Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Big Bottom Creek

Water Body Segment at a Glance:

County: Ste. Genevieve
Nearby Cities: Rocky Ridge
Length of impaired segment: 1.9 miles
Pollutant - length of impairment within segment:
Low Dissolved Oxygen - 1.7 miles
Ammonia - 0.5 mile
Organic Sediment - 0.5 mile
Source: Lake Forest Subdivision WWTP
Water Body ID: 1746


State map showing location of watershed

Scheduled for TMDL Development: Established by EPA 2010

Description of the Problem

Designated Beneficial uses of Big Bottom Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Human Health Protection (Fish Consumption)

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

- The Missouri Water Quality Standard, or WQS, found in 10 CSR 20-7.031 Table A, the criterion for dissolved oxygen, or DO, in streams is a minimum of 5 mg/L (milligrams per liter or parts per million).
- The criteria for ammonia are found in the WQS at 10 CSR 20-7.031. These values are taken from Table B3 and vary with water temperature and pH. At typical temperatures and pH values, the chronic criterion[1] for ammonia would be 1.5 mg/L in the summer and 3.1 mg/L in the winter. The acute criterion at 7.8 pH for cool and warm-water fisheries is 12.1 mg/L.
- The standards for organic sediment may be found in the general criteria section of the WQS at 10 CSR 20-7.031(3)(A), (C) and (G). Here it states:

[1] Acute criteria apply to short exposures to toxic conditions that aquatic creatures can survive without harm. Chronic criteria apply to conditions producing adverse effects of aquatic life or wildlife following long term exposure but having no readily observable effect over a short time period. Chronic criteria are much lower than the acute criteria.

(A) 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.
(C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
(G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

Background information and water quality data

The department made visual inspections of Big Bottom Creek below the Lake Forest Estates Subdivision wastewater treatment plant, or WWTP, in 1995 and 2001 during summer low flow conditions. These inspections showed a scarcity of aquatic life. In addition, almost all of the life forms that were present are known to be tolerant of pollution. These conditions are characteristic of streams impacted by pollution from wastewater (or organic pollution). Additional data were gathered by the department in 2005, 2006 and 2008 and by a contractor (RTI) in 2009 to develop the TMDL. The impairments are based on these data.

Low Dissolved Oxygen

Wastewater is often high in biochemical oxygen demand, which reduces the amount of dissolved oxygen in the stream. Most aquatic organisms require high levels of oxygen to survive. For dissolved oxygen, if more than 10 percent of measurements in a water body fail to meet the water quality criterion, that water body is judged to be impaired. In the case of Big Bottom Creek, 16 of 31 samples (51.6 percent) did not meet the water quality criterion (Figure 1).

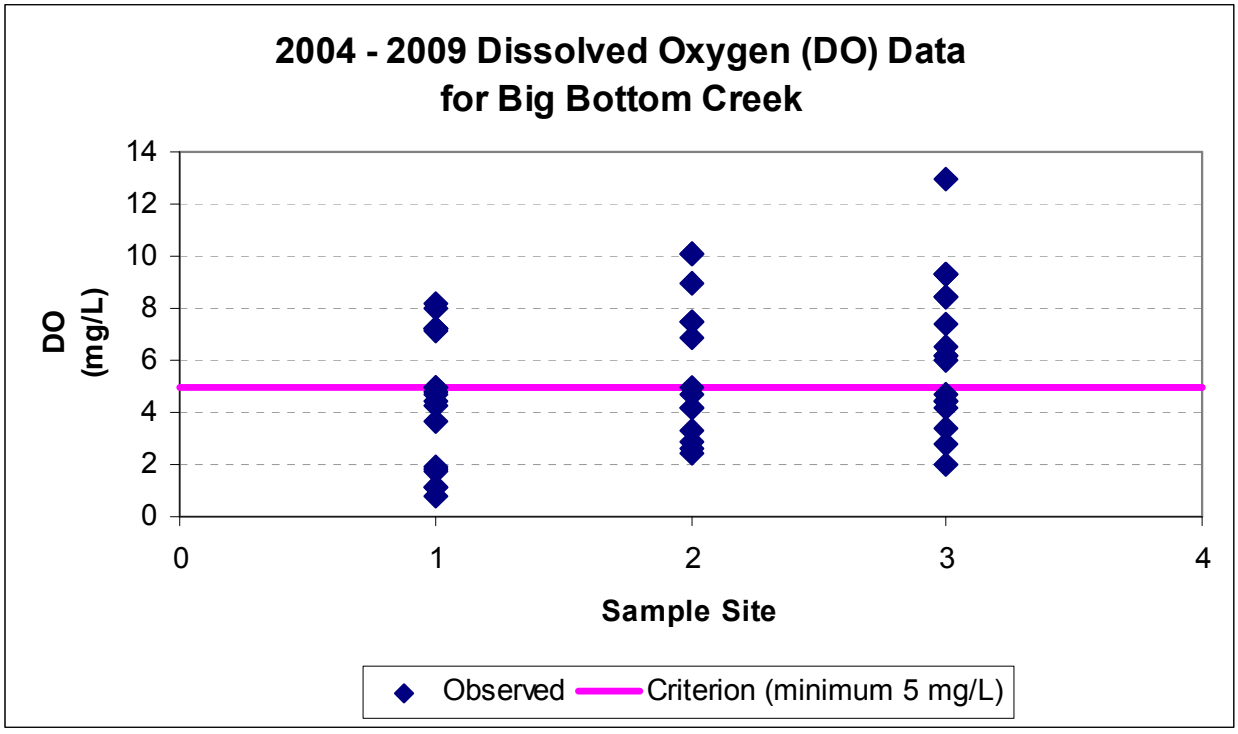


Figure 1

Ammonia

In addition, ammonia is a common by-product of wastewater treatment and, under certain conditions, can be toxic to aquatic life. A water body is judged to be impaired if chronic or acute numeric criteria are exceeded on more than one occasion during the last three years for which data is available. The chronic criterion for ammonia was exceeded in all six measurements gathered in 2004-2006 just downstream (Site 1) of the Lake Forest lagoon (Figure 2). Given that the discharge is from a lagoon and the data were collected during stable low flow conditions, it is likely that these high levels of ammonia can persist for 30 days or more in this stream. Thus, a 0.5-mile segment of Big Bottom Creek immediately below the Lake Forest lagoon was judged to be impaired by ammonia. However, in 2009, none of the eight samples collected at Site 1 was above instream criteria.

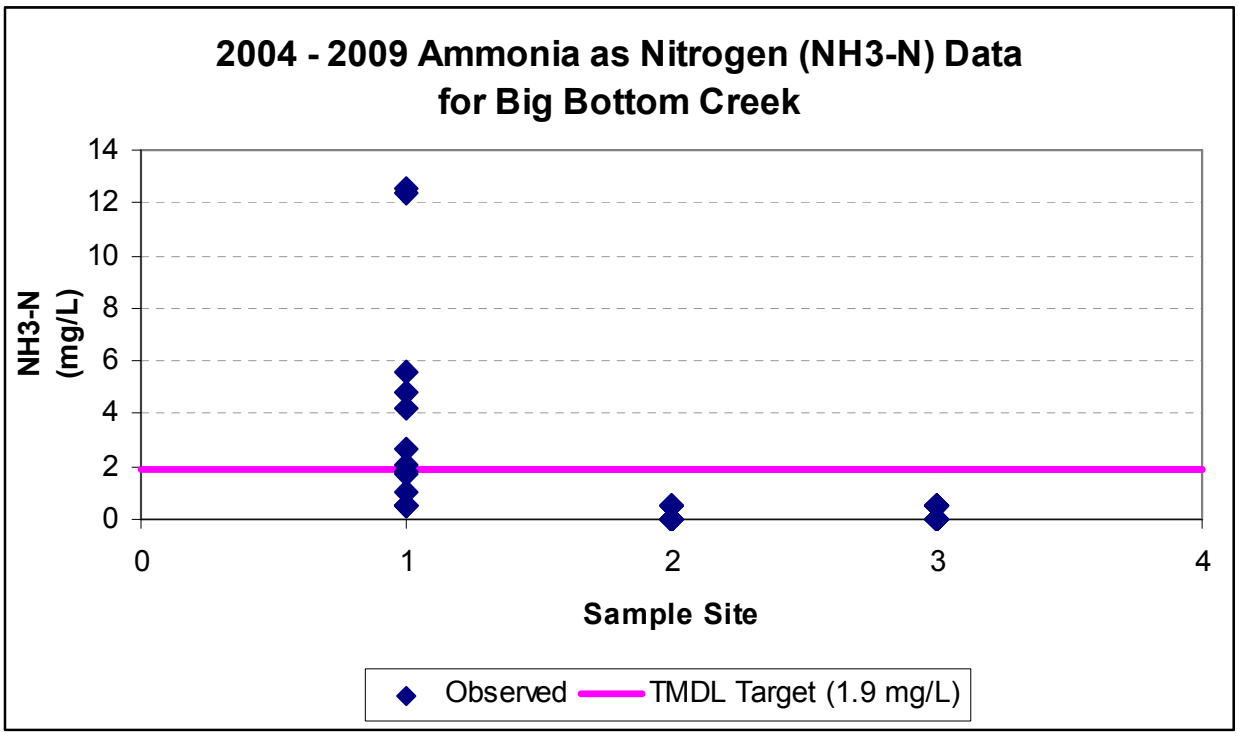


Figure 2

Organic Sediment (formerly identified as volatile suspended solids, or VSS)

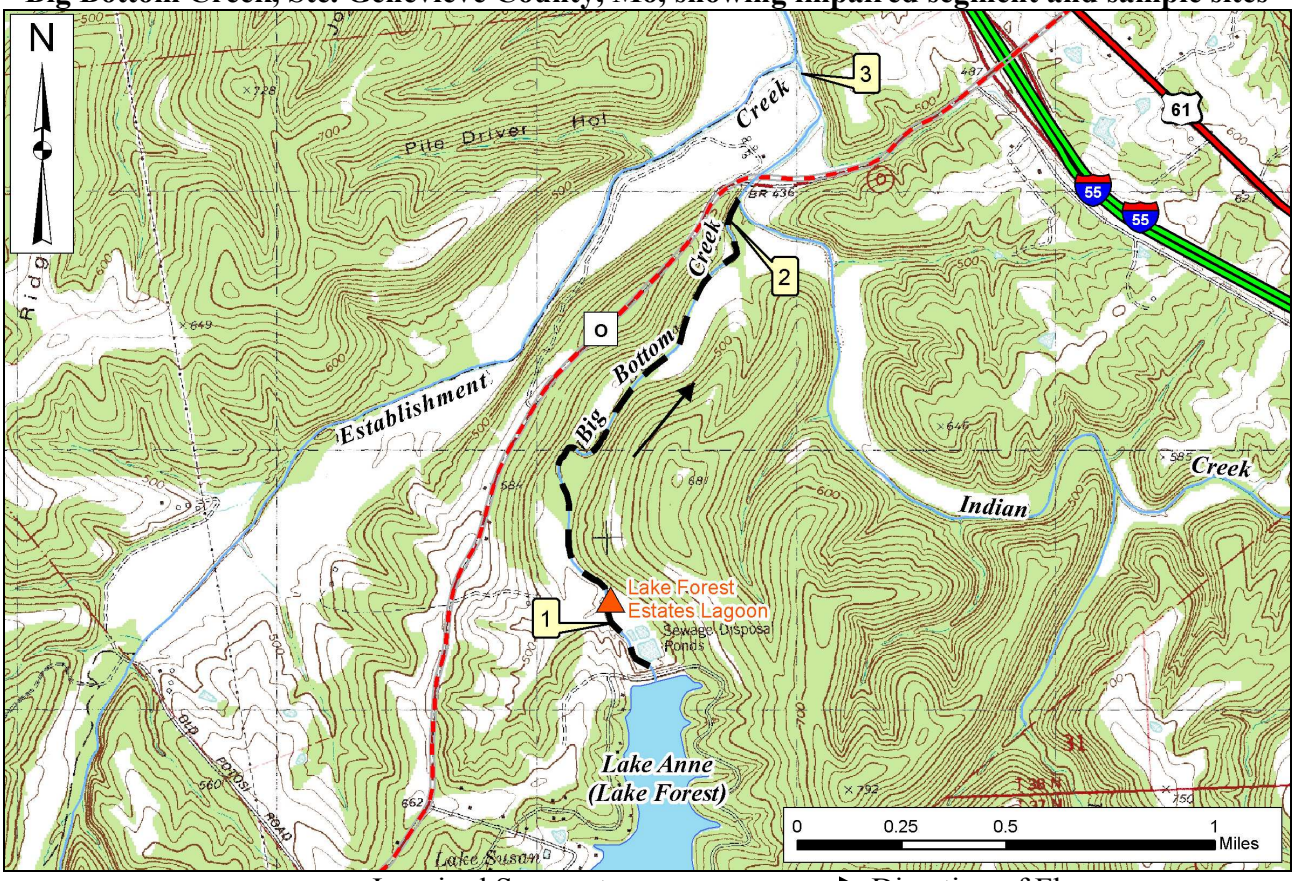
Finally, organic sediment (suspended algae and sewage sludge) can settle onto the bottom of a stream and smother natural substrates (materials in the streambed), aquatic invertebrate animals (like crayfish and water insects) and fish eggs. There are no numeric criteria for organic sediment in the WQS. The 303(d) listing guidelines do allow for quantitative measurements of deposited solids that, if exceeded, would be assumed to exceed narrative water quality standards. At this time, no quantitative measurements of deposited solids have been made. It was recommended that VSS (now organic sediment) be deleted as a pollutant on the 2006 303(d) list. EPA denied the request, saying the department offered no data to show the creek is meeting WQS.

Like all wastewater discharges in Missouri, the Lake Forest WWTP has to meet the requirements of a discharge permit issued by the department. To correct the problems mentioned above, changes were made to the discharge permit in 200?? to improve the quality of the wastewater discharge improve water quality in Big Bottom Creek. The WWTP was upgraded in 2003 to meet these new

permit limits and went online December 2004. More water chemistry data were collected in 2005 and 2006 to monitor the effect of the upgrades. These data show that the stream was still not meeting water quality standards. More data were collected in 2009 to develop a TMDL, another wasteload allocation was calculated and the permit was reissued.

The U.S. Environmental Protection Agency, or EPA, established this TMDL Oct. 26, 2010. It calculates wasteload allocations for ammonia, biochemical oxygen demand (to address the low dissolved oxygen impairment) and total suspended solids, total nitrogen and total phosphorus (to address the organic sediment problem).

Big Bottom Creek, Ste. Genevieve County, Mo, showing impaired segment and sample sites



Impaired Segment Direction of Flow

Sample Sites
1 – Big Bottom Cr. just bl. Lake Forest Lgn
2 – Big Bottom Cr. just ab. Indian Cr.
3 – Big Bottom Cr. nr. Mouth

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: dnr.mo.gov/env/wpp/index.html