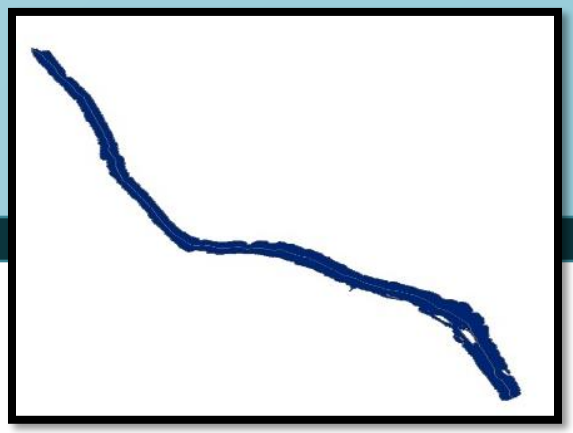
Big Stone 06-0152-00

2018 Summary



Understanding Our Lake

1. Big Stone Lake is in Western Minnesota adjacent to Ortonville, MN in Big Stone county. It is located within the Minnesota River- Headwaters watershed.
2. It is a highly productive lake and a popular recreational destination in west-central Minnesota, according the DNR fisheries report.
3. Big Stone is a Minnesota- South Dakota border lake and is subject to border water fishing regulations.
4. It is known for great Yellow Perch, Walleye, White Bass, and Freshwater Drum fishing over the last few years. The last fisheries survey was conducted by the MN DNR in 2017.
5. Big Stone is a shallow lake (16' max) is fed by the Little Minnesota River. There are also several smaller inlets that flow into it.
6. Currently, Curly Leaf Pondweed is the only know aquatic invasive species in Big Stone Lake.

Make Up of Big Stone Lake

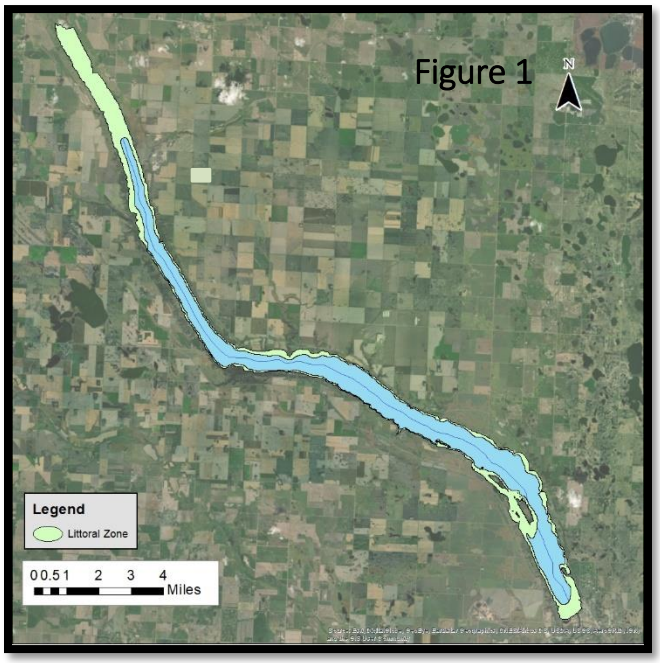


Figure 1: The littoral area is the area around a lake that is shallow enough to support plant growth (usually less than 15 feet). This part of the lake also provides the essential spawning habitat for most warm water fishes (e.g. bass, walleye, and panfish). Big Stone Lake has a relatively large littoral area. Big Stone Lake has a surface area of 12,610 acres, 4,795.29 acres are within the littoral area of the lake. 38.0% of the lake make up is considered a part of the littoral area.

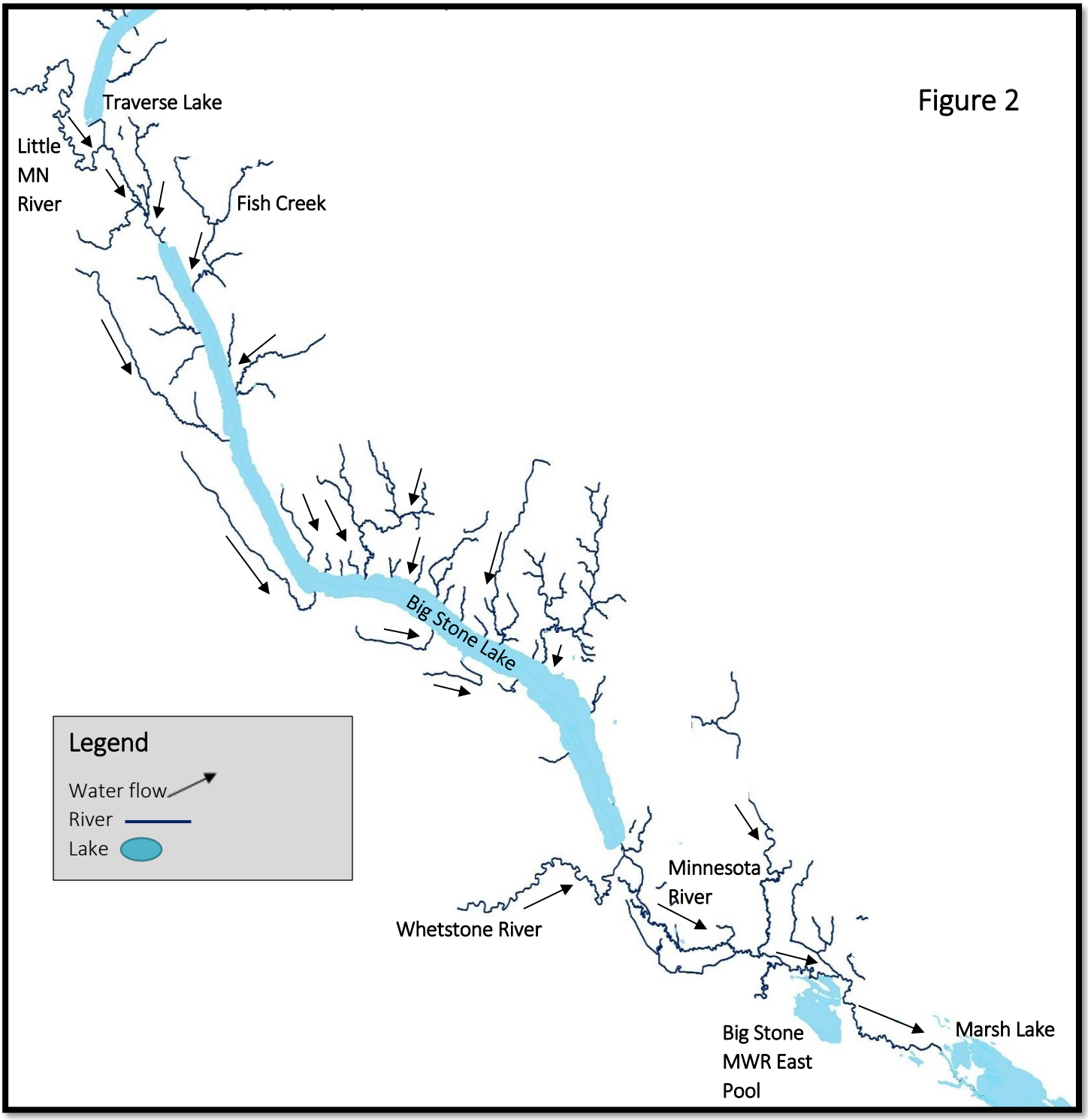


Figure 2. The Big Stone Lake catchment is represented in figure 2. The Little Minnesota river feeds into Big Stone lake as well as numerous tributaries along the way; therefore, it is a potential source of phosphorus as the stream brings sediments from further up in the watershed.

Water Quality Summary

Big Stone Lake is a shallow eutrophic lake and is the source of the Minnesota River, which flows 332 miles to the Mississippi River. The lake is fed by the Little Minnesota River at its north end and numerous tributaries along its length. Big Stone Lake is not a typical lake. It is a reservoir in the Minnesota River, acting more like a large river system than a contained lake. Currently, there is a statistically significant trend indicating that total phosphorus concentrations are improving.

Big Stone 06-0152-00

Lake Information

MN Lake ID: 06-0152-00
County: Big Stone
Ecoregion: NGP
Latitude/Longitude: 45.3 / -96.45
Years Monitored: 2007 - 2018
Monitored Sites: 107,108,205,208,209,210,217

Physical Characteristics

Surface area (acres): 12610
Littoral area (acres): 12484
% Littoral area: 40.0
Max depth (ft): 16

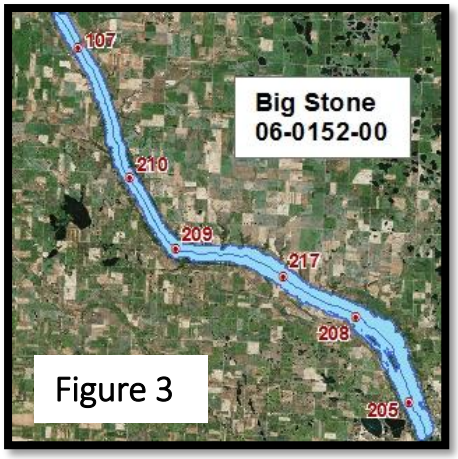


Figure 3: Big Stone Sampling Sites

Water Quality Characteristics

(data from RMB monitoring database only)

Parameters	Primary Site 208	Site 205	Site 217	Site 209
Total Phosphorus Mean:	131.5	122.8	141.7	156.8
Total Phosphorus Min:	38	36	27	38
Total Phosphorus Max:	246	225	249	284
Number of Observations:	747	47	47	48
Chlorophyll-a Mean:	24.9	36.3	27.7	33.6
Chlorophyll-a Min:	1.8	1	0	1
Chlorophyll-a Max:	157	284	138	169
Number of Observations:	46	45	46	48
Secchi Depth Mean:	6.6	5.3	6.5	5.5
Secchi Depth Min:	3	1.5	3	1.5
Secchi Depth Max:	13	12	14	14.1
Number of Observations:	45	45	44	46
Trophic State Index Mean:	60.4	62.3	60.3	62.6

Trophic State: Eutrophic

Table 1: 2018 Averages

Site	Total Phosphorus (ug/L)	Chlorophyll-a (ug/L)	Secchi Depth (ft)
107	201.6	30.3	4.1
205	102.8	28.84	5.4
208	110.6	8.74	7.5
209	128.8	14.1	6.2
210	127.8	14.62	4.325
217	120.2	9.08	7.7

Trends

(Primary site only. For detecting trends, a minimum of 8-10 years of data with 4 or more readings per season are recommended)

Years Monitored: 2007 - 2018
Total Phosphorus: Improving with 99.9% confidence.
Chlorophyll-a: No significant trend exists.
Secchi Depth: No significant trend exists.
Trophic State Index: Improving with 80% confidence.

Ecoregion Comparisons

(Primary site only. Comparisons are based on interquartile range, 25th-75th percentile, for ecoregion reference lakes)

Ecoregion: Northern Glaciated Plains
Total phosphorus: Within Expected Range
Chlorophyll-a: Better Than Expected Range
Secchi depth: Better Than Expected Range

Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed. The basic purpose of land use planning is to ensure that each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.

Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the land's ability to absorb and store water rather than cause it to flow overland (gathering nutrients and sediment as it moves) towards the lowest point, typically the lake. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

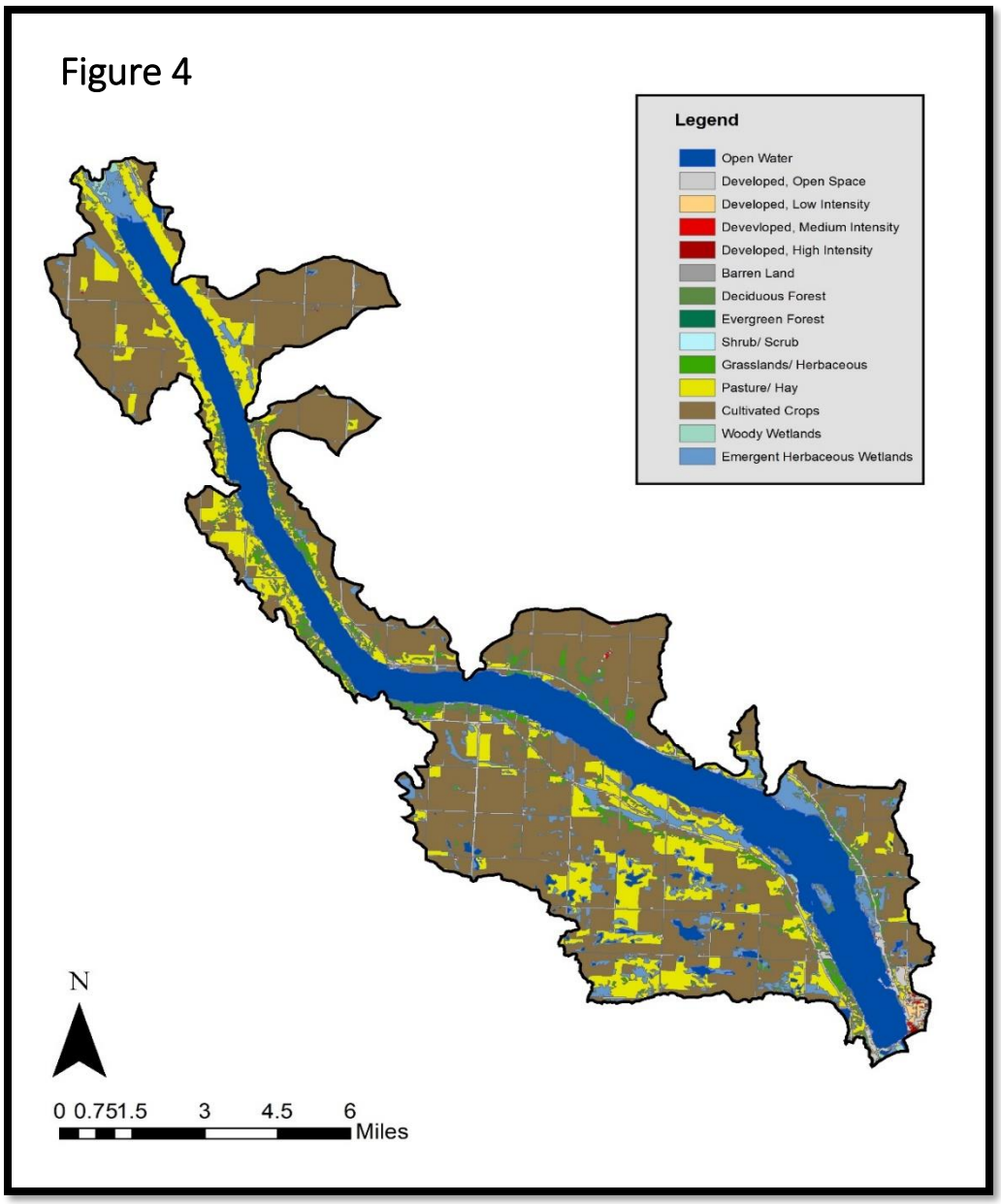


Figure 4. Big Stone Lake lakeshed land cover (NLCD 2011).

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed. Figure 4 depicts the land cover in Big Stone Lake 's lakeshed.

Big stone's lakeshed consists of primarily cultivated crops and pastures. Conservation farming practices such as crop rotation, cover crops, and wetland restoration can minimize the nutrients running off the farmland to the lake. In addition, making sure there is a vegetated buffer around the lake on agricultural and developed properties consisting of trees and native vegetation can reduce runoff and prevent shoreline erosion.

2018 A Year in Review

In 2018, Big Stone Lake conducted water quality testing for the following parameters: Chlorophyll-a, Total Phosphorus, and Secchi Depth readings to determine the transparency. These three parameters help to portray the overall health of the lake. In comparison to the historical data, all the sampling sites on Big Stone Lake, in 2018, indicate a decline in both the total phosphorus and chlorophyll-a concentrations, as well as an increase in the transparency. These results were reflected in the trend analysis stating that the total phosphorus concentration average is improving with a 99% confidence.

Conclusions and Action Steps

Monitoring matters, but only if you do something with the data that you collect. Whether the data is simply used to track trends or take steps to help maintain the overall health of your lake. Here are a few ideas to consider:

1. Establish realistic long-term water quality goals (i.e. TSI, phosphorus, clarity) for Big Stone Lake. *This would be used to educate homeowners as to potential for quantitative water quality improvements.* The current TSI (60.4 at primary site 208) is very reasonable for Big Stone lake, being a shallow lake. Trends show improvement, so protecting the lake in its current state will reach the goal. See more information about shallow lake ecology below.
2. Increase awareness, education and involvement in water quality conditions, plans and initiatives among lake property owners. Encourage shoreline best management practices such as natural shoreline buffers, tree planting and rain gardens to capture storm runoff. Trees and vegetation can help in preventing shoreline erosion.
3. Protect native aquatic plant beds – emergent (bulrush) and submerged. Educate homeowners about only clearing a small area for swimming and leaving the other plants for fish spawning, habitat and nutrient uptake. See more information shallow lake ecology below.
4. Consider permanently protecting large shoreline parcels on the north and south sides of the lake that are not currently developed. This can be done through establishing conservation easements or aquatic management areas. Talk to the local SWCD or DNR about options.
5. Increase AIS awareness and education in visitor's lake property owners.

Shallow Lake Ecology Notes

A healthy shallow lake typically has clear water and a diverse aquatic plant community. The plants in these shallow lakes lock up a lot of the nutrients in their tissues so that there is not excessive algae growth, and they produce oxygen throughout the water as a byproduct of photosynthesis. These plants also keep the sediments stable at the bottom of the lake and not mixed up into the water column. Tiny invertebrates called zooplankton consume algae and can maintain the lake in a clear state.

Unfortunately, if a shallow lake isn't taken care of, it can switch to a turbid state (cloudy & green) and be difficult to restore. If large areas of plants are removed by pulling them out, cutting them with a weed roller or with a boat motor, the sediments can get churned up and nutrients are released. If there are fewer plants to use the nutrients, the algae will use them and multiply. The lake then turns green and is difficult to get back to the clear state. Goals for shallow lakes should include protecting native vegetation.