

minor point sources that were not captured in NWPCAM version 1.1. NWPCAM version 1.6 models water quality using a stream reach network with greater resolution and incorporates additional point and nonpoint source loadings.

The NWPCAM version 1.6 generates a water quality index (WQI-6) from six indicators of water quality (TSS, DO, BOD5, FC, nitrate ( $\text{NO}_3^-$ ), and phosphate ( $\text{PO}_4^{3-}$ )). The weights on individual water quality parameters are adjusted from WQI-4 to reflect the increased number of parameters in WQI-6. The new WQI-6 is a broader measure of water quality and is expected to provide a better representation of changes in water quality downstream of MPP facilities. A version of NWPCAM capable of simulating nitrogen and phosphorus concentrations and employing the WQI-6 is described in EPA, 2002.<sup>1</sup>

EPA solicits comment on the use of the six-parameter Water Quality Index (instead of the four-parameter Index) to assess the environmental improvements from revising the current MPP regulation. In particular, EPA solicits comment on the inclusion of nitrogen and phosphorus in the kinetics model.

EPA is considering the use of National Water-Quality Assessment Program (NAWQA) data to calibrate the baseline predicted by NWPCAM version 1.6 for the stream reaches associated with MPP facilities. EPA proposes to download NAWQA data for as many of the regions where MPP facilities are located as possible. Based on the comparison of NAWQA vs. NWPCAM version 1.6 data, EPA plans to estimate the prediction errors for each region using the NAWQA data and use the errors to adjust the NWPCAM results in each region. EPA then plans to generate a probability distribution for the errors for each parameter and then set up a Monte Carlo program to simulate variability in the water quality index as a function of NWPCAM uncertainty for all parameters at once. EPA solicits comment on the use of NAWQA data to calibrate the baseline, and solicits other sources of data to use in the calibration effort.

## 2. Site-Specific or Watershed-Specific Models

In order to more comprehensively simulate detailed water quality and aquatic ecosystem responses to MPP loadings and loading reductions, EPA is considering the use of other available

models to evaluate the effects of nutrients and pollutants on receiving waterbodies from individual representative MPP facilities at a more site specific level either in lieu of or in addition to NWPCAM. In particular, the Agency is investigating the use of a simulation model for aquatic ecosystems (AQUATOX), an enhanced stream water quality model (QUAL2E), and the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) model. One advantage of using these models is their capacity to predict impacts of nutrient inputs on dissolved oxygen through eutrophication. Detailed information on each of these models can be found at <http://www.epa.gov/waterscience/wqm/>. Output from these candidate models could be used to qualitatively and quantitatively illustrate potential water quality and aquatic ecosystem responses to MPP loads and load reductions, or could be used in conjunction with environmental benefits valuation methods to estimate monetized benefits of MPP loads reductions. For example, water quality output from one or more of these models could be used as the basis for the calculation of the WQI-6 described above, and subsequent monetization. Alternatively, other output parameters from these models, such as levels of rough, forage, and game fish, could be used as the basis for other monetization approaches.

AQUATOX is an ecosystem model that estimates the environmental fate and effects of toxic chemicals, conventional pollutants, and nutrients from point and non-point sources on a stream-specific basis. In particular, AQUATOX allows assessors to model the fate of TSS, ammonia, nitrate, phosphate, carbon dioxide, DO, pH, temperature, light, and dissolved organic toxicants on the receiving waterbody. AQUATOX also provides an assessment of the impacts of these pollutants on assorted organisms (*e.g.*, phytoplankton, certain guilds and taxonomic groups of invertebrates and fish) and detrital components. AQUATOX can be used to investigate pollutant effects on streams, small rivers, ponds, and lakes. AQUATOX is relatively applicable to site-specific studies, models many conventional pollutants and nutrients, and estimates the impacts on a wide range of key aquatic ecosystem variables. Possible constraints of using AQUATOX to model the impacts and benefits from regulating the MPP industry are that (a) fairly detailed pollutant- and reach-specific parameters must be compiled to run the model, (b) it does not estimate

BOD and FC (pollutants necessary for the water quality index (WQI) calculations) concentrations in the receiving waterbody, (c) AQUATOX is intended to represent a single stream or river reach or an entire pond, lake, reservoir, or estuary. A segmented version of AQUATOX, or multiple model runs, would be required to evaluate spatially variable conditions downstream of the immediate waterbody of interest if this were determined to be necessary.

QUAL2E simulates the in-stream behavior of toxic chemicals, conventional pollutants, and nutrients on a branching, one-dimensional stream-specific basis. In particular, QUAL2E models the concentrations of DO, BOD, temperature, algae, organic nitrogen, ammonia, nitrite, nitrate, organic phosphorus, dissolved phosphorus, FC, up to three conservative pollutants (pollutants that remain chemically unchanged in the water), and one non-conservative pollutant from point and non-point sources. QUAL2E allows a user to model up to 25 reaches on a river and 25 pollution sources along the river. Like AQUATOX, QUAL2E is relatively applicable to a site-specific analysis, and it also models many conventional pollutants and nutrients. Possible constraints of using QUAL2E to model the MPP industry are that (a) detailed pollutant- and reach-specific parameters must be compiled to run the model, (b) it does not estimate the TSS (a pollutant necessary for the WQI calculations) concentration in the receiving waterbody, and (c) it is only applicable for rivers, not lakes or estuaries.

BASINS is a multipurpose environmental analysis system that allows users to perform watershed- and water-quality based studies. This tool allows users to investigate river segments and how they may be impaired by point source and non-point source discharges. Databases available for use with BASINS provide necessary environmental background data, environmental monitoring data, and point source loading data. BASINS integrates the use of models such as QUAL2E, the Hydrological Simulation Program Fortran (HSPF) and Soil and Water Assessment Tool (SWAT) to conduct fate and transport assessments of point and non-point sources. BASINS models conventional pollutants and nutrients, including all the pollutants necessary to calculate a WQI, and (a) all the pollutant- and reach-specific parameters are available in the system's database files, (b) reach background concentrations for DO, ammonia, and BOD are available in the system's

<sup>1</sup> U.S. EPA (U.S. Environmental Protection Agency). Estimation of National Economic Benefits Using the National Water Pollution Control Assessment Model to Evaluate Regulatory Options for Concentrated Animal Feeding. December, 2002.