ГРАЂЕВИНСКИ ФАКУЛТЕТ

Water Research

Објављен рад

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Modelling faecal microbe levels is performed widely in natural and wastewater wetlands, yet these predictions can be challening due to highly stochastic storm events. In our study, a coupled hydrodynamic and microorganism model was developed and tested to predict the long-term faecal microbial removal in stormwater constructed wetlands. The microorganism model simulates the fate and transport of the faecal indicator organism Escherichia coli (E. coli), resolving advection-dispersion, sedimentation, resuspension and die-off based on temperature and UV exposure. The model was tested using a two-year monitoring dataset collected from Troups Creek wetland, a multiple-inflow stormwater wetland in Melbourne, Australia. The model parameter values applied in the coupled model were based on a mixture of site-specific data and values obtained from literature. The only adjusted parameter in our microorganism model was the die-off rate in dark conditions in the stormwater wetlands. An urban stormwater microorganism model, MOPUS, was used to generate continuous catchment E. coli loading rates as input to the wetland. The hydrodynamic model was evaluated using flow rate monitored at the outlet weir, achieving Nash- Sutcliffe Efficiency (E) values of 0.86 over the two-year monitoring period. The E. coli model was tested using outflow E. coli concentration data and achieved an overall E of 0.37. The performance of the microbial model was variable across the 22 monitored events, with E ranging from <0 to 0.8. Sensitivity tests were performed to evaluate the model outputs and the results indicated that (a) the importance of collecting high-quality data for stormwater inputs into wetlands and (b) the importance of accurate estimation of the die-off rate in wetland microbial removal models. Our research showed that this model can be used to help design and rectify stormwater constructed wetlands for better faecal microbial removal, vegetation maintenance and support future real-time decision-making.