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Abstract
Stormwater management using Water Sensitive Urban Design (WSUD) is emerging as an alternative to traditional structural engineering solutions. Here stormwater infiltration is analyzed as a means for increasing the flow in a stream with unacceptably low flows during the dry season. The analyses were carried out by developing a hydrogeological model of the Beder area in Aarhus, Denmark. The model area is characterized by the presence of a secondary unconfined aquifer that partly contributes baseflow to the local streams and partly to recharge to the underlying primary aquifer.

The model was applied to assess the impact of stormwater runoff infiltration on (1) the water balance; (2) stream flow of the local stream Hovedgrøften; and (3) the risk of polluting the primary aquifer. The hydrogeological model was developed in a deterministic groundwater model (MIKE SHE) which was coupled dynamically to a hydrodynamic 1-D river model (MIKE 11). Geological data based on spear mapping, geophysical data and lithology from local boreholes were used to set up the geological model. Groundwater observation and stream flow measurements were used for model calibration and validation.Different scenarios were analyzed in order to evaluate the impact of implementing stormwater runoff infiltration. The 'Baseline scenario' was run for a 5 year period and was used to establish the water balance, the stream flow and the groundwater flow. The 'realistic infiltration scenario' simulated stormwater runoff infiltration from a 6.8 ha area, as suggested by the Aarhus municipality, with approximately 25% imperviousness. This scenario was used to track the flow path of infiltrated stormwater, and to quantify both the water balance and the stream flow of Hovedgrøften and compare them with the 'Baseline scenario'. The 'potential infiltration scenario' simulated stormwater runoff infiltration from the whole Beder area of 1.5 km2. This scenario was used to quantify both the water balance and the stream flow of Hovedgrøften and compare them with the 'Baseline scenario'.

Results show that the water balance is moderately affected by the recharge from the WSUDs and that 25-27% of the infiltrated stormwater would reach the stream and 67-73% the primary aquifer for both scenarios. The infiltrated stormwater poses a risk to the primary aquifer, as particle tracking showed that the infiltrated water would reach the primary aquifer. Stormwater infiltration in the 'potential infiltration scenario' was shown to contribute an additional 11% to the Hovedgrøften stream flow during a very low stream flow period and by 0.1% in the 'realistic infiltration scenario' (these result were based on the assumption that all stormwater runoff was infiltrated).

Stormwater infiltration in Beder was shown to have a small impact on the streamflow of Hovedgrøften. This is because the impervious area available for stormwater runoff infiltration is small compared to the catchment area of Hovedgrøften. A more impervious catchment would have greater potential for increasing the contribution to streamflow.

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