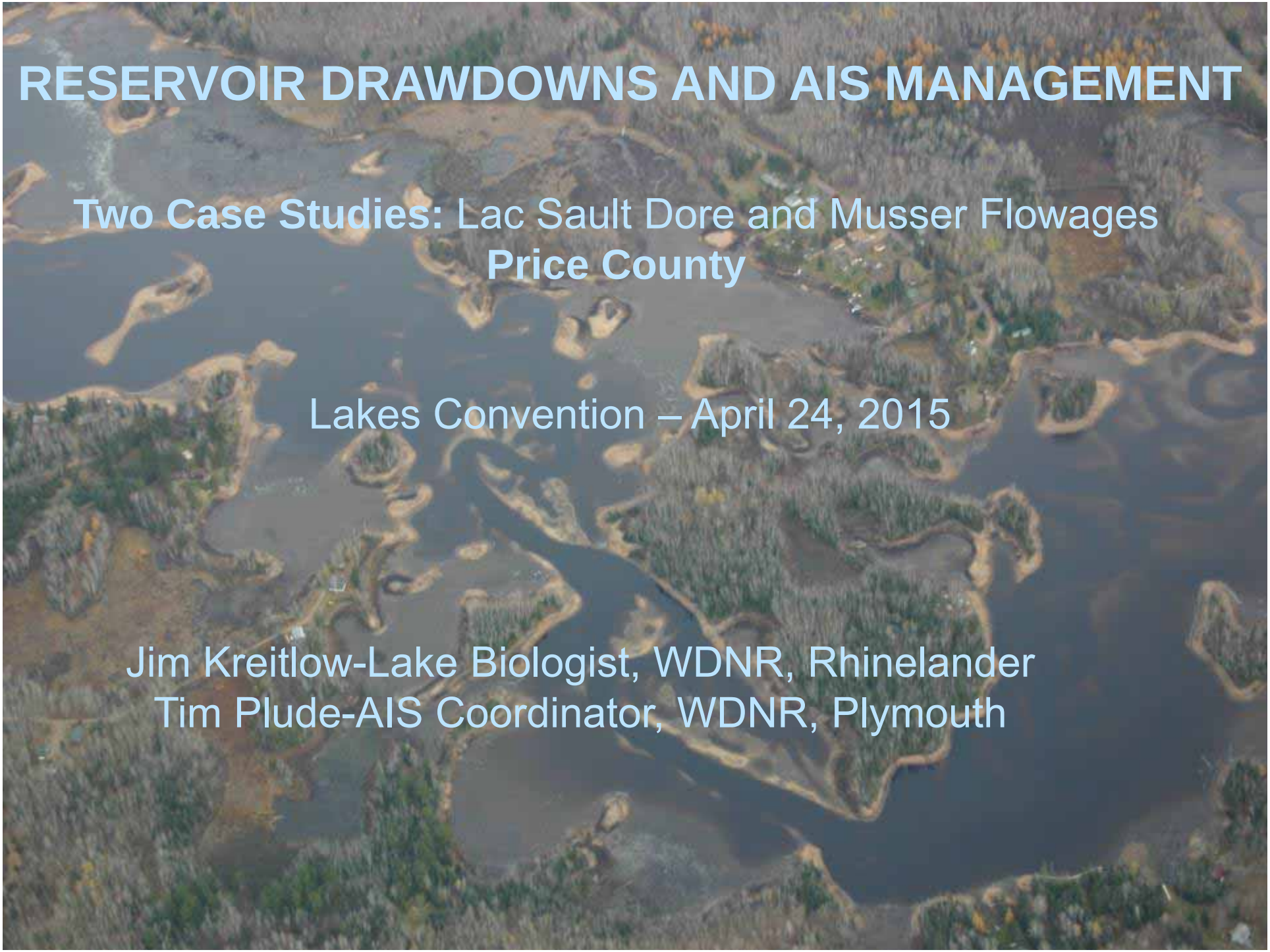


RESERVOIR DRAWDOWNS AND AIS MANAGEMENT

Two Case Studies: Lac Sault Dore and Musser Flowages
Price County

Lakes Convention – April 24, 2015

Jim Kreitlow-Lake Biologist, WDNR, Rhinelander
Tim Plude-AIS Coordinator, WDNR, Plymouth

Aquatic Invasive Plant Management Methods

Chemical
- Selective
- Contact

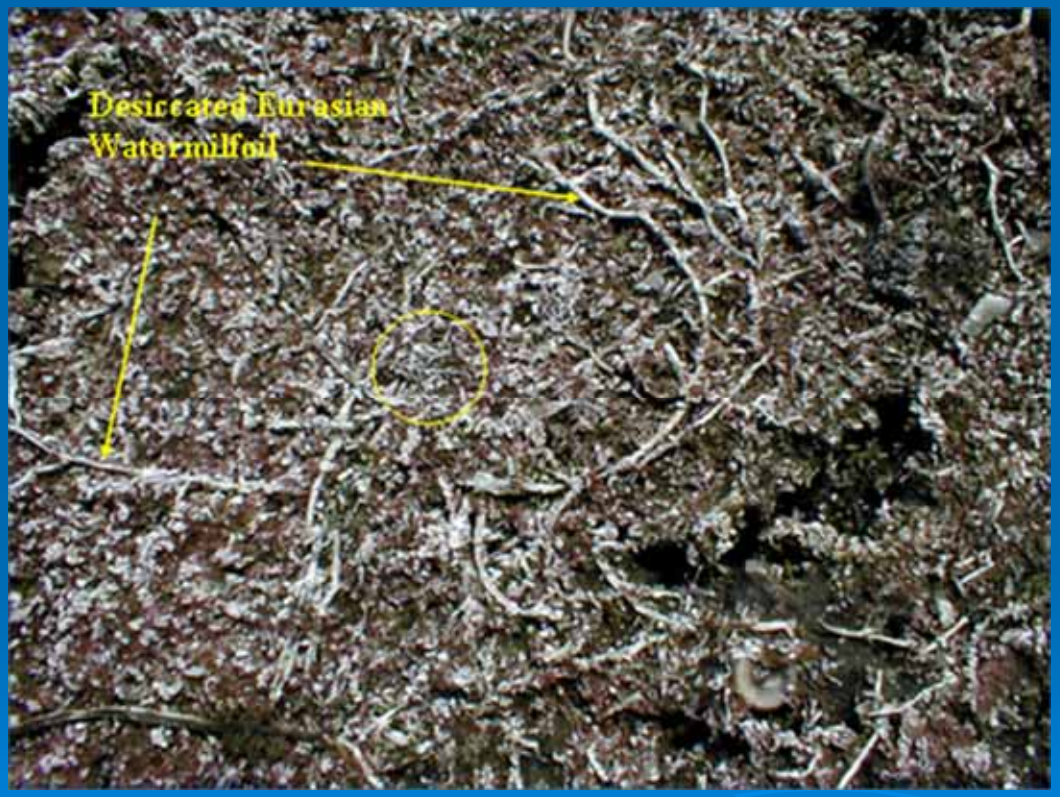
Biological
- Weevils
- Beetles

Mechanical
- Manual
- Harvesting
- Dredging

Physical
- **Drawdown**
- Bottom Barriers

Generally Used in WI

Drawdown



- Limited applicability
- Requires 2-3 months of freezing conditions
- Low cost if available
- Near shore areas only

Expected Benefits

- Winter drawdowns have been shown to be effective in controlling Eurasian water milfoil (EWM)
- Need to study what it can do to other invasives like curly-leaf pondweed (CLP)
- Mixed results on controlling CLP (not many studies out there)

Background

- Winter drawdowns proposed for dam repair (both cases).
- Both flowages have AIS/opportunity to evaluate as a management tool.

  Lac Sault Dore (Soo) in 2010, EWM

  Musser in 2013, CLP

Drawdown pre-planning considerations

- Who has Legal Authority?
- Who owns the dam?
- Review existing Chapter 31 operating order
- May have to request a temporary exemption to the existing operating order if drawdown is more than what is allowed in current order (obtain permit)
- Is an Environmental Assessment (EA) required?
- Meet with County Dam Tender
- Meet with Lake Association Board Members
- Initiate Consultation with Tribes
- Any loss of Hydropower Generation?

Public Participation/Communication (once drawdown plans are set)

- Develop frequently asked questions document
- Meet with County Board
- Attend Lake Association Annual meeting
- Complete Environmental Assessment
- Address Tribal Concerns
- Receive one year exemption to operate outside of existing Chapter 31 permit
- Public Information Meeting

Resource Issues that need evaluation (EA)

- Timing and extent of drawdown
- Why is dam repair necessary?
- Will the reservoir refill?
- Amount of flowage bed exposed?
- Any impact on private water supplies?
- Fishery impacts
- Wildlife impacts
- Dissolved Oxygen problems?
- Will the ice be safe?
- Impact on native and Invasive plants.
- Will the flowage get deeper?
- Can shoreline work (chapter 30) be done?
- Pre/post monitoring plan

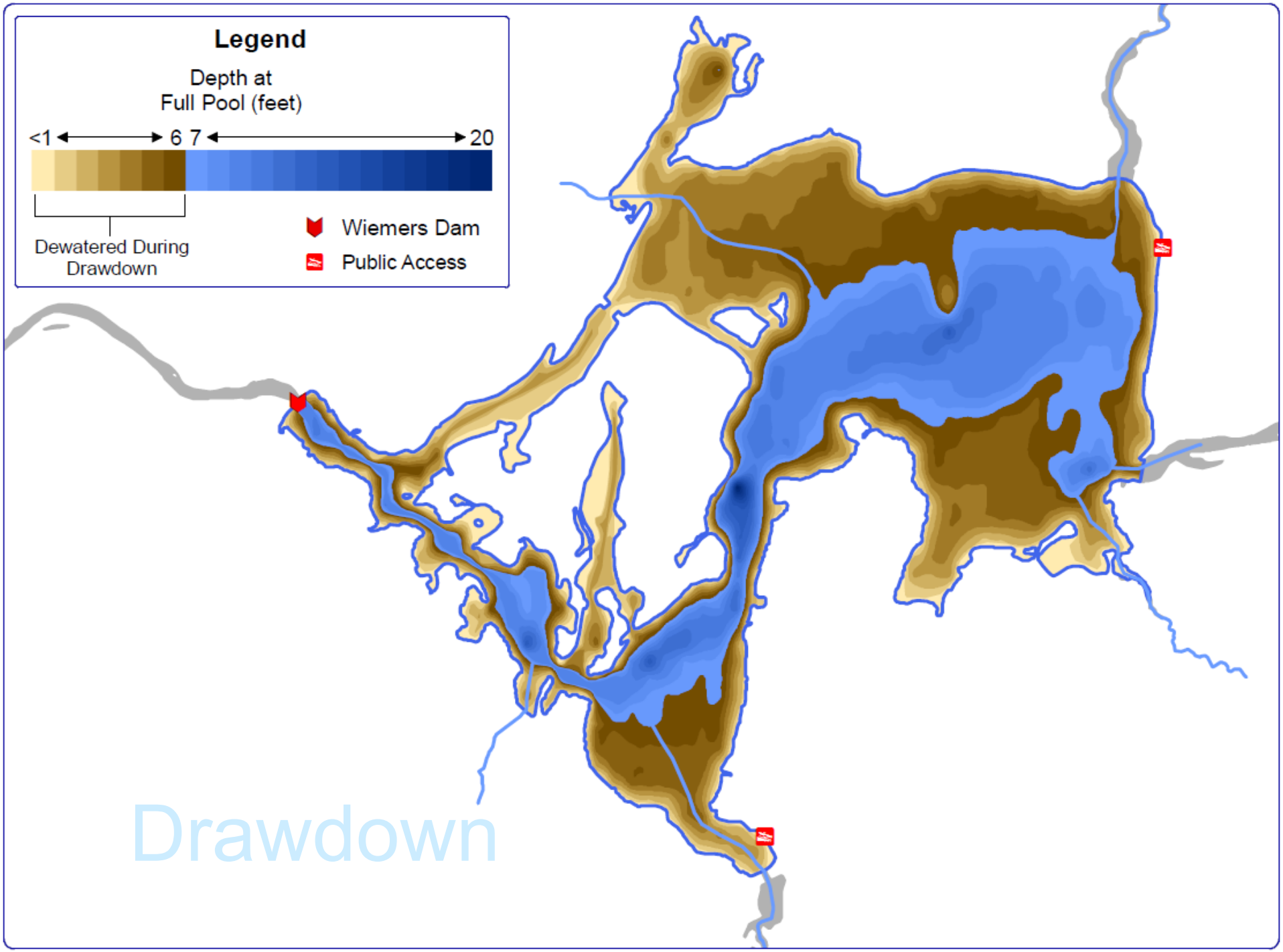

SOO LAKE (Lac Sault Dore)
DRAWDOWN
WINTER 2010-2011
Eurasian Water Milfoil

Introduction

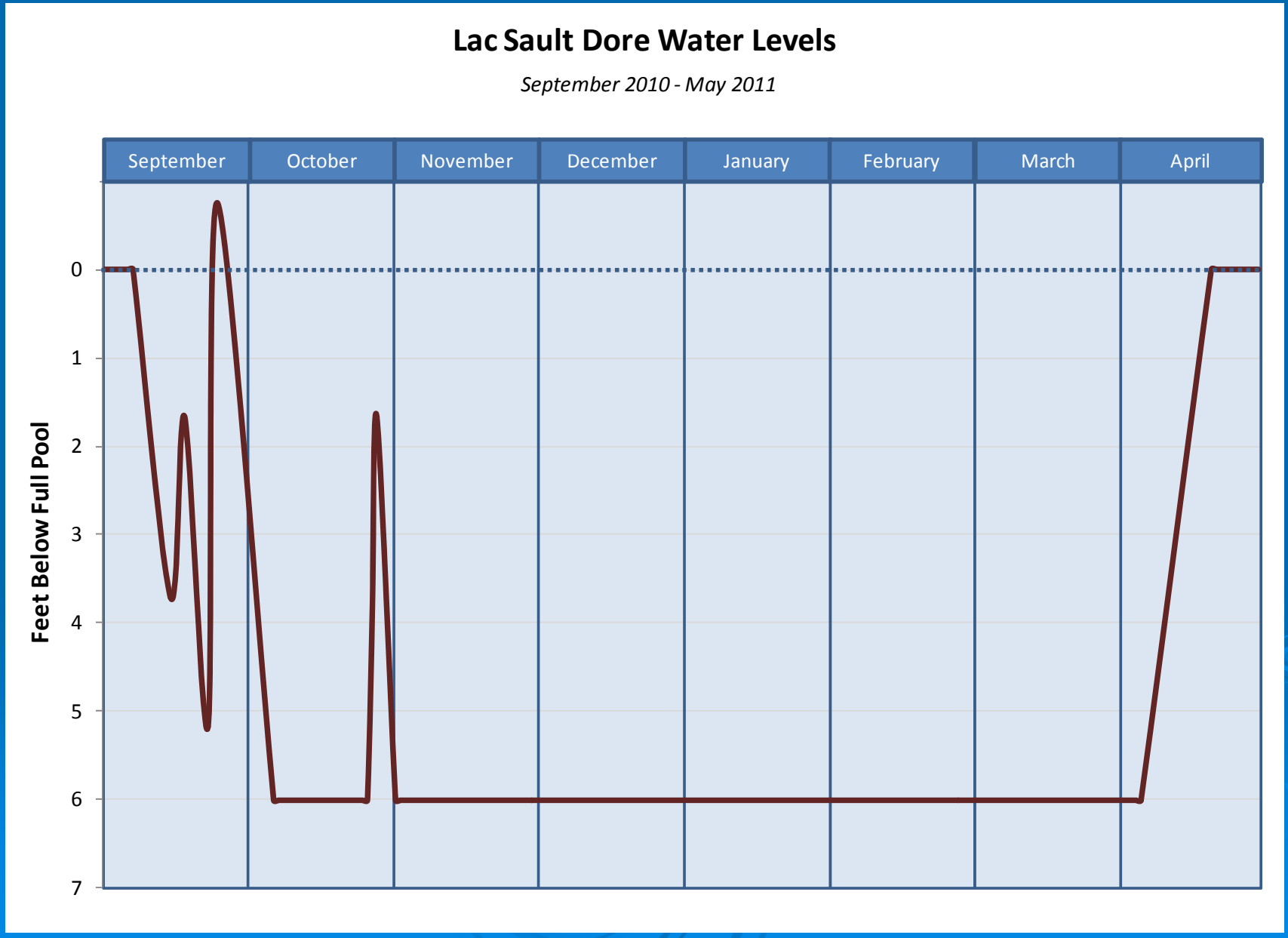
- Lac Sault Dore (Soo Lake) on Elk River - Price County, WI
- 561-acre shallow reservoir
- Max depth: 21ft, Mean depth: 6ft
- 165,981-acre watershed
- Eutrophic system, highly stained water
- EWM discovered in 2004
- 254 acres of EWM in 2010 (pre-drawdown)
- No previous management actions to control EWM

Introduction

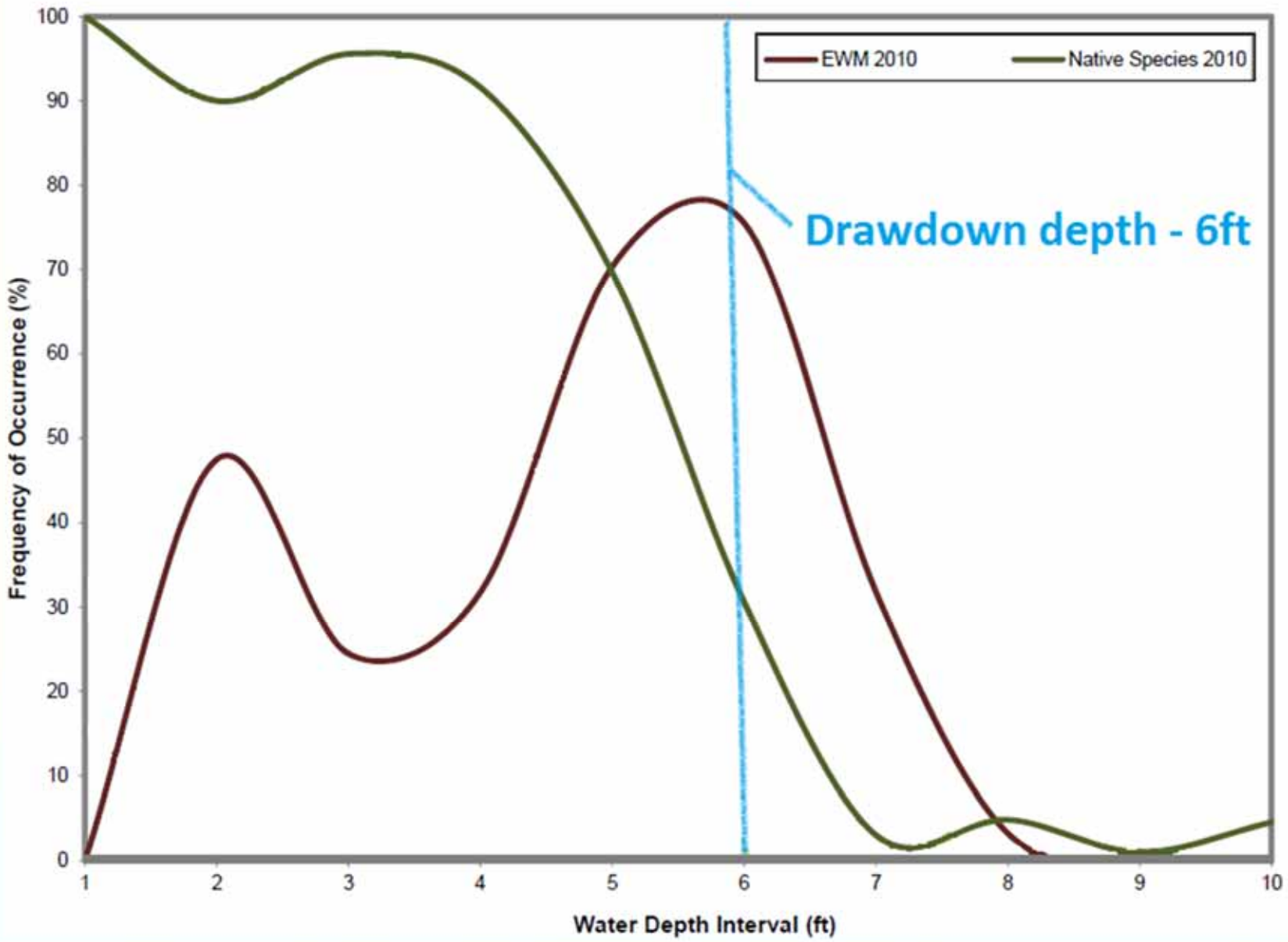
- Winter drawdown required for maintenance on Weimer Dam
  - Limited to 6 feet, per specs of the dam
  - Start water drawdown after Labor Day 2010
  - Refill by May 1, 2011
  - Secondary benefit to possible control EWM population


Legend
Depth at
Full Pool (feet)
<1
6 7
20
Dewatered During
Drawdown
Wiemers Dam
Public Access
Drawdown

Drawdown Water Levels



Plant Depths- pre drawdown



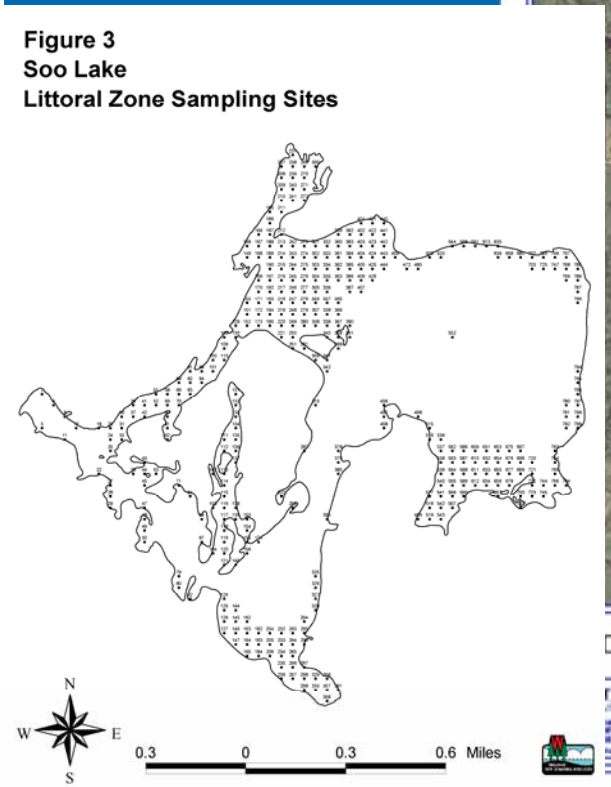
Monitoring Methods

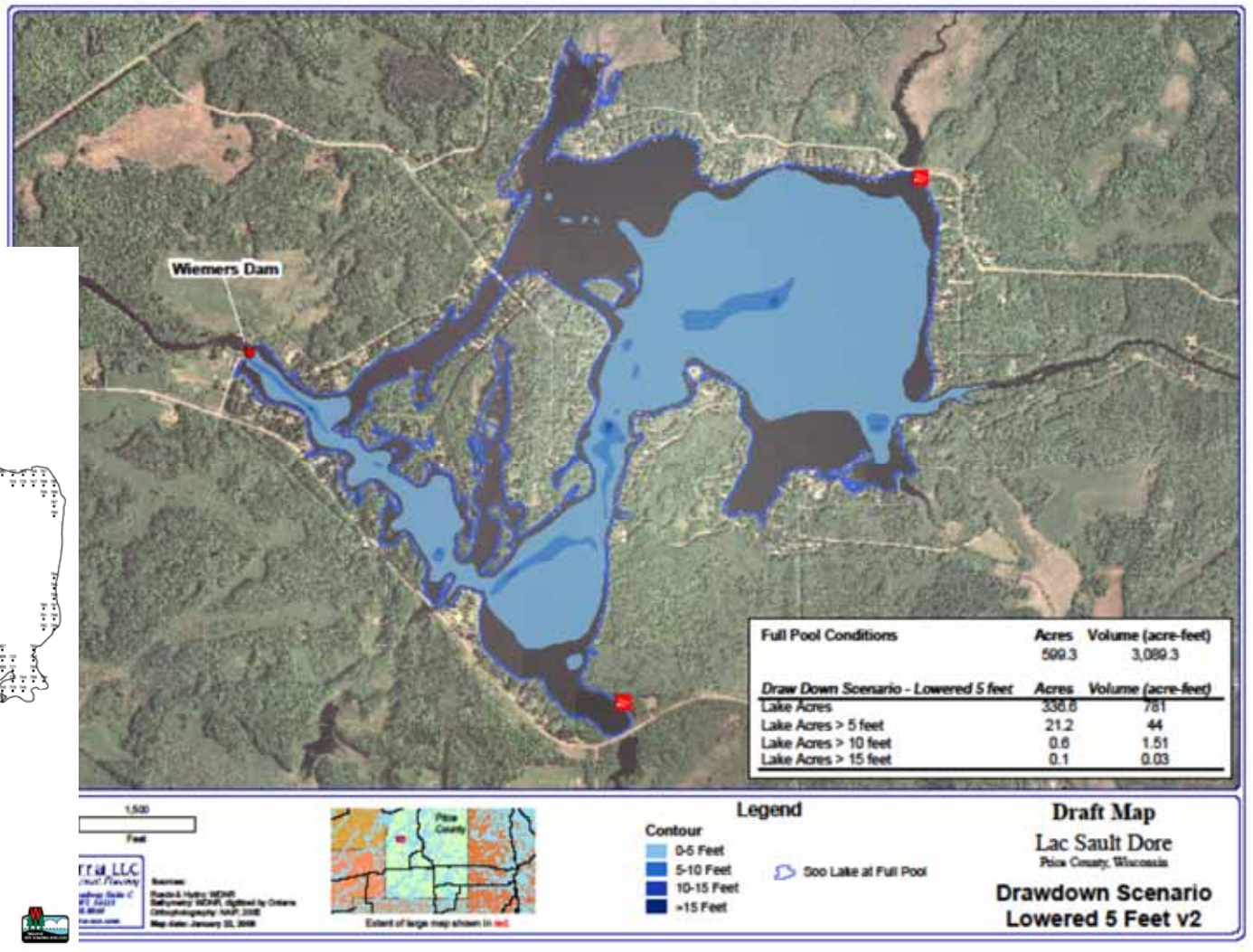
- Objective: Evaluate response of EWM and native plants to drawdown
  - Whole-lake point-intercept survey (2010, 2011, 2012)
  - EWM colony/density mapping
  - Emergent/floating-leaf community mapping

Whole-lake Point-intercept Survey

55-meter resolution- 799 total points

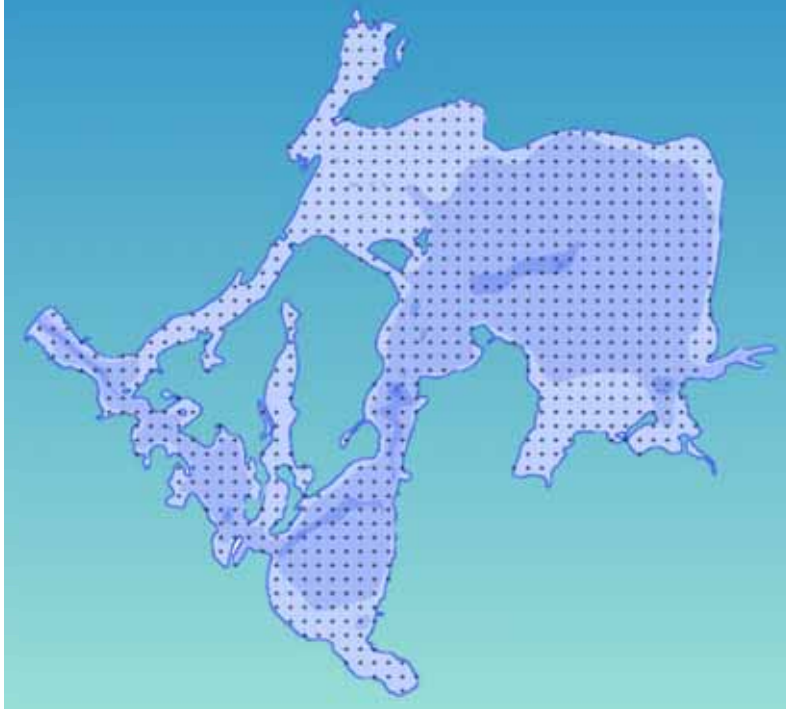
Surveys Completed:
August 17-18, 2010
August 18-19, 2011
August 14-15, 2012



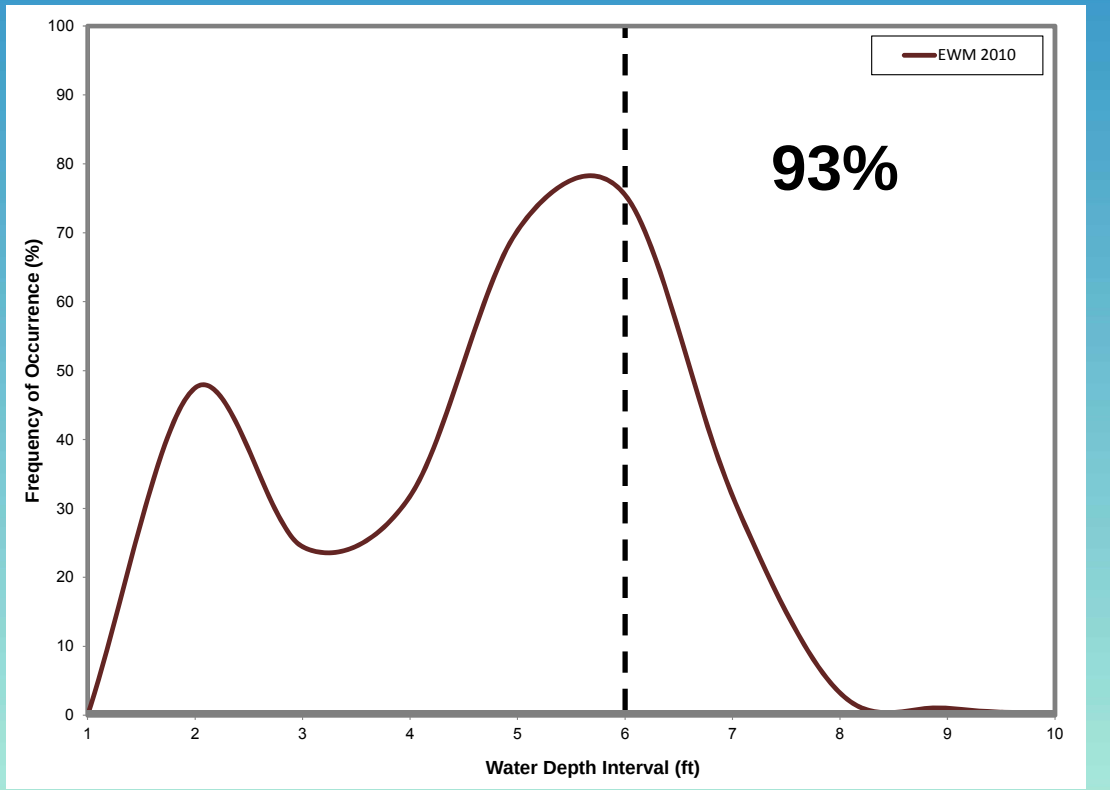


Results:
EWM – Point-intercept Survey

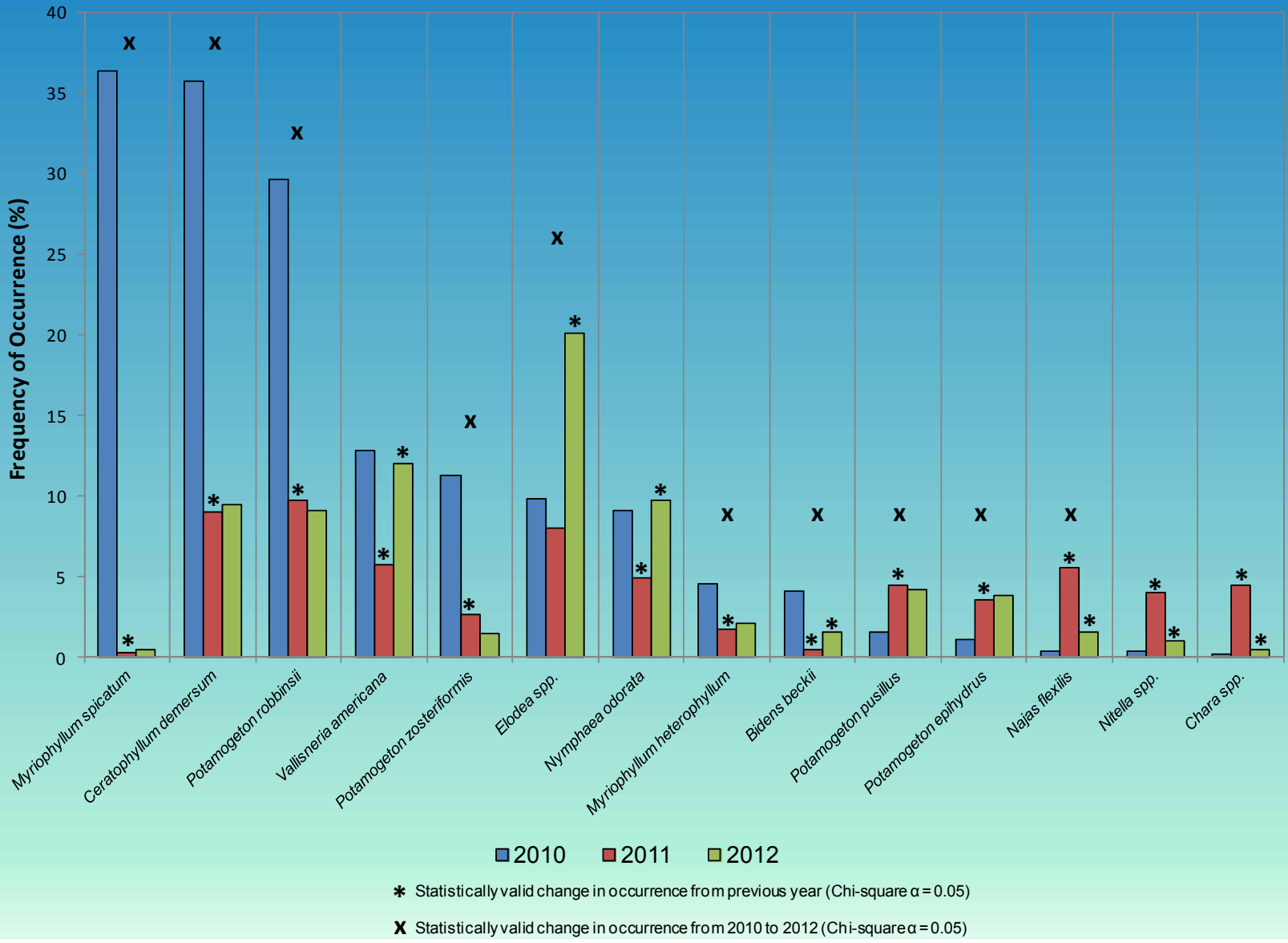
Frequency of Occurrence for EWM in 2010 (pre-drawdown)



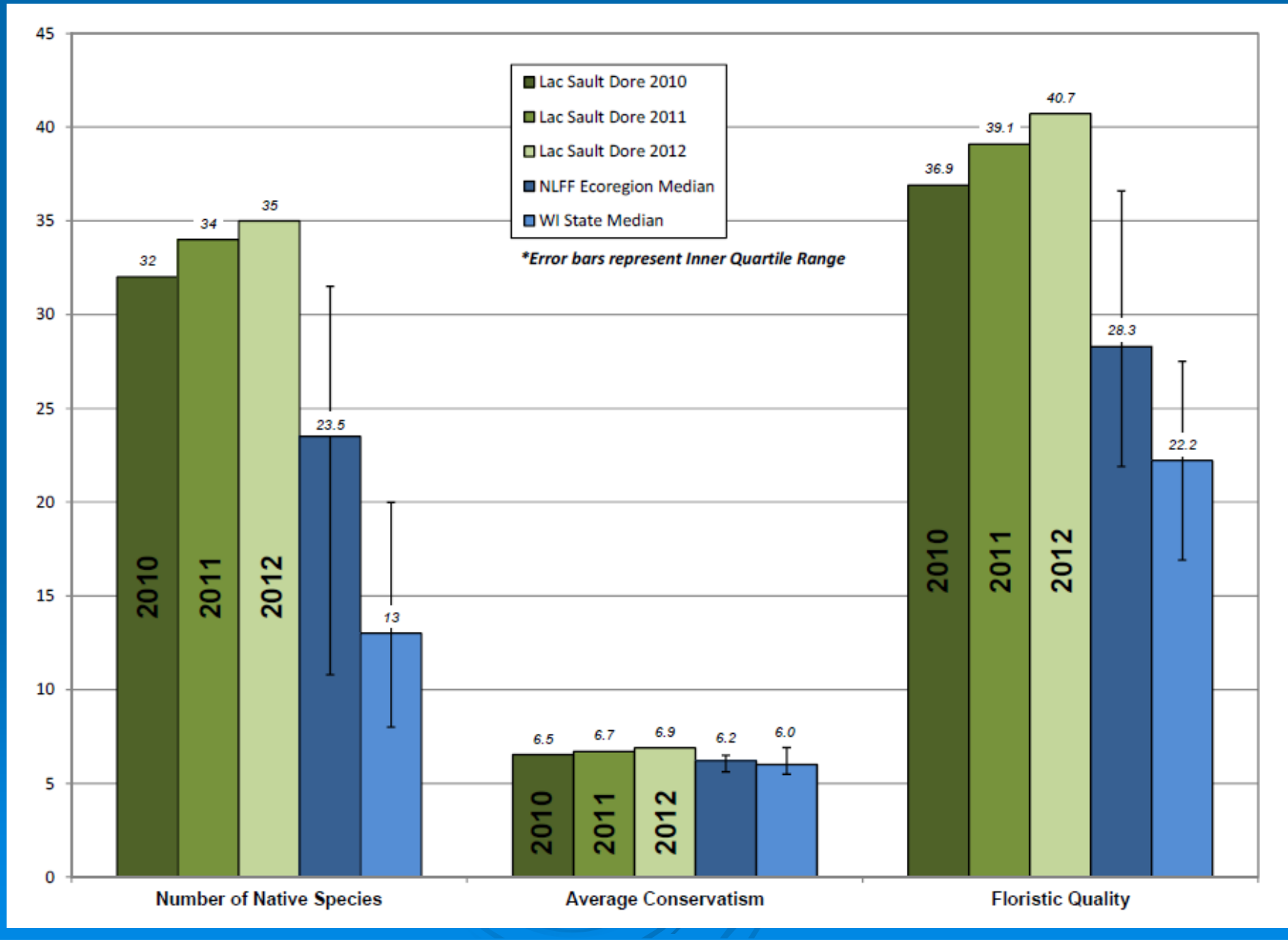
Whole-lake PI Survey



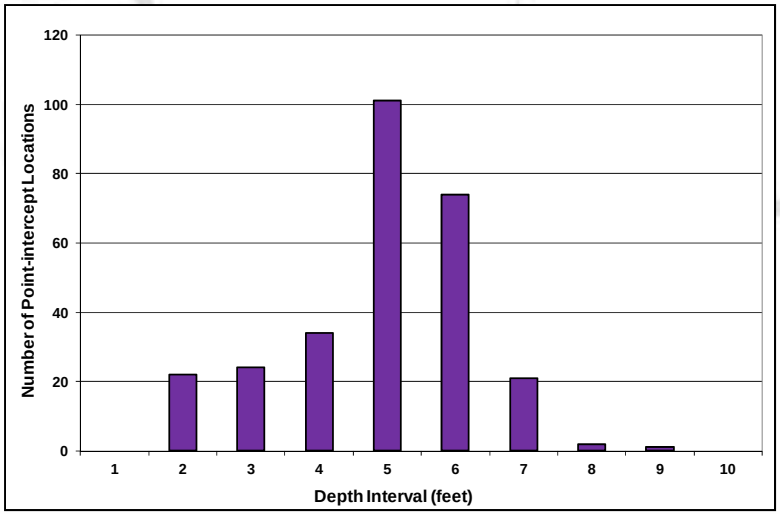
PI Survey Results – changes in frequency of occurrence

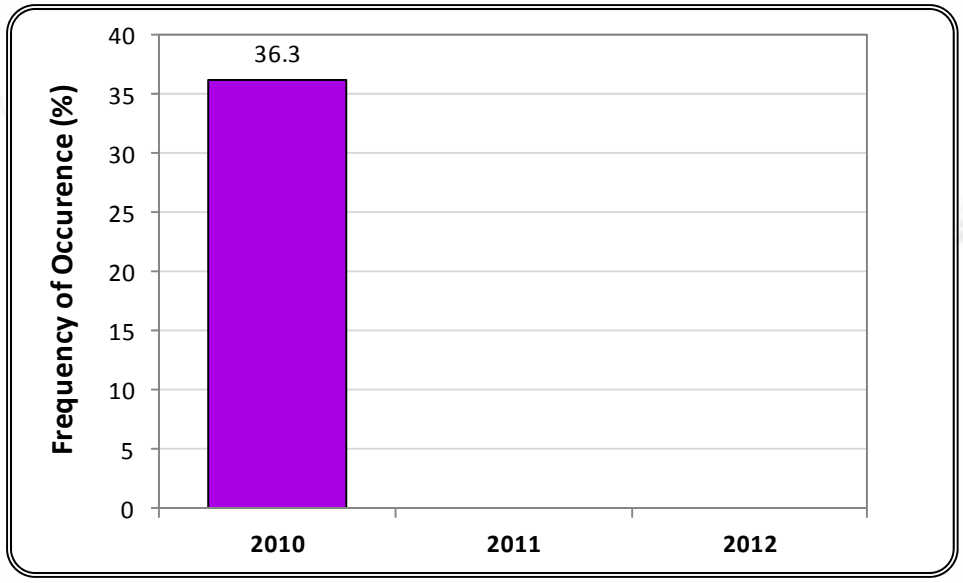


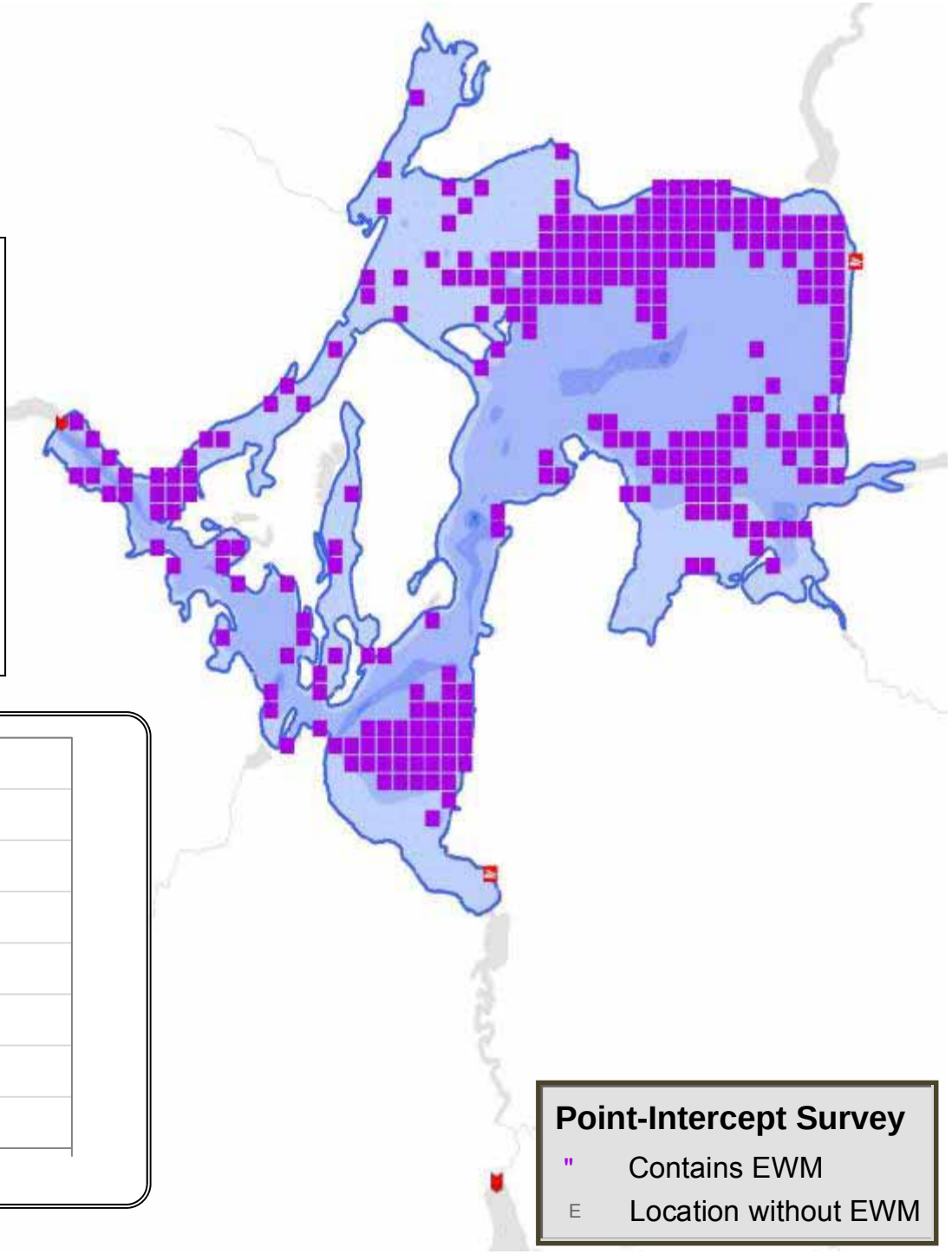
PI Survey- Summary Stats



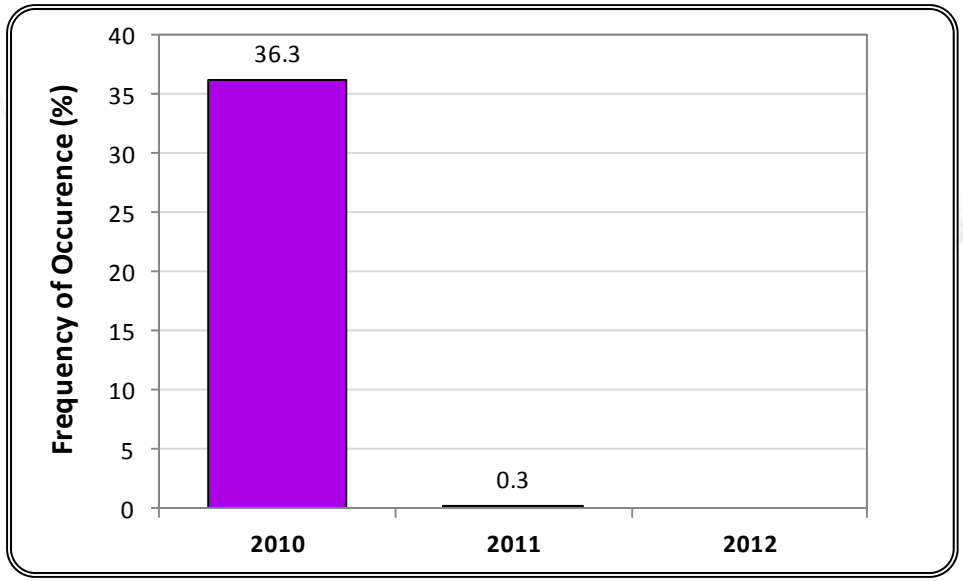
2010 PI: EWM
1Y Pre-Drawdown







2011 PI: EWM
1Y Post Drawdown

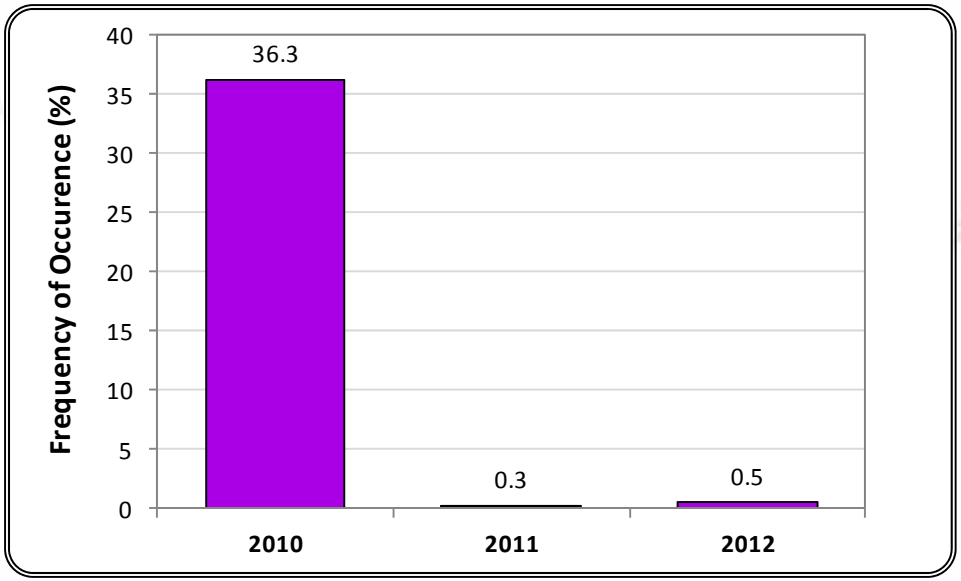


Point-Intercept Survey

" Contains EWM

E Location without EWM

2012 PI: EWM
2Y Post Drawdown



Point-Intercept Survey

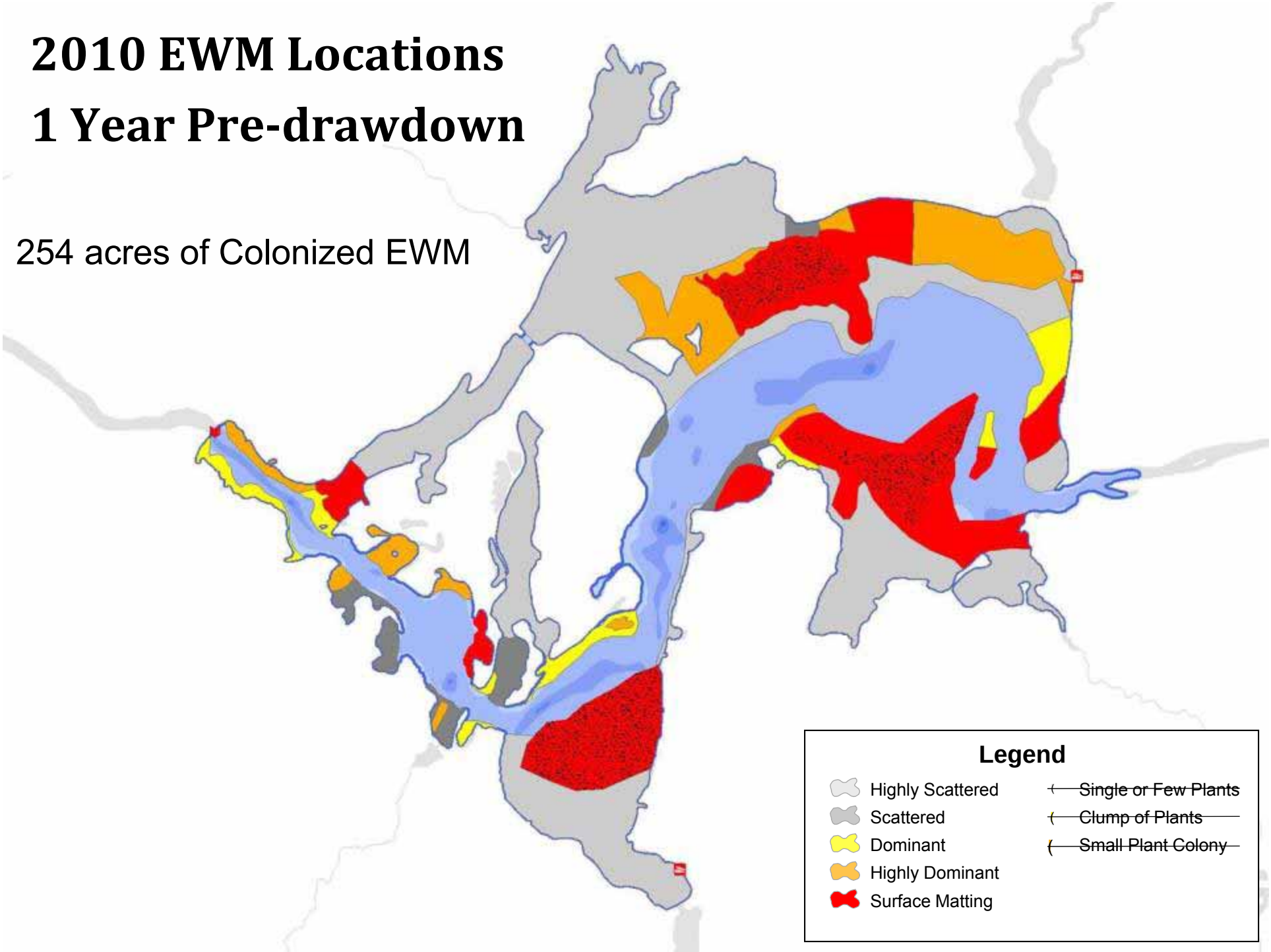
" Contains EWM

E Location without EWM

Results:
EWM – Colony/Density Mapping Survey

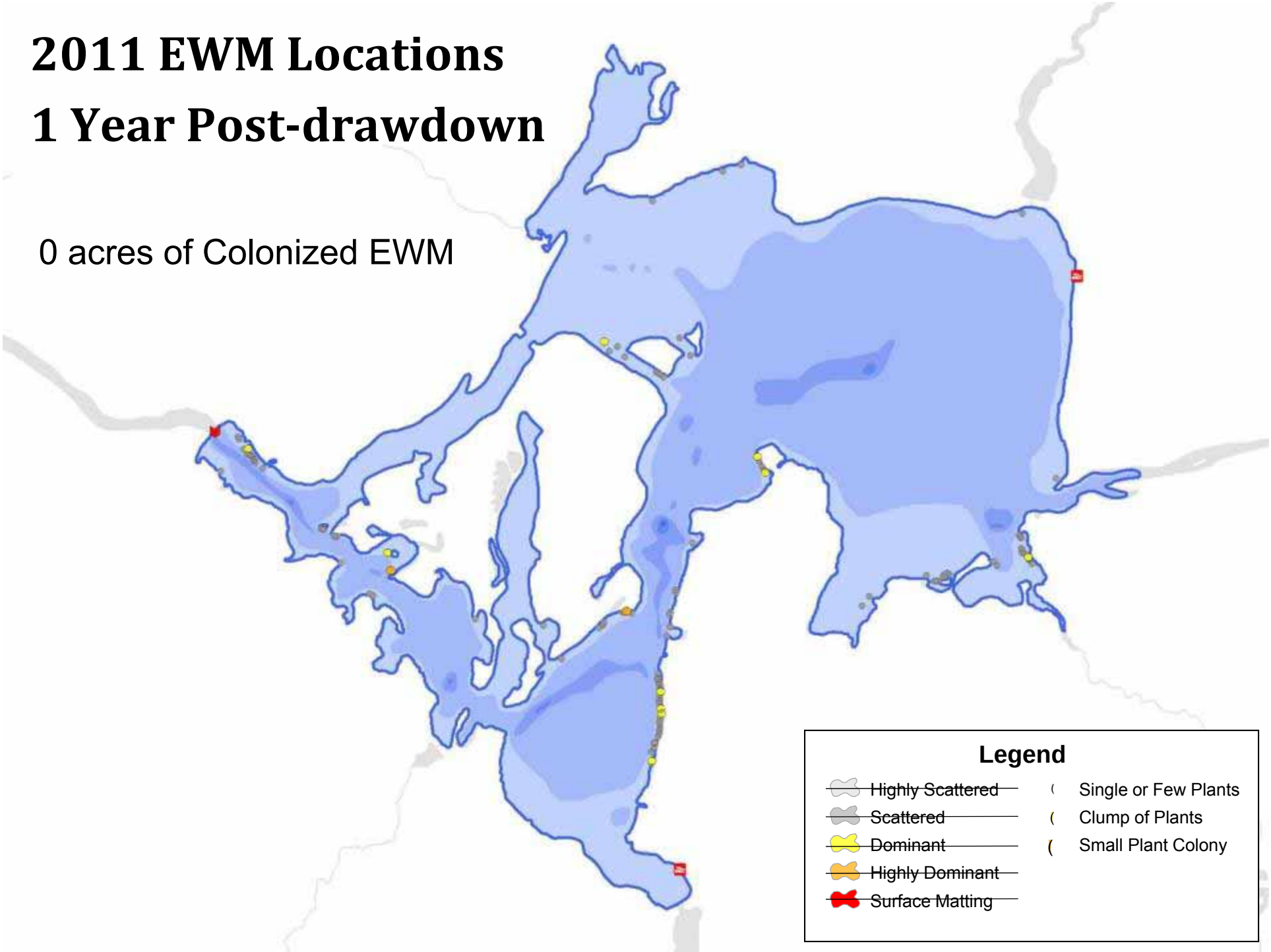
2010 EWM Locations
1 Year Pre-drawdown

254 acres of Colonized EWM

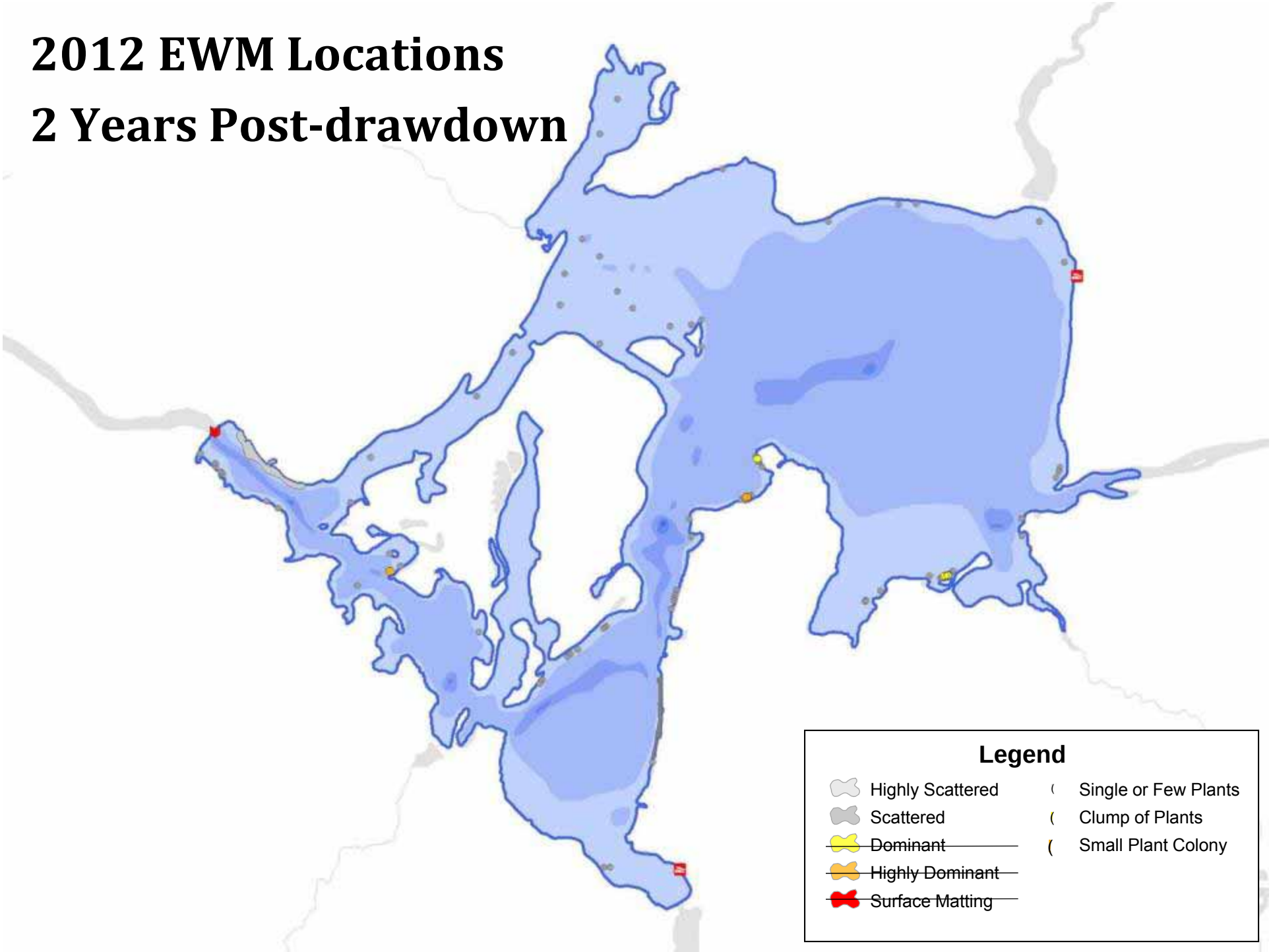


2011 EWM Locations
1 Year Post-drawdown

0 acres of Colonized EWM

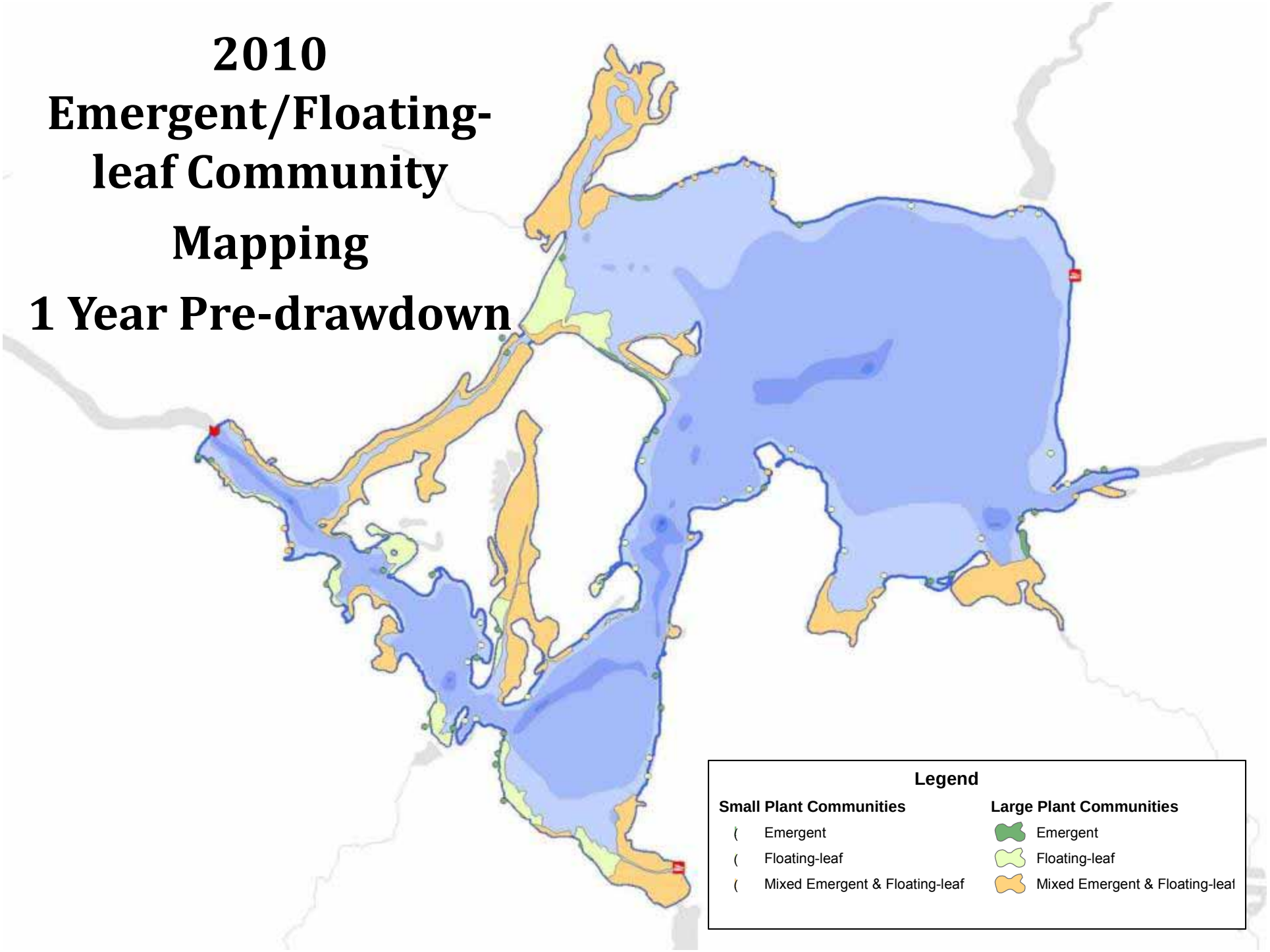


2012 EWM Locations
2 Years Post-drawdown

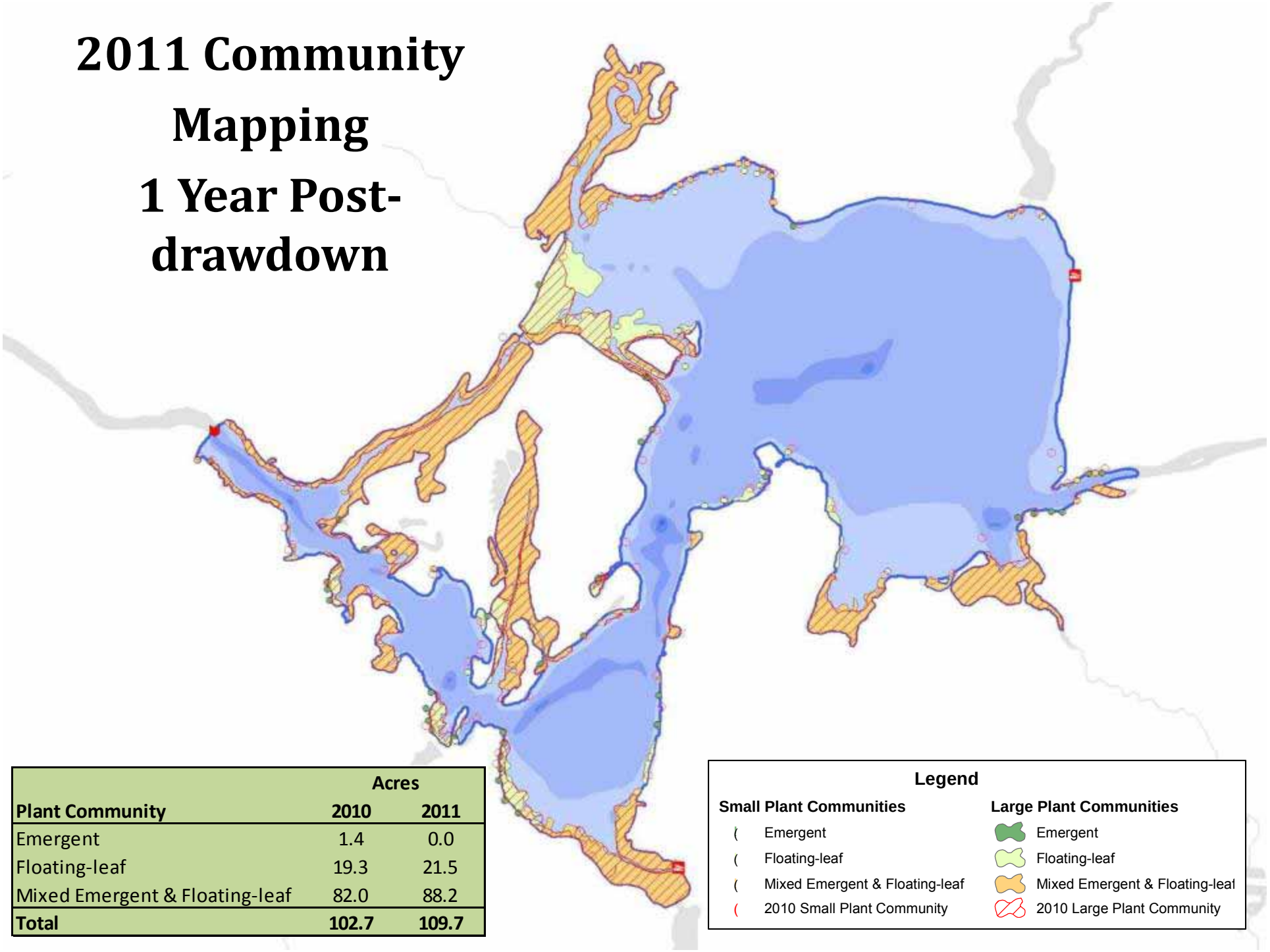


Results:
Floating-leaf & Emergent Community Mapping

2010 Emergent/Floating-leaf Community Mapping 1 Year Pre-drawdown



2011 Community Mapping 1 Year Post-drawdown



	Acres	
Plant Community	**2010**	**2011**
Emergent	1.4	0.0
Floating-leaf	19.3	21.5
Mixed Emergent & Floating-leaf	82.0	88.2
Total	**102.7**	**109.7**

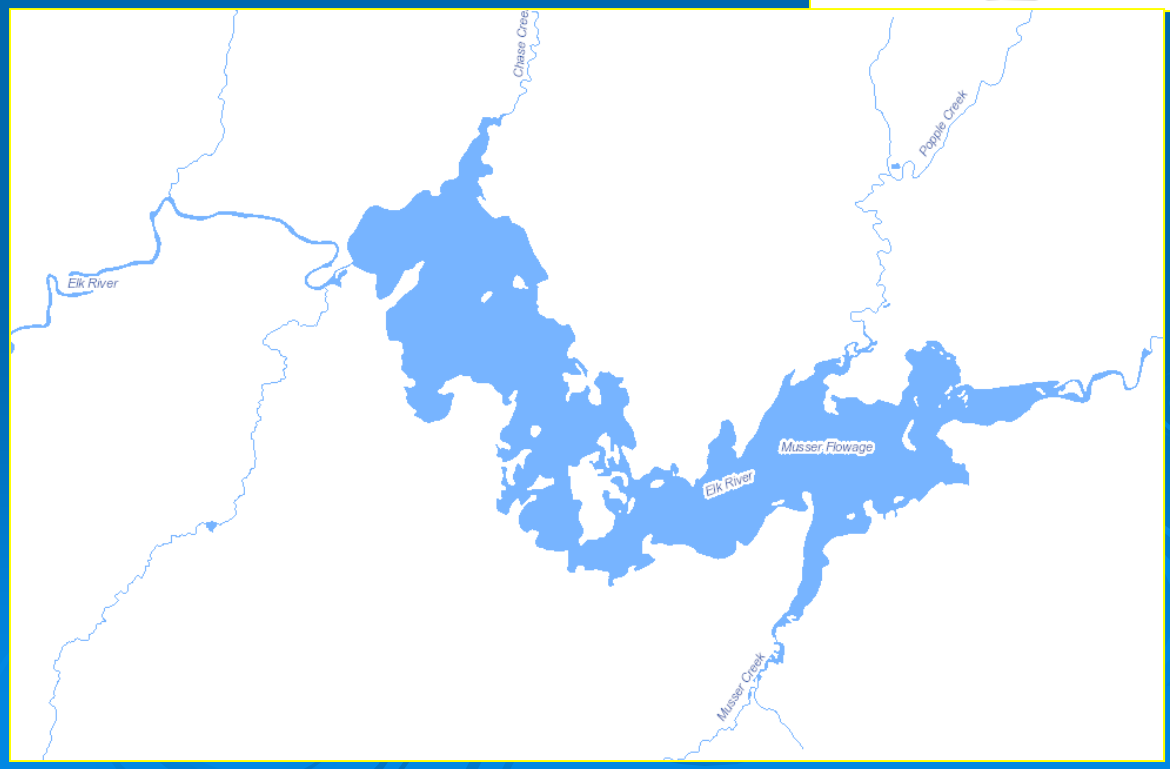
Conclusions:

- Overall success reducing EWM plants (~98% reduction in littoral FOC)
- Colonized acreage of EWM reduced to 0
- Drawdown had impacts on native plant community
- Minor changes to Emergent/Floating-leaf community
- The Soo Lake chapter 31 order was amended to include periodic drawdowns to target EWM (Trigger 30 % or greater littoral frequency, or greater than 175 point intercept locations that contain EWM)


MUSSER LAKE
DRAWDOWN
WINTER 2013-2014
Curly Leaf Pondweed

Introduction

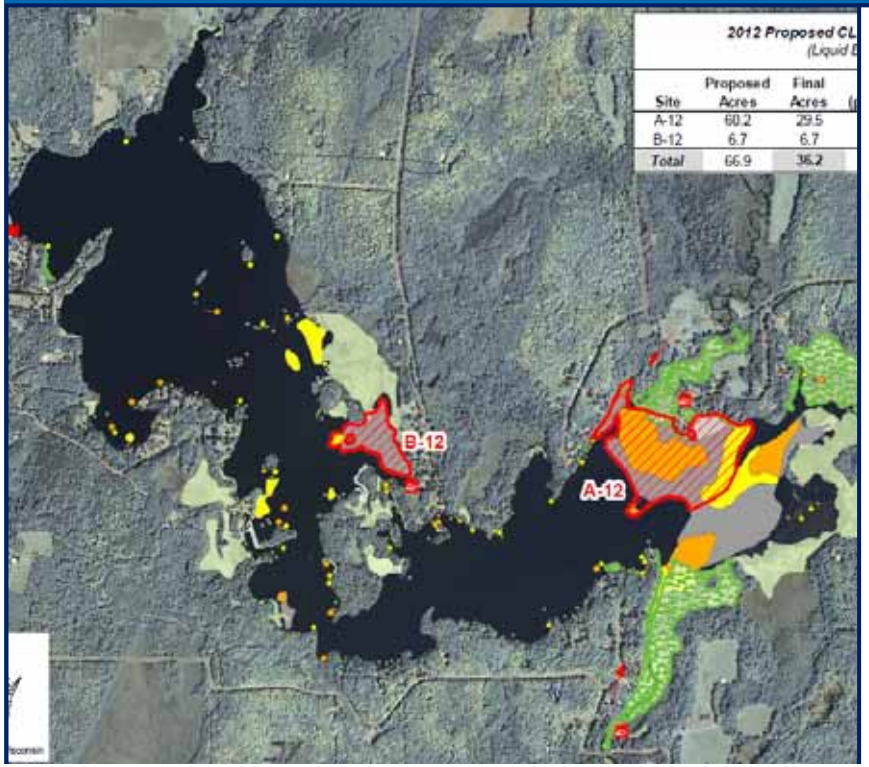
- 563 acre impoundment on the Elk River
- Maximum depth is 15 feet
- Average depth is 5 feet
- The flowage is fertile and considered eutrophic.
- Dam repair needed

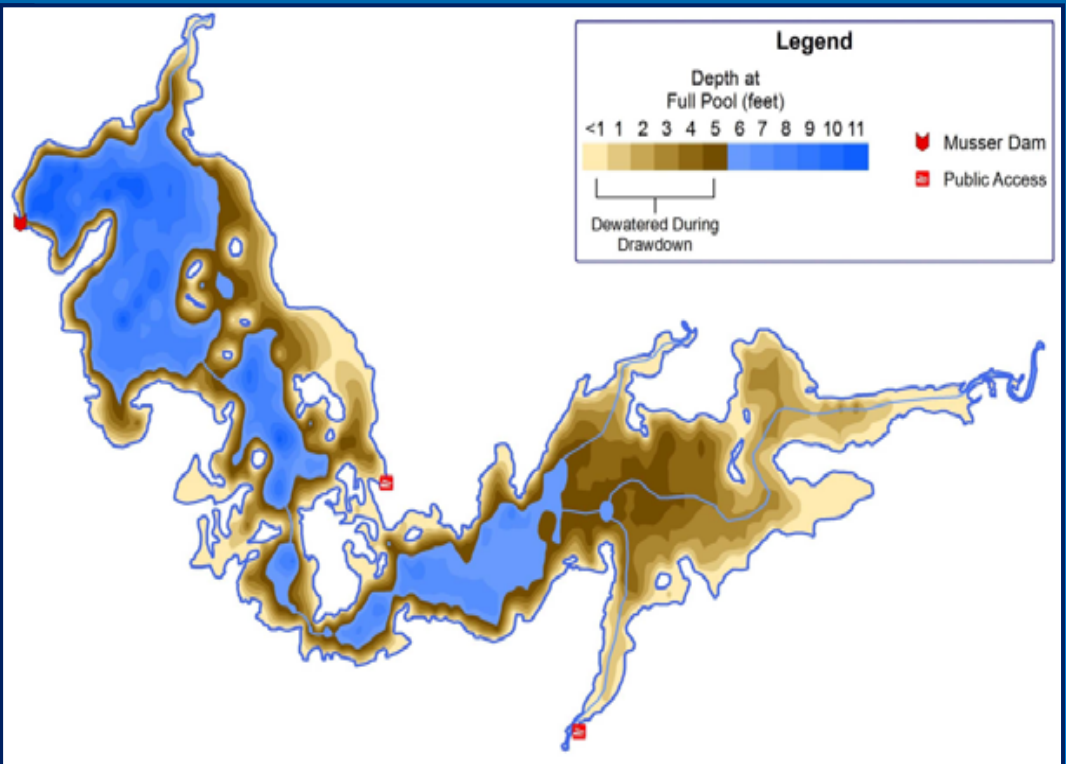


CLP in Musser

- First discovered in Musser Lake in 2002
- Chemically treated from 2005-2010

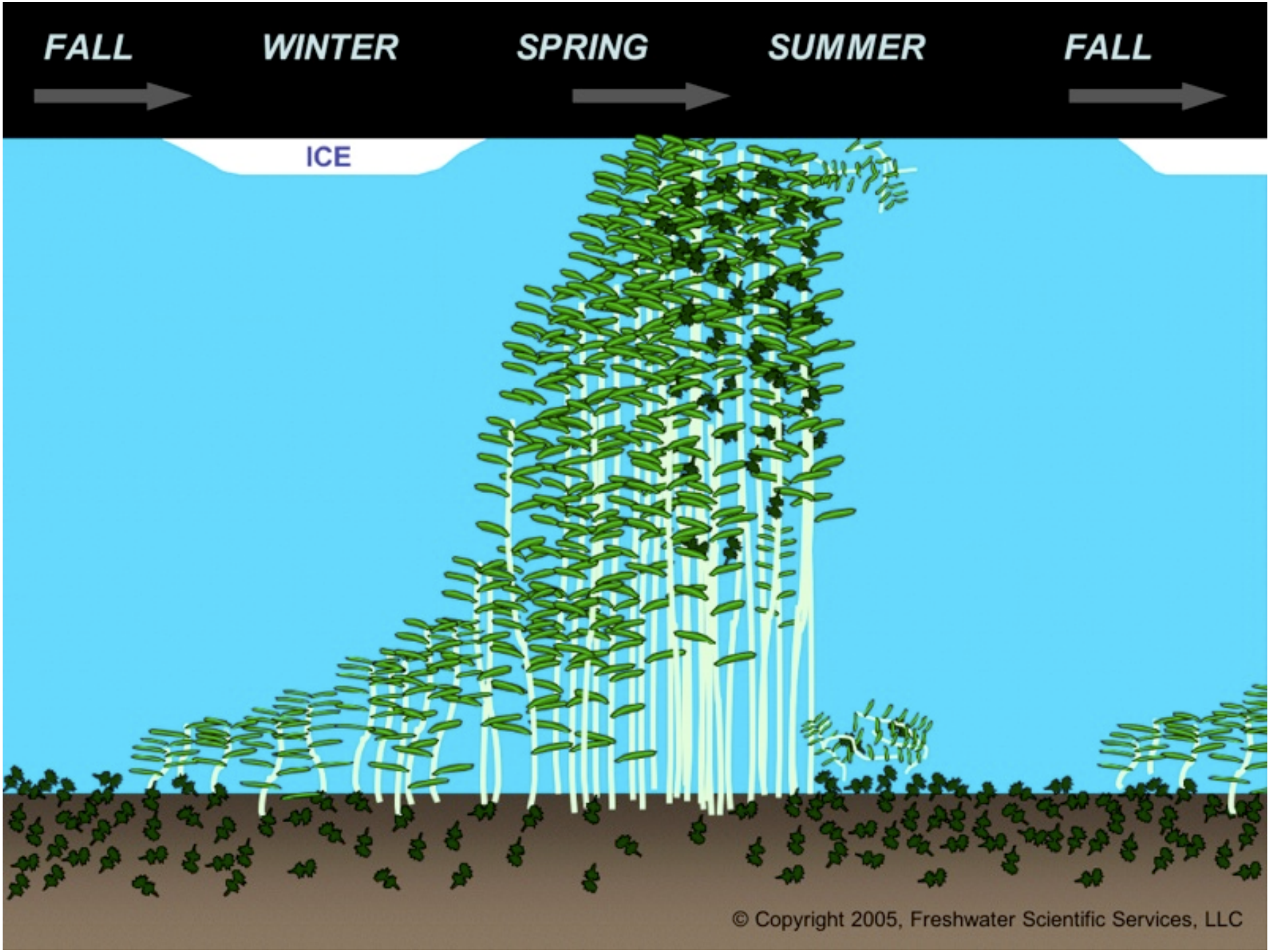
- In 2013 there was approximately 70 acres of CLP (52 acres colonized)



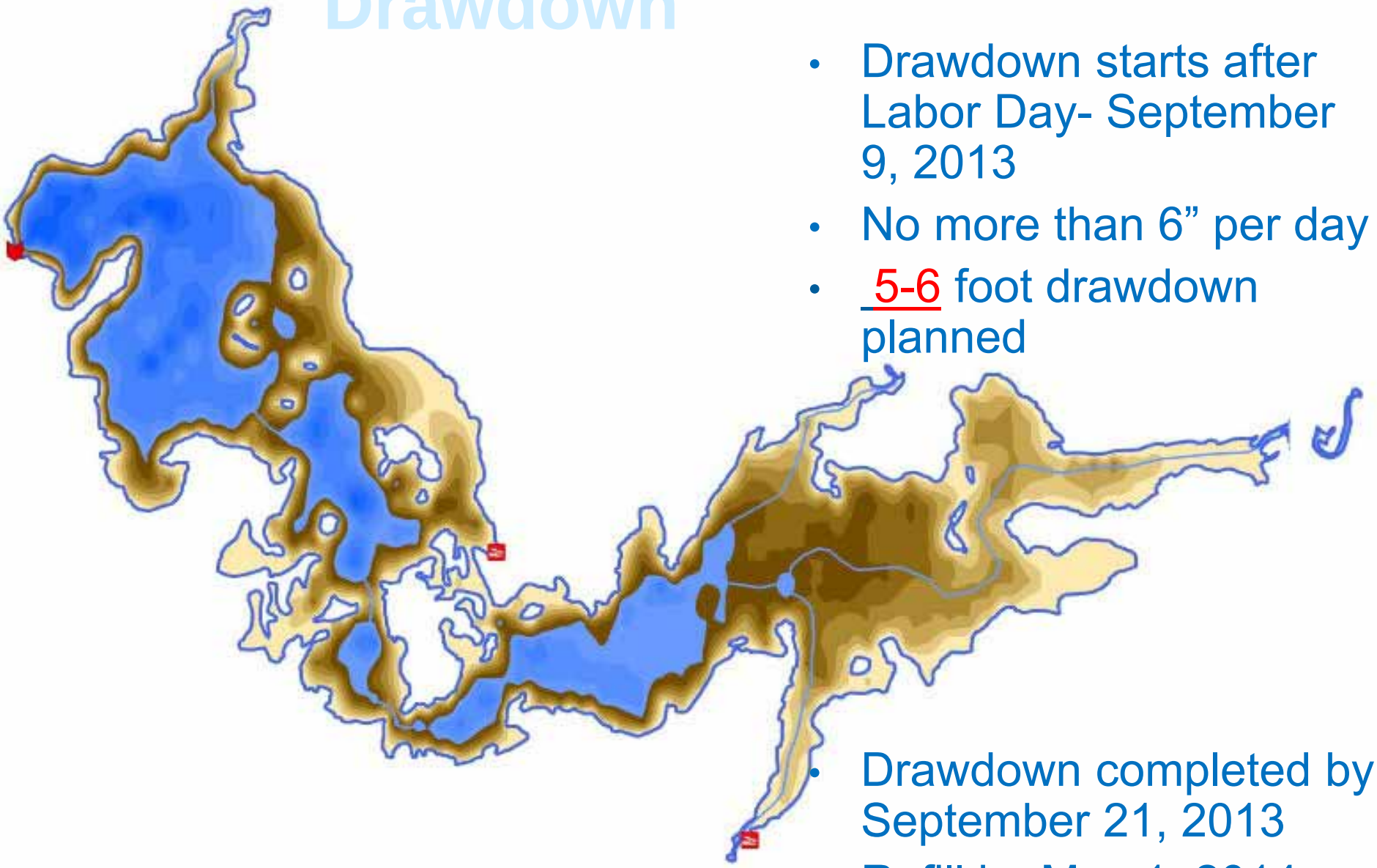


Curly Leaf Pondweed Biology

- Life cycle begins in autumn, with turion germination
- Plant may grow through the winter under the ice
- Maximum growth occurs in May and June
- Turions produced late July before plant dies back
- Turions fall into sediment and are viable 5-7 years

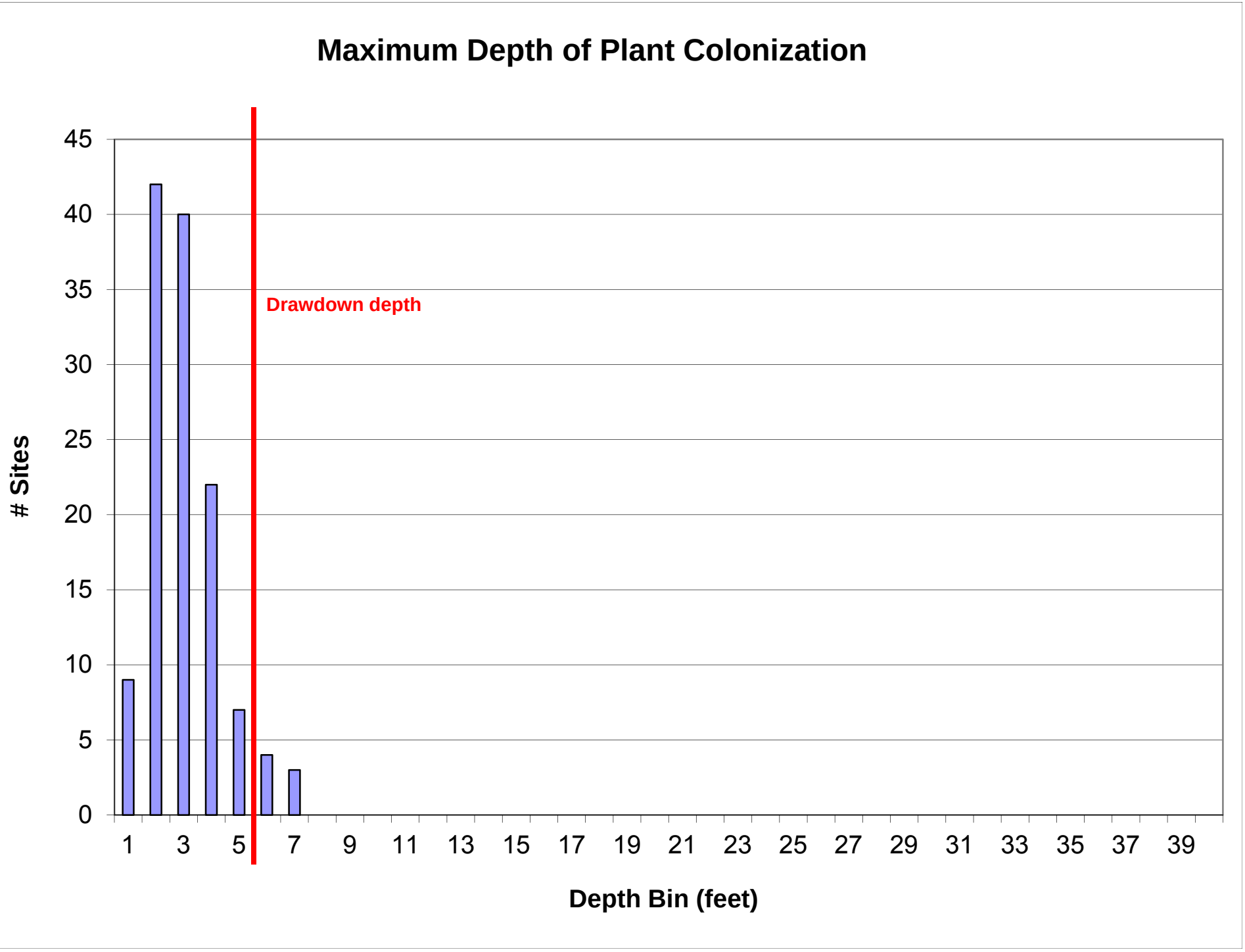

FALL
WINTER
SPRING
SUMMER
FALL
ICE
© Copyright 2005, Freshwater Scientific Services, LLC

Drawdown

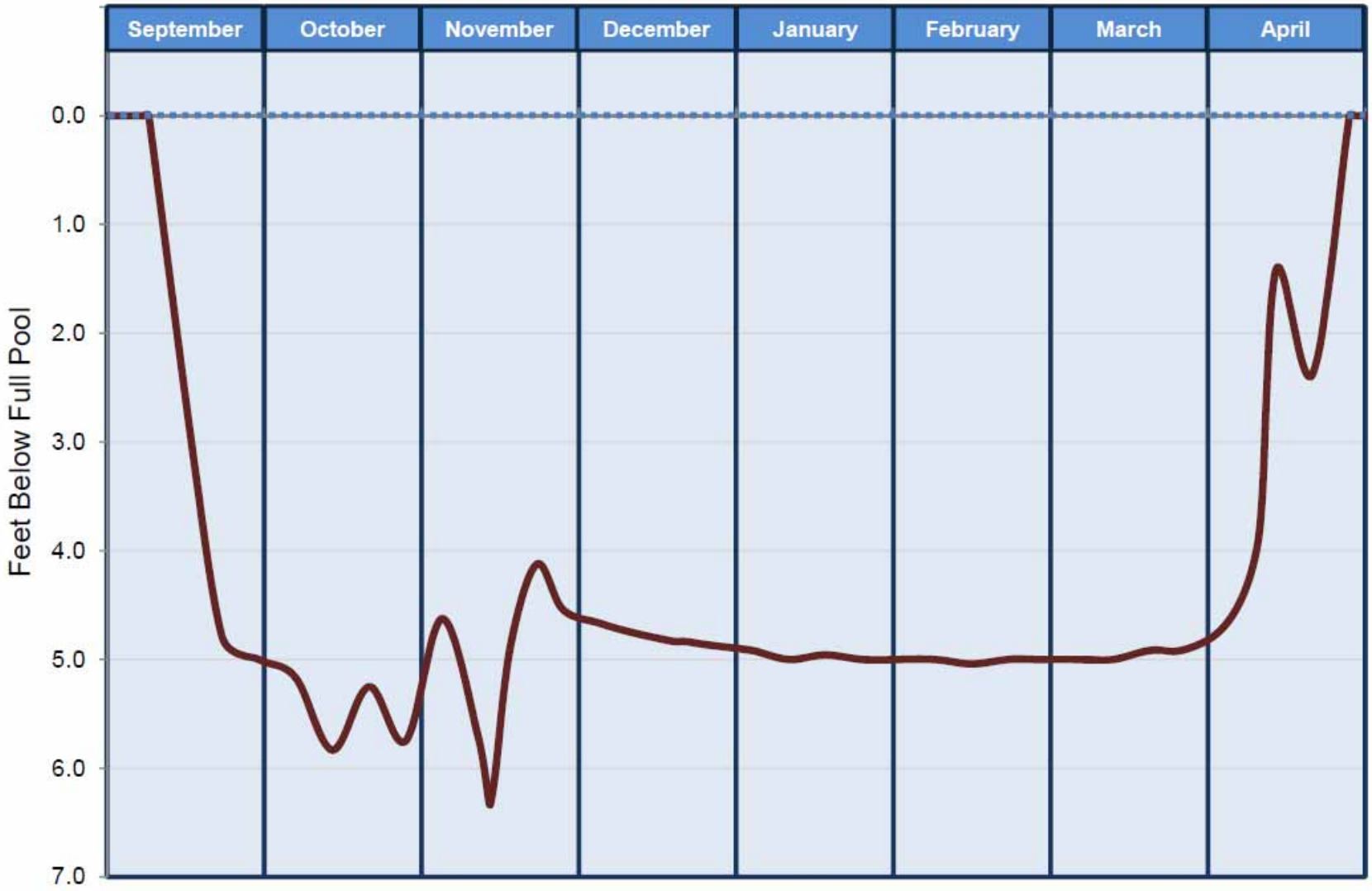


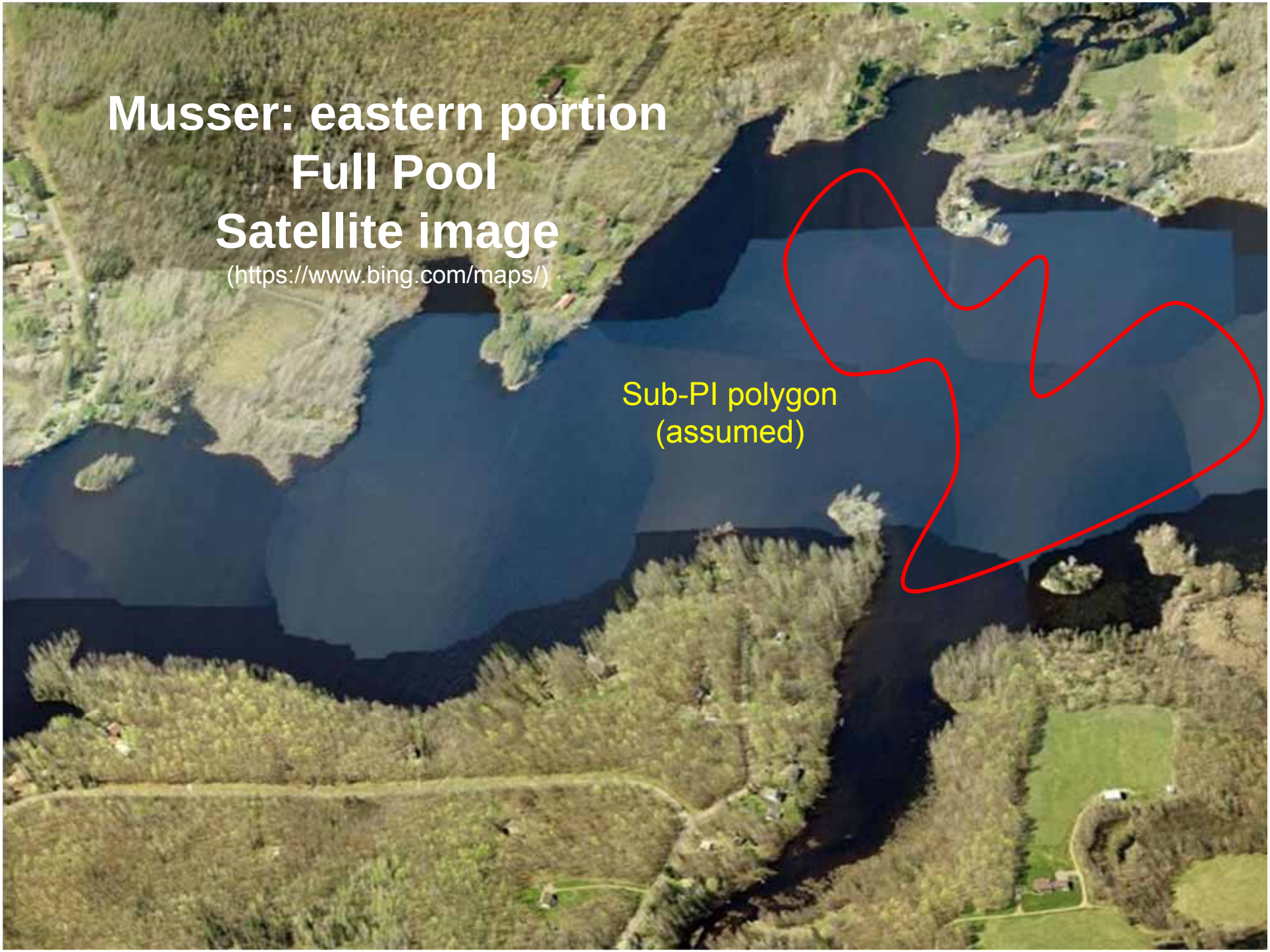
- Drawdown starts after Labor Day- September 9, 2013
- No more than 6” per day
- 5-6 foot drawdown planned

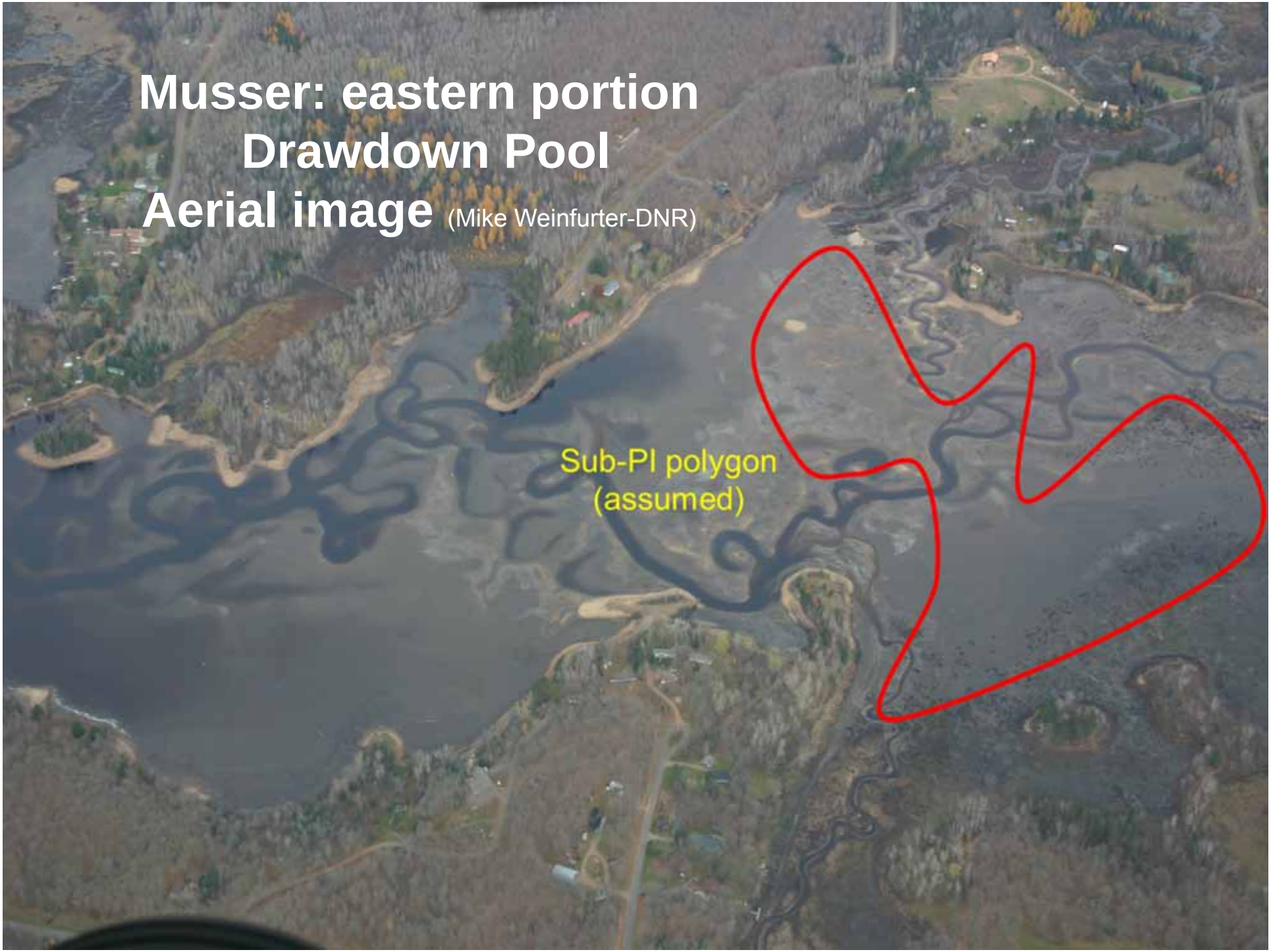
- Drawdown completed by September 21, 2013
- Refill by May 1, 2014


Maximum Depth of Plant Colonization
Sites
45
40
35
30
25
20
15
10
5
0
Drawdown depth
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
Depth Bin (feet)

Winter Water Levels



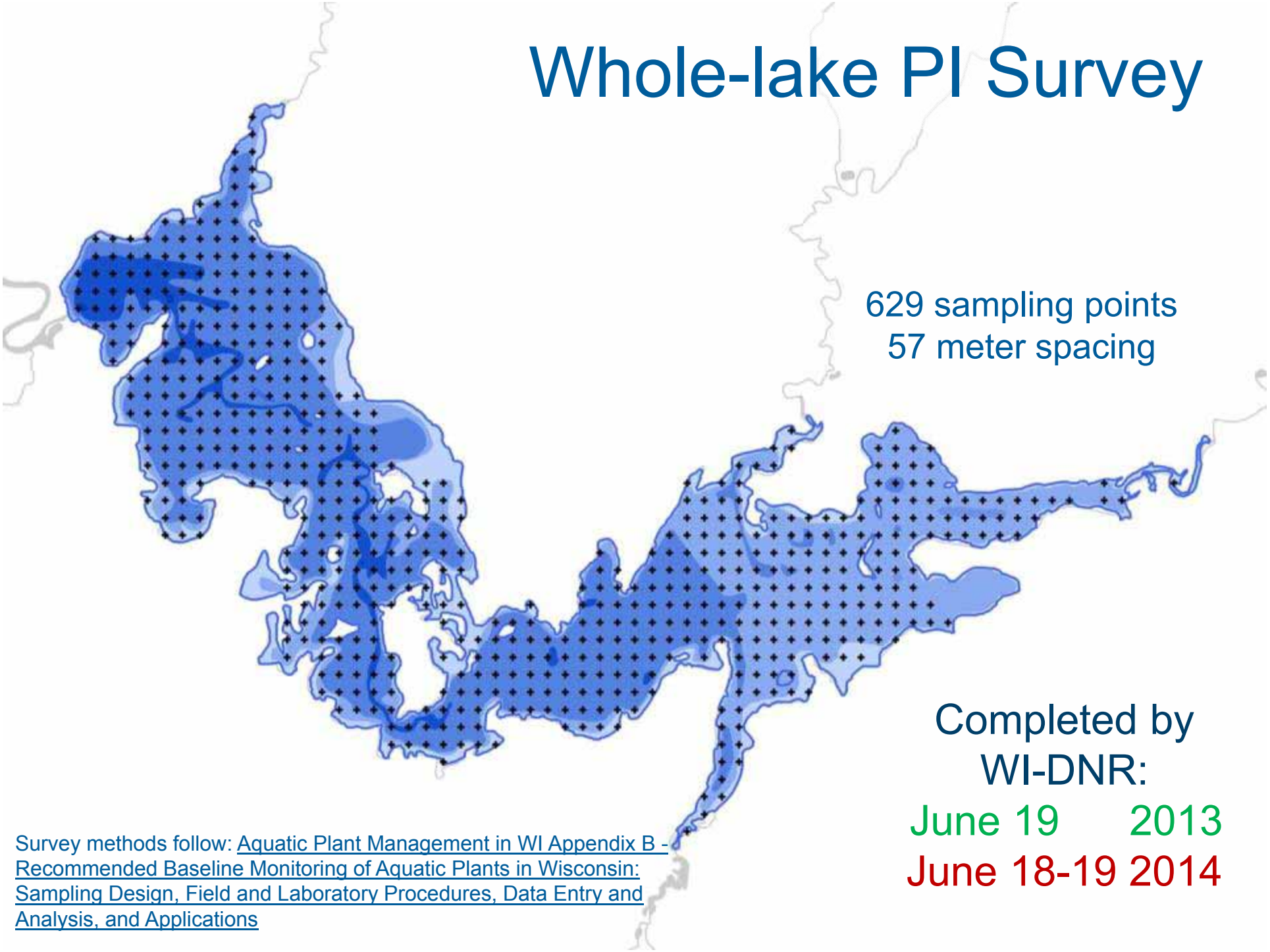

Musser: eastern portion
Full Pool
Satellite image
(https://www.bing.com/maps/)
Sub-PI polygon
(assumed)


Musser: eastern portion
Drawdown Pool
Aerial image (Mike Weinfurter-DNR)
Sub-PI polygon
(assumed)

Monitoring Methodology

- Objective: Evaluate the response of all aquatic vegetation to drawdown
  - Whole-lake point-intercept survey - baseline survey for native plant and CLP response (mid-June both 2013, 2014)
  - Sub-sample PI survey within dense CLP beds - gain a finer detailed account of the CLP response
  - CLP colony/density mapping - track area occupied and density changes qualitatively
  - CLP turion sampling -determine turion response to drawdown

Whole-lake PI Survey

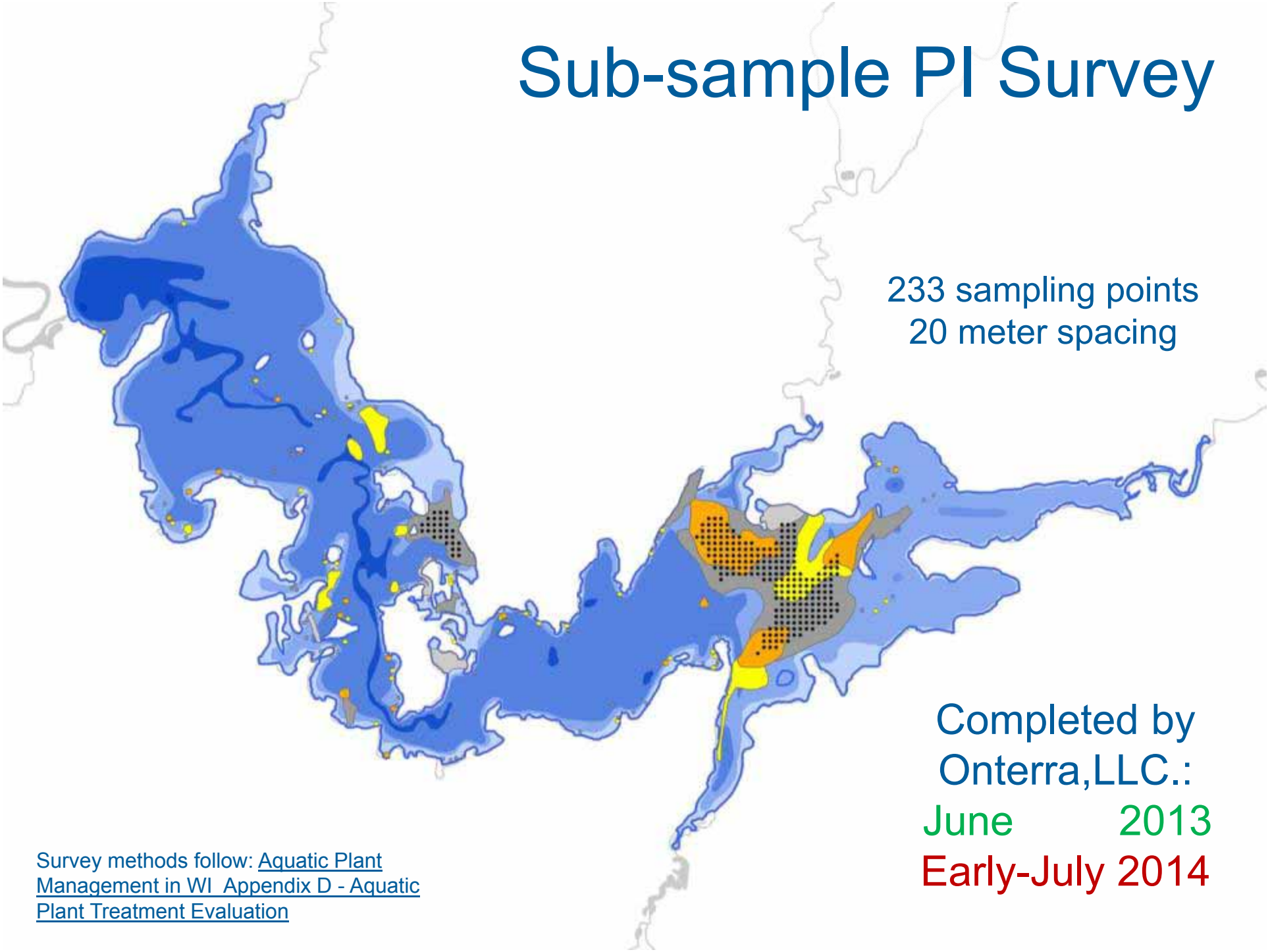


629 sampling points
57 meter spacing

Completed by
WI-DNR:
June 19 2013
June 18-19 2014

Survey methods follow: Aquatic Plant Management in WI Appendix B - Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications

Sub-sample PI Survey

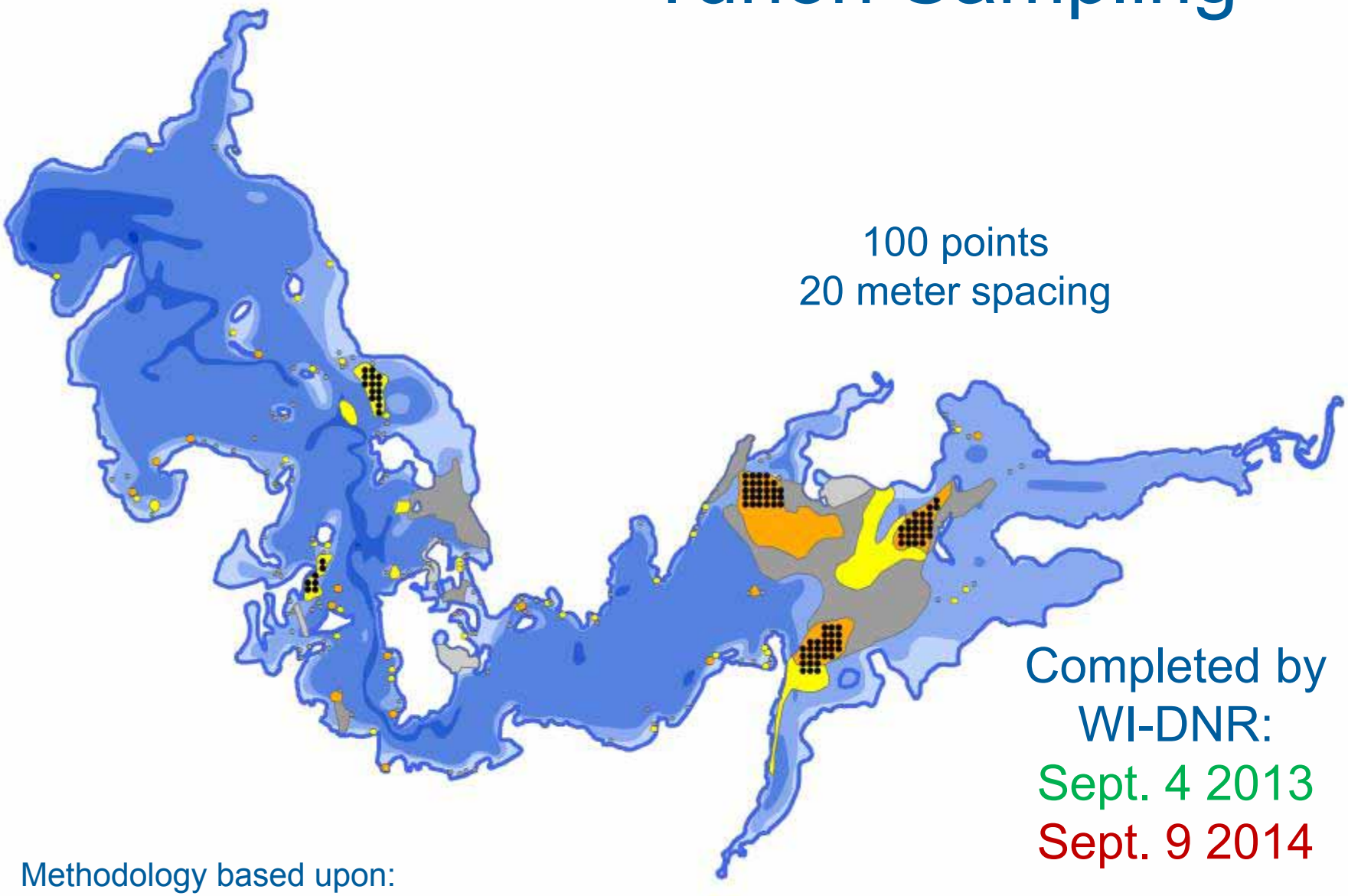


233 sampling points
20 meter spacing

Completed by
Onterra,LLC.:
June 2013
Early-July 2014

Survey methods follow: Aquatic Plant Management in WI Appendix D - Aquatic Plant Treatment Evaluation

Turion Sampling



100 points
20 meter spacing

Completed by
WI-DNR:
Sept. 4 2013
Sept. 9 2014

Methodology based upon:
Madsen 1999; Woolf and
Madsen 2003

Turion Field Collection Method

Turion Germination Method - Lab

1. Chill turions in a refrigerator for 1 week

2. Place turions in aquarium
*some turions floated and after a day I placed plastic paper clips on the floaters to sink them

3. incubate at daily average temp of 81-85°F for 2 weeks
*10 light hours/ 14 dark hours
*nightly average temperature water=65-70°F air=70-72°F

4. note any sprouting and remove sprouted individuals

Soetikno S. Sastroutomo, 1981, *Turion formation, dormancy and germination of curly pondweed, Potamogeton crispus L.,* Aquatic Botany, Volume 10, Pages 161–173

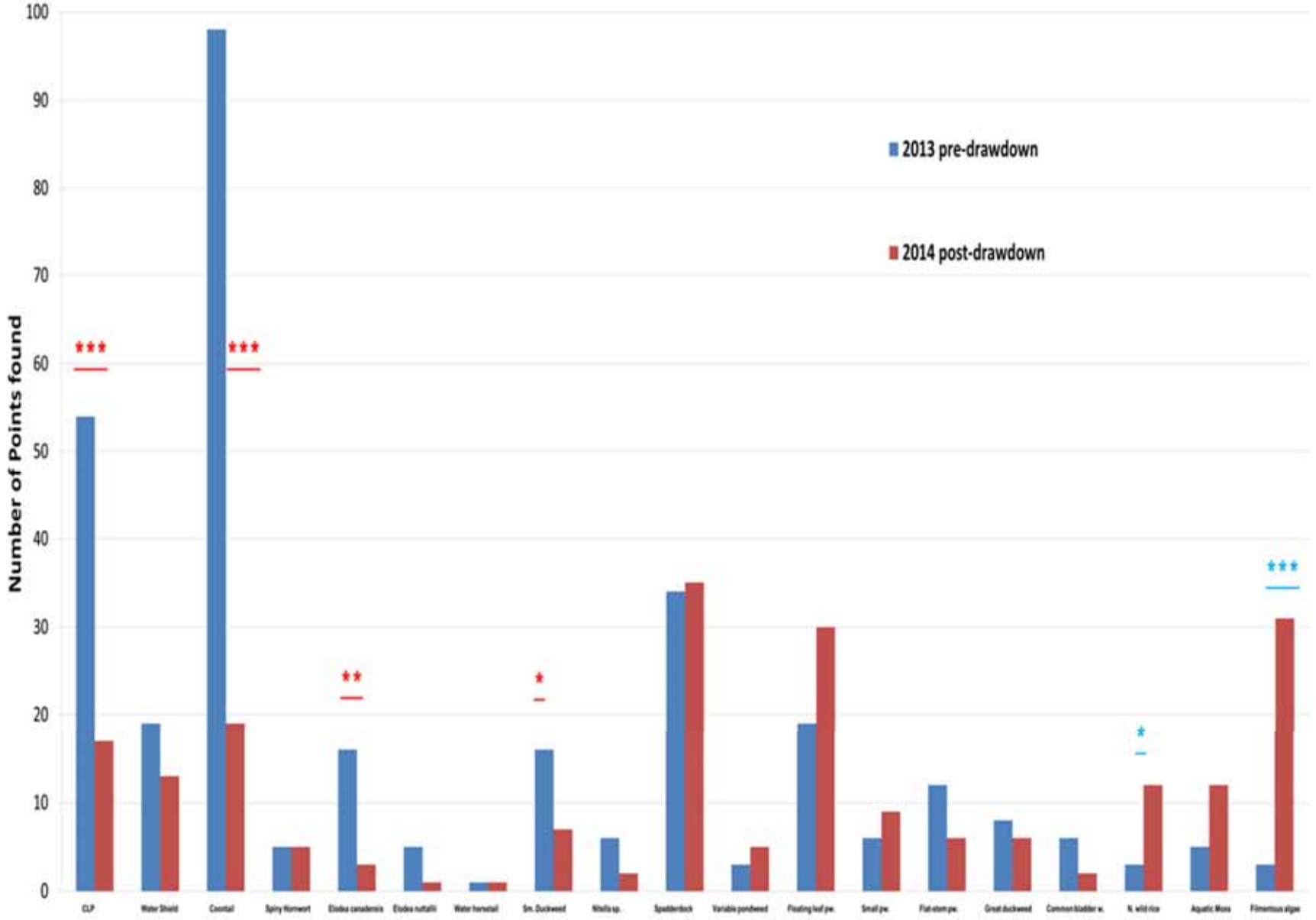
Results:
Point-intercept Survey

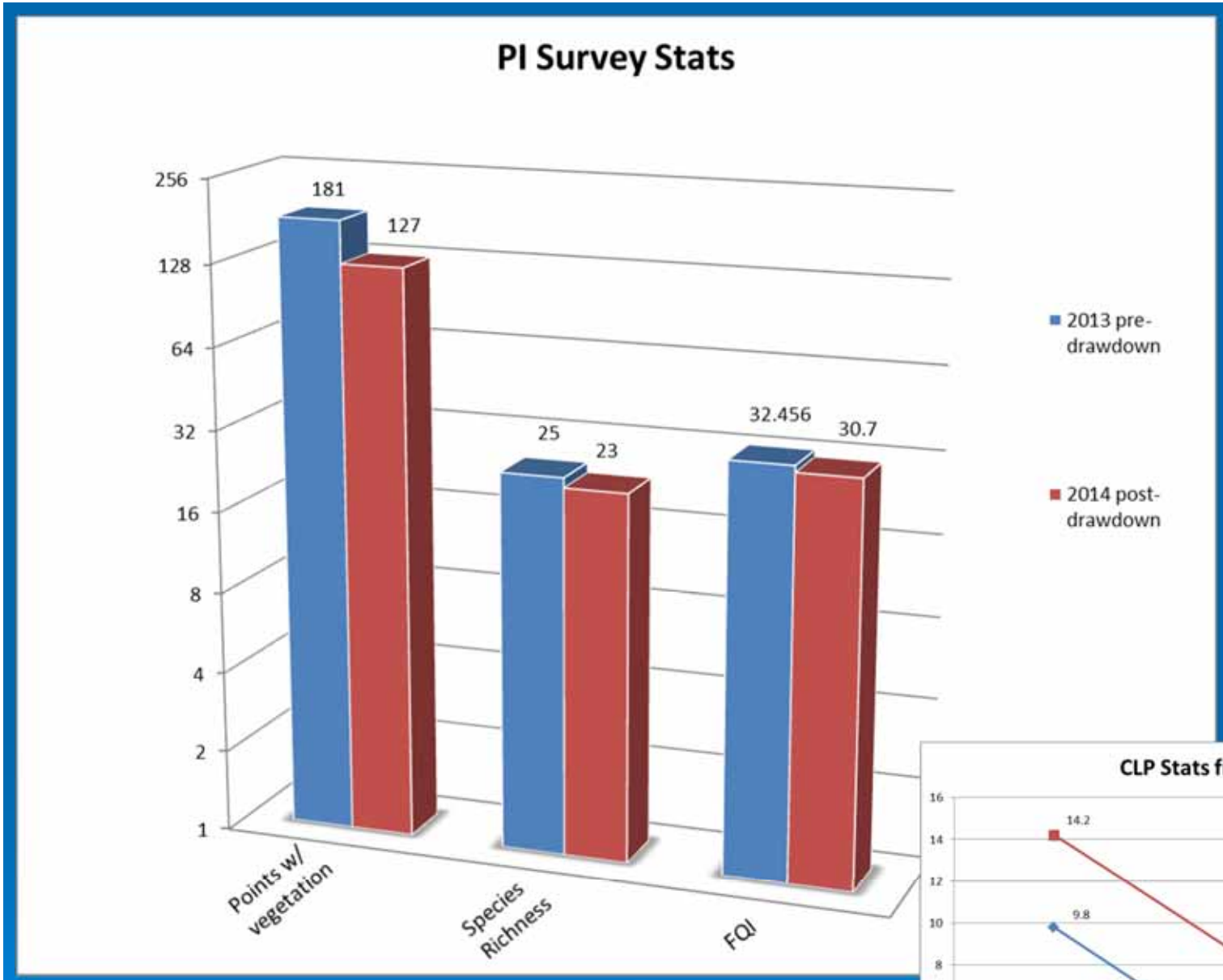
Plant Lists

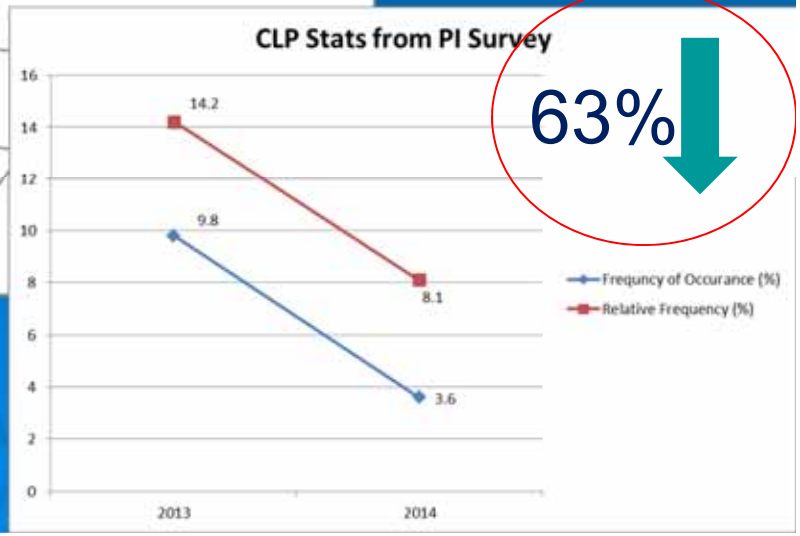
2013	2014
Brasenia schreberi	Acorus americanus
Ceratophyllum demersum	Brasenia schreberi
Ceratophyllum echinatum	Ceratophyllum demersum
Elodea canadensis	Ceratophyllum echinatum
Elodea nuttallii	Chara sp.
Equisetum fluviatile	Elodea canadensis
Lemna minor	Elodea nuttallii
Lemna turionifera	Equisetum fluviatile
Myriophyllum verticillatum	Lemna minor
Nitella sp.	Nitella sp.
Nuphar vareigata	Nuphar vareigata
Potamogeton amplifolius	Potamogeton crispus
Potamogeton crispus	Potamogeton epihydrus
Potamogeton epihydrus	Potamogeton natans
Potamogeton natans	Potamogeton pusillus
Potamogeton pusillus	Potamogeton robbinsii
Potamogeton spirillus	Potamogeton zosteriformis
Potamogeton zosteriformis	Ranunculus aquatilis
Schoenoplectus tabernaemontanii	Sparganium angustifolium
Sparganium fluctuans	Spirodela polyrhiza
Spirodela polyrhiza	Utricularia vulgaris
Utricularia vulgaris	Vallisneria americana
Wolffia sp.	Zizania palustris
Zizania palustris	Aquatic Moss
Aquatic Moss	Filmentous algae
Filmentous algae	
Ricca sp.	
Carex sp.	

indicates found in 2013 but not 2014

indicates found in 2014 but not 2013

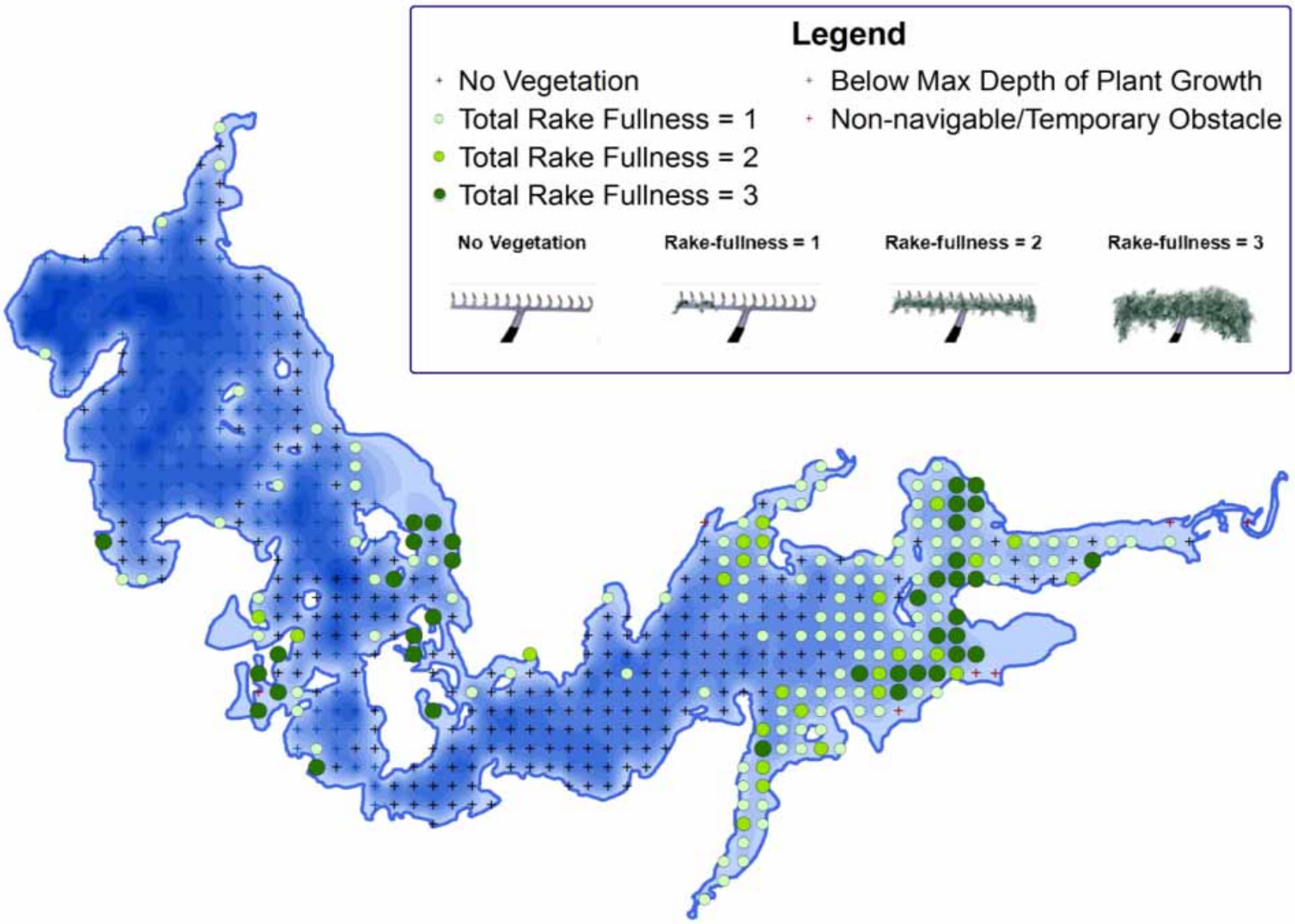

Point-intercept survey results 2013 & 2014
Number of Points found
2013 pre-drawdown
2014 post-drawdown
CLP
Coontail
Elodea
Sm. Duckweed
Wild rice
Fil. Algae


PI Survey Stats
256
128
64
32
16
8
4
2
1
181
127
25
23
32.456
30.7
Points w/ vegetation
Species Richness
FQI
2013 pre-drawdown
2014 post-drawdown

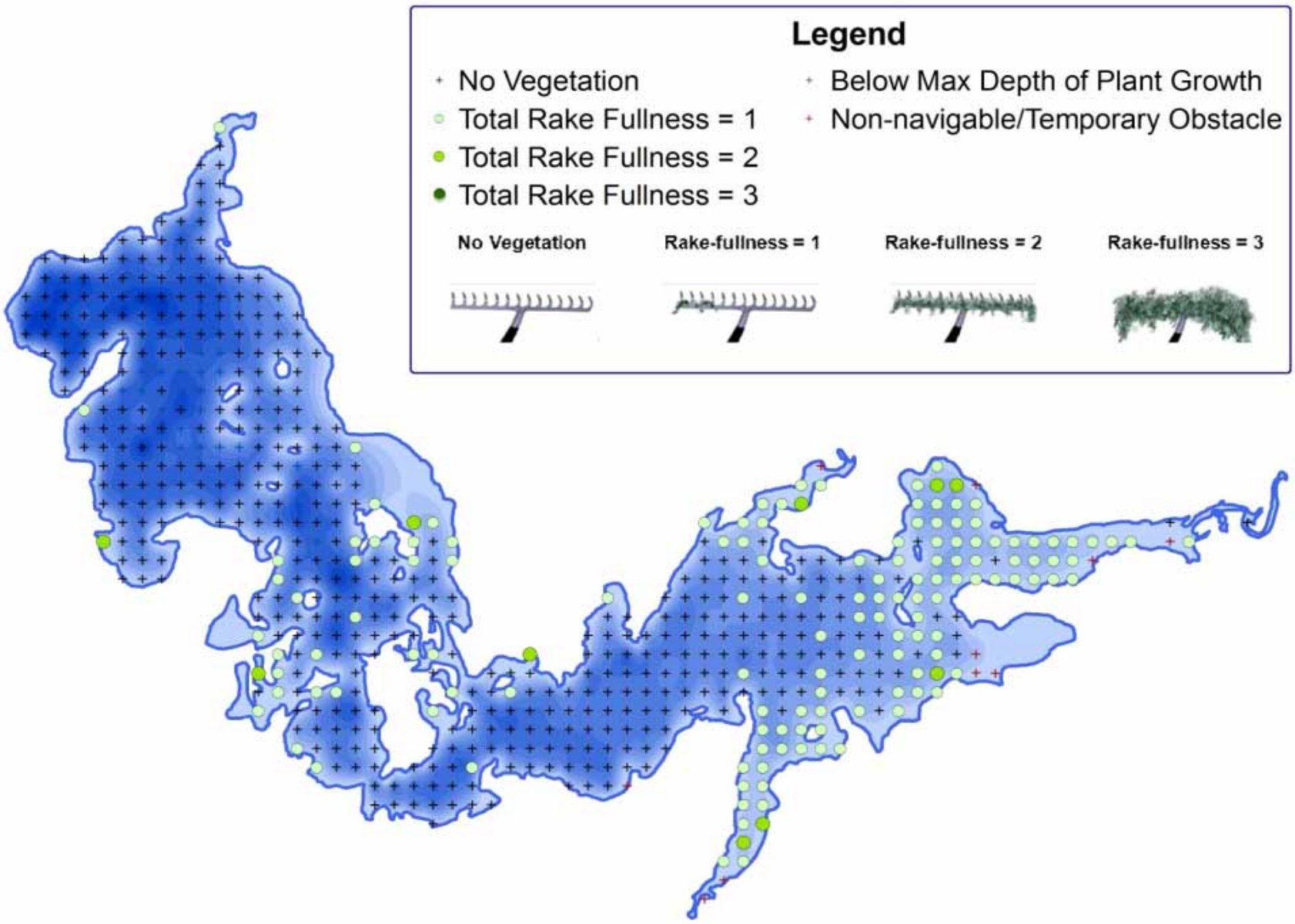

CLP Stats from PI Survey
16
14
12
10
8
6
4
2
0
14.2
8.1
9.8
3.6
2013
2014
Frequncy of Occurance (%)
Relative Frequency (%)

63%

June 2013 (Pre-Drawdown)

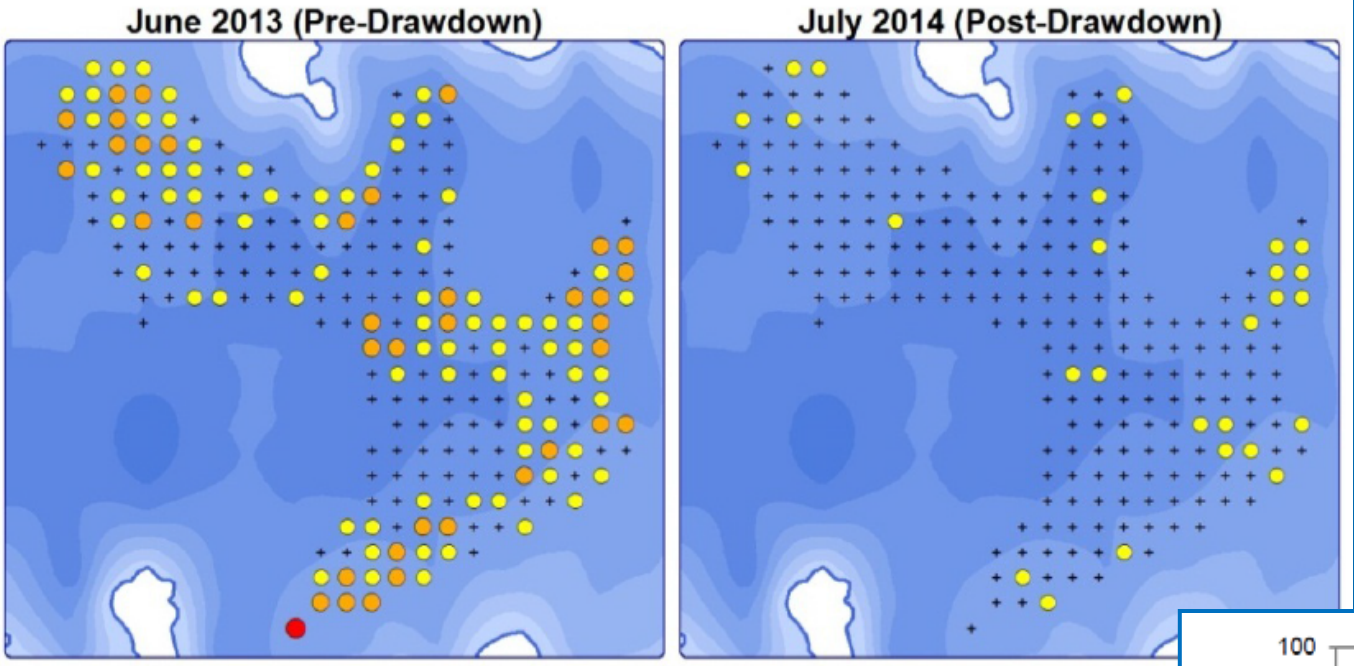


June 2014 (Post-Drawdown)



Results:
CLP Sub Point-intercept Survey

Sub PI Survey



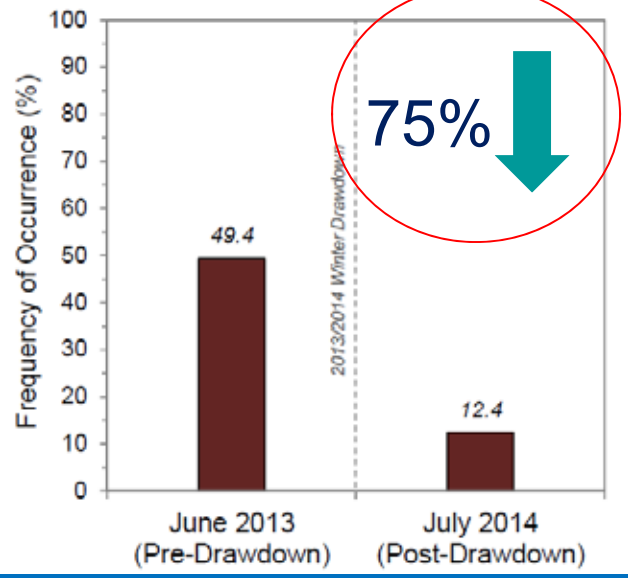
Legend

Curly-Leaf Pondweed

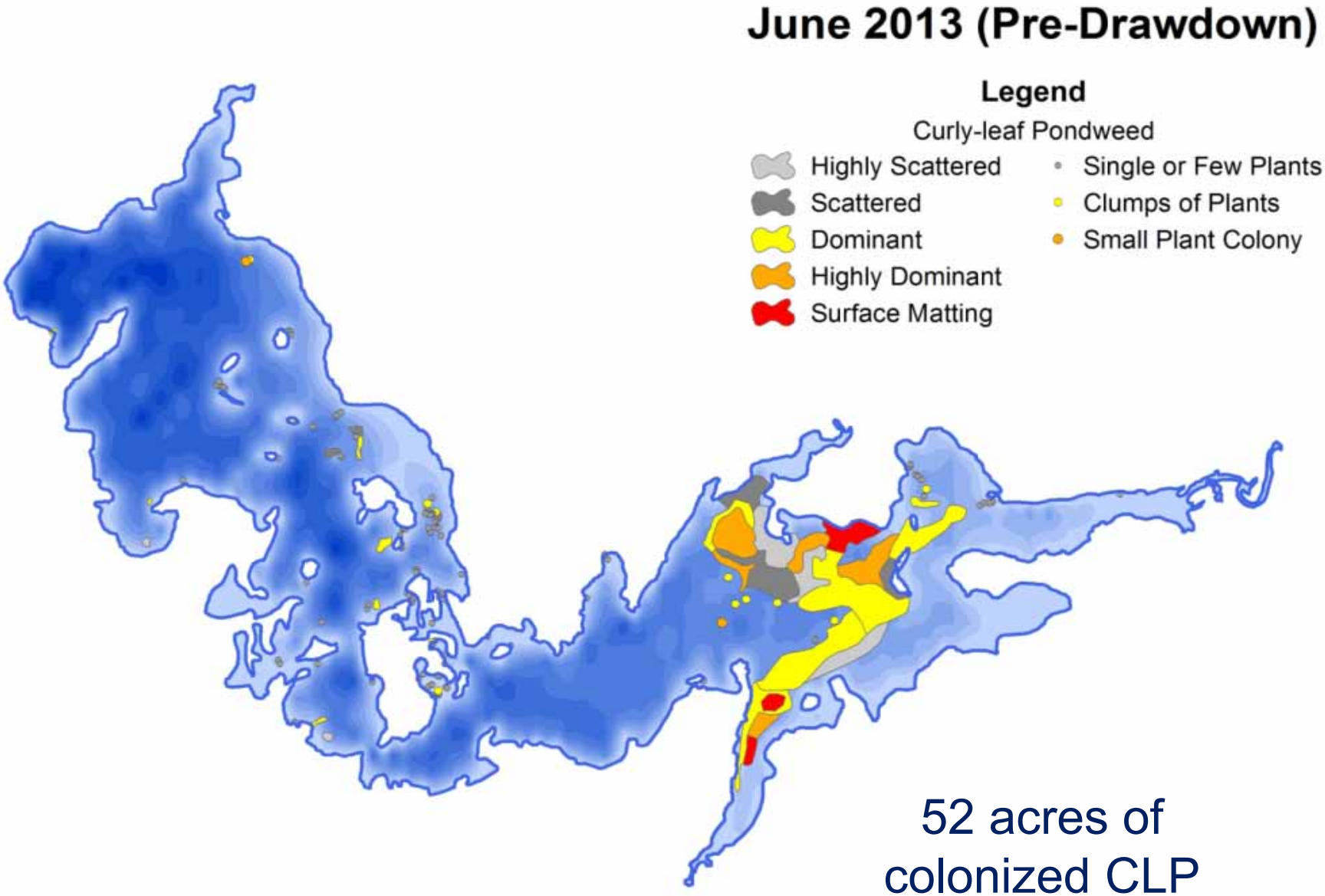
- Not present
- Rake Fullness = 1
- Rake Fullness = 2
- Rake Fullness = 3

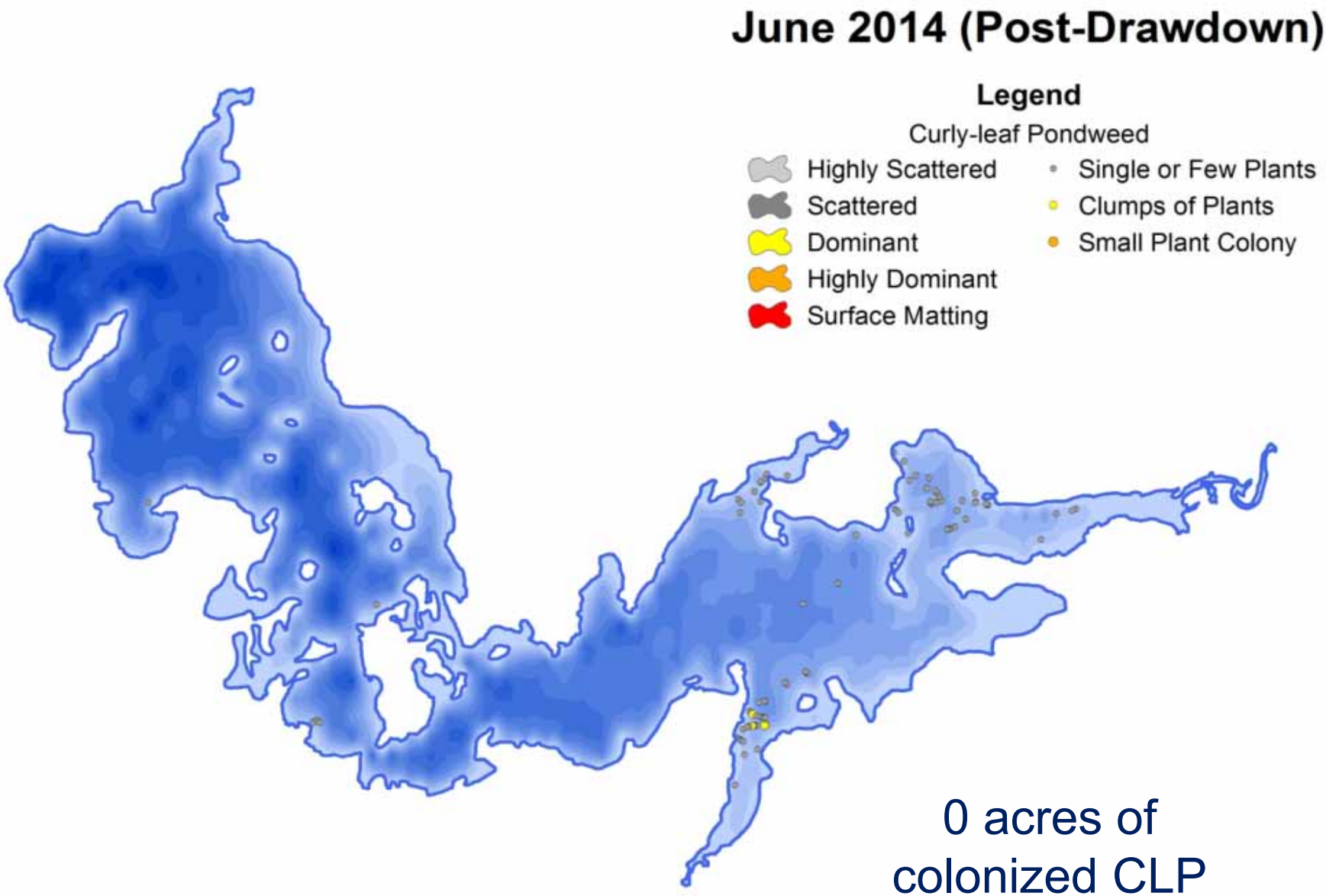
Extent of above images shown in red

Curly-Leaf



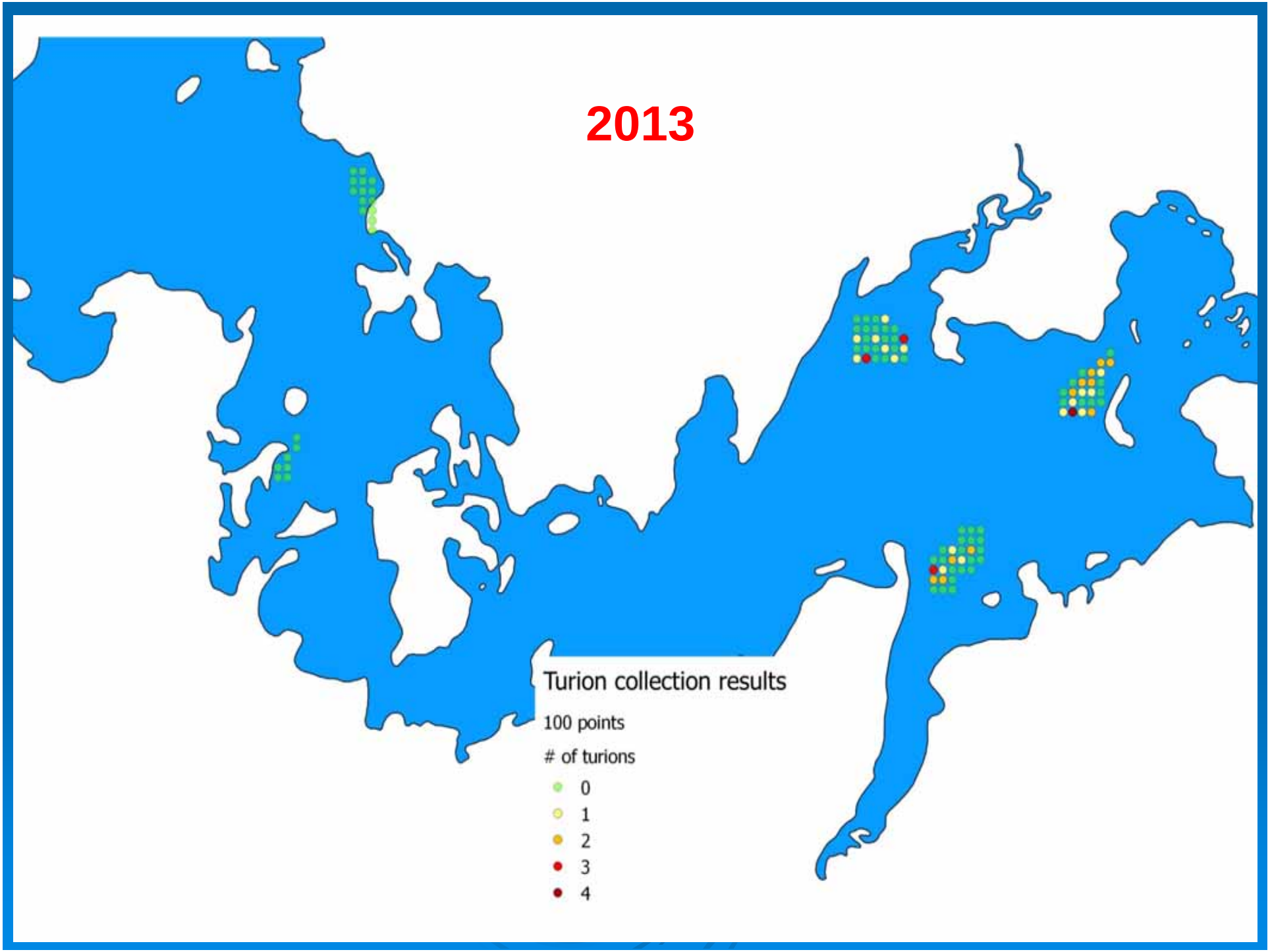
Results:
CLP Colony/Density Mapping

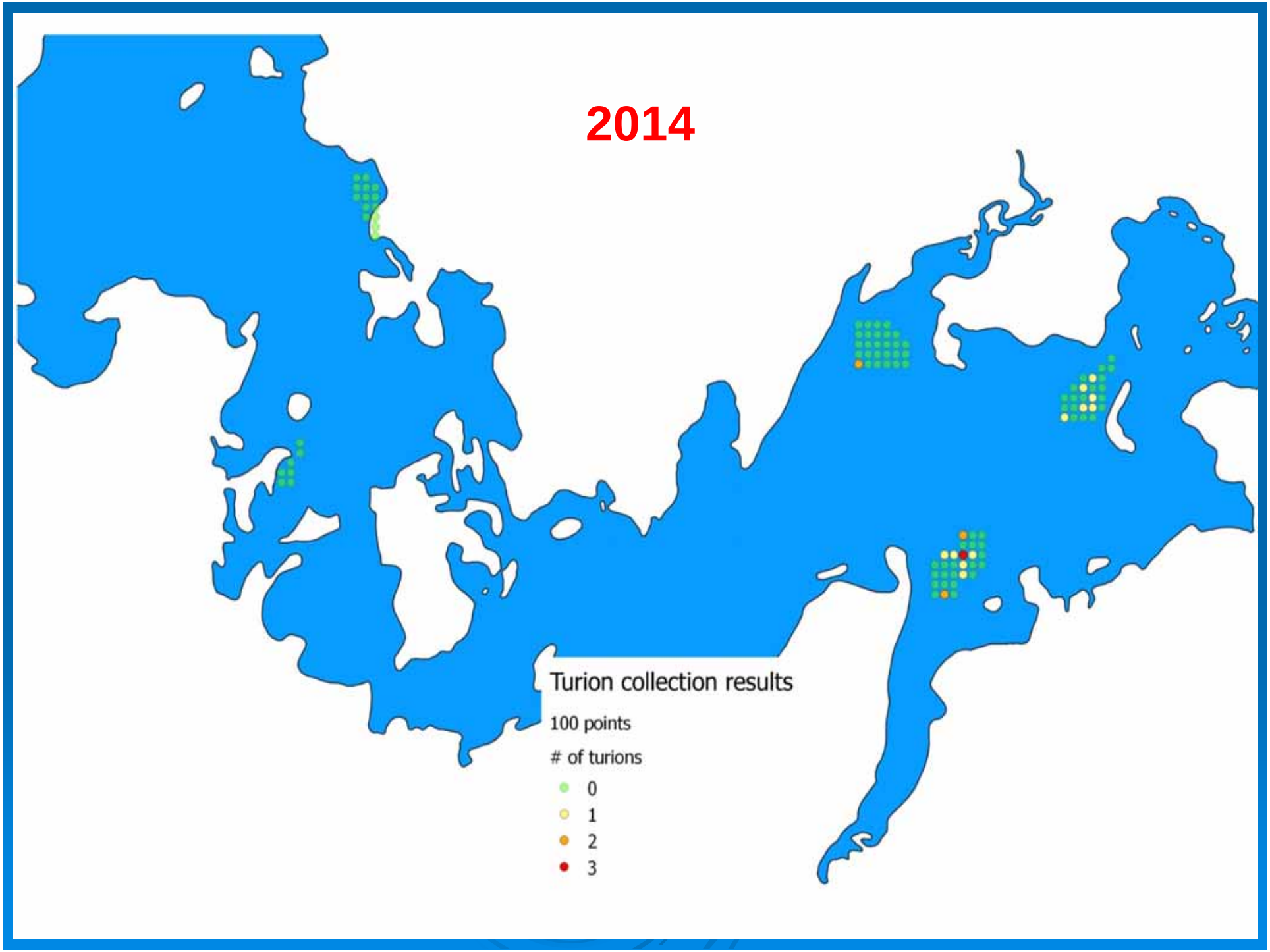

June 2013 (Pre-Drawdown)
Legend
Curly-leaf Pondweed
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
52 acres of
colonized CLP



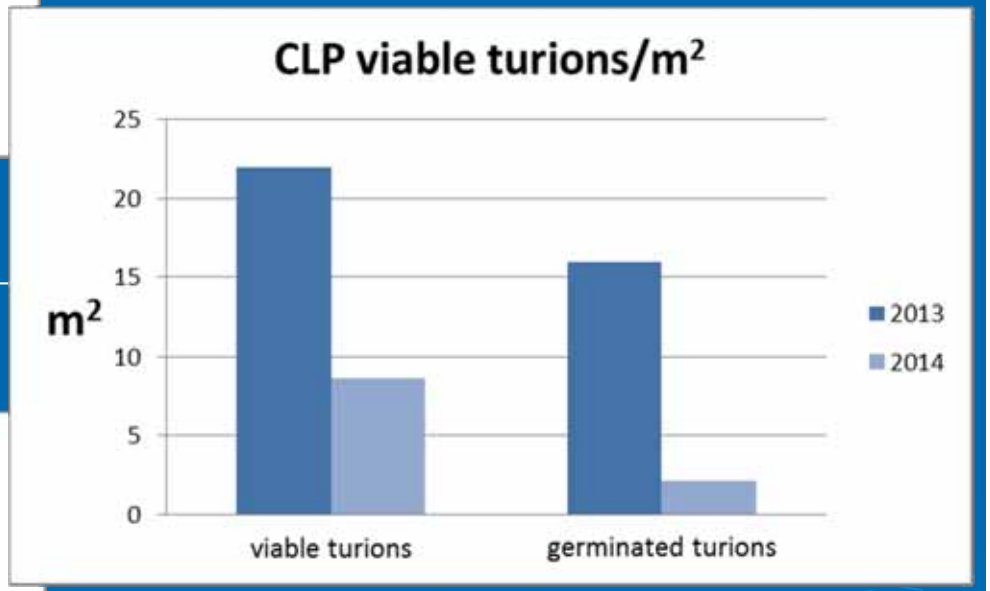
0 acres of
colonized CLP

Results:
CLP turions

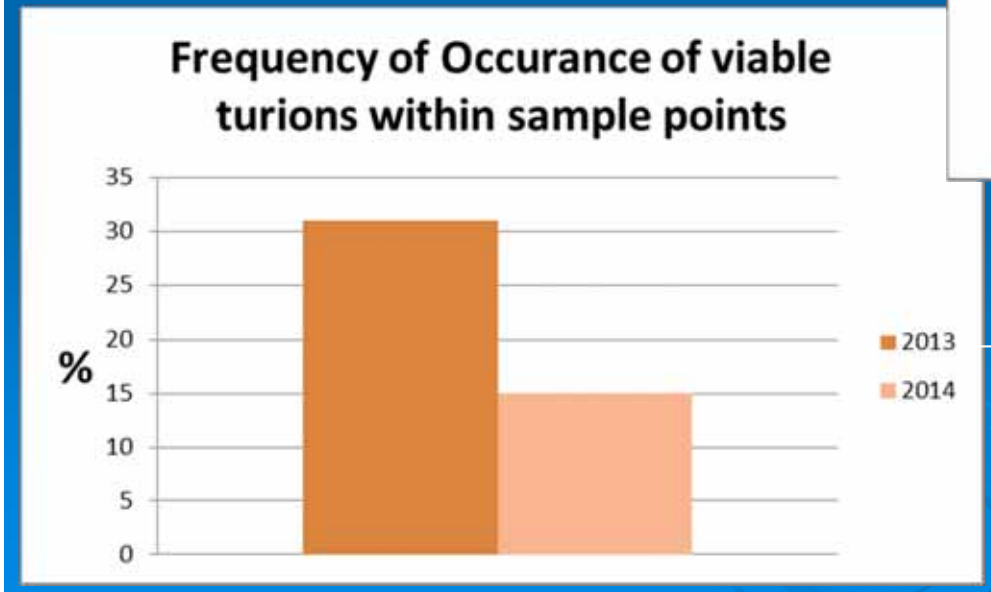

2013
Turion collection results
100 points
# of turions
0
1
2
3
4


2014
Turion collection results
100 points
# of turions
0
1
2
3

65.5%



60.1%
viable difference



51.6%

Conclusions

- Overall success reducing CLP plants/ turions (60-70%)
- Colonized acreage of CLP reduced to 0
- Overall plant biomass reduced (rake fullness)
- Drawdown has impacts on native plant community
- Monitoring to continue in 2015- PI Survey scheduled for mid-to-late June

Acknowledgments

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- Musser Flowage Lake Association
- WDNR Staff


Questions?
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