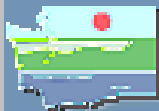


Instream Flows and Water Quality: Spokane River and Lake Spokane

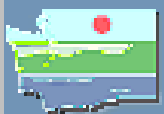
**Drea Traeumer, Hydrologist
August 28, 2007**



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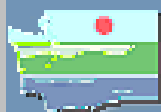
Overview

- **Hydrology**
- **Dissolved Oxygen/Total Phosphorus**
- **Temperature**
- **Sediment Transport**



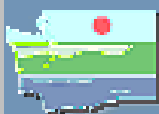
Spokane River Hydrology

- **Lowest Flows generally occur August/September**
- **It has been estimated Spokane River loses 120 cfs downstream of Post Falls gauge**
- **Trend in 7Q10 low river flows 1900 – 2000 suggests groundwater inflows to river have been decreasing**
- **Apparent decreasing trend in low river flows indicates system may provide less dilution for pollutants in future**



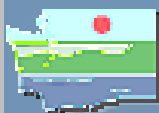
Lake Spokane Dissolved Oxygen

- **Increased algal growth stimulated by nutrient loading (TP, CBOD, NH₃)**
- **Excessive algal growth causes decreases to DO due to plant respiration and decay of organic material**
- **Algal growth exacerbated when surface temperatures high and inflows (and corresponding flushing rates) are low**
- **Greater residence time allows for greater phosphorous assimilation from algal growth**



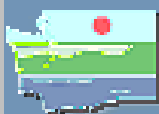
Lake Spokane Hydrodynamics and Effects on Algal Productivity

- **Spring and early summer: lake is mostly mixed due to high inflows from river**
- **Algal blooms occur in lower lake near dam because residence time in upper lake is too short due to high inflows**
- **Late August to early September: lake is thermally stratified**
- **Peak algal blooms occur in upper lake because residence time is longer due to lower inflows**

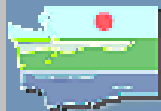


Lake Spokane Interflow

- **Stratification creates complex mixing regime**
- **Inflows are partially separated from hypolimnion and epilimnion, and travel through an interflow zone in the metalimnion**
- **Interflow follows path to the penstock tube openings in Long Lake Dam**
- **Interflow is caused by density difference between inflow groundwater and receiving lake water**



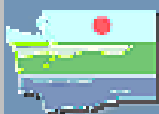
Interflow Zone Simulation



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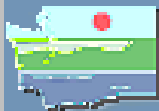
Interflow Effects

- **Decreases the flushing effect in epilimnion (i.e. longer residence time)**
- **Also mitigates effects of higher summer inflow TP concentrations by reducing mixing with the epilimnion**
- **Effects may be converse if no interflow (i.e. no density difference between inflow and receiving water)**



Spokane River DO TMDL

- **2001 measured flows used ~ 7Q10 low flows**
- **Mean August low flow 240 cfs at Post Falls gauge**
- **DO criterion met in river with exception losing reach during hottest part of year upstream Sullivan Rd. where flows dropped to below 100cfs**
- **Maintaining higher minimum flows around 700 cfs can significantly reduce TP and algal productivity.**

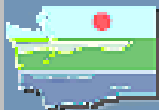


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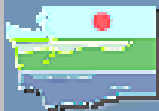
Temperature

- **Limited data**
- **Modeling issues raised**
- **Unable to draw conclusions**

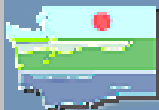


Sediment Transport

- **Unable to draw conclusions at this time**
- **Coeur d'Alene Lake Management Plan**



Thank you



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