

The 2007-2008 Cycle of TMDLs Begins

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The Center is developing sixteen TMDLs during the 2007-2008 cycle for the state of Virginia. Ten of the TMDLs are on segments where excess bacteria is the cause of impairment and 6 are on segments listed for not meeting the states narrative, general aquatic life use standard and the cause of impairment is unknown. The sixteen TMDLs are part of 7 projects (figure 1). The Center is currently working on TMDLs for Lick Creek and the Hardware River.

Lick Creek, located in far southwest Virginia, was listed for violating both the bacteria standard and the general aquatic life use standard. Resource extraction was once a dominate industry in the Lick Creek watershed and some coal mining is still occurring. Poor handling of human wastes (failing or non-existent septic systems) are thought to be an issue in the watershed. The first public meeting for the Lick

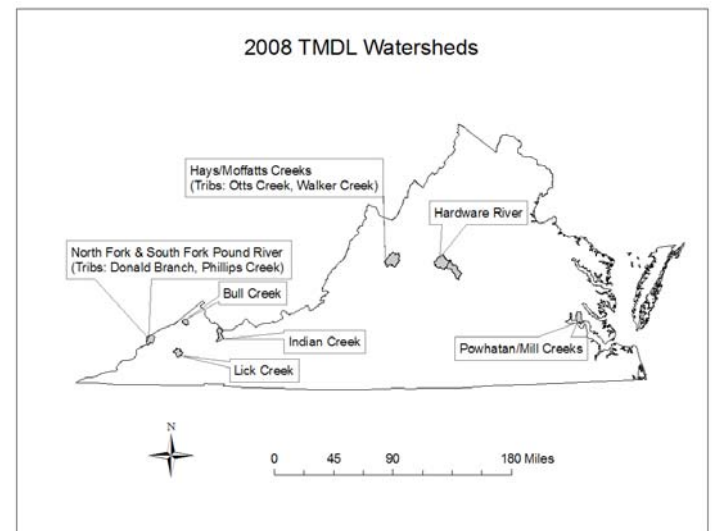


Figure 1: Location of the 7 TMDL Projects.

Creek TMDLs is scheduled for November.

The Hardware River is located South of Charlottesville in central Virginia. The Hardware River project contains two segments where bacteria is the cause of impairment. The first public meeting for the Hardware River project will be in November.

Watershed and source characterization is cur-

rently ongoing for both projects, and the stressor analysis is beginning for Lick Creek.

Webpage's with updates and current information for each active project are available on our website: www.tmdl.bse.vt.edu on the "TMDL Studies" page. Each active project also has a forum (www.tmdl.bse.vt.edu/forums/) where stakeholders can information as well as post questions.

TMDL Clearinghouse Knowledgebase

Constraints of time and resources, rapid advances in related science or engineering disciplines, and information overload often make it difficult for TMDL agency personnel, developers, and stakeholders to find the information they need. To help make relevant, timely TMDL-specific information available to those who need it, the Center for TMDL and Watershed Studies will release the web-based, searchable TMDL Clearinghouse Knowledgebase in early October 2006.

The clearinghouse, funded by a grant from EPA, contains searchable summaries of TMDL programs in the 50 states; causes of impairments for which TMDLs have been developed, and the method used to develop the TMDL; a summary of TMDL development guidance resources available from states; and topical synopses of TMDL-related technical and trade literature.

Data summarized for each state includes consent decree status (is the state under a consent decree), who develops TMDLs in the state (state agency, consultants, others), TMDL implementation planning and execution (are implementation plans being developed and executed), and other relevant information. The state-specific data also summarize the causes of impairments being addressed in each state, the relevant standards, and the approach used to develop TMDLs (e.g., modeling, load duration).

Using the clearinghouse's search features, the information gathered for each state summary can be compiled in a variety of ways depending on the user's information needs. For example, users can generate tabular output from the clearinghouse sorted by cause of impairment, TMDL development method, etc. The literature review portion of the clearinghouse includes 240 citations

from both scientific and trade literature. Each article was reviewed and grouped under one of several topical areas (e.g., TMDL case studies, model reviews, sampling and monitoring for TMDLs, implementation, stakeholder relations, uncertainty analysis).

Users will be able to search the clearinghouse by criteria (cause of impairment, TMDL method, author, etc.) or by a predefined topic list (figure 1). Users will be able to download search results to PDF file. One unique feature of the clearinghouse is that it will be possible to perform state to state comparisons of TMDL development approaches for a given cause of impairment. The clearinghouse will be located at the Center website at: <http://www.tmdl.bse.vt.edu/site/knowledgebase/>.

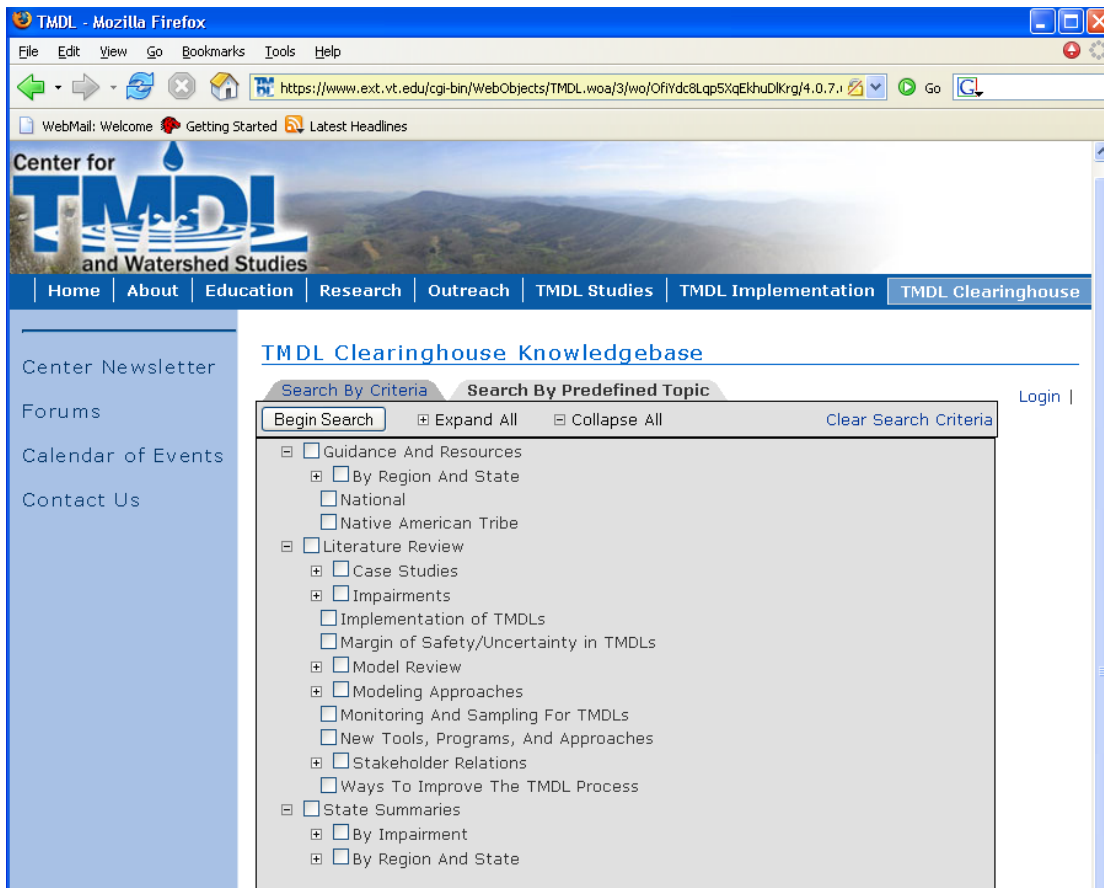
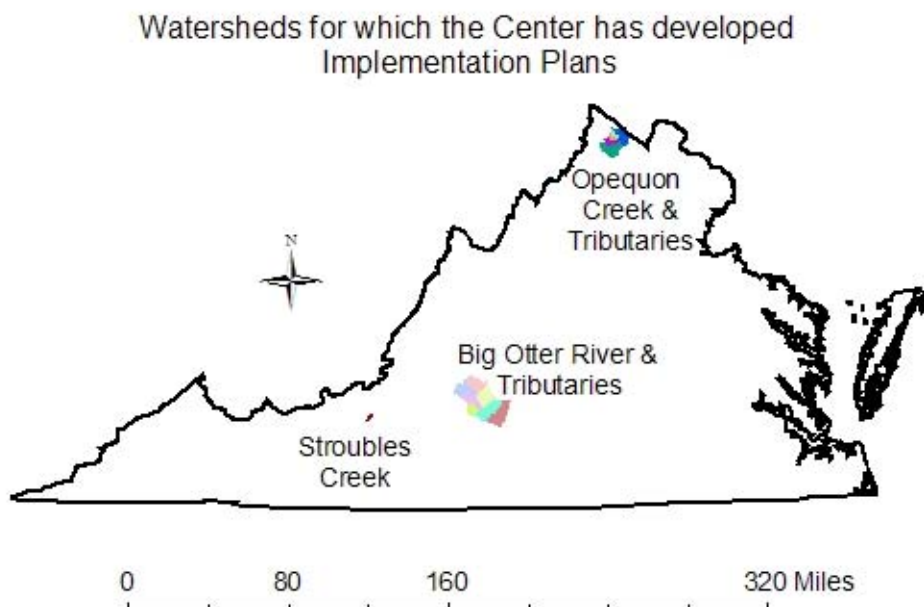


Figure 1: Search by Predefined Topic List.

Center completes three TMDL implementation plans addressing eleven TMDLs

Virginia state law (the Water Quality Monitoring Information and Restoration Act) requires TMDL implementation plans (IP) be developed and implemented within a reasonable time after a TMDL is approved by EPA. A TMDL IP is a watershed plan that specifies the actions, including best management practices (BMPs), needed to reduce pollutant loads to bring a water body into compliance with water quality standards. The TMDL IP must include measurable goals, necessary corrective actions, associated costs and benefits of addressing the impairment, and the date of expected attainment of water quality objectives. The Center recently completed three TMDL IPs for watersheds in Virginia; the Big Otter River, Stroubles Creek, and Opequon Creek.

The Opequon Creek watershed, in northwest Virginia, includes portions of Virginia's Clarke and Frederick counties and encompasses the City of Winchester. The Opequon Creek IP addressed impairments on five stream segments. Three segments have both aquatic life use and bacteria impairments, while two segments only have bacteria impairments. Urban and agricultural nonpoint sources are cited as causes of the impairments, with urban-related sources being the primary cause in a large portion of the watershed. One unique aspect of the Opequon Creek IP was the use of a contingent valuation analysis to assess stakeholders' willingness to pay for improved water quality. The value of two specific benefits, improved aquatic life (game fish population) and improved safety for swimming and wading, resulting from improved water quality was estimated to range from \$2 to \$2.75 million. Proposed actions in the IP to address both bacteria and sediment load reductions include repairing or replacing failing septic systems, pet waste education program, waterfowl feces clean-up, eliminating unrestricted livestock access to streams, establishment/



enhancement of forested riparian buffers, enhanced erosion and sediment control, and various other stormwater management BMPs.

Stroubles Creek is a tributary of the New River in southwest Virginia. The headwaters of the creek originate in the northeastern part of the town of Blacksburg and the creek flows through Blacksburg and the Virginia Tech campus. The upper portion of the watershed is highly urbanized. The Stroubles Creek IP addresses an aquatic life use impairment. A stressor analysis, completed for the TMDL, identified excess sediment as the cause of impairment. Both urban and agricultural nonpoint sources were cited as sediment sources. Proposed actions in the IP include reducing unrestricted livestock access to streams and the establishment of agricultural riparian buffers, stream channel restoration, establishment/enhancement of forested riparian buffers, sanitary sewer improve-

ments, stormwater management BMPs, and urban/residential education components.

The Big Otter River (BOR) Basin, in south central Virginia, lies in portions of Virginia's Bedford and Campbell counties and encompasses the City of Bedford and suburbs of the City of Lynchburg. The Big Otter River IP address five completed bacteria impairment TMDLs and also addresses needed corrective actions on four segments recently listed for violating the state's bacteria standard. Both point and agricultural nonpoint sources were determined to be contributors to the bacteria load, however agricultural nonpoint source pollution was the primary contributor. Proposed corrective actions in the IP include repairing or replacing failing septic systems, eliminating unrestricted livestock access to streams, establishment of riparian buffers, and use of rotational grazing and related intensive pasture land BMPs.

Although each implementation plan is uniquely developed for each watershed, the approach used to develop the TMDL IPs was fairly consistent across the watersheds. Each watershed utilized a Resource Team which included Center personnel and state agency staff. The Opequon Creek Resource Team included a professional facilitator from the Institute for Environmental Negotiation at the University of Virginia. Each project utilized an intensive public participation process to obtain and act on stakeholder input. Sector specific (rural, urban, commercial, government) working groups identified potential cor-

rective actions to address various pollutant sources. A steering committee that included representatives from the working groups and the resource team used the working group input to prioritize the corrective actions to be implemented. The type and quantity of suitable corrective actions were then quantified using spatial data analysis and watershed modeling. For more information on these projects or to obtain copies of the final reports please visit our website at: www.tml.bse.vt.edu on the "TMDL Implementation" page.

Recent Center Publications

Benham, B.L., C. Baffaut, R.W. Zeckoski, K.R. Mankin, Y.A. Pachepsky, A.M. Sadeghi, K.M. Brannan, M.L. Soupir, and M.J. Habersack. 2006. Modeling bacteria fate and transport in watersheds to support TMDLs. *Trans. ASABE* 49(4): 987-1002.

Benham, B.L., M.K. Laird, B.B. Ross, D.H. Vaughan, and D.R. Peek. 2006. Surface quality impacts of conservation tillage practices on burley tobacco production systems in southwest Virginia. *Water Air Soil Pollut.* <http://dx.doi.org/10.1007/s11270-006-9221-z> (published online August 2006, print release follows in two to three months).

Borah, D., G. Yagow, P. Barns, K. Campbell, M. Dozier, W. Rosenthal, R. Rudra, and A. Saleh. 2006. Modeling sediment and nutrients for TMDL development and implementation. *Trans. ASABE* 49(4):967-986.

Kim, S. M., S. W. Park, J. J. Lee, B. L. Benham, and H. K. Kim, 2007. Modeling and Assessing the Impact of Reclaimed Wastewater Irrigation on the Nutrient Loads from an Agricultural Watershed Containing Rice Paddy Fields. *Journal of Environmental Science and Health, Part A* 42(3) (accepted, will be published March 2007).

Kim, S. M., B. L. Benham, K. M. Brannan, R. W. Zeckoski, and J. Doherty, 2006. Comparison of Hydrologic Calibration of HSPF Using Automatic and Manual Methods. *Water Resources Research* (accepted).

Mishra, A., B.L. Benham, and S. Mostaghimi. 2006. Sediment and nutrient transport from agricultural lands fertilized with animal manures. *Water Air Soil Pollut.* 175(1): 61-76.

Yagow, G., B. Wilson, P. Srivastava, and C. Obropta. 2006. Application of biological indicators in TMDL assessment and implementation. *Trans. ASABE* 49(4):1023-1032.

Recent Center Meetings and Presentations

Benham, B. Engaging stakeholders effectively. Water Environment Federation Third-Party TMDL Development Webcast. September 28, 2006.

Benham, B. Enhancing stakeholder effectiveness. Water Environment Federation Third-Party TMDL Development Webcast. September 21, 2006.

Benham, B. Status report: Opequon Creek watershed TMDLs, TMDL IP, and the Opequon Creek targeted watershed grant. Winchester City Council: Public Services Committee. August 25, 2006. Winchester, VA.

Benham, B. 2006. Watershed management research, education, and outreach program: the Center for TMDL and Watershed Studies at Virginia Tech. ASABE Paper No. 068037. Presented at ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Benham, B. Working with stakeholders. Water Environment Federation: Third-Party TMDL Development Workshop. July 26, 2006. Linthicum, MD. (continued on next page)

Recent Center Meetings and Presentations Cont.

Benham, B.L., C. Baffaut, R.W. Zeckoski, K.R. Mankin, Y.A. Pachepsky, A.M. Sadeghi, K.M. Brannan, M.L. Soupir, and M.J. Habersack. 2006. Modeling bacteria fate and transport in watersheds to support TMDLs. ASABE Paper No. 062295. Presented at the ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Borah, D., G. Yagow, P. Barns, K. Campbell, M. Dozier, W. Rosenthal, R. Rudra, and A. Saleh. 2006. Modeling sediment and nutrients for TMDL development and implementation. ASABE Paper No. 062294. Presented at the ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Kim, S. M., B. L. Benham, K. M. Brannan, and R. W. Zeckoski, 2006. Automatic Calibration of Hydrologic Parameters in HSPF Using PEST. ASABE Paper No. 062127. Presented at the ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Yagow, G., B. Wilson, P. Srivastava, and C. Obropta. 2006. Application of biological indicators in TMDL assessment and implementation. ASABE Paper No. 062297. Presented at the ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Yagow, G. and R. Brent. 2006. North River: Case study of a Category 4 TMDL - "Impaired, but TMDL not needed". ASABE Paper No. 067035. Presented at the ASABE 2006 International Meeting, Portland, OR. ASABE, St. Joseph, MI.

Zeckoski, B. and G. Yagow. Lick Creek TMDL Technical Advisory Meeting. October 13, 2006. Dante, Va.



Brian Benham
Biological Systems Engineering (0303)
Virginia Tech, Blacksburg, VA 24061

Phone: 540.231.5705
E-mail: benham@vt.edu
Website: tmdl.bse.vt.edu



The Center's mission is to conduct interdisciplinary research, teaching, and outreach to improve the integrity of the Nation's waters and watersheds by advancing the science, tools, and expertise available for developing, evaluating, and implementing watershed planning and management processes.