Spokane River Dissolved Oxygen TMDL

Modeling Questions

September 26, 2005

At this point, four key questions relating to the TMDL model have been identified for further follow-up. They are listed below in order of timing to evaluate.

1. River Flow Augmentation Scenarios
2. Variability of Phosphorus Inputs During Critical Season
3. Nonpoint Source Pollution Inputs from Hangman (Latah) Creek
4. Sediment Oxygen Demand sensitivity analysis

1. River Flow Augmentation Scenarios

Conduct the following stream flow runs:

- 600 and 800 cfs at Post Falls with the existing operations at Lake Coeur d'Alene.
- 600 and 800 cfs at Post Falls with a delayed draw-down of Lake Coeur d'Alene (draw-down of Lake Coeur d'Alene on Sept. 30 instead of the current right after Labor Day).

Background: The Draft TMDL for Dissolved Oxygen and Ammonia was modeled using the lowest river flow experienced during the critical season. This flow is calculated based on historic data and is commonly referred to as the "7Q10" low flow. There may be an opportunity to increase river flows during the critical season by releasing additional water from Lake Couer d'Alene. Additional flows may provide better habitat and temperature in the Spokane Valley and may provide additional assimilative capacity for nutrients without exceeding dissolved oxygen requirements.

2. Variability of Phosphorus Inputs During Critical Season

Since we have determined that the Spokane River can safely assimilate only a limited number of pounds of phosphorus during the critical season (April through October) in order to meet dissolved oxygen requirements, does it make any difference if the phosphorus loading varies significantly (daily, weekly, or monthly) during the critical season, so long as the total estimated loading capacity in pounds over the course of the 7-month critical season is not exceeded?

If there are differences, can we establish ranges or limits for daily, weekly, or monthly P loading variability that will minimize the impact of such differences?"

Background: Due to climatic conditions it is more difficult to reuse wastewater during spring and fall for irrigation due to cooler temperatures and lower evapotranspiration and nutrient uptake by plants than during the hot part of the summer. Since this is the case, rather than require wastewater treatment plants to maintain the same, continuous low level of P loading during each of the 7 months of the critical season, does it make any difference environmentally (to dissolved oxygen concentrations in Lake Spokane or in the free flowing reaches upstream) if larger P loads from treatment plants are allowed during the spring and fall, with commensurately lower loads during the summer, so that their total loading during the critical season remains the same?

3. Nonpoint Source Pollution Inputs from Hangman (Latah) Creek

An unresolved question is the extent to which a pound of phosphorus entering the Spokane River during the period of November thru May is comparable (in terms of its contribution to algae growth/dissolved oxygen demand) to a pound of phosphorus that enters the river during the June-October period.

This issue is of particular importance, for example, in trying to assess the ecological significance of the relatively large quantities (over 100 pounds per day, on average, according to numbers presented by the Spokane County Conservation District) of phosphorous discharged from Hangman Creek into the Spokane River during the months of April and May. The SCCD numbers show that, on average, the phosphorus releases from Hangman Creek into the river for the months of June through October are at least an order of magnitude lower than the releases in April/May.

In this instance, the basic question is whether a pound of phosphorus discharged from Hangman Creek in the spring is of the same importance as a pound released in the summer.

The Department of Ecology's draft TMDL offers two basic factors that affect the answer to this question.

1) Pollutants such as phosphorus play a role in dissolved oxygen (the criteria on which the TMDL is designed to address) beginning "near April 1st" at the outset of the thermal stratification of Lake Spokane and continuing to late October. (page 5). This factor indicates that phosphorus loading in April/May should be considered.

2) The most sensitive period for Lake Spokane is the summer months when the thermal stratification of the lake is well established and "growing conditions for algae are optimal" due to temperature and dramatically lower stream flows in the river. Algae blooms in the upper reservoir and depressed dissolved oxygen in the middle stratum of the lake are clearly affected by pollutant loading during the June to October growing season. (page 5, page 10). This factor clearly indicates that even in a typical year, the effect of phosphorus entering the river during summer months would be of greater ecological significance.

The work group recognizes that other factors also affect the comparison and, thus, the issue of how to weight (in terms of ecological significance) phosphorous entering the

river at different times of the year. For example, stream flows in the Spokane River are much greater in the spring than they are in the summer months. Thus, fine grain sediments entering the river from Hangman Creek (or any other tributary) in April or May are more likely to flush through the Lake Spokane system than are sediments that enter the lake in the summer months, when stream flows are considerably lower. [Research undertaken by the Spokane County Conservation Service offers a strong indication that fine grain sediments in runoff from fields under cultivation are a primary source of phosphorous loading into Hangman Creek. See Hangman Creek Subwatershed Improvement Project Report, pp. 16-17.]

Yearly flow: The draft TMDL is clear in identifying the low flow year of 2001 as representative of the worst case scenario for dissolved oxygen (DO). However, as the TMDL collaboration process has focused on phosphorus load, the implication of "worst case" could be interpreted differently. Specifically, a worst case scenario for non-point source phosphorus could be a high flow year with significant sediment attached runoff. A wet year with lots of rain to increase sediment runoff could deposit more nutrients in Lake Spokane causing a greater DO problem than a dry year. However, there currently are no solid data to support this possibility.

4. Sediment Oxygen Demand Sensitivity Analysis

Address questions raised by Dr. Eugene Welch re: assumptions about the contribution of Sediment Oxygen Demand (SOD) to lowering of dissolved oxygen in Lake Spokane.