## TMDL FACT SHEET

## TAYLORSVILLE LAKE

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| Project Name: | Taylorsville Lake: Nutrients |
| Location: | Spencer County, Kentucky |
| Scope/Size: | Taylorsville Lake: 3050 acres |
| TMDL Issues: | Point and Nonpoint Sources |
| Data Sources: | Ky. Dept for Environmental Protection - Divi sion of Water (DOW)<br>U.S. Army Corps of Engineers (COE), Louisville District<br>FTN Associates, Ltd., Little Rock, Arkansas (FTN) |
| Control Measures: | Kentucky Pollutant Discharge Elimination System (KPDES)<br>Kentucky Nonpoint Source TMDL Implementation Plan, Kentucky Watershed Management Framework<br>Kentucky Agriculture Water Quality Act |
| Summary: | Taylorsville Lake was determined not to be supporting the designated use of aquatic life and was therefore included on Kentucky's first 303(d) list (1990) for Total Maximum Daily Load (TMDL) development. The lake is impacted by nutrients, in particular phosphorus, mostly from nonpoint sources (agricultural operations). However, background levels of phosphorus are high because of the soils in the watershed (phosphatic limestone). Point sources of phosphorus are minor relative to nonpoint sources and background. The period of greatest contribution is during runoff events. |

TMDL Development: Total maximum daily loads in pounds per day (lbs/day) were computed based on the model results presented by FTN in its 1998 report on Taylorsville Lake to the COE. The load, in lbs/day, was determined by averaging the seasonal loads for the 4 years that were modeled (1988, 1989, 1993, and 1996) and dividing that value by the number of days in the season: spring (Apr-Jun, 91 days), summer (Jul-Sep, 92 days), fall (Oct-Nov, 61 days), and winter (Dec-Mar, 121 days). Point source contribution was determined by (1) multiplying the observed phosphorus concentration from the Harrodsburg and Lawrenceburg wastewater treatment plants (WWTPs) by the design flows for those plants (93 lbs/day) and (2) adjusting that value by the ratio of the design flow for all point sources to the design flow of the Harrodsburg and Lawrenceburg WWTPs. Estimates of phosphorus loads were not available for any other (small design flows) WWTPs. This result was 100 lbs/day for all point sources. This value does not take into account uptake of phosphorus that may occur between the point source and the lake. Point sources were not considered for reduction because this value of design load (100 lbs/day) represents a minor contribution when compared to other sources of phosphorus. In addition, the two major point sources are located approximately 15 and 45 miles upstream of the headwaters of the lake and are unlikely to contribute to lake conditions. As these facilities expand in the future, phosphorus removal is likely to be imposed in order to improve local stream conditions. In February 1999, the city of Lawrenceburg requested effluent limits for an expansion of its facility, and the Division of Water issued a total phosphorus limit of 1 mg/L.

Reducing background loads was also not considered feasible for any season. Because the flushing period was short (100 days) and because of limited opportunity for plankton growth, the winter season was not included in phosphorus reduction scenarios. A decrease in phosphorus loading above existing conditions should occur during the winter with the implementation of best management practices (BMPs). Targeted reduction from nonpoint sources for the spring and summer is 50 percent, 10 percent being the Margin of Safety (MOS) and 40 percent being the value deemed necessary to achieve a significant improvement in water quality of the lake based on the modeling results. For the spring and summer periods, a 50-percent reduction in phosphorus resulted in a 10-14 point change in the Trophic State Index (TSI) during average and wet years and a 15-25 unit change during the dry year at the headwater location of the lake. At the lower and middle locations of the lake, a 50-percent reduction in phosphorus resulted in a 10-12 unit change in the TSI. Because of overturn, which occurs in early October, hypolimnetic phosphorus released from the sediments under stratified anoxic conditions mixes into surface waters. During the fall (Oct-Nov), the external load of phosphorus is of less concern than this internal load. Therefore, quantifying the improvement in water quality during this period is difficult. However, the model results indicate that a 50-percent reduction in phosphorus loading to the lake resulted in a shift in the relative abundance of blue-green algae and an increase in the abundance of diatoms (FTN, 1998).

**Summary of Total Maximum Load Allocations by Season and Corresponding Daily Load:**

| Season | Inflow TP Load lbs/day | Point Sources lbs/day | Background lbs/day | Nonpoint Sources lbs/day | Margin of Safety lbs/day |
|---|---|---|---|---|---|
| Spring Apr-Jun | 701 | 100 | 358 | 103 | 140 |
| Summer Jul-Sep | 207 | 100 | 97 | 0 | 11 |
| Fall Oct-Nov | 379 | 100 | 186 | 17 | 76 |
| Winter Dec-Mar | 1,850 | 100 | 443 | 1,307 | --- |

Waste Load Allocations (WLAs) are shown under the column heading of 'Point Sources.'
Load Allocations (LAs) are the summation of "Background" and "Nonpoint Sources."
Margins of Safety (MOS) are shown under the heading "M argin of Safety."

Point Sources were determined as follows: (1) 93 lbs/day for design flow of 4.58 mgd for the Harrodsburg and Lawrenceburg WWTPs; (2) design flow of all permitted dischargers in the watershed is 4.84 million gallons/day (mgd); and (3) 93 lbs/day multiplied by the ratio of 4.84/4.58 equals 98.2 lbs/day, which was rounded up to 100 lbs/day.

The allowable nonpoint source loading for spring and fall was based on reducing the total phosphorus loading by 50 percent. This reduction has two components: (1) the targeted reduction is 40 percent; and (2) the Margin of Safety (MOS) is 10 percent. The allowable nonpoint source loading for the summer period was also based on reducing the total phosphorus loading by 50 percent. The reduction has two components: (1) the targeted reduction is 40 percent; and (2) the MOS is 2.6 percent because there is a limited amount of load during the summer period that does not allow for an MOS greater than 2.6 percent.

Implementation Controls:

This will be a phas ed TMDL because of the presence of nonpoint sources of pollution on all of the stream reaches listed. A phased TMDL is necessary when the efficiency of remedial activities is unknown. Remedial activities will need to be implemented, and follow-up monitoring will need to be conducted. If water quality standards are still not being met upon review of the data from the follow-up monitoring, the remedial activities will need to be modified. To assist in developing a remediation strategy, the

Kentucky Watershed Management Framework (KWMF) will be utilized in conjunction with plans developed as required by the Kentucky Agriculture Water Quality Act (KAWQA). As part of the KWMF, a Salt River Basin Team, under the leadership of a basin coordinator, has been formed to carry out certain recommended activities. One of these activities is to identify and help develop a local watershed task force. With assistance from the various participating agencies, the river basin team, and the basin coordinator, the local task force will develop a Local Action Plan, particularly for streams impacted by nonpoint source pollution. The Local Action Plan will be the document that describes needed remediation and how implementation will be achieved. The Kentucky Agriculture Water Quality Plans will be an integral part of the Local Action Plan. The Local Action Plan will be developed in the fourth year (2002) of the five-year watershed cycle, and implementation will occur in the fifth and succeeding years of the cycle.

Remedial actions for nonpoint sources of pollution will be taken based on the establishment of BMPs as described in the Kentucky Agriculture Water Quality Plan (KAWQP) of 1996 (KAWQA, 1996). Private landowners of 10 acres or more that conduct agricultural operations (including silviculture) must develop and implement a water quality plan (based on guidance from the KAWQP) for their agricultural operation by October 23, 2001. To assist landowners in developing their plans, the KAWQA has developed the Producer Workbook (KAWQA, 1997). It provides a step-by-step process for developing plans and lists contacts at various state and federal agencies that can provide the technical assistance necessary to develop and implement plans.

Conclusions from the DOW report (1993) state that nonpoint runoff from land used for agricultural operations is the major source of phosphorus to the streams which feed into Taylorsville Lake. Channel erosion may be a contributor as well. This analysis leads to the recommendation to implement land-management practices to reduce erosion and to create riparian zones along stream channels. The FTN report (1998) notes that projects in close proximity to the lake will have the most benefit. These actions would have the greatest impact in reducing phosphorus concentrations in the streams feeding Taylorsville Lake. The Kentucky Watershed Management Framework will be the instrument by which the implementation plans within the basin are addressed.

*The Upper Salt River/Taylorsville Reservoir Watershed Demonstration Project*

Summary: In 1991, the DOW applied for and received Section 319(h) Nonpoint Source Implementation Grant funds for the Upper Salt River/Taylorsville Reservoir (USR/TR) Watershed Demonstration Project. Grant funds were requested to support water quality monitoring in this priority nonpoint source watershed. Funding for agricultural BMP application and implementation was secured through several U.S. Department of Agriculture (USDA) programs.

Types of BMPs: The types of BMPs implemented and planned for the USR/TR watershed are agricultural in nature. Both animal waste and agronomic (cropping) BMPs have been implemented. Controlling manure runoff from the numerous dairies in the watershed and controlling erosion from various types of farming activities were prioritized. The BMPs included (1) animal waste

management (containment, application, etc.), (2) intensive rotational grazing, (3) integrated pest management, (4) riparian area establishment, (5) buffers, (6) no-till crops, and (7) numerous other types of animal waste and agronomic practices.

Past Funding**:** The USR/TR Watershed Demonstration Project received federal agricultural BMP cost-share funding through several USDA programs:

- Hydrologic Unit Area Water Quality Project: 5 years of dedicated funding.
- Agricultural Conservation Program: annual cost-share allocation to counties.
- Water Quality Incentive Project: special one-time cost-share allocation to project.

Future Funding**:** State and federal cost-share funds for agricultural BMPs will continue to be targeted in the USR/TR watershed.

Water Quality Monitoring: Three types of monitoring were conducted in the upper Salt River basin for the USR/TR Watershed Demonstration Project: (1) bacteriological, (2) biological, and (3) physicochemical. The purpose of the monitoring was to collect pre- and post-BMP water quality data in order to document changes in water quality associated with intensive BMP application. Pre-BMP bacteriological monitoring and one year of post-BMP monitoring have been completed. The second round of post-BMP bacteriological monitoring was completed in 1999 in conjunction with biological monitoring in the Salt River basin as part of the Kentucky Watershed Management Framework. A copy of the most recent study plan for the Salt River water quality monitoring project is available through the DOW. Pre- and post-BMP biological monitoring have been completed. Pre-BMP monitoring was conducted as part of the upper Salt River Intensive Survey that was

conducted in 1996. Post-BMP biological monitoring consisted of collecting fishes and macroinvertebrates from three sites. The samples have been identified, and analysis of the data is underway. Post-BMP physicochemical monitoring was completed through a Memorandum of Agreement with the United States Geological Survey (USGS). Monthly high-flow samples were collected from the USGS gaging station on the Salt River at Glensboro, Kentucky. Post-BMP physicochemical monitoring has been completed. This data will be used to assess the post-BMP nonpoint source pollution loads (particularly phosphorous) in the upper Salt River.

Other Focused Projects/Initiatives: Two other projects (Riparian Area Project and Constructed Wetland Evaluation) focused in the watershed resulted in additional BMP applications.

Evaluation of Constructed Wetlands for Animal Waste (Phase II) : The study was designed to use constructed wetlands for treating animal wastewater arising primarily from milking facilities. This study resulted in one constructed wetland implemented in the upper Salt River watershed (Mercer County). The project is complete, and the final report is under development by the contractor. Information on this project is available from the DOW on request.

Riparian Area Project: The project final and close-out reports are available from the DOW. The DOW closed this project because the contractor could not meet the minimum requirement to have BMPs on the ground in time for the DOW to establish a monitoring project. Ten demonstration sites were established within the watershed: two in Boyle County, three in Mercer County, one in Shelby/Spencer County, and two in Nelson County. The Shelby/Spencer cooperator dropped from the project in 1997. Approved BMPs were recommended for each farm on a site-specific basis. A DOW biologist visited each demonstration site

and evaluated each site for monitoring potential. Only one site in ten was deemed by the biologist to be suitable as a monitoring site, but the producer/cooperator at that site chose not to participate in the project. No water quality monitoring was done. However, several BMPs were implemented in the project watershed, one on each of three farms in Anderson, Boyle, and Mercer counties. A more detailed explanation of the BMPs that were implemented is available from the DOW.

The Division of Conservation (DOC) works with local conservation districts in the counties of the Taylorsville Lake area. Unfortunately, funding to establish BMPs is limited. The DOC has, over the past five years, received 102 requests for cost-share assistance. Because of limited funding, however, the DOC has been able to approve only 14 applications for a total amount of $82,000 (Coleman, DOC, written commun., 2000).