

# Examples of managed aquifer recharge (MAR) from the Arabian Peninsula



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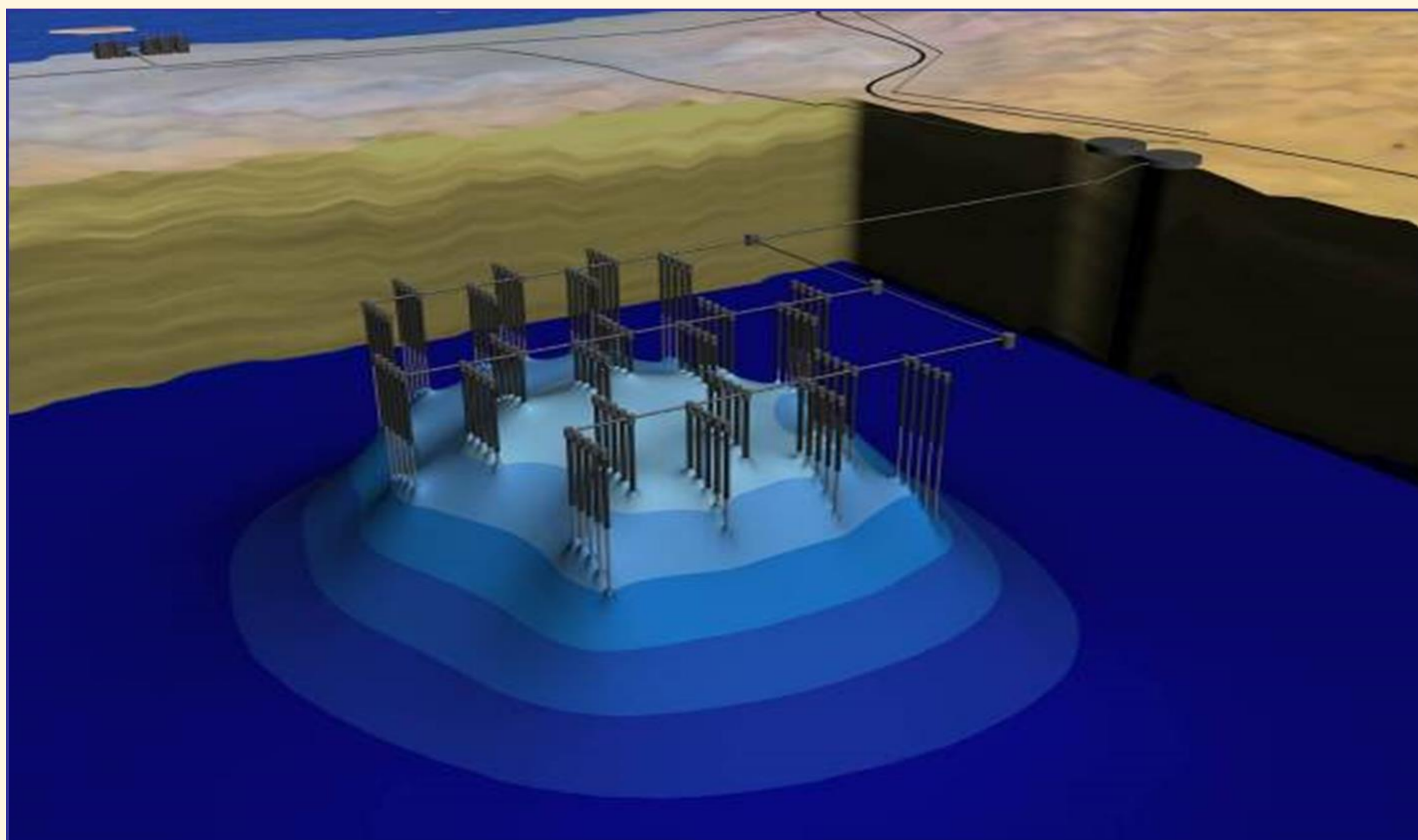
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## 1. Introduction

In recent years, many studies and projects on "Managed Aquifer Recharge (MAR)" have been initiated on the Arabian Peninsula. The arid to hyper-arid climate of the Middle East, the mega cities and the high water demand offer a variety of uses for MAR systems. After the technologically demanding ASR systems were built for a long time only in the USA, Australia and Europe, the countries on the Arabian Peninsula recognized the benefits of MAR/ASR systems for their water supply and are turning more and more systems into reality. In the poster three examples from the Arabian Peninsula are presented.

## 2. Abu Dhabi

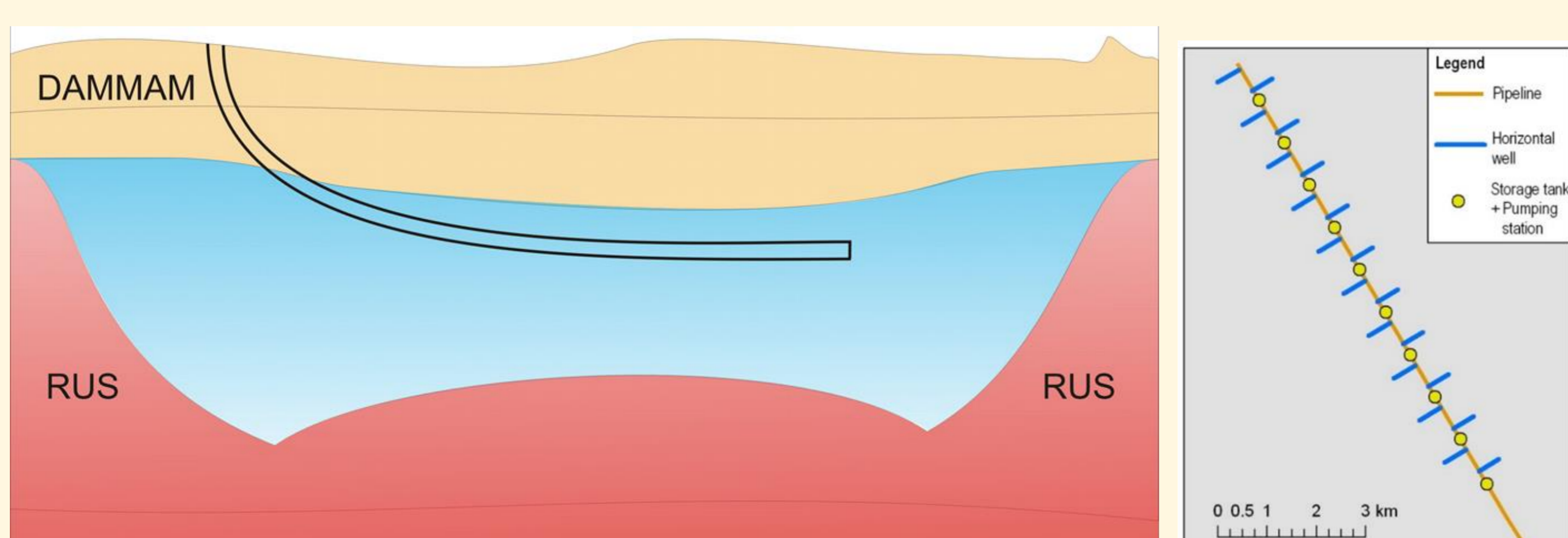
In Abu Dhabi (UAE), desalinated seawater is infiltrated by a well field into a shallow sand aquifer for the emergency water supply [1]. The infiltration takes place over a gravel bed in the unsaturated zone, a drinking water lens forms on saline groundwater.



**Fig. 1:** Simulated groundwater mound by infiltration of desalinated sea water through vertical injection wells into the shallow sand aquifer.

## 3. Qatar

In the northern part of Qatar, a freshwater lens over saline groundwater in a karstified limestone aquifer is depleted by groundwater abstractions for agricultural irrigation. As part of a feasibility study, various measures to prevent "upconing" of the saline groundwater and the complete loss of fresh water were investigated [2]. MAR with the help of horizontal drilling and infiltration of fresh water is a possible solution for the preservation and restoration of the fresh water lens.



**Fig. 2:** Horizontal Wells. Immediate use of depleted aquifer system by applying horizontal wells to minimize upconing of saltwater during abstraction.

## 4. Saudi-Arabia

In Riyadh (Kingdom of Saudi Arabia), the natural regeneration of groundwater in the Al-Alb wadi is increased significantly via injection wells in the reservoir of the Al-Alb dam [3, 4]. The wells intersect the sediments of the reservoir and the unsaturated zone of the alluvial valley deposits. The water infiltrates directly into the wadi aquifer. Down streams the groundwater is used for agricultural irrigation.



**Fig. 3:** Al-Alb dam next to Riyadh with infiltration wells [4].

## 5. Conclusions

Prerequisites on ideal conditions for MAR sites:

- Minimum unsaturated thickness
- High hydraulic conductivity and high specific yield of the aquifer
- Large abstraction rates possible
- No or slow groundwater movement/ flow
- Aquitard below storage zone
- Low groundwater salinity (no saltwater intrusion risk)
- No existing pumping activity
- No or little agricultural activity to avoid contaminations
- Vicinity to existing water distribution network
- Remote, non-developed surface land

## 6. References

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- [3] CASAS, J.-H., KALWA, F., WALTHER, M., RAUSCH, R. (2021): Stormwater harvesting in ephemeral streams: how to bypass clogging and unsaturated layers. Hydrogeology Journal. Doi:10.1007/s10040-021-02345-9.
- [4] AL AL-SHAIKH, A. (2011): Rainwater and Runoff Harvesting and Recharge in Saudi Arabia. Power Point Presentation.