

A Trophic State Assessment Tool For Reservoirs (TASTR) and Watersheds

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The response (e.g. algal blooms) of reservoirs to inputs of nutrients and other materials from their watersheds has been a fundamental water quality issue since the first U. S. Army Corps of Engineers (USACE) dams were constructed. Consequently, understanding and modeling water quality and the trophic response of reservoirs has received substantial attention within the Corps of Engineers over the last several decades. A number of important predictive tools (models) have resulted (for example, Bathtub and CE-QUAL-W2). The USACE has not been alone in this endeavor, and other agencies in the U.S. (i.e., U.S. Department of Agriculture, U.S. Geological Survey, U.S. Environmental Protection Agency) and elsewhere have made large investments to predict water quality in reservoirs and the movement of major plant nutrients (i.e. nitrogen and phosphorus) from the watershed into receiving waters. The Trophic Assessment Screening Tool for Reservoirs (TASTR) described here makes use of these earlier investments and delivers an integrated (watershed & receiving body), assessment for water resource managers and decision makers.

The assessment of water quality conditions in reservoirs and the surrounding watershed should be a multi-tiered process. At the first level, simple, rapid, screening-level procedures should be used to help compile and organize existing knowledge and narrow the questions and possible approaches. At this level, only rough approximations (such as empirical chlorophyll-phosphorus relations) are needed to put boundaries around the problem and identify the most likely avenues for advance. In some cases, the broad estimates provided at the screening-level will be adequate and no further refinements are needed. However, even if these first approaches do not provide the necessary answers, they are still valuable in pointing to those areas where greater resolution is absolutely required. TASTR is a screening-level tool, it is computer software that gives a rapid “first cut” estimate of water quality conditions that can be expected in existing or planned reservoir projects in response to continuing or changed land use patterns in the surrounding watershed. TASTR includes Geographic Information System (GIS) capability for the display and selection of project and watershed information. It uses a central database of reservoirs, watersheds, and model results to display existing information and allow the user to explore, in a broad way, the consequences of changes to the system.

TASTR is the first screening tool produced under the auspices of the System Wide Water Resources Program (SWWRP) of the U.S. Army Corps of Engineers and is now being field tested. At this stage in its development, TASTR uses the simplest possible watershed model (nutrient export coefficients) and a simple reservoir model (Bathtub) as the basis for an integrated assessment. However, the capabilities of more complicated watershed, stream, and reservoir models (e.g. SWAT, GSSHA, HSPF, & CE-QUAL-W2) are intended to be added to this delivery system in the future.

TASTR is a convenient information delivery tool now, but features under development will make it unique and extremely useful tool for decision support and analysis. TASTR now takes advantage of available information to make its estimates, and if very limited information are available, for example, to determine nutrient delivery from the watershed, then, it uses generic, default, export coefficients, runoff, and published landcover in its calculation. If detailed loading data are available, (or provided by the user) it will use these to adjust its calculations. However, an important refinement to TASTR that is now under development, will allow (but not require) the user to provide additional watershed information (e.g., soil types, slopes, cropping practices, fertilizer applications, etc.). TASTR will then use these additional pieces of information to extract data from an extensive model-result database developed with the EPIC model by the U.S. Dept. of Agriculture. It will use these extracted data to refine its estimates of nutrient and sediment delivery. The effect will be to narrow the confidence intervals around the TASTR predictions of reservoir response. In a variation on this capability, TASTR will be able to show the user how much certain types of watershed information could be

expected to improve its prediction if they were available. The user can then weigh the cost of obtaining these additional information, or of making changes in the watershed, against their value in the decision making or restoration process.