

Overview Table

Model Functionality	SWAT	HSPF	WARMF
Spatial Component	●	●	◐
In-Stream Nutrient Transformations	◐	●	●
Sediment Transport	◐	●	●
Nutrient Output by Land Use	●	●	○
Used in TMDL Studies	●	●	◐
EPA BASINS Support	●	●	◐
Ease of Use	◐	○	●
Level of Documentation	●	◐	◐
GIS Application	●	●	●
Continuing Development	●	◐	◐
Anticipated Model Support & Updates	●	◐	○
Farming Practices	●	◐	◐
Implement BMPs	●	●	●
Auto-calibration	●	●	○

Legend

Description	Symbol	Points
Model performs well	●	3
Model performs in a limited manner	◐	2
Model performs poorly	○	1

Detail Table 1

Model Functionality	SWAT	HSPF	WARMF
Model Details			
Model Development	Texas A&M, USDA, open source	Aqua Terra Consultants, USEPA, USGS	Systech, EPRI, USEPA
User Support	Dedicated user groups, FAQs, workshops, conferences, website video training	PowerPoint training presentations, possible email list	Dedicated user group, training manual
GIS Application	ArcSWAT (ESRI), BASINS, MWSWAT (open source)	BASINS	WARMF
Latest Release	SWAT2012, revision 637, 5/18/2015	Version 12.4 pre-release April 2014	EPA version is v.6.1. WARMF 6.5 (5/18/2012) from Systech.
Time Since Model Update	3 months	1.3 years	3.3 years
Overview			
Spatial Disaggregation	Watershed, subwatersheds, HRUs	Watershed, subwatersheds, HRUs	Watershed, Land Catchment
Homogenous Level (land use, soil, etc.)	HRU	HRU	% of land catchment
Runoff/Infiltration Method	SCS Curve Number, Green-Ampt (requires sub-daily precipitation)	Storage based equations (non-linear reservoir)	Hydraulic conductivity
Snow Modeling	Yes	Yes	Yes
Time Step	Daily, sub-daily (requires use of Green-Ampt)	Daily, hourly	Daily
Auto-calibration	SWAT-CUP	PEST	No
Features			
Weather Generator	Yes	No	No
Elevation Bands (for mountainous areas)	Yes, up to 10 elevation bands within a subwatershed to account for orographic effects	Yes, ATEMP modifies using dry and wet lapse rates	Yes, one adjustment made within catchment to account for differences between weather station and land catchment
Ponds and Reservoirs	Yes, ponds are off-channel and reservoirs are on-channel	Yes, reservoirs are on-channel using FTABLES	Yes, reservoirs (CE-QUAL-W2)
Point Source Loading	Yes, daily, monthly, yearly, or average annual loading	Yes, add as time series	Yes, step function loading based on input file dates
Septic Systems	Yes, septic system module added in SWAT2009	Modeled as point sources. Review further	Yes, by population density (standard, advanced, failing)

Detail Table 2

Model Functionality	SWAT	HSPF	WARMF
Watershed			
Sediment Erosion	Modified USLE	USLE	Critical shear stress
Evapotranspiration	Penman-Monteith, Priestly-Taylor, Hargreaves method.	Jeson, Hanson, Penman, Pan Evaporation.	Hargreave's Method
Confined Aquifer	Yes, acts as model sink and allows pumping	Yes	No
Atmospheric Deposition	Nitrogen (dry and wet)	Nitrogen and phosphorus (dry and wet)	Nitrogen and phosphorus (dry and wet)
Nutrient Transport in Watershed	Soluble P in top 10 mm of soil. Organic and mineral P adsorbed to sediment	Phosphate in solution transported with water. Organic P and adsorbed phosphate are removed with sediment	Adsorbed and soluble movement
Channel			
Flow Calculation	Manning's Equation	Stage-discharge or Manning's Equation	Manning's Equation
Flow Routing Methods	Muskingum or variable storage	Kinematic wave of storage-routing method	Kinetic Wave
Sediment Routing Methods	Yes, simplified Bagnold model, Kodatie model, Molinas and Wu model, Yang sand and gravel model	Yes, SANDLD module simulates deposition, scour & transport. Uses Colby Method or Toffaleti's Method for sand	Yes, critical shear stress determines transport or deposition
In-stream Nutrient Transformations	Yes, QUAL2E component	Yes, RCHRES module	Yes
Nutrient Transport	Soluble inorganic P and Organic P. Adsorbed P transport is de-coupled from sediment transport	NH3 and PO4 adsorbed to sediment fractions	Dissolved and adsorbed, partitioned as a function of TSS

Detail Table 3

Model Functionality	SWAT	HSPF	WARMF
Water Quality Parameters			
BOD	○	●	●
CBOD	●	○	○
DO	●	●	●
pH	○	●	●
Temperature	●	●	●
Sediment	● Median particle size	● Sand, silt, clay	● Sand, silt, clay
Nutrients in Channel			
Orthophosphate (PO4) (Soluble P)	●	●	●
Organic (adsorbed) Phosphorus	●	●	●
Total Phosphorus	●	●	●
Organic (adsorbed) Nitrogen	●	●	●
Nitrite (NO2)	●	●	●
Nitrate (NO3)	●	●	●
Ammonium	●	●	●
Total Nitrogen	●	●	●
Algae	● Suspended algal biomass (phytoplankton)	● Phytoplankton, zooplankton, benthic algae (attached algae)	● Phytoplankton, periphyton
Bacteria Modeling	●	●	●
Pesticide Modeling	●	●	●
Management Practices			
Fertilizer and Manure Applications	● Yes, daily, monthly, automatic or continuous rates	● Yes, application interval specified in subroutine SPECL	● Yes, applied via monthly loading rates
Grazing operations	●	○	○
Tile drainage	●	○	○
Urban Areas/ Impervious Area	●	●	●
Irrigation Practices	● Yes, manual and auto- application routines	● Yes, manual and auto- application routines	● Yes, simplified routines
BMPs	● Yes, filter strips, detention pond, street sweeping, etc.	● Yes, filter strips, detention pond, street sweeping, etc.	● Yes, buffer strips, livestock fencing, detention ponds, street sweeping