Distribution and Management of Starry Stonewort (*Nitellopsis obtusa*) in Wisconsin Lakes

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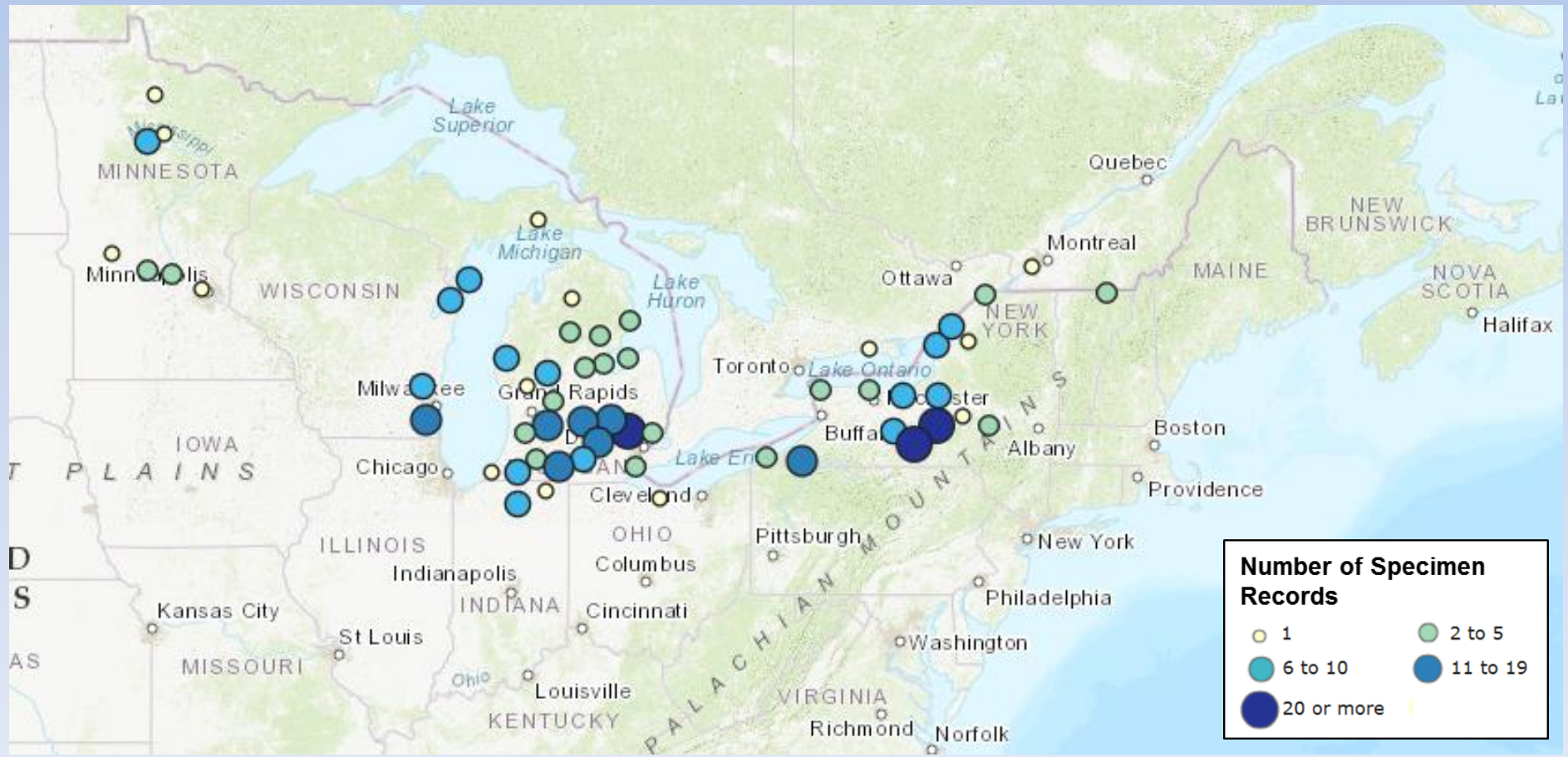
Photo: Paul Skawinski

What is starry stonewort?

- Starry stonewort (*Nitellopsis obtusa*) is a macroalgae in the Characeae family.
- Not a vascular plant like most our aquatic plant species.
- Native to Europe & Asia; rare in portions of its range.
- First documented in St. Lawrence River in 1970s; likely transported to U.S. via international ballast water.

Non-Native Range Expansion

- Documented in lower Michigan inland lakes in the mid-2000s; Indiana in 2008.
- First documented in Wisconsin in September 2014; Minnesota in 2015.
- Currently known from Indiana, Michigan (Lower), Minnesota, New York, Ohio, Pennsylvania, Vermont, Wisconsin, and Ontario.



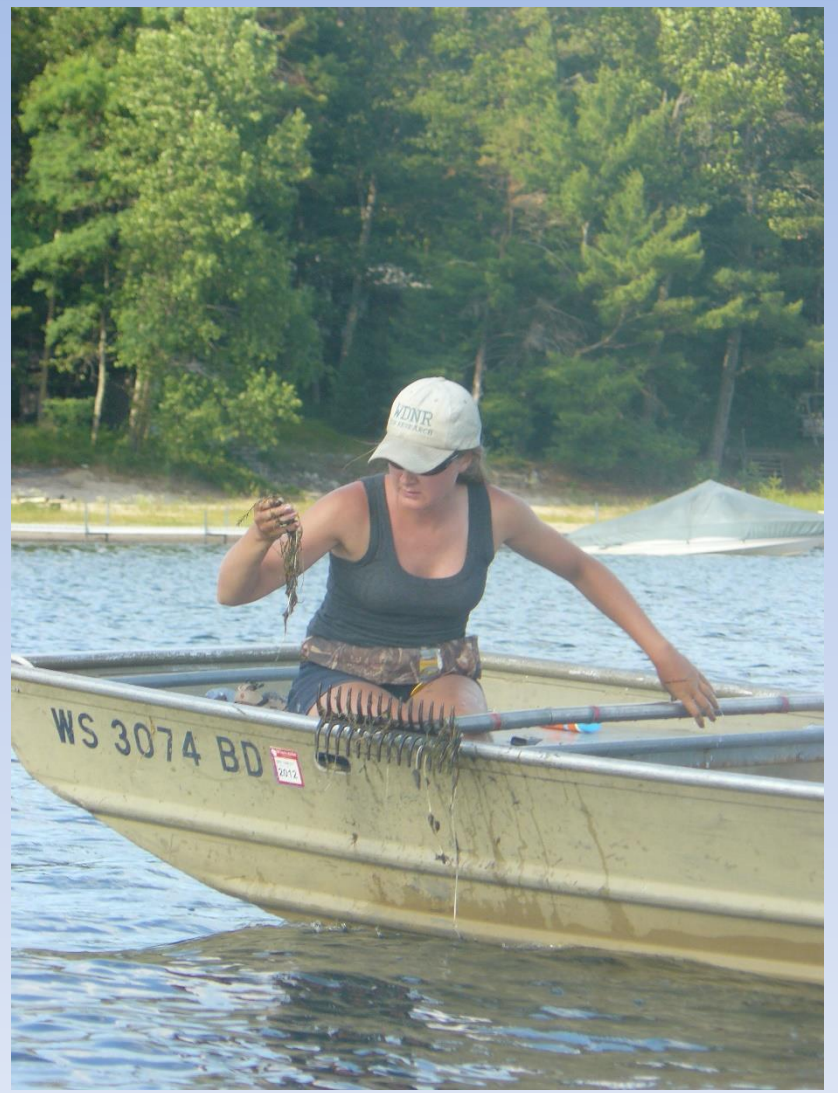
First Discovery of SSW in Wisconsin

- WDNR staff first discovered starry stonewort in September 2014 while conducting an aquatic plant point-intercept (PI) survey out on Little Muskego Lake, Waukesha Co.
- Verified by WDNR and the New York Botanical Garden.

Little Muskego, Waukesha Co.

Monitoring & Response Approach

- Regional SSW Monitoring (Rapid Assessment)
  - Targeted monitoring effort in southeast WI waterbodies around Little Muskego Lake
  - Monitoring consisted of rake tosses at boat launches, shoreline meanders, snorkeling, and lakewide AIS surveys
  - Heightened outreach, education and awareness of starry stonewort
- Statewide AIS & PI Monitoring



Verified SSW Populations

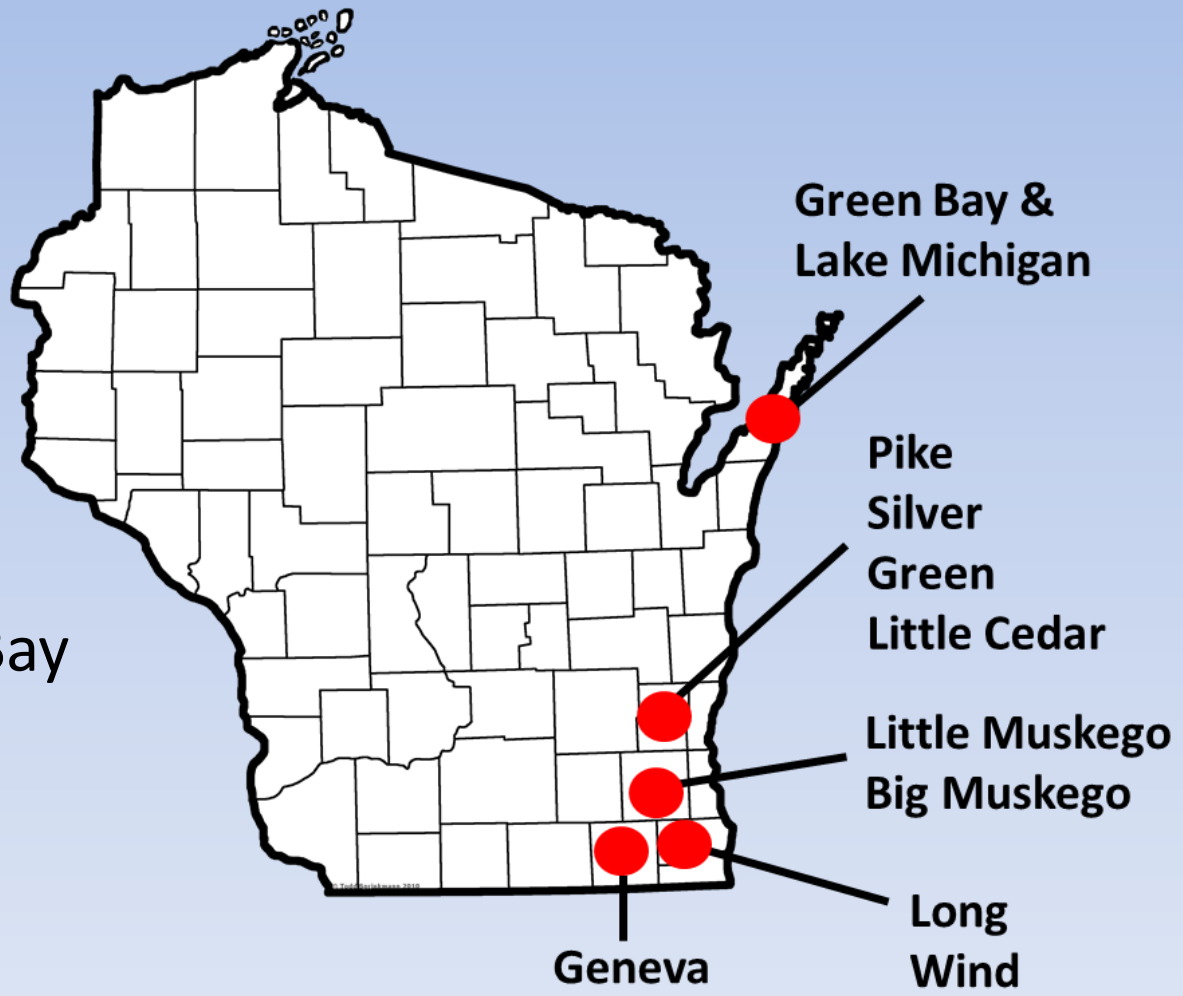
2014
- Little Muskego

2015
- Big Muskego
- Long
- Pike
- Silver

2016
- Green
- Lake Michigan/Green Bay

2017
- Wind

2018
- Geneva
- Little Cedar



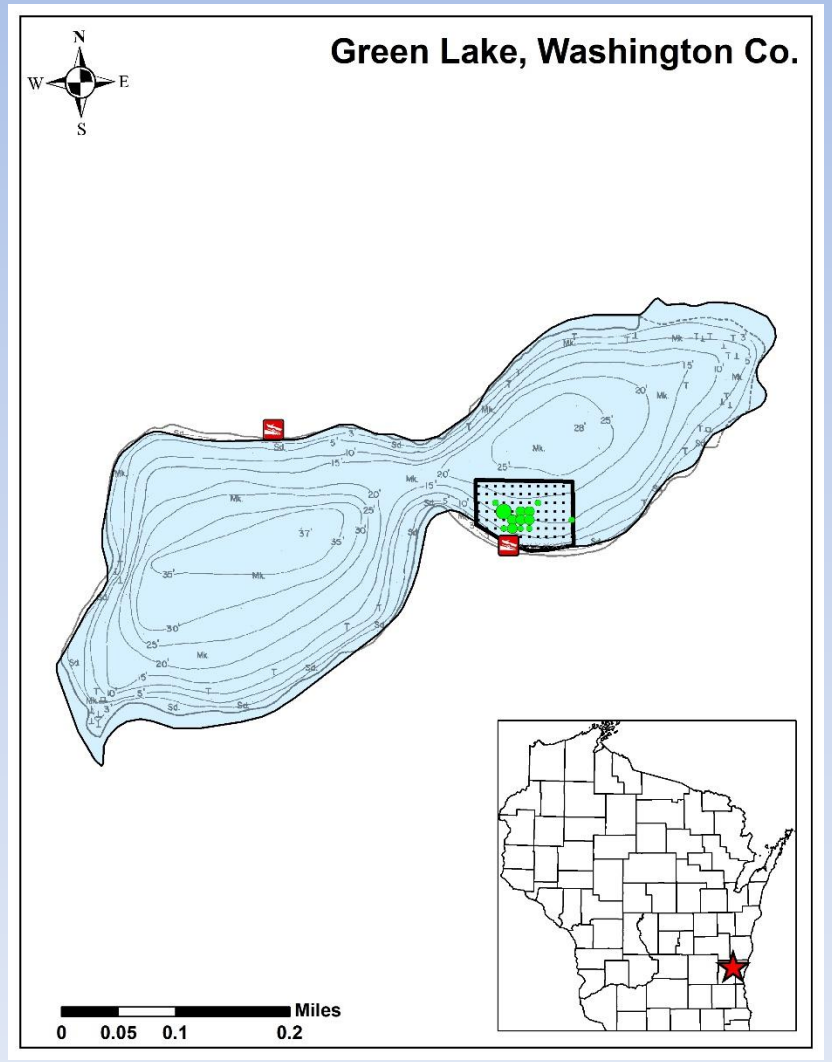
SSW Management Projects

- **Green Lake, Washington Co.**
  - Small-scale copper/hydrothol treatment within limno-barrier
- **Wind Lake, Racine Co.**
  - Large-scale copper/hydrothol treatments
- **Little Muskego Lake, Waukesha Co.**
  - Water level winter drawdown

Green Lake

- Management Approach: Limno-barrier

- 70 acre seepage lake
- 37 feet max depth
- 17 feet mean depth
- SSW discovered in July 2016 near public boat access
- Great Lakes Restoration Initiative (GLRI) funding obtained to help support monitoring and control efforts

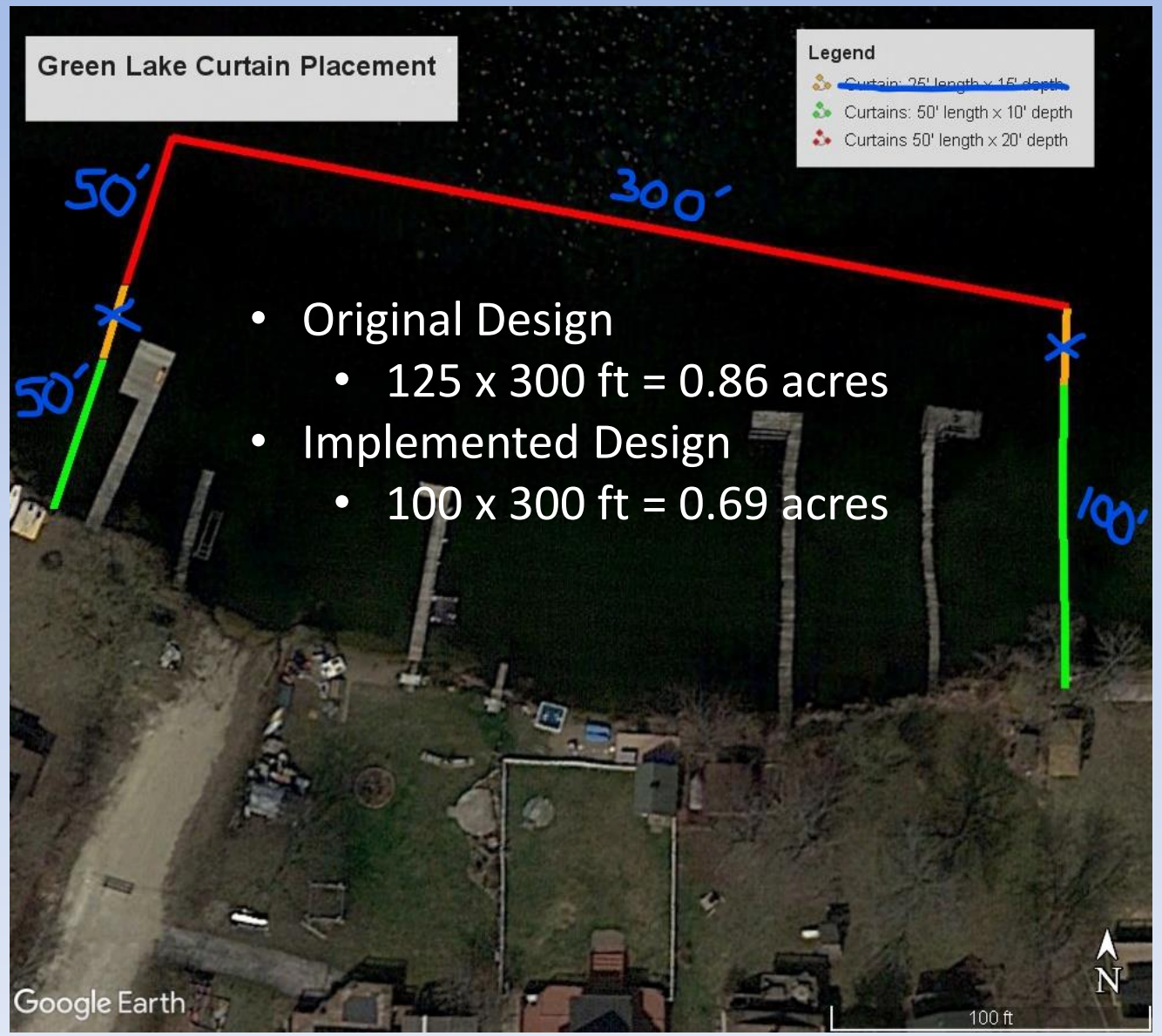


Green Lake

- Management Approach: Limno-barrier

- Localized area of SSW near public access location
- Goal: Apply herbicide within a limno-barrier to increase CET and SSW control efficacy
- Limno-barrier installed on September 17, 2018
- Cutrine Ultra/Hydrothol 191 treatment occurred on September 18, 2018
- Limno-barrier removed on September 27, 2018

Green Lake



- Original Design
  - 125 x 300 ft = 0.86 acres
- Implemented Design
  - 100 x 300 ft = 0.69 acres

Green Lake

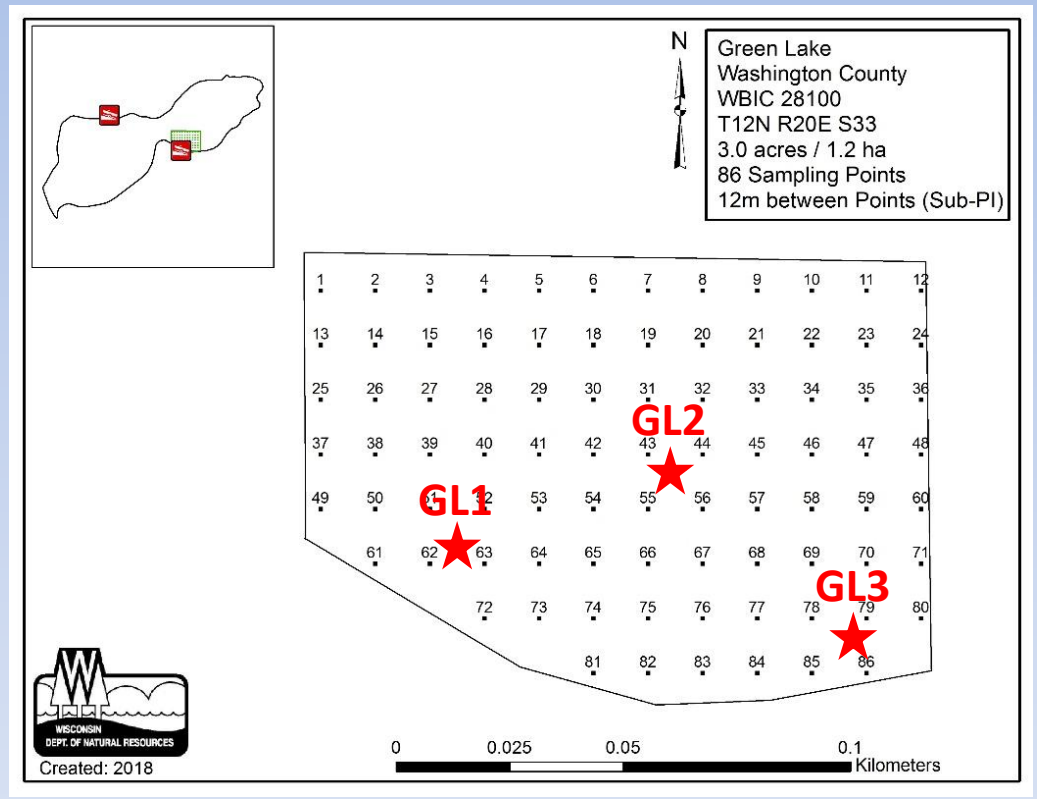
Green Lake

Green Lake

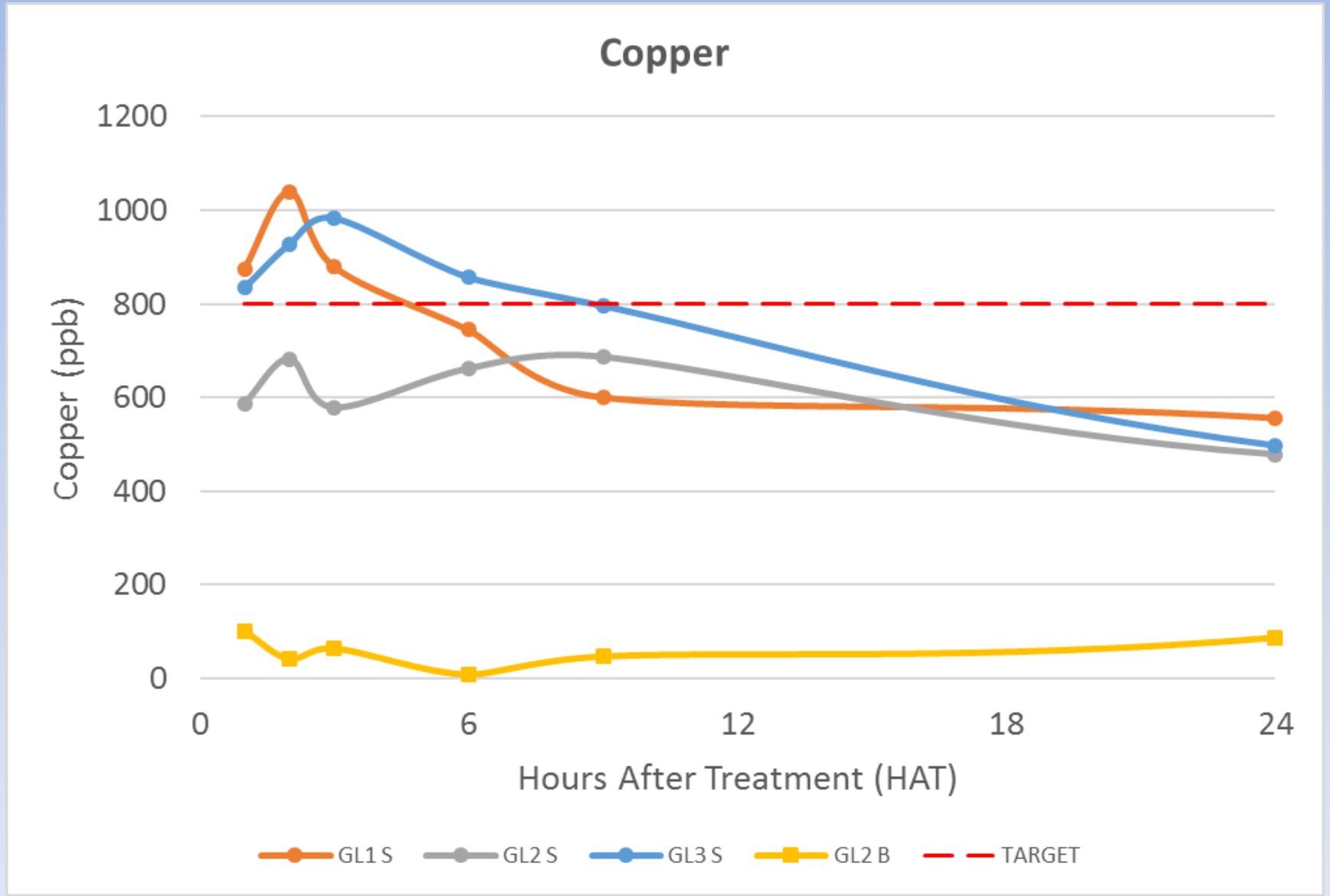
Green Lake

- Management Approach: Limno-barrier

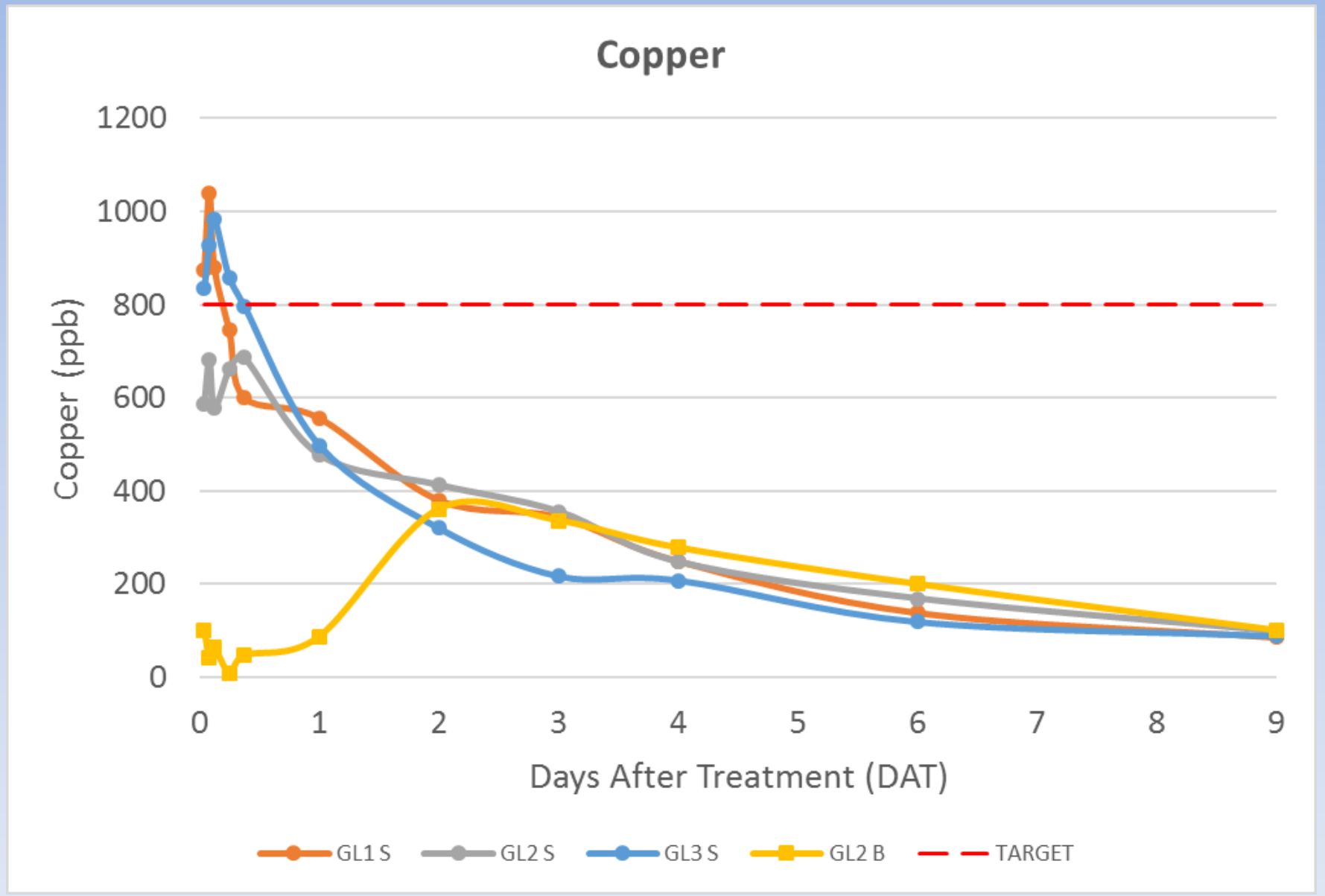
- Herbicide Concentration Monitoring
  - Water samples collected at 1, 2, 3, 6, 9, 24, 48, 72, 96, 144, & 216 HAT
  - Analyzed for copper and endothall at WI State Lab of Hygiene
- Aquatic Plant Monitoring
  - Pre- and post-treatment sub-PI plant surveys conducted within limno-barrier treatment area in June, August & October 2018
  - Lakewide PI surveys conducted annually 2016-2018



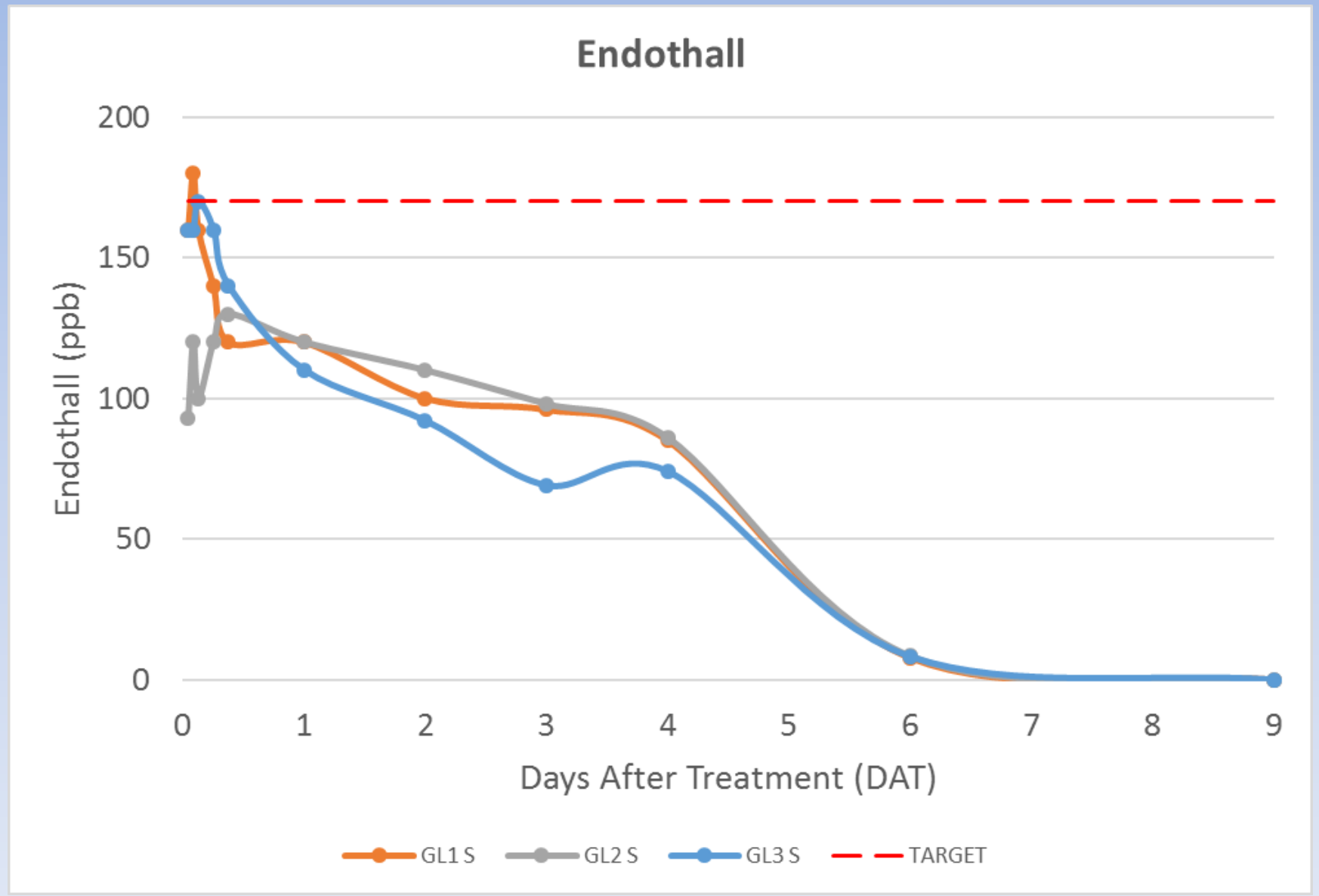
Green Lake


Copper
1200
1000
800
600
400
200
0
Copper (ppb)
0
6
12
18
24
Hours After Treatment (HAT)
GL1 S
GL2 S
GL3 S
GL2 B
TARGET

Green Lake


Copper
1200
1000
800
600
400
200
0
Copper (ppb)
0
1
2
3
4
5
6
7
8
9
Days After Treatment (DAT)
GL1 S
GL2 S
GL3 S
GL2 B
TARGET

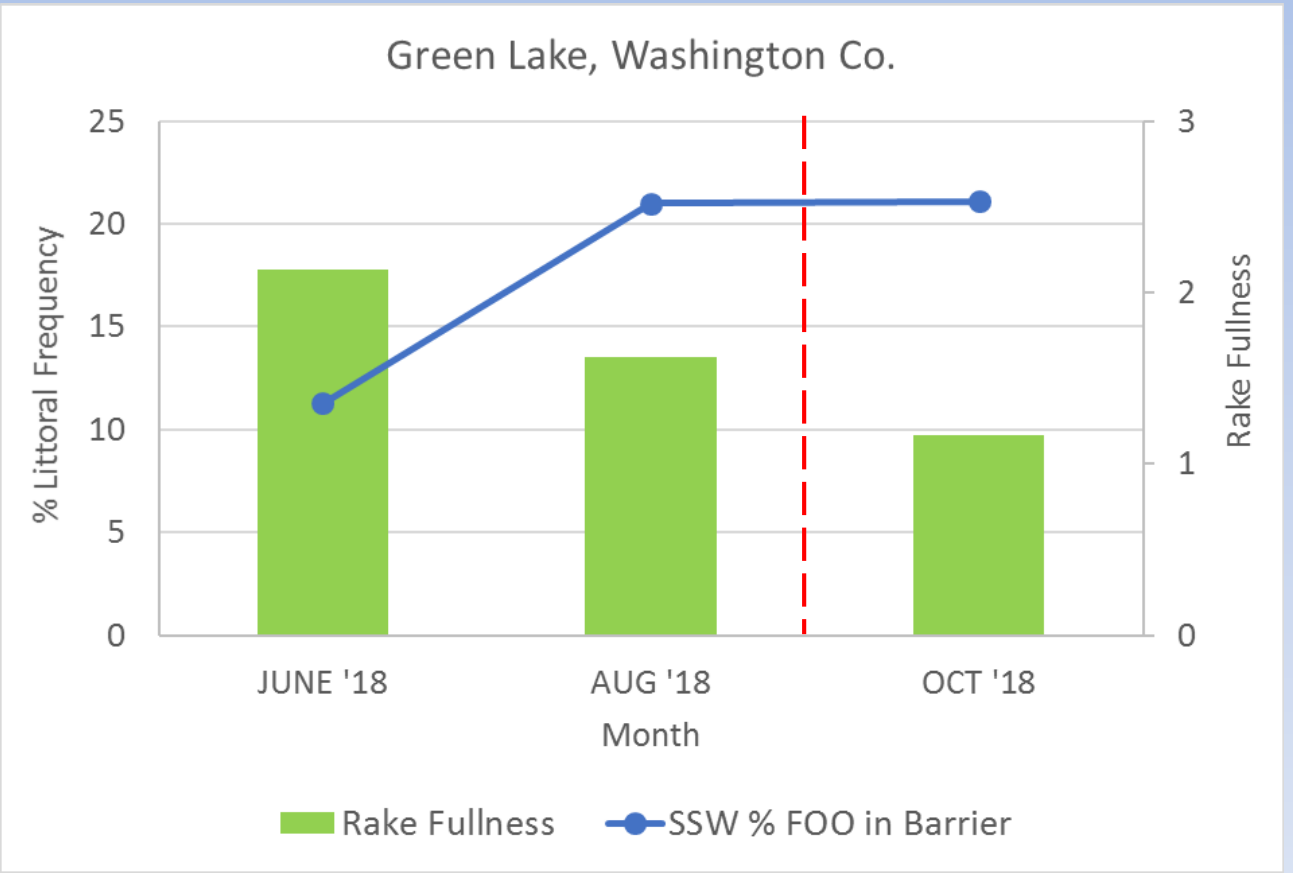
Green Lake


Endothall
200
150
100
50
0
Endothall (ppb)
0
1
2
3
4
5
6
7
8
9
Days After Treatment (DAT)
GL1 S
GL2 S
GL3 S
TARGET

Green Lake

- Management Approach: Limno-barrier

- Aquatic Plant Sub-PI Monitoring
  - June ‘18: **11.3%**
  - August ‘18: **21.0%**
  - October ’18: **21.1%**
- Lakewide PI Monitoring
  - 2016: **0.0%**
  - 2017: **0.7%**
  - 2018: **2.7%**

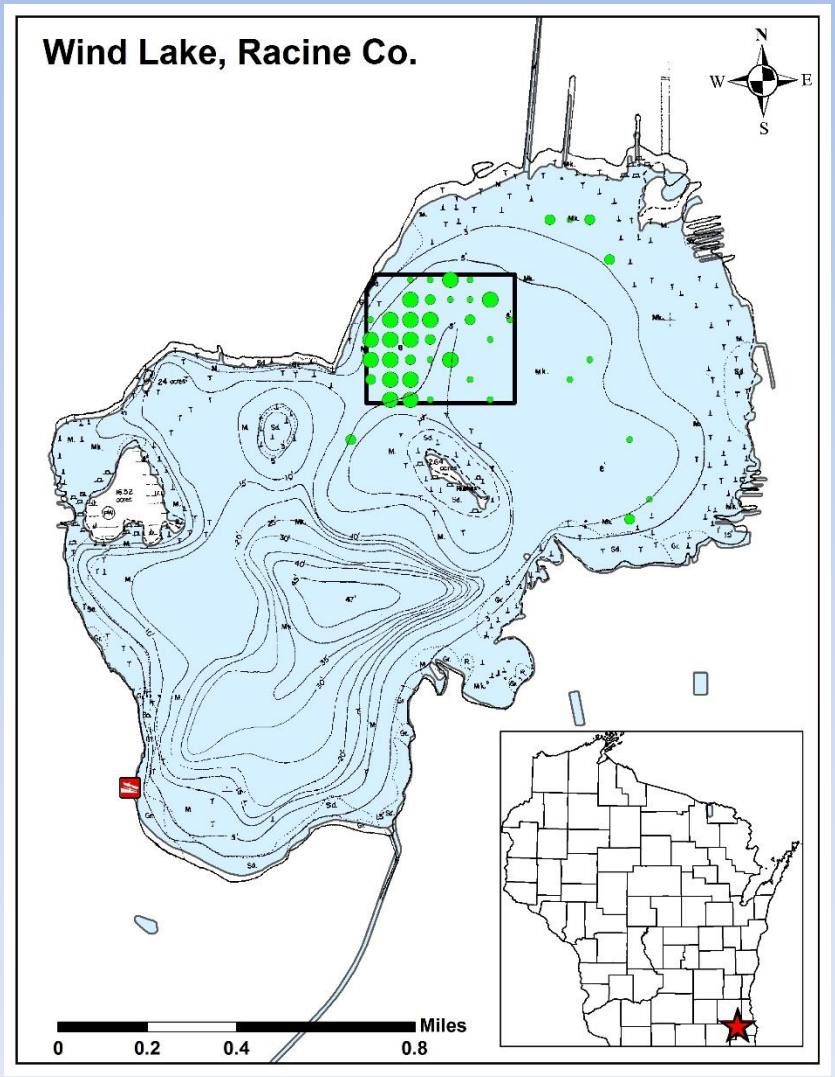


SURVEYS	PRE	POST	CHANGE	P-VALUE
AUG '17 vs OCT '18	21.0	21.1	↑	0.991

Wind Lake

- Management Approach: Large-scale herbicide

- 919 acre drainage lake
- 47 feet max depth
- 90% muck, 5% gravel, 5% sand
- SSW discovered in August 2017
- 2017: Treated five isolated SSW patches (1 acre total) with copper/hydrothol



Wind Lake

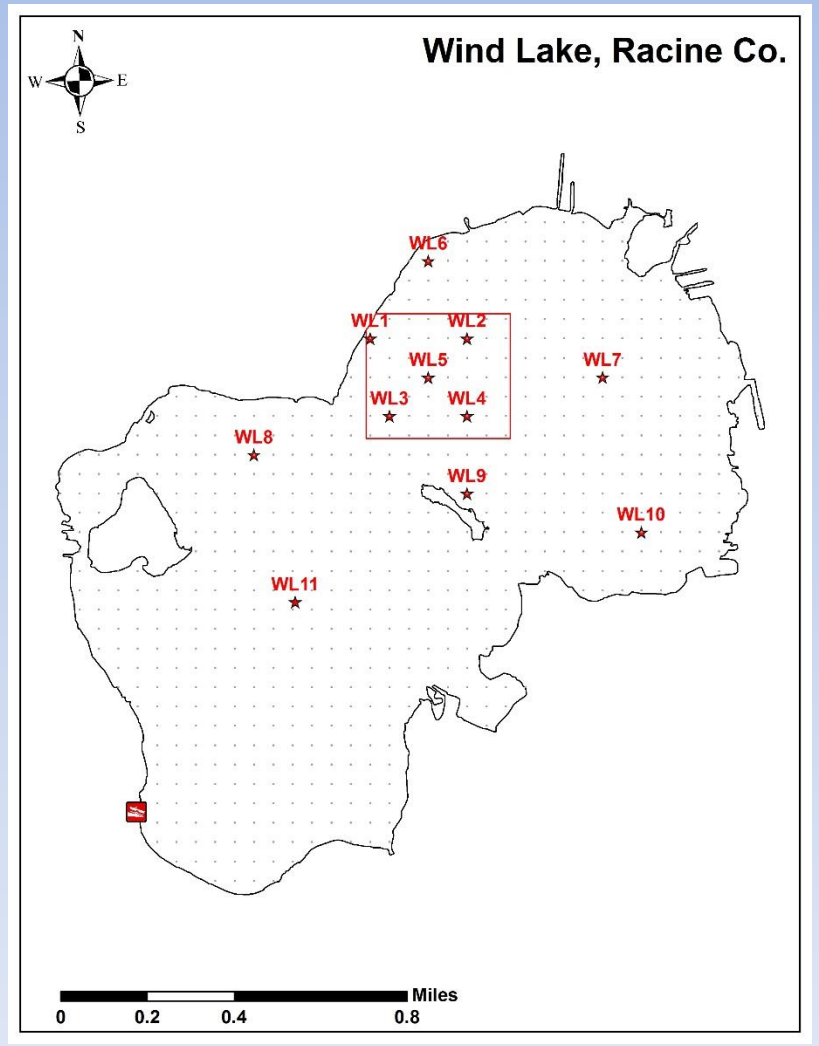
- Management Approach: Large-scale herbicide

- Large, but relatively localized population of SSW within large lake
- Goal: Apply herbicide to large established population and satellite populations to prevent spread to other areas of the lake
- Cutrine Ultra/Hydrothol 191 treatment occurred on June 20, 2018
  - 50.3 acres + 3 acres + [1 acre x 5]
- Cutrine Ultra/Hydrothol 191 treatment occurred again on July 30, 2018
  - 51.2 acres + 2.6 acres + 0.5 acre + [1 acre x 4]

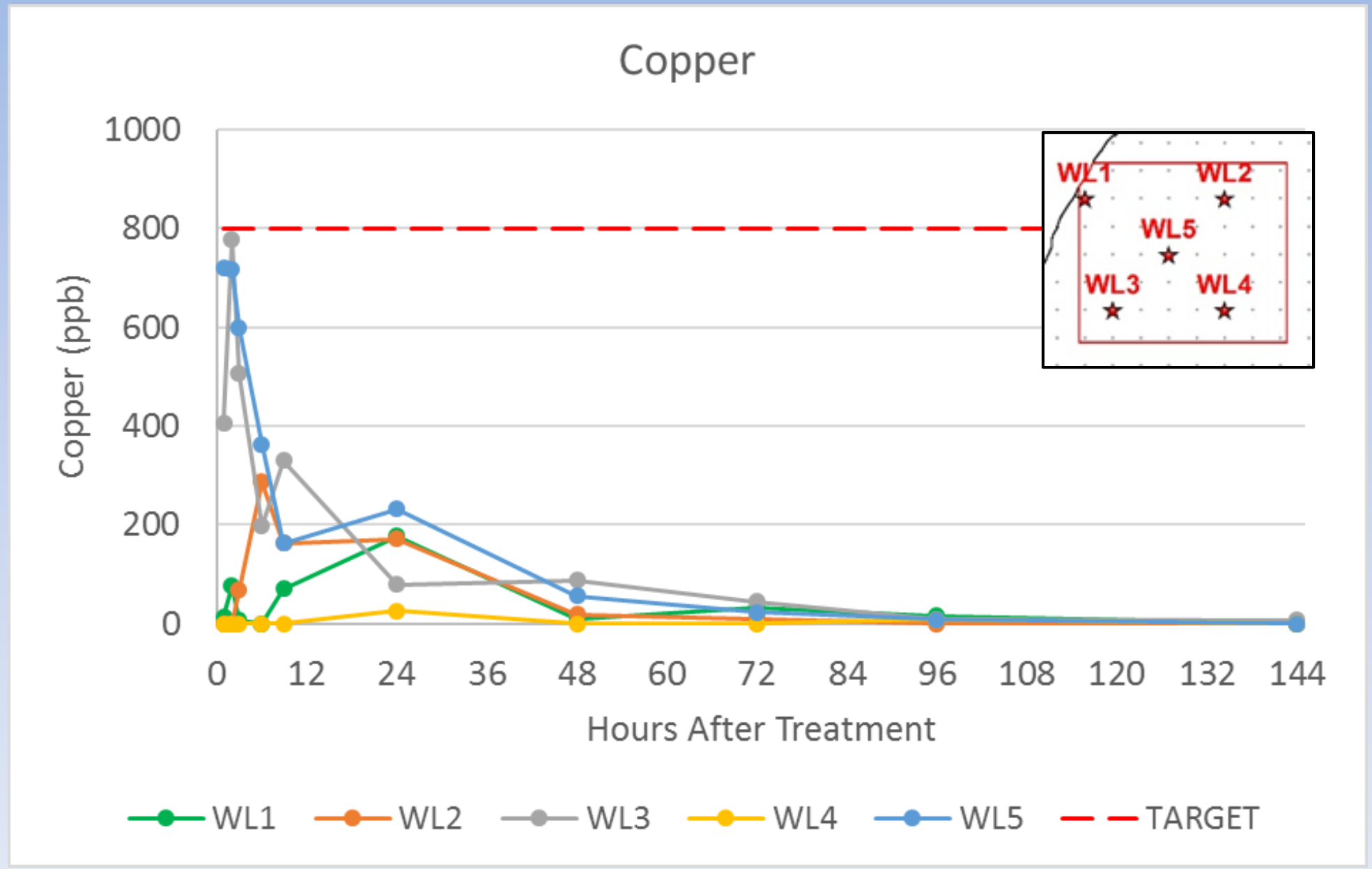
Wind Lake

- Management Approach: Large-scale herbicide

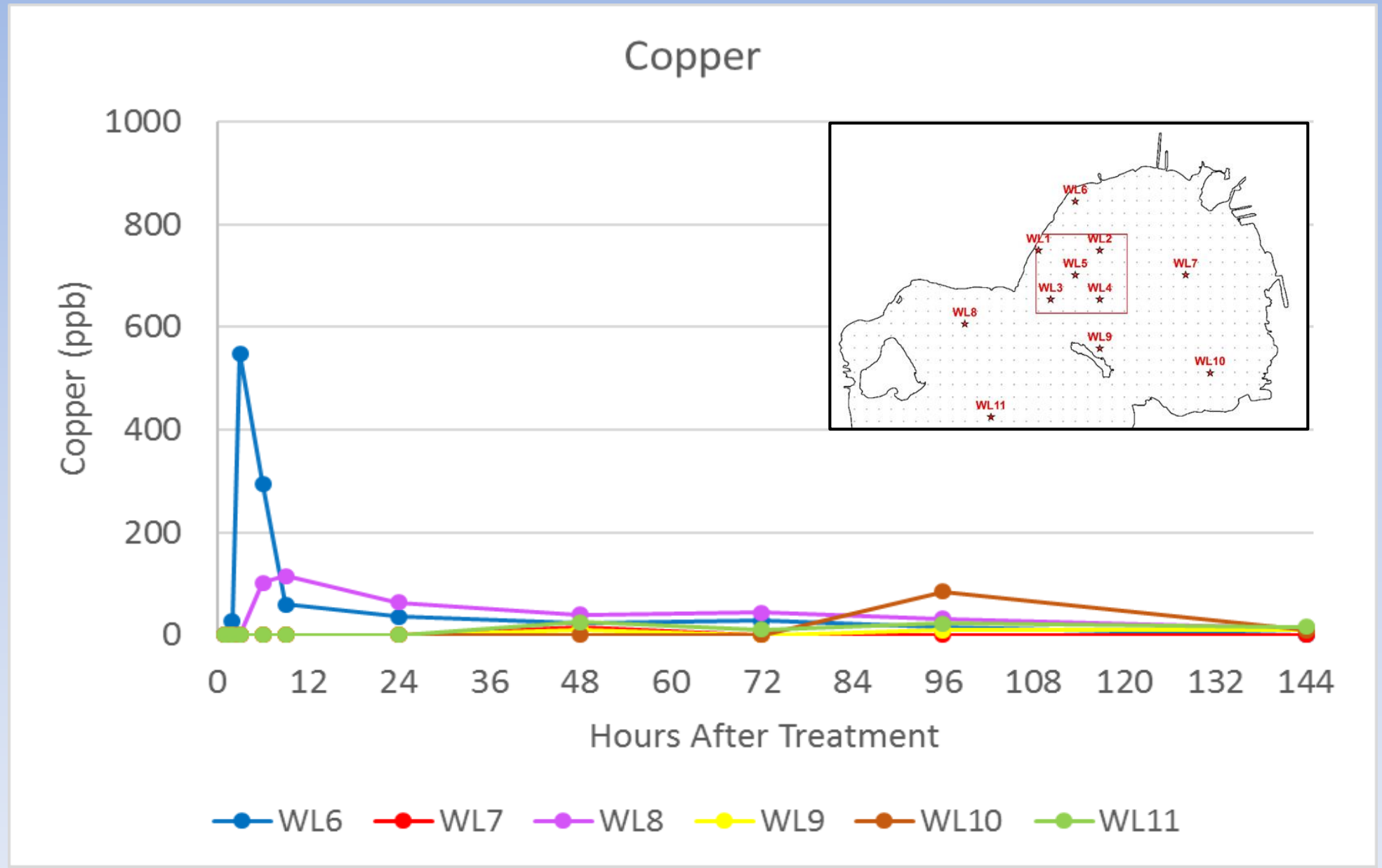
- Herbicide Concentration Monitoring
  - Water samples collected at 1, 2, 3, 6, 9, 12, 24, 48, 72, 96, 144, & 216 HAT.
  - Analyzed for copper and endothall at WI State Lab of Hygiene.
- Aquatic Plant Monitoring
  - Pre- and post-treatment lakewide PI plant surveys conducted in June, July, and August 2018.



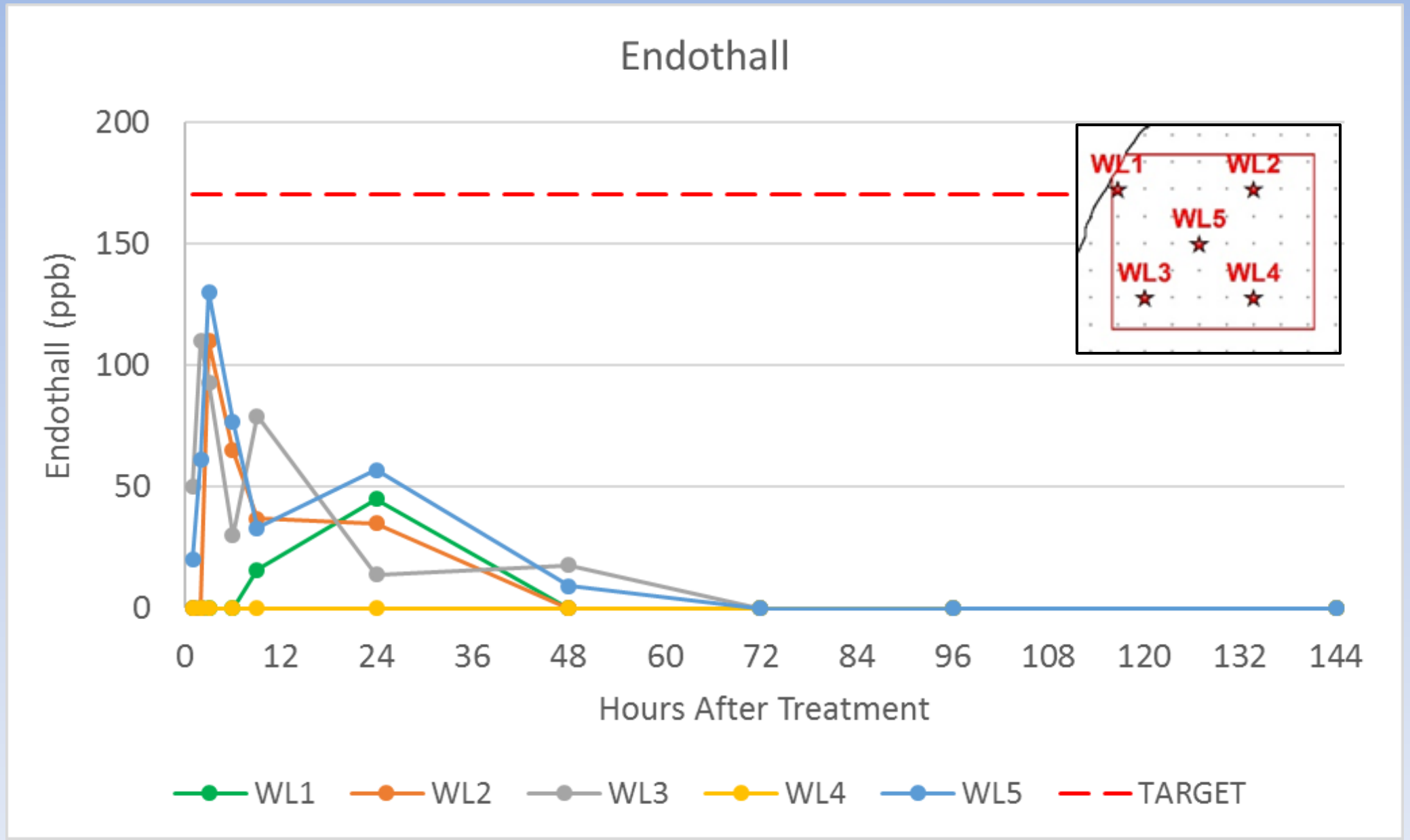
Wind Lake


Copper
1000
800
600
400
200
0
Copper (ppb)
0
12
24
36
48
60
72
84
96
108
120
132
144
Hours After Treatment
WL1
WL2
WL5
WL3
WL4
WL1
WL2
WL3
WL4
WL5
TARGET

Wind Lake


Copper
Copper (ppb)
1000
800
600
400
200
0
0
12
24
36
48
60
72
84
96
108
120
132
144
Hours After Treatment
WL6
WL7
WL8
WL9
WL10
WL11
WL1
WL2
WL3
WL4
WL5

Wind Lake

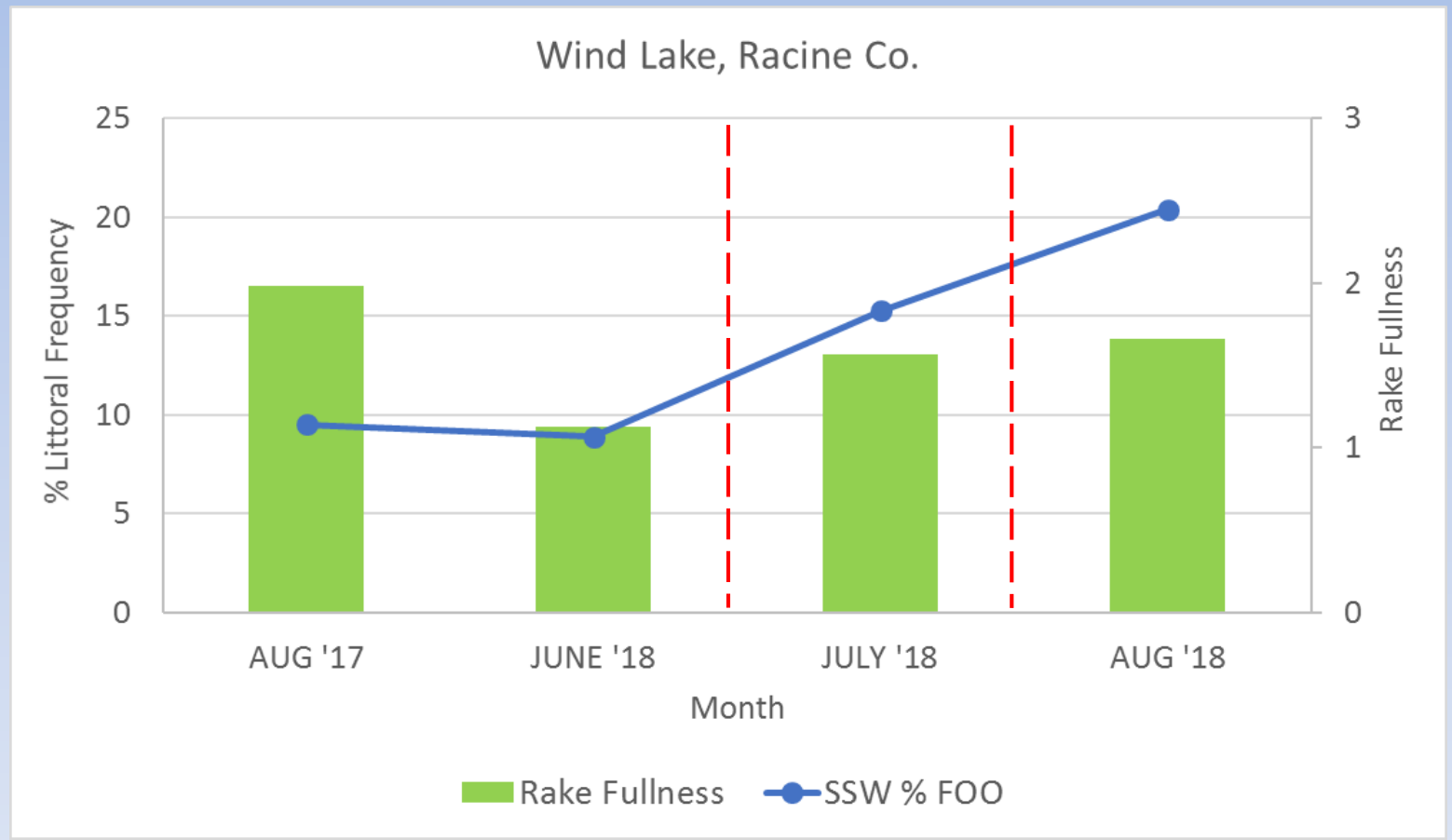

Endothall
Endothall (ppb)
200
150
100
50
0
0
12
24
36
48
60
72
84
96
108
120
132
144
Hours After Treatment
WL1
WL2
WL3
WL4
WL5
TARGET
WL1
WL2
WL5
WL3
WL4

Wind Lake

- Management Approach: Large-scale herbicide

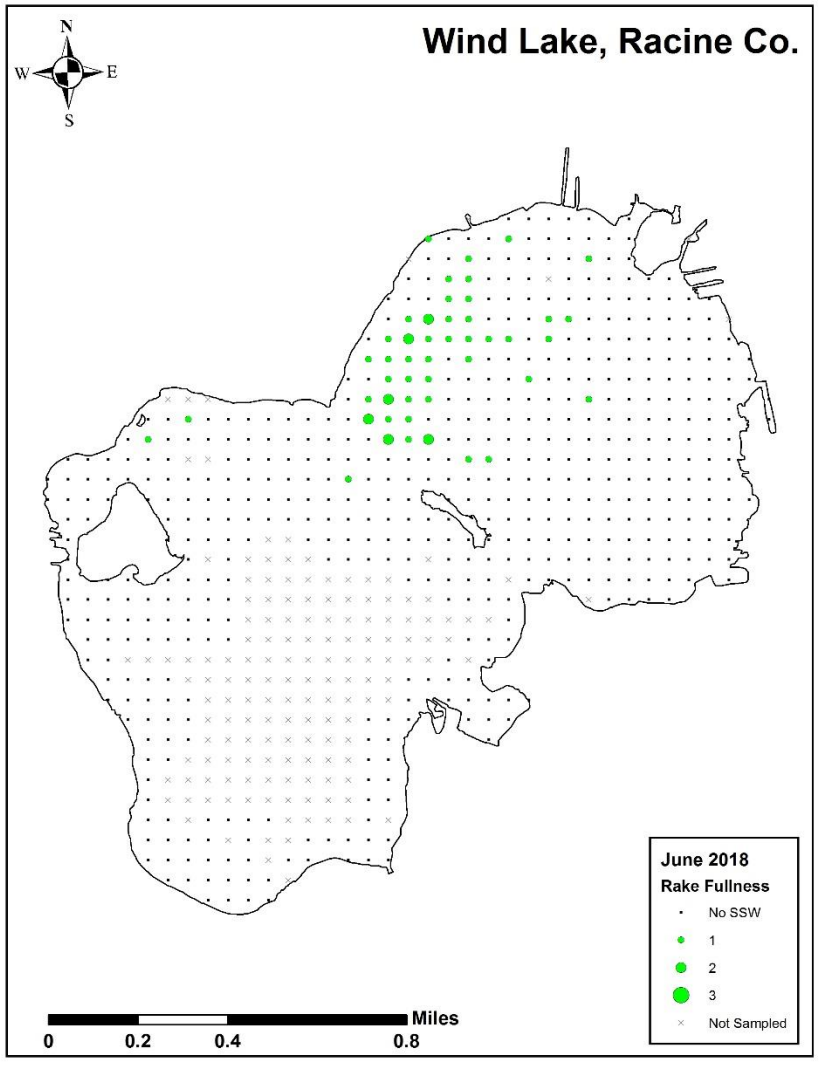
- Aquatic Plant PI Monitoring
  - August ’17: **9.5%**
  - June ‘18: **8.9%**
  - July ‘18: **15.3%**
  - August ‘18: **20.4%**

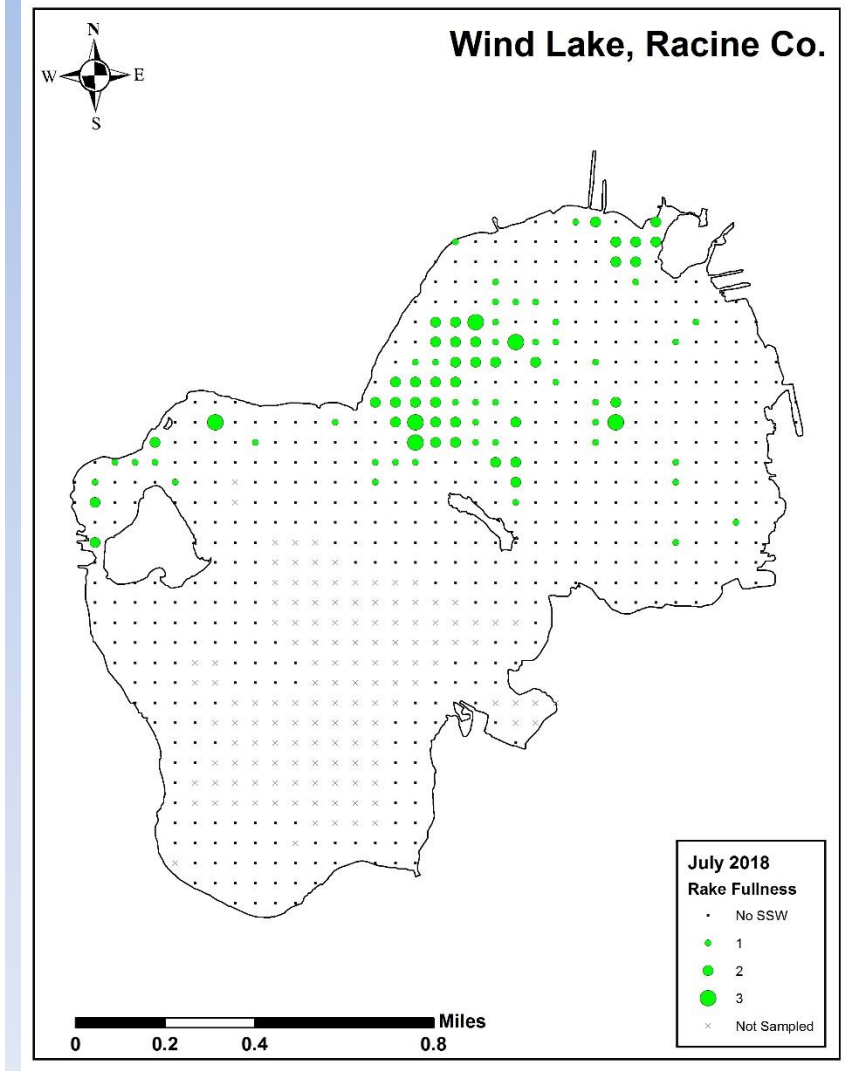
SURVEYS	PRE	POST	CHANGE	P-VALUE
JUNE '18 vs JULY '18	8.9	15.2	↑↑	0.0013
JULY '18 vs AUG '18	15.2	20.4	↑	0.0264
JUNE '18 vs AUG '18	8.9	20.4	↑↑↑	<0.001
AUG '17 vs AUG '18	9.5	20.4	↑↑↑	<0.001

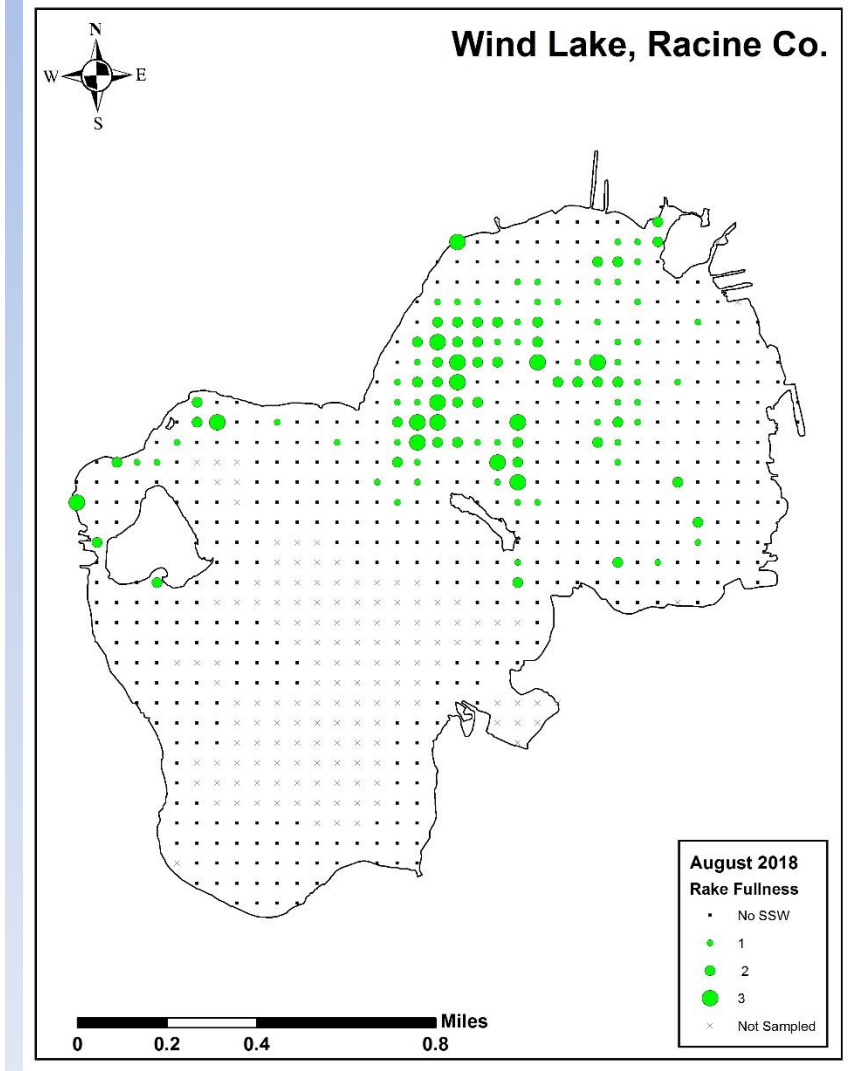


Wind Lake

- Management Approach: Large-scale herbicide



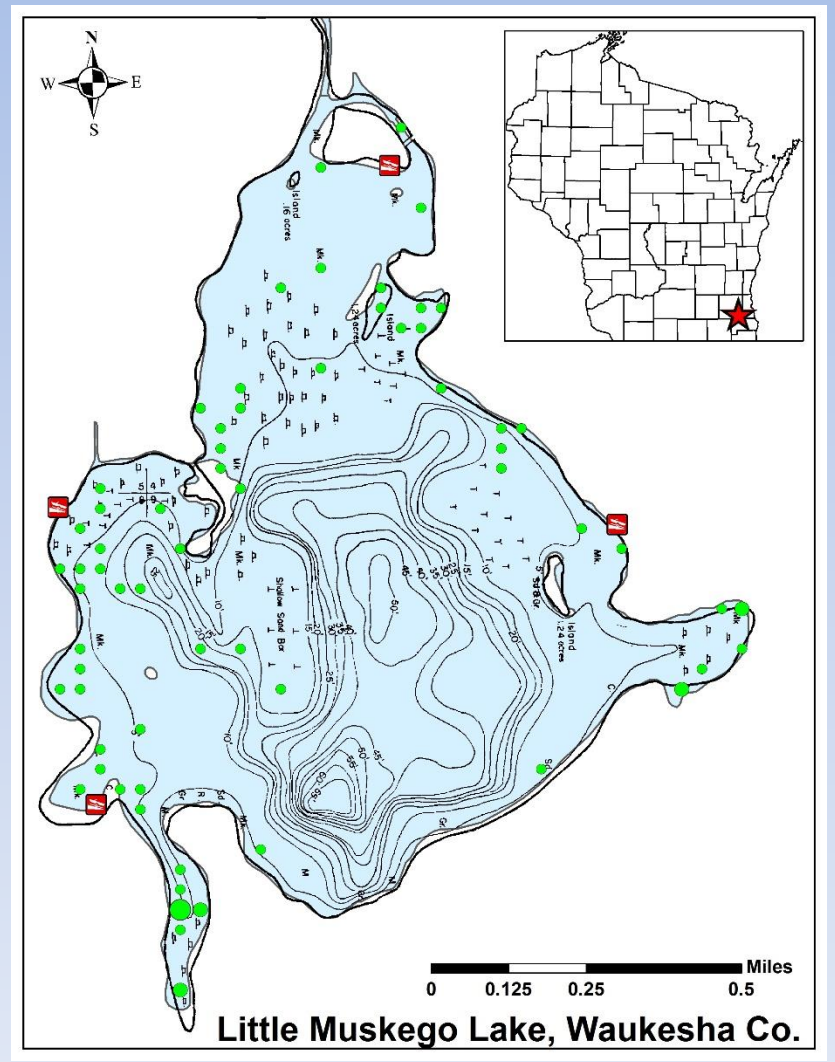




Little Muskego Lake

- Management Approach: Water Level Drawdown

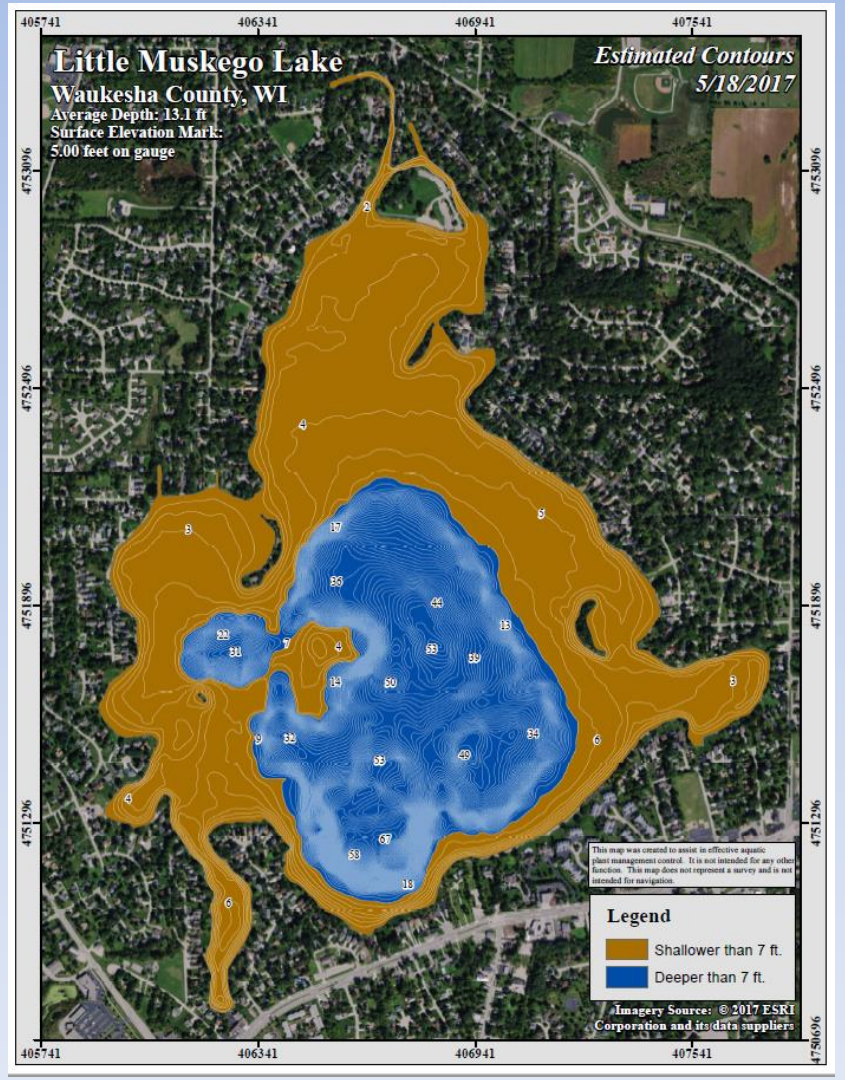
- 470 acre drainage lake
- 65 feet max depth
- 14 feet mean depth
- 70% muck, 25% gravel, 5% sand
- SSW discovered in Sept 2014
- 2015: DASH and hand pulling
- 2016: Small-scale copper treatments in Hillview Bay



Little Muskego Lake

- Management Approach: Water Level Drawdown

- Start: September 5, 2017
- Goal: Water level drawdown of 7.0 ft (84 in)
- End: October 12, 2017
  - Drawdown concluded when temperature was <55°F
  - Water level drawdown of 6.2 ft (74 in) achieved
  - Weather during the drawdown (Sept 5 - Oct 12) was ideal
- Fishery: Closed to all fishing from Nov 1 - March 4, 2018

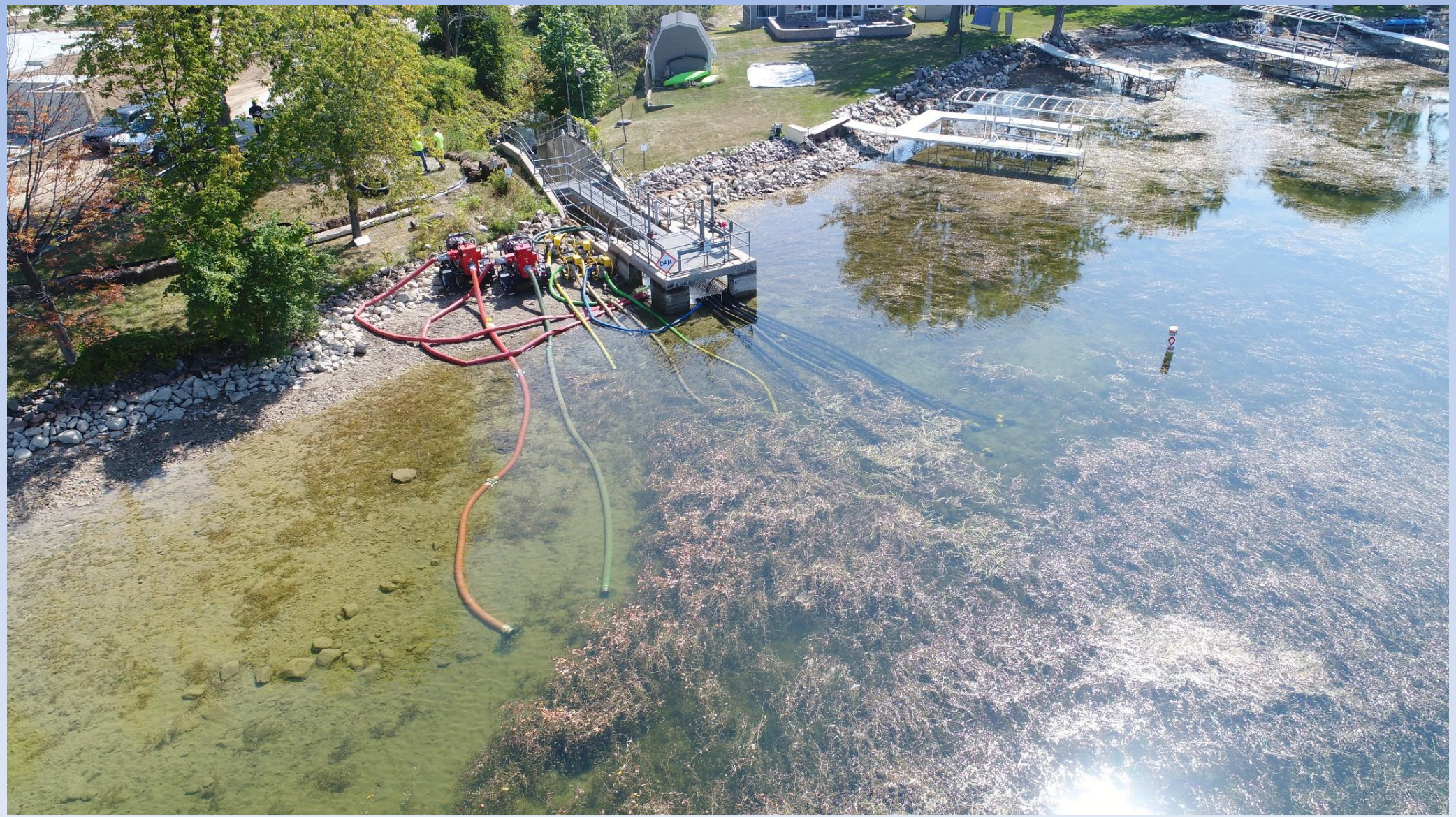


Little Muskego Lake

- Management Approach: Water Level Drawdown

- Post-drawdown: Two days after achieving 6.2 ft (74 in) it rained for many days
  - Pumps and siphons ran all winter in attempt to keep lake level down
  - Winter water levels ranged from (40-65 in) due to rain and groundwater discharge
- Refill: Started after ice out (April 2018) with goal of full pool by Memorial Day

Little Muskego Lake



Little Muskego Lake

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Little Muskego Lake

- Management Approach: Water Level Drawdown

- Aquatic Plant Monitoring
  - Lakewide PI plant surveys conducted in 2014, 2015, 2017, & 2018
  - Hillview Bay sub-PI plant surveys conducted in 2015-2018
  - Chi-square analysis of pre- and post-drawdown plant surveys communities at lakewide and bay-wide scales

Little Muskego Lake

- Management Approach: Water Level Drawdown

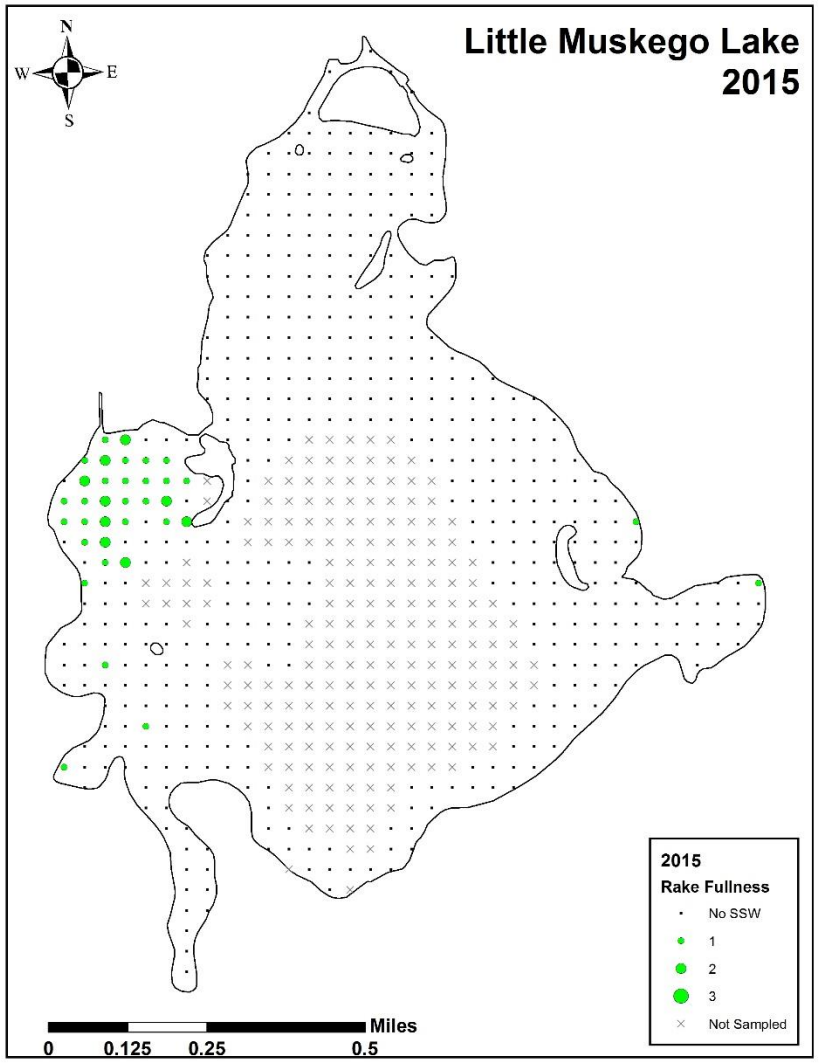
- Aquatic Plant Monitoring
  - Lakewide PI plant surveys
    - 2014: **1.0%**
    - 2015: **7.0%**
    - 2017: **12.5%**
    - 2018: **27.9%**
  - Hillview Bay sub-PI plant surveys
    - 2015: **58.6%**
    - 2016: **67.7%**
    - 2017: **32.4%**
    - 2018: **71.4%**

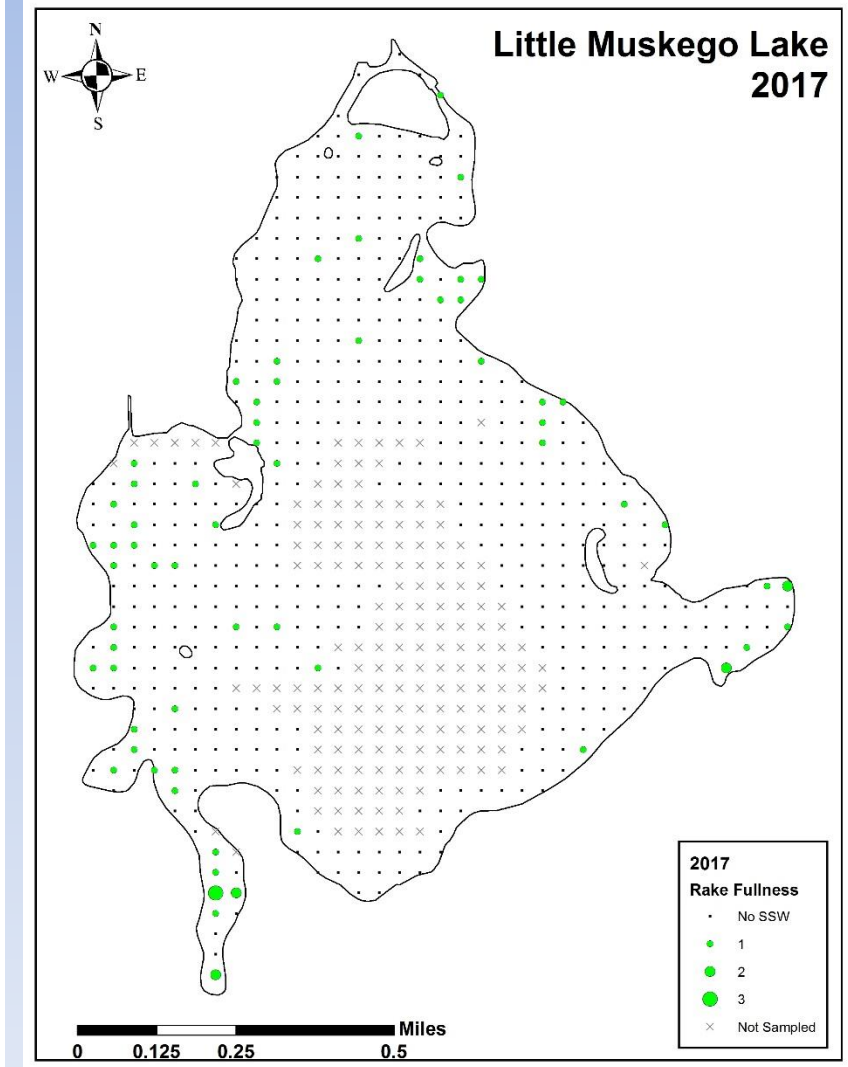
	PRE [2017]	POST [2018]	p-value	Sig. change	Increase/ Decrease
SSW	65	124	< 0.001	***	+
Wild celery	335	196	< 0.001	***	-
Chara	195	125	0.0023	**	-
Coontail	183	69	< 0.001	***	-
EWM	152	24	< 0.001	***	-
Elodea	145	10	< 0.001	***	-
Sago pondweed	134	52	< 0.001	***	-
Illinois pondweed	96	11	< 0.001	***	-
Southern naiad	54	0	< 0.001	***	-
Slender naiad	3	34	< 0.001	***	+
Fries' pondweed	1	25	< 0.001	***	+
Clasping-leaf pondweed	18	8	0.1138	n.s.	-
Water star-grass	17	11	0.4682	n.s.	-

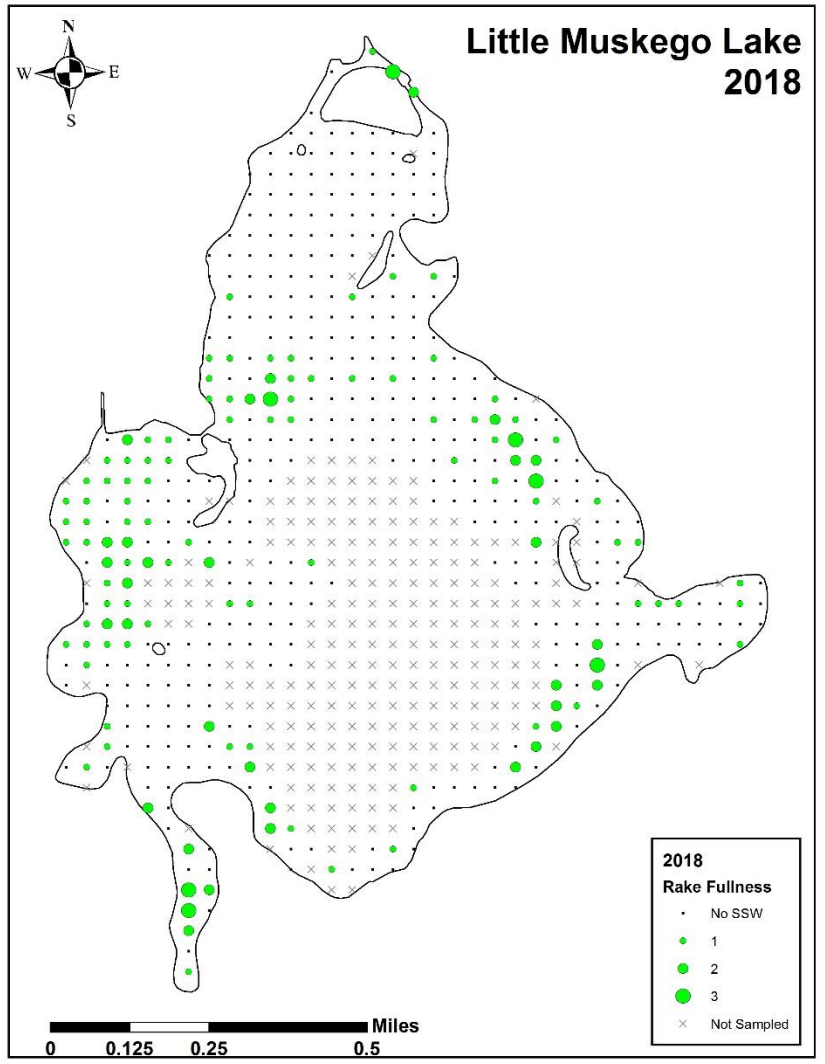
- Chi-square analysis of pre- and post-drawdown plant surveys indicate significant increase in SSW

Little Muskego Lake

- Management Approach: Water Level Drawdown

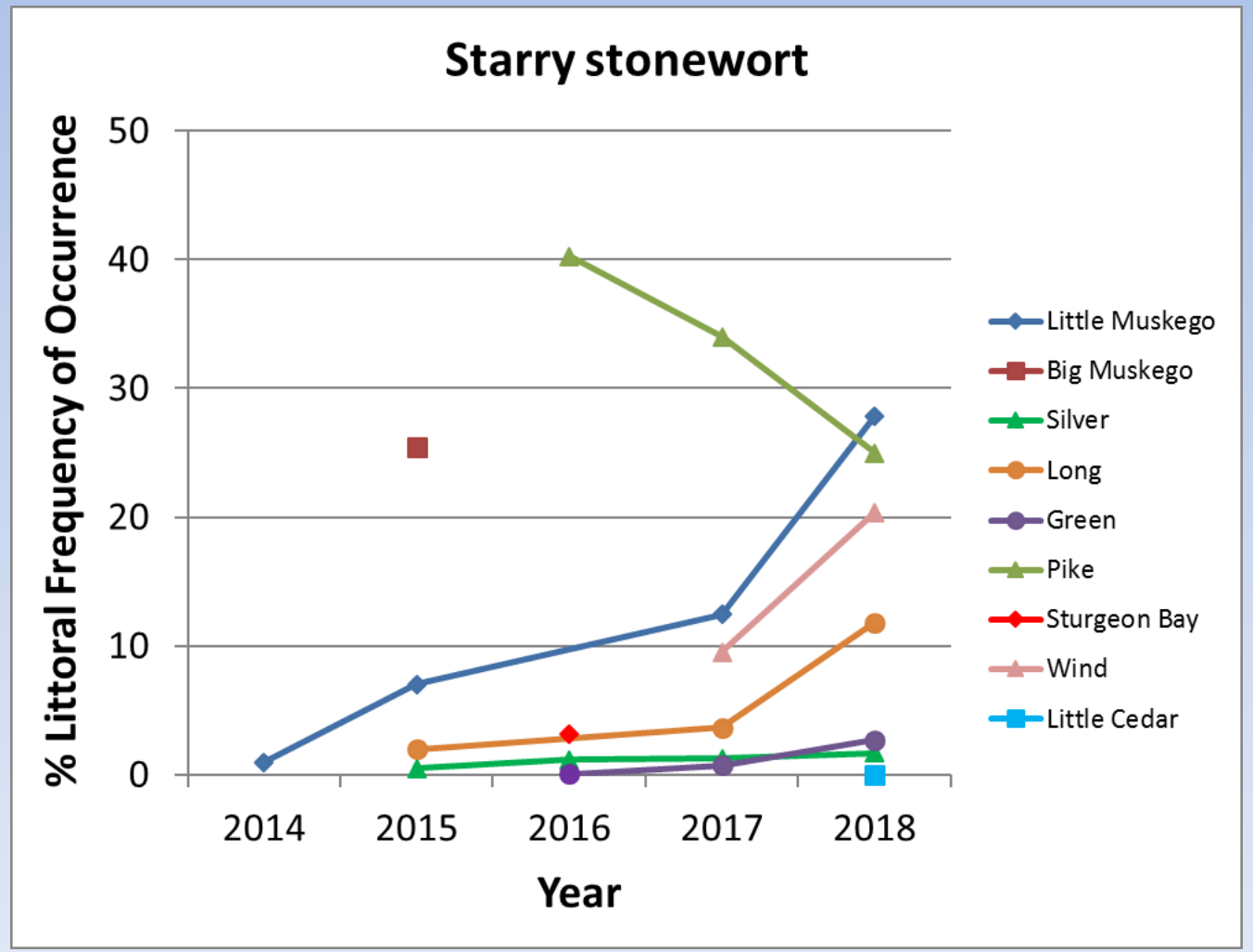






Lakewide SSW Monitoring

SSW littoral % frequency of occurrence has ranged from 0 – 40%



Next steps

- Prevent the further spread of starry stonewort.
- Search for starry stonewort at nearby suitable lakes.
- Assess SSW populations at newly discovered sites to help guide appropriate management.
- If management occurs, collect quantitative pre- and post-treatment data to assess efficacy and longevity of control.
- Conduct lakewide monitoring of SSW populations over time to better understand long-term impacts.
- Work collaboratively with other states and partners to learn and adaptively manage SSW.
- Work collectively to better understand ecologic and economic impacts of SSW – current largely unknown and not many science based studies.

Acknowledgements

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Amy Kretlow

Michaela Kromrey

Ali Mikulyuk

Kyle Mosel

Justin Poinsatte

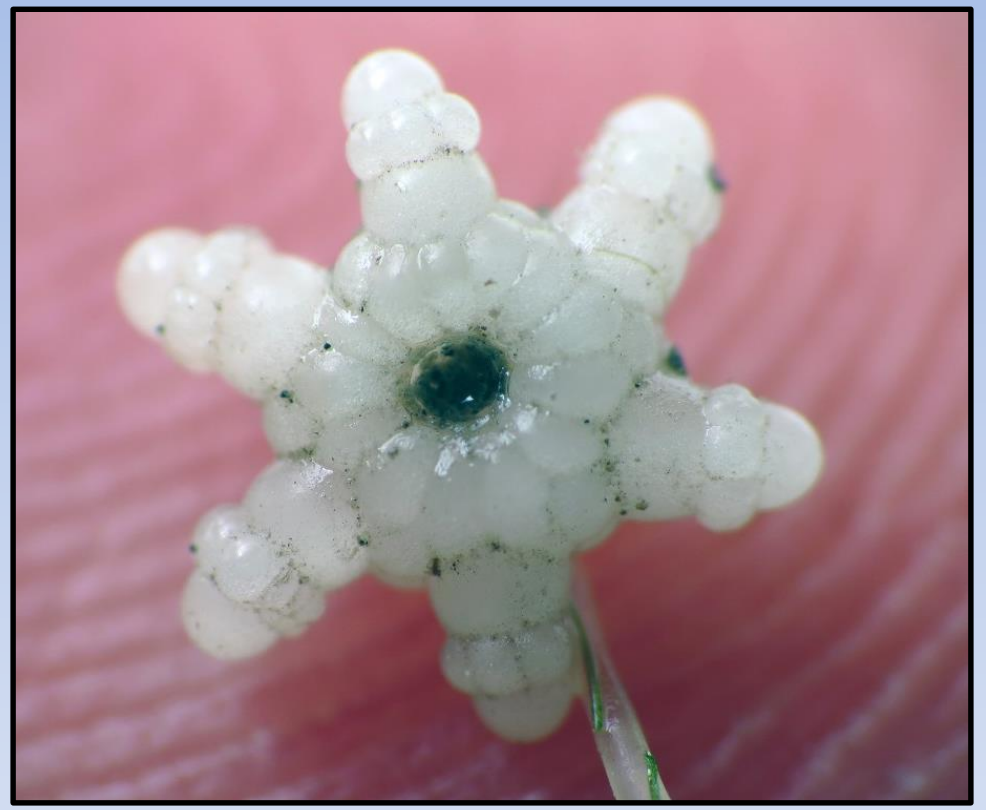
Paul Skawinski

Brad Steckart

Scott Van Egeren

Bob Wakeman

Questions?



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