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TMDL implementation plan development to address multiple impairments for a rapidly urbanizing watershed

The Center for TMDL and Watershed Studies at Virginia Tech led development a TMDL Implementation Plan (IP) for the Opequon Creek watershed, which includes portions of Virginia's Clarke and Frederick counties and encompasses the City of Winchester. The IP addresses impairments on five stream segments in the watershed. Abrams Creek, Lower Opequon Creek, and Redbud Run have both benthic and bacteria impairments, while Upper Opequon Creek and Lick Run have bacteria impairments. Urban and agricultural nonpoint sources are cited as causes of the impairments, with urban being the primary cause in a large portion of the watershed. TMDLs were developed previously for Abrams, Lower Opequon, and Upper Opequon Creeks. The other two segments were listed as impaired after the other TMDLs had been developed. One important feature of the IP development process was the intensive public participation process involving a Resource Team (comprised of personnel from three universities, two state agencies, and a local watershed group), a Steering Committee (representatives from local government, watershed groups, and watershed residents; and two Working Groups (urban and rural). Through facilitated sessions, the working groups identified and discussed potential corrective actions and the Steering Committee prioritized the actions with respect to likelihood of adoption of and other characteristics. These actions were then quantified using spatial data analysis and watershed modeling. The IP includes a date of expected achievement of water quality objectives; the types and quantities of necessary corrective measures; measurable goals; and the associated costs and benefits of addressing the impairments in the watersheds. While many of the potential benefits are difficult to quantify, through analyses of responses to a survey mailed to watershed residents, the value of two specific benefits, improved aquatic life (game fish population) and the safety of swimming and wading, resulting from improved water quality within the watershed was estimated to range from \$2.0 to \$2.75 million. This study highlights the methods that were used to develop an IP for a rapidly urbanizing watershed.

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