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Fishermans Bend Campus Waste Strategy

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Client: University of Melbourne

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1.0 Fishermans Bend Campus Waste Strategy

1.1 Introduction

Waste has become an issue of significant public concern in recent years. The need to approach waste in a new way is essential to the University and wider community to create a transition towards a zero-waste future.

The development of a new campus provides an opportunity to re-think how the University manages unwanted materials.

A circular economy provides a framework for an economy that is restorative and regenerative by design[1]. A circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles; design out waste and pollution; keep products and materials in use; and, regenerate natural systems.

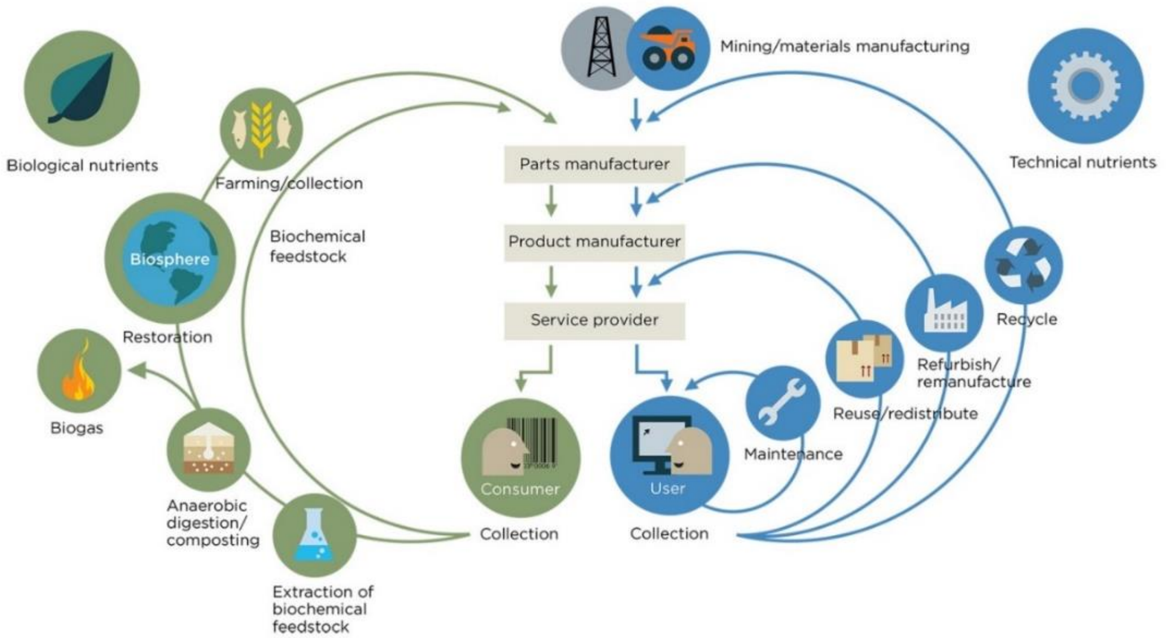

Figure 1: Circular economy framework, Ellen MacArthur Foundation

The Campus has an opportunity to integrate circular principles into material and waste reuse from day 1 of the campus opening. Making waste visible and educating the community on circular principles in waste recovery and the supply of goods and services should be seen as a priority for the University. Reframing waste and recycling in a reuse and circular context is critical to a regenerative future.

1.2 Existing conditions

The existing condition for waste is informed primarily by the AECOM 'Improved Resource Recovery within Fishermans Bend' report of 2018.

Key considerations of this report with reference to the future University campus include;

- Due in part to the history of industrial land use in the FBURA, there is varying risk of land contamination across the Fishermans Bend precinct. In addition, the precinct has significant geotechnical / groundwater constraints such as shallow groundwater levels. These factors impact the potential for use of basements and underground services at the new University campus. This will influence the type of waste storage and collection options which are appropriate for the campus.
- Advanced waste technologies (AWT) have been considered for development within the Fishermans Bend precinct. Application of AWT would create a thermal and electrical energy source for potential use by the University. Such opportunities are currently under consideration at a precinct level within the Fishermans Bend Sustainability Hub.
- Based on the waste characterisation for the new campus, opportunities may be available for on-site treatment / processing of waste to produce energy/heat and/or other solid products (e.g. compost).
- Access for waste collection vehicles (e.g. heavy rigid trucks or hook lift) to/from the campus will be important to understand given the current (and future) traffic constraints on the site including shared access with pedestrians etc.

1.3 Objectives

The Fishermans Bend Campus is a central enabler for the success of the precinct, with the opportunity to set the benchmark for innovative, reliable and flexible site waste infrastructure. Leveraging the precincts vision and the principles put forward within the Campus Masterplan; the design objectives that shall guide the provision of waste infrastructure for the Fishermans Bend Campus include;

Sustainability Objectives

The Sustainability Framework for the Fishermans Bend Campus has established flagship objectives with a series of key supporting actions that require review in the context of the waste strategy. Although all flagship objectives and key supporting actions require attention, particular focus shall be given to;

- **Flagship Objective Three – Sustainable and resilient infrastructure:** Development of infrastructure that supports the Universities sustainability aspirations showcasing world-leading technology and energy-efficient, resilient, low-impact sustainable buildings
- **Flagship Objective Four – Supporting a circular economy:** A campus that uses waste as a resource and encourages the circular flow of materials

Precinct Scale Initiatives

The concurrent development of the wider Employment Precinct presents unique opportunities to leverage whole of precinct infrastructure and waste initiatives. Such initiatives considered in conjunction with respective authorities including South East Water, CitiPower, APA and local councils provides significant opportunities in reduction in ongoing operational costs, improved site amenity and improved sustainability outcomes.

Plans for a precinct **'Sustainability Hub'**, led by the City of Port Phillip, present exciting opportunities for centralised waste to energy facilities within the Fishermans Bend precinct.

It is critical the University explores opportunities to leverage and enhance precinct infrastructure in collaboration with Development Victoria and precinct neighbours, waste opportunities and the precinct 'Sustainability Hub'.

Living Lab

The alignment between the University, industry partners and the foreseeable infrastructure requirements for the campus create a unique opportunity for imbedding research and teaching & learning outcomes into the provision of new site waste management infrastructure.

Flexibility & Adaptability

University campuses are as diverse and ever changing as the research and teaching and learning outcomes they support, and infrastructure needs to be established to be able to support these changes. Flexibility and adaptability is therefore a key driving objective for the provision of waste infrastructure with design considerations including;

- Capacity built in to support planned and foreseeable processes/facilities.

[1] Ellen MacArthur Foundation

- Where it is not practical to build in capacity, provide space to allow future expansion to foreseeable full build-out scenarios.
- Design for adaptability in waste service provisions including considerations such as accessibility and modularisation.

Reliability & Resilience

The research and teaching & learning functions of a University demand a level of reliability and resilience in the provision of site infrastructure commensurate with the criticality of operations. The reliability and resilience of waste infrastructure therefore requires consideration with design considerations including;

- Consideration of reliability in the specification of plant and equipment.
- Design for maintainability.

Integrated Design

That enables rather than constrains the wider masterplan and architectural objectives for the campus including the need to enhance visibility of building research, technology and operations, connectivity and sense of place.

The above design objectives shall be reflected upon at each stage of the design process to ensure alignment with the vision for the new campus and wider precinct.

1.4 Fishermans Bend Campus waste strategy

The following sections establish for the Fishermans Bend Campus the waste strategy, design considerations/innovations and preliminary design response; leveraging the infrastructure design objectives and wider Fishermans Bend Framework vision for waste management.

1.4.1 Waste Strategy

The operational waste management strategy shall be developed by adopting the waste hierarchy as a framework that underpins waste management, recycling and resource recovery in a circular economy.

1. **Avoid** the potential of waste generation;
2. **Reduce** generation of waste during operations;
3. **Re-use** and repair materials/products where applicable;
4. **Recycle** resources whenever possible;
5. **Recovery** of waste materials; and
6. **Disposal** of waste as the final option when there is no reuse or recycling potential.

Source Separation

Source separation of recyclables from the general waste stream will be integral to increasing resource recovery at the campus. Source separation involves identification and separation of waste into the correct material streams or categories at the point of generation. This aids material reuse and improves recycling, thereby capturing reusable or recyclable material that would otherwise end up in landfill.

Given the nature of the campus operations, it is envisaged that an emphasis will be placed on trade waste including general construction waste materials and hazardous wastes produced from research and teaching & learning operations within MSE and ABP.

The following waste streams should be source-separated at the UoM campus:

- organic waste (food organics from retail/catering premises as well as food science and research facilities);
- general waste;
- co-mingled recyclables (bottles, cans etc.);
- paper / cardboard;
- e-waste;
- timber;
- plasterboard;
- ferrous metals;
- non-ferrous metals;
- soil, sand and rubble fines;
- bricks and tiles;
- concrete, and;
- hazardous waste.

Hazardous wastes will likely change over time depending on the type of research being conducted. Some of the categories may include:

- Batteries
- Paints, fuels and oils;
- Rubbers;
- Chemicals;

1.4.2 Preliminary Design Response – Stage 1

As per the City of Melbourne Guidelines for Preparing a Waste Management Plan 2017 (CoM Guidelines), new developments must provide a dedicated room for storing waste and recycling, and in the case of mixed-use developments, multiple rooms may be required. If relevant, residential waste must be kept separately and clearly labelled.

The approximate area required for a dedicated storage room for waste and recycling within this Stage is approximately **200 m^2**. This takes into account the following:

- 40 L general waste bins
- 120 L food and organic waste bins
- 660 L co-mingled recycling bins
- 1100 L paper/cardboard bins
- Bin wash area
- Cardboard baler and sorting space
- 12 sqm cage for hard/bulky waste
- Scaling factor of 1.5 for manoeuvrability of bins and safe access

It should be noted that the inclusion of a cardboard baler accounts for a compaction ratio of 4:1. This may change depending on the equipment supplier. If the cardboard baler was to be excluded, the area required for the waste and recycling storage room would be **250 m^2**.

- The waste generation model and area estimates are based on these assumptions and inputs:
- Waste, organics and recycling is collected twice per week, assuming the University operates 6 days a week.
- No compaction has been applied to general waste, mixed recyclables or organics.
- A compaction factor of 4:1 has been used for paper and cardboard only.
- Space for a paper/cardboard baler has been allowed for.
- This area does not include interim waste storage rooms around the campus.
- We have not included space for on-site processing of organic waste.
- It is assumed that storage, plant and services areas do not generate any waste.

Waste generation rates from the City of Sydney Guidelines for Waste Management in New Developments 2018 have been applied to the current area estimates for Stage 1. These rates have been used as they provide generation rates for organics. We would expect that should actual waste generation rates from UoM be provided these numbers may change, particularly based on further discussion with research facilities that produce organic waste. These rates have been used in conjunction with Sustainability Victoria (Encycle Study Final Report 2013) composition and diversion data to provide an estimated volume of waste and recyclables.

Room

Adequate space must be provided within the bin room to allow for safe manoeuvring of bins. Each bin storage room should have a wash-down area with hot water access, mechanical ventilation, doorways that may be closed to prevent vermin, and stormwater pollution prevention.

The waste and recycling storage room should be located on the same level as the loading dock, within close proximity to the collection zone to enable convenient access for waste service collectors. The pathway from the waste and recycling storage room to the collection zone should be free of steps and slopes and must not obstruct pedestrian pathways.

Vehicle

The loading dock and waste collection zone should be designed to cater for a medium rigid vehicle (MRV). Table 1 outlines both the CoM Guidelines and Australian Standard 2890.2-2002 (AS 2890.2) dimensions for a standard MRV.

Table 1 MRV dimensions

Dimension	CoM and AS 2890.2
Minimum clearance height	4.5 metres
Minimum vehicle width	2.5 metres
Minimum vehicle length	8.80 metres

The waste collection vehicle should be able to enter and exit the collection zone in a forward-facing direction. To enable this, adequate space should be provided to enable safe manoeuvring of the waste collection vehicle. A turntable or loop road may also be considered.

Public Bins

Bins should be placed in public walkways and shared spaces to facilitate higher rates of resource recovery and reduce litter around campus. According to the Sustainability Victoria Public Place Recycling Toolkit Third Edition, 2013, these bins should be placed every 3 – 14 metres and careful consideration should be given to place these in ‘pedestrian destination’ locations. Public place bins should also be aligned with emergency response plans for practicality and safety.

1.4.3 Preliminary Design Response – Stage 2/3

Under the full build out scenario presented within the masterplan, the approximate area required for the storage of waste and recycling at the UoM campus is **588 m²**. This area may increase to **810 m²** if cardboard compaction is excluded.

This area may be accommodated through expansion of the Stage 1 facility, creation of a new central waste facility within Stage 2/3, or division of the area between two separate waste facilities. This would be subject to consideration of operational efficiencies between each option in latter design stages.

It is preferable to consider two collection points for the long-term development of the site given size of the facility and challenges in bin movements through the site to a single location. Notwithstanding consideration may be required in locating select enhanced equipment in a single location to minimise cost, for example compost facilities if provided would be in a single waste location that is in close proximity to major retail provisions.

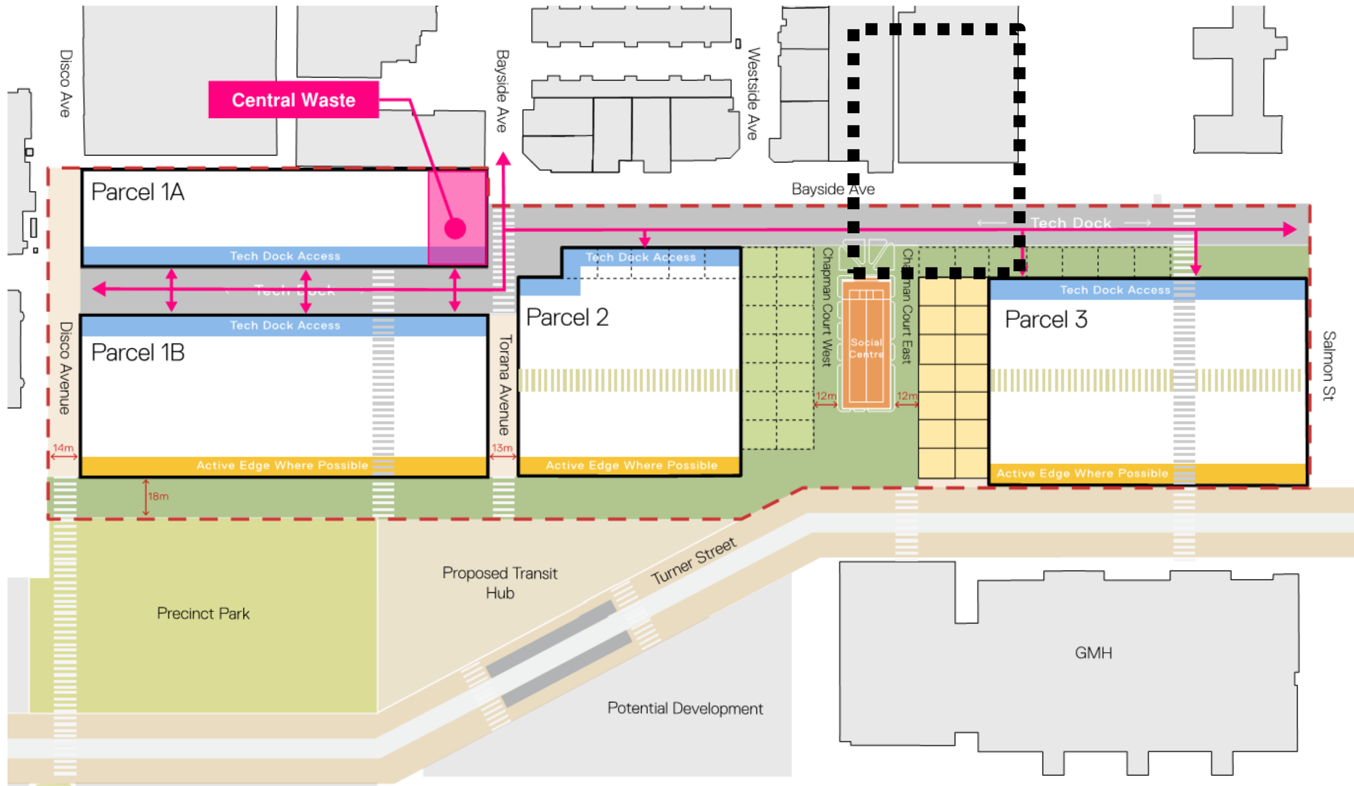

Figure 2: Proposed location of central waste facility as part of the Stage 1 development

1.4.4 Innovation

The campus provides a unique opportunity to look at ways to avoid waste generation, transform management processes, implement innovative on-site waste processing technologies to increase resource recovery, involve staff/students in data collection/research and potentially to link into the larger precinct scale plans for waste management in Fishermans Bend.

Such initiatives may be explored in the context of the Living Lab framework to enable their implementation and success on the campus.

Areas of exploration include;

Management Procedures - Sustainable Procurement Policy

In order to prioritise the higher orders of the waste hierarchy such as reduction and recycling, the University could develop a sustainable procurement policy for the UoM campus to ensure all materials purchased by the University and its retailers/tenants have a low environmental footprint, do not contain single-use plastic, and are made from recycled materials where possible. A sustainable procurement policy might also encourage better waste avoidance behaviours of students and staff by implementing discounts on reusable food and drink containers, and paying for printing.

By incorporating sustainable procurement into its leasing agreements and campus policies, the University is able to better understand the materials it is responsible for managing and hence seek out the appropriate recovery solutions for the campus.

Data Collection and Analysis

As a campus specifically focussed on engineering and information technology, there is an opportunity to showcase engineering, design and technology in how the University manages its waste and recycling. A key consideration for the campus is the collection of waste data to analyse trends and monitor how and where waste is generated to inform the ongoing waste strategy.

Possible options for implementation include:

- Load cells for food bins in communal dining areas
- Coffee cup bins
- Indoor bins with screens that educate and inform users on how to separate waste and recycling
- Solar-powered compacting public bins for general waste only

Student Involvement

There is a major opportunity for the campus to enable students to immerse themselves into their surroundings, particularly when it comes to waste and recycling. Possible opportunities include:

- Students learn about different forms of biological treatment options for organic waste streams (e.g. food waste and garden waste) including vermicomposting, in-vessel composting, and anaerobic digestion.
- Waste equipment could be the focus of research on process engineering, data management, greenhouse gas emissions, urban agriculture, etc.
- Efforts to maximise diversion from landfill could include clothing swaps, zero waste social events, donation drives, etc.

Students of UoM can experience hands-on learning in an environment that supports their interests and positively impacts the environment.

Innovative Waste Infrastructure

New innovations in waste technology are to be explored within each stage of campus development with consideration of changing management processes, living lab opportunities and the wider precinct scale plans for waste management in Fishermans Bend.

Consideration of such initiatives shall be completed within the context of the stated design objectives for infrastructure, subsequent design user groups and individual business case/cost benefit.

It is envisaged detailed consideration of organic waste management initiatives to be a focus of the latter retail heavy design stages (Stage 2 & 3) whilst Re-use & Repair and Materials Recovery Facilities shall be a focus of Stage 1 aligning to foreseeable campus use and waste streams.

1. **Food Dehydrator -** Dehydrators process food waste at high temperatures into a dry, soil-like odourless output and can reduce the volume of food waste by up to 90%. Most machines will stop processing when it detects the moisture content of the waste has reduced to 4 – 6%. Steam generated from the process is typically condensed and discharged into a trade water outlet or sewer. The machines are typically quiet, air-tight and are not hot to touch.
2. **In-vessel Composting** - In-vessel composting systems are enclosed units capable of processing a range of organic waste (food and dairy products) with some level of automation (mixing, aeration, heating), allowing the operator close monitoring of process conditions. Whilst in-vessel systems often have a high capital cost, they can provide a large capacity solution for recycling food waste efficiently onsite in urban areas, and, with correct management, they can minimise odours, vermin and other amenity impacts. These composting systems all produce a biologically stabilised "compost" product if operated and maintained correctly. Examples of building scale composting systems include:
    a. HotRot System, which is designed to process organic waste from canteens and commercial premises.
    b. Closed Loop Domestic Composter - CLO'ey
    c. Rocket Composter
    d. OSCA Bite-Size: An Australian design
    e. Biobox on-site aerobic, in-vessel composting system
3. **Small-scale Biogas Facilities -** Organic waste is fermented to produce a biogas in a three stage process. The generation of biogas begins and lasts approximately 2-6 weeks. The biogas produced is used directly on site by means of a cogeneration unit in the form of electric and thermal energy. The remaining material is subsequently processed and made into compost through secondary composting. The technology is modular and can range between demonstration to full scale units. MobiGas is a modular bio-gas facility that may be considered suitable.

Figure 3 MobiGas modular biogas producer

4. **Re-use and Repair Centre** – a university-based repair and/or reuse centre may be implemented where university equipment and furniture can be refurbished and reused on-campus. A reuse centre would result in reduction of bulky waste requiring disposal, and an increase in opportunities for the university to consider the wider use of the materials consumed and their place in the built environment. An existing facility of this nature is in operation within the Parkville Campus and may be leveraged to design a similar facility within Fishermans Bend, or be utilised to directly support re-use and repair within the new campus (https://sustainablecampus.unimelb.edu.au/key-areas/furniture-And-e-waste).
5. **On-site Materials Recovery Facility -** Small-scale recycling units have typically been used for event style applications; however, they are now growing more popular with the rise in urgency of Australia's War on Waste. Similar units have been developed at Monash University and the University of New South Wales, whereby one or two small machines use patented technology to turn waste products into new and reusable products, thus creating 'micro-factories'.

    This application would be well suited to engineering and design students interested in understanding materials and the circular economy. Students would be responsible for overseeing the process, ensuring the system is efficient, and obtaining waste items for recycling. There is also an opportunity for students to research and develop solutions for how to manage unique waste streams on multiple scales. The campus would benefit from a reduction in waste collection costs and a reduction in procurement of raw materials for classes.

    As an example the waste generated by 3D printing machines is a readily reusable by-product that is able to be melted and formed into pellets for processing into a filament spool. This spool is then able to be used again in a 3D printer, thus closing the loop on single-use plastic, reducing the cost of waste collection, and maximising the resources available to the University. Some examples of collection, processing and recycling are:
    a. Terracycle Zero Waste Box for 3D Printing Materials
    b. Filabot Extruder machines that convert plastic waste into filament for 3D printers onsite
    c. DCycle closed loop program for collection and purchase of 3D printer waste turned into spool filament.
6. **Smart Compacting Bins** - A strategy for management of public waste may include use of solar compaction bins. A compaction bin can have a capacity of 600 litres which would assist in reducing collection frequencies. When bins are near capacity (85% capacity) a communication is sent to an online waste management system to alert that collection is required. These bins are also used to reduce pest

access and prevent windblown litter. Approximately 24 × 600L smart compaction bins would be placed in public areas for collection of source-separated organic waste, residual waste and comingled recyclables.

2.0 Fishermans Bend Campus Waste Framework

Objectives	Key Supporting Actions	Timing
Sustainability	Sustainability Objective Three – Sustainable and resilient infrastructure: Development of infrastructure that supports the Universities sustainability aspirations showcasing world-leading technology and energy-efficient, resilient, low-impact sustainable buildings	Planning + Design
Circular economy	Sustainability Objective Four – Supporting a circular economy: A campus that uses waste as a resource and encourages the circular flow of materials	Design, Construct + Operation
Precinct level integration and leverage	Explore opportunities to leverage and enhance precinct infrastructure in collaboration with Development Victoria and precinct neighbours, waste opportunities and the precinct 'Sustainability Hub'.	Planning + Design
Living Lab opportunities	The alignment between MSE/University research, MSE/University industry partners and the foreseeable infrastructure requirements for the campus create a unique opportunity for imbedding research and teaching & learning outcomes into the provision of new site infrastructure.	Planning, Design, Construction + Operation
Flexible and adaptable infrastructure	Capacity built in to support planned and foreseeable waste processes and facilities.	Planning + Design
	Where it is not practical to build in capacity, provide space to allow future expansion to foreseeable full build-out scenarios.	Planning + Design
	Design for adaptability in waste service provisions including considerations such as accessibility and modularisation.	Planning + Design
Reliability & Resilience	Consideration of reliability in the specification of plant and equipment.	Design
	Design for maintainability.	Design
Integrated Design	That enables rather than constrains the wider masterplan and architectural objectives for the campus including the need to enhance visibility of building research, technology and operations, connectivity and sense of place.	Design
Operational approach	The operational waste management strategy shall be developed by adopting the waste hierarchy as a framework that underpins waste management, recycling and resource recovery in a circular economy.	Operation
Separation	The following waste streams should be source-separated at the UoM campus: • organic waste (food organics from retail/catering premises as well as food science and research facilities); • general waste; • co-mingled recyclables (bottles, cans etc.); • paper / cardboard; • e-waste; • timber; • plasterboard; • ferrous metals; • non-ferrous metals; • soil, sand and rubble fines; • bricks and tiles; • concrete, and; • hazardous waste.	Planning + Design
Space allocation	Approximate area required for a dedicated storage room for waste and recycling within Stage 1 is approximately **200 m²**.	Planning + Design
	Approximate area required for the storage of waste and recycling for Stages1,2 and 3 is **588 m²**. This area may increase to **810 m²** if cardboard compaction is excluded.	Planning + Design
	Consider two collection points for the long-term development of the site given size of the facility and challenges in bin movements through the site to a single location	Planning + Design
Sustainable procurement policy	Develop a sustainable procurement policy for the campus to ensure all materials purchased by the University and its retailers/tenants have a low environmental footprint, do not contain single-use plastic, and are made from recycled materials where possible.	Operation
Data Collection and Analysis	collection of waste data to analyse trends and monitor how and where waste is generated to inform the ongoing waste strategy. Possible options for implementation include: • Load cells for food bins in communal dining areas • Coffee cup bins • Indoor bins with screens that educate and inform users on how to separate waste and recycling • Solar-powered compacting public bins for general waste only	Operation
Student Involvement	• Students learn about different forms of biological treatment options for organic waste streams (e.g. food waste and garden waste) including vermicomposting, in-vessel composting, and anaerobic digestion. • Waste equipment could be the focus of research on process engineering, data management, greenhouse gas emissions, urban agriculture, etc. • Efforts to maximise diversion from landfill could include clothing swaps, zero waste social events, donation drives, etc.	Operation

Objectives	Key Supporting Actions	Timing
Innovative Waste Infrastructure	Consideration of innovative initiatives shall be completed within the context of the stated design objectives for infrastructure, subsequent design user groups and individual business case/cost benefit. It is envisaged detailed consideration of organic waste management initiatives to be a focus of the latter retail heavy design stages (Stage 2 & 3) whilst Re-use & Repair and Materials Recovery Facilities shall be a focus of Stage 1 aligning to foreseeable campus use and waste streams.	Planning + Design