ARUP

Victorian Planning Authority

Croskell Precinct Structure Plan (PSP)

Integrated Water Management Plan

Reference: Issue

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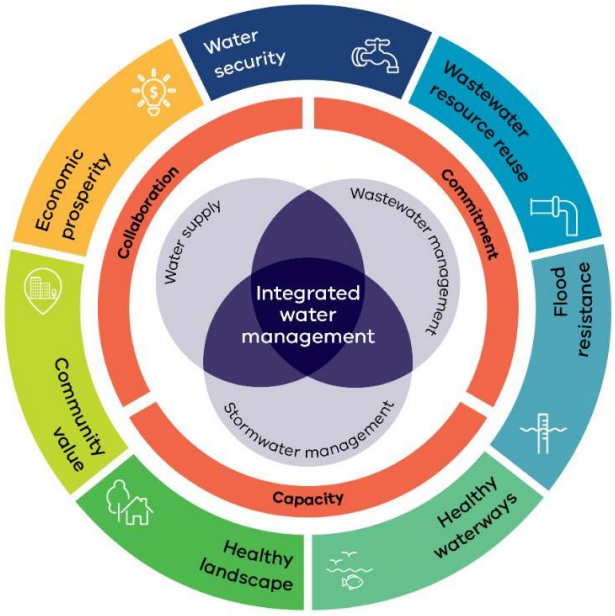

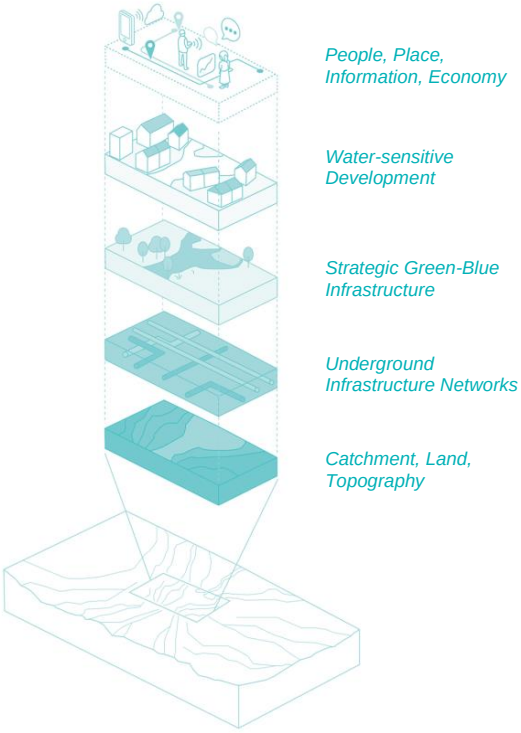

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Contents

Tables

Figures

Appendices

Acronyms

Abbreviation	Definition
BAU	Business as Usual
CSIWM	Catchment Scale Integrated Water Management
DEECA	Department of Energy, Environment, and Climate Action
DSS	Development Services Scheme (Drainage)
ETP	Eastern Treatment Plant
GMA	Groundwater Management Area
GP	Gross Pollutants
IWM	Integrated Water Management
LCA	Land Capability Assessment
LSIO	Land Subject to Inundation
mAHD	Metres relative to the Australian Height Datum
MERI	Monitoring, Evaluation, Reporting & Improvement Plan
MW	Melbourne Water
PSP	Precinct Structure Plan
RWH	Rainwater Harvesting
SEW	South East Water
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
VPA	Victorian Planning Authority
WWTP	Wastewater treatment plant

Executive summary

This report summarises the Integrated Water Management (IWM) options assessed for Croskell, and provides recommendations to be incorporated by the VPA as part of the wider Precinct Structure Plan (PSP). This is a concept level IWM investigation, which aims to provide inputs for the development of a PSP, and so further investigation is still necessary at a subdivision or development scale to assess the feasibility of the recommended options, and the associated costs, benefits, and other elements to ensure the best community outcomes can be achieved.

A summary of the process used to undertake this study is listed below.

A contextual analysis and base case report, which outlined the context of the site to date, and used a high-level land use budget (provided by VPA) to estimate water demands, wastewater generation and stormwater runoff volumes and pollutant loads.

A Shared IWM Vision Workshop which brought together water corporations, council, VPA and DEECA to identify outcomes and possible solutions for IWM at Croskell PSP.

A quantitative assessment of identified IWM opportunities against assessment criteria that incorporates stakeholder desires.

A second stakeholder workshop to discuss implementation pathways of IWM.

Clustering of various IWM options into Portfolios that could be delivered as a suite of complementary IWM solutions for Croskell PSP.

This report should be read in conjunction with the Contextual Analysis and Base Case report (appended), prepared by Arup for the VPA (21 July 2023).

By undertaking the steps outlined above, three IWM portfolios were proposed. These are;

- **Portfolio 1 - Centralised network:** A centralised network which comprises recycled water being supplied from the nearest treatment plant to meet all the PSPs water demands (residential, non-residential and open space) and a dedicated infiltration ‘spongy’ area alongside the waterway corridor.
- **Portfolio 2 - Decentralised and flexible systems:** A decentralised and flexible system, which comprises recycled water from the nearest treatment plant to meet residential demands only, precinct scale stormwater harvesting to meet open space irrigation demands, rainwater harvesting and roof irrigation to evaporate rainwater in non-residential lots and passively irrigated trees at the street scale.
- **Portfolio 3 - Maximising greening:** A maximised green solution which comprises recycled water being supplied from the nearest treatment plant to meet residential and non-residential demands, regional rainwater harvesting to serve open space irrigation demands, raingardens and green roofs in non-residential lots and passively irrigated trees at the street scale.

Based on the quantitative assessment and analysis of possible implementation pathways, it is recommended that the preferred IWM solutions for Croskell PSP are based on Portfolio 2, but that some flexibility is provided to substitute some solutions based on individual development design, and site constraints.

Portfolio 2 offers decentralised and flexible solution, that enables IWM solutions to be determined at a development scale, based on the scale of demand for alternative water, and opportunities for stormwater management and greening.

Within this portfolio, the core IWM solutions recommended are **providing recycled water to residents, on lot rainwater harvesting for non-residential plots and passively irrigating trees.**

These core options can be complemented by the following adaptable options, designed to enhance the objectives outlined in the table below.

Objective: Support enhanced greening and liveability by supporting open space irrigation with alternative water sources	Objective: Reduce stormwater runoff from impervious areas in non-residential developments
Possible opportunities: - Stormwater harvesting for open space irrigation - Recycled water for open space irrigation	Possible opportunities: - Stormwater harvesting scheme for open space irrigation Lot-based stormwater reduction activities suitable for the development proposal which could include: - Roof irrigation on large industrial buildings for rainwater evaporation - Raingardens in car parks - Green roofs - Permeable paving in car parking areas - Infiltration areas

It is understood based on discussions with South East Water, that meeting residential non-potable demands with recycled water in this region is more certain than meeting commercial and industrial demands (which is understood to happen on a case-by-case basis). Having lot-based flow reduction opportunities in non-residential lots allows flexibility in the PSP by creating a level of decentralisation which increases the resilience of non-potable water supply in the site. Finally, passively irrigated trees increases public amenity, contributes to urban cooling and provides a level of stormwater runoff reduction into the receiving waterway.

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:

- Geotechnical investigations have not been carried out. Soil parameters were based on an assumption that the development will be built on clay. Infiltration rates will differ between different soils which may alter the performance of options.
- The DSS is not complete at the time of this study. A single wetland was used to represent the pollutant and flow reduction performance from the DSS, however actual treatment performance may vary.
- 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.

The portfolios suggested are not final and require further analysis to be undertaken by the implementing stakeholders. It is recommended that the VPA continue to liaise with MW as the DSS progresses, liaise with SEW to understand possible connection points for a recycled water network and review the viability of the preferred portfolio as the nature of commercial and industrial businesses become known.

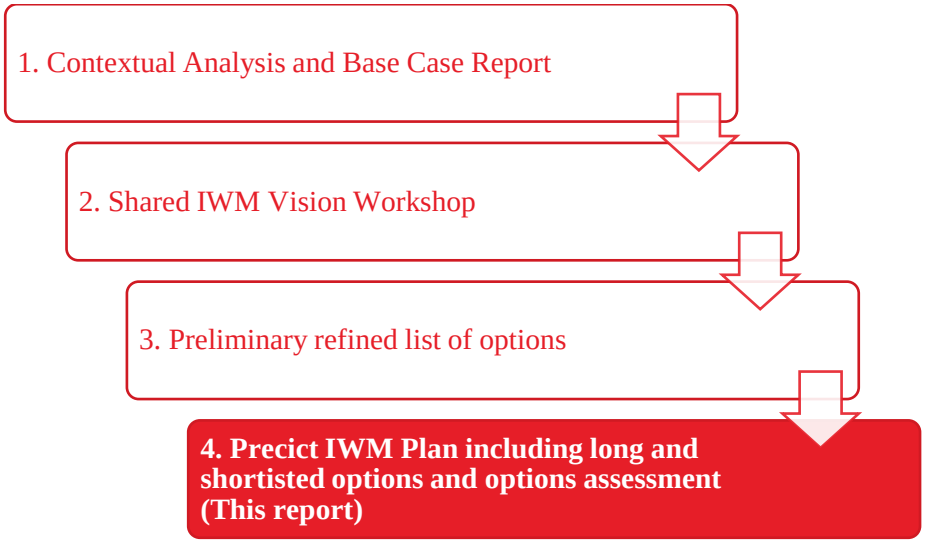
Finally, the assessment and grouping of options to create portfolios was adopted in this study as a quantitative way to compare IWM options against one another. Some portfolios inevitably score higher for outcomes such as healthy landscapes and community value, while others score higher for healthy waterways by meeting pollutant load runoff targets. The intention of the recommended portfolio is not to favour one outcome over another, but to provide stakeholders with direction on how to meet key policy and guidance as well as factor in costs, land take, constructability and maintenance.

1. Introduction and project context

Arup was engaged by the Victorian Planning Authority (VPA) to review the Integrated Water Management (IWM) opportunities for the Croskell Precinct Structure Plan (PSP). Croskell PSP is approximately 317ha and is intended for commercial and residential development.

This report summarises the IWM opportunities at Croskell and recommends a portfolio of IWM solutions for this PSP. The objective of this IWM assessment is to provide concept-level guidance to the VPA and stakeholders which can be incorporated into the development of the PSP.

A Contextual 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 Contextual Analysis and Base Case report.



Section 2 of this report provides a high-level summary of the Contextual Analysis and Base Case Report.

Section 3 summarises the context and outputs of the Shared IWM Workshop which was held to understand the desired outcomes for this PSP and propose IWM solutions.

Section 4 lists the IWM solutions identified and explains how they were refined to determine a short list.

Section 5 discusses the assessment criteria used to assess the options and summarises the results of the analysis.

Section 6 and Section 7 propose potential portfolios of IWM solutions for Croskell PSP and proposed a recommended way forward.

Finally, Section 8 concludes this study and summarises this report.

1.1 Key Stakeholders

The key stakeholders for IWM in Croskell PSP are summarised in **Error! Reference source not found.**. It is 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 who each hold differing responsibilities.

Table 1-1 Key stakeholders

Stakeholder	Responsibility	Relevance
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 is a key stakeholder for the study.
VPA	Responsible for development of the precinct structure plan. Undertake strategic planning and coordinated infrastructure.	The VPA will deliver a precinct structure plan for Croskell, of which an IWM Plan will feed into.
Melbourne Water (MW)	Manage bulk water resources in the Melbourne region and distributes to suppliers including South East Water (SEW). Responsible for major drainage assets, waterway and catchment management.	MW are planning assets within the Croskell PSP and are in the process of undertaking drainage modelling to size and located retarding basins within the site. MW also own and operate Eastern Treatment Plant (ETP) which is located 14 km away from the site.
South East Water (SEW)	Provides water supply and wastewater services to urban and commercial customers. Manages water and wastewater related infrastructure.	SEW is the responsible authority for supply of water and provision of recycled water and sewerage for the Croskell PSP area and is a key stakeholder for this study.
Southern Rural Water (SRW)	Responsible for regulating surface and groundwater use across Southern Victoria.	The project lies within the Koo Wee Rup Water Supply Protection Area which is within the boundaries of SRW. SRW will need to be contacted if groundwater is identified as a possible source of water in order to obtain a license.
City of Casey	Local government responsible for minor drainage assets, open space, community facilities and streets.	Council sets a vision for the municipality and will implement the PSP and be the local authority for the community created at Croskell, managing minor drainage assets, open spaces and streets.
Major Road Projects Victoria	Authority responsible for planning major road assets 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 Croskell.

2. Summary of Contextual Analysis & Base Case

This section summarises the key findings from the Contextual Analysis and Base Case Report. It is recommended that the Contextual Analysis and Base Case Report, prepared by Arup for the VPA (21 July 2023), is read in conjunction with this report. The report has been appended for convenience, in Appendix C.

2.1 Contextual analysis

The site is 317ha in area and approximately 7km southwest of the Western Port National Employment and Innovation Cluster, bounded by Thompsons Road to the north and Berwick Cranbourne Road to the east.

2.1.1 Terrain and hydrology

Terrain in Croskell is generally flat with gently sloping hills that slope towards the northeast corner of the precinct. There is also limited vegetation within the project area. Croskell PSP lies within the Dandenong catchment, within the Eumemmerring sub-catchment. The site is situated at the head of the catchment along the boundary, upstream of Eumemmerring Creek. An unnamed waterway intersects the project area from the southwest at Linsell Boulevard Wetlands to the northeast where it connects to The Avenue Wetlands. The waterway continues to pass through a series of drains before ultimately linking with Eumemmerring Creek further downstream where it exits into Port Phillip Bay.

Note that there is a difference between catchment boundaries defined by the IWM Forum and Melbourne Water, as shown in Figure 2-1. Croskell PSP lies within the Western Port IWM Forum boundary and Dandenong River catchment boundary. The distinction is important when considering objectives and targets from the relevant strategies.

Hence, the project will align with the regional objectives and targets identified in the Western Port IWM Plan, and the healthy waterway objectives identified in the Healthy Waterways Strategy for the Dandenong catchment.

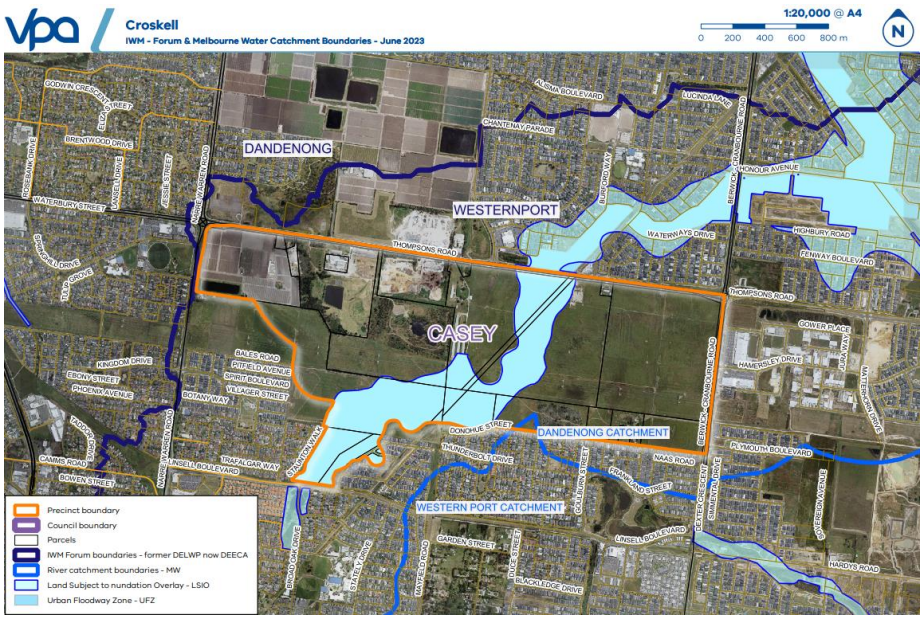


Figure 2-1 Croskell PSP and catchment boundaries

Figure 2-2 Location of Croskell PSP within the Dandenong catchment, map from Healthy Waterways Strategy by Melbourne Water (2018)

There are two wetland-swamps (Ti-Tree Creek-Linsell Boulevard Sediment Trap and Ti-Tree Creek-Linsell Boulevard Lake) that are connected to Linsell Boulevard Wetlands, located in the south. The majority of the waterbodies within the site boundary are unnamed.

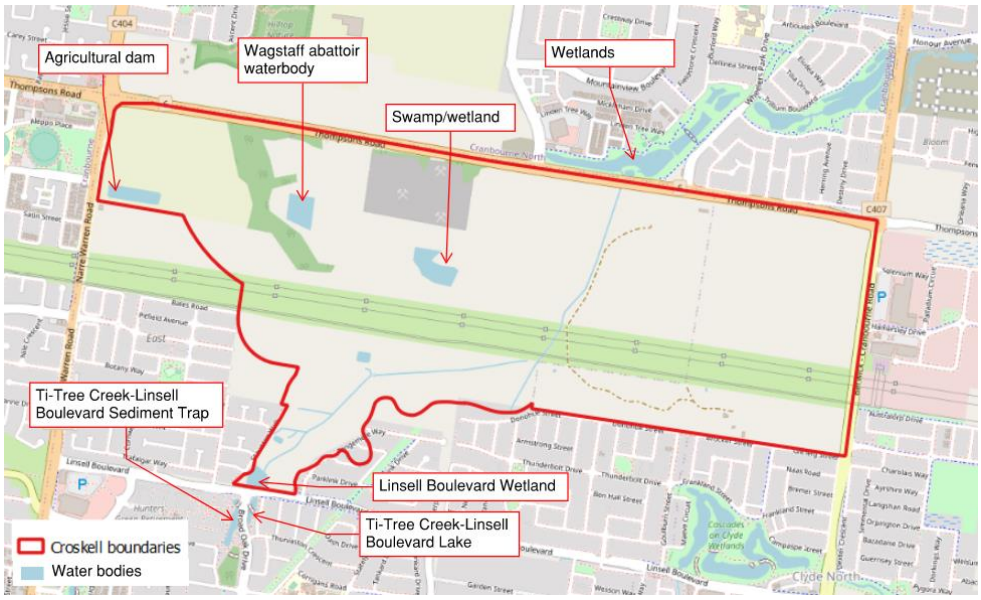


Figure 2-3 – Water bodies within project area

The watercourses within the project area are likely originated from or modified by human activities. They drain to a series of wetlands located in the northwest that ultimately link to the Tooradin Road Drain.

Based on the Healthy Waterways Strategy by Melbourne Water, Eumemmerring Creek is identified as a waterway with very low to low ratings in water quality for the environment, vegetation extent and quality, stormwater condition, and access to the waterway. As the waterway located in the project area is upstream of Eumemmerring Creek, the project should contribute towards meeting the performance objectives identified in the Healthy Waterways Strategy to mitigate the deterioration of the creek.

The Land Capability Assessment by Kleinfelder indicates that groundwater is expected to be encountered at a depth between 5-10mbgl with a total dissolved solid (TDS) concentration of 501-1000mg/l. The assessment also identified the project area is within Zone 3 of the Koo Wee Rup water supply protection area (WSPA). The area is protected by a groundwater management plan to ensure the long-term sustainability of groundwater as a resource.

The watercourse running south to north through the site sits within an urban floodway zone (UFZ) and a land subject to inundation overlay (LSIO). LSIO represents areas that are likely to be covered by floodwaters in a 1 in 100-year event.

2.1.2 Biodiversity and Environment

WSP conducted a Biodiversity Assessment in June 2022, and discovered the project area has been highly modified since pre-European settlement. Indigenous understory species are effectively absent except for sporadic occurrences of low-quality remnant native vegetation. The assessment concluded there was limited value in retaining the patches of remnant vegetation and is likely required to be cleared for the development of the precinct.

2.1.3 Contamination and geotechnical constraints

A Land Capability Assessment by Kleinfelder conducted a desktop site contamination assessment. Figure 2-4 shows the areas identified with a high, medium, and low potential for contamination.

Note, any land use on the high and medium contamination potential areas may require an environmental audit or intrusive assessment of the site.

Figure 2-4 – Potential locations for contaminated land, map from Land Capability Assessment by Kleinfelder (March 2023)

The terrain within the project area is a poorly drained soil with a moderate susceptibility to waterlogging and a low susceptibility to salinity issues. Gullying and landslip potential are also low and very low respectively.

Potential geotechnical constraints include;

- Uncontrolled fill form quarry operations and other activities on site

- High expansivity soils
- Low bearing capacity soils
- Poor trafficability
- Elevated perched water tables

2.1.4 Utilities

There are a number of existing utilities within the PSP boundary, as shown in Figure 2-5. Existing utilities include electricity, telecoms and fibre, gas, recycled water, wastewater and water supply. SEW is the responsible authority for the supply of water, wastewater and recycled water. City of Casey is the responsible authority for local stormwater drainage within the project area and connects to Melbourne Water stormwater network. The significant recycled water mains include:

- 300mm PVC pipe in the north along Thompsons Road and in the west along Narre Warren-Cranbourne Road.
- 100mm CICL pipe along Bales Road, Donohue Street, Brocker Street, Pipers Place and Glenelg Street in the south.

Figure 2-5 – Existing utilities, map from Utility Services Assessment by Kleinfelder (May 2023)

Figure 2-6 shows the extent of the utilities which marks the boundaries for overhead power lines, and an underground high voltage power cable feeding the Victorian Desalination plant. The easement presents constraints and challenges in connecting communities, pathways and waterways, location of future infrastructure and any other associated construction work.

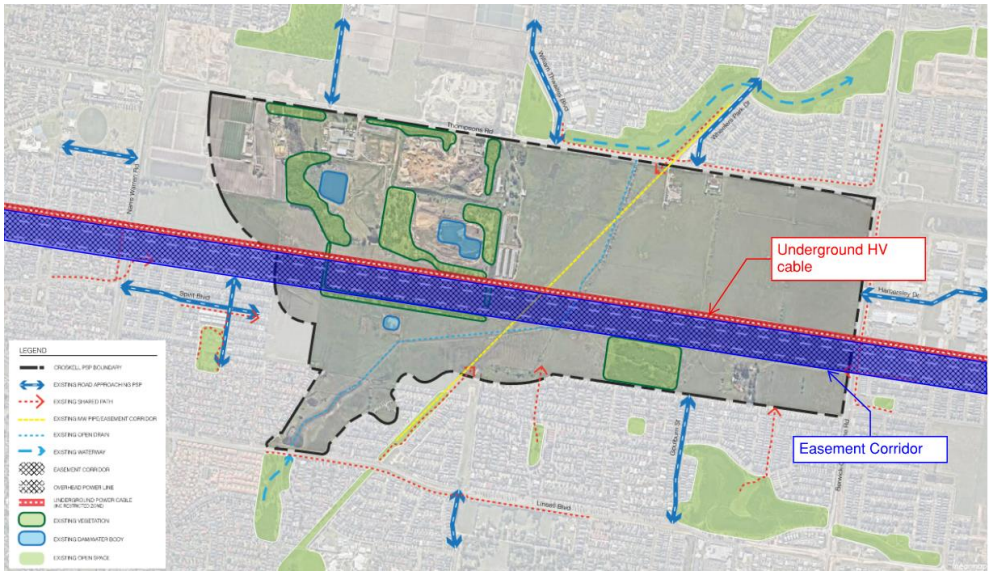
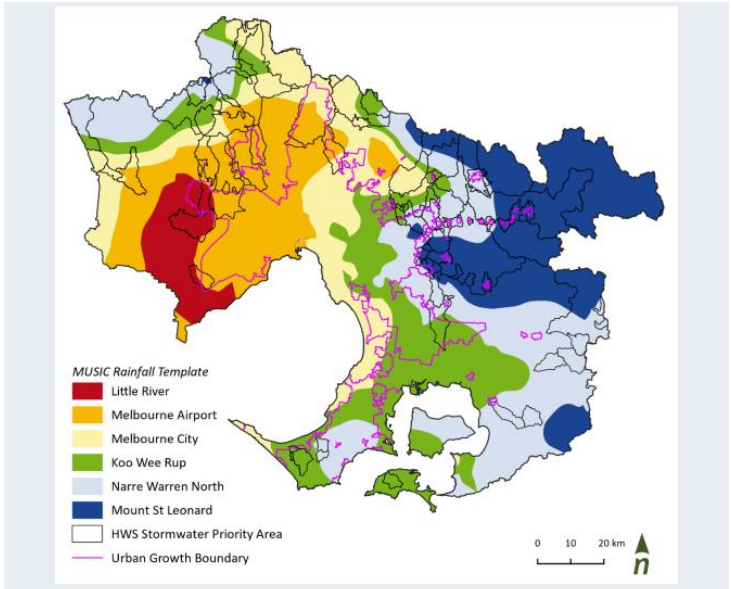


Figure 2-6 – Utilities easement existing conditions, map from Transmission Easement: Easement Framework and Concept Package by Spiire (July 2022)

2.1.5 Drainage

Melbourne Water is responsible for the development of the Ti-Tree Drainage Scheme (DSS). As part of the stormwater drainage scheme several options are being considered within the PSP boundary, including retarding basins and stormwater treatment infrastructure, however the exact location and dimensions are not yet confirmed. Melbourne Water is undertaking modelling to confirm locations of drainage assets as part of the DSS.

Melbourne Water in collaboration with the EPA developed the 'Healthy Waterways Strategy Stormwater Targets– Practitioner's Note', to develop a consistent framework, whereby the targets in the EPA guideline and in the Healthy Waterway Strategy are aligned. This document included the figure below, which provides stormwater runoff targets for areas based on MUSIC Modelling Targets.



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

Figure 2-7 - Urban Stormwater Management Guidelines targets

This document clarifies that the target **for stormwater harvesting is 26%** and the target for **infiltration is 10%** in Croskell PSP, which is situated within the Koo Wee Rup zone and a non-priority area.

2.2 Base Case

A proposed land use budget was received from the VPA on 09/06/2023. It is acknowledged that this land use budget is subject to change, particularly due to ongoing drainage modelling being undertaken by Melbourne Water.

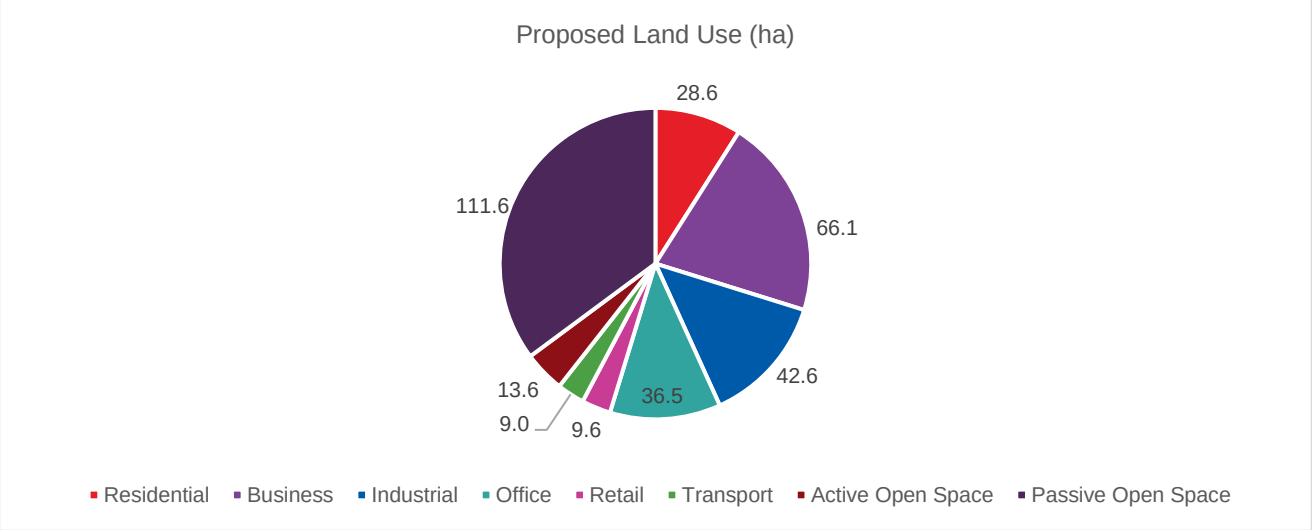


Figure 2-8 – Proposed land use

To calculate the anticipated water demands, and wastewater generation volumes for the PSP, assumptions were taken from various sources which are outlined in Table 2-1.

Table 2-1 Demand assumptions

Assumption	Value	Unit	Source
Residential potable demand	90	kL/hh/yr	50% of South East Water peak day potable rate, with the SEW non-potable demand rate subtracted.
Residential non-potable demand (e.g. toilet flushing, irrigation)	80.5	kL/hh/yr	50% of South East Water peak day rate for alternative water supply
Business / Industrial/ Office/ Retail water demand	1,861	kL/ha/yr	South East Water commercial / industrial rate
Non-residential non-potable proportion	40	%	Assumed. Will vary between depending on use type.
Open space- passive	2000	kL/ha/yr	Functional Open Space BPG
Open space- sports turf	3000	kL/ha/yr	Functional Open Space BPG
Water to wastewater generation	80	%	Industry assumption

A breakdown of residential demands was not supplied by SEW. The resulting water demands are shown in Figure 2-9. Refer to the Contextual Analysis and Base Case Report in Appendix C for further assumptions on water demands and base case wetland sizing.

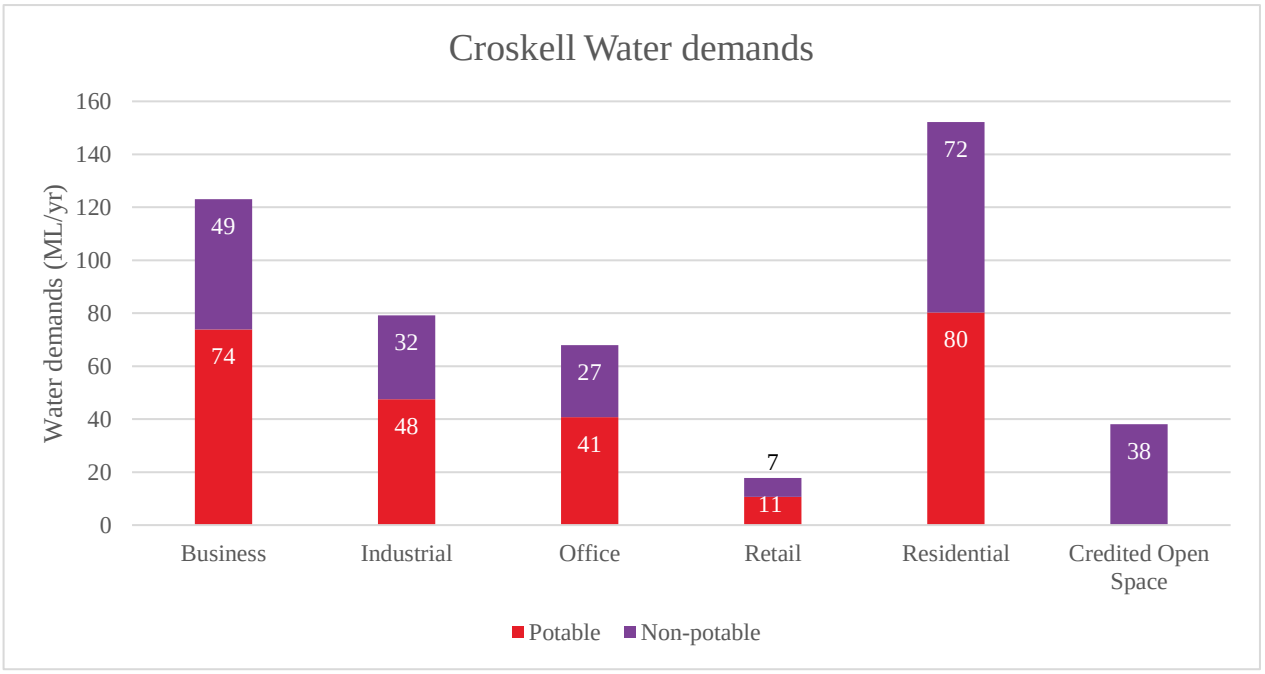


Figure 2-9 - Water demands by land use

Figure 2-10 summarises the water generation and demand within the site, including new stormwater generated (i.e. minus the predevelopment scenario) and the sewerage generated, compared to the potable and non-potable water demands.

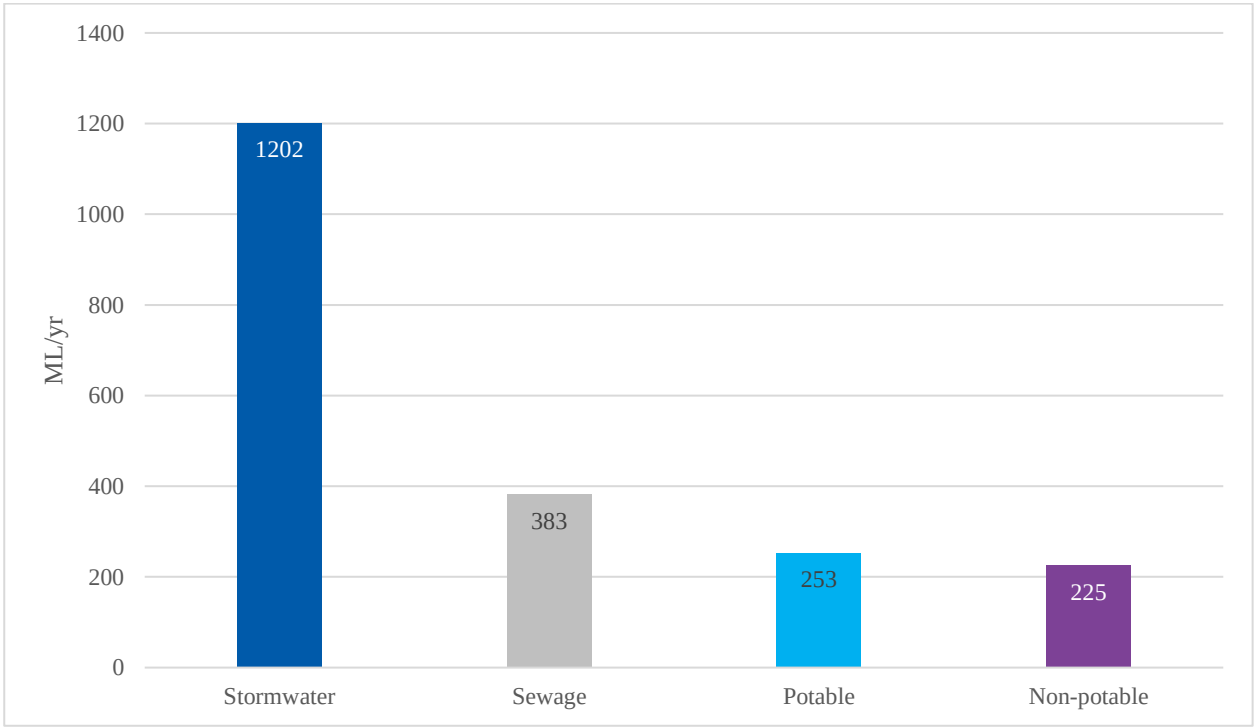


Figure 2-10 – Total storm and wastewater water generation and water demands

Figure 2-11 summarises the base case scenario of the proposed development showing water demands, sewage generation, flows and pollutant loads as a result of the development and assuming a wetland to meet BPEM targets.

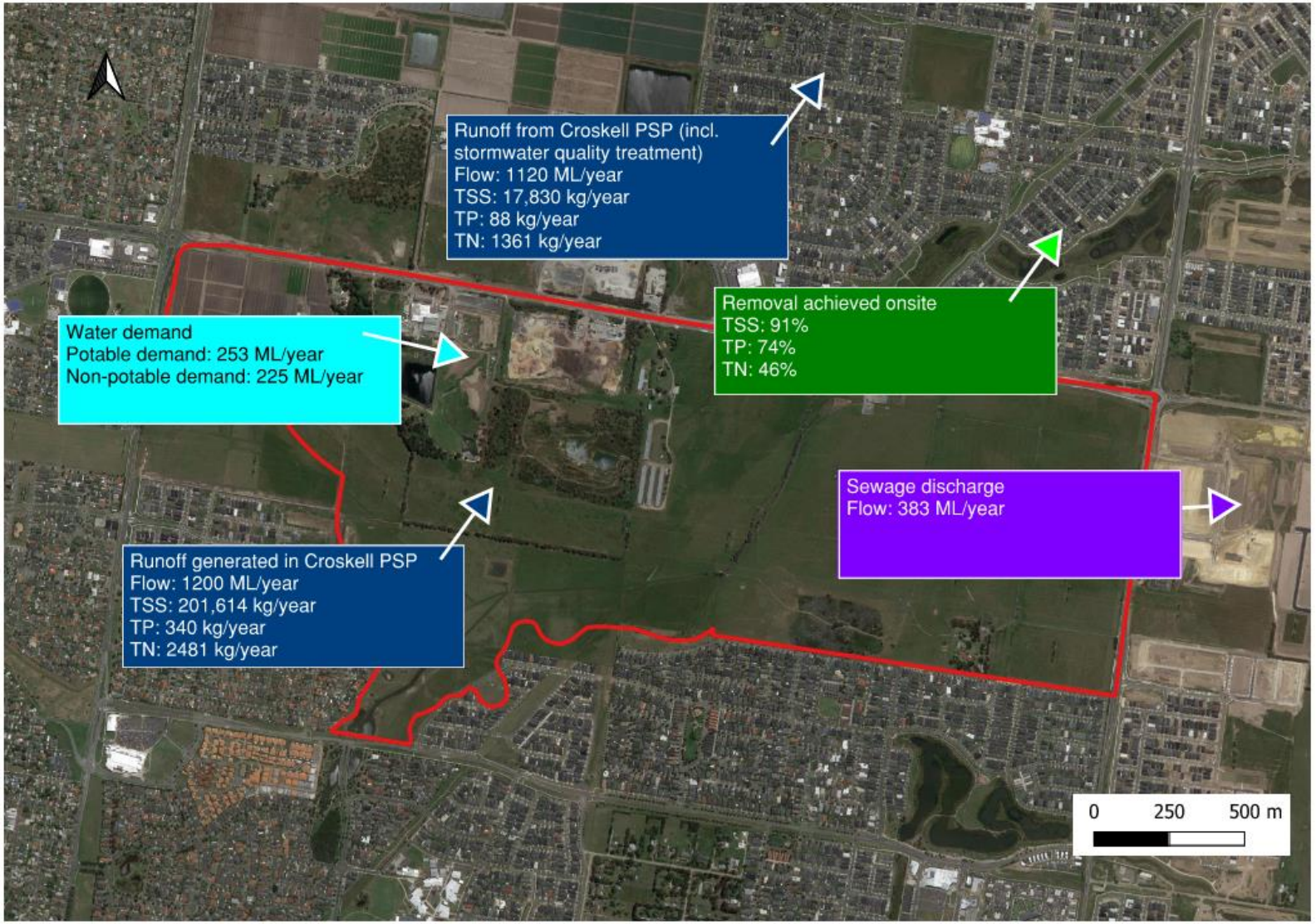


Figure 2-11 Base Case Summary, post development conditions

3. Shared IWM Vision Workshop

Following the Contextual Analysis and Base Case stage of this study, an IWM Shared Vision workshop took place on 6th July 2023. The list of participants is shown below.

Table 3-1 Shared IWM workshop participants

Role(s) of participants	Organisation
Strategic Planners, Strategic Planning Manager, Infrastructure Engineer	Victorian Planning Authority (VPA)
IWM Planners	Melbourne Water
Integrated Water Manager & IWM Engineer	South East Water
Senior Strategic Planner & Principal Water Planner	City of Casey Council
IWM project team and workshop facilitators	Arup
Senior IWM Manager	DEECA

The objective of the Shared IWM Vision workshop was to present findings from the Contextual Analysis and Base Case report, which was circulated to attendees prior to the workshop, as well as to determine desired goals, directions and outcomes for the Croskell PSP to guide the development of the IWM Plan.

Attendees were asked to develop desired outcomes or the precinct. For example, minimising flood risk downstream of the development, or making Croskell an attractive and sustainable place to live and work. When grouping the participant responses for desired outcomes at Croskell as a whole, they can be grouped into the following themes;

1. Contributing to climate resilience.

2. Using IWM to promote a circular economy.

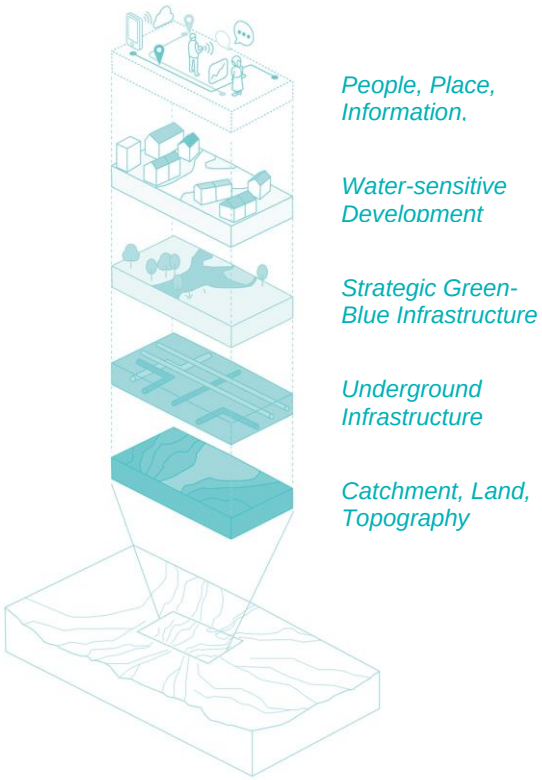
3. Leveraging alternative water.

4. Create high value public realm and streets for the community and local businesses.

5. Minimise harm to waterways by reducing flooding, flows and pollutant loads.

These themes were taken forward and considered when assessing IWM solutions.

Attendees were then encouraged to consider water assets and methods which can be used to unlock wider outcomes and address water challenges, using the 5 layers shown below as a basis.



The output of the Shared IWM Vision workshop is included in Appendix B , and the long list of IWM options that emerged from that workshop is discussed in the next section.

4. Long list to short list

The long list of IWM options that were identified by participants of the Shared IWM workshop is shown below in Table 4-1.

Table 4-1 Long list of IWM options identified in the Shared IWM Vision workshop

Layer	IWM opportunity	IWM Planning and engineering-based solutions	IWM solutions post PSP construction
Precinct scale			
Catchment, waterways, topography	Upgrade the existing un-named waterway into a constructed waterway	X	
Underground infrastructure networks	Use a recycled water network for third pipe system.	X	
	Use regional rainwater harvesting tanks	X	
Strategic blue-green infrastructure	Leverage DSS assets for delivery of IWM infrastructure	X	
	Precinct scale WSUD (i.e. wetlands/bioretention basins) to mitigate downstream stormwater impacts, integrated with open space and used to enhance liveability	X	
	Stormwater harvesting schemes for open space irrigation	X	
	Using recycled water for active and passive open space irrigation	X	
	Monitoring and evaluation of stormwater runoff (i.e. checking water quality)		X
	Community gardens, particularly within the easement, and linear parks to enhance biolinks and connectivity		
Lot and street scale			
Water sensitive development	Residential rainwater harvesting	X	
	Rainwater harvesting to commercial/industrial zones	X	
	Passively irrigated parks & trees from road runoff	X	
	Maximise use of permeable pavements	X	
	Roof irrigation to evaporate rainwater	X	
	Water sensitive carparks	X	
	Water efficient fixtures	X	
People, information and jobs	Encourage high water usage industries to the development (i.e. nursery, indoor farming, Bunnings, food and beverage, laundries, etc...)	X	
	Building efficiency & education for circular water usage		X
	Provide information, education and communication around alternative water to increase its uptake		X
	Businesses encouraged to provide sustainable practice		X

4.1 Initial screening of the long list

An initial assessment was performed to screen the long list and short list opportunities for assessment. Reasons opportunities were excluded from the assessment include:

- Opportunities were repeated, or too similar to another option.
- Opportunities were not considered IWM solutions.
- Opportunities cannot be assessed against an assessment criteria, but are still on the table.

Table 4-2 Initial screening of long list

Layer	IWM opportunity	Assessed?	Justification and other comments
Precinct scale			
Catchment, land, topography	Upgrade the existing un-named waterway into a constructed waterway	N	As part of the ongoing DSS scheme by MW, there may be upgrades to the existing waterway, or parts of the waterway that are part of the scheme. It's been assumed for this study that this is the base case, and not a new additional intervention.
Underground infrastructure networks	Use a recycled water network to serve residential demands	Y	This will be assessed using the criteria
	Use a recycled water network to serve the non-residential demands. Two scenarios will be considered for non-residential which are; a high industrial and low industrial scenario.	Y	This will be assessed using the criteria
	Use regional rainwater harvesting tanks for open space irrigation	Y	This will be assessed using the criteria
Strategic blue-green infrastructure	Dedicated spongy areas in open spaces	Y	This is a new option following the workshop and will be assessed using the criteria
	Stormwater harvesting schemes for open space irrigation and nearby developments	Y	This will be assessed using the criteria
	Using recycled water for open space irrigation	Y	This will be assessed using the criteria. We will develop a low and high irrigation scenario where open spaces in the land use budget are the BAU, and the high irrigation scenario considers a park in the easement and greenery in industrial plots
	Community gardens, particularly within the easement, and linear parks to enhance biolinks and connectivity	N	This is not a standalone IWM solution, however we will develop a low and high irrigation scenario where open spaces in the land use budget are the BAU, and the high irrigation scenario considers a park in the easement and greenery in industrial plots
	Leverage DSS assets for delivery of IWM infrastructure	N	This option is captured and assessed in the stormwater harvesting option
	Precinct scale stormwater drainage assets (i.e. wetlands/bioretention basins) to treat to BPEM standards	N	This would happen as part of the DSS scheme by MW, and therefore is base case and not a new additional option
Lot and street scale			
	Rainwater harvesting for residential zones	Y	This will be assessed using the criteria

Water sensitive development	Rainwater harvesting to commercial/industrial zones	Y	This will be assessed using the criteria. Two scenarios will be considered for non-resi. A high industrial and low industrial scenario.
	Passively irrigated trees from road runoff	Y	This will be assessed using the criteria
	Permeable pavements for car parks in non-residential areas	Y	This will be assessed using the criteria
	Roof irrigation to evaporate rainwater for industrial areas	Y	This will be assessed using the criteria
	Car parks with integrated rain gardens	Y	This will be assessed using the criteria
	Green roofs for commercial buildings	Y	This is a new option following the workshop and will be assessed using the criteria
	Water efficient fixtures in homes	Y	This will be assessed using the criteria
	Infiltration trenches for industrial buildings	Y	This is a new option following the workshop and will be assessed using the criteria
People, information and jobs	Encourage high water usage industries to the development (i.e. nursery, indoor farming, Bunnings, food and beverage, laundries, etc.)	N	This is not an IWM solution, however two scenarios will be considered for non-resi. A high industrial and low industrial scenario.
	Building efficiency & education for circular water usage	N	This will be taken forward as a solution, but won't be assessed using the assessment criteria as it's specific to the operational phase
	Provide information, education and communication around alternative water to increase its uptake	N	This will be taken forward as a solution, but won't be assessed using the assessment criteria as it's specific to the operational phase
	Businesses encouraged to provide sustainable practice	N	This will be taken forward as a solution, but won't be assessed using the assessment criteria as it's specific to the operational phase
	Monitoring and evaluation of stormwater runoff (i.e. checking water quality)	N	This will be taken forward as a solution, but won't be assessed using the assessment criteria as it's specific to the operational phase

4.2 Short list of options assessed

Following the initial screening, the shortlist of options to be assessed using the assessment criteria is shown in Table 4-3.

Table 4-3 Description of short listed options

Layer	Ref	Name and description	Example
Underground infrastructure networks	1	Use a recycled water network to serve residential demands Engagement with SEW confirms that recycled water will be delivered to residents in Croskell PSP. There is a recycled water pipe is located on Thompsons Road and therefore this option is viable for this PSP. It is also a more climate resilient source of non-potable water as it is not climate dependent	
	2	Use a recycled water network to serve non-residential demands. Non-residential demands can also be serviced by recycled water which is a reliable and resilient source of water. LOGIS Eco Industrial Park in Dandenong is an example of an industrial development that employs recycled water. Due to the uncertainty of the type of non-residential demands expected from the development at this stage, a high and low demand scenario was considered for this option to allow for flexibility. Further details on each demand scenario are discussed in Section 5.2.	
	3	Use regional rainwater harvesting tanks for open space irrigation. This solution requires the conveyance of rainwater into an underground tank located within the PSP. This water can then be pumped and reticulated to be used for open space irrigation. This differs from stormwater as runoff is collected from roofs rather than drains. A high and low demand scenario was considered for this option to allow for flexibility. Further details on each demand scenario are discussed in Section 5.2.	
Strategic blue-green infrastructure	4	Dedicated spongy areas in the waterway corridor. This solution would typically be located downstream of a wetland and allows stormwater to be infiltrated or evaporated before discharging into the waterway. This solution can contribute to meeting the stormwater harvesting and infiltration targets.	
	5	Stormwater harvesting schemes for open space irrigation 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. A high and low demand scenario was considered for this option to allow for flexibility. Further	

Layer	Ref	Name and description	Example
		details on each demand scenario are discussed in Section 5.2.	
	6	Using recycled water for open space irrigation Recycled water from SEW's network can be used for irrigation of open space. It is a reliable source of water that is climate resilient. A high and low demand scenario was considered for this option to allow for flexibility. Further details on each demand scenario are discussed in Section 5.2.	
Water sensitive development	7	Rainwater harvesting for residential zones. Rainwater can be conveyed from roofs to residential tanks, which can then be used in homes to serve non-potable demands.	
	8	Rainwater harvesting for commercial/industrial zones. Rainwater can be conveyed from roofs to tanks, which can then be used to meet non-potable demands in the commercial and industrial areas.	
	9	Passively irrigated trees from road runoff. 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.	
	10	Permeable pavements for car parks in non-residential 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 car parks of industrial and commercial areas.	
	11	Roof irrigation to evaporate rainwater in industrial areas. A thin film of harvested rainwater is pumped up and released across a large roof to be evaporated on hot days. This reduces runoff leaving a plot and provides cooling benefits to the building. This solution is currently being investigated in an industrial park in Sydney.	

Layer	Ref	Name and description	Example
	12	Car parks with integrated rain gardens Rain gardens can treat runoff from car parks and is a common stormwater treatment element.	
	13	Green roofs for commercial buildings Installing green roofs across commercial buildings can act as a bioretention basin and reduce stormwater runoff and enhance biodiversity, as well as decrease urban heat island effects. Green roofs have been used throughout Australia. It is expected these will be maintained by the plot or building owner.	
	14	Water efficient fixtures in homes This option is equipping homes with fixtures which have higher efficiency ratings to reduce water demands.	
	15	Infiltration trenches for industrial buildings This involves a designated infiltration area to receive stormwater runoff in void space. It receives rainwater from a downpipe from the industrial area building roofs. Pollutants are removed through filtering through the filter media.	

5. Assessment of options

5.1 Assessment criteria

The assessment criteria to assess the short-list of opportunities has been developed using the Preliminary Assessment Method (PAM). It integrates the outcomes discussed in the workshop with the strategic outcomes from the Strategic Direction Statement for Western Port catchment.

Table 5-1 shows the assessment criteria for the IWM solutions proposed.

Table 5-1 Assessment criteria

Strategic Outcome (from the Western Port IWM Plan)	Workshop theme	Measure	Unit
Strategic Outcome 1 - Safe, secure and affordable supplies in an uncertain future 	Leveraging alternative water Using IWM to promote a circular economy	Potable water demand reduction	ML/year
Strategic Outcome 2 - Effective and affordable wastewater systems 	Contributing to climate resilience Leveraging alternative water Using IWM to promote a circular economy	Volume of recycled water delivered to customers	ML/year
Strategic Outcome 3 - Existing and future flood risks are managed to maximise outcomes for the community 	Contributing to climate resilience Minimise harm to waterways by reducing flooding, flows and pollutant loads	Impact on downstream fluvial flood mitigation	H/M/L
Strategic Outcome 4 - Healthy and valued waterways and marine environments 	Minimise harm to waterways by reducing flooding, flows and pollutant loads.	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	tonnes/year
Strategic Outcome 5 - Healthy and valued urban and rural landscapes 	Create high value public realm and streets for the community and local businesses	New total number of passively irrigated trees	No.
		New area of open space supported by an alternative water source	Hectare
Strategic Outcome 6 - Community values are	Create high value public realm and streets for the	Opportunity to embed Traditional Owner values in the delivery of solution	H/M/L

reflected in place-based planning 	community and local businesses	Contribution to enhancing biodiversity	H/M./L
		Provides sense of place and amenity	H/M/L
Strategic Outcome 7 - Jobs, economic benefits and innovation 	Leveraging alternative water	Alternative water supplied to businesses and industry	ML/year
Additional criteria not covered by IWM Plan	Delivery of IWM	Implementation and complexity	H/M/L
		Indicative total cost	H/M/L
		Relative land take	H/M/L
		Requirement for operation and maintenance	H/M/L

5.2 Assumptions

Several assumptions were made to model each scenario. Assumptions were based on the most appropriate data or project experience. A summary of assumptions used for each opportunity are described in Table 5-2 below.

Table 5-2 General assumptions for each opportunity

Option	Option Description	Assumptions	References and notes
1	Use a recycled water network to serve residential demands only	• 100% of non-potable demands from residential areas can be met	None.
2	Use a recycled water network to serve non-residential demands.	• 100% of non-potable demands from non-residential areas can be met	None.
3	Use regional rainwater harvesting tanks for open space irrigation	• 27% of commercial and industrial areas is connectable roof area to a tank	Based on typical industrial areas
		• Active open space includes sports reserves • Active open space irrigation demands equate to 3000 kL/ha/yr	Demand rate based on Best Practice Guidelines for Functional Open Space
		• Passive open space includes utilities easement and additional open space created in industrial areas • Passive open space irrigation demands equate to 2000 kL/ha/yr	Demand rate based on Best Practice Guidelines for Functional Open Space
4	Dedicated spongy areas in the waterway corridor	• Surface area of spongy area equates to surface area of the wetland in the base case (6.55 ha)	None.
5	Stormwater harvesting for open space irrigation	• Stormwater will be collected and treated in a wetland then harvested and stored for irrigation. Typically 60% of open space irrigation demands can be met.	Demand rate based on Best Practice Guidelines for Functional Open Space

Option	Option Description	Assumptions	References and notes
		• Active open space includes sports reserves and irrigation demands equate to 3000 kL/yr/ha • Passive open space includes utilities easement and additional open space created in industrial areas. Passive open space irrigation demands equate to 2000 kL/yr/ha	
6	Using recycled water for open space irrigation	• 100% of active and passive irrigation demands can be met • Active open space includes sports reserves and irrigation demands equate to 3000 kL/yr/ha • Passive open space includes utilities easement and additional open space created in industrial areas. Passive open space irrigation demands equate to 2000 kL/yr/ha	Demand rate based on Best Practice Guidelines for Functional Open Space
7	Rainwater harvesting for residential zones	• 75% of non-potable residential demands can be met with rainwater harvesting • 208kg/ML of TSS is removed from rainwater harvesting • 1.5 kg/ML of TN is removed from rainwater harvesting	Based on music modelling
8	Rainwater harvesting for commercial/industrial zones	• 75% of non-potable non-residential demands can be met with rainwater harvesting • 208kg/ML of TSS is removed from rainwater harvesting • 1.5 kg/ML of TN is removed from rainwater harvesting	Based on music modelling
9	Passively irrigated trees from road runoff	• Dimensions of tree pits are 2x2m • Trees are spaced 20m apart • Typical road width across the development is 12m •	Trees are modelled as bioretention basins within MUSIC modelling
10	Permeable pavements for car parks in non-residential areas	• 33% of commercial and industrial areas are carparks • 30% of carparks can be turned into permeable pavement	Based on typical industrial areas
11	Roof irrigation to evaporate stormwater in industrial areas	• 27% of commercial and industrial areas is connectable roof area to a tank Roof irrigation requirement is 4.5 ML/ha/yr	Based on typical industrial areas
12	Car parks with rain gardens	• 33% of commercial and industrial areas are carparks • Raingardens sized to 2% of carpark area	Based on typical industrial areas Based on Melbourne Water Guidance
13	Green roofs for commercial buildings	• 27% of commercial and industrial areas is roof area	Based on typical industrial areas

Option	Option Description	Assumptions	References and notes
		• 50% of roof area can be converted into a green roof	
14	Water efficient fixtures in homes	• Water efficient fixtures have a 3-6 star rating depending on end use	Based on water usage rates for advanced water efficient fixtures within Western Growth IWM for Approved PSPs Summary Analysis Report 2020
15	Infiltration trenches for industrial buildings	• Infiltration trenches are sized to 2% of commercial and industrial areas	Based on typical industrial areas

5.2.1 High and low demand scenarios

Water demands for non-residential and open space areas are dependent on the type of businesses operating within the precinct and the area of open space available for irrigation. As such, a low and high water demand scenario was tested for opportunities related to non-residential and open space demands. Table 5-3 below describes the different conditions under each scenario.

Non-residential water demands include commercial and industrial demands. While commercial demands are typically less variable and consistent between different businesses, industrial demands are highly dependent on business operations. Industrial businesses could vary between warehousing where water demands are minimal from toilet flushing and tap use, and manufacturing where water is required for processing.

Similarly, open space water demands can vary significantly depending on the development. At a minimum, active open spaces should be irrigated to provide liveability and amenity benefits for the community. To maximise greening and encourage liveability, a precinct could create more open space to irrigate or decide to irrigate passive open spaces as well as active.

Table 5-3 Conditions for low and high demand scenarios

Demand Type	Low Demand Scenario	High Demand Scenario
Non-residential (includes commercial and industrial)	Includes all commercial demands and 10% of industrial non-potable demands	Includes all commercial and industrial non-potable demands
Open space (includes active and passive open space)	Includes irrigation for all active open space	Includes irrigation for all active open space, the utilities easement, and additional open spaces created in industrial areas (assume 5% of industrial land use is open space)

5.3 Score Ratings

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. Table 5-4 below describes the rating adopted for each criterion.

Table 5-4 Description of score ratings adopted for each criterion

Criteria	1	2	3
Potable water demand reduction (ML/yr)	0-50	51-100	101+
Volume of recycled water delivered to customers (ML/yr)	0-50	51-100	101+

Criteria	1	2	3
Impact on downstream fluvial flood mitigation	Low impact: Option can reduce stormwater runoff, but has minimal impact under high rainfall events	Medium impact: Option can withhold some volumes during rainfall events, minimising flooding impacts downstream	High impact: Option can withhold large volumes during rainfall events, minimising flooding impacts downstream
Reduction in mean annual runoff volume (ML/yr)	0-100	101-200	200+
TSS prevented from discharging to receiving waters (Tonnes/yr)	0-50	51-100	101+
TN prevented from discharging to receiving waters (kg/yr)	0-500	501-1000	1001+
New total number of passively irrigated trees	0-200	201-400	400+
New area of open space supported by an alternative water source (ha)	0-10	11-20	21+
Opportunity to embed Traditional Owner values in the delivery of solution	Low impact: Minimal opportunity for Traditional Owners to influence delivery of solution	Medium impact: Some opportunity for Traditional Owners to influence delivery of solution	High impact: Opportunity for on-going engagement with Traditional Owners to influence delivery of solution
Contribution to enhancing biodiversity	Low impact: Small areas of open space created or improved with low potential to increase biodiversity	Medium impact: Some areas of open space created or improved with potential to increase biodiversity	High impact: Significant areas of open space created or improved with high potential to increase biodiversity
Provides sense of place and amenity	Low impact: Small areas of open space created or improved with low potential to increase amenity for the community	Medium impact: Some areas of open space created or improved with potential to increase amenity for the community	High impact: Significant areas of open space created or improved with high potential to increase amenity for the community
Alternative water supplied to businesses and industry (ML/yr)	0-50	51-100	101+
Implementation and complexity	Opportunity is complex, requires the involvement of multiple stakeholders and will take a long time to implement.	Opportunity has been implemented in other contexts, requires some stakeholders involvement but still involves a complex process to build.	Opportunity requires a standard and easy process to build and will likely not require a long time to implement
Indicative total cost	Relatively higher cost to implement	Relatively medium cost to implement	Relatively lower cost to implement
Relative land take	Relatively higher land take required	Relatively medium land take required	Relatively lower land take required
Requirement for operation and maintenance	Relatively higher operation and maintenance requirements	Relatively medium operation and maintenance requirements	Relatively lower operation and maintenance requirements

5.4 Results of assessment

The final scores for each opportunity are shown in Table 5-5 below. Although some opportunities score poorly, they are not discarded from the assessment as they can be combined and complement other

opportunities. Table 5-6 provides a breakdown of scores for each opportunity against each criterion. Further details on the results of the assessment can be found in Appendix A.

Table 5-5 Total score for each option assessed

Option	Option Description	Total Score
1	Use a recycled water network to serve residential demands	15
2 (low)	Use a recycled water network to serve the non-residential demands (low demand)	16
2 (high)	Use a recycled water network to serve the non-residential demands (high demand)	19
3 (low)	Use regional rainwater harvesting tanks for open space irrigation (low demand)	14
3 (high)	Use regional rainwater harvesting tanks for open space irrigation (high demand)	18
4	Dedicated spongy areas in the waterway corridor	22
5 (low)	Stormwater harvesting schemes for open space irrigation (low demand)	20
5 (high)	Stormwater harvesting schemes for open space irrigation (high demand)	26
6 (low)	Using recycled water for open space irrigation (low demand)	15
6 (high)	Using recycled water for open space irrigation (high demand)	22
7	Rainwater harvesting for residential zones	17
8 (low)	Rainwater harvesting to commercial/industrial zones (low demand)	20
8 (high)	Rainwater harvesting to commercial/industrial zones (high demand)	20
9	Passively irrigated trees from road runoff	24
10	Permeable pavements for car parks in non-residential areas	16
11	Roof irrigation to evaporate rainwater for industrial areas	14
12	Car parks with integrated rain gardens	20
13	Green roofs for commercial buildings	23
14	Water efficient fixtures in homes	14
15	Infiltration trenches for industrial buildings	14

Table 5-6 Score breakdown of IWM assessment against key criteria

Option	1	2 (low)	2 (high)	3 (low)	3 (high)	4	5 (low)	5 (high)	6 (low)	6 (high)	7	8 (low)	8 (high)	9	10	11	12	13	14	15
Potable water demand reduction (ML/yr)	2	2	3	1	1	0	1	1	1	1	2	2	2	1	0	0	0	0	2	0
Volume of recycled water delivered to customers (ML/yr)	2	2	3	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Impact on downstream fluvial flood mitigation	0	0	0	2	2	1	2	2	0	0	1	3	3	1	1	1	1	1	0	1
Reduction in mean annual runoff volume (ML/yr)	0	0	0	1	1	2	1	1	0	0	1	1	1	1	3	3	1	2	0	1
TSS prevented from discharging to receiving waters (Tonnes/yr)	0	0	0	1	1	1	3	3	0	0	1	1	1	1	1	1	1	1	0	1
TN prevented from discharging to receiving waters (kg/yr)	0	0	0	1	1	2	3	3	0	0	1	1	1	1	1	1	1	1	0	1
New total number of passively irrigated trees	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	2	0	0	0
New area of open space supported by an alternative water source (ha)	0	0	0	0	2	0	0	2	0	2	0	0	0	0	0	0	0	3	0	0
Opportunity to embed Traditional Owner values in the delivery of solution	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contribution to enhancing biodiversity	0	0	0	1	1	2	1	3	1	3	0	0	0	2	0	0	2	3	0	2
Provides sense of place and amenity	0	0	0	1	3	1	1	3	1	3	0	0	0	3	0	0	2	3	0	1
Alternative water supplied to businesses and industry (ML/yr)	0	2	3	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
Implementation and complexity	3	2	2	1	1	3	2	2	3	3	3	3	3	3	3	1	3	2	3	2
Indicative total cost	2	2	2	2	2	3	3	3	2	2	3	3	3	3	3	2	3	1	3	2
Relative land take	3	3	3	1	1	2	1	1	3	3	3	2	2	2	3	3	2	3	3	2
Requirement for operation and maintenance	3	3	3	2	2	2	2	2	3	3	2	2	2	3	1	2	2	3	3	1
TOTAL	**15**	**16**	**19**	**14**	**18**	**22**	**20**	**26**	**15**	**22**	**17**	**20**	**20**	**24**	**16**	**14**	**20**	**23**	**14**	**14**

6. Potential IWM Portfolios for Croskell

6.1 Selection of portfolios

Following the scoring of shortlisted IWM opportunities using the assessment criteria, complementary opportunities were grouped into three distinct themes to form portfolios. The portfolios are exploratory and can be tweaked as required to better suit the objectives of the precinct. High demand scenarios were used for the scoring of the three portfolios.

Portfolio 1: Centralised network

Portfolio 2: Decentralised and flexible systems

Portfolio 3: Maximising greening

The three IWM portfolios were proposed and discussed at a second workshop. The second workshop was held on 10/08/23 with the same participants as the Shared IWM Vision workshop.

6.2 Ranking Portfolios

To quantitatively assess and compare the portfolios, it was found that summing up the scores for individual IWM solutions would favour the portfolio with the highest number of solutions. Furthermore, it's noted that the assessment criteria in Table 5-1 does not have an equal number of measures per Outcome. E.g. there are 3 measures relating to 'Strategic Outcome 4 - Healthy and valued waterways and marine environments' whereas there is only 1 for 'Strategic Outcome 7 - Jobs, economic benefits and innovation.'

To ensure each portfolio is ranked equally, a single keystone measure was selected for each strategic outcome from the from the Western Port Catchment Scale IWM Plan to ensure that each strategic outcome was weighted equally. *Healthy Landscapes* was an exception as there are no opportunities that have scores for both new total number of passively irrigated trees and new area of open space supported by alternative water, so both were included in the scoring.

Table 6-1 below shows the measures selected for each strategic outcome. Scores for the portfolios are defined as the sum of corresponding scores for each opportunity within the portfolio. For options where a high or low demand scenario exists, the high demand scenario was considered for the total score.

Table 6-1 Measures used to represent strategic outcomes

Strategic Outcome	Measure Selected
Water security	Potable water demand reduction (ML/yr)
Wastewater resource reuse	Volume of recycled water delivered to customers (ML/yr)
Flood resistance	Impact on downstream fluvial flood mitigation (H/M/L)
Healthy waterways	Reduction in mean annual runoff volume (ML/yr)
Healthy landscape	New total number of passively irrigated trees (#)
	New area of open space supported by an alternative water source (ha)
Community value	Provides sense of place and amenity
Economic prosperity	Alternative water supplied to businesses and industry (ML/yr)

6.2.1 Portfolio 1: Centralised network

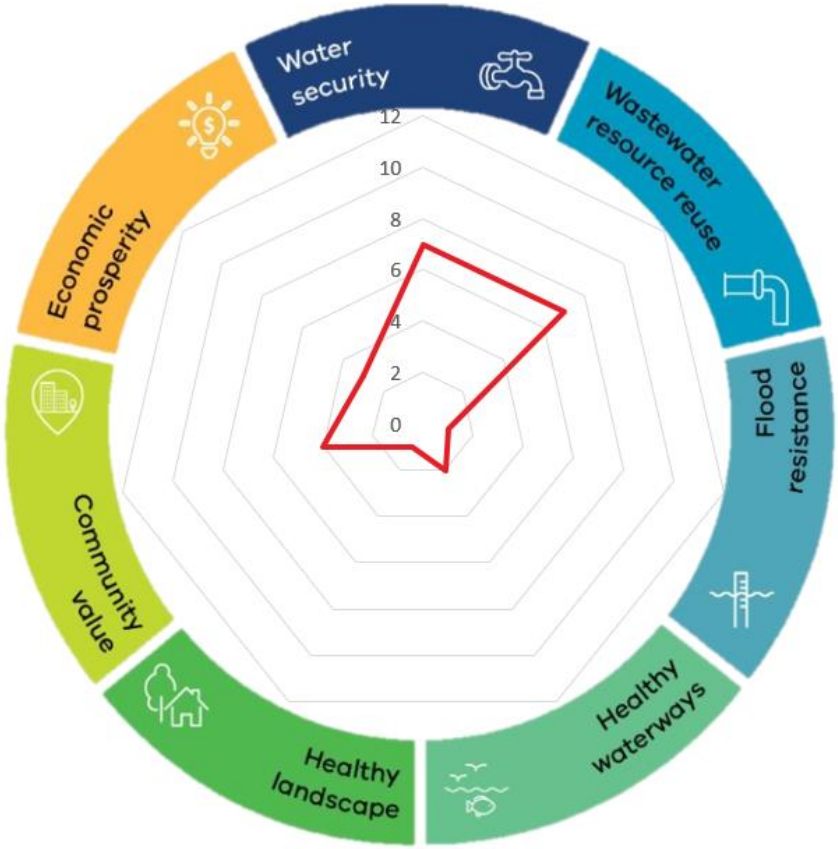
Portfolio 1 focusses on delivering precinct scale opportunities for Croskell to establish a reliable and centralised supply of alternative water. It aims to simplify delivery by keeping interventions centralised and non-reliant on landowner or tenant management. However, careful planning is required to ensure a centralised network is a worthwhile investment for the precinct.

This portfolio includes:

- A recycled water network to service all non-potable demands across the precinct (Options 1, 2, and 6)
- Dedicated spongy areas in waterway corridor for infiltration and pollutant reduction (Option 4)

Table 6-2 Description of Portfolio 1 in relation to the strategic outcomes

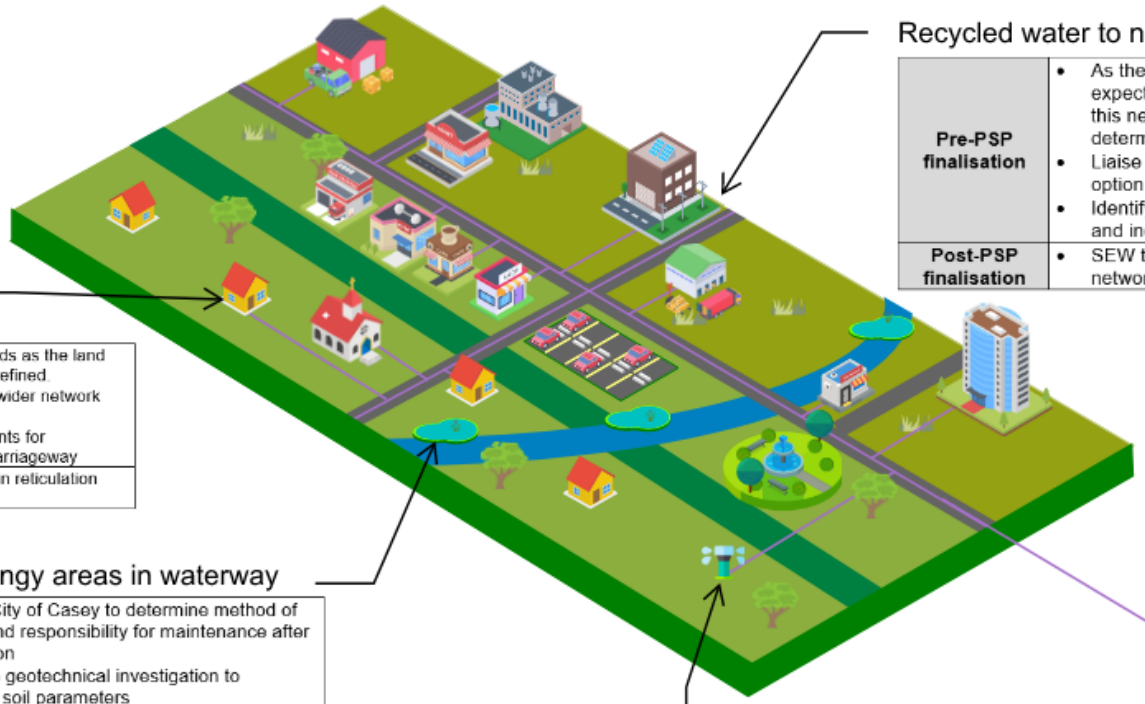
Water security	• High water security as recycled water is a reliable water source that is not climate dependent. The network could easily be upgraded to accommodate future growth. • Potable water reduction of 46**%** from alternative water sources
Wastewater resource reuse	• Recycled water would be used to service all non-potable demands in the precinct.
Flood resistance	• Minimal flood mitigation value as spongy areas will not be designed to contain large volumes of water.
Healthy waterways	• Spongy areas are designed to allow infiltration, reducing flow discharging into the waterway. It will provide additional treatment to stormwater runoff. • Flow reduction of **18%** (assuming 7% reduction from base case wetlands)
Healthy landscape	• Minimal value to healthy landscapes as new open space will not be created from spongy areas.
Community value	• Spongy areas create a varied landscape with visual appeal. However, as it is within the waterway corridor, it takes space away from the community for recreation and amenity. • Irrigating open spaces with alternative water ensures they stay green even during dry weather periods. This promotes amenity and liveability.
Economic prosperity	• Commercial and industrial businesses will be provided with recycled water in the hopes of attracting businesses with high water demands.



Portfolio 1: Centralised Networks

Potable water demand reduction: 46%

Stormwater flow reduction: 18% (26% harvesting, 10% infiltration target)



Recycled water to non-residential areas

Pre-PSP finalisation	• As the type of businesses and their expected water demands becomes known, this needs to be communicated to SEW to determine feasibility. • Liaise with SEW to confirm feasibility of option based on demands. • Identify connection point to wider network and include into PSP
Post-PSP finalisation	• SEW to operate and maintain reticulation network

Recycled water to residential areas

Pre-PSP finalisation	• Confirm non-potable demands as the land use budget becomes more refined. • Identify connection point to wider network and include into PSP. • Identify land take requirements for reticulation network in the carriageway
Post-PSP finalisation	• SEW to operate and maintain reticulation network

Spongy areas in waterway

Pre-PSP finalisation	• MW and City of Casey to determine method of delivery and responsibility for maintenance after construction • Undertake geotechnical investigation to determine soil parameters • Embed spongy areas within DSS design to determine land take • Allocate space within PSP for spongy areas.
Post-PSP finalisation	• Design and incorporate spongy areas within DSS assets

Recycled water to open space

Pre-PSP finalisation	• Confirm location of open space areas • Determine which open space areas will benefit from active irrigation • Identify connection point to wider network and include into PSP
Post-PSP finalisation	• Design reticulation network • Implement irrigation regime and maintenance processes

Eastern Treatment Plant

6.2.2 Portfolio 2: Decentralised and flexible solutions

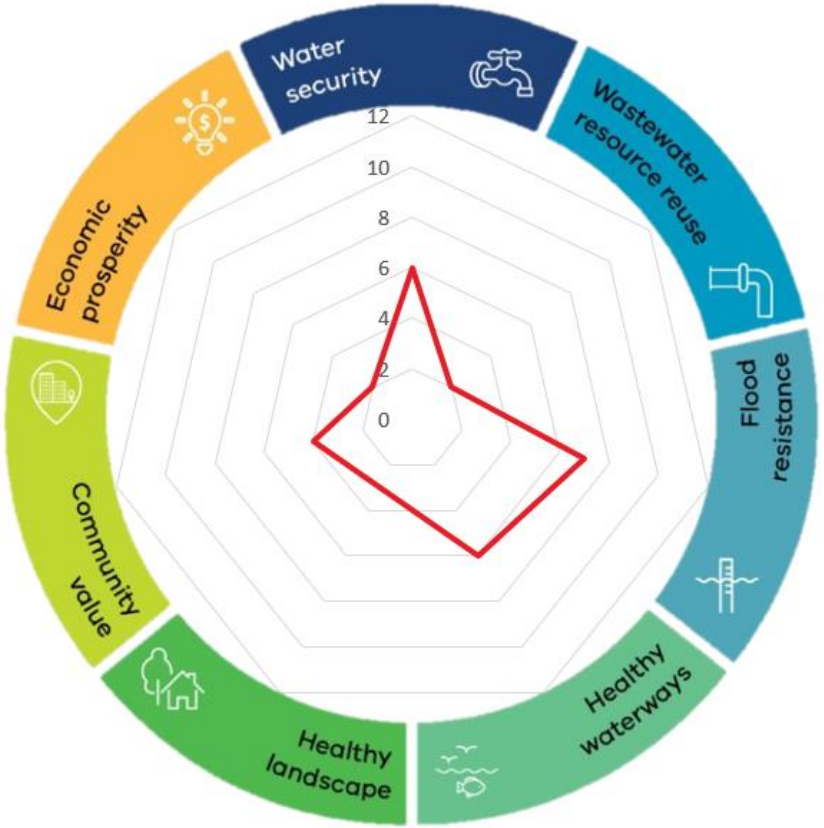
Portfolio 2 has an emphasis on providing a broad variety of solutions across both lot scale and precinct scale in order to deliver a flexible and well-rounded solution. The portfolio incorporates a centralised recycled water network to serve residents which reduces maintenance requirements but also includes flexible options to reuse stormwater to minimise runoff into the waterway. This portfolio aims to reduce stormwater flow to meet Urban Stormwater Management Guidelines targets.

Portfolio 2 includes:

- A recycled water network to residential users only (Option 1)
- Stormwater harvesting schemes for open space irrigation (Option 5)
- Rainwater harvesting for commercial/industrial use (Option 8)
- Reducing flow with roof irrigation on large industrial buildings for rainwater evaporation (Option 11) and passively irrigated street trees (Option 9)

Table 6-3 Description of Portfolio 2 in relation to the strategic outcomes

Water security	• Diversified portfolio of alternative water sources including stormwater, rainwater and recycled water. • Potable water reduction of **40%** from alternative water sources
Wastewater resource reuse	• Relatively low wastewater reuse priority as it only provides recycled water to residential areas.
Flood resistance	• High flood resistance as stormwater and rainwater harvesting options provide additional capacity to store water during large rainfall events.
Healthy waterways	• High flow reduction particularly from roof irrigation. However, note that the volume of flow reduced will depend on the number of lots with roof irrigation systems. • Flow reduction of **34%** (assuming 7% reduction from base case wetlands)
Healthy landscape	• Passively irrigated trees elevates the landscape and provides additional habitat for the ecosystem. • Contributes to VPA's 30% canopy tree coverage target, dependent on the tree species selected by landscape architects.
Community value	• Moderate community value as passively irrigated trees and greening from open space irrigation provides amenity and urban cooling benefits.
Economic prosperity	• Lower economic prosperity as rainwater harvesting may not meet all non-potable industrial and commercial demands.



Portfolio 2: Decentralised and Flexible

Potable water demand reduction: 40%

Stormwater flow reduction: 34% (26% harvesting, 10% infiltration target)

Recycled water to residential areas

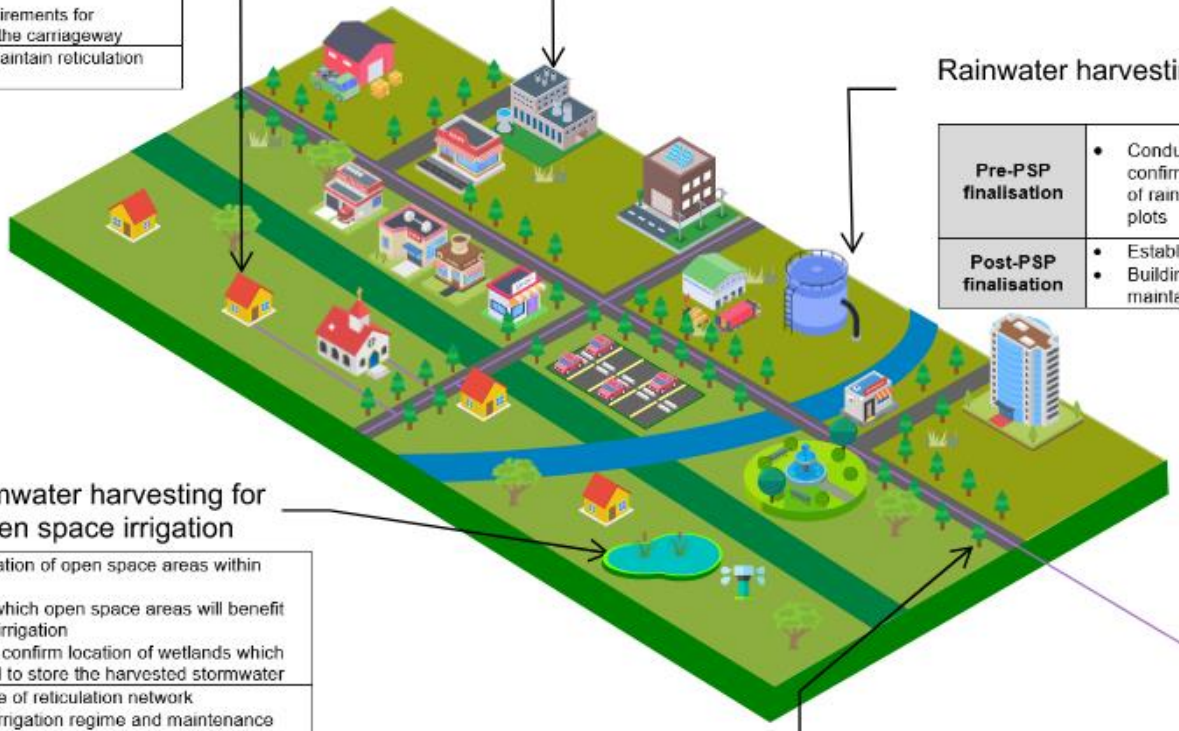
Pre-PSP finalisation	• Confirm non-potable demands as the land use budget becomes more refined. • Identify connection point to wider network and include into PSP • Confirm land take requirements for reticulation network in the carriageway
Post-PSP finalisation	• SEW to operate and maintain reticulation network

Roof irrigation to evaporate rainwater

Pre-PSP finalisation	• Conduct early engagement with the confirmed developers encourage uptake of rainwater harvesting tanks and associated pumps for roof irrigation for evaporation for the commercial plots
Post-PSP finalisation	• Establish future planning controls • Building management to operate and maintain tanks, pipes, and sprinklers

Rainwater harvesting for commercial/industrial areas

Pre-PSP finalisation	• Conduct early engagement with the confirmed developers to encourage uptake of rainwater harvesting for the commercial plots
Post-PSP finalisation	• Establish future planning controls • Building management to operate and maintain RWH tanks

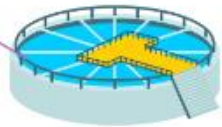


Stormwater harvesting for open space irrigation

Pre-PSP finalisation	• Confirm location of open space areas within PSP • Determine which open space areas will benefit from active irrigation • Identify and confirm location of wetlands which can be used to store the harvested stormwater
Post-PSP finalisation	• Maintenance of reticulation network • Implement irrigation regime and maintenance processes

Passively irrigated trees

Pre-PSP finalisation	• Support City of Casey with including passively irrigated trees to council policy
Post-PSP finalisation	• Maintain passively irrigated trees



Eastern Treatment Plant

6.2.3 Portfolio 3: Maximising greening

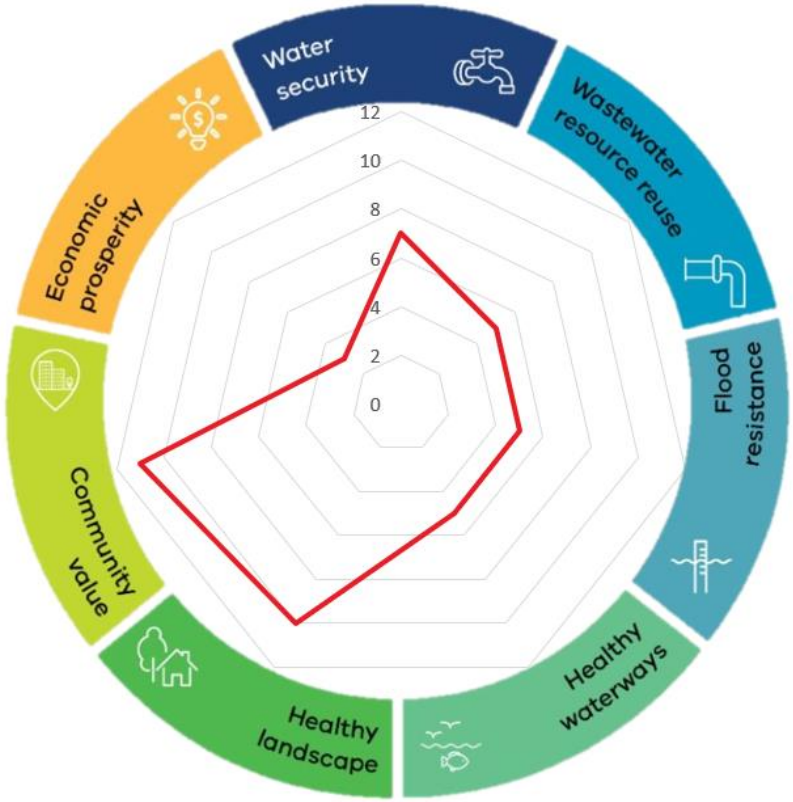
Portfolio 3 reimagines the idea of a traditional business and industrial park to a diverse landscape where green space is accessible and integrated with the development. It aims to provide a high standard of liveability for residents and workers whilst also improving the environment by creating additional habitat and enforcing stormwater management principles.

This portfolio includes:

- Providing recycled water to residential and non-residential areas (Options 1 and 2)
- Regional rainwater harvesting for open space irrigation (Option 3)
- Managing stormwater through passively irrigated trees (Option 9), raingardens in car parks (Option 12), and green roofs (Option 13)

Table 6-4 Description of Portfolio 2 in relation to the strategic outcomes

Water security	• High water security for residential and non-residential areas as recycled water is a climate resilient water source. Rainwater harvesting is fit for purpose for open space demands. • Potable water reduction of **45%** with alternative water sources
Wastewater resource reuse	• Moderate wastewater reuse as recycled water is used for residential and non-residential uses.
Flood resistance	• Rainwater harvesting creates additional storage capacity to store water during high rainfall events, increasing flood resilience.
Healthy waterways	• Diverse range of stormwater management practices to reduce flow and pollutants. Sizes for all options could be tweaked to provide higher reductions. • Flow reduction of **23%** (assuming 7% reduction from base case wetlands)
Healthy landscape	• High impact as open space is supported by alternative water. • Contributes to VPA's 30% canopy tree coverage target, dependent on the tree species selected by landscape architects.
Community value	• Community value is high as green roofs, raingardens, passively irrigated trees create a varied landscape which is visually appealing. • Reusing rainwater for irrigation promotes liveability by ensuring open spaces remain green and healthy.
Economic prosperity	• Commercial and industrial businesses will be provided with recycled water in the hopes of attracting businesses with high water demands.



Portfolio 3: Maximising Greening

Potable water demand reduction: 45%

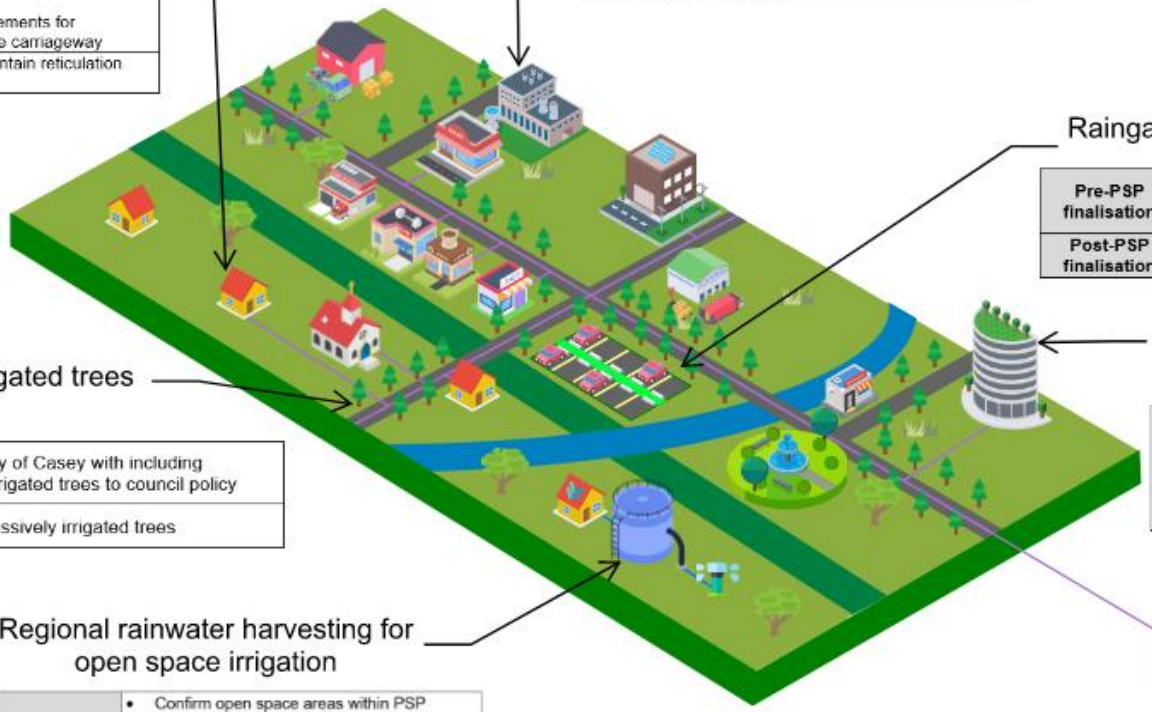
Stormwater flow reduction: 23% (26% harvesting, 10% infiltration target)

Recycled water to residential areas

Pre-PSP finalisation	• Confirm non-potable demands as the land use budget becomes more refined. • Identify connection point to wider network and include into PSP • Confirm land take requirements for reticulation network in the carriageway
Post-PSP finalisation	• SEW to operate and maintain reticulation network

Recycled water to non-residential areas

Pre-PSP finalisation	• As the type of businesses and their expected water demands becomes known, this needs to be communicated to SEW to determine feasibility. • SEW to confirm feasibility of option based on demands • Identify connection point to wider network and include into PSP
Post-PSP finalisation	• SEW to operate and maintain reticulation network



Raingardens in car parks

Pre-PSP finalisation	• Conduct early engagement with the confirmed developers to encourage uptake of raingardens for the commercial plots
Post-PSP finalisation	• Establish future planning controls • Plot owner to maintain raingarden

Green roofs on non-residential buildings

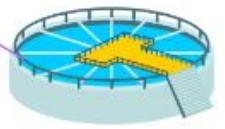
Pre-PSP finalisation	• Conduct early engagement with the confirmed developers to encourage uptake of green roofs for the commercial plots
Post-PSP finalisation	• Establish future planning controls • Plot owner to maintain green roof

Passively irrigated trees

Pre-PSP finalisation	• Support City of Casey with including passively irrigated trees to council policy
Post-PSP finalisation	• Maintain passively irrigated trees

Regional rainwater harvesting for open space irrigation

Pre-PSP finalisation	• Confirm open space areas within PSP • Dedicate spatial allowance of pipes and tanks in strategic locations that are near to large roof areas but also open spaces
Post-PSP finalisation	• Implement irrigation regime and maintenance processes • Operate and maintain pipes and tank which stores rainwater



Eastern Treatment Plant

7. Recommended portfolio

7.1 Comparison of portfolios

A comparison of the benefits for each portfolio are shown in Figure 7-1 below. Table 7-1 compares the relative complexity to implement, total costs, relative land take, and operational and maintenance requirements.

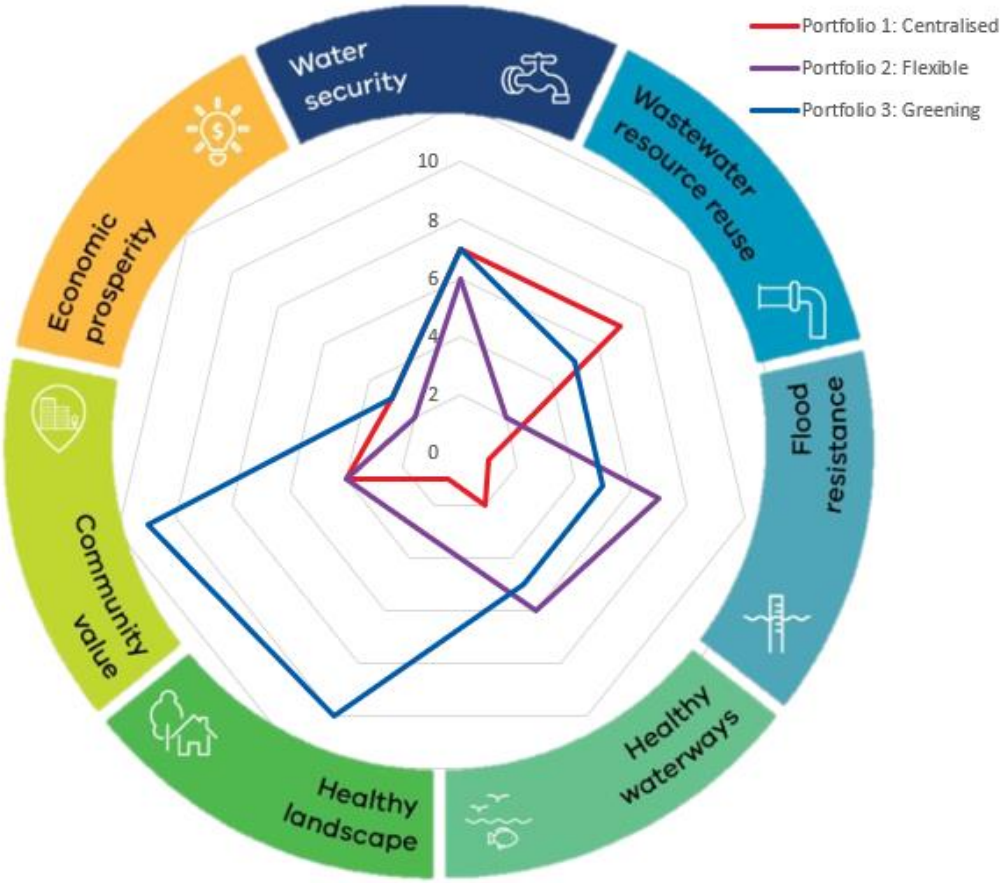


Figure 7-1 - Comparison of portfolio benefits

Table 7-1 - Additional considerations of each portfolio

Portfolio	Implementation and complexity	Indicative total cost	Relative land take	Requirement for operation and maintenance
Portfolio 1 (Centralised)	L	M	L	L
Portfolio 2 (Flexible)	M	L	H	H
Portfolio 3 (Greening)	H	H	M	M

Portfolio 3 is able to significantly contribute to community, healthy landscapes and waterways values, and flood resilience. It is also likely that flow reduction targets can be met if stormwater management assets are sized adequately. However, the complexity to implement and total costs associated with this portfolio are relatively higher than the other portfolios. For example, green roofs can be expensive to implement as they can cause additional structural capacity of buildings to withstand the additional loading. Additionally, the onus of implementing green roofs and maintaining them would fall onto the developer or building management, and there is no guarantee that they would do this.

A regional rainwater harvesting scheme is likely to be expensive and complex as an extensive network would be required to capture and convey rainwater from commercial/industrial plots to an underground tank, which then needs a reticulation network to irrigate open spaces. Additionally, the portfolio relies heavily on lot scale solutions to help meet the flow reduction target. Lot scale solutions require significant buy in from developers which cannot be guaranteed at this stage and therefore, precinct scale solutions are more attractive from a cost and management perspective.

Portfolio 1 (Centralised network) consists of solely precinct scale solutions. It proposes to supply all demands within the precinct with a recycled water network and direct all stormwater to dedicated spongy areas. The recycled water network would be buried, and the spongy areas will be situated within the waterway corridor, giving this portfolio a relatively low land take. Although there will be a requirement to maintain the spongy areas and recycled water network, this will also be relatively lower than Portfolio 2 and 3. This portfolio is relatively low complexity, however this portfolio will not meet the flow reduction targets as it provides no reuse opportunities for stormwater, and provides minimal contribution to broader community outcomes.

A recycled water network can be costly to implement, especially if water demands are expected to be low which makes the business case for a recycled water network unviable. SEW have indicated that residential areas within the development have been provisioned for and can be supplied with recycled water. On the other hand, water demands from commercial/industrial and open space can vary significantly which makes justifying a recycled water network difficult. LOGIS Eco Industrial Park is an example of an industrial business park supplied with recycled water. The business park has ample green space to provide amenity for workers and urban cooling benefits. However, the park is under utilising the recycled water network as high-water users have not been attracted to the park as originally intended. To mitigate this risk, instead of constructing a dedicated recycled water network for commercial/industrial lots, provisions for future connections can be made to the existing trunk network such that a high-water user can be connected to the network if they desired.

Portfolio 2 (Decentralised and flexible network) offers a compromise between Portfolios 1 and 3. This portfolio replaces a recycled water network for commercial/industrial and open space demands with rainwater and stormwater harvesting schemes. The range of stormwater management solutions contribute to meeting the flow reduction target whilst providing amenity, urban cooling, and liveability benefits for the community. Note, achieving the flow reduction targets will rely on the roof irrigation and passively irrigated trees which are lot scale solutions. However, the stormwater and rainwater harvesting solutions can be tweaked and paired with other precinct scale solutions such as infiltration trenches or spongy areas to help meet the targets.

It should also be noted that Portfolio 2 will require buy in from the City of Casey with respect to the stormwater harvesting and passively irrigated trees, from developers with respect to on plot rainwater harvesting and roof irrigation for evaporation, and SEW with respect to the residential recycled water network. Furthermore, open spaces would need to be strategically located near stormwater harvesting assets to minimise irrigation reticulation pipe lengths.

The portfolios developed in this report are recommendations and remain flexible. For example, a mix of Portfolio 2 and Portfolio 3 can provide best community value.

7.2 Recommended portfolio of options

Based on the quantitative assessment and analysis of possible implementation pathways, it is recommended that the preferred IWM solutions for Croskell PSP are based on Portfolio 2, but that some flexibility is provided to substitute some solutions based on individual development design, and site constraints.

Portfolio 2 offers decentralised and flexible solution, that enables IWM solutions to be determined at a development scale, based on the scale of demand for alternative water, and opportunities for stormwater management and greening.

The core opportunities recommended from Portfolio 2 are:

- A recycled water network to residential users (Option 1)
- Rainwater harvesting for commercial/industrial use (Option 8)
- Passively irrigated street trees (Option 9)

These core options can be complemented by the following adaptable options, designed to enhance the objectives outlined in the table below.

Objective: Support enhanced greening and liveability by supporting open space irrigation with alternative water sources	**Objective: Reduce stormwater runoff from impervious areas in non-residential developments**
Possible opportunities: - Stormwater harvesting for open space irrigation (Option 5) - Recycled water for open space irrigation (Option 6)	Possible opportunities: - Stormwater harvesting scheme for open space irrigation (Option 5) Lot-based stormwater reduction activities suitable for the development proposal which could include: - Roof irrigation on large industrial buildings for rainwater evaporation (Option 11) - Raingardens in car parks (Option 12) - Green roofs (Option 13) - Permeable paving in car parking areas (Option 10) - Infiltration areas (Option 15)

For residents, the preferred portfolio offers a low maintenance and reliable source of non-potable water using SEW's recycled water network (Option 1). This solution would be low complexity, as there is an existing recycled water network located on Thompsons Road and SEW have previously stated that homes in this region will be connected to a recycled water network. This source of water is also resilient to climate variations, as it is independent of rainfall.

For businesses, the preferred portfolio offers a flexible solution to meet non-potable water demands, using on lot rainwater harvesting tanks (Option 8). This solution is desirable as it contributes to the stormwater flow reduction target defined for the region by the Urban Stormwater Management Guidelines, however it is expected that businesses will operate and maintain their own on-plot rainwater harvesting infrastructure. Furthermore, industrial lots are likely to have large roof areas, ideal for rainwater capture, and provides control to the landowner/ tenant of how they manage their own water on site. Feedback from SEW has expressed that providing recycled water to non-residents is less certain and happens on a case-by-case basis, and therefore this solution mitigates the risk of having no alternative water for businesses. However, it is recommended that recycled supply network planning for the area incorporates flexibility to enable connection of potential non-residential users to the network.

At a street scale, it is recommended that passively irrigated trees (Option 9) are included to manage and reduce stormwater runoff from roads while enhancing amenity and shade. This option is in keeping with the PSP guidelines.

The adaptable opportunities in the preferred portfolio are designed to meet two key objectives, but provide flexibility to adapt to the development proposals and site constraints. Open space irrigation should be supported by either stormwater or recycled water. Stormwater is a preferable source given the benefit to flow reduction and flood mitigation, however, a stormwater harvesting scheme is subject to feasibility investigations and consideration by City of Casey. It is likely to be more feasible if the irrigation areas can be expanded, and include enhanced greening and irrigation of the east-west easement as a key green corridor. If a stormwater harvesting scheme is not feasible, recycled water should be utilised to support open space.

A set of adaptable opportunities are also included to enhance flow reductions with the aim of meeting the Urban Stormwater Management Guidelines. The appropriateness and practicality of delivering these solutions is dependent on the type of non-residential development that comes forward, including the relative prevalence of roof or carpark areas, and potential to integrate greening. The need for on-lot provisions would be lessened if a precinct stormwater harvesting scheme is found to be viable.

In conjunction with the solutions presented in the portfolios, there are several non-infrastructure IWM solutions identified from the Shared IWM Vision Workshop which should be included in the final suite of solutions. These include:

- Encouraging high water usage industries to the PSP.
- Building efficiency and education for circular water usage.
- Provide information, education and communication around alternative water to increase its uptake.
- Encouraging businesses to provide sustainable practice.
- Monitoring and evaluation of stormwater runoff (i.e. checking water quality).

Refer to Figure 7-2 below which summarises the recommendations.

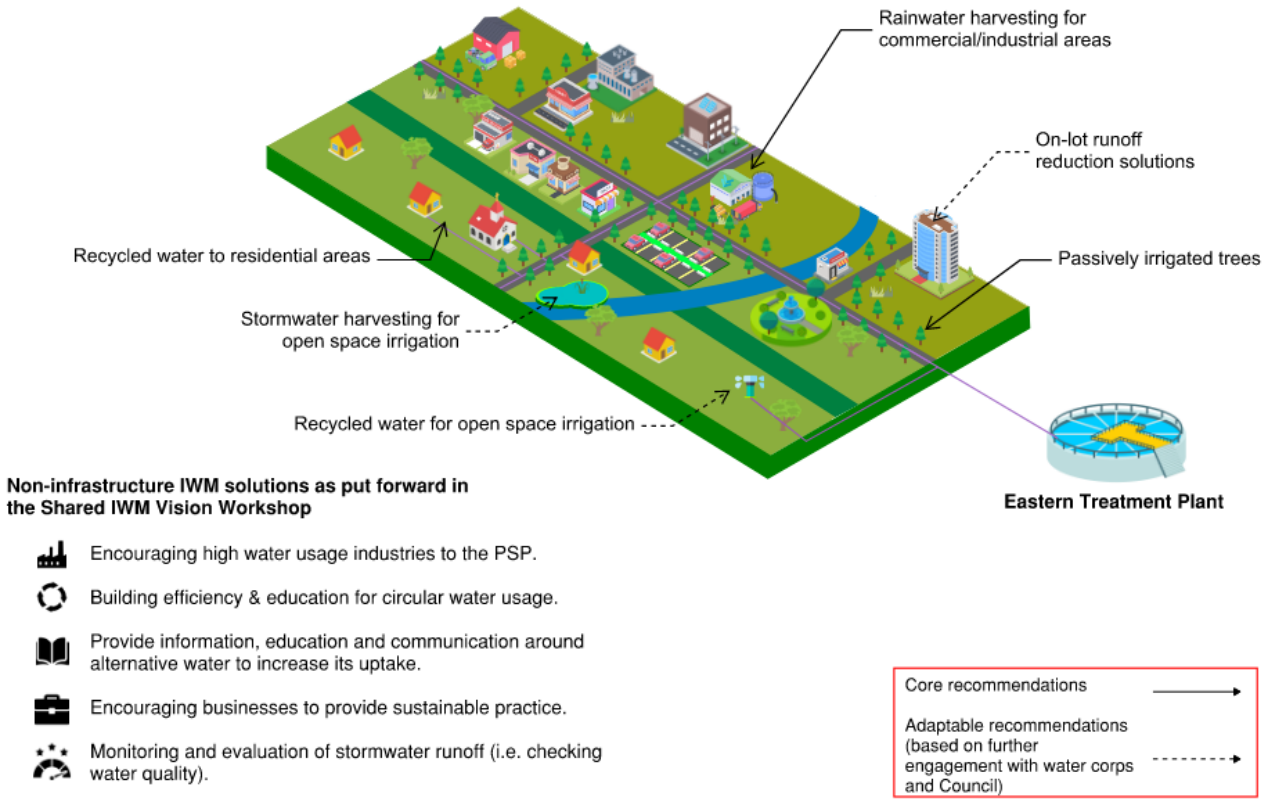


Figure 7-2 Recommended portfolio

7.3 Limitations and ongoing review of opportunities

Although the preferred portfolio is based around Portfolio 2, it's acknowledged that this 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:

- Geotechnical investigations have not been carried out. Soil parameters were based on an assumption that the development will be built on clay. Infiltration rates will differ between different soils which may alter the performance of options. Given a portion of the site lies within the Koo Wee Rup water supply protection area which is under a groundwater management plan, it's strongly recommended that further groundwater and infiltration analyses are carried out as an immediate next step.
- The DSS is not complete at the time of this study. A single wetland was used to represent the pollutant and flow reduction performance from the DSS, however actual treatment performance may vary.
- 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.

7.4 Implementation plan

The following actions are recommended to integrate the recommended IWM opportunities into the PSP and support delivery.

Table 7-2 – Implementation actions

Action	Lead stakeholder	Stakeholder	Justification
PSP Finalisation			
Finalise DSS and integrate with IWM recommendations	MW	VPA	This will confirm waterway corridor and flood management areas and treatment assets required by the DSS.
Liaise with water and power corporations to understand offsets, and technical requirements within the easement.	VPA	VPA, SEW	Provides a better understanding of what options for additional open space, planting and irrigation are viable for the easement.
As the PSP develops, review water demands for residential, non-residential and open spaces to determine viability of supplying these areas with alternative water	SEW, MW	VPA	A review of water demands for the PSP once the land use budgets are more certain would allow the viability of IWM solutions to be confirmed with greater confidence.
Conduct site investigations into permeability and groundwater levels	TBC	TBC	Provides a better understanding of soil parameters (including infiltration) and groundwater levels to measure treatment performance. The results of this investigation will impact the viability of spongey areas, rain gardens, passively irrigated trees and permeable paving. The area is protected by a groundwater management plan to ensure the long-term sustainability of groundwater as a resource.
Post PSP			
Investigate recycled water supply pipe alignments and integration to provide future connection points with recycled water system for non-residential demands	SEW	City of Casey	Provides a better understanding of where the recycled water network would be situated. This action would help enable any IWM solutions relating to the use of recycled water.
Review non-potable demands for businesses and re-evaluate alternative water supply options as they become more known	SEW	SEW	Provides a better understanding of industrial water demands to help justify whether a recycled water network is feasible for commercial/industrial areas.
Conduct early engagement with the confirmed developers to increase uptake of rainwater harvesting or recycled water connection, and any other lot scale solutions	City of Casey	SEW	Early engagement and communication of IWM objectives to developers with help ensure buy-in, and is likely to make the implementation, operation and maintenance of lot scale solutions more effective.
Confirmation of feasibility and willingness to adopt stormwater harvesting for open space irrigation by the City of Casey, including consideration of enhanced public landscapes and irrigation along the east-west easement	City of Casey	City of Casey	Precinct scale stormwater harvesting for open space irrigation contributes positively by reducing flows and pollutants from entering the waterway, but also provides an alternative water source to irrigate green areas in the PSP. Discussions should be held early with council to increase likelihood of adoption.

8. Conclusion

This report summarises the identified IWM opportunities and recommends a portfolio of IWM solutions for Croskell PSP. This report concludes this study for the VPA which comprised:

1. **A contextual analysis and base case report**, which outlined the context of the site to date, and used a high-level land use budget to estimate water demands, wastewater generation and stormwater runoff volumes and pollutant loads.
2. **A Shared IWM Vision Workshop** which brought together water corporations, council, VPA and DEECA to identify outcomes and possible solutions for IWM at Croskell PSP.
3. **A quantitative assessment** of identified IWM opportunities against assessment criteria that incorporates stakeholder desires.
4. **A second stakeholder workshop** to discuss implementation pathways of IWM.
5. **Clustering of various IWM options into Portfolios** that could be delivered as a suite of complementary IWM solutions for Croskell PSP.

By undertaking the steps outlined above, three IWM portfolios have been proposed. These are;

Portfolio 1: A centralised network which comprises recycled water being supplied from the nearest treatment plant to meet all the PSPs water demands (residential, non-residential and open space) and a dedicated infiltration 'spongy' area alongside the waterway corridor.

Portfolio 2: A decentralised and flexible system, which comprises recycled water from the nearest treatment plant to meet residential demands only, precinct scale stormwater harvesting to meet open space irrigation demands, rainwater harvesting and roof irrigation to evaporate rainwater in non-residential lots and passively irrigated trees at the street scale.

Portfolio 3: A maximised green solution which comprises recycled water being supplied from the nearest treatment plant to meet residential and non-residential demands, regional rainwater harvesting to serve open space irrigation demands, raingardens and green roofs in non-residential lots and passively irrigated trees at the street scale.

Based on the quantitative assessment and analysis of possible implementation pathways, it is recommended that the preferred IWM solutions for Croskell PSP are based on Portfolio 2.

Within this portfolio, the core IWM solutions recommended are providing recycled water to residents, on lot rainwater harvesting for non-residential plots and passively irrigating trees. Depending on buy-in from developers and council, additional recommendations include precinct scale stormwater harvesting for open space irrigation and lot-based flow reduction opportunities in non-residential lots.

Portfolio 2, relative to Portfolios 1 and 3 could meet the Urban Stormwater Management Guidelines targets, as this portfolio has a balance of meeting non-potable demands through recycled water and stormwater. Furthermore, based on discussions with SEW, meeting residential non-potable demands with recycled water in this region is more certain than meeting commercial and industrial demands (which is understood to happen on a case-by-case basis). Having rainwater harvesting in non-residential lots allows flexibility in the PSP by creating a level of decentralisation which increases the resilience of non-potable water supply in the site.

The IWM assessment and grouping of options to create portfolios was adopted in this study as a quantitative way to compare IWM options against one another. Some portfolios inevitably score higher for outcomes such as healthy landscapes and community value, while others score higher for healthy waterways by meeting pollutant load runoff targets. The intention of the recommended portfolio is not to favour one

outcome over another, but to provide stakeholders with direction on how to meet key policy and guidance as well as factor in costs, land take, constructability and maintenance.

Appendix A

Scoring of short-listed options

Score Rating	Score description for each criteria															
3	101+	101+	High impact (60+ ML/	201+	101+	1001+		21+	High impact	High impact	High impact	101+	Low impact	Low impact	Low impact	Low impact
2	51-100	51-100	Medium impact (31-6(	101-200	51-100	501-1000		11-20	Medium impact	Medium impact	Medium impact	51-100	Medium impact	Medium impact	Medium impact	Medium impact
1	0-50	0-50	Low impact (0-30 ML/	0-100	0-50	0-500		0-10	Low impact	Low impact	Low impact	0-50	High impact	High impact	High impact	High impact

	Options	Potable water demand reduction (ML/yr)	Volume of recycled water delivered to customers (ML/yr)	Impact on downstream fluvial flood mitigation (H/M/L)	Reduction in mean annual runoff volume (ML/yr)	Total Suspended Solids (TSS) prevented from discharging to receiving waters (Tonnes/yr)	Total Nitrogen (TN) prevented from discharging to receiving waters (kg/yr)	New total number of passively irrigated trees (#)	New area of open space supported by an alternative water source (ha)	Opportunity to embed Traditional Owner values in the delivery of solution (H/M/L)	Contribution to enhancing biodiversity (H/M/L)	Provides sense of place and amenity (H/M/L)	Alternative water supplied to businesses and industry (ML/yr)	Implementation and complexity (H/M/L)	Indicative total cost (H/M/L)	Relative land take (H/M/L)	Requirement for operation and maintenance (H/M/L)	Total Score
1	Use a recycled water network to serve residential demands	71.84	60.4											L	M	L	L	15
2 (low)	Use a recycled water network to serve the non-residential demands (low demand)	86.71	86.71										86.71	M	M	L	L	16
2 (high)	Use a recycled water network to serve the non-residential demands (high demand)	115.24	115.24										115.24	M	M	L	L	19
3 (low)	Use regional rainwater harvesting tanks for open space irrigation (low demand)	25.9		M	25.9	0.9	75.5				L	L		H	M	H	M	14
3 (high)	Use regional rainwater harvesting tanks for open space irrigation (high demand)	25.9		M	34.6	0.9	75.8		11.67		L	H		H	M	H	M	18
4	Dedicated spongy areas in the waterway corridor			L	121.1	16.4	759.4			M	M	L		L	L	M	M	22
5 (low)	Stormwater harvesting schemes for open space irrigation (low demand)	32.5		M	32.5	183.9811	1164				L	L		M	L	H	M	20
5 (high)	Stormwater harvesting schemes for open space irrigation (high demand)	32.5		M	54.5	188.143	1299		11.7		H	H		M	L	H	M	26
6 (low)	Using recycled water for open space irrigation (low demand)	32.85	32.85								L	L		L	M	L	L	15
6 (high)	Using recycled water for open space irrigation (high demand)	32.85	56.18						11.67		H	H		L	M	L	L	22
7	Rainwater harvesting for residential zones	53.88		L	53.88	11.21	80.8							L	L	L	M	17
8 (low)	Rainwater harvesting to commercial/industrial zones (low demand)	65.03		H	65.03	13.53	97.5						65.03	L	L	M	M	20
8 (high)	Rainwater harvesting to commercial/industrial zones (high demand)	86.43		H	86.43	17.98	129.6						86.43	L	L	M	M	20
9	Passively irrigated trees from road runoff	26.0		L	26.01	8.20	104.04	684		M	H			L	L	M	L	24
10	Permeable pavements for car parks in non-residential areas			L	235.7	39.9	498							L	L	L	H	16
11	Roof irrigation to evaporate stormwater for industrial areas			L	188.1	39.1	282.1							H	M	L	M	14
12	Car parks with integrated rain gardens			L	9.8	28.1	414.0	342		M	M			L	L	M	M	20
13	Green roofs for commercial buildings*			L	113.6	21.6	257.0		51.9	H	H			M	H	L	L	23
14	Water efficient fixtures in homes	65.59												L	L	L	L	14
15	Infiltration trenches for industrial buildings*			L	47.4	37.6	244.4			M	L			M	M	M	H	14

Appendix B

Shared IWM Vision and Workshop 2 outputs

ARUP

Victorian Planning Authority

Croskell
IWM Vision

Thursday 6th July2023 10am - 12.30pm

2.5 hours

Introductions

- Name
- Organisation / role

Please grab a sticky note and add your name and role!

Phoebe Mack SEW Integrated Water Manager

Will Bain Jones IWM Planner Melbourne Water

Alastair Jaffray VPA

Anass Jerrari SEW IWM Engineer

Celeste Morgan Arup IWM Lead

Inneke deVilliers-Engelbrecht VPA

Andrea Echeverry Senior Strategic Planner Casey Council

Kuan Yeoh Casey Council Principal Water Planner

April Chan VPA

Ayisha Paw IWM Engineer, Arup.

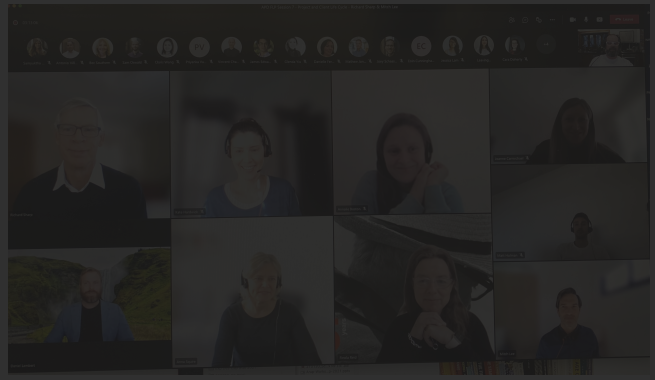
Mel Arup Water engineer

Rebecca Nguyen, MW

Gabby, Arup water

Who's on the call

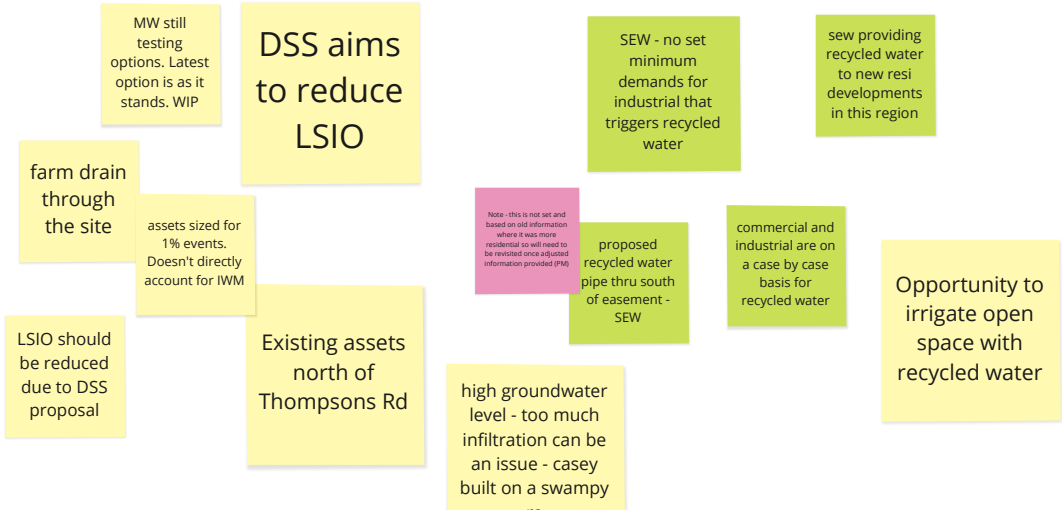
ARUP

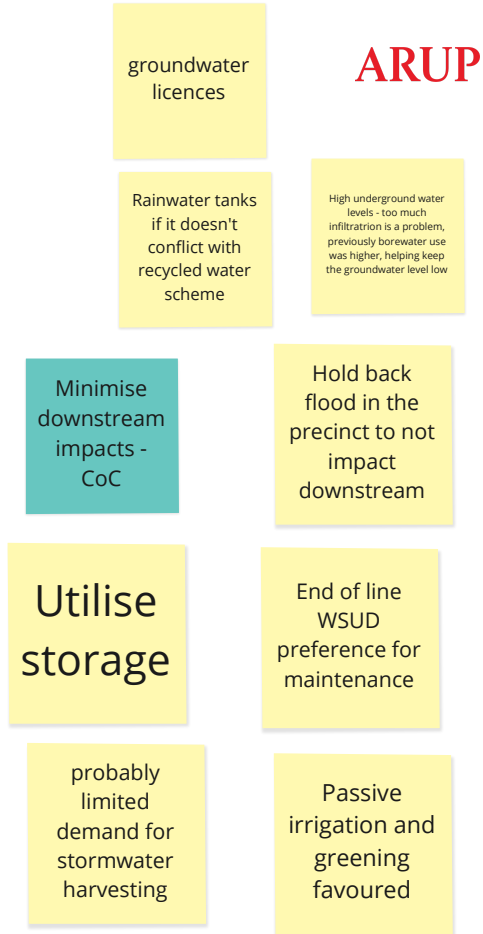


Stakeholder Perspectives

Please provide a contextual overview on IWM perspectives for Croskell;

- Melbourne Water - Drainage Scheme and waterways
- South East Water - Water supply and recycled water
- City of Casey - Stormwater management and liveability





Activity 1 - Defining Outcomes

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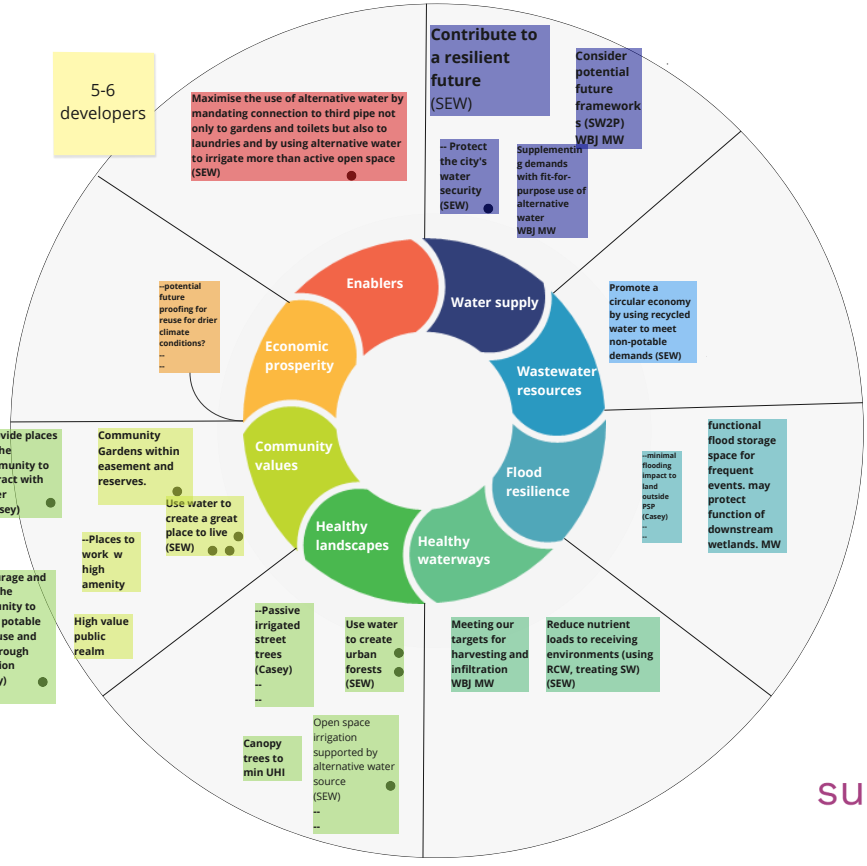
What are the wider strategic outcomes that are important for this place/ project?

light industrial, retail (big box retail), carparking

5-6 developers



casey - design guidelines for employment land - permeability - going through a design review process with Casey

Exercise instructions

1.Define Outcomes (20 mins)

- Reflecting on the context of Croskell PSP, identify what wider outcomes should be considered?
- Individually, place the outcomes cards inside the wheel in the relevant section.
- Add more detail about the outcome in the card's text box.
- Use blank cards to generate new outcomes.

2. Prioritise Outcomes (10 mins)

- Individually, use coloured dots to vote for three outcomes that you think should be prioritised.

Exercise time
30 minutes

unlocker
innovation circular collaboration liveability
sustainability
interaction
collaborative

Activity 2 - IWM Opportunities

What are the water cycle interventions that can unlock wider outcomes and address water challenges?

Exercise instructions

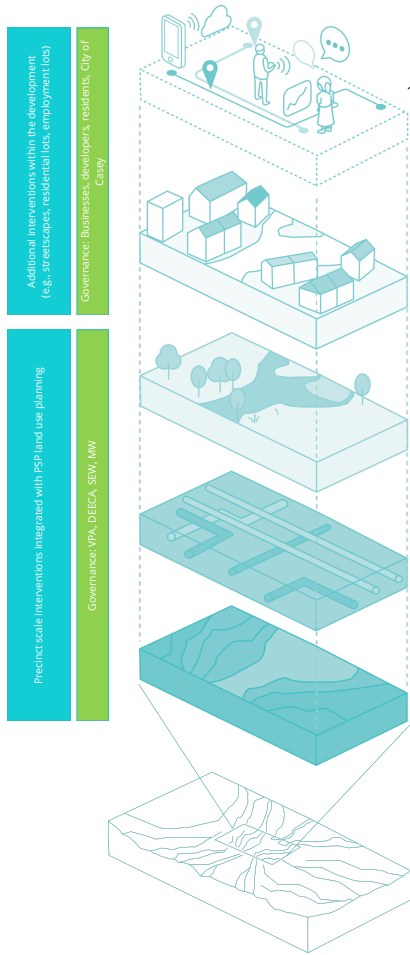
- Consider what water infrastructure assets can be used to unlock wider outcomes?
- Place selected water asset on the relevant water system layer.
- In group share your ideas.

Optional

- Map interdependencies between the assets using Miro arrow tool.

Exercise time
30 minutes

Move cards that are most important to the relevant section layer



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People, information and jobs (Lot)

e.g., Traditional Owner involvement in asset management	e.g., Education and awareness and behaviour change	Encourage high water usage industry (nursery, indoor farming, Bunnings)	Building efficiency & education for circular water usage	provide information, education and communicate around alternative water to increase its uptake (SEW)	Encourage high non-potable water use industry (food and beverage, laundries etc.) (SEW)	Provide opportunity for localise community gardens	Businesses encouraged to provide sustainable practice
Community gardens (such as within easement)	Explore opportunities to use water feature for water sports activities	...	...	...	...	...	...

Water-sensitive Development (Lot/Street)

Residential rainwater harvesting	Passively irrigated parks & trees from road runoff	Permeable pavement - maximise its use (SEW)	Irrigation of active and passive open space (where reasonable) with alternative water (SEW)	Recycled water connections to laundry, toilet and outdoor use for residential properties (SEW)	Rainwater harvesting to commercial/industrial zones.	Linear parks which enhance biolinks, connectivity	...
Roof irrigation to evaporate stormwater	water sensitive carpark	efficient fixture	...	...	...	...	...

Strategic Blue-Green Infrastructure

Precinct scale wetlands and retarding basins	Stormwater harvesting schemes for open space irrigation and nearby developments (i.e. nursery)	Recycled water for open space irrigation	High amenity values along waterway corridor	recycled water use for private residences	Monitoring & evaluation of stormwater run off (quality checking)	WSUD - wetlands/bio retention to mitigate d/s stormwater impacts, integrated with open space and used to enhance liveability (don't just fence off) (SEW)	
...	...	...	...	...	...		

Strategic Infrastructure Networks

Recycled water network for third pipe system	e.g. Stormwater harvesting scheme for potable reuse	Regional rainwater harvesting tanks	Leverage DSS assets for delivery of WM infrastructure	Adaptive Planning Approach to enable future alt. water frameworks	...	...	...
...	...	...	...	...	...	...	...

Catchment, waterways, topography

e.g., Waterway Naturalisation	e.g., Protected flood plain	Constructed Waterway—	Learn from past mistakes and dont build in swamps/LSI areas (SEW)		Introduce "High Groundwater Overlay"	...	...
...	...	...	...	...	...	...	...

ARUP

Victorian Planning Authority

Croskell
IWM Assessment and Options

Thursday 10th August 13.00-15.00

2 hours

Introductions

- Name
- Organisation / role

Please grab a sticky note and add your name and role!

Will Bain Jones IWM Planner Melbourne Water

Inneke de Villiers-Engelbrecht VPA Strategic Planning

Phoebe Mack, Integrated Water Manager South East Water

Alastair Jaffray, VPA Strategic Planning Manager

Margaret, Property Manager. Coordinating comms

Kuan Yeoh Principal Water Planner (Casey City Council)

Andrea Echeverry - Senior Strategic Planner - Casey

Margo Savage City of Casey Principal Strategic Planner, Growth & Infrastructure.

Nausheen Obaid - TL - Water Planning and Operations City of Casey

Rajika Rajapakshe Water growth planning Eng SEW

April Chan Infrastructure Engineer, VPA

Ayisha Paw PM and IWM Engineer, Arup

Shiroma Maheepala, DEECA, Mananger Metro IWM

Gabby Wu Arup

Richard Overall - VPA (Croskell PM)

Who's on the call

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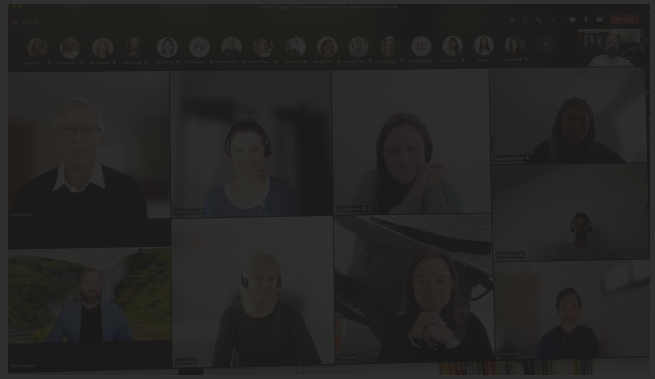
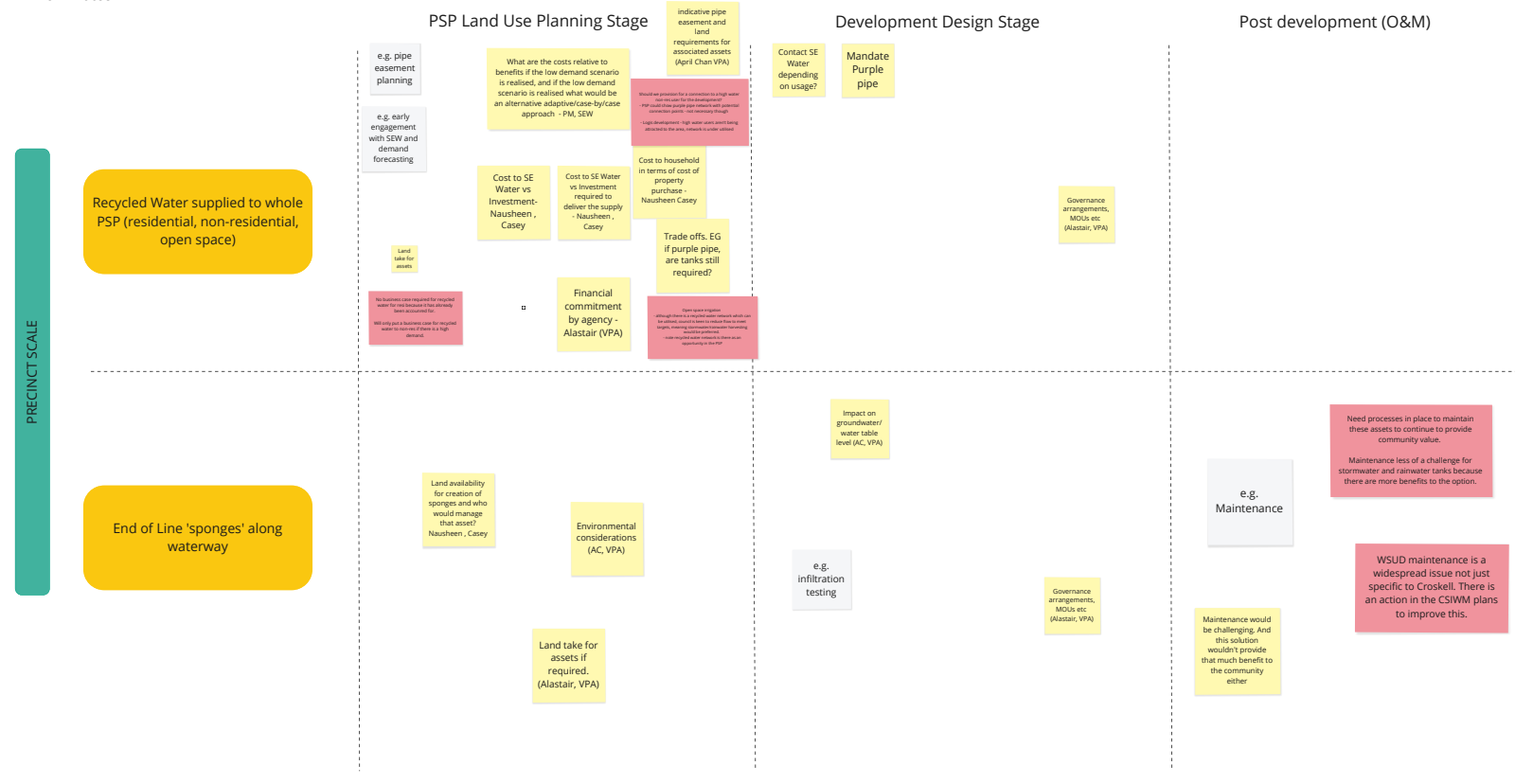


Activity - Delivery Pathways - Portfolio 1

WHAT NEEDS TO BE CONSIDERED AT THE FOLLOWING STAGES?

ARUP

Exercise time
15 minutes

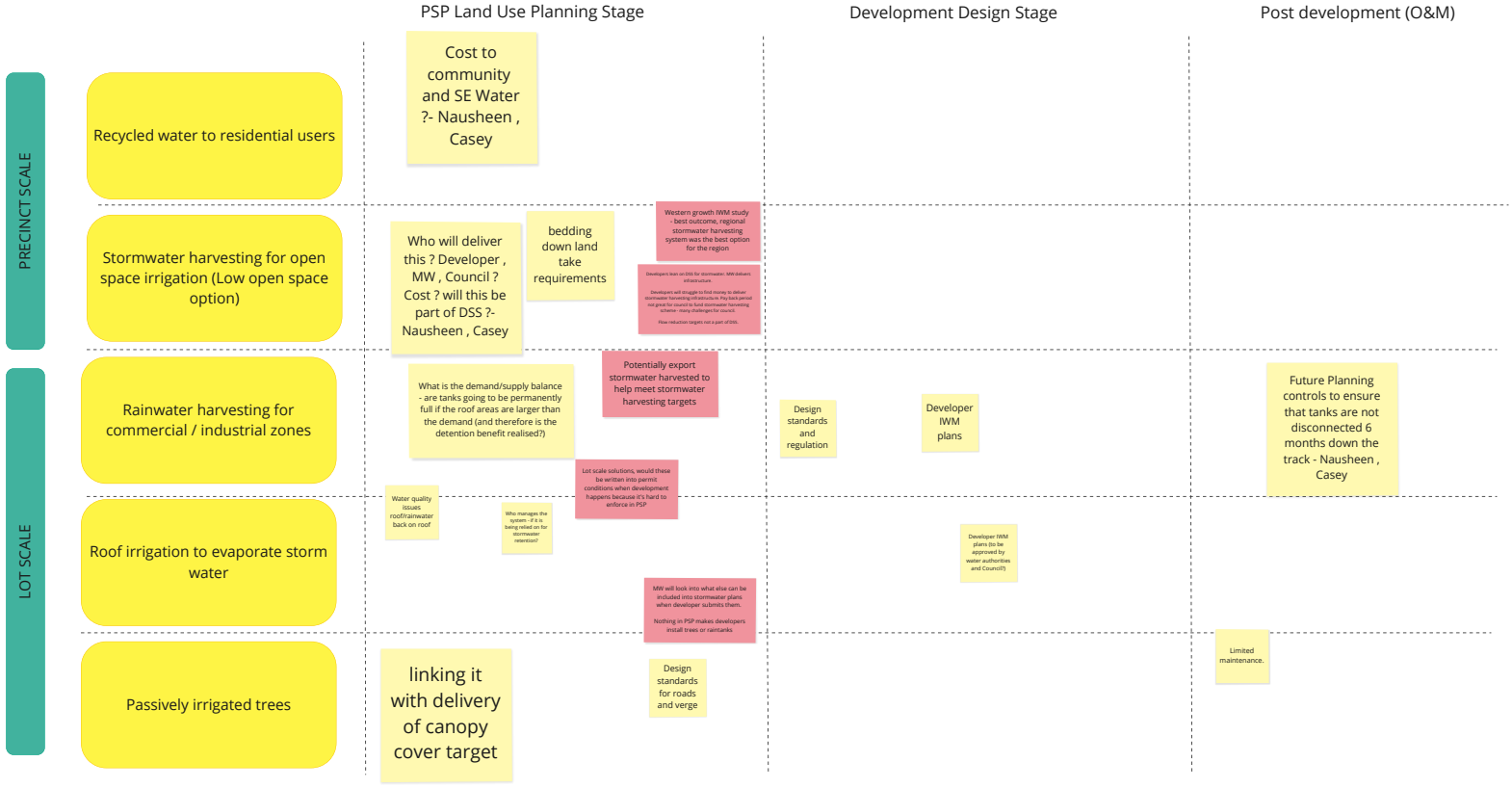


Activity - Delivery Pathways - Portfolio 2

WHAT NEEDS TO BE CONSIDERED AT THE FOLLOWING STAGES?

ARUP

Exercise time
15 minutes

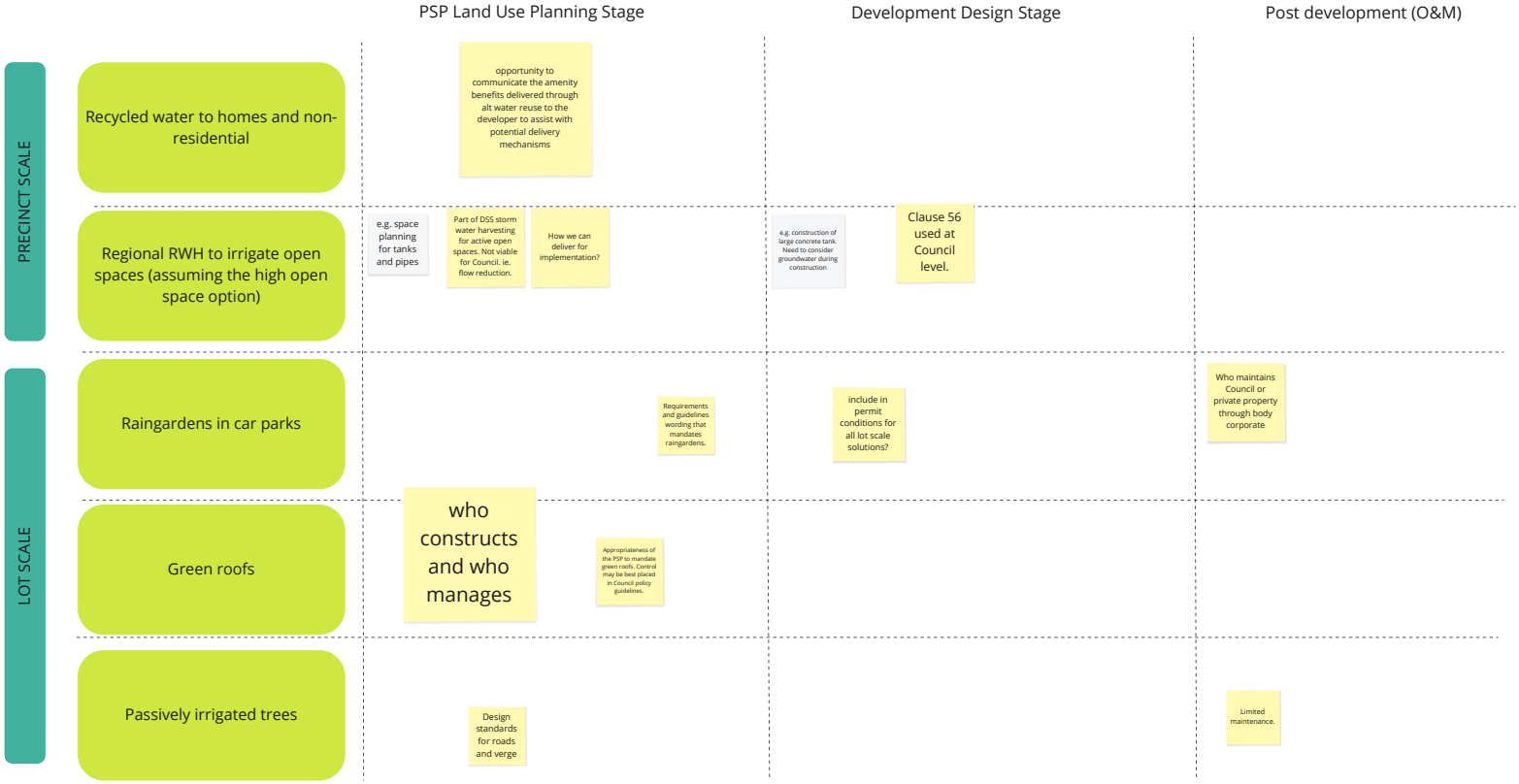


Activity - Delivery Pathways - Portfolio 3

WHAT NEEDS TO BE CONSIDERED AT THE FOLLOWING STAGES?

ARUP

Exercise time
15 minutes



Pause

Exercise time
15 minutes

Consider all three portfolios - which is the preferred portfolio?

PRECINCT SCALE

Portfolio -2

Nausheen (Casey)

All portfolios could work, with a combination of the different IWM 'elements'. It'll come down to further investigations and preference from delivery agencies and developer. (AC)

LOT SCALE

Portfolio -2

xx

Appendix C

Contextual Analysis and Base Case Report