A

APPENDIX A

Public Participation Materials

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of a Lake Management Planning Project
  - Data & Information
  - Planning Process
- 2010 Treatment Monitoring
- Recommendation for 2011

Onterra, LLC

- Founded in 2005
- Staff
  - Four full-time ecologists
  - One part-time ecologist
  - One field technician
- Services
  - Science and planning
- Philosophy
  - Promote realistic planning
  - Assist, not direct

Why create a lake management plan?

- To create a better understanding of lake's positive and negative attributes.
- To discover ways to minimize the negative attributes and maximize the positive attributes.
- To foster realistic expectations and dispel myths.
- To create a snapshot of the lake for future reference and planning.

A goal without a plan is just a wish!

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

Data and information gathering

- Aquatic Plant Surveys
  - AIS (CLP & EWM)
  - Comprehensive
- Water Quality Analysis
- Watershed Assessment
- Shoreline Assessment
- Fisheries Data Integration
- Stakeholder Survey

Updated methods & compare to past surveys

Update & compare

Review (only moderate changes)

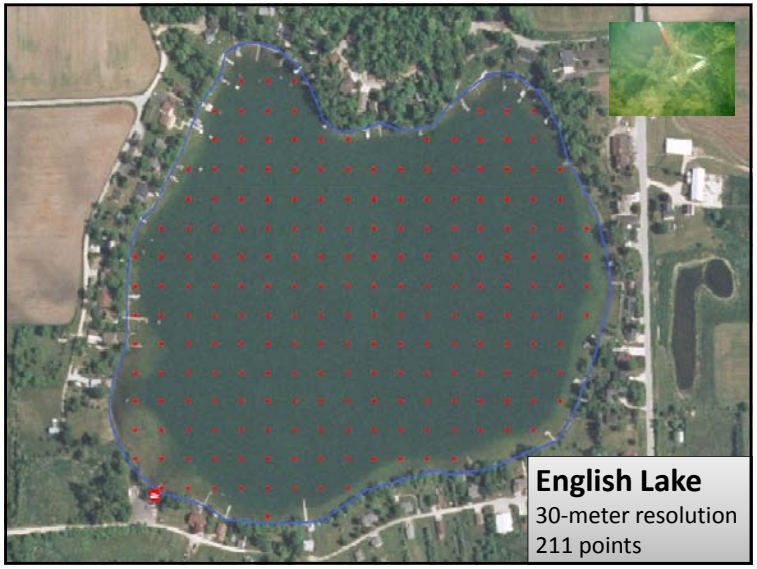
Evaluate shoreline condition

Include available data

Official WDNR-approved survey

Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Curly-leaf pondweed survey
  - Point-intercept survey
  - Plant community mapping



Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized **Natural**

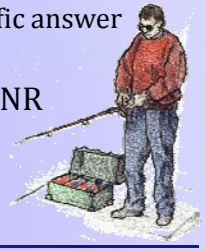
Range

Fisheries Data Integration

- No fish sampling completed
- Assemble data from WDNR, USGS, & USFWS
- Fish survey results summaries (if available)
- Use information in planning as applicable

Stakeholder Survey

- Standard survey used as base
  - Planning committee develops additional questions and options
  - Must not lead respondent to specific answer through a "loaded" question
- Survey must be approved by WDNR

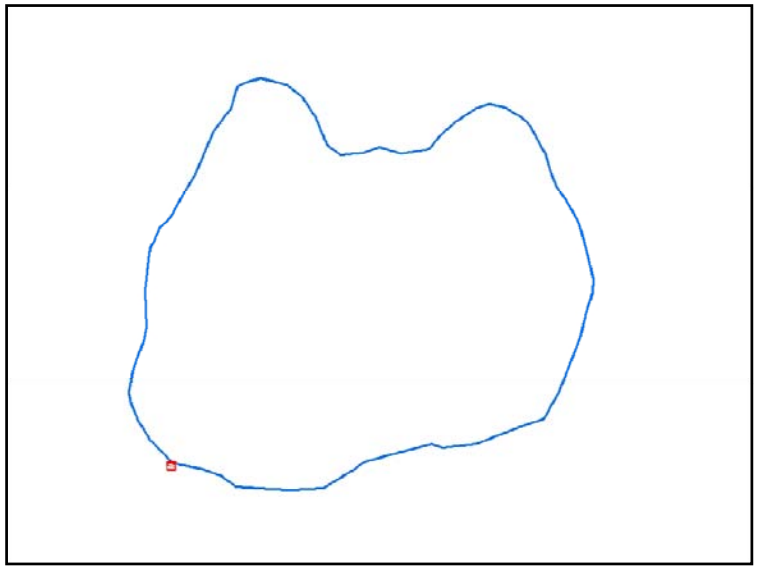


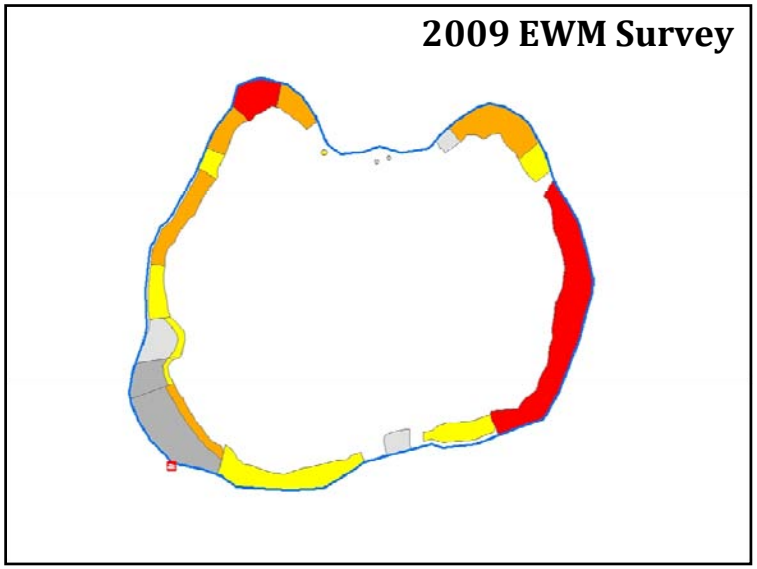
Planning Process

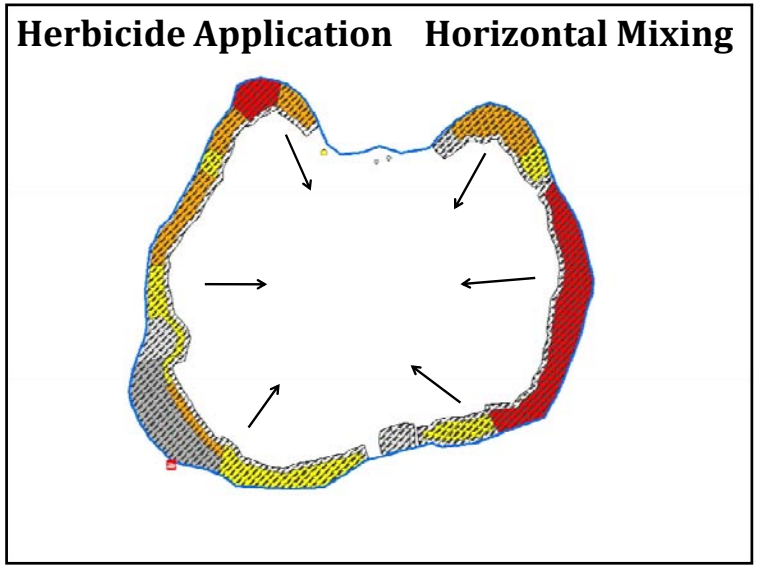
Planning Committee Meetings

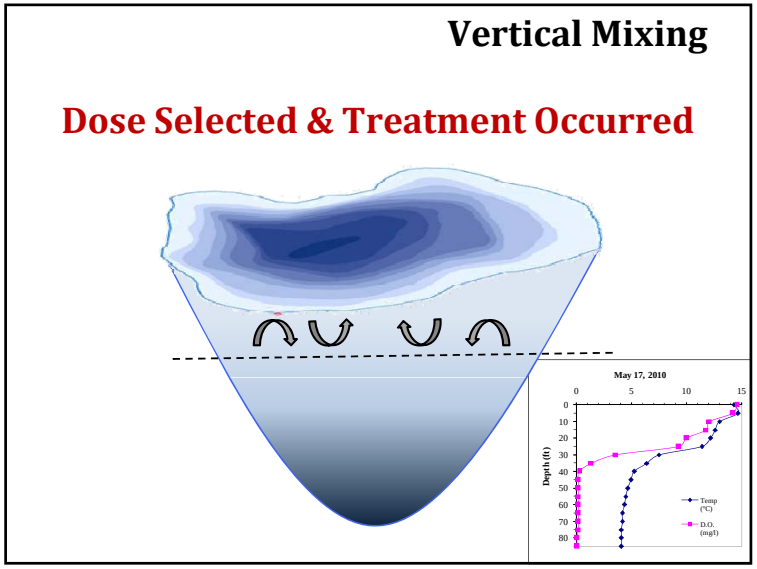
Study Results (including a stakeholder survey)
Conclusions & Initial Recommendations
Management Goals
Management Actions
Timeframe
Facilitator(s)

Implementation Plan




2009 EWM Survey

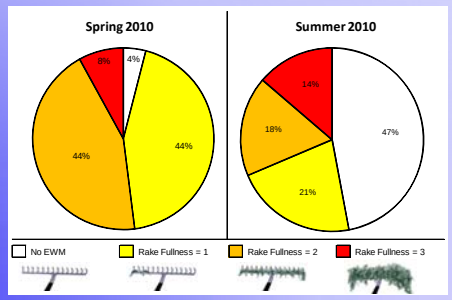

Herbicide Application
Horizontal Mixing


Vertical Mixing
Dose Selected & Treatment Occurred
May 17, 2010
Depth (ft)
Temp (°C)
D.O. (mg/l)

Quantitative Monitoring

2010 Spring FOO	2010 Summer FOO	% Change	Chi-square Analysis	
			Direction	p-value
96.0	52.9	-44.9	▼	0.000

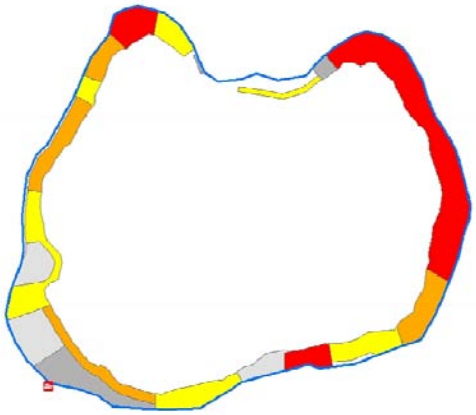
2010 Spring N = 50, 2010 Summer N= 51; FOO = Frequency of Occurrence



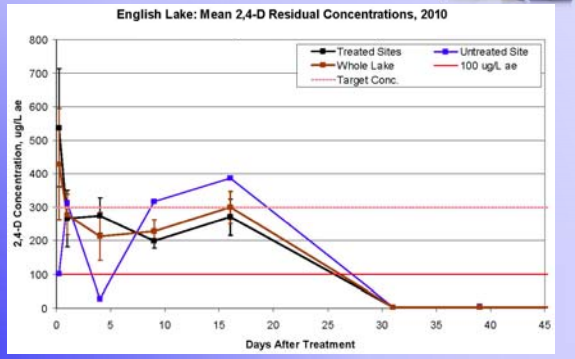
Qualitative Monitoring

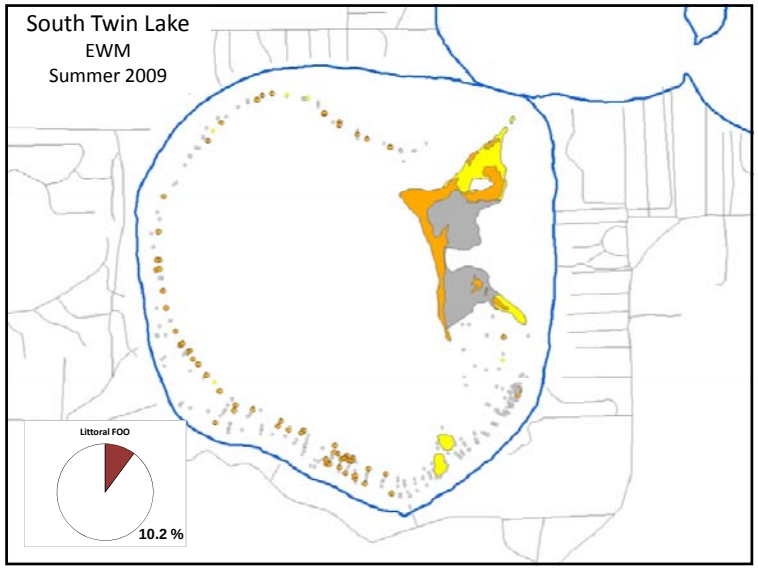
2009 EWM Survey

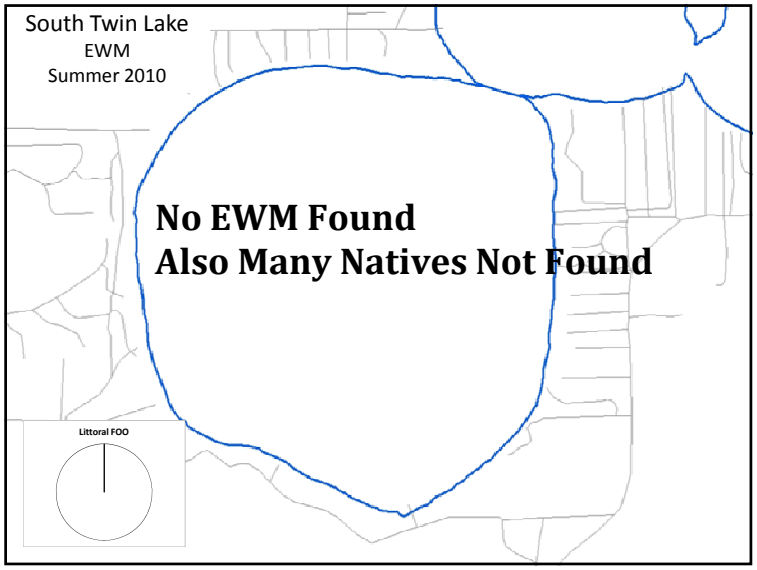
2010 EWM Survey

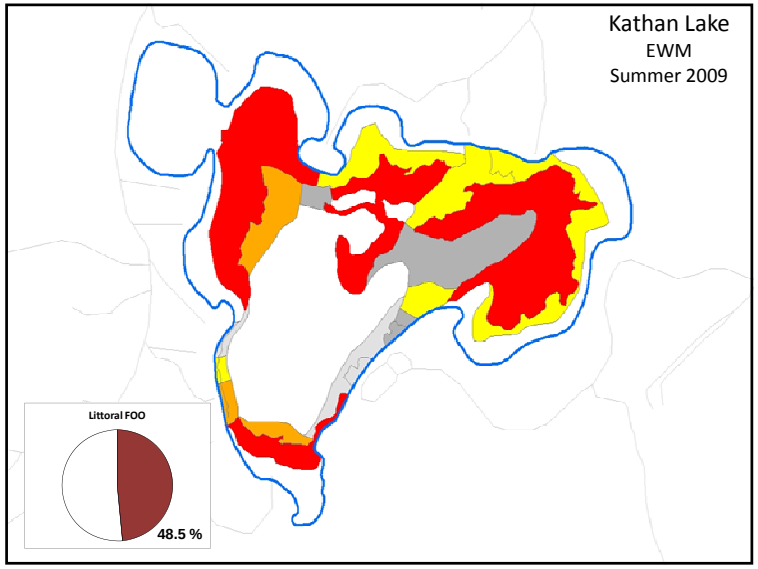


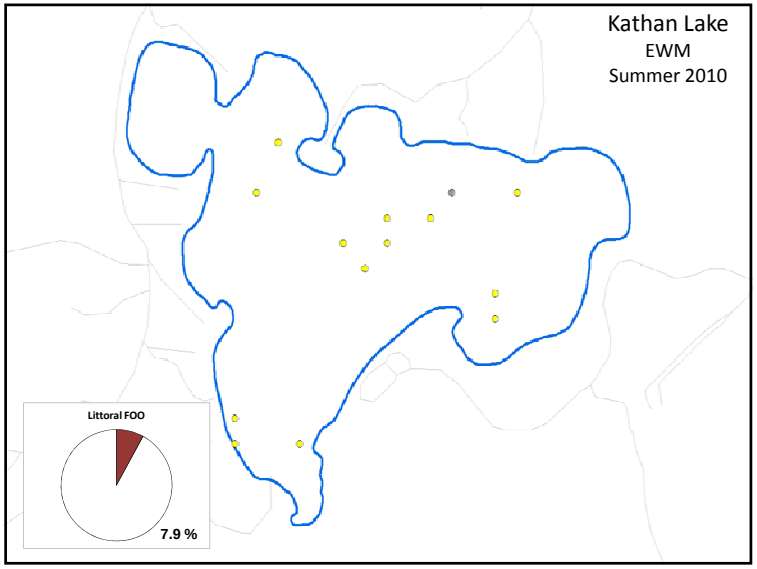
Residual Herbicide Monitoring



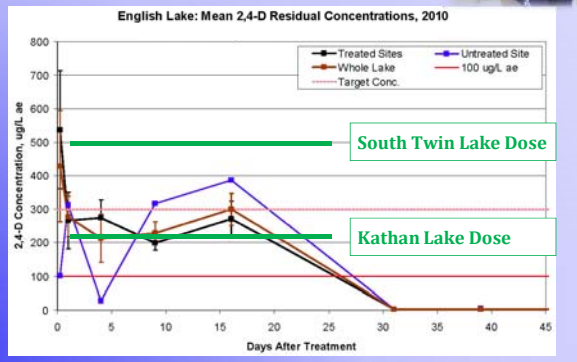

South Twin Lake
EWM
Summer 2009
Littoral FOO
10.2 %


South Twin Lake
EWM
Summer 2010
No EWM Found
Also Many Natives Not Found
Littoral FOO


Kathan Lake
EWM
Summer 2009
Littoral FOO
48.5 %


Kathan Lake
EWM
Summer 2010
Littoral FOO
7.9 %

Residual Herbicide Monitoring



2010 Treatment Results

- **Results did no meet expectations**
- **Likely not a dosing issue**
- **Possible contributing factors to lack of effectiveness**
  - pH: English Lake has a high pH
    - Herbicide formulation used (amine) not as susceptible to pH issues as other formulation (ester)
  - **EWM genetics (tolerant strain)**
    - Plant have not had DNA analysis (will this summer)
  - **Filamentous algae covering EWM during treatment**
    - No scientific evidence supports this claim
    - Herbicide was in water for at least 15 days

What is the next step?

- Options
  - **Retreat at higher dose**
    - This may impact important native species and still not control EWM.
  - **Treat at same dose if filamentous algae is not present**
    - Likely a waste of money
  - **Do not treat until better information is available**
    - Most prudent option with information at hand
    - Recommended by WDNR
    - Important to continue monitoring

Thank You

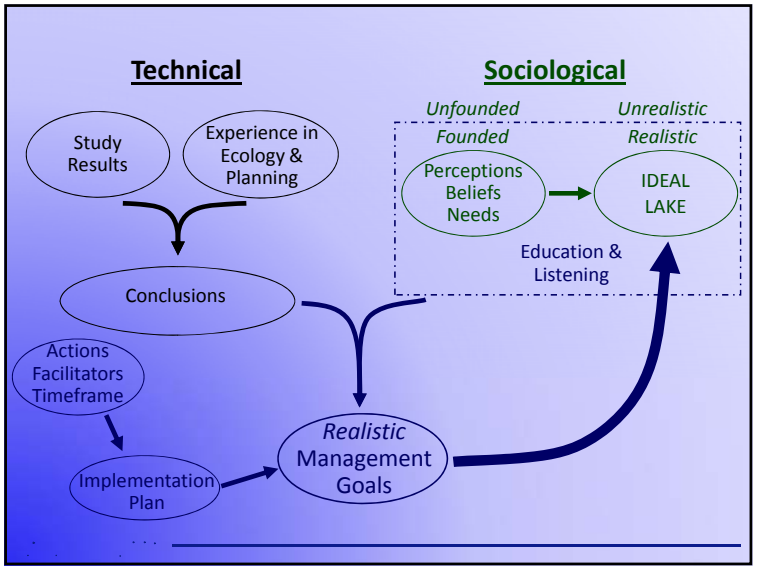
Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

The Planning Process
…it's not as easy as you may think.


Technical
Sociological
Unfounded
Unrealistic
Founded
Realistic
Study Results
Experience in Ecology & Planning
Perceptions Beliefs Needs
IDEAL LAKE
Education & Listening
Conclusions
Actions Facilitators Timeframe
Realistic Management Goals
Implementation Plan

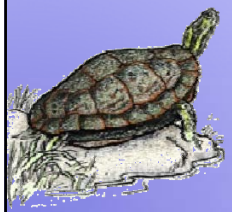
English Lake
Protection & Rehabilitation District
English Lake
Management Planning Project
Planning Meeting I
November 10, 2011
Tim Hoyman &
Dan Cibulka
Onterra LLC
Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Aquatic Plants
  - Eurasian Water Milfoil
- "Big Picture"
- Stakeholder Survey
- Management Goals

Study and Plan Goals

- Collect & Analyze Data
- Construct Long-Term & Useable Plan



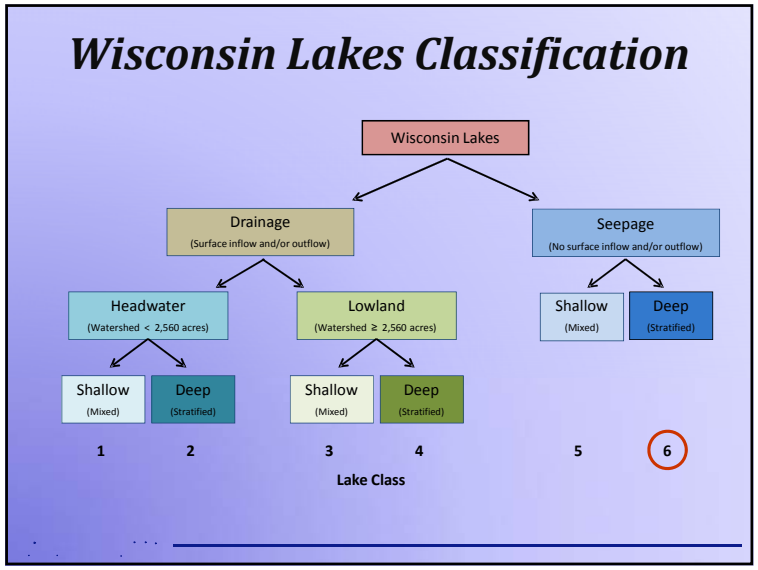
Water Quality

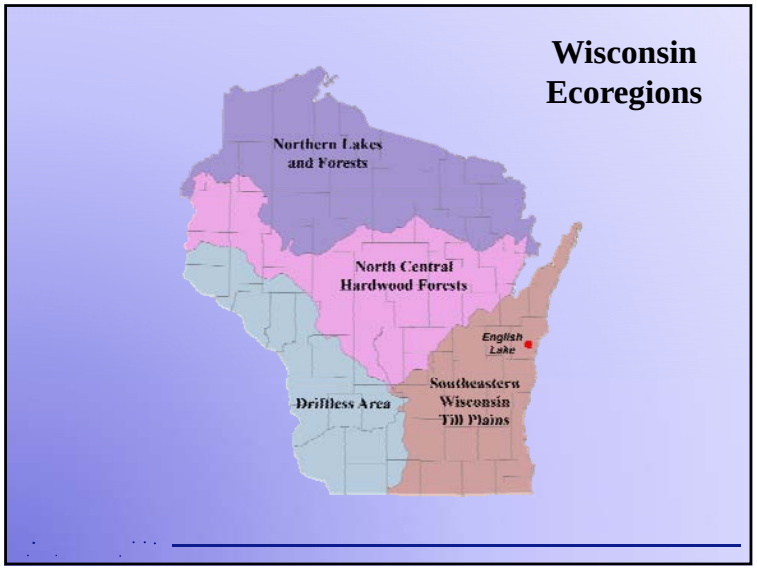
↑ Phosphorus (Limiting Plant Nutrient)

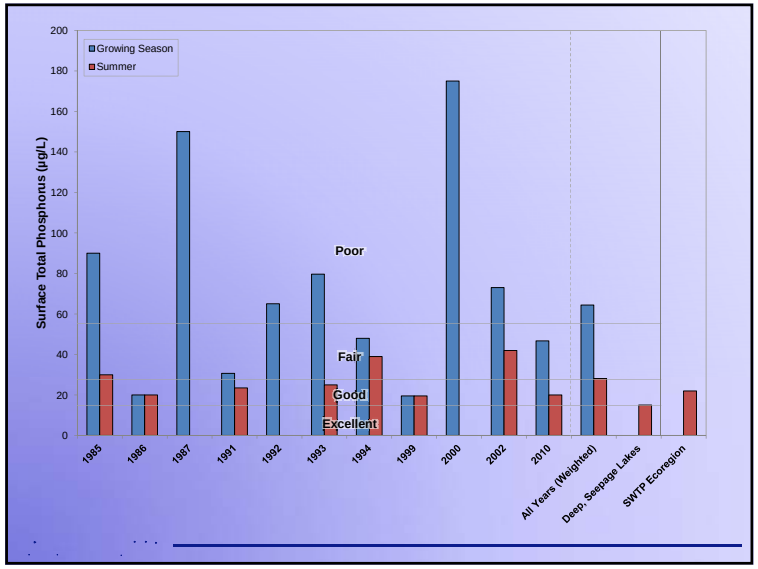
Nitrogen:Phosphorus 51:1

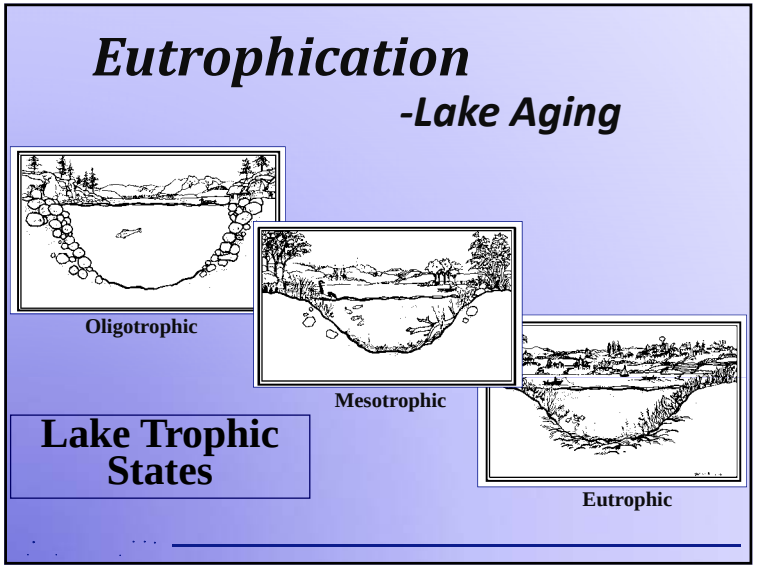
↑ Chlorophyll-*a* (Algal Abundance)

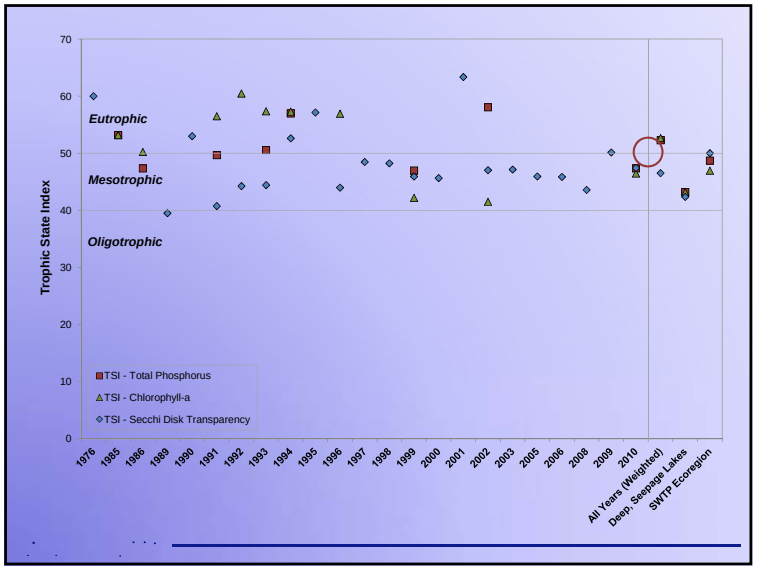
↓ Water Clarity (Secchi Disk)


Wisconsin Lakes Classification
Wisconsin Lakes
Drainage
(Surface inflow and/or outflow)
Seepage
(No surface inflow and/or outflow)
Headwater
(Watershed < 2,560 acres)
Lowland
(Watershed ≥ 2,560 acres)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)
1
2
3
4
5
6
Lake Class


Wisconsin Ecoregions
Northern Lakes and Forests
North Central Hardwood Forests
English Lake
Driftless Area
Southeastern Wisconsin Till Plains

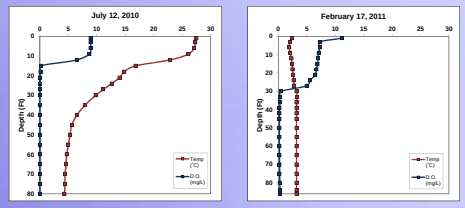

Surface Total Phosphorus (µg/L)
Growing Season
Summer
Poor
Fair
Good
Excellent
1985
1986
1987
1991
1992
1993
1994
1999
2000
2002
2010
All Years (Weighted)
Deep, Seepage Lakes
SWTP Ecoregion


Eutrophication
-Lake Aging
Oligotrophic
Mesotrophic
Eutrophic
Lake Trophic States



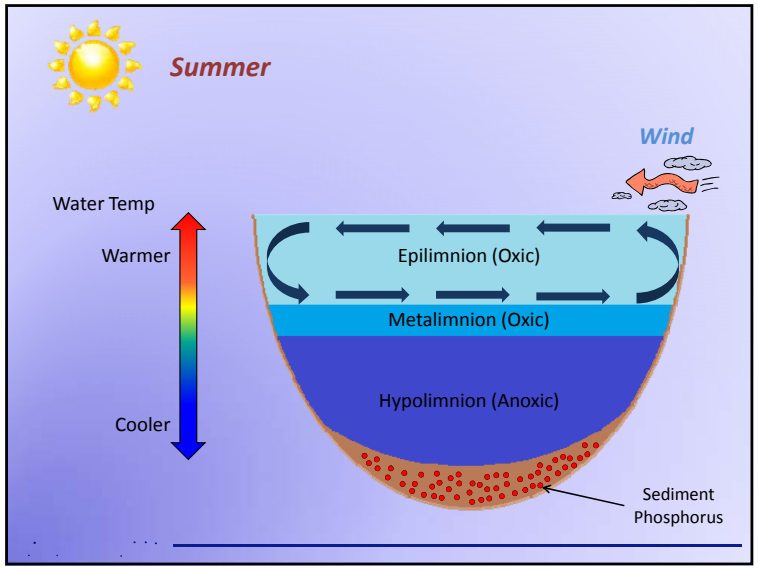
Dissolved Oxygen and Temperature Profiles

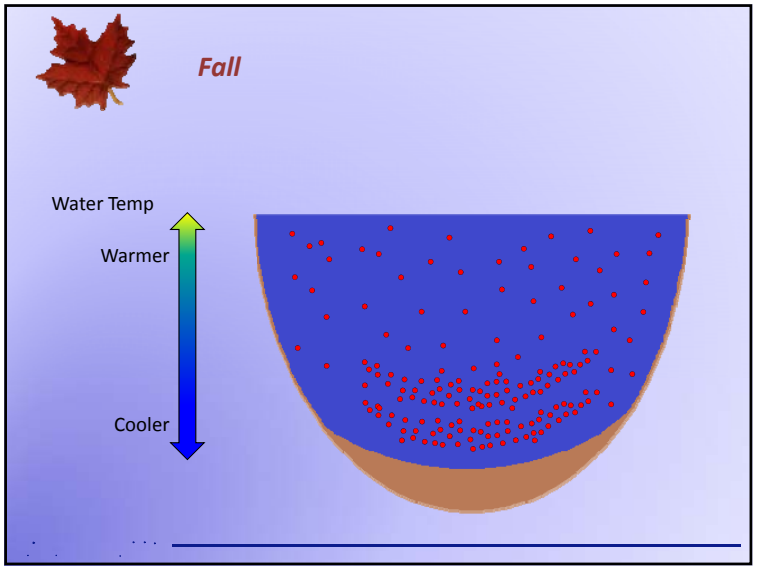
- **Dissolved Oxygen and Temperature Profiles**
  - English Lake has a small surface area and a high mean depth (36 feet)
    - Lake is ***dimictic***: mixes (turns over) 2 times/year; early spring and late fall
    - Lake remains thermally stratified between mixing events and develops anoxic hypolimnion (bottom layer)

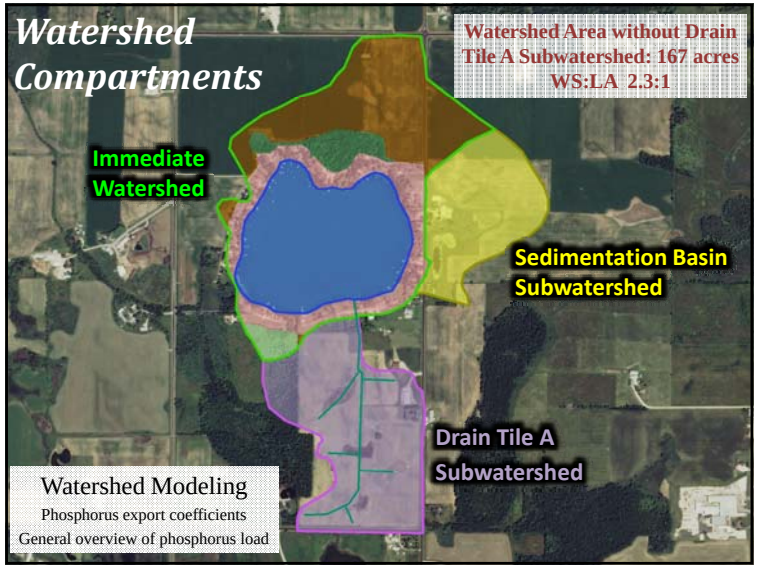


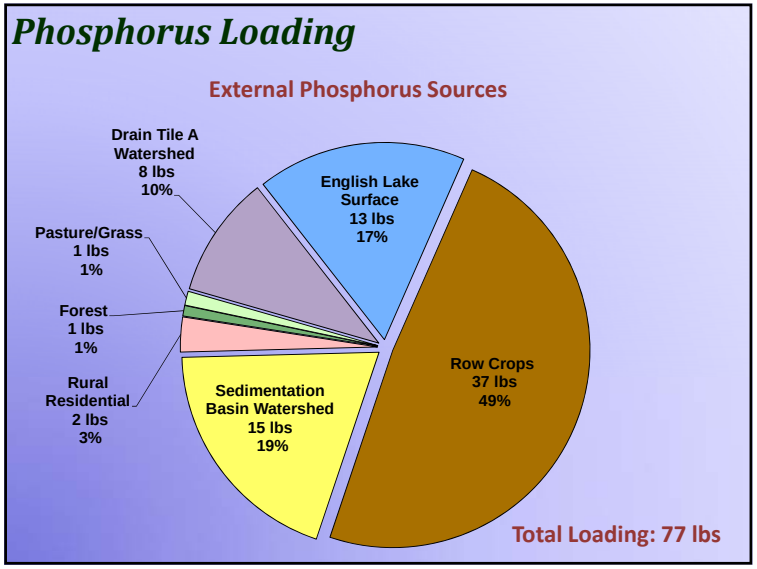
Discrepancy between WiLMS watershed modeling predicted phosphorus and 2010 field measurements

- **Unaccounted source(s) of phosphorus**
  - Likely due to internal phosphorus loading from bottom sediments
    - When lake is stratified, anoxic hypolimnion (bottom layer) causes release of phosphorus from sediments
    - Bottom phosphorus levels increase throughout the summer while surface levels decrease
    - Phosphorus from the bottom diffuses throughout the water column in early spring and late fall
    - Late fall epilimnion phosphorus levels may persist through winter
    - Additional diffusion in spring leads to higher algal growth rates throughout summer


Summer
Wind
Water Temp
Warmer
Cooler
Epilimnion (Oxic)
Metalimnion (Oxic)
Hypolimnion (Anoxic)
Sediment
Phosphorus

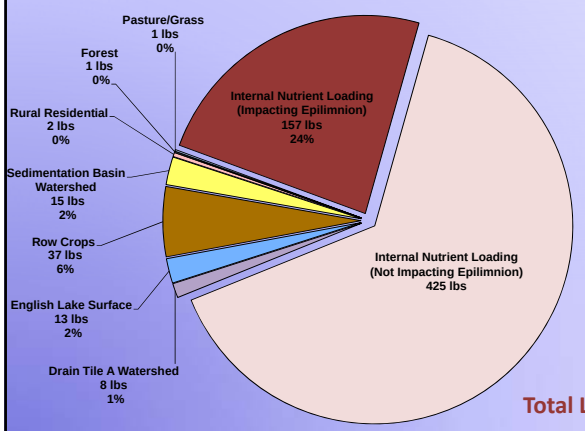

Fall
Water Temp
Warmer
Cooler


Watershed Compartments
Watershed Area without Drain Tile A Subwatershed: 167 acres
WS:LA 2.3:1
Immediate Watershed
Sedimentation Basin Subwatershed
Drain Tile A Subwatershed
Watershed Modeling
Phosphorus export coefficients
General overview of phosphorus load


Phosphorus Loading
External Phosphorus Sources
Drain Tile A Watershed 8 lbs 10%
English Lake Surface 13 lbs 17%
Pasture/Grass 1 lbs 1%
Forest 1 lbs 1%
Rural Residential 2 lbs 3%
Sedimentation Basin Watershed 15 lbs 19%
Row Crops 37 lbs 49%
Total Loading: 77 lbs

Phosphorus Loading

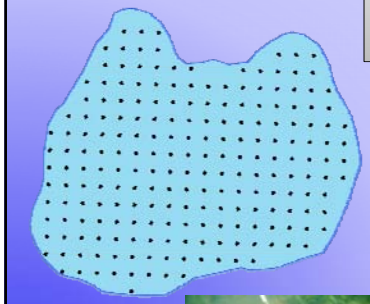
External and Internal Phosphorous Sources



Total Loading: 659 lbs

Total Loading to Epilimnion: 234 lbs

- **English Lake**
- 30-meter resolution
- 211 total points
- Survey Completed: July 27, 2010 & August 12, 2011



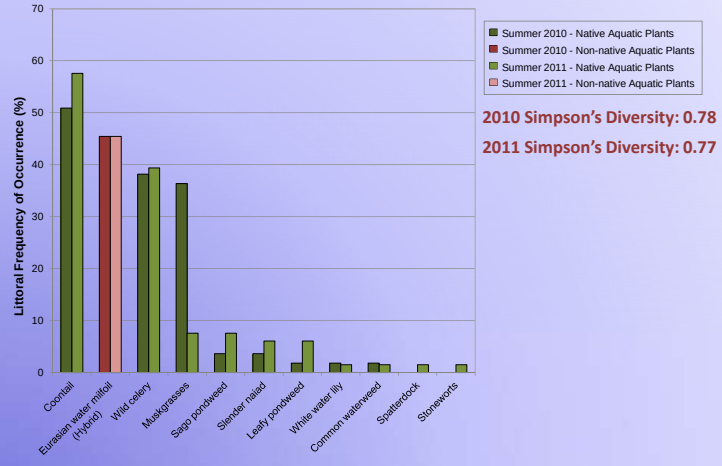
Species List

- **13 Native Species**
- **1 Non-native Species**
  - Eurasian water milfoil
  - Curly-leaf pondweed?

Life Form	Scientific Name	Common Name	Coefficient of Conservatism (c)
Emergent	*Sagittaria latifolia*	Common arrowhead	3
	Schoenoplectus acutus	Hardstem bulrush	5
	Schoenoplectus pungens	Three-square rush	5
FL	*Nuphar variegata*	Spatterdock	6
	Nymphaea odorata	White water lily	6
FL/E	*Sparganium eurycarpum*	Common bur-reed	5
Submergent	*Chara sp.*	Muskgrasses	7
	Ceratophyllum demersum	Coontail	3
	Elodea canadensis	Common waterweed	3
	Myriophyllum sibiricum x spicatum	Northern x Eurasian water milfoil (hybrid)	Exotic
	Najas flexilis	Slender naiad	6
	Potamogeton foliosus	Leafy pondweed	6
	Stuckenia pectinata	Sago pondweed	3
	Vallisneria americana	Wild celery	6

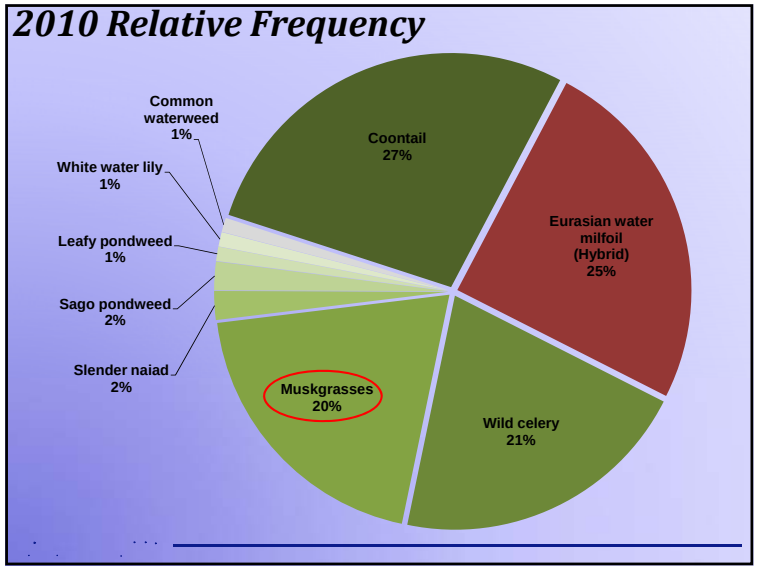
FL = Floating Leaf
FL/E = Floating Leaf and Emergent

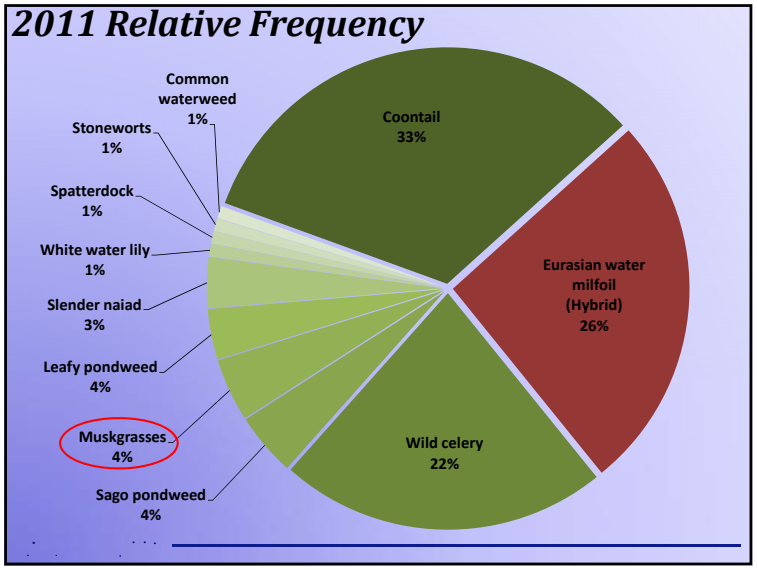
Littoral Frequency of Occurrence

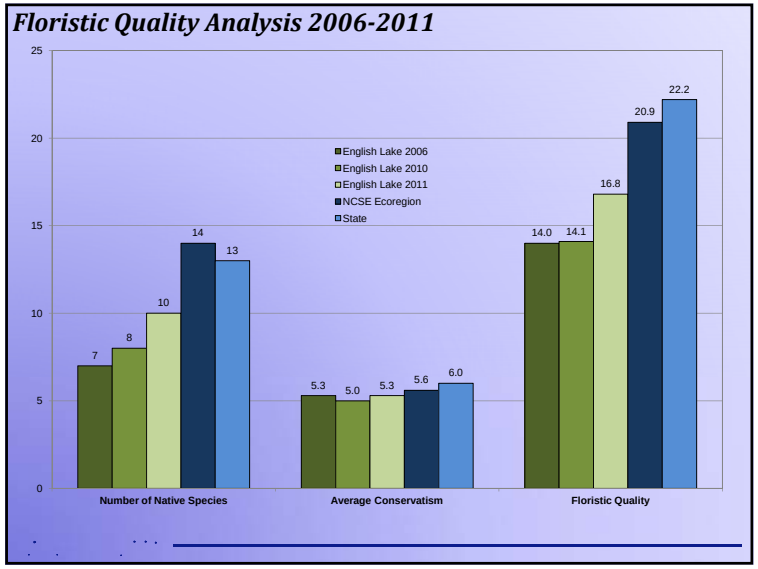


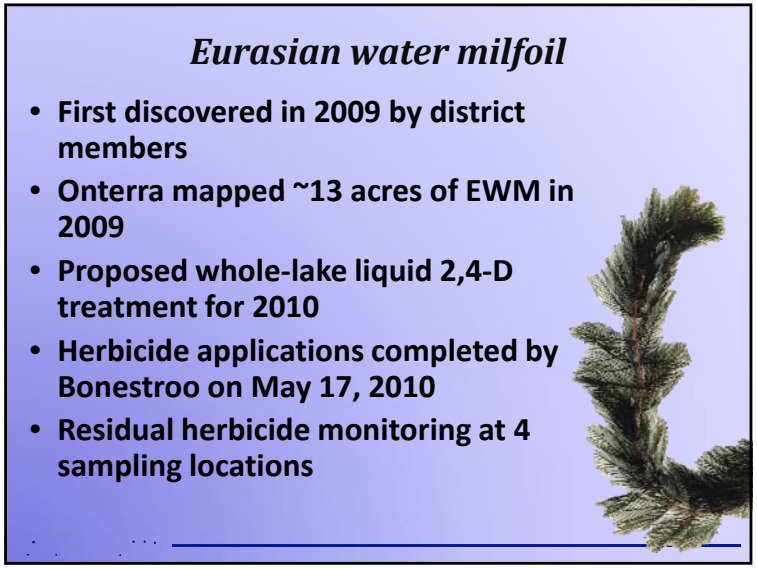
2010 Simpson's Diversity: 0.78

2011 Simpson's Diversity: 0.77


2010 Relative Frequency
Common waterweed 1%
White water lily 1%
Leafy pondweed 1%
Sago pondweed 2%
Slender naiad 2%
Coontail 27%
Eurasian water milfoil (Hybrid) 25%
Muskgrasses 20%
Wild celery 21%

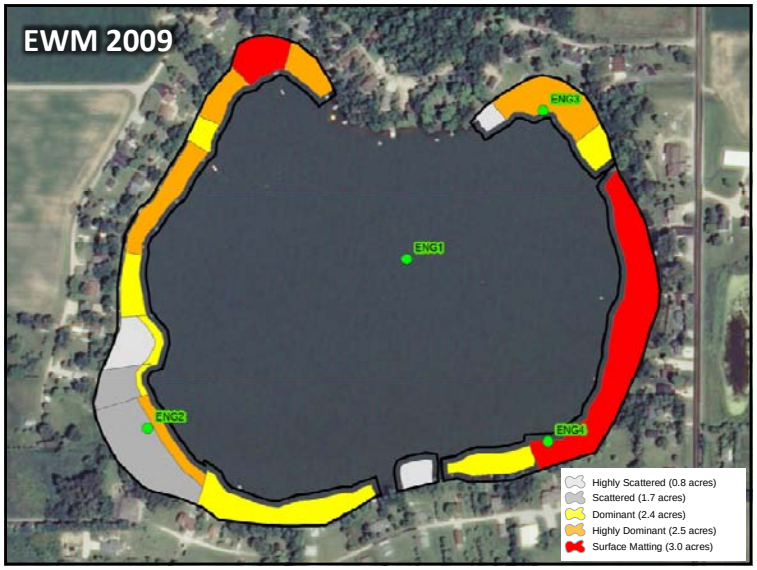

2011 Relative Frequency
Common waterweed 1%
Stoneworts 1%
Spatterdock 1%
White water lily 1%
Slender naiad 3%
Leafy pondweed 4%
Muskgrasses 4%
Sago pondweed 4%
Coontail 33%
Eurasian water milfoil (Hybrid) 26%
Wild celery 22%

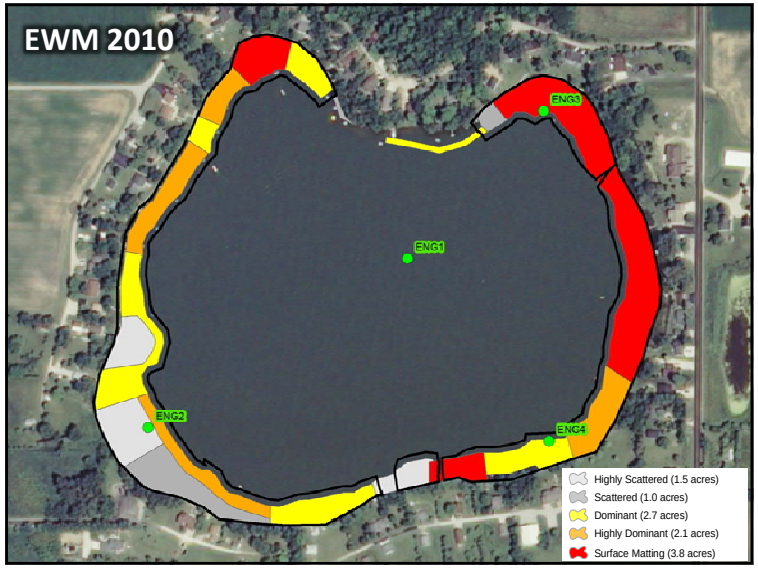

Floristic Quality Analysis 2006-2011
25
20
15
10
5
0
English Lake 2006
English Lake 2010
English Lake 2011
NCSE Ecoregion
State
7
8
10
14
13
5.3
5.0
5.3
5.6
6.0
14.0
14.1
16.8
20.9
22.2
Number of Native Species
Average Conservatism
Floristic Quality


Eurasian water milfoil
First discovered in 2009 by district members
Onterra mapped ~13 acres of EWM in 2009
Proposed whole-lake liquid 2,4-D treatment for 2010
Herbicide applications completed by Bonestroo on May 17, 2010
Residual herbicide monitoring at 4 sampling locations

2010 Treatment Results

- **Initially, treatment appeared highly effective**
  - Quantitatively, EWM decreased in occurrence by a statistically valid 44.9%
- **Later in summer, EWM rebounded; increased density**



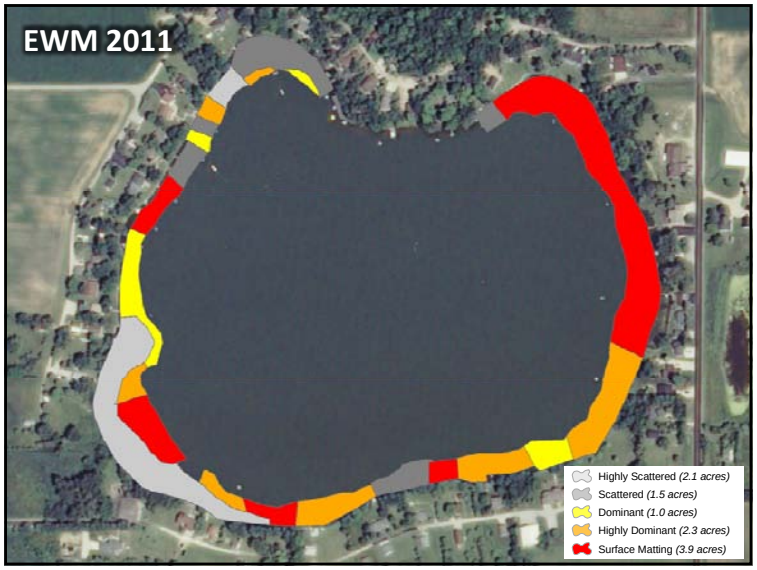


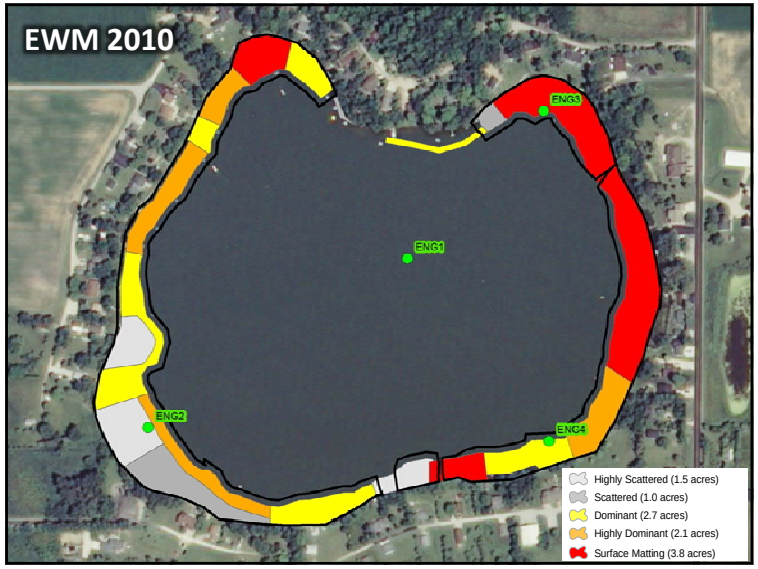
2010 Treatment Results Continued Residual Herbicide Monitoring

- **0.277 ppm 1 day following treatment**
- **0.300 ppm 16 days following treatment**
- **Likely mixed to 15 feet**
- **With concentration/exposure time, should have seen better EWM control (60-75% reduction)**
- **Treatment deemed unsuccessful**
  - High pH?
  - Filamentous algae?
  - EWM genetics?

2011 EWM Monitoring

- **No treatment conducted in 2011 due to unknown reason(s) as to why 2010 treatment was unsuccessful**
- **Repeat of whole-lake PI survey found EWM occurrence same as in 2010**
- **DNA testing revealed EWM is hybrid (Northern x Eurasian)**
- **~600 live EWM specimens sent to SePRO & USACE for resistance testing**
  - Results expected in winter 2012
- **Once we have results, move forward on <u>specific</u> future treatment strategy**





Conclusions

- Water quality is fair.
  - High phosphorus values resulting mainly from internal nutrient loading.
  - Remedies for internal nutrient loading need to be considered after more specific studies are completed.
- Watershed
  - The district has made great strides at reducing external phosphorus sources.
  - Need to continue to reduce sedimentation from runoff which maintains internal load capacities.
  - Majority of shoreline is in urbanized condition; restoration may improve water quality and increase wildlife habitat.
- Aquatic plant community
  - Based upon standard analysis, native community is of lower quality than other lakes within the ecoregion and the state
    - Likely a result of water quality, EWM infestation, and human shoreline development.
  - Eurasian water milfoil is the primary concern.

Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

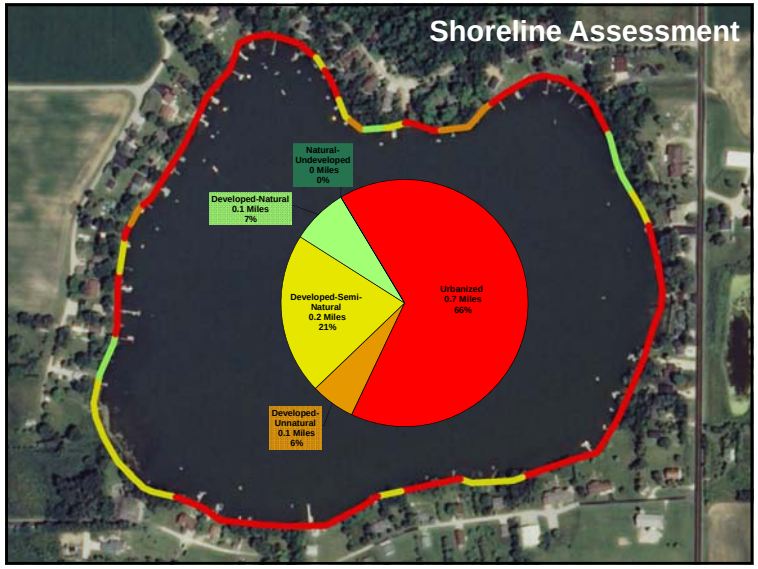
Urbanized Range **Natural**

Shoreline Assessment Category Descriptions

More Natural Habitat

Urbanized | Developed-Unnatural | Developed-Semi-Natural | Developed-Natural | Natural/Undeveloped

Greater Need for Restoration



Thank You

Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UWEX Extension

Wisconsin Dept. of Natural Resources

B

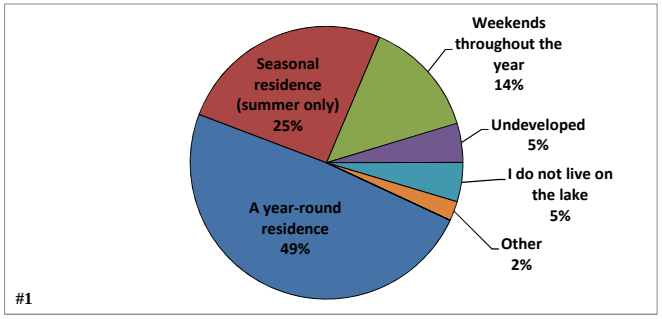
APPENDIX B

Stakeholder Survey Response Charts and Comments

Returned Surveys	42
Sent Surveys	63
Response Rate (%)	66.7

#1 What type of property do you own on English Lake?

	Total	%
A year-round residence	21	*48.8*
Seasonal residence (summer only)	11	*25.6*
Weekends throughout the year	6	*14.0*
Undeveloped	2	*4.7*
I do not live on the lake	2	*4.7*
Other	1	*2.3*
Resort property	0	*0.0*
Rental property	0	*0.0*
	43	*100.0*

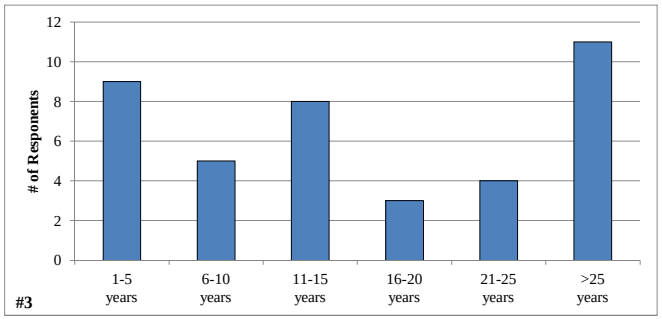


#2 How many days each year is your property used by you or others?

Answered Question	38
Average	162.1
Standard deviation	153.0

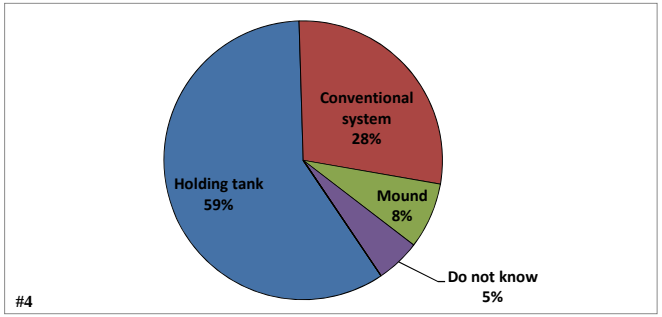
#3 How long have you owned your property on English Lake?

	Total	%
1-5 years	9	*22.5*
6-10 years	5	*12.5*
11-15 years	8	*20.0*
16-20 years	3	*7.5*
21-25 years	4	*10.0*
>25 years	11	*27.5*
	40	*100.0*



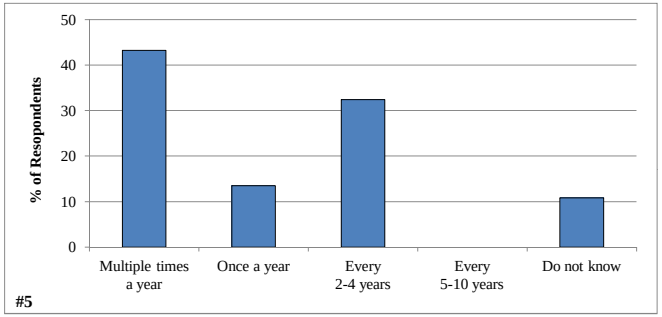
#4 What type of septic system does your property utilize?

	Total	%
Holding tank	23	*59.0*
Conventional system	11	*28.2*
Mound	3	*7.7*
Do not know	2	*5.1*
Advanced treatment system	0	*0.0*
Municipal sewer	0	*0.0*
	39	*100.0*



#5 How often is the septic tank on your property pumped?

	Total	%
Multiple times a year	16	*43.2*
Once a year	5	*13.5*
Every 2-4 years	12	*32.4*
Every 5-10 years	0	*0.0*
Do not know	4	*10.8*
	37	*100.0*

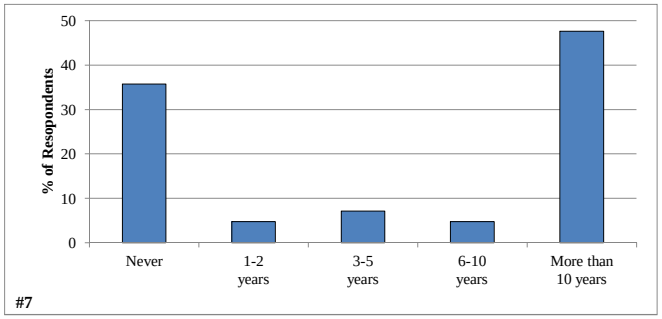


#6 How many years ago did you first visit English Lake?

Answered Question	41
Average	32.6
Standard deviation	21.2

#7 For how many years have you fished English Lake?

	Total	%
Never	15	*35.7*
1-2 years	2	*4.8*
3-5 years	3	*7.1*
6-10 years	2	*4.8*
More than 10 years	20	*47.6*
	42	*100.0*

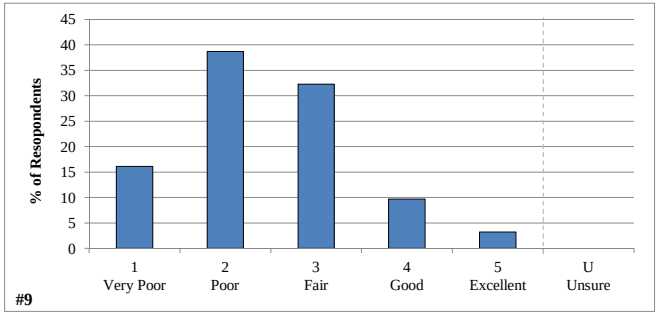


#8 Have you personally fished on English Lake in the past 3 years?

	Total	%
Yes	22	*64.7*
No	12	*35.3*
	34	*100.0*

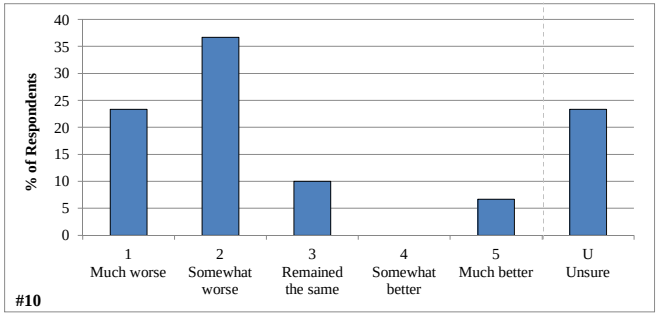
#9 How would you describe the current quality of fishing on English Lake?

	Total	%
1 - Very Poor	5	*16.1*
2 - Poor	12	*38.7*
3 - Fair	10	*32.3*
4 - Good	3	*9.7*
5 - Excellent	1	*3.2*
U - Unsure	0	*0.0*
	31	*100.0*



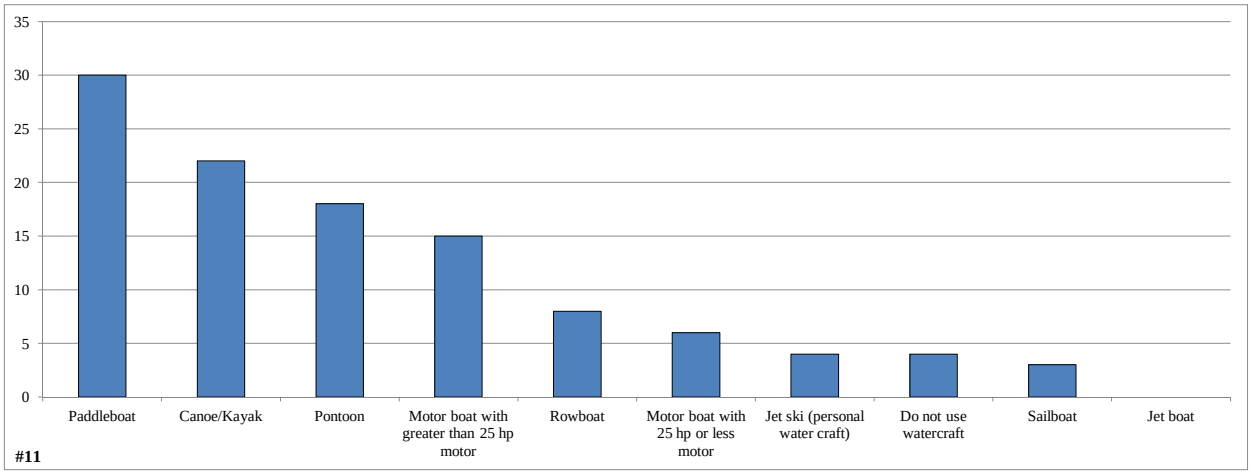
#10 How has the quality of fishing changed since you started fishing on the lake?

	Total	%
1 - Much worse	7	*23.3*
2 - Somewhat worse	11	*36.7*
3 - Remained the Same	3	*10.0*
4 - Somewhat better	0	*0.0*
5 - Much better	2	*6.7*
U - Unsure	7	*23.3*
	30	*100.0*



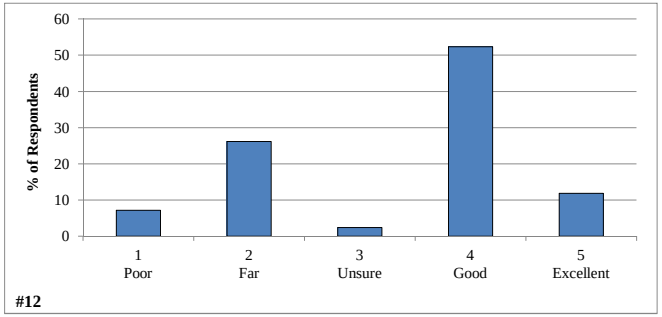
#11 What types of watercraft do you currently use on the lake?

	Total
Paddleboat	30
Canoe/Kayak	22
Pontoon	18
Motor boat with greater than 25 hp motor	15
Rowboat	8
Motor boat with 25 hp or less motor	6
Jet ski (personal water craft)	4
Do not use watercraft	4
Sailboat	3
Jet boat	0



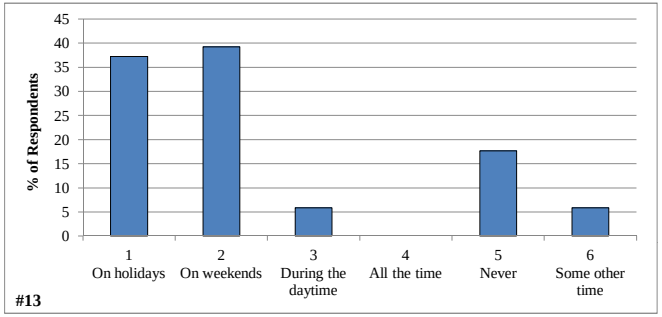
#12 In general, would you say the safety practices of boaters on English Lake are:

	Total	%
1 - Poor	3	*7.1*
2 - Far	11	*26.2*
3 - Unsure	1	*2.4*
4 - Good	22	*52.4*
5 - Excellent	5	*11.9*
	42	*100.0*



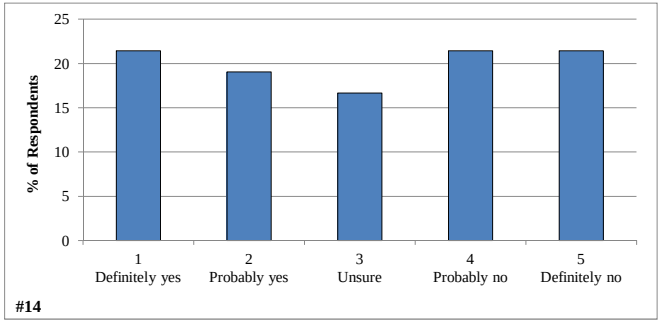
#13 When, if at all, are you aware of unsafe boating practices?

	Total	%
1 - On holidays	19	*37.3*
2 - On weekends	20	*39.2*
3 - During the daytime	3	*5.9*
4 - All the time	0	*0.0*
5 - Never	9	*17.6*
6 - Some other time	3	*5.9*
	51	*100.0*



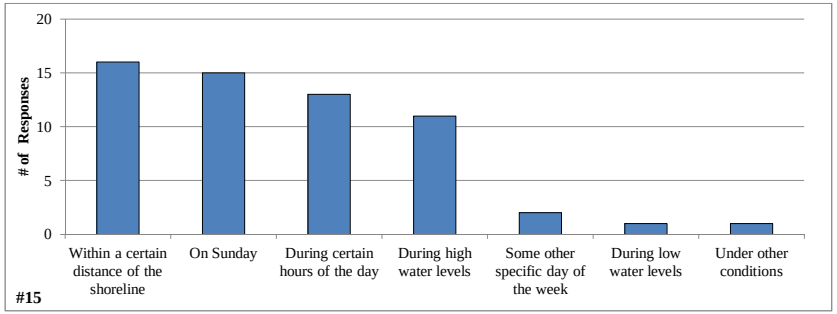
#14 Do you believe adoption of slow-no-wake hours are needed to improve boater safety on English Lake?

	Total	%
1 - Definitely yes	9	*21.4*
2 - Probably yes	8	*19.0*
3 - Unsure	7	*16.7*
4 - Probably no	9	*21.4*
5 - Definitely no	9	*21.4*
	42	*100.0*



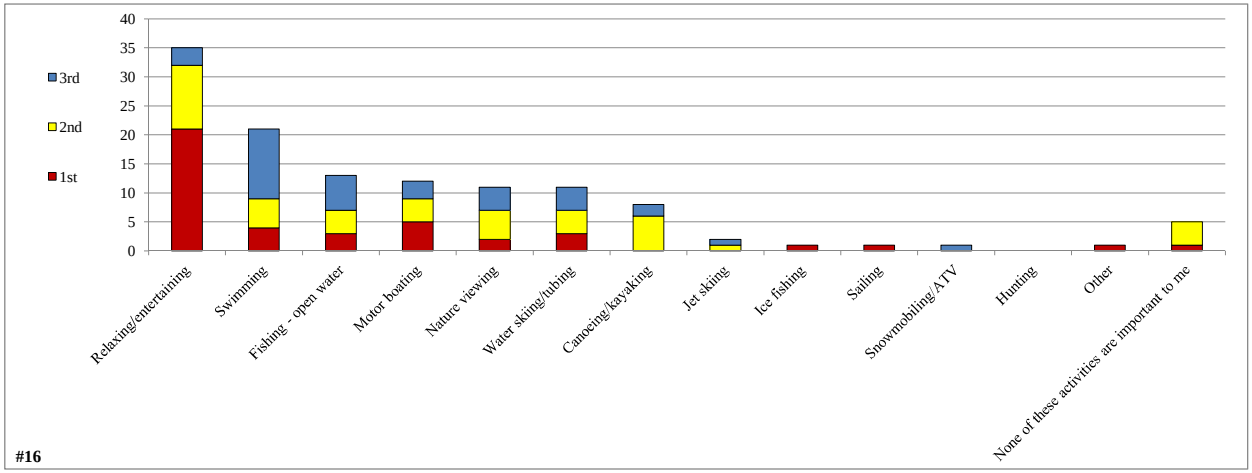
#15 When, if at all, would you suggest that slow-no-wake restrictions be applied?

	Total
Within a certain distance of the shoreline	16
On Sunday	15
During certain hours of the day	13
During high water levels	11
Some other specific day of the week	2
During low water levels	1
Under other conditions	1



#16 Please rank up to three activities that are important reasons for owning your property on or near the lake.

	1st	2nd	3rd	*% ranked*
Relaxing/entertaining	21	11	3	*28.7*
Swimming	4	5	12	*17.2*
Fishing - open water	3	4	6	*10.7*
Motor boating	5	4	3	*9.8*
Nature viewing	2	5	4	*9.0*
Water skiing/tubing	3	4	4	*9.0*
Canoeing/kayaking	0	6	2	*6.6*
Jet skiing	0	1	1	*1.6*
Ice fishing	1	0	0	*0.8*
Sailing	1	0	0	*0.8*
Snowmobiling/ATV	0	0	1	*0.8*
Hunting	0	0	0	*0.0*
Other	1	0	0	*0.8*
None of these activities are important to me	1	4	0	*4.1*
	42	44	36	*100.0*

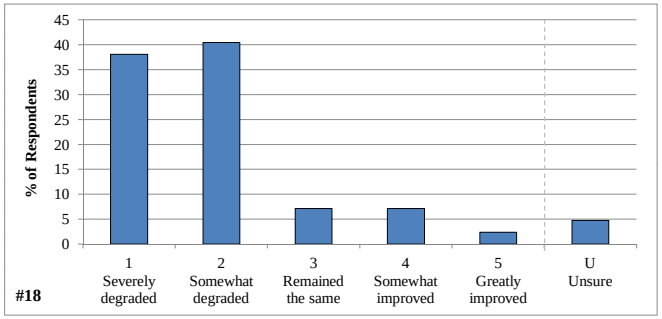


#17 How would you describe the current water quality of English Lake?

	Total	%
1 - Poor	24	*57.1*
2 - Fair	9	*21.4*
3 - Unsure	4	*9.5*
4 - Good	5	*11.9*
5 - Excellent	0	*0.0*
	42	*100.0*

#18 How has the water quality changed in English Lake since you visited the lake?

	Total	%
1 - Severely degraded	16	*38.1*
2 - Somewhat degraded	17	*40.5*
3 - Remained the same	3	*7.1*
4 - Somewhat improved	3	*7.1*
5 - Greatly improved	1	*2.4*
U - Unsure	2	*4.8*
	42	*100.0*



#19 Have you ever heard of aquatic invasive species?

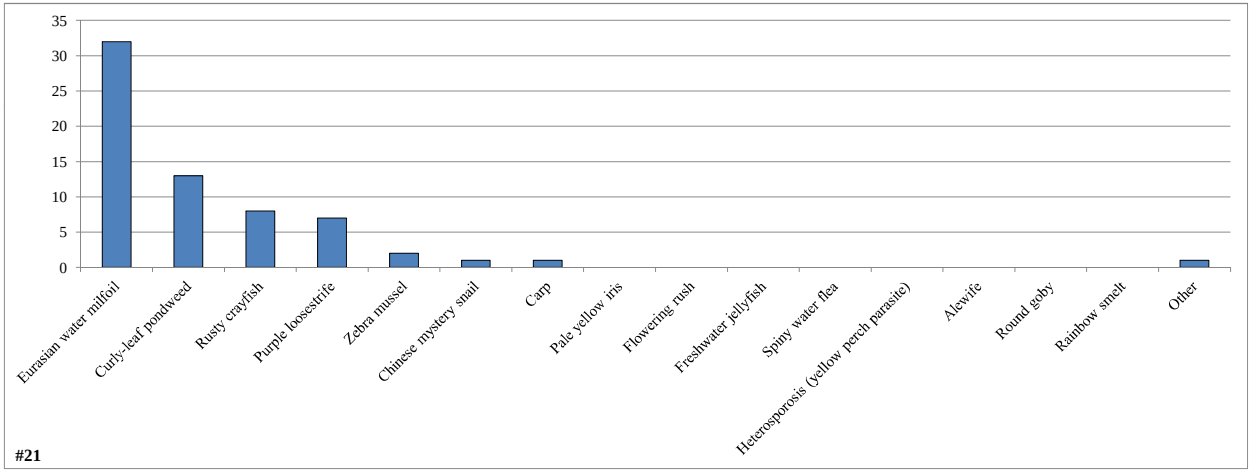
	Total	%
Yes	40	*95.2*
No	2	*4.8*
	42	*100.0*

#20 Are you aware of aquatic invasive species in English Lake?

	Total	%
Yes	32	*80.0*
No	8	*20.0*
	40	*100.0*

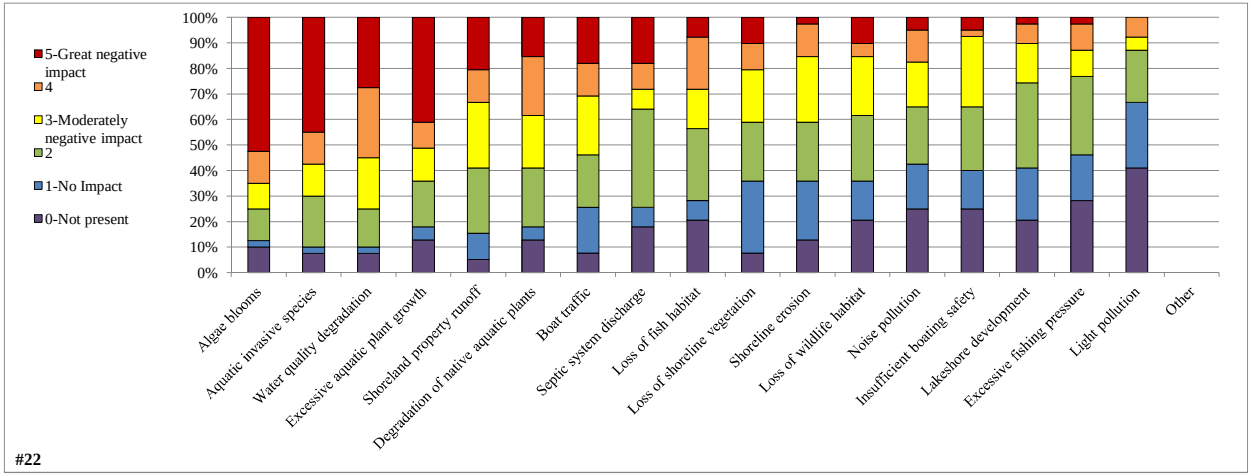
#21 Which aquatic invasive species are you aware of in the lake?

	Total
Eurasian water milfoil	32
Curly-leaf pondweed	13
Rusty crayfish	8
Purple loosestrife	7
Zebra mussel	2
Chinese mystery snail	1
Carp	1
Pale yellow iris	0
Flowering rush	0
Freshwater jellyfish	0
Spiny water flea	0
Heterosporosis (yellow perch parasite)	0
Alewife	0
Round goby	0
Rainbow smelt	0
Other	1



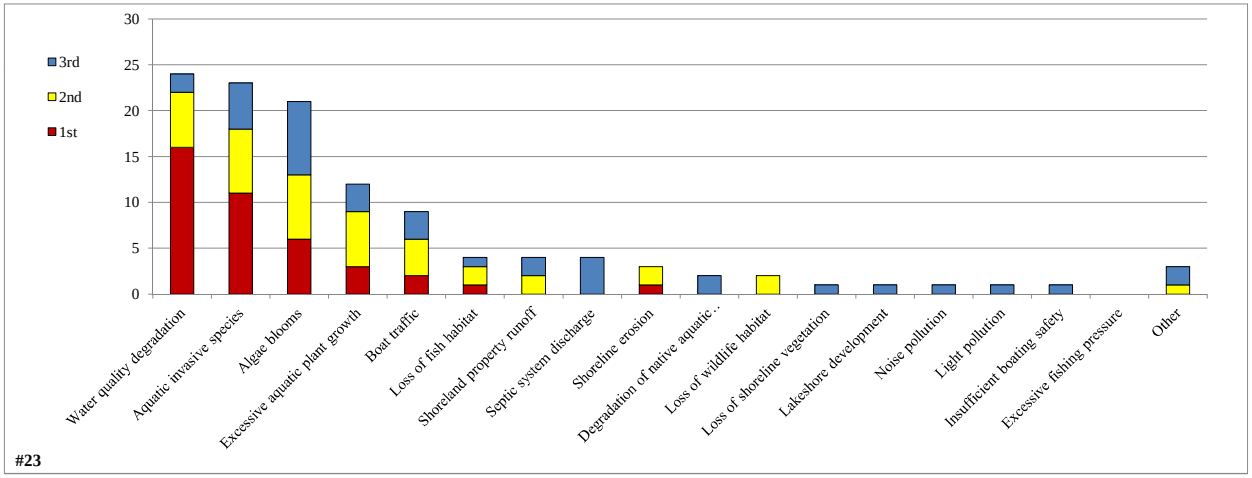
#22 To what level do you believe each of the following factors may be negatively impacting English Lake?

	0-Not present	1-No Impact	2	3-Moderately negative impact	4	5-Great negative impact	*Total*	*Average*
Algae blooms	4	1	5	4	5	21	*36*	*3.7*
Aquatic invasive species	3	1	8	5	5	18	*37*	*3.6*
Water quality degradation	3	1	6	8	11	11	*37*	*3.4*
Excessive aquatic plant growth	5	2	7	5	4	16	*34*	*3.3*
Shoreland property runoff	2	4	10	10	5	8	*37*	*2.9*
Degradation of native aquatic plants	5	2	9	8	9	6	*34*	*2.8*
Boat traffic	3	7	8	9	5	7	*36*	*2.7*
Septic system discharge	7	3	15	3	4	7	*32*	*2.4*
Loss of fish habitat	8	3	11	6	8	3	*31*	*2.3*
Loss of shoreline vegetation	3	11	9	8	4	4	*36*	*2.3*
Shoreline erosion	5	9	9	10	5	1	*34*	*2.1*
Loss of wildlife habitat	8	6	10	9	2	4	*31*	*2.1*
Noise pollution	10	7	9	7	5	2	*30*	*1.9*
Insufficient boating safety	10	6	10	11	1	2	*30*	*1.8*
Lakeshore development	8	8	13	6	3	1	*31*	*1.8*
Excessive fishing pressure	11	7	12	4	4	1	*28*	*1.6*
Light pollution	16	10	8	2	3	0	*23*	*1.1*
Other	0	0	0	0	0	0	*0*	*0.0*



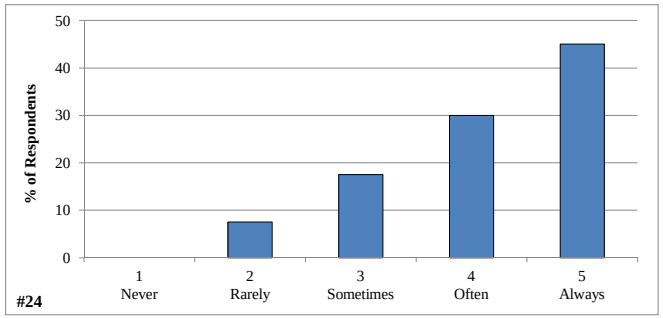
#23 From the list below, please rank your top three concerns regarding the lake.

	1st	2nd	3rd	*% Ranked*
Water quality degradation	16	6	2	*20.7*
Aquatic invasive species	11	7	5	*19.8*
Algae blooms	6	7	8	*18.1*
Excessive aquatic plant growth	3	6	3	*10.3*
Boat traffic	2	4	3	*7.8*
Loss of fish habitat	1	2	1	*3.4*
Shoreland property runoff	0	2	2	*3.4*
Septic system discharge	0	0	4	*3.4*
Shoreline erosion	1	2	0	*2.6*
Degradation of native aquatic plants	0	0	2	*1.7*
Loss of wildlife habitat	0	2	0	*1.7*
Loss of shoreline vegetation	0	0	1	*0.9*
Lakeshore development	0	0	1	*0.9*
Noise pollution	0	0	1	*0.9*
Light pollution	0	0	1	*0.9*
Insufficient boating safety	0	0	1	*0.9*
Excessive fishing pressure	0	0	0	*0.0*
Other	0	1	2	*2.6*
	40	39	37	*100.0*



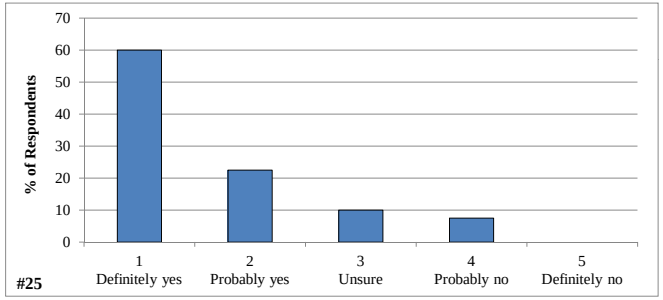
#24 During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of English Lake?

	Total	%
1 - Never	0	*0.0*
2 - Rarely	3	*7.5*
3 - Sometimes	7	*17.5*
4 - Often	12	*30.0*
5 - Always	18	*45.0*
	40	*100.0*



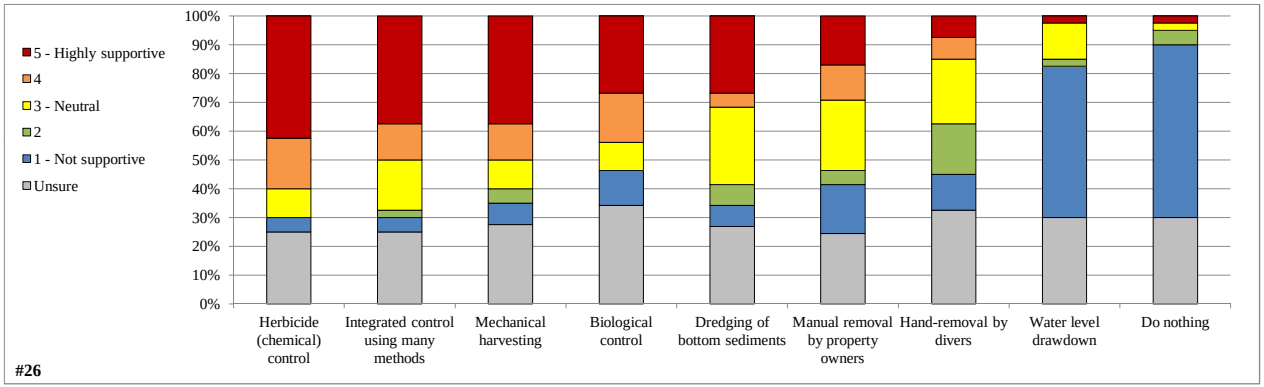
#25 Considering your answer to the question above, do you believe aquatic plant control is needed on English Lake?

	Total	%
1 - Definitely yes	24	*60.0*
2 - Probably yes	9	*22.5*
3 - Unsure	4	*10.0*
4 - Probably no	3	*7.5*
5 - Definitely no	0	*0.0*
	40	*100.0*



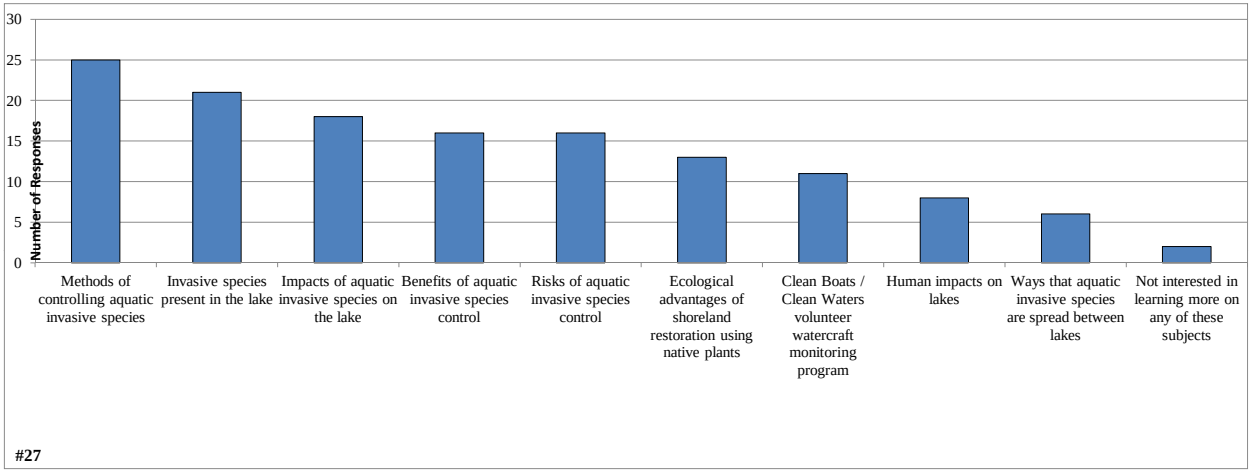
#26 What is your level of support for the responsible use of the following techniques on the lake?

	1 - Not supportive	2	3 - Neutral	4	5 - Highly supportive	Unsure	Total	Average
Herbicide (chemical) control	2	0	4	7	17	10	*30*	*4.2*
Integrated control using many methods	2	1	7	5	15	10	*30*	*4.0*
Mechanical harvesting	3	2	4	5	15	11	*29*	*3.9*
Biological control	5	0	4	7	11	14	*27*	*3.7*
Dredging of bottom sediments	3	3	11	2	11	11	*30*	*3.5*
Manual removal by property owners	7	2	10	5	7	10	*31*	*3.1*
Hand-removal by divers	5	7	9	3	3	13	*27*	*2.7*
Water level drawdown	21	1	5	0	1	12	*28*	*1.5*
Do nothing	24	2	1	0	1	12	*28*	*1.3*



#27 Which of these subjects would you like to learn more about?

	Total
Methods of controlling aquatic invasive species	25
Invasive species present in the lake	21
Impacts of aquatic invasive species on the lake	18
Benefits of aquatic invasive species control	16
Risks of aquatic invasive species control	16
Ecological advantages of shoreland restoration using native plants	13
Clean Boats / Clean Waters volunteer watercraft monitoring program	11
Human impacts on lakes	8
Ways that aquatic invasive species are spread between lakes	6
Not interested in learning more on any of these subjects	2

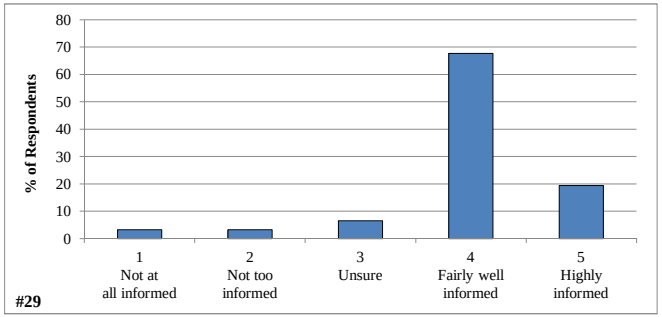


#28 Before receiving this mailing, have you ever heard of the English Lake P & R District?

	Total	%
Yes	31	*77.5*
No	9	*22.5*
	40	*100.0*

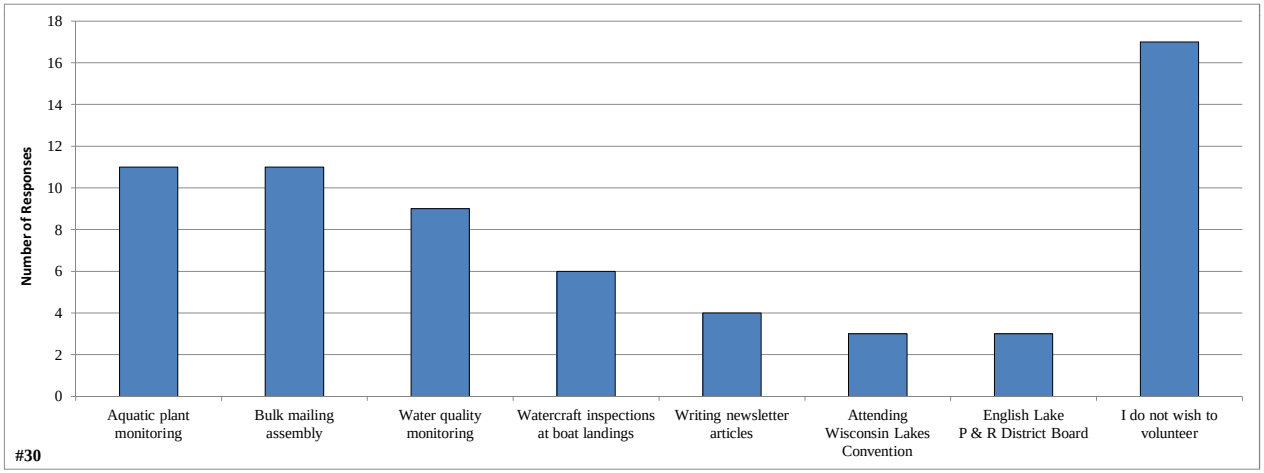
#29 How informed has the English Lake P & R District kept you regarding issues with English Lake and its management?

	Total	%
1 - Not at all informed	1	*3.2*
2 - Not too informed	1	*3.2*
3 - Unsure	2	*6.5*
4 - Fairly well informed	21	*67.7*
5 - Highly informed	6	*19.4*
	31	*100.0*



#30 Please circle the activities you would be willing to participate in if the English Lake P & R District requires additional assistance.

	Total
Aquatic plant monitoring	11
Bulk mailing assembly	11
Water quality monitoring	9
Watercraft inspections at boat landings	6
Writing newsletter articles	4
Attending Wisconsin Lakes Convention	3
English Lake P & R District Board	3
I do not wish to volunteer	17



Survey Number	1g Comment	13 Comment	15e Comment	15f Comment	15g Comment	16m Comment	21p Comment	22r Comment	23r Comment	Other Comments (and Question 31)
1										
2		New to Lake resident					Lake Michigan	i. There isnt any, l Natural, p. South Side	e. AIV: None the lake shore is at full capacity everything has been here for a long time	
3				<11:00AM, >5:00PM						
4			Would Like to see only cottage/home owners on Sunday. No Outsiders				Snails (don't know what kind)			Many years ago a property owner sprayed in front of each home and weeds were controlled. This year it is almost impossible to get a boat away from dock to open water due to excessive weeds and green algae. On top of this, it also prohibits swimming from shore to raft. We need to get weeds under control!! Some of the boats on the lake on the weekends do not belong on a small inland lake. Some pass in front of the property and waves just about knock you over if standing on shore and if children or adults are in water, the wake scares you to death. Motors need to be limited to HP size and Size of boat. Many that come are made for Lake Michigan, not our lake.
5										
6										We need a day off from high speed boating, preferrably on Sunday. 6 days a week should be enough for fast boating. We also need a constable with ticket writing authority for boating infractions.
7				before 11am, after 6pm						
8					Leave as is, If it ain't broke don't fix it!					
9										Closing the lake is not an option, but I think I would like to see more opportunities for the property owners to have the lake to themselves and not have to fight all the other boat traffic.
10				no wake outside of 11am-7pm						
11										
12										must control water flow from the pond during the rainy season
13										
14										
15										Need Fish habitat, no wake on Sundays, and are boaters responsible for their wake?
16		Seldom								
17										
18										
19										
20				11am-6pm						
21									People Urinating in grass near boat landing	
22				before 11-after 6						
23				Present system seems fine						
24				after 2pm on sundays						
25										
26										
27				after 2pm sundays						
28										
29										Would like to see that jet skis not be allowed early spring-reason being spawning of fish
30										
31										
32										
33										
34										
35										
36										
37										
38										I feel the overall water quality has declined drastically in the last 5 years
39										We Love the lake and the people that live on or own property. We are blessed with some good dedicatedhard workers. We would like to see less wake hours and more no-wake hours. The lake is small. We would like to see some people who live in the english lake inn on union road-CLEAN UP.
40				6pm - 11am	more monitoring of public use.					As a kid living on the lake algae and plant growth was maintained with chemical application every spring and possibly in 2 more times during summer. There was more fish and clear water and that was even with farm run-off, imagine that! Now the lake seemsto be filling in with plant growth under and shoreline overgrowth around. It is starting to close off the lake which is I suppose the "natural" process. But, if this is allowed eventually it will all be like living on a swamp. We need Chemical treatment to stunt the growth. With owning a small pond and using more natural chemicals, I know this is possible.
41				5pm-11am						
42			Saturday	noon-3pm						
43										Would like limit on motor sizes and much shorter hours for motor boats can wreck the lake more than it already is.

C

APPENDIX C

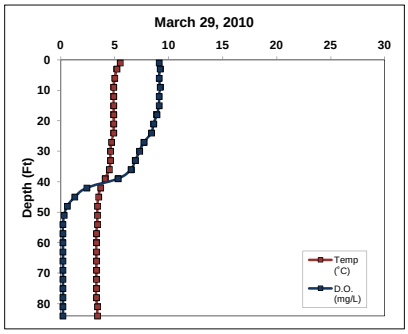
Water Quality Data

English Lake

Date: 3/29/2010
Time: 12:00
Weather: 100% sun, 36°F, calm
Entry: BTB

Max Depth: 86.5
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): 4.8

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	5.5	9.1	7.8	409.0
3	5.2	9.2	7.8	408.0
6	5.0	9.1	7.9	408.0
9	4.9	9.2	7.9	408.0
12	4.9	9.1	7.9	408.0
15	4.9	9.1	7.9	408.0
18	4.9	8.9	7.8	408.0
21	4.9	8.6	7.8	409.0
24	4.9	8.4	7.8	409.0
27	4.7	7.7	7.7	411.0
30	4.6	7.3	7.7	413.0
33	4.6	6.9	7.7	413.0
36	4.5	6.5	7.6	414.0
39	4.1	5.3	7.5	424.0
42	3.7	2.4	7.4	428.0
45	3.5	1.3	7.4	429.0
48	3.4	0.6	7.4	431.0
51	3.4	0.3	7.3	434.0
54	3.4	0.2	7.3	435.0
57	3.3	0.2	7.3	437.0
60	3.3	0.2	7.3	438.0
63	3.3	0.2	7.3	438.0
66	3.3	0.2	7.3	439.0
69	3.3	0.2	7.3	443.0
72	3.3	0.2	7.3	448.0
75	3.3	0.2	7.3	453.0
78	3.3	0.2	7.2	464.0
81	3.4	0.2	7.2	487.0
84	3.4	0.2	7.1	500.0



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

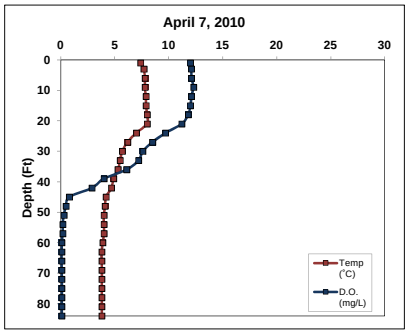
Data collected by BTB and DAC (Onterra)

English Lake

Date: 4/7/2010
Time: 7:45
Weather: windy, snowing, 32°F
Entry: TWH

Max Depth: 86.6
ELS Depth (ft): 3.0
ELB Depth (ft): 84.0
Secchi Depth (ft): 5.4

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	7.4	12.0		
3	7.7	12.1		
6	7.8	12.1		
9	7.8	12.3		
12	7.9	12.1		
15	7.9	12.0		
18	8.0	11.8		
21	8.0	11.2		
24	7.0	9.7		
27	6.2	8.5		
30	5.7	7.6		
33	5.5	7.2		
36	5.3	6.1		
39	4.9	4.0		
42	4.7	2.9		
45	4.2	0.8		
48	4.1	0.5		
51	4.0	0.3		
54	4.0	0.2		
57	4.0	0.2		
60	3.9	0.1		
63	3.8	0.1		
66	3.8	0.1		
69	3.8	0.1		
72	3.8	0.1		
75	3.8	0.1		
78	3.8	0.1		
81	3.8	0.1		
84	3.8	0.1		



Parameter	ELS	ELB
Total P (µg/L)	112.00	224.00
Dissolved P (µg/L)	52.00	194.00
Chl-a (µg/L)	31.20	NA
TKN (µg/L)	1740.00	2090.00
$NO_3 + NO_2$-N (µg/L)	248.00	255.00
NH_3-N (µg/L)	46.00	959.00
Total N (µg/L)	1740.00	2090.00
Lab Cond. (µS/cm)	413.00	448.00
Lab pH	8.33	7.74
Alkalinity (mg/L $CaCO_3$)	162.00	175.00
Total Susp. Solids (mg/L)	3.00	ND
Calcium (mg/L)	35.10	NA

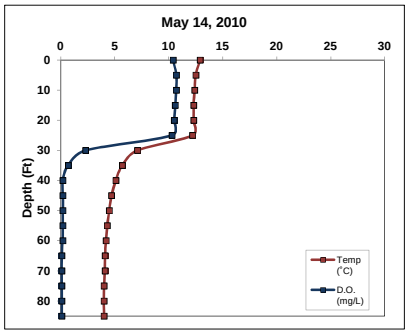
Data collected by BTB (Onterra)

English Lake

Date: 5/14/2010
Time: 10:20
Weather: Windy, 50?F, 100% Clouds
Entry: BTB

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): 11.4

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0	12.9	10.4		
5	12.5	10.7		
10	12.4	10.7		
15	12.3	10.6		
20	12.3	10.5		
25	12.2	10.3		
30	7.1	2.3		
35	5.7	0.7		
40	5.1	0.2		
45	4.7	0.2		
50	4.5	0.2		
55	4.3	0.2		
60	4.2	0.2		
65	4.1	0.1		
70	4.1	0.1		
75	4.0	0.1		
80	4.0	0.1		
85	4.0	0.1		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

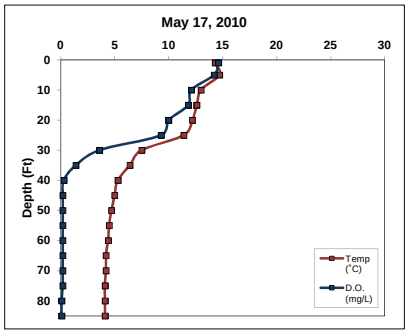
Data collected by: Tim Hoyman (Onterra)

English Lake

Date: 5/17/2010
Time: 5:30
Weather: sunny 68°F
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): NA

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	14.3	14.6		
5	14.7	14.2		
10	13	12.1		
15	12.6	11.8		
20	12.2	10		
25	11.4	9.3		
30	7.5	3.6		
35	6.4	1.4		
40	5.3	0.3		
45	5	0.2		
50	4.7	0.2		
55	4.5	0.2		
60	4.4	0.2		
65	4.2	0.2		
70	4.2	0.2		
75	4.1	0.2		
80	4.1	0.1		
85	4.1	0.1		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

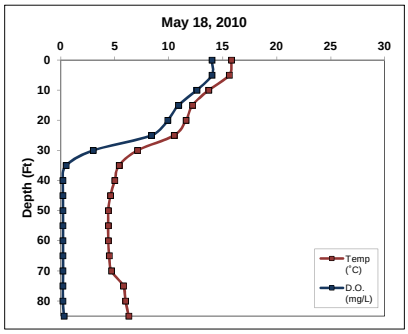
Note: volunteer residual sampling

English Lake

Date: 5/18/2010
Time: 4:30
Weather: windy, sunny, 68°
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): NA

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0.0	15.8	14.0		
5.0	15.6	14.0		
10.0	13.7	12.6		
15.0	12.2	10.9		
20.0	11.6	9.9		
25.0	10.5	8.4		
30.0	7.1	3.0		
35.0	5.4	0.5		
40.0	5.0	0.2		
45.0	4.6	0.2		
50.0	4.4	0.2		
55.0	4.4	0.2		
60.0	4.4	0.2		
65.0	4.5	0.2		
70.0	4.7	0.2		
75.0	5.8	0.2		
80.0	6.0	0.2		
85.0	6.3	0.3		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

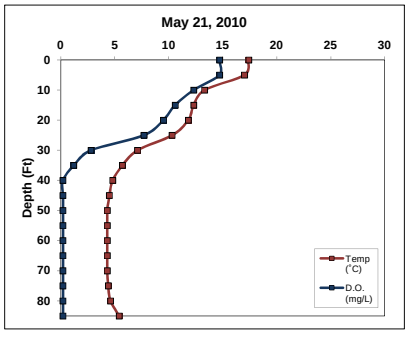
Note: volunteer residual sampling

English Lake

Date: 5/21/2010
Time: 7:15
Weather: foggy, rain all day, 60°F
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): NA

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0.0	17.4	14.7		
5.0	17.0	14.7		
10.0	13.3	12.3		
15.0	12.3	10.6		
20.0	11.8	9.5		
25.0	10.3	7.7		
30.0	7.1	2.8		
35.0	5.7	1.2		
40.0	4.8	0.2		
45.0	4.5	0.2		
50.0	4.3	0.2		
55.0	4.3	0.2		
60.0	4.3	0.2		
65.0	4.3	0.2		
70.0	4.3	0.2		
75.0	4.4	0.2		
80.0	4.6	0.2		
85.0	5.4	0.2		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

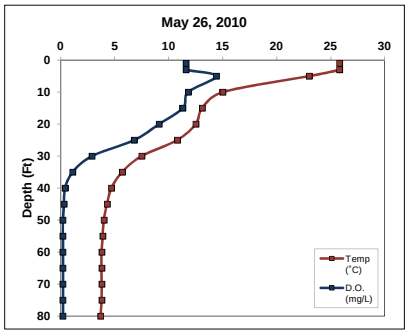
Note: volunteer residual sampling

English Lake

Date: 5/26/2010
Time: 16:15
Weather:
Entry: TWH

Max Depth: 84.2
ELS Depth (ft): 3
ELB Depth (ft): 80
Secchi Depth (ft): 6.8

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	25.8	11.6	9.2	
3.0	25.8	11.6	9.2	
5.0	23.0	14.4	9.2	
10.0	15.0	11.8	8.8	
15.0	13.1	11.3	8.7	
20.0	12.5	9.1	8.6	
25.0	10.8	6.8	8.2	
30.0	7.5	2.9	7.5	
35.0	5.7	1.1	7.4	
40.0	4.7	0.4	7.3	
45.0	4.3	0.3	7.3	
50.0	4.0	0.2	7.3	
55.0	3.9	0.2	7.2	
60.0	3.8	0.2	7.2	
65.0	3.8	0.2	7.2	
70.0	3.8	0.2	7.2	
75.0	3.8	0.2	7.2	
80.0	3.7	0.2	7.2	



Parameter	ELS	ELB
Total P (µg/L)	35.0	453.0
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	9.68	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	9.20	7.20
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	2	3
Calcium (mg/L)	NA	NA

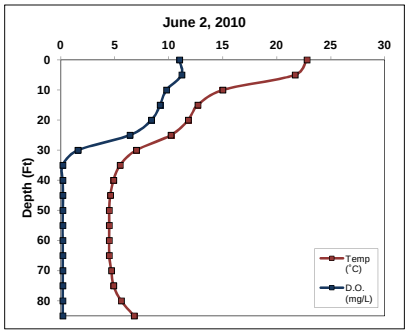
Note: volunteer residual sampling

English Lake

Date: 6/2/2010
Time: 3:45
Weather: sunny, 70°
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): NA

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0.0	22.8	11.0		
5.0	21.7	11.2		
10.0	15.0	9.8		
15.0	12.7	9.2		
20.0	11.8	8.4		
25.0	10.2	6.4		
30.0	7.0	1.6		
35.0	5.5	0.2		
40.0	4.9	0.2		
45.0	4.6	0.2		
50.0	4.5	0.2		
55.0	4.5	0.2		
60.0	4.5	0.2		
65.0	4.5	0.2		
70.0	4.7	0.2		
75.0	4.9	0.2		
80.0	5.6	0.2		
85.0	6.8	0.2		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

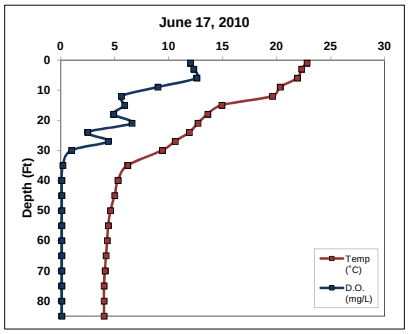
Note: volunteer residual sampling

English Lake

Date: 6/17/2010
Time: 13:15
Weather: clear, 71°F
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): 4.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	22.8	12.0		
3.0	22.3	12.3		
6.0	21.9	12.6		
9.0	20.3	9.0		
12.0	19.6	5.6		
15.0	14.9	5.9		
18.0	13.6	4.9		
21.0	12.7	6.6		
24.0	11.9	2.5		
27.0	10.6	4.4		
30.0	9.4	1.0		
35.0	6.2	0.2		
40.0	5.3	0.1		
45.0	5.0	0.1		
50.0	4.6	0.1		
55.0	4.4	0.1		
60.0	4.3	0.1		
65.0	4.2	0.1		
70.0	4.1	0.1		
75.0	4.0	0.1		
80.0	4.0	0.1		
85.0	4.0	0.1		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

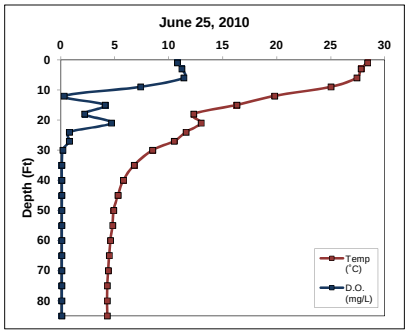
Data collected by: TAH and MKH (Onterra)
Note: residual sampling

English Lake

Date: 6/25/2010
Time: 13:20
Weather: sunny, 80°F
Entry: TWH

Max Depth: NA
ELS Depth (ft): NA
ELB Depth (ft): NA
Secchi Depth (ft): 4.1

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	28.4	10.8		
3.0	27.8	11.2		
6.0	27.4	11.4		
9.0	25.0	7.4		
12.0	19.8	0.3		
15.0	16.3	4.1		
18.0	12.3	2.2		
21.0	13.0	4.7		
24.0	11.6	0.8		
27.0	10.5	0.8		
30.0	8.5	0.2		
35.0	6.8	0.1		
40.0	5.8	0.1		
45.0	5.3	0.1		
50.0	4.9	0.1		
55.0	4.8	0.1		
60.0	4.6	0.1		
65.0	4.5	0.1		
70.0	4.4	0.1		
75.0	4.3	0.1		
80.0	4.3	0.1		
85.0	4.3	0.1		



Parameter	ELS	ELB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	NA	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

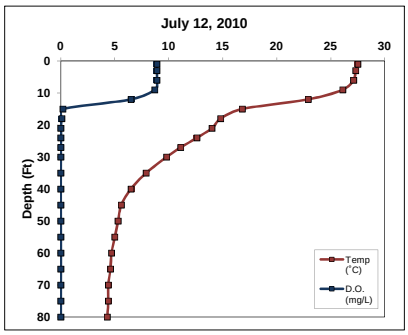
Data collected by: TWH (Onterra)
Note: residual sampling

English Lake

Date: 7/12/2010
Time: 11:45
Weather: 60% clouds, breezy, 78°F
Entry: TWH

Max Depth: 81.9
ELS Depth (ft): 3
ELB Depth (ft): 77
Secchi Depth (ft): 8.4

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	27.5	8.9		
3.0	27.3	8.9		
6.0	27.1	8.9		
9.0	26.1	8.7		
12.0	22.9	6.5		
15.0	16.8	0.2		
18.0	14.8	0.1		
21.0	14.0	0.0		
24.0	12.6	0.0		
27.0	11.1	0.0		
30.0	9.8	0.0		
35.0	7.9	0.0		
40.0	6.5	0.0		
45.0	5.6	0.0		
50.0	5.3	0.0		
55.0	5.0	0.0		
60.0	4.7	0.0		
65.0	4.6	0.0		
70.0	4.4	0.0		
75.0	4.4	0.0		
80.0	4.3	0.0		



Parameter	ELS	ELB
Total P (µg/L)	24.0	660.0
Dissolved P (µg/L)	ND	593.0
Chl-a (µg/L)	6.0	NA
TKN (µg/L)	1010.0	3930.0
$NO_3 + NO_2$-N (µg/L)	ND	ND
NH_3-N (µg/L)	19.0	2770.0
Total N (µg/L)	1010.0	3930.0
Lab Cond. (µS/cm)	349.0	491.0
Lab pH	9.1	7.4
Alkalinity (mg/L $CaCO_3$)	136.0	198.0
Total Susp. Solids (mg/L)	2.0	4.0
Calcium (mg/L)	NA	NA

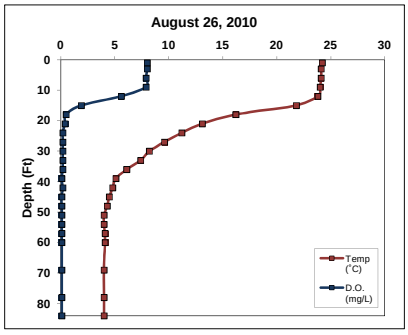
Data collected by: Tim Hoyman (Onterra)
Note: Rained for half hour.

English Lake

Date: 8/26/2010
Time: 10:00
Weather: clear, little breeze, 68°F
Entry: TWH

Max Depth: 85
ELS Depth (ft): 3
ELB Depth (ft): 82
Secchi Depth (ft): 7.3

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	24.2	8.0	9.0	356
3.0	24.1	8.0	9.0	356
6.0	24.1	7.9	9.0	351
9.0	24.0	7.9	9.0	357
12.0	23.8	5.6	8.8	368
15.0	21.8	1.9	8.2	399
18.0	16.2	0.5	7.8	419
21.0	13.1	0.4	7.7	418
24.0	11.2	0.2	7.6	421
27.0	9.6	0.2	7.5	426
30.0	8.2	0.2	7.4	430
33.0	7.4	0.2	7.4	434
36.0	6.1	0.2	7.4	434
39.0	5.1	0.1	7.3	437
42.0	4.8	0.2	7.3	436
45.0	4.5	0.1	7.3	441
48.0	4.3	0.1	7.3	442
51.0	4.0	0.1	7.3	445
54.0	4.0	0.1	7.2	449
57.0	4.1	0.1	7.2	455
60.0	4.1	0.1	7.2	456
63.0				
66.0				
69.0	4.0	0.1	7.1	471
72.0				
75.0				
78.0	4.0	0.1	7.1	478
81.0				
84.0	4.0	0.1	7.1	482



Parameter	ELS	ELB
Total P (µg/L)	16.0	698.0
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	4.1	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	356.0	482.0
Lab pH	9.0	7.1
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	3.0	3.0
Calcium (mg/L)	NA	NA

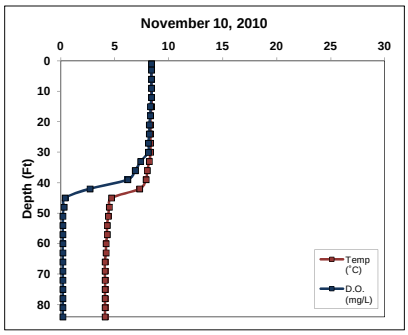
Data collected by: Tim Hoyman (Onterra)
Note: Water was noticably clearer, very little algae on plants and in lake, FA is basically gone.

English Lake

Date: 11/10/2010
Time: 9:30
Weather: 75% sun, light breeze, 55°
Entry: TWH

Max Depth: 87.2
ELS Depth (ft): 3
ELB Depth (ft): 84
Secchi Depth (ft): 11.5

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	8.4	8.4	8.1	397
3.0	8.4	8.4	8.2	396
6.0	8.4	8.4	8.2	397
9.0	8.4	8.4	8.3	397
12.0	8.4	8.4	8.3	397
15.0	8.4	8.3	8.3	396
18.0	8.3	8.3	8.3	396
21.0	8.3	8.2	8.4	397
24.0	8.3	8.2	8.4	397
27.0	8.3	8.1	8.4	396
30.0	8.3	8.1	8.4	397
33.0	8.2	7.4	8.3	398
36.0	8.0	6.9	8.3	399
39.0	7.9	6.2	8.2	401
42.0	7.3	2.7	7.8	414
45.0	4.7	0.4	7.5	449
48.0	4.5	0.3	7.4	454
51.0	4.4	0.2	7.4	456
54.0	4.3	0.2	7.4	457
57.0	4.3	0.2	7.4	461
60.0	4.2	0.2	7.4	465
63.0	4.2	0.2	7.4	467
66.0	4.1	0.2	7.4	469
69.0	4.1	0.2	7.3	472
72.0	4.1	0.2	7.3	475
75.0	4.1	0.2	7.3	478
78.0	4.1	0.2	7.3	481
81.0	4.1	0.2	7.3	486
84.0	4.1	0.2	7.3	487



Parameter	ELS	ELB
Total P (µg/L)	46.0	750.0
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	6.0	NA
TKN (µg/L)	NA	NA
$NO_3 + NO_2$-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	7.3	8.2
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	ND	3.0
Calcium (mg/L)	NA	NA

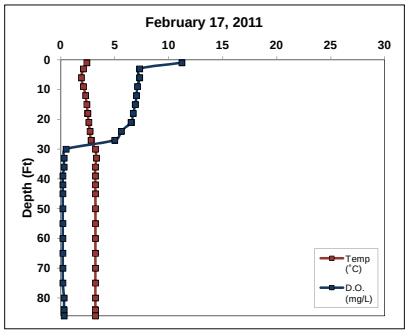
Data collected by: TWH (Onterra)

English Lake

Date: 2/17/2011
Time: 9:30
Weather: 100% clouds, fog, light breeze, 11.2°C air
Entry: TWH

Max Depth: 87.5
ELS Depth (ft): 3
ELB Depth (ft): 84
Secchi Depth (ft): 13.2

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	2.4	11.2		
3.0	2.1	7.3		
6.0	1.9	7.3		
9.0	2.1	7.1		
12.0	2.3	7.0		
15.0	2.4	6.9		
18.0	2.5	6.7		
21.0	2.6	6.5		
24.0	2.7	5.6		
27.0	2.8	5.0		
30.0	3.2	0.5		
33.0	3.3	0.3		
36.0	3.2	0.3		
39.0	3.2	0.2		
42.0	3.2	0.2		
45.0	3.2	0.2		
50.0	3.2	0.2		
55.0	3.2	0.2		
60.0	3.2	0.2		
65.0	3.2	0.2		
70.0	3.2	0.2		
75.0	3.2	0.2		
80.0	3.2	0.3		
84.0	3.2	0.3		
86.0	3.2	0.3		



Parameter	ELS	ELB
Total P (µg/L)	151.0	238.0
Dissolved P (µg/L)	133.0	199.0
Chl-a (µg/L)	NA	NA
TKN (µg/L)	1670.0	2060.0
$NO_3 + NO_2$-N (µg/L)	67.0	58.0
NH_3-N (µg/L)	809.0	1160.0
Total N (µg/L)	1737.0	2118.0
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	ND	3.0
Calcium (mg/L)	NA	NA

Data collected by: TAH, DAC, TWH (Onterra)

Trophic State Index (WTSI)

Year	TP	Chl-a	Secchi
1976			60.0
1985	53.2	53.2	
1986	47.3	50.2	
1987			
1989			39.5
1990			53.0
1991	49.7	56.5	40.8
1992		60.5	44.3
1993	50.6	57.4	44.4
1994	57.0	57.3	52.6
1995			57.1
1996		56.9	44.0
1997			48.5
1998			48.2
1999	47.0	42.2	45.9
2000			45.7
2001			63.4
2002	58.0	41.5	47.0
2003			47.2
2005			45.9
2006			45.9
2008			43.6
2009			50.1
2010	47.3	46.5	47.4
All Years (Weighted)	52.3	52.7	46.5
Deep, Seepage Lakes	43.2	43.2	42.4
SWTP Ecoregion	48.7	47.0	50.0

Water Quality Data

2010	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	10	7.8	NA	NA
Total P (µg/L)	6	64.0	6	503.8
Dissolved P (µg/L)	2	92.5	3	328.7
Chl a (µg/L)	5	11.4	0	NA
TKN (µg/L	3	1473.3	3	2693.3
NO3+NO2-N (µg/L)	2	157.5	2	156.5
NH3-N (µg/L)	3	291.3	3	1629.7
Total N (µg/L)	3	1495.7	3	2712.7
Lab Cond. (µS/cm)	3	372.7	3	473.7
Lab pH	5	8.6	5	7.5
Alkal (mg/l CaCO3)	2	149.0	2	186.5
Total Susp Sol (mg/l)	4	2.5	6	3.2
Calcium (µg/L)	1	35.1	0	NA

	Secchi (feet)				Chlorophyll-a (µg/L)				Total Phosphorus (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season		Summer	
Year	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean
1976	2	3.7	1	3.3								
1985					3	29.7	1	10.0	3	90.0	1.0	30.0
1986					2	21.7	1	7.4	1	20.0	1.0	20.0
1987					1	21.0	0		1	150.0	0.0	
1989	8	13.3	5	13.6								
1990	11	5.5	9	5.3								
1991	15	12.0	8	12.5	3	14.3	2	14.0	3	30.7	2.0	23.5
1992	11	10.0	7	9.8	3	19.8	1	21.0	2	65.0	0.0	
1993	13	9.6	6	9.7	3	11.3	1	15.3	3	79.7	1.0	25.0
1994	13	6.4	10	5.5	3	13.5	1	15.2	3	48.0	1.0	39.0
1995	1	4.0	1	4.0								
1996	9	9.5	8	10.0	3	11.3	2	14.6				
1997	5	7.3	5	7.3								
1998	9	7.5	6	7.4								
1999	11	8.5	7	8.7	2	3.3	2	3.3	2	19.5	2.0	19.5
2000	8	9.0	6	8.9	1	8.6	0		1	175.0	0.0	
2001	8	3.0	5	2.6								
2002	13	7.7	8	8.1	3	3.0	3	3.0	4	73.0	3.0	42.0
2003	8	6.9	5	8.0								
2005	12	9.3	10	8.7								
2006	8	9.6	6	8.8								
2008	9	10.9	6	10.3								
2009	1	6.5	1	6.5								
2010	4	7.0	2	7.9	4	12.7	2	5.0	4	46.8	2.0	20.0
All Years (Weighted)		8.5		8.4		14.2		9.5		64.4		28.2
Deep, Seepage Lakes				11.2				3.6				15.0
SWTP Ecoregion				6.6				5.3				22.0

D

APPENDIX D

Watershed Analysis WiLMS Results

Date: 11/3/2011 English Lake Current

Lake Id: English_Current
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 81.0 acre
Total Unit Runoff: 7.60 in.
Annual Runoff Volume: 51.3 acre-ft
Lake Surface Area <As>: 51.0 acre
Lake Volume <V>: 1836.0 acre-ft
Lake Mean Depth <z>: 36.0 ft
Precipitation - Evaporation: 3.2 in.
Hydraulic Loading: 86.6 acre-ft/year
Areal Water Load <qs>: 1.7 ft/year
Lake Flushing Rate <p>: 0.05 1/year
Water Residence Time: 21.21 year
Observed spring overturn total phosphorus (SPO): 112.0 mg/m^3
Observed growing season mean phosphorus (GSM): 46.8 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	43.0	0.50	1.00	3.00	48.8	9	17	52
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	3.0	0.10	0.30	0.50	1.0	0	0	1
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	28.0	0.05	0.10	0.25	3.2	1	1	3
Wetlands	0.0	0.10	0.10	0.10	0.0	0	0	0
Forest	7.0	0.05	0.09	0.18	0.7	0	0	1
Lake Surface	51.0	0.10	0.30	1.00	17.4	2	6	21

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Drain Tile A	11028	0.0	3.5	0.0	9.8
Sedimentation Basin	15680	0.0	6.8	0.0	19.1

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	0.0				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	25.6	78.6	169.3	100.0
Total Loading (kg)	11.6	35.6	76.8	100.0
Areal Loading (lb/ac-year)	0.50	1.54	3.32	
Areal Loading (mg/m^2-year)	56.18	172.71	372.09	
Total PS Loading (lb)	0.0	22.7	0.0	28.9
Total PS Loading (kg)	0.0	10.3	0.0	28.9
Total NPS Loading (lb)	21.0	42.2	123.8	71.1
Total NPS Loading (kg)	9.5	19.2	56.2	71.1

Phosphorus Prediction and Uncertainty Analysis Module

Date: 11/3/2011 English Lake Current
Observed spring overturn total phosphorus (SPO): 112.0 mg/m^3
Observed growing season mean phosphorus (GSM): 46.8 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	15	46	99	-1	-2
Canfield-Bachmann, 1981 Natural Lake	13	25	39	-22	-47
Canfield-Bachmann, 1981 Artificial Lake	15	25	35	-22	-47
Rechow, 1979 General	5	14	30	-33	-71
Rechow, 1977 Anoxic	23	70	152	23	49
Rechow, 1977 water load<50m/year	6	17	37	-30	-64
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	25	78	167	-34	-30
Vollenweider, 1982 Combined OECD	18	44	83	-35	-44
Dillon-Rigler-Kirchner	25	78	167	-34	-30
Vollenweider, 1982 Shallow Lake/Res.	14	37	73	-42	-53
Larsen-Mercier, 1976	19	60	128	-52	-46
Nurnberg, 1984 Oxic	21	63	137	16	34

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	23	82	Tw	0	GSM
Canfield-Bachmann, 1981 Natural Lake	8	72	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	8	72	FIT	1	GSM
Rechow, 1979 General	7	25	qs	0	GSM
Rechow, 1977 Anoxic	36	125	FIT	0	GSM
Rechow, 1977 water load<50m/year	9	31	Pin	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	33	149	FIT	0	SPO
Vollenweider, 1982 Combined OECD	19	82	FIT	0	ANN
Dillon-Rigler-Kirchner	40	138	P qs p	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	16	69	FIT	0	ANN
Larsen-Mercier, 1976	31	105	P Pin	0	SPO
Nurnberg, 1984 Oxic	29	119	P	0	ANN

Date: 11/3/2011 English Lake Current with Internal Nutrient Loading Estimate

Lake Id: English_Current_InternalLoading
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 81.0 acre
Total Unit Runoff: 7.60 in.
Annual Runoff Volume: 51.3 acre-ft
Lake Surface Area <As>: 51.0 acre
Lake Volume <V>: 1836.0 acre-ft
Lake Mean Depth <z>: 36.0 ft
Precipitation - Evaporation: 3.2 in.
Hydraulic Loading: 86.6 acre-ft/year
Areal Water Load <qs>: 1.7 ft/year
Lake Flushing Rate <p>: 0.05 1/year
Water Residence Time: 21.21 year
Observed spring overturn total phosphorus (SPO): 112.0 mg/m^3
Observed growing season mean phosphorus (GSM): 46.8 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	43.0	0.50	1.00	3.00	5.8	9	17	52
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	3.0	0.10	0.30	0.50	0.1	0	0	1
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	28.0	0.05	0.10	0.25	0.4	1	1	3
Wetlands	0.0	0.10	0.10	0.10	0.0	0	0	0
Forest	7.0	0.05	0.09	0.18	0.1	0	0	1
Lake Surface	51.0	0.10	0.30	1.00	2.1	2	6	21

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %
Drain Tile A	11028.0	0.0	3.5	0.0	1.2
Sedimentation Basin	15680.0	0.0	6.8	0.0	2.3
Internal Nutrient Loading	0.0	0.0	263.7	0.0	88.1

SEPTIC TANK DATA

Description	Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)	0.30	0.50	0.80	
# capita-years	0.0			
% Phosphorus Retained by Soil	98.0	90.0	80.0	
Septic Tank Loading (kg/year)	0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	25.6	659.9	169.3	100.0
Total Loading (kg)	11.6	299.3	76.8	100.0
Areal Loading (lb/ac-year)	0.50	12.94	3.32	
Areal Loading (mg/m^2-year)	56.18	1450.39	372.09	
Total PS Loading (lb)	0.0	604.1	0.0	91.5
Total PS Loading (kg)	0.0	274.0	0.0	91.5
Total NPS Loading (lb)	21.0	42.2	123.8	8.5
Total NPS Loading (kg)	9.5	19.2	56.2	8.5

Phosphorus Prediction and Uncertainty Analysis Module

Date: 11/3/2011 English Lake Current with Internal Nutrient Loading Estimate
Observed spring overturn total phosphorus (SPO): 112.0 mg/m^3
Observed growing season mean phosphorus (GSM): 46.8 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	5	140	36	93	199
Canfield-Bachmann, 1981 Natural Lake	13	85	39	38	81
Canfield-Bachmann, 1981 Artificial Lake	15	64	35	17	36
Rechow, 1979 General	5	119	30	72	154
Rechow, 1977 Anoxic	23	592	152	545	1165
Rechow, 1977 water load<50m/year	6	146	37	99	212
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	25	652	167	540	482
Vollenweider, 1982 Combined OECD	18	253	83	174	219
Dillon-Rigler-Kirchner	25	651	167	539	481
Vollenweider, 1982 Shallow Lake/Res.	14	242	73	163	205
Larsen-Mercier, 1976	19	500	128	388	346
Nurnberg, 1984 Oxic	21	533	137	486	1038

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	49	221	Tw Pin	0	GSM
Canfield-Bachmann, 1981 Natural Lake	26	245	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	20	184	FIT	1	GSM
Rechow, 1979 General	40	192	qs	0	GSM
Rechow, 1977 Anoxic	213	924	Pin	0	GSM
Rechow, 1977 water load<50m/year	50	234	P Pin	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	191	1135	Pin	0	SPO
Vollenweider, 1982 Combined OECD	73	453	Pin	0	ANN
Dillon-Rigler-Kirchner	232	1021	P qs p	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	70	429	Pin	0	ANN
Larsen-Mercier, 1976	184	770	P Pin	0	SPO
Nurnberg, 1984 Oxic	166	901	P	0	ANN

E

APPENDIX E

Aquatic Plant Survey Data

sampling point	Latitiude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Vallisneria americana*	*Chara sp.*	*Stuckenia pectinata*	*Najas flexilis*	*Elodea canadensis*	*Nymphaea odorata*	*Potamogeton foliosus*	Filamentous algae
1	44.0460132	-87.78875295	2	S	P		1		1	1							
2	44.0457433	-87.788763	2	S	P		1	1		1							1
3	44.0454734	-87.78877304	2	R	P		1										1
4	44.0452035	-87.78878309	2	S	P		1			1	1						1
5	44.0449335	-87.78879313	3	S	P		3			3							1
6	44.0446636	-87.78880318	3	M	P		2		2						1		1
7	44.0443937	-87.78881322	3	S	P		3		1		3						1
8	44.0441238	-87.78882326	2	S	P		1						1				1
9	44.0462758	-87.78836871	9	M	P		3	3	1								
10	44.0460059	-87.78837875	21		R	No Vegetation											
11	44.045736	-87.7883888				Deep											
12	44.0454661	-87.78839885				Deep											
13	44.0451962	-87.78840889	4	S	P		1			1	1						1
14	44.0449263	-87.78841894	15		R		3		3								
15	44.0446564	-87.78842899	14		R		3	2	2								
16	44.0443865	-87.78843903	4	M	P		1	V	1	1							2
17	44.0441166	-87.78844908	3	M	P		1			1	1						1
18	44.0438467	-87.78845913	3	S	P	No Vegetation											1
19	44.0468084	-87.78797441	6	M	P		3		3	1	1	1					3
20	44.0465385	-87.78798446	16		R		2	1	2								
21	44.0462686	-87.78799451				Deep											
22	44.0459987	-87.78800456				Deep											
23	44.0457288	-87.78801461				Deep											
24	44.0454589	-87.78802466				Deep											
25	44.045189	-87.7880347				Deep											
26	44.0449191	-87.78804475				Deep											
27	44.0446492	-87.7880548				Deep											
28	44.0443793	-87.78806485	17		R	No Vegetation											
29	44.0441094	-87.7880749	10	M	P		2	2	1								1
30	44.0438394	-87.78808494	2	M	P		1			1							1
31	44.0473409	-87.78758011	7	M	P		2	1	1	1	1						
32	44.047071	-87.78759016				Deep											
33	44.0468011	-87.78760021				Deep											
34	44.0465312	-87.78761026				Deep											
35	44.0462613	-87.78762031				Deep											
36	44.0459914	-87.78763036				Deep											
37	44.0457215	-87.78764041				Deep											
38	44.0454516	-87.78765046				Deep											
39	44.0451817	-87.78766051				Deep											
40	44.0449118	-87.78767056				Deep											
41	44.0446419	-87.78768061				Deep											
42	44.044372	-87.78769066				Deep											
43	44.0441021	-87.78770071	15		R		3		3								
44	44.0438322	-87.78771076	4	M	P		1		1	1							
45	44.0476036	-87.78719585	6	M	P		3	2	2		1						
46	44.0473337	-87.78720591				Deep											
47	44.0470638	-87.78721596				Deep											

sampling point	Latitiude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Vallisneria americana*	*Chara sp.*	*Stuckenia pectinata*	*Najas flexilis*	*Elodea canadensis*	*Nymphaea odorata*	*Potamogeton foliosus*	Filamentous algae
48	44.0467939	-87.78722601				Deep											
49	44.046524	-87.78723606				Deep											
50	44.0462541	-87.78724612				Deep											
51	44.0459842	-87.78725617				Deep											
52	44.0457143	-87.78726622				Deep											
53	44.0454444	-87.78727627				Deep											
54	44.0451745	-87.78728632				Deep											
55	44.0449046	-87.78729638				Deep											
56	44.0446347	-87.78730643				Deep											
57	44.0443648	-87.78731648				Deep											
58	44.0440949	-87.78732653				Deep											
59	44.043825	-87.78733658	14		R		1		1			V					
60	44.0475963	-87.78682165	13		R		1		1								
61	44.0473264	-87.7868317				Deep											
62	44.0470565	-87.78684176				Deep											
63	44.0467866	-87.78685181				Deep											
64	44.0465167	-87.78686187				Deep											
65	44.0462468	-87.78687192				Deep											
66	44.0459769	-87.78688197				Deep											
67	44.045707	-87.78689203				Deep											
68	44.0454371	-87.78690208				Deep											
69	44.0451672	-87.78691213				Deep											
70	44.0448973	-87.78692219				Deep											
71	44.0446274	-87.78693224				Deep											
72	44.0443575	-87.78694229				Deep											
73	44.0440876	-87.78695235				Deep											
74	44.0438177	-87.7869624	16		R		1		1								
75	44.0435478	-87.78697245	2	S	P		2		1	1	1		2				1
76	44.0475891	-87.78644744	6	S	P		2	1	1	1							
77	44.0473192	-87.7864575	18		R	No Vegetation											
78	44.0470493	-87.78646756				Deep											
79	44.0467794	-87.78647761				Deep											
80	44.0465095	-87.78648767				Deep											
81	44.0462396	-87.78649772				Deep											
82	44.0459697	-87.78650778				Deep											
83	44.0456998	-87.78651783				Deep											
84	44.0454299	-87.78652789				Deep											
85	44.04516	-87.78653794				Deep											
86	44.0448901	-87.786548				Deep											
87	44.0446202	-87.78655805				Deep											
88	44.0443503	-87.78656811				Deep											
89	44.0440804	-87.78657816				Deep											
90	44.0438104	-87.78658822	17		R	No Vegetation											
91	44.047042	-87.78609335				Deep											
92	44.0467721	-87.78610341				Deep											
93	44.0465022	-87.78611347				Deep											
94	44.0462323	-87.78612353				Deep											

sampling point	Latitiude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Vallisneria americana*	*Chara sp.*	*Stuckenia pectinata*	*Najas flexilis*	*Elodea canadensis*	*Nymphaea odorata*	*Potamogeton foliosus*	Filamentous algae
95	44.0459624	-87.78613358				Deep											
96	44.0456925	-87.78614364				Deep											
97	44.0454226	-87.7861537				Deep											
98	44.0451527	-87.78616375				Deep											
99	44.0448828	-87.78617381				Deep											
100	44.0446129	-87.78618387				Deep											
101	44.044343	-87.78619392				Deep											
102	44.0440731	-87.78620398				Deep											
103	44.0438032	-87.78621404	15		R		2		2								
104	44.0470348	-87.78571915	3	S	P		1	1		1	1						
105	44.0467649	-87.78572921				Deep											
106	44.046495	-87.78573927				Deep											
107	44.0462251	-87.78574933				Deep											
108	44.0459552	-87.78575939				Deep											
109	44.0456853	-87.78576945				Deep											
110	44.0454153	-87.78577951				Deep											
111	44.0451454	-87.78578956				Deep											
112	44.0448755	-87.78579962				Deep											
113	44.0446056	-87.78580968				Deep											
114	44.0443357	-87.78581974				Deep											
115	44.0440658	-87.7858298				Deep											
116	44.0437959	-87.78583985	10	M	P		3	3	1								
117	44.0467576	-87.78535501				Deep											
118	44.0464877	-87.78536507				Deep											
119	44.0462178	-87.78537513				Deep											
120	44.0459479	-87.78538519				Deep											
121	44.045678	-87.78539525				Deep											
122	44.0454081	-87.78540531				Deep											
123	44.0451382	-87.78541537				Deep											
124	44.0448683	-87.78542543				Deep											
125	44.0445984	-87.78543549				Deep											
126	44.0443285	-87.78544555				Deep											
127	44.0440586	-87.78545561	17		R		1		1								
128	44.0467503	-87.78498081				Deep											
129	44.0464804	-87.78499087				Deep											
130	44.0462105	-87.78500094				Deep											
131	44.0459406	-87.785011				Deep											
132	44.0456707	-87.78502106				Deep											
133	44.0454008	-87.78503112				Deep											
134	44.0451309	-87.78504119				Deep											
135	44.044861	-87.78505125				Deep											
136	44.0445911	-87.78506131				Deep											
137	44.0443212	-87.78507137				Deep											
138	44.0440513	-87.78508143	6	M	P		2			1	2						1
139	44.047013	-87.78459655	12	M	P		3	3		1							
140	44.0467431	-87.78460661				Deep											
141	44.0464732	-87.78461668				Deep											

sampling point	Latitiude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Vallisneria americana*	*Chara sp.*	*Stuckenia pectinata*	*Najas flexilis*	*Elodea canadensis*	*Nymphaea odorata*	*Potamogeton foliosus*	Filamentous algae
142	44.0462033	-87.78462674				Deep											
143	44.0459334	-87.7846368				Deep											
144	44.0456635	-87.78464687				Deep											
145	44.0453936	-87.78465693				Deep											
146	44.0451237	-87.784667				Deep											
147	44.0448538	-87.78467706				Deep											
148	44.0445839	-87.78468712				Deep											
149	44.044314	-87.78469719				Deep											
150	44.0440441	-87.78470725	6	S	P		1			1							1
151	44.0470057	-87.78422235				Deep											
152	44.0467358	-87.78423241				Deep											
153	44.0464659	-87.78424248				Deep											
154	44.046196	-87.78425255				Deep											
155	44.0459261	-87.78426261				Deep											
156	44.0456562	-87.78427268				Deep											
157	44.0453863	-87.78428274				Deep											
158	44.0451164	-87.78429281				Deep											
159	44.0448465	-87.78430287				Deep											
160	44.0445766	-87.78431294				Deep											
161	44.0443067	-87.784323				Deep											
162	44.0440368	-87.78433307	4	S	P		3	1	1	1	2			1			3
163	44.0472684	-87.78383808	14		R	No Vegetation											
164	44.0469985	-87.78384815				Deep											
165	44.0467286	-87.78385821				Deep											
166	44.0464587	-87.78386828				Deep											
167	44.0461888	-87.78387835				Deep											
168	44.0459189	-87.78388842				Deep											
169	44.045649	-87.78389848				Deep											
170	44.0453791	-87.78390855				Deep											
171	44.0451092	-87.78391862				Deep											
172	44.0448393	-87.78392868				Deep											
173	44.0445694	-87.78393875				Deep											
174	44.0442995	-87.78394882				Deep											
175	44.0472611	-87.78346388	8	R	P		3	3	1								1
176	44.0469912	-87.78347395				Deep											
177	44.0467213	-87.78348402				Deep											
178	44.0464514	-87.78349408				Deep											
179	44.0461815	-87.78350415				Deep											
180	44.0459116	-87.78351422				Deep											
181	44.0456417	-87.78352429				Deep											
182	44.0453718	-87.78353436				Deep											
183	44.0451019	-87.78354443				Deep											
184	44.044832	-87.7835545				Deep											
185	44.0445621	-87.78356457				Deep											
186	44.0442922	-87.78357463	15		R		3	1	3								1
187	44.0472538	-87.78308967	2	S	P		1			1							1
188	44.0469839	-87.78309974	8	M	P		2	2	1								

sampling point	Latitiude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*	*Ceratophyllum demersum*	*Vallisneria americana*	*Chara sp.*	*Stuckenia pectinata*	*Najas flexilis*	*Elodea canadensis*	*Nymphaea odorata*	*Potamogeton foliosus*	Filamentous algae
189	44.046714	-87.78310982				Deep											
190	44.0464441	-87.78311989				Deep											
191	44.0461742	-87.78312996				Deep											
192	44.0459043	-87.78314003				Deep											
193	44.0456344	-87.7831501				Deep											
194	44.0453645	-87.78316017				Deep											
195	44.0450946	-87.78317024				Deep											
196	44.0448247	-87.78318031				Deep											
197	44.0445548	-87.78319038				Deep											
198	44.0442849	-87.78320045	3	S	P		2	1			2						1
199	44.0467068	-87.78273562	5	M	P		2	1	1	1							
200	44.0464369	-87.78274569	12	M	P		2	2									
201	44.046167	-87.78275576	16		R		1				1						
202	44.0458971	-87.78276584	18		R												
203	44.0456272	-87.78277591				Deep											
204	44.0453573	-87.78278598	17		R						1						
205	44.0450874	-87.78279605	15		R		3	3			1						
206	44.0448175	-87.78280612	14		R		2	2			1						
207	44.0445476	-87.7828162	3	S	P		2	1		1	2	1				1	1
208	44.0461597	-87.78238157	5	M	P		3	1	2								1
209	44.0458898	-87.78239164	6	M	P		2	2			1						1
210	44.0456199	-87.78240172	6	M	P		3	3			1						1
211	44.04535	-87.78241179	5	M	P		3	2			2						3

F

APPENDIX F

English Lake, Herbicide Residual Summary 2010 – Draft v.1

Draft: English Lake, Manitowoc County, Residual Monitoring Results, 2010

John Skogerboe
US Army Engineer Research and Development Center

A liquid formulation of 2,4-D was applied to English Lake at a target concentration of 2000 ug/L ae (Figure 1) on 13 May 10. English Lake is 49 acres and has a maximum depth of 90 ft . Based on water temperature and dissolved oxygen data collected by Onterra LLC, English Lake was stratified at 25 to 30 ft. A target whole lake concentration was calculated to be 300 ug/L ae assuming no dissipation of 2,4-D below 25 ft. Four herbicide residual sample locations were located in the lake, three in treated areas (ENG2, ENG3, and ENG4) and one in a deep untreated location (ENG1) (Figure 2). Sampling was conducted by lake volunteers at pre-determined sample intervals (Table 1). Water samples were collected at mid depth in the shallow, treated locations (ENG2, ENG3, and ENG4). Water samples were collected at depths of 5, 15, 25, 35, and 55 ft at the deep sample site (ENG1). Following completion of each sample interval, 2-3 drops of muriatic acid were added to the sample to fix the herbicide.

Concentrations of 2,4-D in treated and untreated areas were similar by 1 day after treatment (DAT) (Figure 3). Concentrations at depths $\geq$ 25 feet were at the detection limit of 10 ug/L ae indicating that 2,4-D did not dissipate beyond the target depth (Figure 4). The mean lake wide concentration at 1 DAT was 277 ug/L ae compared to the target concentration of 300 ug/L ae. The mean lake wide concentration for all sites, 0 to 9 DAT was 286 ug/L ae and did not reach the irrigation restriction limit of 100 ug/L ae until approximately 26 DAT.

Based on point intercept data collected by Onterra LLC, percent control of Eurasian watermilfoil was only 49% which was less than might be expected given the 2,4-D concentrations and exposure times. Eurasian watermilfoil was reported to be heavily covered with filamentous algae which may have adversely affected control. Other factors that should be investigated are hybrids, and water chemistry such as pH.

Figure 1. English Lake Herbicide Application Map and Herbicide Residual Sample Locations (Onterra LLC)

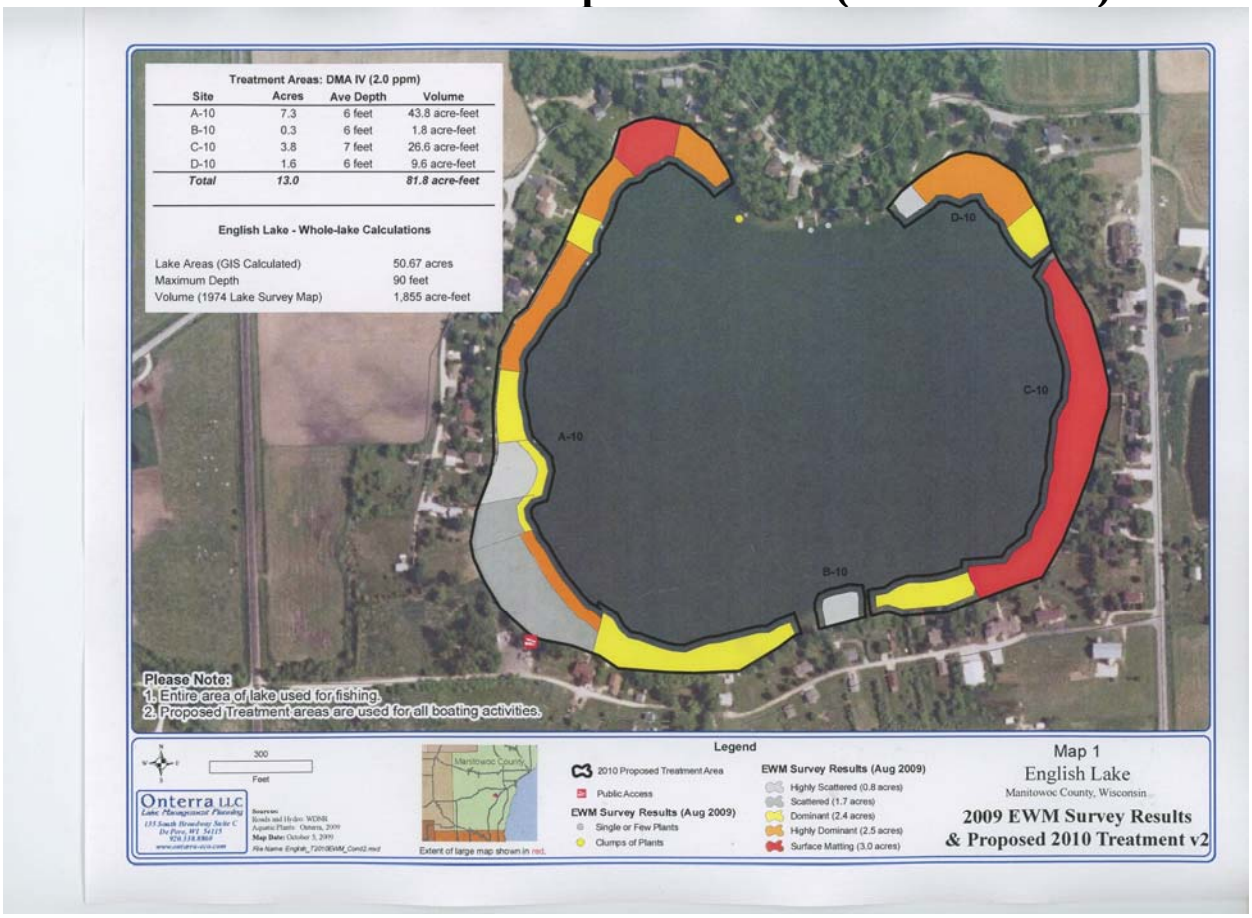


Figure 2. English Lake Herbicide Residual Sample Locations, 2010

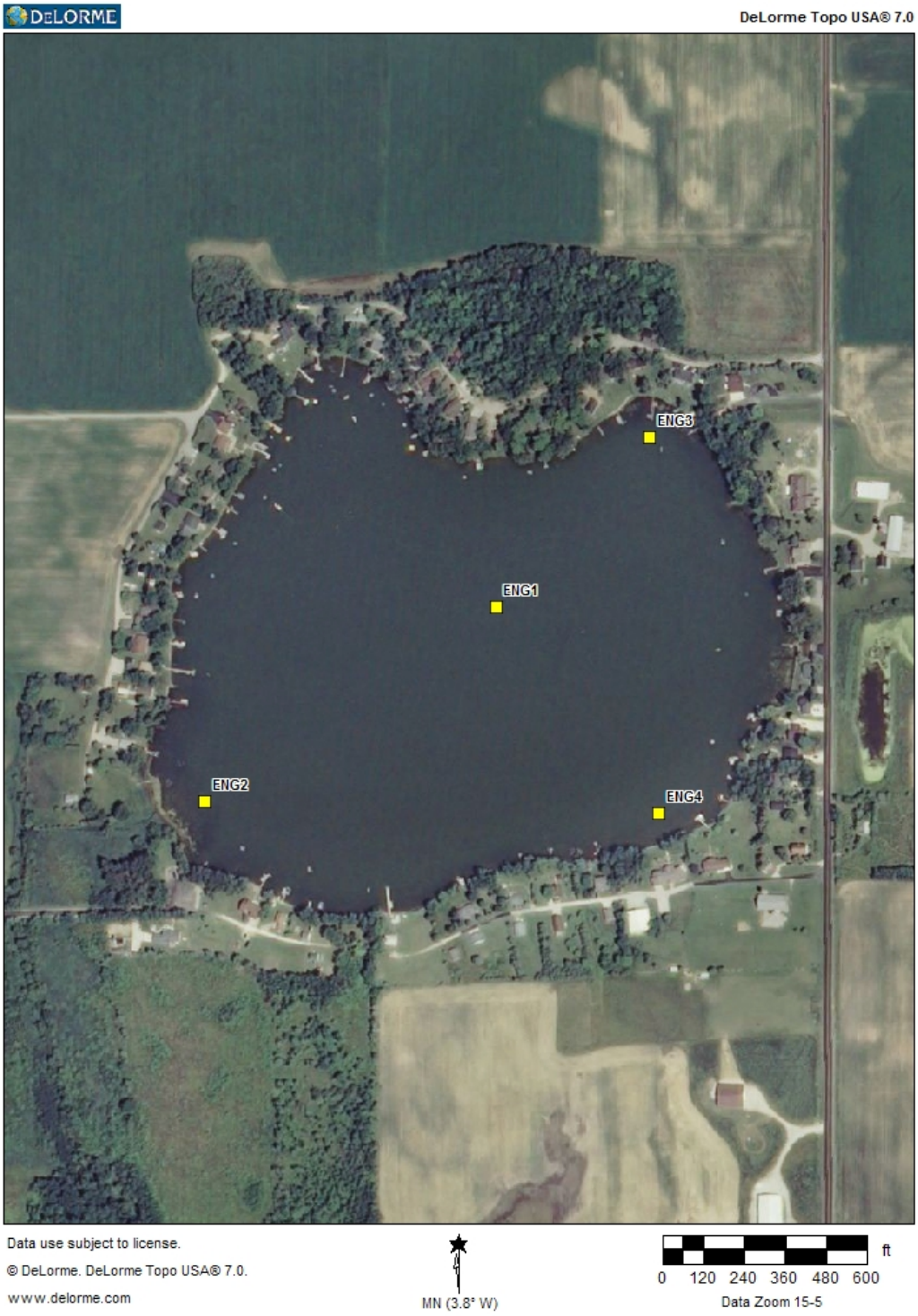


Table 1. Herbicide Residual Sample Data Sheet

English Lake Sample Intervals		
Sample Interval	**Samples per Interval**	**Total Samples**
3-6 HAT	7	7
1 DAT	7	14
3 DAT	7	21
5 DAT	7	28
7 DAT	7	35
14 DAT	7	42
21 DAT	7	49
28 DAT	7	56
42 DAT	7	63
56 DAT	7	70

Figure 3

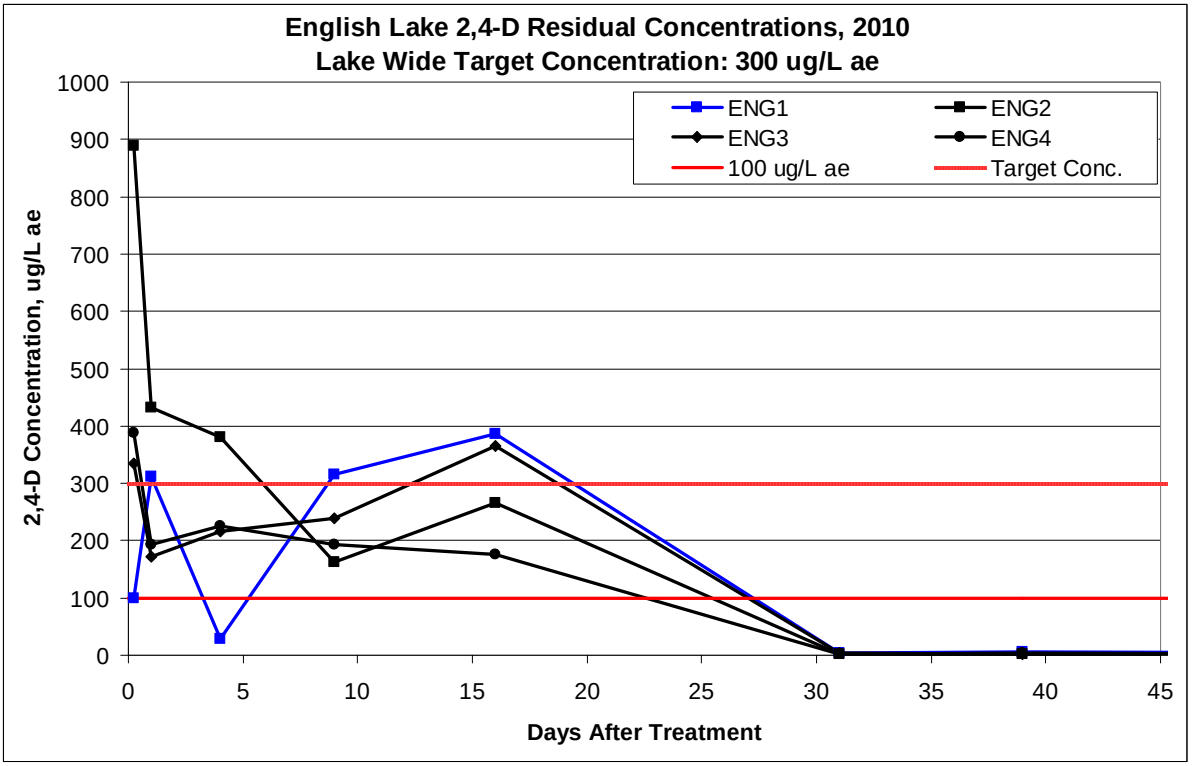


Figure 4

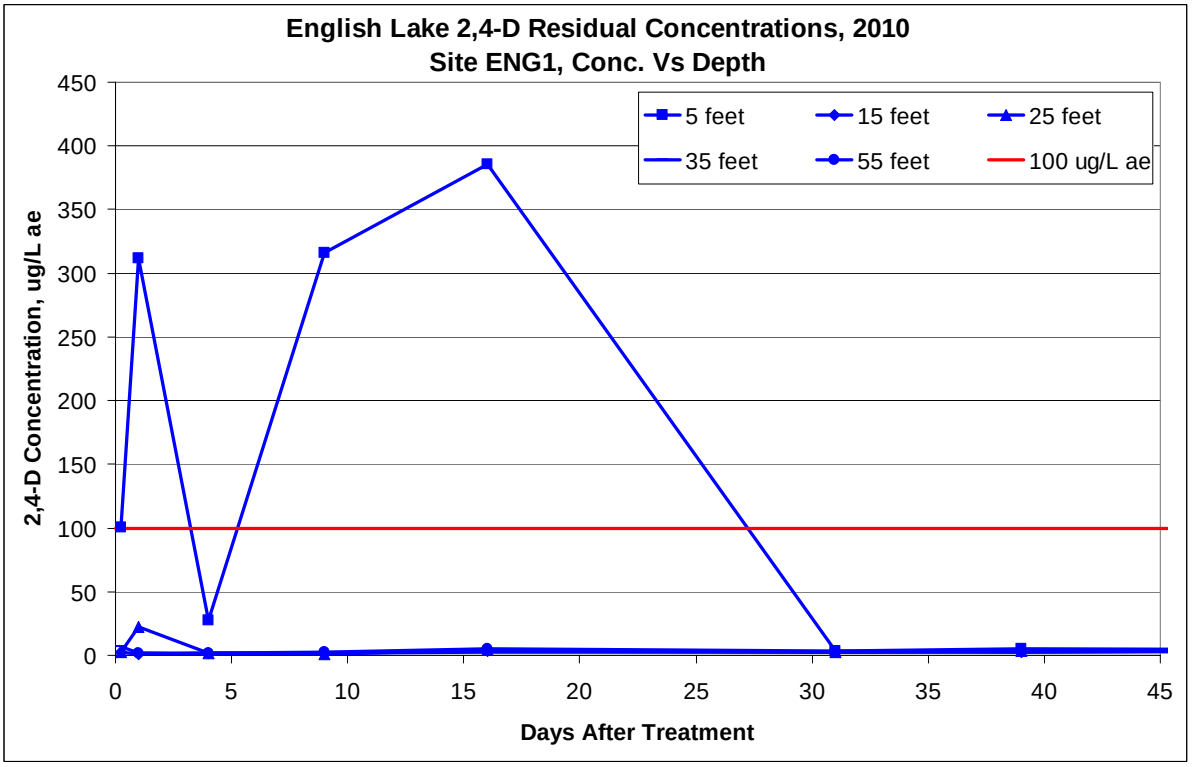
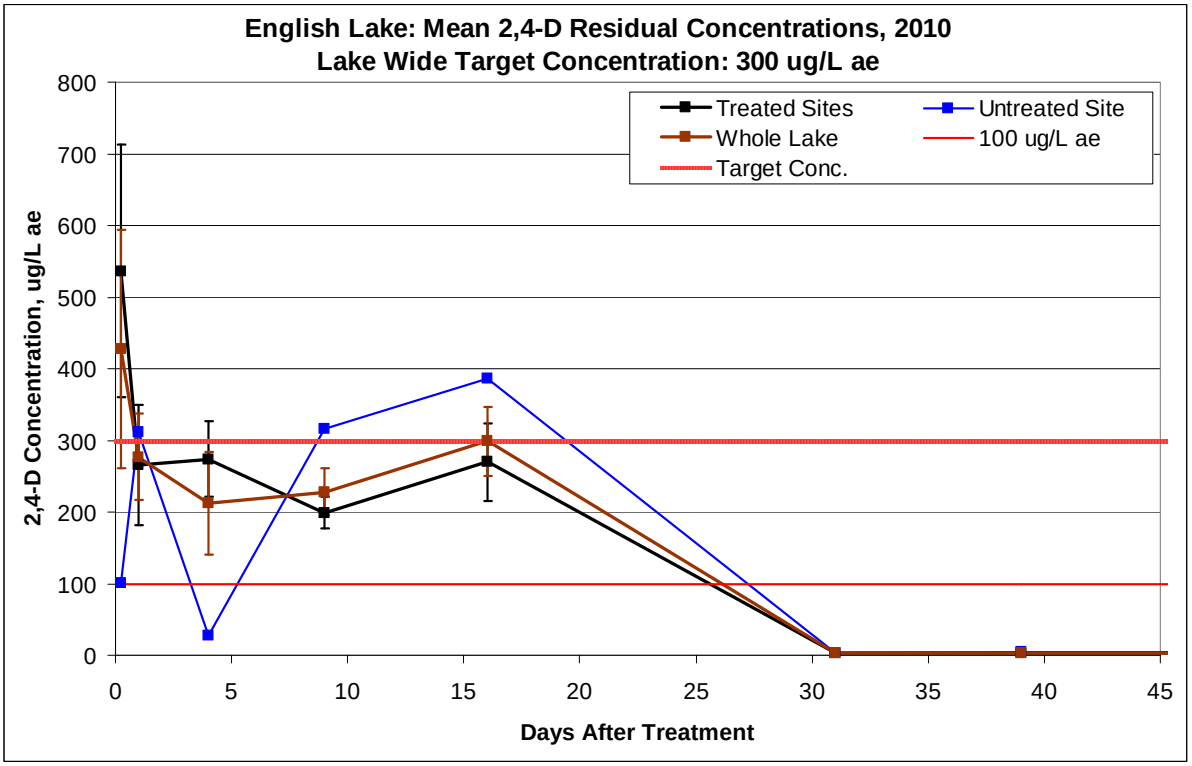


Figure 5


English Lake: Mean 2,4-D Residual Concentrations, 2010
Lake Wide Target Concentration: 300 ug/L ae
Treated Sites
Untreated Site
Whole Lake
100 ug/L ae
Target Conc.
2,4-D Concentration, ug/L ae
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
Days After Treatment

G

APPENDIX G

WDNR 2006 Fisheries Survey Report

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: [Click **here** and type date] FILE REF: [Click **here** and type file ref.]

TO: English Lake File

FROM: Steve Hogler
Steve Surendonk

SUBJECT: Fall 2006 Electrofishing Survey of English Lake

Background of English Lake:
English Lake is a 51 acre lake located seven miles southwest of the City of Manitowoc that experiences heavy boating and moderate angling activity. It is a seepage lake with a maximum depth of 80 feet. Its water is clear and hard, and the lake bed is mostly muck with scattered gravel deposits. Much of the English Lake shoreline is developed with cottages and year-round residences.

Fish Survey History:
The fishery of English Lake has undergone substantial changes in the past sixty years as documented by past surveys. Surveys in the 1940's found that bluegill were the dominant panfish and that they exhibited excellent growth. Walleye were the dominant gamefish, and grew near statewide averages. Few northern pike and no largemouth bass were collected. It was recommended to discontinue stocking bass into this lake. Surveys conducted in the late 1950's found fair to good numbers of northern pike and bass, but fair to poor numbers of walleye. It was felt the walleye population was maintained by stocking because of the lack of suitable spawning habitat. Yellow perch was the dominant panfish. Electrofishing surveys in the 1960's found good numbers of walleye, but low numbers of bass, bluegill and crappie. A large number of yellow perch were collected, but were small in size.

By the 1970's small, slow growing black crappie dominated the fishery. During 1977, fyke nets were used to thin the populations of black crappie and black bullhead found in the lake. A total of 57,049 black crappie, and 5,609 black bullhead were removed during this effort. Following the removal effort, yellow perch, largemouth bass and walleye were stocked to add predation pressure on young of the year crappie. Surveys conducted in the 1980's found that largemouth bass and walleye were the most common gamefish. Black crappie were numerous and dominated the panfish catch. Bluegill, yellow perch and black bullhead were also captured but in much lower number.

In 1995, a comprehensive fish survey was conducted to assess the fish populations of the lake. Largemouth bass were found to be the dominant predator. Northern pike and walleye were also captured during surveys but in low numbers. Black crappie were the dominant panfish catch in this survey and were small in size. Bluegill and yellow perch were also captured but in substantially lower numbers.

2006 Survey Results:
The entire 1.13 mile shoreline of English Lake was electroshocked on the night of October 9th using pulsed DC current. An attempt to net all fish was made and all captured fish were measured to the nearest 1 mm. Scales for age analysis were collected from largemouth bass and bluegill at the rate of 10 per centimeter group.

During the 31 minutes of shocking, 181 individual fish representing nine species were captured (Table 1). Total CPE was 362 fish per hour or 160.2 per mile shocked. Largemouth bass dominated the catch with substantially fewer individuals of other species captured. CPE for largemouth bass CPE was 280/hour or 123.9/mile shocked. Bluegill, the second most abundant species, had a CPE of 66 per hour or 29.2 per mile shocked.

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Table 1. Length frequency of captured fish from English Lake caught during electroshocking on the night of October 9, 2006.

Length (mm)	Largemouth Bass	Northern Pike	Walleye	Bluegill	Rock Bass	Yellow Perch	Green sunfish
70	1			1			
80	3						
90	4			1			
100	1			1			
110	1						
120	1			2			
130	2			1	1		
140	1			5			
150	4			5			
160	7			6			
170	6			5			
180	13			3			1
190	7			1			
200	8			1			
210	8			1			
220	3						
230	5						
240	2						
250	1						
260	4						
270	1						
280	3					1	
290	3						
300	5						
310	4						
320	14						
330	4						
340	8						
350	2						
360	3						
370	3						
380	1						
390							
400	4						
410	1						
420	1						
430	1		1				
440							
450			1				
460							
470							
480							
490							
500			1				
510							
520		1					
530							
540							
550							
560							
570							
580							
590			1				
600							
Total	140	1	4	33	1	1	1
Ave. Length	243	520	493	152	130	280	180
S.D.	87.5	--	71.4	29.6	--	--	--

Gamefish

Largemouth bass were the dominant gamefish captured. The 140 bass ranged in length from 77 mm to 437 mm and had an average length of 243 mm. Fourteen bass (10.0%) of captured bass were greater than the 14 inch minimum size limit. When scales were aged, age classes from young of year to age 8 and age 10 were detected (Table 2).

Table 2. Age distribution of largemouth bass in English Lake.

Length (mm)	Total	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+
70	1	1										
80	3	3										
90	4	4										
100	1	1										
110	1	1										
120	1	1										
130	2		1	1								
140	1		1									
150	4		3	1								
160	7		1	6								
170	6			6								
180	13			11	2							
190	7			2	5							
200	8			8								
210	8			5	2	1						
220	3			3								
230	5			1	3	1						
240	2			1	1							
250	1				1							
260	4			3	1							
270	1			1								
280	3			1	2							
290	3				3							
300	5				5							
310	4				4							
320	14				6	7		1				
330	4					3	1					
340	8				2	6						
350	2					1	1					
360	3					1	1	1				
370	3					1	1	1				
380	1							1				
390												
400	4							1	2	1		
410	1							1				
420	1							1				
430	1											1
440												
450												
Total	140	11	6	50	37	21	4	7	2	1	0	1
Ave. Length	243	91	147	195	269	323	353	380	400	400		430
S.D.	87.5	14.5	10.3	32.5	52.3	27.3	17.1	34.1	--	--	--	--

Age 2 fish were the most common age bass captured, but age 3 and age 4 were also common. When compared to statewide length at age averages, bass in English Lake grew at less than average rates at all ages (Table 3). Younger aged fish showed the largest departure from average length, while older fish were closer to an average largemouth bass of equal age.

Table 3. Average length at age for largemouth bass and bluegill captured in English Lake during fall electroshocking. Statewide average lengths at age for largemouth bass and bluegill are in (). Since little growth will occur until January 1, fall fish are placed into the next whole age category (1+ fish are placed into the age 2 category) for comparative purposes.

	Age							
	1	2	3	4	5	6	7	8
Largemouth Bass	91 (97)	147 (165)	195 (229)	269 (290)	323 (338)	380 (383)	400 (414)	400 (447)
Bluegill	87 (64)	128 (97)	160 (122)	180 (147)				

Northern pike and walleye were also captured, but in low number. Captured walleye averaged 493 mm in length and the single northern pike was 520 mm in length.

Panfish

Bluegill were the most common panfish captured during this survey. The thirty-three bluegill ranged in length from 75 mm to 210 mm and had an average length of 152 mm (Table 1).

When scales were aged, age classes 0+ through 3+ were detected in the sample (Table 4). Age 2+ was the most common age bluegill and these fish had an average length of 160 mm. Only five bluegill were older than age 2+.

Table 4. Age distribution of bluegill captured on English Lake during fall electroshocking.

Length (mm)	Total	0+	1+	2+	3+
70	1	1			
80					
90	1	1			
100	1	1			
110					
120	2		2		
130	1		1		
140	5		1	3	1
150	5			5	
160	6			6	
170	5			4	1
180	3			2	1
190	1			1	
200	1				1
210	1				1
220					
230					
240					
250					
Total	33	3	4	21	5
Ave. Length	152	87	128	160	180
S.D.	29.6	15.3	9.6	13.8	22.4

When compared to statewide length at age averages, bluegill in English Lake were longer at each age than an average bluegill from other lakes in Wisconsin.

Other captured panfish included rock bass, yellow perch and green sunfish. The lengths of these fish were 130 mm, 280 mm and 180 mm respectively.

Discussion and Conclusions:

Gamefish

Largemouth bass were the dominant gamefish captured during electrofishing in 2006. This was similar to the 1995-96 comprehensive survey when during fall electroshocking bass dominated the gamefish catch. Unlike the previous survey in which YOY bass dominated the catch, in 2006 ages 2, 3 and 4 were the most common ages. In addition, average length and the number of fish greater than 14" increased in 2006 from what was measured in 1995-96. It is likely catch and release and 9 more years of the 14" minimum size limit increased average size and the age of bass in English Lake.

Length at age of bass in 2006 was less than in previous surveys. With more bass protected by the 14" size limit, increased predation pressure on limited forage may be causing growth to slow. The bass population should be monitored to see if current population trends continue.

Walleye and northern pike continue be present in the lake but in low numbers. This is similar to what was seen in 1995-96. Limited spawning habitat will always limit their populations in English Lake.

Panfish

Bluegill dominated the panfish catch in 2006. Bluegill in 2006 were young in age, but were fast growing. It is likely that predation by gamefish has reduced bluegill number thus reducing competition for food resources. Because English Lake has a small littoral area that limits the reproduction of bluegill and other panfish, we should monitor panfish numbers to determine if predation is too great to maintain a healthy bluegill population.

Clearly there is marked difference between surveys conducted in the 1970's and the present. Earlier surveys found a lake that was dominated by slow growing overabundant panfish, chiefly black crappie. Major predators in the lake were walleye and northern pike. Largemouth bass were infrequently collected. Black bullhead were also abundant in the system. This survey and the comprehensive survey of 1995-96 have documented a shift in the primary predator from walleye to largemouth bass. Panfish which were overabundant and slow growing are now much lower in number and exhibiting good growth.