A

APPENDIX A

Public Participation Materials

Presentation Outline

- Introduction to Lake Ecology
- Current Lake Project
  - Goals
  - Components
  - Process

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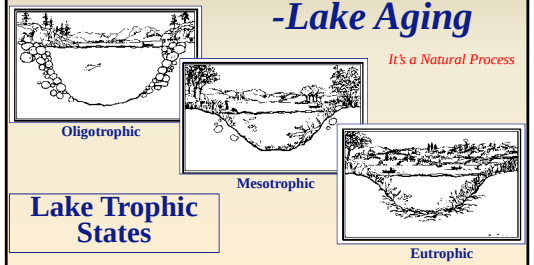
Introduction to Lake Ecology

General Lake Ecology

Eutrophication -Lake Aging

It's a Natural Process



Lake Trophic States

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General Lake Ecology

Cultural Eutrophication

Accelerated eutrophication caused by human activity.

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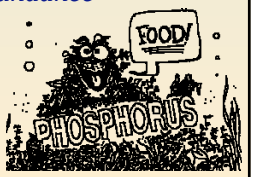
General Lake Ecology

Phosphorus

- *Limiting Nutrient*
- *Controls Plant Abundance (Productivity)*
  - *Algae*
  - *Macrophytes*

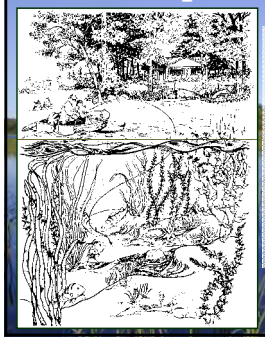


General Lake Ecology

Aquatic Plants (macrophytes)

- *Native Plants*
- *Exotic Plants (non-native)*

Native Aquatic Plants



- Base of the Food Web
- Cover (not only fish)
- Nursery
- Sediment Stabilization

General Lake Ecology

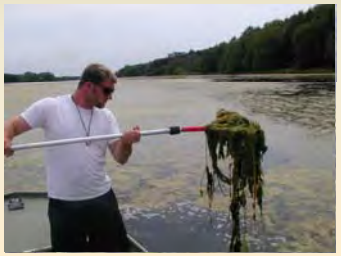
Non-native Aquatic Plants

Curly-leaf Pondweed

General Lake Ecology

Non-native Aquatic Plants

Eurasian Water Milfoil



General Lake Ecology

Consequences of Exotics

- Competition with Natives
  - Monotypic Community
- Decreased Recreational Value
- Decreased Property Value

Current Project

Study and Plan Goals

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

A goal without a plan is just a wish.

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Current Project

Study Components

- Public Participation
- Watershed Modeling
- Water Quality
- Aquatic Vegetation
  - Curly-leaf Survey
  - Comprehensive Survey
- Plan Development

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Current Project

Your Participation is Important to the Success of this Project

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Arbutus Lake Planning Committee

- What is the *Planning Committee*?
  - Focus Group
  - Steering Committee
- Who should be on the *Planning Committee*?
  - 6-10 People
  - Cross-section
    - Age
    - Property Ownership
    - Perceptions & Interests
- What is expected of *Planning Committee* members?
  - Stakeholder Survey Mailing
  - 2-3 Meetings (1.5-3 hours each)

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Current Project

Planning Process

Planning Committee Meetings

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

↓

Implementation Plan

Onterra LLC

Thank You

Tim Hoyman **thoyman@onterra-eco.com**

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

Wisconsin Lakes Partnership

Extension

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Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Aquatic Plants
  - Miscellaneous Findings
- "Big Picture"
- Goals and Actions Discussion

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Study and Plan Goals

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

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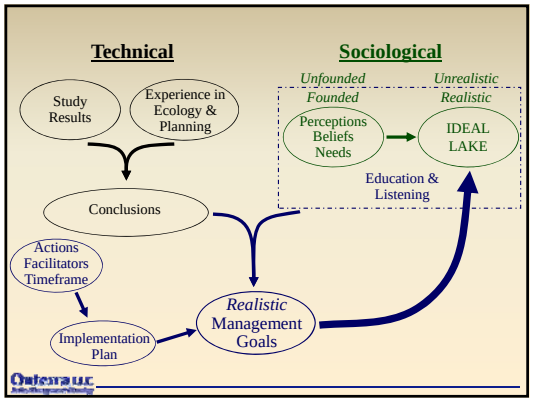
The Planning Process

…it's not as easy as you may think.



Lillie Mason Regions

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Water Quality

- Phosphorus (Limiting Plant Nutrient)
- Chlorophyll-*a* (Algal Abundance)
- Water Clarity (Secchi Disk)

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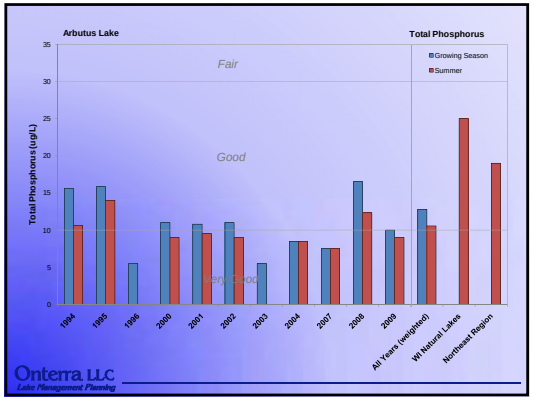
Lake Management Planning



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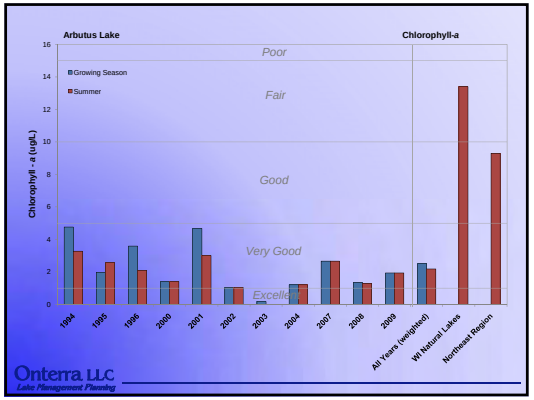
Lake Management Planning



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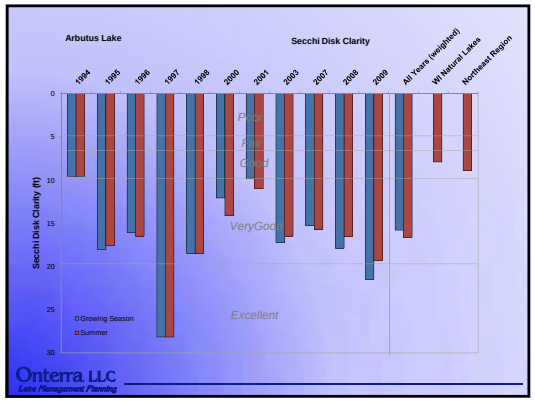
Lake Management Planning



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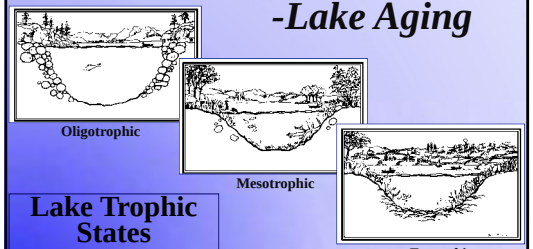
Lake Management Planning

Eutrophication -*Lake Aging*



Lake Trophic States

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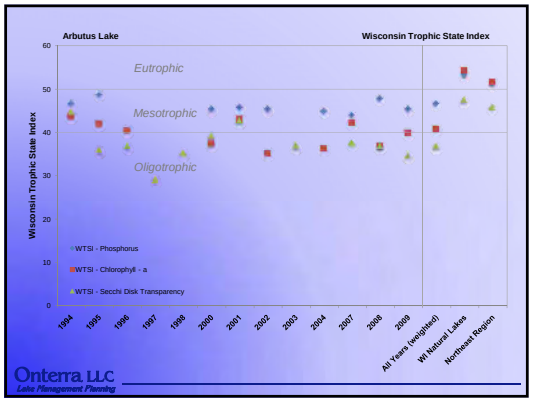
Lake Management Planning



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Lake Management Planning

Additional Water Quality Results

- Dissolved Oxygen and Temperature Profiles
  - Stratification occurs, but hypolimnion holds O_2 during winter.
  - Some limited anoxia may occur during summer ('94 &'95 data from NET study).
  - No current summer data available.
- Limiting Nutrient
  - Nitrogen:Phosphorus = 37:1(Phosphorus limited)

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Lake Management Planning

Additional Water Quality Results

- Internal Nutrient Loading
  - Unlikely to be significant
  - No (or limited) anoxia in hypolimnion
  - Low P values in hypolimnion
- Alkalinity (buffer capacity)
  - 24 ppm $CaCO_3$ – May 2008
  - Very low sensitivity to acid rain

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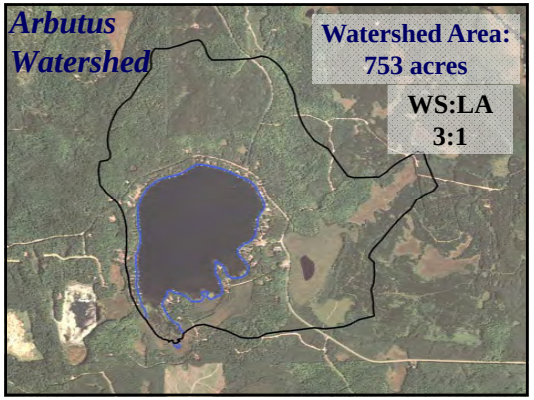
Lake Management Planning

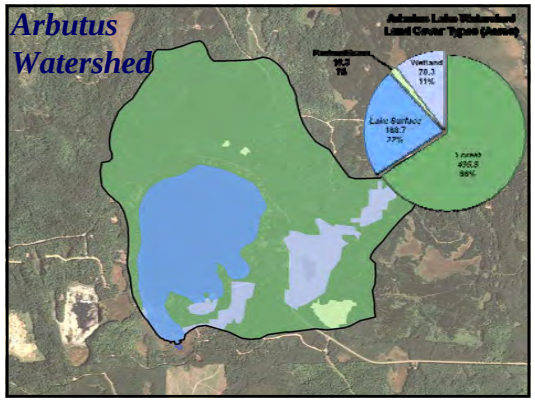
Arbutus Watershed

Watershed Area: 753 acres

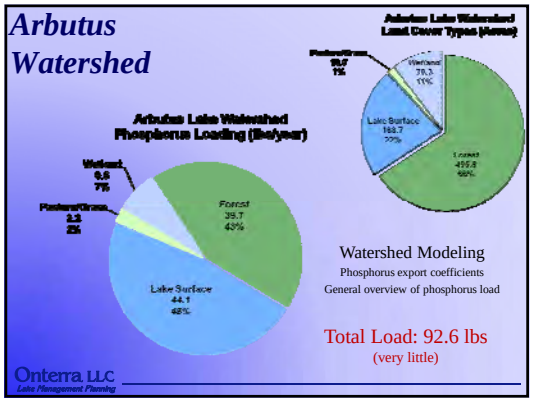
WS:LA 3:1



Arbutus Watershed



Arbutus Watershed



Watershed Modeling

Phosphorus export coefficients

General overview of phosphorus load

Total Load: 92.6 lbs

(very little)

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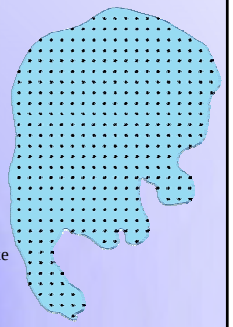
Point-Intercept Survey



Arbutus Lake

43-meters

358 points

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Lake Management Planning

Species List

- 36 Total Species
  - No non-natives

Arbutus Lake

Life Form	Scientific Name	Common Name	Coefficient of Conservatism (c)
E	*Carex riparia**	Beaked sedge	10
	Dulichium arundinaceum	Three-way sedge	9
	*Eleocharis erythropoda**	Creeping spikerush	3
	*Sagittaria latifolia**	Common arrowhead	3
	Schoenoplectus subterminalis	Water bulrush	9
	*Typha latifolia**	Broad-leaved cattail	1
FL	*Brasenia schreberi*	Watershield	7
	Nuphar variegata	Spatterdock	6
	Nymphaea odorata	White water lily	6
FLHE	*Sparganium angustifolium*	Narrow-leaf bur-reed	9
	*Sparganium emersum**	Short-stemmed bur-reed	8
Submergent	*Chara sp.*	Muskgrasses	7
	Elodea nuttallii	Waterwort	9
	Elodea canadensis	Common waterweed	3
	Eriocaulon aquaticum	Pipewort	9
	Heteranthera dubia	Water stargrass	6
	Isoetes lacustris	Lake quillwort	8
	Lobelia dortmanna	Water lobelia	10
	Myriophyllum tenellum	Dwarf water milfoil	10
	Najas flexilis	Slender naiad	7
	Nitella sp.	Stoneworts	7
	Potamogeton amplifolius	Large-leaf pondweed	7
	Potamogeton epihydrus	Ribbon-leaf pondweed	8
	Potamogeton foliosus	Leafy pondweed	6
	Potamogeton gramineus	Variable pondweed	7
	Potamogeton natans	Floating-leaf pondweed	5
	Potamogeton pusillus	Small pondweed	7
	Potamogeton richardsonii	Clasping-leaf pondweed	5
	Potamogeton robbinsii	Fern pondweed	8
	Potamogeton zosteriformis	Flat-stem pondweed	6
	Ranunculus flammula	Creeping spearwort	9
	Utricularia intermedia	Flat-leaf bladderwort	9
	Utricularia vulgaris	Common bladderwort	7
	Vallisneria americana	Wild celery	6
SE	*Eleocharis acicularis*	Needle spikerush	5
	Juncus pelocarpus	Brown-fruited rush	8

E = Emergent
FL = Floating Leaf
FLHE = Floating Leaf and Emergent
SAE = Submergent and Emergent
* = Incidental

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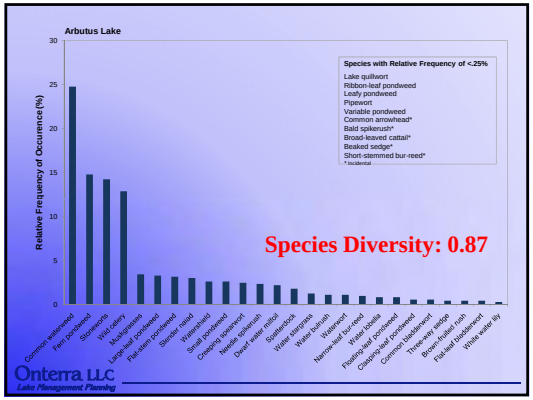
Lake Management Planning



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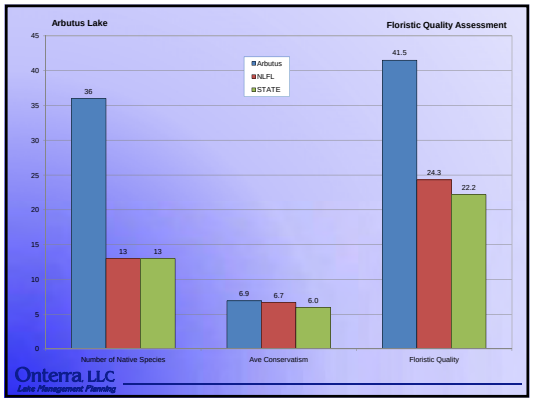
Lake Management Planning

Aquatic Plants

Wisconsin Ecoregions

Onterra LLC
Lake Management Planning



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Lake Management Planning

Aquatic Plant Community Mapping

- Mapped Communities
  - Floating-leaf
  - Emergent
- Important Indicators
  - Vulnerable to ecosystem changes
    - Loss of species
    - Expansion or recession

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Lake Management Planning

Additional Results

- *Dreissena* mussel monitoring
  - No veligers found
- Fisheries Data Summary
  - Compilation nearly complete
  - Analysis will be completed for report
- Stakeholder Survey
  - Tabulation completed (Thanks Karen!)
  - Charts and comments compiled

Conclusions

- Water quality is *very good*
  - Limited historic data indicates that water quality has fluctuated, but remained pretty much the same over the past 1 ½ decades.
- Overall watershed is in great condition.
  - Land cover exports minimal phosphorus.
  - Largest, *controllable* contributor is likely shoreland properties.

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Lake Management Planning

Conclusions

- Aquatic plant community is very healthy
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  - No exotic species found during surveys
  - *Many* residence are concerned about increasing amounts of aquatic plants

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Lake Management Planning

Thank You

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Onterra LLC
Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Aquatic Plants
- "Big Picture"
- Implementation Plan Highlights

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Study and Plan Goals

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

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Lillie Mason Regions

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Water Quality

- Phosphorus (Limiting Plant Nutrient)
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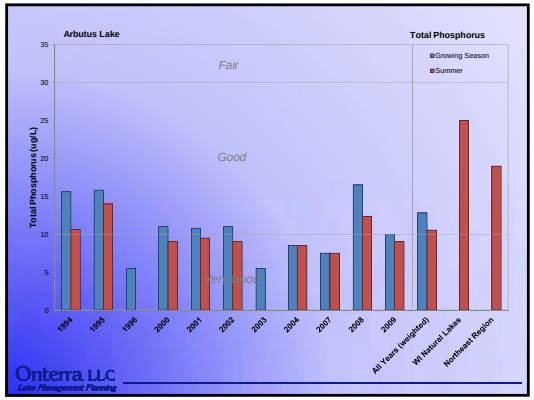

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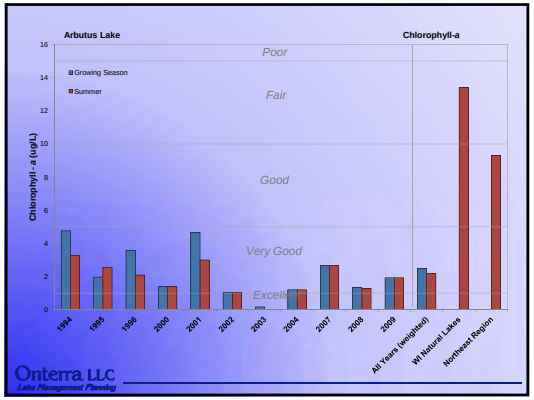

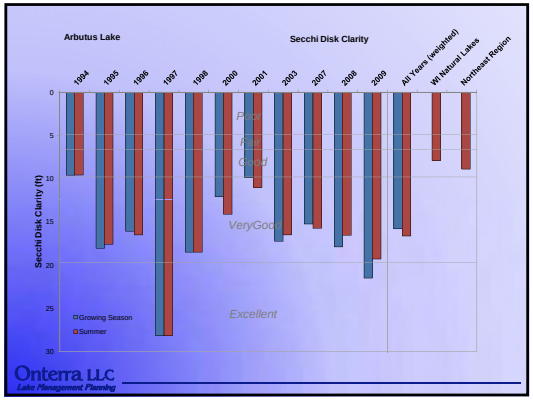

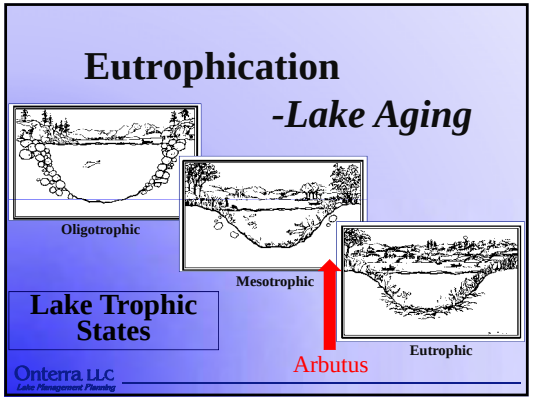

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  - Low P values in hypolimnion
- Alkalinity (buffer capacity)
  - 24 ppm $CaCO_3$ – May 2008
  - Very low sensitivity to acid rain
- Zebra Mussel Veliger Sampling
  - None found

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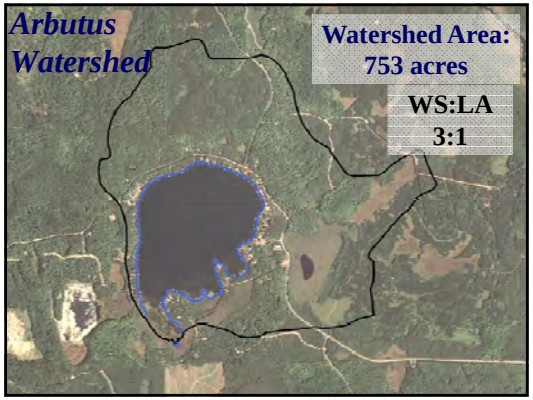
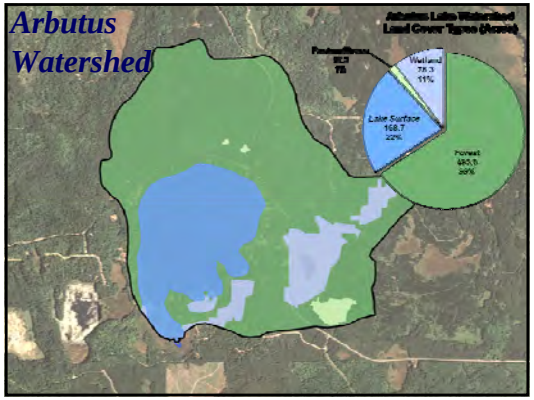
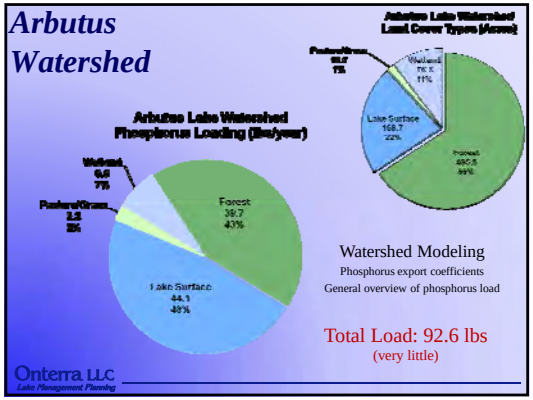
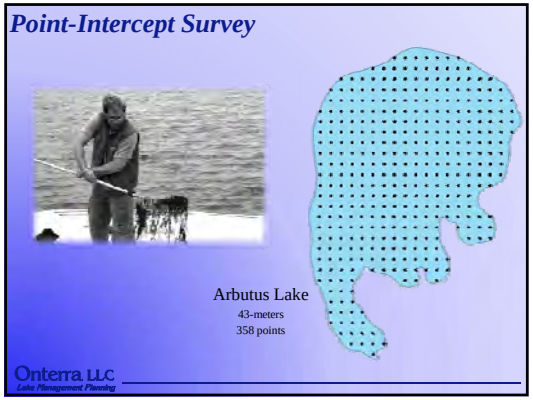
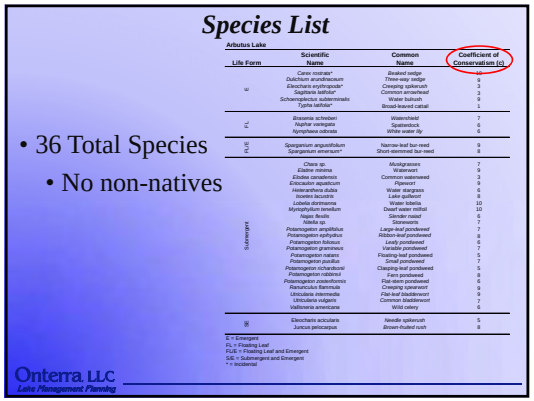
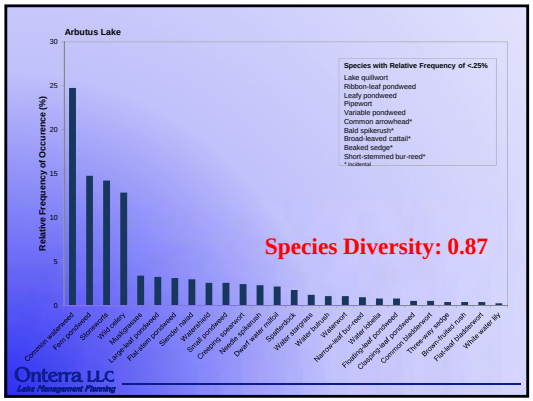



Arbutus
Watershed
Arbutus Lake Watershed
Land Cover Types (Acres)
Wetland
78.3
11%
Lake Surface
168.7
22%
Forest
495.5
66%

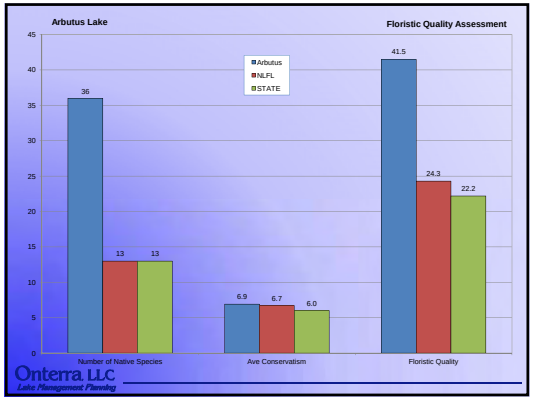

Arbutus
Watershed
Arbutus Lake Watershed
Phosphorus Loading (lbs/year)
Wetland
6.6
7%
Pasture/Grass
3.3
3%
Forest
39.7
43%
Lake Surface
44.1
48%
Watershed Modeling
Phosphorus export coefficients
General overview of phosphorus load
Total Load: 92.6 lbs
(very little)
Onterra LLC
Lake Management Planning


Point-Intercept Survey
Arbutus Lake
43-meters
358 points
Onterra LLC
Lake Management Planning


Species List
• 36 Total Species
• No non-natives
Arbutus Lake
Life Form
Scientific Name
Common Name
Coefficient of Conservatism (c)
Onterra LLC
Lake Management Planning


Arbutus Lake
Relative Frequency of Occurence (%)
Species with Relative Frequency of <.25%
Lake quillwort
Ribbon-leaf pondweed
Leafy pondweed
Pipewort
Variable pondweed
Common arrowhead*
Bald spikerush*
Broad-leaved cattail*
Beaked sedge*
Short-stemmed bur-reed*
* Incidental
Species Diversity: 0.87
Common waterweed
Fern pondweed
Stonewort
Wild celery
Muskgrasses
Large-leaf pondweed
Flat-stem pondweed
Slender naiad
Watershield
Small pondweed
Creeping spearwort
Needle spikerush
Dwarf water milfoil
Southern bulrush
Water stargrass
Water bulrush
Waterwort
Narrow-leaf bur-reed
Water lobelia
Floating-leaf pondweed
Clasping-leaf pondweed
Common bladderwort
Three-way sedge
Brown-fruited rush
Flat-leaf bladderwort
White water lily
Onterra LLC
Lake Management Planning


Aquatic Plants
Wisconsin
Ecoregions
Northern Lakes and Forests
North Central Hardwood Forests
Driftless Area
Southeastern Wisconsin Till Plains
Arbutus Lake
Onterra LLC
Lake Management Planning



Aquatic Plant Community Mapping

- Mapped Communities
  - Floating-leaf
  - Emergent
- Important Indicators
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    - Loss of species
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Lake Management Planning

Conclusions

- Water quality is *very good*
  - Limited historic data indicates that water quality has fluctuated, but remained pretty much the same over the past 1 ½ decades.
- Overall watershed is in great condition.
  - Land cover exports minimal phosphorus.
  - Largest, *controllable* contributor is likely shoreland properties.

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Lake Management Planning

Conclusions

- Aquatic plant community is very healthy
  - Native community is of high quality
  - No exotic species found during surveys
  - *Many* residence are concerned about increasing amounts of aquatic plants
    - Minimize algae blooms
    - Compete against exotic plant infestations

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Lake Management Planning

Goal 1: Maintain Current Water Quality Conditions

Management Actions

1. Continue monitoring water quality through WDNR Citizens Lake Monitoring Network.
2. Reduce phosphorus and sediment loads from immediate watershed (shorelands).

Goal 2: Strengthen Communication Capacity and Content of Arbutus Lake Association

Management Actions

1. Create and Support an Arbutus Lake Association Education and Communication Committee.
2. Bring about a better understanding of shoreland and watershed zoning regulations among lake association and its members.

Goal 3: Prevent Aquatic Invasive Species Establishment in Arbutus Lake

Management Actions

1. Begin *Modified* Clean Boats Clean Waters watercraft inspections at Arbutus public access.
2. Coordinate annual volunteer monitoring for Aquatic Invasive Species

Goal 4: Increase Understanding and Effective Management of Arbutus Lake Fishery

Management Actions

1. Create Resolution of Arbutus Lake Association urging WDNR to complete comprehensive studies of Arbutus Lake fishery and form a fishery management plan.

Thank You

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

Wisconsin Lakes Partnership

Onterra LLC

B

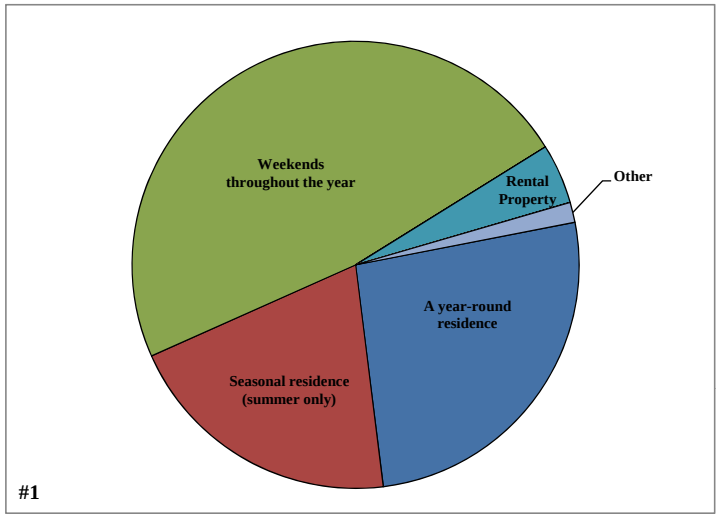
APPENDIX B

Stakeholder Survey Response Charts and Comments

Returned Surveys	71
Sent Surveys	98
Response Rate (%)	72.4

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

	Total	*%*
A year-round residence	18	*26.1*
Seasonal residence (summer only)	14	*20.3*
Weekends throughout the year	33	*47.8*
Resort	0	*0.0*
Rental Property	3	*4.3*
Undeveloped	0	*0.0*
Other	1	*1.4*
	69	*100.0*

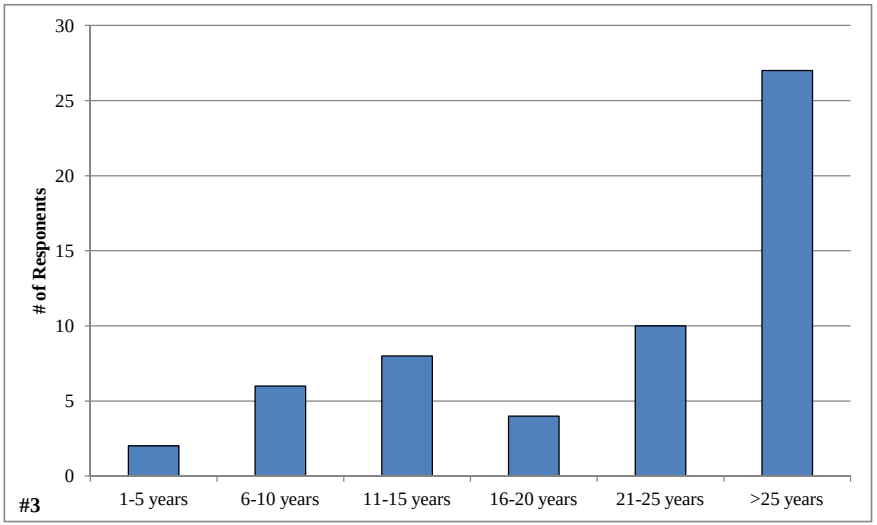


#2 If you are not a year-round resident, how many days each year is your property used by you or others?

Answered Question	50
Average	68.6
Standard deviation	35.2

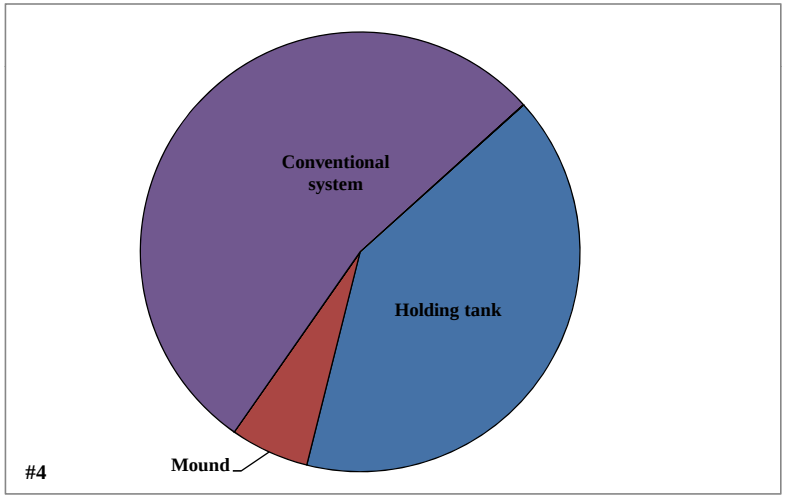
#3 How many years have you owned property on Arbutus Lake?

	Total	%
1-5 years	2	*3.5*
6-10 years	6	*10.5*
11-15 years	8	*14.0*
16-20 years	4	*7.0*
21-25 years	10	*17.5*
>25 years	27	*47.4*
	57	*100.0*



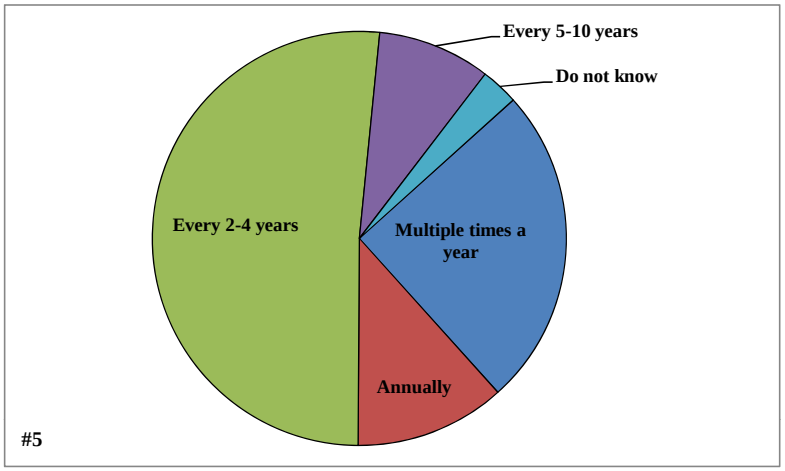
#4 What type of septic system does your property utilize?

	Total	%
Holding tank	28	*40.6*
Mound	4	*5.8*
Advanced treatment system	0	*0.0*
Conventional system	37	*53.6*
Municipal Sewer	0	*0.0*
Do not know	0	*0.0*
	69	*100.0*



#5 How often is the septic system on your propery pumped?

	Total	%
Multiple times a year	17	*24.6*
Annually	8	*11.6*
Every 2-4 years	35	*50.7*
Every 5-10 years	6	*8.7*
Do not know	2	*2.9*
	68	*98.6*

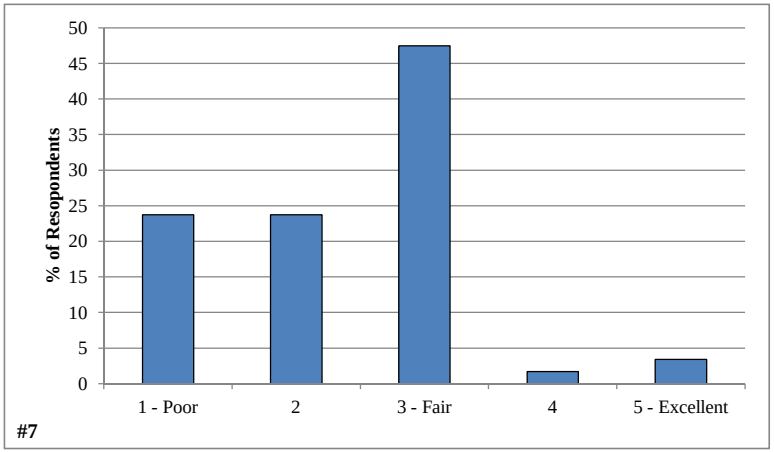


#6 Have you fished on Arbutus Lake in the past 3 years?

	Total	%
Yes	63	*90.0*
No	7	*10.0*
	70	*100.0*

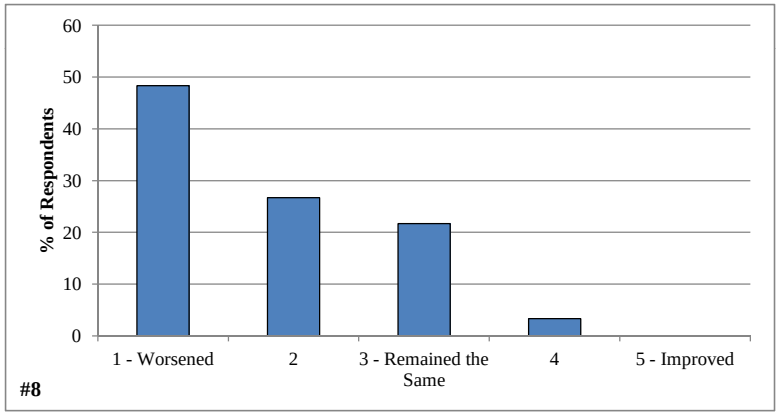
#7 How would you describe the current quality of fishing on Arbutus Lake?

	Total	%
1 - Poor	14	*23.7*
2	14	*23.7*
3 - Fair	28	*47.5*
4	1	*1.7*
5 - Excellent	2	*3.4*
	59	*100.0*



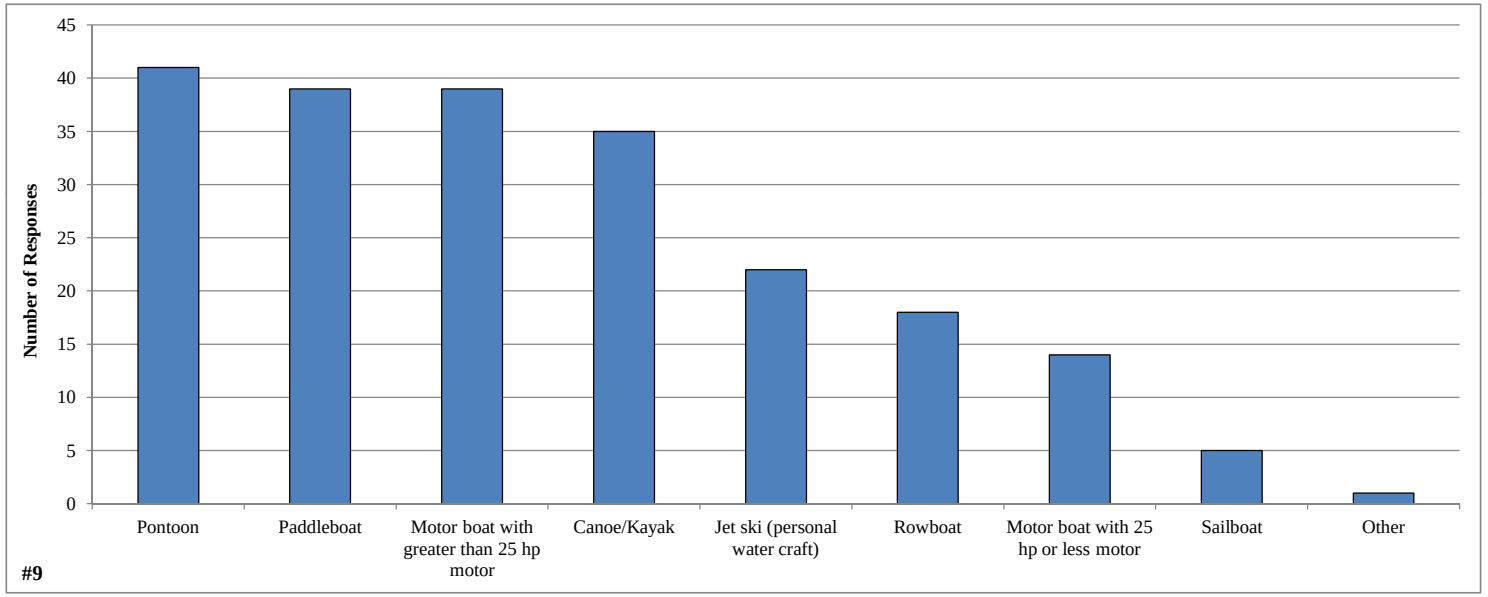
#8 How has the quality of fishing changed on Arbutus Lake since you obtained your property?

	Total	%
1 - Worsened	29	*48.3*
2	16	*26.7*
3 - Remained the Same	13	*21.7*
4	2	*3.3*
5 - Improved	0	*0.0*
	60	*100.0*



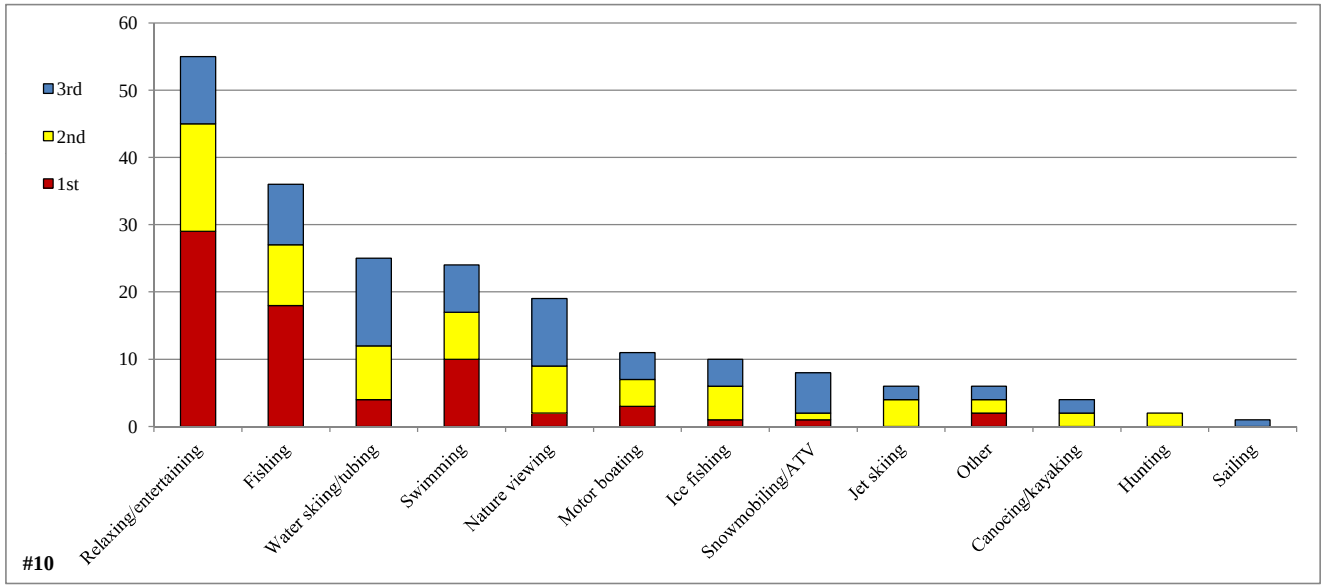
#9 What types of watercraft do you or others that use your property, currently use on the lake?

	Total
Pontoon	41
Paddleboat	39
Motor boat with greater than 25 hp motor	39
Canoe/Kayak	35
Jet ski (personal water craft)	22
Rowboat	18
Motor boat with 25 hp or less motor	14
Sailboat	5
Other	1
	213



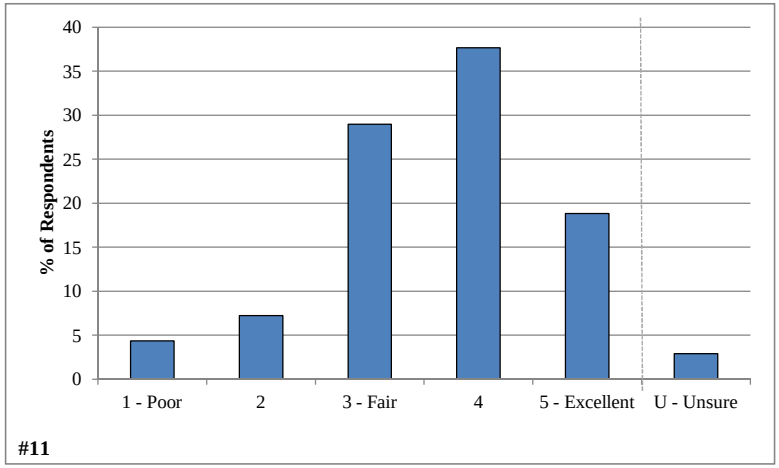
#10 Please rank the activities below that are the most important or enjoyable to you on Arbutus Lake?

	1st	2nd	3rd	*% ranked*
Relaxing/entertaining	29	16	10	*26.2*
Fishing	18	9	9	*17.1*
Water skiing/tubing	4	8	13	*11.9*
Swimming	10	7	7	*11.4*
Nature viewing	2	7	10	*9.0*
Motor boating	3	4	4	*5.2*
Ice fishing	1	5	4	*4.8*
Snowmobiling/ATV	1	1	6	*3.8*
Jet skiing	0	4	2	*2.9*
Other	2	2	2	*2.9*
Canoeing/kayaking	0	2	2	*1.9*
Hunting	0	2	0	*1.0*
Sailing	0	0	1	*0.5*
	70	67	70	*98.6*



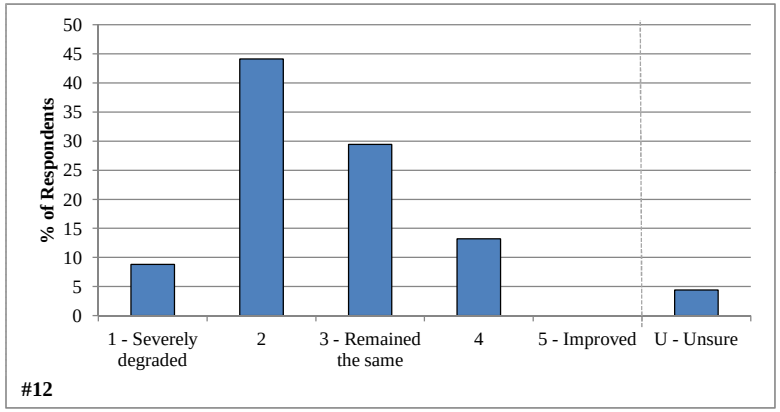
#11 How would you describe the current water quality of Arbutus Lake?

	Total	%
1 - Poor	3	*4.3*
2	5	*7.2*
3 - Fair	20	*29.0*
4	26	*37.7*
5 - Excellent	13	*18.8*
U - Unsure	2	*2.9*
	69	*100.0*



#12 How has the water quality changed in Arbutus Lake since you obtained your property?

	Total	%
1 - Severely degraded	6	*8.8*
2	30	*44.1*
3 - Remained the same	20	*29.4*
4	9	*13.2*
5 - Improved	0	*0.0*
U - Unsure	3	*4.4*
	68	*100.0*



#13 Have you ever heard of aquatic invasive species?

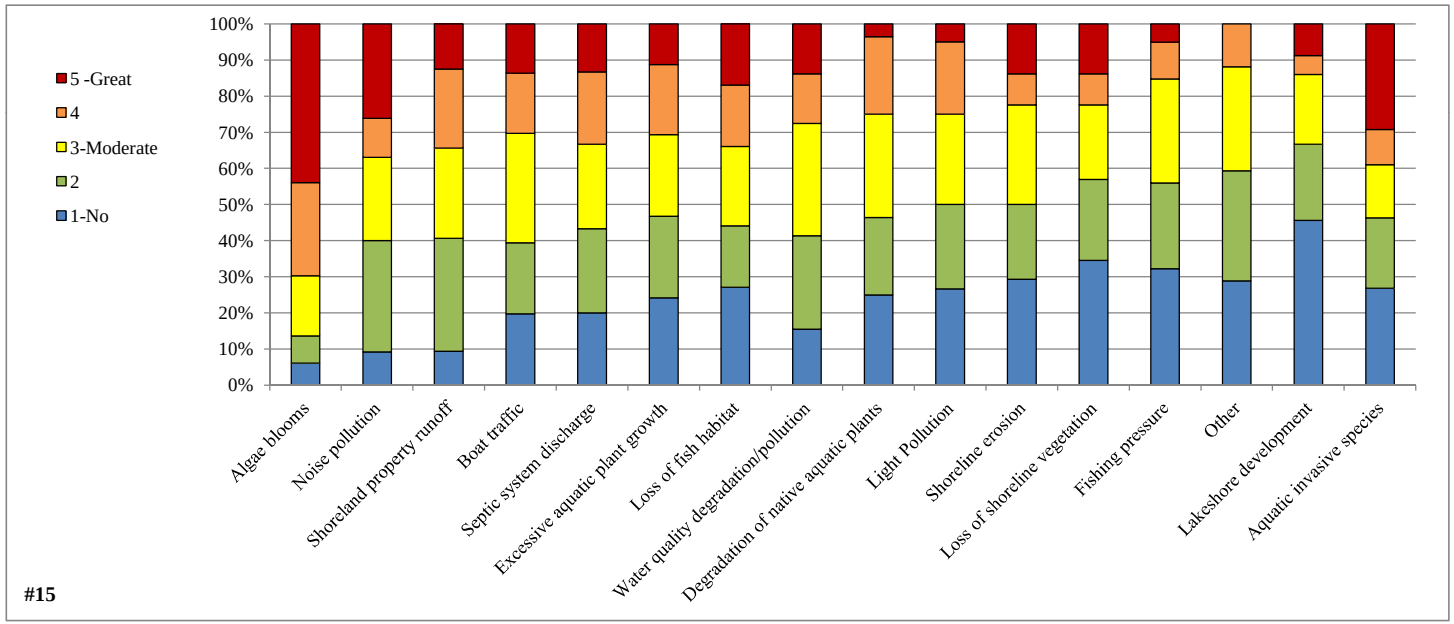
	Total	%
Yes	69	*98.6*
No	1	*1.4*
	70	*100.0*

#14 Are you aware of aquatic invasive species in Arbutus Lake?

	Total	%
Yes	12	*17.9*
No	55	*82.1*
	67	*100.0*

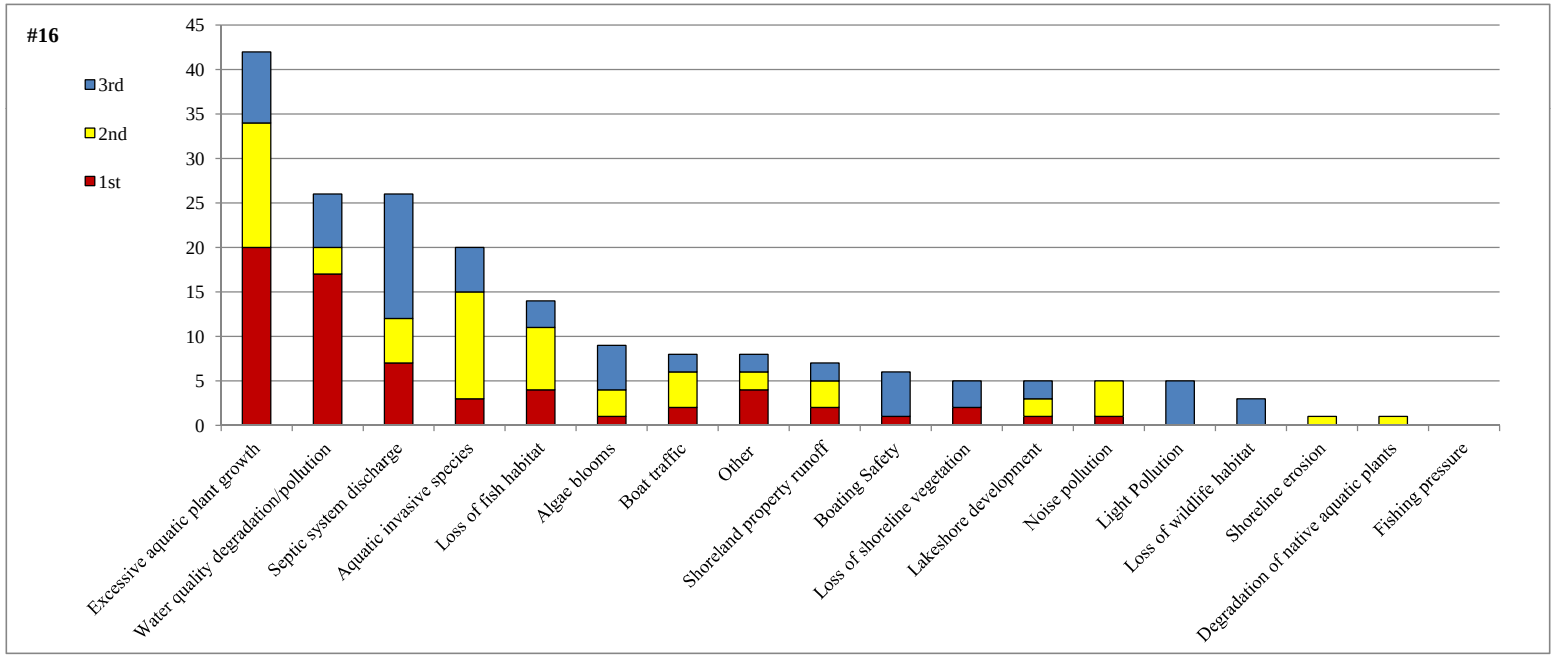
#15 To what level do you believe each the following factors are negatively impacting Arbutus Lake?

	Not Present	1-No	2	3-Moderate	4	5 -Great	*Total*	*Average*
Algae blooms	1	4	5	11	17	29	*66*	*3.9*
Noise pollution	1	6	20	15	7	17	*65*	*3.1*
Shoreland property runoff	1	6	20	16	14	8	*64*	*2.9*
Boat traffic	2	13	13	20	11	9	*66*	*2.8*
Septic system discharge	4	12	14	14	12	8	*60*	*2.7*
Excessive aquatic plant growth	3	15	14	14	12	7	*62*	*2.6*
Loss of fish habitat	6	16	10	13	10	10	*59*	*2.5*
Water quality degradation/pollution	8	9	15	18	8	8	*58*	*2.5*
Degradation of native aquatic plants	5	14	12	16	12	2	*56*	*2.4*
Light Pollution	5	16	14	15	12	3	*60*	*2.3*
Shoreline erosion	9	17	12	16	5	8	*58*	*2.2*
Loss of shoreline vegetation	7	20	13	12	5	8	*58*	*2.2*
Fishing pressure	6	19	14	17	6	3	*59*	*2.1*
Other	6	17	18	17	7	0	*59*	*2.0*
Lakeshore development	4	26	12	11	3	5	*57*	*2.0*
Aquatic invasive species	24	11	8	6	4	12	*41*	*1.9*



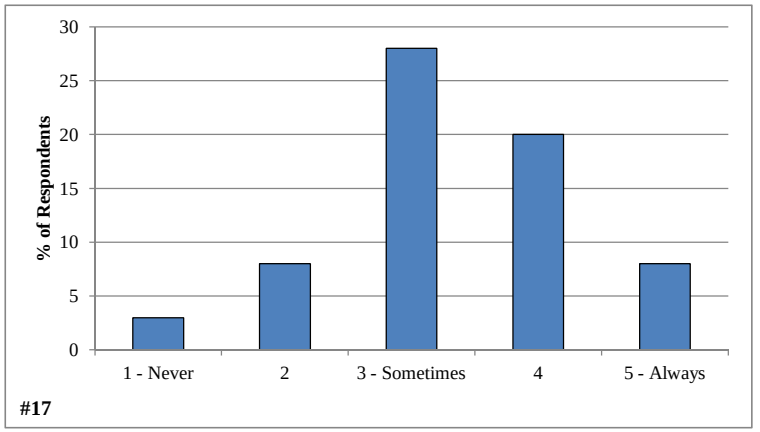
#16 From the list below, please rank your top three concerns regarding Arbutus Lake?

	1st	2nd	3rd	*% Ranked*
Excessive aquatic plant growth	20	14	8	*64.6*
Water quality degradation/pollution	17	3	6	*40.0*
Septic system discharge	7	5	14	*40.0*
Aquatic invasive species	3	12	5	*30.8*
Loss of fish habitat	4	7	3	*21.5*
Algae blooms	1	3	5	*13.8*
Boat traffic	2	4	2	*12.3*
Other	4	2	2	*12.3*
Shoreland property runoff	2	3	2	*10.8*
Boating Safety	1	0	5	*9.2*
Loss of shoreline vegetation	2	0	3	*7.7*
Lakeshore development	1	2	2	*7.7*
Noise pollution	1	4	0	*7.7*
Light Pollution	0	0	5	*7.7*
Loss of wildlife habitat	0	0	3	*4.6*
Shoreline erosion	0	1	0	*1.5*
Degradation of native aquatic plants	0	1	0	*1.5*
Fishing pressure	0	0	0	*0.0*
	65	61	65	*293.8*



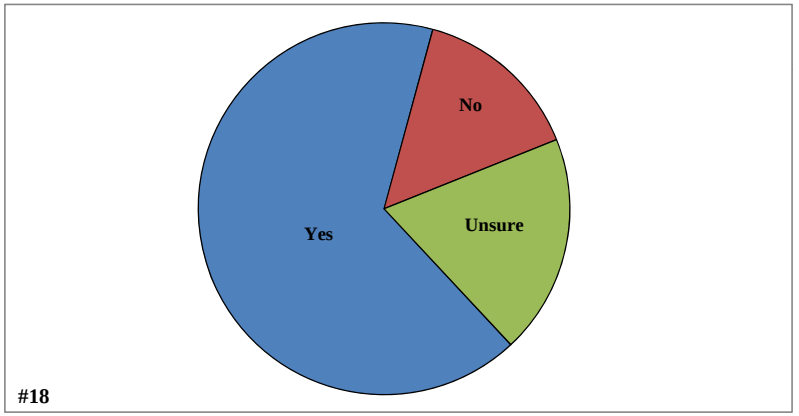
#17 How often does aquatic plant growth impact your enjoyment of Arbutus Lake?

	Total	%
1 - Never	3	*4.5*
2	8	*11.9*
3 - Sometimes	28	*41.8*
4	20	*29.9*
5 - Always	8	*11.9*
	67	*100.0*



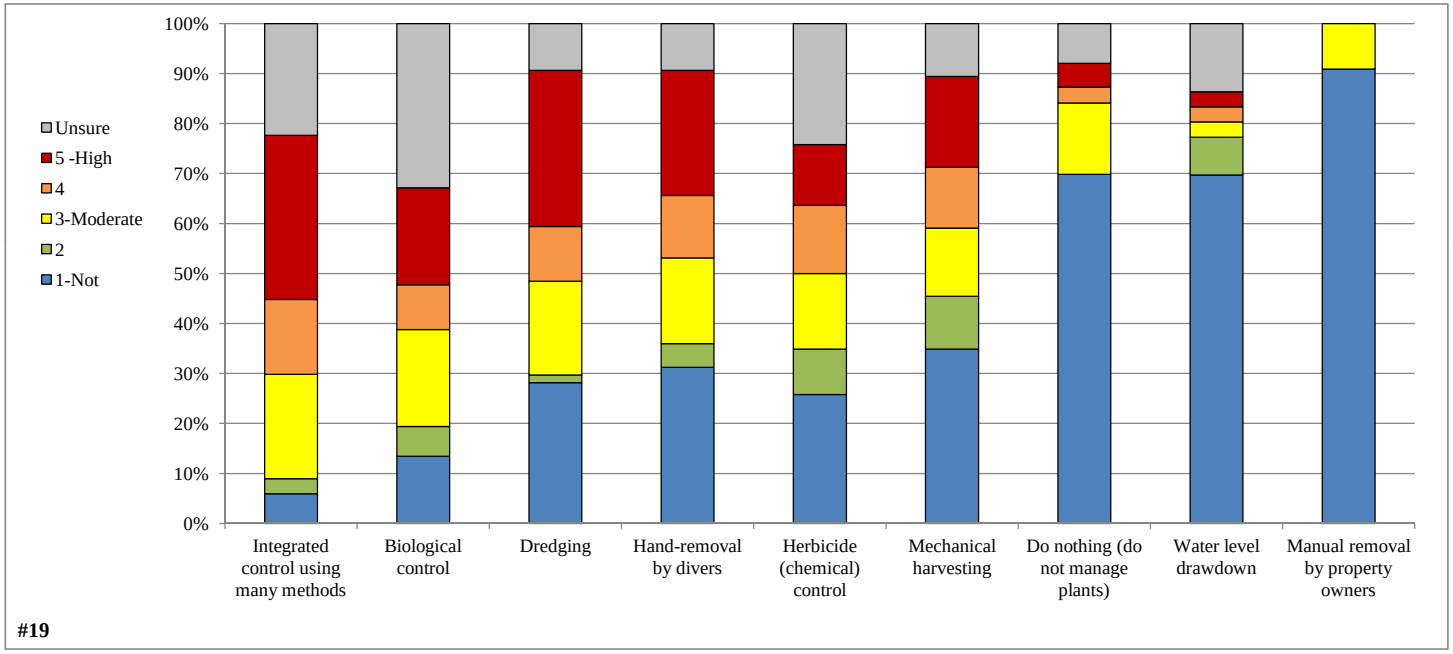
#18 Considering your answer to the question above, do you believe aquatic plant control is needed on Arbutus Lake?

	Total	%
Yes	45	*66.2*
No	10	*14.7*
Unsure	13	*19.1*
	68	*100.0*



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

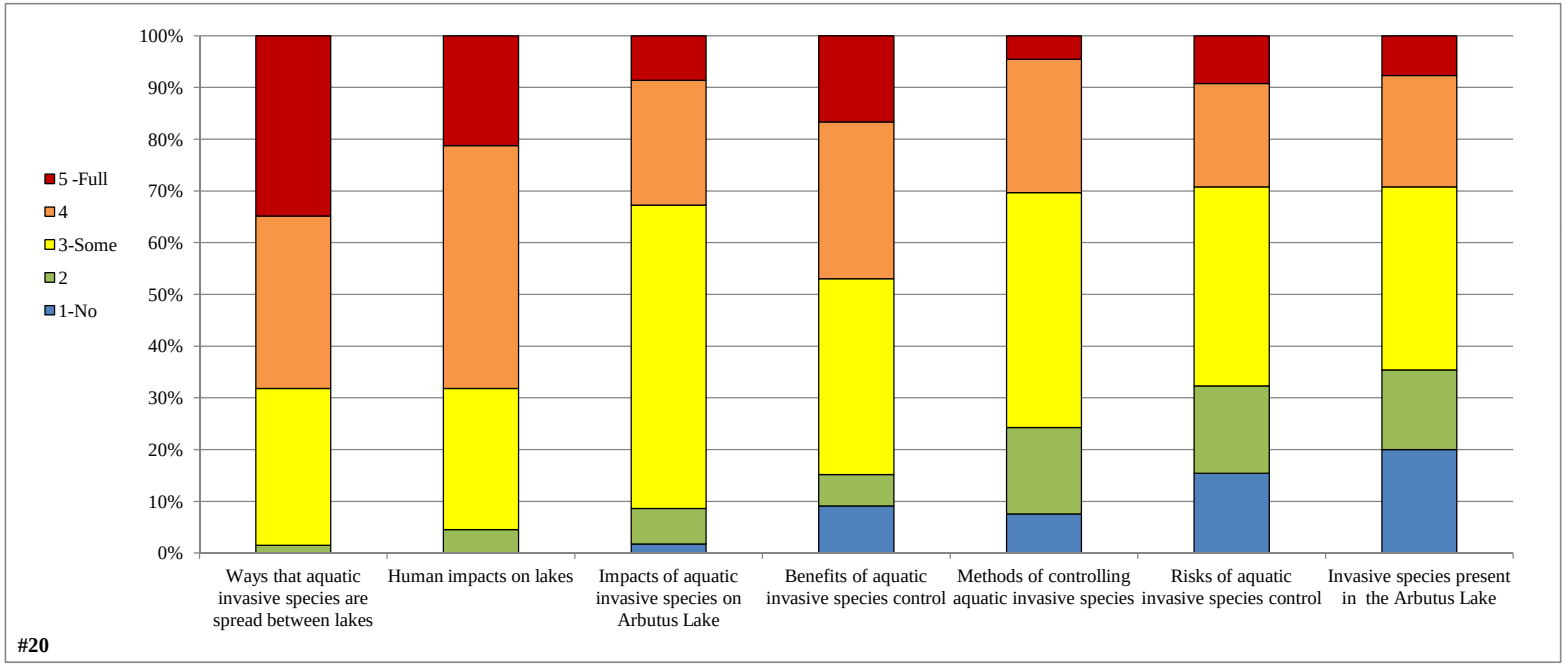
	1-Not	2	3-Moderate	4	5 -High	Unsure	*Total*	*Average*
Integrated control using many methods	4	2	14	10	22	15	*67*	*3.8*
Biological control	9	4	13	6	13	22	*67*	*3.2*
Dredging	18	1	12	7	20	6	*64*	*3.2*
Hand-removal by divers	20	3	11	8	16	6	*64*	*2.9*
Herbicide (chemical) control	17	6	10	9	8	16	*66*	*2.7*
Mechanical harvesting	23	7	9	8	12	7	*66*	*2.6*
Do nothing (do not manage plants)	44	0	9	2	3	5	*63*	*1.6*
Water level drawdown	46	5	2	2	2	9	*66*	*1.4*
Manual removal by property owners	10	0	1	0	0	0	*11*	*0.2*



#19

#20 **Please describe your level of understanding of each of the following lake management issues.**

	1-No	2	3-Some	4	5 -Full	*Total*	*Average*
Ways that aquatic invasive species are spread between lakes	0	1	20	22	23	*66*	*4.0*
Human impacts on lakes	0	3	18	31	14	*66*	*3.8*
Impacts of aquatic invasive species on Arbutus Lake	1	4	34	14	5	*58*	*3.5*
Benefits of aquatic invasive species control	6	4	25	20	11	*66*	*3.4*
Methods of controlling aquatic invasive species	5	11	30	17	3	*66*	*3.0*
Risks of aquatic invasive species control	10	11	25	13	6	*65*	*2.9*
Invasive species present in the Arbutus Lake	13	10	23	14	5	*65*	*2.8*



#21 Before receiving this mailing, have you ever heard of the Arbutus Association?

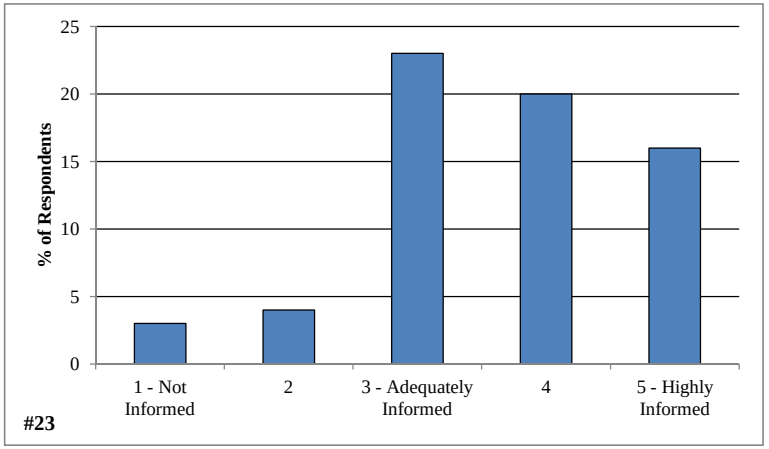
	Total	%
Yes	67	*98.5*
No	1	*1.5*
	68	*100.0*

#22 Are you currently a member of the Arbutus Lake Association

	Total	%
Yes	60	*89.6*
No	7	*10.4*
	67	*100.0*

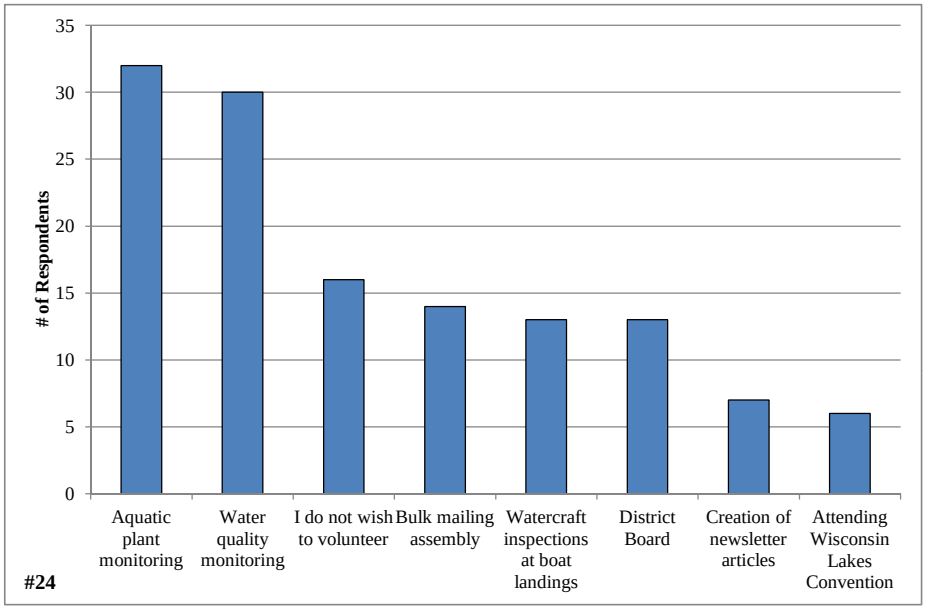
#23 Do you believe the Arbutus Association has kept you adequately informed regarding issues with Arbutus Lake and its management?

	Total	%
1 - Not Informed	3	*4.5*
2	4	*6.1*
3 - Adequately Informed	23	*34.8*
4	20	*30.3*
5 - Highly Informed	16	*24.2*
	66	*100.0*



#24 Please circle the activities you would be willing to participate in if called upon.

	Total
Aquatic plant monitoring	32
Water quality monitoring	30
I do not wish to volunteer	16
Bulk mailing assembly	14
Watercraft inspections at boat landings	13
District Board	13
Creation of newsletter articles	7
Attending Wisconsin Lakes Convention	6
	131



Survey Number	Comments
1	I believe the last several years of below average precipitation is having a negative effect wieth reduced/lower water level. A precipitation change will occur and result in higher lake levels and eleviate some of the problems
2	Question 15 is unsubstantiated opinion. We don't have the answers but hope Onterra can tell us the answers. Our largest concerns have to do with rapid & intrusive aquatic weed growth. Also concerned with number of jet skis dodging all over lake. 15r - Jet skis going in all directions too much action for small lake 16r - Low water level
3	DNR & Indian spearing killed off walleye stock
4	Self responsibility. You don't need to manage everything
6	We would like to see people clean their leaves off their shoreline so the sediment does not settle into the lake. Seems to be much more silt in the lake that was not there years ago. Low water levels are a huge concern. 15r - fireworks
7	
8	
9	
11	
12	
13	I am very surprised that the survey did not cover the silt build up in the bays. 15r - silt build up in bays 16r - silt build up in bays
14	
15	I believe water levels have much to do with the new weed growth we have experienced. Leight Tresspass concerns shouldn't rule out or condemn tastefull use of lighting in landscapes etc. But it should focus on spot lights, motion lights & barnyard lighting shared or directed at others on the lake tiaking in night time scenes. these lights should be directed down or shrouded. Game fish in the lake have declined. A fish mgnt. plan would be nice so as to cull the bad and support the good through management fishing. What is best for the lake? (Northern pike or bass) Lg mouth bass seem to be overtaking the fish population - not edible by most fisherman's standards! 15r - lake water levels 15r - water level
16	
17	
18	I feel that Arbutus is way to small for the number of personal watercrafts. I also feel that the large number of personal watercraft has affect the fishing and plant life in the lake. At one time the DNR was going to ban personal waterraft from lkaes under 200 acres which would have included Arbutus. Every time I'm at the lake I see violations of the watercraft rules but no one does anything about it.
19	I have been on Arbutus Lake for 50 years. The Association has helped improve many things, including getting many faulty septic systems replaced. We do have many more weeds than we used to and the fishing has changed. Different species are more prominent than in the past. There is much more muck than there has ever been, and the rising to the surface of huge mats of the bottom plant life is a concern. I realize that the lower water level contributes to this as much as anything, because it means boat propellers and jets are that much closer to the bottom and more able to stir them up. The plant life has changed, with newer, thicker weeks replacing the ones form years gone by, and much earlier in the season. I do not recall algae before, but see it now. The "swamp" used to be a great place for canoeing, fishing, turtle catching - but much of it in now 6 inches deep and impassable and completely over-run by lily pads. Canoes & paddle boats now get stuck where there used to be 4 - 5 feet of water. I don't think shoreline and land developement are an issue. This lake has been almost completely developed for over 30 years. What may have once been issues are now the norm for this lake. Boat are more numerous and more powerful. Activities have changed. Where before there was waterskiing and swimming, now there is tubing & skiing & jetskiing, activities that are fun going different directions very quickly, but less predicatble for others who are trying to avoid them. It is also harder to maintain safe distances between participants, docks, rafts & fishing or swimming boats.
20	
21	Discharge of septic system into the lake & faulty noncompliant systems are at the top of my list. I think we need to associate ourselves with a town, county or atate agency that has powers to force complaincy on sewer systems. There a number of conventional drainage fields that are actually 50' or less from the shoreline. The property owners should be held accountable and be required to have their systems tested by an outside firm. If we would be connected to a municiple sewage system and found to be defective, we would be required to repair or replace at the owners expense. Just my two cents.
22	
23	There are many people on this lake that I do believe will help with anything if they are informed on what area help is needed. This just needs to be addresed with the breakdown of what is needed, when & where. It is my hope that included in the lake study that they ? and go down in the bay or bays and do a study on whst is in the muck which is 10-12' ? down so people know what is in this as far as a chemical standpoint. Thank you for your interest and stepping to the plate to make our lake better. 15r - use of fertilizer 16r - bays filled with silt, loss of water depth
24	We are five year residents of Arbutus Lake. We find it to be calming, exciting and picturesque. In our opinion a true gem of the North. We are strong supporters of the early and late "no wake" times.
25	
26	
27	
28	
29	
30	
31	The boat landing is problem for the people that have property near it. There are people that launch their boats and then need to use an adjacent dock because they have no way to get into their boat. They also tend to steal gas tanks and other items that they may have forgotten. They also get stuck and come over to my place to ask for a pull. 16r - boat landing

Survey Number	Comments
32	Arbutus Lake is a beautiful lake. We feel its current condition is somewhat less pristine than it used to be - mainly because of increased weed growth. The third bay is mushy on the bottom- but has always been that way (40 years). We feel that maybe that is the natural way for it to be.
33	When first purchasing my property on Arbutus Lake the water was so clean and clear and over the years it's gotten so bad my grandchildren don't even want to swim in the lake. I think everyone should have to have their septic systems checked, as I know there is a lot of polution going on. There is a major weed problem also.
34	15r - fireworks debris
35	All watercrafts need to abide by skiing hours better than they have in the past. Way to many bass in the lake! I blame the drop in perch, crappie & walleye fishing in the lake directly to the big increase in the amount of bass in lake. Raise the daily bag limit on bass and drop the legal size limit. Do this for a couple years or until there becomes a better balance between the species. Make EVERYONE come up to code with their septic systems.
36	
37	
38	
39	
40	In my opinion the biggest problem is the continuing build up of the rocks on the shoreline which most are taken out of the lake. The shorelines need to be put back to their natural habitat along with trees left fallen in the water and rocks in the water. I haven't seen fish in and around the docks in years where it use to be plenty. Also the cribs need to be done again. Scott Torgerson did some diving 2 years ago where he inspected some cribs (his wife Luann has lots of old pictures showing the 1st cribs being put in out on the ice) and he said they deperately need to be replaced, some were practically gone. Its time for a winter crib party! You should contact Scott again and have him do more diving, he and his wife have th equipment and brains to get it done. Also the time limit for motor sports needs to be enforced, there are several people on the northeast side of the lake that apparently didn't get the memo! Also that same area theres a lot of foam that comes across the lake and lands on the west shore. I think someones emptying laundry water out or something. I've sat and watched it many times. I would be interesting to put a bulletin board on display at the picnic showing the old cribs being put in. People would find it fascinating and want to participate. 10m - Country living (Privacy)
41	
42	Jet skiing and water skiing should be cut down so the fish have spawning beds. After a day of skiing (jet & water) the lake is floating with weeds from the wave action. 1g - property on on lake
43	10m - pontooning
44	
45	We left Pickerel Lake in 1960s as it had turned from a great fishing lake to one choked with weeds because it was so shallow. All because of septic tanks. When we moved to Arbutus Lake there were very few weeds, waleye fishing was good. Now it seems only bass survive, bluegills appear to be diseased. Fishing is now poor.
46	We have been coming to Arbutus Lake for many years. The biggest change I notice in the lake itself is the gradual build-up of silt & muck and the growth of weeds, which seems to get worse every year. Back in the 40s when we came up to the lake the south bay had 3 feet of water throughout the whole bay- the only weeds were water lilies. When we were trolling for walleyes, there were no weeds picked up by the lure we were using - only clear lake with sand at the bottom. One-third of the lake was developed at that time, one resort, a saw mill, and about 3 year-round homes. The rest were mostly summer cabins. The lake has changed a lot since that time. If we get to the point where we dredge, or pump the muck from the lake, I would gladly help in any way that I could. 15r - lake silt
47	
48	Remote security cameras at the boat landing can be obtained through an AIS control grant program, this should be looked in to. Although I have owned this property for 28 yrs, I have been on the lake for 52 years. Water quality has remained good, but aquatic plant growth has gotten out of control. Corrective action must be taken. PWC have taken over Arbutus Lake. This is the main source of boater safety violations and noise pollution. The ALA must take a stand on fireworks, to the point of reporting violators to the proper authority. Fireworks are a source of water, air and noise pollution. Water quality as referred to a clarity. 50 years ago you could drink the water. I would not try it now. Arbutus Lake does have some of the clearest water of any lake in Wisconsin. 10m - quality of living 15r - PWC
49	1. Regulate to full extent of authority the use and speed of motorized watercraft n bays. The bottoms are often significantly disturbed. 2. Evaluate the benefits/disadvantages & cost of bay dredging. 3. Pursue working w/ all property owners on nutrient/runoff management. 4. Notify all property owners to have shields on outside lights to reduce pollution. 5. Promote lake association membership.
50	
51	At one point we were members of the Lake Association. It is difficult to define and separate a member of the Lake Association and a member that works as an inspector for the town. Many favors have been granted to a few because of friendships resulting in overlooking many ordinances (for example, how can owners enclose their porches or add and remodel with a threat from the inspector that they will have to tear down what was contructed legallay and years pass only to find nothing was ever returned to its original state.) Hopefully new leaders for the Lake Association will result in more action. Personal watercraft rip around the bays and disturb the fish beds but nothing is done to restrict them. We know septic systems have failed in many cottages. Why not have the DNR or the County test the septic system for each cottage and require a holding tank. Only a few have been required to do so at this time. I think whoever composed the survey did an excellant job and hopefully will continue to do so.
52	we recently sold our lake property and are not currently property owners. We do belong to the lake association and are greatly concerned about the quality and health of the lake. We do use the lake for recreational purposes. We feel the ALA is doing a good job or caring for the lake.
53	

C

APPENDIX C

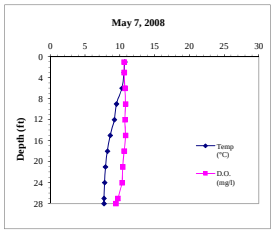
Water Quality Data

Arbutus Lake

Date: 05-07-08
Time: 9:35
Weather: 100% Clouds, Windy, 55°F
Ent: BTB **Verf:**

Max Depth (ft): 30.6
ALS Depth (ft): 3.0
ALB Depth (ft): 28.0
Secchi Depth (ft): 15.0

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	10.7	10.6	7.2	65
3.0	10.6	10.6	7.2	65
6.0	10.3	10.7	7.1	65
9.0	9.5	10.8	7.1	65
12.0	9.2	10.7	7.1	65
15.0	8.6	10.8	7.1	65
18.0	8.2	10.6	7.0	65
21.0	7.9	10.4	7.0	65
24.0	7.8	10.3	6.9	65
27.0	7.7	9.7	6.8	65
28.0	7.7	9.4	6.8	65



Parameter	ALS	ALB
Total P (µg/L)	30.000	9.000
Dissolved P (µg/L)	5.000	ND
Chl a (µg/L)	0.97	NA
TKN (µg/L	590.00	450.00
NO3+NO2-N (µg/L)	77.000	71.000
NH3-N (µg/L)	15.000	15.000
Total N (µg/L)	667.00	521.00
Lab Cond. (µS/cm)	69	69
Lab pH	7.45	7.38
Alkal (mg/l CaCO3)	24	NA
Total Susp Sol (mg/l)	ND	ND
Calcium (mg/l)	5.8	NA

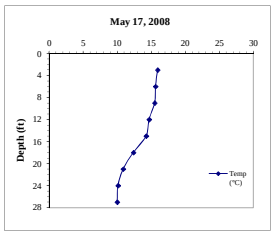
Data collected by BTB and SNK

Arbutus

Date: 05-17-08
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): 27.0
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 22.5

Depth (ft)	Temp (°C)	Temp (°F)
3.0	15.9	57.5
6.0	15.6	57.0
9.0	15.5	56.8
12.0	14.7	55.5
15.0	14.3	54.8
18.0	12.4	51.8
21.0	10.9	49.4
24.0	10.1	48.2
27.0	10.0	48.0



Parameter	ALS	ALB
Total P (µg/L)	17.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	ND	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

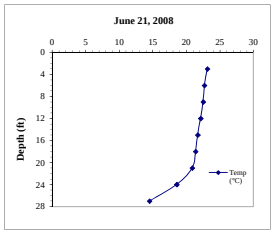
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 06-21-08
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): 27.0
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 18.0

Depth (ft)	Temp (°C)	Temp (°F)
3.0	23.1	69.0
6.0	22.7	68.3
9.0	22.5	68.0
12.0	22.1	67.4
15.0	21.7	66.7
18.0	21.4	66.2
21.0	20.9	65.4
24.0	18.6	61.7
27.0	14.5	55.2



Parameter	ALS	ALB
Total P (µg/L)	10.00	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	0.77	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

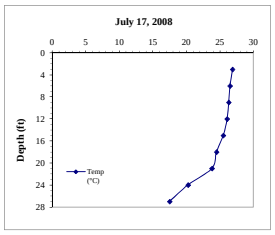
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 07-17-08
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): 27.0
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 18.3

Depth (ft)	Temp (°C)	Temp (°F)
3.0	26.9	75.0
6.0	26.5	74.4
9.0	26.3	74.1
12.0	26.1	73.7
15.0	25.5	72.8
18.0	24.5	71.2
21.0	23.8	70.1
24.0	20.3	64.4
27.0	17.5	60.0



Parameter	ALS	ALB
Total P (µg/L)	16.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	0.66	NA
TKN (µg/L	450.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	ND	NA
Total N (µg/L)	450.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

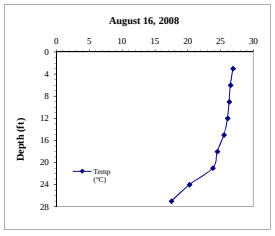
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 08-16-08
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): 27.0
ALS Depth (ft): 6.0
ALB Depth (ft): 27.0
Secchi Depth (ft): 15.0

Depth (ft)	Temp (°C)	Temp (°F)
3.0	26.5	74.4
6.0	25.9	73.5
9.0	25.9	73.4
12.0	25.8	73.2
15.0	25.8	73.2
18.0	25.5	72.8
21.0	24.5	71.2
24.0	22.4	67.8
27.0	19.1	62.6



Parameter	ALS	ALB
Total P (µg/L)	11.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	2.41	NA
TKN (µg/L	440.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	17.000	NA
Total N (µg/L)	440.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

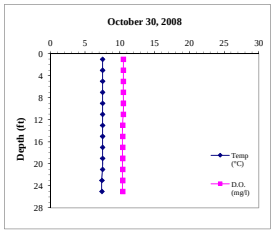
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 10-30-08
Time: 14:42
Weather:
Ent: BTB **Verf:**

Max Depth (ft): 28.2
ALS Depth (ft): 3.0
ALB Depth (ft): 25.0
Secchi Depth (ft): 24.4

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	7.5	10.5	6.7	63
3.0	7.5	10.5	6.3	63
5.0	7.5	10.5	6	64
7.0	7.5	10.5	5.8	63
9.0	7.5	10.5	5.7	63
11.0	7.5	10.5	5.7	64
13.0	7.5	10.4	5.7	63
15.0	7.5	10.4	5.7	64
17.0	7.5	10.4	5.8	64
19.0	7.5	10.4	5.8	64
21.0	7.5	10.4	5.9	63
23.0	7.4	10.4	6	63
25.0	7.4	10.4	6.0	63



Parameter	ALS	ALB
Total P (µg/L)	15.000	11.000
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	3.24	NA
TKN (µg/L	460.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	ND	NA
Total N (µg/L)	460.00	NA
Lab Cond. (µS/cm)	63	63
Lab pH	6.30	6.00
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	ND	ND
Calcium (mg/l)	NA	NA

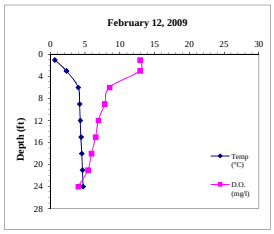
Data Collected by TAH

Arbutus

Date: 02-12-09
Time: 9:30
Weather: 33°F, Cloudy
Ent: BTB **Verf:**

Max Depth (ft): 26.5
ALS Depth (ft): 3.0
ALB Depth (ft): 23.0
Secchi Depth (ft): 26.2

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	0.6	12.9	7.7	71
3.0	2.3	12.9	7.6	71
6.0	4.0	8.5	7.3	72
9.0	4.2	7.8	7.2	72
12.0	4.3	6.9	7.1	72
15.0	4.4	6.5	7	73
18.0	4.5	5.9	6.9	74
21.0	4.6	5.4	6.9	75
24.0	4.7	4	6.8	82



Parameter	ALS	ALB
Total P (µg/L)	39.000	15.000
Dissolved P (µg/L)	8.000	7.000
Chl a (µg/L)	NA	NA
TKN (µg/L	420.00	450.00
NO3+NO2-N (µg/L)	ND	ND
NH3-N (µg/L)	55.000	86.000
Total N (µg/L)	420.00	450.00
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	ND	ND
Calcium (mg/l)	NA	NA

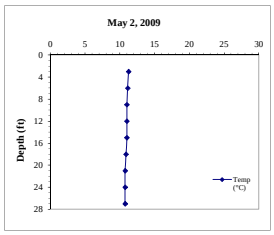
Data collected by EJH and SNK (Onterra)
Ice - 1.5 ft

Arbutus

Date: 05-02-09
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): NA
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 28.0

Depth (ft)	Temp (°C)
3.0	11.3
6.0	11.1
9.0	11.0
12.0	11.0
15.0	11.0
18.0	10.9
21.0	10.8
24.0	10.8
27.0	10.8



Parameter	ALS	ALB
Total P (µg/L)	12.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	NA	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

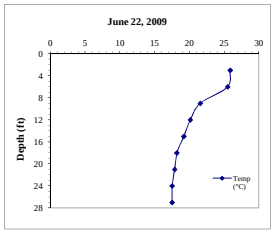
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 06-22-09
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): NA
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 24.0

Depth (ft)	Temp (°C)
3.0	25.9
6.0	25.5
9.0	21.6
12.0	20.1
15.0	19.2
18.0	18.2
21.0	17.9
24.0	17.5
27.0	17.5



Parameter	ALS	ALB
Total P (µg/L)	8.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	1.840	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

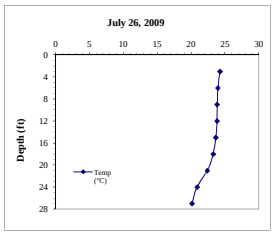
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 07-26-09
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): NA
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 17.0

Depth (ft)	Temp (°C)
3.0	24.3
6.0	23.9
9.0	23.8
12.0	23.8
15.0	23.6
18.0	23.3
21.0	22.4
24.0	20.9
27.0	20.1



Parameter	ALS	ALB
Total P (µg/L)	10.000	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	2.020	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

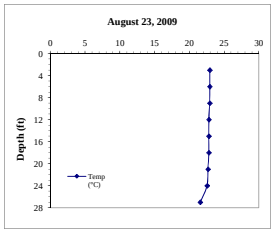
Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Arbutus

Date: 08-23-09
Time: NA
Weather: NA
Ent: BTB **Verf:**

Max Depth (ft): NA
ALS Depth (ft): 6.0
ALB Depth (ft): NA
Secchi Depth (ft): 17.0

Depth (ft)	Temp (°C)
3.0	22.9
6.0	22.9
9.0	22.9
12.0	22.8
15.0	22.8
18.0	22.8
21.0	22.7
24.0	22.6
27.0	21.6



Parameter	ALS	ALB
Total P (µg/L)	NA	NA
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	NA	NA
TKN (µg/L	NA	NA
NO3+NO2-N (µg/L)	NA	NA
NH3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	NA	NA
Calcium (mg/l)	NA	NA

Data collected by Logan Van Hoof (Arbutus Lake Association CLMN)

Water Quality Data

2007	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	11	20.5	NA	NA
Total P (µg/L)	10	16.8	3	11.7
Dissolved P (µg/L)	2	6.5	2	7.0
Chl a (µg/L)	7	1.7	NA	NA
TKN (µg/L	5	472.0	2	450.0
NO3+NO2-N (µg/L)	5	77.0	2	78.5
NH3-N (µg/L)	5	29.0	2	50.5
Total N (µg/L)	5	487.4	2	228.7
Lab Cond. (µS/cm)	2	66.0	2	66.0
Lab pH	2	6.9	2	6.7
Alkal (mg/l CaCO3)	1	24.0	NA	NA
Total Susp Sol (mg/l)	3	ND	3	ND
Calcium (µg/L)	1	5.8	NA	NA

Wisconsin Trophic State Index (WTSI)

Year	TP	Chla	SD
1994	46.51	43.65	44.56
1995	48.68	41.82	35.79
1996		40.30	36.71
1997			29.00
1998			35.06
2000	45.24	37.29	38.95
2001	45.66	43.01	42.56
2002	45.24	35.06	
2003			36.71
2004	44.79	36.13	
2007	43.82	42.10	37.38
2008	47.69	36.62	36.66
2009	45.24	39.70	34.45
All Years (weighted)	46.48	40.62	36.60
WI Natural Lakes	53.19	54.23	47.33
Northeast Region	51.05	51.49	45.61

Morphological / Geographical Data

Parameter	Value
Acreage	161
Volume (acre-feet)	1,925
Perimeter (miles)	2.5
Shoreland Development	
Maximum Depth (feet)	29
County	Forest County
WBIC	181400
Lillie Mason Region(1983)	Northeast
Nichols Ecoregion(1999)	NLFF

Watershed Data

WiLMS Class	Acreage	kg/yr	lbs/yr
Forest	432.8		
Open Water	168.7		
Pasture/Grass	73.5		
Row Crops	0.0		
Urban - Rural Residential	0.0		
Wetland	78.3		

Watershed to Lake Area	3:1

	Secchi (feet)				Chlorophyll a (µg/L)				Phosphorus (µg/L)				Phosphorus (µg/L)				Nitrogen (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season				Spring Turnover		Fall Turnover		Spring Turnover		Fall Turnover	
Year	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean
1994	10	9.6	5	9.6	6	4.76	3	3.27	10	15.6	5	10.6								
1995	12	18.1	8	17.6	9	1.97	4	2.56	12	15.83	6	14								
1996	5	16.1	3	16.5	2	3.59	1	2.09	2	5.5										
1997	3	28.2	3	28.2																
1998	2	18.5	2	18.5																
2000	3	12.1	2	14.1	2	1.4	1	1.4	2	11	1	9								
2001	7	9.9	2	11.0	3	4.67	2	3	5	10.8	2	9.5								
2002					2	1.04	2	1.04	3	11	2	9								
2003	4	17.3	2	16.5	1	0.17			2	5.5										
2004					2	1.2	2	1.2	2	8.5	2	8.5								
2007	3	15.3	2	15.8	4	2.66	4	2.66	4	7.5	4	7.5								
2008	8	17.9	4	16.6	6	1.34	3	1.28	6	16.5	3	12.33								
2009	4	21.5	3	19.3	2	1.93	2	1.93	3	10	2	9								
All Years (weighted)		15.8		16.6		2.5		2.2		12.8		10.6								
WI Natural Lakes				7.9				13.4				25								
Northeast Region				8.9				9.3				19.0								

Summer 2008 N:	445	GSM:	12.8
Summer 2008 P:	12	Mean SPO:	21.0
Summer 2008 N:P	37 :1		

D

APPENDIX D

Watershed Analysis WiLMS Results

Date: 9/29/2009 Scenario: Arbutus Current

Lake Id: ArbutusForest
Watershed Id: Arbutus

Hydrologic and Morphometric Data

Tributary Drainage Area: 584.6 acre
Total Unit Runoff: 13.10 in.
Annual Runoff Volume: 638.2 acre-ft
Lake Surface Area <As>: 168.7 acre
Lake Volume <V>: 1925.0 acre-ft
Lake Mean Depth <z>: 11.4 ft
Precipitation - Evaporation: 5.3 in.
Hydraulic Loading: 712.7 acre-ft/year
Areal Water Load <qs>: 4.2 ft/year
Lake Flushing Rate <p>: 0.37 1/year
Water Residence Time: 2.70 year
Observed spring overturn total phosphorus (SPO): 21.0 mg/m^3
Observed growing season mean phosphorus (GSM): 12.8 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|	
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0	0	0
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	10.5	0.10	0.30	0.50	3.0	0	1	2
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	78.3	0.10	0.10	0.10	7.4	3	3	3
Forest	495.8	0.05	0.09	0.18	42.0	10	18	36
Lake Surface	168.7	0.10	0.30	1.00	47.6	7	20	68

POINT SOURCE DATA

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

SEPTIC TANK DATA

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

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	45.1	94.8	241.8	100.0
Total Loading (kg)	20.5	43.0	109.7	100.0
Areal Loading (lb/ac-year)	0.27	0.56	1.43	
Areal Loading (mg/m^2-year)	29.96	62.96	160.66	
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	30.0	49.6	91.3	100.0
Total NPS Loading (kg)	13.6	22.5	41.4	100.0

Phosphorus Prediction and Uncertainty Analysis Module

Date: 9/29/2009 Scenario: **Arbutus Current**

Observed spring overturn total phosphorus (SPO): 21.0 mg/m^3
Observed growing season mean phosphorus (GSM): 12.8 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	12	25	63	12	94
Canfield-Bachmann, 1981 Natural Lake	11	18	35	5	39
Canfield-Bachmann, 1981 Artificial Lake	11	18	32	5	39
Rechow, 1979 General	2	5	12	-8	-63
Rechow, 1977 Anoxic	15	31	79	18	141
Rechow, 1977 water load<50m/year	5	10	27	-3	-23
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	10	21	54	0	0
Vollenweider, 1982 Combined OECD	9	17	37	0	0
Dillon-Rigler-Kirchner	6	12	30	-9	-43
Vollenweider, 1982 Shallow Lake/Res.	7	13	30	-4	-24
Larsen-Mercier, 1976	9	18	47	-3	-14
Nurnberg, 1984 Oxic	5	11	28	-2	-16

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	14	50	Tw	0	GSM
Canfield-Bachmann, 1981 Natural Lake	6	52	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	6	52	FIT	1	GSM
Rechow, 1979 General	3	10	L	0	GSM
Rechow, 1977 Anoxic	18	62	FIT	0	GSM
Rechow, 1977 water load<50m/year	6	21	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	10	45	FIT	0	SPO
Vollenweider, 1982 Combined OECD	8	34	FIT	0	ANN
Dillon-Rigler-Kirchner	7	24	L qs	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	6	26	FIT	0	ANN
Larsen-Mercier, 1976	11	36	P Pin	0	SPO
Nurnberg, 1984 Oxic	6	23	FIT	0	ANN

E

APPENDIX E

Aquatic Plant Survey Data

Sample Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock	Rope (R); Pole (P); Visual (V)	Comment	Brasenia schreberi	Chara sp.	Dulichium arundianaceum	Elatine minima	Eleocharis acicularis	Elodea canadensis	Eriocaulon aquaticum	Heteranthera dubia	Isoetes lacustris	Juncus pelocarpus	Lobelia dortmanna	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton folliosus	Potamogeton illinoensis	Potamogeton natans	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton zosteriformis	Ranunculus flammula	Scirpus subterminalus	Sparganium angustifolium	Utricularia intermedia	Utricularia vulgaris	Vallisneria americana
1	45.40374	-88.86556	5	S	P					1	1	1		1	1								1							1		1						
2	45.40335	-88.86556	5	M	P							1							1				1							1		1						1
3	45.40296	-88.86557	10	M	P							1																	1	1							1
4	45.40258	-88.86558	7	M	P				1			1																	1			1					
5	45.40219	-88.86559	5	S	P							1						1	1													1					
6	45.40180	-88.86559	3	S	P							1						1																			
7	45.40141	-88.86560	5	S	P					1																						2					
8	45.40103	-88.86561	5	S	P					1		1																				1					
9	45.40064	-88.86562	6	M	P							1						1					1									1					
10	45.40025	-88.86563	4	M	P							1		1					1											1							1
11	45.39987	-88.86563	7	M	P						1								1																		1
12	45.39948	-88.86564	5	M	P				1		1																	1									1
13	45.39909	-88.86565	6	M	P			1				1		1									1							1							2
14	45.39871	-88.86566	6	M	P			1																							1						2
15	45.39832	-88.86566	4	M	P							1						1	1				1									1					2
16	45.39793	-88.86567	3	M	P																																2
17	45.39754	-88.86568	2	M	P		1											1	1		1						1						1			
18	45.40450	-88.86499	6	S	P																		1							1							1
19	45.40412	-88.86500	7	M	P							1		1																							1
20	45.40373	-88.86501	11	M	P							1																		1							
21	45.40334	-88.86501	10	M	P	No Vegetation	1	1																													
22	45.40296	-88.86502	16	-	R							1								1																	
23	45.40257	-88.86503	15	-	R							1								1										2							
24	45.40218	-88.86504	14	-	R							1																		1							
25	45.40180	-88.86504	14	-	R					1		1																		2		2					
26	45.40141	-88.86505	12	M	P							1													1												
27	45.40102	-88.86506	14	-	R							1								1										1							
28	45.40064	-88.86507	10	M	P							1																	1	1	1						
29	45.40025	-88.86508	11	M	P							1																									
30	45.39986	-88.86508	9	M	P							1																		2							
31	45.39947	-88.86509	8	M	P							1																		1							1
32	45.39909	-88.86510	6	M	P			1																						2							1
33	45.39870	-88.86511	5	M	P							1						1												1							2
34	45.39831	-88.86511	4	M	P							1																		1							
35	45.39793	-88.86512	3	M	P						1	1																		1							1
36	45.39754	-88.86513	2	M	P			1																													
37	45.39715	-88.86514	2	M	P		1														1						1						1				
38	45.39677	-88.86515				Missing																															
39	45.39638	-88.86515				Missing																															
40	45.39599	-88.86516				unreachable																															
41	45.40489	-88.86443	2	S	P							1		1		1													1								
42	45.40450	-88.86444	10	M	P							1																									1
43	45.40411	-88.86445	14	-	R							1																									
44	45.40373	-88.86446	15	-	R							1								2																	
45	45.40334	-88.86446	18	-	R							1								1						1				1							
46	45.40295	-88.86447	21	-	R							1								2																	
47	45.40256	-88.86448	18	-	R							1								1											1						
48	45.40218	-88.86449	19	-	R							1								1										1	1						
49	45.40179	-88.86450	19	-	R							1								2																	
50	45.40140	-88.86450	7	-	R							1																			2						
51	45.40102	-88.86451	16	-	R							1								1										1	1						
52	45.40063	-88.86452	15	-	R																									1							
53	45.40024	-88.86453	14	-	R							1								1										1	1						
54	45.39986	-88.86453	13	-	R							2																		1							
55	45.39947	-88.86454	10	M	P							1																		1							1
56	45.39908	-88.86455	7	M	P			2																						1							
57	45.39869	-88.86456	6	M	P																																1
58	45.39831	-88.86457	5	M	P			1																													
59	45.39792	-88.86457	4	M	P							1																		1							
60	45.39753	-88.86458	4	M	P						1																										1
61	45.39715	-88.86459	3	M	P																												1				
62	45.39676	-88.86460	2	M	P		1														1											1		1	1	
63	45.39637	-88.86460	3	M	P		1														1															

Sample Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock	Rope (R); Pole (P); Visual (V)	Comment	Brasenia schreberi	Chara sp.	Dulichium arundianaceum	Elatine minima	Eleocharis acicularis	Elodea canadensis	Eriocaulon aquaticum	Heteranthera dubia	Isoetes lacustris	Juncus pelocarpus	Lobelia dortmanna	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton folliosus	Potamogeton illinoensis	Potamogeton natans	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton zosteriformis	Ranunculus flammula	Scirpus subterminalus	Sparganium angustifolium	Utricularia intermedia	Utricularia vulgaris	Vallisneria americana
64	45.39599	-88.86461				Missing																															
65	45.39560	-88.86462				unreachable																															
66	45.40488	-88.86388	8	M	P			1				1																1								2
67	45.40449	-88.86389	14	-	R	No Vegetation																															
68	45.40411	-88.86390	21	-	R							1								1										2						
69	45.40372	-88.86391	23	-	R															1																
70	45.40333	-88.86392	23	-	R	No Vegetation																															
71	45.40295	-88.86392	23	-	R	No Vegetation																															
72	45.40256	-88.86393	23	-	R															1																
73	45.40217	-88.86394	19	-	R							1								1																
74	45.40179	-88.86395	20	-	R							1								1											1					
75	45.40140	-88.86395	20	-	R							1								1											1					
76	45.40101	-88.86396	17	-	R							1								2											1					
77	45.40062	-88.86397	16	-	R							1																		2						
78	45.40024	-88.86398	15	-	R							1								1										1	1					
79	45.39985	-88.86399	13	-	R							1																		2						
80	45.39946	-88.86399	11	M	P							1																								
81	45.39908	-88.86400	7	M	P			1				1																		1						2
82	45.39869	-88.86401	6	M	P			1																						1						1
83	45.39830	-88.86402	5	M	P	No Vegetation																															
84	45.39792	-88.86402	4	M	P			1				1																		2						1
85	45.39753	-88.86403	4	M	P						1	1		1																						2
86	45.39714	-88.86404	3	M	P		1				1			1												1						1	1	1	1	
87	45.39675	-88.86405				Missing																															
88	45.39637	-88.86405	3	M	P		1																									1				
89	45.39598	-88.86406	2	M	P		1														1											1			1	
90	45.39559	-88.86407				unreachable																															
91	45.39521	-88.86408				unreachable																															
92	45.40488	-88.86333	10	-	R																																1
93	45.40449	-88.86334	18	-	R	No Vegetation																															
94	45.40410	-88.86335	23	-	R															1																
95	45.40371	-88.86336	24	-	R	No Vegetation																															
96	45.40333	-88.86337	24	-	R	No Vegetation																															
97	45.40294	-88.86337				Too Deep																															
98	45.40255	-88.86338	24	-	R															2																
99	45.40217	-88.86339	19	-	R							1								2																
100	45.40178	-88.86340	21	-	R							1								1																
101	45.40139	-88.86340	18	-	R							1								2										1						
102	45.40101	-88.86341	16	-	R							1								2											1					
103	45.40062	-88.86342	16	-	R							1								2																
104	45.40023	-88.86343	15	-	R							1								1										1						
105	45.39984	-88.86344	12	M	P							1								1										2						
106	45.39946	-88.86344	11	M	P							1								1										1						
107	45.39907	-88.86345	9	M	P							1																		1						2
108	45.39868	-88.86346	6	M	P			1																												2
109	45.39830	-88.86347	6	M	P																									1						1
111	45.39636	-88.86351	2	M	P													1	1		1			1				1							1	
112	45.39597	-88.86351	2	M	P		1														1											1				
112	45.39559	-88.86352				unreachable																															
113	45.39520	-88.86353				unreachable																															
114	45.40526	-88.86278	5	S	P												1																			
115	45.40487	-88.86279	13	-	R																									2						
116	45.40448	-88.86279	21	-	R							1								2																
117	45.40410	-88.86280	24	-	R	No Vegetation																															
118	45.40371	-88.86281				Too Deep																															
119	45.40332	-88.86282				Too Deep																															
120	45.40294	-88.86282				Too Deep																															
121	45.40255	-88.86283	24	-	R	No Vegetation																															
122	45.40216	-88.86284	19	-	R	No Vegetation						1								2																
123	45.40177	-88.86285	10	-	R							1								1																
124	45.40139	-88.86286	17	-	R							1								2																
125	45.40100	-88.86286	16	-	R							1								1								1								
126	45.40061	-88.86287	15	-	R							1								1										1	1					

Sample Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock	Rope (R); Pole (P); Visual (V)	Comment	Brasenia schreberi	Chara sp.	Dulichium arundianaceum	Elatine minima	Eleocharis acicularis	Elodea canadensis	Eriocaulon aquaticum	Heteranthera dubia	Isoetes lacustris	Juncus pelocarpus	Lobelia dortmanna	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton folliosus	Potamogeton illinoensis	Potamogeton natans	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton zosteriformis	Ranunculus flammula	Scirpus subterminalus	Sparganium angustifolium	Utricularia intermedia	Utricularia vulgaris	Vallisneria americana
127	45.40023	-88.86288	14	-	R							1								1										1	1						
128	45.39984	-88.86289	12	M	P	No Vegetation																															
129	45.39945	-88.86289	11	M	P							1								1								1									
130	45.39907	-88.86290	7	M	P			2																													1
131	45.39868	-88.86291	7	M	P																																1
132	45.39829	-88.86292	6	M	P						1	1											2							1							1
133	45.39790	-88.86293				dock																															
134	45.39558	-88.86297	2	M	P		1												1		1						1						1		1		
135	45.39520	-88.86298				unreachable																															
136	45.39481	-88.86299				unreachable																															
137	45.40525	-88.86223	9	M	P							1							1																		
138	45.40486	-88.86224	17	-	R	No Vegetation																															1
139	45.40448	-88.86224	24	-	R	No Vegetation																															
140	45.40409	-88.86225				Too Deep																															
141	45.40370	-88.86226				Too Deep																															
142	45.40332	-88.86227				Too Deep																															
143	45.40293	-88.86228				Too Deep																															
144	45.40254	-88.86228	23	-	R	No Vegetation																															
145	45.40216	-88.86229	21	-	R							1								1																	
146	45.40177	-88.86230	18	-	R							1								1																	
147	45.40138	-88.86231	17	-	R															1																	
148	45.40099	-88.86231	16	-	R							1								1								1									
149	45.40061	-88.86232	14	-	R							1								1											1						
150	45.40022	-88.86233	13	-	R							1																			2						
151	45.39983	-88.86234	11	M	P	No Vegetation																						1									
152	45.39945	-88.86234	9	M	P							1																			1							2
153	45.39906	-88.86235	8	M	P														1												1						
154	45.39867	-88.86236	7	M	P																																1
155	45.39829	-88.86237	6	M	P			1				1																			1	1					
156	45.39790	-88.86238	3	M	P		1						1				1				1												1				
157	45.39519	-88.86243				unreachable																															
158	45.40563	-88.86167	2	S	P													1																			
159	45.40525	-88.86168	14	-	R							1								1																	
160	45.40486	-88.86169	21	-	R							1								2											1						
161	45.40447	-88.86169				Too Deep																															
162	45.40409	-88.86170				Too Deep																															
163	45.40370	-88.86171				Too Deep																															
164	45.40331	-88.86172				Too Deep																															
165	45.40292	-88.86173				Too Deep																															
166	45.40254	-88.86173	23	-	R							1								1																	
167	45.40215	-88.86174	18	-	R							1								1																	
168	45.40176	-88.86175	17	-	R							1								2																	
169	45.40138	-88.86176	16	-	R															1								2									
170	45.40099	-88.86176	15	-	R							1								1																	
171	45.40060	-88.86177	14	-	R							1								1											1						
172	45.40022	-88.86178	13	-	R															1												1					
173	45.39983	-88.86179	10	M	P							1								1																	
174	45.39944	-88.86180	9	M	P							1								1											1						2
175	45.39905	-88.86180	8	M	P																																2
176	45.39867	-88.86181	7	M	P																																1
177	45.39828	-88.86182	3	M	P																		2								1						1
178	45.39789	-88.86183	3	M	P							1											1						1								2
179	45.40563	-88.86112	7	M	P																		2														
180	45.40524	-88.86113	16	-	R							1								1											2						
181	45.40485	-88.86114	23	-	R															1																	
182	45.40447	-88.86115				Too Deep																															
183	45.40408	-88.86115				Too Deep																															
184	45.40369	-88.86116				Too Deep																															
185	45.40331	-88.86117				Too Deep																															
186	45.40292	-88.86118				Too Deep																															
187	45.40253	-88.86118	23	-	R															1																	
188	45.40214	-88.86119	20	-	R							1								2																	
189	45.40176	-88.86120	18	-	R																							2									

Sample Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock	Rope (R); Pole (P); Visual (V)	Comment	Brasenia schreberi	Chara sp.	Dulichium arundianaceum	Elatine minima	Eleocharis acicularis	Elodea canadensis	Eriocaulon aquaticum	Heteranthera dubia	Isoetes lacustris	Juncus pelocarpus	Lobelia dortmanna	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton folliosus	Potamogeton illinoensis	Potamogeton natans	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton zosteriformis	Ranunculus flammula	Scirpus subterminalus	Sparganium angustifolium	Utricularia intermedia	Utricularia vulgaris	Vallisneria americana
190	45.40137	-88.86121	16	-	R																									2							
191	45.40098	-88.86122	14	-	R							1								2																	
192	45.40060	-88.86122	13	-	R							1								1																	
193	45.40021	-88.86123	10	M	P							1								1			1							1							
194	45.39982	-88.86124	10	M	P							1																		2							
195	45.39944	-88.86125	8	M	P							2																		1							
196	45.39905	-88.86125	7	M	P							1																									1
197	45.39866	-88.86126	6	M	P							1																									
198	45.39827	-88.86127	5	M	P	No Vegetation						1																									
199	45.39789	-88.86128	4	M	P																											2					1
200	45.39750	-88.86129				Missing																															
201	45.40562	-88.86057	12	M	P							1								1										1							
202	45.40523	-88.86058	20	-	R							1								1										1							
203	45.40485	-88.86059	24	-	R	No Vegetation																															
204	45.40446	-88.86060				Too Deep																															
205	45.40407	-88.86060				Too Deep																															
206	45.40369	-88.86061				Too Deep																															
207	45.40330	-88.86062				Too Deep																															
208	45.40291	-88.86063				Too Deep																															
209	45.40253	-88.86063				Too Deep																															
210	45.40214	-88.86064	23	-	R							1								1																	
211	45.40175	-88.86065	17	-	R							1								1										1							
212	45.40137	-88.86066	16	-	R							1								1										2	1						
213	45.40098	-88.86067	15	-	R							1																		1							
214	45.40059	-88.86067	12	M	P							1								1																	
215	45.40020	-88.86068	8	M	P							1																		1							1
216	45.39982	-88.86069	8	M	P							1																		1							2
217	45.39943	-88.86070	8	M	P																									1							1
218	45.39904	-88.86070	7	M	P																									1							2
219	45.39866	-88.86071	5	M	P	No Vegetation																															
220	45.39827	-88.86072	5	M	P	No Vegetation																															
221	45.39788	-88.86073	3	M	P		1					1					1															1					
222	45.39750	-88.86074	2	M	P		1																				1						1				
223	45.40562	-88.86002	12	M	P							1																1		1							1
224	45.40523	-88.86003	20	-	P							1								1																	
225	45.40484	-88.86004	24	-	P	No Vegetation																															
226	45.40446	-88.86005				Too Deep																															
227	45.40407	-88.86005				Too Deep																															
228	45.40368	-88.86006				Too Deep																															
229	45.40329	-88.86007				Too Deep																															
230	45.40291	-88.86008				Too Deep																															
231	45.40252	-88.86009				Too Deep																															
232	45.40213	-88.86009	21	-	R	No Vegetation																															
233	45.40175	-88.86010	18	-	R							1								1																	
234	45.40136	-88.86011	16	-	R													1	1											2							
235	45.40097	-88.86012	14	-	R							1																		1							
236	45.40059	-88.86012	12	M	P							1																		1							
237	45.40020	-88.86013	8	M	P							1																		1							1
238	45.39981	-88.86014	7	M	P							1																		1							1
239	45.39942	-88.86015	7	M	P																									1							2
240	45.39904	-88.86016	6	M	P																																2
241	45.39865	-88.86016	5	M	P																																1
242	45.39826	-88.86017	4	M	P	No Vegetation																															
243	45.39788	-88.86018	2	S	P												1	1														1					1
244	45.40561	-88.85947	10	M	P														1											2							1
245	45.40522	-88.85948	19	-	R							1								1																	
246	45.40484	-88.85949	24	-	R	No Vegetation																															
247	45.40445	-88.85950				Too Deep																															
248	45.40406	-88.85951				Too Deep																															
249	45.40368	-88.85951				Too Deep																															
250	45.40329	-88.85952				Too Deep																															
251	45.40290	-88.85953				Too Deep																															
252	45.40252	-88.85954				Too Deep																															

Sample Point	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock	Rope (R); Pole (P); Visual (V)	Comment	Brasenia schreberi	Chara sp.	Dulichium arundianaceum	Elatine minima	Eleocharis acicularis	Elodea canadensis	Eriocaulon aquaticum	Heteranthera dubia	Isoetes lacustris	Juncus pelocarpus	Lobelia dortmanna	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton folliosus	Potamogeton illinoensis	Potamogeton natans	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton zosteriformis	Ranunculus flammula	Scirpus subterminalus	Sparganium angustifolium	Utricularia intermedia	Utricularia vulgaris	Vallisneria americana
253	45.40213	-88.85954	23	-	R	No Vegetation																															
254	45.40174	-88.85955	18	-	R							1								2																	
255	45.40135	-88.85956	17	-	R							1								1																	
256	45.40097	-88.85957	13	-	R							1																		2							
257	45.40058	-88.85958	11	M	P							1																		2							
258	45.40019	-88.85958	7	M	P							1							1											1							1
259	45.39981	-88.85959	2	S	P					1							1															1				
260	45.39942	-88.85960	6	M	P			1			1	1							1																	1
261	45.39903	-88.85961	4	M	P			1			1																									1
262	45.39865	-88.85961	5	M	P	No Vegetation																															
263	45.39826	-88.85962	4	M	P						1	1																									2
264	45.39787	-88.85963	3	M	P		1									1																				1
265	45.39748	-88.85964	2	M	P																1						1						1			
266	45.40561	-88.85892	8	M	P			1			1	1		1														1								1
267	45.40522	-88.85893	17	-	R							1																		1							
268	45.40483	-88.85894	23	-	R							1								1																	
269	45.40444	-88.85895				Too Deep																															
270	45.40406	-88.85896				Too Deep																															
271	45.40367	-88.85896	26	-	R	No Vegetation																															
272	45.40328	-88.85897				Too Deep																															
273	45.40290	-88.85898				Too Deep																															
274	45.40251	-88.85899	23	-	R	No Vegetation																															
275	45.40212	-88.85899	22	-	R							1																									
276	45.40174	-88.85900	19	-	R							1								1																	
277	45.40135	-88.85901	15	-	R															2										1							
278	45.40096	-88.85902	13	-	R							1								1										1							
279	45.40057	-88.85903	11	M	P							1																		2							1
280	45.40019	-88.85903	6	M	P							1																		2	1						
281	45.39980	-88.85904	4	M	P					1																						1					1
282	45.39825	-88.85907	3	M	P			1				1						1					1									1					1
283	45.39787	-88.85908	2	M	P							1						1															1				1
284	45.40560	-88.85838	5	M	P						1	1																		1							1
285	45.40521	-88.85838	13	-	R																									1							
286	45.40483	-88.85839	21	-	R							1								1										1							
287	45.40444	-88.85840	24	-	R	No Vegetation																															
288	45.40405	-88.85841	24	-	R	No Vegetation																															
289	45.40367	-88.85841	24	-	R	No Vegetation																															
290	45.40328	-88.85842	23	-	R	No Vegetation																															
291	45.40289	-88.85843	20	-	R	No Vegetation																															
292	45.40250	-88.85844	18	-	R															1																	
293	45.40212	-88.85845	16	-	R															1										2							
294	45.40173	-88.85845	13	-	R							1								1										1	1						
295	45.40134	-88.85846	13	-	R							1								1								1		2							
296	45.40096	-88.85847	9	M	P							1								1																	2
297	45.40057	-88.85848	8	M	P							1								1										2							
298	45.40018	-88.85848	6	M	P	No Vegetation																															
299	45.39980	-88.85849	4	M	P							1							1																		1
300	45.39941	-88.85850	3	S	P		1				1						1	1	1		1																
301	45.40521	-88.85783	7	M	P							1																		1							1
302	45.40482	-88.85784	13	-	R							1																		2							
303	45.40443	-88.85785	20	-	R							1								2																	
304	45.40405	-88.85786	23	-	R	No Vegetation																															
305	45.40366	-88.85786	24	-	R															1																	
306	45.40327	-88.85787	22	-	R							1								1																	
307	45.40289	-88.85788	15	-	R															1										2							
308	45.40250	-88.85789	14	-	R							1								1								1		2							
309	45.40211	-88.85790	12	M	P															1			2														
310	45.40172	-88.85790	11	M	P			2				1								1																	1
311	45.40134	-88.85791	11	M	P															1																	
312	45.40095	-88.85792	9	M	P			1				1																									1
313	45.40056	-88.85793	7	M	P							1																		1							2
314	45.40018	-88.85793	6	M	P																																1
315	45.39979	-88.85794	4	M	P							1																									1

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316	45.39940	-88.85795	4	M	P	No Vegetation																															
317	45.39902	-88.85796	4	M	P						1																								1			1
318	45.40482	-88.85729	12	M	P							1											1							1							2
319	45.40443	-88.85730	16	-	R							1																		2							
320	45.40404	-88.85731	19	-	R							1																									
321	45.40365	-88.85732	19	-	R							1								1																	
322	45.40327	-88.85732	16	M	P							1								1										1							
323	45.40288	-88.85733	15	M	P							1								1										2							
324	45.40249	-88.85734	11	M	P							1								1																	1
325	45.40211	-88.85735	10	M	P							1								1			1							1							1
326	45.40172	-88.85735	10	M	P			1				1																1								2
327	45.40133	-88.85736	9	M	P							1							1	1																	1
328	45.40095	-88.85737	6	M	P			1										1																			
329	45.39978	-88.85739	4	M	P																		1														
330	45.39940	-88.85740	4	M	P																																1
331	45.39901	-88.85741	3	M	P		1																1														
332	45.40481	-88.85674	7	M	P							1							1				1														
333	45.40442	-88.85675	12	M	P							1											1							1							
334	45.40404	-88.85676	14	-	R							1								2										2							
335	45.40365	-88.85677	15	-	R	No Vegetation																															
336	45.40326	-88.85677	14	-	R							1																	1		1						
337	45.40287	-88.85678	8	M	P							1								1									1		1						2
338	45.40249	-88.85679	10	M	P							1		1						1																	1
339	45.40210	-88.85680	9	M	P														1	1																	
340	45.40171	-88.85681	8	M	P			1			1	1																									2
341	45.40133	-88.85681	7	M	P							1								1										1							2
342	45.40094	-88.85682	2	S	P					1							1																				
343	45.39978	-88.85684	3	M	P		1					1									1	1													1		
344	45.39939	-88.85685	3	M	P		1									1																					1
345	45.39900	-88.85686	3	M	P		1														1	1															1
346	45.40442	-88.85620	6	M	P							1											2							1	1						1
347	45.40403	-88.85621				Boat																															
348	45.40364	-88.85622	10	M	P							1								1																	1
349	45.40326	-88.85622	8	M	P			2				1											2					1								1
350	45.40287	-88.85623	8	M	P							1							1	1										1							2
351	45.40248	-88.85624	7	M	P			2				1							1																		1
352	45.40210	-88.85625	6	M	P							1											1														1
353	45.40171	-88.85626	5	M	P							1						1					1														1
354	45.40132	-88.85626	4	M	P							1								1											1						1
355	45.40402	-88.85566	4	S	P	No Vegetation																															
356	45.40364	-88.85567	5	M	P							1							1				1							1	1	1					2
357	45.40325	-88.85568	7	M	P							1																			1						
358	45.40286	-88.85568	3	S	P				1	1	1	1																				1					