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Simulating Water Flow to a Subsurface Drain in a Layered Soil

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Abstract: The objective of the work presented in this paper was to simulate drain flow into subsurface drainage pipes for a layered soil profile using a finite element based HYDRUS-2D model. Data from the drainage experiment in North Central Ohio were used as input to the model. Studies were conducted to determine the ability of the model to predict drain discharge-water table elevation relationships. The model was also used to evaluate the effect of backfill on drain discharge-water table elevation relationships. HYDRUS-2D underpredicted drain discharge compared to the empirical and Kirkham-Hooghoudt equations for water table elevations above 70 cm. However, HYDRUS-2D predictions were very close to those using empirical and Kirkham-Hooghoudt equations for water table elevations below 70 cm. In the backfill simulation scenario with backfill soil saturated hydraulic conductivity values obtained 40 years after the installation of the drains, the model produced higher drain flow rates than those obtained without simulating backfill when the midspace water table elevation was greater than 70 cm, but still underpredicted drain discharge compared to the empirical and Kirkham-Hooghoudt equations. In conclusion, to predict drain flow into a subsurface drain pipe for a layered soil using HYDRUS-2D, the model may give better results with the hydraulic conductivity values of backfill and the model needs more tests for layered soil conditions.

Key Words: Drain discharge, finite element, layered soil, HYDRUS-2D

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