Government of **Western Australia**
Department of **Water and Environmental Regulation**

Myalup irrigated horticulture managed aquifer recharge - Prefeasibility study

Report Summary

Water Supply Planning Report no. 6
April 2018

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Prepared for the Myalup–Wellington Water for Food project

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Cover photograph: Crop irrigation in the Myalup area (Department of Water and Environmental Regulation)

New water sources for Myalup

The Myalup Irrigated Agricultural Precinct (Myalup IAP) is located 150 km south of Perth, and 40 km north of Bunbury (Figure 1). Land use is a mixture of irrigated horticulture, pine plantations, pastures, and native vegetation. Water for irrigated horticulture is sourced from groundwater bores in the superficial and Leederville aquifers, but crop production is constrained by the limited groundwater available and declining water quality. Salinity levels are increasing in some locations in the superficial aquifer, and the risk of saltwater intrusion into the aquifer from the coast has to be carefully managed.

The Western Australian Government's Myalup–Wellington Water for Food project aims to improve the agricultural productivity of this region and the adjacent Collie River Irrigation District (CRID), through identifying additional water sources (20 GL/year) and improving water quality.

Planned upgrades to Wellington Dam (south-east of the Myalup IAP) will change its connection to the CRID from irrigation channels to gravity-fed pipelines, and should achieve water savings of 15 GL/year, which could then be directed to the Myalup IAP. One delivery option is to infiltrate this additional water into the superficial aquifer to allow more abstraction from groundwater bores for agriculture.

A prefeasibility study has developed a concept for a Managed Aquifer Recharge (MAR) scheme to infiltrate additional water into the superficial aquifer, along with a preliminary economic and environmental assessment to determine if it is a viable water supply option.

Wellington Dam

Managed Aquifer Recharge

Managed Aquifer Recharge (MAR) is a process where water is infiltrated or injected into an aquifer to store, transport, and then recover it where it is needed. MAR can help to manage water table levels and saline intrusion, and support additional water abstraction from groundwater bores. It can also provide storage to accommodate seasonal variations in water availability, such as when surplus water is available in winter, while extra irrigation water is needed in summer.

Central to the recommendations from this study is the Myalup Local Area Model, created by the then Department of Water in 2016. This model is based on the Department's understanding of the superficial aquifer groundwater system and associated geology of the region, and uses a median climate scenario for rainfall and evaporation, with natural recharge based on known land use and soil mapping parameters. Existing groundwater abstraction information is based on licenced entitlements and metered data from bores.

The model was used to explore the storage capacity of the aquifer, understand the water balance throughout the system, and investigate the potential risks and benefits of different MAR scenarios. The scenarios assessed were:

- Scenario 1: MAR infiltration with no additional abstraction, to test the capacity of the superficial aquifer to receive water and understand the changed water balance in the Myalup and Lake Preston South groundwater management sub-areas.
- Scenario 2: MAR infiltration with 10.3 GL/year additional abstraction from existing bores on the coastal plain. This option reduces cost as existing infrastructure is used, and water is delivered to where it is already needed and used.
- Scenario 3: MAR infiltration with 10.4 GL/year additional abstraction from a new wellfield on the western side of the dune system near the infiltration basins. This option was considered as preliminary modelling indicated this could be a necessary requirement. It requires additional infrastructure and management (new bores and piping of water to the farm gate).

Example of an infiltration basin, located at the Kwinana wastewater treatment plant (2016)

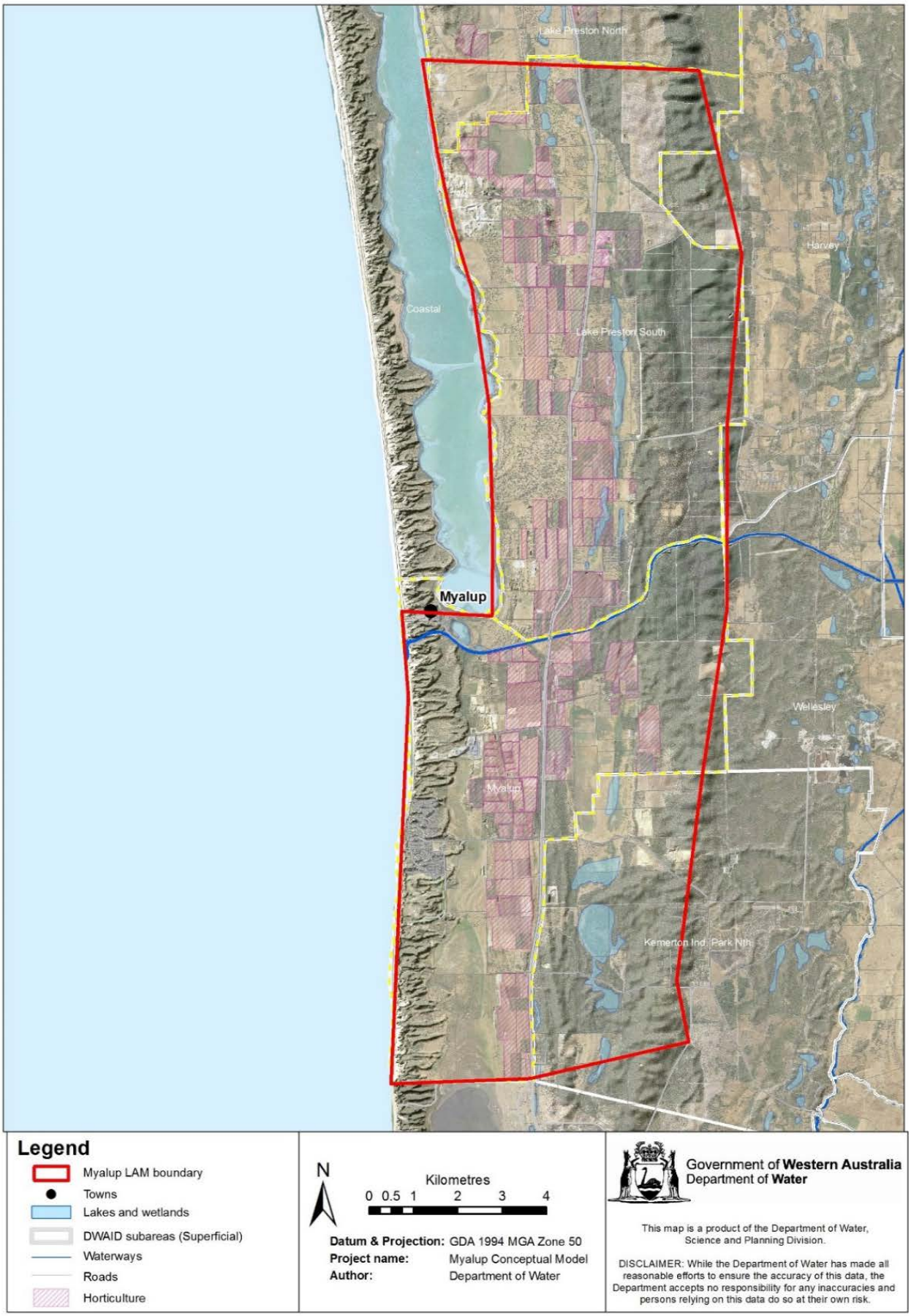

Figure 1 Study boundary for the Myalup IAP prefeasibility study

The model assumes:

- Availability of 15 GL/year of water from Wellington Dam, delivered via a pipeline from the CRID and infiltrated across eight separate locations. The Spearwood Dunes area was the only infiltration zone assessed as it was considered the most viable based on previous studies.
- Water is infiltrated throughout the year with no prior water treatment.
- The water abstraction volume (currently 14.6 GL/year) is based on the location and licenced entitlement of existing irrigation bores, scaled by month to represent a typical irrigation season: higher water use during summer and lower volumes in winter.

Choosing the best MAR scenario

Results from modelling each scenario were compared to current conditions to estimate aquifer storage capacity. Any changes in groundwater levels, groundwater flow paths and overall water balance were also considered. Figure 2 shows the assumed modelling locations for MAR infiltration basins and proposed abstraction bores.

Modelling MAR without increased abstraction (Scenario 1) indicated that the aquifer has the storage capacity to receive an additional 15 GL/year. Groundwater levels near the infiltration sites could be at greater risk of seasonal surface flooding in some areas. With increased abstraction, the risk of flooding on the coastal plain lessened (Scenario 2) or was similar (Scenario 3) to current conditions.

Modelling also showed that increased abstraction from the existing bores (Scenario 2) will likely cause localised drawdown along the coastal plain and increased saltwater intrusion from Lake Preston. This could result in further deterioration of groundwater quality.

In contrast, abstracting from a new wellfield (Scenario 3) should only result in small, localised groundwater drawdown, and it may be possible for more than 15 GL/year to be infiltrated under these conditions. Flow tracking showed that most infiltration flow would be abstracted through the new bores, with minimal changes to the water balance along the coastal plain indicated. This outcome raises the potential for improvements in water quality, if better quality water from Wellington Dam is infiltrated.

Potential environmental impacts

The Myalup IAP encompasses many groundwater-dependent ecosystems, including the Ramsar-listed Peel–Yalgorup wetland system, and several other high-value conservation wetlands and reserves.

The modelling indicates that MAR may raise watertable levels near the infiltration sites. Sensitive ecosystems in the area, particularly native vegetation at the base of the Spearwood dune system, could potentially experience waterlogging beyond their tolerance.

Future increases in irrigated agriculture in the area, as a result of the availability of additional water, may also lead to increased nutrient inflows through runoff and natural recharge, with potential adverse effects on sensitive ecosystems.

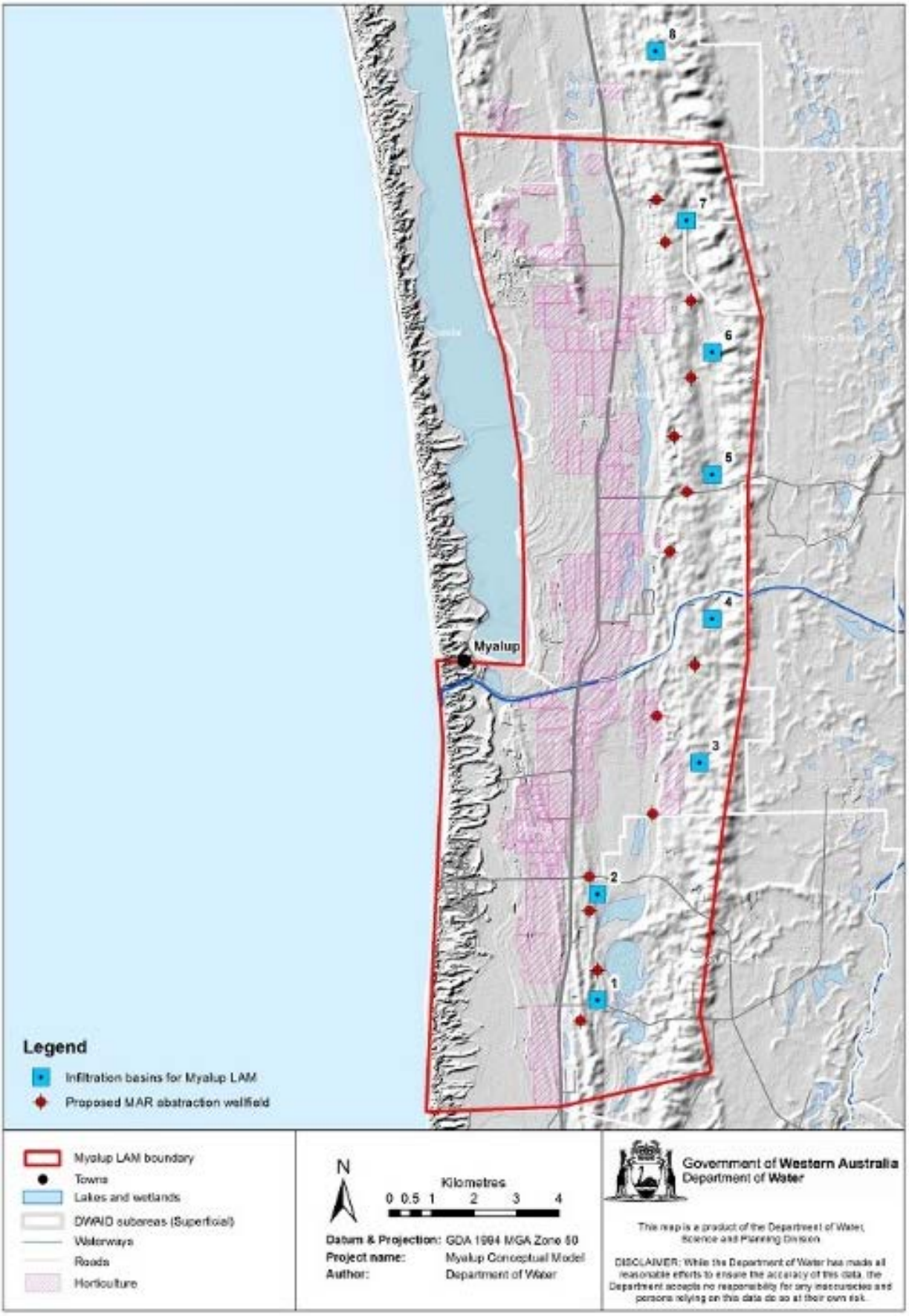

Figure 2 Prefeasibility study locations of MAR infiltration basins and proposed abstraction borefield

Additional modelling to optimise the location of infiltration basins, recovery bores, volumes and timing of infiltration, and test any risk to environmental values such as groundwater-dependent ecosystems, coastal lakes, Leschenault estuary, Lake Preston and Lake Clifton will be carried out during feasibility studies and approvals assessments.

Economic considerations

Cost estimations for the Myalup MAR scheme are competitive with other local MAR examples. Costs for Scenario 3 are estimated at $320/ML with infiltration basins (surface ponds, where the water seeps directly into the aquifer), and $500/ML with infiltration galleries (where water is pumped into porous modular frameworks underground), over a project life of 50 years. As infiltration galleries have significantly higher capital and operating costs than infiltration basins, using infiltration basins is recommended unless a specific need for galleries is identified.

Scenario 3 with its new abstraction wellfield is about $80/ML more costly than Scenario 2 ($241/ML), mostly due to the additional pipework needed. This is a relatively small additional cost considering the significant benefits.

These estimations indicate that MAR is economically realistic, although it must be noted that the exclusion of water treatment from the prefeasibility study concept reduces costs significantly. Water treatment has high capital and operating costs and could change the economic feasibility of the scheme, if required. This cannot be determined until analyses are done to determine the current and potential future water quality from Wellington Dam, and the groundwater chemistry specific to the infiltration sites. These issues will be investigated in more detail in a full feasibility study.

Next stages

A MAR scheme appears to have limited benefit for improving groundwater quality and mitigating saltwater intrusion in the Myalup IAP, if the infiltrated water does not quite reach the coast or change the groundwater levels on the coastal plain when abstraction is increased. Further studies to investigate and confirm this are recommended.

This prefeasibility study identified MAR as a potentially viable option to provide additional irrigation water into the Myalup IAP. Further work is required to build on the assumptions made in the study, including water quality testing, soil and groundwater chemistry, site-specific field work and more detailed groundwater modelling to confirm the likely outcomes, refine the scheme layout and tighten cost estimations.

As such, a full feasibility study is recommended to develop a more thorough understanding of the preferred MAR scheme, including optimisation of the location of infiltration sites and abstraction bores, the volume and timing of infiltration and abstraction, and the likely impact on environmental values and groundwater-dependent ecosystems.

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