SIMPLE
(Spatially Integrated Model for Pollutant Loading Estimates)

Automating Pollutant Loading Estimation

Sarasota County
September 18, 2006
Presentation Outline

- Model history and overview
- Discussion of current development efforts
- Optional model demonstration
History

- Watershed Management Model (WMM)
  - Phase 1 MS4 NPDES Permit
  - SBEP
- Lemon Bay Model
- Differ in hydrologic methods and handling of BMPs
- Not spatially enabled
SIMPLE Overview

- Combined strengths of previous models
- Spatially enabled within ArcGIS v.9.x
- Created BMP feature class
- Comprehensive point and non-point source pollutant loading model
- NPDES compliance with future uses
SIMPLE Overview

- Pollutant Loading currently considered:
  - Direct Runoff
  - Point Sources
  - Septic Tanks
  - Baseflow

- Constituents Modeled:
  - BOD, COD, TSS, TDS, 4 N-species, 2 P-species, 4 metals, Oil & Grease, Fecal Coliform
Some Modeling Terminology…

- **EMC**
  Event Mean Concentration Model – Total load divided by total flow

- **BMP**
  Best Management Practice – stormwater ponds, swales, etc.
Creation of BMP Feature Class

- Compare recent aerial photography with NHAP 1984 photography
- SWFWMD ERP coverage
- Most ponds > 1 ac.
- Treatment Types
  - Retention
  - Detention
  - Others
  - Expandable
Direct Runoff LOADING =

Rainfall * Area * C * EMC * (1-BMP)

- **Rainfall**: User Input
- **Area**: Size of GIS drainage basin polygon
- **C**: Depends on land use & soil
- **EMC**: Based on previous studies in the area
- **(1-BMP)**: Efficiency based on previous studies

Runoff Volume
Point, Septic, Baseflow
LOADING =

Flow * Concentration

User Input

Use Average Data:
- FDEP/WMD
- Individual Plants
- Average for Entire Study Area

Spatial Location:
- WMD/County
- WMD/County
Model Output

- Lbs/year or Lbs/acre/year
- Spatially referenced
<table>
<thead>
<tr>
<th>Major Basin</th>
<th>BOD</th>
<th>TSS</th>
<th>TP</th>
<th>Nitrate</th>
<th>Metals</th>
<th>NH3</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>Catfish Creek</td>
<td>206,292</td>
<td>896,081</td>
<td>53,297</td>
<td>12,267</td>
<td>2,292</td>
<td>88,664</td>
<td>109,013</td>
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<td>Hudson Bayou</td>
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<td>8,802</td>
<td>4,040</td>
<td>8,502</td>
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<td>Matheny Creek</td>
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<td>4,242</td>
<td>1,190</td>
<td>20,978</td>
<td>32,541</td>
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<td>Phillippi Creek</td>
<td>1,486,962</td>
<td>12,710,876</td>
<td>84,233</td>
<td>88,212</td>
<td>22,718</td>
<td>456,481</td>
<td>696,424</td>
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<td>Sarasota Bay Coastal</td>
<td>305,256</td>
<td>3,101,444</td>
<td>15,306</td>
<td>20,253</td>
<td>6,163</td>
<td>39,991</td>
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<td>Whitaker Bayou (Sar. Co.)</td>
<td>199,531</td>
<td>2,083,368</td>
<td>8,432</td>
<td>11,723</td>
<td>4,334</td>
<td>36,492</td>
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<td>Palma Sola Drain</td>
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<td>478,783</td>
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<td>1,047</td>
<td>2,044</td>
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<td>Cedar Hammock</td>
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<td>Anna Maria Island</td>
<td>62,463</td>
<td>712,018</td>
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<td>4,604</td>
<td>1,297</td>
<td>2,395</td>
<td>14,630</td>
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</tbody>
</table>
Model Demonstration/Discussion

You’ll need:
- GDB Template
- Model MXD
- Supporting shps or feature classes
GDB Template
Basins

- Model is scalable on this coverage
Soils

- **Hydrologic Soil Group** — Dictates how quickly water will drain
- Compress 6 groups to 4
- Updatable!!!
Land Use

- FLUCCS Code
- Compress 46 classes into 10
- Updatable!!!
BMP – Best Management Practices
Point Sources

- Q, Concentrations go into a point shapefile
Septic Tanks

- Q, Avg. Effluent Concentrations
  - Working/Failing
  - Residential/Non-Residential

- Woah! Over 45,000 tanks in Sarasota County
- Can account for significant load coming from a basin
Modeling Action~

- **Reclass** land use into EMC land use using landuse compression table and dissolving.
- **Reclass** dual hydrologic group soils into A, B, C, D based on land use and dissolving.
Almost ready to run…
User Inputs

[Image of a computer interface showing a window titled "Pollutants loading" with options for data setup, run model, and model log. The window includes buttons for start over and close.]
Modeling Action~

- Sum DRO load for each basin by:
  - Geoprocessing EMC land use/soils/basin(s)/BMP type-unique polygons
  - Use Runoff Coeff. relate table ($C_{wet}$, $C_{dry}$)
  - Use EMC relate table
  - Use BMP removal efficiency relate table

Rainfall * Area * C * EMC * (1-BMP)
- lbs/year or lbs/acre/year
- Spatially referenced
Current Model

- Seasonal and average annual loads
- Single rainfall input
- Standard GIS output
- No calibration/verification
Current Development Efforts

- Calibration/verification
  - Selected monitoring
  - Refinements in selected land uses
  - Local, intermediate, and bayshed

- Model enhancements
  - NEXRAD rainfall input
  - Monthly output
  - Time-stamped data
  - Improved reporting

- Peer review