TMDL Implementation – Characteristics of Successful Projects

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INTRODUCTION

TMDLs and TMDL implementation plans are being developed across the country using a variety of approaches, with varying levels of detail, stakeholder participation, and success. The ultimate goal of the TMDL program is to improve water quality through the implementation of TMDLs. This project identified watersheds from across the country that successfully developed TMDLs and TMDL implementation plans that resulted in improvements in water quality. Case studies of these watersheds were developed to identify the characteristics and approaches that facilitated implementation and water quality improvement.

The TMDLs evaluated for this project varied in their complexity, some being very detailed (e.g. extensive source and watershed characterization) while others were less detailed (one watershed had an 11-page TMDL). The level of detail often varied with the complexity of the watershed and the source, but not always. Many of the TMDL implementation efforts assessed as part of this project did not have a formal 'stand alone' implementation plan; several of those that did had developed the plan after implementation efforts had already begun. This final report includes the methods used to select the case study watersheds and perform the case studies, a brief summary of factors that affected implementation success, and lessons learned. Matrices of watershed characteristics, detailed case studies, and synopses of case studies are includes as appendices to this document.

METHODS

There were three phases to this project: identification and selection of the case study watersheds, development of the project case studies, and identification and synthesis of characteristics that lead to successful TMDL implementation.

WATERSHED SELECTION PROCESS

The agency responsible for the TMDL program in each state was contacted via email or telephone to obtain information about the current status of TMDLs and TMDL implementation in the state. Representatives from each state agency responsible for TMDL development (Appendix A) were asked to provide the names of waterbodies where they believed a TMDL implementation or other watershed planning success story existed. Additional candidate watersheds were found by searching the EPA Section 319 Success Stories website (http://www.epa.gov/owow/nps/Section319III/) and the EPA TMDL Case Studies website (http://www.epa.gov/owow/tmdl/case.html). Information collected from these sources was used to develop an initial list of candidate watersheds. Forty-four candidate watersheds (Appendix B) were initially selected based upon the existence of documented evidence to support water quality improvement that resulted from TMDL implementation or other related watershed planning efforts.

The candidate watershed list for each state was then sent with specific questions to state agency personnel and EPA regional personnel to determine whether a detailed case study review of the watershed would be performed. The questions sent to state agencies and EPA regional offices included queries regarding the developer of the implementation plan, documentation of the project, availability of reports and/or data documenting water quality improvement, and the link between water quality improvement and TMDL implementation activities. The decision to further evaluate a watershed and perform a case study was based primarily upon data availability and existing documentation. Watersheds were removed from the candidate list if no formal TMDL study had been conducted, if water quality improvement occurred prior to

TMDL implementation, if insufficient data were available to verify water quality improvement, or if there was no response or insufficient response from the responsible state agencies. Following this procedure, seventeen case-study watersheds were selected for additional, detailed review (Table 1).

Table 1. Watersheds selected for detailed case study development.

Lake Allegan, Michigan	Lower Nooksack River Basin, Washington
Aquilla Reservoir, Texas	North Fork of the South Branch of the Potomac River, West Virginia
Cascade Reservoir, Idaho	
Clear Creek, Texas	Quail Run, Virginia
Deep Creek, Montana	Slip Bluff Lake, Iowa
Hutton Creek, Virginia	South Platte River, Colorado
James River, Missouri	Swan Lake, Alaska
Medicine Lodge Creek, Idaho	Truckee River, Nevada
Nine Eagles Lake, Iowa	Lower Yakima River, Washington

CASE STUDY DEVELOPMENT

Documents and data were obtained from the internet and from agency personnel to support case study development. Each case study addressed fifteen key points of interest that described specific aspects of the watershed projects. Each case study also included an executive summary and a list of factors that affected implementation. Draft case studies were reviewed by state agency and EPA personnel. The key points of interest were:

a. Applicable water quality standards
b. Degree of impairment in terms of applicable water quality standards
c. Approach used to develop the TMDL (modeling or other, specific model(s), developer, stakeholder involvement, etc.)
d. Actual TMDL and supporting loading and concentration data in terms of spatial loadings
e. Scientific reasonableness of proposed reductions (are they likely to be attainable)
f. Public involvement during the TMDL development process (degree of active participation)

g. Approach used to develop the implementation plan and differences from the approach used to develop the TMDL (modeling or other, specific model(s), developer, stakeholder involvement)
h. Usefulness of data and information from the TMDL study in the development of the implementation plan
i. Public involvement during the implementation plan development process
j. Implementation plan loading reductions and phases (temporal and spatial loading reductions, specificity of plan in terms of contributors, etc.)
k. Scientific reasonableness of proposed implementation plan reductions (phases, likelihood of attainment of proposed water quality improvements)
l. Identification and availability of required resources
m. Proposed water quality and progress monitoring system
n. Progress towards implementation (actions taken, water quality improvements)
o. Degree to which the implementation plan is facilitating implementation (strengths and weaknesses).

EVALUATION OF SUCCESSFUL CHARACTERISTICS

After compiling the detailed case studies, the last phase of the project began: the identification of factors that aided or hindered successful implementation. Watersheds were assigned to categories according to the presence or absence of a permitted discharger and the influence thereof; type of impairment; and degree of reduction required by the TMDL. Several characteristics of interest were then identified, and each watershed was classified as possessing or not possessing each characteristic. Some of the characteristics were drawn from details of the fifteen key points of interest above: type of watershed strategy (e.g., implementation plan, portion of TMDL report), type of calculations used in the TMDL (e.g., simulation model, statistical model), funding, stakeholder involvement and meetings during TMDL or implementation plan development, and whether implementation was staged or phased. Other common characteristics that surfaced during the review of the case studies

included: agency involvement, targeting of implementation efforts, presence of educational activities and resulting increase of awareness of water quality issues, spatially-specific data used to identify pollutant sources, leadership structure for the execution of watershed strategies, point source involvement, availability of technical assistance, nonpoint source pollution regulations, existence/development of watershed groups, and water quality trading. Characteristics identified that hindered successful implementation included lack of monitoring data prior to TMDL development (which made assessing progress difficult and/or impossible); lack of monitoring data following implementation (again, this made assessing implementation progress difficult and/or impossible, which in turn influenced public perception of the effort); loss of funding; natural disasters; poorly organized, ineffective leadership structures; and lack of stakeholder confidence in the science used to develop a TMDL for a particular pollutant. The matrices containing the watershed classifications are included in Appendix C.

RESULTS

CHARACTERISTICS OF THE WATERSHEDS

Seventeen TMDL implementation watershed case studies were developed as a part of this study. Most of these watersheds were dominated by nonpoint sources of pollution. Eight of the seventeen watersheds contained at least one permitted discharger, and four of the watersheds were point source dominated, meaning that the permitted discharge facilities in the watershed were the primary pollutant sources. The most common cause of impairment in the watersheds was some form of sediment/solids (e.g., total suspended solids, total dissolved solids, turbidity) (six watersheds), followed by nutrients (five watersheds), low dissolved oxygen (four watersheds), toxic chemicals (e.g., atrazine, chlordane, chlorine, DDT) (four watersheds), bacteria (three watersheds), elevated temperature (three watersheds), ammonia (two watersheds), pH (one watershed), and solid waste (one watershed).

As can be seen from the impairment list in the previous paragraph, some watersheds were impaired by more than one pollutant. Correspondingly, reductions in the TMDL plans were frequently specified for multiple pollutants. A few of the more simple TMDL plans did not present specific reductions. Of the 13 plans that enumerated needed reductions, most (10) called for moderate reductions in the 25-50% range; four called for reductions in the 0-24% range; three called for reductions in the 51-75% range; and five called for reductions in the 76-100% range. The magnitude of the reduction gives some idea as to the practicability of achieving the TMDL; larger percent reductions are more difficult to achieve.

The watersheds and their sources of impairments varied in complexity. In general, watersheds with fewer stakeholders (e.g., point source dominated watersheds or watersheds covered primarily by government land) or with a very specific pollutant source (e.g., point source or legacy pollutant) exhibited fewer of the factors affecting implementation listed in the following section. However, despite the lack of exhibition of the factors, these watersheds were equally

successful in their achievement of water quality goals compared to more complex watersheds.

The most common characteristics of successful watershed improvements in this study were (in order): adequate funding, government agency interest and involvement; stakeholder meetings during TMDL development; stakeholder interest and involvement; the presence of a TMDL where the pollutant and needed reductions were systematically assessed and quantified; targeted implementation; staged implementation; and increasing awareness and/or educational activities. Each of these characteristics was possessed by more than half of the surveyed watersheds. The primary characteristics that hindered implementation success were lack of data and lack of funding. Complete matrices of characteristics of the seventeen watersheds with successful implementation and water quality restoration are presented in Appendix C.

UNIQUE FEATURES OF SUCCESSFUL IMPLEMENTATION

Several watersheds contained particularly unique beneficial features. In Segment 15 of the South Platte River in Colorado, the 'Metro District,' a permitted discharger, funded many of the implementation efforts, conducted water quality studies, and produced watershed plans. In Swan Lake, Alaska, the local municipality embraced water quality improvement efforts with the establishment of lake clean-up days, which engaged many stakeholders in active clean-up of debris in watershed. In Nine Eagles Lake, Iowa, the department of natural resources and the department of forestry worked together to reduce sources of sediment in the watershed. A watershed group in James River, Missouri, was the main force behind extensive nonpoint source BMP installation, despite a TMDL that focused primarily on the dominant point source polluter in the watershed. In Truckee River, Nevada, the river has been delisted for the pollutant for which a detailed, modeling-based TMDL was completed (nitrogen), while it is still listed for the pollutants for which a less-detailed 'bare bones' TMDL (term used by the Nevada Division of Environmental Protection) was developed. Synopses and detailed case studies that present more complete picture of the

TMDL implementation efforts in the seventeen watersheds are presented in Appendices D and E, respectively.

FACTORS AFFECTING IMPLEMENTATION

Although each watershed reviewed was unique, most possessed several common characteristics that enhanced or hindered implementation.

Factors that enhanced implementation included:

- The existence of a watershed plan that was focused and achievable –
  - focused on the issues in the watershed,
  - achievable through corrective actions that could be made/adopted with active stakeholder participation;
- Active involvement of stakeholders, local government, and responsible state agencies;
- Coordination of local governments and state agencies;
- Diversity of approaches to address sources;
- Adequate Resources
  - to implement voluntary incentive-based corrective measures, and
  - to provide technical assistance and conduct educational efforts.

Factors that hindered implementation included:

- Lack of resources;
- Lack of sufficient data to characterize the watershed and pollutant sources through modeling and/or monitoring activities;
- Lack of monitoring data to reflect water quality improvement;
- Lack of communication and coordination between local governments and responsible agencies; and
- Lack of funding, particularly cuts that occurred during the middle of the implementation effort.

LESSONS LEARNED

- One size implementation plan doesn't fit all
  - for nonpoint source dominated watersheds:
    - Stakeholder engagement is crucial in privately owned lands.
    - Implementation on publicly owned lands is often more straight forward as there is typically a single stakeholder.
  - for point source dominated watersheds:
    - Active engagement of point sources can accelerate attainment of water quality standards.
- A focused, relevant, achievable watershed plan facilitates implementation.
  - A traditional stand alone TMDL implementation plan is not the only approach, and is not a prerequisite to successful implementation.
  - Developing an implementation plan at the same time the TMDL is being developed benefits from continuous stakeholder involvement.
- The existence of watershed activist/interest group promotes implementation.
  - These groups often have a strong local citizen base, are well-informed regarding watershed issues, and have the knowledge and experience to aid in early and successful implementation.
- The identification of responsible party or entity to execute and track implementation helps to coordinate the efforts of all involved and ensure that someone will keep the project on target.
- Adequate resources are necessary.
  - Funding is needed to implement corrective actions and monitor progress.
  - Human resources are required to educate stakeholders, manage the project, and implement corrective actions.