



#### Introduction

Due to ease of computation, mitigation wetland designers have developed wetland water budgets assuming the wetland acted as a "bathtub," assuming little to no interaction with groundwater. However, most natural wetlands are dynamically linked to groundwater. Wetbud provides designers a spatially and temporally discretized method for calculating wetland water budgets that considers groundwater flows, stream and overbank inputs, and flow resistance from wetland vegetation.



# Wetbud Program

- Available for Windows <sup>™</sup> Systems ONLY (7, 8.1, 10)
- Setup for a single user or a multiuser office environment
- Features multiple projects, multiple scenarios per project, and a project setup wizard
- Data stored using Firebird open source database software for fast data export and retrieval.
- Multiple output graphing options are provided and model output includes monthly water surface elevations for specified years, suitable for design reports.



# Wetbud: A wetland hydrologic design model

Tess Thompson<sup>1</sup>, W. Lee Daniels<sup>1</sup>, Rich Whittecar<sup>2</sup>, Zach Agioutantis<sup>3</sup>

<sup>1</sup>Virginia Tech, <sup>2</sup>Old Dominion University, <sup>3</sup>University of Kentucky

# **Model Structure**

#### **Basic Model**

The basic model of Wetbud uses level pool routing and assumes a flat uniform wetland for computing monthly water balances.



The advanced model incorporates a Generated User Interface (GUI) with the MODFLOW-NWT modular finite difference groundwater model. Both flat and irregular wetland topography, as well as up to four layers can be modeled. The advanced model calculates water elevations on a daily basis.

# **Surface Water Routines**

Hillslope runoff from the wetland watershed is calculated using the NRCS Curve Number Method.

Flows in adjacent stream channels can be estimated using the NRCS dimensionless unit hydrograph or input as time series from a USGS stream gage or a modeling program, such as HEC-HMS.





through the stream overbank module. Outflow is assumed to occur through an outflow weir.



If inflow weirs or channels exist, inflow from adjacent streams can be incorporated



Thank you to the Peterson Family Foundation and Wetland Studies and Solutions, Inc. for providing funding for this project. Peterson Family Foundation









Outlet

Advanced Model

Stream čhannel





Alternatively, precipitation data for specific wet-drynormal years and VA State Boundary calculated nenandoah Valley RC Region East Blue Ridge evapotranspiration (ET) Richmond Byrd Field values for specific regional Farmville RGNL • - Roanoke MUNI weather stations are angley AFB Lones ome Pine available for the state of Virginia.

Either the Penman-Monteith or the Thornthwaite method of determining ET can be used.









#### **Software Utilities**

Wetbud employs a Google maps interface for locating weather stations near a given site.

Precipitation and weather data can be downloaded automatically from the National Climate Data Center and NRCS WETS for any site in the US.

Groundwater inputs from adjacent hillslopes can be estimated for any year with historic weather data using the effective monthly recharge routine (WEM), if several months of well data are available at a site.

> For Advanced models, grid utilities assist with the setup of Modflow layers and the assignment of cell elevations and properties using cell zones and grid zones.