Watershed Assessment Model (WAM) Applications in Florida

Del Bottcher, Andy James, and Bret Whiteley

Soil and Water Engineering Technology, Inc.

Jeff Hiscock

JGH Engineering
Why Model?

Educate stakeholders on watershed behavior for better decision making!

- Quantify change from native conditions
- Quantify relative contributions by land use
- Evaluate alternative abatement scenarios
  - Environmental benefit
  - Economic Impact
- Evaluate impact of new developments
  - Environmental response vs. cost
- Help set reasonable TMDLs
- Evaluate compliance of implemented programs
A Few of the Available Watershed Models

- ANSWERS
- HSPF
- MIKE-SHE
- SWAT
- SWMM
- WASH
- Neural Networks
- EMC models
- RSM
- WAM

Each model has its strengths and weaknesses so selection should be based on the modeling objectives and the model’s available to meet those objectives.
Watershed Assessment Model (WAM)

- Developed specifically for Florida conditions
- Simulates surface and groundwater flow and TSS and nutrient loadings. DO and Chl-a when combined with WASP
- GIS Based to maximize use of spatial datasets
- Detailed field scale land source simulation
- Handles complex flow networks
- User friendly interface
Conceptual Layout of WAM Processes Handled
How WAM Works!

Depression
Overland
Stream
Loop
Wetland
Basin Outlet

GW (1 ha)

Flow Routing
Grid Cell

Dam

How WAM Works:

- Depression
- Overland
- Stream
- Loop
- Wetland
- Basin Outlet

GW (1 ha)
Key
1. Source to nearest Stream
2. Source to Nearest Wetland
3. Source to Nearest Depression
4. Wetland to nearest stream
5. Depression to nearest stream
6. Source to groundwater stream

Legend
- Source Cell
- Springshed Boundary
- Surface Runoff
- Groundwater Flow
- Wetland
- Reach
- Depression
**WAM ToolBar in ArcMap 10**

Selected map feature

The selected map features parameters are loaded into a property grid making them available for edit.

Contextual parameter definitions
Watersheds Simulated by WAM in Florida
Developing Predevelopment Conditions

- Digital Elevation Maps
- Soils Map
- Historic Photos
- Historic Land Cover Maps & Research Lit.
- Descriptive Literature
GW Recharge - N
Existing vs Pre-Dev.

Coastal Springs Watershed Assessment Model

Existing Land Use
Predevelopment Land Use
GW Recharge - N
Existing vs Build-Out

Coastal Springs Watershed Assessment Model

Existing Land Use

Build Out Land Use
Distribution of Anthropogenic (Legacy) P in Okeechobee Watershed
P Impacts in Okeechobee Watershed

- Legacy P in Watershed = 190,000 mt

- At current P discharge levels it would take about 380 years to wash out the existing Legacy P

- Knowledge base for transport and abatement strategies is good
Upper Peace River - Three Lakes TMDL Model Using WAM & WASP
TMDL and Abatement Issues

- TMDL preliminarily set at 30 TSI
- N and P reductions needed to meet TMDL were estimated
- Source loads reductions of N and P could not meet target
- Lake sediment removal was identified as a necessary abatement practice in order to meet TMDL target
Development and Application of a GIS-Based Springshed Nonpoint Source (NPS) Pollutant Loading Model for Rainbow Springs for Marion County by SWET, HDR, & JGH
Special Considerations

- Land use affluency
- Land management activities
- Retention systems mapping
- Well fields
- Septic tanks and service areas
- Urban impervious surfaces and landscape management
- Depressions
- Ag irrigation withdrawals
Units = grams/ha/year
Conversion: 1 gram/ha/yr = .00089 lbs/ac/yr
Simulated Future Impacts at Rainbow Spring

- WAM Predicted Equilibrium Point ~5.0 mg/l for 2055 Predicted Land Use
- WAM Predicted Equilibrium Point ~4.3 mg/l for 2025 Predicted Land Use
- WAM Predicted Equilibrium Point ~3.34 mg/l for Current Land Use
- Current Trend in N Levels in Rainbow
- Measured Data
- Probable Trend if Land Use Activities were Frozen to 2007 Levels
- Probable Trend with predicted future land use

Graph showing nitrogen concentration over time with various predicted and measured data points.
PreDrainage vs Post Drainage Assessment

Modeled by
SWET and HDR

Fisheating Creek Feasibility Study
Pre-drainage vs. Existing Land Use
Pre-drainage vs. Existing Hydrography
Pre-drainage vs. Existing TP Runoff
Fisheating Creek WAM Results
C139
C139 TP Concentrations

- Observed
- Simulated (Calibrated)
- Simulated (Uncalibrated)
Summary and Conclusions

- Florida is highly impacted by humans

- Modeling of anthropogenic impacts can
  - Identify and quantify sources
  - Quantify changes - what did it used to be like? or
    “How can we know where we are going, if we don't know where we came from?”
  - Evaluate alternative abatement scenarios

- Educate stakeholders for better decision making
Visit Us at
www.swet.com

Soil & Water Engineering Technology, Inc.
3448 NW 12th Ave
Gainesville, FL 32605
352 378-7372
dbottcher@swet.com