

North American Wetland Engineering Subsurface Flow Modeling

NAWE has expertise in numerical modeling of subsurface flow and mass transport processes in both saturated and variably saturated systems. These models are useful in designing engineered wetlands for wastewater/groundwater treatment processes, determining the impact of soil disposal of treated wastewater on groundwater elevations and nutrient concentrations, assessing water supply characteristics of confined aquifers, and optimizing groundwater remediation processes for petroleum hydrocarbons and chlorinated solvents.

1. Engineered Wetlands for Wastewater/Groundwater Treatment

The HYDRUS numerical model can be used for designing engineered wetlands for wastewater treatment of high-strength streams such as propylene glycol aircraft de-icing fluid and petroleum hydrocarbon-contaminated groundwater. This model incorporating variably saturated flow, Monod microbial growth kinetics, sequential first-order reactions, and adsorption and retardation.

2. Impact of Soil Disposal of Treated Wastewater on Groundwater Elevations, etc.

The HYDRUS numerical model is ideal for assessing flow characteristics of variably saturated porous media underlying soil disposal areas for treated wastewater. Such impacts include water table elevation changes due to groundwater mounding and nitrate-nitrogen transport characteristics under various combinations of hydraulic gradient, groundwater velocity, and loading geometries.

3. Water Supply Characteristics of Confined Aquifers

The MODFLOW numerical model is commonly used for determining aquifer productivity and the impact of new production wells on potentiometric surfaces in confined aquifers, including well interference, drawdown, and impacts on overlying confined and unconfined aquifers and surface waters.

4. Groundwater Remediation

The MODFLOW numerical model, in combination with the MT3D mass transport model, is ideal for assessing groundwater contamination and designing groundwater remediation systems, including permeable reactive barriers, hydraulic containment, electron donor injections/microbial amendments (e.g., dextrose, diammonium phosphate) for anaerobic dehalogenation, in situ oxygenation, and monitored natural attenuation. Such models can include linear and nonlinear adsorption, and first-order decay, along with advection and multi-dimensional dispersion.