Management Planning Project Overview

- Foster holistic understanding of Phillips Chain ecosystem
- Collect & analyze data
  - Technical & sociological
- Construct long-term & useable plan
  - Living plan subject to revision over time
- Onterra's role is to provide technical direction
  - Not really recommendations

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Comprehensive Management Plan Outline

- 1.0 Introduction
- 2.0 Stakeholder Participation
- 3.0 Study Results
  - 3.1 Water Quality
  - 3.2 Watershed
  - 3.3 Shoreland Condition
  - 3.4 Aquatic Plants
  - 3.5 AIS
  - 3.6 Fishery
- 4.0 Summary & Conclusions
- 5.0 Implementation Plan
- 6.0 Methods
- 7.0 Literature Cited

Plan Mtg I

- 8.0 Individual Lake Sections
  - 8.X.0 Introduction
  - 8.X.1 Water Quality
  - 8.X.2 Watershed Assessment
  - 8.X.3 Shoreland Condition
  - 8.X.4 Aquatic Vegetation

Plan Mtg I

Planning Meeting II

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Management Planning Project Overview

Collect and compile information about Phillips Chain Waters

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

Planning Meeting I
Report Sections

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 II
Implementation Plan

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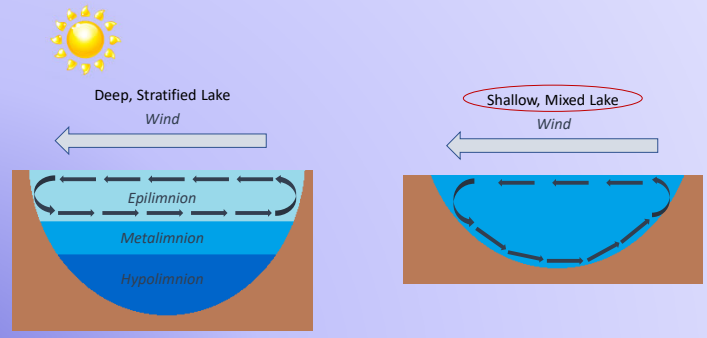
Wisconsin Lakes Classification



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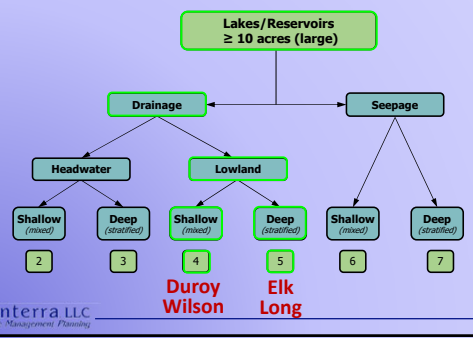
Natural Community Types

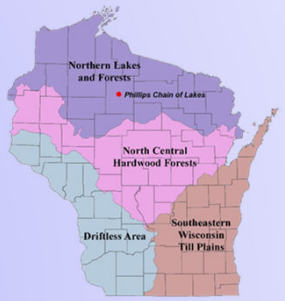
Categorization of lakes with similar features that influence water quality

With exception of Wilson, Phillips Chain are considered *impounded flow waters*



Ecoregions

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



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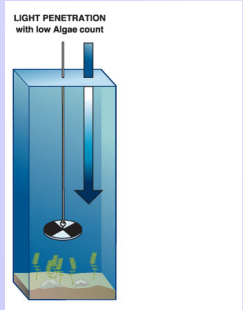
Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human 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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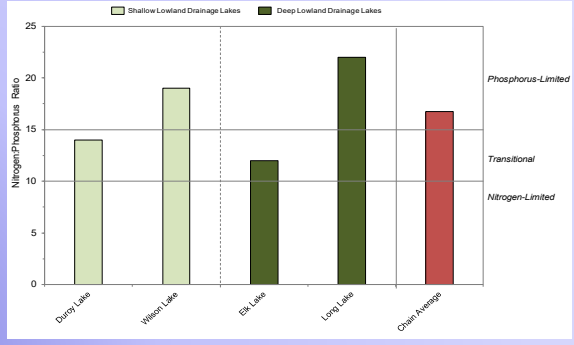
Phillips Chain Water Quality

Limiting Nutrient



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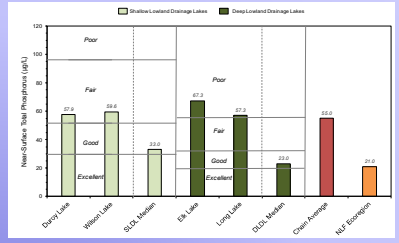
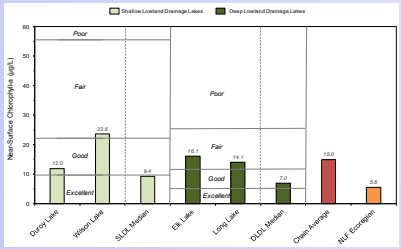
Phillips Chain Water Quality

Near-Surface Total Phosphorus



Total Phosphorus fall in the *fair* to *poor* categories

Chlorophyll-a



Chlorophyll-a fall in the *fair* to *good* categories

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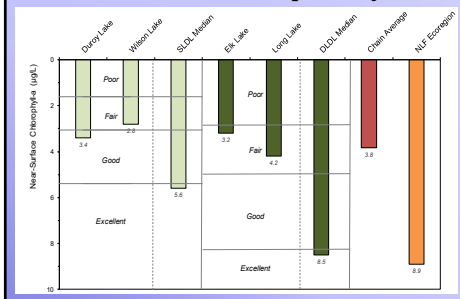
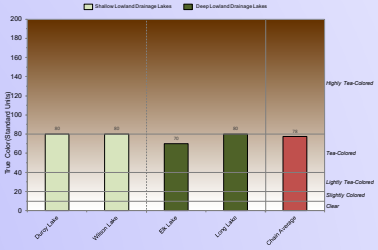
Phillips Chain Water Quality

Secchi Disk Transparency





Secchi Disk in the *fair* to *good* categories

Greatly impacted by organic acids (staining)

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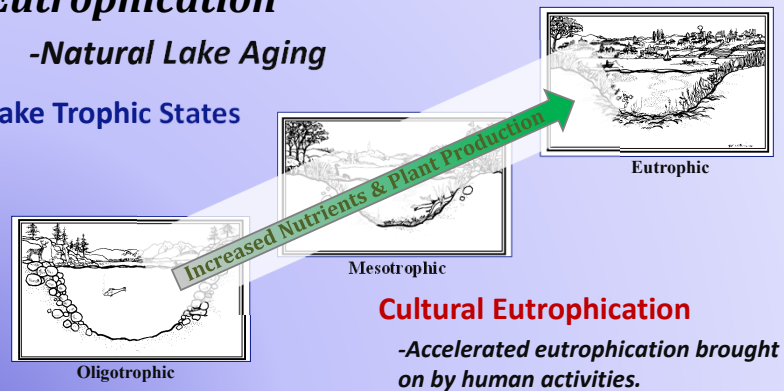
Eutrophication

-Natural Lake Aging

Lake Trophic States



Cultural Eutrophication

-Accelerated eutrophication brought on by human activities.

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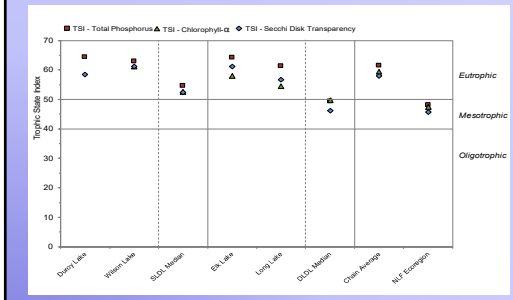
Phillips Chain Water Quality



Trophic State Index

A method to relate the trophic parameters – phosphorus, chlorophyll-a, and Secchi transparency, and understand the trophic lake of a lake.

All lakes considered Eutrophic

Residence time is short, so minimal nutrient settling occurs – function more as a river than as a lake.

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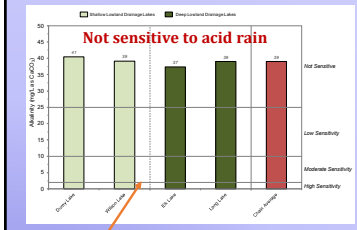
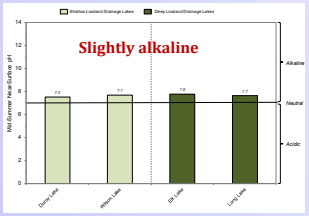
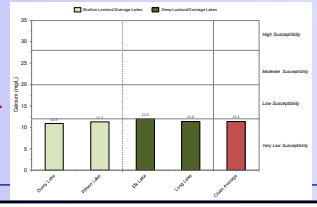
Additional Water Quality Parameters



Spring alkalinity



Calcium is likely too low for ZM population establishment. pH is ideal for ZMs (7-9)



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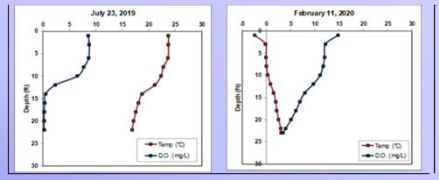
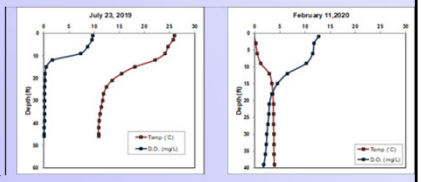
Oxygen and Temperature

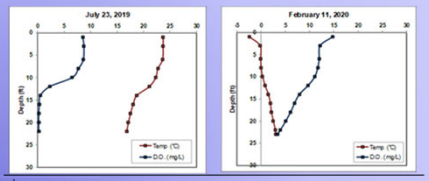
DUROY LAKE



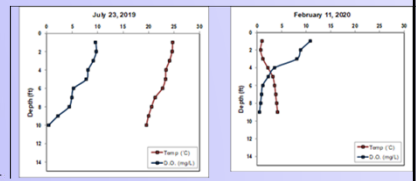
LONG LAKE



ELK LAKE



WILSON LAKE



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Algae Issues

Large areas of cladophora on Wilson Lake in 2019

Localized blue-green algae blooms in some years (picture from Late-August 2013)

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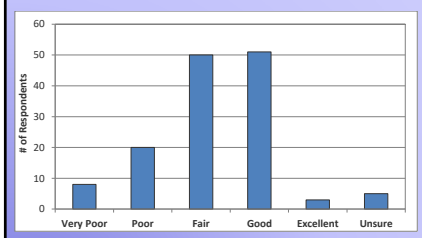
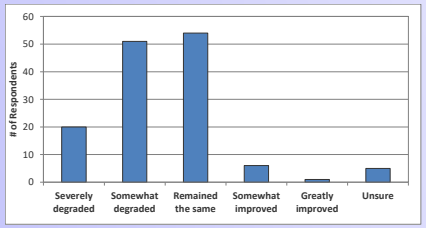
Stakeholder Perceptions of Water Quality

35% Response Rate

How would you describe the current water quality of Phillips Chain?



How has water quality changed in Phillips Chain since you first visited the lake?



~56% of stakeholder survey respondents indicated that *water clarity (clearness of water)* is the single most important aspect when considering water quality, whereas aquatic plant growth was most important to ~72% of respondents (Appendix B Question #21).

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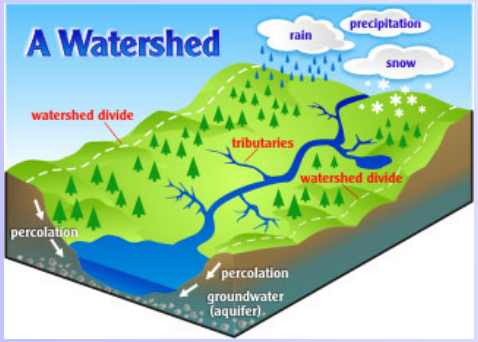
Watershed

- Geographic area within which all water drains to a common point



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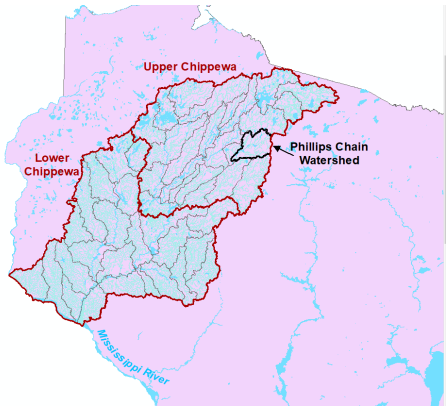
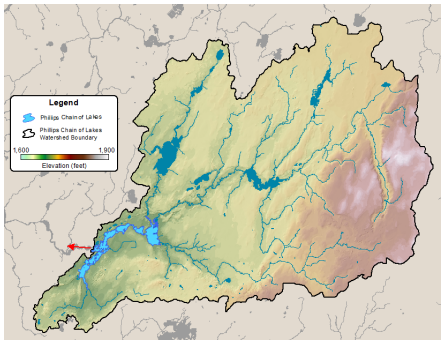
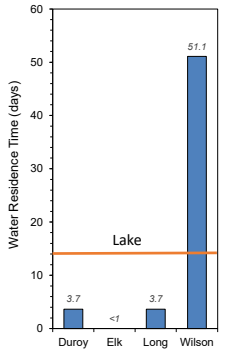
Upper & Lower Chippewa Watersheds



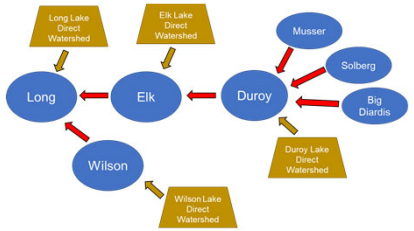
Phillips Chain Watershed



127,288 acres or 199 sq. miles

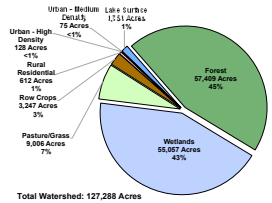


Phillips Chain Watershed Modeling

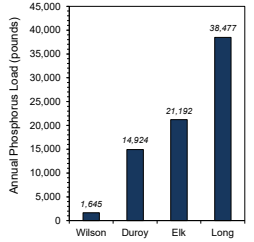


Sub-watersheds & direct watersheds

Landcover of Entire WS



Total Watershed: 127,288 Acres



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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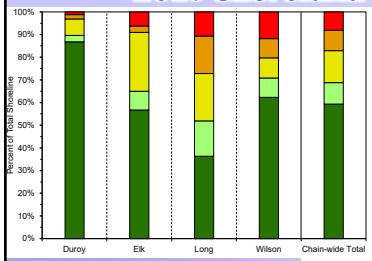
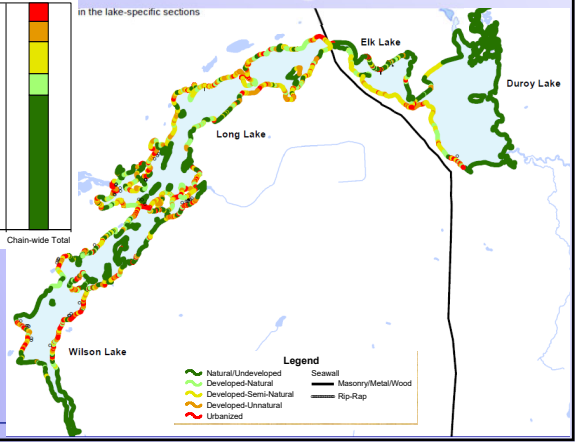
2019 Shoreland Condition Survey Results





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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 Mid Lake

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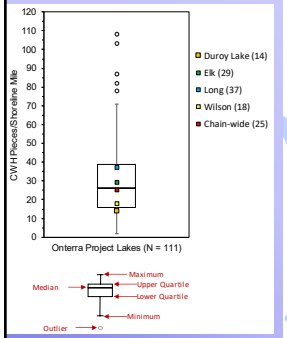
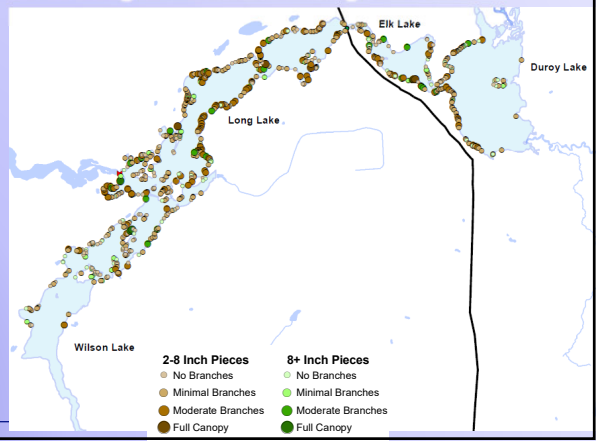
2019 Coarse Woody Habitat Survey Results





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Aquatic Plant Surveys

- Determine changes in plant community from past surveys
- Assess both native and non-native populations
- Numerous surveys used in assessment
  - Whole-Lake Point-Intercept Surveys
  - EWM Mapping Surveys
  - Emergent/Floating-Leaf Community Mapping Survey

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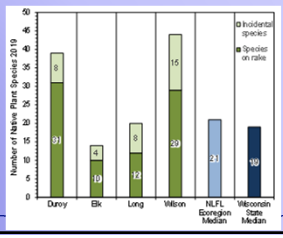
Aquatic Plant Surveys

- **53 total species found during point-intercept and/or community mapping survey**
  - 6 non-native
  - 2 special concern
  - Northern wild rice



Scientific Name	Common Name	Status in Wisconsin	Coefficient of Conservatism	Growth Form	Duroy 2019	Elk 2019	Long 2019	Wilson 2019
Bidens beckii	Water marigold	Native	8	S	X		X	
Brasenia schreberi	Watershield	Native	7	FL	I	I		X
Calla palustris	Water arum	Native	9	E	X			I
Callitriche hermaphroditica	Autumnal water starwort	Native - Special Concern	9	S	X			
Callitriche palustris	Common water starwort	Native	8	S	I			
Carex utriculata	Common yellow lake sedge	Native	7	E				I
Ceratophyllum demersum	Coontail	Native	3	S	X	X	X	X
Ceratophyllum echinatum	Spiny hornwort	Native	10	S	X			X
Chara spp.	Muskgrasses	Native	7	S	X			X
Eleocharis palustris	Creeping spikerush	Native	6	E	X			I
Elodea canadensis	Common waterweed	Native	3	S	X	X	X	X
Elodea nuttallii	Slender waterweed	Native	7	S	X			X
Glyceria canadensis	Rattlesnake grass	Native	7	E				I
Iris pseudacorus	Pale-yellow iris	Non-Native - Invasive	N/A	E			I - P	
Iris versicolor	Northern blue flag	Native	5	E			I - P	
Lemna turionifera	Turion duckweed	Native	2	FF		I		I
Lythrum salicaria	Purple loosestrife	Non-Native - Invasive	N/A	E				I
Myriophyllum heterophyllum	Various-leaved watermilfoil	Native	7	S	X	X		X
Myriophyllum sibiricum	Northern watermilfoil	Native	7	S	X			
Myriophyllum spicatum	Eurasian watermilfoil	Non-Native - Invasive	N/A	S	X	I		X
Myriophyllum verticillatum	Whorled watermilfoil	Native	8	S			X	
Najas flexilis	Slender naiad	Native	6	S	X		X	X
Nitella spp.	Stoneworts	Native	7	S	X	X	X	X
Nuphar variegata	Spatterdock	Native	6	FL	X		X	X
Nymphaea odorata	White water lily	Native	6	FL	X	X	X	X
Phalaris arundinacea	Reed canary grass	Non-Native - Invasive	N/A	E				I
Pontederia cordata	Pickerelweed	Native	9	E	X	I	I	
Potamogeton amplifolius	Large-leaf pondweed	Native	7	S	X			X
Potamogeton berchtoldii	Slender pondweed	Native	7	S	X		X	X
Potamogeton crispus	Curly-leaf pondweed	Non-Native - Invasive	N/A	S	X			X
Potamogeton epihydrus	Ribbon-leaf pondweed	Native	8	S	X	X	X	X
Potamogeton foliosus	Leafy pondweed	Native	6	S	X			X
Potamogeton natans	Floating-leaf pondweed	Native	5	S	X			X
Potamogeton obtusifolius	Blunt-leaved pondweed	Native	9	S	X			X
Potamogeton pusillus	Small pondweed	Native	7	S	X			X
Potamogeton robbinsii	Fern-leaf pondweed	Native	8	S	X	X	X	X
Potamogeton spirillus	Spiral-fruited pondweed	Native	8	S	X	X	X	
Potamogeton vaseyi	Vasey's pondweed	Native - Special Concern	10	S	I			X
Potamogeton zosteriformis	Flat-stem pondweed	Native	6	S	X			X
Riccia fluitans	Slender riccia	Native	7	FF	I			X
Sagittaria latifolia	Common arrowhead	Native	3	E	I			I
Sagittaria rigida	Stiff arrowhead	Native	8	E				I
Sagittaria spp. (rosette)	Arrowhead spp. (rosette)	Native	N/A	S				X
Schoenoplectus tabernaemontani	Softstem bulrush	Native	4	E	I		I	X
Scirpus cyperinus	Wool grass	Native	4	E			I	I
Sparganium emersum var. acaule	Short-stemmed bur-reed	Native	8	FL/E	X			I
Sparganium eurycarpum	Common bur-reed	Native	5	E	X			I
Sparganium fluctuans	Floating-leaf bur-reed	Native	10	FL	X		I	I
Sparganium sp.	Bur-reed sp.	Native	N/A	FL/E		I	I	I
Spirodela polyrhiza	Greater duckweed	Native	5	FF	I			X
Stuckenia pectinata	Sago pondweed	Native	3	S				X
Typha angustifolia	Narrow-leaved cattail	Non-Native - Invasive	N/A	E				I
Typha spp.	Cattail spp.	N/A	N/A	E		I	I	I
Utricularia vulgaris	Common bladderwort	Native	7	S	X			X
Vallisneria americana	Wild celery	Native	6	S				X
Zizania palustris	Northern wild rice	Native	8	E	X			I

FL = Floating Leaf; FL/E = Floating Leaf and Emergent; FF = Free Floating; S= Submergent; E = Emergent
X = Located on rake during point-intercept survey; I = Incidental Species, P = Probable but ID not confirmed

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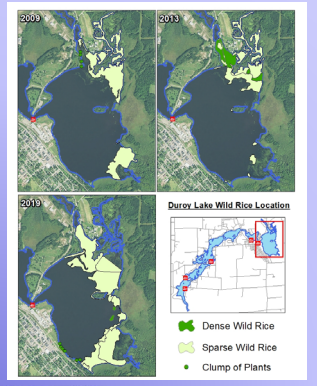
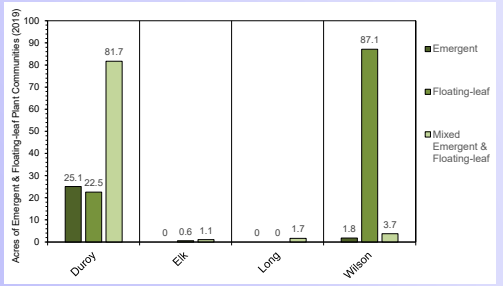
Community Mapping Surveys





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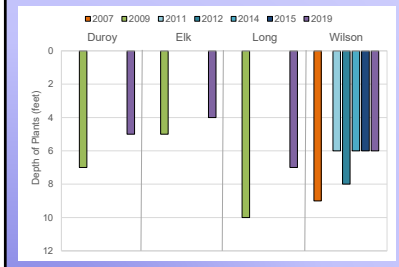
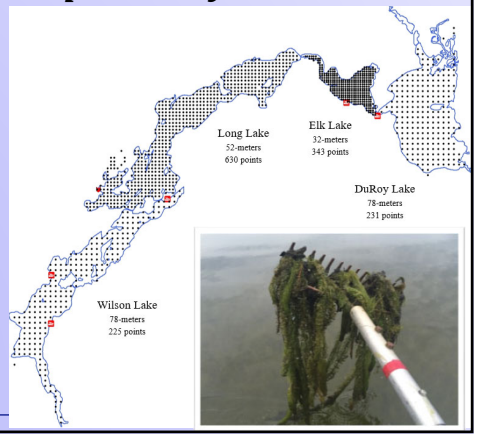
Point-Intercept Surveys





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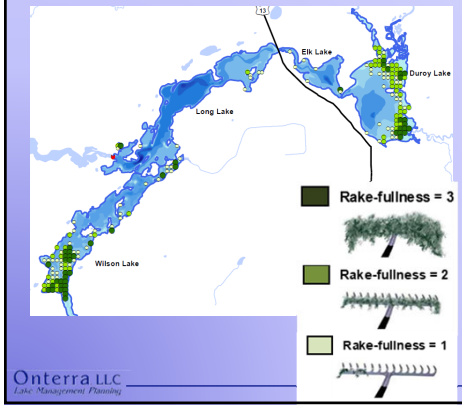
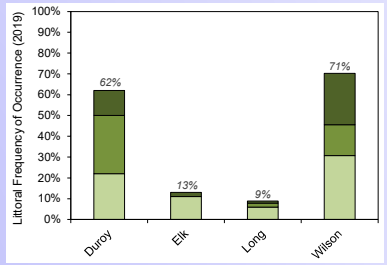
Point-Intercept Surveys





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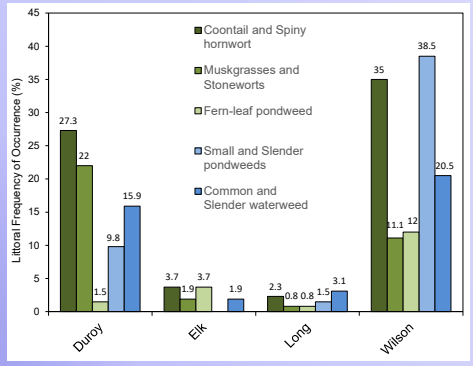
Point-Intercept Surveys



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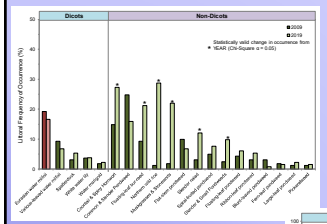
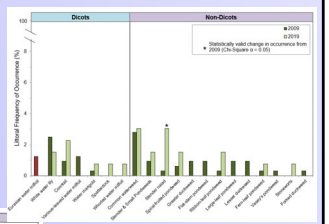
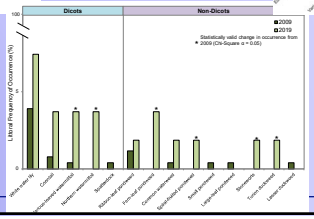
Vegetation Trend Analysis



Elk
- **6 statistically valid increases**



Duroy
- **6 statistically valid increases**



Long
- **1 statistically valid increase**

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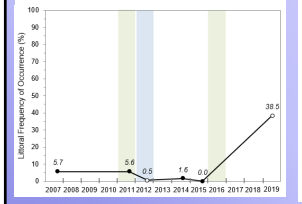
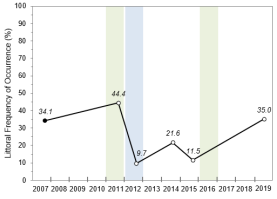
Vegetation Trend Analysis

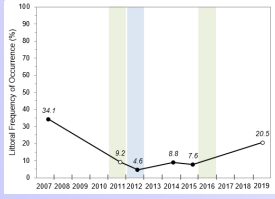
Small & slender pondweeds (Potamogeton pusillus & P. berchtoldii)



Coontail & Spiny hornwort (Ceratophyllum demersum and C. echinatum)



Common & Slender waterweeds (Elodea canadensis & E. nuttallii)



Wilson
- **Management history impacting populations**
- **Natural variability higher, more-typical of true "lake"**

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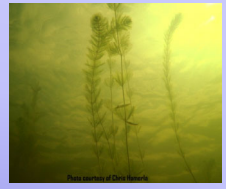
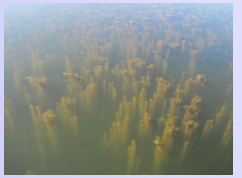
Professional AIS Mapping





Point-Based Mapping
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Polygon-Based Mapping
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

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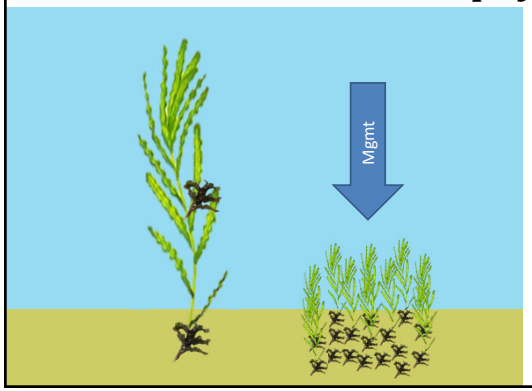
Non-Native Aquatic Plants
Curly-Leaf Pondweed

- **First officially documented in 2013**
- **Need to rely on mapping data, as CLP senescence occurs before point-intercept surveys**

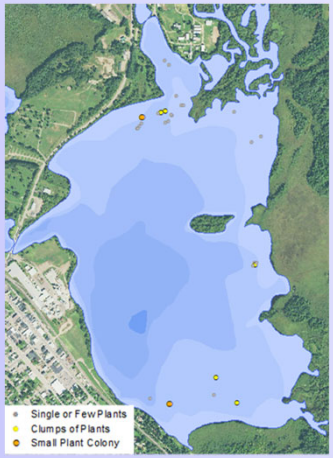
CLP Life-Cycle & Control Strategy Philosophy



- Established populations typically have 5-10 years of viable turions in sediment
- Unless documented ecological impacts, established populations not targeted for lake-wide management
- Dies off around July 4th

CLP Population

- June 2019 Survey Results



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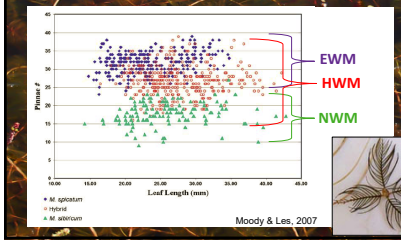
Non-Native Aquatic Plants

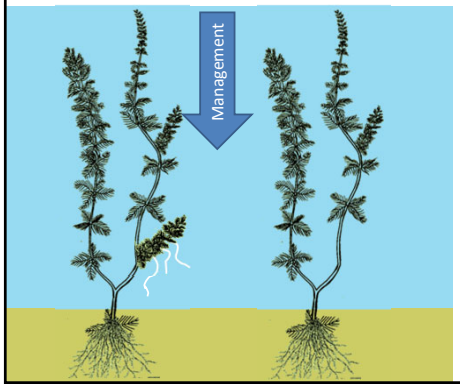
Eurasian Watermilfoil

- First "officially" documented in 2000.
- Only pure-strain EWM documented



Moody & Les, 2007

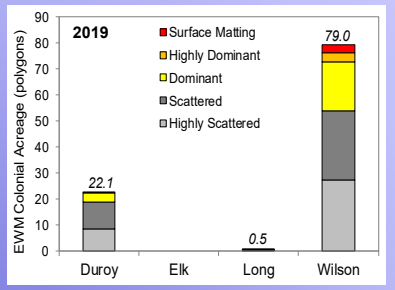
EWM Life-Cycle & Control Strategy Philosophy



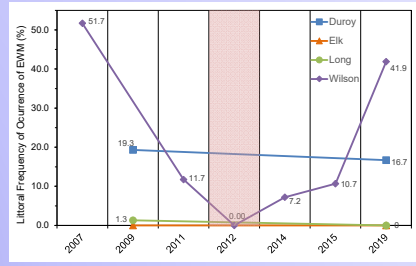
- Strategy is straight-forward compared to CLP management
- Herbicide needs to translocate to root crown (*hard to kill with herbicides*)
- Hand-harvesting is analogous to single treatment (*extremely time intensive)*
- Winter drawdown can be effective if completely de-water and desiccate/freeze roots.

EWM Population

LSAIS Mapping Survey



Point-Intercept Survey



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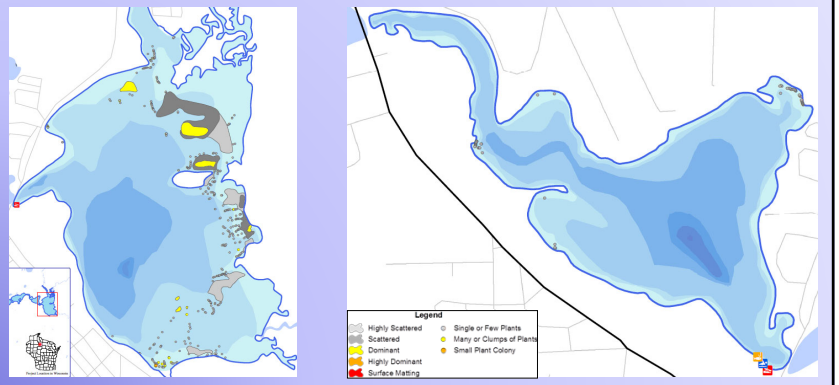
2019 EWM Population



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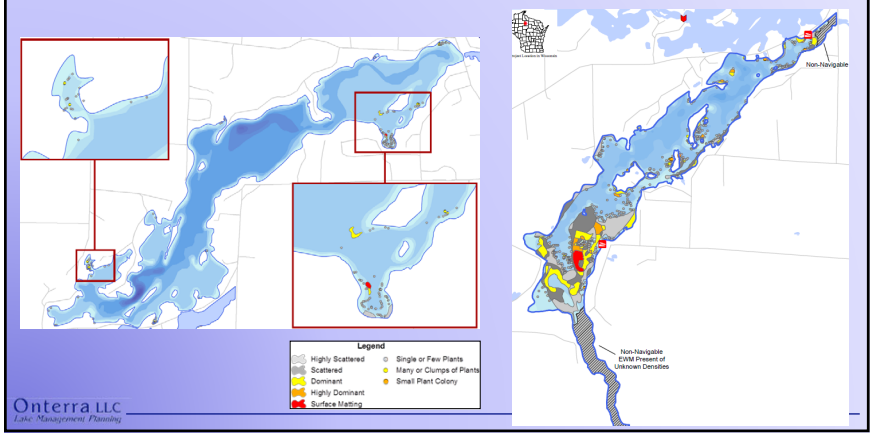
2019 EWM Population



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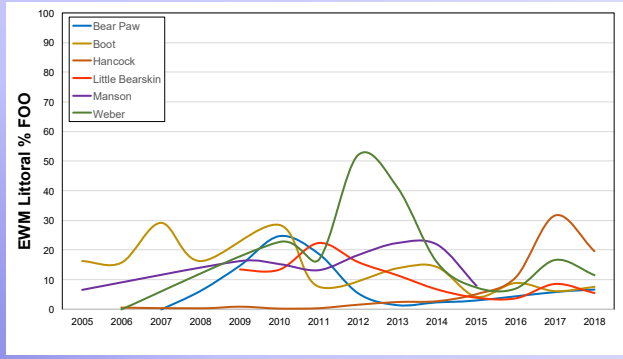
WDNR EWM Long-Term Monitoring Trends

NLF Ecoregion – Unmanaged



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AIS Management Perspectives

1. **No Coordinated Active Management (Let Nature Take its Course)**
   - Focus on education of manual removal by property owners
2. **Reduce AIS Population on a lake-wide level (Population Management)**
   - Would likely rely on herbicide treatment and/or winter drawdown (risk assessment)
   - Will not "eradicate" AIS
   - Set triggers (thresholds) of implementation and tolerance
3. **Minimize navigation and recreation impediment (Nuisance Control)**
   - May be accomplished through herbicide treatment, hand-harvesting, or mechanical harvesting

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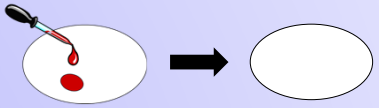
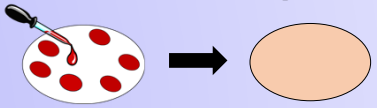
Ecological Definitions of Herbicide Treatment

Spot Treatment: Herbicide applied at a scale where dissipation will not result in significant lake wide concentrations; impacts are anticipated to be localized to in/around application area.



Whole-Lake Treatment: Herbicide applied at a scale where dissipation will result in significant lake wide concentrations; impacts are anticipated to be on a lake wide scale.



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2015 Treatment on Loon Lake

- **Diquat (2 gallons per surface acre of application area)**
- ~24 acres of 305 acre lake (7.8%)
- Tracer Dye (Rhodamine WT) Survey

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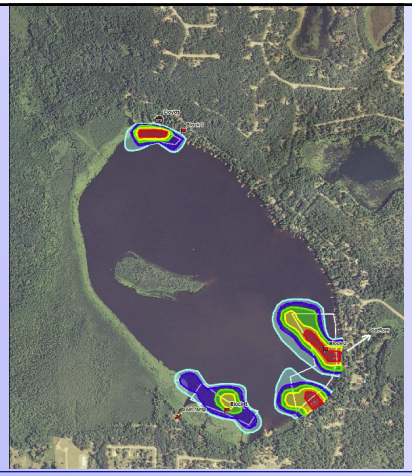
1 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



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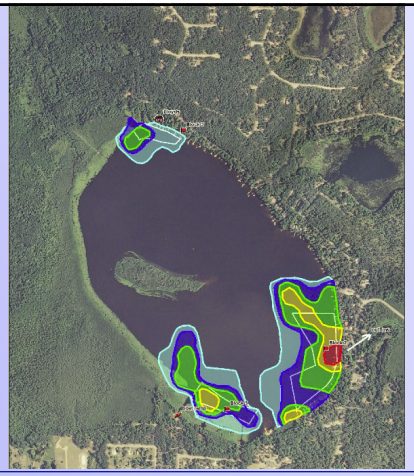
2.5 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



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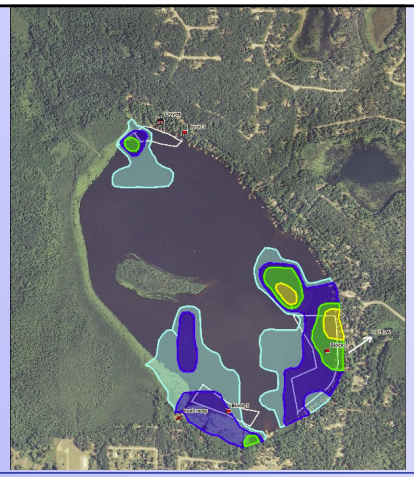
4 HAT

75-100%
50-75%
25-50%
10-25%
5-10%



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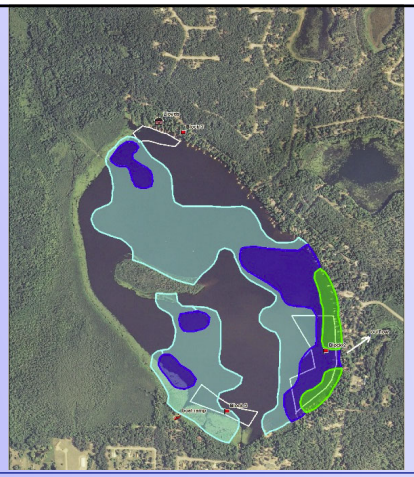
6 HAT

75-100%
50-75%
25-50%
10-25%
5-10%

If apply 2,4-D at 4.0 ppm, 5-10% would be 0.2 - 0.4 ppm



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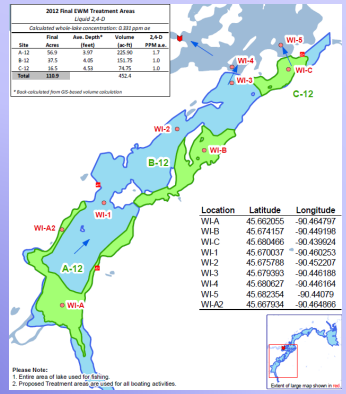
2012 Whole-Lake Treatment

2012 Final EWM Treatment Areas
Liquid 2,4-D

Calculated whole-lake concentration: 0.331 ppm ae

Site	Final Acres	Ave. Depth* (feet)	Volume (ac-ft)	2,4-D PPM a.e.
A-12	56.9	9.97	225.90	1.7
B-12	37.5	4.05	151.75	1.0
C-12	10.5	4.53	74.75	1.0
Total	118.9		452.4	

* Back-calculated from GIS-based volume calculation



Location	Latitude	Longitude
WI-A	45.662055	-90.464797
WI-B	45.674157	-90.449198
WI-C	45.680466	-90.439924
WI-1	45.670037	-90.460253
WI-2	45.675798	-90.452267
WI-3	45.679393	-90.446188
WI-4	45.680627	-90.446164
WI-5	45.682354	-90.44079
WI-A2	45.667034	-90.464866

Figure 3
Wilson Lake 2,4-D Concentrations, 2012

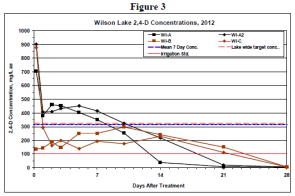
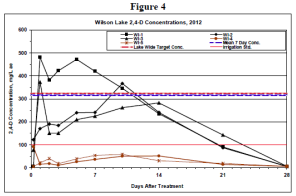


Figure 4
Wilson Lake 2,4-D Concentrations, 2012



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2019 Treatment Discussions

Question 34. How do you feel about the past use of herbicides to treat EWM in previous years?

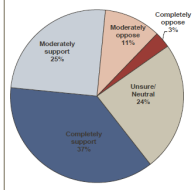


Figure 3.4-18. Select survey responses from the Phillips Chain Stakeholder Survey. Additional questions and response charts may be found in Appendix B.

Question 35. What concerns, if any, do you have for the future use of the following techniques to target EWM in the Phillips Chain

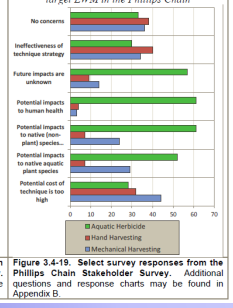


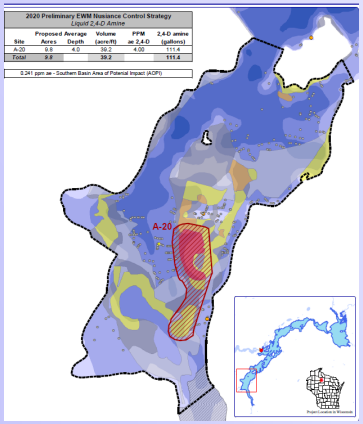
Figure 3.4-19. Select survey responses from the Phillips Chain Stakeholder Survey. Additional questions and response charts may be found in Appendix B.

35% Response Rate

2020 Preliminary EWM Nuisance Control Strategy
Liquid 2,4-D Amine

Site	Proposed Acres	Average Depth	Volume (acre-ft)	PPM ae 2,4-D	2,4-D amine (gallons)
A-20	9.8	4.0	39.2	4.00	111.4
Total	9.8		39.2		111.4

0.241 ppm ae - Southern Basin Area of Potential Impact (ACP)



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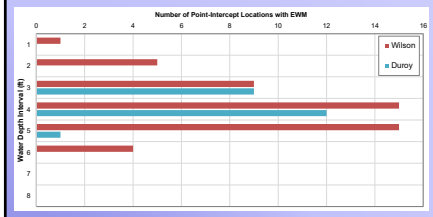
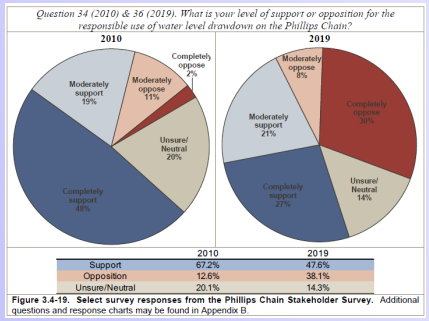
Winter Drawdown





	2010	2019
Support	67.2%	47.6%
Opposition	12.6%	38.1%
Unsure/Neutral	20.1%	14.3%

Figure 3.4-19. Select survey responses from the Phillips Chain Stakeholder Survey. Additional questions and response charts may be found in Appendix B.

35% Response Rate

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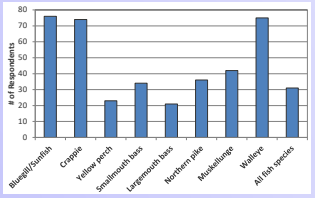
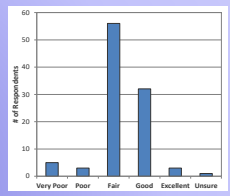
Stakeholder Perceptions of Fisheries

22.5% Response Rate

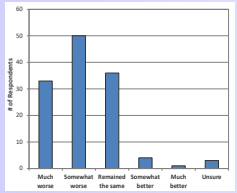
What species of fish do you like to catch on Phillips Chain?



How would you describe the current quality of fishing on Phillips Chain?



How has the quality of fishing changed on Phillips Chain since you started fishing the lake?



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Fisheries Data

Walleye	From 2008-2014, Duroy Lake population increased, Elk Lake remained unchanged, Wilson Lake & Long Lake declined.
Muskellunge	A2 chain which means the waterbody has the capabilities of producing consistent angling action and the potential to harbor trophy sized fish
Northern Pike	Considered common, w/ increase in size & density from 2008 to 2014
Bass	Smallmouth and largemouth are present, w/ smallmouth under preforming
Panfish	Bluegill objectives for moderate density achieved in all but Wilson (higher density). Yellow perch were moderately abundant (no goals), Black crappie populations increasing (goal of moderate density)

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4.0 Brief Initial Conclusions

Water Quality, Watershed, Shoreland

- Huge watershed, but in relatively good condition
- Largely functions as a river (except Wilson), so comparable analysis is not that helpful
- Shoreland protection and enhancement important to long-term health, particularly for habitat

Aquatic Plants

- Native plant increases in Elk River waterbodies, changes in response to EWM and management in Wilson Lake.
- AIS (EWM, CLP, PL, PYI) monitoring & management strategy needs to be updated

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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
3. Send potential report section edits and questions to Onterra

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Thank You

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