Focus

Dissolved Oxygen in the Spokane River and Long Lake

Issue

The Spokane River and Long Lake exhibit depressed dissolved oxygen (DO) levels during low flow in the summer months. At the same time, most wastewater dischargers along the Spokane River have requested to increase their discharge of wastewater to the river, which can further decrease DO. Maintaining good water quality in the river, especially adequate concentrations of DO, is vitally important for supporting fish, invertebrates and other aquatic life.

Background

Most of the Spokane River violates the Washington State water quality standards for DO during low summer flows, and some segments of the river are listed on the 1998 Clean Water Act (CWA) 303(d) list of impaired water bodies. Total Maximum Daily Loads (TMDLs), also known as Water Cleanup Plans, are required by the CWA to return water bodies on the 303(d) list to a healthy condition. TMDLs established today can also help manage water quality on a watershed scale to prevent the loss of beneficial uses in the future.

A TMDL includes an assessment of the water quality problems; a technical analysis to determine how much pollution must be reduced from all sources to meet water quality standards; the selection and implementation of appropriate control measures; and follow-up monitoring to determine the success of the effort. TMDLs are established for each water quality problem as necessary to protect all designated beneficial uses of the river. Beneficial uses may include swimming, boating, fishing, aquatic habitat and aesthetic value as well as being a source of drinking, irrigation, and industrial water.

TMDLs have previously been established in the Spokane River for metals (lead, cadmium, and zinc) and for phosphorus (a nutrient that feeds plants) to control excessive algae blooms in Long Lake. A TMDL for dissolved oxygen will likely be developed help the river meet water quality standards.

What affects DO levels?

Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. While photosynthesis occurs only during daylight hours, respiration and decomposition continue throughout the night. Therefore, streams with significant plant life can have DO levels that fluctuate greatly over a 24-hour period. DO concentrations also increase in surface water wherever the water flow becomes turbulent, such as in a riffle area, or waterfall. This turbulence brings more water into contact with the air thus increasing the amount of atmospheric gas (including oxygen) that is dissolved into the water. This process is called reaeration.

Temperature, flow, elimination of rapids and riffles, and pollution can all have an impact on the amount of DO in the water. Cold water can hold more dissolved gas, such as DO, than

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warm water. Therefore, during the summer months when stream water is warmer, oxygen can be limited by the ability of the water to "soak up" atmospheric gases. During late summer, stream flows can get very low. When there is less water in a stream, it can heat up more rapidly. It also has less opportunity for reaeration as it moves slowly through areas which were once riffles at higher flows or when it stagnates in reservoirs and then is diverted around waterfalls through hydropower penstocks.

Wastewater discharges and stormwater runoff often carry oxygen-demanding substances (pollution) to streams and lakes. Most conventional pollutants (nutrients, organic matter, and other chemicals) require oxygen for decomposition and/or other chemical reactions. The amount of oxygen required for some of these processes is called the Biochemical Oxygen Demand or BOD. As BOD concentrations increase and if there is a lack of reaeration, the river DO concentration decreases. Nutrients also stimulate algae growth which can contribute to long term DO depletion when dying algae decomposes in the sediment.

Current Situation

A study is in progress to examine river DO and pollution. The study will determine the minimum DO concentrations available during critical conditions in the Spokane River from the Idaho border through Long Lake, and will establish allocations (load limits) for oxygen consuming substances (i.e., it will set limits for BOD). If necessary, the study may also make recommendations to reduce the amount of phosphorus that may be discharged into the river in order to control oxygen demand created by the increased growth and decay of algae.

Sources of Oxygen-Consuming Substances (BOD) and Nutrients:
These substances can come from both point source and nonpoint sources. Point sources are end-of-pipe discharges such as from wastewater treatment plants or stormwater collection systems. Nonpoint sources come from diverse sources where the exact source is usually not easily determined. Some examples include runoff containing fertilizer and pesticides from lawns and croplands, organic debris from forested land, soil erosion, and faulty septic tanks.

Facilities that discharge effluents (point sources) to the Spokane River are required to have a National Pollutant Discharge Elimination System (NPDES) permit. Currently, these permits tell the discharger how much of each pollutant they are allowed to discharge to the river. The NPDES permit limits the amount of BOD, phosphorus and other compounds that can be discharged. For the most part, the current permits have limits that are called technology-based limits, which were to be applied consistently across the country without consideration for water quality. As permits are renewed, limits may become more stringent if it is necessary to protect the beneficial uses of the receiving water.

<u>NPDES permitted facilities along the Spokane River in Washington include</u>:

- Liberty Lake SD Treatment Plant
- Kaiser Aluminum – Trentwood
- Inland Empire Paper (IEP)
- Avista Headquarters (Cooling water discharge only)
- City of Spokane Treatment Plant and combined sewer overflows (CSOs)

A water-quality computer model developed specifically for the Spokane River and Long Lake from recent and past river studies will be used to predict how water quality will be affected by varying types, quantity, and discharge locations of pollution. These predictions will be used to

formulate a TMDL and to set new "waste load allocations" for the point sources and "load allocations" for the nonpoint sources. Once these allocations are set, new permit limits and control measures need to be implemented to achieve water quality standards.

Proposed Timeline:

Dissolved Oxygen Study/Model Report

- January 2002: Ecology's study/model summary report with appended final U.S. Army Corps of Engineers model report distributed for public review.
- March 2002: Distribute Draft Dissolved Oxygen Technical Report and conduct a public workshop to explain the proposed "waste load allocation." The report will be available for public review and comment for 30 days.
- July 2002: Publish final Dissolved Oxygen Technical Report.

TMDL / Waste Load Allocation - Formal Adoption Process

- July 2002: Public workshop to discuss formal adoption of TMDL / "waste load allocation" and potential implementation strategies.
- September 2002: Publish Draft TMDL and implementation plan for public review and comment.
- December 2002: Respond to comments and submit Final TMDL to the U.S. Environmental Protection Agency for approval.

Additional Information:

Check out these websites:

Ecology's Spokane River TMDL Website - http://www.ecy.wa.gov/programs/wq/tmdl/watershed/spokaneriver/index.html

Ecology's Water Quality Homepage - http://www.ecy.wa.gov/programs/wq/wqhome.html

Ecology's TMDL Homepage - http://www.ecy.wa.gov/programs/wq/tmdl/watershed/index.html

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