Brock Baker
Environmental
Consulting

Waste and Resource Recovery Infrastructure Data and Spatial Analysis

Supporting Infrastructure Victoria Resource Recovery Infrastructure Gap Analysis

Final Report

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Executive summary

Infrastructure Victoria engaged Brock Baker Environmental Consulting to provide a comprehensive understanding of the location, capacity and capability of Victoria's resource recovery infrastructure network to manage priority materials and identify gaps and opportunities to meet future policy settings.

Priority waste materials focus include paper, plastic, glass, organics, tyres, and e-waste and the four policy and target settings focus being:

1. The draft COAG Waste Export Ban proposal that seeks to restrict the export of certain unprocessed waste materials which will be phased in from July 2020 and come into full effect by July 2022. The materials include glass, paper and cardboard, plastics and tyres.
2. The Australian Packaging Covenant Organisation (APCO) plastics recycling target of 70% of plastics to be recycled in Australia by 2025.
3. The National Waste Policy target of an 80% average resource recovery rate from all waste streams following the waste hierarchy by 2030.
4. The Victorian Government discussion paper on Waste to energy

Results

The result of the infrastructure capacity and capability assessment, as shown in Table 1, identified:

- a shortfall in capacity in paper and cardboard to meet the proposed COAG ban
- a shortfall in capacity for plastics and organics by 2025, and
- a shortfall in capacity for recovering e-waste by 2030
- no shortfall in processing capacity for glass and tyres

Table 1: Current infrastructure capacity to meet future generation and policy settings

Priority Material	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Paper and cardboard	✗	✗	✗	✗
Plastic	✓	✗	✗	✗
Organics	✓	✗	✗	✗
E-waste (recovery capacity)	✓	✓	✗	✗
Glass	✓	✓	✓	✓
Tyres	✓	✓	✓	✓

The extent of the shortfall for paper and cardboard is around 1.3 million tonnes by 2022, while for plastic and organics it is around 290,000 tonnes and 130,000 tonnes respectively by 2025, and for e-waste around 4,300 tonnes by 2030, see Table 2.

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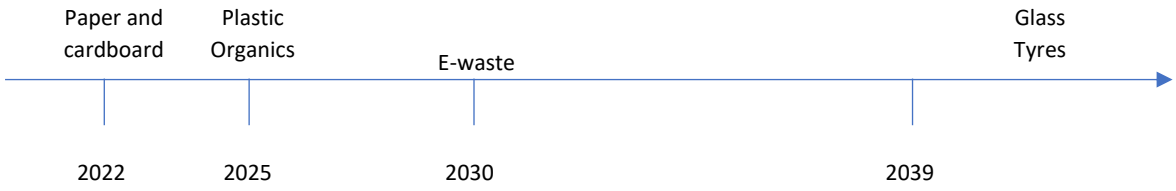
Table 2: Excess or shortfall in capacity in current infrastructure to meet future generation and policy settings

Priority Material	Current processing infrastructure capacity	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Paper and cardboard	232,000	-1,326,600	-1,292,900	-1,605,000	-2,010,400
Plastic	160,050	15,150	-288,650	-381,250	-501,750
Organics [1]	764,800	229,900	-129,600	-314,300	-555,000
E-waste[2]	49,400	26,900	5,000	-4,300	-9,100
Glass	494,200	212,100	226,800	170,300	95,800
Tyres	112,500	29,100	42,700	28,600	10,300

Gaps and opportunities

Over the next 20 years there will be a need to invest in capacity infrastructure initially in paper and cardboard followed by plastics and organics and finally e-waste with sufficient capacity currently in glass and tyres to meet future policy setting, see Figure 1.

Figure 1: Year shortfall in capacity will occur to meet future generation and policy settings



Paper

There is a significant shortfall in Victorian processing infrastructure capacity by an estimated 1.3 million tonnes by 2022 and 2 million tonnes by 2039 to meet future policy settings. Investment in new infrastructure is required immediately with opportunities to support additional processing capacity in Melbourne or regional areas.

To make up a large proportion of the shortfall, and to continue to export out of Australia, investment in large scale pulping facilities is required either in Melbourne or regional Victoria. In addition, alternative processing will need to increase or be developed. Alternate processing can include:

- Moulded fibre production
- insulation
- kitty litter
- Composting

These alternative processing facilities can range between 2,000 to 15,000 tonnes which may provide opportunities in regional areas with most regions generating sufficient paper to support such facilities.

Plastic

Overall, there is enough capacity to meet the 2022 export ban however significant shortfall in processing infrastructure capacity to meet targets set for 2025 and beyond. With a significant shortfall

[1] Refers to capacity and excess and shortfall to manage food and garden organics
[2] Refers to the recovery capacity of dedicated e-waste facilities

in processing capacity by 2025, there is a need and opportunity to establish processing infrastructure in Melbourne and regional Victoria with current processing capacities ranging anywhere from 100 to 15,000 tonnes. In addition, there is a gap within the current capacity to sort mixed plastics from MRFs with currently no market outlet for material recovered which is either being stockpiled or landfilled.

Organics

Overall, there is a shortfall by an estimated 130,000 tonnes by 2025 and 555,000 tonnes by 2039 in processing infrastructure capacity to meet future policy settings for food and garden organics.

Melbourne's processing capacity is significantly less than what is recovered with Melbourne reliant of regional and interstate processing capacity. Opportunities to add additional processing capacity in Melbourne is restricted due to a lack of available land that can meet regulatory requirements. Future capacity will either need to be created within existing sites or provided by a dedicated organics recovery facility to recover and transport out of Melbourne.

With a projected shortfall by 2025 there is a need and opportunity for additional processing capacity in regional areas, such as in the Barwon South West and Grampians Central West regions with future processing capacity to prioritise the recovery of food organics.

E-waste

There is a small shortfall by an estimated 4,000 tonnes by 2030 and 9,000 tonnes by 2039 in recovery infrastructure capacity to meet future policy settings. Pathways for collection are now in place, with waste facilities in Victoria providing a separate bin for e-waste and other disposal points at various council and private facilities to be transported to dedicated e-waste facilities. With a shortfall in capacity by 2030 there may be an opportunity to establish additional dedicated e-waste dismantling facilities in Melbourne or regional areas.

Glass and tyres

The capacity of Victoria's glass processing is estimated at around 494,200 tonnes which is enough to meet requirements of the ban and future policy settings and while there is sufficient capacity to meet future projections there may be opportunities in regional areas for small scale processing into glass sand, aggregates and other products.

With the removal of baling capacity for tyres from the network, there is sufficient tyre processing capacity to meet requirements of the ban and future policy settings. There are no gaps or immediate opportunity for investment in regional areas with the largest output being produced (shredded tyres) being almost entirely exported overseas making the location in Melbourne more appropriate

Waste to energy

For the purpose of the project, the role for waste to energy has been set for the remaining 10% after materials recovery target of 90% is achieved by 2039. This approach recognises Infrastructure Victoria's waste advice Terms of Reference which state, "Support a waste to energy sector that prioritises the extraction of recyclable material and recovers energy only from the residual waste (i.e. without diverting waste from reuse or recycling)."

The priority materials suitable for waste to energy are paper, plastic, organics and tyres. A total of almost 650,000 tonnes will be available for waste to energy after 90% materials recovery rate has been achieved. Currently there are four project proposals for waste to energy using thermal processes moving through Victorian Government or local council approvals processes. The total of the proposed four facilities are around 1 million tonnes which would be enough to manage the remaining 10% of priority materials generated in 2039.

Introduction

The Special Minister of State has requested that Infrastructure Victoria (IV) provide advice about the infrastructure requirements for increased recycling and resource recovery.

The Government is seeking advice from IV on the infrastructure requirements and the role for government in providing support to:

- Develop Victoria's reprocessing sector for recycled material, particularly those that currently rely heavily on overseas markets such as plastics.
- Better enable the use of products containing recycled materials in a variety of Victorian industries, such as manufacturing, construction and agriculture.
- Support a waste to energy sector that prioritises the extraction of recyclable material and recovers energy only from the residual waste (i.e. without diverting waste from reuse or recycling).
- Support high levels of resource recovery for organics, particularly food organics.

In December 2019, Infrastructure Victoria (IV) engaged Brock Baker Environmental Consulting (BB Environmental) to undertake data and spatial analysis on Victoria's resource recovery infrastructure to support IV's Resource Recovery Infrastructure Gap Analysis project.

The project

Requirement

Provide a comprehensive understanding of the location, capacity and capability of Victoria's resource recovery infrastructure network to manage materials and reach end markets and identify gaps and opportunities to meet future policy setting. The project to focus on priority waste materials:

- Paper and cardboard (referred to throughout the rest of the report as paper)
- Plastic
- Glass
- Organics
- Tyres
- E-waste

The assessment of gaps and opportunities to meet future policy setting to be based on the following:

- Ban on the export of unprocessed waste by 2022
- 70% recovery rate achieved by 2025
- 80% recovery rate achieved by 2030
- 90% recovery rate achieved by 2039

Method

To provide an assessment of capacity, capability, gaps and opportunities to meet future policy setting, BB Environmental undertook the following:

- Compiled a list of waste facilities managing priority materials and, assigned where possible:
    - Location (address, coordinates, Local Government Area, Waste and Resource Recovery Group (WRRG))
    - Role within the resource recovery supply chain (recovery or processing)

    - Facility type (based on infrastructure type outlined in Sustainability Victoria's Statewide Waste and Resource Recovery Infrastructure Plan[3] (SWIRRP))
    - Priority material managed
    - Infrastructure capability (developed for this project, see Appendix 2)
    - Output category (developed for this project, see Appendix 2)
    - Capacity
- Mapped the list of waste facilities based on role and infrastructure capability
- Developed a workbook to contain:
    - waste generation and recovery by priority material and WRRG projected to 2039
    - infrastructure capacity by recovery supply chain role, infrastructure capability, and WRRG
    - assessment of current capacity to meet future policy setting and identify gaps and opportunities for infrastructure investment including when future investment is likely to be required.

Data sources

This report uses a synthesis of available data and industry knowledge to provide an evidence-based foundation for understanding Victoria's resource recovery infrastructure capacity and capability.

Most data within this report was obtained from Victorian Government agencies, which collect it for monitoring and reporting purposes, or from recently commissioned projects by IV, such as this one. Where available, this data has been supplemented and sometimes replaced by more recent industry data. Where data gaps existed, such as infrastructure capacity, estimates were made based on comparable data.

All data used in the development of this report is included in the accompanying Microsoft Excel workbook. Note all numbers expressed in this report have been rounded and may include estimates where required for data availability or quality purposes.

Datasets used in the report have been made available to the public in the interest of transparency, where possible. Some datasets contain sensitive commercial and legal information and are classified as confidential. Any confidential data included in the report has been de-identified or aggregated to mitigate disclosure risks.

Background

Priority materials

IV identified six core statewide waste streams to provide detailed focus for analysis. The priority waste materials identified were paper, plastic, glass, organics, tyres, and e-waste.

These priority materials were identified because of:

- Current market challenges
- Proposed COAG Waste Export Ban requirements
- The introduction of the Victorian e-waste landfill ban in July 2019
- The significant opportunity that exists to increase resource recovery rates for organics

The current generation and recovery rate of priority materials are outlined in Table 3.

[3] Section 6: Infrastructure supporting the waste and resource recovery system

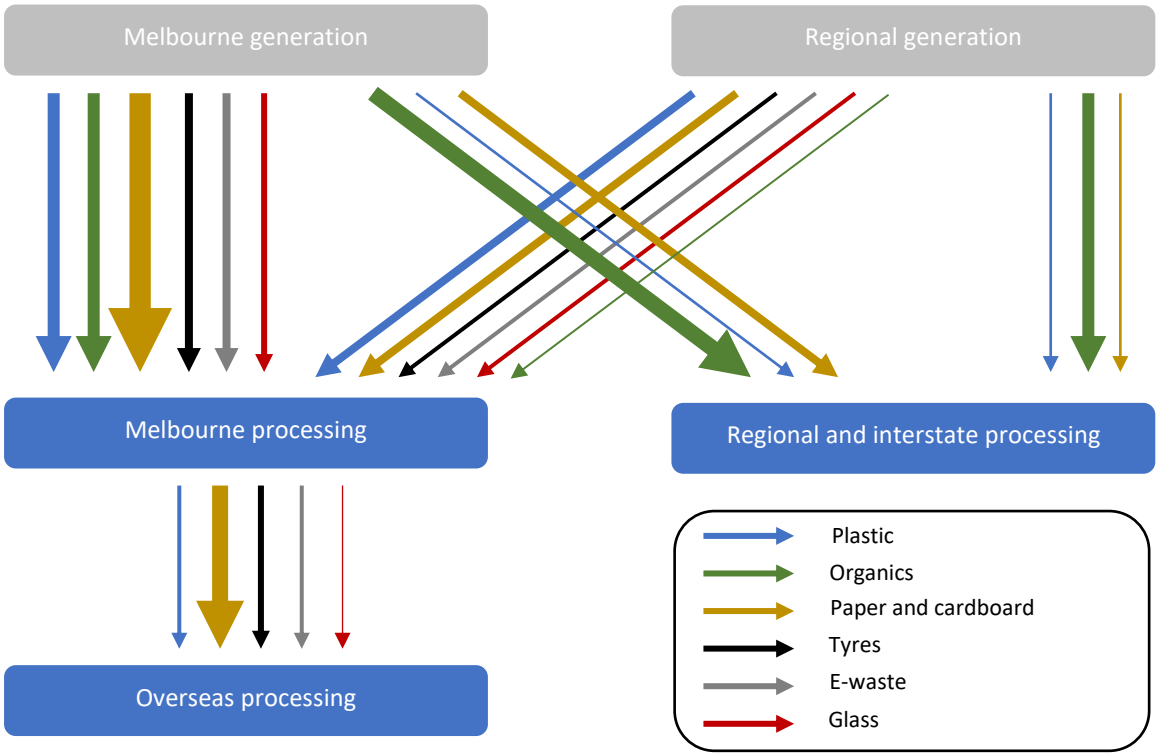
Table 3: Priority material generation and recovery rate, 2018[4]

Priority material	Landfill	Recovery	Generation	Recovery Rate
Paper	516,800	1,481,000	1,997,800	74%
Plastic	449,100	137,200	586,300	23%
Glass	80,400	263,700	344,100	77%
Organics	1,407,300	1,081,800	2,489,100	43%
Tyres	17,300	66,200	83,500	79%
E-waste	12,300	79,400	91,700	87%

Materials flow

Most of the processing capacity in Victoria is located in Melbourne and as a result, most material generated in regional Victoria is transported into Melbourne for processing or export overseas, see Figure 2. The exception is organics where a large proportion of what is recovered in Melbourne is transported to regional or interstate processing capacity. Paper and plastics are other priority materials transported out of Melbourne for processing with one of three large paper pulp mills located in the Gippsland region.

Figure 2: Priority materials movement between regional Victoria, Melbourne and export overseas



Future policy settings

The project analysis adopts four policy and target settings to assess current and future infrastructure capacity and capability needs. These four policy settings are:

[4] Victorian waste flows projections, prepared for Infrastructure Victoria, Blue Environment, December 2019

1. The draft COAG Waste Export Ban proposal that seeks to restrict the export of certain unprocessed waste materials which will be phased in from July 2020 and come into full effect by July 2022. The materials include glass, paper and cardboard, plastics and tyres.
2. The Australian Packaging Covenant Organisation (APCO) plastics recycling target of 70% of plastics to be recycled in Australia by 2025.
3. The National Waste Policy target of an 80% average resource recovery rate from all waste streams following the waste hierarchy by 2030.
4. The Victorian Government discussion paper on Waste to energy

As a result, the infrastructure capacity and capability assessment presented in this report has been based on the below four settings across all priority waste streams:

- Ban on the export of unprocessed waste by 2022
- 70% recovery rate achieved by 2025
- 80% recovery rate achieved by 2030
- 90% recovery rate achieved by 2039

Banning exports of waste plastic, paper, glass and tyres[5]

Commonwealth, state and territory governments have agreed that waste plastic, paper, glass and tyres that have not been processed into value-added materials should be progressively banned from export from Australia by no later than 30 June 2022, starting from next year. This would mean:

- Waste plastic, paper, glass and tyres that have not been processed into a value-added material cannot be exported.
- Value-added materials that can be exported would include plastic, paper, glass and tyres that have been processed into materials ready for further use and should not harm human health or the environment in the importing country. These include the materials listed in Table 4.

Table 4: Proposed value-added materials not subject to the export ban

Waste stream	Value added material
Plastic	Clean plastics sorted to a single resin type and processed ready for further use (e.g. flakes and pellets)
Paper	Paper pulp
Glass	Washed, colour sorted cullet ready for further use
Tyres	Crumb rubber, powder and granules or shredded tyres exported for tyre derived fuel

On 8 November 2019, Commonwealth, state and territory Environment Ministers determined that the waste export ban should commence on 1 July 2020 with a phased approach. Ministers agreed the phase out should be completed by the following dates:

- all waste glass by July 2020
- mixed waste plastics by July 2021
- all whole tyres including baled tyres by December 2021
- remaining waste products, including mixed paper and cardboard, by no later than 30 June 2022.

[5] Banning exports of waste plastic, paper, glass and tyres: Discussion paper on implementing the August 2019 decision of the Council of Australian Governments, Department of the Environment and Energy Dec 2019

APCO plastics recycling target of 70% of plastics to be recycled in Australia by 2025

APCO is a co-regulatory, not for profit organisation partnering with government and industry to reduce the environmental impact of packaging in Australian communities. APCO delivers this model of shared responsibility through the promotion of sustainable packaging activities including sustainable design, recycling initiatives, waste to landfill reduction and circular economy projects.

In 2018, Australia established the 2025 National Packaging Targets to create a new sustainable pathway for the way we manage packaging in Australia. The target to be achieved by 2025 applicable to the project is:

- 70% of plastic packaging being recycled or composted

National Waste Policy target of an 80% average resource recovery rate[6]

In December 2018, the *2018 National Waste Policy: Less waste, more resources* was agreed by Australia's Environment Ministers and the President of the Australian Local Government Association. It set a new unified direction for waste and recycling in Australia.

To implement the 2018 National Waste Policy, the government released *The National Waste Policy Action Plan 2019* (Action Plan). The Action Plan creates targets and actions to investment and national efforts to 2030 and beyond. The target to be achieved by 2030 applicable to the project is:

- 80% average recovery rate from all waste streams

Victorian Government discussion paper, Turning waste into energy

In 2017, the State of Victoria Department of Environment, Land, Water and Planning (DELWP) released a discussion paper on waste to energy facilities in Victoria. The Government's preliminary position is to consider facilitating greater recovery of energy from waste where there are clear net benefits to society. This is likely to be where a waste to energy facility does not displace resource recovery options that sit higher in the waste hierarchy where they are technically and economically feasible.[7]

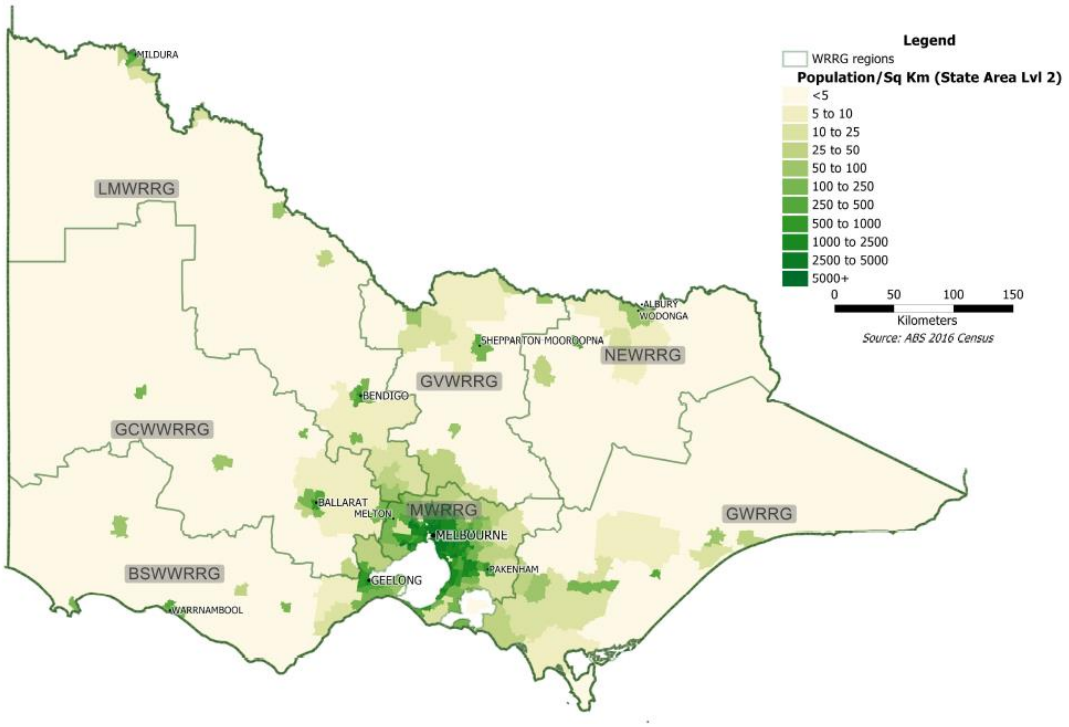
For the purpose of the project a materials recovery target of 90%[8] is set by 2039 providing a role for waste to energy to assist in recovering the remaining 10% of waste generated.

Victorian waste and resource recovery regions

The Victorian waste management and resource recovery planning framework is built on the establishment of seven regions across local government boundaries, see Figure 3. Each region has a Waste and Resource Recovery Group (WRRG), established as statutory authorities under the *Environment Protection Act* 1970. Among other responsibilities, they develop Regional Implementation Plans for their regions to identify local waste infrastructure needs and how to meet them over a 10-year period[9].

[6] The National Waste Policy Action Plan 2019
[7] Turning waste into energy: Join the discussion, DELWP 2017
[8] Includes processing of organic waste by anerobic digestion facilities
[9] Statewide Waste and Resource Recovery Infrastructure Plan, Sustainability Victoria (SV) 2018

Figure 3: Waste and Resource Recovery Group regions



Resource Recovery Infrastructure

Infrastructure types and resource recovery supply chain

The resource recovery infrastructure network is made up of three main infrastructure groups excluding disposal as identified in the SWRRIP, see Table 5.

Table 5: The three major groups of resource recovery infrastructure[10]

Infrastructure group	Function
Collection infrastructure	Facilitates recovery of materials at the point of generation by collecting and transporting to facilities for sorting, consolidation or disposal.
Recovery facilities	Facilitates recovery of resources primarily through segregating, sorting, consolidating and aggregating before transporting for reuse, reprocessing or disposal
Reprocessing facilities	Facilitates recovery of resources primarily by converting materials into products that can be used again or energy

These three groups typically operate as a recovery supply chain, see

Table 6. This supply chain can be as short as collection and transport directly to a processing facility or involve several recovery facilities before being transported to a processing facility to be turned into a product.

[10] SWRRIP, Sustainability Victoria 2018

Table 6: Typical resource recovery infrastructure supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
				
Commingled or sourcec sperated		Manage multiple materials or specialise in one		Typically manage one material type

Collection infrastructure

Collection infrastructure, also known as binfrastructure, is varied and can be:

- located at point of generation or at a drop-off point (e.g. in stores) and recovery facilities
- used to collect:
    - source separated materials (e.g. garden kerbside bin or office wastepaper bin)
    - multiple materials together or commingled (e.g. kerbside recycling or skip bins at construction sites)
- provided by local governments (e.g. residential kerbside bins) or commercial operators (e.g. skip bins)

Recovery infrastructure

While the primary project focus is on processing facilities and the capability and capacity to process recovered resources suitable for accessing domestic and export markets, the project incorporates information on the recovery facilities supporting them. Recovery facilities play a critical role in the waste and recycling system by aggregating, sorting and consolidating materials and making them available for processing in Melbourne, regional Victoria, interstate or overseas. The SWRRIP outlines five types of recovery facilities operating across Victoria, see Table 7 below.

Table 7: Major types of recovery infrastructure across Victoria[11]

Facility type	Function (can include)	Materials accepted
Drop-off centres	Unload of materials Point source separation Aggregation for transfer	Depends on the facility, and can include residual waste
Resource recovery centres (RRC) (also called transfer stations)	Unload of materials Point source separation and sorting Aggregation and consolidation for transfer Consolidating kerbside collected material for bulk haul (increasing trend) Some resale to public	Wide range of materials depending on the facility including garden organics, wood, timber, commingled recyclables, batteries, e-waste, whitegoods, tyres, mattresses and residual waste
Bulk haul consolidation centres	Consolidation of kerbside collected materials for bulk haul transfer	Kerbside collected commingled recyclables, garden organics, combined FOGO and residual waste

[11] SWRRIP, Sustainability Victoria 2018

Facility type	Function (can include)	Materials accepted
Specific materials recovery centres (SMRC)	Unload of specific material streams Sorting and some separation of components Aggregation and consolidation for transfer Some resale to public	Most facilities will only accept certain types of materials. For example, scrap metal yards or C&D materials or paper and cardboard. They generally do not accept residual waste.
Material recovery facilities (MRF)	Sorting Aggregation and consolidation for transfer	Currently primarily kerbside collected commingled streams. Some facilities also cater for mixed streams of materials from C&I and C&D activities.

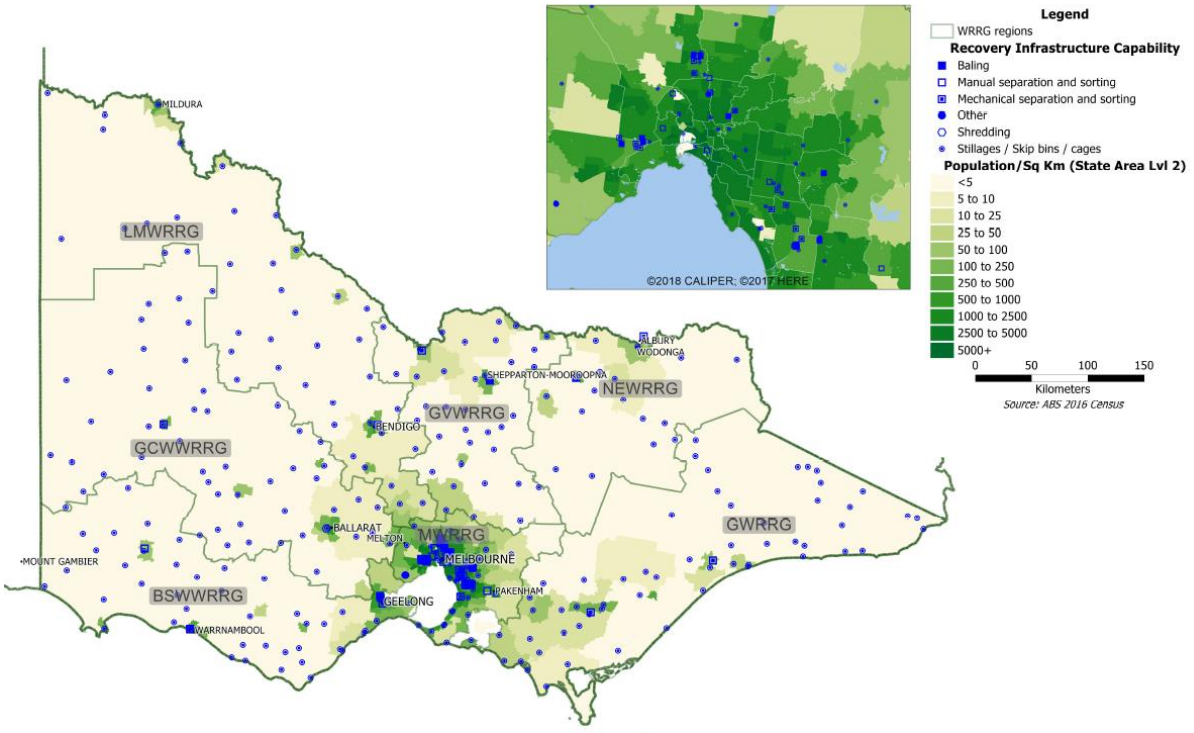
Recovery facilities have the capability of shredding, separating, bailing and providing binfrastructure. Table 8 outlines the capability and outputs of resource recovery facilities developed as part of the project. See Appendix 1 for further details.

Table 8: Resource recovery facility capability and outputs

Infrastructure capability	Output category
Baling, Shredding, Manual separation and sorting, Mechanical separation and sorting, Stillages / Skip bins / cages, Other	Baled waste, Components, Cullet, Garden Shred, Raw Mulch, Separated wastes

Victoria's recovery network is located across Victoria, see Figure 4 and primarily council operated resource recovery centres.

Figure 4: Location of recovery infrastructure by capability



Processing infrastructure

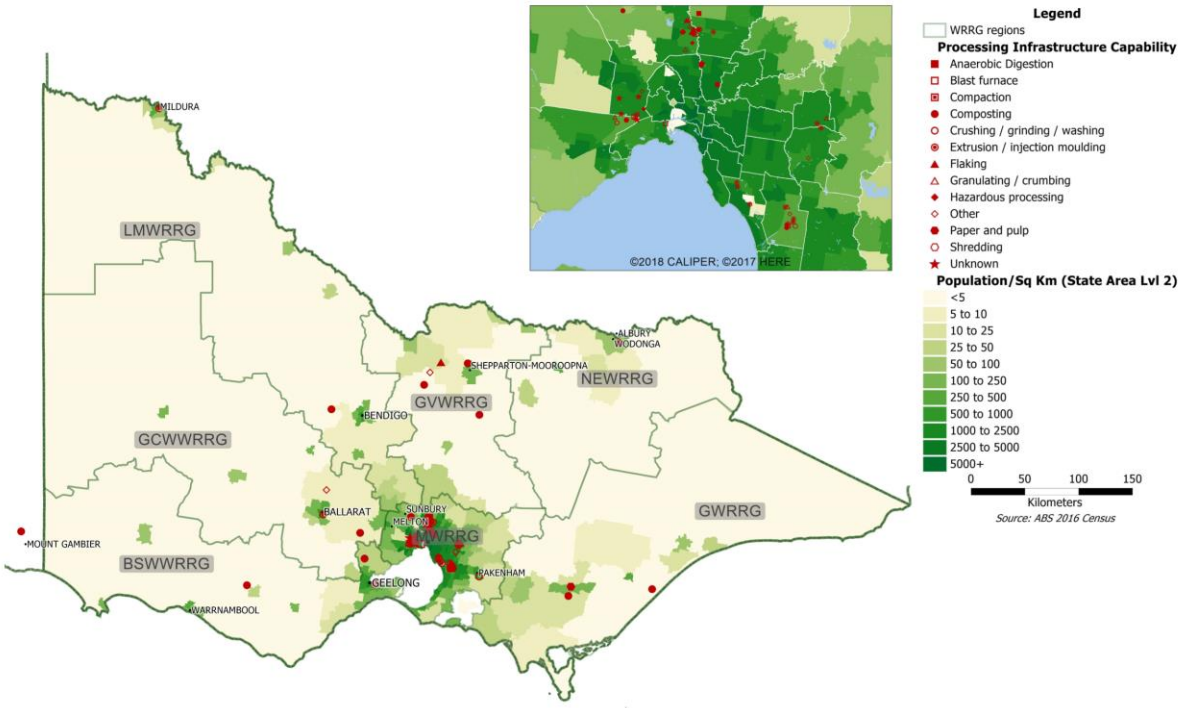
Processing infrastructure recover resources and primarily convert materials into products that can be used again or for energy. Table 9 outlines the capability and outputs of resource recovery facilities developed as part of the project. See Appendix 1 for further details.

Table 9: Processing infrastructure capability and outputs by priority material

Priority material	Infrastructure capability	Output category
Paper	Paper and pulp, Other	Recycled paper, Other
Plastic	Extrusion / injection moulding, Flaking, Granulating / crumbing, Compaction, Other	Flakes / Resins / Compounds, Packaging, Structural products, Other
Glass	Blast furnace, Crushing / grinding / washing	Packaging, Glass sands, aggregates and other
Organics	Composting, Anerobic Digestion, Other	Compost / Mulch, Energy
Tyres	Granulating / crumbing, Shredding	Granules / crumb, Tyre shred
E-waste	Hazardous processing	Other

In addition to the above categories, several facilities were allocated the category of 'Unknown' where capability was unable to be identified or interpreted from company websites. Figure 5 shows the location of processing across Victoria with most facilities located in Melbourne.

Figure 5: Location of processing infrastructure by capability



Infrastructure capacity and capability assessment

IV identified six core statewide waste streams to provide detailed focus for analysis. The priority waste materials identified were paper, plastic, glass, organics, tyres, and e-waste.

This section provides an assessment of the capacity and capability of the recovery and processing infrastructure against projected generation and future policy settings. A more detailed overview of current generation and recovery for each material can be found in Appendix 2.

Most data within this report was obtained from Victorian Government agencies, which collect it for monitoring and reporting purposes, or from recently commissioned projects by IV, such as this one. Where available, this data has been supplemented and sometimes replaced by more recent industry data. Where data gaps existed, such as infrastructure capacity, estimates were made based on comparable data.

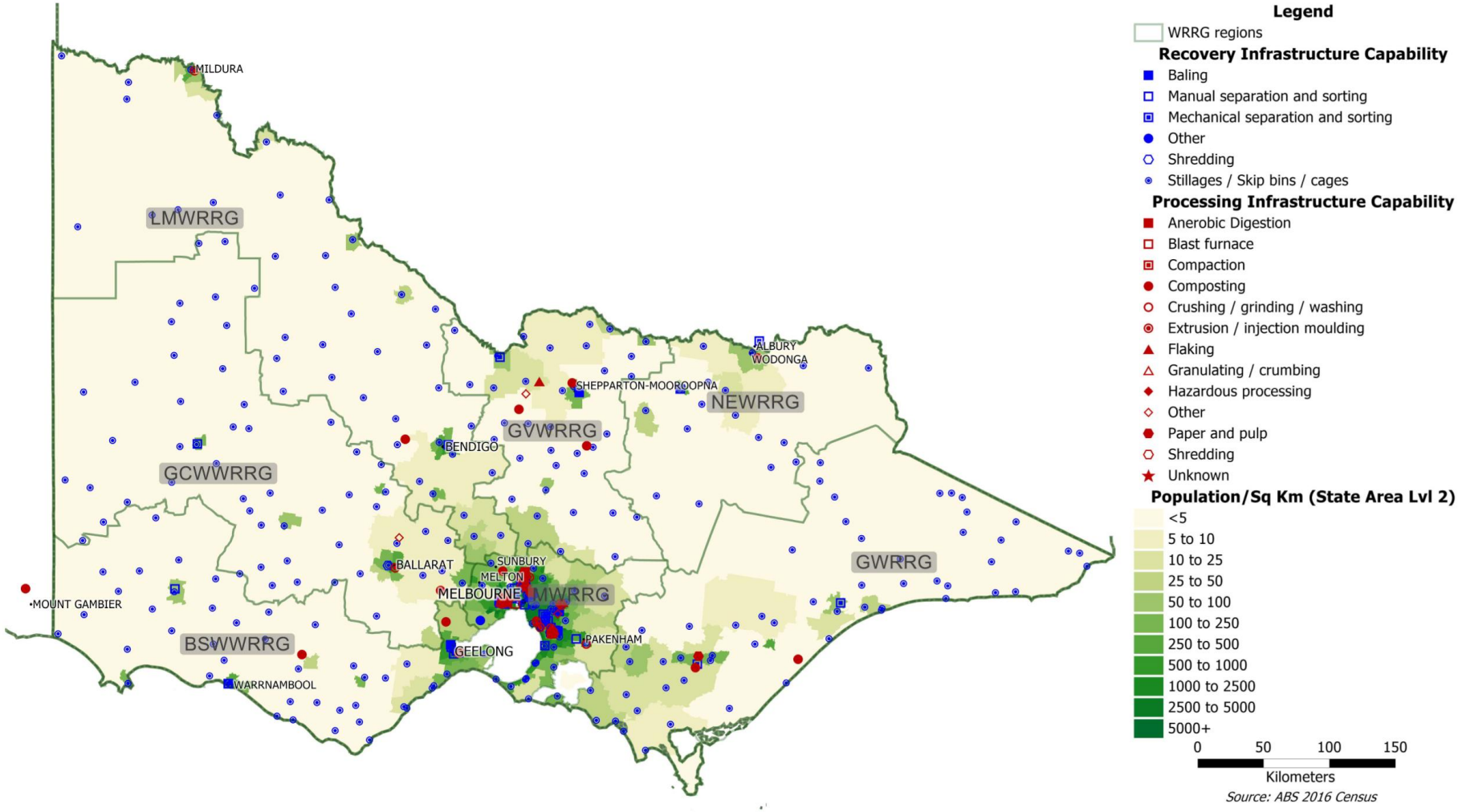
A total of 430 facilities were identified as part of the project contributing to the resource recovery network. This is considered not to be a complete list, particularly in regard to recovery infrastructure. Table 10 shows the number of facilities managing each of the priority materials.

Table 10: Summary of resource recovery infrastructure by priority material.

Infrastructure type	Paper & Cardboard	Plastics	Glass	Tyres	Organics	E-waste	Multiple
Processing Infrastructure							
Reprocessing Facility	9	32	6	3	19	4	-
Recovery Infrastructure							
Specific Materials Recovery Centre	7	-	1	5	5	24	-
Materials Recovery Facility	-	-	-	-	-	-	13
Resource Recovery Centre	1	-	-	-	-	-	265
Bulk haul Consolidation Centre	-	-	-	-	-	-	1
Drop-off Centre	-	-	-	-	-	6	15
Other	-	-	-	-	-	-	14

Figure 6 shows the location and capability of Victoria's recovery and processing infrastructure to manage the priority materials with most processing capability located in Melbourne.

Figure 6: Location of recovery and processing infrastructure capability



OFFICIAL

Paper and Cardboard

Paper includes mixed paper and cardboard, office paper and newspaper, and magazine print. In 2018, an estimated 2 million tonnes of paper waste were generated with an overall resource recovery rate of 74%. Of the material recovered, about 630,000 tonnes were exported with Victoria a major exporter overseas of paper accounting for between 40-50% of all paper exported from Australia[12].

Infrastructure and recovery supply chain

Victoria's paper fixed recovery infrastructure has been grouped into two main types:

- Materials Recovery Facilities (MRFs)
- Specific Materials Recovery Centres (SMRCs), single-stream facilities that only receive paper

Victoria's paper processing infrastructure has been grouped into two main types:

- Paper and pulp e.g. processing of recycled paper / paperboard and moulded fibre packaging
- Other e.g. processing of insulation and kitty litter

Paper is collected as a commingled stream primarily managed through MRFs and source separated stream primarily managed through single-stream recovery facilities, see Table 11.

Table 11: Typical paper recovery and processing supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
Source separated collection infrastrucutre primarily located within commercial business or located at drop-off points.	»	Single-stream recovery facilities bale the separated paper grades to trade domestically or in overseas markets. Minor collection occurs at resource recovery facilities.	»	Processing in Victoria is limited with the largest processing capacity being for paper and pulp. A significant proportion of recovered paper is exported to intersate or overseas paper mills or into stockpiles.
Commingled collection typically as a MSW recyclables kerbside service.	»	MRFs segregate from other recyclables to produce predominantly a mixed paper output.	»	Primarily exported in the past however currently being stockpiled or landfilled as there is no market outlet. Some local processing occuring within intergrated companies such as Visy.

Capability, capacity and infrastructure location

Limited data was available to estimate both processing and recovery capacity in Victoria with a large proportion of recovered paper exported out of Victoria for processing in other states or overseas. As a result, an unknown number of recovery facilities have not been identified to account for the 1.48 million tonnes of paper recovered in 2018.

To estimate an approximate capacity of these unknown facilities, the capacity has been estimated by subtracting the estimated combined capacity of both the identified recovery and processing facilities

[12] Analysis of Australia's municipal recycling infrastructure capacity October 2018, Commonwealth of Australia 2018

from the 1.48 million tonnes recovered in 2018. This is a crude estimate and further work is required to have greater confidence in the capacity of both the recovery and processing infrastructure.

Capability

The primary capability of Victoria's fixed paper recovery infrastructure is to consolidate and bale with most recovered paper being exported interstate or overseas. MRFs have the capability of mechanically separating and sorting, however the capability is primarily to separate paper from other recyclables such as glass, metals and plastics resulting in a mixed paper that is then baled. Few facilities can separate the mixed paper into separate paper streams.

The capability of Victoria's paper processing infrastructure is largely geared around recycling of recovered fibre back into paper and cardboard. Other processing capabilities exist for recovered paper in Victoria such as turning recovered paper into insulation.

Capacity

The current estimated capacity of Victoria's recovery infrastructure is around 1.3 million tonnes while processing capacity is estimated to be around 232,000 tonnes, see Table 12. The estimated processing capacity may be conservative with information published in Sustainability Victoria's suggesting processing capacity is around 450,000 to 500,000 tonnes[13].

Table 12: Current paper recovery and processing Infrastructure Capacity

Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	MRF[14]	13	Mechanical separation and sorting	421,850
	SMRC	8	Baling	325,500
	Unknown	Unknown	Unknown (likely baling)	519,000
			Total recovery capacity	**1,316,350**
Processing	Processing facility	6	Paper and pulp	227,000
	Processing facility	3	Other	5,000
			Total processing capacity	**232,000**
			Interstate capacity	**Unknown**

Interstate capacity – outside of Victoria, paper mills operate in New South Wales, Queensland and Tasmania providing processing capacity for paper recovered from Victoria. The amount of paper exported from Victoria to interstate facilities was unable to be established as part of this project and therefore no estimate of the interstate capacity available to Victoria was able to be made. Interstate capacity will need to be a consideration to deal with the short fall to meet the proposed export ban.

Location

Most regions have recovery capacity through collection at MRFs while processing capacity is currently only located in Metropolitan Melbourne and Gippsland regions, see Figure 7 and Figure 8.

[13] 'Production capacity in Victoria totals approximately 1 million tonnes, with an estimated 45% to 50% supplied by recovered paper.' Recovered Resources Market Bulletin March 2019, Sustainability Victoria

[14] Capacity calculated based on total MRF capacity multiplied by the proportion of paper within the kerbside commingled composition sourced from Victorian Local Government Annual Report 2017–18, SV 2019

Figure 7: Location of paper processing and dedicated recovery infrastructure including MRFs

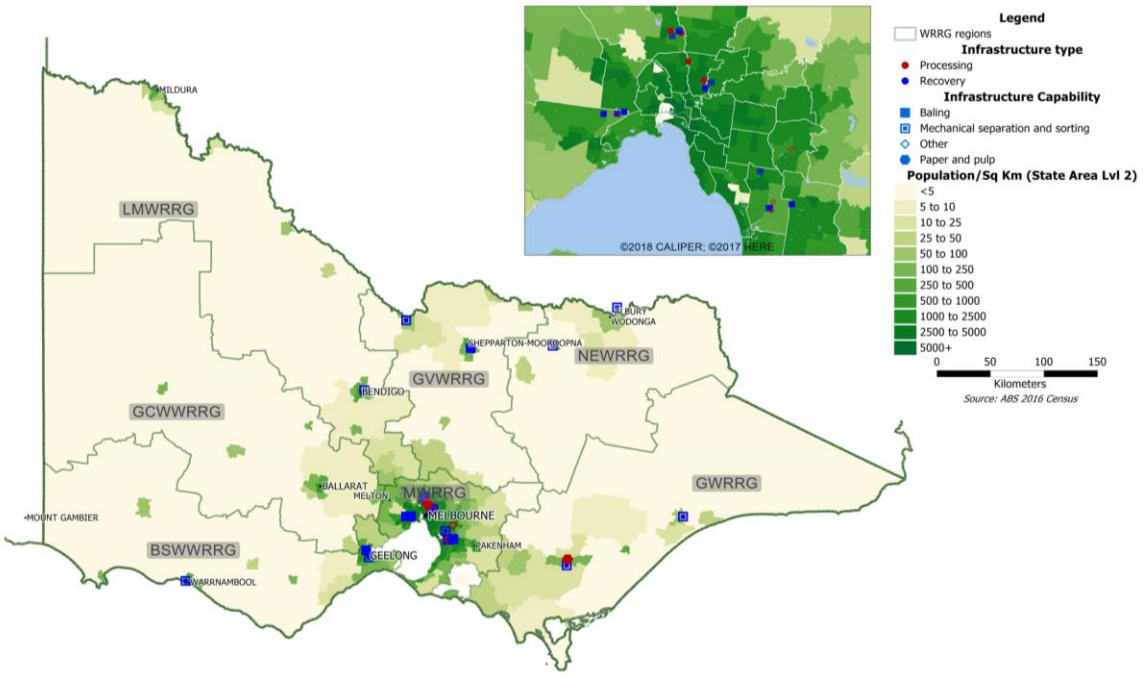
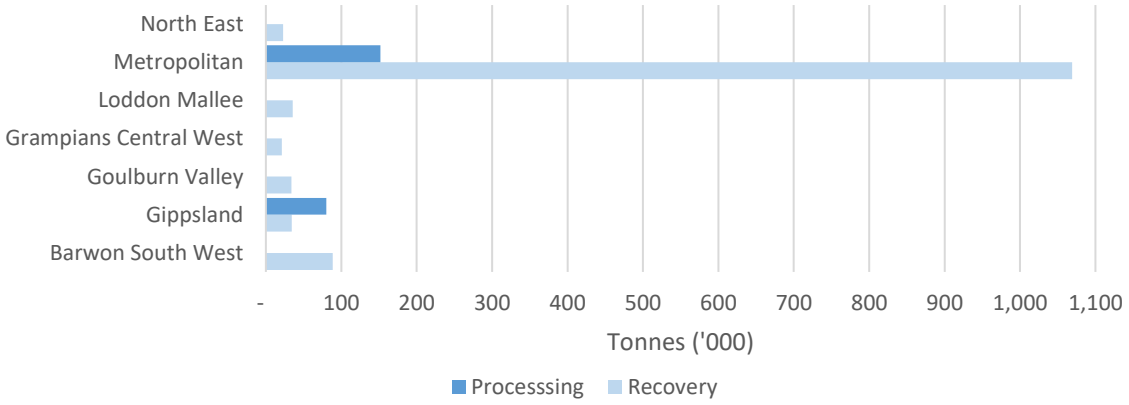


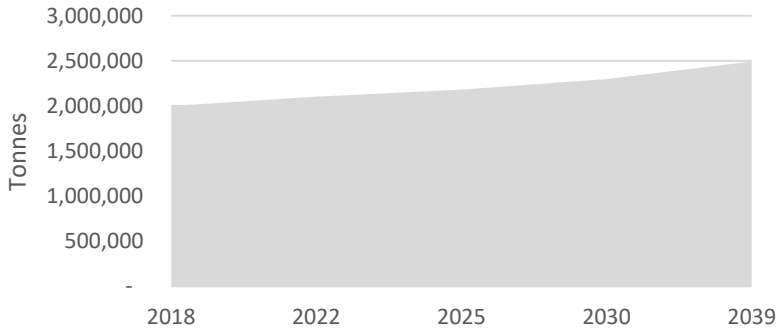
Figure 8: Recovery and processing capacity to manage paper waste by region, 2018



Capability and capacity assessment to meet future generation and policy settings

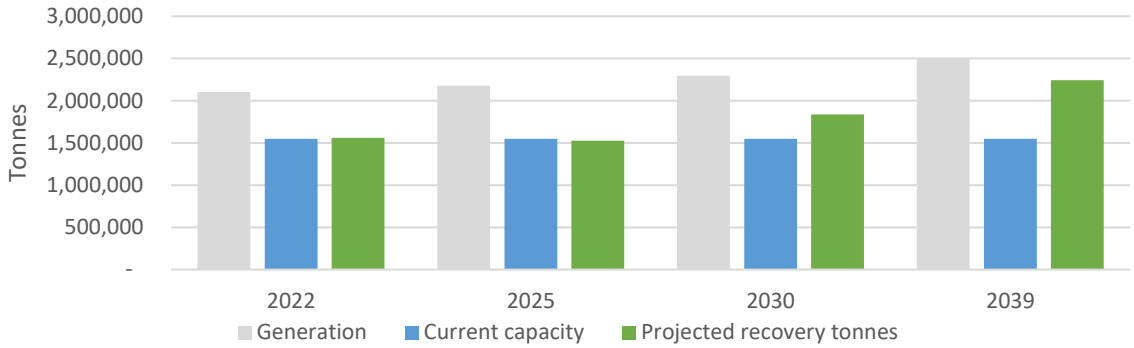
Generation of paper waste is forecast to increase to almost 2.5 million tonnes by 2039, see Figure 9.

Figure 9: Projected generation of paper waste, 2018 - 2039



Under current conditions and no export ban on paper, the recovery and processing capacity is estimated to be sufficient to meet recovery projections up until 2025 however would need to expanded to meet recovery projection targets for 2030 and 2039, see Figure 10.

Figure 10: Paper recovery and processing capacity



Meeting future policy settings

The current paper resource recovery rate is 74% which would meet recovery targets set for 2025 however this relies on the export market. The current draft COAG waste export ban proposes that by June 2022, all mixed paper and cardboard, and baled paper and cardboard sorted by type be banned from export. Paper will need to be pulped in order to be exported under the draft ban definition.

In 2018, Victoria exported overseas about 630,000 tonnes. This is projected to be about 660,000 tonnes by 2022, all of which would need to be processed locally, see Table 13.

Table 13: Current and projected export of paper waste out of Australia impacted by the ban, 2018 - 2039[15]

	2018	2022	2025	2030	2039
Tonnes exported	632,300	662,400	684,000	718,200	775,300

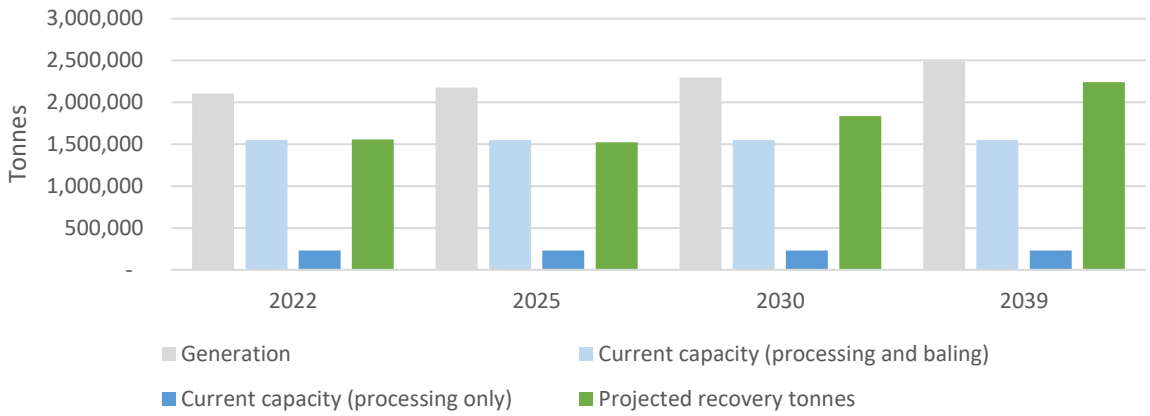
The current capacity of Victoria's processing capacity is estimated at around 232,000 tonnes which is significantly under what is required to meet the export ban and other policy settings, see Figure 11.

Even if processing capacity was underestimated and around 450,000 to 500,000 tonnes, it remains significantly less than what is required to meet the ban and future recovery targets.

Processing capacity within other states will be able to make up part of the shortfall however processing capacity within other states available to Victoria were unable to be established and they too will be impacted by the ban. Based on the information available for this report, it is estimated between 400,000 – 530,000 tonnes of paper recovered in Victoria was sent to interstate for processing which may represent the capacity within other states available to Victoria.

[15] Victorian waste flows projections, prepared for Infrastructure Victoria, Blue Environment, December 2019

Figure 11: Capacity to meet future policy setting and projected paper tonnes to recover



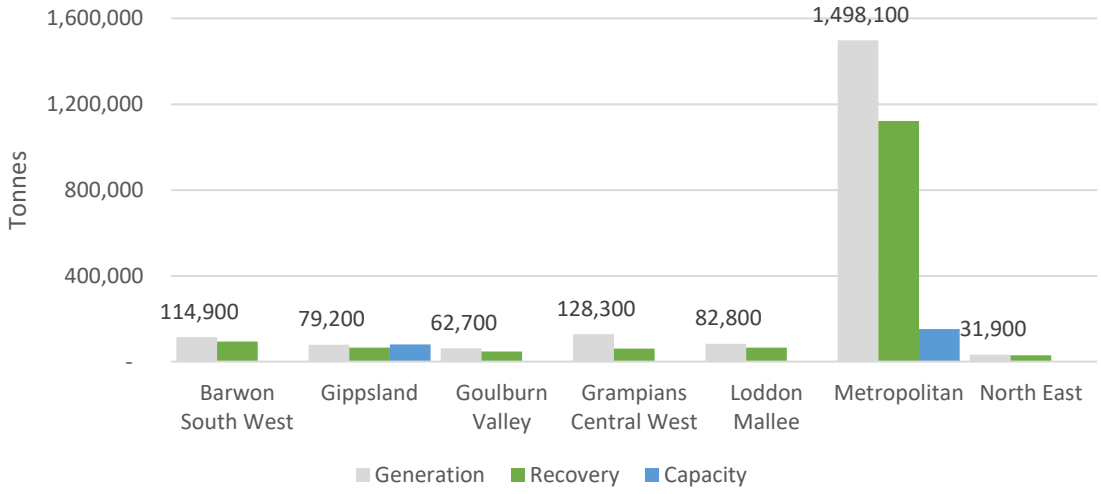
With such a significant shortfall in processing capacity in Victoria, and potentially interstate, businesses recovering and baling paper will be affected and unable to continue to operate with no outlet. As a result, recovery capacity will reduce and exacerbate the shortfall in recovery capacity from 2030, as shown in Figure 11.

Recovery capacity requires low investment and while it may reduce as a result of the export ban, it is expected to be able to increase with little assistance providing there is processing capacity and strong demand for recovered paper. Currently there is limited to no demand for recovered mixed paper produced from MRFs and prices for all grades of recovered paper and paperboard continue to deteriorate.[16]

Gaps and opportunities

There is a significant shortfall in processing capacity and a need to establish large processing infrastructure to meet future policy settings. Two of the three largest paper mills in Victoria are in Melbourne with the third located in the Gippsland region. The remaining processing capacity is also located in Melbourne, see Figure 12.

Figure 12: Capacity to manage paper waste by region, 2018[17]



[16] Recovered Resources Market Bulletin December 2019, Sustainability Victoria 2019
[17] Numbers displayed in the figure represent tonnes generated in each region

To make up a large proportion of the shortfall, and to continue to export out of Australia, investment in large scale pulping facilities is required either in Melbourne or regional Victoria. In addition, alternative processing will need to increase or be developed. Alternate processing can include:

- Moulded fibre production
- Insulation
- Kitty litter
- Composting

These alternative processing facilities can range between 2,000 to 15,000 tonnes which may provide opportunities in regional areas with most regions generating sufficient paper to support such facilities, see Figure 12.

If additional processing capacity can be established, the current recovery capacity suggests it would be able to supply the tonnes required. However, investment in sorting infrastructure may be required for mixed paper from MRFs which currently doesn't have a market other than within integrated companies such as Visy.

Summary

Overall there is a significant shortfall in Victorian processing infrastructure capacity by an estimated 1.3 million tonnes by 2022 and 2 million tonnes by 2039 to meet future policy settings, see Table 14. Investment in new infrastructure is required immediately with opportunities to support additional processing capacity in Melbourne or regional areas.

Table 14: Summary of current infrastructure capacity to meet future generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	2,103,700	2,178,400	2,296,300	2,491,600
Current processing infrastructure capacity	232,000	232,000	232,000	232,000
Projected recovery required to meet policy settings	1,558,600	1,524,900	1,837,000	2,242,400
Excess or shortfall in capacity	-1,326,600	-1,292,900	-1,605,000	-2,010,400
	✗	✗	✗	✗

Plastics

There are seven different categories of plastic: polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), and all others (including composites).

In 2018, an estimated 586,000 tonnes of plastic waste were generated with an overall resource recovery rate of 23%. Of the material recovered, about 66,000 tonnes were exported.

Infrastructure and recovery supply chain

Victoria's plastic fixed recovery infrastructure can be grouped into two main facility types:

- Materials Recovery Facilities
- Resource Recovery Centres, primarily regional Victoria facilities participating in drumMUSTER (recovery of empty plastic chemical drums)

Victoria's plastics processing infrastructure has been grouped into five main types based on capability:

- Extrusion / injection moulding
- Flaking
- Granulating / crumbing
- Compaction
- Other and unknown

Plastics are collected in a commingled stream primarily managed through MRFs while source separated stream are primarily collected and sent directly to a processing facility, see Table 15.

Table 15: Typical plastic recovery and processing supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
Source separated collection infrastrucutre primarily undertaken by commercial operators.	»	Primarily by-passed and delivered directly to processing infrastructure. Most regional resource recovery centres provide the recovery of plastic chemical drums. A separated plastic stream can be produced from e-waste recovery facilities.	»	Victoria has the largest recycled plastic processing industry in Australia. Processing facilities range from specialising in one or a limited range of polymer types to processing many polymer types.
Commingled collection typcially as a MSW recyclables kerbside service.	»	Managed through MRFs who produce predomintely a separated PET and HDPE stream and a mixed plastic output. A mixed plastic stream can be produced from e-waste recovery facilities.	»	Primarily exported in the past however currently being stockpiled or landfilled as there is limited processing capacity which will accept a mixed plastic stream.

Capability, capacity and infrastructure location

Victoria's recovery infrastructure is primarily servicing the export market and not supplying to the domestic processing capacity which mainly receives directly from source.

Capability

Victoria's fixed plastic recovery infrastructure primarily consists of MRFs who have the capability of mechanically separating and sorting. The capability within MRFs are to separate plastics from other recyclables such as glass, metals and paper with several having the ability to separate plastics into PET, HDPE and mixed grades. RRCs have the capability to collect and transport source separated plastics however do not collect large volumes as they primarily service residents who have access to a kerbside recycling service for plastics. RRCs in regional Victoria provide capacity and capability to recovery empty plastic chemical drums as part of drumMUSTER program.

The capability of Victoria's plastic processing is mechanical, where the use of physical processes such as sorting, washing, granulating and extruding convert scrap plastics to a usable input for the manufacture of new products.

Mechanical recycling is the most economically viable for plastics that are available in large quantities, in a clean and homogenous form. Mixed polymer plastics can also be recycled mechanically to produce a reduced range of mixed polymer product types. These mixed polymer products often have long lifespans and may be recycled back into similar products at end of life.

Capacity

The current estimated capacity of Victoria's MRF recovery infrastructure is around 69,000 tonnes[18] while Victoria's processing capacity is estimated to be around 160,050 tonnes, see Table 16.

Table 16: Recovery and processing infrastructure capacity, 2018

Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	MRF	13	Mechanical separation and sorting[19]	69,000
	RRC	266	Stillages / Skip bins / cages	N/A
			Total recovery capacity	**69,000**
Processing	Processing facility	16	Extrusion / injection moulding	80,850
	Processing facility	3	Flaking	71,300
	Processing facility	3	Granulating / crumbing	2,000
	Processing facility	2	Compaction	400
	Processing facility	8	Other and unknown	5,500
			Total processing capacity	**160,050**
			Interstate capacity	**N/A**

Interstate capacity – in 2016-17, around 3,700 tonnes of plastic was exported interstate while 5,200 tonnes was imported from interstate[20]. As Victoria is a net importer of plastics from other states, no interstate capacity has been accounted for in the analysis of capacity to meet future policy settings.

Of the processing capacity, the majority (96%) has the capability to extrude recovered plastics into resins, flakes or structural products with flakes and resins being the dominant output, see Table 17.

[18] Capacity calculated based on total MRF capacity multiplied by the proportion of plastic within the kerbside commingled composition sourced from Victorian Local Government Annual Report 2017–18, SV 2019.
[19] Separating plastic from other recyclables recovered in the commingled system
[20] Analysis of Australia's municipal recycling infrastructure capacity October 2018, Commonwealth of Australia 2018

Table 17: Processing infrastructure capacity by output, 2018

Infrastructure outputs	Facility capacity (tonnes)	Proportion	No. of facilities
Flakes / Resins / Compounds	143,500	89.7%	11
Structural products	7,250	4.5%	8
Packaging	900	0.6%	3
Other and unknown	8,400	5.2%	10
Total	**160,050**		**32**

Location

Most regions have recovery capacity through collection at MRFs while five regions have at least one processing facility with most processing infrastructure located in Metropolitan Melbourne, see Figure 13 and Figure 14.

Figure 13: Location of plastic processing and dedicated recovery infrastructure including MRFs

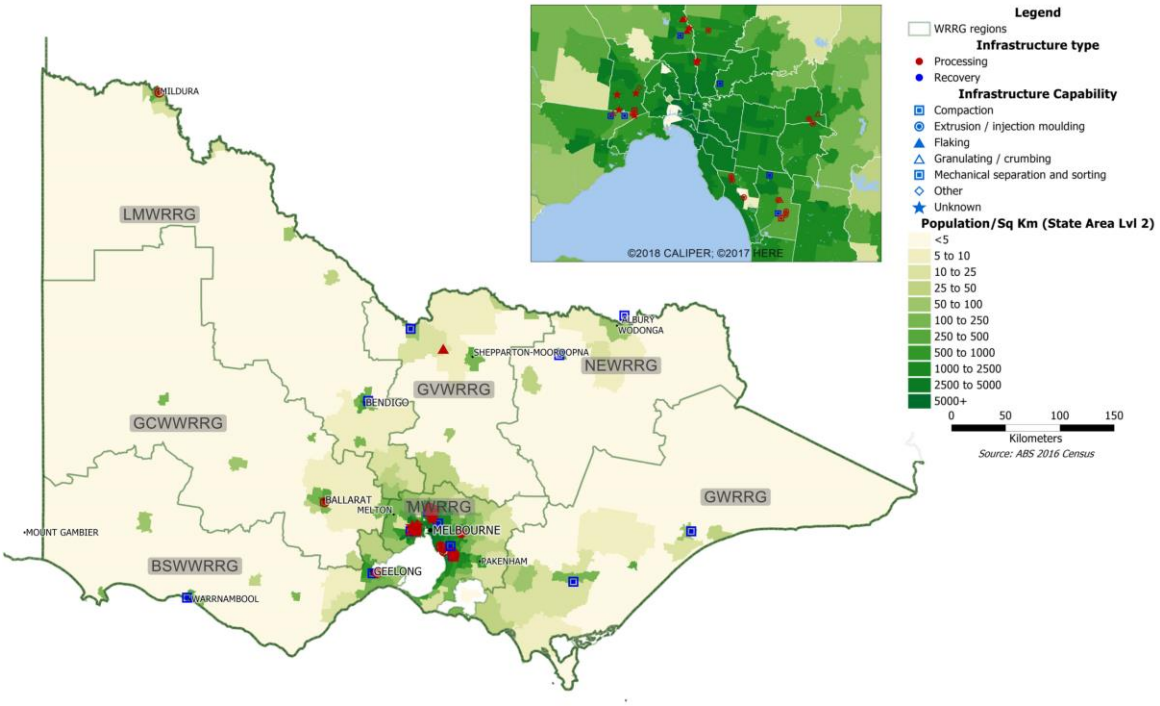
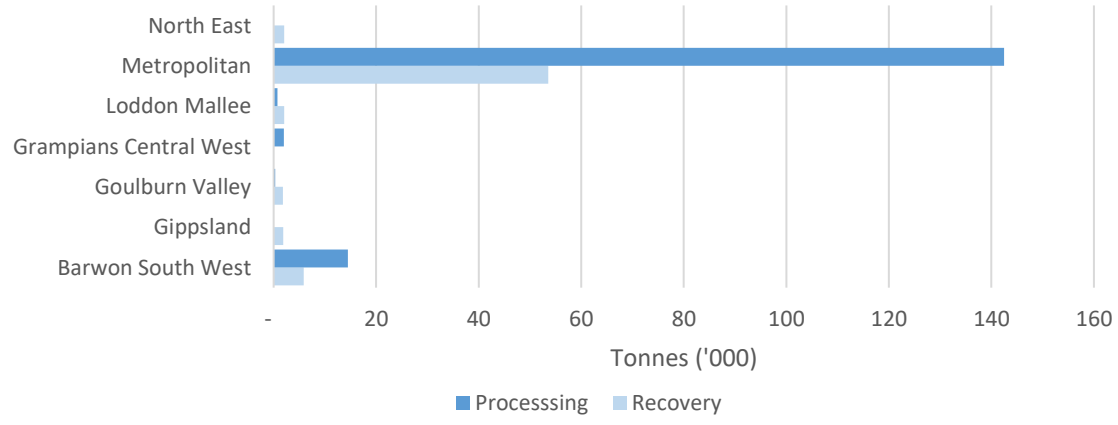


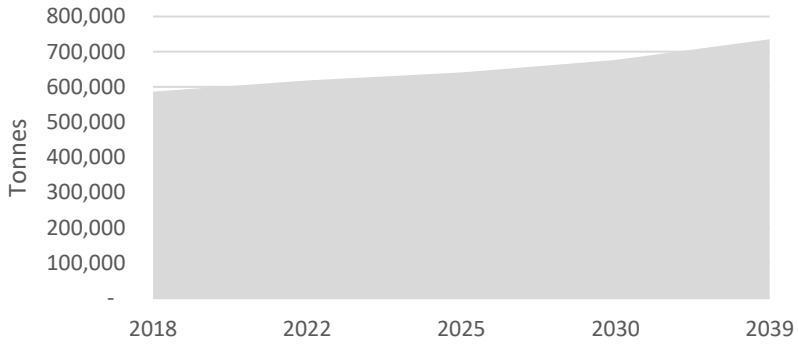
Figure 14: Recovery and processing capacity to manage plastic waste by region, 2018



Capability and capacity assessment to meet future generation and policy settings

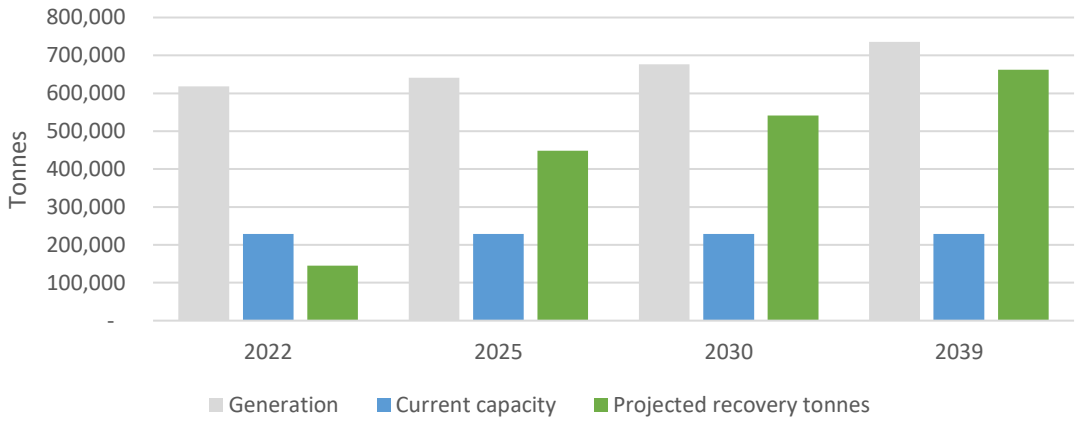
The generation of waste plastics is forecast to increase to 735,000 tonnes by 2039, see Figure 15.

Figure 15: Projected generation of waste plastic, 2018 - 2039



Under current conditions, and no export ban on plastics, the recovery and processing capacity is sufficient to meet projected recovery up until 2022, however with a current recovery rate of 23%, would need to significantly expand to meet recovery projection targets set for 2025, 2030 and 2039, see Figure 16.

Figure 16: Plastic recovery and processing capacity



Meeting future policy settings

The current draft COAG waste export ban proposes that by June 2021, all waste plastic be banned from export. Plastic will need to be clean plastics sorted to a single resin type and processed ready for further use (e.g. flakes and pellets) in order to be exported. In 2018, Victoria exported about 38,300 tonnes that would be impacted by the ban. This is projected to be about 40,600 tonnes by 2022, all of which would need to be processed locally, see Table 18.

Table 18: Current and projected export of waste plastic out of Australia impacted by the ban, 2018 - 2039[21]

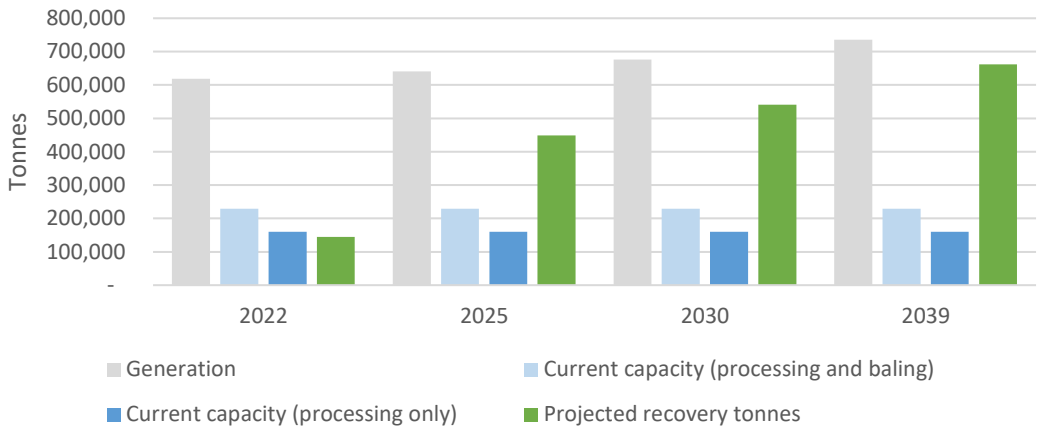
	2018	2022	2025	2030	2039
Tonnes exported	38,300	40,600	42,200	44,600	48,500

[21] Victorian waste flows projections, prepared for Infrastructure Victoria, Blue Environment, December 2019

This capacity of Victoria's processing capacity is estimated at around 160,000 tonnes which appears to be enough to meet requirements of the ban however there is currently limited capacity to process recovered mixed plastic being exported. Mixed plastics can be processed into structural products and as outlined in Table 13, capacity for producing structural products is estimated to be around 7,250 tonnes. For exported mixed plastics to be consumed within current processing capacity it will require separating.

To meet future policy settings for 2025, 2030 there is insufficient processing capacity, see Figure 17.

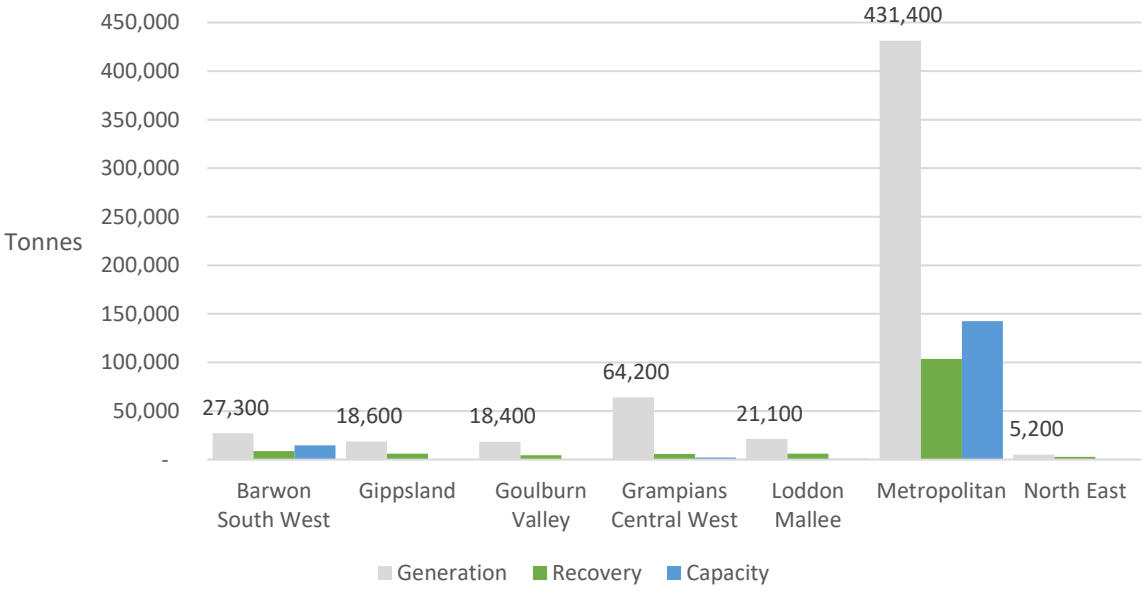
Figure 17: Capacity to meet future policy setting and projected plastic tonnes to recover



Gaps and opportunities

Most processing capacity is currently located in Melbourne, however outside Melbourne, processing capacity exists within five facilities across four regional areas (Barwon South West, Goulburn Valley, Grampians Central West, and Loddon Mallee), see Figure 18.

Figure 18: Capacity to manage plastic waste by region, 2018[22]



[22] Numbers displayed in the figure represent tonnes generated in each region

With a significant shortfall in processing capacity by 2025 to meet future policy settings, there is a need to establish processing infrastructure and an opportunity in Melbourne and regional Victoria. Current processing facility capacities range anywhere from 100 to 15,000 tonnes with most regions generating enough tonnages to support new infrastructure providing markets for outputs are available.

In addition, there is a gap within the current capacity to sort mixed plastics from MRFs with currently no market outlet for material recovered and it either being stockpiled or landfilled.

Summary

Overall there is a sufficient capacity to meet the 2022 export ban however significant shortfall in processing infrastructure capacity to meet targets set for 2025 by an estimated 288,650 tonnes by 2025 and over 500,000 tonnes by 2039, see Table 19.

Table 19: Summary of current infrastructure capacity to meet future generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	618,600	641,100	676,700	735,300
Current processing infrastructure capacity	160,050	160,050	160,050	160,050
Projected recovery required to meet policy settings	144,900	448,700	541,300	661,800
Excess or shortfall in capacity	15,150	-288,650	-381,250	-501,750
	✓	✗	✗	✗

Glass

There are two main categories of glass:

- Packaging glass: typically used to produce bottle and jar products in three distinct colours (flint, amber or green)
- Non-packaging glass: used to produce windows and automotive glass products, consumed by a range of automotive and built environment industries.

In 2018, an estimated 344,000 tonnes of glass waste were generated with a resource recovery rate of 77%. Nearly all the recovered material is packaging waste, most of which is recovered through MRFs as a component of comingled recycling streams from the MSW and C&I sectors. Most MRFs in Victoria sort glass into a single mixed stream with further sorting by colour undertaken at a glass beneficiation plants.[23]

Infrastructure and recovery supply chain

Victoria's glass fixed recovery infrastructure can be grouped into two main facility types:

- Materials Recovery Facilities (MRFs)
- Beneficiation plant (associated with MRFs)

Victoria's glass processing infrastructure has been grouped into two main types based on capability:

- Crushing / grinding / washing
- Blast furnace

Glass is collected in a commingled stream primarily managed through MRFs while source separated stream are primarily collected and sent directly to beneficiation plants, see Table 20.

Table 20: Typical glass recovery and processing supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
Source separated collection infrastructure primarily bins and dedicated equipment used in hospitality.	»	Source separated collection will be sent to a glass beneficiation plant or direct to non-packaging glass processing facilities.	»	Source separated glass (cullet) is sent to Victoria's only glass packaging manufacturer. Glass fines from MRFs and beneficiation plants and other recovered glass is directed to other processing infrastructure for processing into recycled glass sand or other abrassives and aggregates products.
Commingled collection typcially as a MSW recyclables kerbside service.	»	Managed through MRFs who produce predominantly a single mixed glass stream which is sent for futher sorting by colour at a glass beneficiation plant.	»	

[23] Victorian waste flows projections, Infrastructure Victoria 2019

Capability, capacity and infrastructure location

Capability

Victoria's fixed glass recovery infrastructure consists of a two-stage process with different capabilities. MRFs receive commingled recyclables from council kerbside bin service and have the capability of mechanically separating and sorting the glass from other recyclables to produce a mixed glass stream. This mixed glass is then sent to a beneficiation plant who have the capability of sorting the mixed glass into separate colours down to a certain fraction. The beneficiation plants are located with two MRFs.

The capability of Victoria's main glass processing infrastructure can be grouped into two:

- Capability to process glass back into glass packing such as bottles and jars
- Capability to process glass into a recycled glass sand, abrasive or decorative aggregate.

Capacity

The current estimated capacity of Victoria's beneficiation recovery infrastructure is around 100,000 tonnes while Victoria's processing capacity is estimated to be around 494,200 tonnes, see Table 21, with the majority of capacity to produce a clean recycled sand being commissioned in the past two years.

Table 21: Current Recovery and processing Infrastructure Capacity

Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	MRF	13	Mechanical separation and sorting[24]	N/A
	Beneficiation plant	2	Mechanical separation and sorting	100,000
			Total recovery capacity	**100,000**
Processing	Processing facility	4	Crushing / grinding / washing	376,200
	Processing facility	2	Blast furnace	118,000
			Total processing capacity	**494,200**
			Interstate capacity	**Unknown**

Until late 2019, there was a third glass beneficiation business in Melbourne, GRS, however its operations have now ceased. This has resulted in a significant drop in Victoria's glass beneficiation capacity

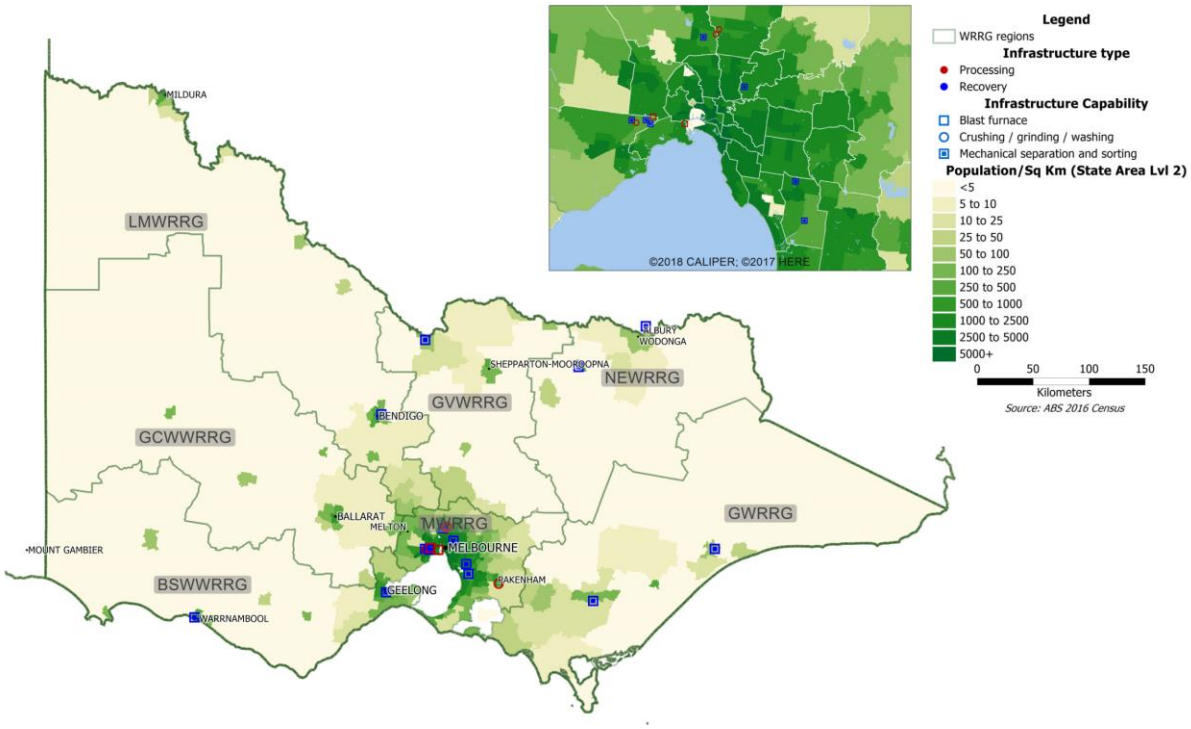
Interstate capacity – As well as operating a glass manufacturing plant in Melbourne, Owens Illinois (O-I) operates plants in Brisbane, Sydney, and Adelaide. The other main glass manufacturer in Australia is Orora who operate a single plant in Gawler just north of Adelaide which largely services the wine industry. While other glass manufacturing plants exist, it is understood that no glass is currently being exported from Victoria to plants in other states.

Location

Most regions have recovery capacity through collection at MRFs while all processing capacity is located in Metropolitan Melbourne, see Figure 19.

[24] All glass recovered from MRFs for sorting into cullet are sent to beneficiation plants associated with two MRFs

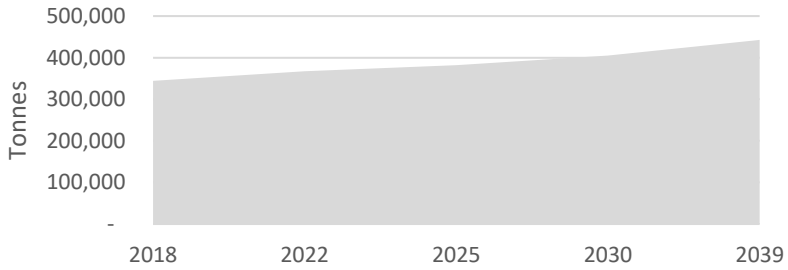
Figure 19: Location of glass processing and dedicated recovery infrastructure including MRFs



Capability and capacity assessment to meet future generation and policy settings

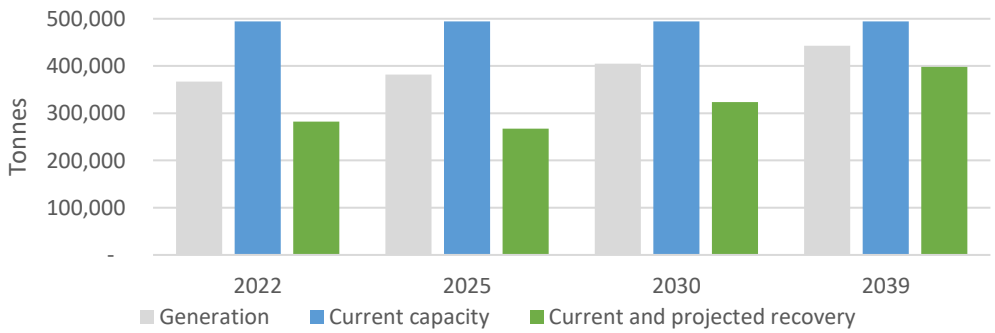
The generation of glass waste is forecast to increase to over 440,000 tonnes by 2039, see Figure 20.

Figure 20: Projected generation of waste glass, 2018 - 2039



Under current conditions, and no export ban on glass, the recovery and processing capacity is sufficient to meet recovery projection targets through to 2039, see Figure 21.

Figure 21: Glass processing capacity

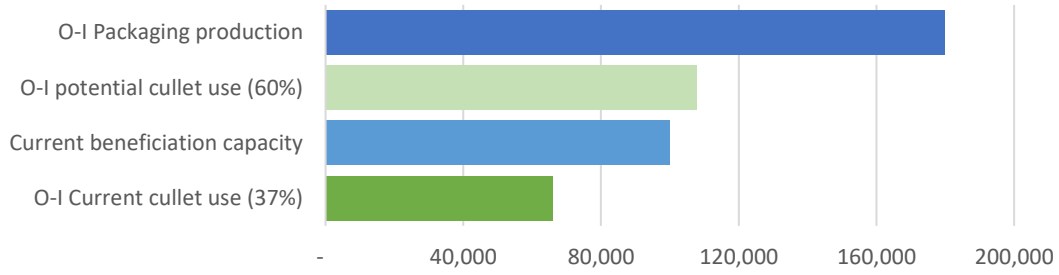


Meeting future policy settings

The capacity of Victoria's glass processing is estimated at around 494,200 tonnes which is enough capacity to meet requirements of the ban, future policy settings and projected glass generation out to 2039. However, while there is enough processing capacity to recovery all glass waste generated, there is only one manufacturer of glass packaging in Victoria, O-I, which requires highlighting.

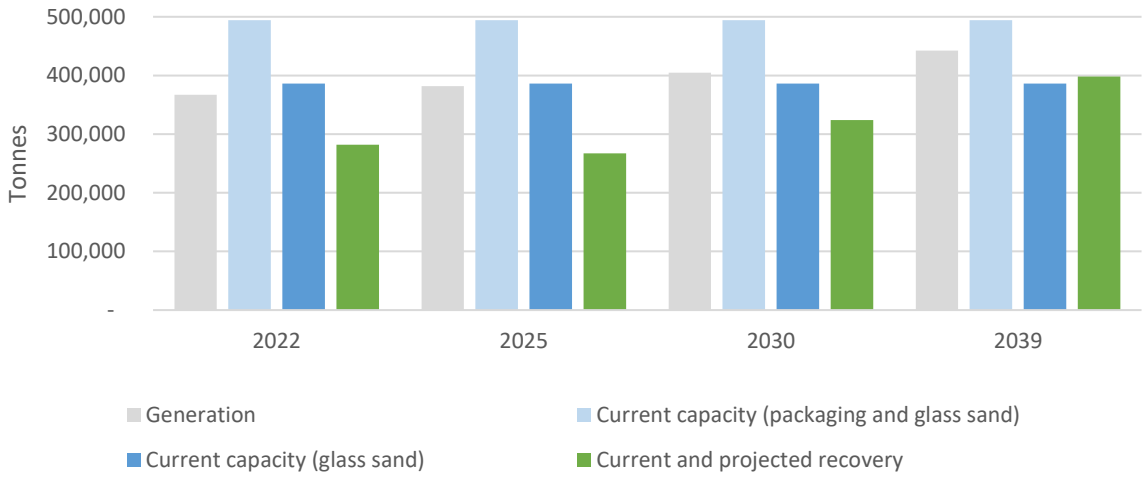
Glass cullet from two beneficiation plants (Visy, Polytrade) is sold to O-I as feedstock to manufacture new glass packaging products. There is enough beneficiation capacity to recover glass for OI's current glass packaging production requirements, see Figure 22. Presently, O-I is using approximately 37% recycled glass cullet in its production (approximately 67,000 tonnes). O-I have the potential to increase to 60% if the quality of the recovered glass cullet was improved. If O-I were to specify such an increase, there would be a slight shortfall in Victoria's beneficiation capacity to meet the increase.

Figure 22: Beneficiation capacity to meet O-I recycled packaging potential



If future recovery for processing back into packaging were to decline opposed to increasing, there is still capacity within the remaining processing capacity to process into glass sand, aggregates and other until 2039, see Figure 23.

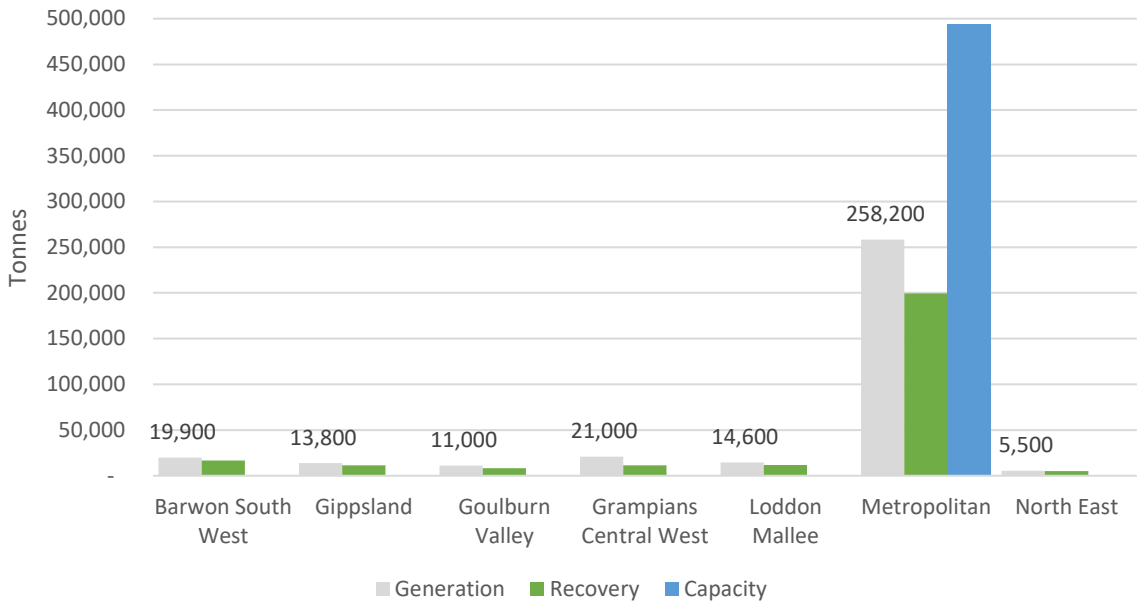
Figure 23: Impact of a decline in processing back into glass packaging on capacity to recover glass



Gaps and opportunities

Processing capacity is currently located in Melbourne only, see Figure 24 and while there is sufficient capacity to meet future projections there may be opportunities in regional areas for small scale processing into glass sand, aggregates and other products.

Figure 24: Capacity to manage waste glass by region, 2018[25]



Summary

The capacity of Victoria's glass processing is estimated at around 494,200 tonnes which is enough to meet requirements of the ban and future policy settings, see Table 22.

Table 22: Summary of current infrastructure capacity to meet future generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	367,000	382,000	404,900	442,600
Current processing infrastructure capacity	494,200	494,200	494,200	494,200
Projected recovery required to meet policy settings	282,100	267,400	323,900	398,400
Excess or shortfall in capacity	212,100	226,800	170,300	95,800
	✓	✓	✓	✓

[25] Numbers displayed in the figure represent tonnes generated in each region

Organics

Organics refers to the core waste types of food organics (FO), garden organics (GO), mixed food organics and garden organics (FOGO), timber and biosolids. It excludes paper and cardboard and primary industry organics such as forestry wastes, crop stubbles and residues, fisheries waste, paunch, prunings, grain dust, fruit and vegetable trimmings, etc. except where these wastes enter landfill or the organics recovery sector.[26]

In 2018, an estimated 2.5 million tonnes of organic waste were generated with an overall resource recovery rate of 43%.

Infrastructure and recovery supply chain

Victoria's organics fixed recovery infrastructure can be grouped into two main facility type:

- Specific Materials Recovery Centres (SMRCs)
- Resource Recovery Centres (RRCs)

Victoria's organics processing infrastructure has been grouped into three main types based on capability:

- Composting
- Anerobic Digestion
- Other

Not all facilities that would fall into the category 'other' have been identified as part of this project.

Organics are collected or dropped-off as a source separated stream to a recovery facility or directly to a processing facility, see Table 23.

Table 23: Typical organics recovery and processing supply chain

Binfrastructure	**Transport**	**Recovery Infrastructure**	**Transport**	**Processing Infrastructure**
Source separated bin infrastrucutre offered by coucils through kerbside bin services and commercial collection companies. Commercial operators provide a pick up service and deliver directly to a processing facility.	»	Resource recovery centres located in every local government provide a drop-off service to residents for garden waste along with other materials. Regional sites may shred and provide back to residents or send to organics processing facility. SMRC facilities focus on the recovery of organics, primarily garden organics, to consolidate, shred, decontaminate and send to a processing facility often located some distance away.	»	Victoria organics processing infrastructure is mostly in the form of composting facilities but also includes anaerobic digestion facilities and other.

Unlike other waste materials, a large proportion of organics are transported out of Melbourne for processing with collectively more processing capacity located in regional areas.

[26] Victorian waste flows projections, Infrastructure Victoria 2019

Capability, capacity and infrastructure location

Capability

Victoria's fixed organics recovery infrastructure consists of RRCs and SMRCs.

- RRCs, while classed as having the capability of Stillages / Skip bins / cages for the purpose of other materials such as e-waste, have the capability of consolidating organics for transport with several also having shredding capability, often provided by mobile contractors.
- The capability within SMRCs are to shred and decontaminate to consolidate and transport to create transport efficiencies and provide a clean feedstock to processing facilities.

The capability of Victoria's organics processing is largely composting to produce composts and soil conditioners followed by anaerobic digestion to generate energy. Other capabilities include the production of other organic outputs.

Capacity

The current estimated capacity of processing capacity to service Victoria is estimated to be almost 1.5 million tonnes with Melbourne relying on interstate facilities to process waste organics. The capacity within Victoria is around 1 million tonnes while interstate capacity is estimated to be 450,000 tonnes, see Table 24.

Table 24: Current Recovery and processing Infrastructure Capacity

Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	SMRC	5	Shredding	69,000
	RRC	266	Stillages / Skip bins / cages	N/A
			Total recovery capacity	**399,000**
Processing	Processing facility	15	Composting	1,419,800
	Processing facility	1	Anaerobic Digestion	33,000
	Processing facility	3	Other	18,000
			Total Victorian processing capacity	**1,020,800**
			Interstate capacity	**450,000**
			Total processing capacity	**1,470,800**

Interstate capacity – several composting facilities operate close to the Victorian border in South Australia (SA) and New South Wales (NSW). The facility operating in SA currently receives material from Melbourne and has been included as part of the capacity to process organic waste generated. Facilities operating in NSW have not been identified and have not been included as part of the assessment however are known to be receiving organic waste from Victoria.

Location

All regions have processing capacity with at least one processing facility, see Figure 25 and Figure 36. A large proportion of organics are transported out of Melbourne for processing in regional areas and interstate with collectively more processing capacity located in regional areas.

Figure 25: Location of organics processing and dedicated recovery infrastructure

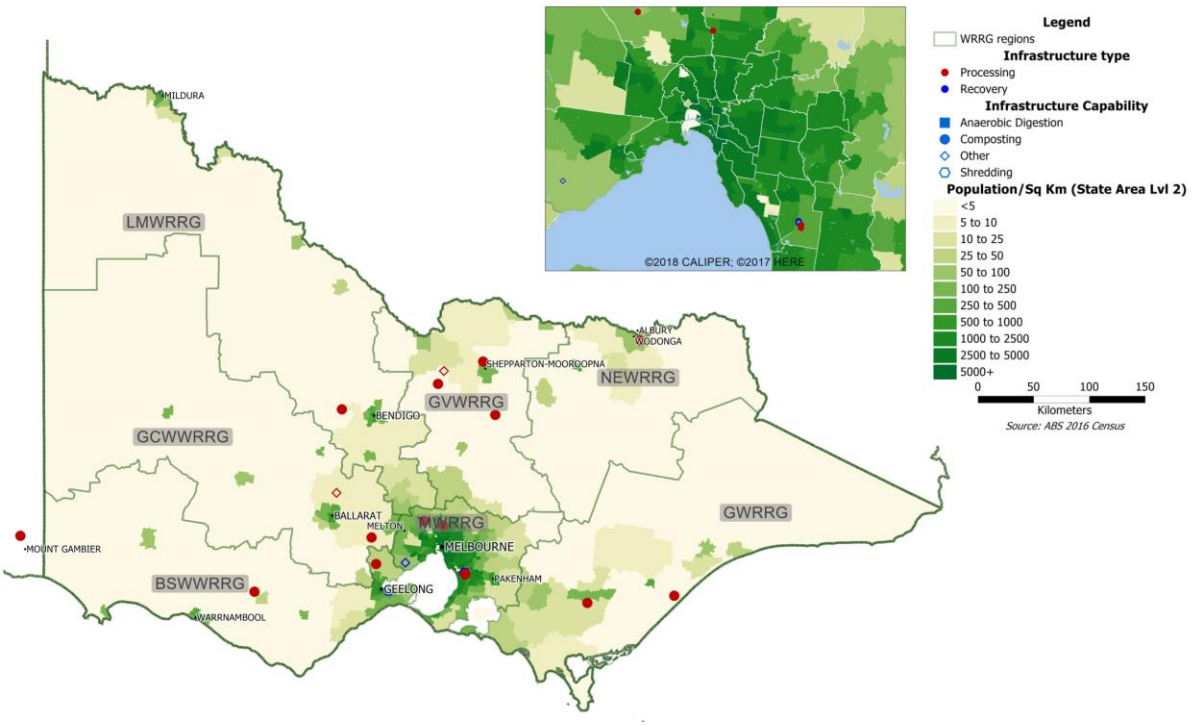
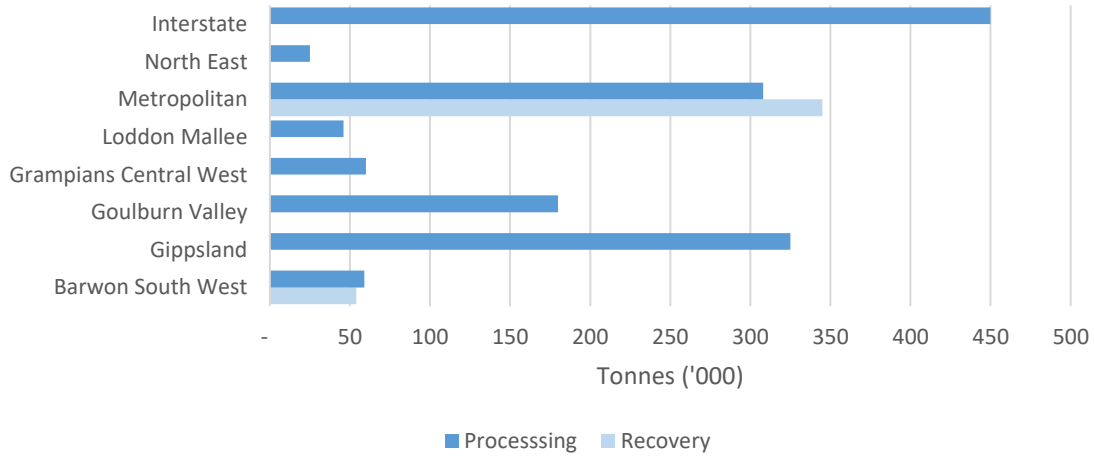


Figure 26: SMRC recovery and processing capacity to manage organics waste by region, 2018

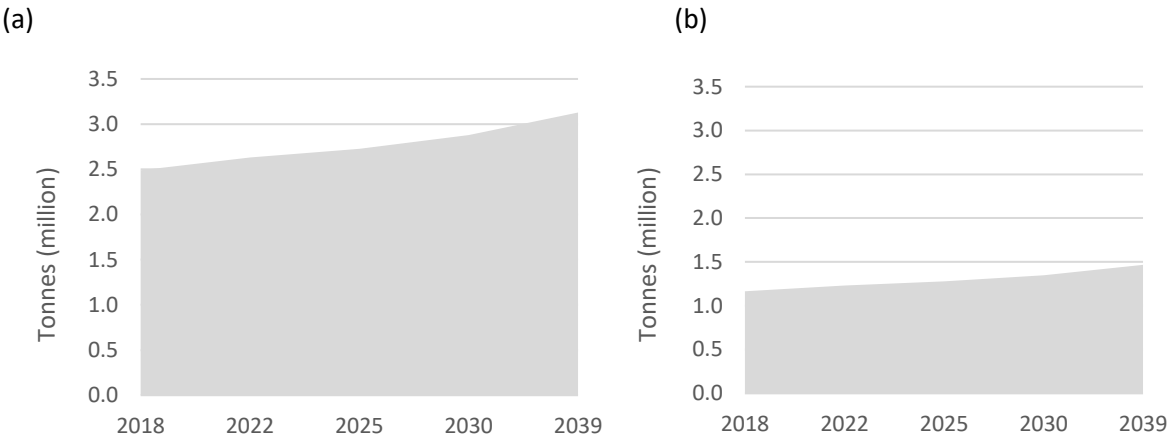


Capability and capacity assessment to meet future generation and policy settings

Note: The following assessment to meet future generation and policy settings has been based on; the capacity to process all organics, and food and garden organics only, with the processing infrastructure identified as part of the project primarily focused on processing food and garden organics.

The generation of total organics is forecast to increase to over 3 million tonnes by 2039, while food and garden organics is forecast to increase to almost 1.5 million tonnes, see Figure 27.

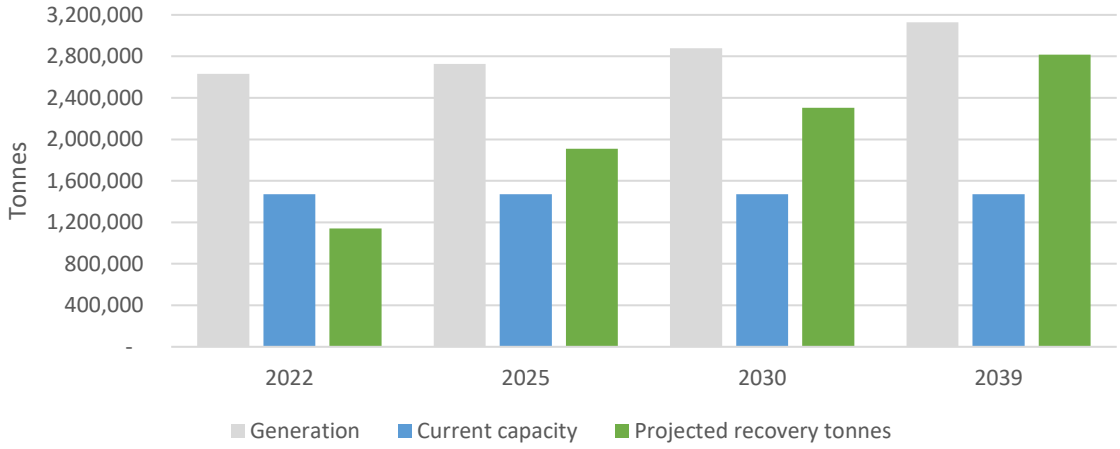
Figure 27: Projected generation of total waste organics (a) and food and garden organics (b), 2018 – 2039



Under current conditions, the processing capacity is sufficient to meet recovery projections to manage all organics up until 2022 however would need to expanded to meet recovery targets set for 2025 and beyond, see Figure 28.

Capacity and meeting future targets for food and garden only provided in the next section.

Figure 28: Organics processing capacity



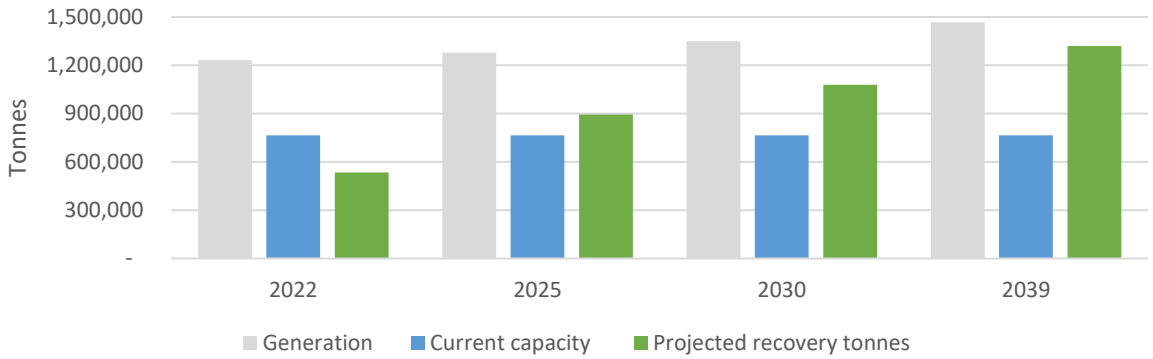
Meeting future policy settings – food and garden waste

Figure 28 above demonstrates a shortfall in capacity to manage all waste organics which includes core waste types of food organics (FO), garden organics (GO), mixed food organics and garden organics (FOGO), timber and biosolids. Future policy is generally aimed at the recovery of garden and food waste only. The following assessment on capability and capacity to meet future policy settings has been limited to food and garden waste organics.

The generation of food and garden organics is forecast to increase to almost 1.5 million tonnes by 2039. The capacity of Victoria's processing to manage food and garden waste is estimated at around

764,800 tonnes[27] which is under what is required to meet future policy settings, see Figure 29. This includes utilising capacity in other states, mainly SA in Mt Gambier.

Figure 29: Organics processing capacity to meet future projection of food and garden waste to meet targets



Gaps and opportunities

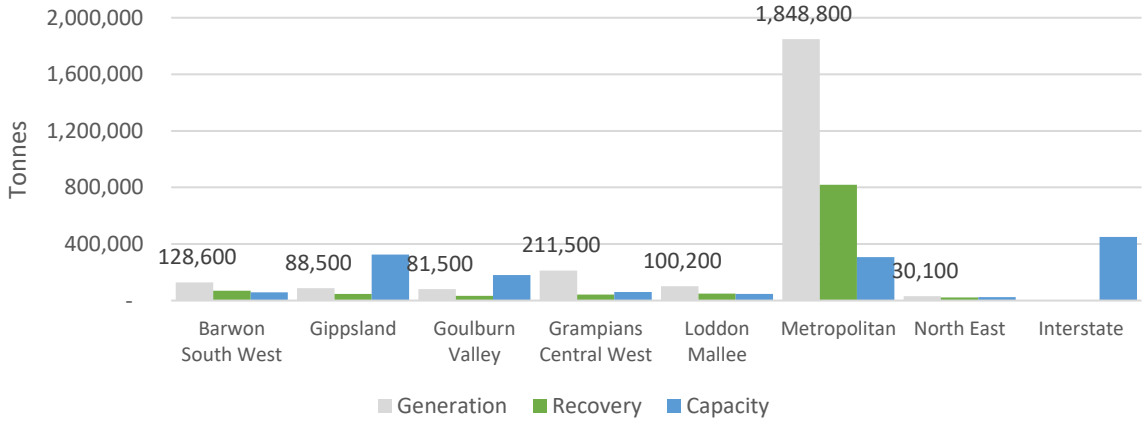
All regions have capacity to process organic waste with Gippsland, Goulbourn Valley, Melbourne and Interstate having the largest capacities, see Figure 30.

As shown, Melbourne's processing capacity is significantly less than what is recovered with organics generated in Melbourne reliant of regional and interstate processing capacity. Opportunities to add additional processing capacity in Melbourne is restricted due to a lack of available land that can meet regulatory requirements. Future capacity will either need to be created within existing sites or be provided as a SMRC facility to recover and transport out of Melbourne for further processing in regional Victoria or interstate.

With a projected shortfall in capacity by 2025 there is an opportunity for additional processing capacity in regional areas, such as in the Barwon South West and Grampians Central West regions.

Future processing capacity to prioritise the recovery of food organics.

Figure 30: Capacity to manage total waste organics by region, 2018[28]



[27] A recent study by the Metropolitan Waste and Resource Recovery Group on the capacity of organics processing facilities to manage organics generated in Melbourne indicated around 52% of material managed was food and garden. Total capacity identified has been adjusted to 52% to represent capacity to process food and garden organics.

[28] Numbers displayed in the figure represent tonnes generated in each region

Summary

Overall there is a shortfall by an estimated 130,000 tonnes by 2025 and 555,000 tonnes by 2039 in processing infrastructure capacity to meet future policy settings for food and garden waste organics, see Table 25. Investment will be required in processing capacity in regional areas with additional recovery infrastructure required in Melbourne to consolidate and transport to regional and interstate processing facilities.

Table 25: Summary of current infrastructure capacity to meet future food and garden generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	1,232,300	1,277,700	1,348,900	1,466,400
Current processing infrastructure capacity	764,800	764,800	764,800	764,800
Projected recovery required to meet policy settings	534,900	894,400	1,079,100	1,319,800
Excess or shortfall in capacity	229,900	-129,600	-314,300	-555,000
	✓	✗	✗	✗

Tyres

Tyres are managed in three broad tyre categories: passenger, truck, and off-the-road (OTR) with limited recovery of OTRs occurring. In 2018, an estimated 91,700 tonnes of waste tyres and rubber were generated with a resource recovery rate of 87%.

Infrastructure and recovery supply chain

Victoria's tyre fixed recovery infrastructure has been grouped into two main facility types:

- Special Resource Recovery Centres who bale whole tyres for export
- Resource Recovery Centres, providing a drop-off point for used tyres by residents

Victoria's tyre processing infrastructure has been grouped into two main types based on capability:

- Granulating / crumbing
- Shredding

Used tyres are primarily collected from tyre retailers or through on-site servicing such as at fleet operators where tyre replacement occurs on site, while a small amount is collected at council resource recovery centres where permissible to drop-off, see Table 26.

Table 26: Typical tyre recovery and processing supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
Tyres are typically stacked at site of generation e.g. tyre retailers, and recovered by tyre collectors for baling or processing.	»	While permissable, recovery infrastructure primarily involves the baling of tyres for export. These companies will collect tyres from source of generation. Most regional resource recovery centres allow drop-off of tyres.	»	Victoria's processing capacity and capability involves either the shredding of tyres for export or further processed into rubber granules or powder.

Capability, capacity and infrastructure location

Capability

Victoria's tyre recovery infrastructure has the capability of baling tyres to provide to export markets and will be directly impacted by the draft COAG waste export ban which proposes all whole tyres, including baled tyres be banned from export.

Victoria's tyre processing infrastructure has the capability to shred tyres to predominantly provide into export markets and further process into granules and crumb to provide to domestic markets.

Capacity

The current estimated capacity of Victoria's recovery infrastructure baling tyres is over 55,000 tonnes while Victoria's processing capacity is estimated to be around 112,500 tonnes, see Table 27.

Table 27: Current tyre recovery and processing infrastructure capability and capacity, 2018

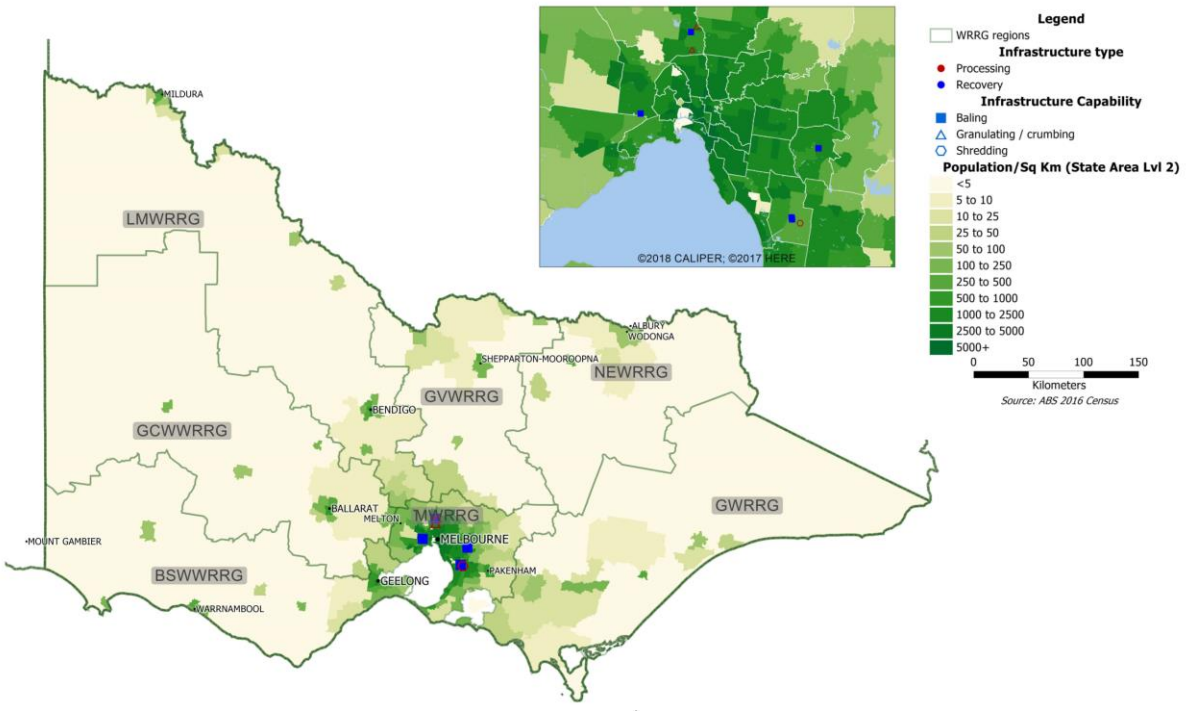
Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	SMRC	5	Baling	55,250
			Total recovery capacity	**55,250**
Processing	Processing facility	3	Granulating / crumbing, Shredding	112,500
			Total processing capacity	**112,500**
			Interstate capacity	**N/A**

Interstate capacity – Victoria does not send tyres interstate for processing however receives tyres from other states. Tyrecycle have facilities in most states however only have the one processing facility to crumb tyres which is in Melbourne. Tyres collected in other states by Tyrecycle to be crumbed are sent to the Melbourne facility.

Location

All processing and baling capacity and capability is located in Melbourne, see Figure 31 with export being a large destination for recovered tyres both shredded and whole. Tyre collection occurs across Victoria by companies involved in baling and processing.

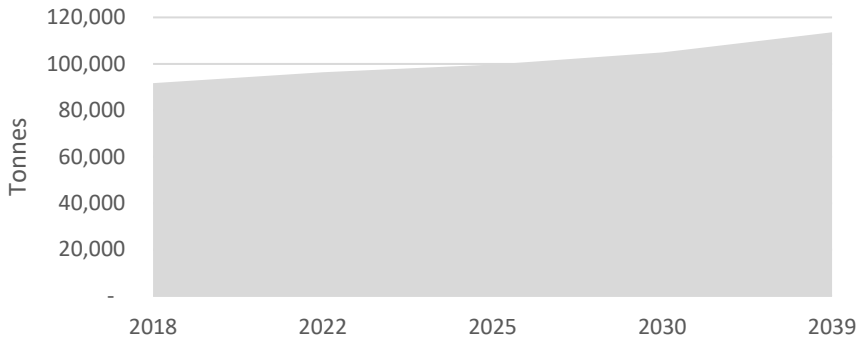
Figure 31: Location of tyre processing and dedicated recovery infrastructure



Capability and capacity assessment to meet future generation and policy settings

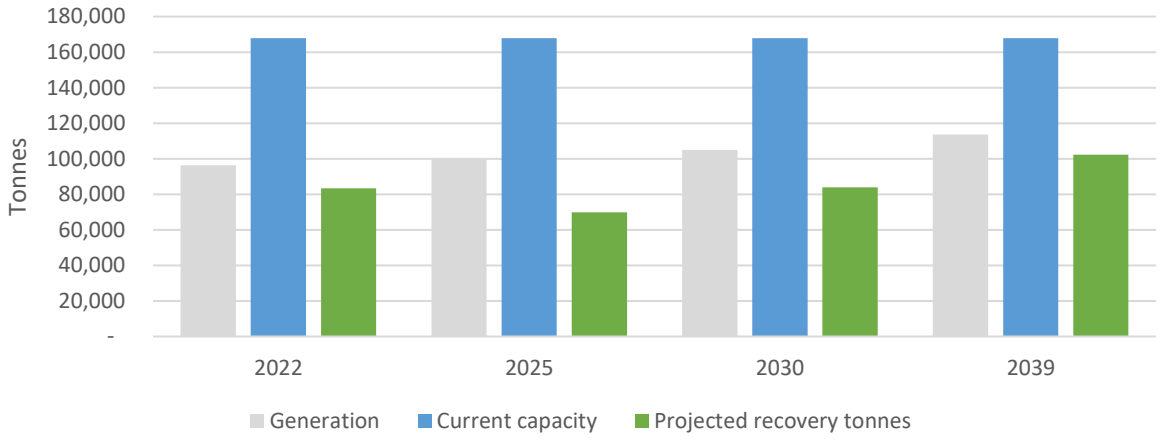
The generation of waste tyres is forecast to increase to 113,000 tonnes by 2039, see Figure 32.

Figure 32: Projected generation of waste tyres, 2018 - 2039



Facilities recovering and baling tyres operate in parallel to processing facilities shredding and crumbing and under current conditions and no ban, the recovery and processing capacity is enough to meet projected generation out to 2039, see Figure 33.

Figure 33: Tyre recovery (baling) and processing capacity



Meeting future policy settings

The current tyre resource recovery rate is estimated to be 87% which would meet the recovery target set for 2030 however this relies on the export of whole tyres. The current draft COAG waste export ban proposes that by December 2021, all whole tyres, including baled tyres will be banned from export. Tyres will need to be either shredded for use as a tyre derived fuel, or further processed into crumb rubber, granules or powder. In 2018, Victoria exported about 39,000 tonnes of tyres that would be impacted by the ban and this is projected to be 41,000 tonnes by 2022, see Table 28.

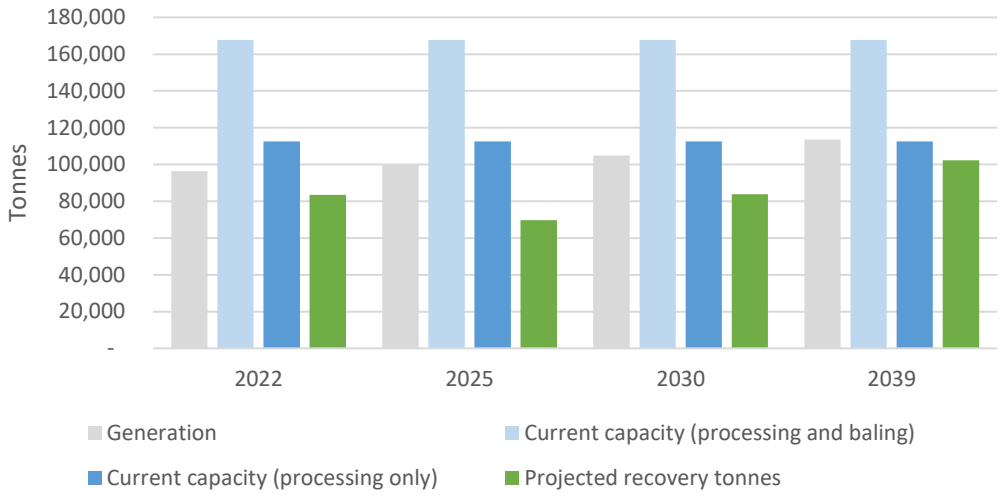
Table 28: Current and projected export of waste tyres out of Australia impacted by the ban, 2018 - 2039[29]

	2018	2022	2025	2030	2039
Tonnes exported	39,000	41,000	42,400	44,600	48,200

The effect of banning the export of whole tyres from Australia will result in the loss of baling capacity (55,250 tonnes) from Victoria's recovery capacity, see Figure 34.

Figure 34: Impact of ban on capacity to recover tyres

[29] Victorian waste flows projections, prepared for Infrastructure Victoria, Blue Environment, December 2019

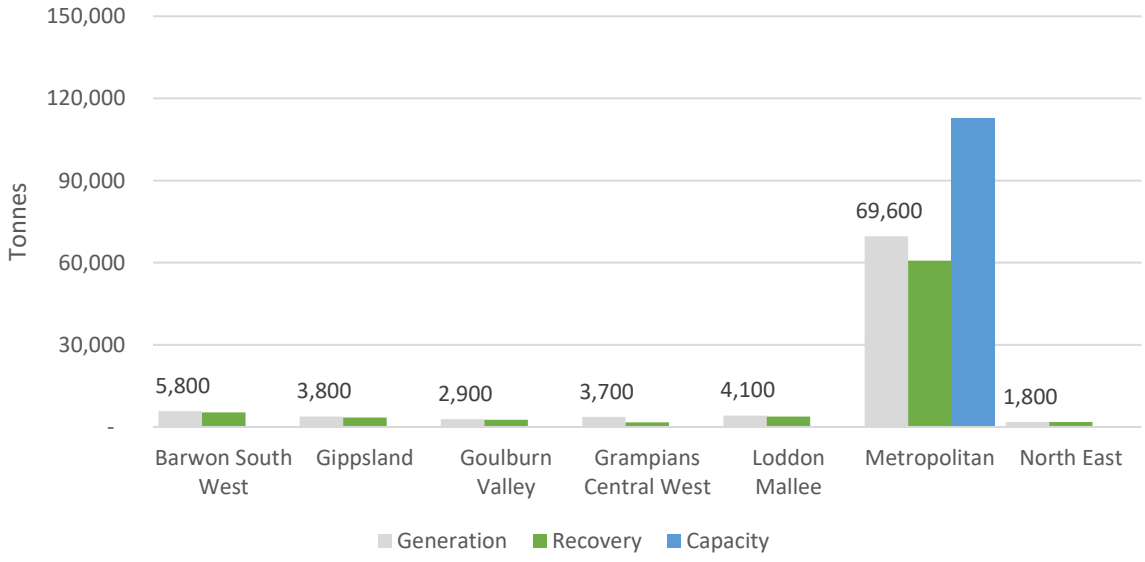


The loss of baling capacity will have little effect on meeting future policy settings with processing capacity able to meet recovery projection targets out to 2039. However, while processing capacity can meet projected recovery, the ongoing viability of existing baling businesses will be challenged. It is unlikely that baling businesses will generate a profit by continuing to collect tyres and then send them to a current competitor who processes tyres into shred or crumb.

Gaps and opportunities

All processing and baling capacity is in Melbourne, see Figure 35 and exceeds generation for the state. There are no gaps or immediate opportunity for investment in regional areas with the largest output being produced (shredded tyres) being almost entirely exported overseas making the location in Melbourne more appropriate.

Figure 35: Capacity to process used tyre by region, 2018[30]



[30] Numbers displayed in the figure represent tonnes generated in each region

Summary

With the removal of baling capacity from the network, there is sufficient processing capacity to meet requirements of the ban and future policy settings, see Table 29.

Table 29: Summary of current infrastructure capacity to meet future generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	96,400	99,700	104,900	113,600
Current processing infrastructure capacity	112,500	112,500	112,500	112,500
Projected recovery required to meet policy settings	83,400	69,800	83,900	102,200
Excess or shortfall in capacity	29,100	42,700	28,600	10,300
	✓	✓	✓	✓

E-waste

Electronic or electrical waste (e-waste) covers a wide range of electric or battery-powered items including televisions, computers, mobile phones, kitchen appliances and whitegoods. These items are made up of composite materials and can contain both valuable and hazardous materials that can be recovered. Depending on the type of e-waste, typical components can include:

- plastics (various types)
- glass
- circuit boards, hard drives, central processing units
- ferrous and non-ferrous metals (including iron, aluminium, copper and precious metals).

E-waste can be grouped into 10 broad categories according to the United Nations University 'UNU-KEYS' e-waste categories and types. These are:

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic
7. Toys, leisure and sports equipment
8. Medical devices
9. Monitoring and control instruments
10. Automatic dispensers.

In 2018, an estimated 83,000 tonnes of e-waste were generated with a resource recovery rate of 79%.

Infrastructure and recovery supply chain

The introduction of the e-waste landfill ban in Victoria in July 2019 requires all e-waste to be diverted from landfill for recovery. Pathways for collection are now in place, with waste facilities in Victoria providing a separate bin for e-waste and other disposal points at various council and private facilities (including retailers)[31], see Table 30.

Victoria's e-waste fixed recovery infrastructure can be grouped into two main facility type:

- Resource Recovery Centres (RRCs) and drop-off sites
- Specific Materials Recovery Centres (SMRCs) split into two:
    - Mechanical separation and sorting
    - Manual separation and sorting

Large household appliance such as whitegoods have a high metal content and are typically recovered for scrap metal via metal recovery facilities. For the purpose of this analysis, metal recovery facilities have been excluded as it is assumed that there is enough capacity within these facilities to manage all large appliances generated.

Victoria's e-waste processing infrastructure has been grouped into one main type based on capability:

- Hazardous processing

[31] Victorian waste flows projections, Infrastructure Victoria 2019

Table 30: Typical e-waste recovery and processing supply chain

Binfrastructure	Transport	Recovery Infrastructure	Transport	Processing Infrastructure
Source separated collection infrastructure in the form of bins at recovery facilities and variety of retail outlets and council buildings.	»	Most regional resource recovery centres provide the recovery of e-waste. Dedicated e-waste recovery facilities receive e-waste and either mechanically or manually separate e-waste components to send to processing facilities.	»	Processing infrastructure for e-waste varies depending on the separated component, be it plastic, glass, ferrous and non-ferrous metals. For the purpose of the project, e-waste processing relates to the processing of the hazardous materials recovered.

Capability, capacity and infrastructure location

The e-waste recovery network has primarily been established to support the delivery of the National Television and Computer Recycling Scheme (NTCRS) which has annual targets and mainly handle e-waste categories: IT and telecommunications equipment and Electrical and electronic.

Capability

Victorian dedicated e-waste recovery infrastructure use either manual or mechanical dismantling and sorting processes to disassemble e-waste into component parts for sale into relevant markets for further processing: scrap metal, plastics, glass, and intact components such as printed circuit boards.

Victoria's e-waste processing capability highlighted in this report has the capability to process the hazardous components contained in e-waste. Two hazardous components are batteries and mercury.

Capacity

The current estimated capacity of dedicated e-waste recovery infrastructure is around 49,500 tonnes while Victoria's hazardous processing capacity is estimated to be around 18,100 tonnes, see Table 31.

Table 31: Current Recovery and processing Infrastructure Capacity

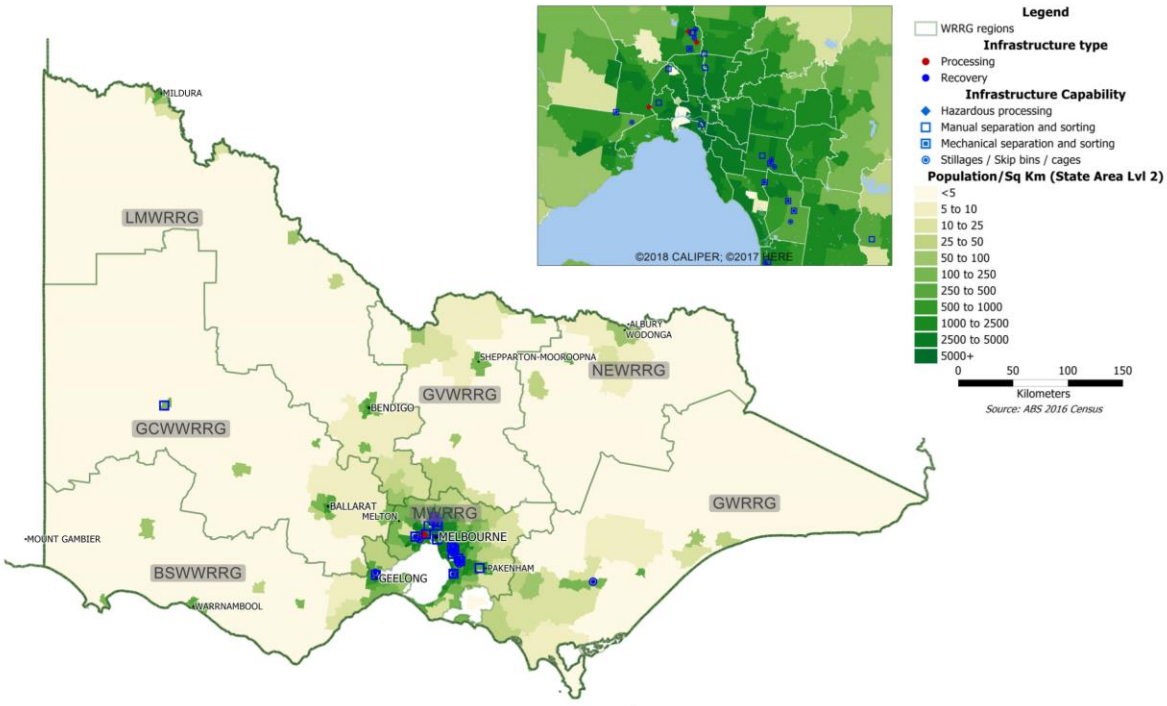
Supply chain role	Facility type	No. of facilities	Capability	Capacity
Recovery	RRC and drop-off	>266	Stillages / Skip bins / cages	N/A
	SMRC	6	Mechanical separation and sorting	27,500
	SMRC	17	Manual separation and sorting	22,000
			Total recovery capacity	**49,500**
Processing	Processing facility	4	Hazardous processing	18,100
			Total processing capacity	**18,100**
			Interstate capacity	**N/A**

Interstate capacity – No e-waste is thought to be transferred interstate for dismantling however processing of hazardous materials is available interstate and overseas and deemed not relevant for this assessment.

Location

All regions have recovery capacity though RRC while four regions have at least one dedicated e-waste recovery facility with the majority located in Metropolitan Melbourne, see Figure 36.

Figure 36: Location of e-waste processing and dedicated recovery infrastructure



Most manual dismantling recovery facilities are associated with social enterprises and not all social enterprises undertaking e-waste dismantling may have been identified during the project.

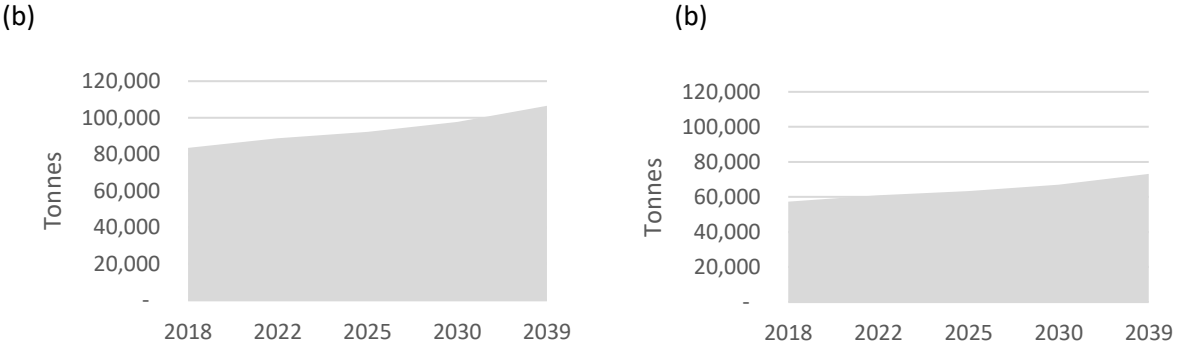
Capability and capacity assessment to meet future generation and policy settings

The assessment applies the same policy settings as for other materials however acknowledges a landfill ban is in place and a 100% recovery rate is the current policy objective.

Note: The following assessment to meet future generation and policy settings has been based on the capacity of the dedicated e-waste recovery facilities and excludes the large appliances e-waste category as these items are typically recovered through metal waste recovery facilities.

The generation of e-waste is forecast to increase to over 100,000 tonnes in 2039, and excluding large appliances forecast to increase to 73,000 tonnes, see Figure 37.

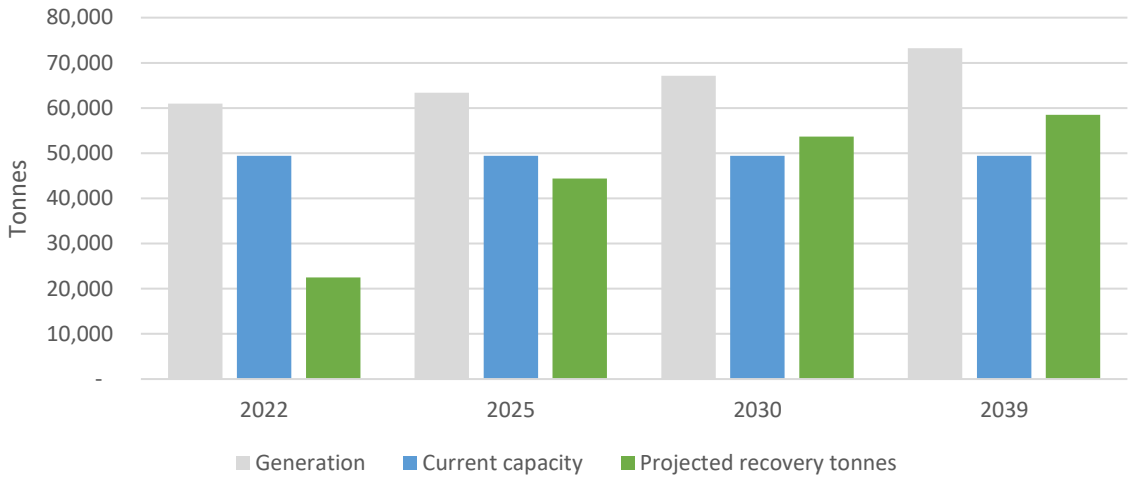
Figure 37: Projected generation of e-waste (a) total and (b) excluding large appliances, 2018 – 2039



Meeting future policy settings

This capacity of Victoria's dedicated e-waste recovery infrastructure is estimated at around 49,500 tonnes which is sufficient to meet future policy settings up until 2030, see Figure 38 however, not sufficient to meet the current landfill ban.

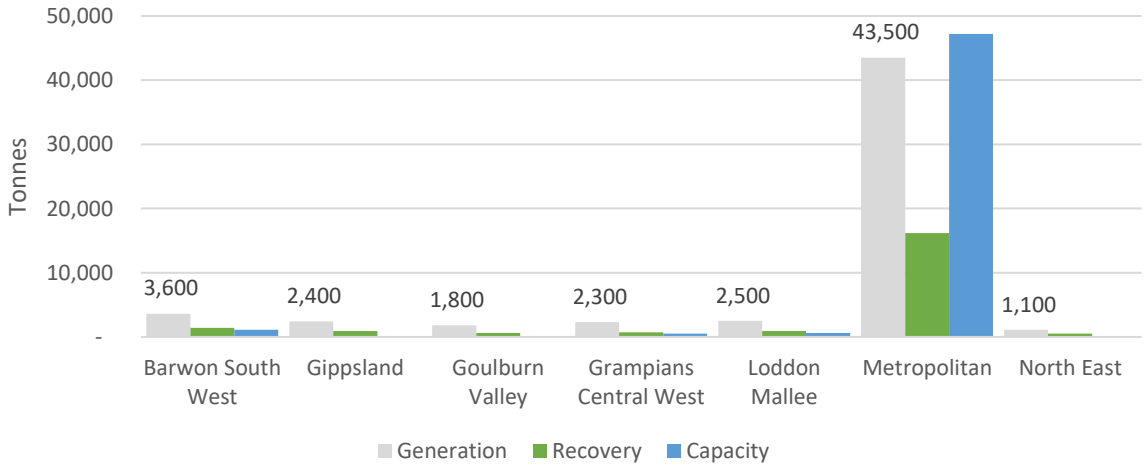
Figure 38: Impact of ban on capacity to recover e-waste



Gaps and opportunities

Dedicated e-waste recovery capacity is currently located in Melbourne and three regional areas (Barwon South West, Grampians Central West, and Loddon Mallee), see Figure 39. As previously mentioned, not all organisation undertaking manual e-waste dismantling may have been identified.

Figure 39: Capacity to manage e- waste by region, 2018[32]



Pathways for collection are now in place, with waste facilities in Victoria providing a separate bin for e-waste and other disposal points at various council and private facilities to be transported to dedicated e-waste facilities. There appears to be a shortfall in capacity by 2030 and there may be an opportunity to establish additional dedicated e-waste dismantling facilities in Melbourne or regional areas.

[32] Numbers displayed in the figure represent tonnes generated in each region

Summary

Overall there is a small shortfall by an estimated 4,000 tonnes by 2030 and 9,000 tonnes by 2039 in recovery infrastructure capacity to meet future policy settings, see Table 32.

Table 32: Summary of current infrastructure capacity to meet future generation and policy settings

	2022 (COAG Ban)	2025 (70% RR)	2030 (80% RR)	2039 (90% RR)
Generation	61,000	63,400	67,100	73,200
Current processing infrastructure capacity	49,400	49,400	49,400	49,400
Projected recovery required to meet policy settings	22,500	44,400	53,700	58,500
Excess or shortfall in capacity	26,900	5,000	-4,300	-9,100
	✓	✓	✗	✗

Waste to energy

In 2017, the State of Victoria Department of Environment, Land, Water and Planning (DELWP) released a discussion paper on waste to energy facilities in Victoria. The Victorian Government's preliminary position is to consider facilitating greater recovery of energy from waste where there are clear net benefits to society. This is likely to be where a waste to energy facility does not displace resource recovery options that sit higher in the waste hierarchy where they are technically and economically feasible.[33]

For the purpose of the project, the role for waste to energy has been set for the remaining 10% after materials recovery target of 90% is achieved by 2039. This approach recognises Infrastructure Victoria's waste advice Terms of Reference which state, "Support a waste to energy sector that prioritises the extraction of recyclable material and recovers energy only from the residual waste (i.e. without diverting waste from reuse or recycling)."

The priority materials suitable for waste to energy are paper, plastic, organics and tyres. A total of almost 650,000 tonnes will be available for waste to energy after 90% materials recovery rate has been achieved, see Table 33.

Table 33: remaining tonnes after reaching 90% materials recovery rate

	Tonnes remaining
Paper	249,200
Plastic	73,500
Organics	312,800
Tyres	11,400
Total	646,900

Currently there are four project proposals for waste to energy using thermal processes moving through Victorian Government or local council approvals processes. The total of the proposed four facilities are around 1 million tonnes which would be enough to manage the remaining 10% of priority materials generated in 2039.

[33] Turning waste into energy: Join the discussion, DELWP 2017

Appendix 1: Infrastructure capabilities and outputs development

A major component of the project was to assess the capability of the current infrastructure to yield resources suitable for accessing domestic and export markets. This is of most importance in relation to the proposed export ban by the Australian Government on waste plastic, paper, glass and tyres by no later than 30 June 2022. The ban would mean value-added materials that can be exported would include plastic, paper, glass and tyres that have been processed into materials ready for further use and should not harm human health or the environment in the importing country. These include the materials listed in Table 34.

Table 34: Proposed value-added materials not subject to the export ban

Waste stream	Value added material
Plastic	Clean plastics sorted to a single resin type and processed ready for further use (e.g. flakes and pellets)
Paper	Paper pulp
Glass	Washed, colour sorted cullet ready for further use
Tyres	Crumb rubber, powder and granules or shredded tyres exported for tyre derived fuel

As a result, each facility identified was assigned a capability to identify which facilities will be affected by the ban.

The capabilities developed have been based on technology and equipment used by facilities and the outputs they produce. Allocation of capability has been made based on data available at the time of the project and is believed to be the first time this type of classification of waste and resource recovery facilities has been attempted. Facilities may have more than one capability however for the purpose of the project have been assigned the most appropriate for the assessment to be completed by priority material. The capabilities categories developed for the project are:

- Anaerobic Digestion
- Baling
- Blast furnace
- Compaction
- Composting
- Crushing / grinding / washing
- Extrusion / injection moulding
- Flaking
- Granulating / crumbing
- Hazardous processing
- Manual separation and sorting
- Mechanical separation and sorting
- Optical sorting and cleaning
- Paper and pulp
- Shredding
- Stillages / Skip bins / cages
- Unknown and other

In addition to developing capability categories to assign to each facility, the project developed categories of outputs. The output categories developed for the project are:

- Baled waste
- Components
- Compost / Mulch
- Cullet
- Energy
- Flakes / Resins / Compounds
- Garden Shred
- Glass sands, aggregates and other
- Granules / crumb
- Packaging
- Raw Mulch
- Recycled paper
- Separated wastes
- Structural products
- Tyre shred
- Unknown and other

The recovery infrastructure identified as part of the project were assigned a capability and output as outlined in Table 35.

Table 35: Resource recovery facility capability and outputs

Infrastructure capability	Output category
Baling, Shredding, Manual separation and sorting, Mechanical separation and sorting, Stillages / Skip bins / cages, Other	Baled waste, Components, Cullet, Garden Shred, Raw Mulch, Separated wastes

The processing infrastructure identified as part of the project were assigned a capability and output as outlined in Table 36

Table 36: Processing infrastructure capability and outputs by priority material

Priority material	Infrastructure capability	Output category
Paper	Paper and pulp, Other	Recycled paper, Other
Plastic	Extrusion / injection moulding, Flaking, Granulating / crumbing, Compaction, Other	Flakes / Resins / Compounds, Packaging, Structural products, Other
Glass	Blast furnace, Crushing / grinding / washing	Packaging, Glass sands, aggregates and other
Organics	Composting, Anaerobic Digestion, Other	Compost / Mulch, Energy
Tyres	Granulating / crumbing, Shredding	Granules / crumb, Tyre shred
E-waste	Hazardous processing	Other

Appendix 2: Detailed overview of priority materials

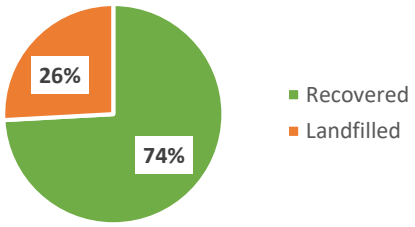
The following detailed overview of priority materials is based on Victorian waste flows projections, prepared for Infrastructure Victoria, Blue Environment, December 2019.

Paper

Paper includes mixed paper and cardboard, office paper and newspaper, and magazine print. It is estimated that around 1.48 million tonnes of all types of paper were recovered in Victoria in 2017-18 with about 0.52 million tonnes landfilled. The commercial and industrial (C&I) sector accounts for around 85% of all paper waste generated.

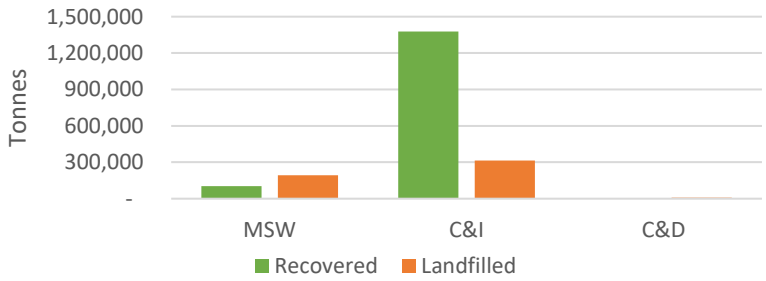
In 2018, the overall resource recovery rate for paper in Victoria was 74%, see Figure 40.

Figure 40: Paper recovery rate, 2018



Most paper in Victoria is recovered from the C&I sector with a resource recovery rate of 81%, see Figure 41. Paper recovered from the C&I sector is primarily collected directly from commercial businesses where it is separated from other waste streams. This is unlike the municipal sector (MSW) which is collected as a co-mingled stream and has a recovery rate of 35%[34].

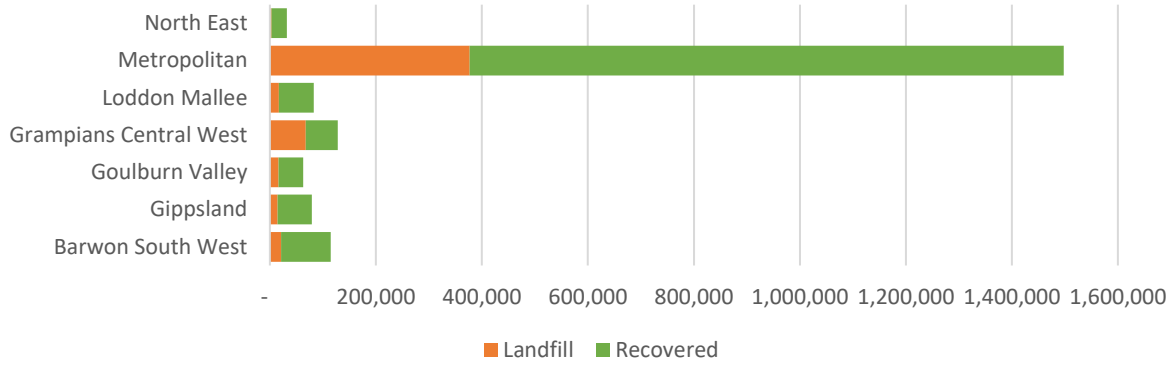
Figure 41: Paper recovered and landfilled by sector, 2018



Three regions, North East, Gippsland and Barwon South West have a recovery rate above 80% while Metropolitan Melbourne has a recovery rate of 75%, see Figure 42. Grampians Central West has the lowest recovery rate of 47%.

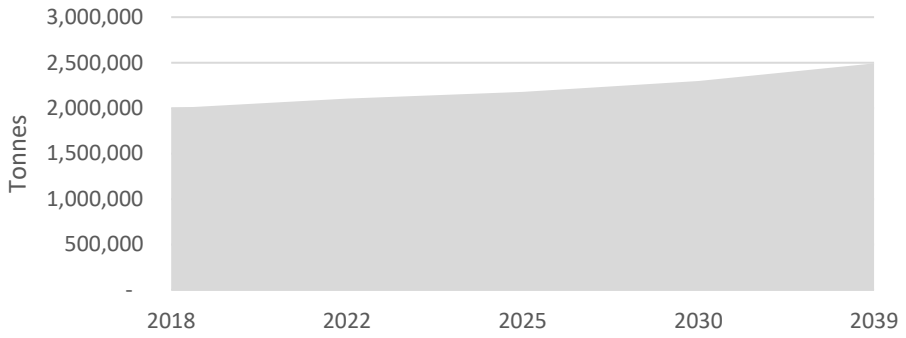
[34] Sustainability Victoria report two different figures for the recovery of paper and cardboard. The Victorian Recycling Industry Annual Waste Services (VRIAWS) Report indicates 102,400 tonnes recovered in 2017-18 while the Victorian Local Government Waste Services (VLGWS) Report indicates 308,600 tonnes recovered. Data to inform the modelling for the project is based on the VRIAWS which suggests an underestimation of the recovery rate for the municipal sector. Utilising the VLGWS data would suggest the MSW recovery rate is closer to 50% opposed to 35%.

Figure 42: Paper recovered and landfilled by region, 2018



An estimated 2 million tonnes of paper waste was generated in 2018. This is forecast to increase to almost 2.5 million tonnes in 2039, see Figure 43.

Figure 43: Paper projected generation, 2018 - 2039



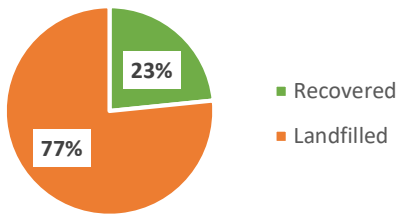
Plastic

It is estimated that in Victoria in 2017-18, around 137,000 tonnes of plastics were recovered, and 450,000 tonnes landfilled. There are seven different categories of plastic:

1. polyethylene terephthalate (PET)
2. high density polyethylene (HDPE)
3. polyvinyl chloride (PVC)
4. low density polyethylene (LDPE)
5. polypropylene (PP)
6. polystyrene (PS)
7. all others (including composites).

In 2018, the overall resource recovery rate for plastic in Victoria was 23%, see Figure 44.

Figure 44: Plastic recovery rate, 2018



Mixed packaging plastics collected from MSW (and to a lesser extent C&I) comingled recycling are generally managed and baled at MRFs in one of two ways:

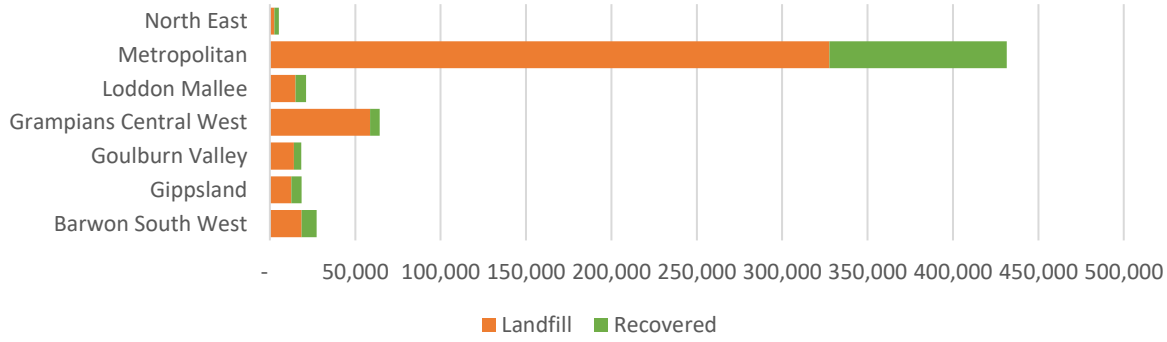
- into a single mixed plastics grade, which typically comprises around 40% PET, 40% HDPE and 20% all other plastics, producing so-called 4:4:2 bales
- into three different streams: - PET - HDPE - mixed plastics, which generally incorporate about 20% PET and 20% HDPE that passed through the sorting process, resulting in so-called 2:2:6 bales.

Recovery rate from the MSW sector is around 32%, see Figure 45. Other waste plastics from the C&I and C&D sectors are not directed to MRFs but collected separately by commercial contractors for local recyclers. While a cleaner stream, the C&I sector has an estimated recovery rate of 18%.

Figure 45: Plastic recovered and landfilled by sector, 2018

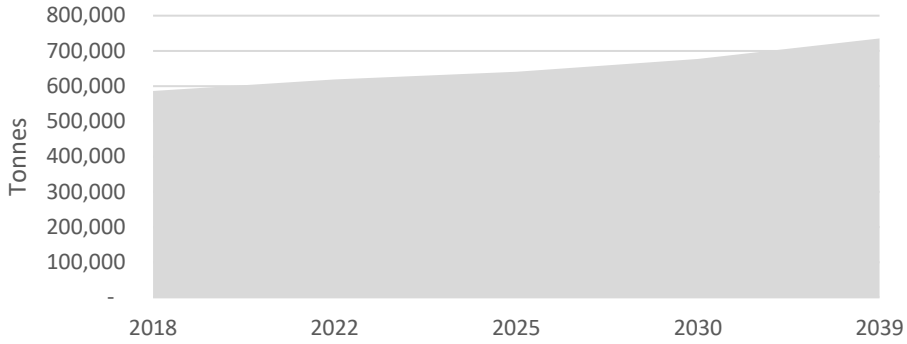
With an overall state recovery rate of 32%, it is unsurprising that recovery rates across all regions are low see Figure 46.

Figure 46: Plastic recovered and landfilled by region, 2018



An estimated 586,000 tonnes of waste plastic was generated in 2018. This is forecast to increase to almost 735,000 tonnes in 2039, see Figure 47.

Figure 47: Plastic projected generation, 2018 - 2039

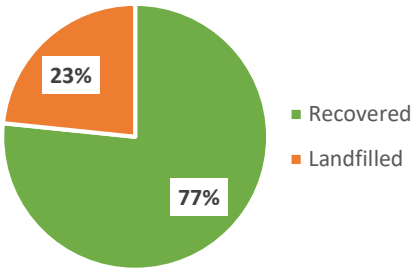


Glass

About 264,000 tonnes of glass were recovered in 2017-18 and about 80,000 tonnes landfilled. Nearly all the recovered material is packaging waste, most of which is recovered through MRFs as a component of co-mingled recycling streams from the MSW and C&I sectors. Most MRFs in Victoria sort glass into a single mixed stream with further sorting by colour undertaken at a glass beneficiation plant.

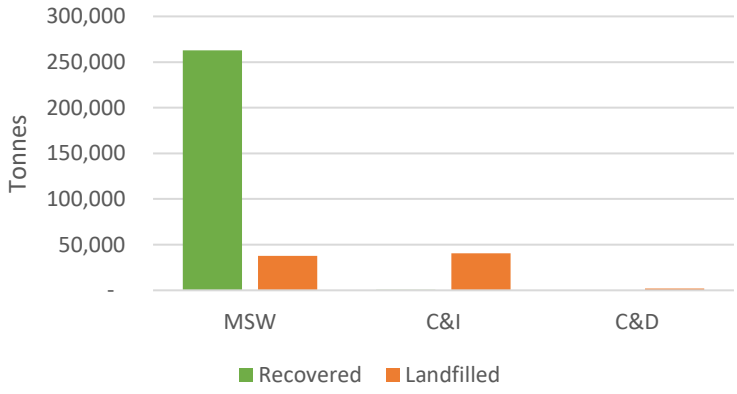
In 2018, the overall resource recovery rate for glass in Victoria was 77%, see Figure 48.

Figure 48: Glass recovery rate, 2018



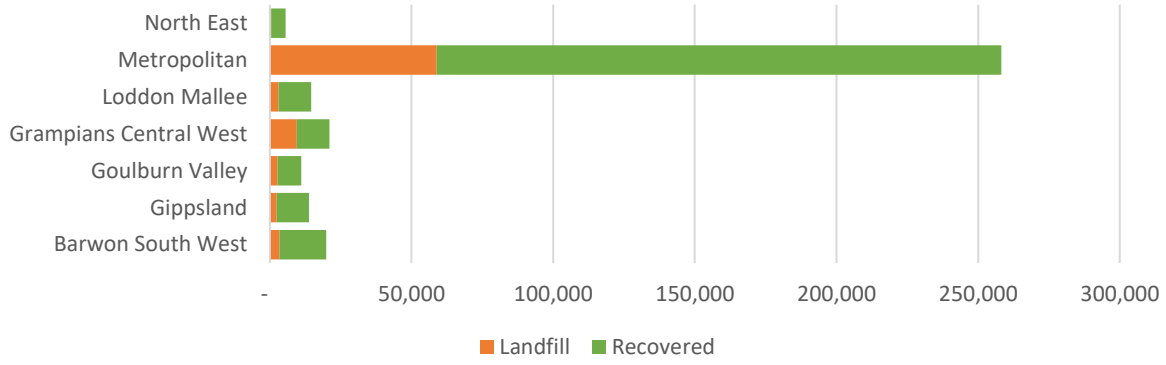
In 2018, the MSW sector had a high recovery rate of 87% while the C&I sector had a very low recovery rate of 2%, comprising mostly of packaging glass, see Figure 49. There is limited data however presently available for other glass types generated by the C&I and C&D sector.

Figure 49: Glass recovered and landfilled by sector, 2018



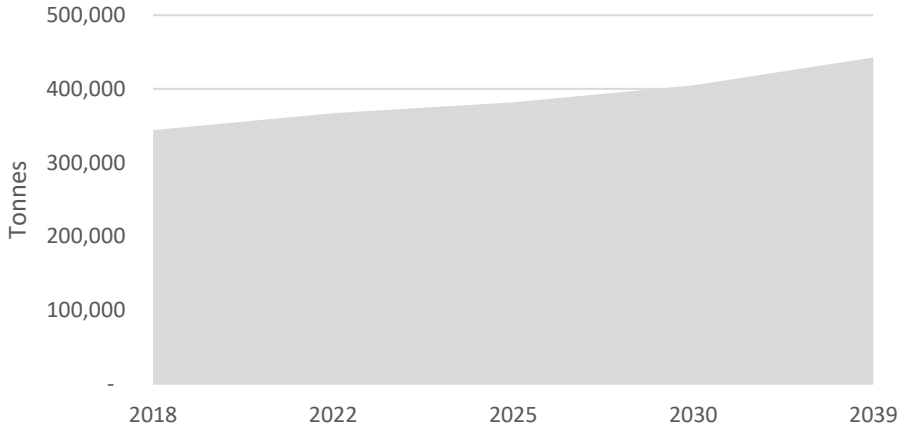
With a high recovery rate, it is not surprising almost all the regions (six) have recovery rates above 75%, see Figure 50. The exception is Grampians Central West who have low recovery rate across the board and is at 55% for glass.

Figure 50: Glass recovered and landfilled by region, 2018



An estimated 344,000 tonnes of waste glass was generated in 2018. This is forecast to increase to almost 443,000 tonnes in 2039, see Figure 51.

Figure 51: Glass projected generation, 2018 - 2039

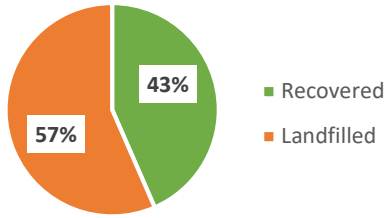


Organics

Organics refers to the core waste types of food organics (FO), garden organics (GO), mixed food organics and garden organics (FOGO), timber and biosolids. It excludes Paper and primary industry organics such as forestry wastes, crop stubbles and residues, fisheries waste, paunch, prunings, grain dust, fruit and vegetable trimmings, etc. except where these wastes enter landfill or the organics recovery sector. The estimated quantity of organics recovered in Victoria in 2017-18 was around 1.08 million tonnes and about 1.4 million tonnes landfilled.

In 2018, the overall resource recovery rate for organics in Victoria was 43%, see Figure 52.

Figure 52: Organics recovery rate, 2018

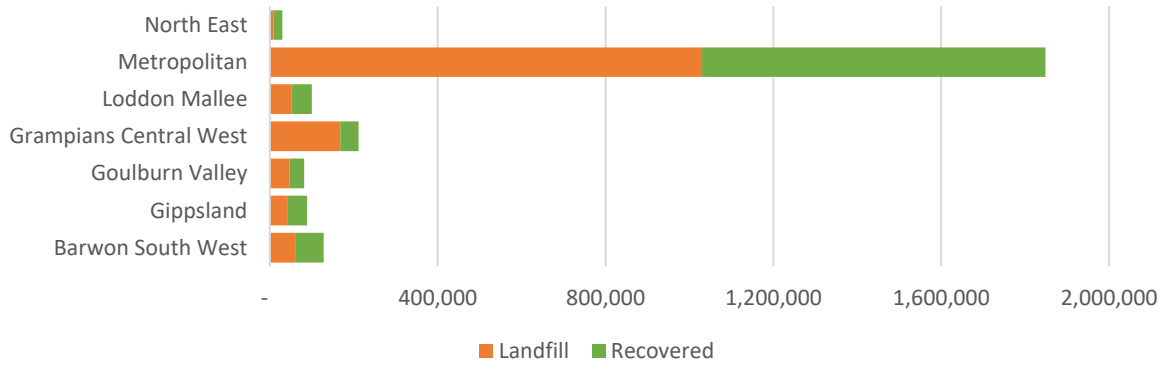


With just over half of organic waste generated from the MSW sector, the recovery rate is only 29% while the C&I sector has a higher recovery rate of 58%, see Figure 53.

Figure 53: Organics recovered and landfilled by sector, 2018

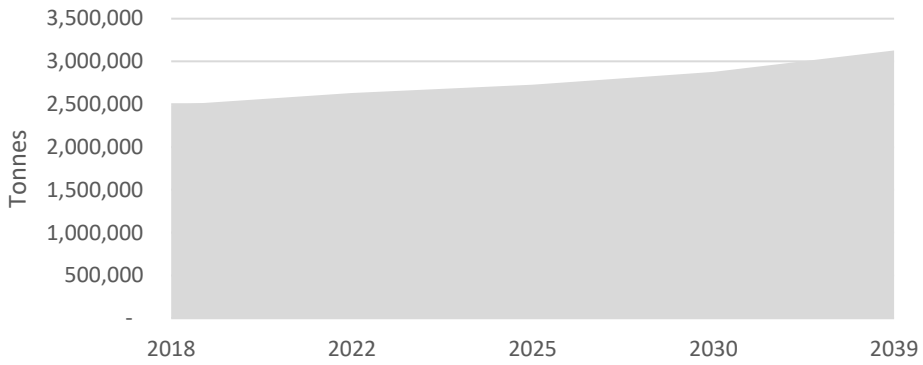
Three regions (Barwon South West, Gippsland, and North East) have recovery rates above 50% while Goulburn Valley, Loddon Mallee and Metropolitan Melbourne have recovery rates between 40-50%, see Figure 54. Grampians Central West had a low recovery rate of 20%.

Figure 54: Organics recovered and landfilled by region, 2018



An estimated 2.5 million tonnes of waste organics was generated in 2018. This is forecast to increase to over 3.1 million tonnes in 2039, see Figure 57.

Figure 55: Organics projected generation, 2018 - 2039

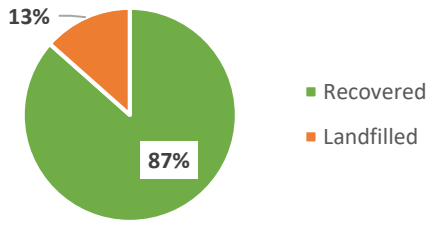


Tyres

Tyres are a composite product, made from natural and synthetic rubber, steel, carbon, fibre (nylon, rayon and/or polyester) and bonding agents. Processed tyres are shredded to separate textile, steel and rubber materials, most of which have markets for recovery. Whole tyres can be re-treaded or used as a fuel for low-grade technologies. The estimated quantity of tyres recovered in Victoria in 2017-18 was around 79,000 tonnes and about 12,000 tonnes landfilled.

In 2018, the overall resource recovery rate for tyres in Victoria was 87%, see Figure 56.

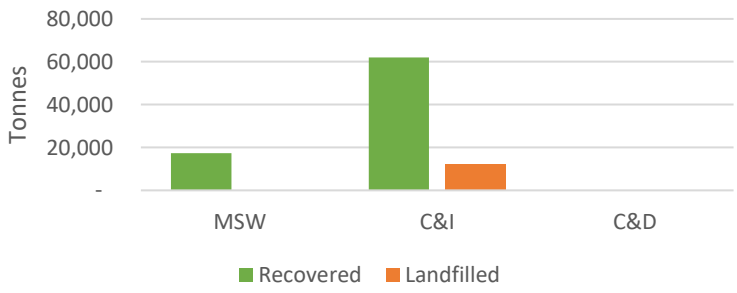
Figure 56: Tyres recovery rate, 2018



Most end-of-life tyres are recovered from the C&I sector which has a recovery rate of 83%, see Figure 57. This is because the predominant form of End of Life tyres are removed at tyre retailers when new tyres are fitted. Tyre retailers then contract a tyre collector to remove tyres from these premises.

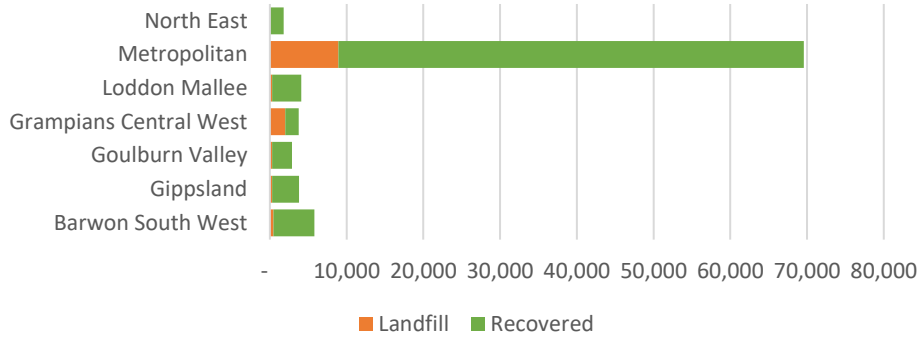
The MSW sector recovery rate was 100% with only a small proportion of tyres managed through the sector. This is typically tyres that are disposed of at Resource Recovery Centres and Transfer Stations, or are collected through the clean-up of tyres dumped on local government managed land. Whole tyres are banned from being disposed of in landfill in Victoria but shredded tyres may be disposed of in landfill.

Figure 57: Tyres recovered and landfilled by sector, 2018



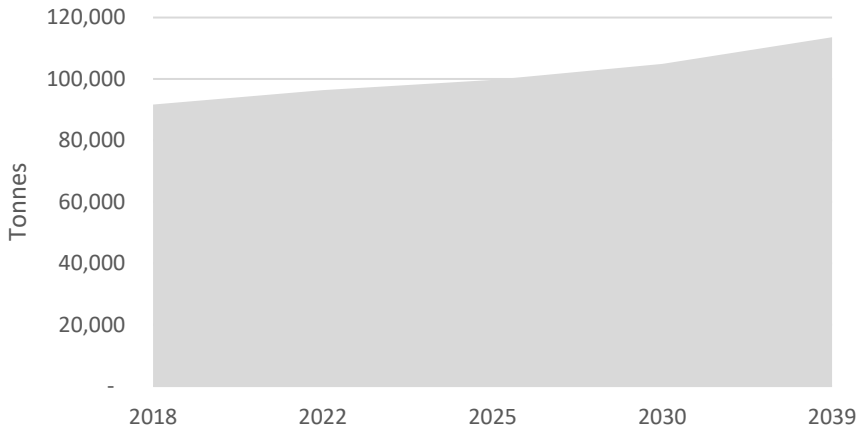
All regions have high recovery rates apart from Grampians Central West with a recovery rate of only 46%, see Figure 58.

Figure 58: Tyres recovered and landfilled by region, 2018



An estimated 92,000 tonnes[35] of waste tyres was generated in 2018. This is forecast to increase to over 113,000 tonnes in 2039, see Figure 59.

Figure 59: Tyres projected generation, 2018 - 2039



E-waste

Electronic or electrical waste (e-waste) covers a wide range of electric or battery-powered items including televisions, computers, mobile phones, kitchen appliances and white goods. These items are made up of composite materials and can contain both valuable and hazardous materials that can be recovered when they reach the end of their life. Depending on the type of e-waste, typical components can include:

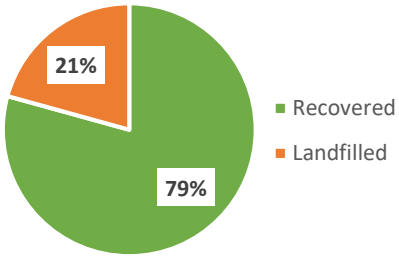
- plastics (various types)
- glass
- circuit boards, hard drives, central processing units
- ferrous and non-ferrous metals (including iron, aluminium, copper and precious metals).

[35] Sustainability Victoria (2017) estimated that around 107,700 tonnes of end-of-life tyres were generated in Victoria in 2015-16, of which around 43% were from passenger vehicles, 29% from trucks and the remaining 28% from off-road vehicles (for mining sites and heavy industry applications). This is higher than estimated tonnes from the Blue Environment model.

The estimated quantity of e-waste recovered in Victoria in 2017-18 was around 66,000 tonnes and about 17,000 tonnes landfilled. The quantity of e-waste generated is expected to more than double over the next 20 years; this reflects both growth of some waste materials (such as solar panels), as well as light-weighting of others (such as computers).

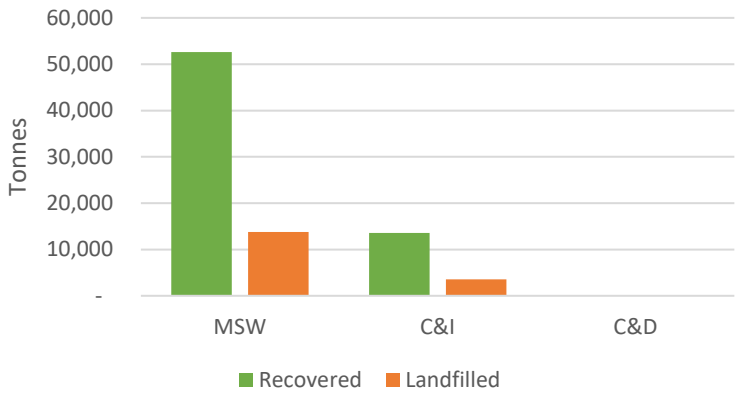
In 2018, the overall resource recovery rate for e-waste in Victoria was 79%, see Figure 60

Figure 60: E-waste recovery rate, 2018



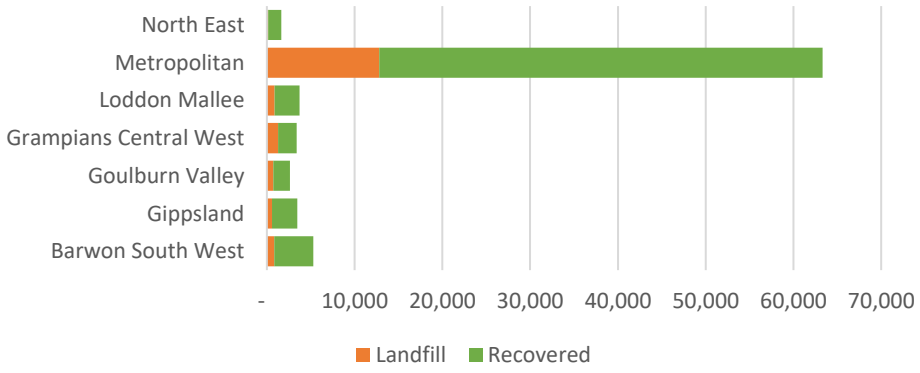
Most e-waste is generated by the MSW sector which has a recovery rate of 79%, see Figure 61. Equally has high as the MSW sector, the C&I sector has a recovery rate of 79%.

Figure 61: E-waste recovered and landfilled by sector, 2018



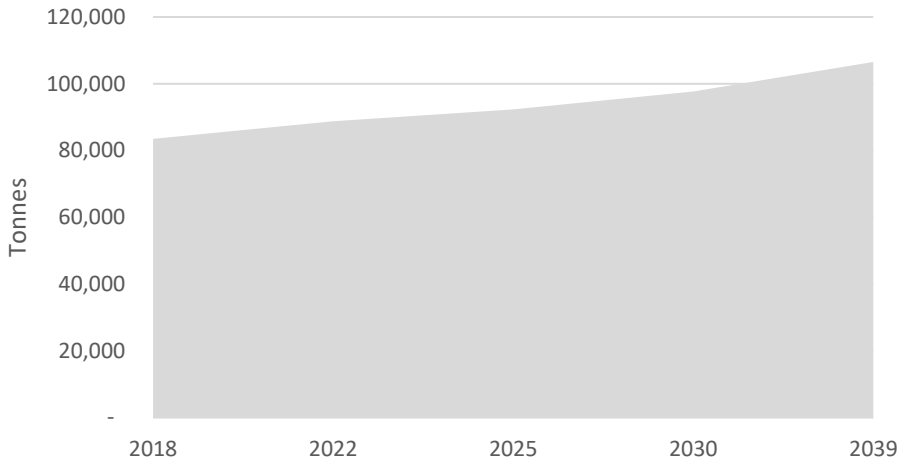
All regional areas have a high coverage of recovery infrastructure to support diversion of e-waste from landfill and as a result all regions have a recovery rate above 60% with four regions having a recovery rate above 80%, see Figure 62.

Figure 62: Glass recovered and landfilled by region, 2018



An estimated 83,000 tonnes[36] of e-waste was generated in 2018. This is forecast to increase to over 106,000 tonnes in 2039, see Figure 63.

Figure 63: E-waste projected generation, 2018 - 2039

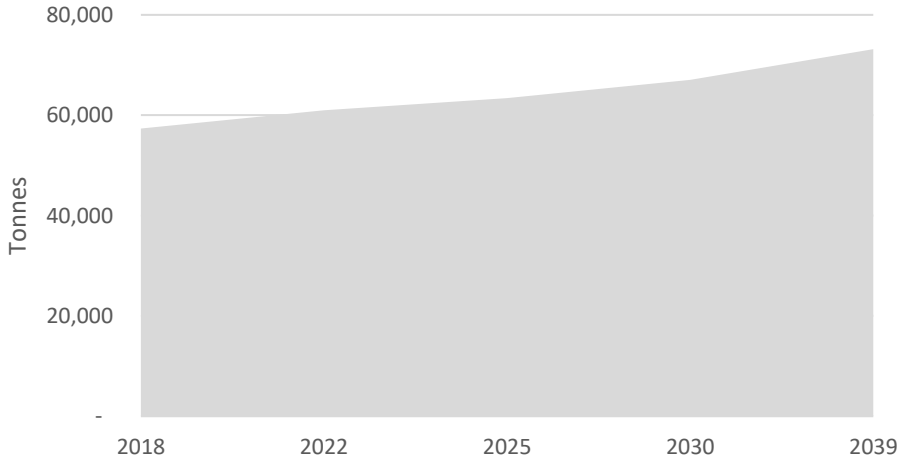


Exclusion of large appliances

Large e-waste appliances such as fridges and freezers with high steel content are assumed to be collected and sent to metals recycling (to large shredders) which contributes to the high recovery rate. To assess the capacity and capability of dedicated e-waste facilities the above generation has been adjusted to remove large appliances.[37]

An estimated 57,000 tonnes of e-waste excluding large appliances was generated in 2018. This is forecast to increase to over 73,000 tonnes in 2039, see Figure 64

Figure 64: E-waste excluding large appliances projected generation, 2018 - 2039



[36] In the Victorian e-waste market flow analysis, prepared by Randell Environmental Consulting for Sustainability Victoria, 2015 e-waste generation was estimated to be 106,000 tonnes. This is equal to the estimated generation in 2039 within the Blue Environment model.

[37] The calculations to remove large appliances have been based on data used to produce the Victorian E-waste Market Flow Analysis (MFA), SV 2015