South Australia's Recycling Activity Survey

2016-17 Financial Year Report

March 2018

Government of South Australia

Green Industries SA

Prepared by rawtec

Contents

About data used in this report

The resource recovery data presented in this report was collected from a survey sent to 117 organisations in South Australia (SA) that are involved in collecting waste material for recycling.

This resource recovery data describes the quantity of waste resources collected in SA over the 2016-17 financial year for the purpose of recycling, excluding net losses of these materials arising from resource recovery and/or re-processing activities. Comparisons are made to the last reported financial year (2015-16).

Estimates of reporting accuracy have been used to ensure that resource recovery data is reported to an appropriate level of certainty.

This data provides a comprehensive and reliable account of SA's resource recovery. Combined with landfill disposal data collected by the South Australian Environment Protection Authority, it enables assessment of SA's resource recovery performance including diversion rate. This includes comparing SA's performance with the State's Waste Strategy targets as well as benchmarking this performance against other jurisdictions in Australia.

Further information about the Survey Methodology is included in Appendix 1 of this report. This information includes a description of how the survey data was compiled and analysed to produce the assessment results and findings presented in this report.

About this report

This report has been prepared by Rawtec Pty Ltd (Rawtec) for Green Industries SA to present the results and findings from the 2016-17 South Australian Recycling Activity Survey.

The information contained within this document is based upon sources, experimentation and methodology which at the time of preparing this document were believed to be reasonably reliable and the accuracy of this information subsequent to this date may not necessarily be valid. This information is not to be relied upon or extrapolated beyond its intended purpose by a third party unless it is confirmed in writing by Green Industries SA that it is permissible and appropriate to do so.

This document, parts thereof or the information contained therein must not be used in a misleading, deceptive, defamatory or inaccurate manner or in any way that may otherwise be prejudicial to Green Industries SA or Rawtec, including without limitation, in order to imply that Green Industries SA or Rawtec has endorsed a particular company, product and/or service.

11 Paringa Avenue, Somerton Park, SA 5044

PO Box 1159, Glenelg South, SA 5045

T: +61 8 8294 5571

Executive Summary

Introduction

Each year since 2003-04, Green Industries SA has measured recycling activity and waste disposal to landfill in South Australia (SA) to assess the State's performance against South Australia's Waste Strategy. This report presents the results from the SA Recycling Activity Survey for 2016-17.

Summary of 2016-17 results

SA's landfill diversion rate is the highest accomplished since the survey commenced, and the State has once again achieved the highest diversion rate of any state in Australia. The increase in diversion rate is driven by yet another decrease in the volume of waste sent to landfill as well as a substantial increase in recovered Separately Reported Materials and Clean Fill.

Although the diversion rate of Standard Reporting Materials increased slightly from 2015-16, this was driven by a decrease in tonnes sent to landfill rather than an increase in the volume of recovered Standard Reporting Materials. Another important area of focus for the State is waste generation per capita. Although this decreased from 2015-16, it remains at an elevated level from the baseline year (2014-15).

In this year's survey, industry commented on challenges associated with China changing its acceptance criteria of recovered materials, particularly plastics and cardboard, which will likely impact the recovery of materials in the 2017-18 financial year. Other discussions with industry indicated that large government projects in the state such as the Northern Connector and Darlington Upgrade have led to increases in the recovery of clay, fines and soil.

By the numbers

The total resource recovery for SA in 2016-17 was 4.4 million tonnes (see Table 1 below). This comprised:

- 2.88 million tonnes of 'Standard Reporting Materials' (including metals, organics, cardboard and paper, glass and plastics);
- 1.52 million tonnes of 'Separately Reported Materials' and Clean Fill (including soil, sand and rubble, which can fluctuate significantly across reporting years).

Total landfill disposal for SA was 0.87 million tonnes. Approximately 15% of this landfill disposal was contaminated soil from construction activities ('Separately Reported Material').

SA therefore achieved a total diversion rate of 83.4% (of waste material diverted to resource recovery).

Table 1 **Summary of 2016-17 Recycling Activity results for resource recovery, landfill disposal, total waste generated and total diversion (waste to resource recovery) achieved in SA.**

	2016-17 Recycling Activity Data Account Summary		
	Standard reporting materials*	Separately reported materials & Clean Fill**	**TOTAL (All materials)**
Resource recovery, tonnes	2.880 million	1.521 million	4.401 million
Landfill disposal, tonnes	0.739 million	0.134 million	0.873 million
Waste generated, tonnes	3.619 million	1.655 million	5.274 million
Diversion, % to resource recovery	79.6%	91.9%	**83.4%**

* *Standard Reporting Materials and Separately Reported Materials & Clean Fill, as specified in Dept of Env and Energy (2015)*

** *Total waste generated = Resource recovery + landfill disposal*

Resource recovery by material category

The majority of SA's resource recovered material was Clean Fill (1.31 million tonnes or 30%), followed by Organics (1.11 million tonnes or 25%) and then Masonry (1.06 million tonnes or 24%). Organics materials were predominately from the Commercial and Industrial (C&I) sector with Garden Organics and Timber the greatest contributors to this material stream. The Construction and Demolition (C&D) sector contributed 98% of the Masonry materials recycled in the state in 2016-17.

Metals remained the third greatest contributor by weight (of the Standard Reporting Materials), remaining at 7% in 2016-17. Following this was Cardboard and Paper (6% by weight) and Glass (1%). In line with 2015-16, most Metals were from the C&I sector, and Cardboard and Paper and Glass were sourced predominately from the Municipal and C&I sectors.

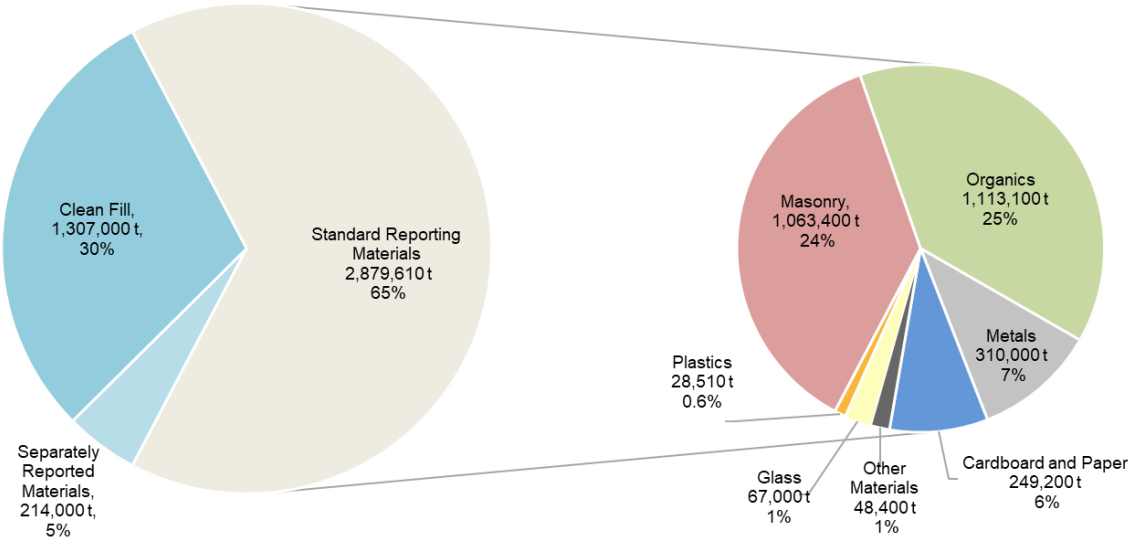

Figure 1 **Contribution of different material categories to SA's resource recovery during 2016-2017**

Other key trends

When observing differences in material recovery from 2015-16 to 2016-17 (see Section 3) the biggest increases were seen in:

- Separately Reported Materials (clay, fines, rubble and soil or clean fill and intermediate waste fill), which increased significantly (up by 661,000 tonnes);
- Metals, due to an increase in recycled steel, up by 43,000 tonnes;
- Paper and Cardboard, driven by a continued upward trend in Cardboard & Waxed Cardboard (up by 19,000 tonnes), and Magazines & Newsprint (up by 8,000 tonnes), and
- Glass increased slightly (from 64,000 tonnes in 2015-16 to 67,000 tonnes in 2016-17).

Organics, Plastics and E-Waste tonnes recovered remained in line with 2015-16 tonnes, and there were no volumes of Fly Ash recovered in the state, as the Port Augusta Power Station closed in the previous financial year.

This year saw an increase in energy recovery up to 94,900 tonnes (see Table 2.6), due to the inclusion of energy derived from anaerobically digested organics. There was a slight decrease in the volume of imported materials for resource recovery (from 177,000 tonnes in 2015-16 to 158,000 tonnes in 2016-17 (see Table 2.7).

It is also worth noting that the value of the recovered materials in SA this year increased significantly and now sits at approximately $320 million. This increase in value can be attributed to an improved reporting methodology – refer to *Section 6 – Resource Recovery Value* for further information.

When considering the state's 2020 targets (see Figure 1.1):

- The state is approximately 6 percentage points short of achieving its reduction in waste to landfill (from 2002-03 levels) by 35%.
- We have exceeded the 2020 target of 80% and 90% diversion for metropolitan C&I and C&D respectively, with C&I diversion at 85.2% and C&D at 91.1% overall (see Table 2.9).
- Although the MSW metropolitan diversion rate increased slightly (to 59.1%), the state still needs to increase this by over 10% to achieve the 2020 target of 70% (See Table 2.9).
- Waste generation per capita remains a challenge. The target is >5% reduction in waste generation per capita by 2020 from 2015 levels, and although the 2016-17 figure is lower than the 2015-16 financial year, it is an increase of 1.0% from the baseline level (see Table 2.8).

1 Introduction

At a glance:

- *This report presents the findings from a survey with South Australian recyclers and re-processors on resource recovery of waste materials during the 2016-17 financial year.*
- *This data enables us to measure South Australia's performance against waste diversion goals and targets in South Australia's Strategic Plan (2011) and South Australia's State Waste Strategy 2015-2020.*
- *The data has been compiled and reported in accordance with the National Guidelines for compiling waste and recycling data ("NWDCRS supporting documentation: SOPs, reporting tool user guide, and reporting guidance", Dept of Environment and Energy 2015).*

1.1 Background

Over the past decade South Australia (SA) has established itself as a leader in waste management reform and resource recovery. Significant initiatives have been implemented to divert and recycle waste materials instead of simply disposing them to landfill. These actions are helping SA to become more resource efficient, recover and recycle more waste materials, and avoid damaging greenhouse gas emissions caused by waste disposal to landfill.

SA's improvement in waste management is underpinned by requirements set out in SA's Strategic Plan (SA Government, 2011) and SA's State Waste Strategy 2015-2020 (Green Industries SA, 2015). These requirements include targets for reducing waste generation and diverting waste materials from landfill (Figure 1.1 overleaf). Monitoring the State's performance against these targets requires measurement and collection of data for both resource recovery and landfill disposal of waste materials.

Green Industries SA's annual survey of South Australian recyclers and re-processors collects data about SA's handling of resources which would otherwise go to waste.

This report identifies waste streams by waste type, including recycling tonnages and potential reductions achieved in greenhouse gas emissions. We continue the separate analysis of resource recovery for material recovery versus energy production in SA, and present data reported on waste materials imported into SA for resource recovery, which was introduced in the 2013-14 report. The current market conditions for resource recovery and recycling are also discussed including market size and strength, and the section on employment figures in the resource recovery industry in SA remains in this year's report. We have also included a summary of the revenue generated in the industry based on survey responses and updated the figures that summarise the market value of resource recovery in SA.

The annual survey data collected and presented in this report allows Green Industries SA to measure progress towards meeting the waste reduction targets of SA's Waste Strategy and is an authoritative reference for industry, government and the community.

Importantly, the results of the survey are compiled according to the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015), which ensures that SA's recycling data can successfully contribute to national recycling surveys and assessments undertaken by the Australian Government.

***South Australia's Strategic Plan 2011* (Department of the Premier and Cabinet)**

> 35% reduction in landfill disposal from 2002-03 level by 2020[19]
milestone of 30% by 2017–18

Per capita waste generation target

> 5% reduction in waste generation per capita by 2020 (from 2015 baseline)

Landfill diversion targets

Year	Metropolitan (% diversion)	Non-metropolitan
Municipal solid waste (MSW) landfill diversion targets		
2009 (baseline)	55	Not applicable
2012	60	Maximise diversion to the extent practically and economically achievable.
2015	70	Maximise diversion to the extent practically and economically achievable.
2020	70*	Maximise diversion to the extent practically and economically achievable.
Commercial and industrial (C&I) landfill diversion targets		
2009 (baseline)	60	Not applicable
2012	65	Maximise diversion to the extent practically and economically achievable.
2015	75	Maximise diversion to the extent practically and economically achievable.
2020	80	Maximise diversion to the extent practically and economically achievable.
Construction and demolition (C&D) landfill diversion targets		
2009 (baseline)	80	Not applicable
2012	85	Maximise diversion to the extent practically and economically achievable.
2015	90	Maximise diversion to the extent practically and economically achievable.
2020	90	Maximise diversion to the extent practically and economically achievable.

*MSW target comprises 60% diversion from high performing bin systems contributing to an overall MSW target of 70%.

Figure 1.1 Summary of South Australia's goals and targets for diversion from landfill.

Reproduced from SA's State Waste Strategy 2015-2020 (Green Industries SA, 2015)

1.2 The 2016-17 Recycling Activity Survey Report

This report presents the results of Green Industries SA's annual Recycling Activity Survey for the 2016-17 financial year. The results in this report are compared to the last reporting period, which was the 2015-16 financial year.

The following provides a guide to how this data and information is organised and presented in this report.

- **Section 2** – Provides an overview of key Recycling Activity statistics obtained for 2016-17.
- **Section 3** – Presents the 2016-17 Recycling Activity Survey data by material category, including reporting of resource recovery for material recovery and energy production.
- **Section 4** – Gives a separate analysis obtained for resource recovery of electrical and electronic (E-waste) materials.
- **Section 5** – Presents a separate analysis of packaging materials derived from the 2016-17 Recycling Activity Survey data.
- **Section 6** – Assesses the environmental benefits, including greenhouse gas emission savings, of recycling for SA achieved by its 2016-17 recycling performance.
- **Section 7** – Provides an estimated market value for SA resources recovered during 2016-17.
- **Section 8** – Lists participating organisations, which consented to their survey contributions being acknowledged in this report.
- **Section 9** – Provides a glossary of common terms used in this report which may aid the reader.
- **Section 10** – Indicates common sources and end uses for different types of waste materials.
- **Section 11** – Outlines key abbreviations used throughout the report.
- **Section 12** – Lists references and other sources of information used in compiling this report.
- **Appendices** –
  - *Appendix 1* – Describes the methodology that was used to undertake the 2016-17 Recycling Activity Survey.
  - *Appendix 2* – Summarises selected 2016-17 Recycling Activity Survey statistics relating to industry participation.
  - *Appendix 3* – Provides a copy of the questions used in the 2016-17 Recycling Activity Survey.
  - *Appendix 4* – Lists the emission and conversion factors that were adopted for the environmental benefits analysis of the 2016-17 Recycling Activity data.

2 Key 2016-17 Recycling Activity Statistics

At a glance:

- *This section summarises the key outcomes and statistics obtained from analysis of the 2016-17 SA Recycling Activity Survey data. The outcomes and statistics include:*
  - *Resource recovery and landfill disposal – Total and by type of material, source sector, geographical origin, destination for re-processing, whether re-processed for material recovery or energy production in SA and market value;*
  - *SA's performance against State goals and targets for waste management;*
  - *SA's resource recovery performance relative to other states and territories in Australia;*
  - *Full time equivalent employment in the SA waste and resource recovery sector.*

2.1 Resource recovery and landfill disposal

2.1.1 Overview

In 2016-17 SA's recycling industries reported 4.4 million tonnes of material diverted to resource recovery (Table 2.1 overleaf). This total resource recovery comprised:

- 2.88 million tonnes of 'Standard Reporting Materials' – which includes traditionally reported material categories of Metals, Organics, Cardboard & Paper, Glass, Plastics, Masonry, etc, and;
- 1.52 million tonnes of 'Separately Reported Materials' & Clean Fill – reported data for soil, sand, rock, rubble[1].

Total resource recovery volumes were up by 12.6% from the 3.91 million tonnes reported for 2015-16. However, it is worth noting that Standard Reporting Materials decreased by 2.4% from 2015-16, from 2.95 to 2.88 million tonnes. When including both Standard and Separately Reported Materials, SA's 2016-17 per capita diversion/recovery rate increased to 2,555 kg/p/yr (up from 2,290 kg/p/yr in 2015-16). Material recovered per $ Gross State Product (GSP) in 2016-17 also increased to 43.2 tonnes per $1 million in 2016-17 from 39.2 tonnes in 2015-16.

Based on this total resource recovery, SA achieved a diversion rate of 83.4%, which is up from 81.5% in 2015-16. This outcome is the highest resource recovery rate achieved since the beginning of this survey.

During 2016-17 the amount of waste received at landfills in SA decreased for another year, to 0.87 million tonnes (from 0.89 million tonnes in 2015-16). This represents a per capita waste-to-landfill rate of 505 kg/p/yr (down from 520 kg/p/yr in 2015-16). Waste to landfill in tonnes per $1 million GSP also decreased from 8.9 in 2015-16 to 8.6 in 2016-17.

[1] These materials are considered separately because they can fluctuate significantly across reporting years and between different States and Territories.

Table 2.1 **Annual South Australian resource recovery and landfill disposal quantities diversion performance for 2016-17, 2003-04 (first survey year) and since 2012-13.** *This table presents a breakdown of Standard Reporting Materials and Separately Reported Materials & Clean Fill in accordance with the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015). Of 4.40 million tonnes of recycling reported in 2016-17, 1.52 million tonnes were recycled soil, sand and rock materials, or Separately Reported Materials & Clean Fill. Percentage changes in performance from 2003-04 and from 2015-16 are shown.*

	2003-04	2012-13	2013-14	2014-15	2015-16	2016-17	Change	
							15-16 to 16-17	*03-04 to 16-17*
RESOURCE RECOVERY (TONNES)								
Standard Reporting Materials	1,880,000	2,660,000	2,720,000	2,760,000	2,950,000	2,880,000	-2.4%	53%
Separately Reported Materials & Clean Fill	162,000	790,000	870,000	940,000	960,000	1,521,000	58.4%	839%
TOTAL (for SA)	**2,042,000**	**3,450,000**	**3,590,000**	**3,700,000**	**3,910,000**	**4,401,000**	**12.6%**	**116%**
LANDFILL DISPOSAL (TONNES)								
Standard Reporting Materials	1,258,000	867,000	865,000	724,000	772,000	739,000	-4.3%	-41%
Separately Reported Materials & Clean Fill	20,000	140,000	49,000	180,000	118,000	134,000	13.6%	570%
TOTAL (for SA)	**1,278,000**	**1,007,000**	**914,000**	**904,000**	**890,000**	**873,000**	**-1.9%**	**-32%**
WASTE GENERATION (TONNES)								
Standard Reporting Materials	3,138,000	3,527,000	3,585,000	3,484,000	3,722,000	3,619,000	-2.8%	15%
Separately Reported Materials & Clean Fill	182,000	930,000	919,000	1,120,000	1,078,000	1,655,000	53.5%	809%
TOTAL (for SA)	**3,320,000**	**4,457,000**	**4,504,000**	**4,604,000**	**4,800,000**	**5,274,000**	**9.9%**	**59%**
DIVERSION/RECOVERY RATE (%)								
Standard Reporting Materials (ONLY)	59.9%	75.4%	75.9%	79.2%	79.3%	79.6%	0.3%	20%
TOTAL (for SA)	**61.5%**	**77.4%**	**79.7%**	**80.4%**	**81.5%**	**83.4%**	**2.0%**	**22%**
SA population (persons)	**1,534,000**	**1,667,500**	**1,682,600**	**1,698,900**	**1,708,200**	**1,723,500**	**0.9%**	**12.4%**
PER CAPITA DIVERSION/RESOURCE RECOVERY (KG/PERSON/YR)								
Standard Reporting Materials (ONLY)	1,230	1,600	1,620	1,650	1,730	1,670	-3.5%	36%
TOTAL (for SA)	**1,330**	**2,070**	**2,135**	**2,205**	**2,290**	**2,555**	**11.6%**	**92%**
PER CAPITA LANDFILL DISPOSAL (KG/PERSON/YR)								
Standard Reporting Materials (ONLY)	820	520	510	430	450	430	-4.4%	-48%
TOTAL (for SA)	**830**	**600**	**545**	**535**	**520**	**505**	**-2.9%**	**-39%**
PER CAPITA WASTE GENERATION (KG/PERSON/YR)								
Standard Reporting Materials (ONLY)	2,050	2,120	2,130	2,080	2,180	2,100	-3.7%	2%
TOTAL (for SA)	**2,160**	**2,670**	**2,680**	**2,740**	**2,810**	**3,060**	**8.9%**	**42%**
SA Gross State Product[(a)] (GSP) ($millions)	**81,022**	**97,402**	**98,069**	**99,298**	**99,627**	**101,791**	**2.2%**	**25.6%**
PERFORMANCE METRICS PER $GSP (TONNES/$MILLION GSP)								
TOTAL SA Diversion/Resource Recovery (b)	25.2	35.4	37.7	37.3	39.2	43.2	10.2%	72%
TOTAL SA Landfill Disposal (b)	15.8	10.3	9.6	9.1	8.9	8.6	-4.0%	-46%
TOTAL SA Waste Generation (b)	41.0	45.8	47.3	46.4	48.2	51.8	**7.5%**	**26%**

Notes:

(a) Reference year for GSP chain volume measures (which removes the inflation effects on GSP values) is reported as 2016-17 (ABS 2016).

(b) Total tonnes of diversion, landfill and waste generation in per $GSP metrics include both Standard Reporting Materials and Separately Reported Materials & Clean Fill

2.1.2 Comparison with 2003-04

Changes from 2003-04 to 2016-17 include:

- Reported resource recovery has increased from approximately 2 million tonnes to just over 4.4 million tonnes a year.
- Diversion rate has increased by nearly 22 percentage points over this period.
- The volume of Standard Reporting Materials sent to landfill has decreased by 41% from 2003-04.

Figure 2.1 displays the increase in diversion rate and materials recovered over time, as well as the change in landfill disposal (for Standard Reported Materials and Separately Reported Materials). Percentage changes from the 2003-04 financial year are stated.

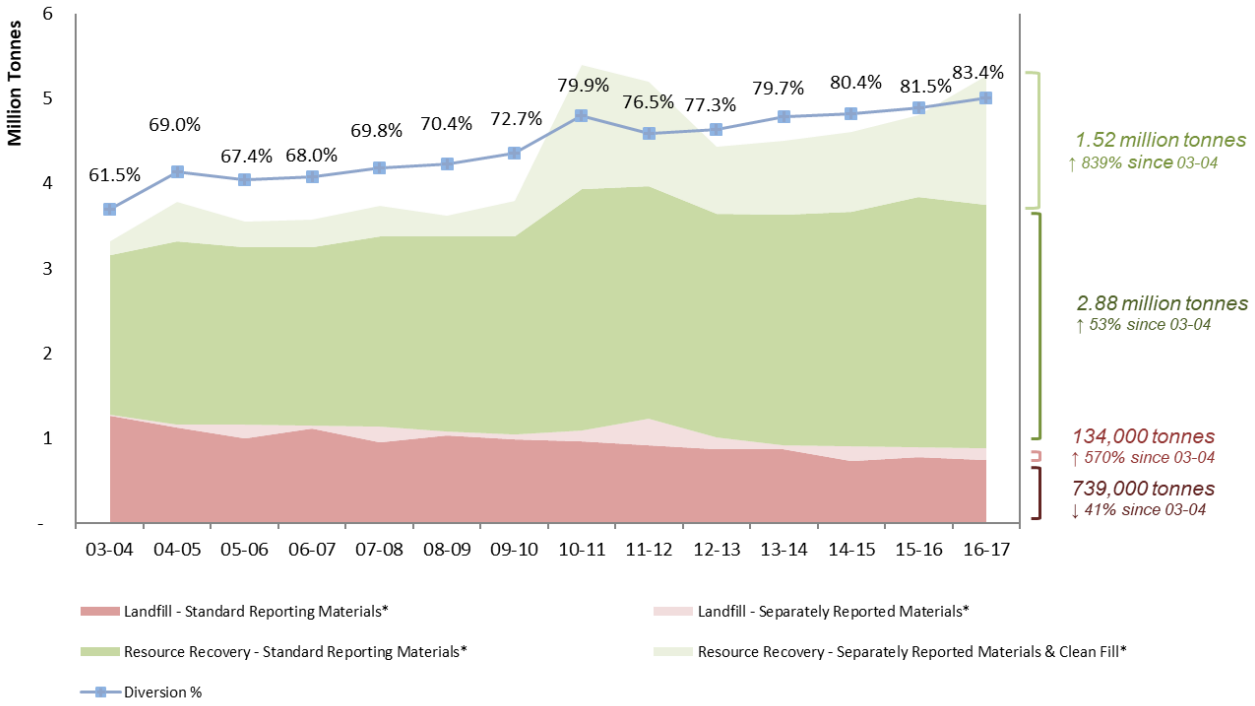

Figure 2.1 **Trend in resource recovery and landfill disposal in SA since 2003-04.**

** Reporting of both resource recovery and landfill disposal is divided into Standard Reporting Materials and Separately Reported Materials & Clean Fill categories.*

2.1.3 Recovery by material type

The recovery of materials from 2015-16 to 2016-17 remained consistent in some cases while there were some significant changes for other materials (see Table 2.2 and Figure 2.2).

These changes are described in more detail by material category in Section 3 of this report, but some important or interesting changes are highlighted in this section.

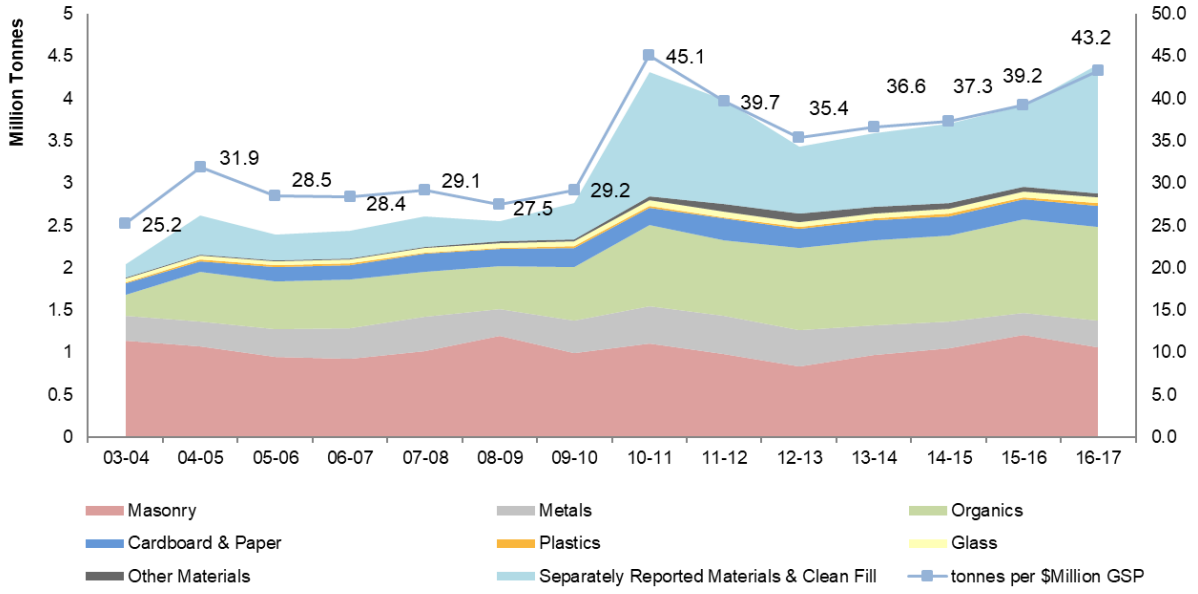

Figure 2.2 **Trend in resource recovery for SA by material category since 2003-04, including tonnes per $m of Gross State Product (GSP).**

There was a significant increase in resource recovery reported for Metals (up 16% overall from 2015-16). This is the first period since 2010-11 that Metals has increased, due to an increase in recovered Steel, which may have been driven by an increase in the price per tonne for this commodity, but also the recycling of metal framework and equipment used in buildings of a few manufacturing businesses that have recently closed.

There was a significant increase in the tonnes reported for Separately Reported Masonry Material, with Clay, Fines, Rubble & Soil increasing 77% from 2015-16. There have been several large infrastructure projects occurring in SA since 2009-10, which have contributed substantially to resource recovery of Clean Fill material over this period. While a number of these projects have completed or progressed past their major waste generation stages, infrastructure projects have continued (e.g. South Road upgrades in metropolitan Adelaide) and new projects commenced (e.g. the Northern Connector). Clean Fill volumes reported in SA have therefore, as anticipated, remained at elevated levels (i.e. above those seen before 2009-10). It is anticipated that this

will remain the case over the next 1 to 2 years. However, there was a slight decline in Standard Reporting Masonry materials (12% decrease from 2015-16). When observing the streams within the Masonry material, this decline was driven by Bricks and Concrete, decreasing by 21% and 20% respectively, as Asphalt increased by 29% from 2015-16.

Cardboard & Waxed Cardboard and Magazines & Newsprint increased by 19,000 tonnes and 8,000 tonnes from 2015-16 respectively. Magazines drove the increase in Magazines & Newsprint, with Newsprint decreasing slightly (1,000 tonnes) from 2015-16. Printing & Writing Paper also decreased by 5,000 tonnes or 36% from 2015-16. Use of paper, magazines and newsprint is expected to decrease as they are displaced by online access to subscriptions and books. However, magazines appear to be remaining at or increasing from previous levels while the other streams decline.

Plastics remained steady with a 2% increase from 2015-16, mainly due to an increase in Mixed &/or Other Plastics, and Low density polyethylene (LDPE). Polyvinyl chloride (PVC) saw a sharp decrease of 97% due to the closure of businesses that previously accepted this material, and there were also declines in resource recovery of Polypropylene (PP, down 13% from 2015-16) and High density polyethylene (HDPE, down 6%).

The Plastics and Cardboard industries, although recovering similar tonnes to 2015-16, are likely to see a decrease in future years, as these industries respond to international changes in acceptance of these materials. China for example has changed the acceptance criteria for materials, driving some companies to send recycled materials to other countries. This drop in demand has decreased the price per tonne for recycled materials. Plastics is likely to show declines in recovery in future years, with some businesses closing in the 2016-17 and 2017-18 financial years.

Although demand for organics was strong, the overall tonnes recovered for this material remained consistent with 2015-16. Garden Organics and Food Organics increased by 15% and 3% respectively, while the other Organics streams decreased slightly. The demand for organics derived products remains high. The challenge lies with increasing the incoming tonnes to organics recovery facilities and decreasing contamination.

Glass continued its steady incline from 2013-14 tonnes, and Fly ash is now at zero tonnes, due to the closure of the Port Augusta coal-fired power stations.

Table 2.2 **Reported material quantities (tonnes) being diverted for resource recovery in SA for 2016-17, preceding 5 years, and first Survey year, 2003-04.** *This table shows the changes in resource recovery of waste materials which have occurred in SA during these periods, including the percentage increase or decrease between 2015-16 and 2016-17. The data is presented in accordance with the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015).*

ID	Material	2003-04	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Change (%) 15-16 to 16-17
	Masonry								
1	Asphalt	100,000	143,000	148,000	148,000	170,000	210,000	270,000	29%
2	Bricks	165,000	73,000	50,000	63,000	55,000	53,000	42,000	-21%
3	Concrete	877,000	760,000	640,000	760,000	820,000	940,000	750,000	-20%
4	Plasterboard		600	600	1,000	1,100	1,400	1,400	0%
	Subtotal	*1,142,000*	*976,600*	*838,600*	*972,000*	*1,046,100*	*1,204,400*	*1,063,400*	*-12%*
	Metals								
7	Steel	264,200	404,000	387,000	320,000	280,000	230,000	275,000	20%
8	Aluminium	19,000	20,500	18,500	14,000	18,000	18,000	17,000	-6%
9	Non-ferrous metals	13,000	27,800	24,400	18,000	20,000	19,000	18,000	-5%
	Subtotal	*296,200*	*452,300*	*429,900*	*352,000*	*318,000*	*267,000*	*310,000*	*16%*
	Organics								
10	Food Organics	0	5,600	7,900	7,000	7,600	7,900	8,100	3%
11	Garden Organics	130,100	212,000	209,000	260,000	259,000	255,000	293,000	15%
12	Timber	116,700	281,000	237,000	180,000	220,000	273,000	250,000	-8%
13,14,15,16	Other Organics	0	403,000	510,000	550,000	530,000	570,000	562,000	-1%
	Subtotal	*246,800*	*901,600*	*963,900*	*997,000*	*1,016,600*	*1,105,900*	*1,113,100*	*1%*
	Cardboard & Paper								
17	Cardboard & Waxed Cardboard	91,000	183,000	190,000	180,000	149,000	151,000	170,000	13%
18	Liquid Paperboard	0	3,600	3,600	3,100	1,800	1,700	1,200	-29%
19, 20, 21	Magazines & Newsprint	32,701	39,500	38,800	33,000	62,000	61,000	69,000	13%
22	Printing & Writing Paper	12,300	23,300	20,700	24,000	19,000	14,000	9,000	-36%
	Subtotal	*136,001*	*249,400*	*253,100*	*240,100*	*231,800*	*227,700*	*249,200*	*9%*
	Plastics								
23	Polyethylene Terephthalate	0	4,500	4,300	4,200	4,400	4,200	4,200	0%

ID	Material	2003-04	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Change (%) 15-16 to 16-17
24	High Density Polyethylene	0	3,200	3,600	3,200	4,500	4,800	4,500	-6%
25	Polyvinyl Chloride	0	50	260	300	300	300	10	-97%
26	Low Density Polyethylene	0	4,400	4,600	3,400	3,600	3,700	4,100	11%
27	Polypropylene	0	2,100	2,200	2,000	1,700	1,600	1,400	-13%
28	Polystyrene	0	270	410	410	250	300	300	0%
29	Mixed &/or Other Plastics	8,607	5,100	6,000	9,000	12,000	13,000	14,000	8%
	Subtotal	*8,607*	*19,620*	*21,400*	*22,500*	*26,800*	*27,900*	*28,500*	*2%*
	Glass								
30	Glass	45,600	68,000	61,000	56,000	61,000	64,000	67,000	*5%*
	Other Materials								
40	Foundry Waste	0	60,900	70,200	51,600	40,800	34,400	24,500	*-29%*
41	Leather & Textiles	4,080	4,500	3,900	4,000	4,000	4,000	4,000	*0%*
42	Tyres & Other Rubber	88	17,400	19,700	21,300	18,500	18,400	19,900	*8%*
	Subtotal	*4,168*	*82,800*	*93,800*	*76,900*	*63,300*	*56,800*	*48,400*	*-15%*
	Total of above materials	***1,879,376***	***2,750,320***	***2,661,700***	***2,716,500***	***2,763,600***	***2,953,700***	***2,880,000***	***-2%***
39	Fly Ash	0	160,000	120,000	114,000	146,000	100,000	0	*-100%*
5	Clay, Fines, Rubble & Soil – Clean Fill	162,400	910,000	480,000	590,000	660,000	760,000	1,307,000	*72%*
6	Clay, Fines, Rubble & Soil – Intermediate Waste Soil[1]	NRS[2]	160,000	190,000	170,000	130,000	100,000	214,000	*114%*
	Total Clay, Fines, Rubble & Soil	162,400	1,070,000	*670,000*	760,000	790,000	860,000	1,521,000	*77%*
	Total Reported	***2,041,776***	***3,980,000***	***3,450,000***	***3,590,000***	***3,700,000***	***3,910,000***	***4,401,000***	***13%***

Notes:

1. *'Intermediate Waste Soil' is a soil classification used in SA (South Australia EPA, 2009) (Draft Waste Classification Guidelines) which is indicative of 'minor contamination' (as opposed to major contamination), separating this type of soil from Waste Derived Fill (WDF, or 'clean fill'). Intermediate Waste Soil can be used as WDF for construction fill or purposes without remediation or treatment but only when subject to a site-specific risk-based assessment verified by an independent auditor.*
2. *NRS – Not reported separately*
3. *Totals may not equate to sums due to rounding.*

2.1.4 Source sector outcomes

During 2016-17, Municipal (MSW) sources contributed 461,000 tonnes to resource recovery (see Table 2.3 below and Figure 2.3 overleaf). This is 9,000 tonnes more than volumes reported from 2015-16 (at 452,000 tonnes). This is mainly due to a reported increase in Organics, specifically Garden Organics (which may be driven by a high amount of rainfall in 2016-17), and Metals, specifically Steel. While the additional MSW tonnes recovered increased, so did the estimated quantity of MSW volumes to landfill up 4,000 tonnes from 2015-16 to 392,000 tonnes in 2016-17. This led to a small increase in the MSW diversion rate for SA, up to 54.0% (from 53.8% in 2015-16).

The reported quantity of C&I resource recovery in 2016-17 (of 1.32 million tonnes) decreased slightly from 2015-16 levels (at 1.37 million tonnes). The volume of C&I waste to landfill (at 189,000 tonnes) fell by 19,000 tonnes from 2015-16 levels. This led to a slight increase in the C&I diversion rate for SA to 87.4% (up from 86.7% in 2015-16).

C&D recovery was reported at 2.63 million tonnes), which rose substantially from 2015-16 (up from 2.09 million tonnes). At the same time, C&D landfill disposal remained steady at 292,000 tonnes. This has led to an increase in C&D diversion to 90.0% (up from 87.7% in 2015-16).

C&I and C&D sources (at 30% and 60%, respectively) continued to constitute the main sources of resource-recovered material reported by SA recycling industries in 2016-17 (see Table 2.3 and Figures 2.3 and 2.4). Due to the increase in reported C&D recovered volumes, the proportion of this waste stream relative to C&I and MSW sources has increased again in 2016-17 from previous years.

MSW sources still make up the majority (at 45%) of waste disposed of to landfill. C&I and C&D sources for landfill disposal remain lower, at 22% and 33% respectively (see Figure 2.5). These contributions remain consistent with 2015-16.

Table 2.3 **Source sector origins (by weight, tonnes and %) of SA recovered materials and waste to landfill, 2016-17, and diversion rates (%).** *Source data for resource recovery by source sector was obtained from the 2016-17 Recycling Activity Survey data. Source data for landfill disposal by source sector during 2016-17 was obtained from Green Industries SA.*

Sector Origin	Resource Recovery		Landfill		Diversion (%)
	tonnes	(%)	tonnes	(%)	
Municipal	461,000	11%	392,000	45%	54.0%
C&I	1,315,000	30%	189,000	22%	87.4%
C&D	2,625,000	60%	292,000	33%	90.0%
Total[1]	**4,401,000**	**100%**	**873,000**	**100%**	**83.4%**

1. Some totals may not equate precisely due to rounding

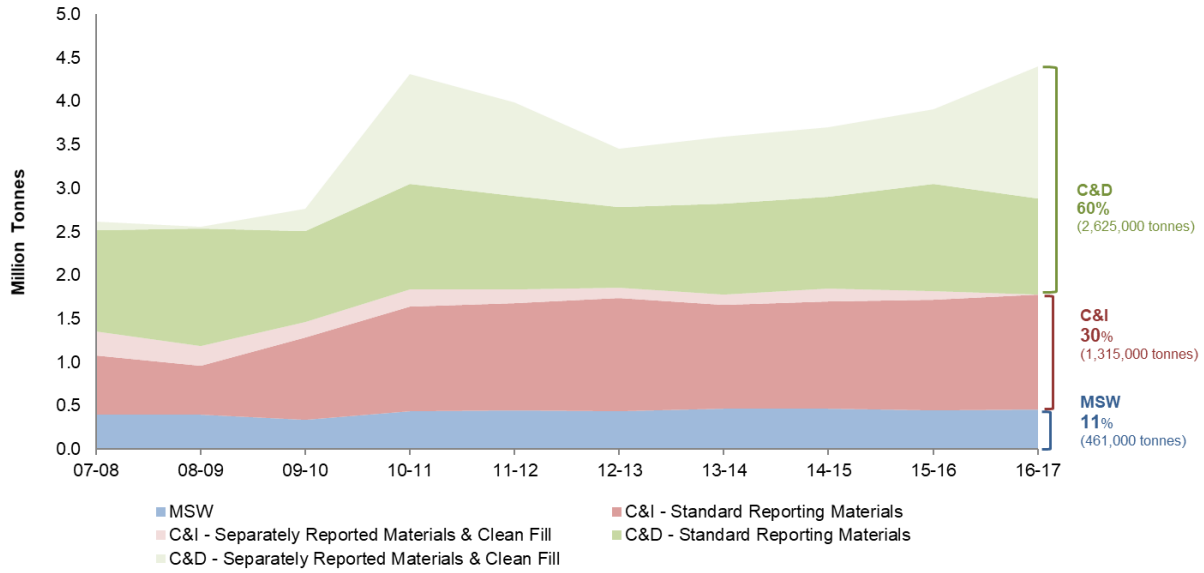

Figure 2.3 **Contribution to resource recovery in SA by source sector for 2016-17 and trend since 2007-08** *(note percentages may not equate due to rounding)*

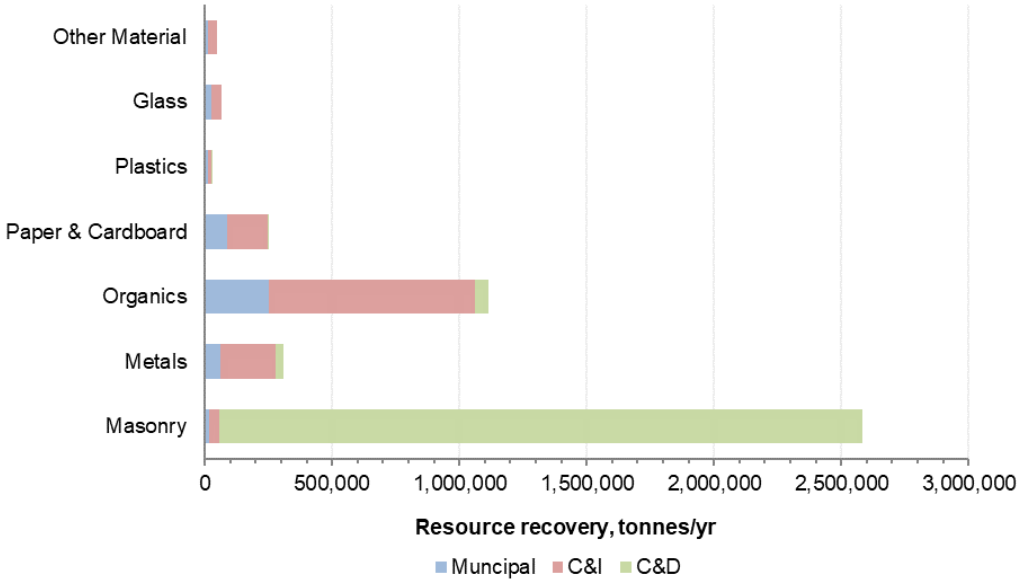

Figure 2.4 **Sector origin of SA recovered materials according to material category (by weight, tonnes), SA 2016-17.** *This figure shows the source sector splits for resource recovered materials by source sector (MSW, C&I and C&D)*

2.1.5 Landfill Disposal

Landfill disposal in South Australia continues to decrease, with 2016-17 landfill disposal falling to 873,000 tonnes from 890,000 tonnes in 2015-16 (or a 1.9% decrease, see Figure 2.5 below). This decrease in landfill disposal from 2015-16 was mostly due to a fall in the volumes of C&I landfilled materials (decrease of 20,000 tonnes), and Standard Reporting Materials in the C&D sector (which decreased 17,000 tonnes), while MSW disposal to landfill increased (4,000 tonnes) and C&D Separately Reported Materials increased more substantially from 2015-16 volumes (up 16,000 tonnes).

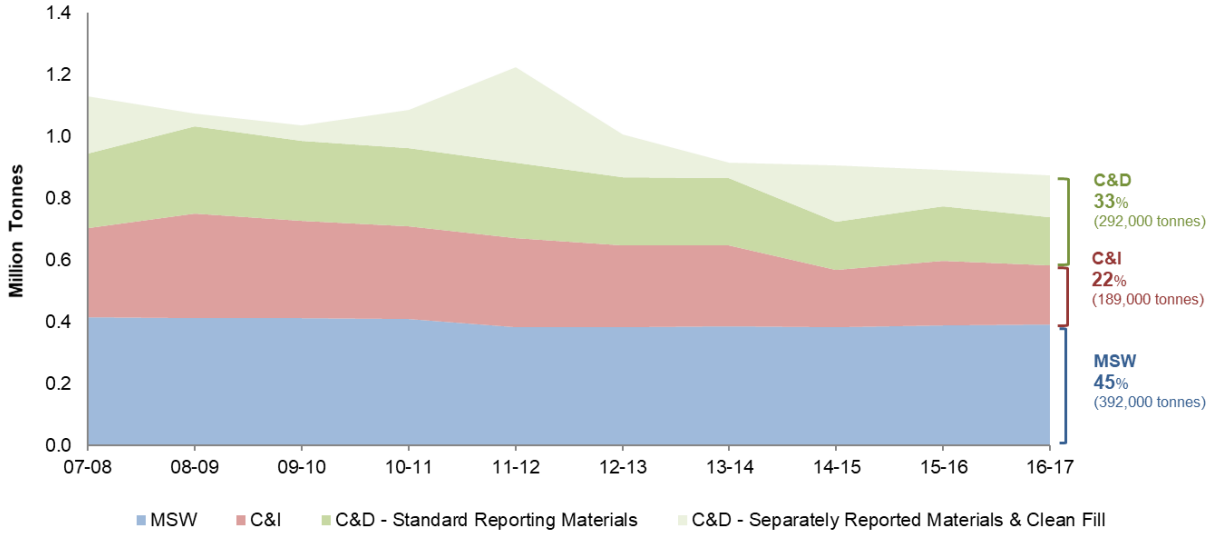

Figure 2.5 **Contribution to landfill disposal in SA by source sector for 2016-17 and trend since 2007-2008.** *This figure shows the tonnes of landfilled materials by source sector (MSW, C&I and C&D) over time. Note percentages may not equate due to rounding.*

2.1.6 Geographical origin

Figures 2.6 and 2.7 overleaf show the indicative locations in SA of main sites for recyclers/re-processors reporting resource recovery data to Green Industries SA Recycling Activity Survey.

During 2016-17, metropolitan areas contributed to 85% (or 3.74 million tonnes) of resource recovery in SA and 76% (0.66 million tonnes) of waste sent to landfill (Table 2.4 below).

Regional areas once more contributed strongly to SA's recycling activity in 2016-17, providing the balance (at 0.66 million tonnes or 15%) of material being resource recovered. This is a slight decrease from its 2015-16 contribution of 20%. In line with previous years, a significant proportion of this regional resource recovery arises from processing of primary products (e.g. wine, timber, meat). Regional areas were also responsible for 0.21 million tonnes (or 24%) of waste disposed to landfill in SA.

Table 2.4 **Geographical origins (by weight, tonnes and %) of SA recovered materials and waste to landfill, 2016-17, and diversion rates (%).** *The separate contributions by metropolitan and regional areas to resource recovery and landfill disposal in SA are shown in this Table.*

Sector Origin	Resource Recovery		Landfill[1]		Diversion
	tonnes[2]	(%)	tonnes	(%)	
Metro	3,738,000	85%	662,000	76%	85.0%
Regional	663,000	15%	211,000	24%	75.9%
Total	**4,401,000**	**100%**	**873,000**	**100%**	**83.4%**

1. Landfill data was provided by Green Industries SA
2. Sums may not equate due to rounding. Rounding also influences diversion rates

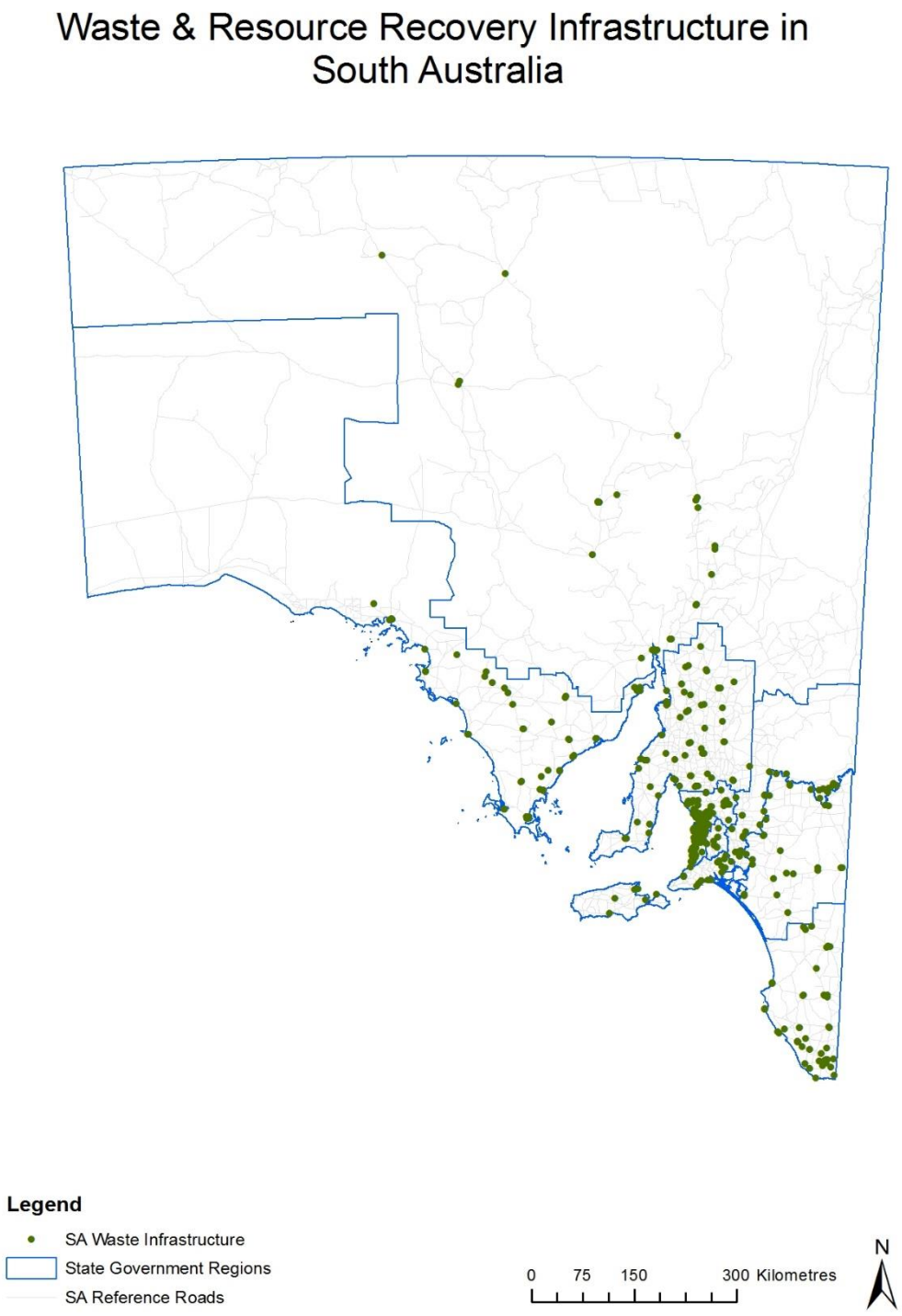

Figure 2.6 **Approximate geographical location of main sites for recyclers/re-processors in SA.** *This map was produced by Green Industries SA during the 2016-17 Recycling Activity Survey Year. Refer Figure 2.7 for enlargement of metropolitan Adelaide area*

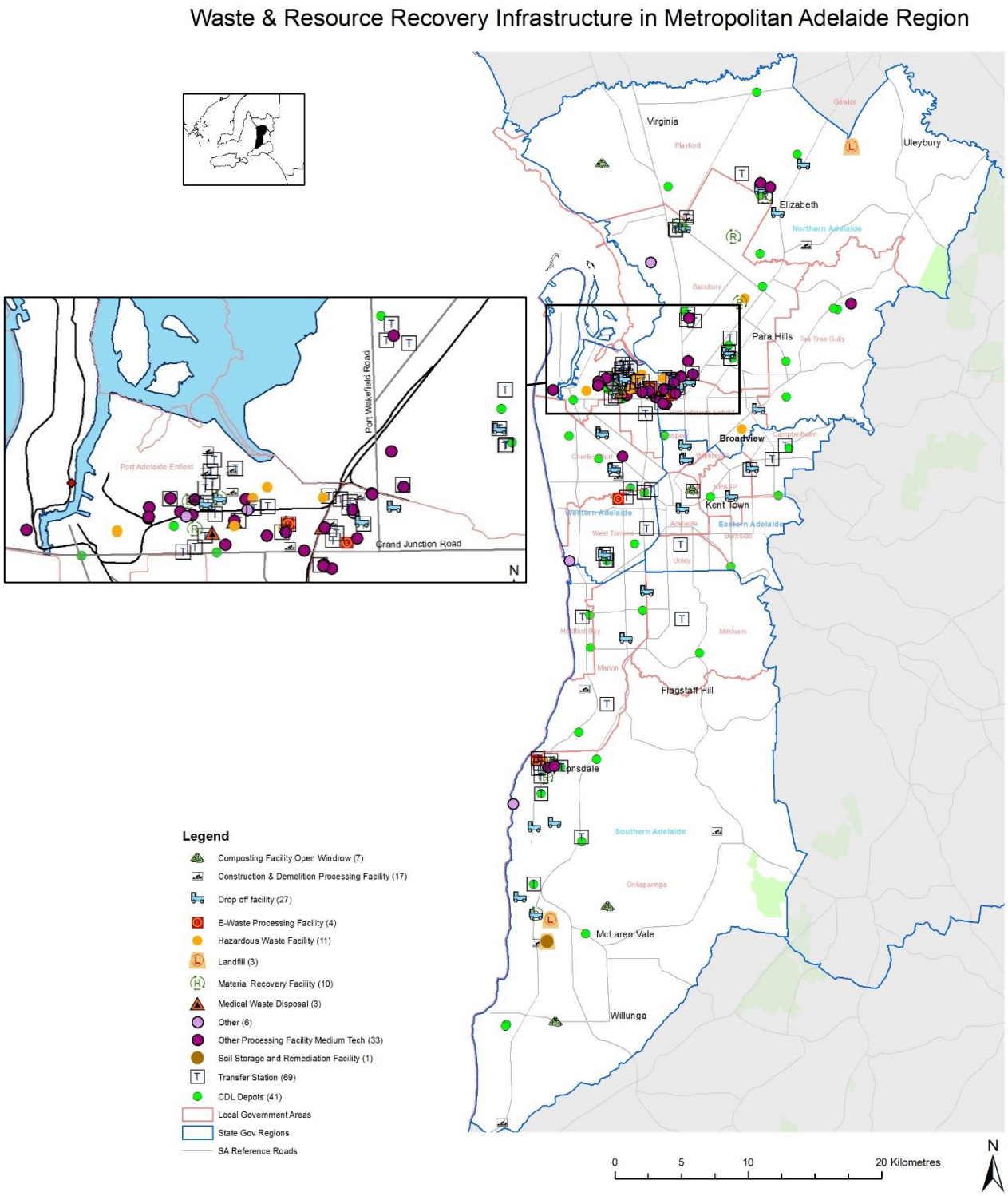

Figure 2.7 **Approximate geographical location of main sites for recyclers/ re-processors in Adelaide.**

This map was produced by Green Industries SA during the 2016-17 Recycling Activity Survey Year.

2.1.7 Destination for Recovered Materials

In 2016-17, an estimated 3.84 million tonnes or 87% of all recovered material reported was re-processed in SA (Table 2.5 below). SA has well-developed recycling industry capabilities in most material streams, and while the proportion of materials re-processed locally remained steady at 87%, the total tonnes rose by 451,000 tonnes (or 13%) from 2015-16.

The tonnes and proportion of materials sent overseas increased, from 210,000 in 2015-16 to 274,000 in 2016-17 or an increase from 5% to 6% of all materials. The quantity of materials reported as being sent interstate decreased from 310,000 tonnes or 8% in 2015-16, to 6% or 286,000 tonnes in 2016-17.

All Masonry materials and the majority of Organics and Glass remained in SA, while almost all Cardboard & Paper (99.7%) and the majority of Metals (75.9%) were sent interstate or overseas for re-processing.

In the Other Materials category, 100% of both Leather & Textiles and Tyres & Other Rubber were sent interstate or overseas (see Figure 2.8).

The volume of Organics reprocessed in the state increased slightly (from 1,074,000 tonnes in 2015-16, to 1,087,000 in 2016-17). There was a decline in Other Material re-processed within the state due to no Fly Ash in 2016-17 coupled with a decrease in recovered Foundry Waste.

The proportion and tonnes of Metals sent interstate decreased from 2015-16 to 2016-17 (from 121,000 tonnes or 39% of all materials sent interstate in 2015-16, to 100,000 tonnes or 35% in 2016-17), while the proportion and tonnes of Metals sent overseas increased by almost 50,000 tonnes (from 86,000 tonnes sent overseas in 2015-16 to 135,000 in 2016-17).

Table 2.5 **Final reported destination (by weight, tonnes and %) of SA sourced materials, 2016-17.**

The destination is where material is sent for re-processing. The majority of resource recovered material in SA is locally re-processed to use in the manufacture of new products.[1]

Destination	Quantity	
	tonnes	%
SA	3,841,000	87%
Interstate	286,000	6%
Overseas	274,000	6%
Total	**4,401,000**	**100%**

1. Sums and percentages may not equate due to rounding.

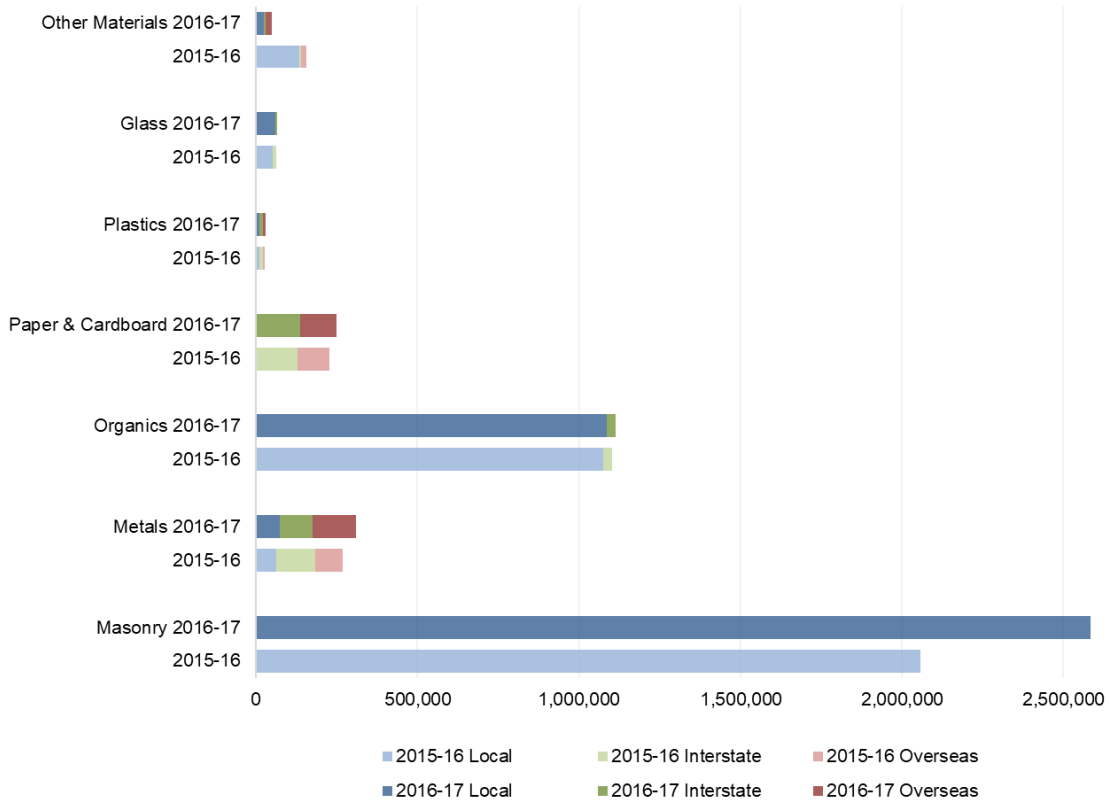

Figure 2.8 **Destination of SA recovered materials according to material category (by weight, tonnes), SA 2016-17 compared with 2015-16.** *The majority of materials are being re-processed within SA, but significant quantities of some materials are exported interstate or overseas.*

2.1.8 Energy recovery

Energy recovery may be useful for waste that is deemed unsuitable or cost-effective for material recovery. Some industries produce energy from waste by-products generated on their own sites, which is not reportable under the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015). There are also several waste companies that collect and re-process waste materials, which are then sent overseas and/or interstate for energy recovery. This circumstance is still technically deemed as 'material recovery' as any potential energy recovery from the recovered waste material occurs later, once it is exported outside of SA. Resource recovery considered as 'energy recovery' in this report is therefore classified as: *SA-derived waste materials recovered and used for the purpose of energy production in SA, instead of being sent for landfill disposal*[2].

In 2016-17, the tonnes of recovered materials identified as used for the production of energy in SA increased to 94,900 tonnes of material (from 73,100 tonnes in 2015-16), which includes Timber, Mixed Plastics and Other Organics. This quantity contributed 1.8% to the State's total diversion rate.

Table 2.6 (overleaf) includes 2016-17 recovered materials, broken down by recovery method (material versus energy recovery). This data is displayed under Standard Reporting Materials, Separately Reported Materials & Clean fill and total (all materials).

The overall diversion rate for all materials is 83.4%, which includes 81.6 percentage points from materials recovery and 1.8 percentage points from energy recovery. The overall diversion rate for Standard Reporting Materials is 79.6%, which includes 77.0 percentage points from material recovery and 2.6 percentage points from energy recovery. Lastly, the overall recovery of Separately Reported Materials & Clean Fill is 91.9%, which is all from material recovery. Energy recovery is anticipated to continue to grow over the next 5 to 10 years, from sources such as additional anaerobic digestion facilities, pyrolysis of agricultural waste, and/or large-scale diversion of the municipal waste/C&I residuals away from landfill to waste-to-energy plants.

[2] This necessarily excludes energy recovery from landfill gas arising from waste already disposed to landfills.

Table 2.6 **Resource recovery (tonnes) for material recovery and energy production, from SA sourced materials reported during 2016-17.** *Reported tonnes are for energy recovery in SA from waste materials diverted from landfill. These 'energy recovery' tonnes do not include materials that are re-processed and sent interstate and/or overseas for energy recovery, which is still deemed as material recovery. The respective contributions of resource recovery for material recovery and energy production to SA's diversion rate is also shown.*

		Standard Reporting Materials	Separately Reported Materials & Clean Fill	**TOTAL (All materials)**
Material recovery	Quantity, tonnes	2.79 million	1.52 million	4.31 million
	Diversion rate, %	77.0%	91.9%	81.6%
Energy recovery	Quantity, tonnes	94,900	Nil	94,900
	Diversion rate, %	2.6%	0.0%	1.8%
Total (resource) recovery	**Quantity, tonnes**	2.88 million	1.52 million	4.40 million
	Diversion rate, %	79.6%	91.9%	83.4%

2.1.9 Imported materials

Imported waste materials brought into SA for resource recovery and/or re-processing are separately identified during the SA's Recycling Activity survey, to ensure that they are not counted towards SA's recycling performance. This does not include already re-processed materials imported for manufacturing.

Table 2.7 overleaf summarises these imported waste materials identified in reported data for 2016-17. Approximately 158,000 tonnes of imported waste materials for resource recovery were recorded. This represents a 19,000 tonne decrease from 2015-16.

The origin of waste changed slightly with waste materials from Victoria and NSW increasing whilst waste materials imported from Overseas decreased significantly (by 30,000 tonnes) due to decreases in the importing of Other Materials and Glass. Overall, there were reported decreases in Metal (down 11,500 tonnes from 2015-16) and Other Materials (down 27,900 tonnes from 2015-16). Glass and Plastics decreased to a smaller degree at 1,500 and 800 tonnes respectively, while the import of Organics increased by 23,000 tonnes from 2015-16.

Table 2.7 **Waste materials reported as imported to SA for resource recovery in 2016-17, including estimated accuracy of data.** *Significant quantities of Organics, Glass and Other Materials were imported for resource recovery. The highest quantities came from Victoria, NSW and Overseas.*

Material sector	Interstate								Overseas	TOTAL	Est. Accuracy (%)
	VIC	NT	QLD	WA	NSW	ACT	TAS	State not identified			
Masonry	-	-	-	-	-	-	-	-	-	**-**	N/A
Metals	3,000	200	-	-	3,000	-	-	-	-	**6,200**	5%
Organics	58,400	-	-	-	6,000	-	-	-	-	**64,400**	1%
Cardboard and Paper	-	-	-	-	-	-	-	-	-	**-**	N/A
Plastics	1,800	200	100	1,800	2,900	-	-	-	100	**6,900**	17%
Glass	22,400	4,000	-	2,600	18,400	-	-	-	2,000	**49,400**	7%
Other materials	8,300	500	-	-	4,000	-	-	-	18,600	**31,400**	1%
Total	**93,900**	**4,900**	**100**	**4,400**	**34,300**	**-**	**-**	**-**	**20,700**	**158,300**	4%

2.1.10 Market value of resource recovery

This year's survey asked participants to provide the value per tonne for each material stream that was re-processed within their respective organisations. This provided more accurate data to estimate the market value of resource recovery in SA. The more accurate data has led to a substantial increase in the market value of resource recovery in SA (see Figure 2.9). Metals remains the greatest contributor to the market value of resource recovery in SA at $150 million, with Organics now the second greatest contributor, estimated at $81 million and then Cardboard & Paper at $58 million. Note that Meat Rendering contributes the majority of the overall Organics market value (89% or $72 million), with garden, food and timber contributing the remaining $9 million.

Overall, it was estimated that the resource recovery sector in SA is worth $320 million. Further details on the value of each of these streams and a comparison with previous years can be found in Section 6.

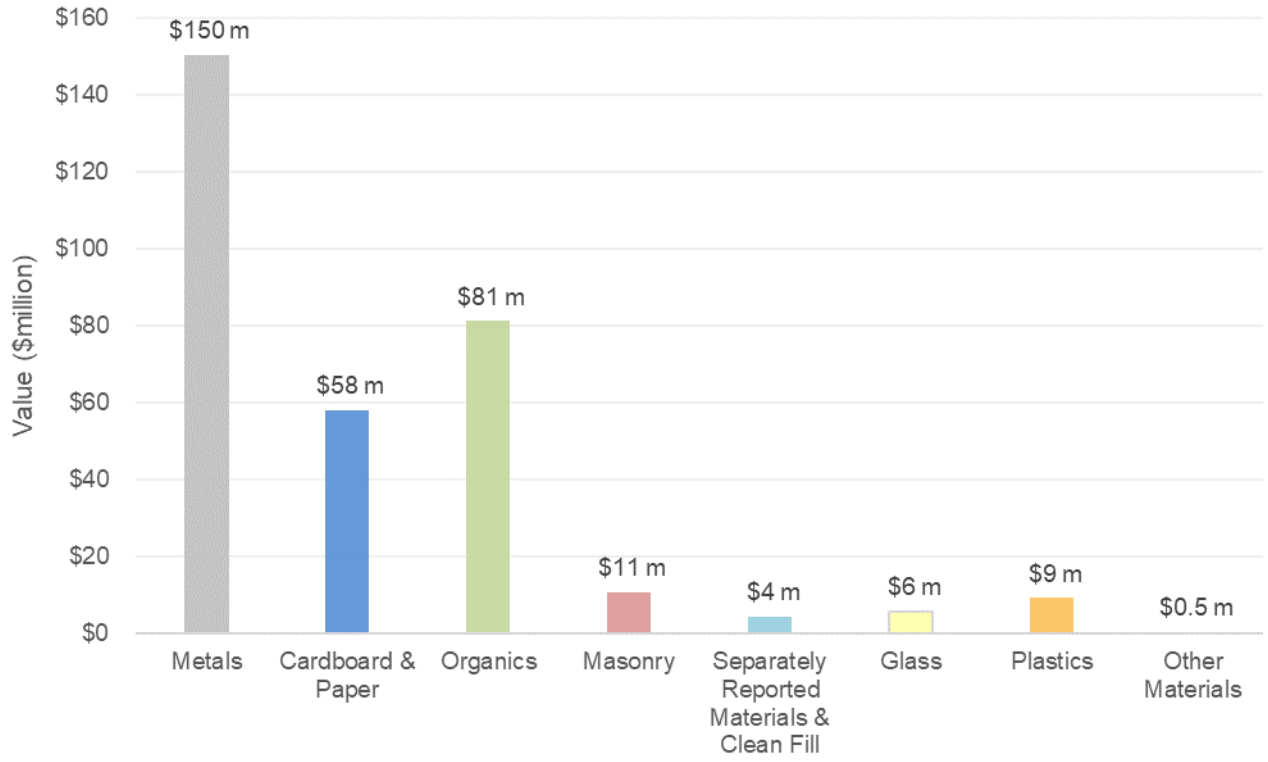

Figure 2.9 **Estimated market value of resource recovered material in SA during 2016-17.** *Organics now contributes the second greatest proportion of all materials behind Metals.*

2.2 Performance against State Waste Strategy Targets

2.2.1 Landfill Reduction Target

South Australia's Strategic Plan includes targets for the state (SA Government, 2011). Target 67 sets the following landfill reduction goal for SA:

- ***Reduce waste to landfill by 35% by 2020 (baseline: 2002-03), Milestone of 30% by 2017-18.***

According to data collected for the 2016-17 SA Recycling Activity Survey, the state is on track to reach its waste to landfill target of 35% reduction (from 2002-03) by 2020 (see yellow dotted trend line in Figure 2.10). SA's disposal to landfill for 2016-17 was 872,600 tonnes, which has almost met the Milestone of 30% reduction by 2017-18 in this reported financial year (2016-17) and is 29% lower than 2002-03 volumes. However, as per the previous year, to reach these milestones will require ongoing commitment to achieving further gains in diverting waste materials from landfill disposal to resource recovery, including contaminated soil.

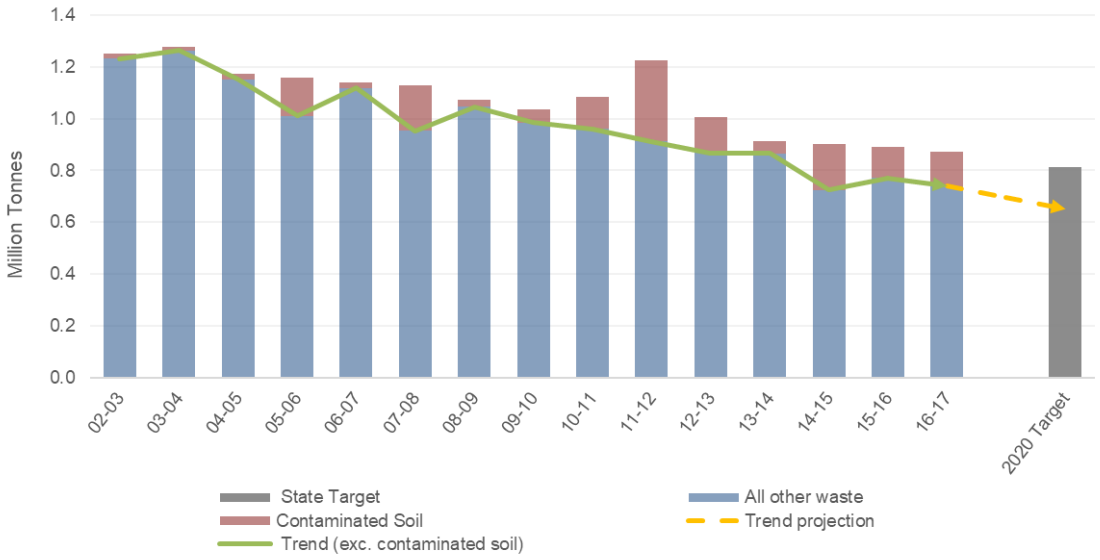

Figure 2.10 **Landfill disposal: Trend in SA since 2002-03 and the State Waste Strategy Target.** *This figure shows how landfill disposal in SA has changed since 2002-03 relative to SA's Strategic Plan (SA Government, 2011) landfill reduction target. The separate contribution to landfill disposal of contaminated soil is also identified and the historical trend of landfill disposal excluding contaminated soil is illustrated.*

2.2.2 Per capita Waste Generation Reduction Target

South Australia's Waste Strategy (Green Industries SA, 2015) sets a state-wide per capita waste generation target of:

- ***> 5% reduction in waste generation per capita by 2020 (baseline: 2015)***

Data collected for the 2016-17 SA Recycling Activity Survey indicates that there has been a 1.0% increase in waste generation per capita from 2014-15 to 2016-17. This can be found in Table 2.8, which includes the per capita waste generation from 2010-11 to 2016-17.

The % change refers to the difference between 2014-15 (baseline year for Target) and 2016-17 (current year). There will need to be a reduction in waste generation per person to reach the target, as although this is less than the per capita waste generation in 2015-16, it is still above the 2014-15 baseline generation rate and needs to reduce to 1,976 kg/person/yr in 2020 to reach the target.

Table 2.8 2016-17 Recycling Activity results per capita waste generation vs. State Waste Strategy target

	Per capita Waste Generation (kg/person/yr)								2020 Target
	10-11	*11-12*	*12-13*	*13-14*	*14-15*	*15-16*	*16-17*	***% Change***	
Standard Reporting Materials	2,300	2,210	2,120	2,130	2,080	2,180	2,100	**1.0%** Increase from 2014-15	5% Reduction from 2014-15
Separately Reported Materials & Clean Fill	950	930	550	550	660	630	960		
TOTAL	3,250	3,140	2,670	2,680	2,740	2,810	3,060	**11.7%** Increase from 2014 -15	

2.2.3 Metropolitan Diversion Targets

SA's Waste Strategy 2015-20 (Green Industries SA, 2015) includes targets for metropolitan diversion (to resource recovery) by source sector (Table 2.9 below).

In 2016-17, all three sectors' diversion rates increased:

- MSW – Diversion rate increased to 59.1% (up from 58.2% in 2015-16). This remains below the 2015 and 2020 Target of 70%.
- C&I – Diversion rate increased to 85.2% (from 82.0% in 2015-16). This remains above the 2020 Target of 80%.
- C&D – The diversion rate increased:
  - *Excluding Separately Reported Materials & Clean Fill:* A diversion rate of 90.1% was achieved (up from 89.9% in 2015-16), which is now in line with the 2020 Target of 90%.
  - *Total C&D sector result:* The diversion rate was 91.0% (up from 88.9% in 2015-16). This is above the 2015 and 2020 Target of 90%.

Table 2.9 Metropolitan diversion by source sector: 2016-17 Recycling Activity results and State -Waste Strategy targets. *This table compares the metropolitan diversion outcomes achieved for MSW, C&I and C&D sectors with diversion targets in SA's Waste Strategy 2015-2020 (Green Industries SA, 2015).*

Source Sector	2016-17 Diversion Achieved	Metro Diversion Target	
		By 2015	*By 2020*
▪ MSW	59.1%	70%	70%
▪ C&I	85.2%	75%	80%
▪ C&D – *Excluding Separately Reported Materials & Clean Fill*	90.1%	90%	90%
▪ C&D – *Total*	91.0%		

2.3 Comparative performance (with other jurisdictions)

Based on resource recovery and landfill data for 2016-17, SA currently achieves both the highest publicly reported diversion (at 83.4%) and per capita resource recovery (2,555 kg/p/yr) of any state or territory in Australia[3] (Figure 2.11). SA achieved the second highest per capita resource recovery for standard reporting material only, at 1,670 kg/p/yr, falling behind the ACT in 2015-16 (however, note that the proportion of Separately Reported Materials in ACT's data is unknown), and the highest per capita recycling of separately reported materials (of those states that reported this figure), at 885 kg/p/yr. In addition, SA has the lowest per capita landfill disposal rate at 505 kg/p/yr. With this in mind, SA continues to report high overall per capita waste generation rates, and in 2016-17 it was again had the highest value in Australia at 3,060 kg/p/yr).

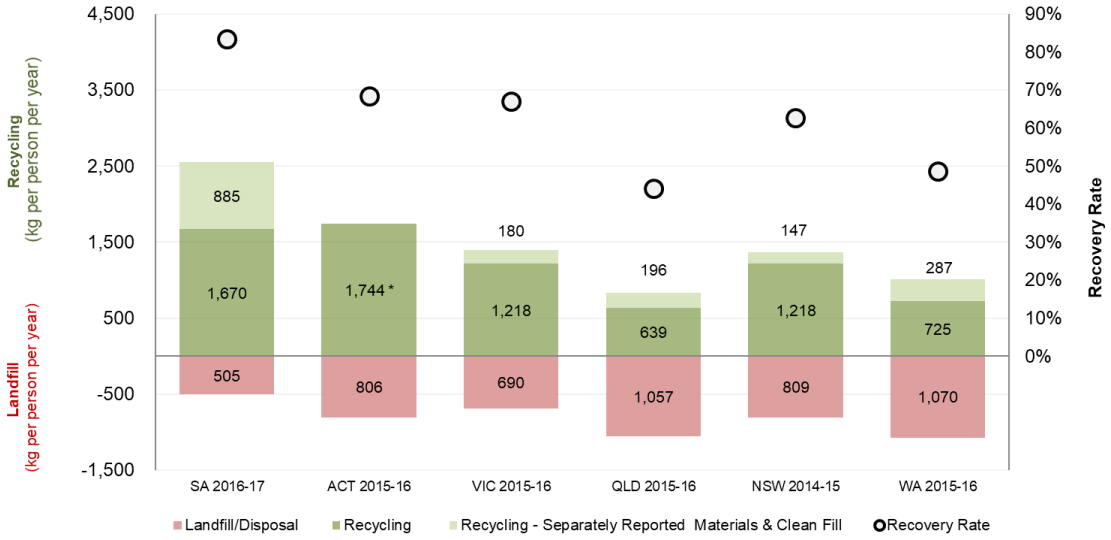

Figure 2.11 **Comparison of reported per capita (kg/person/yr) resource recovery and landfill disposal and recovery (%) by state or territory.** These figures are based on the latest currently available data. The per capita data for resource recovery is differentiated according to Standard Reporting Materials and Separately Reported Materials & Clean Fill scopes in line with the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015). Note: Reported recovery for ACT does not show a breakdown between Standard Reporting Materials and Separately Reported Materials & Clean Fill, and thus, these quantities are aggregated in the Recycling category of reported per capita data.

[3] Not all recycling data could be obtained for 2016-17. Furthermore, not all Australian states and territories collect and report this data in conformance with the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015).

Estimated waste generation, recycling and landfill disposal were based on most current and best available data for each State/Territory. Further details explaining how SA data was benchmarked against recycling data reported by other states and territories are provided in the Methodology section of this report.

2.4 Employment in the SA Resource Recovery Sector

Participants in the 2016-17 SA Recycling Activity survey were asked to provide the number of full time equivalent (FTE) employees directly employed by the company/ organisation's site(s) or operations(s) associated with material collection, resource recovery and/or recycling. Not all participating organisations provided a response to this question – in total, 52 responses were received, and an additional 17 responses were used from 2015-16. This figure is therefore an underestimate of the entire industry in South Australia, as not all waste, recycling and resource recovery organisations were surveyed and of those that were, not all provided a response. In addition, the data was obtained through survey responses only, and more comprehensive figures could be found through further investigations by Green Industries SA.

Table 2.10 below summarises the employment figures captured in the 2016-17 survey. As can be seen in this table, of the organisations that reported, there were a total of 1,440 FTE employees reported, and 278 other employees that were not classed as an FTE but were employed in 2016-17 (e.g. casual, part-time or contractor). This is a sub-set of total employment in the SA's waste and resource recovery industry which is estimated at 4,800 people across a wide spectrum of jobs (direct and indirect).

Organisations also provided feedback on annual sales revenue for the 2016-17 financial year. The combined revenue from the 25 organisations that provided data was $413 million. Again, this is likely to be an underestimation of the value of the industry due to the limited number of responses.

Table 2.10 **2016-17 Recycling Activity results of FTEs in SA associated with material collection, resource recovery and/or recycling (including comparison with 2015-16).** *Note that is a sub-set of employment in the SA industry, with data from 69 organisations used in the 2016-17 results (61 organisations' data were used in 2015-16). It also does not include indirect employment.*

Year	2016-17	2015-16
Employment type	**Number**	**Number**
Full time Equivalent (FTE)	1,440	1,410
Additional employment, unable to be converted to FTE	278	254
Total	**1,718**	**1,664**

3 Material Resource Recovery (Activity) Reports

At a glance:

- *This section presents the key findings from analysis of 2016-17 Recycling Activity Survey data by material type. These resource recovery reports are presented according to traditionally accepted material sectors as listed below, which align with the National Guidelines for compiling waste and recycling data (Dept of Environment and Energy, 2015). Where relevant, the reports differentiate between resource recovery for material recovery and energy recovery.*

1. ***Masonry [refer pg. 34 of this report]***
   - *Asphalt*
   - *Bricks*
   - *Concrete*
   - *Plasterboard*
   - *Clay, Fines, Rubble & Soil*
   - *Clay, Fines, Rubble & Soil- Intermediate Waste Soil*
2. ***Metals [refer pg. 38]***
   - *Steel or Ferrous Metals*
   - *Aluminium*
   - *Non-ferrous Metals (exc. Aluminium)*
3. ***Organics [refer pg. 42]***
   - *Food Organics*
   - *Garden Organics*
   - *Timber*
   - *Other Organics*
4. ***Cardboard & Paper [refer pg. 46]***
   - *Cardboard and Waxed Cardboard*
   - *Liquid Paperboard*
   - *Magazines & Newsprint*
   - *Printing & Writing Paper*
5. ***Plastics [refer pg. 50]***
   - *Polyethylene Terephthalate (PET)*
   - *High Density Polyethylene (HDPE)*
   - *Polyvinyl Chloride (PVC)*
   - *Low Density Polyethylene (LDPE)*
   - *Polypropylene (PP)*
   - *Polystyrene (PS)*
   - *Mixed &/or Other Plastics (MIX)*
6. ***Glass [refer pg. 55]***
7. ***Other Materials [refer pg. 57]***
   - *Fly Ash*
   - *Foundry Sands*
   - *Leather & Textiles*

3.1 Masonry

Highlights:

- *In 2016-17 the quantity of recovered Masonry materials, including Clean Fill and Intermediate Waste Soil, increased from 2015-16.*
- *This was due to an increase in Asphalt (60,000 tonnes), and substantial increases in Clean Fill and Intermediate Waste Soil (547,000 tonnes and 114,000 tonnes respectively).*
- *Concrete and Bricks declined from 2015-16 tonnes (down by 190,000 and 11,000 tonnes respectively).*
- *All of this material is re-processed in SA.*
- *The outlook for recovery of Masonry materials remains strong, with supply of materials expected to remain high due to generation of materials from infrastructure projects, and the commercial viability of Masonry materials reprocessing is strengthened by increases in the SA Solid Waste Levy.*

The total quantity of recovered Masonry materials reported for SA during 2016-17 was 2.58 million tonnes (Table 3.1 below), which is up by 15% from 2015-16 (2.06 million tonnes). The majority of this resource recovery was from Total Clay, Fines, Rubble & Soil (Clean Fill and Intermediate Waste Soil[4], at 59%), followed by Concrete (at 29%, see Figure 3.1 overleaf).

Clean Fill, Intermediate Waste Soil and Asphalt increased by 547,000 tonnes, 114,000 tonnes and 60,000 tonnes respectively from 2015-16 values (Figure 3.2 overleaf and 3.3 two pages overleaf), while Bricks and Concrete decreased, down by 11,000 tonnes and 190,000 tonnes or 21% and 20% respectively from 2015-16.

Table 3.1 **Quantity (tonnes) of Masonry material recovered in SA during 2016-17, including estimated reporting error (in tonnes & %).** *This table includes separate reporting of Clean Fill and Intermediate Waste Soil in the total Clay, Fines, Rubble & Soils.*

Item	Net Recovery[1]	Reporting Error	
	tonnes	tonnes	%
Asphalt	270,000	22,000	8%
Bricks	42,000	7,000	17%
Concrete	750,000	91,000	12%
Plasterboard	1,400	220	16%
Total Clay, Fines, Rubble & Soil [2]	1,520,000	333,000	22%
Clay, Fines, Rubble & Soil – Clean Fill[2]	1,307,000	302,000	23%
Clay, Fines, Rubble & Soil – Intermediate Waste Soil[3]	214,000	31,000	14%
Total	**2,583,400**	**450,000**	17%

1. Net recovery excludes re-processing losses.
2. The 'Clay, Fines, Rubble & Soil' material category does not include stockpiled material where reuse may not occur and also only relates to material that has been diverted from landfill
3. Intermediate Waste Soil[4] was reported for the first time in 2011-12.

[4] Intermediate Waste Soil (IWS) is a soil classification used in SA (South Australia EPA, 2009) (Draft Waste Classification Guidelines) to indicate 'minor contamination' (as opposed to major contamination), which separates this soil type from Waste Derived Fill (WDF) (commonly known as 'Clean Fill').

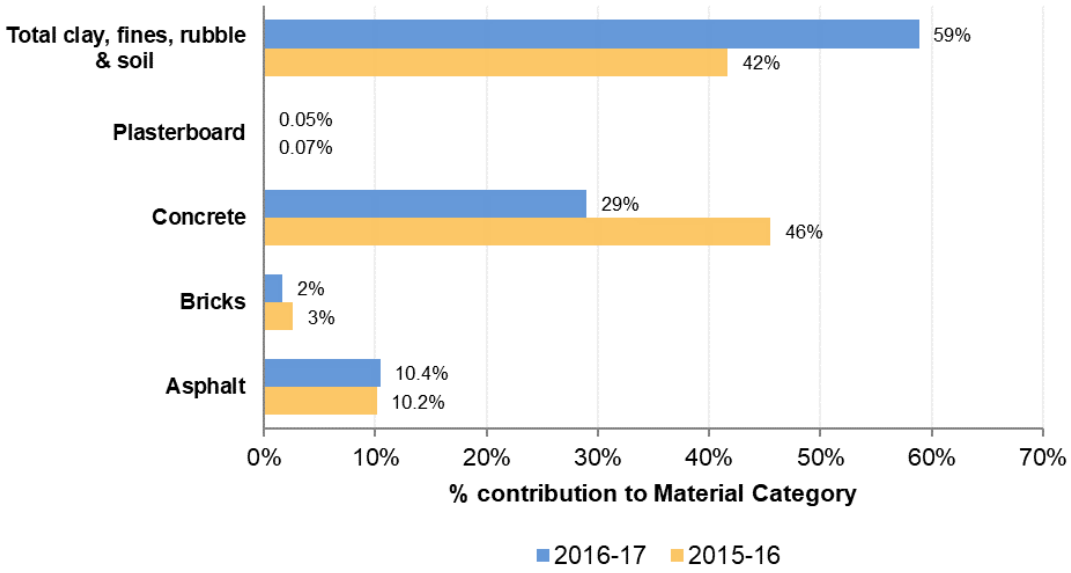

Figure 3.1 **Changes in percent composition of recovered Masonry (by weight), SA, between 2015-16 and 2016-17.**

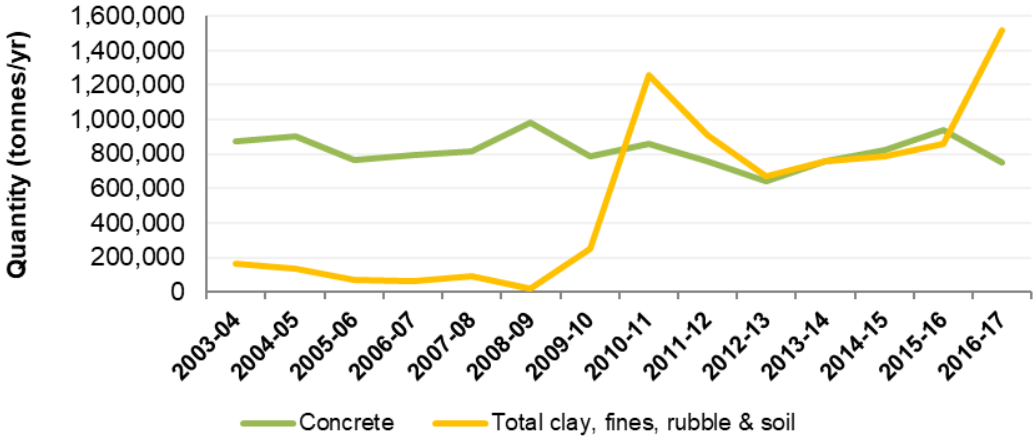

Figure 3.2 **Changes in reported recovered Masonry quantities since 2003-04 – Concrete and Total Clay, Fines, Rubble & Soil.** *Concrete decreased from 2015-16 while and Total Clay, Fines, Rubble and Soil continues increased at a higher rate compared to the previous three surveys.*

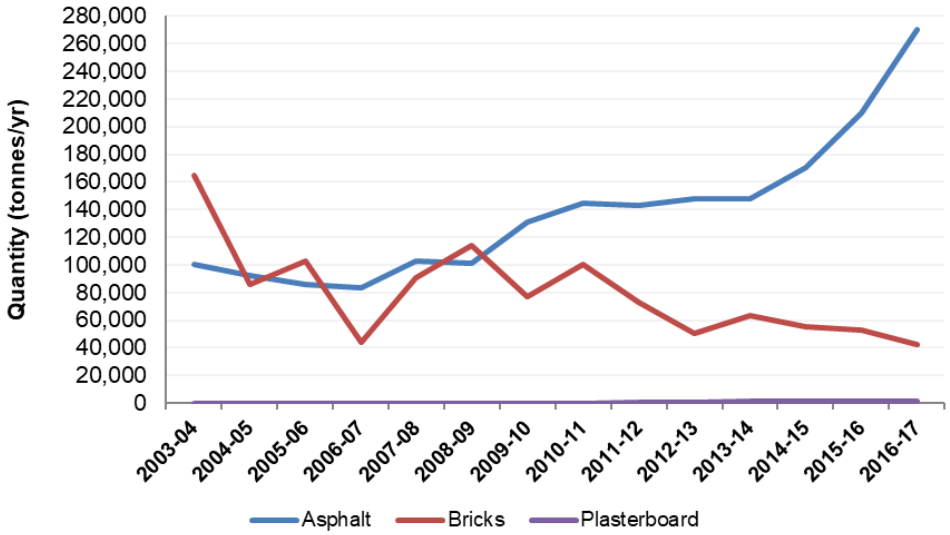

Figure 3.3 **Changes in reported recovered Masonry quantities since 2003-04 – Asphalt, Bricks and Plasterboard.** *Bricks again declined slightly while asphalt continued to increase. Plasterboard maintained its slight rise from its low base.*

As expected and in line with previous years, the majority (98%) of recovered Masonry materials arose from C&D sources (Table 3.2 below) with only small quantities reported from C&I and municipal sources (1% each). Table 3.2 also shows that most of these Masonry materials (97%) were sourced from Metropolitan SA, and all the materials were re-processed locally in SA.

Table 3.2 **Sector and geographical origins and re-processing locations for recovered Masonry in SA in 2016-17.** *The metropolitan region and C&D sector provided the source of most recovered Masonry for SA, which was locally re-processed.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	Municipal	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Asphalt	0.5%	2%	97.5%	99%	1%	100%	0%	0%
Bricks	2%	2%	96%	91%	9%	100%	0%	0%
Concrete	1%	3%	96%	96%	4%	100%	0%	0%
Plasterboard	6%	1%	93%	92%	8%	100%	0%	0%
Total Clay, Fines Rubble & Soil	0%	1%	99%	98%	2%	100%	0%	0%
Clay, fines, rubble & soil - IWS (separately reported)	0%	0%	100%	100%	0%	100%	0%	0%
Total clay, fines, rubble & soil	0%	1%	99%	99%	1%	100%	0%	0%
Total	**1%**	**1%**	**98%**	**98%**	**2%**	**100%**	**0%**	**0%**

The volumes of Masonry materials recovered in SA are affected by fluctuations in building C&D activity that occur from year to year (Figures 3.2 and 3.3).

- Clay, Fines, Rubble & Soil rose to the highest levels since the survey commenced, on the back of several major infrastructure projects in 2010-11.
  - These high levels reduced over the 2011-12 and 2012-13 financial years as projects progressed past their major waste generating phases but have since increased as new Government funded infrastructure projects (e.g. South Road upgrades, Northern Connector) in SA continue or commence.
- Asphalt rose again, which may also relate to the above major infrastructure projects in SA.
- Plasterboard, which was introduced as its own category to the SA Recycling Activity Report in 2010-11, remains a minor quantity and the tonnes are consistent with 2015-16.

The outlook for recovery of Masonry materials is strong:

- The commercial viability of Masonry materials reprocessing is strengthened by the SA Solid Waste Levy, which is set to increase from $57 /tonne at the start of 2016-17 up to $103/tonne in 2019-20 for Metropolitan waste. This levy makes recovery of C&D materials more cost-effective than sending the material to landfill.
- The supply of Masonry materials is expected to remain high due to generation of materials from infrastructure projects including South Road upgrades and the Northern Connector project.
- It is expected that demand for recovered clean fill materials will outstrip supply in the short term, with many infrastructure projects (Northern Connector) needing significant volumes of fill material to their needs.

3.2 Metals

Highlights:

- *In 2016-17 the quantity of recovered Metals increased for Steel and decreased slightly for Non-ferrous Metals and Aluminium when compared to 2015-16.*
- *Recycled Steel volumes were affected by higher metal prices and larger volumes of recovered material from a few manufacturing business closures.*
- *The price of scrap steel, although slightly higher, remains low compared to prices over the last 20 years.*
- *The immediate outlook for Metals recovery is positive (for the 2017-18 financial year), as prices remain steady and the sale of Whyalla Steelworks. However, there is still some uncertainty long term as declines in scrap metal from the manufacturing sector are expected to continue, placing greater competition to secure the remaining local sources of scrap steel.*

The total quantity of recovered Metals reported for SA during 2016-17 was approximately 310,000 tonnes (Table 3.3 overleaf), which is up by 16% (or 43,000 tonnes) from 2015-16. This increase was due to an improvement in recovered Steel:

- Steel increased by 20% (or 45,000 tonnes); while
- Non-ferrous Metals decreased by 6% (or 1,000 tonnes) and
- Aluminium volumes decreased by 5% (or 1,000 tonnes) from 2015-16.

Although Steel quantities increased from 2015-16, it is still below all other volumes reported since 2005-06 (see Figure 3.4 overleaf).

The deterioration in scrap steel resource recovery has placed significant pressure on SA's metal re-processors over recent years, and there is greater competition to secure the remaining local sources of scrap steel that is reducing in volume with manufacturing activity reductions. Lower volumes mean higher re-processing costs due to reduced economies of scale from their fixed capital investments in equipment and plant.

Despite this, the price for scrap steel has increased for the first time in 20 years, relieving some of the pressure on local reprocessing of scrap steel. In addition, a few manufacturing businesses that have closed have now been demolished and the metal from this recovered. These factors have led to an increase in Metal recovery for the 2016-17 financial year.

Table 3.3 **Quantity of Metals (tonnes) recovered in SA during 2016-17, including estimated reporting error (tonnes & %).** *Steel remained the dominant contributor to recovered Metals in SA.*

Item	Net Recovery[1]	Reporting Error	
	tonnes	tonnes	%
Steel	275,000	26,000	9%
Aluminium	17,000	2,100	12%
Non-ferrous Metals	18,000	4,100	23%
Total	**310,000**	**32,000**	**10%**

1. Net recovery excludes re-processing losses

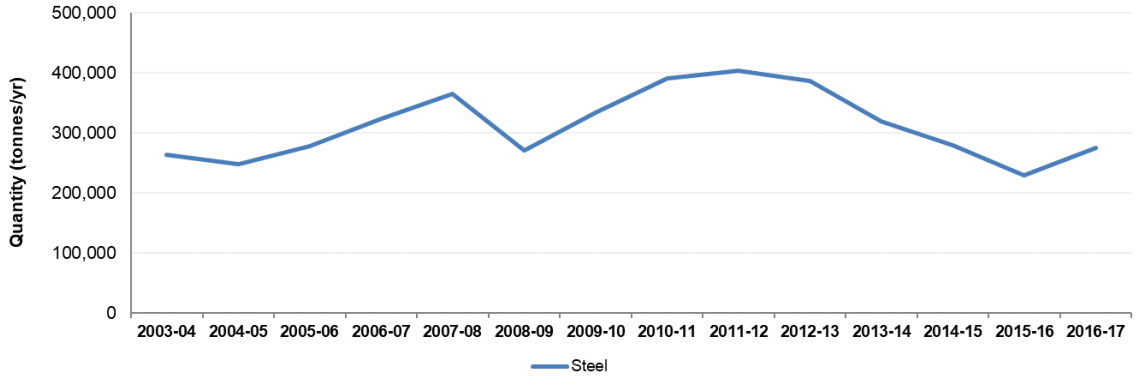

Figure 3.4 **Changes in reported *recovered* metal quantities since 2003-04 – Steel.** *Although recovery fell from 2011-12 to 2015-16, there has been an increase in the 2016-17 financial year.*

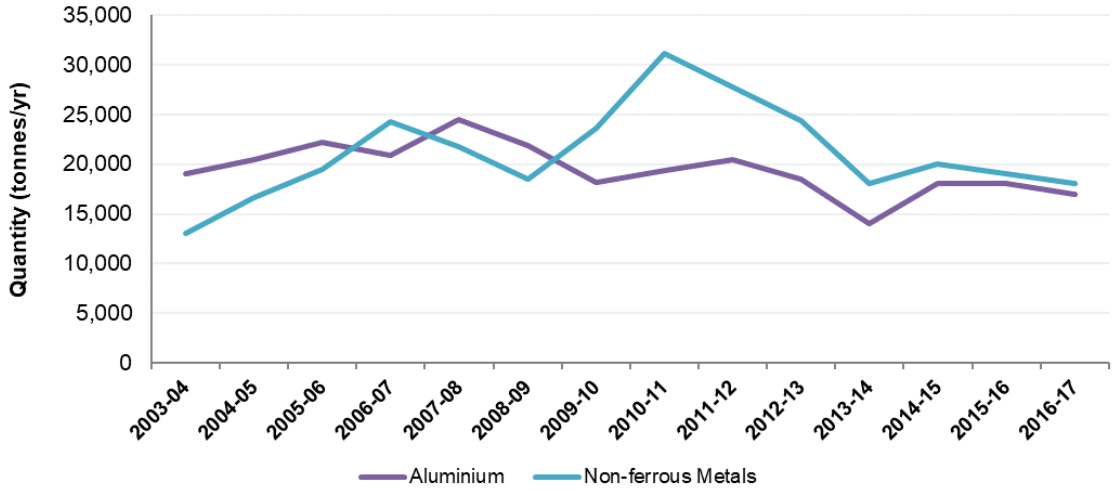

Figure 3.5 **Changes in reported *recovered* metal quantities since 2003-04 – Aluminium and Non-ferrous Metals.** *Recovery of Aluminium and Non-ferrous has fallen slightly from 2014-15.*

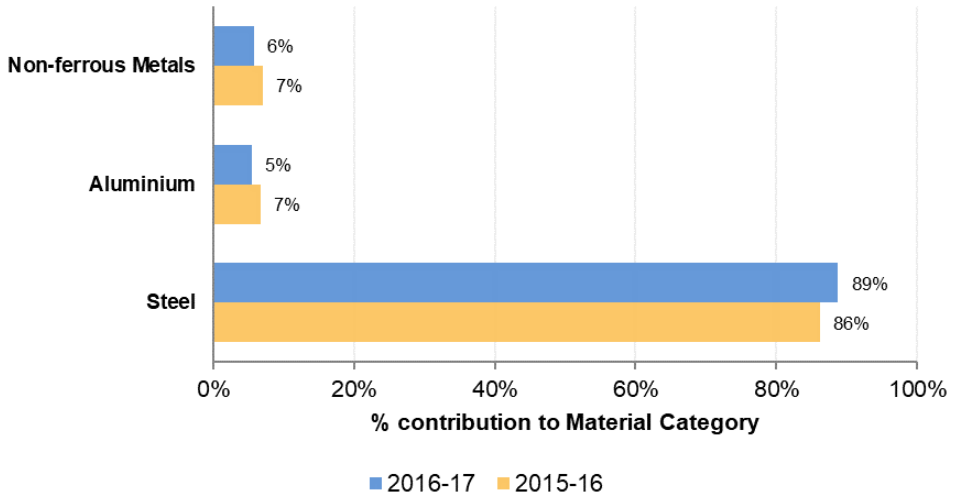

Figure 3.6 **Changes in percent composition of recovered Metals (by weight), SA, between 2015-16 and 2016-17.** From 2015-16 to 2016-17, Steel's composition has increased slightly while Aluminium and Non-Ferrous metals have decreased their composition.

All scrap metal recovered in SA 2016-17 was sent for material recovery. There were 6,200 tonnes (3,000 from Victoria, 3,000 from NSW and 200 from Northern Territory) of scrap metals imported into SA during 2016-17 for resource recovery or re-processing (which is additional to tonnes reported for SA in Table 3.3).

Steel continued to constitute the majority (89%) of Metal recovery (Figure 3.6 above). Non-ferrous Metals and Aluminium made up 6% and 5% of reported Metal recovery respectively.

During 2016-17, 70% of scrap metal volumes were sourced from the C&I sector, with remaining volumes sourced from the MSW sector (20%) and C&D sector (10%).

A total of 24% of scrap metal was re-processed locally at a local steelworks and metals foundries, while overseas exports increased by 12 percentage points to 44% in 2016-17 (from 32% in 2015-16), with the balance sent interstate (32%) for recycling.

There has been an increase in the recovered Aluminium and Non-ferrous Metals re-processed in SA (up 10 percentage points and 34 percentage points respectively from 2015-16). This has led to a decline in the proportion of Aluminium and Non-ferrous Metals sent interstate or overseas for recycling from 2015-16 (see Table 3.4).

Table 3.4 **Sector and geographical origins and re-processing locations for recovered Metals in SA during 2016-17.** *C&I was the major sector origin for recovered Metals. There is some re-processing of recovered Steel in SA, but most recovered Metals are sent interstate or overseas. Note that sums may not equate due to rounding.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	Municipal	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Steel	19%	70%	10%	77%	23%	24%	33%	43%
Aluminium	31%	62%	7%	79%	21%	11%	9%	80%
Non-ferrous Metals	17%	70%	14%	77%	23%	40%	40%	20%
Total	**20%**	**70%**	**10%**	**77%**	**23%**	**24%**	**32%**	**44%**

Although there was a slight improvement in overall recovered Metals volumes in the 2016-17 financial year, the outlook for Metals recovery for the next period is expected to remain challenging, with further falls anticipated for quantities recovered in SA.

- Declines in scrap metal from the manufacturing sector are expected to continue as businesses that traditionally produce scrap metal as part of their processes close. As a consequence, there will be even more intense competition for the scrap metal left in the market.

Another factor reported to be impacting on the Metals recovery sector is the Solid Waste Levy. This levy increases operating costs involved with disposing the 'flock' residual from re-processing to landfill. To limit further increases in the levy from adding more pressure on local scrap metal recovery operations, the State Government fixed the Solid Waste Levy applicable to shredder floc disposal at $62 per tonne for disposal in metropolitan Adelaide (rather than the standard rate of $76 per tonne) for the period between September 2016 and 30 June 2017.

In addition, the sale of Whyalla Steelworks, and other business ventures planned in the state (for example manufacturing of electric cars) may help the Metals industry.

3.3 Organics

Highlights:

- *In 2016-17 overall quantities of Organic material recovery increased slightly.*
- *This increase was largely driven by a rise in Garden Organics, which may be partly attributed to higher rainfall volumes in 2016-17 than 2015-16.*
- *While there was a decline in Timber and Other Organics reprocessed in SA that were sourced from SA, an additional 23,000 tonnes of organic waste materials were imported to SA for resource recovery.*
- *Most organics recovered in SA (98%) is locally reprocessed.*
- *The outlook for recovered organics remains positive.*

The total quantity of recovered Organics reported for SA during 2016-17 was approximately 1.1 million tonnes (Table 3.5 below), which is up by 0.7% (or 7,200 tonnes) from 2015-16.

Figures 3.7 and 3.8 overleaf demonstrate that the increases came from Garden Organics (up 38,000 tonnes or 15%) and Food Organics (up 200 tonnes or 2.5%). Organics Other decreased by 8,000 tonnes (or 1%), and Timber decreased by 23,000 tonnes or 8% from 2015-16.

The decrease in timber volumes was driven by a natural ebb and flow effect in SA's forestry industry, and volumes of Other Organics decreased due to Miscellaneous Organics decreasing by 20,000 tonnes (as Meat Rendering volumes remained consistent and Waste Grease & Fat and Waste Sludge & Bio-solids both increased from 2015-16).

Most recovered Organics materials were sent for material recovery. Some timber (69,000 tonnes or 28%) and Other Organics (19,000 tonnes) were used for energy recovery in SA. Table 3.5 below includes the material recovery quantities versus tonnes used for energy recovery (in SA).

Table 3.5 **Quantity of Net Organics (tonnes) recovered in SA during 2016-17, including estimated reporting error (tonnes & %).** *Use of Timber and Miscellaneous Organics for energy production in SA is presented in this table by columns to show recovery for material and energy recovery.*

Item	Material Recovery tonnes	Energy Recovery tonnes	Net Recovery[1,2] tonnes	Reporting Error tonnes	Reporting Error %
Food Organics	8,100	-	8,100	1,200	15%
Garden Organics	293,000	-	293,000	58,000	20%
Timber	182,000	69,000	250,000	39,000	16%
Other Organics	543,000	19,000	562,000	61,000	11%
- Meat Rendering	240,000	-	240,000	12,000	5%
- Waste Grease & Fat	130,000	-	130,000	22,000	17%
- Waste Sludge & Bio-solids	32,000	-	32,000	9,000	29%
- Miscellaneous Organics	143,000	19,000	160,000	18,000	11%
Total	**1,025,100**	**88,000**	**1,113,100**	**159,200**	14%

1. Net recovery excludes re-processing losses
2. Net recovery = Material Recovery + Energy Recovery

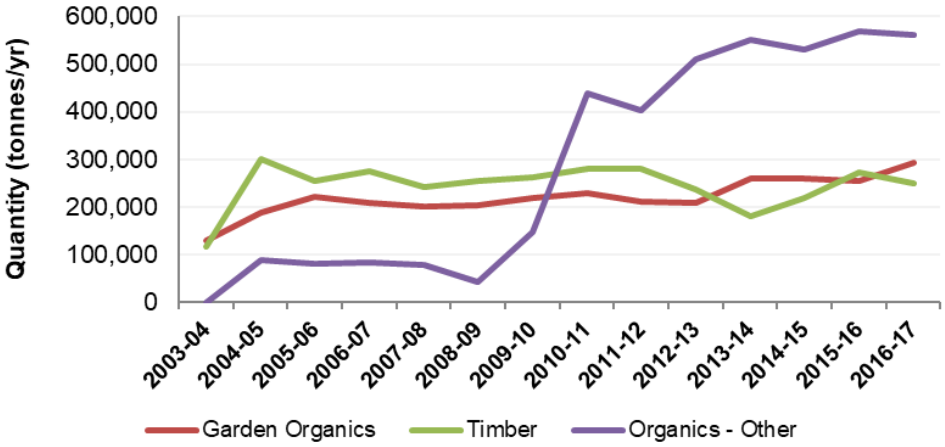

Figure 3.7 **Changes in reported recovered organics quantities since 2003-04 – Garden Organics, Timber and Other Organics.** *Organics – Other and Timber decreased slightly, while Garden Organics increased from 2015-16.*

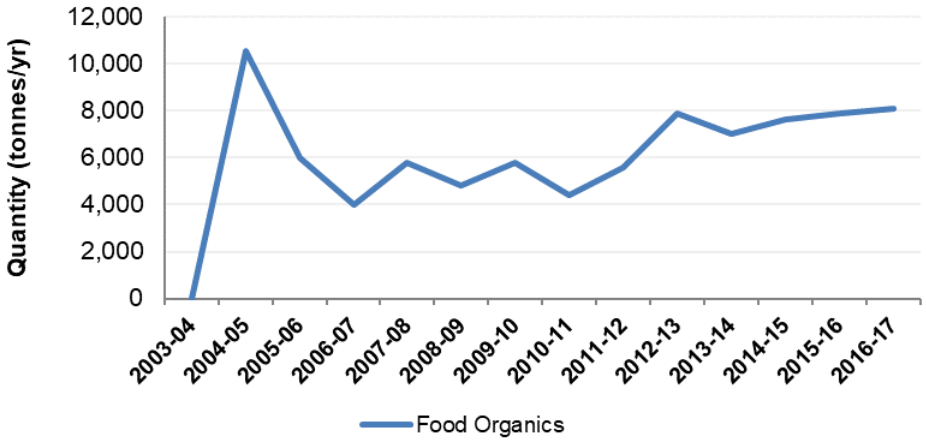

Figure 3.8 **Changes in reported recovered organics quantities since 2003-04 – Food Organics**. *There was an increase in Food Organics during 2016-17 from the last reported financial year (2015-16).*

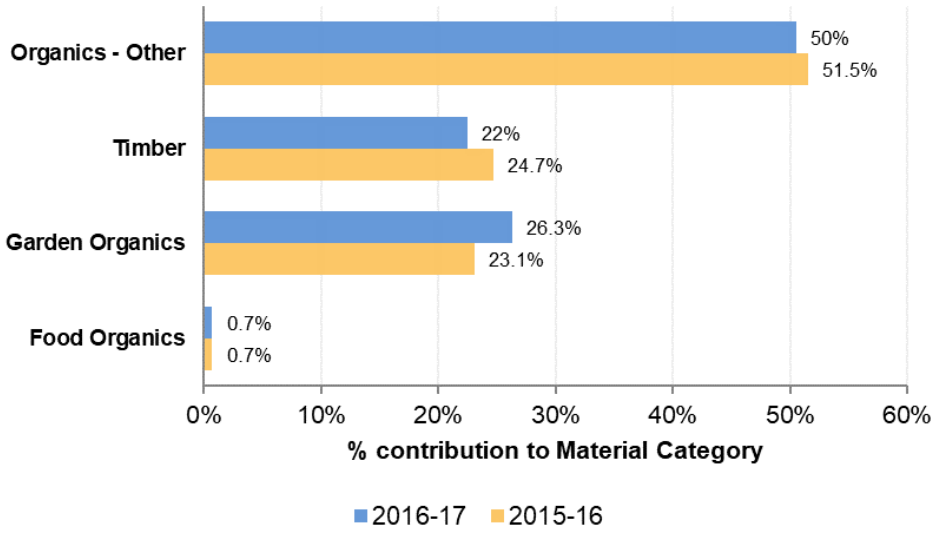

Figure 3.9 **Changes in percent composition of recovered Organics (by weight), SA, between 2015-16 and 2016-17.** *Garden Organics increased its contribution to this material sector.*

During 2016-17, 64,400 tonnes of organic waste material was imported to SA for resource recovery (which is additional to tonnes reported for SA in Table 3.5). About 91% of this material (Timber and Green Waste and Meat Rendering) originated from Victoria with the balance arriving from NSW.

Other Organics (meat rendering, grease trap, bio-solids, etc.) continued to constitute the majority (50%) of Organics recovery (Figure 3.9 above).

Garden Organics and Timber were also significant contributors, making up 26% and 22%, respectively of reported Organics recovery.

In 2016-17, the majority (73%) of recovered Organics originated from C&I sources including material from the timber, meat rendering and wine production industries (Table 3.6 overleaf). Approximately 22% of recovered Organic materials originated from municipal sources, which was dominated by a large amount of Garden Organics. Small quantities (5%) were sourced from the C&D sector, which were the Timber and Garden Organics streams.

Due to the significant contribution by regional industries to Other Organics and Timber, nearly half (43%) of recovered Organics was sourced from SA's regional areas (see Table 3.6 overleaf). The majority (97%) of Organics was re-processed in SA.

Table 3.6 **Sector and geographical origins and re-processing locations for recovered organics in SA during 2016-17.** *C&I is still the major source sector for organics and regional areas contribute substantially to resource recovery. Nearly all re-processing of waste organics occurs in SA. Note percentages may not sum to 100% due to rounding.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Food Organics	0%	100%	0%	90%	10%	100%	0%	0%
Garden Organics	76%	20%	5%	90%	10%	100%	0%	0%
Timber	0.2%	84%	16%	60%	40%	100%	0%	0%
Other Organics	5%	95%	0%	37%	63%	95%	5%	0%
Total	**22%**	**73%**	**5%**	**57%**	**43%**	**97%**	**3%**	**0%**

The outlook for Organics recovery for the next period generally remains positive:

- Feedback from the industry during the survey indicated a positive outlook for organics recycling;
- However, the competition for incoming tonnes remains high, with a number of organics re-processors in the market and demand for end products often exceeding supply;
- An ongoing challenge for some re-processors is contamination of incoming tonnes of organics;
- Although Timber decreased slightly from 2015-16, the tonnes recovered remained strong compared to previous years;
- Anaerobic digestion of organic streams is currently undertaken or being considered in a number of locations across the state by a selection of organisations.

Reported barriers for re-processors in the organics sector included on-going high cost of electricity, transport costs, the cost to remove contamination, and the challenges associated with meeting demand when it can take some time to make the product.

3.4 Cardboard and Paper

Highlights:

- *In 2016-17 overall quantities of recovered Cardboard & Paper increased (by 9% from 2015-16).*
- *All Cardboard & Paper was reported to be sent interstate or overseas for re-processing.*
- *The commodity price of cardboard remained strong in 2016-17, however recent changes in China led to a late decrease in the value of this commodity, which is expected to decrease in the 2017-18 financial year.*
- *Overall volumes of Cardboard and Paper are expected to decline over the coming years in response to the declining local manufacturing industry and reduced print media.*

The total quantity of recovered Cardboard & Paper materials reported for SA during 2016-17 was approximately 249,000 tonnes (Table 3.7 below), which was an increase of 9% (or about 21,500 tonnes) from 2015-16 figures.

There was an increase in Cardboard & Waxed Cardboard (up 13% from 2015-16) and Magazines & Newsprint (13% increase, driven by Magazines), while Liquid Paperboard and Printing & Writing Paper decreased (down 39% and 36% respectively, Figures 3.10 and 3.11 overleaf). This is anticipated to continue to decline as increased electronic media is used in place of printing and writing paper.

However, despite anticipation that overall volumes of Magazines & Newsprint will decline as digital continues to replace printed media, the data here suggests that while Newsprint is declining slowly, and Phone Books have declined to very small volumes, the recycling of magazines is increasing.

During 2016-17 no Cardboard & Paper was reported as being collected for energy production in SA, nor were any of these waste materials imported into SA for resource recovery. This aligns with the findings in the 2015-16 survey.

Table 3.7 **Quantity of Cardboard & Paper (tonnes) recovered in SA during 2016-17, including estimated reporting error (tonnes & %).** *Cardboard & Waxed Paper and Magazines & Newsprint remained the dominant contributors in this sector.*

Item	Net Recovery [1]	Reporting Error	
	tonnes	tonnes	%
Cardboard & Waxed Cardboard	170,000	19,000	11%
Liquid Paperboard	1,200	390	33%
Magazines & Newsprint[2]	69,000	9,067	13%
Printing & Writing Paper	9,000	2,500	28%
Total	**249,200**	**31,000**	**12%**

1. Net recovery excludes re-processing losses
2. Magazines & Newsprint includes Phone Books. All three material streams were reported together for the first time in 2012-13.

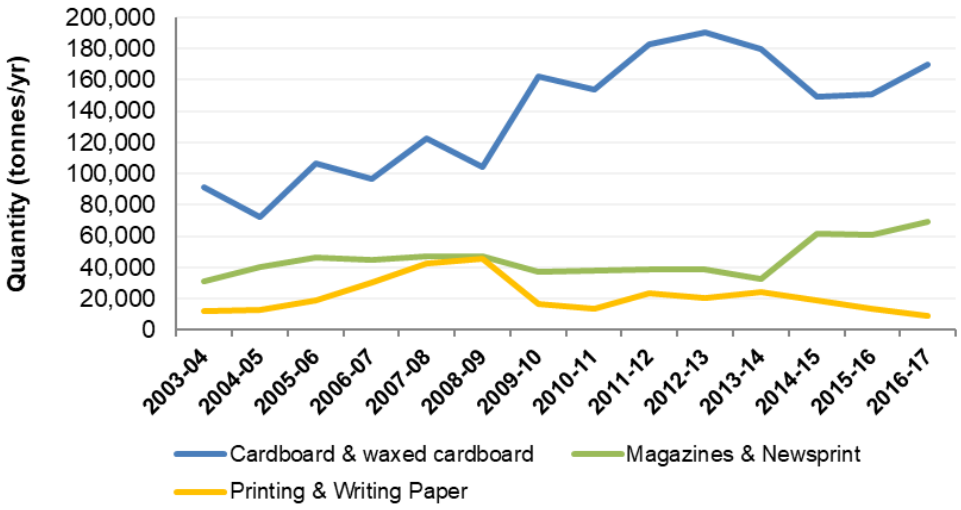

Figure 3.10 **Changes in reported recovered Cardboard & Paper quantities since 2003-04 – Cardboard & Waxed Cardboard, Magazines & Newsprint and Printing & Writing Paper.** *There was an increase in Cardboard & Waxed Cardboard and Magazines & Newsprint.*

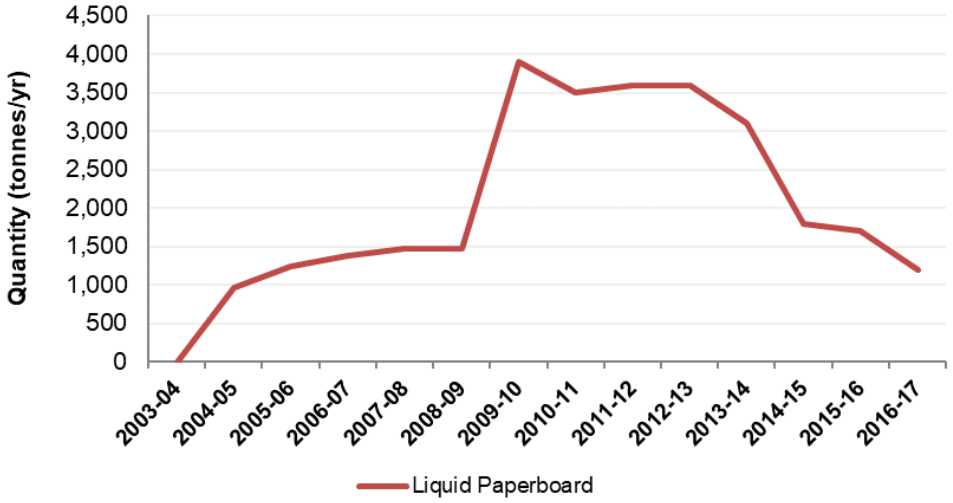

Figure 3.11 **Changes in reported recovered Cardboard & Paper quantities since 2003-04 – Liquid Paperboard.** *Liquid Paperboard continued to decline.*

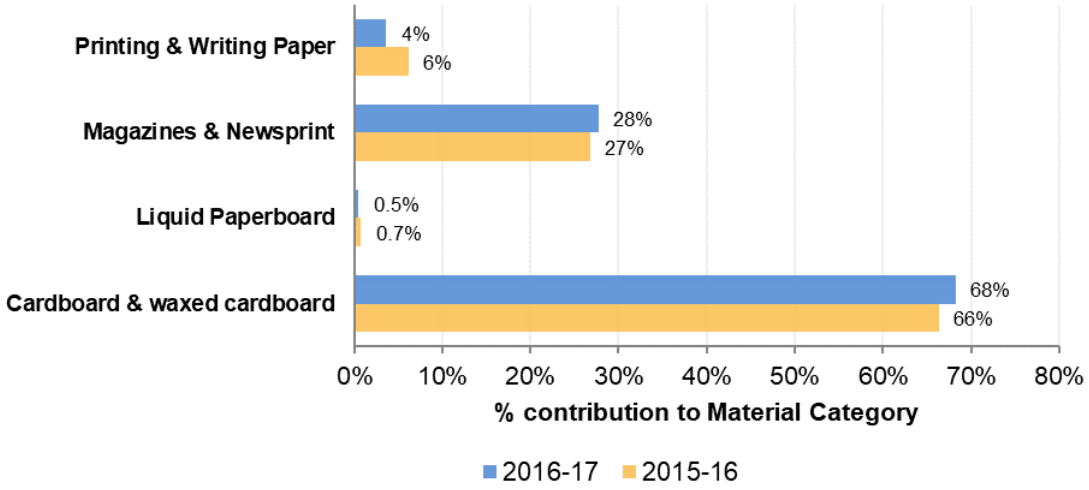

Figure 3.12 **Changes in percent composition of recovered Cardboard & Paper (by weight), SA, between 2015-16 and 2016-17.** *Relative contributions by the different material types has remained consistent with the previous financial year.*

The relative contributions of each material to the Cardboard & Paper sector have remained consistent with 2015-16 (Figure 3.12 above). In 2016-17, Cardboard & Waxed Cardboard contributed 68% of the resource recovery, Magazines & Newsprint provided 28%, Printing & Writing Paper delivered 4%, with Liquid Paperboard at only 0.5%.

2016-17 sources and destinations aligned with findings from 2015-16:

- C&I and Municipal sources made up 64% and 35% of reported recovered Cardboard & Paper materials respectively (Table 3.8 overleaf).
- The proportion of Cardboard & Paper sent overseas for re-processing was 45%, with the remaining 55% sent interstate (Table 3.8 overleaf)
- Most Cardboard & Paper (91%) was sourced from Metropolitan SA (Table 3.8 overleaf).

Table 3.8 **Sector and geographical origins and re-processing locations for recovered Cardboard & Paper in SA during 2016-17.** *C&I and MSW were the main source sectors, most recovery occurred from metropolitan Adelaide, and all recovered materials are sent interstate and overseas for re-processing. Note that percentages may not equate to 100% due to rounding.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Cardboard & Waxed Cardboard	15%	85%	0%	91%	9%	0%	35%	65%
Liquid Paperboard	77%	23%	0%	71%	29%	0%	47%	53%
Magazines & Newsprint	87%	13%	0%	90%	10%	0%	100%	0%
Printing & Writing Paper	21%	79%	0%	94%	6%	0%	70%	30%
Total	**35%**	**64%**	**0%**	**91%**	**9%**	**0%**	**55%**	**45%**

The outlook for recovery of Cardboard & Paper is expected to become challenging, as the price for recovered Cardboard in 2016-17 fluctuated substantially and at the end of the financial year dropped considerably. Prices are expected to remain low in 2017-18, as fewer tonnes are sent to China while additional tonnes are sent to other countries, decreasing overall demand for the materials.

Overall volumes of Cardboard & Paper are expected to reduce over time due to continued reduction of Cardboard generation as SA's manufacturing industry declines coupled with expected declines in print media (e.g. Magazines and Newspapers) as digital consumption of news media rises.

However, this may be offset by businesses improving recycling of paper and cardboard, as it was mentioned in the surveys that waste generators are recycling more. There may also be additional cardboard due to increase in online purchases which require delivery and subsequently, cardboard packaging may increase.

3.5 Plastics

Highlights:

- *2016-17 saw a slight increase in reported quantities of recovered Plastics from 2015-16.*
- *This was due to an increase in LDPE and Mixed Plastics. About a third of total plastic generated in SA was re-processed locally.*
- *In addition, 6,950 tonnes of plastic were imported into SA for recycling.*
- *Although Plastics volumes increased in 2016-17 from the previous financial year, a significant decline in this sector is anticipated for the 2017-18 financial year, with some Plastics recyclers closing.*
- *There are challenges associated with re-processing the materials to meet China's standards as well as the decreasing price of plastics.*

The total quantity of recovered Plastics reported for SA during 2016-17 was 28,500 tonnes (Table 3.9 below), which is up by 2% (or 619 tonnes) from 2015-16.

Mixed &/or Other Plastics constituted the majority (49%) of reported Plastics recovery followed by HDPE (16%), PET (15%), and LDPE (14%) (Figure 3.13 overleaf). All plastics recovered as individual polymers were sent for material recovery, while 54% (7,600 tonnes) of Mixed Plastics recovered during 2016-17 were re-processed for energy recovery in SA (Table 3.9). In 2016-17, local re-processors imported 6,950 tonnes of Plastics into SA for resource recovery (which is additional to tonnes reported for SA in Table 3.9). The imported waste plastic material was in the form of source separated polymers and the majority (42%) of this imported waste plastic was sourced from NSW. Waste plastic material was also obtained from Vic (27%), WA (26%), NT (3%), and Queensland (1%).

Table 3.9 **Quantity of Plastics recovered (tonnes) in SA during 2016-17, including estimated reporting error (tonnes & %).** *There was a slight increase in net resource recovery from 2015-16.*

Item	Material Recovery tonnes	Energy Recovery tonnes	Net Recovery[1,2] tonnes	Reporting Error	
				tonnes	%
Polyethylene Terephthalate (PET)	4,200	-	4,200	1,020	24%
High density Polyethylene (HDPE)	4,500	-	4,500	590	13%
Polyvinyl Chloride (PVC)	10	-	10	0	0%
Low density Polyethylene (LDPE)	4,100	-	4,100	930	23%
Polypropylene (PP)	1,400	-	1,400	140	10%
Polystyrene (PS)	300	-	300	25	8%
Mixed &/or Other Plastics (MIX)	6,400	7,600	14,000	3,310	24%
Total	**20,900**	**7,600**	**28,500**	**6,000**	**21%**

1. Net recovery excludes re-processing losses
2. Net recovery = Material Recovery + Energy Recovery

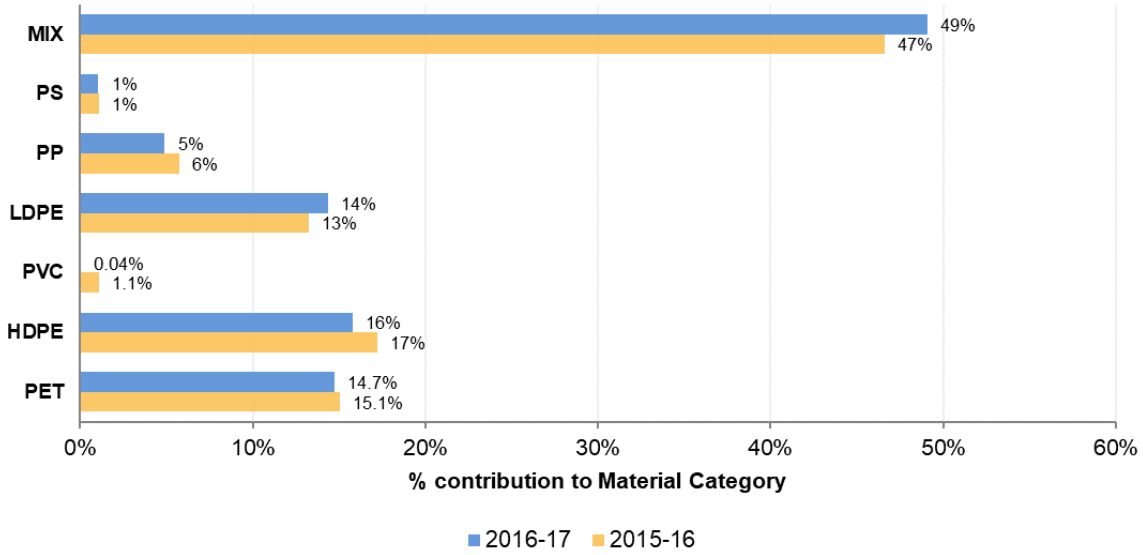

Figure 3.13 **Changes in percent composition of recovered Plastics (by weight), SA, between 2015-16 and 2016-17.** *Mixed Plastics remained a significant contributor to resource recovery at 49% of all plastics.*

The increase in Plastics recovery during 2016-17 from 2015-16 was due to increases in Mixed Plastics and LDPE (Figures 3.14 and 3.15 overleaf):

- Mixed &/or Other Plastics was up by 8% (or 1,000 tonnes);
- LDPE also increased slightly, up 11% (or 410 tonnes);
- PET and PS remained stable at 4,200 and 300 tonnes respectively;
- The remaining polymers decreased, with PVC decreasing 97% or 290 tonnes due to the closure of PVC re-processing businesses, HDPE decreasing 7% or 330 tonnes and PP reducing 15% or 230 tonnes.

The continued rise in Mixed Plastics appears to be due to several factors:

- There has been an increase of mixed plastics recovered by MRF operators.
- There has been a steady increase in mixed plastics recovery from commercial and industrial businesses.
- There has been an increase of mixed plastics sent to energy from waste facilities.

The recovery of total plastics has risen since 2003-04 (Figure 3.16), from 8,600 tonnes in 2003-04 up to 28,500 in 2016-17.

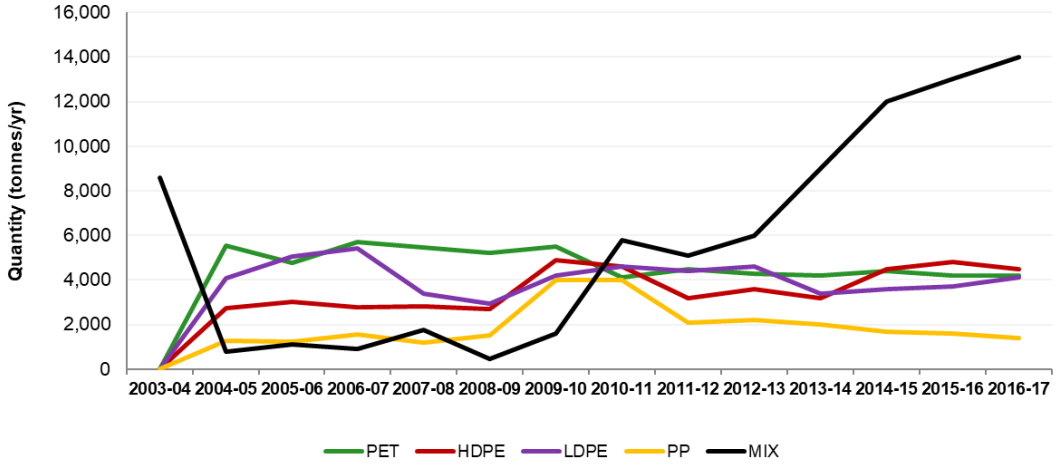

Figure 3.14 **Changes in reported recovered Plastics quantities since 2003-04 – PET, HDPE, LDPE, PP and MIX.** *Mixed plastics remains a significant contributor to plastics recovery by weight.*

Figure 3.15 **Changes in reported recovered Plastics quantities since 2003-04 – PVC and PS. PVC** *recovery decreased significantly, while PS quantities rose.*

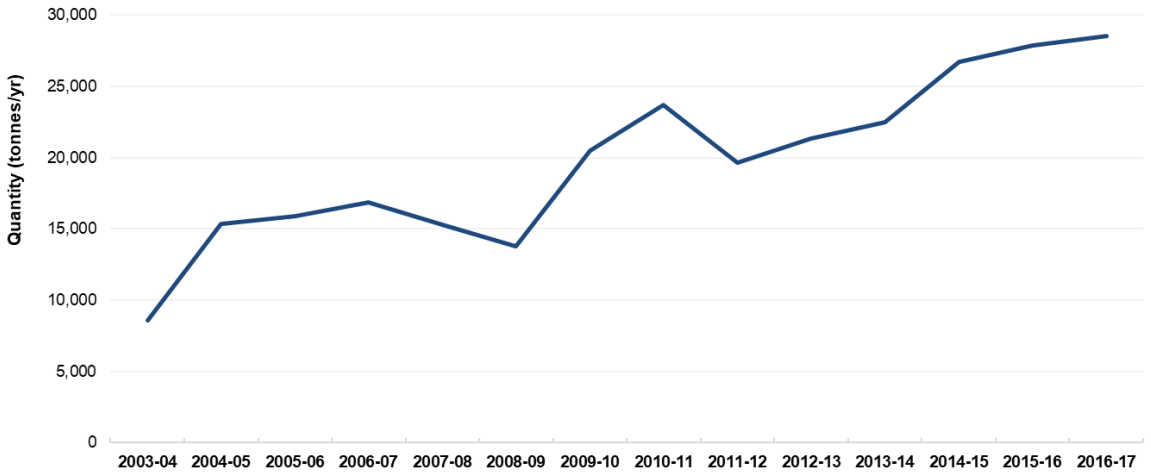

Figure 3.16 **Changes in reported recovered Plastics quantities since 2003-04 – all Plastics.** *Overall quantity of recovered plastics rose since 2015-16, maintaining a steady upward trend over time.*

In 2016-17, C&I and C&D sources of reported recovered Plastics remained steady from 2015-16 sources in relation to sector and geographical origin (see Table 3.10 below for 2016-17 data). Almost half (48%) comes from the C&I sector and the majority from Metropolitan Adelaide (86%). Only 37% of Plastics re-processing occurred in SA in 2016-17, although this is a slight increase from 2015-16, where 34% was re-processed in SA. This is expected to decline as a large Plastics re-processor closed down in the state during the period. However, in 2016-17 SA re-processors continued to take all types of recovered plastic materials except for PVC, and PET to a lesser extent. While this included re-processing for material recovery, significant quantities (7,600 tonnes) continue to be sent for re-processing into a form suitable for energy recovery in SA.

Plastics reprocessing in SA is expected to decline:

- The value of plastics per tonne has fallen;
- Local re-processors reported that high electricity and utility costs in SA continued to be a large cost to their operations;
- Multiple large Plastics recyclers ceased trading in 2016-17 and 2017-18 in South Australia;
- Significant challenges remain in the international market, with China changing the accepted contamination levels and format of plastics (e.g. from baled to granulated), which has reduced some SA Plastics recycler's ability to send plastics to China without purchasing equipment here or paying to further reduce contamination or change the format of the plastics. As such, recovered plastics are shifting from China to other countries such as Vietnam, lowering the overall demand for plastics but increasing supply. This lowers the price and number of destinations for the plastics.
- However, a local facility is investigating increasing re-processing of mixed plastics into fuel for energy recovery, which may see greater volumes of waste plastics re-processed in SA for this purpose.

Table 3.10 **Sector and geographical origins and re-processing locations for recovered plastics in SA in 2016-17.** *The majority of plastic is recovered from the C&I and MSW sectors. Metropolitan Adelaide is the source of most plastics. There is still substantial re-processing of plastics in SA with an increase from 34% in 2015-16 to 37% in 2016-17.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Polyethylene Terephthalate (PET)	65%	35%	0%	79%	21%	1%	92%	7%
High density Polyethylene (HDPE)	58%	38%	3%	83%	17%	36%	39%	25%
Polyvinyl Chloride (PVC)	0%	100%	0%	80%	20%	0%	0%	100%
Low density Polyethylene (LDPE)	10%	90%	0%	75%	25%	19%	11%	69%
Polypropylene (PP)	3%	95%	3%	80%	20%	38%	0%	62%
Polystyrene (PS)	1%	61%	38%	92%	8%	10%	0%	90%
Mixed &/or Other Plastics (MIX)	35%	38%	27%	94%	6%	54%	38%	8%
Total	**37%**	**48%**	**14%**	**86%**	**14%**	**37%**	**40%**	**23%**

3.6 Glass

Highlights:

- *In 2016-17 the total quantity of recovered Glass increased by 5% from 2015-16.*
- *The majority of Glass was sourced from the C&I sector and was re-processed locally.*
- *In addition, 49,400 tonnes of glass were imported to SA for re-processing.*
- *The outlook for glass is expected to remain steady.*

The total quantity of recovered Glass reported for SA during 2016-17 was 67,000 tonnes, which is an increase of 5% (or 3,000 tonnes) from 2015-16 (see Table 3.11 below and Figure 3.17 overleaf). All of this recovered glass was packaging, including glass bottles and jars (see Section 5 for additional information on packaging).

A further 49,400 tonnes of Glass was imported to SA in 2016-17 for re-processing. Victoria was the major source (at 45%), with NSW (37%), NT (8%), WA (5%) and overseas (4%).

During 2016-17, most Glass (65%) was recovered from C&I sources and the remainder was from MSW (35%, see Table 3.12 overleaf). The decrease in Glass from MSW was due to a change in composition of kerbside recycling in this year's survey, with this material contributing a lower percentage of comingled recycling materials arriving at MRFs.

The majority (87%) of Glass was from metropolitan sources and re-processed in SA (89%), with the balance (11%) sent interstate (Table 3.12 overleaf).

The outlook for recovery of Glass is expected to remain steady:

- A significant part of the Glass recovery arises from glass bottles returned as part of SA's container deposit (or CDL) scheme.
  - This source of glass is of high quality and highly prized by re-processors and glass bottle manufacturers as a source for recycled glass content.
- Industry have indicated that prospects of Glass is positive.

Table 3.11 Quantity of Glass recovered (tonnes) in SA during 2016-17, including estimated reporting error (tonnes & %).

Item	Net Recovery [1]	Reporting Error	
	tonnes	tonnes	%
Glass	**67,000**	**17,000**	25%

1. Net recovery excludes re-processing losses

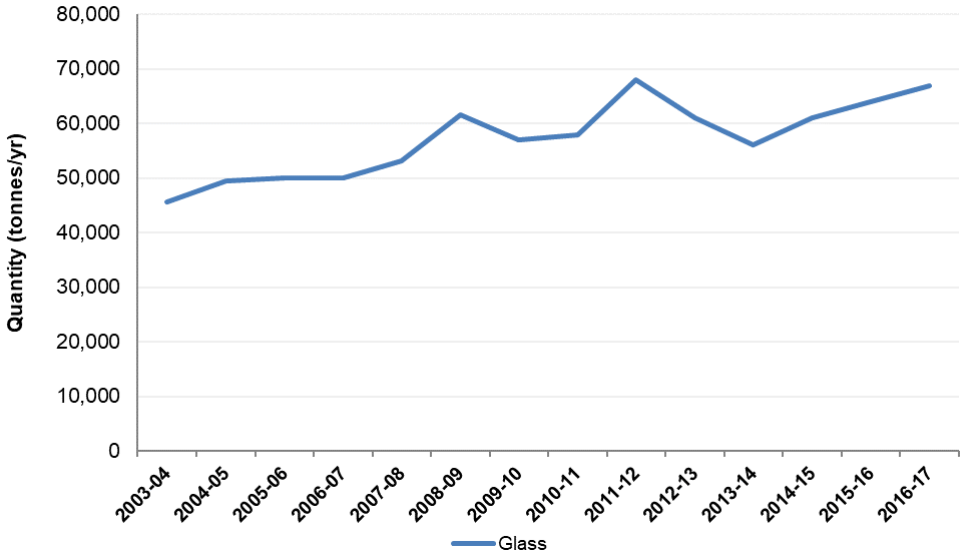

Figure 3.17 **Changes in reported recovered Glass quantities since 2003-04 – Glass.** *Glass quantities have increased since 2013-14.*

Table 3.12 **Sector and geographical origins and re-processing locations for recovered Glass in SA in 2016-17.** *All resource recovery occurs from Municipal and C&I sources, most of which is re-processed locally.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Glass	35%	65%	0%	87%	13%	89%	11%	0%

3.7 Other Materials

Highlights:

- *In 2016-17 the overall quantity of recovered Other Materials declined, which was largely driven by another drop in Fly Ash and Foundry Waste.*
- *Recovery of Fly Ash is now at zero tonnes, reflecting the closure of coal-fired power stations in SA and depletion of stockpile fly ash volumes.*
- *The reduction in Foundry Waste is following the decline in SA's manufacturing and industrial activity.*

The total quantity of recovered Other Materials reported for SA during 2016-17 was approximately 48,400 tonnes (Table 3.13 below), which is down by 69% (108,400 tonnes) from 2015-16. This decrease was principally driven by:

- Fly Ash, which decreased by from 100,000 tonnes in 2015-16 to zero tonnes in 2016-17 (see Figure 3.19 overleaf);
- Foundry Waste (down 29% or 11,000 tonnes from 2015-16, see Figure 3.18 overleaf); and

Meanwhile, Tyres & Other Rubber increased by 1,500 tonnes or 8%, and Leather & textiles remained consistent with 2015-16. None of the waste material from this sector was used for energy production in SA, but all Tyres & Other Rubber (predominantly tyres) are understood to be exported overseas for energy recovery.

During 2016-17, 31,400 tonnes of Other Materials were imported into SA for resource recovery, 59% of which was from overseas. The majority of interstate imports were from Victoria (26%).

Table 3.13 **Quantity of Other Materials (tonnes) Net recovered in SA during 2016-17, including estimated reporting error (tonnes & %).** *Tyres & other rubber has increased and leather & textiles remained the same. Foundry Waste decreased and Fly ash moved to zero with the closure of Port Augusta power station.*

Item	Net recovery [1]	Reporting Error	
	tonnes	tonnes	%
Fly ash	0	0	0%
Foundry Waste	24,500	900	4%
Leather & textiles	4,000	600	15%
Tyres & other rubber	19,900	900	5%
Total	**48,400**	**2,400**	5%

1. Net recovery excludes re-processing losses

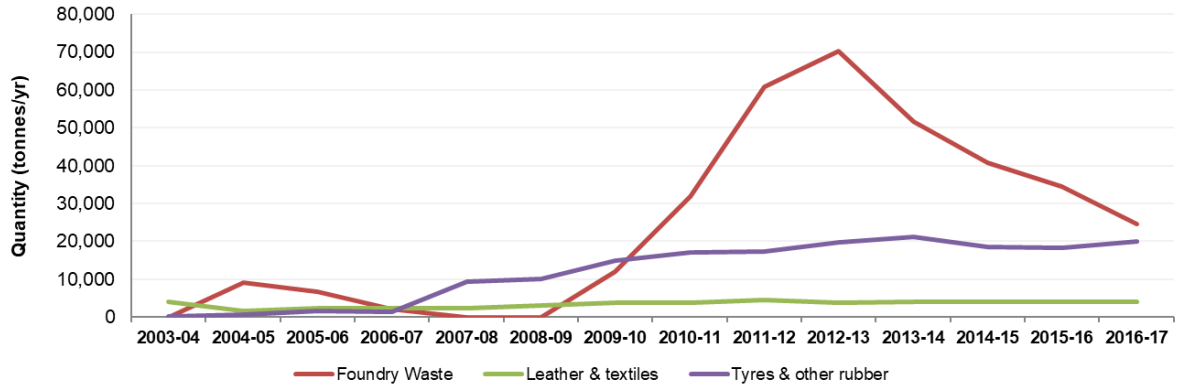

Figure 3.18 **Changes in reported recovered Other Materials quantities since 2003-04 – Foundry Waste, Leather & Textiles, and Tyres & Other Rubber.** *Foundry Waste continues to drop, while Leather & Textiles and Tyres & Rubber remain stable.*

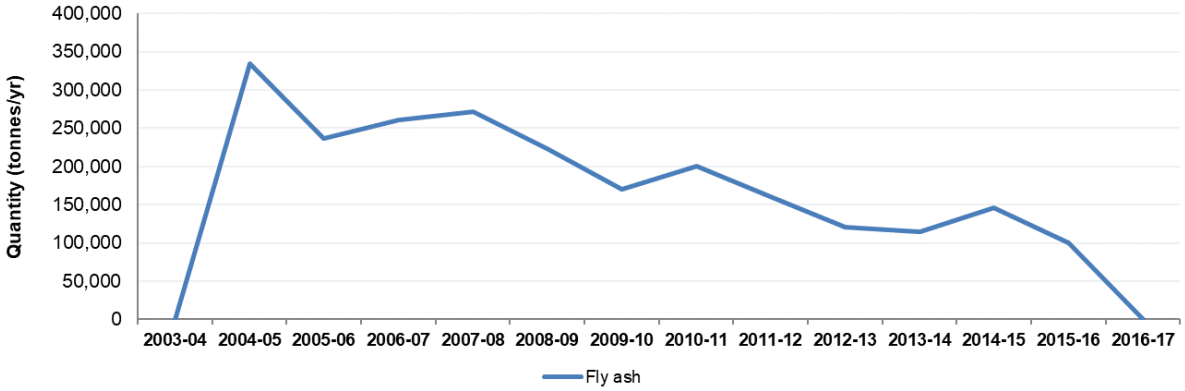

Figure 3.19 **Changes in reported recovered Other Materials quantities since 2003-04 – Fly Ash.** *Fly Ash decreased to zero with the closure of the Port Augusta Power Station*

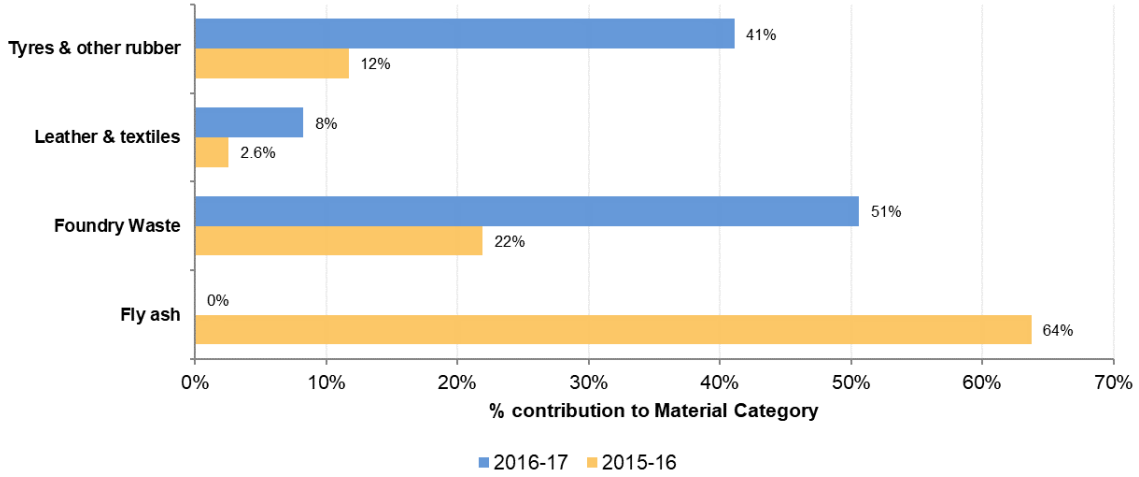

Figure 3.20 **Changes in percent composition of recovered Other Materials (by weight), SA, between 2015-16 and 2016-17.** *Proportions of the other materials increased due to Fly Ash decreasing to 0% contribution.*

With Fly Ash at zero, Foundry Waste is now the biggest contributor to Other Materials (51%), and Tyres & Other Rubber now contribute 41% of all the Other Materials (see Figure 3.20 above). The proportion of material sourced from metropolitan Adelaide has increased relative to regional SA, and while C&I volumes make up the majority (77%) of overall volumes (Table 3.14 below), which decreased from 93% in 2015-16 due to no tonnes of Fly Ash.

All reported Foundry Waste was re-processed in SA for cement production (Table 3.14), and most of the Leather & Textiles were sent interstate (80%) for processing into cleaning cloths.

Table 3.14 **Sector and geographical origins and re-processing locations for recovered Other Materials in SA in 2016-17.** *Most Other Materials are produced by the C&I Sector with the origin shifting from 2015-16 to predominantly metro based*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Fly Ash	NA	NA	NA	NA	NA	NA	NA	NA
Foundry Waste	0%	100%	0%	56%	44%	100%	0%	0%
Leather & Textiles	18%	82%	0%	99%	1%	0%	80%	20%
Tyres & Other Rubber	4%	96%	0%	75%	25%	0%	6%	94%
Total	**23%**	**77%**	**0%**	**67%**	**33%**	**51%**	**9%**	**40%**

All tonnes of recovered Tyres & Other Rubber were sent interstate or overseas. The minority of this material is granulated for tyre-derived products interstate, with the remainder exported overseas for energy recovery.

The outlook for future resource recovery in the Other Materials sector is expected to continue to decline, due to on-going reductions the recovery of Foundry Waste in line with reduced manufacturing and industrial activity in SA. Fly Ash is expected to remain at zero tonnes per annum.

Tyre recyclers indicated that there is no growth in the market for tyre consumption and therefore the recovered tyre quantities are likely to remain steady.

4 Electronic and Electrical Waste

At a glance:

- *The total volumes of recovered E-waste increased in 2015-16 by 6% from the previous year, with larger volumes of Computers, Batteries, Printer Cartridges and Compact Fluorescent Lamps.*
- *TVs / monitors, Mobile Phones and Other E-Waste decreased, potentially due to reduced weight of these items, as well as fewer CRT televisions presented for recycling with most CRTs recovered in previous years during the digital switchover. The reduction in E-waste volumes may also be due to reduced promotion of the product stewardship scheme.*
- *Most material (74%) continues to be reprocessed in SA, mostly through manual disassembly into constitute parts.*

The total quantity of recovered E-waste reported for SA during 2016-17 was 5,130 tonnes (Table 4.1 below), which is up by 6% from the reported tonnes in 2015-16 (4,850 tonnes).

The increase was mainly due to additional tonnes of Computers being recycled, up from 1,800 tonnes in 2015-16 to 2,300 tonnes in 2016-17 (28% increase). There were slight increases in Printer Cartridges (10 tonnes or 7%), Batteries (20 tonnes or 50%) and Compact Fluorescent Lamps (30 tonnes or 50%).

There were decreases in Televisions and Monitors (200 tonnes or 8%), Other E-Waste (20% or 80 tonnes) and Mobile Phones (1 tonne or 17%). The continued decrease in Televisions/ Monitors could be due to:

- Reduced weight of these items
- Reduced number of Cathode Ray Tube (CRT) televisions and an increase in lighter flat screen televisions, and
- Reduced promotion of the product stewardship scheme for Computers and TVs.

Table 4.1 **Changes in reported quantities of E-waste between 2015-16 and 2016-17**[1]**.** *TVs/Monitors and Computers were major contributors to E-waste recovery in SA.*

Item	2015-16	2016-17	% change 15-16 to 16-17
Printer Cartridges	140	150	7%
Compact Fluorescent Lamps	60	90	50%
Batteries	40	60	50%
Computers	1,800	2,300	28%
Televisions / Monitors	2,400	2,200	-8%
Mobile Phones	6	5	-17%
Other E-waste	400	320	-20%
Total	**4,850**	**5,130**[2]	**6%**

1. Net recovery excludes re-processing losses
2. This value has a reporting error of 880 tonnes (+/-17%).

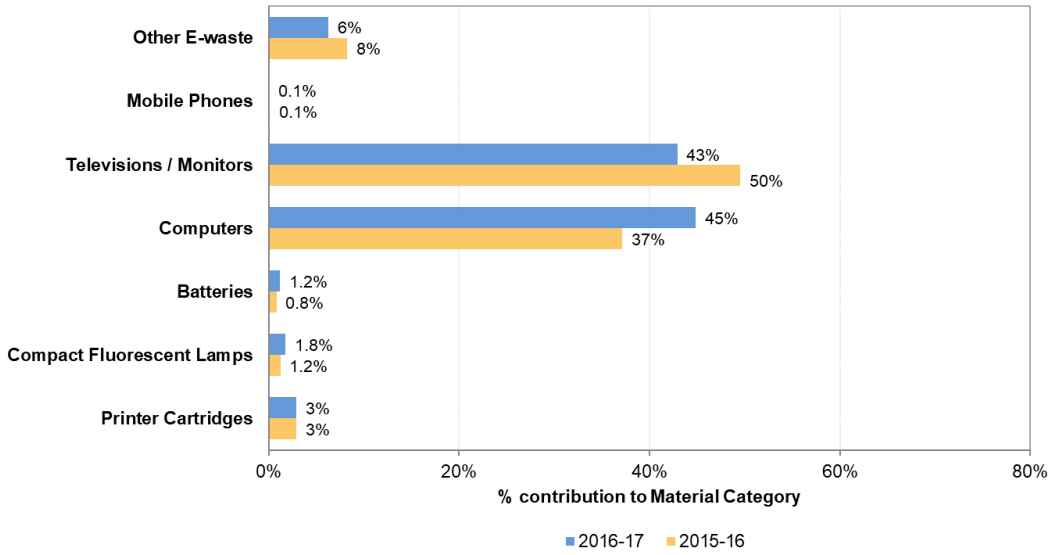

Figure 4.1 **Changes in percent composition of recovered E-waste (by weight), SA, between 2015-16 and 2016-17.** *Although there has been a significant decrease in TVs/Monitors, they remain the major contributors to E-waste in SA, along with Computers.*

Compared to 2015-16, changes were seen in received E-Waste in Televisions/ Monitors (down to 43% contribution), Computers (up to 45%) and Other E-Waste (down to 6%, see Figure 4.1 above).

Most E-waste (68%) during 2016-17 was sourced from MSW sources, which is above the 2015-16 proportion (61%). C&I again made up the balance in SA (32% in 2016-17).

Table 4.2 also shows that 7% of E-waste volumes was recovered from regional sources, with the balance (93%) from metropolitan SA. The destination for 74% of E-waste materials was reported as SA, with the rest sent interstate.

This mainly reflects the location where the E-waste is dissembled or separated into its metal, plastic and other material constituents, which are disposed to local aggregators/merchants. These local aggregators/merchants then determine where the constituent materials will be re-processed. It is understood that smelting of E-waste to break it down to its constituent parts (e.g. lead, copper etc) will continue to increase, as the development of a large smelter completes its upgrade in regional SA. However, for E-waste sent to other destinations, it can be challenging to accurately discern the ultimate re-processing destination for E-waste materials.

Table 4.2 **Sector and geographical origins and re-processing locations for recovered E-waste in SA in 2016-17.** *C&I has increased to become the dominant sector, most the E-Waste was recovered from metropolitan areas, and was initially re-processed in SA.*

Item	Sector Origin (%)			Geographical Origin (%)		Re-processing Location (%)		
	MSW	C&I	C&D	Metro	Regional	SA	Interstate	Overseas
Total E-waste	68%	32%	0%	93%	7%	74%	26%	0%

The recovery of E-waste items is anticipated to increase as the End-Of-Life (EOL) National TV/ Computer Recycling Scheme increases its recovery targets[5]. In addition, stations have been set up in more convenient locations across the state (e.g. hardware stores), which may increase the number of E-Waste items properly disposed by the public. However, while the number of items may increase, the overall weight may not change significantly, due to electronic waste weighing less per unit.

In 2016-17, the recycling target for industry was 58% (which will rise to 80% by 2026-27, see ANZRP, 2017). State, territory and/or local governments are responsible for the remainder of the waste (e.g. 42% in 2016-17).

Presently, there is no requirement for how governments should deal with the remainder of the EOL TV/Computer E-waste (not handled by industry under the scheme) and it may be dealt with as deemed appropriate in each jurisdiction. For SA, a landfill ban has been implemented on E-Waste. As mentioned, SA now has a well-established E-waste drop off network in public areas to capture both scheme and non-scheme E-waste. This will help reduce these risks, although it remains an ongoing challenge for future E-waste recovery to ensure that these alternative options exist and that the public is educated about these options and is encouraged to use them.

Figure 4.2 overleaf shows the trends for each E-Waste stream from 2009-10. This displays the televisions/ monitors trend highlighted earlier, which has decreased significantly since 2013-14. Computers have increased since 2013-14.

[5] Under this scheme, industry is responsible for recycling EOL TV/Computer E-waste up to a recycling target set per co-regulatory arrangements established with the Australian Government (Australian Department of Environment, 2014).

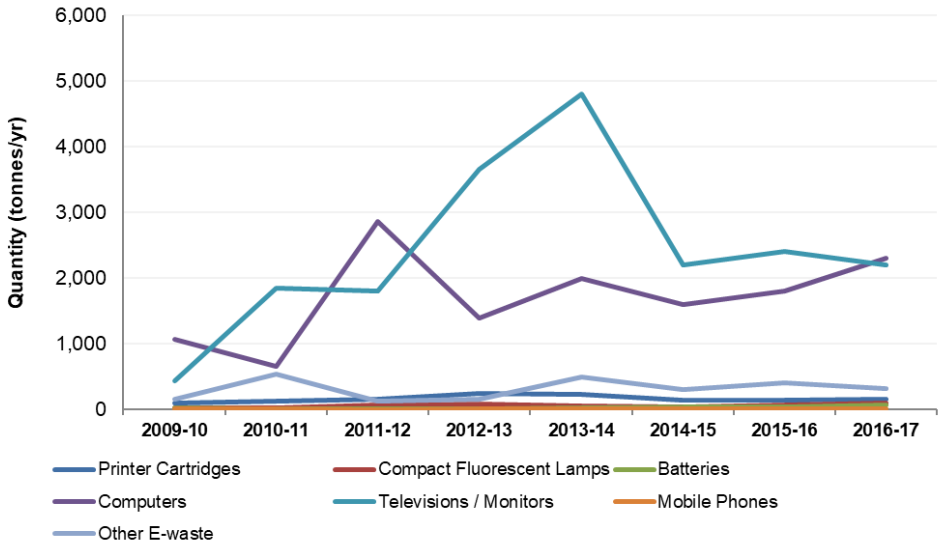

Figure 4.2 **Changes in quantities of recovered E-waste (by weight), SA, between 2009-10 and 2016-17.** *TVs/Monitors and Computers remain the major contributors to E-waste in SA.*

5 Packaging Materials

At a glance:

- *2016-17 saw an increase in the recovery of packaging materials in SA, up by 9% from 2015-16.*
- *The main contributor to this increase was increases in cardboard packaging (17,000 tonnes or 11%).*
- *SA's Container Deposit scheme continues to make a substantial contribution to the recovery of packaging materials in SA.*

5.1 Total Packaging

Total packaging recovery was estimated at 250,700 tonnes, of which 43,100 tonnes (17%) was recovered through SA's container deposit scheme, and 207,600 tonnes (83%) was recovered from other sources (Table 5.1 overleaf). The 2016-17 outcome is an increase of 9% or 22,100 tonnes from 2015-16's reported packaging recovery. Most packaging material streams recorded increases from 2015-16 to 2016-17:

- Cardboard packaging increased by 11% (or 17,000 tonnes),
- Glass increased by 3,000 tonnes (4%), due to increases in Glass recycling;
- Another significant increase was LDPE Packaging, which increased by 1,200 tonnes or 29%;
- Steel cans, Aluminium cans, PS packaging and Other Plastics packaging all increased slightly (up by 7%, 3%, 10% and 6% respectively);
- PVC increased from 0 to 10 tonnes.

Decreases were seen in:

- Liquid paperboard (42% reduction or 500 tonnes), which reflects improved reporting rather than a large change in quantities.
- HDPE, which decreased slightly (1%), from 3,757 in 2016-17 to 3,724 tonnes in 2015-16.

The quantities of PET remained steady.

These packaging quantities are a subset of the individual material data presented in Section 3. Packaging materials therefore constitute an important proportion of the total amount of recycling activity reported in SA for some of these individual materials. For example, in 2016-17:

- Glass packaging, PVC packaging, and LPB packaging were all 100% of total recycling activity reported for these materials; and
- PET packaging, Cardboard Packaging and LDPE Packaging were all at least 90% of each materials' recycling activity.

Table 5.1 **Estimated packaging recovery, SA 2016-17**. *Cardboard and glass remain dominant contributors to packaging recovery. Packaging constitutes significant proportions of resource recovery for some materials, such as PET, LDPE, PP, PVC, glass, cardboard and LPB. Note some numbers may not equate due to rounding.*

Packaging Material	Origin (tonnes)		Total packaging (tonnes)	Packaging as a proportion of total material recovered
	CDL [1]	Other		
Steel Cans		2,310	2,310	0.8%
Aluminium Cans	3,800	70	3,870	23%
Cardboard Packaging		153,000	153,000	90%
Liquid Paperboard Cartons	663	578	1,200	100%
PET Packaging	3,900	289	4,189	99.7%
HDPE Packaging	230	3,494	3,724	83%
PVC Packaging		10	10	100%
LDPE Packaging		4,065	4,065	99%
Polypropylene Packaging		1,400	1,400	100%
Polystyrene Packaging		147	147	49%
Other Plastics Packaging		9,744	9,744	70%
Glass bottles & Jars	34,500	32,500	67,000	100%
Total	**43,093**	**207,606**	**250,699**	

1. Data provided by the South Australian Environmental Protection Authority.

5.2 Container Deposits

SA is one of three Australian states or territories to have a container deposit system for return of recyclable beverage bottles and cans.

In 2016-17, glass containers represented 80% (by weight) of returned deposit containers in SA, followed by Aluminium and PET (both 9% by weight, see Figure 5.1). The average return rate for container deposits was 82% (by weight) from approximately 698 million containers (estimated as sold in SA during 2016-17). Although the number of returned CDL was slightly lower in 2016-17 when compared with 2015-16, the return rate remains high and is slightly higher than the return rate of 78% in 2015-16.

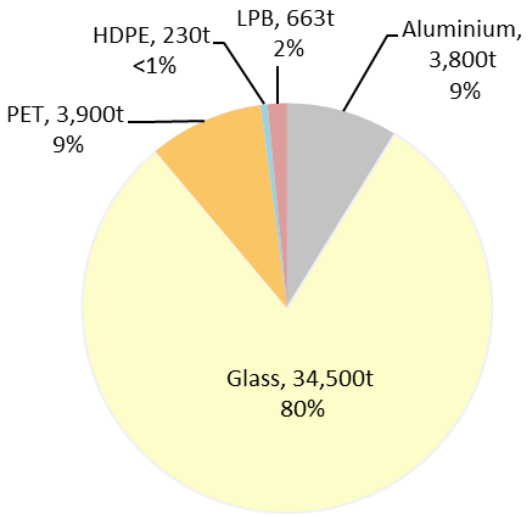

Figure 5.1 **Relative proportions of returned recycled deposit containers (by weight), SA 2016-17**
Glass is the major contributor by weight.

Table 5.2 **Return rates for recycled deposit containers, SA 2016-17.** *SA continues to achieve high return rates of recycled deposit containers, with a slightly higher return rate than 2015-16.*

Material	Recovered (tonnes)	Return rate (%)
Aluminium	3,800	89%
Glass	34,500	85%
PET	3,900	66%
HDPE	230	54%
LPB	663	67%
Total	**43,093**	**82%**

5.3 Other Packaging Materials

Other packaging material is collected through routes such as kerbside recycling and commercial collections. The non-CDL packaging is captured in Figure 5.2 below.

As can be seen in this figure, Cardboard (74%) and Glass (15%) materials were the main contributors to resource recovery of Other Packaging Materials, followed by other Plastics packaging (5%), and all others contributing 2% or less to overall packaging materials by weight.

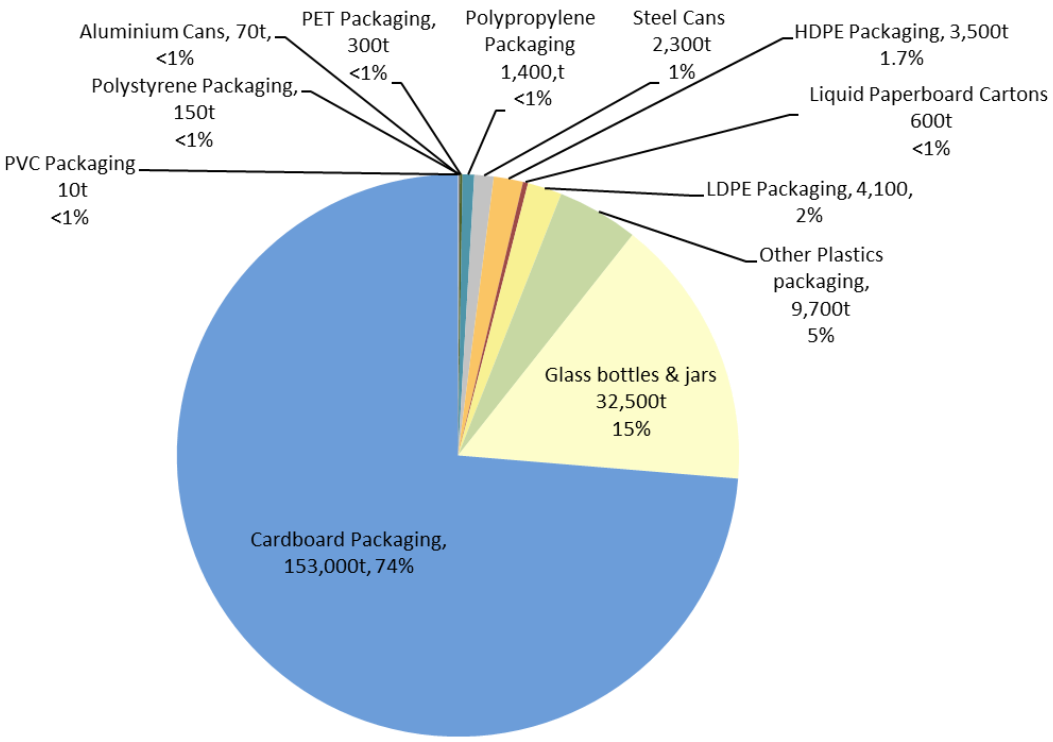

Figure 5.2 **Relative proportions of recovered other packaging materials by weight, SA 2016-17.**

Cardboard and Glass materials are the major contributors to recovery for other packaging materials. Plastics materials overall were a significant contributor to recovery for other packaging materials at 9% of all packaging materials.

6 Resource Recovery Value

At a glance:

- *The resource value of recovered materials in 2016-17 was estimated at $320 million.*
- *This large increase is due to more accurate reporting of commodity/ material values. Comparisons with updated data from previous years are provided.*
- *As a result of the updated data, Organics is now the second largest contributor to the overall value, at 25% of the total. Metals remains first, at 47% of the total resource recovery value in SA.*
- *The average resource value for recovered materials was $85 per tonne.*

The 2016-17 Survey was the first year that included a question on the value of commodities/ materials by stream. This provided more accurate data and resulted in higher resource recovery values. Comparisons with updated figures (prices per tonne) from previous years are made on the following pages to enable an appropriate comparison.

Table 6.1 overleaf provides a general estimated sale price for each material category, and this table and Figure 6.1 (two pages overleaf) provide a breakdown of the value of the materials by their sub-categories.

It is important to recognise that the value of waste materials recovered for recycling can vary significantly from year to year and between jurisdictions depending on a range of factors. These factors can include:

- The type of waste material and industrial product for which it can be recycled or reused;
- The commodity market prices for virgin material that they replace;
- Whether the material will be re-processed locally or exported overseas;
- The quality of this material, including the extent of source separation and/or pre-processing which might have already occurred;
- The demand for the recovered product;
- Regulatory environment, and
- Local waste management and resource recovery practices.

Despite improved data in 2016-17, the resource value estimate presented in this report remains an approximation only.

Based on the quantities reported during this year's Recycling Activity survey, the estimated value of resource recovery for SA during 2016-17 was $320 million, or $85 for each tonne of resource recovered on average (Table 6.1 overleaf).

The major contributor to the 2016-17 resource recovery valuation (at 47%) was Metals (Figure 6.1 and 6.2), of which the commodity value has increased slightly since the updated last reported period. The next most significant contributors to resource recovery value were Organics (at 25%) and Cardboard and Paper (at 18%).

Table 6.1 Assumed market values, quantities and estimated resource value for resource recovered material, 2016-17 [(a)].

Material category	Resource recovery (tonnes)	Estimated on-sale price[(a)] ($/tonne)	Estimated Resource Value ($ millions)[(c)]	Price data source[(a)]:
Masonry	1,063,400	$10	$10.6	Based on RAS survey results
Metals – Steel	275,000	$247	$67.9	Based on RAS survey results and public commodity data
Metals – Other (non-ferrous including Aluminium)	35,000	$2,357	$82.5	Based on RAS survey results and public commodity data
Organics – Meat Rendering[(b)]	120,000	$600	$72.0	Based on RAS survey results
Organics – Garden, Food and Timber[(b)]	375,550	$25	$9.2	Based on RAS survey results
Cardboard & Paper	249,200	$233	$58.2	Based on RAS survey results
Plastics	28,500	$323	$9.2	Based on RAS survey results
Glass	67,000	$85	$5.7	Based on RAS survey results
Other Materials	48,400	$10	$0.5	Based on author estimate
Separately Reported Materials & Clean Fill	1,521,000	$3	$4.3	Based on RAS survey results
TOTAL ALL Materials	3,783,000	$85	$320	

Notes:

(a) Refer to Survey Methodology in Appendix 1 for additional information on resource recovery value assumptions and methodology. Note that 2016-17 was the first year that participants were asked to provide information on the commodity price or value of each material. This provided more accurate estimations on sale price are provided here, based on the price of each stream under the broader material categories above.

(b) Note that the resource recovery tonnes for organics is reduced due to loss of weight during the re-processing phase and therefore the volumes that can be sold, and that tonnes of resource recovered waste grease and fat, waste sludge and biosolids, and miscellaneous organics were not included in the total.

(c) Note that sums may not equate due to rounding

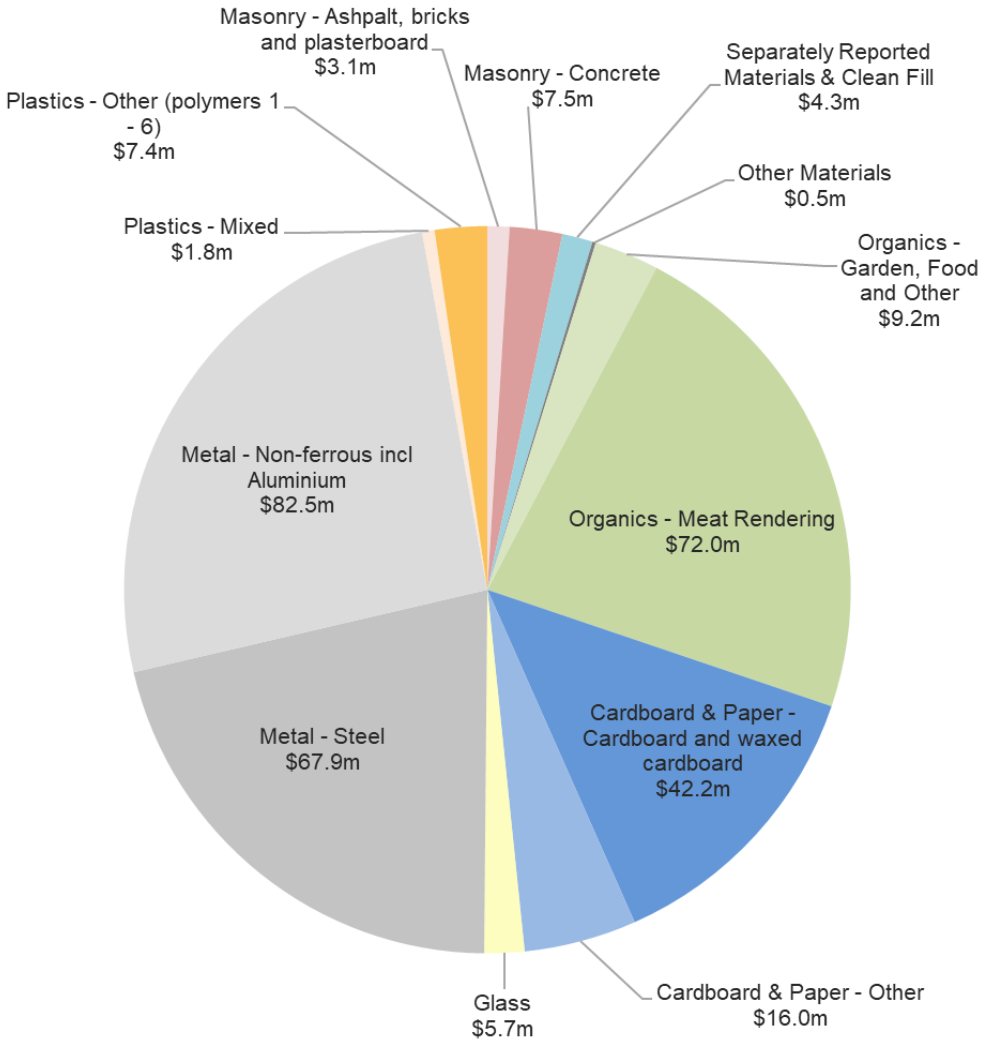

Figure 6.1 Estimated market value of resource recovered materials in SA from the 2016-17 Recycling Activity Survey

Figure 6.1 and Table 6.1 on the previous two pages show a breakdown of the estimated resource value for a number of material streams. As this table and figure demonstrate, large proportions of the value of Organics is due to Meat Rendering, and a large proportion of the value of Metals is attributed to non-steel products, based on the tonnes recovered and the price per tonne for these materials.

Figure 6.2 below compares the estimated market value of resource recovered materials in SA from 2012-13 to 2016-17. The method utilised for this year's analysis was improved and differs to previous years. To enable the comparison with previous years' results, the commodity price or market value data has been applied to previous years where relevant.

As a result, the numbers outlined in Figure 6.2 do not match that of those found in the 2015-16 Report.

The updated data reveals that the value of Resource Recovery to South Australia is much higher than previously reported, with $320 million value reported in 2016-17 (compared with $203 million reported in 2015-16 when less detailed market values were used). When the updated data is compared to previous years, it can be seen that the value of resource recovery market in 2016-17 was only slightly higher than 2015-16, and the value was at its highest in 2012-13. Fluctuations over the past five years are predominately due to changes in the value of the Metals market.

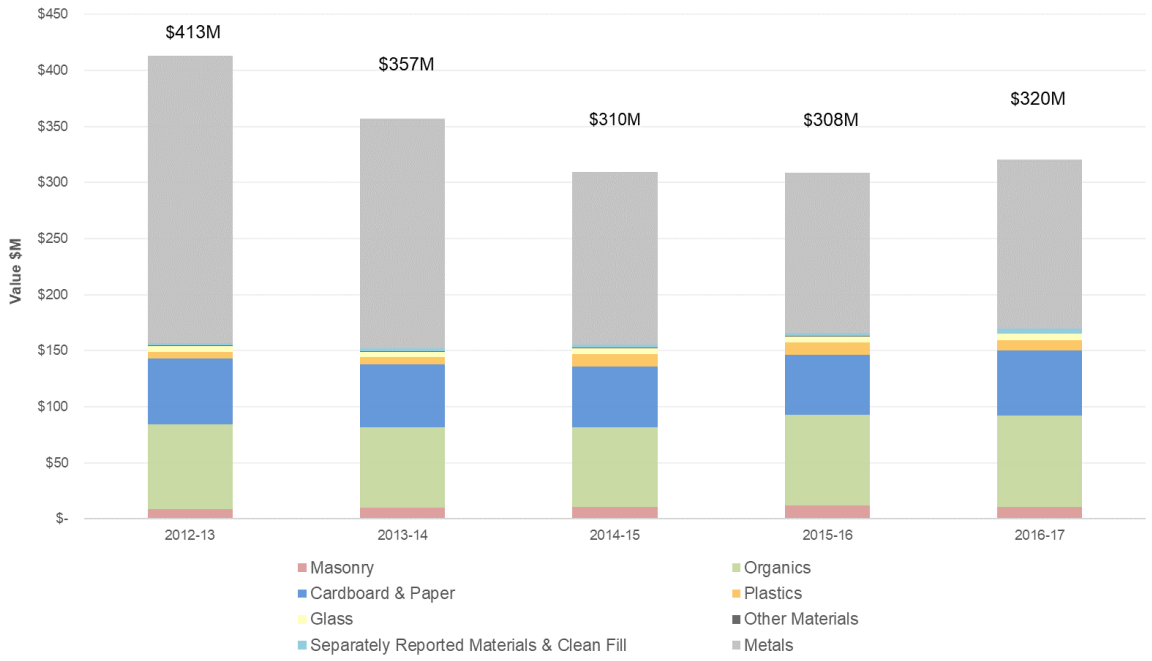

Figure 6.2 Estimated market value of resource recovered materials in SA, 2012-13 to 2016-17

7 Environmental Benefits of Recycling

At a glance:

- *The resource recovery in this year's recycling activity survey was projected to achieve the following environmental benefits from recycling of these materials.*
  - ***Greenhouse Gas Savings** – 1.25 million tonnes of CO2-e*
  - ***Cumulative Energy Demand saved** – 16,030 TeraJoules (TJ)*
  - ***Water Savings** – 13,100 Megalitres (ML)*

7.1 Greenhouse gas savings (or avoided emissions)

Recycling reduces Greenhouse Gas (GHG) emissions primarily by:

- Decreasing the amount of energy, particularly fossil fuels, used by industry to make products compared with using virgin raw materials.
- Reduced emissions of greenhouse gases achieved from diverting recovered materials from landfills which biologically decompose in landfills and generate methane.
- The total estimated greenhouse gas savings from recycling in SA during 2016-17 is about 1.25 million tonnes of CO_2-e (Tables 7.1 and 7.2 and Figure 7.1 on following pages).
- This is an increase of about 6% on the value reported for 2015-16.
- Metals (at 39%) generated the substantive part of the estimated greenhouse gas savings, closely followed by Organics (at 34%), Masonry (13%) and Cardboard & paper (7%). This is in line with findings from the 2015-16 survey.
- These GHG savings are considered approximately equivalent to:
  - About 1.9 million trees that would have to be planted to absorb the same amount of CO_2.
  - The greenhouse gas emissions that 288,500 cars would produce in a year[6].
- The greenhouse gas savings from SA recycling, 2016-17 equate to:
  - Approximately 18% of SA's total Community sector GHG emissions in 2011[7]

[6] Ave car GHG emissions value ≈ 4.25 tonnes CO_2-e/yr, one tonne of recycled material ≈ 1.49 trees; Source: SA 2008-09 Recycling Activity report (Zero Waste SA, 2010)

[7] The Community sector includes GHG emissions associated with residential stationary energy use and passenger vehicle use; Source: Report on the operation on the 'Climate Change and Greenhouse Gas Emissions Reduction Act' 2007 (SA DEWNR 2015).

Table 7.1 Estimated environmental benefits as a result of recycling in SA, 2016-17[a]

	Material	Material Quantity	GHG Emissions Saved[a]	Energy Saved[a]	Water Saved[a]
		tonnes	tonnes CO2-e	TJ LHV	ML
	Masonry				
1	Asphalt	270,000	4,300	550	240
2	Bricks	42,000	400		50
3	Concrete	750,000	21,800	410	960
4	Plasterboard	1,400	66	320	-40
5, 6	Clay, fines, rubble & soil	1,521,000	131,600	1,020	670
	Metals				
7	Steel	275,000	169,100	2,180	-650
8	Aluminium	17,000	251,100	2,910	3,090
9	Non-ferrous metals	18,000	61,100	650	110
	Organics				
10	Food Organics	8,100	4,200	10	6
11	Garden Organics	293,000	67,500	140	140
12	Timber	250,000	82,100	330	140
13, 14, 15, 16	Organics - Other	562,000	270,300	1,220	130
	Cardboard & paper				
17	Cardboard & waxed cardboard	170,000	51,700	2,130	5,620
18	Liquid Paperboard	1,200	800	10	20
19, 20, 21	Magazines & Newspaper	69,000	32,100	620	1,530
22	Printing & Writing Paper	9,000	5,200	120	280
	Plastics				
23	Polyethylene terephthalate	4,200	4,300	210	-90
24	High density polyethylene	4,500	3,100	250	-20
25	Polyvinyl chloride	10			
26	Low density polyethylene	4,100	2,800	230	-10
27	Polypropylene	1,400	2,300	80	-20
28	Polystyrene	300	400	20	-10
29	Mixed &/or Other plastics	14,000	19,100	850	-250
	Glass				
30	Glass	67,000	40,000	430	160
	Other Materials				
39	Fly Ash	0			
40	Foundry Waste	24,500			
41	Leather & Textiles	4,000			
42	Tyres & Other Rubber	19,900	23,600	1,340	1,040
	Total[b]	**4,401,000**	**1,249,000**	**16,000**	**13,100**

Notes:

(a) Refer to Survey Methodology in Appendix 1 for additional information on environmental benefits analysis assumptions and methodology.

(b) Note numbers may not equate due to rounding.

Table 7.2 Estimated greenhouse gas savings as a result of recycling in SA, 2016-17[(a)]

Sector Origin	GHG Emissions Saved[(a)] tonnes CO2-e	Equivalent trees planted required for carbon absorption[(a)]	Equivalent cars off the road (1 year) [(a)]
Masonry	158,200	236,000	36,500
Metals	481,300	719,000	111,200
Organics	424,100	634,000	97,900
Cardboard & paper	89,800	134,000	20,700
Plastics	32,000	48,000	7,400
Glass	40,000	60,000	9,200
Other Material	23,600	35,000	5,500
Total[(b)]	1,249,000	1,866,000	288,000

Notes:

(a) Refer to Survey Methodology in Appendix 1 for additional information on environmental benefits analysis assumptions and methodology.

(b) Note numbers may not sum due to rounding.

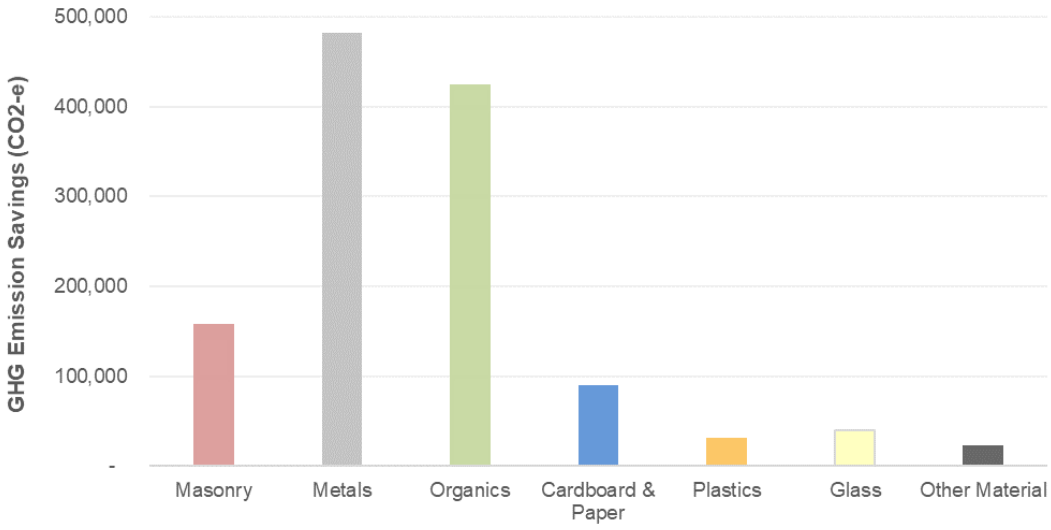

Figure 7.1 Avoided greenhouse gas emissions (by material category), as a result of recycling in SA 2016-17

7.2 Energy Savings

The total projected energy savings (in Terajoules or TJ[8]) from recycling in SA during 2016-17 was about 16,000 TJ (Table 7.1 above and Table 7.3 below & Figure 7.2 overleaf).

- Metals contribute 36% of projected energy savings, even though it represents only 7% of material being recovered in SA. This is because less energy is required to recover metals than to manufacture it from raw materials.
- Similarly, plastics contribute to 10% of energy savings even though it is only 1% of total resource recovery.
- After Metals, Cardboard & Paper (at 18%) is the next most significant contributor to energy savings, followed by Masonry at 14%.
- These energy savings are considered approximately equivalent to:
  - Energy use by 269,500 average households in one year[9].
  - The energy supplied by 2.8 million barrels of oil.
- The energy savings from SA's recycling activity during 2016-17 equate to:
  - Approximately 4.8% of SA's total energy consumption reported for 2016-17[10].

Table 7.3 Estimated energy savings as a result of recycling in SA, 2016-17(a)

Sector Origin	Energy Saved TJ LHV	Equivalent households (1 year) (a)	Barrel of Oil Equivalents (BOE) (a)
Masonry	2,300	38,700	404,000
Metals	5,740	96,500	1,007,000
Organics	1,700	28,600	298,000
Cardboard & paper	2,880	48,400	505,000
Plastics	1,640	27,600	288,000
Glass	430	7,200	75,000
Other Material	1,340	22,500	235,000
Total(b)	16,000	269,500	2,812,000

Notes:

(a) Refer to Survey Methodology in Appendix 1 for additional information on environmental benefits analysis assumptions and methodology.

(b) Note numbers may not sum due to rounding

[8] 1 Terajoule or TJ = 10^{12} Joules (J) = 1,000 Gigajoules (GJ)

[9] Average household energy use value ≈ 59.5 GJ/yr; Source: Han and Karuppannan (2014)

[10] Source: 2017 Australian Energy Update (Australian Government Department of Environment and Energy, 2017).

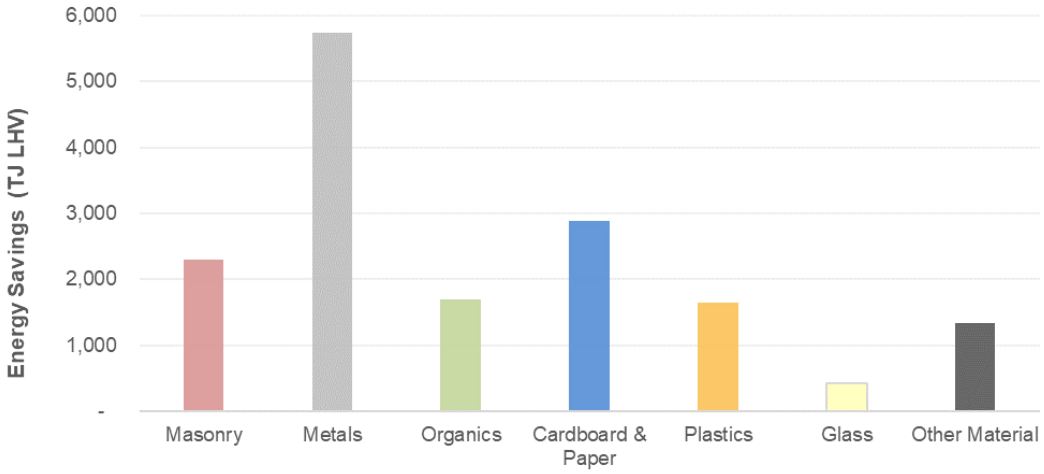

Figure 7.2 **Avoided energy consumption (by material category) as a result of recycling in SA, 2016-17**

7.3 Water savings

The total projected water savings (in Megalitres or ML[11]) from recycling in SA during 2016-17 was approximately 13,096 ML (Table 7.1 and Table 7.4 and Figure 7.3 overleaf).

- Cardboard & Paper contributes most significantly (at 57%) to water savings achieved from recycling (see Figure 7.3 overleaf) as manufacture of virgin cardboard and paper materials consumes large volumes of water.
- Metals are also a significant contributor at 19%. These water savings principally result from recycling of aluminium which consumes substantial quantities of water in its manufacturing process.
- Recycling of some plastics consume more water than they save.
- The overall water savings for SA's recycling activity during 2016-17 are considered approximately equivalent to:
  - Water use by about 79,130 average Adelaide households in one year[12].
  - The water contained in about 5,200 Olympic-sized swimming pools[13].
- The water savings from SA's recycling activity in 2016-17 equate to:
  - 6% of Metropolitan Adelaide's total water consumption reported for 2016-17[13]

[11] 1 Megalitre or ML = 10^6 Litres (J) = 1,000 kilolitres (kL)

[12] Average household water consumption value ≈ 203 kL/yr; Source: South Australian Water Corporation Annual Report 2016-17 SA Water (2017)

[13] Olympic-sized pool value ≈ 2,500 kL/yr

Table 7.4 Estimated water savings as a result of recycling in SA, 2016-17[(a)]

Sector Origin	Water saved ML	Equivalent households (1 year) [(a)]	Olympic Swimming Pools[(a)]
Masonry	1,880	11,360	750
Metals	2,550	15,410	1,020
Organics	416	2,510	170
Cardboard & paper	7,450	45,020	2,980
Plastics	-400	-2,420	-160
Glass	160	970	60
Other Material	1,040	6,280	420
Total[(b)]	13,100	79,100	5,200

Notes:

(a) Refer to Survey Methodology in Appendix 1 for additional information on environmental benefits analysis assumptions and methodology.

(b) Note numbers may not sum due to rounding.

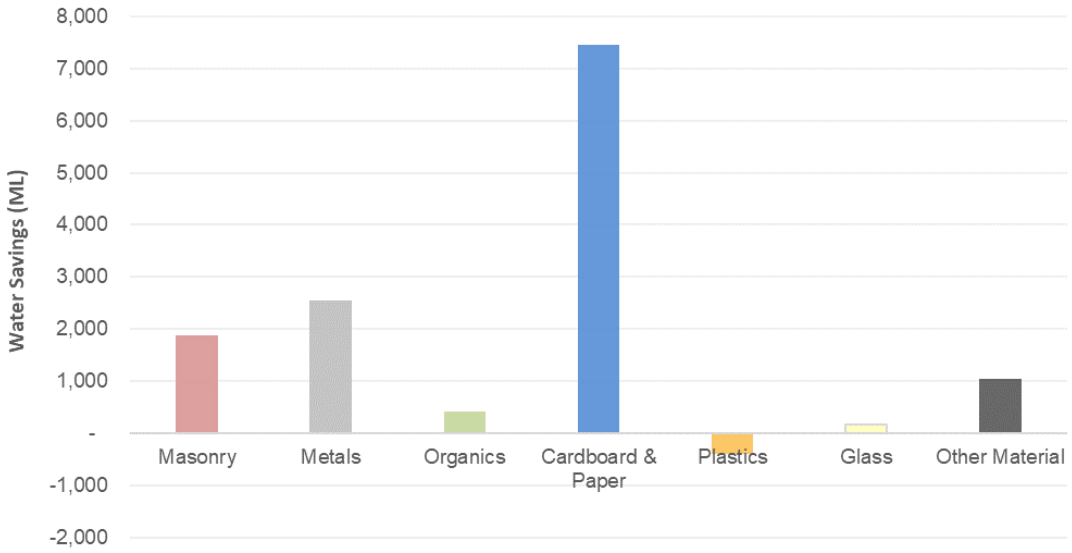

Figure 7.3 Avoided water consumption (by material category) as a result of recycling in SA, 2016-17

8 Acknowledgements

Green Industries SA and Rawtec would like to recognise and thank the following participants in the 2016-17 SA Recycling Activity Survey. The list below does not indicate all organisations who participated in the survey but those that agreed to be recognised.

- *AMTA (Mobile Muster)*
- *Bio Gro/Van Schaik's Organic Soils*
- *Ceduna Recycling*
- *Cleanaway*
- *Downer Group*
- *Department of Planning Transport and Infrastructure*
- *Ecycle SA*
- *Fulton Hogan Pty Ltd - Construction Central Region*
- *Green Team Shred Safe*
- *Green Triangle Recycling*
- *Intercast & Forge Pty Ltd*
- *Jeffries*
- *MRI (Aust) Pty Ltd*
- *Naracoorte Recyclables*
- *Normetals Pty Ltd*
- *Norske Skog*
- *Nystar*
- *O-I Adelaide Plant*
- *Orora Recycling*
- *Peats Soil & Garden Supplies*
- *Renewal SA*
- *ResourceCo Pty Ltd*
- *SA Water Corporation*
- *Simsmetal*
- *Southern Region Waste Resource Authority*
- *St Vincent de Paul Society (SA) Inc.*
- *Statewide Recycling*
- *Tarac Technologies Pty Ltd*
- *Thomas Foods International*
- *Top Coat Asphalt Contractors Pty Ltd*
- *Toxfree Australia Pty Ltd*
- *Trident Plastics*
- *Tyrecycle Pty Ltd*
- *Whyalla City Council*
- *YCA Recycling*

9 Glossary[14]

Alternative fuel	A fuel usually derived from renewable sources, used as an alternative to fossil fuels.
Bio-solids	Waste organic solids derived from biological wastewater treatment plants.
Clean fill (also known as Waste Fill)	Reported in the survey as Clay, Fines, Rubble & Soil. Waste fill is defined in the Environment Protection (Fees and Levy) Regulations 1994 as: waste consisting of clay, concrete, rock, sand, soil or other inert mineralogical matter in pieces not exceeding 100 millimetres in length and containing chemical substances in concentrations (calculated in a manner determined by the Authority) less than the concentrations for those substances set out in Schedule 6 [of the Regulations], but does not include waste consisting of or containing asbestos or bitumen.
Container deposit	Sometimes referred to as container deposit legislation or CDL. A refundable charge imposed on a range of recyclable beverage containers. The deposit is included in the retail price and refunded when the container is returned to a collection point.
Commercial and Industrial waste (C&I)	Comprises solid waste generated by the business sector as well as solid wastes created by state and federal government entities, schools and tertiary institutions. Unless otherwise noted, C&I waste does not include waste from the Construction and Demolition (C&D) sector.
Construction and Demolition waste (C&D)	Includes waste from residential, civil and commercial Construction and Demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber. C&D waste excludes construction waste from owner/occupier renovations, which are included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the commercial and industrial waste stream.
E-waste	End-of-life electrical and electronic equipment, including computers, televisions, monitors, household electrical appliances, batteries (but not automotive), etc.
Ferrous metals	Metals with iron as the major constituent.
Fly ash	Inorganic residue of coal combustion in power stations.
Food organics	Organic waste derived from food preparation and/or surplus food.
Garden organics	Organics derived from garden sources e.g. grass clippings, tree prunings.
Greenhouse gasses (GHGs)	For the purposes of this report GHGs are the six gases listed in the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (NO), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6).
High density polyethylene (HDPE)	A member of the polyethylene family of plastics and is used to make products such as milk bottles, pipes and shopping bags. HDPE may be coloured or opaque.
Industry organics	Organic materials recovered as a waste by-product of industrial processing of organically materials, e.g. wine, meat, dairy, etc.
Kerbside collection	Collection of household waste, recyclable materials (separated or co-mingled), and organic waste that are left at the kerbside for collection by local council collection services.
Liquid paperboard	Liquid paperboard is made from cardboard or paperboard with a liquid-proof wax, plastic or foil coating on one or both sides. It is commonly used for packaging of liquid materials, such as milk, fruit juice, cream and/or detergents or providing water resistance to other types of packaging.
Low density polyethylene (LDPE)	A member of the polyolefin family of plastics. It is a flexible material and usually used as film for packaging or as bags.
Municipal waste	Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. May also includes waste dropped off at recycling centres, transfer stations and construction waste from owner/occupier renovations.
National Guidelines for compiling waste and recycling data	National Guidelines for compiling waste and recycling data (NWDCRS Supporting documentation: SOPs, reporting tool user guide, and reporting guidance. Department of the Environment and Energy 2015);
Non-ferrous metals	Those metals that contain very little or no iron, e.g. copper, brass, bronze, lead, etc.
Packaging	Material used for the containment, protection, marketing or handling of product.
Polyethylene terephthalate (PET)	A clear, tough, light and shatterproof type of plastic, used to make products such as soft drink bottles, film packaging and fabrics.

[14] A number of the definitions in this Glossary were re-produced from the SA 2008-09 Recycling Activity survey (Zero Waste SA, 2010)

Polypropylene (PP)	A member of the polyolefin family of plastics. PP is light, rigid and glossy and is used to make products such as washing machine agitators, clear film.
Polystyrene (PS)	A member of the styrene family of plastics. PS is easy to mould and is used to make refrigerator and washing machine components. It can be foamed to make single use packaging, such as cups, meat and produce trays.
Polyvinyl chloride (PVC)	A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.
Post-consumer material	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.
Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for re-processing at a different site. Excluded are 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).
Recovered material	Material that would have otherwise been disposed of as waste, but has instead been collected and reclaimed as a material input, in lieu of a new primary material, for a recycling or manufacturing process.
Recycling	Material that has been re-processed 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, re-processing 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.
Re-processing	Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to allow it to be reused or re-incorporated into manufactured products.
Reuse	Reuse involves recovering value from a discarded resource in its original state without re-processing or remanufacture.
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.
Waste Hierarchy	An internationally recognised aspirational framework for managing waste generation and disposal that is a guiding principle of South Australia's Waste Strategy. Levels in order of precedence in the hierarchy include: Avoid, Reduce, Reuse, Recycle, Recover, Treat, Disposal.

10 Typical Sources & End Uses for Recovered Materials

Material	Source products	End Products
Alternative fuel	Plastic & timber C&D-derived material, Dry comingled recyclables, Cardboard & paper, Tyres & rubber	Energy production for power & industrial heating
Auto-parts	Auto-parts salvaged from end-of-life motor vehicles	Auto-parts
Aluminium	Windows and doors, automotive engines, assorted industrial scrap and production scrap, aluminium cans, electrical cable, electronic and electrical waste	Valves and extrusions, consumer products, automotive parts, building industry and aluminium cans.
Asphalt	Roads, footpaths, car parks and kerbing	Road base, quarry rehabilitation material
Batteries	End-of-life lighting primary & secondary consumer batteries. Excludes automotive batteries	Shredding and/or disassembly to plastic, metal and other constituents for re-processing
Bricks	Mainly walls and other general C&D activity	Primarily crushed for road base and drainage, but also directly reused
Cardboard & Waxed Cardboard	Mostly corrugated cardboard use for the packaging of industrial and consumer goods	Packaging
Clays, Fines, Rubble & Soil	General C&D, Earthworks for site preparation	Road base, batters/bunds, compost (bulking agent), quarry rehabilitation material
Clothes	Clothes donated to charities by the public or business	Clothes
Compact Fluorescent Lamps	End-of-life lighting	Disassembly to various material constituents for re-processing
Computers	End-of-life computer equipment, accessories and peripherals	Salvage and/or refurbishment for reuse of components, Shredding and/or disassembly to plastic, metal and other constituents for re-processing
Concrete	Slabs, footings, kerbing, channel and walls	Crushed as aggregate for road base and drainage, construction fill
Fly Ash	Residue from coal-fired power generation	Cement manufacture, fill, soil stabilisation, fertiliser production
Food	Surplus or out-of-date food donated to charities and sold, reused or supplied to the community	Food
Food Organics	Kerbside collected and commercial food wastes	Composted soil conditioners, potting mixes and mulches
Foundry Waste	Foundry waste materials including sands, dusts, slag and refractory ceramics	Cement manufacture, fill, manufactured soils, blending with composts
Garden Organics	Kerbside collected, other municipal, commercial garden organics	Composted soil conditioners, potting mixes and mulches
Glass	Building glass, Packaging – beer, wine, food	Bottle manufacture, reflective beads for road marking, aggregate for road base
High Density Polyethylene (HDPE)	Milk bottles, sheet liners and covers, manufacturing scrap, other packaging bottles, mobile garbage bins, drums, pipes, crates and pallets	Pallets, agricultural pipes, bins, industrial film, water tanks, crates and mixed polymer timber replacement products
Leather & Textiles	Clothes, other textiles	Cleaning cloths

Material	Source products	End Products
Liquid Paperboard	Liquid paperboard LPB packaging, both container deposit (CD) and non-CD. CD LPB packaging (includes flavoured milk beverages and fruit juice flavoured beverages). Non-CD packaging includes milk and fruit juice packaging.	New paper and cardboard products and packaging
Low Density Polyethylene (LDPE)	Flexible film used as distribution packaging, packaging bottles and manufacturing scrap	Builders film, damp course linings, garbage bags, retail carry bags, mixed polymer timber replacement products, irrigation piping, timber replacement products and garden furniture
Magazines	Magazines Pre-consumer waste and post-consumer magazine material	Newsprint, paperboard, tissue, stationery and copy and printer paper
Mixed &/or Other Plastics (MIX)	Manufacturing scrap and domestic durables	Various, including composite materials for bollards and posts
Mobile Phones	End-of-life mobile phones, including accessories and batteries	Shredding and/or disassembly to plastic, metal and other constituents for re-processing
Newsprint	Both pre- and post-consumer newsprint and some magazine material. Includes magazines and TV guides printed on newsprint or improved newsprint.	Newsprint, packaging, cat litter, insulation, building products and composting
Non-ferrous Metals	Copper pipe, automotive batteries and cable, general industrial and production scrap, electrical cable	Many, including batteries, cables, valves and extrusions.
Other E-waste	All other end-of-life electrical and electronic equipment, including whitegoods	Shredding and/or disassembly to plastic, metal and other constituents for re-processing
Phonebooks	Phone books	Newsprint and packaging
Polyethylene Terephthalate (PET)	Soft drink bottles, fruit juice bottles	Soft drink bottles, other packaging applications, fibre applications
Polypropylene (PP)	Manufacturing scrap, rigid packaging applications, pallet strapping and automotive parts	Crates, boxes, plant pots, building materials, electrical cable cover, automotive parts, irrigation fittings and mixed polymer timber replacement products
Polystyrene (PS)	Manufacturing scrap, pipe supports, EPS freight packaging and rigid food packaging	Waffle pods, produce boxes, building materials, concrete reinforcement stools, extruded polystyrene and mixed polymer timber replacement products
Polyvinyl Chloride (PVC)	Manufacturing scrap	Floor coverings, pipes, electrical conduit, clothing, shoes, hose fitting and garden hoses
Printer Cartridges	Empty or redundant ink-jet or laser printers	Re-filled cartridges, disassembly to material constituents for re-processing
Printing & Writing Paper	Office paper and a small amount of packaging paper from office sources	Packaging and writing paper
Timber	Timber Barks, sawdust, wood/timber packaging, general wood/timber	Composted soil conditioners, potting mixes and mulches; Alternative fuel source
Tyres & Rubber	Tyres, other rubber products	New tyres, industrial adhesives and non-slip paints, road surfacing, brake pads, sporting and playground surfaces, alternative fuel for energy production
Televisions/Monitors	End-of-life CRT, LCD or LED televisions or computer monitors	Shredding and/or disassembly to plastic, metal and other constituents for re-processing

11 Abbreviations

C&D	Construction & Demolition
C&I	Commercial & Industrial
CO_2-e	Carbon dioxide equivalent
EOL	End of Life
GHG	Green House Gas
GSP	Gross State Product
HDPE	High Density Polyethylene
kg/p/yr	Kilograms per person, per year
kL	Kilolitre
LDPE	Low Density Polyethylene
LPB	Liquid Paper Board
ML	Megalitre
MSW	Municipal Solid Waste
PET	Polyethylene Terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl Chloride
t	Tonnes
TJ	Terajoule

12 References

ACT Government Transport Canberra and City Services Directorate (TCCS) (2016); Territory and Municipal Services Directorate Annual Report 2015-16, Volume 1.

ANZRP (Australia and New Zealand Recycling Platform Limited) (2017). Review of the Product Stewardship Act and National Television and Computer Recycling Scheme. White Paper. 17 August 2017.

Australian Bureau of Statistics (ABS) (2015); 3101.0 – Australian Demographic Statistics, March Quarter 2015, Issued 11:30 AM (CANBERRA TIME) 17/12/2015.

Australian Bureau of Statistics (ABS) (2016); 5220.0 – Australian National Accounts, State Accounts, 2016-17. Issued at 11:30 AM (CANBERRA TIME) 17/11/2017.

Australian Bureau of Statistics (ABS) (2016b); 3101.0 – Australian Demographic Statistics, June Quarter 2016, Issued 11:30 AM (CANBERRA TIME) 8/1/2018.

Australian Department of Environment (2014); The National Television and Computer Recycling Scheme — Operational Review, November 2014.

Department of the Environment and Energy (2015); National Waste Data Classification and Reporting System (NWDCRS) supporting documentation: SOPs, reporting tool user guide, and reporting guidance. Project number PREC037.

Australian Government Department of Environment and Energy (2017); 2017 Australian Energy Update, Australian Government Department of Environment and Energy, Canberra, August 2017.

EcoRecycle Victoria (2005); Life Cycle Impact Data for Resource Recovery for Commercial and Industrial and Construction and Demolition Waste in Victoria.

Green Industries SA (previously Zero Waste SA) (2009); Benefits of Recycling in South Australia.

Green Industries SA (previously Zero Waste SA) (2010); Recycling Activity in South Australia, 2008-09 Financial Year.

Green Industries SA (previously Zero Waste SA) (2011); Recycling activity in South Australia 2009-10 Financial Year.

Green Industries SA (previously Zero Waste SA) (2012); Recycling activity in South Australia 2010-11 Financial Year.

Green Industries SA (previously Zero Waste SA) (2013); Recycling activity in South Australia 2011-12 Financial Year.

Green Industries SA (previously Zero Waste SA) (2015); South Australia's Waste Strategy 2015-2020.

Green Industries SA (previously Zero Waste SA) (2016); Waste and Resource Recovery Infrastructure Plan, Consultation Draft, September 2016.

id Community: Demographic Resources (2017); South Australia Household Type.

Han and Karuppannan (2014). Non-transport household energy consumption in Adelaide and Melbourne. *Local Environment – The International Journal of Justice and Sustainability, 21, 3*.

National Appliance and Equipment Energy Efficiency Committee (1998); Household Energy Use in Australia: End Uses, Greenhouse Gas Emissions and Energy Efficiency Program Coverage.

NSW Department of Environment, Climate Change and Water (NSW DECCW) (2010); Environmental benefits of recycling DECC 2010/58.

NSW Environmental Protection Authority (2017); NSW Waste Avoidance and Resource Recovery Strategy: Progress Report 2014-15.

QLD Department of Environment and Heritage Protection (DEHP) (2017). Recycling and Waste in Queensland 2016.

SA Department of Environment, Water and Natural Resources (DEWNR) (2015), Report on the operation of the 'Climate Change and Greenhouse Emissions Reduction Act 2007.

SA Environment Protection Authority (2009); Draft Guidelines for the assessment, classification and disposal of solid waste: criteria for assessment, classification and disposal of waste

SA Government (2011); SA's Strategic Plan 2011

SA Water (2017); South Australian Water Corporation Annual Report: 2016-17

Sustainability Victoria (2017); Victorian Recycling Industry Annual Report 2015-16.

Western Australia Waste Authority (2017); Recycling Activity in Western Australia 2015-16.

13 Document Status

Revision	Date	Prepared by	Checked by	Approved by
Draft	31/1/18	M. Allan, K Le Gallou, K. Heinrich, M Rawson	M. Rawson	M. Rawson
Revised Draft	5/3/18	M. Allan, K Le Gallou, K. Heinrich, M Rawson	M. Allan	K. Heinrich
Final	7/3/18	M. Allan, K Le Gallou, K. Heinrich, M Rawson	M. Allan	K. Heinrich

11 Paringa Avenue, Somerton Park, SA 5044
PO Box 1159, Glenelg South, SA 5045
T: +61 8 8294 5571

Appendix 1: Survey Methodology

Rawtec was engaged by Green Industries SA to undertake the Recycling Activity (survey) in South Australia (SA) for the 2016-17 financial year. This section summarises the approach and methodology used to conducting the survey.

- *Rawtec was engaged to conduct the survey for 2016-17.*
- *This approach and methodology was similar to that used for the 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2015-16 recycling activity surveys, which were also undertaken by Rawtec.*

A1.1 Selection of Materials

The materials to be surveyed for recycling activity was agreed with Green Industries SA – see Appendix 3 for a complete list.

- *This list was considered to include the majority (at least >95%) of the material types recovered in SA for re-processing.*

A1.2 Survey Design & Delivery

A1.2.1 Survey Respondents

All known local (SA based) and interstate companies or organisations involved with recycling were identified.

- *The final list included 117 organisations, which included survey respondents from 2015-16 and any newly identified companies involved with recycling activity in SA.*

In broad terms, these organisations could be classified as follows.

1. ***Industry-based Recycled Material Collectors, Aggregators and/or Re-processors***
   Companies or organisations in SA or interstate involved with collecting, aggregating, transporting, exporting and/or re-processing materials recovered in SA.

2. ***Representative or Industry Bodies***
   Representative organisations for industry or material sectors involved with resource recovery or recycling that conduct their own surveys or collect data on recycling performance of these sectors.

3. Government agencies/bodies

Commonwealth or South Australian government agencies concerned with collecting data or other statistics on recycling activity in SA.

- Green Industries SA –
  - During 2010-11 Green Industries SA (previously Zero Waste SA) commenced collection of resource recovery data for organic material from SA composters through its Zero Waste SA Environment Users System (ZEUS)[15]
- South Australian Government Environment Protection Authority (EPA) –
  - Data for recycled deposit containers and bottles collected in SA; and
  - Landfill disposal data.
- Australian Department of Foreign Affairs & Trade (DFAT) Statistical Information Service –
  - Australian Customs Export Data.

A1.2.2 Confidentiality

It was agreed with Green Industries SA that the names of, and data provided by industry-based recycling companies or organisations would be kept confidential in the public reporting of data except where the survey respondent indicated otherwise.

- *Providing this assurance of confidentiality was deemed important to encouraging survey participation by the recycling industry.*

A1.2.3 Survey Questionnaire

A survey questionnaire was developed and agreed with Green Industries SA. This survey questionnaire was in line with the 2015-16 questionnaire, except for:

- A question was included in the report this year requesting the approximate commodity price (if sold as a commodity) or approx. retail market price per tonne in 2016-17.

[15] ZEUS is a web-based system that has been purpose developed by Green Industries SA to collect data from local government and industry on waste disposal and resource recovery within South Australia.

A1.2.4 Survey Deployment

The survey was deployed to survey respondents in September 2017.

- *The deployment method was by email*
- *An additional option of filling-out the survey online was also offered to respondents.*
- *Following survey deployment, respondents were also contacted to confirm receipt of the survey and determine if they had any queries or required assistance with completing the survey. In some instances, it was discovered that the relevant company or organisation no longer existed or recycling activity had not occurred during 2016-17.*

Each respondent was given several weeks to complete and return the survey.

- *Outstanding survey returns were followed up by email and/or phone at least once, to encourage completion and submission by the respondent of the survey.*

The collection of survey data was closed in mid-December 2017.

A1.2.5 Consultation

A selected number of recycling industry companies were given the opportunity to participate in direct face-to-face consultation as part of the 2016-17 Recycling Activity survey.

- *These companies were usually key players in specific material categories. The more detailed information obtained from these consultations were used to guide survey data analysis and interpretation.*

A1.3 Data Analysis

A1.3.1 Materials Analysis & Reporting

Data collected by the survey was analysed to determine the following for each material. This analysis was conducted according to the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015).

- ***Quantity*** – The total reported quantity of that material recovered in SA for recycling or reuse.
- ***Imported Waste Material*** – Separate identification of waste material imported from interstate and overseas, which is excluded from measuring SA's recycling performance
- ***Energy Recovery*** – Separate identification of waste materials recovered and used for energy production in SA[16].

[16] Resource recovery considered as 'energy recovery' in this report is therefore classified as: where waste materials are recovered and used for the purpose of energy production in SA, instead of being sent for landfill disposal. Some industries already produce energy from waste by-products they generate on their own sites, but this is excluded under the under the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015). There are also several waste

- ***Destination*** – Where the material was sent for recycling:
    - SA – Including what degree of re-processing occurred:
        - Manufactured Product – Incorporated into a final consumer or market product.
        - Recycled Product – Re-processed to a feedstock material to replace a virgin material used for manufacture.
    - Interstate – Where the material might be re-processed or exported overseas.
    - Export – Where the material was directly exported from SA to an overseas destination for re-processing.
- ***Sector Origin*** –The reported sector origin from where the material was recovered:
    - Municipal (MSW) – From kerbside collection, general public and/or via Council or other Municipal authority.
    - Commercial & Industrial (C&I) – Collected from business or industrial activities (but excluding C&D).
    - Construction & Demolition (C&D) – Collected from construction or demolition activities involved with building and/or infrastructure construction.
- ***Geographical Origin*** – The reported geographical origin for recovered materials:
    - Metropolitan area – From the metropolitan Adelaide area.
    - Regional – From other areas outside the metropolitan Adelaide area.

In conducting the above analysis, the following principles were applied:

- Any materials imported into SA from other states and territories or overseas for re-processing were excluded.
- Great care was taken to avoid double counting of recovered materials which can occur where same material is handled multiple times by different parties before reaching its eventual destination.
- In almost all cases, direct industry estimates were relied upon to estimate the splits where reported data for materials were aggregated.
- In occasional instances where a survey respondent did not report data for the current year:
    - Third party estimates of the respondent's recycling activity were identified from industry or other published sources; and/or
    - The respondent's previous years' data, if available, was used to reasonably estimate recycling activity (only when such data was considered a reliable indication of current recycling activity).

companies that collect and re-process waste materials, which are then sent overseas and/or interstate for energy recovery. This circumstance is still classified 'material recovery' as any potential energy recovery from the waste material occurs outside of SA. This definition also necessarily excludes energy recovery from landfill gas arising from waste disposed to landfills.

A1.3.2 Accuracy of Reported Data

Survey respondents were asked to report on the accuracy of the data they were providing (e.g. could be accurate to, or have error of, ±2%). This accuracy data was used to determine an estimated reporting accuracy for each material[17].

- *The estimated reporting accuracy for each material was used to select an appropriate number of significant figures that should reasonably apply to presentation of the reported data.*

Where third party estimates and/or previous years' data were adopted for recycling activity, a greater error of appropriate value (i.e. usually between ±10-30%) was applied to reflect the greater uncertainty in the accuracy of this data.

A1.3.3 Per Capita Analysis & National Benchmarking

Metrics for per capita waste and recycling by SA and benchmarking of these metrics against similar data were calculated using the following data and assumptions.

- Population statistics were sourced from the Australian Bureau of Statistics (ABS) (2017, 2016 and 2015).
- The relevant reporting periods and sources of recycling activity data were:
  - SA: 2016-17, as reported in this survey;
  - ACT: 2015-16, as reported by: Territory and Municipal Services Annual Report 2015-16, (ACT Territory and Municipal Services, 2016) and discussions with Transport Canberra and City Services Directorate staff;
  - VIC: 2015-16, as reported by: Victorian Recycling Industry Annual Report 2015-16 (Sustainability Victoria, 2017);
  - WA: 2015-16, as reported by: Recycling Activity in Western Australia, 2015-16 (WA Waste Authority, 2017);
  - NSW: 2014-15, as reported by: NSW Waste Avoidance and Resource Recovery Strategy: Progress Report 2014-15 (NSW EPA, 2015);
  - QLD: 2015-16, as reported by: Recycling and Waste in Queensland 2016 (QLD DEHP, 2017).
- Adjustments were made to the above data to present recycling data in accordance with the National Guidelines for compiling waste and recycling data (Dept Environment and Energy, 2015).

[17] Standard error propagation techniques were applied for calculating errors when adding or subtracting data for reported resource recovery of materials

A1.3.4 Packaging Recovery Analysis & Reporting

Packaging data was taken directly from Recycling Activity Survey data:

- Container deposit bottle and can packaging:
  - From 2016-17 CDL data reported by industry to the South Australian EPA.
- Cardboard packaging:
  - Derived from cardboard material recovery data which was adjusted to account for pre-consumer material.
- Other plastic packaging:
  - Derived from industry data for plastic packaging materials recovered by Adelaide MRFs and other sources.
- Other glass packaging:
  - Determined from balance between CDL data and industry-reported glass recovery and re-processing data.

A1.3.5 Environmental Benefits Analysis

A1.3.5.1 General Approach

The methodology for this analysis was aligned as much as possible to the approach applied in previous recycling activity surveys developed for SA and was essentially the same as that developed for the 2009-10 SA Recycling Activity Survey. The scope of environmental benefits analysis included the following metrics.

- ***Greenhouse Gas Savings*** (quantified as tonnes of CO_2-e) – The reduction in greenhouse gas emissions achieved by replacing virgin materials with recycled materials.
- ***Cumulative Energy Demand Savings*** (as Terajoules (TJ) – The amount of energy saved, including all fossil, renewable, electrical and embodied energy, by using recycled materials.
- ***Water Savings*** (as Megalitres (ML) H_2O) **–** The reduction in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

A1.3.5.2 Assumptions & Data Sources

The conversion and emission factors used to assess the benefits of recycling materials have been widely studied and established methods are developed to calculate them. These methods are based on Life Cycle Analysis (LCA) techniques. Figure A1.1 gives a useful illustration of how LCA techniques approach the assessment of resource recovery and recycling activities in order to calculate the benefits that can be achieved.

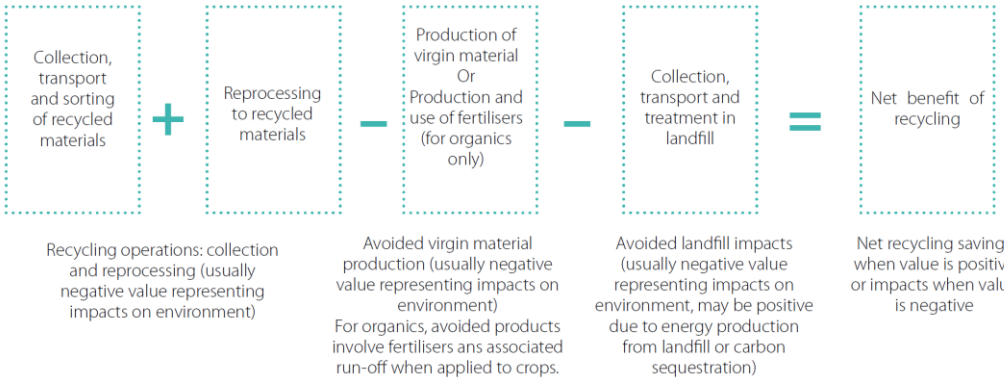

Figure A1.1 Method for calculating the net environmental impacts in the recycling process. Source: NSW DECCW (2010)

LCA techniques have previously been used to estimate conversion and emission factors for Australian situations including for SA. For the purpose of this study, the following sources were used to infer or obtain relevant conversion and emission factors for environmental benefits of recycling in SA:

- Benefits of Recycling in South Australia study (Green Industries SA, previously Zero Waste SA, 2009);
- Life Cycle Impact Data for Resource Recovery for Commercial and Industrial and Construction and Demolition Waste in Victoria (EcoRecycle Victoria 2005);
- Environmental benefits study of recycling for NSW (NSW DECCW, 2010); and
- SA Recycling Activity survey, 2008-09 (Green Industries SA, previously Zero Waste SA, 2010).

These sources often provided or suggested separate conversion and emission factors relevant to materials recovered for recycling from Municipal, C&I and C&D sectors. The conversion and emission factors between these different sectors were generally found to be similar.

In view of this, a single material conversion and emission factor for each material was usually adopted. SA specific or source values were adopted first. Otherwise, conversion or emission factors from another source were used. In this situation, where there were multiple values available, the lower value was normally adopted in order to be conservative in the estimate of environmental benefits.

Sufficiently comprehensive and/or reliable conversion or emission factors data could not be identified for the following materials:

- Foundry Waste; and
- Leather & Textiles.

As a consequence, these materials were not included in the environmental benefits analysis.

The 2016-17 environmental benefits analysis adopted the same conversion and emission factors that were developed from the above sources and used for the 2009-10 SA recycling activity report (Green Industries SA, previously Zero Waste SA, 2011). These conversion and emission factors are listed in Appendix 4. Some brief notes on the sources and key assumptions made in deriving these conversion and emission factors are included in Appendix 4.

A1.3.5.3 Qualifications & Limitations

The following qualifications and limitations should be recognised about the environmental benefits analysis presented in this report. These qualifications and limitations are not unique to the 2016-17 Recycling Activity survey and would also have applied to similar assessments conducted in previous Recycling Activity surveys.

1. Many of the conversion and emission factors adopted are not specifically calculated for SA, and in most cases, are derived from interstate studies, i.e. Victoria, NSW.
2. It is important to recognise that not all environmental benefits reported directly accrue to SA, because:
    - Some of the virgin materials that are replaced by recycling are not manufactured in SA, e.g. metals, plastics, cardboard & paper; and/or
    - The material recovered from SA for recycling is used to manufacture products that end up being consumed outside of the State, e.g. metals, plastics, cardboard & paper.

In view of the above, the assessment in this study represents a generalised estimate of the life cycle benefits involved with recycling of these materials and does not precisely depict the environmental benefits of recycling activity in SA.

A1.3.6 Resource Recovery Value

The value of waste materials recovered for recycling is influenced by:

- The type of waste material and industrial product in which it can be recycled or reused;
- The commodity market prices for virgin material that they replace;
- Whether the material will be re-processed locally or exported overseas;
- The quality of this material, including the extent of source separation and/or pre-processing which might have already occurred.

A number of recovered materials in SA are exported to international markets; particularly metals and plastics. In these markets, prices can be highly volatile and may fluctuate by up to ±60-80% from year to year (Dept Environment and Energy, 2015).

Pricing for recovered materials re-processed locally, such as masonry, glass and organics, are usually more stable. But these prices too can vary considerably depending on local economic outlook and/or activity and between jurisdictions.

Plastics already source separated by polymer will have greater market value than mixed plastics. Glass recovered in SA from container deposit depots is more highly prized and valued than glass recovered from material recovery facilities interstate due to lower contamination. In the case of organics, which are putrescible, most recovered material must be composted before it realises a market value.

As a consequence, the value of recovered material can vary over time, between jurisdictions, and depending on local waste management and resource recovery practices. Price and/or value estimates are therefore usually based on highly aggregated average prices to take into account all of these factors.

For the purpose of this study, the assumed values of various recovered materials obtained in SA during 2016-17 are given in Table A1.1. These assumed values are based on:

- Consultations with industry in October and November 2017;
- 2016-17 survey responses (this question was new to the 2016-17 survey, which asked participants to provide a price per tonne for each material recovered, reflecting the commodity price or market value for that material.
- Publicly available information on market values of recovered materials;
- Where such market values for a recovered material were not presented above, the consultants' own estimate were used based on our knowledge and insight of the South Australian waste management industry and local markets for recycled materials.

Table A1.1 Assumed values for recovered materials in SA during 2016-17 used to estimate resource market value.

Material category	***Estimated on-sale price ($/tonne)***	***Price data source:***
Masonry	$10	Based on RAS survey results
Metals – Steel	$247	Based on RAS survey results and commodity data
Metals – Non-ferrous including Aluminium	$2,357	Based on RAS survey results and commodity data
Organics – Meat Rendering	$600	Based on RAS survey results
Organics – Garden, Food and Timber	$25	Based on RAS survey results
Paper & cardboard	$233	Based on RAS survey results
Plastics	$323	Based on RAS survey results
Glass	$85	Based on RAS survey results
Other materials	$10	Based on author estimate
Separately Reported Materials & Clean Fill	$3	Based on RAS survey results

Appendix 2: Survey Participation

The following presents some survey statistics that may provide a useful insight into the recycling activity occurring in South Australia (SA) and the types of data and information sets that were returned and analysed in 2016-17.

A2.1 Survey Participation & Reported data

Table A2.1 below summarises the survey participation and reported data points for 2016-17.

- The survey questionnaire was successfully deployed to 117 or 94% of the initial list of 125 organisations identified as potentially involved with recycling activity in SA.
- The survey returns produced recycling activity data or information sets for 92 of these companies or organisations.
- Of these 92 data or information sets, the following types of activity were classified. Note: the activity type classifications are not mutually exclusive as many companies or organisations reporting data were involved with multiple activities and/or aspects of the resource recovery and/or recycling industry.
    - Three reference &/or aggregated data sets from industry bodies or government agencies.
    - 17 data sets came from companies or organisations that generated the material that was being recovered for recycling.
    - 64 data sets were companies or organisations involved in collection or aggregation of recovered material.
    - 50 data sets were for companies or organisations undertaking re-processing activities.
    - 33 of these companies or organisations were also involved in manufacturing products from the recovered or re-processed material.

Table A2.1 Overall Survey Statistics

Statistic		No.	(%)	% Basis
Sample Size		125		
Surveys Deployed*		117	94%	of Sample Size
Survey Data Points		92	79%	of Surveys Deployed
Activity Type	Industry Reference Data	3	3%	of Survey Data Points
	Source	17	18%	of Survey Data Points
	Aggregator/Collector	64	70%	of Survey Data Points
	Recycler	50	54%	of Survey Data Points
	Manufacturer	33	36%	of Survey Data Points

A2.2 Industry Data Segmentation

Table A2.2 below summarises the reported industry data (excluding reference data) points or sets from companies or organisations by the following classifications. Again, these classifications are not mutually exclusive.

- Material Activity – The materials and/or industry sector the company or organisation was handling.
- Material Destination – Where were recovered materials sent?
- Waste Hierarchy[18] – At what level of the waste hierarchy were materials being handled?

Table A2.2 Industry Sourced Data Statistics

Statistic		No.	(%)
No. Industry-Sourced Data Points		92	100%
Material Activity	Masonry	15	16%
	Metals	19	21%
	Organics	20	22%
	Cardboard & paper	17	18%
	Plastics	21	23%
	Glass	9	10%
	Other Materials	9	10%
	E-waste	13	14%
	Reuse Materials	4	4%
Material Destination	SA	70	76%
	Interstate	30	33%
	Export	21	23%
Waste Hierarchy	Reuse	7	8%
	Recycle	53	58%
	Material Recovery	62	67%
	Energy Recovery	2	2%

[18] The waste hierarchy is an internationally recognised aspirational framework for managing waste generation and disposal that is a guiding principle of South Australia's Waste Strategy (ZWSA 2012). The levels presented here are not necessarily given in any particular order of preference but it is widely accepted that the precedence should be: Reuse > Recycling > Material or Energy Recovery.

Appendix 3: 2016-17 Recycling Activity Survey Questionnaire

Survey Form – Recycling Activity in SA, 2016-17

Issued: 20 September 2017

1. Survey Company & Contact Details

Rawtec Pty Ltd (www.rawtec.com.au)
• Kat Heinrich, Senior Consultant, p: (08) 8294 5571, e: kat.heinrich@rawtec.com.au
• Matthew Allan, Consultant, p: (08) 8294 5571, e: matthew.allan@rawtec.com.au
• Jarvis Webb, Consultant, p: (08) 8294 5571, e: jarvis.webb@rawtec.com.au

2. Survey Questions for Period 1 July 2016 - 30 June 2017

1.	Please provide your company or organisation's contact address and details. Please also include the location(s) of your main facility(ies) for re-processing or handling of materials
2.	Are you happy for your company to be recognised in the report as participating in the 2015-16 SA Recycling Activity survey? (*Please Circle/Highlight)* *[Yes / No]*
3.	How many people (FTE's) 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?
4.	Please fill in Table 1 (overleaf) for each relevant material listed in Table 2 (page 3). ***This is the critical information required for the survey. All data will be kept confidential and anonymised for reporting purposes.***
5.	What is the estimated accuracy of the data provided in Table 1, **e.g. ±5%**

Table A3.1 Material and tonnage data requested from industry

ID	Material	Data for 2016/17 Financial Year (July 2016 – June 2017)											Approx. material value (2016-17)
		MATERIAL SOURCE/INPUT						MATERIAL DESTINATION/OUTPUT				RESIDUAL	
		Total materials received for recycling in 2016/17 (in tonnes)	Materials received for recycling metro vs regional (in tonnes or %)		Source of material (in tonnes or %)			Destination of material for re-processing (in tonnes or as %)				% residual (if any) generated from recovery or re-processing to landfill	Approx. commodity price (if sold as a commodity) or approx. retail market price per tonne in 2016-17
			SA-Metro	SA-Regional	MSW	C&I	C&D	Your SA facility (ies)	Elsewhere in SA	Sent Interstate	Sent Overseas		
	EXAMPLE: Steel	*23,100*	*20,100*	*3,000*	*25%*	*70%*	*5%*	*-*	*-*	*23,100*	*-*	*10%*	*$35 per tonne*

Note: please state all quantities in metric tonnes (1000kg = 1 tonne)

Definitions:

MSW - Municipal - Domestic household sourced waste

C&I - Commercial and Industrial- Industry and business sourced waste

C&D - Construction and Demolition- Building, construction and demolition

Table 2: List of Materials 2016-17 Recycling Activity Survey

Category	ID	Material
A	***Masonry***	
	1	Asphalt
	2	Bricks
	3	Concrete
	4	Plasterboard
	5	Waste Fill (or "clean" fill) – **Clay, fines, rubble & soil** (which meets EPA's WDF criteria)
	6	Intermediate Waste Soil (or "contaminated" fill) – **Clay, fines, rubble & soil** (which meets EPA's Intermediate Soil criteria)
B	***Metals***	
	7	Steel
	8	Aluminium
	9	Non-ferrous metals
C	***Organics***	
	10	Food Organics
	11	Garden Organics
	12	Timber
	13	Meat Rendering
	14	Waste Grease & Fat
	15	Waste Sludge & Bio-solids
	16	Organics - Other
D	***Cardboard & paper***	
	17	Cardboard & waxed cardboard
	18	Liquid Paperboard
	19	Magazines
	20	Newsprint
	21	Phonebooks
	22	Printing & Writing Paper
E	***Plastics***	
	23	Polyethylene terephthalate [PIC 1]
	24	High density polyethylene [PIC 2]
	25	Polyvinyl chloride [PIC 3]
	26	Low density polyethylene [PIC 4]
	27	Polypropylene [PIC 5]
	28	Polystyrene [PIC 6]
	29	Mixed &/or Other plastics [PIC 7]
F	***Glass***	
	30	Glass
G	***Electronic Waste***	
	31	Printer cartridges
	32	Compact fluorescent lamps
	33	Batteries
	34	Computers
	35	Televisions / Monitors
	36	Mobile phones
	37	Other e-waste (not classified above)
H	***Alternative Fuels***	
	38	Alternative Fuel
I	***Other Materials (exc. e-waste)***	
	39	Fly ash
	40	Foundry sands
	41	Leather & textiles
	42	Tyres & other rubber
J	***Re-use Materials***	
	43	Auto-Parts
	44	Home Furnishings & Goods
	45	Clothes
	46	Food Products

2. Continued Survey Questions for Period 1 July 2016 - 30 June 2017

	For the following questions, please enter responses directly into the table below.
6.	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 (see Table 2) and state volumes and sources. If you received any plastics, please provide this information in the plastics recyclers survey form. *Material* *Tonnes received* *Source location* • •
7.	Were any of the reported materials derived from packaging? If yes, (for each material) approximately what proportion (as % of total)? If you received any plastics, please provide this information in the plastics recyclers survey form. *Material* *Tonnes received* *Source location* • •
8.	If there have been any significant changes in quantities, stockpiles, sources or destinations from the 2015-16 financial year, what was the reason for this?
9.	Where do you receive most of your material from, e.g. Councils, manufacturing, retail, hospitality, etc.?
10.	Which organisation(s) did you send each of your recovered or re-processed materials (e.g. Company X for organics and Company Y for plastics)?
11.	What is your opinion about the market strength/prospects for recycled materials?
12.	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?
13.	Are there any significant barriers, e.g. market, regulatory, technology, for your SA operations?

14.	What is your organisation's approximate Annual Sales Revenue (Turnover) from material collection, resource recovery and/or recycling activities?
15.	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)*
16.	Would you like to be invited to an industry seminar by Green Industries SA (GISA) summarising the findings of this 2016-17 SA Recycling Activity survey? (*Please Circle/Highlight)* *Y/N*

Appendix 4: 2016-17 Environmental Benefits Conversion & Emission Factors

Table A4.1 **Emission and conversion factors adopted for estimation of environmental benefits of recycling, SA 2016-17.** *(For references in the Table notes, refer to Section 12)*

	Material	GHG Emissions Saved		Energy Saved		Water Saved	
		Emission factor (t CO2-e/t)	*Note*	*Conversion factor (GJ LHV/t)*	*Note*	*Conversion factor (kL/t)*	*Note*
	Masonry						
1	Asphalt	0.016	(1)	2.037	(1)	0.880	(9)
2	Bricks	0.009	(1)	0.117	(1)	1.260	(9)
3	Concrete	0.029	(1)	0.552	(1)	1.280	(9)
4	Plasterboard	0.047	(1)	0.227	(1)	-0.030	(9)
5	Clay, fines, rubble & soil	0.087	(1)	0.675	(1)	0.440	(1)
	Metals						
6	Steel	0.615	(2)	7.940	(9)	-2.360	(9)
7	Aluminium	14.773	(2)	171.100	(8)	181.770	(8)
8	Non-ferrous metals	3.395	(3)	36.090	(9)	5.970	(9)
	Organics						
9	Food Organics	0.518	(3)	1.608	(1)	0.700	(1)
10	Garden Organics	0.230	(3)	0.470	(8)	0.480	(8)
11	Timber	0.328	(3)	1.318	(10)	0.540	(10)
12	Organics - Other	0.481	(3)	2.165	(1)	0.230	(1)
	Cardboard & paper						
13	Cardboard & waxed cardboard	0.304	(1)	12.532	(1)	33.040	(1)
14	Liquid Paperboard	0.641	(1)	9.191	(1)	16.220	(1)
15	Magazines	0.464	(1)	9.065	(1)	22.160	(1)
16	Newsprint	0.464	(1)	9.065	(1)	22.160	(1)
17	Phonebooks	0.243	(1)	12.306	(1)	33.120	(1)
18	Printing & Writing Paper	0.579	(1)	12.989	(1)	31.110	(1)
	Plastics						
19	Polyethylene terephthalate	1.032	(2)	50.703	(4)	-21.078	(4)
20	High density polyethylene	0.692	(2)	55.952	(4)	-3.510	(4)
21	Polyvinyl chloride	1.568	(4)	42.146	(4)	66.406	(4)
22	Low density polyethylene	0.692	(5)	55.952	(5)	-3.510	(5)
23	Polypropylene	1.644	(1)	58.632	(1)	-12.980	(1)
24	Polystyrene	1.365	(6)	60.663	(6)	-17.631	(6)
25	Mixed &/or Other plastics	1.365	(3)	60.663	(4)	-17.631	(4)
	Glass						
26	Glass	0.597	(1)	6.417	(1)	2.420	(1)
	Other Materials						
27	Fly ash	0.029	(7)	0.552	(7)	1.260	(7)
28	Foundry sands	NS		NS		NS	
29	Leather & textiles	NS		NS		NS	
30	Tyres & other rubber	1.185	(3)	67.162	(1)	52.430	(1)

Notes:

(1) Source: EcoRecycle Victoria (2005)
(2) Source: Zero Waste SA (2009); Municipal, C&I & C&D emission factors weighted by 2009-10 Sector Origin
(3) Source: Zero Waste SA (2010); 2008-09 Recycling Activity emission factor
(4) Source: NSW DECCW (2010); Kerbside and C&I/C&D emission factors weighted by 2009-10 Sector Origin
(5) HDPE value adopted per Zero Waste SA (2010)
(6) Mixed/Other plastics value adopted per Zero Waste SA (2010)
(7) Concrete value adopted per Zero Waste SA (2010)
(8) Source: NSW DECCW (2010); Kerbside value
(9) Source: NSW DECCW (2010); C&I/C&D value
(10) Source: EcoRecycle Victoria (2005); Saw dust value
(11) Organics - Other value adopted
NS Not specified as insufficient reference data identified