Victorian Planning Authority (VPA)

# Integrated Water Management Opportunities in the Merrimu, Parwan Station, and Parwan Employment PSPs

## Merrimu Integrated Water Management Opportunities Report

Reference:

VERSION 5 | 8 May 2025



Job number 292585-00

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# Glossary of terms

| | |
|---|---|
| BMID | Bacchus Marsh Irrigation District |
| BPEM | Best Practice Environmental Management |
| CGRSWS | Central Gippsland Regional Sustainable Water Strategy |
| DEECA | Department of Energy, Environment and Climate Action |
| EPA | Environment Protection Authority |
| GWW | Greater Western Water |
| IWM | Integrated Water Management |
| ktpa | Kilo-Tonnes per Annum |
| MW | Melbourne Water |
| PEP | Parwan Employment Precinct |
| PSP | Precinct Structure Plan |
| RWH | Rainwater Harvesting |
| TN | Total Nitrogen |
| TSS | Total Suspended Solids |
| UGF | Urban Growth Framework |
| VPA | Victorian Planning Authority |
| WID | Werribee Irrigation District |
| WIN | Werribee Irrigation Network |

## Disclaimer

This report is an Integrated Water Management (IWM) opportunities paper prepared for the Victorian Planning Authority. It examines IWM opportunities within the Merrimu PSP. It is important to note that this report focuses on exploring IWM within this precinct. The options presented herein should be regarded as suggestions and are not definitive. Further investigation, public consultation, and policy amendments may be necessary to enable these opportunities.

# Executive Summary

The three Precinct Structure Plan (PSP) areas in Bacchus Marsh – Merrimu, Parwan Station and Parwan Employment Precinct – provide an opportunity to showcase Integrated Water Management (IWM) planning, building on work that has already been completed and is underway. In the Melbourne context where policy and targets around IWM are evolving rapidly, these PSP areas could be an exemplar for testing how to contribute to the broader catchment targets at a precinct scale and a catalyst for broader IWM initiatives in the catchment.

There are many unique regional opportunities in the area with the proximity of the Bacchus Marsh Irrigation District (BMID) and Werribee Irrigation Network (WIN), the Werribee River, Melton and Merrimu Reservoir and a possible recycled water supply. There are also some exciting precinct level opportunities to link to urban greening, amenity and cooling, integrated drainage design and provision of alternative supplies to both residents and business. There is significant IWM work being undertaken across Melbourne's West, to develop it into an exemplary region as population grows and Melbourne expands. However, to deliver the potential, there are also some significant site constraints to be consideration, including the integration of sodic soil considerations, topography and the escarpment, and the local waterway and development needs.

This report sets out the methodology undertaken to shortlist IWM opportunities for the Merrimu PSP, and to determine a final recommended portfolio of IWM solutions.

The report outlines the context, policy drivers and requirements for IWM, summarises the site context, explains how a long list of options were shortlisted, how each shortlisted option was appraised, and recommendations and next steps.

This report is for Merrimu PSP, however the description of site context and shortlisting of options considered the wider Bacchus Marsh region, which also includes Parwan Station PSP and Parwan Employment Precinct.

The shortlisted IWM options, following a stakeholder workshop with VPA, DEECA, Moorabool Shire Council, Greater Western Water and Melbourne Water, is shown below.

| Shortlisted Option | Precinct relevance for opportunity |
|---|---|
| 1. Rainwater tanks in all new homes | ✓ |
| 2. Rainwater harvesting transfer to Merrimu Reservoir for potable supply | ✓ |
| 3. Passive irrigation of street trees with stormwater | ✓ |
| 4. Precinct-scale stormwater harvesting<br>a. For open space irrigation<br>b. For non-potable supply to homes | ✓ |
| 5. Aquifer injection instead of piping down escarpment | ✓ |
| 6. Stormwater infiltration into Alluvium formation | ✓ |
| 7. Class A recycled water supply to PSP | ✓ |
| 8. Class B/C recycled water supply to open spaces throughout precinct | ✓ |
| 9. Transfer stormwater to Melton Reservoir and then to Merrimu Reservoir for potable supply | ✓ |

The criteria used to assess each shortlisted option has been adapted from the Werribee IWM plan, as well as bespoke criteria. A full list of criteria can be found in Appendix A.

For the Merrimu PSP, it is recommended a combination of a lot scale and precinct scale are further investigated and integrated in the planning and development process. This includes:

- **Option 1: Rainwater tanks in all new homes**
- **Option 3: Passive irrigation of street trees with stormwater**
- **Option 4a: Stormwater harvesting for open space irrigation**

Complimenting this, it is also recommended that authorities work together in the wider catchment to further investigate and implement one of two complimentary regional options outside of the PSP area, utilising excess stormwater from the PSP:

- **Option 6: Stormwater infiltration into alluvium.**
- **Option 9: Treated water transferred to the Melton Reservoir and then eventually to Merrimu Reservoir for potable reuse**

The outcomes of this opportunity assessment have recommended precinct scale and lot scale solutions as well as continued work on regional initiatives. This has been based on available information and a qualitative and quantitative opportunity assessment of benefits. The estimated infrastructure requirements and benefits identified through this project have been developed based on a number of assumptions, and further investigation and consultation will be needed to refine and optimise outcomes, particularly costing and detailed design of the options within the developments in the PSPs.

Integrated Water Management is a continuous process and is led by different stakeholders at different phases throughout the entire 'IWM journey', from high level strategic directions through to conceptual analysis, to functional design, funding, and implementation. The development of this report was led by the VPA and the analysis is at the conceptual level, but IWM investigations and stakeholder collaborations continue post PSP process. The 'next phase' will be led by a different (or a consortium of) authority to further investigate the concepts developed by this process. As understanding of the options improve, further details such as timelines, adaptive pathways, costs, benefits, and design details can be established.

The following recommendations for next steps are:

- Inclusion of the IWM recommendations in the PSP documentation, and a requirement for developers within the PSP to document their integration of the IWM strategy as part of the planning application process, demonstrating integration of the recommended portfolio, or alternative options that would achieve equivalent outcomes. Council should refer develop IWM plans to Greater Western Water to review in accordance with their Developer IWM Guidance.
- Continued and regular stakeholder engagement between Council, Melbourne Water and Greater Western Water, Traditional Owners, DEECA and local developers post PSP gazettal to understand the outcomes of any IWM investigations and to align agency positions on preferred IWM solutions. The Bacchus Marsh IWM working group should be maintained and a lead agency should be appointed to coordinate collaboration and engagement. In particular, updates should be made to the stakeholder group at key points regarding:
    - The evolving drainage solution under the drainage scheme, and implications for stormwater harvesting on or near site.
    - The outcomes of the recycled water optimisation study for the Werribee catchment and any proposals for recycled water networks from Bacchus Marsh RWP. Engagement may lead to identifying potential opportunities for joint business cases and synergies between projects, such as offtakes from proposed networks. Any changing priorities and policy, particularly as to how it affects any options that are not yet possible.
    - Implementation and adoption pathway for the recommended IWM options.
    - Engagement with interested developers to ensure a shared understanding of IWM requirements and outcomes from the outset.

# 1. Introduction

Arup has been engaged by the Victorian Planning Authority to review the Integrated Water Management (IWM) Opportunities for the Merrimu, Station and Employment Precincts, within Bacchus Marsh. This Opportunities Report has been developed in conjunction with completed and current work underway by stakeholders and takes a holistic approach to designing with water, considering all aspects of the water cycle and how they interact with urban design, infrastructure planning and place-making.

This strategy is for the **Merrimu PSP**.

## 1.1 What is Integrated Water Management?

Integrated Water Management (IWM) recognises the interconnected nature of the water cycle, seeking to manage water across the whole water cycle in a coordinated manner and improve its interactions with the built and natural environment. Traditionally, three 'areas' of the water cycle have been managed separately: water supply, wastewater, and stormwater. Roles and responsibilities have similarly focused on the different areas of water management.

Integrated water management recognises the interrelationships between different sources of water, and also views water cycle management within a specific environmental, social, cultural and economic context – recognising the needs of local catchments and waterways, communities and industries.

The three Precinct Structure Plan (PSP) areas in Bacchus Marsh – Merrimu, Parwan Station and Parwan Employment Precinct – provide an opportunity to showcase IWM planning, building on work that has already been completed and is underway. In the Melbourne context where policy and targets around IWM are evolving rapidly, these PSP areas could be an exemplar for testing how to contribute to the broader catchment targets at a precinct scale and a catalyst for broader IWM initiatives in the catchment.

There are many unique regional opportunities in the area with the proximity of the Bacchus Marsh Irrigation District (BMID) and Werribee Irrigation Network (WIN), the Werribee River, Melton and Merrimu Reservoir and a possible recycled water supply. There are also some exciting precinct level opportunities to link to urban greening, amenity and cooling, integrated drainage design and provision of alternative supplies to both residents and business. There is significant IWM work being undertaken across Melbourne's West, to develop it into an exemplary region as population grows and Melbourne expands. However, to deliver the potential, there are also some significant site constraints to be consideration, including the integration of sodic soil considerations, topography and the escarpment, and the local waterway and development needs.

In a greenfield environment, such as these PSPs, it is important to recognise how the water cycle could be affected by urbanisation as significant growth occurs. In these PSPs, the growth is forecasted to be a combination of residential, non-residential and industrial. As urban development occurs, there is an opportunity to protect the natural environment and water cycle as it transitions to an 'urban water cycle'. The urban water cycle encompasses water supplies extracted from or imported to a local catchment, wastewater and stormwater generated locally, and the catchments and receiving environments affected by those water cycle interactions. As urban settlements grow, additional water demands and changes in generation of wastewater and stormwater will have knock-on effects on the natural water cycle, requiring forethought and understanding of the environmental, economic and social influences and sensitivities in the system.

## 1.2 What does this study consider?

The aim of this IWM Opportunities Report is to bring together previous IWM options proposed, with new targets, objectives and work underway, to recommend proposed IWM options for each PSP.

It explores and prioritises opportunities to maximise outcomes across the water cycle, including consideration of:

- Water supply (potable and non-potable)

- Wastewater management
- Stormwater management
- Green-blue infrastructure

Waterway health

The study also naturally connects directly with the ecology, landscape, cultural and infrastructure plans for the site. This study includes a baseline analysis of the site and broader area context, building on literature reviews and stakeholder interviews, examines an initial long list of options, proposes and assesses shortlisted options to recommend a consolidated portfolio of options for each PSP, to deliver integrated water management objectives.

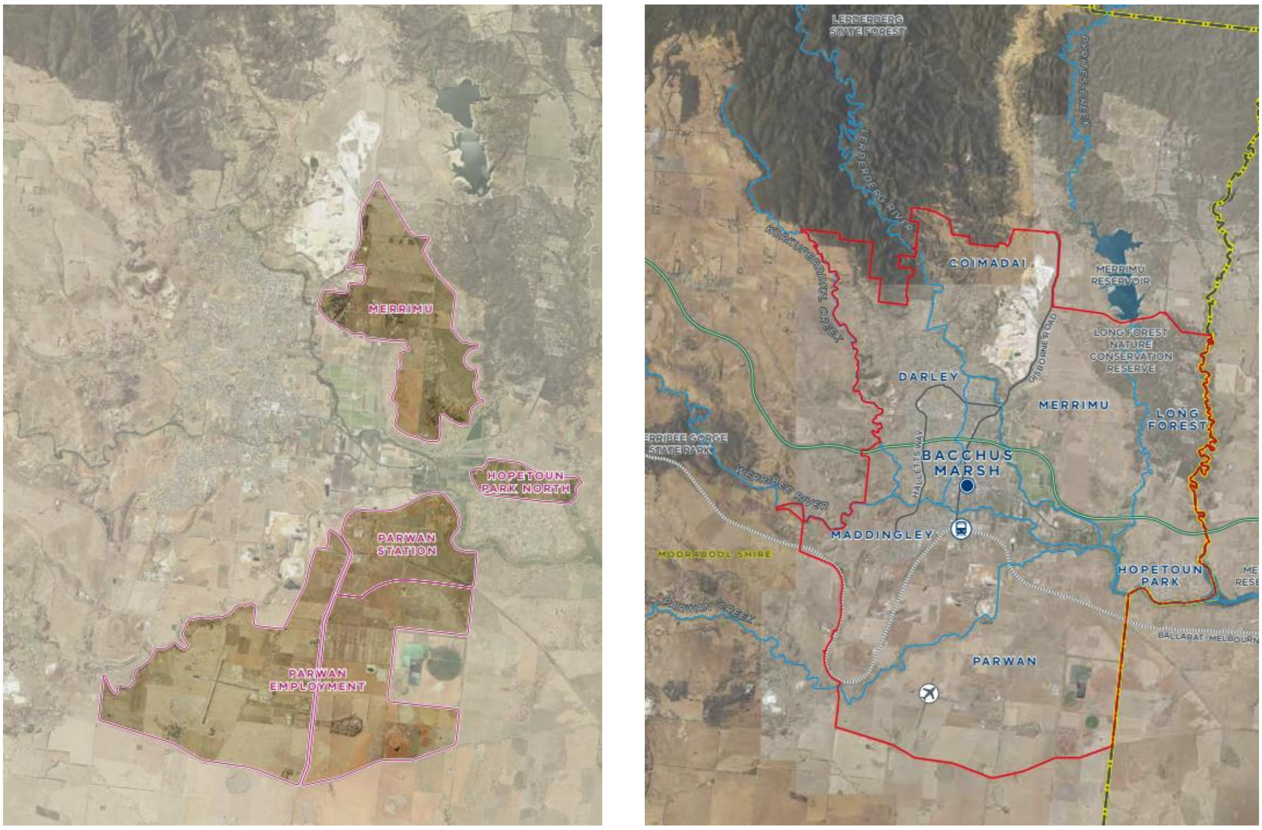


**Figure 1-1 Merrimu, Parwan Station & Parwan Employment Precinct location plans in relation to Bacchus Marsh (Arup, 2023)**

This study is built from a holistic and continual exploration of IWM that has been developed alongside stakeholder investigations and concurrent projects, with the intent of informing and feeding from evolving land use and IWM proposals to maximise outcomes, create opportunities and minimise risks.

Accordingly, a layered approach has been taken from the ‘bottom-up’ as demonstrated in the figure below, whereby the key spatial and infrastructural opportunities to embed IWM have been explored from first to inform the development of the masterplan and to drive synergistic place-making outcomes at a strategic planning level, before then exploring recommendations the development and facility scale which can be driven through subsequent planning and design processes. This strategy is focussed primarily on the three base layers to set the foundation for IWM, but also makes recommendations for subsequent design stages.

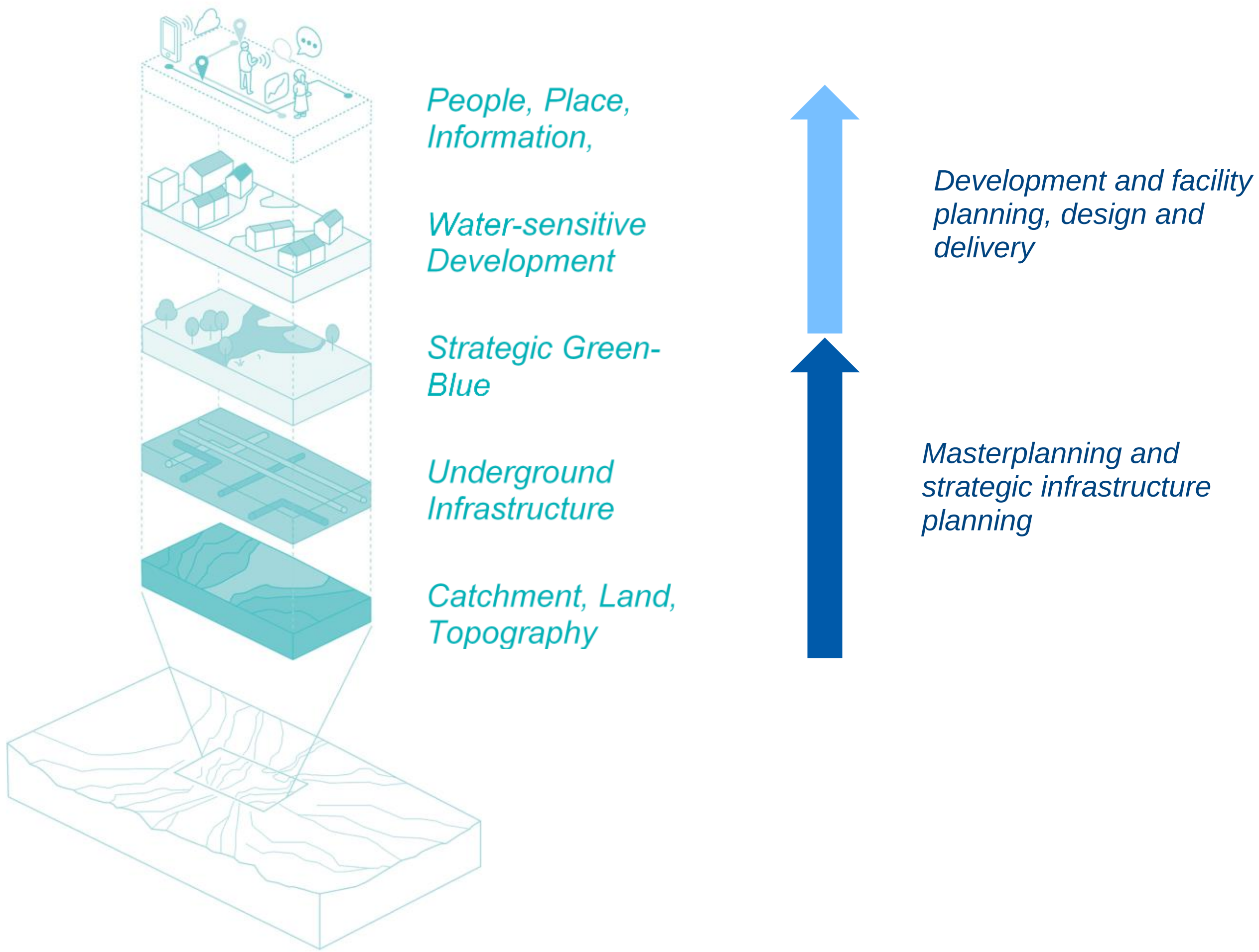


**Figure 1-2 Layered approach to IWM (Arup)**

## 1.3 IWM Opportunities methodology

This study is based on information collected through previous assessments provided by VPA, including the Bacchus Marsh IWM Strategy, prepared for Moorabool Shire Council (September, 2021), a series of interviews conducted with key stakeholders to inform additional work underway, a site visit and a stakeholder workshop to prioritise options.

Following this, the shortlisted options were further developed and assessed using an IWM Options Preliminary Assessment Method (DELWP, 2016). Options were then prioritised into recommended portfolios for each PSP.

The methodology undertaken is illustrated below.

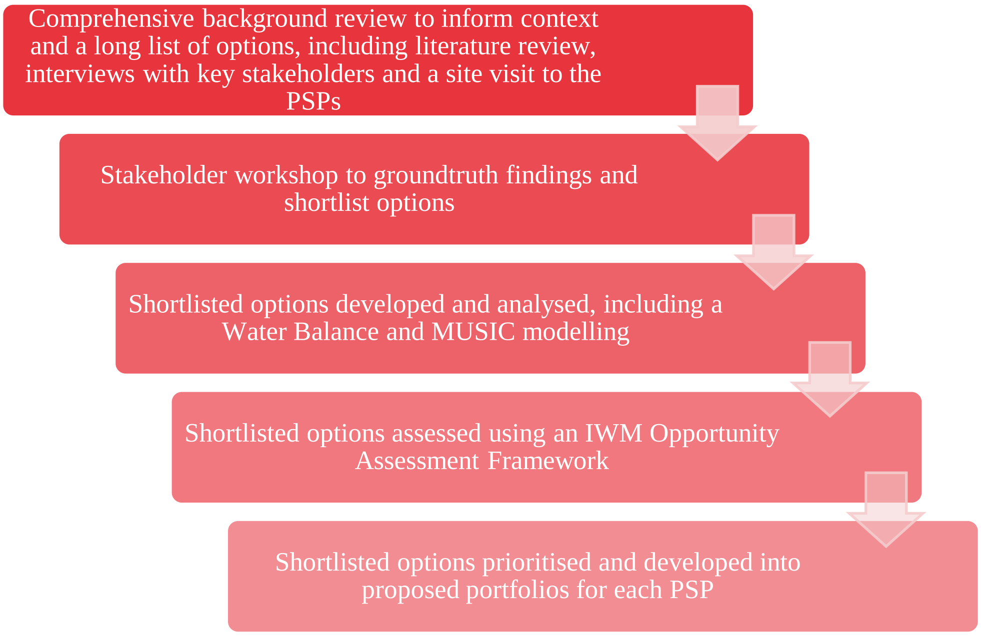


**Figure 1-3 Methodology (Arup, 2023)**

## 1.4 Key stakeholders

Stakeholders were consulted in the development of this study as outlined above. There is extensive work underway across the water cycle, with multiple stakeholder touch points. The purpose of this study is to bring together all of the work underway, identify opportunities and consolidate it in this Opportunities report. The key stakeholders consulted as part of this study are listed below.

- VPA
- Melbourne Water
- Greater Western Water
- Moorabool Shire Council
- DEECA

# 2. Policy drivers and requirements for IWM

## 2.1 Overarching IWM strategies and frameworks

*Water for Victoria* (Victorian State Government, 2016) is a “framework to guide smart water management, bolster the water grid and support more liveable Victorian communities”. *Water for Victoria* identified eight themes and associated actions to implement the policy. One of those themes is “resilient and liveable towns and cities” and State Government provided a commitment to:

- “Adopt integrated water planning across Victoria, with place-based planning supporting community values and local opportunities”, and
- “Put integrated water management into practice, working with water corporations to develop a common economic evaluation framework, promoting exemplar projects, building the capacity of the water sector and local government to participate, and continuing research to improve urban water management.”

In September 2017, the Department of Environment, Energy and Climate Action (DEECA) released a document titled *Integrated Water Management (IWM) Framework for Victoria.* The IWM framework provides guidance aimed at helping government, the water sector and the community to work together to better plan and deliver solutions for water management across Victoria’s towns and cities.

The IWM framework supports the establishment of IWM forums in each region to drive coordinated delivery of IWM. The IWM Forums have been established across the state to identify, prioritise and oversee the implementation of collaborative water opportunities. The Forums bring together all organisations with an interest in water cycle, recognising that each has an important role to play in the management of our most vital resource.

The Bacchus Marsh PSPs are part of the Werribee Catchment and the strategic objectives and IWM Plan for the catchment have been developed by a collaborative union of relevant authorities brought together in the Werribee Catchment IWM Forum.

### 2.1.1 Monitoring, Evaluation, Reporting and Improvement (MERI) Plan

Alongside the Catchment Scale IWM Plans and Action Plans developed under the aforementioned IWM Framework, the MERI Plan is being developed collaboratively to track progress against the performance targets and prioritised actions. The MERI Plan aims to support each metro IWM Forum to demonstrate accountability by monitoring and transparently reporting on progress towards the 2030 and 2050 performance targets set out in the CSIWM Plans, and other performance measures nominated for monitoring only. The MERI Plan also helps understand how prioritised actions have contributed to achieving the 2030 and 2050 catchment performance targets, as well as evaluating the appropriateness, effectiveness, efficiency, impact and legacy of the implementation of the Catchment Scale IWM Plans and Action Plans.

Monitoring and evaluation is essential as it provides feedback to decision-makers on how well a project or program is performing, whether it is on track, or whether changes need to be made. Therefore, the MERI collects evidence to demonstrate the level of investment needed to improve IWM outcomes across each catchment and to inform policy reform, is intended to help share lessons and achievements to continuously improve the performance of IWM programs, initiatives and projects and improves capacity to analyse and report on performance. Finally, the MERI is intended to inform review and update the CSIWM Plans and Action Plans in response to new evidence and evaluation findings.

The MERI is currently being piloted for 2021/22 data, which will inform finalisation of the MERI Plan in early 2024. The relevant measures and targets for this area are outlined in the following section.

### 2.1.2 Werribee Catchment IWM Forum Strategic Directions Statement and IWM Plan

The Werribee Catchment IWM Forum has developed a Catchment-specific vision based on the opportunities and challenges specific to the Catchment. The vision, along with the Catchment context, are captured in the *Strategic Directions Statement* (2022) which outline seven strategic outcomes for IWM. These outcomes provide a framework that recognises the multiple benefits that IWM delivers and drives the creation of holistic solutions. Some of the key outcomes are highlighted below.

| | |
|---|---|
| | – 16 Gigalitres/year of alternative water sources that substitute potable mains supply by 2030 for the catchment<br>– 53 Gigalitres/year of alternative water sources that substitute potable mains supply by 2030 for the Greater Melbourne Region |
| | – 85 Gigalitres/year of recycled water delivered to customers by 2030 for the Greater Melbourne Region |
| | – 100% of projects cross-consider IWM and flood mitigation opportunities as part of their design by 2030 and maintained by 2050 for the catchment and Greater Melbourne Region |
| | – 46 Gigalitres/year and 197 Gigalitres/year of mean annual urban runoff volume reduction by 2050 for the catchment and Greater Melbourne Region respectively<br>– Remove TSS and TN to achieve the marine pollutant load objectives for the Port Phillip Bay and Western Port |
| | – 14% and 30% of street trees are supported with permanent irrigation from an alternative water supply by 2030 and 2050 respectively, for the catchment<br>– 22% and 50% of active public open space (sports fields and organised recreation) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment<br>– 9% and 25% of passive public open space (parklands and gardens) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment |
| | – Rating of 5 out of 5 for water as a key element in city planning and design processes by 2030 and maintained by 2050 for the catchment |
| | – 41 Gigalitres/year of alternative water is supplied to agricultural production in the catchment by 2030<br>– 60 Gigalitres/year of alternative water is supplied to agricultural production in the catchment by 2050 |
| | – Rating of 5 out of 5 for vision, leadership and long-term commitment through vision statement and objectives articulated in corporate documents by 2030 and maintained by 2050, for the catchment<br>– Rating of 5 out of 5 for knowledge, skills and organisational capacity by 2030 and maintained by 2050, for the catchment<br>– Rating of 5 out of 5 for cross-sector institutional arrangements and processes by 2030 and maintained by 2050, for the catchment |

Performance measures have been developed for each of the outcomes and for a set of enabling factors that underpin all outcomes in the *Werribee Catchment IWM Plan* (2022), as shown in Figure 2-1. **This has also been incorporated into the assessment framework for the shortlisted options.**


**Figure 2-1. Werribee Catchment IWM Outcomes and Measures (Werribee Catchment IWM Plan, 2022)**

### 2.1.3 Central Gippsland Regional Sustainable Water Strategy, 2022

The Central Gippsland Regional Sustainable Water Strategy (CGRSWS) sets policy direction and outlines actions for securing the region's long-term water supplies to protect the jobs, farms, ecosystems, communities, and Traditional Owners that rely on them.

The proposals which are relevant to the Werribee region include:

- Proposal 5-4: It is proposed that water returned to rivers and creeks as a result of substitution by alternative water sources will be shared equally between the environment (the Victorian Environmental Water Holder) and Traditional Owners.
- Proposal 5-5: It is proposed that the business case for the recycled water substitution project in the Werribee and Bacchus Marsh irrigation districts include the benefits to Traditional Owners of receiving an equitable proportion of water saved as a result of water substitution.

The following actions and policy directions are set to address the above proposals:

- Action 4-10: Reconfiguring the Werribee system to provide climate-resilient water sources for non-drinking purposes and better use of existing water and reservoirs in the system.
- Action 4-3: Substituting river water with manufactured water in the longer term.

### 2.1.4 Water for Life: The Greater Melbourne Urban Water Systems Strategy

*Water for Life* (2022) sets out the strategy for the future of Melbourne's water supply. Importantly, the strategy recognises and prioritises IWM with the aim of diversifying water supplies for Melbourne as part of an adaptable and resilient future water supply. Integration of opportunities for recycled water supply, stormwater and rainwater harvesting in combination with other water supply resilience measures were shown to deliver the greatest benefits to the community, due to the co-benefits these alternative water supplies deliver in terms of waterway health, circular economy outcomes, landscape amenity and community well-being. Actions 4.2, 6.2, 6.5 and 6.6 seek to enhance investment in alternative water supplies.

### 2.1.5 Water is Life: Traditional Owner Access to Water Roadmap, 2022

Water is Life is a framework to create and maintain a careful and considered balance between Traditional Owner self-determination in water access and management, and the rights and entitlements of a range of stakeholders. The strategy outlines actions to deliver meaningful outcomes to Traditional Owners to enable deeper involvement with decisions around water management.

The outcomes from the strategy include:

- Increased role in determining how environmental water is used for the purpose of healing Country
- Increased involvement in public land management
- Recognition of Traditional Owners as waterway managers for specific locations
- Recognition of Traditional Owners as environmental water holders

### 2.1.6 VPA guidelines for PSPs, October 2021

In October 2021, VPA prepared Precinct Structure Planning Guidelines for new communities in Victoria. The objective of the VPA was to "lift the bar" by encouraging higher standards of design and development. One way in which the guidelines do this is by "improving outcomes for the whole water cycle by referencing regional integrated water management plans to resolve development-related water balance challenges". General principles followed by a method for application is outlined in this document. With respect to IWM, the following targets were included:

- T14–- All streets containing canopy trees should use stormwater to service their watering needs
- T17–- IWM solutions should meaningfully contribute towards the actions and targets from the relevant Catchment Scale Public Realm & Water Plans and any relevant water-related strategies, plan, or guideline.

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## 2.2 Key policies and legislation

### 2.2.1 Urban Stormwater Best Practice Environmental Management (BPEM) Guidelines

The *Urban Stormwater 'BPEM' Guidelines* (1999) were produced to assist in the protection of stormwater quality. The BPEM included best practice performance objectives (at the post construction phase) of:

- 80% retention of the typical urban annual load for suspended solids,
- 45% retention of the typical urban annual load for phosphorous,
- 45% retention of the typical urban annual load for nitrogen,
- 70% reduction of typical urban annual load for Litter; and
- Flows: maintain discharges for 1.5 year Average Recurrence Interval (ARI) at pre-development levels.

The BPEM guidelines are included within Victorian Planning Schemes, within the Victorian Planning Provisions (VPPs), although it is noted that they were not introduced into the planning provisions until 2006.

### 2.2.2 Victorian Planning Provisions

*Clause 56.07 Integrated Water Management* provides objectives and discretionary standards in relation to drinking water supply, reused and recycled water, waste water management, and stormwater management for subdivisions, including meeting the stormwater quality performance objectives in the Urban Stormwater BPEM Guidelines outlined above. For apartments, Clauses 55.03 and 55.07 also encourage the use of alternative water sources, facilitate stormwater collection, utilisation and drainage; and reduce the impact of stormwater run-off. Amendment VC154 also recently introduced Clause 53.18 which extends the stormwater management requirements for residential subdivision and apartment development to all commercial and industrial and subdivision development, all public use development and all residential multi-dwelling developments.

Amendment VC224 which was gazetted by Victorian Government on 28 October 2022. The amendment updates the policy document reference to Melbourne Water's Healthy Waterways Strategy (at Clause 12.03-1S), from the outdated 2013 strategy to the current 2018 strategy. This is an important change ensuring the VPP is current, and supports better waterway outcomes through strategic planning processes and statutory decision-making.

Amendment VC224 also makes changes to Clause 53.18 (Stormwater management in urban development) to clarify that the stormwater management provisions for commercial, industrial and public use development (in particular) are applied equally in growth areas (where a Precinct Structure Plan applies) as in established areas. This change removes ambiguity that existed in the application of relevant stormwater standards to non-residential land in growth areas.

### 2.2.3 Urban Stormwater Management Guidance, EPA, 2021

EPA Victoria published urban stormwater management guidelines in 2021, which aims to help improve the management of urban stormwater by highlighting the risk of harm caused by stormwater and helps developers who create new impervious surfaces to minimise risks to human health and the environment. The guideline sets out a hierarchy of hazard reduction, which prioritises eliminating the hazard as far as reasonably practicable as the most favourable solution. This includes eliminating specific impervious surfaces, using permeable or porous paving, capturing and infiltrating stormwater, eliminating pollutants from stormwater from entering waterways etc.


**Figure 2-2 Hierarchy of controlling hazards in Urban Stormwater Guideline, 2021**

Quantitative performance objectives are set in this Guideline, where MUSIC modelling should be carried out to assess performance against these objectives. The water quality objectives remain unchanged from those referenced in the Victorian Planning Provisions and state there should be a;

- 80% reduction in mean annual load[1] of suspended solids
- 45% reduction in mean annual load of total Phosphorus
- 45% reduction in mean annual load of total Nitrogen
- 70% reduction in mean annual load of litter

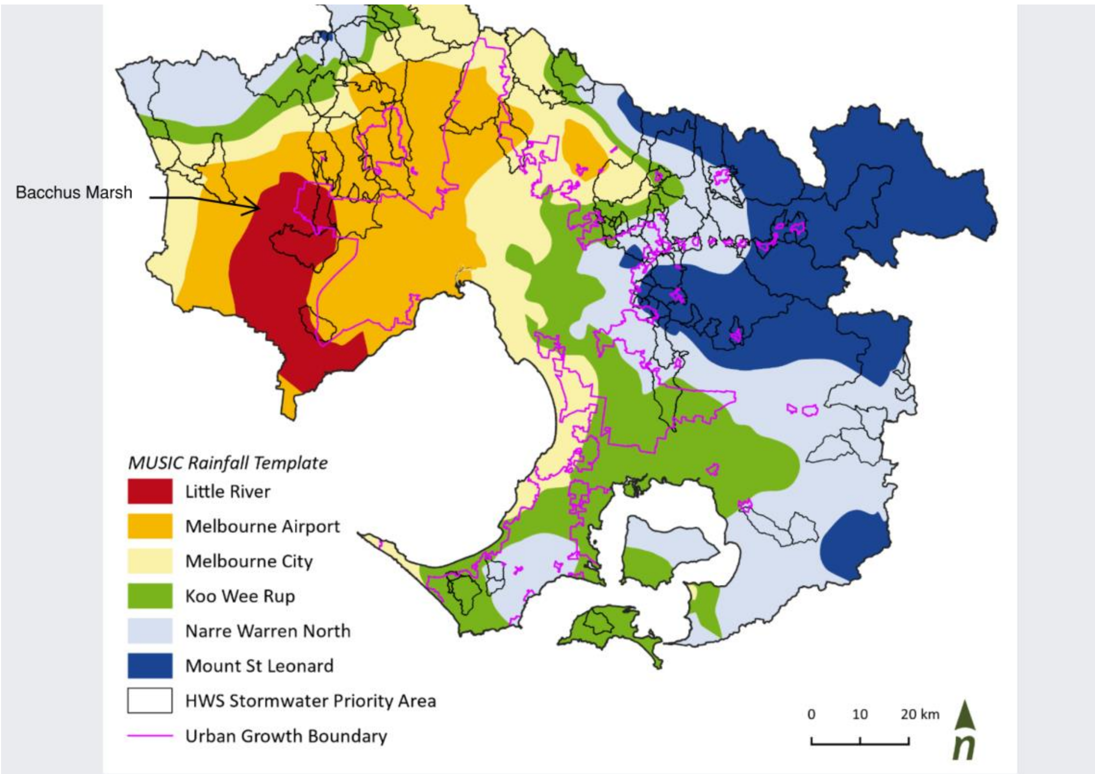
Significantly, the guidance introduced objectives for mean annual run-off reduction, whereby the target reduction is based on mean annual rainfall, and differs for priority and non-priority areas. Previously, Melbourne Water set a preferred target of a 50% runoff reduction to recognise the sensitivity of the Werribee and the downstream platypus population. Subsequent advice from Melbourne Water is that the target should now be in line with that defined by the Urban Stormwater Management Guideline, and the subsequent Healthy Waterways Strategy Stormwater Targets–- Practitioner's Note (see below).

### 2.2.4 Healthy Waterways Strategy Stormwater Targets–- Practitioner's Note, July 2021

Melbourne Water in collaboration with the EPA developed this note to develop a consistent framework, whereby the targets in the EPA guideline and in the Healthy Waterway Strategy are aligned. This document included the Figure below, which provides stormwater runoff targets for areas based on MUSIC Modelling Targets.

**This document clarifies that the targets for the Bacchus Marsh region is 29-32% for stormwater harvesting, and 3-6% for infiltration (Bacchus Marsh bridges two rainfall templates as shown in Figure 2-3).**

[1] Reduction in the load discharged from the managed development compared to pre-development levels without management




| | | | | Priority areas | | | | Other Areas | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Template Name | Annual rainfall range | Model annual rainfall | Runoff | Harvesting target | | Infiltration target | | Harvesting target | | Infiltration target | |
| | (mm) | (mm) | ML/year from 1 impervious ha | ML/year from 1 impervious ha (and %) | | | | | | | |
| Little River | 400 - 500 | 472 | 3.7 | 2.9 | (79 %) | 0.1 | (4 %) | 1.2 | (32 %) | 0.1 | (3 %) |
| Melbourne Airport | 500 - 650 | 575 | 4.6 | 3.4 | (74 %) | 0.4 | (8 %) | 1.4 | (29 %) | 0.3 | (6 %) |
| Melbourne City | 650 - 750 | 708 | 5.8 | 3.9 | (67 %) | 0.7 | (12 %) | 1.6 | (27 %) | 0.5 | (9 %) |
| Koo Wee Rup | 750 - 850 | 769 | 6.3 | 4.1 | (65 %) | 0.8 | (13 %) | 1.6 | (26 %) | 0.7 | (10 %) |
| Narre Warren North | 850 - 1100 | 932 | 7.8 | 4.6 | (59 %) | 1.3 | (16 %) | 1.8 | (23 %) | 1.0 | (13 %) |
| Mount St Leonard | 1100 - 2100 | 1221 | 10.6 | 5.3 | (50 %) | 2.2 | (21 %) | 2.1 | (20 %) | 1.8 | (17 %) |

**Figure 2-3 Mean annual runoff objectives (Healthy Waterways Strategy, 2021)**

To meet these targets, it depends on the scale of the development, i.e., Allotment / street scale, Precinct scale, or regional / catchment scale.

It's acknowledged that while initiatives such as rainwater tanks and wetlands represent an important contribution to infiltration and harvesting targets, they are unlikely to be sufficient in isolation to meet the Healthy Waterway Strategy stormwater targets. Meeting the targets therefore likely requires a focus on harvesting and interventions across a range of scales. Examples of interventions at each scale are listed in Figure 2-4.

| Scale | Description | Typical interventions (examples) |
|---|---|---|
| Allotment / street scale | Typically a smaller residential, commercial or industrial development.<br>Relies on landscape design to enable infiltration in the streetscape<br>Assumed to have little to no public open space and limited potential for stormwater irrigation. | • Lot scale rainwater tanks ('leaky tanks')<br>• Lot scale raingardens<br>• Street scale infiltration including passive irrigation for street trees |
| Precinct scale | A larger greenfield development or area covered by a precinct structure plan (PSP)<br>Include features like community facilities, active open space and passive space for relaxation.<br>May include a natural or (proposed) constructed waterway, stormwater treatment wetland or headwater stream<br>May also include commercial areas and one or more schools | Allotment / street scale interventions plus<br>• Stormwater harvesting for the irrigation of open space<br>• Leaky wetlands for infiltration<br>• Infiltration trenches in open space / garden beds<br>• Large roof rainwater harvesting |
| Regional / catchment scale | An area defined more by regional than development or precinct boundaries<br>Would include a number of precincts that would incorporate a number of open spaces and treatment wetlands<br>Likely to include minor and potentially major waterways. | A stormwater network, collecting outflows from treatment wetlands for conveyance to meet a large demand (e.g. water for an irrigation district).<br>Plus precinct and allotment scale interventions as required. |

**Figure 2-4 Interventions to meet targets at the 3 scales (Healthy Waterways Strategy, 2021)**

### 2.2.5 National Construction Code requirements regrading rainwater tanks

The *Building Act* sets out the framework for the regulation of building construction, building standards and building safety features in Victoria. Nested beneath the Building Act, as subordinate pieces of legislation, are the *Building Regulations 2018* and the *Plumbing Regulations 2018*.

The National Construction Code (NCC) 2019 in Schedule 2 of the plumbing regulations also notes that "the Victorian variation to the energy efficiency provisions of the Building Code of Australia (as incorporated by the Building Regulations) provides that the energy efficiency performance requirement for a new Class 1 building is satisfied if either a rainwater tank is connected to all sanitary flushing systems, or a solar water heater is installed in accordance with these Regulations." A recycled water connection is also accepted as an alternative to a rainwater tank. The NCC 2022 will replace the NCC 2019 provisions on the 1 October 2022, whereby this requirement is superseded.

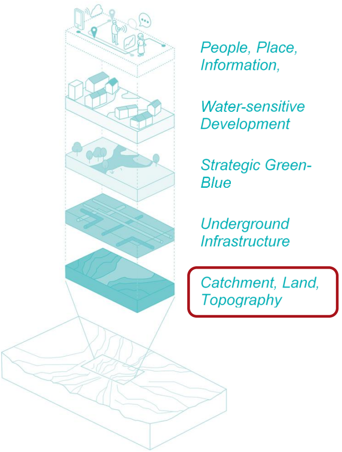
The Victorian Government proposes to implement stronger state building and plumbing regulations for water efficiency, to improve the water efficiency of all buildings, subject to a regulatory impact statement and stakeholder and community consultation. As such, there is currently no specific requirement for rainwater tanks within NCC 2022. Instead, NCC 2022 refers practitioners to regulations made under the Act to provide for water efficiency requirements that may be set in future.

# 3. Project context

The following section outlines the key project context. This context is drawn from the background review and the stakeholder interviews. The detailed findings from the background review and stakeholder interviews can be found in Appendix B and Appendix C. It includes the existing state, anticipated changes due to growth in the PSPs and work underway by stakeholders.

## 3.1 Catchments, Land, Topography

*Consideration of the functionality of the landform, waterways, and their catchments should inform the location and density of development to ensure that waterway health, ecological health and flood resilience outcomes can be supported.*




### 3.1.1 Site Analysis

Figure 3-1 shows some of the key features and constraints in the region.

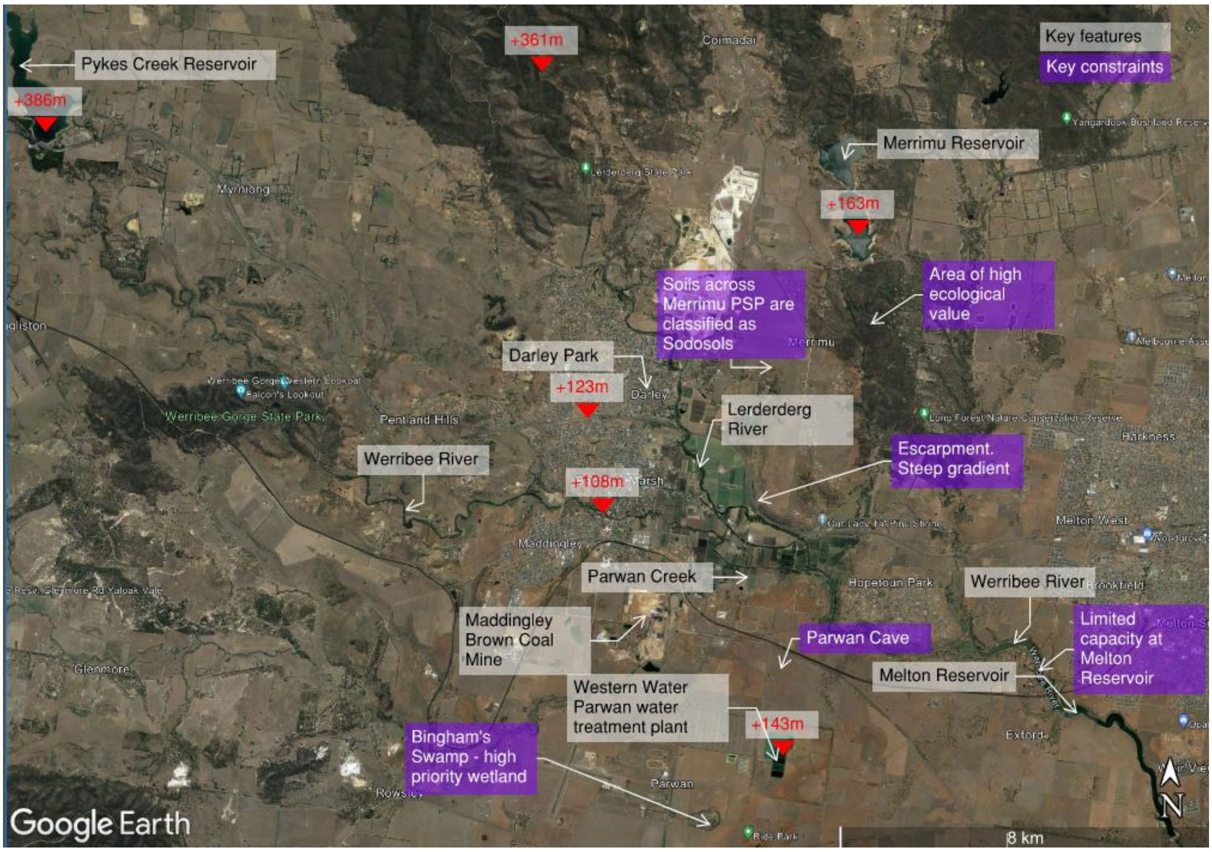



Figure 3-1–- Key features in the Bacchus Marsh region (Arup, 2023)

## Regional catchment context

Bacchus Marsh is the largest urban area in the government area of the Moorabool Shire and is set to grow significantly over the coming decades. The Bacchus Marsh Urban Growth Framework 2018 (UGF) was jointly prepared by Moorabool Shire Council and the Victorian Planning Authority (VPA) and provides a vision for development, including coordinated infrastructure delivery.

The UGF identifies three precincts as growth areas; Merrimu Residential Growth Precinct, Parwan Employment Growth Precinct and Parwan Station Residential and Commercial Precinct.

### *Merrimu PSP*

The Merrimu precinct is located towards the east of Bacchus Marsh and is the largest of the three precincts with the capability of accommodating all of Bacchus Marsh's estimated growth until 2041. This precinct will be predominantly residential and comprise approximately 8,900 dwellings (based on preliminary estimates (2023)). The precinct is flanked by the Merrimu reservoir to its north and the BMID to its south. The key feature of this precinct is that is relatively flat however is situated on top of an escarpment where the land generally falls from north to south. The escarpment, sodic soils around the area present a challenge in implementing any development.

## Topography

The Merrimu escarpment provides the precinct with unique view lines, and the relatively flat and unencumbered landscape above the escarpment has an advantage for infrastructure planning. However steep escarpment conditions and potential occurrence of erosive/sodic soils poses an issue which may constrain development opportunities and connections.

## Sodic soils

A large number of assessments have been completed for the Merrimu precinct, focussing on geotechnical constraints, extent of sodic and dispersive soils, impacts of development on stormwater and options for managing discharge to within likely constraints (flow volumes). The work completed identified:

- Erosion risks associated with the presence of sodic and dispersive soils (particularly of the Werribee formation), gully erosion (existing and potential impact resulting from development) and thin topsoils.
- Erosion risks were particularly associated with stormwater discharge and steep slopes along the escarpment, and that stringent controls would be required to control risk posed by the development.

An assessment was undertaken and further works are recommended based on the findings of this assessment, which will further inform the risk profile at the Precinct and enable appropriate control of planning/design of infrastructure to meet the objectives of the Precinct Planning process underway.

The recommendation relevant for this study includes:

1. Precinct scale Erosion risk plan: A precinct scale plan which highlights areas of high risk, medium risk and low risk in relation to erosion potential, which will inform strategic and statutory controls. The map should be developed based on agreed buffers from edge of plateau, location of existing gullies, known/inferred mapping of Werribee formation geology, and consideration of slope of land.

2. Precinct scale erosion controls: The erosion control component of the precinct structure plan (PSP) should include the following precinct scale considerations:

— Waterway and gully management: Implemented at the statutory level by applying an environmental overlay (or equivalent) to require/encourage particular management in these areas (e.g. enforce riparian land management controls, minimise disturbance to native vegetation, etc.). At the strategic level, this land could be incorporated into the precinct to enable developer control over greenspace development/establishment.

— Topsoil and urban run-off management: To minimise the risks during and post construction, strategic controls may include implementing water sensitive urban design in the precinct, and statutory controls may include specifying conservative stormwater retention and discharge parameters to reduce impact to waterways to acceptable levels (as established by others).

— Greenspace and buffer zones: The strategic implementation of a green corridor along the escarpment has the dual benefit of improving land management along the highest risk part of the precinct and preventing the construction of housing too close to the edge of the plateau.

3. Development or Lot scale erosion controls: To control erosion risk during and post development, the PSP may specify strategic controls for development, or require proponents to demonstrate appropriate controls are in place as part of the planning application process (statutory conditions). Strategic controls may include staging release of development and consideration of development that is sympathetic to the landform (as may be applicable in particular areas), and Statutory conditions may include a requirement for an erosion control management plan addressing risks and providing best-practice mitigations and which has been endorsed by a suitably qualified professional (e.g. a certified professional in erosion and sediment control or soil science), requirement for intrusive (physical) soil investigations where constructions are deemed medium to high risk (e.g. along the escarpment, steep slopes, or where infrastructure is likely to be placed within the Werribee formation) to confirm soil conditions and erosion risk (driven by dispersivity), and a general condition for a minimum thickness of topsoil to be retained or placed in exposed soil areas (nature strips, yards, parks, etc.) to provide a suitable depth of growing media to support vegetation growth and cover.

### Erosion in Merrimu PSP

It was identified in the interviews that the area east of Merrimu is of very high ecological value. It is important this area is protected from any stormwater runoff and that all options direct flows away from here. According to a sodic/dispersive soils peer review and assessment, a precinct-scale erosion risk plan which highlights areas of high, medium, and low risk erosion is recommended to inform strategic and statutory controls. In addition, a set of precinct-scale erosion controls should include the following considerations:

- **Waterway and gully management:** Implemented at the statutory level by applying an environmental overlay (or equivalent) to require/encourage particular management in these areas (e.g. enforce riparian land management controls, minimise disturbance to native vegetation, etc.). At a strategic level, this land could be incorporated into the precinct to enable developer control over greenspace development/establishment.

- **Topsoil and urban run-off management:** To minimise the risks during and post construction, strategic controls may include implementing water sensitive urban design in the precinct, and statutory controls may include specifying conservative stormwater retention and discharge parameters to reduce impact to waterways to acceptable levels (as established by others).

- **Greenspace and buffer zones:** The strategic implementation of a green corridor along the escarpment has the dual benefit of improving land management along the highest risk part of the precinct and preventing the construction of housing too close to the edge of the plateau.

As for development-scale or lot-scale erosion controls; to control erosion risk during and post development the PSP may specify strategic controls for development or require proponents to demonstrate appropriate controls are in place as part of the planning application process (otherwise known as statutory conditions). Strategic controls may include staging the release of development and consideration of development that is sympathetic to the landform (as may be applicable in particular areas). Statutory conditions may include:

- a requirement for an erosion control management plan addressing risks and providing best-practice mitigations and which has been endorsed by a suitably qualified professional (e.g. a certified professional in erosion and sediment control or soil science),

- a requirement for physical soil investigations where constructions are deemed medium to high risk (e.g. along the escarpment, steep slopes, or where infrastructure is likely to be placed within the Werribee formation) to confirm soil conditions and erosion risk (driven by dispersivity)

- a general condition for a minimum thickness of topsoil to be retained or placed in exposed soil areas (nature strips, yards, parks, etc.) to provide a suitable depth of growing media to support vegetation growth and cover.

Figure 3-2 Conservation area east of Merrimu PSP (Arup, 2023)

### Sensitive areas in Merrimu PSP

In the southwest of Merrimu PSP there are also high ecological values with the presence of river blackfish and platypus. These areas are to be protected and any outfalls are to be located away from here. Buffer interfaces from the Bacchus Marsh RWP and the Maddingley composting facilities need to be adhered to and measured so as to not cause a conflict between sensitive uses and buffer throwing uses.

### Ecology

At a regional level, growling grass frogs, platypus, and significant fish species are present in the Werribee, Lerderderg and Parwan waterways. Conservation of these species is a priority. Significant flora (Buloke, Fragrant Saltbush, Rye Beetle-grass, Arching Flax-lily, Golden Cowslips, and Black-tip Greenhood) were found in Parwan Station PSP, the habitat of which is recommended to be prioritised for retention. Updated assessments are recommended for Merrimu and Parwan Employment PSPs to confirm the current quality and extent for native flora and fauna.

### Traditional owner values

Bacchus Marsh is on the border between the Woiwurrung and Wathaurong territories of the Kulin Nation. The Wathawurrung name for the area is Pullerbopulloke with ''bulu'' meaning lake.

The Waterways of the West Discussion Paper recognises the importance of Traditional Owner values and practices, which are reflected through two of the seven key directions for the Waterways of the West:

- **Key Direction 1:** Embedding Traditional Owners and their values and culture in waterway planning and management.
- **Key Direction 3:** Providing water for the environment and Country.

The VPA report summarising key issues and opportunities for the Merrimu PSP lists managing future development whilst protecting Aboriginal cultural heritage, post-colonial heritage and biodiversity as an issue. Additionally, the high sensitivity of Aboriginal cultural heritage and post-colonial heritage can be protected and incorporated into the precinct as passive open space with pedestrian/bike paths connecting biodiversity and landscape features.

## 3.1.2 Anticipated changes

### Industry and agriculture

The Bacchus Marsh Irrigation District (BMID) was established on the fertile alluvial soils in Bacchus Marsh. It consists of 1,000 ha of high value agricultural land for production of a range of fruits and vegetables.

Water supply is managed by Southern Rural Water who recently completed upgrade works on BMID's irrigation network, vastly improving the efficiency of supply.

Bacchus Marsh is also home to significant local industry, some of which hold extraction licences for river water supply. Bacchus Marsh, and the west of Melbourne generally, is a fast growing industrial and innovation hub. Parwan employment precinct is proposed for development in the future, but the vision for the precinct includes the creation of agribusiness and complementary businesses that could support upwards of 1,500 jobs. The area has also been flagged for new industries, such as hydrogen production.

Both industry and agriculture present opportunities for IWM. It was recommended in previous background studies, that once planning is further progressed for the Precinct, that the impact of the development of the area on the local water cycle is evaluated, and appropriate initiatives are put in place.

#### Environmental flows for the Werribee River

Previous IWM related studies indicated concerns that there will not be enough capacity in Melton Reservoir to provide adequate storage for environmental flows, and that focus should be on creating new environmental flow allocations in existing storages (e.g, Pykes Creek Reservoir or Merrimu Reservoir).

Options such as using recycled and harvested stormwater to serve the BMID, and making full use of the high permeability of the alluvium formation by using swales to capture treated stormwater would positively contribute to increasing environmental flows from the Merrimu reservoir and recharging river baseflows respectively.

It was also identified that environmental flows could be beneficial for the Lerderderg River.

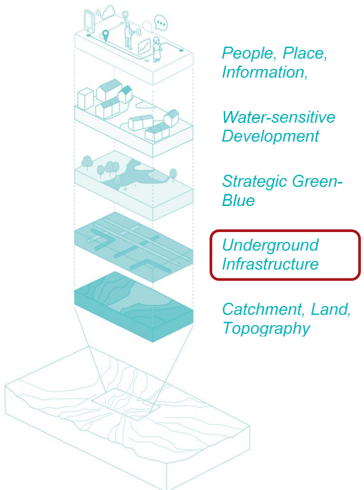
### 3.1.3 Work underway

#### Drainage

Melbourne Water is currently undertaking drainage plans for the Merrimu PSP. Due to the difficulty in removing water from the escarpment, options for infiltration (combined with local ponds) are being investigated. MUSIC models have been set up and Melbourne Water are awaiting groundwater data. An investigation of outfalls has shown that outfalls placed towards the eastern side would be a high risk to the conservation area, impacting on ecological and cultural heritage values. Outfalls towards the southwest could impact the area with significant environmental and cultural values, including the presence of river blackfish and platypus.

## 3.2 Water Utility Infrastructure

*This section considers the water utility infrastructure that is already in place on site for water supply, wastewater management and underground drainage, and identifies any constraints or opportunities to improve those networks to prepare for development and drive IWM outcomes.*




### 3.2.1 Site analysis

Figure 3-6 below shows the key water infrastructure in the region.

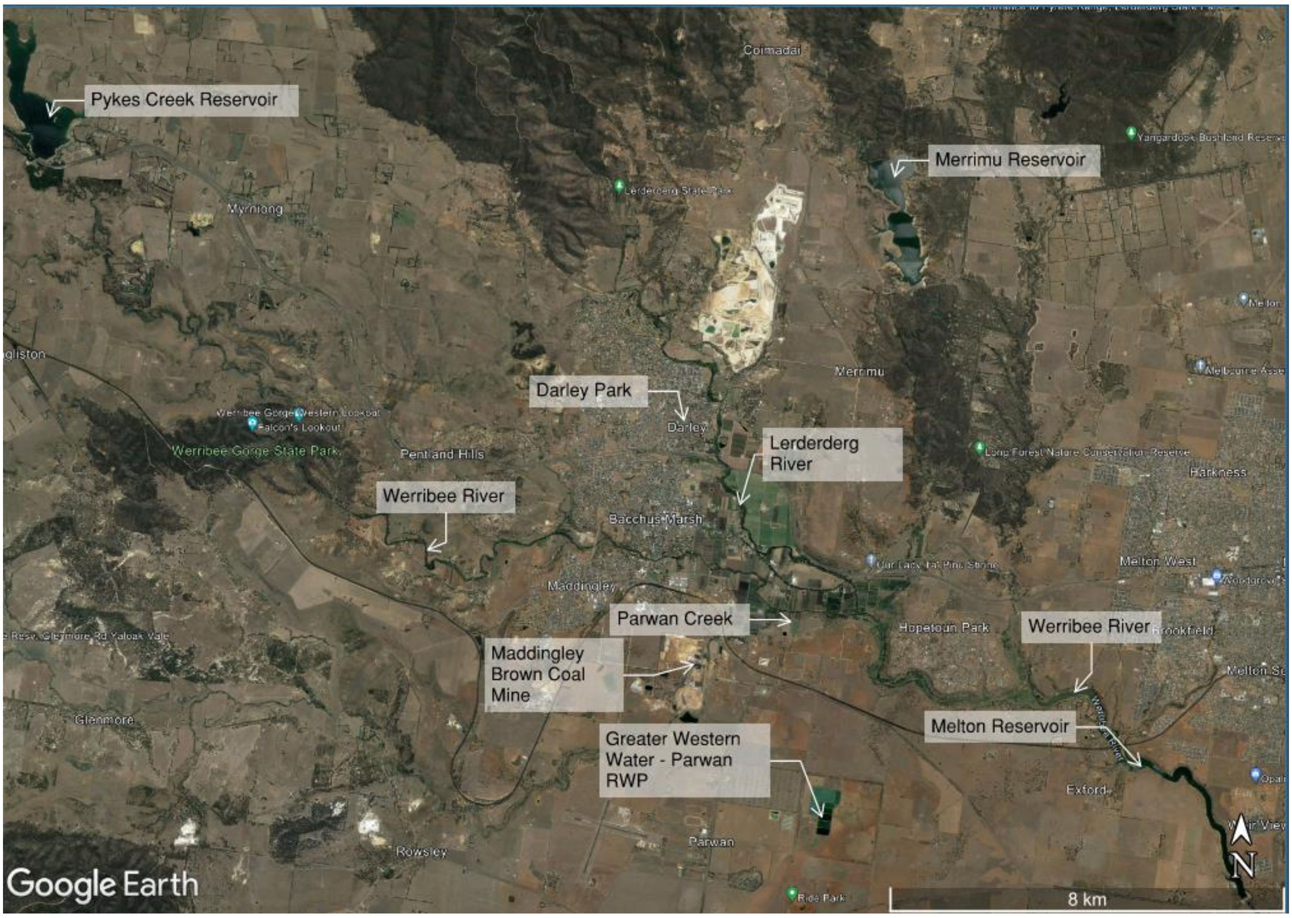



**Figure 3-3 Existing key water features (Arup, 2023)**

## Existing services

The existing Bacchus Marsh drinking water is primarily supplied from Merrimu Reservoir with connection to the Greater Melbourne water supply system. Wastewater generated in the existing Bacchus Marsh area is managed by Bacchus Marsh Recycled Water Plant (RWP), also known as Bacchus Marsh RWP.

### 3.2.2 Anticipated changes

## Water Demands

growing population, water demand is expected to nearly double between 2020 and 2065 according to previous studies. Based on the water balance calculations as part of this study, it's estimated that total water demands for Merrimu PSP will be approximately 1.6GL/y.

## Stormwater flows

As development increases, and the impervious area in each catchment grows, as will stormwater flows. Based on the water balance calculations as part of this study, it is expected that stormwater flows will increase by up to 5 times the pre-development scenario for Merrimu PSP.

## Wastewater treatment plant and recycled water

The Bacchus Marsh recycled water scheme has existed as a standalone scheme, located at the Bacchus Marsh RWP, treating sewage collected from Bacchus Marsh to Class C standard and recycling it locally for agricultural irrigation on the adjacent farmland. Urban growth in Bacchus Marsh has seen a corresponding increase in the volume of recycled water available so Greater Western Water has progressively expanded the treatment capacity.

The reconfiguration of the Werribee catchment water system, and the creation of a Western Irrigation Network (WIN) at a regional scale, presents opportunities for innovative IWM solutions for irrigation provision and population growth. Currently, Class B/C water is available from Bacchus Marsh Recycled Water Plant, which is linked to the Western Irrigation Scheme. A potential upgrade to supply Class A recycled water (to Bacchus Marsh Irrigation District) and other local users is currently being considered as part of the Werribee System Reconfiguration.

### 3.2.3 Current investigations

#### Potable water supply

GWW is responsible for funding trunk infrastructure and shared assets. The existing water supplies systems are insufficient to meet its growing demand, and Bacchus Marsh will need to import water from Melbourne Water supply systems and expand its supply capacity through accessing entitlements from other systems.

#### Recycled water supply

DEECA advised that a non-potable (purple pipe) network could be beneficial for the region. There are existing opportunities for synergy, such as potential upgrades to the Bacchus Marsh Recycled Water Plant to supply Class A recycled water to service BMID and the creation of a Western Irrigation Network (WIN) at a regional scale as part of the broader Werribee System Reconfiguration.

The Werribee System Reconfiguration Project is exploring the feasibility of making better use of river water along with alternative water sources to meet future water demands. Water resource modelling has been undertaken on reconfiguration options to assess the benefits predicted from converting BMID and WID to recycled water.

For these three PSPs, the options that were proposed that could be considered include:

- Supplying BMID from the Bacchus Marsh Recycled Water Plant (Class A recycled water).
- Supplying the Werribee Irrigation District (WID) with recycled water from Bacchus Marsh via the wider WIN network (though an alternative connection from Western Treatment Plant is also being tested) (Class B recycled water)
- Supplying the PSPs (Class A recycled water)
- Supplying open space irrigation throughout the PSPs (Class B recycled water)

The feasibility of recycled water use in the precincts is currently unknown. There are challenges with supplying the PSP with recycled water as the pipeline alignment would need to cross a highway and two rivers. The quantity of recycled water availability is uncertain at this stage given the other priorities. This results in challenges in confirming potential end uses within the PSP, as residential and industrial non-potable uses will require Class A, whereas open space irrigation can use Class B treated effluent.

#### Rainwater tanks

Rainwater tanks are a viable opportunity as identified previously and by the VPA 2.0 guidelines. They are important in reaching the harvesting targets and provide a flexible option for servicing of development with an alternative water source.

#### Storage capacity of Melton Reservoir and possible connection to Merrimu Reservoir

There is work underway looking at a stormwater harvesting scheme for Melton Reservoir (which is a non-potable supply reservoir for agricultural use). Possible options would be for this source to supply environmental flows and eventually transfer to Merrimu for indirect potable reuse.

Stormwater harvesting was also trialled from Toolern to Melton Reservoir however resulted in spilling of Melton Reservoir due to limited capacity. There is the potential for environmental damage if the reservoir continues to spill. Melton Reservoir capacity will limit options to transfer stormwater for reuse, unless a pumped connection can be made with Merrimu Reservoir for potable substitution.

An image of the Melton Reservoir from the site visit undertaken can be seen below.

Figure 3-4–- Photo of Melton Reservoir (Arup, 2023)

# 4. Long list of IWM Options

A long list of options was identified based on:

- Bacchus Marsh IWM Strategy prepared for Moorabool Shire Council (September, 2021)
- Previous IWM project experience
- Industry best practice
- Stakeholder interviews
- Desktop review

These options are categorised based on if they are “local” or “regional” options. Local options are at the lot scale and regional options are at a precinct scale.

Section 4.3 provides an overview of the additional options identified.

## 4.1 Local options

Local options include rainwater tanks and increased permeability at a lot scale. An overview of the options, as well as key findings from the policy review, interviews and stakeholder workshop, are outlined below.

### Rainwater tanks in all new homes

Rainwater tanks would be installed for new homes in Merrimu PSP to supplement non-potable household water demands such as water for toilets, gardens, and laundry. Rainwater tanks offered a flexible solution as they can be delivered on a lot-by-lot basis. Although ongoing maintenance is required which can impact their long-term viability. A more successful management model could be created if coordinated and supported by an external party.

This option is still seen as viable as it is a flexible alternative water supply and can be implemented in combination with any other option. It aligns with the EPA guidelines and IWM plans for the Werribee Catchment in that it is a substitute for potable water as well as reducing runoff and contaminants to waterways.

In the interview with Moorabool Council, it was noted that rainwater tanks work well if they are implemented as designed, i.e. across the whole precinct. There are potential challenges when rainwater tanks are a requirement and Council are not involved in the decision making or implementation. Moorabool Council is looking at how rainwater tanks can be implemented in a way that is manageable.

It was noted in the Situational Analysis Workshop that this is a good opportunity to reduce potable demands for areas which may not be serviced by recycled water. Additional variations were also discussed, such as larger rainwater tanks for industrial areas and a lot to regional scale option (collective rainwater harvesting servicing the region) and rainwater for potable reuse.

Therefore, this option is still deemed viable however it is important to ensure all stakeholders, particularly Council, are engaged throughout the planning process.

### Increased permeability and stormwater capture

This option involves increasing permeability in developed areas in order to reduce runoff in the water ways with two available sub-options. This option focusses on residential areas.

1. In previous work undertaken it was highlighted that “leaky” rainwater tanks would be combined with improved on lot permeability. This would meet the 25% reduction target in total mean annual runoff, as proposed in the draft Urban Stormwater Management Guidelines at that time.
2. In addition to this, the alternative was to meet the previously outlined target of 50% reduction in mean annual flow from new impervious areas by Melbourne Water and a combination of on lot and precinct scale measures were proposed:

- Stormwater treatment wetlands (base case)
- On-lot leaky tanks
- Improved lot permeability from 20% to 30% (larger garden area or permeable paving)
- Passively irrigated street trees
- Stormwater harvesting for active open space in the greenfield areas.

**Since the previous studies that were undertaken, the Urban Stormwater Management Guidelines were published by EPA Victoria. The previous draft guidelines proposed a 25% reduction target in total mean annual runoff. A target of 50% reduction was discussed with Melbourne Water due to there being areas of ecological significance. Both were considered for the Bacchus Marsh IWM Strategy (September, 2021).**

**Both targets are no longer relevant, and it is the targets in the final Urban Stormwater Management Guidelines that are to be adhered to (as outlined in Section 2.2.4). For the Little River rainfall template area, where Bacchus Marsh is located, there is a harvesting target of 32% and infiltration target of 3%.**

Therefore, in progressing this option the analysis will consider this updated target and adjusting the infrastructure required and targets accordingly. The option will have significantly less infrastructure than the option meeting the previous Melbourne Water target of 50%.

Similarly, to the above option, this is a viable and flexible option, aligning with the guidelines and plans for the area. It was noted in the Council interview that stormwater harvesting is favoured at a local scale.

This was also flagged in the Situational Analysis workshop (refer to Section 5) as a good opportunity to reduce potable demands for areas which may not be serviced by recycled water. The additional variations are also applicable for this option. It will be important to ensure all stakeholders, particularly Council and Melbourne Water, are engaged throughout the planning process to mitigate challenges in implementation.

## 4.2 Regional options

The regional options include large scale stormwater harvesting and recycled water supply to various regional water demands. An overview of the options, as well as key findings from the policy review, interviews and stakeholder workshop, are outlined below.

### End of line infiltration of stormwater runoff from new precincts

This option investigated the potential to infiltrate stormwater runoff from new development areas into the alluvium formation which has a higher permeability. Swales in this area would have the capacity to slow and store stormwater to then recharge river baseflows. Stormwater infiltration swales were proposed for Merrimu PSP.

The option was previously seen to be both passive and simple in design which could be easily deliverable with the main constraint being the finding and securing low-cost land for infiltration.

This option will be taken further for analysis, since from the interviews and site visit, the feasibility and desirability of the option needs to be considered as further constraints have been identified.

For this option to be delivered, stormwater will need to be transferred down the escarpment for infiltration on the alluvial plains. Transfer down the escarpments is a major challenge for the drainage scheme design for the PSP areas and it may be preferable to focus on reducing runoff within the precinct area.

Figure 4-1 Merrimu PSP escarpment (Arup, 2023)

As can be seen above, Merrimu PSP has challenging escarpments and it will be important to consider this in assessing the options further. Melbourne Water is currently undertaking assessments for the Merrimu PSP to capture stormwater and infiltrate within the PSP itself (on the plateau) to avoid difficult transfers down the escarpments.

Environmental Planners from Melbourne Water have reviewed the areas surrounding Merrimu PSP and it has been deemed that the outfalls are constrained. Further, in Merrimu there is a conservation area in the east, which would be high risk and impact on ecological and cultural heritage values. On the southwest side, there are also high values with river blackfish and platypus. Therefore, complete infiltration on the PSP is being considered. Borehole testing is currently in place to monitor the seasonal capacity of the aquifer.

Therefore, as this option is progressed, it is recommended to do so carefully and consider all possible challenges that may occur. In reanalysing this option, it is recommended the challenges and risks are built into the cost estimates. This could be considered in combination with other options, such as the work currently being undertaken by Melbourne Water for Merrimu PSP which consists of injecting stormwater into aquifers. This combined could be considered as part of an adaptive plan for the PSP.

### Bacchus Marsh Class A recycled water scheme

This option explored the opportunity to utilise recycled water in the Bacchus Marsh area. It includes the creation of a Class A recycled water treatment facility at the Bacchus Marsh Recycled Water Plant and a distribution network to service the PSP areas, and potentially also connect to BMID in the future. As the feasibility of upgrading the Bacchus Marsh RWP is currently under assessment, the possibility of this option would depend on whether GWW decides to decommission Bacchus Marsh RWP.

While historically GWW had moved away from Class A recycled water supply to residential developments, there may be efficiencies that could be driven by delivering a combined Class A scheme to service BMID and the PSPs.

### Stormwater for BMID irrigation supply

This option explored using stormwater from the new development areas for irrigation in the BMID, replacing current river water use for irrigation. As part of this option, stormwater would flow to Melton Reservoir for storage and mixing with river flows, before being pumped back to BMID for irrigation via a piped transfer. There were two options examined.

***The treated stormwater from the development areas is released to the Lerderderg and the Werribee Rivers and flows in river into Melton Reservoir***

There were some challenges identified in the situational analysis regarding this option. Firstly, initial assessments have shown that Melton Reservoir has limited storage capacity. If spilling occurs, this could have adverse impacts on the environment. Water balance modelling has been undertaken by DEECA for Melton Reservoir which will be required for further updates.

***The treated stormwater from the development areas is transferred via a pipe to Melton Reservoir, thereby protecting the downstream section of waterway from 50% of new urban runoff flows (based on the previous target)***

A transfer pipeline from the development areas to Melton Reservoir will have constructability challenges based on the topography which may escalate the costs beyond those estimated in the high level analysis outlined in previous studies. This would be a challenging escarpment to build a transfer pipeline, as well as the area adjacent to the river. This could also have adverse impacts on the waterway health during construction. Further, additional pipe and pumping infrastructure back to BMID would be required and poses further challenges.

As identified in the interviews with GWW, recycled water supply for BMID and WID are being reconfigured. Therefore, an alternate supply is already being provided and the stormwater supply may not be required.

If shortlisted, the above is imperative to consider in further development and analysis of this option. Similarly to the other options, it is important any progression of this option is done in close collaboration with GWW and Melbourne Water.

**Figure 4-2 Bacchus Marsh Irrigation District (Arup, 2023)**

### Stormwater to supplement regional water resources

This option examined the opportunity to transfer treated stormwater from new development areas in Bacchus Marsh to Melton Reservoir and then transfer the stormwater to Merrimu Reservoir to supplement regional potable water supplies.

The Melton-Merrimu connection is being explored by GWW. The modelling considers the contribution of additional harvested stormwater to Melton Reservoir, and it was noted that Melton may need to be connected to Merrimu Reservoir to recognize stormwater harvesting and reuse. The interim concept is that the Melton Reservoir could supply environmental flows with the final concept being that it could transfer to Merrimu Reservoir. However, in this interview the technical challenges of using Melton as a storage (as aforementioned) were also flagged. Further, given that currently there is a lack of enabling policy, an interim option or an adaptive plan would be required, to identify the short term demands and transfer for the stormwater.

Two variations were considered for a transfer of stormwater from growth areas in Bacchus Marsh to Melton Reservoir, as discussed below.

***Stormwater is released to the Werribee River whereby it flows to Melton Reservoir***

Stormwater could be released from new development areas to the Werribee River where it would be mixed with river water, which would naturally flow to the Melton Reservoir. If a connection to Merrimu was created, a portion of the flow (related to the stormwater contribution) could be transferred to supplement regional potable supplies. However, these arrangements would need to be agreed. In allowing the stormwater to flow to the Werribee (as per business as usual), there will be water quality and flow volume impacts to the Werribee.

***A dedicated piped transfer to the reservoir is delivered to protect the waterway between Bacchus Marsh and Melton Reservoir from the majority of excess urban stormwater flows***

This option considers constructing a transfer pipeline to Melton Reservoir to protect Werribee River from the urban stormwater discharges and direct these to Melton Reservoir. Like the the previous option to transfer stormwater to supply BMID,  there are challenges in the constructability of a transfer pipeline that is adjacent to the waterways.

**Figure 4-3 Merrimu Reservoir (Arup, 2023)**

### Recycled water to supplement regional water resources

This option explored treating the Class C recycled water at Bacchus Marsh Recycled Water Plant to a potable standard and pumping it back to the Merrimu Reservoir, from where it would indirectly supplement the raw water resources and potable water network for the PSPs. This option is not supported by regulation at this time, and could only be considered for future planning.

Potable reuse involves treating effluent from wastewater treatment plants to an advanced standard and then either transferring it to a waterway, storage or injecting it into groundwater (in the case of 'indirect' potable reuse) or sending it directly to a Water Filtration Plant or to distribution (in the case of 'direct' potable reuse). Potable reuse is an emerging water source in Australia due to it being (mostly) rainfall independent and therefore independent of climate stressors and shocks. There are other benefits, including the significant quantities of wastewater available and contributing to a circular economy, as well as being a resilient water source in drought. There are many examples overseas where this has been adopted and water utilities across Australia are investigating this as an option for the future, with growing populations and a changing climate. For example, in Perth, a Managed Aquifer Recharge (MAR) scheme, using indirect potable reuse, has been in place since 2017. This is the largest MAR operation in Australia and uses wastewater from the nearby Beenyup Wastewater Treatment Plant treated to drinking water standards and injects it into the aquifer. The water is recovered by Water Corporation to supplement Perth's public drinking water supply. In Victoria, in the 'Water for Life' strategy, 'Manufactured Sources' of water is flagged as a potential future opportunity, which includes 'fit-for-purpose recycled water', though purified recycled water for drinking is yet to be considered 'fit-for-purpose' in Victoria. In all adaptive planning cases, 'Manufactured Sources' as a proportion of total available water is expected to increase beyond 50% in 2070 to meet growing population demands.

For the Bacchus Marsh areas, it has been predicted that by 2035-40, the potable water demand will exceed the capacity of the Merrimu Reservoir (which is currently the sole supply of potable water for the area). GWW stated that there are no plans to expand the existing Water Treatment Plant, as the yield at Merrimu is limited.

Although in the longer term, potable reuse may be possible, it is unlikely that in the short term it will be possible given the current regulatory context. An adaptive plan is required if it is to be progressed.

## 4.3 Additional opportunities identified

In the desktop review and interview process, several new options arose. These options are outlined briefly below and will be progressed further in the options analysis if shortlisted.

### Passive irrigation of street trees with stormwater

Irrigation of street trees is a priority for Council, as well as the following specific targets:

- From the IWM plans for Werribee Catchment: *14% and 30% of street trees are supported with permanent irrigation from an alternative water supply by 2030 and 2050 respectively, for the catchment*
- From the VPA Guidelines for PSPs 2.0: *T14–- All streets containing canopy trees should use stormwater to service their watering needs*

Passively irrigated street trees have been included in the "Increased permeability and stormwater capture" option, however it is recommended that either the revision of the existing options include irrigation of street trees from stormwater harvesting or recycled water supply, or the addition of options that specifically considers irrigation of street trees.

### Class B/C recycled water open space irrigation within PSPs

In the interviews with Greater Western Water, a potential option raised was the provision of Class B or Class C recycled water for open space irrigation within the PSPs.

This aligns with the following targets from the IWM plans for the Werribee Catchment:

- 22% and 50% of active public open space (sports fields and organised recreation) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment
- 9% and 25% of passive public open space (parklands and gardens) is supported by an alternative water source by 2030 and 2050 respectively, for the catchment

A variant to this option was raised at the Situational Analysis Workshop, which is a combined stormwater and recycled water reuse option for open space irrigation.

### Class B/C recycled water open space irrigation to Bacchus Marsh town

An additional variant to the Class B/C supply was raised at the Situational Analysis Workshop, which is the option to provide recycled water for irrigation to open spaces in Bacchus Marsh town. The proximity to Bacchus Marsh town from Parwan Station make this a viable option.

### Aquifer injection in Merrimu PSPs instead of piping down escarpment

Melbourne Water are currently assessing options for local drainage and infiltration at Merrimu PSP. The challenge of the 'end of line' infiltration was raised due to the difficulty of piped transfers down the escarpment. Therefore, an option that explores tying in with the local infiltration plans is recommended to be explored. This could include capture of stormwater in these ponds for local reuse in addition to infiltration.

### Stormwater or rainwater harvesting from Merrimu PSP to Merrimu Reservoir for indirect potable reuse

A previous option was raised in the interviews which explored local stormwater harvesting in the Merrimu PSP and then transfer to the Merrimu Reservoir for indirect potable reuse. The site visit confirmed that the local topography could possibly support a direct transfer. However, a policy change would be required to support this option, and an interim plan for stormwater management would need to be put in place.

### Rainwater harvesting from Merrimu PSP to Merrimu Reservoir for indirect potable reuse

Similar to above, rainwater could be harvested and directed to Merrimu Reservoir for potable water supply. Unlike the stormwater harvesting option, the rainwater harvesting option (roof water only) would require a separate drainage system which could lead to high costs and would produce a lower yield than stormwater harvesting. However, there is precedent for transfer of roof water to a raw water reservoir (Wannon Water at Warrnambool), and this could be delivered without policy change.

### Precinct-scale rainwater harvesting

An additional option was raised in the workshop which is the potential to explore a precinct scale rainwater harvesting solution. This could include industrial areas, with large roof areas, such as the Parwan Employment precinct connected with a number of collective rainwater tanks and a third pipe network for the rainwater.

### Recycled water and stormwater combined servicing

Recycled water and stormwater combined servicing was mentioned at the workshop as a potential option. This is currently being explored in growth areas in Sydney. Harvested stormwater is used to supplement recycled water in a third pipe network, meeting non-potable demands for residential, non-residential and open space users. This option would require additional investigation, particularly regarding treatment requirements, infrastructure requirements, costs, policy, geographical constraints and location. The combination of supplies could be further considered based on the demands in the PSP areas.

## 4.4 Summary

The table below outlines a summary of the opportunities, findings from the desktop review, interviews and site visit, next steps and a ‘traffic light assessment’ of the current potential of the opportunities based on ease of deliverability.

The traffic light assessment is qualitative and based on findings from the interviews and workshop. They are representative of the stakeholder perspectives of the options.

**Table 4-1–- Summary of options**

| Option | Summary | Findings | Next steps | Potential |
|---|---|---|---|---|
| **Local opportunities** | | | | |
| **Rainwater tanks in all new homes** | Rainwater tanks for new homes for non-potable household demands. | • Flexible option that aligns with local strategy<br>• May be challenge in implementation – stakeholder engagement important | Updated analysis of rainwater tanks with updated land use plans and targets. | High potential given flexibility and objectives |
| **Increased permeability and stormwater capture** | Leaky rainwater tanks combined with on lot permeability, stormwater harvesting and | • Flexible option that aligns with local strategy<br>• Designed for previous flow target | Updated analysis with updated land use plans and targets. | High potential given flexibility and objectives. This option may be challenging |

| | | | | |
|---|---|---|---|---|
| | street tree irrigation. | • May be challenge in implementation – stakeholder engagement important<br>• Must consider outcomes of latest sodic soil assessment | | to implement depending on stakeholder engagement. |
| **Regional opportunities** | | | | |
| **End of line infiltration of stormwater runoff** | Infiltrate stormwater runoff into alluvium formation. | • May be desirable to avoid transfer of stormwater down escarpment (but may be unavoidable)<br>• Existing analysis underway on alternate local option | Re-evaluate option in light of assessments underway. Upon analysis, incorporate design risks in any costing and assessments. | Suitable option however design complexities may pose challenges. |
| **Bacchus Marsh Class A recycled water scheme** | Reuse of Class A recycled water for BMID, residential non-potable use and industrial use. | • Existing analysis underway to provide recycled water to BMID<br>• Recommended to include alternatives | Update for new land use plans. Consider offtakes from planned recycled water network. Collaboration with Greater Western Water. | High potential option and in line with existing work underway by stakeholders. |
| **Stormwater for BMID irrigation supply** | Transfer of stormwater to Melton Reservoir for reuse for irrigation in the BMID. | • Assessments have shown challenges in capacity of Melton Reservoir and potential environmental damage<br>• Challenging transfer pipeline<br>• Difficult to distinguish stormwater from river water in terms of allocations<br>• Recycled water for BMID is already a priority | Consider flow balance of Melton Reservoir in updated analysis. Upon analysis, incorporate design risks in any costing and assessments. Review priority for stormwater for BMID given recycled water is already likely. | Not a preferred option particularly given reliability in comparison with recycled water. |
| **Stormwater harvesting to supplement regional water resources** | Transfer of stormwater to Melton Reservoir and then transfer to Merrimu Reservoir for indirect potable reuse. | • Assessments have shown challenges in capacity of Melton Reservoir and potential environmental damage<br>• Challenging transfer pipeline<br>• Mentioned as an optimised option in | Consider flow balance of Melton Reservoir in updated analysis. Upon analysis, incorporate design risks in any costing and assessments. Need to confirm infrastructure requirements with GWW including | Option still has high potential however may not be possible in short term given regulatory context. |

| | | | | |
|---|---|---|---|---|
| | | existing work underway | challenging pipeline (and construction methodology required), pump sizing and installation, as well as ongoing operating and maintenance costs and energy requirements. | |
| **Recycled water to supplement regional water resources** | Upgrade of Bacchus Marsh Recycled Water Plant to potable standard and transfer to Merrimu Reservoir | • Potable supply for Merrimu already planned<br>• Regulatory challenges | Consider tying this option into existing plans. Review of regulation changes required. | Option still has high potential however may not be possible in short term given regulatory context. |
| **Additional opportunities** | | | | |
| **Stormwater harvesting for street tree irrigation** | Tying into existing or a new option, stormwater harvesting for street tree irrigation. | • Raised as potential new option given local targets | Analysis of new option required or an "add on" to an existing option. | Flexible option that can be achieved in combination with other options. |
| **Class B/C open space irrigation** | Additional option reviewing targeted open space irrigation using Class B or Class C recycled water. This could include within PSPs or to Bacchus Marsh town. | • Raised as alternative to Class A recycled water and residential reuse | Analysis of new option required. | Likely option and in line with existing work underway by stakeholders. |
| **Local infiltration at Merrimu PSP** | Investigate how to tie into the existing work being undertaken identifying and assessing local infiltration at Merrimu PSP. | • Raised as alternative to constructing transfers down the escarpments given challenges | Pending results of Melbourne Water investigation. Consider of Sodic Soils report. | Currently underway by Melbourne Water. Challenging given site constraints. |
| **Local stormwater harvesting to Merrimu Reservoir** | Local stormwater harvesting in Merrimu PSP to then transfer to Merrimu Reservoir for indirect potable reuse. | • Raised as a potential previous option to review | Analysis of new option required. Consider infrastructure requirements including outfalls, pump sizing and installation, as well as ongoing | Option has potential but may have regulatory and design challenges. |

| | | | | |
|---|---|---|---|---|
| | | | operating and maintenance costs and energy requirements.<br><br>Policy barriers | |
| **Local rainwater harvesting to Merrimu Reservoir** | Rainwater harvesting to potable reuse | • Rainwater collection within Merrimu PSP and transfer to Merrimu Reservoir for potable reuse. | Likely to be a higher cost option due to pumping and intermediate storage requirements, but possible under existing policy conditions. | Option has potential but may have regulatory and design challenges. |
| **Precinct-scale rainwater harvesting for local use** | Collective, larger rainwater tanks for a region scale, third pipe network serviced by rainwater. | • Raised as a potential variation to rainwater harvesting in the Situational Analysis workshop. | Potential for areas with industrial land uses. | Option has potential but requires additional analysis and stakeholder buy-in.. |
| **Precinct scale stormwater harvesting for local use** | Harvesting stormwater following wetland treatment in a precinct and transferring to a storage for distribution and reuse for open space irrigation or in-home use | • Raised as a potential option to assist with reduction of stormwater in Situational Analysis workshop. | Potential as a third pipe feed source for Merrimu PSP (if recycled water not deliverable) which would also assist with runoff reduction | Option has potential but requires additional analysis. |
| **Recycled water and stormwater combined servicing for open space irrigation** | A combined stormwater harvesting and Class A or Class B/C third pipe network. | • Raised as a potential option in the Situational Analysis workshop. | Requires significant further investigation and depends on quantum of demand. May not be cost effective. To be considered further following individual option analysis. | Option has potential but requires significant additional analysis and may be a high cost option. |

# 5. Stakeholder workshop and shortlisted options

## 5.1 Stakeholder Workshop

A workshop was held on the 15th of February 2023 from 9am to 11:30 am with members from VPA, DEECA, Melbourne Water, Greater Western Water, and Moorabool Shire council to discuss IWM opportunities for the region and provide input to the situational analysis. The workshop was facilitated by Arup and held online. The workshop included:

- A review of IWM constraints and opportunities for the region, and within Merrimu, Parwan Station, and Parwan Employment Precincts.
- A review of shortlisted options presented in previous IWM studies for this region.
- A presentation of current conditions for the project including information gathered from updated studies and guidelines, stakeholders involved, and a site visit.
- A discussion on the viability of the original shortlisted options from the previous work, as well as additional ones identified.

A summary of the key constraints, drivers and opportunities identified from the workshop are presented in Appendix D and have been integrated throughout the report.

Refer to Appendix E for the complete Miro board from the workshop.

## 5.2 Shortlisted options

The following options have been shortlisted for further investigation. These options have been shortlisted based on the assessment above and the feedback in the Situational Analysis workshop.

The precincts in which the options are applicable are provided below.

**Table 5-1 Shortlisted options**

| Shortlisted Option | Merrimu |
|---|---|
| Rainwater tanks in all new homes | ✓ |
| Rainwater harvesting transfer to Merrimu Reservoir for potable supply | ✓ |
| Passive irrigation of street trees with stormwater | ✓ |
| Precinct-scale stormwater harvesting<br>a. For open space irrigation<br>b. For non-potable supply to homes | ✓ |
| Aquifer injection instead of piping down escarpment | ✓ |
| Stormwater infiltration into Alluvium formation | ✓ |
| Class A recycled water supply to PSPs (and BMID) | ✓ |
| Class B/C recycled water supply to open spaces throughout precincts | ✓ |
| Transfer stormwater to Melton Reservoir and then to Merrimu Reservoir for potable supply | ✓ |

# 6. Establishing the base case

To inform the analysis of the shortlisted options, a base case is required for comparison. This section details the water balance calculations and pollutant modelling results based on land use budgets received from VPA and no stormwater or IWM interventions.

## 6.1 Merrimu PSP

### 6.1.1 Proposed development and base water case

The proposed Merrimu PSP is 1,016ha, 58% of which is residential development and 31% is classified as "uncredited open space" which includes conservation, waterways and utility easements according to the land use budget estimate provided by the VPA on 23/02/2023. Within the proposed residential area, an estimated 8,912 new dwellings are proposed. The land use budget shown in Figure 6-1 has been used for this assessment.

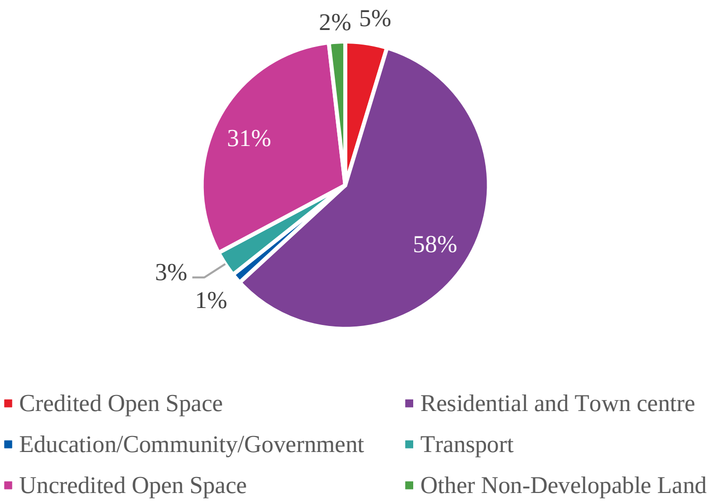



**Figure 6-1 Merrimu land use budget (VPA)**

### 6.1.2 Base case water demands

Water demands for potable, non-potable water, and sewage generation in the Merrimu PSP were estimated. Key assumptions made include:

**Table 6-1 Merrimu base case water demand assumptions**

| Assumption | Unit | Value | Source |
|---|---|---|---|
| **Residential** | | | |
| **Water demand** | kL/household/year | 153 | Bacchus Marsh IWM Strategy prepared for Moorabool Shire Council (September, 2021) |
| **Wastewater generation** | % water demands | 80 | Industry assumption for water to wastewater conversion based on experience |
| **Non-potable demands** | % water demand | 35 | Bacchus Marsh IWM Strategy prepared for Moorabool Shire Council (September, 2021) |

| | | | |
|---|---|---|---|
| | | | Non-potable water is used for toilet flushing, gardens, lawns and half of washing machine demands. |
| **Non-residential** | | | |
| **Water consumption per school** | L/student/day | 10.5 | Average between Primary and Secondary school (Sydney Water) |
| **Students per school** | # | 444 | Summary statistics for Victorian Schools 2022 |
| **Number of schools** | # | 2 | VPA Land use budget |
| **Water demand for commercial and retail** | kL/ha/year | 2,504 | Western Melbourne Suburbs 2011 |
| **Open space** | | | |
| **Area** | Ha | 47.67 | Credited Open Space – VPA Land use budget.<br>Open space irrigation is to be served using non-potable water and no runoff enters the sewage network from this space.<br>No water demand is attributed to the "uncredited open space" which includes conservation, waterways and utility easements. |
| **Water demand for open space** | kL/year | 5,000 | Bacchus Marsh IWM Strategy prepared for Moorabool Shire Council (September, 2021) |

Results of predicted water demands based on the land use budget and assumptions outlined is shown in Table 6-2 and Figure 6-2.

**Table 6-2–- Merrimu PSP water demands**

| ML/year | Residential | Commercial/Retail | Education | Open space irrigation |
|---|---|---|---|---|
| Potable | 884 | 5 | 0.2 | 0 |
| Non-potable | 483 | 10 | 3.2 | 238 |
| Total water demand | 1,367 | 15 | 3.4 | 238 |
| Wastewater generated | 1,093 | 12 | 2.7 | 0 |

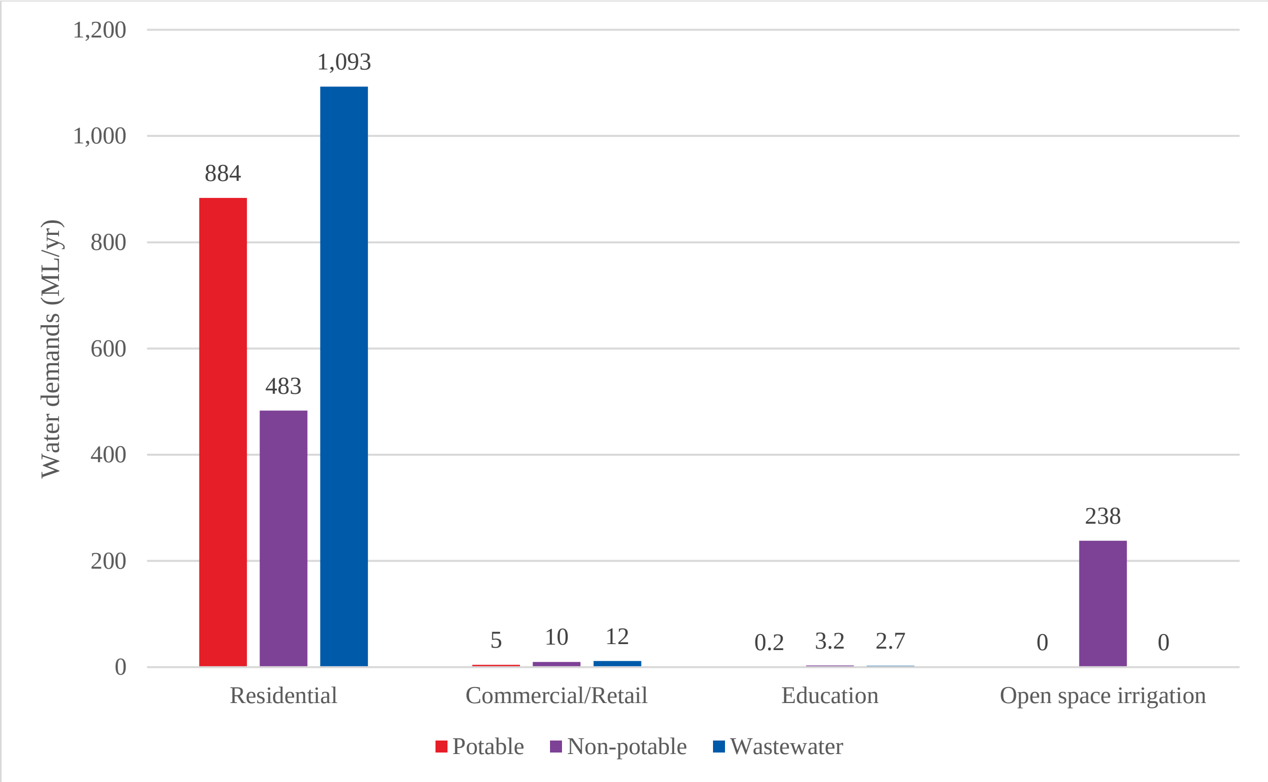



Figure 6-2- Merrimu water demands

### 6.1.3 Stormwater base case

To analyse the base case stormwater generation, a MUSICX model was set up for this PSP. Table 6-3 shows the flow, Total Suspended Solids (TSS) and Total Nitrogen (TN) generated as a result of the proposed development.

Table 6-3– Merrimu PSP Stormwater flows and pollutants as a result of the development

| Source Node | Impervious Stormflow Out (ML/y) | Impervious Stormflow out TSS kg/yr | Impervious Stormflow out TN kg/yr |
|---|---|---|---|
| Local Open Space | 22 | 2,605 | 485 |
| Residential | 1,636 | 336,451 | 4,767 |
| Town Centre and Education | 49 | 10,078 | 140 |
| Road | 82 | 28,877 | 197 |
| Conservation Open Space | 113 | 9,833 | 110 |
| Existing Developed Land | 52 | 10,983 | 151 |
| **Total** | **1,954** | **398,826** | **5,850** |

In addition, two scenarios were modelled to show a predevelopment scenario, and a scenario to meet BPEM targets;

1. A pre-development scenario to understand flow and pollutants if there was no development at all; and
2. A post development scenario using the areas provided in the land use budget. For each of these land uses, Melbourne Water MUSIC guidelines were used to allocate fraction impervious values and soil parameters (Soil Storage Capacity = 120mm and Field Capacity = 50mm). This scenario assumed the presence of a wetland before discharge into the Lerderderg River, which has a surface area of 20.3ha (this represents 2% of the total PSP area) and an extended detention depth of 350mm. This wetland was added to meet Best Practice Environmental Management (BPEM) as set out by the EPA.

Table 6-4 shows the results of the stormwater base case modelling.

**Table 6-4– Merrimu PSP Stormwater base case comparison with pre-development**

| | Flow (ML/y) | TSS (kg/y) | TP (kg/y) | TN (kg/y) | Gross Pollutants (kg/y) |
|---|---|---|---|---|---|
| Pre-development | 387 | 33,330 | 34 | 379 | 15,350 |
| Post-development, with wetland | 2,054 | 34,240 | 181 | 2,679 | 48 |
| % reduction achieved with wetland to meet BPEM | **11.13** | **91.6** | **77.96** | **54.38** | **99.94** |

# 7. IWM measures and criteria

Comprehensive and holistic criteria have been used to assess the opportunities and constraints of each option. This assessment of IWM options combines performance measures from the Werribee IWM Plan, the VPA brief and option delivery considerations, to bring together the intent and strategic objectives of the state and local policy framework and focus on the outcomes which can be driven through a precinct scale approach.

These are summarised below and have been used in the opportunity assessment of shortlisted options in Section 8.

## 7.1 Performance measures used to assess IWM

The scoring criteria is on a scale of 0 (not applicable), 1 (worst) and 5 (best) and can be found in Appendix A.

**Table 7-1 Performance measures**

| Performance measure | Unit | Description and calculation | Scoring method |
|---|---|---|---|
| **Alternative water sources that substitute potable mains water supply** | ML/year | Using the water balance for each option, the total alternative water use (rainwater, stormwater and recycled water) is calculated. | Using the qualitative assessment, ranges for 1-5 were defined and used for scoring. |
| **Recycled water delivered to customers** | ML/year | Using the water balance for each option, recycled water supply is calculated. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Impact on fluvial flood mitigation** | High/Medium/Low | The contribution of each option towards fluvial flood mitigation is qualitatively estimated relative to other options as the impact on fluvial flood mitigation cannot be determined with a water balance. | Low = 1, Medium = 3, High = 5 |
| **Mean annual runoff volume reduction** | ML/year (and % reduction) | The mean annual runoff reduction is calculated using the water balance for each option. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Total Suspended Solids (TSS) prevented from discharging to receiving waters** | kg/year | TSS reduction is calculated using MUSICX modelling. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Total Nitrogen (TN) prevented from discharging to receiving waters** | kg/year | TN reduction is calculated using MUSICX modelling. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |

| | | | |
|---|---|---|---|
| **Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways** | ML/year | Volume of water entering a waterway to increase environmental flows is calculated for each option. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **New total number of passively irrigated trees** | No. trees | New number of passively irrigated trees based on tree density assumptions. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **New area of public open space supported by an alternative water source** | hectares | New area of public space supported by an alternative water source is calculated by accounting for new areas irrigated by stormwater or recycled water, or if there is a wetland. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Opportunity to embed Traditional Owner values in the delivery of solution** | High/Medium/Low | Based on the complexity of the solution and the opportunities for engagement with Traditional Owners. | Low = 1, Medium = 3, High = 5 |
| **Blue-green infrastructure created by integrated water management as a proportion of total area** | % of total area | Proportion of area for blue-green infrastructure. Based on wetland area assumptions | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Contribution to community literacy** | High/Medium/Low | Based on the prominence of the option in community on the justification that visibility will associate with community literacy. | Low = 1, Medium = 3, High = 5 |
| **Alternative water supplied to agricultural production** | ML/year | Volume of water supplied to agricultural production by rainwater, stormwater or recycled water. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Alternative water supplied to businesses and industry** | ML/year | Volume of water supplied to businesses and industry by rainwater, stormwater or recycled water. | Using the qualitative assessment and defined ranges, each option is scored 1 to 5. |
| **Implementation and complexity** | High/Medium/Low | An estimation based on the general implementation requirements of the option. Higher complexity options score lower than low complexity options. | Low = 5, Medium = 3, High = 1 |

| | | | |
|---|---|---|---|
| **Resilience to extreme climate events caused by climate change** | High/Medium/Low | Based on the options relative impact to the PSP's climate resilience compared with each other. | Low = 1, Medium = 3, High = 5 |
| **Relative land take** | High/Medium/Low | Based on the options land take, relative to other options. High land take scored lower and low land take scored higher. | Low = 5, Medium = 3, High = 1 |

# 8. Opportunity Assessment of Shortlisted Options

The shortlisted IWM options have been assessed against the measures and criteria set out in Section 7 to quantify the benefits of each option. The scoring criteria is on a scale of 0 (not applicable), 1 (worst) and 5 (best). The scoring methodology is described in Section 7. The detailed results for each option can be found in Appendix A. It should be noted that costing for these solutions is not included as part of this study, however is discussed in the results and discussion section.

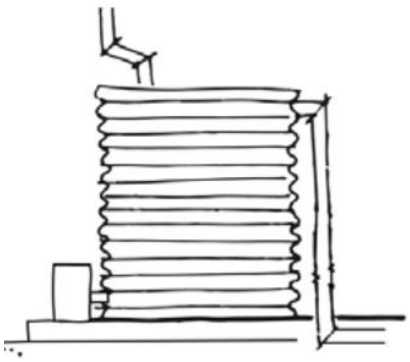
The following sections provide a description of each option, assumptions, and the results of the scoring.

## 8.1 Merrimu PSP

### Option 1: Rainwater Tanks in all new homes

**Description**

Rainwater tanks store collected water from residential roofs and can be reused to supplement non-potable domestic demands such as toilet flushing, laundry and irrigation. This option is a flexible and decentralised alternative water supply that can be implemented in combination with any other option.



*Source: EPA Urban Stormwater management guidelines*

**Key assumptions**

- 4kL tank in each home
- There are 8,912 dwellings (based on land use budget)
- Reuse is for toilet flushing, laundry (50%) and irrigation of gardens and lawns in homes
- There is one tank per home and 100% uptake of rainwater tanks across the precinct

**Stormwater targets**

Stormwater harvesting volume achieved: 20% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 0% (Target is 3-6%)

**Indicators (Scale 1-5)**

| | Value | Units | Score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 400 | ML/year | 2 |
| Recycled water delivered to customers | NA | ML/year | 0 |

| | | | |
|---|---|---|---|
| Impact on fluvial flood mitigation | M | H/M/L | 3 |
| Mean annual runoff volume reduction | 400 | ML/year | 2 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 120,318 | kg/year | 1 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | 1274 | kg/year | 1 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | H | H/M/L | 5 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | L | H/M/L | 5 |
| Resilience to extreme climate events caused by climate change | M | H/M/L | 3 |
| Relative land take | L | H/M/L | 5 |
| | Total score: | | 28 |

**Required infrastructure**

- 4kL PE rainwater tank
- Collection gutters
- Third pipe plumbing to toilet and laundry
- Overflow infrastructure

**Constraints and benefits**

**Sodic soil compatibility**

Rainwater tanks store collected rainwater, and above ground tanks do not require excavation or disturbance of soil to construct. Therefore, this solution is compatible to the sodic soils present on site.

**Implementation and governance**

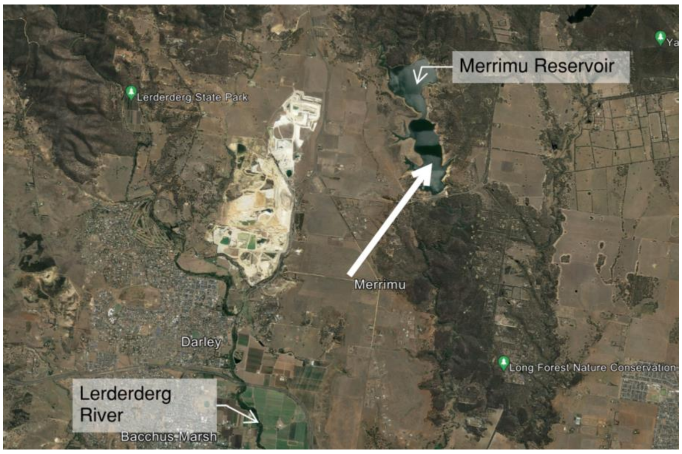
Implementation of rainwater tanks is relatively simple in buildability terms, however clear requirements should be embedded through the planning process to require their implementation

| |
|---|
| and council should be engaged throughout the process. To ensure their use, residents should be upskilled on their use and maintenance. Tanks would be owned by residents. |
| **Climate Resilience**<br><br>As decentralised systems, rainwater tanks are resilient in the face of water shortages. In addition, by minimising stormwater runoff into the environment, they have a positive impact on reducing stormwater flooding. |
| **Land take**<br><br>Rainwater tanks have a comparatively low land use as they are contained within the footprint of the dwelling. |

Option 2 : Rainwater (Roofwater) harvesting transfer to Merrimu Reservoir for potable supply

## Description

Rainwater is collected from the roofs of residential, town centre, community facilities and education buildings of Merrimu PSP, treated and transferred to Merrimu Reservoir to supplement indirect potable water supply. Roof water is relatively clean and could be considered an acceptable addition to a raw water reservoir under current policy conditions, as demonstrated through the Wannon Water scheme in Warrnambool. A separate roof drainage collection and transfer system will be needed to isolate the roof supply.




*Source - Arup*

## Key assumptions

- Based on topography, it is assumed it will be practicable to direct roofwater from the northern and eastern catchments (catchments 1 and 2 indicated in the RAIN report))to Merrimu. Some areas may be able to drain by gravity, but it is likely that pumping would be required. This area represents approximately 50% of the total development area.
- No losses to evapotranspiration
- Dwellings are evenly dispersed over catchment and each dwelling roof size is 290m, which is all directed to a separate drainage network.

## Stormwater targets (estimates)

Stormwater harvesting volume achieved: 33% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 0% (Target is 3-6%)

## Indicators (Scale 1-5)

| | **Value** | **Units** | **Score** |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 646 | ML/year | 3 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | H | H/M/L | 5 |
| Mean annual runoff volume reduction | 646 | ML/year | 2 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 17110 | kg/year | 1 |

| | | | |
|---|---|---|---|
| Total Nitrogen (TN) prevented from discharging to receiving waters | 1424 | kg/year | 1 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | NA | Trees | 0 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | M | H/M/L | 3 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | H | H/M/L | 5 |
| Relative land take | H | H/M/L | 1 |
| | Total score: | | 24 |

Required infrastructure

- Roofwater collection pipes and manholes
- Pump and pressurised pipe to transfer rainwater from PSP to Merrimu Reservoir

Constraints and benefits

**Sodic soil compatibility**

Sodic and dispersive soils may be affected during the installation of pipework and pumps. To overcome this, the levels and earthworks strategy can be designed so that finished surface levels are well above the dispersive sub-soil, and any pipes are laid in clean imported soil.

**Implementation and governance**

The complexity of implementing this option is relatively high compared to other options. This is because it requires collection, treatment and pumping infrastructure to transfer water off of the escarpment which is challenging. It also requires works to be undertaken outside of the PSP boundary. Therefore, there needs to be significant stakeholder engagement, particularly with landowners and Melbourne Water. Furthermore, this solution would require agreements on who would adopt and maintain the infrastructure assets. There are case studies of rainwater to potable reuse that have been implemented however given it is a fairly new concept this would also require stakeholder engagement.

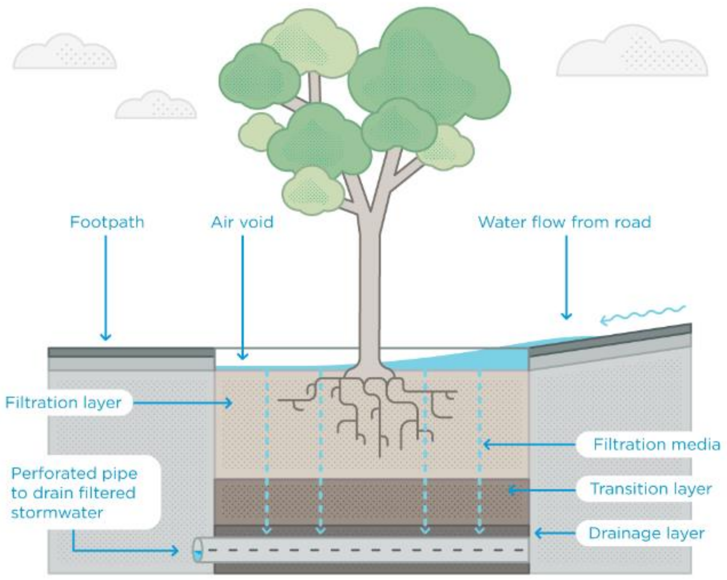
**Climate Resilience**

This solution contributes to circular economy principles, as water from the development is fed to the reservoir, ready to be reused again downstream. This is helpful from a climate resilience

| |
|---|
| perspective, as the reservoir is topped up from an additional source and can provide more water. Energy consumption from pumping, however, should be factored into this, and its embodied and operational emissions calculated. |
| **Land take**<br><br>This option requires the construction of a dedicated drainage system, but the aboveground land take should be minimal. Roof water would be combined with raw water at the Merrimu Reservoir and tested using the existing treatment plant.. This solution, if selected, should be incorporated into the project masterplan to ensure the associated infrastructure is spatially planned for. |

## Option 3: Passive irrigation of street trees with stormwater

| Description |
|---|
| Street trees are passively irrigated using stormwater. This option aligns with Council priorities and targets. |




*Source: Melbourne Water*

| Key assumptions |
|---|

- Tree density is 15 trees per hectare (assuming 1 tree per dwelling)
- Runoff into tree pits is from roads only.
- Tree pits are 1m deep with 30% porosity. Size of a tree pit is 2.2 x 2.2m (City of Melbourne)
- Inlet capture efficiency is 50%
- Flow reductions are associated with stormwater attenuated in a tree pit, assuming no infiltration

| Stormwater targets |
|---|

Stormwater harvesting volume achieved: 4% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 4% (Target is 3-6%) Assuming half of the flow reduction is due to infiltration

| Indicators (Scale 1-5) |
|---|

| | Value | Unit | Score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | NA | ML/year | 0 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | L | H/M/L | 1 |
| Mean annual runoff volume reduction | 161.3 | ML/year | 1 |
| Total Suspended Solids (TSS) prevented from discharging to receiving water | 52,937 | kg/year | 1 |

| | | | |
|---|---|---|---|
| Total Nitrogen (TN) prevented from discharging to receiving waters | 94 | kg/year | 1 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | 8,912 | trees | 4 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | 1 | % | 1 |
| Contribution to community literacy | M | H/M/L | 3 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | L | H/M/L | 5 |
| Resilience to extreme climate events caused by climate change | L | H/M/L | 3 |
| Relative land take | L | H/M/L | 5 |
| | Total score: | | 26 |

Required infrastructure

- Tree pits and associated outflow pipework
- Penetrated kerb inlets

Constraints and benefits

**Sodic soil compatibility**

Analysis of passively irrigated trees in sodic soil areas has shown there should be no adverse impact provided flow infiltrates vertically and is well distributed.

**Implementation and governance**

Passively irrigated street trees are relatively simple to implement and cooling and greening is a priority for the Council. Standard designs could be developed for the area to aid implementation.

**Climate Resilience**

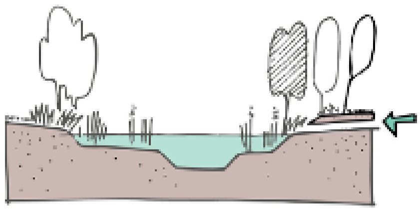
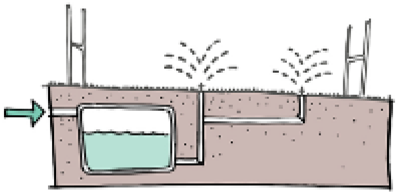
Using stormwater to irrigate trees provides a cooling effect to surrounding areas in the summer, which adds to the resilience of a PSP in the face of climate related shocks and stresses.

**Land take**

No land take impacts, as passive irrigation can be included within standard street cross-sections..

Option 4a: Precinct-scale stormwater harvesting for open space irrigation

| Description |
|---|
| Stormwater from the impermeable areas of the PSP is harvested and treated in a wetland. This water can then be used to irrigate open spaces in the precinct. |

*Source: EPA Urban Stormwater management guidelines*

| Key assumptions |
|---|

- Total wetland area of 20.3ha (representing 2% of the PSP area) is assumed, with an extended detention depth of 0.35m. It is assumed this is delivered through the base case drainage scheme.
- Total potential water demand for open space irrigation is 238 ML/y assuming a demand of 5ML/ha/year. It is assumed that 50% of open space could be irrigated and reached by a network within a reasonable distance of a wetland.
- Treated stormwater is distributed from precinct wetlands to open spaces utilising a storage to balance seasonal demands. It is assumed 60% reliability of supply can be achieved.
- Wetland is impermeable (lined)

| Stormwater targets |
|---|

Stormwater harvesting volume achieved: 6% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 0% (Target is 3-6%)

| Indicators (Scale 1-5) |
|---|

| | **Value** | **Units** | **Score** |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 113 | ML/year | 1 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | H | H/M/L | 5 |
| Mean annual runoff volume reduction | 113 | ML/year | 1 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 187,420 | kg/year | 1 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | 1766 | kg/year | 1 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |

| | | | |
|---|---|---|---|
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | 23.8 | ha | 2 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | H | H/M/L | 3 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | M | H/M/L | 3 |
| Resilience to extreme climate events caused by climate change | M | H/M/L | 3 |
| Relative land take | M | H/M/L | 3 |
| | Total score: | | 24 |

Required infrastructure

- Pump sand reticulation pipework to serve open space irrigation areas.
- Storage tanks for treated water to be stored

Constraints and benefits

**Sodic soil compatibility**

The excavation of a wetland has the potential to disrupt the sodic and dispersive soils. Geotechnical and site investigations should inform the location of any wetland(s), and wetlands should be lined to prevent water coming into contact with subsoils. The irrigation of open space should not have an impact on sodic soils beneath the ground surface.

**Implementation and governance**

Implementation of this solution requires  wetlands, an interim storage tank and primary treatment to remove larger solids, and a pump and pipe network to open spaces. Roads should allow for a non-potable pipe network in the utility/service corridor. The wetland, pipes and pump would need to be adopted and maintained by the local council or a water authority.

**Climate Resilience**

Harvesting stormwater for reuse on open spaces reduces the potable demand of the PSP. Furthermore, biological processes within wetlands naturally remove pollution from water which has a beneficial impact to waterways downstream. In addition, wetlands provide a cooling effect to surrounding areas in the summer, and reduce the risk of fire, which adds to the resilience of a PSP in the face of climate related shocks and stresses.

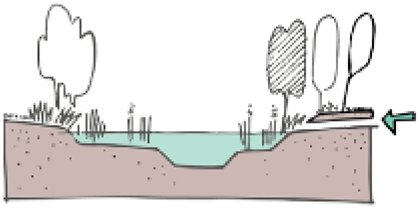
**Land take**

There would be some land use implications for this option, with local storages needing to be integrated into open space, or integrated into wetland design.  Easements may be needed to allow connection of the stormwater to open spaces around the development.

### Option 4b: Precinct-scale stormwater harvesting for non-potable supply to homes

**Description**

Stormwater from the impermeable areas of the PSP is harvested and treated in a wetland. This water is then pumped into a third-pipe, centralised non-potable network to serve the non-potable residential demands of the precinct.



*Source: EPA Urban Stormwater management guidelines*

**Key assumptions**

- Total wetland area of 20.3ha (representing 2% of the PSP area) is assumed, with an extended detention depth of 0.35m.
- A large storage would be required to increase reliability of supply. It is assumed that 60% reliability could be delivered.
- Daily non-potable residential water demand is 1,323 kL/day
- Wetland is impermeable (lined)

**Stormwater targets**

<u>Stormwater harvesting volume achieved:</u> 23% (+7% from base case wetlands) (Target is 29-33%)

<u>Stormwater infiltration volume:</u> 0% (Target is 3-6%)

-

**Indicators (Scale 1-5)**

| | Value | Units | Score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 441 | ML/year | 2 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | H | H/M/L | 5 |
| Mean annual runoff volume reduction | 441 | ML/year | 2 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 238,162 | kg/year | 1 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | 2358 | kg/year | 1 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | NA | trees | 0 |

| | | | |
|---|---|---|---|
| New area of public open space supported by an alternative water source | 47.7 | ha | 4 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | H | H/M/L | 5 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | M | H/M/L | 3 |
| Relative land take | H | H/M/L | 1 |
| | Total score: | | 26 |

**Required infrastructure**

- Treatment wetlands (delivered in base case)
- Balancing storage
- Screening and water treatment for non-potable use
- Pumps, storage tanks and reticulation pipework to serve residential areas.

**Constraints and benefits**

**Sodic soil compatibility**

The excavation of a wetland has the potential to disrupt the sodic and dispersive soils. Geotechnical and site investigations should inform the location of any wetland(s), and wetlands should be lined to prevent water coming into contact with subsoils.

**Implementation and governance**

The supply scheme would need to be managed by a water authority in order to provide a water supply to customers and to manage any water quality risks. There are no other large scale stormwater supply schemes to homes in Victoria, so implementation would be relatively new and require learning.

**Climate Resilience**

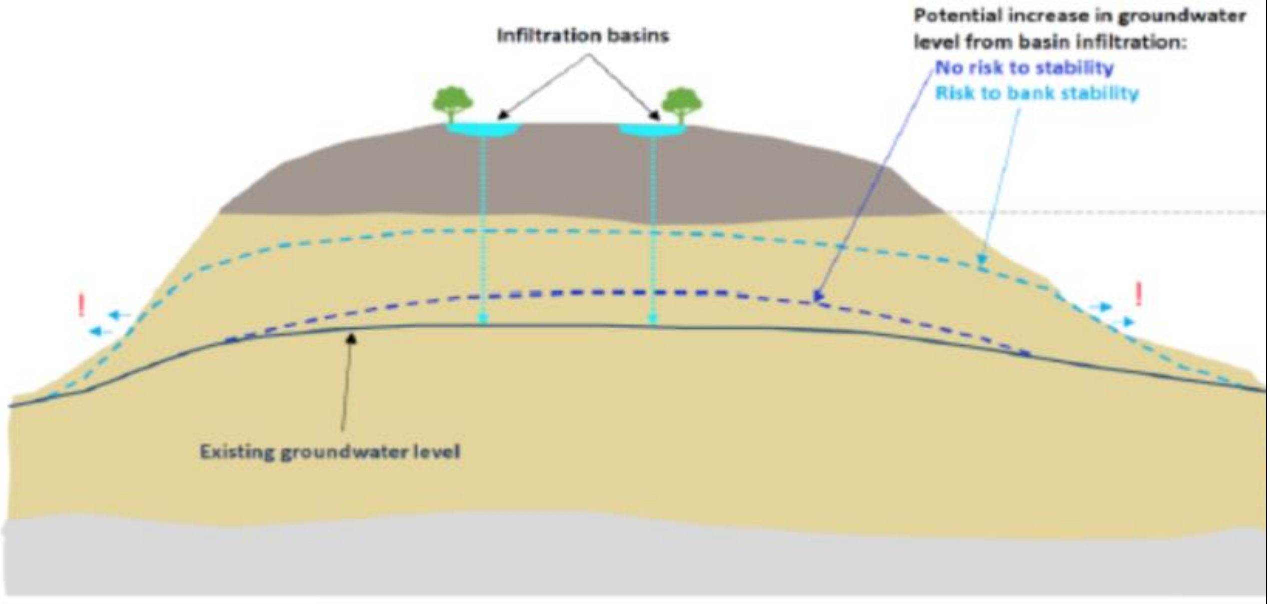
Harvesting stormwater for reuse in homes, reduces the potable water demand of the PSP. In case of a water outage in the potable network, having an independent non-potable network enhances the resilience of the town’s water infrastructure.

**Land take**

Land take would be required for a storage to balance supply and demand. Easements for transfer infrastructure may also be needed.

### Option 5: Aquifer injection instead of piping down escarpment

| Description |
|---|
| The capture of stormwater in the precincts will avoid the challenge of transferring stormwater down the escarpment where outfalls are constrained around the precinct and conservation areas and other high environmental value areas surround the Merrimu PSP. This infiltration option would be an alternative the assumed base case where stormwater is intercepted and treated, then transferred down the escarpment and released to waterways. This large scale infiltration option is being explored as part of the Drainage Services Scheme optioneering. |




*Source: Melbourne Water*

| Key assumptions |
|---|
| • Assumed that 100% of flow from the is impermeable areas of new development is intercepted and injected into deep groundwater at a depth that avoids any impact on bank stability.<br>• As stormwater is not infiltrated from the ground level, the relationship with waterways and baseflow recharge is unknown. It is assumed that 50% of infiltrated water is beneficial to waterways as a baseflow and characterised as infiltration, and 50% is retained as aquifer recharge and is characterised as harvesting. |

| Stormwater targets (estimated) |
|---|
| Stormwater harvesting volume achieved: 50% (Target is 29-33%)<br>Stormwater infiltration volume: 50% (Target is 3-6%) |

Indicators (Scale 1-5)

| | Value | Units | Score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | NA | ML/year | 0 |
| Recycled water delivered to customers | NA | ML/year | 0 |

| | | | |
|---|---|---|---|
| Impact on fluvial flood mitigation | H | H/M/L | 5 |
| Mean annual runoff volume reduction | 1954 | ML/year | 4 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 398,826 | kg/year | 2 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | 5850 | kg/year | 3 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | 976.9 | ML/year | 2 |
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | L | H/M/L | 1 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | L | H/M/L | 1 |
| Relative land take | H | H/M/L | 1 |
| | Total score: | | 21 |

Required infrastructure

- Aquifer injection ponds
- Injection pipe

Constraints and benefits

**Sodic soil compatibility**

This solution would pipe stormwater deep into the ground, avoiding the disturbance of sodic and dispersive soils exposed on the escarpments.

**Implementation and governance**

The aquifer injection option is a response to the challenge of piping transfers down the Merrimu escarpment but still has a high level of complexity. It would need careful management by Melbourne Water and Moorabool Shire Council.

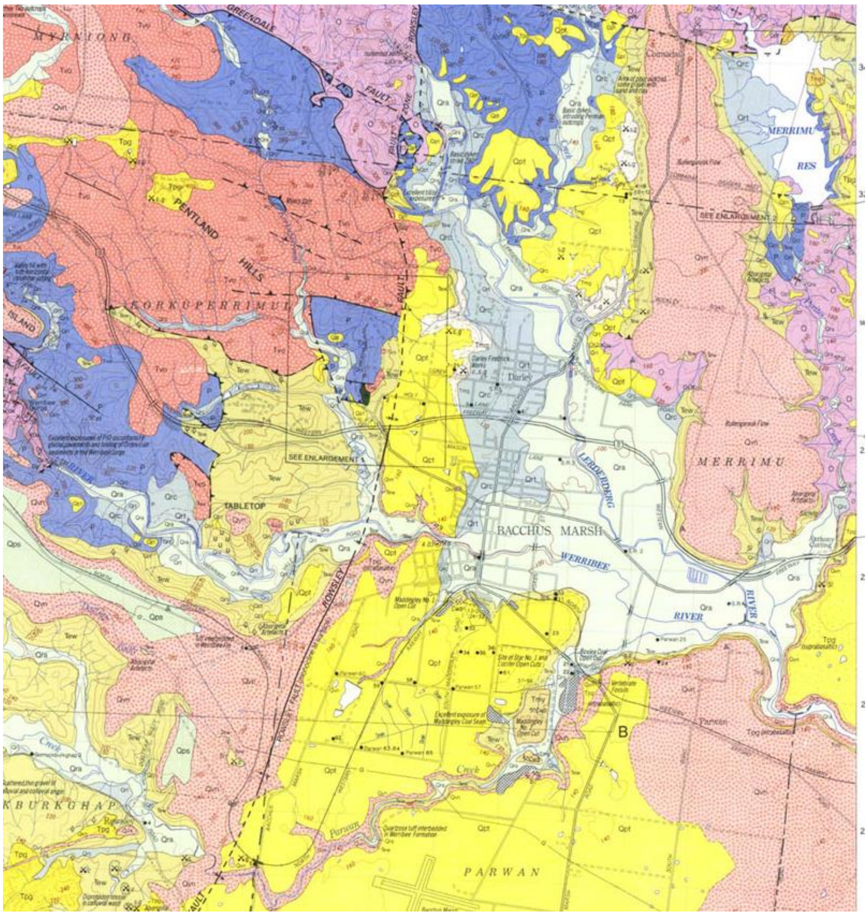
**Climate Resilience**

| |
|---|
| Aquifer injection replenishes diminishing aquifer supplies and can act as storage for stormwater. Groundwater resources are less responsive to climate events, and therefore provide higher levels of resilience to extreme climate events. |
| **Land take**<br>The land area required for aquifer injection is likely to be significant for the storage areas involved and injection infrastructure., |

### Option 6: Stormwater infiltration to alluvium formation

#### Description

Stormwater runoff from new development areas has the potential to be infiltrated into the alluvium formation, which has a high permeability. This could be done through swales, which has the capacity to slow and store stormwater and recharge river baseflows. For this to be delivered, stormwater must be transferred down the Merrimu escarpment for infiltration before it enters the Werribee River.




**Highly permeable alluvium formation adjacent to the Werribee River in the study area (shown in light green)**

#### Key assumptions

- It is assumed 60% of runoff (excluding higher flow events) from impermeable areas of new development can be practically intercepted and directed to infiltration swales to promote infiltration into the highly permeable alluvium soils in the valley below the development area.
- It is assumed that the majority of flow reduction is through infiltration, with a smaller proportion lost through evaporation and evapotranspiration which is characterised as harvested water.

#### Stormwater targets (estimated)

Stormwater harvesting volume achieved: 10% (+7% from base case wetlands) (Target is 29-33%)

Stormwater infiltration volume: 50% (Target is 3-6%)

#### Indicators (Scale 1-5)

| | Value | Units | Score |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | NA | ML/year | 0 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | H | H/M/L | 5 |
| Mean annual runoff volume reduction | 1172 | ML/year | 4 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | 239,296 | kg/year | 1 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | 3510 | kg/year | 2 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | 586 | ML/year | 1 |
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | H | H/M/L | 5 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | L | H/M/L | 1 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | L | H/M/L | 1 |
| Relative land take | M | H/M/L | 3 |
| | Total score: | | 24 |

**Required infrastructure**

- Stormwater swales
- Conveyance pipe infrastructure down escarpment

**Constraints and benefits**

**Sodic soil compatibility**

Infiltration through the topsoil would minimally impact sodic and dispersive soils. Careful consideration should be given if excavating to construct swales or infiltration basins near where there are sodic soils.

**Implementation and governance**

The complexity of implementing this option is high, as there is a steep gradient and level drop between the PSP and alluvium formation. It would require flows to be conveyed down a steep escarpment. Drop structures may be required to dissipate velocities.  Stormwater swales would need to be managed by the Council or Melbourne Water.

**Climate Resilience**

The effect of infiltrating stormwater into the alluvium would recharge the aquifer flow as well as river base flows. Groundwater resources are less responsive to climate events, and therefore provide higher levels of resilience to extreme climate events. Enhancing base flows in rivers can be beneficial in the long-term, especially when abstraction rates are likely to increase in the future.

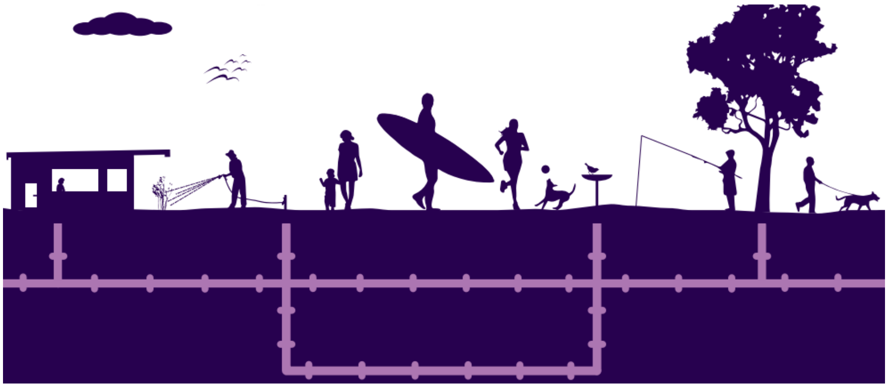
**Land take**

Land take would be required for the infiltration basins / swales, but this would be outside the development area. Land would need to be purchased or infiltration areas would need to be identified on public land or within the waterway corridor.

## Option 7: Using Class A recycled water for non-potable demands

**Description**

The generation of a Class A water would be from Bacchus Marsh RWP and a distribution network would service Merrimu PSP. Servicing of the PSP area could be an extension of a possible Class A scheme to service Bacchus Marsh Irrigation District, which is currently being considered as part of the Werribee System Reconfiguration Project.



*Source: Westernport water*

**Key assumptions**

- Class A recycled water is used for all non-potable water demands in Merrimu PSP, including open space irrigation
- Total non-potable water demands in Merrimu PSP is 735 ML/y
- The RWP will have capacity to provide the non-potable demand.

**Stormwater targets**

Not applicable

**Indicators (Scale 1-5)**

| | Value | Units | Score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 735 | ML/year | 3 |
| Recycled water delivered to customers | 735 | ML/year | 3 |
| Impact on fluvial flood mitigation | L | H/M/L | 1 |
| Mean annual runoff volume reduction | NA | ML/year | 0 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | NA | kg/year | 0 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | NA | kg/year | 0 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | NA | trees | 0 |

| | | | |
|---|---|---|---|
| New area of public open space supported by an alternative water source | 47.7 | ha | 4 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | H | H/M/L | 5 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | H | H/M/L | 5 |
| Relative land take | L | H/M/L | 5 |
| | Total score: | | 28 |

Required infrastructure

- Upgrade Bacchus Marsh Recycled Water Plant to a Class A facility.
- Reticulation (third-pipe) network including pumps, reservoirs and pipework.
- Housing to accommodation a third-pipe connection

Constraints and benefits

**Sodic soil compatibility**

Sodic and dispersive soils may be affected during the installation of pipework and pumps. To overcome this, the levels and earthworks strategy can be designed so that finished surface levels are well above the dispersive sub-soil, and any pipes are laid in clean imported soil.

**Implementation and governance**

Implementation of Class A recycled water treatment is dependent on Greater Western Water, as the asset owner of the WWTP. Therefore, the timelines for construction and upgrade would need to be coordinated with broader upgrades as part of the vision for the Werribee catchment and its recycled water resources. For Merrimu PSP, the network would be required to cross the Werribee River and major road infrastructure as well as climbing some significant topography, making Merrimu the most challenging PSP to service. Parwan Station and Parwan Employment are located adjacent to the Parwan Treatment Plant and could be serviced more easily.

**Climate change**

Supplying recycled water would reduce freshwater demand in the PSP. Energy and cost required to treat and reticulate the water should be considered.

**Land take**

There would be minimal land take within the PSP area for reticulated recycled water. Balancing tanks may be required along with easements for distribution infrastructure. Roads should allow for a non-potable pipe network in the utility/service corridor.

### Option 8 Using Class B/C recycled water supply for open space irrigation

| Description |
|---|
| This option involves the supply of Class B or C recycled water from Bacchus Marsh Recycled Water Plant to Merrimu PSP.<br><br>*Source: Westernport Water* |
| **Key assumptions** |
| • Class B/C is only used for open space irrigation.<br>• Open space irrigation demand is 238 ML/y |
| **Stormwater targets** |
| Not applicable |
| **Indicators (Scale 1-5)** |

| | Value | Units | Individual score |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 238 | ML/year | 1 |
| Recycled water delivered to customers | 238 | ML/year | 1 |
| Impact on fluvial flood mitigation | L | H/M/L | 1 |
| Mean annual runoff volume reduction | NA | ML/year | 0 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | NA | kg/year | 0 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | NA | kg/year | 0 |
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | NA | ML/year | 0 |
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | 47.7 | ha | 4 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |

| | | | |
|---|---|---|---|
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | M | H/M/L | 3 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | M | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | H | H/M/L | 5 |
| Relative land take | M | H/M/L | 5 |
| | Total score: | | 22 |

**Required infrastructure**

- Reticulation (third-pipe) network including pumps, reservoirs and pipework

**Constraints and benefits**

**Sodic soil compatibility**

Sodic and dispersive soils may be affected during the installation of pipework and pumps. To overcome this, the levels and earthworks strategy can be designed so that finished surface levels are well above the dispersive sub-soil, and any pipes are laid in clean imported soil.

**Implementation and governance**

Implementation of Class B/C recycled water treatment is dependent on Greater Western water, as the asset owner of the WWTP. Therefore, the timelines for construction and upgrade would need to be coordinated. For Merrimu PSP, the network would be required to cross the Werribee River and major road infrastructure as well as climbing some significant topography, making Merrimu the most challenging PSP to service. Parwan Station and Parwan Employment are located adjacent to the Parwan Treatment Plant and could be serviced more easily.

**Climate change**

Supplying recycled water would reduce freshwater demand in the PSP. Energy and cost required to treat and reticulate the water should be considered.

**Land take**

There would be minimal land take within the PSP area for reticulated recycled water. Balancing tanks may be required along with easements for distribution infrastructure. Roads should allow for a non-potable pipe network in the utility/service corridor.

## Option 9: Transfer stormwater to Melton Reservoir then to Merrimu Reservoir for potable supply

**Description**

Treated stormwater would be transferred from new development areas in the PSP to Melton Reservoir and then to Merrimu Reservoir to supplement the regional potable water supply.

*Source: VicScreen*

## Key assumptions

- Stormwater from the PSP enters a wetland, which is sized as 2% of the PSP area.
- Treated outflow from the wetland is released into the Werribee River where it flows to Melton Reservoir. From there, it's pumped up to Merrimu Reservoir via a new piped connection which is being explored by Greater Western Water as part of broader system resilience measures.
- It is assumed that 50% of the volume transferred to Melton could be pumped to Merrimu Reservoir to supplement potable supply and 50% could be retained in Melton Reservoir to supplement an environmental water reserve.
- Future regulatory environment enables the user of stormwater for potable supply.

## Stormwater targets

Stormwater harvesting volume achieved: 7% from base case wetlands (Target is 29-33%) Note: Full flow is eventually harvested downstream but the adjacent stretch of waterway does not benefit from flow reduction.

Stormwater infiltration volume: 0% (Target is 3-6%)

## Indicators (Scale 1-5)

| | **Value** | **Units** | **Individual score** |
|---|---|---|---|
| Alternative water sources that substitutes potable mains water supply | 1,027 | ML/year | 4 |
| Recycled water delivered to customers | NA | ML/year | 0 |
| Impact on fluvial flood mitigation | L | H/M/L | 1 |
| Mean annual runoff volume reduction | NA | ML/year | 0 |
| Total Suspended Solids (TSS) prevented from discharging to receiving waters | NA | kg/year | 0 |
| Total Nitrogen (TN) prevented from discharging to receiving waters | NA | kg/year | 0 |

| | | | |
|---|---|---|---|
| Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | 1,027 | ML/year | 2 |
| New total number of passively irrigated trees | NA | trees | 0 |
| New area of public open space supported by an alternative water source | NA | ha | 0 |
| Opportunity to embed Traditional Owner values in the delivery of solution | L | H/M/L | 1 |
| Blue-green infrastructure created by integrated water management as a proportion of total area | NA | % | 0 |
| Contribution to community literacy | L | H/M/L | 1 |
| Alternative water supplied to agricultural production | NA | ML/year | 0 |
| Alternative water supplied to businesses and industry | NA | ML/year | 0 |
| Implementation and complexity | H | H/M/L | 1 |
| Resilience to extreme climate events caused by climate change | H | H/M/L | 5 |
| Relative land take | L | H/M/L | 5 |
| | Total score: | | 20 |

Required infrastructure

- Base case wetlands
- Outfall connection pipe from PSP wetland to Werribee River
- Pump and pressurised pipe to transfer water from Melton Reservoir to Merrimu Reservoir

Constraints and benefits

**Sodic soil compatibility**

The excavation of a wetland has the potential to disrupt the sodic and dispersive soils. Geotechnical and site investigations should inform the location of any wetland(s), and wetlands should be lined to prevent water coming into contact with subsoils.

**Implementation and governance**

Releasing stormwater to the Werribee River without the Melton-Merrimu connection could have adverse effects on the downstream environment. The interim concept is that Melton Reservoir could supply environmental flows and the final concept is that it could transfer to Merrimu Reservoir, however there are concerns about the lack of capacity in the Melton Reservoir to provide the required storage, which requires further investigation. There is a current lack of enabling policy for use of stormwater for potable supply, so an interim option or adaptive plan would be required to identify the short term demands and transfer for the stormwater.

**Climate change**

This option could enhance water security in the region by topping up potable water supplies. There are also possible benefits of environmental flows within the Werribee River if stormwater is held into Melton Reservoir and allocated as an environmental flow.

**Land take**

There would be no land take within the PSPs for this option.

# 9. Merrimu recommended portfolio and next steps

## 9.1 Results and discussion

The combined scores for the IWM options for Merrimu PSP are shown in Table 9-1.

**Table 9-1 - Scores for Merrimu PSP**

| Merrimu PSP | Alternative water sources that substitute potable mains supply | Recycled water delivered to customers | Impact on fluvial flood mitigation | Mean annual runoff volume reduction | Total Suspended Solids prevented from discharging to receiving waters | Total Nitrogen prevented from discharging to receiving waters | Additional ML/yr water allocated to environmental water reserve | New total number of passively irrigated trees | New area of public open space supported by an alternative water source | Opportunity to embed Traditional Owner values in delivery of solution | Blue-green infrastructure created by IWM as a proportion of total area | Contribution to community literacy | Alternative water supplied to agricultural production | Alternative water supplied to businesses and industry | Implementation and complexity | Resilience to extreme climate events caused by climate change | Relative land take | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1- Rainwater tanks in all new homes | 2 | 0 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 5 | 3 | 5 | 28 |
| 2- Rainwater harvesting transfer to Merrimu Reservoir for potable supply | 3 | 0 | 5 | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 1 | 5 | 1 | 24 |
| 3- Passive irrigation of street trees with stormwater | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 4 | 0 | 1 | 1 | 3 | 0 | 0 | 5 | 3 | 5 | 26 |
| 4a- Precinct scale stormwater harvesting for open space irrigation | 1 | 0 | 5 | 1 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 3 | 3 | 3 | 24 |
| 4b- Precinct scale stormwater harvesting for residential non-potable supply | 2 | 0 | 5 | 2 | 1 | 1 | 0 | 0 | 4 | 1 | 0 | 5 | 0 | 0 | 1 | 3 | 1 | 26 |
| 5- Aquifer injection instead of piping down escarpment | 0 | 0 | 5 | 4 | 2 | 3 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 21 |
| 6- Stormwater infiltration into alluvium | 0 | 0 | 5 | 4 | 1 | 2 | 1 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 1 | 1 | 3 | 24 |
| 7-Class A recycled water to PSP | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 5 | 0 | 0 | 1 | 5 | 5 | 28 |
| 8-Class B/C recycled water supply to open spaces | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 0 | 0 | 1 | 5 | 5 | 22 |
| 9- Transfer stormwater to Melton and then Merrimu Reservoir for potable supply | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 5 | 5 | 20 |

The key insights from the comparative analysis of options for the PSP are:

- The highest scoring options for Merrimu PSP are the inclusion of rainwater tanks to provide both stormwater volume reduction and substitution of potable water for non-potable uses in homes, or the provision of Class A recycled water to homes. These options that provide alternative water resources to homes scored highly for the criterion relating to community literacy with respect to IWM, as it requires residents to understand non-potable water and its benefit in the home. Rainwater tanks and Class A recycled water scored higher than providing treated precinct scale harvested stormwater into homes (Option 4b)
- Of the options that deliver an alternative water supply to homes, rainwater tanks are the most readily implementable for Merrimu PSP as they provide a decentralised source of water, and they are also relatively low cost and easy to install. Rainwater tanks also have the advantage of being rolled out incrementally with development. The delivery of a Class A recycled water supply to the precinct could also deliver strong benefits to the region, though the location of the Merrimu PSP relative to the Bacchus Marsh Recycled Water Plant is likely to make servicing challenging and costly.
- Many of the highest scoring options respond to the waterway health drivers and intercept stormwater and contribute to the IWM targets relating to flow and pollutant reductions in receiving waterways. Options to capture stormwater for open space irrigation within the precinct and to support tree irrigation scored well and offer greening and liveability benefits. Both of these options could be delivered in combination with rainwater tanks to enhanced benefits to the PSP and to meet flow volume reduction targets for the catchment. Passive irrigation of street trees with stormwater scored points for the provision of street trees being irrigated by an alternative source of water, and also directly align with VPA's guideline for PSPs.
- Larger scale and more complex solutions such as the transfer of rainwater to Merrimu Reservoir, transfer of stormwater to Melton and then Merrimu reservoir, aquifer injection and infiltration into the alluvium formation presented some implementation challenges and require close collaboration between stakeholders. These options often contributed very strongly to one or two of the IWM strategic outcomes, but fell short in their contribution to place-making and greening outcomes within the PSP. In many cases these regional scale options could be delivered in tandem with lot and precinct scale options in a complimentary manner, embedding flexibility in the long term.

## 9.2 Recommended portfolio for further consideration

**For the Merrimu PSP, it is recommended a combination of a lot scale and precinct scale solutions are taken forward for further investigation through the development process. This includes:**

- **Option 1:** Rainwater tanks in all new homes
- **Option 3:** Passive irrigation of street trees with stormwater
- **Option 4a:** Stormwater harvesting for open space irrigation

Portfolio options were selected based on the following:

- Meeting stormwater harvesting and infiltration targets for the area (29-32% for stormwater harvesting, 3-6% for infiltration)
- Scoring highly in the Opportunities assessment (which considers performance measures and VPA specific objectives)
- A combination of lot scale and precinct scale solutions to meet targets and standards and enable flexibility and adaptability. In particular, opting for readily implementable and adaptable rainwater tanks in homes to meet residential non-potable demands as opposed to centralised Class A recycled water. Despite both options scoring highly, the location of the Merrimu PSP relative to the Bacchus Marsh Recycled Water Plant is likely to make servicing challenging and costly

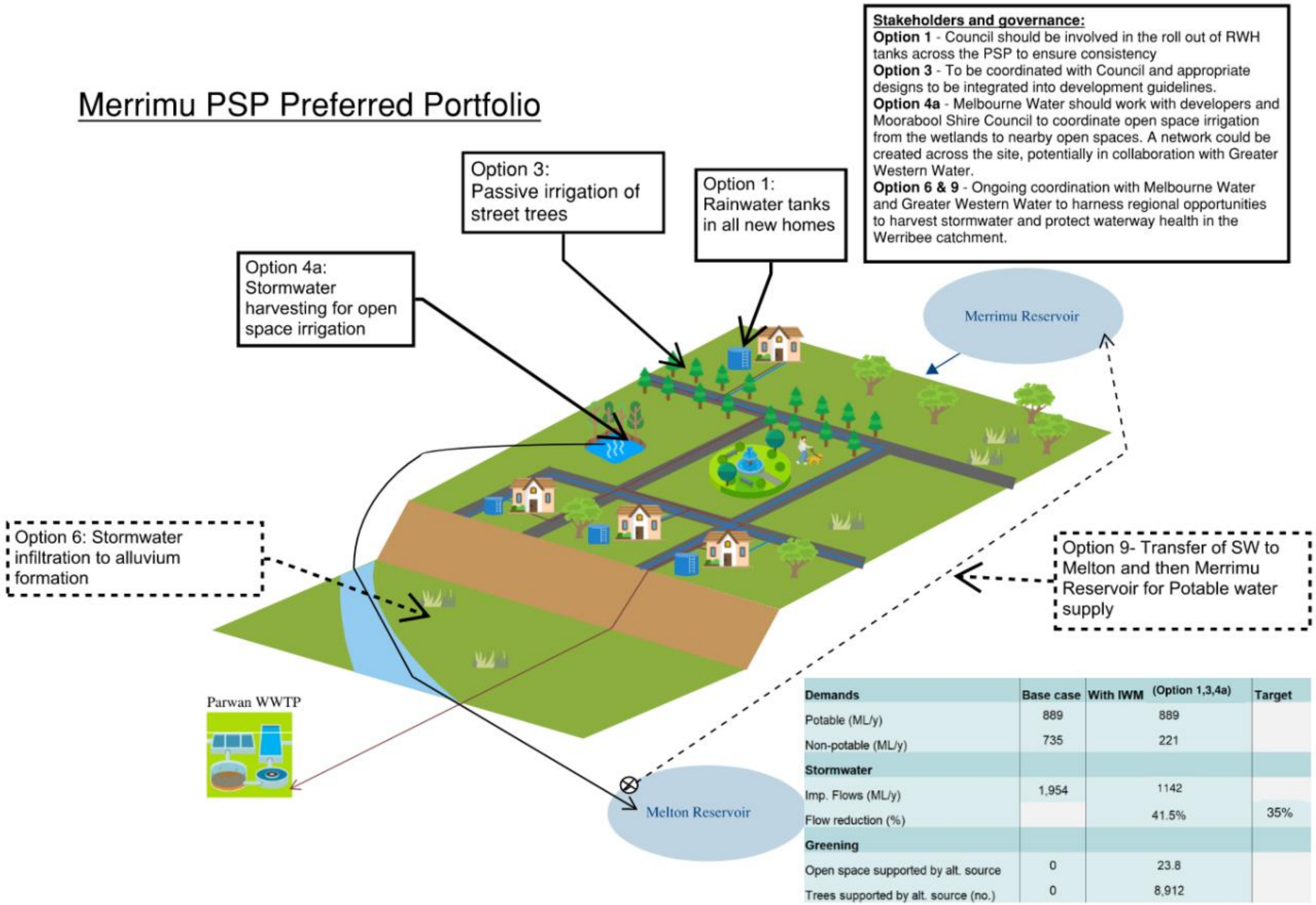
Costs were not considered in selecting the preferred portfolio.

Option 4b (Precinct scale stormwater harvesting for residential non-potable supply) is not recommended as the installation of Option 1 (rainwater tanks in new homes) would meet the residential non-potable demands. Therefore, these two options are not recommended to be delivered in tandem.

Furthermore, Option 4a (using harvested stormwater to irrigate open spaces) is preferred over Option 8 (Class B/C recycled water for open space irrigation), as it scores higher and contributes to meeting stormwater harvesting targets.

To strategically contribute to the targets in the wider Werribee IWM Catchment Plan, it’s recommended that at least one of the regional scale stormwater harvesting solutions are pursued and further investigated. Regional options that could be combined with the preferred portfolio of options in the PSP include:

- **Option 6: Stormwater infiltration into alluvium.** If the drainage scheme for Merrimu PSP includes transfer down the escarpments to release to the Werribee and Lerderderg Rivers, there is an opportunity to lessen flow impacts on the rivers and to recharge baseflows through infiltration into the highly permeable alluvium fields in the Werribee River valley. This initiative would involve collaboration with adjacent landowners, and partnerships to establish and manage the infiltration assets.
- **Option 9: Treated stormwater transferred to the Melton Reservoir and then eventually to Merrimu Reservoir for potable reuse.** Option 9 is only possible in the long term as it involves regulatory change, therefore it is not selected as a short-term solution. This option could be delivered with the preferred portfolio, as the residual stormwater from the development can still meaningfully contribute to regional water resource management from Melton Reservoir.




| Demands | Base case | With IWM (Option 1,3,4a) | Target |
|---|---|---|---|
| Potable (ML/y) | 889 | 889 | |
| Non-potable (ML/y) | 735 | 221 | |
| **Stormwater** | | | |
| Imp. Flows (ML/y) | 1,954 | 1142 | |
| Flow reduction (%) | | 41.5% | 35% |
| **Greening** | | | |
| Open space supported by alt. source | 0 | 23.8 | |
| Trees supported by alt. source (no.) | 0 | 8,912 | |

**Figure 9-1 Schematic showing IWM solutions in Merrimu PSP**

## 9.3 Next steps

The outcomes of this opportunity assessment have recommended a precinct scale and lot scale solution as well as continued work on regional initiatives. This has been based on available information and a qualitative and quantitative opportunity assessment of benefits. The estimated infrastructure requirements and benefits identified through this project have been developed based on a number of assumptions, and further investigation and consultation will be needed to refine and optimise outcomes, particularly costing and detailed design of the options within the developments in the PSPs.

Integrated Water Management is a continuous process and is led by different stakeholders at different phases throughout the entire 'IWM journey', from high level strategic directions through to conceptual analysis, to functional design, funding, and implementation. The development of this report was led by the VPA and the analysis is at the conceptual level, but IWM investigations and stakeholder collaborations continue post PSP process. The 'next phase' will be led by a different (or a consortium of) authority to further investigate the concepts developed by this process. As understanding of the options improve, further details such as timelines, adaptive pathways, costs, benefits, and design details can be established.

The following recommendations for next steps are:

- Inclusion of the IWM recommendations in the PSP documentation, and a requirement for developers within the PSP to document their integration of the IWM strategy as part of the planning application process, demonstrating integration of the recommended portfolio, or alternative options that would achieve equivalent outcomes. Council should refer develop IWM plans to Greater Western Water to review in accordance with their Developer IWM Guidance.
- Continued and regular stakeholder engagement between Council, Melbourne Water and Greater Western Water, Traditional Owners, DEECA and local developers post PSP gazettal to understand the outcomes of any IWM investigations and to align agency positions on preferred IWM solutions. The Bacchus Marsh IWM working group should be maintained and a lead agency should be appointed to coordinate collaboration and engagement. In particular, updates should be made to the stakeholder group at key points regarding:
    - The evolving drainage solution under the drainage scheme, and implications for stormwater harvesting on or near site.
    - The outcomes of the recycled water optimisation study for the Werribee catchment and any proposals for recycled water networks from Bacchus Marsh RWP. Engagement may lead to identifying potential opportunities for joint business cases and synergies between projects, such as offtakes from proposed networks. Any changing priorities and policy, particularly as to how it affects any options that are not yet possible.
    - Implementation and adoption pathway for the recommended IWM options.
    - Engagement with interested developers to ensure a shared understanding of IWM requirements and outcomes from the outset.

# Appendix A

## Assessment Criteria

| | Alternative water sources that substitutes potable mains water supply (ML/y) | Recycled water delivered to customers (ML/year) | Impact on fluvial flood mitigation (H/M/L) | Mean annual runoff volume reduction (ML/y) | Total Suspended Solids (TSS) prevented from discharging to receiving waters (kg/year) | Total Nitrogen (TN) prevented from discharging to receiving waters (kg/year) | Additional ML/yr of water allocated to environmental water reserve that increases environmental benefits in waterways | New total number of passively irrigated trees | New area of public open space supported by an alternative water source (ha) | Opportunity to embed Traditional Owner values in the delivery of solution (H/M/L) | Blue-green infrastructure created by integrated water management as a proportion of total area (%) | Contribution to community literacy (H/M/L) | Alternative water supplied to agricultural production (ML/y) | Alternative water supplied to businesses and industry (ML/y) | Implementation, and complexity (H/M/L) | Resilience to extreme climate events (flood or drought) caused by climate change (H/M/L) | Relative land take (H/M/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1 | 0-300 | 0-300 | L | 0-300 | 0-250,000 | 0-2,500 | 0-600 | 0-5,000 | 0-15 | L | 0-1 | L | 0-300 | 0-300 | H | L | H |
| 2 | 301-500 | 301-500 | | 301-500 | 250,001-500,000 | 2,501-5,000 | 601-1,200 | 5,001-10,000 | 16-30 | | 2-3 | | 301-500 | 301-500 | | | |
| 3 | 501-1,000 | 501-1,000 | M | 501-1,000 | 500,001-1,000,000 | 5,001-7,500 | 1,201-1,800 | 10,001-15,000 | 31-45 | M | 4-5 | M | 501-1,000 | 501-1,000 | M | M | M |
| 4 | 1,001-2,000 | 1,001-2,000 | | 1,001-2,000 | 1,000,001-1,500,000 | 7,501-10,000 | 1,801-2,400 | 15,001-20,000 | 46-60 | | 6-7 | | 1,001-2,000 | 1,001-2,000 | | | |
| 5 | >2,000 | >2,000 | H | >2,000 | >1,500,000 | >10,000 | >2,400 | >20,000 | >60 | H | >7 | H | >2,000 | >2,000 | L | H | L |

# Appendix B

## Literature Review

The following table outlines work currently in progress or undertaken between the completion of the previous IWM strategy and now.

| Name and year of document or workshop | Summary and key points |
| --- | --- |
| Sodic soils report by Coffey (2020) | A geotechnical investigation was undertaken in the Merrimu Precinct in 2020 by Coffey. This investigation followed on from a previous geotechnical investigation and a desktop assessment which classified soils across the PSP as Sodosols (these include subsoils that are sodic and prone to dispersion)<br><br>The 2020 study concluded that the geological units in the Merrimu PSP site comprise Quaternary age Newer Volcanics, located on the plateau, and Tertiary age Werribee formation, located on the mid and lower slopes below the plateau.<br><br>The testing on soils of the Newer Volcanics indicates that the soils are moderately to highly sodic and dispersion may be variable. These results indicate that there is potential for erosion, and care should be taken to reduce this potential. The erosion potential of the Newer Volcanics soils needs to be considered in the preparation of the surface water / stormwater management plan.<br><br>The testing on soils of the Werribee Formation indicates that the soils are slightly to highly sodic and dispersive. The laboratory results are consistent with the observations of erosion in the gully. Any development should ensure that appropriate plans are put in place to ensure that no additional runoff is discharged from the development to areas where Werribee Formation soils are exposed (such as gullies) to mitigate the potential of any increased erosion as a result of the development. |
| Merrimu IWM Opportunities (2021) and Merrimu Stormwater Management Strategy (2022) by Rain Consulting. | An IWM Opportunities and stormwater management report was prepared for Bacchus Marsh Developments Pty Ltd by Rain Consulting for the Merrimu Precinct. Bacchus Marsh Developments Pty Ltd owns a large proportion of the developable land, which will comprise approx. 5,500 lots, a “green network”, and urban farms that could be managed by CERES, a social enterprise organisation.<br><br>A summary of key findings and options from the IWM Opportunities report are as follows:<br>• Based on contours, there are potentially 5 stormwater discharge points which are all tributaries to the Werribee River.<br>• The Werribee River has flow reduction targets, there are sodosols present which are at risk of erosion, the majority of waterways in the study site are extremely sensitive to change and there are runoff reduction targets between 25-50%. This drives the decision to reuse stormwater on site as a top priority.<br>• The disadvantages and challenges of stormwater reuse is that rainfall is not constant and tends to occur at times of lower demand, which means large storage areas are required. Furthermore, reticulation of stormwater around the site needs further consideration<br>• An alternative option is stormwater reuse offsite, or the use of recycled water. Recycled water requires more treatment than stormwater and does not contribute to meeting the stormwater runoff reduction targets. Offsite stormwater reuse requires several agreements, and a backup plan for when demand is no longer required.<br>• Opportunities for water use include a CERES community garden / farm, and irrigation of a Spiny Rice Flower colony.<br><br>A summary of key findings and options from the Stormwater Management Strategy report are as follows:<br>• The Merrimu PSP area is 530 ha in size. Existing use is farming and rural use. The proposed masterplan is intended to be residential-led mixed-use development.<br>• Soil conditions on the site can be roughly grouped into two categorisations, the erosion resistant finely grained clays and silts (New Volcanics) covering most of the top of the plateau and highly dispersive sandy textured sodic soils (Werribee Formation) that are present along the escarpment<br>• Outfall analysis –7 outfalls were deemed to be acceptable with little to no erosion mitigation required while another 5 would require some erosion mitigation works to facilitate flows without adverse impacts. |

| Name and year of document or workshop | Summary and key points |
| --- | --- |
| | • TUFLOW flood analysis was undertaken with $2m^2$ resolution using LiDAR and available contour data. The 1% AEP 6- hour and 12-hour storm was simulated.<br>• Proposed options by catchment:<br>  ○ Catchment 1: There are two main wetlands/retarding basins proposed with the requirement to build water reuse assets later. Both are serviced by pipes only. The smaller basin discharges directly to Stable Gully, and the larger basin is to discharge directly to the tributary of the Lerderderg River.<br>  ○ Catchment 2: Two main wetlands/retarding basins. The northern most basin has area which can accommodate water reuse assets. The basin is served by pipes only. Outlet piped to the intersection of Bences Road and Buckleys Road prior to discharge directly to the tributary Pyrites Creek. The southern basin is served by a 45-50 m wide waterway corridor which should be potentially part of a future drainage scheme. The outlet discharges to the nearby gully where, according to Streamology's work, gully stabilisation and protection works will be required. Both require water reuse assets later.<br>  ○ Catchment 3: One wetland / retarding basin served by pipes only, requiring water reuse assets later. The outlet discharges to the nearby gully requiring some stabilisation and protection works.<br>  ○ Catchment 4: One wetland / retarding basin served by pipes only. requiring water reuse assets later. The outlet discharges to the nearby gully requiring some stabilisation and protection works.<br>  ○ Catchment 5 and 6: Four stormwater basins, with two connected. Large catch drains required to avoid unstable outfalls. In the northeast, there is no suitable outlet so treated and retarded flows are then piped south to another wetland, picking up additional flows. |
| Parwan Station PSP Key Issues and Opportunities Paper by VPA (March 2022). | This VPA report summarised the key issues and opportunities for the Parwan Station PSP. These are listed below.<br>Issues:<br>• Steep escarpment conditions and potential occurrence of erosive/ sodic soils<br>• Buffer interfaces from Western Water treatment plant and the Maddingley composting facilities need to be adhered to and measured so as to not cause a conflict between sensitive uses and buffer throwing uses<br>• Unknown Eastern Link Road location<br>• High quality biodiversity may limit development area<br>Opportunities:<br>• Escarpment provides precinct with unique view lines<br>• Relatively flat and unencumbered landscape above escarpment<br>• Recreational open space can be designated around tree clusters which would not only preserve habitat for wildlife but could also become a significant health and wellbeing asset for the community. |
| Parwan PSP Co-Design Workshop by VPA (June 2022). | A co-design workshop was undertaken to discuss key issues and opportunities presented in the Paper as well as discuss approach to precinct planning. A council workshop was also held. The activities looked at the PSP guidelines; one activity looked at "*What is important to consider to support climate change adaptation and integrated water management opportunities?*".<br>Key comments included:<br>• Parks and sports reserves should have resilient water supply.<br>• Active recreation should be co located with waterways. Also, opportunity to harvest stormwater.<br>• Consider whole of water cycle, collection, treatment and reuse |

| Name and year of document or workshop | Summary and key points |
|---|---|
| | • Blue/green infrastructure should be incorporated into planning to enhance biodiversity values |
| Merrimu Key Issues and Opportunities Paper by VPA (July 2022). | This VPA report summarised the key issues and opportunities for the Merrimu PSP. These are listed below.<br>Issues –<br>• Managing future development whilst protecting Aboriginal cultural heritage, post-colonial heritage and biodiversity<br>• Managing the interface with Bacchus Marsh Irrigation District, farming areas and the quarry to the west will be vital to ensure there are no conflicts between sensitive land uses and buffer throwing uses<br>• Steep escarpment conditions and potential occurrence of erosive/ sodic soils, which may constrain development opportunities and connections<br>Opportunities –<br>• Protect Aboriginal cultural heritage and post-colonial heritage<br>• Escarpment provides precinct with unique view lines<br>• Aspirational permeability targets, implementing best practice water capturing and closed loop system, passive irrigation innovations and use of alternate water<br>• Sodic soil further investigations are required to establish the large areas of the unencumbered landscape above the escarpment. |
| Merrimu PSP Co-Design workshop by VPA (October 2022). | Participants with an interest in the Precinct were invited from a range of organisations from the public and private sectors, as well as private landowners, to participate in the Workshop. Feedback included:<br>• Rehabilitation and restoration of degraded vegetation areas<br>• A priority action was identified to finalise location and land take for drainage and integrated water management infrastructure across the precinct.<br>• A comment in the workshop noted that it is important to use more water up on the plateau.<br>• Link soil management and integrated water management.<br>• Important to incorporate appropriate setbacks to the waterways |
| November Merrimu Melbourne Water VPA Meeting (November 2022). | Three key challenges were discussed at this meeting:<br>1. Active eroding escarpment<br>Setback required for drainage reserve locations for assets.<br>2. Allowable discharge and outfalls<br>Erodible soils, physical formation, environmental criteria and cultural heritage of outfall locations may restrict allowable discharges and locations. This may increase drainage reserve sizing and location.<br>3. Constructability<br>The construction process in this will have larger disturbance zones, larger costs which are specific at each outfall locations. |
| Parwan Employment Precinct Key Issues and Opportunities Paper by VPA (July 2022). | This VPA report summarised the key issues and opportunities for the Parwan Employment Precinct. These are listed below<br>Issues:<br>• Ecological communities, wetlands and native vegetation of significance will require protection<br>• Sensitive areas of aboriginal and historic cultural heritage significance should be retained in their current forms and rehabilitated<br>• Existing drainage only cater for farming activities |

| Name and year of document or workshop | Summary and key points |
|---|---|
| | • Need for connectivity to local and regional businesses in Bacchus Marsh Irrigation District and the future Western Irrigation Network for greater synergy<br>Opportunities:<br>• High sensitivity of Aboriginal cultural heritage and post-colonial heritage can be protected and incorporated into the precinct as passive open space with pedestrian/bike paths connecting biodiversity and landscape features<br>• Unique biodiversity features and values can be preserved and incorporated into the precinct. Notable landscape and visual features include wetlands and bushlands.<br>• Council received fast-tracked funds for undertaking the service network planning study for electricity, water and sewer connections<br>• VPA is undertaking the integrated water management study to inform the drainage strategy<br>• Connectivity to local and regional businesses in Bacchus Marsh Irrigation District and the future Western Irrigation Network for greater synergy |
| Parwan Lava Cave Assessment by Golder (December 2022). | Golder Associates prepared a Geotechnical assessment of the Parwan Lava Cave on behalf of the VPA.<br>The cave is 8 to 10m below level of land surface, is important for the occurrence of a newly described mineral and is of geological heritage significance.<br>The key recommendation is a 10-meter buffer for any development or works, as a 'cave protection zone'. Activities causing vibration to the ground may require a larger buffer. Within the buffer, any development is to be assessed on impact to the cave. Voids were also found which may also be found in the PSP. |
| Drainage for Merrimu PSP by Melbourne Water – in progress | Melbourne Water is currently undertaking a drainage plan for Merrimu PSP. This is particularly important as Merrimu PSP has sodic soils present, which are highly erosive. These sodic soils are present in the escarpments between the Merrimu PSP plateau and Bacchus Marsh and could be highly problematic if stormwater runoff reaches them. The current drainage plan is looking at infiltration and ponds to capture stormwater locally. These plans can be seen below. |

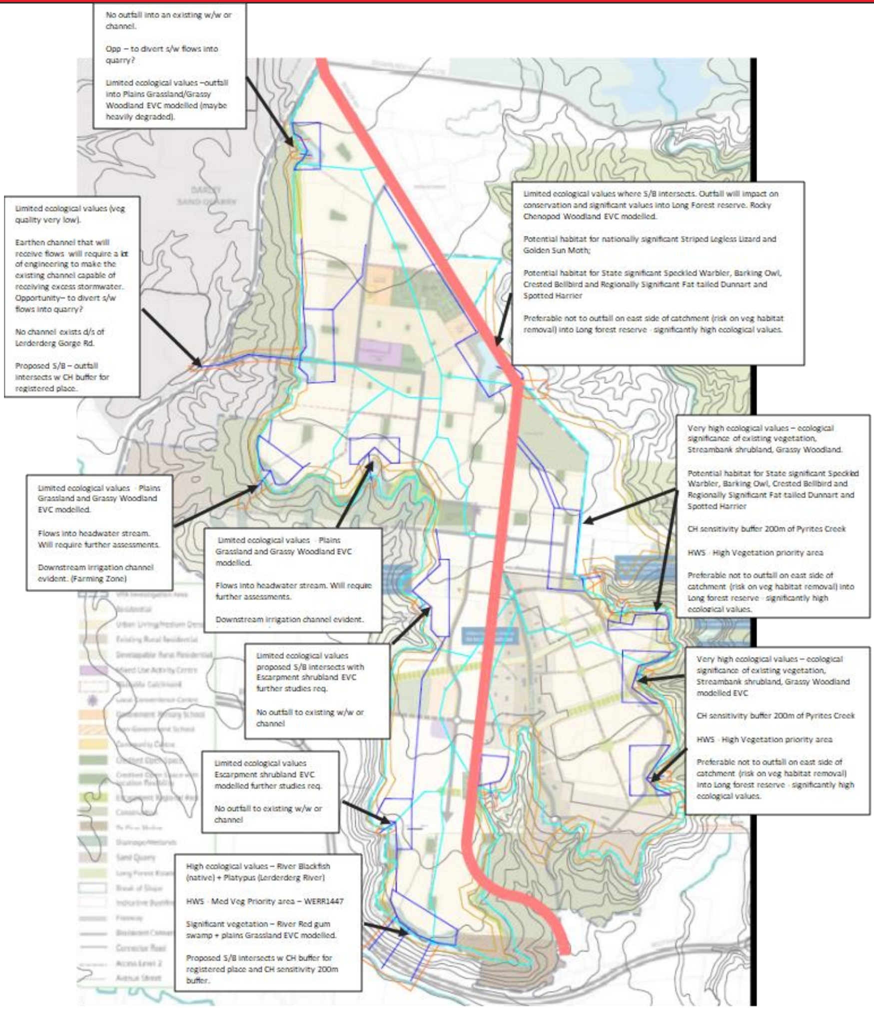
<table>
<tr><th>Name and year of document or workshop</th><th>Summary and key points</th></tr>
<tr><td></td><td>


Figure 9-2 Current Melbourne Water drainage plans for Merrimu PSP
</td></tr>
<tr><td>Recycled water network modelling by Greater Western Water – in progress</td><td>Greater Western Water is currently undertaking modelling for recycled water and stormwater across their servicing area, in order to assess the existing uses, demands, supply and optimise recycled water reuse. This is of particular importance as the BMID and Werribee Irrigation District (WID) will continue to grow and Greater Western Water is looking for a transition plan for both irrigation districts to recycled water.</td></tr>
<tr><td>Merrimu Precinct Structure Plan, Bacchus Marsh – High Level Utility Servicing and Infrastructure Assessment</td><td>Creo Consultants were engaged to undertake a high-level utilities servicing assessment to identify current services and infrastructure capacity issues within the Merrimu precinct.<br><br>Recommendations for potable and non-potable water are listed below.<br><br>Potable water<ul><li>The existing elevated tank in Dodemaide Circuit can be used as an interim potable water supply for Merrimu Precinct.</li><li>Western Water is responsible for funding trunk infrastructure and shared assets.</li></ul>Non-potable water<ul><li>Class A recycled water is currently not available.</li><li>BMA/VPA need to determine from Western Water if the irrigation scheme for the provision of Class C recycled water to Parwan-Balliang is the preferred strategy in lieu of Class A to the Merrimu Precinct.</li></ul></td></tr>
<tr><td>Sodic/ dispersive Soils Peer Review and Assessment Merrimu Precinct (WSP, 2022)</td><td>An assessment was undertaken to provide specialist services relating to a preliminary, desk-based, sodic/dispersive soils risk assessment at the Merrimu Precinct, at Merrimu, Victoria. This built on the previous report undertaken in 2020.</td></tr>
</table>

| Name and year of document or workshop | Summary and key points |
|---|---|
| | A large number of assessments have been completed for the Merrimu precinct, focussing on geotechnical constraints, extent of sodic and dispersive soils, impacts of development on stormwater and options for managing discharge to within likely constraints (flow volumes). The work completed identified:<br><br>— Erosion risks associated with the presence of sodic and dispersive soils (particularly of the Werribee formation), gully erosion (existing and potential impact resulting from development) and thin topsoils.<br><br>— Erosion risks were particularly associated with stormwater discharge and steep slopes along the escarpment, and that stringent controls would be required to control risk posed by the development.<br><br>An assessment was undertaken and further works are recommended based on the findings of this assessment, which will further inform the risk profile at the Precinct and enable appropriate control of planning/design of infrastructure to meet the objectives of the Precinct Planning process underway.<br><br>The recommendation relevant for this study includes:<br><br>1. Precinct scale Erosion risk plan: A precinct scale plan which highlights areas of high risk, medium risk and low risk in relation to erosion potential, which will inform strategic and statutory controls. The map should be developed based on agreed buffers from edge of plateau, location of existing gullies, known/inferred mapping of Werribee formation geology, and consideration of slope of land.<br><br>2. Precinct scale erosion controls: The erosion control component of the precinct structure plan (PSP) should include the following precinct scale considerations:<br><br>— Waterway and gully management: Implemented at the statutory level by applying an environmental overlay (or equivalent) to require/encourage particular management in these areas (e.g. enforce riparian land management controls, minimise disturbance to native vegetation, etc.). At the strategic level, this land could be incorporated into the precinct to enable developer control over greenspace development/establishment.<br><br>— Topsoil and urban run-off management: To minimise the risks during and post construction, strategic controls may include implementing water sensitive urban design in the precinct, and statutory controls may include specifying conservative stormwater retention and discharge parameters to reduce impact to waterways to acceptable levels (as established by others).<br><br>— Greenspace and buffer zones: The strategic implementation of a green corridor along the escarpment has the dual benefit of improving land management along the highest risk part of the precinct and preventing the construction of housing too close to the edge of the plateau.<br><br>3. Development or Lot scale erosion controls: To control erosion risk during and post development, the PSP may specify strategic controls for development, or require proponents to demonstrate appropriate controls are in place as part of the planning application process (statutory conditions). Strategic controls may include staging release of development and consideration of development that is sympathetic to the landform (as may be applicable in particular areas), and Statutory conditions may include a requirement for an erosion control management plan addressing risks and providing best-practice mitigations and which has been endorsed by a suitably qualified professional (e.g. a certified professional in erosion and sediment control or soil science), requirement for intrusive (physical) soil investigations where constructions are deemed medium to high risk (e.g. along the escarpment, steep slopes, or where infrastructure is likely to be placed within the Werribee formation) to confirm soil conditions and erosion risk (driven by dispersivity), and a general condition for a minimum thickness of topsoil to be retained or placed in exposed soil areas (nature strips, yards, parks, etc.) to provide a suitable depth of growing media to support vegetation growth and cover. |

The following studies have also been undertaken however were not provided or have not been reviewed as part of this study:

- Preliminary land use budgets for the PSP areas
- Land capability assessment by SMEC

- Water innovation ideas– work currently underway by Melbourne Water and Greater Western Water
- Priority wetland assessments by DEECA for Parwan Employment PSP
- Planning for Green Wedge and Agriculture is a study currently in progress by DEECA

# Appendix C

## Stakeholder Interviews

Arup undertook stakeholder interviews in December 2022 with the following organisations to seek updates on IWM options and actions arising from the Bacchus Marsh IWM Strategy (2021):

- Melbourne Water
- Greater Western Water (and Colac Consulting regarding the Werribee system reconfiguration)
- Moorabool Council
- DEECA

Key findings from the interviews, that influence the options and their development, are outlined below.

| Stakeholder | Summary and key points |
|---|---|
| Melbourne Water | • Melbourne Water is currently undertaking drainage plans for Merrimu PSP. Due to the difficulty in removing water from the escarpment, options for infiltration (combined with local ponds) are being investigated. MUSIC models have been set up and Melbourne Water are awaiting groundwater data.<br>• Outfalls have been investigated. Outfalls towards the eastern side would be a high risk as there is a conservation area, impacting on ecological and cultural heritage values. Outfalls towards the southwest could impact an area with significant environmental and cultural values, including the presence of river blackfish and platypus.<br>• Stormwater harvesting is an option, however it's important that downstream environments are protected.<br>• Parwan Station and Parwan Employment areas are less challenging than Merrimu. It has a deeper basalt covering with an underlying Werribee formation.<br>• Regarding Parwan Station PSP, there are no flow paths off of it. There are all piped flows down to the Werribee River or Parwan Creek. There is an option to outfall at the confluence of the Parwan Creek and Melton Reservoir<br>• Infiltration, wetlands and depressions have not been investigated at Parwan Station.<br>• Bingham Swamp is a high priority and should be retained. There is no clear guidance from an ecological perspective. |
| Greater Western Water (supplemented with an additional interview with Colac Consulting concerning the Werribee System Reconfiguration) | • Greater Western Water advised that they are currently undertaking detailed analysis and modelling to investigate where recycled water priorities are and what the plan is for recycled water in their service area.<br>• The reconfiguration of the Werribee water system, and the optimal plan for recycled water supply across the region is currently being modelled by Greater Western Water. The options that could be considered include:<br>  ○ Supplying BMID from the Bacchus Marsh Recycled Water Plant (Class A recycled water).<br>  ○ Supplying the Werribee Irrigation District (WID) with wastewater from Parwan via the wider WIN network (though an alternative connection from Western Treatment Plant is also being tested) (Class B recycled water)<br>  ○ Supplying the PSPs (Class A recycled water)<br>  ○ Supplying open space irrigation throughout the PSPs (Class B recycled water)<br>• An interview was also undertaken with Colac Consulting who is undertaking a modelling project for Greater Western Water, covering their sewer and recycled water infrastructure and optimising the recycled water network across the Werribee catchment. This includes looking at a transition plan for BMID and WID to recycled water. |

| Stakeholder | Summary and key points |
|---|---|
| | • Stormwater harvesting was trialed from Toolern to Melton Reservoir. This illustrated that there was limited capacity at Melton and stormwater was spilling. Whilst there is an opportunity to pump harvested stormwater back into the Merrimu reservoir the capacity of Melton Reservoir is to be considered.<br>• Regarding potable supply, Merrimu Reservoir currently supplies Bacchus Marsh, however the existing WTP will exceed its capacity in 2035-2040. There are two options currently proposed for potable water supply. This includes:<br>  ○ Connecting the existing Pykes Reservoir to Merrimu – Pykes Reservoir is currently used for environmental flows and irrigation. It has a large catchment however is a small online reservoir and weir, just used locally. An existing small connection exists however a large pipeline would be needed to connect the two.<br>  ○ Connecting to the Melbourne drinking water system (via Pykes) – connect the two reservoirs to the Melbourne drinking water system to supply the growth areas. |
| Moorabool Council | • Moorabool Council advised that Parwan Employment will comprise agribusiness, industry, commercial and maybe even hydrogen production. Therefore its desired to have a reliable water supply here. Class A recycled water would be beneficial.<br>• The Eastern Link could impact waterways in Parwan Employment and Parwan Station PSPs. Whilst IWM is supported, developers are hoping to get this approved first.<br>• It was noted that east of Merrimu is long forest which is significant conservation park area. Any solutions should be mindful of water quality impacting area.<br>• Council noted the difficulty with sodic soil.<br>• Council noted their support of stormwater harvesting at a local scale and supportive of alternative supplies for open space irrigation.<br>• Currently the strategy for the PSPs and the direction is not yet fixed. Council are keen to find a solution that balances a climate resilient supply, costs and operational and maintenance requirements.<br>• A Landscape Design Manual has been adopted which includes street trees.<br>• Regarding PSPs, Council's objective are regarding place making and greening, to bring basins into the centre and link stormwater harvesting to end uses.<br>• Whilst rainwater tanks are supported there is also difficulty in implementation. Council is investigating how to best implement rainwater tanks. |
| DEECA | • It was highlighted in this meeting that all options are on the table currently. DEECA are not currently undertaking the discussed investigations however are engaged and involved in them.<br>• DEECA advised that a non-potable (purple pipe) network would be beneficial for DEECA and Greater Western Water.<br>• Greater Western Water are in the process of undertaking a sewer and recycled water mass balance for this whole region (as described above).<br>• There is work underway looking at a stormwater harvesting scheme for Melton Reservoir. Possible options would be for this source to supply environmental flows and eventually water transfer to Merrimu for indirect potable reuse.<br>• One key challenge raised was funding of IWM projects with multiple monetizable and non-monetizable benefits and beneficiaries. |

# Appendix D

## Workshop outcomes

**IWM constraints, drivers and opportunities identified from workshop**

| | Constraints | Drivers | Opportunities |
|---|---|---|---|
| **Regional** | • Presence of sodic soils will impact options for infiltration<br>• Escarpment in the area<br>• Declining inflows into Merrimu Reservoir<br>• Storage constraints at Pykes Reservoir<br>• Several small natural wetlands throughout Parwan Employment<br>• Werribee, Lerderderg and Parwan waterways have Growling Grass Frogs, platypus, and significant fish species present | • Region supports BMID is key to Melbourne's food industry<br>• Werribee and Lederderg River, and Parwan Creek experience significant environmental flow shortfalls and would benefit from increased baseflows<br>• Returning water to the environment and/or Traditional Owners<br>• Increased flow reduction target from the EPA stormwater guidelines (from 35% to 50%) | • Supplying Merrimu Reservoir with alternative flows<br>• Entitlement exchanges between surface water and environment or Traditional Owners<br>• Protecting and maintaining ecological values by controlling or providing additional flows (if required)<br>• Increased infiltration and harvesting opportunities |
| **Merrimu** | • Presence of sodic soils will impact options for infiltration<br>• Standard drainage infrastructure will be expensive to implement due to unstable escarpments and sodic soils<br>• Elevated terrain and steep unstable escarpments constrain pipe alignment to or from river flats<br>• A recycled water pipe alignment will need to cross a highway and two river crossings<br>• Sewer alignment for Merrimu is unknown<br>• All discharges from Merrimu will go to a retarding basin before exiting at an outfall | • WIN alignment will cross the PSP | • Potential offtakes from WIN alignment (e.g., irrigation for open space)<br>• Potential to utilise a new road network as a conduit for a recycled water network |
| **Parwan Station** | • Steep unstable escarpments constrain pipe alignments<br>• Location of Parwan Station is still unknown. Conversations with Department of Transport (DoT) suggest a station may not be implemented | • Close to Bacchus Marsh<br>• Greater Western Water project exploring alternative water sources for open spaces<br>• Supporting business cases such as the Werribee System Reconfiguration project<br>• Located in between Bacchus Marsh | • Opportunity to supply Bacchus Marsh with stormwater, replacing supply from Werribee River<br>• Diverting recycled water from any potential alignment between BMTP and BMID |

| | | | |
|---|---|---|---|
| | | Treatment Plant (BMTP) and BMID | |
| **Parwan Employment** | • Industrial growth and water demand unknown<br>• Area of imperviousness and hence, volume of stormwater runoff is unknown<br>• Natural wetlands in addition to Bingham Swamp require further advice on values and retention<br>• Some areas are distant from waterways, making stormwater discharge difficult<br>• Bingham Swamp has high ecological value<br>• Potable water network will be expensive to implement due to crossing rivers and a trainline<br>• Infiltration will not be viable around the lava cave | • High non-potable demand in Parwan employment to maximise<br>• Close proximity to Parwan Treatment Plant which can produce Class A water recycled water<br>• High water demands from agribusinesses | • Allocate treated stormwater to the natural wetlands and Bingham Swamp for ecological outcomes<br>• Supplying the zone with Class A recycled water from Parwan Treatment Plant<br>• Reuse more stormwater onsite as discharge locations may be distant and expensive to implement<br>• Large rooftop surfaces to harvest rainwater |

# Appendix E

## Stakeholder Workshop Miro Board