PREFACE

Under the Clean Water Act (1972), states are required to develop total maximum daily load (TMDL) programs for impaired waters: waters that do not meet numeric ambient water quality standards or narrative water quality goals such as aquatic support. The TMDL program consists of a TMDL report and a TMDL implementation plan. A TMDL report aims at quantitative assessment of water quality problems, identification of contributing sources, and estimation of pollutant load reductions needed to attain established ambient water quality standards or water quality goals. A TMDL plan identifies pollution control practices and allocates pollution control or management responsibilities among pollution sources in a watershed. Stakeholder participation is required in all phases of program development. An estimated 40,000 TMDLs on 21,000 polluted stream segments are to be developed across the United States (U.S.) in the next 10-12 years.

Technical information needed to develop a full TMDL program includes: definition of the geographic area of the impaired segment; estimation of anthropogenic point, non-point sources, and natural background pollutant loads; estimation of the assimilative capacity of an impaired segment for one or more impairment parameters; predictive analysis of the consequences of pollutant loads for the impairment parameter; and allocation of the pollutant load from all sources to achieve water quality goals.

An effective TMDL program should be science-based and requires expertise on data collection and analysis, database management, data interpretation, and the use of hydrologic and water quality models. State environmental agencies in collaboration with the U.S. Environmental Protection Agency (EPA) are striving to develop TMDL reports that are scientifically defensible. Many questions are raised in the process of developing TMDL reports. Below are examples of some questions posed by a state agency regarding the use of Hydrologic Simulation Program-FORTRAN (HSPF) in TMDL modeling:

- What peak concentrations should be assumed where no measured data exist?
- What is the best way in HSPF to represent storm event durations for up to three days?
- What is the best way to represent unknown source inputs (direct deposition / ground water) that contribute significantly to the bacteria load during base flow conditions? How reasonable is it to keep fecal production rates constant throughout the state? In general, how much flexibility do we need to allow in model set-up to allow reasonable calibrations and still maintain some statewide consistency?
- In terms of addressing the impairment, what should be the time step of the geometric mean calculation: daily average values averaged to a 30-day geometric mean or daily geometric mean values averaged to a 30-day geometric mean?
- Should models be calibrated to land use loading or measured bacterial source tracking (BST)?

The state-of-the-art on these requirements is continuously evolving with major contributions from university researchers. Furthermore, lack of adequate hydrologic and water quality data has necessitated the use of innovative approaches and professional judgment in TMDL decisionmaking; this is where the role of university researchers becomes critical and significant. Several universities across the country have been contracted to develop TMDL reports. Papers presented in this document are typical of such activities, but by no means indicate comprehensive university involvement with TMDL programs.

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