A

APPENDIX A

Public Participation Materials

Marl Lake Management District

Marl Lake Management Planning Update Project

Kick-off Meeting

June 19, 2010



Timothy A. Hoyman, CLM
Onterra LLC
Lake Management Planning

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of a Lake Management Planning Project
  - Data & Information
  - Planning Process



Onterra, LLC

- Founded in 2005
- Staff
  - Five full-time ecologists
  - One part-time ecologist
  - One intern
- 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.



Elements of an Effective Lake Management Plan

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together



Data and Information Gathering

- Study Components
  - Water Quality Analysis
  - Watershed Assessment
  - Aquatic Plant Surveys
  - Fisheries Data Integration
  - Stakeholder Survey
  - Shoreline Assessment



Water Quality

- General water chemistry (current & historic)
  - Enhanced to meet needs of Waushara County project
- Nutrient analysis
  - Lake trophic state (Eutrophication)
  - Limiting plant nutrient
- Supporting data for watershed modeling

Watershed

- Update of 2003 modeling
  - Land use verification survey



Aquatic Plants

- Concerned with both native and non-native plants
- Multiple surveys used to assess aquatic plant community
  - Curly-leaf pondweed survey
  - Point-intercept survey
  - Plant Community Mapping
- Compare with 2002 results



Curly-leaf pondweed



Eurasian Water Milfoil

Fisheries Information

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



Stakeholder Survey

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



Shoreline 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



Planning Process

Planning Committee Meetings

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



Marl Lake District

Marl Lake
Management Planning Project
Planning Meeting I
October 5, 2012

Tim Hoyman &
Brenton Butterfield
Onterra LLC

Presentation Outline

- **Lake Management Planning Project Overview**
- **Study Results**
  - Water Quality
  - Watershed
  - Aquatic Plants
  - Fisheries
- **"Big Picture"**



Onterra LLC

Study and Plan Goals

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



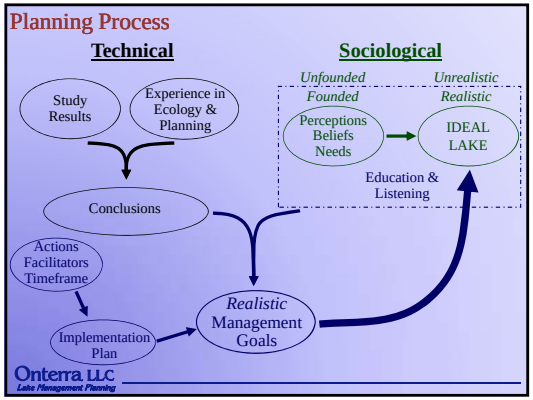
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The Planning Process

…it's not as easy as you may think.



Planning Process

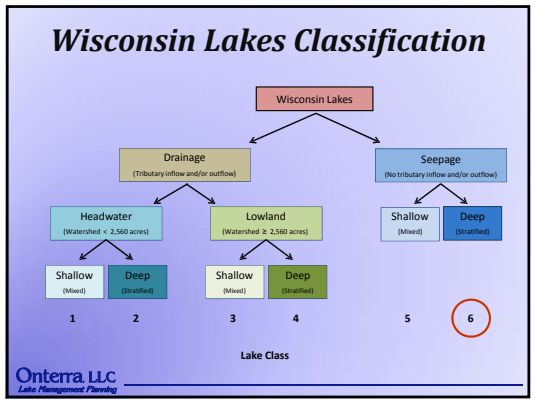


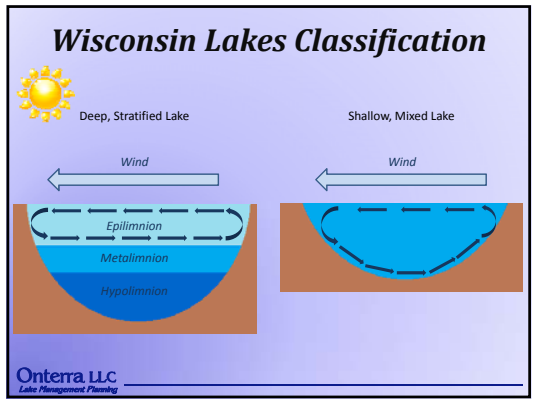
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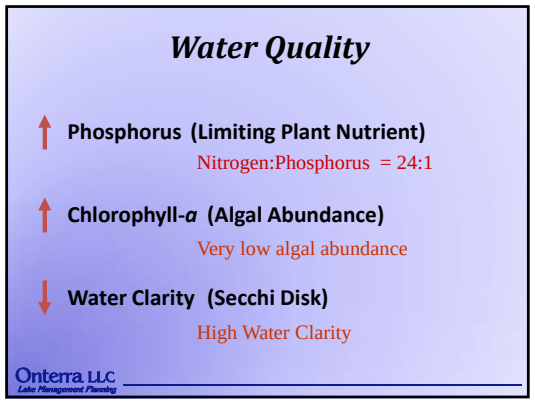
Wisconsin Ecoregions

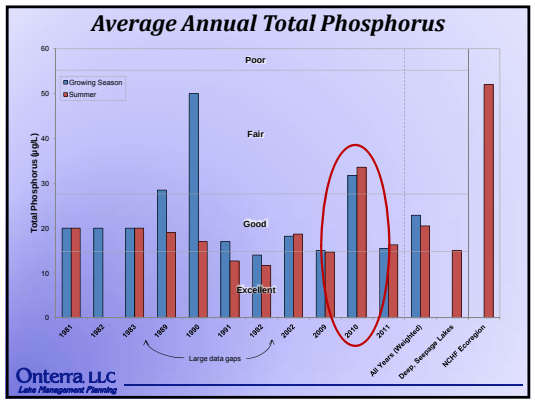


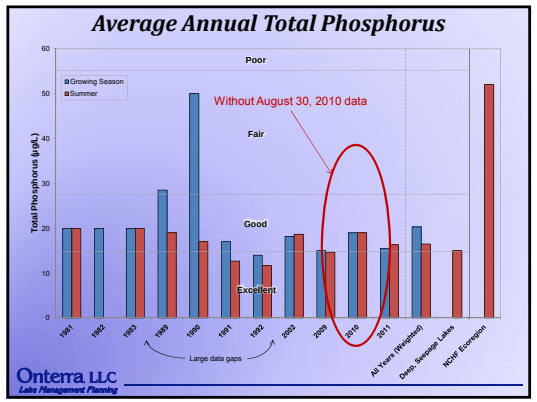
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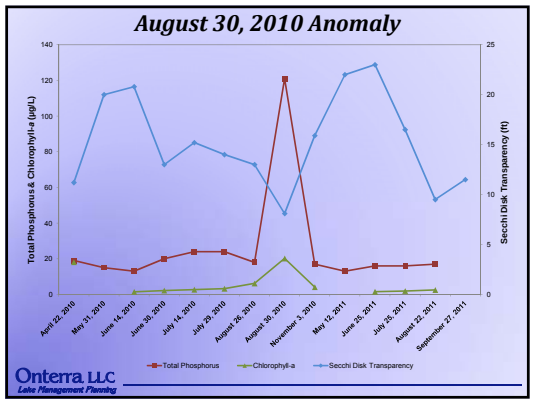

Wisconsin Lakes Classification
Wisconsin Lakes
Drainage
(Tributary inflow and/or outflow)
Seepage
(No tributary inflow and/or outflow)
Headwater
(Watershed < 2,560 acres)
Lowland
(Watershed ≥ 2,560 acres)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)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

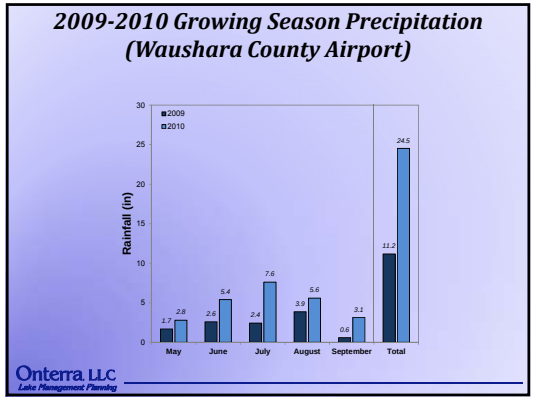

Wisconsin Lakes Classification
Deep, Stratified Lake
Shallow, Mixed Lake
Wind
Wind
Epilimnion
Metalimnion
Hypolimnion
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Lake Management Planning

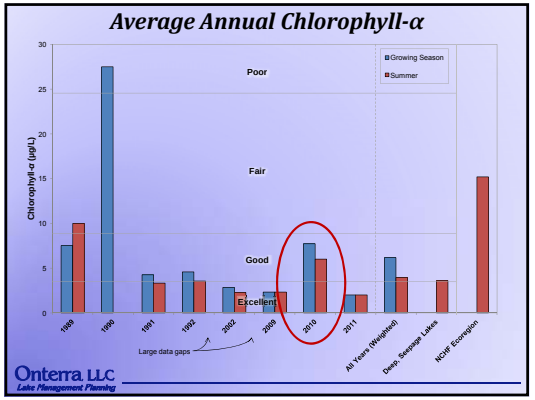

Water Quality
Phosphorus (Limiting Plant Nutrient)
Nitrogen:Phosphorus = 24:1
Chlorophyll-a (Algal Abundance)
Very low algal abundance
Water Clarity (Secchi Disk)
High Water Clarity
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Lake Management Planning

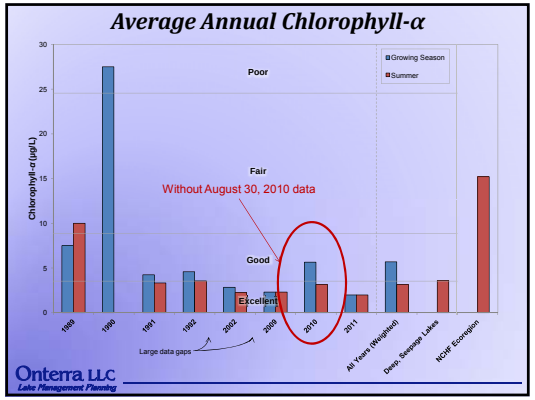

Average Annual Total Phosphorus
Poor
Fair
Good
Excellent
Growing Season
Summer
Total Phosphorus (µg/L)
Large data gaps
All Years (Weighted)
Deep, Seepage Lakes
NCHF Ecoregion
Onterra LLC
Lake Management Planning

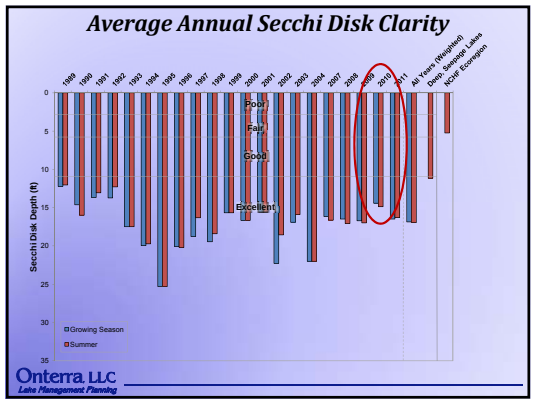

Average Annual Total Phosphorus
Without August 30, 2010 data
Poor
Fair
Good
Excellent
Growing Season
Summer
Total Phosphorus (µg/L)
Large data gaps
All Years (Weighted)
Deep, Seepage Lakes
NCHF Ecoregion
Onterra LLC
Lake Management Planning

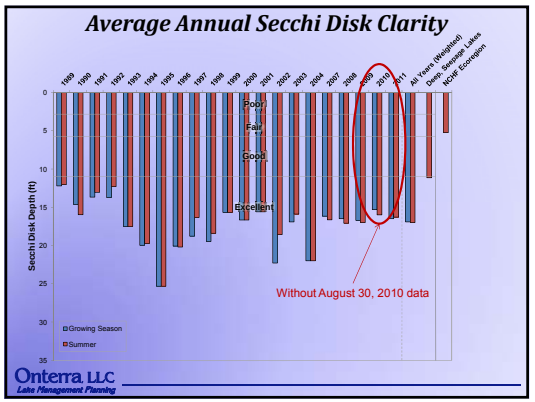

August 30, 2010 Anomaly
Total Phosphorus & Chlorophyll-a (µg/L)
Secchi Disk Transparency (ft)
Total Phosphorus
Chlorophyll-a
Secchi Disk Transparency
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Lake Management Planning

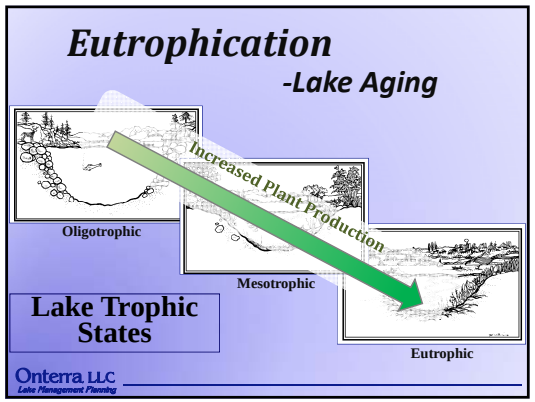

2009-2010 Growing Season Precipitation
(Waushara County Airport)
Rainfall (in)
2009
2010
May
June
July
August
September
Total
Onterra LLC

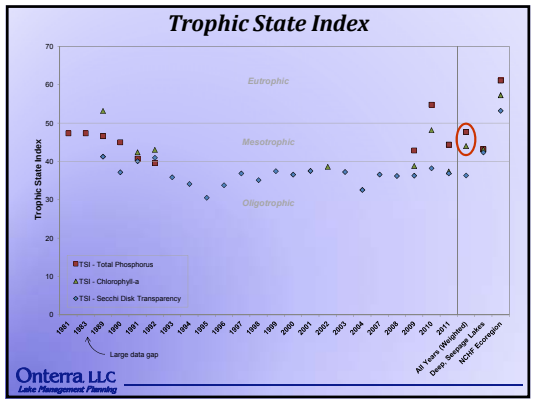

Average Annual Chlorophyll-α
Chlorophyll-α (µg/L)
Growing Season
Summer
Poor
Fair
Good
Excellent
Large data gaps
All Years (Weighted)
Deep, Sewage Lakes
NCHF Ecoregion
Onterra LLC

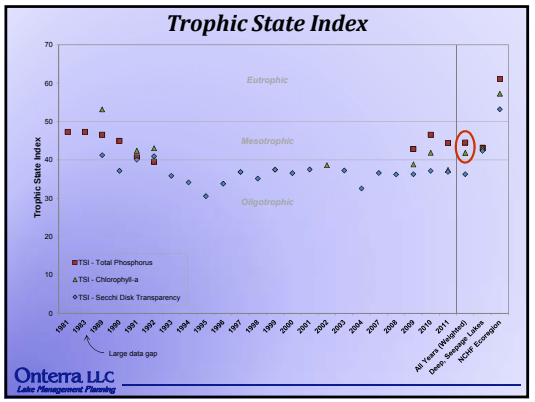

Average Annual Chlorophyll-α
Chlorophyll-α (µg/L)
Growing Season
Summer
Poor
Fair
Without August 30, 2010 data
Good
Excellent
Large data gaps
All Years (Weighted)
Deep, Sewage Lakes
NCHF Ecoregion
Onterra LLC

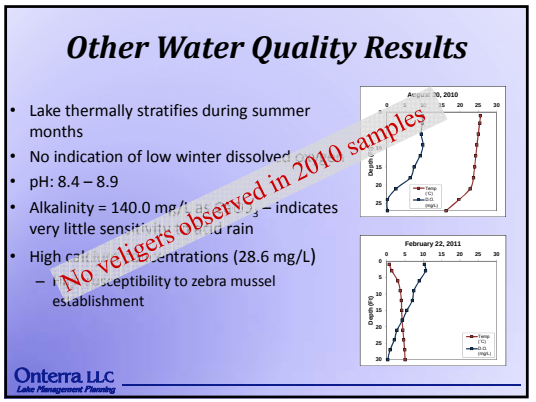

Average Annual Secchi Disk Clarity
Secchi Disk Depth (ft)
Poor
Fair
Good
Excellent
Growing Season
Summer
All Years (Weighted)
Deep, Sewage Lakes
NCHF Ecoregion
Onterra LLC

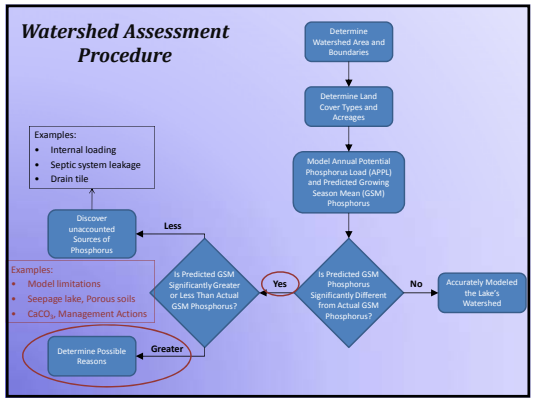

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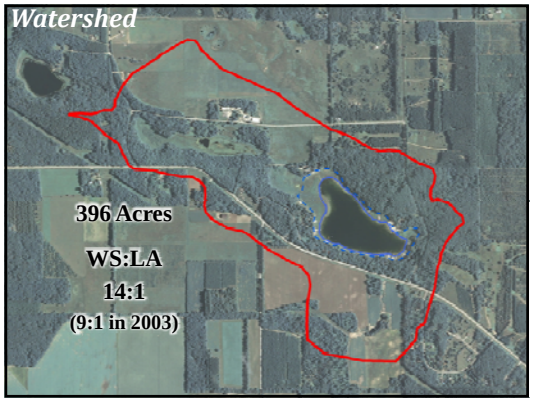

Eutrophication
-Lake Aging
Increased Plant Production
Oligotrophic
Mesotrophic
Eutrophic
Lake Trophic States
Onterra LLC

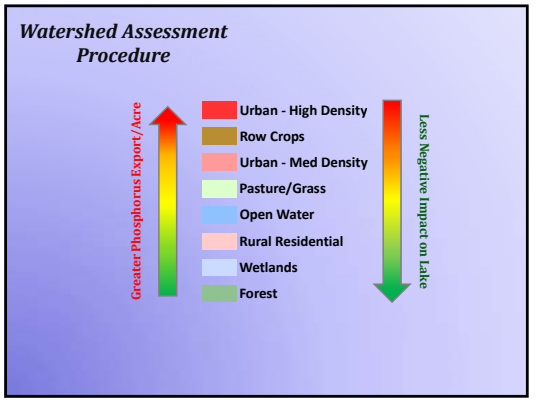

Trophic State Index
Trophic State Index
Eutrophic
Mesotrophic
Oligotrophic
TSI - Total Phosphorus
TSI - Chlorophyll-a
TSI - Secchi Disk Transparency
Large data gap
All Years (Weighted)
Deep, Seepage Lakes
NCHF Ecoregion
Onterra LLC
Lake Management Planning

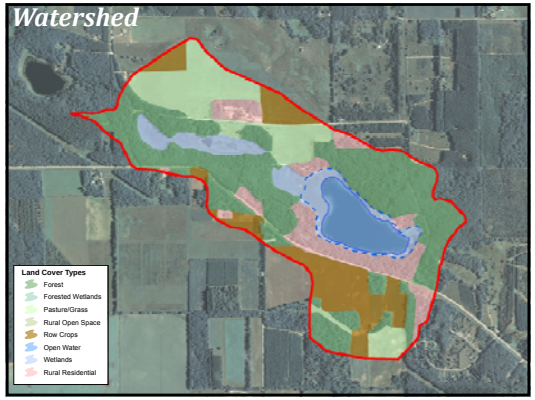

Trophic State Index
Trophic State Index
Eutrophic
Mesotrophic
Oligotrophic
TSI - Total Phosphorus
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TSI - Secchi Disk Transparency
Large data gap
All Years (Weighted)
Deep, Seepage Lakes
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Onterra LLC
Lake Management Planning

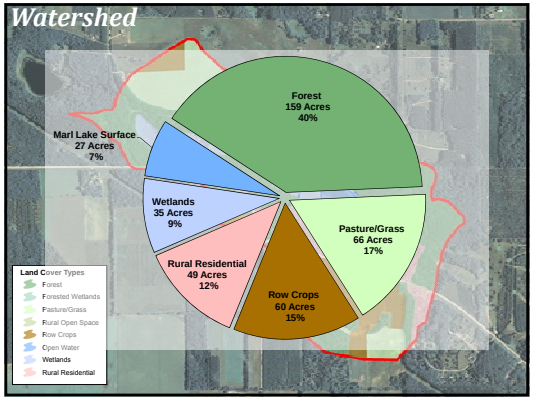

Other Water Quality Results
Lake thermally stratifies during summer months
No indication of low winter dissolved
pH: 8.4 – 8.9
Alkalinity = 140.0 mg/L as
– indicates very little sensitivity to acid rain
High calcium concentrations (28.6 mg/L)
susceptibility to zebra mussel establishment
No veligers observed in 2010 samples
February 22, 2011
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Lake Management Planning

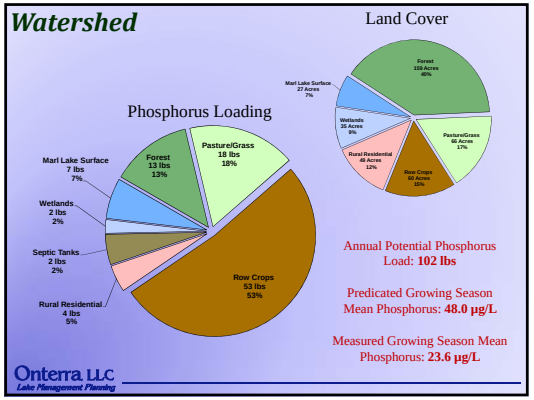

Watershed Assessment Procedure
Determine Watershed Area and Boundaries
Determine Land Cover Types and Acreages
Model Annual Potential Phosphorus Load (APPL) and Predicted Growing Season Mean (GSM) Phosphorus
Examples:
Internal loading
Septic system leakage
Drain tile
Discover unaccounted Sources of Phosphorus
Less
Is Predicted GSM Significantly Greater or Less Than Actual GSM Phosphorus?
Yes
Is Predicted GSM Phosphorus Significantly Different from Actual GSM Phosphorus?
No
Accurately Modeled the Lake's Watershed
Examples:
Model limitations
Seepage lake, Porous soils
CaCO3 Management Actions
Determine Possible Reasons
Greater


Watershed
396 Acres
WS:LA
14:1
(9:1 in 2003)

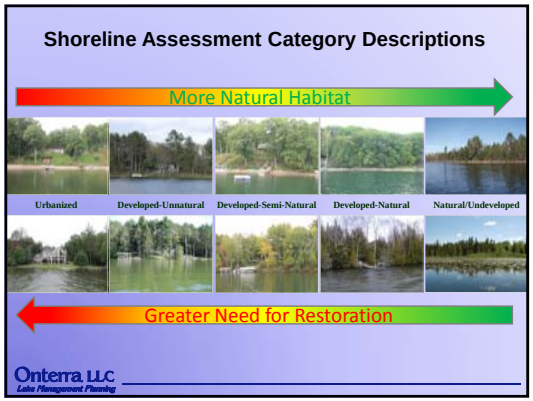

Watershed Assessment Procedure
Greater Phosphorus Export/Acre
Urban - High Density
Row Crops
Urban - Med Density
Pasture/Grass
Open Water
Rural Residential
Wetlands
Forest
Less Negative Impact on Lake

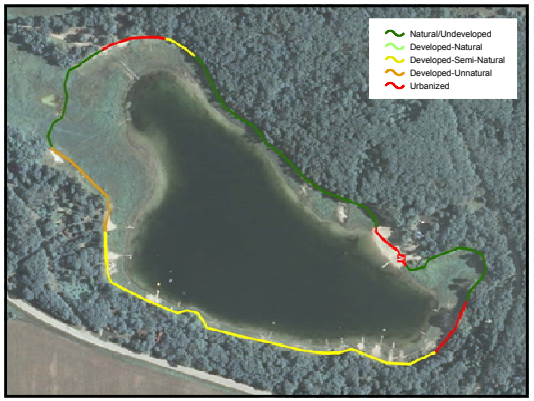

Watershed
Land Cover Types
Forest
Forested Wetlands
Pasture/Grass
Rural Open Space
Row Crops
Open Water
Wetlands
Rural Residential

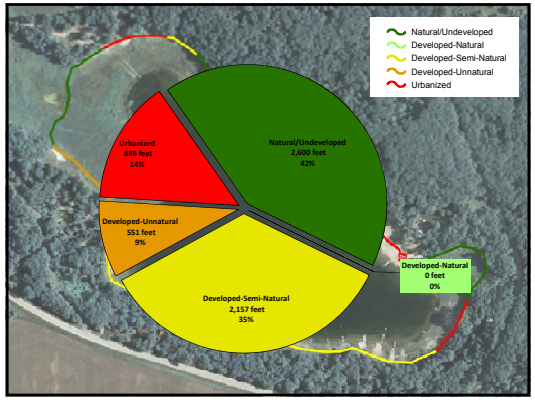

Watershed
Forest
159 Acres
40%
Marl Lake Surface
27 Acres
7%
Wetlands
35 Acres
9%
Pasture/Grass
66 Acres
17%
Rural Residential
49 Acres
12%
Row Crops
60 Acres
15%
Land Cover Types
Forest
Forested Wetlands
Pasture/Grass
Rural Open Space
Row Crops
Open Water
Wetlands
Rural Residential


Watershed
Land Cover
Phosphorus Loading
Forest
13 lbs
13%
Pasture/Grass
18 lbs
18%
Marl Lake Surface
7 lbs
7%
Wetlands
2 lbs
2%
Septic Tanks
2 lbs
2%
Rural Residential
4 lbs
5%
Row Crops
53 lbs
53%
Annual Potential Phosphorus Load: 102 lbs
Predicated Growing Season Mean Phosphorus: 48.0 µg/L
Measured Growing Season Mean Phosphorus: 23.6 µg/L
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Lake Management Planning

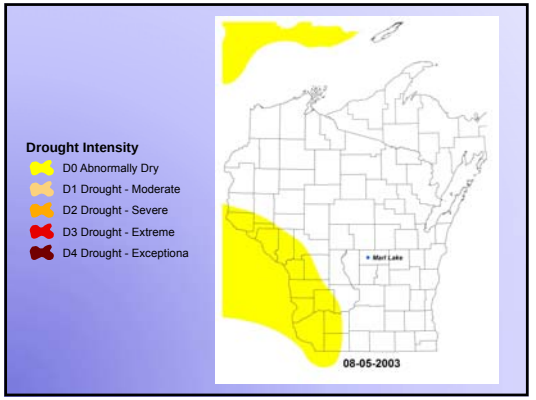

Shoreland Assessment
Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
It does not look at lake shoreline on a property-by-property basis.
Assessment ranks shoreland area from shoreline back 35 feet
Urbanized
Natural
Range
Onterra LLC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

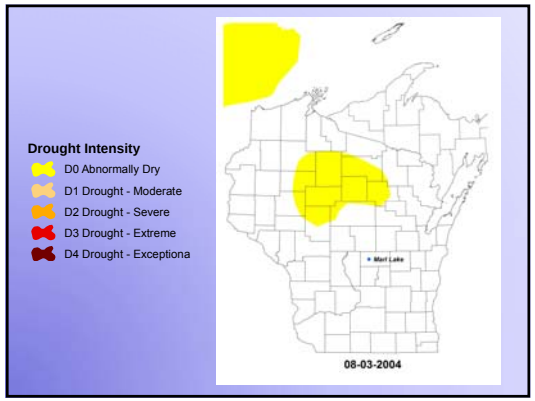

Shoreline Assessment Category Descriptions
More Natural Habitat
Urbanized
Developed-Unnatural
Developed-Semi-Natural
Developed-Natural
Natural/Undeveloped
Greater Need for Restoration
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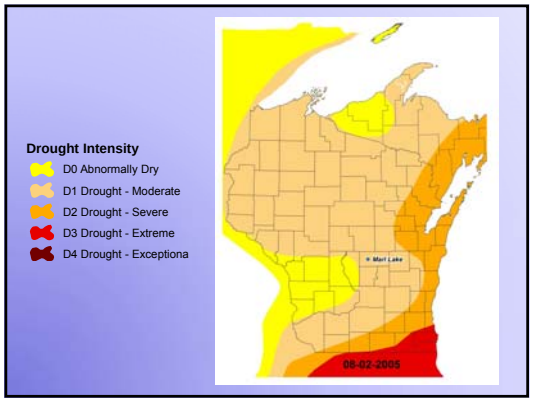

Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized

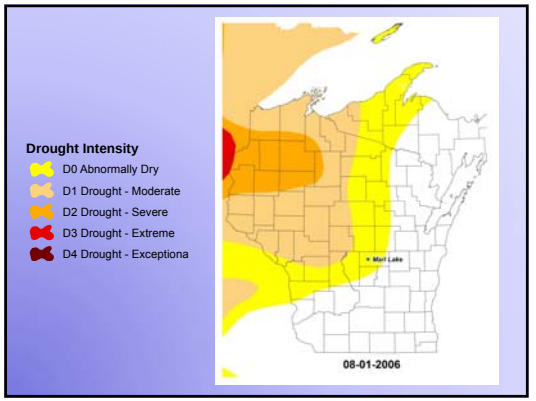

Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Urbanized
886 feet
14%
Natural/Undeveloped
2,600 feet
42%
Developed-Unnatural
551 feet
9%
Developed-Natural
0 feet
0%
Developed-Semi-Natural
2,157 feet
35%

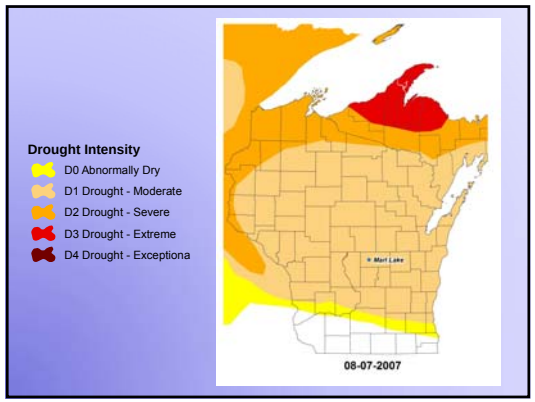

Marl Lake Water Levels

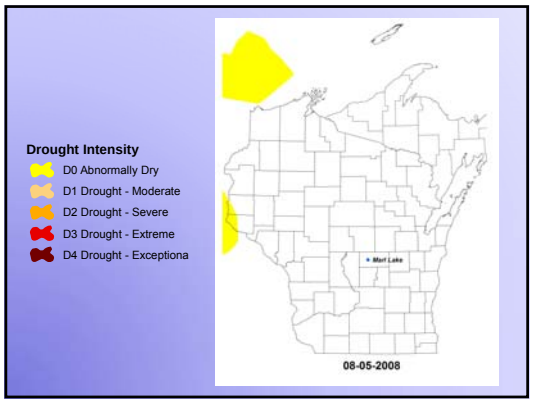

Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
Marl Lake
08-05-2003

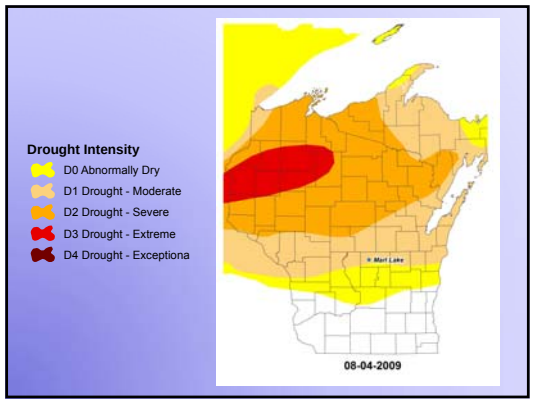

Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
Marl Lake
08-03-2004

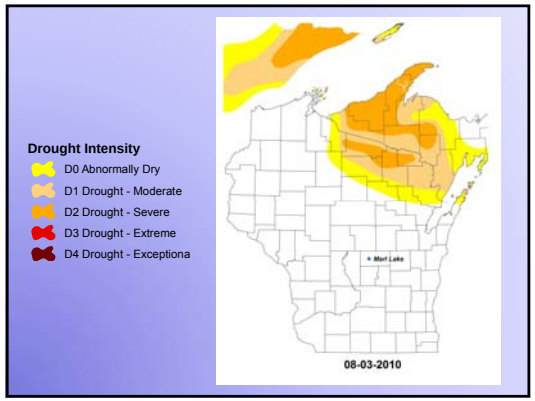

Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
Marl Lake
08-02-2005

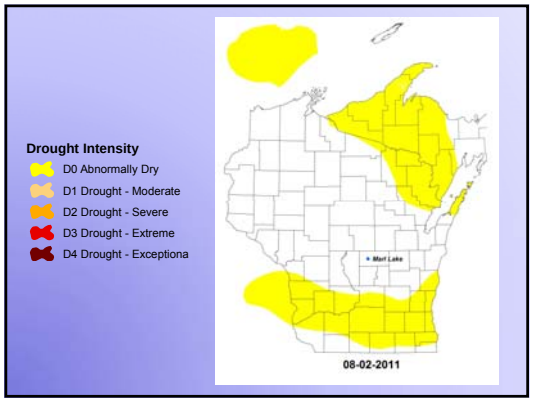

Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
Marl Lake
08-01-2006

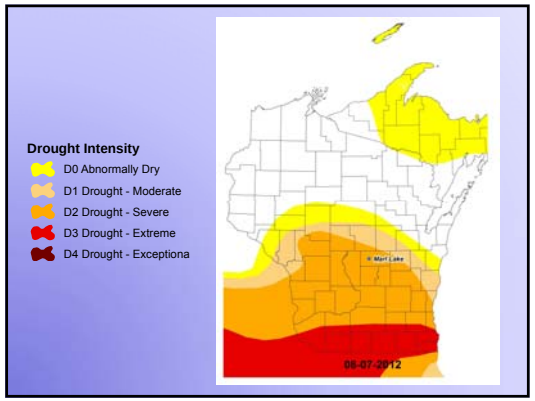

Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-07-2007


Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-05-2008


Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-04-2009


Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-03-2010


Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-02-2011


Drought Intensity
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptiona
08-07-2012

Marl Lake Water Levels

- Drought conditions 4 of the last 10 years.

Drought Intensity

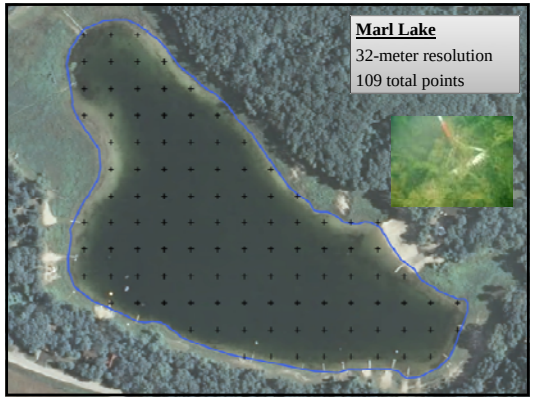
D0 Abnormally Dry	
D1 Drought - Moderate	2005, 2007, 2009
D2 Drought - Severe	2012
D3 Drought - Extreme	
D4 Drought - Exceptional	

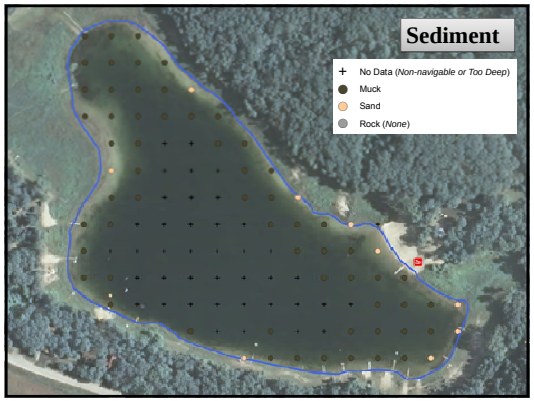
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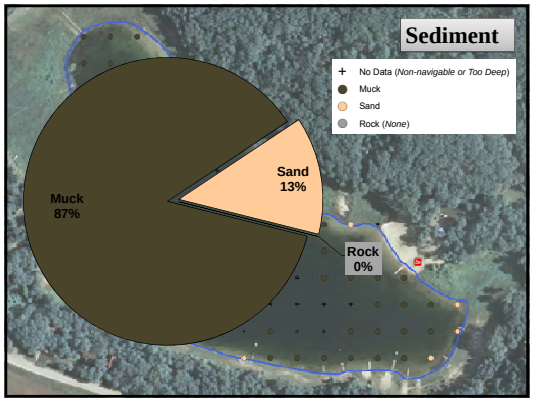
Aquatic Plant Surveys

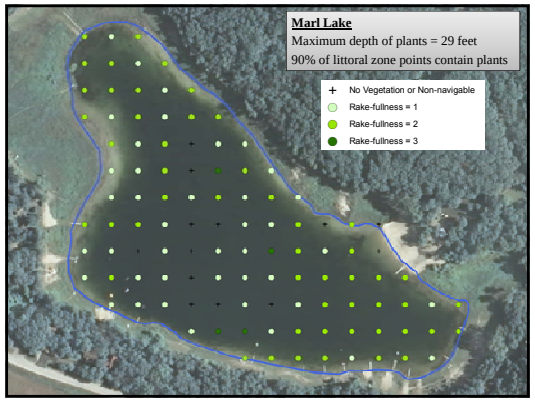
- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early-season AIS survey
  - Point-intercept survey
    - Systematic sampling method
    - Can compare lakes within same ecoregion
  - Plant community mapping
    - Accurately map floating-leaf & emergent communities
    - May compare to future surveys

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Species List

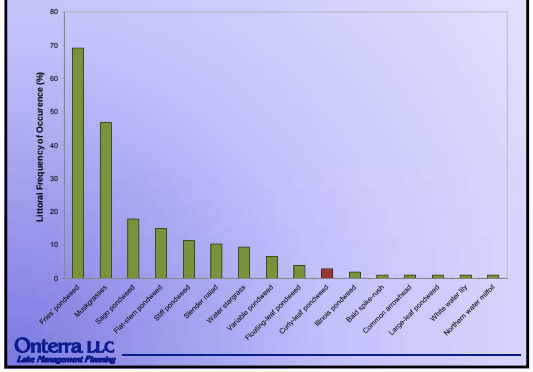
- **19 Native Species**
  - 15 from the PI survey
- **3 Non-native Species**
  - Curly-leaf pondweed
  - Eurasian water milfoil (hybrid)
  - Reed canary grass

Life Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2002 (NES)	2010 (Onterra)
Emergent	*Eleocharis erythropoda*	Bald spikerush	3		X
	Eupatorium perfoliatum	Common boneset	6	X	
	Carex comosa	Bristly sedge	5	X	
	Carex vulpinoidea	Brown fox sedge	2	X	
	Juncus effusus	Soft rush	4	X	
	Juncus tenuis	Path rush	1	X	
	Leersia oryzoides	Rice cut grass	4	X	
	Lycopus americanus	American water horehound	3	X	
	Phragmites australis	Common reed	Exotic	X	I
	Sagittaria latifolia	Common arrowhead	3	X	X
	Salix exigua	Sandbar willow	2	X	
	Schoenoplectus acutus	Hardstem bulrush	6	X	I
	Schoenoplectus tabernaemontani	Softstem bulrush	4	X	I
	Typha latifolia	Broad-leaved cattail	1	X	
FF	*Lemna minor*	Lesser duckweed	5	X	
	Wolffia columbiana	Common watermeal	5	X	
FL	*Nuphar variegata*	Spatterdock	6	X	I
	Nymphaea odorata	White water lily	6	X	X
	Polygonum amphibium	Water smartweed	5	X	
Submergent	*Ceratophyllum demersum*	Coontail	3	X	I
	Chara spp.	Muskgrasses	7	X	X
	Elodea canadensis	Common waterweed	3	X	
	Heteranthera dubia	Water stargrass	6	X	X
	Myriophyllum sibiricum	Northern water milfoil	7	X	X
	*Myriophyllum sibiricum X M. radicatum**	Northern X Eurasian water milfoil	Exotic		I
	Najas flexilis	Slender naiad	6	X	I
	Potamogeton amplifolius	Large-leaf pondweed	7		X
	Potamogeton crispus	Curly-leaf pondweed	Exotic		X
	Potamogeton foliosus	Leafy pondweed	7		X
	Potamogeton gramineus	Variable pondweed	7		X
	Potamogeton illinoensis	Illinois pondweed	6	X	X
	Potamogeton natans	Floating-leaf pondweed	5	X	X
	Potamogeton nodosus	Long-leaf pondweed	7	X	
	Potamogeton praelongus X P. richardsonii	White-stem X Clasping-leaf pondweed	N/A		X
	Potamogeton strictifolius	Stiff pondweed	8		X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X	X
	Stuckenia pectinata	Sago pondweed	3	X	X
M-E	*Eleocharis acicularis*	Needle spikerush	5	X	

FF = Free-Floating; FL = Floating-leaf; S/E = Submergent and Emergent.
X = Observed during 2002 NES transect survey or located on the lake during the 2011 Onterra point-intercept survey; I = Incidental Species
* This species was actually located during a spring CLP survey in 2011

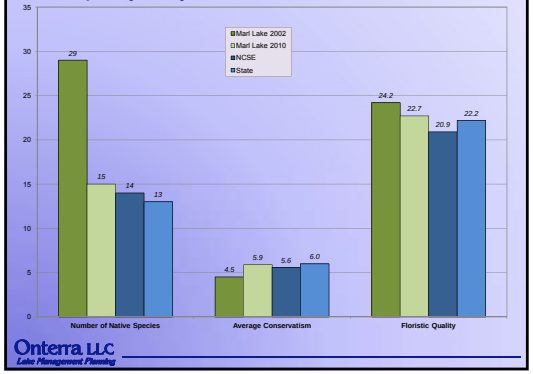
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Littoral Frequency Analysis



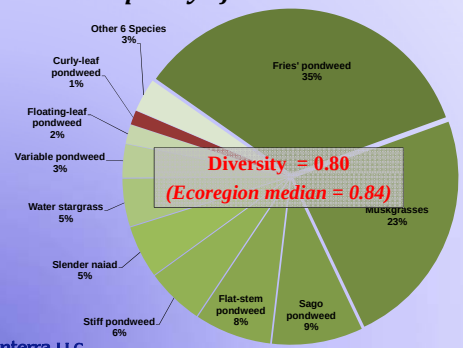
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Floristic Quality Analysis



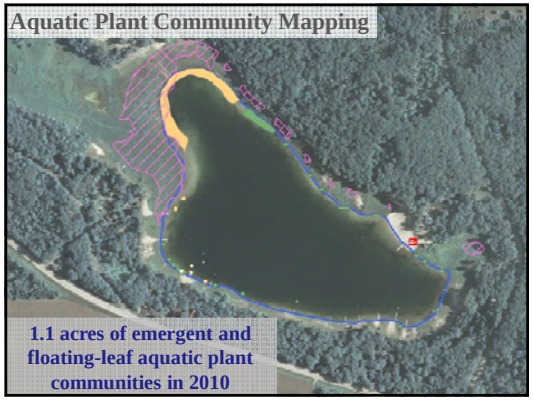
Onterra LLC Lake Management Planning

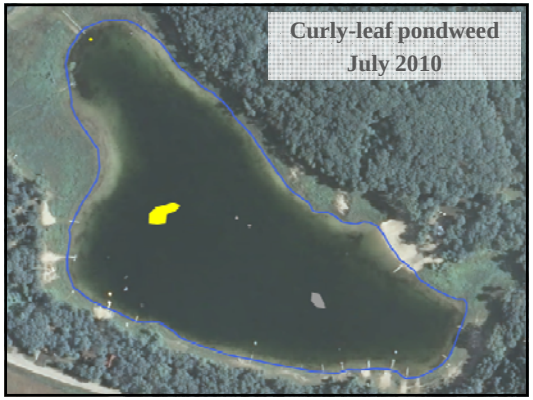
Relative Frequency of Occurrence



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Aquatic Plant Community Mapping



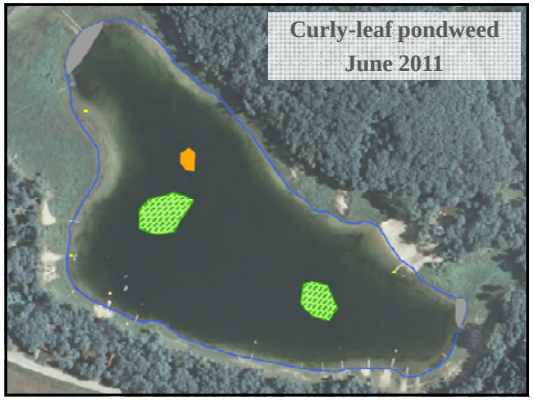


Curly-leaf pondweed Hand-harvesting, June 2011





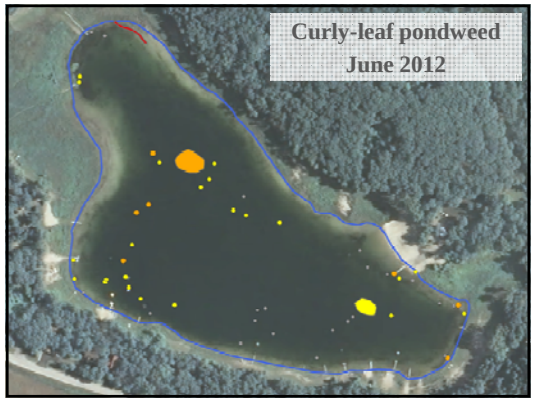


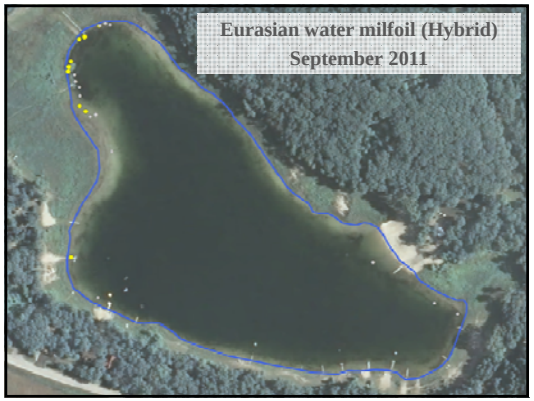


Curly-leaf pondweed Mapping, June 2012

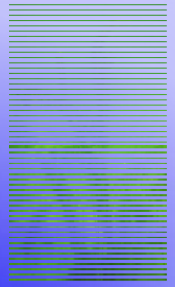




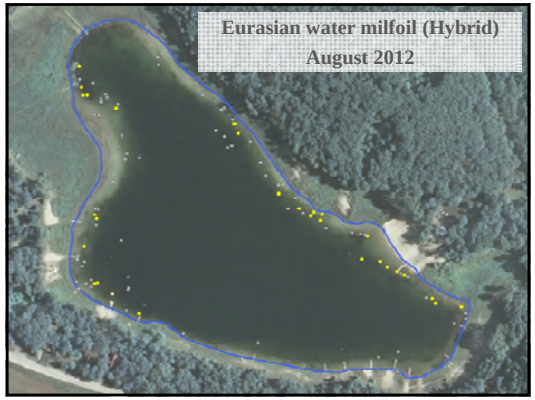




Eurasian water milfoil Mapping, August 2012

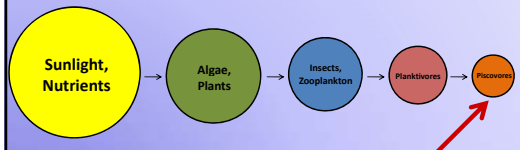






Marl Lake Fisheries

Energy Flow



Gamefish Anglers Target

Onterra LLC Lake Management Planning

Marl Lake Fisheries

- 2006 WDNR Study
  - Largemouth bass and northern pike recorded
  - Bluegill were the most common panfish species
  - Trout were stocked in 1960; after several years, declined due to increasing bluegill and yellow perch populations
  - Largemouth bass abundance increased in 2006 survey, while panfish declined
  - Likely due to water level changes

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Conclusions

- Water quality is good to excellent
- Overall watershed is largely in healthy condition
  - Minimal phosphorus input; ecologically valuable land cover types present
  - Shoreline is mostly undeveloped or semi-natural state
- Aquatic plant community
  - Based on standard analysis, native community is of similar quality to other lakes in the region and the state
  - CLP and EWM have spread over the last two years and should be the focus of the management plan at this time

Onterra LLC Lake Management Planning

B

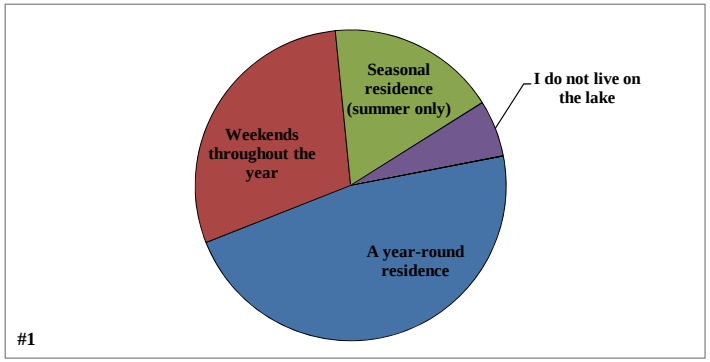
APPENDIX B

Stakeholder Survey Response Charts and Comments

Returned Surveys	18
Sent Surveys	32
Response Rate (%)	56.3

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

	Total	%
A year-round residence	8	*47.1*
Weekends throughout the year	5	*29.4*
Seasonal residence (summer only)	3	*17.6*
I do not live on the lake	1	*5.9*
Resort	0	*0.0*
Rental property	0	*0.0*
Undeveloped	0	*0.0*
Other	0	*0.0*
	17	*100.0*

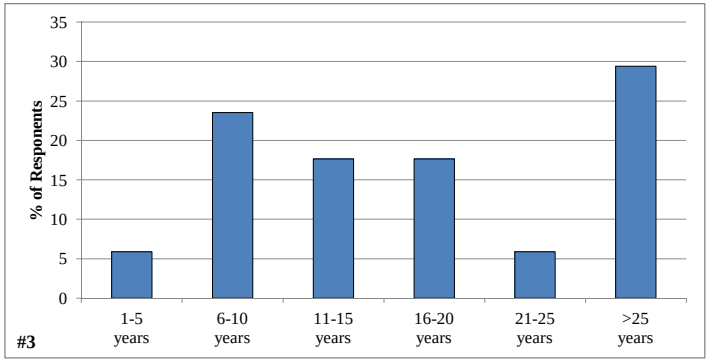


#2 If you are not a year-round resident, how many days each year is your property used by you or others?

Answered Question	17
Average	146.8
Standard deviation	117.0

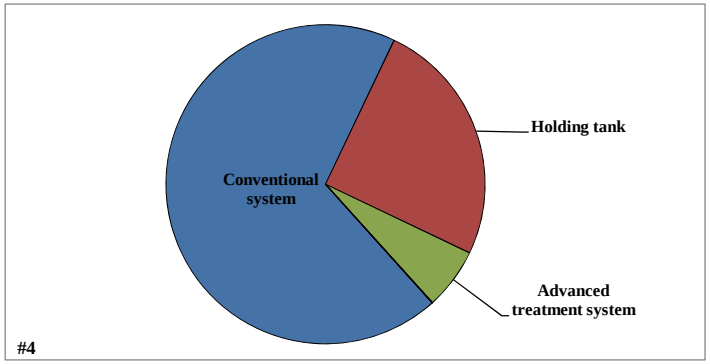
#3 How long have you owned your property on Marl Lake?

	Total	%
1-5 years	1	*5.9*
6-10 years	4	*23.5*
11-15 years	3	*17.6*
16-20 years	3	*17.6*
21-25 years	1	*5.9*
>25 years	5	*29.4*
	17	*100.0*



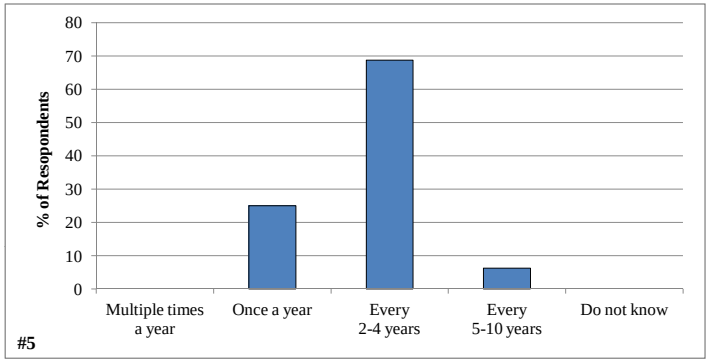
#4 What type of septic system does your property utilize?

	Total	%
Conventional system	11	*68.8*
Holding tank	4	*25.0*
Advanced treatment system	1	*6.3*
Mound	0	*0.0*
Municipal sewer	0	*0.0*
Do not know	0	*0.0*
	16	*100.0*



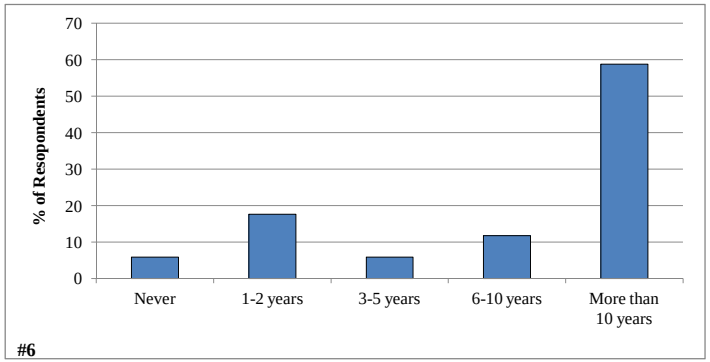
#5 How often is the septic tank on your property pumped?

	Total	%
Multiple times a year	0	*0.0*
Once a year	4	*25.0*
Every 2-4 years	11	*68.8*
Every 5-10 years	1	*6.3*
Do not know	0	*0.0*
	16	*100.0*



#6 For how many years have you fished Marl Lake?

	Total	%
Never	1	*5.9*
1-2 years	3	*17.6*
3-5 years	1	*5.9*
6-10 years	2	*11.8*
More than 10 years	10	*58.8*
	17	*100.0*

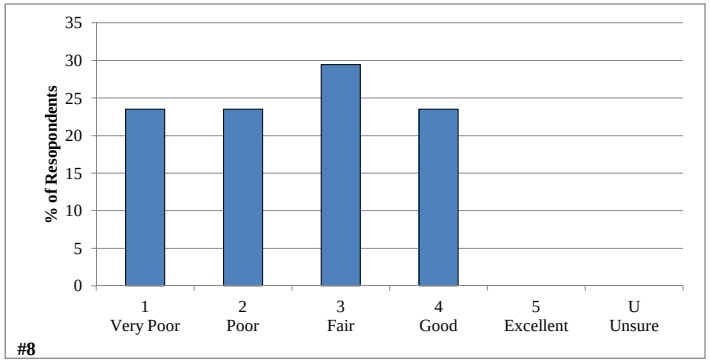


#7 Have you personally fished on Marl Lake in the past 3 years?

	Total	%
Yes	9	*52.9*
No	8	*47.1*
	17	*100.0*

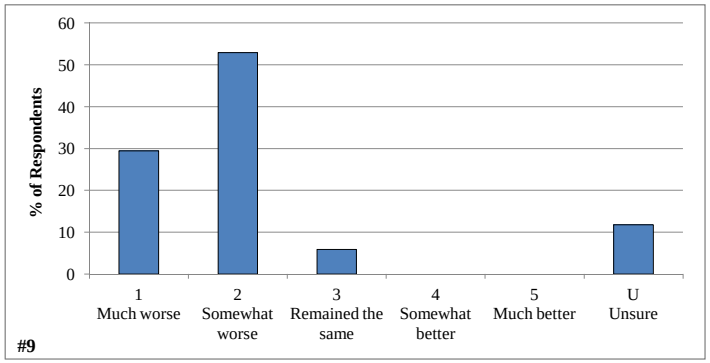
#8 How would you describe the current quality of fishing on Marl Lake?

	Total	%
1 - Very Poor	4	*23.5*
2 - Poor	4	*23.5*
3 - Fair	5	*29.4*
4 - Good	4	*23.5*
5 - Excellent	0	*0.0*
U - Unsure	0	*0.0*
	17	*100.0*



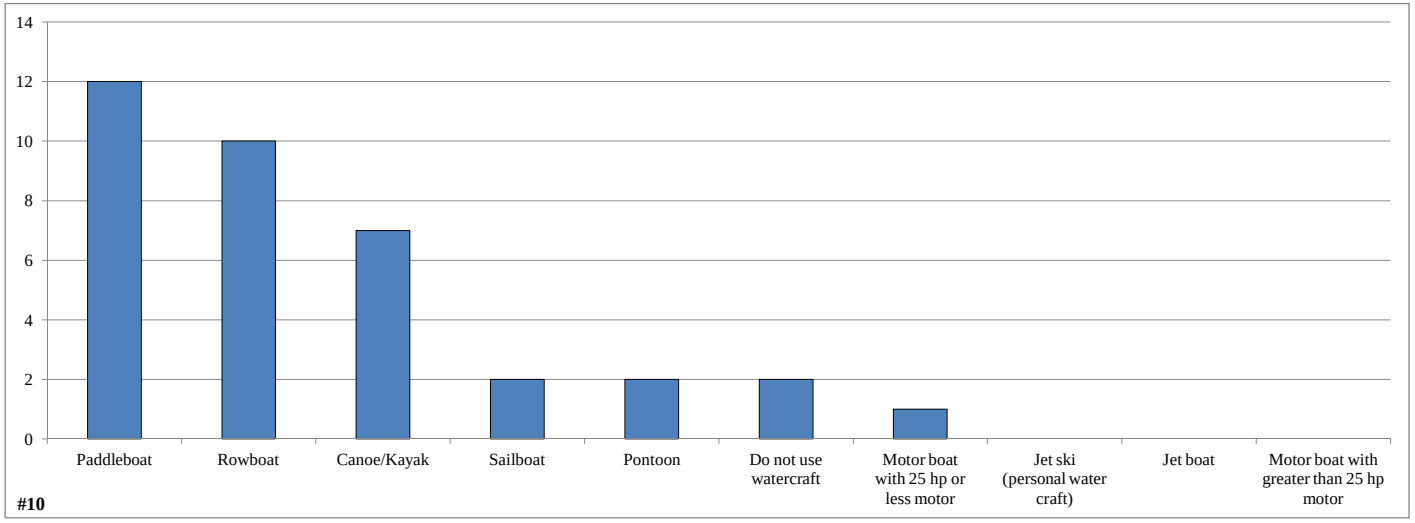
#9 How has the quality of fishing changed on Marl Lake since you started fishing the lake?

	Total	%
1 - Much worse	5	*29.4*
2 - Somewhat worse	9	*52.9*
3 - Remained the Same	1	*5.9*
4 - Somewhat better	0	*0.0*
5 - Much better	0	*0.0*
U - Unsure	2	*11.8*
	17	*100.0*



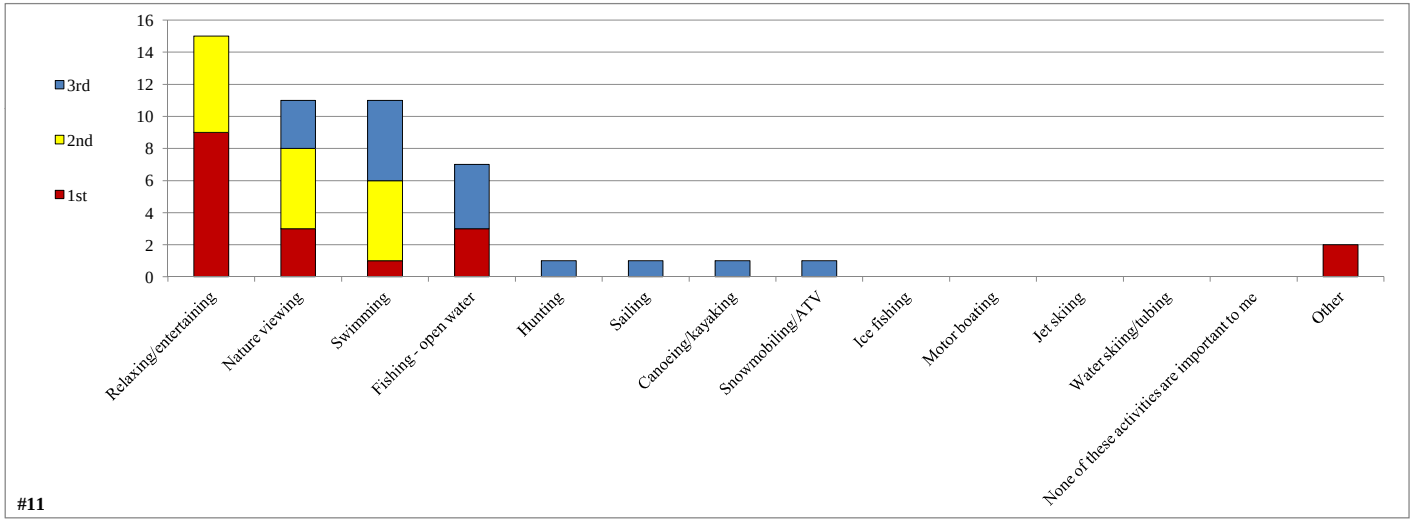
#10 What types of watercraft do you currently use on the lake?

	Total
Paddleboat	12
Rowboat	10
Canoe/Kayak	7
Sailboat	2
Pontoon	2
Do not use watercraft	2
Motor boat with 25 hp or less motor	1
Jet ski (personal water craft)	0
Jet boat	0
Motor boat with greater than 25 hp motor	0
	36



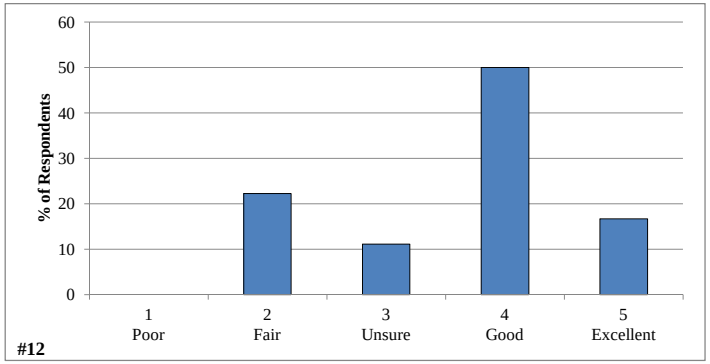
#11 Please rank up to three activities that are important reasons for owning your property on or near the lake.

	1st	2nd	3rd	*% ranked*
Relaxing/entertaining	9	6	0	*31.3*
Nature viewing	3	5	3	*22.9*
Swimming	1	5	5	*22.9*
Fishing - open water	3	0	4	*14.6*
Hunting	0	0	1	*2.1*
Sailing	0	0	1	*2.1*
Canoeing/kayaking	0	0	1	*2.1*
Snowmobiling/ATV	0	0	1	*2.1*
Ice fishing	0	0	0	*0.0*
Motor boating	0	0	0	*0.0*
Jet skiing	0	0	0	*0.0*
Water skiing/tubing	0	0	0	*0.0*
None of these activities are important to me	0	0	0	*0.0*
Other	2	0	0	*4.2*
	16	16	16	*100.0*



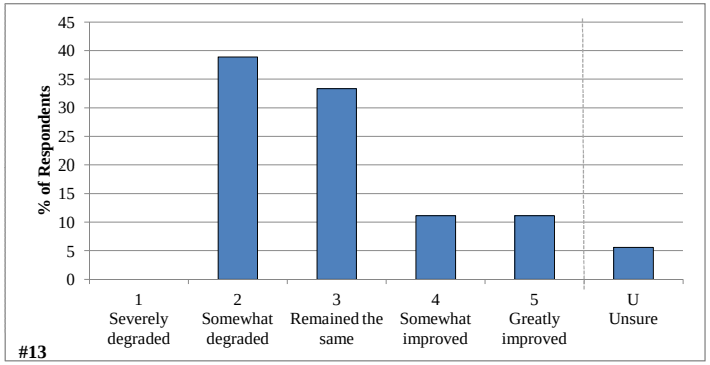
#12 How would you describe the current water quality of Marl Lake?

	Total	%
1 - Poor	0	*0.0*
2 - Fair	4	*22.2*
3 - Unsure	2	*11.1*
4 - Good	9	*50.0*
5 - Excellent	3	*16.7*
	18	*100.0*



#13 How has the water quality changed in Marl Lake since you obtained your property?

	Total	%
1 - Severely degraded	0	*0.0*
2 - Somewhat degraded	7	*38.9*
3 - Remained the same	6	*33.3*
4 - Somewhat improved	2	*11.1*
5 - Greatly improved	2	*11.1*
U - Unsure	1	*5.6*
	18	*100.0*



#14 Have you ever heard of aquatic invasive species?

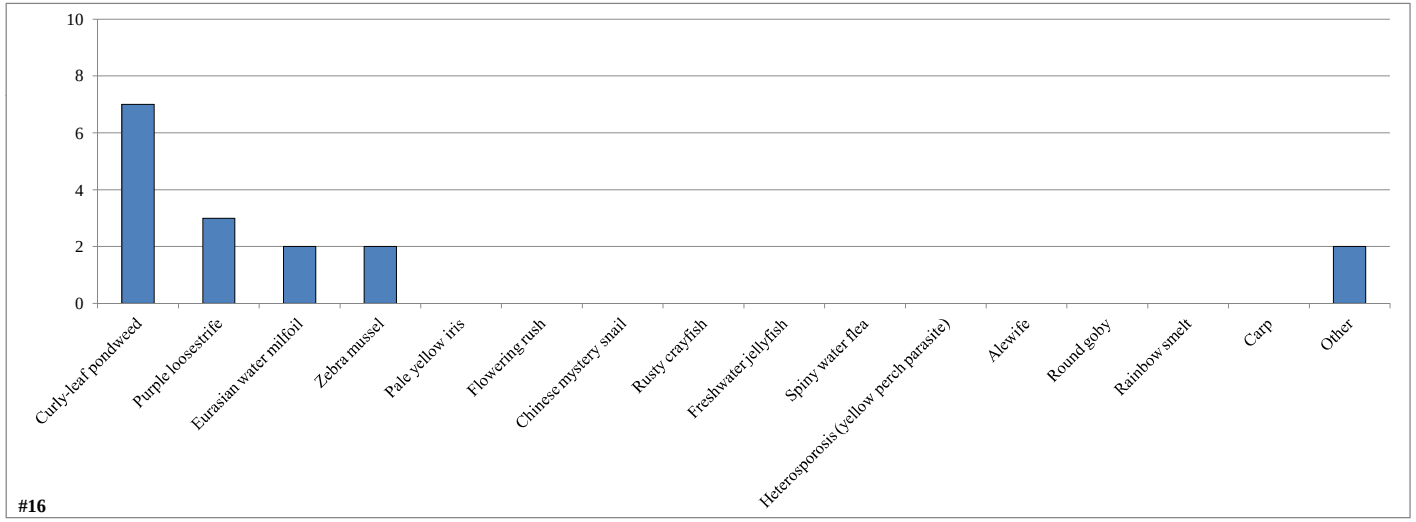
	Total	%
Yes	18	*100.0*
No	0	*0.0*
	18	*100.0*

#15 Are you aware of aquatic invasive species in Marl Lake?

	Total	%
Yes	10	*62.5*
No	6	*37.5*
	16	*100.0*

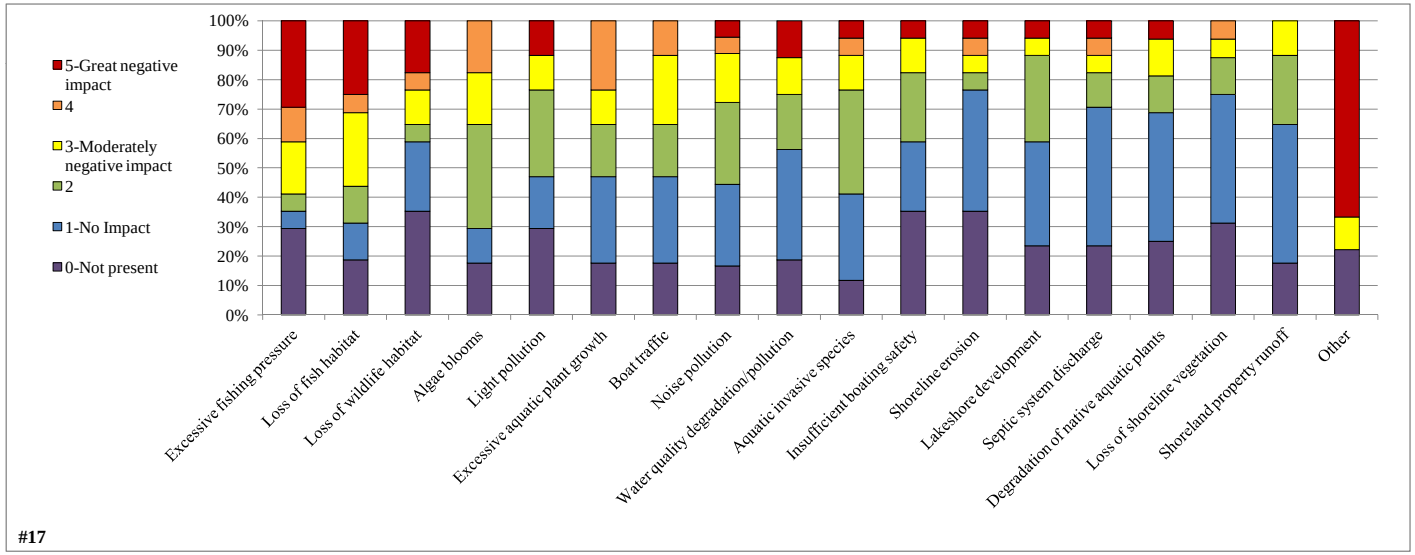
#16 Which aquatic invasive species are you aware of in Marl Lake?

	Total
Curly-leaf pondweed	7
Purple loosestrife	3
Eurasian water milfoil	2
Zebra mussel	2
Pale yellow iris	0
Flowering rush	0
Chinese mystery snail	0
Rusty crayfish	0
Freshwater jellyfish	0
Spiny water flea	0
Heterosporosis (yellow perch parasite)	0
Alewife	0
Round goby	0
Rainbow smelt	0
Carp	0
Other	2



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

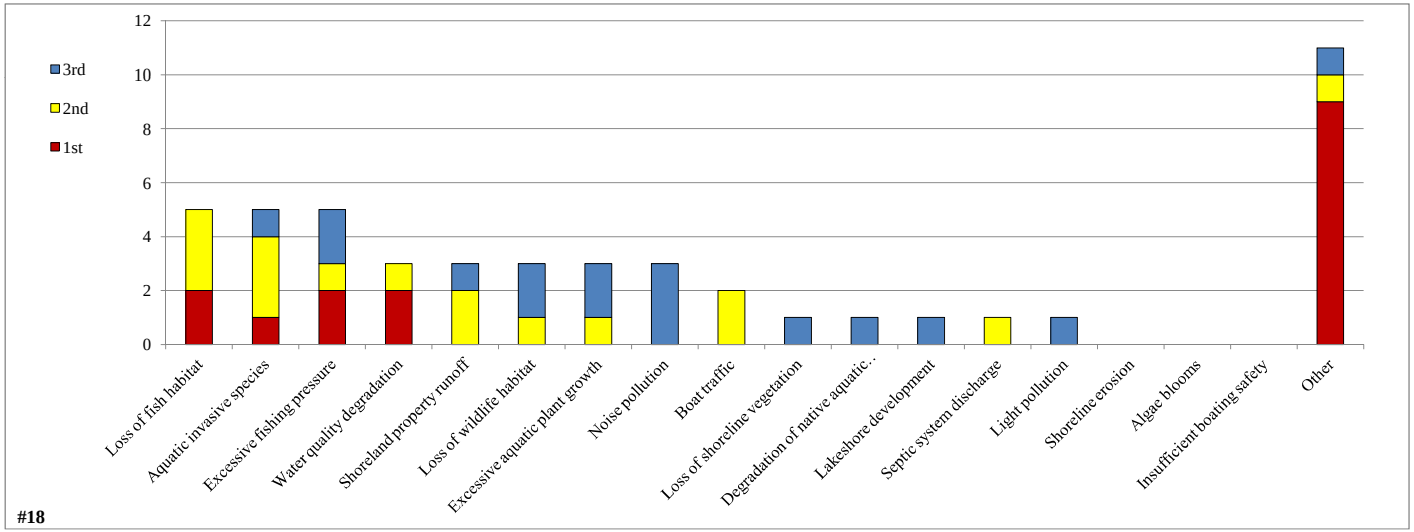
	0-Not present	1-No Impact	2	3-Moderately negative impact	4	5-Great negative impact	*Total*	*Average*
Excessive fishing pressure	5	1	1	3	2	5	*12*	*3.8*
Loss of fish habitat	3	2	2	4	1	4	*13*	*3.2*
Loss of wildlife habitat	6	4	1	2	1	3	*11*	*2.8*
Algae blooms	3	2	6	3	3	0	*14*	*2.5*
Light pollution	5	3	5	2	0	2	*12*	*2.4*
Excessive aquatic plant growth	3	5	3	2	4	0	*14*	*2.4*
Boat traffic	3	5	3	4	2	0	*14*	*2.2*
Noise pollution	3	5	5	3	1	1	*15*	*2.2*
Water quality degradation/pollution	3	6	3	2	0	2	*13*	*2.2*
Aquatic invasive species	2	5	6	2	1	1	*15*	*2.1*
Insufficient boating safety	6	4	4	2	0	1	*11*	*2.1*
Shoreline erosion	6	7	1	1	1	1	*11*	*1.9*
Lakeshore development	4	6	5	1	0	1	*13*	*1.8*
Septic system discharge	4	8	2	1	1	1	*13*	*1.8*
Degradation of native aquatic plants	4	7	2	2	0	1	*12*	*1.8*
Loss of shoreline vegetation	5	7	2	1	1	0	*11*	*1.6*
Shoreland property runoff	3	8	4	2	0	0	*14*	*1.6*
Other	2	0	0	1	0	6	*7*	*4.7*



#17

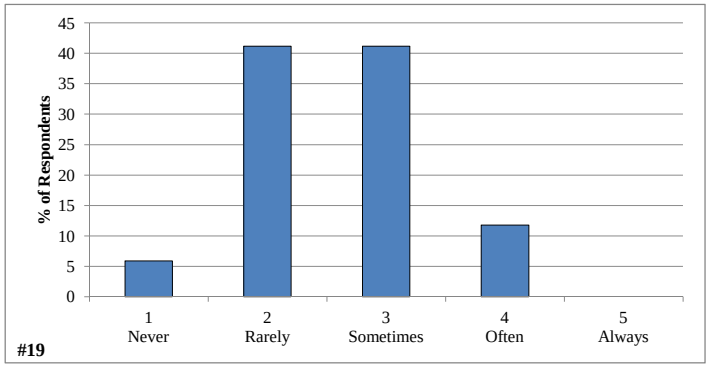
#18 From the list below, please rank your top three concerns regarding Marl Lake.

	1st	2nd	3rd	*% Ranked*
Loss of fish habitat	2	3	0	*10.4*
Aquatic invasive species	1	3	1	*10.4*
Excessive fishing pressure	2	1	2	*10.4*
Water quality degradation	2	1	0	*6.3*
Shoreland property runoff	0	2	1	*6.3*
Loss of wildlife habitat	0	1	2	*6.3*
Excessive aquatic plant growth	0	1	2	*6.3*
Noise pollution	0	0	3	*6.3*
Boat traffic	0	2	0	*4.2*
Loss of shoreline vegetation	0	0	1	*2.1*
Degradation of native aquatic plants	0	0	1	*2.1*
Lakeshore development	0	0	1	*2.1*
Septic system discharge	0	1	0	*2.1*
Light pollution	0	0	1	*2.1*
Shoreline erosion	0	0	0	*0.0*
Algae blooms	0	0	0	*0.0*
Insufficient boating safety	0	0	0	*0.0*
Other	9	1	1	*22.9*
	16	16	16	*100.0*



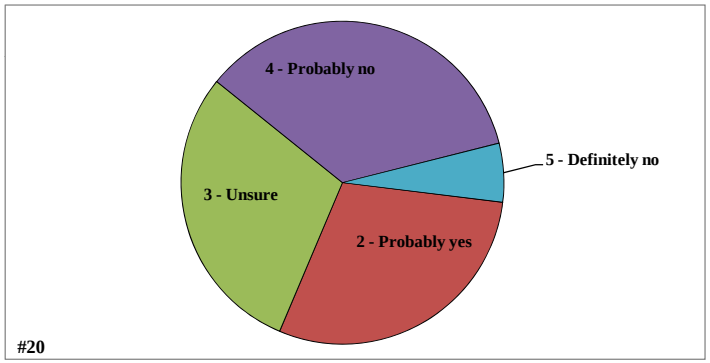
#19 During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of Marl Lake?

	Total	%
1 - Never	1	*5.9*
2 - Rarely	7	*41.2*
3 - Sometimes	7	*41.2*
4 - Often	2	*11.8*
5 - Always	0	*0.0*
	17	*100.0*



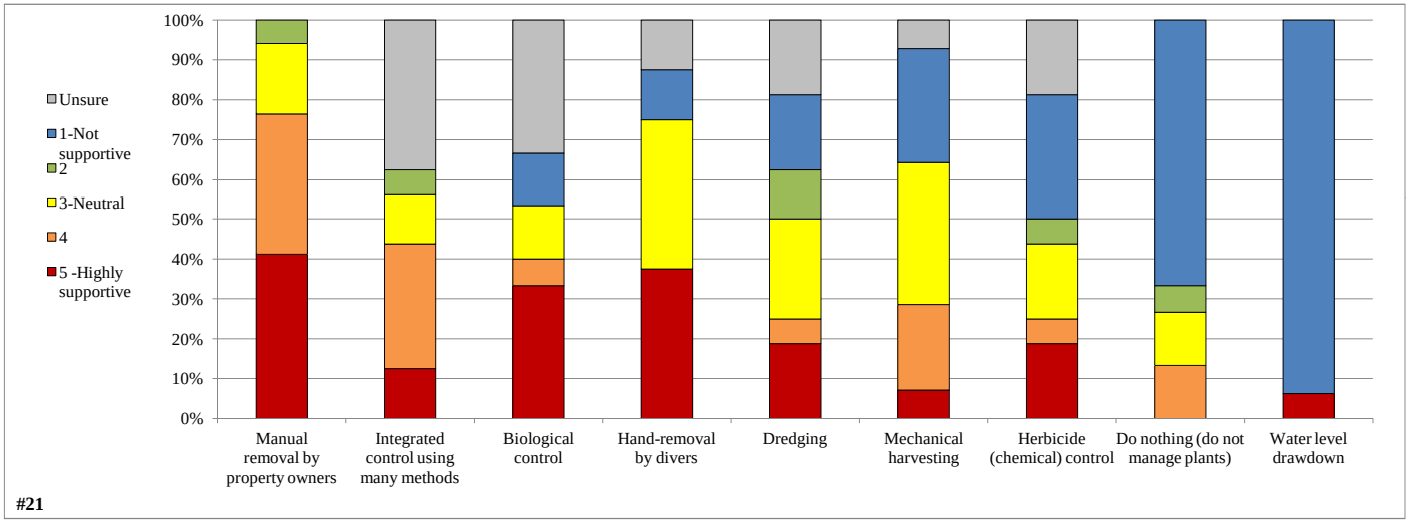
#20 Considering your answer to the question above, do you believe aquatic plant control is needed on Marl Lake?

	Total	%
1 - Definitely yes	0	*0.0*
2 - Probably yes	5	*29.4*
3 - Unsure	5	*29.4*
4 - Probably no	6	*35.3*
5 - Definitely no	1	*5.9*
	17	*100.0*



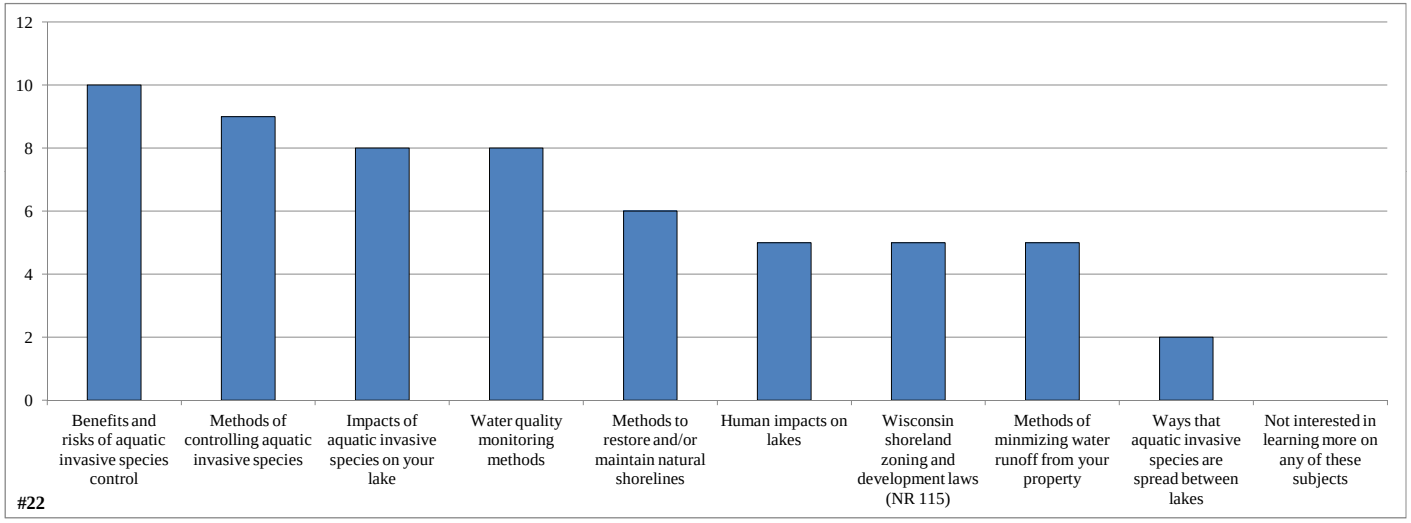
#21 What is your level of support for the responsible use of the following techniques on Marl Lake?

	1-Not supportive	2	3-Neutral	4	5 -Highly supportive	Unsure	*Total*	*Average*
Manual removal by property owners	0	1	3	6	7	0	*17*	*4.1*
Integrated control using many methods	0	1	2	5	2	6	*10*	*3.8*
Biological control	2	0	2	1	5	5	*10*	*3.7*
Hand-removal by divers	2	0	6	0	6	2	*14*	*3.6*
Dredging	3	2	4	1	3	3	*13*	*2.9*
Mechanical harvesting	4	0	5	3	1	1	*13*	*2.8*
Herbicide (chemical) control	5	1	3	1	3	3	*13*	*2.7*
Do nothing (do not manage plants)	10	1	2	2	0	0	*15*	*1.7*
Water level drawdown	15	0	0	0	1	0	*16*	*1.3*



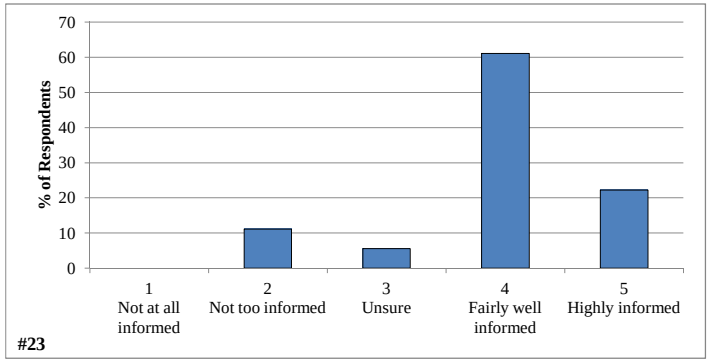
#22 Which of these subjects would you like to learn more about?

	Total
Benefits and risks of aquatic invasive species control	10
Methods of controlling aquatic invasive species	9
Impacts of aquatic invasive species on your lake	8
Water quality monitoring methods	8
Methods to restore an/or maintain natural shorelines	6
Human impacts on lakes	5
Wisconsin shoreland zoning and development laws (NR 115)	5
Methods of minmizing water runoff from your property	5
Ways that aquatic invasive species are spread between lakes	2
Not interested in learning more on any of these subjects	0



#23 How informed has the Marl Lake District kept you regarding issues with Marl Lake and its management?

	Total	%
1 - Not at all informed	0	*0.0*
2 - Not too informed	2	*11.1*
3 - Unsure	1	*5.6*
4 - Fairly well informed	11	*61.1*
5 - Highly informed	4	*22.2*
	18	*100.0*

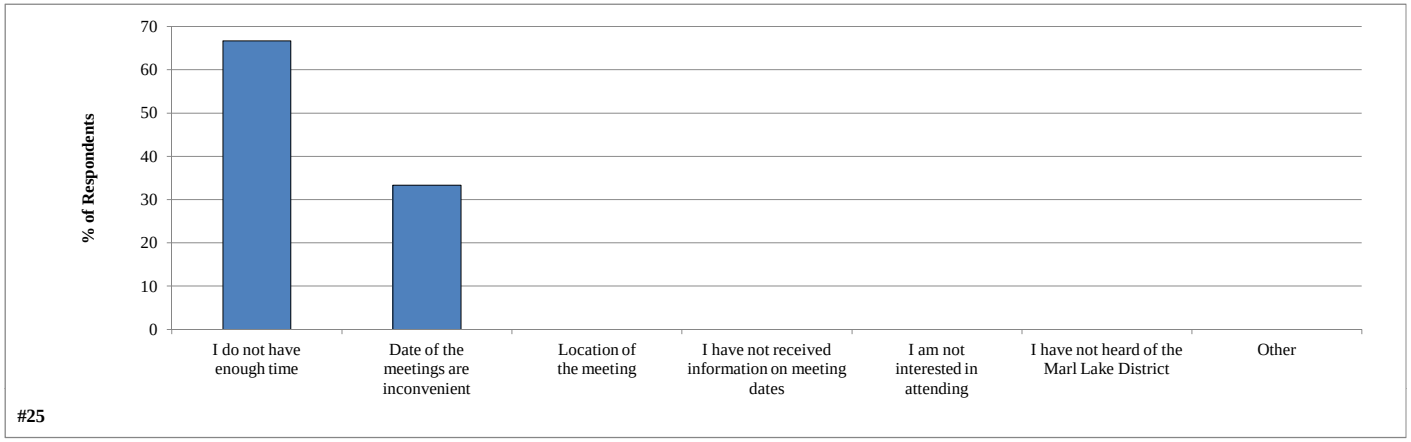


#24 How many Marl Lake District meetings have you attended?

	Total	%
None	1	*5.6*
1-2 meetings	1	*5.6*
3-4 meetings	6	*33.3*
5 or more meetings	10	*55.6*
	18	*100.0*

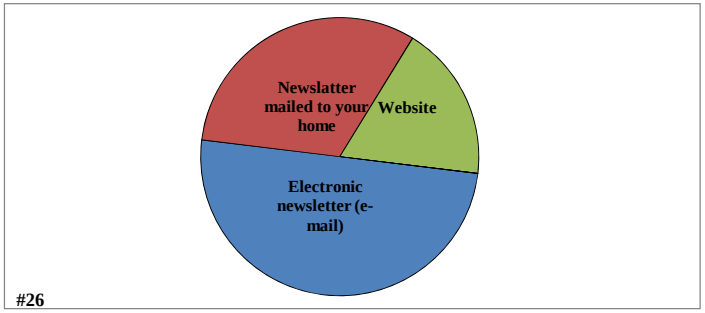
#25 What is the reason you choose not to attend Marl Lake District meetings?

	Total	%
I do not have enough time	2	*66.7*
Date of the meetings are inconvenient	1	*33.3*
Location of the meeting	0	*0.0*
I have not received information on meeting dat	0	*0.0*
I am not interested in attending	0	*0.0*
I have not heard of the Marl Lake District	0	*0.0*
Other	0	*0.0*
	3	*100.0*



#26 Through what source would you most like to receive communication about Marl Lake?

	Total
Electronic newsletter (e-mail)	11
Newslatter mailed to your home	7
Website	4
Other	0
Not interested in receiving any information	0



Survey Number	1g Comment	11m Comment	16p Comment	17r Comment	18r Comment	25g Comment	26d Comment	Other Comments (and Question 28)
1			koi fish		water level decline			
2				nothing selected for "water quality degradation. 17f - motorized, 17o - road, 17r - drop in water level	18f - motorized, 18r - water level			We are very concerned with irrigation practices in Waushara County and impact on Groundwater levels and effect on level of water in Marl Lake and other lakes in Waushara County.
3				depth, size of lake	shrinking size of lake			Q15: Answered (b) No - not before survey was done. Q17o: Comment "Park".
4					lake water level			Causes and solutions for the low water level. County Park trash/refuse control and cleanup. Concerns about refuse from park users getting into the lake, such as cans and bottles, etc.
6			garlic mustard					
7				public don't follow no wake	Irrigation not regulated, high capacity wells			We love the lake and are deeply concerned about: the quality of the water, and the low level of the water. I don't understand why other states have legislation to monitor irrigation sysytems and make sure there is some control to prevent abuse of the water. Like the farmers, the lake owners should also have some protection to conserve our valuable resources.
8				Size of lake shrinking dramatically	size of lake shrinking			Very concerned about lake water level and decreasing property value. We believe the decreasing lake level is due to in part the unlimited access the farmers have to deep well irrigation.
9								People who have been involved in the Marl Lake District have been doing a fantastic job. I believe the water quality is wonderful. It is greatly improved over the years and I would love to see it stay this way. It seems to me as I watch our lake that our water fowl population has grown considerably over the years. I love to see so many birds, escpecially the large varieties. I also have observed that there is a great decrease in the fish population. May be related to the increase in water fowl but i've noticed far fewer fish when I sit on my pier and look in the water. I'm not overly concerned. Just making an observation.
11			snails?		water level			Higher water level needs to be maintained. Removal of algae and othe plants which remove O2 (oxygen) from the lake. Studies to determine how to improve water quality and increase water level. NEEDS TO INCREASE and improve the quality of the water around the lake.
12		Want to sell			Loss of shore			
13					very low lake level			
14					Excessive fish harvest			The amount of recreational use of this small lake is amazing! The fishing pressure is urelenting almost 11 months of the year! We should try to put fish "cribs" in the lake ASAP due to low water leverls. The loss of the marsh habitat is a severe blow to the spawning habitat of this jewel! I'd also like to see more enforcement action on the lake! Every spring and summer I'm forced to use my landing net to retrieve litter! Bag limits should also be enforced! People fish the lake every day of their vacation and keep fish each day, probably exceeding possession limits! Me and my family onjoy the lake and atmosphere but we can't tolerate the abuse the so called "lake lovers" heap on it!
15				low water				Find out what is causing low lake level.
16				public usage				
17				Loss of ground water	Loss of ground water.			
18		retirement						I would be able to do more if I had a place on the lake. Will help when I can.
19								
20								

C

APPENDIX C

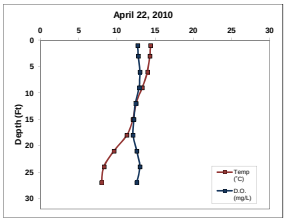
Water Quality Data

Marl Lake

Date: 4/22/2010
Time: 14:25
Weather: 100% sun, light breeze, 60°F
Entry: BTB

Max Depth: 29.2
MLS Depth (ft): 3.0
MLB Depth (ft): 27.0
Secchi Depth (ft): 11.2

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	14.4	12.7	8.8	
3.0	14.3	12.8	8.8	
6.0	14.0	13.0	8.8	
9.0	13.3	12.9	8.8	
12.0	12.5	12.4	8.7	
15.0	12.1	12.2	8.7	
18.0	11.3	12.1	8.7	
21.0	9.6	12.6	8.5	
24.0	8.3	13.0	8.5	
27.0	8.0	12.6	8.4	



Parameter	MLS	MLB
Total P (µg/L)	19.000	18.000
Dissolved P (µg/L)	5.000	3.000
Chl-a (µg/L)	18.10	
TKN (µg/L)	1030.00	980.00
NO_3 + NO_2-N (µg/L)	233.000	200.000
NH_3-N (µg/L)	37.000	173.000
Total N (µg/L)	1030.00	980.00
Lab Cond. (µS/cm)	299	346
Lab pH	8.72	8.35
Alkalinity (mg/L $CaCO_3$)	142	166
Total Susp. Solids (mg/L)	3	3
Calcium (mg/L)	25.9	

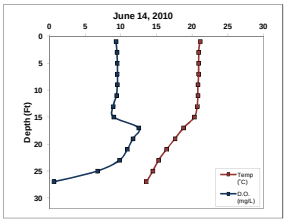
Data collected by TAH (Onterra)
Note: Specific conductivity not callibrated correctly on hydrolab.

Marl Lake

Date: 6/14/2010
Time: 10:30
Weather: 100% clouds, 65°F
Entry: TWH

Max Depth: 29.5
MLS Depth (ft): 3.0
MLB Depth (ft): 27.0
Secchi Depth (ft): 20.8

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	21.1	9.3		
3.0	20.9	9.5		
5.0	20.9	9.5		
7.0	20.9	9.5		
9.0	20.8	9.5		
11.0	20.8	9.4		
13.0	20.7	8.9		
15.0	20.3	9.0		
17.0	18.8	12.5		
19.0	17.6	11.7		
21.0	16.4	10.9		
23.0	15.3	9.8		
25.0	14.5	6.7		
27.0	13.6	0.6		



Parameter	MLS	MLB
Total P (µg/L)	13.000	35.000
Dissolved P (µg/L)		
Chl-a (µg/L)	1.48	
TKN (µg/L)		
NO_3 + NO_2-N (µg/L)		
NH_3-N (µg/L)		
Total N (µg/L)		
Lab Cond. (µS/cm)		
Lab pH		
Alkalinity (mg/L $CaCO_3$)		
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)		

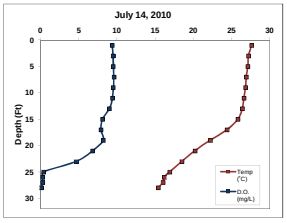
Data collected by TWH (Onterra)

Marl Lake

Date: 7/14/2010
Time: 8:00
Weather: 100% sun, very light wind, 75°F
Entry: TWH

Max Depth: 29.7
MLS Depth (ft): 3.0
MLB Depth (ft): 27.0
Secchi Depth (ft): 15.2

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	27.6	9.4		
3.0	27.2	9.5		
5.0	27.1	9.5		
7.0	26.9	9.6		
9.0	26.8	9.5		
11.0	26.6	9.4		
13.0	26.4	9.0		
15.0	25.8	8.1		
17.0	24.4	7.9		
19.0	22.2	8.2		
21.0	20.2	6.8		
23.0	18.5	4.7		
25.0	16.9	0.4		
26.0	16.2	0.3		
27.0	16.0	0.3		
28.0	15.4	0.1		



Parameter	MLS	MLB
Total P (µg/L)	24.000	29.000
Dissolved P (µg/L)	ND	ND
Chl-a (µg/L)	2.70	
TKN (µg/L)	680.00	940.00
NO_3 + NO_2-N (µg/L)	74.000	60.000
NH_3-N (µg/L)	61.000	216.000
Total N (µg/L)	680.00	940.00
Lab Cond. (µS/cm)	272	340
Lab pH	8.87	7.90
Alkalinity (mg/L $CaCO_3$)	128	162
Total Susp. Solids (mg/L)	ND	2
Calcium (mg/L)		

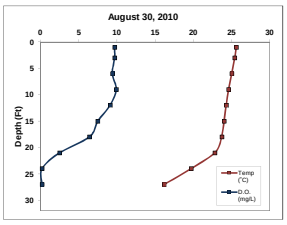
Data collected by TWH (Onterra)

Marl Lake

Date: 8/30/2010
Time: 10:30
Weather: clear, light breeze, 80°F
Entry: TWH

Max Depth: 30.1
MLS Depth (ft): 3
MLB Depth (ft): 27
Secchi Depth (ft): 8.1

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	25.6	9.7	8.9	275
3.0	25.4	9.7	8.9	275
6.0	25.0	9.4	8.9	277
9.0	24.6	9.9	8.9	275
12.0	24.3	9.1	8.9	277
15.0	24.0	7.5	8.8	280
18.0	23.7	6.4	8.7	283
21.0	22.8	2.5	8.2	297
24.0	19.7	0.2	7.7	345
27.0	16.2	0.2	7.5	395



Parameter	MLS	MLB
Total P (µg/L)	121.000	19.000
Dissolved P (µg/L)		
Chl-a (µg/L)	20.20	
TKN (µg/L)		
NO_3 + NO_2-N (µg/L)		
NH_3-N (µg/L)		
Total N (µg/L)		
Lab Cond. (µS/cm)	275	395
Lab pH	8.90	7.50
Alkalinity (mg/L $CaCO_3$)		
Total Susp. Solids (mg/L)	3	13
Calcium (mg/L)		

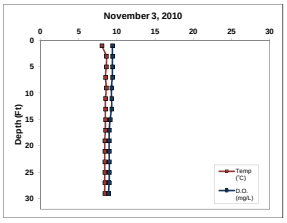
Data collected by TAH (Onterra)

Marl Lake

Date: 11/3/2010
Time: 10:45
Weather: cloudy, light breeze, 45°F
Entry: TWH

Max Depth: 30.2
MLS Depth (ft): 3
MLB Depth (ft): 28
Secchi Depth (ft): 15.9

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	8.0	9.4	8.4	308
3.0	8.6	9.4	8.4	308
5.0	8.6	9.4	8.4	308
7.0	8.5	9.4	8.4	308
9.0	8.6	9.3	8.4	308
11.0	8.5	9.3	8.4	308
13.0	8.5	9.3	8.4	309
15.0	8.5	9.1	8.4	309
17.0	8.5	9.0	8.4	309
19.0	8.4	9.0	8.4	309
21.0	8.4	9.0	8.4	309
23.0	8.4	9.0	8.4	309
25.0	8.4	9.0	8.4	309
27.0	8.4	9.0	8.4	309
29.0	8.4	8.9	8.4	310



Parameter	MLS	MLB
Total P (µg/L)	17.000	16.000
Dissolved P (µg/L)	ND	
Chl-a (µg/L)	4.10	
TKN (µg/L)	1010.00	
NO_3 + NO_2-N (µg/L)	195.000	
NH_3-N (µg/L)	371.000	
Total N (µg/L)	1010.00	
Lab Cond. (µS/cm)	315	
Lab pH	8.34	
Alkalinity (mg/L $CaCO_3$)	150	
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)	31.9	

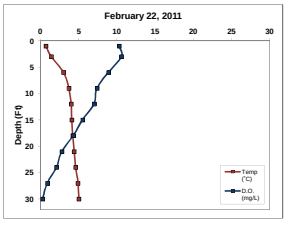
Data collected by DAC and TWH (Onterra)

Marl Lake

Date: 2/22/2011
Time: 13:30
Weather: overcast, light wind, 12" snow, 21°F
Entry: TWH

Max Depth: 31.4
MLS Depth (ft): 3
MLB Depth (ft): 28
Secchi Depth (ft): 13.4

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1.0	0.7	10.3		
3.0	1.4	10.6		
6.0	3.0	8.9		
9.0	3.7	7.4		
12.0	4.0	7.0		
15.0	4.1	5.5		
18.0	4.2	4.3		
21.0	4.4	2.8		
24.0	4.6	2.1		
27.0	4.9	0.9		
30.0	5.0	0.3		



Parameter	MLS	MLB
Total P (µg/L)	17.000	33.000
Dissolved P (µg/L)	ND	20.000
Chl-a (µg/L)		
TKN (µg/L)	1230.00	1410.00
NO_3 + NO_2-N (µg/L)	471.000	1870.000
NH_3-N (µg/L)	460.000	848.000
Total N (µg/L)	1230.00	1410.00
Lab Cond. (µS/cm)		
Lab pH		
Alkalinity (mg/L $CaCO_3$)		
Total Susp. Solids (mg/L)	ND	ND
Calcium (mg/L)		

Data collected by TAH and BTB (Onterra) Ice depth 1.4'

Water Quality Data

2010	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	6	14.1	NA	NA
Total P (µg/L)	6	35.2	6	25.0
Dissolved P (µg/L)	4	5.0	3	11.5
Chl a (µg/L)	5	9.3	0	NA
TKN (µg/L	4	987.5	3	1110.0
NO3+NO2-N (µg/L)	4	243.3	3	710.0
NH3-N (µg/L)	4	232.3	3	412.3
Total N (µg/L)	4	987.5	3	1110.0
Lab Cond. (µS/cm)	4	290.3	3	360.3
Lab pH	4	8.7	3	7.9
Alkal (mg/l CaCO3)	3	140.0	2	164.0
Total Susp Sol (mg/l)	6	3.0	6	6.0
Calcium (µg/L)	2	28.6	0	NA

Morphological / Geographical Data

Parameter	Value
Acreage	
Volume (acre-feet)	
Perimeter (miles)	
Shoreland Developmetnt Factor	
Maximum Depth (feet)	
County	
WBIC	
Lillie Mason Region (1983)	NLF Ecoregion
Nichols Ecoregion (1999)	NLFL

Watershed Data

WiLMS Class	Acreage	kg/yr	lbs/yr
Forest			0.0
Open Water			0.0
Pasture/Grass			0.0
Row Crops			0.0
Urban - Rural Residential			0.0
Wetland			0.0
Watershed to Lake Area			

Trophic State Index (WTSI)

Year	TP	Chl-a	Secchi
1981	47.3		
1982			
1983	47.3		
1988			
1989	46.6	53.2	41.3
1990	45.0		37.2
1991	40.8	42.4	40.1
1992	39.6	43.0	41.0
1993			35.9
1994			34.1
1995			30.6
1996			33.8
1997			36.9
1998			35.1
1999			37.5
2000			36.6
2001			37.5
2002		38.6	
2003			37.3
2004			32.6
2005			
2006			
2007			36.6
2008			36.2
2009	42.9	38.8	36.3
2010	54.8	48.2	38.2
All Years (Weighted)	48.3	44.8	36.4
Deep, Seepage Lakes	43.2	43.2	42.4
NLF Ecoregion	48.1	47.5	45.7

	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
1981									2	20.0	1.0	20.0
1982									1	20.0	0.0	
1983									1	20.0	1.0	20.0
1988												
1989	15	12.2	8	12.0	2	7.5	1	10.0	2	28.5	1.0	19.0
1990	18	14.6	10	16.0	2	27.5	0		3	50.0	1.0	17.0
1991	19	13.7	12	13.1	4	4.3	3	3.3	4	17.0	3.0	12.7
1992	10	13.7	6	12.3	5	4.6	3	3.6	5	14.0	3.0	11.7
1993	2	17.5	2	17.5								
1994	14	20.0	13	19.7								
1995	7	25.3	7	25.3								
1996	15	20.1	14	20.2								
1997	12	18.8	10	16.3								
1998	14	19.5	11	18.4								
1999	6	15.7	6	15.7								
2000	6	16.7	6	16.7								
2001	5	15.6	5	15.6								
2002	1	30.0	0		4	3.3	3	2.3				
2003	6	16.9	5	15.9								
2004	1	22.0	1	22.0								
2005												
2006												
2007	9	16.2	7	16.6								
2008	7	16.5	6	17.1								
2009	7	16.7	3	17.0	3	2.3	3	2.3	4	15.0	3.0	14.7
2010	8	14.4	7	14.9	7	7.7	6	6.0	8	31.8	7.0	33.6
All Years (Weighted)		16.8		16.9		6.8		4.2		24.6		21.4
Deep, Seepage Lakes				11.2				3.6				15.0
NLF Ecoregion				8.9				5.6				21.0

Summer 2010 N: 987.5
Summer 2010 P: 35.2

Summer 2011 N:P 28 :1

D

APPENDIX D

Watershed Analysis WILMS Results

Date: 9/14/2012 Scenario: 71

Lake Id: Marl_Working_AllYears
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 369.0 acre
Total Unit Runoff: 10.30 in.
Annual Runoff Volume: 316.7 acre-ft
Lake Surface Area <As>: 26.6 acre
Lake Volume <V>: 373.0 acre-ft
Lake Mean Depth <z>: 14.0 ft
Precipitation - Evaporation: 3.2 in.
Hydraulic Loading: 323.8 acre-ft/year
Areal Water Load <qs>: 12.2 ft/year
Lake Flushing Rate <p>: 0.87 1/year
Water Residence Time: 1.15 year
Observed spring overturn total phosphorus (SPO): 29.0 mg/m^3
Observed growing season mean phosphorus (GSM): 23.6 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	60.0	0.50	1.00	3.00	51.7	12	24	73
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	66.0	0.10	0.30	0.50	17.1	3	8	13
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)	49.0	0.05	0.10	0.25	4.2	1	2	5
Wetlands	35.0	0.10	0.10	0.10	3.0	1	1	1
Forest	159.0	0.05	0.09	0.18	12.3	3	6	12
Lake Surface	26.6	0.10	0.30	1.00	6.9	1	3	11

POINT SOURCE DATA

Point Sources	Water Load	Low	Most Likely	High	Loading %
	(m^3/year)	(kg/year)	(kg/year)	(kg/year)	

SEPTIC TANK DATA

Description	Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)	0.30	0.50	0.80	

# capita-years	45				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.27	2.25	7.20	4.8

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	48.0	103.5	269.2	100.0
Total Loading (kg)	21.8	47.0	122.1	100.0
Areal Loading (lb/ac-year)	1.81	3.89	10.12	
Areal Loading (mg/m^2-year)	202.36	436.29	1134.48	
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	45.1	91.5	229.6	95.2
Total NPS Loading (kg)	20.4	41.5	104.2	95.2

Phosphorus Prediction and Uncertainty Analysis Module

Date: 9/14/2012 Scenario: 47
Observed spring overturn total phosphorus (SPO): 29.0 mg/m^3
Observed growing season mean phosphorus (GSM): 23.6 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	20	42	109	18	76
Canfield-Bachmann, 1981 Natural Lake	26	46	90	22	93
Canfield-Bachmann, 1981 Artificial Lake	24	39	68	15	64
Rechow, 1979 General	13	27	71	3	13
Rechow, 1977 Anoxic	41	89	231	65	275
Rechow, 1977 water load<50m/year	21	46	120	22	93
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	29	63	163	34	117
Vollenweider, 1982 Combined OECD	23	42	93	16	61
Dillon-Rigler-Kirchner	15	32	84	3	10
Vollenweider, 1982 Shallow Lake/Res.	18	36	83	10	38
Larsen-Mercier, 1976	26	57	147	28	97
Nurnberg, 1984 Oxic	17	36	95	12	51

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	24	86	FIT	0	GSM
Canfield-Bachmann, 1981 Natural Lake	14	132	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	12	112	FIT	1	GSM
Rechow, 1979 General	15	56	FIT	0	GSM
Rechow, 1977 Anoxic	52	180	FIT	0	GSM
Rechow, 1977 water load<50m/year	25	95	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	31	134	FIT	0	SPO
Vollenweider, 1982 Combined OECD	20	84	FIT	0	ANN
Dillon-Rigler-Kirchner	19	66	P	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	17	73	FIT	0	ANN
Larsen-Mercier, 1976	34	114	P Pin	0	SPO
Nurnberg, 1984 Oxic	19	77	FIT	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	Potamogeton crispus	Potamogeton friesii	Chara spp.	Stuckenia pectinata	Potamogeton zosteriformis	Potamogeton strictifolius	Najas flexilis	Heteranthera dubia	Potamogeton gramineus	Potamogeton natans	Potamogeton illinoensis	Myriophyllum sibiricum	Nymphaea odorata	Potamogeton amplifolius	Sagittaria latifolia	Eleocharis erythropoda	Aquatic moss	Freshwater Sponge	Filamentous algae
1	44.1113486	-89.39071305	2	M	P			1		1				2		1									
2	44.1110605	-89.39071601	5	M	P			1		1				2		1									
3	44.1107724	-89.39071897	4	M	P					1				2			1			1					
4	44.1104843	-89.39072193	1	M	P		1	1											1						
5	44.1093319	-89.39073377	2	M	P			1				1	1												
6	44.1090438	-89.39073673	4	M	P				1																
7	44.1087558	-89.39073969	3	M	P			1																	
8	44.1113464	-89.3903132	4	M	P			1								1									
9	44.1110583	-89.39031616	7	M	P			1			2														
10	44.1107703	-89.39031912	7	M	P			1			2														
11	44.1104822	-89.39032208	3	M	P										1										
12	44.1101941	-89.39032504	1	M	P			1		1			1												
13	44.109906	-89.39032801	1	S	P					1			1												
14	44.1096179	-89.39033097	4	M	P					1				1											
15	44.1093298	-89.39033393	9	M	P			1	1			1													
16	44.1090417	-89.39033689	16		R			1	1																
17	44.1087536	-89.39033985	12	M	P			2																	
18	44.1084655	-89.39034281	3	M	P			1				1													
19	44.1113443	-89.38991334	3	M	P			1		1			1			1									
20	44.1110562	-89.3899163	6	M	P			1			1														
21	44.1107681	-89.38991927	11	M	P			2																	
22	44.11048	-89.38992223	10	M	P			1	2																
23	44.1101919	-89.38992519	7	M	P			1	1																
24	44.1099038	-89.38992816	8	M	P			1																	
25	44.1096158	-89.38993112	10	M	P				1																
26	44.1093277	-89.38993408	15		R			2	1																
27	44.1090396	-89.38993705																							
28	44.1087515	-89.38994001	23		R			1																	
29	44.1084634	-89.38994297	18		R			1	1																
30	44.1110541	-89.38951645	2	M	P			1	2	1															
31	44.110766	-89.38951941	7	M	P				1																
32	44.1104779	-89.38952238	13	M	P			1	1		1														
33	44.1101898	-89.38952534	15		R			1	2															1	
34	44.1099017	-89.38952831	14		R			2	1									1							
35	44.1096136	-89.38953128	15		R			2	1																
36	44.1093255	-89.38953424	24		R		1																		
37	44.1090374	-89.38953721	28		R			1																	
38	44.1087493	-89.38954017	28		R									1											
39	44.1084613	-89.38954314	17		R			1	1																
40	44.1107638	-89.38911956	2	S	P			1		1			1												
41	44.1104758	-89.38912253	10	M	P			2			1														
42	44.1101877	-89.3891255	16		R	No Vegetation																			
43	44.1098996	-89.38912846	18		R																				
44	44.1096115	-89.38913143	19		R			1																	
45	44.1093234	-89.3891344	24		R	No Vegetation																			
46	44.1090353	-89.38913736	29		R	No Vegetation																			
47	44.1087472	-89.38914033	29		R	No Vegetation																			
48	44.1084591	-89.3891433	26		R	No Vegetation																			
49	44.108171	-89.38914627	8	M	P			1	1																
50	44.1104736	-89.38872268	5	M	P			1	1						1										
51	44.1101855	-89.38872565	12	M	P			1			1														
52	44.1098974	-89.38872862	15		R			2	2																
53	44.1096093	-89.38873158	18		R			1	2																
54	44.1093213	-89.38873455	25		R																				
55	44.1090332	-89.38873752	28		R			1																	
56	44.1087451	-89.38874049	29		R			1																	
57	44.108457	-89.38874346	24		R	No Vegetation																			
58	44.1081689	-89.38874643	14		R			1	3																
59	44.1101834	-89.3883258	3	M	P				1	1		1													
60	44.1098953	-89.38832877	9	M	P			2			1														
61	44.1096072	-89.38833174	15	M	P			1	1																

sampling point	Latitude (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	Potamogeton crispus	Potamogeton friesii	Chara spp.	Stuckenia pectinata	Potamogeton zosteriformis	Potamogeton strictifolius	Najas flexilis	Heteranthera dubia	Potamogeton gramineus	Potamogeton natans	Potamogeton illinoensis	Myriophyllum sibiricum	Nymphaea odorata	Potamogeton amplifolius	Sagittaria latifolia	Eleocharis erythropoda	Aquatic moss	Freshwater Sponge	Filamentous algae
62	44.1093191	-89.38833471	16		R			1	1																
63	44.109031	-89.38833768	23		R			1						1											
64	44.1087429	-89.38834065	24		R			1																	
65	44.1084548	-89.38834362	22		R			1																	
66	44.1081668	-89.38834659	17		R			3	1		1														
67	44.1078787	-89.38834957	1	S	P			1		1		1	1				1								
68	44.1098932	-89.38792892	1	M	P					1			1												
69	44.1096051	-89.38793189	8	M	P				2		1														
70	44.109317	-89.38793487	13	M	P			1	1																
71	44.1090289	-89.38793784	17		R			3	1																
72	44.1087408	-89.38794081	20		R			1	1																
73	44.1084527	-89.38794379	19		R																				1
74	44.1081646	-89.38794676	15	M	P						1														
75	44.1078765	-89.38794973	2	M	P				1	1			1		1										
76	44.1096029	-89.38753205	1	S	P			1					1									1			
77	44.1093148	-89.38753502	7	M	P			1	1		1														
78	44.1090267	-89.387538	13	M	P			1	2																
79	44.1087386	-89.38754097	16		R			2	1																
80	44.1084506	-89.38754395	19		R			1	1															1	1
81	44.1081625	-89.38754692	16		R			2	1																
82	44.1078744	-89.3875499	4	M	P			1				1			1									1	
83	44.1093127	-89.38713518	3	M	P	No Vegetation																			
84	44.1090246	-89.38713816	9	M	P			1	1																
85	44.1087365	-89.38714113	13	M	P			1	2																
86	44.1084484	-89.38714411	17		R		1	1	1		1													1	
87	44.1081603	-89.38714709	16		R				2																
88	44.1078722	-89.38715006	5	M	P				1		1	1													
89	44.1093105	-89.38673534	1	S	P			1		1				1							1				
90	44.1090224	-89.38673832	7	M	P				2			1		1											
91	44.1087344	-89.38674129	8	M	P			1	1		1														
92	44.1084463	-89.38674427	14		R			1	2																
93	44.1081582	-89.38674725	14	M	P				2		1														
94	44.1078701	-89.38675023	4	M	P					1					1										
95	44.1093084	-89.38633549				Unreachable																			
96	44.1090203	-89.38633847	3	S	P	No Vegetation																			
97	44.1087322	-89.38634146	7	M	P			1	1	1															
98	44.1084441	-89.38634444	12	M	P			1	2																
99	44.108156	-89.38634742	13	M	P				2																
100	44.1078679	-89.3863504	4	M	P			1	1	1															
101	44.1087301	-89.38594162	4	M	P			1				2		1									2		1
102	44.108442	-89.3859446	9	M	P			2	1																
103	44.1081539	-89.38594758	12	M	P				2																
104	44.1078658	-89.38595056	4	M	P			1			1	2			1								2		
105	44.1084398	-89.38554476	5	M	P			1																	
106	44.1081517	-89.38554775	10	M	P			2																	
107	44.1078636	-89.38555073	3	S	P				1			1			1								1		
108	44.1084377	-89.38514492	1	S	P			1		1		1	1	1									1	1	1
109	44.1081496	-89.38514791	1	S	P			1		1			1											1	