

EXECUTIVE SUMMARY

Demonstration and Validation of BASINS Watershed Modeling System Enhanced for Military Installations – AP Hill

ESTCP Project RC-201307

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1.0 INTRODUCTION

The Better Assessment Science Integrating point and Non-point Sources (BASINS) Modeling System is a geographic information system-based system and features a well-developed interface for different dynamic watershed models, as well as numerous pre- and post-processing tools that are shared by the models. Two types of enhancements, using the Hydrological Simulation Program – FORTRAN (HSPF) as the primary modeling code, were developed for the BASINS modeling system for military-specific applications: (1) data and methodologies that address key military land stressors (i.e., urban encroachment, prescribed burning, timber harvesting, military training, and unpaved roads), and (2) software refinements related to model linkages and algorithms.

Military Enhanced BASINS Modeling System (BASINS.MIL) was used to build a continuous computer simulation model of hydrology and water quality for the watersheds on and surrounding Fort Benning (FB), Georgia (GA). This model is referred to as the FB Model (or FB Enhanced Baseline Model). Preliminary model applications of the FB Model were performed to provide proof-of-principle demonstration of the modeling system and the model enhancements to support watershed management decisions on the Installation.

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2.0 OBJECTIVES

The Environmental Security Technology Certification Program (ESTCP) sponsored the demonstration/validation of BASINS.MIL described in this report as the next step to fully demonstrate the validity of the technology to meet the Department of Defense's (DoD) need for tools to evaluate watershed hydrology and water quality for system-level assessments. The technology transfer of BASINS.MIL demonstration/validation leverages the watershed model developed on FB by conducting further modeling applications on FB, and by developing a watershed model for another installation that was used to further demonstrate the technology. Fort AP Hill (FAPH), Virginia was selected as the second site since it provides a unique opportunity to (a) demonstrate the transferability of the BASINS.MIL modeling framework to a new installation and (b) demonstrate the ability of BASINS.MIL to address Total Maximum Daily Load (TMDL) issues. This report provides the results of the FAPH BASINS application.

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3.0 TECHNOLOGY DESCRIPTION

Use of continuous simulation computer techniques (such as BASINS.MIL) for evaluation of watershed hydrology and water quality offers much promise as a system-level assessment tool. However, this technology has been slow to be embraced by DoD installations due in part to a variety of perceived and real shortcomings, such as: 1) uncertainty about costs related to site-specific data needs, 2) expertise needed to apply the modeling system, 3) disparity between the scale of the assessment need and the scale of the model's resolution, and 4) a lack of knowledge regarding the versatility and relevance of the technology to address compliance-specific management issues on installations. The objective for the FAPH component is focused on the transferability of the BASINS.MIL modeling framework to a new installation, and to demonstrate the ability of BASINS.MIL to address TMDL issues and small-scale assessments. Note that the cost assessment task was removed by ESTCP in mid-2018, and thereby deleted from this effort.

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4.0 PERFORMANCE ASSESSMENT

The demonstrations and validations that were performed at FAPH are the following:

- Task 2: Model Set Up and Model Calibration/Validation on FAPH
- Task 3: Assessment and Comparison of Model Loading Rates at FAPH
- Task 8: Small-Scale Stormwater Runoff Analysis at FAPH

This report is comprised of a main body that contains a synopsis and conclusions/ recommendations for each of the following four FAPH tasks:

Task 2: Model Set Up and Model Calibration/Validation on FAPH

To demonstrate that BASINS.MIL can be used to effectively set up a model at another installation and be calibrated and validated at a confident level to apply the tool for practical watershed management issues, a hydrologic and water quality model of the watersheds on FAPH were built by applying BASINS.MIL. The resulting model is named the FAPH Model. This task demonstrates the calibration and validation of the FAPH model.

Task 3: Assessment and Comparison of Model Loading Rates at FAPH

As federally-managed land within the Chesapeake Bay Program (CBP) watershed, FAPH must meet the goals established in the Chesapeake Bay TMDL. A necessary responsibility for installations located in the Chesapeake Bay drainage is to build and demonstrate more local-scale (i.e., at the scale of the installation) BMP strategies that are consistent with the regional-scale TMDL allocation strategies. This requires a comparable TMDL assessment effort at the installation scale. Task 3 focused on comparing the FAPH model's watershed representation and water quality modeling results to alternative models/results. Comparisons are made to the results generated by the United States Environmental Protection Agency (USEPA) CBP TMDL Model and the National Defense Center for Energy and Environment (NDCEE) spreadsheet model.

Task 8: Small-Scale Stormwater Runoff Analysis at FAPH

As part of the overall objective to demonstrate capabilities of a BASINS.MIL model, the objective of this task is to demonstrate how the FAPH Model performs as a tool for small-site stormwater designs and Energy Independence and Security Act Section 438 compliance. BASINS.MIL was applied to a newly-constructed 1.56 acre parking lot at FAPH to corroborate the adequacy of an on-site detention pond.

For interested readers, we recommend an initial review of the summaries for these tasks provided in the main body of the Final Report, and then a follow-up with a more detailed investigation of the individual sections devoted to each specific task effort and the corresponding conclusions and recommendations.