10.2.4 Conclusions at Karkams

This case study demonstrates the value of opportunistic artificial recharge, and that a very low yielding borehole and a low yielding aquifer can be recharged at relatively high rates. An additional benefit of introducing fresh water to the aquifer is that it significantly lowers the salinity of the groundwater.

During years with rainfall, this scheme provides good quality water to the residents of Karkams. This is water that would otherwise be lost to evaporation. The Karkams case study shows that this technology is not only applicable to large-scale schemes, but that it can be used effectively in small-scale operations. It also shows that the principle of conjunctive use is valuable in augmenting Southern Africa's rather limited natural recharge.

10.3 Atlantis: 20 years of artificial recharge using infiltration basins

(adapted from G Tredoux, E C Murray & L C Cavé, 2002)

The town of Atlantis, located 50 km north of Cape Town, has a population in excess of 100 000. It was initially fully dependent on groundwater, however, the reserves were insufficient, and artificial recharge was introduced to augment local groundwater supplies. The recharge system, using urban runoff and high quality treated domestic wastewater, has been in operation for more than 20 years.

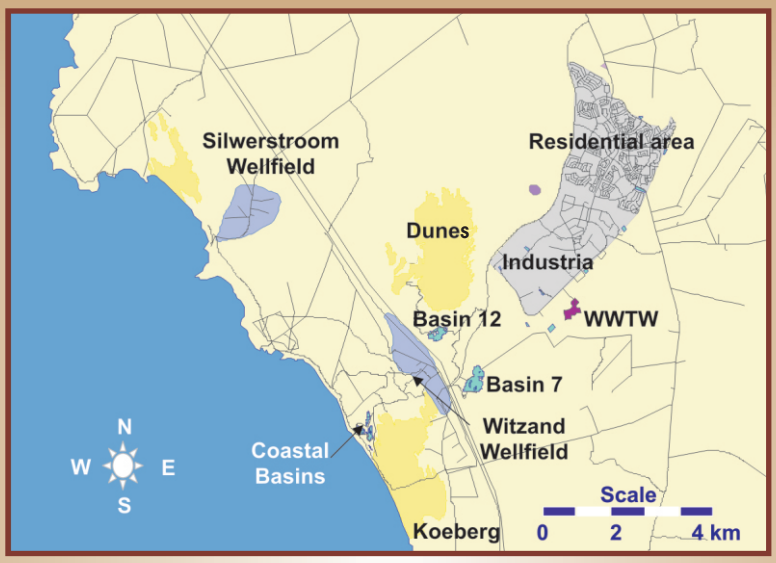
One of the infiltration basins

10.3.1 Hydrogeology

This thin, coastal aquifer consists of unconsolidated dune sands with an average thickness of 25 m. Natural recharge is estimated to be in the order of 15 - 30% of the annual rainfall (450 mm).

10.3.2 Artificial recharge water source and scheme design

The town was planned with fully separated residential and industrial areas. This fact contributed to the success of the artificial recharge operation, as inferior quality storm runoff and wastewater from the industrial area is diverted and not used for artificial recharge purposes.



Atlantis infiltration basins and wellfields

Low salinity storm runoff and high quality treated domestic wastewater are channelled into two large spreading basins for artificial recharge up gradient of the main wellfield.

Treated industrial wastewater, industrial area storm runoff and the relatively high salinity baseflow is diverted to the coastal recharge basins in order to create a hydraulic mound for preventing seawater from intruding into the wellfield.

A coastal infiltration basin

10.3.3 The effectiveness of artificial recharge

The infiltration rates achieved in the basins range from 0.01 to 0,16 m/day depending largely on the thickness of the unsaturated zone.

Storm runoff and wastewater infiltration augments the natural recharge of the groundwater in the main wellfield area (the Witzand unit), by $1.5x10^6$ to $2.5x10^6$ m^3/a.

10.3.4 Main operational challenges

Managing water quality and, in particular, salinity has been one of the greatest challenges for the Atlantis Water Scheme. The recent importation of limited quantities of surface water from outside the catchment is an important additional source of low salinity fresh water entering the system.

A decline in the yield of the boreholes in the Atlantis aquifer led to the discovery of iron-related clogging problems. The cause of the biofouling problem was suspected to be over pumping of the boreholes, which allowed ingress of oxygen into the aquifer.

10.3.5 Conclusions

Artificial groundwater recharge ensured the sustainability of the Atlantis water supply for over two decades and will continue to play a key role. A major component of the scheme has been the separation of the source water into different fractions, as this has allowed recharge of the highest quality water in the areas of greatest importance.

The Atlantis groundwater scheme provides a cost-effective water supply option when coupled with careful management of the water sources and the aquifer.

10.4 Recycling Polokwane's treated wastewater

Polokwane's business area

Polokwane, with a population in excess of 400 000 and water requirements of about 12 million m^3/a, is largely dependent on surface water. However, the town also has an elaborate groundwater abstraction infrastructure that can supply domestic water in times of surface water shortages and during periods of peak demand. During the 1992 to 1994 drought, groundwater accounted for a large proportion of the city's needs (3.7 million m^3/a).

The reliability of this source is largely due to the infiltration of treated municipal wastewater into Polokwane's alluvial and gneissic aquifers.