

# ROGERS LAKE

## WEED CONTROL PROJECT

LYME & OLD LYME, CT

27 APRIL 2015



# PROJECT TEAM

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- Scott Fisher
  - New England Environmental, Inc.
- Mark June-Wells
  - Aquatic Ecosystem Research
- John Hankins
  - Fuss & O'Neill, Inc.
- Debbie Listernick
  - O'Reilly, Talbot & Okun Associates



# SCOPE OF WORK

1. Assessment/Review of Documented Rogers Lake Information
2. Meetings
3. Plant Survey
4. Development of Water Quality Monitoring Protocol
5. Domestic Well Impact Evaluation
6. Herbicide Permitting
7. Herbicide Impact Assessment on Human Health
8. Wildlife Impact Evaluation
9. Non-Chemical/Chemical Vegetative Control Assessment/Options
10. Development of Management Plans



# OVERVIEW

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- Plant Study
- Management Options
- Herbicide Impact Assessment on Human Health
- Domestic Well Impact Evaluation
- Conclusion: Proposed Management Option



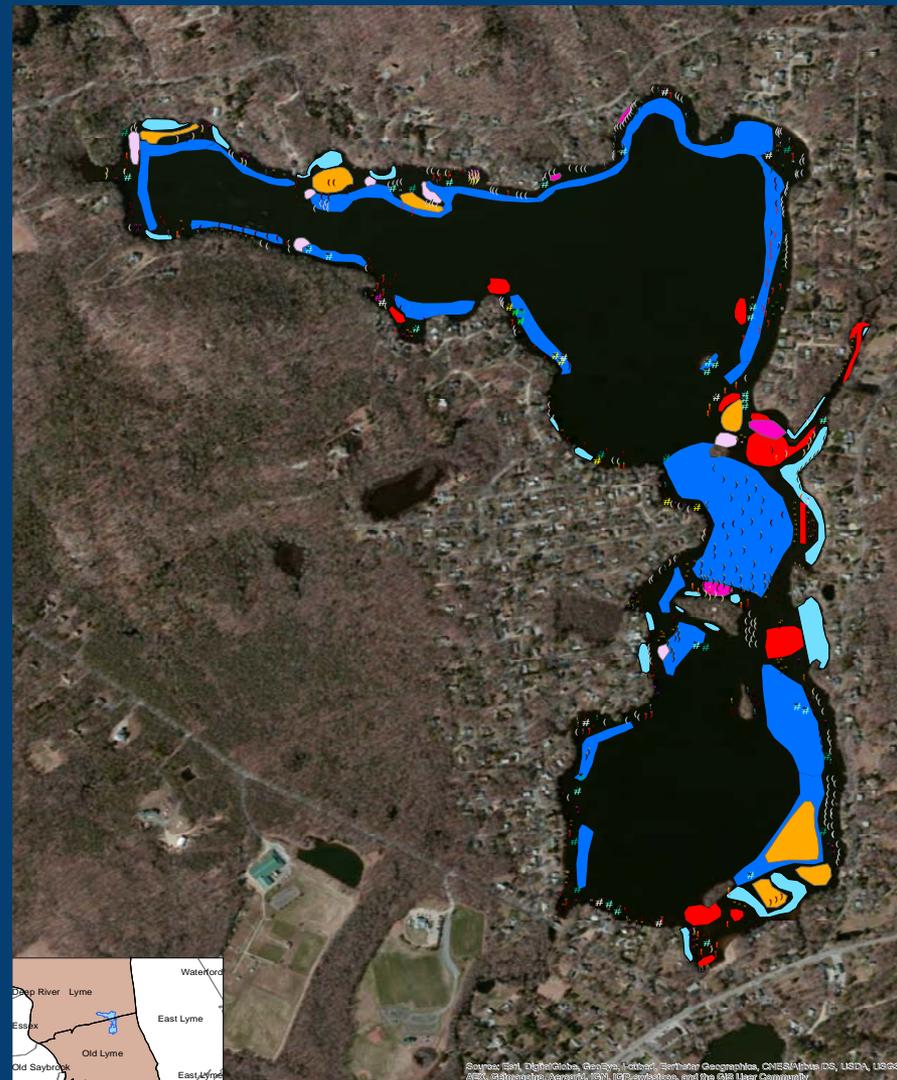
# QUANTITATIVE & QUALITATIVE PLANT STUDY



# QUALITATIVE FINDINGS

## Rogers Lake Aquatic Plant Species Inventory

*Brasenia schreberi*  
*Cabomba caroliniana*  
*Ceratophyllum demersum*  
*Elatine minima*  
*Eleocharis acicularis*  
*Elodea nuttallii*  
*Gratiolia aurea*  
*Lobelia dortmana*  
*Ludwigia lacustris*  
*Myriophyllum heterophyllum*  
*Najas flexilis*  
*Najas guadalupensis*  
*Nuphar variegata*  
*Nymphaea odorata*  
*Pontederia cordata*  
*Potamogeton amplifolius*  
*Potamogeton epihydrus*  
*Potamogeton natans*  
*Potamogeton robbinsii*  
*Sagittaria graminea*  
*Sparganium spp.*  
*Utricularia geminiscapa*  
*Utricularia gibba*  
*Utricularia macrorhiza*  
*Utricularia purpurea*  
*Utricularia radiata*  
*Vallisneria americana*

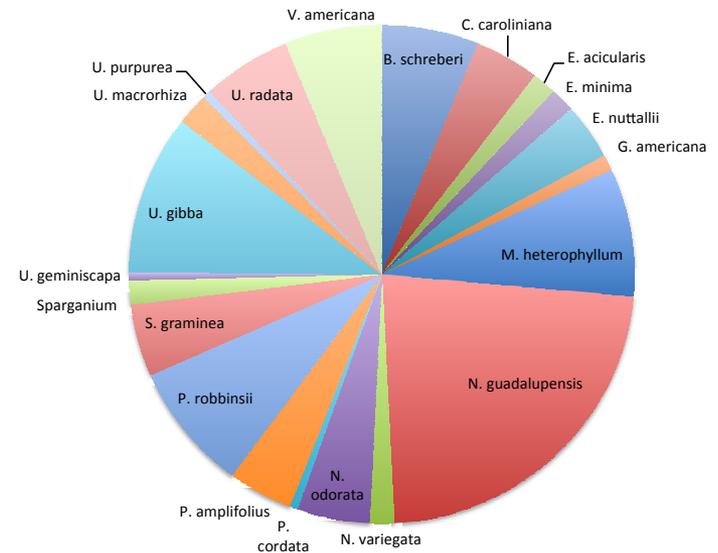


# QUANTITATIVE FINDINGS

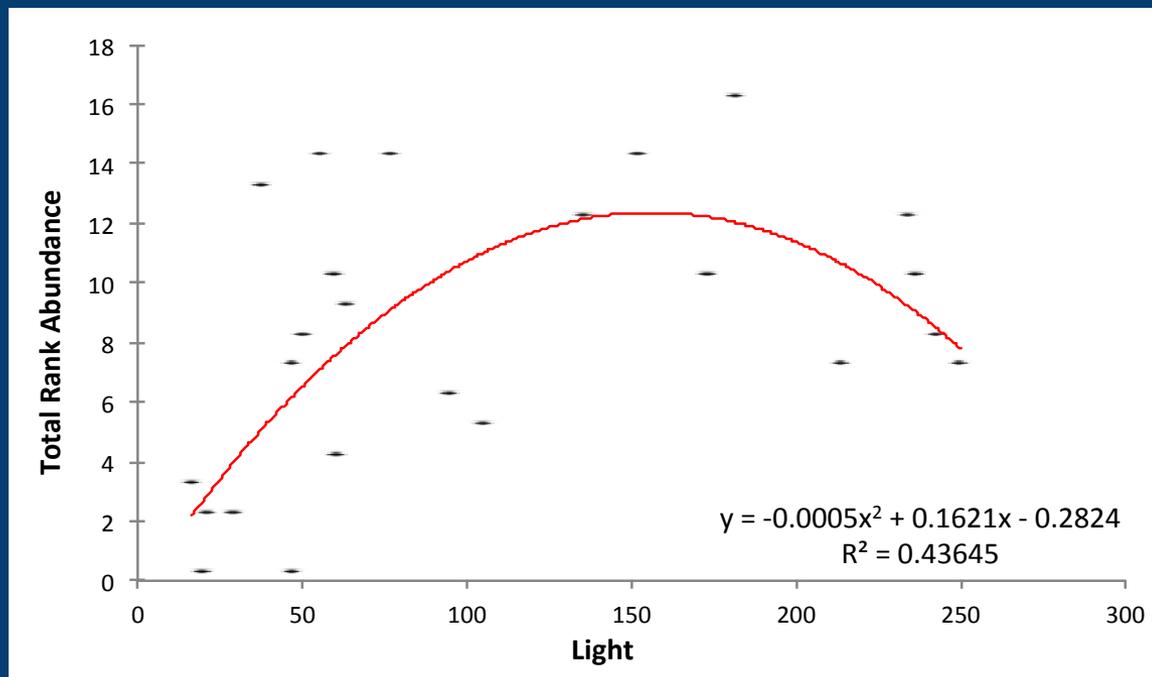
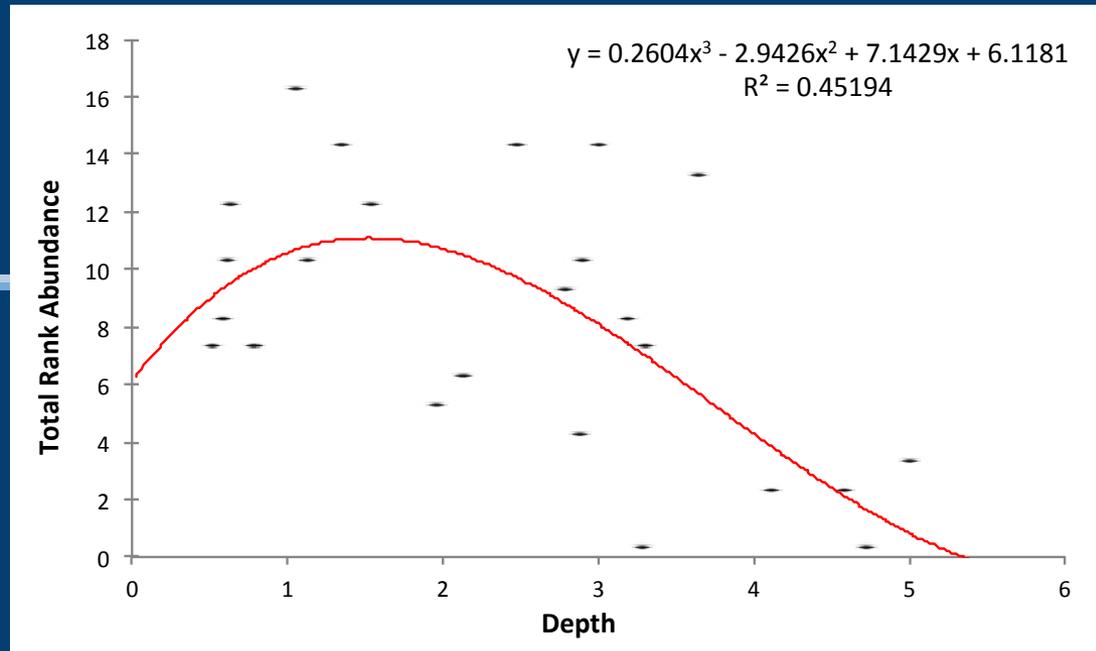
**Rogers Lake Aquatic Plant Community Composition**

Species	Percent of Community
<i>Brasenia schreberi</i>	6.22
<i>Cabomba caroliniana</i>	4.15
<i>Eleocharis acicularis</i>	1.55
<i>Elatine minima</i>	1.55
<i>Elodea nuttallii</i>	3.63
<i>Gratiola aurea</i>	1.04
<i>Myriophyllum heterophyllum</i>	8.29
<i>Najas guadalupensis</i>	22.80
<i>Nuphar variegata</i>	1.55
<i>Nymphaea odorata</i>	4.66
<i>Pontederia cordata</i>	0.52
<i>Potamogeton amplifolius</i>	4.15
<i>Potamogeton robbinsii</i>	8.29
<i>Sagittaria graminea</i>	4.66
<i>Sparganium spp.</i>	1.55
<i>Utricularia geminiscapa</i>	0.52
<i>Utricularia gibba</i>	10.36
<i>Utricularia macrorhiza</i>	2.07
<i>Utricularia purpurea</i>	0.52
<i>Utricularia radiata</i>	5.70
<i>Vallisneria americana</i>	6.22

**Composition of Rogers Lake Plant Community**



# QUALITATIVE FINDINGS



# NON-NATIVE SPECIES DISTRIBUTION

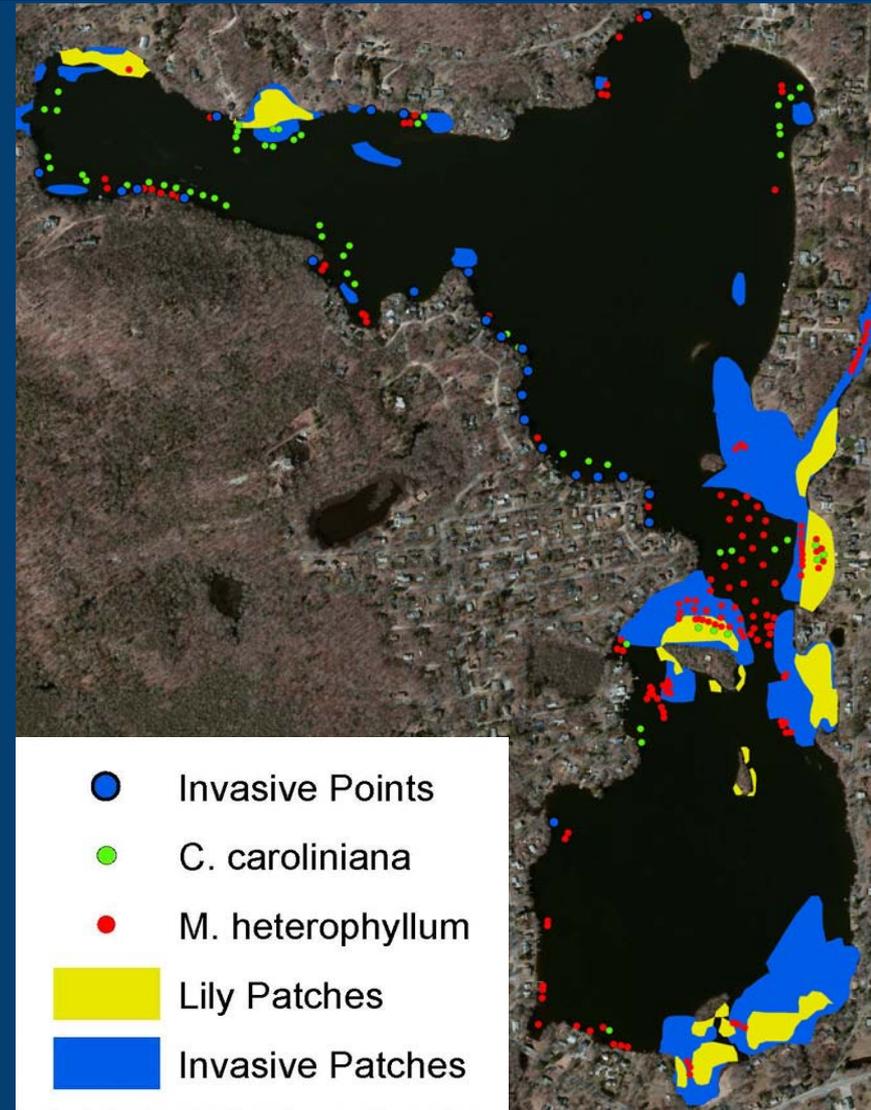
Two Species:

- *C. caroliniana*
- *M. heterophyllum*

They tend to comingle

Littoral Zone:

- 94.1 acres
  - 36% of the waterbody
- 32% of the 94.1 acres contains non-native species
  - 30.5 acres





# INVASIVE SPECIES MANAGEMENT OPTIONS

# MECHANICAL MANAGEMENT OPTIONS

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- Diver Assisted Suction Harvesting (DASH)
- Hand Pulling
- Harvesting
- Hydroraking
- Benthic Barrier/Shading
- Dredging



# DASH/HAND PULLING

## PROS

- High efficacy
  - Lilies
- No state permitting
  - May require local inland wetland permit
- No human health effects

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
    - (Fragmentation may increase density)*
- Not highly efficient
- Expensive
  - \$12,000 - \$15,000 per acre



# HARVESTING

## PROS

- Moderate efficacy
  - Lilies
- No state permitting
  - May require local inland wetland permit
- No human health effects
- Fairly Inexpensive
  - \$500 – \$2,500 per acre

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
  - (Fragmentation may increase density)*
- Previously attempted in Rogers Lake
  - Very unsuccessful



# HYDRORAKING

## PROS

- High efficacy
  - Lilies
- No state permitting
  - May require local inland wetland permit
- Efficient for lilies
- No human health effects

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
  - (Fragmentation may increase density)*
- Fairly Expensive
  - \$6,000 – \$8,000 per acre
  - \$175 per hour



# BENTHIC BARRIER/SHADING

## PROS

- Fair to High Efficacy
  - Integrated Management Plan
- No human health effects

## CONS

- Low Efficacy Alone
  - Variable Leaf Milfoil
  - Fanwort
  - Lilies
- Expensive
  - \$24,000 - \$54,000 per acre
- Extensive permitting
- Negatively effect natives
- Maintenance Level
  - Very High



# DREDGING

## PROS

- High efficacy
  - Lilies
- No human health effects

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Very inefficient
  - Extreme depths required
- Expensive
  - \$50,000 - \$75,000 per acre
- Will negatively effect natives
- Extensive permitting



# BIOLOGICAL MANAGEMENT OPTIONS

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- Grass Carp
- Milfoil Weevil



# GRASS CARP

## PROS

- Inexpensive
  - \$50 - \$300 per acre
- No human health effects

## CONS

- Low Efficacy
  - Lilies
  - Variable Leaf Milfoil
  - Fanwort
- Extensive Permitting
- Possibly spread fish disease to native fish
- Will eat natives first
- Very inefficient



# MILFOIL WEEVIL

## PROS

- No human health effects

## CONS

- Low Efficacy
  - Lilies
  - Variable Leaf Milfoil
  - Fanwort
- Expensive
  - \$6,000 - \$200,000 per year
  - No known stocking rates
- Unpredictable diet
  - May negatively effect natives
- Extensive Permitting
- Very inefficient
- Insufficient research



# CHEMICAL MANAGEMENT OPTIONS

- 2,4-D
- Carfentrazone
- Diquat
- Endothall
- Fluridone
- Flumioxazin
- Triclopyr



# 2,4-D

## PROS

- High Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Moderate Efficacy
  - Lilies
- Inexpensive
  - \$300-800 per acre

## CONS

- Cannot be applied near public water supplies
  - Public water supplies too close to Rogers Lake
- Extensive negative human health effects
- Half-Life: 13-40 days
- Resists decomposition
  - Persists in water for up to 4 years



# DIQUAT

## PROS

- High Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Inexpensive
  - \$320 per acre
- Non-toxic
  - Aquatic organisms
  - Not biologically active in water for long

## CONS

- Low Efficacy
  - Lily
- Half-Life: 2-210 days
- Very toxic
  - Skin contact
  - Juvenile fish
- Not effective
  - Dense vegetation
  - Turbid conditions
- Persistence in soil



# ENDOTHALL

## PROS

- Half-Life: 5-10 days
- Inexpensive
  - \$400 - \$700 per acre

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
  - Lilies
- Not permitted in public water supply watershed
- Very toxic
  - Aquatic Invertebrates
  - Fish



# TRICLOPYR

## PROS

- Fair Efficacy
  - Lilies
- Half-Life: 1-10 days
- Inexpensive
  - \$500 per acre

## CONS

- Low Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Non-Selective
- Possible Groundwater Contamination
  - Possibly toxic to humans



# CARFENTRAZONE

## PROS

- High Efficacy
  - Variable Leaf Milfoil
- Inexpensive
  - \$690 per acre
- Half-Life: 3-9 days
- Least/2nd Least Toxic  
EPA Category

## CONS

- Low Efficacy
  - Lilies
  - Fanwort
- Moderately toxic to rainbow trout and bluegill sunfish



# FLURIDONE

## PROS

- High Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Low risk of O<sub>2</sub> depletion
- Low Toxicity
  - Humans
  - Fish
- Inexpensive
  - \$500 - \$1,000 per acre

## CONS

- Low Efficacy
  - Lilies
- Half-Life: 4-97 days
- Numerous applications
  - 3-5 per season
- High concentrations required
- Usually whole lake treatment



# FLUMIOXAZIN

## PROS

- High Efficacy
  - Variable Leaf Milfoil
  - Fanwort
- Half-Life: 1-5 days
- Highly Regulated
- Low risk of O<sub>2</sub> depletion
- No Signs of Toxicity to humans  
(under regulated parameters)
- Inexpensive
  - \$990 per acre

## CONS

- Low Efficacy
  - Lilies
- Moderately Toxic
  - Aquatic Invertebrates
  - Juvenile Fish
- Non Selective



# IMPACT ASSESSMENT ON HUMAN HEALTH

Rogers Lake  
Lyme & Old Lyme, Connecticut



# REASON FOR STUDY

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- Chemical use is of concern to residents
  - Identify all possible human health risks
- Understand state and federal regulations
  - Parties involved in regulation
  - Level of oversight & monitoring
  - Methods of eliminating risk
- Evaluate efficacy of chemical use
  - Effective on all target species



# CHEMICALS OF INTEREST

- Fluridone
  - Selective systemic aquatic herbicide
- Flumioxazin
  - Broad spectrum contact aquatic herbicide
- Carfentrazone
  - Broad leaf contact herbicide
  - Effectively targets *M. heterophyllum* only



# REGULATORY PARTIES

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- US Environmental Protection Agency (EPA)
- CT Dept. of Energy & Environmental Protection (CTDEEP)
- CT Department of Public Health (DPH)



# OVERSIGHT & MONITORING

- EPA requires all pesticides to be registered
  - Scientific data proving no unreasonable human/environmental health risks
  - 15 year mandatory review
- Issue MOA, etc. between CTDEEP & DPH
  - DPH approves permits involving some herbicides
  - All permit applications reviewed by CTDEEP
- Local government may ask for more information and use restriction



# DOMESTIC WELL IMPACT EVALUATION

# SCOPE

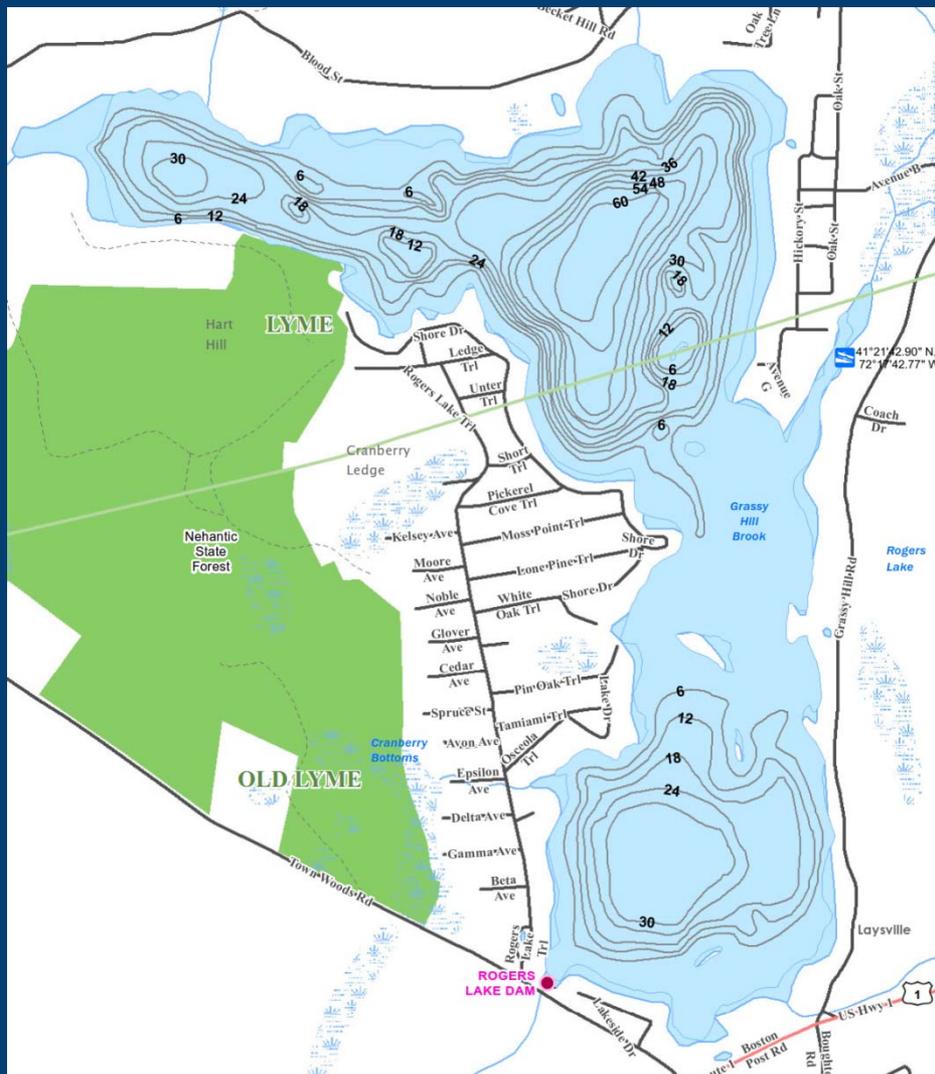
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- Windshield Survey of Lake
- Interviews with Sanitarians in both Towns
- Review of well records
- Review of publically available records such as geologic mapping

# OBSERVATIONS

- At least 50% of wells around lake are “dug” wells
- Dug wells have diameters of 30” to 36”
- Depths range from approximately 10-15 feet
- Not unusual for wells to be located within 20 feet
  - Sometimes much closer
- Water level lowering in lake often followed by complaints of wells drying up

# ROGERS LAKE



# BEDROCK OUTCROP NORTH OF LAKE



# OUTLET TO ROGERS LAKE



# DRILLED WELL NEAR ROGERS LAKE



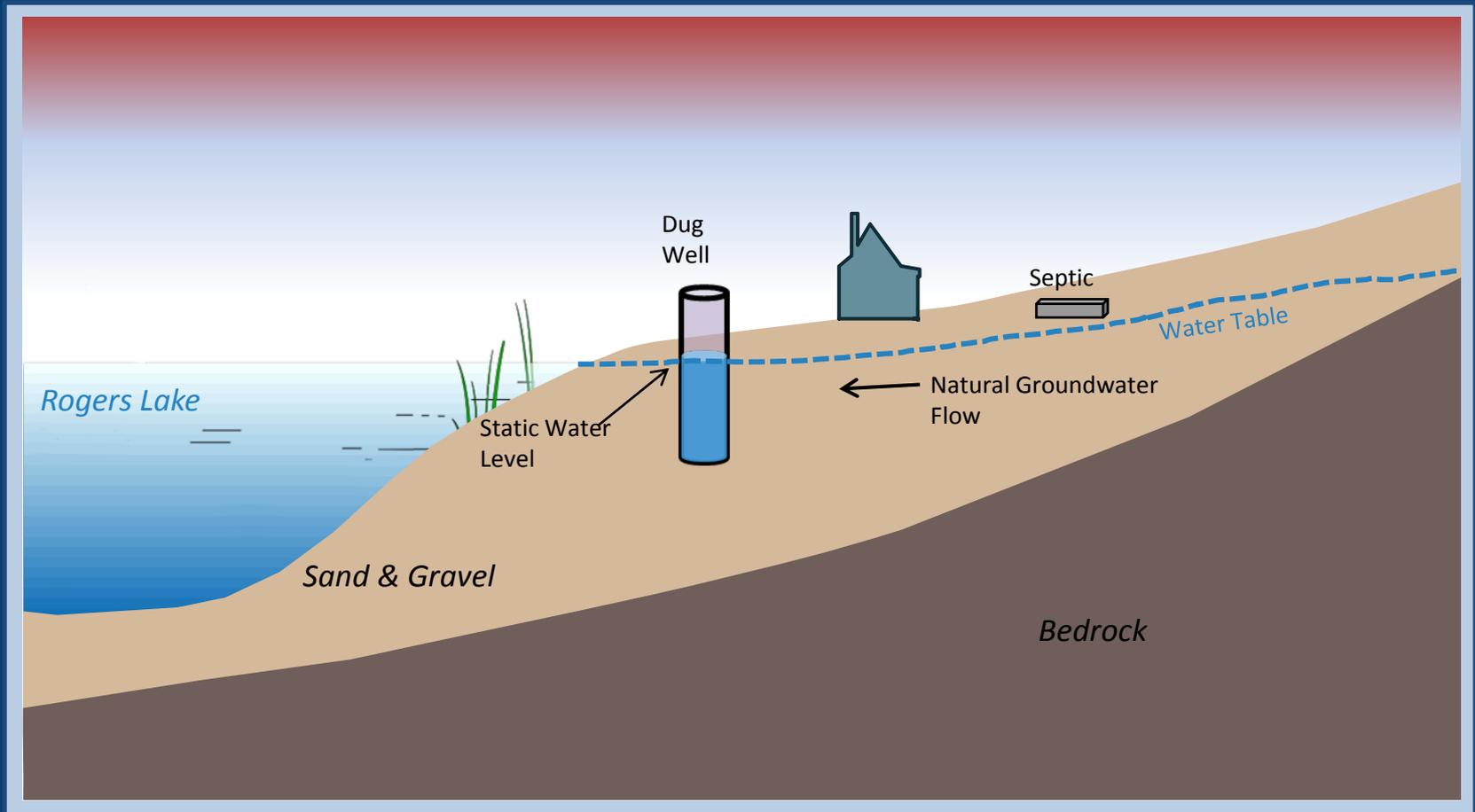
# TYPICAL DUG WELL NEAR LAKE



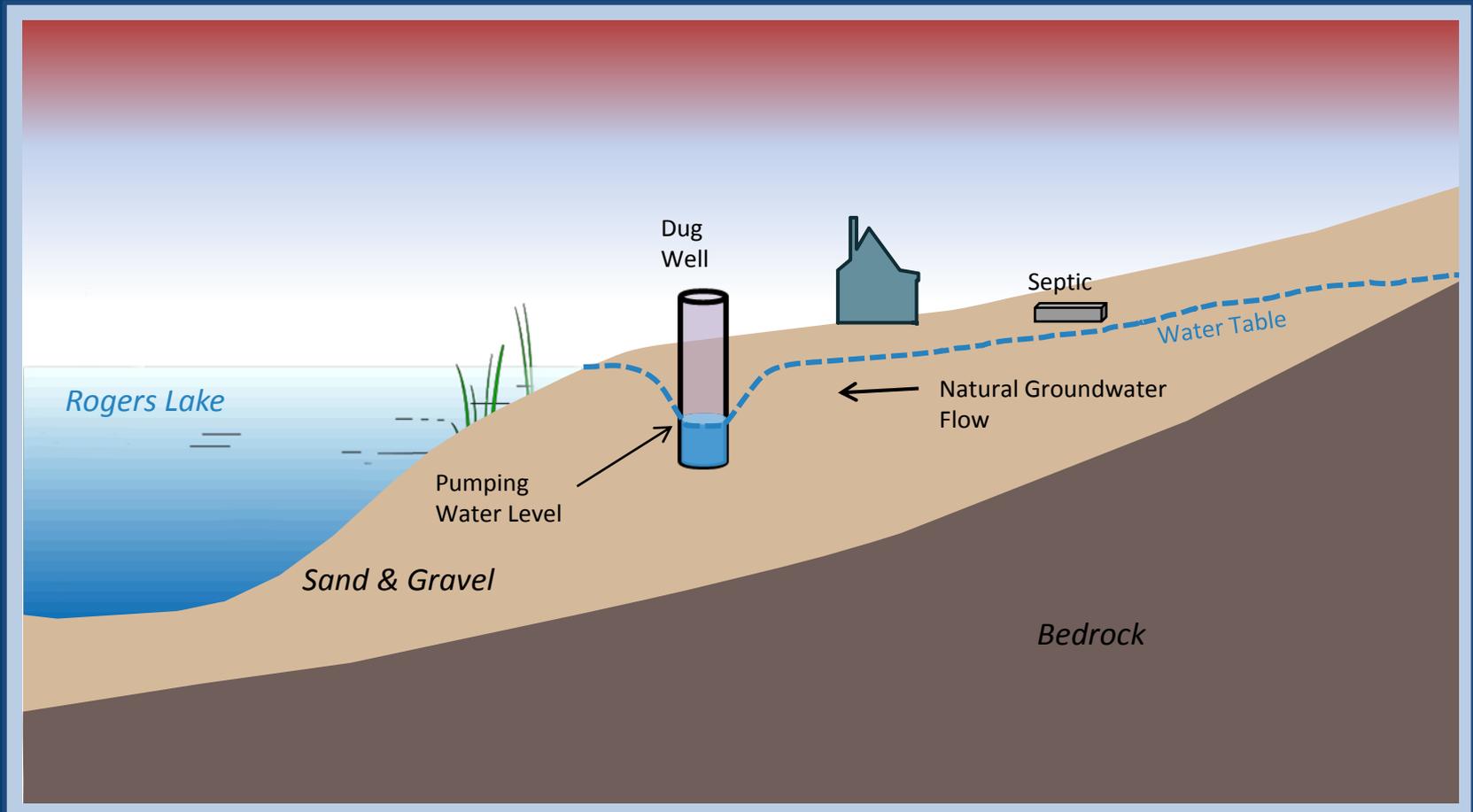
# DUG WELL NEAR ROGERS LAKE



# TYPICAL RESIDENTIAL PROPERTY LAYOUT



# TYPICAL RESIDENTIAL PROPERTY LAYOUT



# SUMMARY OF ADDITIONAL INFORMATION

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- Toxicity considerations
- “Half-Life” considerations
- State guidelines for application

# BREAKDOWN OF FACTORS

Rogers Lake  
Lyme & Old Lyme, Connecticut



# HIGHEST EFFICACY

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## Invasive Species

1. 2,4-D
2. Flumioxazin
3. Carfentrazone (milfoil)  
Fluridone (fanwort)

## Lilies

1. Hydroraking
2. Hand Pulling/DASH
3. Dredging



# LOWEST ENVIRONMENTAL & HUMAN HEALTH IMPACT

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## Invasive Species

1. Harvesting
2. DASH/Handpulling
3. Flumioxazin

## Lilies

1. Hand Pulling/DASH
2. Hydroraking
3. Harvesting



# LOWEST COST

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## Invasive Species

1. Grass Carp
2. 2,4-D
3. Diquat

## Lilies

1. Triclopyr
2. Harvesting
3. Hydroraking



# PROPOSED MANAGEMENT STRATEGY

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- Variable-Leaf Milfoil & Fanwort
  - Flumioxazin
- Water Lilies
  - Hydroraking



# REMAINING 2015 SCOPE

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- Development of Management Plans
  - Plant Management Plan
  - Post Plant Control Monitoring Protocols
  - Water Quality Management Plan
  - Maintenance Plan



# QUESTIONS

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- Old Lyme Contact
  - Bonnie Reemsnyder ~ *First Selectwoman*
  
- Lyme Contact
  - Ralph Eno ~ *First Selectman*



# ADDITIONAL PLANT STUDY INFORMATION

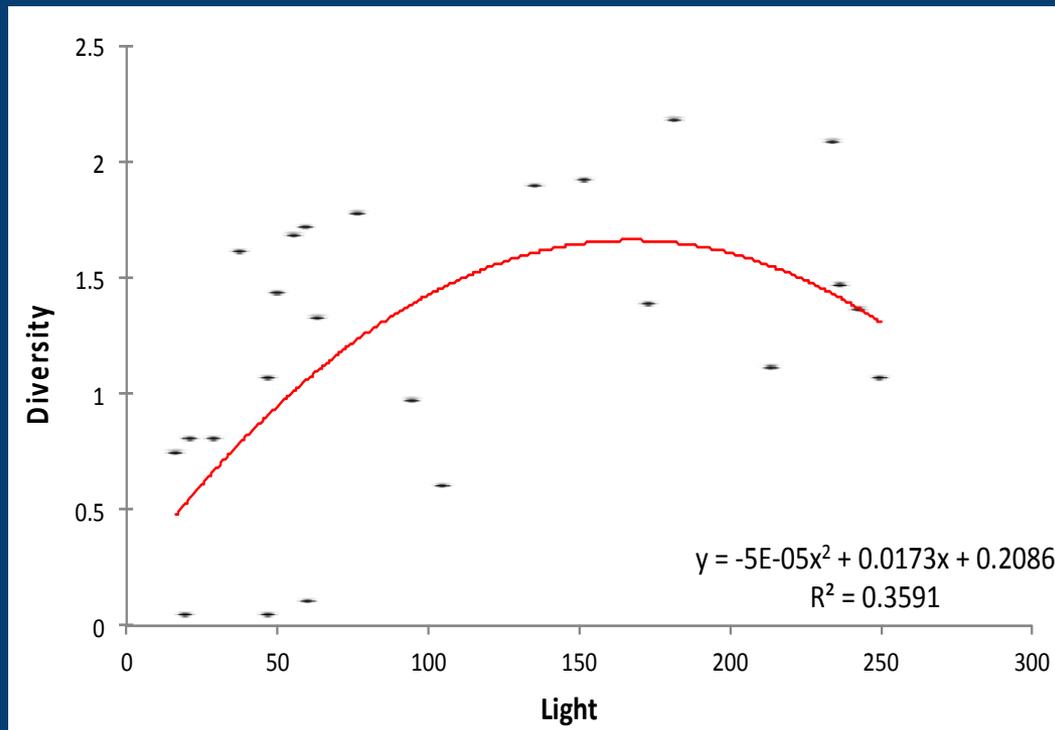
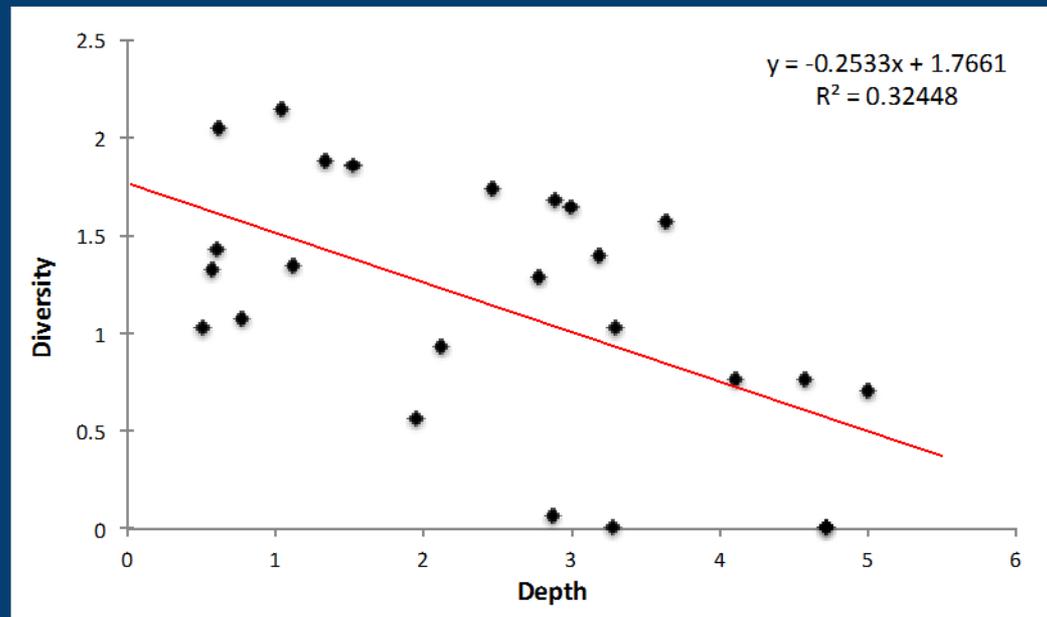


# EXPERIMENTAL DESIGN

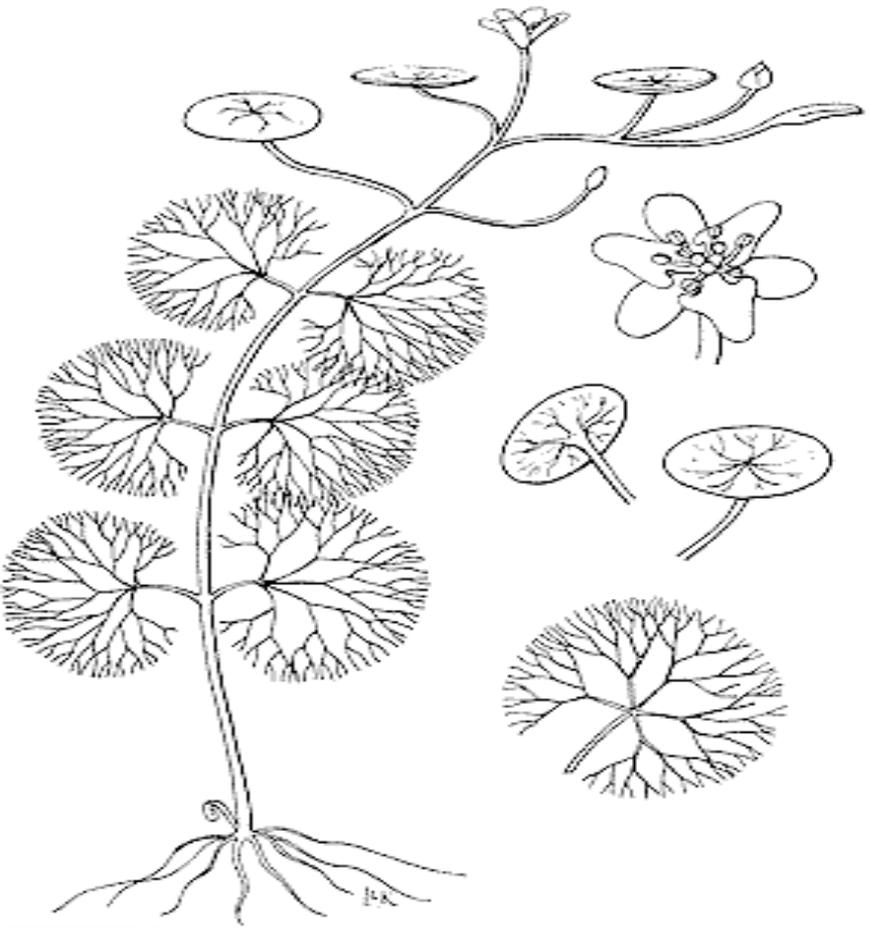
- Random Point Survey
  - 25 Points (0.1 – 5.0m)
  - Depth
  - Grapple Tosses (x4)
  - Plants Identified
  - Rank Abundances
- Plant Community Characteristics
  - Percent Composition
  - Richness
  - Diversity
  - Abundance
  - Community Structure Models



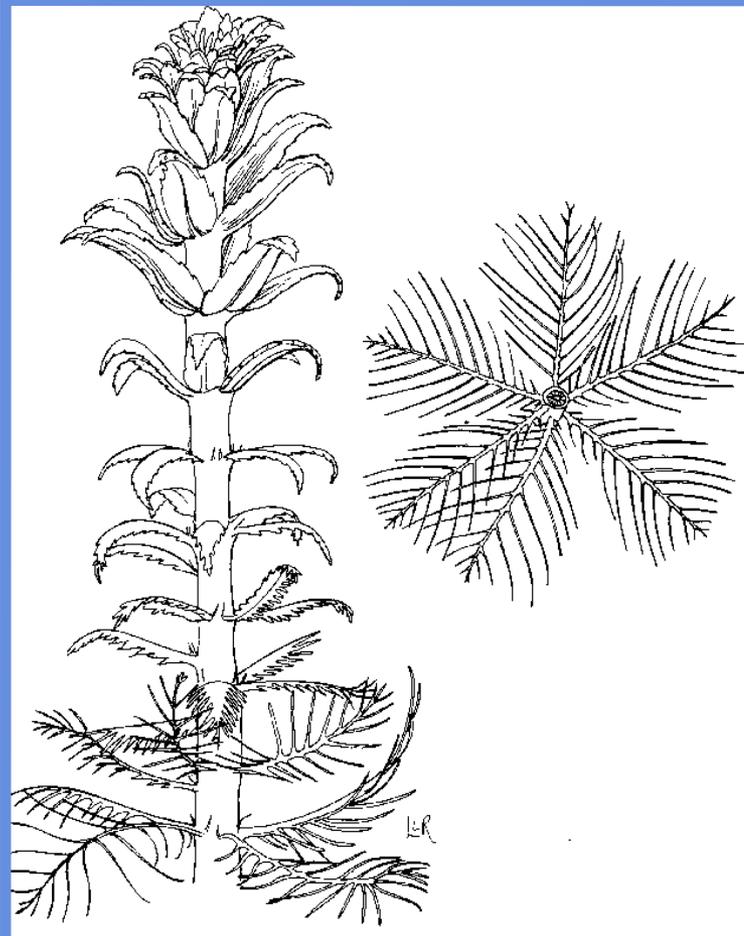
# QUALITATIVE FINDINGS



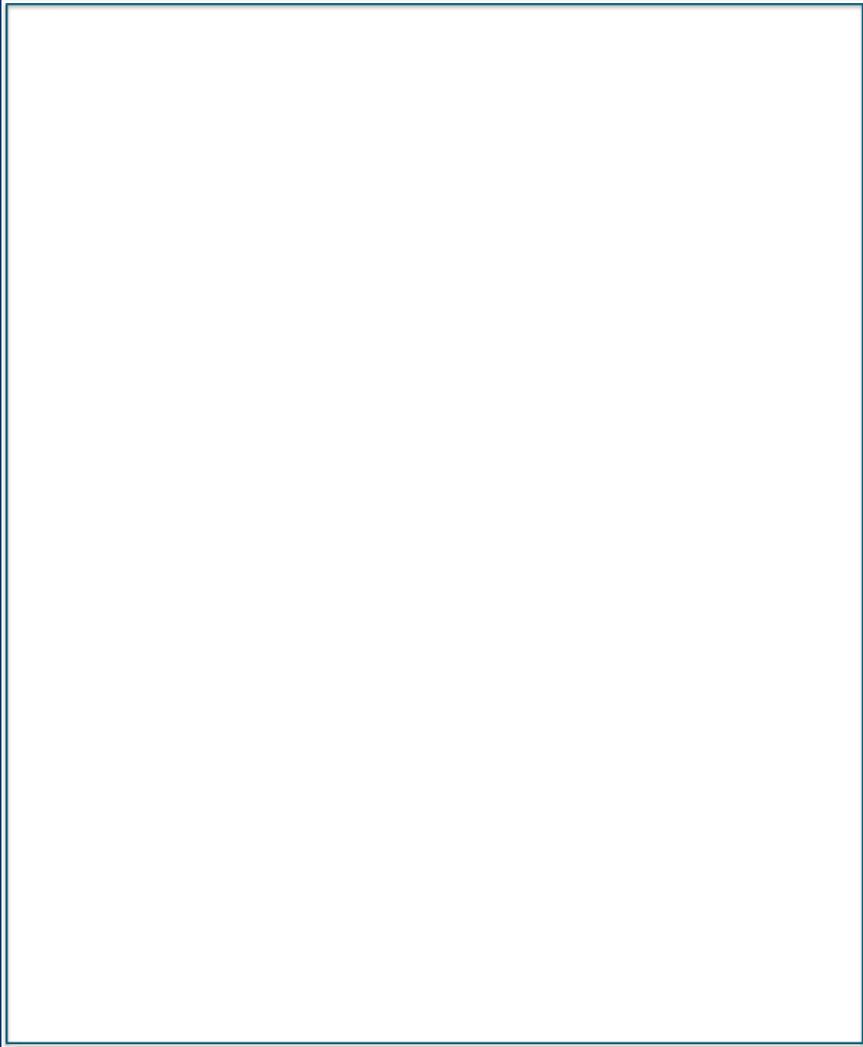




Variable Milfoil (exotic)

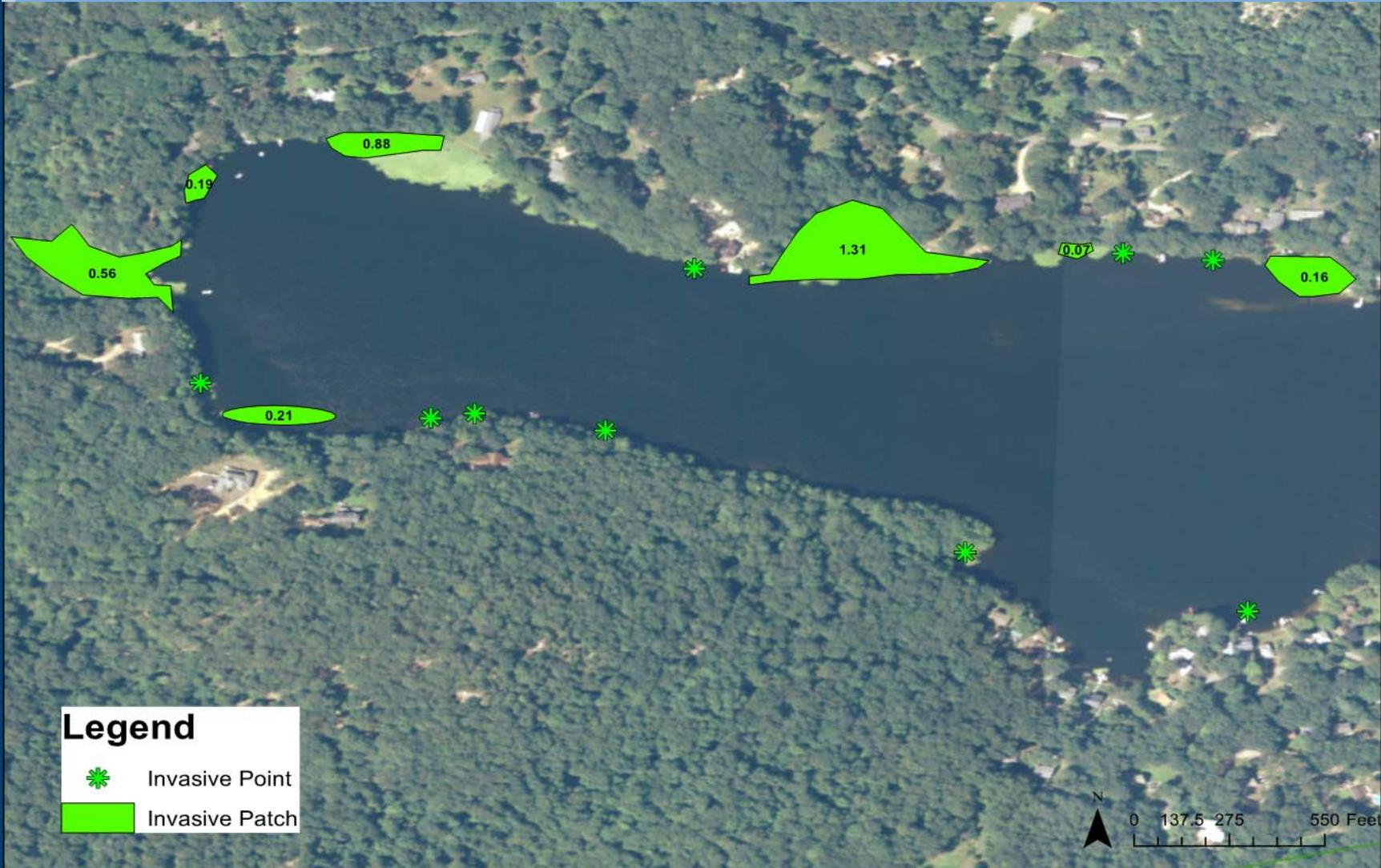


# EXPERIMENTAL DESIGN





# ROGERS LAKE, OLD LYME



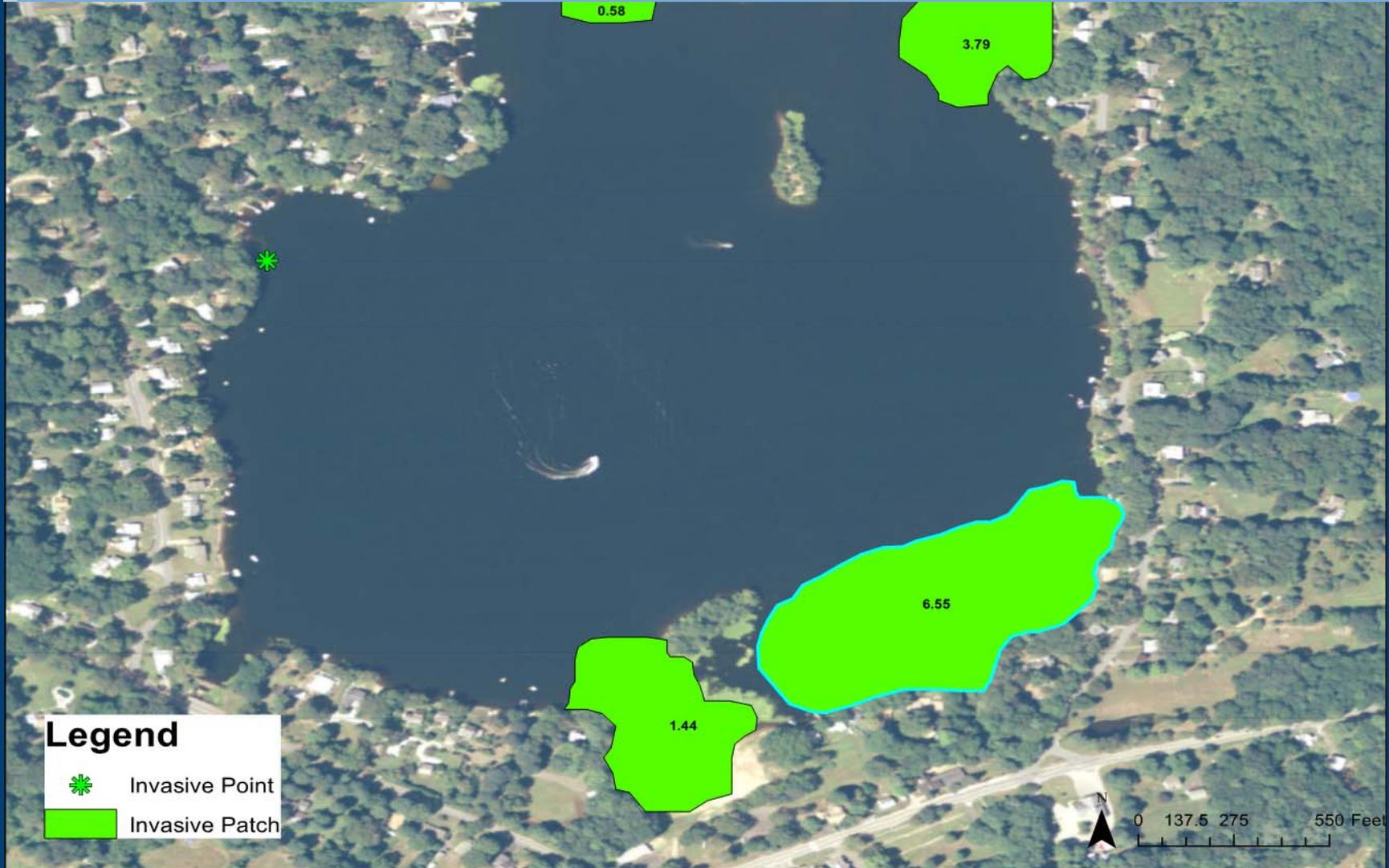


# ROGERS LAKE, OLD LYME



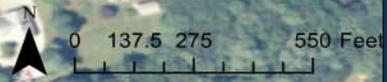


# ROGERS LAKE, OLD LYME



## Legend

-  Invasive Point
-  Invasive Patch



# NUISANCE LILY SPECIES DISTRIBUTION ROGERS LAKE, OLD LYME

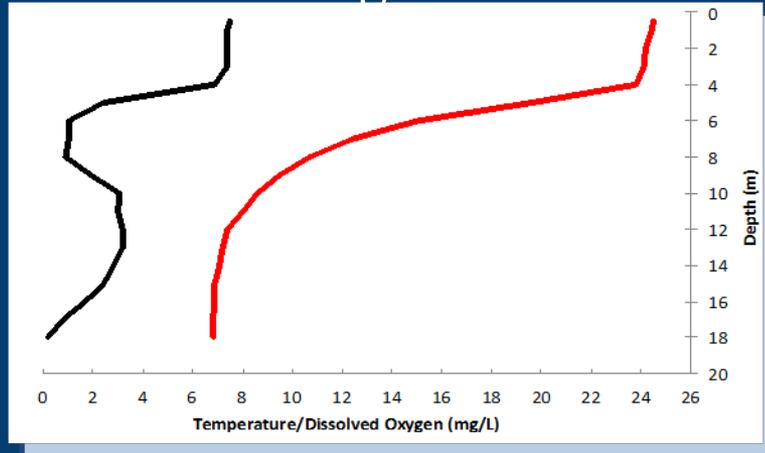


# ADDITIONAL WATER QUALITY INFORMATION

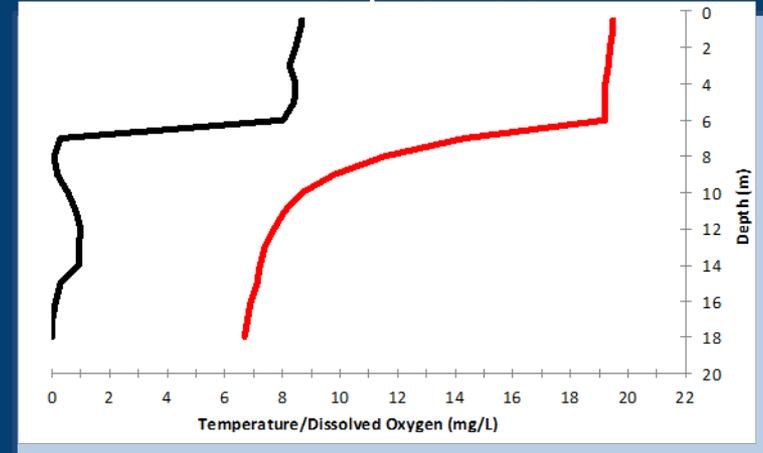


# RESULTS - DEPTH PROFILES

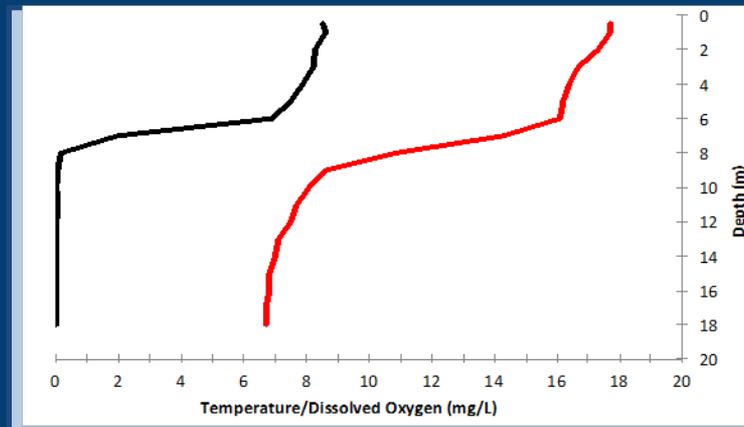
August



September



October



# ADDITIONAL WILDLIFE HABITAT INFORMATION



# OPEN WATER

- Characteristics
  - Deep
  - Cool waters
- Provide habitat for
  - Foraging
  - Overwintering

## Resident Species

Largemouth Bass  
Smallmouth Bass  
Black Crappie  
Chain Pickerel  
Brown Bullhead  
Walleye  
Yellow Perch  
Pumpkinseed  
Bluegill  
Trout



# SUBMERGED AND FLOATING VEGETATION

- Plant Species
  - Lily species
  - Watershield
- Characteristics
  - Warmer waters
  - Organic material build up
- Provide habitat for
  - Perching
  - Shelter
  - Breeding
  - Foraging
  - Hibernation

## Resident Species

Green Frog

American Bullfrog

Minnows

Juvenile Fish

Juvenile Turtles

Largemouth Bass (low plant densities)

Smallmouth Bass (low plant densities)

Snapping Turtles

Great Blue Herron



# SHORELINE

- Rogers Lake Shoreline
  - Inconsistent
  - Highly developed
  - Fragmented Habitat
- Underdeveloped Areas
  - Overhanging branches
  - Downed trees
- Provide habitat for
  - Perching
  - Shelter/Shading
  - Breeding
  - Foraging

## Resident Species

Belted Kingfisher

Largemouth Bass

Smallmouth Bass

Northern Cardinal

Blue Jay

Various piscivorous avian sp.

Various fish sp.

Various reptiles & amphibians



# ISLANDS

- Characteristics
  - Increase shoreline/bank
  - Highly vegetated
- Provide habitat for
  - Perching
  - Shelter
  - Breeding
  - Foraging
  - Nesting

## Resident Species

Fox

White-Tailed Deer

Common Raccoon

Red-Eared Sliders

Eastern Painted Turtles

Northern Watersnake

Kingfishers

Mallard Ducks

Canada Geese



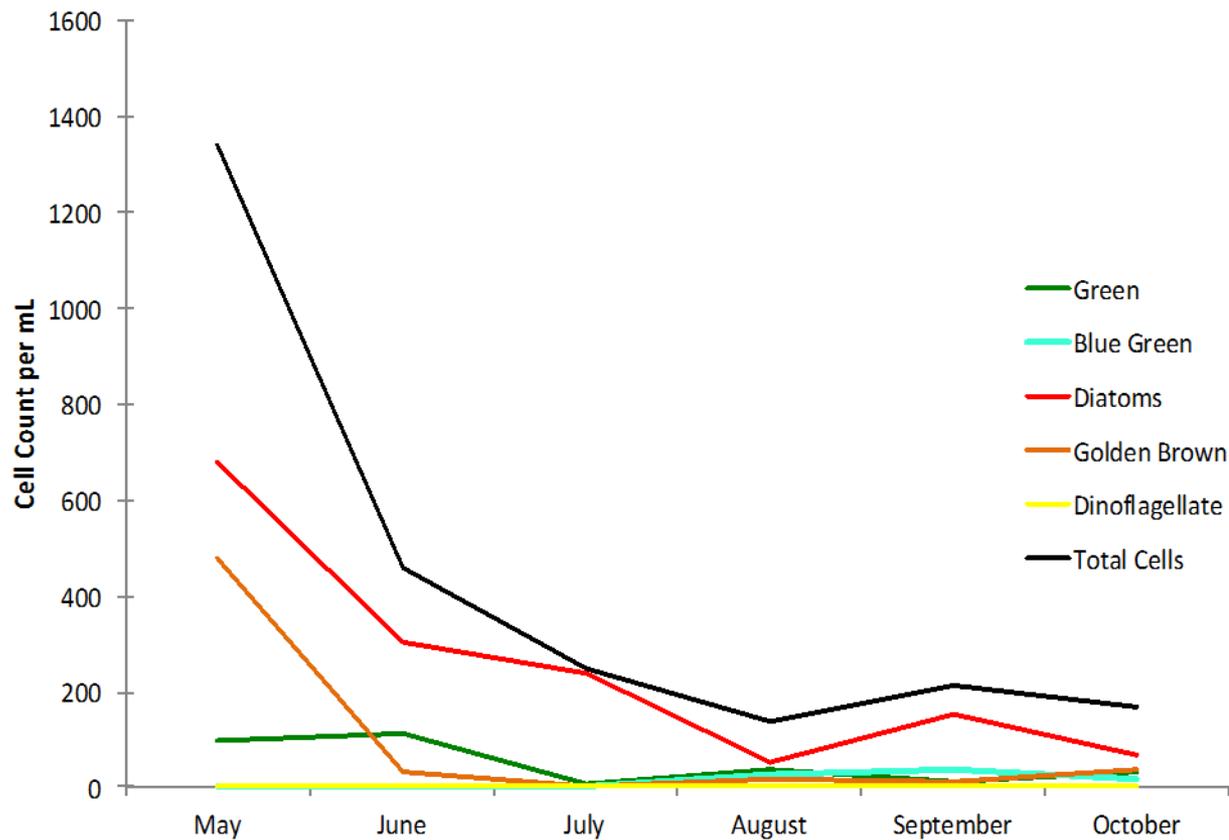
# ADDITIONAL MANAGEMENT OPTION INFORMATION





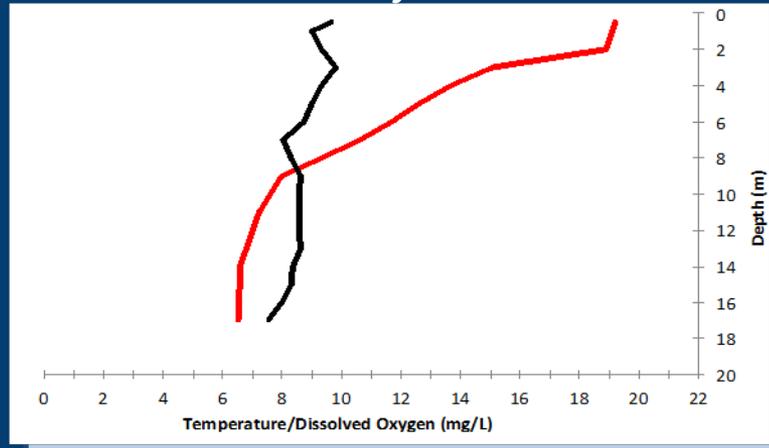
# WATER QUALITY STUDY

# RESULTS - ALGAL COMMUNITY

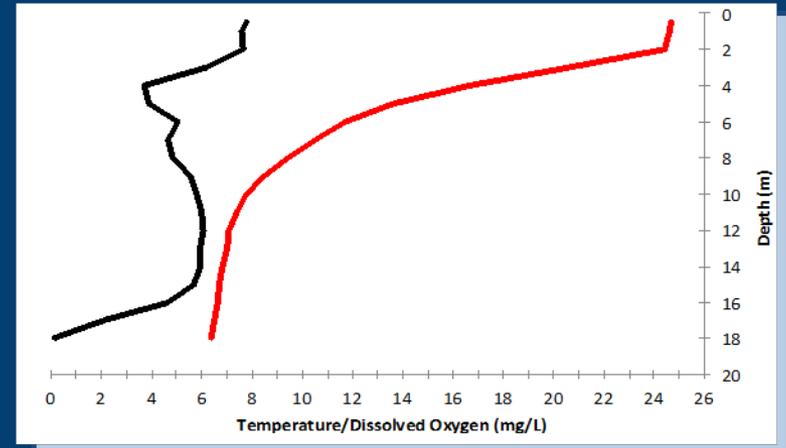


# RESULTS - DEPTH PROFILES

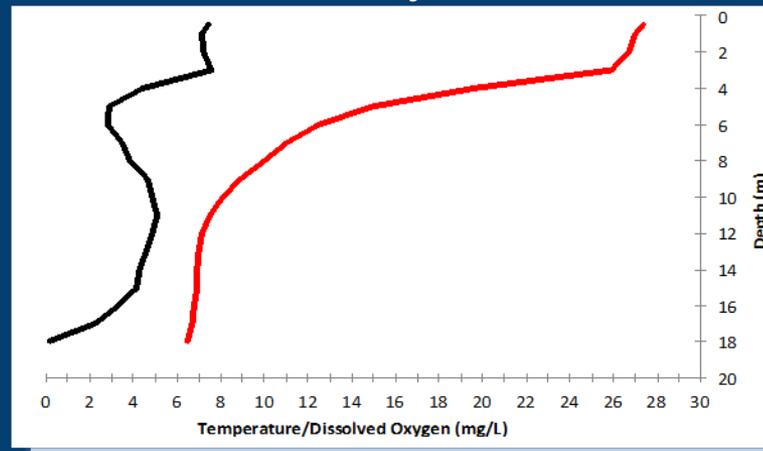
May



June



July



# RESULTS – NUTRIENTS

Surface Water Chemistry Parameters

Month	Ammonia (ug/L)	Nitrite (ug/L)	Nitrate (ug/L)	TKN (ug/L)	Phosphorus (ug/L)	Alkalinity (mg/L)	Transparency (m)
May	<2	<2	<2	860	17	9	2.00
June	30	<2	<2	280	15	11	1.80
July	20	<2	<2	200	20	16	2.05
August	60	<2	<2	394	24	16	2.87
September	40	<2	<2	390	50	13	2.64
October	<2	<2	<2	<2	<2	12	2.82

Bottom Water Chemistry Parameters

Month	Ammonia (ug/L)	Nitrite (ug/L)	Nitrate (ug/L)	TKN (ug/L)	Phosphorus (ug/L)	Alkalinity (mg/L)
May	70	<2	530	880	17	10
June	70	<2	193	270	10	11
July	20	<2	149	200	30	15
August	370	<2	3	735	133	20
September	640	<2	<2	3520	60	25
October	460	<2	<2	2940	<2	39



# WILDLIFE IMPACT EVALUATION

Rogers Lake  
Lyme & Old Lyme, Connecticut



# REASON FOR STUDY

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- Document wildlife habitat in Rogers Lake
- Assess what animal species use the habitat
- Determine effects of management on wildlife habitat
- Ascertain management option of least impact



# TYPES OF HABITAT

- Open Water Habitat
  - Unlikely to be effected by management
  - *Main inhabitant: Adult Fish*
- Submerged and Floating Aquatic Vegetation
  - Definitely effected by management
  - *Main inhabitant: Juvenile Fish/Amphibians*
- Shoreline Habitat
  - Unlikely to be effected by management
- Island Habitat
  - Very unlikely to be effected by management

