



## RESEARCH SERVICES SECTION

# TECHNICAL SUMMARY

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### PROJECT COST:

\$89,000



The enhanced simulation program accounts for off-site sediment control tools such as detention ponds to help planners design environmentally responsible construction sites.

# Design Tool for Controlling Runoff and Sediment from Highway Construction

## What Was the Need?

Storm water runoff from construction sites can degrade the quality of waters in streams and lakes. To protect these valuable resources and limit environmental damage, the Minnesota Pollution Control Agency requires that storm water pollution prevention plans be developed for construction activities that disturb areas of 1 or more acres.

Using best management practices to control runoff sediment from highway construction sites is an important component in construction site design. Understanding erosion processes and implementing erosion/sediment BMPs have been the focus of several research studies sponsored by Mn/DOT and the Minnesota Local Road Research Board. One earlier project to improve the usefulness of experimental data entailed developing a risk simulation tool called WATER (Watershed Assessment Tool for Environmental Risk). WATER simulates the impact of highly variable weather conditions on runoff and erosion for a single construction site.

However, the simulation tool proved to have limitations. Most glaring was the omission from the modeling data of widely used off-site sediment runoff control practices such as detention ponds and rock check dams. Without this data, project planners did not have a complete picture of available practices. Equally important, the simulation tool lacked a user-friendly interface for easy, quick analysis of the runoff data.

## What Was Our Goal?

The objectives of the project were to significantly enhance the WATER simulation tool by:

- Incorporating the effects of off-site sediment control practices (those practices taking place a mile or more from the construction site)
- Expanding the WATER model to include processes at a watershed scale by linking together the responses of different land uses
- Developing a more user-friendly interface

## What Did We Do?

To include off-site data in the modeling equations, the development team expanded the WATER model to include off-site practices like rock check dams, vegetative filters and detention ponds. In addition, the simulation tool was enhanced to accomplish five types of modeling:

- Risk assessment for a single construction site
- Modeling of multiple land uses within a watershed
- Standalone modules to model off-site processes, including rock and gravel infiltration filters
- Calculations from a feedlot runoff
- Application of a statistical tool to analyze environmental problems

The tool's modeling was also expanded to allow flow and sediment from different areas within a watershed to be combined for determining the overall response of the watershed.

*“If not controlled, sediment can impede water flow and reduce water quality. The enhanced WATER simulation tool will provide a more scientific way of defining and managing the erosion risks of construction projects so we can minimize the environmental impact.”*

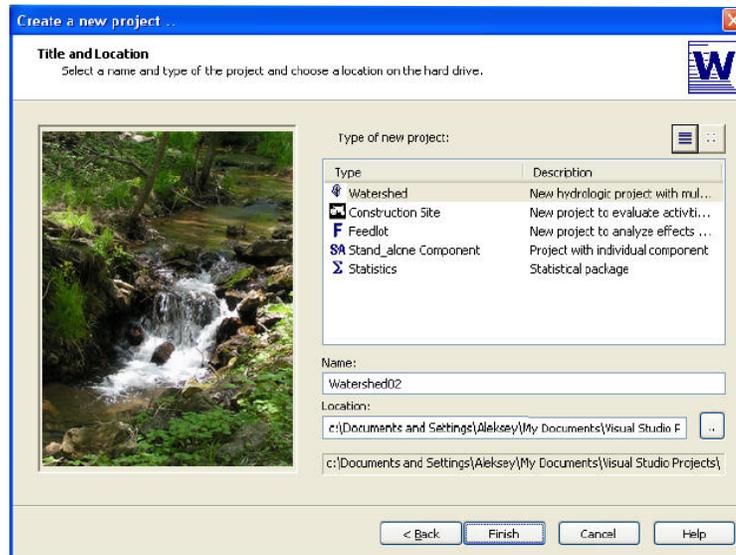
—**Brett Troyer**,  
Principal Engineer,  
Mn/DOT Environmental  
Services

*“We’ve been recording erosion data for awhile, but not in a useful format. Our new simulation program gives construction planners good information that lends itself to real-world applications.”*

—**Bruce Wilson**,  
Professor, University of  
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Creating a new project or running a simulation on an existing one is easy with WATER's project wizard, letting project engineers run simulations against their design to help define, test and, if needed, alter BMPs.

The investigators enhanced WATER to allow users to retrieve and edit input data, carry out continuous simulations, view output results graphically and work with GIS layers. Planners can run extensive simulations for extreme weather conditions—which help to define BMPs—as well as run “what-if” circumstances to determine worst-case scenarios.

In addition, to provide more accurate results, two different algorithms were developed for the WATER model to predict the hydraulic response and removal of sediment in rock and gravel filters.

### What Did We Learn?

Enhancements to the WATER risk simulation tool were critically important for practitioners and construction planners. These enhancements provide scientific support for construction design plans and help to define BMPs.

Overall, Mn/DOT was very satisfied with the improvements made to WATER. With the inclusion of both on- and off-site factors, construction planners have a better source of information to develop and test plans. This ultimately leads to construction projects with less environmental risk to neighboring water supplies.

Interestingly, the enhanced WATER program will benefit not just construction planners, but other agencies in Minnesota as well. For instance, the Minnesota Pollution Control Agency will look to the WATER tool to help define water quality standards throughout the state.

### What's Next?

While WATER was successfully enhanced to provide a better, more complete source of information for construction site planners, improvements are still needed in its usability. Currently, users need extensive knowledge of what data to input and how to input it to obtain accurate, relevant information. Planning is under way for a second phase of this effort, with the goal of creating a simpler, more intuitive user interface.

Mn/DOT Research Services is considering conducting after-the-fact surveys to gauge the degree to which the workshop facilitated changes in practice at the local level.

*This Technical Summary pertains to Report 2008-35, “Design Tool for Controlling Runoff and Sediment from Highway Construction,” published August 2008. The full report can be accessed at <http://www.lrrb.org/PDF/200835.pdf>.*