

Management of an Aquatic Environment: Lake Monger Reserve

Approximately 3.6 kilometres from the City of Perth, the Lake Monger Reserve, as a large **aquatic environment**, is located between the suburbs of Wembley and Leederville (*Figure 1*). It consists of a 71-hectare lake surrounded by open parkland and trees. Rich in Indigenous heritage and a popular recreational site for locals, its modification over recent years, coupled with increased **human activity** within the space, has seen significant change, notably the degradation of the water quality.

Lake Monger – One of Our Urban Wetlands

Urban wetlands are critical contributors to our environment, acting as **urban green spaces**, providing habitats for native flora and fauna, and improving water quality. Increased populations and human activity are primary causes of the degradation of our wetlands, specifically Lake Monger, which has seen great modification since the early 20th century. Lake Monger, along with the wider group of wetlands, including Herdsman Lake and Jackadder Lake is situated within an **interdunal swale** as a freshwater lake.

In 1993, the Town of Cambridge had identified the importance of managing the long-term **sustainability** of the Lake Monger environment for its residents and Indigenous flora and fauna in its *Lake Monger Management Plan (1993-1998)*. However, over the last twenty years, the **scale** in which the population has increased has had severe implications on the aquatic environment – its most pertinent effect being the degradation of its **water quality**.

The Lake Monger Reserve Management Plan (2008-2018)

Due to such changes in **environment**, the Town of Cambridge implemented *The Lake Monger Reserve Management Plan* in 2008, building from the previous *Lake Monger Management Plan (1993-1998)*, which focused on restoring the ecological community within such a place of historical and natural value. The Town of Cambridge particularly developed the lake's eastern edge, **reconstructing** a large portion of the lake edge.

To address the degrading water quality, a **nutrient stripping pond** was created on the eastern perimeter after studies were undertaken to determine the nutrient loads and contaminant levels whilst also locating point sources. As part of the intensive rehabilitation program, the nutrient stripping pond clarifies the water column in the reserve by binding the excess nutrients to the lake bottom in the form of artificial **sedimentation** (*Figure 5* and *Figure 8*). Additionally, ongoing water quality and lake level management are continuously monitored annually. All these strategies aim to improve the water quality and ameliorate the changing environmental conditions.

Another element of the Lake Monger Reserve Management Plan was the **revegetation** of the lake shore, specifically the plantation of low shrubs for the previously cleared areas and **rehabilitation** of Indigenous species. The efforts are aimed to increase tree coverage and also introduce endemic species back to decrease leakage into the groundwater system and restore Lake Monger's soil back to initial salinity and sodicity, further aiming to improve water quality.



Figure 2: Ground photo taken by me looking Eastward, showing a drainage pipe on the Southern bank (June 2022).



Figure 3: Ground photo taken by me showing the Southern periphery of the lake lined with Pine trees (not endemic).

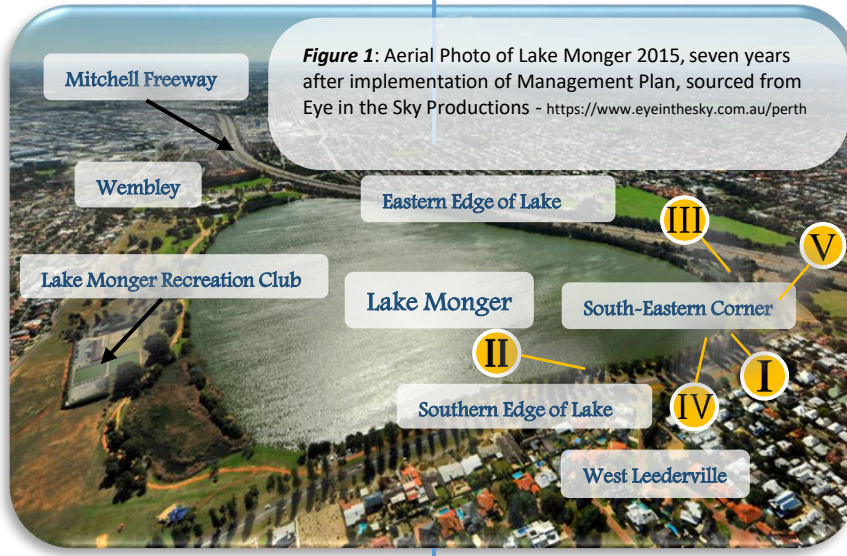


Figure 1: Aerial Photo of Lake Monger 2015, seven years after implementation of Management Plan, sourced from Eye in the Sky Productions - <https://www.eyethesky.com.au/perth>

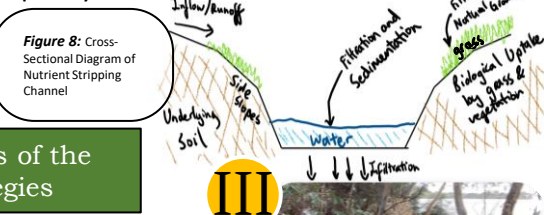


Figure 8: Cross-Sectional Diagram of Nutrient Stripping Channel

Impacts of Human Activities on Aquatic Environments

Due to rapid urban development, increased human activity has resulted in more contaminants entering Lake Monger's waters through groundwater and the **stormwater drains**, drastically reducing the water quality. Lake Monger is particularly vulnerable to changes in water quality as it is a lake fed by various **inputs** such as underground springs, groundwater and now the 23 stormwater drains (*Figure 2*). Run-off from fertilisers used by residents in the surrounding suburbs coupled with the drainage from the road has caused environmental changes like night-time **anoxia** (absence of oxygen). Signified by the rise of algal blooms, noxious odours, and nuisance midge plagues, run-off fertilisers have decreased the water quality and posed a significant threat to native flora and fauna.

Notably, in February 2019, Lake Monger experienced an **algal bloom**, common during summertime due to low rainfall, elevated temperatures and high levels of nutrients. Such eutrophication of the waters not only emitted a musty smell but also impacted the health of the waterbirds (*Figure 4*).



Figure 4: Eutrophication – discolouration of water in the channel, a result of algal bloom.

Furthermore, since settlement, Lake Monger Reserve underwent significant modification in **tree cover**. Before 1930, to create open spaces and parkland for recreation, native vegetation, specifically the swampland trees, were removed and replaced by the non-native Pine and Palm trees which reduced habitats for the endemic waterbirds and tortoises. In addition, these shallow-rooted trees increased leakage to the groundwater system, which has increased water levels in Lake Monger and increased **sodicity** and **salinity** (accumulation of sodium and salt respectively), further degrading the **water quality** (*Figure 3*).

Such modifications has had extensive impacts on the aquatic ecosystem. Notably, the water degradation has seen a decline in local mollusc and insect species as they cannot tolerate low oxygen conditions. With increased **human activity**, most of the fish common in the lake are introduced species such as carp, goldfish and the English perch, which threaten the natural ecosystem.

Evaluating the Effectiveness of the Lake Management Strategies

The Lake Monger Reserve Management Plan in 2008 has seen varying success in terms of revegetation and restoring the Lake's state prior to the modification during the 1990s. A clear example of success is the Eastern Fauna **refuge island** (*Figure 6*), which has grown significantly since the early 2000s. When I visited on the 19th of June 2022, large flocks of White Ibis and other native waterbirds crowded the island.

Figure 5: Ground photo taken by me showing a section of the nutrient stripping channel.

Figure 6: Rehabilitation of the East Fauna Refuge Island has increased space for water birds as well as providing land space for more vegetation (ground photo taken by me looking Eastward from the Southern side, June 2022).

Furthermore, *Figure 7* shows part of the revegetation strategy on the lake's South-Eastern corner, which has increased native tree coverage and decreased leakage back into the **groundwater system** to restore Lake Monger's soil back to its initial salinity and sodicity.



Figure 7: Satellite Image of South-Eastern Corner of the Lake, 3rd March 2001 (Left).
Satellite Image of Same Southern Eastern Corner of the Lake showing notable increase in tree cover, 2nd February 2022 (Right).

The Future of this Aquatic Environment

With increased human activity as seen in recent developments of the South-Eastern Playground and skate park, it could only mean more **modification** of the Lake. As such, the Town of Cambridge continues to monitor the water quality and improve

the Lakeside under the guidance of research and resident surveys. To preserve the biosphere, the Town of Cambridge will maintain the pathways around the Lake and erect signs and billboards in changing conditions. Like Herdsman Lake, the Town of Cambridge could incorporate an educational facility around the Lake to promote sustainability and adaptation to changes in the environment. Nonetheless, the continual **management** of Lake Monger is essential to preserve this heavily utilised urban **green space**.

References

Photos:

Figure 1:

Aerial Photo of Lake Monger [Photograph]. (2015). Eye in the Sky. Retrieved June 24, 2022

<https://www.eyeinthesky.com.au/perth>

Figure 7:

Satellite Photo of Lake Monger's South Eastern Edge (2022). Google Earth Pro. Retrieved June 22, 2022

Figure 2,3,4,5,6:

Ground Photos taken by me at Lake Monger. 19th June 2022.

Figure 8:

Cross-Sectional Diagram of Nutrient Stripping Channel drawn by me 27th June 2022.

Reports:

Ecoscope (Australia) Pty Ltd. (2022). *Lake Monger Reserve Management Plan 2008-2018* [PDF]. <https://www.cambridge.wa.gov.au/Town-Council/Our-Organisation/Major-Plans-Strategies/Lake-Monger-Reserve-Management-Plan>

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Town of Cambridge. (2019, February 21). *Safety signs erected at Lake Monger due to algal bloom*. <https://www.cambridge.wa.gov.au/Town-Council/News/Latest-News/Safety-signs-erected-at-Lake-Monger-due-to-algal-bloom>