	1.4
Modeled Permissible Load:	26.0	23.4	9.1	2.1
Modeled with Town Sewering:	38.0	34.0	15.0	1.6
Option #2	22.3	21.5	8.2	2.2
Option #3a	19.6	19.1	7.0	2.4
Option #3b	19.6	19.1	7.0	2.4
Option #4	16.8	16.5	5.8	2.7

ENSR | AECOM

Stillwater Pond Trophic Conditions after Restoration

Description	Total P Load (kg/yr)	Mean In-lake P (ug/L)	Mean In-lake chl a (ug/L)	Mean SDT (m)
Scenario 1: Current Modeled Conditions:	48.5	40.0	18.0	1.4
Modeled Permissible Load:	22.0	18.4	6.7	2.5
Modeled with Town Sewering:	46.0	38.0	17.2	1.4
Option #2	39.8	33.1	14.3	1.6
Option #3a	18.9	15.7	5.4	2.8
Option #3b	20.2	16.8	5.9	2.7
Option #4	17.9	14.9	5.1	2.9

ENSR | AECOM

Recommended Pond Restoration Option for LL/SP

#	Category	Specific Restoration Tasks	Est. ($)
1	No-Action	No in-pond restoration	$0
2	Maintenance Approach	LL: Install Artificial Circulation SP: No in-pond restoration	$180,000
3a	Phased Approach Alternative 1	LL: Hypolimnetic alum treatment w/ monitoring SP: Hypolimnetic alum treatment w/ monitoring	$214,000
3b	Phased Approach Alternative 2	LL: Pond alum treatment w/ monitoring SP: Delayed (3 yr) installation of hypolimnetic aeration	$297,000
4	Aggressive Approach	LL: Pond alum treatment w/ monitoring and installation of Artificial Circulation SP: Hypolimnetic alum treatment w/ monitoring	$474,000

ENSR | AECOM

Why was Recommended Restoration Option selected ?

- Provides sufficient phosphorus reduction to shift the Ponds from eutrophic state and create significant long-term improvement in water and recreational quality
- Improves fishery habitat in ponds with viable herring run
- It is a safe and highly effective pond management option if correctly designed and tightly monitored
- Addresses both Lovers Lake and Stillwater Pond
- One season application without residual annual O&M costs
- No in-pond equipment w/ possible impairment of recreation
- Is cost-effective relative to the amount of additional P reduction produced by options with greater cost

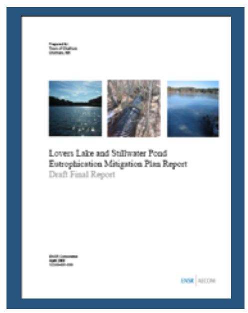
ENSR | AECOM

Potential funding sources for pond restoration

- Pond restoration is imperative to improve the water quality and recreational usage of Lovers Lake and Stillwater Pond, but such activities are expensive and may be beyond the resources of the Town and local stakeholders.
- Therefore, potential funding sources for pond restoration were identified, including:
  - Town Budget;
  - Legislative Budget funding
  - MA DCR Water Quality Grants;
  - Clean Water Act Section 319 Watershed Grants;
  - Coastal Zone Management Grants; and
  - Other grants or funding sources.

ENSR | AECOM

Draft Final Report available at Town of Chatham website:



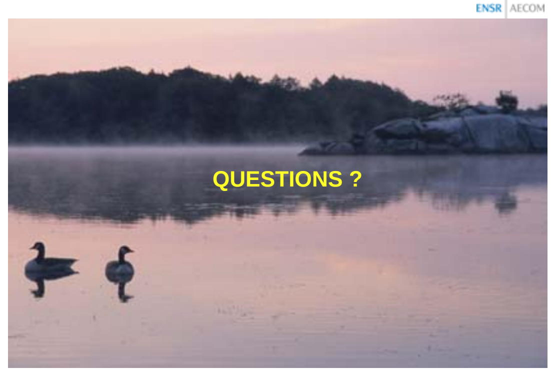
- Draft final report of Lovers Lake and Stillwater Pond Eutrophication Mitigation Plan Report available at:
  - http://www.chatham-ma.gov/Public_Documents/ChathamMA_Health/LoversStillwater/Table%20of%20Contents%20LL-SP
- Public comments are welcome
  - Public comments should be received by May 2nd 2008
  - Comments should be directed to CDH&E (Robert Duncanson) at: [rduncanson@chatham-ma.gov]

ENSR | AECOM

Next Steps in Eutrophication Mitigation Plan

- Town selects its preferred Pond Restoration option(s)
- ENSR to prepare implementation plan and specifications. The plan will include background information, equipment and materials needed, "construction" sequencing, environmental controls, permit needs, a monitoring plan, and refined cost estimates for implementation.
- ENSR will prepare information for Town needed for WPA NOI permitting and other applicable permits.

ENSR | AECOM



Town of Chatham

Department of
Health and Environment

Health *Water Quality Laboratory* *Conservation*
(508) 945-5165 (508) 945-5188 (508) 945-5164
TOWN ANNEX 261 GEORGE RYDER ROAD CHATHAM, MA 02633
FAX (508) 945-5163

May 15, 2008

Dave Mitchell, Ph.D.
ENSR
2 Technology Park Drive
Westford, MA 01886-3140

RE: Lovers Lake and Stillwater Pond Eutrophication Mitigation Plan

Dave
Dear ~~Dr. Mitchell~~:

This letter is to confirm our recent conversation regarding the above referenced project. As we discussed the Town did not receive any comments during the public comment review period on the Draft Report. You are, therefore, authorized to finalize and produce the Final Report.

The Town of Chatham has also determined that nutrient inactivation (alum) is the chosen mitigation alternative for Lovers Lake and Stillwater Pond. Based on the consensus of the community the Town desires to move forward with Phase II, development of the Alum Treatment Implementation Plan and requisite permitting for both Lovers Lake and Stillwater Pond. As mentioned Chatham Town Meeting has appropriate supplemental funding for the treatment.

If you have any questions I can be reached at (508) 945-5165, ext. 483, Monday through Friday from 8 am to 4 pm.

Sincerely,

Bob

Robert A. Duncanson, Ph.D.
Director of Health & Environment

Cc: Lovers Lake/Stillwater Pond Working Group

C:\Documents and Settings\rduncanson\My Documents\Freshwater Ponds\Lovers-Stillwater RFP\Phase II NTP 05-15-08.doc