Developing BMP Efficiencies for Tributary Strategies
The University of Maryland/Mid-Atlantic Water Program's Criteria for Developing Effectiveness Estimates

Criteria

The Mid-Atlantic Water Program (MAWP) housed at the University of Maryland (UMD) was tasked with recommending BMP definition and efficiencies to be used in the Chesapeake Bay Program's Watershed Model and Tributary Strategies. UMD/MAWP contracted experts to conduct literature reviews of individual BMPs and provide recommendations for their definitions. Experts were asked to review literature that is applicable to the Chesapeake Bay Watershed, with applicable location defined as humid, temperate climates east of the Rockies, and fill out a template that discussed various factors that effect efficiency estimates (see Appendix A for copy of the template). Experts were also asked to provide efficiency recommendations that should be used in the Chesapeake Bay Program's Watershed Model and Tributary Strategies.

After experts submitted their reports some oversight was needed. UMD/MAWP used five criteria or guidelines to develop efficiency estimations:

- Efficiency recommendations should reflect operational conditions, defined as the average watershed wide condition. Research scale efficiencies were adjusted to account for differences upon scaling up.

- Studies with negative efficiencies (the BMP acted as a source, not a sink for pollution) were included in the efficiency development process as they reflect operational conditions.

- Since multiple experts were contracted to recommend efficiencies, consistency among the experts' evaluation criteria and process was needed. This does not mean all efficiencies are adjusted equally because with each BMP there is variability in site specific and management conditions. But the evaluation criteria used by the expert during efficiency development to adjust research scale efficiencies were uniform.

- Peer reviewed literature has been subject to stringent evaluation and results from that literature were given more weight than literature that has not undergone the same review process.

- Data from individual BMP project sites were utilized over median or average values calculated from multi-site analysis.

Uncertainty in nonpoint source estimates is due to variability in natural landscape conditions, degree of management, and spatial and temporal changes among BMPs and their location. Examples include precipitation, hydrology and geology, lag time between implementation of practices and full performance, and between implementation and observed water quality benefits. To minimize uncertainty in BMP efficiency estimation, and to more realistically estimate operational pollutant removals from BMPs, one must examine this suite of factors. These factors should be used to adjust efficiencies estimated from research plots. Not every BMP will be subject to all the conditions, but a research project will not capture the entire suite of factors that determine efficiencies when practices are widely implemented across natural landscapes.

The expected spatial and temporal variability for a practice was estimated based on available science and knowledge of the expected geographic extent of implementation of the practice. Different reduction efficiencies was established for practice implementation across different physiographic, geomorphic or hydrologic settings. Where possible, efficiencies were adjusted for surface water and groundwater interactions (permeability), along with geology and soil types (slope, seeps, floodplain, etc.). BMP age, size, time to maturity and species composition are other site specific conditions that create variability in efficiencies.

Management conditions, including operation and maintenance of BMP, design and construction supervision, and/or upland land use change will also impact efficiencies, usually making them lower than research scales. While there is little quantitative information on how BMP efficiencies should be adjusted to account for the impacts of improper maintenance on receiving waters, general adverse impacts on practice operation are understood. If maintenance is neglected a BMP may become impaired, no longer providing its designed functions. Proper maintenance of outlet structures, flow splitters and clean out gates is key to achieving a stormwater BMPs designed efficiency (Koon, 1995). "Average" management was assumed but it was assumed the practices were implemented and being operated and maintained. Reviews and audits of practice implementation and performance are needed to better estimate actual impacts of reported practices.

PROCESS FOR REFINING BMP DEFINITIONS AND EFFECTIVENESS ESTIMATES

Introduction

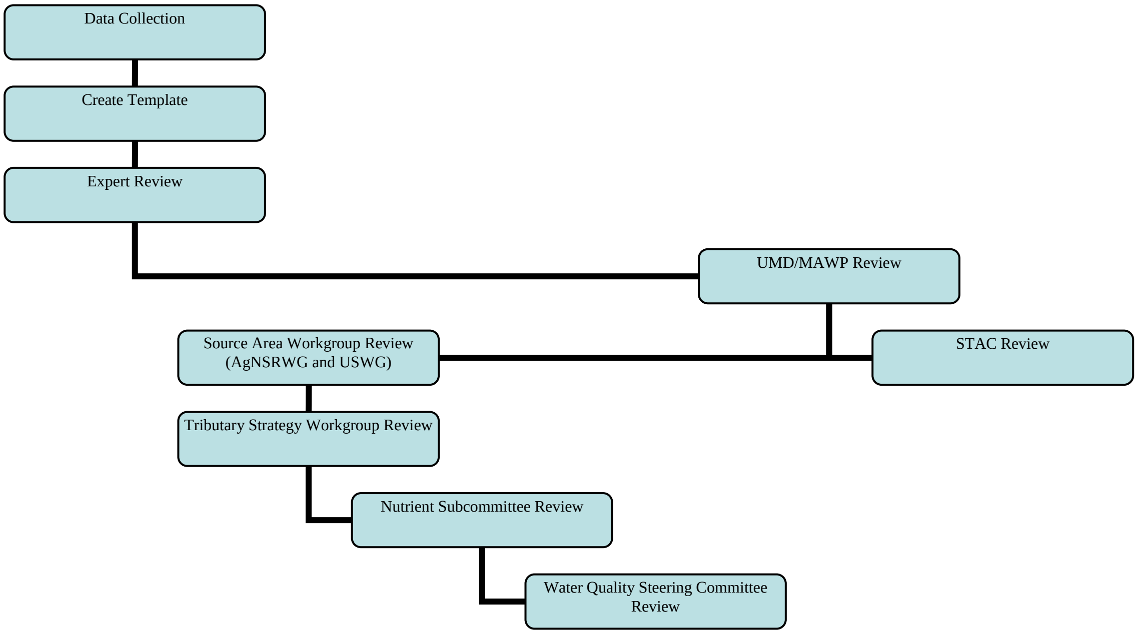
The Mid-Atlantic Water Quality Program (MAWP) housed at the University of Maryland (UMD) reviewed and refined definition and effectiveness estimates for best management practices (BMPs) implemented and reported by the Chesapeake Bay watershed jurisdictions prior to 2003. The main objective was to develop definitions and effectiveness estimates that reflect the average operational condition representative of the entire watershed. The Chesapeake Bay Program (CBP) has historically assigned optimist effectiveness estimates based on controlled research studies that are highly managed and maintained by a BMP expert. This approach is not reflective of the variability of effectiveness estimates in real-world conditions where farmers and county stormwater officials, not BMP scientists, are implementing and maintaining a BMP across wide spatial and temporal scales with various hydrologic flow regimes, soil conditions, climates, management intensities, vegetation, and BMP designs. By assigning effectiveness estimates that more closely align with operational, average conditions modeling scenarios and watershed plans will better reflect monitored data.

One advantage of this project is the wealth of documentation provided on each BMP. Previously, BMP documentation was limited and the CBP has been criticized for this in the press and in governmental reviews. To increase BMP documentation the CBP funded the BMP project and awarded it to the UMD/MAWP. To provide precise documentation the UMD/MAWP engineered a robust practice development and review process utilizing literature, data, and best current professional judgment. All scientific data used to refine BMPs was analyzed for applicability and cited in a report that summarizes all decisions, and also details how best professional judgment was applied to effectiveness development. The process for incorporating both science and best professional judgment is also fully outlined and described in the report. In addition, meeting minutes are included to highlight discussions and decisions made during the review process.

Another objective of the project was to utilize an adaptive management approach to BMP development. An adaptive management approach allows forward progress in implementation, management and policy, while acknowledging uncertainty and limits in knowledge. The adaptive management approach to BMP development incorporates the best applicable science along with best current professional judgment into definition and effectiveness estimate recommendations. With adaptive management it is necessary to include a schedule that allows for revisions as advances knowledge and experience becomes available. UMD/MAWP recommends continued monitoring of BMPs, with revision of definitions and effectiveness estimates scheduled for every three to five years to incorporate new data and knowledge.

To begin developing definitions and effectiveness estimates UMD/MAWP conducted a search for literature and data relevant for most BMPs that have been tracked and reported by jurisdictions to the CBP prior to 2003. A template was also created that outlined the information needed to determine BMP definitions and effectiveness estimates. Next experts were contracted to develop practice definitions and effectiveness estimates. A scientist identified by the Scientific and Technical Advisory Committee (STAC) of the CBP then reviews the report for applicability and accuracy. Following the review submitted by the scientists UMD/MAWP reviewed reports for consistency in effectiveness estimation and attention to project objectives. While reviewing the reports UMD/MAWP used guidelines to aid in refining experts recommendations if needed. Then UMD/MAWP submits the expert's report and recommendations, the reviewer's comments, and UMD/MAWP's recommendations to the workgroups of the CBP for a technical review. These workgroups review the report and submit it to the Nutrient Subcommittee (NSC) for approval. Finally the NSC submits the agreed upon effectiveness estimates and BMP reports to the CBP's Water Quality Steering Committee (WQSC). During the CBP workgroup and NSC review a task force within the STAC of the CBP reviewed UMD/MAWP process and guidelines. A more detailed explanation of this process follows (Figure One).

Figure One. Chart illustrating the process for refining BMP definitions and effectiveness estimates.



Reference:

Koon, J. 1995. Evaluation of Water Quality Ponds and Swales in the Issaquah/East Lake Sammamish Basins. King County Surface Water Management Division, Seattle, WA. IN: Shoemaker, L., Lahlou, M., Doll, A., and P. Cazenas. 2002. Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring; Fact Sheet Detention Ponds. Federal Highway Administration, Landover, Maryland. http://www.fhwa.dot.gov/environment/ultraurb/index.htm