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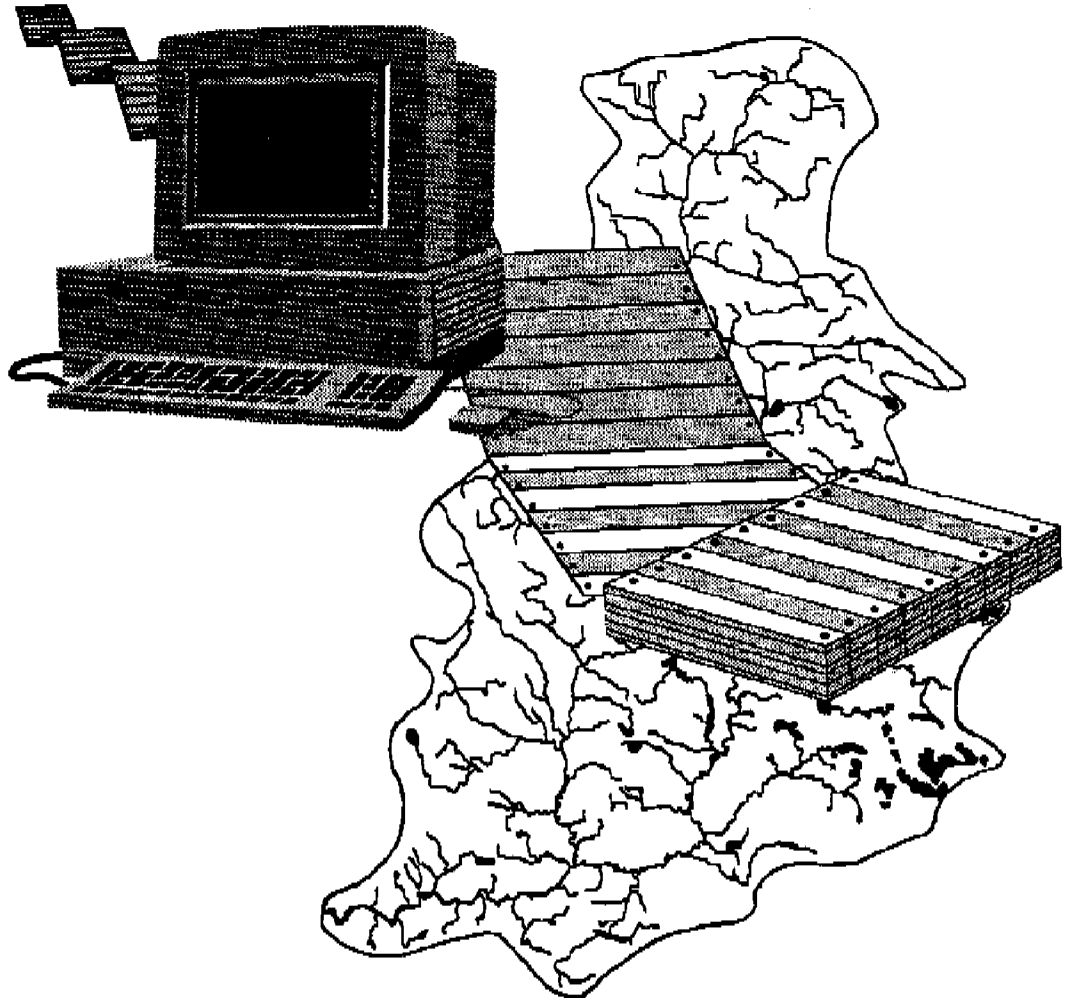
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EPA

# COMPENDIUM OF WATERSHED-SCALE MODELS FOR TMDL DEVELOPMENT



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**COMPENDIUM OF WATERSHED-SCALE MODELS  
FOR  
TMDL DEVELOPMENT**

U.S. Environmental Protection Agency  
Office of Wetlands, Oceans and Watersheds  
Office of Science and Technology  
401 M St., SW  
Washington, DC 20460

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Compendium of Watershed-Scale Models for TMDL Development

Table 1. Evaluation of Model Capabilities - Simple Models

Criteria		EPA <sup>1</sup> Screening	Simple <sup>1</sup> Method	Regression <sup>1</sup> Method	SLOSS-2 PHOSPH <sup>2</sup>	Water Screen	Watershed	FHWA	WMM
Land Uses	Urban	○	●	●	-	○	●	○ <sup>3</sup>	●
	Rural	●	-	○	●	●	●	○	●
Time Scale	Point Sources	-	-	-	-	-	○	-	○
	Annual	●	●	●	●	-	●	●	●
	Single Event	○	○	○	-	-	-	○	-
	Continuous	-	-	-	-	-	-	-	-
Hydrology	Runoff	- <sup>4</sup>	●	-	-	-	-	○	○
	Baseflow	-	-	-	-	-	-	-	○
Pollutant Loading	Sediment	●	●	●	●	●	●	-	-
	Nutrients	●	●	●	●	●	●	●	●
	Others	●	●	●	-	-	●	●	●
	Transport	-	-	-	-	-	-	-	-
Pollutant Routing	Transformation	-	-	-	-	-	-	-	○
	Statistics	-	-	-	-	-	-	-	○
Model Output	Graphics	-	-	-	-	-	●	-	○
	Format Options	-	-	-	-	-	●	-	○
Input Data	Requirements	○	○	○	○	○	○	○	○
	Calibration	-	-	-	○	○	●	-	●
	Default Data	●	●	●	●	○	○	●	●
	User Interface	-	-	-	-	○	●	○	●
BMPs	Evaluation	○	○	-	○	○	●	○	●
	Design Criteria	-	-	-	-	-	-	-	-
Documentation		●	●	●	●	●	●	●	●
		-	-	-	-	-	-	-	-

<sup>1</sup> Not a computer program.  
<sup>2</sup> Coupled with GIS.  
<sup>3</sup> Highway drainage basins.  
<sup>4</sup> Extended versions recommend use of SLOSS-curve number method for runoff estimation.

● High   ○ Medium   ○ Low   - Not Available

*Compendium of Watershed-Scale Models for TMDL Development*

Table 2. Evaluation of Model Capabilities - Mid-Range Models

Criteria		NPSMAP	GWLF	P8-UCM	SWIFTM	Auto-CI	AGNPS	SLAMM
Land Use	Urban	●	●	●	●	●	-	●
	Rural	●	●	-	-	-	●	-
	Point Sources	●	●	●	-	-	●	-
Time Scale	Annual	-	-	-	-	-	●	●
	Single Event	○	-	●	-	-	-	-
	Continuous	●	●	-	-	-	●	-
Hydrology	Runoff	●	●	●	●	●	-	●
	Baseflow	○	●	-	○	○	●	●
	Sediment	-	●	-	●	○	-	○
Pollutant Loading	Nutrients	●	●	●	●	●	●	●
	Others	-	-	●	●	●	●	●
	Transport	○	○	○	○	●	-	●
Pollutant Routing	Transformation	-	-	-	-	-	●	●
	Statistics	●	○	-	○	-	-	-
	Graphics	●	●	●	-	-	-	○
Model Output	Format Options	●	●	●	●	○	●	○
	Requirements	●	●	●	●	●	●	●
	Calibration	○	○	○	○	○	○	○
Input Data	Default Data	●	●	●	●	○	○	○
	User Interface	●	●	●	●	○	○	○
	Evaluation	○	○	●	●	●	●	●
BMPs	Design Criteria	-	-	●	○	○	○	○
	Documentation	●	●	●	○	○	●	○

● High ○ Medium ○ Low - Not Available

Table 3. Evaluation of Model Capabilities - Detailed Models

Criteria		STORM	ANSWERS	DFSM	SWFRBWC	SWMM	HSPF
Land Uses	Urban	●	-	●	○	●	●
	Rural	-	●	-	●	○	○
Time Scale	Point Sources	●	-	●	●	●	●
	Annual	-	-	-	-	-	-
	Single Event	○	●	○	○	●	●
Hydrology	Continuous	●	-	●	●	●	●
	Runoff	●	●	●	●	●	●
	Baseflow	○	-	○	●	●	●
	Sediment	●	●	●	●	●	●
	Nutrients	●	●	●	●	●	●
Pollutant Loading	Others	●	-	-	●	●	●
	Transport	-	○	●	●	○	●
	Transformation	-	-	-	-	○	●
Model Output	Statistics	○	-	●	●	●	●
	Graphics	-	●	○	○	○	○
Input Data	Format Options	●	●	●	●	●	●
	Requirements	●	●	●	●	●	●
	Calibration	○	○	○	○	○	○
	Default Data	○	○	○	○	○	○
BMPs	User Interface	-	-	○	○	-	-
	Evaluation	○	○	○	○	○	○
	Design Criteria	○	○	○	○	○	○
Documentation	●	○	○	○	○	○	

● High ○ Low - Not Available

*Compendium of Watershed-Scale Models for TMDL Development*

Table 4. A Descriptive List of Model Components - Simple Methods

Model	Main Land Use	Hydrology	Erosion/ Sediment	Pollutant Load	Pollutants	Time Scale
EPA Screening Procedures	Mixed watershed	N/A	USLE MUSLE	Loading functions, potency factors	Wide range <sup>1</sup>	Mean annual
The Simple Method	Urban	Runoff coefficient	N/A	Mean concentration	NURP data: TSS, P, metals, O&G	Variable (annual, monthly, event)
Water Screen	Mixed watershed	N/A	USLE	Loading functions, potency factors	N, P, organics	Mean annual
Watershed	Mixed watershed	N/A	USLE	Unit area loadings	Wide range <sup>1</sup>	Annual
FRWA	Highways	Runoff coefficient, observed data	N/A	Median concentration	TSS, N, P Organics, metals	Storm event
WMM	Mixed watershed	Runoff coefficient	N/A	Event mean concentration	N, P, lead, zinc	Annual
SLOSS/PHOSPH Regression Method	Rural	N/A	USLE	Loading functions	P	Annual
	Urban	N/A	N/A	Regression equations	TSS, N, P, COD, metals	Storm event

<sup>1</sup>Depends on available pollutant parameters and default data.

- N Nitrogen
- O+G Oil and gas
- P Phosphorus
- TSS Total suspended solids
- COD Chemical oxygen demand

Table 5. A Descriptive List of Model Components - Mid-Range Models

Model	Main Land Use	Hydrology	Erosion/ Sediment	Pollutant Load	Pollutants	Time Scale
NPSMAP	Mixed watershed	SCS curve number	N/A	Runoff concentration	N, P	Continuous
GWLF	Mixed watershed	SCS curve number	Modified USLE	Unit loading rates	N, P	Continuous
PB-UCM	Urban	SCS curve number -modified TR 20	N/A	Nonlinear accumulation	TSS, N, P, metals	Storm sequence
SIMFTM	Urban	Trapezoidal hyetograph	Modified Yalin equation	Nonlinear accumulation	Wide Range <sup>1</sup>	Storm sequence
Auto-QI	Urban	Water balance	N/A	Accumulation and washoff	Wide Range <sup>1</sup>	Storm event, Continuous
AGNPS	Agriculture	SCS curve number	Modified USLE	Potency factors	N, P	Storm event
SLAMM	Urban watershed	Small storm-based coefficient	N/A	Nonlinear accumulation and washoff	N, P, COD bacteria, metals	Continuous

<sup>1</sup>Depends on available pollutant parameters and default values.

- N Nitrogen
- O + G Oil and gas
- P Phosphorus
- TSS Total suspended solids
- COD Chemical oxygen demand

Table 6. A Descriptive List of Model Components - Detailed Models

Model	Main Land Use	Hydrology	Erosion/ Sediment	Pollutant Load	Pollutants	Time Scale
ANSWERS	Agriculture	Distributed storage model	Detachment transport equations	Potency factors (correlation with sediment)	N/A	Storm event
SWMM	Urban	Nonlinear reservoir	Modified USLE	Buildup/washoff functions	Wide range <sup>1</sup>	Storm event, continuous
HSPF	Mixed watershed	Water balance of land surface and soil processes	Detachment/washoff equations	Loading/washoff functions and subsurface concentrations	Wide range <sup>1</sup>	Storm event, Continuous
STORM	Urban	Runoff coefficient - SCS curve numbers - Unit hydrograph	USLE	Buildup/washoff functions	P, N, OD, metals	Continuous
SWRRB	Agriculture	SCS curve number	Modified USLE	Loading functions	N, P, OD, metals, bacteria	Continuous
DR3M	Urban	Surface storage balance kinematic wave method	Related to runoff volume and peak	Buildup/washoff functions	TSS, N, P, organics, metals	Continuous

<sup>1</sup>Depends on available pollutant parameters and default values.

- N Nitrogen
- O + G Oil and gas
- P Phosphorus
- TSS Total suspended solids
- COD Chemical oxygen demand