Victorian Recycling Infrastructure Plan

2024

RECYCLING VICTORIA

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Contents

Executive summary

Purpose

The Victorian Recycling Infrastructure Plan's (VRIP) purpose is to guide planning and investment in waste, recycling, and resource recovery infrastructure over a 30-year period to support Victoria's transition to a circular economy. The VRIP builds on and supersedes the Statewide Resource Recovery Infrastructure Plan (SWRRIP) and is informed by Infrastructure Victoria's advice to the Victorian Government. Importantly, Importantly, the VRIP is an iterative process in infrastructure planning, as it is legislatively required to be reviewed every three years.

The VRIP takes a strategic approach to waste, resource recovery and recycling infrastructure planning. It provides the market with information about infrastructure needs and opportunities to promote investment in the sector. The aim is to address the current infrastructure capacity and capability issues within the sector, address future infrastructure challenges before they become issues, and support a more reliable waste and recycling system.

The VRIP sets out the current and future infrastructure needs, place-based and regional opportunities. It provides information about land use planning and approvals to help investors design their proposals appropriately and highlights the positive investment environment provided by Victoria to support innovation and investment.

The VRIP also provides information to guide and inform decision making by the government. While not a policy document, it includes information that can guide policy development. It also supersedes the references to the SWRRIP in the Victorian *Planning Provisions and Environment Protection Act 2017*, being a statutory reference document for planning and permissioning decisions. The VRIP provides strategic context and guidance for decision makers, working within regulatory frameworks without presupposing individual decisions by being overly prescriptive.

Scope and context

The VRIP's focus is on infrastructure relating to the recovery and transfer, reprocessing and disposal of waste (including hazardous waste). It considers the state's needs across these infrastructure types and for 10 material streams. While waste collection infrastructure is outside the VRIP scope, the modelling and analysis are informed by recent and planned improvements, including the successful Victorian Container Deposit Scheme (CDS) which provides new opportunities for glass, plastic, paper, and metal recycling – and the signalled improvements to kerbside collections.

The VRIP is strongly informed by the current policy and regulatory framework. This demonstrates the Victorian government's commitment to the circular economy and provides a strong foundation for investing in waste, recycling, and resource recovery infrastructure. *Recycling Victoria: A new economy* guides Victoria's transition to a circular economy and provides the policy context for the VRIP. In this document, the Victorian Government outlined a 10-year policy and action plan for waste and recycling to transition Victoria to a circular economy. Victoria has a target to divert 80% of waste from landfill by 2030, with an interim target of 72% by 2025.

Australian Government legislation, export regulations and product stewardship are also key parts of the policy and legislative framework. The impact of these policies is factored into the quantitative analysis where possible, and the qualitative assessment where there is greater uncertainty. The need for climate change action and mitigation, as outlined in Victoria's Climate Change Strategy is another key factor shaping the state's needs.

The VRIP is an infrastructure plan, not a policy document. The analysis in the VRIP provides valuable insights to guide policy development, highlighting where infrastructure alone will not deliver circularity. At a national level, Victoria will continue to advocate for product stewardship, policies and regulation that drive circularity.

Infrastructure needs analysis

Reprocessing infrastructure

The VRIP assesses the state's infrastructure needs across 10 material streams, recovery and transfer, and residual waste infrastructure. The analysis considers capacity and capability requirements, a place-based assessment, and sets out directions for investment across the 30-year VRIP timeframe. The starting point for this analysis is current infrastructure, the essential foundations for meeting our future needs.

The capacity analysis shows the timing of when material streams are likely to require additional capacity to meet demand, based on current trends. The capability analysis identifies where investment is needed to better align the capability of infrastructure with market requirements, increase recovery rates and move outcomes higher up the waste hierarchy. There is a place-based needs assessment for each material stream based on the current infrastructure location and market structure. This analysis shows there are investment opportunities across all the material streams.

Recovery and transfer infrastructure

Resource recovery centres and transfer stations are important entry points to the waste, recycling, and resource recovery system. They provide the public and industry with opportunities to drop off recyclable materials outside of kerbside collections. These facilities also play an important role in consolidating collected material before it is transported to reprocessing or disposal facilities.

MRFs sort materials for further reprocessing, primarily plastics, glass, metals, and paper. Export regulations are expected to increase the capability requirements at MRFs, and there is a predicted capability challenge in the near to medium term. Additionally, there is a relative lack of MRFs in the west of the state, providing opportunities for investment and to strengthen the place-based capability.

Residual waste

The analysis of residual waste capacity shows that based on current trends, landfill capacity could be exhausted within the 30-year cycle. This underlines the importance of increasing diversion from landfill and making progress towards Victoria's circular economy objectives.

Waste to energy presents an opportunity to divert waste from landfill to higher order energy recovery. This includes through thermal waste to energy through Victoria's Waste to Energy Scheme, administered by Recycling Victoria. The government is considering the thermal waste to energy regulatory settings, which will allow significant volumes of material to be diverted from landfills while still encouraging the highest and best use of material that can be recycled. There are also significant non-thermal waste to energy opportunities that are outside of the regulatory cap. These include technologies such as bioenergy, biogas and landfill gas collection, which can support transition away from fossil fuels.

Alongside waste to energy, achieving Victoria's existing policy objectives around waste reduction and diversion, and infrastructure opportunities such as advanced recycling processes, would keep cumulative residual waste volumes below the State's landfill capacity over the 30-year VRIP period. As such, the VRIP does not include a location for a new landfill in the landfill schedule (Appendix B), but strategic planning for residual waste-needs will be an area of focus for further work.

From a system capability perspective, there are some single points of failure, such as for Category B landfill waste, and surge capacity to deal with extreme weather events, is an area that requires more work. There are also some specific place-based challenges, including the limited capacity in the south east of Melbourne and the Geelong area. These capability issues will also be areas of focus for future work.

Regional opportunities

Some material streams provide more opportunities for regional infrastructure due to the nature of the material and market structure. These include organics, aggregates, masonry, soils, and glass crushing. There may be smaller scale opportunities for plastic recycling, and renewable energy waste is an emerging waste stream that may present regional opportunities. There are some place-specific waste streams, such as agricultural wastes, that present challenges, and opportunities, specific to rural areas. These opportunities are considered for each region.

In addition to the analysis that underpins the VRIP, this section (Section 6) draws on the Regional Circular Economy Plans, which are regionally owned documents, the Infrastructure Victoria advice to the Victorian Government and the work by Regional Development Victoria in identifying regional economic strengths and opportunities.

Land use planning and environmental approvals

Victoria's population is projected to grow significantly over the next 30 years, with most of this growth expected in Melbourne and existing urban areas. Integrating waste and resource recovery infrastructure planning with land-use planning is to support development and manage the interface between competing land uses. The VRIP does this by identifying suitable areas for new development, supporting the protection of existing infrastructure and influencing strategic land use planning.

Development areas for new infrastructure

The VRIP sets out 6 attributes of areas most suitable for new development. The first attribute is strategic alignment with existing planning frameworks and strategies. In Melbourne this includes state and regionally significant industrial land, National Employment and Innovation Clusters and areas identified in local planning schemes. In the peri-urban areas, there are growing towns that have potential for increased economic activity, as well as established regional cities that could service regional and Melbourne markets. Regional cities and regional centres also present opportunities for delivering appropriate economies of scale at regional levels. Another important opportunity is the potential for co-locating new development with existing landfills, waste, recycling and resource recovery infrastructure or other compatible facilities. This offers logistic efficiencies, and the potential to share existing buffers. Other attributes include zoning, buffer requirements, transport considerations and site size.

Protections for existing infrastructure

The analysis in the VRIP makes clear how the ongoing operation of existing facilities is critical to meeting future needs. Encroachment from incompatible land uses is a significant challenge to ongoing operation. The VRIP supports the agent of change principle which requires new development near to existing waste and resource recovery facilities to mitigate potential impacts, and the judicious use of buffer overlays to prevent encroachment.

Strategic land use planning

The planning frameworks that guide decisions relating to new and existing facilities are dynamic. The analysis and information in the VRIP can inform state, regional and local land use planning to support the future supply of suitable areas for development and protect existing infrastructure.

This section (Section 7) also notes the importance of engaging with Traditional Owners, and for building social licence. Victorians are overwhelmingly in favour of recycling, but there can be challenges over the specific locations. The VRIP can support social licence by guiding investment to appropriately site facilities that align with the state's needs. There will still be challenges, as there are with competing land uses, which is why the land use planning framework has the appropriate systems in place.

While the land use planning framework can support and protect facilities, it is equally important that they operate in accordance with their permissions, particularly when encroachment has already occurred.

New facilities will also require appropriate Environment Protection Authority Victoria (EPA) permissions. Aligning with the VRIP can support the process, and the EPA may seek advice from Recycling Victoria about whether a proposal alignment with the VRIP.

Investment attraction

Victoria provides strong investment conditions. As the projections in the VRIP demonstrate, there will be a secure supply of recyclable materials with Victoria's growing population. There is ongoing market demand, and government activity to further develop markets for recycled products. Victoria also has a stable regulatory framework, including waste levies and a clear commitment to increasing resource recovery. Other important conditions include the innovation potential and workforce readiness in Victoria.

There is a strong ecosystem for supporting business and investment. This includes specific support for the waste and recycling sector through Sustainability Victoria, and more general business support through agencies such as Invest Victoria and Global Victoria.

Further information for investors to support the VRIP is available at https://www.vic.gov.au/recycling-infrastructure-planning, and prospective investors can contact Recycling Victoria at recycling.victoria@deeca.vic.gov.au.

Directions and priorities

The directions set out the priorities for development across all material streams and infrastructure types. Having the infrastructure in place that meets the state's needs across all these categories is important, and each category provides investment opportunities. However, the sector is better placed to respond in some areas than others. The criteria used in the VRIP for identifying the priority areas for government are:

- current capacity and capability shortfalls represent the areas facing the most immediate pressures and the sector may not be positioned to respond
- current capability shortfalls where the market may not be well positioned to respond to future capacity challenges or support increased recovery rates
- potential impact on the environment and human health if waste cannot be safely treated and, if necessary, disposed of.

Based on these criteria, the priority areas for investment by the sector and for government actions are:

- **Plastics:** (capacity and capability challenges) Priorities include building capacity for the more easily recycled rigid plastics, building capability for soft and problematic plastics, capitalising on opportunities from the CDS and export restrictions and supporting increased recovery, noting this is likely to require effective product stewardship measures alongside infrastructure investment.
- **Textiles:** (capacity and capability challenges) Priorities are building capability and reducing the reliance on exports, which is likely to require effective product stewardship alongside infrastructure investment.
- **E-waste:** (capacity and capability challenges) Priorities are to address problematic waste, particularly lithium-ion batteries, build capability to extract valuable material from increasingly complex e-waste, and prepare capability for increasing volumes of renewable energy wastes. Again, this is likely to require effective product stewardship measures alongside infrastructure investment.
- **Organics:** (capability challenges) Priorities are to address capability challenges, such as contamination and ability to process problematic wastes, which may restrict the ability to fully utilise potential capacity, to take advantages of opportunities in bioenergy and supporting increased recovery rates.
- **Tyres & Rubber:** (capability challenges) Priorities are to build capability and increase material circularity. Illegal dumping is a challenge for the sector but is not an issue that can be resolved solely through infrastructure investment.
- **Material recovery facilities (MRF):** (capability challenges) Priorities are to build capacity to respond to export restrictions and system changes from the CDS, and potential place-based opportunities for more regional facilities, particularly in the western regions.
- **Hazardous waste:** (capability challenges) Priorities are to address single points of failure and capability issues, such as limited asbestos drop-off points, and address emerging hazardous waste issues.
- **Residual waste:** (capacity and capability challenges) A priority area due to the extended timelines involved in developing new infrastructure. Priorities include strategic planning to ensure there is long-term capacity in the system, addressing specific capability and place-based challenges, and supporting increased diversion from landfill, including through thermal and non-thermal waste to energy technologies.

Actions

The directions set out in the VRIP relate to outcomes across the whole sector. The actions are for State Government to support these outcomes and focus on infrastructure planning. They respond to the priority areas identified above, and to support land use planning, attract investment and support regional development.

- Take a systemic approach to waste, recycling and resource recovery infrastructure planning.
- Address problematic and emerging waste streams.
- Plan for a resilient and safe disposal of residual and hazardous waste.
- Improve data collection and the presentation of analysis to support investment decision making.
- Integrate recycling, resource recovery and waste infrastructure planning into land use planning.
- Work collaboratively with the sector to inform planning and attract investment.

The full list of actions is set out below. The actions will involve collaborative work across government and with key external stakeholders. Engagement with the sector is a priority for Recycling Victoria. Improving data is a priority, to build on the existing analysis and insight to develop an increasingly detailed understanding of the sector and future needs. This will enable Recycling Victoria to provide the sector with the information it needs to support investment.

Recycling Victoria will establish an infrastructure working group, including local government, industry, and regional stakeholders. This will be an important conduit for information and collaboration, supporting the next phase of the VRIP cycle.

Focus area	Action
Taking a systemic approach to waste, recycling, and resource recovery infrastructure planning	Continue to provide information on infrastructure sites across Victoria.
	Evaluate the VRIP approach to statewide infrastructure planning to inform the next VRIP.
Addressing problematic and emerging waste streams	Work collaboratively to support innovation to manage problematic and emerging waste streams.
	Provide regularly updated information and horizon scanning on problematic and emerging waste streams.
Planning for a resilient and safe disposal of residual and hazardous waste	Work with the sector and across government on coordinated strategic planning for the efficient use of the residual waste system and supporting diversion from landfills.
	Establish a cross-agency working group to address specific residual and hazardous waste challenges, including: • legacy contaminated soils and other mining wastes in Loddon Mallee region • category B landfill locations • asbestos disposal locations across Victoria • monitoring the clinical and pharmaceutical waste sector.
Improving data collection and the presentation of analysis to support investment decision making	Work with industry to improve data collection and the analysis provided to the market to inform infrastructure planning and decision making.
Integrating recycling, resource recovery and waste infrastructure planning into land use planning	Integrate waste, recycling and resource recovery infrastructure into State Government planning strategies and frameworks e.g., Plan Melbourne, VPA Precinct Structure Plans & the Victorian Planning Provisions.
	Develop guidance for planners and industry relating to waste, recycling, and resource recovery infrastructure.
Working collaboratively with the sector to inform planning and attract investment	Continue to work collaboratively with other jurisdictions on systemic changes that will drive stronger market certainty and demand for recycled materials and recycling infrastructure (e.g., product stewardship, government procurement).
	Establish an infrastructure working group, including local government areas (LGAs) and industry stakeholders and regional representation, to inform infrastructure planning.
	Provide and maintain guidance materials to support sector investment e.g., investment prospectuses.
	Working collaboratively to support the Victorian community and businesses transition to a circular economy.

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis										Directions
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053	
Organics	48%	3.3	5.2											**Near term:** Increased capability to address contamination across all organic material types; emerging technology further developed to address problem waste types and capitalise on sector opportunities such as bioenergy. **Medium term:** Bioenergy an established sector supporting transition from fossil fuels, increased sector capacity to meet projected FOGO reprocessing demand; increased sector capability supporting higher recovery rates and driving increased market demand for reprocessing capacity. **Long term:** Increased capability and capacity to support significantly increased recovery rates and diversion of organic material from landfill. **Ongoing:** Increased use of 2-stage processing in urban areas, co-location of infrastructure with compatible industries and buffer requirements, (e.g. with water corporation facilities) and increased regional facilities to support regional circularity.
Paper & Cardboard	57%	1.8	2.7											**Near term:** Increased capacity to respond to the 2024 Federal export restrictions (noting the impact of recent investment is still to fully play out). **Medium and long term:** Increased capacity to meet demand and to increase the diversion from landfill.
Plastics*	19%	0.8	1.2											**Near term:** Increased capacity and capability from existing technologies to respond to export restrictions and capitalise on CDS opportunities and new technologies to increase capability for problematic and soft plastics. **Medium term:** Continued deployment of mechanical reprocessing, chemical processing proven at scale, and emerging technologies provide increased capability for challenging plastic types; and increased system capability to support kerbside collection of soft plastics. **Long term:** Increased system capability and capacity to support significantly higher recovery rates and diversion from landfill. **Ongoing:** Opportunities to increase recovery of agricultural or regional-specific plastic wastes (e.g. silage wraps) are considered.
Glass	71%	0.4	0.5											**Ongoing:** Maximised bottle-to-bottle recycling from opportunities presented by the CDS and of glass-only kerbside collection, balanced consideration of regional capacity for glass crushing where economical to do so.
Tyres & Rubber*	84%	0.1	0.1											**Near term:** Increased capability to respond to export restrictions and provide for higher order domestic uses such as crumb rubber; effective regional collection networks. **Medium to long term:** Emerging technologies such as thermal processing for fuel oil, open end markets and improve material circularity, regional tyre recovery needs are considered.

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis										Directions
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053	
Metals	89%	1.7	2.6					✖ ✔						**Ongoing:** Increased capacity as needed to meet future demand and, where economically viable, to replace exports with local reprocessing; increased capability relating to shredder floc and metals from e-waste.
Aggregate, Masonry & Soils	85%	8.4	16.3					✖ ✔						**Ongoing:** Increased capacity to meet future demand as required, best practice management techniques support the re-use of soils and increased diversion from landfill; increased infrastructure located near waste generation to support regional circularity.
Textiles	31%	0.3	0.5					✖ ✖						**Near to medium term:** Improved resource recovery options from new reprocessing technologies. **Medium to long term:** Increased capability and capacity to support increased recovery rates.
E-waste & Emerging Materials	60%	0.2	TBD (0.2 in 2035)					✖ ✖						**Near term:** Increased capability to recycle e-waste and batteries, new technology solutions for recycling zero-carbon waste. **Medium term:** Increased capacity for e-waste, increased capability for net zero carbon waste, any new emerging waste streams mapped. **Long term:** Increased capacity for net zero carbon waste, any new emerging waste streams mapped.
Material Recovery Facilities	n/a	0.5	1	✖ ✔						✖ ✖				**Near term:** Increased capability to respond to export restrictions. **Medium to long term:** Increased capacity to meet projected demand. **Ongoing:** Increased opportunities for regional facilities.
Hazardous waste	n/a	1.4	2.7				✔ ✖							**Ongoing:** Increased capability (and any subsequent capacity) needed to increase system resilience, respond to surge events, and to address specific / emerging waste stream needs (e.g. soils, asbestos, clinical waste, PFAS and Biosolids).
Residual waste**	n/a	5.7	8.9	✔ ✔			✔ ✖				✖ ✖			**Near term:** Maximised use of existing landfill capacity; key system constraints (e.g. Category B waste) and place-based challenges (e.g. Loddon Mallee mining spoils) addressed. **Medium term:** Increased system resilience (e.g. surge capacity) and increased use of waste to energy facilities to divert waste from landfill. **Ongoing:** Increased resource recovery to reduce reliance on landfills, particularly for organics, plastics, soils, paper, and cardboard.

- ✖ ✖ Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]
- ✔ ✖ Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]
- ✖ ✔ Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]
- ✔ ✔ Capacity is sufficient to meet the demand projections [investment focus is optimising infrastructure]

* Proposed additional infrastructure in pipeline that would extend capacity timelines

** Capacity analysis based on Development License Approved Landfill Capacity

1 Introduction

Victoria's waste, recycling and resource recovery system must be equipped to manage future disruptions, such as those arising from climate change, a growing population, increasing material scarcity and evolving technologies. The Victorian Recycling Infrastructure Plan (VRIP) provides a strategic, state-wide plan for waste, recycling, and resource recovery infrastructure over the next 30 years to ensure the resilience and adaptability of Victoria's waste management landscape amidst the changes anticipated in the coming years. The VRIP presents an opportunity to join up Victoria's circular economy with investment into key infrastructure and enablers that can drive a strong and robust circular economy. The VRIP will be updated every 3 years to create transparency and alignment for investment in the system.

1.1.1 Recycling Victoria

Recycling Victoria provides leadership and oversight of waste and resource recovery services to support the development of Victoria's circular economy. The VRIP progresses Recycling Victoria's long-term vision for a world class circular economy system that helps build a sustainable future for all Victorians. It does so by ensuring Victoria is prepared for the future, for both expected and unexpected impacts to our waste, recycling, and resource recovery system.

Recycling Victoria's vision is underpinned by its strategic objectives, which are to:

- Contribute to a strong and robust circular economy.
- Increase the resilience of the Victorian waste and resource recovery system.
- Enable sector investment and growth.
- Build system capacity and capability.

Recycling Victoria's vision and strategic objectives aim to support *Recycling Victoria: A new economy*, the Victorian Government's 10-year policy and action plan for waste and recycling. This policy and action plan outlines a sweeping plan of reform to ensure a recycling system that Victorians can rely on. This includes planning for recycling infrastructure over the long term.

Recycling Victoria provides leadership across the Victorian Government in driving the reform agenda for Victoria's waste and recycling sector. In addition to providing regulatory functions, Recycling Victoria works closely with other parts of the Victorian Government to achieve the government's objectives. This includes Sustainability Victoria which is responsible for providing direct market support, and the Department of Energy, Environment and Climate Action (DEECA) which is responsible for circular economy policy.

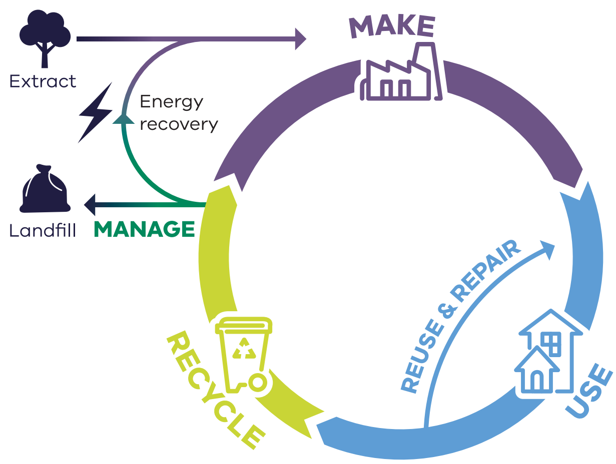
1.2 VRIP purpose

The VRIP's purpose is to guide planning and investment in waste, recycling, and resource recovery infrastructure over a 30-year period and support Victoria's transition to a circular economy.

The VRIP takes a strategic approach to waste, resource recovery and recycling infrastructure planning. The VRIP provides the market with information about infrastructure needs and opportunities, highlighting the positive investment environment provided by Victoria, to drive innovation and investment where it is needed. It also provides information to guide and inform decision making by the government, working within the existing regulatory frameworks, and without presupposing individual decisions by being overly prescriptive.

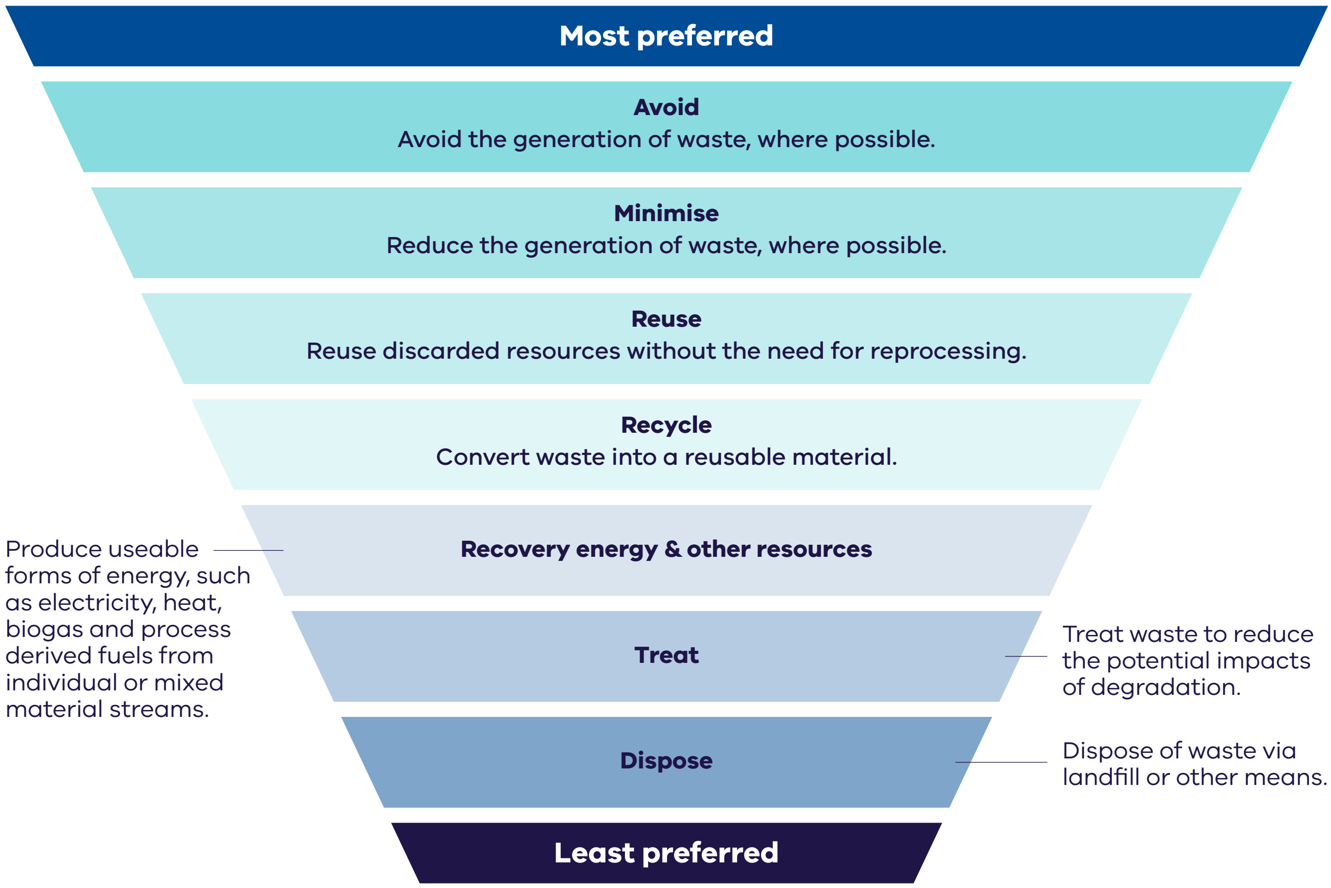
The stages in the circular economy product lifecycle life cycle are shown in Figure 1. The VRIP's primary focuses are the 'recycle,' 'manage,' and 'energy recovery' phases. While not within the core scope of the VRIP, the 'make' and 'use' stages remain important principles and provide important context as these stages of the product lifecycle determine the nature of the materials to be recycled or managed.

Figure 1 Circular economy product lifecycle



To help optimise the value and utility of resources throughout their lifecycle, the *Circular Economy* (*Waste Reduction and Recycling*) *Act 2021* (the *CE Act*) sets out the circular economy hierarchy (Section 8 CE Act) and includes an order of preference for how waste should be managed, as shown in Figure 2. This outlines the desired lifecycle of products and materials, as well as preferred outcomes once they become waste. The primary scope of the VRIP considers the hierarchy from 'recycle' through 'recovery energy and other resources,' 'treat[1] and 'dispose'. A core overarching purpose is to move waste up those levels of the hierarchy and reduce the amount of waste that is disposed of via landfill or other means. The avoid, minimise, and reuse levels are not within the core scope, but they are core principles of a circular economy that provide important context for the VRIP.

Figure 2 Circular economy hierarchy – preference order for waste management



1 In some cases, treatment can proceed use.

1.2.1 Objectives

As set out in section 37A of the CE Act, the objectives of the VRIP are to:

a) Provide long-term strategic planning to guide and inform decision-making in relation to waste, recycling and resource recovery infrastructure at state, regional and local levels.

b) Enable waste, recycling, and resource recovery infrastructure planning to be informed appropriately by:

   i) land use and development planning and policy

   ii) environmental regulatory approvals and policy

   iii) transport planning and policy.

c) Support risk, consequence and contingency planning for the waste, recycling, and resource recovery infrastructure network.

d) Provide long-term strategic planning in relation to Victoria's waste, recycling and resource recovery infrastructure needs for a period of 30 years.

The CE Act also sets out certain matters that must be included in the VRIP. These are:

- areas suitable for developing infrastructure that meet Victoria's waste, recycling, and resource recovery infrastructure needs (Section 7 of this plan, Land use planning and environmental approvals).
- directions or actions to take in relation to waste, recycling, and resource recovery infrastructure at 3-year intervals during the 30-year period of the VRIP (Section 9 of this plan, Directions and actions).
- a list of the future waste, recycling, and resource recovery infrastructure (other than landfill) needed for the State to manage waste (Appendix A of this plan).
- a schedule of existing landfill sites and future landfill sites required across the State for the 30-year period of the VRIP (Appendix B of this plan).
- any matters prescribed by the regulations however at the time of preparing this plan (noting that at present no matters are prescribed regulations).

The VRIP represents an ongoing approach to infrastructure planning. The CE Act mandates that there are annual VRIP progress reports, and the VRIP itself is reviewed and updated every 3 years. There is also a process to update the VRIP between mandated reviews if necessary to ensure the insights remain current.

Under the CE Act, the VRIP replaces the previous SWRRIP and associated regional implementation plans. This includes where they are referenced in regulatory frameworks, such as the Victorian Planning Provisions and *the Environment Protection Act 2017* (the EP Act), as well as their role in informing government policies and strategies.

1.2.2 Methodology

The VRIP is informed by Victorian policies related to the State's future waste, recycling, and resource recovery infrastructure needs (as set out in Section 2.1). It has been developed with advice from Sustainability Victoria, the Secretary of DEECA, EPA Victoria, and informed by engagement with industry stakeholders.

The VRIP uses a combination of analytical techniques to identify Victoria's future waste, recycling and resource recovery infrastructure needs at a state-wide level.

a. Capacity analysis

The capacity analysis is based on Recycling Victoria's bespoke Waste and Resource Recovery (WRR) Projection Model. The figures shown in this document use 2021 – 2022 baseline waste data to project forward to 2023 and then through to 2053. It incorporates population growth estimates and the potential effects of announced waste recycling and recovery programs to project total waste generation by material stream, including hazardous waste.

The model also projects the proportion of that waste destined for reprocessing in Victoria. This is the projected demand for reprocessing. This projected demand is then compared to the current and projected capacity, which is the total throughput of the existing and planned infrastructure. This comparison of demand against capacity projects occurs when capacity shortfalls may occur.

The model also projects the volumes of waste destined for export (which does not require local reprocessing infrastructure capacity) and the residual waste volumes destined for disposal. The latter of which is used to determine the total residual waste capacity needed over the 30-year period. Appendix C contains a detailed overview of the modelling methodology.

b. Sensitivity analysis

Given the inherent uncertainty in projecting demand across 30 years, a sensitivity analysis section qualitatively considers factors that could impact the demand projections. For the material streams with recovery rates below 50%, the projected demand is presented against the total projected waste stream to illustrate the potential to increase recovery rates, which in turn would create increased demand for reprocessing capacity.

c. Capability analysis

A qualitative capability analysis supports the capability gap analysis to provide a more holistic understanding of Victoria's infrastructure needs. Here, capability is defined as the ability of the infrastructure to fully utilise the potential capacity, reprocess the required waste flows, develop outputs, and end products that meet market requirements. It also considers the impact of factors (e.g., regulatory settings such as Australian Government waste export regulations) that are driving the capability requirements, opportunities to open new markets or move up the waste hierarchy, or specific challenges presented by the material stream.

d. Place-based assessment

To inform planning at a regional level, there is a place-based needs assessment for each material stream based on the current infrastructure location and market structure. This also informs a regional assessment of infrastructure opportunities, based on the 7 regions that align with the waste regions defined in the EP Act: Barwon South West, Grampians Central West, Goulburn Valley, Gippsland, Loddon Mallee, Metropolitan – referred to as the Port Phillip region in this document to align with DEECA naming conventions.

e. Directions

The VRIP combines the capacity and capability analyses into an overall assessment of investment directions for each category of waste, recycling, and resource recovery infrastructure. These set out investment priorities, categorised under ongoing, near (0-6 yrs) medium (6-12 yrs) and long term (12+ yrs). The analyses are high level and provide principal strategic direction to the sector.

f. Actions

The actions are primarily for the government sector, and these align with the VRIP's core scope to set out the key activities that will support a new, ongoing, and collaborative approach to infrastructure planning.

g. Previous strategies and regional opportunities

The VRIP builds on the work of the SWRRIP and associated regional implementation plans, while taking a more strategic, less prescriptive approach to infrastructure planning.

The VRIP is also informed by Infrastructure Victoria's *Advice on recycling and resource recovery infrastructure*[2] (2019). This advice and the supporting analysis provide valuable insights into the operation and future needs of the sector.

As part of their advice to government, Infrastructure Victoria included indicative locations for new and upgraded infrastructure. The VRIP takes a different strategic approach by setting out the state's needs and identifying development areas, which allows the sector more flexibility to innovate and respond. The regional locations in the Infrastructure Victoria advice align with the VRIP's development areas, and the suggested location of facilities is broadly consistent with the VRIP's place-based assessment of the material streams. In the regional opportunities section.

1.2.3 Target audience and how to use the VRIP

The VRIP serves as a key reference point to set direction for the sector and inform decision making. The information provided in the VRIP is intended for use by:

- **Industry:** To inform and guide investment decisions, noting that proponents will still need to undertake their own thorough investment analysis[3] and due diligence.
- **Victorian Government:** To inform decision making related to waste, recycling, and resource recovery infrastructure, including landfills.
- **EPA Victoria:** To inform approvals and the regulation of waste management infrastructure establishment and operation as per Section 52A of the EP Act.
- **Local government and Alpine Resorts Victoria:** To support infrastructure planning and development.
- **The Victorian community:** To provide information and give confidence in long-term planning for waste, recycling, and resource recovery infrastructure.

2 https://www.infrastructurevictoria.com.au/resources/advice-on-recycling-and-resource-recovery-infrastructure
3 It is important to note that infrastructure information and analysis included in the VRIP is reflective of the data available at the time of writing and the principles described in the VRIP methodology.

1.2.3.1 How to use the VRIP

The analysis highlights investment opportunities through the material volumes to be managed, and the opportunities to increase resource recovery, to inform investment decisions by the market. The investment directions provide further strategic guidance for the sector while leaving room for industry to innovate and the government to take decisions on their merits.

The place-based assessment of each material stream and the assessment of regional opportunities inform infrastructure planning and potential infrastructure location at a regional level. The land use planning and environmental approvals section provides guidance for industry and planning authorities about the location of infrastructure and planning at a local level.

It also provides information to guide and inform decision making by the government, working within the existing regulatory frameworks, and without presupposing individual decisions by being overly prescriptive. In considering whether a proposal aligns with the VRIP, Recycling Victoria would consider if the proposal were consistent with the capacity and capability needs of the state, addresses place-based challenges, is in a reasonable area given the place-based assessment and location attributes.

Alignment with other Recycling Victoria functions

The role of Recycling Victoria is to support the development of a circular economy through leadership, stewardship, and oversight. The VRIP is a key component and the primary product for supporting long term infrastructure planning to build sector resilience and growth. The VRIP aligns with and informs Recycling Victoria's wider work program in:

- **Market intelligence:** The VRIP sits alongside the Market Intelligence functions by providing valuable information to the sector. The annual Circular Economy Market Report and the online Recycling Victoria Data Hub provide regular, timely, and quality market data and insights to complement the VRIP and help the sector identify key investments, gaps, issues, and opportunities.
- **Risk, consequence and contingency:** The VRIP aligns with and supports the annual Circular Economy Risk, Consequence, and Contingency Plan (CERCC Plan). The CERCC Plan describes current global, national, and Victorian sector trends impacting waste, recycling, and resource recovery, impacts of recent incidents and emergencies on sector resilience, and identifies examples of resilience-building initiatives in aligned industries for strategic risk management. The CERCC Plan documents the serious risks to widespread service continuity and in progressing and developing a more circular economy. The CERCC Plan has a whole of sector risk, consequence, and contingency focus while the VRIP has an infrastructure capacity and capability focus.
- **Strategic procurement:** Recycling Victoria supports councils, alpine resorts, and service providers in the best practice strategic procurement of waste, recycling, and resource recovery services. This function can help deliver some of the infrastructure needs set out in the VRIP.
- **Waste to energy:** The waste to energy regulatory settings have informed the VRIP, and the information in the VRIP will inform Recycling Victoria's oversight role and inviting, assessing, and determining cap licence applications from thermal waste to energy proponents.
- **Container Deposit Scheme (CDS):** While collection infrastructure is not within the core scope, the VRIP considers the impact of the introduction of the CDS on Victoria's infrastructure requirements.
- **Service standards:** The introduction of the 4-stream household waste and recycling system led by Recycling Victoria will present opportunities for greater consistency across local government service to strengthen resource recovery and reduce waste going to landfills.

2 System overview and policy context

This section gives an overview of the end-to-end life cycle of waste, the infrastructure required and the scope of the VRIP. It also provides an overview of the policy and regulatory framework that support the transition to a circular economy and provides a solid foundation for investment in waste, recycling, and resource recovery infrastructure.

2.1 Victoria's waste, recycling and resource recovery system

The primary focus of the VRIP is waste, recycling, and resource recovery infrastructure. These can be divided into 5 types, which serve distinct functions:

- **Recovery and transfer:** Segregating, sorting, and aggregating before transporting for reuse, reprocessing, conversion to energy or disposal. These include resource recovery centres and Material Recovery Facilities (MRFs) and are distinct from collection systems that are out of scope.
- **Reprocessing (including recycling):** Converting waste materials into products that can be sold for reuse. This includes thermal waste to energy that accepts exempt waste and non-thermal waste to energy processes, such as the biological treatment of material to recover energy.
- **Hazardous waste facilities:** Storing, treating, reprocessing, containing, or disposing of hazardous wastes (e.g., incineration of clinical waste).
- **Thermal waste to energy:** Processing to produce fuel from permitted waste or to recover energy from permitted waste in the form of heat, which may be converted to steam or electricity.
- **Disposal facilities:** The final repository for waste after the extraction of all materials that can be viably recovered, these are primarily landfills.

The VRIP considers the state's needs for reprocessing infrastructure in each of the material streams. Thermal waste to energy and disposal facilities are considered together under the residual waste section (Section 5).

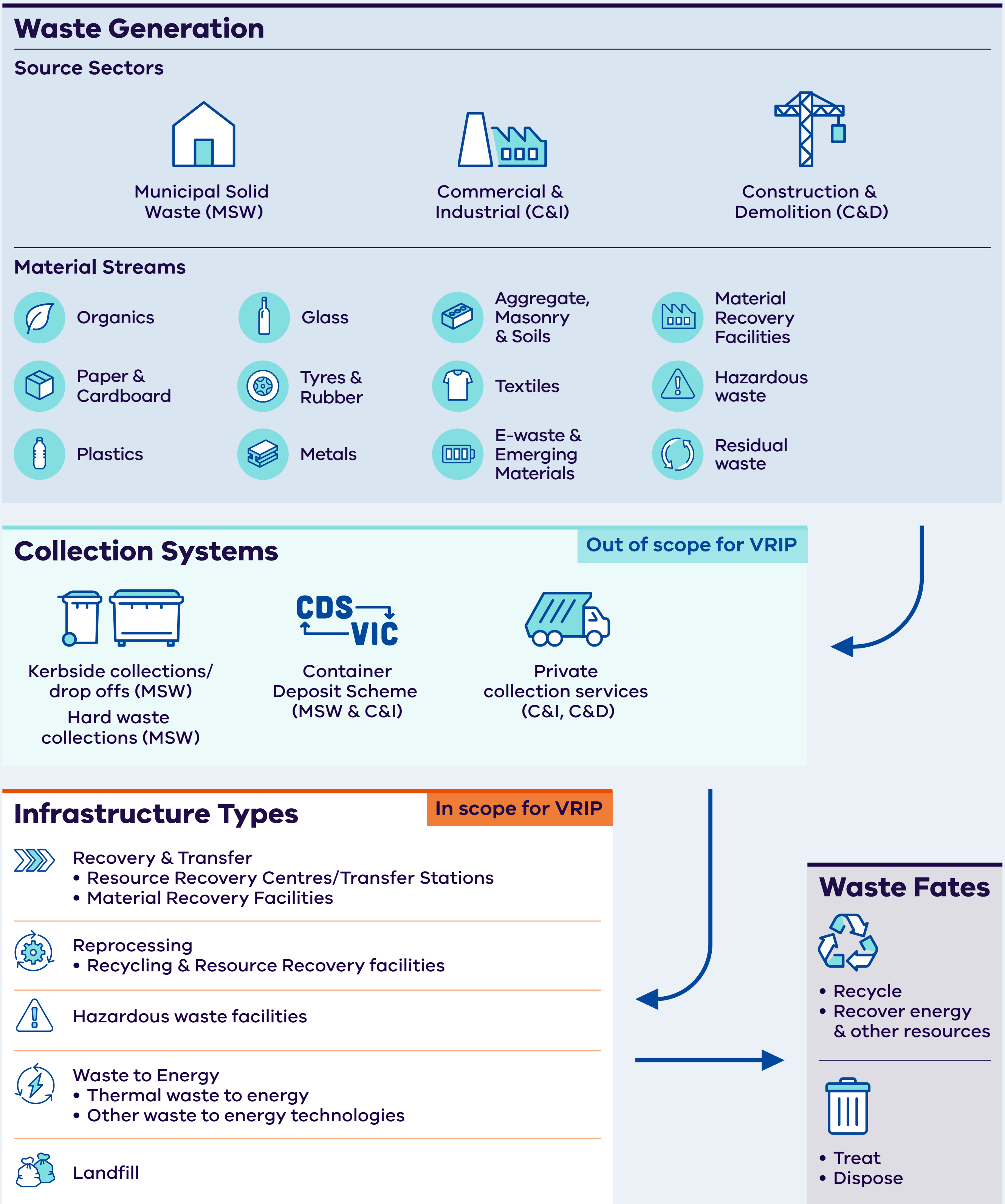
There are 4 potential fates for waste material, listed below in order of preference in the circular economy hierarchy:

- **Recycle:** Waste is converted into a reusable material. This can include locally reprocessed material, or material exported for reprocessing elsewhere.
- **Recover energy and other resources:** Individual or mixed material streams are used to produce useable forms of energy such as electricity, heat, biogas, and process derived fuels.
- **Treat:** waste is treated to reduce the potential impacts of degradation prior to disposal.
- **Dispose:** Waste is disposed of via landfill or other means.

An overarching aim of the VRIP is to provide for the infrastructure capacity and capability needed to enable waste disposal to move to higher order fates under the circular economy hierarchy where possible.

Waste collection systems are out of scope for the VRIP, but they provide important context for the waste, recycling, and resource recovery infrastructure. Figure 3 (below) provides an overview of Victoria's Waste, Recycling and Resource Recovery System.

Figure 3 Victoria's Waste, Recycling and Resource Recovery System



2.1.1 Changes to waste collection services

While collection infrastructure is out of scope for the VRIP, there are significant changes to Victoria's collection systems that are considered in the VRIP analysis and may provide opportunities to increase resource recovery and recycling.

Container Deposit Scheme

On 1 November 2023 Victoria's CDS commenced. The scheme rewards Victorians with a 10-cent refund for every eligible can, carton and bottle they return.

CDS is a product stewardship scheme funded by the beverage industry. It will increase the volume and quality of recycling, optimise reuse of used drink containers, build Victoria's circular economy, and reduce Victoria's litter by up to half by offering a financial reward for returning drink containers for recycling. It lowers clean-up costs for councils and makes producers more responsible for their products once they are used.

CDS provides shared benefits to the community, environment, and economy. This includes supporting more and better recycling. Beverage containers returned through the CDS network are separated from other recyclables and produce a stream of clean and high-quality material that can be remanufactured into new products, presenting new opportunities for recycling and investment. Material types that can be recovered include aluminium, steel, high density polyethylene (HDPE), polyethylene terephthalate (PET), and liquid paperboard.

Household waste and recycling services

Recycling Victoria: A new economy outlines the Victorian Government's commitment to transitioning to a circular economy through the introduction of a consistent, transparent, and high-quality household waste and recycling system. The new system provides households with access to 4 core waste and recycling services:

- residual waste (general rubbish)
- mixed recycling
- glass recycling
- combined food organics and garden organics (FOGO).

This requirement is set out under section 60 of the CE Act. Recycling Victoria is preparing a service standard for household waste and recycling services, which together with regulations, will bring this standardised system into force. Public consultation on the service standard and regulations will occur prior to it being approved by the Minister, and funding has been provided to support the transition to the new system through the Kerbside Reform Program.

These changes will introduce statewide, standardised collection of organic waste and the separation of glass to reduce contamination of other materials. The projected impact of these changes has been included in the quantitative modelling used by the VRIP and considered in the relevant qualitative capability assessments.

2.2 Policy context

In recent years, there have been several changes to the Victorian waste, recycling, and resource recovery system's policy environment and strategic landscape that demonstrate the government's commitment to the circular economy and provide a solid foundation for investment in waste, recycling, and resource recovery infrastructure.

2.2.1 Recycling Victoria: A new economy

Recycling Victoria: A new economy guides Victoria's transition to a circular economy and provides the policy context for the VRIP. The Victorian Government outlined a 10-year policy and action plan for waste and recycling to transition Victoria to a circular economy. The policy and action plan set out 4 goals:

1. **Make:** Design to last, repair and recycle.
2. **Use:** Use products to create more value.
3. **Recycle:** Recycle more resources.
4. **Manage:** Reduce harm from waste and pollution.

These goals align with the United Nations Sustainable Development Goals, including Goal 8 ('promote sustained, inclusive and sustainable economic growth') and Goal 12 ('ensure sustainable consumption and production patterns'). The VRIP directly contributes to the third ('recycle') and fourth ('manage') goals.

Recycling Victoria: A new economy also included the following circular economy targets through which Victoria's progress will be measured:

- **Landfill diversion target:** Divert 80% of waste from landfill by 2030, with an interim target of 72% by 2025.
- **Waste generation target:** Cut total waste generation by 15% per capita by 2030.
- **Organic material to landfill target:** Halve the volume of organic materials going to landfill between 2020 and 2030, with an interim target of a 20% reduction by 2025.
- **FOGO recycling target:** Ensure every Victorian household has access to FOGO waste recycling services or local composting by 2030.

2.2.2 Federal export regulations

In March 2020, the Australian state and territory governments, and the Australian Local Government Association, as members of the former Council of Australian Governments agreed that the export of waste glass, plastic (including processed engineered fuel), tyres and paper would be regulated by the Australian Government[4]. Regulations are already in effect for plastic, glass, and tyres, and are expected for paper and cardboard:

- **Plastic:** Waste plastic can only be exported after it has been:
  - sorted into single resin or polymer type and further processed, for example flaked or pelletised
  - processed with other materials into processed engineered fuel.
- **Glass:** Waste glass can only be exported after it has been processed into, for example, furnace-ready or non-furnace-ready glass cullet or fines.
- **Tyres:** The following waste tyres can be exported with a waste export licence:
  - tyres for retread by an appropriate retreading facility
  - tyres to an appropriate importer for re-use as a second-hand tyre on a vehicle
  - tyres that have been processed into shreds, crumbs, buffings or granules.
- **Paper and Cardboard:** The Australian Government has consulted on imposing a maximum contamination rate of 5% for mixed paper and cardboard from 1 July 2024, tightening to 3% in 2026.

Export restrictions prevent the export of non-processed waste. This is resulting in an increase in demand for domestic processing capacity and capability to process materials to meet the export standards, and to develop alternative local markets for recovered materials.

As the primary focus of the VRIP is Victoria's infrastructure needs, material that needs to be processed in Victoria before it can be exported is treated as being processed locally for the purposes of the VRIP projections – even if it is subsequently exported for further reprocessing. Material is considered exported if it does not require local processing, only sorting and aggregating.

This is an important distinction, as it may mean that some export figures in the VRIP may not align with reports that primarily consider the end fate of waste materials. However, this approach means that the VRIP captures the local processing capacity and capability needed to access these export markets.

2.2.3 Regulation and product stewardship

Waste regulation and product stewardship schemes are important tools for moving towards a circular economy. They can also have an impact on infrastructure requirements by changing the upstream characteristics of waste for reprocessing, strengthening the downstream markets for recycled products, and stimulating investment in the sector.

Policy options currently being considered at the federal level include:

- **Packaging reform:** Australia is shifting toward a safer, circular economy by putting in place a new packaging regulatory scheme that will mandate obligations for packaging design. This scheme is expected to increase the use of reusable and recyclable packaging. It may impact the nature of waste materials that are considered in the plastics, paper and cardboard sections.
- **Product stewardship:** An approach that ensures that those who design, produce, import, sell, use, and dispose of products have a shared responsibility to reduce the environmental and human health and safety impacts of those products. Product stewardship schemes support the environmentally sound management of products and materials throughout their life including at the end of their useful life. The Australian Government has signalled its intention to develop stronger product stewardship schemes including supporting the development of a textiles scheme and has committed to developing a mandatory product stewardship scheme to reduce waste from small electrical products and solar photovoltaic systems. Existing industry-led voluntary product stewardship schemes are in place for oil, televisions, computers, mobile phones, tyres, large plastic bags (over 15 kilograms/15 litres), batteries (handheld), plastics, packaging and paint.
- **The National Framework for Recycled Content Traceability:** This was endorsed by Australia's environment ministers on 10 November 2023[5]. The framework is a national guideline that aims to improve trust in recycled materials. It does this by guiding businesses to collect and share information about recycled materials.

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4 https://www.dcceew.gov.au/environment/protection/waste/exports
5 Environment Ministers Meeting Communique – November 2023 (dcceew.gov.au)

It is not within the scope of the VRIP to advocate for increased regulation or specific product stewardship measures. Where policies are still being developed, they are not factored into the quantitative capacity modelling in the VRIP. However, the VRIP does consider their potential impact on the State's infrastructure capacity through sensitivity analysis and capability assessment.

Maintaining an up-to-date understanding of how these potential changes could impact infrastructure needs will play a key role in the VRIP implementation reports and future VRIPs. Victoria is working collaboratively at a national level for systemic changes to strengthen market conditions for recycled materials and support the move towards a circular economy. The analysis in the VRIP can help inform this activity.

2.2.4 Policy and legislative framework

Australia and Victoria have a strong policy and legislative framework for the waste, recycling and resource recovery sector, with ambitious targets to grow the circular economy. Investors can take advantage of these important opportunities to help develop advanced processing technologies and infrastructure.

Key policies, strategies, and positions with implications for Victoria's waste, recycling, and resource recovery system are outlined in Table 1. Each document influences how waste and resources are managed by Victorian infrastructure or provides an opportunity for the waste, recycling, and resource recovery sector to integrate and support other Victorian policies or plans.

Table 1 Relevant policies, legislation, key settings and plans relevant to waste infrastructure planning

Policy, strategy, or position	Detail
Australian Government	
National Waste Policy 2018	Australia's National Waste Policy provides a national framework for waste, recycling, and resource recovery. It outlines the roles and responsibilities of everyone – businesses, governments, communities, and individuals. The policy is supported by the 2019 National Waste Action Plan, which drives implementation of the nation's targets (Australian Government, 2018).
Recycling and Waste Reduction Act 2020	The *Recycling and Waste Reduction Act 2020* (RAWR Act) repealed and replaced the *Product Stewardship Act 2011* in December 2020. The RAWR Act provides a new framework for managing Australia's recycling and waste reduction objectives. It encourages the development of a circular economy, including through product stewardship arrangements, and maximises the continued use of products and waste materials (Australian Government, 2020).
Victorian Government	
Circular Economy (Waste Reduction and Recycling) Act 2021	The CE Act strengthens regulation and oversight of Victoria's waste, recycling, and resource recovery sector. It provides the foundation for Victoria's transition to a sustainable and thriving circular economy, to minimise waste and landfill, and significantly increase the reuse and recycling of our precious resources (Victorian Department of Energy, Environment and Climate Action, 2022).
Environment Protection Act 2017	The EP Act and subordinate legislation establish Victoria's prevention-focused approach to environment protection. This includes a general environmental duty (GED) which requires that all Victorians take reasonably practicable steps to reduce the human health and environmental risks of their activities. The Act also provides EPA Victoria with powers to investigate businesses and penalise rogue operators (Victorian Government, 2017).
Climate Change Act 2017	The *Climate Change Act 2017* provides the legislative foundation to manage climate change risks, maximise the opportunities that arise from decisive action and drive Victoria's transition to a climate-resilient community and economy. It establishes a long-term emissions reduction target of net zero by 2045[6] (Victorian Government, 2023).
Plan Melbourne 2017–2050	Plan Melbourne 2017-2050 is a long-term planning strategy, guiding the way the city will grow and change to 2050. The strategy outlines measures to support jobs close to homes, services and transport and identifies the areas that will accommodate Melbourne's future growth (Victorian Department of Transport and Planning, 2017).
Victorian Waste to Energy Scheme	The Victorian Waste to Energy Scheme recognises the role of waste to energy to divert waste from landfill. The Scheme implements the Victorian Waste to Energy Framework that places a cap on the amount of waste that can be heat treated to make energy beyond pre-existing approvals and outlines how the cap is to work.
Waste levies	Waste levies encourage the diversion of valuable resources from landfill to recycled and repurposed uses. Victoria's Municipal and Industrial Waste Levy (MIWL) and its distribution is an important mechanism in minimising the environmental impacts of waste and in promoting investment in alternatives to landfills.
Circular Economy Risk Consequence and Contingency Plan	An annual plan that identifies risks of serious failure, disruption, or hindrance to the provision of waste, recycling or resource recovery services and risks to Victoria's transition to a circular economy.
Circular Economy Market Report	The Circular Economy Market Report provides information on the generation, collection, sorting, re-processing, or re-manufacturing of waste within the circular economy market. The report highlights the opportunities to improve circularity in the management of materials, with actions or market strategies provided to address the opportunities.
External policies	
China National Sword Policy 2018 (and consequent Southeast Asian waste import bans)	China's imposition of import restrictions in 2018 excluded 99% of the recyclables that Australia previously sold to China being sent there. In 2017, prior to this effectual ban on waste imports, 29% of all paper and 36% of all plastics collected in Australia's kerbside collections streams were exported to China (Macklin, 2018)[7].

6 There are amendments currently before Parliament that, if passed will amend this to 2045.

7 Other import restrictions also contributed to the need to develop Victorian waste, recycling, and resource recovery infrastructure, such as those implemented by Vietnam and Thailand. These neighbouring southeast Asian countries received large volumes of redirected waste exports in the wake of China's import restrictions. Thailand, for example, implemented a total ban on plastic waste imports by 2025 in response to unmanageable volumes.

2.3 Climate change

Climate change is happening, its impacts are increasing, and it will impact all business sectors. It presents both challenges and opportunities for the waste, recycling, and resource recovery sector.

Victoria's Climate Change Strategy[8] is a roadmap to net-zero emissions and a climate resilient Victoria by 2045. The initiatives in the Climate Change Strategy will support communities and businesses to make the changes we need to reduce the impacts of climate change and continue to support our economy as it grows. Four of the 5 points of the strategy have clear implications for waste, recycling, and resource recovery infrastructure:

- **A clean energy economy:** The Victorian government is investing $1.6bn in the move to a clean energy economy. This will generate new waste streams, such as photovoltaic (PV) solar panels, wind turbine blades. This represents valuable materials that can be recovered, which is considered further in the e-waste and emerging materials section (Section 3.9). The location of this new generation presents both regional opportunities, considered in the land use planning and environmental approvals section (Section 7) of the VRIP, and potential opportunities for co-location to deliver clean energy for recycling these materials.
- **Innovation for the future:** This will result in new waste streams, such as batteries from electric vehicles (EVs) as Victoria moves towards the target of 50% of sales being EVs by 2050 and battery storage for the grid. This is considered in the e-waste and emerging materials section (Section 3.9) of the VRIP. The move to decarbonise gas, presents opportunities for anaerobic digestion to produce bio-methane for hard-to-abate industries currently using fossil gas, as well as opportunities for waste to energy more generally and for biofuels. These are considered further in the residual waste section (Section 5) and in the organics material stream section (Section 3.1).
- **Climate smart businesses and communities:** Two-thirds of Victoria's emissions from the waste sector result from the decomposition of organic material in landfill[9]. By diverting waste from landfill for recycling, we can cut emissions, reduce air, water, and soil pollution, and support economic development. The potential diverting organic waste from landfill is set out in the organics and residual waste sections (Sections 3.1 and 5).
- **A climate resilient Victoria:** Climate change is set to increase likelihood and severity of natural disasters (CSIRO, 2022). This will place pressure on the waste, recycling, and resource recovery sector as communities face an increasing number of major impact events, such as storms, fires, and floods. The need for surge capacity to deal with these events is considered in the residual waste section (Section 5). It also underlines the importance of waste, recycling, and resource recovery infrastructure itself to be climate resilient, in line with the Victorian government's commitment to adapting to climate change[10].

8 https://www.climatechange.vic.gov.au/victorias-climate-change-strategy
9 https://www.climatechange.vic.gov.au/victorias-climate-change-strategy
10 https://www.climatechange.vic.gov.au/building-victorias-climate-resilience/our-commitment-to-adapt-to-climate-change

2.4 Trends affecting waste generation and resource recovery

Waste generation is influenced by numerous macro-level social and economic factors. In Victoria, these include a growing population, changing consumer behaviour and increasing urbanisation. Moreover, Victoria is experiencing growth in new sources of waste, which comes with new challenges.

Population

Victoria's population is expected to reach 7.5 million by 2026 and 11.2 million by 2056 (Victorian Department of Environment, Land, Water and Planning, July 2019). Waste generation typically increases with population growth, due to a corresponding increase in overall consumption. The average household size is expected to decrease in the future, which has implications for waste generation. Population growth is a key input to the Waste and Resource Recovery Projection Model. The spatial impacts of population growth, including strategies such as Plan Melbourne and the recent Housing Statement are considered further in the Land Use Planning and environmental approvals section (Section 7).

Urbanisation and economic activity

Victoria is expected to see increasing urbanisation until 2053 with the perimeter of Melbourne's metropolitan area potentially extending from Torquay to Wallan to Warragul (Infrastructure Victoria, 2021). A greater proportion of Victoria's population living in metropolitan, rather than rural and regional Victoria, will contribute to greater waste generation per capita due to corresponding increases in income per capita, economic activity and consumption.

Economic activity may include further road and rail construction projects beyond Victoria's current 'Big Build,' as urban sprawl will require more transport improvements. Transport improvements also better connect Victoria's regions, facilitating the transport of waste between facilities. C&D waste has grown steeply since 2016/17 resulting from considerable construction activities in recent years including an increase in government-funded construction projects. Victoria's Big Build is underway, a $90 billion investment delivering over 165 major road and rail projects across the state (Victorian Government Department of Transport and Planning, n.d.).

Consumer behaviour

The behaviour of Victorians contributes to patterns in waste generation and recovery. The way Victorians manage their waste has significant implications for the recovery of waste generated by the Municipal Solid Waste (MSW) sector. Fortunately, 92% of Victorians say they are willing to change the way they sort their rubbish (Infrastructure Victoria, April 2020). The Victorian Government's Household Education and Behaviour Change Program is currently in development as committed through the *Recycling Victoria: A new economy* policy. This will help guide Victorians towards important behaviour change.

Resource scarcity

Increased digitalisation and technology consumption habits, alongside shifts in consumer behaviour towards sustainable industry and renewable energy generation, will increase the demand for rare-earth materials. High quality recycled materials can replace raw materials in the manufacturing of these products. This will drive demand for recovery and recycling, as businesses and consumers rely more on recycled resources in production.

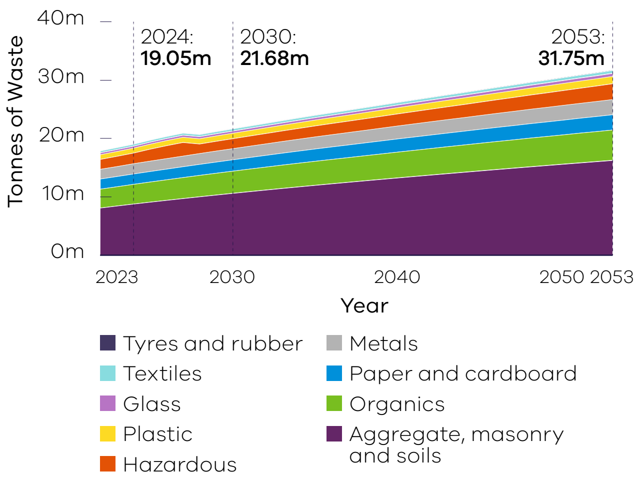
2.5 Overview of current and projected total waste

In 2023[11] an estimated 18.4 million tonnes[12] of hazardous and non-hazardous waste was generated[13] in Victoria. Aggregates, masonry, and soils is the largest material stream, contributing around 46% of the estimated total state-wide waste generation in 2023. Organics, hazardous waste, and paper and cardboard contribute 18%, 10% and 9% respectively of waste entering the Victorian waste, recycling, and resource recovery system.

In 2023, an estimated 71% of state-wide non-hazardous waste was recovered[14]. For the purposes of the VRIP, recovered waste refers to wastes that are recycled, processed by waste to energy and/or exported from Victoria (both interstate and internationally).

Figure 4 provides an overview of how total material-stream waste generation in Victoria is projected to grow over the next 30 years. This includes both waste that is subsequently recovered and residual waste.

Figure 4 Projected Victorian state-wide waste generation from 2023 to 2053 – by material stream

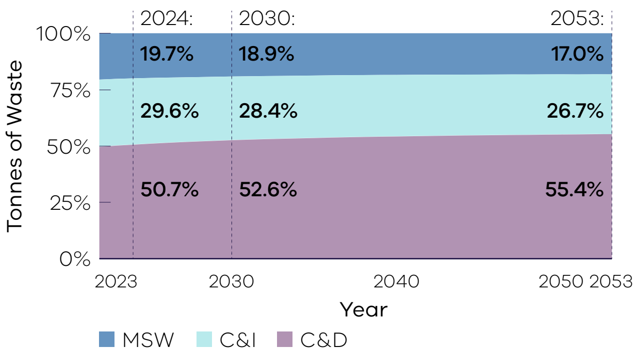


Over the next 30 years state-wide waste generation is projected to increase by approximately 67%, lifting state-wide generation to an estimated 32 million tonnes by 2053. This corresponds to an estimated 11% increase in waste generation per capita from 2023 to 2053, across MSW, Commercial and Industrial (C&I) and Construction and Demolition (C&D), with generation rising from around 2.7 tonnes per capita currently to an estimated 3 tonnes per capita in 2053.

Aggregates, masonry, and soils are expected to be the major contributor of waste generation in Victoria, increasing its share to approximately 51% of state-wide generation by 2053. Approximately 1.8 million tonnes of hazardous waste arisings were produced in Victoria in 2023 with contaminated soils being the largest contributor at around 1.2 million tonnes. Victoria is expected to generate over 2.7 million tonnes of hazardous waste arisings by 2053.

Figure 5 provides an overview of how the contributions of source sectors towards state-wide non-hazardous waste generation is expected to change over the next 30 years.

Figure 5 Projected state-wide non-hazardous waste source sector contribution from 2023 to 2053



The largest contributor to Victorian waste generation is the C&D sector with the sector, projected to grow from 51% of state-wide generation in 2024 to approximately 55% in 2053. The C&I and MSW sectors which are expected to decrease their contribution from 29% to 26% and 20% to 18% respectively of total waste generation over the next 30 years.

11 The 2023 data included throughout the VRIP are projections based on FY2020–21 actuals for non-hazardous waste material streams and FY2021–22 actuals for hazardous waste material streams and landfills.

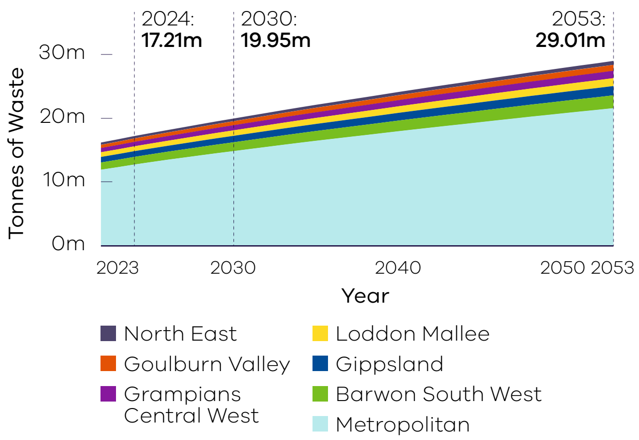
12 This tonnage value sums up quantities of non-hazardous wastes measured in generation (i.e., the amount generated by Victoria that enters the waste system) and hazardous wastes which are measured in arisings (i.e., the amount received by hazardous waste facilities – arisings capture the need for various hazardous wastes to be processed multiple times at different facilities).

13 Generation is distinct from waste 'managed', referring to where waste enters the system rather than where it is managed. The management of waste may involve exporting to other jurisdictions, or at a regional level, waste may flow to other regions for management (i.e., reprocessed in other Victorian regions) or disposed of at landfill.

14 Projection modelling has been undertaken at the material type level (e.g., PET (1) and HDPE (2) within the plastic material stream). The VRIP's analysis has modelled projection rates either at the material stream or type level, depending on the specific material.

Analysis has been conducted on regional trends that disaggregates Victoria into 7 regions which align to Victoria's Waste and Resource Recovery Regions as defined in the EP Act. Waste generation for each of the 7 regions largely aligns with the population of that region relative to Victoria as a whole. Figure 6 provides the regional breakdown of projected Victorian waste generation from 2023 to 2053.

Figure 6 Projected state-wide non-hazardous waste generation from 2023 to 2053 – by region



In 2023, the Port Phillip region comprised around 74% of total state-wide waste generation, with the following 2 largest contributors being the Barwon South West and Gippsland regions, making up 7% and 5% of Victorian waste generation, respectively. Over the next 30 years, it is expected that these regional proportion breakdowns will remain broadly the same.

2.5.1 Waste flows in and out of Victoria

In Victoria waste material is often transported a considerable distance from generation to waste facilities for management. There are numerous factors that influence the distance that waste travels, including:

- the location of re-processors and other recovery infrastructure
- collection service contracts, particularly local government contracts for MSW kerbside collections
- material properties such as putrescible nature and weight, which impact the cost of transport and storage life
- the amount of waste material required to support viable recovery and drive economies of scale
- access to markets, both domestic and international.

For communities near the border, interstate or cross-border flows are important for managing local waste and recycling. For example, infrastructure in Albury plays a key role in managing waste in Wodonga. These cross-border flows present opportunities for Victorian towns, such as Mildura which has good links across 3 states, Victoria, New South Wales, (NSW) and South Australia (SA).

While most waste generated in Victoria is managed in the state, some materials are exported either interstate or overseas. In 2023, an estimated 7% of state-wide generated waste was exported, primarily internationally. The streams that are typically exported are metals, textiles, paper, cardboard, tyres, and rubber. Notably, 33% of Victorian-generated metal waste was exported internationally. Similarly, 24% of state-wide paper and cardboard waste was exported internationally.

The Federal export restrictions will limit the ability of the market to export unprocessed glass, tyres and rubber, and paper and cardboard. For the purposes of the VRIP, material that is processed in Victoria before export will be considered locally reprocessed. Under this definition, by 2053, the proportion of waste generated in Victoria and exported is estimated to be under 16%. While there is a focus on developing the circular economy to manage waste in Victoria, exports are expected to remain an important market for Victoria's recycling and resource recovery sector, particularly for certain material streams such as metals, tyres, and rubber.

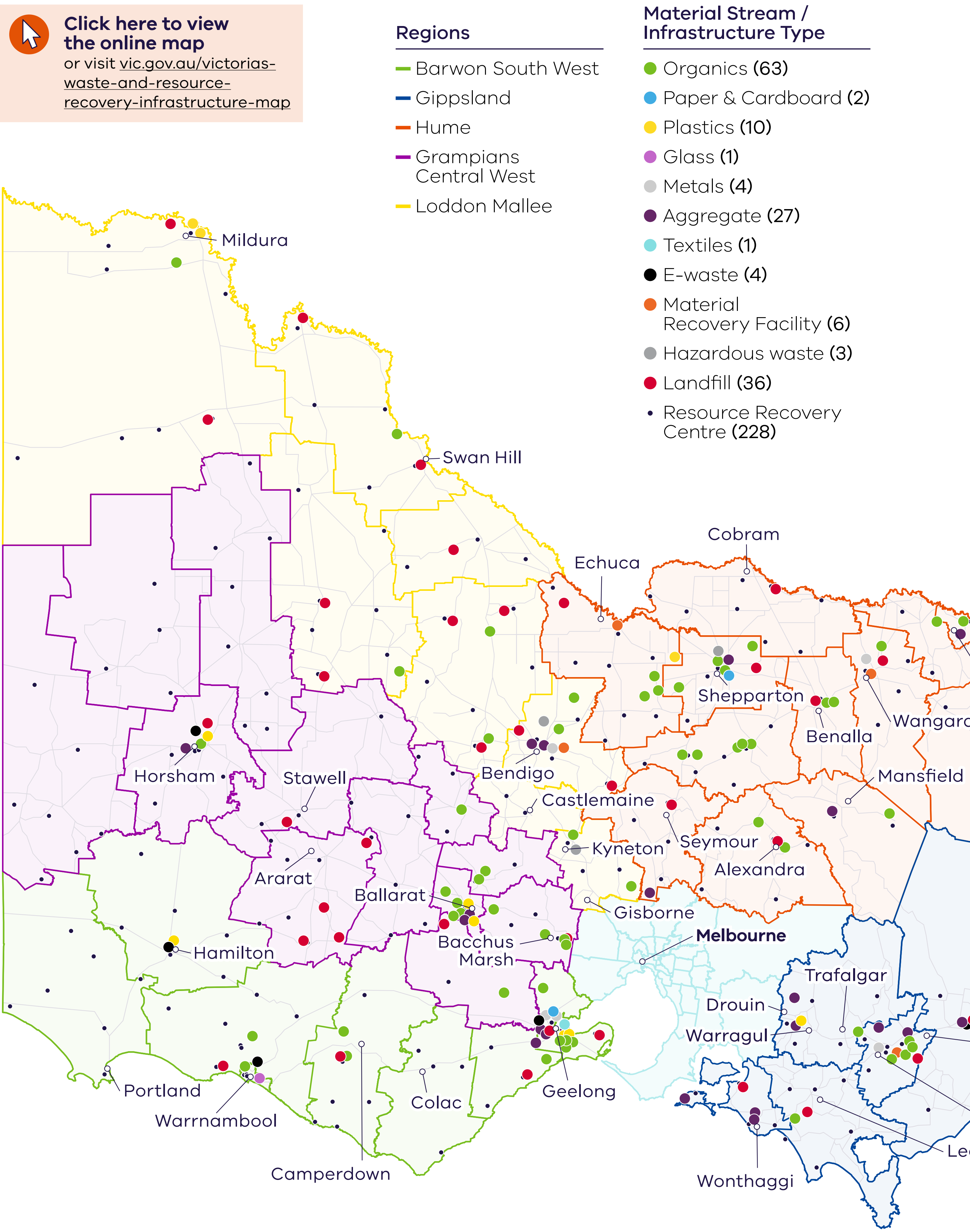
2.6 Current waste, recycling, and resource recovery infrastructure

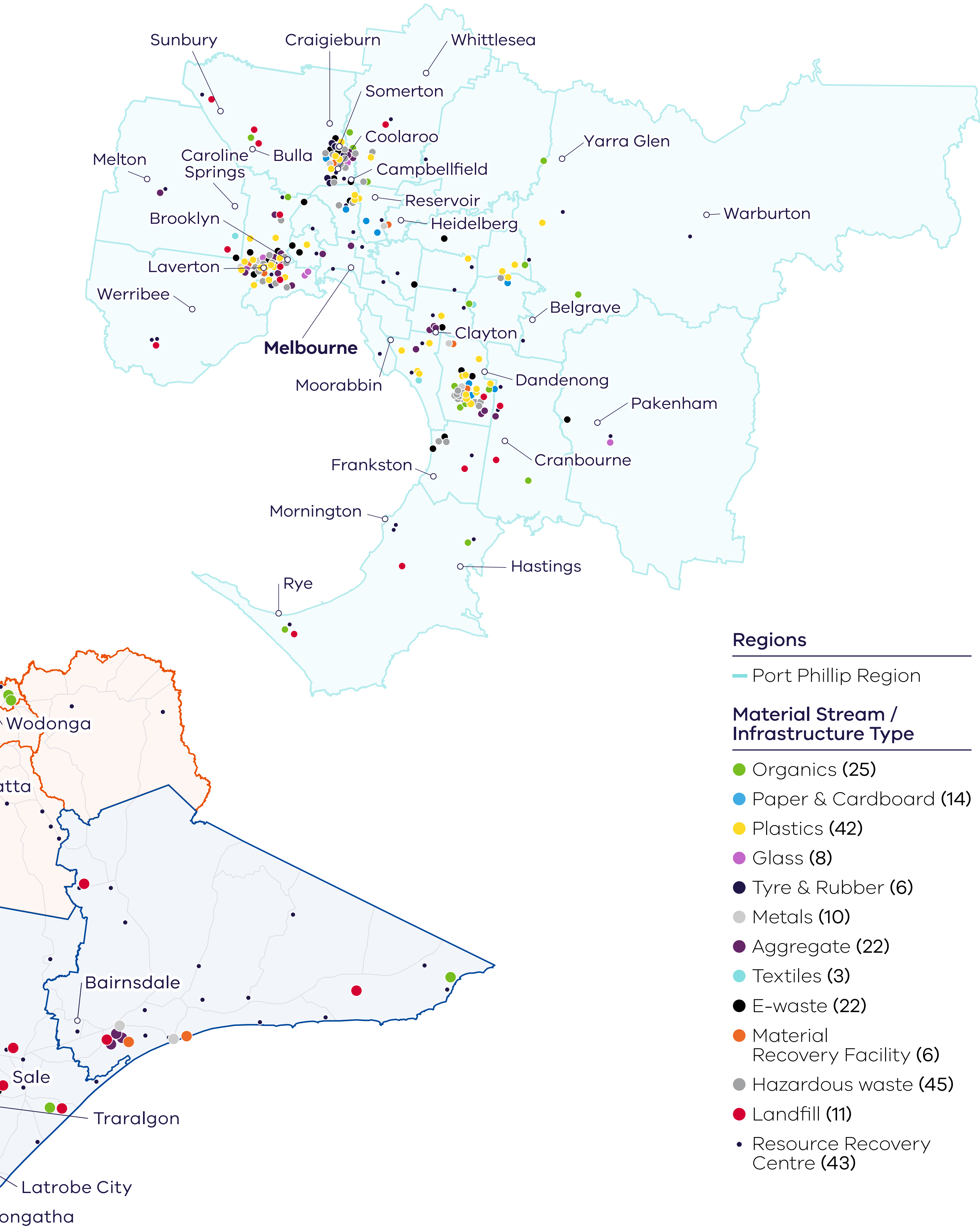
There is a diversity of waste, recycling, and resource recovery infrastructure that manages waste from collection point to reprocessing and treatment for reuse, through to energy recovery and disposal of residual streams. This section provides an overview of the different waste, recycling, and resource recovery infrastructure types in Victoria.

Figure 7 provides a summary of the current number of waste, recycling, and resource recovery infrastructure facilities and landfills in each region.

Figure 7 2023 waste, recycling, and resource recovery infrastructure in Victoria

Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map




Sunbury
Craigieburn
Whittlesea
Somerton
Coolaroo
Melton
Caroline Springs
Bulla
Campbellfield
Yarra Glen
Reservoir
Warburton
Brooklyn
Heidelberg
Laverton
Werribee
Belgrave
Clayton
Melbourne
Moorabbin
Dandenong
Pakenham
Frankston
Cranbourne
Mornington
Hastings
Rye
Wodonga
atta
Bairnsdale
Sale
Traralgon
Latrobe City
ongatha
Regions
Port Phillip Region
Material Stream / Infrastructure Type
Organics (25)
Paper & Cardboard (14)
Plastics (42)
Glass (8)
Tyre & Rubber (6)
Metals (10)
Aggregate (22)
Textiles (3)
E-waste (22)
Material Recovery Facility (6)
Hazardous waste (45)
Landfill (11)
Resource Recovery Centre (43)

2.6.1 Waste, recycling and resource recovery infrastructure

This section provides a detailed view of the current material stream-specific reprocessors and their functions in the waste, recycling, and resource recovery management processes (Table 2).

In the context of the VRIP, reprocessing means changing the physical structure and properties of a waste material that would otherwise have been sent to a landfill to add value to the processed material and prepare it for reuse. Without reprocessing, the beneficial use of waste materials would be lost.

The table also includes MRFs, which are important recovery and transfer facilities, and landfills as the primary infrastructure for the disposal of residual waste.

Recycling Victoria maintains an online map of all known reprocessing, hazardous waste facilities, landfills, MRFs and RRCs in Victoria at https://www.vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map.

The following sections provide more information about the current infrastructure and consider future infrastructure needs, based on projected demand, current capacity, sector capability and place-based analysis of the market.

Table 2 – 2023 Known Victorian recovery infrastructure

Infrastructure Type	Facilities within Port Phillip region	Facilities outside Port Phillip region	Total number facilities Victoria
Organics Anaerobic digestion	1	7	8
Organics reprocessing	24	56	80
Paper and cardboard reprocessing	5	0	5
Paper & cardboard recovery	9	2	11
Glass reprocessing	6	1	7
Glass beneficiation	2	0	2
C&D waste recycling	22	27	49
Tyres reprocessing	6	0	6
Textiles recycling	3	1	4
Metals recovery and reprocessing	10	4	14
Plastics reprocessors	42	10	52
E-waste reprocessors	22	4	26
MRFs	6	6	12
Landfills[15]	11	36	47

15 Landfills currently accepting waste.

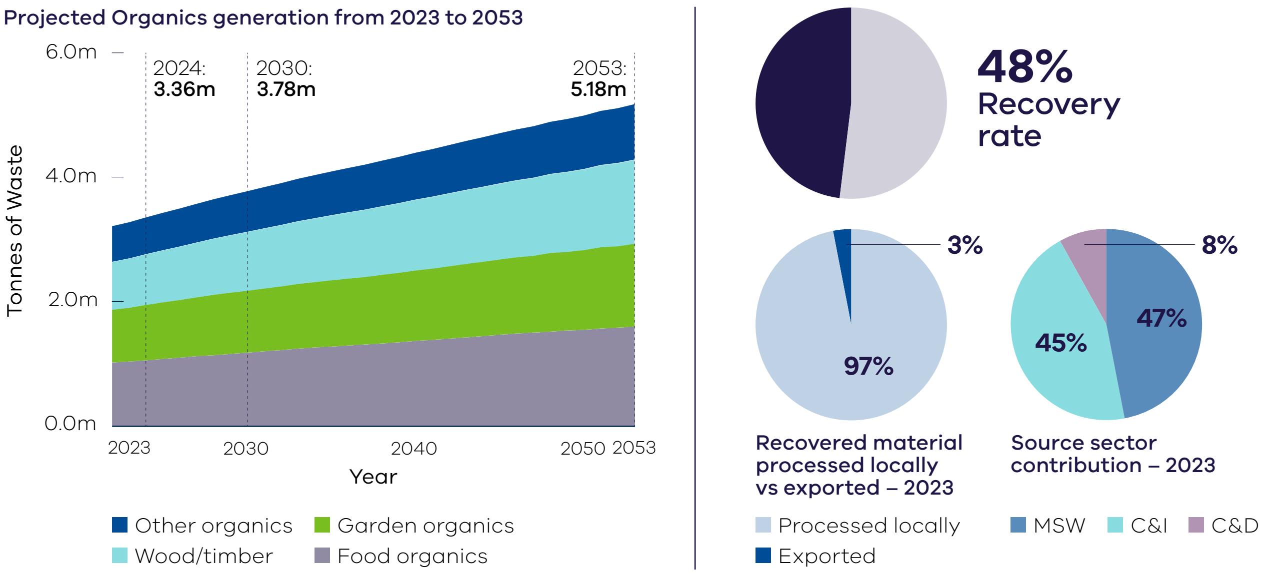
3 Material streams infrastructure needs

3.1 Organics

3.1.1 Organic waste trends

Organic waste is the second largest waste stream in Victoria by weight, currently making up 18% of total state-wide waste generation. Organic waste sources include households and commercial businesses, such as food manufacturers, hospitality, and water treatment. Figure 8 provides a summary of current and projected organic waste generation and its contributing material types, the fate of recovered materials and the source sectors.

Figure 8 Projected organic waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



Organic waste is projected to grow by 54% over the next 30 years, reaching over 5 million tonnes by 2053. The relative contributions of the individual material types are expected to remain broadly unchanged, with wood and timber projected to grow their share slightly from 24% in 2023 to 26% in 2053.

The organic waste recovery rate in 2023 was 48%[16]. Of the recovered materials, only 3% are exported outside of Victoria. The local end-markets can be challenging, and include the agriculture sector for composted products, and consumer market for coarse material used for landscaping. There is a growing bioenergy market. It is projected that the volume of organics collected will progressively increase as councils across the state provide residents with services to increase the recovery of FOGO waste.

A large proportion of waste sent to landfill is organic material, a valuable resource. In landfills, organic material decomposes to produce greenhouses gases, such as methane, and contributes to odour and leachate which have a negative impact on local communities and the environment.

16 The waste projection modelling of the VRIP models the FOGO bin rollout on recovery rate improvements. The recovery improvements are largely only applied to MSW food organics, which accounts for 32 % of total organic waste generation in 2023.

3.1.2 Current infrastructure

There are 80 organic reprocessing facilities in Victoria (Table 3). These represent a range of technologies, ranging from chipping of timber/garden waste to producing coarse material (mulch) for landscaping, to processing of organic material into compost or soil conditioner products.

Of these facilities, 17 have an annual capacity of greater than 20,000 tonnes per annum (tpa) to treat organic waste, most of these facilities are in regional Victoria. There are 3 significant facilities in Melbourne that pre-process material before it is transported to regional Victoria for further processing.

Established composting facilities across Victoria include operations in Cooper St Whittlesea, Bulla, Dandenong South, Dutson Downs, Stanhope and Shepparton.

There are 8 anaerobic digestion facilities that process a wide range of organics including food and biosolids, typically to produce biogas.

Table 3 – 2023 Victorian organics recovery infrastructure

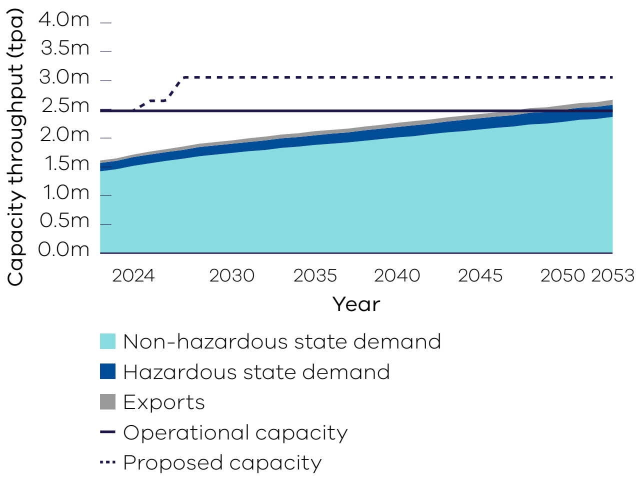
Region	Anaerobic digestion	Organics reprocessing
Port Phillip	1	24
Barwon Southwest	1	9
Gippsland	0	8
Hume	2	21
Grampians Central West	3	11
Loddon Mallee	1	7
Total	**8**	**80**

3.1.3 Organic waste infrastructure needs

State-wide capacity

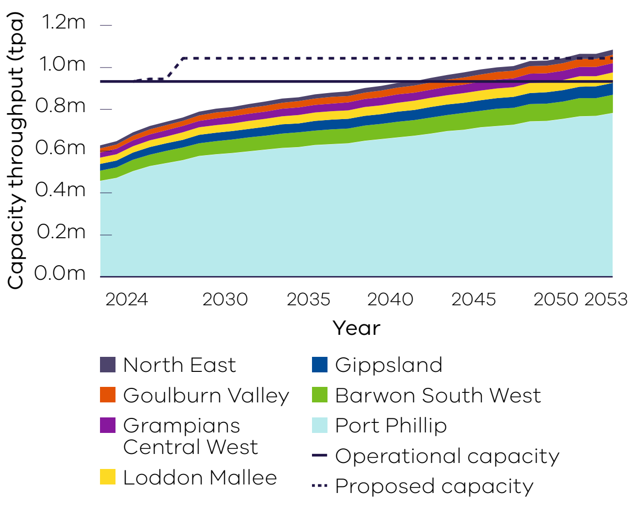
By 2053, the projected demand for organic reprocessing capacity will be over 2.5 million tpa. Recent investments have increased the capacity of existing facilities and new facilities are being developed that will further increase capacity. The assessment of capacity against demand is shown in Figure 9. To avoid double counting when assessing the total capacity of the sector, the VRIP has not included around 300,000 tpa of capacity from pre-processors, as this material requires further processing within Victoria.

Figure 9 Organics reprocessed in Victoria – projected demand and capacity



The VRIP has also considered the FOGO subset of organic waste (Figure 10). Here, the estimated capacity is sufficient meet the projected demand until 2040. Additional planned capacity is estimated to be sufficient to meet projected demand until around 2050.

Figure 10 Food organics and garden organics reprocessing in Victoria per region – projected demand and capacity[17]



17 Demand comprises projected food organics and garden organics for MSW and food organics for C&I. The capacity comprises of food and garden organics facilities and food organics facilities.

State-wide capacity sensitivity analysis

The demand projections shown above are based primarily on current trends. However, organic waste has a current recovery rate of 48%. This presents both an opportunity to increase the recovery rates, and a key variable in the demand analysis.

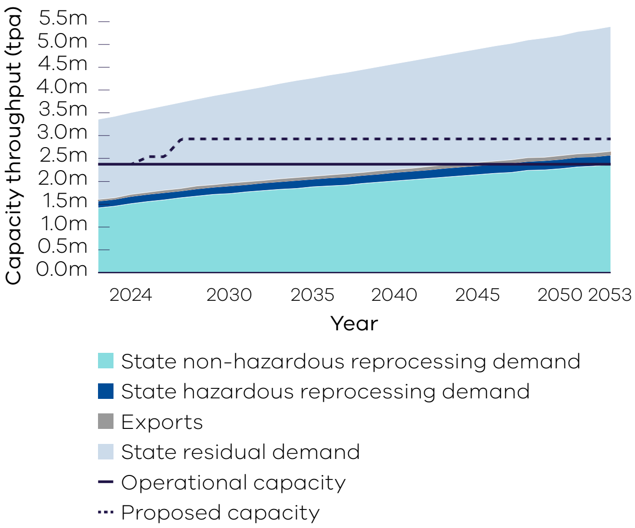
Should recovery rates increase above the projections, this would create demand for more capacity. Figure 11 below shows the capacity and projected demand for resource recovery infrastructure, against the total projection for generated organic waste.

By 2053, the projected demand for reprocessing based on current trends is around 2.5 million tpa, but the total waste generation is around 5.5 million tpa. Even with the proposed capacity, there is still a significant shortfall between reprocessing capacity and projected total waste. This shows the scale of the opportunity to increase resource recovery rates in the organic waste stream, in line with current policy objectives.

The chart above also shows the size of the shortfall between current and proposed reprocessing capacity and the projections for generated organic waste, and that more infrastructure capacity would likely be needed to support significantly increased recovery rates.

The organic material stream is the largest contributor to residual waste. Addressing the volume of organic residual waste through a combination of increased recovery rates, waste reduction, and diversion from landfills will be important to managing landfill capacity (see Residual Waste Section 5).

Figure 11 Organics capacity and total waste stream



State-wide capability

Significant investment by the state government has improved capability of the organic waste stream, but challenges remain. As a diverse waste stream, multiple technologies will be required.

For FOGO waste, the different types of organic waste reprocessing technology each have advantages and challenges. For example, open windrow processing of organics is less capital intensive but requires large buffers. There are challenges with adequately mitigating risks from odour, liquids, and pasteurisation conditions. Closed systems have quicker processing with less amenity impacts, an important consideration for locations in proximity to urban development but involve significant upfront capital costs. Anaerobic processing produces energy and can support the transition away from fossil fuels but prefers food waste and current technologies are challenged by garden waste.

Bioenergy technology more broadly, including biogas generation, presents an opportunity for diversification into new markets. Victoria's Waste to Energy – Bioenergy Fund has awarded $8 million to support farming and food production sectors turn organic waste into energy through novel technology. The bioenergy projects are set to boost Victoria's renewable energy capacity by 6.82 megawatts[18]. More information about this is in the Waste to energy section of the VRIP (Section 5.2.2).

Wood from garden waste and timber are primarily reprocessed through shredding and chipping into mulch for use in landscaping, as a biomass fuel, animal bedding, or as manufacturing input into products such as particle board. This is an established technology that will be an important part of the processing capability for organics. However, there are still challenges for certain material types, including chemically treated or painted timber and engineered timbers (for example, laminates) from demolition waste. Emerging thermal treatments may offer future solutions for these challenging materials.

Bioenergy from biomass feedstocks from agriculture, forestry, and urban sources also present an emerging area for increased recovery.

Over the 30-year future of the VRIP, Victoria will need a combination of these technologies to manage diverse feedstocks and meet end market demand.

18 Department of Premier and Cabinet, 2023

Contamination

A key capability challenge for organic waste processing is contamination. Contamination adversely affects the operating costs of facilities and the quality of end products, for example from the presence of non-compostable materials, such as plastics and glass. This has been an ongoing issue for kerbside collections of organics, with inconsistency over acceptable materials at different facilities.

There can also be issues with chemical contamination, such as from pesticides. Other hazardous materials can also be contaminating, as seen in the challenges with asbestos contaminated mulch. The costs to deal with contamination, including screening equipment and increased processing times, have a direct impact on the value of the outputs and potential applications[19].

Investment in decontamination infrastructure, such as pre-sorting equipment, can help address this issue This is not solely an infrastructure issue, and requires improvements across the waste management system (for example, behaviour changes and awareness), as well as in infrastructure capability. The design of new facilities should consider the issue of contamination, while existing facilities may require additional investment.

Finding end markets for reprocessed materials can be a challenge for the organic waste stream, particularly for reprocessors who are not vertically integrated with their own end uses. Contamination contributes to this challenge.

While the specifics will differ across technologies and locations, the ability to deal with contamination, achieve economies of scale and secure robust end markets for products may result in the potential reprocessing capacity not being fully utilised. This can result in the perception that there is insufficient capacity in the market.

In the near to medium term, building the capability to manage contamination and meet the needs of end markets will be important for the sector. This can strengthen the sector, address potential throughput challenges, and support increased recovery rates, which will in turn create greater demand for more capacity.

3.1.4 Place-based assessment

A feature of organic reprocessing in general, and FOGO in particular, is that it can require significant buffers and may have amenity impacts on surrounding areas. This can be a challenge for situating facilities, particularly in densely populated areas.

Open windrow composting is a well-established technology however requires appropriate siting to meet buffer requirements. Whilst more expensive, in-vessel composting is also a well-established technology that through its closed management technique, may play a role in meeting buffer requirements to minimise neighbouring amenity impacts. Uptake of anaerobic digestion is increasing in Australia and presents an opportunity to manage food waste and generate renewable energy.

As metropolitan Melbourne's population increases over the next 30 years, one option to manage the pressures of meeting amenity and buffer requirements is 2-stage processing, with initial decontamination in urban areas near where the waste is generated, followed by further processing in regional and rural areas. There are also opportunities for co-location with other industries that require large buffers, such as water authorities that use similar technology to process waste, livestock exchanges or landfills. For example, water corporations can play a key role in supporting the circular economy transition due to access to suitable land and expertise in managing organic wastes and treatment technologies such as anaerobic digestion.

These factors mean that a considerable share of organic waste is transported out of the Port Phillip region to the Gippsland, Hume, and Barwon South West regions for reprocessing due to the presence of several organic processing facilities in those regions.

While this material stream does present opportunities for regional reprocessing, facilities still need to be economically viable, with sufficient economies of scale and end markets for products.

A significant proportion of agricultural waste material is organic matter. This presents regionally specific challenges, and opportunities, depending on the prevalent type of agriculture and nature of the waste produced.

19 RMCG (2021) Organics Industry Intervention Strategy for Sustainability Victoria

3.1.5 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Organics	48%	3.3	5.2										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]

Directions

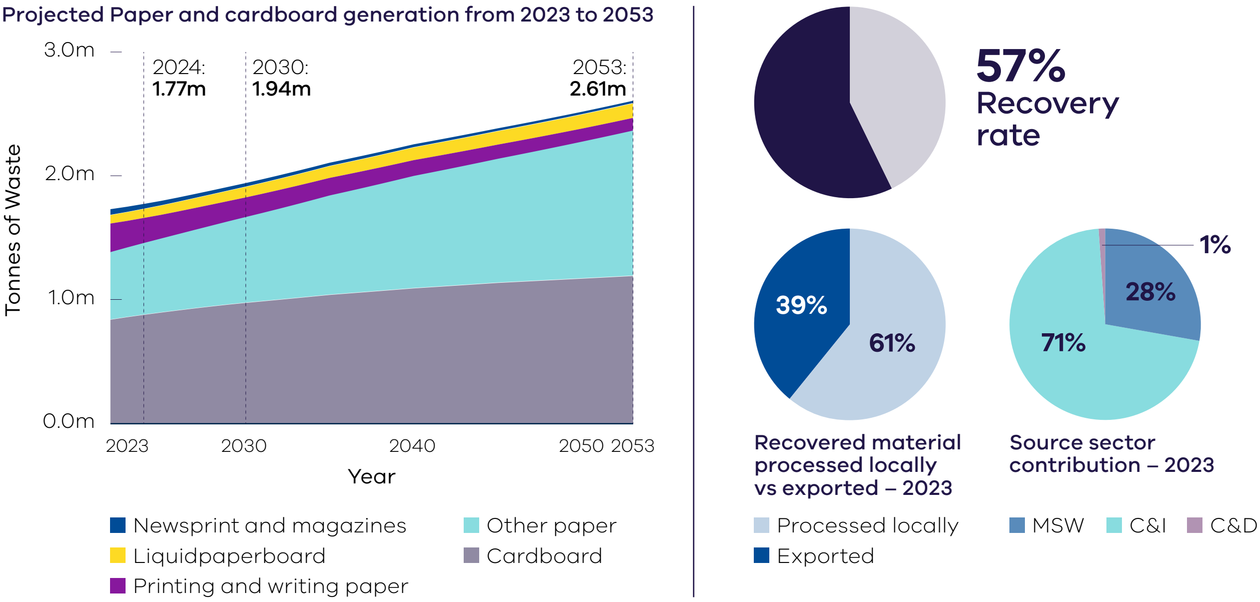
- Near term (0–6 yrs): Increased capability to address contamination across all organic material types; emerging technology further developed to address problem waste types and capitalise on sector opportunities such as bioenergy.
- Medium term (6–12 yrs): Bioenergy as an established sector supporting transition from fossil fuels, increased sector capacity to meet projected FOGO reprocessing demand; increased sector capability supporting higher recovery rates and driving increased market demand for reprocessing capacity.
- Long term (12+ yrs): Increased capability and capacity to support significantly increased recovery rates and diversion of organic material from landfill.
- Ongoing: Increased use of 2-stage processing in urban areas, co-location of infrastructure with compatible industries and buffer requirements, (e.g. with water corporation facilities) and increased regional facilities to support regional circularity.

3.2 Paper and cardboard

3.2.1 Paper and cardboard waste trends

In 2023, Victorians generated an estimated 1.7 million tonnes of paper and cardboard waste, representing around 9% of all state-wide waste generation. Figure 12 outlines the projected waste generation for paper and cardboard waste and its individual material types in addition to its recovered fate and source sector contribution.

Figure 12 – Projected paper and cardboard waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



Over the next 30 years, the paper and cardboard waste stream is projected to grow by 47% with Victorians expected to generate over 2.6 million tonnes by 2053. Cardboard and other paper together make up approximately 81% of the waste stream in 2023 and projected to increase to approximately 91% in 2053.

Most of this waste stream is derived from the C&I sector (71%) and combined with the MSW sector (31%) account for 99% of the generated waste. Paper and cardboard is the third largest material stream after aggregates, masonry and soils and organics, and it is also the third highest contributor to residual waste.

By world standards, Australia has a small pulp, paper, and paperboard industry. There may be opportunities to grow the domestic market and replace virgin products with recycled material. However, the limited size of the domestic market compared to the overall supply of paper and cardboard means exports will continue to play a key role in the sector.

Almost 39% of recovered waste is reprocessed outside of Victoria. Globally, there is significant demand for recovered paper and cardboard, particularly in the packaging and industrial sectors and including corrugated cardboard.

The Australian Government recently sought feedback on proposals to regulate mixed paper and cardboard exports from 1 July 2024 by imposing a maximum contamination rate of 5%, tightening to 3% in 2026.[20] This means that higher value, cleaner materials can continue to be exported, but lower grade materials will require domestic processing.

3.2.2 Current infrastructure

There are 5 paper and cardboard reprocessing facilities in Victoria that clean and pulp paper and cardboard waste to produce new products, all of which are located in the Port Phillip region (Table 4). There is also a paper and cardboard collection network that collects and transports material to domestic reprocessors or to export markets in line with Australian Government export regulations.

20 Consultation hub | Recycling and Waste Reduction (Export – Paper and Cardboard) Rules 2023 – Climate (dcceew.gov.au)

This includes a significant recent investment in a drum pulping facility in Coolaroo, the first of its kind in Australia. The limited local market for recycled material means there are a limited number of domestic paper and card recyclers in Victoria.

Table 4 – 2023 Victorian paper and cardboard recovery infrastructure

Region	Paper and cardboard reprocessing	Paper and cardboard recovery
Port Phillip	5	9
Hume	0	1
Barwon Southwest	0	1
Total	**5**	**11**

Developments in paper and cardboard infrastructure

Visy's Coolaroo paper drum pulper system is an Australian first and implements leading innovation to recycle mixed and contaminated paper. This will aid in the manufacturing of new products such as takeaway packaging and boxes for use in the agricultural sector. The process involves a continuously rotating drum pulper that reduces the loss of paper fibres that is experienced in conventional paper recycling. It also reduces energy use and carbon dioxide emissions compared to other technology (Visy, 2023).

Further research will continue to support the paper and cardboard waste industry. RMIT has partnered with Intrax Consulting Engineers and Citywide to research the application of recycled cardboard in residential and commercial construction. This project is investigating the use of treated cardboard mixture to replace aggregates in production of concrete panels and timber trusses in both commercial and residential buildings. The reprocessing system will crush and shred cardboard waste materials and combine it with recycled plastic resin to form a product that replaces the traditional building materials (Venkatesan, 2023).

3.2.3 Paper and cardboard waste infrastructure needs

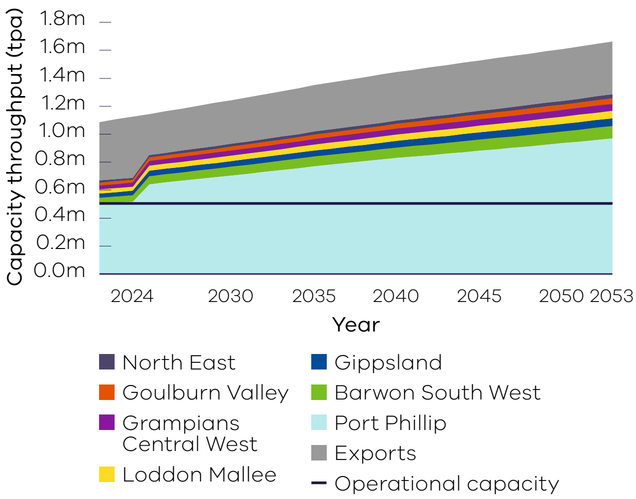
State-wide capacity

The chart below indicates that there is insufficient state-wide capacity to meet demand for paper and cardboard reprocessing from now until 2053 (Figure 13). The response to consultation has highlighted a local gap in both capacity and capability to handle liquid paperboard arising from food and beverage packaging.

Based on existing trends, demand for paper and cardboard reprocessing is projected to increase rapidly in 2024 and then continue to grow steadily. This spike is due to anticipated federal export restrictions that will be placed on some paper and cardboard waste[21] starting in July 2024.

This is projected to increase demand for locally recovered paper and cardboard by around 140,000 tonnes annually. The capacity estimates include the major drum pulping facility commissioned in late 2023, although it is still early to have a clear understanding of the full capacity of this facility.

Figure 13 Paper and cardboard reprocessed in Victoria – projected demand and capacity[22]



Based on this capacity analysis, the investment additional capacity requirements are 514,000 tpa by 2035, and 781,000 tpa by 2035, noting the sensitivity analysis section considers factors that could impact these projections.

21 Applies to mixed paper and telephone books.

22 Capacity data is sourced from data reported by operators. Capacity data assumes these materials are processed through paper and cardboard reprocessing facilities.

Sensitivity analysis

How the Victorian paper and cardboard reprocessing sector responds to the anticipated federal export restrictions are a key near-term variable for local capacity requirements. The modelled scenario projects a spike in demand due to material that can no longer be exported and needs to be processed domestically.

However, it is possible that the new investment in domestic capability will allow the lower quality paper and cards that are currently being exported to be processed locally. This would enable the cleaner material to be exported, leaving demand for local processing more in line with current levels. The approach taken will depend on the commercial and operational decisions taken by reprocessors.

Another variable is the impact of the recent investment. While there is potential that this may provide a significant capability uplift, it is too early to have a clear understanding of the efficiency of the new reprocessing facility and its impact on local reprocessing capacity.

The demand projections shown above are based primarily on current trends. This projects a reprocessing demand of around 1.2 million tpa by 2053. With exports, that rises to around 1.6 million tpa recovered from around 2.6 million tpa of generated waste. This leaves around 1 million tpa as residual waste, which presents a clear opportunity to recover additional material, which in turn would create additional reprocessing demand. Addressing the volume of residual waste generated by this waste stream will be important to managing landfill capacity.

State-wide capability

The introduction of export restrictions could impact the capability requirements at both MRFs (where aggregation and sorting takes place) and reprocessors. The responses to the Australian Government's consultation[23] reported differing views about the capability of existing infrastructure to meet the proposed contamination thresholds.

Some concerns that have been raised are that regional and remote areas mostly operate using small to medium sized entities and they do not currently have the infrastructure to achieve the proposed threshold requirements within the proposed timeframes. However, larger industry entities called for higher levels of regulation and were comfortable with lowering the contamination thresholds to 1–2%, in line with some overseas standards.

The recent investment in domestic reprocessing and major drum pulping facilities, and the consolidation of the market resulting in fewer, larger reprocessors, suggests Victoria is well placed to meet local reprocessing capability requirements.

The response to the targeted consultation has suggested a local gap in capability to handle liquid paperboard arising from food and beverage packaging. The introduction of the CDS, where cartons are accepted, presents a potential opportunity to develop this capability. There is also potential to develop recycling capability and recycled products for the niche paper markets e.g. fibre moulded packaging.

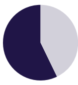
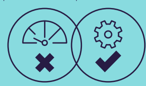
There are 12 MRFs in Victoria, with 75% of the capacity coming from the 6 Melbourne facilities. The export bans are expected to increase the capability requirements at MRFs. While there may be some challenges during the transition to the new requirements, the required technology already exists in the marketplace. This is considered further in the Recovery and transfer infrastructure (Section 4). The analysis undertaken by Infrastructure Victoria also suggests there is the potential to improve recovery from the C&I sector.

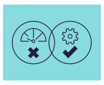
Place-based assessment

The domestic paper reprocessing market is centralised in the Port Phillip Region. The limited size of the domestic market and the investment required for reprocessing provides limited opportunities to develop the economies of scale required in regional areas.

23 https://consult.dcceew.gov.au/recycling-and-waste-reduction-export-paper-and-cardboard-rules-2023

3.2.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Paper & Cardboard	 57%	1.8	2.7										



Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]

Directions

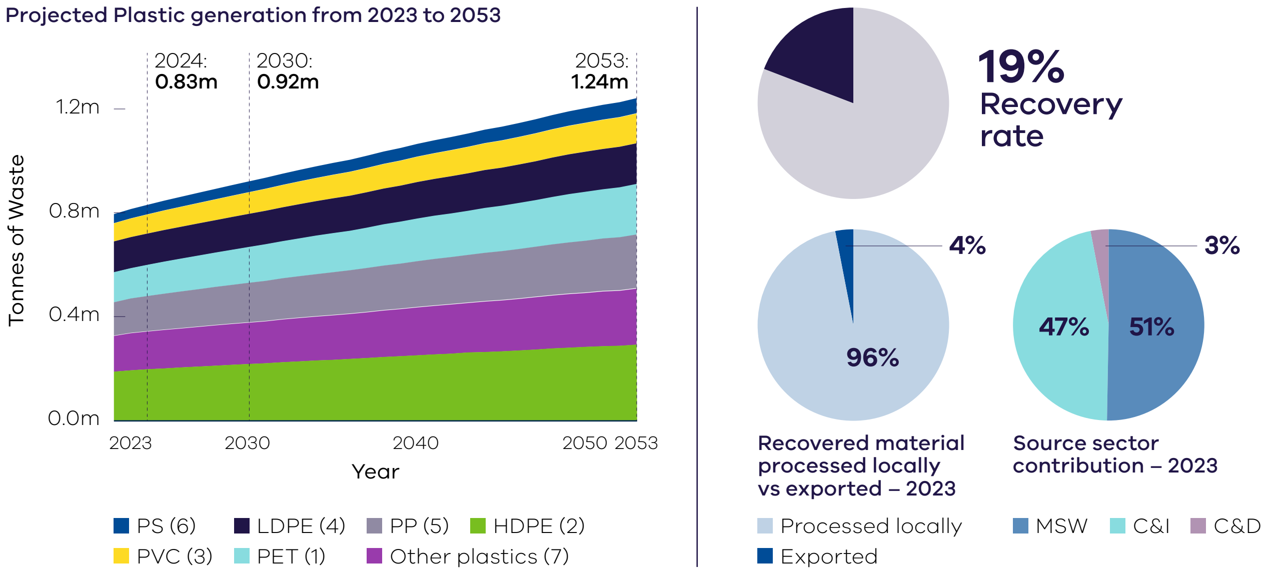
- Near term (0–3 yrs): Increased capacity to respond to the 2024 Federal export restrictions (noting the impact of recent investment is still to fully play out).
- Medium and long term (6–12+ yrs): Increased capacity to meet demand and to increase the diversion from landfill.

3.3 Plastics

3.3.1 Plastic waste trends

Victoria generated 0.8 million tonnes of plastic waste in 2023, making up 4% of total waste generation. Figure 14 provides the current and projected waste generation for plastics and its contributing material types, fates, and source sectors. Plastic is a lightweight material, so the waste volumes will be larger than other materials for the same weight.

Figure 14 Projected plastic waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



Plastic waste is projected to grow by around 50% over the next 30 years, generating over 1.2 million tonnes by 2053. HDPE and Other plastics[24] are the 2 largest contributing material types of plastic waste in Victoria, representing 41% of plastic waste generated in 2023. These 2 material types are expected to remain the major contributors to plastic waste over the next 30 years.

In 2023, around 19% of plastic waste generated was recovered. The introduction of CDS is expected to improve recovery rates for PET and HDPE which account for 14% and 24% respectively of total plastic waste generation in 2023.

The volume of plastic waste (and sufficiency of processing capacity) has seasonal variability – with peaks of plastic generation around the Christmas and holiday periods.

24 "Other plastics" consists largely of polymers ABS/SAN/ASA (7), PU (7), Nylon (7), Bioplastic (7)

Plastics Recycling Numbers – The Plastics Identification Code

1 – PET or Polyethylene Terephthalate:
A clear, tough, solvent resistant plastic. It's used for water, soft drink and detergent bottles. It's usually recycled into bottles and polyester fibres.

2 – HDPE or High-Density Polyethylene:
Found in both rigid and soft plastic forms. It's a very common plastic, and in the rigid form is usually white or coloured, and is used for milk bottles, shampoo bottles and cleaning products. As a soft plastic, HDPE is found in freezer bags, plastic bags, and other plastic food packaging.

3 – PVC or Polyvinyl Chloride:
Found in many products, e.g., pipes, toys, furniture and packaging. It's difficult to recycle and contains harmful chemicals.

4 – LDPE or Low-Density Polyethylene:
Usually a soft, flexible plastic that's used for different kinds of wrapping, bread bags, produce bags and bin bags.

5 – PP or Polypropylene:
A hard but still flexible plastic. It's used for ice cream containers and lids and plastic take away containers.

6 – PS or Polystyrene:
Used to make cups, foam food trays and packing materials. It's also known as Styrofoam. It is bulky yet very light and difficult to recycle.

7 – Other:
This shows the item could be a mixture ofthe above, or a plastic that is not readily recyclable, such as polyurethane.

3.3.2 Current infrastructure

There are 53 plastics facilities in Victoria (Table 5), representing a range of technologies using primarily mechanical reprocessing. Mechanical plastic reprocessing relies upon the sorting and separation by polymer type, followed by mechanical shredding, washing, granulating, flaking by single polymer type or pelletising by single polymer type.

Chemical reprocessing relies upon emerging technologies to return plastics to their original monomer form as a recycled feedstock or pyrolysis (thermal treatment in the absence of any reactive gases such as air or oxygen) to create an alternative fuel.

Of the 52 Victorian facilities, 42 of are located within Melbourne, representing over 90% of the total reprocessing capacity.

Table 5 – 2023 Victorian plastics recovery infrastructure

Region	Plastics reprocessors
Port Phillip	42
Barwon South West	3
Gippsland	1
Hume	1
Grampians Central West	3
Loddon Mallee	2
Total	**52**

3.3.3 Plastic waste infrastructure needs

State-wide capacity

From 1 July 2022, the Federal export restrictions have increased the amount of material that must be reprocessed domestically, as shown by the charts in Figure 15 and Figure 16. The rate of increase is projected to slow as the market stabilises.

As also shown by the charts, domestic capacity is projected to increase rapidly with the proposed new facilities. This includes new chemical recycling facilities that could make a significant difference for some plastic polymers. However, this technology has not yet been deployed at scale in Victoria.

Plastics is a complex waste stream with multiple polymer types (see information box in this section) and capacity is not necessarily interchangeable between different polymers. Most of Victoria’s current and proposed capacity is for PET, HDPE, low density polyethylene (LDPE) and polypropylene (PP) polymers.

Figure 15 – Plastics reprocessed in Victoria – projected demand and capacity

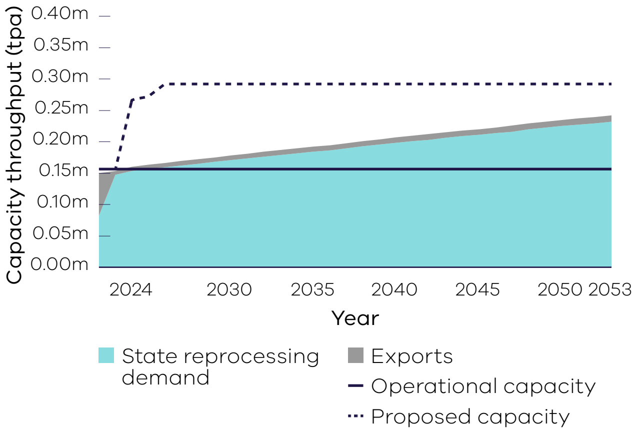
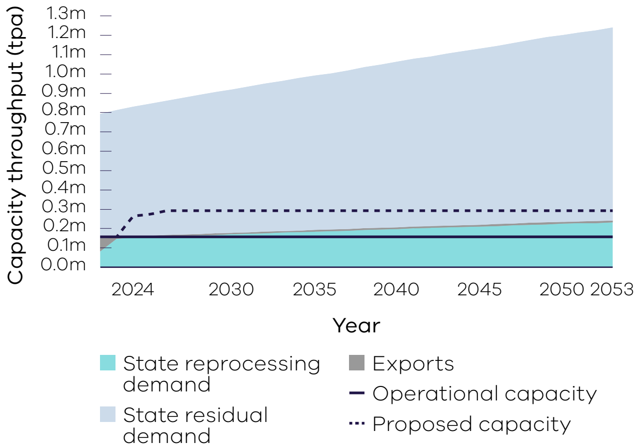


Figure 16 – Plastics capacity, demand, and total projected plastic waste



State-wide capacity sensitivity analysis

The demand projections shown above are based on projected demand for recycling capacity. However, plastics are a material stream with a low recovery rate of 19%. This is both an opportunity to increase the recovery rates, and a key variable for the analysis as increased recovery rates would in turn create demand for more capacity. To illustrate this, the chart below (Figure 16) shows the capacity and projected demand for resource recovery infrastructure, against the projection for the total generated plastic waste.

By 2053, the projected demand for local reprocessing based on current trends is 0.23 million tpa, but total plastic waste is projected to be 1.24 million tpa. This shows the scale of the opportunity to increase resource recovery rates in the plastic waste stream. The chart also shows the size of the shortfall between current and proposed reprocessing capacity and the projections for generated plastic waste, and that more infrastructure capacity would be needed to support significantly increased recovery rates.

Plastics are a significant contributor to residual waste. Addressing the volume of plastic residual waste through a combination of increased recovery rates, waste reduction, and diversion from landfills will be important to managing landfill capacity (see the Residual waste section 5).

State-wide capability

The overall recovery rate for plastics of 19% reflects the capability challenges faced by this complex and challenging material stream, which has been a focus area for the Victoria and the Australian governments.

The Federal export restrictions increase the local capability demands. Improving sorting capability can provide higher quality feedstock materials to use existing mechanical reprocessing capabilities and help maintain access to overseas end markets. As sorting occurs primarily at MRFs, this also impacts their capability requirements.

The introduction of CDS will aggregate and consolidate of high-grade material and recent investments suggest the market is moving to capitalise on this opportunity. The remaining rigid plastics in the waste stream will continue to be sorted, primarily at MRFs, before reprocessing. This underlines the importance of sorting capability to provide suitable materials for recycling.

Since the introduction of the Australian waste export regulations, there has been significant investment in mechanical plastic reprocessing in Victoria. These investments and technologies are now operating at scale and are anticipated to play a critical role now and into future years. As plastics recovery rates improve over time, there will be further opportunities for investment in this technology that is proven at scale.

Soft plastics present a challenge for recycling as a complex, low value, high volume material. Chemical recycling could improve the capability, for certain polymers of soft plastics, such as LDPE and PP. The Victorian Government has signalled the move towards kerbside collection of soft plastics when infrastructure capacity and capability is ready for the material this would deliver (noting product stewardship could be an important part of that consideration).

Polymer types

The 4 polymers PET, HDPE, LDPE, and PP are the most readily recycled and have the highest recovery rates[25]. They account for all the proposed new capacity in Victoria. While polymer types do not align exactly with soft and rigid plastics, PET and HDPE are most often found as rigid plastics. They are recyclable through existing mechanical and chemical reprocessing.

LDPE is commonly found as a soft plastic, and proposed new chemical recycling could increase both capacity and capability for this polymer in Victoria. PP is often found as both rigid and soft plastics, with proposed new facilities deliver additional capability to recycle both rigid and soft PP.

PVC, Polystyrene (PS) and 'Other plastics' (Plastic Identification Code 7) are more difficult to recycle. Even though they make up a significant proportion of the plastic waste, there is limited existing reprocessing capacity in Victoria and no proposed new capacity. Blended polymers are also more challenging than single polymers to recycle.

Product stewardship and packaging reform

Plastics is a complex material stream, and focusing on recycling infrastructure alone is unlikely to be successful in delivering a circular economy. Changing the upstream composition of the waste, such as through product stewardship, can help to better align the materials entering the waste stream with the capabilities of recycling infrastructure.

The Australian Government is leading the design of a new scheme that will mandate obligations for packaging design based on international best practice and make industry responsible for the packaging, including soft plastics, they place on the market. This could help with developing overall system capability and stimulating investment opportunities in new capacity – including to support kerbside collection of soft plastics.

Place-based assessment

The plastics recovery market operates at a state-wide level and is centred on Melbourne. Plastics facilities located in the Port Phillip region account for more than 90% of the state-wide reprocessing capacity[26].

There are some existing regional facilities, and regional waste volumes could support additional facilities. There are also regional specific waste types, such as agricultural waste plastics and silage wraps. These present specific challenges for rural areas, but also possible opportunities for regions outside of Melbourne, noting that an infrastructure solution would need to be economically viable.

25 See the Circular Economy Market Report for latest recovery rates.

26 Australian Plastics Flows and Fates (APFF)

3.3.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024–2026	2027–2029	2030–2032	2033–2035	2036–2038	2039–2041	2042–2044	2045–2047	2048–2050	2051–2053
Plastics*	19%	0.8	1.2										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

* Proposed additional infrastructure in pipeline that would extend capacity timelines

Directions

- Near term (0–6 yrs): Increased capacity and capability from existing technologies to respond to export restrictions and capitalise on CDS opportunities and new technologies to increase capability for problematic and soft plastics.
- Medium term (6–12 yrs): Continued deployment of mechanical reprocessing, chemical processing proven at scale, and emerging technologies provide increased capability for challenging plastic types; and increased system capability to support kerbside collection of soft plastics.
- Long term (12+ yrs): Increased system capability and capacity to support significantly higher recovery rates and diversion from landfill.
- Ongoing: Opportunities to increase recovery of agricultural or regional-specific plastic wastes (e.g. silage wraps) are considered.

Developments in plastic reprocessing in Victoria

Reprocessing methods for plastic materials vary with the type of plastic. PET and HDPE tend to have higher recovery rates than other plastic materials. Improvements in sorting technology will assist the reprocessing and recycling of plastic waste streams by reducing contamination of plastic materials.

Mechanical recycling is the primary type of plastic recycling. It involves reprocessing of plastic materials while largely maintaining its chemical composition.

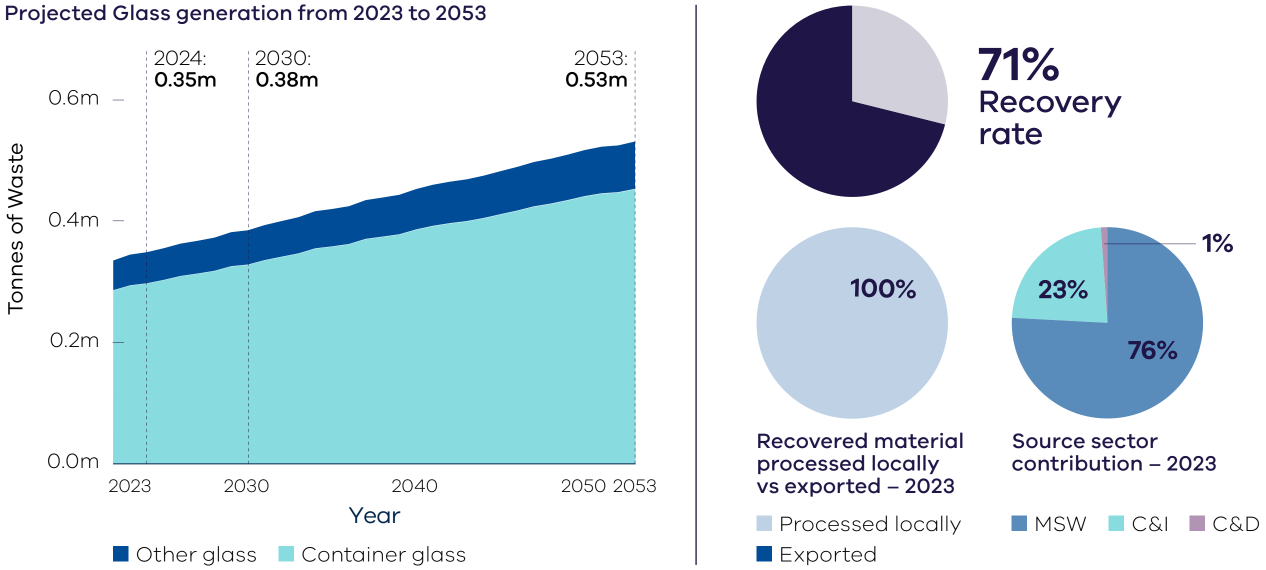
Chemical recycling involves the decomposition or conversion of the plastic to its petrochemical components. This technology has the potential to reprocess hard-to-recycle plastic materials into their original oil components. In this form, materials may be sold for reuse in a wide array of industry applications.

3.4 Glass

3.4.1 Glass waste trends

The volume of glass waste generated in Victoria is estimated to be 0.35 million tonnes in 2023, equivalent to 2% of the total waste generated in Victoria. Figure 17 provides the current and projected glass waste generation in Victoria.

Figure 17 – Projected glass waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



The glass waste stream is expected to grow by over 50% over the next 30 years, with Victoria projected to generate over 0.5 million tonnes by 2053. Most of the glass waste stream comprises container glass and the proportion is expected to remain broadly unchanged over the next 30 years. The recovery rate of glass waste is estimated to be 71% in 2023, with all recovered glass reprocessed in Victoria.

The largest source of glass waste is from MSW, making up 76% of total glass waste generation, with the remainder largely being from C&I.

Glass is currently recycled bottle-to-bottle or crushed for use in civil construction. While recycled bottle-to-bottle material has a high value in end markets, the domestic market is limited and there are only 3 facilities in Australia.

For crushed glass used in construction, any material reprocessed on construction sites rather than at Victoria's standalone glass crushing/reprocessing facilities are not captured in the waste data. Recovering glass for use as glass sand is growing in Victoria, supported by changes to construction specifications, that have increased how much recycled glass sand can be used in road and rail construction.

The CDS will provide a separated stream of material for recycling. Additionally, kerbside reforms will also increase the separation of glass as part of the new four stream household waste and recycling system. Most glass collected through Victoria's CDS is expected to be used for glass-to-glass reprocessing.

3.4.2 Current infrastructure

In Victoria there are 7 glass reprocessing facilities (Table 6). One of these recycles waste glass into new glass packaging, such as bottles and jars. The others recycle glass into glass sands, aggregates, and other uses, such as abrasives, beads, and rendering. Six of the 7 facilities, including the bottle-to-bottle facility, are in Melbourne, with the remaining facility located in the Barwon South West region. In Victoria, there are 2 beneficiation plants. These separate and sort glass cullet as an initial step to make it suitable for glass-to-glass recycling.

Table 6 – 2023 Victorian glass recovery infrastructure (by waste stream)

Region	Glass reprocessing	Glass beneficiation
Port Phillip	6	2
Barwon South West	1	0
Total	**7**	**2**

3.4.3 Glass waste infrastructure needs

State-wide capacity

There is projected to be sufficient state-wide capacity to meet demand for glass beneficiation and reprocessing until 2053 (Figure 18). The available data indicates a spike in local glass reprocessing demand from 2023 due to the introduction of Victoria's CDS and kerbside reforms. However, the current capacity of around 0.65 million tpa is above the projected demand. There is also sufficient capacity in glass beneficiation plants to meet the projected demand (Figure 19).

Figure 18 – Glass reprocessed in Victoria – projected demand and capacity[27]

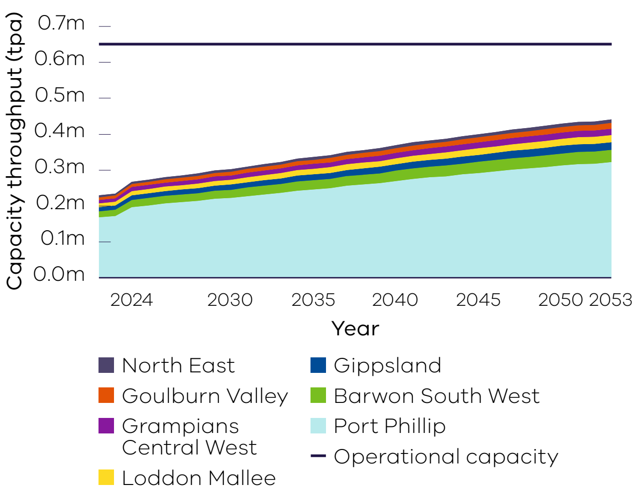
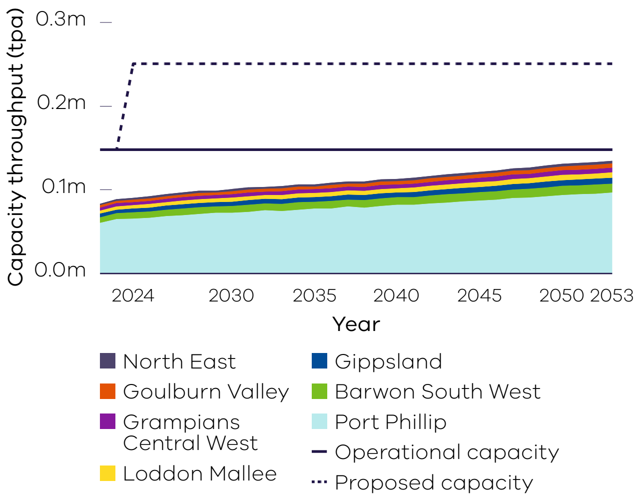


Figure 19 – Waste throughput at glass beneficiation plants – projected demand vs capacity[28]



Sensitivity analysis

With minimal waste exported, the key variable in future demand is the resource recovery rate. However, the current glass reprocessing capacity is greater than the total projected waste generated by 2053.

There may be potential to increase the proportion of bottle-to-bottle recycling compared to glass crushing, and there is significant additional capacity above demand for the beneficiation facilities.

State-wide capability

The recovery rate for this material stream is currently 71%. There are no significant capability issues identified in the glass recycling sector. There is a limited bottle-to-bottle recycling market in Australia, with only 3 facilities known in Australia, one of which is in Victoria.

Most CDS material is expected to go to bottle to bottle recycling, where the existing capacity and capability are expected to meet the State's needs.

There is also sufficient capability in the sector for the glass to be crushed for civil use. Utilising materials at their highest value for as long as possible is key in a circular economy. However, with limited domestic demand for glass production, glass sand is an important resource recovery end market. Glass sand is also one of the only end-uses for glass fines, small glass fragments that are difficult to recover with existing MRF and glass beneficiation infrastructure. Using glass sand will also reduce the need to quarry for virgin sand.

There have been Australian Government export restrictions in place for this material stream since January 2021, however the Victorian sector has low exports due to the costs of transporting glass overseas.

27 Capacity data assumes glass materials are processed at 'glass reprocessing – crushing and blast furnace' facilities.
28 Demand for glass beneficiation plants assumes that these facilities accept MSW recovered glass from material recovery facilities and household glass bins. Data also assumes a small quantity of demand from the C&I source sector.

Place-based assessment

The glass recycling market is currently highly centralised in the Port Phillip region, with 6 of the 7 reprocessing facilities, including the only glass-to-glass recycling facility and the 2 beneficiation facilities. The remaining facility is in the Barwon South West region.

The operation of glass-to-glass recycling manufacturing plants in Australia is limited with 3 large facilities operating in Victoria, Queensland, and SA. Victoria's existing capacity provided by a single recycler is expected to meet the State's future needs, however future opportunities for any emerging glass end markets should continue to be supported.

There is a potential opportunity for regional glass-crushing infrastructure that could be used in civil construction and would reduce transport costs.
This could take the form of partnerships between glass recyclers and sand/asphalt producers, where it is economical to do so with appropriate to local markets. Construction is a significant economic activity in each of Victoria's regions and provides a potential market for these materials[29]. Registrations with EPA Victoria for glass reprocessing facilities are evidence that some regional areas are working towards this.

3.4.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024–2026	2027–2029	2030–2032	2033–2035	2036–2038	2039–2041	2042–2044	2045–2047	2048–2050	2051–2053
Glass	71%	0.4	0.5										

Capacity is sufficient to meet the demand projections
[investment focus is optimising infrastructure]

Directions

- Ongoing: maximised bottle-to-bottle recycling from opportunities presented by the CDS and of glass-only kerbside collection, balanced consideration of regional capacity for glass crushing where economical to do so.

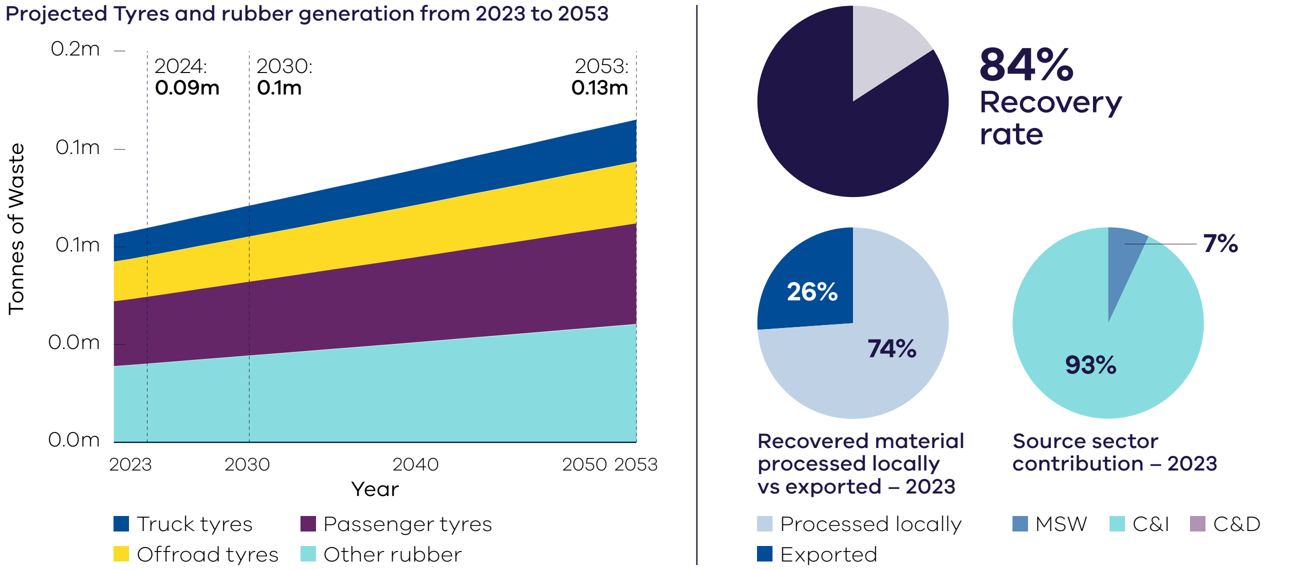
29 Demand for glass beneficiation plants assumes that these facilities accept MSW recovered glass from material recovery facilities and household glass bins. Data also assumes a small quantity of demand from the C&I source sector.

3.5 Tyres and rubber

3.5.1 Tyres and rubber waste trends

The tyres and rubber waste stream generated an estimated 0.1 million tonnes of waste in 2023. This is equivalent to 0.5% of Victoria's total waste generation. Figure 20 provides the projected waste trends for tyres and rubber in addition to its recovered fate and source sector contributions.

Figure 20 Projected tyres and rubber waste generation from 2023 to 2053 recovered fates and source sector splits from 2023



Tyres and rubber waste is expected to grow to 0.13 million tonnes by 2053, representing a 44% increase over the 30-year period. Other rubber[30] and passenger tyres respectively contributed to 37% and 31% to tyres and rubber generation in 2023. These proportions are expected to remain broadly unchanged over the next 30 years. Approximately 93% of tyres and rubber waste are from the C&I sector, and the remaining being from MSW.

The recovery rate of tyres and rubber waste was estimated to be 84% in 2023 with disposing of whole tyres in landfill banned in Victoria. Under the definitions used by the VRIP, most recovered tyres and rubber waste are processed locally (74%). However, much of this waste is subsequently exported after initial processing in Victoria to meet the export regulation requirements.

Passenger car tyres are primarily shredded and are exported to overseas end markets. Truck tyres may also be exported and are also reprocessed locally to make crumb rubber for use in the construction of Australian roads and other products such as soft fall matting. Off-the-road tyres from mining and heavy industry are primarily managed on-site.

30 "Other rubber" consists largely of mixed rubber.

3.5.2 Current infrastructure

There are 6 tyre reprocessors in Victoria, all in the Port Phillip Region (Table 7). These include facilities that reduces the particle size of end-of-life tyres to create rubber granules or crumb rubber products, and tyre derived fuel products for export.

Table 7 – 2023 Victorian tyre and rubber recovery infrastructure

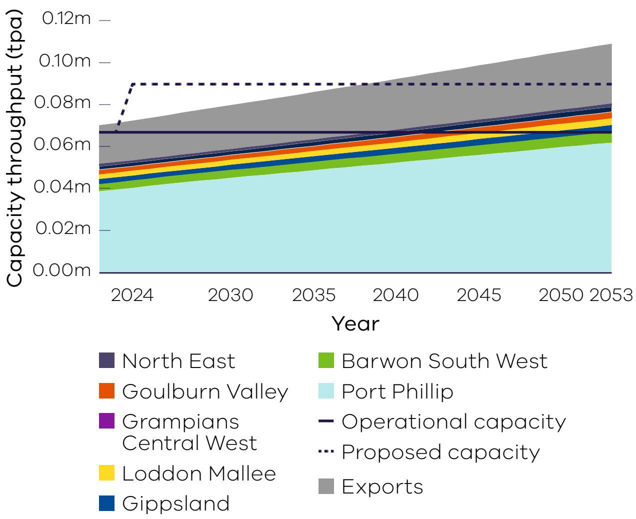
Region	Tyre Reprocessors
Port Phillip	6
Total	**6**

3.5.3 Tyre and rubber waste infrastructure needs

State-wide capacity

Figure 21 shows the capacity analysis for tyres and rubber. The existing capacity would be sufficient until 2037. Potential investment, if delivered, would be sufficient until 2053. Victoria currently exports an estimated 25% of this material stream without local reprocessing.

Figure 21 Tyres and rubber reprocessed in Victoria – projected demand and capacity[31]



Sensitivity analysis

With a recovery rate of 85% in 2023 and a relatively low volume of waste (compared to other material streams), the key variables for demand relate to export rates. The export rates are projected to be around 0.3 million tpa by 2053. With a high volume of tyres captured as domestically reprocessed in the VRIP analysis and subsequently exported, Victoria is reliant on overseas markets, with tyre derived fuels as the primary export market.

Should access to these markets decline, then the domestic market will need to absorb a greater volume of product. This could result in increased overall capacity requirements. Declining access to export markets could also increase capability requirements to be able to access domestic end markets.

State-wide capability

While the current recovery rate for this material stream is 84%, the overall circularity of tyres is limited, as there is no capability within Australia or overseas to undertake direct tyre-to-tyre reprocessing. Passenger tyres are primarily shredded as tyre derived aggregate/tyre derived fuel for export, while truck tyres are primarily reprocessed to make crumb rubber for domestic use on roads.

Federal export restrictions have increased the requirements to legally export tyres, increasing the capability required to access export markets. The 2024 Recycling Victoria Circular Economy Market Report found that national demand for crumb rubber on roads have trended downward.

There is an opportunity to increase the capability of infrastructure to achieve higher order use and more circular outcomes, such as further use of crumb rubber, including reprocessing passenger tyres for crumb rubber, which would require investment in fibre separation infrastructure (this may also require changes to end market specifications). Moving to higher order uses for crumb rubber could help mitigate reliance on export fuel markets. Thermal processing that enables the conversion of tyre materials to oil fuel is another potential opportunity. However, this technology is yet to be proven at scale in Victoria.

Having the capability to produce end products that meet market requirements at a reasonable price is an essential component of an effective recycling system. A lack of cost-efficient solutions can lead to stockpiling or dumping, even if there is enough infrastructure capacity to meet the demand. This is a significant issue given the potential hazards to the environment and human health caused by dumped and stockpiled tyres.

31 Capacity data assumes tyres and rubber waste is processed at rubber recycling, end-of-life tyres facilities and tyre-derived fuel facilities.

Place-based assessment

The market currently operates at a state-level with all current and projected activity in the Port Phillip region. The nature of the tyres and rubber market, with limited volumes and the importance of export markets, mean that regional facilities may face a challenge in generating the economies of scale needed to be commercially viable. With a centralised processing market, effective rural aggregation infrastructure and transport services are important for providing regional waste producers with cost effective options for disposal.

Tyre dumping is a challenge across the state, particularly in rural areas. However, the analysis suggest capacity is not the issue. Instead, it is the cost of recycling tyres that is most likely driving this behaviour. Improving infrastructure capability can help address this issue but this is a medium to long term prospect.

3.5.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 2026	2027 2029	2030 2032	2033 2035	2036 2038	2039 2041	2042 2044	2045 2047	2048 2050	2051 2053
Tyres & Rubber*	84%	0.1	0.1										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]

Directions

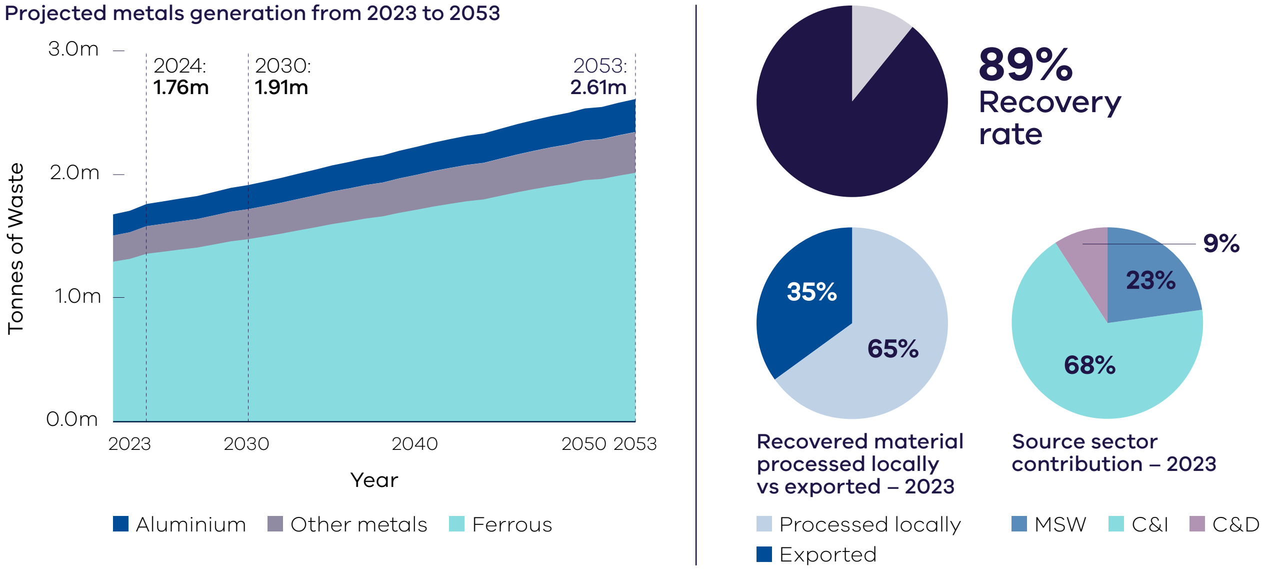
- Near term (0–6 yrs): Increased capability to respond to export restrictions and provide for higher order domestic uses such as crumb rubber; effective regional collection networks.
- Medium to long term (6–12+ yrs): Emerging technologies such as thermal processing for fuel oil, open end markets and improve material circularity, regional tyre recovery needs are considered.

3.6 Metal

3.6.1 Metal waste trends

In 2023, Victoria generated an estimated 1.7 million tonnes of metal waste, which contributed 9% of state-wide waste generation. Figure 22 illustrates the current and future projected waste generation for metals and its recovered fate and source sector contributions.

Figure 22 Projected metal waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



The metal waste stream is projected to grow by around 50% in the next 30 years, generating over 2.6 million tonnes of waste annually in 2053. The largest contributing material type in this stream is ferrous metals, which represented 77% of total metal waste generation in 2023, with other metals[32] and aluminium making up 13% and 10%, respectively. This waste stream is primarily derived from manufacturing, mining, and various other activities within the C&I sector.

Metal waste had the highest recovery rate in Victoria at 90% in 2023. A key driver of the high recovery rate for metal waste is the high commodity prices that can be achieved. Around 65% of recovered metal waste is processed locally, with the remainder being processed outside of Victoria.

32 "Other metals" consists largely of mixed metal, shredder feed, all other non-ferrous scrap and non-ferrous metals (excluding aluminium).

3.6.2 Current infrastructure

There are 12 large metals recovery facilities that reprocess metal waste through sorting and shredding to manufacture new recycled metal products, with 9 in Melbourne and one in Bendigo, Traralgon, and Geelong. There is one facility that reprocesses other metals to manufacture new recycled metal products, which is in Geelong.

Table 8 – 2023 Victorian metal recovery infrastructure

Region	Metals recovery
Port Phillip	9
Barwon South West	1
Gippsland	1
Loddon Mallee	1
Total	**12**

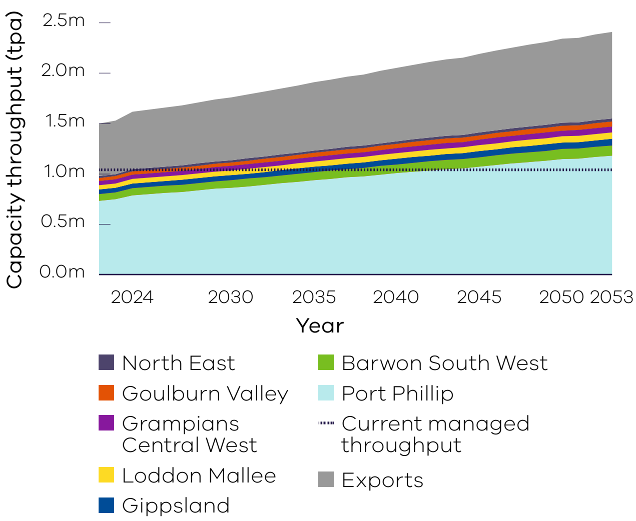
3.6.3 Metal waste infrastructure needs

State-wide capacity

Figure 23 shows the projected demand for metal reprocessing. With the high value of recycled metal materials, the metal reprocessing market has consistently had a recovery rate of around 90%. Throughput data shows there is sufficient capacity at present in the market to meet demand. As there is not sufficient data to make an accurate projection of the total infrastructure capacity currently in the market, the chart displays the additional demand that will be required above the current market throughput.

Exports play a significant role in the market. Victoria, like the rest of Australia, does not have local aluminium reprocessing capacity and so relies on the export market.

Figure 23 – Metals reprocessed in Victoria – projected demand and capacity



Based on this analysis, demand will increase by 193,000 tpa by 2035, and by 511,000 tpa by 2053. This represents the maximum potential additional capacity requirements needed to meet this demand. The sensitivity analysis section considers factors that could impact these projections.

Sensitivity analysis

The consistently high recovery rate for metals is not a significant variable for future demand. In total, local demand plus exports is projected to total nearly 2.5 million tpa out of a projected 2.6 million tpa of total waste generated.

The proportion of material exported has a greater potential impact on future capacity requirements, which are projected to reach around 0.9 million tpa in 2053. This is a potential opportunity to increase domestic reprocessing and expose Victoria to global metal markets. However, these markets are well established, with high value of materials, and storing metals until market conditions are favourable is less problematic than some other materials.

The additional capacity assessment is the upper boundary based on the projected waste generated, so the ability of current infrastructure to increase throughput will influence the additional capacity required.

State-wide capability

Metal recycling is a mature industry with the infrastructure capability required to meet market requirements. Victoria has an effective collection network that aggregates material, and there is more than 1 dominant recycler in the market which improves resilience. Waste generation and management have been relatively stable since 2009 –10[33].

Shredder floc, a solid waste output from the metal's recovery process continues to represent a challenge and higher-order recovery pathways should be explored.

Another opportunity to increase capability is for e-waste: metal is a key component in e-waste, electronics, and white goods. Currently, e-waste is counted by its component materials, primarily metals and plastics. However, improvements in the capability of reprocessing metal components are needed to address the rapidly growing waste stream. The specific capacity and capability requirements relating to e-waste are considered in the E-Waste and Emerging Materials section (Section 3.9).

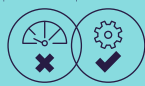
The CDS will create a new collection pathway for metal beverage containers. This may present opportunities for reprocessors to capitalise on the new material stream, including aluminium cans.

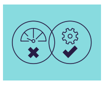
33 National Waste Report 2022: National Waste Report 2022 (dcceew.gov.au).

Place-based assessment

This material stream lends itself to a centralised operational model. State-wide capacity is largely supplied in the Port Phillip region. The costs of developing facilities and the required economies of scale make it challenging for regional facilities to be economically viable. The capacity required at a regional level is primarily sorting, aggregation and transport.

3.6.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Metals	 89%	1.7	2.6										



Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]

Directions

- Ongoing: Increased capacity as needed to meet future demand and, where economically viable, to replace exports with local reprocessing; increased capability relating to shredder floc and metals from e-waste.

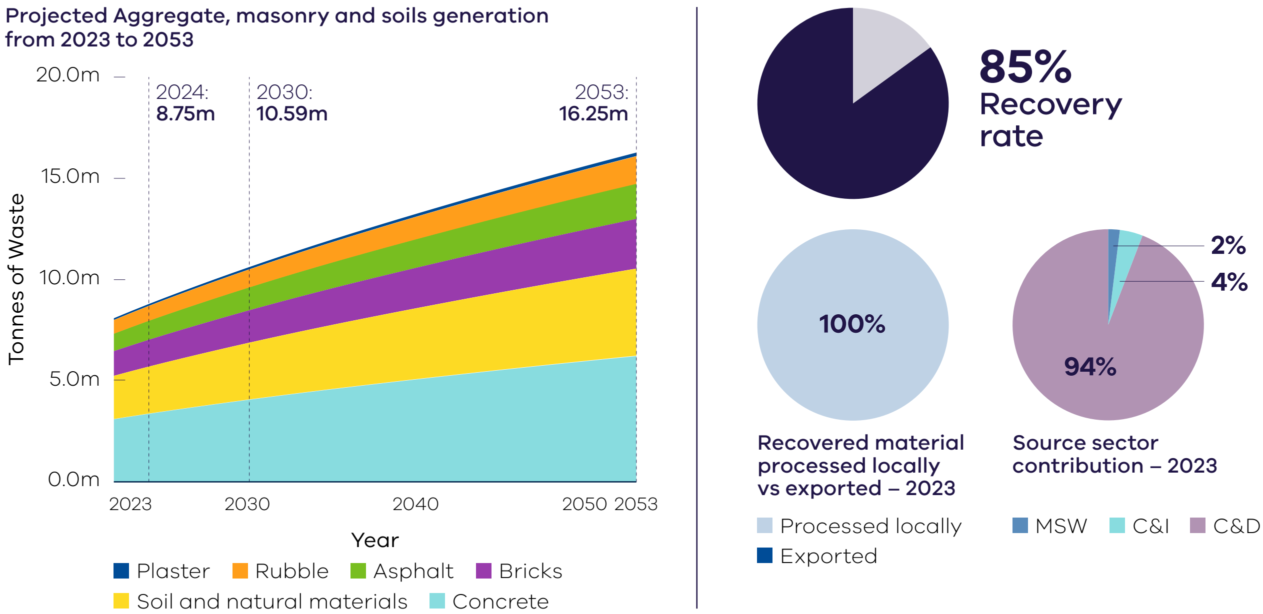
3.7 Aggregates, masonry, and soil

3.7.1 Aggregates, masonry, and soil waste trends

Aggregates, masonry, and soil is Victoria's largest waste stream by mass, representing 46% of all state-wide waste generation, with over 8 million tonnes of waste in 2023. Figure 24 provides the current and projected aggregate, masonry and soil waste generation and its recovered fate and source sector contributions.

Under the Victorian environment protection framework, soil with contaminants above specified thresholds or containing asbestos is classified as contaminated soil (a reportable priority waste). Soil with contaminants below these levels and that does not contain asbestos may be classified as fill material (an industrial waste). It is noted that most fill material does not enter the formal waste management system as it is either reused onsite or transported to fill sites which are outside the scope of this plan. This analysis captures the portion of soil, which is fill material that requires some degree of processing, typically because it is mixed with rubble or tree roots. Contaminated soil is dealt with separately as a component of hazardous waste.

Figure 24 Aggregates, masonry, and soil waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



This waste stream is projected to grow by 86% over the next 30 years to over 16 million tonnes annually by 2053. This growth is largely driven by activity in the C&D sector, including the Big Build infrastructure projects. Concrete, soils, and natural materials comprised 65% of aggregate, masonry, and soil waste generation in 2023, with the relative material type contributions expected to remain broadly similar through 2053.

An estimated 85% of the waste material from this stream was recovered in 2023. This high recovery rate is largely driven by aggregates, masonry and soil waste holding value for a range of applications, and the high landfill costs that can be avoided by reuse of the material with or without reprocessing.

Soil and other natural aggregates are important and limited earth resources. Currently, high demand for earth resources for construction, infrastructure and manufacturing is driving up the cost of virgin quarry materials and making recycled materials increasingly valuable as an alternative and potentially cheaper source of earth resources. All waste recovered from this stream is recovered locally in Victoria, which reflects the high transport costs that would be incurred if it was transported interstate or exported.

Excavated soil which is 'fill' as well as low level contaminated soil can sometimes be reused either directly at the site of origin, or in other specific locations with the appropriate EPA approvals. As this material typically does not enter the formal waste management system, it is difficult to estimate the volume of materials being reused through this mechanism. However, this represents a significant avenue through which soil can be diverted from landfills.

3.7.2 Current infrastructure

There are 49 reprocessing facilities in Victoria (Table 9). These facilities crush, sort, wash and/or screen aggregates, masonry, and soil waste such as concrete and brick into various recycled products. Victoria's current reprocessing facilities are dispersed across the state.

Table 9 – 2023 Victorian aggregates, masonry, and soil recovery infrastructure

Region	C&D waste recycling
Port Phillip	22
Barwon South West	4
Gippsland	14
Hume	4
Grampians Central West	3
Loddon Mallee	2
Total	**49**

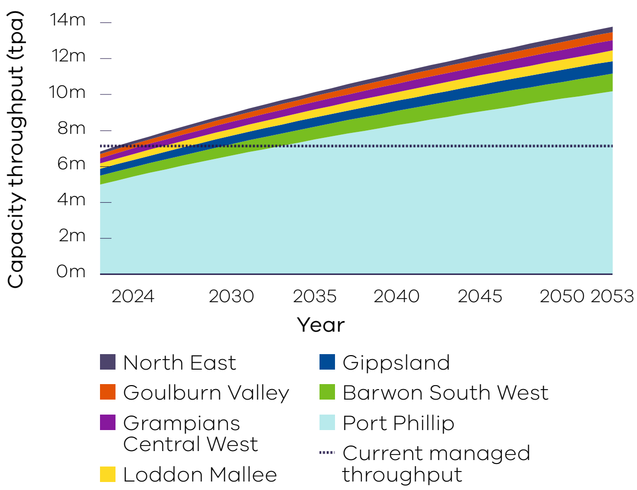
3.7.3 Aggregates, masonry, and soil waste infrastructure needs

State-wide capacity

Figure 25 shows the projected demand for aggregates, masonry, and soils reprocessing. Over the next 30 years the demand for Victorian reprocessing is projected to be nearly 14 million tpa out of a total generated waste of 16.25 million tpa.

With the retained value of reprocessed material and high landfill costs driving a strong local market and throughput data shows there is sufficient capacity at present in the market to meet demand. There is not sufficient data to make an accurate projection of the total infrastructure capacity currently in the market, so the chart instead displays the additional demand that will be required above the current market throughput.

Figure 25 – Aggregates, masonry, and soils reprocessed in Victoria – projected demand and capacity



Based on this capacity analysis, the additional demand from current levels is projected to be 2.9 million tpa by 2035, and 6.6 million tpa by 2053. This is the maximum additional capacity that may be required. The sensitivity analysis section considers factors that could impact these projections.

Sensitivity analysis

This material stream has a recovery rate of 85%, but the high volume of waste material means that the recovery rate is still an important sensitivity for future capacity needs.

The predicted demand by 2053 is around 14 million tpa out of 16.25 million tpa. This still leaves 2.25 million tpa that is not forecast to be recovered. That volume is larger than the total waste generated by many other material streams and is the second largest contributor to residual waste.

This presents an important opportunity to increase recovery rates beyond the demand projections. Addressing the volume of residual waste from this material stream through a combination of waste reduction, increased recovery rates, and increased diversion will be important to managing landfill capacity as set out in the Residual waste section (Section 5).

State-wide capability

The recovery rate of 85% suggests there are no significant capability shortfalls for aggregates and masonry. They have value in construction and the weight of the material attracts high landfill costs, leading to a high recovery rate. It also has low technology requirements for reprocessing. Masonry and aggregates are crushed, which could be at a quarry alongside virgin materials, or mobile facilities on-site.

Soil is an area where there is an opportunity to divert materials from landfills, noting that soil does not necessarily require infrastructure for reprocessing. Whether soil is contaminated or fill material will determine what approvals, duties and other requirements apply to the transport, management and (if appropriate) use of the soil.

The reuse of excavated soil is often constrained by logistical issues such as the lack of space and time to sort and temporarily store the material. One potential solution to this challenge is the use of strategically located soil banks, which are facilities that can be used for intermediate storage and testing of excavated soil and aggregates. The excavated material can be sorted, tested, and appropriately classified to determine its suitability for reuse. Where suitable, the reuse of waste soil or aggregates has the benefit of reducing the demand for mining of the virgin materials.

Another variation of the soil banking concept is the use of a 'virtual' soil bank. This may consist of some form of electronic register recording the location, timing, volumes, and quality of soil generated at project sites along with the timing and requirements of projects that require soil and aggregates to be used in landscaping. This would allow proponents to contact each other and coordinate potential reuse opportunities.

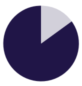
Facilitating the reuse of waste soils and aggregates means diverting these waste streams from landfills. Soil banks represent one of several potential options to support this outcome that may be considered in the future. As with any option to reuse waste material, it is important to ensure that appropriate controls are in place and that all regulatory requirements are met.

Place-based assessment

Aggregates, masonry, and soil waste are not transported long distances given their significant weight which makes transport relatively costly. As a result, there are regional reprocessing facilities to service this waste generation, with 22 facilities in the Port Phillip region and 28 facilities spread across the other regions.

There is high potential for regional circularity and local reprocessing capacity with high transport costs and low technological requirements for reprocessing. With construction being among the top employing sectors in each Victorian region[34], there is a high likelihood of viable local end markets.

3.7.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024–2026	2027–2029	2030–2032	2033–2035	2036–2038	2039–2041	2042–2044	2045–2047	2048–2050	2051–2053
Aggregate, Masonry & Soils	 85%	8.4	16.3										

Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]

Directions

- Ongoing: Increased capacity to meet future demand as required; best practice management techniques support the re-use of soils and increased diversion from landfill; increased infrastructure located near waste generation to support regional circularity.

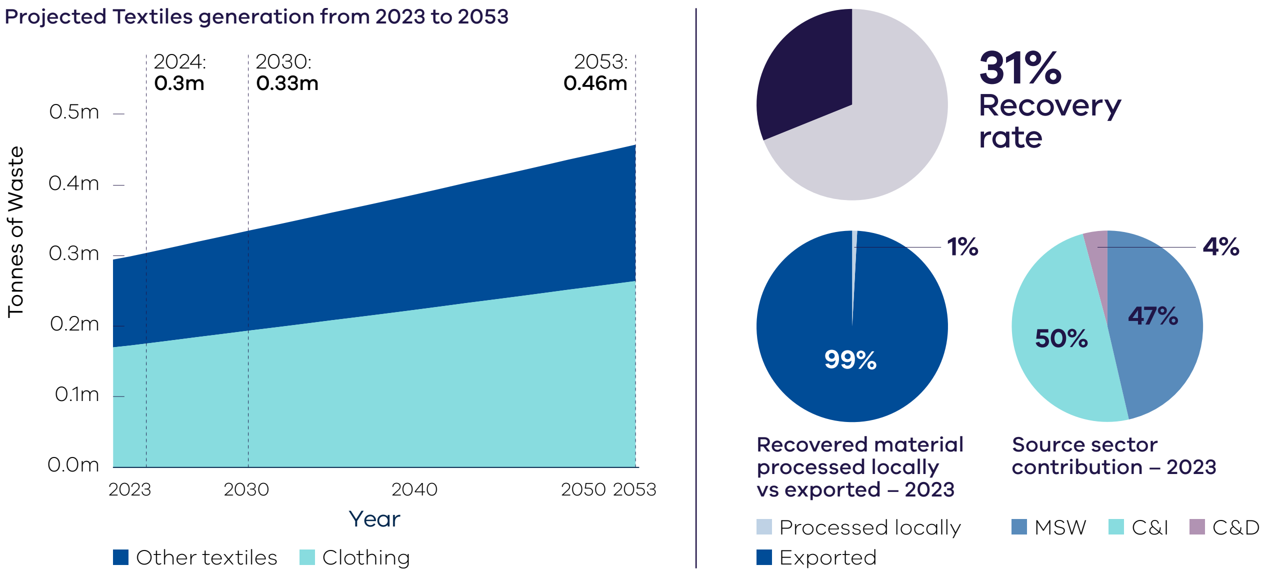
34 National Waste Report 2022: National Waste Report 2022 (dcceew.gov.au).

3.8 Textiles

3.8.1 Textile waste trends

Victorians were estimated to have generated almost 0.3 million tonnes of textile waste in 2023, representing around 2% of state-wide waste generation. Figure 26 provides the current and projected textiles waste and its recovered fate and source sector contributions.

Figure 26 Textile waste generation from 2023 to 2053 with recovered fates and source sector splits from 2023



The textile waste stream is projected to grow to over 0.4 million tonnes annually by 2053, which reflects growth of over 53% over the period. Textile waste material is relatively lightweight and therefore has relatively low transport costs. Textile waste comprises clothing and other textiles[35], representing a 58% and 42% contribution respectively in 2023. The 2 largest source sectors of textile waste are C&I and MSW, making up 95% of all waste generation in this stream.

Textile waste was estimated to have a recovery rate of 31% in 2023, with 99% of the recovered waste exported for reprocessing. There is currently a limited market in Australia for recovered textiles, with 127 Australian textile production businesses in Australia (IBISWorld, 2023).

3.8.2 Current infrastructure

Victoria has 2 facilities in the Port Phillip region that reprocess textiles waste into recycled fibre, and 2 mattress reprocessors (Table 10), including 1 mattress reprocessor in the Barwon South West region.

Table 10 – 2023 Victorian textiles recovery infrastructure (by waste stream)

Region	Textiles Reprocessing	Mattress Reprocessing
Port Phillip	2	1
Barwon South West	0	1
Total	**2**	**2**

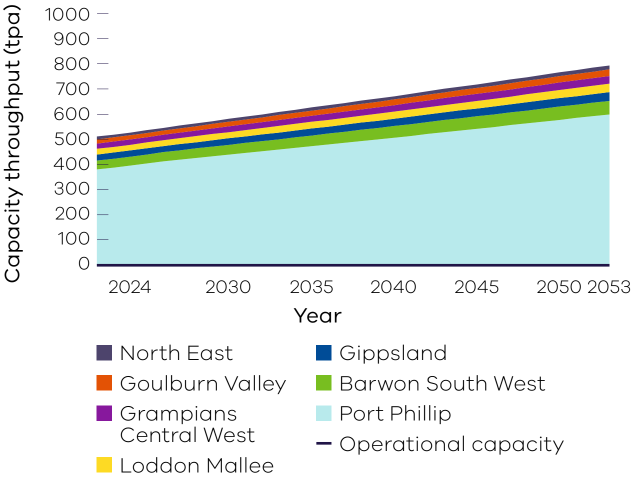
35 National Waste Report 2022: National Waste Report 2022 (dcceew.gov.au).

3.8.3 Textile waste infrastructure needs

State-wide capacity

Victoria is reliant on exports and sends most of its textile waste overseas for reprocessing. The local demand based on existing trends is projected to reach around 800 tonnes by 2053 (Figure 26).

Figure 27 Textiles reprocessed in Victoria – projected demand and capacity



However, rather than rely upon exports, Victoria may seek to reprocess textile waste domestically needing the following additional capacity:

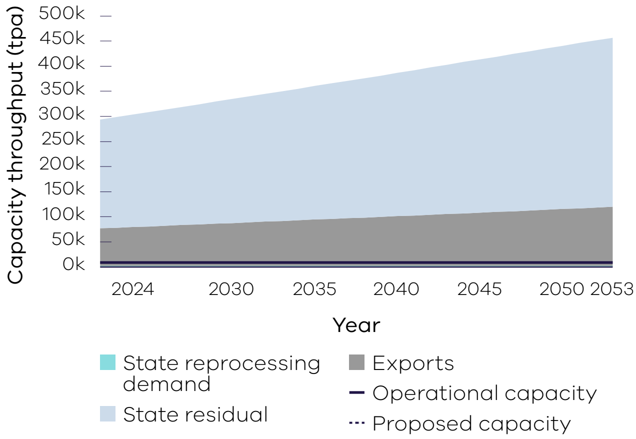
- By 2035: 27,000 tpa
- By 2053: 34,000 tpa.

Sensitivity analysis

The demand projections shown above are based primarily on current trends. Textile recovery rates are 31%, and this recovery rate is almost totally driven by exports. This means there is an opportunity to increase the recovery rates, which in turn would increase demand, and the recovery rates are a key variable in the analysis. The chart below (Figure 28) shows the capacity and projected local demand for resource recovery infrastructure, against the total projection for generated textiles waste.

The reliance on exports is another key variable in the capacity analysis. By 2053, 100,000 tpa is projected to be exported overseas. This means that Victoria is exposed to export markets, further demonstrating the opportunity to increase the local resource recovery rates.

Figure 28 Textiles – projected reprocessing demand, exports, and residual waste



State-wide capability

The recovery rate of 26% is almost wholly dependent on exports, which reflects the limited Victorian textile waste reprocessing capability. Apparel or fashion textiles make up the largest component of the waste stream, which also includes, bedding, carpet, soft furnishings, and mattresses. These present different challenges for recycling and include other materials along with textiles.

The quality of an original textile also impacts its longevity and capacity for re-use. The different types of textiles, such as polyester based fibres and natural fibres (for example, cotton, linen and wool) impact the potential and techniques required for reprocessing, and mixed/blended textiles require separating, (a more complex technology).

There are several methods of textile recycling that are tailored to the nature and fibre type of the recovered textile item[36]. These include:

- Mechanical fibre recycling, which involves shredding textiles into fibres that can be spun and repurposed. The shredding process shortens the length of fibres, deteriorating their quality, and precluding higher-value recycling pathways (e.g., clothing to clothing).
- Mechanical polymer recycling, which involves melting and extruding homogenous synthetic textiles.
- Chemical polymer recycling, where textiles are dissolved using a chemical solvent. The fibres are broken down to their raw polymer components, which can subsequently be re-extruded to form new fibre or other forms of plastic products.
- Chemical monomer recycling, where textile polymers are broken down into individual monomers that can be used to produce virgin-quality fibres.

36 (Ellen MacArthur Foundation, 2017).

Domestic textile reprocessing is generally limited to mechanical fibre recycling. After sorting out the reusable garments, the remaining unusable component is shredded and processed to make panels of felted fibre, which can be incorporated into products like insulation batts, acoustic panelling, cushion inserts and carpet underlay, or spun into new yarn to make new textile products such as rugs.

Although mechanical fibre recycling technologies are well established, there has been little success in commercially scaling up the recycling of the huge quantity and diversity of plastic fibre-based materials contained in textiles such as carpets and mattresses. A Victorian carpet recycler collects used carpets for reprocessing, but the chemical polymer recycling process occurs overseas. There are a limited number of facilities that separate steel, timber, and fibre from mattresses.

In comparison to other material streams, the challenge of recycling material could be considered as an emerging issue by consumers and industry, with a market still in development. Addressing the state's lack of capability is challenging due to the limited opportunities for local reuse and the relatively low product value.

Developments in textiles stewardship

A national voluntary clothing product stewardship, Seamless, has developed a roadmap that may help address some issues for clothing, including a 4% levy per garments to support circularity. Non-clothing textiles like carpets and mattresses presently have limited recycling options due to complexity of materials. There are capability challenges with all current recycling techniques – mechanical, mechanical polymer, chemical polymer, and chemical monomer recycling.

Place-based assessment

The textile reprocessing market operates at a state-wide level with only 2 known facilities. There are limited regional opportunities, and before increasing capacity, addressing capability issues is a crucial preliminary step. As the textile reprocessing industry is in its infancy, any new infrastructure may benefit from being in proximity to relevant supply chain partners either for access to domestic feedstock markets or to shipping ports for export markets.

3.8.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Textiles	31%	0.3	0.5										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Directions

- Near to medium term (0–12 yrs): Improved resource recovery options from new reprocessing technologies.
- Medium to long term (6–12+ yrs): Increased capability and capacity to support increased recovery rates.

3.9 E-Waste and emerging materials

Emerging waste types require forward thinking from the waste, recycling, and resource recovery sectors to develop sufficient infrastructure capacity and capability to properly manage waste flows. Non-hazardous waste types that have grown significantly in recent years or have the potential to do so in the future, are e-waste, clean energy infrastructure (which has some crossover with e-waste) and composites.

There is currently limited market data available on emerging waste streams to enable robust modelling of projections and capacity. This includes the fact that currently e-waste volumes are captured under other material streams (e.g. metal, plastic, glass). However, the VRIP has included the available quantitative analysis on waste generation, and a qualitative analysis of infrastructure needs.

3.9.1 E-waste

Waste trends

E-waste, any discarded item with a plug or battery, is the world's fastest-growing municipal waste stream. This is driven by increasing consumption of electric devices with relatively short life spans and by greater disposal of e-waste that was previously kept in homes as awareness of how to properly dispose of e-waste grows. Victorian e-waste generation is projected to increase at 2.7% per year from 2021 to 2035 (Figure 29).

> **In 2021, Victoria was estimated to have a net recycling rate of 60% for e-wastes.**
>
> (Randell Environmental Consulting, 2022).

There are mandatory product stewardship programs in place for certain 'established' e-waste materials such as televisions. However, with increasing diversity of e-waste, less than 20% of e-waste generated in Victoria is currently covered by a mandatory product stewardship scheme legislation. In 2025, this is projected to be less than 15% of all e-waste streams, partly due to the rapid growth of solar photovoltaic (PV) systems (solar panels).

Presently the 2 main approaches to e-waste recovery in Victoria involve either manual labour to disassemble e-waste into sub-components or mechanical reprocessing to shred e-waste into shredded outputs. Both approaches then on-sell the recovered resources for further downstream processing and recovery. There are also facilities that focus on reprocessing of specific items such as printer cartridges. In total there are 29 facilities in Victoria, with 25 of these in the Port Phillip region.

Emerging techniques include chemical processing such as acid baths, thermal processing, pyrolysis and gasification, or biological processing such as microorganisms, or nanotechnology such as crushing and pulverising into nanosized particles for feedstock.

Figure 29 Total E-waste generation projections in Victoria[37]

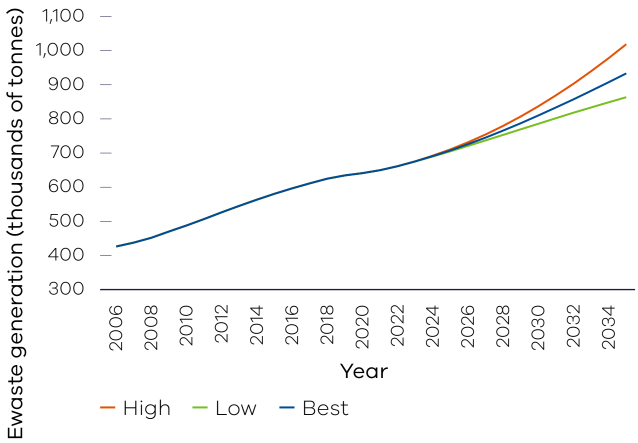
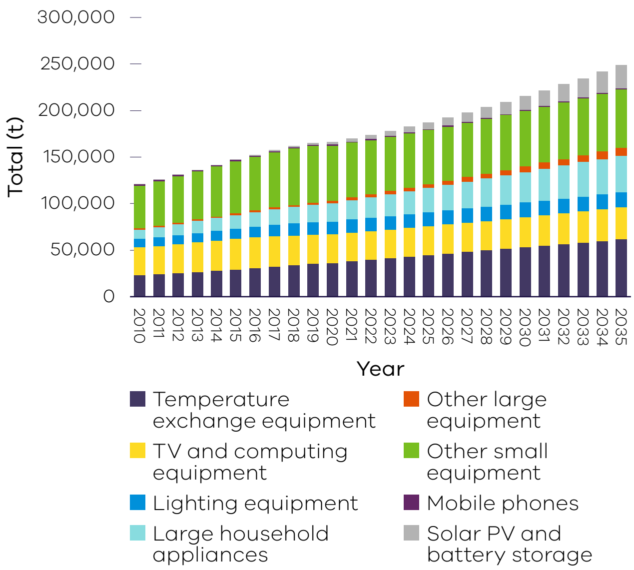


Figure 30 Generation of E-waste projections in Victoria by product group[38]



Australia is experiencing strong growth in e-waste, as one of the world's largest producers of e-waste per capita, ranking fifth in the world in 2019 (United Nations Institute for Training and Research, 2020). Temperature exchange equipment (e.g. refrigerators, air conditioners, heat pumps), large household appliances and other small equipment are the most significant growth material types for e-waste (Figure 30).

37 Source data: (Randell Environmental Consulting, 2022).
38 Source data: (Randell Environmental Consulting, 2022).

While e-waste contains hazardous substances such as mercury, it also contains valuable, recoverable materials, including critical minerals such as cobalt and tungsten. These materials can be recovered and used to produce new electronic devices or other equipment pivotal to Victoria's 2035 Emissions Reduction Target. E-waste has been banned from landfills in Victoria since 2019, increasing the need for reprocessing capacity. With increasing demand for critical minerals, recycled materials can play a significant role, even if recycling opportunities are modest at present. However, the e-waste definition includes a wide variety of products, including some e-waste items that have low material value where resource recovery may be technically challenging, cost-prohibitive or a combination of both.

Similarly, lithium-ion battery waste is growing rapidly, with lithium being another critical mineral. This is mainly due to large stationary electrical energy storage systems and the growing uptake of electric vehicles. Around 95% of lithium-ion battery components are recoverable for alternative use, yet only 10% were recycled in 2021 (CSIRO, 2023). Embedded batteries are also a growing waste stream that present significant challenges for recycling.

Incorrect disposal of e-waste can not only result in a reduction in valuable materials being recovered from e-waste but can also result in contamination of other waste streams and a reduction in the resource recovery potential (the impact is not limited just to e-waste itself). Small, embedded batteries appear to be an increasing hazard here as these are often difficult to remove and hard to identify in mixed waste loads. This can result in increased fire risk at waste facilities and during waste collection, transport, and disposal.

Emerging e-waste infrastructure needs

For e-waste products such as white goods, there are established processes for recycling. From a resource recovery centre, or through separate e-waste collections, the material goes to manual or mechanical processing to break e-waste down into its component parts, which are then reprocessed domestically or exported. The infrastructure requirements for reprocessing these component parts are considered under the relevant material streams sections (see Section 3) in the VRIP such as metals, plastics, glass, and hazardous waste.

However, as e-waste becomes increasingly complex, with high value components, these existing processes become less appropriate. Research is underway in Australia and throughout the world to improve techniques and processes to recover hazardous and high-value materials contained within e-waste. This includes chemical, thermal, nanotechnology, and biological processing.

For batteries, the voluntary battery stewardship scheme commenced in 2022 and does not cover large PV system lithium-ion batteries or embedded batteries. Around 95% of lithium-ion battery components are recoverable for alternative use, but there is a capacity and a capability gap as the technology is still developing.

At present Victoria does not have well developed battery collection services and has limited reprocessing capabilities. Victoria has the only lithium battery processing facility in Australia, noting that end markets for lithium battery derived products are immature compared to other recycling markets.

This is another waste stream where downstream recycling alone may not be sufficient. Education, enhanced collection mechanisms, better product design and improved technologies to improve the recovery of valuable materials in e-waste will all assist to achieve better outcomes.

The Australian Government has committed to developing a mandatory product stewardship scheme to reduce waste from small electrical products and solar PV systems. This is expected to reduce waste going to landfill and increase resource recovery and provide access to recycling services throughout Australia.

Developments in E-waste and battery reprocessing

Battery Pollution, an Australian battery recycling startup, has developed technology capable of recovering metal materials from batteries. Through shredding and reprocessing machinery, alongside robotics and chemical systems, lithium-ion batteries are reprocessed into their material components. This process directly targets the growing demand for sustainable cobalt, lithium, and nickel to be reused in battery cell manufacturing alongside other applications.

3.9.2 Renewable energy generation

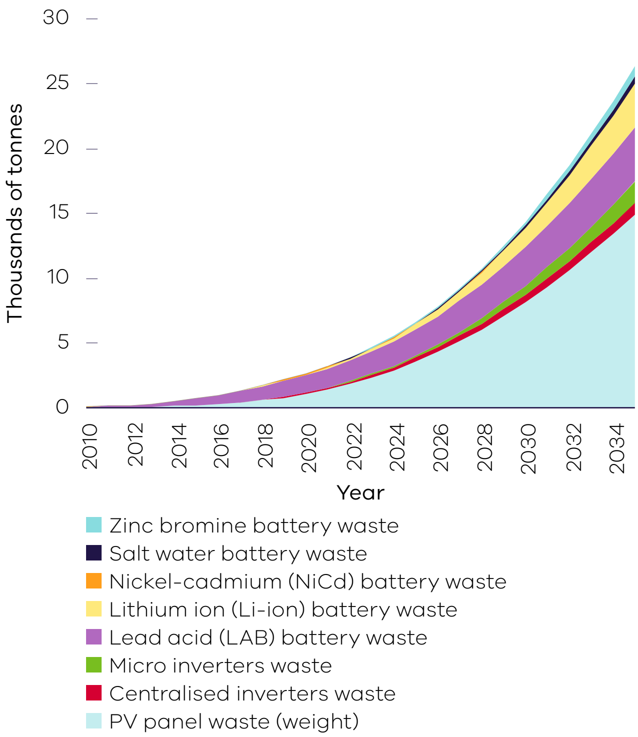
Waste Trends

Victoria's transition towards clean energy creates another source of economic activity that will increasingly contribute to waste generation over the coming decades[39]. Victoria is likely to experience growth in resource-rich waste from end-of-life clean energy infrastructure, such as wind turbines, solar PV panels, and batteries. This reflects the average 20-year lifespan of wind turbines and solar panels, which means that significant decommissioning is expected over the next 30 years (TWI, 2020) (Sustainability Victoria, 2023).

39 Due to its emerging nature, there is limited data collection for waste generated by clean energy infrastructure.

Materials in solar PV panels and wind turbines are also valuable and recyclable. However, these currently pose challenges being recycled commercially (TWI, 2020). The volume of end-of-life PV panels in Victoria is projected to increase very significantly from 1.5 to 15 thousand tonnes per year (or 85,000 to 900,000 panels). This represents a compound annual growth rate of 17%. These projections are set out in the chart below, which also includes waste from inverters and batteries associated with PV systems (Figure 31). Victoria currently has a single local PV system for Li-ion battery reprocessing (Envirostream).

Figure 31 Victoria's PV System historical, current, and projected waste generation[40]



Developments in e-waste and clean energy infrastructure recycling

It is estimated that by 2035, Victoria will have generated 187,000 tonnes of solar panel waste (Infrastructure Victoria, April 2020). Research from Deakin University is supporting the reprocessing of solar panels. Research has led to technology that extracts silicone from solar PV waste streams and reprocesses the material for reuse. Deakin University partnered with Delaminating Resources and Close the Loop to demonstrate the capacity for the reprocessed silicone to be used in a range of applications in the electronic and energy storage industries.

Emerging infrastructure needs

Victoria's transition towards clean energy creates another source of economic activity that will increasingly contribute to waste generation over the coming decades. Victoria is likely to experience growth in resource-rich waste from end-of-life clean energy infrastructure, such as wind turbines and solar photovoltaic panel batteries (as well as lithium-ion batteries which are considered in the VRIP under e-waste).

The average lifespan of wind turbines and solar panels is 20 years and significant decommissioning is expected over the next 30 years. Materials in solar PV panels and wind turbines are valuable and recyclable but they currently pose challenges to being recycled commercially.

PV panels: Victoria lacks an established and proven capacity to process PV panels beyond stripping them of recyclable components, such as aluminium frames. Research has led to a technology that extracts silicone from solar PV waste streams and reprocesses the material for reuse.

Wind turbines: Approximately 85–94% of a wind turbine (by mass) is recyclable, however they are difficult and expensive to recycle and blade recycling is not yet commercialised or competitive. Significant capacity will be needed in the future, but further research and development is needed to develop the capability and technology that can operate at the required scale as waste streams increase.

Place-based opportunities: While domestic solar is becoming increasingly popular and will provide a waste stream in urban areas, most large-scale generation will occur in regional rural locations. Victoria's Climate Change Strategy identifies 6 Renewable Energy Zones (Figure 32) and the most prevalent type of generation expected in each. With the 20-year lifespan, as capability grows there is an opportunity to match infrastructure capacity with the supply of waste.

40 Source: https://assets.sustainability.vic.gov.au/susvic/Report-Waste-PV-system-materials-flow-analysis-public.pdf

Figure 32 Victoria's Renewable Energy Zones

New major transmission links under development

INTEGRATED SYSTEM PLAN

Western Renewables Link (WRL)

PROPOSED ROUTE

New 190 km high voltage overhead transmission line from Sydenham to Bulgana in Victoria's west.

VNI-West

AREA OF INTEREST FOR CURRENT PREFERRED PROJECT OPTION 5A (TO BULGANA)

New high voltage overhead transmission line connecting Victoria and NSW. Option 5A connects WRL (at Bulgana) with EnergyConnect (at Dinawan) via a new terminal station near Kerang, and crossing the Murray River north of Kerang.

MarinusLink

PROPOSED ROUTE

New 1500 MW undersea and underground electricity connection to further link Tasmania and Victoria.

REZ DEVELOPMENT

Offshore Wind Transmission

AREA OF INTEREST FOR OFFSHORE WIND CONNECTION POINTS

Development of transmission infrastructure to provide coordinated connection points for offshore wind developers in Gippsland and Portland.

3.9.3 Composite materials

Emerging waste trends

Composite materials such as carbon fibre and polymer blends are extensively used throughout the automotive, construction and manufacturing sectors for their strong yet lightweight characteristics. These materials are often bonded with other materials to enhance the material's resistance to heat and corrosion. There is strong global demand for composites such as carbon fibre (Deakin University, 2023). Given the complex composition of these products, with multiple materials that are strongly bonded, they are difficult to separate and recover. Furthermore, the high costs associated with recovering these materials make recycling a less economically attractive option.

Emerging infrastructure needs

While wind turbines will be a key contributor to increasing composite waste, it is not the only industry, their use is prevalent in the aerospace, maritime, vehicle manufacturing and construction industries. While options are limited at present, research from Sydney University suggests that methods such as solvolysis, whereby materials can be broken down with an application of solvent under a specific pressure and temperature, and thermal recycling methods such as catalytic pyrolysis and pyrolysis coupled with oxidation, could provide recycling options that achieve an economic return. Solvolysis and electrochemical methods were also shown to lead to substantially lower CO_2 emissions into the atmosphere than landfilling and incineration[41]. While there are no options ready for scale at present, there is an opportunity to develop the capability and undertake material stream analysis to develop the capability and capacity needed to meet future needs.

Other Materials

As the VRIP is updated every 3 years, continued horizon scanning will be important to identify emerging waste streams before they become an issue resulting in large volumes of waste reaching the end of life without sufficient capability and capacity to be managed effectively.

An additional emerging waste EPA Victoria is aware of is manufactured stone materials (containing silica dust). Several bans on the use of this type of material have either been introduced or are being considered. As such, there will likely be significant volumes of this, whether post-use materials or stock that is no-longer usable, needing disposal or processing (noting the significant human health risks may classify processing to not be appropriate).

3.9.4 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024–2026	2027–2029	2030–2032	2033–2035	2036–2038	2039–2041	2042–2044	2045–2047	2048–2050	2051–2053
E-waste & Emerging Materials	60%	0.2	TBD (0.2 in 2035)										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Directions

- Near term (0–6 yrs): Increased capability to recycle e-waste and batteries, new technology solutions for recycling zero-carbon waste.
- Medium term (6–12 yrs): Increased capacity for e-waste, increased capability for net zero carbon waste, any new emerging waste streams mapped.
- Long term (12+ yrs): Increased capacity for net zero carbon waste, any new emerging waste streams mapped.

41 The looming 840,000 tonne waste problem that isn't single-use plastics – The University of Sydney.

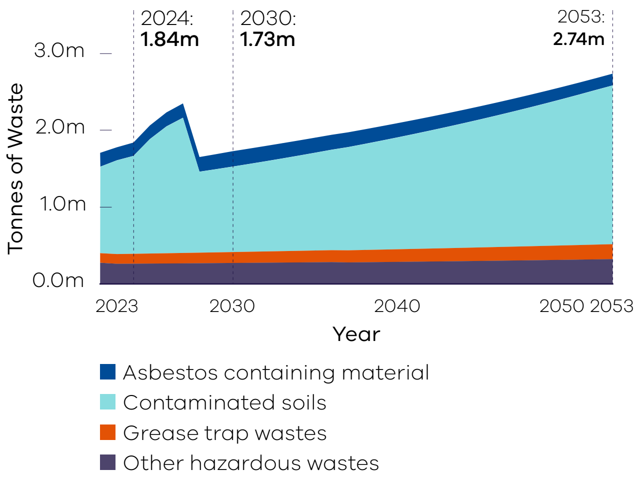
3.10 Hazardous waste

3.10.1 Hazardous waste trends

For the purposes of the VRIP, 'hazardous wastes' refers to wastes regulated as reportable priority wastes under the EP Act. These wastes require the highest level of control. Reprocessing of many hazardous wastes operates on a national level to best utilise specialised technology and economies of scale. However, some hazardous waste, such as asbestos containing material, can only currently be disposed of in landfill. Convenient regional and metropolitan access to disposal options is required to support safe removal, transport and disposal of asbestos and prevent illegal dumping.

In 2023, Victoria generated 1.78 million tonnes of hazardous waste, representing 10% of state-wide waste generation. Hazardous waste generation is projected to decrease slightly to 1.73 million tonnes by 2030, before increasing to approximately 2.74 million tonnes by 2053. Figure 33 provides the current and projected hazardous waste for the next 30 years.

Figure 33 Projected hazardous waste arisings from 2023 to 2053



Contaminated soil is the largest component of hazardous waste by volume and made up almost 69% of all hazardous waste arisings in 2023. Contaminated soil is also a significant contributor to residual waste (see section 5.1). Contaminated soils are expected to increase to approximately 76% of the waste stream by 2053. The projections above include high level estimates of contaminated soil generation from future government infrastructure projects based on the best information available at this time.

The projected reduction in contaminated soils between 2025 and 2026 reflects the anticipated completion of on-going Victorian infrastructure builds such as the Metro Tunnel Project. The projections were in 2023, and they do not include projections for the Suburban Rail Loop, or potential infrastructure projects that could receive future funding.

In 2023, other hazardous wastes (consisting largely of waste oils, oils and paints, resins, inks, organic sludges and clinical waste) made up 15% of hazardous waste arisings, with asbestos containing material comprising a further 10%.

Per – and polyfluoroalkyl substances (PFAS) contaminated soils are increasing in waste. The sources of PFAS contamination are industrial discharges and improper disposal of products containing PFAS. This waste presents a health and environmental concern, with the potential for the chemical to enter the food chain and water supply.

The industrial treatment residue waste type is expected to grow by around 17% over the next 10 years[42]. This waste type is expected to grow further following the expected commissioning of waste to energy facilities in the future.

Biosolid waste, is an increasing stream of hazardous waste. It contains contaminants such as heavy metals and, at times, Persistent Organic Pollutants (POPs). High levels of these contaminants could cause public health-related concerns.

3.10.2 Current infrastructure

In Victoria, there are currently 76 facilities dedicated to managing hazardous waste, predominantly concentrated in Melbourne, with clusters situated in the South East, North, and West regions of the city. These facilities are for the treatment and reprocessing of residual waste. The infrastructure for the disposal of residual hazardous waste is considered in the Residual waste section (Section 5).

3.10.3 Hazardous waste infrastructure needs

State-wide capacity

There is currently sufficient capacity to meet demand for most hazardous waste treatment and disposal in Victoria. It is projected that clinical waste treatment facilities will have sufficient capacity to meet demand until 2050, noting that by 2053 a capacity gap of 678 annual tonnes will need to be met (Table 11).

42 However, the modelling in the VRIP does not consider the further arisings of bottom ash from the additional waste to energy facilities that will become operational in the future.

Table 11 Hazardous waste infrastructure in Victoria – type of facilities and projected year arisings exceed capacity[43]

Hazardous waste management method	Hazardous waste infrastructure type	Projected year that arisings exceed capacity
Recycling	Alternative fuels facility (liquids)	Beyond 2053
	Mercury facility	Beyond 2053
	Oil refining facility	Beyond 2053
	Hazardous waste de-packaging facility	Beyond 2053
Treatment	Chemical physical treatment plant	Beyond 2053
	Soils thermal treatment facility	Beyond 2053
	POP destruction facility	Beyond 2053
	Oil/water (OWT) treatment facility	Beyond 2053
	Clinical waste treatment facility	Beyond 2053
Disposal: Thermal destruction	Clinical waste thermal destruction facility	2050

State-wide capability and place-based assessment

Many hazardous wastes operate on a national level due to specialised technology or economies of scale. Hazardous waste reprocessing capability or disposal is limited in a few areas, including asbestos, contaminated soils, clinical waste and solvents and paints.

- **Asbestos:** Limited access to asbestos disposal options leads to challenges with the management of asbestos waste. Local asbestos disposal points enabling the temporary storage and consolidation of small quantities of asbestos prior to landfill disposal are necessary to ensure safe disposal is widely available and to reduce the occurrence of illegal dumping. As landfill is the only disposal option currently for asbestos, regional and metropolitan landfill capacity is important to support safe and cost-efficient asbestos disposal.
- **Contaminated soil:** Contaminated soil is sometimes disposed of in landfills despite available reprocessing capacity. Issues such as cost, distances to treatment facilities, project timing constraints and characteristics of the materials may make landfills a more convenient option. This could be mitigated by improving the capacity for processing contaminated soil such as by establishing additional facilities in strategic locations to reduce transportation costs. There are currently 4 soil thermal treatment facilities, all located in Melbourne. There are also 2 soil washing facilities which are classified as chemical physical treatment facilities. In addition to this there are businesses which provide in situ soil remediation services.
- **Clinical waste:** Reprocessing capability was not prepared to manage the high volumes of clinical waste generated due to the COVID-19 pandemic. The system is recovering from being overwhelmed during the pandemic, with new capacity coming online. However, the high volumes during the pandemic highlighted capability constraints in clinical waste reprocessing and its ability to cope with surge events.
- **Solvents:** The 2019 Campbellfield factory fire was a major market disruption with adverse impacts on the environment, industry, and community. The system is recovering, but the result of the fire means that, at the time of VRIP publication, Victoria has a single point of dependency on a single facility, located in Ordish Road, Dandenong, for reprocessing solvents and other hazardous waste from paint, and there is potential to increase system capability and resilience.
- **PFAS and biosolid waste:** PFAS contaminated soils are an emerging hazardous waste stream, as biosolids with emerging contaminants are an increasing challenge for biosolid waste. There is a current capability shortfall, particularly for biosolids where most technologies identified for future management of biosolids – such as generating biochar – are still in the trial phase.

43 Hazardous waste infrastructure is assessed based on material arisings and the amount of material anticipated to be sent to processing facilities as either management pathways or end fates. Hazardous waste infrastructure capacity assumes that hazardous material arisings are proportionate to the infrastructure it is received at based on 2020-21 waste transport certificates.

3.10.4 Overall assessment

The following assessment specifically addresses hazardous waste higher order recovery, short-term storage, and thermal destruction. An assessment of landfill capacity and capability can be found in the residual waste section.

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Hazardous waste	n/a	1.4	2.7										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]

Directions

- Ongoing: Increased capability (and any subsequent capacity) is needed to increase system resilience, respond to surge events, and to address specific / emerging waste stream needs (e.g. soils, asbestos, clinical waste, solvents, PFAS and Biosolids).

4 Recovery and transfer infrastructure

4.1 Resource recovery centres and transfer stations

Resource Recovery Centres (RRCs) and transfer stations are facilities that receive and recover reusable and recyclable materials otherwise destined for disposal. RRCs and transfer stations provide a fundamental role in the waste and recycling system by aggregating, sorting, and consolidating materials to make them available for recycling or reprocessing in Melbourne, regional Victoria, or interstate.

A RRC can be combined with a waste transfer station and may include a resale centre. Victoria has 271 RRCs and transfer stations distributed across the state. In the Port Phillip region, RRCs and transfer stations are mainly managed by private operators, with some local government ownership and operation. In Regional Victoria, these facilities are predominantly owned and operated by local government. It is expected that RRCs will have sufficient capability to manage material flows until 2053.

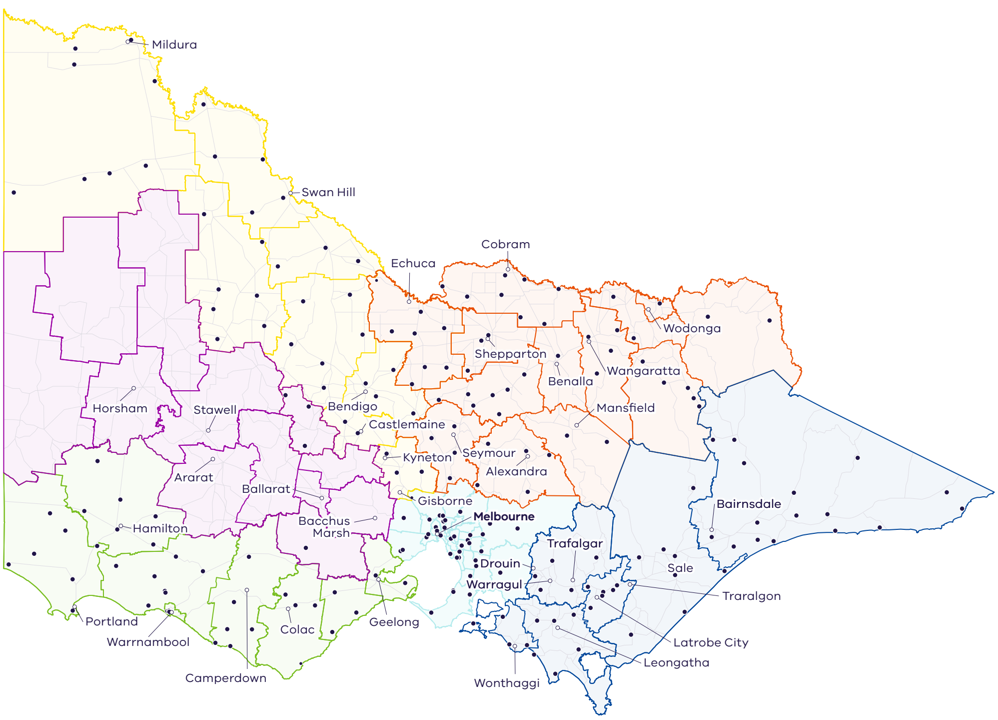
Whereas most reprocessing infrastructure is clustered around metropolitan Melbourne, recovery infrastructure is spread evenly across the state. Many of the recovery infrastructure sites are small, local RRCs. These often serve as points of aggregation for materials to transport to another facility for processing. Resource recovery centres, particularly in regional and rural areas, generally service a local population catchment and provide the local community who are unable to be serviced by a kerbside service with an appropriate means to dispose of their household waste and recyclable materials as well as materials not accepted through kerbside collection services (such as tyres, e-waste and chemical drums).

Over the next 30 years, Victoria's extensive RRC and transfer station network will play a key role in facilitating resource recovery, particularly for material streams with centralised reprocessing as they play a vital role in supporting the consolidation, aggregation and transfer of materials that would otherwise go to landfills.

It is expected that RRCs and transfer stations will have sufficient capability to manage material flows until 2053 however as some landfills reach capacity over the 30-year horizon of the VRIP, it is anticipated that these recovery and transfer facilities will play a critical role in aggregating materials for further recovery efforts or management through waste to energy or disposal to other landfills.

Many local government owned recovery and transfer facilities throughout regional Victoria will face challenges as the infrastructure ages, population patterns change impacting community service provision, and ongoing operating overheads increase, pointing to opportunities to consolidate or rationalise these assets and invest in fewer but improved facilities servicing larger catchments.

Figure 34 Victorian Resource Recovery Centres and transfer stations



Regions

- Barwon South West
- Gippsland
- Hume
- Grampians Central West
- Loddon Mallee
- Port Phillip Region

• Resource Recovery Centre

Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

4.2 Material recovery facilities

Material recovery facilities (MRFs) sort, process and recover materials, particularly plastics, glass, paper, and metal material streams from commingled recyclables streams to turn into viable feedstock for reprocessing. There are 12 MRFs in Victoria, 6 in Port Phillip and 6 in other regions, reflecting the wide-spread need of sorting waste before transporting to its appropriate reprocessing/disposal facility (Table 12).

Table 12 2023 known Victorian recovery infrastructure

Region	Materials recovery facility
Port Phillip	6
Barwon South West	0
Gippsland	3
Hume	2
Grampians Central West	0
Loddon Mallee	1
Total	**12**

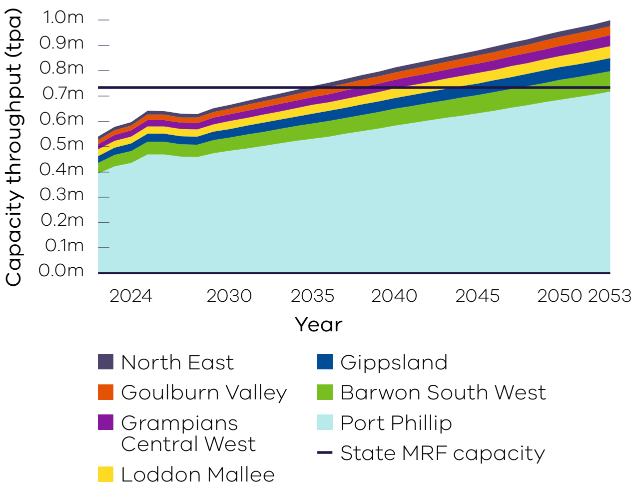
4.2.1 Material recovery facilities infrastructure needs

There are expected to be state-wide shortfalls in Victoria's MRF capacity with opportunities to establish MRFs outside the Port Phillip region. While lifting capacity is the key priority, there is a need to improve sorting capability at these facilities.

State-wide capacity

There is currently sufficient state-wide capacity for throughput of waste at MRFs. However, it is projected that demand will exceed capacity at MRFs from 2034. By 2053, 266,000 additional tonnes of capacity are projected to be required across the State.

Figure 35 Waste throughput at MRFs – projected demand and capacity[44]



Based on this capacity analysis, the investment in additional capacity requirements is set out below. The sensitivity analysis section considers factors that could impact these projections.

- 2035: 6,000 tpa, an increase of 1% over current capacity
- 2053: 266,000 tpa, an increase of 36% over current capacity.

Capacity sensitivity analysis

The key uncertainty relating to future infrastructure requirements is the impact of export restrictions on both the demand and the capability requirements.

Another sensitivity is the potential impact of higher recovery rates for relevant material streams, primarily plastics, paper and cardboard, and glass. It is not a direct correlation as MRFs primarily handle kerbside collections and the CDS is now in operation for eligible containers, but a significant increase in recovered volumes above projections would have a flow on impact on the need for MRF capacity, throughput, and storage capability.

44 Capacity data at MRFs assumes that these facilities accept comingled household materials, including paper and cardboard, plastics, glass and metals. This amount was inflated by 5% to approximately account for C&I waste.

State-wide capability

MRFs are a key part of the recycling system. They recover glass, paper and cardboard, metals and plastics through manual, mechanical and optical sorting approaches. Glass is sorted by colour, paper and cardboard are sorted by type, metals are sorted by ferrous and non-ferrous, and plastics are sorted by polymer type[45]. These recovered materials are then sold to dedicated materials reprocessors domestically or sold for export. As the key entry point into the recycling system for these materials, MRFs can be exposed to changes in material markets if they can no longer find avenues to sell materials, which occurred with the government of China's National Sword ban in 2018.

The Federal export restrictions on plastics and restrictions on paper and cardboard are likely to increase capability requirements for better sorting at MRFs as lower quality, mixed materials can no longer be exported.

Improvements in sorting capability at MRFs have the potential to maintain valuable markets by increasing the value of materials through recovering improved quality of single material streams and reducing contamination. This is important following the introduction of export restrictions.

As consumer participation increases in Victoria's CDS, the composition of material flows through MRFs is expected to change as food grade plastic, glass and metal containers are diverted through the dedicated CDS refund collection point network. This may also increase the need for better sorting of high grade, low contamination waste diverted to other collection routes.

However, there are benefits to MRFs as the CDS will also provide MRFs with a refund payment for eligible containers that are recovered by MRFs through kerbside services and council drop off services. Additionally, the introduction of the CDS and of separate municipal glass services (such as a dedicated kerbside bin for glass, and dedicated community glass drop off services) may further assist MRFs by reducing the amount of glass going through these facilities and relieving the constraint this material can have on MRFs and the potential to contaminate other materials with broken glass shards.

Place-based analysis

There is currently 12 MRFs in Victoria. The Port Phillip region has 6 of Victoria's MRFs, 2 in the West located at Truganina and Laverton North, 2 in the North at Coolaroo and Heidelberg, and 2 in the South East at Springvale and Dandenong South. These collectively represent over 75% of Victoria's MRF capacity.

Figure 36 presents the locations of Victoria's MRFs. There are currently no MRF facilities in the Grampians Central West or Barwon South West region, and no MRF facilities west of Bendigo. There is also a MRF located in Albury, NSW that services some Victorian generated waste. The distribution of the state's MRFs means that the closure of existing facilities could place pressure on state-wide capacity and the system's capability to meet regional needs.

There are sufficient regional waste flows across a region to deliver the economies of scale needed to support MRFs. With the right market conditions regional MRFs can improve efficiencies and reduce waste transport costs. This points to opportunities to increase regional capacity, and to be economically feasible, MRFs require sufficient throughput to deliver economies of scale which is strengthened through the consolidation of waste streams.

45 Sorted plastics are predominately by PET (1), HDPE (2), and mixed plastics (generally bales known as either 2:2:6 bales (20% PET, 20% HDPE, 60% other) or 4:4:2 (40% PET, 40% HDPE, 20% other).

Figure 36 MRFs in Victoria, 2023

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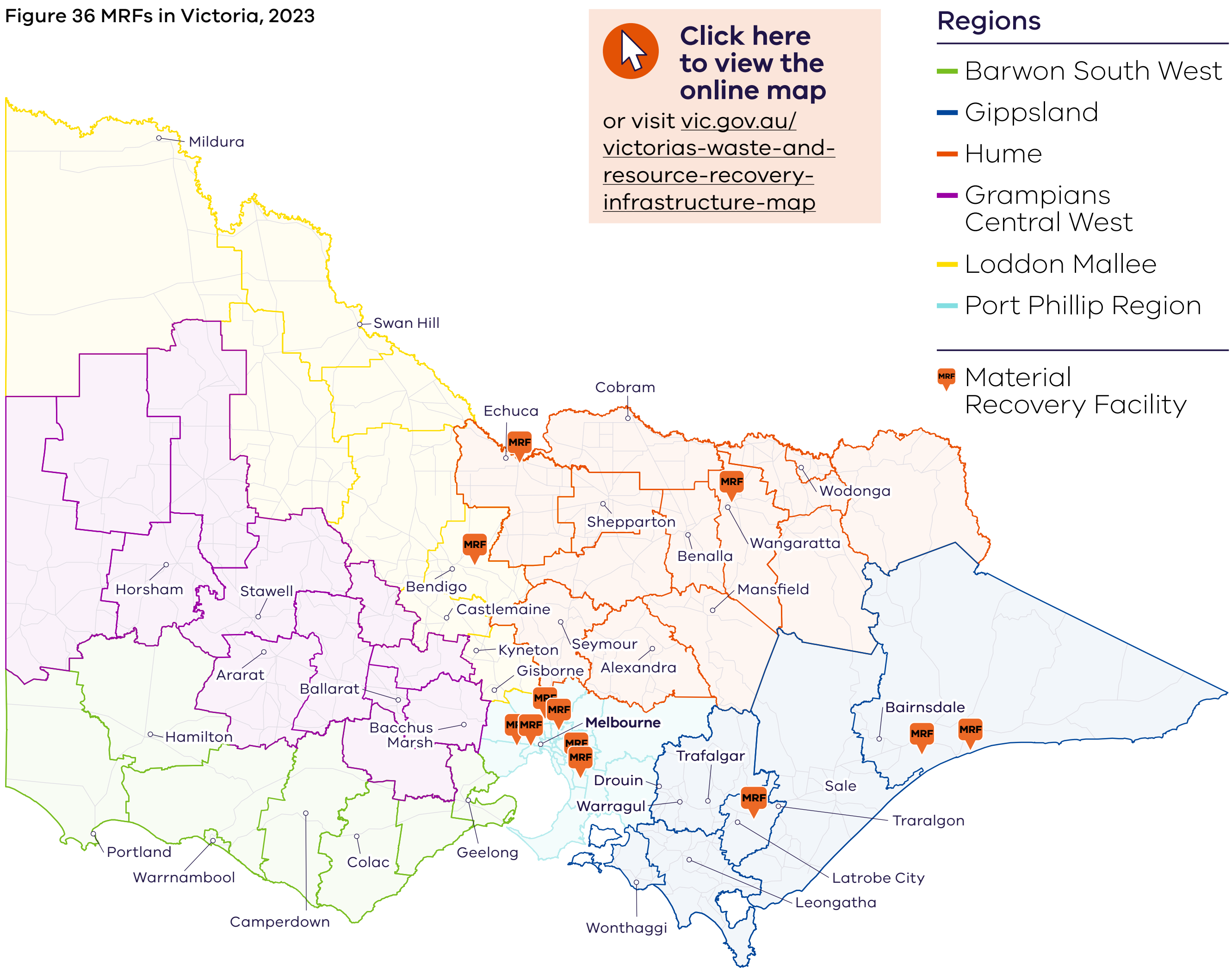


4.2.2 Overall assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Material Recovery Facilities	n/a	0.5	1										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]

Directions

- Near term (0–6 yrs): Increased capability to respond to export restrictions.
- Medium to long term (6–12+ yrs): Increased capacity to meet projected demand.
- Ongoing: Increased opportunities for regional facilities.

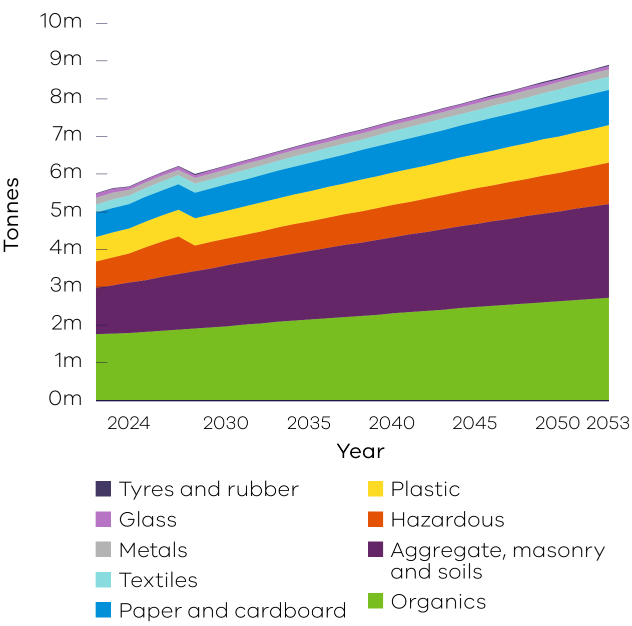
5 Residual waste

A key objective of VRIP is to increase the supply of viable resource recovery infrastructure to improve material circularity. However, managing residual waste remains a vital part of waste, recycling, and resource recovery infrastructure planning. Victoria's landfills play a crucial role in this, and in the future waste to energy facilities are expected to have a key role in managing residual waste and extracting value from materials that would otherwise go to landfills.

5.1 Residual waste trends

The projections for residual waste in Victoria are shown in Figure 37 The total of residual waste is estimated to be 5.7 million tonnes in 2024 (including hazardous waste). This is projected to increase to around 8.9 million tonnes in 2053.

Figure 37 Residual waste by material stream over time

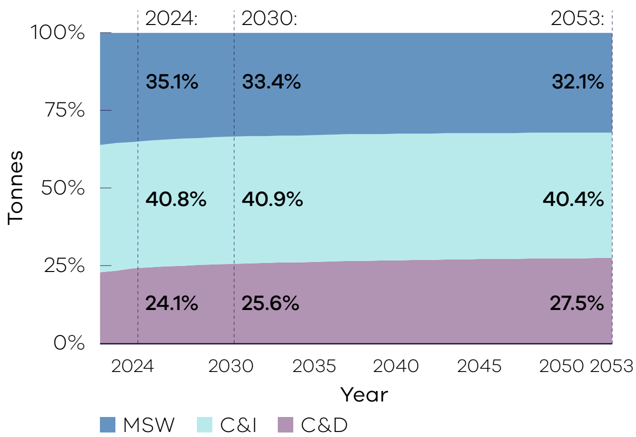


Significant contributors to residual waste include:

- **Organics:** In 2023 an estimated 1.8 million tpa was sent to landfill, with an even proportion of organics residual waste generated by the MSW and C&I source sectors, around 45% each.
- **Plastics:** In 2023, an estimated 0.66 million tpa was sent to landfill, with a similar proportion of plastics residual waste generated by the MSW and C&I source sectors, 50% and 47%, respectively.
- **Paper and cardboard:** In 2023, an estimated 0.64 million tpa was sent to landfill, with the C&I source sector generating 55% of this waste and the MSW sector 44%.
- **Soils:** Soils are considered under 2 waste streams in the VRIP:
  - "Clean" soil and natural material are the largest contributors (>80%) to residual waste from the aggregates, masonry, and soils material stream. While overall the material stream has a high recovery rate of 85%, this is lower for soils.
  - Contaminated soil is the largest proportion of the residual hazardous waste stream. In 2023, 0.75 million tonnes of contaminated soils were generated with an estimated 47% sent to landfill.

As shown in Figure 38 (below), the largest contributor to the projected residual waste stream is C&I, followed by MSW then C&D.

Figure 38 Residual waste by source sector over time



5.2 Current infrastructure

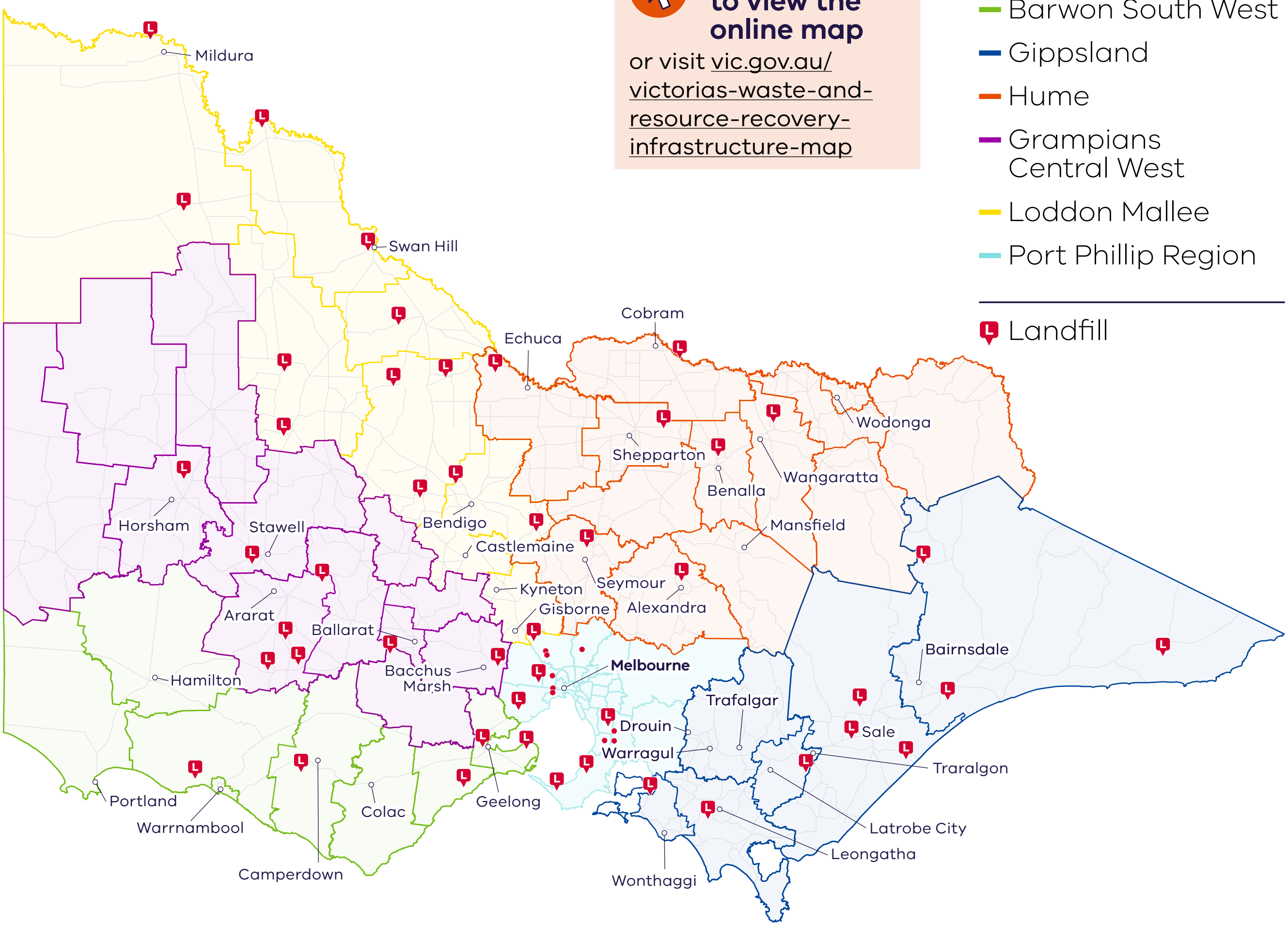
5.2.1 Landfills

Landfills play a critical role in the safe and sanitary management of residual waste and hazardous waste. It is important that Victoria has adequate landfill capacity while supporting Victoria's transition to a circular economy. Table 13 (below) shows the number of landfills currently accepting materials.

Table 13 Number of landfills currently accepting materials by type

Region	Number of landfills currently accepting materials by type								Number of landfills
	MSW	C&D	C&I	Cat B[46]	Cat C[47]	Cat D[48]	SCA[49]	PWA[50]	
Total	39	44	38	1	18	19	4	28	47

Figure 39 Landfills in Victoria



Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

An online map and a supporting CSV data file with the locations of all operating, licensed landfills can be found here: https://www.vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map.

Modern landfill management is heavily regulated and controlled throughout the full life cycle of a landfill (design, construction, operation, and rehabilitation when waste is no longer accepted). This reflects greater expectations from communities to minimise the issues landfills pose to public health and the environment.

46 Priority Waste Category B
47 Priority Waste Category C
48 Priority Waste Category D
49 Soil containing asbestos only
50 Packaged waste asbestos

Challenges for landfills include landfill gas, leachate (a liquid formed when waste decomposes) and loose waste, which attracts disease-carrying vermin. Emerging risks to landfill operation include increasing numbers of lithium-ion batteries entering landfills hidden within mixed waste loads and having the potential to create hot spots (e-waste is considered in Section 3.9).

Best practices for waste disposal and diversion of materials, where possible, for recovery and reprocessing are supported by new technologies. New technologies, like cloud data systems and drone technology, can measure landfill airspace utilisation and maintain the safety of landfill sites (Sliusar et al, 2022). This technology is complemented by advancements in biogas capture technology and chemical processing of waste by-products to reduce environmental impacts.

5.2.2 Waste to energy

Waste to energy provides an alternative to landfills for multiple material streams, reducing the state's reliance on landfills for non-recyclable or non-recoverable waste, and supporting the Government's landfill diversion targets. It also provides opportunities to support the decarbonisation of Victoria, including the gas sector as described in the Gas Substitution Roadmap and Update.

Thermal waste to energy facilities

Thermal waste to energy facilities process waste at high temperatures to reduce the mass and volume of waste sent to landfills and recovers useful resources, such as metals, from the waste. Diversion of the waste to energy feedstock from landfills is typically above 80%. Thermal waste to energy facilities used for steam and/or electricity generation can offset grid electricity from the National Electricity Market (NEM).

The Victorian Government has established a Waste to Energy Scheme, which aims to strike the right balance between support for sustainable and appropriate industry investment in waste to energy technologies, and a focus on waste avoidance and recycling in Victoria's transition to a circular economy. Recycling Victoria administers the Waste to Energy Scheme under the CE Act. EPA also regulates waste to energy facilities (both thermal and non-thermal) in Victoria with the aim of preventing and reducing harm to human health and the environment.

Under the CE Act, thermal waste to energy technologies generate heat, electricity, steam, and/or fuels from waste materials through processes including combustion, gasification, and pyrolysis. In contrast, biological technologies create bioenergy, often in the form of gas, from organic waste. The legislation also defines the waste feedstocks that thermal waste to energy facilities can process and outlines other requirements that thermal waste to energy facilities are subject to.

There are 2 kinds of licences under the Waste to Energy scheme: existing operator licences and cap licences. These licences are required by thermal waste to energy facilities to process permitted waste. Thermal waste to energy facilities do not require a Recycling Victoria licence to process exempt waste. Thermal waste to energy facilities are not allowed to process banned waste.

Operators who were eligible to apply for an existing operator licence were existing operators of thermal waste to energy facilities who had relevant approvals or licences in place by 1 November 2021. This part of the scheme provides the opportunity for those with existing approvals to be grandfathered into the licensing scheme. The application period for existing operator licences closed December 2023.

Victoria currently has one thermal waste to energy facility operating under an existing operator licence, with other facilities under development (both with existing operator licences and relevant approvals that are in the delivery pipeline). Up to date information on Victoria's Waste to Energy Scheme including licenses can be found at https://www.vic.gov.au/waste-energy-scheme

Following the completion of licensing existing operator entities under the CE Act, a second phase of Victoria's Waste to Energy Framework will introduce a cap on the aggregate amount of permitted waste that can be processed each year by thermal waste to energy facilities. The amount of permitted waste that existing operator licence holders that are allowed to process under their licences is outside of the cap limit.

Existing and potential new operators of thermal waste to energy facilities will be able to apply to Recycling Victoria for cap licences to access an allocation under the overall cap limit.

The cap aims to balance the benefits of landfill diversion against meeting Victoria's circular economy targets without impacting the imperative to develop further reprocessing and recovery solutions, which are higher in the waste hierarchy (Victorian Department of Environment, Land, Water and Planning, November 2021).

Non-thermal waste to energy facilities

Waste to energy facilities using non-thermal waste to energy processes are not required to obtain an existing operator licence or a cap licence from Recycling Victoria to operate but do need relevant EPA permissions.

Under the CE Act, non-thermal waste to energy processes include:

- advanced recycling processes
- biological waste to energy processes (e.g., anaerobic digestion)
- landfill gas collection and combustion
- incineration of waste without energy recovery
- processes that recover energy from a material other than waste
- processes prescribed not to be a thermal waste to energy process, including:
  - a thermal waste to energy process where a pilot project licence has been issued and in force
  - a process that treats waste biomass through a pyrolysis process or gasification process to sequester carbon.

Bioenergy

Technology advancements also open up the potential of processing biomass and organic waste to create energy, e.g., through anaerobic digestion, which is not included in the waste to energy cap. Potential diversion of the food components of FOGO waste to anaerobic digestors could result in the generation of bio-methane, which will be important for hard to abate industries currently using fossil gas.

Emerging clean energy sectors such as biomethane and green methanol use waste in their production processes for example residual biomass. Green methanol is an emerging clean energy opportunity for Victoria, led by rising demand for sustainable marine fuels in the international maritime industry. While initial green methanol projects in the state propose to predominantly use residual forestry waste (exempt under the waste to energy scheme), future projects may explore the use of other, non-exempt waste.

5.3 Infrastructure needs

5.3.1 State-wide capacity analysis

Landfills Only

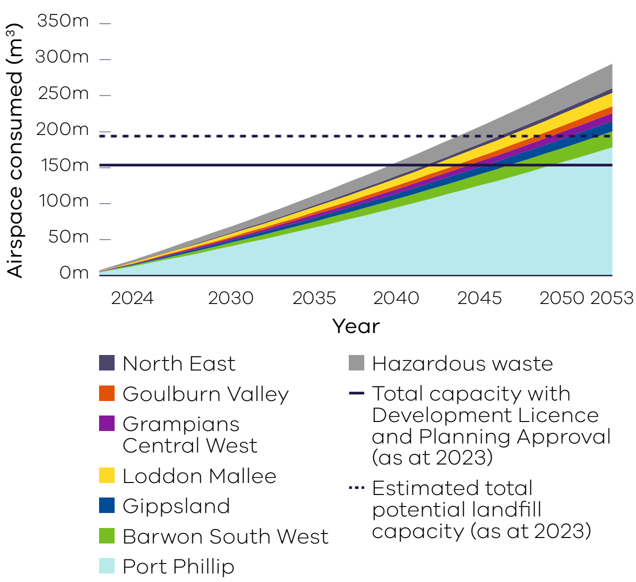
Landfill capacity is measured in cubic metres of airspace. Based on responses to Recycling Victoria's 2023 landfill survey, there is approximately 154 million m3 of available landfill airspace that has planning permission and development licence approval (DLA).

In assessing the overall state-wide capacity, VRIP also considers where there may be potential for further landfill capacity over and above the DLA and planning approved capacity, as reported by landfill operators. Under this definition, there is approximately 194 million m^3 of total capacity. However, this airspace can only be accessed should the appropriate licenses and/or permits be granted for landfills to access and utilise their expected total site capacities.

The analysis of this airspace does not foreshadow any permissions or licensing decisions by the EPA or landfill operators. The capacity modelling does not consider scenarios which may arise from permission decisions, such as whether a landfill does not receive future permission if it still has available airspace after filling of the approved airspace.

The waste projections outlined in the section above are based on current trends. Based on these, the total cumulative demand for landfill airspace over the 30-year VRIP period would be around 295 million m^3. As shown in Figure 40 below, most of that demand is from the Port Phillip Region. With this level of demand there would be a shortfall of landfill capacity in Victoria before 2053. However, as set out in the following sections, the government has existing policy objectives that would significantly reduce the volume of residual waste and the overall demand for landfill capacity.

Figure 40 Total waste disposed of in landfill (hazardous and non-hazardous) – projected demand and capacity[51]



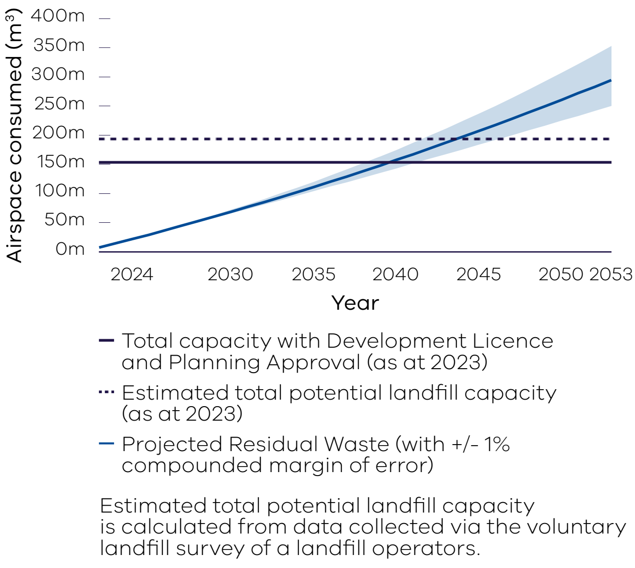
51 Includes both putrescible and inert waste. Waste projection data is split by region only for non-hazardous waste.

In determining Victoria's potential landfill capacity needs, a 5% contingency allowance was also considered to account for waste generated from responses to emergency events, such as natural disasters and pandemics[52]. With the 5% contingency allowance included a shortfall in landfill capacity based on the projected demand would occur between 2039 (based on DLA-approved landfill capacity) and 2043 (total landfill capacity).

Unlike the material stream analyses where the yearly volumes are compared to the processing capacity per year, these projections all consider cumulative demand and overall capacity. This means there is a significant degree of uncertainty in the projections over the VRIP period, as any variations in projections will compound over time There is also uncertainty over the capacity volumes, which in some cases rely on future quarrying work and how much will be available or accessible over the 30 period.

The uncertainty is illustrated in Figure 41. which demonstrates the impact of a plus or minus 1% variation from the central projections, compounded over the 30-year time frame, which gives a margin for error of over 44 million cubic metres less, or 58 million cubic metres over the capacity demand projections.

Figure 41 Residual waste demand with 1% margin for error



Estimated total potential landfill capacity is calculated from data collected via the voluntary landfill survey of a landfill operators.

Landfills capacity, potential capacity and throughput

The analysis demonstrates that all of Victoria's landfills are valuable resources. As set out in more detail in the land use planning and environmental approvals section (Section 7), it is important that all landfills are protected from encroachment to support their ongoing operations, noting it is also important that they meet their licence requirements. Landfills in Victoria vary significantly in capacity and throughput.

There are 6 landfills that accept over 200,000 tpa at Ravenhall, Wollert, Bulla, Hallam Road, Maddingley Brown Coal, and Werribee. Combined they accept around 90% of Victoria's residual waste. The largest landfill, Melbourne Regional Landfill (MRL), accepts significantly more waste than any other in the state. Of those 6, Hallam has the least capacity remaining and is expected to reach capacity within the next 10 years. The remaining 5 account for over 80% of the approved and potential capacity in the State.

As other landfills, including Hallam, reach capacity, the material will need to be diverted to other landfills. This is likely to require additional aggregation and transfer infrastructure to consolidate material and minimise transport movements. Using the existing landfill sites for this infrastructure is one potential approach to this issue.

In addition to overall capacity, the throughput of material at individual sites is an important consideration. Should the above demand scenario eventuate, and material could not be increasingly diverted to other fates such as increased resource recovery and waste to energy, it is likely that throughput would act as a constraint on the system before overall capacity was exhausted.

Landfills and waste to energy

Waste to energy presents an opportunity to divert material away from landfills. The regulatory framework in Victoria includes a proposed cap licensing system for thermal waste to energy facilities, which is yet to be finalised by the government. Facilities that were operating or had approvals or licences as of 1 November 2021 would be excluded from the cap.

An important issue in considering the volume of material that could be diverted by thermal waste to energy is the timing of when the facilities would be operational. The finite nature of landfill capacity meaning the impact from generated waste is cumulative, not only based on annual throughput.

52 The 5% allowance is based on benchmarking waste generated from past disaster events.

The introduction of thermal waste to energy facilities that have current licenses, based on estimates on when facilities may come online and all proposed facilities being delivered, could result in around 25 million fewer cumulative tonnes of waste going to Victorian landfills by 2053 (equivalent to around 31 million m3 of airspace). The total volumes will depend on whether all the facilities are delivered, the timing of facilities coming online and the finalisation of the cap amount. This is the total amount diverted as feedstock to waste to energy, and does not include an allowance for the residues left over from the thermal waste to energy process.

The additional volumes of waste diverted through the introduction of thermal waste to energy facilities licensed under the proposed cap arrangements will depend on the final cap decision, the timing of facilities coming online, and whether the full cap is taken up. Recycling Victoria estimates that every 1 million tonnes per annum permitted under the cap could result in around 15-20 million cumulative tonnes of waste being diverted from Victorian landfills by 2053 (equivalent to around 19-25 million m3 of airspace).

Waste to energy facilities measure waste feedstock throughput in tonnes as the energy generated by the waste is linked to the waste mass, which is independent of the level of compaction. The tonnes measurement approach reflects the wording from the CE Act in relation to the amount of permitted waste that may be processed at a thermal waste to energy facility under an existing operator or cap licence and aligns with how the government's waste to energy annual feedstock cap is measured.

The residues left over from the thermal waste to energy process are estimated to represent around 20% of the waste feedstock by weight. There is a strong commercial incentive to divert residues from landfills to avoid the waste levy. These incentives mean the diversion estimates above do not include the residues, as the assumption that all residues are disposed of in landfills would provide an overly conservative estimate of the impact of thermal waste to energy.

State-wide capacity sensitivity analysis

The CE Act states the VRIP must include a schedule of existing landfill sites and future landfill sites required across the State for the 30-year period of the VRIP.

Diversion to thermal waste to energy facilities would reduce the volumes being sent to landfills under the baseline projections, as per the section above. However, the delivery of waste to energy alone is still expected to leave a cumulative demand for landfill in excess of both the development licence approved and the total potential landfill capacity within the 30-year VRIP period.

Victoria already has policy objectives that would reduce the residual waste volumes further and move waste outcomes higher up the waste hierarchy (see Figure 1 in Section 1 outlining the circular economy waste hierarchy). Opportunities to reduce waste include:

- Generate less waste through more efficient production and re-use.
- Recycle more, increasing resource recovery, particularly for those material streams that compose a high proportion of the residual waste projections and/or have a low recovery rate, e.g. organics, plastics, paper and cardboard, and soils.
- Increase diversion of mixed residual waste away from landfills via advanced sorting technologies to recover resources, non-thermal waste to energy processes which could include organics (e.g. bioenergy) or new and emerging technologies.

The government has committed to these policy objectives. Making progress towards these objectives could keep cumulative residual waste volumes below the state's landfill capacity over the 30-year VRIP period. Even if there is a need for additional capacity in residual waste management, this does not necessarily need to be met with additional landfills.

The shortfall in residual waste capacity under the projections is forecast for the medium to long term. Even accounting for the significant lead times required to build new landfills or develop alternative infrastructure, the overall capacity modelling does not show an immediate need for a new landfill to be commissioned within this 3-year VRIP cycle.

As such, this inaugural VRIP will not take the step of including a new landfill location on the schedule. However, as part of the VRIP cycle, Recycling Victoria will closely monitor future residual waste needs, and the impact of measures to increase diversion away from landfill to fates higher up the waste hierarchy.

5.3.2 State-wide capability assessment

Landfills in their respective design and operational stages must have the appropriate licences, permits and/or approvals in place, and comply with all requirements of approval authorities. The EP Act permissioning framework varies depending on the size of the landfill; larger landfills are subject to an operating licence, whilst municipal landfills servicing less than 5,000 people operate under a permit. Landfills can only accept the categories of waste materials for which they are authorised under a permission.

Table 14 provides an overview of the number of total landfills that currently exist in each Victorian region and the number of landfills that accept the types of licensed material types.

Table 14 Number of Victorian landfills in 2023, by region

Region	Number of landfills currently accepting materials by type								Number of landfills
	MSW	C&D	C&I	Cat B[53]	Cat C[54]	Cat D[55]	SCA[56]	PWA[57]	
Port Phillip	7	11	7	1	4	4	3	6	11
Barwon South West	3	5	3	0	0	0	1	2	5
Gippsland	7	6	6	0	3	4	0	6	8
Hume	7	7	7	0	3	3	0	4	7
Grampians Central West	3	4	3	0	4	4	0	3	8
Loddon Mallee	12	11	12	0	4	4	0	4	12
Total	**39**	**44**	**38**	**1**	**18**	**19**	**4**	**28**	**47**

With the current provision of landfills, there are some capability issues that need to be managed to ensure landfills can continue to meet the State's needs:

- **Putrescible airspace:** It is generally possible to dispose of inert waste in a landfill suitable for putrescible waste, but not the other way round. As landfills reach capacity, putrescible airspace may become a more constrained resource to be managed by the sector.
- **Category B landfills:** Only Taylors Road Landfill in South West Melbourne is licensed to accept this waste. Based on the current total throughput of the site, of which only a small proportion is category B waste, its operational capacity is forecasted to be reached within 10 years. This is a single point of failure, and the state needs a robust, long-term capability to manage this waste, either through Taylors Road and/or developing capability at other facilities.
- **Soil containing asbestos only:** There are 4 landfills licensed for this waste, with only 3 accepting this waste, all of which and they are all located in Melbourne. Although there are a limited number of sites, these are 3 of the largest landfills in Victoria (MRL, Wollert and Hi-Quality) with significant future capacity.
- **Surge capability:** Just as a 5% contingency was applied to the total capacity to account for system resilience, the throughput capability also needs to be able to handle surge events. The location of capacity and type of waste that can be accepted are also factored in. Emergency events typically generate a large volume of waste in a short period and are localised to specific regions. Further work is needed to understand the system constraints and potential dependencies, allowing for adequate planning of contingency provisions related to emergency scenarios.

53 Priority Waste Category B
54 Priority Waste Category C
55 Priority Waste Category D
56 Soil containing asbestos only
57 Packaged waste asbestos

5.3.3 Place-based assessment

It is not a requirement that all regions manage their own residual waste. It is a commercial marketplace, rather than a managed system. There are inter and intra-regional flows, and cross-border flows with other States in some areas. However, as more individual landfills reach capacity, it places greater strain on the system to manage residual waste from areas with no local landfill capacity. Transporting residual waste over large distances also adds costs and increases emissions.

The timeframes for individual and regional landfill capacity being reached will depend on a range of business decisions made by collection services, landfill owners/operators, and authorities, including inter-regional flows, utilisation rates and whether sites obtain the appropriate approvals for additional available airspace. Below are the near to medium term place-based challenges for the system to address, noting that the future location and timing of thermal waste to energy could help address these issues, in strategic locations to service growing populations where landfill capacity is being reached.

Port Phillip and Barwon South West

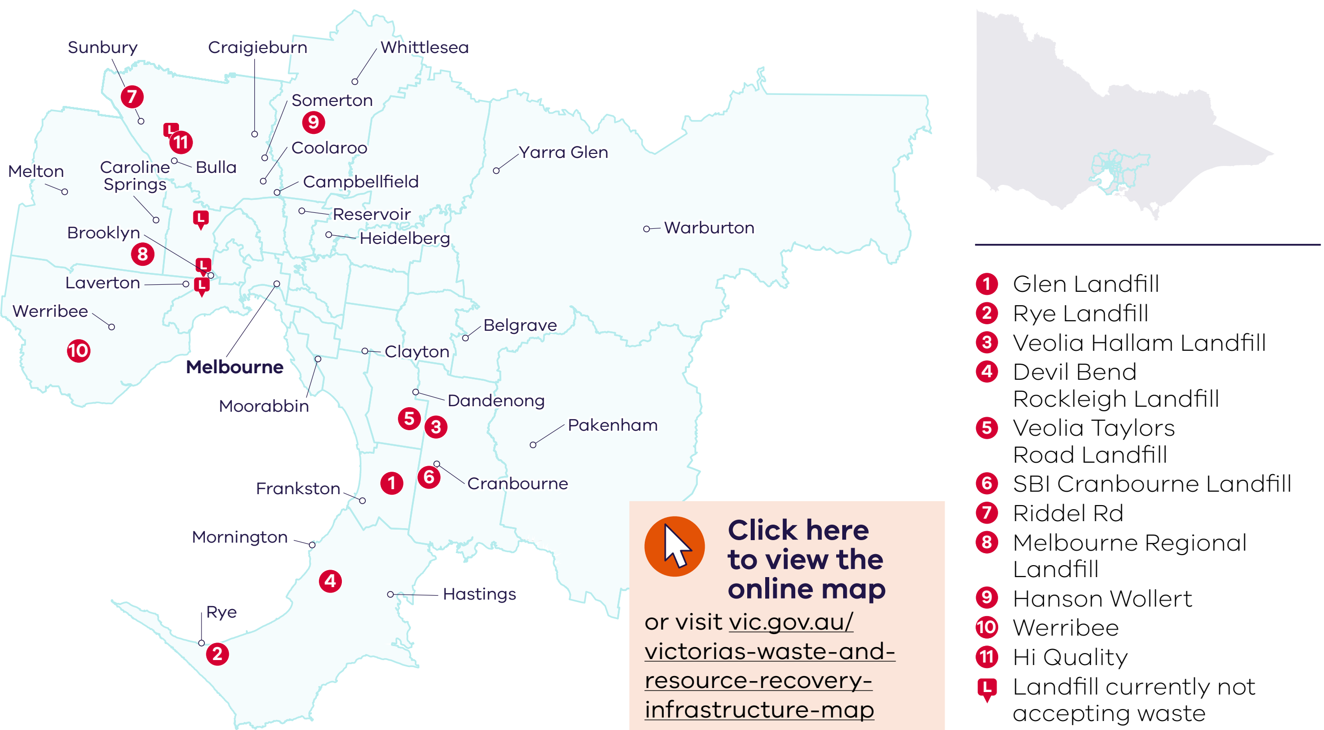
On current throughput, all the South East Melbourne landfills (landfills 1–6 below in Figure 42 below) will reach their development licence and planning approved capacity within 10 years. This includes one of the landfills with the highest throughput in the State, Hallam Road. The operator of only one site, SBI Cranbourne, has indicated they may have potential additional capacity. The South East Melbourne Collaborative Procurement is intended to provide an alternative destination for residual waste.

The remainder of Melbourne benefits from adequate geographical coverage provided by landfills in the North and West. Melbourne Regional Landfill, Wollert, Werribee, Hi-Quality, and Maddingley Brown Coal (landfills 8-12) collectively account for approximately 75% of the State's remaining total capacity. Maddingley Brown Coal is situated in Grampians Central West, but its proximity means it services the metropolitan Melbourne area as well. These landfills serve as potential disposal options for waste generated in SE Melbourne, particularly as other landfills in Melbourne close over in future years.

A key challenge will be the management of throughput. The throughput at each of the Melbourne sites is limited by its ability to operate in accordance with their social and environmental licences, while Maddingley Brown Coal is only able to accept inert waste. This challenge will increase as there are fewer remaining landfills to accept waste.

Anglesea and Geelong's main MSW landfills are due to reach their approved capacity within 5 years, and the operators have not reported the potential for additional capacity at these sites. The most likely destination for this waste would be Melbourne's landfills, as the nearest alternative is Ballarat.

Figure 42 Key Port Phillip landfills currently accepting waste



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Loddon Mallee mining soil

Eaglehawk Landfill, near Bendigo, accepts legacy mine waste contaminated with arsenic from historic widespread gold mining activities. EPA Victoria has issued a designation concerning arsenic impacted soils in the Bendigo region[58]. This designation classifies arsenic-contaminated waste, which may otherwise be categorised as Category A or B waste (as defined in Regulation 4 of the EP Regulations), as Category C waste when it is being deposited or consigned to be deposited at Eaglehawk Landfill. Eaglehawk Landfill is specially authorised to receive this waste for disposal due to being in the area where legacy mine wastes are found.

Eaglehawk Landfill is likely to reach capacity soon. This means that alternative disposal options are needed for the arsenic contaminated legacy mining waste in the region. Transporting this waste out of the region would have cost implications and introduce safety challenges. Some of this waste may be classified as Category B contaminated soils, which only Taylors Road Landfill, 200km from Bendigo, is licenced to accept. Victorian Government agencies are engaging in early discussions with key local stakeholders to explore options for a long-term solution to arsenic-contaminated legacy mining waste in the region. Work is also underway to establish how the life of the existing landfill can be maximised to manage this waste.

Regional landfills

Based on current throughput, the following regional landfills with throughput above 50,000 tpa are projected to reach their approved capacity in 0–5 years. The operators of these sites have reported potential additional capacity and, without prejudice to any operational, licensing or approval decisions, the operational lifespan of these facilities could be extended for several years:

- Kilmany in Gippsland
- Swan Hill landfill in Loddon Mallee
- The Patho landfill in Goulburn Valley.

5.4 Overall Assessment

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis									
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053
Residual waste**	n/a	5.7	8.9										

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]

Capacity is sufficient to meet the demand projections [investment focus is optimising infrastructure]

** Capacity analysis based on Development License Approved Landfill Capacity

Directions

- **Near term (0–6 yrs):** Maximised use of existing landfill capacity; key system constraints (e.g. Category B waste) and place-based challenges (e.g. Loddon Mallee mining spoils) addressed
- **Medium term (6–12 yrs):** Increased system resilience (e.g. surge capacity) and increased use of waste to energy facilities to divert waste from landfill
- **Ongoing:** Increased resource recovery to reduce reliance on landfills, particularly for organics, plastics, soils, paper, and cardboard.

58 (EPA Designation – Classification of arsenic-contaminated waste from the City of Greater Bendigo).

5.5 The landfill schedule

The landfill schedule is a legislated requirement of the VRIP under the CE Act. It is a schedule of existing landfill sites and future landfill sites required across the State for the 30-year period of the VRIP. The landfill schedule supports planning for effective waste management and therefore contains relevant information about each landfill, such as the anticipated date of when capacity will be consumed and the types or categories of waste it is allowed to accept.

The landfill schedule aims to:

- Ensure that Victoria has an adequate landfill capacity, to guarantee the safe and sanitary disposal of wastes that are not recoverable for the next 30 years.
- Specify the estimated timeframe in which the total site capacity will be consumed in operational landfills.
- Inform EPA decision making, because under the EP Act Section 52A (3), EPA may refuse an application or refuse to consider an application for a new landfill site where it may be inconsistent with the VRIP or the landfill schedule in the VRIP. Under section 52A (4) of the EP Act, the EPA must refuse to consider an application that proposes a new landfill site if the proposed site is not a future landfill site included in the schedule.
- Inform land use planning by providing clarity on the location and type of landfills in Victoria.

Please refer to Appendix B for the existing landfill schedule.

The VRIP does not include provision for new landfills on the landfill schedule in Appendix B. This is because for the 30-year life of the VRIP, the combination of existing landfills, proposed waste to energy facilities, and targets to increase resource recovery rates and reduce waste reduction are projected to result in sufficient capacity to manage Victoria's landfill needs.

For landfill applications the EPA must refuse to consider an application if the landfill is not listed in the landfill schedule in Appendix B of the VRIP. A listed landfill may apply for licenses to expand their capacity or to accept additional material. The information provided about each landfill in the schedule is for information purposes only as is not intended to inform or guide decision making on applications.

6 Regional infrastructure opportunities

This section considers opportunities for investment in infrastructure in each of the regions. The Goulburn Valley and North East are considered together as they align within the Hume region. It considers aspects of the regional economy and natural resources that may generate particular types of waste, provide end-markets or skills to support recycling infrastructure.

In addition to the Recycling Victoria analysis that underpins the VRIP, this section draws on the Regional Circular Economy Plans (RCEPs)[59], which are regionally owned documents. It is informed by the Infrastructure Victoria advice to government[60] and the work by Regional Development Victoria in identifying regional strengths and opportunities[61].

While it is not realistic for every region to reprocess all its waste locally, there are benefits from reduced transport costs and emissions, regional development benefits, and overall system benefits from more efficient use of resources, including land.

Some material streams provide more opportunities for regional infrastructure due to the nature of the material and market structure. These include organics, aggregates, masonry, soils, and glass crushing. Renewable energy waste is an emerging waste stream that may present place-based opportunities. There are also particular waste streams, such as agricultural wastes including plastic wraps and other materials, that are a challenge and a potential opportunity, specific to rural areas.

There are potentially sufficient waste streams at a regional level to achieve the economies of scale required to support MRF facilities. These could support other regional opportunities for glass, paper and cardboard, and plastic waste. Resource recovery centres are important local entry points to the recycling system.

A key challenge for regional facilities is often securing the required economies of scale to justify the investment, coupled with the distance for transporting materials. One way this may be addressed is through collaborative procurements and contracting arrangements that combine waste streams from several local government areas, providing the necessary economies of scale to be economically competitive, although this depends on the distance between townships and may be challenging for very remote townships.

This is less of a challenge for the Port Phillip region where higher volumes of waste and transport links out to other regions allow for larger facilities that may undercut the costs of smaller regional operations.

Section 3 details the projected generation rates for each material stream and the state infrastructure capacity over the 30-year life of the plan. The graphs indicate the total amount of materials generated in each region. As the purpose of the Plan is to assess infrastructure capacity the analysis is based on the total volume of material generated and therefore does not provide a breakdown of waste generated from individual sectors, MSW, C&I, and C&D.

The former regional implementation plans detailed local infrastructure available to process each of the material stream, given that significant volumes of materials are now transported between regions, such as organics from Melbourne to regional Victoria and recyclables from regions to Melbourne. The capacity analysis in the VRIP is based on establishing the total capacity in the state so that waste generated in one region and processed in another region is captured.

The following sections provide a summary of the key infrastructure and the challenges and opportunities for each region.

6.1 Barwon South West

The Barwon South West region accounts for approximately 7% of Victoria's annual managed waste tonnes, the largest proportion of any region outside of the Port Phillip region. It has a population of around 330,000[62] and comprises 9 LGAs.

Barwon South West has 2 sub-regions. Barwon's largest centre is Geelong, Victoria's second largest city, with a population greater than 250,000, and the other regional centre is Colac. The largest centre in the Great South Coast is the city of Warrnambool, with Hamilton the other regional centre .

59 https://www.vic.gov.au/regional-circular-economy-plans.
60 https://www.infrastructurevictoria.com.au/resources/advice-on-recycling-and-resource-recovery-infrastructure.
61 https://www.rdv.vic.gov.au/resources/regional-economic-development-strategies.
62 Population in 2020 as quoted in the RCEP

Figure 43 Barwon South West – current waste and resource recovery infrastructure

Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

6.1.1 Current infrastructure – Barwon South West

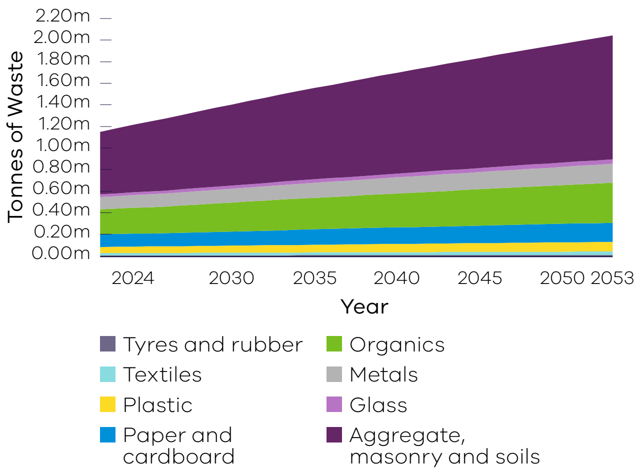
Barwon South West has 24 reprocessing facilities, including 10 organics and 4 construction and demolition facilities. The region has a metal reprocessor and 3 plastics reprocessors, and a paper and cardboard recovery facility, all located in Geelong, as well as a mattress reprocessor. There are 3 e-waste recycling facilities, located in Geelong, Warrnambool, and Hamilton. The region does not have an MRF. There are 41 resource recovery centres distributed across the region.

Barwon South West has 4 landfills. The largest by throughput is Drysdale in Geelong. This facility and Anglesea landfill are projected to reach capacity in the near term, presenting a place-based challenge that is considered further in the Residual waste section (Section 5). The Corangamite regional landfill accepting putrescible and industrial solid waste from the Barwon South West region with DLA capacity sufficient until beyond 2053 based on current throughput. It is co-located with a resource recovery centre and a composting facility.

6.1.2 Waste projections – Barwon South West

The total generated waste projections for the Barwon South West region are set out in the chart below. The region has the largest waste projections outside of the Port Phillip region, which are projected to total over 2 million tpa by 2053. As with all regions, the largest projected waste streams by weight are aggregates, masonry and soils and organics, 2 with high potential for regional circularity.

Figure 44 Barwon South West projected waste



6.1.3 Potential opportunities – Barwon South West

There is potential for additional infrastructure in Barwon South West. The RCEP identified developing a MRF as an infrastructure priority. Similarly, Infrastructure Victoria identified Geelong as a potential location for a MRF with mechanical and optical sorting technology, as well as a potential location for C&I paper recovery.

The RCEP noted that Barwon's strengths include networks and existing collaborations between local government and Deakin University; CSIRO and Deakin University and G21 Alliance and Victoria Cleantech Cluster. The region also has business diversity, high availability of brown-and greenfield land and transport infrastructure and connections.

The size of Geelong and its proximity to Melbourne means it is a potential alternative location for more centralised material streams. It has a strong local manufacturing sector that can provide end markets and could present a suitable alternative to Melbourne for reprocessing in certain markets such as metal waste. With its petrochemical industry, Infrastructure Victoria identified Geelong as the most suitable location outside of Melbourne for chemical plastics reprocessing, as well as for pelletising and flaking facilities. The local oil refinery may also be a suitable co-location site for tyres and rubber reprocessing infrastructure.

The Great South Coast has a different economic outlook, with agriculture the main economic driver, resulting in the region being a major producer of agricultural plastic waste. Infrastructure Victoria identified Warrnambool as potential location for plastic flaking and pelletising plant.

Organics is a material stream well suited to regional reprocessing, and capacity analysis suggests the region has less capacity for processing FOGO than there is generated waste in the region. Infrastructure Victoria identified Geelong and Warrnambool as potential locations for in-vessel facilities. The RCEP highlighted opportunities for organics in the region. The Green Forestry Triangle is a place-based opportunity for bioenergy and sustainable fuel industries using residual forestry waste.

As with other regions there are potential opportunities for local glass crushing for use in local construction, with Infrastructure Victoria identifying Warrnambool as a potential location. Also, in line with the place-based material stream analysis, there are opportunities to develop local reprocessing of aggregates, masonry, and soils to meet demand and support regional circularity. The capacity analysis suggests there is a near-term regional capacity shortfall compared to regionally generated waste.

The Great South Coast also has significant renewable energy potential. The Renewable Energy Zone in Victoria's Climate Change Strategy notes the potential for wind energy in the region. The renewable energy sector was highlighted as a strength by the RCEP. Geelong may also be a suitable location for e-waste recycling, including solar panels. The Barwon South West RCEP identified infrastructure priorities increasing the collection of e-waste to include household battery systems, smart meters, and solar panels.

As the regional centres, Geelong, Warrnambool, Colac, and Hamilton meet the strategic alignment attribute for areas suitable for development, as set out in the land use planning and environmental approvals section (Section 7). Facilities such as Corangamite Regional Landfill present opportunities for co-location of new developments with existing infrastructure in the region.

6.2 Gippsland

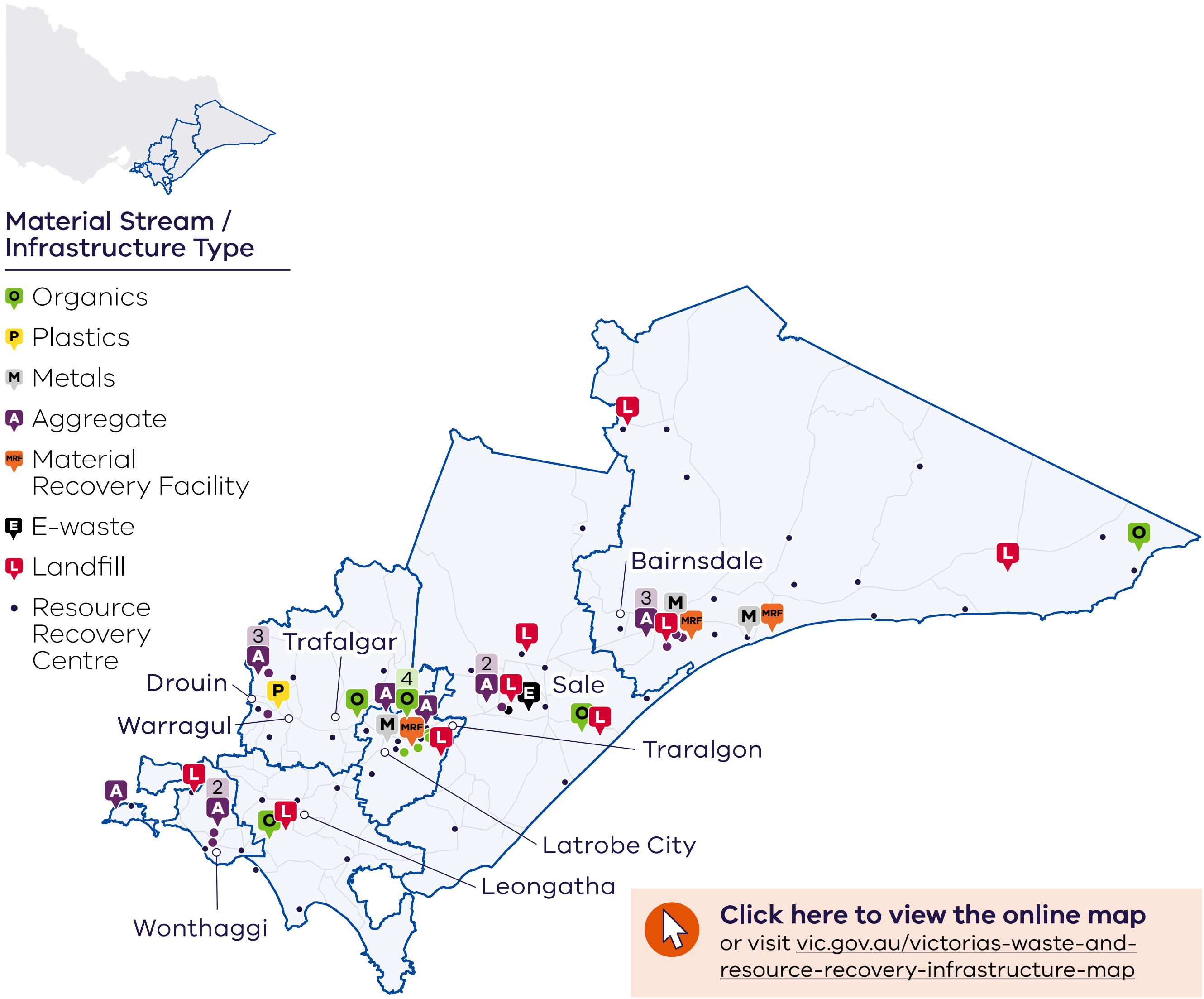
Gippsland accounts for approximately 5% of Victoria's annual managed tonnes. It has 6 LGAs and a population of around 295,000[63].

The largest population centre is the City of Latrobe, which has a population of around 75,000 people, and includes the urban areas of Traralgon, Morwell, Moe, and Churchill.

Other regional centres in Gippsland include Wonthaggi, Leongatha, Sale, and Bairnsdale. There is significant material flow from Gippsland to eastern metropolitan Melbourne.

63 Population in 2020 as quoted in the RCEP

Figure 45 Gippsland – current waste and resource recovery infrastructure



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6.2.1 Current infrastructure – Gippsland

Gippsland has 3 MRFs which are smaller facilities, their combined capacity is still less than the region's generated demand.

There are 26 reprocessing facilities in Gippsland. This includes 8 organics facilities, including Gippsland Regional Organics open windrow reprocessing facility at Dutson Downs, co-located with, and owned by Gippsland Water at their site in Wellington, east of Sale. The region has significant capacity in this sector and attracts a flow of organics materials from across the state.

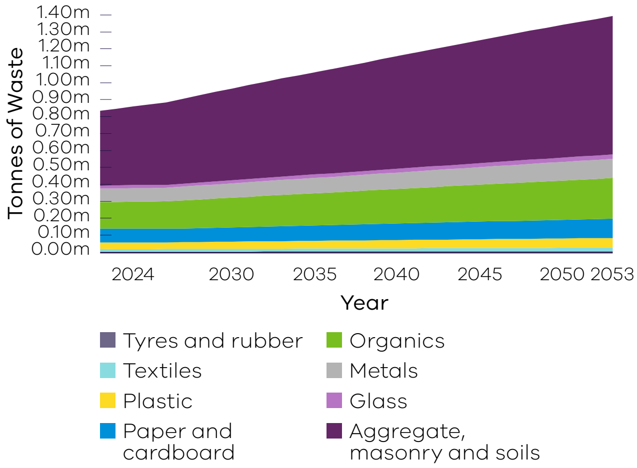
There are 14 C&D reprocessing facilities, a metal reprocessor and one plastics reprocessor. In December 2023, Australian Paper in Maryvale was granted a waste to energy licence from Recycling Victoria, with construction to follow. The largest cluster of facilities is in City of Latrobe as the largest centre, but there are clusters in the other regional centres, as well as some facilities such as Dutson Downs in more rural locations.

Gippsland has 7 landfills (5 currently operating). Bairnsdale has signficant approved capacity, while Kilmany landfill has reported signficant potential capacity above the currently approved capacity. Kilmany also includes co-located resource recovery facilities.

6.2.2 Waste projections – Gippsland

The total generated waste projections for the Gippsland region are set out in the chart below.

Figure 46 Total generated waste projections for the Gippsland region



6.2.3 Opportunities – Gippsland

Gippsland has a strong agricultural economy, notably its dairy and horticulture sectors. The regional RCEP notes the strong agricultural sector is a key strength for Gippsland's circular economy as both a generator of organic feedstock and an end-user of soil enhancers produced from recycled organic material.

The RCEP highlights organics processing capacity and capability as a priority for the region. It also notes a strength of the local circular economy is the ability to draw on and promote existing projects, such as local biochar production where wood waste is converted for use in agriculture. Infrastructure Victoria recommended Morwell as a potential location for in-vessel composting, and Bairnsdale a potential location for open windrow composting.

Consultation feedback reported that there is a strong demand for recycled products in civil construction works in Gippsland. Civil construction projects are sometimes limited by the availability of recycled aggregates and glass products. This represents an opportunity to expand reprocessing of glass and aggregates. The strong agricultural economy also presents opportunity for regional circularity of agricultural waste. This could include more challenging organic material such as treated timber posts, or agricultural plastics. More generally, Infrastructure Victoria suggested Morwell and Bairnsdale as potential locations for plastics flaking and pelletising facilities.

The region has 3 MRFs, although the total capacity is less than the estimated regional generated demand. Infrastructure Victoria recommended paper upgrade for a Gippsland MRF. Infrastructure Victoria also recommended Bairnsdale and Morwell as potential locations for glass sand/aggregates plants.

Latrobe Valley is a key Victorian centre for the mining and energy industry, which are both sectors in transition. Regional priorities include manufacturing capabilities and pursuing opportunities emerging from energy industry transition. The Victorian Climate Change Strategy Renewable Energy Zone (REZ) highlights the potential for wind power generation, which may become a significant future waste stream. A solar panel recycler has recently been established in Wellington, supported by Regional Development Victoria.

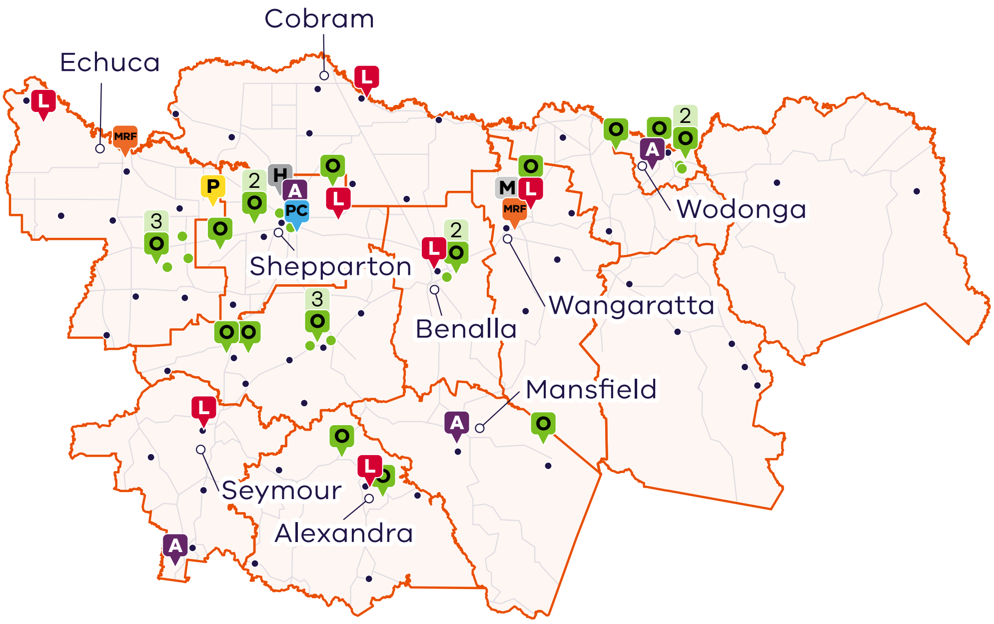
The RCEP notes the region's strengths include a skilled technical workforce transitioning from mining, and land availability for local processing and manufacturing plants or precincts and identified the production of pelletised plastic as a priority opportunity.

As a regional centre the City of Latrobe is strategically located; with Bairnsdale, Sale, Warragul, Drouin and Wonthaggi meeting the strategic alignment attributes for areas suitable for development, as set out in the land use planning and environmental approvals section (Section 7). As the largest centre, the City of Latrobe presents development opportunities for the region. Bairnsdale is strategically located to service the West of the region, while the east Gippland centres are in the peri-urban areas with proximity to Melbourne.

Facilities such as Dutson Downs and other rural facilities may present opportunities for co-locating new development with existing infrastructure, particualry for facilities that require large buffers.

6.3 Goulburn Valley & North East (Hume)

Figure 47 Goulburn Valley & North East (Hume) – current waste and resource recovery infrastructure



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The Goulburn Valley and North East regions of are both covered by the RCEP developed for the Hume region. It has a population of around 342,000[64] and comprises of 13 LGAs in total.

Municipalities with large populations include Wodonga with approximately 43,000 residents, Shepparton, approximately 70,000 residents, and Wangaratta, approximately 30,000 residents. Five of Victoria's Alpine Resorts are in the region and receive 1.4 million visitors annually. The region has good transport links with Melbourne to the south and NSW to the north.

64 Population in 2020 as quoted in the RCEP.

6.3.1 Current infrastructure – Goulburn Valley

Goulburn Valley has 20 reprocessors. There are 14 organics reprocessors, including significant facilities at Stanhope and, Shepparton, and an anaerobic digestor. There are 2 C&D waste recyclers, one plastics processor, and one of the few hazardous waste facilities outside of Melbourne. The region has an MRF at Echuca, and 37 resource recovery facilities.

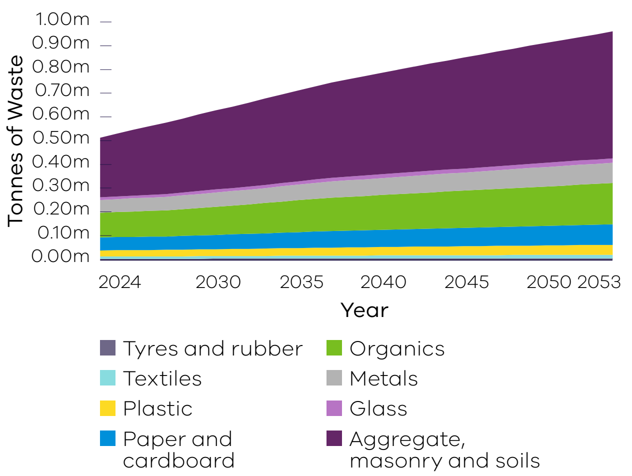
There are 5 operating landfills. Patho is the largest by throughput and the operators have reported potential additional capacity which, without prejudice to any operational, licensing or approval decisions, the operational lifespan of the facility could be significantly extended beyond the current approved capacity. In throughput and potential capacity Patho is the largest landfill in Victoria outside the major Melbourne facilities and Maddingley Brown Coal, and it accepts waste from outside the region, including from Bendigo.

Cosgrove landfill has lower throughput but has significant approved capacity and is another important facility for the region. The other facilities are at Cobram, Alexandra, and Seymour.

6.3.2 Waste projections – Goulburn Valley

The total generated waste projections for the Goulburn Valley region are set out in the chart below.

Figure 48 Total generated waste projections for the Goulburn Valley region



6.3.3 Opportunities – Goulburn Valley

Goulburn Valley has a strength in organics processing, and imports material from other regions. There are only 2 C&D recyclers and there is less capacity than generated waste in the region. The RCEP noted the strength of the region's MRF and resource recovery centres and identified these as a potential investment opportunity. Infrastructure Victoria recommended Echuca as a potential location for MRF upgrades to meet ongoing market requirements, and glass/sand plant for local market needs.

Plastics reprocessing was a priority in the regional implementation plan (particularly from industrial and agricultural sectors), with Infrastructure Victoria also recommending a small plastics flaking and pelletising facility for Shepparton. Strengthening renewable energy generation and the role of the circular economy is a possible opportunity for Goulburn Valley. There is local potential for renewable energy generation, including in solar, pumped hydro, and bioenergy and hydrogen, that can be harnessed to strengthen local supply chains. Circular economy opportunities such as waste to energy, waste processing and resource recovery can also drive growth.

Like most regions, the peri-urban area around Melbourne has relatively high population densities. Mitchell Shire in particular is forecast to have significant population growth over the next 25–30 years. As a potential development area, it has proximity to Melbourne via the Hume Freeway, and access to the Beveridge intermodal Freight Terminal. The Hilldene Employment Precinct, located within the Mitchell Shire, also provides a potential development area for circular economy initiatives, and is already home to the Seymour Resource Recovery Centre.

Goulburn Valley's major population centre, Shepparton is in the centre of the region. As the largest centre this is a potential development area, with existing facilities providing potential for co-location, including the Cosgrove landfill. Its other population centre, Echuca, is in the north of the region, has a MRF for potential co-location and has cross-border potential. There are also significant facilities in the region for potential co-location, including landfills and large organics facilities with existing buffers.

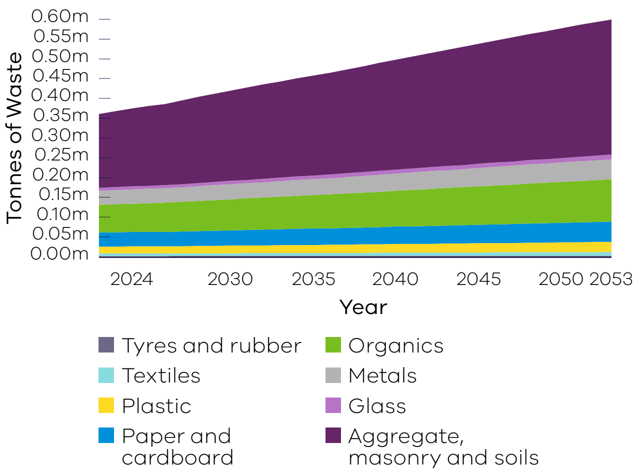
6.3.4 Current infrastructure – North East

The region has an existing MRF facility in Wangaratta (with additional service available from 1 over the border in Albury, NSW), and 2 landfills. The Rural City of Wangaratta built its Wangaratta Organics Processing Facility in 2020 which uses Aerated Static Pile Composting technology to produce compost. There are clusters of facilities in Benalla, Wangaratta, and Wodonga.

6.3.5 Waste projections – North East

The total generated waste projections for the North East region are set out in the chart below.

Figure 49 Total generated waste projections for the North East region



6.3.6 Opportunities – North East

Infrastructure Victoria recommended increased capacity and capability to process glass into sand/aggregates at Wodonga and Wangaratta, and paper sorting upgrades at Wangaratta's MRF to continue to meeting end market demand.

The Wangaratta Organics Processing Facility has significant capacity to accept greater quantities of FOGO presenting an opportunity to optimise existing capacity and capability that is being underutilised.

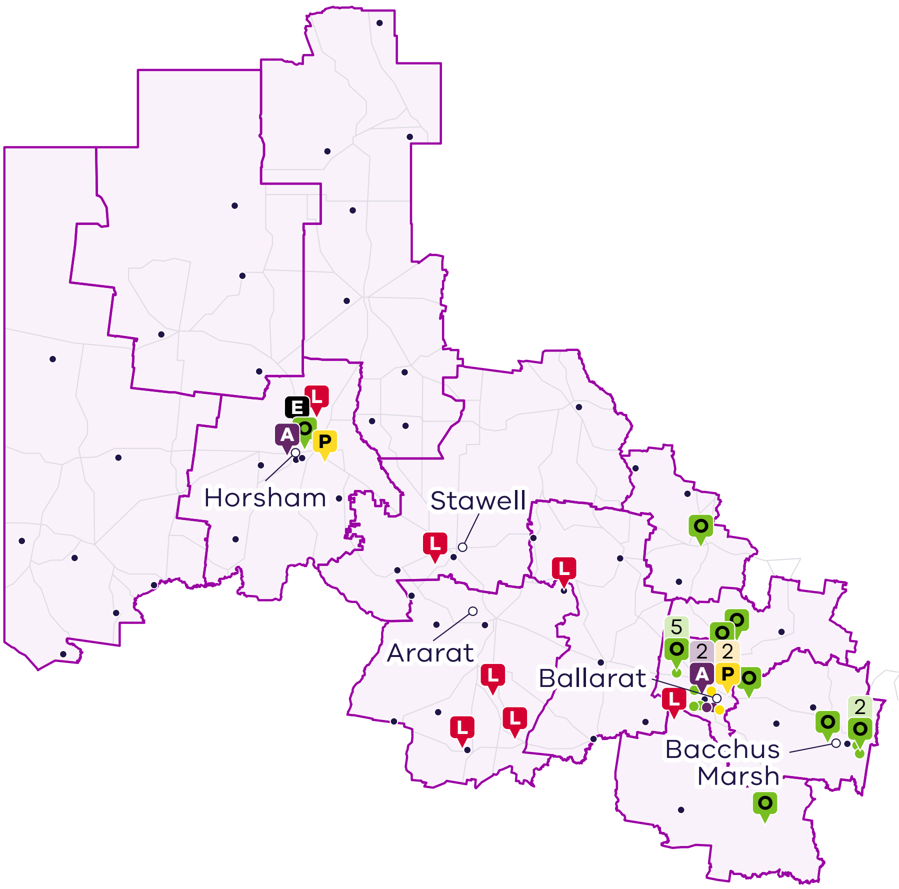
Unlike most other regions, the North East region's major population centres are in the north of the region. This means the movement of materials to facilities across the border. Currently residual waste being sent to Albury landfill from 3 north east councils, mixed recyclables and glass being sent to the Lavington MRF from 5 north east councils (and 1 Goulburn Valley council), FOGO being sent to Wagga Wagga (via decontamination and bulk haulage from Albury) from 4 north east councils. Additionally, a new PET facility opened over the border in Albury in 2022 producing recycled PET feedstock.

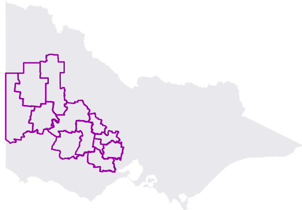
The North East Region's opportunities include expanding on existing manufacturing to take advantage of opportunities in new industries. The Hume RCEP noted the region's access to strategic transport links. Industrial land creates a strong platform to further build on the region's strength in manufacturing, by supporting education and innovation hubs and expanding into circular economy opportunities.

The main centres of Wangaratta and Wodonga are potential development areas, with Wodonga having potential for cross-border development. The other main centre, Benalla is also a potential development area with cluster of existing facilities. There are co-location opportunities with significant regional landfills and large organics facilities. The alpine resorts, with their high visitor numbers also present opportunities for developing infrastructure to meet seasonal demand needs.

6.4 Grampians Central West

Figure 50 Grampians Central West – current waste and resource recovery infrastructure





Click here to view the online map
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Grampians Central West accounts for less than 5% of Victoria's annual managed tonnes. It is home to around 270,000 people[65]. It has 12 LGAs, and 2 sub-regions, Central Highlands, and Wimmera South Mallee.

The major population centre is the city of Ballarat, a population greater than 100,000. Other regional centres are Horsham, Ararat, and Bacchus Marsh. These are all linked by the Western Highway.

6.4.1 Current infrastructure – Grampians Central West

Grampians Central West has 21 reprocessing facilities. This includes 11 organics facilities, including Pinegro composting near Bacchus Marsh, that has received funding to accept FOGO waste, and 3 anaerobic digesters and 3 C&D waste reprocessors. There is also 1 e-waste re-processor and, 3 plastics reprocessors. Most facilities are in Ballarat, the largest population centre.

There are no MRFs in the region. There are 49 RRCs providing a wide geographic spread, although the condition of these assets is not known, although the regional WRRIP found many facilities were aging.

Grampians Central West has 4 landfills currently accepting waste. The largest is, Maddingley Brown Coal which is one of the sixth largest in the State in terms of throughput and fifth largest in terms of available capacity, and the only landfill of this size outside of Port Phillip region. However, its location near Bacchus Marsh means it manages waste mainly from Melbourne. The landfill is co-located with an organic reprocessing facility.

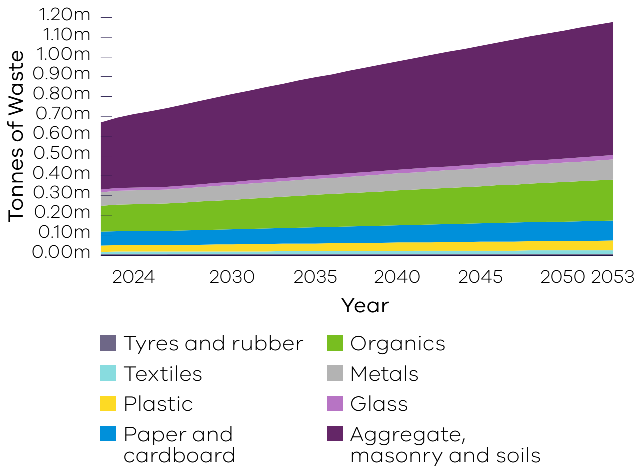
Next largest in terms of throughput is Ballarat Regional Landfill, while Doeen landfill near Horsham is next largest in terms of capacity. Stawell regional landfill is centrally located in GCW region and is also accessible (and being used by) the western section of Barwon region.

65 Population in 2020 as quoted in the RCEP

6.4.2 Waste projections – Grampians Central West

The total generated waste projections for the Grampians Central West region are set out in the chart below.

Figure 51 Total generated waste projections for the Grampians Central West region



6.4.3 Opportunities – Grampians Central West

There is no MRF in the region, and Infrastructure Victoria identified Ballarat as a potential location for a MRF with mechanical separation and optical sorting technology.

An economic opportunity for the region is to strengthen the renewable energy and waste management industries. The development of local renewable energy resources such as wind and solar, and the integration of an efficient waste management sector present opportunities to innovate and strengthen local supply chains, such as agri-food industries.

The relatively low number of C&D reprocessors means there is less reprocessing capacity than waste generated for a material stream with a high potential for regional circularity.

Agriculture is the top sector by employees and gross value add in the Wimmera Southern Mallee. The infrastructure goals outlined in the RCEP involve establishing organics processing facilities across the region. The RCEP notes interest from the agricultural sector highlight the potential to increase the capacity of recycled organics processing. Infrastructure Victoria suggested Ballarat as a potential location for in-vessel composting.

Grampians Central West has 3 plastics reprocessing facilities, however the estimated waste generated in the region exceeds their capacity. The Infrastructure Victoria report suggested Ballarat as the location for a flaking and pelletising facility, and one of the infrastructure priorities in the RCEP was to expand soft plastic collection and processing capacity to divert this resource from landfill.

Another infrastructure priority in the RCEP was to scale up collection, sorting and processing for glass to take advantage of glass as a resource for the region and infrastructure projects.

As with other regions, the sub-regions closer to Melbourne have higher population densities and a different economic make up to the the more remote areas. Construction and manufacturing, alongside agriculture, healthcare, education, and training are important sectors to the Central Highlands economy. Agriculture is the top sector by employees and gross value add in the Wimmera Southern Mallee.

There is an opportunity to position the region to benefit from emerging growth in natural resources. The region's notable potential for mineral extraction and renewable energy generation positions it strongly to take advantage of government investment in energy infrastructure, diversification of local industries, and building a low-carbon future. There are emerging opportunities to recycle e-waste from REZ-type projects in Grampians, which aligns with the opportunity to enhance regional innovation. In addition, the RCEP aims to co-locate renewable energy infrastructure with resource recovery and manufacturing processes to support cost-effective operation of facilities with low environmental impact.

The RCEP notes that the current projects and trials underway demonstrate the value of circular economy initiatives and the Ballarat West Employment Zone, and interest from the agricultural sector highlight the potential to increase the capacity of recycled organics processing. The RCEP noted the region's proximity to Melbourne and high-capacity transport connections to transport recycled products to markets outside the region were also highlighted as strengths. Bacchus Marsh is a regional population centre in the peri-urban area around Melbourne, which already has established facilities that could offer operation for co-location.

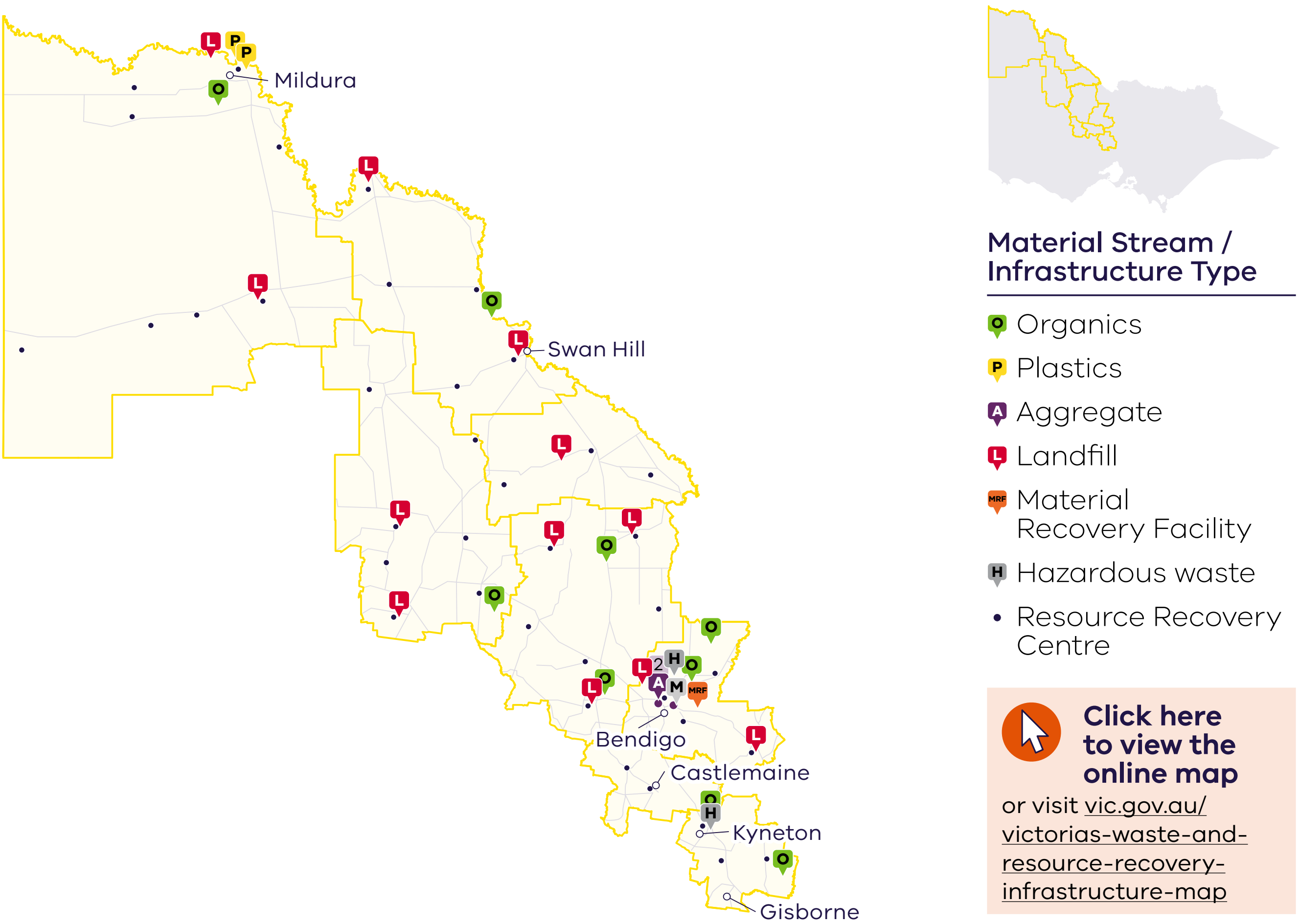
Ballarat is the largest population centre approximately 100 kms from Melbourne's western suburbs, and the Ballarat West Employment Zone provides potential development area with projects and trials underway demonstrate the value of circular economy initiatives. Horsham, another regional city, is well located to support the east of the region. The other regional centre, Ararat, and existing facilities such as the Stawell landfill, provide potential development opportunities in the centre of the region.

6.5 Loddon Mallee

Loddon Mallee accounts for less than 5% of Victoria's annual managed tonnes. It has a population of around 329,000[66], 9 LGAs and 2 sub-regions, Loddon Campaspe and Mallee.

The region includes 2 major population hubs: Bendigo, with a population greater than 120,000, and Mildura with a population of around 35,000 in Mallee. Other regional centres include Swan Hill, Castlemaine, Kyneton, and Gisborne in Loddon Campaspe.

Figure 52 Loddon Mallee – current waste and resource recovery infrastructure



6.5.1 Existing infrastructure – Loddon Mallee

The region has one MRF in Bendigo, and 38 resource recovery centres distributed across the region. This includes 8 organics reprocessors, one anaerobic digester and 2 C&D facilities. There are 2 plastics facilities, both located in Mildura, a metal reprocessor in Bendigo, a refuse derived fuel facility and 2 thermal waste from energy facilities.

The region has one MRF in Bendigo, and 39 resource recovery centres distributed across the region.

The region has 4 licensed active landfills, and several closed landfills. The largest in terms of approved capacity is the Mildura landfill, which has serviced the surrounding area, with the only nearby alternatives interstate facilities, although there has been encroachment on this facility. While the Swan Hill landfill has less approved capacity, there is potential for additional capacity at this site.

The Eaglehawk landfill is nearing capacity, with much of the waste now diverted to Patho landfill in the neighbouring Goulburn Valley Region. The landfill remains a hub for reprocessing materials from C&D activities at the co-located quarry.

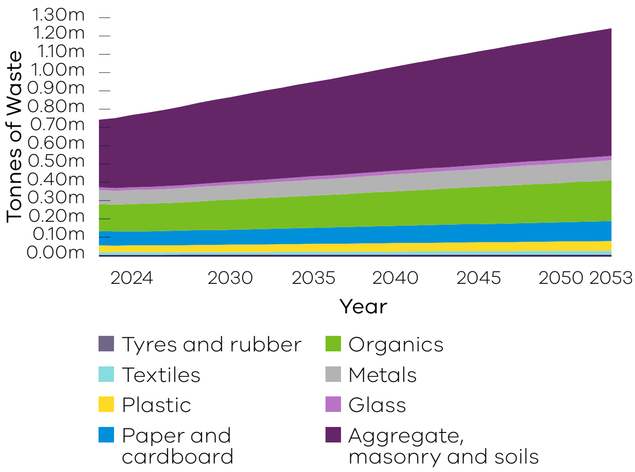
66 Population in 2020 as quoted in the RCEP

There are legacy issues with contaminated soil and historic mining waste that require management in the Bendigo region. Currently, these wastes are being disposed of at the Eaglehawk landfill which is nearing capacity. This issue is considered in Section 5.3.3.

6.5.2 Waste projections – Loddon Mallee

The total generated waste projections for the Loddon Mallee region are set out in the chart below.

Figure 53 Total generated waste projections for the Loddon Mallee region



6.5.3 Opportunities – Loddon Mallee

There is already a MRF in this region, although this provides less capacity than the region's generated demand. Infrastructure Victoria recommended Bendigo as on opportunity for paper separation upgrades.

While there are 10 organics facilities, there may be economic challenges in fully utilising this capacity, particularly in more remote areas, and organic waste including FOGO may be transported for processing to the Goulburn Valley region and NSW.

With only 2 C&D reprocessors, capacity analysis suggests they provide less capacity than waste produced. The Infrastructure Victoria report suggested Bendigo, Echuca, Mildura as potential locations for glass /aggregates facilities for local civil construction needs.

Regional infrastructure ambitions in the RCEPs include investment in collection, reprocessing, and manufacturing technologies. This investment aims to improve access to collection services, and the sorting and cleaning of commercial and commingled plastics, polystyrene, household soft plastics and agricultural plastics. The Infrastructure Victoria report suggested Mildura and Bendigo as potential locations for plastics facilities.

The region covers a large geographic area. The Loddon region has a higher population density, with manufacturing and construction are key sectors. Strategic directions for the region include maximising gains in the employment and innovation corridor, leveraging local opportunities to strengthen value chains, and diversifying into new industries, such as mining, renewable energy, and waste processing.

The Mallee region has lower population densities and greater distances between population centres. Agriculture is the highest value add sector by some distance. Strategic opportunities include leveraging natural endowments to diversify the economy into emerging industries, including solar energy generation and the development of renewable hydrogen technology. The REZ in the Climate Change Strategy highlights the region's potential for solar energy.

There are legacy issues with contaminated soil and historic mining waste that require management in the Bendigo region. Currently, these wastes are being disposed of at the Eaglehawk landfill which is projected to reach its approved capacity soon. This is considered further in the Residual waste section (Section 5).

The region has the potential to move recyclables to processing facilities, and products to end markets. Other strengths include innovation, with trials underway to increase recycling rates and the use of recycled content and notes that there is sufficient land availability with enough of a buffer from residential growth.

For development areas, Mildura and Swan Hill are the main population centres in the Mallee. The RCEP notes that while distance is a challenge for the rural and remote areas, the established transport network links between Victoria, NSW and SA are considered a strength.

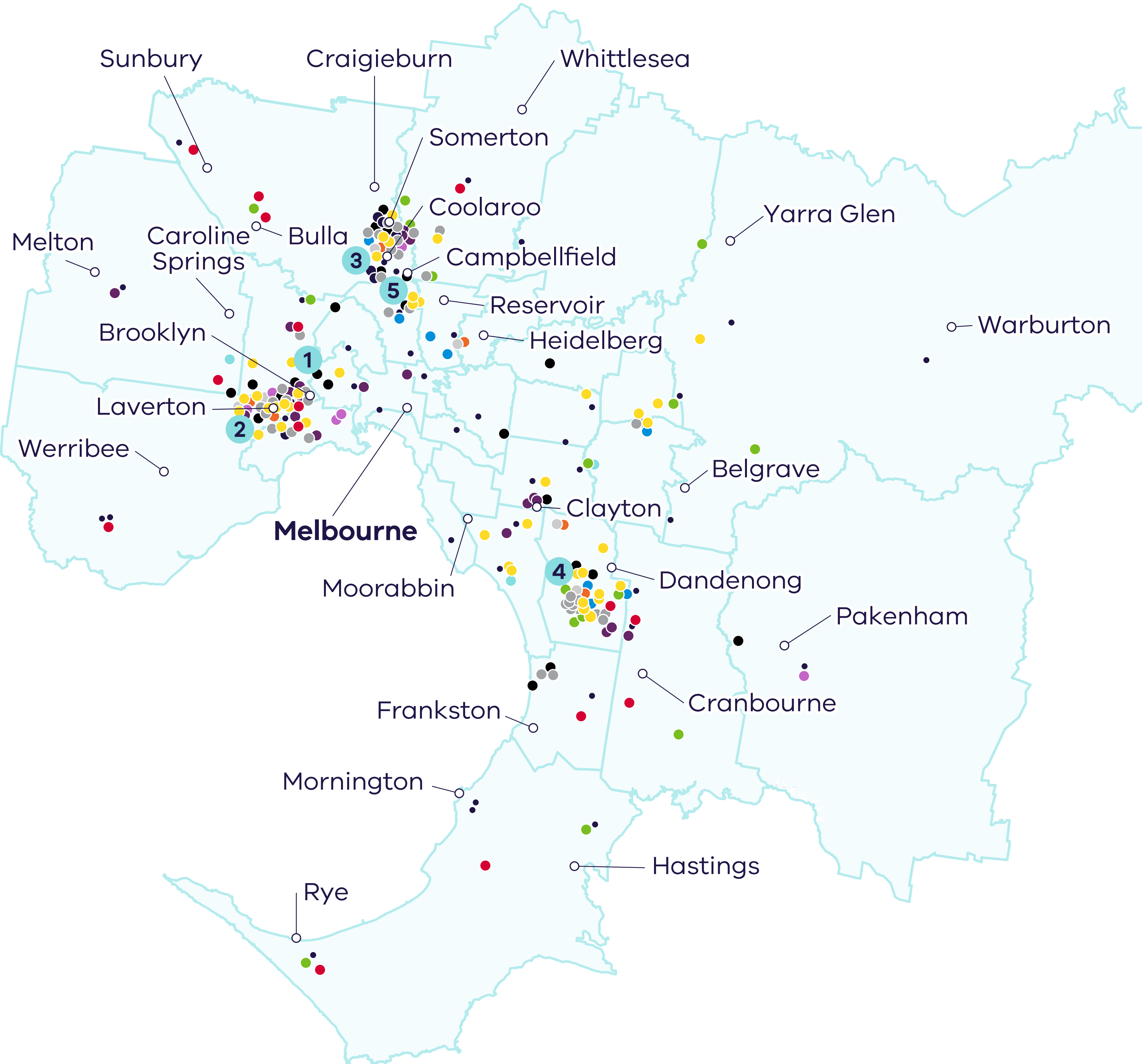
Bendigo is the largest population centre in Loddon Mallee and has potential as a regional development area, with existing facilities providing potential for co-location. The largest centre in the region, Bendigo, is home to a range of unique manufacturing businesses. In the south, Castlemaine, Kyneton and Gisborne are all located along the Calder Highway in a relatively densely populated corridor of the peri-urban area around Melbourne.

Regional infrastructure ambitions in the RCEPs include investment in collection, reprocessing, and manufacturing technologies. This investment aims to improve access to collection services, and the sorting and cleaning of commercial and commingled plastics, polystyrene, household soft plastics and agricultural plastics.

6.6 Port Phillip Region

Port Phillip Region accounts for approximately 74% of Victoria's annual managed tonnes. It contains Melbourne, the 31 metropolitan LGAs and a population of around 4.9 million[67]. As the largest urban centre, generator of most waste and focus of Victoria's transport network, it is well positioned to deliver the economies of scale required by many material streams.

Figure 54 Port Phillip – current waste and resource recovery infrastructure



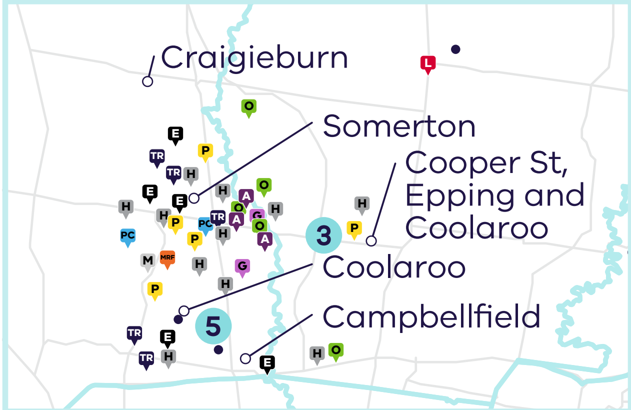
67 https://www.abs.gov.au/articles/snapshot-vic-2021#:~:text=In%20the%202021%20Census%2C%20the,Greater%20Melbourne%20(4.9%20million).3ehy.

Material Stream / Infrastructure Type

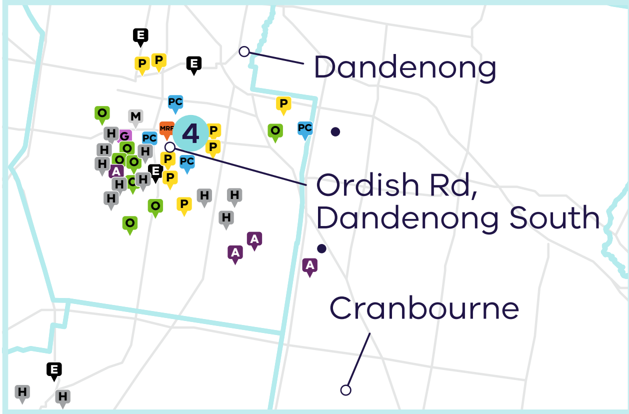
- Organics
- Paper & Cardboard
- Plastics
- Glass
- Tyre & Rubber
- Metals
- Aggregate
- Textiles
- E-waste
- Material Recovery Facility
- Hazardous waste
- Landfill
- Resource Recovery Centre

Brooklyn (1) and Laverton (2)

Cooper St (3) in Epping and Coolaroo (5)



Ordish Rd in Dandenong South (4)



Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

6.6.1 Existing infrastructure – Port Phillip

Port Phillip Region is Victoria's primary location for reprocessing and material recovery facilities. It has over 100 existing facilities covering all 10 material streams in the VRIP. It is a significant location for the state's paper and cardboard reprocessing, including Australia's first drum pulper in Coolaroo.

All of Victoria's tyres and rubber and textiles reprocessing is also in the Port Phillip region. Plastics is another centralised material stream, with Victoria's only chemical recycling facility in Dandenong South. Glass, and metal reprocessing are highly centralised in the Port Phillip Region, including Victoria's only bottle-to-bottle recycling facility in Spotswood, one of only 3 in Australia.

The number of facilities mean there are existing clusters of facilities, including:

- Brooklyn (1) is a significant, well-established cluster of reprocessing facilities that account for a significant proportion of the state's metal reprocessing capacity and large volumes of materials from the C&D sector.
- Laverton (2) supports major metals reprocessors for the state and significant reprocessing of materials from C&D activities.
- Cooper St (3) in Epping has a significant organics reprocessing facility accepting garden organics mainly from the metropolitan area. It is also a significant location for reprocessing materials from C&D activities in the northern metropolitan area of Melbourne.
- Ordish Rd (4) in Dandenong South has many waste and resource recovery facilities including a MRF, organics reprocessing, hazardous waste management, and construction and demolition operations.

These are all located in state-significant industrial precincts. Other clusters of existing facilities, such as ones in Coolaroo (5), Mordialloc and Bayswater, illustrated clearly in the Port Phillip regional map, are located in other appropriately industrial zoned locations across Melbourne.

The region has 6 of Victoria's MRFs, 2 in the West located at Truganina and Laverton North, 2 in the North at Coolaroo and Heidelberg, and 2 in the South East at Springvale and Dandenong South. These collectively represent over 75% of Victoria's MRF capacity.

There are also 42 resource recovery facilities in the region. These include major consolidation points for waste, such as the Citywide RRC which also provides public transfer station services for MSW and C&I waste principally from the inner metropolitan and central business district area. Other transfer stations include Clayton South, where the landfill has closed, and waste is consolidated for transfer to other facilities.

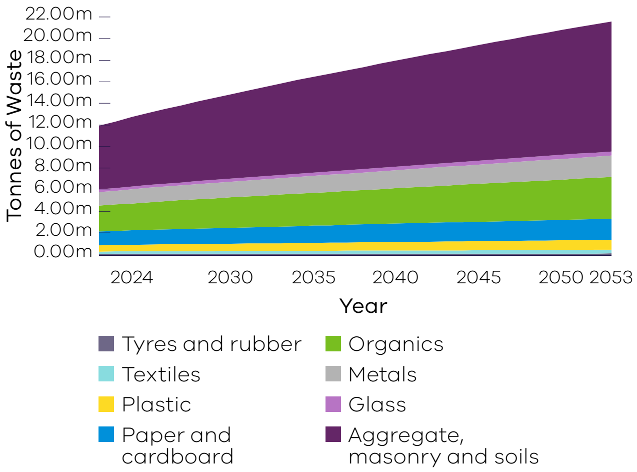
The region has 15 landfills, including 5 of the 6 landfills which accept over 200,000 tpa of waste at Hallam, Bulla, Wollert, and Werribee. These landfills collectively receive over 80% of Victoria's residual waste. Four of these 5 account for around 75% of the available development licence approved capacity in Victoria. The fifth, at Hallam, is nearing capacity. This, along with other nearby landfills also reaching capacity, is creating a place-based challenge in the Southeast of Melbourne, which is considered further in the Residual waste section (Section 5).

Other infrastructure is often co-located with these significant waste facilities. The Bulla landfill is co-located with a significant organics facility and supports recovery of C&D material. There is also a transfer station. The metropolitan region also includes the only Category B landfill in Victoria at Taylors Road. The landfill is co-located with a soil treatment facility.

6.6.2 Waste projections – Port Phillip

The Port Phillip region produces over 75% of Victoria's total waste. On current trends the total waste generated by this region is projected to grow from around 12 million tpa to over 20 million tpa by 2053.

Figure 55 Total generated waste projections for the Port Phillip region



6.6.3 Opportunities – Port Phillip

As by far the largest population centre in Victoria, the Port Phillip region has significant inherent advantages as a location for infrastructure. It produces feedstock that can support facilities that require State-level economies of scale and is at the centre of the State's transport network that can support further aggregation of materials from across the state. The strong manufacturing and research sectors provide end markets, new technology and skilled workers. It is the primary route to international markets through the Port of Melbourne and other international gateways.

These advantages mean the region is well placed to support both capacity and capability improvements across multiple material streams. Infrastructure Victoria identified locations within the Port Phillip Region as having potential for upgrades to existing MRFs, C&I paper recovery, e-waste (for batteries and solar panels), glass sand aggregation, anaerobic digestion, paper and cardboard, plastics and tyres reprocessing facilities. Noting that some of the recommended facilities have been realised or are in delivery (such as a new glass beneficiation plant and chemical plastics reprocessing), these opportunities are broadly aligned with the VRIP needs analysis and are located in areas suitable for development.

However, the large growing population means there is pressure on land use. Encroachment is a significant issue which places existing infrastructure under pressure. For example, the Brooklyn precinct has seen incidences of issues such as odours, dust, stockpiles, and truck movements impacting local amenity.

The Clayton South (5) has a long history associated with waste and resource recovery. It has been a significant hub for the surrounding area for organics reprocessing, landfills, and reprocessing materials from C&D activities. Currently there is a large C&D reprocessing facility, and a resource recovery facility. However, zoning changes to facilitate open space means the C&D reprocessing facility is expected to close and only the transfer station is expected to remain.

Encroachment has also been an issue with landfills, with sensitive uses including residential now close to active facilities. If the needs of the region and the wider state are to be met it is important to preserve adequate buffer distances around existing facilities, and carefully manage the situation where important infrastructure has already been encroached.

These issues mean that the region is less suited to 'open' organics processing, which often requires large buffers and may have amenity impacts. Two stage processing is one model that could help reduce the pressure, with initial processing in Melbourne before the material is transported to other sites for secondary processing (noting transporting unpasteurised waste will need to be managed). For local reprocessing, in-vessel and anaerobic digestion facilities would be more appropriate than open windrow. Infrastructure Victoria noted the potential for anaerobic digestion in the region.

While there is pressure on land use, there are areas suitable for new development. Melbourne includes state and regionally significant industrial precincts, areas specifically designated for their strategic location, buffers, and suitability for large industrial facilities. The number and size of existing facilities means the co-location of facilities presents an opportunity, particularly for infrastructure requiring buffers. This may include organics facilities co-locating with water corporation facilities that use similar technology and require boundaries, or co-locating resource recovery and transfer facilities at landfills.

7 Land use planning and environmental approvals

It is essential that existing and new communities can be serviced by waste, recycling, and resource recovery infrastructure as they develop. The VRIP identifies Victoria's waste, recycling and resource recovery Infrastructure requirements over the next 30 years. This section considers how the land use and environmental planning framework can support the delivery of the required infrastructure.

Victoria has a well-developed land use and environmental planning framework that supports growth and development in suitable locations. It has an established framework for the development of land and the approval of land use. The VRIP works within these frameworks.

This section of the VRIP provides information to guide infrastructure proponents and responsible authorities such as the EPA and local government to determine suitable locations for new infrastructure, and to support the continued operation of existing infrastructure in line with the appropriate planning approvals and operating licenses.

7.1 Strategic context

Victoria's population is growing. The state's population is expected to grow to 10.3 million by 2051. Much of that growth will be in Melbourne, which is projected to grow by 2.9 million people over the same period. Plan Melbourne[68] sets out how 70% of that growth will be in established areas and 30% in growth areas.

Victoria's Housing Statement[69] sets a new target of 2.24 million dwellings for Victoria by 2051, with 1.8 million of those in Melbourne, and foreshadows the new plan for Victoria, which would establish local government housing targets for all LGAs.

The Housing Statement provides further information about how Melbourne will grow. The priority precincts, namely Arden, Docklands, Fishermans Bend, Footscray, and Richmond to Flinders Street corridor; National Employment and Innovation Clusters such as Parkville, Sunshine, and Precincts and suburbs are expected to deliver around 150,000 homes, with further opportunity for more homes to be built as the precincts grow over time[70].

Plan Melbourne also sets out that between 2011 and 2031, regional Victoria's largest local government areas by population (Greater Geelong, Greater Bendigo, and Ballarat) are projected to account for 50% of all population growth outside Melbourne. Growth in peri-urban areas beyond metropolitan Melbourne will attract about 32% of regional Victoria's population in the same period.

This means that the existing population centres and distribution will continue, but there will be continued pressure on land use as Melbourne and other urban areas grow.

The VRIP provides an overview of the waste and resource recovery infrastructure needed to support the growing population. It also identifies that the infrastructure already in place will be equally important.

Integrating waste and resource recovery infrastructure planning with land-use planning is important to ensure that existing and growing communities can be served effectively. The investment required to establish infrastructure, and the nature of the facilities, means that it is important to provide long-term certainty and manage potential conflicts with incompatible nearby land uses.

The VRIP does this by informing:

- investment and planning decisions relating to the location of new infrastructure
- planning decisions and tools that support the ongoing operation of existing infrastructure by managing or mitigating encroachment
- strategic land use planning to support the future supply of suitable areas for development and protect existing infrastructure.

7.2 Informing locations for new infrastructure

Section 37B(1)(a) of the CE Act requires the VRIP to identify suitable development areas that meet Victoria's waste, recycling, and resource recovery infrastructure needs.

The analysis in the previous sections of VRIP provides important information to inform the location of infrastructure. The material stream and residual waste analyses set out what infrastructure is needed at state-wide level, while the place-based analyses and regional opportunities provide guidance for appropriate locations at the regional level. This section provides information to guide infrastructure planning at the local level.

To do this, the VRIP provides information to guide scheme users and responsible authorities about areas that are most suitable for developing infrastructure. It is not intended, or practical, for the VRIP to have a comprehensive list of all locations where infrastructure could be located. Nor is this guidance tacit approval for new developments within potentially suitable areas. Each proposed facility must go through the appropriate planning and environmental approvals processes.

68 https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/plan-melbourne.
69 https://www.vic.gov.au/housing-statement.
70 Housing Statement p16.

The 6 attributes below are indicators that an area is likely to be suitable for waste, recycling, and resource recovery infrastructure development:

- strategic alignment
- potential for co-location
- zoning and planning
- amenity and buffers (or separation distances)
- transport considerations
- site size.

The wide variety of waste, recycling and resource recovery infrastructure needed by the State means these attributes must be applied proportionately to the type of infrastructure proposed. Some infrastructure types require larger buffers from sensitive uses than others. For some material streams a few facilities can service the whole state, but it is equally important there are multiple, convenient recovery and transfer points for materials to enter the recycling system.

It is not a requirement of the VRIP that the proposed location of every facility must meet every one of these attributes, but the location requires to be zoned appropriately. These attributes provide guidance for investors about the areas that are likely to be suitable for developing waste, recycling, and resource recovery infrastructure while leaving them enough flexibility to identify the most suitable location for new facilities. Similarly, the VRIP provides guidance and information for planning and licencing authorities to help them assess a proposal on its individual merits.

7.2.1 Strategic alignment

Victoria's strategic land use framework includes strategies at the State, regional and local levels that identify areas suitable for locating industrial infrastructure. These include:

- Plan Melbourne 2017–2050 (and the forthcoming Plan for Victoria).
- Melbourne Industrial and Commercial Land Use Plan (MICLUP)[71] which considers current and future needs for industrial and commercial land across metropolitan Melbourne.
- Growth Corridor Plans[72], by the Victorian Planning Authority, which provide integrated land use and transport plans for the development of the growth corridors over the next 30 to 40 years.

Responsible authorities and other planning scheme amendment proponents should also consider environment protection strategies that may prevent development in certain areas if mitigation measures cannot be implemented.

Local planning strategies are also important considerations. These include Precinct Structure Plans[73], local planning schemes, and local government strategies, such as local waste, recycling, and resource recovery plans.

The Strategic Planning Framework identifies areas that are suitable for the development of infrastructure in each local government area. These areas are provided for prescribed land uses in designated zones (see zoning Section 7.2.3 below). There are appropriate zoned areas of land across the state, including Melbourne, surrounding areas, and regional Victoria. Where it is appropriate for land to be rezoned to facilitate waste, recycling and resource infrastructure, the planning framework facilitates this through the planning scheme amendment process.

Melbourne

The land use planning framework includes areas specifically identified as suitable areas for developing new infrastructure including:

- **State-significant industrial precincts:** These areas protected from incompatible land uses to allow continual growth in freight, logistics and manufacturing investment. There are 5 State-significant industrial precincts identified across metropolitan Melbourne: Western, Northern, Southern, Officer-Pakenham and Hastings.
- **Regionally significant industrial precincts:** These provide opportunities for industry and business to grow and innovate in appropriate locations for a range of industrial and other employment uses that can contribute significantly to regional and local economies.

These areas are strategically aligned with delivering significant infrastructure, such as existing clusters (such as Brooklyn, Laverton, Cooper Street, Ordish Road and Coolaroo) which are located in State significant industrial precincts, while other clusters of facilities are in regionally significant infrastructure precincts (such as in Mordialloc and Bayswater).

71 https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/melbourne-industrial-and-commercial-land-use-plan.

72 https://vpa.vic.gov.au/metropolitan/growth-corridor-plans/.

73 Precinct structure plans available at the Victorian Planning Authority website provide useful analysis on considerations such as climate risk, resilience, transport and cultural heritage.

Other areas that may also provide strategic alignment in Melbourne include:

- local industrial precincts, which may be suitable areas for smaller facilities and/or less impacting activities (e.g. transfer stations)
- areas that are identified in local government waste management plans or strategies.
- National Employment and Innovation Clusters (NEICs) may also provide opportunities for research and development or manufacturing facilities that do not require large buffers. The Sunshine, Dandenong and Clayton NEICs adjoin state or regionally significant industrial precincts and have a manufacturing focus.

Map 1 in the maps section (Section 7.7) at the end of this chapter shows the existing and future industrial land in Melbourne. Map 2 to Map 4 are aerial photographs of the Western Northern and Southern state significant precincts that clearly demonstrate the suitability of industrially zoned areas compared to neighbouring areas, and the strong correlation between existing reprocessing infrastructure and industrial precincts.

Peri-urban areas

The peri-urban area is the land surrounding Melbourne, often considered to be within 100km of Melbourne's centre. Productive use of land and resources in this area is a strategic planning objective.

The peri-urban area has the potential to service both Melbourne and regional markets. It includes some of Victoria's fastest growing communities which also have capacity for more employment-generating development. It also includes Geelong, Victoria's second largest city, and Ballarat at around 100 km from Melbourne's western suburbs. These have strong transport links, existing infrastructure, an established role as regional centres, proximity to Melbourne and significant populations creating their own local markets.

The peri-urban area also includes green wedge areas. As well as their important environmental role, there are existing resource recovery operations and other complementary industries such as natural resource extraction and, wastewater treatment, which have potential for co-location of new infrastructure (see below).

Developments in the peri-urban area must align with the important environmental and other roles that Melbourne's surrounding non-urban areas serve, including environment protection, and relevant local planning strategies such as green wedge management plans.

Section 7.7, Map 5 shows the peri-urban areas around Melbourne, while Map 6 shows the existing reprocessing infrastructure in these areas.

Regional Victoria

Victoria has 10 regional cities (Greater Geelong, Greater Bendigo, Ballarat, Greater Shepparton, Latrobe City, Wodonga, Warrnambool, Mildura, Wangaratta, and Horsham. These have significant strategic advantages for locating infrastructure. As the largest urban centres outside of Melbourne, they generate the most waste and have the largest local markets. With good transport links, and as established focal points for their regions, they provide the best opportunity for infrastructure that require regional economies of scale. Several are either within the peri-urban zone or close enough to access Melbourne markets, while others have potential to access cross-border markets in NSW or SA.

In addition to the regional cities, there are other regional centres, identified in the regional infrastructure opportunities section (Section 6), that operate as service hubs for many smaller communities. They also tend to have transport links to the regional cities and Melbourne, and there is often already have infrastructure located in or near these areas.

Land in and around these areas that is designated as being available for development by local planning schemes are most likely to be able to deliver economies of scale for regional infrastructure.

A map of Victoria's regional cities and centres is included as Map 7 in the maps section (Section 7.7). Map 8 shows existing reprocessing infrastructure in regional Victoria. This, and the assessment of current infrastructure in the regional infrastructure opportunities section (Section 6), shows a strong correlation with existing infrastructure and regional centres.

7.2.2 Potential for co-location

Co-locating new waste-related infrastructure with complementary activities can deliver operation efficiencies, opportunities to share existing separation distances and facilitate the integration of waste, water, and energy management. Examples of infrastructure and complementary activities that could be suitable for co-location.

- **Landfills:** These have established buffers and are focal points for waste collection. Co-locating recycling and resource recovery infrastructure can provide operational efficiencies, reduce transport costs, and help improve recovery rates. There are already many existing examples of recycling and resource recovery infrastructure co-located with landfills. The landfill schedule provides details of current landfills. Furthermore, landfill sites can transition into transfer stations and/or recycling and resource recovery centres as they approach their landfill capacity. This has the advantage of providing an ongoing and viable use of the site. The closure of the landfills mean that materials and waste traditionally disposed in these locations will need to find alternative management options. This presents an opportunity to establish sorting and consolidation facilities in or near the landfills to provide options to maximise transport efficiencies.
- **Recycling and resource recovery infrastructure:** There are clear benefits to operating alongside or near existing infrastructure, either individual facilities or clusters of facilities. In Melbourne there are clusters of infrastructure in Melbourne, the southeast (including Ordish Road), the west (including Laverton and Brooklyn), and the north (including Cooper Street and Coolaroo), that are aligned with the State Significant Industrial Precincts. There are other smaller clusters aligned with other industrial areas (see map 1 and map 4 below).
- **Compatible industries:** Co-locating recycling with end markets can be efficient and encourage circularity, such as plastics recycling with petrochemical industries, or glass crushing aggregates and masonry reprocessing with the construction industry.
- **Water corporation facilities:** These facilities require large buffers and use similar technology to organics processing. These are often located outside of urban areas, providing for large buffers and opportunity for processing more impacting activities such as organics processing. There could also be opportunities for co-processing other waste material inputs.
- **Extractive industries:** Many landfills are located at quarries, with the excavated pit providing the landfill capacity. Extractive industries may also use similar technology to that required to reprocess C&D waste, masonry, aggregates and even glass crushing for use in construction.
- **Energy generation:** There is the potential for synergies in co-locating with energy infrastructure. Waste to energy and biogas facilities can support the transition away from fossil fuels. As set out previously in the VRIP, the Renewable Energy Zones provide opportunities for co-locating recycling facilities for associated waste streams, while also providing potential sources of clean energy. Similarly, some existing landfills may also offer co-location opportunities for energy generation subject to design and regulatory requirements.

7.2.3 Zoning and planning

In line with the Victorian Planning Framework, any use or development of land must take place in an area that is suitably zoned. Planning zones suitable for the development of waste, recycling and resource recovery infrastructure include zones designated as Industrial 1, Industrial 2, Special Use and 'green wedges' determined by the Minister for Planning in response to proposals from the relevant planning authorities, noting that on a case-by-case basis zoning can be changed through a planning scheme amendment.[74]

- A mapping tool that includes the zoning of all land in Victoria can be found here:
- Vicplan (https:mapshare.vic.gov.au/vicplan).

VicPlan allows prospective investors to view, query and create property reports. As well as a mapping tool, it's a gateway to a range of planning information.

7.2.4 Amenity and buffers (or separation distances).

Waste, recycling and resource recovery infrastructure operations can pose risk of adverse cultural, environmental, and human health impacts. It can also pose risk to sensitive environmental and cultural heritage receptors such as indigenous heritage sites, waterways, coastal environments, groundwater, native vegetation, and native animal habitats.

It is therefore important that such infrastructure is planned and operated according to best practice standards, in accordance with relevant planning and environmental frameworks and is monitored accordingly. Adverse impacts include amenity, odour, dust, noise, litter, gas emissions, vibration, or release of pollutants into air, soil, surface water, groundwater, and marine environments.

74 https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance.

Land use planning plays a key role in the separation of incompatible land uses and ensures that adequate buffers and planning mechanisms are in place to protect communities and the environment from these adverse impacts. It also enables facilities to operate efficiently.

Multiple land use documents and guidelines, outlined in Table 15, ensure Victoria's waste, recycling and resource recovery sector integrates with other land uses effectively[75].

Table 15 Relevant land use planning documents relating to buffers

Policy	Relevance
The Environment Reference Standard	The Environment Reference Standard (ERS) is made up of many reference standards that cover the aspects of ambient air, ambient sound, land, and water (surface water and ground water). The environmental values, indicators and objectives set out in the ERS for each element of the environment can be used to support decision making. This guide provides information about how the ERS should be applied to support decision making, and how the environmental values, indicators, and objectives for each element of the environment should be interpreted.
Separation distance guideline (August 2024)	This guideline provides advice on recommended separation distances between industrial land uses that emit odour and/or dust, and sensitive land uses. This guideline is organised into 2 environmental categories: 1. Odour 2. Dust Each of these categories includes: • information about their potential risks and impacts • recommended separation distances between industries and sensitive land uses • an overview of the separation distance decision-making process • references to the relevant assessment methodology and tools.
1961: Guideline for assessing and minimising air pollution	This EPA guideline provides a framework to assess and control risks associated with air pollution.
Landfill buffer guideline (August 2024)	This guideline is intended to provide all relevant information about buffers for landfills. The guideline provides advice on: • human health and amenity risks posed by landfills • separation distances for landfills • appropriate land uses within landfill buffers.
Victorian Planning Framework – Buffers and land use compatibility[76]	Land use buffers help to minimise land use conflict by managing the location and siting of industries and incompatible uses, for example, residential development. Inappropriate land use and development within buffers can affect the safety, health and amenity of communities and constrain the operation of industries and critical infrastructure. Planning Practice Note 92[77] provides further information about planning policy and tools to manage buffers.

Regulatory agencies such as local government and the EPA work collaboratively to address non-compliance and unauthorised development issues. The EPA is an independent regulatory authority that works to prevent and reduce the harmful effects of pollution and waste on the health of Victorians and the natural environment. The EPA administers the Victorian environment protection framework set out in the *Environment Protection Act 2017 (EP Act)* and *Environment Protection Regulations 2021.*

75 These policies may be subject to change.

76 https://www.planning.vic.gov.au/guides-and-resources/guides/all-guides/buffers-and-land-use-compatibility#:~:text=Buffers%20in%20state%20planning%20policy,-State%20planning%20policy&text=Clause%2013.07%2D1S%20Land%20use,potential%20adverse%20off%2Dsite%20impacts.

77 https://www.planning.vic.gov.au/guides-and-resources/guides/all-guides/buffers-and-land-use-compatibility#:~:text=Buffers%20in%20state%20planning%20policy,-State%20planning%20policy&text=Clause%2013.07%2D1S%20Land%20use,potential%20adverse%20off%2Dsite%20impacts.

All Victorian businesses have a responsibility to reduce the risk to human health and the environment from their activities, as far as reasonably practicable. Many waste recycling, resource recovery and disposal activities require permission to engage in those activities under part 4.2 of the EP Act. Prospective investors should be aware of the legislation to ensure they minimise their offsite impacts and operate in accordance with environment protection framework requirements.

7.2.5 Transport considerations

Transport is an important consideration that influences the viability of an investment in waste, recycling, and resource recovery infrastructure. The ability of waste, recycling, and resource recovery facilities to access major transport routes influences the efficiency and cost to process materials, and to access end markets.

Victoria has a principal freight network to provide efficient, reliable, and sustainable freight transport and logistics services[78]. Victoria also has a freight plan, Delivering the Goods[79]. This sets out short, medium, and long-term priorities to support our freight and logistics system.

As with population growth, the freight plan shows that the existing freight corridors will remain, with investment in key infrastructure to support growth and change in the broader environment, while allowing us to embrace new opportunities in the future.

Other important transport planning considerations include:

- Increasing the load value of materials being transported lowers the cost of transport per tonne. For example, reducing contamination minimises the quantity of unrecoverable materials being transported, increasing load value. Increasing compaction where it does not impact feedstock quality reduces cost per tonne by increasing the amount of material transported.
- Increasing load size by using vehicles with greater storage capacity and aggregating small loads from various sources at regional consolidation hubs improves transport cost effectiveness.
- Decreasing transport time and costs by improving reception bay design (loading and unloading), through choice of route and time of day to travel.
- Decreasing operational costs, for example, fuel costs can be minimised by avoiding traffic congestion or sourcing cheaper fuel alternatives.
- Increasing backloading by using return journeys to transport valuable loads if there is demand for goods along the return route. This is also influenced by the time and cost required to clean and decontaminate vehicles.
- Optimising modes of transport that may be more cost effective based on the circumstances. For example, changing transport modes from road to rail would be viable. This includes achieving economies of scale, the cost of transporting to and from rail and the physical form of feedstock including its weight and storage requirements.
- Reducing vehicle emissions though transport choices that reduce or eliminate CO_2 emissions are preferred. For example, transitioning to low or zero emission vehicle fleets, using rail instead of road, or minimising distances travelled.

The *Transport Integration Act 2010 (*TIA Act) created a new framework for an integrated and sustainable transport system in Victoria. The TIA Act's decision-making framework recognises that land use planning and transport planning are interdependent. The alignment between the freight network and State Significant Industrial land is an example of integrated transport and land use planning.

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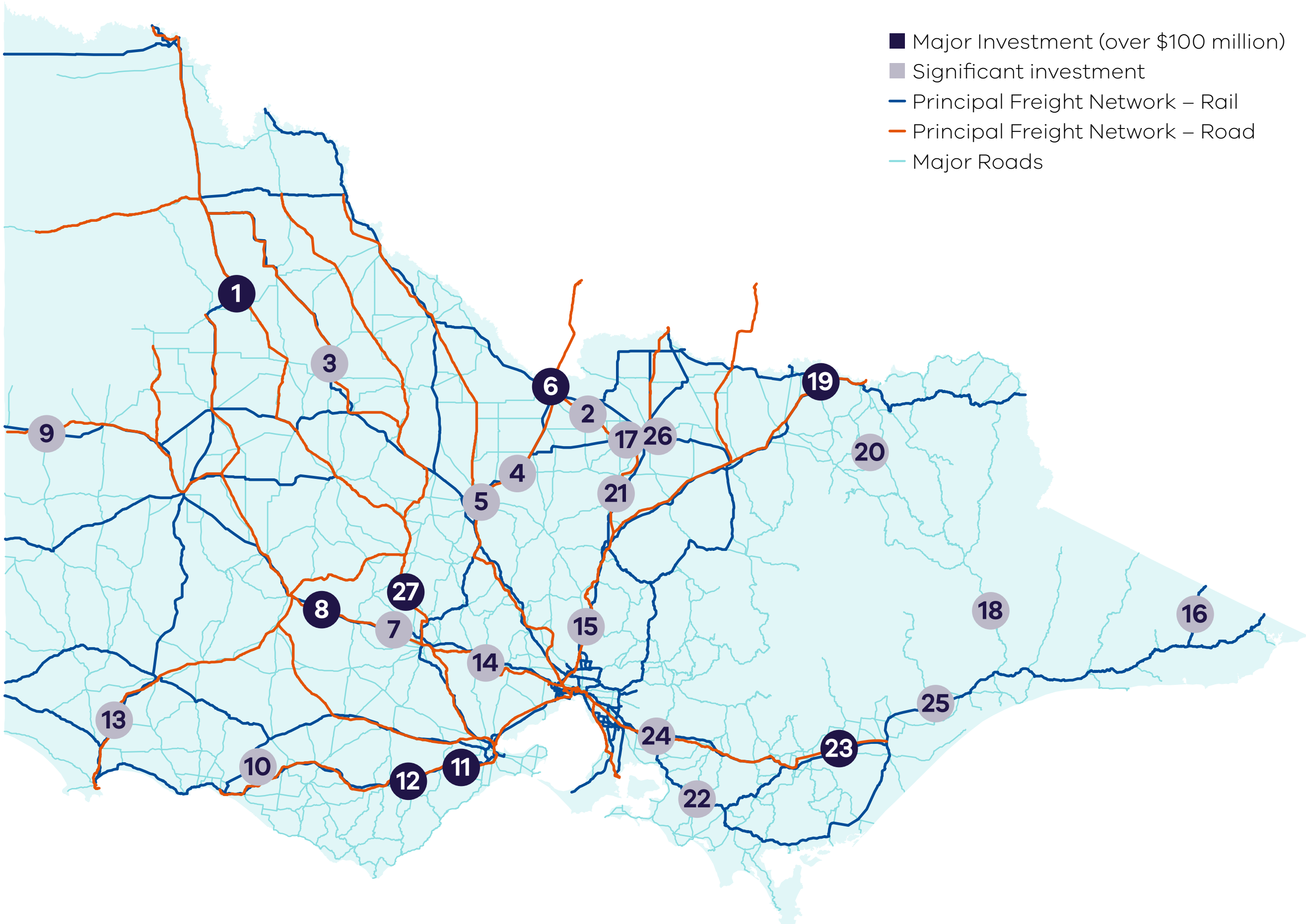
78 https://www.vic.gov.au/principal-freight-network.
79 https://www.vic.gov.au/freight-victoria.

Figure 56 Victoria's Freight Network and Freight Investments[80]



1 Murray Basin Rail Project

2 Murray Valley Hwy upgrade

3 Calder Hwy upgrade Bendigo-Mildura

4 Midland Hwy/Napier St duplication

5 Calder Hwy Ravenswood interchange

6 Echuca-Moama bridge

7 Ballarat West Employment Zone

8 Western Highway duplication – Ballarat to Stawell

9 Western Highway upgrade – Stawell to South Australian border

10 Princes Hwy upgrade – Colac to SA border

11 Princes Hwy duplication – Waurn Ponds-Winchelsea

12 Princes Hwy duplication – Winchelsea-Colac

13 Henty Hwy upgrade Portland-Hamilton

14 Bridge strengthening for HPFV – Western Hwy (4 bridges)

15 Bridge strengthening for HPFV – Hume Hwy (10 bridges)

16 Monaro Hwy upgrade

17 Shepparton Alternative Route

18 Great Alpine Rd upgrade

19 Rutherglen Heavy Truck Route

20 Kiewa Valley Hwy upgrade

21 Bridge strengthening for HPFV – Goulburn Valley Hwy (7 bridges)

22 South Gippsland Hwy upgrade – Koonwarra

23 Princes Highway duplication Traralgon-Sale

24 Sand Road interchange

25 Princes Hwy upgrade east of Sale

26 Shepparton Freight Network Planning

27 Freight-Passenger Rail Separation Project

80 Delivering the Goods, Victoria's Freight Plan: https://www.vic.gov.au/freight-victoria.

7.2.6 Site size

The development site size is an important attribute when considering the location of new infrastructure or the expansion of existing infrastructure. Specific sites should be fit for purpose for the proposed type of facility, both in terms of the required built form and the proposed activity to be undertaken at the site. The site should also consider the potential for possible future expansion of facilities and/or increases in operations or activities. The site needs to be of sufficient size to adequately accommodate the safe and efficient operation of the facility while ensuring there are adequate buffers to minimise adverse impacts on adjacent land use, the environment and human health.

When considering the suitability of areas for developing new infrastructure, having an aggregate of lots of sufficient size with the potential to co-locate compatible activities, incorporate required buffers, and facilitate future growth is advantageous.

7.2.7 Summary of approach

Through the strategic alignment attribute, the VRIP identifies the development areas in existing land use planning strategies (e.g. Plan Melbourne, MICLUP etc) that are most suitable to meet Victoria's waste, recycling, and resource recovery infrastructure needs:

- **Melbourne:** State-significant, regionally significant, and local industrial precincts, National Employment, and Innovation Clusters (NEICs), areas set out in council waste management plans.
- **Peri-urban:** Growing towns and cities with capacity for development, areas with existing waste/recycling operations or complementary industries.
- **Regional Victoria:** Land in and around regional cities and regional centres that is designated as being available for infrastructure development by local planning schemes.

Through the co-location attribute, the VRIP also identifies opportunities to locate new waste, recycling, and resource recovery infrastructure with complementary land uses, such as landfills, existing recycling and resource recovery infrastructure, compatible industries, water corporation facilities, extractive industries, and energy generation.

This guidance provides sufficient development areas to meet the State's future infrastructure needs but does not prevent proponents from finding their own locations in other areas.

The attributes relating to amenity and buffers (or separation distances), transport considerations, zoning and planning, and site size further help scheme proponents and planning authorities to identify suitable locations for infrastructure.

7.3 Assessing proposed locations for new infrastructure

The attributes set out above provide a guide as which areas have been identified as most likely to be suitable for developing new waste, recycling, and resource recovery infrastructure.

However, decisions on locations must be taken following the standard processes for planning approvals. The VRIP is referenced in the Victorian Planning Provisions, so it can inform these decisions. An overview of the process, roles and responsibilities is as follows:

- Infrastructure proponents use the VRIP analysis to inform decision making on proposed locations for new infrastructure that aligns with the State's needs.
- Relevant authorities will use the VRIP to inform their assessment of whether the proposed location is appropriate for the facility and will make the final decision on the suitability of the location under the land use planning framework.

In parallel to this process, the EPA will also consider any required permissions for new waste, recycling, and resource recovery infrastructure.

7.3.1 Social licence

Social licence is critical for any industry. There is strong public support for recycling and resource recovery, and it is important to retain that trust. However, there will also be difficult decisions in balancing competing priorities as there often is with land use planning, licensing, and approvals. Waste and resource recovery management can present challenges, but it is also an essential and critical service required for the community and business.

The VRIP can support social licence by guiding investment to appropriately site facilities that align with the state's needs. There will still be challenges, as there often are with competing land uses, which is why the land use planning framework has the appropriate systems and checks in place.

The land use planning and approvals frameworks have established processes to enable proactive consultation and engagement with potentially impacted parties, in order to build and maintain social licence for such activities. Waste, recycling, and resource recovery projects should follow the appropriate approvals and best practice development pathways.

7.3.2 Traditional Owners

All Victorians, including government departments, agencies, councils, land and resource managers, and developers should be aware that Traditional Owners have legal rights and interests across their country. It is important that consideration is given to Traditional Owner rights and interests at the earliest stages of all proposed new waste infrastructure and expansions to existing waste infrastructure.

To ascertain which Traditional Owner groups a developer should approach, refer to the First Peoples – State Relations website, which provides an interactive map. This includes proposed development of new waste infrastructure and the expansion of existing infrastructure.

If there is no Traditional Owner group formally appointed for the area, it is highly recommended that a developer should engage broadly and inclusively with Traditional Owners who assert rights and interests in the area. This may include Traditional Owner families and groups without formal recognition and neighboring Traditional Owner corporations with formal recognition.

The recommended process for all engagement with Traditional Owners is as follows:

- Step 1: Identify engagement obligations at the earliest stage of project planning, it is recommended a developer identify the relevant Traditional Owner group(s) and prepare a clear engagement plan.
- Step 2: Contact identified Traditional Owner group(s).
- Step 3: Undertake engagement and make sure there is a clear understanding about key matters, such as where engagement will take place, cultural protocols, decision-making steps and timeframes, fees, and other resources to support engagement, dispute resolution avenues and how Traditional Owner input will be acknowledged.

Legal obligations to engage with Traditional Owners

Section 52(1)(c) of the EP Act requires the responsible authority determining a development application to give notice of the application to any person specified in the planning scheme. This may include a referral to Traditional Owners.

Engaging Traditional Owners in infrastructure planning

The ongoing VRIP process presents an opportunity for Traditional Owners and First Peoples to engage with waste and recycling infrastructure and land use as an avenue to support the reconciliation process and increase the engagement of Traditional Owners in the sector.

7.4 Informing planning decisions relating to existing infrastructure

The attributes in the previous section are focused on new developments. However, the continued safe operation of the current infrastructure is vital to meeting current and future needs. Supporting infrastructure to remain fully operational and productive over the life of the investment can be aided by land and separation distances being secured, and by appropriate zoning of land within designated separation distances surrounding landfill sites and resource recovery sites.

This includes well established existing facilities that are operating in suitable locations and accordance with their licenses and approvals, but in locations that may not be suitable for adding new infrastructure – for example because there is not the space or sufficient separation in that location for further development.

There are also instances where historic decisions mean there are strategically important infrastructure operating in line with their permissions and licenses (including landfills) and sensitive land uses located closer than is ideal. These situations need to be carefully managed. Where possible, the land use planning framework and planning decisions should operate to reduce the likelihood of further encroachment and maintain the current buffers for sensitive land uses. It is equally important that the facilities operate in accordance with their licenses and permissions to protect the community.

While no encroachment is the best solution, the VRIP supports the 'agent of change' principle being applied to existing waste, recycling, and resource recovery facilities (as it is with quarries[81]). This principle puts the onus on the applicant proposing a new use or development that encroaches within buffers of an existing facility to take measures to mitigate any impacts from those existing or planned activities.

In some circumstances, the Buffer Area Overlay (BAO) clause 44.0882 of the Victoria Planning Provisions can be used to prevent incompatible use and development. It can apply to areas affected by the potential off-site impacts of industry, warehouse, infrastructure, or other uses. Proponents must meet criteria and provide supporting information to apply the BAO.

81 See page 19 of the Melbourne Industrial and Commercial Land Use Plan (MICLUP) Part A 2020.
82 https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance/44.08.

7.4.1 Expansion of existing infrastructure sites

As set out in section 7.2.2, co-location is one indicator that an area may be suitable for new developments. There are clear strategic benefits of maximising the use of existing sites. In these cases, the land use planning framework can facilitate new developments on existing sites. Again, it is equally important that both the existing and new facility operates in accordance with their licenses and permissions to protect the community and support social license for the facilities.

7.5 Informing strategic land use planning

The previous sections outline how the VRIP informs planning decisions made through the Planning Framework and in line with existing planning schemes. However, planning schemes are dynamic. Strategic land use planning by planning authorities at the state and local government levels set out new strategies and update planning schemes to meet the community's needs.

The analysis in the VRIP provides information so that waste, recycling, and resource recovery infrastructure needs, both present and future, can be built into strategic land use planning. The VRIP outlines infrastructure needs at State, regional and local levels. A core tenet of the VRIP is to provide the ability for the market to respond to need, which it can do more effectively with a supply of suitable locations. This information can support coordinated and structured planning to make provisions for waste and recycling infrastructure alongside other land uses.

7.5.1 Working with planning and other responsible authorities

In developing the VRIP, Recycling Victoria has worked with state planning and other responsible authorities to align the suitability criteria for recycling infrastructure provision with the principles of Victoria's planning system. As future planning positions are created, Recycling Victoria will work to integrate waste, recycling and resource recovery infrastructure planning into new precinct structure plans and Plan Victoria. This includes working with land use planning authorities to support the retention of buffers for existing infrastructure, as well as to provide a supply of areas suitable for development of new infrastructure, in accordance with the attributes set out in the first part of this section.

7.6 Informing permissions and approvals

At the planning stage, prospective investors should be aware of relevant planning and environmental legislation to ensure they have the required permissions prior to construction and operation of any proposed waste infrastructure. Chapter 4 of the EP Act provides for the issue or grant of the following permissions:

- development licences
- operating licences
- pilot project licences
- permits
- registrations.

The VRIP is intended to help inform and strengthen prospective infrastructure proposals and applications to the EPA so that they address the state's capacity and capability needs, and proposed locations have considered the market structure, metropolitan and regional opportunities, with the attributes listed in this section. It also provides valuable strategic context to support the assessment of these proposals.

The strategic approach taken by the VRIP is intended to provide strategic direction to target the state's needs and policy outcomes, while leaving the flexibility for innovation in how these needs are best addressed, working within Victoria's regulatory framework. Under Section 52A (3) of the EP Act, the EPA may consider whether an application is inconsistent with the VRIP. Therefore, the VRIP can be used to inform waste and resource recovery project proposals.

These provisions apply to:

- any application for permission in relation to a waste management facility
- any application to amend a permission in relation to a waste management facility.

For landfill applications the EPA must refuse to consider an application if the landfill is not provided for in the landfill schedule in Appendix B of the VRIP.

In accordance with Section 54(2)(c) the EPA may specify that a permission is subject to a condition ensuring that the permission activity is engaged in consistency with the VRIP.

The EPA may seek advice from RV as to whether an application aligns with the VRIP through referral on relevant applications. Ultimately the EPA is the decision authority based on the proposal being considered.

7.7 Land use maps

These maps illustrate areas outlined in section 7.2.1 that have been identified in existing land use planning strategies as being suitable for development. They also show the alignment between these areas and existing infrastructure, noting they are not intended to provide an exhaustive set of potential development locations.

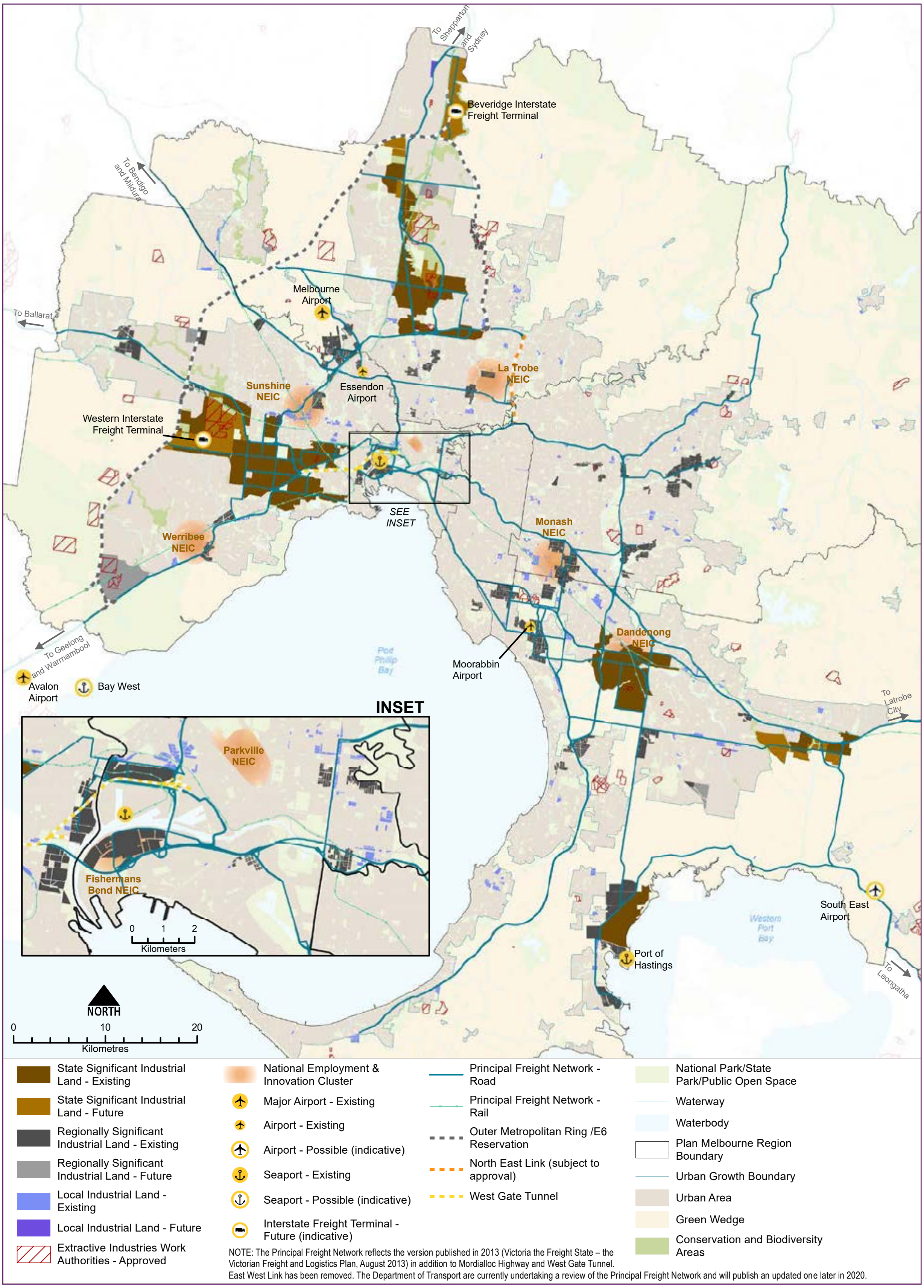
Map 1 shows the industrial precincts set out in MICLUP, which is suitably zoned for industrial uses such as those required for waste and resource recovery operations and recognised in the Victorian Planning Provisions. MICLUP preserves locally significant industrial land for industrial or employment generating uses.

Map 2 to Map 4 show three of the state significant industrial areas, and the existing waste, recycling and resource recovery infrastructure within these areas.

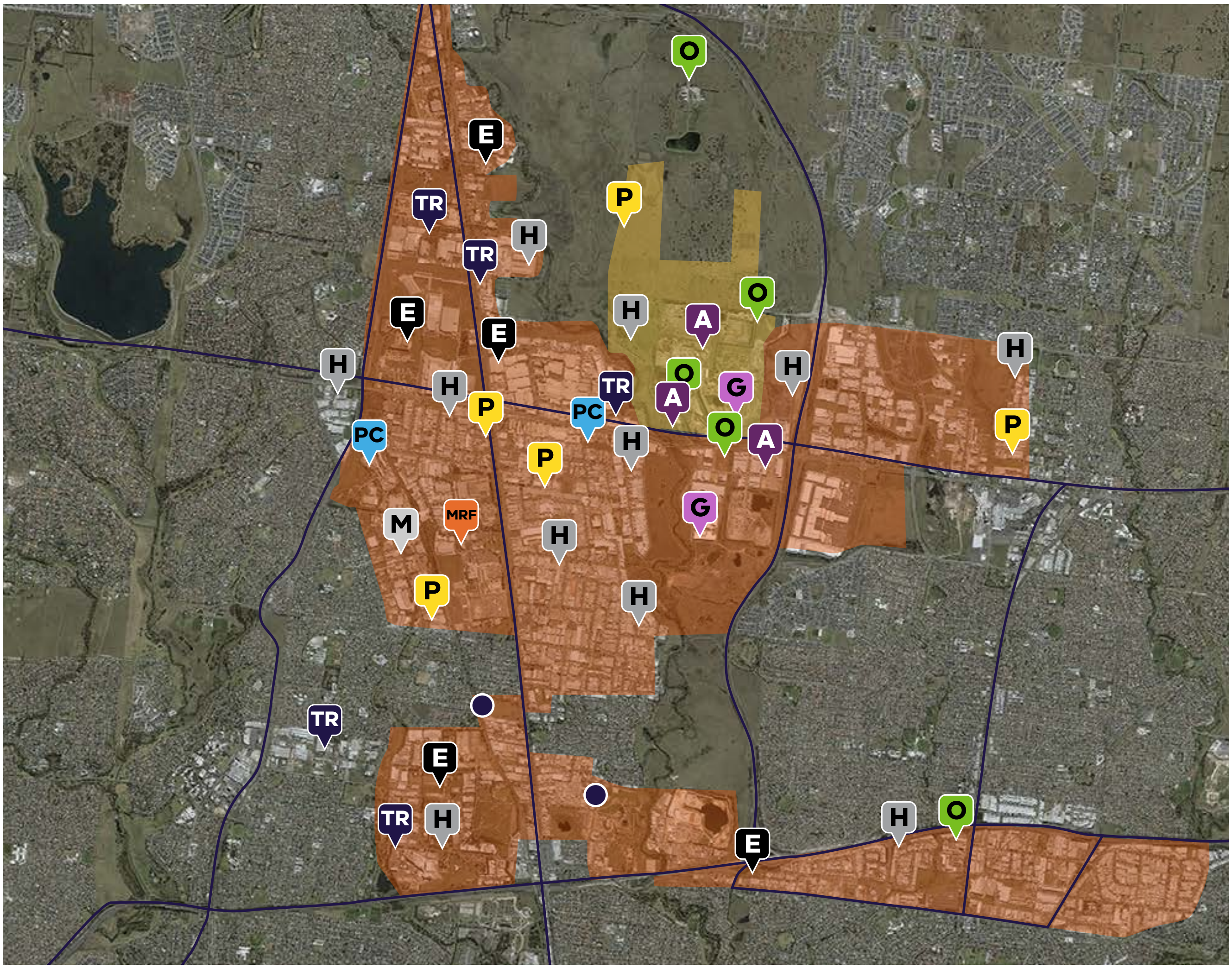
Map 5 shows the peri-urban area, including key population centres and green wedge areas, from Plan Melbourne. Growing towns and cities in these areas have potential to support infrastructure development.

Map 7 shows the regional Victorian cities and centres. Land in and around these population centres that is zoned to allow infrastructure development is most likely to provide be able to generate economies of scale for regional infrastructure.

Map 1 Existing and future industrial land in Melbourne (MICLUP, 2020)



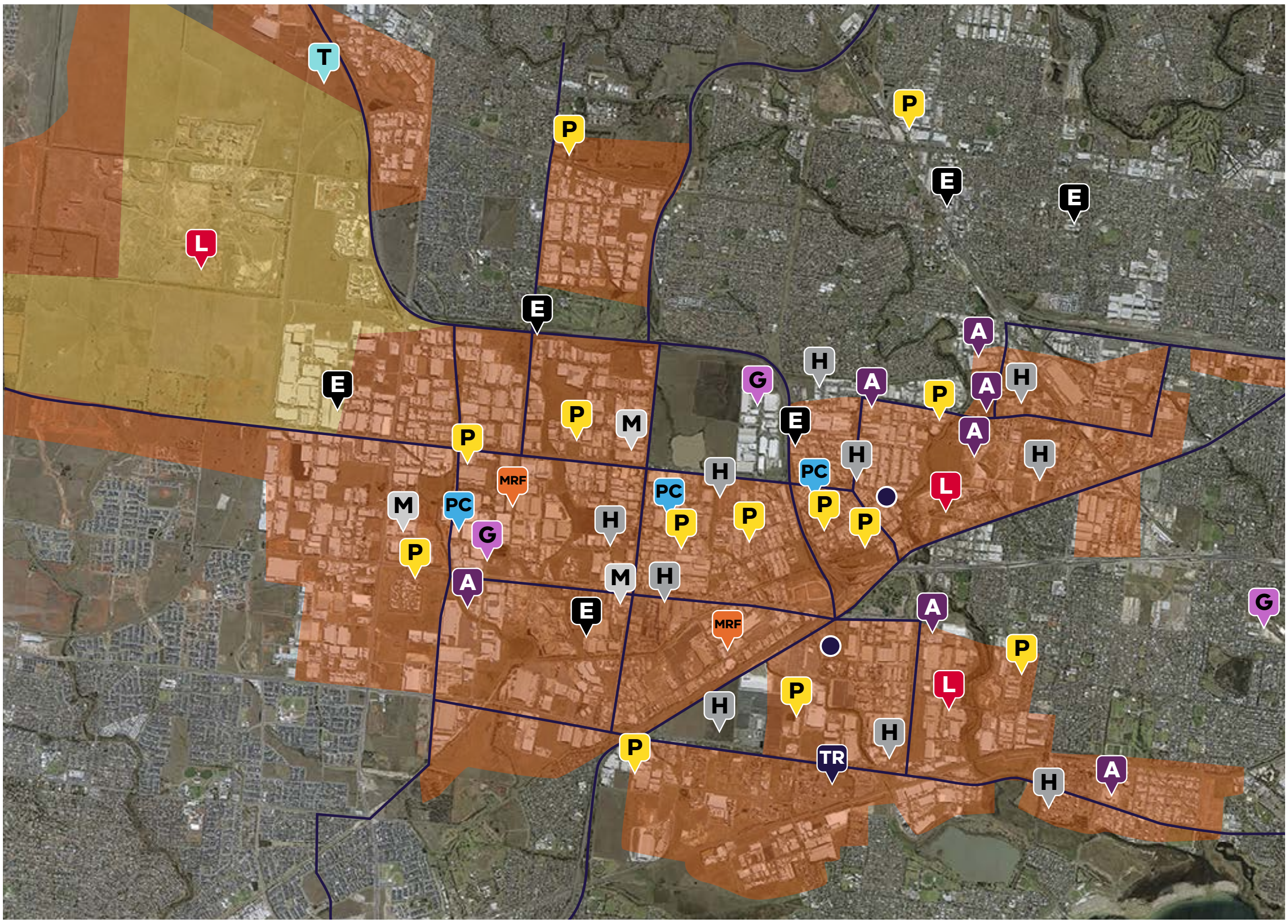
Map 2 Northern State Significant Industrial Precinct and existing infrastructure



Material Stream / Infrastructure Type

- Organics
- Paper & Cardboard
- Plastics
- Glass
- Tyre & Rubber
- Metals
- Aggregate
- Textiles
- E-waste
- Material Recovery Facility
- Hazardous waste
- Resource Recovery Centre
- State significant industrial land – existing
- State significant industrial land – future
- Principle freight network - road

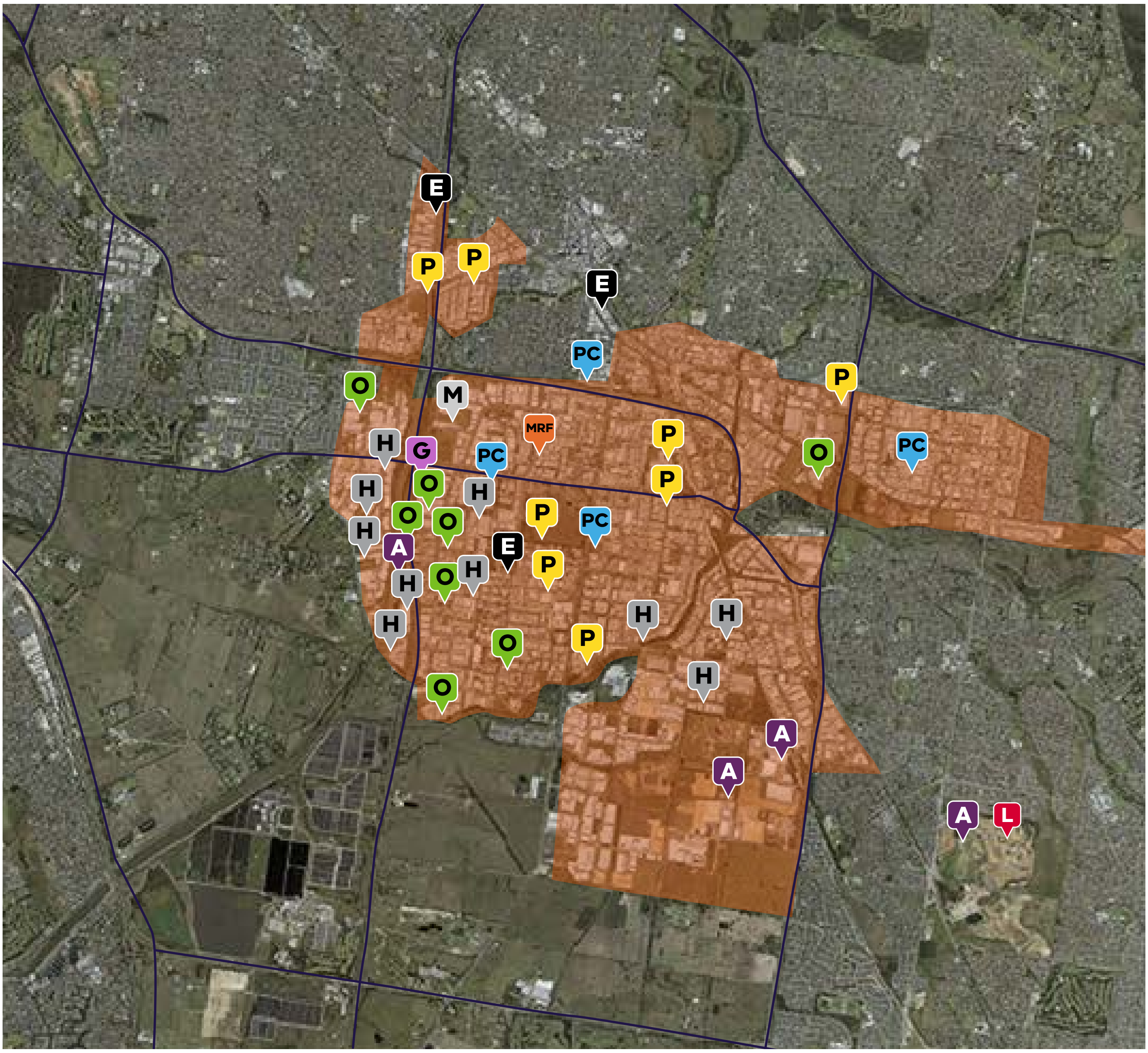
Map 3 Western State Significant Industrial Precinct and existing infrastructure



Material Stream / Infrastructure Type

- Organics
- Paper & Cardboard
- Plastics
- Glass
- Tyre & Rubber
- Metals
- Aggregate
- Textiles
- E-waste
- Material Recovery Facility
- Hazardous waste
- Landfill
- Resource Recovery Centre
- State significant industrial land – existing
- State significant industrial land – future
- Principle freight network - road

Map 4 Southern State Significant Industrial Precinct and existing infrastructure



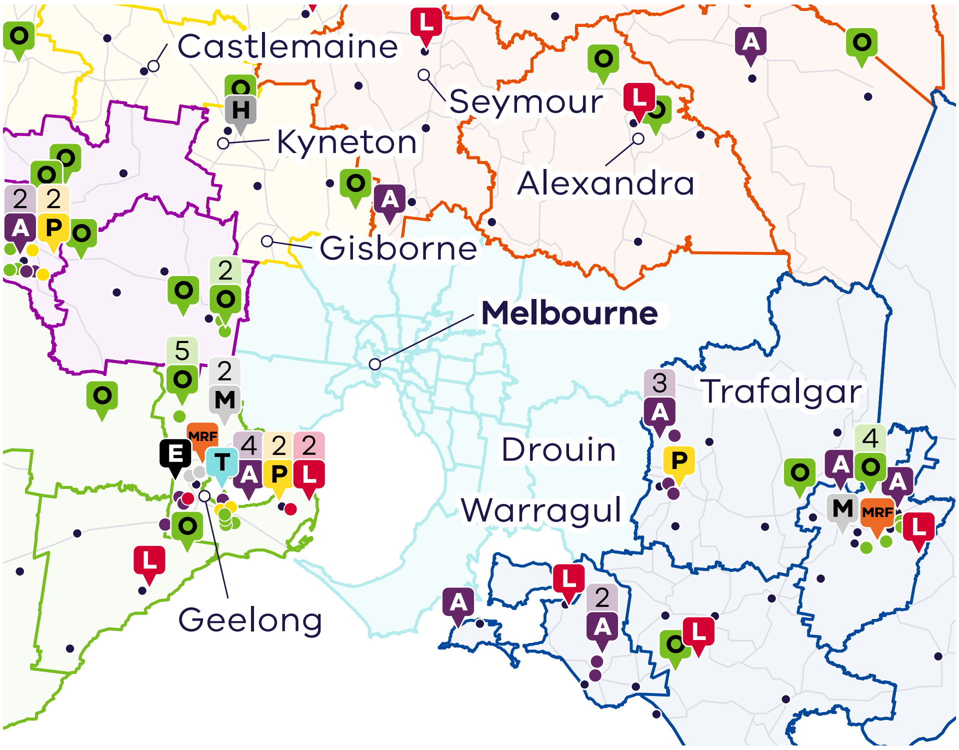
Material Stream / Infrastructure Type

- Organics
- Paper & Cardboard
- Plastics
- Glass
- Tyre & Rubber
- Metals
- Aggregate
- E-waste
- Material Recovery Facility
- Hazardous waste
- Landfill
- Resource Recovery Centre
- State significant industrial land – existing
- State significant industrial land – future
- Principle freight network - road

Map 5 Melbourne's Green Wedges and peri-urban areas (Plan Melbourne 2017–2050)

Green wedge land
Peri-urban area
100-km radius from central Melbourne
Capital city
Regional city
Regional centre
Peri-urban town
Road network
Rail network
Transport gateway – major airport
Transport gateway – airport
Transport gateway – seaport
Urban area
Urban growth boundary
Local government area boundary

Map 6 Existing Infrastructure in Green Wedge and Peri-urban areas [exc. Resource recovery centres]



Regions

- Barwon South West
- Gippsland
- Hume
- Grampians Central West
- Loddon Mallee
- Port Phillip Region

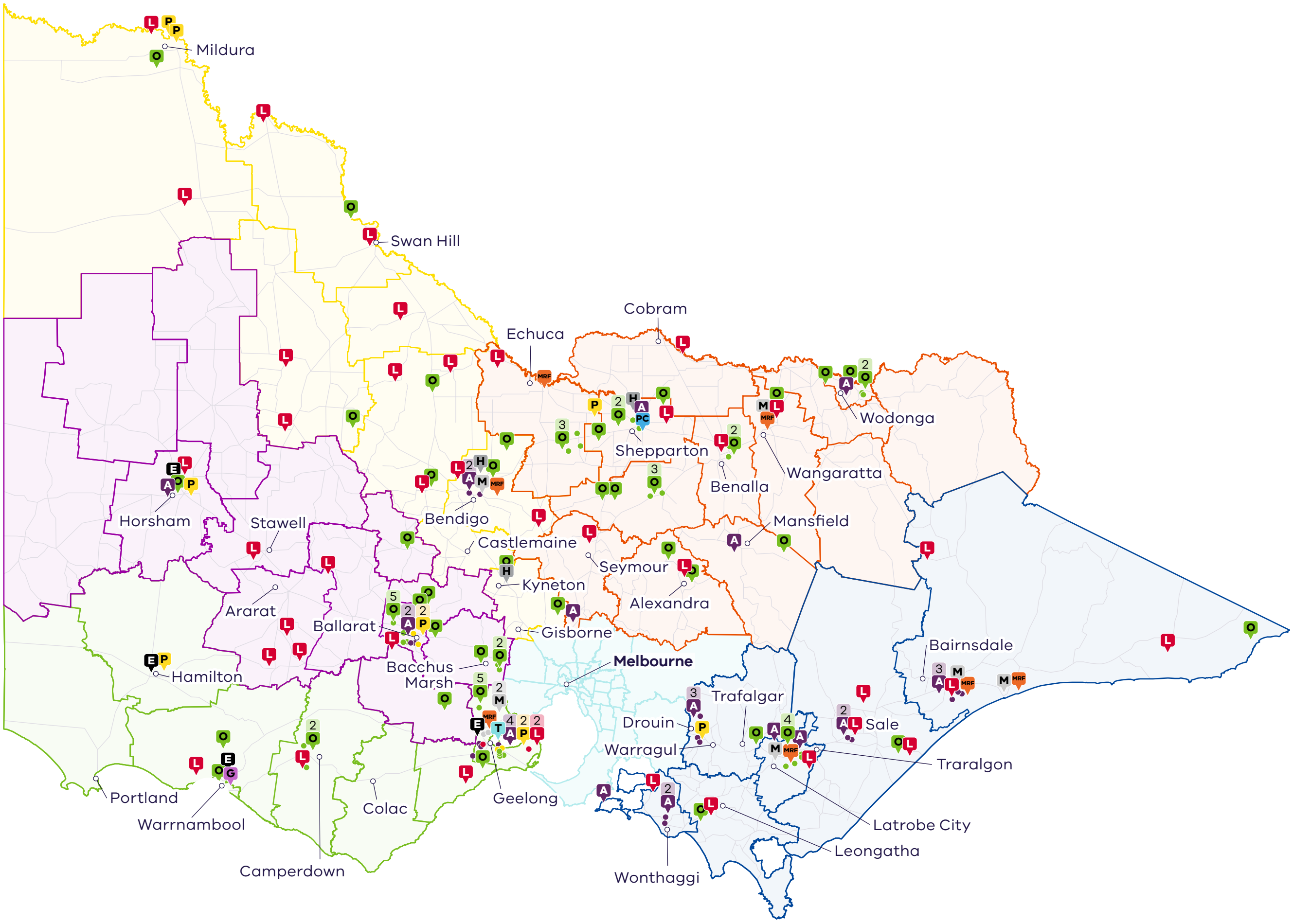
Material Stream / Infrastructure Type

- Organics
- Paper & Cardboard
- Plastics
- Glass
- Tyre & Rubber
- Metals
- Aggregate
- Textiles
- E-waste
- Material Recovery Facility
- Hazardous waste
- Landfill

Click here to view the online map
or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

Map 7 Victoria's Regional Cities and Centres

Map 8 Existing Waste and resource recovery Infrastructure in Victoria (Excl. transfer centres)



Regions

- Barwon South West
- Gippsland
- Hume
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- Loddon Mallee
- Port Phillip Region

Material Stream / Infrastructure Type

- Organics
- Paper & Cardboard
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- Textiles
- E-waste
- Material Recovery Facility
- Hazardous waste
- Landfill

Click here to view the online map

or visit vic.gov.au/victorias-waste-and-resource-recovery-infrastructure-map

8 Infrastructure investment

The VRIP sets out Victoria's waste infrastructure needs over the next 30 years, including material flows, market gaps and opportunities that can support commercial investment cases. This section sets out how Victoria also provides the right conditions to invest in waste, resource recovery and recycling infrastructure.

8.1 Investment conditions and support

Transitioning to a circular economy is expected to boost Victoria's economy by improving material efficiency and recycling. By 2030, Australia is aiming for an 80% average resource recovery rate from all waste streams, equating to an extra 15 million tonnes of material every year[83].

There is an opportunity for investors to capitalise on and help develop processing technologies and infrastructure to service this demand.

Victoria has the conditions to support investment in the waste, recycling, and resource recovery sector, including:

- strong government policy to enable and encourage growth in the sector
- strong domestic demand, supported by waste export restrictions and state recycling targets
- a collaborative research and development (R&D) environment to support innovation and increase resource recovery
- government grants and incentives
- space and natural resources to power recycling and manufacturing facilities.

This section considers in more detail how Victoria provides key underlying conditions for investment, and government support for investment.

Secure supply of materials

Establishing a supply of raw materials is essential for any industry. In the case of recycling and resource recovery infrastructure, this often means having secure contracts in place for feedstock waste materials to justify the costs of operation. Joint procurements by local government can provide greater volumes of feedstock to drive economies of scale. This means prioritising investment in areas that lack the capacity or capability to meet current or projected demand.

The projections in the VRIP show the potential supply of materials to inform the planning of future infrastructure and the case for investment. With a growing population, the supply of materials is expected to increase and providing the infrastructure to deal with this is critical to managing this waste effectively. Collaborative procurement can deliver feedstock certainty and economies of scale that benefit both councils and operators.

Ongoing market demand

Having confidence that demand is likely to persist in the long-term strengthens an investment's viability. This is driven by strong markets. Product stewardship schemes and government procurement can help strengthen market demand. For investors this means targeting infrastructure to deliver the capacity and capability needed to meet current and future demand.

The Victorian Government has detailed guidance to promote sustainable procurement and reduce demand for virgin resources by substituting them with alternative or recycled materials without comprising performance. An example of this is the Recycled First Policy of Victoria's Big Build program led by the Victorian Infrastructure Delivery Authority, which is delivering nearly 3.5 million tonnes of recycled products[84]. Sustainability Victoria also supports suppliers in developing social and environmental outcomes and provides support for other organisations to buy recycled[85].

Innovation potential

Sectors that are characterised by continuous innovation increase the feasibility of investment. Strong potential for future technology and process innovation is a compelling condition for investment. The common emergence of new technologies and other innovations drives improvements in operational efficiency. In turn, this drives down costs and raises capacity.

Victoria has a highly developed tertiary education sector, which is a key source of innovation and helps develop new technologies. There is also a strong innovation ecosystem, as set out below. This includes Breakthrough Victoria, which manages a $2bn investment fund. The circular economy is a priority area, including practices such as breakthrough innovations in recycling and waste management[86].

83 National Waste Policy Action Plan – DCCEEW.
84 https://bigbuild.vic.gov.au/about/ecologiq/recycled-first-policy.
85 https://directories.sustainability.vic.gov.au/buy-recycled/.
86 https://breakthroughvictoria.com/growth-sectors/clean-economy/.

Waste levies

Waste levies are government-imposed fees on the disposal of waste, typically in landfills. Waste levies act as a financial incentive to divert materials from landfills to reduce disposal costs and are an important driver for resource recovery. This increases demand for, and the viability of, investment in reprocessing and recovery infrastructure. The government has committed to aligning the waste levy with NSW and SA which will provide more capacity to invest in resource recovery and waste to energy technologies.

In the 2024/25 State Budget, the government announced that Victoria's metropolitan industrial and municipal waste levy will be increased to $169.79 per tonne from 1 July 2025. The waste levy rates will also be proportionally increased at rural landfills, which attract lower levies than metropolitan landfills. The Priority Waste Levy for Category C and D waste will also increase to $169.79 per tonne on 1 July 2025. The rates for other categories of priority waste will be unchanged to continue to encourage the safe disposal of hazardous waste materials.

Workforce readiness

Sufficient workforce capability or capacity strengthens the viability of an investment. Investment requires both capacity and capability in the state's workforce to deliver on the services required. In some cases, investment in infrastructure may require the support of highly skilled workers.

The Victorian Government has a Clean Economy Workforce Strategy[87]. This strategy is a 10-year framework to inform government planning and investment in the skills and training Victoria requires to transition to a clean economy, and the circular economy is one of the 3 pillars of the strategy. Victoria also has a Local Jobs First policy to promote employment and business growth by expanding market opportunities for local industry and providing for industry development[88].

Suitable timing

Timing plays an important role in investment feasibility, especially in infrastructure development, due to the lengthy time requirements for implementation. The conditions determining investment feasibility must apply at the time the infrastructure is expected to be operational rather than necessarily in the present. This may require analysis to understand investment conditions in the short to medium-term. For example, landfill site expansions and builds have long lead times, typically of 7 to 10 years, for approvals, licenses, and construction.

The VRIP supports this by providing projections of future waste streams. This includes emerging waste streams such as PV solar panels and wind turbines, as well as the growth of more established waste streams and the potential timing of when additional infrastructure capacity will be needed to meet the State's needs.

Stable regulatory and policy framework

Victoria needs the right settings in place to ensure waste and recycling services are reliable and transparent. Government policy has been introduced to support this, including by:

- improving the way that we collect waste from households through introducing a container deposit scheme, reducing contamination, and increasing the value of the materials collected
- landfill levies to make recycling and resource recovery more cost-effective
- regulation and planning to ensure that we maintain reliable and transparent recycling services into the future.

The CE Act and the EP Act establishes the policy framework for environmental protection in Victoria and sets out Victoria's approach to encouraging and enabling the sector towards a stronger circular economy. These acts have a range of guiding principles and objects including the circular economy hierarchy and the waste hierarchy and underpins the government's commitment to strengthen material recovery and circular economy outcomes.

The Victorian Government also has a stable regulatory framework that provides clear expectations of industry supported by a clear pathway for regulatory permissions. This is an important underpinning for stable investment conditions and developing a world-class sector that operates in accordance with contemporary standards expected by the government and the community.

87 https://djsir.vic.gov.au/__data/assets/pdf_file/0012/2179677/Clean-Economy-Workforce-Development-Strategy-2023-2033.pdf.
88 https://localjobsfirst.vic.gov.au/.

Government support

Industry investment incentives from government signal both unmet demand in that industry and improved investment viability due to the assistance available. The Victorian Government has a range of incentives and support on offer for new market entrants or businesses continuing or expanding operations.

- **Sustainability Victoria** supports the transition of Victoria to a circular, climate-resilient economy through developing and implementing initiatives across 3 key focus areas: investment and innovation, behaviour change and education, and community action.
- **Invest Victoria** is the investment attraction agency of the State Government of Victoria, Australia, fostering long term economic prosperity by enabling business opportunities and job creation for Victoria.
- **Global Victoria** connects Victorian businesses to global networks and markets.
- **Regional Development Victoria** helps to grow infrastructure and jobs across the state by working with businesses and communities to support positive change for regional Victoria.
- **Breakthrough Victoria** supports breakthrough ideas and technologies to help solve globally significant problems, create industries of the future, improve health and wellbeing, and deliver prosperity and sustainable returns for Victoria over the next decade and beyond.

Support for Victorian businesses

The Victorian Government has support in place for eligible new, continuing or expanding domestic and international businesses across different phases of operation. To date, this has included:

- The Manufacturing and Industry Sovereignty Fund: $21.2 million for support for the development, expansion and retention of Victoria's strategic manufacturing capability, and support for Victorian businesses to access the Commonwealth's $15 billion National Reconstruction Fund.
- The Industry R&D Infrastructure Fund: $15 million to incentivise and leverage private industry investment in research and development.
- The International Investment Attraction Fund: $40 million to encourage forward-thinking global firms to set up in Victoria, creating local jobs, boosting Victorian manufacturing and supporting new opportunities for local businesses to grow and develop.
- The Victorian Industry Investment Fund: $40 million to help fast-growing companies expand further in key sectors like health, food production, technology, advanced manufacturing and business services to develop more products, create jobs and boost sales.
- The Digital Jobs for Manufacturing Program: $4.5 million to equip workers with the cutting-edge digital skills needed to boost competitiveness and create more jobs of the future.
- The Equity Investment Attraction Fund: $20 million pilot program to attract and retain high-growth start-up companies by providing funding in return for a non-controlling equity stake.
- Breakthrough Victoria: $2 billion to drive investment in translational research, innovation and commercialisation outcomes to accelerate the growth of advanced manufacturing in Victoria.

For the latest information on available support for businesses, please visit the following websites:

- Sustainability Victoria: https://www.sustainability.vic.gov.au/grants-funding-and-investment
- Invest Victoria: https://www.invest.vic.gov.au/how-we-can-help/incentives-grants-and-programs/incentives-grants-and-programs
- Global Victoria: https://global.vic.gov.au/get-help-to-export/financial-support

8.1.1 Investment in Victoria and government support

Victoria is a globally competitive centre for investment. This is thanks to a range of factors, including viable business costs, world-leading research capabilities, incentives for research and development, world class liveability, a vibrant start-up ecosystem, Australia's fastest growing gross state product (Australian Bureau of Statistics, 2022), a highly skilled workforce and a gateway to the Asia-pacific. Victoria's $26 billion manufacturing industry is the largest in Australia, employing approximately 5 % of the population (Premier of Victoria, 2017).

The Victorian workforce is supported by a world class education system that produces more technology, engineering, IT, and business graduates or similar than any other state. Our talent pool in renewable energy and sustainability is growing rapidly with more skilled professionals than the rest of Australia. Our strong market and business ecosystem paves the way for opportunities in advanced materials, artificial intelligence, robotics, transport, engineering, design, and recycling end markets. There is a strong demand for innovative recycling technology for materials and waste.

Research and development in waste, recycling and resource recovery

Investment in R&D is crucial for developing new technologies and solutions to improve landfill diversion and encourage recycling and resource recovery markets. Investing in R&D, enabling infrastructure and Victorian start-ups is equally important for maintaining Victoria's global competitiveness in the R&D space.

The Australian Government's R&D tax incentive aims to boost competitiveness and improve productivity across the Australian economy. It offers a refundable offset rate of 18.5% above the company's tax rate, for an amount of up to $150 million.

The Victorian Government's $100 million Breakthrough Victoria University Innovation Platform Fund provides funds to support research, product concepts and prototypes that have strong commercial and transformational potential. The fund helps businesses translate ideas into commercial realities.

CSIRO is providing R&D support to small to medium sized enterprises who want to progress their R&D opportunities or are in the early decision-making stages about engaging in R&D. Experienced researchers and innovation experts help examine business and technical challenges in the free 10-week 'Innovate to Grow' program.

9 Directions and actions

This section considers the key strategic directions for the sector, and the actions for government to take to support these directions. The CE Act states that the VRIP must include directions or actions to take in relation to waste, recycling, and resource recovery infrastructure at 3-year intervals during the 30-year period of the VRIP.

9.1 Directions

This section sets out the overarching strategic directions for infrastructure to meet the State's future needs by material stream and infrastructure type across the timeframe of the VRIP.

The directions provide the strategic direction and guidance to the sector to inform decision making in relation to waste, recycling, and resource recovery infrastructure. They are based on the analysis in the VRIP. They summarise where additional capacity and/or capability is needed to meet demand. They also consider where there are opportunities to increase recovery rates, deliver place-based infrastructure and divert material from landfills.

Importantly, the directions are not assigned to any organisations and are distinct from the actions. They provide a high-level roadmap for infrastructure delivery outcomes that will require collaboration and work from stakeholders across the sector.

Table 16 sets out the directions, with the capability and capacity assessment at 3-year intervals across the 30-year period of the VRIP, as required by the CE Act. While infrastructure delivery is ongoing, takes time and will not always align perfectly, the directions are categorized into 4 high-level time horizons that synchronise with the 3-year VRIP cycles:

- **Near-term** means 0–6 years.
- **Medium-term** means 6–12 years.
- **Long-term** means 12+ years.
- **Ongoing** means the whole 30-year VRIP period.

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis										Directions
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053	
Organics	48%	3.3	5.2											**Near term:** Increased capability to address contamination across all organic material types; emerging technology further developed to address problem waste types and capitalise on sector opportunities such as bioenergy. **Medium term:** Bioenergy an established sector supporting transition from fossil fuels, increased sector capacity to meet projected FOGO reprocessing demand; increased sector capability supporting higher recovery rates and driving increased market demand for reprocessing capacity. **Long term:** Increased capability and capacity to support significantly increased recovery rates and diversion of organic material from landfill. **Ongoing:** Increased use of 2-stage processing in urban areas, co-location of infrastructure with compatible industries and buffer requirements, (e.g. with water corporation facilities) and increased regional facilities to support regional circularity.
Paper & Cardboard	57%	1.8	2.7											**Near term:** Increased capacity to respond to the 2024 Federal export restrictions (noting the impact of recent investment is still to fully play out). **Medium and long term:** Increased capacity to meet demand and to increase the diversion from landfill.
Plastics*	19%	0.8	1.2											**Near term:** Increased capacity and capability from existing technologies to respond to export restrictions and capitalise on CDS opportunities and new technologies to increase capability for problematic and soft plastics. **Medium term:** Continued deployment of mechanical reprocessing, chemical processing proven at scale, and emerging technologies provide increased capability for challenging plastic types; and increased system capability to support kerbside collection of soft plastics. **Long term:** Increased system capability and capacity to support significantly higher recovery rates and diversion from landfill. **Ongoing:** Opportunities to increase recovery of agricultural or regional-specific plastic wastes (e.g. silage wraps) are considered.
Glass	71%	0.4	0.5											**Ongoing:** Maximised bottle-to-bottle recycling from opportunities presented by the CDS and of glass-only kerbside collection, balanced consideration of regional capacity for glass crushing where economical to do so.
Tyres & Rubber*	84%	0.1	0.1											**Near term:** Increased capability to respond to export restrictions and provide for higher order domestic uses such as crumb rubber; effective regional collection networks. **Medium to long term:** Emerging technologies such as thermal processing for fuel oil, open end markets and improve material circularity, regional tyre recovery needs are considered.

Material Stream / Infrastructure Type	Recovery Rate	Total Waste (Mt)		Capacity & Capability Analysis										Directions
		2023	2053	2024 –2026	2027 –2029	2030 –2032	2033 –2035	2036 –2038	2039 –2041	2042 –2044	2045 –2047	2048 –2050	2051 –2053	
Metals	89%	1.7	2.6											**Ongoing:** Increased capacity as needed to meet future demand and, where economically viable, to replace exports with local reprocessing; increased capability relating to shredder floc and metals from e-waste.
Aggregate, Masonry & Soils	85%	8.4	16.3											**Ongoing:** Increased capacity to meet future demand as required, best practice management techniques support the re-use of soils and increased diversion from landfill; increased infrastructure located near waste generation to support regional circularity.
Textiles	31%	0.3	0.5											**Near to medium term:** Improved resource recovery options from new reprocessing technologies. **Medium to long term:** Increased capability and capacity to support increased recovery rates.
E-waste & Emerging Materials	60%	0.2	TBD (0.2 in 2035)											**Near term:** Increased capability to recycle e-waste and batteries, new technology solutions for recycling zero-carbon waste. **Medium term:** Increased capacity for e-waste, increased capability for net zero carbon waste, any new emerging waste streams mapped. **Long term:** Increased capacity for net zero carbon waste, any new emerging waste streams mapped.
Material Recovery Facilities	n/a	0.5	1											**Near term:** Increased capability to respond to export restrictions. **Medium to long term:** Increased capacity to meet projected demand. **Ongoing:** Increased opportunities for regional facilities.
Hazardous waste	n/a	1.4	2.7											**Ongoing:** Increased capability (and any subsequent capacity) needed to increase system resilience, respond to surge events, and to address specific / emerging waste stream needs (e.g. soils, asbestos, clinical waste, PFAS and Biosolids).
Residual waste**	n/a	5.7	8.9											**Near term:** Maximised use of existing landfill capacity; key system constraints (e.g. Category B waste) and place-based challenges (e.g. Loddon Mallee mining spoils) addressed. **Medium term:** Increased system resilience (e.g. surge capacity) and increased use of waste to energy facilities to divert waste from landfill. **Ongoing:** Increased resource recovery to reduce reliance on landfills, particularly for organics, plastics, soils, paper, and cardboard.

Capacity is unknown / insufficient to meet projected demand, and greater capability needed [investment focus is both capacity and capability needs]

Capacity is sufficient to meet projected demand, but greater capability needed [investment focus is capability needs]

Capacity is unknown / insufficient to meet projected demand, market has the capability to respond [investment focus is market response to capacity needs]

Capacity is sufficient to meet the demand projections [investment focus is optimising infrastructure]

* Proposed additional infrastructure in pipeline that would extend capacity timelines

** Capacity analysis based on Development License Approved Landfill Capacity

9.2 Priority areas

The directions set out the priorities for development across all material streams and infrastructure types. Having the infrastructure in place that meets the state's needs across all these categories is important, and each provides investment opportunities. However, the sector is better placed to respond in some areas than others. The criteria used in the VRIP for identifying the priority areas for government are:

- current capacity and capability shortfalls, as the areas facing the most immediate pressures and where the sector may not be positioned to respond
- current capability shortfalls as the market may not be well positioned to respond to future capacity challenges or support increased recovery rates
- potential impact on the environment and human health if waste cannot be safely treated and, if necessary, disposed of.

Based on these criteria, the priority areas for investment by the sector and for government actions are:

- **Plastics:** (capacity and capability challenges) Priorities include building capacity for the more easily recycled rigid plastics, building capability for soft and problematic plastics, capitalising on opportunities from the CDS and export restrictions and supporting increased recovery, noting this is likely to require effective product stewardship measures alongside infrastructure investment.
- **Textiles:** (capacity and capability challenges) Priorities are building capability and reducing the reliance on exports, which is likely to require effective product stewardship alongside infrastructure investment.
- **E-waste:** (capacity and capability challenges) Priorities are to address problematic waste, particularly lithium-ion batteries, build capability to extract valuable material from increasingly complex e-waste, and prepare capability for increasing volumes of renewable energy wastes. Again, this is likely to require effective product stewardship measures alongside infrastructure investment.
- **Organics:** (capability challenges) Priorities are to address capability challenges, such as contamination and ability to process problematic wastes, which may restrict the ability to fully utilise potential capacity; to take advantages of opportunities in bioenergy and supporting increased recovery rates.
- **Tyres and rubber:** (capability challenges) Priorities are to build capability and increase material circularity. Illegal dumping is a challenge for the sector but is not an issue that can be resolved solely through infrastructure investment.
- **MRFs:** (capability challenges) Priorities are to build capacity to respond to export restrictions and system changes from the CDS, and potential place-based opportunities for more regional facilities, particularly in the western regions.
- **Hazardous waste:** (capability challenges) Priorities are to address single points of failure and capability issues, such as limited asbestos drop-off points, and address emerging hazardous waste issues.
- **Residual waste:** A priority area due to the extended timelines involved in developing new infrastructure. Priorities include strategic planning to ensure there is long-term capacity in the system, addressing specific capability and place-based challenges, and supporting increased diversion from landfill, including through thermal and non-thermal waste to energy technologies.

9.3 Actions

This inaugural VRIP represents a new strategic approach to infrastructure planning. It is designed to provide direction and information to the sector to guide decision making while allowing the market to develop the most appropriate response to the state's future needs.

It is also an important document for guiding government decision making, not just on waste, recycling, and resource recovery infrastructure. It also informs policy development and future market support initiatives and helps government to consider the potential impact on infrastructure from policy or regulatory changes.

The government's role is to support and enable the sector to respond to the State's need. Table 17 sets out the specific actions the government will take to support this strategic approach to infrastructure planning moving forward, working collaboratively with key stakeholders to address the issues raised in the VRIP. The actions are in addition to the ongoing VRIP process in the CE Act.

Table 17 Government Actions

Focus area	Action
Taking a systemic approach to waste, recycling, and resource recovery infrastructure planning	Continue to provide information on infrastructure sites across Victoria.
	Evaluate the VRIP approach to statewide infrastructure planning to inform the next VRIP.
Addressing problematic and emerging waste streams	Work collaboratively to support innovation to manage problematic and emerging waste streams.
	Provide regularly updated information and horizon scanning on problematic and emerging waste streams.
Planning for a resilient and safe disposal of residual and hazardous waste	Work with the sector and across government on coordinated strategic planning for the efficient use of the residual waste system and supporting diversion from landfills.
	Establish a cross-agency working group to address specific residual and hazardous waste challenges and single point dependencies, including: legacy contaminated soils and other mining wastes in Loddon Mallee region category B landfill locations asbestos disposal locations across Victoria monitoring the clinical and pharmaceutical waste sector.
Improving data collection and the presentation of analysis to support investment decision making	Work with industry to improve data collection and the analysis provided to the market to inform infrastructure planning and decision making.
Integrating recycling, resource recovery and waste infrastructure into land use planning	Integrate waste, recycling and resource recovery infrastructure into State Government planning strategies and frameworks e.g., Plan Melbourne, VPA Precinct Structure Plans & the Victorian Planning Provisions.
	Develop guidance for planners and industry relating to waste, recycling, and resource recovery infrastructure.
Working collaboratively with the sector to inform planning and attract investment	Continue to work collaboratively with other jurisdictions on systemic changes that will drive stronger market certainty and demand for recycled materials and recycling infrastructure (e.g., product stewardship, government procurement).
	Establish an infrastructure working group, including local government areas (LGAs) and industry stakeholders and regional representation, to inform infrastructure planning.
	Provide and maintain guidance materials to support sector investment e.g., investment prospectuses.
	Working collaboratively to support the Victorian community and businesses transition to a circular economy.

9.4 Next steps and measuring progress

The CE Act mandates that there are annual VRIP progress reports, and the VRIP itself is reviewed and updated every 3 years. There is also a process to update the VRIP between mandated reviews (if necessary) to ensure monitoring and reporting requirements are met.

In line with the CE Act and VRIP Actions, Recycling Victoria will prepare annual VRIP progress reports. Under the CE Act, an annual VRIP progress report may include the following:

- key indicators and metrics that assess the VRIP's implementation
- progress and achievements to date in the delivery of the VRIP's directions or actions to take in relation to waste, recycling, and resource recovery infrastructure
- any issues that have arisen in the VRIP's implementation
- any matters that the Head, Recycling Victoria considers need further consideration or action, including by a review or amendments under this part.

The VRIP implementation report will monitor the progress of the market in responding to infrastructure needs, and report on government's progress in delivering on the actions.

To assess the VRIP implementation and progress against the actions, the annual progress reports will provide updated sector capacity data, including details of known new investments, and updated capability assessments, with a focus on the priority material streams / infrastructure types. This will also provide updated information to inform the market.

The reports will also include progress against actions and reporting on activities undertaken under the actions. This will include the outputs delivered against each of the actions. To inform the progress reporting, Recycling Victoria will develop a monitoring and evaluation plan, and will evaluate the VRIP approach through its 3-year cycle to inform the next VRIP cycle.

Appendix A
Future WRRR infrastructure list

Section 37B(1)(c) of the CE Act requires that the VRIP includes a list of the future waste, recycling, and resource recovery infrastructure (other than landfill) needed for the State to manage waste in a manner that:

- provides for the orderly development of infrastructure based on the State's needs
- minimises the risk of harm to human health or the environment for the 30-year period of the VRIP.

To provide for the orderly development of infrastructure based on the state's needs, the infrastructure list is taken from the material stream analyses in the VRIP, which consider the state's capacity and capability perspective, at 3 yearly intervals.

This list provides the minimum future infrastructure requirements across Victoria and waste streams, based on 2023 capacity and demand projections based on current trends. It details the size of additional capacity required in the medium term and long term. It does not prescribe locality or recommend infrastructure technology.

The capacity requirements on the list are the minimum required to provide for the orderly development of infrastructure that meets the state's needs. These requirements should be considered alongside the material stream analyses and directions, which provide further details about investment priorities, opportunities to increase recovery rates (which would increase demand) and circularity, and capability needs/opportunities.

While over provision of capacity may in some circumstances be an inefficient use of resources, there are reasons why new developments that provide additional capacity over the minimum requirements would be beneficial. These include:

- improving system resilience and surge capacity
- meeting place-based requirements, improving regional circularity and/or reducing transport distances,
- processing sub-types of materials, for example different plastic polymers, different types of organic waste
- increasing competition and recycling options
- increasing system capability and/or circularity of reprocessing outcomes
- supporting increased recovery rates
- supporting increased domestic reprocessing of materials instead of exports
- the long lead times for infrastructure delivery.

For these reasons, a lack of projected additional capacity needs for a material stream does not automatically result in new infrastructure proposals being inconsistent with the VRIP, as per section 52A of the EP Act 2017.

To minimise the risk of harm to human health and the environment, as well as supporting the orderly development of infrastructure, the list also includes the additional reprocessing capacity that could be needed to maintain the existing landfill capacity to provide for the safe disposal of waste.

Future landfill requirements are documented in the landfill schedule in Appendix B.

Table 18 Future waste, recycling, and resource recovery infrastructure list

Infrastructure type	Proposed investment	Size of state-wide capacity investment needed			
		By 2035		By 2053	
		Additional capacity (tpa)	Relative to existing capacity	Additional capacity (tpa)	Relative to existing capacity
Food organics and garden organics reprocessing	Improved infrastructure capability e.g. decontamination processing FOGO capacity	No additional capacity needed to meet demand	n/a	152,000	16%
Organics	Organics reprocessing	No additional capacity needed to meet demand	n/a	107,000	4%
Paper and cardboard reprocessing	Increased reprocessing capacity	514,000	102%	781,000	155%
Plastics reprocessing	Increased reprocessing capability, and capacity	28,000	18%	75,000	48%
Glass reprocessing	Opportunity for regional crushing facilities	No additional capacity needed to meet demand	n/a	No additional capacity needed to meet demand	n/a
Tyres and rubber reprocessing	Increased reprocessing capacity. Increased capability to grow domestic markets, meet export requirements and increase circularity of end fates.	No additional capacity needed to meet demand	n/a	14,000	21%
Metals reprocessing	Increased reprocessing capacity	Up to 193,000	Up to19%	Up to 511,000	Up to 49%
Aggregate, masonry & soils reprocessing	Increased reprocessing capacity	Up to 2,989,000	Up to 42%	Up to 6,622,000	Up to 93%
Textiles reprocessing	Increased reprocessing capacity	Up to 27,000[89]	No current known capacity	Up to 34,000	No current known capacity
MRFs recovery and transfer	New infrastructure at existing and/or new sites for MSW – Paper and Cardboard, Plastics, Glass, and Metals	6,000	1%	266,000	36%
Hazardous waste (medical waste)	New infrastructure at existing and/or new sites	Nil	n/a	678	3%
Hazardous waste – asbestos	Additional disposal sites to increase system access	No additional capacity needed to meet demand	n/a	No additional capacity needed to meet demand	n/a
E-waste	E-waste reprocessing capacity	Up to 200,000	TBD	TBD – likely over 200,000	TBD
Thermal waste to energy facilities	New thermal waste to energy facilities	Up to cap	TBD pending final decision on cap	Up to cap	TBD pending final decision on cap

89 Additional capacity for textiles reprocessing is under the assumption that Victoria should locally process what it sends elsewhere in Australia, and it will continue to export internationally at existing rates.

The infrastructure listed above is needed to meet projected future demand. The VRIP also sets out the importance of delivering on Victoria's existing policy objectives to reduce the residual waste volumes and reduce the states reliance on landfills. The objective is to generate less waste through more efficient production and re-use, which does not require infrastructure. However, the other objectives could also require additional infrastructure in order to:

- Recycle more to increase resource recovery, particularly for those material streams that compose a high proportion of the residual waste projections and/or have a low recovery rate, such as organics, plastics, paper and cardboard and soils.
- Increase diversion of mixed residual waste away from landfill through advanced sorting technologies to recover resources, non-thermal waste to energy processes which could include organics (e.g. bioenergy) or new/emerging technologies.

The amount of waste the infrastructure would need to process depends on the success of waste reduction measures, but based on the projections in the VRIP is currently estimated at around 7 million tonnes per annum by 2053 [this is the residual waste stream in 2053 less the waste projected to be diverted to thermal waste to energy under the current regulatory framework].

Appendix B
Landfill schedule

As per Section 37B(1)(d) of the CE Act 2021, the VRIP provides the schedule of existing sites and future landfill required to 2053. This appendix sets out the existing landfill schedule, and future residual management needs.

Existing landfill schedule

The landfill schedule includes A05a landfills that are operational in Victoria. It also includes landfills that were not previously licensed under the EP Act 1970. With the change to the EP Act 2017 landfills servicing less than 5000 people are now listed as a prescribed permission activity under the Environment Protection Regulations 2021. The schedule includes operating landfills even if these landfills:

- may not be actively receiving waste but are not confirmed as closed or transitioning to aftercare This may be due to compliance and enforcement action or other matters
- have insufficient information to enable inclusion in the needs analysis
- have future capacity and airspace that require approvals.

The anticipated timeframe that Development Licence Approval (DLA) capacity will be exceeded is an estimate based on approved capacity and current throughput and has been informed by consultation with operators. It should be considered as a guide only. The estimate does not consider where there may be potential for further landfill capacity over and above the DLA and planning approved capacity. The presentation of this information in the schedule is for information only and does not prevent operators applying for approval of additional capacity, nor does it presuppose any regulatory decisions on additional capacity.

Final timeframes for landfill capacity being reached will depend on a range of business decisions made by owners and operators, including the rate of filling, whether sites gain the appropriate approvals for additional available airspace, the location of contingency (natural disaster) events and the possibility of additional stresses placed on landfill infrastructure from activities at other landfills.

This schedule does not account for the reallocation of managed waste from one landfill to another as they close (that is, the schedule is based on individual landfills maintaining a business-as-usual method of operation). Allocation of waste to landfills is a complex process which is dependent on a wide range of factors such as commercial contracts, geographical location, license limits, throughput (logistical) limits, operator relationships, and long-term strategic planning (that is, the purpose of the landfills in question). The waste categories delineated in the VRIP landfill schedule are for informational purposes only, and do not confer any authorisation or restriction on what sites may lawfully receive. The listed waste types represent common broad categories and general waste codes accepted at sites.

The schedule reflects the broad waste streams received at a site at the time of the VRIP's development and may not capture subsequent changes or amendments to relevant approvals. Sites' lawful acceptance of waste may vary over time, and operators reserve the right to refuse to accept certain waste types. The provision of this information in the schedule is for information only. It does not prevent operators from applying for approval to accept additional material types, nor does it presuppose any regulatory decisions.

For full details on what wastes sites can lawfully receive, including additional specific waste types not listed on this schedule, please refer to the relevant EPA licence document available on the EPA's public register.

Table 19 Existing Landfill Schedule

Permission Number	EPA Permission Duty Holder	Site/Premises Address	LGA	Anticipated timeframe DLA landfill capacity is exceeded	Region	Licenced Material Types: MSW	C&D	C&I	B	C	D	Soil containing asbestos only	Packaged waste asbestos
Barwon South West													
OL000072476	CITY OF GREATER GEELONG	502 – 510 Founds Rd Drysdale VIC 3222 AU	Greater Geelong	1–5 years	Barwon SW	Yes	Yes	Yes	No	No	No	No	Yes
OL000012192	CORANGAMITE SHIRE COUNCIL	Lot 1 County Boundary West Rd Cobrico VIC 3266 AU	Corangamite	26–30 years	Barwon SW	Yes	Yes	Yes	No	No	No	No	No
OL000011848	GEELONG LANDFILL PTY LTD	69 Hamilton Hwy, Fyansford, Victoria, 3218	Greater Geelong	16–20 years	Barwon SW	No	Yes	No*	No	No	No	Yes	Yes
	MOYNE SHIRE COUNCIL	Killarney Landfill	Moyne	Not included in analysis	Barwon SW	No	Yes	No	No	No	No	No	No
OL000021470	SURF COAST SHIRE COUNCIL	50 Coalmine Rd Anglesea VIC 3230 AU	Surf Coast	1–5 years	Barwon SW	Yes	Yes	Yes	No	No	No	No	No
Gippsland													
OL000012129	BASS COAST SHIRE COUNCIL	1685 Bass Hwy Glen Forbes VIC 3990 AU	Bass Coast	11–15 years	Gippsland	Yes	Yes	Yes	No	No	Yes	No	Yes
OL000070000	CENTRAL GIPPSLAND REGION WATER CORPORATION	1950 Longford-Loch Sport Rd Dutson VIC 3851 AU	Wellington	1–5 years	Gippsland	No	No	No*	No	No	No	No	Yes
OL000072826	EAST GIPPSLAND SHIRE COUNCIL	200 Johnstons Rd Forge Creek VIC 3875 AU	East Gippsland	30+ years	Gippsland	Yes	Yes	Yes	No	Yes	Yes	No	Yes
P000300528	EAST GIPPSLAND SHIRE COUNCIL	20 Coast Road Cann River 3890	East Gippsland	Not included in analysis	Gippsland	Yes	Yes	Yes	No	No	No	No	No
OL000025565	LATROBE CITY COUNCIL	64 Hyland Hwy Loy Yang VIC 3844 AU	Latrobe	11–15 years	Gippsland	Yes	Yes	Yes	No	Yes	Yes	No	Yes
P000300452	MOUNT HOTHAM ALPINE RESORT MANAGEMENT BOARD	Cobungra, Victoria, Australia	East Gippsland	Not included in analysis	Gippsland	Yes	No	No	No	No	No	No	No
OL000024873	SOUTH GIPPSLAND SHIRE COUNCIL	275 Koonwarra-Inverloch Rd Koonwarra VIC 3954 AU	South Gippsland	6–10 years	Gippsland	Yes	Yes	Yes	No	Yes	Yes	No	Yes

Permission Number	EPA Permission Duty Holder	Site/Premises Address	LGA	Anticipated timeframe DLA landfill capacity is exceeded	Region	Licenced Material Types: MSW	C&D	C&I	B	C	D	Soil containing asbestos only	Packaged waste asbestos
OL000072786	WELLINGTON SHIRE COUNCIL	LOT 1 & PART LOT 2 LP79840 PARISH OF WOOUN DELLAH PRINCES HWY, KILMANY, VIC, 3851, AU	Wellington	1–5 years	Gippsland	Yes	Yes	Yes	No	No	No	No	Yes
OL000072611	WELLINGTON SHIRE COUNCIL	95 Sellings Rd Maffra VIC 3860 AU	Wellington	No longer accepting waste	Gippsland	Yes	Yes	Yes	No	No	No	No	No
Grampians Central West													
	ARARAT RURAL CITY COUNCIL	Elmhurst Resource Recovery Centre and Landfill	Ararat	Not included in analysis	Grampians	No	Yes	No	No	No	No	No	No
	ARARAT RURAL CITY COUNCIL	Lake Bolac Resource Recovery Centre and Landfill	Ararat	Not included in analysis	Grampians	No	Yes	No	No	No	No	No	No
	ARARAT RURAL CITY COUNCIL	Streatham Resource Recovery Centre and Landfill	Ararat	Not included in analysis	Grampians	No	Yes	No	No	No	No	No	No
	ARARAT RURAL CITY COUNCIL	Tatyoon Resource Recovery Centre and Landfill	Ararat	Not included in analysis	Grampians	No	Yes	No	No	No	No	No	No
OL000012008	CITY OF BALLARAT	1380 Glenelg Hwy Smythesdale VIC 3351 AU	Golden Plains	16–20 years	Grampians	Yes	Yes	Yes	No	Yes	Yes	No	Yes
OL000070183	CLEANAWAY PTY LTD	492 – 494 Pomonal Rd Stawell VIC 3380 AU	Northern Grampians	1–5 years	Grampians	Yes	Yes	Yes	No	Yes	Yes	No	Yes
OL000012067	HORSHAM RURAL CITY COUNCIL	132 Ladlows Rd Kalkee VIC 3401 AU	Horsham	30+ years	Grampians	Yes	Yes	Yes	No	Yes	Yes	No	Yes
OL000045288	MADDINGLEY BROWN COAL PTY LTD	11 Tilleys Rd Maddingley VIC 3340 AU	Moorabool	11–15 years	Grampians	No	Yes	No*	No	Yes	Yes	No	No

Permission Number	EPA Permission Duty Holder	Site/Premises Address	LGA	Anticipated timeframe DLA landfill capacity is exceeded	Region	Licenced Material Types: MSW	C&D	C&I	B	C	D	Soil containing asbestos only	Packaged waste asbestos
Hume													
OL000012560	BENALLA RURAL CITY COUNCIL	96 Old Farnley Road Benalla 3672	Benalla	30+ years	Hume	Yes	Yes	Yes	No	No	No	No	Yes
OL000220139	GREATER SHEPPARTON CITY COUNCIL	205 Quarry Rd Pine Lodge VIC 3631 AU	Greater Shepparton	30+ years	Hume	Yes	Yes	Yes	No	Yes	Yes	No	No
OL000070781	MITCHELL SHIRE COUNCIL	470 Seymour-Tooborac Rd Hilldene VIC 3660 AU	Mitchell	6-10 years	Hume	Yes	Yes	Yes	No	No	No	No	No
OL000015500	MOIRA SHIRE COUNCIL	56 Pye Rd Cobram East VIC 3644 AU	Moira	6-10 years	Hume	Yes	Yes	Yes	No	No	No	No	No
OL000012039	MURRINDINDI SHIRE COUNCIL	124 Mt Pleasant Rd Alexandra VIC 3714 AU	Murrindindi	16-20 years	Hume	Yes	Yes	Yes	No	No	No	No	Yes
OL000011908	VEOLIA ENVIRONMENTAL SERVICES (AUSTRALIA) PTY LTD	320 Davis RD, PATHO VIC 3564 – Davis Rd Patho VIC 3564 AU	Campaspe	11-15 years	Hume	Yes	Yes	Yes	No	Yes	Yes	No	Yes
OL000020025	WANGARATTA RURAL CITY COUNCIL	5 Coleman Rd North Wangaratta VIC 3678 AU	Wangaratta	6-10 years	Hume	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Loddon Mallee													
P000300647	BULOKE SHIRE COUNCIL	2094 Birchip-corack Road, Birchip, Victoria, 3483, Australia	Buloke	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
P000300637	BULOKE SHIRE COUNCIL	2006 Depot Road, Donald, Victoria, 3480, Australia	Buloke	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
OL000070151	GANNAWARRA SHIRE COUNCIL	190 Denyer Rd Wandella VIC 3579 AU	Gannawarra	1-5 years	Loddon Mallee	Yes	Yes	Yes	No	Yes	Yes	No	Yes
OL000046490	GREATER BENDIGO CITY COUNCIL	191 – 1 93 Upper California Gully Rd Eaglehawk VIC 3556 AU	Greater Bendigo	1-5 years	Loddon Mallee	Yes	Yes	Yes	No	Yes	Yes	No	Yes

						Licenced Material Types							
Permission Number	EPA Permission Duty Holder	Site/Premises Address	LGA	Anticipated timeframe DLA landfill capacity is exceeded	Region	MSW	C&D	C&I	B	C	D	Soil containing asbestos only	Packaged waste asbestos
P000300494	GREATER BENDIGO CITY COUNCIL	61 Golden Gully Road Heathcote 3523	Greater Bendigo	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
P000300501	LODDON SHIRE COUNCIL	Newbridge, Victoria, Australia	Loddon	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
P000300430	LODDON SHIRE COUNCIL	40 Ballast Rd, Pyramid Hill, Victoria, 3575	Loddon	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
P000300428	LODDON SHIRE COUNCIL	Tip Road Boort 3537	Loddon	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
OL000019951	MILDURA RURAL CITY COUNCIL	15 Scherger Drive Mildura 3500	Mildura	6-10 years	Loddon Mallee	Yes	Yes	Yes	No	Yes	Yes	No	Yes
P000300414	MILDURA RURAL CITY COUNCIL	Ouyen, Victoria, Australia	Mildura	Not included in analysis	Loddon Mallee	Yes	No	Yes	No	No	No	No	No
OL000072505	SWAN HILL RURAL CITY COUNCIL	6859 Sea Lake-Swan Hill Rd Swan Hill VIC 3585 AU	Swan Hill	1-5 years	Loddon Mallee	Yes	Yes	Yes	No	Yes	Yes	No	Yes
P000300549	SWAN HILL RURAL CITY COUNCIL	899 Robinvale-sea Lake Road Bannerton 3549	Swan Hill	Not included in analysis	Loddon Mallee	Yes	Yes	Yes	No	No	No	No	No
Port Phillip													
OL000011940	ALTONA NORTH LANDFILL PTY LTD	55 Barnes Road Altona North 3025	Hobsons Bay	Not included in analysis	Port Phillip	No	Yes	No*	No	No	No	No	No
OL000011758	AUSTRALIAN RECYCLING CORPORATION PTY LTD	500 Sunbury Rd Bulla VIC 3428 AU	Hume	Not currently receiving waste	Port Phillip	No	Yes	No*	No	Yes	Yes	Yes	Yes
OL000080195	BARRO GROUP PTY. LIMITED	22 Sunshine Av Kealba VIC 3021 AU	Brimbank	Not currently receiving waste	Port Phillip	No	No	No	No	No	No	No	No
OL000011818	GLEN LANDFILL PTY LTD	75 Quarry Rd Langwarrin VIC 3910 AU	Frankston	1-5 years	Port Phillip	No	Yes	No*	No	No	No	No	No
OL000045248	GROSVENOR LODGE PTY. LTD.	435 Balnarring Rd Tuerong VIC 3915 AU	Mornington Peninsula	1-5 years	Port Phillip	No	Yes	No*	No	No	No	No	Yes
OL000012309	HANSON LANDFILL SERVICES PTY LTD	45 Bridge Inn Rd Wollert VIC 3750 AU	Whittlesea	30+ years	Port Phillip	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

Permission Number	EPA Permission Duty Holder	Site/Premises Address	LGA	Anticipated timeframe DLA landfill capacity is exceeded	Region	Licenced Material Types: MSW	C&D	C&I	B	C	D	Soil containing asbestos only	Packaged waste asbestos
OL000045279	HI-QUALITY QUARRY PRODUCTS PTY LTD	570 Sunbury Rd Bulla VIC 3428 AU	Hume	30+ years	Port Phillip	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
OL000012450	HUME CITY COUNCIL	515 Riddell Rd Sunbury VIC 3429 AU	Hume	No longer accepting waste	Port Phillip	Yes	Yes	Yes	No	No	No	No	No
OL000012160	LANDFILL OPERATIONS PTY LTD	1100-1152 Christies RD Ravenhall VIC 3023 AU	Melton	11-15 years	Port Phillip	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
OL000070367	MORNINGTON PENINSULA SHIRE COUNCIL	280 Truemans Rd Fingal VIC 3939 AU	Mornington Peninsula	1-5 years	Port Phillip	Yes	Yes	Yes	No	No	No	No	Yes
OL000220551	SBI LANDFILL PTY LTD	950 Ballarto Rd Cranbourne VIC 3977 AU	Casey	16-20 years	Port Phillip	No	Yes	No*	No	No	No	No	No
OL000069939	VEOLIA RECYCLING & RECOVERY PTY LTD	274 – 310 Hallam Rd Hampton Park VIC 3976 AU	Casey	6-10 years	Port Phillip	Yes	Yes	Yes	No	No	No	No	No
OL000070542	VEOLIA RECYCLING & RECOVERY PTY LTD	890 Taylors Rd Dandenong South VIC 3175 AU	Greater Dandenong	6-10 years	Port Phillip	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
OL000011972	WESTERN LAND RECLAMATION PTY LTD	124 Jones Rd Brooklyn VIC 3012 AU	Brimbank	No longer accepting waste	Port Phillip	No	No	No*	No	No	No	No	Yes
OL000012483	WYNDHAM CITY COUNCIL	470 Wests Rd Werribee VIC 3030 AU	Wyndham	30+ years	Port Phillip	Yes	Yes	Yes	No	No	No	No	No

*This site can accept specific types of this waste as specified in the relevant EPA licence. For the full list of wastes that can be lawfully received at sites, please refer to the licence documents available on the EPA's public register.

Appendix C
Modelling assumptions

Appendix C details the assumptions embedded in the modelling and other data considerations.

Data sources

The modelling of the waste generation and infrastructure capacity analysis was informed by various data sources The VRIP uses the Victorian Recycling Industry Annual Survey (VRIAS), EPA landfill levy statements, Waste Transport Certificates, Victorian Local Government Annual Survey and other surveys, such as the National Plastics Survey, to create a historical dataset used for regional waste projection and capacity modelling. Landfill site capacities rely on a mixture of landfill surveys and EPA landfill levy statements.

The analysis in this inaugural VRIP is informed by the best available data. The available data relies on varying reporting methods, changes in tracking systems and the nature of voluntary surveys. A systematic approach was taken to leverage the available data to ensure the robustness of the analysis. As data sources continue to improve, so too will the accuracy of the demand projections.

An additional limitation of the data sources is that the poor visibility of 'hidden' waste streams for which there is limited existing management and/or processing infrastructure available.

Waste projection modelling methodology

This section provides an overview of the methodology applied to the waste projection modelling for the VRIP.

The waste projection modelling for the VRIP was developed using 4 key steps:

- data cleaning – review and clean the input datasets to identify data quality issues and removed noisy data points where appropriate.
- model fitting – fit the models (regression or growth factor with simulation).
- split by region – apportion waste generation to regions.
- split by fate – apportion waste generation to one of 4 fates (disposed, recycled, exported interstate, and exported internationally).

The sections below provide a detailed overview of each step.

Data cleaning

Historical datasets such as the non-hazardous waste generation per source sector across all regions required a level of cleaning. This included removing data outliers with linearly interpolated values or values informed by sector knowledge. For example, future projections for explanatory variables such as population at the LGA level are available only at 5 yearly intervals, requiring linear interpolation to fill in the gaps.

Model fitting

Non-hazardous waste streams

For non-hazardous waste material streams, model fitting steps included:

- Fitting a regression between material stream waste generation and explanatory variables such as population. Checking the fit of the model:
  - do the projections sufficiently follow historical trends – Is R2 above 0.70?
  - are all included explanatory variables statistically significant?
  - are all the projected waste generation values positive?
  - Do the regression coefficients make sense?
  - Does the projection seem reasonable?

Accepting the regression model if 'yes' was the answer to all questions above. Otherwise, a Monte Carlo simulation approach was applied (see below).

Running a Monte Carlo simulation:

- defining the mean of the last 3 years of data as the starting point of a Monte Carlo simulation and run using 3000 simulations
- taking the median of all 3000 simulations and review the projection
- use the initial projections if the re-modelled projections are deemed unreasonable.

Hazardous waste streams

For hazardous waste streams, future arisings were estimated through applying a range of growth factors including but not limited to hazardous waste (except soils) compound annual growth rate, Victorian population growth, Australian 20-year economic growth, Australian manufacturing employment growth and expert industry-informed estimates.

Asbestos containing material was re-modelled with the following approach. The initial projections (obtained from the described process above) were combined with growth factors from the Asbestos Safety and Eradication Agency's Australian Stocks and Flows Model for Asbestos to consider the limited stock of asbestos containing material in Victoria given it is a legacy material.

Split by region

Following the waste generation projection, the state-wide volumes are split into projected waste generation in each of the 7 declared regions: Barwon South West region, Grampians Central West region, Loddon Mallee region, Goulburn Valley region, North East region, Port Phillip region and Gippsland region.

Different methods of splitting by region were applied to each of the 3 source sectors to use the best available and most relevant data:

- MSW: Fit a regression between the total amount of MSW waste in each declared region against the population in the region and project to 2053. Use these regional total MSW projections to apportion projections to respective states.
- C&I: Apply a proportion split based off population projections.
- C&D: Apply a proportion split based off dwelling projections.

Split by fate

The average fate splits (from 2019–2021 data) were used to split projected generated waste in each year to different fates (for example, recycled, disposed, exported interstate, and exported domestically).

In addition, the estimated effects of Government initiatives including the FOGO transition plan, CDS and export ban are applied to modelled fates (recovery rates). This includes applying changes to generation and recovery rates based of expected changes developed by Recycling Victoria.

Infrastructure capacity needs analysis methodology

This section provides an overview of the methodology applied to the needs analysis undertaken for the VRIP.

The needs analysis is divided by waste, recycling and resource recovery infrastructure type and waste stream, with specific steps to the analysis and assumptions applied to each. The general methodology is described below.

Method for comparison of demand and capacity

The following steps relate to the general steps in developing the needs analysis for comparing the demand and capacity information.

Demand Side

Forecast data has been provided in the projection modelling outputs for Non-Hazardous wastes from 2022 to 2053, by stream (MSW, C&I and C&D), category, type, and region for:

- disposal (total tonnes disposed)
- international export (total tonnes exported internationally)
- interstate export (total tonnes exported interstate)
- recycled (total tonnes recycled).

For hazardous waste, forecast data from 2022 to 2053 was provided in the projection modelling outputs by hazardous waste code and type for:

- arisings (tonnes of materials that are managed within the state).

Capacity Side

The recycling infrastructure database prepared by Recycling Victoria was used as a basis to determine the number of facilities and capacity capabilities (where available) for all transfer and recycling/reprocessing infrastructure.

Data on capacity, operational commencement, and approval timing for each infrastructure type necessary to derive state-wide and regional capacity was obtained using the following principles (noting these principles have been applied on a hierarchical basis from a to c based on the appropriateness of the waste material and infrastructure type):

- utilisation of reported capacity data from the recycling infrastructure database
- input direct values or dates (where applicable) based on Recycling Victoria assumed knowledge of the sector or permit data.
- benchmark facility capacities based on other known infrastructure.

Capacity estimates are categorised as either:

- operational, which includes facilities which are considered operational at the time of the VRIP publication including all proposed facilities or site expansions inclusive of 2023/24 financial year.
- proposed, which includes any facility expansions or new proposed facilities which are anticipated to become operational after the VRIP has been finalised.

Additional key assumptions utilised in determining infrastructure capacity include:

- 3-year facility establishment process, from 2024, for proposed facilities with unknown start date.
- when VRIAS throughput data is used to fill facility capacity gaps for a material stream in relation to Step 2b, assume it represents only 90% of facility's capacity.

Method for Residual waste management

Landfill Airspace Capacity

The estimation of landfill capacity has been undertaken based on the following key assumptions to determine airspace and demand:

- Volume of waste sent to landfill was derived from the waste projection model outputs (i.e., generated tonnages).
- Capacity (airspace available) was derived from survey data with capacity with development licence approval status used to assess any gaps.
- Regional airspace consumption was based on regional waste generation (does not account for material flow between regions).

Note: Airspace demand starts from zero and is increased cumulatively based on ongoing yearly residual waste generation.

Landfill Contingency (airspace capacity)

An assessment for state landfill airspace contingency was undertaken using a similar method to the landfill airspace capacity methodology identified in the previous section In addition to the total generated material sent for disposal, an additional factor has been applied to estimate the amount of airspace that may be consumed by unforeseen events such as natural disasters including floods and bushfires and/or other unknown factors such as biohazardous wastes from medial outbreaks.

The contingency factor of 5% was applied for each year for the total disposed material and cumulatively applied to account for airspace consumption. The factor of 5% was developed through benchmarking of the Lismore flood which generated ~220,000tonnes of waste for the 2022 floods which equates to around 5% annually of the projected residual waste send to landfill.

Thermal waste to energy (opportunity to extend airspace capacity)

Thermal waste to energy is considered as an opportunity to extend the life of existing landfill airspace. Waste to energy infrastructure capacity is based on the proposed cap as per the Regulatory Impact Statement, 1 million tonnes per annum at the time the VRIP was prepared, noting that the cap has yet to be determined by government. Capacity has been applied holistically at a state level which allows for economies of scale as these facilities typically process residual waste from a significant catchment area across multiple regions. While the estimates are not applied to a particular source sector or waste stream, it is noted that most proposals, to which the waste to energy cap licence scheme will apply, intend to process (residual) MSW and/or C&I waste.

Waste to energy residues generated from the process are estimated to represent around 20% (by weight) of the waste feedstock. Residue streams will differ by waste feedstock and technology type. All residues are assumed to be taken to landfill; however, it is recognised that there is a strong commercial incentive for proponents to develop reuse pathways for residues where possible to avoid disposal costs.

The demand for landfill airspace capacity has been determined at a state level for all landfill types and is calculated as follows:

- business as usual airspace consumption without waste to energy infrastructure
- airspace consumed with waste to energy infrastructure with residues sent to landfill.
- airspace consumed with waste to energy infrastructure with residues recovered and reused if future opportunities arise.

Appendix D References

Australia, B. (2023). Funding boosts capacity to transform organic waste into renewable energy.

Australian Bureau of Statistics. (2022, November 11). *Australian National Accounts: State Accounts*. Retrieved from Australian Bureau of Statistics: https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/latest-release#:~:text=reverse_axis%22%3Afalse%7D%5D-,Victoria,constrained%20by%20pandemic%20containment%20measures.

Australian Government. (2018). *National Waste Policy 2018*. Retrieved from https://www.dcceew.gov.au/sites/default/files/documents/national-waste-policy-2018.pdf

Australian Government. (2020). *Recycling and Waste Reduction Act 2020*. Retrieved from https://www.austlii.edu.au/cgi-bin/viewdb/au/legis/cth/consol_act/rawra2020287/

Australian Government Department of Climate Change, Energy, the Environment and Water. (2023, August 28). *Waste exports*. Retrieved August 28, 2023, from https://www.dcceew.gov.au/environment/protection/waste/exports

Australian Institute of Health Information. (2023). *Older Australians*. Retrieved from https://www.aihw.gov.au/reports/older-people/older-australians/contents/demographic-profile

Cleanaway Waste Management Limited. (2022). Recycling Behaviours Report. Retrieved from https://cleanaway2stor.blob.core.windows.net/cleanaway2-blob-container/2022/04/Cleanaway_RecyclingBehavioursReport_2022.pdf

CSIRO. (2022). State of the climate.

CSIRO. (2023, July 21). *Lithium-ion battery recycling*. Retrieved from https://www.csiro.au/en/research/technology-space/energy/energy-in-the-circular-economy/battery-recycling

Deakin University. (2023). How can we improve recycled carbon fibre? A Deakin researcher has just been awarded more than $1m in ARC funding to find out.

Department of Environment, Land, Water and Planning. (March 2022). *An overview of Victoria's Circular Economy (Waste and Recycling) Act 2021: Underpinning waste and recycling reform.*

Engage Victoria. (2023, August 29). *Strengthening Victoria's waste, recycling and resource recovery sector.* Retrieved from https://engage.vic.gov.au/risk-consequence-and-contingency-regulations

Engage Victoria. (n.d.). *Standardising recycling at home across Victoria*. Retrieved September 25, 2023, from https://engage.vic.gov.au/sorting-household-recycling

Environment Protection Agency Victoria. (2022, December). Separation distance guideline. Victoria.

Environment Protection Agency Victoria. (n.d.). Comply with the plastic bag ban. Retrieved August 28, 2023, from https://www.epa.vic.gov.au/about-epa/our-programs-and-projects/single-use-plastics-ban/comply-with-plastic-bag-ban

(2022). *Environment Protection Amendment* (Banning Single-Use Plastic Items) Regulations 2022. Chief Parliamentary Council.

Environment Protection Authority Victoria. (2015). 788.3: Siting, design, operation and rehabilitation of landfills. Retrieved from https://www.epa.vic.gov.au/about-epa/publications/788-3

Environmental Protection Authority Victoria. (2023). Waste Levy.

IBISWorld. (2023). *Synthetic and Natural Textile Manufacturing in Australia – Market Size, Industry Analysis, Trends and Forecasts* (2023–2028).

Igini, M. (2023, February 22). Thailand announces ban on plastic waste imports by 2025. *Earth.Org*. Retrieved from https://earth.org/thailand-ban-plastic-imports/

Infrastructure Victoria. (2021). *Victoria's infrastructure strategy 2021–2051*.

Infrastructure Victoria. (April 2020). *Advice on recycling and resource recovery infrastructure*.

Innovating Energy. (2023). Burra foods bioenergy.

Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014: Mitigation of Climate Change*. Cambridge University Press. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf

Jarzebski, M. P. (2021). Ageing and population shrinking: implications for sustainability in the urban century. *Nature*. Retrieved from https://www.nature.com/articles/s42949-021-00023-z

Macklin, J. (2018, April 27). *China's recycling 'ban' throws Australia into a very messy waste crisis*. Retrieved from The Conversation: https://theconversation.com/chinas-recycling-ban-throws-australia-into-a-very-messy-waste-crisis-95522

Premier of Victoria. (2017, November 2). *Victorian Manufacturing Continues To Soar*. Retrieved from https://www.premier.vic.gov.au/site-4/victorian-manufacturing-continues-soar

Randell Environmental Consulting. (2022). *Victorian e-waste material flow analysis 2021*. Sustainability Victoria.

Sustainability Victoria. (2018). *Statewide Waste and Resource Recovery Infrastructure Plan*. Retrieved from https://assets.sustainability.vic.gov.au/asset-download/Plan-Statewide-Waste-and-Resource-Recovery-Infrastructure-Plan-Victoria-2018.pdf

Sustainability Victoria. (2022). Technology that is turbocharging recycling in Victoria.

Sustainability Victoria. (2023, August 1). *The growing issue of PV system waste*. Retrieved from https://www.sustainability.vic.gov.au/recycling-and-reducing-waste/product-stewardship/national-approach-to-manage-solar-panel-inverter-and-battery-lifecycles

TWI. (2020, October 30). *How long do wind turbines last? Can their lifetime be extended?* Retrieved from https://www.twi-global.com/technical-knowledge/faqs/how-long-do-wind-turbines-last

United Nations Institute for Training and Research. (2020). *The Global E-waste Monitor 2020: Quantities, flows and the – 90/olp potentia*l. Trfm7hb.

(May 2023). *Victoria's 2035 Emissions Reduction Target*. Victorian Department of Energy, Environment and Climate Action.

Victorian Department of Energy, Environment and Climate Action. (2022, September 27). Circular Economy (Waste Reduction and Recycling) (Container Deposit Scheme) Regulations 2022. Chief Parliamentary Counsel.

Victorian Department of Environment, Land, Water and Planning. (February 2020). *Recycling Victoria: A new economy*.

Victorian Department of Environment, Land, Water and Planning. (July 2019). *Victoria in Future 2019: Population predictions 2016 to 2056*.

Victorian Department of Environment, Land, Water and Planning. (July 2019). *Victoria in Future 2019: Population predictions 2016 to 2056*.

Victorian Department of Environment, Land, Water and Planning. (November 2021). *Victorian waste to energy framework: Supporting sustainable and appropriate investment*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Barwon: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Barwon: Regional Economic Development Strategy*. Retrieved from https://www.rdv.vic.gov.au/__data/assets/pdf_file/0009/2063907/Barwon-REDS-2022.pdf

Victorian Department of Jobs, Precincts and Regions. (2022). *Central Highlands: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Central Highlands: Regional Economic Development Strategy*. Retrieved from https://www.rdv.vic.gov.au/__data/assets/pdf_file/0010/2063908/Central-Highlands-REDS-2022.pdf

Victorian Department of Jobs, Precincts and Regions. (2022). *Gippsland: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Goulburn: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Great South Coast: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Loddon Campaspe: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Mallee: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Ovens Murray: Regional Economic Development Strategy*.

Victorian Department of Jobs, Precincts and Regions. (2022). *Wimmera Southern Mallee: Regional Economic Development Strategy*.

Victorian Department of Transport and Planning. (2017). *Plan Melbourne 2017–2050*.

Victorian Department of Transport and Planning. (2020). Melbourne Industrial and Commercial Land Use Plan. Retrieved from https://www.planning.vic.gov.au/guides-and-resources/strategies-and-initiatives/melbourne-industrial-and-commercial-land-use-plan

Victorian Department of Transport and Planning. (2023, March 3). VC215. Retrieved from https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/amendments/VC215

Victorian Government. (n.d.). Retrieved from Clean-up program: https://www.vic.gov.au/2022-floods-clean-up-program

Victorian Government. (2010). Transport Integration Act 2010. Retrieved from https://www.legislation.vic.gov.au/in-force/acts/transport-integration-act-2010/073

Victorian Government. (2017). *Climate Change Act*.

Victorian Government. (2017). *Environment Protection Act 2017*. Retrieved from https://content.legislation.vic.gov.au/sites/default/files/2021-06/17-51aa005%20authorised.pdf

Victorian Government. (2022, October 22). Local Jobs First Policy. Victoria, Australia.

Victorian Government. (2023, July 1). *Circular Economy* (*Waste Reduction and Recycling*) *Act 2021*. Victoria, Australia.

Victorian Government. (2023, August 28). *Standardising household recycling across Victoria: A 4-bin waste and recycling system for better recycling*. Retrieved July 5, 2023, from https://www.vic.gov.au/Standardising-household-recycling-across-Victoria

Victorian Government. (2023). *Victoria's 2035 Emissions Reduction Target*. Retrieved from https://www.climatechange.vic.gov.au/legislation/climate-change-act-2017

Victorian Government Department of Transport and Planning. (2018, July 31). Victoria Planning Provisions: Economic Development. Victoria.

Victorian Government Department of Transport and Planning. (n.d.). *Big Build*. Retrieved August 28, 2023, from https://dtp.vic.gov.au/our-transport-future/future-directions-for-transport/big-build

(28 June 2018). *Victorian Government Gazette No. G 26*. Authority of Victorian Government Printer.

Victorian Government. (n.d.). *Regional Recycling Fund*. Retrieved August 28, 2023, from https://www.vic.gov.au/regional-recycling-fund

Victorian Government. (n.d.). *Victoria's waste and recycling industry: New investment opportunities and support*. Retrieved October 4, 2023, from vic.gov.au: https://www.vic.gov.au/waste-and-recycling-industry

Victorian Planning Authority. (2012). *Growth Corridor Plans*. Retrieved from https://vpa.vic.gov.au/metropolitan/growth-corridor-plans/

recycling.vic.gov.au

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