Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

McDaniel Lake

Waterbody Segments at a Glance:

County: Greene
Nearby Cities: Springfield
Area of impairment: 300 lake acres
Pollutant: Algae
Source: Agricultural and Urban Nonpoint Source

State map showing location of watershed

TMDL Priority Ranking: TMDL approved 2004

Description of the Problem

Beneficial uses of McDaniel Lake (as assigned in Missouri's Water Quality Standards)

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health associated with Fish Consumption
- Drinking Water Supply

Use that is impaired

- Drinking Water Supply

Standards that apply

- The impairment of this lake is based on exceedence of the general criteria contained in Missouri's Water Quality Standards, 10 CSR 20-7.031(3)(A) and (C). Here it states:
  - Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
  - Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.

This lake serves as a drinking water supply for the city of Springfield. It should be noted that no livestock watering is permitted in the lake, even though that is designated as a use. It was formed in 1929 by damming the Little Sac River. In the past two decades, there have been complaints about the drinking water having taste and odor problems. These taste and odor problems often occur at the same time that specific types of blue-green algae, also known as cyanobacteria, reach peak levels in the

reservoirs. Increased production of cyanobacteria is related primarily to phosphorus (P) and nitrogen (N) in the water, abundant sunlight and warm water temperatures.

The TMDL was written in the fall of 2003 and approved by the U.S. Environmental Protection Agency February 3, 2004. A TMDL is a numeric calculation of the amount of pollutant a waterbody can assimilate before it violates Water Quality Standards. Since there are no numeric standards for nutrients, a connection needs to be made between the standards and something that can be measured and calculated for the endpoint of the TMDL. Four different endpoiont options were examined. However, none of them provided a significantly strong correlation between the pollutant and the endpoint. Given this predicament, available literature and experts in limnology (the study of lakes) seem to suggest that the best possible approach to minimizing the risks of taste and odor problems is to control algal growth. Twenty-seven µg/L was calculated for the McDaniel Lake TMDL as the concentration of phosphorus that would limit chlorophyll-a (found in the second graph) to 10 µg/L. Chlorophyll-a occurs in all green plants and is used as a measure of the amount of algae. When a certain type of algae (the blue-green algae mentioned above) die, they release the particular compounds that cause unpleasant taste and odor. It has been found that suspended chlorophyll-a predicts the risk of dominance of blue-green algae. This risk increases exponentially in lakes when chlorophyll-a exceeds 10 µg/L.

As part of the TMDL, a monitoring plan has been worked out with Springfield City Utilities to help sort out cause and effect in controlling algal growth and to evaluate the effectiveness of any remediation actions implemented.

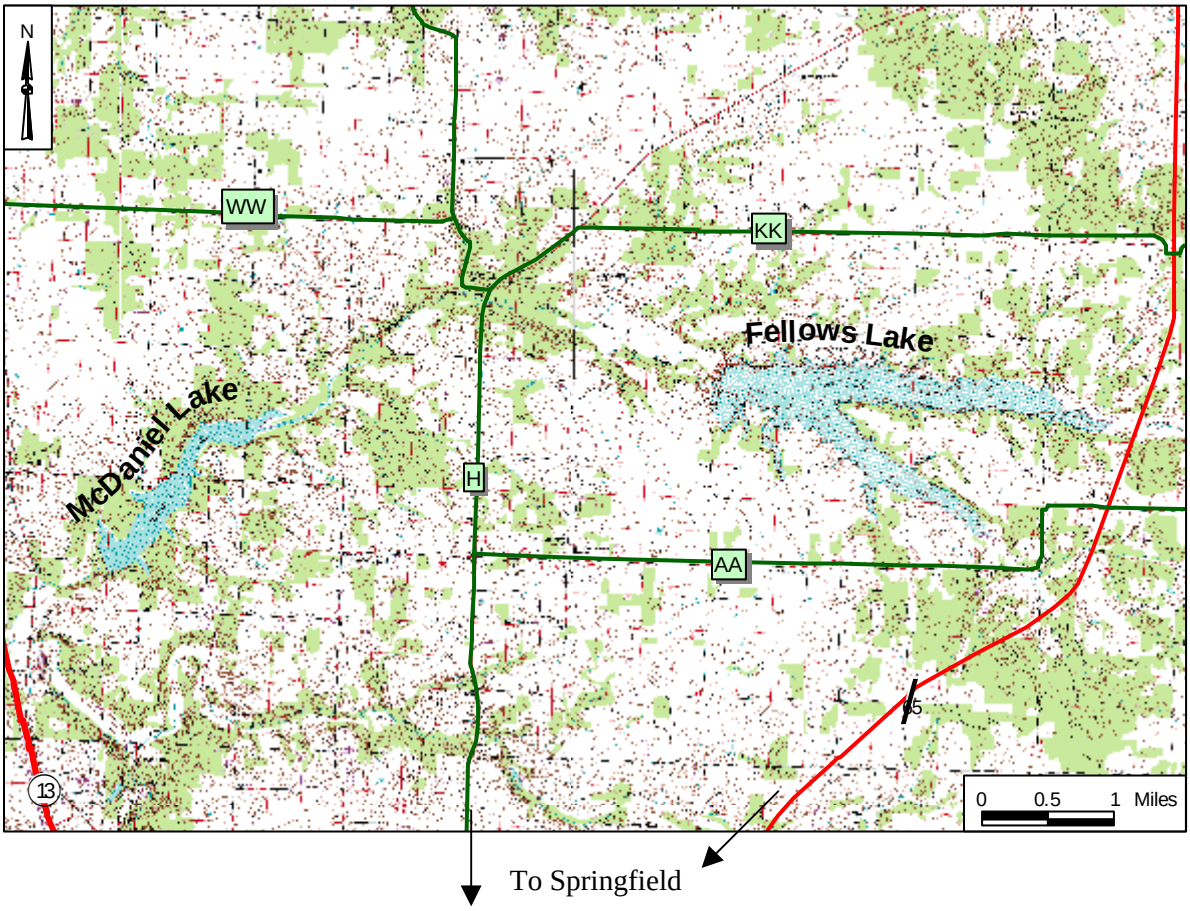
Potential remediation actions to address these problems include:

- Reducing the amount of P and N entering the reservoirs from the watershed by
  - Making sure on-site septic systems are functioning and being properly maintained
  - Planting aquatic plants to compete with the algae for nutrients and space
  - Other best management practices
- Reducing the amount of sunlight reaching shallow shoreline areas using vegetative buffers and aquatic plants
- Evaluation of a chemical treatment by targeting problematic species of algae

Springfield City Utilities and the Watershed Committee of the Ozarks (based in Springfield) are working on these different strategies.

A location map of McDaniel Lake may be found below, followed by a table summarizing data from McDaniel Lake and graphs showing the relationship between phosphorus and chlorophyll-a in the lake.

McDaniel and Fellows Lakes in Greene County, north of Springfield, Missouri



Nutrients, Chlorophyll-a, and Secchi Depth in McDaniel Lake, 1989-2002

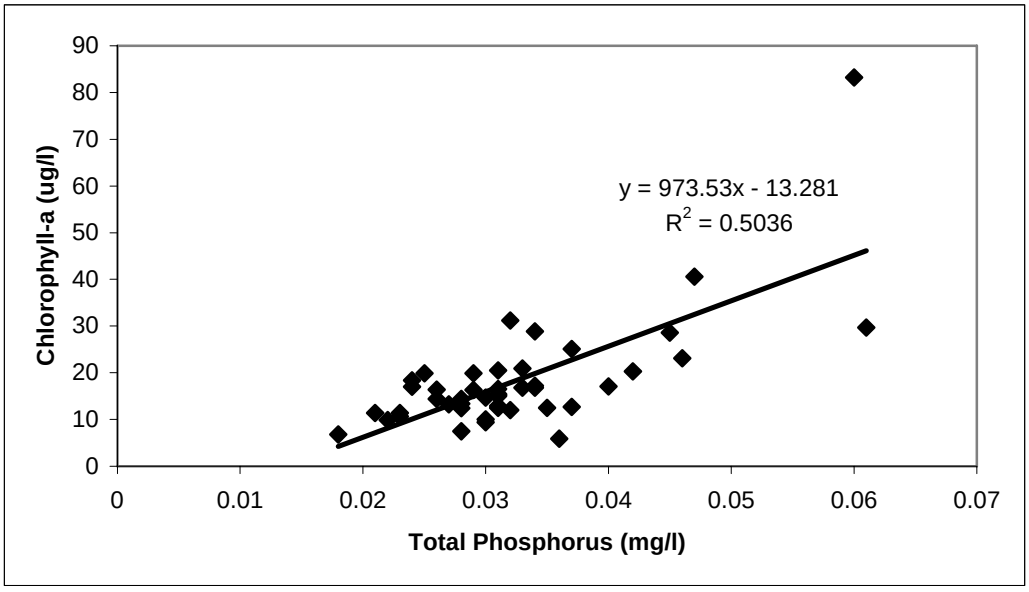
	Average	Maximum	Minimum	Standard Deviation
Total Nitrogen (mg/l)	0.483	0.95	0.27	0.119
Total Phosphorus (mg/l)	0.035	0.082	0.014	0.011
Chlorophyll-a (µg/l)	19.9	106.9	3	13.96
Secchi depth (m)	1.53	3.4	0.8	0.418

Sources: Springfield City Utilities and University of Missouri, Columbia

Secchi depth measures the clarity of a lake. The higher the number (of meters), the deeper one can see down into the lake. Increased suspended algae cloud the water (and make it green), thus decreasing Secchi depth.

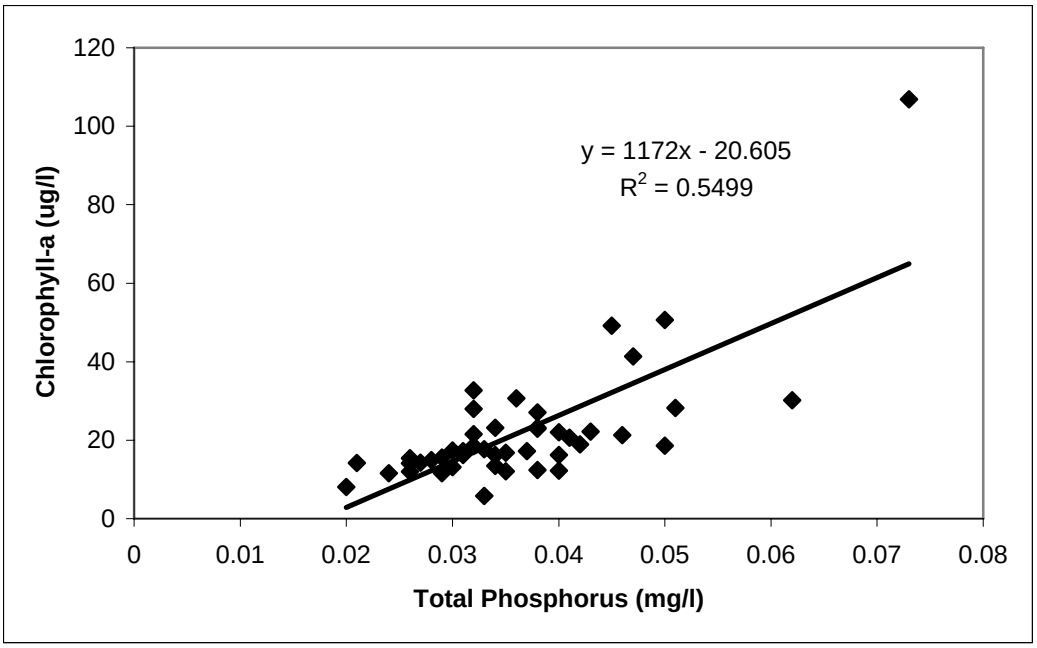
The next two graphs illustrate that, in general, chlorophyll-a increases as the concentration of phosphorus increases.

Graph of surface Chlorophyll-a concentrations vs. total phosphorus concentrations in McDaniel Lake, 1989-2002



Source: University of Missouri, Columbia

Graph of subsurface Chlorophyll-a concentrations vs. total phosphorus concentrations in McDaniel Lake, 1989-2002



Source: University of Missouri, Columbia

For more information call or write:
Missouri Department of Natural Resources
Water Protection Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-1300 office
(573) 522-9920 fax
Program Home Page: www.dnr.mo.gov/env/wpp/index.html