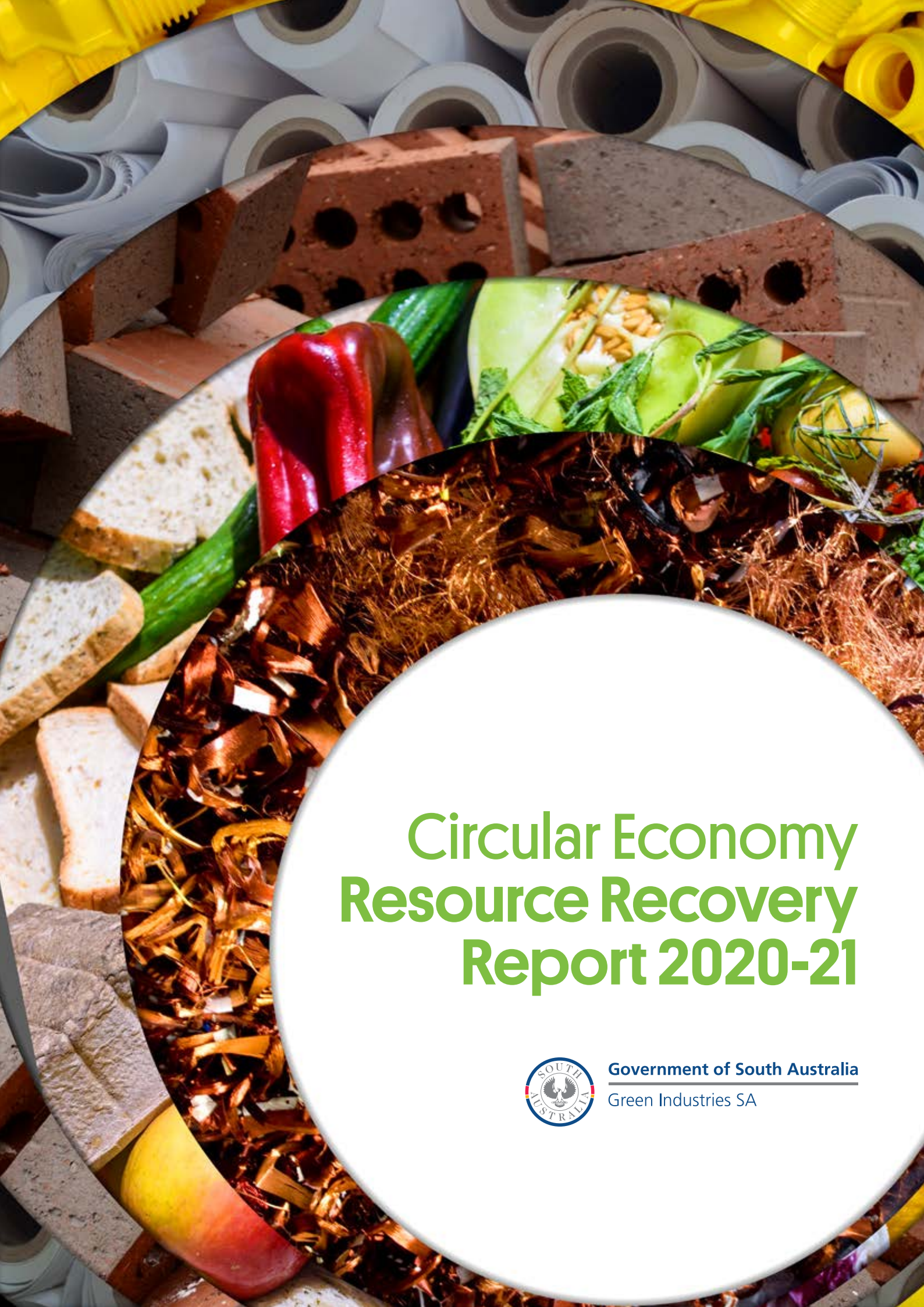

Circular Economy
Resource Recovery Report 2020-21

Government of South Australia

Green Industries SA

Disclaimer

This report has been prepared for Green Industries SA in accordance with the terms and conditions of appointment dated 10 September 2021, and is based on the assumptions and exclusions set out in our scope of work. Information in this document is current as of 22 May 2022. While all professional care has been undertaken in preparing this report, Blue Environment Pty Ltd cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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Abbreviations and glossary

Alternative fuels and raw materials	Non-traditional fuels and raw materials that are co-processed in cement kilns or other thermal facilities, potentially including refuse derived fuels, solid recovered fuels, spent catalysts, waste solvents and others
Biosolids	Waste organic solids derived from biological wastewater treatment plants
C&D	Construction and demolition
C&I	Commercial and industrial
CDL	Container deposit legislation
CERRR	Circular Economy Resource Recovery Report
Circular economy	Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste and pollution out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: design out waste and pollution; keep products and materials in use (ideally at their highest and best value); and regenerate natural systems.
CO_2-e	Carbon dioxide equivalent
Diversion	Sending waste for recycling or energy recovery instead of landfill
Energy recovery	Processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation.
EPA	Environment Protection Authority
GHG	Greenhouse gas
GSP	Gross state product
kg	Kilogram
kt	Kilotonne
LDPE	Low density polyethylene
LHV	Lower heating value
ML	Megalitre
MSW	Municipal solid waste
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
RAS	Recycling Activity Survey
Recovered materials	Waste materials separated, sorted or processed for the purposes of waste reuse, recycling or energy recovery

Recycling	Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product. The term recycling is used to cover a wide range of activities, including collection, sorting, reprocessing, and manufacture into new products. Waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e., process scrap) are not defined as recycling for the purpose of this study. Recycling does not include waste materials that have been received at a recycling facility but have not been processed.
Reprocessing	Processing of recovered materials to make raw materials for use in making new products or direct use. May also be called 'secondary processing'
Resource recovery	Activities through which wastes are collected, sorted, processed (including through composting), and/or converted into raw materials for use in a production system. For data reporting purposes, the quantity of waste allocated to the fate 'resource recovery' is the sum of the quantities allocated to waste reuse, recycling and energy recovery.
Reuse	Reallocation of products or materials to a new owner or purpose without reprocessing or remanufacture, but potentially with some repair (for example, repair of pallets for resale, tyre retreading)
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical, and intractable wastes
The survey	The Circular Economy Resource Recovery Survey 2020-21
TJ	Terajoule

Acknowledgements

Green Industries SA would like to recognise and thank the following participants of the Circular Economy Resource Recovery Survey 2020-21 and the SA Organics Industry Survey 2020-21. The list below does not include all organisations that participated in the surveys but those that agreed to be recognised.

AAIMG

Adelaide Hills Region Waste Management Authority

Alexandrina Council

APR Manufacturing Group

Australia and New Zealand Recycling Platform

Australian Mobile Telecommunications Association

Boral Resources

Ceduna Recycling

Clare Valley Waste

Downer EDI

Ecoplas Australia

Electronic Recycling Australia

Foodbank

Hallett Resources

Intercast and Forge

J Mathews Pty Ltd

JA Braun Investments Pty Ltd

JBS

Jeffries

Kangaroo Island Council

Mobius Farms

Northern Adelaide Waste Management Authority

Normetals

OneFortyOne Wood Products

Opal

OzHarvest

Peats Group

PC and JL Giles

Renewal SA

ResourceCo

SA Composters

SA Water

Sims Metal

Southern Region Waste Resource Authority

Statewide Recycling

Tarac Technologies

YCA Recycling

Summary

Introduction

Each year, Green Industries SA measures recycling and disposal activity in South Australia (SA) to assess how the state is performing on waste management and recycling. The findings are used to track progress against South Australia's state waste targets. This report presents the results for the 2020-21 financial year.

Summary of 2020-21 results

South Australia achieved a recovery rate of 83.3% in 2020-21, equal to the rate achieved in 2019-20, and consistent with performance from the past several years. SA recovered about 4.20 million tonnes of material in 2020-21, a 1.6% increase compared to 2019-20. Disposal to landfill also increased this year; about 840 kilotonnes (kt, or thousands of tonnes) of waste was landfilled in 2020-21 compared to 827 kt in 2019-20. Overall waste generation increased to about 5.04 million tonnes compared to last years' 4.96 million tonnes.

Headline statistics for resource recovery, landfill disposal and waste generation are provided in Table S1. This includes:

- Standard reporting materials, which includes masonry (excluding clay, fines, rubble and soil), metals, organics, cardboard and paper, plastics, glass, foundry sands, leather and textiles, and tyres and other rubber.
- Separately reported materials, which includes clays, fines, rubble and soil and fly ash. These materials are reported separately because they can fluctuate significantly across years and between jurisdictions.

Table S1 Summary of resource recovery, landfill disposal and waste generation, SA 2020-21

	Standard reporting materials	Separately reported materials	Total
Resource recovery (tonnes)	3.47 million	0.73 million	4.20 million
Landfill disposal (tonnes)	0.64 million	0.20 million	0.84 million
Waste generation (tonnes)	4.11 million	0.93 million	5.04 million
Recovery rate (%)	84.4%	78.6%	83.3%

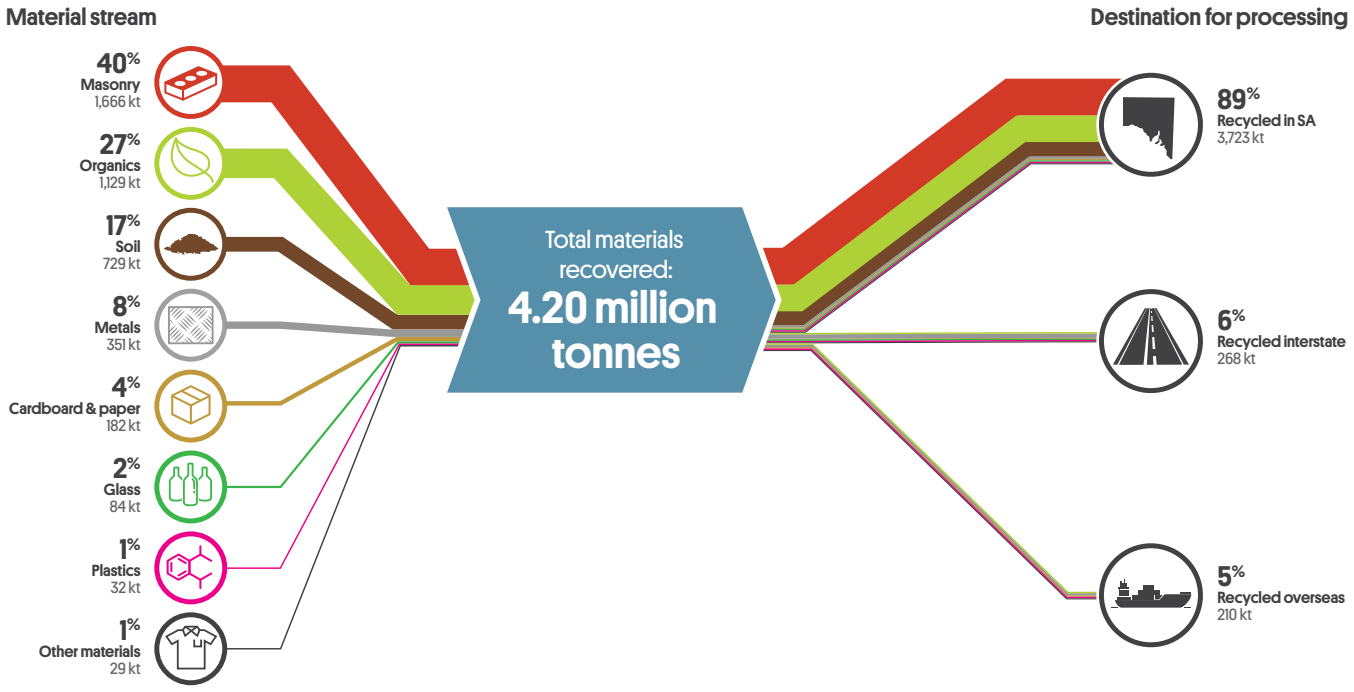
Recovery by material

When comparing 2020-21 data to 2019-20 data:

- **Masonry** (including clays, fines, rubble and soil) recovery was approximately the same at 2.40 million tonnes. Asphalt and concrete increased while clay, fines, rubble and soil decreased.
- **Metals** quantities increased considerably from 268 kt to 351 kt. This was primarily due to a spike in iron and steel recovery. Industry responses indicate that the metals market was very strong in 2020-21.
- **Organics** recovery remained strong, with a boost in recovery for all organics types except for timber. About 1.13 million tonnes of organic materials were recovered in 2020-21, a slight increase from the 1.11 million tonnes recovered in 2019-20.
- **Cardboard and paper** recovery continued to decline and was its lowest since 2007-08. Overall, about 182 kt of cardboard and paper was recovered in 2020-21, about 12 kt less than the year before.
- **Plastics** increased considerably, with a notable shift towards recovery by separated polymers instead of mixed plastic streams. SA recovered 32 kt of plastics in 2020-21, an increase from the 30 kt recovered in 2019-20
- **Glass** recovery remained similar to last year but decreased from 87 kt to 84 kt.
- **Other materials** include fly ash, foundry sands, leather and textiles, and tyres and other rubber. The combined recovery of these materials in 2020-21 was about 29 kt, a considerable decrease from the 44 kt recovered in 2019-20, which was due to a drop in foundry sands.

Figure S1 summarises the material composition and destination of total recovered materials in SA in 2020-21.

Figure S1 Resource recovery in SA, 2020-21, by material and destination



Performance against state waste targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy defines waste diversion[1] and reduction targets to 2025, which are guided by an overall target of zero avoidable waste to landfill by 2030. A summary of progress so far based on 2020-21 data is provided in Table S2.

Table S2 Summary of state waste targets and progress on these

Topic	Target	Progress
Landfill diversion	Zero avoidable waste to landfill by 2030	SA disposed about 840 kt of waste to landfill in 2020-21, an increase from 827 kt in 2019-20
Waste generation	5% reduction in waste generation per capita from a 2020 baseline	Waste generation per capita increased by 1.6% in 2020-21 compared to 2019-20, however the long-term trend is downwards.
Metropolitan diversion	Diversion by 2023: - MSW 65% - C&I 85% - C&D 90%	Diversion rates achieved by metropolitan SA in 2020-21: - MSW 56.1% - C&I 96.9% - C&D 92.5%

Local government kerbside recovery

About 674 kt of waste materials were collected at kerbside in SA, including 522 kt from metropolitan councils and 152 kt from regional councils. SA's recovery rate for kerbside waste in 2020-21 was 47.8%, slightly higher than the previous years' rate of 47.6%. Recovery was higher for metropolitan councils (50.4%) compared to regional councils (38.8%). Compared to the previous year, performance in 2020-21 was similar for metropolitan councils but improved for regional SA.

1 In this report, 'diversion' means sending waste for recycling or energy recovery instead of landfill.

1 Introduction

- The *Circular Economy Resource Recovery Report 2020-21* presents the findings from a survey of SA's resource recovery sector for the 2020-21 financial year.
- The data measures SA's waste generation, landfill diversion and resource recovery, including progress against targets defined in *South Australia's Waste Strategy 2020-2025*.

A circular economy utilises resources to their fullest potential. Waste avoidance, reuse and recycling are maximised while raw material extraction and landfilling are minimised. South Australia (SA) continues to lead the way on resource recovery performance as it pushes towards a circular economy. This report provides a summary on the status of SA's resource recovery sector, including data on reuse, recycling and energy recovery, as well as the environmental, social and financial benefits that the sector provides. The findings are used to assess progress on the state waste targets set out in *SA's Waste Strategy 2020-25* (Green Industries SA 2020), which defines targets for waste reduction and waste diversion[2] from landfill to 2025. Table 1 (overleaf) summarises SA's waste targets.

This report is the first edition of the *Circular Economy Resource Recovery Report* (CERRR); a new iteration of Green Industries SA's previous *Recycling Activity Survey Report* (RAS). It includes several updates implemented for consistency with the recently published *Australian standard for waste and resource recovery data and reporting* (Department of Agriculture, Water and the Environment 2021).

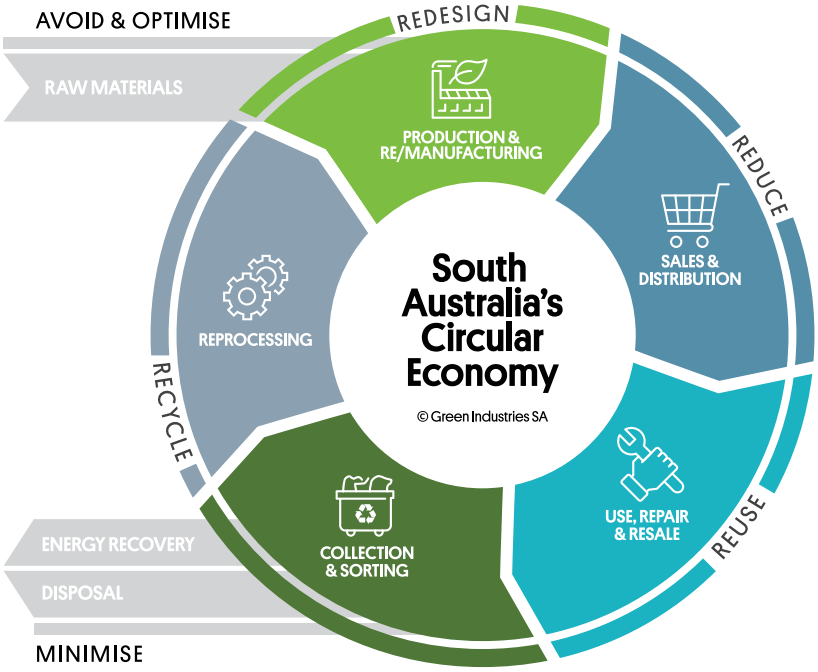


Figure 1 South Australia's circular economy

Source: South Australia's Waste Strategy 2020-2025 (Green Industries SA 2020)

2 In this report, 'diversion' means sending waste for recycling or energy recovery instead of landfill.

The Circular Economy Resource Recovery Survey 2020-21 (the survey) asked recyclers, reprocessors, the reuse sector and the energy recovery industry in SA about their operations in 2020-21. Data were sought on tonnes of materials recovered, including information on:

- source stream – municipal solid waste (MSW), commercial and industrial (C&I) waste, or construction and demolition (C&D) waste
- geographical origin – metropolitan or regional SA
- final reprocessing location – in SA, interstate or overseas
- value of recovered materials.

Survey participants are also requested to report on their views on the resource recovery sector generally, market size and strength, barriers to their operations and employee figures.

On 1 July 2021, the South Australian Environment Protection Authority (SA EPA) introduced mass balance reporting requirements for waste depots that receive over 20,000 tonnes of solid waste per annum. These requirements came into force in July 2022, meaning mass balance data is not a key data source for this report. Future CERRRs may have higher quality data and better reliability if mass balance data can be included.

Table 1 Summary of SA's waste targets

Overall targets				
2025	5% reduction in per capita waste generation from a 2020 baseline			
2030	Zero avoidable waste to landfill by 2030			
Metropolitan waste targets				
	% diversion household bin system	% diversion all MSW[3]	% diversion C&I	% diversion C&D
2023	60%	65%	85%	90%
2025	70%	75%	90%	95%
Non-metropolitan waste targets (all source streams)				
2020	Maximise diversion to the extent practically and economically achievable			
2023	Regional Waste Management Plans are in place for all South Australian regional local government areas and/or regional city clusters and set regionally appropriate and progressive waste diversion targets			

3 Quantities arising from total MSW comprising household bin systems, hard waste services, street sweepings, council-operated parks and gardens, public place locations, waste collected at drop-off facilities, and council-operated commercial services.

2 Circular economy resource recovery statistics

This section summarises the results of the *Circular Economy Resource Recovery Survey 2020-21*, including:

- resource recovery and landfill disposal
- SA's performance against state targets for waste management
- local government recovery
- SA's reuse sector and the transition to a circular economy.

2.1 Resource recovery and landfill disposal

Overview

SA recovered about 4.20 million tonnes of material in 2020-21, a 1.6% increase compared to 2019-20. Disposal to landfill also increased this year; about 840 kilotonnes (kt, or thousands of tonnes) of waste was landfilled in 2020-21 compared to 827 kt in 2019-20. Overall waste generation rose to about 5.04 million tonnes, compared to last year's 4.96 million tonnes. SA achieved a recovery rate of 83.3% in the 2020-21 financial year, the same as the 2019-20 rate and similar to rates achieved since 2016-17.

Table 2 (overleaf) summarises the key statistics for resource recovery and landfill disposal in SA in 2020-21, including a five-year trend and data from 2003-04 (the first year SA conducted a recycling survey). Data are considered in two groups:

1. Standard reporting materials, which includes masonry (excluding clay, fines, rubble and soil), metals, organics, cardboard and paper, plastics, glass, foundry sands, leather and textiles, and tyres and other rubber.

2. Separately reported materials, which includes clays, fines, rubble and soil and fly ash. These materials are reported separately because they can fluctuate significantly across years.

Table 2 shows that the recovery of standard reporting materials increased considerably in 2020-21 while the recovery of separately reported materials fell. Several factors affected 2020-21 data compared to the historical record and may have influenced these variances:

- **The survey questionnaire was updated.** There were several changes, including an additional question that asked survey respondents to report materials sent offsite to another waste and resource recovery facility for further processing. This provided a new method for identifying potential 'double-counts'.
- **A single but significant data point from mass balance reporting was applied.** A known historical gap in survey data was filled using previously unavailable mass balance reporting data. This is understood to be the primary reason for the significant decline in recovered separately reported materials, and highlights the value of mandatory reporting. From next year onwards, data quality may be improved due to mass balance reporting.

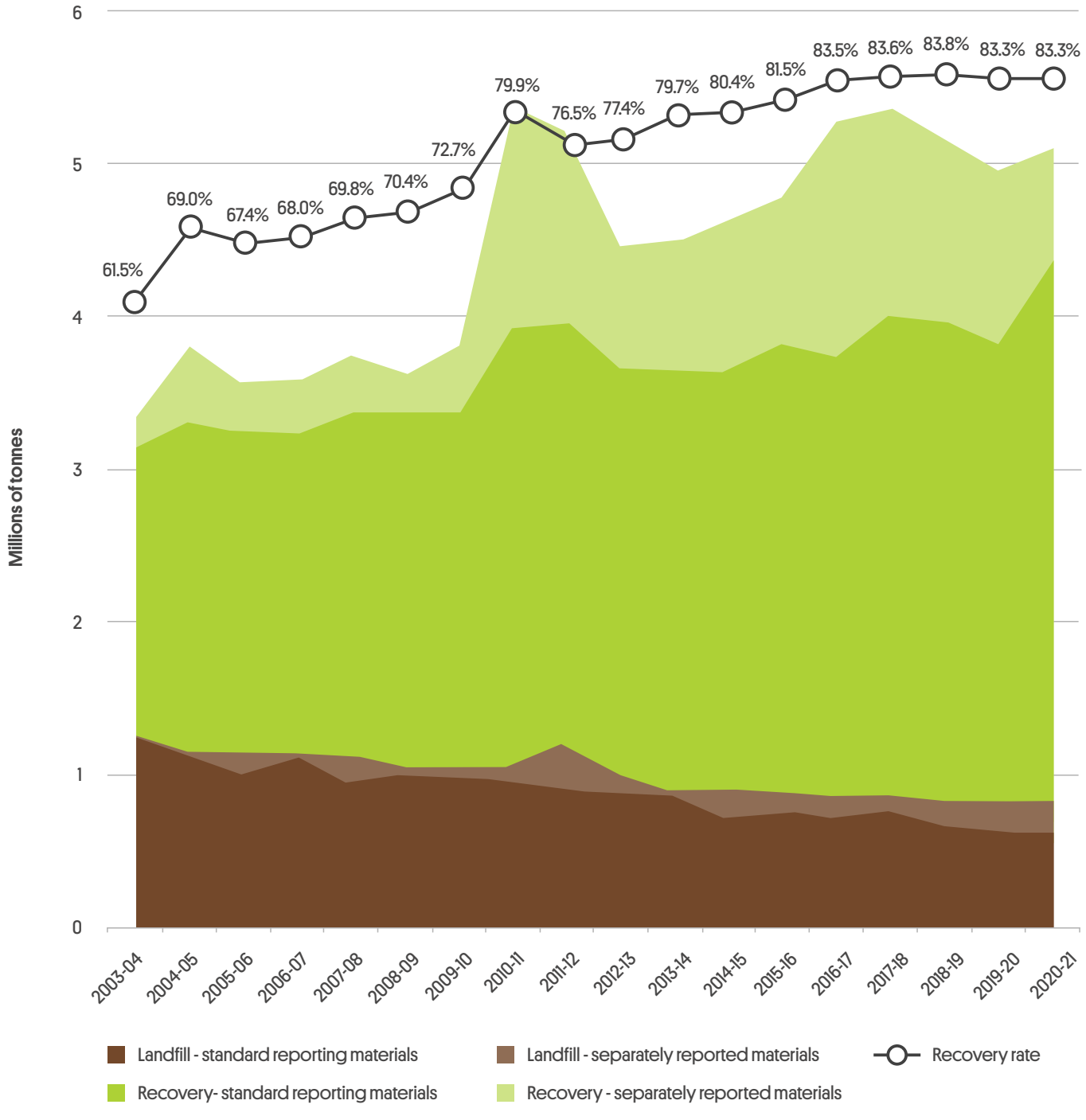
Table 2 Annual SA resource recovery, landfill disposal and diversion performance for 2020-21, 2003-04 (first survey year) and since 2016-17

Parameter	2003-04	2016-17	2017-18	2018-19	2019-20	2020-21	Change	
							19-20 to 20-21	03-04 to 20-21
Resource recovery (kt)								
Standard reporting materials	1,880	2,880	3,143	3,123	2,994	3,472	16%	85%
Separately reported materials	162	1,521	1,346	1,215	1,140	729	-36%	350%
Total	**2,042**	**4,401**	**4,489**	**4,338**	**4,134**	**4,201**	**1.6%**	**106%**
Landfill disposal (kt)								
Standard reporting materials	1,258	739	783	675	631	641	1.6%	-49%
Separately reported materials	20	134	98	165	196	199	1.4%	894%
Total	**1,278**	**873**	**881**	**840**	**827**	**840**	**1.6%**	**-34%**
Waste generation (kt)								
Standard reporting materials	3,138	3,619	3,926	3,798	3,625	4,114	13%	31%
Separately reported materials	182	1,655	1,444	1,380	1,136	928	-18%	410%
Total	**3,320**	**5,274**	**5,370**	**5,178**	**4,961**	**5,042**	**1.6%**	**52%**
Recovery rate (%)								
Standard reporting materials	59.9%	79.6%	80.1%	82.2%	82.6%	84.4%	2.2%	41%
Total	**61.5%**	**83.4%**	**83.6%**	**83.8%**	**83.3%**	**83.3%**	**0%**	**36%**
SA population (persons)	**1,534,000**	**1,723,500**	**1,736,400**	**1,751,700**	**1,769,300**	**1,773,000**	**0.2%**	**16%**
Per capita recovery (kg/person/yr)								
Standard reporting materials	1,230	1,670	1,810	1,780	1,690	1,958	16%	59%
Total	**1,330**	**2,555**	**2,585**	**2,475**	**2,335**	**2,370**	**1.5%**	**78%**
Per capita disposal (kg/person/yr)								
Standard reporting materials	820	430	450	390	360	362	0.5%	-56%
Total	**830**	**505**	**505**	**480**	**465**	**474**	**1.9%**	**-43%**
Per capita waste generation (kg/person/yr)								
Standard reporting materials	2,050	2,100	2,260	2,170	2,050	2,320	13%	13%
Total	**2,160**	**3,060**	**3,090**	**2,960**	**2,800**	**2,844**	**1.6%**	**32%**
SA gross state product (GSP) ($ millions)	**$86,754**	**$108,185**	**$110,504**	**$111,793**	**$110,652**	**$114,921**	**3.9%**	**32%**
Performance metrics per $GSP (tonnes/$ million GSP)								
Total recovery	23.5	40.5	40.5	38.6	37.1	36.6	-1.4%	55%
Total disposal	14.7	8.1	8.0	7.5	7.5	7.3	-2.2%	-50%
Total waste generation	**38.3**	**48.7**	**48.6**	**46.3**	**44.8**	**43.9%**	**-2.1%**	**15%**

Progress since the first survey year (2003-04)

Figure 2 presents the trend for resource recovery and landfill disposal in SA since 2003-04, the first survey year. The overall trend shows an increase in recovery and decrease in disposal over time. Our recovery rate rose gradually but has remained at about 83.5% since 2016-17. Waste generation has increased with population but on a per capita basis our 2020-21 rate (2,844 kilograms per person per year) is lower than it was five years ago (3,060 kilograms per person per year in 2016-17).

Figure 2 Trend in resource recovery and landfill disposal in SA since 2003-04



Recovery by material type

A summary of trends in recovery by material type is shown in Figure 3 and Table 3. A more detailed breakdown is provided in Section 3. Comparing 2020-21 to 2019-20, broadly:

- **Masonry** (excluding clay, fines, rubble and soil) recovery increased significantly, notably for asphalt and concrete.
- **Metals** regained strength compared to last year, increasing by 26%, mostly as a result of greater iron and steel recovery.
- **Organics** recovery remained strong, with a boost for all organics types except for timber.
- **Cardboard and paper** recovery continued to decline and was its lowest since 2007-08.
- **Plastics** increased considerably, with a notable shift towards recovery by separated polymers instead of mixed plastic streams.
- **Glass** recovery remained similar to last year but fell slightly.
- **Other materials** decreased from last year due to a drop in the recovery of foundry sands.
- **Separately reported materials** dropped significantly; this is understood to be primarily due to improved data from mass balance reporting.

Table 3 Summary of SA resource recovery by material type

Material type	Recovery (kt)						Change (%)
	2003-04	2016-17	2017-18	2018-19	2019-20	2020-21	19-20 to 20-21
Standard reporting materials							
Masonry							
Asphalt	100	270	286	269	238	339	42%
Bricks	165	42	102	74	41	44	6%
Concrete	877	750	960	1,049	975	1,283	32%
Plasterboard	0	1.4	1.5	1.1	1.0	0.9	-11%
Subtotal	**1,142**	**1,063**	**1,350**	**1,393**	**1,255**	**1,666**	**33%**
Metals							
Iron and steel	264	275	299	297	248	327	32%
Aluminium	19	17	14	14	11	12	11%
Non-ferrous metals	13	18	19	18	19	11	-40%
Subtotal	**296**	**310**	**332**	**329**	**278**	**351**	**26%**
Organics							
Food organics	0	8.1	9.1	12	13	16	18%
Garden organics	130	293	257	257	250	277	11%
Timber	117	250	270	242	315	202	-36%
Other organics	0	562	563	529	528	634	20%
Subtotal	**247**	**1,113**	**1,099**	**1,040**	**1,106**	**1,129**	**2%**
Cardboard and paper							
Cardboard and waxed cardboard	91	170	162	160	134	138	3%
Liquid paperboard	0	1.2	1.2	0.8	0.6	0.8	33%
Magazines and newsprint	33	69	62	54	47	31	-34%
Printing and writing paper	12	9	11	14	12	12	-4%
Subtotal	**136**	**249**	**236**	**229**	**194**	**182**	**-6%**
Plastics							
Polyethylene terephthalate	0	4.2	4.8	5.0	4.7	8.9	89%
High density polyethylene	0	4.5	6.1	5.9	6.0	12.0	100%
Polyvinyl chloride	0	0.0	0.1	0.1	0.1	<0.1	-80%
Low density polyethylene	0	4.1	3.2	2.0	3.0	4.5	50%
Polypropylene	0	1.4	0.8	0.6	1.1	4.9	347%
Polystyrene	0	0.3	0.3	0.5	0.6	0.4	-33%
Mixed and/or other plastics	8.6	14	16	17	14	1.7	-88%
Subtotal	**8.6**	**29**	**31**	**31**	**30**	**32**	**9%**
Glass							
Glass	46	67	60	74	87	84	-3%
Subtotal	**46**	**67**	**60**	**74**	**87**	**84**	**-3%**

Material type	Recovery (kt)						Change (%)
	2003-04	2016-17	2017-18	2018-19	2019-20	2020-21	19-20 to 20-21
Other materials							
Foundry waste	0	25	10	6.0	24	8.2	-66%
Leather and textiles	4.1	4.0	5.5	2.4	0.9	1.6	73%
Tyres and other rubber	0.1	20	20	19	19	19	0%
Subtotal	**4.2**	**48**	**35**	**27**	**44**	**29**	**-34%**
Total standard reporting materials	**1,879**	**2,880**	**3,143**	**3,123**	**2,994**	**3,472**	**16%**
Separately reported materials							
Fly ash	0	0	0	0	0	0	n/a
Clay, fines, rubble and soil – clean fill	162	1,307	1,052	937	874	659	-25%
Clay, fines, rubble and soil – intermediate waste soil	-	214	294	278	266	70	-74%
Total separately reported materials	**162**	**1,521**	**1,346**	**1,215**	**1,140**	**729**	**-36%**
Grand total	**2,042**	**4,401**	**4,489**	**4,338**	**4,134**	**4,201**	**1.6%**

Figure 3 Trend in resource recovery in SA since 2003-04 by material category, including tonnes per $ millions of gross state product (GSP)

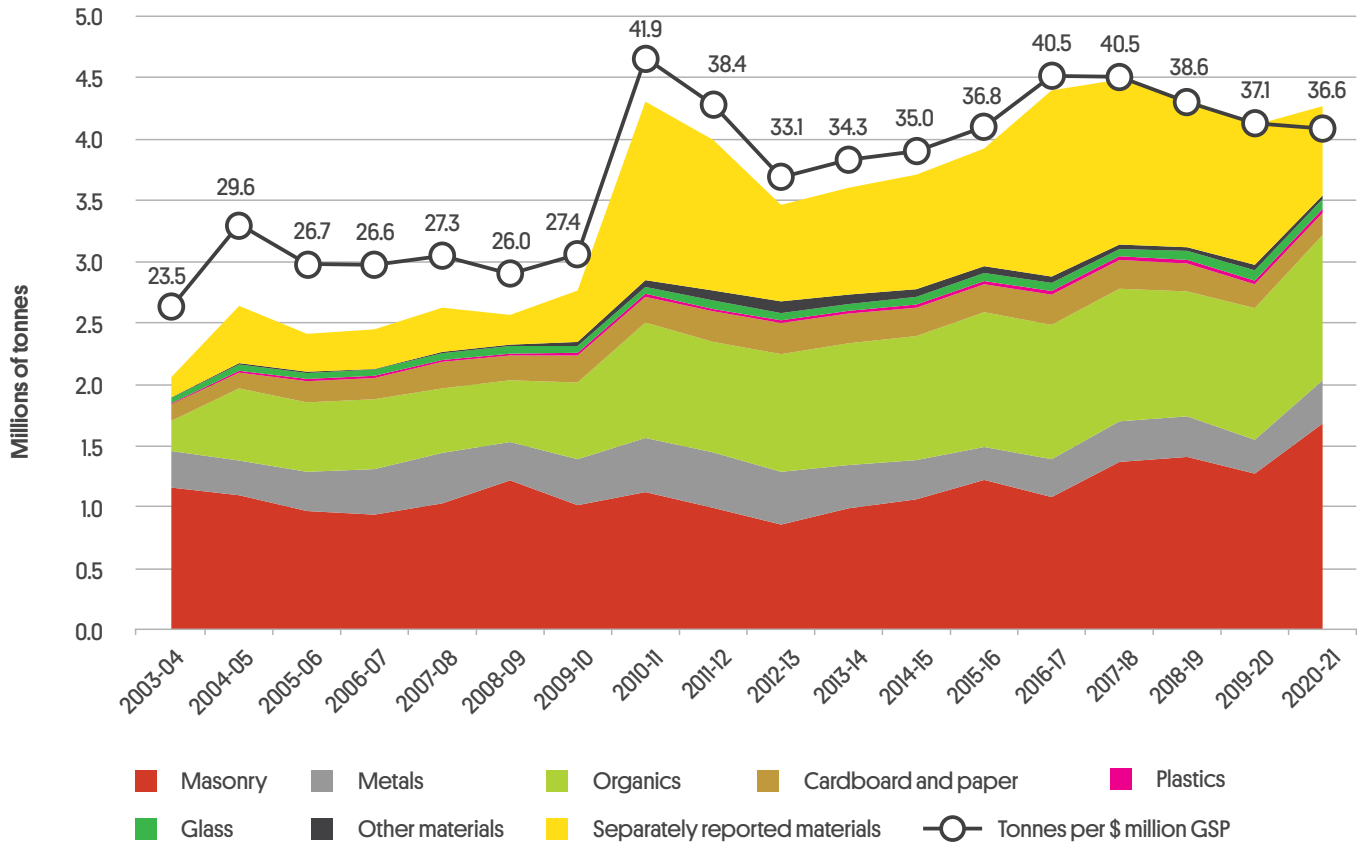
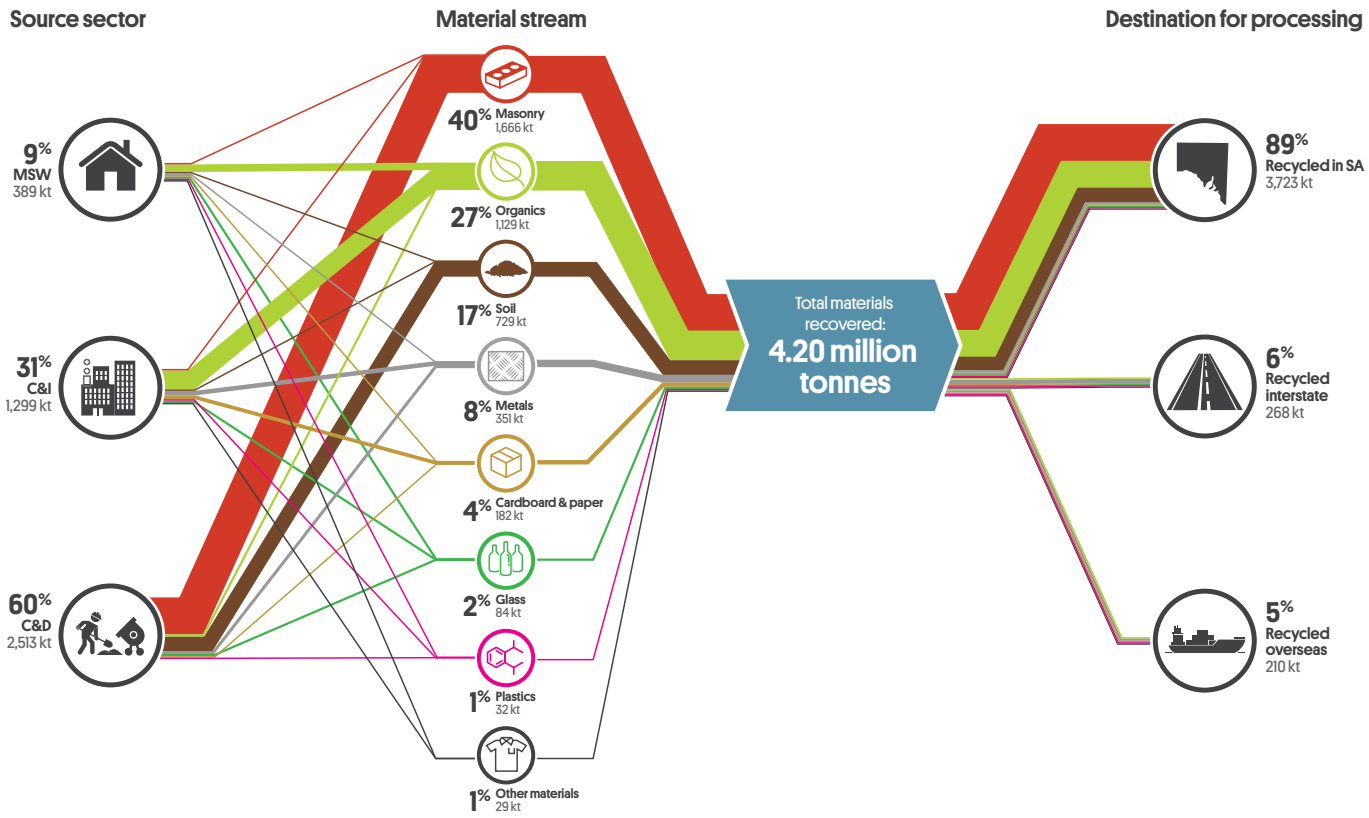


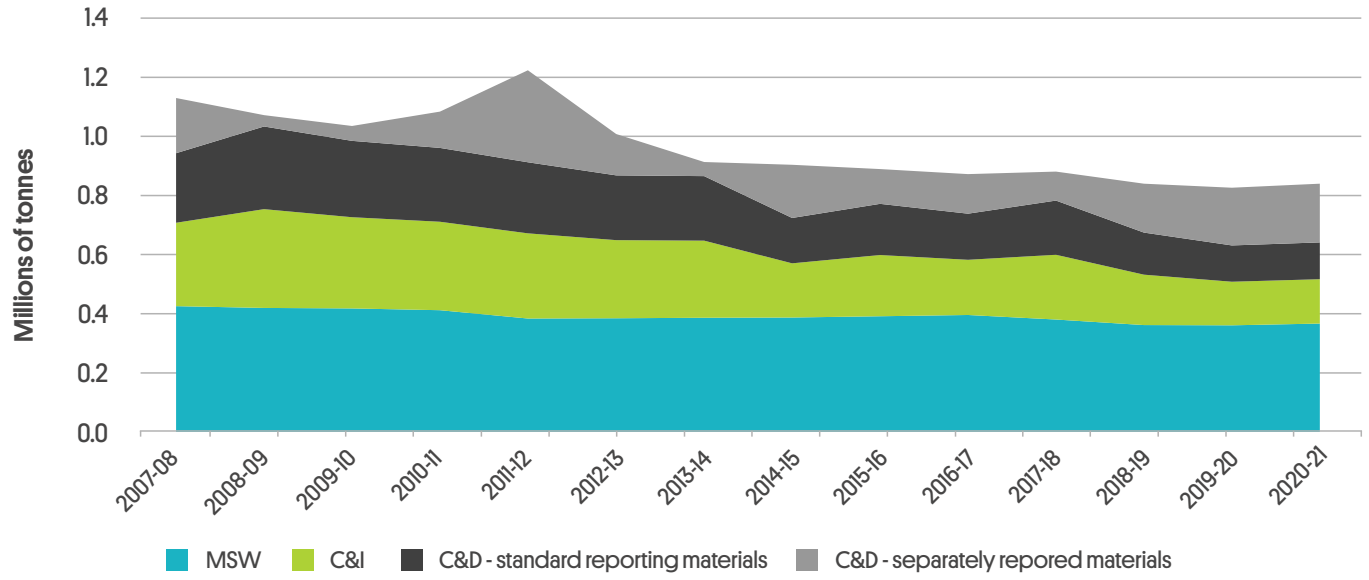
Figure 4 Resource recovery in SA, 2020-21, by material, source stream and destination



Landfill disposal

SA disposed about 840 kt of waste to landfill in 2020-21, an increase from the 827 kt landfilled in 2019-20. Figure 5 displays trends for disposal by source stream, and shows that most landfill waste is from the municipal stream.

Figure 5 Landfill disposal in SA since 2007-08 by source stream



Source stream

The source stream origin for SA waste and recovered materials in 2020-21 is shown in Table 4, Figure 6 and Figure 7. Like previous years, recovered materials mostly comprised C&D waste (60%), followed by C&I (31%) and MSW (9%). On the other hand, waste disposed to landfill was mostly MSW (44%), followed closely by C&D (39%) and lastly C&I (18%).

The recovery rates for the C&I and C&D streams were high and both close to 90%, but the rate for MSW was much lower at 51%. This rate is about the same as last year and the municipal stream still holds the most opportunity for improvement.

Table 4 SA resource recovery and landfill disposal by source stream in 2020-21

	Recovery		Landfill disposal		Recovery rate
Source stream	kt	% of total	kt	% of total	
MSW	389	9%	367	44%	51.5%
C&I	1,299	31%	150	18%	89.7%
C&D	2,513	60%	324	39%	88.6%
Total	**4,201**	**100%**	**840**	**100%**	**83.3%**

Figure 6 Resource recovery in SA since 2007-08 by source stream

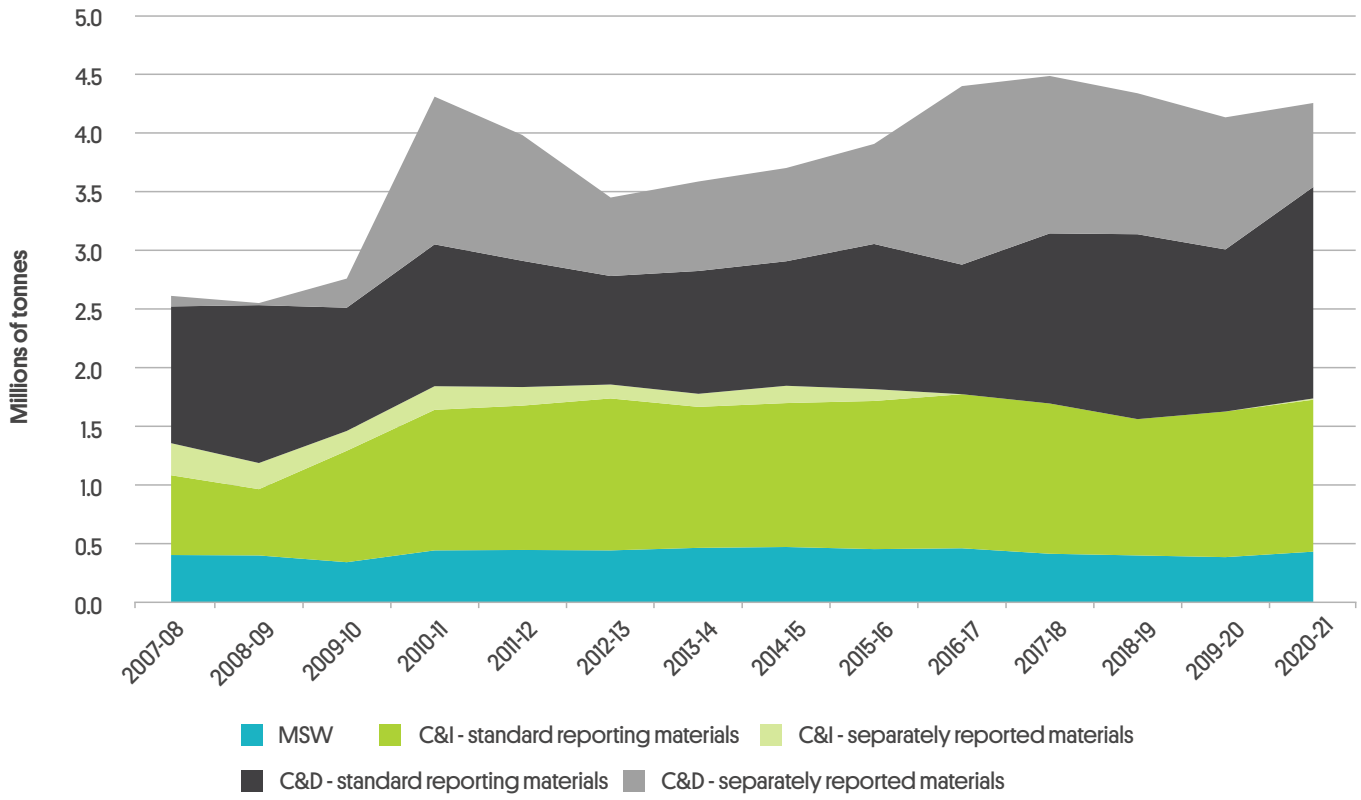
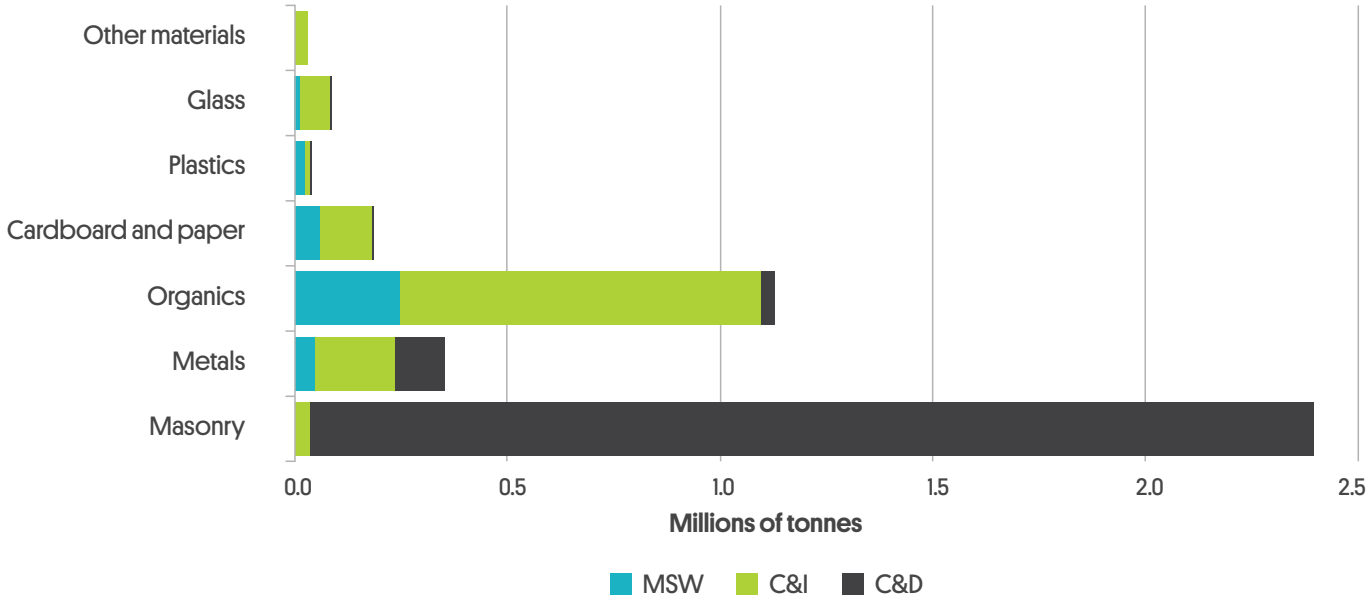


Figure 7 Source stream of recovered materials by material category, SA 2020-21



Geographical origin

The majority of SA's waste and recovered materials originate from SA's metropolitan area, where most reside. Metro SA contributed about 3,518 kt (84%) of the state's total recovered materials in 2020-21, and 599 kt (71%) of total disposed waste. Metro SA achieved an 85.4% recovery rate in 2020-21.

Regional SA is an important part of the state's resource recovery network, and contributed 683 kt (16%) of total recovered materials in the 2020-21 financial year. Regional SA also deposited about 241 kt (29% of total disposal) of waste to landfill, achieving a recovery rate of 73.9%.

When comparing 2020-21 to 2019-20:

- metro recovery and disposal tonnes increased from 3,452 kt to 3,518 kt and 569 kt to 599 kt, respectively, which resulted in an overall slight decrease in recovery rate from 85.8% to 85.4%
- regional recovery remained at 683 kt and regional disposal fell from 257 kt to 241 kt, resulting in an increase in recovery rate from 72.6% to 73.9%.

Table 5 SA resource recovery and landfill disposal by geographical origin in 2020-21

	Recovery		Landfill disposal		Recovery rate
Geographical origin	kt	% of total	kt	% of total	
Metro	3,518	84%	599	71%	85.4%
Regional	683	16%	241	29%	73.9%
Total	**4,201**	**100%**	**840**	**100%**	**83.3%**

The indicative locations of SA's recycling and reprocessing facilities are shown overleaf in Figure 8 and Figure 9.

Figure 8 Approximate geographical location of main sites of recyclers and reprocessors in SA

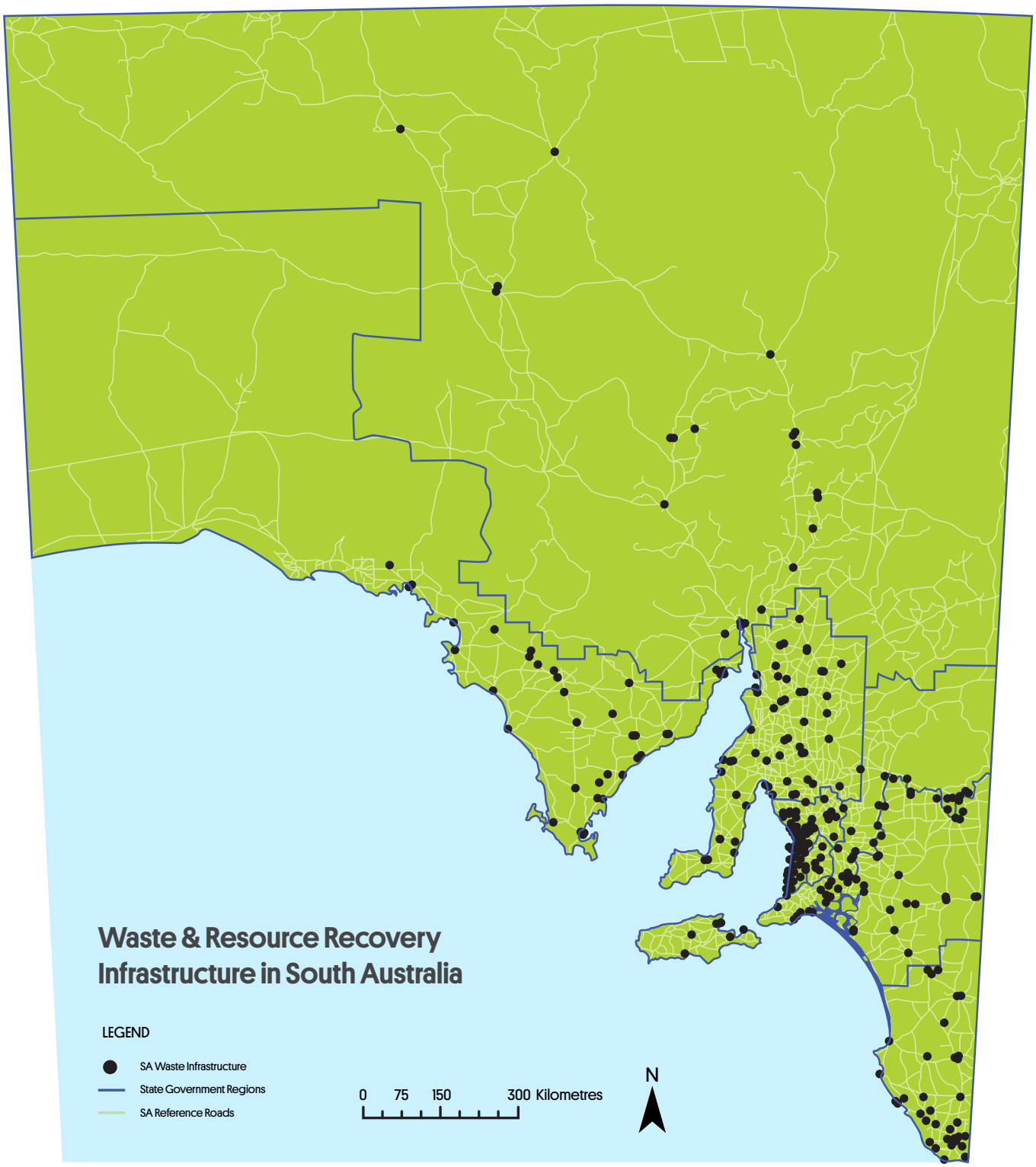
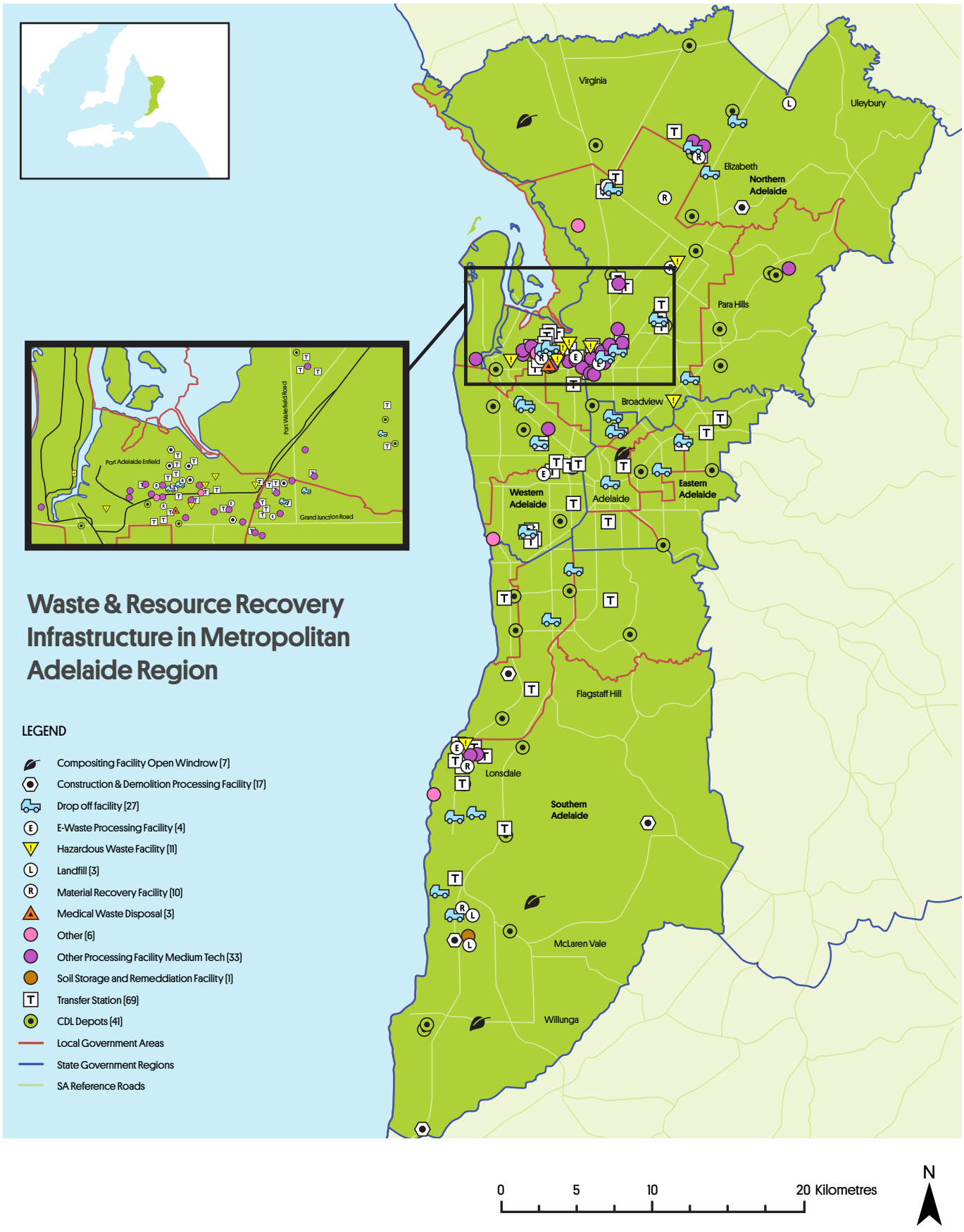


Figure 9 Approximate geographical location of main sites of recyclers and reprocessors in Adelaide



Destination for recovered materials

Most of SA's recovered materials are reprocessed within the state. In 2020-21, 89% of reported materials were reprocessed in SA. About 6% of materials were reprocessed interstate and 5% overseas. In 2019-20, 88% of materials where reprocessed in SA, 5% interstate and 7% overseas. Table 6 below summarises recovery of SA materials by reprocessing destination, while Table 7 provides a more detailed breakdown by material category.

Table 6 Destination of SA sourced materials in 2020-21

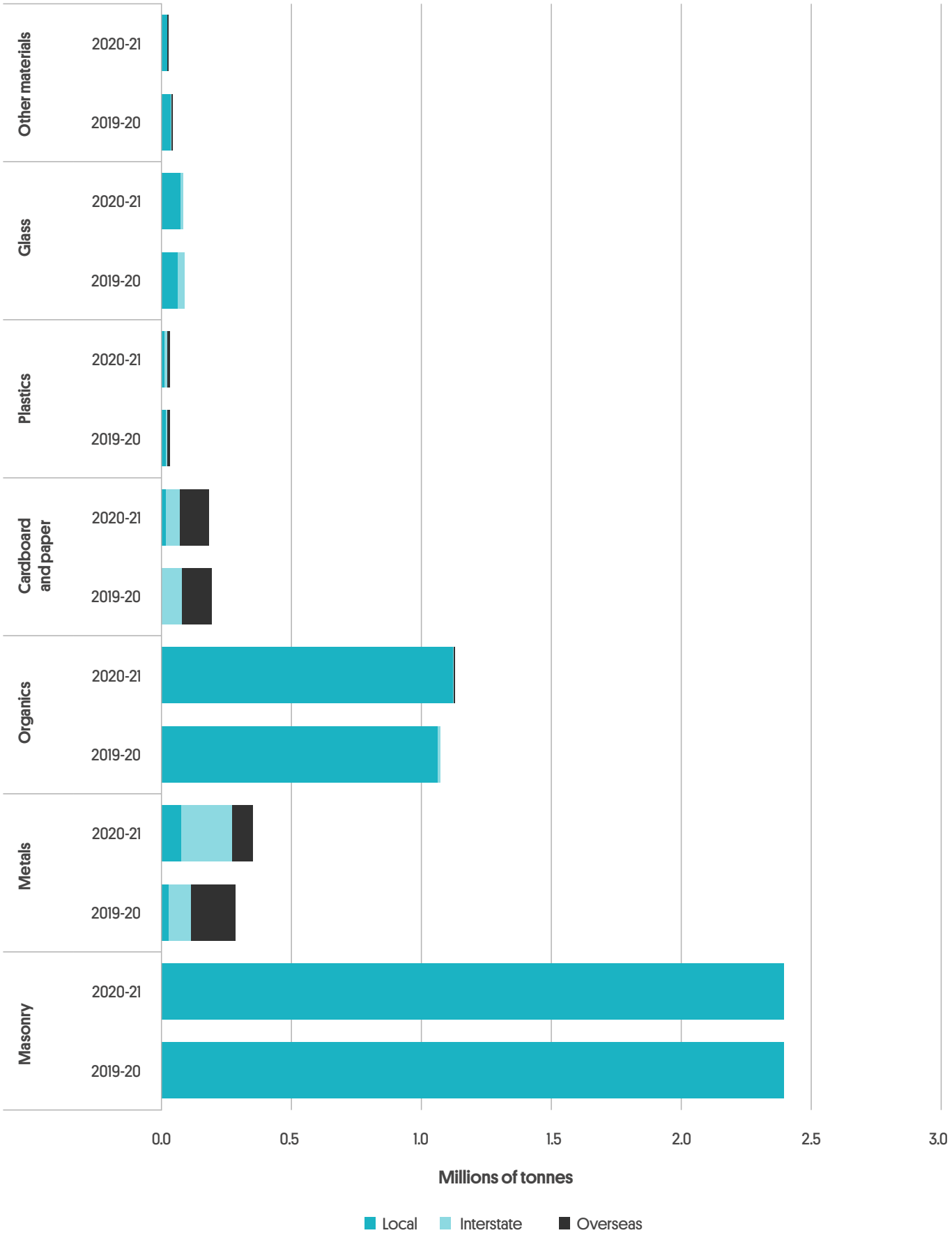
	Recovery	
Destination	**kt**	**% of total**
SA	3,723	89%
Interstate	268	6%
Overseas	210	5%
Total	**4,201**	**100%**

All masonry and separately reported materials (clays, fines, rubble and soil) were reprocessed locally, as well as almost all organics. Additionally, a high proportion of glass (88%), other materials (72%) and plastics (54%) were reprocessed in SA in 2020-21. Most metals (56%) were sent interstate for reprocessing, and most cardboard and paper (63%) were sent overseas. Some materials sent interstate may have been subsequently exported overseas.

Table 7 Destination of SA sourced materials in 2020-21 by material category

	Percent of material recovered (%)		
Material category	**SA**	**Interstate**	**Overseas**
Masonry	100%	0%	0%
Separately reported materials	100%	0%	0%
Organics	100%	0%	<1%
Glass	88%	12%	0%
Other materials	72%	13%	15%
Plastics	54%	18%	28%
Metals	21%	56%	23%
Cardboard and paper	9%	28%	63%
Total	**89%**	**6%**	**5%**

Figure 10 Destination of SA sourced materials by material category in 2020-21 and 2019-20



Energy recovery

Table 8 shows total resource recovery of SA materials in 2020-21, split between recycling and energy recovery. Energy recovery is defined as processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation.

In this report, the quantity of waste allocated to the fate 'energy recovery' is SA derived waste materials recovered and used for the purpose of energy production in SA, instead of being sent for landfill disposal. It excludes:

- residuals from energy from waste facilities that are recycled or sent to landfill
- landfill waste that produces methane gas used for energy recovery.

About 137 kt of SA materials were recovered for energy in 2020-21, slightly down from the 139 kt from the previous year. This equated to about 3.3% of total recovered volumes, also slightly down from 2019-20's 3.8%.

The energy recovery sector is anticipated to expand in the coming years, particularly the thermal incineration of municipal residuals, which may contribute towards SA's MSW diversion targets.

Table 8 Material and energy recovery, SA 2020-21

Recovery type	Tonnes	Contribution to recovery rate (%)
Material recovery	4,064,000	96.7%
Energy recovery	137,000	3.3%
Total (resource recovery)	**4,201,000**	**100%**

Imports

The survey covers reporting of materials that industry imports from interstate or overseas, however these do not count towards SA's recycling performance, and do not include already reprocessed materials imported into SA for manufacturing. Imports into SA in 2020-21 are shown in Table 9.

Table 9 Materials reported as imported to SA for resource recovery in 2020-21

	Imported tonnes								
Material category	**ACT**	**NSW**	**NT**	**Qld**	**Tas**	**Vic**	**WA**	**Overseas**	**Total**
Masonry	-	-	-	-	-	-	-	-	-
Metals	-	-	5,900	-	-	8,900	-	30	14,800
Organics	-	1,800	-	-	-	60,400	-	-	62,200
Cardboard and paper	-	-	20	-	-	-	-	300	320
Plastics	-	-	200	-	-	-	-	80	280
Glass	-	-	-	-	-	-	-	6,400	6,400
Other materials	-	-	-	-	-	-	-	34,100	34,100
Total	**-**	**1,800**	**6,100**	**-**	**-**	**69,300**	**-**	**40,900**	**118,100**

Reported imports from other states and territories were lower in 2020-21 than the previous year, however this is likely a data reporting issue. Less than 10% of survey respondents provided imports information in the 2020-21 survey, which again highlights the importance of mandatory reporting. Imports from overseas in Table 9 are based on Australian Bureau of Statistics trade data.

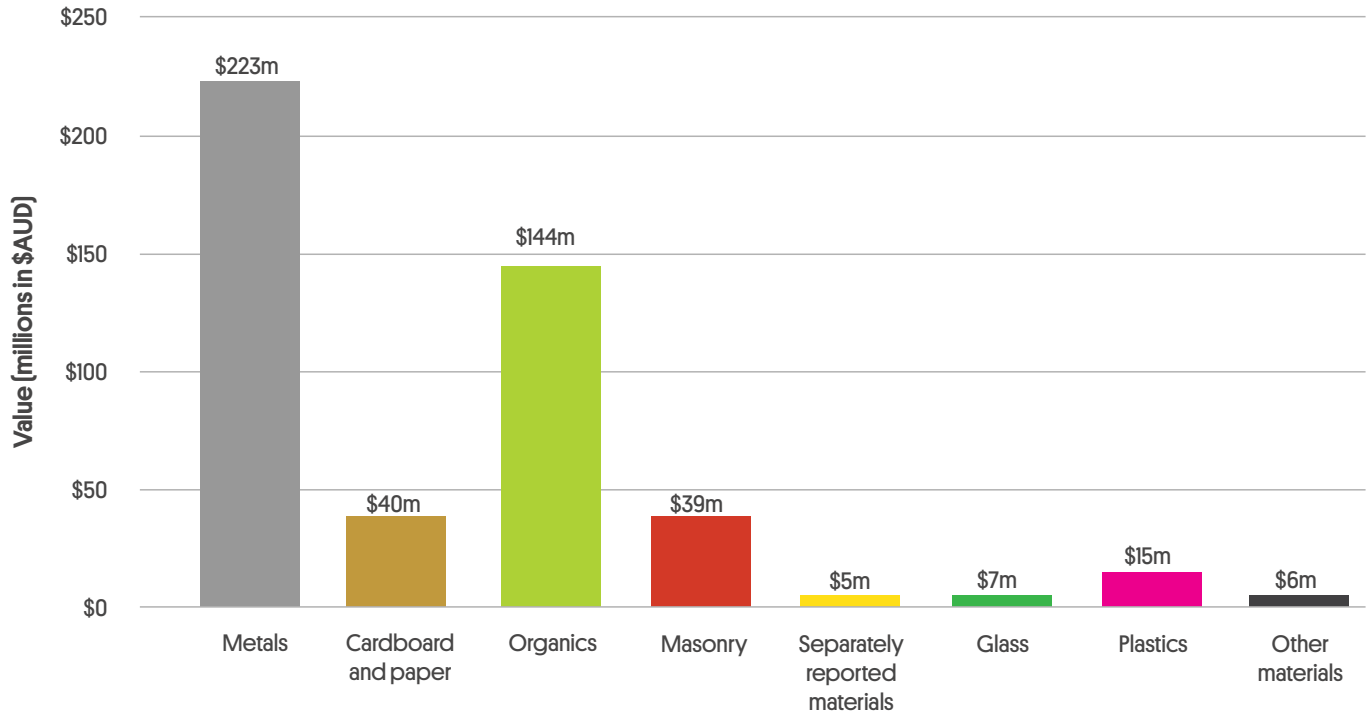
Market value of resource recovery

Survey participants were requested to provide an average value for their materials, and these were used to estimate the total market value of resource recovery in SA. Table 10 lists the estimated on-sale price per tonne for different recovered materials based on industry responses to the survey. The values in Table 10, coupled with recovered tonnes, were used to estimate the total market value of resource recovered materials seen in Figure 11. A more detailed breakdown of the value of resource recovery in SA is provided in Section 6.

Table 10 Assumed values for recovered materials in SA in 2020-21 based on survey responses

Material category or type	Estimated on-sale price ($/tonne)
Masonry	$23
Metals – iron and steel	$591
Metals – non-ferrous including aluminium	$1,245
Organics – meat rendering	$1,500
Organics – garden, food and timber	$20
Cardboard and paper	$224
Plastics	$420
Glass	$83
Other materials (including tyres and other rubber, leather and textiles and foundry sands)	$191
Separately reported materials and clean fill	$7

Figure 11 Estimated market value of resource recovered material in SA during 2020-21



Metals are a high-value commodity and represented the largest share of market value amongst recovered materials in SA. Recovered metals were estimated at a total value of $223 million in 2020-21, an increase from $183 million in 2019-20. This increase was attributed to iron and steel recovery, which increased in both quantity and value in 2020-21.

Organics was estimated as the second greatest contributor to total value in 2020-21 at $144 million, predominantly due to a strong value per tonne for meat rendering products (e.g. tallow). This is an increase from last year's $100 million.

Cardboard and paper prices have been somewhat volatile but industry insights suggest export markets remain strong. The price per tonne for cardboard and paper increased considerably in 2020-21 compared to 2019-20, from $109 to $224 per tonne. The material's total estimate value followed suit, increasing from $21 million to $40 million.

Masonry contributed a good portion of total value in 2020-21, estimated at $39 million, an increase from 2019-20 due to increased tonnes.

Of the remaining material categories, plastics recovery was estimated to contribute a total value of $15 million in SA in 2020-21, glass $7 million, other materials $6 million and separately reported materials (clay, fines rubble and soil) $5 million.

In total, the estimated value of SA's resource recovery in 2020-21 was $478 million. This is a considerable increase from 2019-20, due to increased recovery overall, higher reported values for some materials, and industry bounce-back from COVID-19.

Disaster waste

SA recorded 145 tonnes of bushfire waste sent to landfill in 2020-21, thankfully a small fraction of the 50,000 tonnes[4] reported in the *Recycling Activity Survey 2019-20 Report*, which resulted from the devastating bushfires that year.

4 A conservative estimate for Adelaide Hills and Kangaroo Island alone.

2.2 Performance against state targets

In 2020, Green Industries SA released *South Australia's Waste Strategy 2020-25*. The strategy defines waste diversion and reduction targets to 2025, which are guided by an overall target of zero avoidable waste to landfill by 2030[5]. This section details SA's progress in achieving these targets.

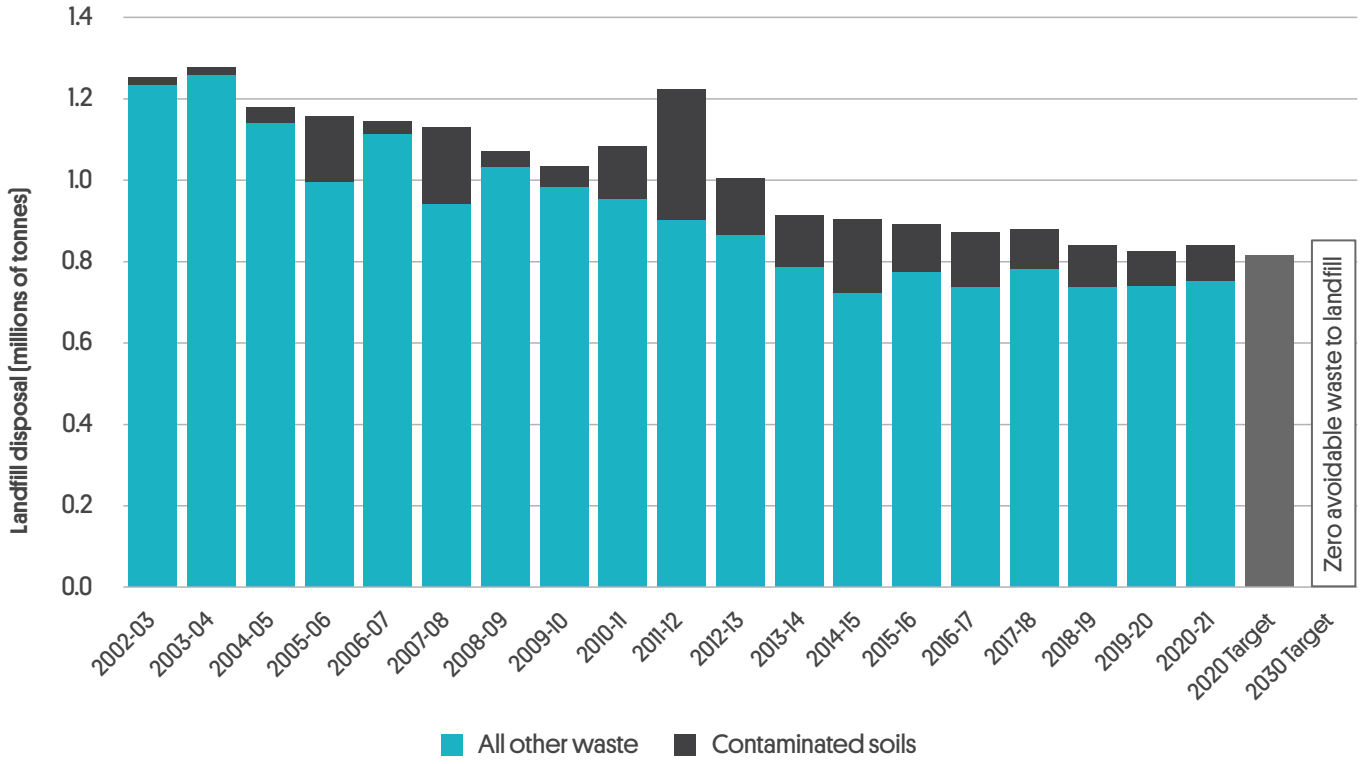
Landfill diversion target

South Australia's Waste Strategy 2020-25 sets out a goal for zero avoidable waste to landfill by 2030[5]. The state disposed about 840 kt of waste to landfill in 2020-21, an increase from 827 kt in 2019-20. A portfolio of actions must be implemented to achieve SA's ambitious landfill target for 2030, however significant work is underway. Increased domestic reprocessing and energy recovery capacity are expected to help improve landfill diversion rates in the coming years.

Figure 12 shows SA's landfill disposal trend since 2002-03.

SA recently surpassed its target for reducing waste to landfill by 35% by 2020 from a 2002-03 baseline. In 2019-20, the state achieved an overall reduction of waste to landfill compared to 2003-04 of 34%, but when excluding contaminated soils this increased to a 49% reduction. Therefore, depending on whether landfilled contaminated soils is included, SA either fell just short of its 2020 target or easily achieved it.

Figure 12 Landfill disposal trend since 2002-03, including state targets for 2020 and 2030



5 Zero avoidable waste to landfill equates to the diversion of all waste from landfill where it is technologically, environmentally, and economically practicable to do so. 'Unavoidable' waste therefore refers to wastes for which no other current treatment is available including (but not limited to) asbestos, toxic and quarantine waste.

Waste generation target

South Australia's Waste Strategy 2020-25 sets a 5% reduction in waste generation per capita from a 2020 baseline. Table 11 summarises a five-year trend in waste generation per capita. Waste generation per capita increased by 44 kilograms (1.6%) in 2020-21 compared to the year before, but over the whole period, waste generation rates appear to be trending downwards. COVID-19 may have affected overall waste generation in 2019-20 and 2020-21 (e.g. lower volumes of business waste due to intermittent lockdowns).

Table 11 Waste generation per capita since 2016-17, including the state target for 2025

						Change (%)	Target
Recovery type	2016-17	2017-18	2018-19	2019-20	2020-21	19-20 to 20-21	2025
Waste generation per capita (kg/person/yr)	3,060	3,090	2,960	2,800	2,844	1.6%	5% reduction from 2020

Metropolitan diversion target

SA has state targets for waste diversion from landfill from its metropolitan region by source stream. The state is moving towards its 2023 goals of 65% diversion for MSW, 85% diversion for C&I, and 90% diversion for C&D. Table 12 presents the diversion rate achieved by metropolitan SA in 2020-21, together with state targets for 2023 and 2025.

Our C&I sector achieved a very high diversion rate at 96.9%, already surpassing both the 2023 and 2025 targets of 85% and 90%, respectively. Our C&D sector achieved a diversion rate of 92.5%, also surpassing the 2023 target of 90% and close to the 2025 target of 95%. In SA, out of the three waste streams, MSW historically has the lowest diversion rate, and this continued in 2020-21 with a rate of 56.1%. The municipal stream has the most room for improvement but is not too far from the 2023 target of 65%. Further diversion of food organics will help close the gap towards the target.

Table 12 Metropolitan diversion rate for SA in 2020-21, including state targets to 2025

	Metro diversion rate for 2020-21	Metro diversion target	
Source stream		2023	2025
MSW	56.1%	65%	75%
C&I waste	96.9%	85%	90%
C&D waste	92.5%	90%	95%

2.3 Local government kerbside recovery

Local governments capture data on materials collected in household bins at kerbside for disposal or recycling. These data are presented and discussed in this section. The data represent a subset of the MSW tonnes discussed elsewhere in this report, which also includes non-kerbside municipal waste such as hard waste, street sweepings and domestic materials dropped off at transfer stations.

Overall kerbside collections

Table 13 shows data on materials collected in household residual, recycling and organics bins at kerbside in SA in 2020-21. About 674 kt of kerbside materials were collected in SA, including 522 kt from the metro region and 152 kt from regional areas. Most kerbside waste was collected in residual bins (352 kt), followed by organics bins (192 kt), and recycling bins (130 kt).

SA's recovery rate for kerbside waste in 2020-21 was 47.8%, slightly higher than the previous year's rate of 47.6%. Recovery was higher for metropolitan councils (50.4%) than regional councils (38.8%). Compared to the previous year, performance in 2020-21 was similar for metropolitan councils (50.5%) but improved for regional SA (37.7%).

Table 13 Materials collected from households at kerbside in SA in 2020-21

Region	Collected at kerbside (kt)				Recovery rate (%)
	Residual	Recycling	Organics	Total	
Metro	259	101	162	522	50.4%
Regional	93	29	30	152	38.8%
SA	352	130	192	674	47.8%

Recovery by region

Table 14 shows population and kerbside data for 2020-21 at the sub-region level, including kilograms of kerbside waste per capita. For metropolitan SA, the Central Eastern region showed the best performance, having achieved the highest overall recovery rate (54.6%) and generated the least waste per capita (383 kg per person per year). Southern and Western councils performed similar to each other, both achieving relatively good recovery rates (51-52%) but also high waste generation rates (402-409 kg per person per year). The Northern region had the lowest waste generation and recovery rates in SA's metropolitan, and regional SA had the lowest waste generation and recovery rates overall.

Table 14 Population and kerbside data statistics by region

Region	Population[6]	Kerbside waste collected (kt)	Kerbside waste per capita (kg/capita)	Recovery rate
Central Eastern	272,340	104	383	54.6%
Northern	366,969	139	379	45.7%
Southern	337,341	138	409	52.0%
Western	349,761	140	402	51.3%
Metro	**1,326,411**	**522**	**393**	**50.4%**
Regional	443,866	152	342	38.8%
SA	**1,770,277**	**674**	**381**	**47.8%**

Coverage

Nearly all households in SA are provided a kerbside service, as summarised in Table 15. Note that coverage percentages in Table 15 are based on figures used in the *Recycling Activity Survey 2017-18 Report*.

Table 15 Kerbside service coverage for SA households

Stream	Number of services in SA	Coverage
Residual	715,689	98.7%
Recycling	699,736	96.5%
Organics	660,580	91.1%
Total households in SA	725,115[7]	100%

6 ABS (2022) *Population estimates by LGA, Significant Urban Area, Remoteness Area and electoral division, 2001 to 2021*, available from: www.abs.gov.au/statistics/people/population/regional-population

7 ABS (2019) *3236.0 Household and Family Projections, Australia, 2016 to 2041* (Series II), online at: www.abs.gov.au/statistics/people/population/household-and-family-projections-australia/2016-2041

2.4 Comparative performance with other jurisdictions

SA has led recycling and resource recovery performance in Australia for many years.

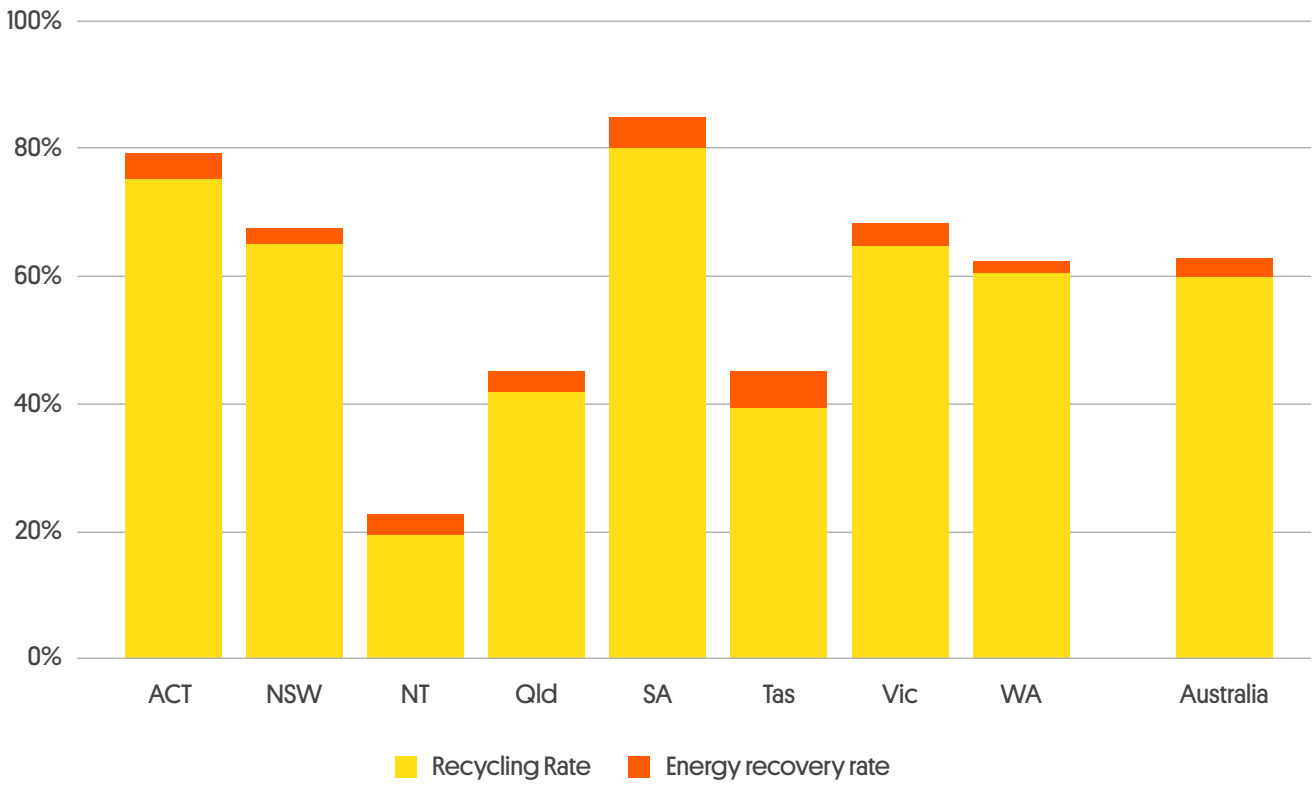
The methods used by states and territories to measure and report waste vary. The *National Waste Report 2020* (Blue Environment 2020), released by the Department of Agriculture, Water and the Environment in 2020, adjusts these methods to provide a consistent comparison of recovery rates across states and territories. These data are discussed in this section.

Figure 13 is taken from the *National Waste Report 2020* and shows resource recovery and recycling rates for each Australian jurisdiction in 2018-19. SA had the highest of both rates with a recovery rate of 85% and a recycling rate of 80%. ACT was not far behind with a recovery rate of 79% and a recycling rate of 75%. NSW and Vic tied for third best performing states, followed closely by WA, then Qld, Tas and NT. Overall, Australia achieved a recovery rate of 63% in 2018-19, and a recycling rate of 60%.

In 2020-21, SA maintained similar rates to those in Figure 13.

Figure 13 Resource recovery and recycling rates by jurisdiction, 2018-19

	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
Recovery rate	79%	68%	23%	45%	85%	45%	68%	62%	63%
Recycling rate	75%	65%	19%	42%	80%	39%	65%	60%	60%



Source: National Waste Report 2020 (Blue Environment 2020)

2.5 Employment in the SA resource recovery sector

SA's resource recovery sector employs thousands of people across a wide range of jobs. The survey asked SA recyclers about their workforce and employment details, and Table 16 and Table 17 summarise the results. The data represents a sub-set of total employment in SA's waste and resource recovery industry, which includes a wider range of positions (e.g. landfill operators).

Table 16 shows an increasing number of reported full-time equivalent employees in SA's resource recovery sector over the last few years. Reported full-time equivalent employees increased from 2,098 in 2019-20 to 2,108 in the latest year[8]. Companies and organisations that reported employee numbers in 2020-21 made up 69% of the year's total recovered tonnes, suggesting the true number may be around 3,000.

Table 16 Reported full-time equivalent employees in SA's resource recovery sector based on survey results

	2017-18	2018-19	2019-20	2020-21
Total full time equivalent employees	1,831	1,850	2,098	2,108

The survey asked respondents to breakdown their reported workforce by employment classification, and the results are shown in Table 17, together with the results from last year. Overall, the percentage of reported employees by employee type remained roughly the same. Machinery operators were the most commonly reported employee classification, followed by drivers and administration.

Table 17 Full time equivalent employees in SA's resource recovery sector by employee type

Employment type	2019-20	2020-21
Unskilled	17%	9%
Administration	15%	13%
Construction/design	0.5%	0.2%
Driver	17%	18%
Machinery operator	26%	31%
Sorting	4%	3%
Technical support	4%	8%
Sales/marketing	4%	5%
Supervisor	5%	7%
Other	7%	6%
Total	**100%**	**100%**

8 This increase could be partly due to more companies reporting employee data in the survey.

2.6 Reuse and the circular economy

Reuse

Reuse can be defined as the reallocation of products or materials to a new owner or purpose without reprocessing or remanufacture (but potentially with some repair). The practice promotes the cycling of material without the need to consume new resources. Australia has a longstanding reuse network that includes its charities, non-government organisations (e.g. food rescue organisations), community groups and online trading platforms (e.g. Gumtree). Items and products commonly recirculated via the Australia's reuse economy include clothing, food, home furniture, whitegoods, vehicles and electronics.

MRA (2021) found that each year, Australians divert about 310 kt of clothing for reuse to charitable organisations nationally. Almost 10% of this is attributed to South Australians. According to the study, reusing clothes instead of landfilling them reduces carbon emissions by 66%, water consumption by 57% and energy use by 59%. Reused clothing also generates an estimated revenue of $1,700 per tonne. Nationally, the charitable recovered clothing industry provides 5,300 jobs and volunteer places for 35,000 people again promoting the economic value in reuse practices.

The COVID-19 pandemic highlighted the importance of food reuse. Intermittent lockdowns led to a rise in food donations from hospitality, manufacturing, and farming industries. The hunger relief organisation, Foodbank, reported a 47% increase in demand for food and groceries in 2020 as a result of the pandemic (Foodbank 2020). In South Australia, more than 126,000 people are assisted every month by Foodbank.

Our survey targeted key players in SA's charitable network and reuse economy. Reported quantities from 2020-21 are shown in Table 18, together with estimated values for the reuse materials. Table 18 is expected to represent a large portion of reuse in SA, but certainly not the entire picture. Some items excluded from Table 18 would contribute significant volumes to overall reuse in SA but are difficult to measure, such as items traded via community platforms (e.g. Facebook Marketplace, Gumtree, etc.). Still, the quantities and estimated values in Table 18 highlight the importance of the reuse economy from both an environmental and economic standpoint. The detail of the reuse section in future reports will improve as better data become available.

Table 18 Reuse in SA in 2020-21 based on survey results

Reuse material	Reported reuse tonnes in 2020-21	Estimated value of reuse materials ($/tonne)[9]	Estimated value of reported reuse materials in 2020-21 ($/yr)
Food products	4,700	$6,000	$28,272,000
Clothes resold as clothes locally and overseas	4,600	$1,700	$7,749,000
Home furnishings and goods	1,400	$15,000	$21,600,000
Books	500	$1,000	$456,000
Electronic items	200	$11,800	$1,888,000
Other donations (toys, etc.)	1,100	n/a	n/a

Industry engagement with the circular economy concept

Our survey asked companies and organisations to nominate which factors were of the highest priority, in a circular economy, for selecting the end destination of the materials they receive. The results to this question are shown in Table 19. Note that not all survey participants provided a response to this question. Based on available data, economic and recycling reasons were the most commonly selected options.

Table 19 Responses to the question "which of the following factors is your highest priority when identifying the reprocessing destination for sourced goods and materials in a circular economy?"

Circular economy factor	Number of responses
Economic	17
Goods or materials being recycled	17
Avoiding landfill	13
Goods or materials being repaired or reused	5
Other	3

9 Based on values applied in the *Recycling Activity Survey 2019-20 Report*.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3 Material resource recovery reports

This section presents the key findings from analysis of 2020-21 survey data by material category and type, comprising:

- masonry – asphalt, bricks, concrete, plasterboard, and clays, fines, rubble and soil
- metals – iron and steel, aluminium, and non-ferrous metals
- organics – food organics, garden organics, timber, and other organics
- cardboard and paper – cardboard and waxed cardboard, liquid paperboard, magazines and newsprint, and printing and writing paper
- plastics – polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene (PP), polystyrene (PS), and mixed and/or other plastics
- glass – glass from food and beverage containers, and other glass
- other materials – fly ash, foundry sands, leather and textiles, and tyres and other rubber.

3.1 Masonry

About 2.40 million tonnes of masonry was recovered in SA in 2020-21, approximately the same as the quantity recovered in 2019-20. Compared to last years' reported tonnes, asphalt and concrete increased significantly while clay, fines, rubble and soil decreased. Recovery of bricks and plasterboard remained similar to last year.

Concrete contributed the greatest proportion of masonry materials (54%), followed by clay, fines, rubble and soil (30%), asphalt (14%), bricks (2%) and plasterboard (<1%). This is a change from last year, which had clay, fines, rubble and soil contributing the greatest proportion toward total masonry recovery at 48%, with concrete second at 41%. The change is partly due to some mass balance reporting becoming available for the first time in 2020-21 data, which reduced estimated quantities of clay, fines, rubble and soil.

Table 20 summarises masonry recovery in 2020-21.

Table 20 Masonry recovered, SA 2020-21

Material type	Net recovery (kt)
Asphalt	339
Bricks	44
Concrete	1,283
Plasterboard	0.9
Clay, fines, rubble and soil – clean fill	659
Clay, fines, rubble and soil – intermediate waste soil	70
Total	**2,395**

Figure 14 and Figure 15 show trends in recovered masonry materials types over time, while Figure 16 compares the reported composition of masonry materials in 2020-21 and 2019-20.

Figure 14 Masonry recovered since 2003-04 – concrete and clay, fines, rubble and soil

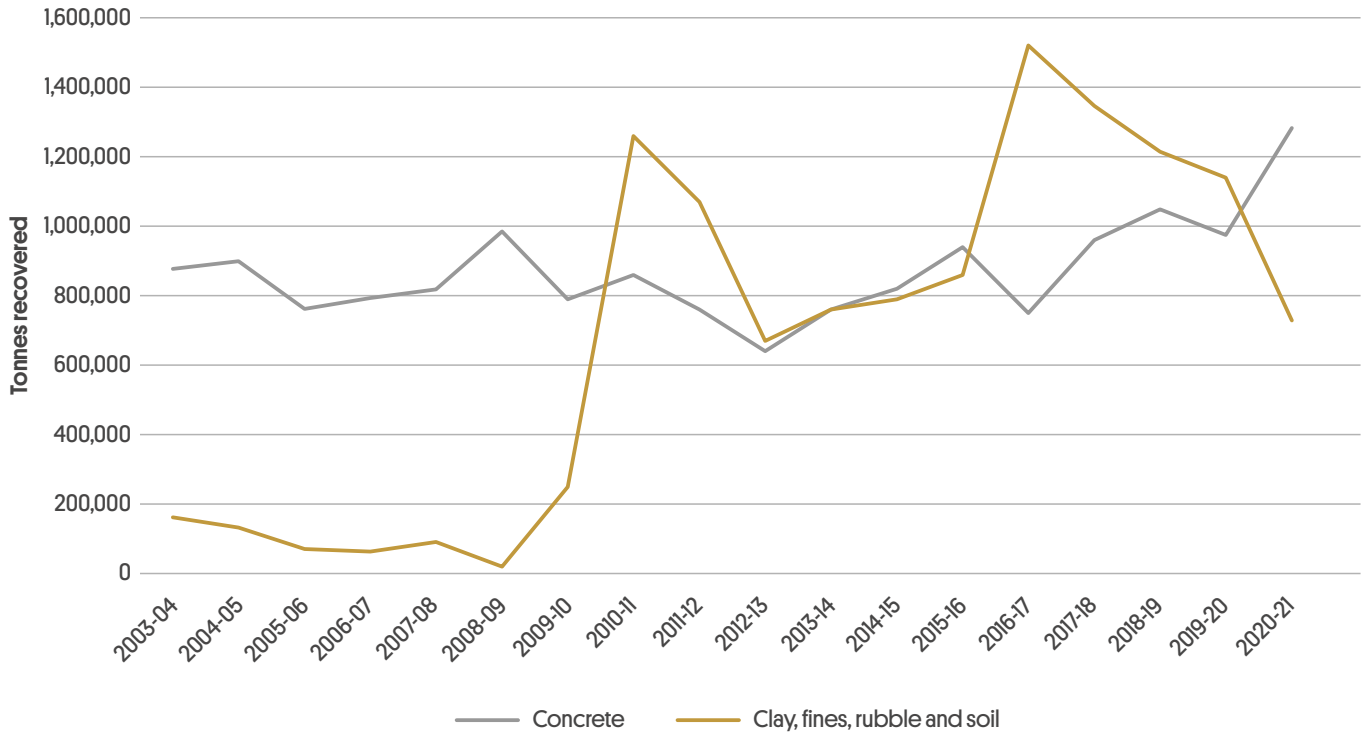


Figure 15 Masonry recovered since 2003-04 – asphalt, bricks and plasterboard

Figure 16 Reported percent composition of masonry recovered in 2020-21 and 2019-20

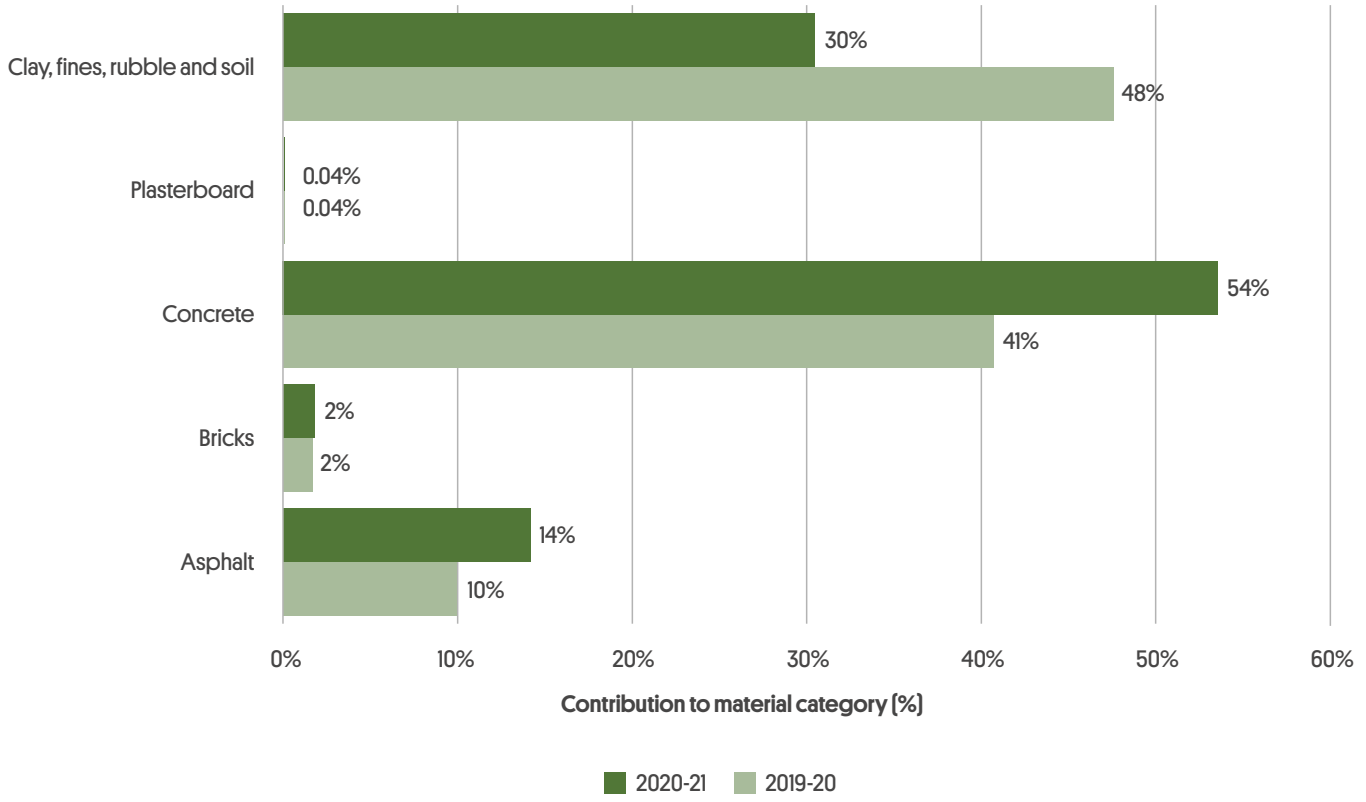


Table 21 below presents details for masonry recovery in SA in 2020-21. Masonry is mostly from infrastructure projects in the metropolitan region, and all recovered masonry is reprocessed locally in the state.

Table 21 Masonry recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Asphalt	0%	0%	100%	93%	7%	100%	0%	0%
Bricks	0%	4%	95%	83%	17%	100%	0%	0%
Concrete	0%	1%	99%	96%	4%	100%	0%	0%
Plasterboard	2%	3%	95%	98%	2%	100%	0%	0%
Clay, fines, rubble and soil – clean fill	0%	2%	98%	97%	3%	100%	0%	0%
Clay, fines, rubble and soil – intermediate waste soil	0%	0%	100%	100%	0%	100%	0%	0%
Total	**0%**	**1%**	**99%**	**95%**	**5%**	**100%**	**0%**	**0%**

3.2 Metals

Metals recovery increased in the 2020-21 financial year to about 351 kt, compared to the previous year's 268 kt. Recovered metals were mostly iron and steel (327 kt), with aluminium and non-ferrous metals contributing 12 kt and 11 kt, respectively.

Iron and steel recovery increased considerably from 2019-20, from 248 kt to 327 kt. Aluminium remained relatively similar with 12 kt recovered in 2020-21 and 11 kt recovered the previous financial year. Non-ferrous metals fell to 11 kt in 2020-21 compared to 19 kt the year before. Table 22 summarises metals recovery in SA in 2020-21.

Table 22 Metals recovered, SA 2020-21

Material type	Net recovery (kt)
Iron and steel	327
Aluminium	12
Non-ferrous metals	11
Copper	0.8
Non-ferrous metals (other)	11
Total	**351**

Figure 17 and Figure 18 show metals recovery trends since 2003-04. The percent composition that iron and steel, aluminium and non-ferrous metals contribute to overall metals recovery is presented in Figure 19.

Figure 17 Metals recovered since 2003-04 – iron and steel

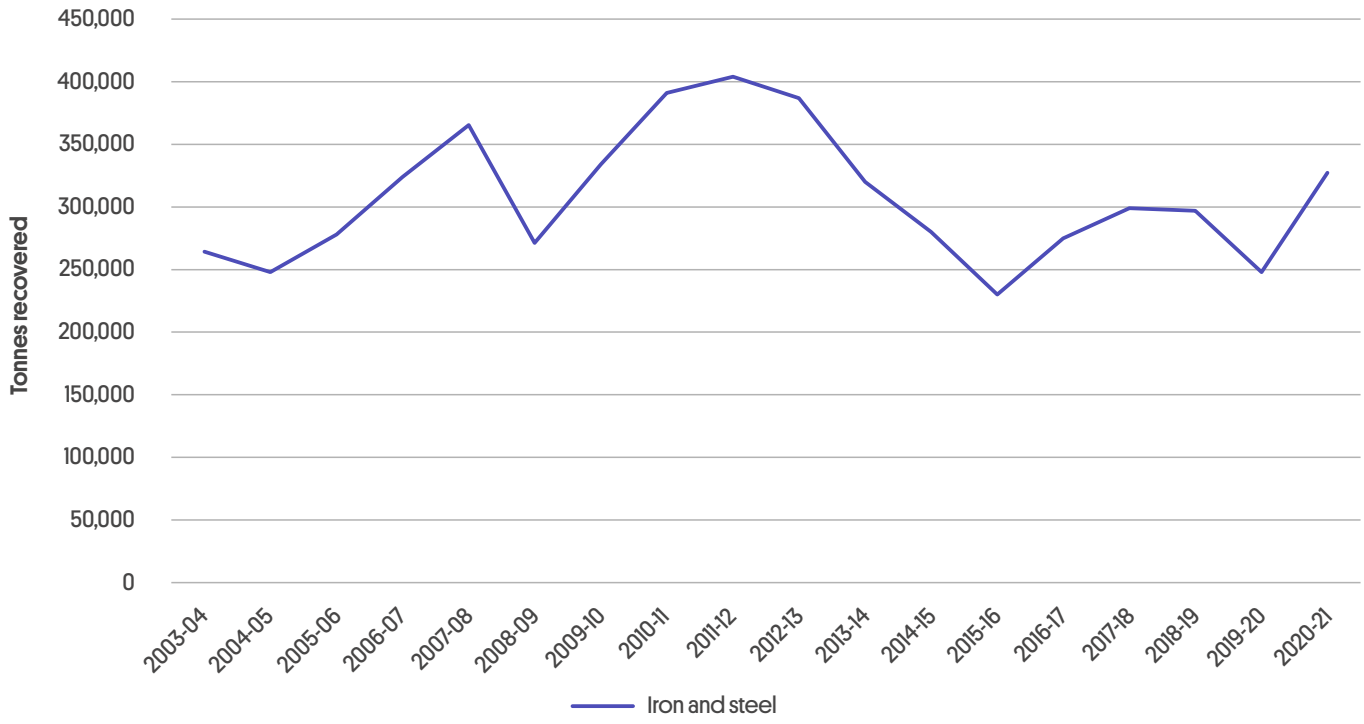


Figure 18 Metals recovered since 2003-04 – aluminium and non-ferrous metals

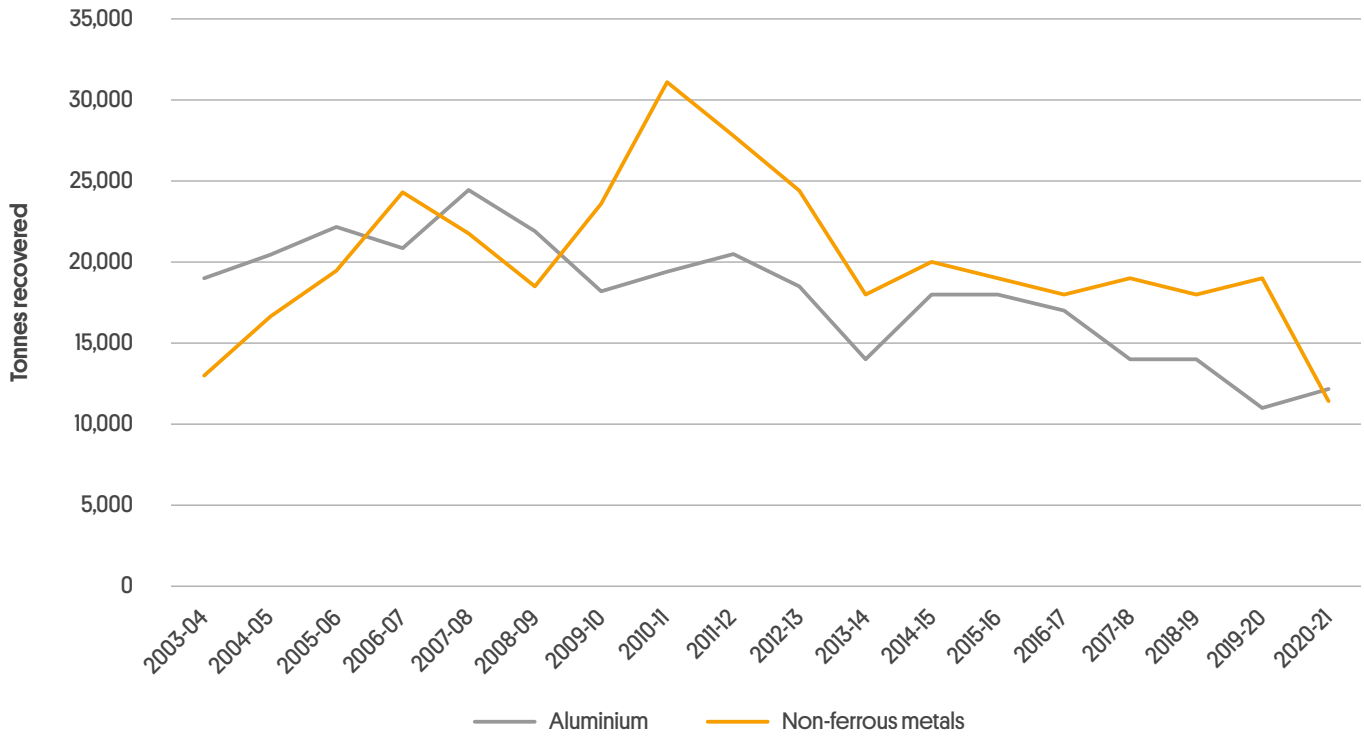


Figure 19 Reported percent composition of metals recovered in 2020-21 and 2019-20

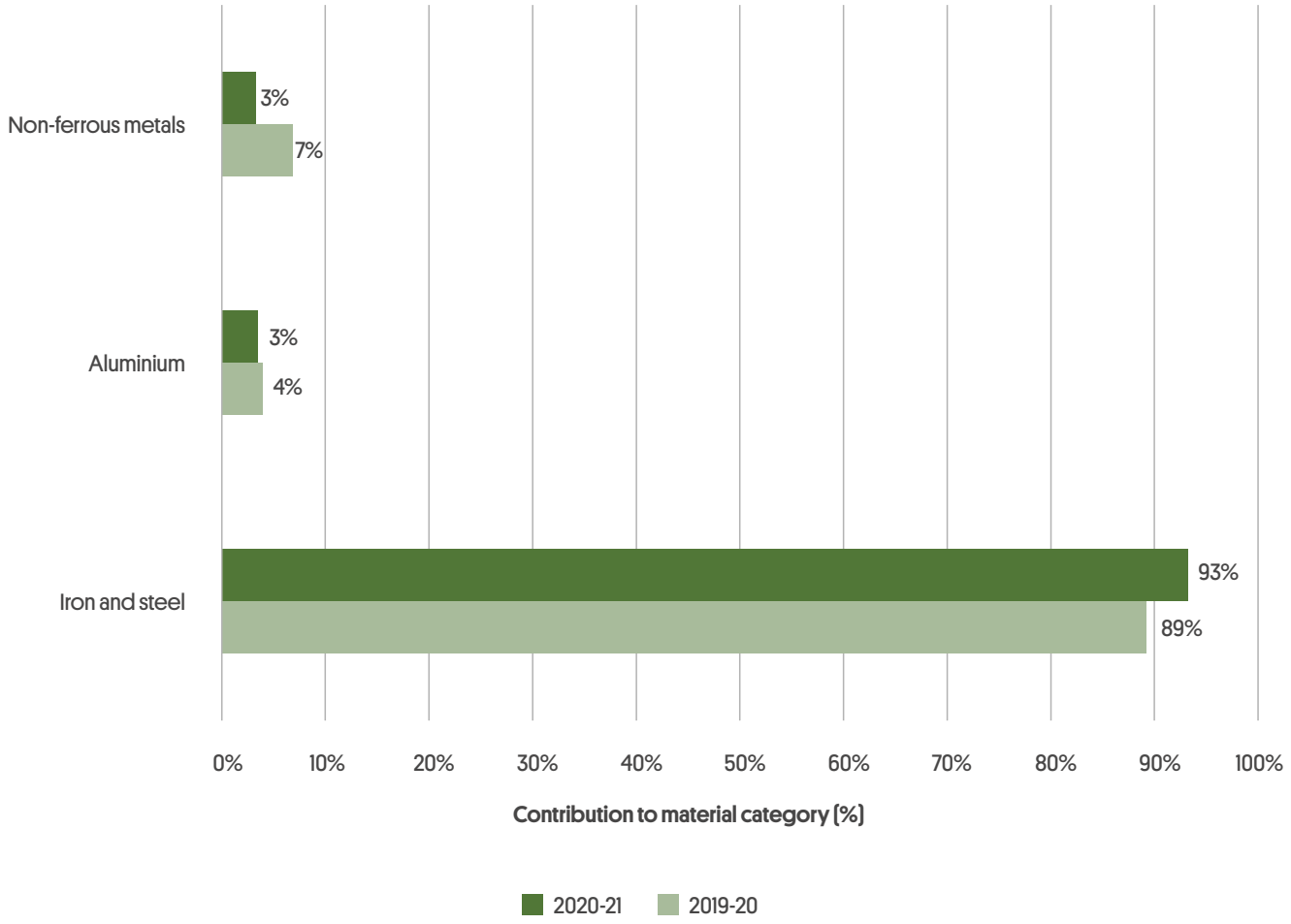


Table 23 shows metals recovery by metal type, source stream, geographical origin and reprocessing location. Recovered metals are mostly within the C&I stream but C&D still contributes about a third of overall quantities. Recovered SA metals are sent interstate for reprocessing (56%)[10], with 23% reprocessed overseas and 21% in SA. It is likely that some of materials sent interstate were subsequently exported overseas.

Table 23 Metals recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Iron and steel	12%	53%	35%	78%	22%	22%	59%	19%
Aluminium	45%	49%	5%	76%	24%	9%	12%	79%
Non-ferrous metals	12%	79%	9%	82%	18%	17%	10%	73%
Total	**13%**	**54%**	**33%**	**78%**	**22%**	**21%**	**56%**	**23%**

10 Much of this material is likely to have been exported from interstate ports.

3.3 Organics

Organics recovery remained strong in 2020-21. Overall, about 1.13 million tonnes of organic materials were recovered in 2020-21[11], an increase from 1.11 million tonnes in 2019-20. Table 24 summarises the recovery of food organics, garden organics, timber and other organics in SA in 2020-21.

Like previous years, 'other organics' contributed the most to overall organics recovery, at 56%. This portion increased considerably from 2019-20, from 528 kt to 634 kt. 'Other organics' includes meat rendering, waste grease and fat, waste sludge and biosolids, and miscellaneous organics. The increase was predominantly due to increased recovery of materials reported as miscellaneous organics.

About 277 kt of garden organics were recovered in SA in 2020-21, contributing about 25% towards overall organics recovery. Volumes increased from 250 kt in 2019-20.

Timber recovery dropped in 2020-21 compared to the previous year. About 202 kt of recovered timber was reported in 2020-21, while 315 kt were recovered in 2019-20. Timber comprised 17% of total organics recovery in 2020-21.

Food organics represent a major opportunity for increased diversion of organics. They increased slightly in 2020-21, but were still the lowest contributor to overall organics recovery at 1.4%.

11 In addition to the material accounted for in the section, approximately 20kt of organic materials derived from mixed waste was used in a trial. The status of this material remains uncertain, so it is not included as recycled or disposed. This will be resolved in the future CERRR.

Table 24 Organics recovered, SA 2020-21

Material type	Net recovery (kt)
Food organics	16
Garden organics	277
Timber	202
Other organics	634
Meat rendering	179
Waste grease and fat	71
Waste sludge and biosolids	79
Miscellaneous organics	305
Total	**1,129**

Figure 20 Organics recovered since 2003-04

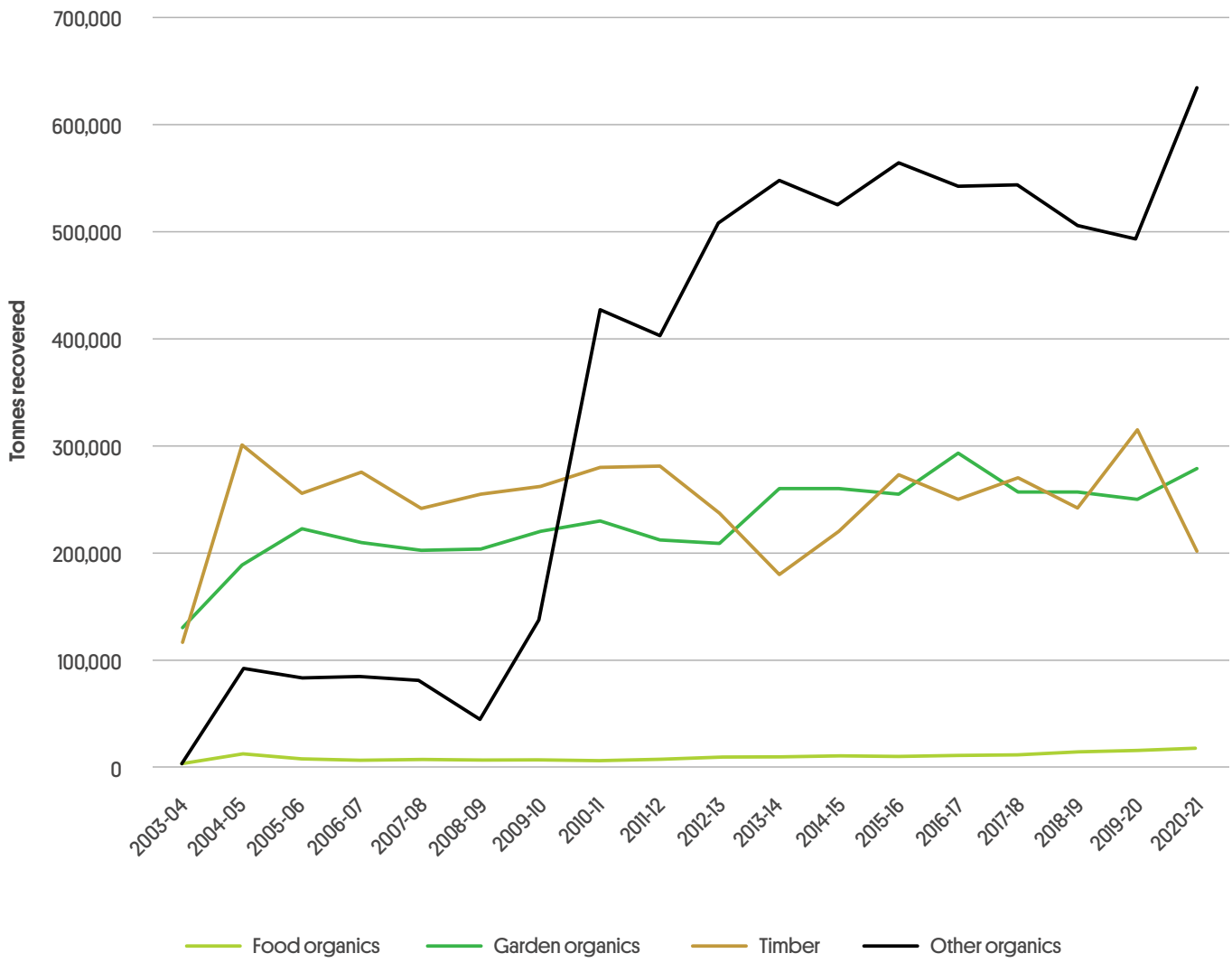


Figure 21 Other organics recovered since 2009-10 (when data first became available)

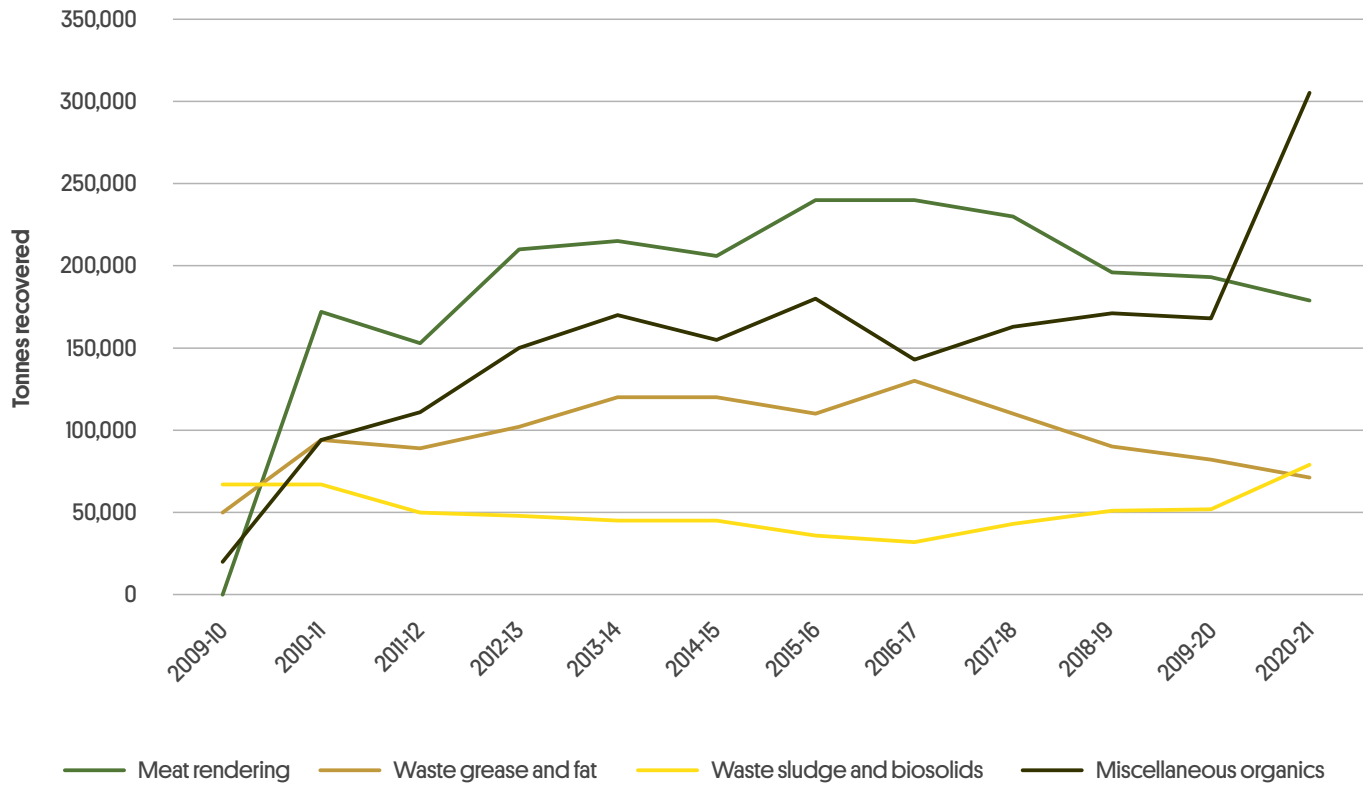


Figure 22 Reported percent composition of organics recovered in 2020-21 and 2019-20

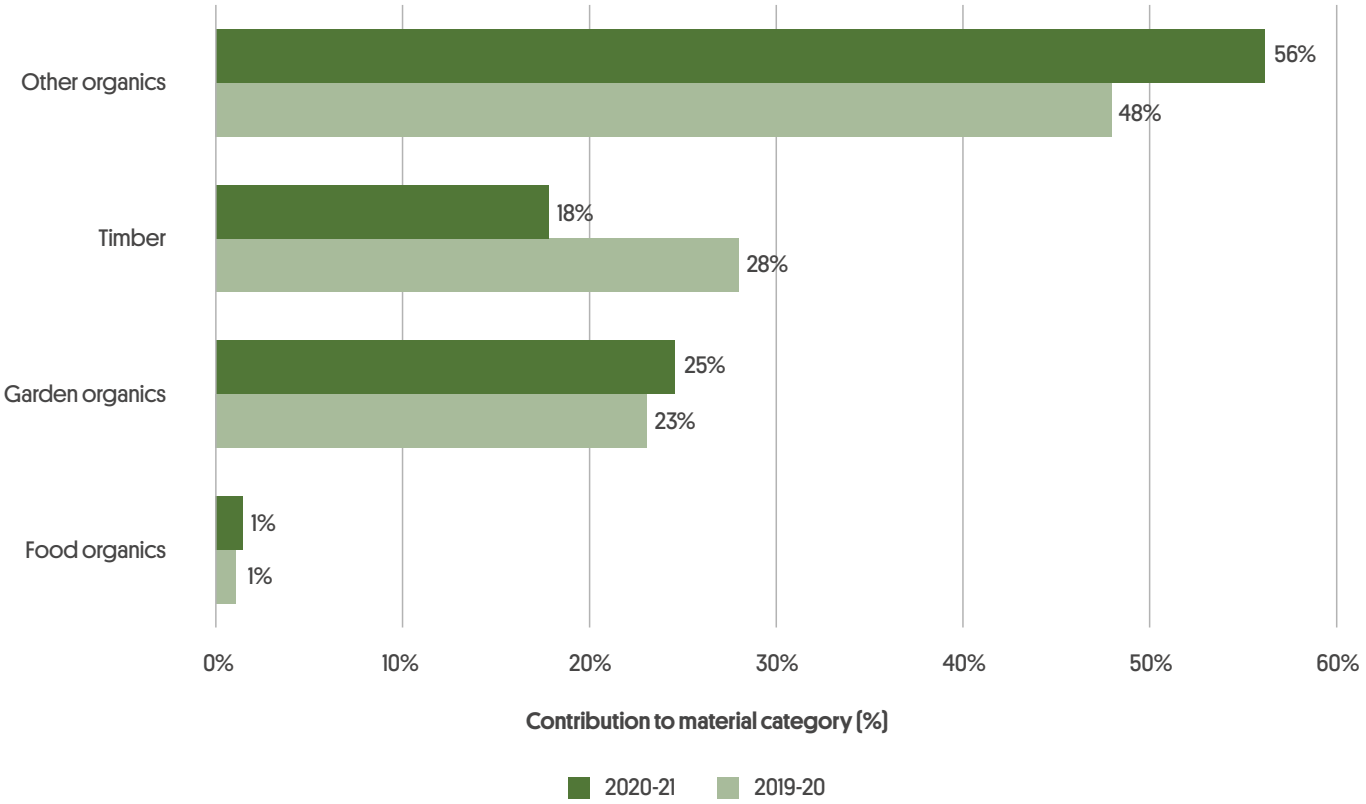


Table 25 provides detail of organics recovery in SA in 2020-21, including information of source stream, geographical origin and reprocessing location. Most organics came from SA's C&I stream (75%), followed by the MSW stream (22%), with a small proportion being C&D waste (3%). Almost all SA organics that were recovered were recycled in SA. The majority of organics came from the metropolitan region, although regional SA remains an important contributor for organic materials and recovery.

Table 25 Organics recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Food organics	0%	100%	0%	90%	10%	100%	0%	0%
Garden organics	76%	14%	10%	89%	11%	100%	0%	0%
Timber	0%	97%	2%	8%	92%	100%	0%	0%
Other organics	6%	94%	0%	64%	36%	99%	0%	1%
Total	**22%**	**75%**	**3%**	**61%**	**39%**	**99%**	**0%**	**1%**

3.4 Cardboard and paper

Cardboard and paper recovery declined from 2018-19 to 2019-20, and this trend continued into 2020-21. Overall, about 182 kt of cardboard and paper were recovered in SA in 2020-21, about 12 kt less than the year before. Total cardboard and paper decreased in 2020-21 compared to 2019-20, however cardboard and waxed cardboard increased slightly. Liquid paperboard quantities also increased, although tonnages are small. Cardboard and waxed cardboard dominated overall recovery volumes for the cardboard and paper material category, contributing 76% of the total.

Table 26 Cardboard and paper recovered, SA 2020-21

Material type	Net recovery (kt)
Cardboard and waxed cardboard	138
Liquid paperboard	0.8
Magazines and newsprint	32
Printing and writing paper	12
Total	**182**

Figure 23 and Figure 24 show trends in cardboard and paper material types over time, while Figure 25 compares the percent composition for different cardboard and paper types in 2020-21 and 2019-20. Consumption of paper and cardboard – and particularly newsprint and magazines – is declining due to digitisation.

Figure 23 Cardboard and paper recovered since 2003-04 – cardboard and waxed cardboard, magazines and newsprint and printing and writing paper

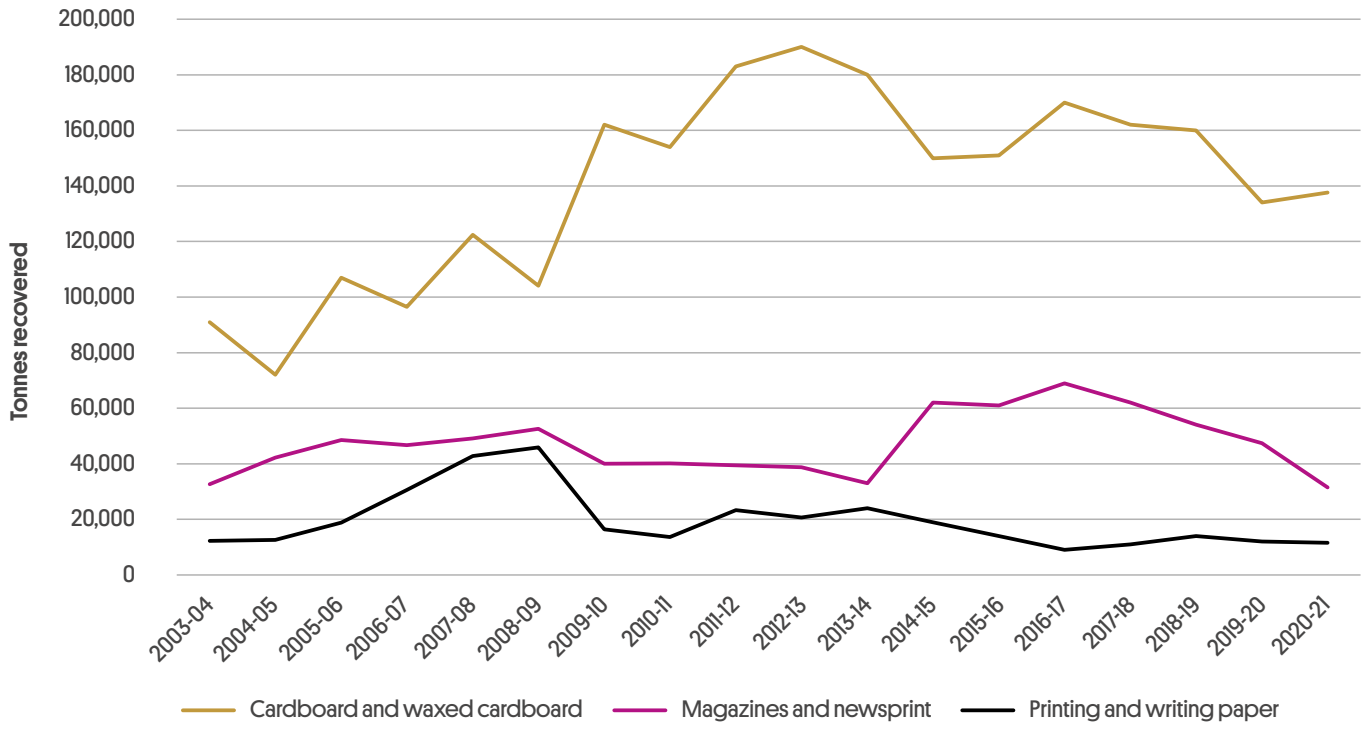


Figure 24 Cardboard and paper recovered since 2003-04 – liquid paperboard

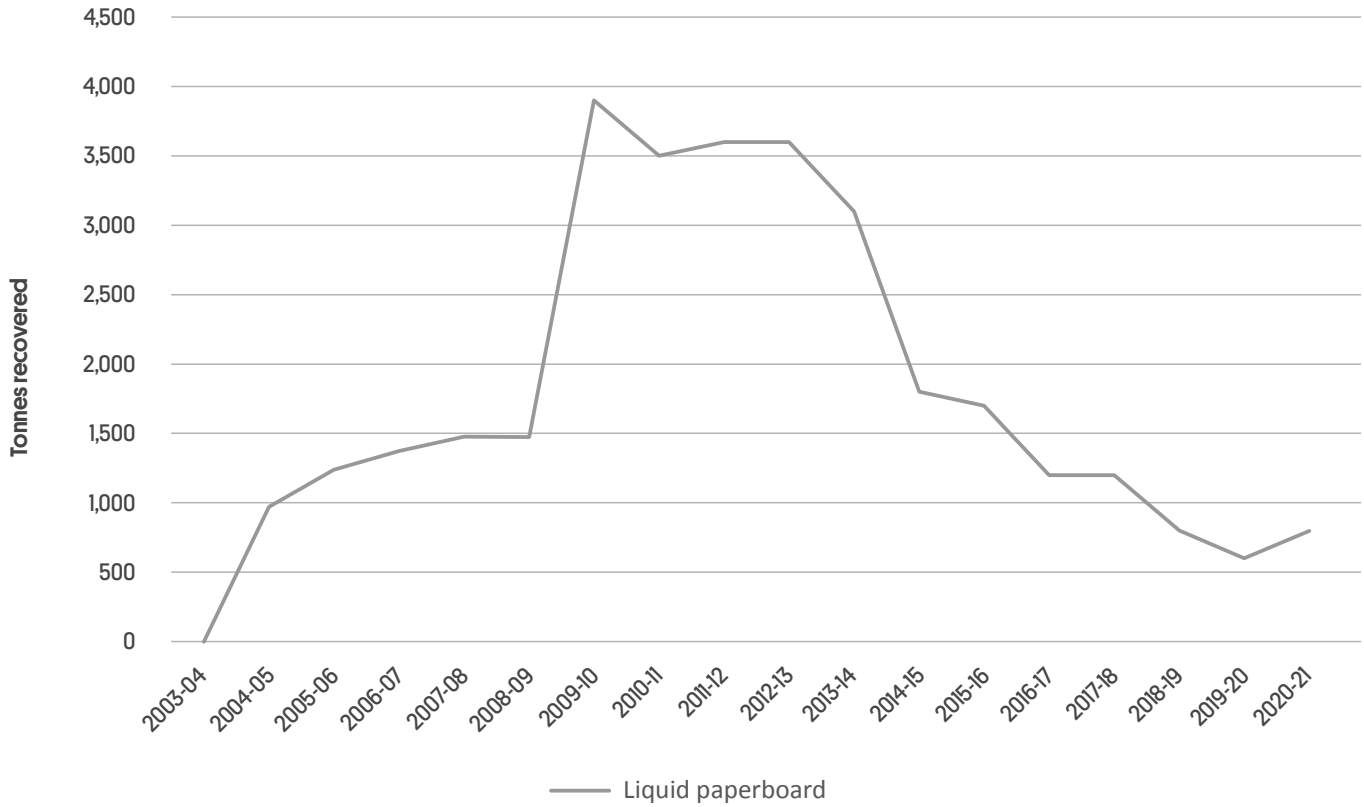


Figure 25 Reported percent composition of cardboard and paper recovered in 2020-21 and 2019-20

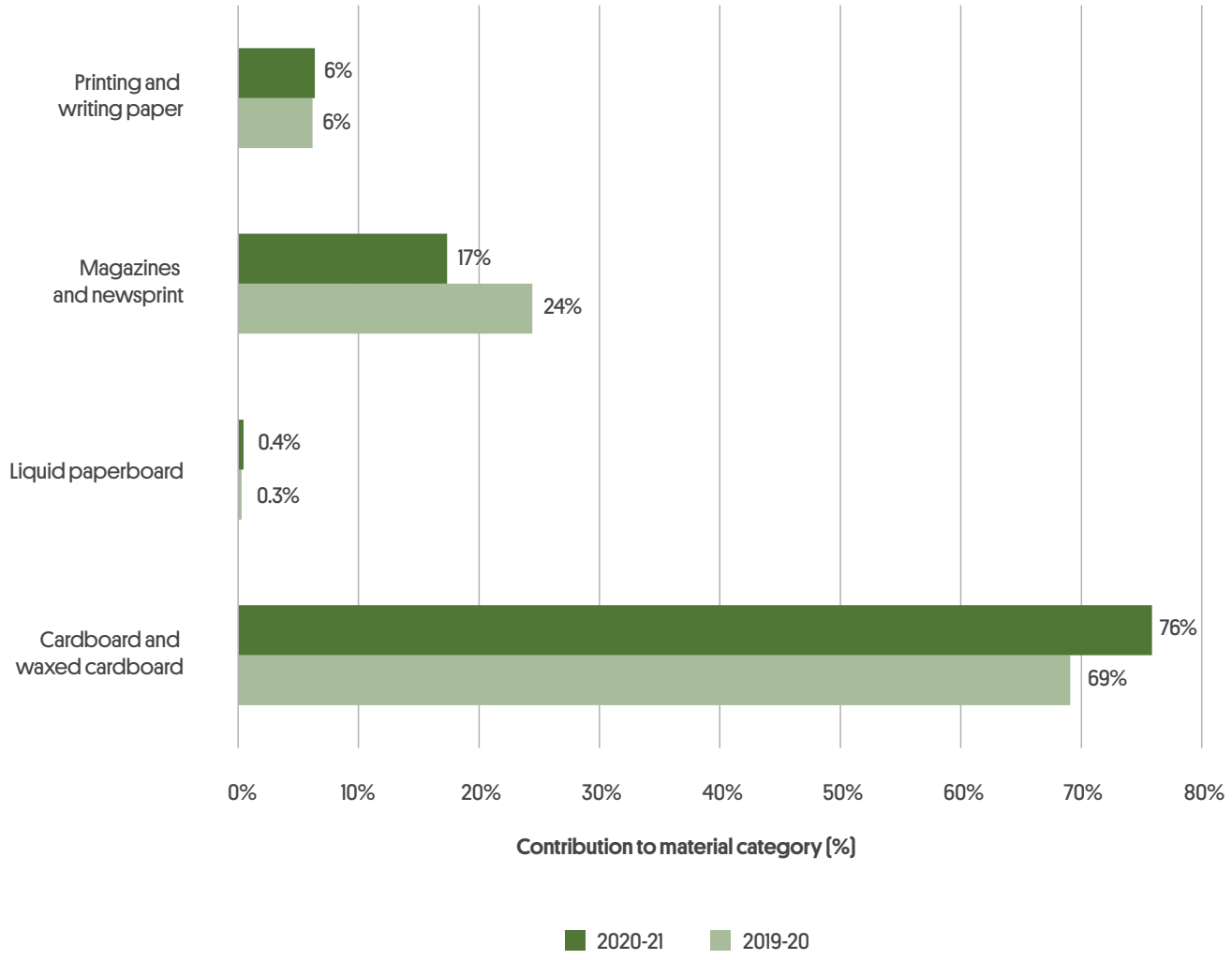


Table 27 presents the source stream, geographical origin and reprocessing location for recovered cardboard and paper in SA in 2020-21. Cardboard and paper were mostly from the C&I stream and reprocessing was mostly undertaken overseas.

Table 27 Cardboard and paper recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Cardboard and waxed cardboard	12%	88%	0%	85%	15%	9%	25%	67%
Liquid paperboard	82%	18%	0%	69%	31%	39%	3%	59%
Magazines and newsprint	98%	1.5%	0.1%	71%	29%	18%	41%	42%
Printing and writing paper	73%	27%	0%	70%	30%	27%	36%	64%
Total	**31%**	**69%**	**0%**	**82%**	**18%**	**9%**	**28%**	**63%**

3.5 Plastics

SA recovered 32 kt of plastics in 2020-21, an increase from the 30 kt recovered in 2019-20. Table 28 summarises plastics recovery from 2020-21. Figure 26, Figure 27 and Figure 28 show plastics recovery trends.

Figure 26 highlights a drastic decrease in mixed and/or other plastics recovered coupled with sharp increases in individual plastic polymer types. Most recovered plastics in 2020-21 were high-grade polymers such as HDPE (37%) and PET (27%), as shown in Figure 29. This is a change from 2019-20, where mixed and/or other plastics were the most common type recovered at 54%.

This change can be attributed to the Commonwealth Government's ban on the export of mixed plastics. Previously, most collected plastics were exported still containing significant contaminants. This contamination caused environmental problems in China and other receiving countries. It is now the responsibility of Australia to manage this process. The ban did not come into force until July 2021, after the period examined in this report. It appears that materials recovery facilities that receive domestic recyclables were preparing for the ban by putting more effort into sorting plastics by type.

The rise in certain separated plastic polymers is also attributed to increased capacity from one of SA's major plastics reprocessors.

Table 28 Plastics recovered, SA 2020-21

Material type	Net recovery (kt)
Polyethylene terephthalate	8.9
High density polyethylene	12
Polyvinyl chloride	0.02
Low density polyethylene	4.5
Polypropylene	4.9
Polystyrene	0.4
Mixed and/or other plastics	1.7
Total	**32**

Figure 26 Plastics recovered since 2003-04 – PET, HDPE, LDPE, PP and mixed and/or other plastics

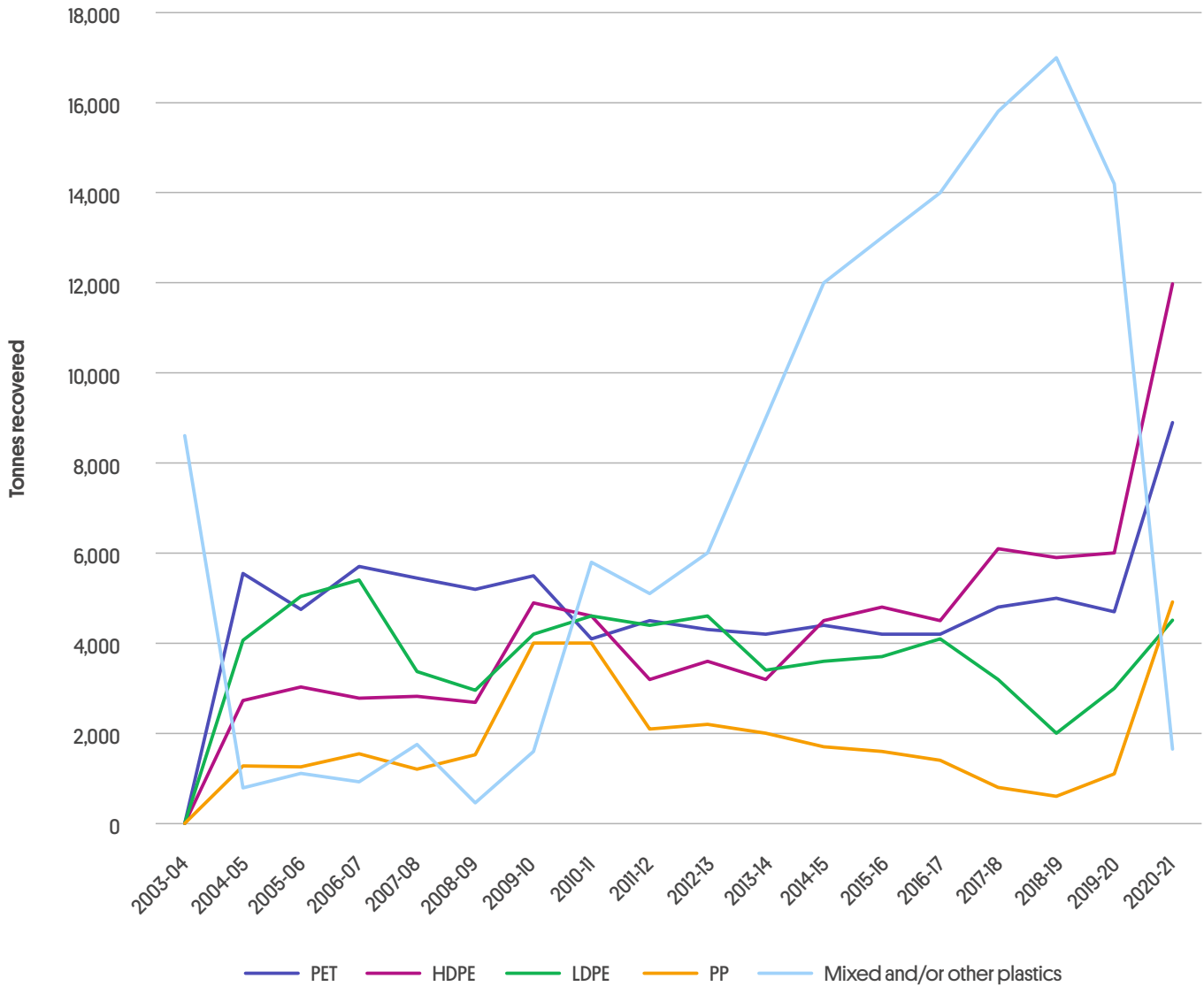


Figure 27 Plastics recovered since 2003-04 – PVC and PS

Figure 28 Plastics recovered since 2003-04 – all plastics

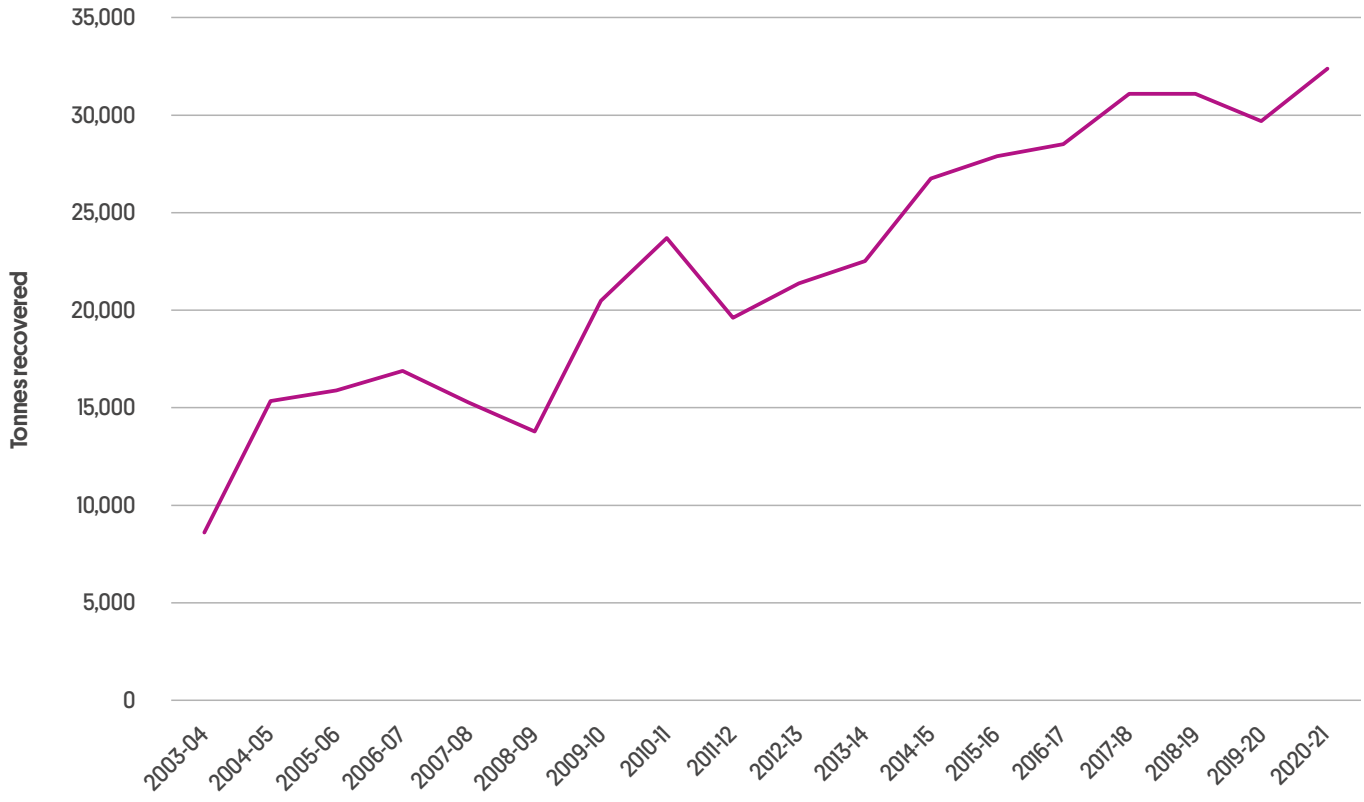
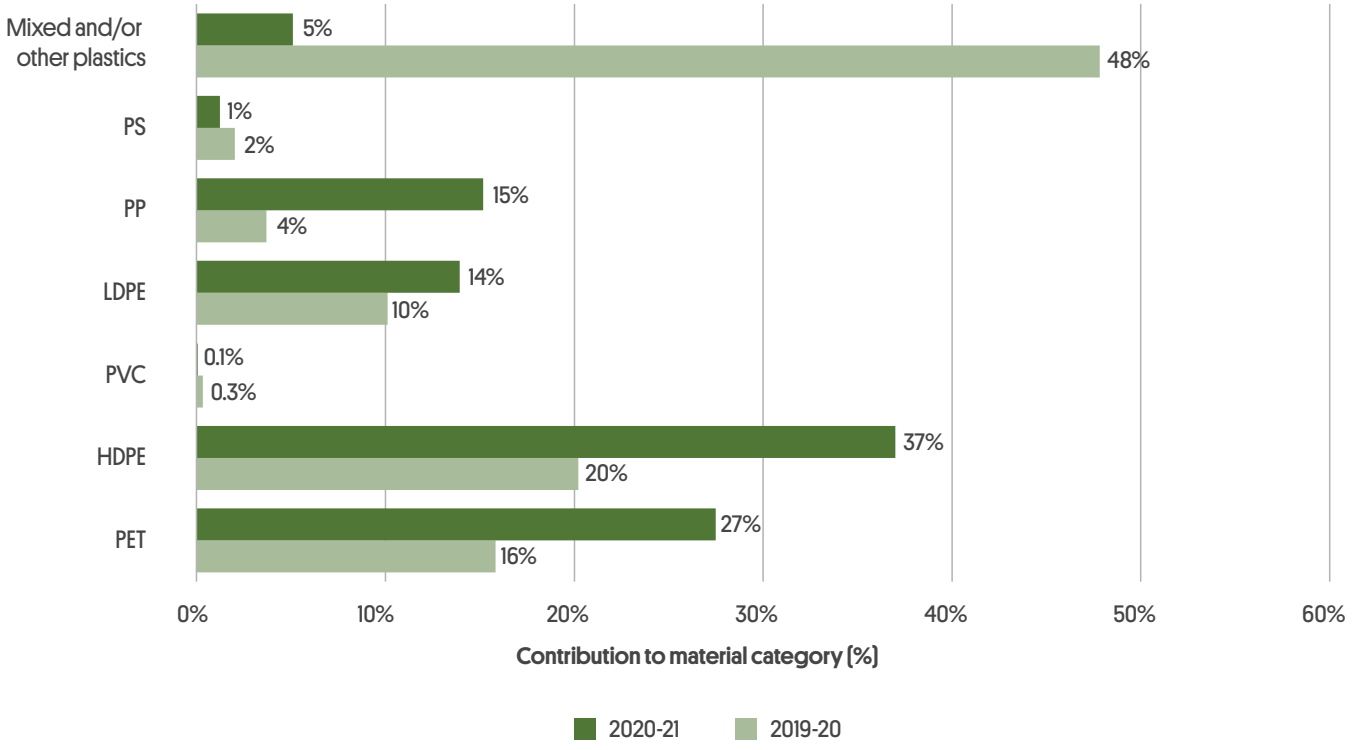


Figure 29 Reported percent composition of plastics recovered in 2020-21 and 2019-20



Plastics recovery in 2020-21 by plastics type, source stream, geographical origin and reprocessing location is shown in Table 29. About two thirds of recovered plastics came from the MSW stream, with the remaining third from C&I sources.

The proportion of plastics from regional sources increased once again this year, from 13% in 2019-20 to 23% in 2020-21. Over half (54%) of total recovered plastics were reprocessed locally, however this was a slight decrease from last year (57%).

Table 29 Plastics recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Polyethylene terephthalate	82%	18%	0%	65%	35%	9%	38%	53%
High density polyethylene	70%	30%	0%	82%	18%	68%	17%	15%
Polyvinyl chloride	5%	95%	0%	100%	0%	0%	0%	100%
Low density polyethylene	3%	97%	0%	79%	21%	8%	21%	71%
Polypropylene	86%	14%	0%	97%	3%	98%	0%	2%
Polystyrene	11%	89%	0%	99%	2%	0%	0%	100%
Mixed and/or other plastics	63%	37%	0%	67%	33%	89%	10%	1%
Total	**66%**	**34%**	**0%**	**77%**	**23%**	**54%**	**18%**	**28%**

3.6 Glass

SA recovered about 84 kt of glass in 2020-21, down from 87 kt from 2019-20. For the first time this year, the reporting of glass is distinguished in two types: glass from food and beverage containers; and other glass. Other glass includes products such as window glass and laminated glass.

Recovered glass were mostly containers; 89% of overall volumes in 2020-21 were glass from food and beverage containers, with the remaining 11% being other glass.

Table 30 Glass recovered, SA 2020-21

Material type	Net recovery (kt)
Glass from food and beverage containers	75
Other glass	9.5
Total	**84**

Glass recovery trends since 2003-04 are shown in Figure 30. The proportions of glass from food and beverage containers and other glass recovered in 2020-21 are shown in Figure 31.

Figure 30 Glass recovered since 2003-04

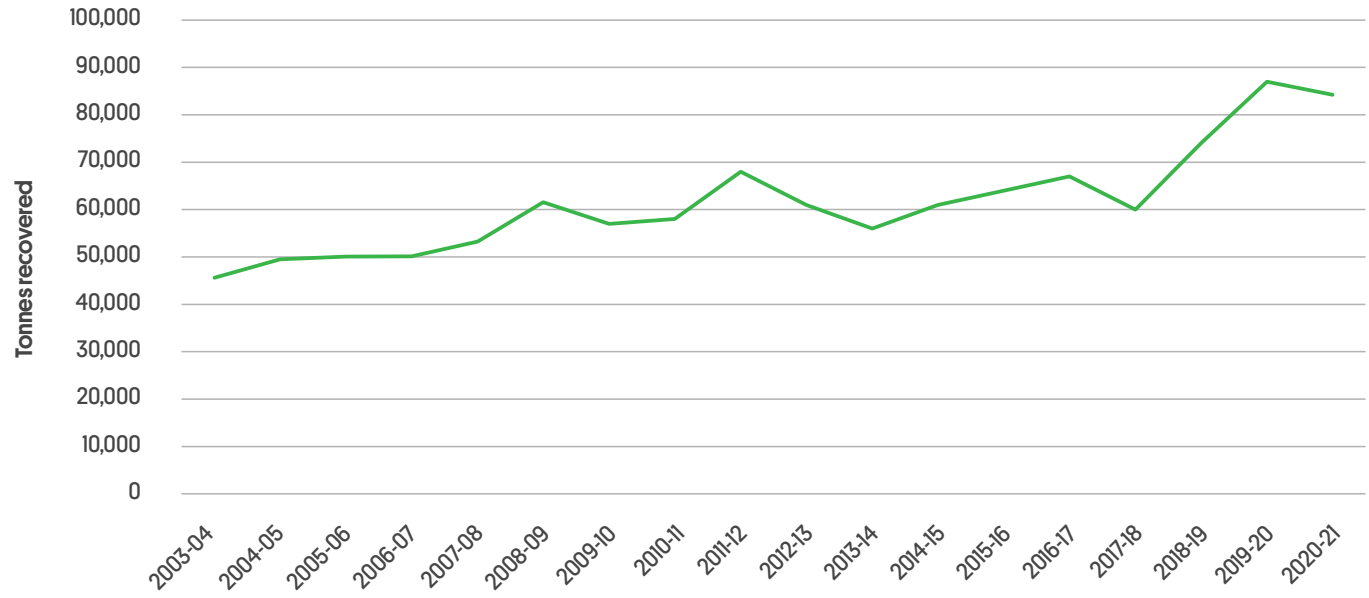


Figure 31 Reported percentage of glass recovered by material type in 2020-21

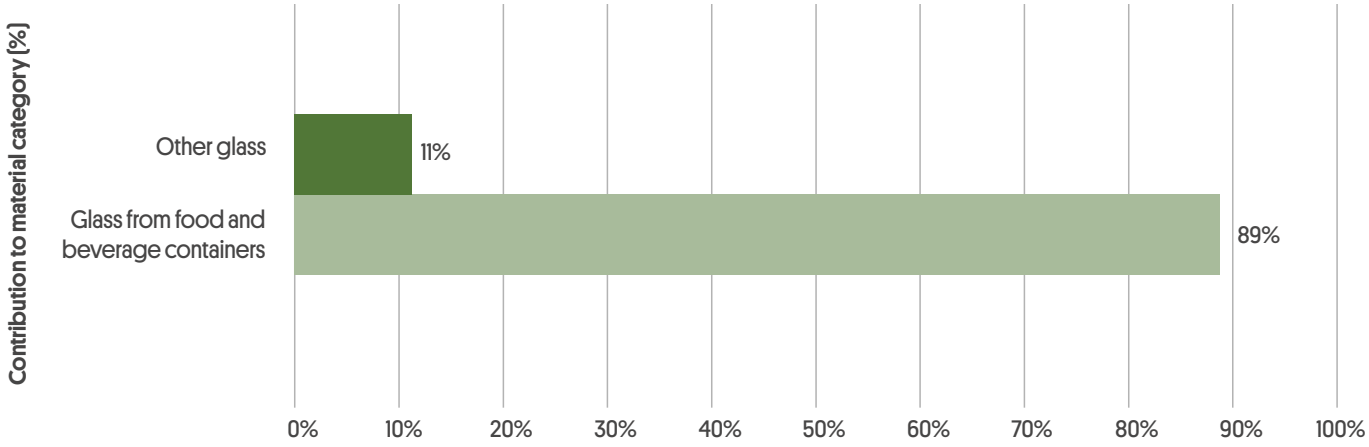


Table 31 presents the source stream, geographical origin and reprocessing location for recovered glass in SA in 2020-21. Glass was mostly from the C&I stream, followed by MSW. Most glass was from the metropolitan region, and reprocessing was primarily undertaken locally.

Table 31 Glass recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Glass	15%	83%	2%	84%	16%	88%	12%	0%

3.7 Other materials

The 'other materials' category includes fly ash, foundry sands, leather and textiles, and tyres and other rubber. The combined recovery of these materials in 2020-21 was about 29 kt. This was considerably less than 2019-20, when about 44 kt of other materials was recovered. This fall was predominantly due to the cessation of foundry sands recovery by a major industry player. SA has not recovered any fly ash since the closure of the Port Augusta Power Station. Quantities of tyres and other rubber remained stable from 2019-20, and these contributed the most to overall recovery in this category. Leather and textiles increased from 0.9 kt in 2019-20 to 1.6 kt in 2020-21.

Table 32 Other materials recovered, SA 2020-21

Material type	Net recovery (kt)
Fly ash	0
Foundry sands	8.2
Leather and textiles	1.6
Tyres and other rubber	19
Total	**29**

Figure 32 and Figure 33 show trends in the recovery of other materials by type. Figure 34 compares the contribution for different other material types toward total recovery from 2020-21 and 2019-20.

Figure 32 Other materials recovered since 2003-04 – foundry sands, leather and textiles and tyres and other rubber

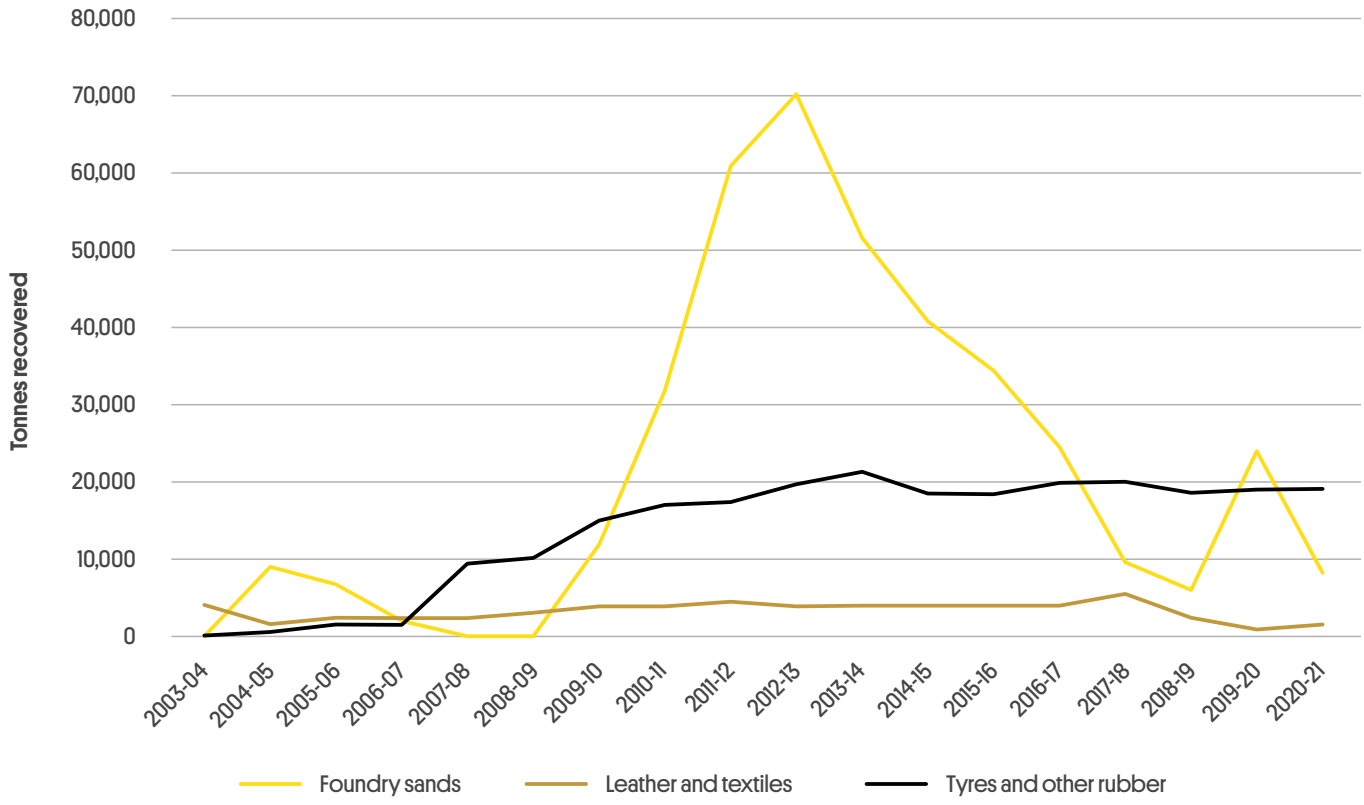


Figure 33 Other materials recovered since 2003-04 – fly ash

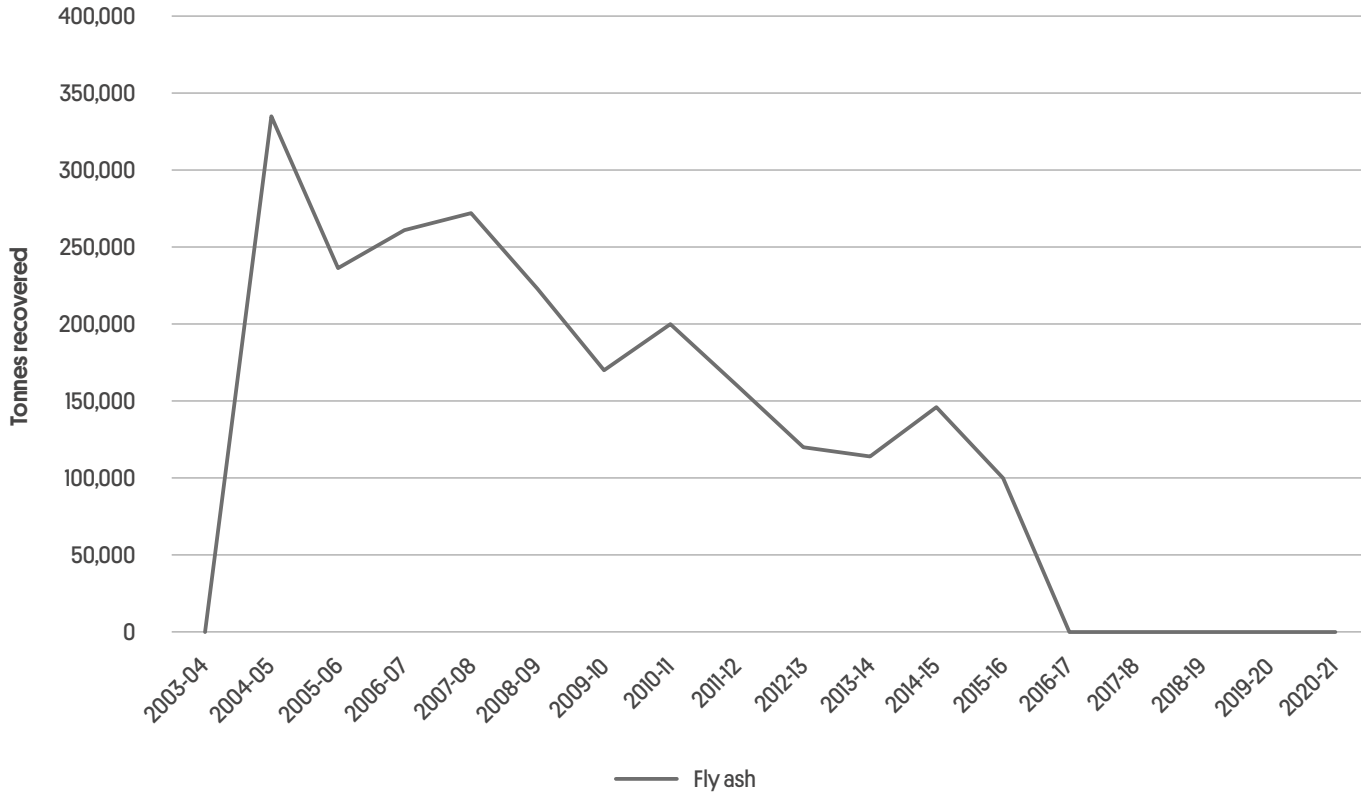


Figure 34 Reported percent composition of other materials recovered in 2020-21 and 2019-20

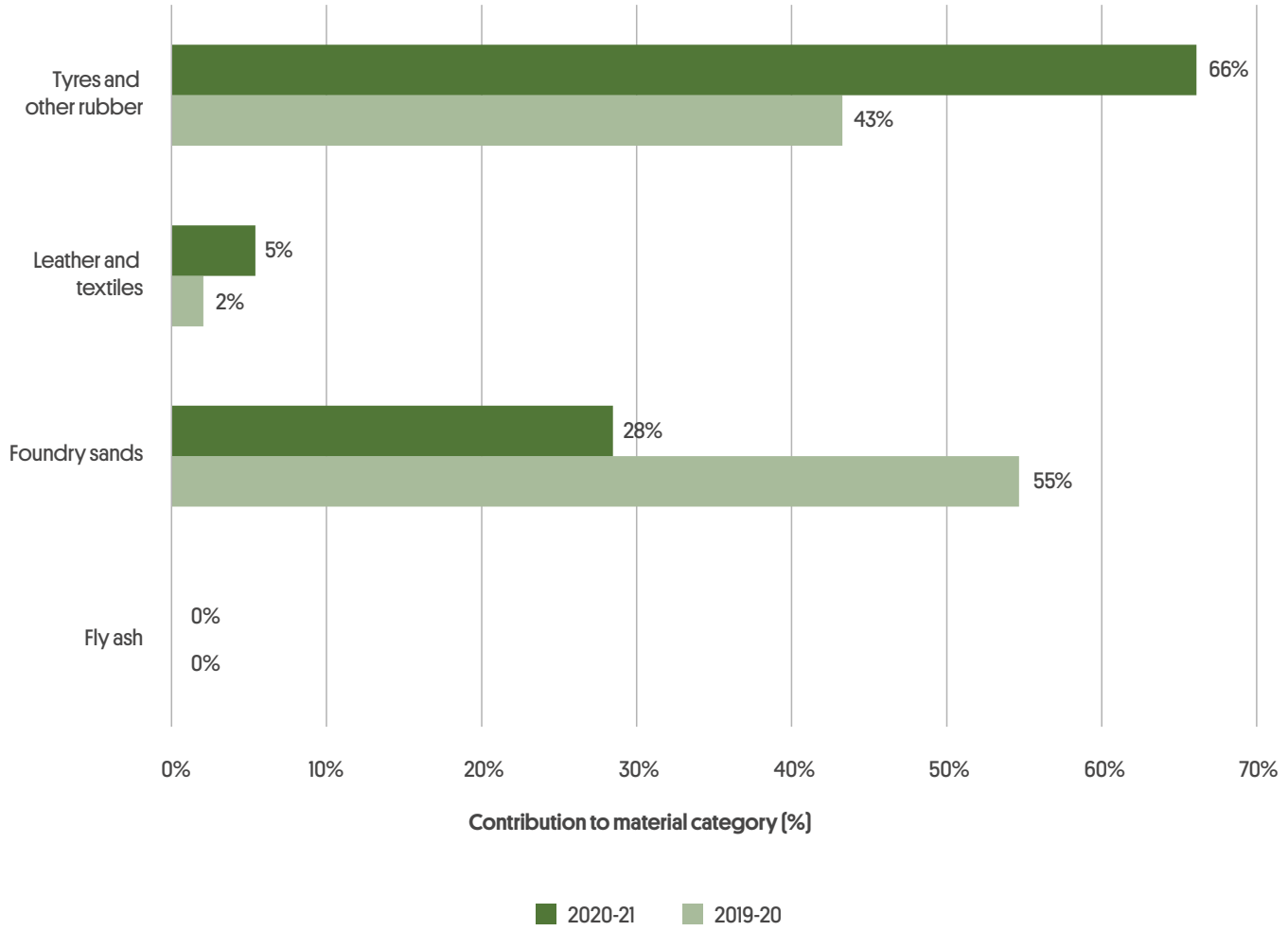


Table 33 presents the source stream, geographical origin and reprocessing destination for material types within the other materials category. Foundry sands and tyres and other rubber were entirely from C&I sources, while leather and textiles were made up entirely of MSW. About 81% of other materials was from metropolitan SA, and 19% from regional SA. Most other materials were reprocessed locally, including all foundry sands and leather and textiles. The destination for tyres and other rubber was 57% SA, 20% interstate and 23% overseas.

Table 33 Other materials recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	**MSW**	**C&I**	**C&D**	**Metro**	**Regional**	**SA**	**Interstate**	**Overseas**
Fly ash	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foundry sands	0%	100%	0%	100%	0%	100%	0%	0%
Leather and textiles	100%	0%	0%	82%	18%	100%	0%	0%
Tyres and other rubber	0%	100%	0%	73%	27%	57%	20%	23%
Total	**6%**	**94%**	**0%**	**81%**	**19%**	**72%**	**13%**	**15%**


HyFlex

4 E-waste

- Electronic waste (e-waste) is a globally growing waste stream, and reported tonnes continued to rise in 2020-21.
- Reported e-waste recovery in SA increased by 9% from 2019-20 to 2020-21, from about 5.4 kt to 5.9 kt.
- Televisions/monitors and computers were the most commonly reported e-waste types.

Electronic waste (e-waste) can be defined as anything with a plug or battery that is no longer wanted, and includes a wide range of items such as computers, televisions and white goods. The survey requested data on e-waste for printer cartridges, compact fluorescent lamps, batteries, computers, television/monitors, mobile phones and other. The results are provided in this section. The data discussed below represent a subset of the data presented in Section 3.

E-waste recovery in SA increased by 9% from 2019-20 to 2020-21, from about 5.4 kt to 5.9 kt. The quantity of reported televisions/monitors recovered increased significantly, from about 1.7 kt to 2.9 kt. Computers, on the other hand, fell from 2.6 kt to 1.7 kt. A shift to more lightweight devices may have contributed to this decrease. Batteries and other e-waste both increased in recovery this year compared to last. Table 34 summarises e-waste recovery in SA in 2019-20 and 2020-21.

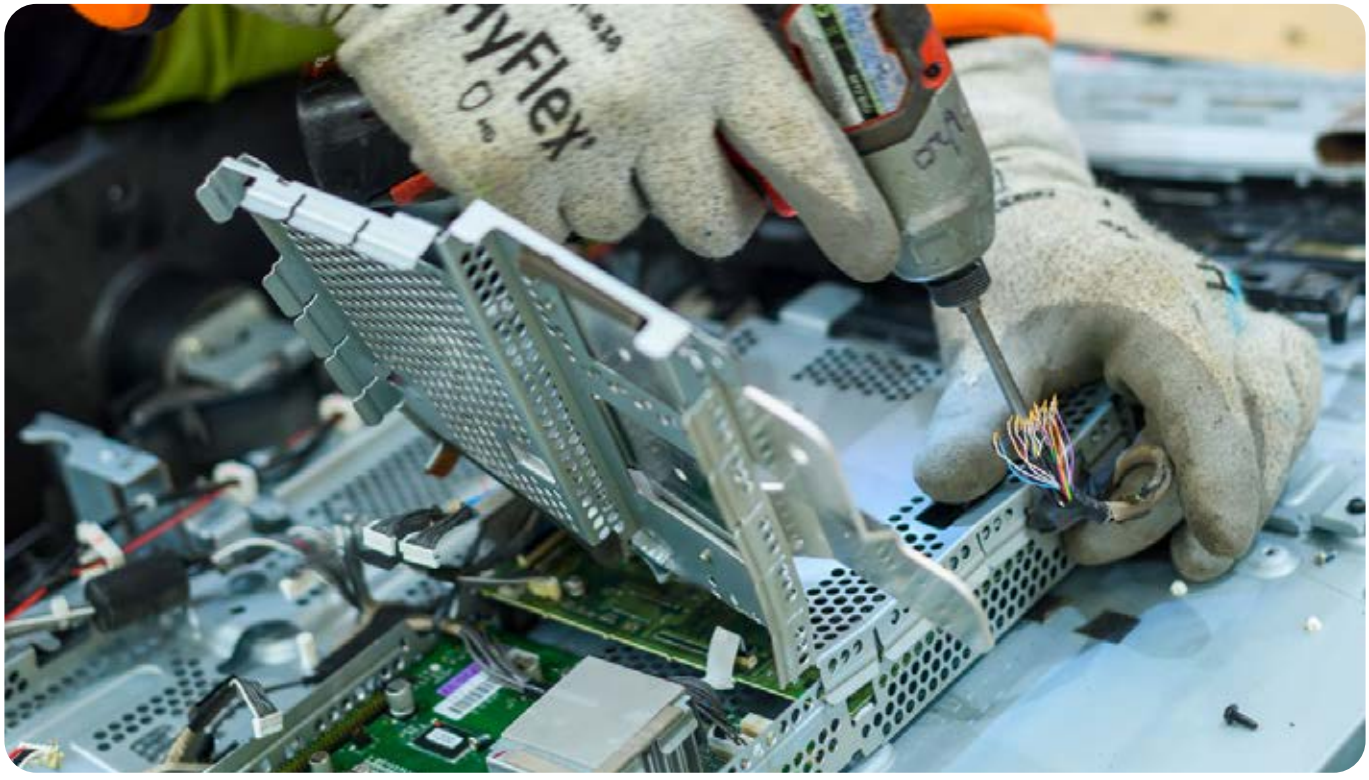


Table 34 Reported tonnes of e-waste in SA, 2020-21 and 2019-20

E-waste type	2019-20 (tonnes)	2020-21 (tonnes)	Change (%)
Printer cartridges	170	150	-12%
Compact fluorescent lamps	120	120	0%
Batteries	50	90	80%
Computers	2,600	1,700	-36%
Televisions/monitors	1,700	2,900	72%
Mobile phones	6.0	5.7	-5%
Other e-waste	740	920	24%
Total	**5,400**	**5,900**	**9%**

Table 35 lists the proportion of total e-waste recovered from different source streams, geographical origins and reprocessing locations. Most e-waste came from municipal sources (89%), with the remainder from the C&I stream (11%). Table 35 shows that the destination for e-waste is mostly SA (66%), followed by overseas (30%), with a lesser proportion being sent interstate (5%).

Table 35 E-waste recovered in 2020-21 by source stream, geographical origin and reprocessing location

	Source stream (%)			Geographical origin (%)		Reprocessing location (%)		
Material type	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
E-waste	**89%**	**11%**	**0%**	**88%**	**12%**	**66%**	**5%**	**30%**

Figure 35 and Figure 36 show e-waste trends since 2009-10 and a comparison of 2019-20 and 2020-21 data, respectively.

Figure 35 Reported e-waste recovered since 2009-10

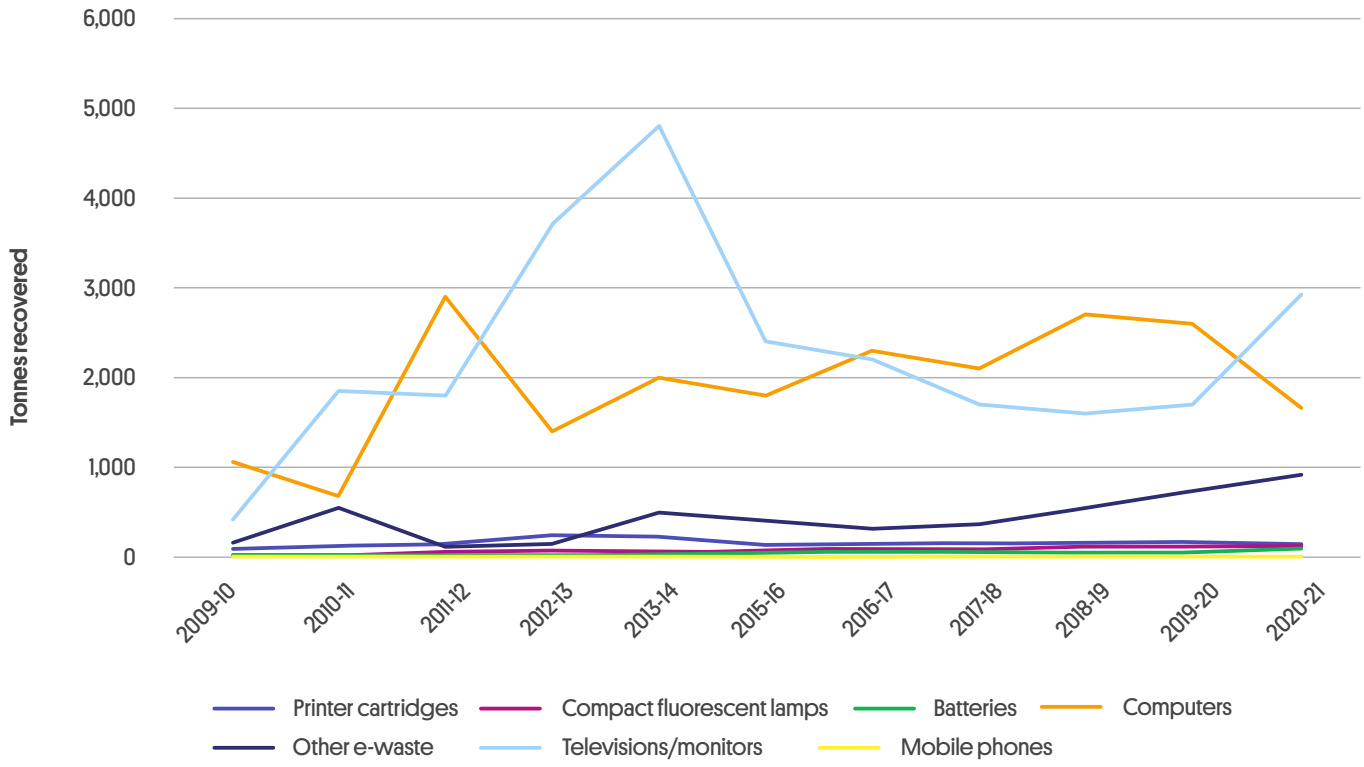
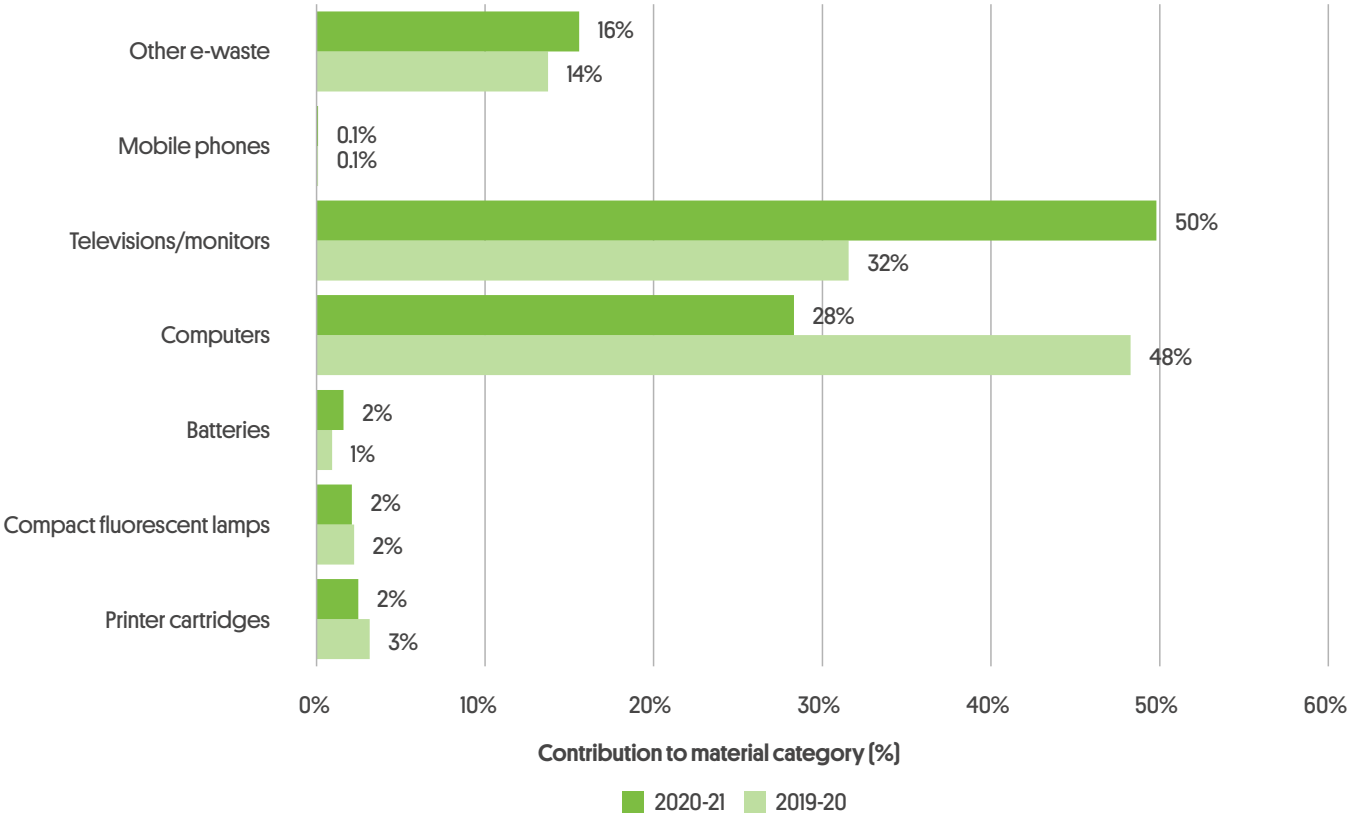


Figure 36 Reported percent composition of e-waste recovered in 2020-21 and 2019-20



5 Packaging

Australia has established targets for the management of packaging waste by 2025, as follows (Department of Agriculture, Water and the Environment 2022):

- 100% of packaging being reusable, recyclable or compostable by 2025
- 70% of plastic packaging being recycled or composted by 2025
- 50% of average recycled content included in packaging by 2025
- the phase out of problematic and unnecessary single-use plastic packaging by 2025.

As the ambitious targets above suggest, the recovery of packaging waste is important part of sustainable waste management in Australia. Packaging data is requested in the survey and the results are detailed in this section. The data presented are a subset of the data in Section 3.

Overview

Data in this section includes container deposit legislation (CDL) materials, as well as any other packaging collected from kerbside collections and businesses. Overall, SA recovered about 228 kt of packaging materials in 2020-21, comprising about 42 kt (18%) CDL materials and 185 kt (82%) non-CDL materials.

Table 36 summarises estimated packaging recovery in SA in 2020-21. Broadly, compared to the previous year, quantities of:

- metal cans increased, especially aluminium cans
- cardboard packaging and liquid paperboard cartons increased
- most plastics packaging increased considerably
- glass bottles and jars declined.

Table 36 Estimated packaging recovered in SA in 2020-21

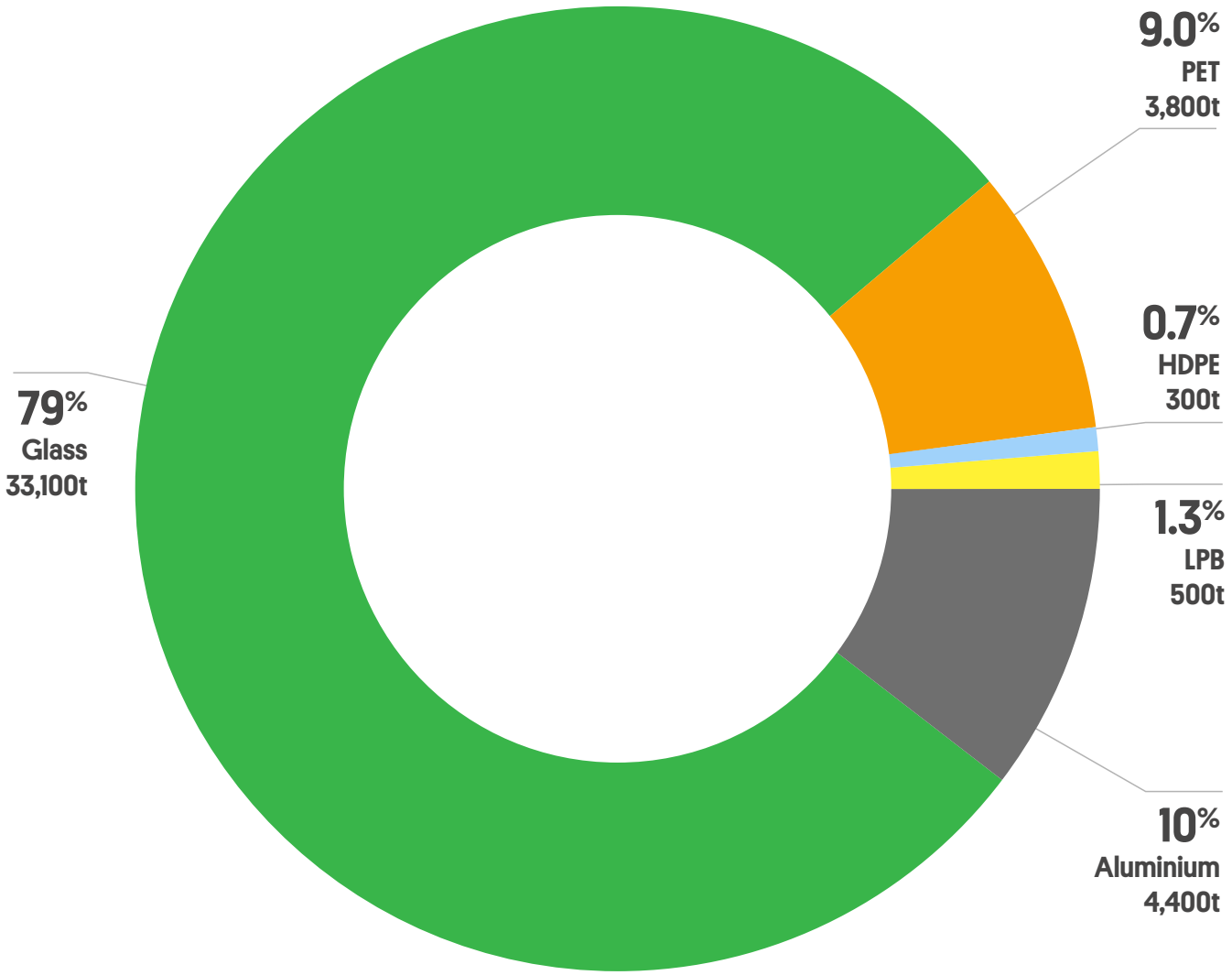
Packaging type	Recovered (kt)			Packaging as a proportion of total recovery
	CDL	Other	Total	
Steel cans	-	2.7	2.7	1%
Aluminium cans	4.4	0.1	4.4	36%
Cardboard packaging	-	124	124	90%
Liquid paperboard cartons	0.5	0.3	0.8	100%
PET packaging	3.8	5.1	8.9	100%
HDPE packaging	0.3	8.8	9.1	76%
PVC packaging	-	0.01	0.01	56%
LDPE packaging	-	4.4	4.4	97%
Polypropylene packaging	-	4.2	4.2	85%
Polystyrene packaging	-	0.3	0.3	68%
Other plastics packaging	-	0.8	0.8	47%
Glass bottles and jars	33	35	68	91%
Total	**42**	**185**	**228**	**-**

5.1 Container deposit legislation

SA has the longest working container deposit scheme in Australia, having introduced its CDL in 1977. The next jurisdiction after SA to implement CDL was the NT in 2012. Today, all states and territories have either implemented a CDL or are planning to.

In total, South Australians returned about 42 kt of containers to CDL locations across the state. The bulk of these materials are glass containers, which made up about 33 kt (79%) of total CDL materials in 2020-21. Also recovered were about 4,400 tonnes (10%) of aluminium cans, 3,800 tonnes (9%) of PET, 500 tonnes (1.3%) of liquid paperboard and 300 tonnes (<1%) of HDPE.

Figure 37 Relative proportions of returned container deposit legislation materials, SA 2020-21



The return rates for CDL materials are provided in Table 37 below. Return rates were high for glass and aluminium at over 80%, while plastics packaging and liquid paperboard exhibited more moderate return rates at 54% to 67%. Compared to 2019-20, the return rates for PET, HDPE and liquid paperboard increased, the rate for glass fell, and the rate for aluminium remained approximately the same.

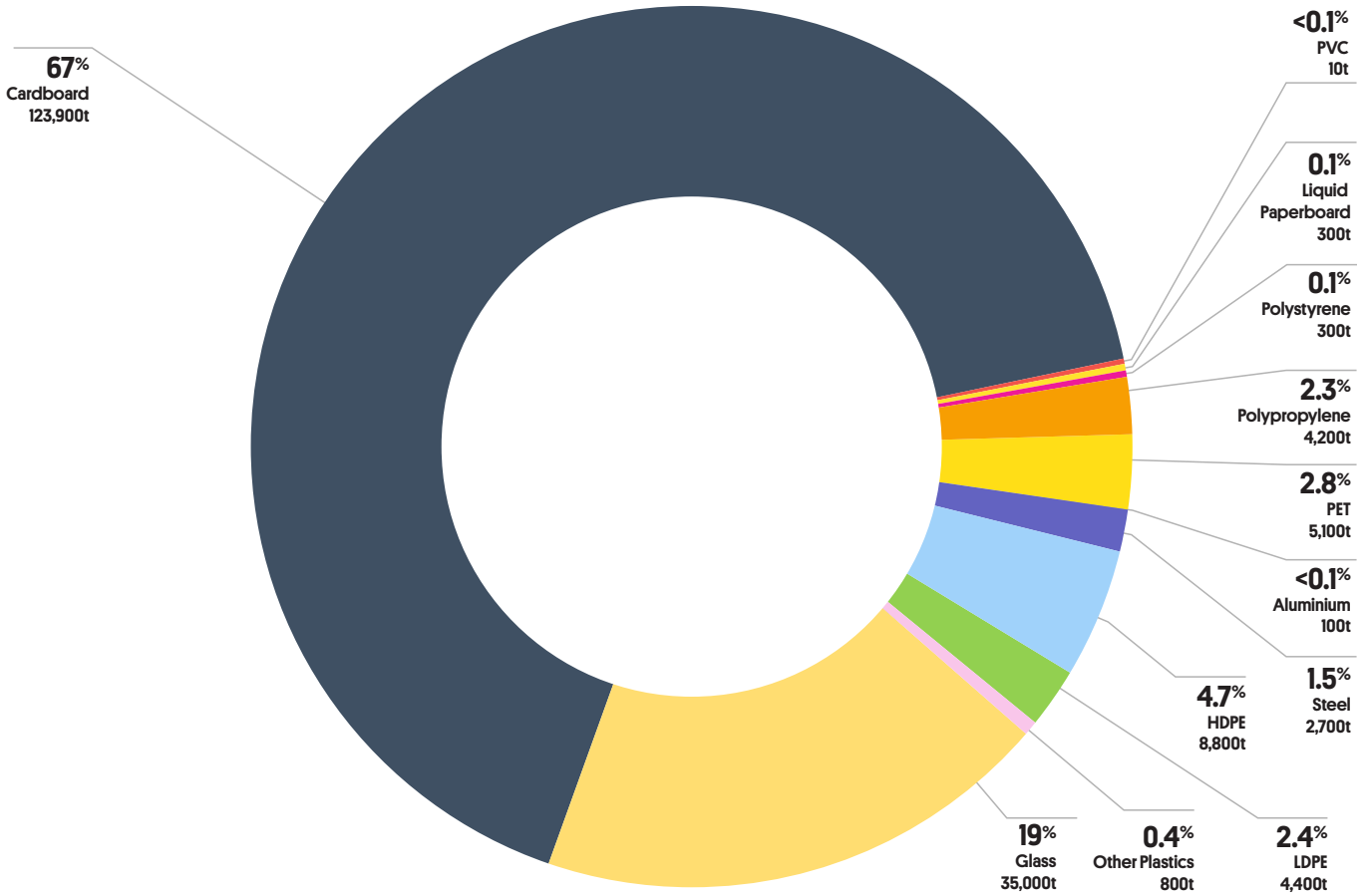
Table 37 Return rates for SA's container deposit legislation materials in 2020-21

Packaging material	Recovered (kt)	Return rate
Glass	33	81%
Aluminium	4.4	82%
PET	3.8	67%
Liquid paperboard	0.5	54%
HDPE	0.3	65%

5.2 Other packaging materials

Figure 38 presents the tonnes and proportions of non-CDL recovered packaging material from 2020-21. Cardboard packaging remained the highest contributor (67%), slightly up from 2019-20 (65%). The second highest proportion was glass bottles and jars (19%), which fell from 2019-20 (25%). Other non-CDL packaging materials comprise plastics, metals and liquid paperboard, each of which contributed less than 5% to the total.

Figure 38 Relative proportions of other (non-CDL) packaging materials, SA 2020-21




THIS MACHINE IS UNDER CONSTANT VIDEO SURVEILLANCE
CONTAINER DEPOSIT SYSTEMS
ELIGIBLE GLASS CONTAINERS ONLY
EMERGENCY STOP
CONTAINERS MUST BE PLACED ONE AT A TIME
START
PAY OUT
1. ELIGIBLE CONTAINERS ONLY
2. YOUR SUPERVISOR WILL SWIPE ON
3. PRESS TO BEGIN
4. PLACE CONTAINERS ONE AT A TIME
5. ON COMPLETION PRESS TO FINISH
6. REMOVE TICKET AND PROCEED TO CASH REDEMPTION TERMINAL
CHILDREN MUST BE SUPERVISED AT ALL TIMES

6 Resource recovery value

- The total value of recovery in SA in 2020-21 is estimated at about $478 million, a considerable increase from the estimated value from 2019-20 of $342 million.
- The increase is predominantly a spike in metals quantities and prices.
- Overall, iron and steel was the category contributing most to the resource recovery value in 2020-21, followed by meat rendering, cardboard and paper, masonry and other metals.

Surveyed companies and organisations were asked to provide the value per tonne for each of the materials they recycled. These were used to estimate the market value of resource recovery in SA.

Table 38 summarises the estimated value of recovery in SA in 2020-21, including recovered tonnes by material, estimated on-sale values per tonne and estimated overall value per material. The total value of recovery in SA in 2020-21 is estimated at about $478 million, a considerable increase from the estimated value from 2019-20 of $342 million. The increase is predominantly attributed to iron and steel, which increased this year in both tonnage and value.

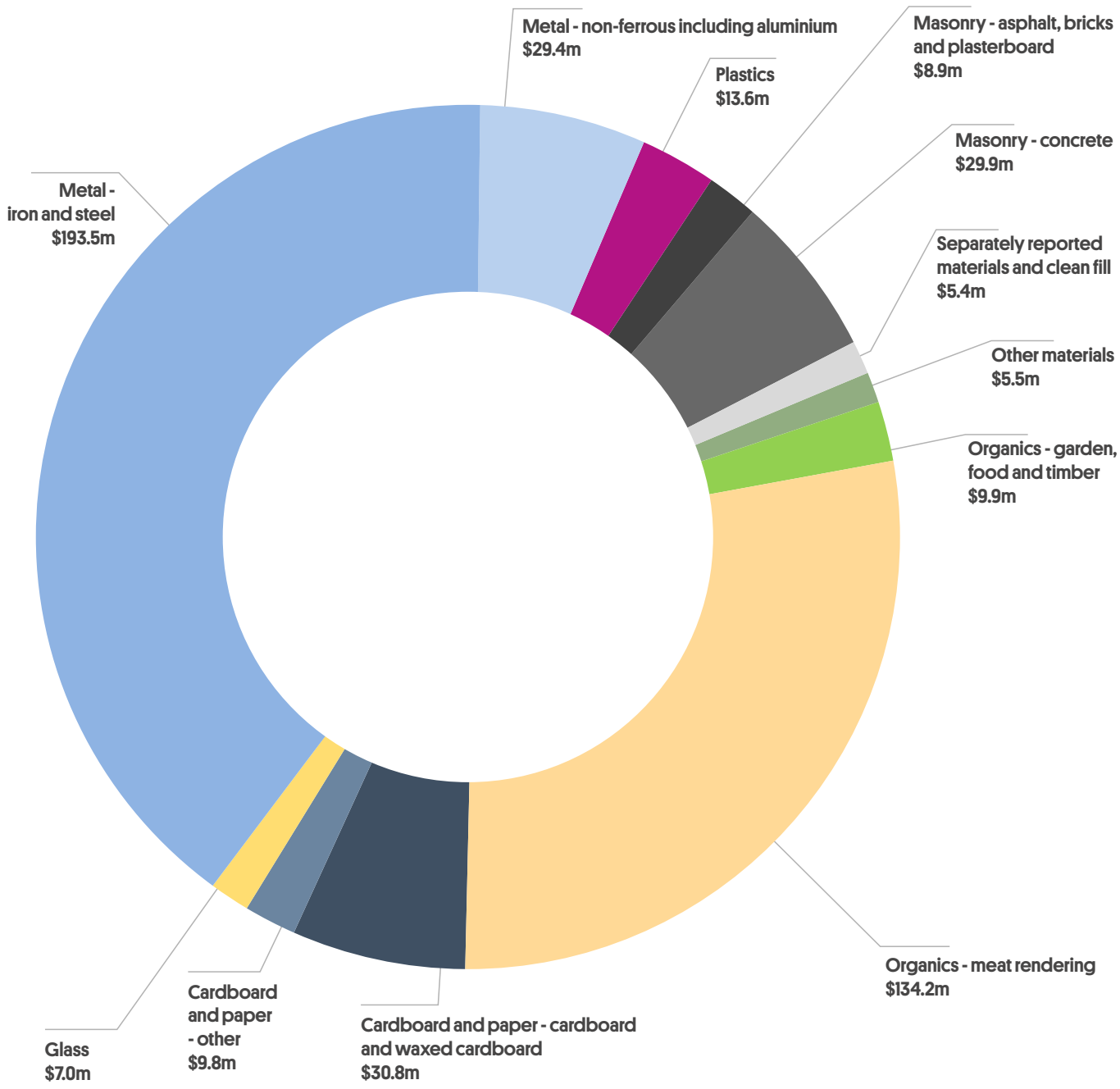
Overall, iron and steel was the greatest contributor to total resource recovery value in 2020-21, followed by meat rendering, cardboard and paper, masonry and other metals.

Table 38 Estimated resource value for recovered materials in SA in 2020-21

Material category or type	Recovered (kt)	Estimated on-sale price ($/tonne)	Estimated value ($ millions)
Masonry	1,666	$23	$38.8
Metals – iron and steel	327	$591	$193.5
Metals – non-ferrous including aluminium	24	$1,245	$29.4
Organics – meat rendering[12]	89	$1,500	$134.2
Organics – garden, food and timber	495	$20	$9.9
Cardboard and paper	182	$224	$40.6
Plastics	32	$420	$13.6
Glass	84	$83	$7.0
Other materials	29	$191	$5.5
Separately reported materials and clean fill	729	$7	$5.4
Total	**3,713**	-	**$477.8**

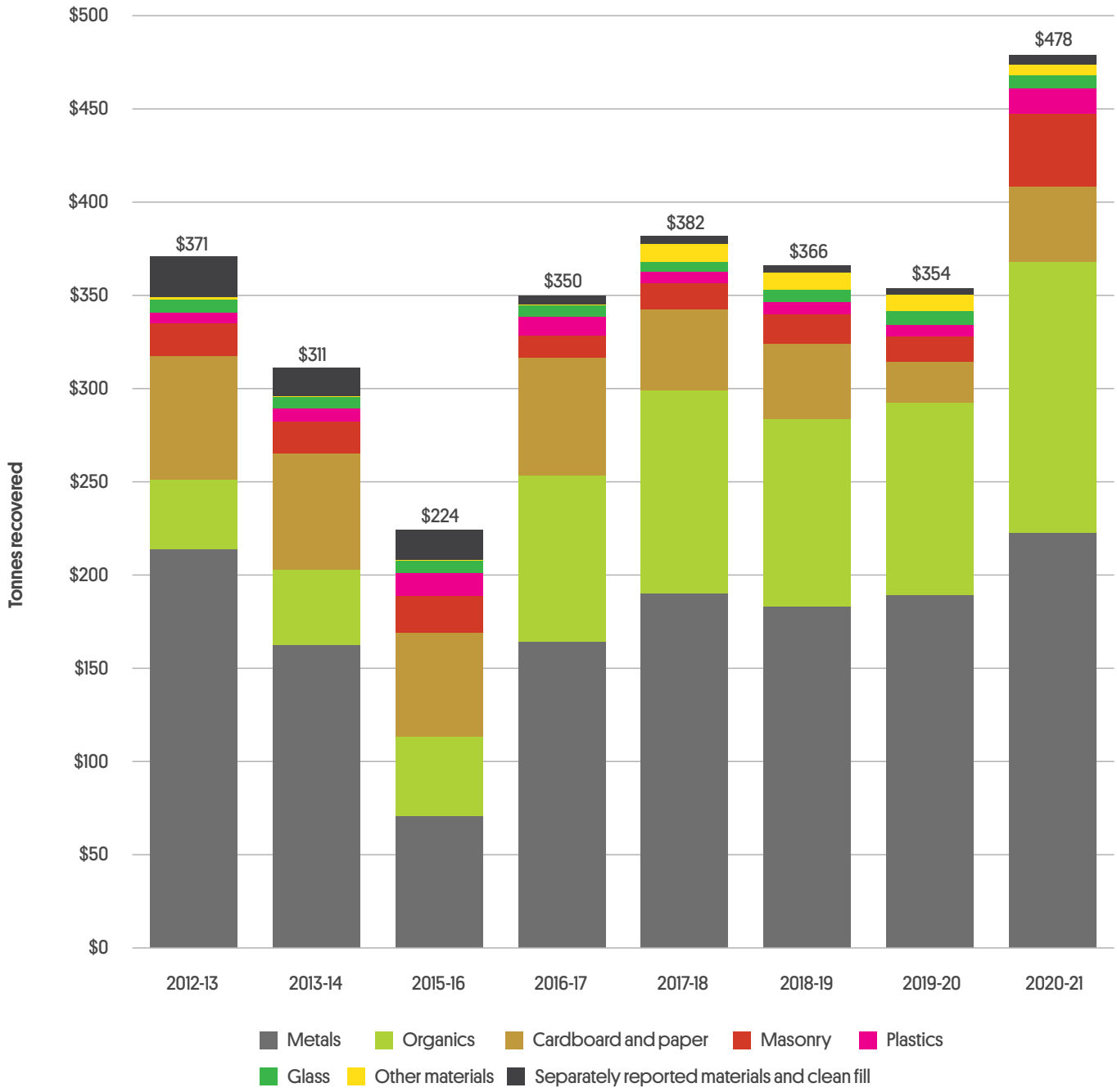
12 Note that the meat rendering tonnage is reduced due to mass loss during processing, resulting in lower volumes that can be sold. Tonnes of resource recovered waste grease and fat, waste sludge and biosolids, and miscellaneous organics were not included in the total.

Figure 39 Estimated market value of resource recovered materials, SA 2020-21



The trend for estimated market value of resource recovery in SA is shown in Figure 40, which highlights a big increase in value in 2020-21, mostly as a result of the uptick in iron and steel quantities and value. The market for metals in 2020-21 was strong and values for iron and steel were high. Organics also showed an increase in value in 2020-21; this market has remained strong for many years. The prospect for cardboard and paper is somewhat uncertain; its market has experienced a decline since the implementation of China's *National Sword Policy*, although it recouped some strength in value in 2020-21 compared to 2019-20.

Figure 40 Estimated market value of resource recovered materials in SA, 2012-13 to 2020-21[13]



13 Historical values have been adjusted to account for inflation.

7 Environmental benefits of recycling

Resource recovery in SA in 2020-21 was estimated to achieve the following environmental benefits:

- greenhouse gas emissions savings about 1.14 million tonnes of carbon dioxide equivalent
- energy savings of about 14,500 terajoules (TJ).
- water savings of about 7,900 megalitres (ML).

The production and consumption of materials requires the use of energy and water and emits greenhouse gases. When a recoverable material is landfilled, the resource and the energy 'embodied' within it (that is, the energy used to make it) are wasted. Additionally, when materials prone to biological decay (i.e. organics) are landfilled, they generate and release the potent greenhouse gas, methane. This section details the environmental benefits of SA's resource recovery sector, including the estimated emissions, energy and water savings the sector achieved in 2020-21. This is based on the information sources discussed in Appendix B. The results are summarised below in Table 39.

Table 39 Estimated environmental benefits of recycling in SA in 2020-21

Material type	Recovered kt	Emissions saved kt CO_2-e	Energy saved TJ LHV	Water saved ML
Masonry				
Asphalt	339	10	810	300
Bricks	44	0.9	10	50
Concrete	1,283	26	450	1,640
Plasterboard	0.9	0.03	0.5	-0.03
Clay, fines, rubble and soil	729	64	1,040	320
Metals				
Iron and steel	327	144	2,450	-770
Aluminium	12	203	2,510	360
Non-ferrous metals	11	10	410	70
Organics				
Food organics	16	16	3	7
Garden organics	277	186	86	1,550
Timber	202	36	2,160	-8.1
Organics – other	634	305	1,370	146
Cardboard and paper				
Cardboard and waxed cardboard	138	23	60	1,530
Liquid paperboard	0.8	0.1	0.4	10
Magazines and newspaper	31	14	10	340
Printing and writing paper	12	15	-10	130

Material type	Recovered kt	Emissions saved kt CO_2-e	Energy saved TJ LHV	Water saved ML
Plastics				
Polyethylene terephthalate	8.9	11	490	610
High density polyethylene	12	10	600	270
Polyvinyl chloride	0.02	0.01	0.6	0.5
Low density polyethylene	4.5	3.7	230	100
Polypropylene	4.9	1.5	150	130
Polystyrene	0.4	0.1	10	10
Mixed and/or other plastics	1.7	0.5	50	40
Glass				
Glass	84	44	370	80
Other materials				
Fly ash	-	-	-	-
Foundry sands	8.2	-	-	-
Leather and textiles	1.6	-	-	-
Tyres and other rubber	19	20	1,220	1,000
Total	**4,201**	**1,140**	**14,500**	**7,900**

7.1 Greenhouse gas emission savings

It is estimated that SA saved about 1.14 million tonnes of carbon dioxide equivalent (CO_2-e) through recycling its materials in 2020-21. This is a decrease from the estimated emissions savings reported in the previous year (1.32 million tonnes CO_2-e), however the decrease is partly attributed an updated and lower emissions savings factor for timber (see Appendix B).

Like previous years, organics recycling contributed the greatest proportion of greenhouse gas emissions savings at about 543 kt CO_2-e, which equates to about half of the total estimated savings. Metals contributed about 31% of total emission savings, masonry 9%, and the remainder was made up of other material categories, each contributing less than 5%.

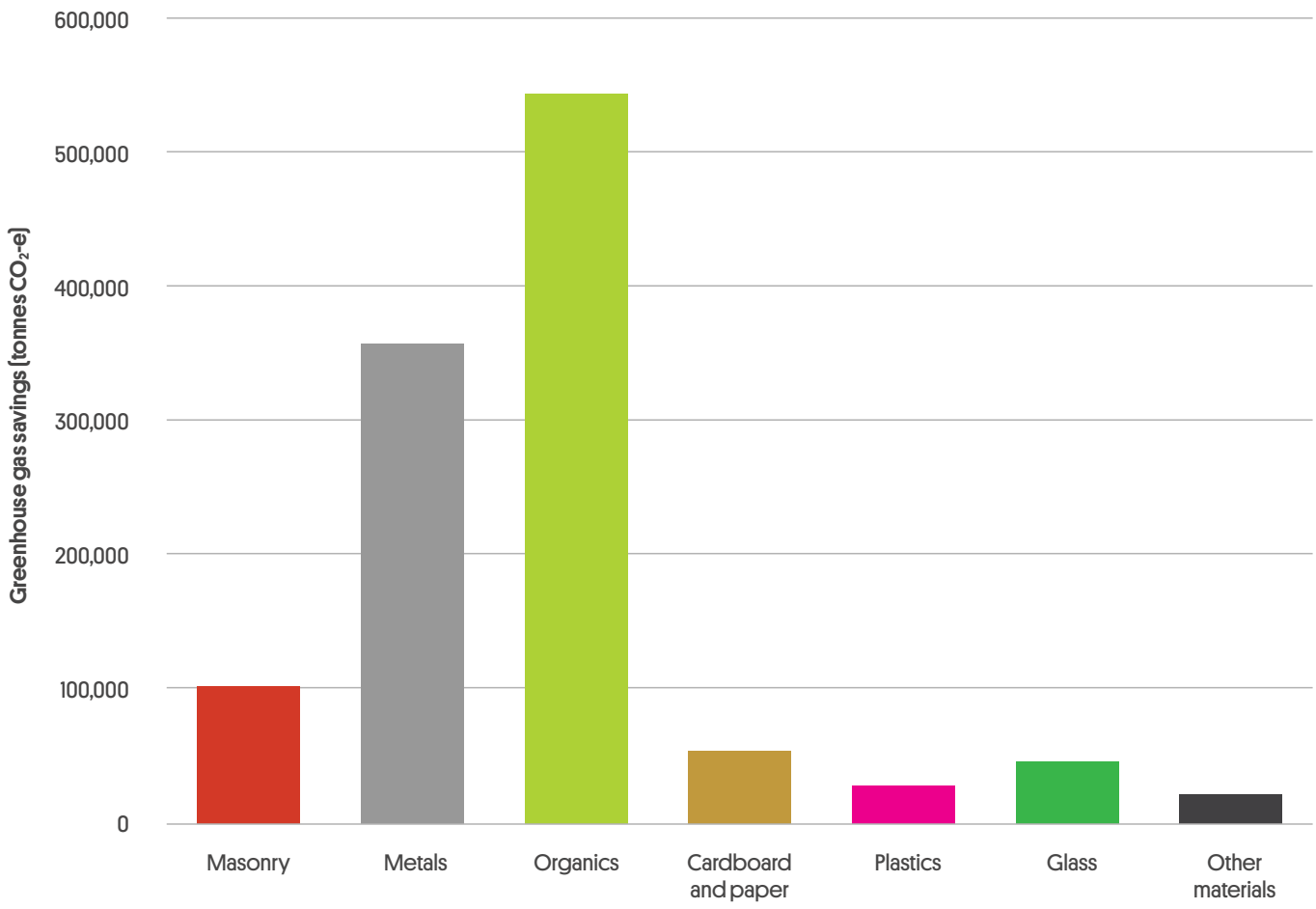
Table 40 and Figure 41 provide detail on estimated greenhouse gas emissions savings due to recycling in 2020-21. It is estimated that emissions saved due to recycling in 2020-21 is approximately equivalent to:

- the CO_2 absorbed by 1.7 million trees
- the annual emissions from 229,000 cars.

Table 40 Estimated greenhouse gas emissions savings due to recycling in SA in 2020-21

Material category	Emissions saved kt CO_2-e	Equivalent trees planted required for carbon absorption	Equivalent cars off the road in one year
Masonry	101	150,000	20,000
Metals	357	531,000	71,000
Organics	543	809,000	109,000
Cardboard and paper	53	78,000	11,000
Plastics	26	39,000	5,000
Glass	44	66,000	9,000
Other materials	20	30,000	4,000
Total	**1,144**	**1,705,000**	**229,000**

Figure 41 Estimated greenhouse gas emissions savings due to recycling, SA 2020-21



7.2 Energy savings

Energy savings from recycling in SA during 2020-21 were estimated at 14,500 terajoules (TJ). This is slightly lower than the estimate of 14,800 TJ from 2019-20, mostly due to lower quantities of recovered timber.

Metals contributed to most energy savings in 2020-21, at about 5,400 TJ, or 37% of the total. Metals were followed by organics at 25% of total savings, then masonry at 16%, plastics at 11%, other materials at 8%, and glass at 3%.

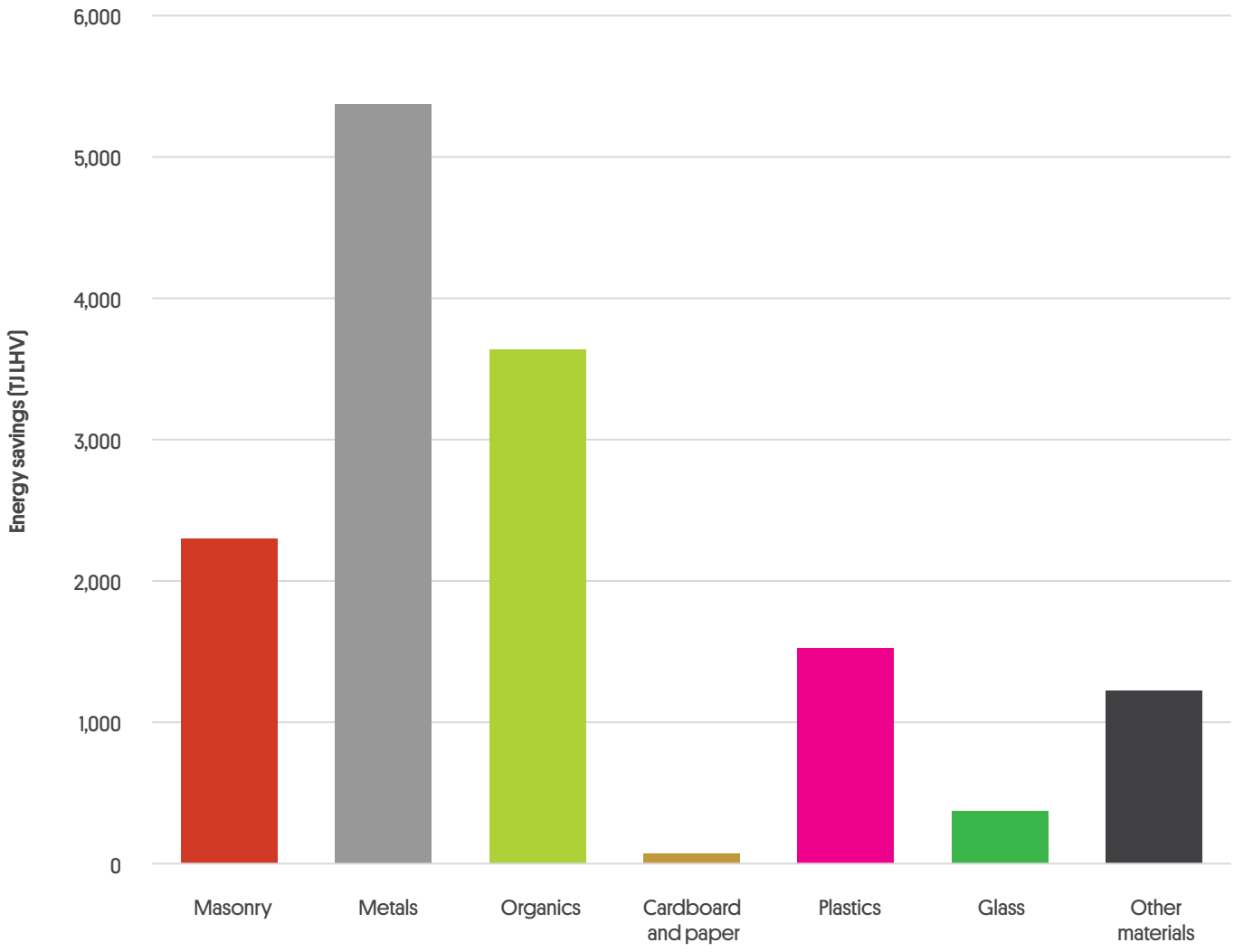
It is estimated that energy savings due to the recycling of SA materials in 2020-21 are equivalent to:

- energy use from 284,000 households in one year
- the energy supplied by 2.4 million barrels of oil.

Table 41 Estimated energy savings due to recycling in SA in 2020-21

Material category	Energy saved TJ LHV	Equivalent household energy use in one year	Barrel of oil equivalents
Masonry	2,300	45,000	378,000
Metals	5,400	105,000	881,000
Organics	3,600	71,000	594,000
Cardboard and paper	70	1,000	11,000
Plastics	1,500	30,000	250,000
Glass	400	7,000	61,000
Other materials	1,200	24,000	200,000
Total	**14,500**	**284,000**	**2,376,000**

Figure 42 Estimated energy savings due to recycling, SA 2020-21



7.3 Water savings

The total estimated water savings from recycling SA materials in 2020-21 were 7,900 megalitres (ML), an increase from the 7,500 ML estimated in 2019-20.

Masonry contributed to highest proportion towards these savings at 29%, followed by cardboard and paper at 25%, organics at 21%, plastics at 15%, other materials at 13% and glass at 1%. Although metals recycling provides significant environmental benefits in terms of greenhouse gas emissions and energy savings, it is understood to be a net water cost compared to its virgin equivalent.

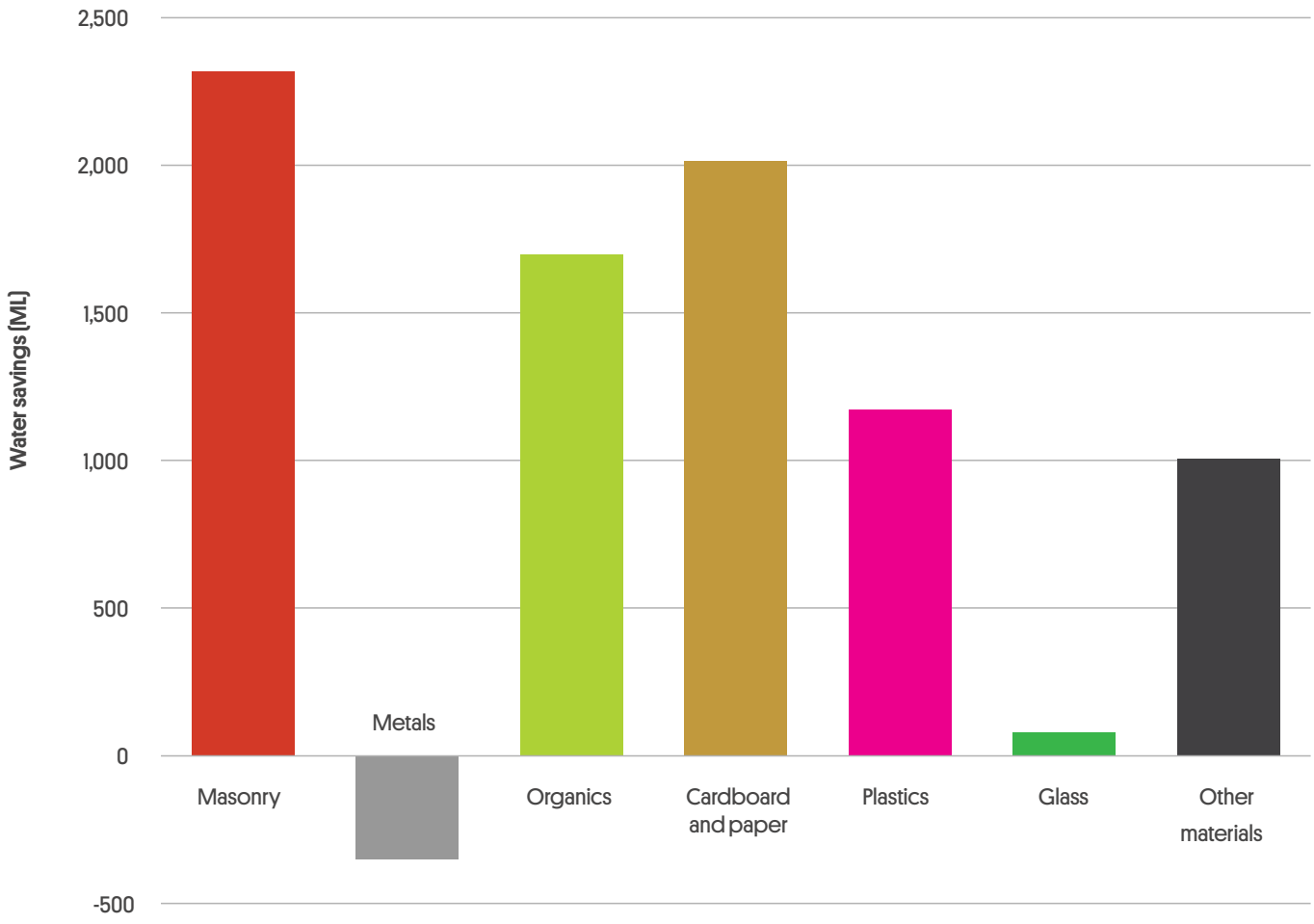
Water savings from recycling in SA in 2020-21 are estimated to be approximately equivalent to:

- annual water use from 48,000 households
- the water contained in 3,200 olympic sized swimming pools.

Table 42 Estimated water savings due to recycling in SA in 2020-21

Material category	Water saved ML	Equivalent household water use in one year	Equivalent olympic swimming pools
Masonry	2,300	14,000	900
Metals	-300	-2,000	-100
Organics	1,700	10,000	700
Cardboard and paper	2,000	12,000	800
Plastics	1,200	7,000	500
Glass	80	500	30
Other materials	1,000	6,000	400
Total	**7,900**	**48,000**	**3,200**

Figure 43 Estimated water savings due to recycling, SA 2020-21



References

ABS (2022) *Population estimates by LGA, Significant Urban Area, Remoteness Area and electoral division*, 2001 to 2021, online at: www.abs.gov.au/statistics/people/population/regional-population

ABS (2021a) *Australian National Accounts: State Accounts*, online at: www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/

ABS (2021b) *National, state and territory population*, online at: www.abs.gov.au/statistics/people/population/national-state-and-territory-population/

ABS (2019) *Household and Family Projections, Australia*, online at: www.abs.gov.au/statistics/people/population/household-and-family-projections-australia/2016-2041

Department of Agriculture, Water and the Environment (2021) *Australian standard for waste and resource recovery data and reporting*, prepared by Blue Environment, online at: www.awe.gov.au/environment/protection/waste/publications/national-standard-waste-and-resource-recovery-data-and-reporting

Department of Agriculture, Water and the Environment (2022) *Australian Packaging Covenant*, online at: www.awe.gov.au/environment/protection/waste/plastics-and-packaging/packaging-covenant

Department of Industry, Science, Energy and Resources (2020) *Australian Energy Update 2020*, Australian Energy Statistics, online at: www.energy.gov.au/sites/default/files/Australian%20Energy%20Statistics%202020%20Energy%20Update%20Report_0.pdf

Blue Environment (2020) *National Waste Report 2020*, prepared for the Department of Agriculture, Water and the Environment, online at: www.awe.gov.au/sites/default/files/env/pages/5a160ae2-d3a9-480e-9344-4eac42ef9001/files/national-waste-report-2020.pdf

Foodbank (2020) *Foodbank Hunger Report 2020*, online at: www.foodbank.org.au/research-reports/?state=vic

Green Industries SA (2021) *Recycling Activity Survey 2019 20 Report*, online at: www.greenindustries.sa.gov.au/GISA_RAS_19-20.pdf?downloadable=1

Green Industries SA (2020) *South Australia's Waste Strategy 2020-2025*, online at: www.greenindustries.sa.gov.au/resources/sa-waste-strategy-2020-2025

Lifecycles et al (Lifecycles, EconSearch, Colby Industries and the University of Queensland 2017) *Potential Benefits of a Circular Economy in South Australia*, prepared for Green Industries SA, online at: www.greenindustries.sa.gov.au/__media_downloads/172204/Potential%20Benefits%20of%20a%20Circular%20Economy%20in%20South%20Australia%20-%20report%20(2017).pdf#

MRA (Mike Ritchie & Associates Consulting Group 2021) *Measuring the Impact of the Charitable Reuse and Recycling Sector: A comparative study of clothing A comparative study using clothing donated to charitable enterprises*, online at: Charitable-Recycling-Australia-Recycled-Clothing-Impact-Assessment-240521.pdf

SA Water (2020) *South Australian Water Corporation Annual Report: 2019-20*, online at: www.sawater.com.au/__data/assets/pdf_file/0008/524780/SA-Water_2019-20-Annual-Report_Accessible.pdf

Trellis Technologies (2019) *Green Industries South Australia - Emission Factor Review*, prepared for Green Industries SA

Appendices

Appendix A Technical methodology

A1 Overview

Green Industries SA commissioned Blue Environment to undertake a survey on SA's recycling and energy recovery industries for the 2020-21 financial year. This section outlines the approach for conducting the survey and analysing the collected data.

A2 The survey

A2.1 Design

The survey was developed to broadly follow previous Recycling Activity Surveys, although several changes were made to implement better consistency with the Commonwealth Government's *Australian standard for waste and resource recovery data and reporting*, the first edition of which was published in August 2021, and its supporting *Workbook to present a model set of data requests on resource recovery*. These changes included:

- updating the classification of some materials (e.g. 'glass' was split into 'glass from food and beverage containers' and 'other glass', as per the national standard)
- asking about infrastructure classification and capacity
- asking for additional geographical information, such as the state or territory to which materials were destined if sent interstate
- asking for more detail on outputs, including about productive use
- including a question for materials sent offsite to waste and resource recovery facilities for further processing.

The survey questionnaire was developed in consultation with Green Industries SA and can be seen in Appendix C.

A primary survey form was developed in Microsoft Excel. An online form was also developed via Survey Monkey.

A2.2 Participants

Using Recycling Activity Survey 2019-20 respondents as a foundation, a list of companies and organisations involved with recycling, reuse and energy recovery in SA was developed. This covered recovery facilities, reprocessors, industry bodies, local government waste management authorities and reuse organisations. The final list, developed in consultation with Green Industries SA, comprised 138 companies and organisations. It should be noted that this did not include composters, which received a separate survey from Green Industries SA, the data from which were received and applied in this report.

A2.3 Delivery

The survey was deployed to participants in November 2021 via email. The survey form, an introduction letter from GISA and a confidentiality deed from the consultant team were attached to the email.

Participants were offered an opportunity to go through the survey with a member of the consultant team, or fill out the form in their own time. Participants were sent follow-up reminders on the survey via email and/or phone multiple times to encourage submission. The surveying period lasted several weeks and closed in December 2021, although some data was received in early 2022.

A selection of key SA recyclers nominated by Green Industries SA were approached for a site visit and face-to-face survey interview. Eight site visits were conducted, where members of the consultant team and a representative from GISA filled out the survey questionnaire in-person alongside the survey respondent. An additional two interviews were conducted via videoconference. These face-to-face consultations provided additional detail and industry insights that guided the interpretation of data and the report.

The survey was voluntary and not all approached companies and organisations provided a response, despite the consultant team's best efforts. In instances of non-response, data were filled where possible using previous years' data. In one case, mass balance reporting data was applied.

A3 Data analysis

A3.1 Survey data analysis

Data collected via the survey were collated into a Microsoft Excel database. The data were cleaned and verified, and then analysed to determine the following for each material type:

- **Net recovery**: the quantity of SA materials recovered, net of residuals and accounting for known and assumed double-counts.
- **Source stream**: the source stream from which the SA materials came from, including MSW, C&I and C&D.
- **Geographical origin**: the geographical origin within SA from which the material came from, including metropolitan region and regional areas.
- **Destination**: where the material was sent for recycling, including in SA, interstate or overseas.

The following principles were applied when analysing survey data to generate reported figures:

- The scope of the survey was for materials generated in SA only. Therefore, any materials imported into SA from interstate or overseas for recycling were excluded.
- The proportion of received materials that were residual waste sent to landfill was excluded from reported quantities.
- Care was taken to avoid double-counts of materials, which can arise when material flows through more than one facility and is subsequently reported by more than one survey participant. Double-counts were mostly addressed via a survey question regarding materials sent offsite to another waste and resource recovery facility for further processing. This approach was slightly different to the approach in previous years.
- In instances where a company or organisation did not provide data for the year, previous years' data was used where available. In the future, mass balance reporting may be used to supplement the data collected.

A3.2 Reuse and the circular economy

The survey sought data on reuse and the circular economy, building from the approach introduced for the *Recycling Activity Survey 2019-20 Report*. This involved engaging major South Australian reuse organisations about reuse flows through their operations in the 2020-21 financial year, as well asking all survey participants about their motivations within a circular economy context. The approach will likely be refined and improved in future surveys.

Reported reuse quantities are not exhaustive and exclude some major reuse items, such as vehicles and anything traded via online community platforms. Again, the survey will capture more comprehensive data in the future as the data collection method is refined.

The estimated value of reused items in is based on dollar values provided by industry for the *Recycling Activity Survey 2019-20 Report*.

A3.3 Per capita analysis

Metrics for per capita statistics were calculated using population and demographic data from the Australian Bureau of Statistics [ABS 2022; ABS 2021b; ABS 2019].

A3.4 Packaging

The survey sought data on the recovery of packaging materials. These were supplemented by container deposit legislation data provided by SA EPA. For non-CDL packaging:

- **cardboard packaging** was derived from cardboard material recovery data which was adjusted to account for pre-consumer material
- **plastics packaging** was derived from industry data for plastic packaging materials recovered by Adelaide MRFs and other sources.
- **glass packaging** was determined from industry-reported glass containers recovery data.

A3.5 Environmental benefits of recycling

The method for the environmental benefits of recycling used the same approach as for previous *Recycling Activity Survey* reports. The scope of environmental benefits analysis included the following metrics:

- **Greenhouse gas emissions savings** (in tonnes CO_2-e): The reduction in greenhouse gas emissions achieved by replacing virgin materials with recycled materials.
- **Energy savings** (in terajoules): The amount of energy saved, including all fossil, renewable, electrical, and embodied energy, by using recycled materials.
- **Water savings** (in megalitres): The reduction in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

The conversion and emission factors used to assess the benefits of recycling materials are based on life cycle analysis techniques. These can be found in Appendix B. Sufficiently comprehensive and/or reliable conversion factors could not be identified for foundry sands and leather and textiles. Therefore, these materials were not included in the environmental benefits analysis.

The following limitations apply to the environmental benefits analysis presented in this report, as well as in previous Recycling Activity Survey reports:

- Many of the conversion and emission factors adopted are derived from interstate studies and were not calculated specifically for SA. This may mean estimated savings do not account for all local factors.
- SA may not necessarily accrue all total estimated environmental benefits because:
  - » some of the virgin materials that are replaced by recycling are not manufactured in SA
  - » some material recovered from SA for recycling is used to manufacture products that end up being consumed outside of the state.

Due to this limitation, the environmental benefits assessment presented in this study is a generalised estimate and should be used with caution.

A3.6 Value of resource recovery

Values for products used in this report were based on industry-responses to the survey. These were supplemented by personal consultations with industry conducted in late 2021 and early 2022, as well as publicly available information on market values of recovered materials.

Appendix B Environmental benefits conversion factors, 2020-21

The table below lists a set of factors used to estimate the environmental benefits of recycling SA materials in 2020-21. They are based on a study commissioned by Green Industries SA by Trellis Technologies (2019). Three greenhouse gas emissions conversion factors were updated in 2020-21 compared to previous years – these are highlighted in yellow below.

		GHG emissions saved	Energy saved	Water saved
Category	**Type**	**Emissions factor (t CO_2-e/t)**	**Conversion factor (GJ LHV/t)**	**Conversion factor (kL/t)**
Masonry	Asphalt	0.030	2.380	0.880
	Bricks	0.020	0.280	1.260
	Concrete	0.020	0.350	1.280
	Plasterboard	0.030	0.550	-0.030
	Clays, fines, rubble and soil	0.088	1.420	0.440
Metals	Iron and steel	0.440	7.490	-2.360
	Aluminium	16.667	206.667	29.333
	Non-ferrous metals	0.880	36.090	5.970
Organics	Food organics	0.980	0.180	0.440
	Garden organics	0.670	0.309	5.592
	Timber	0.180	10.730	-0.040
	Organics – other	0.481	2.165	0.230
Cardboard and paper	Cardboard and waxed cardboard	0.169	0.467	11.111
	Liquid paperboard	0.169	0.467	11.111
	Magazines	0.455	0.364	10.909
	Newsprint	0.455	0.364	10.909
	Phonebooks	0.455	0.364	10.909
	Printing and writing paper	1.300	-0.680	11.000

		GHG emissions saved	Energy saved	Water saved
Category	**Type**	**Emissions factor (t CO_2-e/t)**	**Conversion factor (GJ LHV/t)**	**Conversion factor (kL/t)**
Plastics	Polyethylene terephthalate	1.200	55.000	68.750
	High density polyethylene	0.825	50.000	22.750
	Polyvinyl chloride	0.313	30.000	26.250
	Low density polyethylene	0.825	50.000	22.750
	Polypropylene	0.313	30.000	26.250
	Polystyrene	0.313	30.000	26.250
	Mixed and/or other plastics	0.313	30.000	26.250
Glass	Glass	0.528	4.444	0.931
Other materials	Fly ash	0.029	0.552	1.260
	Foundry sands	Not specified as insufficient reference data identified		
	Leather and textiles			
	Tyres and other rubber	1.070	64.080	52.250

The updated emissions factors for food organics, garden organics and timber were calculated by Blue Environment based on *National Greenhouse and Energy Reporting (Measurement) Determination 2008* methods. The calculations compared emissions from landfilling these organics types (assuming a landfill gas recovery rate of 43%) with emissions from composting them.

Appendix C Circular Economy Resource Recovery Survey 2020-21

SA Circular Economy and Resource Recovery Survey 2020-21	(1 July 2020 - 30 June 2021)
Please enter information in white cells in this worksheet.	
1. Please provide details of the person filling out this survey.	
Name	
Position	
Phone	
Email	
2. Please provide your company or organisation's contact address and details. Please also include the address of your main facility(ies) for reprocessing or handling of materials.	
Company/organisation name	
ABN	
Contact address	

	Facility 1	Facility 2	Facility 3	Facility 4	Facility 5
Address of your main facility(ies) for reprocessing or handling of materials					
Waste and resource recovery facility classification					
Annual throughput capacity (without significant capital expenditure or new approvals) in tonnes per year					

3. Are you happy for your company to be recognised in the report as participating in the 2020-21 Circular Economy and Resource Recovery Survey?	
4. Please fill in Table 1 for each relevant material. This is the critical information required for the survey. All data will be kept confidential and anonymised for reporting purposes. Data in Table 1 should cover material generated in SA only.	

Table 1: Goods and material data from the 2020-21 financial year

GOODS AND MATERIAL TYPE	GOODS AND MATERIAL SOURCE/INPUT								GOODS AND MATERIAL DESTINATION/OUTPUT							RESIDUAL	PACKAGING	VALUE
	Total goods and material received for recycling in 2020-21	Goods and material received for recycling			Source of goods and material				Destination of goods and material for reprocessing or reuse							Proportion of residual waste to landfill	Proportion of material (if any) derived from post-consumer packaging[4]	Approx. average value per tonne[5]
		From SA - Metro	From SA - Regional		MSW[1]	C&I[2]	C&D[3]		Your SA facility(ies)	Elsewhere in SA - Metro	Elsewhere in SA - Regional		Sent interstate		Sent overseas (if known)			
	Tonnes	Tonnes or %	Tonnes or %	Region	%	%	%		Tonnes or %	Tonnes or %	Tonnes or %	Region	Tonnes or %	Jurisdiction	Tonnes or %	%	%	$ per tonne
EXAMPLE: Iron and steel	*23,100*	*20,100*	*3,000*	*-*	*25%*	*70%*	*5%*		*-*	*-*	*-*	*-*	*23,100*	*Vic*	*-*	*0%*	*0%*	*$200*

Please add additional rows if required.

Notes:

1. MSW = Municipal solid waste - domestic household sourced waste
2. C&I = Commercial and industrial - industry and business sourced waste
3. C&D = Construction and demolition - building, construction and demolition
4. Excludes pre-consumer packaging manufacturing scrap
5. Commodity or market price

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5. What is the method for measuring the data provided in Table 1?	Measurement method		
6. What is the estimated accuracy of the data provided in Table 1 (e.g. ±5%)? *If weighbridge, a suitable accuracy may be ±1%.*			
7. What material types were sent offsite from your facility(ies) for further processing at a waste and resource recovery facility?	Material type	Tonnes sent for further processing	Name of receiving waste and resource recovery facility
Please add additional rows if required.			
8. What output types were sent offsite from your facility(ies) to be returned to productive use?	Output type	Tonnes sent to productive use	Productive use type
Please add additional rows if required.			
9. In addition to the volumes reported in Table 1, did you receive any waste from interstate or overseas sources that was reprocessed at your site? If so, please list materials received and state volumes and sources.	Material type	Tonnes received	Source location
Please add additional rows if required.			
10. If there have been any significant changes in quantities, stockpiles, sources or destinations from the 2019-20 financial year, what was the reason for this?			
11. Where do you receive most of your material from (e.g. Councils, manufacturing, retail, hospitality, donations, etc.)?			
12a. How many people (FTEs) are directly employed by your company/ organisation's site(s) or operations(s) associated with material collection, resource recovery and/or recycling (i.e. permanent or casual staff, individual contractors)?			
12b. What are the employment classifications in your company/organisation? Please complete the following table.	Classification		No. FTE
Please add additional rows if required.			

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13. What is your opinion about the market strength/prospects for recycled goods and materials?	
14. Does your company or organisation intend to expand or contract its SA facilities or make new investments in recycling activity? If yes, what will this involve?	
15. Are there any significant barriers (e.g. market, regulatory, technology) for your SA operations?	
16. What is your organisation's approximate annual sales revenue (turnover) from goods and material collection, resource recovery and/or recycling activities?	
17. What are the names of other recyclers in your area of the SA recycling industry? *This helps us ensure that we have captured all recyclers in the industry.*	Circular economy factor
18. Which of the following factors (in the drop down list) is your highest priority when identifying the reprocessing destination for sourced goods and materials in a circular economy?	
19. Would you like to be invited to an industry seminar by Green Industries SA (GISA) summarising the findings of this 2020-21 Circular Economy and Resource Recovery Survey?	

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