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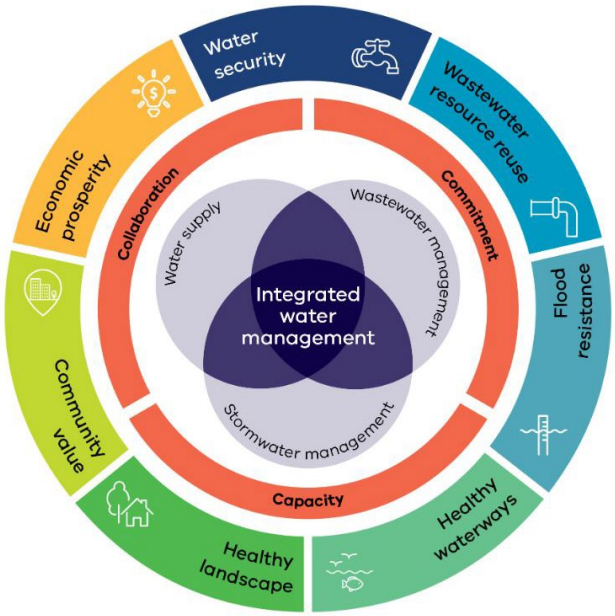
Department of Transport and Planning

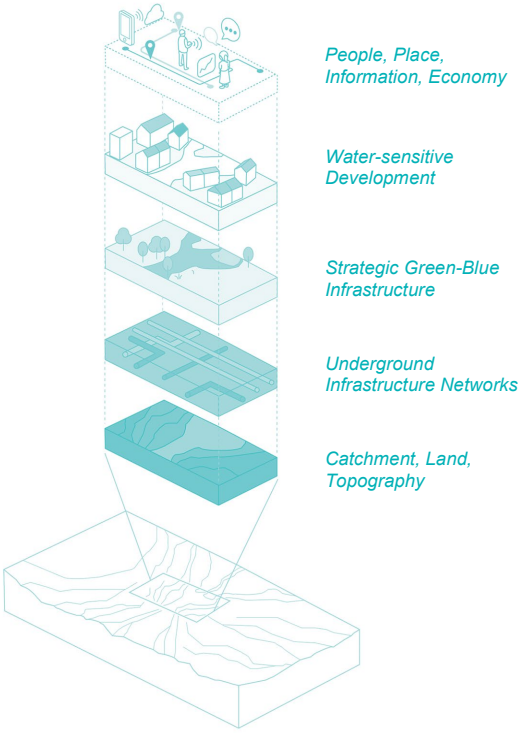
Merrifield North precinct

Integrated Water Management Plan

Reference: 03

03 | 30 October 2026





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Job number 314813-00

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Document Verification

Project title	Merrifield North precinct
Document title	Integrated Water Management Plan
Job number	314813-00
Document ref	03
File reference	

Revision	Date				
01	01/05/2026	**Description**	Draft for comment		
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02	10/06/2026	**Filename**	Final Report		
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03	30/10/2026	**Filename**	Final Report		
		Description			
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Issue Document Verification with Document ☑

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Acknowledgement of Country

Arup acknowledges the Traditional Owners of the land on which we work, live and play. We pay our respects to Elders past and present and hold deep respect for the wisdom and diversity of the Wurundjeri-woi Wurrung people of the Kulin Nation who have been custodians of the Kalkallo Creek sub-catchment, Merri Creek and the Birrarung River for thousands of years.



Executive summary

Arup was engaged by the Department of Transport and Planning (DTP) to assess Integrated Water Management (IWM) opportunities for the Merrifield North Precinct Structure Plan (PSP). This report summarises the IWM opportunities at Merrifield North and recommends a portfolio of IWM solutions for this precinct that can be supported and enabled through the PSP. The objective of this IWM assessment is to provide concept-level guidance to the DTP and stakeholders which can be incorporated into the development of the PSP and to subsequent development plans.

Site Context

Merrifield North precinct is approximately 970.4 ha, and the focus for future land use is on employment uses, most likely with an industrial and commercial focus. The precinct spans both Hume City Council and Mitchell Shire Council areas, and is predominantly surrounded by rural land, with existing residential development to the south-west and north of the precinct.

The precinct lies within the Upper Merri Creek sub-catchment of the Yarra River catchment and is characterised by modified waterways, including straightened agricultural drains and a channelised section of Kalkallo Creek draining to the Kalkallo Retarding Basin. A pre-European wetland is thought to have been present in the area, although its original extent and hydrological connections are uncertain. The Kalkallo Creek sub-catchment is identified as a stormwater priority area in Melbourne Water's (MW) Healthy Waterway Strategy, with runoff reduction targets applying to future urban development. The Kalkallo Retarding Basin (RB) performs a critical regional flood management role and has been identified as a strategic location for stormwater treatment and potential harvesting.

The south-eastern corner of the precinct contains significant remnant native vegetation and also supports habitat for several threatened species, including the Golden Sun Moth, Growling Grass Frog and Victorian Grassland Earless Dragon. Aboriginal cultural heritage is concentrated along Kalkallo Creek, with a high density of recorded Aboriginal Cultural Heritage Places within the marram baba Merri Creek Regional Parklands. Flood and stormwater management is guided by the Kalkallo Creek Developer Services Scheme (DSS), currently under review by Melbourne Water. While potable water, recycled water and sewer services are to be delivered by Yarra Valley Water. Collectively, these factors highlight the need for future development to carefully integrate waterway health, flood management, environmental values, cultural heritage and servicing infrastructure within a highly modified catchment setting.

Possible IWM portfolios

Three IWM Portfolios which combine different IWM interventions were examined:

- **Portfolio 1 Catchment Focus: best practice:** Adopts a catchment scale approach to meeting the Healthy Waterway Strategy (HWS) stormwater harvesting targets. Utilising stormwater harvesting at Kalkallo RB for regional use. Delivered along advanced waterway remediation to enhance waterway health and deliver stabilisation works.
- **Portfolio 2 Development Focus: good practice:** Focuses on measures that reflect established good practice for new development within an employment context, while also considering catchment considerations and servicing approaches already being delivered across the broader sub-catchment. Infrastructure solutions include recycled water supply for open space irrigation and industrial uses, advanced water-efficient appliances and passively irrigated street trees.
- **Portfolio 3 Development Focus: best practice:** Looks to represent a best-practice approach that seeks to meet the meeting the HWS stormwater runoff reduction targets through a localised and place-based response within the precinct. Infrastructure solutions included are rainwater tanks for non-potable industrial use, permeable pavements, localised stormwater harvesting through precinct wetlands, enhanced drainage corridors and spongy riparian zones adjacent to waterways.

Comparison of scenarios

Each portfolio offers different advantages but doesn't deliver IWM outcomes in the round. For example, portfolio 1 uses large scale interventions aimed at reducing stormwater runoff that also contribute to water security for the region, but does not contribute to community value due to the focus on large-scale interventions managed in the public realm (in the RB and creek corridor) rather than within the precinct. The development focussed portfolios, 2 and 3, offer more localised benefits, contributing to local alternative water use, greening and source control of stormwater.

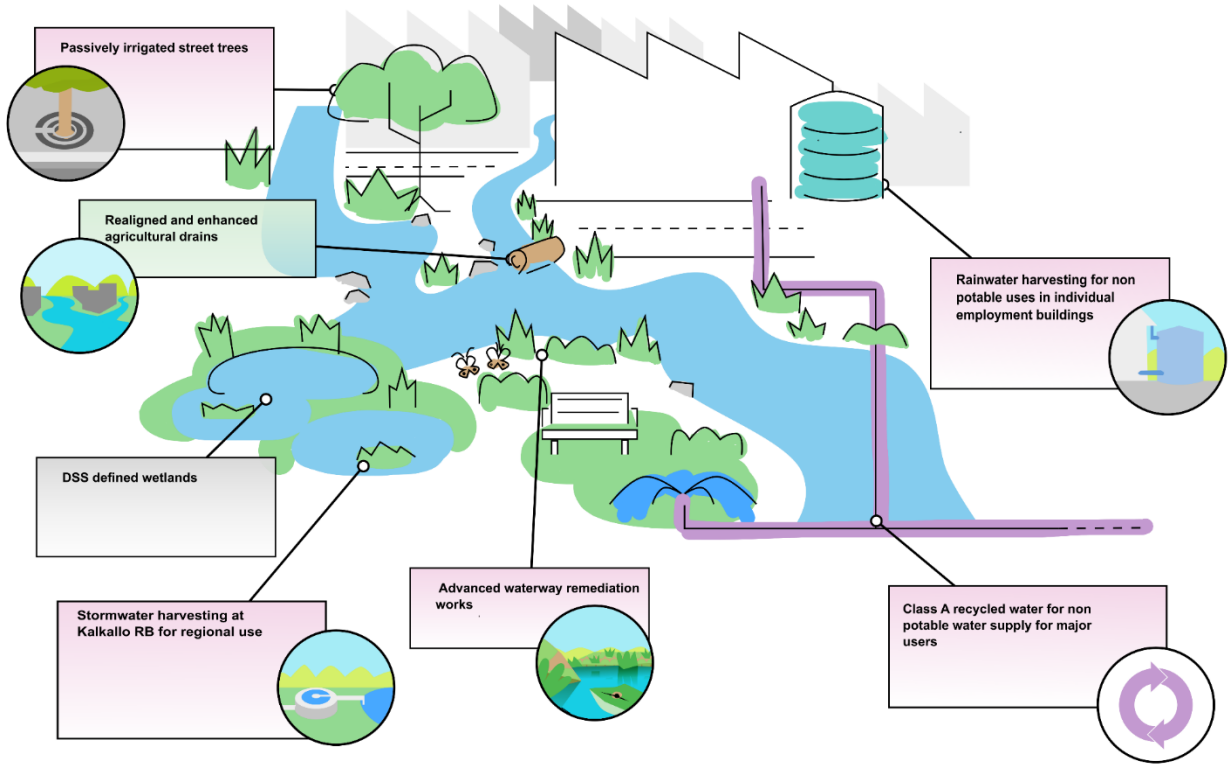


Recommendations

The preferred portfolio of IWM initiatives for the Merrifield North precinct are:

- Enabling **stormwater harvesting from the Kalkallo RB for regional use** to enable catchment scale objectives to be delivered and the Healthy Waterways Strategy target for stormwater harvesting to be achieved.
- **Advanced waterway remediation of Kalkallo Creek**, creating a biodiverse and high value landscape corridor.
- **Class A recycled water for non-potable supply for major users** within the precinct (which could for example include data centres or industrial processes with significant demand for non-potable water). This could open pathways for providing climate resilient alternative supply for council open space as well as marram baba regional parkland.
- **Lot scale rainwater tanks** should be included for employment buildings to provide for toilet flushing, irrigation and appropriate wash down activities. This could be in combination with or instead of recycled water, pending on demand availability and the viability of recycled water. Rainwater harvesting will assist in providing local runoff reduction at source to reduce downstream impacts in a sodic soil environment. The use of rainwater harvesting aligns with council priorities for rainwater tank use in employment areas.[1] Depending on the types of employment developments that come forward, the use of a local micro-grid for rainwater harvesting which matches supply from large roofs with demand from large users could be delivered but would require further investigation with development proponents.
- Lot and street-scale opportunities where feasible to support greening and amenity while reducing runoff in a sodic soil-friendly manner (a council priority[10]), a key focus supported by Council is the inclusion of **passively irrigated trees** and **opportunities to embed increased permeability in developments and natural infiltration areas in riparian zones should also be encouraged**. These initiatives also support WWCHAC objectives to keep water on Country.
- **Enhancement of local waterways and agricultural drains** and utilising these as green-blue corridors for enhanced recreation, amenity and habitat value.

[1] Communicated during the Merrifield North IWM Plan check in with Mitchell Shire Council and Hume City Council staff on the 17th April 2026



Summary of the preferred IWM initiatives for Merrifield North precinct

The recommendations below are proposed for implementation of this IWM plan through the PSP development process, noting that several investigations are still ongoing.

IWM Solution	Recommendation	Responsibility (Lead, Partner)	PSP Implementation	Timing
All IWM solutions	The Merrifield North PSP to reference the IWM Plan and require development applications to include IWM proposals in keeping with this plan	DTP	Inclusion of text, referencing IWM Plan, within the PSP.	Prior to PSP finalisation
All IWM solutions	This IWM Plan recommendations be reviewed upon key decisions being made. The plan should continue to be refined as decisions and investment pathways are identified.	All parties	Ensure reference to IWM allows it to be updated.	Post PSP finalisation
Stormwater harvesting at Kalkallo RB for regional use	The PSP make allowance for completion of investigations and decisions regarding the extent, function and objectives for the Kalkallo RB, as recommended by the Kalkallo Creek Sub-Catchment IWM Plan.	DTP: PSP timing MW: completion of investigations	Confirmation of Kalkallo retarding basin extent	Prior to PSP finalisation
	Ensure the PSP makes land take allowances for core infrastructure required for the Kalkallo RB regional stormwater harvesting scheme. While wetlands will be included in the drainage scheme, the regional scheme will require space for other assets including additional storage, stormwater treatment and the stormwater transfer pipe connecting the scheme to Bald Hill storage tanks.	MW & YVW: assets and their land take required. Where engagement with WWCHAC strongly recommended DTP: inclusion in the PSP	Confirmation of Kalkallo retarding basin extent. Allowance for infrastructure and easement for connection to Bald Hill.	Prior to PSP finalisation if decision timing aligns with PSP Delivery. Or post PSP finalisation, by assigning the full extent of the Kalkallo RB as an 'investigation area' within the PSP until the decision is made
Advanced waterway remediation works	Ensure Kalkallo Creek waterway corridor land take accounts for MW decisions made in relation to advanced waterway remediation works, including stabilisation and riparian enhancement to address sodic soil environment.	MW (via the DSS), DTP	Decision to be made as part of DSS development, which will influence PSP land allocations.	Prior to PSP finalisation
Rainwater harvesting for non-potable supply	Uptake of rainwater tanks should be encouraged with the aim of supporting local alternative water use and providing local source control of stormwater runoff from commercial and industrial buildings.	DTP: make allowance within the PSP by referencing the IWM Plan	Sets lot scale guidance and requirements for developers for installation of rainwater tanks	Prior to PSP finalisation

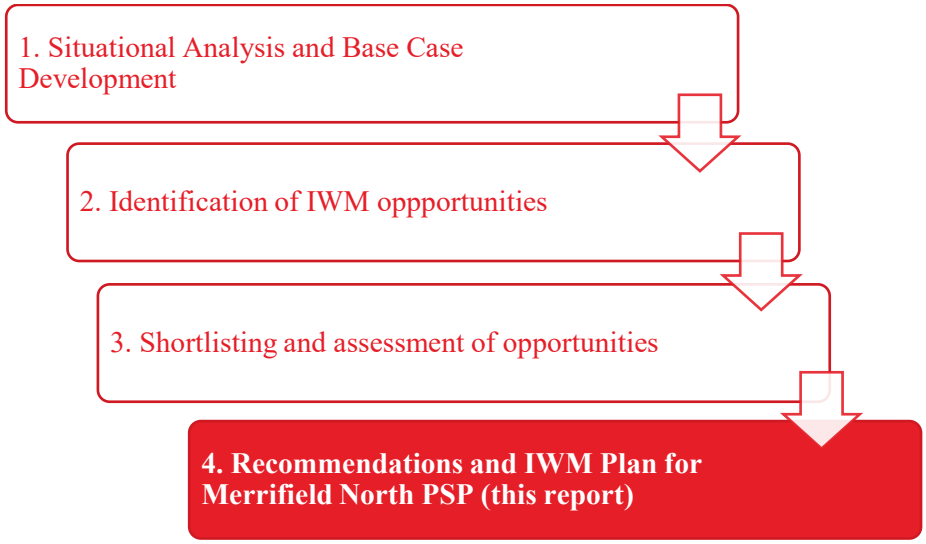
IWM Solution	Recommendation	Responsibility (Lead, Partner)	PSP Implementation	Timing
Class A recycled water for non-potable supply	The PSP should include enabling guidance that support the connection of large water users to the recycled water supply network. Where this is coordinated and approved by YVW. Engagement with councils on if or when recycled water is preferenced versus rainwater tanks is recommended.	DTP: Make allowance within the PSP by referencing the IWM Plan YVW: work with DTP and councils to finalise recycled water offering for large demand users	Sets lot scale guidance and requirements for developers, by outlining the opportunity to connect to the recycled water network for large water users, and rainwater tanks otherwise.	Prior to PSP finalisation
Permeable pavement in employment car parks Passively irrigated street trees Spongy riparian zones	Include guidance in the PSP to encourage the inclusion of lot and street-scale IWM opportunities where feasible to support greening and amenity while reducing runoff in a sodic soil-friendly manner, including passively irrigated trees and increased permeable car parking areas and natural infiltration areas in riparian zones.	DTP: make allowance within the PSP by referencing the IWM Plan	Sets lot and street scale guidance for developers for installation of permeable carparks, passively irrigated street trees and natural infiltration areas.	Prior to PSP finalisation
Realigned & enhanced agricultural drains	Realignment and enhancement of existing agricultural drains, including introduction of ephemeral sections to support key ecosystems historically present in the catchment. PSP planning and decision making for active transport corridors connect and enhance blue green corridors (e.g. through agricultural drains enhancement) to enable walking and cycling pathways through the precinct and connecting to neighbouring residential precincts.	DTP, Councils, MW, WWCHAC	Informs transport corridor planning within the PSP and potentially waterway improvement planning (via the DSS). Informing developable land area.	Prior to PSP finalisation
Drainage scheme wetlands and retarding basin	Explore the potential to introduce or restore ephemeral landscapes to support key ecosystems historically present in the catchment.	MW (via the DSS), DTP, WWCHAC, Councils	Informs design and planning of the retarding basin area and drainage assets	Prior to PSP finalisation

1. Introduction

Arup was engaged by the Department of Transport and Planning (DTP) to assess Integrated Water Management (IWM) opportunities for the Merrifield North Precinct Structure Plan (PSP). Merrifield North precinct is a greenfield area located in Melbourne's northern growth corridor, planned for primarily employment land uses in the future.

This report summarises the IWM opportunities at Merrifield North and recommends a portfolio of IWM solutions for this precinct that can be supported and enabled through the PSP. The objective of this IWM assessment is to provide concept-level guidance to the DTP and stakeholders which can be incorporated into the development of the PSP and to subsequent development plans.

A Situational Analysis and Base Case report was prepared, which summarises the site context, constraints, and base water case. This was completed before any IWM Opportunities were identified. This IWM Plan report should be read in conjunction with the Situational Analysis and Base Case report (Appendix A).



Merrifield IWM Plan development process

1.1 Structure of this plan

The plan is set out in the following sections:

- Section 2 & Section 3 of this report provides a high-level summary of the Situational Analysis and Base Case Report.
- Section 4 summarises the IWM Vision for Merrifield North used to inform desired outcomes for this precinct and propose IWM solutions.
- Section 5 lists the IWM opportunities identified and explains how they were refined for the Merrifield North precinct.
- Section 6 discusses the assessment criteria used to assess the options and summarises the results of the analysis.
- Section 7 and Section 8 propose potential portfolios of IWM solutions for Merrifield North and proposes a recommended way forward.

- Finally, Section 9 concludes this study and provides recommendations for implementation.

1.2 Key Stakeholders

The key stakeholders for IWM in Merrifield North are summarised in Table 1-1. It's important to note that although the water cycle is interconnected, and an IWM approach recognises the interrelationships between different sources of water, there are various organisations involved in water management who each hold differing responsibilities.

Table 1-1 Key Stakeholders

Stakeholder	Responsibility	Relevance
Department of Transport and Planning (DTP) *Now encompassing the Victorian Planning Authority (VPA)*	Responsible for development of the precinct structure plan. Undertake strategic planning and coordinated infrastructure.	The DTP will deliver a precinct structure plan for Merrifield North, of which an IWM Plan will feed into.
Wurundjeri Woi-Wurrung Cultural Heritage Aboriginal Corporation (WWCHAC)	Wurundjeri people are the traditional owners of the land where Merrifield North PSP is located.	The WWCHAC have input into the suitability of the expanded growth area, the cultural heritage within the site and parameters for development within the growth area.
Melbourne Water (MW)	Manage bulk water resources in the Melbourne region and distributes to suppliers including Yarra Valley Water (YVW). Responsible for major drainage assets, waterway and catchment management.	MW plan for assets (such as the Kalkallo RB) and are currently undertaking drainage modelling within this site. MW are also the responsible authority for floodplain and river health management. Kalkallo Creek flows through the precinct and the land surrounded the creek within the site is partially in a flood plain.
Yarra Valley Water (YVW)	Provides water supply and wastewater services to urban and commercial customers. Manages water and wastewater related infrastructure.	YVW is the responsible authority for supply of water, recycled water provisions and sewerage for the Merrifield North precinct area and is a key stakeholder for this study.
Hume City Council	Local government responsible for drainage assets, open space, community facilities and streets.	Council sets a vision for the municipality and will implement the PSP, managing drainage assets, open spaces and streets.
Mitchell Shire Council	Local government responsible for drainage assets, open space, community facilities and streets.	Council sets a vision for the municipality and will implement the PSP, managing drainage assets, open spaces and streets.
Department of Environment, Energy, and Climate Action (DEECA)	Responsible for defining standards for groundwater, catchments and waterways, as well as various matters related to environment, energy, and climate change.	DEECA oversee the various water corporations in Victoria and work closely with the Yarra Catchment IWM Forum to prioritise IWM initiatives in the area.
Major Road Projects Victoria	Authority responsible for planning major road assts and upgrades, before road assets are adopted by Department of Transport.	MRPV are investigating major road upgrades adjacent to the site and are responsible for delivering IWM initiatives for road infrastructure which could potentially interact with those in Merrifield North.

2. Summary of Situational Analysis

This section summarises the key findings from the Situational Analysis Report. It is recommended that the Situational Analysis Report, prepared by Arup for the DTP (26 April 2026), is read in conjunction with this report. The report has been appended for convenience, in Appendix A.

2.1 Contextual analysis

Merrifield North precinct is approximately 970.4 ha, and the focus for future land use is on employment uses, most likely with an industrial and commercial focus. The precinct located within the Mickleham and Beveridge localities, spanning both Hume City Council and Mitchell Shire Council areas (Figure 2-1). The precinct is predominantly surrounded by rural land, with existing residential development to the east (Lockerbie PSP and Kalkallo township) and south-west (Merrifield West PSP), and the Beveridge South West precinct located to the north, for which planning has not yet been scheduled.

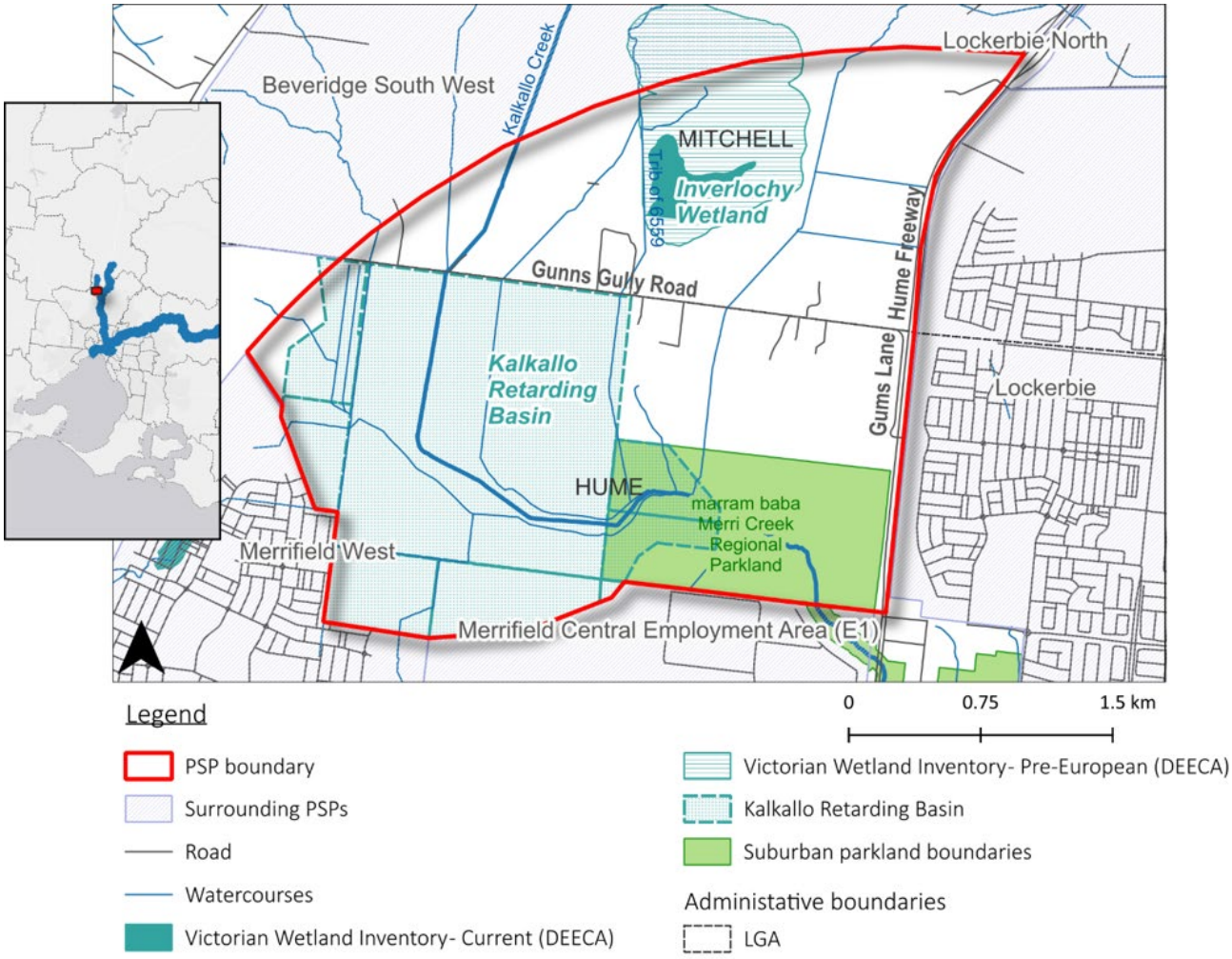


Figure 2-1 Merrifield North PSP overview

2.1.1 Catchment and waterways

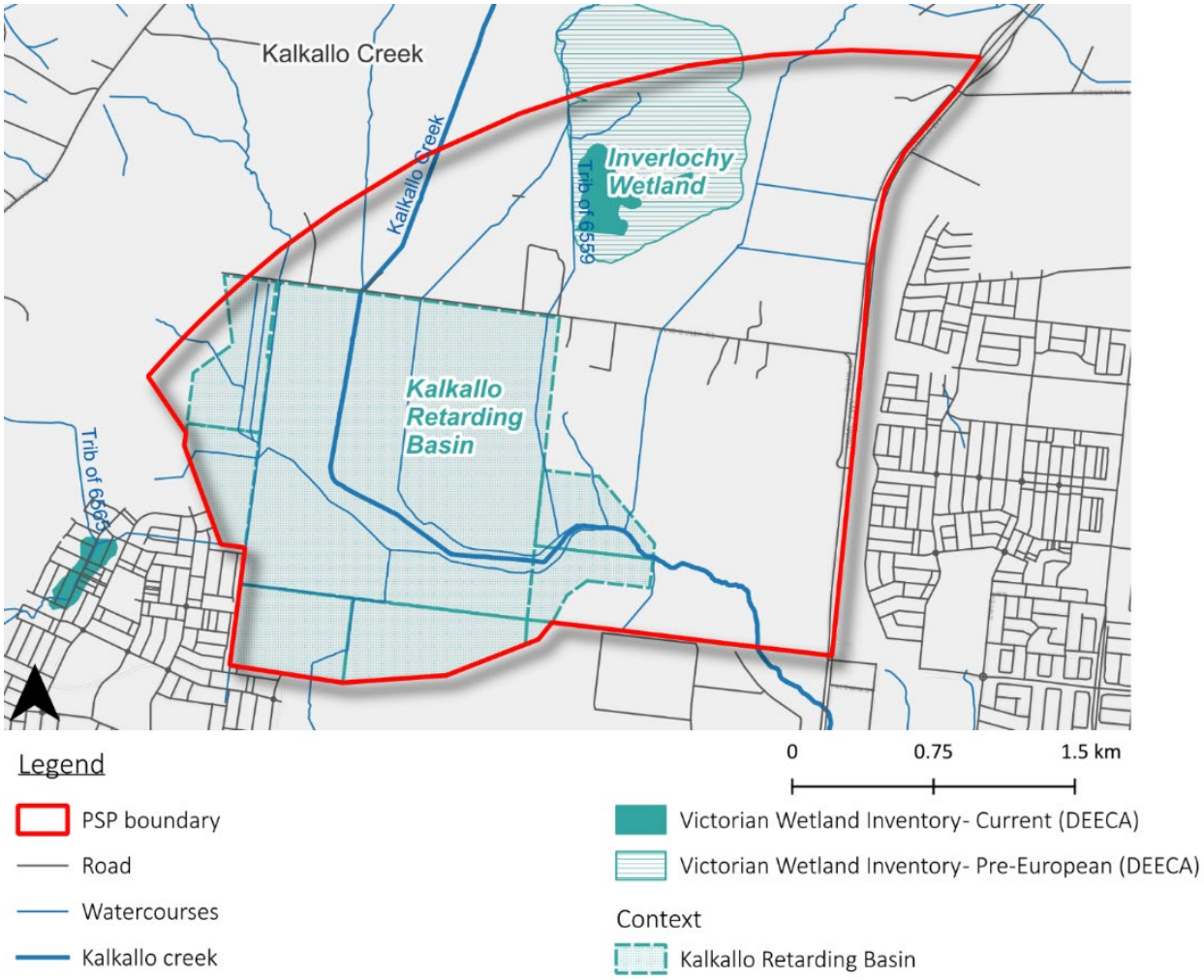
The Merrifield North precinct is relatively flat, with elevations generally between 230–240 mAHD, and steeper land in the east and north-east draining toward low points in the south-east where Kalkallo Creek exits the site. Soils present in the precinct require consideration for water management, with the presence of sodic soils which are highly dispersive and have the potential for erosion along waterway channels when soil layers are exposed.

The precinct sits within the Upper Merri Creek sub-catchment of the Yarra catchment. The entire area is within the Kalkallo Creek catchment, with Kalkallo Creek flowing through the precinct and converging to the Kalkallo Retarding Basin (Figure 2-2). Other waterways on the site are straightened agricultural drains which have been created to provide drainage and support existing farming use of the land. Inverlochy Wetland was a pre-European ephemeral wetland in the area, though the original extents and functionality remain uncertain but may have contained the current Kalkallo RB and pre-European wetland (Alluvium, 2024).

The Kalkallo Creek sub-catchment is designated as a 'stormwater priority area' in Melbourne Water's Healthy Waterway Strategy. Relevant performance objectives include:

- Identify and implement opportunities to reduce the key threat of flow stress on waterways by addressing causal factors such as water for domestic and stock use, climate change, diversions or urbanisation.
- For every hectare of new impervious area, harvest 4.2 ML/y (or 74%)
- For every hectare of new impervious area, infiltrate 1.1 ML/y (or 8%)

These targets for reduction of Mean Annual Runoff to support waterway health are recognised in the Urban Stormwater Management Guidance (EPA, 2021).



This map reflects acknowledgement of existing publicly available information only, it does not identify Inverlochy Wetland as a Biodiversity Conservation Area under the MSA, and therefore does not imply a conservation retention requirement. The drainage footprint will be determined through the DSS (not DEECA mapping), while cultural heritage will be identified through existing information via the ACHIA and CVA, with the PSP seeking to avoid precinct infrastructure in culturally sensitive areas where possible and permit applications addressing requirements under the Aboriginal Cultural Heritage Act through any CHMPs

Figure 2-2 Waterways within the Merrifield North PSP

Existing waterway condition is rated as very low to moderate, with degraded habitat, poor bank stability and straightened channels contributing to reduced ecological values, despite high amenity and recreation value. Groundwater levels are shallow across much of the precinct, generally less than 5 m below ground level, with saline groundwater and limited opportunities for infiltration.

The Kalkallo Retarding Basin, a 370 ha Melbourne Water asset within the precinct, plays a key flood management and drainage role and has been identified as a strategic location for stormwater management functions. Potential existing flooding is concentrated around Kalkallo Creek, its tributaries and the retarding basin, with modelling showing that while post-European channelisation has reduced inundation extent, it has increased peak flows compared to pre-European conditions.

2.1.2 Existing landscapes and land uses

The south-eastern corner of the precinct has significant areas of remnant native vegetation (Figure 2-3). The Environmental Vegetation Classification (EVC) for these areas is predominantly Plains Grasslands and Chenopod Shrublands however prior to land clearing for agriculture, the majority of the precinct would have consisted of wetlands. The eastern edge of the site also includes remnant Plains Woodlands and the outgoing section of Kalkallo Creek maintains Riparian Scrubs. All EVCs within the precinct are considered endangered. The precinct also provides habitat for threatened species such as the Golden Sun Moth, Growling Grass Frog and Victorian Grassland Earless Dragon.

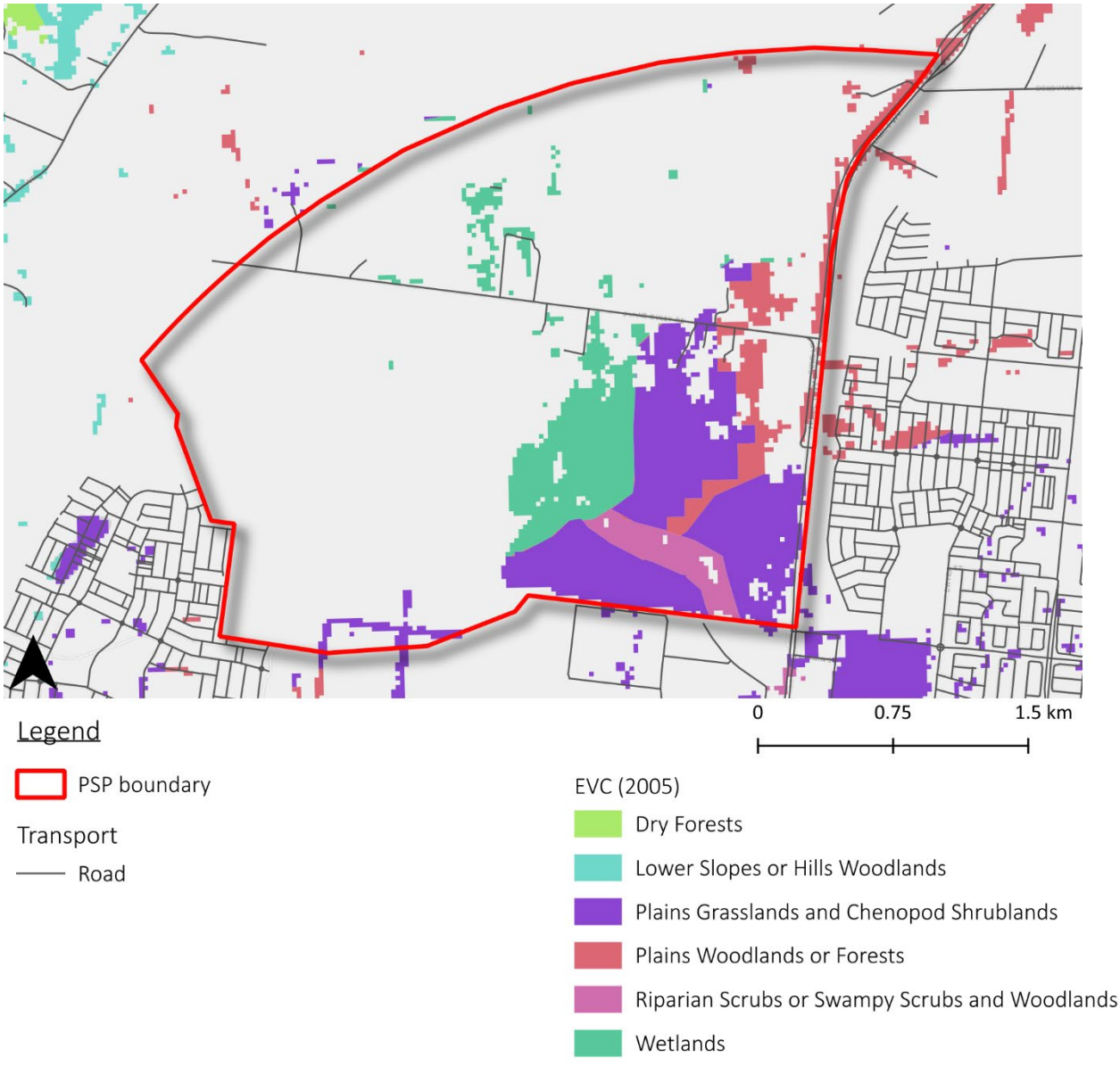


Figure 2-3 Modelled 2005 Ecological Vegetation Classes for Merrifield North PSP

As shown in Figure 2-4, Aboriginal cultural heritage sensitivity is concentrated along Kalkallo Creek, with a high density of Aboriginal Cultural Heritage Places identified within the marram baba Merri Creek Regional Parklands[2].

[2] *marram baba Merri Creek Regional Parklands Wurundjeri Woi-wurrung Cultural Values Position Statement.* Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation, 2023

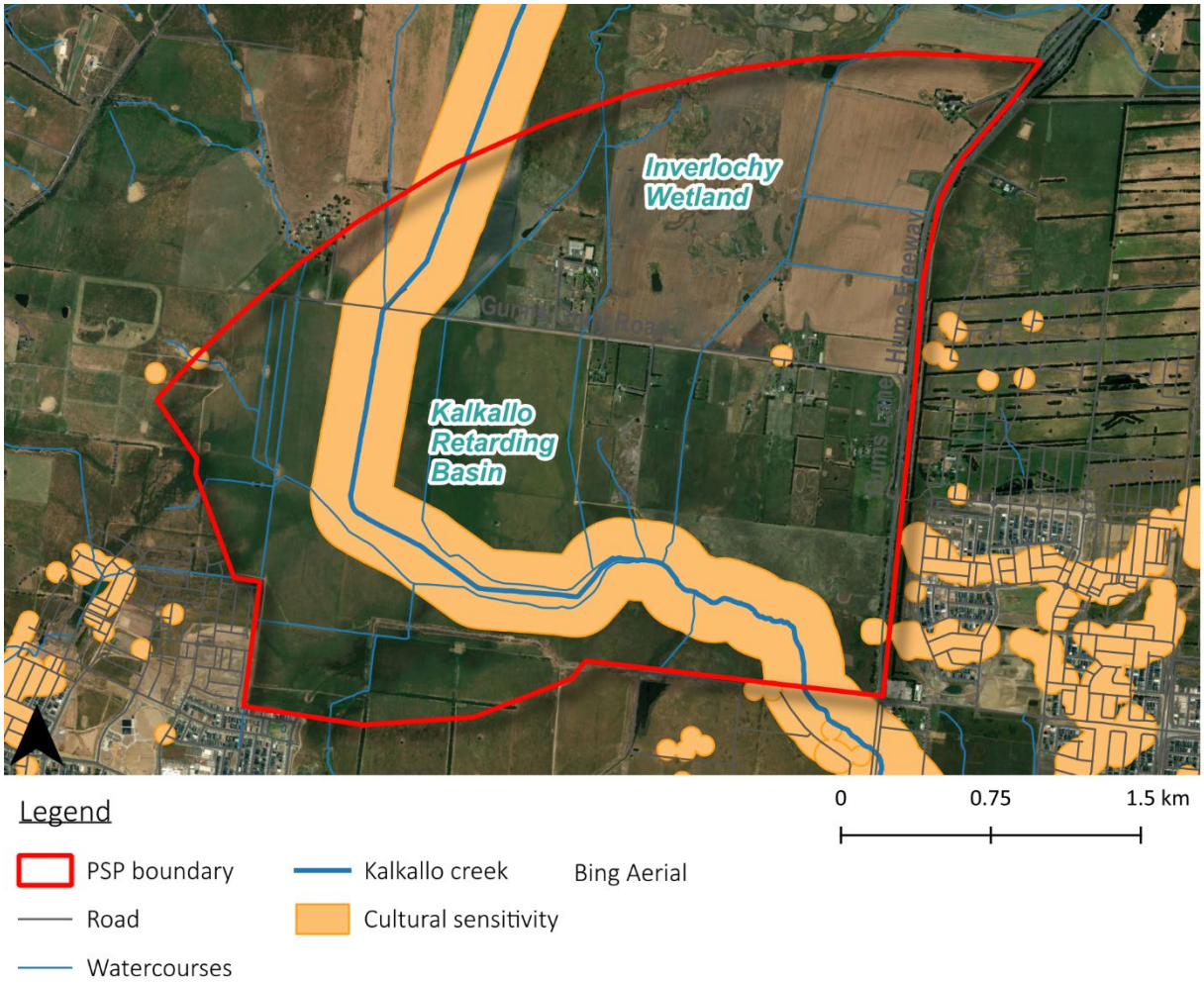


Figure 2-4 Cultural Sensitivity within and surrounding the Merrifield North PSP

The marram baba Merri Creek parklands is situated in the south east corner of the precinct. The parklands are part of the traditional Country of the Wurundjeri Woi-wurrung people, encompassing an area of 2,778 ha, including 126 ha within the Merrifield North precinct.

2.1.3 Planned water infrastructure

Merrifield North is part of the 6550 Kalkallo Creek Drainage Scheme (Figure 2-5), which currently utilises the Kalkallo Retarding Basin (RB) for flood management and stormwater treatment (with three wetlands planned within the RB). The drainage scheme (also referred to as the developer services scheme) is under review and amendment by Melbourne Water. Melbourne Water developer services team have been actively working on functional designs for stabilisation of Kalkallo Creek with the consideration of future urban development.

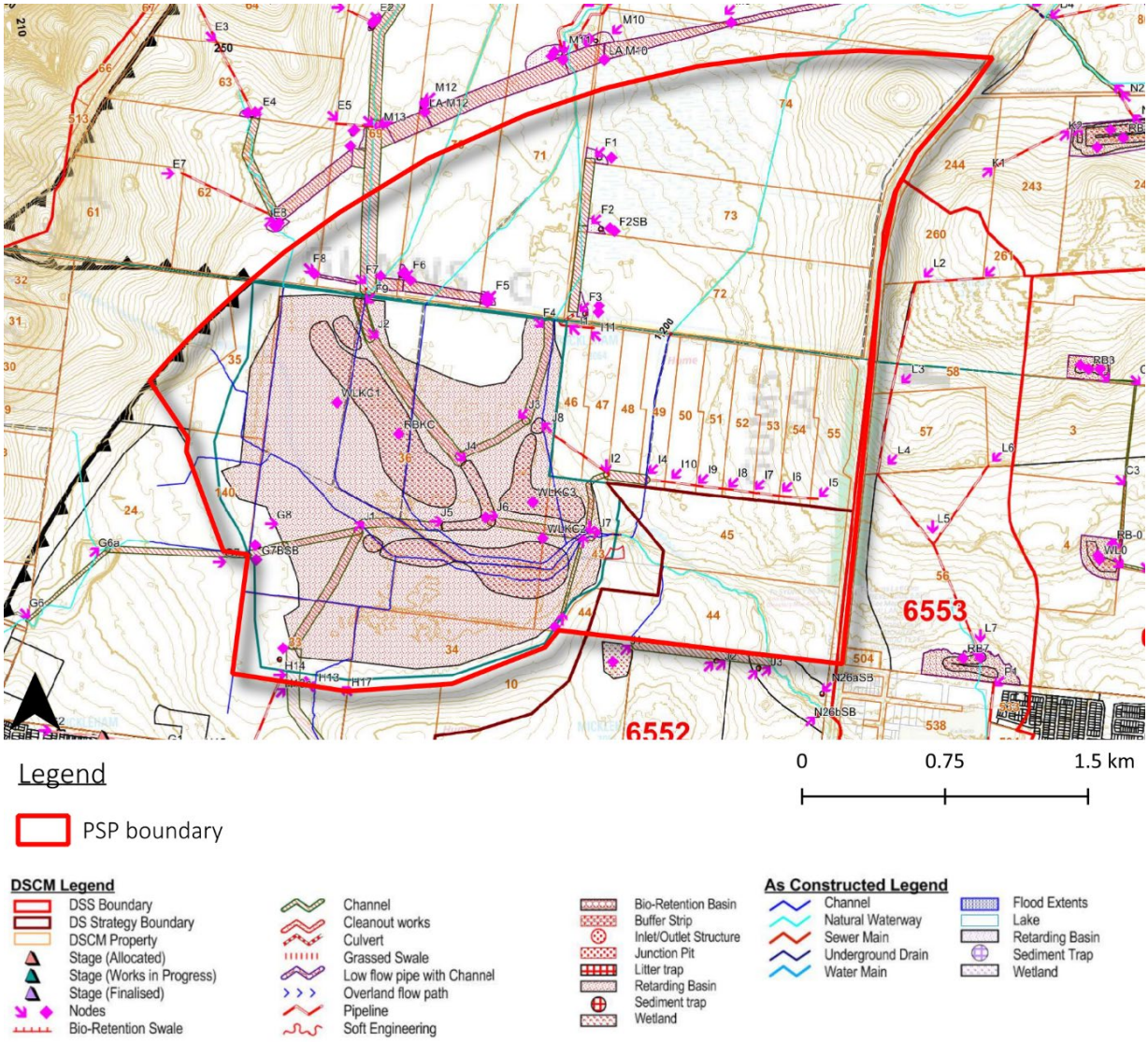


Figure 2-5 Current Drainage Scheme applying to Merrifield North PSP (being updated)

Existing stormwater drainage infrastructure within the precinct is minimal, with local drainage infrastructure to be constructed progressively with development and connected to the broader scheme. There is a 2250 mm reinforced concrete pipe linking the southern end of Kalkallo RB to Merrifield West and two smaller pipes connecting Kalkallo RB to several tributaries and other waterways (Figure 2-6).

Previous studies have identified the potential for stormwater harvesting from the wetlands within Kalkallo RB, and transfer of stormwater to Bald Hill for potential blending with the recycled water supply to the Northern Growth Corridor. As part of the potential Kalkallo RB stormwater regional stormwater harvesting solution, Yarra Valley Water (YVW) have planned for a stormwater pipeline asset to transfer treated stormwater at the RB to a storage asset at Bald Hill, located outside the precinct boundary.

YVW is the responsible water retailer for potable water and wastewater services to the precinct area. The PSP is mandated for recycled water use, however this was put in place when the PSP was zoned for residential use. YVW have indicated that the employment focus of the precinct will mean that recycled water will be available for use but not mandated[3]. Merrifield North sits within the Kalkallo sewer catchment, with several existing and proposed trunk sewer pipelines traversing the retarding basin and precinct to service future development (Figure 2-6).

While precinct-scale infrastructure delivered via the drainage scheme is expected to achieve stormwater treatment requirements, a range of lot and street scale initiatives can be delivered that will enhance liveability

[3] Update provided during the Merrifield North IWM Plan check in with YVW staff on the 8th April 2026

and greening, while also driving alternative water use. Additionally, Hume council requires industrial developments to have a stormwater management system designed to meet the stormwater treatment performance objectives unless these objectives will be met by offsite treatment. Victorian Planning Authority guidelines for PSPs set objectives for support of street trees with alternative water sources, and contribution to the objectives of the Catchment Scale IWM Plans.

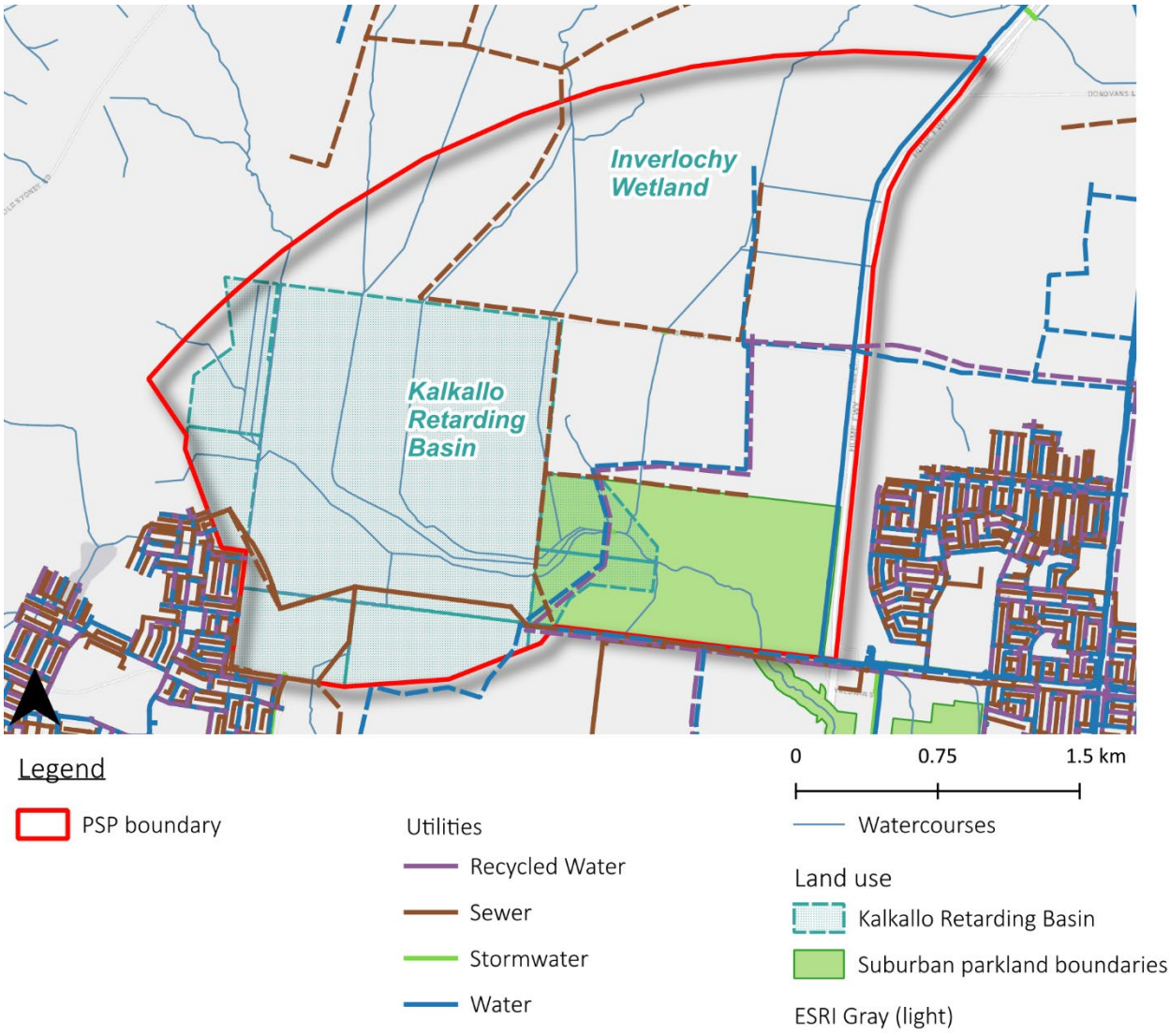


Figure 2-6 Existing and proposed utilities within and surrounding the Merrifield North PSP. Proposed works are marked with dashed lines

3. Water and Pollutant Base Case

A ‘base case’ has been developed which characterises the water and pollutant balance for the development area, understanding water demands, wastewater generation and stormwater generation.

The base case was completed using an indicative land use budgets provided by DTP to Arup in March 2026. This land use budget is indicative in nature and will vary as the PSP planning progresses. The land use breakdown and areas were used to calculate water demands for the proposed development, as well as flow, and pollutant loads generated as a result of the site. These can then be used as a base for comparison for future IWM solutions.

3.1 Development scenarios

This report investigates the base case for two possible land use budget scenarios, which represent an upper and lower bound of possible developable area:

- Scenario 1: This scenario assumes an employment land area of 255 ha with the assumption that 15% of this area would be roads and 2% would be open space within the precinct.
- Scenario 2: This scenario assumes an employment land area of 450 ha with the assumption that 15% of this area would be roads and 2% would be open spaces within the precinct.

Figure 3-1 shows the assumed land use budgets for Merrifield North PSP based on the two scenarios.

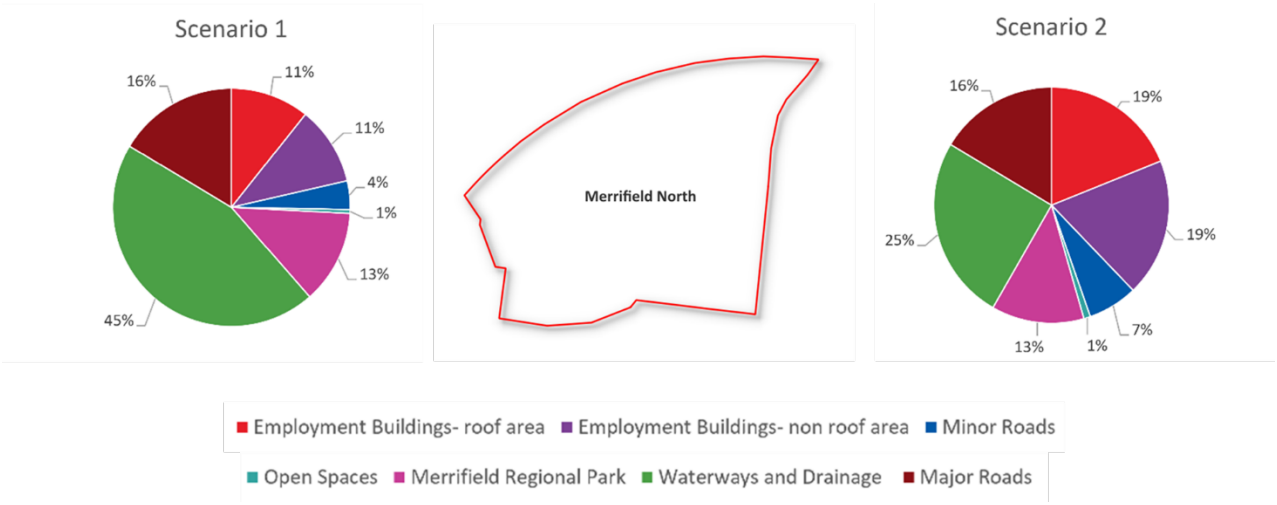


Figure 3-1 Assumed land use breakdown for Merrifield North PSP

3.2 Water demands

As Merrifield North precinct is predominantly a employment precinct, assumptions on anticipated water demands and wastewater generation volumes shown in Table 3-1 were adopted.

Table 3-1 Water demand assumptions

Type	Water Demand	Unit	Assumption source
Commercial/Industrial	1861	kl/ha/year	Review of non-residential water use (Sydney Water)
Active open space	4.5	ML/ha/year	Based on Yarra Valley Water (2023) Water Planning and Design Principles. For an active open space, 100% of the OS area is irrigated.
Passive open space (Merrifield Regional Park)	4.5	ML/ha/year	Based on Yarra Valley Water (2023) Water Planning and Design Principles. For a passive open space, only 5% of the OS area is irrigated. This is the assumption for Merrifield Regional Park.
Water to wastewater generation	80	%	Industry assumption

The assumptions outlined in Table 3-1 were applied to the assumed land use as described in Section 4.2. Figure 3-2 represents estimated demands for Scenario 1 and 2.

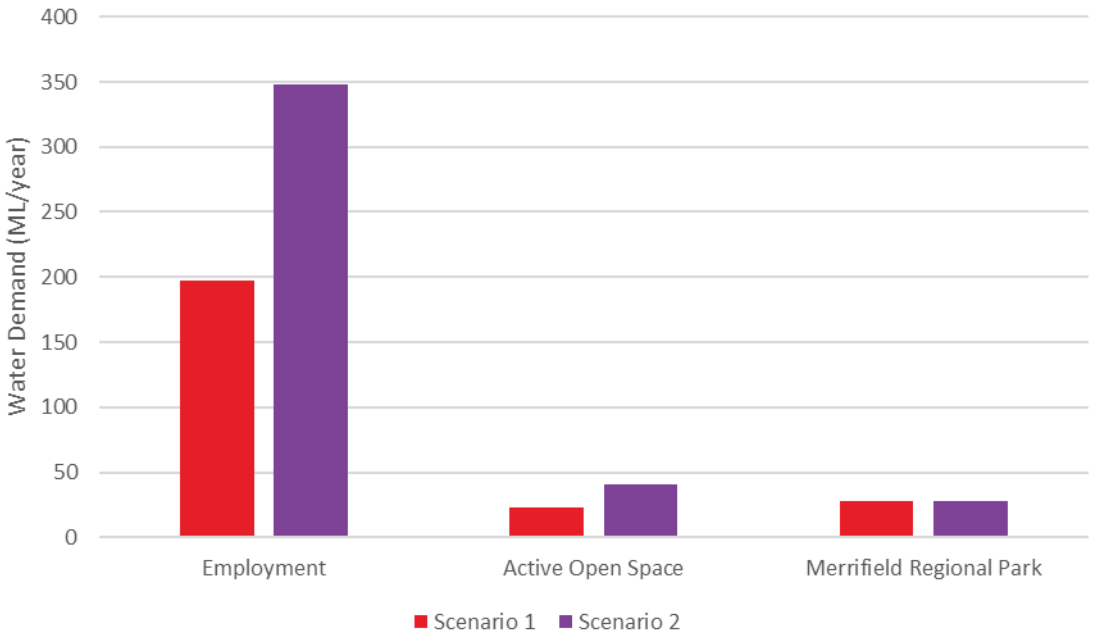


Figure 3-2 Water demand for Scenarios 1 and 2

3.3 Stormwater Base Case

The volume of stormwater generated by the developed area and the pollutants within stormwater have been modelled. MUSICX modelling was undertaken using meteorological data (Station 086282 Melbourne Airport) from Bureau of Meteorology over a 10-year period to determine flows and pollutant loads for pre-development and post-development.

Stormwater generation within the development area will depend on the relative imperviousness of development, and the degree to which source control management measures are included within development.

In both cases, it is assumed that precinct-scale stormwater treatment wetlands would be constructed to achieve BPEM standards for stormwater pollutants. These are currently planned to be located within the

Kalkallo Retarding Basin under the drainage scheme. Accordingly, for the base case, two options have been assessed for Scenario 1 and 2.

Table 3-2 shows the assumed impervious fraction for the land use budget and key model inputs based on Melbourne Water MUSIC Guidelines (2024) and design assumptions are as follows:

- Source Nodes
  - Soil Storage Capacity: 120 mm
  - Field Capacity: 50 mm
- Wetland
  - Extended Detention Depth for wetland: 350 mm
  - Evaporative Loss as % of PET: 125 %
  - Detention Time: 72 hours
  - Permanent Pool Volume: 40% of wetland surface area
  - Inlet Pond Volume: 10% of wetland surface area

Table 3-2 Land use budget assumptions

Land Use Type Source Nodes	Assumed Imperviousness	Scenario 1	Scenario 2
Major Roads	70%	162	162
Merrifield Regional Park	10%	445	250
Waterway and Drainage	10%	126	126
Assumed Employment area		255	450
Employment buildings (roof area)	100%	106	187
Employment buildings (non-roof area)	60%	106	187
Open Space	10%	5	9
Minor Roads	60%	38	67
TOTAL (ha)*		**988**	**988**

*Since completion of the modelling in this report, the total PSP area has been revised from 988ha to 970.4ha.

Table 3-3 summarises the stormwater treatment results using wetland sized 110,000 m^2 and 140,000 m^2 for Scenario 1 and Scenario 2 respectively.

Table 3-3 MUSICX results for Scenario 1 and 2

	Scenario 1			Scenario 2		
	Source	Post-treatment	% Reduction	Source	Post-treatment	% Reduction
Flow (ML/yr)	1,954	1,811	7.3%	2,489	2,308	7.3%
Total Suspended Solids (kg/yr)	343,700	54,680	84%	392,100	61,870	84%
Total Phosphorus (kg/yr)	709	207	71%	846	258	69%
Total Nitrogen (kg/yr)	4,828	2,625	46%	6,192	3,378	45%
Gross Pollutants (kg/yr)	70,800	0	100%	95,570	0	100%

Based on the stormwater pollutant results, the target reductions for TSS, TP and TN are achieved (80%, 45%, 45% respectively) to meet the water quality targets in the Urban Stormwater Management Guidance. In terms of stormwater harvesting and infiltration targets (74% and 8% respectively) set out in the Urban Stormwater Management Guidance (see Section 2.2), opportunities to meet both the harvesting and infiltration targets will be explored through the analysis of possible IWM opportunities.

3.4 Water Balance Summary

Figure 3-3 and Figure 3-4 summarise the water balance results for Scenario 1 with 255 ha employment area and Scenario 2 with 450 ha employment area.

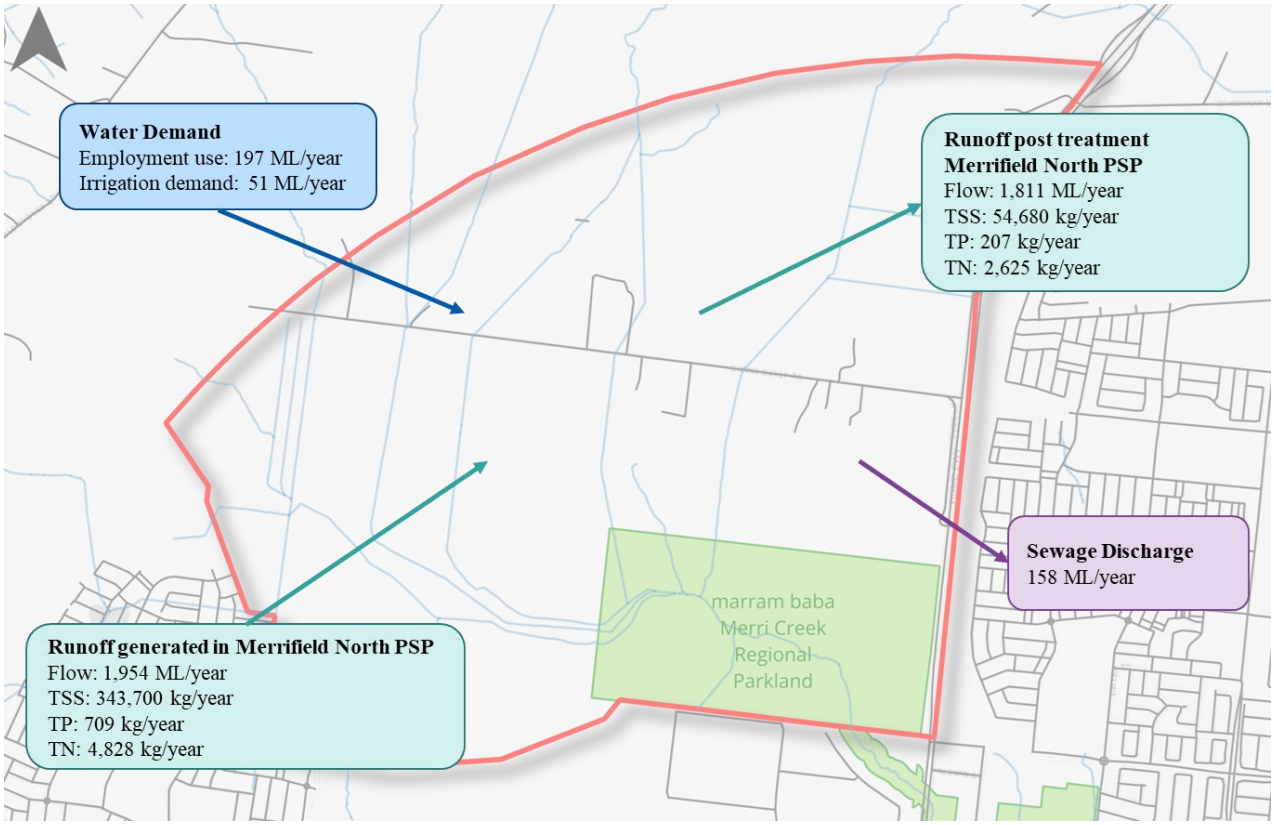


Figure 3-3 Scenario 1: Water Balance Summary

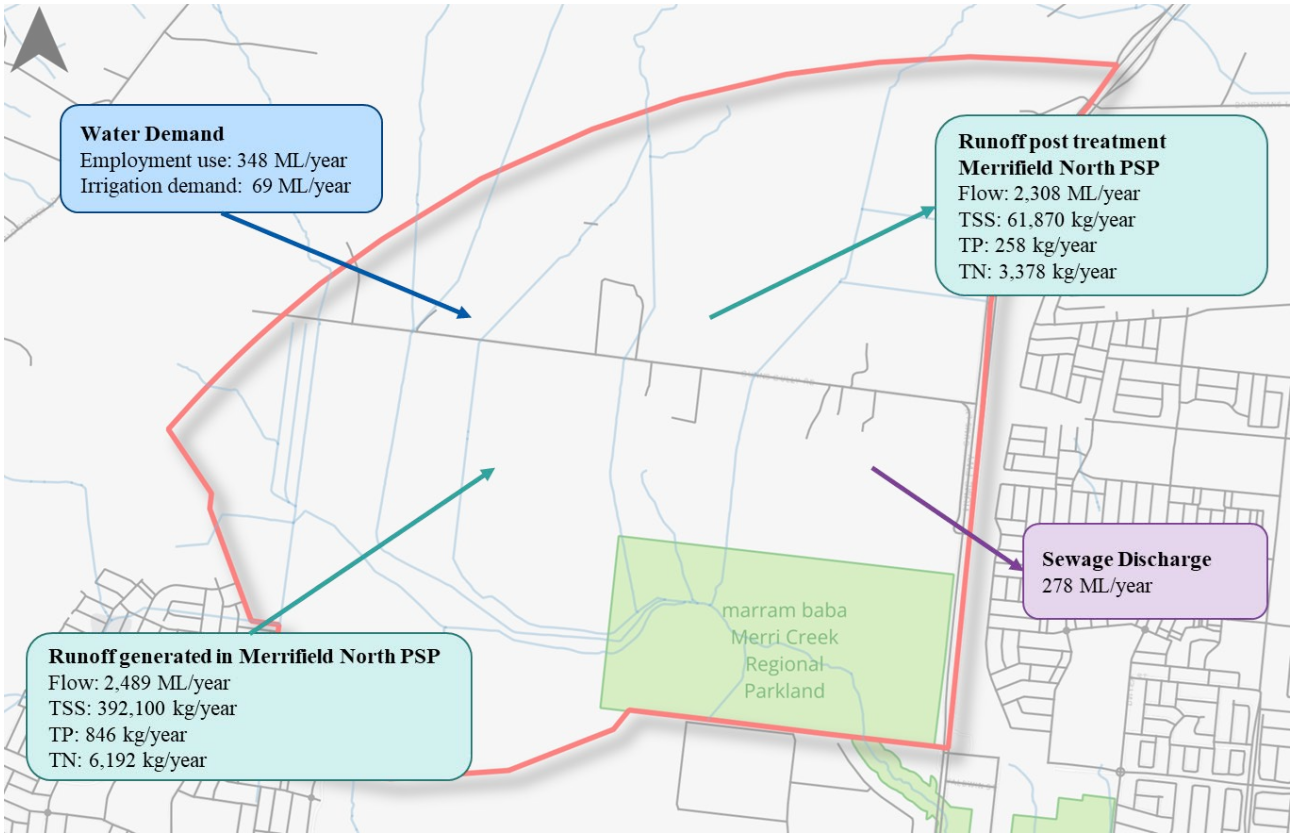


Figure 3-4 Scenario 2: Water Balance Summary

4. IWM Objectives for Merrifield North precinct

Planning and delivery of the Merrifield North precinct is informed by multiple vision statements that operate at different scales and address different aspects of the precinct's future. The Economic Growth Statement provides the overarching economic context for the precinct, identifying Merrifield North as a priority employment area within Melbourne's northern growth corridor. At the precinct scale, stakeholder engagement undertaken by DTP in 2025 articulated a set of emerging themes that reflect local priorities for employment, transport, environmental protection, infrastructure delivery and staging. In parallel, the Yarra Catchment IWM Plan establishes a catchment-scale vision for water-sensitive outcomes, with any IWM solutions for the Kalkallo Creek sub-catchment required to contribute to its strategic objectives and targets. Additional detail on these visions is provided in Section 2 of the Merrifield North Situational Analysis Report.

4.1 IWM objectives for Merrifield North

The Yarra Catchment IWM Plan sets out strategic outcomes for IWM in the catchment. These have been developed into place-based objectives, which have been reviewed and adopted for Merrifield North precinct.

Strategic IWM Outcome	Place-based IWM objectives for Kalkallo Creek Sub-Catchment and Merrifield North precinct
Safe, secure and affordable water supplies in an uncertain future 	• Deliver an alternative water supply to the Merrifield North precinct to service non-potable demand to reduce potable water demand.
Effective and affordable wastewater systems 	• Leverage the Class A recycled water scheme that is currently planned across the whole of the Northern Growth Corridor to service the precinct.
Existing and future flood risks are managed to maximise outcomes for the community 	• Effective utilisation of the Kalkallo Retarding Basin and Kalkallo creek corridor as part of a multi-functional flood storage and conveyance system. Both of which are located, and run through the precinct.
Healthy and valued waterways and marine environments 	• Reduce the mean annual runoff to mimic natural runoff volumes (meeting Healthy Waterways harvesting target where reasonably practicable) • Reduce the impacts of urban development on waterway water quality • Create a waterway geometry in equilibrium to manage sodic soils • Create waterway conditions to support healthy marine life.
Healthy and valued urban and rural landscapes 	• Healthy native vegetation communities are preserved and enhanced. • Active and passive open spaces are supported by alternative water source(s) • Increase canopy cover (meeting Upper Merri Creek IWM plan target of 27% canopy coverage by 2050).

Strategic IWM Outcome	Place-based IWM objectives for Kalkallo Creek Sub-Catchment and Merrifield North precinct
Community values are reflected in place- based planning 	• Engagement of Wurundjeri's Narrap team to care for Country • Utilise planning of water assets to foster connections with urban form to support community and livability • Connection to Country is fostered through water related initiatives • Healing Country by restoring Kalkallo Creek and its catchment so that it is considered healthy by Wurundjeri people.
Jobs, economic benefits and innovation 	• Enable utilisation of rainwater, stormwater and recycled water within the precinct to support agricultural, industrial, residential and cultural water users or new potable supplies.
Enablers 	• Ease of Adaptability, how easily could the opportunity be replaced or removed • Ease of Delivery, complexity and duration of delivery • Rating of Feasibility, dependence on buy-in from stakeholders

5. List of IWM Opportunities

The list of IWM Opportunities for Merrifield North PSP is shown below in Table 5-1. The selection of appropriate opportunities considered the employment-focused nature of the precinct. These opportunities were developed based on the review of background information including the Kalkallo IWM plan as well as check in with key stakeholders from Yarra Valley Water, Mitchell Shire Council, Hume City Council and Melbourne Water. Some of these opportunities are likely to be delivered as the 'base case' through existing commitments and the Melbourne Water drainage scheme (though this is currently under review).

Table 5-1 List of IWM options identified for Merrifield North precinct

	No.	Opportunity
Base case	A	Standard water efficient employment building fixtures and fittings
	B	Wetland treatment at strategic locations defined by Kalkallo Creek drainage scheme
	C	Standard waterway remediation works
	D	Utilising Kalkallo RB to mitigate downstream flooding
Lot scale	1	Advanced water efficient employment building fixtures and fittings
	2	Rainwater harvesting for non potable uses in individual employment buildings
	3	Permeable paving in employment car park areas
	4	Biofiltration systems on lot
Street scale	5	Biofiltration systems in streets
	6	Passively irrigated street trees
Precinct scale	7	Class A recycled water for non potable water supply
	8	Micro grid rainwater harvesting to non potable network
	9	Stormwater harvesting at Kalkallo RB for marram baba regional park and nearby open spaces
	10	Stormwater harvesting at Kalkallo RB for regional use
	11	Advanced waterway remediation works
	12	Realignment and enhance agricultural drains
	13	Spongy riparian zones

The following IWM opportunities were not included in the shortlist for Merrifield North precinct:

- **Preserving existing tributaries of Kalkallo creek:** there are no known intact tributaries of Kalkallo creek within the Merrifield North precinct. With all waterways having been straitened for agricultural drainage.
- **Restoration of Inverlochy Wetland:** Uncertainty around the extent and functionality of the Inverlochy Wetland combined with a lack of mechanisms within the existing planning and regulatory framework to allocate land and reestablish the wetland have meant that the wholesale regeneration of an ephemeral wetland in a dedicated area has not be examined further in this study. A key limitation identified is the absence of any mandate or statutory mechanism under the Planning and Environment Act 1987 to protect pre-European wetlands where these areas are not designated as

Areas of Cultural Heritage Sensitivity. As a result, there is reliance on the Cultural Heritage Management Plan (CHMP) process, which applies to formally recognised Areas of Cultural Heritage Sensitivity only. However, further opportunities to integrate ephemeral landscapes and wetlands can be further explored through the design of the Kalkallo Retarding Basin and associated stormwater management assets delivered through the Developer Services Scheme with it is recommended these opportunities are developed with WWCHAC and Melbourne Water.

- **Green roofs:** With employment type typology not confirmed, there is too much uncertainty around the practicality of this option at this point in time (e.g. delivery challenges would exist for wide span warehouses).
- **Increased permeability at the lot scale:** Considered impractical in a industrial and commercial settings due to heavy vehicle use. Also aligns with decisions made as part of Kalkallo IWM Plan. Permeable paving may be possible for a portion of carparking areas and this has been included as an option.
- **Rainwater harvesting for potable water supply:** While enabled through the DEECA water security plan[4], timing for delivery within a policy, community and change management lens is not considered to align with timing of delivery of the PSP for the Merrifield North precinct.

[4] https://www.water.vic.gov.au/our-programs/water-monitoring-and-reporting/water-security-plan

5.1 Description of options

A brief description of the options is shown in Table 5-2.

Table 5-2 Description of short listed options

	No.	Opportunity
Base case	A	**Standard water efficient fixtures and fittings** This option considers standard water fixtures and fittings per building regulations.
	B	**Wetland treatment at strategic locations defined by Kalkallo Creek drainage scheme** This option includes wetland treatment sized to meet the stormwater quality standards required under the Victorian Planning Provisions. These wetlands are currently planned to be located within Kalkallo RB in Melbourne Water's drainage services scheme.
	C	**Standard waterway remediation works** This option includes waterway remediation to reduce/stop further degradation of the creek including bank/bed stabilisation works and revegetation which would be included in a conventional drainage scheme.
	D	**Utilising Kalkallo RB to mitigate downstream flooding** The Kalkallo RB will be used for flood mitigation downstream as set out in the Kalkallo Creek drainage scheme.
Lot scale	1	**Advanced water efficient employment building fixtures and fittings** This option considers provision of fixtures which have higher efficiency ratings to reduce water demands.
	2	**Rainwater harvesting for non potable uses in individual employment buildings** Rainwater can be conveyed from roofs to tanks, which can then be used to meet non-potable demands in individual buildings. Commonly, this would support toilet flushing but could also provide non-potable water for irrigation, industrial processes and washdown (use dependant). 
	3	**Permeable paving in employment car park areas** Permeable paving is made of porous material or blocks with spaces which allow water to pass through the pavers and into the soil to reduce and treat stormwater flow. This has potential to be used in some parts of car parks of employment areas where the ground contamination risk is low. 
	4	**Biofiltration systems on-lot** Biofiltration systems treat and reduce stormwater flow through infiltration, filtering and slowing flows before they pass through to the stormwater pipe network. These systems do not require a large footprint and can take the form of small garden beds or carpark medians, making them suitable in some employment land uses. It is expected these will be maintained by the plot or building owner.
Street scale	5	**Biofiltration systems in streets** Biofiltration systems treat and reduce stormwater flow through infiltration, filtering and slowing flows before they pass through to the stormwater pipe network. These could be included in parking areas or traffic medians in streets. 

	No.	Opportunity
	6	**Passively irrigated street trees** This solution includes a system to redirect, collect, filter, and transfer road runoff into underdrains to water street trees. Passively irrigating trees can reduce stormwater pollutants and volumes from entering the waterway.
	7	**Class A recycled water for non potable water supply** Non-residential demands can also be serviced by recycled water which is a reliable and resilient source of water. A non-potable water supply network could be extended to users in the precinct to deliver recycled water. The precinct sits within a mandated recycled water area, however this only mandates residential recycled use and not industrial use. 
Precinct Scale	8	**Micro-grid rainwater harvesting to non-potable network** Rainwater from large employment buildings could be harvested and transferred to shared storage tanks then connected to a local grid supplying non-potable water to large users in the precinct. Individual users may need more or less rainwater than they harvest. A collective system is more resilient to this as excess demands of one user can be met by the excess supply of another.
	9	**Stormwater harvesting at Kalkallo RB for marram baba regional park and nearby open spaces** Stormwater harvesting is the collection, treatment, storing and using stormwater runoff. It differs from rainwater harvesting as the runoff is collected from drains rather than roofs and is of a lower quality. Treated stormwater from the wetlands in the Kalkallo RB could be transferred for irrigation use for nearby open space. 
	10	**Stormwater harvesting at Kalkallo RB for regional use** Stormwater harvested from the wetlands in Kalkallo RB could be further treated and supplied to non-potable network for the broader growth area, or utilised for another regional use. A Kalkallo RB concept design has been developed by Yarra Valley Water which includes two pond storages for harvested water and a proposed stormwater treatment plant in the north-east of the retarding basin land, where it can be transferred to Bald Hill for network distribution.
	11	**Advanced waterway remediation works** Kalkallo creek is highly degraded and requires remediation works to prevent further erosion and destabilisation. Remediation of Kalkallo creek and its tributaries could protect the waterway from further degradation and restore its role as habitat. Remediation works would also improve amenity. This could include bank fill and stabilisation, extensive revegetation, habitat creation.
	12	**Realignment and enhance agricultural drains** There are several drainage channels that run north-south through the precinct. These are agricultural drains created to drain the land for farming. These can be realigned and enhanced as green-blue corridors within the development area, providing recreational links, habitat and a drainage function.
	13	**Spongy riparian zones** A spongy riparian zone is a shallow vegetated area designed to capture and hold water. This solution would typically be located upstream of a waterway or the wetlands in the retarding basin and would allow stormwater from development areas to be infiltrated or evaporated before discharging into the waterway. This solution can contribute to meeting the stormwater harvesting and infiltration targets.

6. Assessment of options

6.1 Assessment criteria

The assessment criteria have been developed using the Preliminary Assessment Method (PAM) developed by DEECA for initial comparison of IWM options. It integrates the place-based objectives from the Kalkallo sub-catchment IWM plan, outcomes discussed in the stakeholder check-ins and the strategic outcomes from the Strategic Direction Statement for Yarra catchment. Table 6-1 shows the assessment criteria for the IWM solutions proposed.

Table 6-1 Assessment criteria

	Place based objectives	Measure	Unit
Strategic Outcome 1 - Safe, secure and affordable supplies in an uncertain future 	Deliver an alternative water supply to all homes in the precinct to service non-potable demand to reduce potable water demand.	Volume of potable water demand reduction through water efficiency or substituted by alternative water supplies	ML/year
Strategic Outcome 2 - Effective and affordable wastewater systems 	Leverage the Class A recycled water scheme that is currently planned across the whole of the Northern Growth Corridor to service the precinct.	Volume of recycled water delivered to industries	ML/year
Strategic Outcome 3 - Opportunities are optimised to manage existing and future flood risks and impacts 	Effective utilisation of the Kalkallo Retarding Basin and Kalkallo creek corridor as part of a multi-functional flood storage and conveyance system.	Impact on downstream flood mitigation	H/M/L
Strategic Outcome 4 - Healthy and valued waterways and marine environments 	Reduce the mean annual runoff to mimic natural runoff volumes, meeting HWS harvesting targets where reasonably practicable Reduce the impacts of urban development on waterway water quality Create a waterway geometry in equilibrium to manage sodic soils Create waterway conditions to support healthy marine life.	Reduction in Mean annual runoff volume	ML/year
		Total Suspended Solids (TSS) prevented from discharging to receiving waters	tonnes/year
		Total Nitrogen (TN) prevented from discharging to receiving waters	Kg/year
		Prevention of sodic soil dispersal by capturing water at source or through physical controls	H/M/L
		Rating of impact on waterway conditions to create habitat	H/M/L
Strategic Outcome 5 - Healthy and valued urban and rural landscapes	Healthy native vegetation communities are preserved and enhanced Active and passive open spaces are supported by alternative water source(s) Increase canopy cover	New total number of passively irrigated trees	No.
		Area of open space supported by an alternative water source	Hectare

			
Strategic Outcome 6 - Community values are reflected in place-based planning 	Engagement of Wurundjeri' s Narrap team to care for Country Utilise planning of water assets to foster connections with urban form to support community and livability.	Rating of degree that supports ongoing collaboration with Traditional Owners	H/M/L
		Rating of contribution to supporting livability	H/M./L
Strategic Outcome 7 - Jobs, economic benefits and innovation 	Enable utilisation of rainwater, stormwater and recycled water within the precinct to support agricultural, industrial, residential and cultural water users or new potable supplies.	Volume of Alternative water supplied to businesses and industry	ML/year
Enablers 	Delivery of IWM	Ease of Adaptability, how easily could the opportunity be replaced or removed	H/M/L
		Ease of Delivery, complexity and duration of delivery	H/M/L
		Rating of Feasibility, dependence on buy-in from stakeholders	H/M/L

A three-score rating system was adopted to assess the comparative impact of opportunities towards each criterion. As such, the ratings were created to rank opportunities against one another. Zeros were given when the criteria were not relevant to the opportunity. The rating criteria are summarised in Appendix B.

The Kalkallo Creek IWM Plan (Melbourne Water and Yarra Valley Water, 2025) includes modelling of a range of IWM options for the Kalkallo Creek catchment as a whole. The performance of these options in the catchment has been reviewed as a basis for the preliminary assessment.

Table 6-2 Summary of land use and demand for Scenario A and B

Land Use Type	Assumed Imperviousness	Scenario A		Scenario B	
		Area (ha)	Demand (ML/year)	Area (ha)	Demand (ML/year)
Major Roads	70%	162	-	162	-
Merrifield Regional Park	10%	445	-	250	-
Waterway and Drainage	10%	126	28	126	28
Assumed Employment area		255		450	
Employment buildings (roof area)	100%	106	197	187	348
Employment buildings (non-roof area)	60%	106	-	187	-
Open Space	10%	5	23	9	41
Minor Roads	60%	38	-	67	-
TOTAL (ha)*		**988**	**248**	**988**	**417**

*Since completion of the modelling in this report, the total PSP area has been revised from 988ha to 970.4ha.

6.2 Results of preliminary assessment

The final scores for each opportunity are shown in Table 6-3 below. Using the preliminary assessment results, IWM opportunities were shortlisted further and strategically grouped and placed in portfolios. Details on the portfolios can be found in Section 7.

Table 6-3 Score breakdown of IWM assessment against key criteria

No.	Opportunity	Volume of potable water demand reduction through water efficiency or substituted by alternative water supplies	Volume of recycled water delivered to industries	Impact on downstream flood mitigation	Reduction in Mean annual runoff volume	Total Suspended Solids (TSS) prevented from discharging to receiving waters	Total Nitrogen (TN) prevented from discharging to receiving waters	Prevention of sodic soil dispersal by capturing water at source or through physical controls	Rating of impact on waterway conditions to create habitat	New total number of passively irrigated trees	Areas of open space supported by an alternative water source	Rating of degree that supports ongoing collaboration with Traditional Owners	Rating of contribution to supporting livability	Volume of Alternative water supplied to businesses and industry	Ease of Adaptability	Ease of Delivery	Rating of Feasibility
A	Standard water efficient employment building fixtures and fittings	1	0	0	0	0	0	0	0	0	0	0	1	0	3	3	3
B	Wetland treatment at strategic locations defined by Kalkallo Creek drainage scheme	0	0	1	3	3	3	3	0	0	0	0	2	0	1	2	3
C	Standard waterway remediation works to reduce or stop further degradation of the creek including bank and bed stabilisation works and revegetation	0	0	1	0	0	0	2	1	0	0	3	3	0	1	1	1
D	Utilising Kalkallo RB to mitigate downstream flooding	0	0	3	0	0	0	0	1	0	0	0	3	0	1	2	3
1	Advanced water efficient employment building fixtures and fittings	2	0	0	0	0	0	0	0	0	0	0	1	0	3	3	3
2	Rainwater harvesting for non potable uses in individual employment buildings	2	0	2	2	2	2	1	0	0	0	1	1	2	3	3	3
3	Permeable paving in employment car park areas	0	0	1	2	2	2	1	0	0	0	1	1	0	2	2	2
4	Biofiltration systems on lot	0	0	1	2	2	2	1	0	0	0	1	2	0	2	2	2
5	Biofiltration systems in streets	0	0	1	2	2	2	1	0	0	0	1	2	0	2	2	2
6	Passively irrigated street trees	0	0	1	2	1	1	1	0	3	0	1	2	0	3	3	2
7	Class A recycled water for non potable water supply	3	3	0	0	3	3	0	0	0	3	0	1	3	1	2	1
8	Micro grid rainwater tanks to non potable network	3	0	2	3	2	2	1	0	0	2	1	1	2	2	1	1

9	Stormwater harvesting at Kalkallo RB for marram baba regional park and nearby open spaces	2	0	2	3	3	3	0	1	0	3	3	3	0	2	2	2
10	Stormwater harvesting at Kalkallo RB for regional use	2	0	2	3	3	3	0	1	0	3	2	3	2	2	2	3
11	Advanced waterway remediation works: bank fill and stabilisation, extensive revegetation, habitat creation	0	0	1	0	0	0	3	3	0	0	3	3	0	1	1	1
12	Realignment of creek sections and tributaries previously straightened for agricultural drainage	0	0	0	0	0	0	3	3	0	0	3	3	0	1	1	1
13	Spongy riparian zone	0	0	2	3	3	3	3	3	0	0	3	3	0	1	2	1

7. Potential IWM Portfolios for Merrifield North

7.1 Opportunities excluded from the portfolios

The following opportunities in the IWM Opportunities list (Table 5-1) were excluded from portfolio development for the following reasons:

- **Micro-grid rainwater harvesting for supplementary non-potable water supply:** the opportunity has good potential to increase both stormwater reduction volumes and alternative water supply for the precinct compared to lot scale assets. However, as the investigation by Yarra Valley Water has not begun at this stage, it cannot be appropriately included in the IWM Plan.
- **Biofiltration at lot and street scale:** other lot and street scale assets, such as rainwater tanks and passive street trees, were communicated to be preferenced by councils during stakeholder check-ins.

7.2 Selection of portfolios

To achieve Integrated Water Management strategic outcomes, often a combination of options are required, focussing on different scales and benefits. Following the scoring of individual IWM opportunities against the assessment criteria, complementary opportunities were grouped into three distinct themes to form portfolios which have then been conceptualised and modelled in further detail. Portfolio development was informed by:

1) the recommendations of the Kalkallo Creek Sub-Catchment IWM Plan (Melbourne Water and Yarra Valley Water, 2025), where relevant to an employment precinct context, and
2) priorities we heard during stakeholder check-ins undertaken with Yarra Valley Water, Melbourne Water, Hume City Council and Mitchell Shire Council.

The portfolios by nature explore different delivery focusses – exploring a catchment scale approach led by water authorities and focussing on public realm infrastructure in waterway corridors, and a development scale approach led by developers and focussing on private realm and local public realm interventions in streets and open spaces. The portfolios are not intended to represent mutually exclusive, fixed sets of interventions, rather they are an exploratory tool to examine how different approaches could achieve the IWM objectives set out in this plan.

The portfolios proposed for the Merrifield North precinct are outlined in Figure 7-1 with additional information on each portfolio provided below.

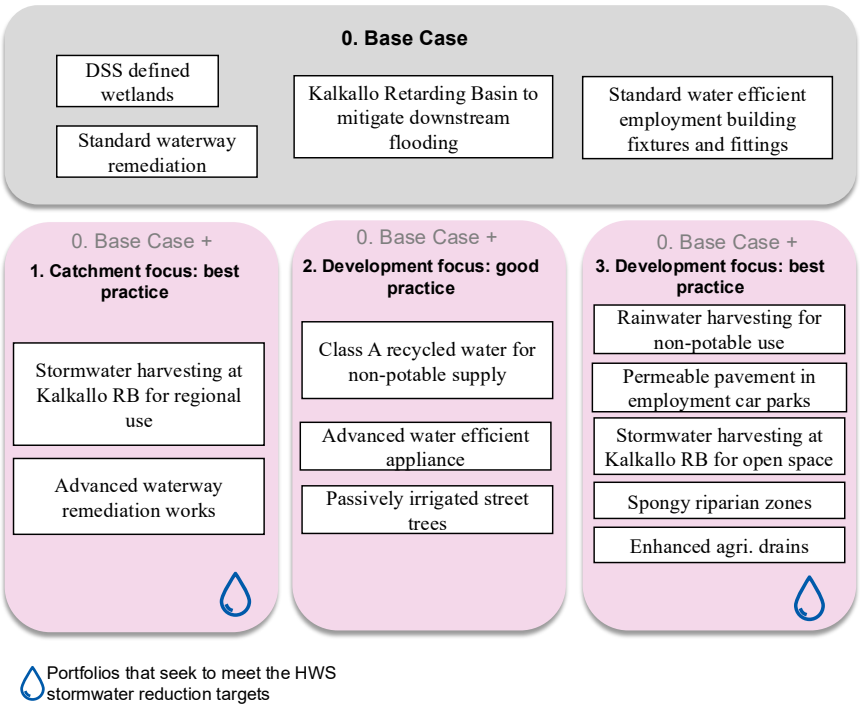


Figure 7-1 IWM portfolios for Merrifield North precinct

Portfolio 0. Base case

The base case portfolio represents a business-as-usual approach, incorporating infrastructure that is either committed or required under Victorian Planning Provisions:

- The Kalkallo Retarding Basin is retained to manage downstream flooding.
- Wetlands are planned to be included within the retarding basin land to provide stormwater treatment to meet stormwater quality requirements.
- Kalkallo Creek is stabilised and managed as a key waterway conveyance corridor.
- Standard water efficiency measures are included in new buildings.

The purpose of the base case in the context of this report is to provide a reference case that the three IWM portfolios are then compared to. It is not intended to represent a default or 'do-nothing' solution for the precinct.

To note, Portfolio's 1 to 3 all incorporate and build on the base case as part of their infrastructure solution.

Portfolio 1 - Catchment Focus: best practice

This portfolio adopts a catchment scale approach to meeting the HWS stormwater harvesting target. It builds upon the recommendations from the Kalkallo Creek IWM Plan which recommend stormwater harvesting at Kalkallo RB for regional use, where this solution would be delivered by Melbourne Water alongside advanced waterway remediation to enhance waterway health and deliver stabilisation works. With the RB sitting with the Merrifield North precinct, and regional harvesting from the site being actively investigated by MW and YVW[5], it is of strong relevance to explore this option as part of the Merrifield North IWM Plan. It represents a whole-of-catchment approach to meeting the Healthy Waterways Strategy target for

[5] Information provided during the Merrifield North IWM Plan check in with MW staff on the 14th April 2026

stormwater harvesting, utilising the waterway corridor and the Kalkallo RB site to capture, convey, treat and harvest stormwater. The Kalkallo Creek IWM Plan explores two potential approaches to this:

1. Use the Kalkallo RB for regional scale stormwater harvesting, with storage and treatment provided within the footprint of the Kalkallo RB. In this case, Kalkallo Creek is used for stormwater conveyance, but the benefits of stormwater harvesting for waterway health are seen downstream of the Kalkallo RB, or

2. Creation of a chain of ponds along Kalkallo Creek, whereby ponds are used for local storage and harvesting, along the length of the green, as well as a harvesting point at the Kalkallo RB location. This approach is currently being proposed by YVW for the upper reach of Kalkallo Creek in the Beveridge North West precinct. It involves harvesting stormwater at multiple points to thereby enhance Kalkallo Creek along its length. In this scenario, harvesting at Kalkallo RB would still be in place, forming the final storage in the chain of ponds, but the amount of water harvested at the RB site would be less.

With the Merrifield North precinct at the downstream end of the Kalkallo sub-catchment, this portfolio focusses on embedding flexibility for future decision making as to what implementation looks like within the precinct, by ensuring that sufficient land is allocated for key infrastructure to allow regional scale harvesting to be implemented.

For both pathways, any stormwater treated in the wetlands at Kalkallo RB would be stored in local above ground or below ground storages, and be treated at a newly constructed stormwater treatment plant within the RB footprint and transferred via a planned pipeline asset to Bald Hill storage where it could be mixed with the Class A recycled water supply and provided to the non-potable water network within the Kalkallo sub-catchment. While Bald Hill storage sits outside the precinct, land use consideration would be required for the transfer pipeline from the RB.

The portfolio also maintains the extent of Kalkallo Retarding Basin to enable this flexibility, which is a future decision to be made by Melbourne Water, in conjunction with Yarra Valley Water[6].

To note, for the purposes of representing the relative performance of this option for stormwater volume and demand reduction outcomes show in Section 7.1, the results have been apportioned from the Kalkallo Creek IWM Plan to only account for the Merrifield North Precinct.

Portfolio 2 - Development focus: good practice

This portfolio focuses on measures that reflect established good practice and the level of expectation for new development within an employment context, while also considering catchment considerations and servicing approaches already being delivered across the Northern Growth Corridor. The portfolio includes three development-based initiatives:

- Use of **recycled water supply for open space irrigation and industrial uses** for non-potable use, delivered by YVW via a dual pipe non-potable network. While recycled water is not mandated for this precinct (see Section 2.1.3), YVW have mandated it's use in neighbouring residential precincts and have indicated its availability for high demand industrial users in Merrifield North. Uptake could be broadened through partnerships with council for open space irrigation, including marram baba regional parkland, and communicating its availability to developers during the pre-planning and planning application process. This portfolio explores what recycled water could deliver in terms of benefits based on anticipated average demands for non-potable water, though it is acknowledged this could vary substantially depending on the types of industry that come forward.

- Use of **advanced water-efficient appliances** in commercial and industrial buildings, aimed at reducing overall potable water demand. These measures represent good practice in non-residential development and support improved water use efficiency without relying on bespoke infrastructure.

- Implementing **passively irrigated street trees** through streetscape design guidance and encouraged through the planning application process. This infrastructure solution is consistent with the Victorian

[6] Information provided during the Merrifield North IWM Plan check in with MW staff on the 14th April 2026

Planning Authority *PSP 2.0 Integrated Water Management Guidance Note*, which identifies passive irrigation for street trees as a good-practice approach for supporting urban canopy health and improving local waterway outcomes through place-based retention of impervious stormwater runoff. Passive irrigation is also generally considered suitable in sodic soil contexts, as runoff is captured and applied locally within tree pits, rather than relying on broader infiltration across dispersive soil profiles[7]. Within an employment precinct context, successful implementation requires consideration of site-specific design factors, including wider road reserves, sufficient space for tree planting, and utility services installed at depths greater than 900 mm to provide adequate soil volume for tree establishment. These measures help mitigate known challenges associated with applying passive irrigation systems in industrial and commercial environments[8].

Portfolio 3. Development focus: best practice

Portfolio 3 represents a best-practice approach that seeks to achieve the Healthy Waterways Strategy stormwater runoff reduction target through a localised, place-based response within the precinct, without reliance on regional scale harvesting (as per Portfolio 1). The portfolio prioritises retaining, treating, and reusing stormwater close to where it is generated.

The portfolio includes five infrastructure solutions:

- **Rainwater tanks for non-potable industrial use**, installed to capture roof runoff and reduce stormwater volumes at source. Non-potable demand is assumed to be limited in most light industrial and commercial settings to toilet flushing and washdown, though this can vary greatly with the proposed use.
- **Permeable pavement in carparks and building surrounds**, assumed to be applied for 20% of impervious non-roof areas on-lot to promote infiltration and temporary detention of stormwater runoff. This measure supports localised runoff reduction by allowing rainfall to be managed within hardstand areas, rather than being rapidly conveyed into the drainage network. Regarding sodic soils, vertical infiltration of rainwater from runoff is not considered a significant risk, as long as the sodic soil layer is not exposed.
- **Localised stormwater harvesting** from wetlands within the Kalkallo RB to provide open space irrigation while also contributing to runoff reduction and water quality outcomes. These schemes include local storage associated with open space and harvesting infrastructure sized to meet irrigation demands within the precinct.
- **Spongy riparian zones adjacent to waterways**, alongside riparian corridors to encourage evapotranspiration and infiltration. These are shallow vegetated areas designed to hold and slow stormwater prior to discharge to a creek. A land area of 2% of the developable area has been assumed, representing the upper limit of what is considered 'deliverable'. It is assumed that 50% of this area would be within the open space allocation for a development, and 50% would require 'developable land take'. Sponges contribute to the stormwater runoff target by evaporating and infiltrating runoff while encouraging uptake by plants. Special consideration, may be required to avoid exposure of sodic soil layers.
- **Realignment and enhancement of existing agricultural drains** in the precinct to add sinuosity and enhance ecological and cultural values within the precinct and broader sub-catchment. This could be paired with amenity and cycling and walking connectivity for the Merrifield North precinct and neighbouring precincts.

Under this portfolio, stormwater runoff reduction is achieved through a distributed network of localised assets within the precinct, integrating stormwater management and reuse functions into streetscapes, open space, and development design.

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[7] Stated as a priority by Mitchell Shire Council and Hume City Council staff during the Merrifield North IWM Plan check in on the 17th April 2026
[8] Information provided during the Merrifield North IWM Plan check in with Mitchell Shire Council and Hume City Council staff on the 17th April 2026

7.3 Evaluation of IWM portfolios

Each portfolio was evaluated, with options conceptualised and modelled in MUSIC utilising the assumptions described in Appendix C.

This section provides a relative comparison of all portfolios against the base case, highlighting differences in benefits and outcomes the portfolios would drive. For each portfolio, the below sections provide:

- Qualitative and quantitative assessment of how the portfolio performs against seven strategic outcomes. For quantitative metrics, both land use scenarios A and B are used to show a range (see Appendix C for details).
- A spidergram showing relative performance of the portfolio against the base case
- A conceptualised image, providing IWM opportunity based quantitative performance for potable water reduction, runoff reduction and alternative water open space irrigation provided. The images also help visualise the portfolio within the precinct.

7.3.1 Portfolio 1 - Catchment focus: best practice

Portfolio 1 adopts a catchment-scale approach to meeting the HWS stormwater runoff reduction targets, reflecting limited opportunity and appetite for lot or precinct scale IWM interventions within new development. Emphasis is placed on stormwater volume reduction being led by YVW and Melbourne Water within the DSS footprint for Kalkallo Creek and Kalkallo RB.

This portfolio includes:

- Stormwater harvesting at Kalkallo RB for regional use
- Advanced waterway remediation works

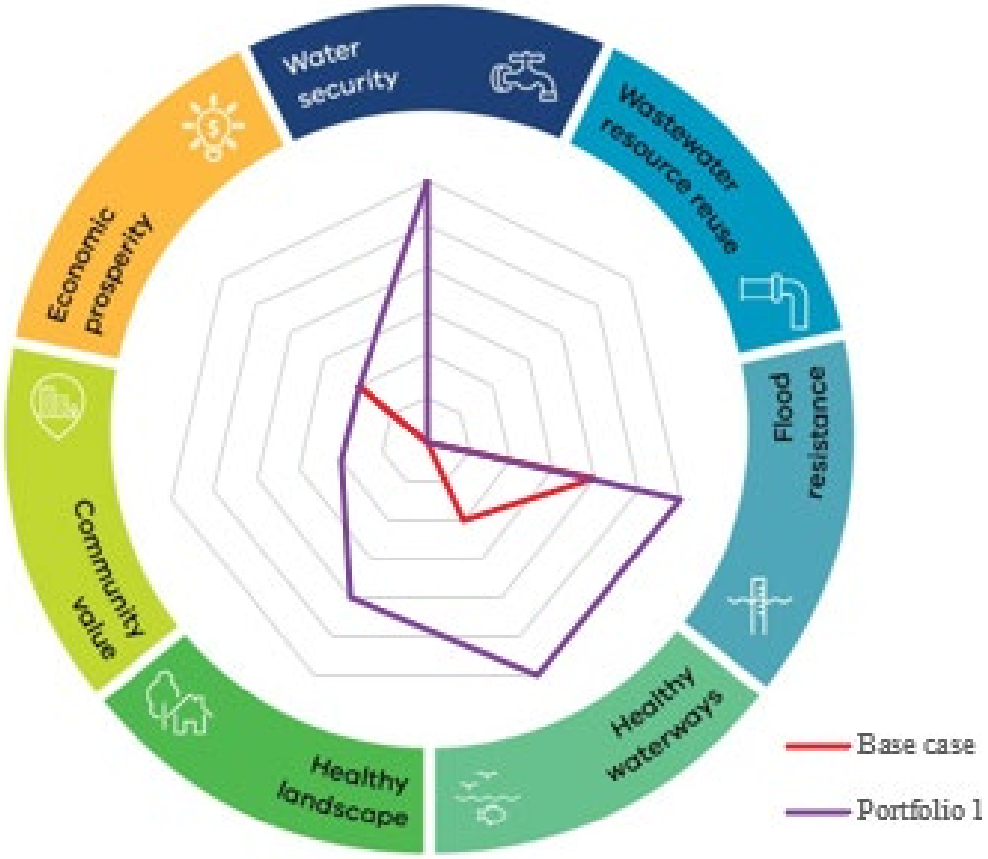
Table 7-1 Description of Portfolio 1 in relation to the strategic outcomes

Water security	• High water security is achieved due to the regional nature of the portfolio, contributing to alternative water usage across the Kalkallo sub-catchment, including the Merrifield North precinct. • An equivalent potable water reduction of 100% (248-416 ML) from stormwater harvesting and reuse is achieved for the Merrifield North precinct (in terms of demand offset through non-potable use outside the precinct). Overall, the regional scheme has the potential to harvest a yield of 9492 ML/year[9].
Wastewater resource reuse	• There is no wastewater reuse benefit in this portfolio. Alternative demand is supported through stormwater harvesting and reuse.
Flood resistance	• High flood resistance, with this scenario focussing on harvesting stormwater from a flood asset (Kalkallo RB). This provides multiple benefits including flood resistance.
Healthy waterways	• Flow reduction of **77%** in mean annual runoff is achieved for the catchment as a whole if the proposal to deliver stormwater harvesting for regional use is delivered. This will achieve the harvesting target in the Healthy Waterways Strategy. • This will benefit the health of the section of Kalkallo Creek downstream of the RB. The benefit of flow reduction volume achieved to the upstream reach of Kalkallo Creek will be dependent on future decisions relating to the implementation of the chain of ponds infrastructure approach.
Healthy landscape	• Moderate value to healthy landscapes is achieved. The enhanced waterway remediation would create a biodiverse and high value landscape corridor However, healthy landscapes and biodiversity benefit cannot be achieved precinct wide with this portfolio alone.
Community value	• Overall, community value is low as the portfolio only considers Kalkallo Creek and Kalkallo RB, with other key community and cultural opportunities such as marram baba regional parklands not considered in this portfolio.

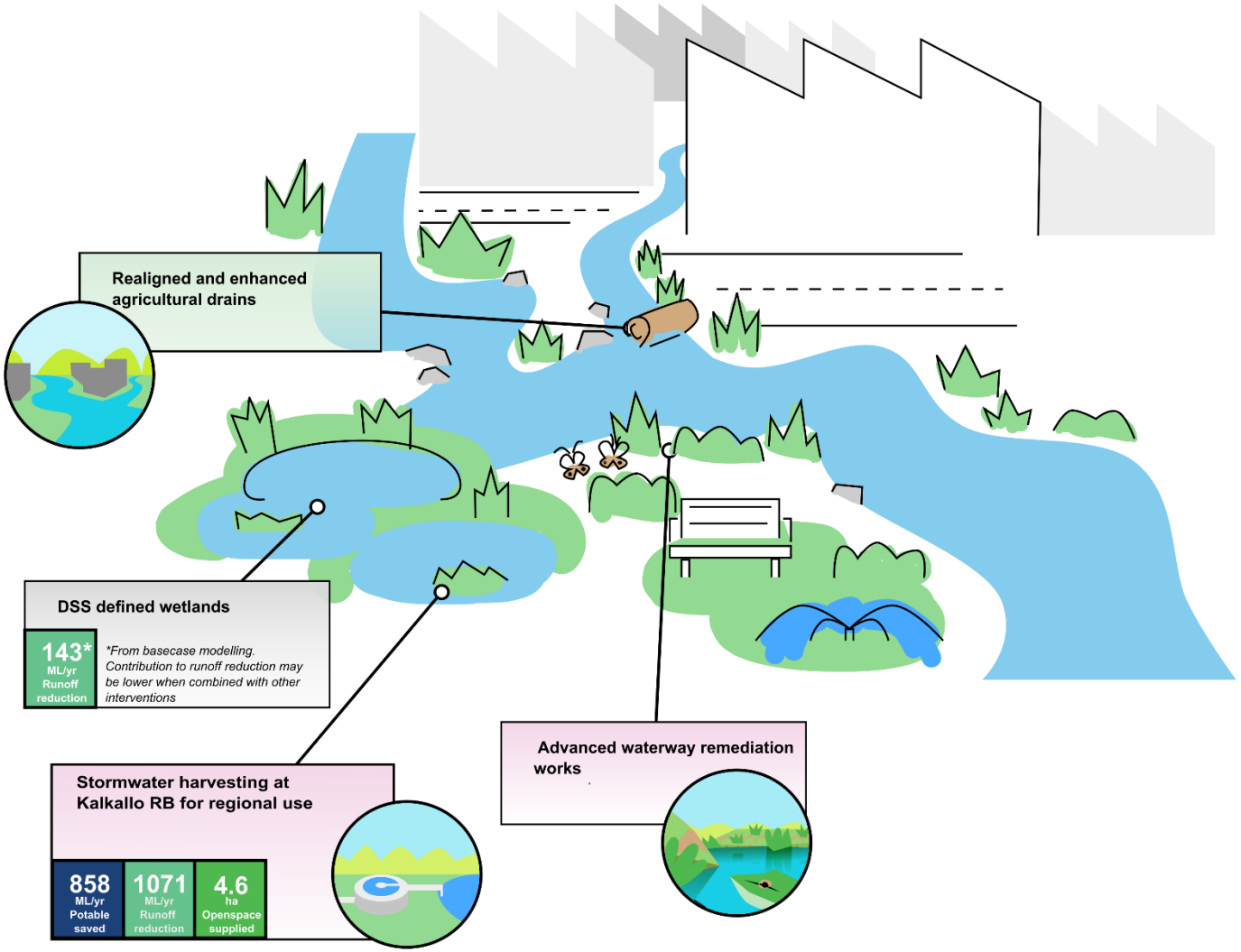
[9] References from the Kalkallo IWM Plan (Scenario 2b)

	• Investing in advanced waterway remediation and protection of Kalkallo Creek from urban runoff positively contributes to Wurundjeri Woi-wurrung values of healthy Country and is likely enhancing connection to Country. Some opportunity to engage Wurundjeri's Narrap team to care for Country is provided. • This scenario provides some liveability benefits through advanced remediation of the creek, which allows communities to feel connected to nature.
Economic prosperity	• The portfolio will support economic prosperity at a regional scale by bolstering water security and natural asset health, but has limited impact on industries within the precinct itself.

Portfolio 1: Relative performance against strategic outcomes



Portfolio 1 - Catchment focus: best practice



7.3.2 Portfolio 2 - Development focus: good practice

It prioritises delivery through development-scale measures that are 1) familiar to developers 2) aligned with existing sub-catchment servicing arrangements already delivered in neighbouring precincts and available within Merrifield North and 3) considers catchment context considerations that would inform asset uptake by developers and local councils.

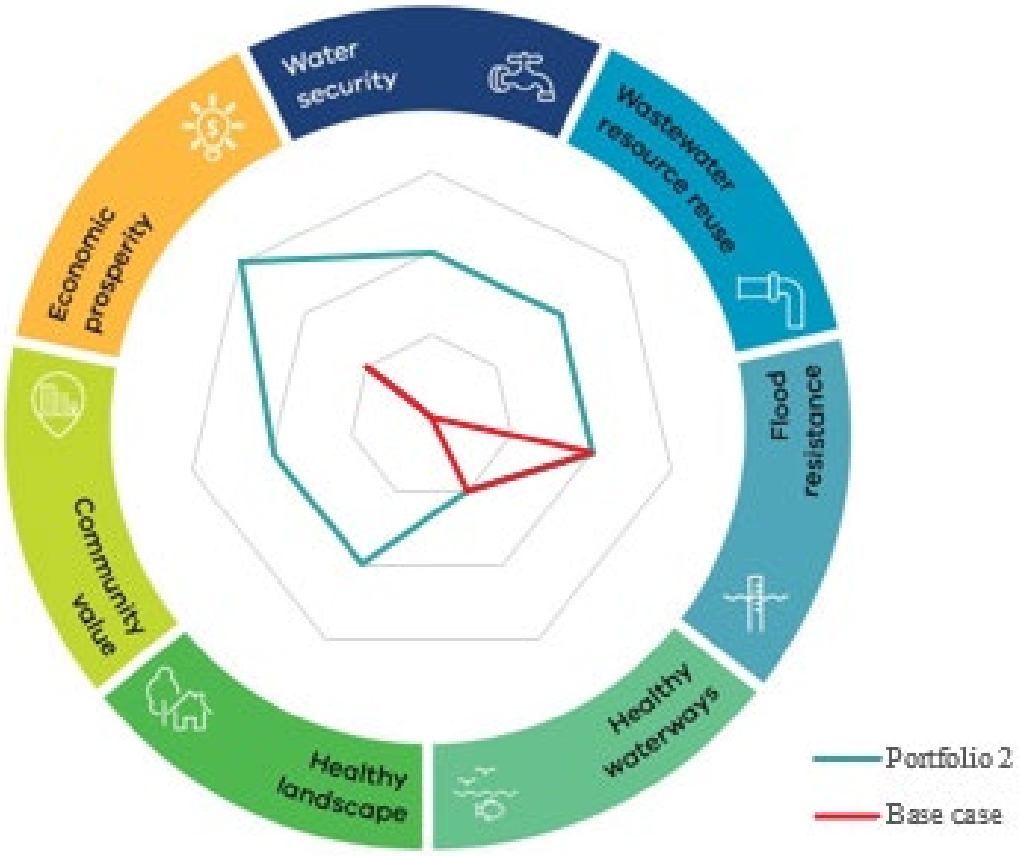
Portfolio 2 includes:

- Class A recycled water for non-potable supply
- Advanced water efficient appliance
- Passively irrigated street trees

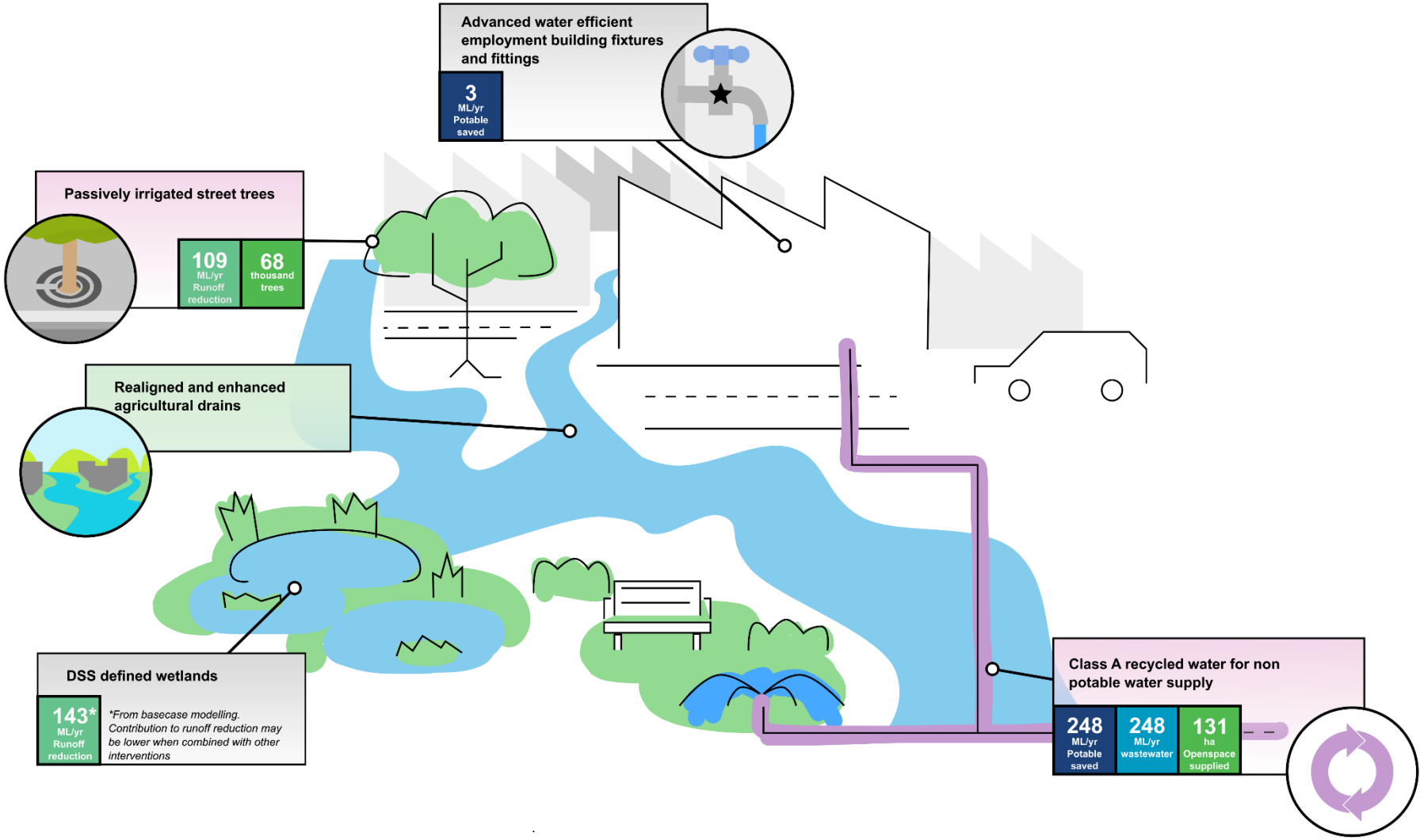
Table 7-2 Description of Portfolio 2 in relation to the strategic outcomes

Water security	• Moderate water security is provided through a reliable Class A recycled water supply. Uptake is dependent on development uses and may be limited to minor uses such as toilet flushing and washdown. A higher benefit would require major water user uptake in Class A supply, such as a major industrial process or data centre. • Use of advanced water efficient appliances support reducing potable supply demand on the broader centralised potable network. • A potable water reduction of 57-134 ML supplying 100% of the non-potable demand with recycled water use and advanced water efficient appliances is achieved for the Merrifield North precinct.
Wastewater resource reuse	• The servicing of this precinct with recycled water will reduce wastewater leaving the catchment and make use of this valuable resource locally to support circular economy principles.
Flood resistance	• Moderate flood resistance provided through Kalkallo RB providing localised flood mitigation, delivered through the DSS. • Passive street trees are unlikely to provide flood resistance to nuisance flooding, unless paired with other lot and street scale interventions.
Healthy waterways	• Flow reduction of **13-15%** in mean annual runoff is achieved (assuming 7.3% reduction from base case wetlands). • Low flow reduction is achieved, with base case Kalkallo RB and passive street tree irrigation providing insufficient harvesting and infiltration capacity to capture impervious stormwater runoff.
Healthy landscape	• Moderate healthy landscapes value is achieved. Active and passive open space would be supported by Class A supply from YVW network. Passive irrigation of trees will support healthier and larger canopies, and will provide greening and cooling benefits. • Standard waterway remediation may create opportunity for a biodiversity corridor.
Community value	• Moderate community value as passively irrigated trees and greening from open space irrigation provides amenity and urban cooling benefits. • Standard waterway remediation and protection of Kalkallo Creek from urban runoff is unlikely to contribute to Wurundjeri Woi-wurrung values of healthy Country. Minimal opportunity to engage Wurundjeri's Narrap team to care for Country is provided.
Economic prosperity	• Improving climate resilience of active and passive open space, including marram baba regional park, through use of alternative water supply can be used to attract business with a higher employment rate. • Commercial and industrial businesses can be provided with recycled water in the hopes of attracting businesses with high water demands.

Portfolio 2: Relative performance against strategic outcomes



Portfolio 2 - Development focus: good practice



7.3.3 Portfolio 3 - Development focus: best practice

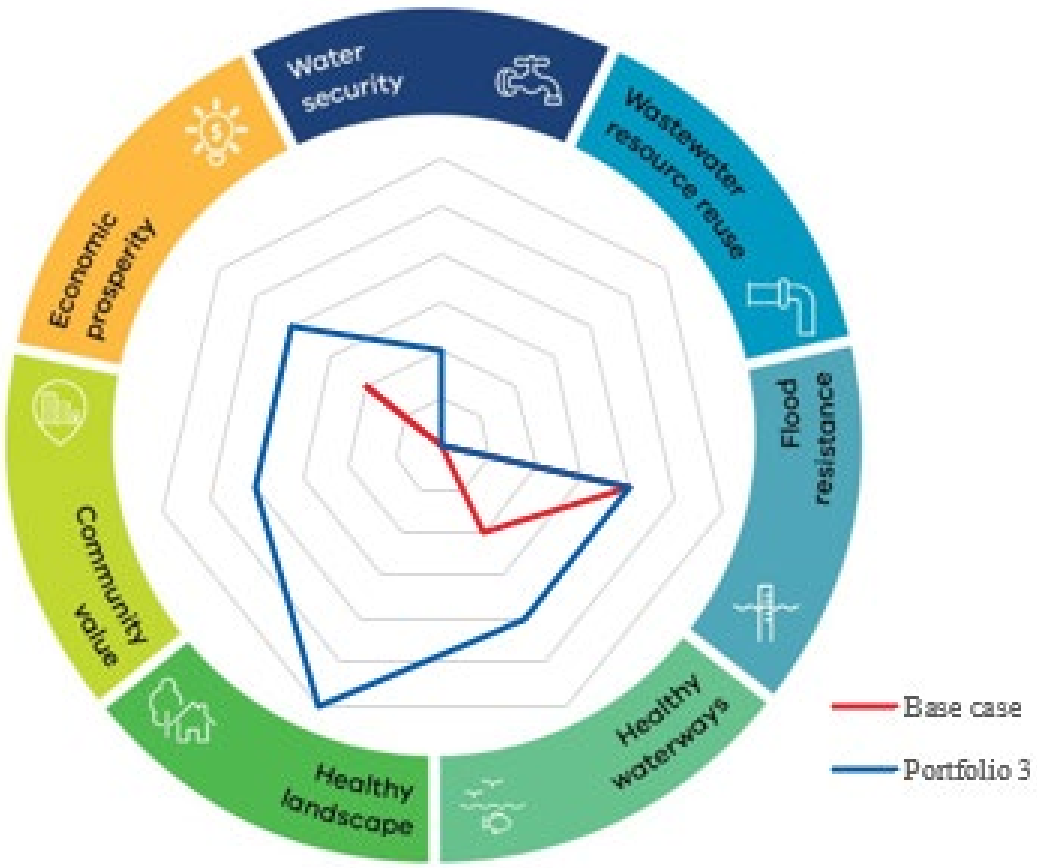
Portfolio 3 adopts a localised, place-based approach to achieving the HWS stormwater runoff reduction targets. It focuses on retaining, infiltrating, and reusing stormwater at or near the point of generation, reducing reliance on downstream conveyance and supporting more distributed water management outcomes. This portfolio includes:

- Rainwater harvesting for non-potable use
- Permeable pavement in employment car parks
- Stormwater harvesting at Kalkallo RB for marram baba regional park and nearby open spaces
- Spongy riparian zones
- Realigned and enhanced agricultural drains

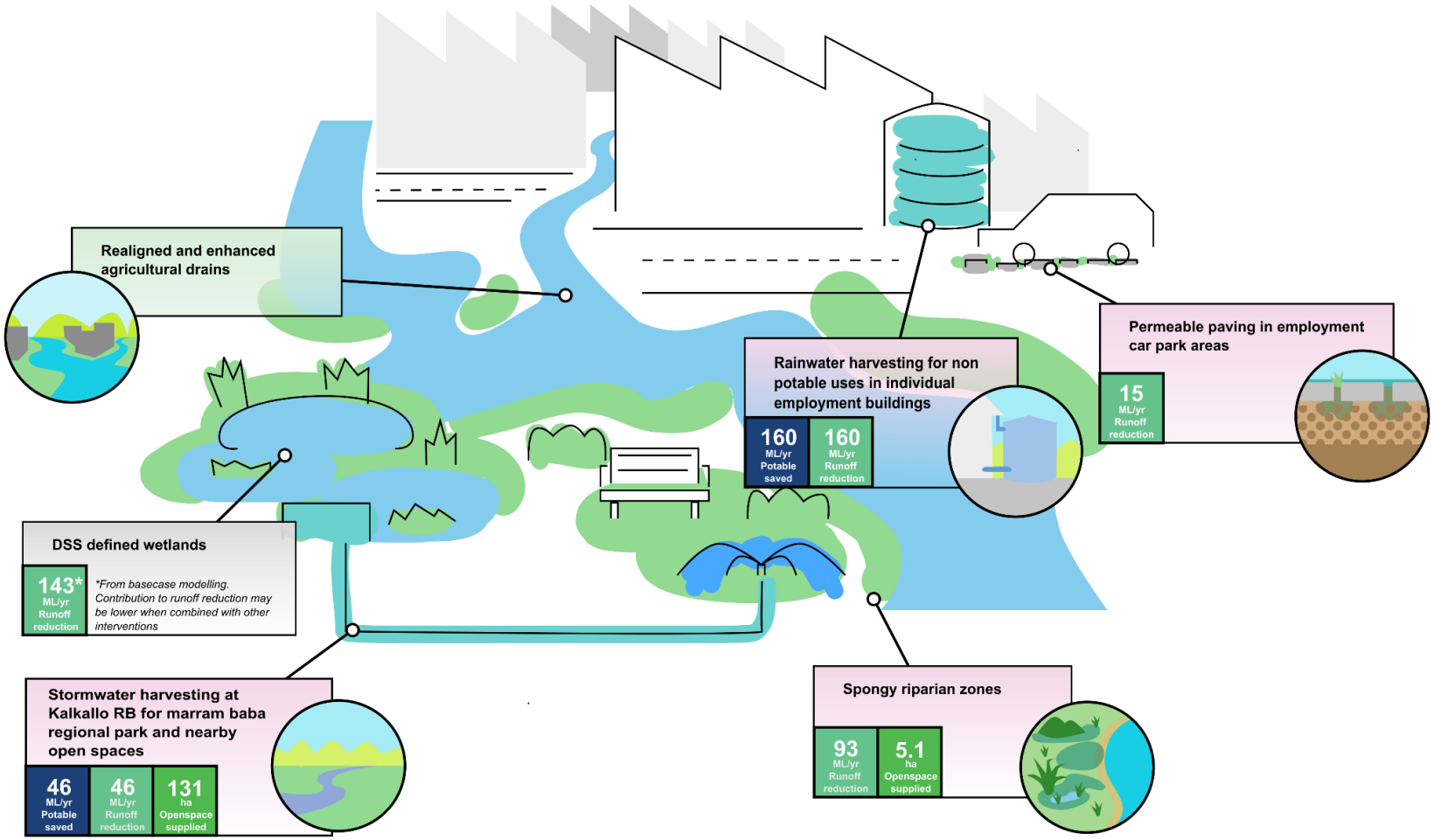
Table 7-3 Description of Portfolio 3 in relation to the strategic outcomes

Water security	• Low water security is achieved through the use of lot scale rainwater tanks, with demand limited to end uses such as toilet flushing and wash down. • A potable water reduction of 160-278 ML, reducing non-potable water use by 83-85% from rainwater tank water use and stormwater harvesting is achieved for the Merrifield North precinct for this portfolio.
Wastewater resource reuse	• There is no wastewater reuse benefit in this portfolio. Alternative demand is supported through stormwater harvesting and reuse.
Flood resistance	• Flood resistance relative to the base case has not changed. • While this is the case, rainwater harvesting creates some additional storage capacity to store water during rainfall events, increasing nuisance flood resilience.
Healthy waterways	• Flow reduction of **17-20%** in mean annual runoff is achieved (assuming 7.3% reduction from base case wetlands). • This portfolio does not meet the HWS target for harvesting and only meets the infiltration target. Portfolio offers a diverse range of stormwater management practices to reduce flow and pollutants, however the amount of harvesting is limited by the relatively low demand in an employment precinct. • Spongy areas and permeable pavement are designed to allow localised infiltration, reducing flow discharge into the waterway. Spongy areas also provide additional treatment of stormwater runoff.
Healthy landscape	• High impact as open space, including marram baba regional parkland, is supported by harvested stormwater. This can also provide urban cooling benefit for areas in close proximity to open space. • The creation of spongy riparian zones could also enhance landscape value and habitat.
Community value	• This scenario allows communities to feel connected to nature through the presence of localised water sensitive urban design to treat and harvest stormwater and spongey riparian zones. The presence of these assets could increase community awareness of water resources and water stewardship. • Standard waterway remediation and protection of Kalkallo Creek from urban runoff is unlikely to contribute to Wurundjeri Woi-wurrung values of healthy Country. • The spongey riparian zones have the opportunity to support use of indigenous species and to partner with Wurundjeri's Narrap team to care for Country.
Economic prosperity	• Improving climate resilience of active and passive open space, including marram baba regional park, through use of alternative water supply can be used to attract business with a higher employment rate.

Portfolio 3: Relative performance against strategic outcomes



Portfolio 3 - Development focus: best practice



8. Portfolio Recommendations

8.1 Comparison of IWM portfolios

Figure 8-1 compares how the three portfolios perform against one another for the seven strategic outcomes. Each portfolio provides additional benefits from the base case in different ways. For example, portfolio 1 achieves the highest for healthy waterways, flood resistance and water security outcomes, portfolio 2 achieves the highest for economic prosperity and portfolio 3 scores highest for healthy landscape.

There is no one scenario that stands out as being the best performing scenario across all seven strategic outcomes, with different advantages of each approach. For example, portfolio 1 uses large scale interventions aimed at reducing stormwater runoff that also contribute to water security for the region but does not contribute to precinct community value due to the focus on large-scale interventions managed in the public realm (in the RB and creek corridor) rather than within the precinct. The development focussed portfolios, 2 and 3, offer more localised precinct scale benefits, contributing to local alternative water use, greening and source control of stormwater.

The deliverability of each portfolio and individual IWM opportunities is critical to the feasibility of precinct implementation and informing the PSP. While every effort has been made to select IWM opportunities that align with stakeholder preferences through the stakeholder check-ins, further work is required to ensure possible delivery pathways and key decisions relating to PSP planning processes are enabled. This is further explored in the next section.

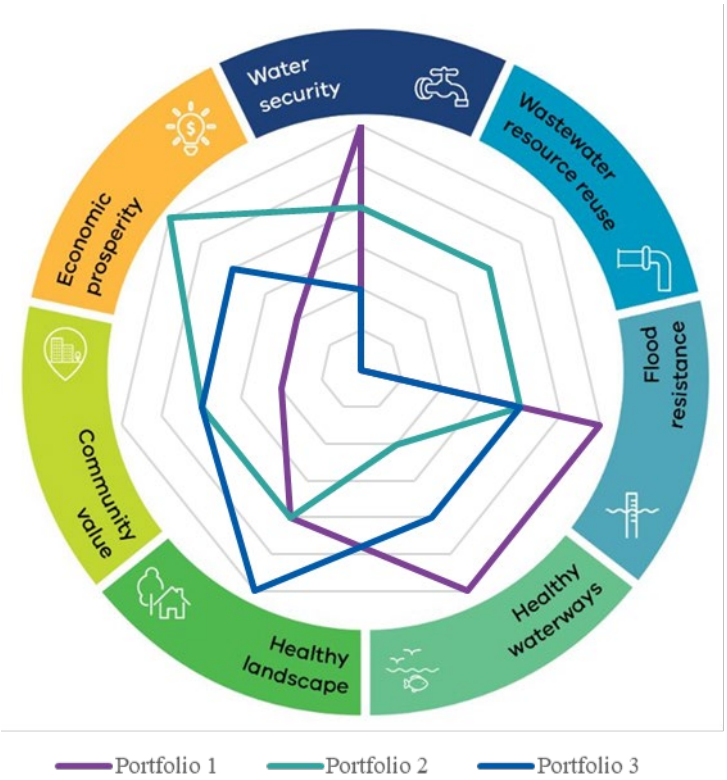


Figure 8-1 Comparison of portfolios

9. Recommended portfolio of IWM options

Based on assessment of the portfolios against the strategic outcomes and delivery priorities communicated by MW, YVW and councils during stakeholder check ins, it is recommended that the preferred IWM solution for Merrifield North precinct is based on enabling the regionally significant IWM initiatives in Portfolio 1 plus specific measures from Portfolio 2 and 3 that support localised outcomes of alternative water use and enhancement of liveability and environment (Figure 9-1). Further rationale is provided below with roles and responsibilities for delivery of the elements of the IWM solution, including how they inform the PSP provided in section 1.

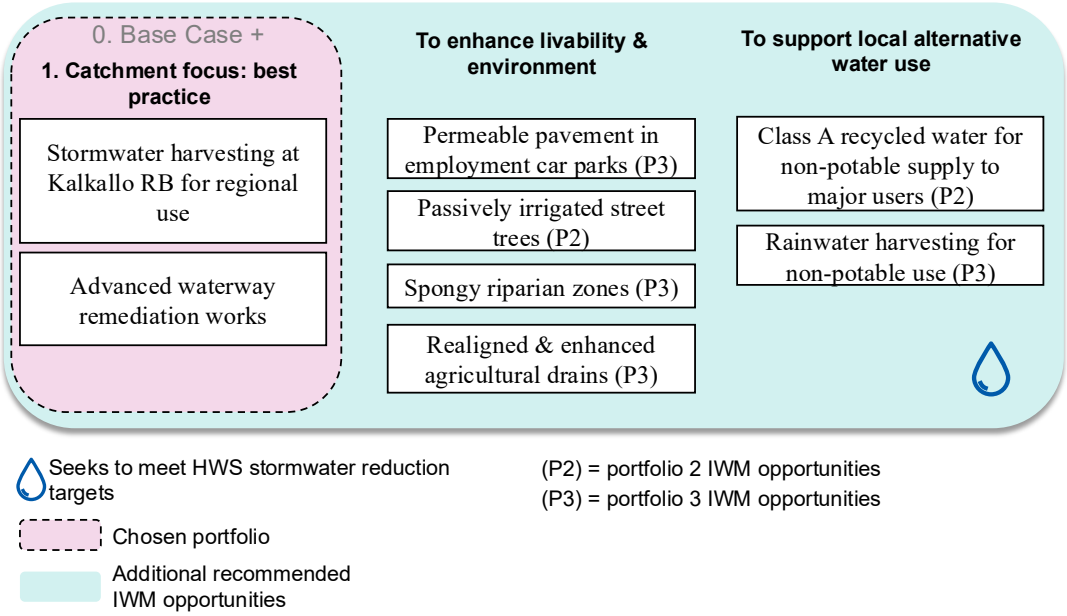


Figure 9-1 Recommended IWM solutions for Merrifield North precinct

Recommendation description & rationale

The IWM solution recommendation looks to balance delivery of the strategic outcomes, with the employment nature of the precinct, catchment contexts, including sodic soils, and investment pathways already under investigation by stakeholders.

Stormwater harvesting at Kalkallo RB for regional use is an investment pathway under active investigation by MW and YVW. While a catchment scale initiative, and not for delivery by developers, the initiative will inform the area of developable land within the PSP. With its performance as part of this assessment, and its priority to key stakeholders MW and YVW, it is a key recommendation for inclusion within the PSP. The scheme will achieve HWS stormwater volume reduction targets and significantly contribute to both local and regional alternative water use within the Northern Growth Corridor, setting a strong foundation to bring the broader Kalkallo sub-catchment vision to life.

It is complimented in portfolio 1 by **Advanced waterway remediation of Kalkallo Creek**, creating a biodiverse and high value landscape corridor. While portfolio 1 has strong waterway health, flood resilience and water security benefits, supplementing it with IWM opportunities within the development area from portfolio 2 and 3 will result in greater localised performance and enhanced community value and economic prosperity for the precinct. This is further discussed below.

To support local alternative water use:

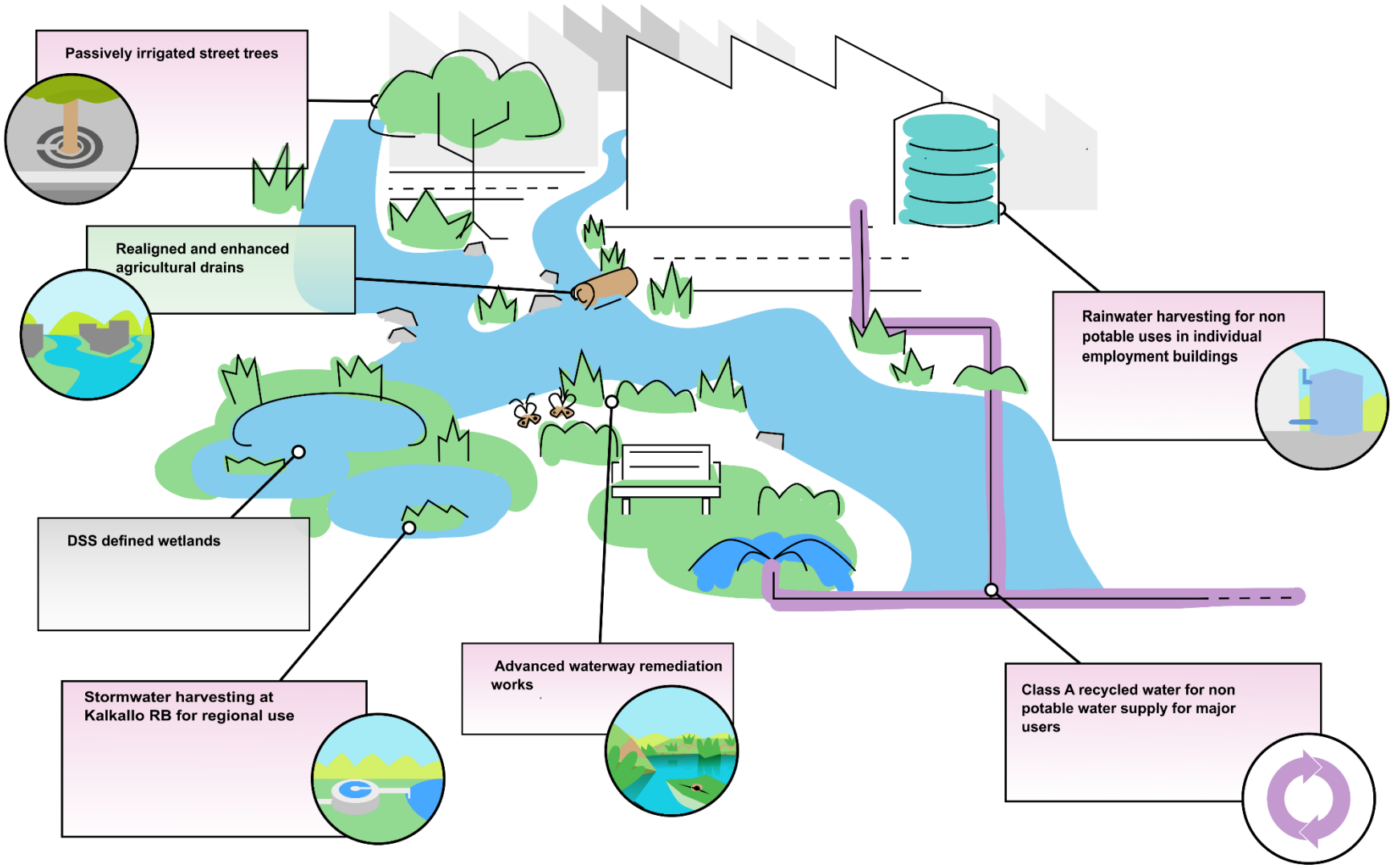
- **Class A recycled water for non-potable supply for major users** within the precinct (which could for example include data centres or industrial processes with significant demand for non-potable water). Recycled water is advantageous for industrial processes with high non-potable demand due to its supply reliability relative to stormwater. This could open pathways for providing climate resilient alternative supply for council open space as well as marram baba regional parkland.
- **Lot scale rainwater tanks** should be included for employment buildings to provide for toilet flushing, irrigation and appropriate wash down activities. This could be in combination with or instead of recycled water, pending on demand availability and the viability of recycled water. Rainwater harvesting will assist in providing local runoff reduction at source to reduce downstream impacts in a sodic soil environment. The use of rainwater harvesting aligns with council priorities for rainwater tank use in employment areas[10]. Depending on the types of employment developments that come forward, the use of a local micro-grid for rainwater harvesting which matches supply from large roofs with demand from large users could be delivered but would require further investigation with development proponents.

To enhance liveability and environment:

- Lot and street-scale opportunities where feasible to support greening and amenity while reducing runoff in a sodic soil-friendly manner, a key focus supported by councils[10] is the inclusion of **passively irrigated trees** and opportunities to embed increased permeability in developments and natural infiltration areas in riparian zones should also be encouraged. These initiatives also support WWCHAC objectives to keep water on Country.
- **Enhancement of local waterways and agricultural drains** and utilising these as green-blue corridors for enhanced recreation, amenity and habitat value. Where these waterway corridors can act as an opportunity to act as walking and cycling paths, both creating connectivity within the precinct and opening up opportunities to connect neighbouring precincts to unique environmental and liability areas within the precinct. This strongly aligns with the DTP vision of the precinct goal of *creating a transport network that connects people to jobs and services efficiently*, and is also echoed by council priorities[10].

[10] Communicated during the Merrifield North IWM Plan check in with Mitchell Shire Council and Hume City Council staff on the 17th April 2026

Summary of recommended IWM interventions



10. Implementation recommendations

The recommendations below are proposed for implementation of this IWM Plan through the PSP development process, noting that several key investigations are still ongoing.

Table 10-1 Key implementation recommendations for the proposed IWM solutions

IWM Solution	Recommendation	Responsibility (Lead, Partner)	PSP Implementation	Timing
All IWM solutions	The Merrifield North PSP to reference the IWM Plan and require development applications to include IWM proposals in keeping with this plan	DTP	Inclusion of text, referencing IWM Plan, within the PSP.	Prior to PSP finalisation
All IWM solutions	This IWM Plan recommendations be reviewed upon key decisions being made. The plan should continue to be refined as decisions and investment pathways are identified.	All parties	Ensure reference to IWM allows it to be updated.	Post PSP finalisation
Stormwater harvesting at Kalkallo RB for regional use	The PSP make allowance for completion of investigations and decisions regarding the extent, function and objectives for the Kalkallo RB, as recommended by the Kalkallo Creek Sub-Catchment IWM Plan.	DTP: PSP timing MW: completion of investigations	Confirmation of Kalkallo retarding basin extent	Prior to PSP finalisation
	Ensure the PSP makes land take allowances for core infrastructure required for the Kalkallo RB regional stormwater harvesting scheme. While wetlands will be included in the drainage scheme, the regional scheme will require space for other assets including additional storage, stormwater treatment and the stormwater transfer pipe connecting the scheme to Bald Hill storage tanks.	MW & YVW: assets and their land take required. Where engagement with WWCHAC strongly recommended DTP: inclusion in the PSP	Confirmation of Kalkallo retarding basin extent. Allowance for infrastructure and easement for connection to Bald Hill.	Prior to PSP finalisation if decision timing aligns with PSP Delivery. Or post PSP finalisation, by assigning the full extent of the Kalkallo RB as an 'investigation area' within the PSP until the decision is made

IWM Solution	Recommendation	Responsibility (Lead, Partner)	PSP Implementation	Timing
Advanced waterway remediation works	Ensure Kalkallo Creek waterway corridor land take accounts for MW decisions made in relation to advanced waterway remediation works, including stabilisation and riparian enhancement to address sodic soil environment.	MW (via the DSS), DTP	Decision to be made as part of DSS development, which will influence PSP land allocations.	Prior to PSP finalisation
Rainwater harvesting for non-potable supply	Uptake of rainwater tanks should be encouraged with the aim of supporting local alternative water use and providing local source control of stormwater runoff from commercial and industrial buildings.	DTP: make allowance within the PSP by referencing the IWM Plan	Sets lot scale guidance and requirements for developers for installation of rainwater tanks	Prior to PSP finalisation
Class A recycled water for non-potable supply	The PSP should include enabling guidance that support the connection of large water users to the recycled water supply network. Where this is coordinated and approved by YVW. Engagement with councils on if or when recycled water is preferenced versus rainwater tanks is recommended.	DTP: Make allowance within the PSP by referencing the IWM Plan YVW: work with DTP and councils to finalise recycled water offering for large demand users	Sets lot scale guidance and requirements for developers, by outlining the opportunity to connect to the recycled water network for large water users, and rainwater tanks otherwise.	Prior to PSP finalisation
Permeable pavement in employment car parks Passively irrigated street trees Spongy riparian zones	Include guidance in the PSP to encourage the inclusion of lot and street-scale IWM opportunities where feasible to support greening and amenity while reducing runoff in a sodic soil-friendly manner, including passively irrigated trees and increased permeable car parking areas and natural infiltration areas in riparian zones.	DTP: make allowance within the PSP by referencing the IWM Plan	Sets lot and street scale guidance for developers for installation of permeable carparks, passively irrigated street trees and natural infiltration areas.	Prior to PSP finalisation

IWM Solution	Recommendation	Responsibility (Lead, Partner)	PSP Implementation	Timing
Realigned & enhanced agricultural drains	Realignment and enhancement of existing agricultural drains, including introduction of ephemeral sections to support key ecosystems historically present in the catchment. PSP planning and decision making for active transport corridors connect and enhance blue green corridors (e.g. through agricultural drains enhancement) to enable walking and cycling pathways through the precinct and connecting to neighbouring residential precincts.	DTP, Councils, MW, WWCHAC	Informs transport corridor planning within the PSP and potentially waterway improvement planning (via the DSS). Informing developable land area.	Prior to PSP finalisation
Drainage scheme wetlands and retarding basin	Explore the potential to introduce or restore ephemeral landscapes to support key ecosystems historically present in the catchment.	MW (via the DSS), DTP, WWCHAC, Councils	Informs design and planning of the retarding basin area and drainage assets	Prior to PSP finalisation

11. Limitations and ongoing review of opportunities

It is acknowledged that the IWM proposal recommended in this plan is not fixed and can be revised as the PSP progresses.

The analysis performed as part of this strategy was based on an extensive desktop review of previous studies and reports. As such, there are limitations to the recommendations from this report including:

- The Melbourne Water Developer Services Scheme is not finalised at the time of this study.
- Geotechnical studies are currently ongoing at the time of this study.
- Studies relating to the extent and values of Inverlochy Wetland were not completed at the time of this study.
- The nature of industrial and commercial businesses entering the precincts are unknown. To account for the variance in water demands between different industrial businesses, a low and high-water demand scenario was created to represent uncertainty. Water demands for data centres was not accounted for within this range due uncertainty of their inclusion within this precinct at this stage.
- Waterway health risks relating to pollution runoff from industrial business has as not been explicitly considered for in this study. It is recommended that mitigation measures are included in site-specific development proposals in keeping with City of Hume's guidance.