**Long-term monitoring and assessment of phosphorus and nitrogen concentrations and loadings in two inflowing tributaries to Lake Mendota: Yahara River and Pheasant Branch**

## A. Project Description

Phosphorus concentrations and loads have been continuously monitored (along with streamflow and suspended sediment) by the USGS since 1990 during periods of both baseflow and runoff on two inflowing tributaries to Lake Mendota: Yahara River (@ Windsor) and Pheasant Branch (@ old US Hwy 12). Since 2002, similar monitoring has also been conducted on the Yahara River at Hwy 113. Starting in 2011, nitrogen concentrations and loads (all N species) have been monitored at the Yahara-Windsor and Pheasant Branch stations. From the monitoring data, the USGS develops daily P, N and suspended sediment loads that are reported and freely made available through the USGS. These data along with earlier data obtained during 1976-1980 allow an assessment to be made of nonpoint source pollution related to changing landuse practices, and different storm events and runoff patterns over many decades. To date, the loading analyses have been used in many studies and watershed assessment programs of Lake Mendota and the other Yahara lakes. In addition, many peer-reviewed publications have also highlighted the long-term P loading data.

This work is being conducted as part of a cooperative agreement called the "Dane County Cooperative Water Resources Monitoring Program" managed by the Capital Area Regional Planning Comm. Dane County, the Town of Westport and the Cities of Madison and Middleton contribute approximately 75% of the annual operation and maintenance costs for the three stations, with the remainder provided by the USGS. The DNR covers the sample costs by budgeting for laboratory P and N analyses at the Wisconsin State Lab of Hygiene.

## B. Project Locations

The Pheasant Branch monitoring station is located at Old Hwy 12 (now Parmenter St.); its SWIMS Station ID is 133315. The Yahara River @Windsor station has a SWIMS Station ID of 133399. The Yahara River @ Hwy 113 station has a SWIMS Station ID of 133040.

## C. Day and Time of Monitoring

The USGS maintains fully automated monitoring equipment at each of the three stations including refrigerated water sampling equipment. Samples are collected periodically during baseflow conditions and during all runoff events that may occur throughout each year. On average, about 80 P and N samples are being collected each year at the Pheasant Branch and Yahara-Windsor stations. Approximately 50 samples for P are collected at the Yahara-113 station because stream hydrographs are less variable during runoff events. For each sample, both total P and dissolved reactive P are analyzed to develop daily load data. The N series includes NO3+NO2, NH4, and Kjeldahl-N with Organic-N determined by calculation. However, the number of samples analyzed is approximate. During drought years, many fewer samples are analyzed; during wet years as many as 100 samples may be analyzed at the Pheasant Branch and Yahara-Windsor stations.

These number of discrete samples represent a reduction from what was analyzed in earlier years due to a protocol for flow-weighted compositing of samples for relatively minor events. In addition, N sampling is proposed to be dropped beginning in 2016 at the Pheasant Branch station to save money. This station is downstream of the confluence pond where a significant amount of denitrification occurs as confirmed by recent data. Thus, N non-point source loads at this station cannot be linked to watershed landuse practices. N loads to Lake Mendota will be assessed based on the 5 years of data (2011-2015) now collected. Depending on available funds, the N data collection can either continue on the Yahara-Windsor station where links to landuse are possible, or the N sampling can be dropped to save money.

**D.-F. Field Activities, SOP's, and Safety**

Not applicable

**G. Data Management**

All streamflow, N & P concentration and derived daily load data are fully maintained by the USGS.

**H. Updates and Tracking**

All data collected and analyzed for each USGS Water Year (Oct. – Sept.) are reported in annual electronic reports.