Burches Run Lake, West Virginia

Total Maximum Daily Loads
for
Phosphorous and Sediment

Established by
The Environmental Protection Agency, Region III

September 30, 1998

TOTAL MAXIMUM DAILY LOAD
BURCHES RUN LAKE, WEST VIRGINIA

Introduction

The West Virginia Division of Environmental Protection (DEP) listed the Burches Run Lake (stream code #O(L)83-C-(1)) on its 1996 Section 303(d) list due to metals, nutrients, and siltation from agriculture and domestic sewage. Since the time of the 1996 303(d) list, DEP has determined that the lake is not impaired due to metals, and will not be including this pollutant on the 1998 edition of the 303(d) list. A summary of the available metals data from Burches Run, included with the technical Total Maximum Daily Load (TMDL) development report, supports DEP's decision to remove metals as a cause of impairment. These TMDLs presented here address nutrients and siltation, the two remaining causes of impairment.

To develop these TMDLs, EPA used two computer models. The Hydrologic Simulation Program Fortran (HSPF) was used to simulate the runoff of pollutants from the watershed, the delivery of those pollutants to the stream channels, and the routing of the pollutants to the lake. The Environmental Fluid Dynamics Code (EFDC) was used to simulate the transport and fate of the pollutants once they were delivered to the lake. The models were then run with reduced pollutant loads until water quality standards were met.

EPA is establishing a TMDL for phosphorous to address the nutrient impairment. Based on previous studies of Burches Run Lake and similar lakes in West Virginia, EPA determined that phosphorous is the limiting nutrient[1] in the lake, and thus a TMDL for phosphorous, in lieu of other nutrients, is adequate to control the eutrophication problem. For siltation, EPA is establishing a TMDL for the amount of sediment that enters the lake. Table 1 summarizes the TMDLs and the component wasteload (WLA) and load allocations (LA) needed to meet the TMDL.

[1]Algae require inorganic carbon, nitrogen, phosphorous, silica, and various trace elements in the presence of light in order to grow. The ratio of these nutrients to each other falls into a known range depending on the age of the algae and species composition. If the quantity any one of the nutrients is too low, falling outside the range of ratios, the algae will not grow. In other words, a single nutrient—known as the limiting nutrient—can control algae growth.

Table 1. Summary of TMDLs (lb/day)[a]

PARAMETER	WLA	LA[b]	MOS	TMDL
Phosphorous	0	0.95	implicit	0.95
Sediment	0	1793	implicit	1793

TABLE NOTES:

a. The TMDL technical development report expresses the phosphorous and sediment loads on an annual basis. For the purpose of this table, and consistency with previous TMDLs, EPA has divided those values by 365 days to arrive at daily loads.

b. The load allocation is the sum of the loads from several categories of nonpoint sources. The separate allocations are shown below in the discussion of WLAs and LAs.

EPA developed these TMDLs consistent with statutory and regulatory requirements and EPA policy and guidance. The Burches Run Lake TMDL addresses the following seven regulatory elements:

1. Water quality standards.

These TMDLs ensure that Burches Run Lake will meet the applicable water quality criteria for nutrients and siltation, thus ensuring that the water supports its designated use. West Virginia has only narrative criteria related to nutrients and siltation.

For the nutrient TMDL, EPA has elected to use chlorophyl-a as a surrogate indicator of eutrophication. A value of 15 μg/l, which represents the low end of a range of published acceptable values, was selected as the specific endpoint. The phosphorous load, therefore, was reduced to the point where chlorophyl-*a* was below 15 μg/l. The endpoint for the iron TMDL is the numeric criteria: 1.5 mg/l.

For siltation, selecting an endpoint to represent attainment of standards is more difficult. Impoundments such as Burches Run Lake, by their nature, are subject to siltation. The challenge is to select a rate of siltation that is reasonable, recognizing that a significant amount of siltation is inevitable. For this TMDL, EPA determined, based on best professional judgement, that an appropriate indicator of standards attainment was a sedimentation rate that would result in 30% of the depth being preserved (70% reduced) after 40 years. At the existing rate of siltation, 70% of the capacity would be reduced in only 32 years.

The bathymetry of Burches Run Lake, including information such as mean depth, is not well documented, making the fate of sediment delivered to the lake difficult to predict. As a result, we have chosen to evaluate attainment of standards at a location adjacent to an inlet of the lake rather than over the lake as a whole. In other words, we are evaluating the indicator of standards attainment (30% preservation of depth after 40 years) at an inlet of the lake rather than applying the indicator to the mean lake depth. This TMDL, therefore, insures that 30% of the depth of an inlet cell is preserved after 40 years. This is a conservative approach; sediment tends to accumulate faster in inlet areas than elsewhere in the lake, and thus evaluating siltation at an inlet provides a margin of safety.

EPA believes the TMDLs and the associated pollutant reductions are reasonable and implementable. A number of best management practices—both structural and non-structural—can significantly reduce sediment loads. For instance, maintained vegetated buffer strips along stream channels (in this case, the tributaries draining to Hurricane Lake) have been shown to capture a significant amount of sediment. The vegetation also helps reduce stream bank erosion. Recent estimates of the trap efficiency of buffer strips range from 70% to 90%.[2] Many of the same management practices that reduce sediment loss also reduce phosphorous and iron because a large proportion of these pollutants are bound to soil particles. On agricultural lands, terracing, contouring, and conservation tillage have been reported to reduce sediment-associated phosphorous by 50% to 90%.[3]

2. Waste load allocations and load allocations.
There are no point sources contributing to the nutrient and siltation problems in Burches Run Lake, and thus the wasteload allocations are zero.

The TMDLs do include load allocations (LA) for nonpoint sources. The overall load allocation is broken down into allocations from the most significant categories of nonpoint sources. Table 2 summarizes the LAs.

Table 2. Load Allocations and Needed Reductions (lb/day)

SOURCE	PHOSPHOROUS		SEDIMENT	
	Allocation	% Reduction	Allocation	% Reduction
Agriculture/Pasture	0.536	40	751.7	30
Urban	0.003	35	6.4	30
Forest	0.402	10	1019	10
Barren	0.014	0	25.1	0
TOTAL	0.951	30 (area-weighted)	1792	20 (area-weighted)

[2]Qui, Z. and T. Prato, 1998. Economic Evaluation of Riparian Buffers in an Agricultural Watershed. Journal of the American Water Resources Association, Vol. 34, No. 4, pp. 877-890.

[3]Illinois Environmental Protection Agency, 1986. Phosphorous: A Summary of Information regarding Lake Water Quality. IEPA/WPC/86-010.

3. Impacts of background pollutant contributions.

Natural background is included as a component of the load allocations. The phosphorous and sediment loads associated with each land use category include the naturally occurring as well as human-induced contributions. The model was calibrated (i.e., adjusted so that the model predictions matched measured values) to water quality data that represents the cumulative impact from all sources—naturally-occurring and human-induced combined.

4. Critical conditions.

The critical conditions for phosphorous are not easily defined. In terms of the water quality impact of phosphorous, the critical conditions occur during the warmer times of the year that favor eutrophication. However, in terms of phosphorous loading, the critical conditions occur throughout the year during wet-weather events that transport the nutrient to the lake. By using a continuous simulation model in developing these TMDLs, we have accounted for all possible critical conditions, both in terms of loading and water quality.

The critical conditions for siltation are also difficult to precisely define. In terms of the water quality impact of siltation, there is no single critical period; siltation negatively impact the lake regardless of when it occurs. In terms of sediment loading, the critical conditions occur during wet-weather events when the greatest amount of sediment is delivered to the lake. As is the case with phosphorous, the use of a continuous simulation model in developing these TMDLs accounts for all possible critical conditions, both in terms of loading and water quality.

5. Seasonal variation.

These TMDLs appropriately consider seasonal variation. By using a continuous simulation model that simulates loading and water quality throughout an entire year, we have explicitly considered all seasonal variation.

6. Margin of safety.

The Clean Water Act and federal regulations requires TMDLs to include a margin of safety (MOS) to take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. EPA guidance suggests two approaches to satisfy the MOS requirement. First, it can be met implicitly by using conservative model assumptions to develop the allocations. Alternately, it can be met explicitly by allocating a portion of the allowable load to the MOS.

We have employed the implicit approach to satisfying the MOS requirement in these TMDLs by using conservative assumptions in the modeling process. First, the allocations and associated reductions are based on comparisons with the loads simulated for 1990. Of the four years over which the model was run, 1990 had the highest loads. By prescribing reductions based on a high-load year, we have ensured that water quality standards will be met in high-load years and, with a margin of safety, in typical years with lower loads. Second, this TMDL ensures that the indicator of water quality standards (preservation of 30% of the depth after 40 years) is met at a lake inlet rather than over the entire lake. As discussed above, this approach is necessary because of significant uncertainty in the geometry of the lake as a whole. However, sediment tends to accumulate faster in inlet areas than elsewhere in the lake, and thus this approach bolsters the margin of safety.

7. Public participation

EPA published and requested comments on the proposed TMDLs on July 2, 1998 in the Charleston Gazette and six other newspapers across the state. EPA held a public meeting on July 16, 1998 in Parkersburg, West Virginia. In addition, EPA requested comments from United States Fish and Wildlife Service and no comments were received. EPA did not receive comments from any individuals and organizations specifically for Burches Run Lake.

FINAL AGENCY ACTION

W. Michael McCabe
Regional Administrator
EPA Region III

OCT 0 1 1998
Date