Stephen Kissane

Managed Aquifer Recharge Project Preparation

Project Rationale and Objectives

Stephen Kissane

- **Education:**
- **MSc (Hydrogeology) - Birmingham University 1980-1981**
- **Higher Diploma (Education) - National University of Ireland 1977-1978**
- **BA (Natural Sciences) - Dublin University, Trinity College 1972-1976**

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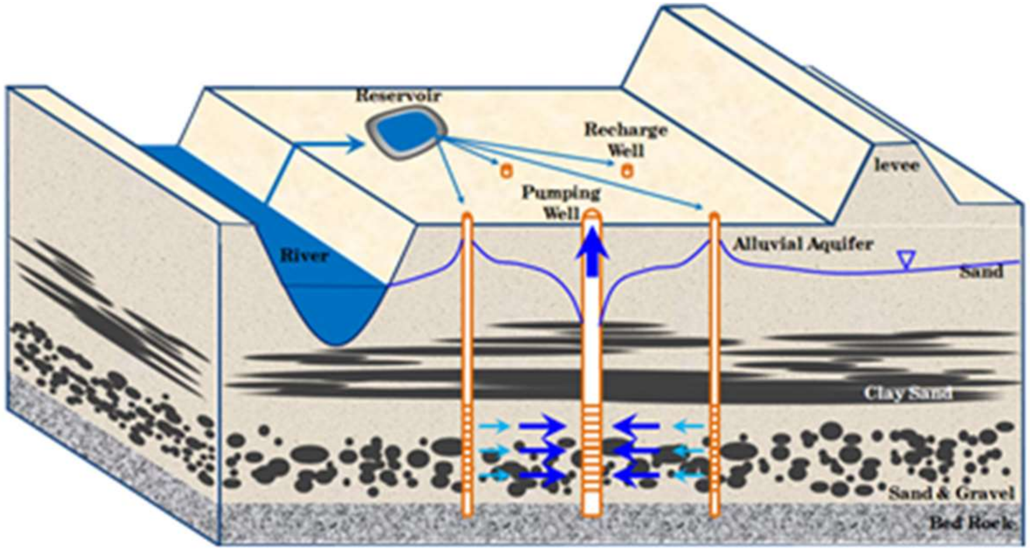
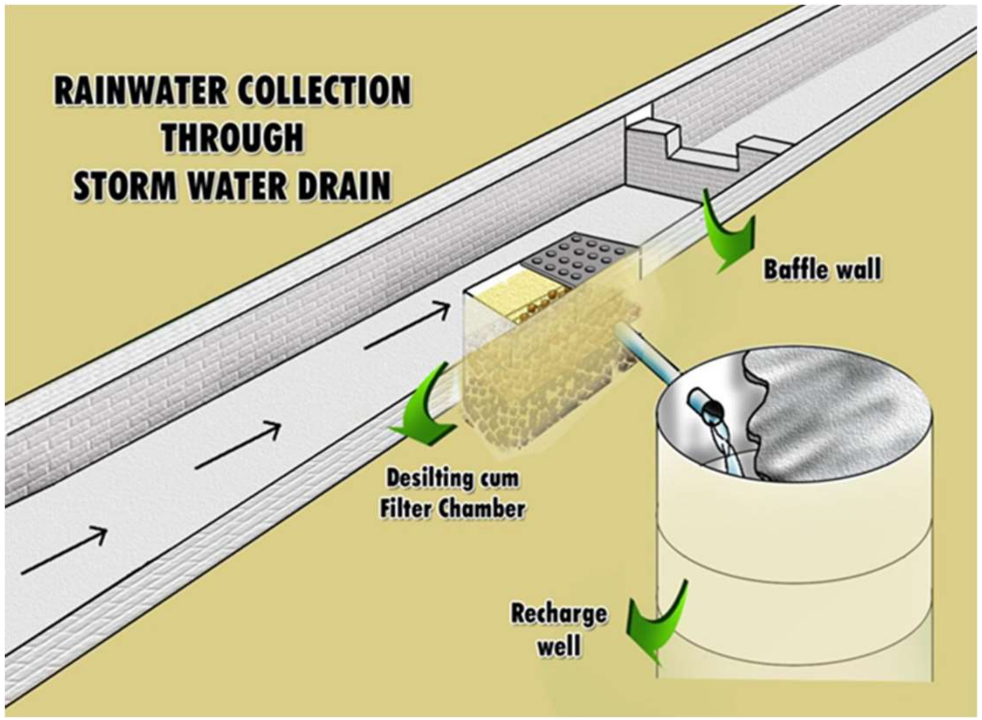


Objectives

- To plan and later test Managed Aquifer Recharge (MAR) / Aquifer Storage and Recovery (ASR) technologies as one solution to improving the domestic water supply
- If feasible, to prepare a scaled-up MAR investment project



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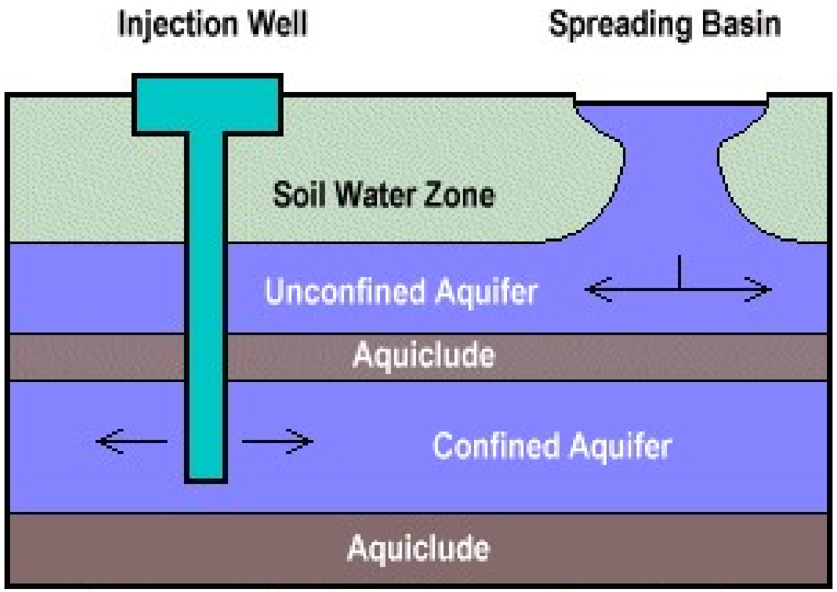
Concepts - MAR and ASR

- One of the solutions for water shortage is Managed Aquifer Recharge MAR or Artificial Storage and Recovery (ASR).

- What is ASR? Artificial Storage and Recharge/Recovery

- ASR is a water resource management tool, using below ground storage of water with the intent to recover water at a later date.

- Managed aquifer recharge (MAR) involves various types of aquifer recharge, including ASR. If there is no plans to recover, then MAR is the preferred term.



Injection Well vs. Spreading Basins

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Concepts – Water Sources

Classification of ASR system by water type includes:

Potable water.

Raw (untreated) freshwater.

Treated wastewater (reclaimed water).

Stormwater (surface water) or snow melt.

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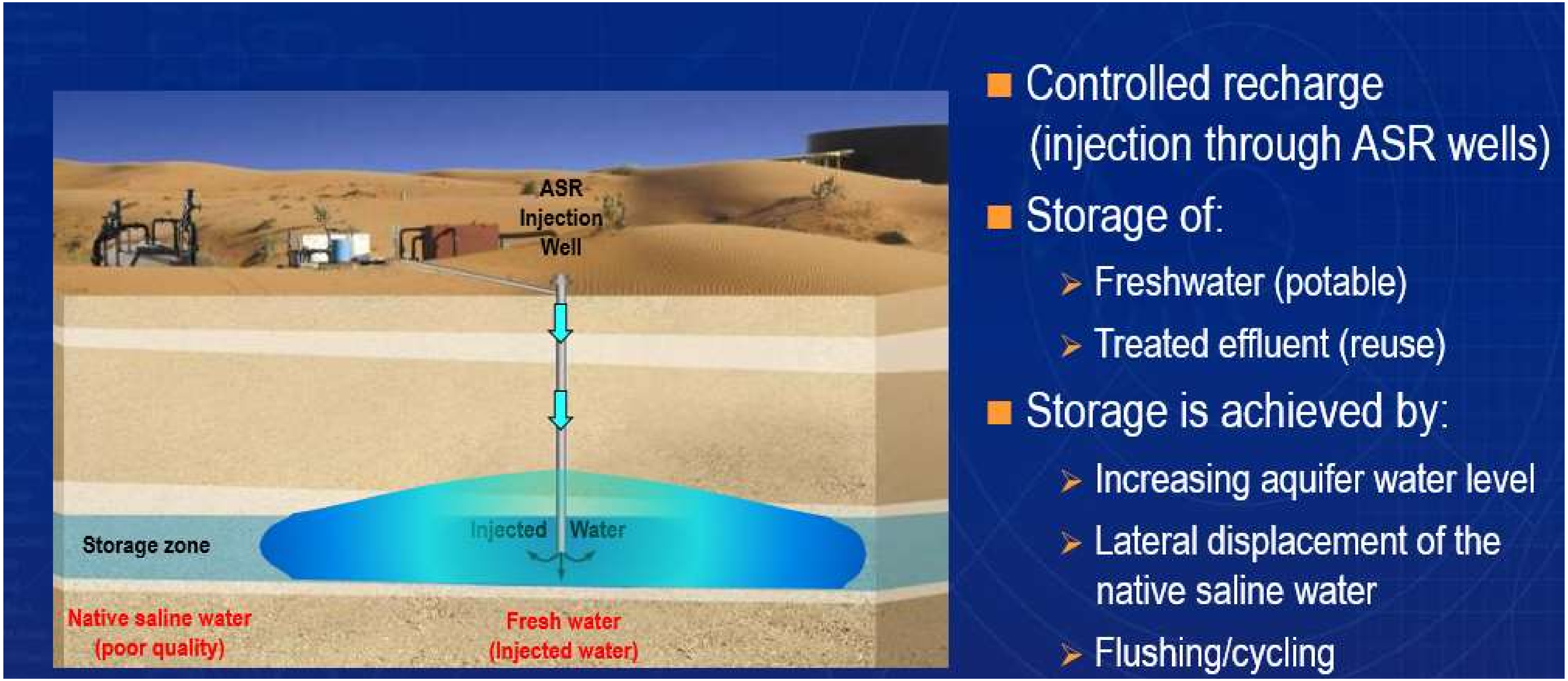
Concepts



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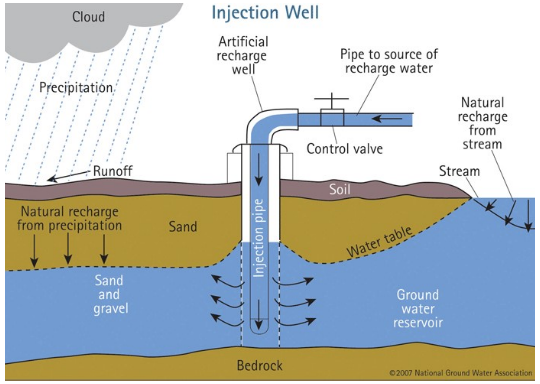
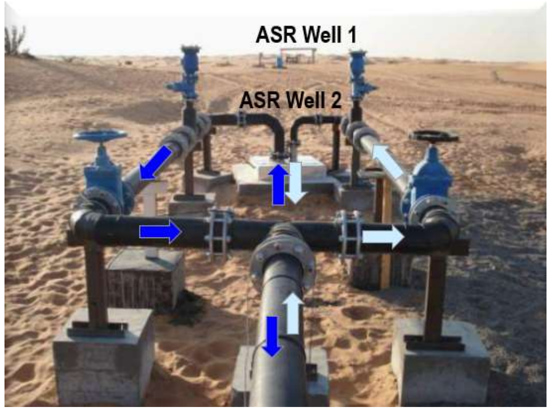
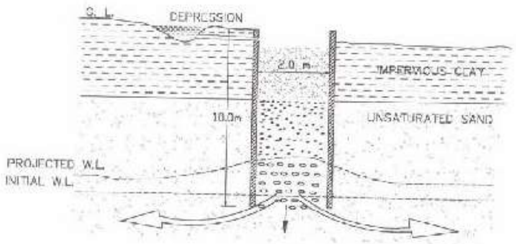
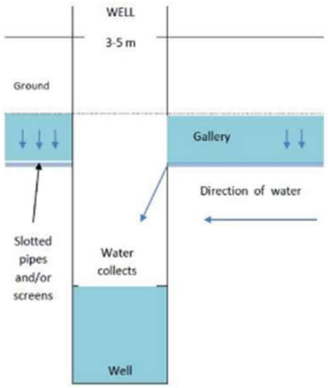
ASR – MAR Technologies (8) - 1

- Injection Well (pumping)
- Injection Well (Gravity)
- Large Diameter Receiving Well
- Large Diameter Receiving Well with galleries
- Above Surface Receiving well
- Spreading Basin
- Ditch and Furrow System
- Contour Bunds
- Check Dam









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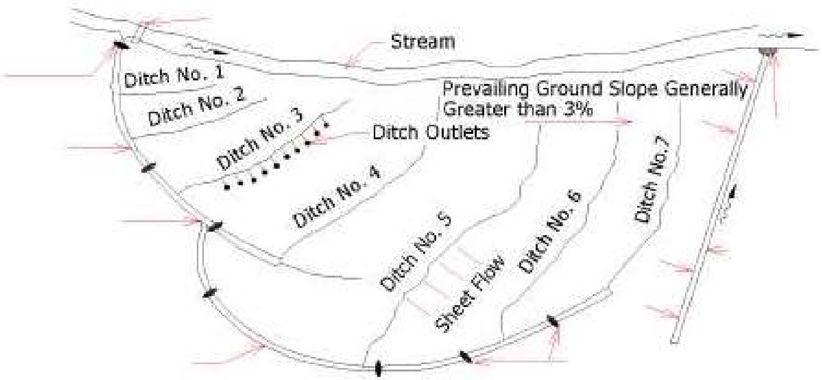
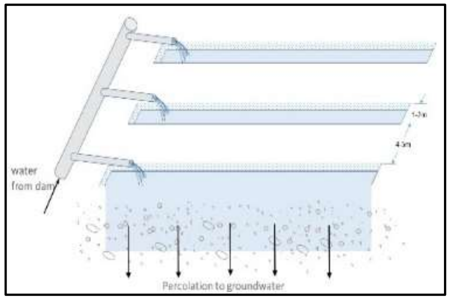
ASR – MAR Technologies (8)-2

- Above Surface Receiving Well
- Spreading Basin
- Ditch and Furrow System
- Contour Bunds





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Importance of Artificial Recharge

To Maximise Storage (long term and seasonal)

Can be recovered when needed

Water Quality improvement via dilution

Can reduce salinity and prevent saline intrusion and land subsidence

Addressing the impact of climate change

To meet seasonal demand and be a strategic storage

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Identification of Areas for Recharge

Where groundwater levels are declining due to over abstraction

Where a substantial part of the aquifer has been desaturated

Where water availability is limited during dry months

Where Groundwater quality is poor and there is no alternative source

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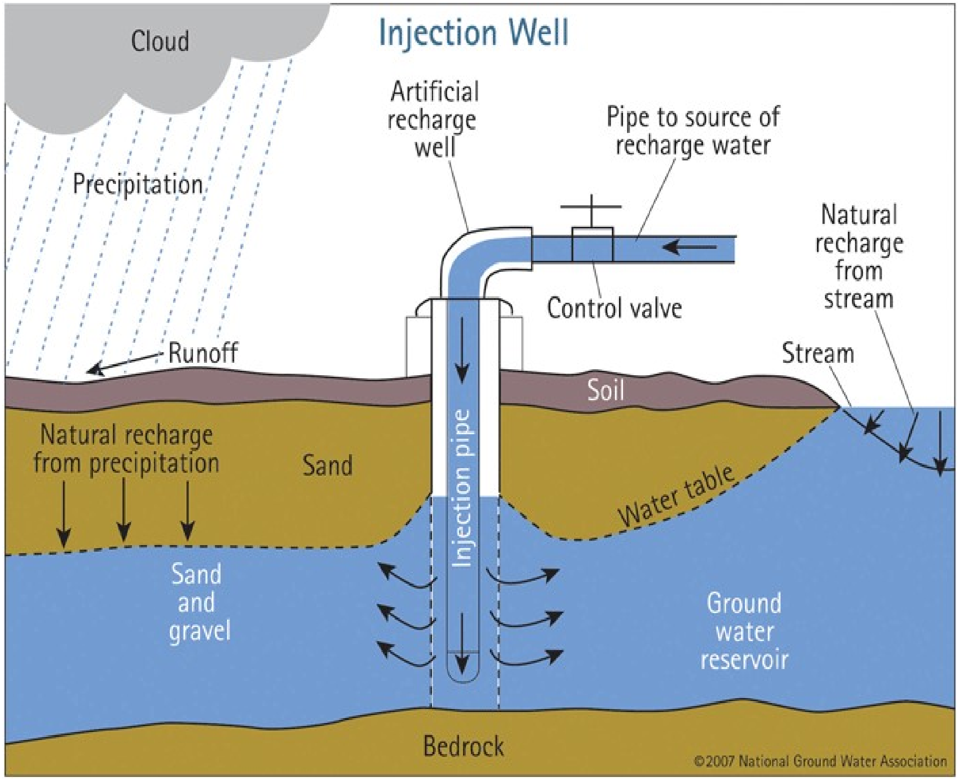
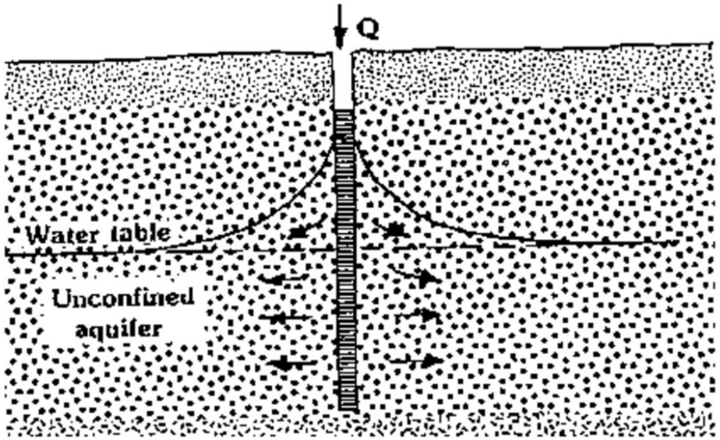
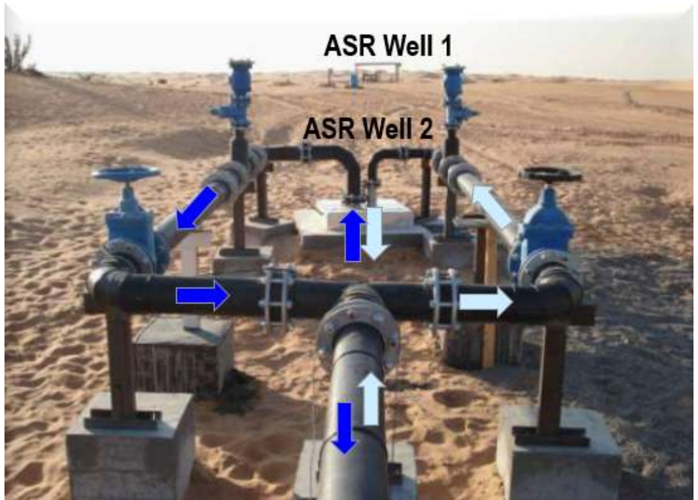
Recharge Boreholes -

It is the direct opposite of a pumping well. A recharge well pushes back surface water into the groundwater system







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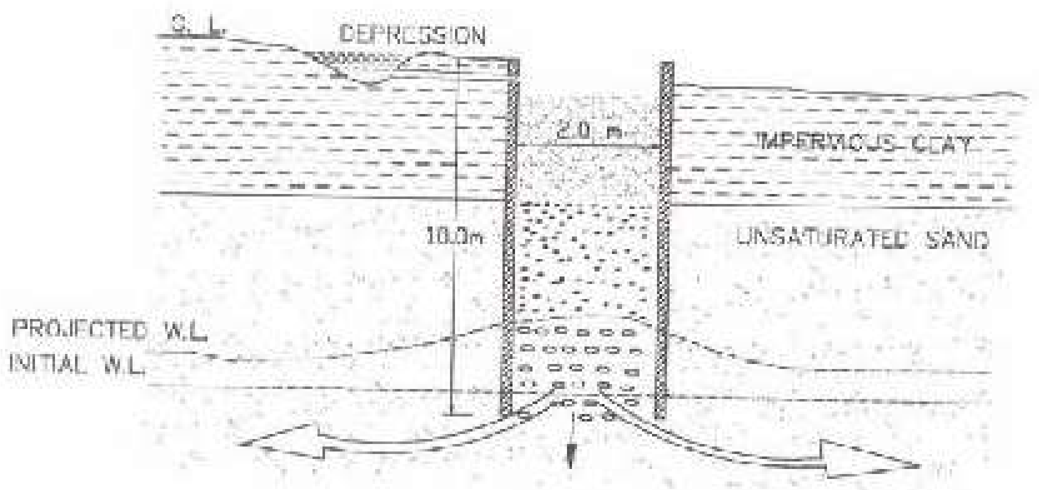
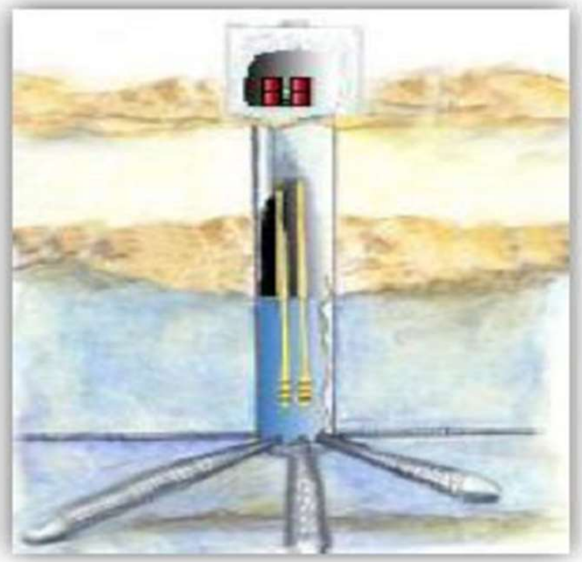
Recharge Wells (Large Diameter)

A recharge well pushes back surface water into the groundwater system. Usually, a recharge well is one metre in diameter and six metres deep, lined with concrete rings having perforations. These perforations let water seep from the sides.





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ABOVE SURFACE TUBE WELLS-1

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ABOVE SURFACE TUBE WELLS-2

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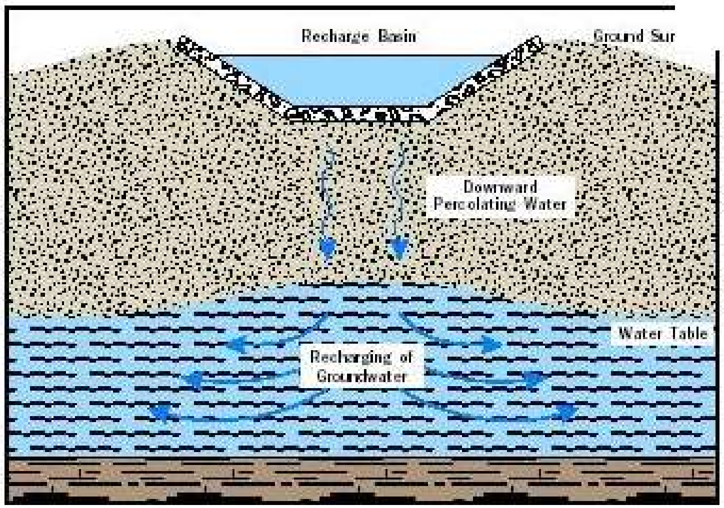
SPREADING BASINS

- After settling of pollutants, surface water is either pumped or siphoned to the spreading basin.
- Offers natural recharge through infiltration which allows for further filtering of pollutants



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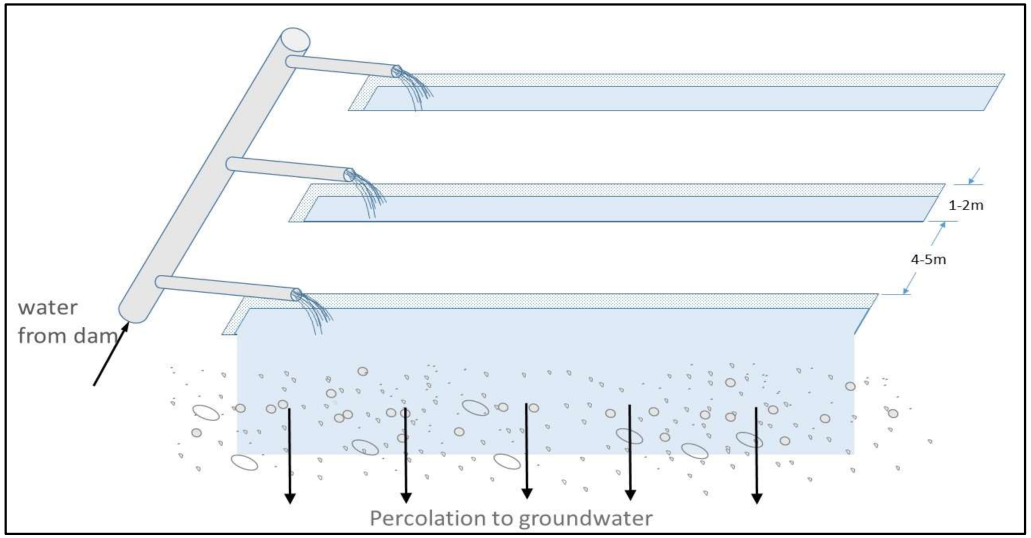
Ditch and Furrow

A series of closely spaced shallow and flat bottomed ditches are dug and water is diverted into them. Three layout can be used:

1) Contour. The ditch follows the ground contour

2) Tree shaped. The main ditch successively branches to smaller branches.

3) Lateral. A series of smaller ditches extending laterally from the main ditch



The needed length of furrows is determined based on several variables such as the amount of surface water to be recharged, the length of time allowed for recharge, and permeability of recharge zone. This is calculated using a modified version of Zangar's equation. The ditch and furrow system is susceptible to clogging because the shallowness of the ditches encourages site build up. To prevent this, the gradient of the ditches should be steep enough to carry suspended material through the system

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ASR – MAR Technologies

- Contour Bunds

The bunds are created along the contour lines. There are also small earth ties, perpendicular to the bunds, that subdivide the system into micro-catchments. Contour bunds aim to slow down runoff and improve water infiltration in the soil.

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MAR/ASR technology – Conclusions

- Relatively low capital cost but still needs O&M plus monitoring to ensure that GW levels don't increase too high
- Applicability depends on aquifers…etc. Need reliable data to assess and model – could be an issue
- Finding suitable locations is key – land availability could be a potential problem
- Pilots to be set-up and GW levels and quality monitored. Feasibility determined and costs/benefits compared with other solutions

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Good Bye