

## Morris County Water Balance Model – A Tool for Water Resources Planning in the New Jersey Highlands

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A Water Balance Model was conceptually developed for Morris County by delineating the watersheds of the Passaic, Raritan and Delaware Rivers that intersect with the County and the underlying groundwater aquifers. A calibrated surface water model was linked with a calibrated groundwater model in a computer program (MCWBM) that facilitates executing these models, changing certain input data and presenting the model results for assessment and planning. HDR transferred the MCWBM to the Planning Department and the MCMUA for their use.

The MCWBM user can apply the model to evaluate the relationships between component inflows and outflows (water transported into and from Morris County) during average precipitation, as well as dry and wet annual conditions. For example, land use within a municipality or a selection of sub-watersheds (HUC14's) can be changed to simulate the effect of the altered impervious surface area on stormwater runoff, groundwater recharge and baseflow. This is relevant for analyzing zoning and land use policies proposed by local municipalities and regional entities such as the New Jersey Highlands Council.

The latest available data on land use, well pumping and wastewater treatment plant flows were used in the MCWBM to simulate existing (baseline) conditions. The MCWBM results were summarized in a water balance that quantifies the annual inflows and outflows to the surface water and groundwater systems.

Hypothetical county-wide increases in well pumping were simulated and the water balance results were compared to the baseline condition. The increased pumped groundwater came from higher river leakage into the groundwater and resulted in lower flow from groundwater to rivers. The net effect is reduced baseflow leaving the County as well as within the County and suggests potential impacts on the reservoir water supplies and flows for ecological habitat. These model projections indicated the areas of concern for increased well pumping. The largest drop in groundwater elevation in the buried valley aquifer is in the southeast part of the County. The largest groundwater drops in the sedimentary bedrock aquifer east of the Ramapo Fault are in the southeast and northeast parts of Morris County. The highest groundwater decreases in the bedrock aquifer are in southwest Morris County.

The MCWBM is a mechanistic model, and offers an alternative analytical approach to the statistical methods used in New Jersey Highlands Council's water capacity analysis. HDR recommends that the NJGS data on the transfers of water for public supply and wastewater be taken to a more exact geographical basis to refine the analysis of water imports and exports as well as intra-county transfers. Further, the groundwater model (MODFLOW) should be enhanced to simulate transient conditions and be applied to assess water supply under the drought conditions of the 1960's. The MCWBM is a powerful tool for developing water use and conservation land use plans that will be integral to sustainable management of water resources in the New Jersey Highlands.

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