

Images courtesy of the San Antonio River Authority

Water quality monitoring tools provide means to measure effective BMPs & LID

By Sheeba Thomas, Yu-Chun Su, Ka-Leung Lee & Paul Hummel

Quantitative watershed master planning in the hydrologic and hydraulic field has been a standard practice for many decades. However, rural and urban runoff water quality management using BMPs and low impact development (LID) generally has been limited to qualitative planning, mostly due to the lack of suitable tools to conduct quantitative assessment.

In many cases, BMPs/LID has been implemented and then found ineffective through follow-up monitoring. In addition, inappropriate types and numbers of BMPs/LID also have been implemented in locations that provided little or no benefit to in-stream water quality. Consequently, many BMP/LID implementations were simply “best management” or “to the extent practicable” and the effectiveness of the BMPs/LID could only rely on follow-up long-term monitoring to verify.

With the costs of BMP/LID

construction, operation, maintenance and monitoring increasing substantially over the years, implementing water quality BMPs/LID in a watershed without prior quantitative planning could result in substantial waste of public funding. To address this issue, a project team led by the San Antonio River Authority (SARA), Lockwood, Andrews & Newnam Inc. (LAN) and Aqua Terra Consultants (a division of RESPEC) developed, tested and implemented a suite of water quality modeling tools to allow quantitative water quality master planning and BMP/LID prioritization. These tools were then applied to three major watersheds in the San Antonio River Basin: the Salado Creek, Leon Creek and Upper San Antonio River watersheds.

Modeling Tools

As there were various ongoing water quality modeling efforts in the San

Antonio River Basin, in December 2013 SARA and the project team first authored a water quality modeling standards document to ensure the quality and consistency of the developed water quality models. The document was one of the first of its kind to ensure consistency in water quality model development, calibration, validation and application.

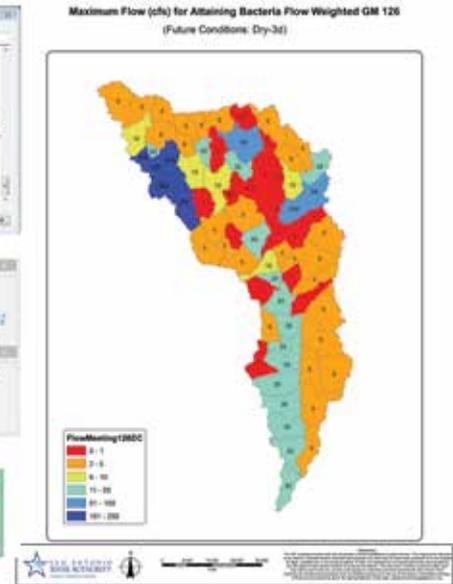
Next, the project team developed and tested tools to work with the Hydrological Simulation Program-FORTRAN (HSPF). HSPF is a well-documented and verified hydrologic and water quality program that has been in use for several decades all over the world and is a major component of the U.S. Environmental Protection Agency’s (EPA) Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) system. The developed tools included utility, load reduction and BMP tools.

The SARA Timeseries Utility Tool was

developed for efficient processing and exporting of large HSPF time series, such as runoff and pollutant time series, from a specific land use in the watersheds as well as from the reaches. The tool was developed, tested and released to the public through EPA's BASINS user community on Oct. 24, 2013.

The SARA Load Reduction Tool (LRT) was developed to determine any load reduction needed to meet specified screening levels within a watershed on a constituent-by-constituent and subbasin-by-subbasin basis. The tool was developed, tested and released to the public through EPA's BASINS user community on May 9, 2014.

The SARA Enhanced BMP Tool was developed to optimize the types and number of BMPs and LID needed to achieve the required load reductions within a watershed. The tool uses the HSPF model and LRT results, and the BMP optimization components of EPA's System for Urban Stormwater Treatment and Analysis Integration program. The tool's output includes types, numbers, and costs of LID and BMPs, as well as constituent load and



The SARA Enhanced BMP Tool determines the optimal combinations of BMP/LID units and types to achieve target constituent load reduction.

concentration reduction results. It includes a BMP Tool Database that contains BMP and LID data such as types, dimensions, areas served, constituent removal efficiencies and costs.

Community Impact

The water quality modeling tools developed by the project team provide water authorities and storm water professionals around the country a new,

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more effective way to address water quality issues in their communities. Using these tools, communities now can determine the optimal combinations of BMPs/LID to accomplish their goals and save storm water infrastructure and management costs. In addition, regulatory and planning agencies can use the tools to determine sustainable strategies for managing water

quality and urbanization.

Moreover, the results from these models could potentially help EPA and state agencies determine BMPs/LID needed in order to delist many impaired water bodies around the country, or to determine whether delisting is possible using BMPs/LID alone. Several water bodies in Texas have been listed as impaired due to

bacteria concentrations exceeding Texas Surface Water Quality Standards for contact recreation. With bacteria concentrations typically being high in storm water runoff, meeting these standards can be a challenge for many communities. Applying these tools will provide a scientific basis to determine suitable bacteria criteria.

In the long run, applying these tools will enable communities to manage storm water runoff as close as possible to the source, thereby creating more sustainable watersheds.

Future Application

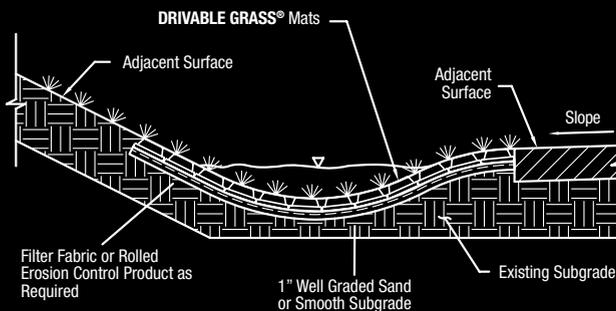
The project team's efforts are increasingly gaining national attention. The developed models were calibrated and validated to available water quality data and peer reviewed by national experts to ensure conformance with water quality modeling standards. The modeling efforts and results have been published at professional conferences and were well-received by technical and policy audiences. Multiple water agencies and regulatory authorities have expressed interest in these tools.

SARA, LAN and RESPEC visited EPA's Athens, Ga., lab in October 2015 to discuss these tools. EPA provided positive feedback on the effort and the SARA tools may be on the BASINS website soon to allow broader applications. EPA and SARA also are discussing potential case studies to further advance storm water quality management and modeling. **SWS**

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