Concepts for sourcing manufactured water for mine rehabilitation in the Latrobe Valley

Department of Energy, Environment and Climate Action cover note
November 2024

Purpose

Over the coming decades the three Latrobe Valley coal mine sites will continue the transition from active mining and power generation to closure and mine rehabilitation. The enclosed further assessment report supports the Amendment to the *Latrobe Valley Regional Rehabilitation Strategy* (LVRRS 2020) released by the Victorian Government in October 2023 by providing mine licensees and the community with a shared information base on concepts for sourcing manufactured water for mine rehabilitation and required infrastructure to inform rehabilitation planning. Manufactured water is a term used to describe water sources including desalinated water, recycled water and treated stormwater.

A range of stakeholders including mine licensees, the Mine Land Rehabilitation Authority, the Environment Protection Authority Victoria and water corporations were consulted during the implementation of the LVRRS on concepts for sourcing manufactured water for mine rehabilitation and to identify some of the considerations required if a mine licensee were to further pursue a manufactured water supply for mine rehabilitation.

The Department of Energy, Environment and Climate Action (DEECA) engaged a consultant to prepare a report to further assess concepts for sourcing manufactured water for mine rehabilitation in the Latrobe Valley. The report provides a desktop assessment, prepared using primarily publicly available information and acknowledges the work of the Water Services Association of Australia (WSAA)[1] study – which is at time of publishing, is considered to be the most robust summary of manufactured water supply options, drawing on case studies from across Australia. Information gaps identified during the assessment were managed by the consultant by extrapolating and providing estimates based on similar types of infrastructure projects.

The information contained in the report is conceptual estimates only – noting the high uncertainty, particularly due to continuing increases and high variability of infrastructure costs following the Covid-19 pandemic and particularly since 2021. Actual costs would be influenced by several factors, some of which may become more certain over time. Specifically, both the annual volume and total volume of manufactured water required to support mine rehabilitation will influence the size and cost of any manufactured water source and transfer scheme. The volume of water will be determined by the mine rehabilitation timeframe, final void size, void fill level, climate and associated surface water availability.

The contextual changes that have occurred since the LVRRS was released in 2020, such as early power station closures – which are expected to reduce the size of mine voids, bring forward rehabilitation timeframes and potential future water needs – are evidence of the shifting factors that will impact the consideration of using manufactured water for mine rehabilitation. The assessment confirmed that while a manufactured water supply for mine rehabilitation is technically feasible, it remains complex and expensive.

Preparing and implementing mine rehabilitation plans is the responsibility of mine licensees. This needs to be underpinned by robust assessment and well-informed decision-making. In preparation of Declared Mine

[1] All options on the table - Urban water supply options for Australia ’Water Services Association of Australia (WSAA), 2020

Rehabilitation Plans (DMRPs) by the due date of October 2025[2], mine licensees may consider that a manufactured water supply is preferred as a primary water source, as a contingency under a dry climate scenario or drought conditions, or not needed at all. Each DMRP must consider climate change impacts to surface water availability and be resilient to a future potentially drier climate.

The enclosed report provides the community and stakeholders with information about potential manufactured water concepts for mine rehabilitation if manufactured water were to be required during a filling phase and/or needed post rehabilitation to meet annual water top-up requirements into perpetuity. The concepts do not represent the Victorian Government's preferred approach if a manufactured water source is required by a mine licensee for mine rehabilitation. Securing a manufactured water supply would require significant further feasibility and detailed assessment, and – if it is required to implement an approved DMRP – costs associated with a manufactured water source, any necessary infrastructure to deliver water to the mine from the source, and ongoing costs during and post rehabilitation would remain the obligation of the mine licensee. The *Mineral Resources (Sustainable Development) Act 1990* (the MRSD Act) places responsibility for rehabilitation of individual mine sites on mine licensees, including planning, rehabilitation works and associated costs.

Central and Gippsland Region Sustainable Water Strategy

In September 2022, the Victorian Government released the *Central and Gippsland Region Sustainable Water Strategy* (CGRSWS) – setting directions and outlining actions to meet current and emerging water challenges, including in the Latrobe River and Gippsland Lakes system. The CGRSWS takes a long-term view – the next 50 years – to describe the water challenges and sets out actions to meet these challenges for communities, healthy rivers and wetlands, Traditional Owners, farmers, industries and tourism.

The CGRSWS outlines the Victorian Government's plan to invest in manufactured water, including desalinated water, recycled water and treated stormwater, to meet growing urban water needs. This will reduce water corporations' reliance on river water for urban water security to enable river water to be returned to the environment and Traditional Owners. Importantly, any investment in manufactured water for potable use (drinking water quality) will prioritise potential future urban demand – to continue to supply cities and towns with high quality and reliable drinking water. Melbourne customers will not be impacted if any of the mine licensees identify the need for manufactured water to undertake mine rehabilitation in their DMRPs. Any access to recycled water from existing infrastructure such as the Eastern Treatment Plant (ETP) will be considered in the context of other growing demands in southern and south-eastern Victoria for Class A recycled water (e.g. agricultural and urban non-potable) which is the quality of recycled water produced by the ETP.

The Victorian Government is committed to supporting the Latrobe Valley socio-economic transition. The reallocation of 16 gigalitres of the Latrobe 3-4 Bench entitlement and the range of other complementary actions in the CGRSWS, coupled with measures including the Latrobe Reserve review are designed to mitigate potential impacts from surface water access for mine rehabilitation. Together these existing and proposed measures will build system resilience to climate change and drought conditions for all water uses and values.

Please refer to the LVRRS 2023 Amendment for more information on CGRSWS actions specific to the Latrobe region and other regional water planning including the *Victorian Waterway Management Strategy* and the *Gippsland Lakes Ramsar Site Management plan*. The LVRRS and CGRSWS are further complemented by the *Latrobe Valley and Gippsland Transition Plan*, released in August 2023 by the Latrobe Valley Authority.

Other water related LVRRS implementation actions

Guidance on potential surface water sources and access arrangements for mine licensees to undertake rehabilitation

The LVRRS 2023 Amendment introduced guidance on potential surface water sources and access arrangements for mine licensees to undertake rehabilitation. This guidance aims to ensure that any surface water accessed for

[2] Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019, r 64A(a).

mine rehabilitation will not diminish the water entitlements of existing water users and values in Gippsland while providing an achievable way forward to reaching a safe, stable and sustainable rehabilitated landform within an acceptable timeframe, if a water-based mine rehabilitation plan is approved.

Guidance on the use of climate change scenarios for water resources planning for mine rehabilitation

The LVRRS 2023 Amendment provided a summary of the *Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria* (the Guidelines) which were released in November 2020.[3] They set out scenarios for assessing the impact of climate change on water availability, supply and demand across Victoria, taking into account changes in temperature, potential evapotranspiration, rainfall, runoff and groundwater recharge.

For further information, you can find a copy of the Latrobe Valley Regional Rehabilitation Strategy and related information online at https://www.water.vic.gov.au/our-programs/long-term-water-resource-assessments-and-strategies/latrobe-valley-regional-rehabilitation-strategy.

[3] Department of Land, Water and Planning, 2020. Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria. https://www.water.vic.gov.au/__data/assets/pdf_file/0023/502934/GuidelinesClimateChangeWaterAvailVic_2020_FINAL.pdf

Technical Report

Concepts for sourcing manufactured water for mine rehabilitation in the Latrobe Valley

Prepared for the Department of Energy, Environment and Climate Action (DEECA)

23 October 2024

Contents

1 - Introduction

1.1 Background

Regional planning for mine rehabilitation is underway for the post-mining legacy of the Latrobe Valley with the Hazelwood mine ceasing operations in 2017 and the Yallourn mine and Loy Yang A power station proposed for closure in 2028 and 2035, respectively.

One of the possible approaches to mine rehabilitation is to use manufactured water (i) to completely or partially fill the mine voids and/or for post water-based rehabilitation to meet annual evaporative losses. There are a series of decision points that will determine whether manufactured water will be required to support mine rehabilitation.

There are many possible scenarios for mine rehabilitation using manufactured water. These scenarios vary in the amount of manufactured water required for filling the mines and the timing of supply to the mines.

1.2 Project overview

As part of the Latrobe Valley Regional Rehabilitation Strategy (LVRRS) GHD was engaged by the Department of Energy, Environment and Climate Action (DEECA) to undertake some preliminary investigations into concepts for the supply of manufactured water for the purpose of mine rehabilitation in the event that water-based mine rehabilitation is adopted for one or all mines in the Latrobe Valley.

Figure 1: Lake Narracan in the foreground with Latrobe power stations in the background(1)

(i) Manufactured water sources include desalinated water, recycled water and treated stormwater.

1 - Introduction

1.3 Scope of work

GHD were requested to:

- Review potential concepts for sourcing manufactured water if required for mine rehabilitation by a mine licensee. These concepts were developed by DEECA and regional stakeholders
- Identify key infrastructure components required to deliver manufactured water to the Latrobe Valley under each scenario, including potential staging opportunities
- Provide comparative capital and operating costs for infrastructure
- Prepare a high-level implementation timeline

1.4 Purpose of this report

This report has been prepared to summarise some key findings from this work. This work was preliminary in nature, undertaken at a very high level, and informed by inputs from various regional stakeholders.

1.5 Limitations

Manufactured water supply concepts were provided by DEECA, with GHD preparing summary assessment information on each of the concepts using existing information from a variety of sources. This current assessment builds upon previous work completed by various stakeholders [(ii)].

Importantly, GHD has not identified a preferred option between any of the manufactured water concepts included in the report. This work showed that supplying manufactured water will involve projects which are very substantial in scope, complexity and costs, and which therefore require substantial future feasibility studies, investigations and other work before they can be properly understood. Further, any of these projects will involve many different stakeholders including the community and their views will be important inputs. Key technical inputs like the water quality objectives, flow requirements, environmental constraints and other inputs were not available, and could significantly alter the scope of these concepts.

(ii) Stakeholders include different arms of government, water corporations, mine licensees, and other relevant parties such as regulators.

2 – Manufactured water scenarios

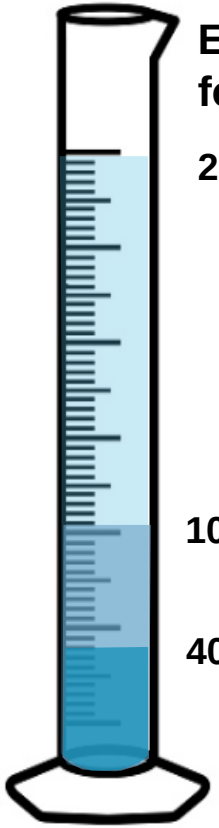
2.1 Scenarios and required volumes

There are many different scenarios for filling the mine voids, which vary in the amount and timing for supply of manufactured water.

DEECA provided GHD a variety of scenarios to consider, which included volumes and timing.

Many variables determine the volume of manufactured water required, including:

- Target end state for mines may be partially or completely full
- Mine voids sizes at closure
- Manufactured water may be used for once-off filling and annual top up of the mine voids, or annual top up only
- Availability of other water sources for mine rehabilitation



Estimated total manufactured water supplied for fill(iii)

2,800 GL 100 % manufactured water supply to completely fill all three mines

1000 GL Manufactured water supply supporting partial fill for multiple mines in addition to other water sources

400 GL Manufactured water supply to partially fill one mine in addition to other sources, with a significant volume available from other sources

(iii) Numbers are illustrative only — maximum volume estimate based on the 2020 LVRRS

2 – Manufactured water scenarios

2.2 Scenarios and timing

There are many factors that influence the timeframe for filling the mines with manufactured water and/or other water sources, such as the volume of water required, water availability and mine rehabilitation plans. The scenarios considered in this project used a 30-year timeframe as an input assumption. Varying this parameter creates another area of uncertainty which alters the timing and size of concepts.

Shorter time to fill mines:

- Smaller mine voids
- Partial fill of mine voids
- Manufactured water needed for one or two mine voids only
- Large transfer and supply infrastructure capacity from manufactured water source to the mines
- More water available from other sources

Longer time to fill mines:

- Larger mine voids
- Full fill of mine voids
- Manufactured water needed to fill all mine voids
- Smaller transfer and supply infrastructure capacity from manufactured water source to the mines
- Less water available from other sources

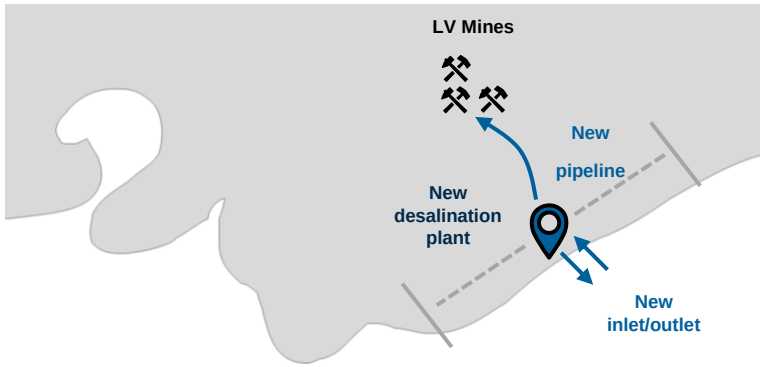
3 – Potential manufactured water concepts

3.1 Overview

The following manufactured water concepts identified by DEECA and regional stakeholders were explored at a high level [iv].

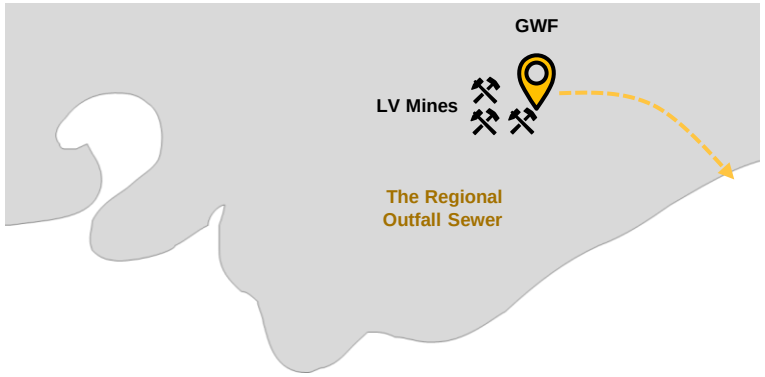
New Seawater Desalination

Water from a theoretical new seawater desalination plant.



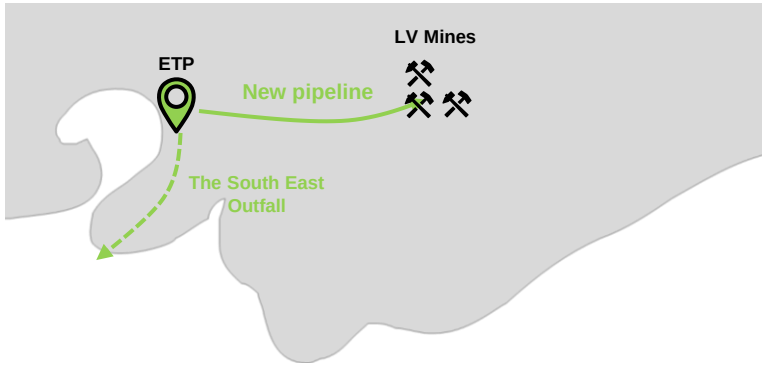
Water from the Gippsland Water Factory

Water from the Gippsland Water Factory (GWF), possibly adding additional treatment if needed.



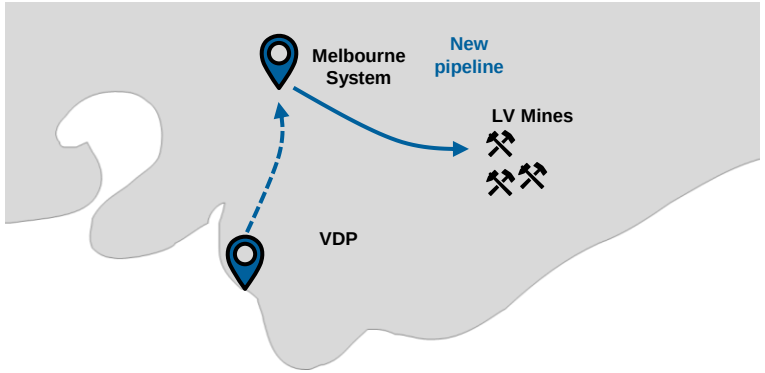
Water from Eastern Treatment Plant

Water from Eastern Treatment Plant (ETP) possibly adding additional treatment steps if needed.



Existing Seawater Desalination

Leverage potential capacity from existing Wonthaggi desalination plant in wet years.



(iv) All concepts presented involve a range of stakeholders who would need to be consulted, and in some cases may have competing uses for the water.

3 – Potential manufactured water concepts

3.2 Manufactured water sources (v)

GHD investigated concepts to supply manufactured water to the Latrobe Valley mine sites. These included transferring water from sources such as desalinated seawater (from a theoretical new site or existing greater Melbourne system) and recycled water (from a existing greater Melbourne site). The existing local manufactured water source from the Gippsland Water Factory, could also be used noting that it only produces relatively small annual volumes compared to the other sources and may have constraints around availability.

GHD drew on knowledge from similar infrastructure projects across Australia and internationally to provide an indication of the costs, noting there is a high level of uncertainty on a range of critical factors including water quality treatment risks, operational implications, timeframes to construct and high-level costs for different supply and transfer volumes.

This investigation found that the key project components include treatment plants and pipelines. Considerable further work is needed to determine the appropriate approach if a manufactured water source is required by mine licensees for the rehabilitation of one or more of the Latrobe Valley mines.

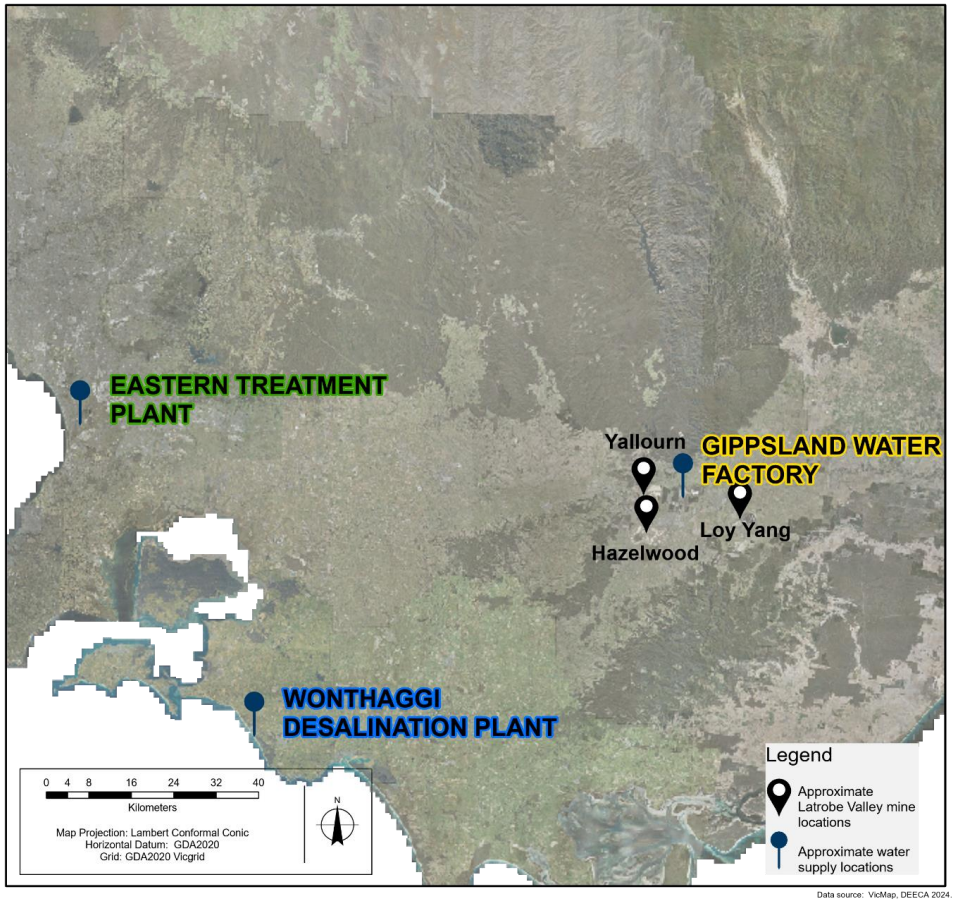


Figure 2: Latrobe Valley mine sites relative to manufactured water sources(2)

(v) All concepts presented in this report would be subject to supply agreements and other necessary approvals.

3 – Potential manufactured water concepts

3.2 Manufactured water sources

Seawater desalination

Figure 3: Ocean wave

- Construction of new seawater desalination plant
- This work assumed that salt would need to be removed from the seawater for it to be suitable
- Volume available for mine fill limited by capacity of new plant and other demands on the plant (if any)
- Energy intensive
- Cost dependent on location of new plant
- Seawater intake and concentrated brine outlet are high-cost elements and are heavily influenced by offshore and environmental conditions

Water from Gippsland Water Factory

Figure 4: The Gippsland Water Factory [3]

- High-quality recycled water from the GWF could supply water for mine rehabilitation
- Location is relatively central to the three Latrobe Valley mines
- Gippsland Water have advised there is currently limited water availability. Access to this water would require further consideration. Unlikely to materially impact fill timeframes
- Water is only available when it is not otherwise committed to supplying other users. This need might be more likely to arise during periods of drier climatic conditions
- Supply volumes may become greater over time

3 – Potential manufactured water concepts

3.2 Manufactured water sources

Recycled water from the Eastern Treatment Plant

Figure 5: Eastern Treatment Plant[4]

- It is assumed that water from ETP requires further treatment before being used to fill the mine voids
- If very high-quality water is needed, treatment could involve reverse osmosis or some equivalent
- Taking losses into account, up to 90 GL/a supply to mines is estimated to be available over long term[5]
- Transfer distance is significant as ETP is around 110 km from the Latrobe Valley

Leverage capacity from Wonthaggi desalination in wet years

Figure 6: Victorian Desalination Plant [6]

- There could be an opportunity to access desalination water produced by the existing Wonthaggi plant in wet years, e.g. when water orders are less than plant capacity, and when capacity exists in the greater Melbourne water grid[vi]
- Significant volumes may be available, but it is assumed this can only be accessed during wet periods, this source is likely to be less reliable than other supply concepts
- Transfer distance is significant as supply points are 50-100 km from the Latrobe Valley

(vi) Note, this would be subject to a number of different entitlement & contractual decisions, alongside Greater Melbourne's urban water supply needs & subsequent water access decisions. DEECA advise that this would be dependent on purchase of entitlement from current entitlement holders. Given cost is highly uncertain, input would be required from a wide range of stakeholders.

3 – Potential manufactured water concepts

3.3 Transfer infrastructure

- All concepts involve long pipelines to supply the water from the potential source of manufactured water to the Latrobe Valley mines
- General alignments for these pipelines were considered to estimate pipeline lengths but no specific routes were identified
- The duration to construct pipelines required for various concepts were estimated at a high level. It may be possible to stage part of the pipelines depending on the scenario

Figure 7: Victorian Desalination Plant

4 – High level concept assessment

4.1 Implementation timeline

- Implementation of infrastructure projects like this typically take eight to ten years, but can be significantly longer depending on planning and approval processes
- Some activities could be undertaken earlier, such as approvals, site selection and determination of pipeline alignments. Implementation of later activities could be deferred until a decision was made to progress to the next stage
- GHD identified three key implementation stages:

1. **Feasibility studies -** activities undertaken to identify & develop a preferred concept to design stage
2. **Field investigations & approvals -** activities required prior to construction, with significant public involvement
3. **Contract phase -** design, construction and commissioning of the project

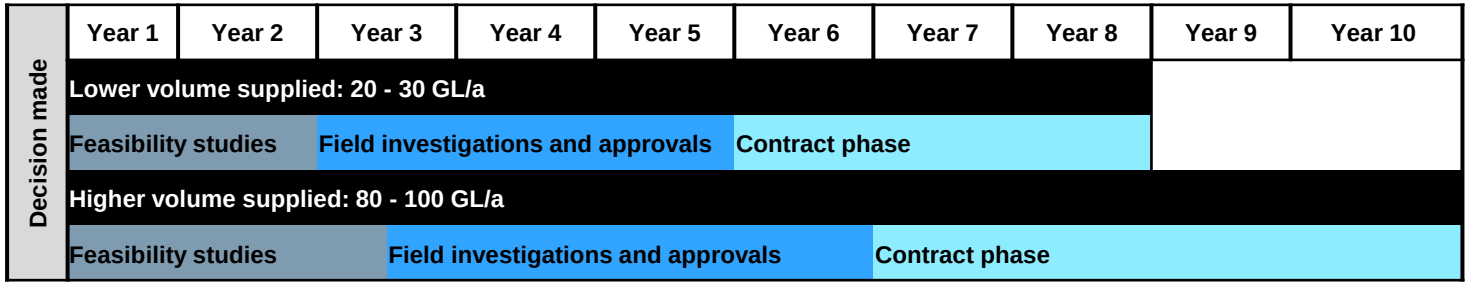


Figure 8: Implementation timing

Figure 9: Illustration of key implementation stages and associated activities

4 – High level concept assessment

4.2 Cost

Large manufactured water sources are significant infrastructure projects with high capital and operating costs, typically costing billions of dollars when implemented at the scale required for water based mine rehabilitation in the Latrobe Valley.

The costs of the concepts outlined in this report are of a similar order of magnitude to those found in other studies such as the 2020 Water Services Association of Australia (WSAA) study (see Appendix A)[7]. The seawater desalination and recycled water concepts were found to have costs of the same order of magnitude.

Costs will vary depending on timing of implementation. Spending could be deferred through staging, at the risk of needing a larger plant and infrastructure capacity to fill the mine voids within the required time frame.

4 – High level concept assessment

4.3 Indicative cost ranges

Using WSAA cost estimates as a basis, indicative costs were developed for the high-level concepts under consideration[7]. These were calibrated by comparing these projects with broadly similar projects elsewhere in Australia[vii].

Costs estimates are based on 2021 dollars and do not account for increases in construction costs. Substantial future work including feasibility studies and other investigations would be required to determine the actual project costs. These indicative cost ranges are in the same range as the comparative order of seawater desalination and recycled water options presented by WSAA.

Gippsland Water Factory costs have not been included due to high uncertainty following recent declines from major industrial customers in the region. The cost of potentially accessing manufactured water from existing Wonthaggi desalination plant during wet years requires further investigation – noting this supply would not be available in every year and is therefore not included.

Present value costs will vary depending on timing of implementation. Spending may be deferred by staging implementation, at the risk of needing a larger plant and infrastructure capacity to fill the mine voids within the required time frame.

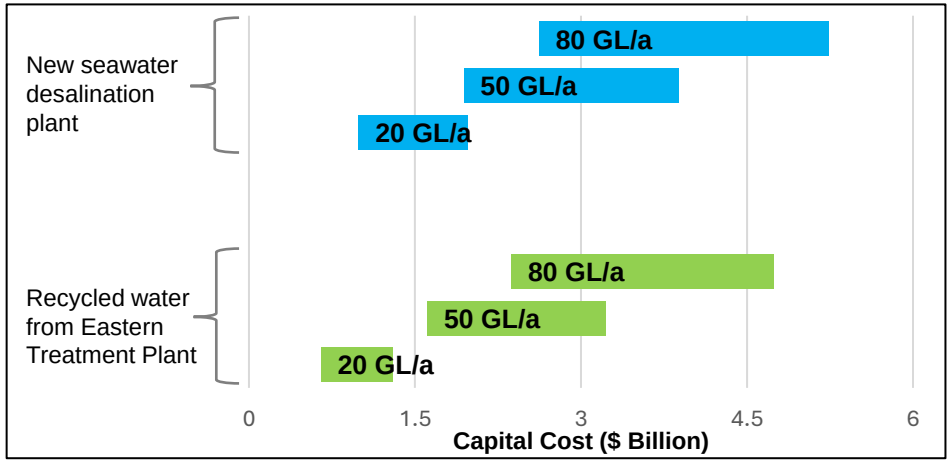


Figure 10: Capital costs (CAPEX) ($ Billion)

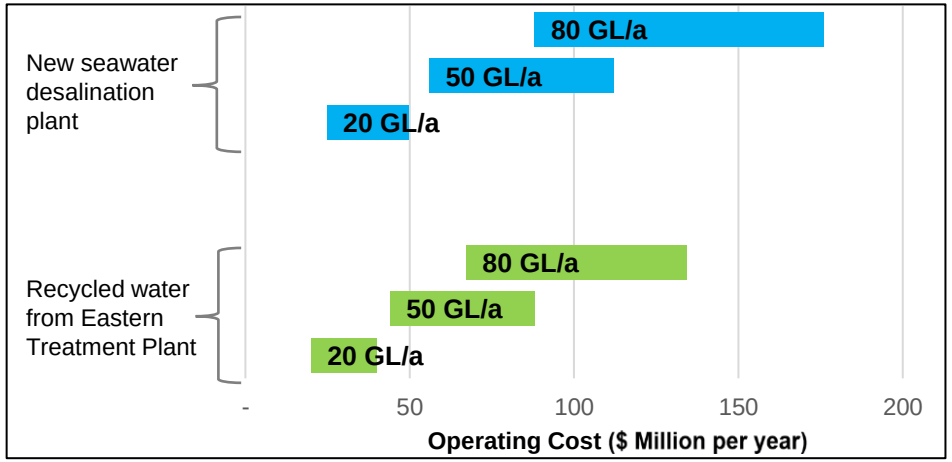


Figure 11: Operating costs (OPEX)

(vii) Some cost information presented is drawn from other projects and is therefore confidential.

5 – References

1 State of Victoria, DEECA. Credit: James Lauritz, May 2024

2 DEECA 2024, VicMap Imagery

3 Gippsland Water, The Gippsland Water Factory, 2023. Accessed July 31, 2024

4 Melbourne Water, Eastern Treatment Plant, 2023. Accessed July 31, 2024

5 Melbourne Water 2024, “Wastewater Outlet - Hourly Flow - Eastern Treatment Plant (ETP).” *Melbourne Water Open Data Hub.* Accessed July 31, 2024

6 Melbourne Water, Victorian Desalination Plant, 2023. Accessed July 31, 2024

7 ‘All options on the table - Urban water supply options for Australia’ *Water Services Association of Australia (WSAA),* 2020

Appendix A

→ Additional cost estimates

A-1 WSAA levelised costs

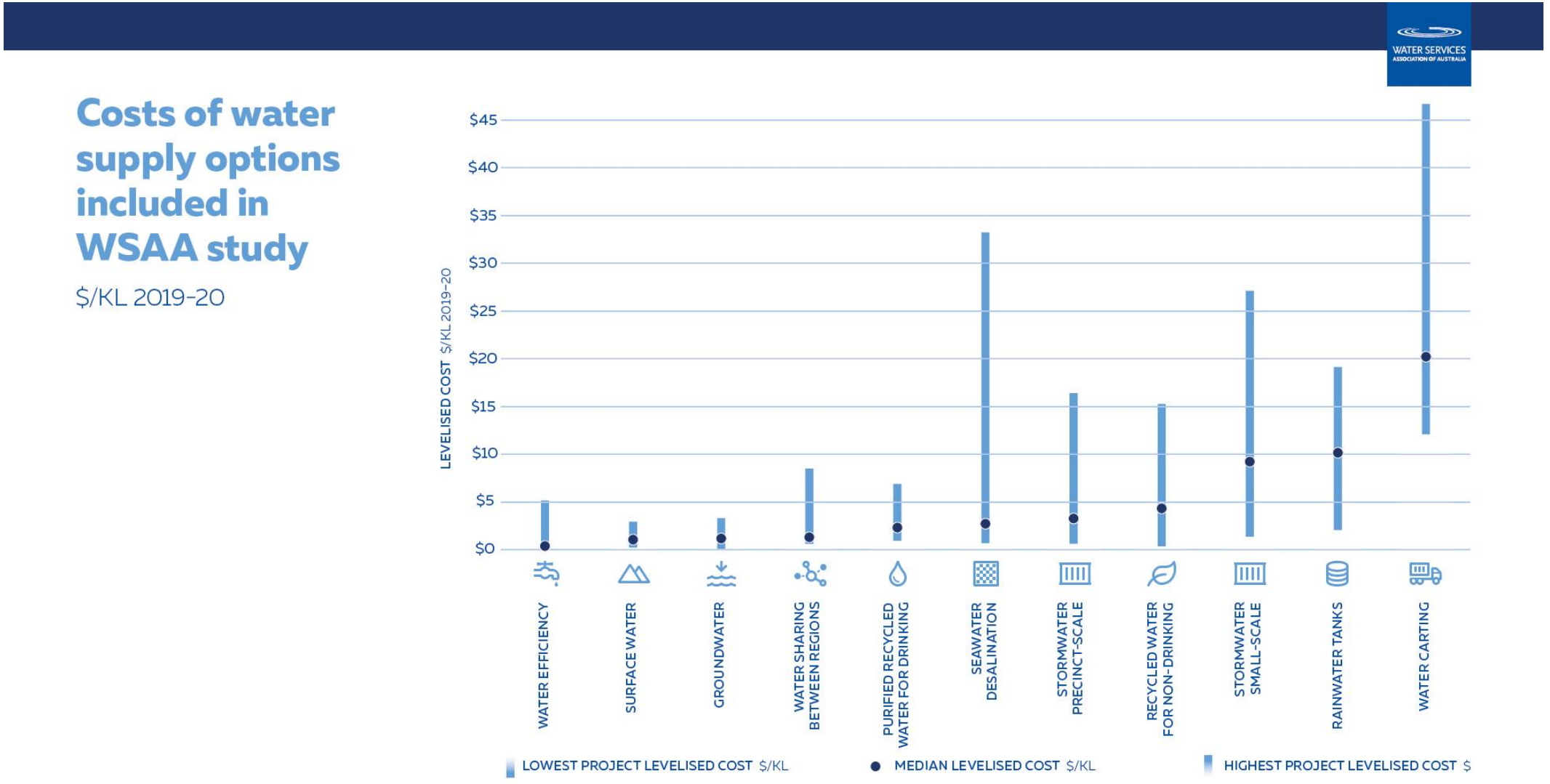


Figure 12: Water Services Association of Australia costs ($/KL, 2020 dollars) [7]

A-2 Levelised costs

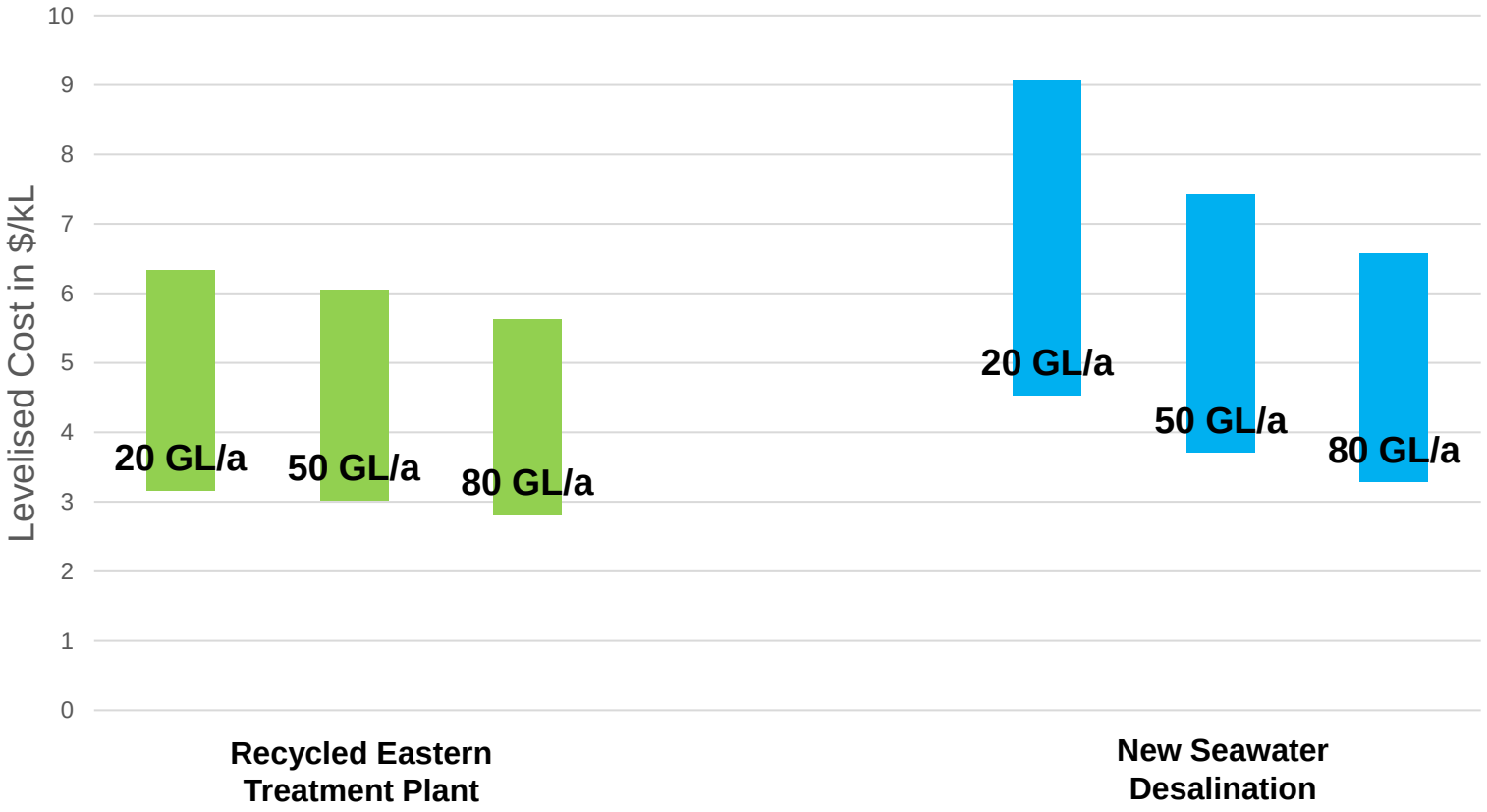


Figure 13: Levelised Costs of concepts ($/KL, 2021 dollars)

