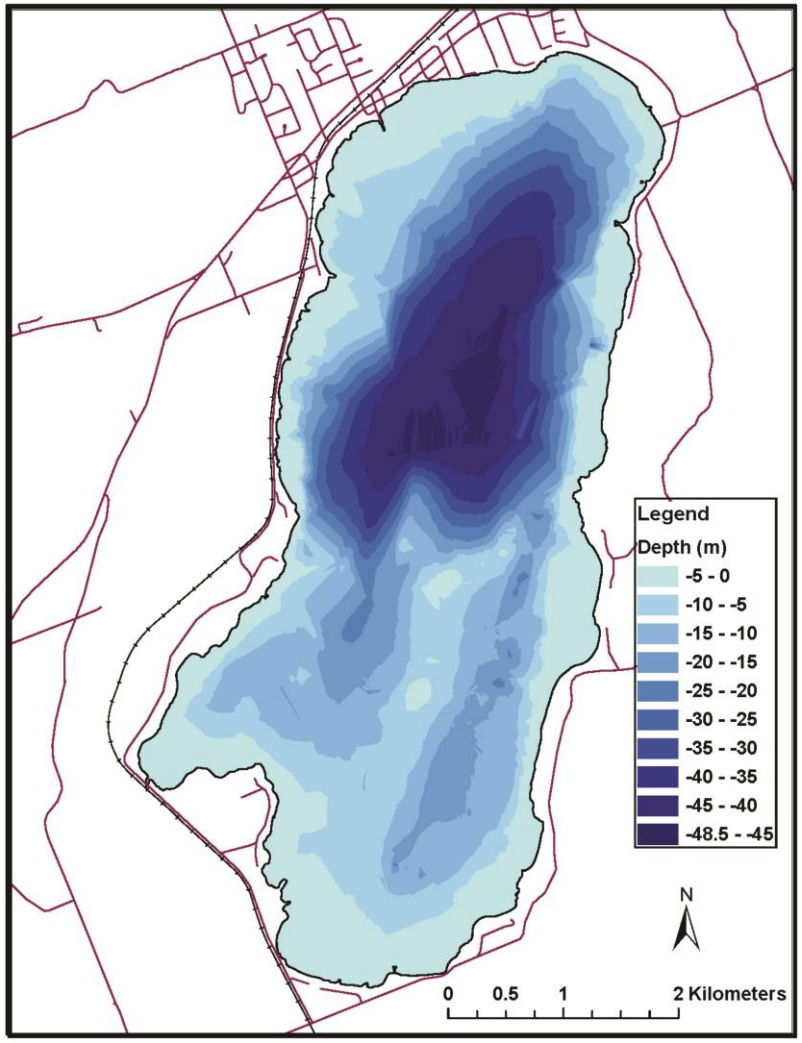
Alan J. Burt

- Aquatic Biologist for 37 Years
- Freshwater Macroinvertebrate Biologist
- Masters of Environmental Science (2012)
- Certified Environmental Professional - EP (2018)
- Certificate in Biostatistics (Ecological and Environmental Statistics)

Lake Bernard

As We Know It



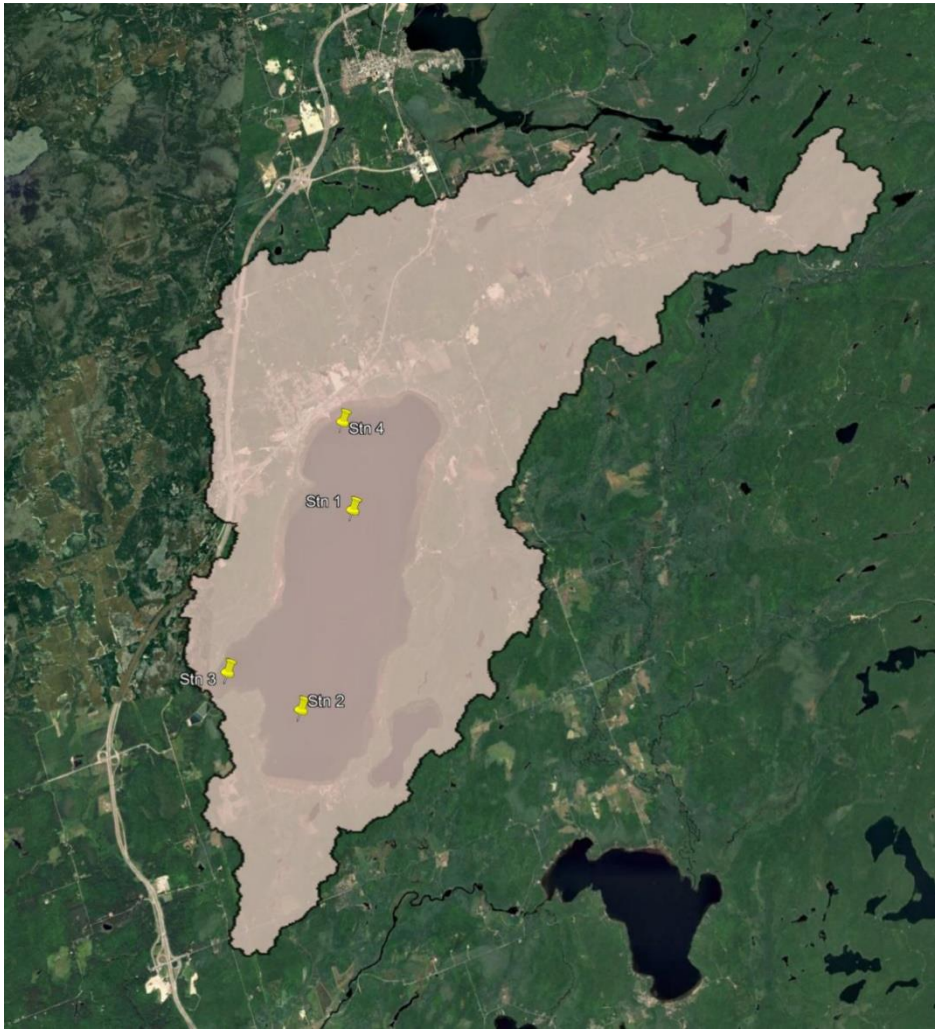
Updated bathymetry produced by MNR, 2011

Large lake: 20.9 km^2
Deep: Maximum Depth – 49 m
Mean Depth – 15 m
Watershed Area: 79.9 km^2
Shoreline Development: Intense
Hydraulic Retention Time: 8.3 yrs

Oligotrophic Lake
Deep
Clear - Secchi depth 4.0 m
Unproductive – Spring TP 5 µg/L
Stratified in summer
Lake trout lake
Bottom water remains aerated in summer
No algal blooms

If this is all true then why have we experienced blue-green algae blooms the past two summers?

Lake Bernard Watershed



Lake Bernard
What Do We Know?

- In 1997 Lake Bernard joined the MOE's Lake Partner Program to monitor the trophic status of the lake – **how productive is it?**

Secchi Depth (SD)

- Initially started measuring SD as a measure of transparency of the water or how clear it is in 1997

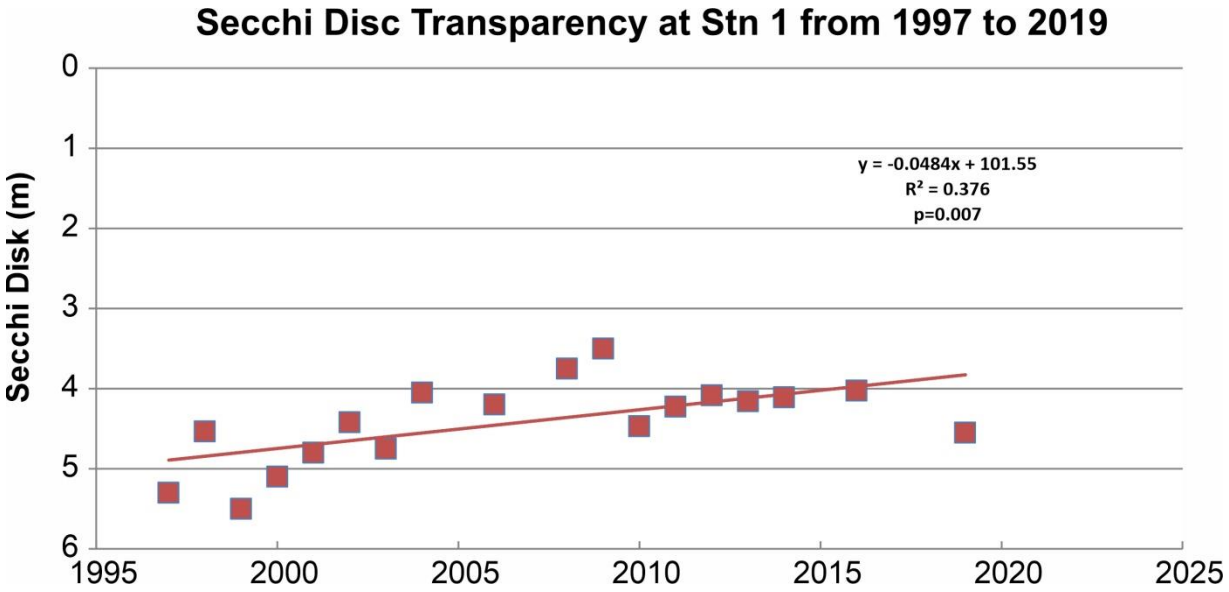
Total Phosphorus (TP)

- In 2002 included TP (low detection limit) to measure potential productivity in the lake as TP controls the growth of algae in Ontario Lakes

Calcium

- Added in 2008 in response to declining concentrations in many Ontario Shield lakes (~80% < 10 mg/L). Led to impacts on daphnids and other crustaceans

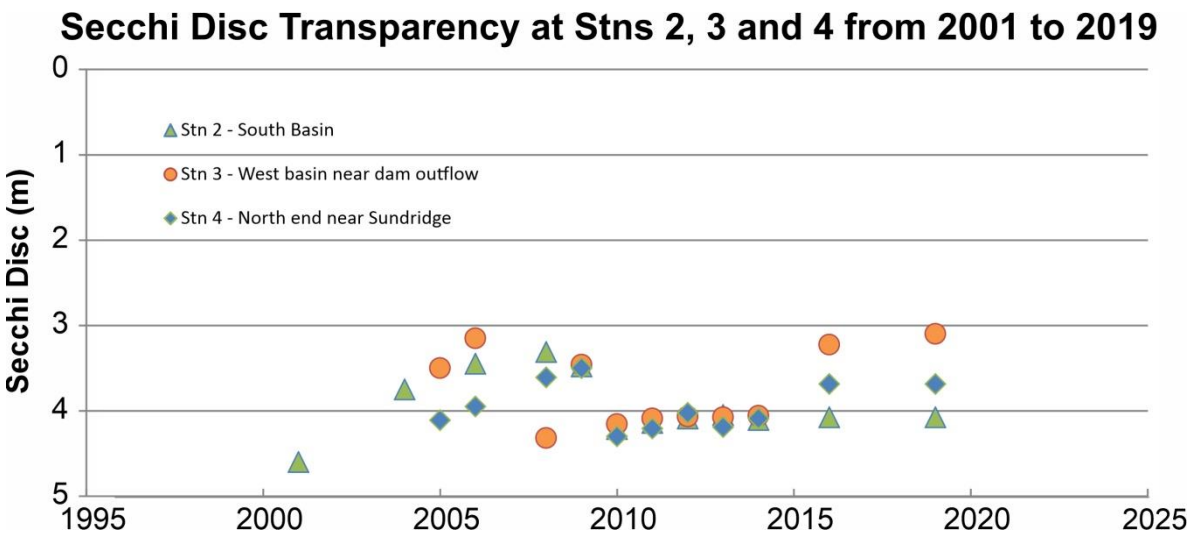
Secchi Depth
What Do We Know



- At Stn 1 (Main Basin) SD has declined from a high of 5.5 m in 1999 to 4.6 m in 2016 (statistically significant at p = 0.007).
- SD fairly constant from 2004 to 2016 at ~4 m

- **Suggests a decrease in water clarity that could be related to increased algal production or a disturbance in the watershed (eg. Dissolved Organic Carbon, suspended solids)**

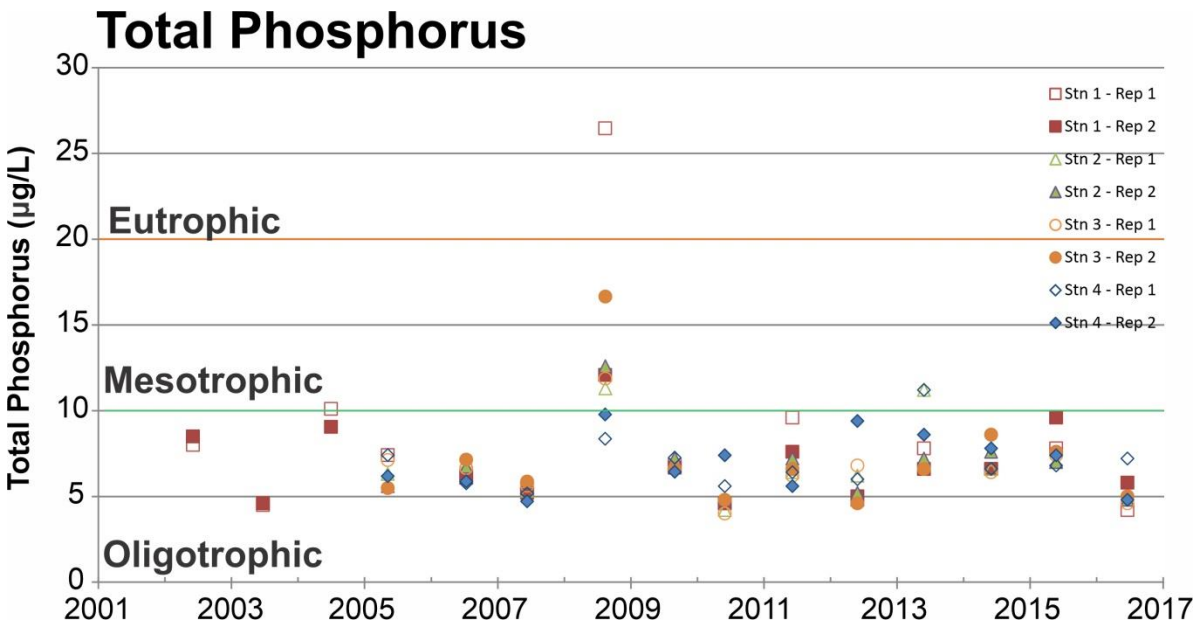
Secchi Depth
What Do We Know



- No clear overall trend at the 3 other stations
- These stations are much shallower than Stn 1 and likely more subject to disturbance

Total Phosphorus

What Do We Know



- All stations have TP concentrations between 5 and 10 µg/L since 2002, classifying the lake as oligotrophic, with one exceptional year.
- In 2008, TP concentrations responded to sewer overflow in spring.

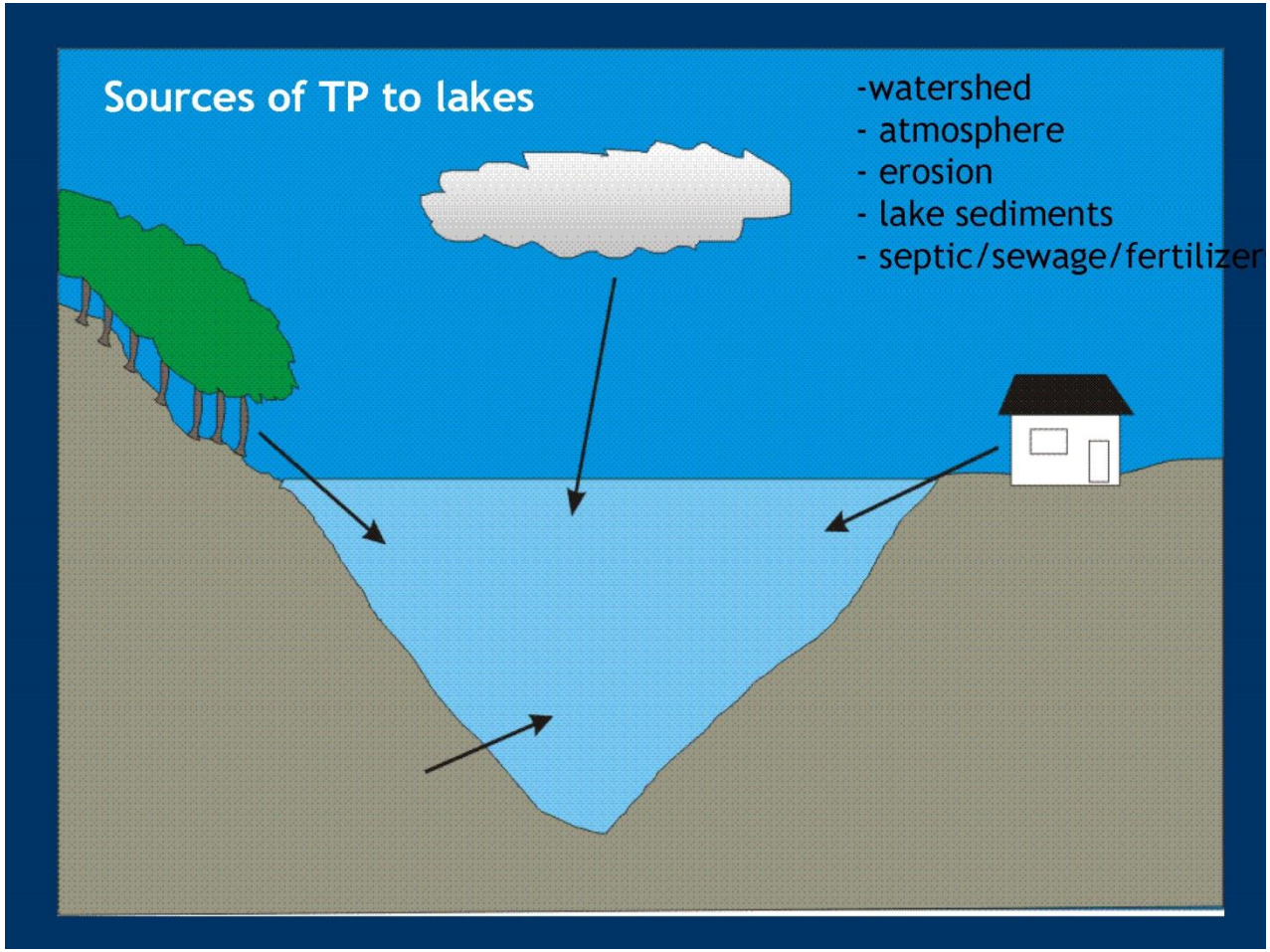
- **Overall, results do not suggest that blue-green algae blooms should have occurred. So why did they?**

So What's Happening?

- In 2011 MNR conducted an assessment of Lake Trout and Development on Lake Bernard
- Found depleted levels of dissolved oxygen in the deep water basin during the summer (~ 7 mg/L)
- The amount (and rate of depletion) of oxygen is determined by:
  - Size/shape of the lake basin
  - Nutrients (phosphorus)
- Shoreline development increases phosphorus loading to the lake = **less oxygen**
- Lake Bernard is at its development capacity.

- **So what now?**
- **Find ways to reduce TP inputs to Lake Bernard**

Sources of Total Phosphorus



Source: MNR, 2011. Lake Trout and Shoreline Development on Lake Bernard, July 20, 2011

So What's Happening?

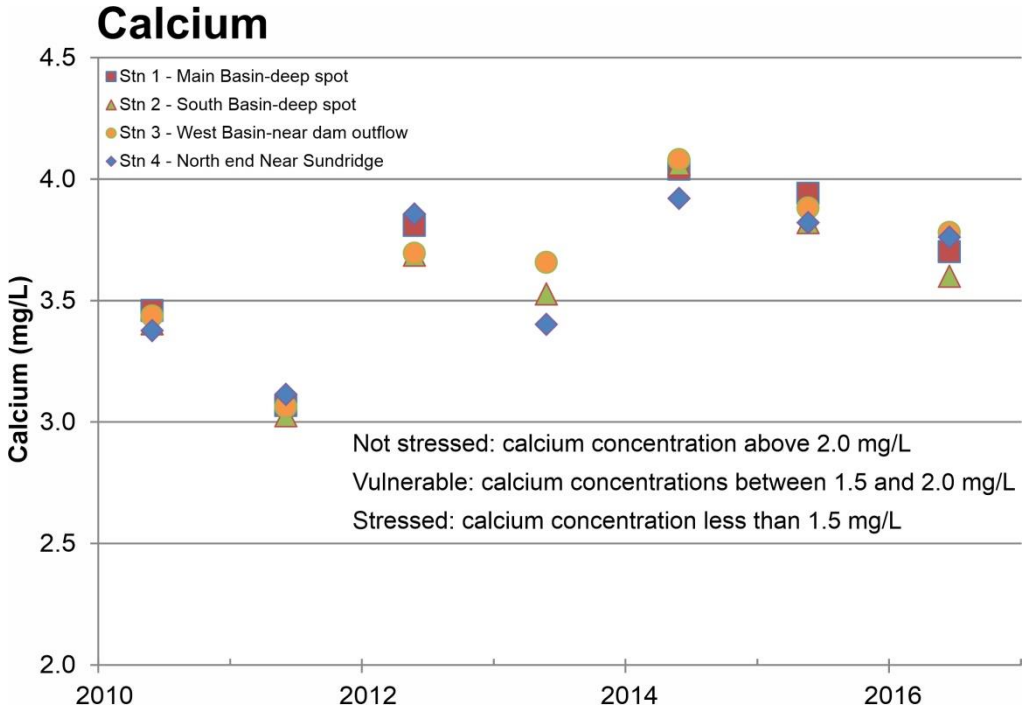
- At recent seminar on blue-green algae in South River some new insight into mechanisms triggering algal blooms in spite of low TP were presented.
- Climate change has resulted in slow warming of Lake Bernard waters.
- Warmer shallow waters during periods of calm, hot weather can cause local depletion of oxygen in bottom waters.
- Low oxygen levels trigger release of **ferrous iron** from the sediment causing a local algal bloom.

- **So what can be done?**

So What Can be Done?

- Investigate sources of TP to lake and find ways to reduce/eliminate them
- Identify areas of previous algal blooms to establish critical areas that may help identify TP sources. (Plot on map)
- Collect water samples during bloom to identify triggering concentrations of TP.
- If possible measure oxygen levels near sediment surface to confirm depleted levels (need O_2 meter or Hach kit)
- Ultimately may need to investigate appropriate means of aerating these areas of the lake if TP control is not successful in limiting blooms (potentially very expensive)

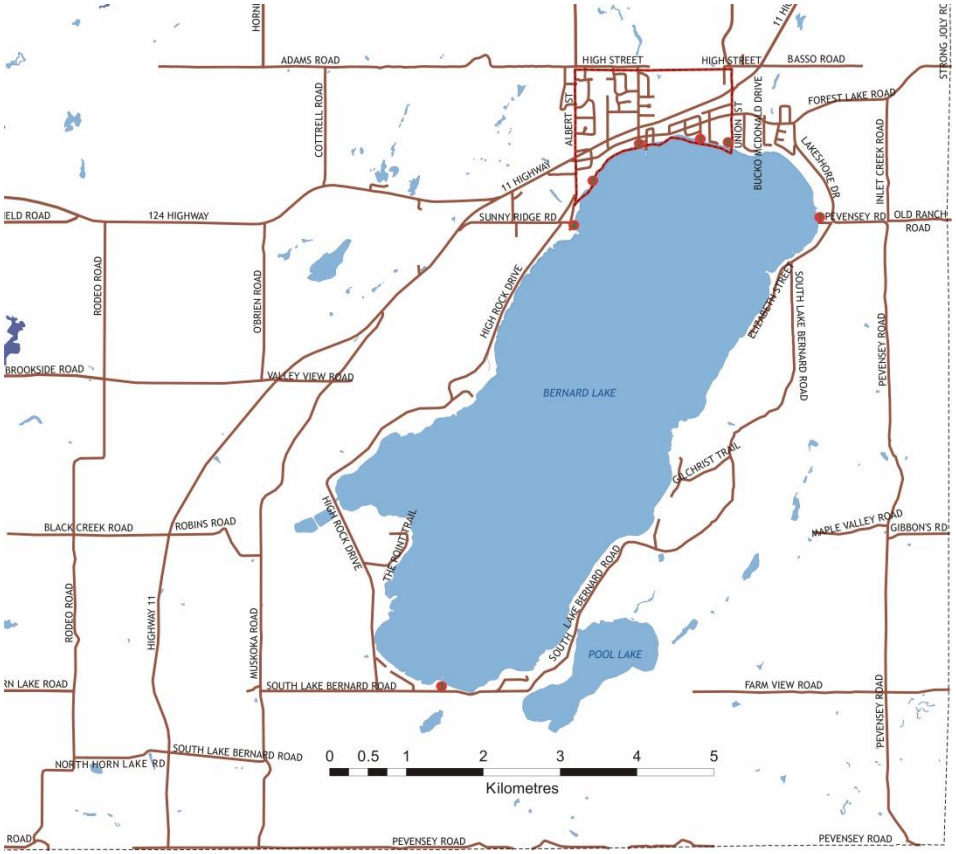
Calcium



- Existing calcium concentrations in Lake Bernard classify the lake as **not stressed**.
- MOE indicated Ca concentrations apparently at historical background levels.
- Shield Lake calcium concentrations declined due to decades of acid rain and logging which have depleted watershed stores of calcium.
- Low calcium impacts the survival and reproduction of crustaceans and molluscs which then impacts several fish species.

- **While not stressed, calcium can be introduced into the lake by placing fireplace ash in your yard where it can be flushed into the lake. This ash is rich in calcium.**

E. coli Bacteria



- Ministry of Health (MoH) monitors E. coli at the above beach sites on a monthly basis – no exceedances in 2018.
- MoH has modified the E. Coli standards in 2018
  - <200 counts/ 100 mL as geometric mean of 5 samples
  - <400 counts/ 100 mL on single sample
- Recommended sampling at sensitive sites after storm events as these may produce exceedances from sites susceptible to sewage runoff.