Big Eau Pleine Flowage Winter Runoff Study

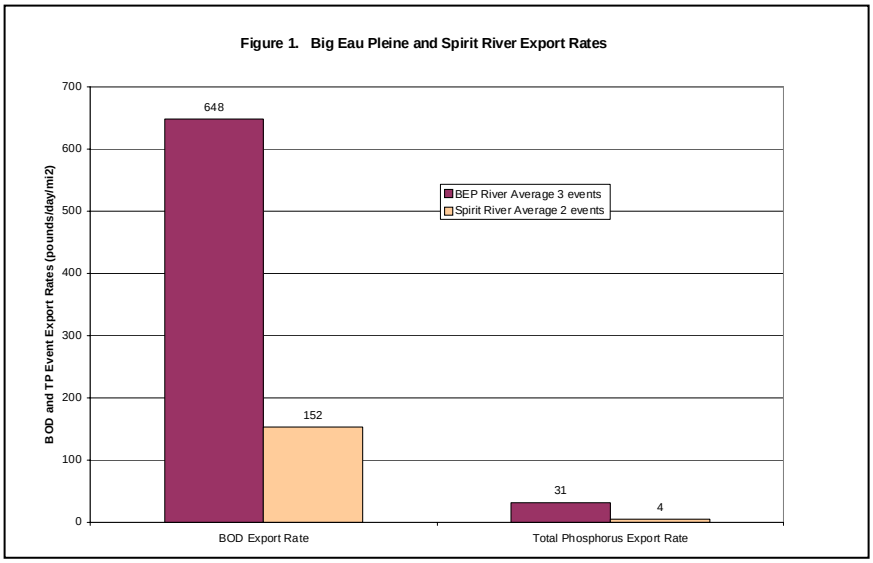
1/6/2009

Big Eau Pleine Flowage – 2005 Fish Kill

Background: Winter runoff from agricultural watersheds can deliver high concentrations of organic matter, nutrients and bacteria to surface water during snowmelt and/or winter rainfall events. The Biochemical Oxygen Demand (BOD) in manure from agricultural runoff can deplete dissolved oxygen levels under the ice which can cause fish kills in flowages. BOD is defined as the amount of dissolved oxygen required by micro organisms for the aerobic decomposition of organic matter present in water. Winter runoff high in BOD was delivered to the Big Eau Pleine Flowage from the watershed in a 2005 winter runoff event. During ice out in April, little oxygen and dead fish were found throughout much of the flowage.

Methods: The Big Eau Pleine Flowage and major tributaries were monitored during the winter and early spring months in 2006 and 2007. The Spirit Flowage was monitored to serve as reference site for the study. Landuse in the Spirit Flowage watersheds consists mostly of wetland and woodland and agriculture comprises 11% of the watershed. In comparison, the Big Eau Pleine Watershed consists of 77% agricultural landuse. Dairy farming is the dominant agriculture landuse type in the watershed and winter spreading of manure is a common practice. Two sampling periods were targetted including non event and active runoff events. Export rates for BOD and total phosphorus were estimated for the Big Eau Pleine and Spirit Rivers using 2007 events samples and streamflow collected by USGS gauges.

Big Eau Pleine River – March 2007 Runoff Event



Results: BOD and total phosphorus export rates from the Big Eau Pleine River were 4 and nearly 8 times greater, respectively, than the rates from the Spirit River (Figure 1). Tributary monitoring in both watersheds found higher concentrations of bacteria in events versus non event samples; however average *E. coli* concentrations in the Big Eau Pleine River runoff events were seven times higher than levels found in the Spirit River. The higher bacteria concentrations in the Big Eau Pleine River were likely the result of domestic animal waste runoff.

Conclusions:

*These results show the BOD and total phosphorus export rates from an agricultural watershed (Big Eau Pleine) during snowmelt are substantially higher than from a minimally disturbed watershed (Spirit River). *E. coli* bacteria numbers in runoff from an agricultural watershed are substantially higher than a watershed with minimal agricultural landuse.

*Dairy farming is the dominant agricultural landuse type in the Big Eau Pleine watershed and winter spreading of manure is a common practice. The winter runoff of domestic animal waste is a significant contributor of BOD, total phosphorus and bacteria to the Big Eau Pleine Flowage.

*The average BOD load during three days of runoff in the Big Eau Pleine River, adjusted for natural background using data from the Spirit River (73,713 pounds), was compared to the City of Wausau's average three day influent BOD load (5,220 pounds) for the same time period. The BOD load in the Big Eau Pleine River above background conditions was 14 times greater than the influent (raw sewage) BOD load to the Wausau WWTP.

*Three days of event BOD load in the Big Eau Pleine River minus background was estimated at 221,138 pounds. According to literature, a 1,500 pound dairy cow produces 2.4 pounds of BOD each day or 144 pounds of BOD in 60 days. If 60 days of stored manure from 8,000 cows were winter spread in the watershed and only 20% was lost to runoff that would be equivalent to the estimated load of 221,138 pounds. Based on the ratio of dairy cows to farm land acres in Marathon County, the number of dairy cows in the Big Eau Pleine Watershed could be as high as 17,000.

*BOD and total phosphorus loads to the Big Eau Pleine Flowage from 2007 events in the Big Eau Pleine Watershed are likely higher than presented in this study. Loads from Freeman and Fenwood Creeks were not included due to the lack of streamflow data at the time of sample collection. However, loads from these streams were likely substantial given parameter concentrations and high discharge. The estimated event loads for the Big Eau Pleine River are based on one or two samples collected during an event. The estimated loads would likely be greater if samples were collected allowing quantification for the entire duration of each event.