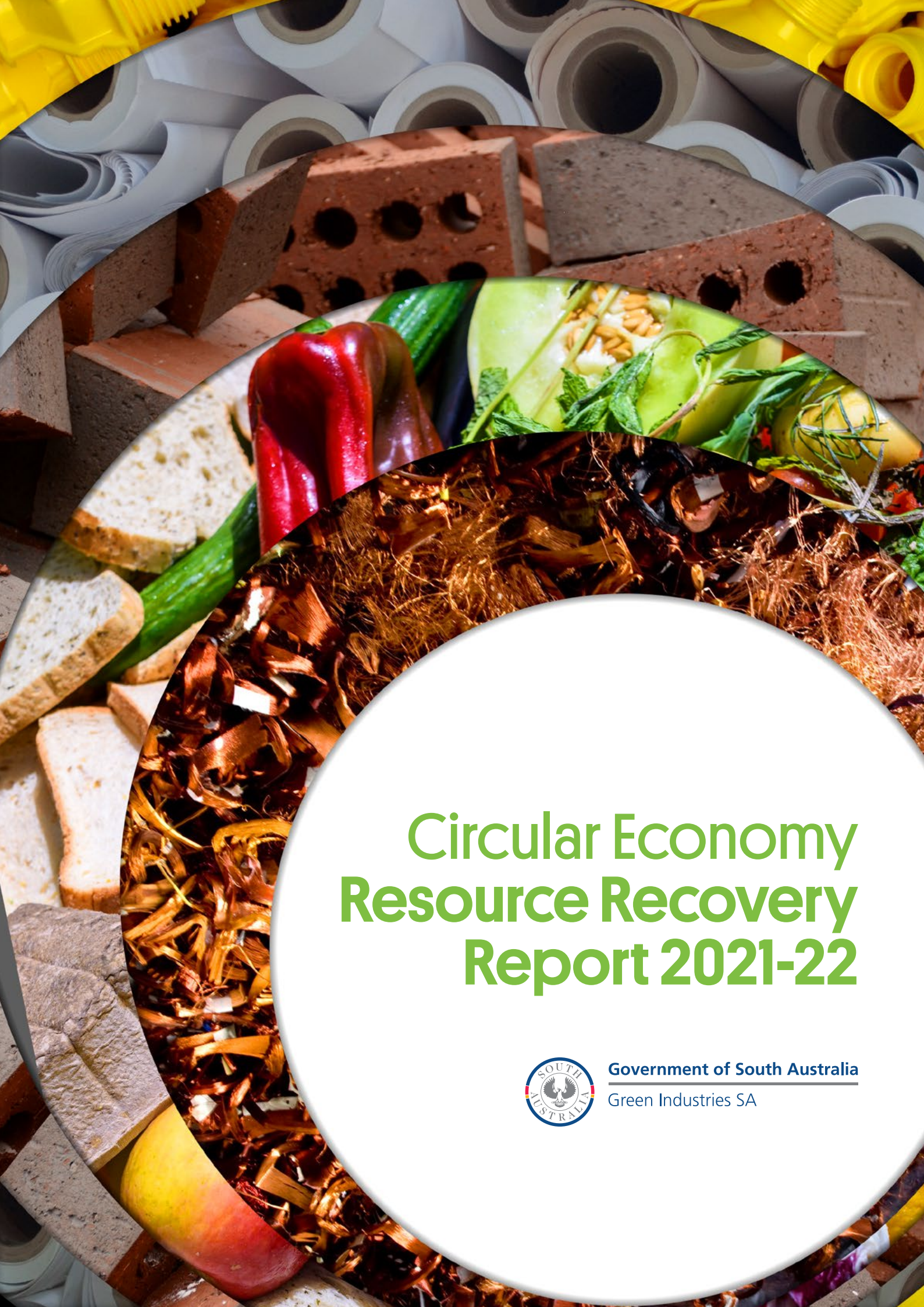

Circular Economy
Resource Recovery Report 2021-22

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 30 June 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 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
MFA	Material flow analysis
ML	Megalitre
MSW	Municipal solid waste
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
Recovered materials	Waste materials separated, sorted or processed for the purposes of 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 2021-22
TJ	Terajoule

Acknowledgements

Green Industries SA would like to acknowledge and thank the following participants of the Circular Economy Resource Recovery Survey 2021-22 and the SA Organics Industry Survey 2021-22. The list below excludes organisations that asked not to be identified.

Adelaide Hills Region Waste Management Authority

Agricycling Australia

APR Manufacturing Group

Ceduna Recycling

Central Adelaide Waste and Recycling Authority

Clare Valley Waste

Downer EDI

Ecoplas Australia

Electronic Recycling Australia

Foodbank

Green Triangle Recyclers Pty Ltd

Hallett Resources Pty Ltd

Infrabuild

Intercast and Forge Pty Ltd

J Mathews Pty Ltd

JA Braun Investments Pty Ltd

JBS

Jeffries

MBL Protein

Mobile Muster

Mobius Farms

Mulbarton Pty Ltd

Northern Adelaide Waste Management Authority

OneFortyOne Wood Products

Opal

OzHarvest

Peats Group Ltd

Recycling Plastics Australia

Remondis Australia Pty Ltd

Renewal SA

ResourceCo

SA Composters

Salvos Stores

Shred-x Pty Ltd

Sims Metal

South Australian Water Corporation (SA Water)

Southern Region Waste Resource Authority

Statewide Recycling

Tarac Technologies Pty Ltd

Topcoat Asphalt

Van Schaik's Biogro

Summary

Introduction

Each year, Green Industries SA measures recovery and disposal activity in South Australia (SA) to assess how the State is performing on waste management and resource recovery. The findings are used to track progress against SA's state waste targets. This report presents the results for the 2021-22 financial year.

Summary of 2021-22 results

SA's recovery rate in 2021-22 was an estimated 81.9%, which is slightly lower than previous years. SA recovered about 3.99 million tonnes of material in 2021-22, a 4.9% decrease compared to 2020-21. Disposal to landfill increased this year; about 885 kilotonnes (kt, or thousands of tonnes) of waste was landfilled in 2021-22 compared to 840 kt in 2020-21. Overall waste generation decreased slightly to about 4.88 million tonnes compared to last years' 5.04 million tonnes.

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

- Standard reporting materials, comprising 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, comprising clay, 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, 2021-22

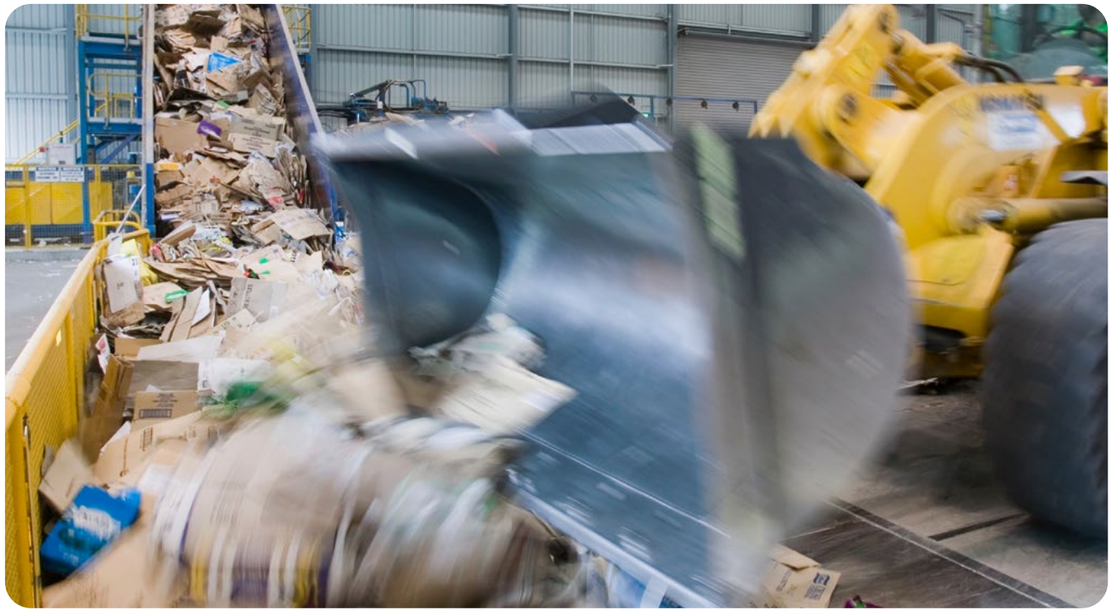
	Standard reporting materials	Separately reported materials	Total
Resource recovery (million tonnes)	3.39	0.60	**3.99**
Landfill disposal (million tonnes)	0.68	0.21	**0.88**
Waste generation (million tonnes)	4.07	0.81	**4.88**
Recovery rate (%)	83.4%	74.3%	**81.9%**

Recovery by material

When comparing 2021-22 data to 2020-21 data:

- **Masonry** (including clay, fines, rubble and soil) recovery was slightly lower at 2.03 million tonnes, down from 2.4 million tonnes. Recovery of all material types in this category decreased; plasterboard and bricks experienced the largest reported declines.
- **Metals** quantities fell to 329 kt from 351 kt. The spike in iron and steel recovery seen in 2020-21 resolved, and an increase in aluminium recovery was recorded in 2021-22.
- **Organics** recovery remained strong with about 1.35 million tonnes of organic materials recovered in 2021-22, an increase from the 1.13 million tonnes recovered in 2020-21. The growth was mostly of 'other' organics which includes meat rendering, waste grease and fat, waste sludge and biosolids and other organic materials. Recovery of food organics also grew in 2021-22.
- **Cardboard and paper** recovery continued to decline. Overall, about 164 kt of cardboard and paper was recovered in 2021-22, this is about 17 kt less than 2020-21. This rate is lower than levels seen since 2005-06. This fall is associated with digitisation of communications, especially news.
- **Plastics** recovery increased, with greater emphasis on sorting to individual polymers rather than the old practice of sorting to mixed plastic streams for export. SA recovered about 33 kt of plastics in 2021-22; a steady increase from 32 kt recovered in 2020-21 and 30 kt recovered in 2019-20.
- **Glass** recovery declined to 54 kt in 2021-22 from 84 kt in 2020-21.
- **Other materials** include fly ash, foundry sands, leather and textiles, and tyres and other rubber. The combined recovery of these materials in 2021-22 was about 34 kt, higher than last year's 29 kt.

Figure S1 summarises the material composition and destination of total recovered materials in SA in 2021-22.



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. 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. A summary of progress so far based on 2021-22 data is provided in Table S2.

Table S2 Summary of state waste targets and progress on them

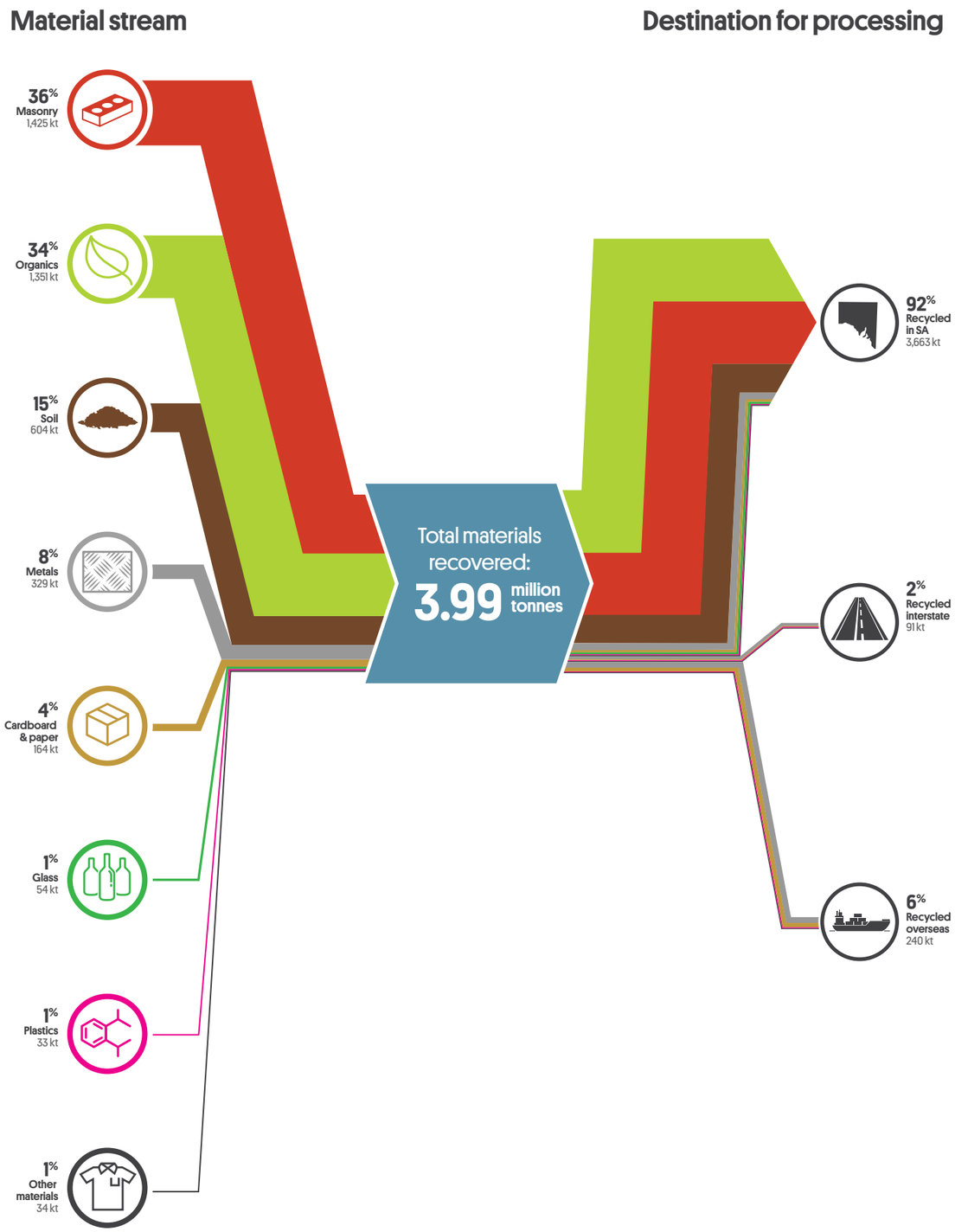
Topic	Target	Progress
Landfill diversion	Zero avoidable waste to landfill by 2030	SA disposed about 885 kt of waste to landfill in 2021-22, an increase from 840 kt in 2020-21
Waste generation	5% reduction in waste generation per capita from a 2020 baseline	Waste generation per capita showed 5.8% reduction in 2021-22 compared to 2020-21, 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 2021-22: - MSW 56% - C&I 88% - C&D 87%

Local government kerbside recovery

About 683 kt of waste materials were collected at kerbside in SA, including 527 kt from metropolitan councils and 156 kt from regional councils. SA's estimated recovery rate for kerbside waste in 2021-22 was 49%, slightly higher than the 2020-21 rate of 47.8%. Recovery was higher for metropolitan councils (51%) than regional councils (40%). Compared to 2020-21, overall quantities of waste were higher but recovery performance was also slightly higher.

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

Figure S1 Resource recovery, including energy recovery, SA, 2021-22, by material and destination, not including e-waste or materials reused



1 Introduction

- The *Circular Economy Resource Recovery Report 2021-22* presents the findings of a survey of SA's resource recovery sector for the 2021-22 financial year.
- It shows data on SA's waste generation, landfill disposal and resource recovery, including progress against targets set 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. This is illustrated in Figure 1.

South Australia (SA) continues to lead the way on resource recovery performance as it pushes towards a circular economy. This report provides a summary of 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 *South Australia'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 second edition of the *Circular Economy Resource Recovery Report* (CERRR) which is a new iteration of Green Industries SA's previous *Recycling Activity Survey Reports*. The CERRR 2021-22 builds on the findings of previous years and is consistent with the *Australian standard for waste and resource recovery data and reporting* (DCCEEW 2021).

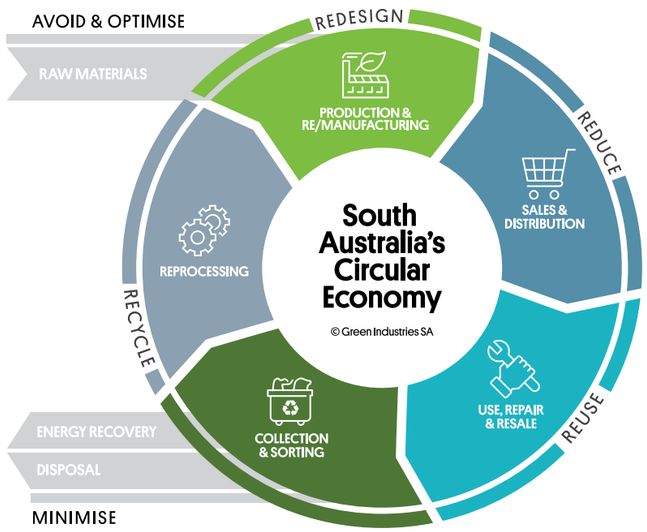


Figure 1 South Australia's circular economy

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 2021-22* (the Survey) asked recyclers, reprocessors, the reuse sector and the energy recovery industry in SA about their operations in 2021-22. 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
- proportion of material derived from post-consumer packaging
- the type of productive use made of the recovered material.

Survey participants were also asked about the status of resource recovery, barriers to their operations and employee figures.

On 1 July 2021, the South Australian Environment Protection Authority's (SA EPA) mass balance reporting requirements came into effect for waste depots that receive over 20,000 tonnes of solid waste per annum.

While significant effort has been taken to verify the Survey responses it is acknowledged that some quantities are based on estimates or with large margins of error. This is discussed in Appendix A.

Table 1 Summary of SA's waste targets

Overall targets				
2025	Per capita waste generation 5% reduction 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 material 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 2021-22*, 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 towards a circular economy.

2.1 Resource recovery and landfill disposal

Overview

SA recovered about 3.99 million tonnes of material in 2021-22, a 4.9% decrease compared to 2020-21. Disposal to landfill increased this year; about 885 kilotonnes (kt, or thousands of tonnes) of waste was landfilled in 2021-22 compared to 840 kt in 2020-21. Overall waste generation was 4.88 million tonnes, slightly down from 5.04 million tonnes in the previous year. SA achieved a recovery rate of 81.9% in the 2021-22 financial year, slightly lower than the 2020-21 rate of 83.3% and slightly lower than rates achieved since 2016-17.

Table 2 (overleaf) summarises the key statistics for resource recovery and landfill disposal in SA in 2021-22, including records from the past five-year and also from 2003-04 (the first year SA conducted a recycling activity 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 clay, fines, rubble and soil and fly ash. These materials are reported separately because they can fluctuate significantly across years as they are strongly influenced by large infrastructure projects.

Table 2 shows that the recovery of standard reporting materials fell by 2.4% in 2021-22 and the recovery of separately reported materials fell by 17%.

There was a change in the data source for a number of organisations from voluntary survey to mass balance reporting from EPA. The reported materials could not always be readily mapped to the material categories reported here, which could lead to some variation in the reporting of recovery.

Several respondents to the 2021-22 survey had been infrequent respondents to previous surveys. The improved visibility from these companies may have led to increased reported recovery in the relevant sectors in 2021-22.

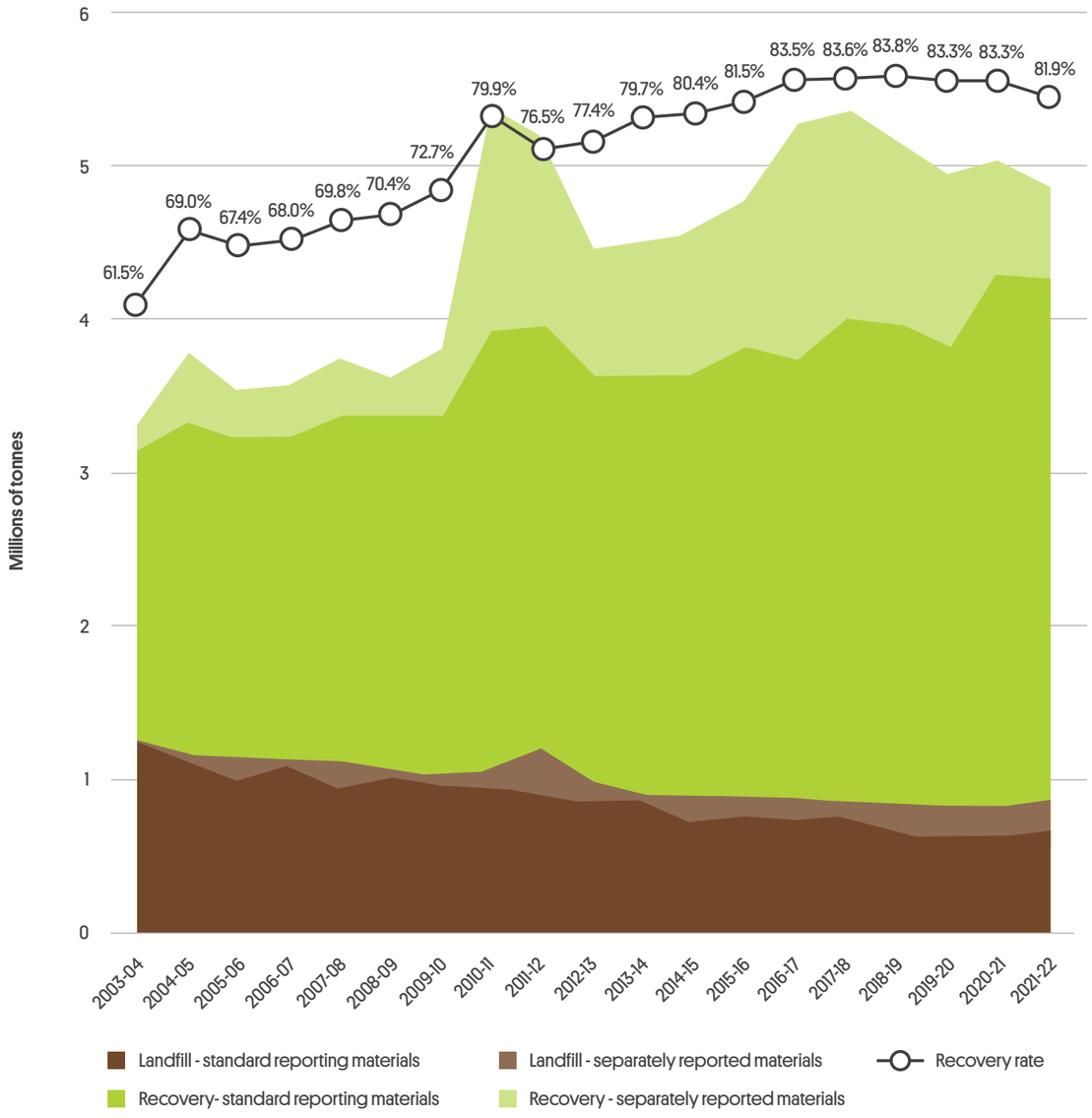
Table 2 Annual SA resource recovery and landfill diversion performance for 2021-22 and previous years

Parameter	2003-04	2017-18	2018-19	2019-20	2020-21	2021-22	Change	
							20-21 to 21-22	03-04 to 21-22
Resource recovery ('000 tonnes)								
Standard reporting materials	1,880	3,143	3,123	2,994	3,472	3,389	-2.4%	80%
Separately reported materials	162	1,346	1,215	1,140	729	604	-17.2%	273%
Total	**2,042**	**4,489**	**4,338**	**4,134**	**4,201**	**3,994**	**-4.9%**	**96%**
Landfill disposal ('000 tonnes)								
Standard reporting materials	1,258	783	675	631	641	676	5.3%	-46%
Separately reported materials	20	98	165	196	199	209	5.0%	947%
Total	**1,278**	**881**	**840**	**827**	**840**	**885**	**5.3%**	**-31%**
Waste generation ('000 tonnes)								
Standard reporting materials	3,138	3,926	3,798	3,625	4,114	4,065	-1.2%	30%
Separately reported materials	182	1,444	1,380	1,136	928	813	-12.3%	347%
Total	**3,320**	**5,370**	**5,178**	**4,961**	**5,042**	**4,878**	**-3.2%**	**47%**
Recovery rate (%)								
Standard reporting materials	59.9%	80.1%	82.2%	82.6%	84.4%	83.4%	-1.0%	24%
Total	**61.5%**	**83.6%**	**83.8%**	**83.3%**	**83.3%**	**81.9%**	**-1.4%**	**20%**
SA population (persons)	**1,534,000**	**1,736,400**	**1,751,700**	**1,769,300**	**1,773,000**	**1,821,000**	**2.7%**	**19%**
Per capita recovery (kg/person/yr)								
Standard reporting materials	1,230	1,810	1,780	1,690	1,958	1,861	-1.2%	51%
Total	**1,330**	**2,585**	**2,475**	**2,335**	**2,370**	**2,193**	**-7.5%**	**65%**
Per capita disposal (kg/person/yr)								
Standard reporting materials	820	450	390	360	362	371	2.6%	-55%
Total	**830**	**505**	**480**	**465**	**474**	**486**	**2.6%**	**-41%**
Per capita waste generation (kg/person/yr)								
Standard reporting materials	2,050	2,260	2,170	2,050	2,320	2,232	-3.8%	9%
Total	**2,160**	**3,090**	**2,960**	**2,800**	**2,844**	**2,679**	**-5.8%**	**24%**
SA Gross State Product (GSP) ($ millions)	**$108,396**	**$112,842**	**$114,089**	**$112,954**	**$114,921**	**$124,252**	**5.1%**	**15%**
Performance metrics per GSP (tonnes/$ million GSP)								
Total recovery	36.2	40.5	38.3	35.9	36.6	32.1	-13.6%	-11%
Total disposal	11.8	7.8	7.4	7.3	7.3	7.1	0.3%	-40%
Total waste generation	**30.6**	**47.6**	**45.4**	**43.9**	**43.9**	**39.3**	**-7.9%**	**28%**

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 trend shows increasing recovery and declining disposal over time. The recovery rate has been consistently around 83% for the past five years. Waste generation has increased with population but on a per capita basis the 2021-22 rate (2.68 tonnes per person) continues a decline seen in the previous four years since the 2017-18 value of 3.09 tonnes per person.

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 2021-22 to 2020-21, broadly:

- **Masonry** (excluding clay, fines, rubble and soil) recovery fell, notably for bricks and plasterboard.
- **Metals** recovery stayed consistent with last year overall but fluctuated by material with an increase in reported recovery of aluminium and non-ferrous metals making up for a reported reduction in iron and steel recovery.
- **Organics** recovery continued to increase in 2021-22 with growth in recovery of food organics and other organics.
- **Cardboard and paper** recovery declined significantly following low recovery last year. Recovery dropped in cardboard and liquid paperboard.
- **Plastics** recovery was consistent with last year overall, maintaining a trend to better sorting into separated polymers rather than export of mixed plastics.
- **Glass** recovery fell compared to last year.
- **Other materials** recovery increased slightly compared to last year due to an increase in reported leather and textiles recovery.
- **Separately reported materials** recovery declined slightly.

Table 3 Summary of SA resource recovery by material type in kilotonnes

Material type	Recovery (kt)						Change (%)
	2003-04	2017-18	2018-19	2019-20	2020-21	2021-22	20-21 to 21-22
Standard reporting materials							
Masonry							
Asphalt	100	286	269	238	339	284	-16%
Bricks	165	102	74	41	44	27	-38%
Concrete	877	960	1,049	975	1,283	1,114	-13%
Plasterboard	0.0	1.5	1.1	1.0	0.9	0.2	-72%
Subtotal	**1,142**	**1,350**	**1,393**	**1,255**	**1,666**	**1,425**	**-14%**
Metals							
Iron and steel	264	299	297	248	327	281	-14%
Aluminium	19	14	14	11	12	29	135%
Non-ferrous metals	13	19	18	19	11	19	71%
Subtotal	**296**	**332**	**329**	**278**	**351**	**329**	**-6%**
Organics							
Food organics	0.0	9.1	12	13	16	30	88%
Garden organics	130	257	257	250	277	290	4%
Timber	117	270	242	315	202	238	18%
Other organics	0.0	563	529	528	634	794	25%
Subtotal	**247**	**1,099**	**1,040**	**1,106**	**1,129**	**1,351**	**20%**
Cardboard and paper							
Cardboard and waxed cardboard	91	162	160	134	138	60	-56%
Liquid paperboard	0.0	1.2	0.8	0.6	0.8	0.2	-80%
Magazines and newsprint	33	62	54	47	31	70	124%
Printing and writing paper	12	11	14	12	12	33	185%
Subtotal	**136**	**236**	**229**	**194**	**181**	**164**	**-10%**
Plastics							
Polyethylene terephthalate	0.0	4.8	5.0	4.7	8.9	9.2	4%
High density polyethylene	0.0	6.1	5.9	6.0	12.0	11.9	-1%
Polyvinyl chloride	0.0	0.1	0.1	0.1	<0.1	<0.1	-
Low density polyethylene	0.0	3.2	2.0	3.0	4.5	6.7	49%
Polypropylene	0.0	0.8	0.6	1.1	4.9	5.5	12%
Polystyrene	0.0	0.3	0.5	0.6	0.4	0.1	-69%
Mixed and/or other plastics	8.6	16	17	14	1.7	0.2	-88%
Subtotal	**8.6**	**31**	**31**	**30**	**32**	**33**	**3%**
Glass							
Glass	46	60	74	87	84	54	-36%
Subtotal	**46**	**60**	**74**	**87**	**84**	**54**	**-36%**
Other materials							
Foundry sands	0.0	10	6.0	24	8.2	4.2	-49%
Leather and textiles	4.1	5.5	2.4	0.9	1.6	4.9	213%
Tyres and other rubber	0.1	20	19	19	19	25	29%
Subtotal	**4.2**	**35**	**27**	**44**	**29**	**34**	**17%**
Total standard reporting materials	**1,879**	**3,143**	**3,123**	**2,994**	**3,472**	**3,389**	**-2%**
Separately reported materials							
Fly ash	0	0	0	0	0	0	n/a
Clay, fines, rubble and soil – clean fill	162	1,052	937	874	659	551	-16%
Clay, fines, rubble and soil – intermediate waste soil	-	294	278	266	70	53	-25%
Total separately reported materials	**162**	**1,346**	**1,215**	**1,140**	**729**	**604**	**-17%**
Grand total	**2,042**	**4,489**	**4,338**	**4,134**	**4,201**	**3,994**	**-5%**

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

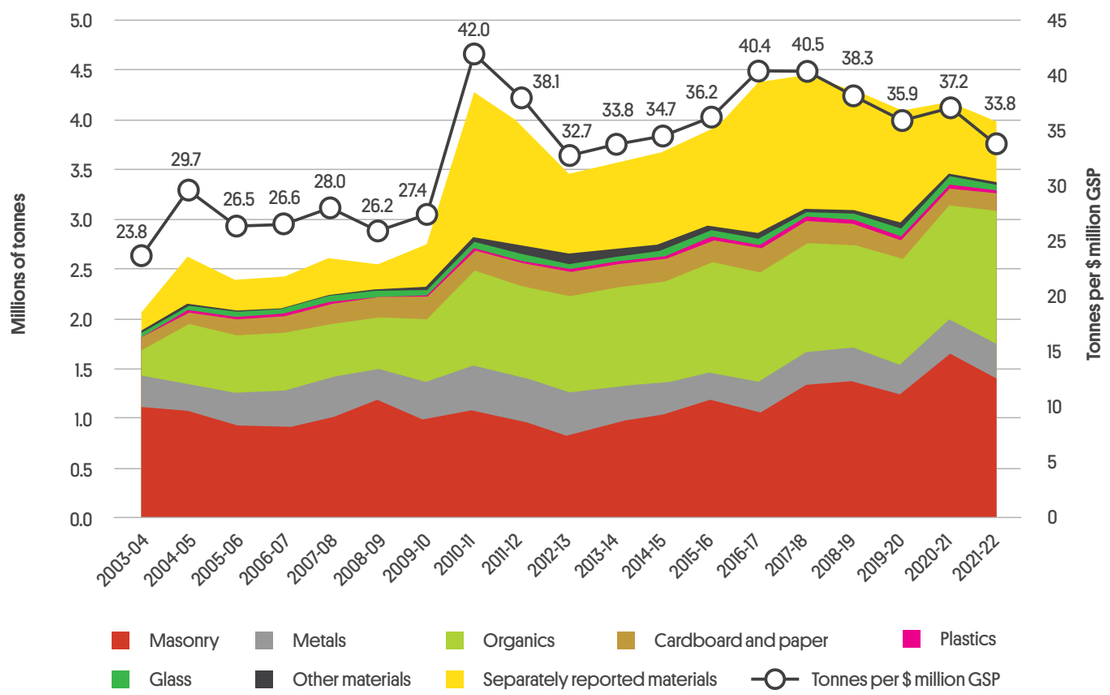
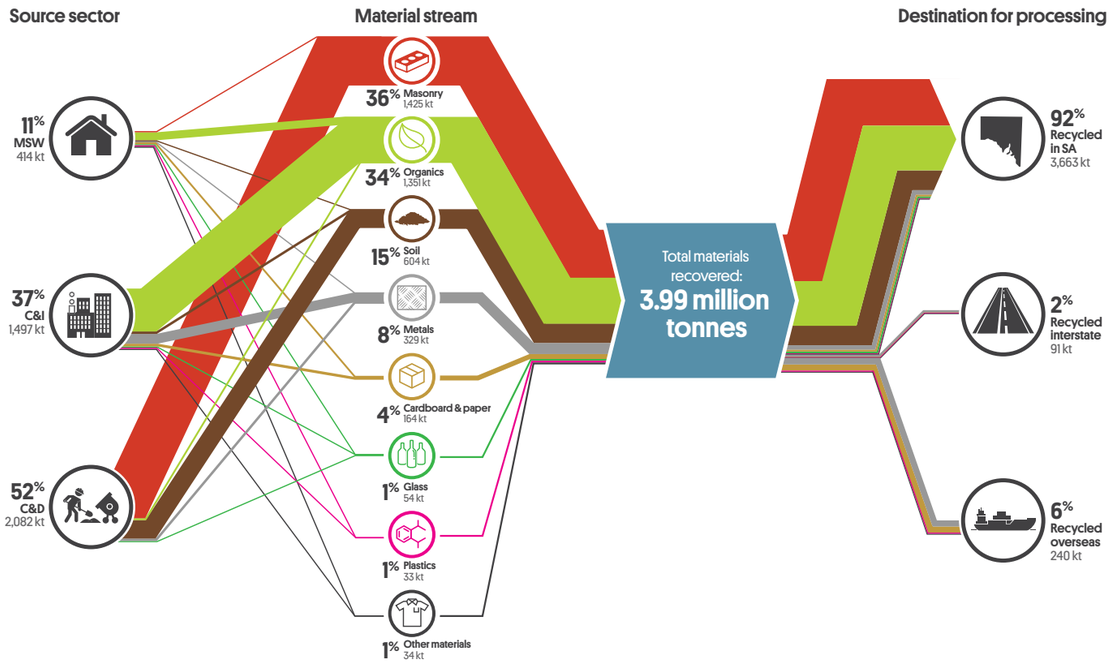


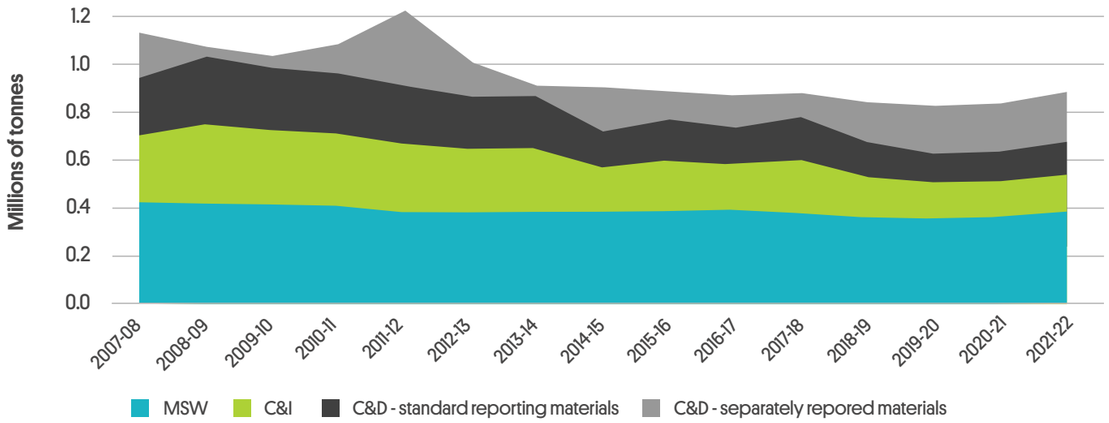
Figure 4 Resource recovery, including energy recovery, SA, 2021-22, by material, source stream and destination, not including e-waste or material reused



Landfill disposal

SA disposed about 885 kt of waste to landfill in 2021-22, an increase from the 840 kt landfilled in 2020-21. Landfill disposal data by source stream was estimated using local government collection data and a historical landfill audit, the same proportional splits as previous years as follows: MSW (44%), C&D (39%) and C&I (18%). 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

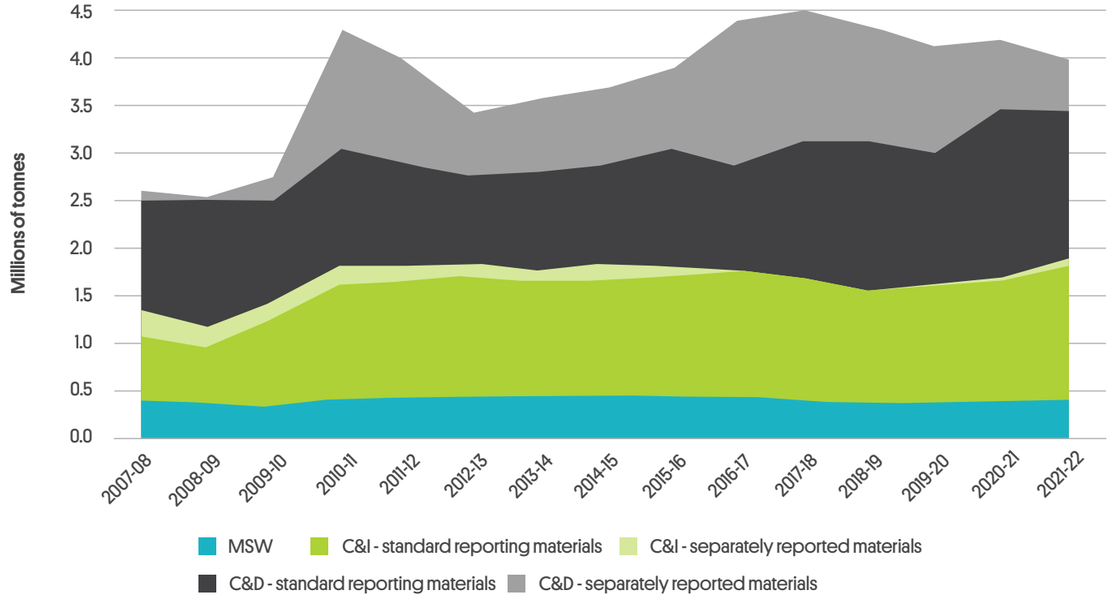
The source stream origin for SA waste and recovered materials in 2021-22 is shown in Table 4, Figure 6 and Figure 7. Like previous years, recovered materials mostly comprised C&D waste (52%), followed by C&I (37%) and MSW (11%).

The estimated recovery rate for C&I was the highest in 2021-22 at 91%, followed by C&D at 86% then MSW at 52%. The MSW rate is slightly lower than last year and holds the most opportunity for improvement.

Table 4 South Australia recovery and landfill disposal by source stream in 2021-22[4]

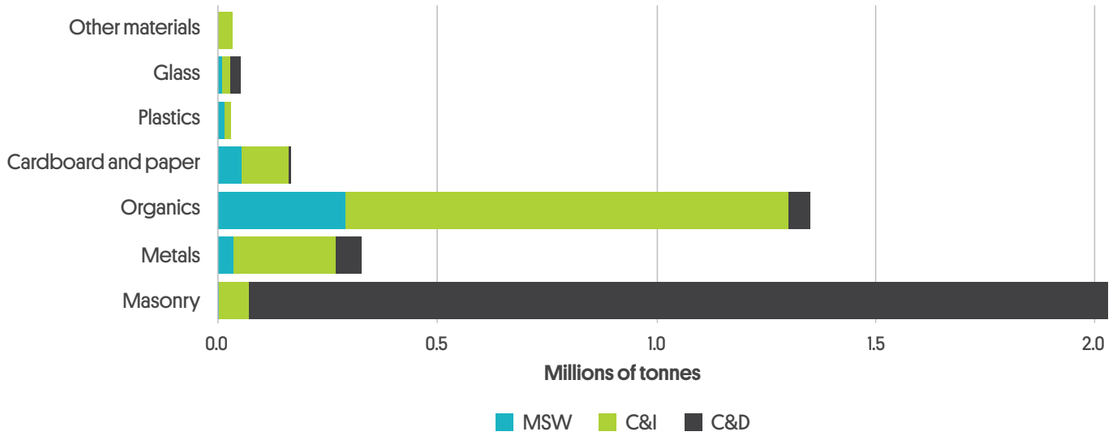
Source stream	Recovery		Landfill disposal		Recovery rate
	kt	% of total	kt	% of total	
MSW	414	11%	386	44%	52%
C&I	1,497	37%	158	18%	91%
C&D	2,082	52%	341	39%	86%
Total	**3,994**	**100%**	**885**	**100%**	**82%**

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



4 Recovery rates by source stream listed in Table 4 include material from metropolitan and regional SA. In contrast, only metropolitan recovery is included in Table S2 and Table 12.

Figure 7 Source stream of recovered materials by material category, SA, 2021-22



Geographical origin

The majority of SA's waste and recovered materials originate from the metropolitan area, where 74% of the population resides. Metro SA contributed about 2,868 kt (72%) of the state's total recovered materials in 2021-22, and 641 kt (72%) of total disposed waste. Of waste generated in metropolitan SA, 81.7% was recovered in 2021-22.

Material recovery reported in regional SA significantly increased in 2021-22, contributing 1,126 kt (28%) of total recovered materials in the 2021-22 financial year. This is partly due to improved data visibility on meat rendering in regional SA. Regional SA deposited about 244 kt (28% of all SA disposal) of waste to landfill, achieving a recovery rate of 82.2%.

When comparing to 2021-22 to 2020-21:

- Metropolitan recovery decreased from 3,518 kt to 2,868 kt and disposal tonnes increased from 599 kt to 641 kt, which resulted in an overall drop in the recovery rate from 85.4% to 81.7%
- Regional recovery rose to 1,126 kt from 683 kt and regional disposal rose slightly from 241 kt to 244 kt, resulting in an increase in recovery rate from 73.9% to 82.2%. The material type contributing the most to regional recovery was meat rendering (18%). The high recovery rate for regional SA is impacted by improved visibility into the recovery activities of survey respondents operating in regional SA that have not previously been involved in the surveys or have not responded for several data collection periods.

Table 5 SA recovery and landfill disposal by geographical origin in 2021-22

Sector	Recovery		Landfill disposal		Recovery rate
	kt	% of total	kt	% of total	
Metro	2,868	72%	641	72%	81.7%
Regional	1,126	28%	244	28%	82.2%
Total	**3,994**	**100%**	**885**	**100%**	**81.9%**

The locations of SA's recycling and reprocessing facilities are shown in Figure 8 and Figure 9. The figures were accurate at the time of preparation in 2019-20.

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

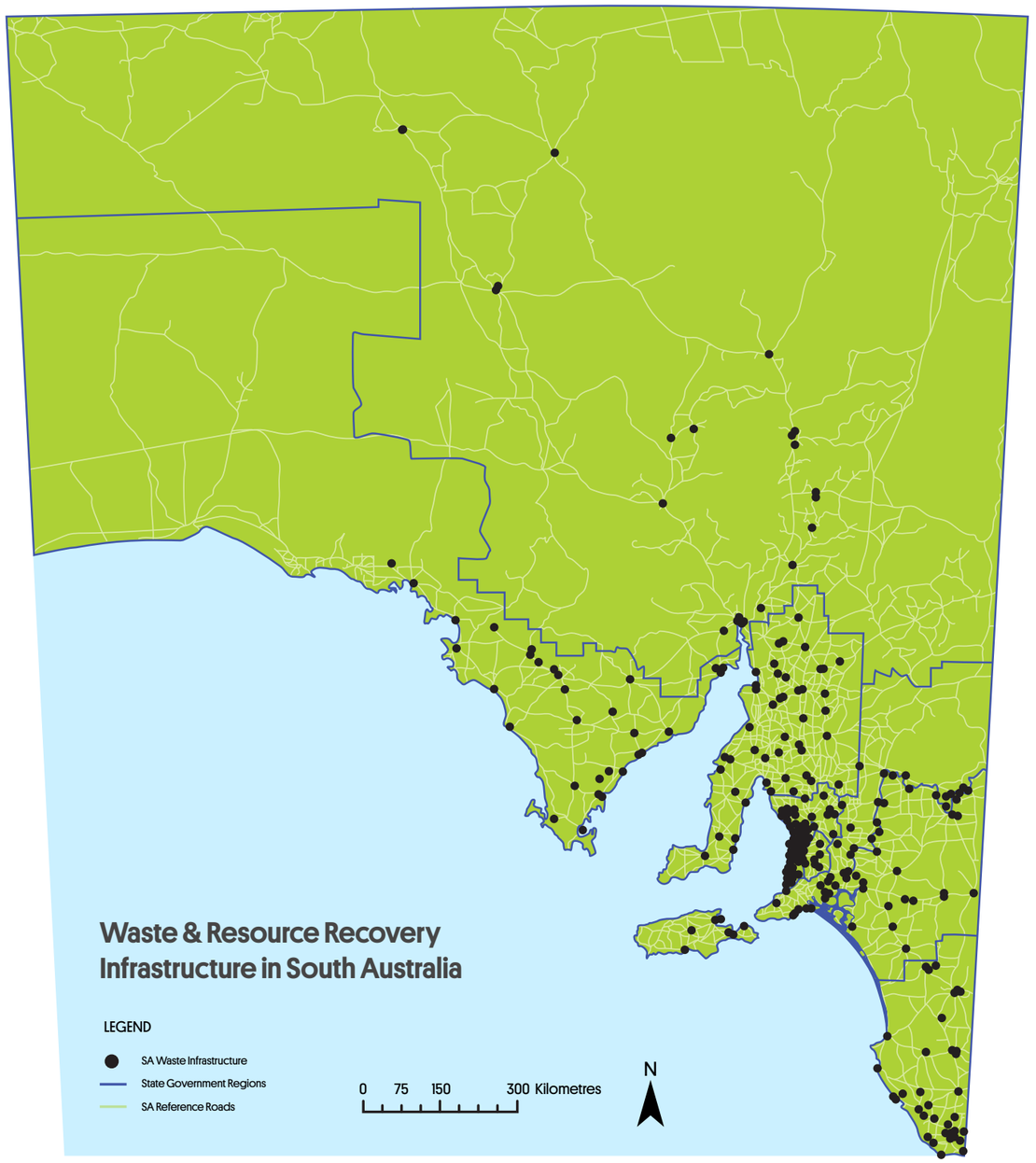
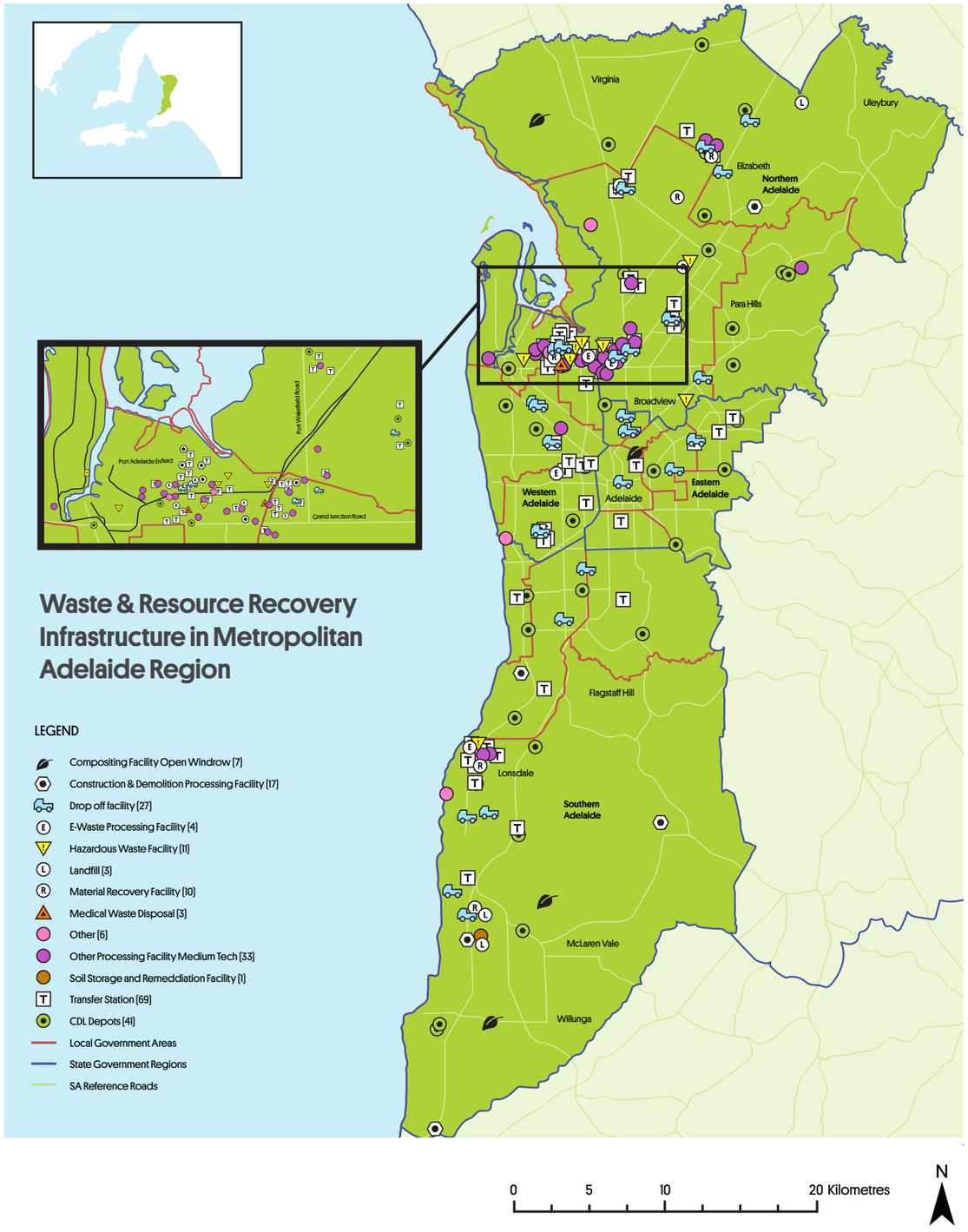


Figure 9 The locations of main sites of recyclers and reprocessors in Adelaide



Destination for recovered materials

Most recovered materials are reprocessed within the state (92%). About 2% of materials were reportedly reprocessed interstate and 6% overseas. In 2020-21, 89% of material was reprocessed in SA, 6% was sent interstate and 5% sent overseas. Table 6 below summarises recovery of SA materials by reprocessing destination, while Table 7 provides a more detailed breakdown by material category.

Survey data was supplemented by data on exports from the Australian Bureau of Statistics (ABS). Waste materials exported from SA were counted as recovered as they were assumed to be sent overseas for recycling. This method is different from previous years where the survey was exclusively used as the data source for material sent overseas.

Table 6 Destination of SA sourced materials in 2021-22

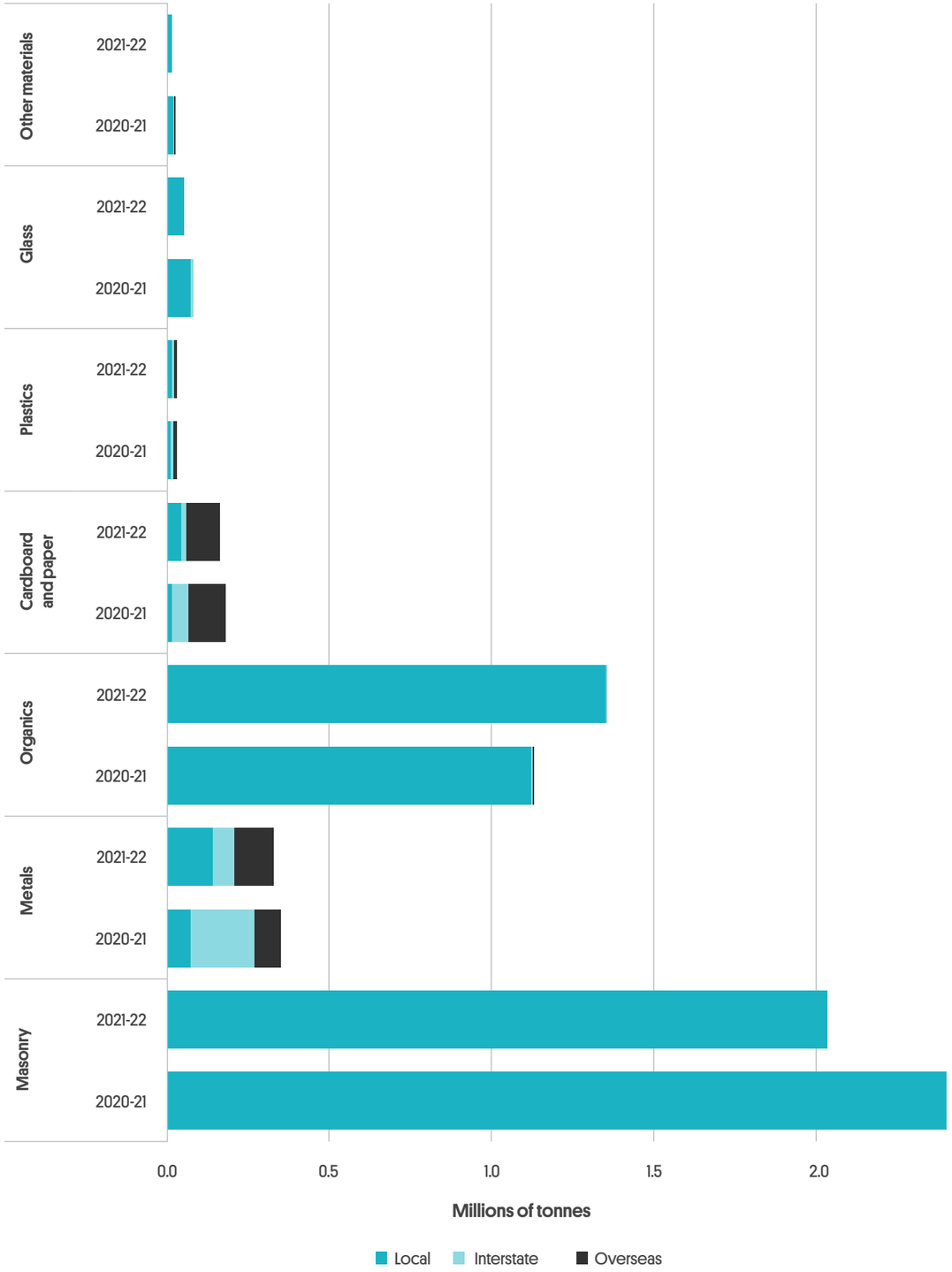
	Recovery	
Destination	**kt**	**% of total**
SA	3,663	92%
Interstate	91	2%
Overseas	240	6%
Total	**3,994**	**100%**

All masonry, including separately reported materials (clay, fines, rubble and soil) and glass were reprocessed locally. All recovered organics and over half of 'other' materials (55%) were reprocessed in SA in 2021-22. Most cardboard and paper materials (62%) were sent overseas for reprocessing. The largest portion of metals was processed locally (43%), 36% was sent directly overseas from SA ports and the remainder was sent interstate. Plastics were mostly reprocessed in SA (60%) but with notable quantities sent interstate (16%) and overseas (24%). Some materials sent interstate may have been subsequently exported overseas.

Table 7 Destination of SA sourced materials in 2021-22 by material category

	Percent of material recovered (%)		
Material category	**SA**	**Interstate**	**Overseas**
Masonry	100%	0%	0%
Organics	100%	0%	0%
Glass	100%	0%	0%
Other materials	55%	11%	34%
Plastics	60%	16%	24%
Metals	43%	21%	36%
Cardboard and paper	30%	8%	62%
Total	**92%**	**2%**	**6%**

Figure 10 Destination of SA sourced materials by material category in 2021-22 and 2020-21



Energy recovery

Table 8 shows total resource recovery of SA materials in 2021-22, 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.

About 308 kt of SA materials were estimated as recovered for energy in 2021-22, compared to 137 kt from the previous year. This equated to about 8% of recovered volumes. This apparent increase is mostly due to improved data visibility on products from meat rendering used in biodiesel production from survey respondents that have not reported recovery activities for several reporting periods.

Table 8 Material and energy recovery, SA, 2021-22

Recovery type	kt	Contribution to recovery rate (%)
Material recovery	3,686	92%
Energy recovery	308	8%
Total (resource recovery)	**3,994**	**100%**

Imports

The survey covers reporting of waste and recovered materials imported from interstate or overseas for information purpose, however these do not count towards SA's recycling performance. Reported imports of waste and recovered materials into SA in 2021-22 are shown in Table 9. The table also shows imports from overseas based on Australian Bureau of Statistics trade data.

Table 9 Materials reported as imported to SA for resource recovery in 2021-22, tonnes

	Imported tonnes								
Material category	**ACT**	**NSW**	**NT**	**Qld**	**Tas**	**Vic**	**WA**	**Overseas**	**Total**
Masonry	0	0	0	0	0	0	0	0	0
Metals	0	5,330	19,980	0	0	5,000	0	0	30,310
Organics	0	3,500	0	0	0	70,000	0	0	73,500
Cardboard and paper	0	0	20	0	0	0	0	0	20
Plastics	0	100	200	10	0	10	0	160	480
Glass	0	0	0	0	0	0	0	230	230
Other materials	0	0	0	0	0	0	0	0	0
Total	**0**	**8,900**	**20,200**	**0**	**0**	**75,000**	**0**	**400**	**104,500**

Reported imports from other states and territories were higher in 2021-22 than the previous year, but still lower than 2019-20 reports. Only 230 tonnes of glass were imported from overseas in 2021-22 compared to 6.4 kt imported in 2020-21. Imports of 'other' materials declined from 34.1 kt in 2020-21 to zero in 2021-22.

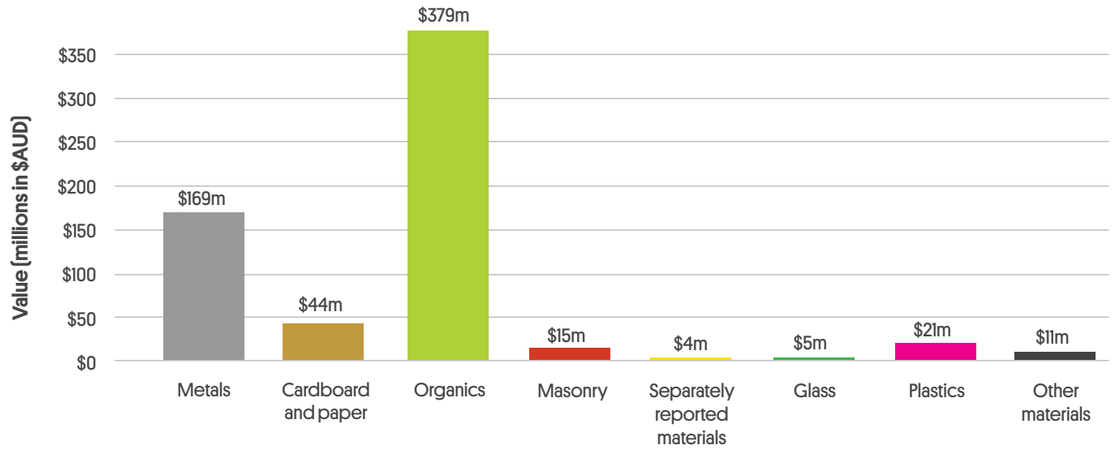
Market value of resource recovery

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 7.

Table 10 Assumed values for recovered materials in SA in 2021-22 based on survey responses

Material category or type	Estimated on-sale price ($/t)
Masonry	11
Metals – steel	390
Metals – non-ferrous including aluminium	1,245
Organics – meat rendering	2,000
Organics – garden, food and timber	*Not available* [5]
Organics – other	Variable
Cardboard and paper	192
Plastics	625
Glass	90
Other materials (including tyres and other rubber, leather and textiles and foundry sands)	237
Separately reported materials and clean fill	7

Figure 11 Estimated market value of resource recovered material in SA during 2021-22



5 A dollar per tonne value for this grouping is not available as the value was reported by the products made from these materials such as compost and mulch.

Recovered organics represent the largest share of the market value amongst recovered materials in 2021-22 at $379 million. Meat rendering products such as tallow have a high value per tonne and improved data visibility on this area in 2021-22 has increased the contribution of organics to recovered materials market value, meat rendering products were reported as worth around $2,000 per tonne. Compost, mulch and timber were reported in both cubic metres and tonnes, but the data did not permit an estimated industry-wide average in dollars per tonne. 'Other' organics are included in value estimations this year as there have been improved insights on the organic materials recycled or reused and their values in 2021-22. 'Other' organics includes waste sludge and biosolids and miscellaneous organics. Some of the products reported in this group were aquafeed, insect protein used in pet food, stockfeed, calcium tartrate and ethanol.

Scrap metals are a high-value commodity and represented the next largest share of market value. Recovered metals were estimated at a total value of $169 million in 2021-22, which is a decrease from $223 million in 2020-21.

Scrap cardboard and paper overall was valued at $44 million, which is a slight increase from its value of $40 million in 2020-21. There is some variation in value of each material type based on the survey responses. Printing and writing paper had the highest reported value of between $275 and $300 per tonne compared to newsprint and magazines valued at $100 per tonne.

Recovered masonry materials contributed about $15 million in 2021-22, a decrease from 2020-21 which was estimated at $39 million. In 2021-22, three Survey respondents reported $ per tonne values for masonry materials averaging $11 per tonne. In contrast, in 2020-21, ten survey respondents reported dollar values per tonne for masonry materials averaging $23 per tonne.

Of the remaining material categories, scrap plastics were estimated to contribute a total value of $21 million in SA in 2021-22, other materials $11 million, glass $5 million and separately reported materials (clay, fines rubble and soil) $4 million.

In total, the estimated value of SA's resource recovery in 2021-22 was $649 million. This is significantly higher than 2020-21 when the total value was approximately $479 million mostly due to the additional value of 'other' organics and new information about quantities of material in meat rendering.

Disaster waste

SA recorded 4,290 tonnes of bushfire waste sent to landfill in 2021-22 which is higher than the 145 tonnes reported in 2020-21.

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[6]. This section details SA's progress in achieving these targets.

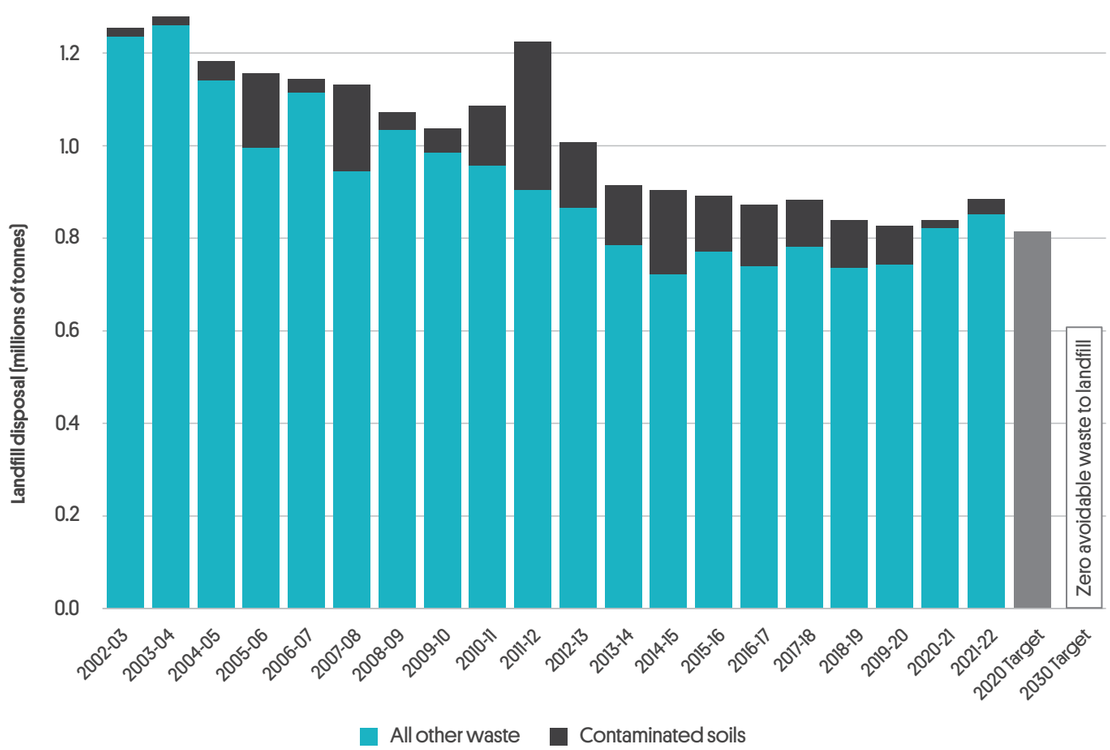
Landfill diversion target

South Australia's Waste Strategy 2020-25 sets out a goal for zero avoidable waste to landfill by 2030[6]. The State disposed about 885 kt of waste to landfill in 2021-22, an increase from 840 kt in 2020-21 and 827 kt in 2019-20. A range of actions will need to be implemented to achieve SA's ambitious landfill target for 2030.

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

SA came close to meeting the 2020 target for reducing waste to landfill by 35% from a 2002-03 baseline, but increases in landfill in 2021-22 resulted in a lower reduction of 27% against the 2002-03 levels.

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



6 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 target of 5% reduction in waste generation per capita from a 2020 baseline. Table 11 summarises a five-year trend in waste generation per capita for all reported materials. Waste generation per capita decreased by 165 kilograms (5.8%) in 2021-22 compared to the previous year, and an overall reduction of 4.3% since the period 2019-20.

Table 11 Waste generation per capita since 2017-18, including the state target for 2025

Recovery type	2017-18	2018-19	2019-20	2020-21	2021-22	Change (%) 20-21 to 21-22	Target 2025
Waste generation per capita (kg/person/yr)	3,090	2,960	2,800	2,844	2,679	-5.8%	5% reduction from 2020 baseline

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 in metropolitan SA in 2021-22, together with State targets for 2023 and 2025.

The metropolitan C&I and C&D recovery rates declined slightly since 2020-21 when the recovery rate of C&I was 96.9% and of C&D was 92.5%. In 2021-22, the C&I recovery rate was 88.2%, above the 2023 target of 85% and close to the diversion target of 90% by 2025. The C&D source stream recovery rate was 87.2%, just shy of the target of 90% for 2023. The MSW recovery rate was 55.9%, slightly lower than the previously held recovery rate of 56.1% in 2020-21. There is significant room for improvement for municipal stream to achieve state targets.

Landfill disposal data by source stream is estimated based on the proportions used in previous years of 44% MSW, 18% C&I and 39% C&D. This data will be revised in future CERRR as better data is made available.

Table 12 Metropolitan diversion rate for SA in 2021-22, including state targets to 2025

Source sector	2021-22 diversion rate	Metropolitan diversion target 2023	2025
MSW	55.9%	65%	75%
C&I	88.2%	85%	90%
C&D	87.2%	90%	95%

2.3 Local government 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 2021-22. About 684 kt of kerbside materials were collected in SA, of which 527 kt were from the metro region and 156 kt were from regional areas. This was very similar to last year. Most kerbside waste was collected in residual bins (350 kt), followed by organics bins (202 kt), and recycling bins (132 kt).

SA's recovery rate for kerbside waste in 2021-22 was an estimated 49%, slightly higher than the previous year's rate of 48%. Recovery was higher for metropolitan councils (51%) than regional councils (40%). Compared to the previous year, performance in 2021-22 was slightly improved for both metropolitan and regional SA.

Table 13 Materials collected from households at kerbside in SA in 2021-22

Region	Collected at kerbside (kt)				Recovery rate (%)
	Residual	Recycling	Organics	Total	
Metro	256	103	169	527	51.5%
Regional	94	29	33	156	39.8%
SA	350	132	202	684	48.8%

The household hazardous waste collection program offers free drop-off for hazardous waste items in SA. This prevents hazardous substances from ending up in landfill. Table 14 summarises the material collected through the program.

Table 14 Household hazardous waste collection, 2021-22

Hazardous waste	Tonnes
Aerosol cans	4.8
Batteries	8.2
Corrosives	2.4
Fertilisers	1.6
Fire extinguishers	7.0
Flammables	72.1
Fumigants	0.0
Gas bottles	34.3
Heavy metals and compounds	0.0
Inert liquids	54.0
Light tubes	4.5
Oils	80.8
Oxidisers	1.3
Paint	162.4
Pesticides	2.8
Pharmaceuticals	0.0
Poisons	0.0
Preservatives	9.1
Smoke detectors	0.0

Recovery by region

Table 15 shows population and kerbside data for 2021-22 at the sub-region level, including kilograms of kerbside waste per capita. Within metropolitan SA, the Central Eastern sub-region achieved the highest overall recovery rate (54%) followed closely by Southern (53%) and Western (52%) sub-regions. The Northern region generated the least waste per capita (379 kg per person per year) followed closely by Central Eastern (381 kg per person per year). The Western and Southern regions had higher waste generation per capita at 391 and 411 kg per person per year respectively. Regional SA had the lowest waste generation per capita at 332 kg per person per year and lowest overall recovery rate overall at 40%.

Table 15 Population and kerbside data statistics by region

Region or sub-region	Population	Kerbside waste collected (kt)	Kerbside waste per capita (kg/capita)	Recovery rate
Metro	1,349,929	527	391	51%
Central Eastern	276,240	105	381	54%
Northern	375,546	142	379	47%
Southern	340,458	140	411	53%
Western	357,685	140	391	52%
Regional	470,601	156	332	40%
All SA	**1,820,530**	**684**	**376**	**49%**

Coverage

Nearly all households in SA are provided a kerbside service. About 99% of households live in a council area providing a residual waste service, 97% have a recycling service and 91% have an organics service.

2.4 Comparative performance with other jurisdictions

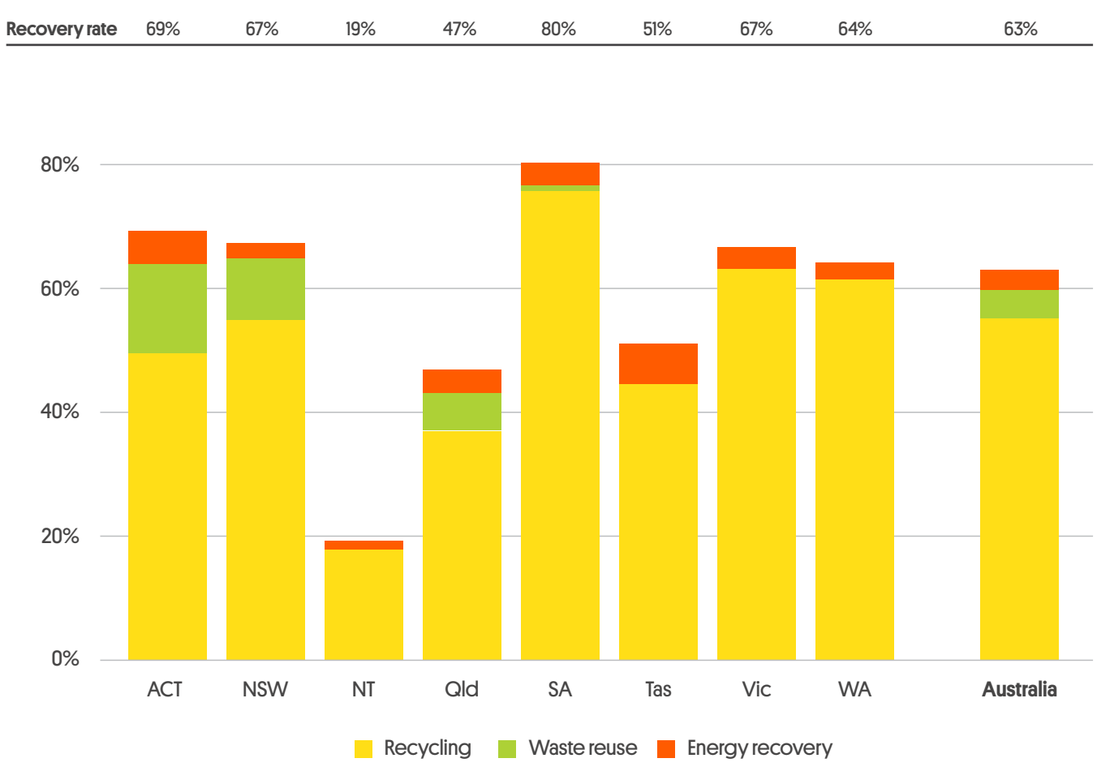
SA has led recycling and resource recovery performance in Australia for many years.

The methods used by states and territories to measure and report waste vary. The *National Waste Report 2022* (Blue Environment 2022), released by the Department of Climate Change, Energy, the Environment and Water in 2022, adjusts these methods to present a consistent as possible comparison of recovery rates across states and territories. These data are discussed in this section.

Figure 13 is taken from the *National Waste Report 2022* and shows recycling, waste reuse and energy recovery and overall recovery rates for each Australian jurisdiction in 2020-21. SA had the highest recycling rate with a recovery rate of 80%.[7] The nearest recovery rate was ACT at 69% and NSW and Vic at 67%. Overall, Australia achieved a recovery rate of 63% in 2020-21.

In 2021-22, SA maintained similar rates to those in Figure 13.

Figure 13 Resource recovery and recycling rates by jurisdiction, 2020-21



Source: National Waste Report 2022 (Blue Environment 2022)

7 This differs from the value reported in the CERRR 2020-21 due to differences in method.

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. In 2021-22, 1,957 equivalent full-time employees were reported, several companies reported fewer employees working for the waste and resource recovery areas of their business. Companies and organisations that reported employee numbers in 2021-22 made up 62% of the year's total recovered tonnes, suggesting the true number may be significantly higher. Some companies making large contributions to resource recovery in SA did not respond to this question.

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

Employment category	2017-18	2018-19	2019-20	2020-21	2021-22
Total full time equivalent employees	1,831	1,850	2,098	2,108	1,957

The survey asked respondents to breakdown their reported workforce by employment classification, and the results are shown in Table 17 with results of previous years. Machinery operators were the most reported employee classification, followed by drivers and administration. There has been little variation in the proportions since 2019-20.

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

Employment type	2019-20	2020-21	2021-22
Unskilled	17%	9%	4%
Administration	15%	13%	14%
Construction /design	0.5%	0.2%	0%
Driver	17%	18%	14%
Machinery operator	26%	31%	37%
Sorting	4%	3%	8%
Technical support	4%	8%	11%
Sales/ marketing	4%	5%	3%
Supervisor	5%	7%	5%
Other	7%	6%	3%
Total	**100%**	**100%**	**100%**

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 CERRR survey targeted key players in SA's charitable network and reuse economy. Reported quantities from 2021-22 are shown in Table 18, together with estimated values for the reuse materials. Table 18 is expected to represent only a portion of reuse in SA. 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 2021-22 based on survey results

Reuse material	Tonnes	Estimated value of reuse material ($/tonne)	Estimated value of reuse materials in SA ($/yr)
Home furnishings and goods	1,500	$15,000	$22,740,000
Clothes	2,000	$1,700	$3,426,000
Re-use food products	4,400	$2,586	$11,499,000
Books	400	$1,000	$404,000
Other donations (toys, etc.)	1,300	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. Not all survey participants provided a response to this question, however based on available data, economic and recycling reasons were the most 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
Financial	10
Avoiding landfill	9
Goods or material can be recycled	12
Goods or material can be repaired or reused	2
Other	10

3 Material resource recovery reports

This section presents the key findings from analysis of 2021-22 survey data by material category and type. It covers all the main material types except plastics, which are given a special focus in Section 4. The materials covered in this section are:

- masonry – asphalt, bricks, concrete, plasterboard, and clay, 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
- 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 2.03 million tonnes of masonry was recovered in SA in 2021-22 which is lower than previous years that were around 2.40 million tonnes. There were declines in reported quantities recovered across all material types but especially plasterboard and bricks. The masonry recovery figures are significantly affected by a small number of recycler returns with data quality issues, therefore there may be some variation between calculated recovery and actual recovery, especially for bricks.

Concrete contributed the greatest proportion of masonry materials (55%), followed by clay, fines, rubble and soil (30%), asphalt (14%), bricks (1%) and plasterboard (<1%). This is consistent with last year.

Table 20 summarises masonry recovery in 2021-22.

Table 20 Masonry recovered, SA, 2021-22

Material type	Net recovery (kt)
Asphalt	284
Bricks	27
Concrete	1,114
Plasterboard	0.2
Clay, fines, rubble and soil – clean fill	551
Clay, fines, rubble and soil – intermediate waste soil	53
Total	**2,029**

Figure 14 and Figure 15 show trends in masonry materials types over time, while Figure 16 compares the reported composition of masonry materials in 2021-22 and 2020-21.

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

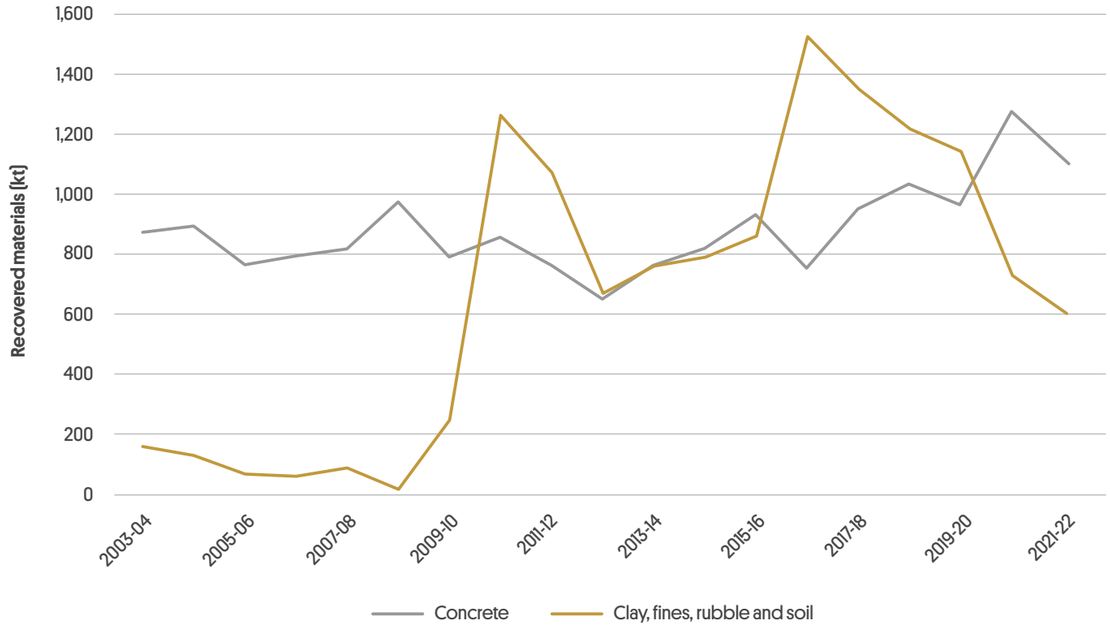


Figure 15 Masonry recovered since 2003-04 – asphalt, bricks and plasterboard

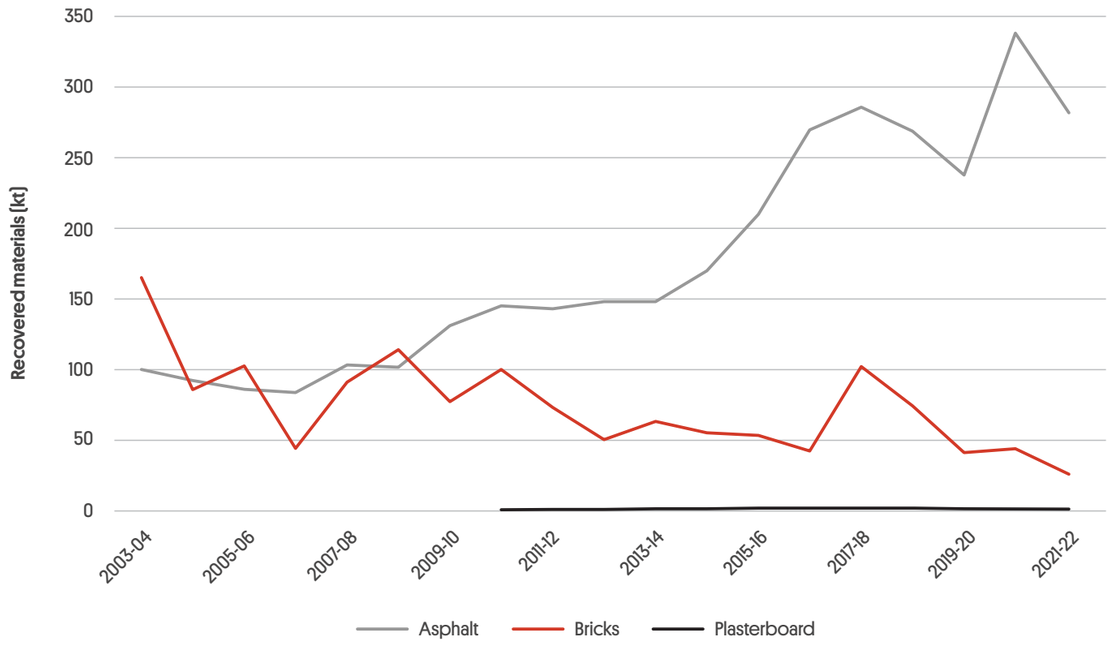


Figure 16 Reported percent composition of masonry recovered in 2021-22 and 2020-21

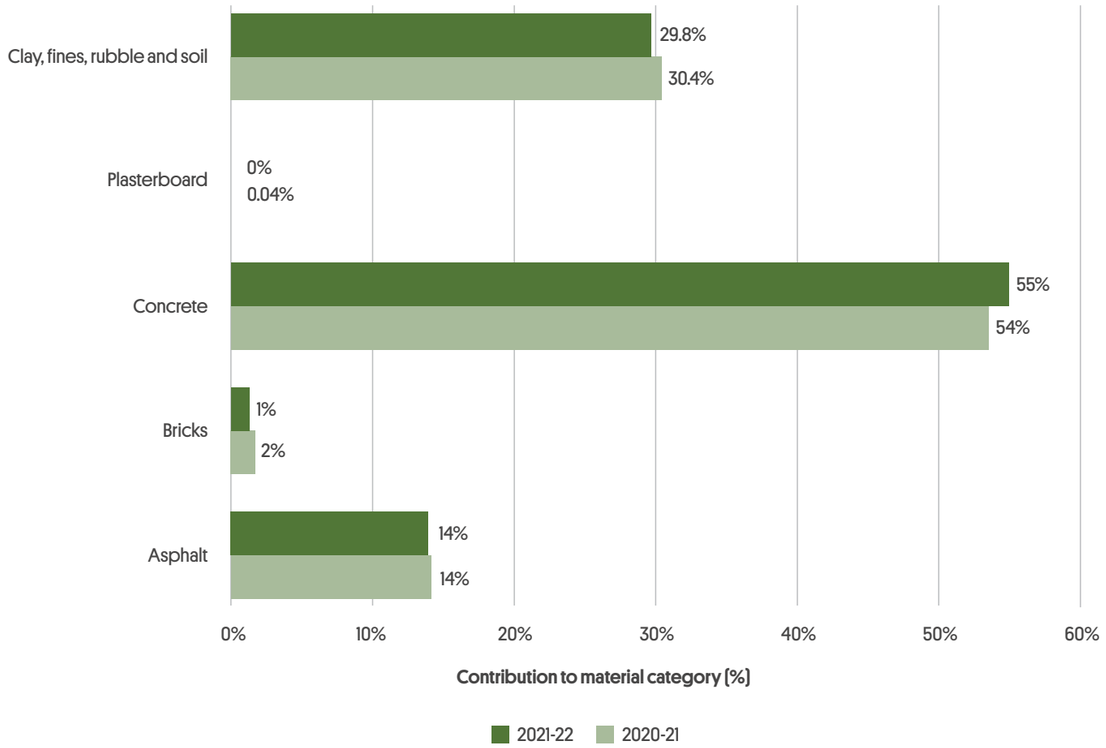


Table 21 below presents details for masonry recovery in SA in 2021-22. Masonry is mostly from infrastructure projects in the metropolitan region, and all recovered masonry is reprocessed locally in the State.

Table 21 Masonry recovered in 2021-22 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%	91%	9%	100%	0%	0%
Bricks	0%	1%	99%	64%	36%	100%	0%	0%
Concrete	0%	0%	100%	84%	16%	100%	0%	0%
Plasterboard	41%	0%	59%	100%	0%	100%	0%	0%
Clay, fines, rubble and soil – clean fill	0%	11%	89%	72%	28%	100%	0%	0%
Clay, fines, rubble and soil – intermediate waste soil	0%	19%	81%	73%	27%	100%	0%	0%
Total	**0.3%**	**3.4%**	**96.4%**	**81%**	**19%**	**100%**	**0%**	**0%**

3.2 Metals

Recovery of scrap metals fell in the 2021-22 financial year to about 329 kt, compared to the previous year's 351 kt. Recovered metals were mostly iron and steel (281 kt), followed by aluminium (29 kt), copper (13 kt) and non-ferrous metals (6 kt).

This year, information from the ABS was used to identify recovered material exported from SA. This identified significantly more aluminium and non-ferrous metals recovered overseas originating from SA than was captured in the CERRR survey. The ABS exports information is consistent with previous years, Table 22 summarises metals recovery in SA in 2021-22.

Table 22 Metals recovered, SA, 2021-22

Material type	Net recovery (kt)
Iron and steel	281
Aluminium	29
Copper	13
Non-ferrous metals (excl. aluminium and copper)	6
Total	**329**

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

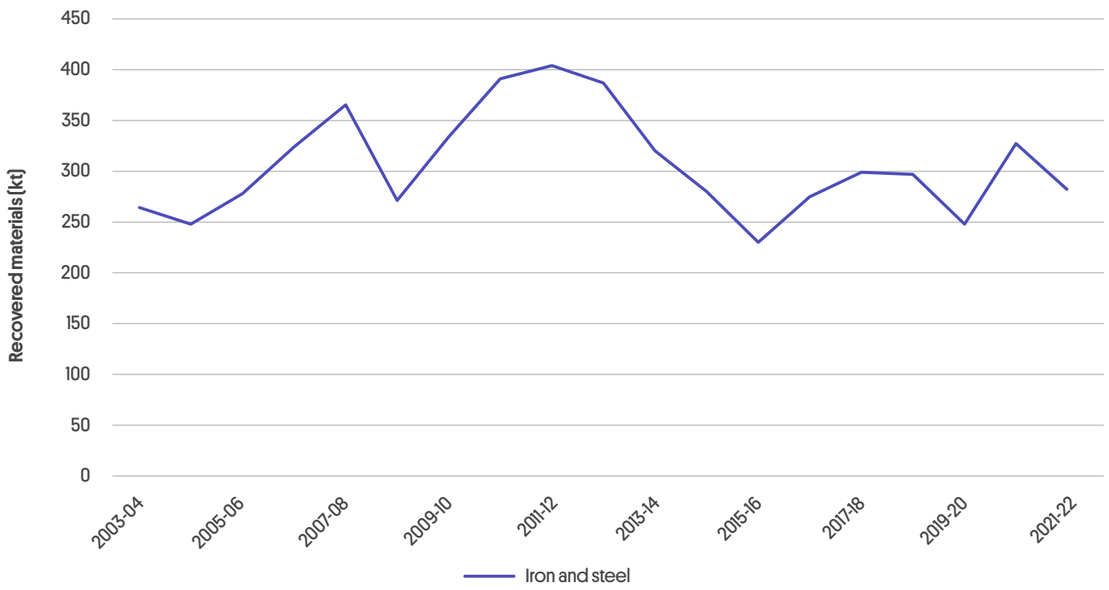


Figure 18 Metals recovered since 2003-04 – aluminium and non-ferrous metals

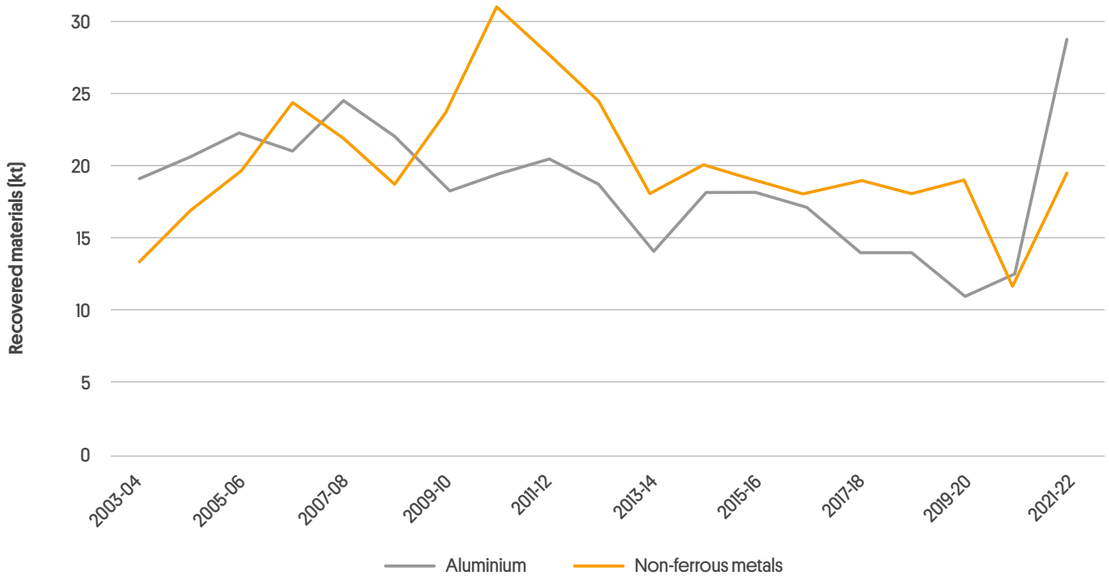


Figure 19 Reported percent composition of metals recovered in 2021-22 and 2020-21

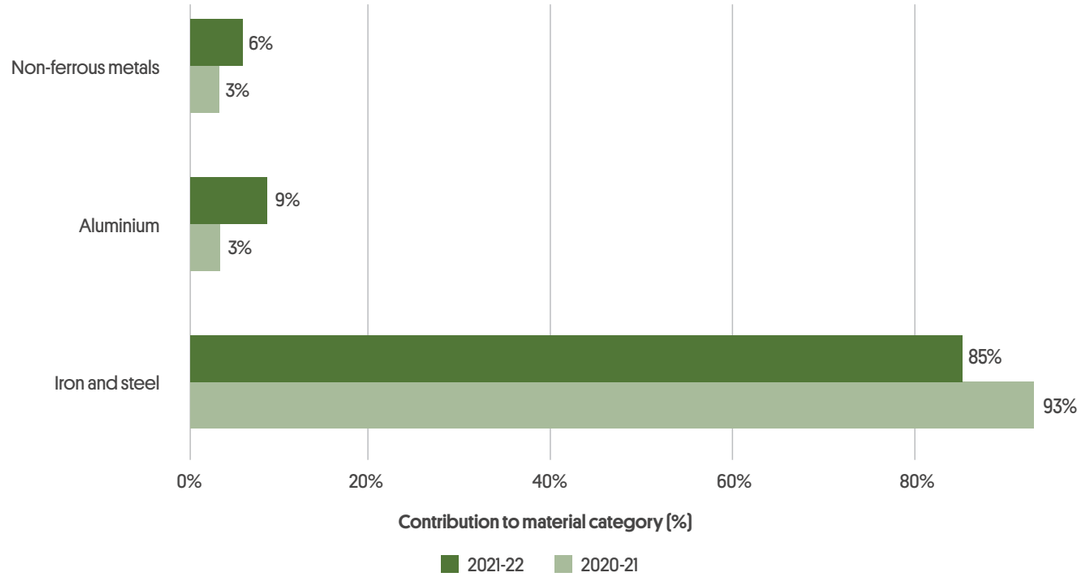


Table 23 shows metals recovered by type, source stream, geographical origin and reprocessing location. Recovered metals were mostly from C&I sources but C&D contributes 17% and MSW 12%.

Table 23 Metals recovered in 2021-22 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	11%	71%	19%	75%	25%	48%	24%	27%
Aluminium	28%	67%	5%	66%	34%	6%	0%	94%
Copper	0%	96%	4%	62%	38%	15%	0%	85%
Non-ferrous metals (excl. aluminium and copper)	4%	57%	39%	73%	27%	44%	1%	55%
Total	**12%**	**71%**	**17%**	**74%**	**26%**	**43%**	**21%**	**36%**

3.3 Organics

Organics recovery remained strong in 2021-22, with about 1.35 million tonnes of organic materials recovered. Table 24 summarises the recovery of food organics, garden organics, timber and other organics in SA in 2021-22.

As in previous years, 'other organics' contributed the most to overall organics recovery, at 59%. The 'other' organics material continued to grow in 2021-22 with 794 kt, up from 634 kt in 2020-21. 'Other organics' includes meat rendering, waste grease and fat, waste sludge and biosolids, and miscellaneous organics. New information from a renderer and a grower contributed to this increase. New insights indicate other product outputs from recycling organic material captured in 'miscellaneous organics' include ethanol, stockfeed, aquafeed and calcium tartrate.

About 290 kt of garden organics (including household food organics) were recovered in SA in 2021-22, contributing about 21% towards overall organics recovery.

Timber recovery increased in 2021-22 to 238 kt compared to 202 kt in 2020-21. This is remains lower than the 315 kt recovered in 2019 20. Timber comprised 18% of total organics recovery in 2021-22.

Increased reporting on food organics has created an increase in 2021-22 to 30 kt. The material type remains the lowest contributor to organics recovery at 2%.

Table 24 Organics recovered, SA, 2021-22

Material type	Net recovery (kt)
Food organics	30
Garden organics	290
Timber	238
Other organics	794
Meat rendering	398
Waste grease and fat	73
Waste sludge and biosolids	61
Organics – other	261
Total	**1,351**

Figure 20 Organics recovered since 2003-04

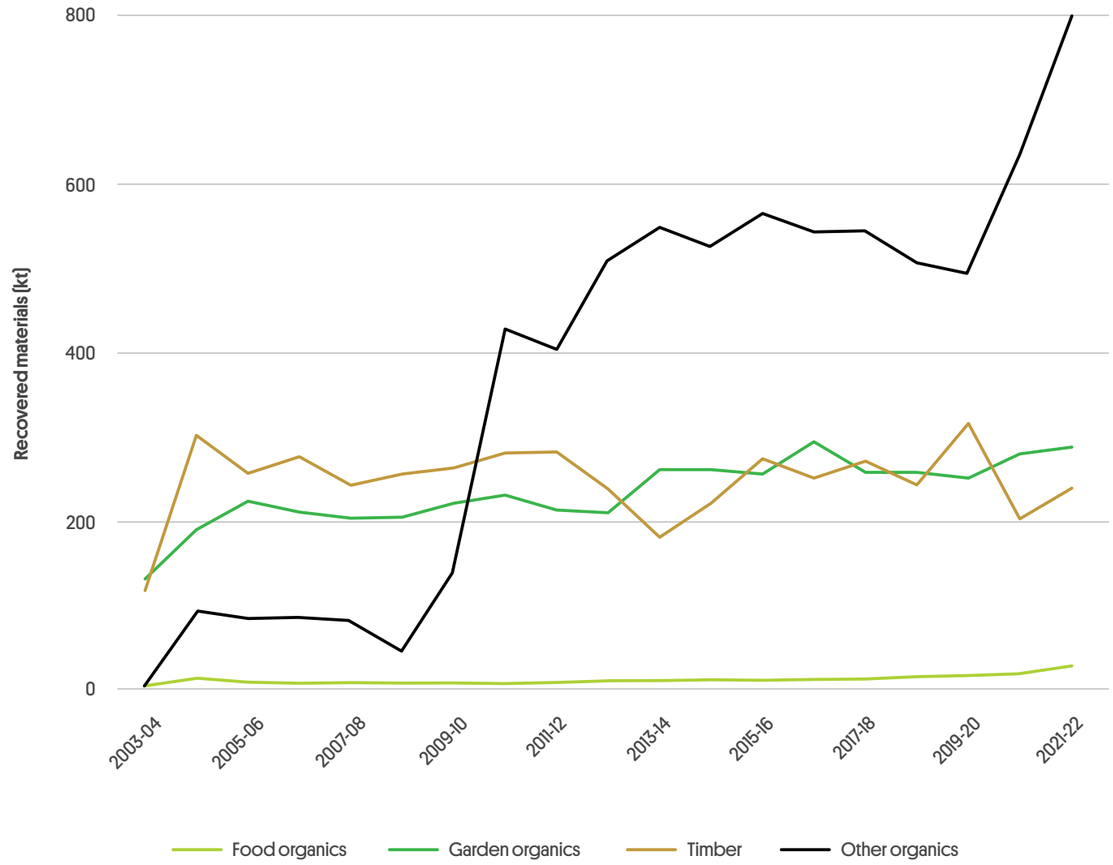


Figure 21 Other organics recovered since 2009-10

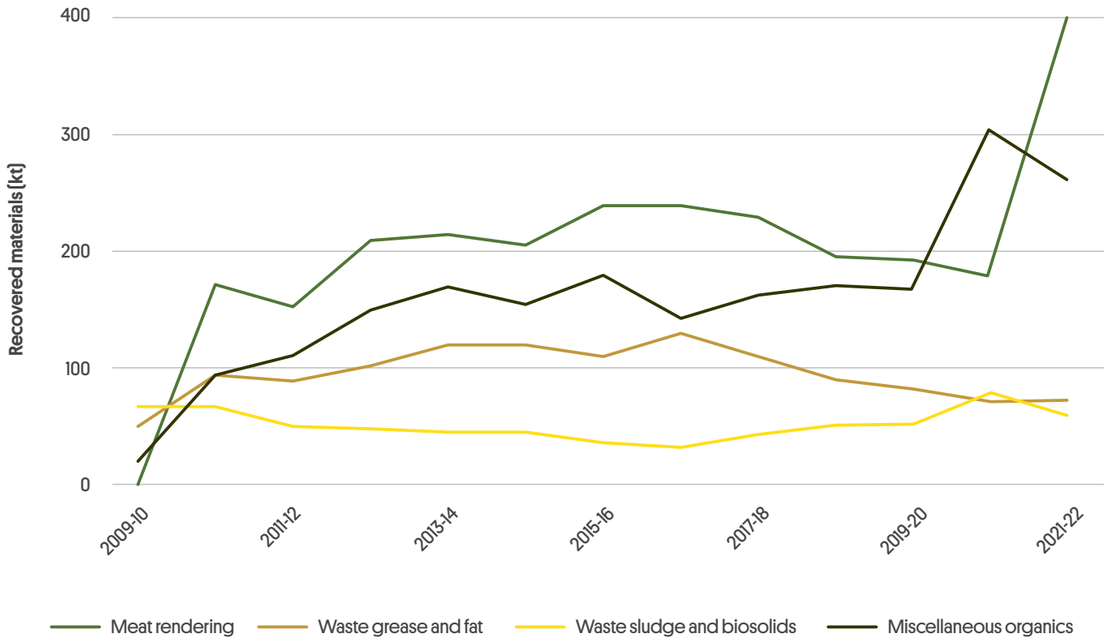


Figure 22 Reported percent composition of organics recovered in 2021-22 and 2020-21

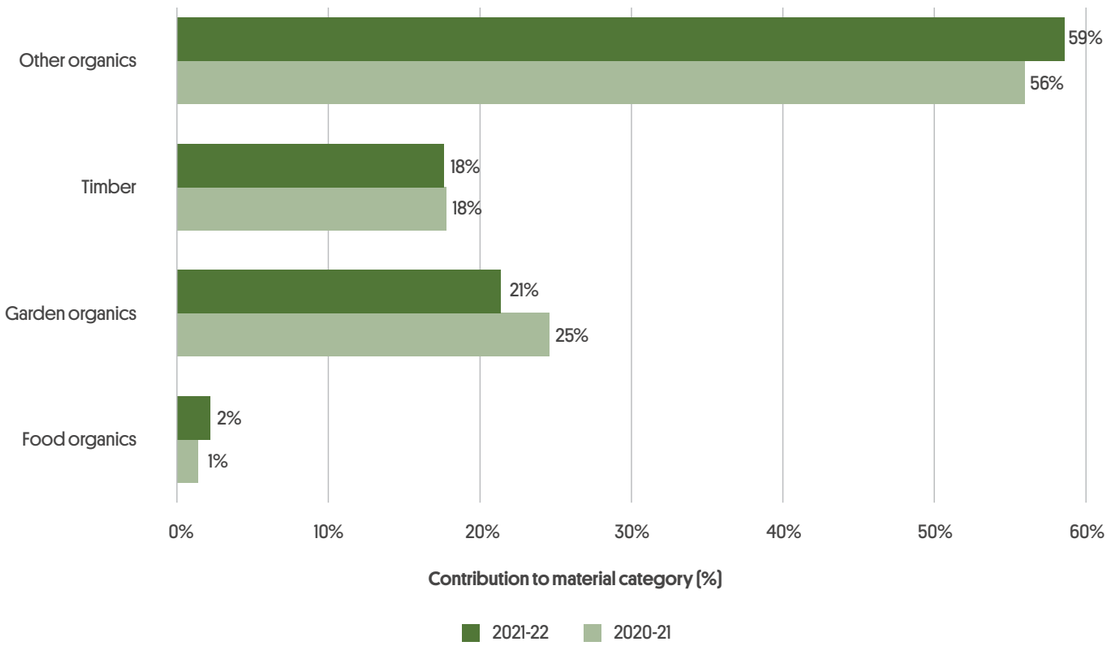


Table 25 provides detail of organics recovery in SA in 2021-22, including information on source stream, geographical origin and reprocessing location. Most organics came from SA's C&I stream (76%). All SA recovered organics were recycled in SA. Metropolitan SA generated slightly more organics than regional SA.

Table 25 Organics recovered in 2021-22 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	49%	51%	0%	71%	29%	100%	0%	0%
Garden organics	80%	14%	6%	90%	10%	100%	0%	0%
Timber	8%	80%	13%	24%	76%	100%	0%	0%
Other organics	2%	98%	0%	50%	50%	100%	0%	0%
Total	**21%**	**76%**	**3%**	**55%**	**45%**	**100%**	**0%**	**0%**

3.4 Cardboard and paper

Recovery of scrap cardboard and paper continued the decline that began in 2018-19. Overall, about 164 kt of cardboard and paper were recovered in SA in 2021-22, down from 182 kt in 2020-21. Magazines and newsprint is the largest portion of the category with 70 kt reported as recovered in 2021-22. Cardboard and waxed cardboard accounted for 60 kt while printing and writing paper totalled 33 kt. A small amount of liquid paperboard was recovered (151 tonnes). Reports of mixed paper and cardboard were apportioned into the sub-categories of magazines and newsprint and printing and writing paper but would otherwise make up 56% of the total recovered paper and cardboard.

Table 26 Cardboard and paper recovered, SA, 2021-22

Material type	Net recovery (kt)
Cardboard and waxed cardboard	60
Liquid paperboard	<1
Magazines and newsprint	70
Printing and writing paper	33
Total	**164**

Figure 23 and Figure 24 show trends in cardboard and paper material types over time with mixed paper and carboard apportioned into other material types, while Figure 25 compares the percent composition for different cardboard and paper types in 2021-22 and 2020-21. Consumption of paper and cardboard – and particularly newsprint and magazines – continue to decline due to digitisation.

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

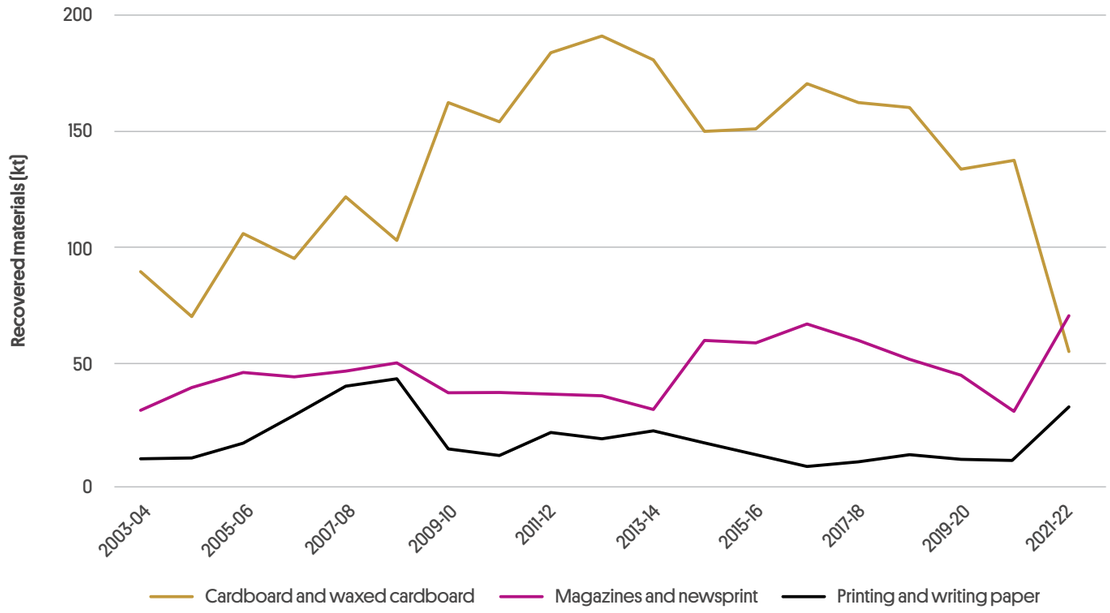


Figure 24 Cardboard and paper recovered since 2003-04 – liquid paperboard

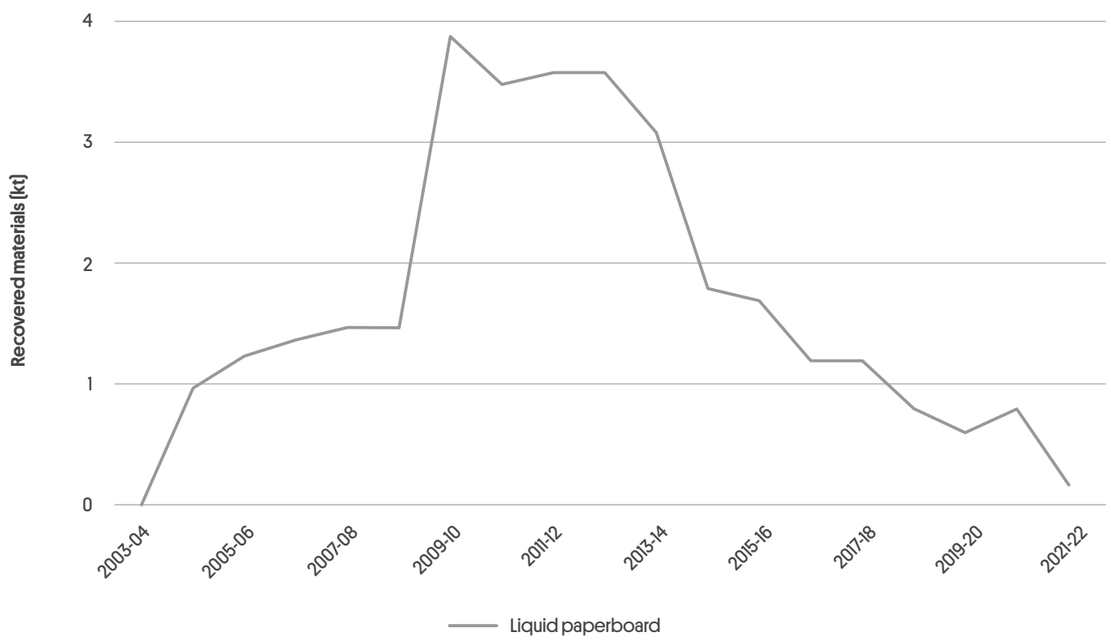


Figure 25 Reported percent composition of cardboard and paper recovered in 2021-22 and 2020-21

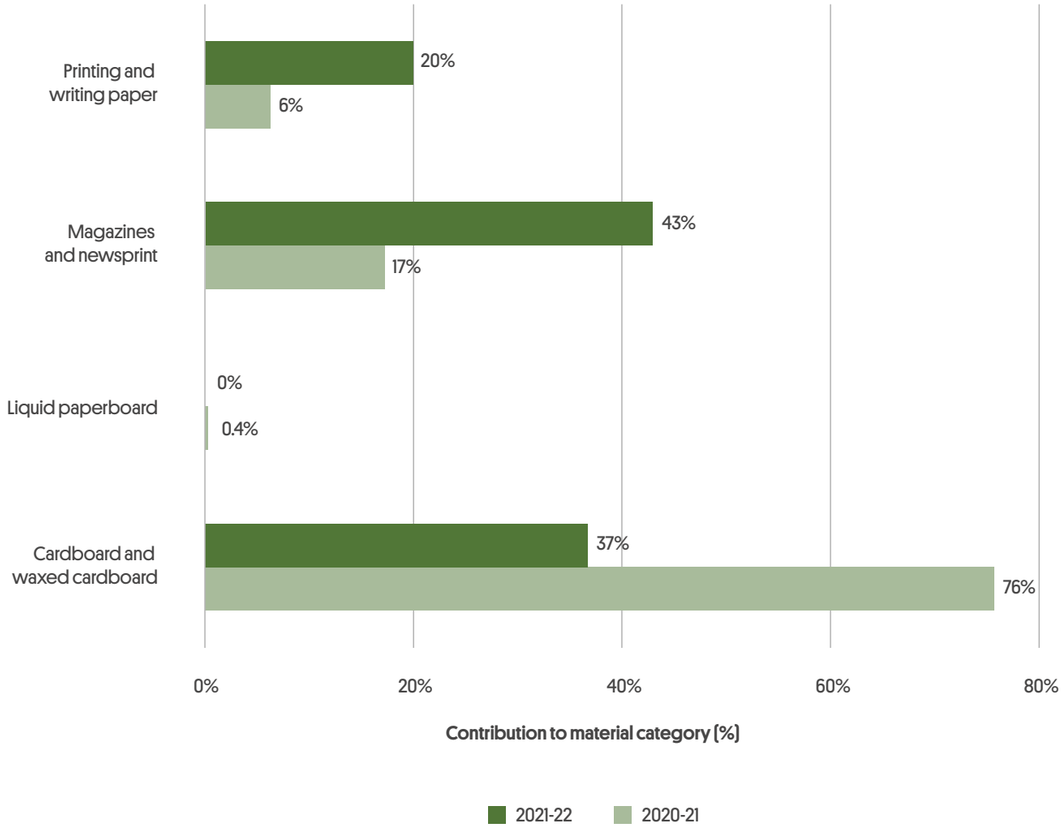


Table 27 presents the source stream, geographical origin and reprocessing location for recovered cardboard and paper in SA in 2021-22. Cardboard and paper were mostly recovered from the C&I stream and reprocessing was mostly undertaken overseas.

Table 27 Cardboard and paper recovered in 2021-22 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	15%	85%	0%	86%	14%	47%	3%	50%
Liquid paperboard	9%	91%	0%	90%	10%	90%	10%	0%
Magazines and newsprint	49%	51%	0%	79%	21%	20%	9%	71%
Printing and writing paper	45%	55%	0%	81%	19%	19%	15%	67%
Total	**35%**	**65%**	**0%**	**82%**	**18%**	**30%**	**8%**	**62%**

3.5 Glass

SA recovered about 54 kt of scrap glass in 2021-22, down from 84 kt from 2020-21. While lower than previous years, Orora's new glass beneficiation plant commenced operation in October 2022 outside this reporting period and stockpiling may have occurred within the reference period, contributing to lower glass recovery figures. Visy was also rebuilding its glass facility, which may have also been a factor.

Recovered glass was mostly containers; 59% of overall volumes in 2021-22 was glass from food and beverage containers and 41% other glass.

Table 28 Glass recovered, SA, 2021-22

Material type	Net recovery (kt)
Glass from food and beverage containers	32
Other glass	22
Total	**54**

Glass recovery trends since 2003-04 are shown in Figure 26. The proportions of glass from food and beverage containers and other glass recovered in 2021-22 are shown in Figure 27.

Figure 26 Glass recovered since 2003-04

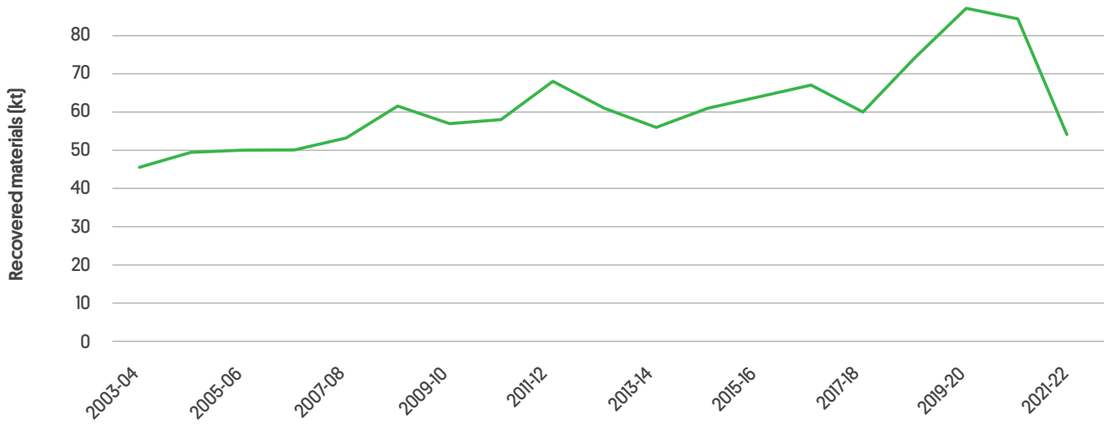


Figure 27 Reported percent composition of glass recovered in 2021-22

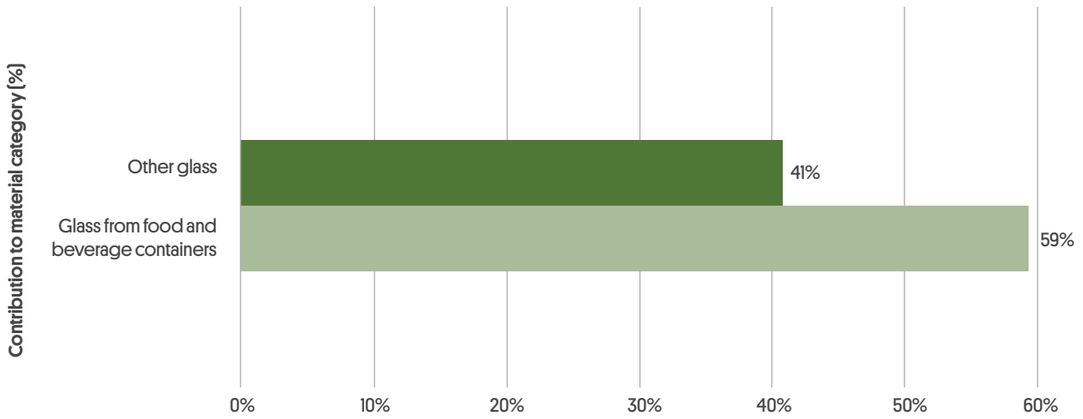


Table 29 presents the source stream, geographical origin and reprocessing location for recovered glass in SA in 2021-22. The C&D stream generated the most glass as almost all 'other' glass was generated in the C&D stream. The next largest glass generating stream was C&I and then MSW. These streams were mostly food and beverage containers. Most glass was from the metropolitan region, and all reprocessing occurred in SA.

Table 29 Glass recovered in 2021-22 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	23%	37%	40%	92%	8%	100%	0%	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 2021-22 was about 34 kt. This was slightly more than the 29 kt recovered in 2020-21. Minimal quantities of foundry sands have been recovered since 2019-20 and SA has not recovered any fly ash since the closure of the Port Augusta Power Station. Quantities of tyres and other rubber have increased since 2020-21 possibly due to the variation in reporting exported material. Tyres and other rubber contributed the most to overall recovery in this category. Leather and textiles increased from 1.6 kt in 2020-21 to 5 kt 2021-22.

Table 30 Other materials recovered, SA, 2021-22

Material type	Net recovery (kt)
Fly ash	0
Foundry sands	4
Leather and textiles	5
Tyres and other rubber	25
Total	**34**

Figure 28 and Figure 29 show trends in the recovery of other materials by type. Figure 29 compares the contribution for different other material types toward total recovery from 2021-22 and 2020-21.

Figure 28 Other materials recovered since 2003-04 – foundry sands, leather and textiles and tyres and other rubber

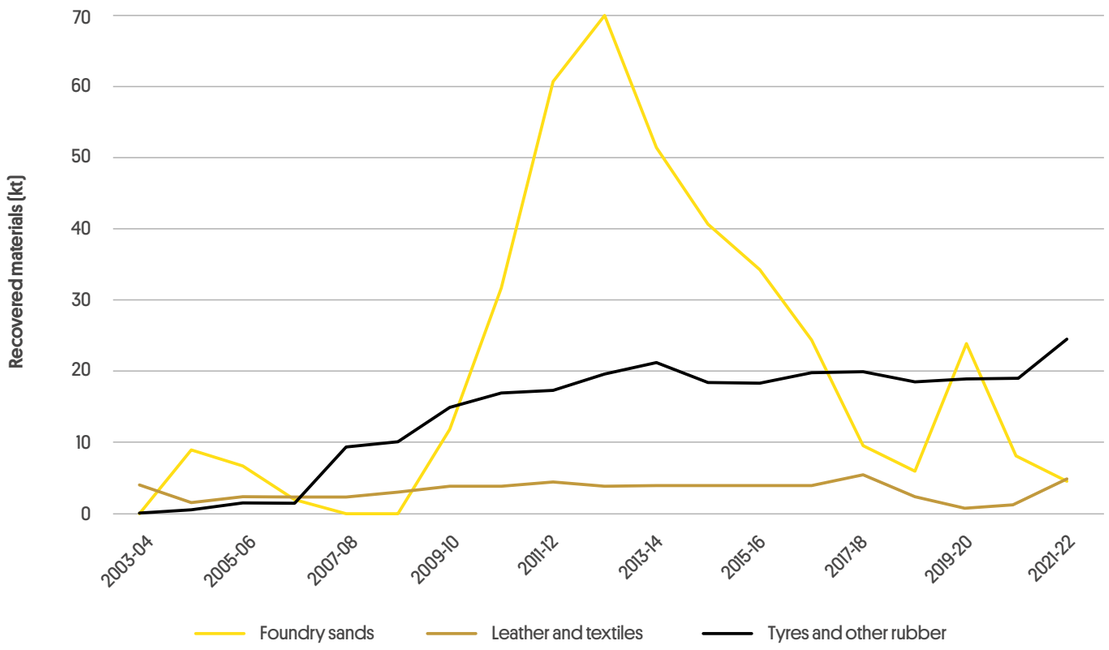


Figure 29 Reported percent composition of other materials recovered in 2021-22 and 2020-21

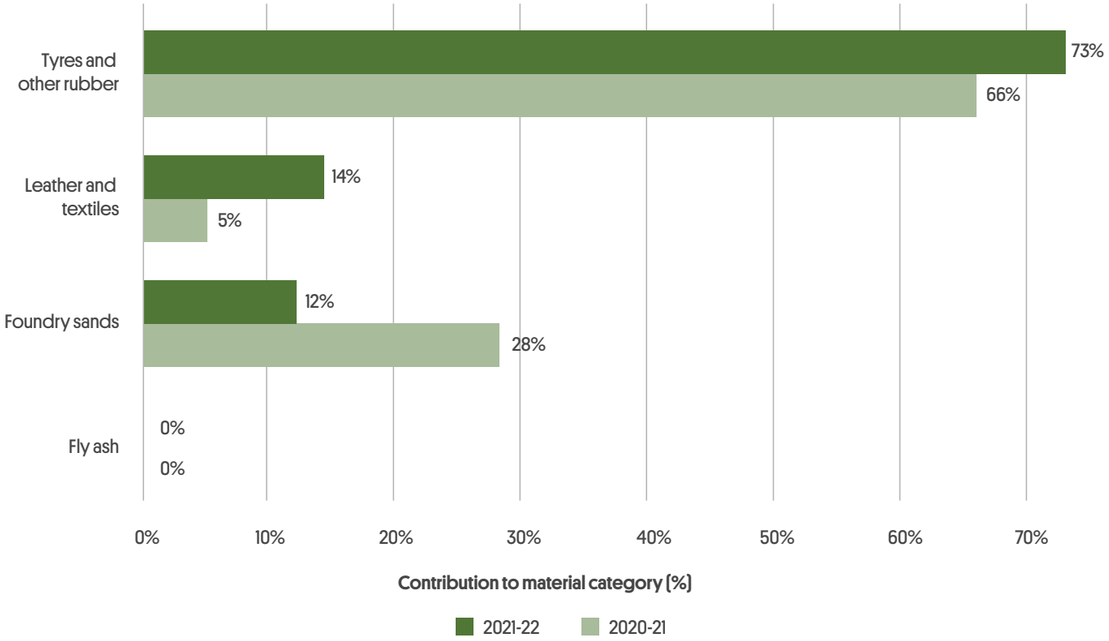


Table 31 presents the source stream, geographical origin and reprocessing destination for material types within the other materials category. Most materials in this category were from C&I sources except some textiles. About 77% of were from metropolitan SA and 23% from regional SA. Most other materials were reprocessed locally (55%), with some sent interstate (11%) and overseas (34%). The destination for tyres and other rubber was 58% SA, 27% overseas and 15% interstate.

Table 31 Other materials recovered in 2021-22 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	0%	0%	0%	0%	0%	0%	0%	0%
Foundry sands	0%	100%	0%	100%	0%	100%	0%	0%
Leather and textiles	48%	52%	0%	76%	24%	2%	0%	98%
Tyres and other rubber	0%	100%	0%	73%	27%	58%	15%	27%
Total	**7%**	**93%**	**0%**	**77%**	**23%**	**55%**	**11%**	**34%**

4 Plastics

This version of the CERRR includes a special focus on plastics, reflecting the serious global problems presented by waste plastics. These problems include pollution of the oceans, low recovery rates and weak markets for recovered material.

This section firstly presents a resource recovery report for waste plastics similar to reports on other material types given in the previous section. It then describes the results of material flow analyses for each of the major plastic polymer types from production through to waste management, illustrating these with a series of Sankey diagrams.

4.1 Plastics resource recovery report

SA recovered 33 kt of plastics in 2021-22, an increase from the 32 kt recovered in 2020-21. Table 32 summarises 2021-22 plastics recovery from 2021-22. Figure 30, Figure 31 and Figure 32 show plastics recovery trends.

Mixed plastics recovery fell to 199 tonnes in 2021-22, while recovery of individual polymers types increased. Most recovered plastics in 2021-22 were HDPE (35%), PET (28%) and LDPE (20%), as shown in Figure 33.

The transition from large amounts of mixed plastics to reports by polymer type can be attributed to the Commonwealth Government's ban on the export of mixed plastics. Previously, most collected plastics were exported poorly sorted and containing significant contaminants. This contamination caused environmental problems in China and other receiving countries. From July 2021, at the beginning of this reporting period, exporters needed to sort plastics into single polymer streams.

Table 32 Plastics recovered, including energy recovery, SA, 2021-22

Material type	Net recovery (kt)
Polyethylene terephthalate	9
High density polyethylene	12
Polyvinyl chloride	0
Low density polyethylene	7
Polypropylene	5
Polystyrene	<1
Mixed and/or other plastics	<1
Total	**33**

Figure 30 Plastics recovered since 2003-04 – PET, HDPE, LDPE, PP and mixed and/or other plastics

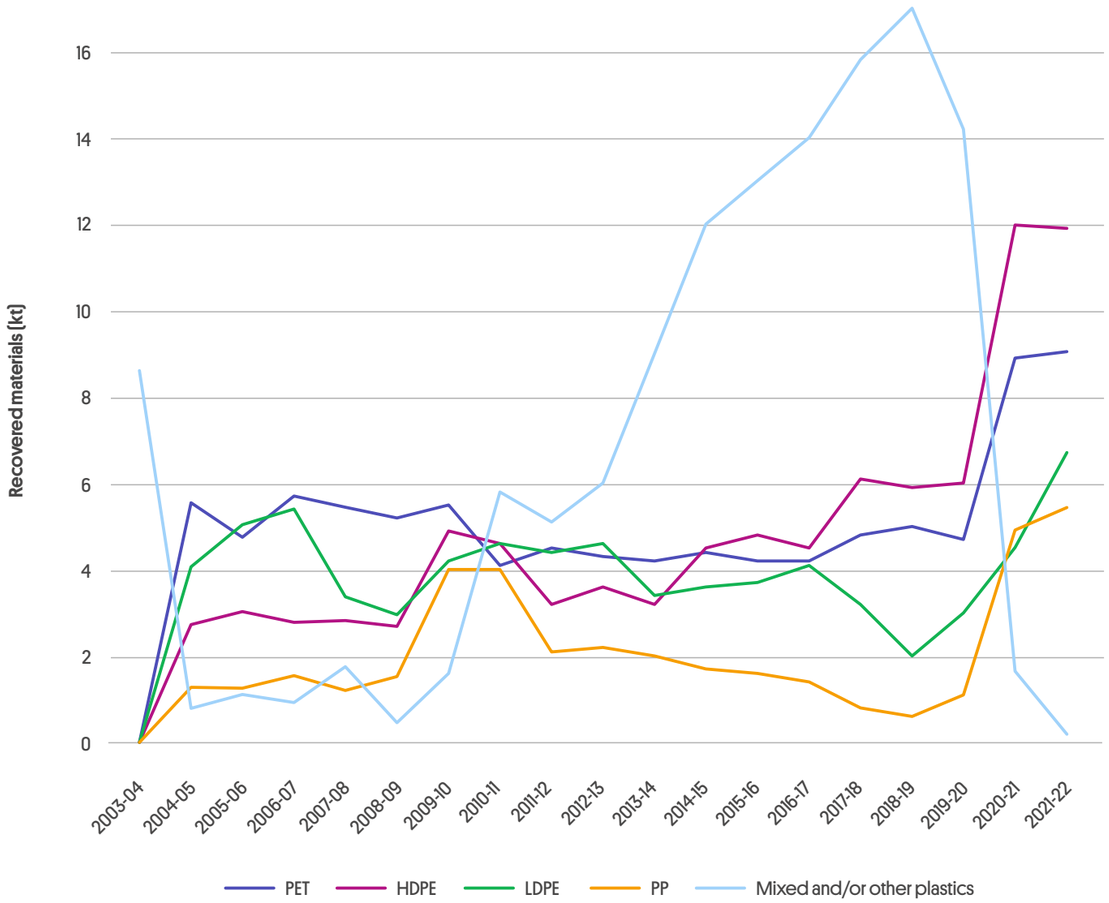


Figure 31 Plastics recovered since 2003-04 – PVC and PS

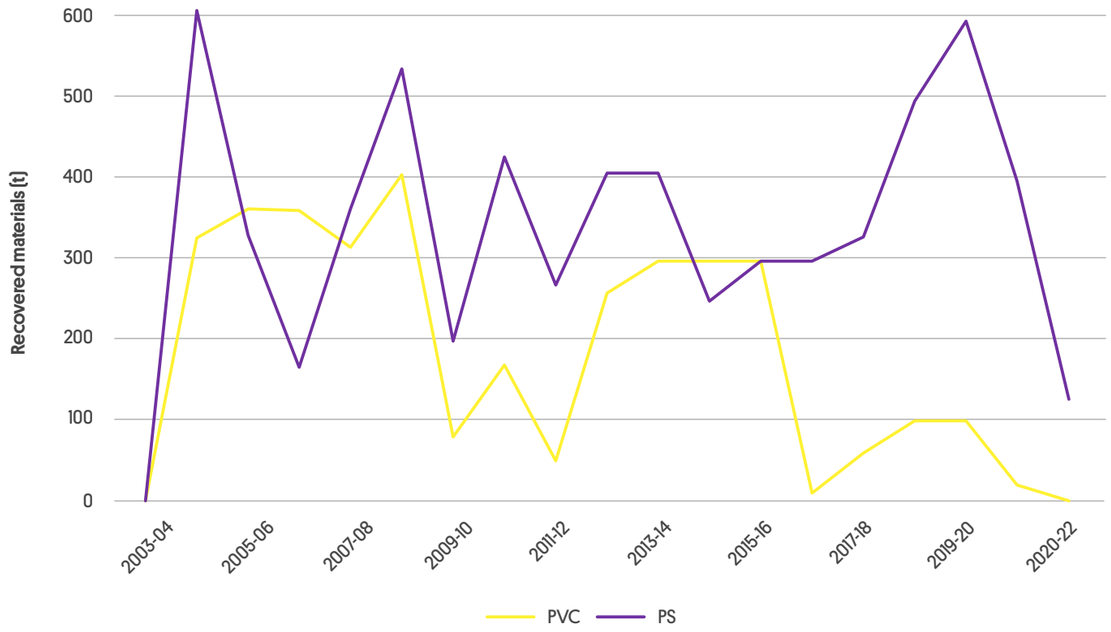


Figure 32 Plastics recovered since 2003-04 – all plastics

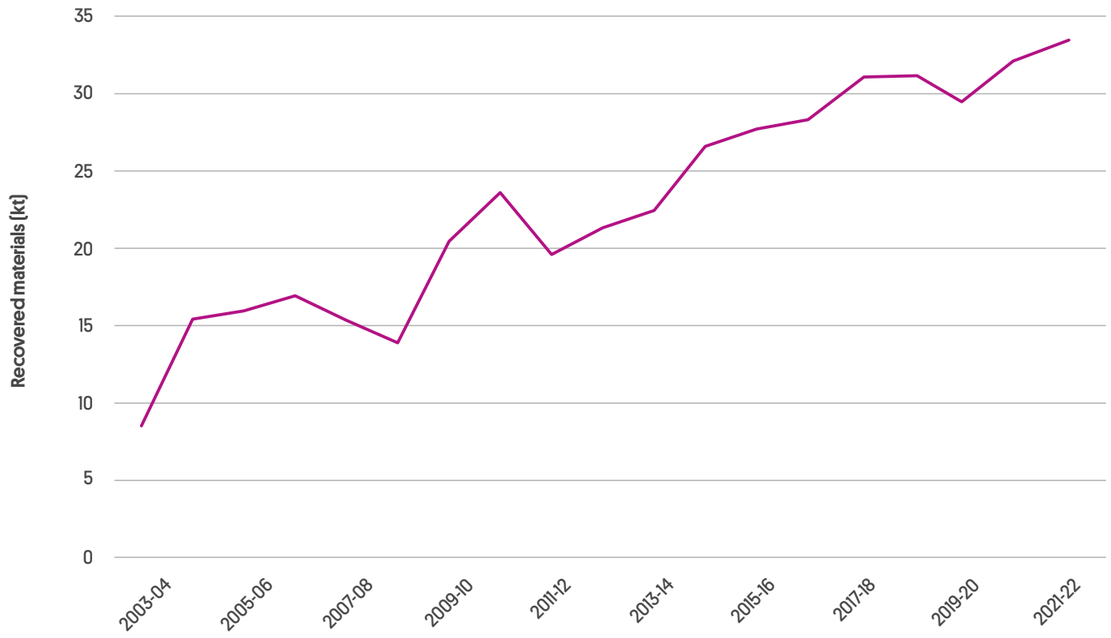
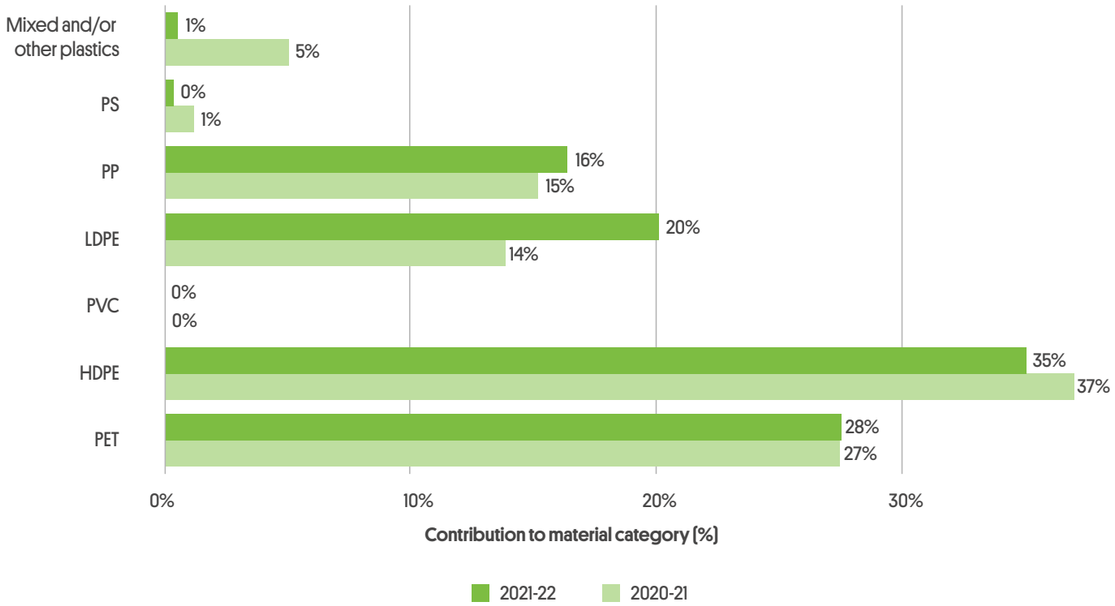


Figure 33 Reported percent composition of plastics recovered in 2021-22 and 2020-21



Plastics recovery in 2021-22 by plastics type, source stream, geographical origin and reprocessing location is shown in Table 33. More than half of recovered plastics were reported as coming from the MSW stream, with the remainder from C&I sources.

About 60% of total recovered plastics were reprocessed locally, an increase compared to previous years. A quarter of all plastics were exported under the new export restrictions.

Table 33 Plastics recovered in 2021-22 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	73%	27%	0%	87%	13%	52%	24%	25%
High density polyethylene	63%	37%	0%	88%	12%	74%	19%	7%
Polyvinyl chloride	0%	0%	0%	0%	0%	0%	0%	0%
Low density polyethylene	2%	98%	0%	76%	24%	25%	1%	73%
Polypropylene	85%	15%	0%	92%	8%	83%	16%	0%
Polystyrene	4%	96%	0%	100%	0%	43%	40%	17%
Mixed and/or other plastics	48%	52%	0%	99%	1%	96%	4%	0%
Total	**57%**	**43%**	**0%**	**86%**	**14%**	**60%**	**16%**	**24%**

4.2 Material flow analyses for plastics

Introduction to material flow analysis (MFA)

A general definition of MFA is provided by the UN Environment Programme International Resource Panel (UNEP 2020):

> *Material flow analysis (MFA) comprises a group of methods to analyse the physical flows of materials into, through and out of a given system. It can be applied at different levels of scale, i.e. products, firms, sectors, regions, and whole economies. The analysis may be targeted to individual substance or material flows, or to aggregated flows, e.g. of resource groups (fossil fuels, metals, minerals).*

They follow the principle of conservation of mass, tracing material flows by balancing inputs and outputs and drawing on the following concepts of:

- a *system* of processes, flows and stocks
- *processes* that transform, transport or store materials
- *flows* between connected processes
- *transfer coefficients* that apportion outgoing flows from a process to downstream processes
- *stocks* resulting from a portion of the flow remaining as an 'accumulation', going back 100 years (e.g. accumulated materials in use, stockpiling of wastes or landfill).

MFA and the scientific field developing around it support the analysis of anthropogenic (and natural) material flows through manufacturing, use, disposal and recovery. This is useful for measuring and monitoring the transition to a circular economy, identifying opportunities for maximising recovery, and improving environmental outcomes generally.

Plastics MFAs

This report pilots material flow analysis for the plastics material category. The MFAs are quantitative assessments of the state and change of flows and stocks of plastics within SA in 2021-22.

A key data input for these pilot plastic MFAs was the *Australian Plastic Flows and Fates Study 2020-21* (Blue Environment 2022), which provided a baseline for national plastics consumption that was apportioned to SA using population data. Plastics consumption data were coupled with studies on material lifespans and the results of the survey to model material flows within the defined system.

MFAs can help to measure material circularity and assess the performance of the waste and resource recovery sector at different stages of recovery. A set of circular economy indicators were selected for this work:

- **Recycled content:** Performance of the manufacturing system in utilising recycled materials.
- **Collection efficiency:** Performance of the collection system. Low efficiency means a high proportion of material isn't separated from material flows at the household or business and is directed to landfill, e.g., owing to limited source separation and/or poor disposal practices.
- **Sorting efficiency:** Performance of the system to sort materials designated for specific recovery pathways. Low sorting efficiency highlights opportunities to reduce contamination of collected materials received and/or improve sorting processes at the sorting facilities.
- **Reprocessing efficiency:** Performance of the system to reprocess materials to be ready for specific remanufacturing or energy recovery pathways. Low reprocessing efficiency highlights opportunities to reduce contamination of sorted materials received, improve product design, and/or improve processes at the reprocessing facilities.
- **Recycling rate:** Performance of the system in recycling end-of-life materials.
- **Energy recovery rate:** Performance of the system in diverting end-of-life materials to energy recovery.
- **Recovery rate:** Performance of the system in diverting end-of-life materials to recycling and energy recovery.
- **Landfill rate:** Performance of the system in generating material losses to landfill.
- **Local material utilisation rate:** Performance of the system in on-shore remanufacturing, relative to the amount of material that is potentially available.

A description on how these indicators were derived is provided in a more detailed MFA method in Appendix A.

MFA results

The MFA results on plastics consumption, waste generation and recovery in SA in 2021-22 are provided in Table 34, together with estimated material accumulations in use and in landfill as of 2021-22. The estimated performance of plastics based on the set of nominated circular economy indicators is shown in Table 35.

Plastics consumption in SA in 2021-22 was estimated at 240 kt. It is estimated that locally manufactured and imported plastics comprised about 9% recycled content.

Stocks of plastics in use were estimated at about 1,610 kt. Most consumed plastics arise in short lived applications like packaging, but significant quantities of plastics have accumulated over time in the built environment and in long-lasting consumer products. It is estimated that about 190 kt of plastics reached end of life in SA in 2021-22. As described in Section 4.1, about 33 kt of these were recovered. This equates to an estimated recovery rate of 18%.

It is estimated that about 82% of end-of-life plastics were sent to landfills in SA in 2021-22, which now contain at least 3.8 million tonnes of plastics.

Table 34 Key MFA results for plastics in SA, 2021-22

Parameter	PET	HDPE	PVC	LDPE	PP	PS	Mixed/other	Plastics
Consumption (kt)	29	51	29	28	43	10	49	240
Waste generation (kt)	27	41	15	27	38	7	34	190
Recovery (kt)	9	12	0	7	5	<1	<1	33
Stocks in use (kt)	89	240	530	73	180	98	400	1,610
Landfill sink (kt)	380	770	360	650	640	190	840	3,800

Table 35 Circular economy indicators for plastics in SA, 2021-22

Indicator	PET	HDPE	PVC	LDPE	PP	PS	Mixed/other	Plastics
Recycled content	18%	19%	0%	4%	11%	0%	0%	9%
Collection efficiency	67%	37%	2%	23%	24%	19%	18%	30%
Sorting efficiency	82%	84%	0%	100%	60%	13%	9%	71%
Reprocessing efficiency	53%	93%	0%	100%	96%	65%	32%	78%
Recycling rate	28%	26%	0%	22%	12%	1%	0%	15%
Energy recovery rate	5%	5%	0%	2%	2%	1%	0%	3%
Recovery rate	33%	31%	0%	24%	14%	2%	1%	18%
Landfill rate	65%	70%	100%	78%	82%	97%	99%	82%
Local material utilisation rate	18%	23%	0%	4%	12%	0%	0%	11%

Estimated plastics flows in SA in 2021-22 are depicted in aggregate in Figure 34 (overleaf) and by polymer type in the pages following (Figure 35 though to Figure 40).

Figure 34 Plastic flows in SA, 2021-22

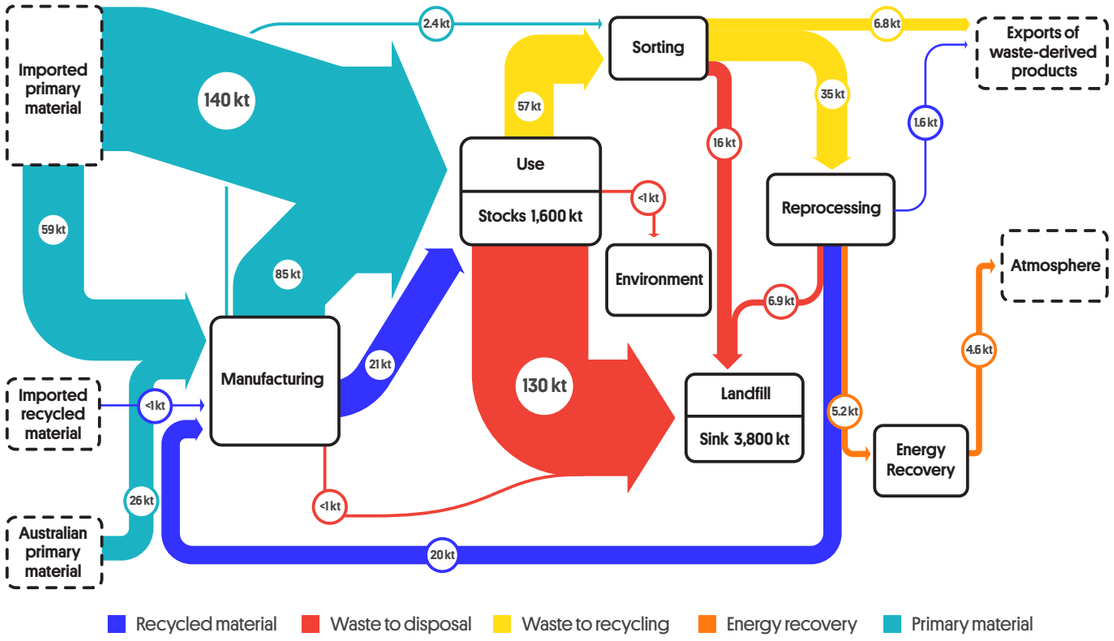


Figure 35 PET flows in SA, 2021-22

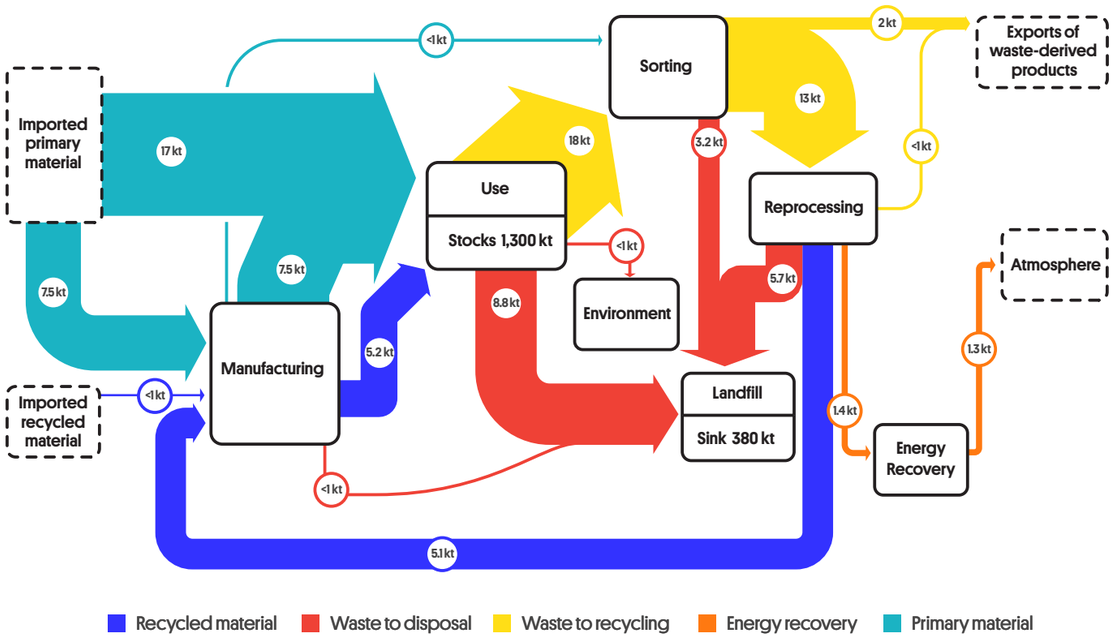


Figure 36 HDPE flows in SA, 2021-22

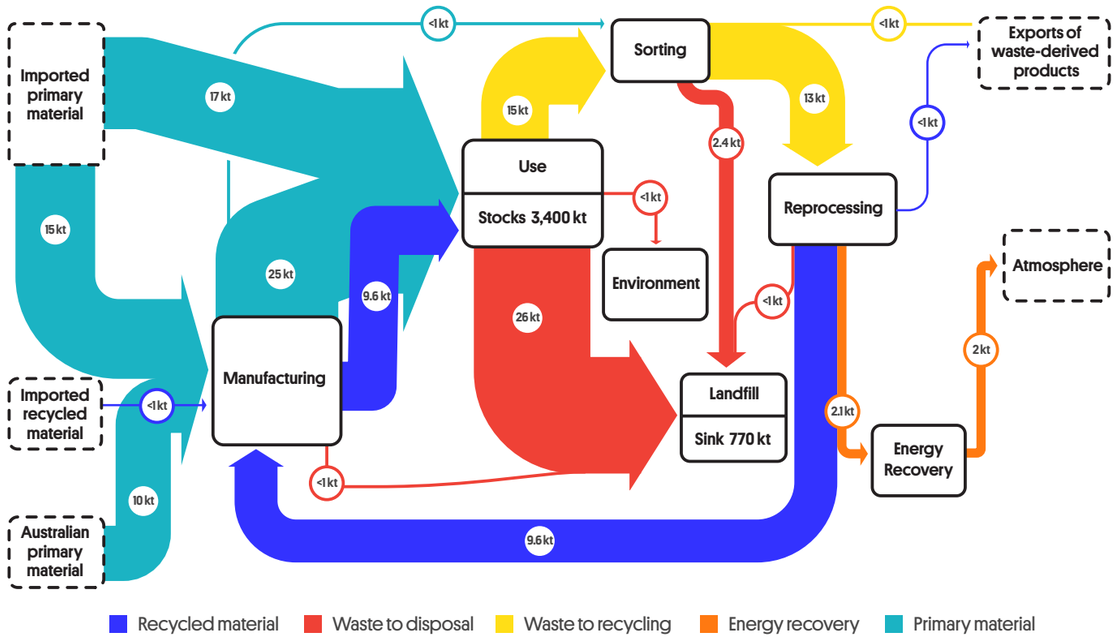


Figure 37 PVC flows in SA, 2021-22

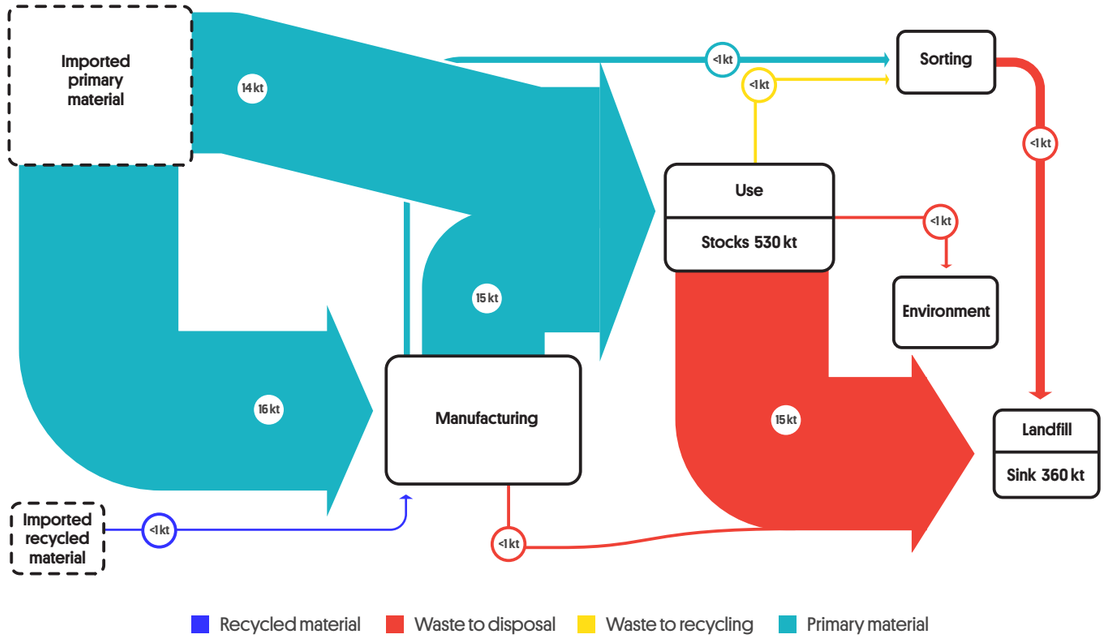


Figure 38 LDPE flows in SA, 2021-22

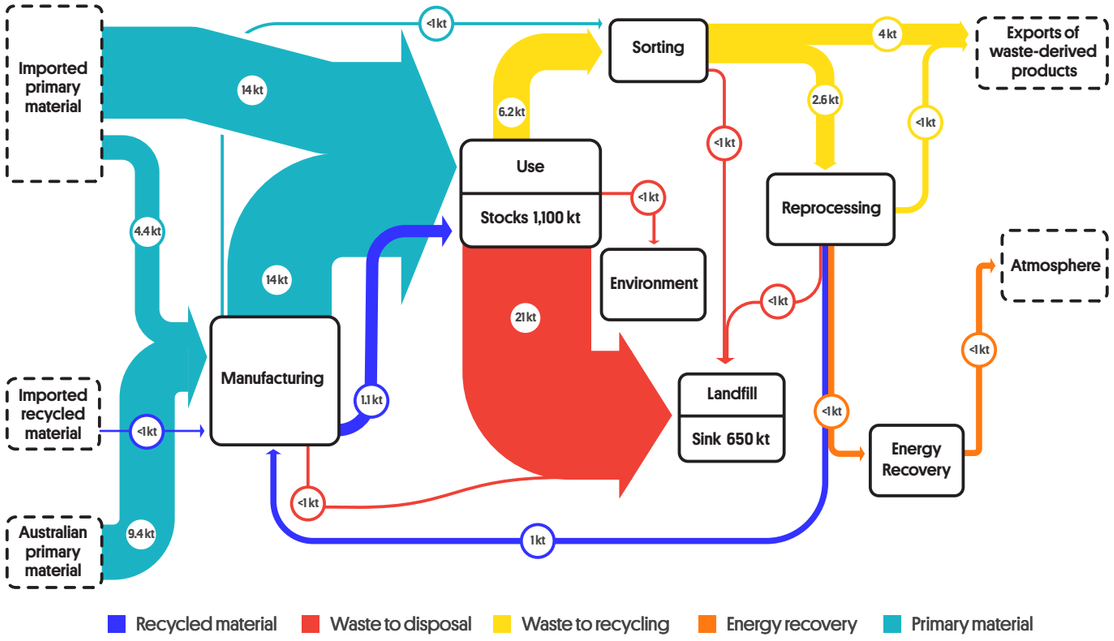


Figure 39 PP flows in SA, 2021-22

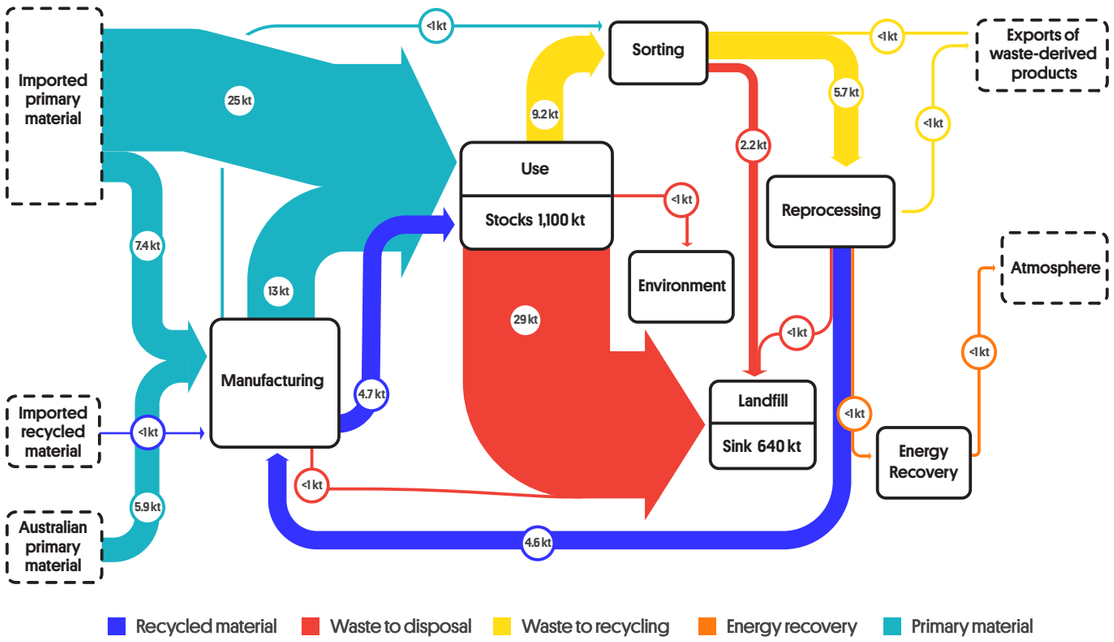


Figure 40 PS flows in SA, 2021-22

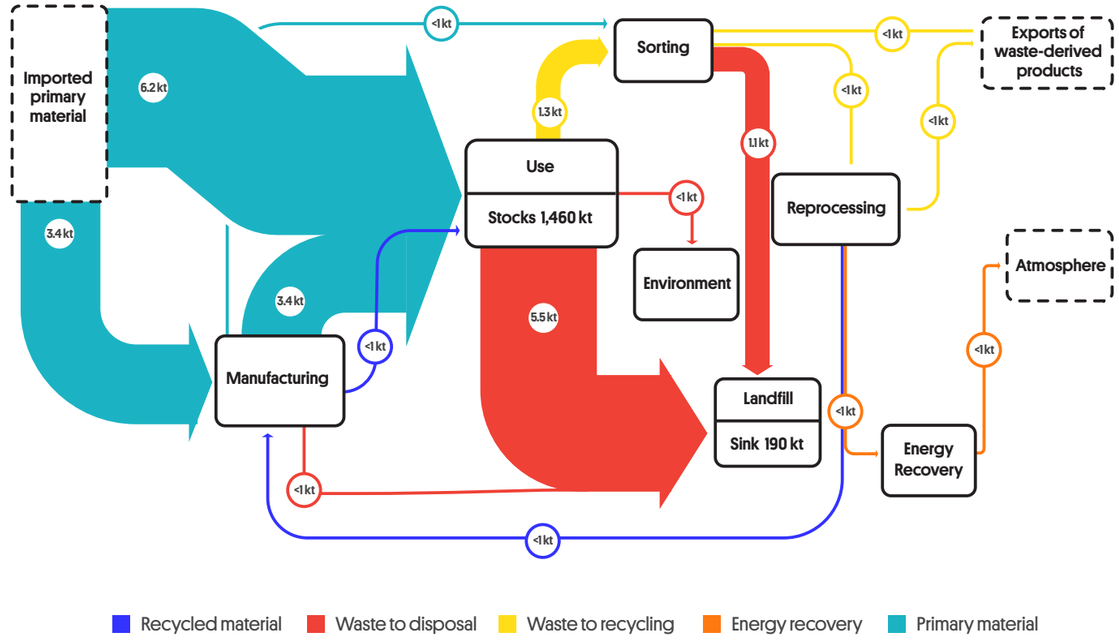
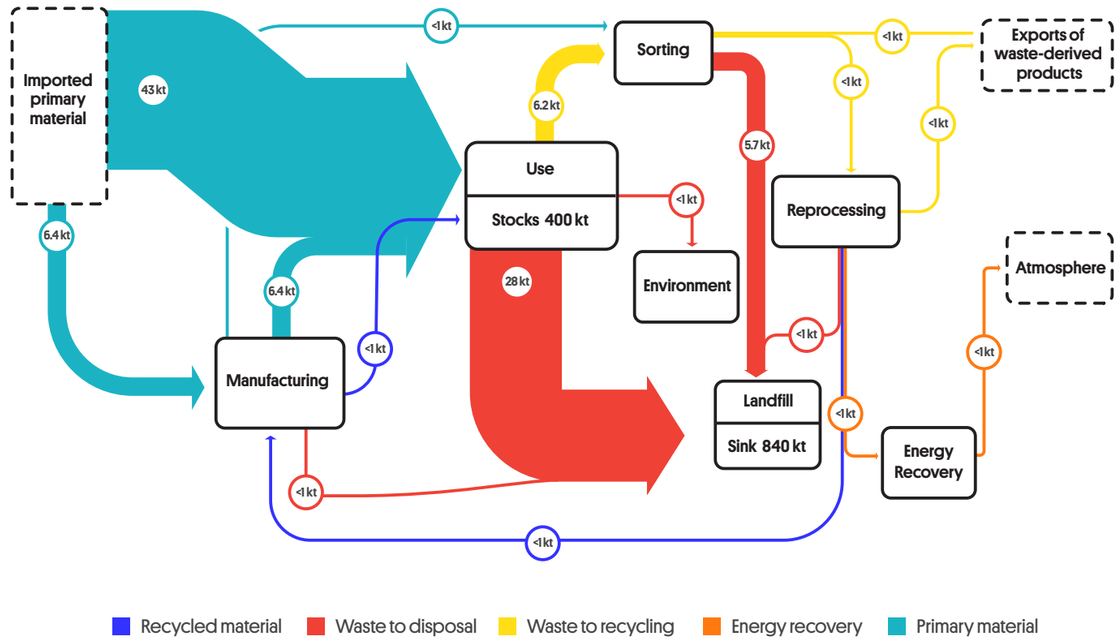


Figure 41 Mixed and/or other plastic flows in SA, 2021-22



5 E-waste

- Electronic waste (e-waste) is a globally growing waste stream, and reported tonnes continued to rise in 2021-22.
- Reported e-waste recovery in SA decreased by 10% from 2020-21 to 2021-22, from about 5.9 kt to about 5.3 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 materials recovery data presented in Section 3.

E-waste recovery in SA dropped 10% from 2020-21 to 2021-22, from 5.9 kt to 5.3 kt. The quantity of batteries reported recovered greatly increased in 2021-22. Quantities of all other e-waste materials declined. Reports from industry indicated that plastics from dismantled e-waste were stockpiled in 2021-22 as they were no longer able to be exported due to the export restrictions. This will be addressed in future CERRRs. Table 36 summarises e-waste recovery in SA in 2019-20, 2020-21 and 2021-22.

Table 36 Reported tonnes of e-waste, SA, 2021-22, 2020-21 and 2019-20

E-waste type	2019-20 (tonnes)	2020-21 (tonnes)	2021-22 (tonnes)	Change (%)
				20-21 to 21-22
Printer cartridges	170	150	20	-86%
Compact fluorescent lamps	120	120	120	-3%
Batteries	50	90	2,270	2291%
Computers	2,600	1,660	860	-48%
Televisions/monitors	1,700	2,930	1,140	-61%
Mobile phones	6.0	5.7	4.8	-15%
Other e-waste	740	920	860	-6%
Total	**5,390**	**5,870**	**5,270**	**-10%**

Table 37 lists the proportion of total e-waste recovered from different source streams, geographical origins and reprocessing locations. E-waste is split between C&I sources (53%) and MSW (47%). Table 37 shows that the destination for e-waste is mostly interstate (64%), followed by SA (34%). Analysis of ABS exports of materials likely containing e-waste show that 59 tonnes of e-waste products were sent overseas for reprocessing in 2021-22. Materials from e-waste products were also sent overseas for reprocessing after dismantlement and sorting in SA but the exported figures are captured in exports of plastics, metals and other materials.

Table 37 E-waste recovered in 2021-22 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	47%	53%	0%	89%	11%	34%	64%	1%

Figure 42 and Figure 43 show e-waste trends since 2009-10, while Figure 44 shows a comparison of 2020-21 and 2021-22 data.

Figure 42 Reported e-waste recovered since 2009-10 (batteries, televisions and monitors, computers and other e-waste)

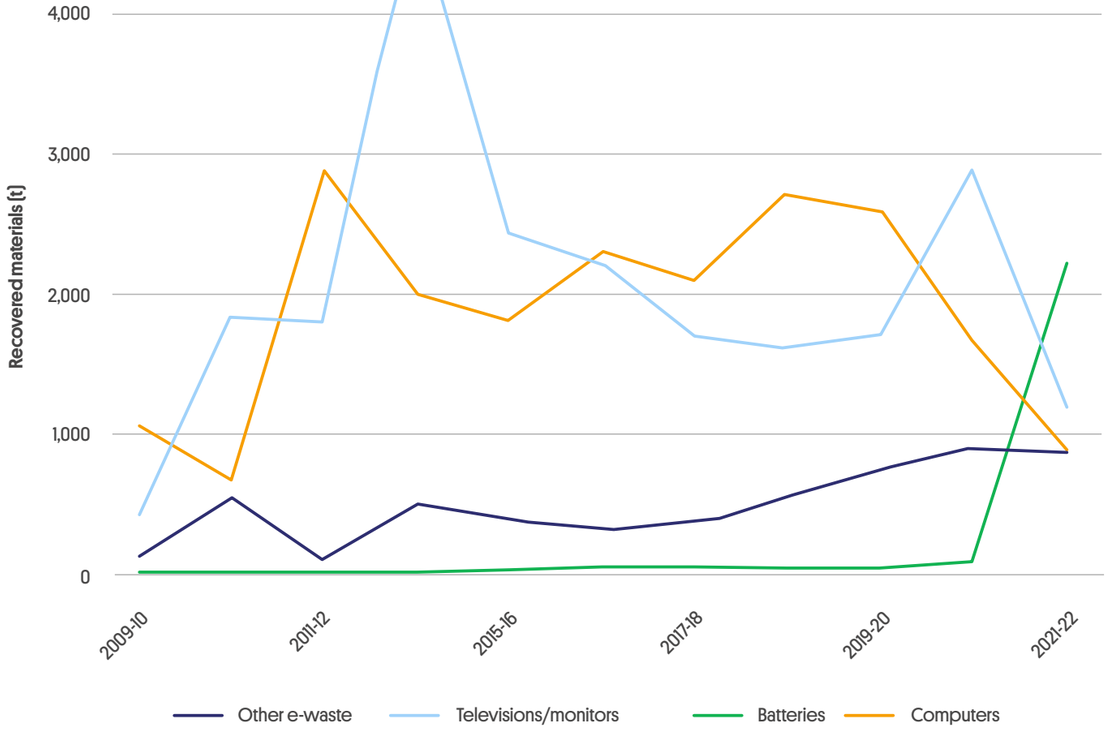


Figure 43 Reported e-waste recovered since 2009-10 (compact fluorescent lamps, printer cartridges and mobile phones)

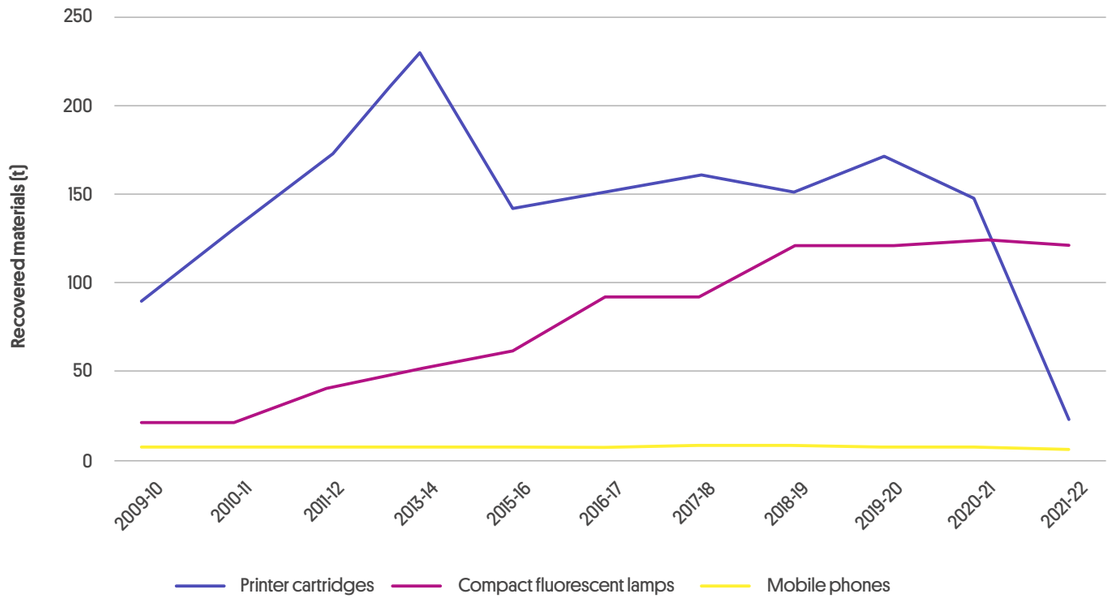
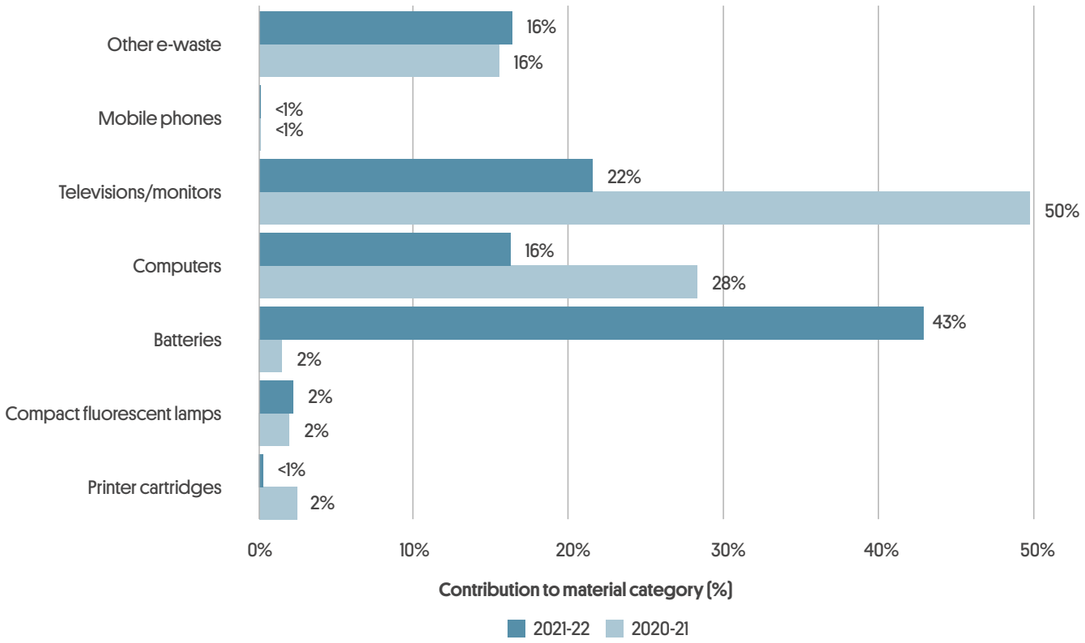


Figure 44 Reported percent composition of e-waste recovered in 2021-22 and 2020-21



6 Packaging

Australia has established targets for the management of packaging waste by 2025, as follows (DCCEEW 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 204 kt of packaging materials in 2021-22, comprising about 39 kt (19%) CDL materials and 165 kt (81%) non-CDL materials.

Table 38 summarises estimated packaging recovery in SA in 2021-22. Broadly, compared to the previous year, quantities of recovered:

- aluminium cans increased
- cardboard and most plastics packaging decreased slightly
- glass bottles and jars maintained a similar level to 2020-21.

Table 38 Estimated packaging recovered in SA in 2021-22 (kt)

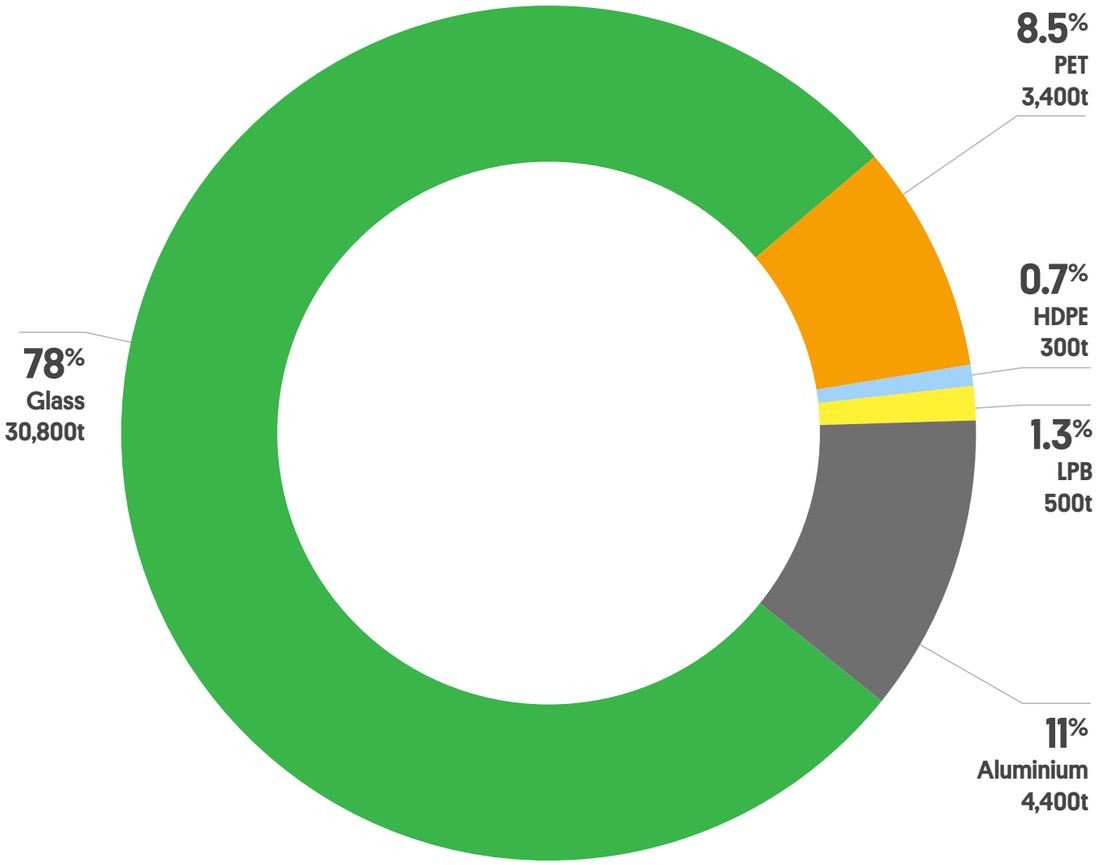
Packaging type	Recovered (kt)			Packaging as a proportion of total recovery
	CDL	Other	Total	
Aluminium cans	4.4	0.5	4.9	42%
Cardboard packaging	0.0	109.1	109.1	90%
Glass bottles and jars	30.8	34.0	64.9	100%
HDPE packaging	0.3	9.9	10.2	56%
LDPE packaging	0.0	2.9	2.9	33%
Liquid paperboard cartons	0.5	0.6	1.1	100%
Other plastics packaging	0.0	0.5	0.5	48%
PET packaging	3.4	2.5	5.8	19%
Polypropylene packaging	0.0	2.4	2.4	33%
Polystyrene packaging	0.0	0.0	0.0	0%
PVC packaging	0.0	0.0	0.0	56%
Steel cans	0.0	2.3	2.3	63%
Total	**39.4**	**164.9**	**204.3**	**-**

6.1 Container deposit legislation

SA has the longest established CDL in Australia, having introduced its container deposit scheme 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 39 kt of containers to CDL locations across the State in 2021-22. The bulk of these materials were glass containers, which made up about 31 kt (78%) of total CDL materials in 2021-22. About 4,400 tonnes (11%) of aluminium cans, 3,400 tonnes (9%) of PET, 500 tonnes (1%) of liquid paperboard and 300 tonnes (<1%) of HDPE packaging was returned.

Figure 45 Relative proportions of returned container deposit legislation materials by weight, SA, 2021-22



The return rates for CDL materials are provided in Table 39 below. Return rates were high for glass and aluminium at over 80%, while plastics packaging and liquid paperboard exhibited more moderate return rates at 70% to 53%. Compared to 2020-21, the return rates for aluminium, glass, PET and HDPE increased slightly, while liquid paperboard declined slightly.

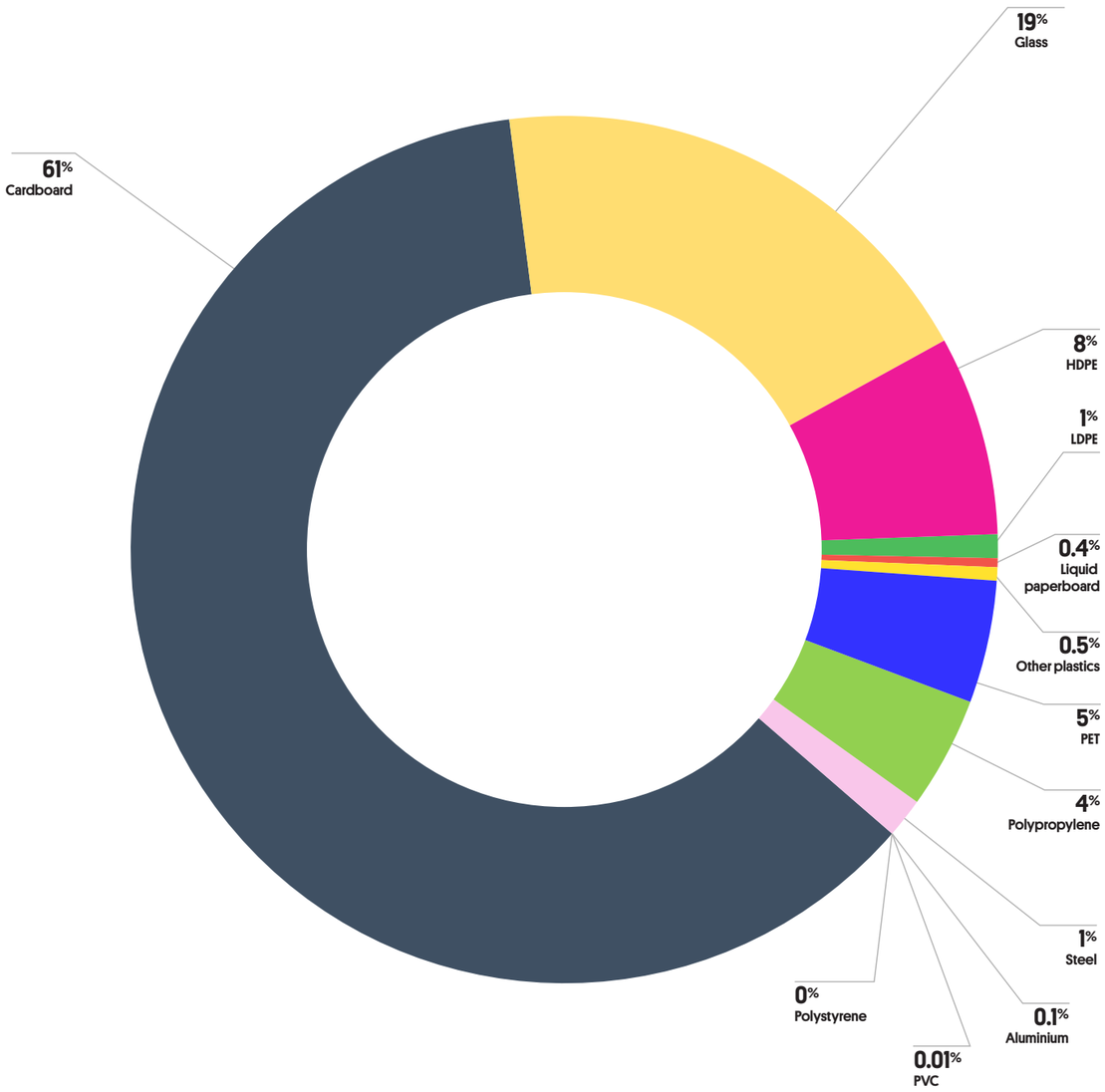
Table 39 Return rates for SA's container deposit legislation materials in 2021-22

Packaging material	kt	Return rate (%)
Glass	31	82%
Aluminium	4.4	84%
PET	3.4	70%
Liquid paperboard	0.5	53%
HDPE	0.3	61%

6.2 Other packaging materials

Figure 46 presents the tonnes and proportions of non-CDL recovered packaging material from 2021-22. Cardboard packaging remained the highest contributor (61%), which was about the same as 2020-21. The second highest proportion was glass bottles and jars (19%), which was slightly higher than 2020-21. Other non-CDL packaging materials comprise plastics (18%), with metals and liquid paperboard each contributing less than 5% to the total. This was overall very similar to 2020-21.

Figure 46 Relative proportions of other (non-CDL) packaging materials, SA, 2021-22



7 Resource recovery value

- The total value of recovery in SA in 2021-22 is estimated at about $649 million, an increase from the estimated value from 2020-21 of $478 million.
- The increase is mostly due to increases in quantities of meat rendering to 125 kt which has a high $ value per tonne.
- ‘Other organics’ were included for the first time this year in the resource recovery value.
- Overall, organics was the category contributing the most to the resource recovery value in 2021-22, followed by metals, cardboard and paper, plastics, masonry and other materials.

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, noting that not all respondents provided this information.

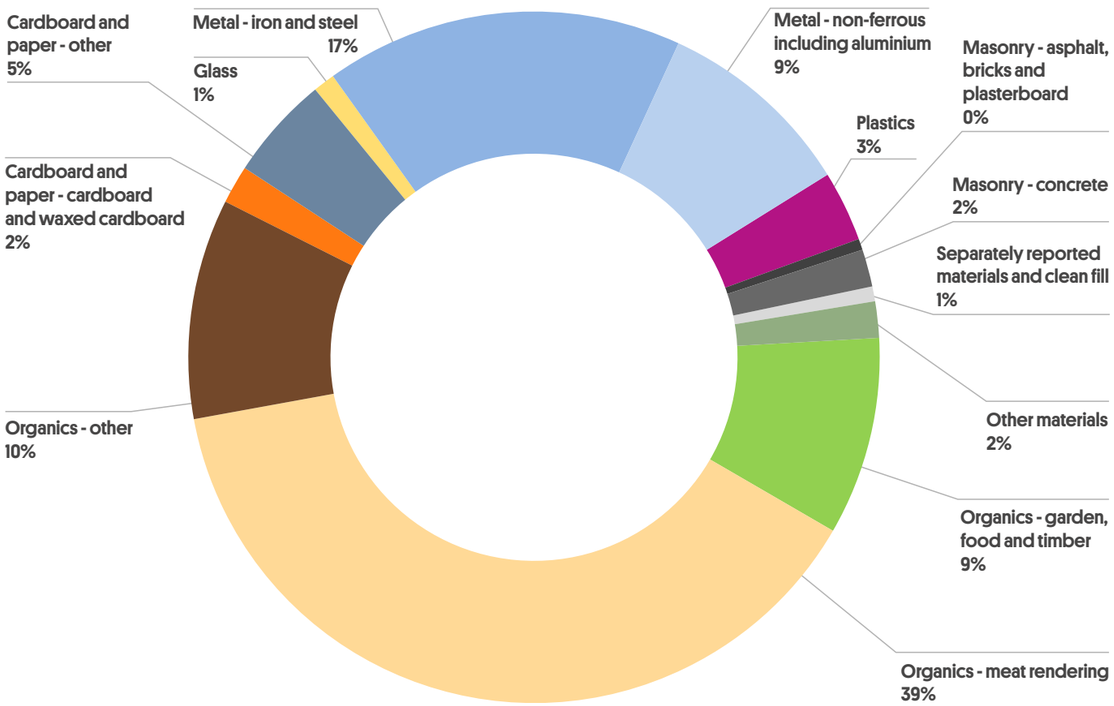
Table 40 summarises the estimated value of recovery in SA in 2021-22, including recovered tonnes by material, estimated on-sale values per tonne and estimated overall value per material. The total value of recovery in SA in 2021-22 is estimated at about $649 million, an increase from the estimated 2020-21 value of $478 million. The increase is due to the inclusion of other organics in resource recovery values as improved information about the value of these products was well reported this year.

Overall, organics ($379 million) was the greatest contributor to total resource recovery value in 2021-22, followed by metals ($170 million), cardboard and paper ($44 million), plastics ($21 million), and masonry ($15 million).

Table 40 Estimated resource value for recovered materials in SA in 2021-22

Material category or type	Recovered (kt)	Estimated on-sale price ($/tonne)	Estimated value ($ millions)
Masonry	1,425	$11	$15
Metals – iron and steel	281	$390	$110
Metals – non-ferrous including aluminium	48	$1,245	$60
Organics – meat rendering	125	$2,000	$250
Organics – garden, food and timber	557	NA	$61[8]
Organics – other	225	Variable	$67
Cardboard and paper	164	$192	$44
Plastics	33	$625	$21
Glass	54	$90	$5
Other materials (including tyres and other rubber, leather and textiles and foundry sands)	47	$237	$11
Separately reported materials and clean fill	**604**	**$7**	**$4**
Total			**$649**

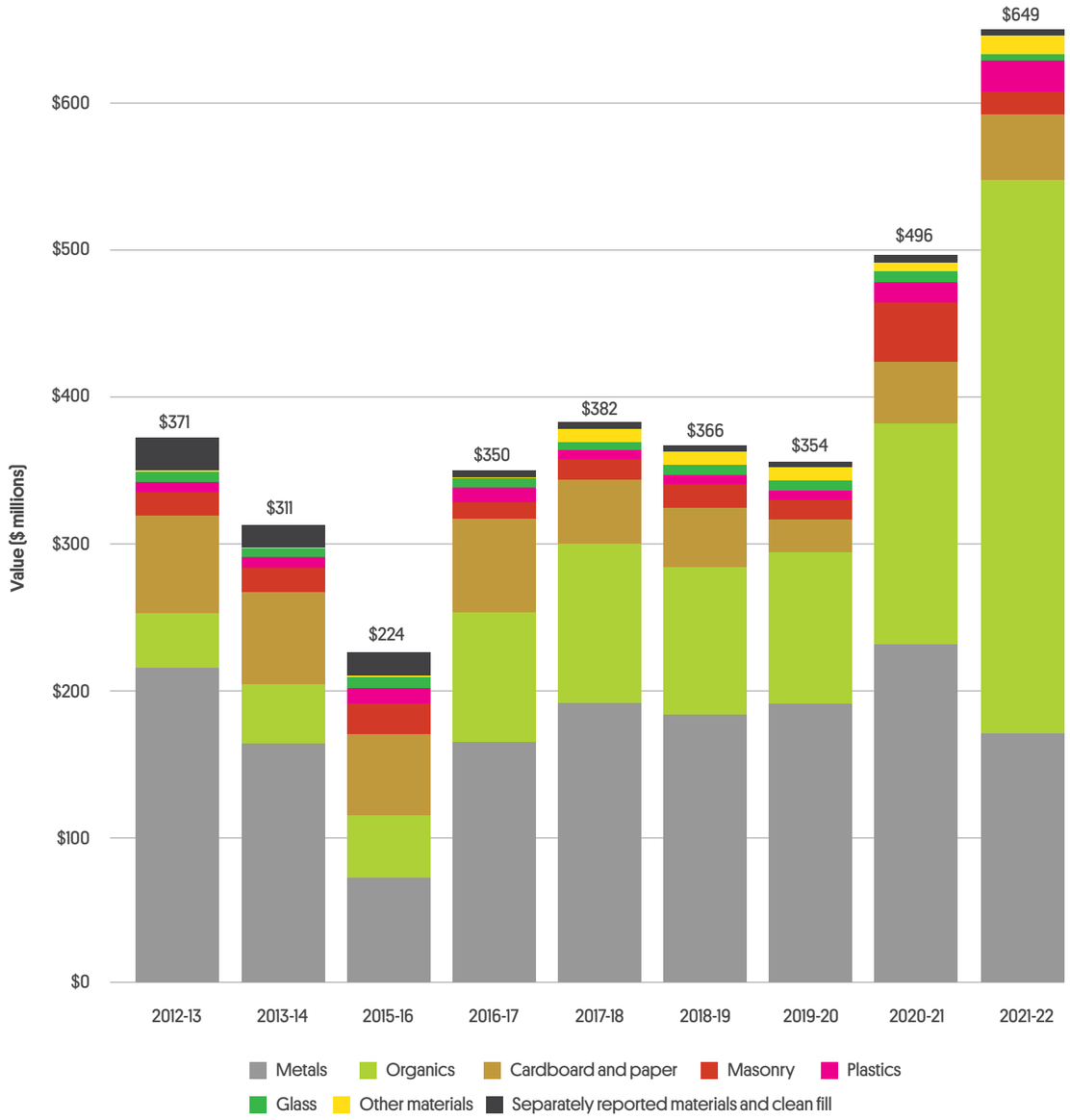
Figure 47 Estimated market value of resource recovered materials, SA, 2021-22



8 The estimated value for this grouping is calculated using dollar per unit values for products such as compost and mulch

The trend for estimated market value of resource recovery in SA is shown in Figure 48. The value in 2021-22 is high compared to previous years, with high quantities of meat rendering and also includes other organics. The value and quantity of metal has dropped against 2020-21 to levels seen in 2019-20 and earlier. Plastics contributed more to the value of resource recovery than previous years, possibly due to increased sorting by polymer type as highlighted by the decline of mixed plastics discussed previously in this report.

Figure 48 Estimated market value of resource recovered materials in SA, 2012-13 to 2021-22[9]



9 Historical values have been adjusted to account for inflation.

8 Environmental benefits of recycling

Resource recovery in SA in 2021-22 was estimated to achieve the following environmental benefits:

- greenhouse gas emissions savings about 1.52 million tonnes of carbon dioxide equivalent [Mt CO_2-e]
- energy savings of about 18,500 terajoules [TJ].
- water savings of about 8,400 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 (organics, paper and cardboard or textiles.) 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 2021-22. This is based on life cycle assessments and other information sources as given in Appendix B. The results are summarised below in Table 41.

Table 41 Estimated environmental benefits of recycling in SA in 2021-22

Material type	Recovered kt	Emissions saved kt CO_2-e	Energy saved TJ LHV	Water saved ML
Masonry				
Asphalt	284	9	675	250
Bricks	27	1	8	34
Concrete	1,114	22	390	1,426
Plasterboard	0	0	0	0
Clay, fines, rubble and soil	604	53	858	266
Metals				
Iron and steel	281	124	2,105	-663
Aluminium	29	477	5,909	839
Non-ferrous metals	19	17	703	116
Organics				
Food organics	30	29	5	13
Garden organics	290	194	90	1,620
Timber	238	43	2,550	-10
Organics – other	794	382	1,718	183
Cardboard and paper				
Cardboard and waxed cardboard	60	10	28	669
Liquid paperboard	<1	0	0	2
Magazines and newspaper	70	32	26	768
Printing and writing paper	33	43	-22	362
Plastics				
Polyethylene terephthalate	9	11	498	622
High density polyethylene	12	10	596	271
Polyvinyl chloride	0	0	0	0
Low density polyethylene	7	6	336	153
Polypropylene	5	2	164	144
Polystyrene	<1	0	4	3
Mixed and/or other plastics	<1	0	6	5
Glass				
Glass	54	28	238	50
Other materials				
Fly ash	0	n/a	n/a	n/a
Foundry sands	4	n/a	n/a	n/a
Leather and textiles	5	n/a	n/a	n/a
Tyres and other rubber	25	26	1,583	1,291
Total	**3,994**	**1,517**	**18,470**	**8,421**

8.1 Greenhouse gas emission savings

It is estimated that SA saved about 1.52 million tonnes of carbon dioxide equivalent (CO_2-e) through recycling its materials in 2021-22. This is a significant increase from the estimated emissions savings reported in the previous year (1.19 million tonnes CO_2-e), and more consistent with emissions estimates reported historically. This is partly attributed to higher quantities of organics recovered and higher quantities of aluminium recovered. Aluminium has a high emissions factor meaning recycling aluminium is significantly less emission intensive than producing virgin aluminium.

Organics recycling contributed the greatest proportion of greenhouse gas emissions savings at about 648 kt CO_2-e or 43% of total estimated emissions savings. This is due to avoided landfill emissions.

The next greatest contribution was from recycling metals, which contributed 617 kt CO_2-e, about 41% of total emission savings. This benefit is from avoided emissions from manufacture of metals from virgin materials, which is more emissions intensive than recycling.

Recycling of masonry and cardboard and paper both contributed about 6%, and the remainder was made up of plastics, glass and 'other' materials, each contributing around 2%.

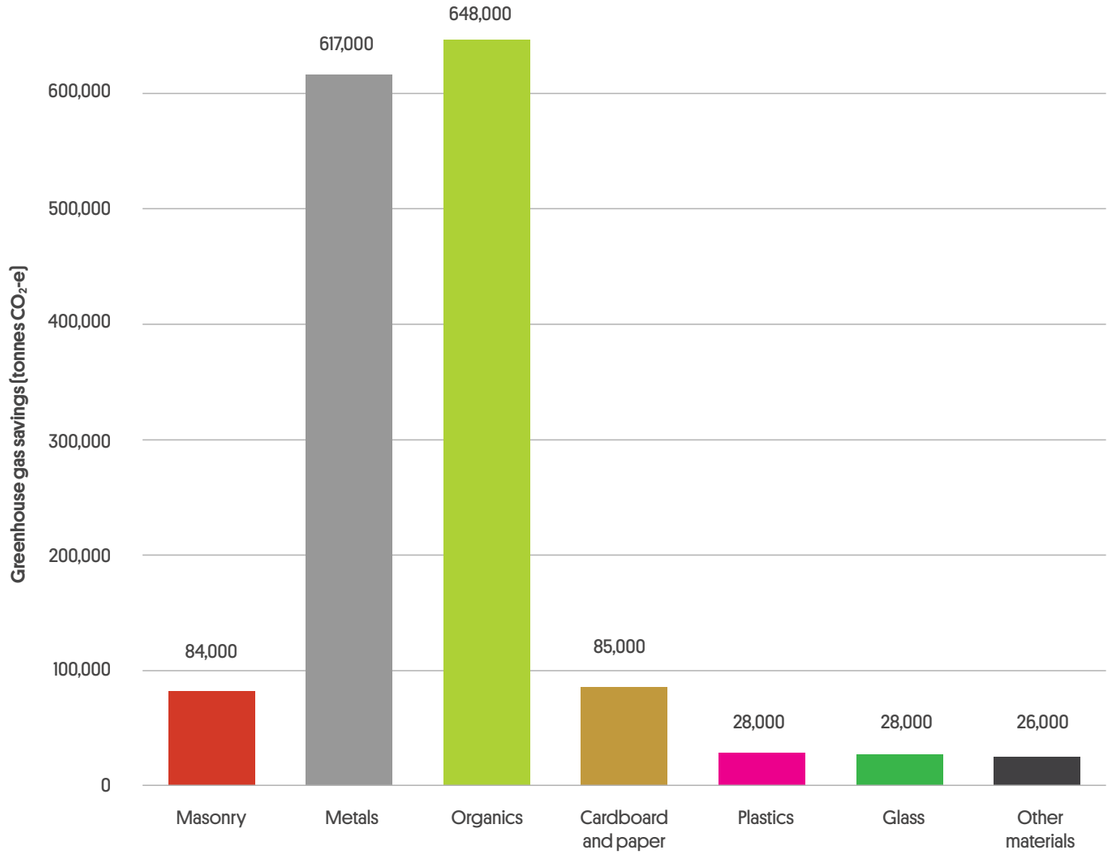
Table 42 and Figure 49 provide detail on estimated greenhouse gas emissions savings due to recycling in 2021-22. It is estimated that emissions saved due to recycling in 2021-22 is approximately equivalent to:

- the CO_2 absorbed by 2.26 million trees
- the annual emissions from 303,000 cars.

Table 42 Estimated greenhouse gas emissions savings due to recycling in SA in 2021-22

Material category	Emissions saved kt CO_2-e	Equivalent trees planted required for carbon absorption	Equivalent cars off the road in one year
Masonry	84	126,000	17,000
Metals	617	920,000	123,000
Organics	648	965,000	130,000
Cardboard and paper	85	127,000	17,000
Plastics	28	42,000	6,000
Glass	28	42,000	6,000
Other materials	26	39,000	5,000
Total	**1,517**	**2,261,000**	**303,000**

Figure 49 Estimated greenhouse gas emissions savings due to recycling, SA, 2021-22



8.2 Energy savings

Energy savings from recycling in SA during 2021-22 were estimated at 18,500 terajoules (TJ). This is significantly higher than the 2020-21 estimate of 14,500 TJ. Some of this is due to higher quantities of aluminium and other non-ferrous metals reported as recovered, which have high energy consumption. Higher quantities of waste grease and fat recovery were also reported which, when converted to biodiesel, saves energy compared to use of other energy sources.

The top three contributors to total energy savings in 2021-22 were metals (47%), followed by organics at 24% and then masonry at 10%.

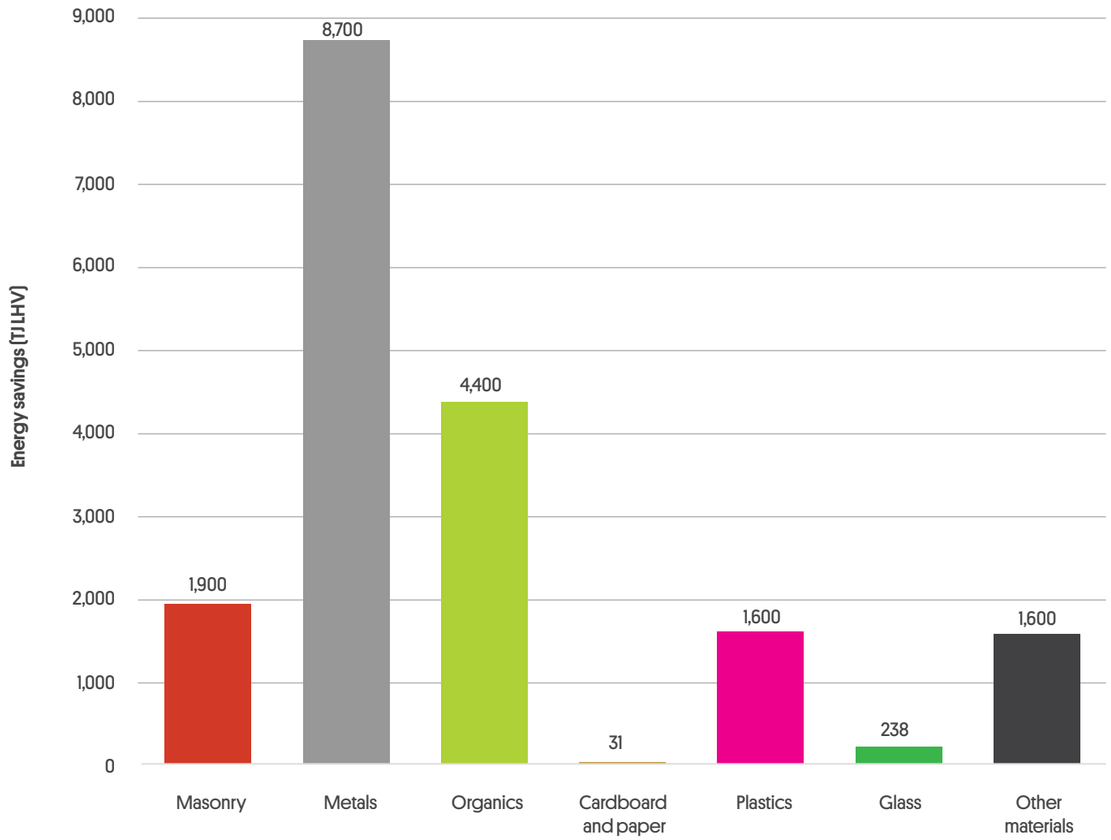
It is estimated that energy savings due to the recycling of SA materials in 2021-22 are equivalent to:

- energy use from 362,000 households in one year
- the energy supplied by 3.03 million barrels of oil.

Table 43 Estimated energy savings due to recycling in SA in 2021-22

Material category	Energy saved TJ LHV	Equivalent household energy use in one year	Barrel of oil equivalents
Masonry	1,900	38,000	317,000
Metals	8,700	171,000	1,429,000
Organics	4,400	86,000	715,000
Cardboard and paper	30	1,000	5,000
Plastics	1,600	31,000	263,000
Glass	200	5,000	39,000
Other materials	1,600	31,000	260,000
Total	**18,500**	**362,000**	**3,028,000**

Figure 50 Estimated energy savings due to recycling, SA, 2021-22



8.3 Water savings

The total estimated water savings from recycling SA materials in 2021-22 were 8,400 megalitres (ML), this is an increase from the 7,900 ML estimated in 2020-21. This is mostly due to higher quantities of aluminium reported recovered which has a high water-use factor, and less iron and steel reported recovered which has a negative water use factor.

Masonry contributed to highest proportion towards these savings at 23%, followed by organics (21%) and cardboard and paper (21%), then followed by other materials (15%), plastics (14%), metals (3%) and glass (1%).

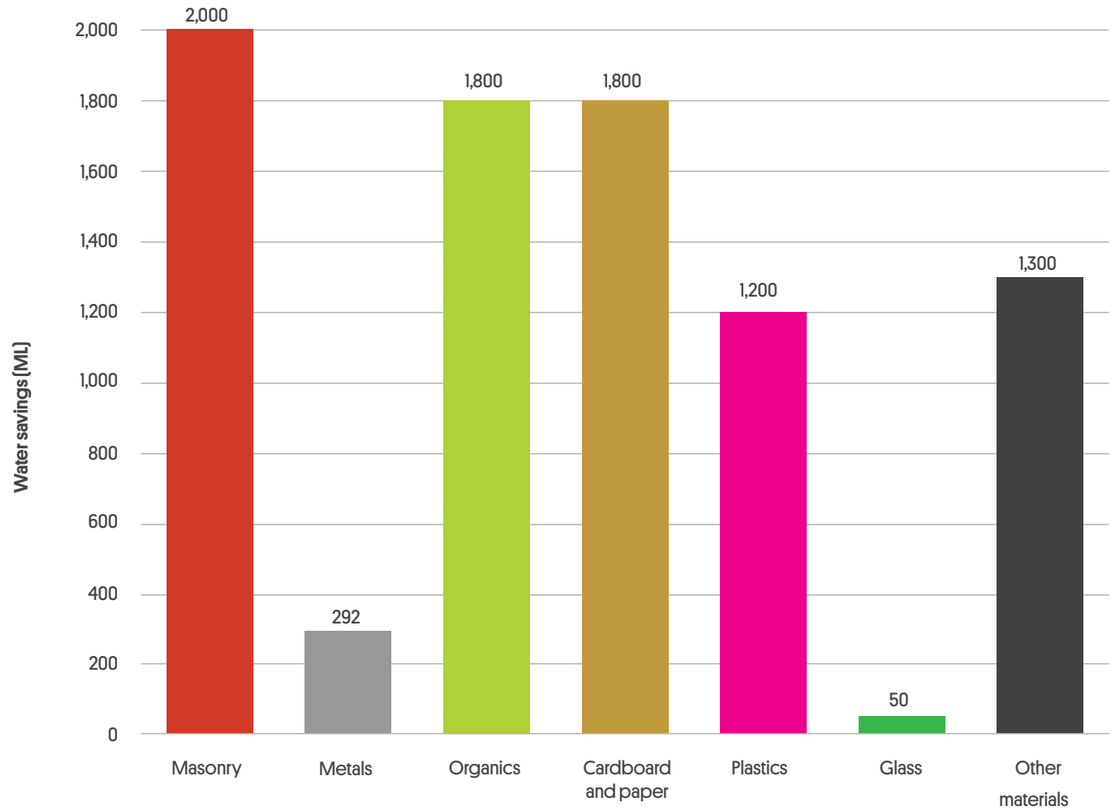
Water savings from recycling in SA in 2021-22 are estimated to be approximately equivalent to:

- annual water use from 51,000 households
- the water contained in 3,400 Olympic sized swimming pools.

Table 44 Estimated water savings due to recycling in SA in 2021-22

Material category	Water saved ML	Equivalent household water use in one year	Equivalent olympic swimming pools
Masonry	2,000	12,000	800
Metals	300	2,000	100
Organics	1,800	11,000	700
Cardboard and paper	1,800	11,000	700
Plastics	1,200	7,000	500
Glass	50	300	20
Other materials	1,300	7,800	500
Total	**8,400**	**51,000**	**3,400**

Figure 51 Estimated water savings due to recycling, SA, 2021-22



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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 2021-22 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 based on the survey from used in CERRR 2020-21 with some minor changes to facilitate information gathering. The survey remained consistent with the Commonwealth Government's *Australian standard for waste and resource recovery data and reporting*. The changes were:

- separating input spaces for material coming to the organisation for recovery and recovered material leaving the organisation
- requesting information on fate of incoming material, i.e. reuse, recycling or energy recovery
- requesting information on waste to landfill as an overall figure for the organisation as requesting by material type in 2020-21 did not have a strong response
- simplifying the information request on geographical source
- allowing respondents to elect units for reporting (tonnes, % or volumetric).

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

A2.2 Participants

Using the Circular Economy Resource Recovery Survey 2020-21 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 123 companies and organisations. This did not include all composters, only those that received other material in addition to composting. Composters 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 October 2022 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 2022, although some data was received in early 2023.

A selection of key SA recyclers nominated by GISA were approached for a site visit and face-to-face survey interview. Nine 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 interview was 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, mass balance reporting data from SA EPA or information from the Australian Plastics Flows and Fates survey.

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.
- **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 where materials were sent offsite to for further processing. This approach was slightly different to the approach in previous years.
- Some companies did not provide the requested survey data. A list of these companies was made and data was requested, via GISA, from the SA EPA for mass balance data. Mass balance data is compulsorily reported under Environment Protection Act 1993 by companies handling more than 20 kt/year of waste. Mass balance data was used in the data set where available, although there were difficulties in mapping the data by waste type. Where mass balance data was not available, previously reported survey data was applied.
- Some respondents were only able to provide an estimate of the quantity of material processed at their site. Factors such as rainfall and seasonality had major impacts on the quantity of material recovered and therefore some survey responses had large margins of error. This issue particularly affects the accuracy of organics recovery reported.

A3.2 Reuse and the circular economy

The survey sought data on reuse and the circular economy, building on the progress of the CERRR 2020-21. This involved engaging major South Australian reuse organisations about reuse flows through their operations in the 2021-22 financial year, as well asking all survey participants about their motivations within a circular economy context. The approach will continue to 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.

A3.3 Per capita analysis

Metrics for per capita statistics were calculated using population and demographic data from the Australian Bureau of Statistics (ABS 2022a; ABS 2022b; ABS 2022c; 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 *Circular Economy Resource Recovery and 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 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 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:

- 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.

A4 Material flow analysis method

A4.1 What is material flow analysis?

A general definition of MFA is provided by the UN Environment Programme International Resource Panel (UNEP 2020):

> *Material flow analysis [MFA] comprises a group of methods to analyse the physical flows of materials into, through and out of a given system. It can be applied at different levels of scale, i.e. products, firms, sectors, regions, and whole economies. The analysis may be targeted to individual substance or material flows, or to aggregated flows, e.g. of resource groups (fossil fuels, metals, minerals).*

A more operationalised definition of MFA (Brunner and Rechberger 2017), as applied in the analysis undertaken for this report, involves a quantitative assessment of the state and change of flows and stocks of materials within a system defined in space and time. It follows the principle of conservation of mass, tracing material flows by balancing inputs and outputs, and draws on the concepts described in Table 45.

Table 45 Key concepts and terminology in MFA modelling

Term	Definition
System	A system is the object of an MFA investigation.
Material	This is an umbrella term for both substances (homogenous materials) and goods (materials or products made up of one or more substances).
Process	A process is defined as the transformation, transport or storage of materials.
Flow	A flow is a mass flow rate per unit time (e.g. year), in or out of a process.
Stock	A stock is the quantity of materials stored within a process. Any process can potentially contain stocks. Input flows into a process equals the output flows plus the change in stocks.
Residence time	The time period for which a material remains in a stock process.
Transfer coefficient	Transfer coefficients quantify the partitioning of outgoing materials from a process to downstream processes.
Final sink	A final sink is a process where materials have very long residence times (>1,000 years).

A4.2 Material scope

The material in scope of the MFAs are plastics, including polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polypropylene (LDPE), polypropylene (PP), polystyrene (PS) and mixed and/or other plastics.

A4.3 Time boundary

The MFA time boundary is financial year 2021-22. The underlying model, however, has been set up with a time boundary of 1918-19 to 2049-50. The modelling period is wider than is minimally necessary for the material groups modelled, but this ensures good model coverage into historical stocks, particular in the built environment, and the ongoing use of some of the materials in long-lived applications, again primarily in the built environment.

A4.4 Modelling software

The modelling for the MFAs was undertaken in Microsoft Excel. Widespread use of this software supports transparency of the modelling and data manipulations and is simpler and more 'future-proof'.

A4.5 Sankey diagrams

Sankey diagrams are visual tools that can be used to show the flow of material through a system. The software used for this project was e!Sankey. In e!Sankey, the diagram is built, using boxes and arrows. The arrow width is adjusted automatically by the software so that flow quantity proportions can be accurately represented.

A4.6 Indicator selection

A potentially large number of indicators can be established from economy-wide MFAs, as undertaken for the pilot MFAs. Those selected for this work are outlined in Table 46. These different types of indicators deliver complementary information about various aspects related to material use.

Table 46 Circular economy indicators developed through MFA

Performance metric	Definition	What it measures	Numerator	Denominator
Recycled content	Secondary sourced material divided by consumption.	Performance of the manufacturing system in utilising recycled materials.	Import recycled to Manufacturing + Import recycled to Use + Reprocessing to Manufacturing	Use (input)
Collection efficiency	Discarded materials that are collected for recovery (not directed to landfill), divided by total materials entering the waste system.	Performance of the collection system. Low efficiency means a high proportion of material isn't separated from material flows at the household or business and is directed to landfill, e.g., owing to limited source separation and/or poor disposal practices.	Use to Sorting	Use (output)
Sorting efficiency	Materials recovered out of sorting divided by materials sent to sorting.	Performance of the system to sort materials designated for specific recovery pathways. Low sorting efficiency highlights opportunities to reduce contamination of collected materials received and/or improve sorting processes at the sorting facilities.	Sorting to Reprocessing + Sorting to Export	Sorting (input)
Reprocessing efficiency	Materials recovered out of reprocessing divided by materials sent to reprocessing.	Performance of the system to reprocess materials to be ready for specific remanufacturing or energy recovery pathways. Low reprocessing efficiency highlights opportunities to reduce contamination of sorted materials received, improve product design, and/or improve reprocessing processes at the reprocessing facilities.	Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Energy recovery + Reprocessing to Open loop	Reprocessing (input)
Recycling rate	Materials recycled back to local or overseas manufacturing divided by material entering the waste system (excluding materials sent to energy recovery).	Performance of the system in recycling end-of-life materials.	Sorting to Export + Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Open loop	Use (output)
Energy recovery rate	Post-consumer materials recovered back to local or overseas energy recovery (excluding residuals from energy recovery) divided by material entering the waste system.	Performance of the system in diverting end-of-life materials to energy recovery.	Reprocessing to Energy recovery + Landfill to Energy recovery	Use (output)
Recovery rate	Materials recovered back to local or overseas manufacturing, and to energy recovery (excluding residuals), divided by material entering the waste system.	Performance of the system in diverting end-of-life materials to recycling and energy recovery.	Sorting to Export + Reprocessing to Manufacturing + Reprocessing to Export + Reprocessing to Energy recovery + Reprocessing to Open loop + Landfill to Energy recovery	Use (output)
Landfill rate	Materials sent to landfill divided by materials entering the waste system.	Performance of the system in generating material losses to landfill.	Landfill	Use (output)
Local material utilisation rate	Secondary material used locally for manufacturing, divided by total material potentially available for local manufacturing.	Performance of the system in on-shore remanufacturing, relative to the amount of material that is potentially available.	Reprocessing to Manufacturing + Reprocessing to Open loop	Use (output)

Appendix B Environmental benefits factors, 2021-22

The table below lists a set of factors used to estimate the environmental benefits of recycling SA materials in 2021-22. They are based on a study commissioned by Green Industries SA by Trellis Technologies (2019) and the greenhouse gas emissions factors updated in 2021-22 for food organics, garden organics and timber.

		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
	Clay, 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%) compared with emissions from composting them.

Appendix C Circular Economy Resource Recovery Survey 2021-22

SA Circular Economy and Resource Recovery Survey 2021-22						(1 July 2021 - 30 June 2022)
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 2021-22 Circular Economy and Resource Recovery Survey?						
4. Please fill in Table 1 for each relevant material you received for recycling, reuse or energy recovery. 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: Material recovery data from the 2021-22 financial year (material generated in SA only)

MATERIAL TYPE RECEIVED	Quantity of material received for recycling, reuse or energy recovery 2021-22	Main fate of this material (select from the list)	Quantity of material received from these regions			Quanity of material from these source streams			Proportion of material (if any) derived from post-consumer packaging[4]
			From SA - Metro	From SA - Regional		MSW[1]	C&I[2]	C&D[3]	
	Click here to select unit >		*Click here to select unit >*			*Click here to select unit >*			%

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

SA Circular Economy and Resource Recovery Survey 2021-22 **(1 July 2021 - 30 June 2022)**

5. Please fill in Table 2 for each relevant material or product output from your operation. All data will be kept confidential and anonymised for reporting purpose.

Table 2: Material or product output data from the 2021-22 financial year

MATERIAL OR PRODUCT OUTPUT	Destination of materials or products for reprocessing or reuse								Product use type (select from list)	Approx. average value per tonne[5]
	Quantity to your SA facility(ies)	Quantity to elsewhere in SA - Metro	Quantity to elsewhere in SA - Regional		Quantity sent iterstate		Quantity sent overseas (if known)	Name of receiving facility		
	Click here to select unit >	*Click here to select unit >*			*Click here to select unit >*	Jurisdiction	*Click here to select unit >*			

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

6. How many tonnes of residual waste were sent to landfill? (t)	
7. What is the method for measuring the data provided in Table 1?	**Measurement method**
8. What is the estimated accuracy of the data provided in Table 1 (e.g. ±5%)? *If weighbridge, a suitable accuracy may be ±1%.*	
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**
10. If there have been any significant changes in quantities, stockpiles, sources or destinations from the 2020-21 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.)?	
12. 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)?	
13. What are the employment classifications in your company/organisation? Please complete the following table.	Classification / No. FTE
14. What is your opinion about the market strength/prospects for recycled goods and materials?	

15. 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?	
16. Are there any significant barriers (e.g. market, regulatory, technology) for your SA operations?	
17. What is your organisation's approximate annual sales revenue (turnover) from goods and material collection, resource recovery and/or recycling activities?	
18. 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**
19. 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?	
20. Would you like to be invited to an industry seminar by Green Industries SA (GISA) summarising the findings of this 2021-22 Circular Economy and Resource Recovery Survey?	

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