Phosphorus Mass Balance of an Urban Eutrophied Drinking Water Reservoir: Eagle Creek Reservoir, Indianapolis Indiana

Raftis, R., D.L. Pascual, G. Filippelli, L.P. Tedesco, and M. Gray

The cultural eutrophication of urban reservoirs coupled with increasing population demands is an environmental concern of growing urgency. The eutrophication, or nutrient loading, of reservoirs results in the formation of nuisance algal blooms, which can degrade water quality by producing toxins and/or taste and odor causing metabolites. Therefore identifying and quantifying the causes of eutrophication, such as the sources and respective loads of nutrients, is necessary for developing whole system management polices for watersheds and their reservoirs.

From 2003 to 2005 a nutrient mass balance study and phosphorus (P) cycling in sediments study focused on determining how P an algal limiting nutrient, is externally and internally supplied to a reservoir, was conducted in Eagle Creek Watershed (ECW) and its Reservoir (ECR). Accumulated P in lake sediments from sustained eutrophication may increase the rate of algal production when anoxic bottom waters allow for the redissolution and subsequent redistribution of orthophosphate, a form of bioavailable P that can spur algal growth. Organically bound P from whole water samples was analyzed using the ascorbic acid – molybdate blue method after a sulfuric acid and persulfate digestion. This analysis showed that 2004 Total P inputs to ECR from external watershed sources were ~42 metric tons/yr, and exports from ECR were ~17 metric tons/yr, resulting in a 60% P retention or ~25 metric tons/year. Sedimentary P accumulation rates were calculated from an average sedimentation rate of 2 cm/yr of reducible, organic, and mineral fractions of P which were determined using a modified SEDEX method. P accumulation rates for all P fractions averaged ~241 metric tons/yr. However, organically bound P accumulation rates of ~30 metric tons/yr corresponded to the ~25 metric tons/year of organically bound P from external sources. Sequential P extraction shows that ~75% of sediment bound P is readily reducible during anoxic conditions which can potentially become bioavailable for phytoplankton growth.