
Western Parkland City Authority

Bradfield City Centre
Master Plan Application

Circular Economy (Waste and Services Report)

Prepared by WSP

October 2023

wpc.a.sydne.y

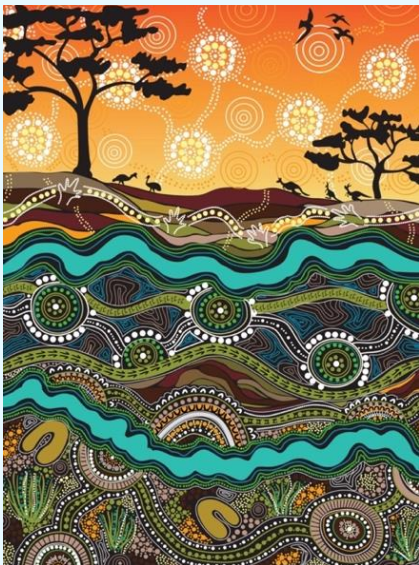
Acknowledgement of Country

Aboriginal people have had a continuous connection with the Country encompassed by the Western Parkland City (the Parkland City) from time immemorial. They have cared for Country and lived in deep alignment with this important landscape, sharing and practicing culture while using it as a space for movement and trade.

We Acknowledge that four groups have primary custodial care obligations for the area: Dharug/Darug, Dharawal/Tharawal, Gundungurra/Gundungara and Darkinjung. We also Acknowledge others who have passed through this Country for trade and care purposes: Coastal Sydney people, Wiradjuri and Yuin.

Western Sydney is home to the highest number of Aboriginal people in any region in Australia. Diverse, strong and connected Aboriginal communities have established their families in this area over generations, even if their connection to Country exists elsewhere. This offers an important opportunity for the future of the Parkland City.

Ensuring that Aboriginal communities, their culture and obligations for Country are considered and promoted will be vital for the future of the Parkland City. A unique opportunity exists to establish a platform for two-way knowledge sharing, to elevate Country and to learn from cultural practices that will create a truly unique and vibrant place for all.



Garungarung Murri Murri Nuru
(Beautiful Grass Country)

Artwork created by Dalmarrri artists Jason Douglas and Trevor Eastwood for the Western Parkland City Authority

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Executive Summary

WSP has been engaged by Western Parkland City Authority (WPCA) to prepare a holistic waste management and circular economy strategy (Strategy) to support the staged delivery of the new Bradfield City Centre. Bradfield City Centre is envisaged to become a globally recognised circular city, leading in the integration of circular economy principles into every aspect of the city's design, construction, and operations.

This Strategy provides recommendations on how to design out waste from the outset, use and keep resources in use to their highest value, regenerate natural systems and limit waste to landfill by embedding circular economy principles into infrastructure, land use planning, space allocation, precinct and building design.

The report provides an overview of the circular economy approach in the global and local context to provide an insight into trends and help shape the Strategy for Bradfield City Centre. It then identifies circular economy opportunities for Bradfield City Centre and sets pioneering targets for waste generation reduction informed by best practice in consultation with WPCA.

The process of developing the Strategy included evaluation of various strategy options to achieve the objectives and strategic outcomes set out for Bradfield City Centre. Based on the option evaluation results, a preferred strategy is outlined.

The adopted Strategy takes a flexible approach allowing evolution as Bradfield Centre grows. Key strengths of the Strategy are:

- Holistic, covering waste generation reduction during the construction and operation phases of Bradfield City Centre.
- Anchored in circular economy principles
- Sets pioneering targets for reducing waste generation from the outset
- Flexibility to accommodate:
 - development staging
 - changes to material types and volumes
 - advancement of processing technologies
- Has a strong focus on enhancing the liveability of residents and businesses that will call Bradfield City Centre home
- Embeds a 'pilot, test and grow' approach allowing for new approaches to be trialled before scaling up practical measures

The recommended Strategy is mindful of the need for integration with key utility services (water, energy, waste and digital infrastructure). Therefore, discussions and implementation processes will need to be developed in conjunction with the ultimate asset owner and operator.

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Glossary of Terms

AS	Australian Standard
Aerotropolis	Western Sydney Aerotropolis
BC Act	Biodiversity Conservation Act 2016
CIV	Capital Investment Value
DA	Development Application
DP	Deposited Plan
DPE	Department of Planning and Environment
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
LEP	Local Environmental Plan
LGA	Local Government Area
NSW Government	State Government for NSW
SEPP	State Environmental Planning Policy

1 Introduction

1.1 Purpose of this report

This report accompanies the Master Plan Application for the Bradfield City Centre submitted to the Department of Planning and Environment (DPE).

Additionally, the WPCA's Sustainability and Resilience Strategy (2023-2027) sets ambitious targets for the development and precincts the WPCA is responsible for delivering. The WPCA will develop further guidance to deliver on initiatives that relate to circular economy and waste management. Including sufficient space allocation for the effective separation, aggregation and collection of waste streams.

All matters were considered to have been adequately addressed within the Master Plan Application or in the accompanying appendices.

1.2 The Western Sydney Aerotropolis

The Western Sydney Aerotropolis is an 11,200-hectare region set to become Sydney's third city (the Western Parkland City), and the gateway and economic powerhouse of Western Sydney.

The Aerotropolis comprises of the new Western Sydney (Nancy-Bird Walton) International Airport surrounded by five initial precincts which include the Aerotropolis Core, Wianamatta– South Creek Northern Gateway, Agri-business and Badgerys Creek outlined in **Figure 1** below.

The final Aerotropolis planning package, including the Precinct Plan and State Environmental Planning Policy (SEPP) Amendment, was gazetted by DPE in March 2022 and the Development Control Plan Phase 2 was finalised in November 2022. These documents have been used to inform the preparation of the Bradfield City Centre Master Plan.

The proposed Master Plan Application for the site has also been prepared using the Western Sydney Aerotropolis Master Plan Guideline and Master Plan Requirements.

2 Bradfield City Centre

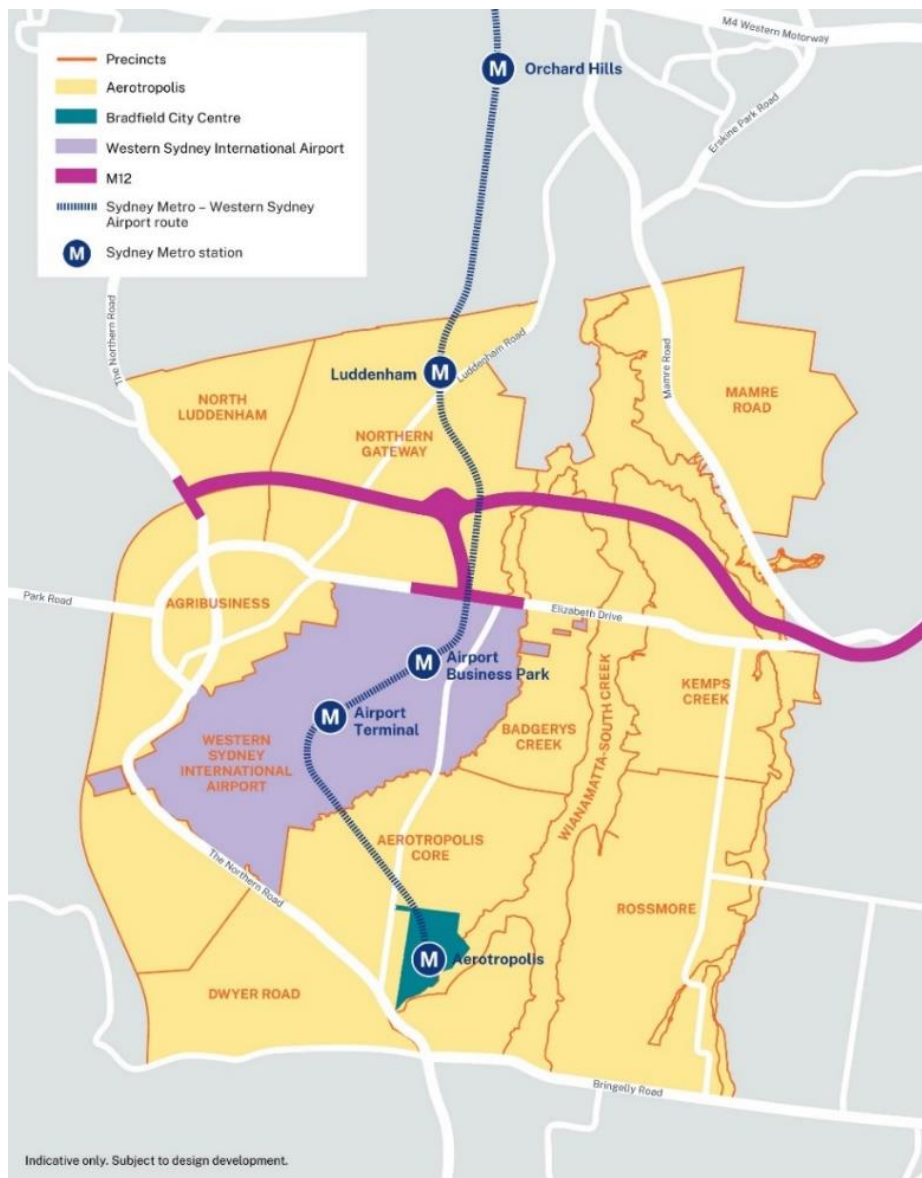
2.1 Strategic Context

The Bradfield City Centre is located to the south-east of the new Western Sydney International (Nancy-Bird Walton) Airport at the intersection of Badgerys Creek Road and The Northern Road (see **Figure 1** below).

The Sydney Metro Western Sydney Airport line runs through the site, providing connections from the key centre of St Marys through to stations at Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and the Aerotropolis which is located within the site.

The site is surrounded by several key roads and infrastructure corridors including Bringelly Road, Badgerys Creek Road, Elizabeth Drive, M12 and The Northern Road.

Figure 1 Strategic Context



Set on natural waterways, Bradfield City Centre presents a rare opportunity to showcase the best urban design and to create a thriving, blue and green, connected City in which Australians will want to live, learn and work. The Bradfield City Centre will be a beautiful and sustainable 22nd Century City. It will foster the innovation, industry and technology needed to sustain the broader Aerotropolis and fast track economic prosperity across the Western Parkland City.

2.2 The Master Plan Site

The street address for Bradfield City Centre is 215 Badgerys Creek Road, Bradfield (the Site) within the Liverpool Council Local Government Area (LGA). The site is legally described as Lot 3101 DP 1282964 and has an area of 114.6 hectares, with road access to Badgerys Creek Road located at the north-western corner. The site spans across the Aerotropolis Core and Wianamatta-South Creek Precinct, within Western Sydney Aerotropolis. The Site is outlined in **Figure 2** below.

The Site is predominantly zoned Mixed Use under the Western Parkland City SEPP, with a small portion of Enterprise zoned land located on the north-western corner of the site. The site also includes Environment and Recreation zoned land mostly along Thompsons Creek.

Figure 2 Master Plan Site



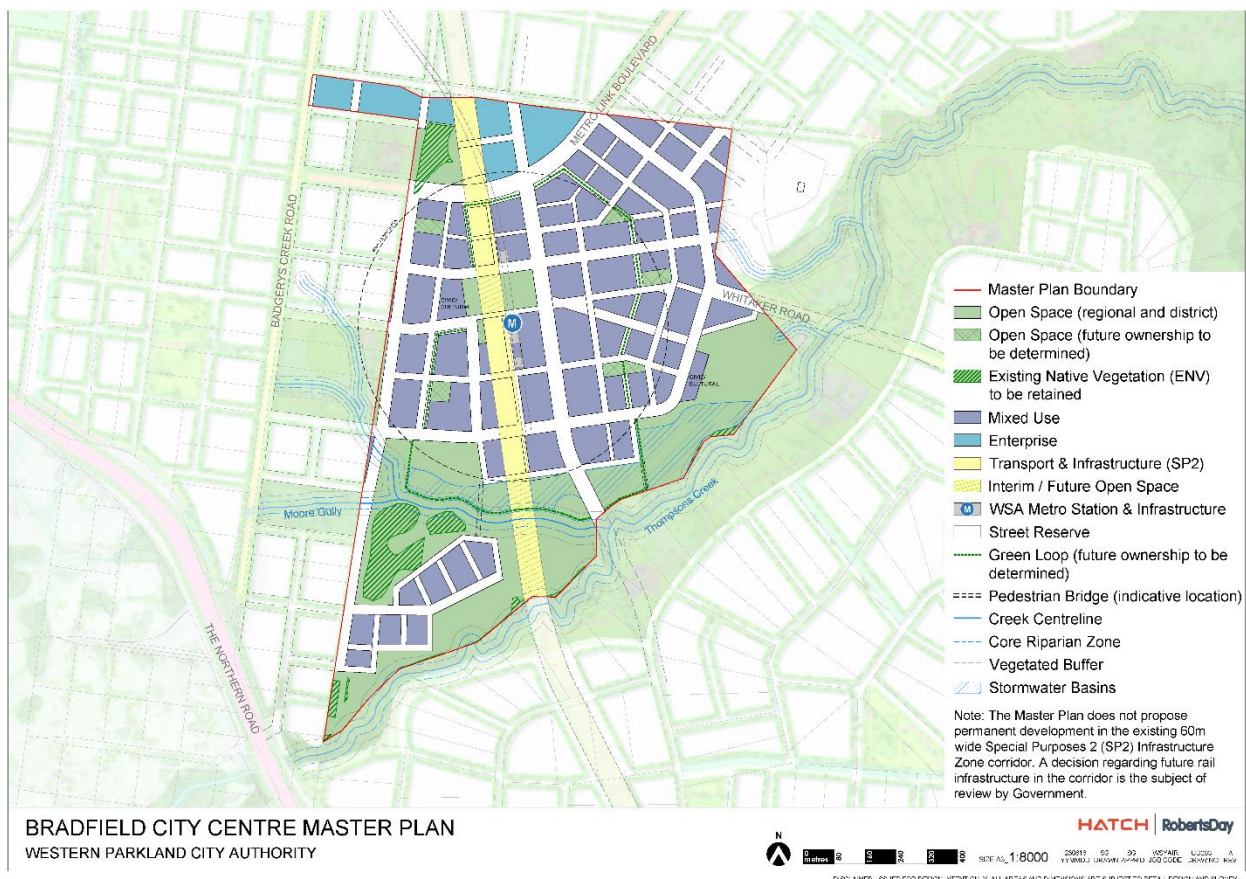
2.3 The Bradfield City Centre Master Plan

The Western Parkland City Authority has prepared a Master Plan (**Figure 3** below) in accordance with the DPE Master Plan Requirements.

The Master Plan sets out a framework for future development within the Bradfield City Centre which includes:

- Road network, key connectors to adjoining land and the regional road network (existing and future)
- Block structure
- Indicative open space network
- Sustainability strategy
- Social and infrastructure strategy
- Arts and culture strategy
- Infrastructure servicing strategy

Figure 3 Master Plan



2.4 The Proposal

The Bradfield City Centre Master Plan is intended to facilitate the growth of the centre over time. The Master Plan has established the following three planning horizons for technical assessments.

Table 1 - Planning & Development Horizons

Phase	Indicative Timeframe	Estimated employment	Estimated residential population	Estimated Gross Floor Area (cumulative)
Immediate	2026	1,000 - 1,200 jobs	0 residents	48,500 sqm
Medium-term	2036	8,000 - 8,300 jobs	3,000 - 3,100 residents	341,000 sqm
Long-term	2056	20,000 – 24,000 jobs	15,000 – 15,200 residents	1,258,000 sqm

Note: The table above is an estimate of the population and employment forecast used for the purposes of modelling only.

The master plan has the capacity to accommodate ~10,000 residential dwellings. In accordance with NSW Government policy a proportion of the residential dwellings will be affordable housing. The timing and delivery of residential dwellings will be subject to market demand and future master plan reviews that consider the impact of additional population on the scope and timing of social and physical infrastructure.

3 Baseline investigations

This section is not applicable to waste management and circular economy discipline as the existing site is greenfield (e.g., no existing built asset to be assessed) and excavated soil is not considered in this report.

3.1 Technical baseline site consideration

Not applicable

3.2 Area of Focus

Not applicable

4 Assessment Requirements and Policy Context

This section provides an overview of relevant policies and technical requirements that inform and scope the assessment, including the Master Plan Requirements (MPRs) applicable technical standards/plans/policies.

4.1 Master Plan Requirements

The DPE have issued Master Plan Requirements (MPRs) to the Authority for the preparation of a Master Plan for Bradfield City Centre. This report has been prepared to address the following MPRs.

Table 2 - Master Plan Requirements

Reference	Master Plan Requirement	Where addressed
Part A: Master Plan Requirements - Key issues to be addressed	To achieve compliance, the draft master plan must include a detailed justification demonstrating how the development will identify the waste management measures.	Section 5 and Section 6
9. Complying Development		
Part B: Reports and further information for the lodgement and assessment of the master plan	The master plan may include a sustainability strategy for waste management.	Section 5 and Section 6

The following table indicates the relevant agency/council comments applicable to waste management & circular economy.

Table 3 – Agency and Council Comments

Reference	Master Plan Requirement	Where addressed
Part A: Master Plan Requirements - Key issues to be addressed	To achieve compliance, the draft master plan must include a detailed justification demonstrating how the development will identify the waste management measures.	Section 5 and Section 6
9. Complying Development		
Part B: Reports and further information for the lodgement and assessment of the master plan	The master plan may include a sustainability strategy for waste management.	Section 5 and Section 6

4.2 International, National, and State Government Plans/Policies

4.2.1 International Waste and Circular Economy Megatrends

At a global scale, sustainable waste management and a positive shift towards a circular economy are recognised as key strategies that must be integrated into the international response to climate change.

This is reflected in the United Nations Sustainable Development Goals – particularly *SDG 12: Responsible Consumption and Production*, which identifies the following targets:

- 12.2: By 2030, achieve the sustainable management and efficient use of natural resources.
- 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.
- 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.
- 12.7: Promote public procurement practices that are sustainable, in accordance with national policies and priorities.

Specifically for plastic waste, a global movement has formed in response to the widescale generation and pollution of plastics. Recent developments include the March 2022 UN Environment Assembly resolution to 'end plastic pollution', and to draft an international legally binding instrument on plastic pollution by the end of 2024.

4.2.2 Overview of National and State Government policies

In Australia, all level of governments have recognised the strategic importance of transitioning to a circular economy. As a first step in February 2019, the NSW Government released a *Circular Economy Policy Statement*, setting the ambition and approach for a circular economy in NSW.

This was followed by the 2021 release of the *NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027*, which reaffirmed the NSW Government’s commitment to facilitating a circular economy and articulated key principles for how this may be achieved.

A high-level summary of the strategic context for this project at National and State Government level is provided in **Figure 4**.



Figure 4 High level summary of the National and State Level Strategic context

4.2.3 National Policy

Underpinning policy at all levels of government is the Waste Hierarchy (refer **Figure 5**), which identifies a set of priorities for the efficient use of resources.

The National Waste Policy sets the following targets for Australia¹:

- halve the amount of organic waste sent to landfill by 2030
- phase out problematic and unnecessary plastics by 2025
- reduce total waste generated in Australia by 10% per person by 2030
- 80% average recovery rate from all waste streams by 2030
- significantly increase the use of recycled content by governments and industry
- make comprehensive, economy-wide and timely data publicly available to support better consumer, investment and policy decisions.

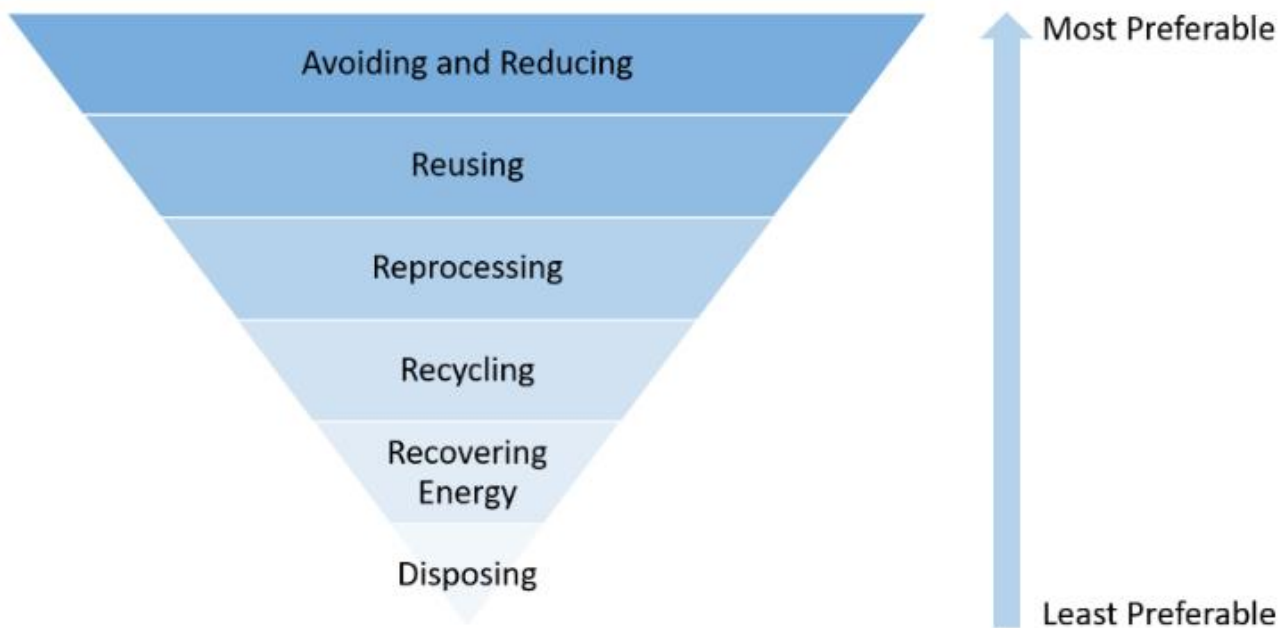


Figure 5 The Waste Hierarchy

¹ Department of the Environment and Energy. (2019). *National Waste Policy: Action Plan 2019*.

4.2.4 State Government Policy

4.2.4.1 NSW Waste and Sustainable Materials Strategy

The NSW 20 Year Waste Strategy has aligned its targets with the National Waste Action Plan, notably reaching an 80 per cent resource recovery rate by 2030 and reducing total waste generation by 10 per cent. Key targets set out in the strategy are as below:

Table 4 Key targets from NSW Waste and Sustainable Materials Strategy 2041

Category	Targets
5-year targets	Phase out problematic and unnecessary plastics by 2025 Plastic litter reduction target of 30% by 2025
10-year targets	Reduce total waste generated by 10% per person by 2030 80% average recovery rate from all waste streams by 2030 Introduce a new overall litter reduction target of 60% by 2030
Plastics	Eliminate problematic and single use plastics by 2025 Triple the plastics recycling rate by 2030
Organic waste	Halve the amount of organic waste sent to landfill by 2030 Net zero emissions from organics to landfill by 2030 The strategy also seeks to mandate food and garden organics collection for all NSW households and select businesses which will require the separate collection of: • food and garden organics from all NSW households by 2030 • food waste from targeted businesses and other entities that generate the highest volumes of food waste, including large supermarkets and hospitality businesses, by 2025.

Regarding plastic waste, the NSW Plastic Action Plan was issued by the NSW Government in June 2021, identifying the most littered plastic items and a timetable for their phasing out.

4.2.4.2 Plastic Reduction and Circular Economy Act 2021

The Plastic Reduction and Circular Economy Act 2021 introduces and regulates key objectives for product designers and users to promote and support material circularity through design, production, use, re-use, collection, recycling, reprocessing and end-of-life management. The goal is to reduce the impact on the environment and human health.

It also presents a list of materials that were phased out from 1st June 2022 including integrated packaging, lightweight plastic bags, single-use plastic items such as straws, cutlery, plate, and expanded polystyrene food service items. From 1st November 2022, plastic microbeads were prohibited in certain rinse-off personal care products.

4.3 Western Sydney Aerotropolis

At a local level, a suite of relevant policies is applicable to waste management and circular economy as summarised in **Figure 6**.



Figure 6 High level summary of the Local Government Level Strategic context

Notably, the *Western Sydney Aerotropolis Development Control Plan – Phase 2* (finalised on 10 November 2022) sets out performance outcomes and benchmark solutions to guide developments, providing a practical approach to the management of waste across the whole development lifecycle, including demolition, construction and occupation.

Table 5 outlines how the proposed masterplan design aligns with each performance outcomes, as applicable.

Table 5 Policy Requirements

Numeric Section	Performance Outcome	Benchmark Solution	Master Plan consideration and comment
P01	Waste management measures are implemented at lot and neighbourhood scale to support circular economy activities.	1. Support circular economy activities and detail the quantity and type of waste generated and how this will be managed, reused and recycled. Where possible, incorporate technologies such as vacuum extraction or on-site food processing. 2. Co-locate and integrate waste infrastructure on sites with multiple uses by providing a single collection point for waste and recycling. 3. Demonstrate that organic waste can be managed in the building through measures such as: a. Multiple options for on-site organic waste to maximise recovery (e.g., communal composting, worm farms, individual composting, dehydrators); b. Organics and recycling service to all households; or c. Energy generation from organic waste (anaerobic digestion) at lot and precinct scale.	1. Circular economy principles are embedded into the design to ensure waste is designed out from the outset. Pioneering targets for waste generation reduction across the whole life cycle of the precinct directly inform the masterplan design. Particularly, Section Error! Reference source not found. provides a high-level overview of the quantity and type of operational waste generated and how this will be managed, reused and recycled. A bespoke solution for food waste management is also proposed, subject to further assessment. 2. As described in Section 6, the proposed design includes opportunities for shared waste infrastructure onsite (within the building envelope) with a single point of collection (e.g., shared loading docks and waste equipment across clusters of mixed-use buildings). 3. A bespoke centralised solution is being explored for managing organic waste, subject to further assessment. Food waste could be macerated within each building and transferred via a dedicated pipe to a shared holding tank on-site and then transferred to the preferred processing facility. The processing facility could be co-located on-site (e.g., maggot farm, small scale in-vessel composting) or off-site. Options for Community based on-site organic processing (e.g., communal composting, worm farms, individual composting) will be assessed

during detailed design at DA Stage

P02	Waste and recycling facilities promote waste separation and reduce contamination. Materials are separated at source to achieve higher value recovery.	1. Collection points (including but not limited to reverse vending machines and e-waste drop-off) must be located with adequate space for servicing, ease of use and to encourage the separation of waste material. 2. Provide separate and enclosed storage for liquid, chemicals, and hazardous waste. 3. Where general waste chutes are used, provide for the collection of recycling and organic waste at each level within the building. 4. Consolidated organic waste drop off points are designed to minimise any potential odour and vermin risks. This includes the provision of rooms that are temperature controlled and suitably ventilated.	1. Section 6 provides an overview of the extended operational waste/material streams expected to be generated in Bradfield City Centre, with a focus on contamination reduction. Additional assessment would need to be undertaken during detailed design at DA Stage to determine space allocation for extended waste streams. 2. Additional assessment would need to be undertaken during detailed design at DA Stage. 3. Use of dual chute system is not confirmed. Subject to detailed design for DA. 4. A bespoke centralised solution is being explored for managing organic waste that will minimise any potential odour and vermin risks as described above (response to PO1-benchmark solution 3), subject to further assessment.
P03	The location of waste management is clearly indicated for each site and neighbourhood.	1. Provide uniform waste management design and colour coding in accordance with AS 4123 across residential and commercial developments. 2. Waste management systems and rooms are located inside buildings to support a heightened amenity and urban design outcome. Waste must not be left outside (excluding during collection) to avoid attracting animals.	1. This outcome is subject to detailed design at DA Stage. 2. As described in Section 6, all waste management systems and rooms are proposed to be located inside buildings. Subject to detailed design for DA.
P04	Waste bins are provided to a level commensurate with waste produced for each development as outlined in	1. Waste storage areas are designed to: a. Accommodate the required number and size of waste bins;	1. Further details would need to be provided during detailed design at DA Stage. 2. Further details would need to be provided during detailed design at DA Stage.

	Council's waste and recycling service.	b. Provide space for the bins to be accessed, rotated and manoeuvred for emptying; c. Allow for future waste separation practices; and d. Account for different uses in mixed use development through the provision of separate and enclosed collection rooms for both residential and commercial uses.	
		2. Align building design and collection points with Council's waste and recycling services and collection fleets.	
P05	Implement innovative waste management storage systems that are safe, healthy, and efficient.	1. Waste storage areas are to: a. Be well-lit and ventilated; b. Include water and drainage facilities for cleaning the bins and bin storage area; c. Be easily and conveniently accessible for all users and collection contractors; d. Be located so that residents do not have to walk more than 30m for access; and e. Comply with Local Council Policy and contractual service provisions. 2. Collection and loading points are to be: a. Level; b. Free of obstructions; c. Easily accessible from the nominated waste and recycling storage area; d. Be integrated wholly within the built form to support a heightened amenity outcome; e. Be accessible by heavy rigid collection vehicles to permit	1. Further details would need to be provided during detailed design at DA Stage.

		entry and exit of the site in a forward direction;	
		f. Comply with the Building Code of Australia and Relevant Australian Standards; and	
		g. Comply with Local Council Policy and contractual service provisions.	
		3. Provide safe and easy access to waste and resource recovery areas for residents, building managers and collection contractors.	
		4. Ensure waste and recycling areas flexibly adapt to other types of waste and materials storage over time.	
		5. Design waste and recycling facilities to prevent litter and contamination of the stormwater drainage system.	
P06	Waste management storage systems minimise negative impacts on the streetscape, public domain, building presentation or amenity of pedestrians, occupants, and neighbouring sites.	- Waste storage and collection areas are to: - Where possible, be integrated wholly within the developments built form; - Not be visible from the street or public domain; - Not adjoin private open space, windows, habitable rooms, or clothes drying areas; - Not be located within front setbacks; and - Comply with Local Council Policy and contractual service provisions. - Collection points and systems are designed to minimise noise for occupants and neighbours during operation and collection.	Further details would need to be provided during detailed design at DA Stage.
P07	Recognise waste types, generation rates and separation needs may	Waste and resource recovery facilities are sited to enable possible future expanded floor area.	The Master Plan design approach is flexible enough to ensure that changes to waste types, generation rates and separation requirements

change during the useful life of a building.	2. Design waste and resource recovery facilities to enable installation of new, potentially larger equipment.	can be accommodated. Further details would need to be provided during detailed design at DA Stage.
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4.4 Other Relevant Technical Standards

The following table provides a summary of requirements from the relevant agency/ council comments applicable to waste management & circular economy.

Table 6 Policy Requirements

Document	Agency/ Council	Summary of requirements	Master Plan consideration and comment
Liverpool Council comment – Bradfield Master Plan – 215 Badgerys Creek Road	Liverpool City Council	The following are the minimum waste standards required by Liverpool City Council. <i>Waste streams:</i> - A minimum of three core waste streams including a storage area for hard waste must be provided (to be proportional to max expected disposal per unit over 1 month). - The waste fit out must have a capacity for a minimum of 2 days' worth of storage for waste items per unit. <i>Collection:</i> - Council pick up for residential only. - All waste to be off-street collection only (optional at grade or in basement). <i>Traffic:</i> - Must allow for a 10.5m 26t HRV to reverse enter and forward exit. <i>Other:</i> - For multi-unit developments, building/ strata management to be responsible for waste separation and disposal by residents. - Provide initiatives/ facilities to permit a portion of the produced waste by the Bradfield community to be separated, re-use, or recycled locally.	The design is in alignment with circular economy principles, emerging changes to the Australian waste management environment (including changes to waste/materials streams), and best practice, with a focus on operational safety and improving environmental sustainability outcomes where possible. It includes provision for extended operational waste/material streams such as fit-out waste, hard/bulky waste, e-waste, textile etc. with a focus on contamination reduction. Further details would need to be provided during detailed design at DA Stage.
DOC22/604955	EPA	The master plan must identify, quantify, and classify the likely waste to be generated	Circular economy principles are embedded into the master plan design to ensure that waste is designed out from the outset.

	during construction and operation AND describe measures to be implemented to minimise, reused, recycled and safely dispose waste. • It is recommended for waste generation and impact on site to be guided by the following NSW Government documents: Circular Economy Policy Statement: Too Good To Waste, NSW Waste, and Sustainable Materials Strategy 2041 (DPIE). • Facilitate the establishment of circular economy industries. • Provide better consideration for operational waste management requirements. • Include waste and circular economy in master plan technical report. Optional: Discuss all stages of development (construction AND operation). • Provide alternative resource recovery streams e.g., Textiles, E-waste, and bulky waste for capacity expansion.	Pioneering targets for waste generation reduction across the whole life cycle of the precinct directly inform the masterplan design, in alignment with key policy documents. Particularly, Section 6 provides a high-level overview of the operational waste expected to be generated and how this will be managed, reused and recycled. It also includes provision for extended operational waste/material streams such as fit-out waste, bulky waste, e-waste, textile etc. with a focus on contamination reduction. A bespoke solution for food waste management has also been investigated. From a broader precinct perspective, there is the opportunity to establish a Circular Economy Hub as a consolidated point of collection for materials where to potentially co-locate last-mile and reverse logistics and reuse, repair, repurpose, recycling solutions.
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4.5 Summary of Key Implications for Master Plan

The above policy context and technical requirements confirm that all level of governments in Australia have recognised the strategic importance of transitioning to a circular economy where waste is minimised, and materials are considered a valuable resource.

This Waste Management and Circular Economy Strategy (The Strategy) is in alignment with the above requirements (exceeding them in a number of areas) and provides recommendations on how to design out waste from the outset, use and keep resources in use to their highest value, regenerate natural systems and limit waste to landfill by embedding circular economy principles into infrastructure, land use planning, space allocation, precinct and building design.

5 Technical Approach/ Framework

This section provides an overview of the framework that has guided ‘The Strategy’ for Bradfield City Centre from a waste management and circular economy perspective, with waste reduction as a vital part of the overarching approach of the City’s infrastructure, buildings and operations across three horizons (2026, 2036 and 2056).

5.1 Embedding Circular Economy into Bradfield City Centre

Bradfield City Centre represents a great opportunity to embed circular economy principles at a precinct level from the early stages of the design process and become a globally competitive circular city.

Underpinned by the key sustainability objective to “manage waste to landfill, target zero waste by 2030 and promote a circular economy between symbiotic uses”, this document will detail the integration of circular economy principles and strategies in every aspect of the City’s infrastructure, buildings and operations across three horizons (2026, 2036 and 2056).

Waste reduction is a vital part of the overarching approach for developing waste strategy options in line with circular economy for Bradfield City Centre. The Strategy needs to be designed considering the expected changes in waste volumes and types (e.g., increase in e-waste, single use plastics bans, decrease in paper waste). Changes in waste volumes and types mean that the Strategy will need to include mitigations strategies to allow for flexibility (e.g., waste storage space to be easily repurposed for other uses).

Moreover, buildings that are designed in line with circular design principles typically have an extended lifespan, the ability to accommodate change in use and can be easily disassembled to facilitate reuse or recyclability of materials. Material circularity can be maximized designing buildings that reuse existing assets and materials, use new materials with high recycle content and specify construction processes and products that are easy to disassemble into component parts.

For the purpose of this report, operational waste and construction waste have been considered separately.

5.2 Pioneering Approach to Waste Generation Reduction

5.2.1 Operational waste

Operational waste is defined as typical waste and materials that are generated when the precinct and their buildings are operational (e.g., tenants and residents living within the precinct).

Australian waste data indicates that whilst ongoing efforts to improve waste stream separation, reuse and recycling have resulted in improved landfill diversion rates, total waste volumes at a wider scale have remained relatively stable.

In contrast, the Bradfield City Centre development will adopt a pioneering approach to waste generation reduction – striving towards the following aspirational targets:

- Waste reduction of 30% (by volume) in 2026
- Waste reduction of 50% (by volume) in 2036
- Waste reduction of 70% (by volume) in 2056

Understanding the national context and current rates of change, it is clear that such ambitious targets will only be achieved by the embedding of circular economy principles into all aspects of the development, from its early inception.

This must be built upon a strong foundation that reshapes the way resources are viewed across the development, and also seeks to eliminate waste from its source by not creating it in the first place. This will rely on the widespread implementation of circular economy initiatives.

This will also require an awareness of predicted waste stream trends (i.e., materials that will likely be phased in or out of circulation), and consideration of the consequences this may have for waste systems at a wider scale. Examples include, but are not limited to:

- Phasing out of polystyrene packaging and single use packaging
- Phasing out of paper and reducing cardboard, with a corresponding increase in electronics
- Acknowledge that certain ‘problem’ waste types are likely to remain in use e.g., human-soiled materials

5.2.2 Construction Waste

Construction waste is defined as typical waste and materials that are generated during the construction phase of each development (i.e., on the construction site). For the purpose of this report, fit-out waste is also included in the construction waste section as it refers to typical waste and materials that are generated during office tenancy renovation (e.g., internal partitions, carpet, lighting, furniture).

Australian construction waste data indicates that whilst ongoing efforts to improve waste stream separation, recovery and recycling have resulted in improved landfill diversion rates (55% of materials recovered on average across Australia with more than 75% recovery rate in best performing jurisdictions²), total construction waste volumes have continued to increase.³

In contrast, the Bradfield City Centre development will adopt a pioneering approach to construction waste generation reduction through the implementation of the Circular Design Strategies proposed in Table 9 – striving towards aspirational targets based on the positive experience of Australian leading construction companies⁴ and international rating tools (UK BREEAM⁵ and Canada LEED 2009⁶).

² Hyder Consulting. (2011). *Construction and demolition waste status report - management of construction and demolition waste in Australia*.

³ Department of Agriculture, Water and the Environment. (2020). *National Waste Report 2020*.

⁴ Mirvac. (2020). *Planet Positive: Waste & Materials*.

⁵ BREEAM UK. (2014). *BREEAM UK Refurbishment and Fit-out 2014*.

⁶ Canada Green Building Council. (2010). *LEED® Canada for New Construction and Major Renovations 2009*.

5.2.3 Summary of Proposed Targets for Bradfield City Centre

A summary of the targets proposed for Bradfield City Centre is provided in **Table 7**.

Table 7 Summary of key targets for operational and construction waste in Bradfield City Centre (WPCA)

Application	Intent	Circular Economy Principles Alignment	Target
Operational waste	Reduce waste generation during operations	Design Out Waste	Step 1 - 30% reduction by volume in 2026
			Step 2 - 50% reduction by volume in 2036
			Step 3 - 70% reduction by volume in 2056
Construction / fit-out waste	Reduce waste generation during construction	Design Out Waste	50% reduction by weight across 2026 to 2056

To guide the practical achievement of the above targets, it is fundamental to acknowledge that a system of initiatives and requirements in line with the key Circular Economy principles will need to be effectively implemented and monitored across the whole life cycle of the precinct. This document will provide guidance with respect to Bradfield City Centre on the following key areas:

- Operational waste – Design for efficient waste management (Section 5.3)
- Operational waste – From users' perspective (Section 5.4)
- Construction waste – Circular Design principles (Section 5.5)

5.3 Operational Waste – Design for Efficient Waste Management

From an operational waste management perspective, best practice design choices need to be implemented to ensure as a minimum that:

- Waste management systems are easy to use and facilitate correct waste stream separation, internal transfer and collection (e.g., waste chutes, compactors etc)
- Adequate storage space is allocated within each building (from each tenancy fit-out through to the loading dock) to facilitate separation of extended / specialty waste streams
- Storage space is shared among buildings to increase economies of scale and reduce collection vehicles movements and related traffic
- Adequate access to loading docks through good design
- Health and safety for users and operators is managed

5.4 Operational Waste – from Users' Perspective

From a user perspective, continuous education is necessary to ensure stakeholder engagement and the achievement of the proposed pioneering waste reduction targets. A list of possible actions is included in Table 8.

Additionally, a 'Green concierge service' as facility manager/s is highly recommended to provide ongoing practical advice to tenants regarding best practice from an operational waste management perspective, which will play a pivotal role in achieving precinct targets.

The success of this Strategy will build on the results that have been demonstrated in the following examples:

- Barangaroo (Sydney) Eco-concierge service, achieving 80% diversion of operational waste through education and engagement initiatives
- One Brighton (UK) case study.

Table 8 Operational waste – possible strategies that align with circular economy principles

Principle	Strategy	Examples & Opportunities
Design Out Waste	Reduce consumption Reduce waste generation	• Community education e.g., 'menu planning' to minimise food waste and 'slow fashion' to reduce textile waste and related environmental impacts • Resource policies – e.g., plastic-free zones • Community gardens and produce sharing (e.g., fruit trees – harvest as required) • Sharing hubs (e.g., toys, tools, libraries) • Community event days (e.g., clothing swaps) • Leasing opportunities (e.g., electronics, clothing) • 'Little Free Pantry' movement (sharing over supply/purchase) • Encourage journeys by public transport, foot or cycle • Deliveries and waste collection by zero emission vehicles

Keep Materials in Use	Reuse materials	• Repair hubs • Food rescue (donations) • Food waste pelletisation – create animal feed
	Donate materials	
	Remanufacture	
Return Materials to System	Recycle materials	• On-site recycling plants (e.g., micro-factories) • Local company take back schemes • Create compost • Create energy

It is also acknowledged that the 'First Building' has been designed using a circular design approach and to be disassembled and repurposed at the end of its life, demonstrating WPCA's strong commitment to embedding circular economy principles into Bradfield City Centre from its early stages.

5.5 Construction Waste – Circular Design

From a construction waste perspective, the achievement of waste generation reduction targets will strongly rely upon more stringent legislative requirements combined with economic incentives and the review of the construction code to facilitate the implementation of circular design principles. Educating the construction industry stakeholders also plays an important role as well as raising the awareness about the 'true cost of construction waste disposal.

A set of potential circular design strategies to be incorporated into building design is included in Table 9.

Table 9 Construction waste – possible strategies that align with circular economy principles

Principle	Strategy	Examples & Opportunities
Design Out Waste	Reduce waste generation through design (e.g., design for longevity, flexibility, disassembly, materials optimisation etc.)	• Design a built asset to minimise waste generation throughout its whole lifecycle such as: ○ Design spaces with the ability to accommodate change of use ○ Design assets for ease of deconstruction ○ Maximize the efficient use of materials and minimize unnecessary offcuts ○ Select durable materials that can be easily maintained, repaired and upgraded • Minimise waste during construction stage, such as: ○ Use of prefabricated and modular components Use of fully electric equipment (e.g., electric cranes, trucks, delivery vans) to minimise carbon emissions and pollution
Keep Materials in Use	Reuse existing assets and materials Remanufacture	• Establish a Materials Passport system • Product leasing agreements (e.g., rent lighting systems, elevators, facades etc.)
Return Materials to System	Recycle materials	• Take back schemes

-
- Use problematic waste streams (e.g., textiles, soft plastic) to produce construction materials with high % of recycled content
-

It is also acknowledged that the ‘First Building’ has been designed using a circular design approach and to be disassembled and repurposed at the end of its life, demonstrating WPCA’s strong commitment to embedding circular economy principles into Bradfield City Centre from its early stages.

5.6 Moving From “Waste Streams” To “Material Streams”

In alignment with Circular Economy principles, shifting away from the terminology ‘waste streams’ towards ‘materials streams’ represents an important step to acknowledge the potential for each material based on its value for reuse, repair, repurpose and recycle rather than limiting it to Business as Usual (BAU) waste management practices. In turn, this encourages better practice stream separation, and more accurately represents the target scenario in which all recyclable materials may be recovered.

It is, however, noted that a number of references to ‘waste’ are included throughout this report. The intended application of each intervention / technology remains to the specified material streams (rather than BAU waste streams), however certain terminology remains in use due to current industry practice and standard naming conventions.

5.7 Circular Economy Hub

From a broader precinct perspective, there is also an opportunity to create a Circular Economy Hub as a consolidated point of collection for materials that can be repaired, repurposed, or recycled to keep resources in use for as long as possible.

Based on international research, indicative sizing of the Circular Economy Hub to serve Bradfield City Centre would require a dedicated area of 3,000 m² to showcase innovative solutions and the opportunities related to circular economy. It would include:

- A 4-storey building with an approximate footprint of 500m² that will accommodate materials storage, workshops, space for circular economy start-ups, micro-factories etc.
- A micro-logistics hub (potentially 200m² undercover excluding circulation space – to be further assessed during detailed design)
- Circulation space and loading dock area
- Additional outdoor space for community educational events and pop-up initiatives

5.8 Additional Opportunities to be Considered

5.8.1 Industrial Symbiosis

The industrial symbiosis term describes industrial activities where a waste or by-product of one actor becomes a resource for another actor. The implementation of industrial symbiosis as a framework to a precinct will provide environmental benefits such as reducing the use of virgin resources and waste production along with commercial benefits (e.g., new revenue streams from waste by-products, less disposal costs).

At a precinct / citywide scale, as the Bradfield City Centre development progresses and the involvement of specific industries can be confirmed, a detailed analysis of their waste inputs and outputs (materials flow) can be performed to develop a comprehensive list of opportunities for co-location of industries and waste streams exchange. The introduction of local reprocessing plants can also provide opportunities for job growth within the area and encourages the wider community to reap the benefits from their own local resources.

5.8.2 Last Mile Logistics

Movement of logistics adds to the waste, particularly cardboard and soft plastics, flowing in our towns and cities. Last mile delivery, defined as the 'last stretch of a business to consumer parcel delivery service', is a growing challenge with the demand for deliveries on the rise and a shift towards consumers buying their products online, exacerbated by the onset of COVID-19. Under-utilised trucks making multiple deliveries to the same location can clog roads and streets, while packaging leads to waste generation.

Bradfield City Centre will have a strong focus on placemaking with streets that will be designed for people not cars, with the central core likely to showcase streets that are car-light, favouring public transport and active transport modes to meet its emission reduction targets. To meet its waste reduction targets, the Bradfield City Centre needs to adopt ways of reducing packaging waste and the movement of underutilised trucks.

Micro-logistics centres can enable packages to be consolidated and transferred from trucks onto smaller, environmentally friendly vehicles (e.g., people or electric powered bikes, cargo bikes, scooters) for delivery to the final consumer. These centres can also act as pick up point for people who would rather collect their packages. Space can also be dedicated to hold unwanted packaging from deliveries removed during the consolidation process or returned by consumers on delivery.

Allowing space for micro-logistics centres in the Master Plan will enable the Bradfield City Centre to secure space before the city begins to take shape. These micro-logistics centres can be combined with other uses such as reverse logistics, circular economy information centres and community gardens to maximise learning opportunities and minimise waste generation.

5.8.3 Reverse Logistics

Reverse logistics is the process of collecting and aggregating products, components, or materials at their end of life for reuse and repurpose in line with a circular economy. It can help remove high value materials from the waste stream. Implementation of reverse logistics can also help create jobs and enable better supply chain management.

Reverse logistics is becoming a feasible opportunity with the emergence of digital tools such as artificial intelligence, tracking capabilities, and digital twins. The WPCA can investigate opportunities to promote testing of reverse logistics in Bradfield City Centre to maximise land use of the last-mile logistics hub.

6 Technical Assessment

This section details the technical assessment undertaken to support the staged delivery of the new Bradfield City Centre from a waste management and circular economy perspective. It demonstrates how the Strategy addresses relevant design criteria and provides recommendations with respect to operational waste including:

- A high-level demand analysis to understand the quantity and type of operational waste generated by the Precinct.
- Operational waste design advice for Master Planning, to identify how operational waste/materials generated by Bradfield City Centre will be effectively managed, reused and recycled. This was underpinned by a detailed options analysis, based on best practice circular economy and waste management solutions.

It is to be noted that further assessment will need to be undertaken during the conceptual and detailed design phases of each building.

6.1 Operational Waste Generation Assessment

This section outlines key findings from the high-level demand analysis for operational waste, taking into consideration the pioneering approach to waste generation reduction identified in **Section 5.2**. The operational waste calculations performed were based on industry standard operational waste generation rates and predicted GFAs for the precinct.

The waste generation assessment was calculated based upon common waste streams (garbage, commingled recycling and food organics). Garden waste was excluded from this assessment.

The resulting impact of the operational waste reduction targets on total waste volumes for the Precinct are illustrated in **Figure 7**.

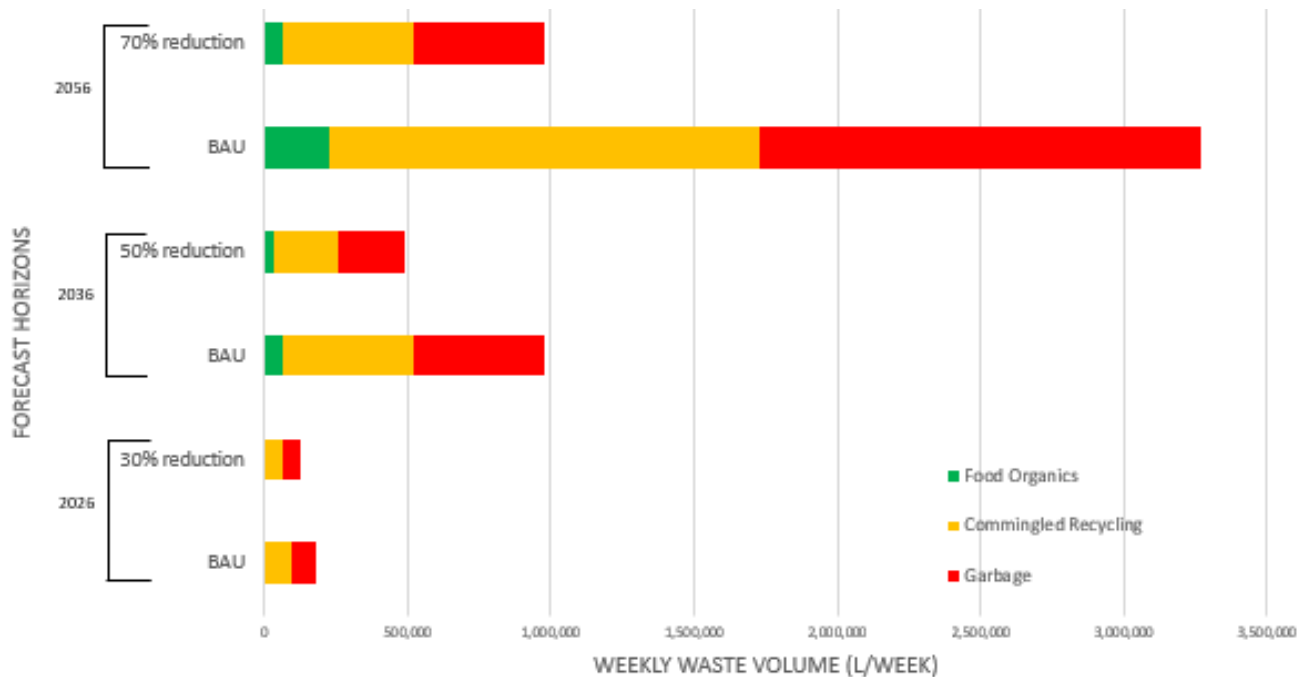


Figure 7 Impact of Operational Waste Generation Reduction Targets on Total Weekly Waste Volumes for the Precinct

6.2 Operational Waste Design for Master Planning

This section includes an overview of recommended operational waste design solutions for master planning, based on the preliminary waste calculations.

The proposed design allows for extended operational waste/material streams separation with a focus on contamination reduction, as detailed in **Table 10**.

Table 10 Operational material streams expected to be generated from Bradfield City Centre

Principle		Inclusions		
Operational Streams	Food Organics	Fruit, vegetables, meat, fat, oil, dairy, bone, shell		
	Recyclables	Commingled	Timber pallets	Textiles
		Paper / secure paper	Metals	E-waste
		Cardboard	Hard plastics	Polystyrene
		Glass	Soft plastics	Bulky Waste
	Non-Recyclables (Residual Waste)	• Take back schemes • Use problematic waste streams (e.g., textiles, soft plastic) to produce construction materials with high % of recycled content		
Exclusions: garden waste, hazardous waste, chemical waste, trade waste, public place recycling, clinical waste.				

Note: materials to be phased out are polystyrene and soft plastics

The masterplan design advice was underpinned by a detailed options analysis, which applied best practice circular economy and waste management solutions to develop a shortlist of suitable options for each material stream (as shown in the following **Table 11** through

Table 13).

In line with best practices for effective operational waste management, the following key design elements are proposed for Master Plan design:

- A combination of waste equipment including dual chutes, food waste macerators, compactors, glass crushers, balers etc. to ensure that management systems are easy and safe to use and facilitate correct waste stream separation, internal transfer, and collection (to be further refined by each building design team)
- Recommendation for adequate storage space in each tenancy fit-out to facilitate extended waste stream separation (to be further developed by each building design team)
- Recommendation for minimum storage space for material/waste streams to be located in a shared loading dock (one per each cluster of buildings) to increase economy of scale and reduce collection vehicles movements and related traffic
- Recommendation for minimum height requirements to allow adequate and safe waste collection vehicle access to loading docks

Table 11 Shortlist for food organic options

SHORTLIST: FOOD ORGANICS					Horizon - legend		2026	2036	2056	
Fruit, vegetables, meat, fat, oil, dairy, bone, shell					Note		Timing is for the option to be operational by the specified year. Preparatory work will need to be done ahead of time.			
THRESHOLD	PREREQUISITES	POINTS OF INTERVENTION	INTERVENTION TYPE	DESCRIPTION	POSSIBLE INTERVENTIONS					
	EDUCATION	PRODUCTION	AVOID WASTE	Reducing waste production in the first place and making the best use of any waste produced	Stakeholder education for waste avoidance	Stakeholder education to improve source separation	Source separation to minimise contamination	Increase duration of food life	Food rescue initiatives	
	N/A	MOVEMENT	MANUAL INTERNAL TRANSFER TO AT SOURCE STORAGE	Waste is manually transported	Manual transfer					
	PIPED SYSTEM TO BE INTEGRATED IN THE BUILDING DESIGN		AUTOMATED SYSTEM TO AT SOURCE STORAGE	Waste is transported using a piped system	Macerator with third pipe to tank	Macerator to sewer	Food waste chute (Not an option due to smell)			
	UNDERGROUND OR ABOVE GROUND	AT SOURCE STORAGE	SHARED STORAGE	Shared storage will reduce spatial requirements per building, increase storage capacity and reduce waste vehicle movements	Above ground (applicable only to industrial sites)	Underground	Underground communal bins (residential use only)			
Small volumes of organics	EXTRA STORAGE SPACE	COLLECTION	COLLECTION BY VEHICLES	Waste is collected and transported to the identified transfer/ processing location	BAU waste collection trucks via above ground road	Pilot EV waste collection trucks via above ground road	BAU waste collection trucks via underground tunnel	EV waste collection trucks via underground tunnel	Waste collection trucked to rail combo (above or underground)	
High volumes of organics; max capacity of vacuum system	LESS STORAGE SPACE		MODULAR PIPED SYSTEM (no waste vehicles within the precinct)	Waste is collected and transported to the identified transfer/ processing location using a piped system	Macerator or vacuum with third pipe to sewer	Integrated vacuum system to transfer station				
	EXTRA SPACE WITHIN THE PRECINCT, Constant high-quality feedstock, end market	PROCESSING	ON-SITE PROCESSING	On-site (precinct wide) food waste processing	Larvae	Digester	Dehydrator	Community garden with compost bins	Pelletisation	In-vessel composting
Processing costs, waste stream type	PLANT AVAILABILITY, contract agreement, compliant feedstock		OFF-SITE PROCESSING	Off-site (outside precinct) food waste processing	Water Treatment Plant	In-vessel composting	Anaerobic digester	Waste to Energy		
	MARKET DEVELOPMENT	END OF LIFE (END MARKET)	BACK IN USE	Back in use	Sale of fertiliser	Aggregate (ash) for construction industry	Energy			
			DISPOSAL	No end market		N/A	N/A	N/A	N/A	N/A

Table 12 Shortlist for recyclable materials

SHORTLIST: RECYCLABLES					Horizon - legend		2026	2036	2056			
Paper / Secure paper, Cardboard, Glass, Timber pallets, Metals, Hard plastics, Soft plastics, Textiles, Polystyrene, E-waste, Workshop streams; Manufacturing streams					Note		Timing is for the option to be operational by the specified year. Preparatory work will need to be done ahead of time.					
THRESHOLD	PREREQUISITES	POINTS OF INTERVENTION	INTERVENTION TYPE	DESCRIPTION	POSSIBLE INTERVENTIONS							
	EDUCATION	PRODUCTION	AVOID WASTE	Reducing waste production in the first place and making the best use of any waste produced	Stakeholder education for waste avoidance	Stakeholder education to improve source separation	Source separation to minimise contamination	Research & development for packaging improvements	Reverse logistics	Tenant agreements (Reuse policies)	Reuse and sharing hubs	
	N/A	MOVEMENT	MANUAL INTERNAL TRANSFER TO AT SOURCE STORAGE	Waste is manually transported	Manual transfer							
	PIPED SYSTEM TO BE INTEGRATED IN THE BUILDING DESIGN		AUTOMATED SYSTEM TO AT SOURCE STORAGE	Waste is transported using a piped system	Chutes (not applicable to bulky waste)	Modular vacuum system (N/A to bulky waste)						
	UNDER GROUND OR ABOVE GROUND	AT SOURCE STORAGE	SHARED STORAGE	Shared storage will reduce spatial requirements per building, increase storage capacity and reduce waste vehicle movements	Above ground	Underground	Underground communal bins (residential use only)					
	EXTRA STORAGE SPACE	COLLECTION	COLLECTION BY VEHICLES	Waste is collected and transported to the identified transfer/processing location	BAU waste collection trucks via above ground road	Pilot EV waste collection trucks via above ground road	BAU waste collection trucks via underground tunnel	EV waste collection trucks via underground tunnel	Waste collection trucked to rail combo (above or underground)			
	LESS STORAGE SPACE		MODULAR PIPED SYSTEM (no waste vehicles within the precinct)	Waste is collected and transported to the identified transfer/processing location using a piped system	Integrated vacuum system to transfer station (N/A to bulky waste)							
	N/A	PROCESSING	ON-SITE PROCESSING	On-site (precinct wide) repair / remanufacture / reprocess / recycle	Repair centres for non-problematic waste streams (e.g., furniture, textiles, small appliances)	Autoclaving (medical waste sterilisation)	Micro-factory					
Processing costs, waste type	PLANT AVAILABILITY, contract agreement, compliant feedstock		OFF-SITE PROCESSING	Off-site (outside precinct) repair / remanufacture / reprocess / recycle	Disassembly and Remanufacturing centres	Recycling centres						
	MARKET DEVELOPMENT	END OF LIFE (END MARKET)	BACK IN USE	Back in use	Take back schemes (pilot programs)	2nd hand shops						
	N/A		DISPOSAL	No end market	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Table 13 Shortlist for non-recyclable materials

SHORTLIST: NON-RECYCLABLES					Horizon - legend		2026	2036	2056
Residual waste, clinical waste, industrial waste (including table glassware, footwear, glued materials, human contaminated, nappies)					Note		Timing is for the option to be operational by the specified year. Preparatory work will need to be done ahead of time.		
THRESHOLD	PREREQUISITES	POINTS OF INTERVENTION	INTERVENTION TYPE	DESCRIPTION	POSSIBLE INTERVENTIONS				
	EDUCATION	PRODUCTION	AVOID WASTE	Reducing waste production in the first place and then make the best use of any waste produced	Stakeholder education for waste avoidance	Stakeholder education to improve source separation	Source separation to minimise contamination		
	N/A	MOVEMENT	MANUAL INTERNAL TRANSFER TO AT SOURCE STORAGE	Waste is manually transported	Manual transfer				
	PIPED SYSTEM TO BE INTEGRATED IN THE BUILDING DESIGN		AUTOMATED SYSTEM TO AT SOURCE STORAGE	Waste is transported using a piped system	Chutes (not applicable to bulky waste)	Modular vacuum system (not applicable to bulky waste)			
	UNDERGROUND OR ABOVE GROUND	AT SOURCE STORAGE	SHARED STORAGE	Shared storage will reduce spatial requirements per building, increase storage capacity and reduce waste vehicle movements	Above ground (applicable only to industrial sites)	Underground	Underground communal bins (residential use only)		
Small volumes of recyclables	EXTRA STORAGE SPACE	COLLECTION	COLLECTION BY VEHICLES	Waste is collected and transported to the identified transfer/processing location	BAU waste collection trucks via above ground road	Pilot EV waste collection trucks via above ground road	BAU waste collection trucks via underground tunnel	EV waste collection trucks via underground tunnel	Waste collection trucked to rail combo (above or underground)
High volumes of recyclables	LESS STORAGE SPACE		MODULAR PIPED SYSTEM (no waste vehicles within the precinct)	Waste is collected and transported to the identified transfer/processing location using a piped system	Integrated vacuum system to transfer station (N/A to bulky waste)				
	N/A	PROCESSING	ON-SITE PROCESSING	N/A	N/A	N/A	N/A	N/A	N/A
Processing costs, waste stream type	PLANT AVAILABILITY, contract agreement, compliant feedstock		OFF-SITE PROCESSING	Off-site (outside precinct)	Landfill	Incinerator (medical waste only)	Waste to Energy	Sterilisation (Advanced Recycling Technology)	
	MARKET DEVELOPMENT	END OF LIFE (END MARKET)	BACK IN USE	Back in use	Landfill gas capture	Aggregate (ash) for construction industry	Biofuel	Energy	
	N/A		DISPOSAL	No end market	Landfill material				

The proposed design was further refined to identify best practice solutions for early concept design, as illustrated in **Figure 8**.

Key benefits of this recommended design are summarised in **Table 14**.

It is to be noted that further assessment will need to be undertaken during the conceptual and detailed design phases.

Table 14 Key benefits of best practice solutions for early concept design

Material Stream	Key Benefits of the Recommended Option*
Food Organics	• Simple system from a users' perspective • Collection via pipe (eliminates trucks) • No odours during storage • Opportunity for composting and/or energy recovery
Recyclables & Non-Recyclables	• Flexible system that can be adapted to changes in material stream types and volumes • Storage space can be repurposed for other uses • Waste vehicle collection frequency can be easily modified as required • Alternative collection options (e.g., micro-mobility and electric vehicles could be trialled)

* Note: the proposed options are subject to a feasibility assessment and are not confirmed to occur

WITHIN PRECINCT BOUNDARIES						
WITHIN THE BUILDING/CLUSTER OF BUILDINGS				OUTSIDE PRECINCT BOUNDARIES		
Generation	Movement	Storage	Collection	On-site storage/processing	Off-site processing	End market/product
Food Organics	Macerators (sludge to be piped to the basement of each cluster of buildings)	4 th pipe to a shared collection tank located on-site		On-site processing (depending on volumes. Opportunity for trials)	Sydney Advanced Water treatment plant (subject to further assessment)	Horticultural/animal feed/fertilizer/energy (depending on technology)
Recyclables	A combination of manual transfer (e.g. for office and retail) and dual chute system (e.g. for residential) depending on each building tenants needs	Shared <u>underground</u> storage within each cluster of buildings.	Waste collection vehicles to a shared loading dock	Circular Economy Hub inclusive of sharing/repair centres and micro factories	Reprocessing/recycling plants	Materials
Bulky waste		Option for shared <u>aboveground</u> storage within each cluster of buildings, where required.				
Residual				Option is currently not available	Landfill or better alternatives to be further discussed	Option currently not available. Alternatives to be further discussed

Note: processing and end market/product options described above represent the preferred option in line with circular economy principles but not necessarily the only possible option

Figure 8 Overview of best practice solutions for early concept design

7 Recommendations

This section is not directly applicable to waste management and circular economy discipline.

8 Conclusion

This Strategy is the first of its kind where circular economy principles have been embedded in the design from the masterplan phase. The Strategy takes a proactive approach in tackling difficult waste streams and missed opportunities in the current way of managing waste and materials, including a shift in thinking about waste as a resource rather than an issue to be managed.

The Strategy investigates the following opportunities, subject to further feasibility assessment:

- setting ambitious targets for waste generation reduction (operational and construction)
- solutions to avoid waste generation for the outset
- dedicated food organics management solution
- minimising waste vehicles movements
- integrates community education through a circular economy hub
- includes circular sharing initiatives
- considers opportunities for last mile logistics and industrial symbiosis

The Strategy is intentionally designed to be adaptable so it can learn and evolve as Bradfield City Centre takes shape.

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