

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



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Lake Management Planning

Onterra, LLC

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

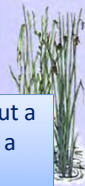


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Why create a lake management plan?

- 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!



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Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together



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Data and information gathering

- Study Components – Each Lake
 - Water Quality Analysis
 - Watershed Assessment
 - Aquatic Plant Surveys
 - Shoreland Assessment
 - Fisheries Data Integration
 - Stakeholder Survey



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Water Quality Analysis

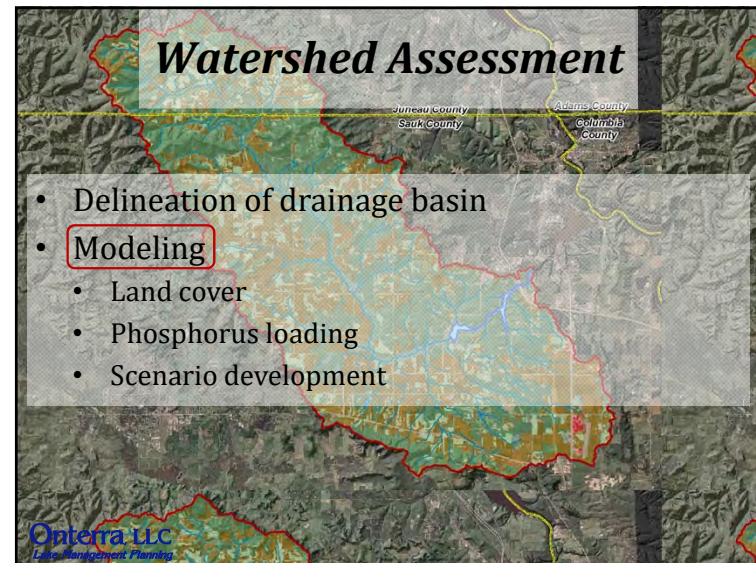
- General water chemistry (current & historic)
 - Citizens Lake Monitoring Network
- Nutrient analysis
 - Lake trophic state (Eutrophication)
 - Limiting plant nutrient
- Supporting data for watershed modeling



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Watershed Assessment

- Delineation of drainage basin
- **Modeling**
 - Land cover
 - Phosphorus loading
 - Scenario development



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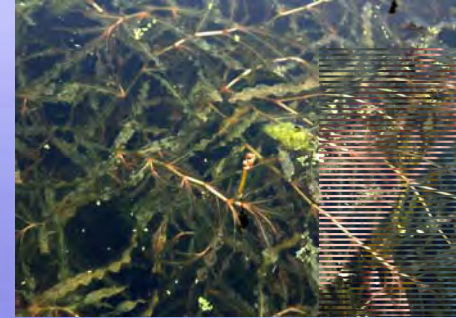
Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
 - Early-season AIS survey
 - Point-intercept survey
 - Aquatic plant community mapping

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Non-native Aquatic Plants

Curly-leaf Pondweed



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Non-native Aquatic Plants

Eurasian Water Milfoil



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Non-native Aquatic Plants

Pale Yellow Iris



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Non-native Aquatic Plants

Purple Loosestrife



S. Kelly Kearns

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Point-Intercept Surveys

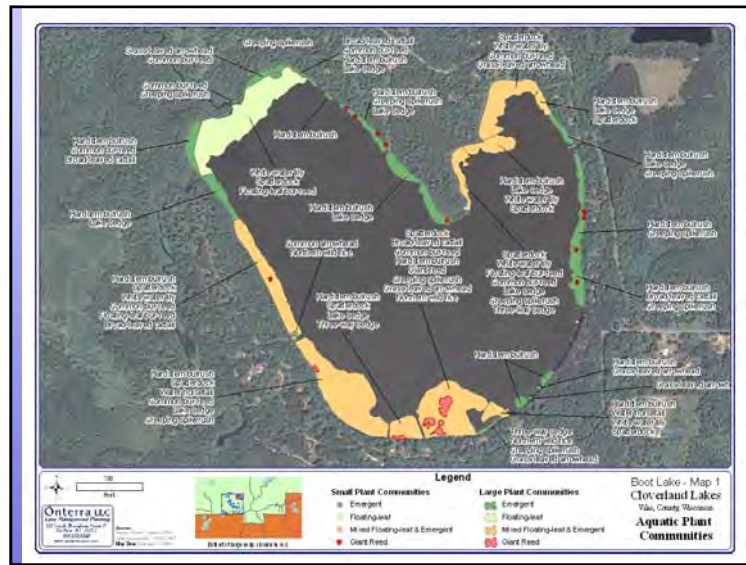
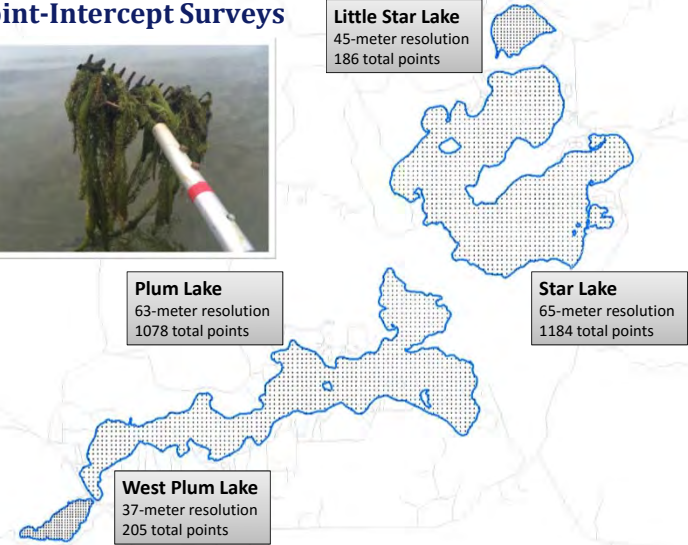


Little Star Lake
45-meter resolution
186 total points

Plum Lake
63-meter resolution
1078 total points

Star Lake
65-meter resolution
1184 total points

West Plum Lake
37-meter resolution
205 total points



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



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Fisheries Data Integration

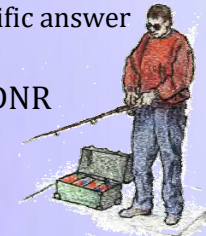
- No fish sampling completed
- Assemble data from WDNR, USGS, USFWS, & GLIFWC
- Fish survey results summaries (if available)
- Use information in planning as applicable



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Stakeholder Survey ***(Each Phase)***

- 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



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Planning Process

Planning Committee Meetings

- Study Results
- Conclusions & Initial Recommendations
- Management Goals
- Management Actions
- Timeframe
- Facilitator(s)



Implementation Plan

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Town of Plum Lake Planning Process

- Town-wide project brings on unique situation
 - Cost savings are great
 - Providing attention to individual lakes is difficult
- Lake representatives
 - Communication link between stakeholders from individual lakes and Lakes Committee
- Stakeholder survey comments will be important

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Town of Plum Lake Management Plan Documents

- Multiple document types
 - Town of Plum Lake Management Plan
 - Lake-Specific Results and Conclusions
 - Lake-Specific Implementation Plan
 - Appendices (raw data, etc.)
- Town-wide Compilation
 - All documents
- Individual Lake Document
 - Town-wide management plan
 - Lake-specific documents



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Thank You

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



Wisconsin
Lakes
Partnership



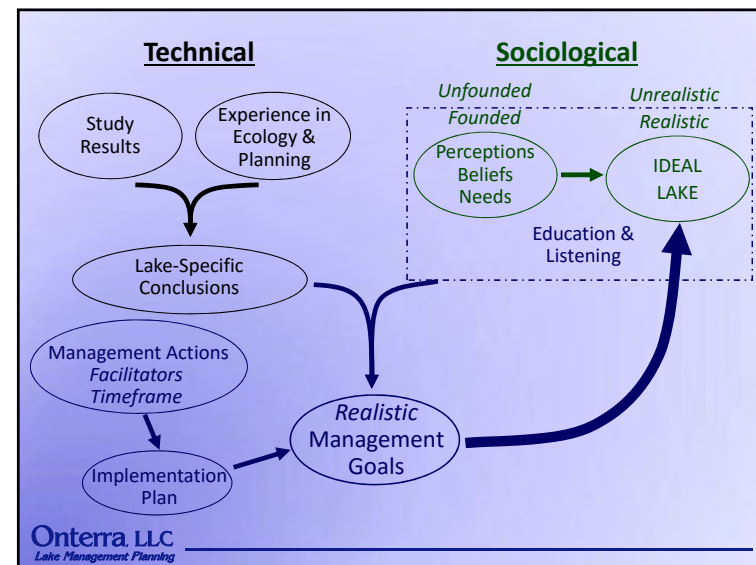

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The Planning Process

...it's not as easy as you may think.



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Town of Plum Lake

Phase I
Star, Little Star, Plum & West Plum Lakes
Management Planning Project
Planning Meeting I
June 11, 2018

Tim Hoyman
 Onterra LLC
 Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
 - Water Quality
 - Watershed
 - Shoreland Condition
 - Aquatic Plants
 - Fishery (Next Meeting)
- “Big Picture”
- Implementation Plan Development



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Meeting Objective

Planning Committee Meetings

Study Results
 Conclusions & Initial Recommendations

Planning Meeting I

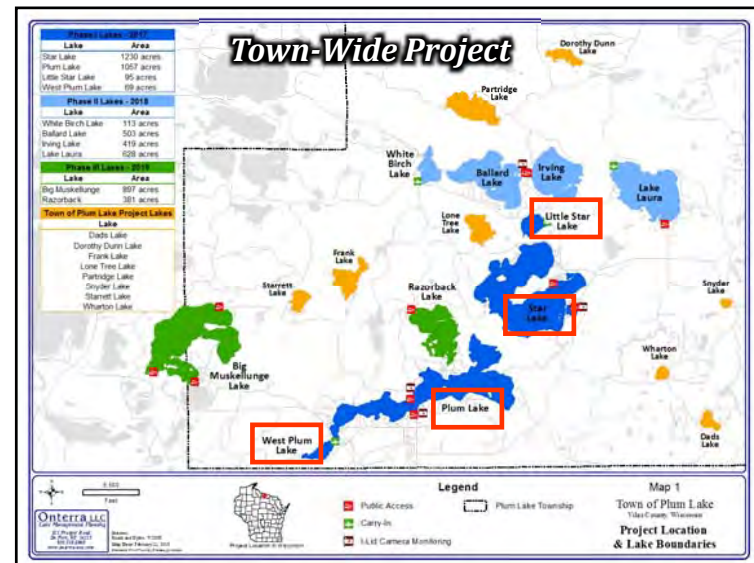
Management Goals
 Management Actions
 Timeframe
 Facilitator(s)

Planning Meeting II



Implementation Plan

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Summary of Project Results

Water Quality

- Overall good, but Little Star Lake is experiencing symptoms from its past

Watershed & Immediate Shoreline

- Watersheds are in excellent condition and deliver low levels of nutrients to the lakes
- Shorelines are in very good shape overall, but there is always room for improvement

Aquatic Plant Community

- The aquatic plant communities are as expected for the lake types studies
- All four lakes have some non-native aquatic plants

Fisheries (Will discuss in more detail at next meeting)

- Some survey/stocking data available
- Tribal spear-harvest records for Star and Plum Lakes

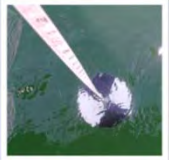
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Introduction to Lake Water Quality

↑ Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in most WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human development often increases P delivery to lakes

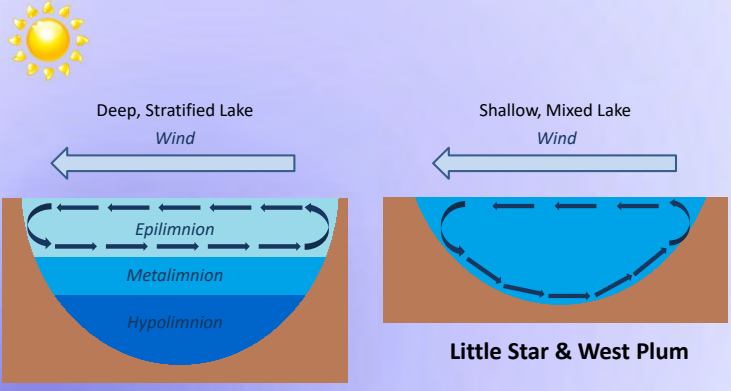
↑ Chlorophyll-a
Pigment used in photosynthesis
Used as surrogate for phytoplankton biomass

↓ Secchi Disk Transparency
Measure of water clarity
Measured using a Secchi disk



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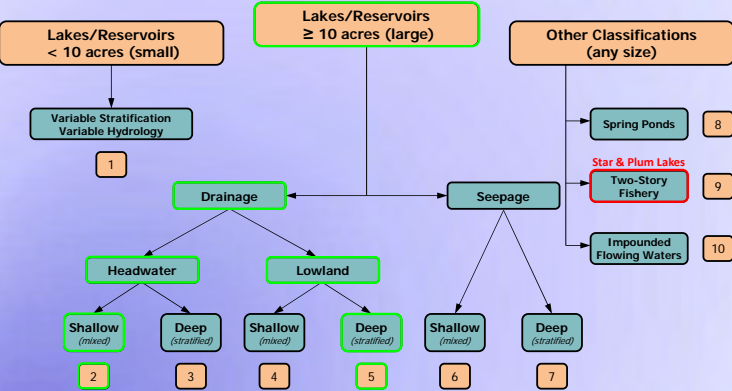
Wisconsin Lakes Classification



Star & Plum **Little Star & West Plum**

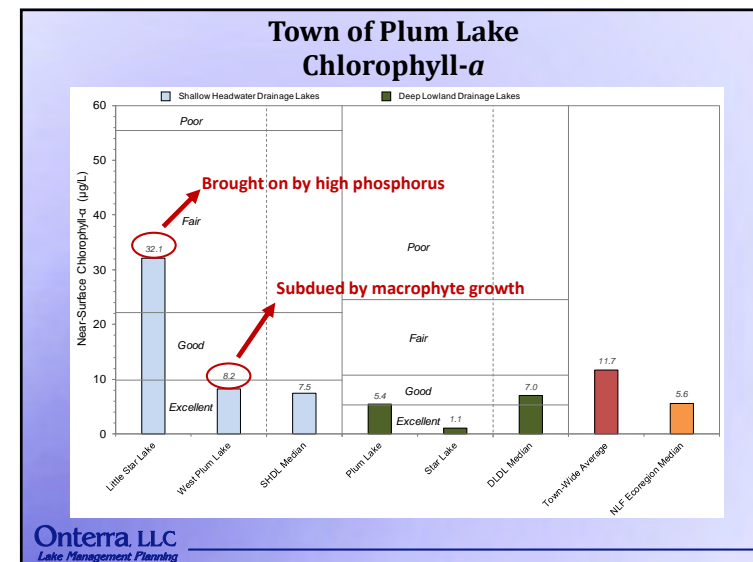
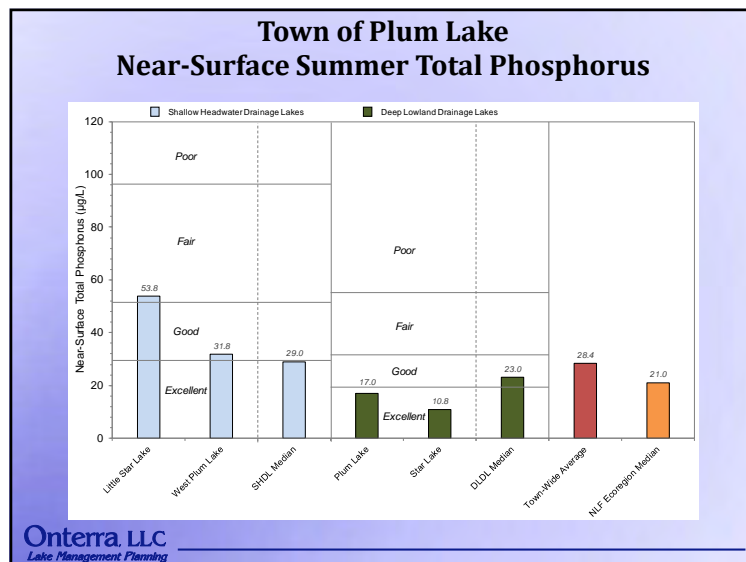
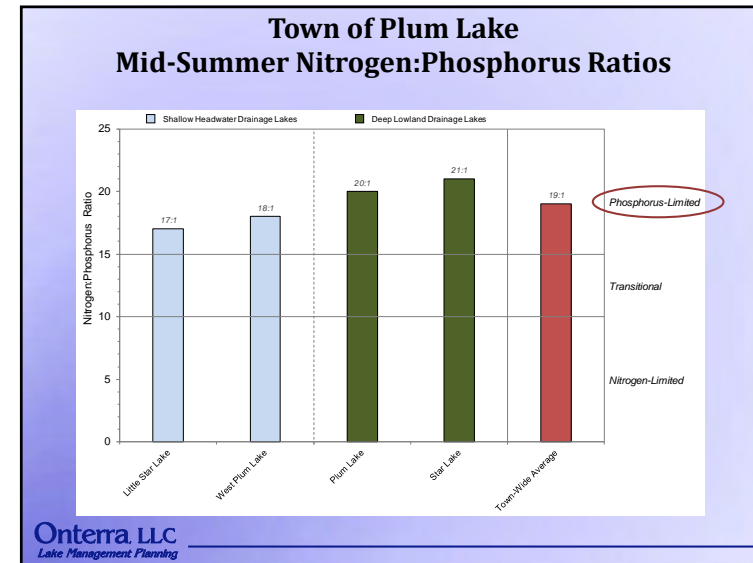
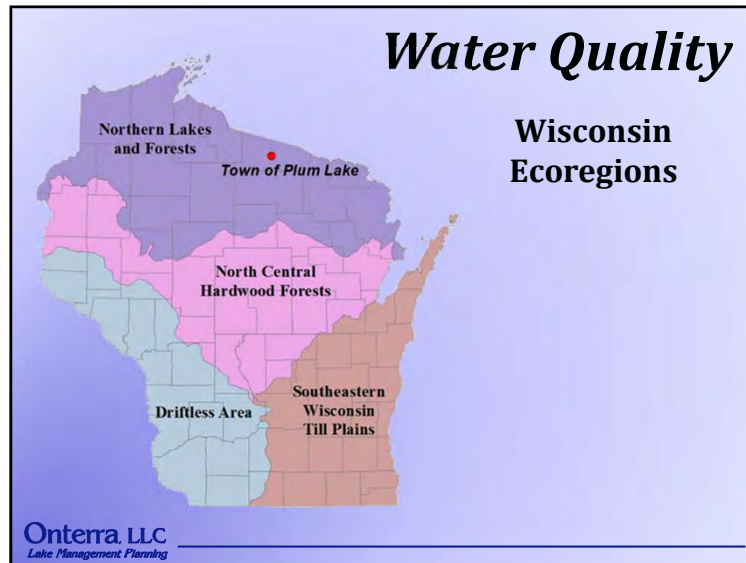
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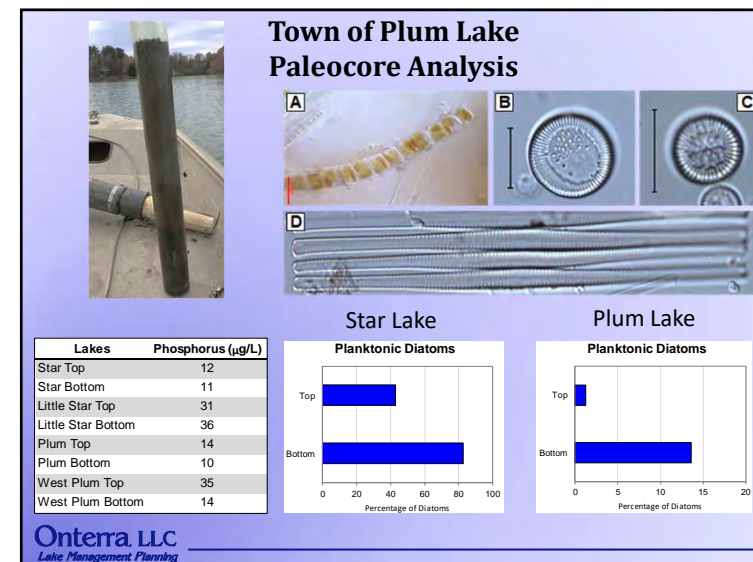
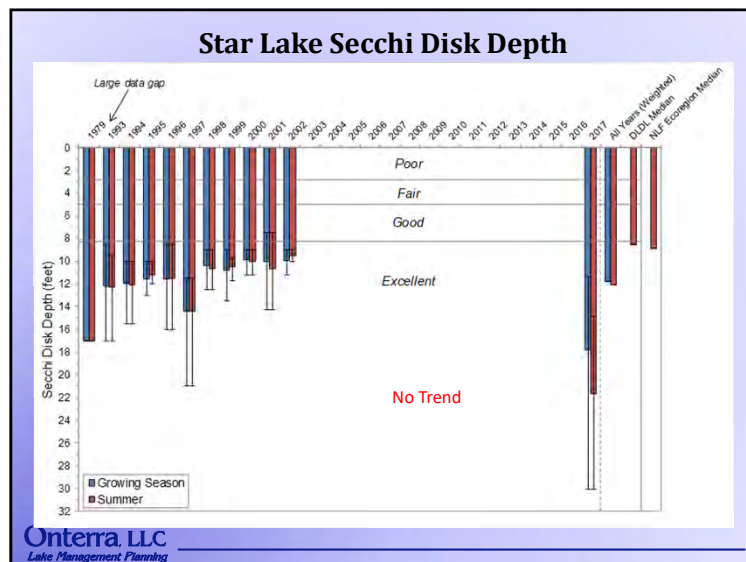
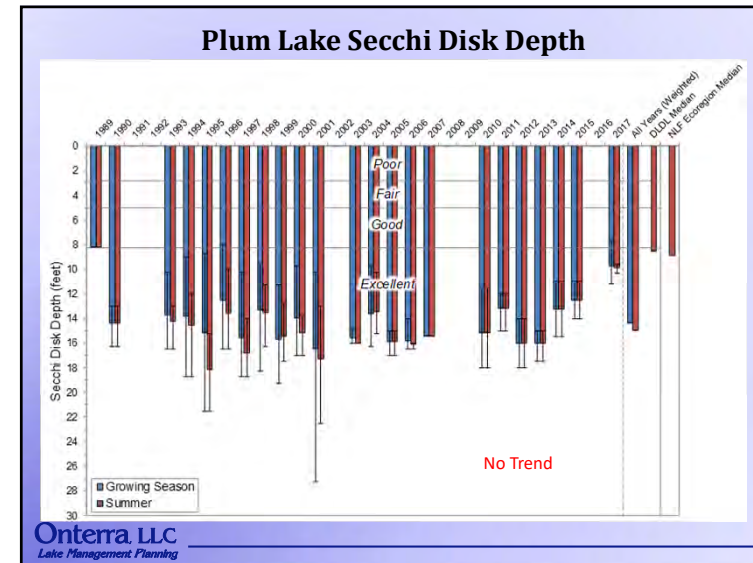
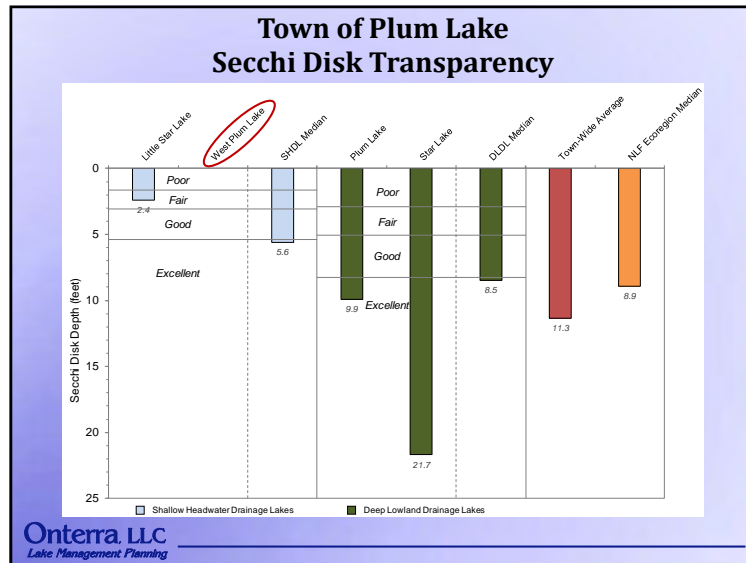
Wisconsin Lakes Natural Community Types

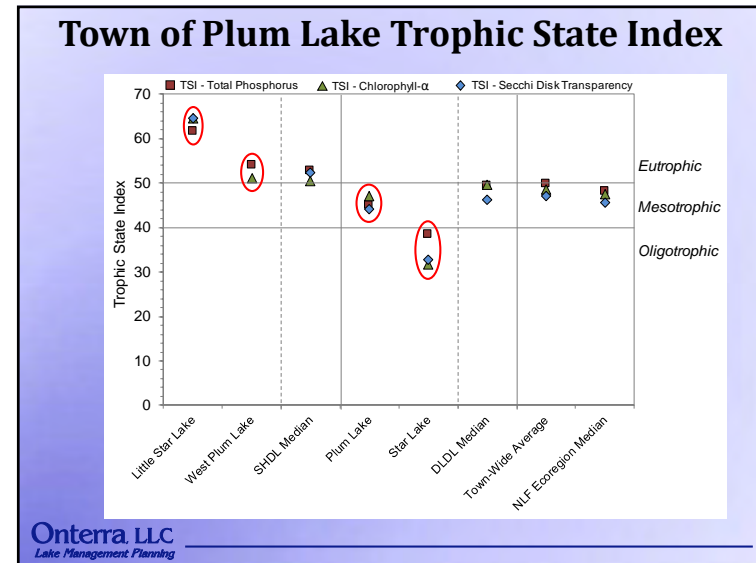
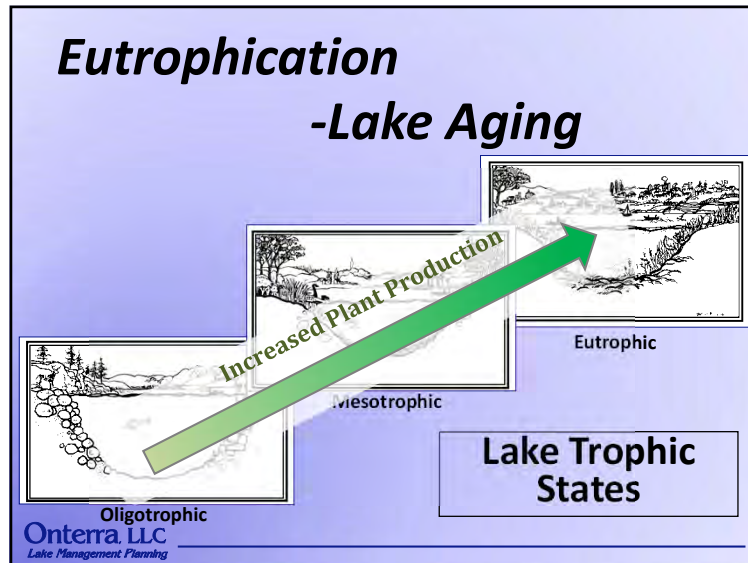


Little Star & West Plum **Star & Plum***

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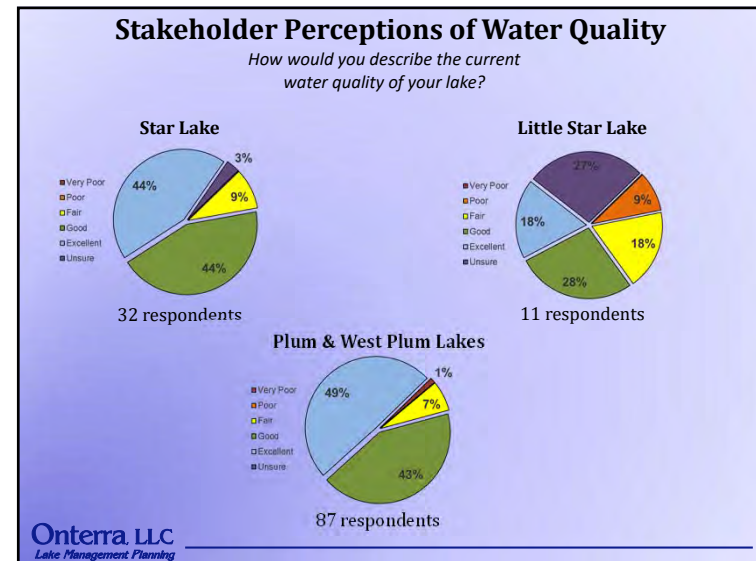
Additional Water Quality Parameters

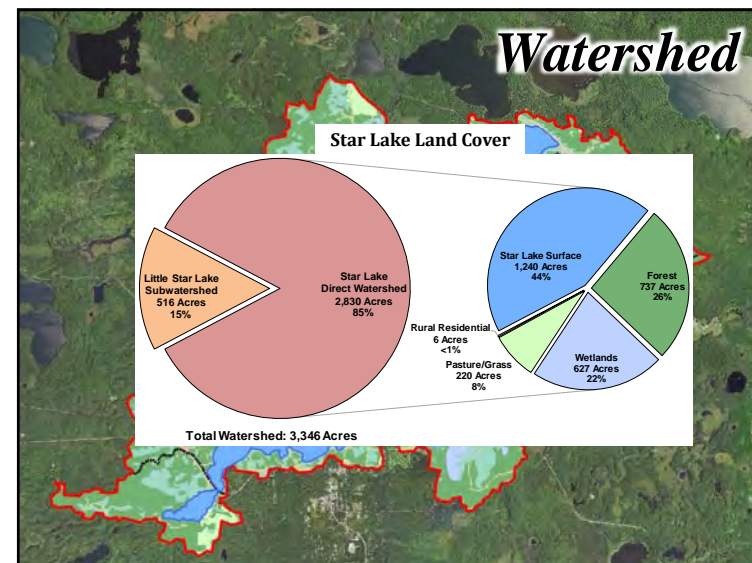
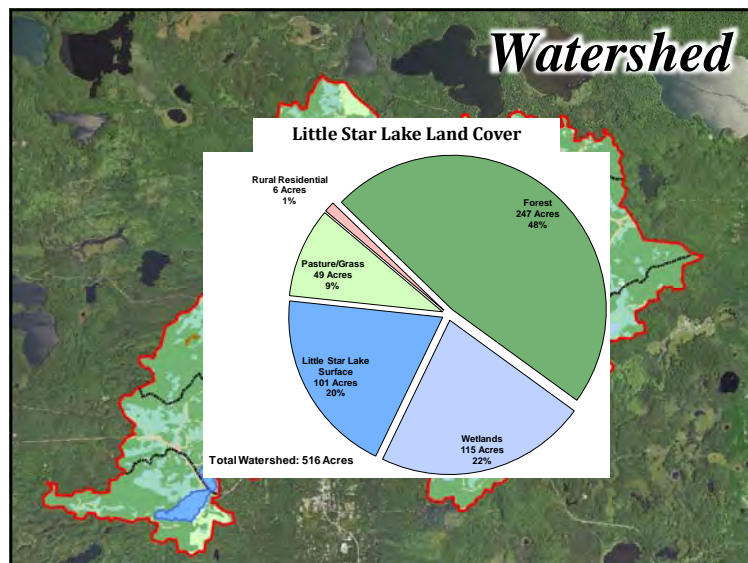
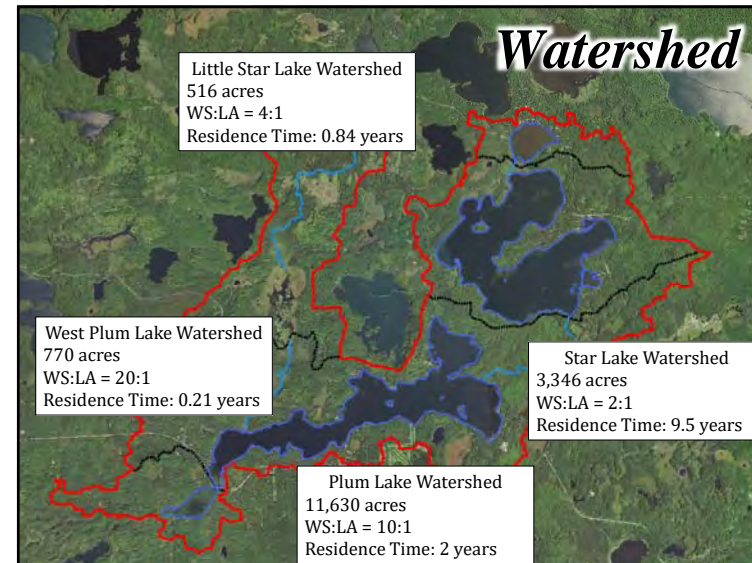
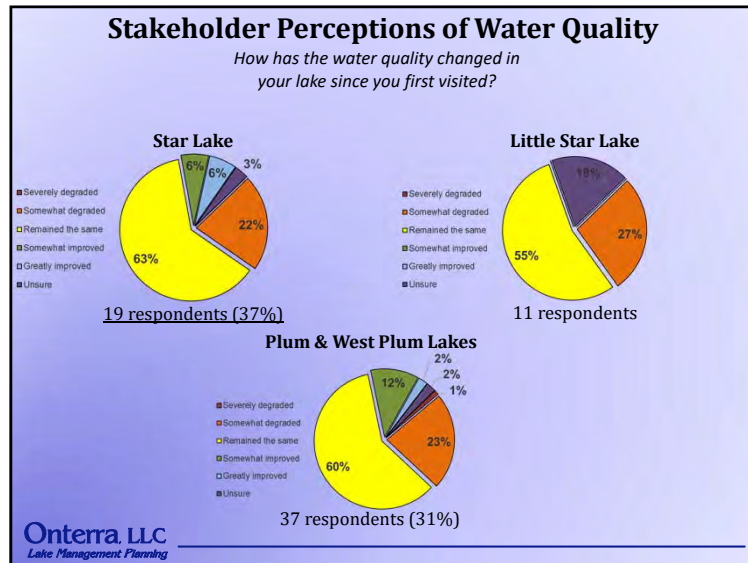
Dissolved Oxygen
All lakes had sufficient DO during summer and fall
Star & Plum Lakes had sufficient DO during winter
Little Star and West Plum were not sampled during winter

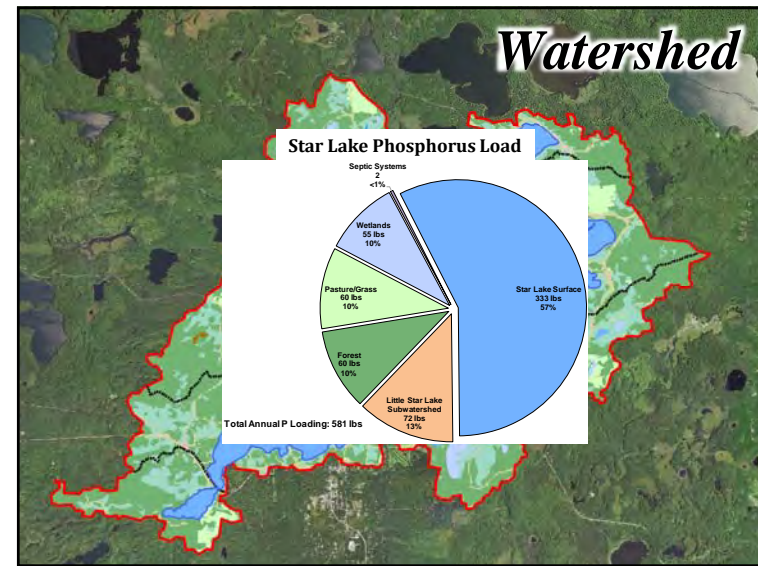
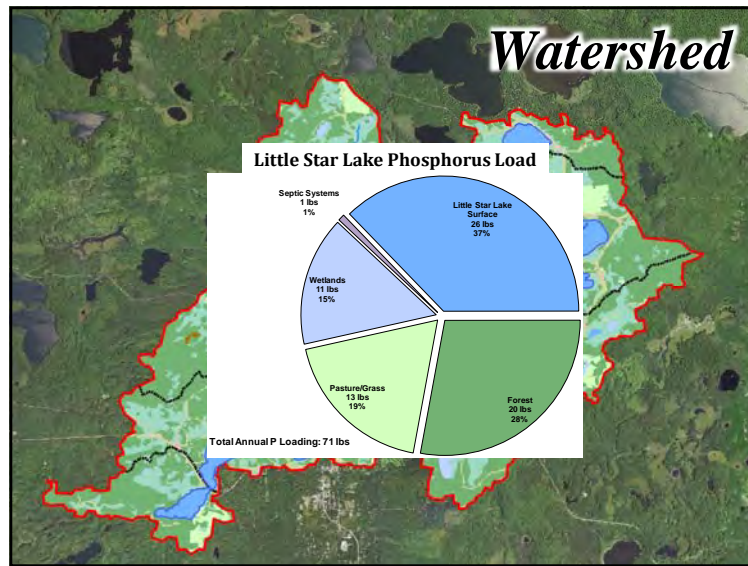
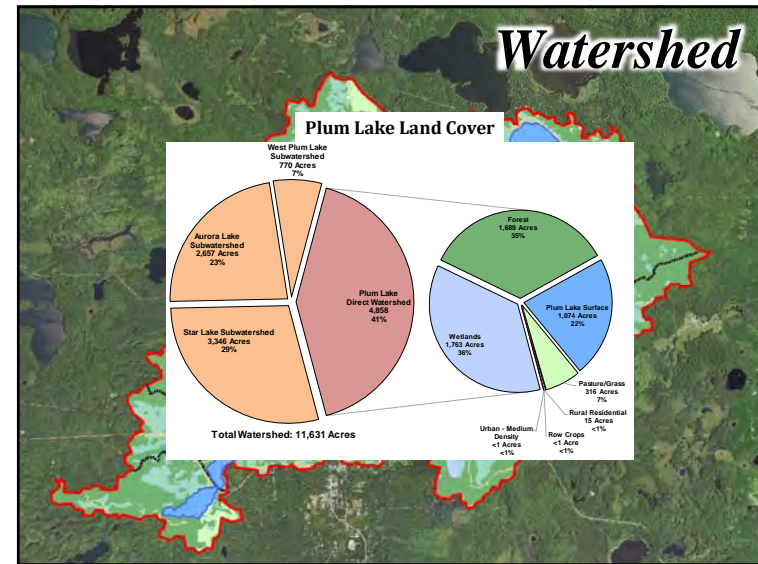
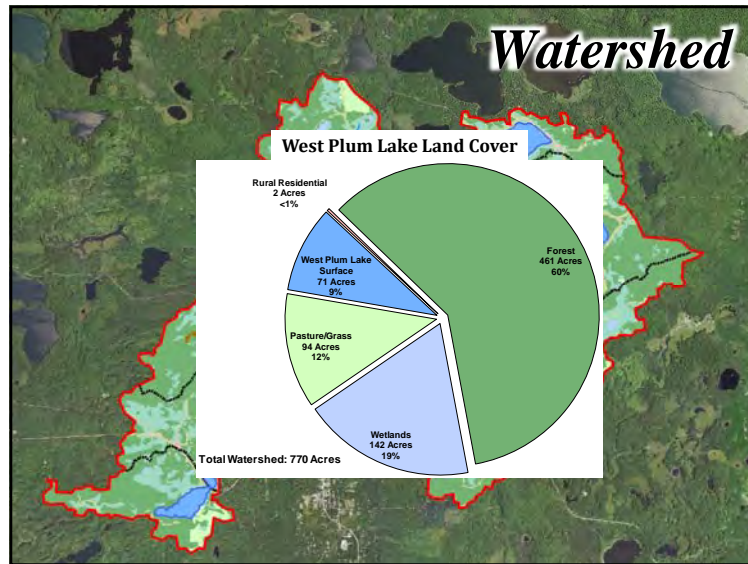
Alkalinity
Star and Plum Lakes have high alkalinity
Star and Plum Lakes have high buffering capacity against acid rain

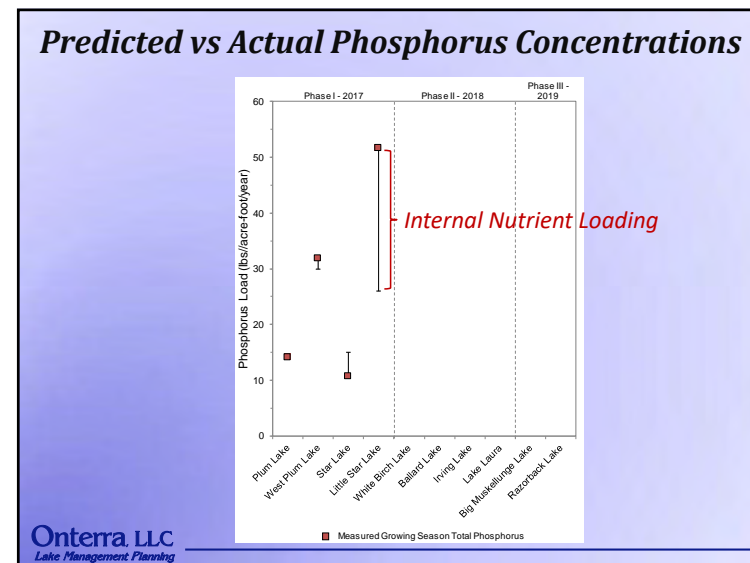
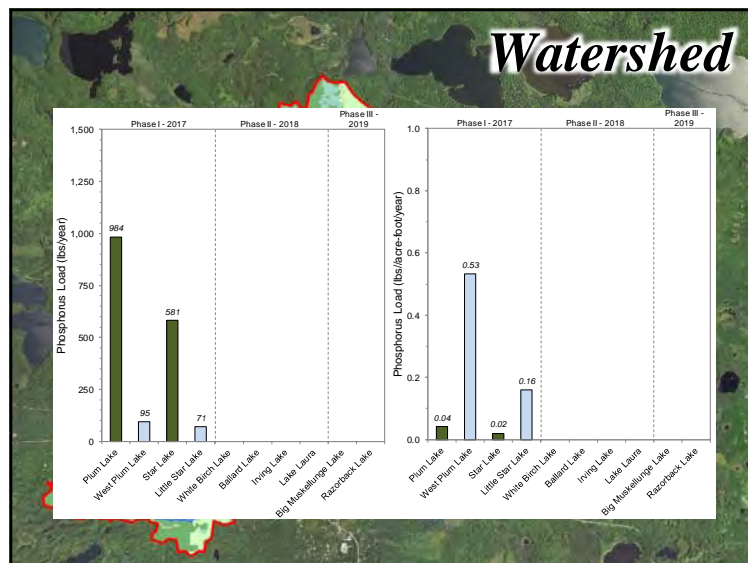
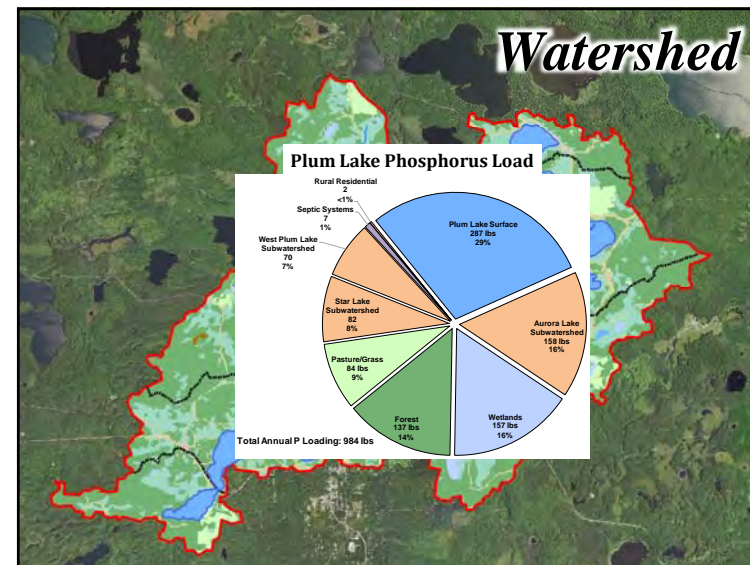
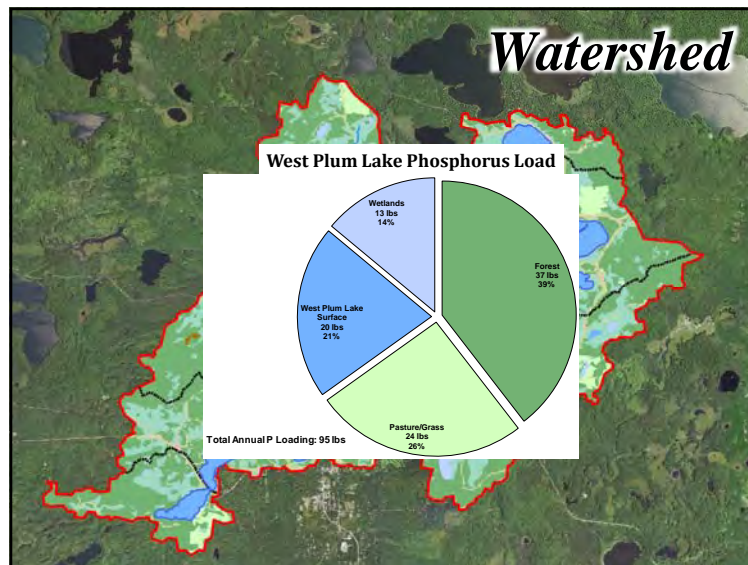
Calcium Content
Star and Plum Lakes have low calcium content
Star and Plum Lakes have very low susceptibility to zebra mussel establishment

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Internal Nutrient Loading

- Normally, the net movement of phosphorus is to the sediment in lakes.
- Under certain conditions, phosphorus (and other nutrients) get released from bottom sediments into the overlying water.
- Anoxic (devoid of oxygen) conditions cause phosphorus release.
- Becomes problematic if phosphorus is mobilized to surface in summer (polymictic lakes).
- Little Star Lake is polymictic, so process repeats over growing season

The diagram shows a cross-section of a lake with sediment at the bottom. Red 'P' symbols are scattered in the sediment. Arrows point from the sediment up into the water column, and other arrows point from the water column down to the sediment, illustrating the cycle of phosphorus release and deposition.

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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- EPA National Lakes Assessment results indicate shoreland development has greatest negative impact to health of our nation's lakes.
- 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

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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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Shoreland Condition Little Star Lake

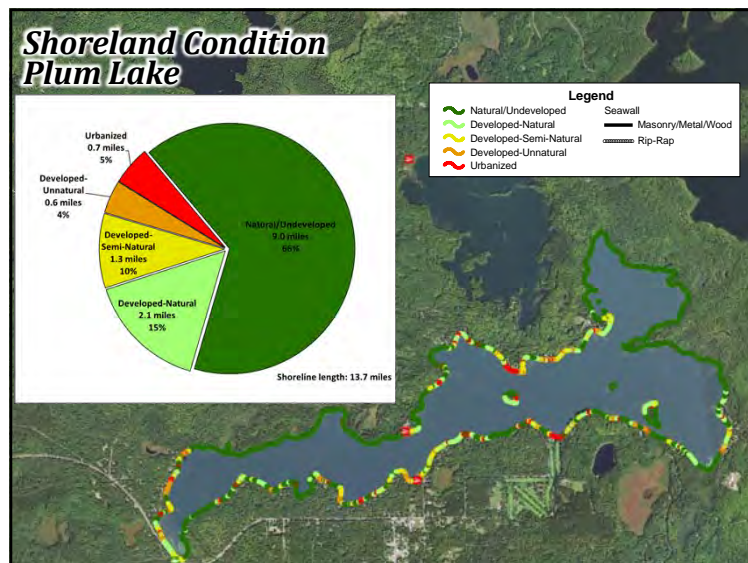
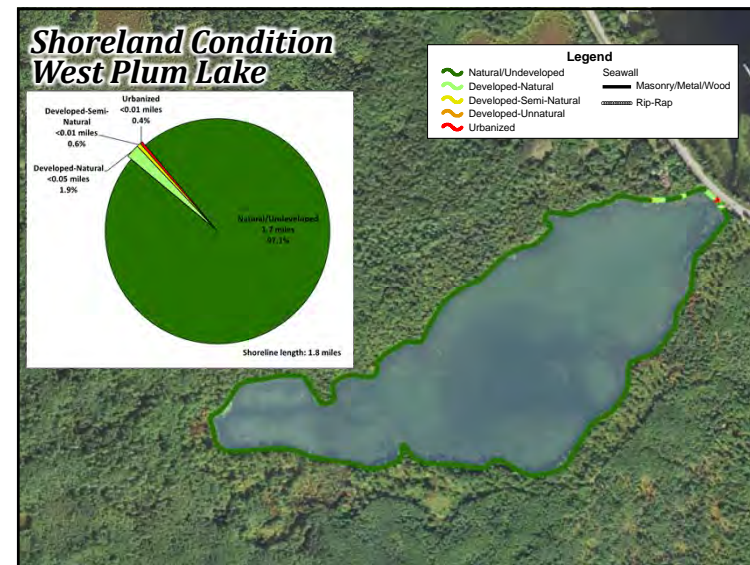
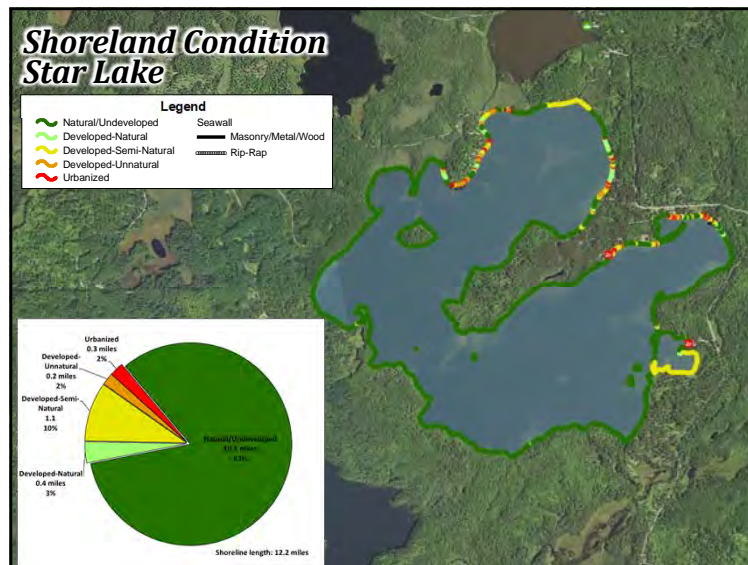
Legend

- Natural/Undeveloped
- Developed-Natural
- Developed-Semi-Natural
- Developed-Unnatural
- Urbanized
- Seawall
- Masonry/Metal/Wood
- Rip-Rap

Category	Shoreline Length (miles)	Percentage
Natural/Undeveloped	1.4	81%
Developed-Natural	0.1	5%
Developed-Semi-Natural	0.2	13%
Developed-Unnatural	0.05	3%
Urbanized	<0.1	1%

Shoreline length: 1.7 miles

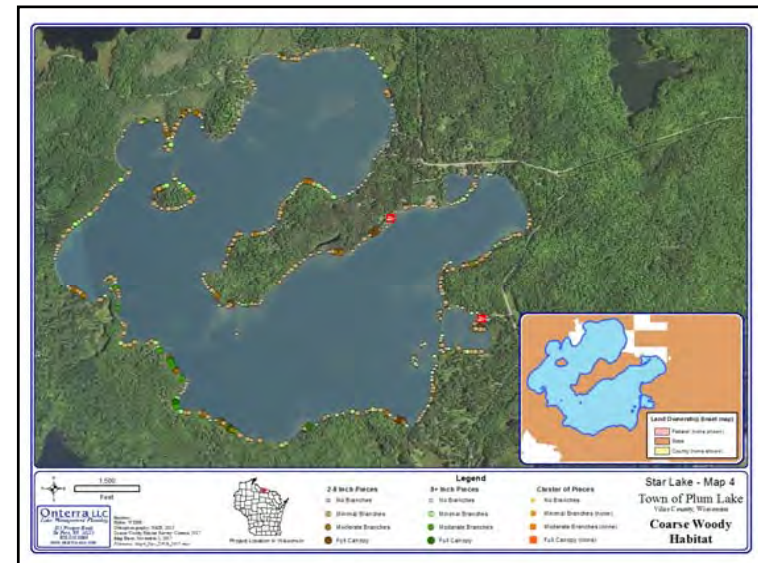
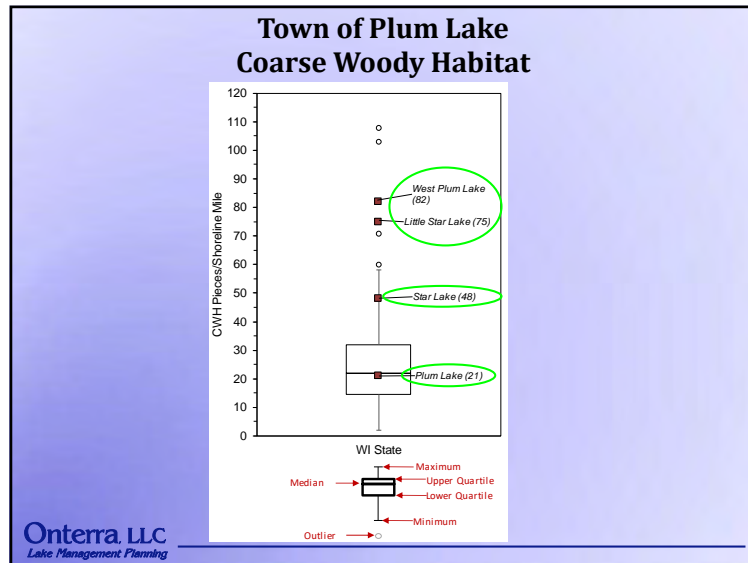
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Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
 - Periphyton growth fed upon by insects.
 - Refuge, foraging and spawning habitat for fish.
 - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in Town Lakes

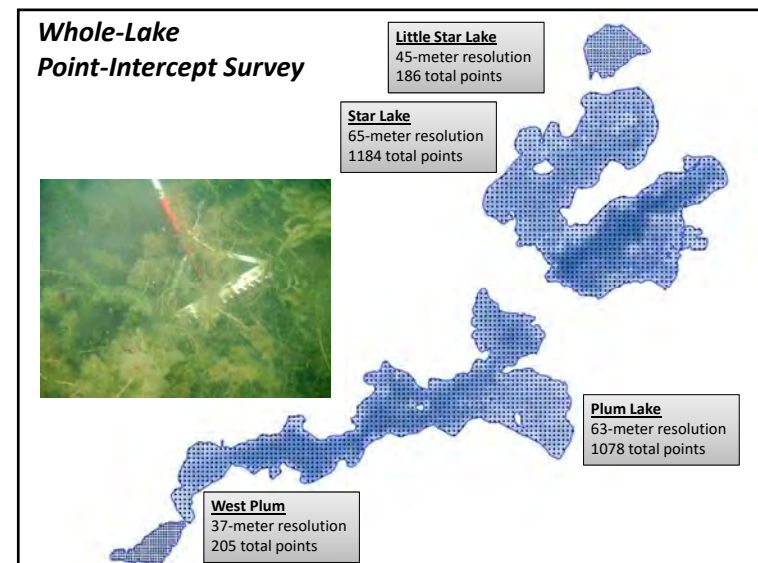
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Aquatic Plant Surveys


- Assess both non-native & native species
- Four surveys completed in 2017
 - Early-Season AIS Survey
 - Whole-Lake Point-Intercept Survey**
 - Emergent/Floating-Leaf Community Mapping Survey

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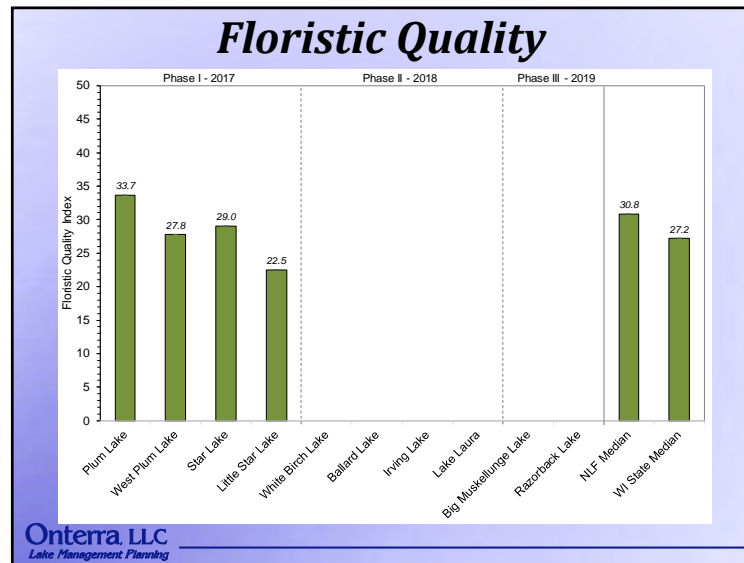
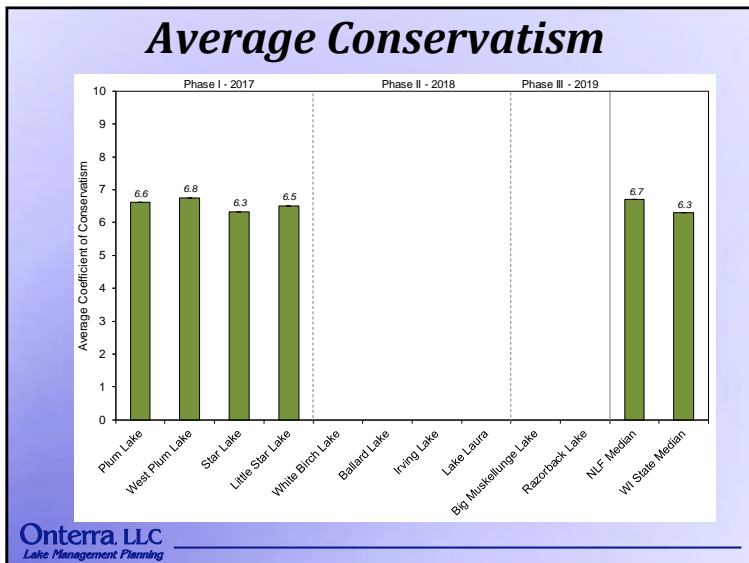
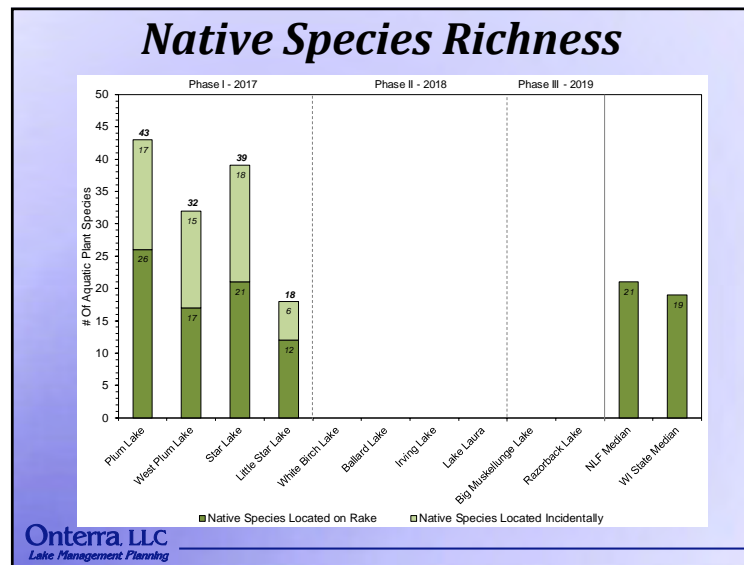
Plant Data Overview

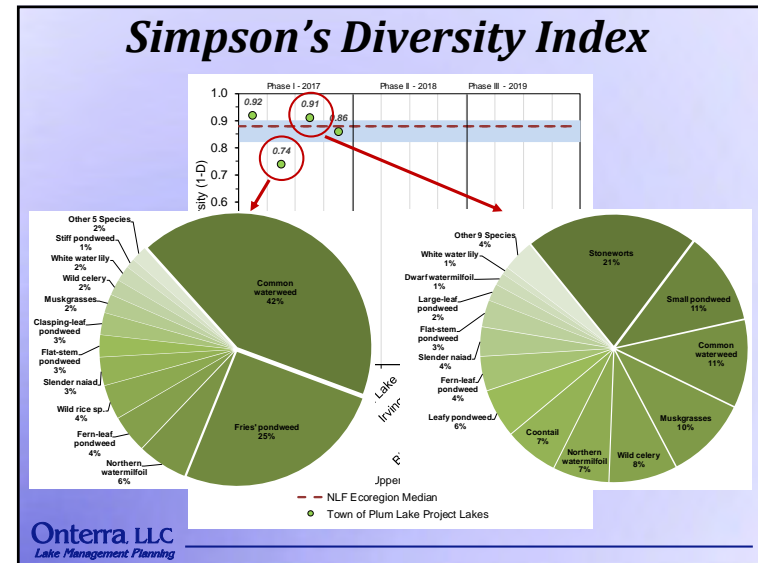
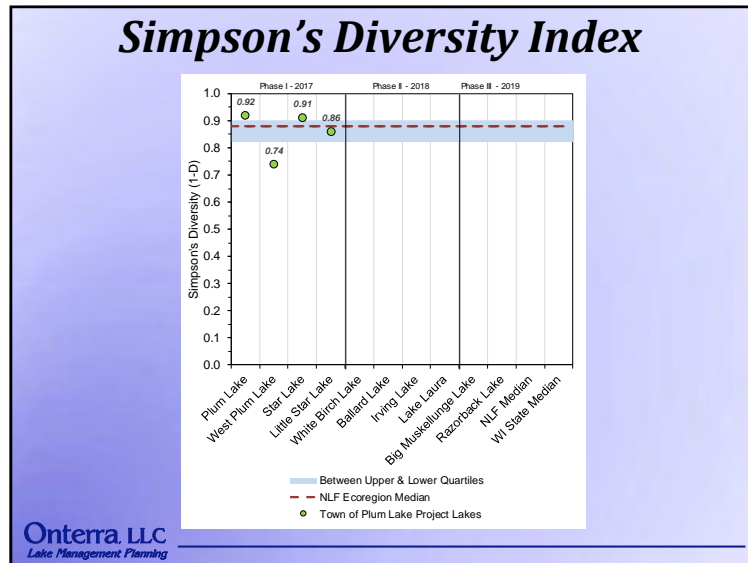
- 69 native plant species located to date
 - 1 listed as special concern: Vasey's pondweed



- 4 non-native plant species
 - Narrow-leaved cattail (West Plum)
 - Pale-yellow iris (Plum, West Plum, & Star)
 - Purple Loosestrife (Star)
 - Eurasian watermilfoil (Little Star)

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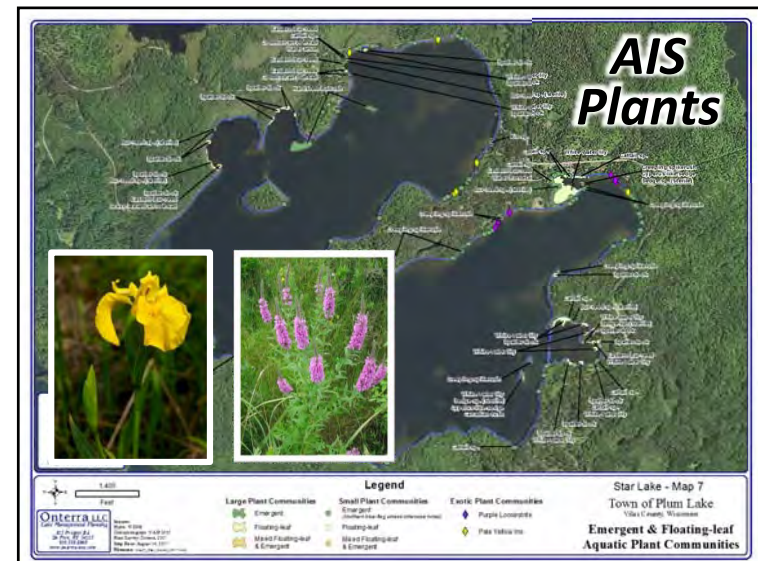




Emergent & Floating-leaf Aquatic Plants

Plant Community	Phase I - 2017				Phase II - 2018				Phase III - 2019	
	Plum Lake	West Plum Lake	Star Lake	Little Star Lake	White Birch Lake	Ballard Lake	Irving Lake	Lake Laura	Big Muskeellunge Lake	Razorback Lake
Emergent Acres	6.1	18.7	3.5	0.0						
Floating-leaf Acres	2.1	4.0	8.2	16.1						
Mixed Emergent & Floating-leaf Acres	21.9	42.1	1.1	0.0						
Total Acres	30.1	64.8	12.8	16.1						
% Lake Area	2.8	91.3	1.0	16.0						

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Other Aquatic Invasive Species

Type	Common name	Scientific name	Lake	Location within report
Plants	Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	Little Star Lake	Section 3.5 – Aquatic Plants
	Pale-yellow iris	<i>Iris pseudacorus</i>	Plum Lake, West Plum Lake, Star Lake	Section 3.5 – Aquatic Plants
	Purple loosestrife	<i>Lythrum salicaria</i>	Star Lake	Section 3.5 – Aquatic Plants
	Narrow-leaved cattail	<i>Typha angustifolia</i>	West Plum Lake	Section 3.5 – Aquatic Plants
Invertebrates	Freshwater jellyfish	<i>Craspedacusta sowerbyi</i>	Plum Lake	Section 3.6 – Aquatic Invasive Species
	Rusty crayfish	<i>Orconectes rusticus</i>	Plum Lake, Star Lake, Little Star Lake	Section 3.6 – Aquatic Invasive Species
	Banded mystery snail	<i>Viviparus georgianus</i>	Plum Lake, Star Lake	Section 3.6 – Aquatic Invasive Species
	Chinese mystery snail	<i>Cipangopaludina chinensis</i>	Plum Lake, West Plum Lake, Star Lake	Section 3.6 – Aquatic Invasive Species
	Spiny waterflea	<i>Bythotrephes longimanus</i>	Star Lake	Section 3.6 – Aquatic Invasive Species

Conclusions

Water Quality

- Plum, West Plum, and Star have very good to excellent water quality
- Little Star’s water quality is unexpectedly fair
 - Likely brought on by internal nutrient loading of historic phosphorus loads that entered the lake during timber boom years
 - There are in-lake techniques that could reduce internal loading, but likely not feasible due to the current use level on lake

Watershed & Immediate Shoreline

- Watersheds in excellent shape – primarily forests & wetlands
- Majority of shoreland contains little to no harmful development, but always room for improvement

Aquatic Plant Community

- Plant communities are as expected for lake types and indicate overall good health of the lakes
- Concerning non-native species: Pale-yellow iris, purple loosestrife, & Eurasian watermilfoil

Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

Completed Tasks

- All fieldwork
- Draft report sections
- Planning Meeting I – June 11, 2018 (10 Plum Lake and Star Lake residents)

Tasks Remaining to Completed

- Planning Meeting II (not yet set)
- Creation of Draft Management Plan (late summer)
- Submittal of Draft Plan to Planning Committee (early fall)
- Submittal of Draft Plan to Lakes Committee (early fall)
- Submittal of Draft Plan to WDNR (winter 2019)

Interesting Conclusions

- Plum, West Plum, and Star have very good to excellent water quality
- Little Star's water quality is unexpectedly fair
 - Likely brought on by internal nutrient loading of historic phosphorus loads that entered the lake during timber boom years
 - There are in-lake techniques that could reduce internal loading, but likely not feasible due to the current use level on lake
- Watersheds in excellent shape – primarily forests & wetlands
- Majority of shoreland contains little to no harmful development, but always room for improvement
- Plant communities are as expected for lake types and indicate overall good health of the lakes
- Concerning non-native species: Pale-yellow iris, purple loosestrife, & Eurasian watermilfoil

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

- Spring water quality collections
- Kick-off Meeting set for July 27, 2018

Tasks Remaining to Completed

- Field studies through winter 2019
- Stakeholder survey (fall 2018)
- Planning process (2019)

Town-wide Project

Topics for Consideration during 2018

- Action plan for discovery of new invasive in town lake
- Little Star Lake Eurasian watermilfoil management (survey to be completed in early July)
 - Hand-harvesting during summer 2018?

Phase III – Big Muskellunge and Razorback

Project Considerations

Do not complete stakeholder survey due to low number of private properties?

Utilize Lakes Committee as the planning committee and invite private property owners?

Reduce other “stakeholder” components?

Combine Phase III & Town AIS prevention components in one AIS-Educ. Prev. and Plan Grant?

Project Costs – Phase III

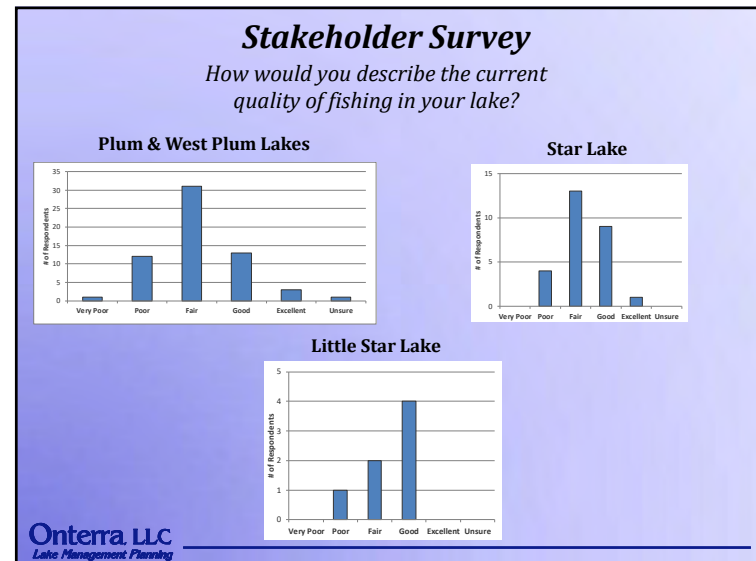
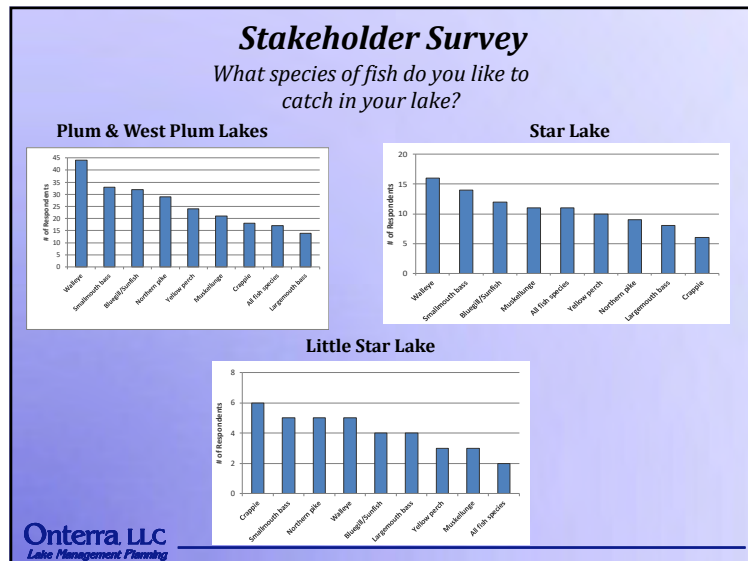
	Cash Cost	Donated Value
Onterra Fees		
Project Administration & Communications	\$1,495.00	
Stakeholder Participation - Onterra Facilitated	\$2,945.00	
Watershed Assessment	\$970.00	
Water Quality Assessment	\$4,840.00	
Paleocore Collection & Analysis	\$2,400.00	
Fishery Data Compilation & Integration	\$755.00	
Shoreland & Coarse Woody Habitat Assessment	\$1,910.00	
Early-Season AIS Survey	\$3,455.00	
Point-Intercept Survey	\$8,540.00	
Aquatic Plant Community Mapping	\$3,615.00	
Data Analysis & Report/Plan Creation	\$6,485.00	
Onterra Printing, Shipping & Voucher Materials	\$325.00	
Travel (Lodging, Incidentals, & Mileage @ 0.58/mi)	\$4,690.00	
Professional Dreissena Mussel Monitoring		\$1,600.00
<i>Subtotal</i>	<i>\$42,425.00</i>	<i>\$1,600.00</i>
Other Cash Costs		
State Laboratory of Hygiene Fees	\$2,600.00	
Stakeholder Survey - Third Party Contractor	\$700.00	
TPL Project-Related Printing Costs	\$200.00	
<i>Subtotal</i>	<i>\$3,500.00</i>	
Volunteer & In-kind Match Opportunities		
Planning Comm. – Stakeholder Survey		\$288.00
Planning Comm. – Plan Development		\$576.00
Kick-off Mtg Attendance		\$360.00
Wrap-up Mtg Attendance		\$540.00
TPL Grant Project Administration		\$600.00
<i>Subtotal</i>	<i>\$45,925.00</i>	<i>\$3,964.00</i>
Project Total	\$49,889.00	

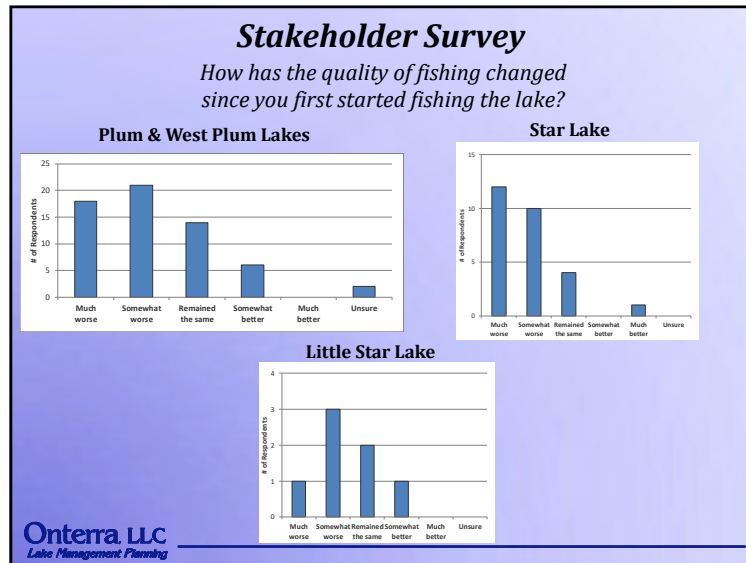
Lake Management Planning Grant Specifics		
WDNR Portion (67%)		\$33,425.63
Local Match (33%)		\$16,463.37
Actual Cash Cost to TPL		\$12,499.37
WDNR Planning Grant Prepayment to TPL		\$25,069.22
Total Cash Outlay by TPL During Project		\$20,855.78
Final Reimbursement to TPL Following Project Completion		\$8,356.41

Town of Plum Lake

Phase I
Star, Little Star, Plum & West Plum Lakes
Management Planning Project
Planning Meeting II
July 16, 2018


Tim Hoyman
 Onterra LLC
 Lake Management Planning



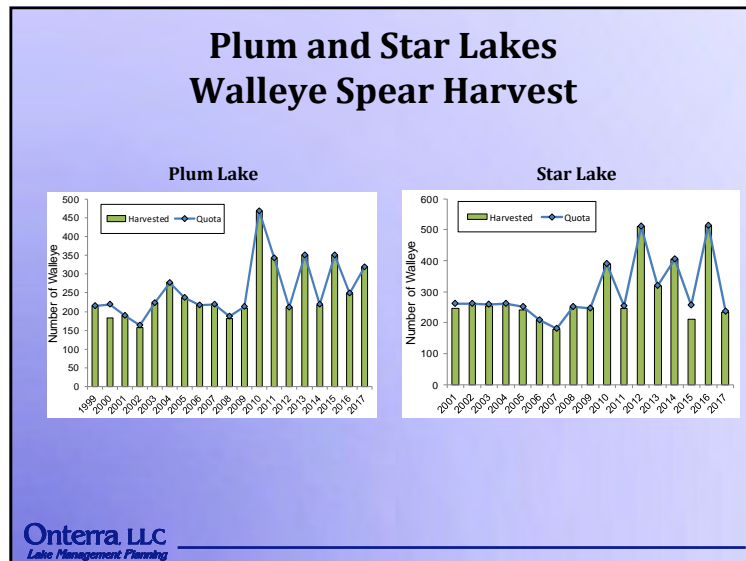


Native American Spear Harvest

- Town is within Treaty of 1842
- Tribal and State authorities establish *total allowable catch* based on population estimates (typically 35% for walleye & 27% for muskellunge)
- The total allowable catch number may be reduced based on confidence in population estimates: *safe harvest level*
- Tribal community claims percentage of safe harvest level, or *declaration*
- Bag limits for hook and line anglers set to accommodate declaration
- Can only harvest two walleye over 20 inches per night – one between 20 and 24” and one any size over 20”



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Conclusions

Water Quality

- Plum, West Plum, and Star have very good to excellent water quality
- Little Star's water quality is unexpectedly fair
 - Likely brought on by internal nutrient loading of historic phosphorus loads that entered the lake during timber boom years
 - There are in-lake techniques that could reduce internal loading, but likely not feasible due to the current use level on lake

Watershed & Immediate Shoreline

- Watersheds in excellent shape – primarily forests & wetlands
- Majority of shoreland contains little to no harmful development, but always room for improvement

Aquatic Plant Community

- Plant communities are as expected for lake types and indicate overall good health of the lakes
- Concerning non-native species: Pale-yellow iris, purple loosestrife, & Eurasian watermilfoil

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Thank You

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



Wisconsin
Lakes
Partnership



UW
Extension



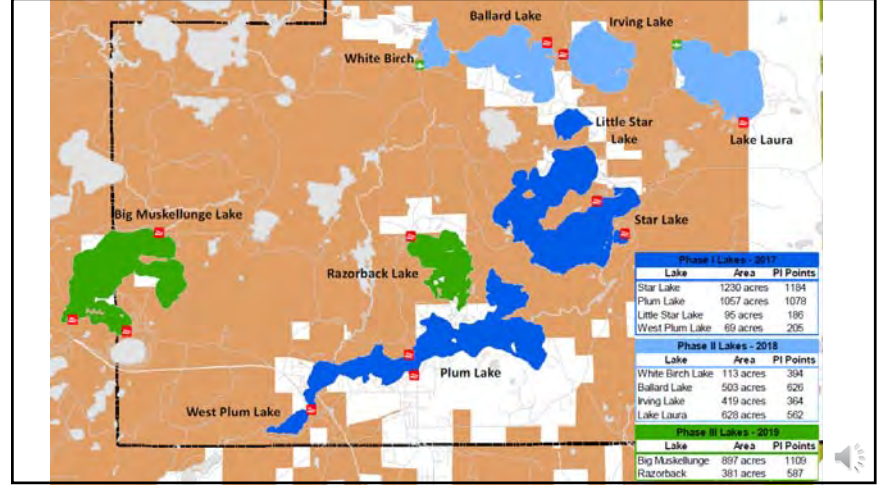
WISCONSIN
DEPT. OF NATURAL RESOURCES

Onterra LLC
Lake Management Planning

Town of Plum Lake

Phase I
Management Planning Project
Plum Lake
Wrap-up Presentation
August 2020

Tim Hoyman, CLM
 Onterra LLC
 Lake Management Planning



Management Planning Project Overview

Collect and compile information about lake
Includes both environmental & sociological data
Historical & current information
Past management actions

Create a realistic and implementable management plan
Challenges facing lake and lake group
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators

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 Lake Management Planning

Summary Results for Plum Lake

Overarching Conclusion: Plum Lake is ecologically healthy.

Water Quality

- Plum Lake has excellent water quality as expected for its lake type.

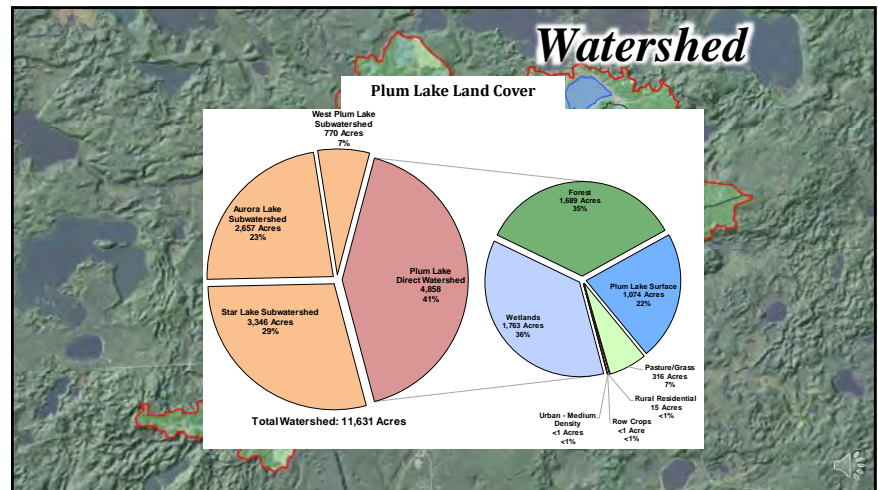
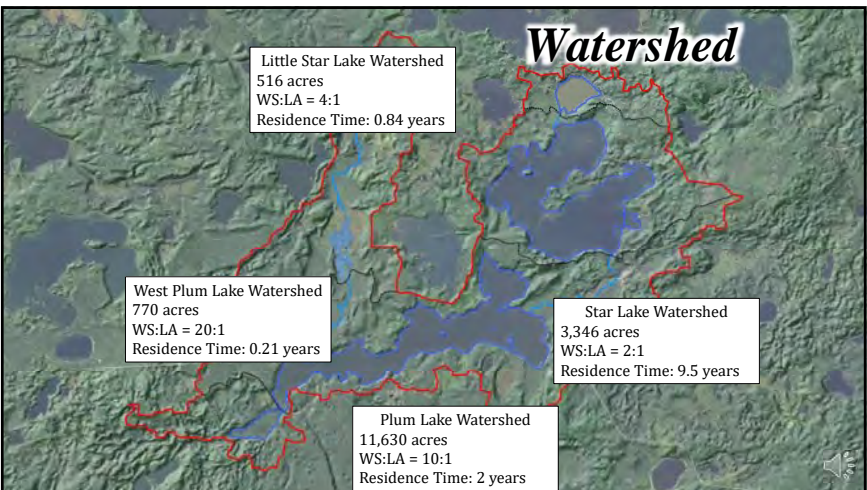
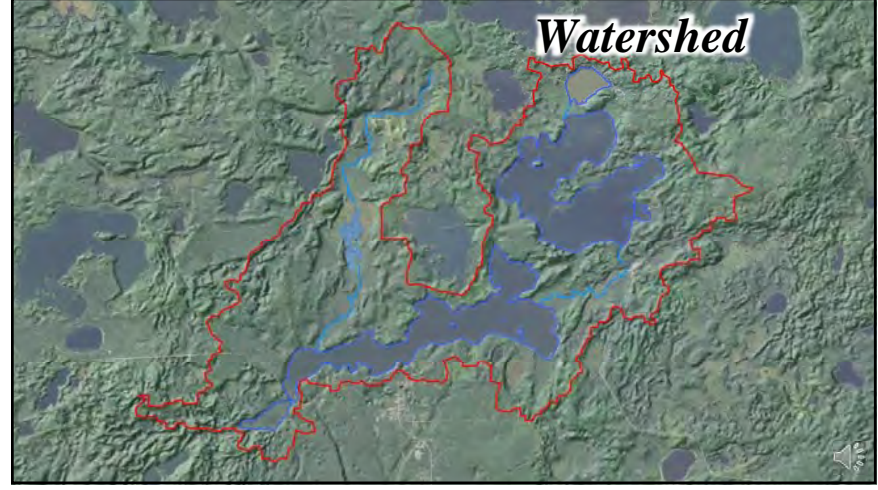
Watershed & Immediate Shoreline

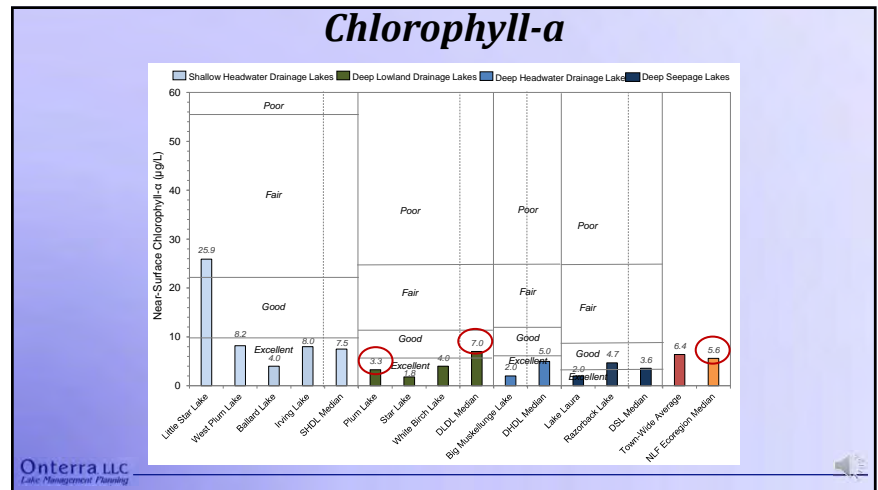
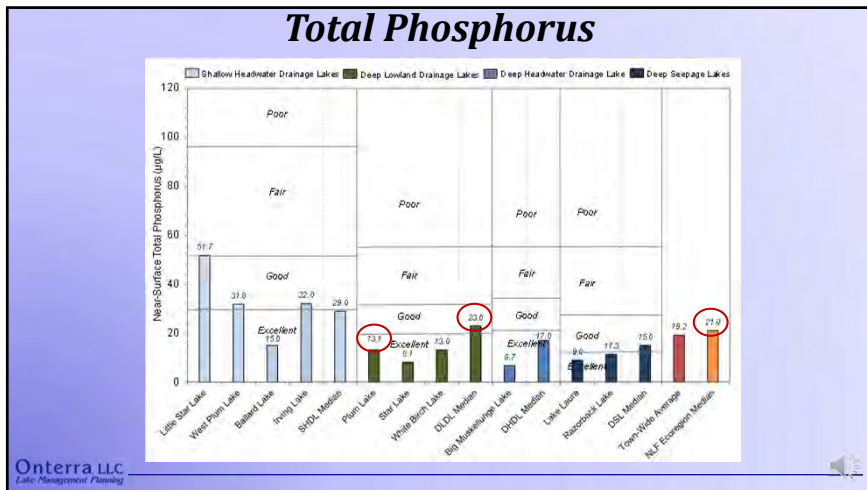
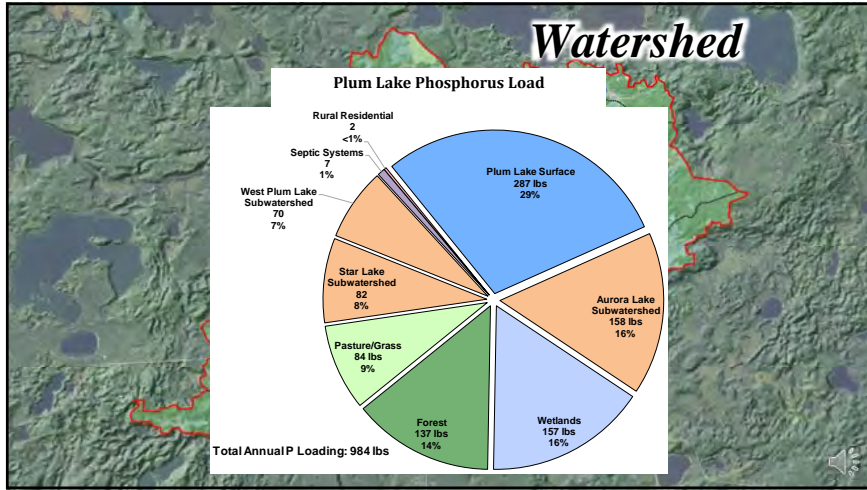
- Watershed is in excellent shape and is largely responsible for water quality.
- Plum Lake has large areas with no or little shoreland development.

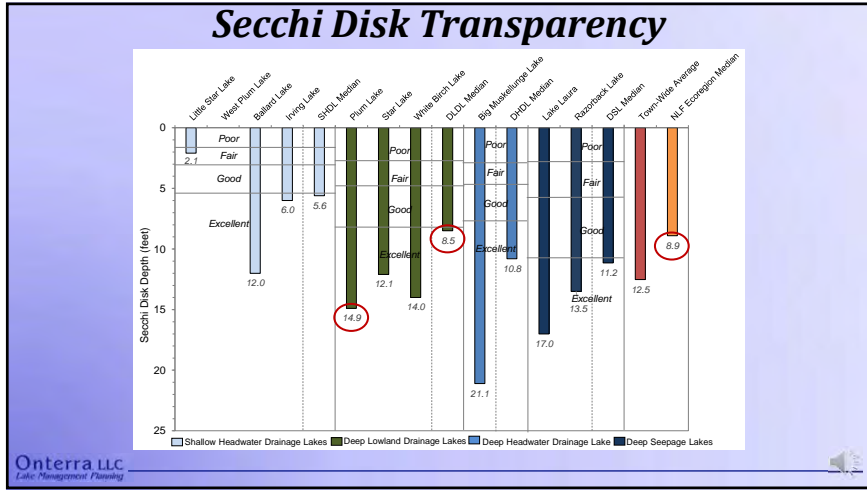
Aquatic Plant Community

- Aquatic plant community indicate that lake is healthy.
- No Eurasian watermilfoil or curly-leaf pondweed were found during surveys, but an emergent species called pale-yellow iris was mapped on the shoreline.

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 Lake Management Planning







Paleoecology

Top → Present
 Bottom → ~150 years

Microscopic images: A, B, C, D

Paleoecology

Top → Present
 Bottom → ~150 years

Lakes	Phosphorus (µg/L)
Star Top	12
Star Bottom	11
Little Star Top	31
Little Star Bottom	36
Plum Top	14
Plum Bottom	10
West Plum Top	35
West Plum Bottom	14

Plum Lake
 Planktonic Diatoms
 Top: ~1%
 Bottom: ~15%



Aquatic Plant Surveys

- Assess both non-native & native species
- Three surveys completed in 2017
 - Early-Season AIS Survey
 - Whole-Lake Point-Intercept Survey
 - Emergent/Floating-Leaf Community Mapping Survey



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Whole-Lake Point-Intercept Survey



Plum Lake
63-meter resolution
1078 total points

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Lake Management Planning

Vegetation Analysis Matrices

Floristic Quality Analysis

Evaluates the closeness of an area's flora to undisturbed conditions.

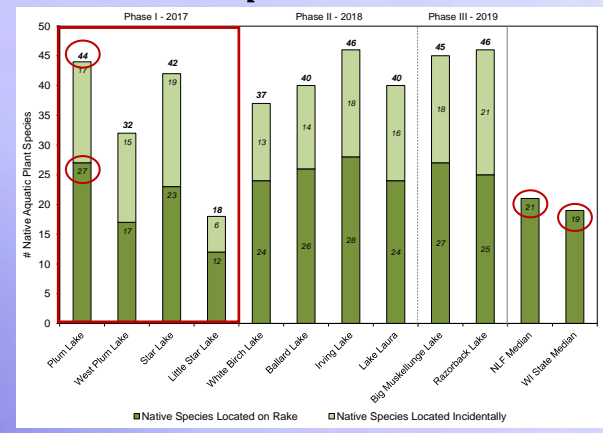
$$I = \bar{C} \times \sqrt{N}$$

- I** Floristic Quality Index
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Only species encountered on the rake are used (no incidentals)

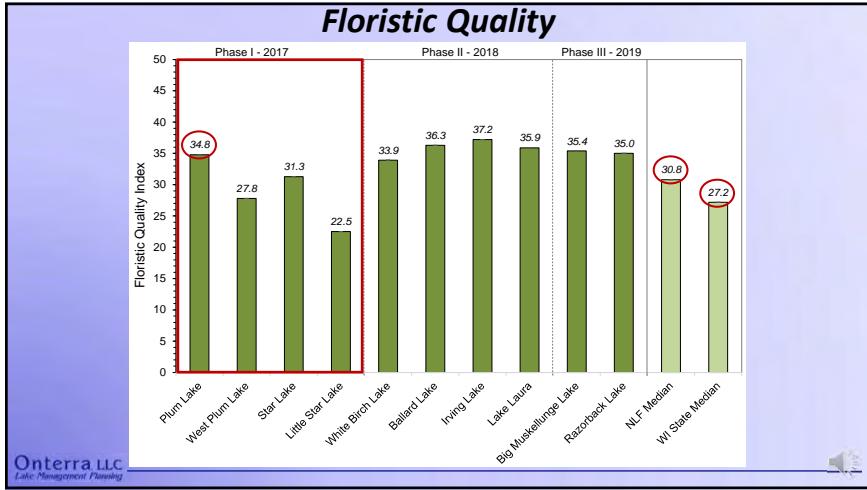
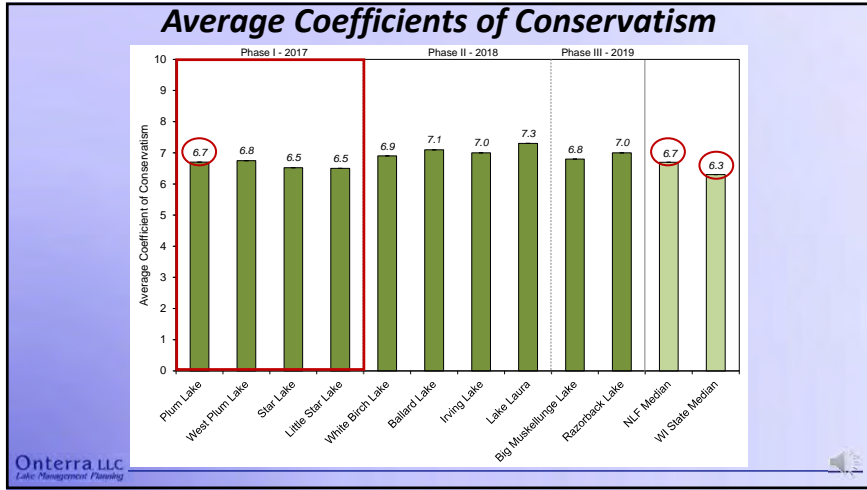


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Native Species Richness



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Town of Plum Lake Implementation Plan

Goal: Maintain Lake Water Quality in the Town of Plum Lake
Action: Monitor water quality through CLMN or town-coordinated program.

Goal: Prevent Further Introductions & Manage Current AIS in Town Lakes
Action: Continue CBCW inspections at town boat landings.
Action: Coordinate annual volunteer monitoring for AIS in town lakes.
Action: Purchase & install I-LIDS at boat landings within Town of Plum Lake.
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Goal: Increase the Town of Plum Lake’s Capacity to Communicate with Lake Stakeholders and Facilitate Partnerships with Other Management Entities

- Action:* Promote lake protection and enjoyment through stakeholder education.
- Action:* Continue the Town of Plum Lake’s involvement with other entities that have responsibilities in managing (management units) town lakes.



Thank You
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Lake Management Planning

Town of Plum Lake Email:
office@townofplumlake.com

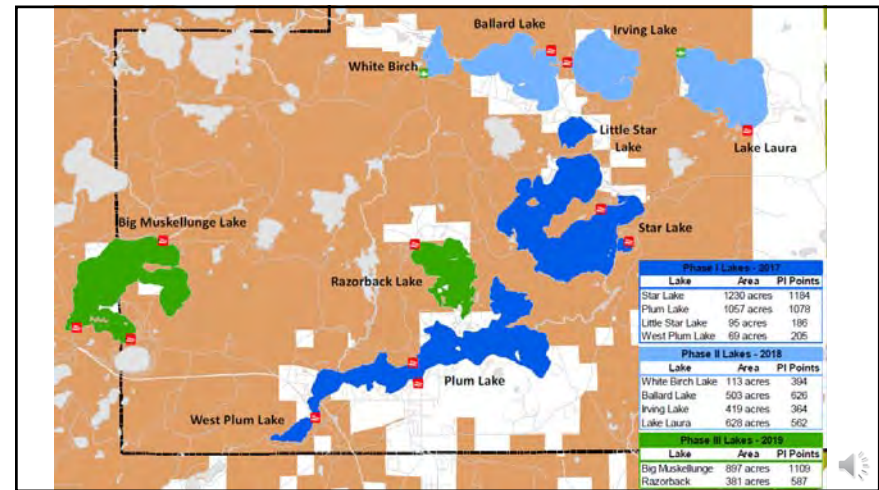
Subject Line: Plum Lake Wrap-up Meeting Presentation
Include name(s) of individuals who viewed this presentation



Town of Plum Lake

**Phase I
Management Planning Project
Star Lake
Wrap-up Presentation
August 2020**

Tim Hoyman, CLM
Onterra LLC
Lake Management Planning



Management Planning Project Overview

Collect and compile information about lake
*Includes both environmental & sociological data
Historical & current information
Past management actions*

Create a realistic and implementable management plan
*Challenges facing lake and lake group
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators*

Onterra LLC
Lake Management Planning

Summary Results for Star Lake

Overarching Conclusion: Star Lake is ecologically healthy.

Water Quality

- Star Lake has excellent water quality as expected for its lake type.

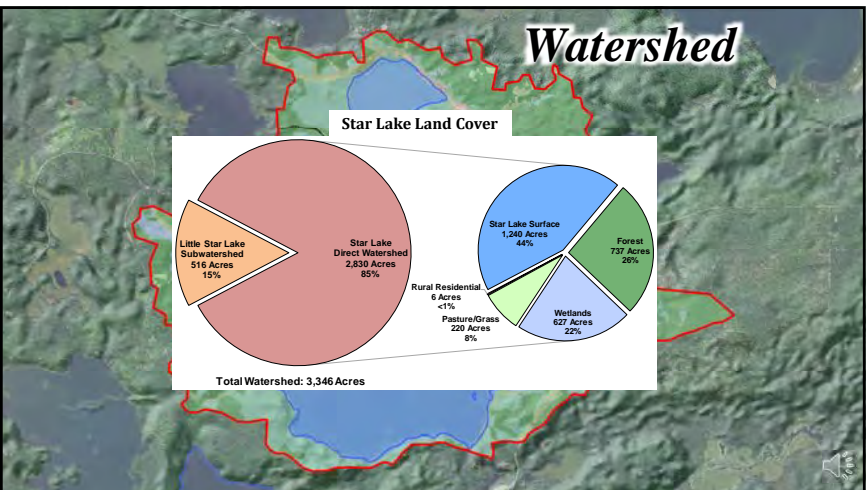
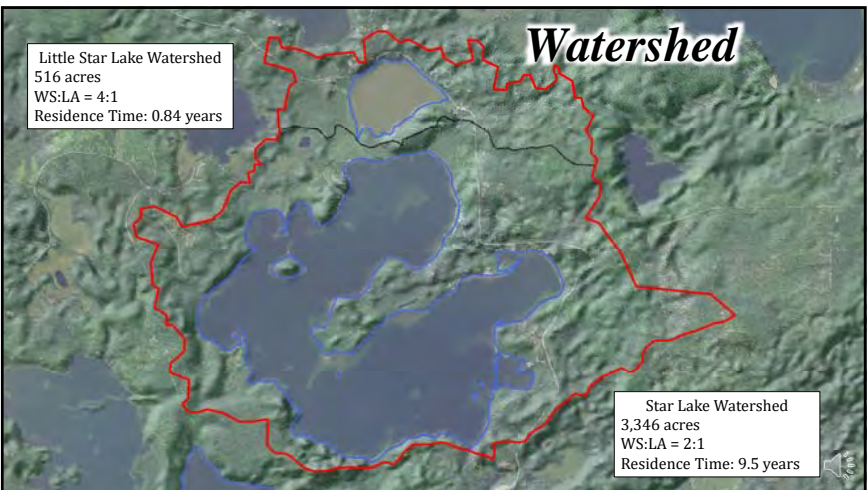
Watershed & Immediate Shoreline

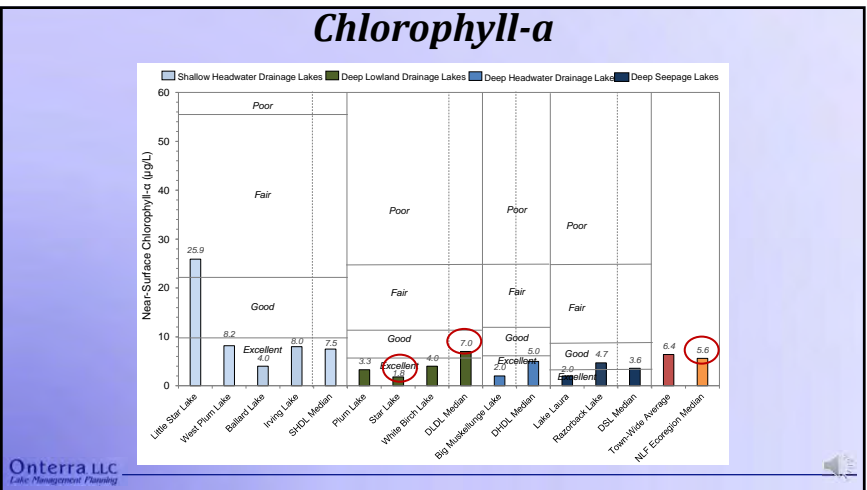
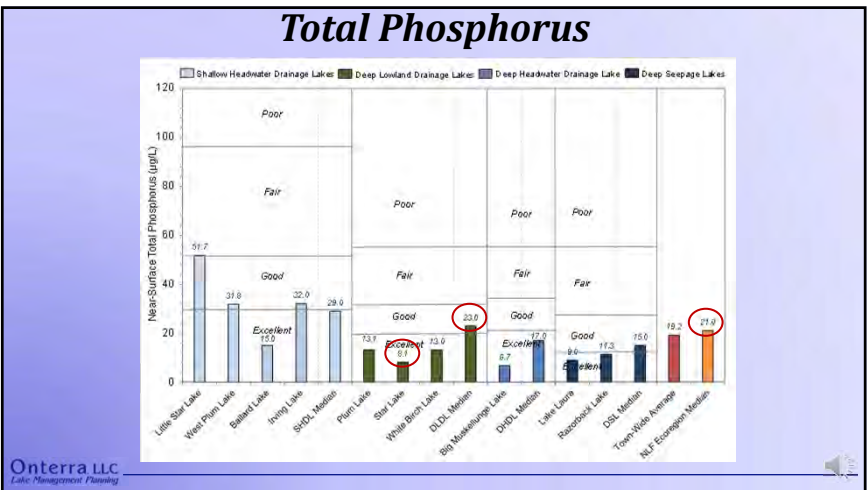
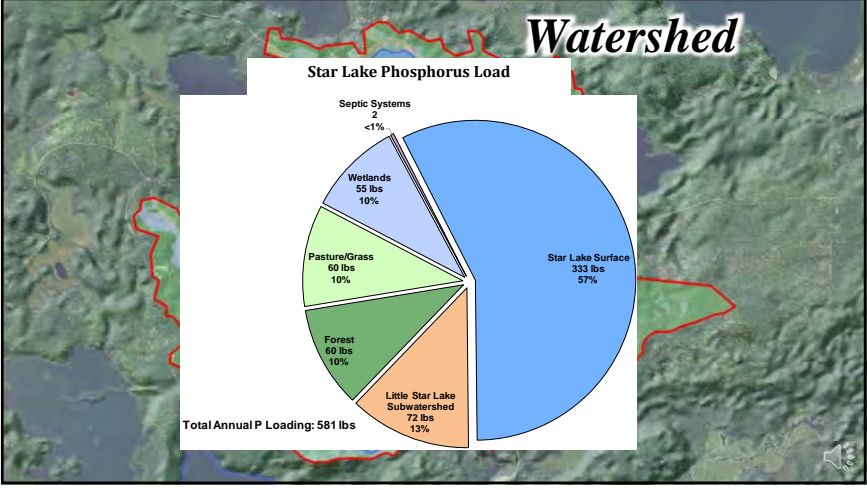
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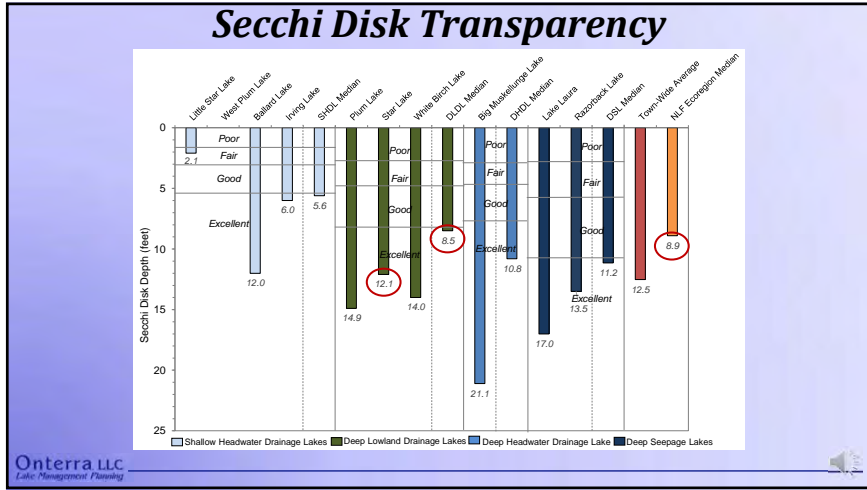
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Onterra LLC
Lake Management Planning







Paleoecology

Paleoecology

Lakes	Phosphorus (µg/L)
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Star Lake

Planktonic Diatoms



Aquatic Plant Surveys

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Lake Management Planning

Whole-Lake Point-Intercept Survey



Star Lake
65-meter resolution
1184 total points

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Lake Management Planning

Vegetation Analysis Matrices

Floristic Quality Analysis

Evaluates the closeness of an area's flora to undisturbed conditions.

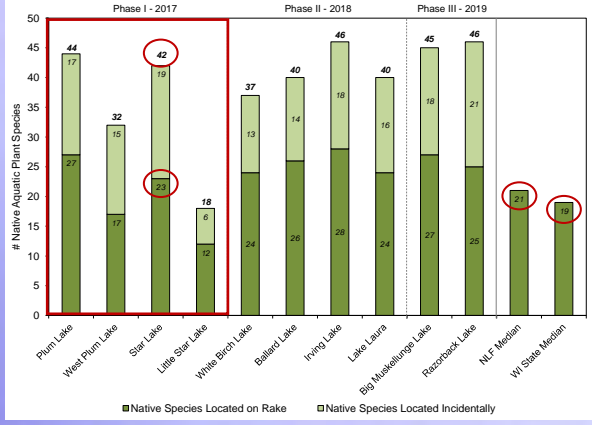
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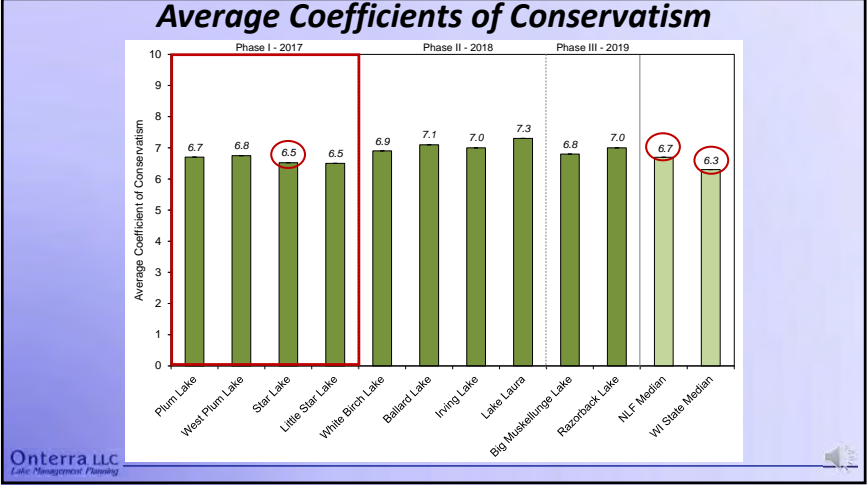


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Native Species Richness



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Town of Plum Lake Implementation Plan

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Thank You
Onterra LLC
Lake Management Planning

Town of Plum Lake Email:

office@townofplumlake.com

Subject Line: Star Lake Wrap-up Meeting Presentation

Include name(s) of individuals who viewed this presentation





Town of Plum Lake

Phase II
White Birch, Ballard, Irving, & Laura Lakes
Management Planning Project
Kick-off Meeting
July 27, 2018

Tim Hoyman
Onterra LLC
Lake Management Planning

Presentation Outline

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



Onterra LLC
Lake Management Planning

Onterra, LLC

- Founded in 2005
- Staff
 - Two full-time ecologists
 - One part-time paleoecologist
 - Three full-time field technicians
 - Four summer interns
- Services
 - Science and planning
- Philosophy
 - Promote realistic planning
 - Assist, not direct



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Lake Management Planning

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.
- Snapshot of lake's current status or health.
- Foster realistic expectations and dispel any misconceptions.

A goal without a plan is just a wish!



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Lake Management Planning

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together



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Data and information gathering

- Study Components
 - Water Quality Analysis
 - Watershed Assessment
 - Paleocore Collection & Analysis
 - Aquatic Plant Surveys
 - Fisheries Data Integration
 - Shoreland & CWH Assessment
 - Stakeholder Survey



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Water Quality Analysis

- General water chemistry (current & historical)
 - Citizens Lake Monitoring Network
- Nutrient analysis
 - Lake trophic state (Eutrophication)
 - Limiting plant nutrient
- Supporting data for watershed modeling



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Watershed Assessment

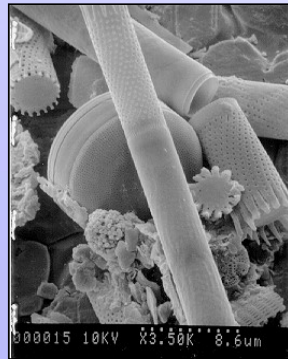
- Delineation of drainage basins
- Modeling
 - Land cover
 - Phosphorus loading
 - Lakes are modeled in series
 - Scenario development

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Paleocore Collection & Analysis



Sediment core



Diatoms

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Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
 - Early-Season AIS Survey
 - Whole-lake point-intercept surveys
 - Emergent/Floating-leaf Mapping Survey

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Lake Management Planning

Non-native Aquatic Plants

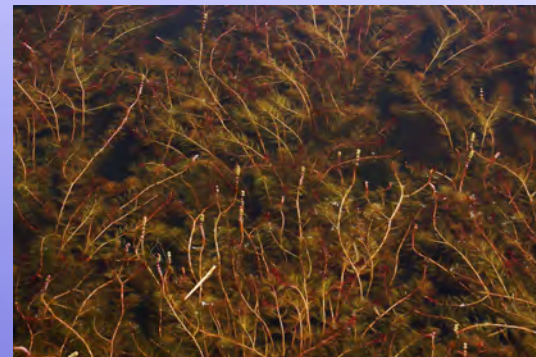
Curly-leaf Pondweed



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Non-native Aquatic Plants

Eurasian Water Milfoil



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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

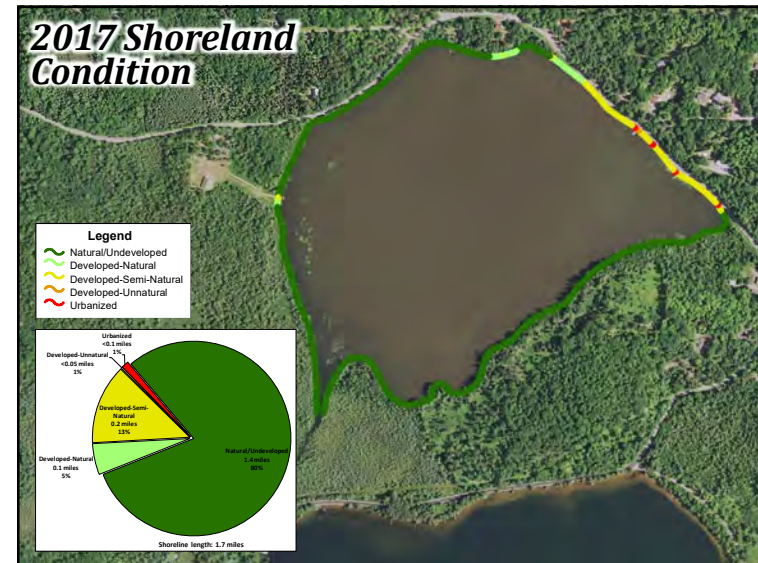


Range →

Natural





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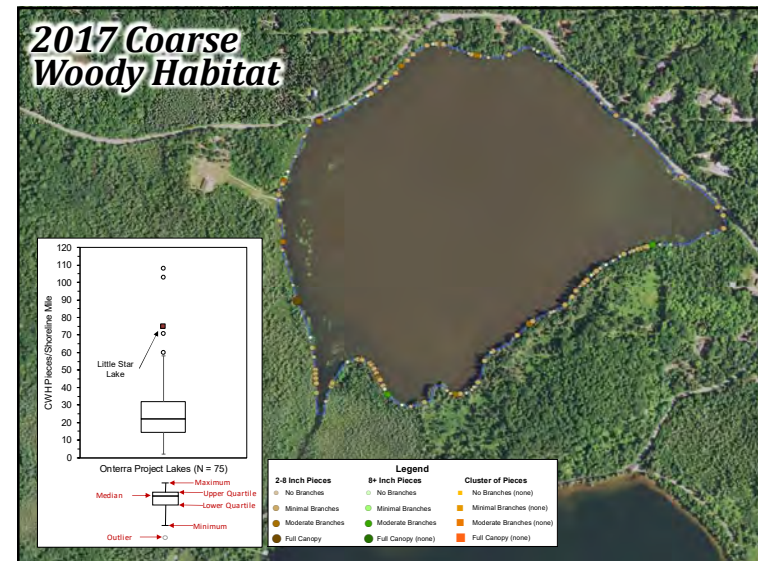


Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
 - Periphyton growth fed upon by insects.
 - Refuge, foraging and spawning habitat for fish.
 - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in system.

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Fisheries Data Integration

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



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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



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Lake Management Planning

Planning Process

Planning Committee Meetings

- Study Results
- Conclusions & Initial Recommendations
- Management Goals
- Management Actions
- Timeframe
- Facilitator(s)



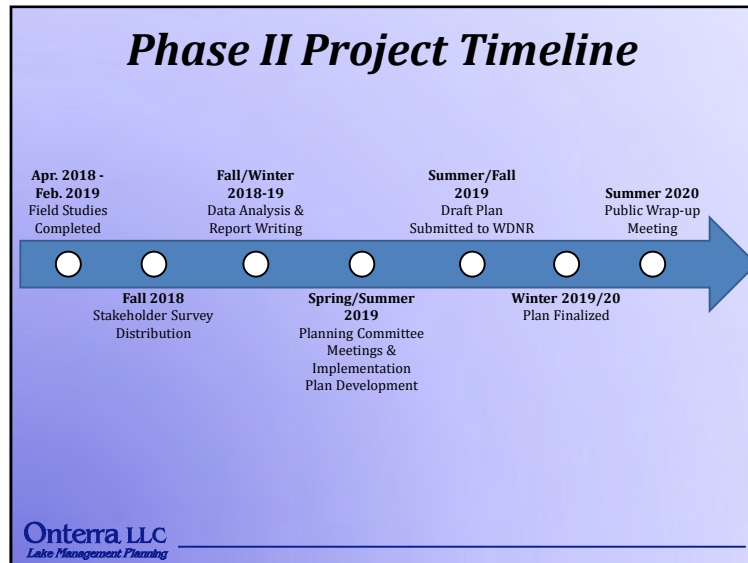
Implementation Plan

Onterra LLC
Lake Management Planning

Town of Plum Lake Planning Process

- Town-wide project brings on unique situation
 - Cost savings are great
 - Providing attention to individual lakes can be difficult
- Lake representatives
 - Communication link between stakeholders from individual lakes and Lakes Committee
- Stakeholder survey comments will be important

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Lake Management Planning



Town of Plum Lake Management Plan Documents

- Multiple document types
 - Town of Plum Lake Management Plan
 - Lake-Specific Results and Conclusions
 - Lake-Specific Implementation Plan
 - Appendices (raw data, etc.)
- Town-wide Compilation
 - All documents
- Individual Lake Document
 - Town-wide management plan
 - Lake-specific documents



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Lake Management Planning

Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

Completed Tasks

- All planning meetings completed during summer 2018
- Draft implementation plan provided to committee on May 14, 2019

Tasks Remaining to Completed

- Integrate Phase I committee comments in draft
- Create Official First Draft and provide to WDNR for comments

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

- All fieldwork complete
- Data has been compiled and standard analysis completed
- Report sections are underway

Tasks Remaining to Completed

- Planning meetings to be scheduled for summer 2019

Town-wide Project

Topics for Consideration during 2019

- Action plan for discovery of new invasive in Little Star Lake
 - Little Star Lake Eurasian watermilfoil management (first survey to be completed in late-June or early-July)
 - Hand-harvesting during summer 2019?
 - AIS-Early Detection and Response Grant for monitoring and control in 2020 and beyond

Phase III – Big Muskellunge and Razorback

Phase Alterations from other phases

- Will not complete stakeholder survey due to low number of private properties
- Will utilize Lakes Committee as the planning committee and invite private property owners
- Water quality on Muskellunge completed as a part of Long-term Ecological Research program
- Razorback has had water quality sample collected already
- Fieldwork will continue through summer and fall
- Planning meetings will occur during summer 2020




Town of Plum Lake

Phase II
White Birch, Ballard, Irving & Laura Lakes
Management Planning Project
Planning Meeting I
July 29, 2019

Tim Hoyman, CLM
 Onterra LLC
 Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview & Meeting Objective
- Study Results
 - Water Quality
 - Paleoecology → *Next Meeting*
 - Watershed
 - Shoreland Condition/Coarse Woody Habitat
 - Aquatic Plants
 - Fishery → *Next Meeting*
- “Big Picture”
- Planning Meeting II



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Lake Management Planning

Management Planning Project Overview

Collect and compile information about Phase II lakes
Includes both environmental & sociological
Historical & current information
Past management actions


Create a realistic and implementable management plan
Challenges facing lakes and lake groups
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators

Planning Meeting I
Report Sections

Planning Meeting II
Implementation Plan

Onterra LLC
Lake Management Planning

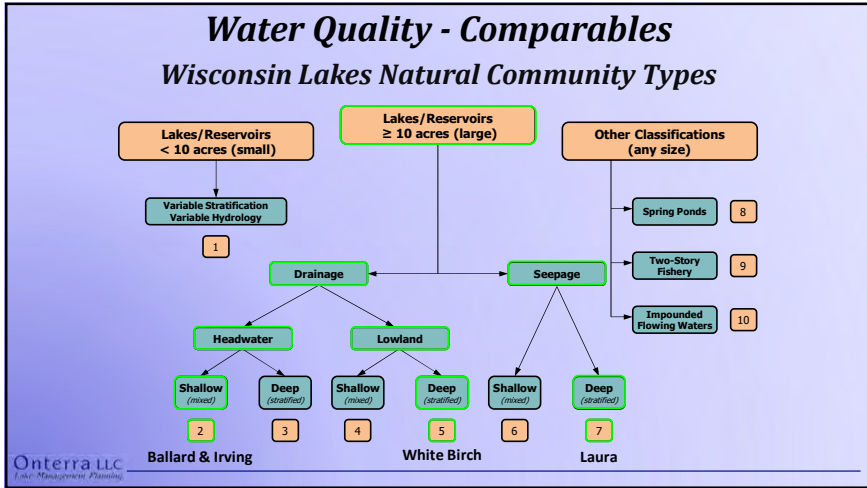
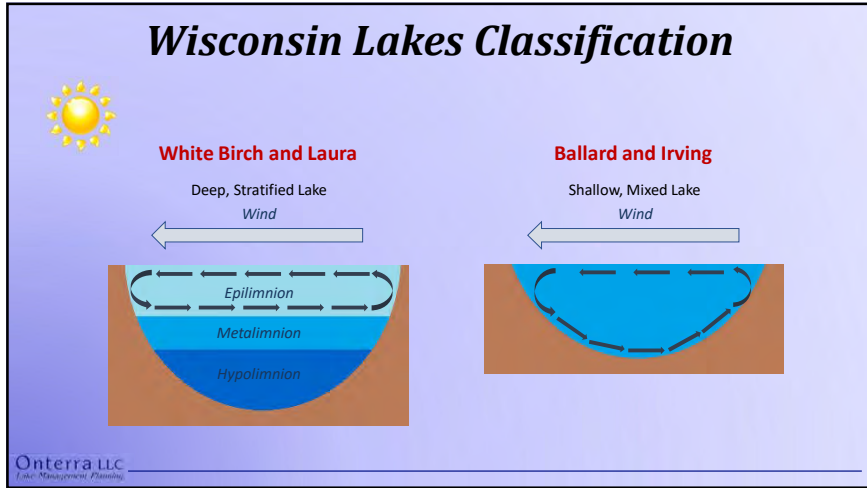
Water Quality - Comparables



Wisconsin Ecoregions

An area containing similar geology, physiography, hydrology, climate, and soils. As well as common terrestrial and aquatic fauna.

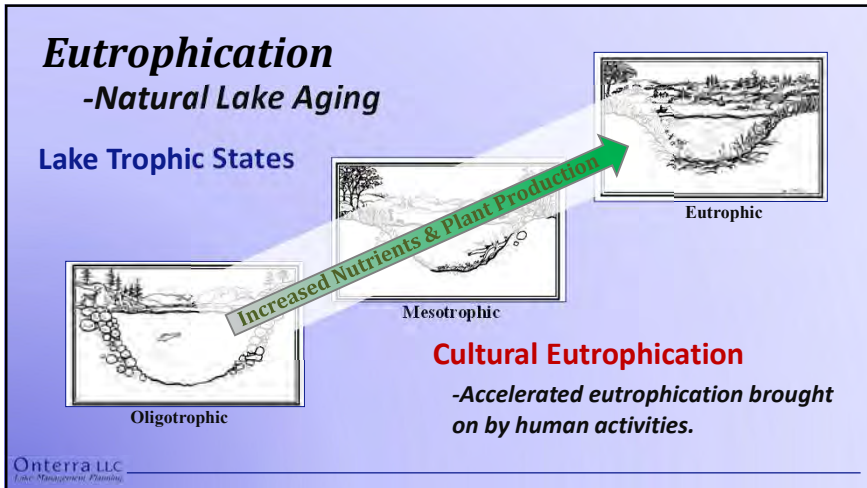
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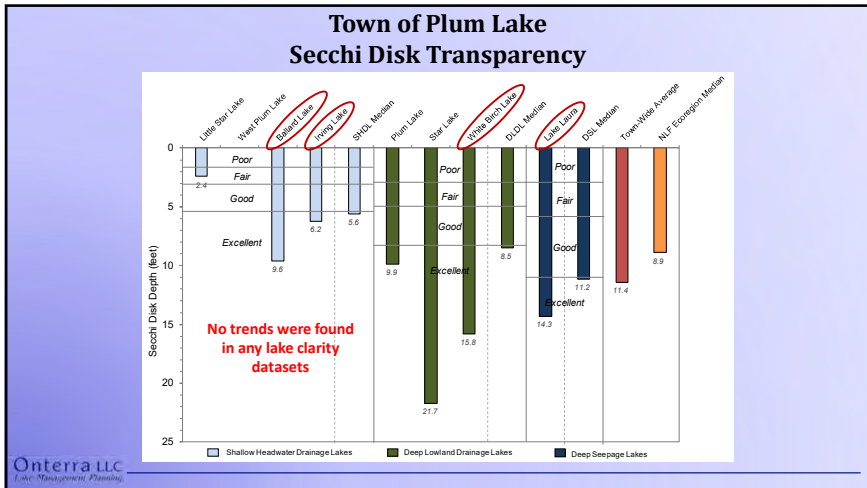
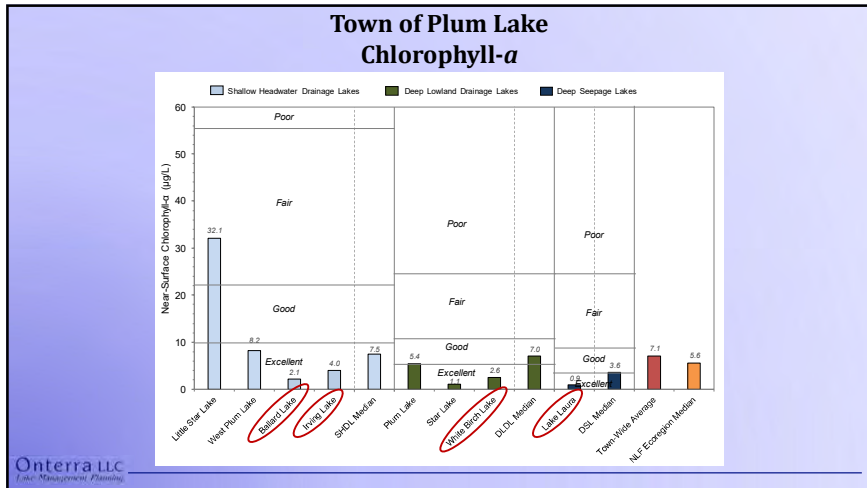
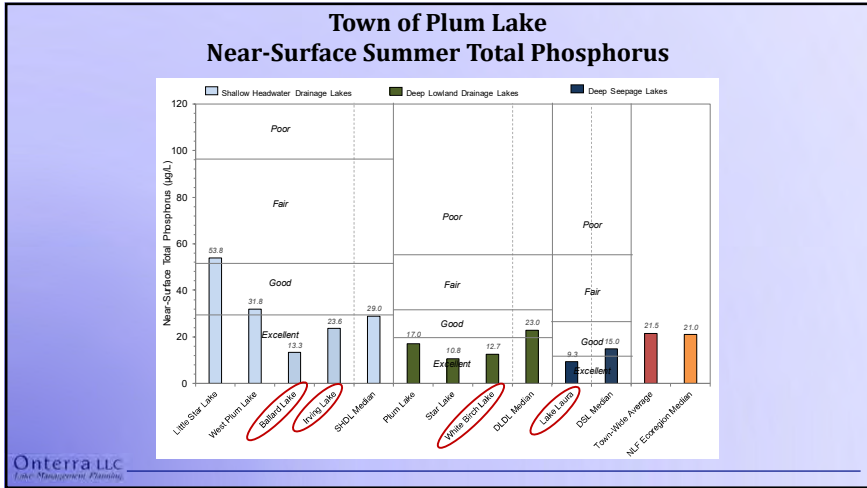
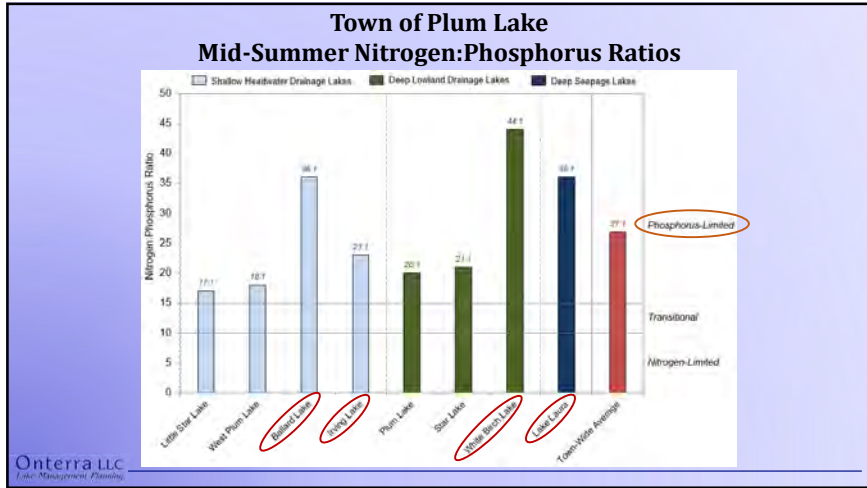


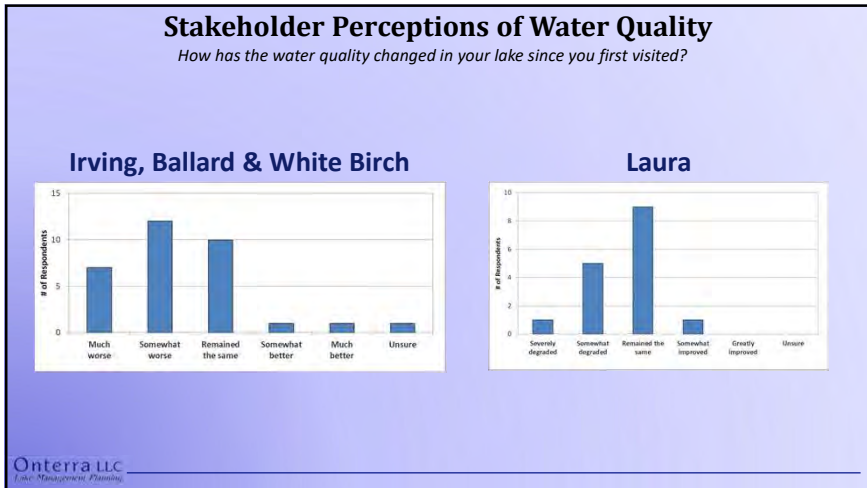
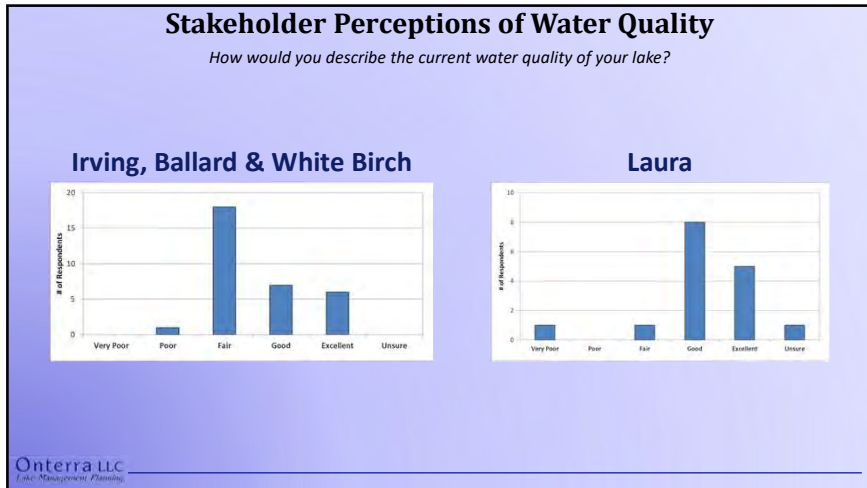
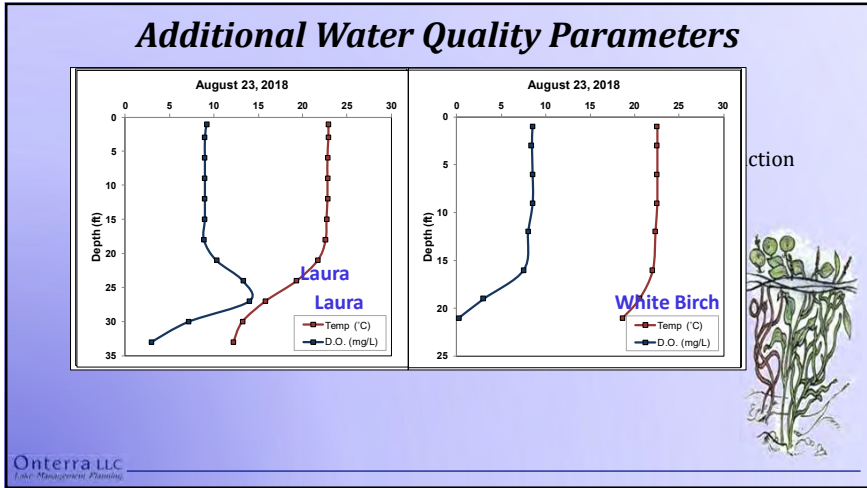
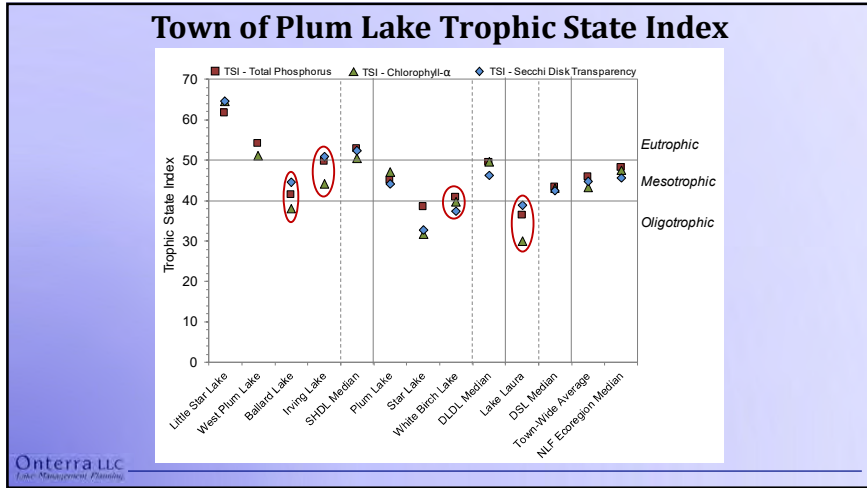
Lake Water Quality – Trophic Parameters

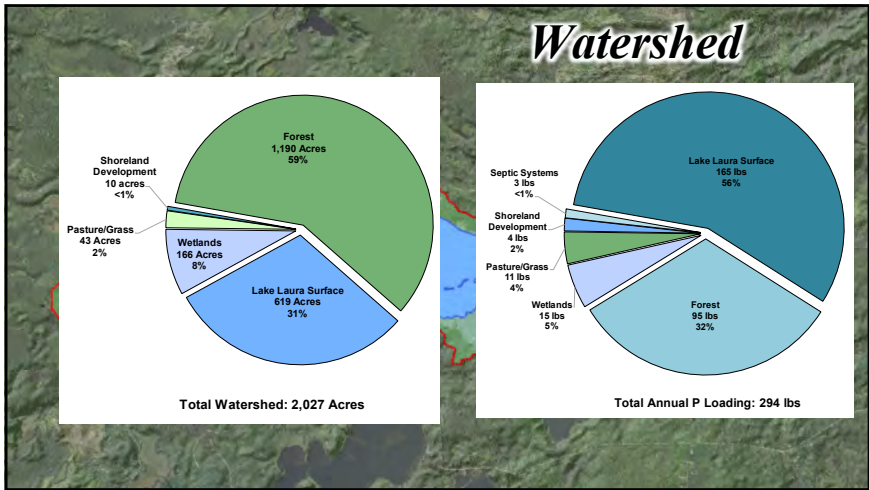
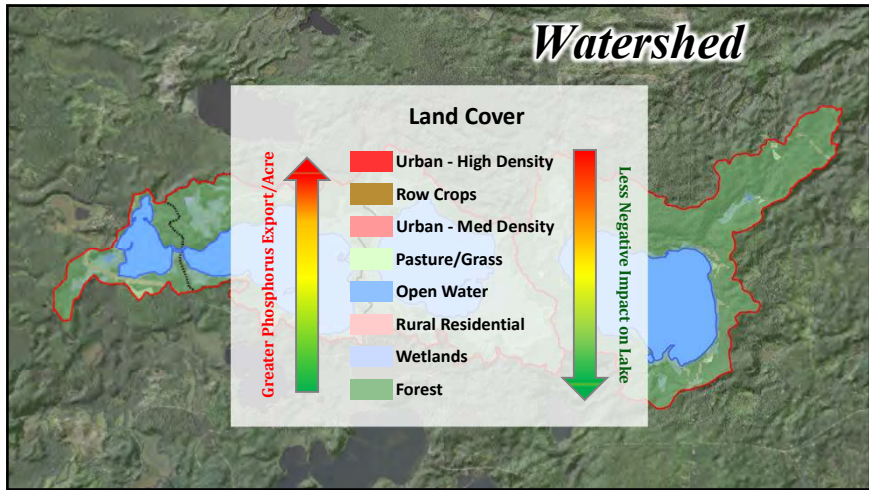
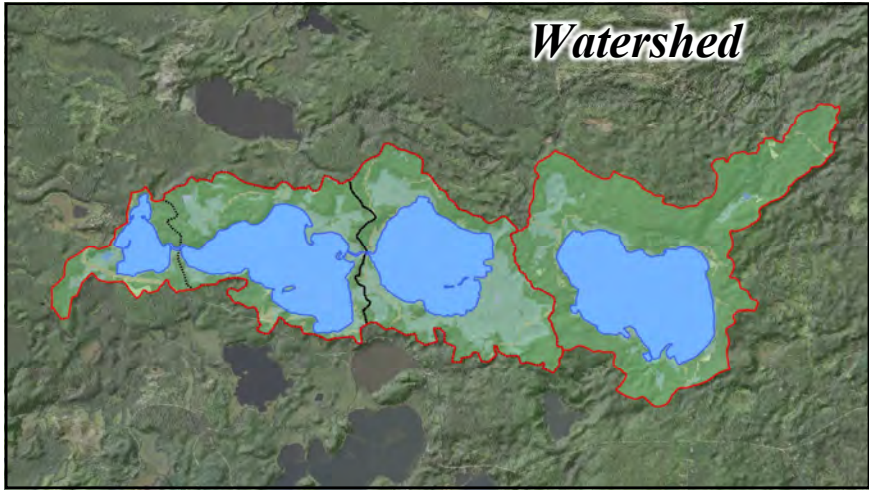
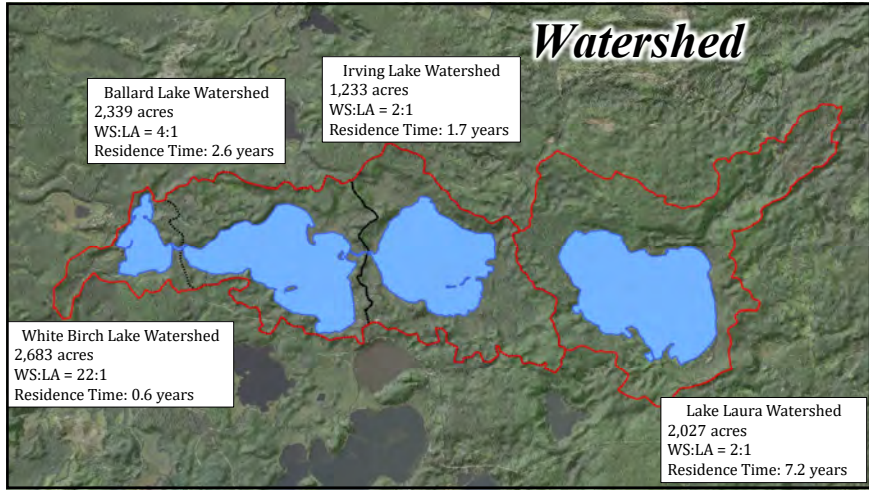
- ↑ **Phosphorus**
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human activity often increases P delivery to lakes
- ↑ **Chlorophyll-*a***
Pigment used in photosynthesis
Used as surrogate for phytoplankton biomass
- ↓ **Secchi Disk Transparency**
Measure of water clarity
Measured using a Secchi disk

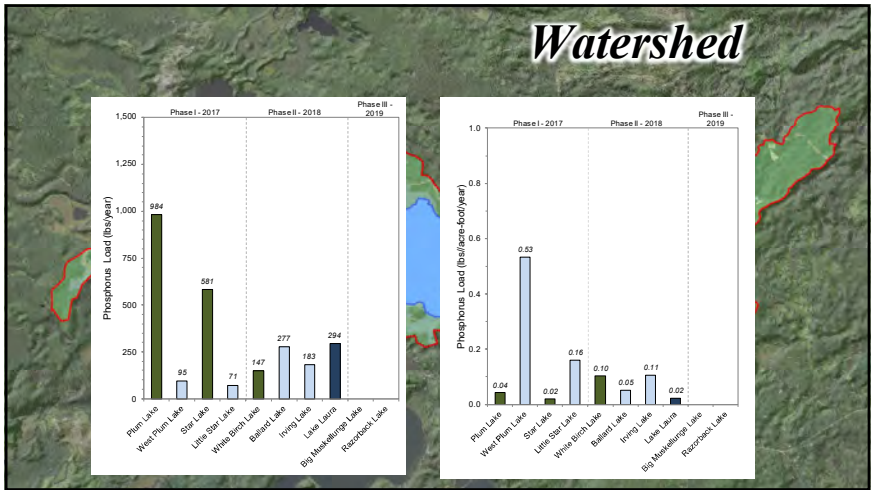
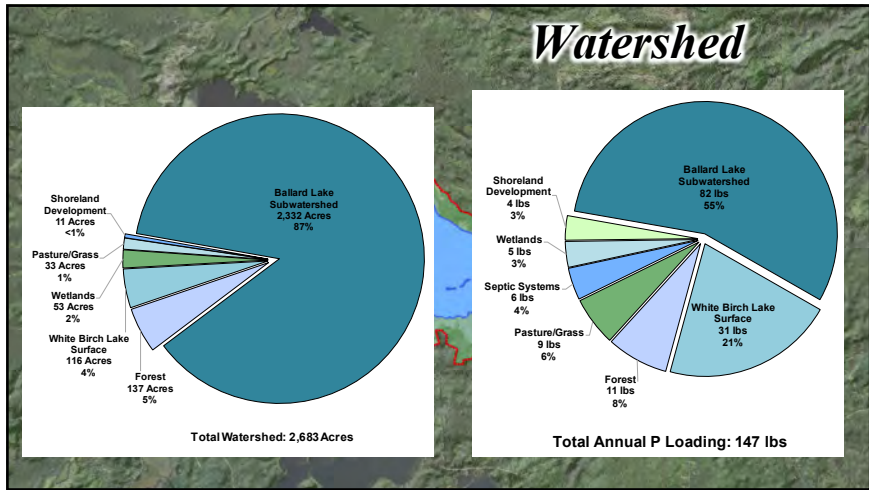
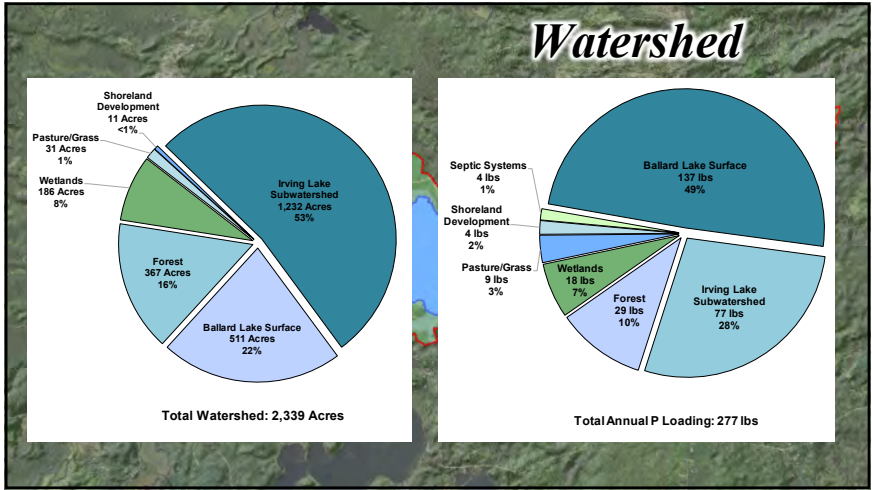
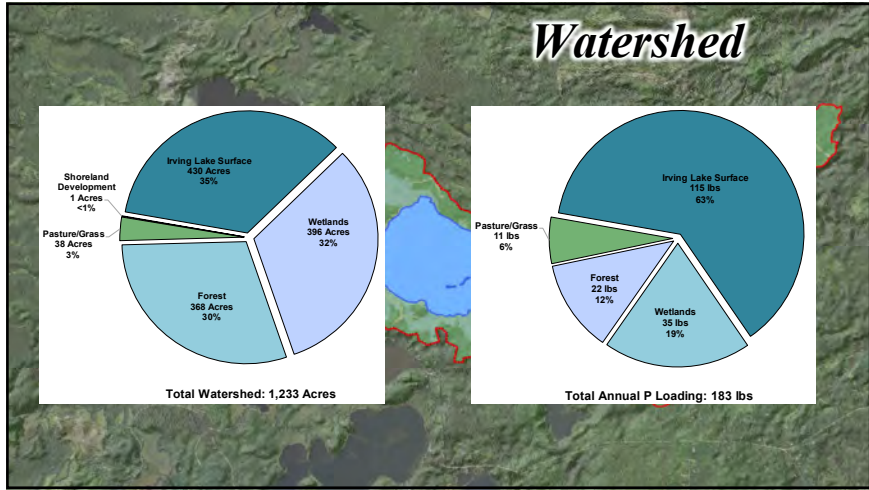
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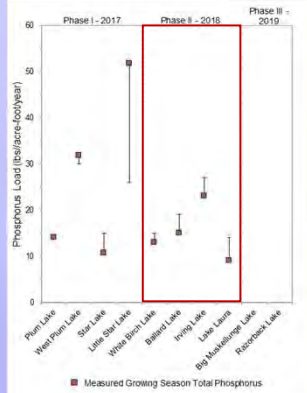








Predicted vs Actual Phosphorus Concentrations



For all lakes, predicted value was slightly more than actual value.

This means that there are likely no unaccounted phosphorus sources.



Shoreland Assessment

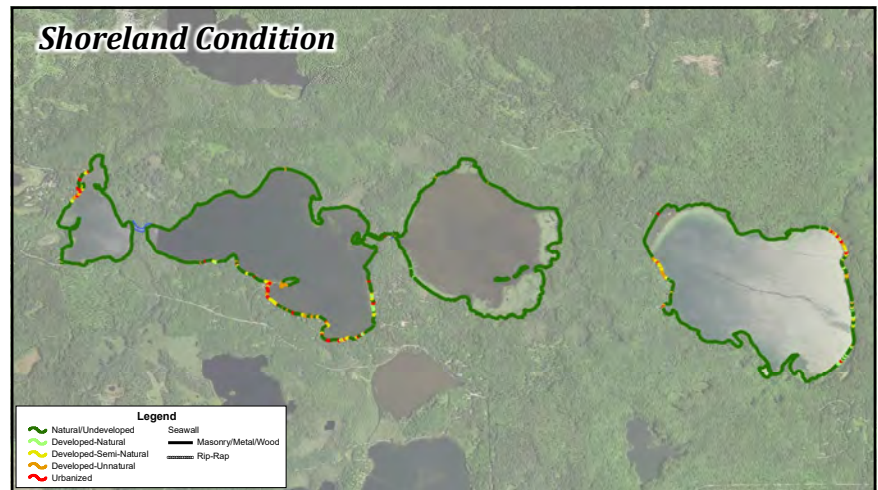
- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- EPA National Lakes Assessment results indicate shoreland development has greatest negative impact to health of our nation's lakes.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

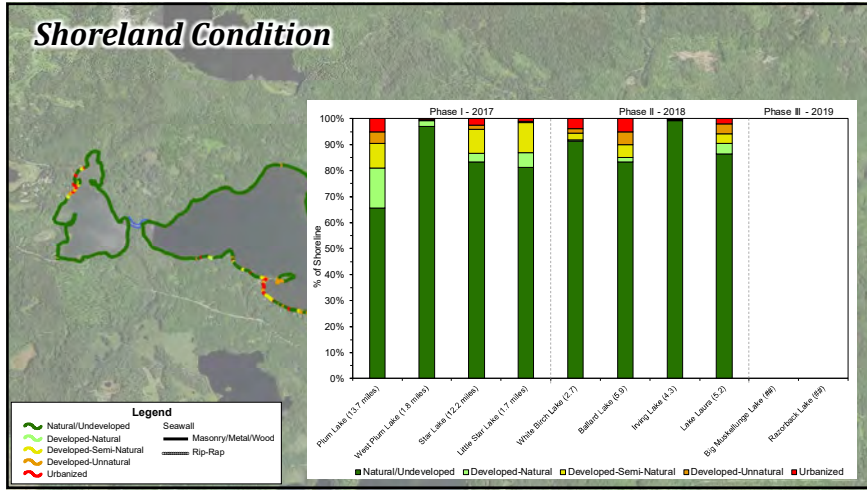


Shoreline Assessment Category Descriptions



Shoreland Condition

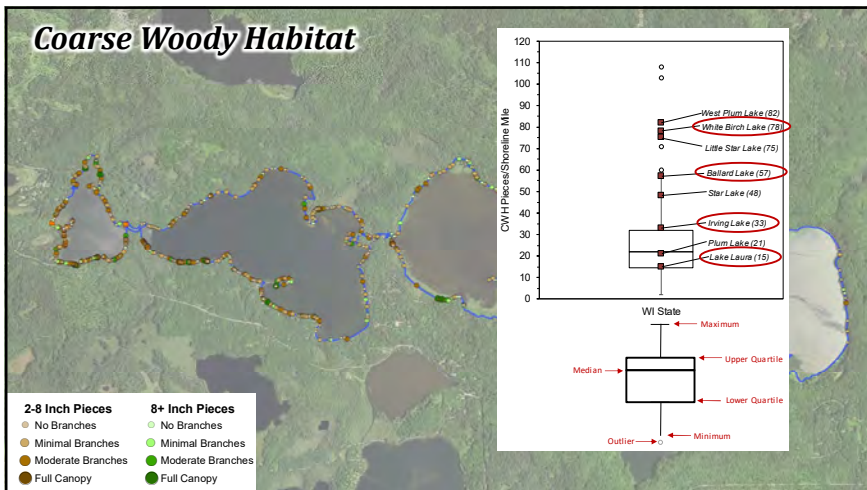
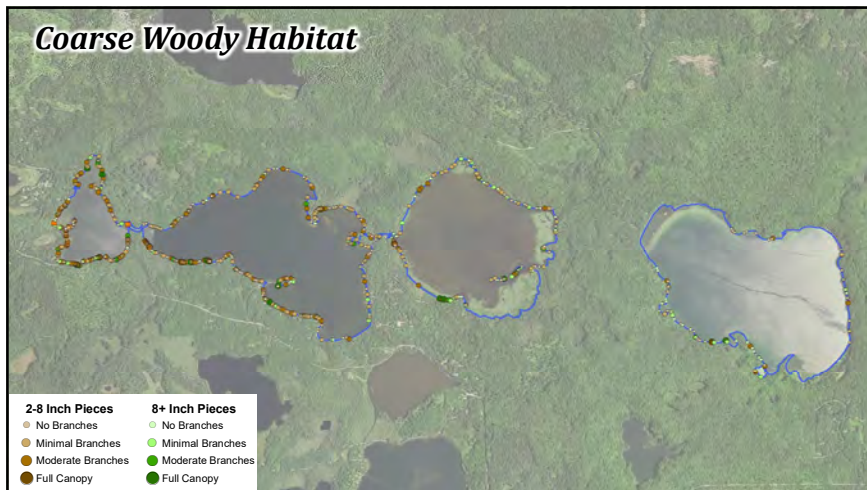




Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
 - Periphyton growth fed upon by insects.
 - Refuge, foraging and spawning habitat for fish.
 - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in Town Lakes

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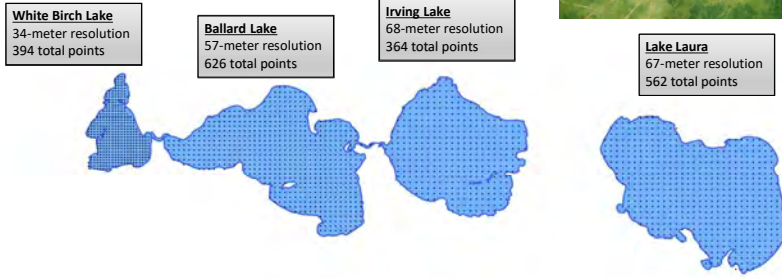
Aquatic Plant Surveys

- Assess both non-native & native species
- Four surveys completed in 2018
 - Early-Season AIS Survey
 - Whole-Lake Point-Intercept Survey**
 - Emergent/Floating-Leaf Community Mapping Survey



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Whole-Lake Point-Intercept Survey



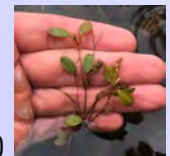
Plant Data Overview

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism	2017		2018			2019		
				Plum Lake	West Plum Lake	Star Lake	Little Star Lake	White Birch Lake	Ballard Lake	Irving Lake	Lake Laura
	<i>Bidens beckii</i>	Water marigold	8	X	X			X			
	<i>Ceratophyllum demersum</i>	Coontail	3	X	I	X		X	X		
	<i>Chara</i> spp.	Muskgrasses	7	X	X	X	X	X	X	X	
	<i>Elatine minima</i>	Waterwort	9	I							
	<i>Elodea canadensis</i>	Common waterweed	3	X	X	X	X	X	X	X	
	<i>Eriocaulon aquaticum</i>	Pipewort	9	I				X	X	X	
	<i>Heteranthera dubia</i>	Water stargrass	6	X			I				
	<i>Isoetes echinospora</i>	Spiny-spored quillwort	8							I	
	<i>Isoetes</i> spp.	Quillwort spp.	8			X		X			
	<i>Lobelia dortmanna</i>	Water lobelia	10	I	I	I		X	X	X	
	<i>Myriophyllum alterniflorum</i>	Alternate-flowered watermilfoil	10							X	

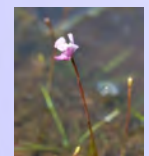
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Plant Data Overview

- 97 native plant species located to date
 - 2 listed as special concern:
 - Vasey's pondweed (Plum, Little Star, & Ballard)
 - Northeastern bladderwort (White Birch & Ballard)
- 4 non-native plant species
 - Narrow-leaved cattail (West Plum)
 - Pale-yellow iris (Plum, West Plum, & Star)
 - Purple Loosestrife (Star)
 - Eurasian watermilfoil (Little Star)



Vasey's Pondweed



Northeastern Bladderwort

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Vegetation Analysis Matrices

Floristic Quality Analysis

Evaluates the closeness of an area's flora to undisturbed conditions.

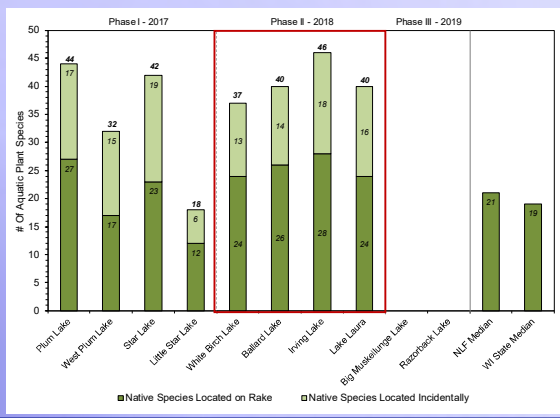
$$I = \bar{C} \times \sqrt{N}$$

- I** Floristic Quality Index
- C̄** Average Species Conservatism
1 - 10, higher number requires less disturbed condition
- N** Number of Native Species
Only species encountered on the rake are used (no incidentals)



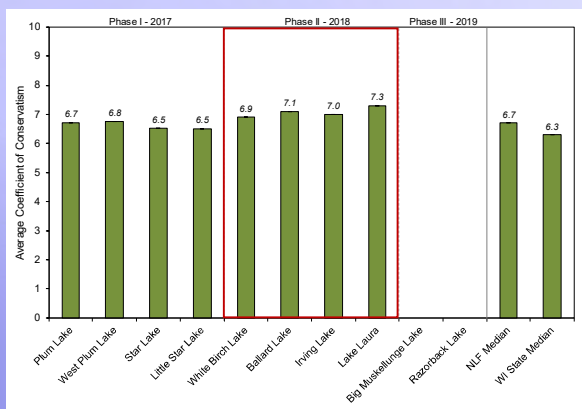
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Native Species Richness



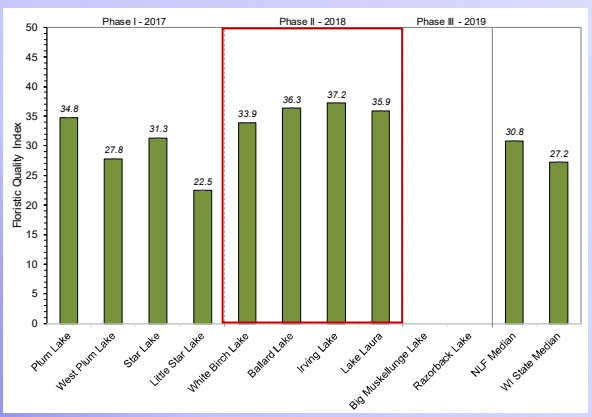
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Average Conservatism



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Floristic Quality



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Vegetation Analysis Matrices

Species Diversity

Species diversity utilizes species richness and also takes into account evenness or the variation in abundance of the individual species within the community.

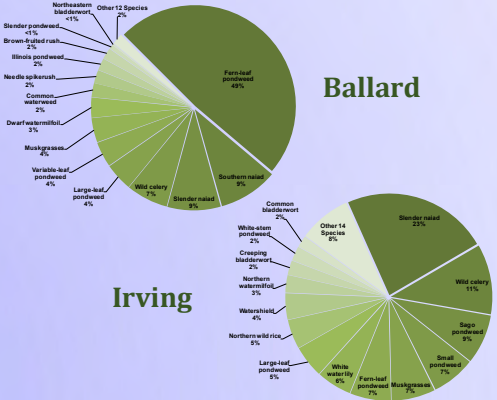
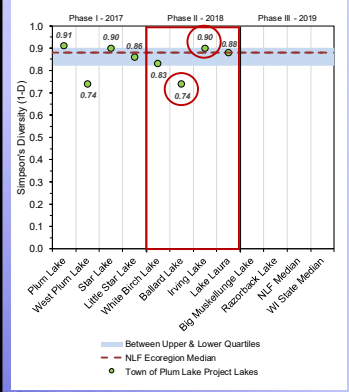
A community of 10 species with the population evenly divided among those species is more diverse than a community of 10 species with 50% of the population in one or two species.

A more diverse community can withstand environmental fluctuations better than a less diversity community.



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Simpson's Diversity Index



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Emergent & Floating-leaf Aquatic Plants

Plant Community	Phase I - 2017				Phase II - 2018				Phase III - 2019	
	Plum Lake	West Plum Lake	Star Lake	Little Star Lake	White Birch Lake	Ballard Lake	Irving Lake	Lake Laura	Big Muskellunge	Razorback Lake
Emergent Acres	6.1	18.7	3.5	0.0	0.4	1.7	0.2	4.1		
Floating-leaf Acres	2.1	4.0	8.2	16.1	13.9	7.1	0.4	0.7		
Mixed Emergent & Floating-leaf Acres	21.9	42.1	1.1	0.0	2.4	4.0	150.6	19.0		
Total Acres	30.1	64.8	12.8	16.1	16.6	12.9	151.3	23.7		
% Lake Area	2.8	91.3	1.0	16.0	14.3	2.5	35.2	3.8		

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Aquatic Invasive Species

Type	Common name	Scientific name	Lake	Location within report
Plants	Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	Little Star Lake	Section 3.5 – Aquatic Plants
	Pale-yellow iris	<i>Irís pseudacorus</i>	Plum Lake, West Plum Lake, Star Lake	Section 3.5 – Aquatic Plants
	Purple loosestrife	<i>Lythrum salicaria</i>	Star Lake	Section 3.5 – Aquatic Plants
	Narrow-leaved cattail	<i>Typha angustifolia</i>	West Plum Lake	Section 3.5 – Aquatic Plants
	Phragmites/Giant reed	<i>Phragmites australis subsp. australis</i>	Lake Laura	Section 3.5 – Aquatic Plants
Invertebrates	Freshwater jellyfish	<i>Craspedacusta sowerbyi</i>	Plum Lake	Section 3.6 – Aquatic Invasive Species
	Rusty crayfish	<i>Orconectes rusticus</i>	Plum Lake, Star Lake, Little Star Lake	Section 3.6 – Aquatic Invasive Species
	Banded mystery snail	<i>Viviparus georgianus</i>	Plum Lake, Star Lake, Ballard Lake, Lake Laura	Section 3.6 – Aquatic Invasive Species
	Chinese mystery snail	<i>Cipangopaludina chinensis</i>	Plum Lake, West Plum Lake, Star Lake	Section 3.6 – Aquatic Invasive Species
	Spiny waterflea	<i>Bythotrephes longimanus</i>	Star Lake	Section 3.6 – Aquatic Invasive Species

Verified as native strain

Common

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Conclusions

Water Quality

- Water quality for all four lakes is very good to excellent.
- Limited data prevents long-term analysis.

Watershed & Immediate Shoreline

- Limited development on shorelands and high quality landcover lead to very good water quality and habitat value.

Aquatic Plant Community

- Aquatic plant communities are varied between the four lakes.
- All communities are of high quality.

Planning Meeting II

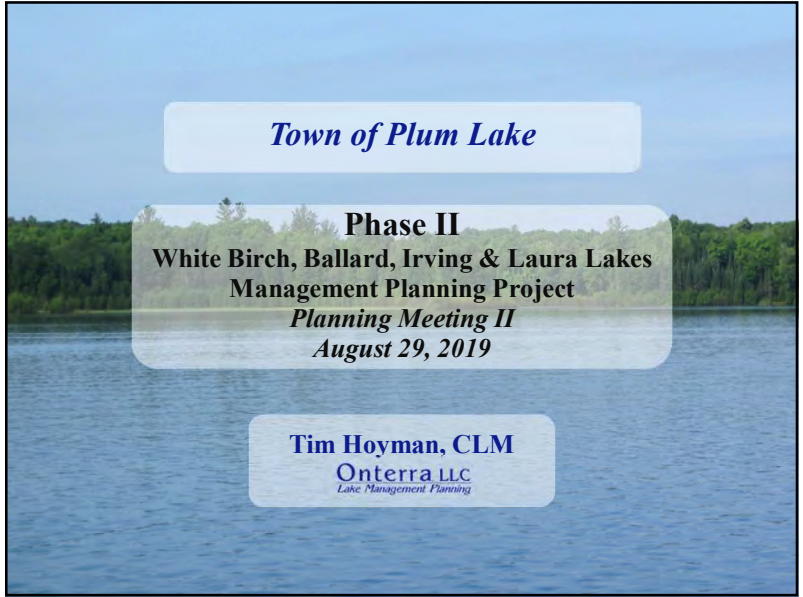
Primary Objective: Create implementation plan framework

Steps to Achieve Objective:

1. Discuss challenges facing lakes and lake groups
2. Convert challenges to management goals
3. Create management actions to meet management goals
4. Determine timeframes and facilitators to carry out actions

Assignment for Planning Meeting II

1. Create list of challenges facing lake and lake group (keep to yourself)
2. Review stakeholder survey results (**Tim! - Handout**)
3. Send potential report section edits and questions to Tim



Town of Plum Lake

Phase II
 White Birch, Ballard, Irving & Laura Lakes
 Management Planning Project
Planning Meeting II
 August 29, 2019

Tim Hoyman, CLM
 Onterra LLC
 Lake Management Planning

Management Planning Project Overview

Collect and compile information about Phase II lakes

- Includes both environmental & sociological*
- Historical & current information*
- Past management actions*

Create a realistic and implementable management plan

- Challenges facing lakes and lake groups*
- Create goals that will address challenges*
- Develop actions that will meet goals*
- Assign timeframes & facilitators*

Planning Meeting I
Report Sections

Planning Meeting II
Implementation Plan

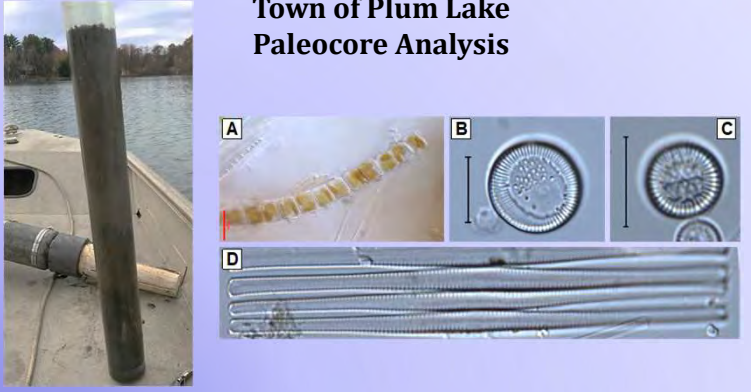
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General Study Results of
 White Birch, Ballard, Irving & Laura Lakes

All four lakes are in very good ecological health

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Town of Plum Lake Paleocore Analysis



A **B** **C**

D

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Town of Plum Lake Paleocore Analysis

Irving Lake (Full-Core – 1999)

- Wild rice increase from 1960 caused higher sedimentation rates (organic) and higher sediment phosphorus.
- Increased sediment and phosphorus is not from watershed, but from increased retention in the lake brought on by the wild rice increase.

Ballard Lake (Top/Bottom - 1999)

- Less planktonic diatoms in top section compared to bottom section indicate increased macrophytes in lake.
- Increase in *Navicula* in top sample indicate that despite increased macrophytes, the lake has not seen much increase in phosphorus.



Town of Plum Lake Paleocore Analysis

White Birch Lake (Top/Bottom - 1999)

- More planktonic diatoms in top section compared to bottom indicates loss of plants or increase in phosphorus. Since White Birch has a lot of plants, there must have been an increase in phosphorus.
- Increase is small as indicated by small increase in benthic *Flagilaria*.

Laura Lake (Top/Bottom - 2018)

- Top and bottom sections dominated by sediment diatoms.
- Indicates water quality in the lake has remained about the same and the water has remained clear as it was presettlement.



Town of Plum Lake Paleocore Analysis

Inference Modeling

Phosphorus Concentration Estimates

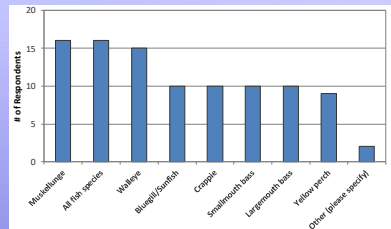
Star Top	12	
Star Bottom	11	
Little Star Top	31	
Little Star Bottom	36	
Plum Top	14	
Plum Bottom	10	
West Plum Top	35	
West Plum Bottom	14	
Laura Top	22	9.5
Laura Bottom	13	
Ballard Top	10	15.3
Ballard Bottom	11	
White Birch Top	10	13.3
White Birch Bottom	12	
Irving Top	21	32.1 (24)
Irving Bottom	21	



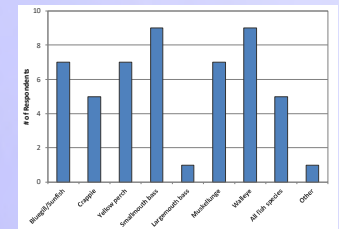
Stakeholder Survey

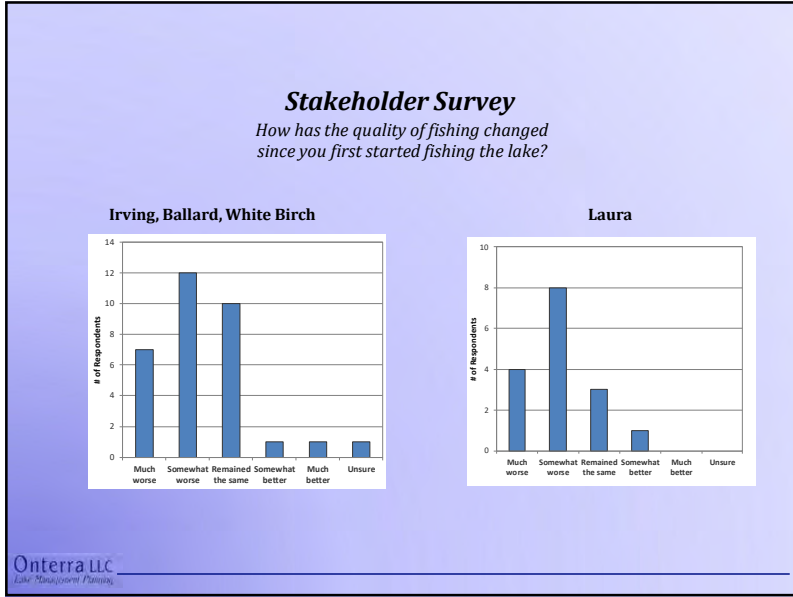
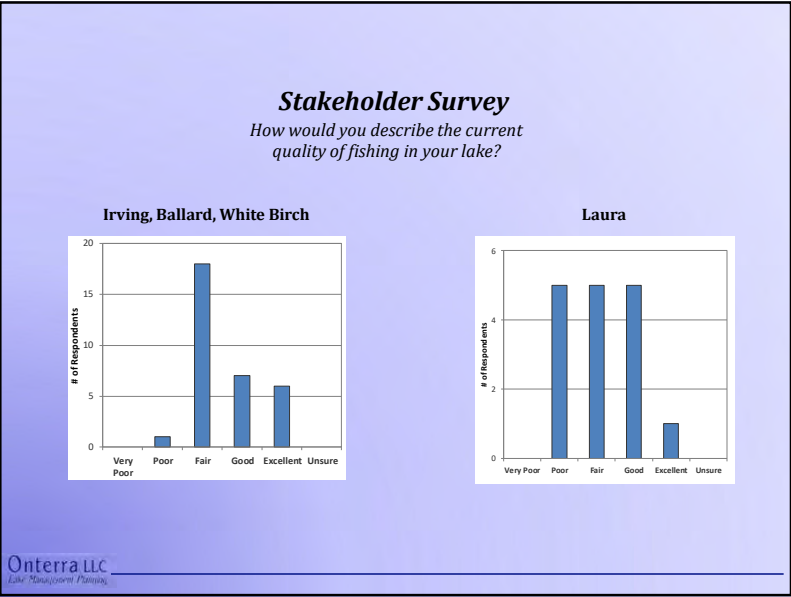
What species of fish do you like to catch in your lake?

Irving, Ballard, White Birch



Laura

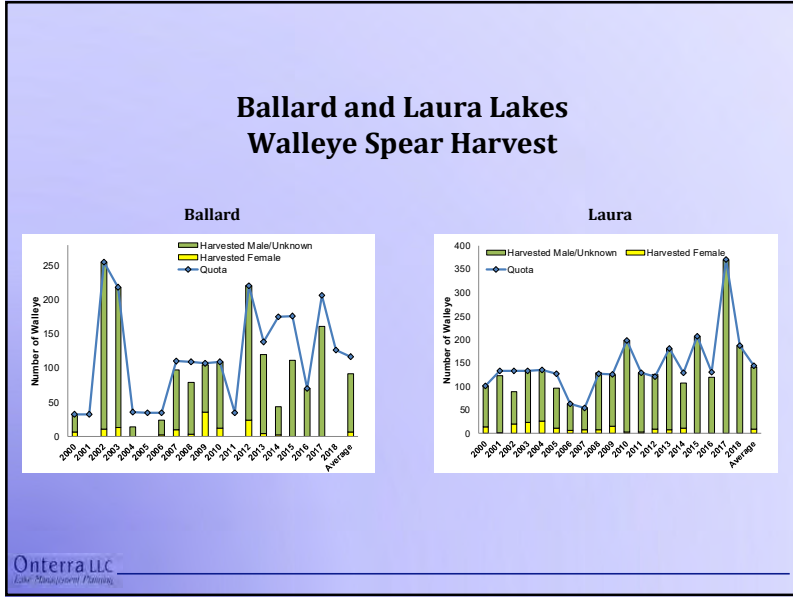




Native American Spear Harvest

- Town is within Treaty of 1842
- Tribal and State authorities establish *total allowable catch* based on population estimates (typically 35% for walleye & 27% for muskellunge)
- The total allowable catch number may be reduced based on confidence in population estimates: *safe harvest level*
- Tribal community claims percentage of safe harvest level, or *declaration*
- Bag limits for hook and line anglers set to accommodate declaration
- Can only harvest two walleye over 20 inches per night – one between 20 and 24” and one any size over 20”

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Conclusions

Water Quality

- Water quality for all four lakes is very good to excellent.
- Limited data prevents long-term analysis.

Watershed & Immediate Shoreline

- Limited development on shorelands and high quality landcover lead to very good water quality and habitat value.

Aquatic Plant Community

- Aquatic plant communities are varied between the four lakes.
- All communities are of high quality.

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Thank You

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Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

Tasks Remaining

- Integrate Doug's comments in draft
- Create Official First Draft and provide to WDNR for comments prior to December 1, 2019
- Wrap-up meeting in Summer 2020 (need request grant extension)

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

- All fieldwork complete
- Report sections complete
- All planning meetings complete

Tasks Remaining

- Complete draft of full implementation plan for committee's review (October)
- Will be completing reimbursement for study phases this month (\$8,714.98)

Phase III – Big Muskellunge and Razorback

Completed Tasks

- All plant studies completed and most water quality sampling

Tasks Remaining

- Fall and winter water quality sampling
- Creation of report sections
- Planning meetings with Town Lakes Committee summer 2020

Town-wide Project

Little Star Lake AIS-Early Detection and Response Grant

- Accepted by Town Lakes Committee?
- Need town resolution for grant application
- Grant application 'due' February 1, 2020

AIS Monitoring on Project Lakes?

- Overall AIS monitoring program should include trained volunteer and professional surveys
- Suggestion: Professional monitoring every third year with volunteer surveys in between
- Use of trained volunteer surveys may help obtain grants in the future

Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

Completed Tasks

Official first draft completed last fall to qualify Plum Lake Association for WDNR Land Acquisition Grant submittal. Minor comments received from WDNR.

Wrap-up Meeting Presentations for Plum and Star Lake Associations available on YouTube.

Tasks Remaining

All WDNR comments have been integrated within report. Final draft will be sent out during week of September 14th. This is the final task for the project.

Final billing will be sent out during week of September 14th.

Onterra will begin reimbursement paperwork in late September/early October.

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

Draft implementation plan provided to Joe Heitz and Bob Jackson for their initial review before passing it along to the rest of the Phase II planning committee.

Tasks Remaining

Integrate planning committee changes when received.

Send to WDNR as Official First Draft.

Integrate WDNR comments, which will be few because they already reviewed and accepted Phase I plan.

Phase III – Big Muskellunge and Razorback

Completed Tasks

All field studies completed.

Report sections are complete with the exception of adding information to Big Muskellunge report regarding some comparative analysis we did between the plant data collected by the WDNR in 2010 and the data Onterra collected in 2019.

Tasks Remaining

Phase III implementation plan development.

This was originally going to be completed in June, but COVID-19 prevented in-person meetings. As a substitute, I believe the lakes committee should review the implementation plan being completed for Phase II, which is primarily from the town-wide perspective and includes Phase I, discuss potential changes/additions, and once a final plan is agreed upon, recommend that the Town of Plum Lake adopt it. This can likely be completed over email and/or video-teleconferencing if face-to-face meetings are not possible.

Phase III – Big Muskellunge and Razorback (con't)

Tasks Remaining (con't)

Razorback Lake study results presentation. I had a great conversation with Wayne Ax on September 10th and we agreed that a YouTube video presentation, much like those created for Plum and Star, would be a great way to get information about the lake to interested Razorback riparians. This will be completed the week of September 14th so Wayne can include the YouTube link in a communication with his fellow riparians

If there is interest, we could create a similar presentation for Big Muskellunge, but there would need to be a good method to get the link out to the folks around the lake and I do not know if that exists or not.

Little Star Lake AIS-Early Detection and Response Grant

Completed Tasks

All 2020 field studies completed.

All 2020 hand-harvesting by APM completed.

Tasks Remaining

2020 Annual Report. Will be completed in early winter 2021.

Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

Completed Tasks

This project has been finalized and accepted by WDNR.
Final invoices completed.
Reimbursement information sent to key players from Plum and Star Lakes.
Star Lake Wrap-up video: 29 views
Plum Lake Wrap-up video: 81 views

Tasks Remaining

Reimbursement paperwork.

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

Draft implementation plan provided to Joe Heitz and Bob Jackson for their initial review before passing it along to the rest of the Phase II planning committee.

Tasks Remaining

Integrate planning committee changes when received.
Send to WDNR as Official First Draft.
Integrate WDNR comments, which will be few because they already reviewed and accepted Phase I plan.

Phase III – Big Muskellunge and Razorback

Completed Tasks

All field studies completed.
Report sections are complete.
Big Muskellunge additional analysis and reporting complete.
Razorback Lake Wrap-up video: 48 views

Tasks Remaining

Phase III implementation plan development.

This was originally going to be completed in June, but COVID-19 prevented in-person meetings. As a substitute, I believe the lakes committee should review the implementation plan being completed for Phase II, which is primarily from the town-wide perspective and includes Phase I, discuss potential changes/additions, and once a final plan is agreed upon, recommend that the Town of Plum Lake adopt it. This can likely be completed over email and/or video-teleconferencing if face-to-face meetings are not possible.

Little Star Lake AIS-Early Detection and Response Grant

Completed Tasks

All 2020 field studies completed.

All 2020 hand-harvesting by APM completed.

Tasks Remaining

2020 Annual Report. Will be completed in early winter 2021.

Remaining Billing and Anticipated Completion

Project	Remaining Billing	Project Completion	Reimbursement	
			Timeframe	Amount (Max)
Phase I	\$0.00	Complete	Fall 2020	\$12,497.18
Phase II	\$3,853.82	Fall 2020	Fall 2020	\$4,219.20
Phase III	\$12,628.12	Spring 2021	Spring 2020	\$7,444.54
Little Star AIS-EDR	\$9,497.50	Spring 2023	Periodic	\$14,974.87

Town of Plum Lake Lake Management Planning Project Update to Lakes Committee

Phase I – Plum, West Plum, Star, and Little Star

This phase is complete.

Phase II – White Birch, Ballard, Irving, and Laura

Completed Tasks

Official first draft has been approved by WDNR.

Tasks Remaining

Finalize document and provide to WDNR and town.

Finalize billing so reimbursement paperwork can be completed (Onterra will assist).

Phase III – Big Muskellunge and Razorback

Completed Tasks

All reports and draft implementation plan are complete.

A recorded wrap-up/information meeting was created for the folks on Razorback Lake.

Tasks Remaining

Meet with Lakes Committee to discuss final changes to town-wide implementation plan.

I suggest that I send out draft plan as written now and then meet with committee in June.

Once the committee settles on the implementation plan, the Official First Draft would be provided to WDNR for comments. Considering the positive comments on Phase II, I would not expect much different for Phase III.

Little Star Lake AIS-Early Detection and Response Grant

Completed Tasks

All 2020 field studies completed.

All 2020 hand-harvesting by APM completed.

2020 Annual report furnished to town and WDNR on March 3, 2021.

Tasks Remaining

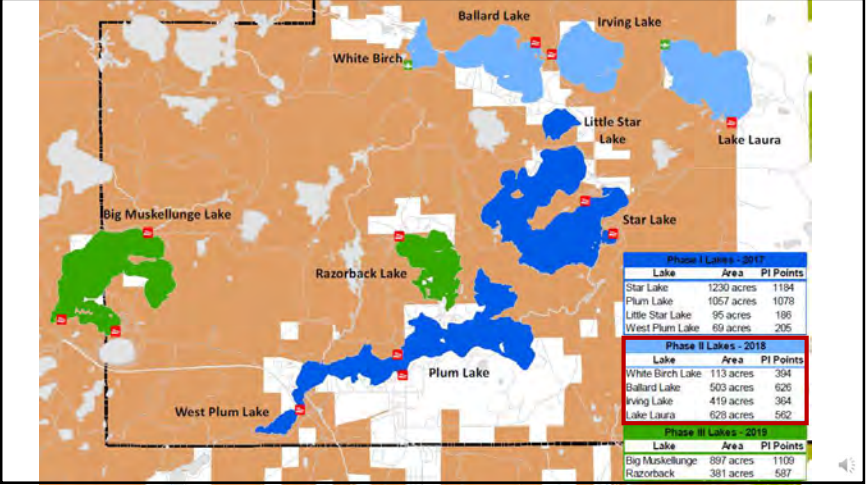
2021 is the second year of the project and will proceed like 2020.

Onterra and APM staff met on March 12th to discuss overlapping projects and as of that meeting, APM had not set a date for their work on Little Star Lake. Once APM determines their work date, we will set up our first survey, the early-season AIS survey, a week or so before APM's date.

Town of Plum Lake

Phase II
Management Planning Project
Irving, Ballard, White Birch, & Laura
Information Presentation
November 2021

Tim Hoyman
Onterra LLC
Lake Management Planning



Management Planning Project Overview

Collect and compile information about lake
Includes both environmental & sociological data
Historical & current information
Past management actions

Create a realistic and implementable management plan
Challenges facing lake and lake group
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators

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Lake Management Planning

Summary Results for Phase II Lakes

Overarching Conclusion: All Phase II Lakes are ecologically healthy.

Water Quality

- All lakes have good to excellent water quality as expected for lakes of these types.
- Lack of historical data made long-term analysis impossible.

Watershed & Immediate Shoreline

- The most abundant types of land cover located in the watersheds are those that export the least amount of pollutants.
- All lakes have large areas with little or no shoreland development.

Aquatic Plant Community

- Aquatic plant communities are as expected and indicate that lakes are healthy.
- No Eurasian watermilfoil or curly-leaf pondweed were found during any plant surveys, but emergent AIS do occur within the Phase II lakes and are addressed in the management plan.

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Water Quality - Comparables

Wisconsin Ecoregions

An area containing similar geology, physiography, hydrology, climate, and soils. As well as common terrestrial and aquatic fauna.

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Wisconsin Lakes Classification

White Birch and Laura
Deep, Stratified Lake
Wind

Ballard and Irving
Shallow, Mixed Lake
Wind

Epilimnion
Metalimnion
Hypolimnion

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Lake Management Planning

Water Quality - Comparables

Wisconsin Lakes Natural Community Types

Lakes/Reservoirs < 10 acres (small)
Variable Stratification
Variable Hydrology
1

Lakes/Reservoirs \geq 10 acres (large)

Other Classifications (any size)
Spring Ponds 8
Two-Story Fishery 9
Impounded Flowing Waters 10

Drainage
Headwater
Lowland

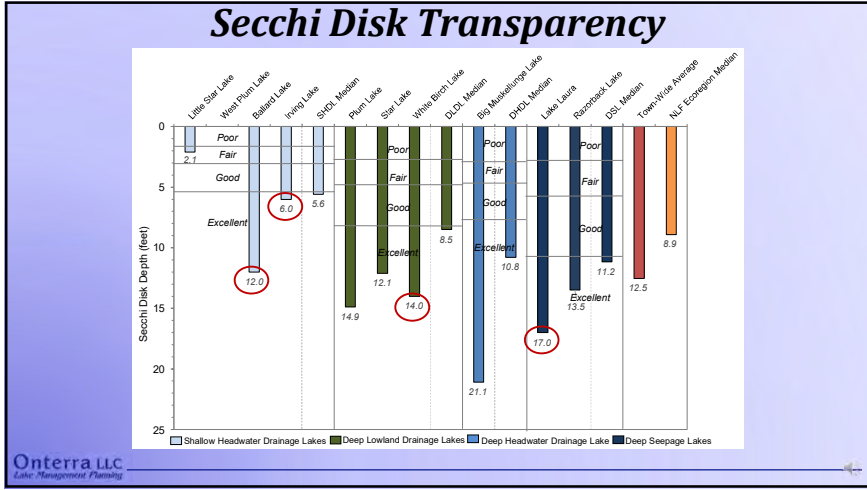
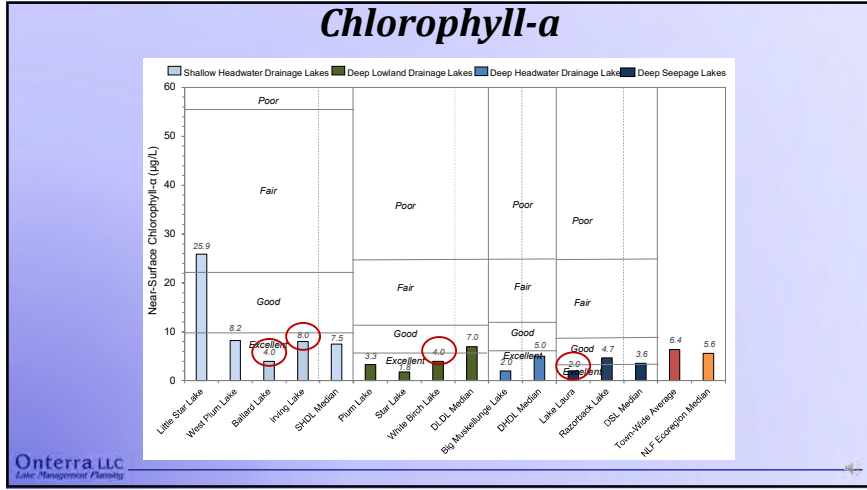
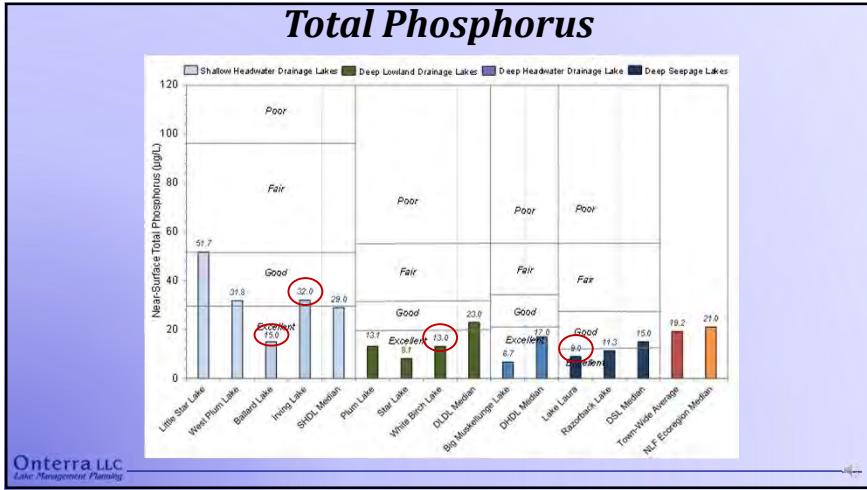
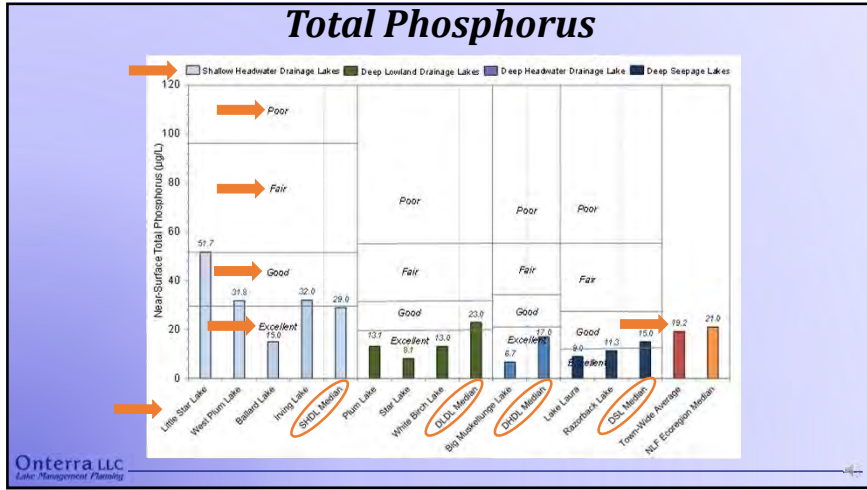
Headwater
Shallow (mixed) 2
Deep (stratified) 3

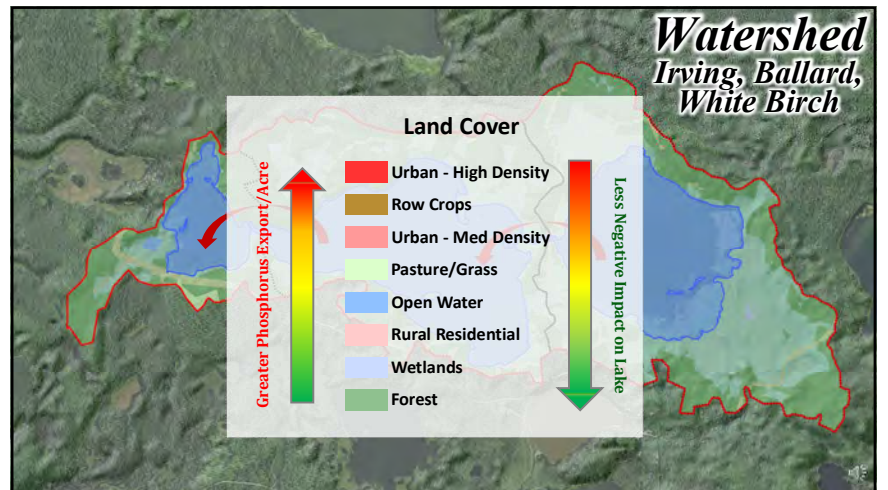
Lowland
Shallow (mixed) 4
Deep (stratified) 5

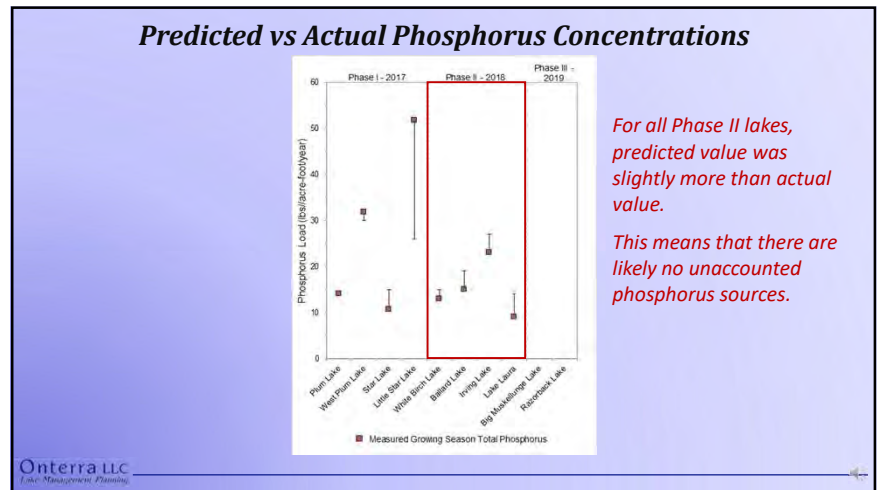
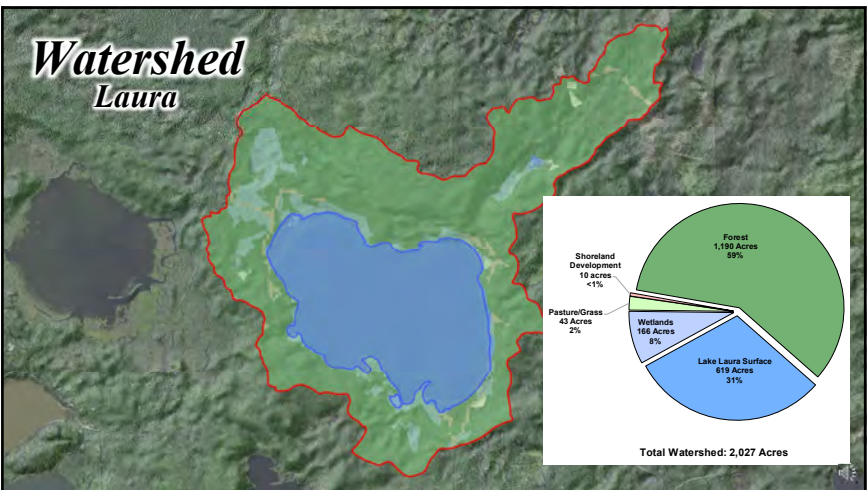
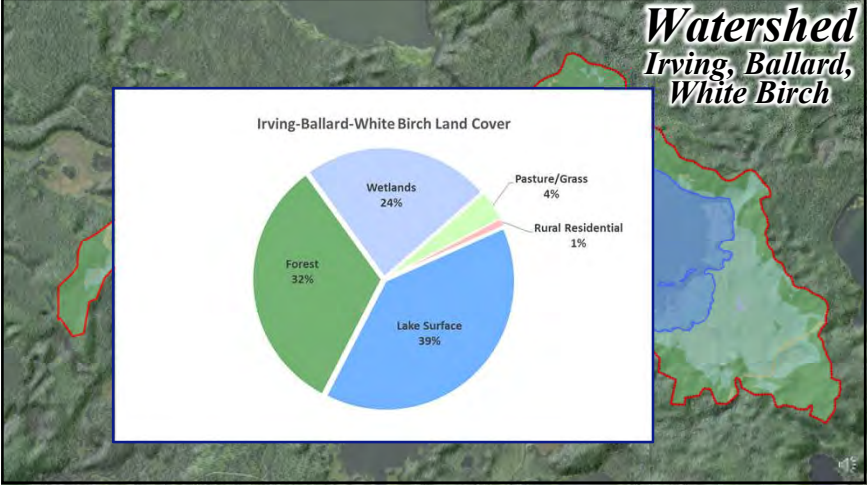
Seepage
Shallow (mixed) 6
Deep (stratified) 7

Ballard & Irving **White Birch** **Laura**

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Lake Management Planning








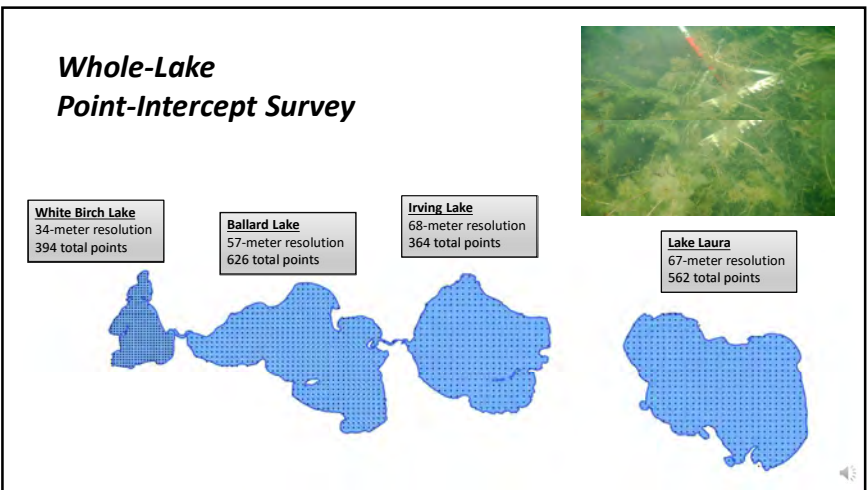


Aquatic Plant Surveys

- Assess both non-native & native species
- Three surveys completed in 2018
 - Early-Season AIS Survey
 - Whole-Lake Point-Intercept Survey
 - Emergent/Floating-Leaf Community Mapping Survey



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Vegetation Analysis Matrices

Floristic Quality Analysis

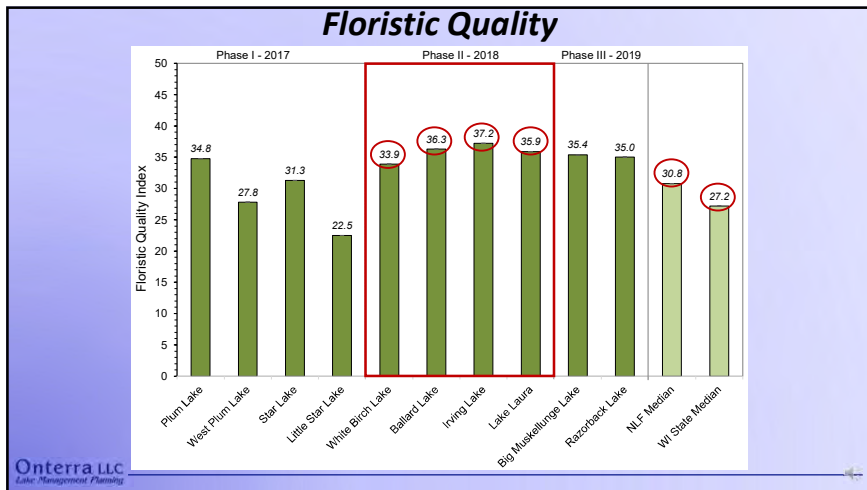
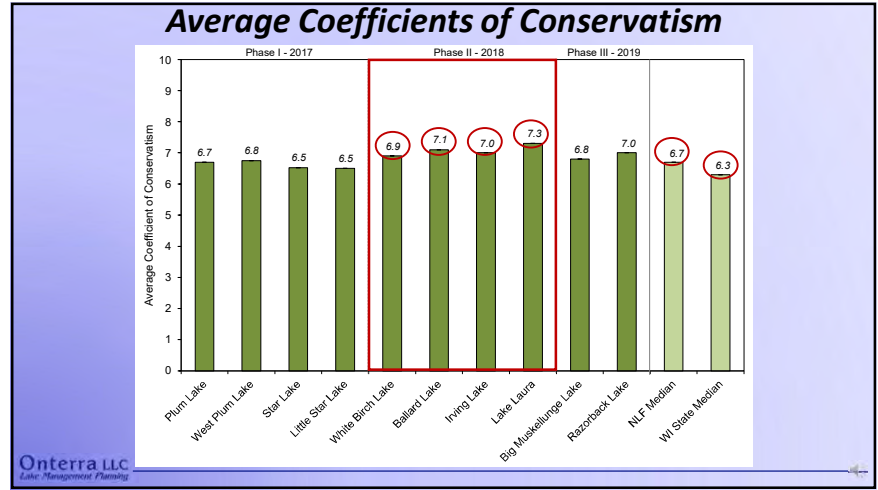
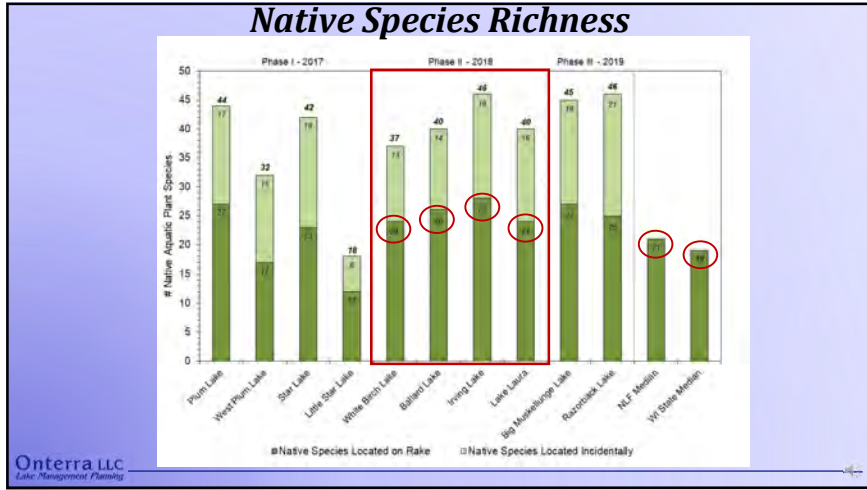
Evaluates the closeness of an area's flora to undisturbed conditions.

$$I = \bar{C} \times \sqrt{N}$$

- I** Floristic Quality Index
- \bar{C}** Average Species Conservatism
1 - 10, higher number requires less disturbed condition
- N** Number of Native Species (Species Richness)
Only species encountered on the rake are used (no incidentals)



Onterra LLC
Lake Management Planning



Town of Plum Lake Implementation Plan

Goal: Maintain Lake Water Quality in the Town of Plum Lake

Action: Monitor water quality through CLMN or town-coordinated program.

Action: Protect forested watersheds of town lakes on state-owned property during timber harvest.

Goal: Prevent Further Introductions & Manage Current AIS in Town Lakes

Action: Continue CBCW inspections at town boat landings.

Action: Coordinate annual volunteer monitoring for AIS in town lakes.


Action: Purchase & install I-LIDS at boat landings within Town of Plum Lake.

Action: Initiate rapid response plan following detection of new AIS in town lake.

Action: Manage Eurasian watermilfoil in Little Star Lake.

Action: Manage existing shoreline/wetland invasive plants in town lakes.

Purple loosestrife - Ballard Phragmites (Giant Reed) - Laura



Town of Plum Lake Implementation Plan

Goal: Preserve & Restore Ecological Integrity of Lakes in the Town of Plum Lake

Action: Educate stakeholders on the importance of shoreland condition and shoreland restoration for lakes of the Town of Plum Lake.

Action: Coordinate with WDNR and private landowners to expand coarse woody habitat in town lakes.

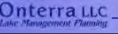
Action: Investigate feasibility of restoring a portion of shoreland area of Plum Lake Golf Club to a more natural condition. (Partly Completed)

Action: Conduct periodic quantitative vegetation monitoring on town lakes.

Action: Coordinate with the Northwoods Land Trust and other public charities to understand options to acquire or preserve undeveloped lakefront property on town lakes.

Action: Monitor tadpole and other wildlife populations in the lakes of the Town of Plum Lakes annually.

Action: Monitor scientific research on spiny water fleas (present in Star and Plum Lake) to determine when a viable treatment option exists and develop a treatment plan for infected lakes.




Town of Plum Lake Implementation Plan

Goal: Increase the Town of Plum Lake’s Capacity to Communicate with Lake Stakeholders and Facilitate Partnerships with Other Management Entities

Action: Promote lake protection and enjoyment through stakeholder education.

Action: Continue the Town of Plum Lake’s involvement with other entities that have responsibilities in managing (management units) town lakes.



Thank You

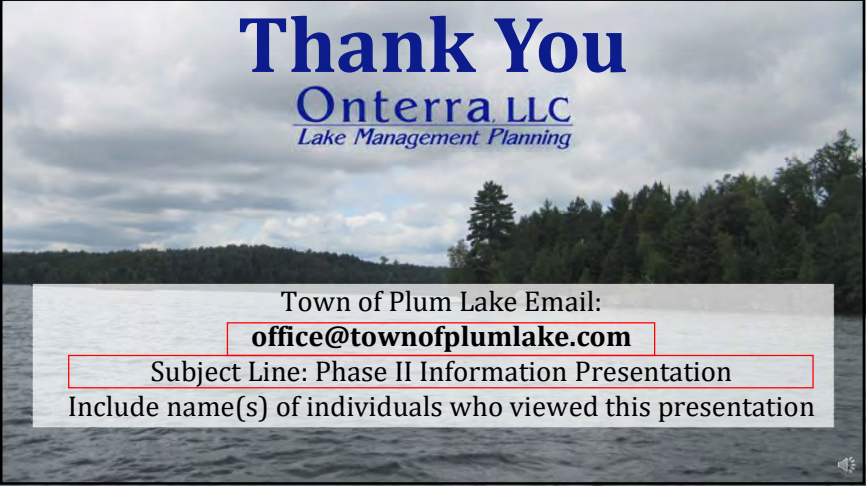
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Town of Plum Lake Email:

office@townofplumlake.com

Subject Line: Phase II Information Presentation

Include name(s) of individuals who viewed this presentation

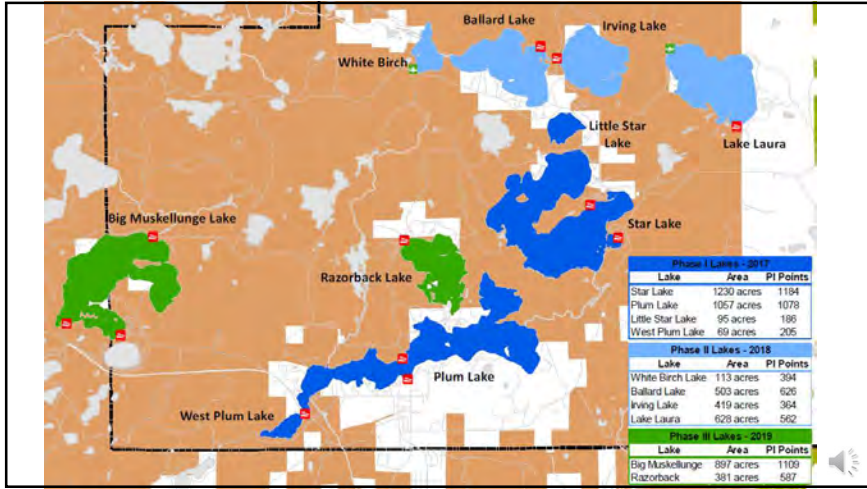




Town of Plum Lake

**Phase III
Management Planning Project
Razorback Lake
Information Presentation
September 2020**

Tim Hoyman, CLM
Onterra LLC
Lake Management Planning



Management Planning Project Overview

Collect and compile information about lake
*Includes both environmental & sociological data
Historical & current information
Past management actions*

Create a realistic and implementable management plan
*Challenges facing lake and lake group
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators*



Onterra LLC
Lake Management Planning

Summary Results for Razorback Lake

Overarching Conclusion: Razorback Lake is ecologically healthy.

Water Quality

- Razorback Lake has excellent water quality as expected for its lake type.
- Basically no historical data exists, making long-term trends analysis impossible.

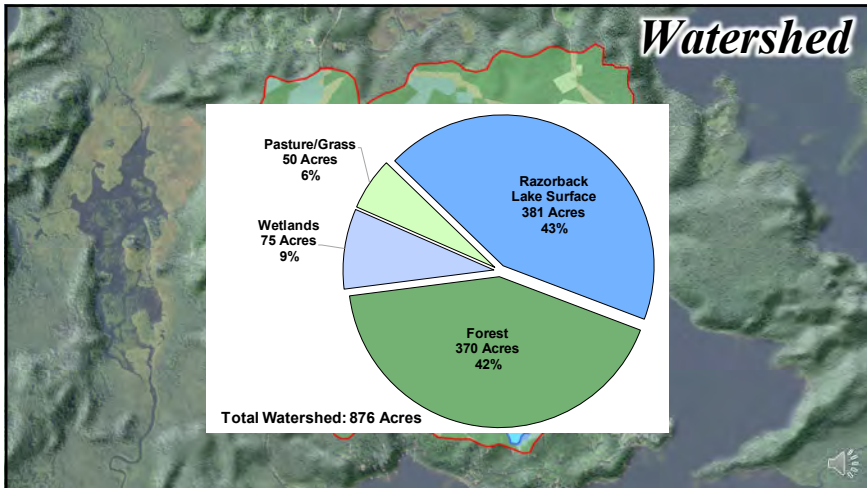
Watershed & Immediate Shoreline

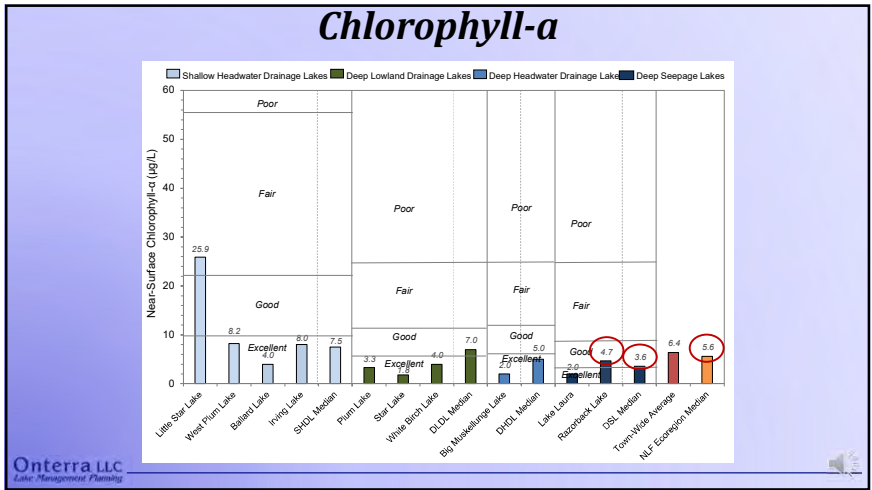
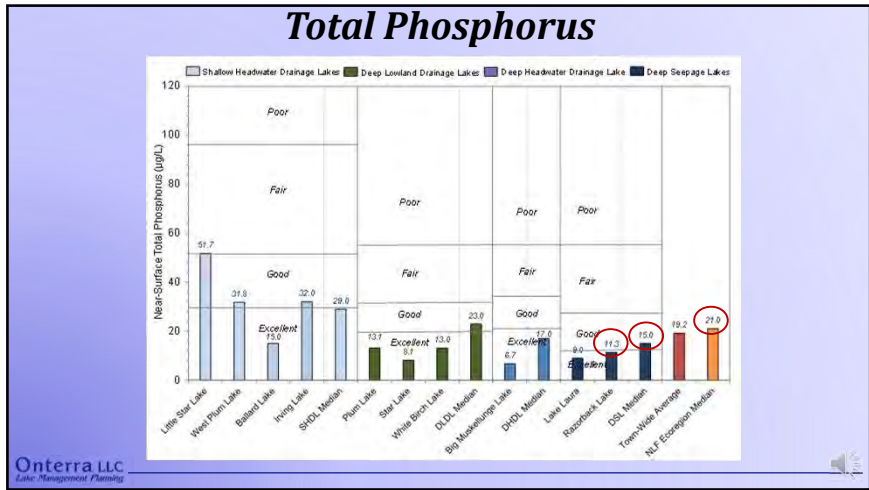
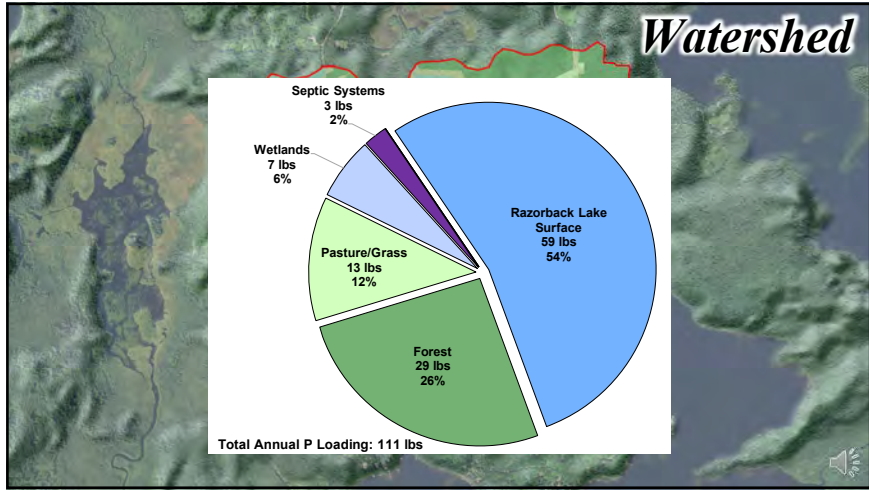
- Watershed is small and in excellent shape and is responsible for water quality.
- Razorback Lake has vast areas with little or no shoreland development.

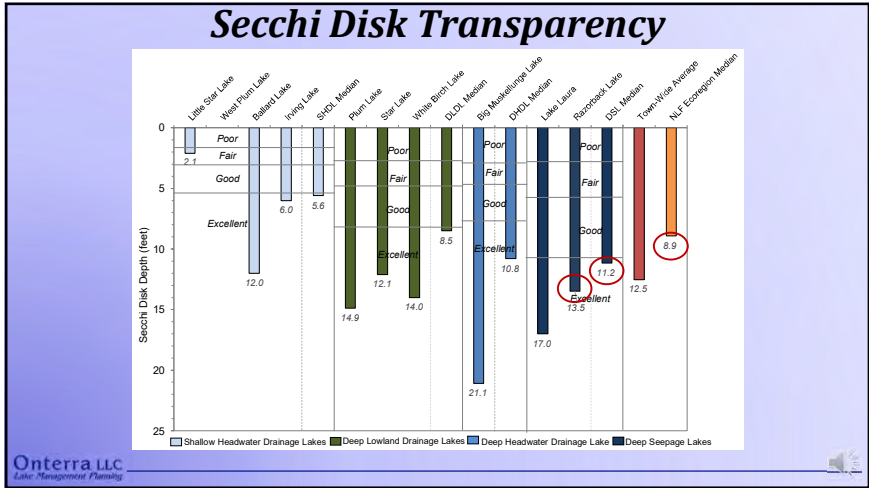
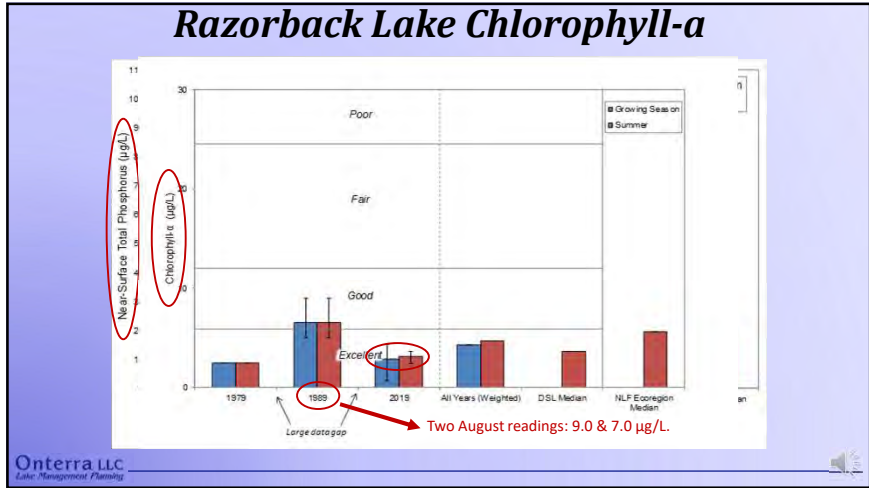
Aquatic Plant Community

- Aquatic plant community is as expected and indicates that lake is healthy.
- No Eurasian watermilfoil or curly-leaf pondweed were found during surveys, but two emergent species, reed canary grass and narrow-leaved cattail were mapped on the Razorback Lake shoreline during the surveys.

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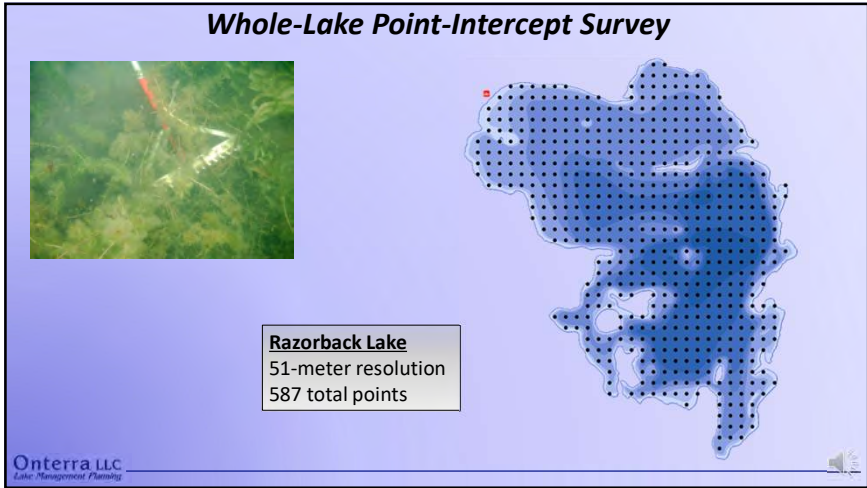






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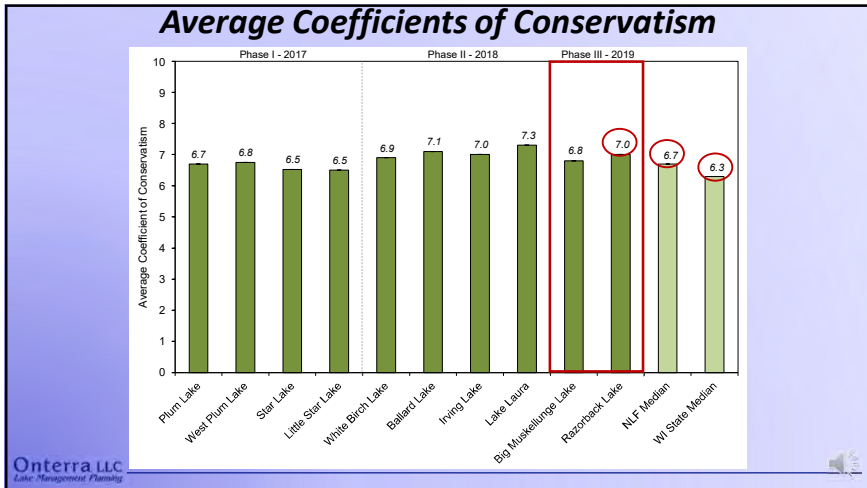
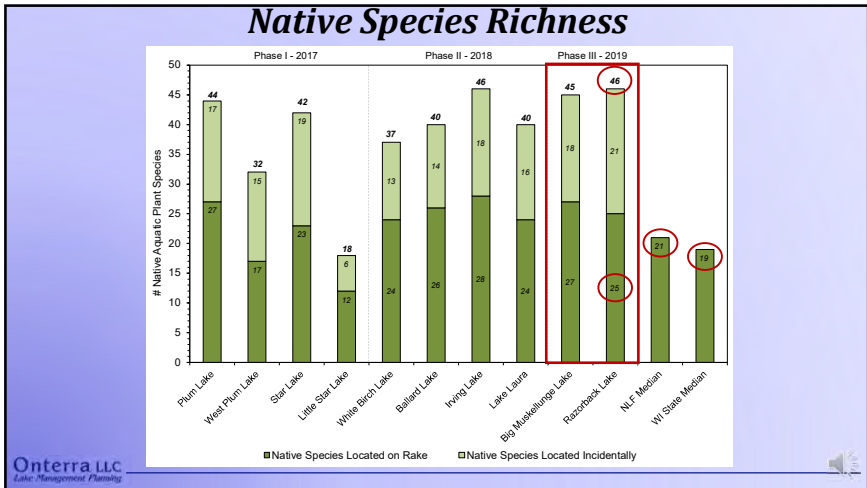
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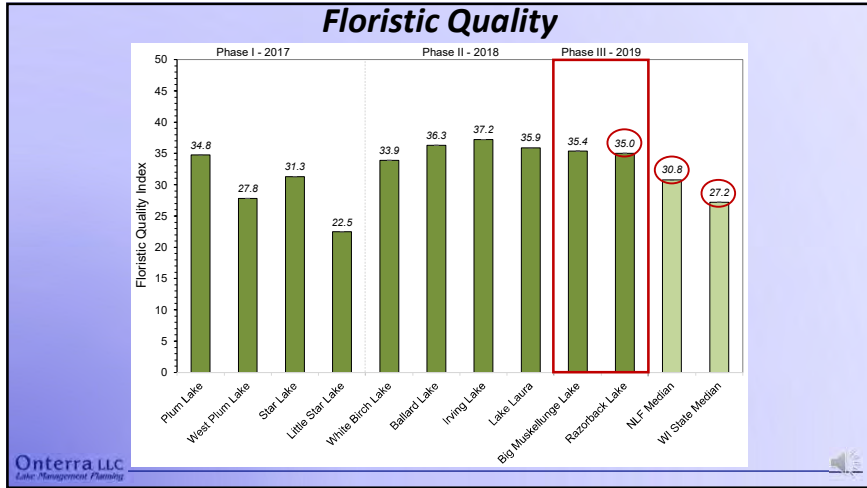
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