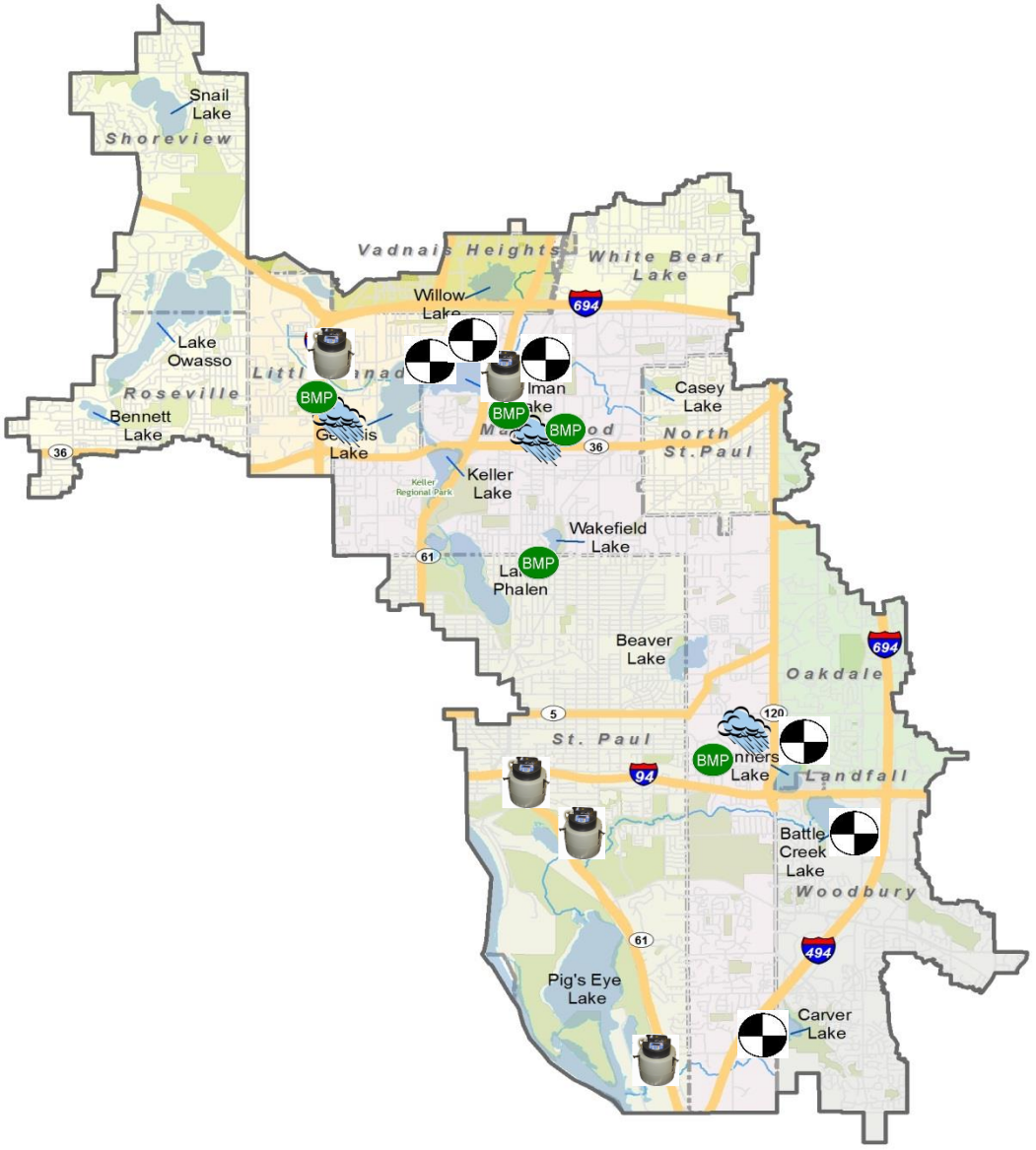
2017 Water Quality Program Summary

Outline

- Lake Water Quality
- Alum Plant and the Drawdown
- Wakefield Spent Lime
- Enhanced Sand Filter
- Kohlman Test Basin Chambers
- Future Monitoring

Water Quality Program Sites

- Lakes and Ponds
- Streams and Creeks
- Best Management Practices
  - Alum Plant
  - Iron Enhanced Sand Filter
  - Office Site
  - Wakefield Spent Lime
  - Maplewood Mall Retrofit
- Rain Gages



Lake Water Quality Monitoring

Overall Objective:
to assess the condition of our lakes over time

Lake and Pond Water Quality Monitoring

- Sample at deepest point
- Sample every two weeks
- Monitor June – September
- Readings at 1 meter intervals (Dissolved Oxygen, Temperature, pH, Turbidity and Conductivity)
- Water Samples (Top two meters & bottom)
  - Phosphorus
  - Chloride (also at ice out)
  - Chlorophyll A
  - Nitrogen

Trophic State Index

- Determine the condition
- Chlorophyll is a main component in the index
- A measure of algal production in a lake
- Scale: 0 to 100
- Simplified and normalized way of looking at data
- Standard measure in lake water quality monitoring

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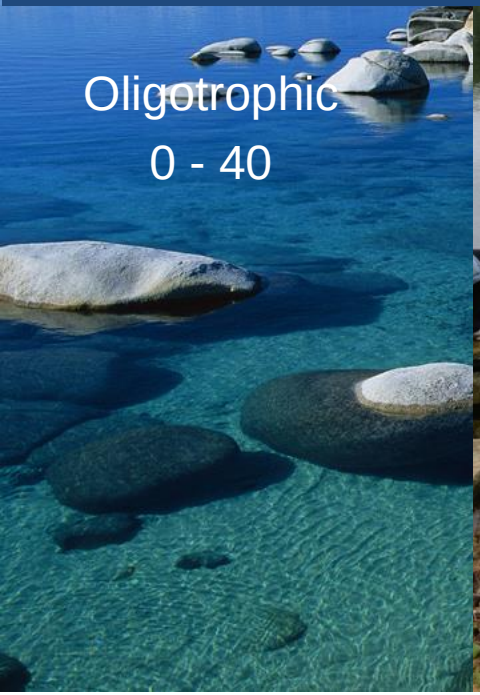
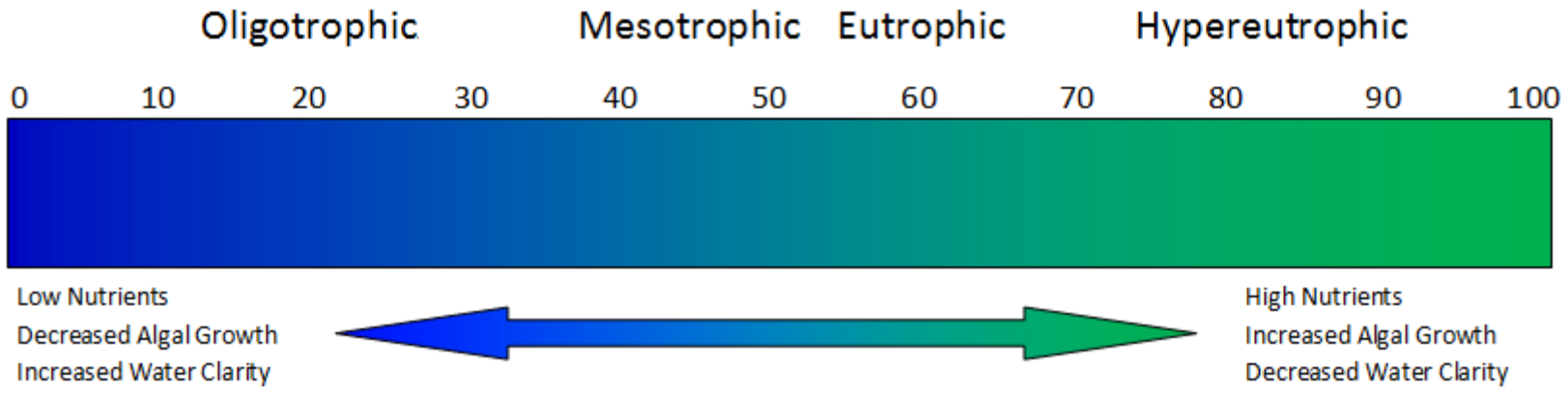
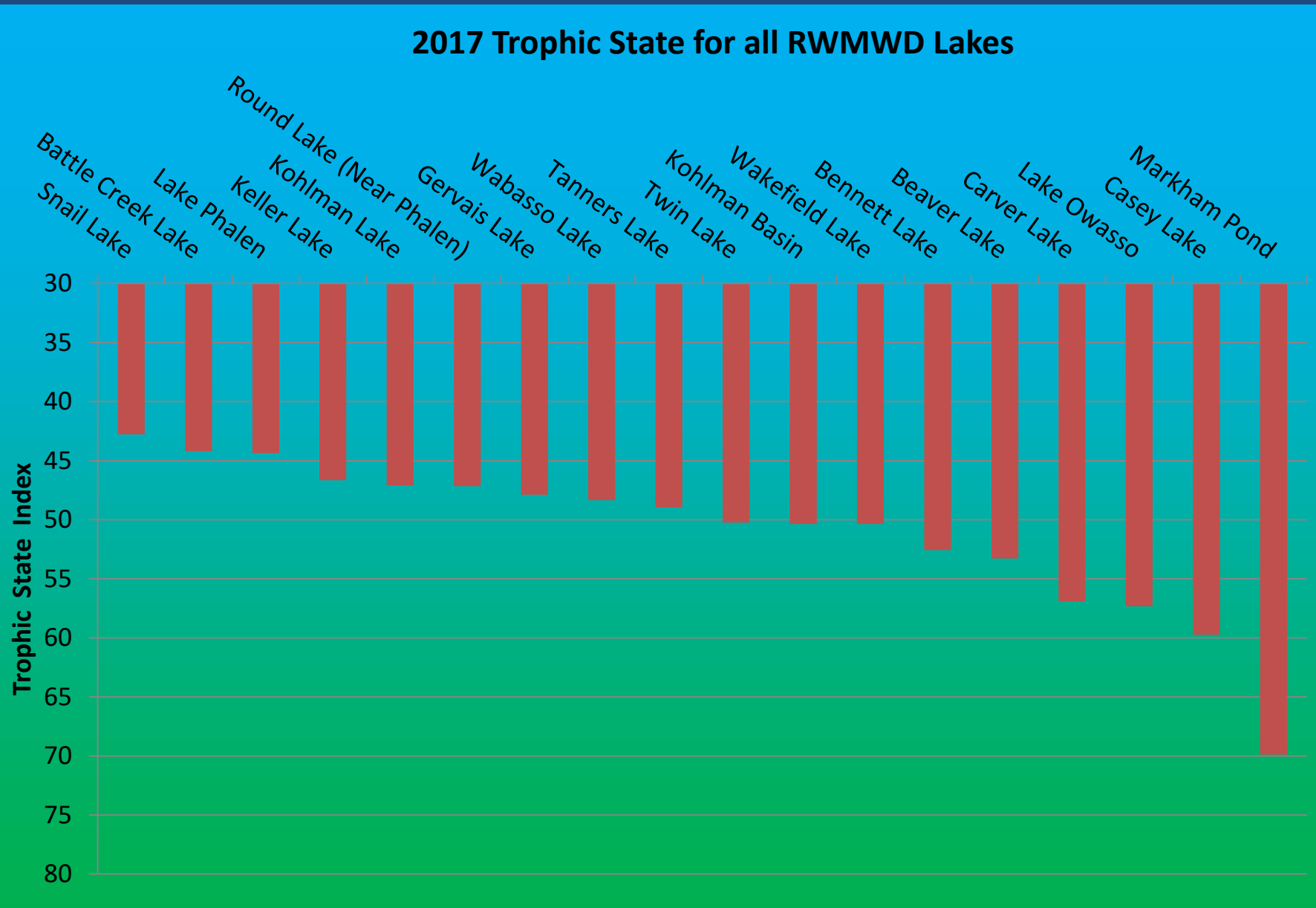
Different Trophic States





2017 Comapring Trophic States



Lake Condition Over Time

- Computed summer TSI averages for each lake
- Looked at trends for two time scales – 10 and 30 years
- Use a test called the “Mann-Kendall” to determine significance
- Standard procedure used in water quality data analysis

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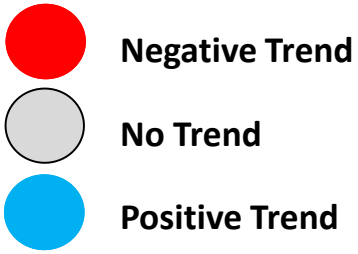
30 Trend Analysis for TSI



Lake	Trend?
Battle Creek Lake	Positive
Beaver Lake	Positive
Bennett Lake	Positive
Carver Lake	No
Gervais Lake	Positive
Keller Lake	Positive
Kohlman Lake	Positive
Lake Owasso	No
Lake Phalen	No
Round Lake	Positive
Snail Lake	No
Tanners Lake	No
Twin Lake	No
Wabasso Lake	No
Wakefield Lake	Positive

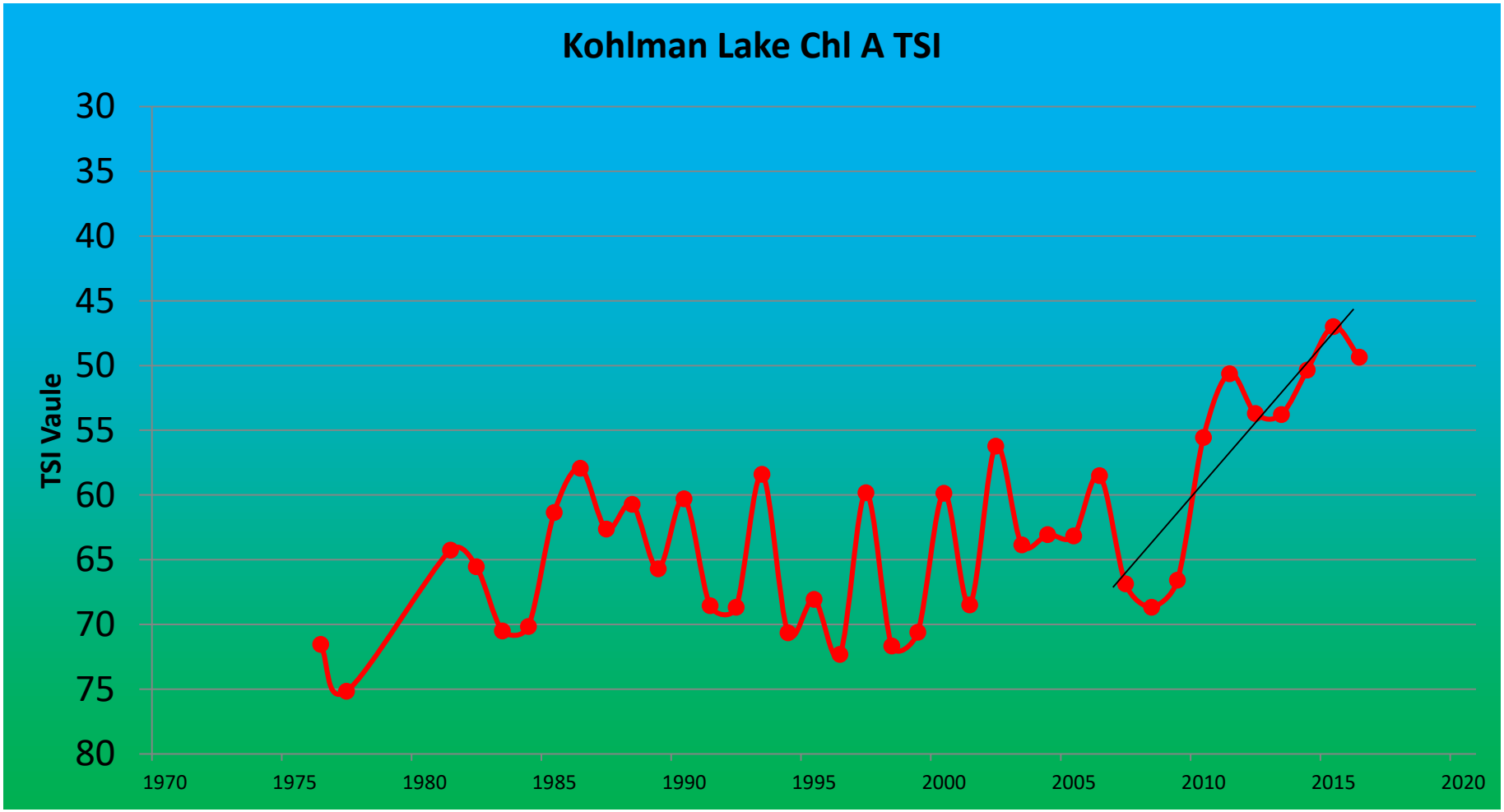
10 Year Trend Analysis for TSI

Negative Trend

No Trend

Positive Trend

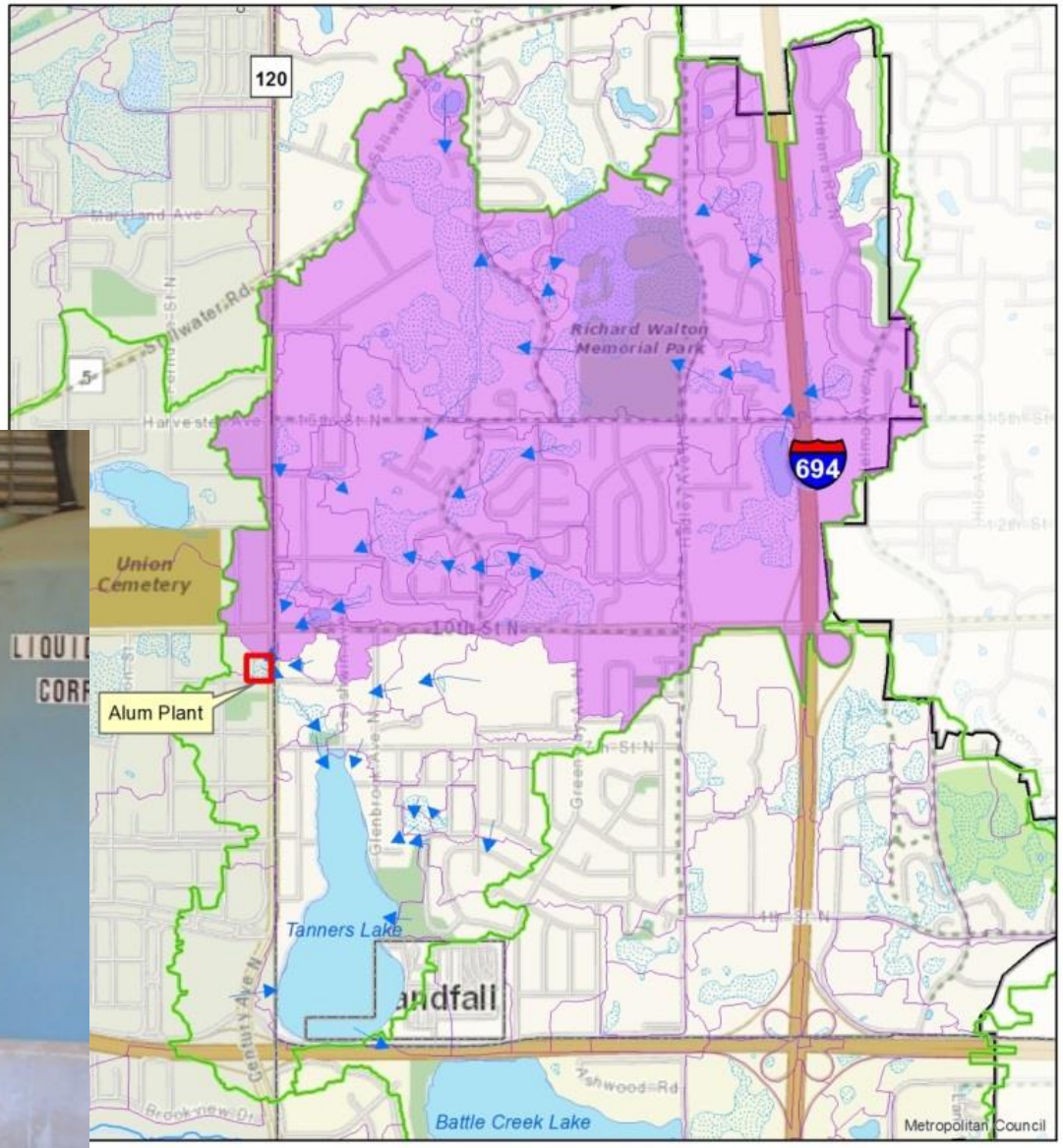
Lake	Trend?	Years
Battle Creek Lake	Positive	10
Beaver Lake	No	10
Bennett Lake	No	10
Carver Lake	No	10
Casey Lake	No	10
Gervais Lake	No	10
Keller Lake	No	10
Kohlman Basin	No	7*
Kohlman Lake	Positive	10
Lake Owasso	No	10
Lake Phalen	No	10
Markham Pond	No	7*
Round Lake	No	10
Snail Lake	No	10
Tanners Lake	No	10
Twin Lake	No	10
Wabasso Lake	No	10
Wakefield Lake	No	10



- Whole lake alum treatment
- Herbicide treatments for curly leaf pond weed
- Carp removal in the chain
- Plus other BMPs upstream

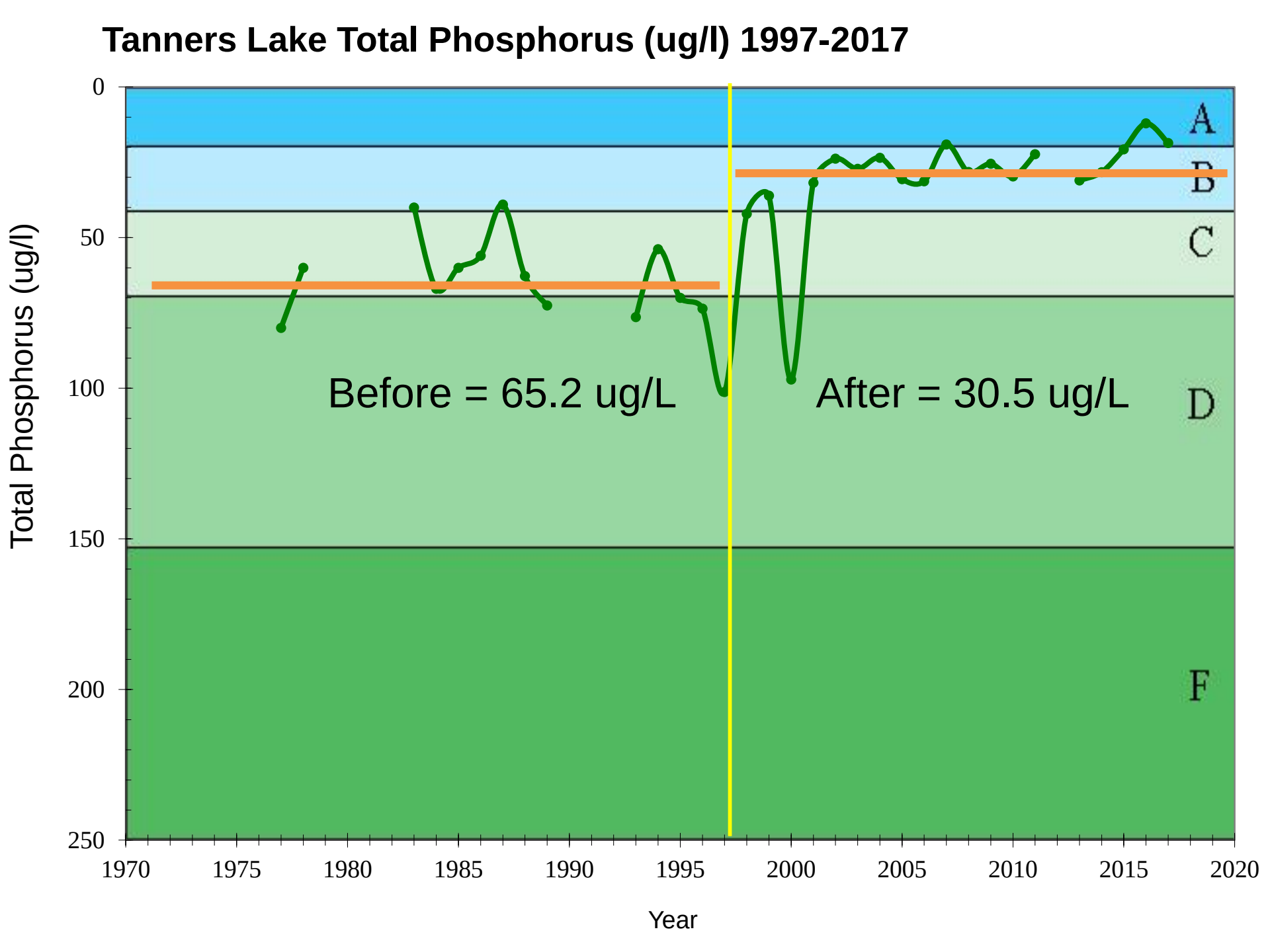
Best Management Practices – Alum Plant

- North of Tanners Lake
- Treats 60% surface water that enters Tanners
- Reduces phosphorus



Alum Plant

- Alum added to stormwater, binds with phosphorus, creates a floc, settles out.
- In 2017
  - •Ran for 7 months
  - •17,685 gallons of alum
  - •Average phosphorus removal was 76%
- 1998 to present - TP removal 72%


Tanners Lake Total Phosphorus (ug/l) 1997-2017
Total Phosphorus (ug/l)
0
50
100
150
200
250
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year
A
B
C
D
F
Before = 65.2 ug/L
After = 30.5 ug/L

Alum Plant Drawdown History

- 2003 - added fly ash, hauled out, expensive
- 2006 - Contractor pumped into sanitary, cheaper
- 2012 - same as 2006
- 2014 - District staff run, pumps installed, minimal approach
- 2015 – mixing with air powered mixer and boat
- 2017 - added air cooled motor

2017 Alum Plant Drawdown

- 6th Cleanout of the Pond
- Pumped out 1,100,000 gallons of water
- 14 days

Removed Solids

- 2014 - 500 lbs
- 2015 - 62,000 lbs
- 2017 - 142,000 lbs

Iron Enhanced Sand Filter

- Upstream of Kohlman Lake (Beam & County View Lane)
- Sand with 5% iron filings with an underdrain
- Iron binds with phosphorus
- Constructed in 2008
- Lab tests have show that this could last for 30 years
- Problem? First 15 feet solidified but still working

Percent Reduction

	TP	TSS	Iron
2009	77%	97%	
2010	76%	92%	90%
2011	46%	84%	84%
2012	N/A	64%	89%
2013	72%	86%	86%
2014	91%	91%	97%
2015	87%	54%	89%
2016	72%	88%	91%
2017	90%	96%	96%
Average	**76%**	**84%**	**90%**

Wakefield Spent Lime Filter

- Installed in 2011
- South of Wakefield Lake
- Spent lime is waste product from drinking water facilities
- Runoff from a small part of Larpenteur Ave
- Average TP removal of 52%
- Maintenance?

Percent Reduction

	TP	Ortho	TSS
2012	33%	60%	26%
2013	61%	54%	61%
2014	NA		
2015	73%	77%	55%
2016	42%	39%	61%
2017	52%	65%	66%
Average	**52%**	**58%**	**51%**

Kohlman Basin Test Chambers

- Test facility
- Upstream of Kohlman lake
- Four chambers
- Test multiple materials (biochar with sand, spent lime, spent lime mixed with iron and crush limestone)
- Test for phosphorus before and after
- Adjust flow to change contact time
- What works best?
- Finished our first run

Future Monitoring

- 2018 - Frost and Kennard Spent Lime Filter
- 2018 – Shoreview Commons Pond treated with Iron
- 2019 – Willow Pond Continuous Monitoring and Adaptive Control Filtration BMP
- Future - Battle Creek TSS study

Questions?

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