
Calument County L & W
Conservation Dept
CalMan Lakes
Water Quality
April 13, 2017
Paul Garrison
Tim Hoyman
Onterra LLC
Lake Management Planning

Presentation Outline

- Project Overview
  - Study Lakes/Watershed ⇨ Determine Realistic Solutions ⇨ Create Plan to Implement Solutions
- Update on Project Study Results
  - Introduction to Water Quality
  - Trophic Parameters on Cal-Man Lakes
  - Seasonal Trends in Phosphorus and Algae
  - Tributary Monitoring
  - Internal Nutrient Loading in the Cal-Man Lakes
  - Phosphorus Inputs
  - Paleoecology
- Conclusions
- Next Steps

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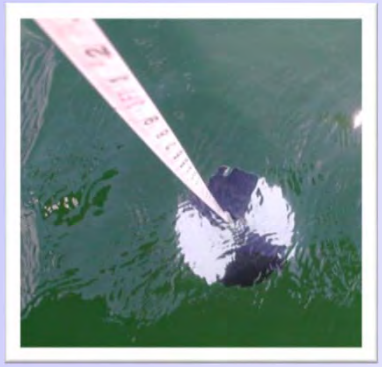
Introduction to Lake Water Quality

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

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



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

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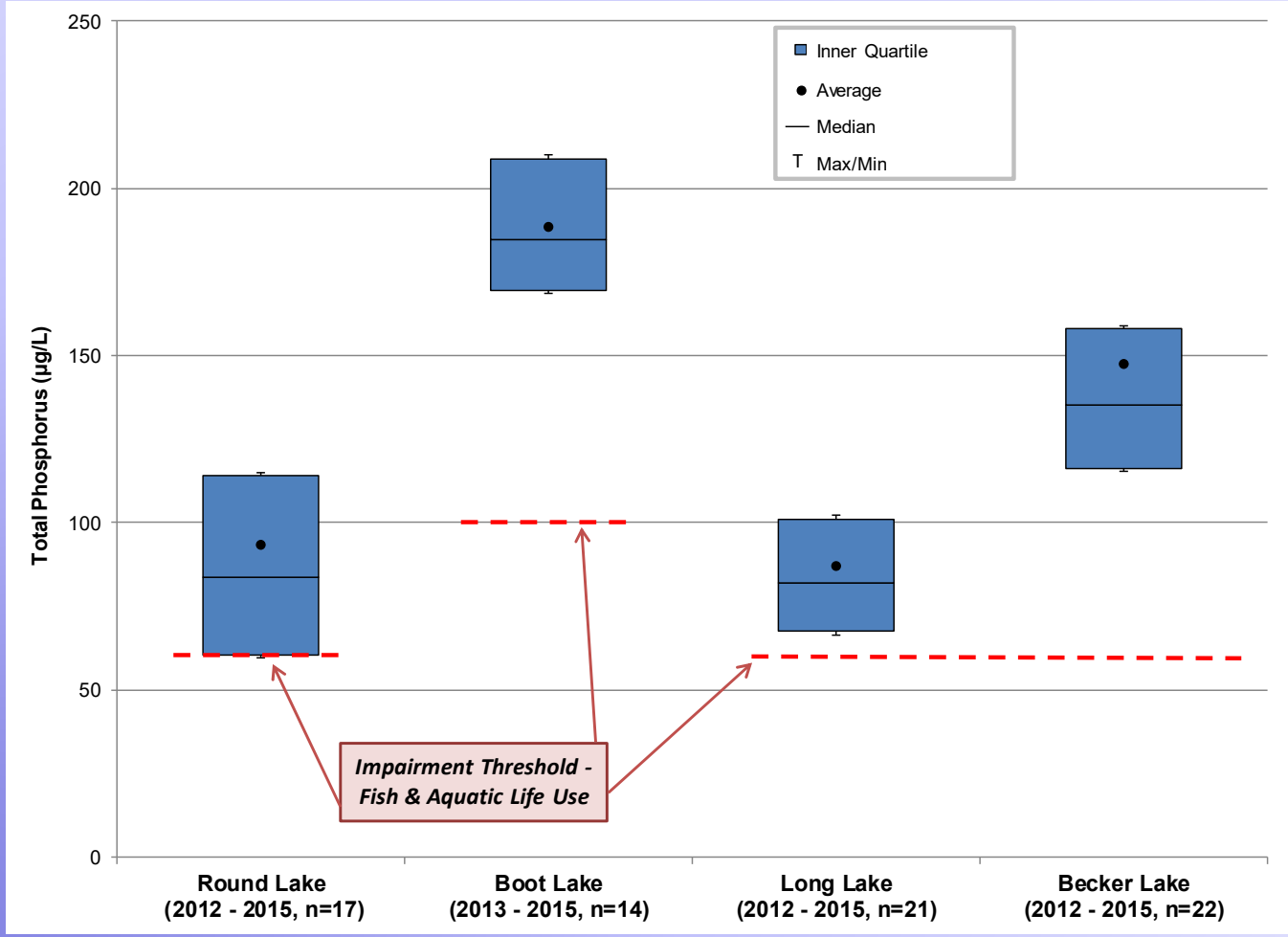
Phosphorus as Limiting Nutrient

Summer Phosphorus



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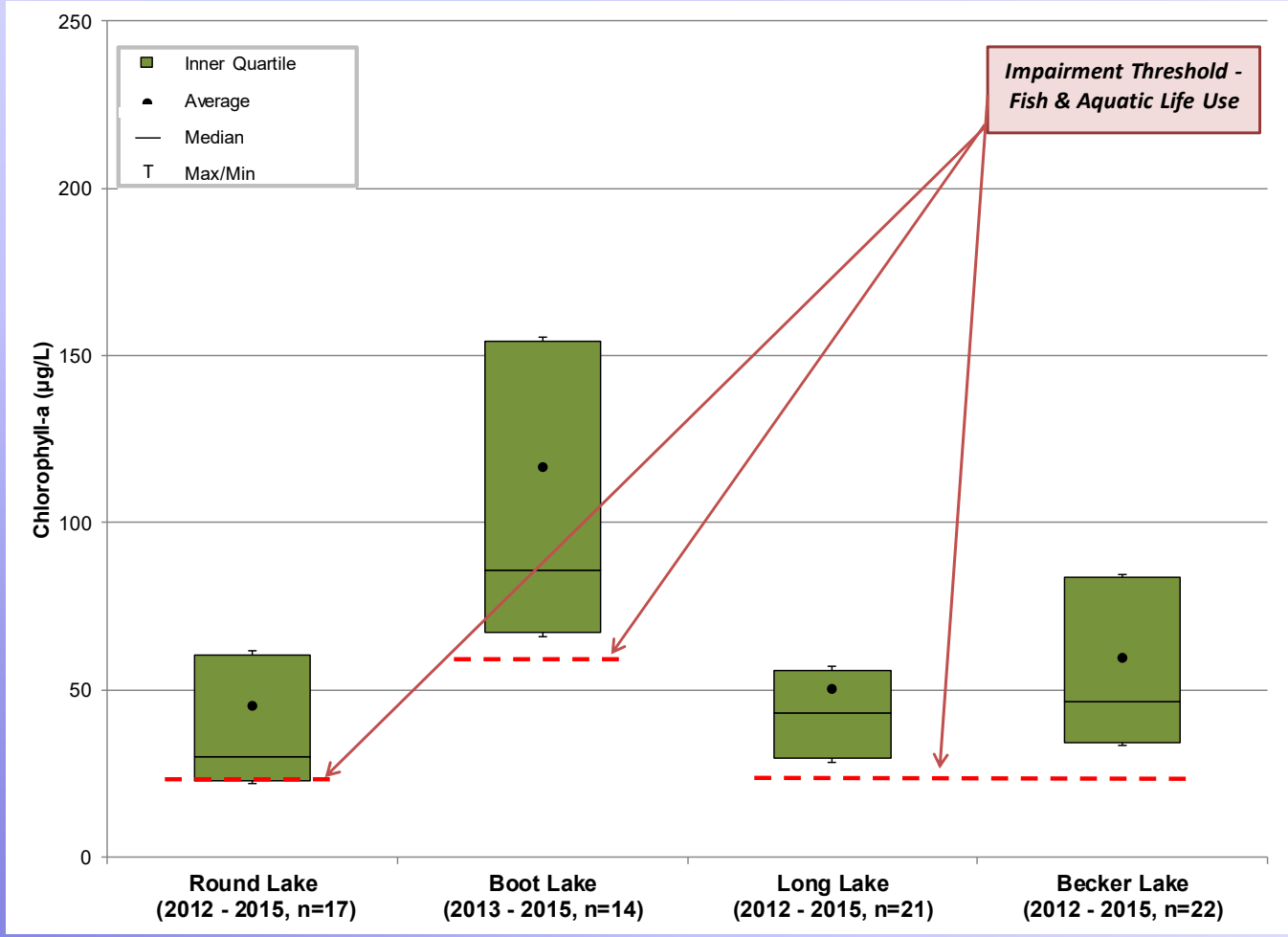
Summer Chlorophyll-a



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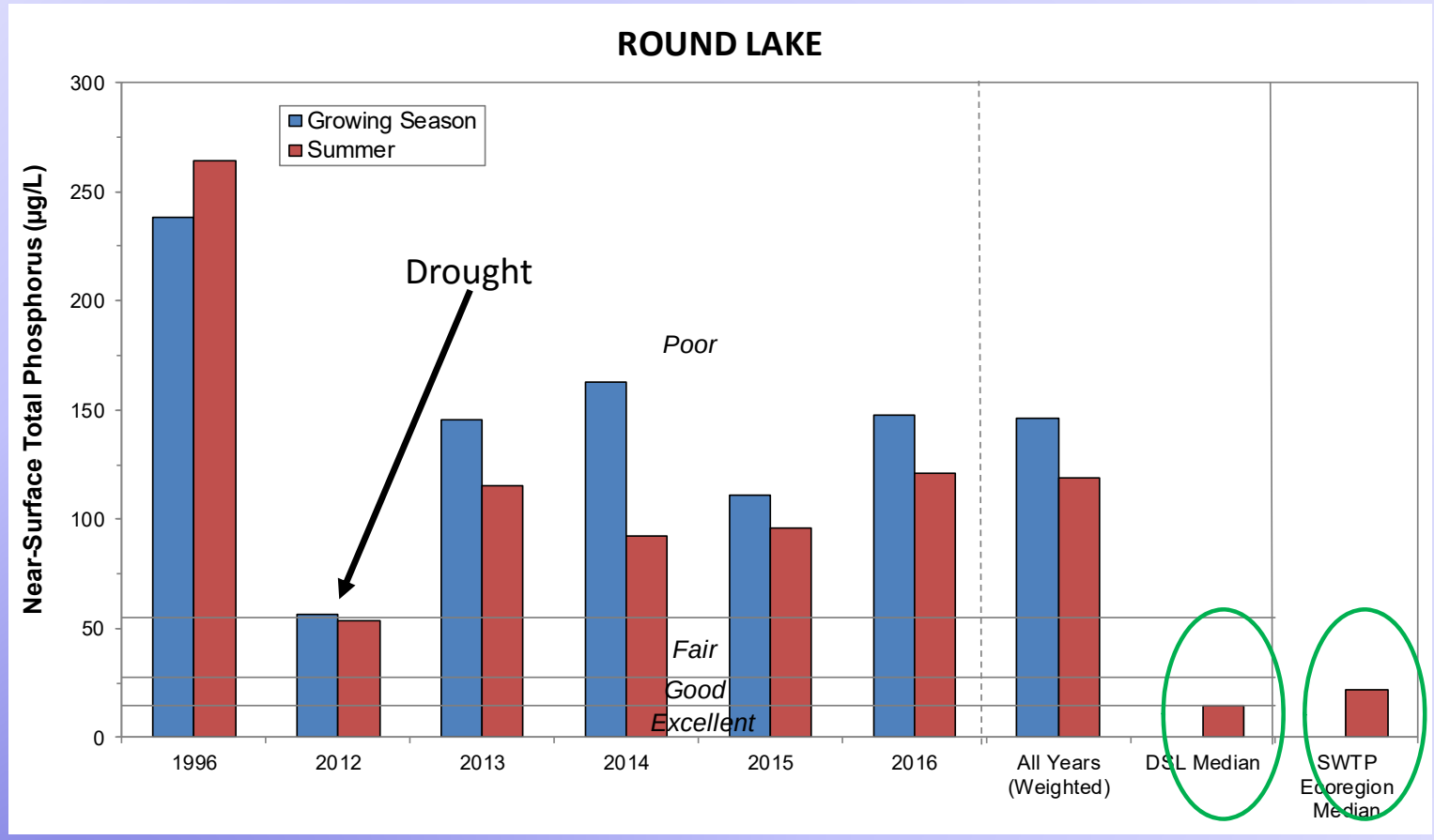

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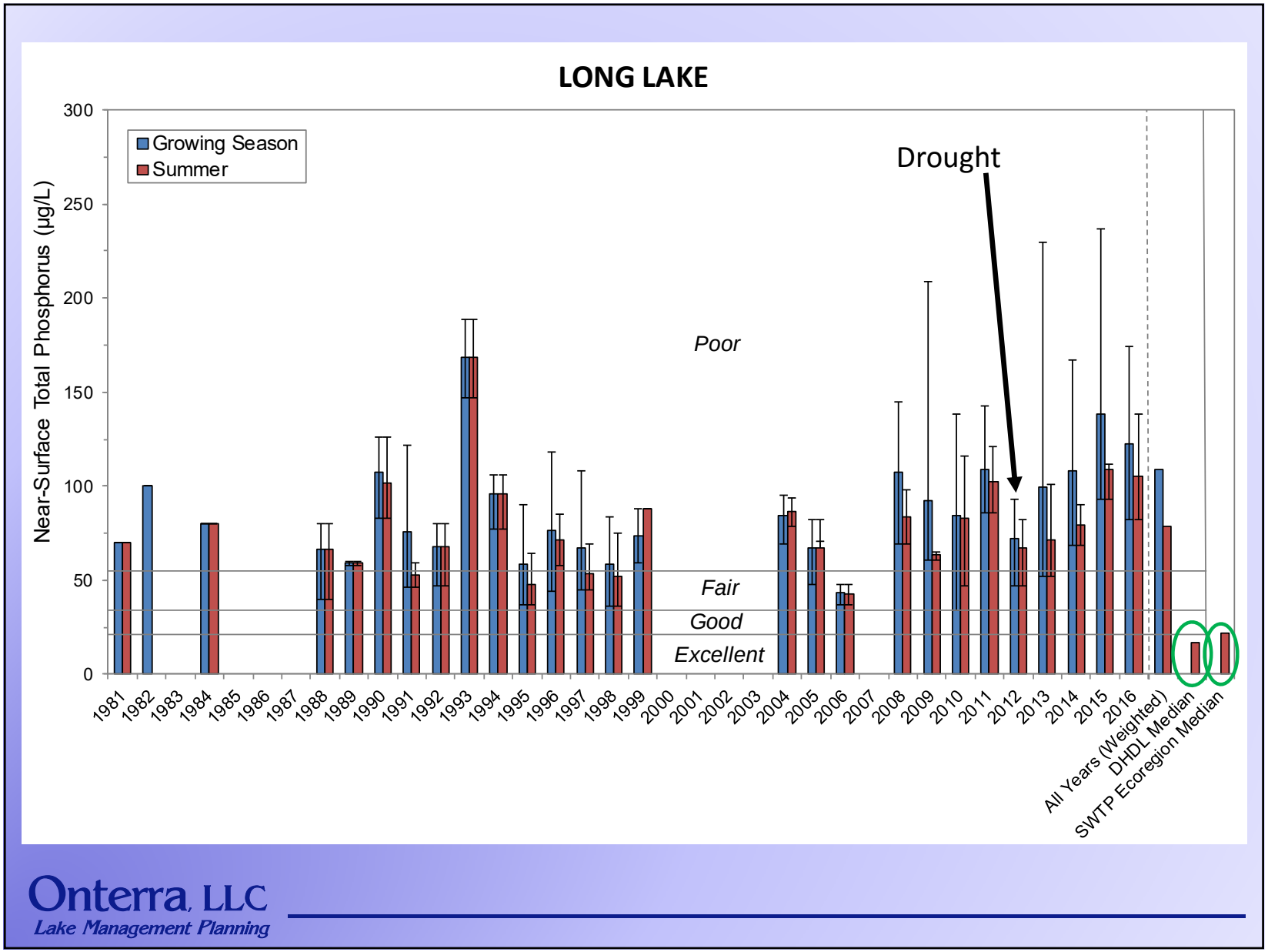
LONG LAKE
Near-Surface Total Phosphorus (µg/L)
300
250
200
150
100
50
0
Growing Season
Summer
Drought
Poor
Fair
Good
Excellent
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
All Years (Weighted)
DHDL Median
SWTP Ecoregion Median
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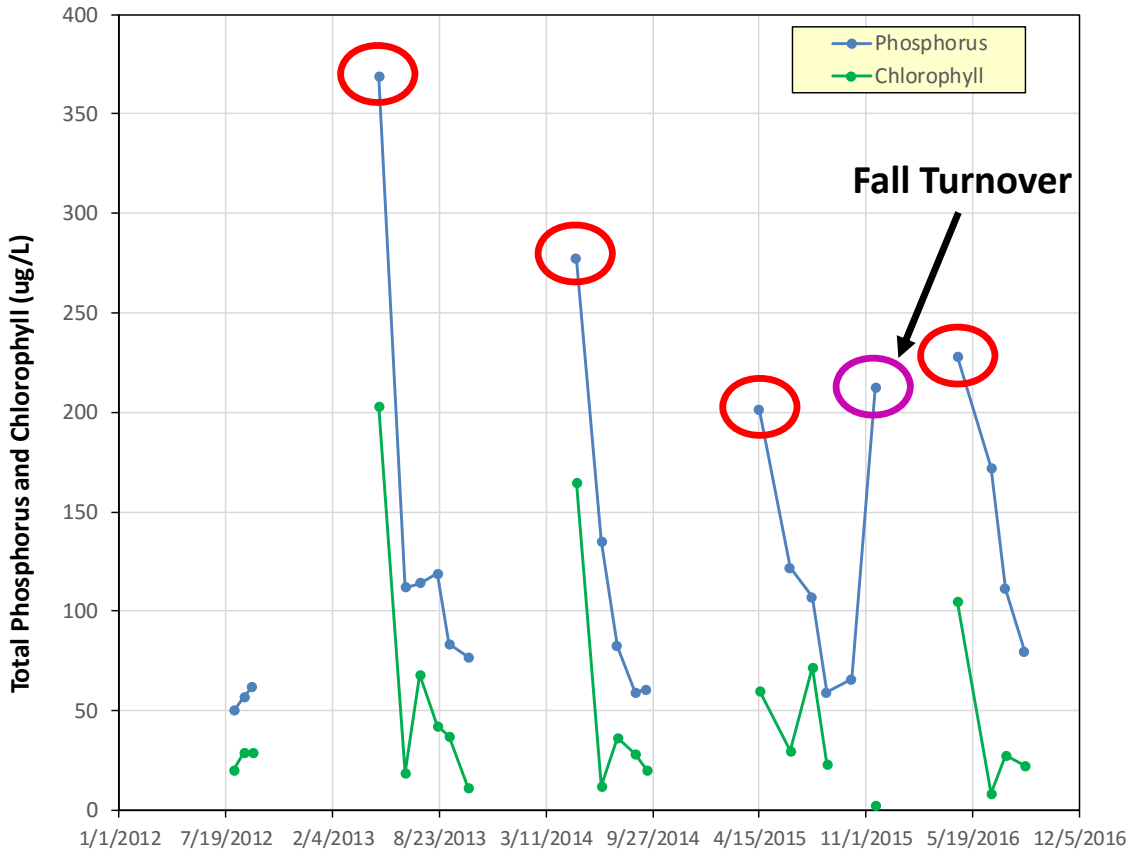
ROUND LAKE



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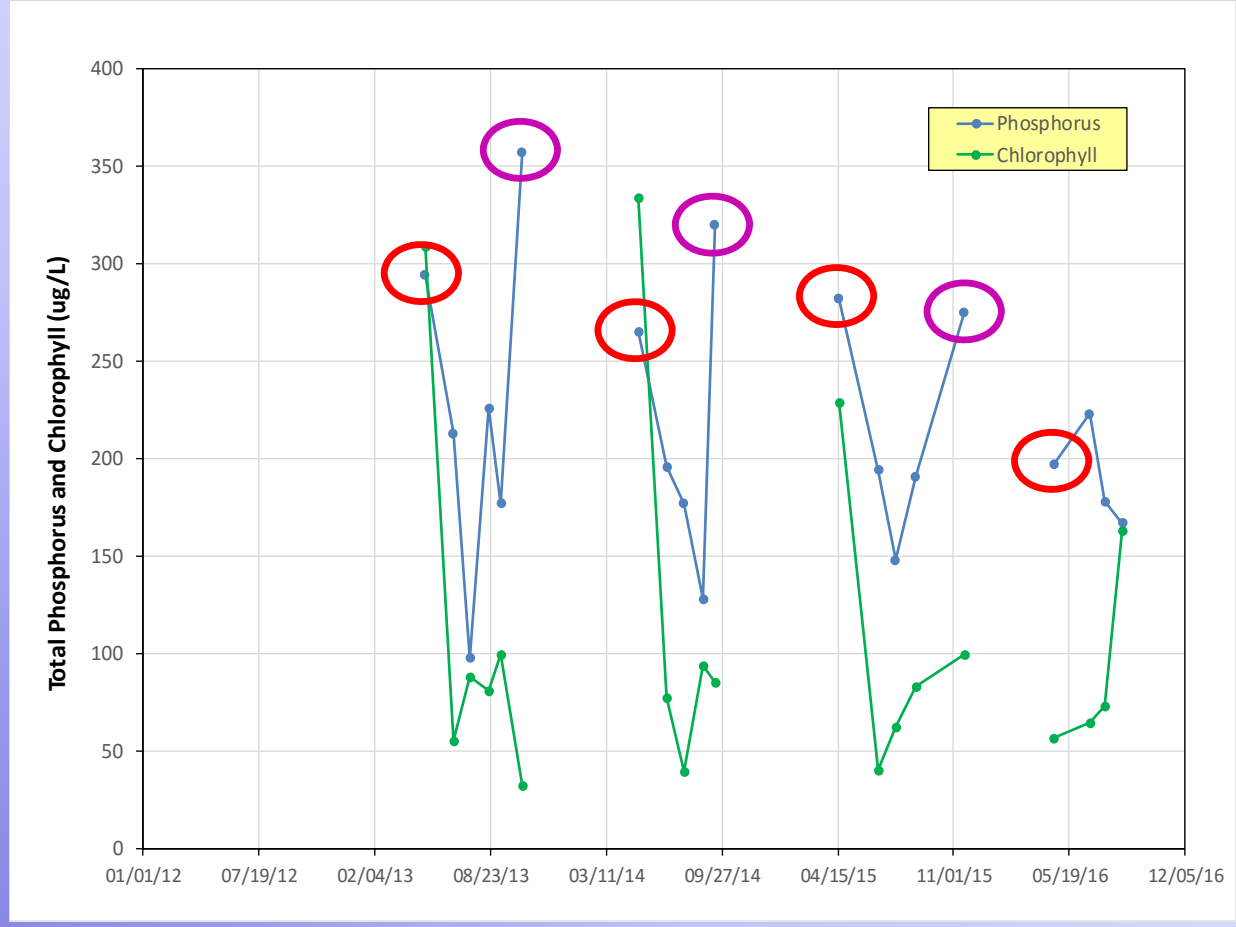
BOOT LAKE



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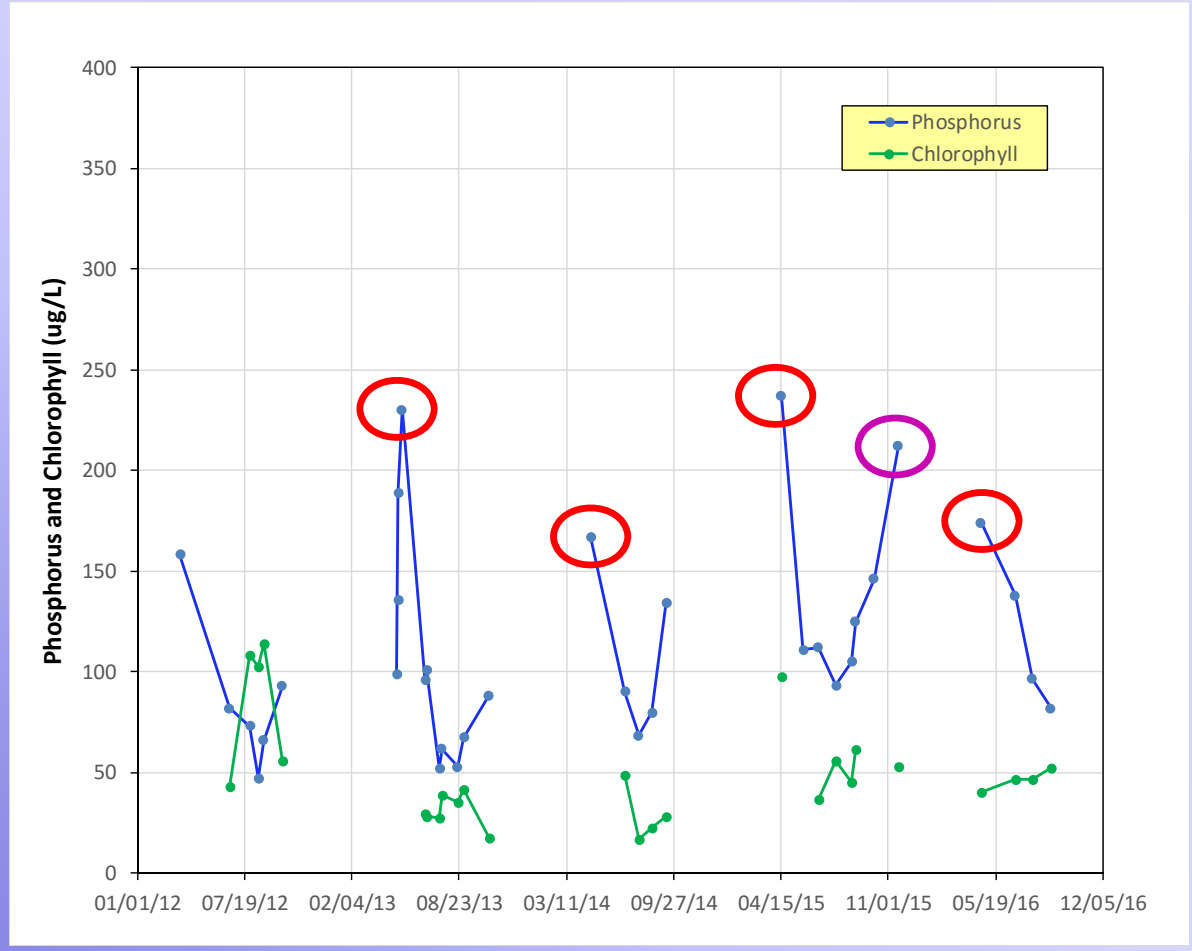
LONG LAKE



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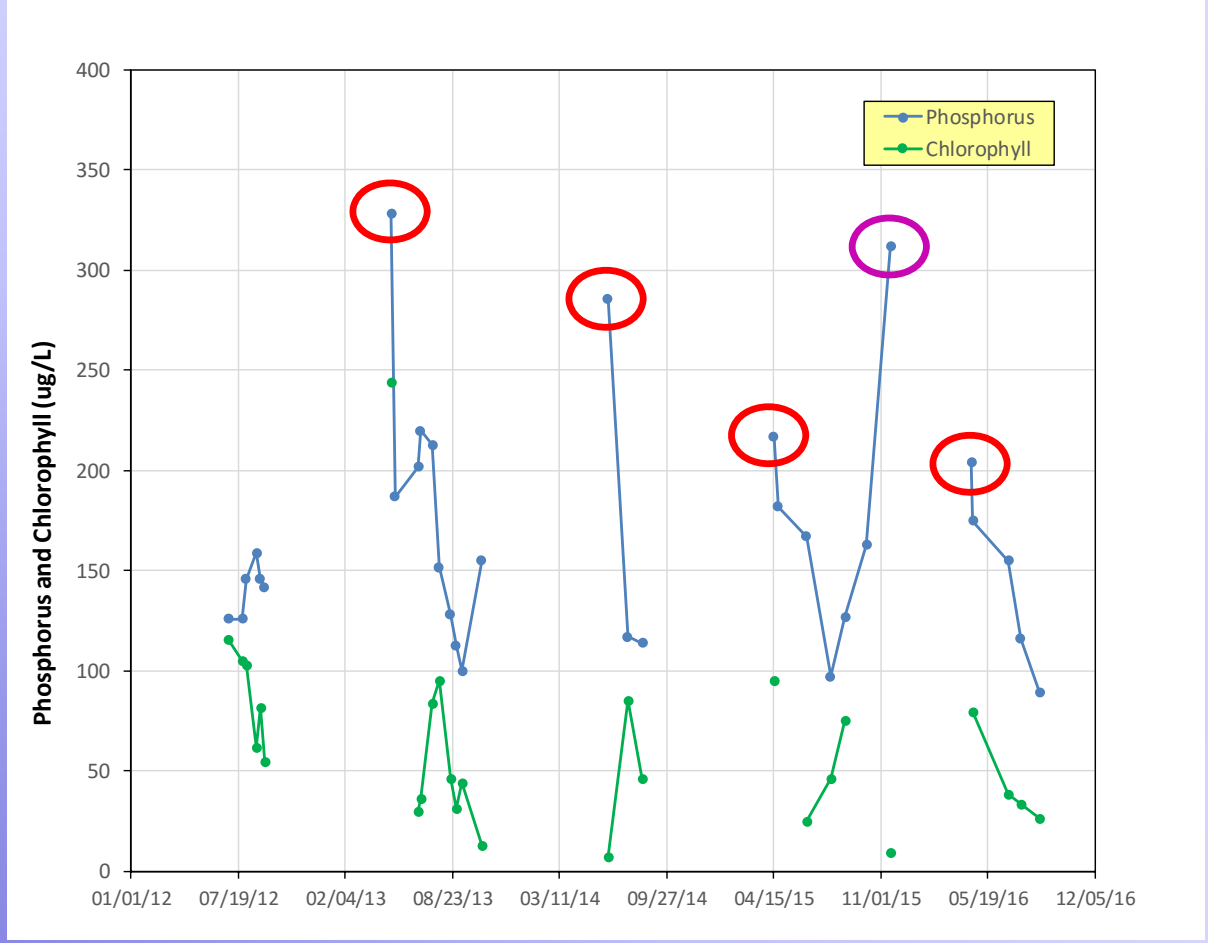
BECKER LAKE



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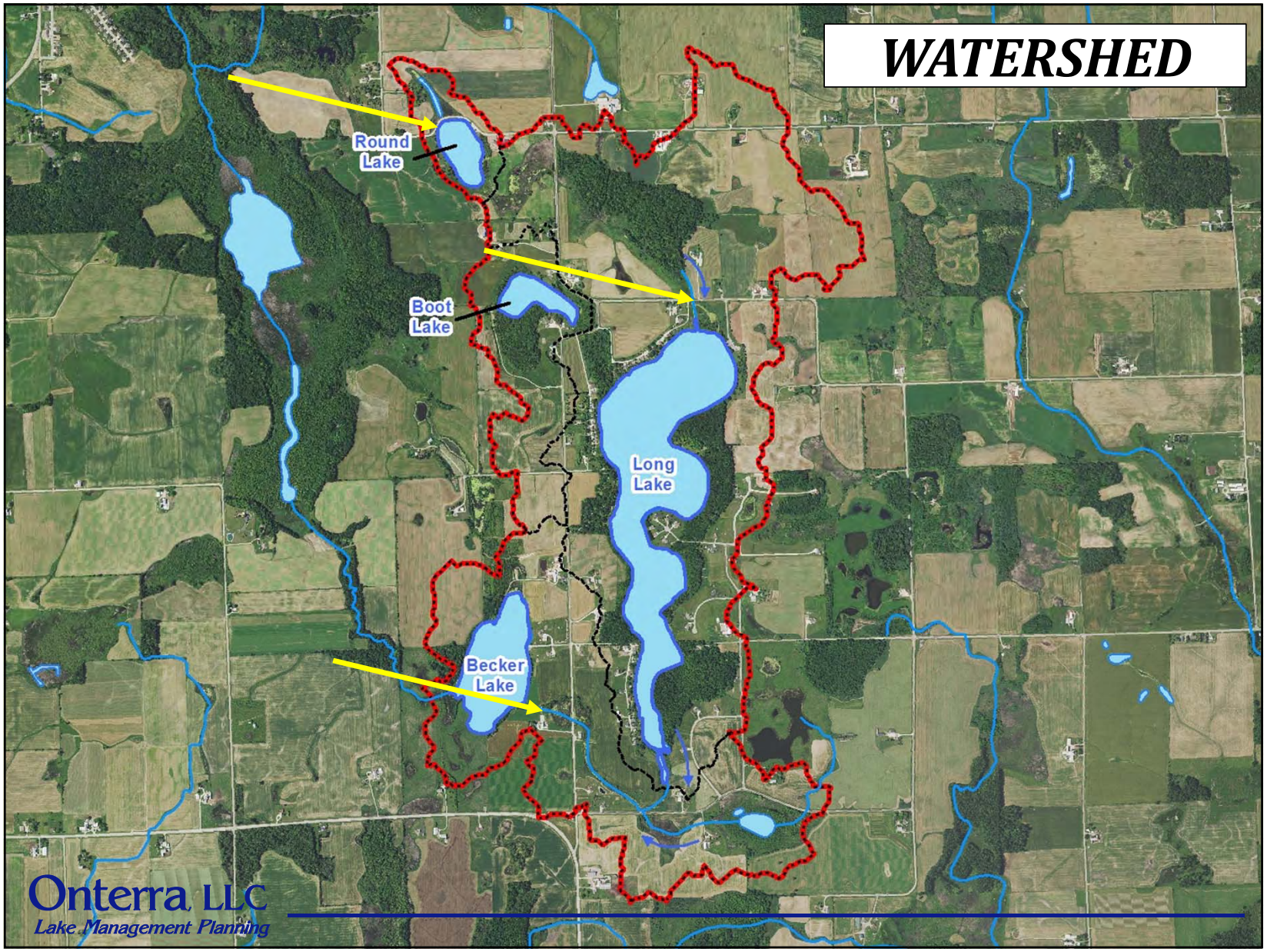
WATERSHED
Round Lake
Boot Lake
Long Lake
Becker Lake
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ROUND LAKE

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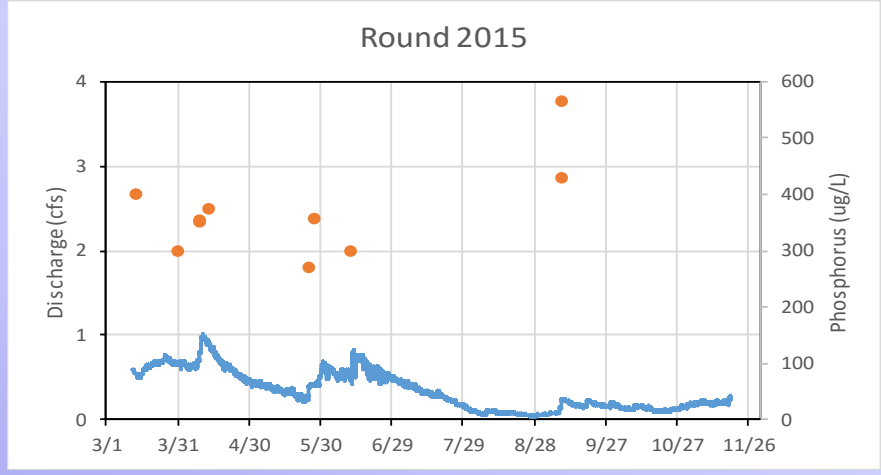
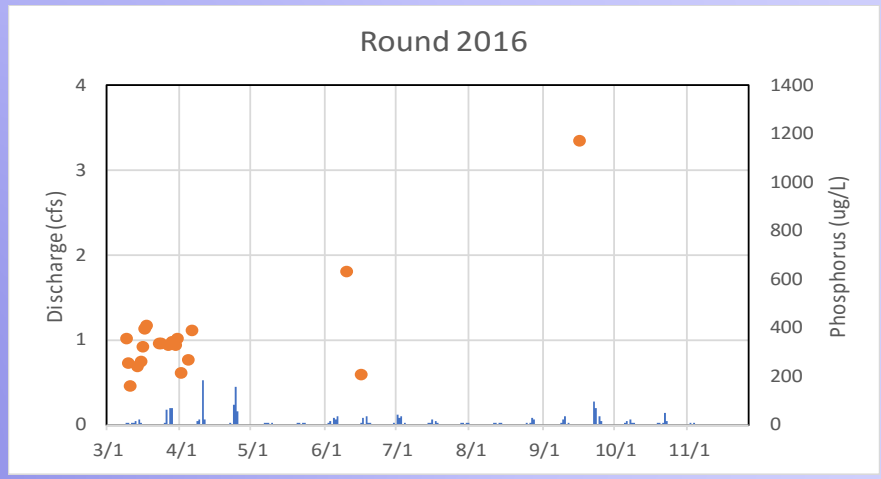
ROUND LAKE





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LONG LAKE

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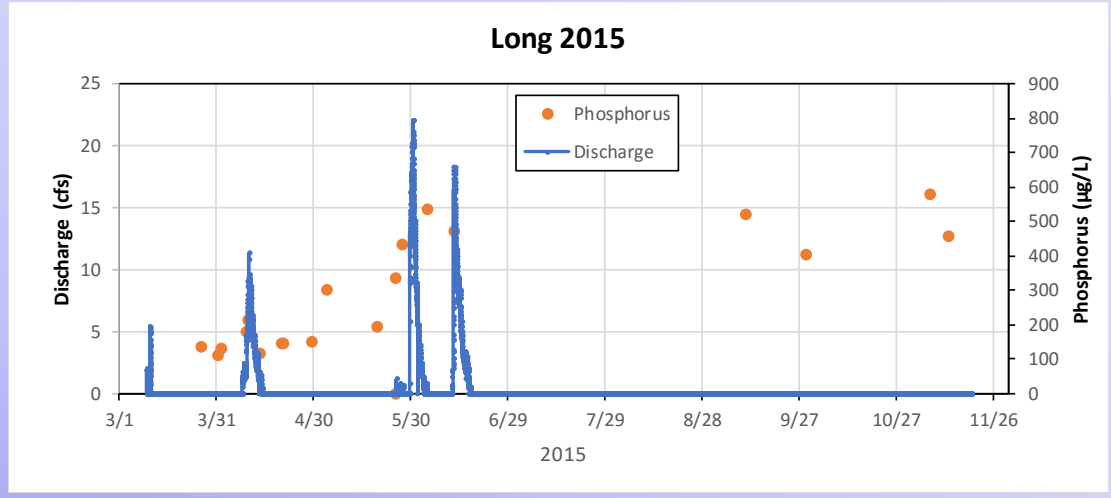
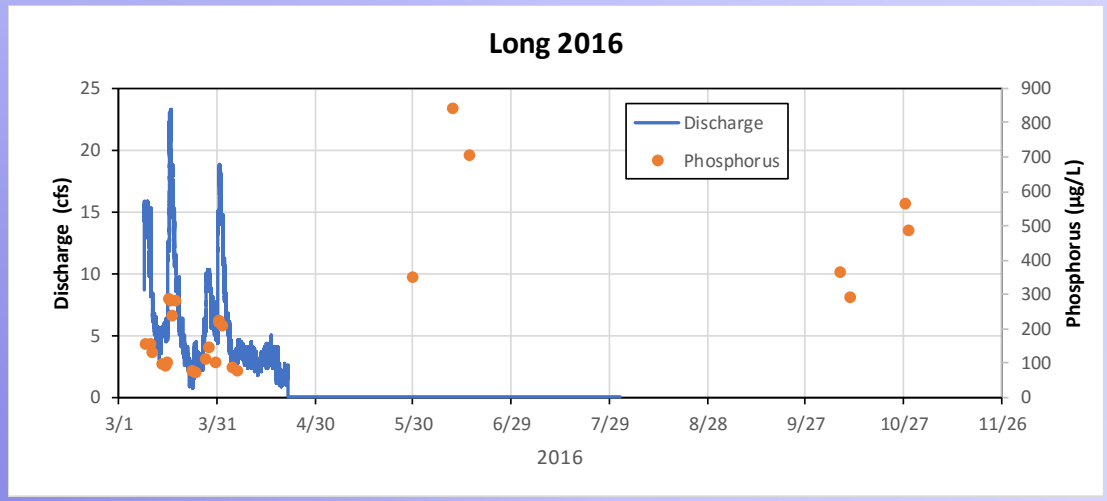
LONG LAKE





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BECKER LAKE

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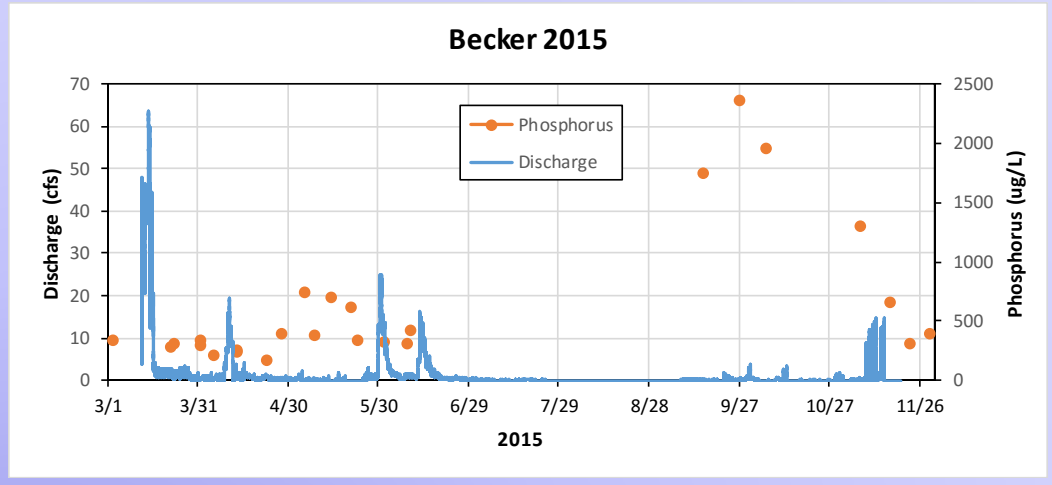

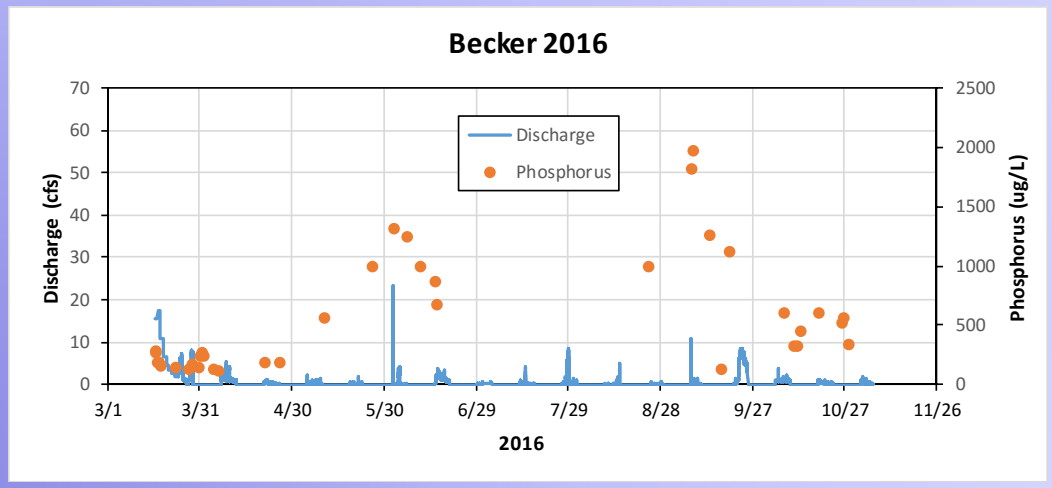

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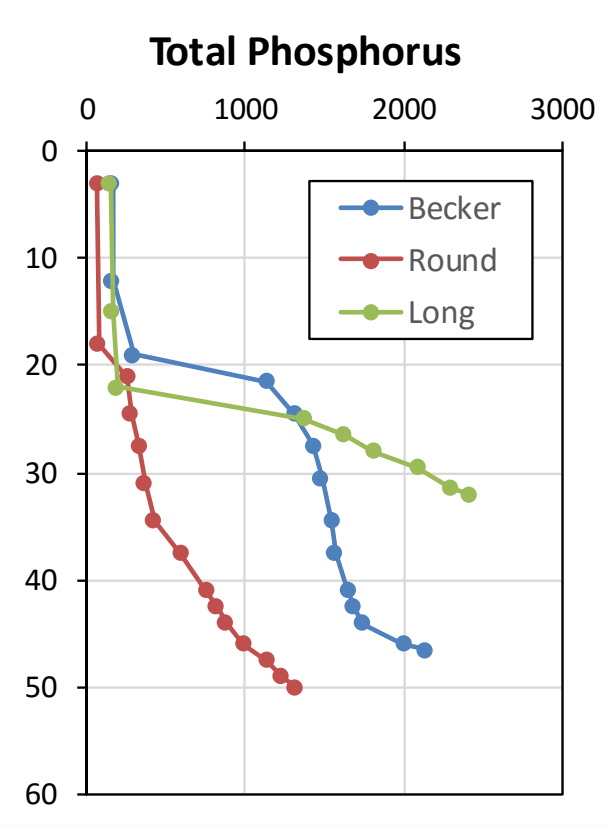
INTERNAL LOAD



	PHOSPHORUS LOAD (lbs)
ROUND	92
BOOT	66
LONG	381
BECKER	334

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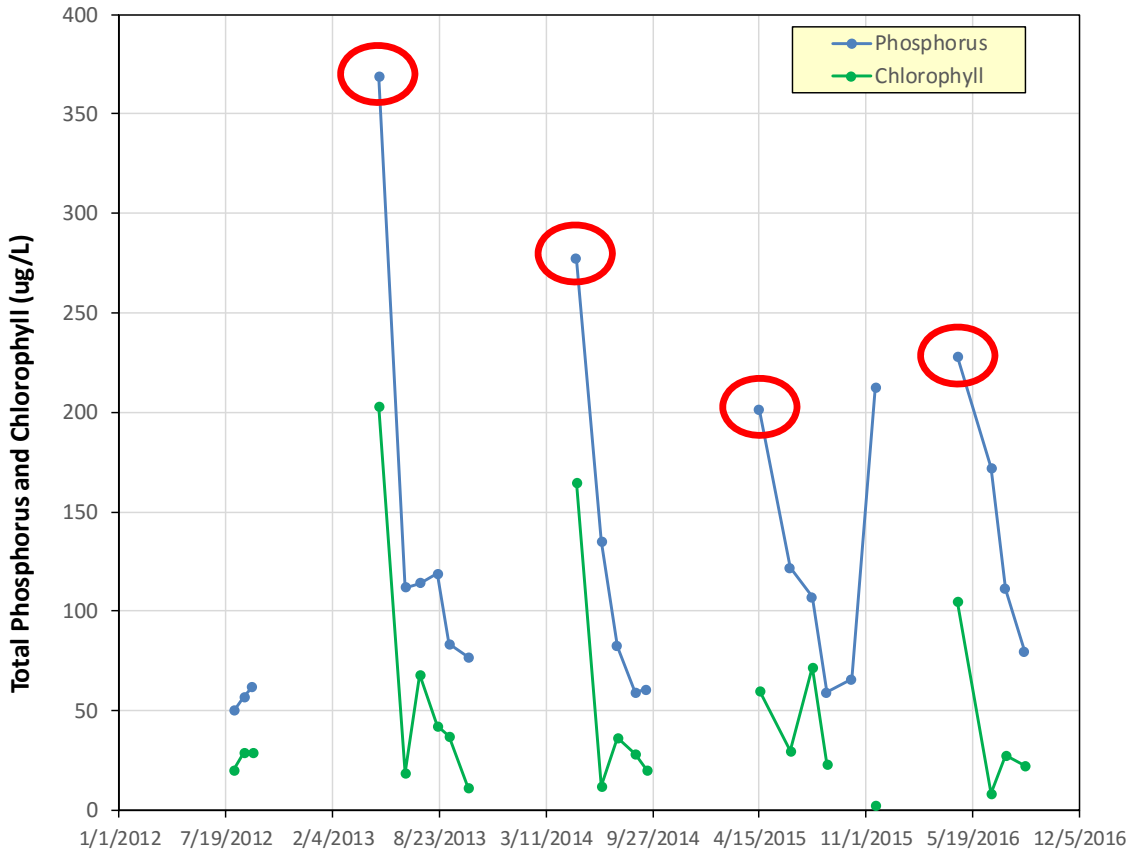
ROUND LAKE



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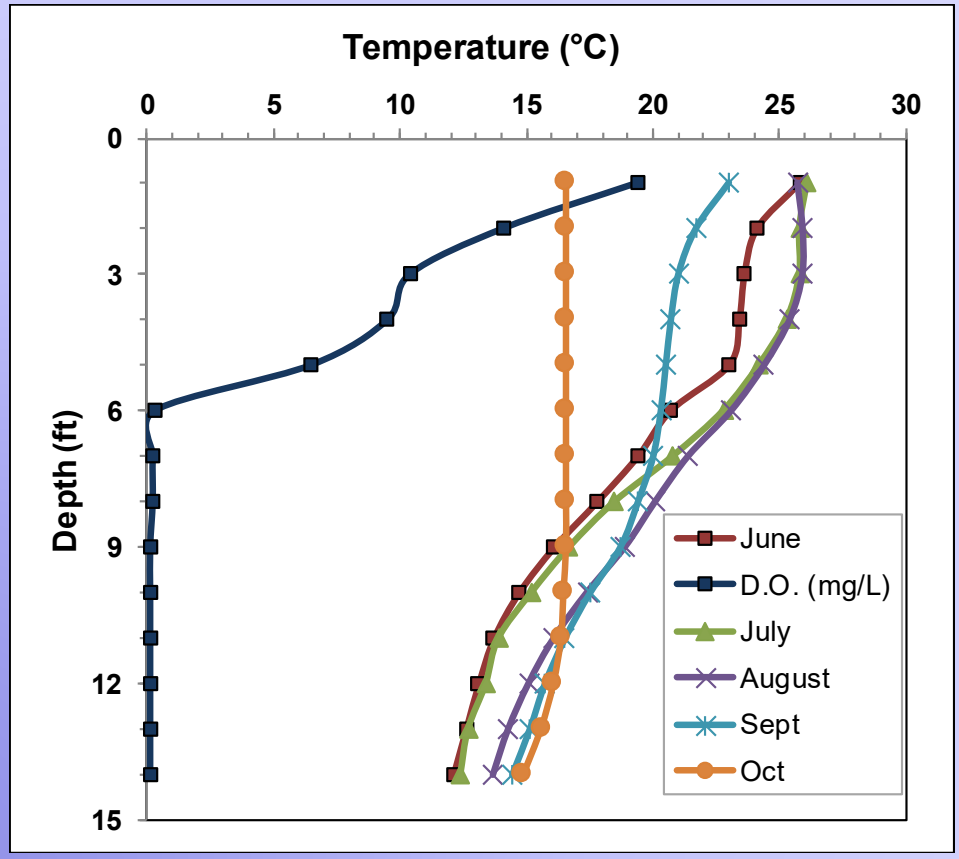
BOOT LAKE



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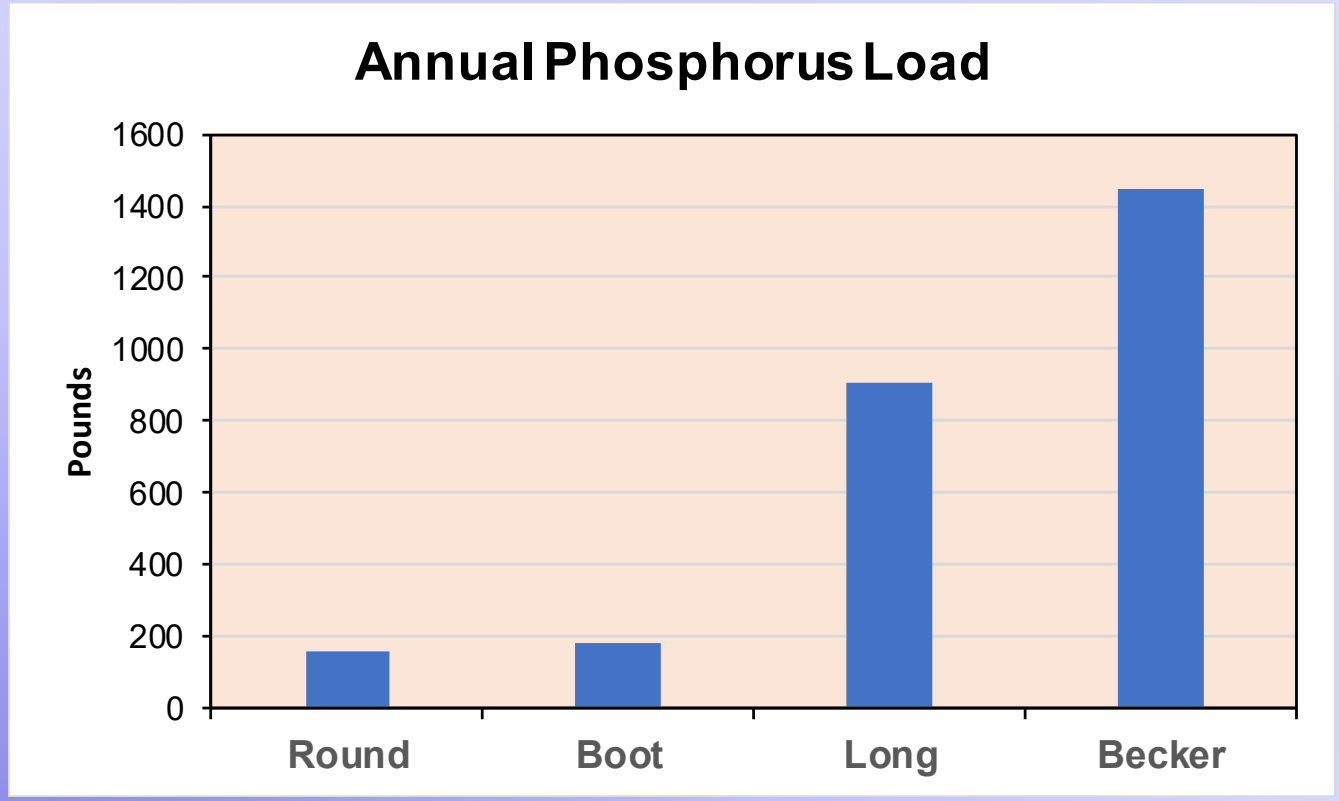

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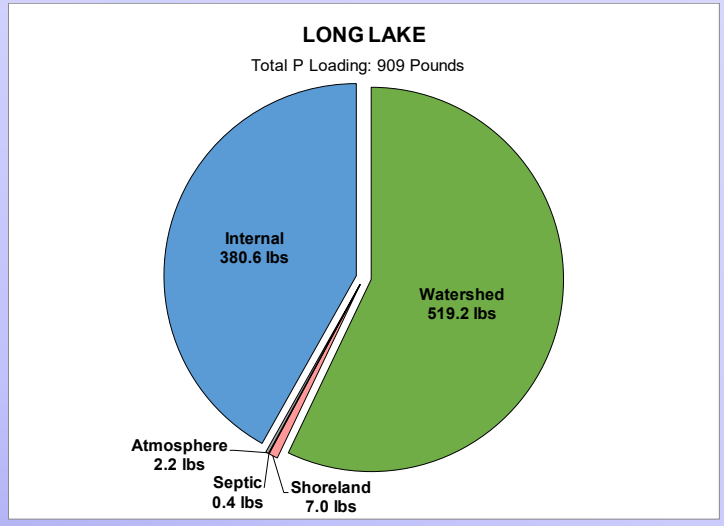

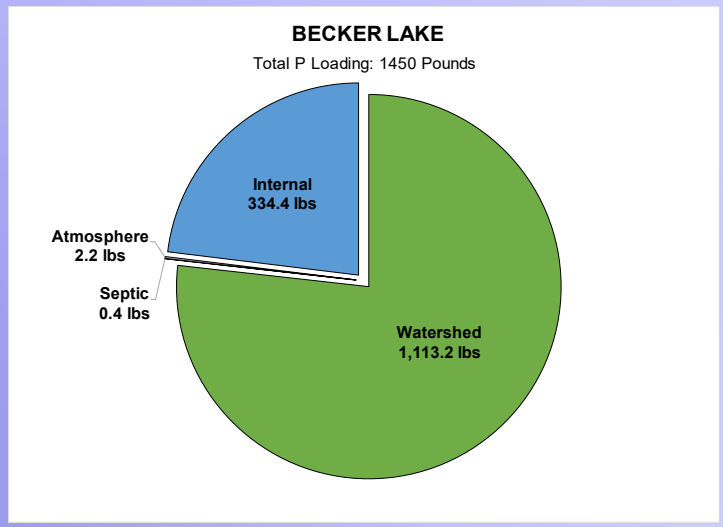

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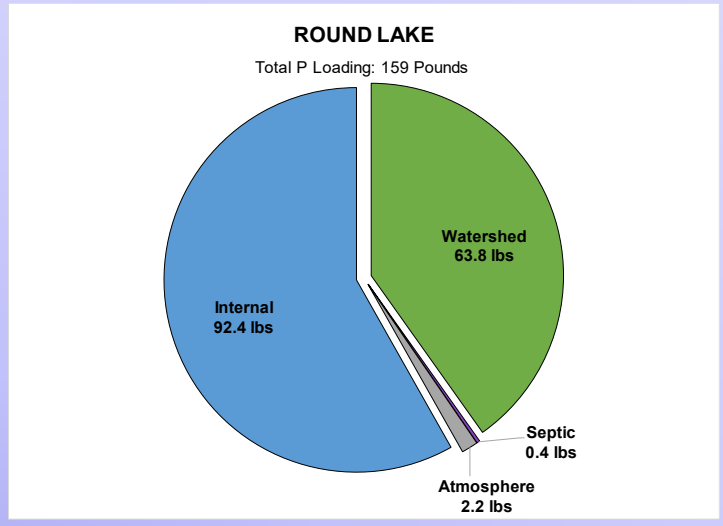

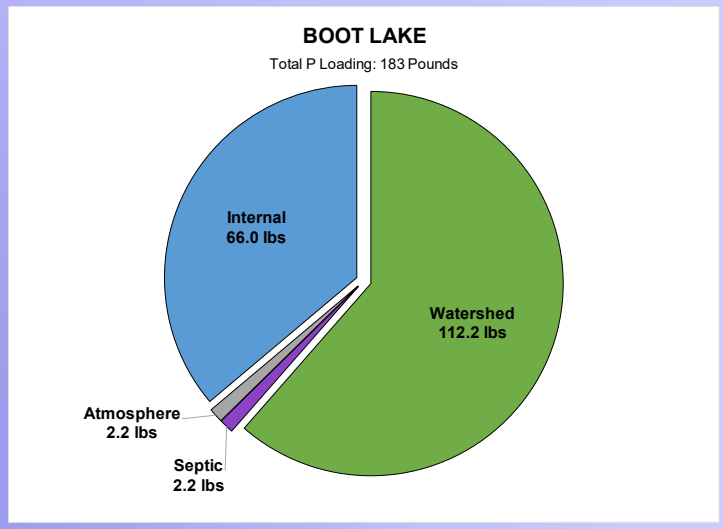

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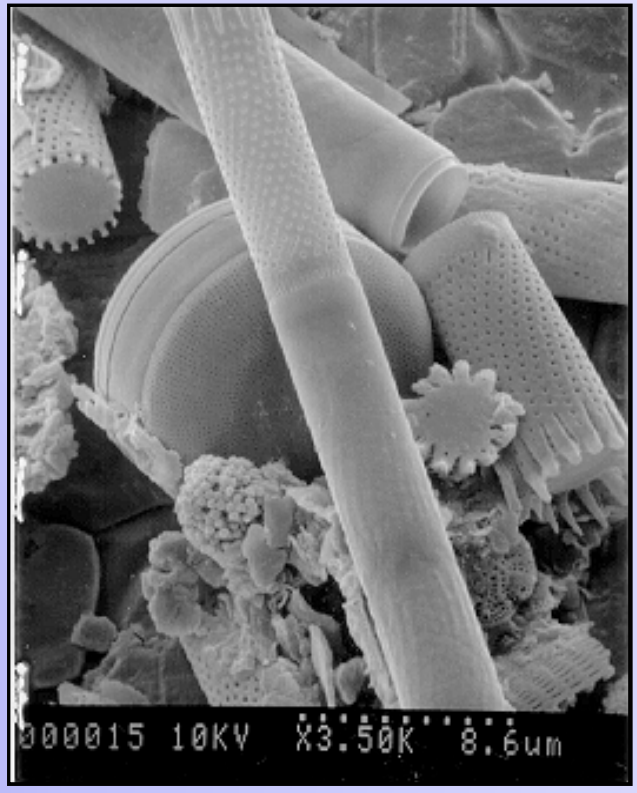
PALEOECOLOGY

SEDIMENT CORE



DIATOMS

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PALEOECOLOGY

Lakes	Observed	Top	Bottom
Round	93	73	15
Boot	188	66	65
Long	87	66	62
Becker	147	86	94

Age to be determinied

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Conclusions

- Water quality in all four lakes is poor
  - This was known, but these studies helped quantify levels
- Tributary monitoring at most sites is difficult
  - Information and insight were gained through the effort
- All four lakes have high phosphorus loads
  - Compartmentalization has lead to an idea of sources
  - Spring runoff impacts overall load greatly (surprisingly high)
  - Internal nutrient loads need to be refined and will lead to a better understanding of overall load and possible solutions
- Paleocores indicate that with some major changes, better water quality may be a reality in Boot and Round
  - Sediment dating results are needed to make this determination on Long and Becker

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Next Steps

- Refine estimate of internal phosphorus loads
  - Phosphorus profile collections during summer 2017
    - Round, Long, & Becker – May, June, July, August, and September
    - Boot – May and September
- Update compartmentalization of phosphorus loads to each lake
- Determine possible effectiveness of alum treatments
- Determine watershed phosphorus load reduction requirements for each lake to see improvements
- Determine if watershed load reductions are realistic
  - EVAAL and STEPL modeling
- Develop plan to implement (and fund) realistic watershed load reduction actions (BMPs)

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