The functioning of water-storing roads in relation to groundwater

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Introduction

Water-storing roads (WSRs) are a blue adaptation measure, which can store water directly beneath the road surface. While WSRs are theoretically a promising measure, knowledge gaps with respect to their relationship to groundwater dynamics prevent them from widespread implementation. This poster presents the first results of a measurement campaign at several WSRs in the Netherlands as part of the SIA RAAK Project the water-storing road (RAAK.PUB07.012).

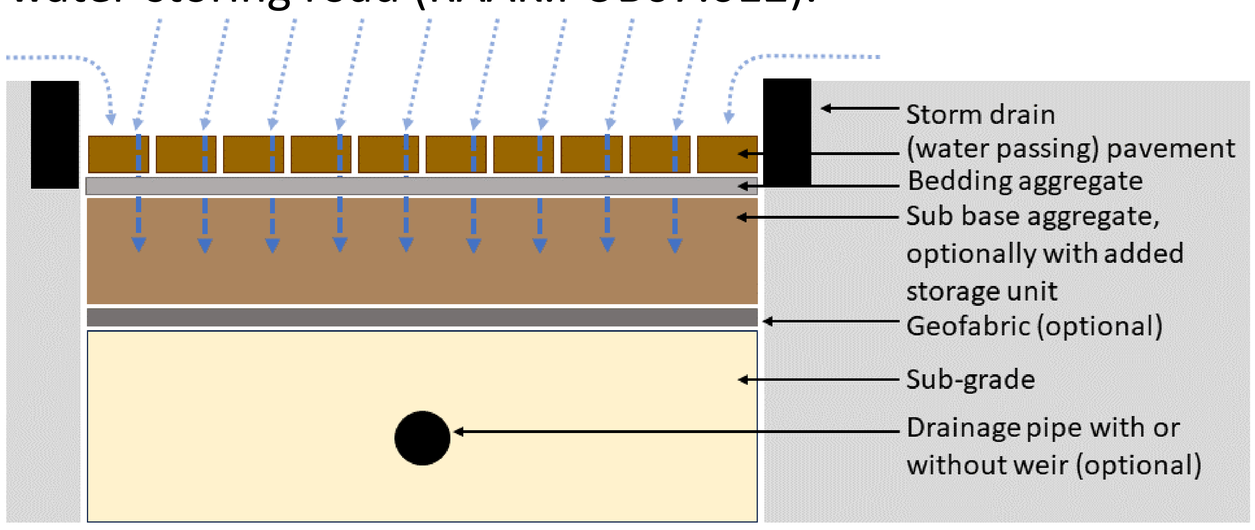

Figure 1 – Cross-section of a WSR design. Adapted from Veldkamp, Boogaard and Kluck (2022).

Methods

Eight different (in soil type and design) WSRs in the Netherlands were monitored up to 2 years:

- Storage dynamics: water levels in the underground storage with 5-10 minute interval.
- Groundwater (GW) dynamics: Daily GW-levels at 2-6 monitoring wells placed perpendicular to the road.
- Weather dynamics: precipitation with a 10 minute/daily interval was taken from the nearest KNMI or private weather station.

Additionally, soil and design characteristics of each WSR were collected.

Conclusions

This poster presents the first results of a measurement campaign of WSRs. While most WSRs function as originally designed with respect to storing and discharging water, longer and additional measurements are needed to determine the actual effects of WSRs on groundwater recharge and drainage.

Results & Discussion

Analysis of the 8 cases indicate that WSRs can generally be divided in 4 categories, with similar influence on groundwater dynamics (figure 2). Results indicate:

- The drainage system had the most impact on groundwater in and near the WSRs:
  - In WSRs with draining drains without weir, around 80% of the time groundwater was drained to surface waters.
  - In WSRs with infiltrating drains, around 100% of the time water was infiltrated, mostly from surface waters and less from precipitation.
- In WSRs without drain, 100% of the precipitation was infiltrated.
- The WSRs with additional storage unit were the most complex and the most prone to failure, with either no storage fill, or a permanently filled storage.
- Infiltration from the researched WSRs with draining drains is small, as most WSRs are empty within a couple of hours, indicating little infiltration, or show little water-level fluctuations within the storage unit.
- In future work a statistical time-series analysis could be applied, potentially leading to new insights in the rainfall-recharge relationship of the wells around the WSRs. With additional discharge measurements through the drain a parameterized water balance of the WSRs can be applied to study the gains/losses of the different water fluxes.

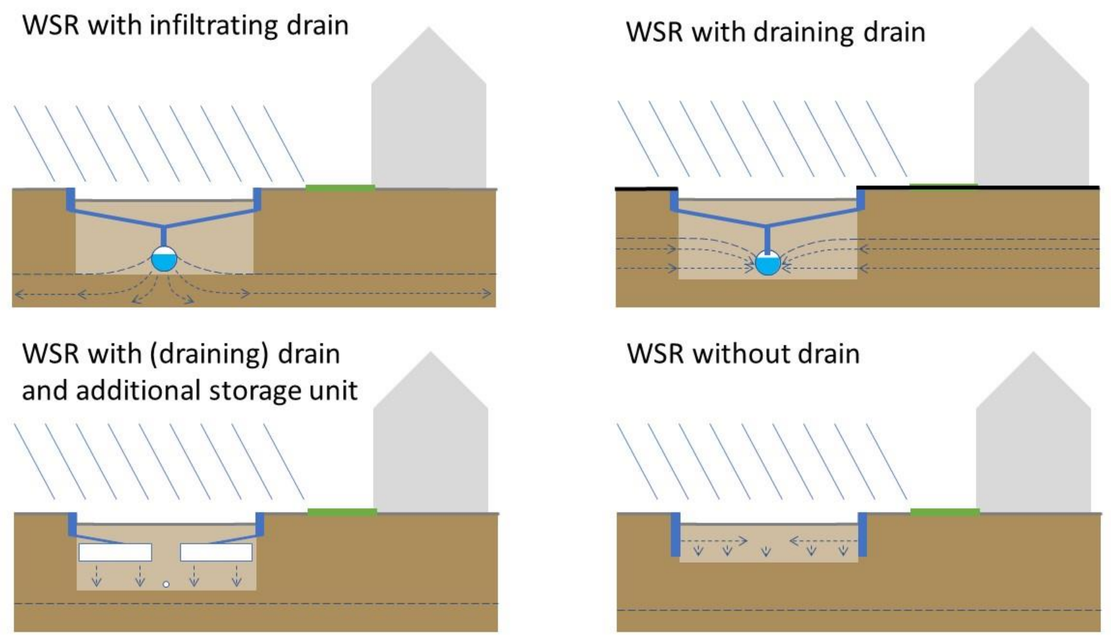

Figure 2 – Categorisation of the researched WSRs

References

Veldkamp, T. I. E., Boogaard, F. C., & Kluck, J. (2022). Unlocking the potential of permeable pavements in practice: A large-scale field study of performance factors of permeable pavements in the Netherlands. Water, 14(13), 2080.

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