Hartfield Park Managed Aquifer Recharge

Land use / development type	Scale
Public open space	District

Stormwater controls	Scale
Harvesting	Precinct

Efficient use of water	Scale
Efficient irrigation	Precinct

Water reuse	Scale
Aquifer injection and reuse	Precinct

Site conditions	
Soils	Bassendean sands over Guildford Clay
Static groundwater depth	8-12m
Slope	NA

Local government	Location
City of Kalamunda	Hartfield Park

Growing demands on the City of Kalamunda to provide community sporting fields and recreational spaces, coupled with a drying climate and population growth were at the core of the Hartfield Park Managed Aquifer Recharge (MAR) project.

Groundwater allocations were insufficient for the irrigation needs of the growing council, as identified in the Hartfield Park Master Plan (2010) and Communities Facilities Plan (2011). This led to an investigation into the opportunities for alternative water sources for irrigation of the Hartfield Park regional open space.

A concept was developed to extract water from the nearby Water Corporation Woodlupine Main Drain during winter, as these stormwater flows were destined for the urban water runoff system with the Swan Canning Rivers being the ultimate receiving bodies. It was proposed that following filtration, harvested stormwater could be used to recharge the Leederville Aquifer in winter and be extracted for irrigation in summer.

MAR could increase the City's water allocation under the *Rights in Water and Irrigation Act 1914* by up to100% and provide a sustainable water source into the future.

Although infiltration ponds were a lower cost and simpler recharge option, this was not possible due to a layer of impermeable Guildford Clay between the Bassendean Sands of the region and the superficial aquifer. Further investigations and on-site drilling indicated that MAR was feasible using an injection bore to recharge the Leederville Aquifer.

For the project to be viable and provide the City with an alternative water source, at least 50,000kL per annum was required. At full capacity, flows from the drain can reach 1.5gL per annum. Extracting 30% of the Woodlupine Main Drain flow (300,000kL) would increase Hartfield Park's water allocation under the *Rights in Water and Irrigation Act 1914* by up to 100% for the Hartfield Park site and provide a sustainable water source into the future. Modelling and aquifer drilling calculations indicated the Leederville Aquifer could receive between 115,000kL and 230,000kL of water. Modelling undertaken by Rockwater showed that MAR at Hartfield Park could far exceed project objectives.

Prior to implementing the trial and obtaining licences, a Water Resource Management Operating Strategy (WRMOS) was developed, which specified the following:

- Management objectives;
- Operating rules;
- Monitoring and reporting;
- Environmental impact management;
- Contingency plan; and
- Water use efficiency.

In the first year, despite some teething technical issues, the trial injected 4,400kL of filtered stormwater between June and October 2016. The City is currently reviewing results from the winter 2017 trial, with the preliminary outlook being very positive.

This project was developed in consultation with the Department of Water and Environmental Regulation (DWER) and the Water Corporation.

Key Project Features

- When fully operational, the City expects to harvest 30L/sec. through the 200mm orifice.
- As the source water is very fresh (<250mg/L TDS), the harvested stormwater only required filtration treatment.
- Water is delivered under dynamic pressure via a 4-part filtration process: first filter to 70 micron; second filter to 50 micron; third filter to 2 micron; and finally the water is filtered using activated carbon prior to re-injection.
- The bore is approximately 50m deep. The bore used to inject water into the aquifer in winter is also used to extract groundwater for irrigation in summer.
- The injection to abstraction ratio is projected to be 1:1 and is subject to annual approval by DWER.
- The extraction point in the Woodlupine Main Drain is located 600m from the injection point.
- A low maintenance self-backwashing filter system was engineered to filter water to 2 micron with a 'slow opening' injection valve. This ensures air is not injected into the aquifer during backwash periods, mitigating the risk of entrained air clogging the long-term aquifer flow.
- Until more examples are established, MAR technology requires bespoke design, innovation and research to accommodate site-specific conditions.

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Government of Western Australia
Department of Planning, Lands and Heritage
Department of Biodiversity, Conservation and Attractions
Department of Water and Environmental Regulation
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Development Costs[1]

Extraction pump and 600m of pressurised water supply pipe	$150,000
Filtration package	$320,000 (approx.)
Injection valve	$50,000
Building	$100,000

Maintenance Costs[1]

Harvested water	30c/kL
Running costs inside building	$1.20/day (in winter)
Extraction pump running costs	$20 per day
Water monitoring and reporting by a Hydrogeologist	$20,000

[1]All costs are site-specific and are an approximation given for guidance purposes only

Issues

The first step in the approval process involved obtaining a Department of Water and Environmental Regulation (DWER) 5C licence to take surface water, a section 11/17/21A permit to interfere with bed and banks and a 5C licence to extract the injected stormwater. This included demonstrating that any impacts of recharge and recovery on the groundwater system, the environment and existing groundwater users (through changes in water quantity or quality) are acceptable. Once this was demonstrated, a licence was granted with conditions outlined in the WRMOS specific to the site. Approval from the Water Corporation to abstract water from the Water Corporation main drain was also required.

In the first trial year, record low winter rainfall and runoff affected the main drain and resulted in lower than expected available runoff. This highlighted the need to factor extreme climate conditions in the project's risk modelling. The filtration system was custom built to cater to site-specific conditions. A key consideration was the need to allocate sufficient time for the commissioning of specialised equipment to ensure smooth installation and operation. There was also a stringent approvals process which included discussion with DWER, Department of Health and the Water Corporation. Together with an extensive hydrological feasibility and viability assessment, the need for appropriate time and resource allocation was imperative to the success of the project.

The water abstracted from the Woodlupine Main Drain had high levels of suspended solids particularly in the first flush runoff. This resulted in the need for the four-tier filtration process before aquifer injection could take place. It is highly recommended that future projects consider investing in a greater level of water quality treatment upstream of the harvesting location. This could involve the establishment of side entry pit catch basket inserts and up-stream pollutant traps to reduce the flow of suspended solids into the drain and reduce the concentration of very small diameter particles that clog filters and bores. The Hartfield Park MAR used the AMIAD filtration process, which has been successful. However, an alternative system that has a smaller footprint and the ability to operate during backwash could be considered in future projects.

Outcomes

A diverse and multidisciplinary team was a major factor in this project. Hydrogeologists, engineers, economists, environmentalists, microbiologists and publicists are among the professionals who worked together on the risk assessment prior to establishing the Hartfield Park MAR project. Furthermore, ongoing and stringent maintenance and monitoring programs are imperative in successful MAR projects to prevent clogging and costly infrastructure breakdown and replacement.

The Hartfield Park MAR requires minimal on-going personnel involvement. Two reticulation members are employed over the winter months to ensure that the filters are in working condition during the recharge phase. Woven cartridges in filters are replaced after 10,000 backwashes, approximately every 10-15 years.

When running at capacity the full scheme is likely to produce a 100-150kL water surplus, after meeting the community's recreation and amenity needs. The City of Kalamunda is considering using the excess water for trading or to irrigate other parklands in the City

Contact details for further information

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