Government of South Australia
Zero Waste SA

SA Recycling Activity Report

2010-11





rawtec

In association with

infraPlan Life Cycle Strategies

May 2012

- IMPORTANT NOTES-

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Executive Summary

Resource Recovery & Diversion

1. During the financial year 2010-11 South Australia's (SA's) recycling industries reported 4.31 million tonnes of material diverted to resource recovery.
   (a) Table 1 and Figure 1 (overleaf) reports SA's resource recovery and landfill disposal data for 2010-2011 and the same data from the preceding 5 years and SA's first survey (base) year, 2003-04.
   (b) Resource recovery data in report are presented in accordance with the new National Waste and Recycling Reporting Guidelines (DSEWPC, 2010):
      - ***Recycling**– includes most of the traditionally reported material categories;*
      - ***Separately reported recycling**– data reported for recycled soil, sand, rock and fly ash materials.*
2. In 2010-11 material diverted to resource recovery has increased by 56% compared with 2.76 million tonnes of resource recovery reported in SA last financial year (2009-10).
   - *This significant increase is attributed to substantial resource recovery of waste fill (approximately an extra 1.1 million tonnes) which took place during 2010-11 at several major infrastructure projects in SA, including the Adelaide Desalination Plant and Royal Adelaide Hospital.*
3. In 2010-11, waste accepted by SA landfills increased to 1.08 million tonnes (an increase of 4.7% from 2009-10).
   - *This increase in landfill waste tonnage is also linked to major infrastructure projects in SA that contributed large volumes of contaminated fill to landfill.*
4. Despite an increase in landfill disposal, the higher resource recovery achieved during 2010-11 produced a significant increase in the recovery (or diversion) rate[1] for SA (from 72.7% in 2009-10) to 79.9%.
   (a) It is anticipated that the high level of recovery seen in 2010-11 will not be repeated in 2011-12 as these major infrastructure projects are completed and relative levels of resource recovery and landfill disposal return to more normal levels.
      - *Even with the effects of these infrastructure projects being removed from SA's 2010-11 resource recovery data, the underlying recovery rate would be at least 74.8%[2], still an increase from 2009-10.*
   (b) Furthermore, it should be recognised that such an increase (or decrease) reflects the inherent volatility of annual resource recovery data, which can fluctuate from year to year depending on economic cycles and activities occurring in SA.

[1] Recovery rate (also referred to as diversion rate) is defined as the proportion (by weight) of material resource recovered for re-processing as a percentage (%) of total waste being generated – as defined by the National Waste and Recycling Reporting Guidelines (DSEWPC, 2010).

[2] Approximated by subtracting 1.1 million tonnes of estimated extra soil (resource recovered from major infrastructure projects during 2010-11) from both total recycling and waste generated line in Table 1, i.e. Diversion Rate = 3.21 million tonnes/4.294 million tonnes ~ 74.8%.

Table 1 Annual South Australian resource recovery, landfill quantities and recovery performance in 2010-11, preceding 5 years, and first survey year 2003-04[3]

	2003-04[4]	2005-06[4]	2006-07[4]	2007-08[4]	2008-09[4]	2009-10	2010-11	Change 09-10 to 10-11	Change 03-04 to 10-11
Total recycling reported:	2,042,000	2,396,000	2,434,000	2,611,000	2,552,000	2,760,000	4,310,000	56%	111%
-Recycling Data (tonnes)[(a)]	*1,880,000*	*2,088,000*	*2,110,000*	*2,248,000*	*2,309,000*	*2,340,000*	*2,850,000*	*22%*	*52%*
-Separately Reported Recycling Data (tonnes)[(b)]	*162,000*	*308,000*	*324,000*	*363,000*	*243,000*	*420,000*	*1,460,000*	*248%*	*801%*
Waste to landfill (tonnes)	1,278,000	1,158,000	1,144,000	1,130,000	1,072,000	1,035,000	1,084,000	4.7%	-15%
Total waste generation (tonnes)	**3,320,000**	**3,554,000**	**3,578,000**	**3,741,000**	**3,624,000**	**3,795,000**	**5,394,000**	42%	62%
SA recovery rate (%)	**61.5%**	**67.4%**	**68.0%**	**69.8%**	**70.4%**	**72.7%**	**79.9%**	10%	30%
- If extra soil from major infrastructure projects was removed[(c)]							**74.8%**	2.9%	22%
South Australian population	1,534,000	1,550,042	1,584,500	1,601,800	1,622,700	1,644,600	1,657,000	0.8%	8%
Per capita diversion (kg/person)	1,330	1,550	1,540	1,630	1,570	1,680	2,600	55%	95%
Per capita landfill (kg/person)	830	750	720	710	660	630	650	3.2%	-22%
Per capita total waste (kg/person)	2,160	2,300	2,260	2,340	2,230	2,310	3,250	41%	50%

Notes:

(a) Recycling– includes most of the traditionally reported material categories

(b) Separately reported recycling– data reported for recycled soil, sand, rock and fly ash materials

(c) If effect of *ca.* 1.1million tonnes of estimated extra soil arising from major infrastructure projects during 2010-11 was removed – also see Footnote 2 (on previous page)

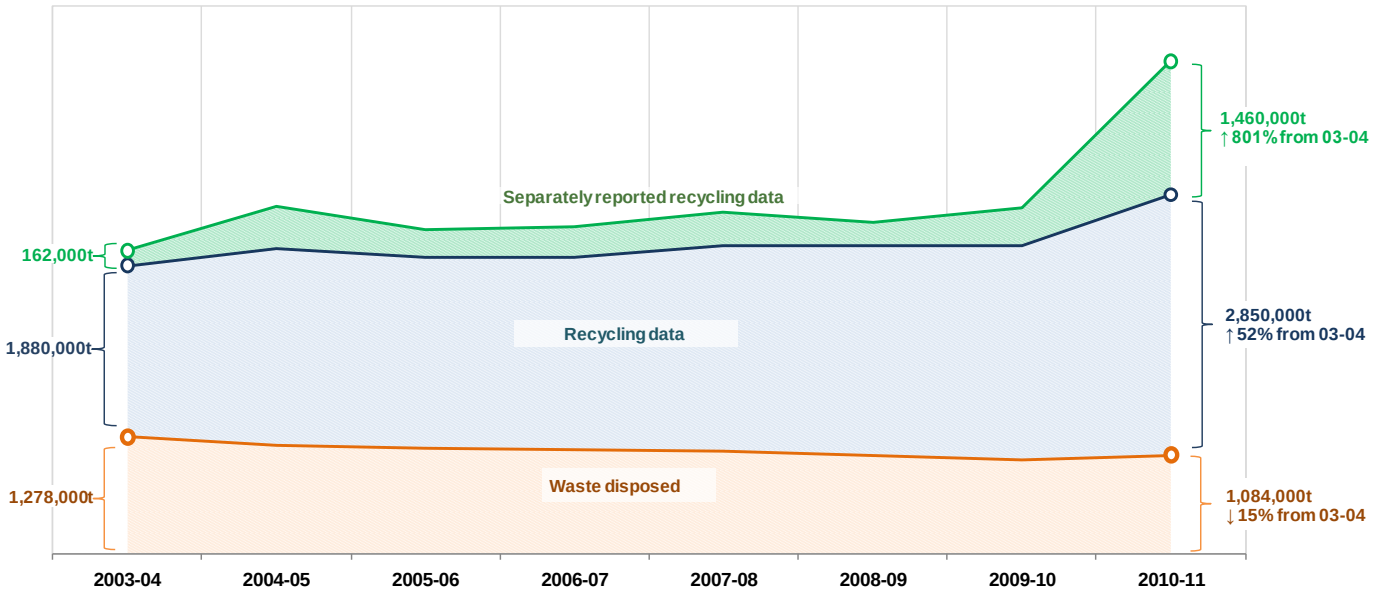

Figure 1 Trend in annual SA resource recovery and landfill disposal since 2003-04[3]

[3] Data is presented in accordance with new National Waste and Recycling Guidelines (DSEWPC, 2010).

[4] Data from surveys in these years has been rounded to 3 significant figures.

5. Higher resource recovery for 2010-11 has increased SA's per capita diversion/recovery rate to 2,600 kg per person (up 55% from 2009-10) – see Table 1 and Figure 2 below.

   (a) SA currently has the both the highest publicly reported diversion (at 79.9%) and per capita resource recovery rate of any state or territory in Australia[5].

   - *Note: At the time of preparing this report, 2010-11 recycling activity data was not publicly available for (or had not yet been publicly released by) other Australian states and territories. The most recent recycling activity data was therefore used for comparison purposes.*
   - *Furthermore, not all Australian states and territories collected and reported their recycling data in conformance with the National Waste and Recycling Reporting Guidelines (DSEWPC, 2010).*
   - *Refer Figure 2's label and associated footnotes on this page for additional explanation of differences between recycling data sets that were used for this comparison.*

   (b) Even with the effect of major infrastructure projects (i.e. 1.1million tonnes) removed from SA's 2010-11 recycling activity data, the underlying per capita recovery rate for SA in 2010-11 would be at least 1930 kg per person, which is up 15% from 2009-10.

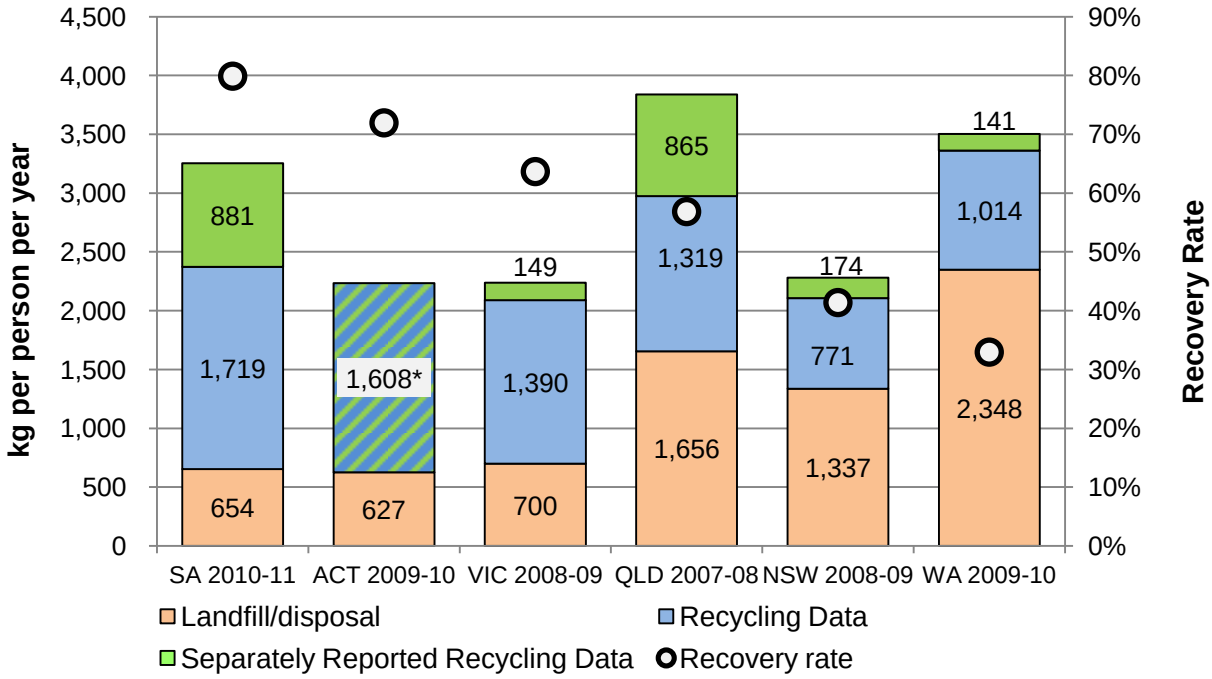

Figure 2 Comparison of reported per capita (kg/person/yr) resource recovery and landfill disposal and recovery (%) by State or Territory.[6,7] Note: *ACT recycling data for 09-10 does not separately indicate soil, sand and rock from C&D data and therefore the distinction between recycling data and separately reported recycling data could not be made.

[5] Note: Not all recycling data needed for this comparison could be obtained for 2010-11. Furthermore, not all Australian states and territories collect and report this data in conformance with the National Waste and Recycling Reporting Guidelines (DSEWPC, 2010). Also see Figure 2 label for further explanation of differences between data sets that were used.

[6] Data is presented in accordance with new National Waste and Recycling Guidelines (DSEWPC, 2010).

[7] Estimated waste generation, recycling and landfill disposal were based on most current and best available data for each State/Territory. Fly ash was excluded from SA and QLD recycling data for comparison purposes. All figures have been rounded. 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.

Material Recovery

6. The increase in SA's reported resource recovery during 2010-11 was driven by several factors:
   (a) *There has been a slight underlying increase to the volumes of resource recovered materials from recycling industries that have traditionally reported to this survey in past years.*
   (b) *There has been continuing growth in newer sources of resource recovered material from other recycling industries not previously surveyed. These newer sources include meat rendering and bio-solids, and contributed at least 290,000t – see Organics Other in Table 2 (overleaf).*
   (c) *Several major infrastructure projects, including Adelaide Desalination Plant and Royal Adelaide Hospital, contributed to substantial volumes of waste fill being resource recovered as Clay, fines, rubble & soil, which increased from approximately 250,000t in 2009-10 to 1.26 million tonnes during 2010-11).*
7. Table 2 overleaf itemises SA 2010-11 reported values of resource recovery for each material category.
   (a) *The highest recorded quantities, by weight and in decreasing order (see Figure 3 below), were: Clay, fines, rubble & soil (1,260,000 tonnes), Concrete (860,000 tonnes), Organics Other (440,000 tonnes), Steel (391,000 tonnes), Timber (282,000 tonnes), Garden Organics (230,000 tonnes), Fly ash (200,000 tonnes), Cardboard & waxed cardboard (154,000 tonnes), Asphalt (145,000 tonnes), Bricks (100,000 tonnes) and Glass (58,000 tonnes).*
   (b) *The most significant rises in resource recovery by material during 2010-11 were for Clay, fines, rubble and soil (+1,010,000 tonnes or 404%) and Organics Other (+292,000 or 197%).*
   (c) *Lower reported recovery during 2010-11, however, occurred for several materials –the greatest decreases (by weight) were seen in Cardboard (- 8,000 tonnes or -5%) and Printing and writing paper (-2,800 tonnes of -17%).*

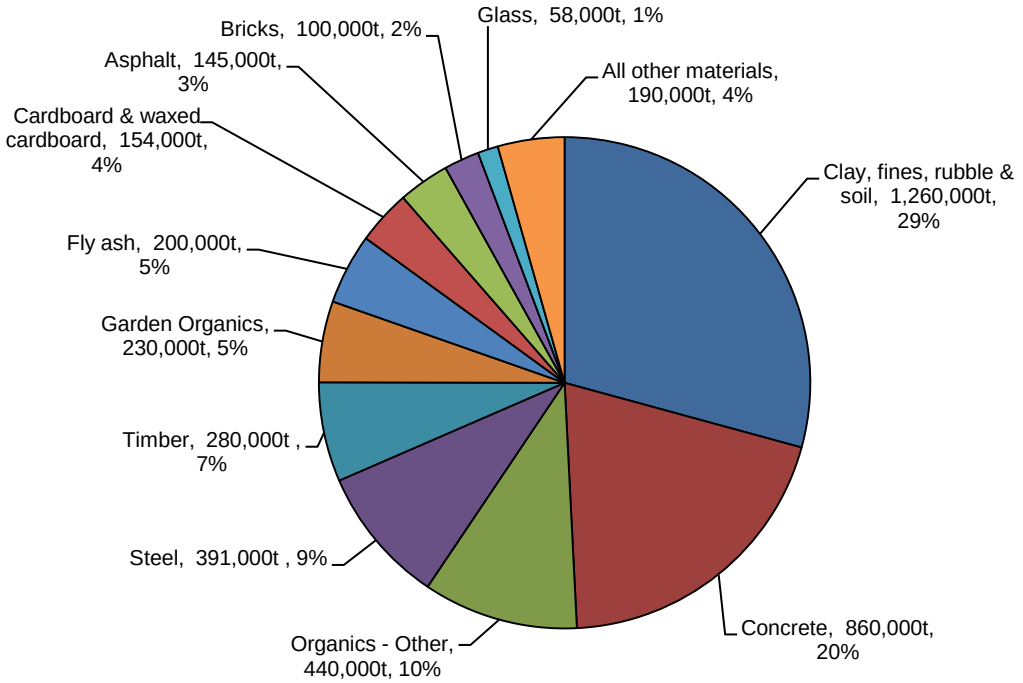

Figure 3 Composition of recovered materials (by weight, tonnes (t) and %), SA 2010-11

Table 2 Reported material quantities (tonnes) being diverted for resource recovery in SA for 2010-11, preceding 5 years, and first Survey year, 2003-04[8]

ID	Material	2003-04	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Change (%) 09-10 to 10-11
	Masonry								
1	Asphalt	100,000	85,900	83,640	103,070	101,484	131,000	145,000	11%
2	Bricks	165,000	102,475	43,962	90,846	113,993	77,000	100,000	30%
3	Concrete	877,000	762,134	793,710	818,116	984,735	790,000	860,000	8.9%
4	Plasterboard	0	0	0	0	0	0	300	N/A
	Subtotal	*1,142,000*	*950,509*	*921,312*	*1,012,032*	*1,200,212*	*998,000*	*1,105,300*	*11%*
	Metals								
5	Steel	264,200	278,028	323,850	365,391	271,277	334,000	391,000	17%
6	Aluminium	19,000	22,171	20,845	24,434	21,895	18,200	19,400	6.6%
7	Non-ferrous metals	13,000	19,470	24,300	21,755	18,495	23,600	31,100	32%
	Subtotal	*296,200*	*319,669*	*368,995*	*411,580*	*311,667*	*375,800*	*441,500*	*17%*
	Organics								
8	Food Organics	0	6,005	3,981	5,796	4,820	5,800	4,400	-24%
19	Garden Organics	130,100	222,499	209,725	202,397	203,558	220,000	230,000	4.5%
10	Timber	116,700	255,728	275,385	241,387	254,866	262,000	280,000	6.9%
11	Organics Other	0	81,625	82,636	79,359	41,666	148,000	440,000	197%
	Subtotal	*246,800*	*565,857*	*571,727*	*528,939*	*504,910*	*635,800*	*954,400*	*50%*
	Cardboard & paper								
12	Cardboard & waxed cardboard	91,000	106,943	96,436	122,357	104,128	162,000	154,000	-4.9%
13	Liquid Paperboard	0	1,239	1,373	1,476	1,475	3,900	3,500	-10%
14	Magazines	0	5,918	4,680	5,728	7,313	5,500	5,700	3.6%
15	Newsprint	31,398	40,607	40,000	41,393	40,219	32,000	32,000	0%
16	Phonebooks	1,303	2,042	2,042	2,000	5,051	2,500	2,500	0%
17	Printing & Writing Paper	12,300	18,803	30,574	42,745	45,877	16,400	13,600	-17%
	Subtotal	*136,001*	*175,552*	*175,105*	*215,699*	*204,063*	*222,300*	*211,300*	*-4.9%*
	Plastics								
18	Polyethylene terephthalate	0	4,753	5,704	5,440	5,200	5,500	4,100	-25%
19	High density polyethylene	0	3,026	2,779	2,821	2,685	4,900	4,600	-6.1%
20	Polyvinyl chloride	0	365	363	317	408	80	170	113%

[8] Data is presented in accordance with new National Waste and Recycling Guidelines (DSEWPC, 2010).

ID	Material	2003-04	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Change (%) 09-10 to 10-11
21	Low density polyethylene	0	5,043	5,403	3,375	2,954	4,200	4,600	10%
22	Polypropylene	0	1,252	1,542	1,202	1,529	4,000	4,000	0%
23	Polystyrene	0	332	167	365	540	200	430	115%
24	Mixed &/or Other plastics	8,607	1,107	922	1,755	462	1,600	5,800	263%
	Subtotal	*8,607*	*15,878*	*16,880*	*15,275*	*13,778*	*20,480*	*23,700*	*16%*
	Glass								
25	Glass	45,600	50,067	50,110	53,224	61,552	57,000	58,000	1.8%
	Other Materials								
26	Foundry sands	0	6,755	2,000	0	0	11,900	31,800	167%
27	Leather & textiles	4,080	2,419	2,348	2,376	3,052	3,900	3,900	0%
28	Tyres & other rubber	88	1,535	1,486	9,434	10,138	15,000	17,000	13%
	Subtotal	*4,168*	*10,709*	*5,834*	*11,810*	*13,190*	*30,800*	*52,700*	*71%*
	Total of above materials	***1,879,376***	***2,088,241***	***2,109,963***	***2,248,559***	***2,309,372***	***2,340,180***	***2,846,900***	***22%***
	Materials reported separately (per new National Waste and Recycling Guidelines (DSEWPC 2010)								
29	Fly ash	0	236,343	260,913	272,000	223,000	170,000	200,000	18%
30	Clay, fines, rubble & soil	162,400	70,989	63,251	90,837	19,831	250,000	1,260,000	404%
	Total Reported	***2,041,776***	***2,395,573***	***2,434,127***	***2,611,396***	***2,552,203***	***2,760,000***	***4,310,000***	***56%***

Sector Origins of Recovered Material

8. Commercial and industry (C&I) and construction and demolition (C&D) activities (at 32% and 57%, respectively) continued to constitute the main sources of resource-recovered material reported by SA recycling industries in 2010-11 (Table 3).

   (a) The principal material contributors for each source sector (Figure 4) were:

   - *C&D – Masonry materials.*
   - *C&I – Organics, Paper/Cardboard, Metals and Other materials.*
   - *Municipal – Organics, Paper/Cardboard, Metals and Glass.*

   (b) Materials being reported by industry as originating from Municipal sources for 2010-11 (at 440,000 tonnes) were greater than in 2009-10 (reported at 340,000 tonnes) even through its relative contribution decreased from 12% (in 2009-10) to 10% (in 2010-11).

   (c) In 2010-11, the quantity of materials originating from the C&D sector significantly increased (nearly doubling from 1.3million tonnes reported in 2009-10) due to waste fill being resource recovered by (the aforementioned) infrastructure projects occurring in SA during the 2010-11 survey period.

Table 3 Sector origins (by weight, tonnes and %) of SA recovered materials, SA 2010-11

Sector Origin	Quantity	
	tonnes	(%)
Municipal	440,000	10%
C&I	1,400,000	32%
C&D	2,470,000	57%
Total	**4,310,000**	**100%**

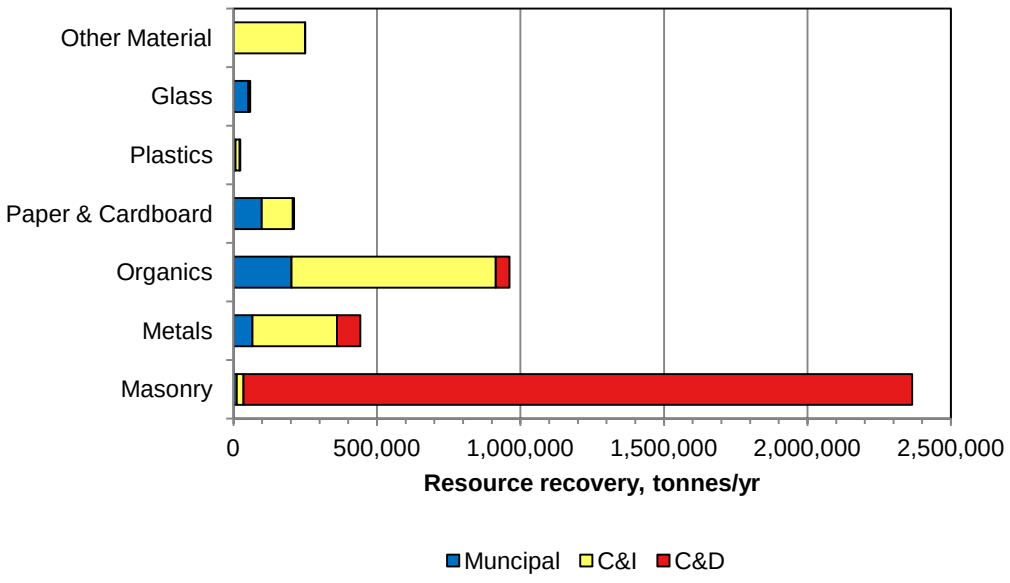

Figure 4 Sector origin of SA recovered materials according to material category (by weight, tonnes), SA 2010-11

Geographical Origin of Recovered Materials

9. The 2010-11 recycling activity survey again asked the industry to report whether materials were sourced from metropolitan or regional areas (Table 4 below).
   (a) Survey responses to this question confirm regional areas contribute significantly to SA's recycling activity.
   (b) Materials being reported by industry as originating from Regional areas for 2010-11 (at 780,000 tonnes) were greater than in 2009-10 (reported at 640,000 tonnes) even though its relative contribution to resource recovery decreased from 23% (in 2009-10) to 18% (in 2010-11).
   - *This increase in Regional volumes in 2010-11 is principally attributed to resource recovered material from new sources not previously surveyed.*
   - *The relative Regional area contribution to total SA resource recovery, however, decreased because of extra resource recovery in the Metro area from infrastructure projects during 2010-11.*

Table 4 Geographical origins (by weight, tonnes and %) of SA recovered materials, SA 2010-11

Sector Origin	Quantity	
	tonnes	(%)
Metro	3,530,000	82%
Regional	780,000	18%
Total	**4,310,000**	**100%**

Destination of Recovered Materials

10. At least 3.7 million tonnes or 86% of all recovered material reported for 2010-11 was sent for re-processing within South Australia (Table 5 below). These recovered materials were converted into:
    - Recycled Product – Material feedstock to replace virgin material;

      or
    - Manufactured Product – Final consumer or market product.

   (a) Consequently, most recycling activity in SA directly leads to production of a manufactured product.
   (b) These findings confirm that SA has developed its own recycling industry capabilities in most material sectors with the exception of Paper and Cardboard (Figure 5 overleaf).
   (c) It is noted that the quantity of materials reported as being exported overseas substantially increased in 2010-11 (at 370,000tonnes) from the 251,000tonnes reported as exported during 2009-10.
   - *This export value for resource recovered material in SA, however, has fluctuated considerably from year-to-year, with both higher and lesser export values (than 370,000tonnes) being reported in previous survey years.*
   - *Such variation in export values may reflect economic cycles and demand for these materials occurring locally in SA and Australia, as well as international economic activity and overseas demand and commodity prices for these materials.*

Table 5 Final reported destination (by weight, tonnes and %) of SA sourced materials, SA 2010-11 – see footnote for explanatory remarks[9].

Destination		Quantity	
		tonnes	%
SA	*Manufactured Product*	3,707,000	86%
	Recycled Product	15,000	0.3%
	Material Recovery	300	0.01%
Interstate		217,700	5%
Export		370,000	9%
Total		**4,310,000**	**100%**

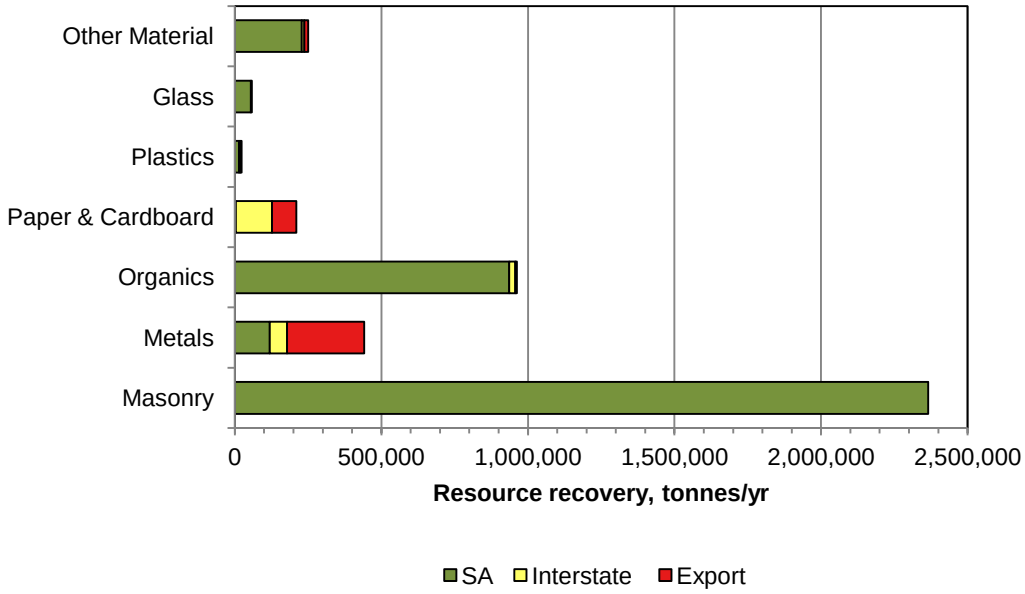

Figure 5 Destination of SA recovered materials according to material category (by weight, tonnes), SA 2010-11

[9] SA Destinations: Manufactured product – material re-processed to final consumer product and sold to market; Recycled Product – material re-processed to feedstock to replace a virgin material; Material Recovery – Material reported as sent to recyclers in SA but which could not be attributed to another specific SA destination category. Interstate – material sent interstate for re-processing or export overseas. Export – material exported directly from SA to overseas destination

E-waste Recycling

11. The resource recovery of e-waste reported during 2010-11 was 3,220 tonnes, which is 78% higher than that reported in 2009-10 (1,805 tonnes).
    (a) A driver of this increase was the Digital TV Switchover which commenced in regional areas of SA during 2010-11.
    (b) The source of this e-waste was split approximately 77%/23% between municipal and C&I sectors (respectively).
    (c) The majority of collected e-waste was:
        - Aggregated – then sent interstate or overseas for re-processing;

          and/or additionally,
        - Sorted & Disassembled – Material recovery of metals, plastics and/or glass components, with these materials and residual components then sent to local aggregators or directly interstate or overseas[10].

    (d) Demand for e-waste recycling is projected to increase substantially when landfill bans in SA for e-waste begin on 1 September 2012 and under the National Product Stewardship Framework for televisions and computers, which also commences in the second-half of 2012 (DEHWA 2010).

Table 6 Industry reported e-waste recovery (by weight, tonnes and %) for SA, 2010-11

Item	Quantity	
	tonnes	%
Printer cartridges	130	4%
Compact fluorescent lamps	18	1%
Batteries	1	0%
Computers	660	21%
Televisions / Monitors	1,840	57%
Mobile phones	30	1%
Other e-waste	540	17%
Total	**3,220**	**100%**

[10] For this reason, e-waste is reported separately to other materials as the majority of the recovered constituents are already included in industry-reported data for metals, plastic and/or glass.

Packaging Recovery

12. Total packaging recovery for 2010-11 was estimated at close to 220,000 tonnes, which is similar to packaging recovery reported in 2009-10 (221,000 tonnes).
    - *There was negligible change in the container deposit recovery rate during 2010-11 (82%) compared with 2009-10 (83%).*

Environmental Benefits Assessment

13. Environmental benefits for recycling of resource-recovered materials from SA during 2010-11 were assessed (Table 7 overleaf):
    - Greenhouse Gas Savings – 1,290,900 tonnes of CO2-e
    - Energy Savings –16,100 Terajoules (TJ) [Note: 1 TJ = 1,000 Gigajoules (GJ)]
    - Water Savings – 12.6 Gigalitres (GL)

    (a) Greenhouse gas savings estimated for 2010-11 were 33% greater than that reported in 2009-10. This increase is principally due to the greater material recovery achieved during 2010-11.

    (b) This analysis demonstrates that the high levels of resource recovery and recycling of waste materials achieved by SA delivers significant environmental benefits by substantially reducing resource consumption of virgin materials that would have otherwise occurred.

Table 7 Environmental benefits projected from resource recovery and recycling for SA, 2010-11

Environmental Benefit	Value		Equivalent Measure	
GHG Emissions Saved	1,290,900	tonnes CO2-e	297,000	Equivalent cars off the road (1 year)
Energy Saved	16,100	TJ LHV	2,824,000	Barrel of Oil Equivalents (BOE)
Water Saved	12,600	ML	5,030	Olympic Swimming Pools

Contents

1 Introduction

Since 2003-04, Zero Waste SA has undertaken a recycling activity survey of the South Australia's recycling industries.

- *The objective of this survey has been to collect industry statistics on resource recovery of materials which might otherwise be sent to landfill.*
- *These statistics are being used by Zero Waste SA to monitor and report the performance of South Australia against sustainability targets for resource recovery in the State's 2011-2015 Waste Strategy (Zero Waste SA 2012).*

This report summarises the findings of the 2010-11 Recycling Activity survey for South Australia.

- Section 2 – Describes the methodology that was used
- Section 3 – Summarises selected survey statistics relating to industry participation
- Section 4 – Presents the final survey results by each material category
- Section 5 – Gives a separate analysis of packaging materials derived from the survey data
- Section 6 – Assesses the environmental benefits of recycling for South Australia based on its 2010-11 recycling performance
- Section 7 – Lists a number of the participating organisations (which consented to their survey contributions being acknowledged in this report)
- Section 8 – Gives a glossary of some common terms used in this report which may aid the reader
- Section 9 – Lists the references used in compiling this report
- Appendices –
    - Appendix 1 – Gives a copy of the questions used in the 2010-11 Recycling Activity Survey
    - Appendix 2 – Lists the emission and conversion factors that were adopted for the environmental benefits analysis of the 2010-11 recycling activity data

2 Methodology

Rawtec was engaged by Zero Waste SA to undertake the Recycling Activity (survey) in South Australia for the financial year 2010-11. Input was provided by Infra-Plan and Life Cycle Strategies for the environmental benefits analysis conducted on the reported recycling activity data. This section summarises the approach and methodology used to conducting the 2010-11 recycling activity survey.

- *This approach and methodology was similar to that used for the 2009-10 recycling activity survey, which was also undertaken by Rawtec.*

2.1 Selection of Materials

The materials to be surveyed for recycling activity was agreed with Zero Waste SA – see Appendix 1 for a complete list.

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

2.2 Survey Design & Delivery

2.2.1 Survey Respondents

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

- *The final list included over 109 companies or organisations, which included all survey respondents from 2009-10 and newly identified companies involved with recycling activity in SA.*

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

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

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.

   - Plastics and Chemicals Industries Association (PACIA) – Data on plastics production and recycling by the plastics industry
   - Publishers National Environment Bureau (PNEB) – Data on newsprint consumption and recycling by the publishing industry

3. Government agencies/bodies

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

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

2.2.2 Confidentiality

It was agreed with Zero Waste 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.*

2.2.3 Survey Questionnaire

A survey questionnaire was developed and agreed with Zero Waste SA.

- *The 2010-11 Questionnaire was slightly modified to that used during 2009-10 to improve the quality of data collection. These improvements focussed on clarifying the source and destination of each material stream received for resource recovery or recycling.*

Appendix 1 lists the questions that were included in the 2010-11 Questionnaire.

2.2.4 Survey Deployment

The survey was deployed to the survey respondents during November and early December 2011.

- *The deployment method was by email except in several instances where it was faxed to respondents without internet access.*
- *Following survey deployment, respondents were also contacted by phone to confirm receipt of the survey and determine if they had any queries or required assistance with completing the survey. In several instances it was discovered that the relevant company or organisation no longer existed or recycling activity had not occurred during 2010-11.*

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

[11] ZEUS is a new web-based system that has been purpose developed by Zero Waste SA to collect data from local government and industry on waste disposal and resource recovery within South Australia. The system is currently being piloted for collection of resource recovery data with a select group of industry sectors.

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

The collection of survey data was closed in mid-February 2012.

2.2.5 Consultation

A selected number of recycling industry companies were given the opportunity to participate in direct face-to-face consultation as part of the 2010-11 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.*

2.3 Data Analysis

2.3.1 Materials Analysis & Reporting

Data collected by the survey was analysed to determine the following for each material.

- ***Quantity*** – The total reported quantity of that material recovered in South Australia for recycling or reuse
- ***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 – 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 South Australia from other states and territories or overseas for reprocessing 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 2010-11, the only exception to this approach were:
    - Metal, Cardboard & paper and Plastics material data from Adelaide Material Recovery Facilities (MRFs) where SA LGA packaging[12] and metropolitan kerbside collection data were used to interpolate some material stream compositions

[12] SA Government (2010a), Report to the NEPC on the implementation of the National Environment Protection (Used Packaging Materials) Measure for South Australia

2.3.2 Accuracy of reported data

In 2010-11, survey respondents were asked to report on the accuracy of the data they were providing. This accuracy data was used to determine an estimated reporting accuracy for each material[13].

- *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.*

2.3.3 Per capita analysis & National benchmarking

Metrics for per capita waste and recycling by South Australia and benchmarking of these metrics against similar data from other states and territories is only presented in the Executive Summary to this report. These metrics were calculated using the following data and assumptions. It should be noted that some of the interstate resource recovery data employed for benchmarking in 2010-11 is the same as that for 2009-10; more recent resource recovery data in these instances has either not been compiled or released publicly including in sufficient detail to enable proper analysis (at the time this analysis was undertaken).

- Population statistics were sourced from the Australian Bureau of Statistics (ABS) (2011).
- The relevant reporting periods and sources of recycling activity data were:
  - SA: 2010-11, as reported in this survey;
  - ACT: 2009-10, as sourced from: ACT Rubbish and Recycling Statistics (ACT DTMS, 2011);
  - VIC: 2008-09, as reported by: Victorian Recycling Industries Annual Survey, 2008–2009 (Sustainability Victoria, undated);
  - WA: 2009-10, as reported by: Recycling Activity in Western Australia, 2009-10 (WA Waste Authority, 2010);
  - NSW: 2008-09, as reported by: Waste Avoidance and Resource Recovery Strategy Progress Report, 2010 (NSW DECCW, 2010);
  - QLD: 2007-08, as reported by: The State of Waste and Recycling in Queensland 2008 – Technical Report (QLD DERM, 2009).
- Adjustments were made to the above data to present recycling data in accordance with the new National Waste and Recycling Guidelines (DSEWPC, 2010).

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

2.3.4 Packaging Recovery Analysis & Reporting

Packaging data was taken directly from Recycling Activity Survey data:

- Container deposit bottle and can packaging:
  - From 2010-11 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.

2.3.5 Environmental Benefits Analysis

2.3.5.1 General Approach

The methodology for this analysis was aligned as much as possible to the approach applied in previous recycling activity surveys developed for South Australia and was essentially the same as that developed for the 2009-10 SA Recycling Activity Survey.

The scope of environmental benefits analysis therefore 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) H2O) –*** The reduction in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

2.3.5.2 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 2.1 overleaf 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.

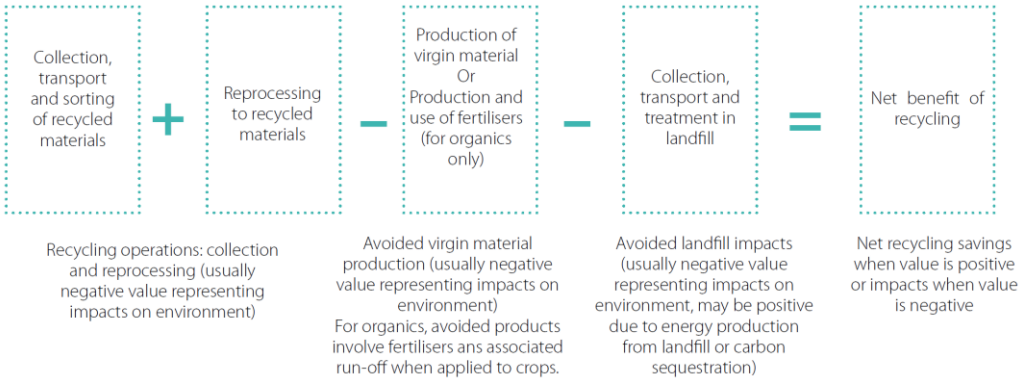

Figure 2.1 Method for calculating the net environmental impacts in the recycling process. Source: NSW DECCW (2010)

LCA techniques have previously been used to estimate conversion and emission factors for Australian situations including for South Australia. 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 South Australia.

- Benefits of Recycling in South Australia study (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)
- SA Recycling Activity survey, 2008-09 (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.

- Industry organics
- Foundry sands
- Leather & textiles
- Alternative Fuel
- E-waste
- Reuse items

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

The 2010-11 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 (Zero Waste SA 2011a).

- *Before this decision was made, a review of 2009-10 recycle activity report emission factors was undertaken.*
- *This review noted that a number of recycling industries in Australia and South Australia had developed and released new emission factor data for recycling of selected materials since the SA 2009-10 Recycling Activity Report. These newly published emission factors were slightly different to the emission factor data used by the 2009-10 SA recycling activity analysis, e.g. ARRB (2010), NTPSG (2012) and generally predicted higher greenhouse gas recycling benefits from recycling of these materials.*
- *Consequently, it was decided that no change to the 2009-10 analysis emission factors should be made.*

The final values adopted for conversion and emission factors using in the 2010-11 recycling activity survey are listed in Appendix 2. Some brief notes on the sources and key assumptions made in deriving these conversion and emission factors are included in Appendix 2.

2.3.5.3 Qualifications & Limitations

The following qualifications and limitations should be recognized about the environmental benefits analysis presented in this report. These qualifications and limitations are not unique to the 2010-11 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 recognize 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.
3. In view of the above, the assessment in this study represents a generalized 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.

3 Selected Survey Statistics

The following presents some survey statistics that may provide a useful insight into the recycling activity occurring in South Australia and the types of data and information sets that were returned and analysed in 2010-11.

3.1 Survey Participation & Reported Data

Table 3.1 below summarises the survey participation and reported data points for 2010-11.

- The survey questionnaire was successfully deployed to approximately 93 or 85% of the initial list of 109 companies or organisations potentially involved with recycling activity.
- The survey returns produced recycling activity data or information sets for 78 of these companies or organisations.
- Of these 78 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.
    - 8 were reference data sets from industry bodies or government agencies
    - 19 data sets came from companies or organisations that generated the material that was being recovered for recycling
    - 62 data sets were companies or organisations involved in collection or aggregation of recovered material
    - 53 data sets were for companies or organisations undertaking re-processing activities
    - 46 of these companies or organisations were also involved in manufacturing products from the recovered or re-processed material.

Table 3.1 Overall Survey Statistics

Statistic		No.	(%)	% Basis
Sample Size		109		
Surveys Deployed*		93	85%	of Sample Size
Survey Data Points		78	84%	of Surveys Deployed
Activity Type	Industry Reference Data	8	10%	of Survey Data Points
	Source	19	24%	of Survey Data Points
	Aggregator/Collector	62	79%	of Survey Data Points
	Recycler	53	68%	of Survey Data Points
	Manufacturer	46	59%	of Survey Data Points

3.2 Industry Data Segmentation

Table 3.2 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[14] – At what level of the waste hierarchy were materials being handled?

Table 3.2 Industry Sourced Data Statistics

Statistic		No.	(%)
No. Industry-Sourced Data Points		70	100%
Material Activity	Masonry	21	30%
	Metals	25	36%
	Organics	20	29%
	Cardboard & paper	15	21%
	Plastics	15	21%
	Glass	11	16%
	Other Materials	12	17%
	E-waste	6	9%
	Reuse Materials	11	16%
Material Destination	SA	61	87%
	Interstate	24	34%
	Export	13	19%
Waste Hierarchy	Reuse	19	27%
	Recycle	41	59%
	Material Recovery	66	94%
	Energy Recovery	4	6%

[14] 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.

4 Material Activity Reports

This section presents the key findings from analysis of Recycling Activity Survey data for each material. These material recycling activity reports are presented according to commonly accepted material sectors as follows.

1. **Masonry**
   - Asphalt
   - Bricks
   - Concrete
   - Plasterboard
   - Clay, fines, rubble & soil
2. **Metals**
   - Steel or ferrous metals
   - Aluminium
   - Non-ferrous metals (exc. Aluminium)
3. **Organics**
   - Food Organics
   - Garden Organics
   - Timber
   - Other Organics
4. **Cardboard & Paper**
   - Cardboard and waxed cardboard
   - Liquid paperboard
   - Magazines
   - Newsprint
   - Phone books
   - Printing & writing paper
5. **Plastics**
   - 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**
7. **Other Materials**
   - Fly Ash
   - Foundry sands
   - Leather & Textiles
   - Tyres & Rubber
8. **E-waste – Waste or scrap electronic or electrical equipment items**

4.1 Masonry

4.1.1 Typical Source & End Products

Tables 4.1.1 and 4.1.2 below give the source and end products that have been typically identified with resource recovery and recycling of masonry materials (ZWSA 2010). In SA,

- Masonry material is usually recovered by building and construction companies.
- Some building and construction companies source separate and/or re-process the C&D waste on or off site, directly reusing the end products for their own C&D activity (on the same site or elsewhere).
- Others deliver or arrange for transport of the material to specialised C&D material aggregators, collectors and/or reprocessors, either directly or via drop-off points and/or transfer stations, where it is then transformed into manufactured products for reuse by the C&D industry. In this situation, this material may be handled several times by different parties before reaching its final re-processing destination.

Table 4.1.1 Typical sources of recovered masonry materials

Material	Source products
Asphalt	Roads, footpaths, car parks and kerbing
Bricks	Mainly walls and other general C&D activity
Concrete	Slabs, footings, kerbing, channel and walls
Clays, fines, rubble & soil	General C&D, Earthworks for site preparation

Table 4.1.2 Typical end-products for recycled masonry materials

Material	End Products
Asphalt	Road base, quarry rehabilitation material
Bricks	Primarily crushed for road base and drainage, but also directly reused
Concrete	Crushed as aggregate for road base and drainage, construction fill
Clays, fines, rubble & soil	Road base, batters/bunds, compost (bulking agent), quarry rehabilitation material

4.1.2 Quantities & Trends

The quantity of masonry materials reported as recovered in South Australia during 2010-11 is presented in Table 4.1.3 overleaf. The Table includes the estimated reporting error for each material.

Figure 4.1.1 (also overleaf) compares the composition of the masonry materials reported in this (2010-11) and last year (2009-10).

Figures 4.1.2 and 4.1.3 summarise the changes in recycling activity of masonry materials that have occurred since 2003-04.

Key comments and observations about reported quantities and trends in masonry materials are summarised below.

- The quantity recovered of masonry materials in 2010-11 was approximately 2,365,300 tonnes. This value represents a significant increase on 2009-10 (up by 90%)
    - Clay, fines, rubble and soil increased significantly (404% or 1,010,000 tonnes increase above 2009-10) –
        - This increase was confirmed by the industry as being due to construction and demolition activity associated with a number of large transport and infrastructure projects including the Adelaide Desalination Plant and Royal Adelaide Hospital.
        - Large quantities of Waste Fill (previously known as clean fill) were recovered for beneficial reuse in these infrastructure projects or for other construction projects requiring clean fill.
    - Brick and Concrete increased by 30% and 8.9% respectively in 2010-11 (from 2009-10), which is in line with the above increase in construction and demolition activity associated with major projects in SA.
    - Similarly, asphalt recovery also appears to have risen by 11% (from 2009-10).
    - Plasterboard recovery and recycling was recorded by a number of participants for the first time –
        - Most of the reported plasterboard recovery was being recycled through organics recycling.
        - This plasterboard recovery is not a new activity and has probably been occurring for years, but this is the first time it has been reported distinctly since introduction of this material category in the 2009-10 survey. Previously, plasterboard resource recovery would have been hidden in another survey material category. It should therefore be expected that this material category grow in subsequent years as more recyclers start reporting it as a separate item.

Table 4.1.3 Masonry materials recovery and destination, SA 2010-11

Item	Net recovery [1]	Estimated Reporting Error		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Asphalt	145,000	6,000	4%	100%	0%	0%
Bricks	100,000	6,000	6%	100%	0%	0%
Concrete	860,000	28,000	3%	100%	0%	0%
Plasterboard	300	100	33%	100%	0%	0%
Clay, fines, rubble & soil [2]	1,260,000	130,000	10%	100%	0%	0%
Total	**2,365,300**	**170,000**	**7%**	**100%**	**0%**	**0%**

1. Net recovery excludes reprocessing 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

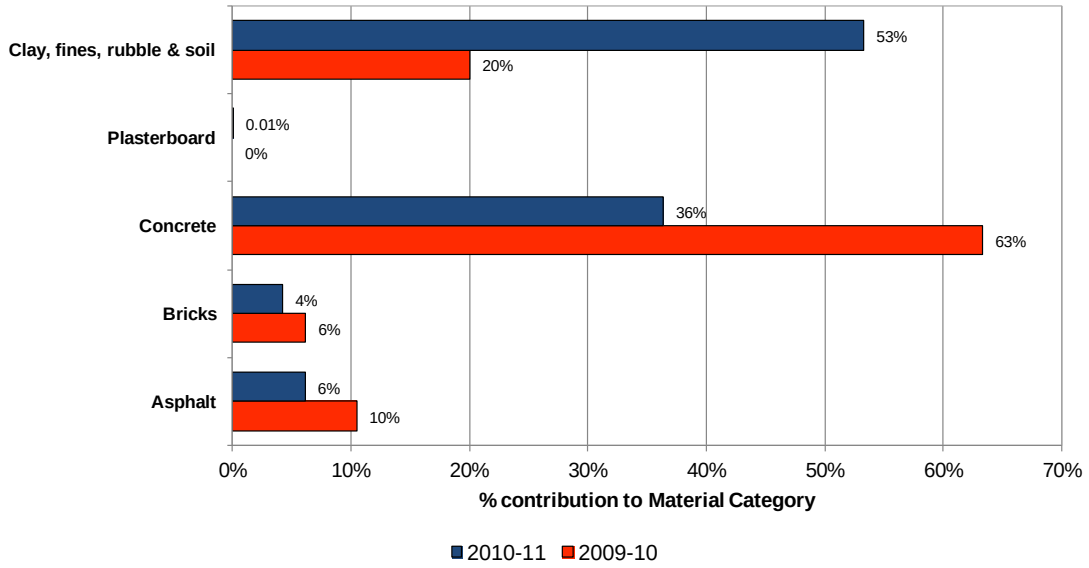

Figure 4.1.1 Changes in percent composition of recovered masonry materials (by weight), SA, between 2009-10 and 2010-11

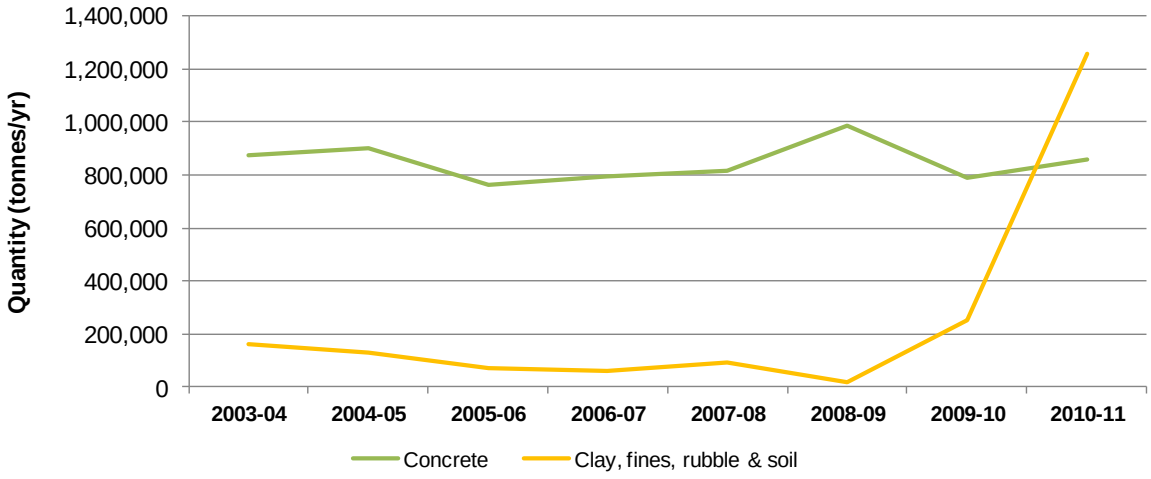

Figure 4.1.2 Changes in reported masonry material quantities since 2003-04 – Concrete and Clay, fines & soil

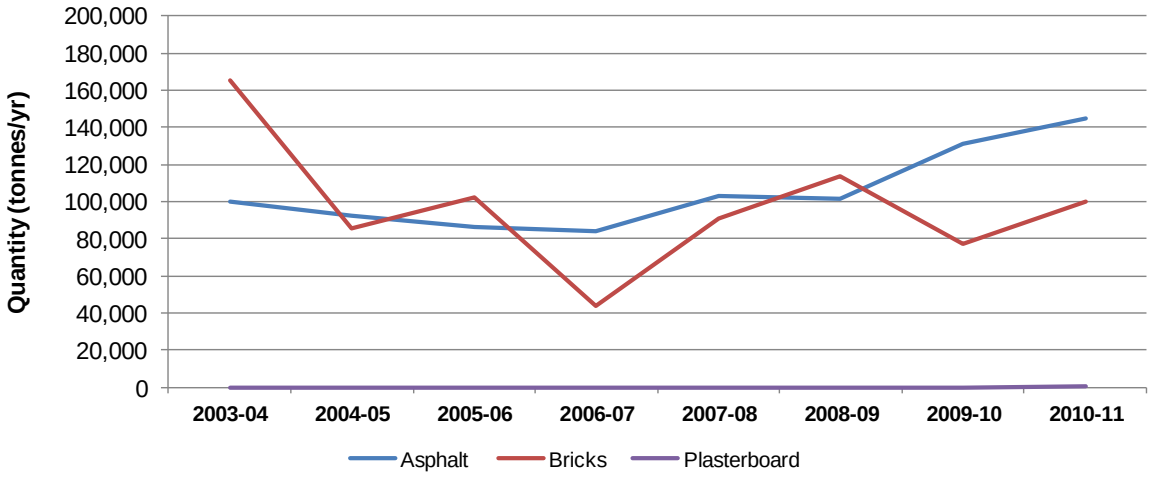

Figure 4.1.3 Changes in reported masonry material quantities since 2003-04 – Asphalt, Bricks and Plasterboard

- The reported quantities and relative contributions of masonry materials between 2009-10 and 2010-11 (Figures 4.1.1, 4.1.2 and 4.1.3) have changed significantly. Key factors for the changes include:
    - The large volumes of beneficial reuse of soils from new infrastructure sites to sites earmarked for future development.
        - It is considered the SA EPA's Standard for the Production and use of Waste Derived Fill (Issued January 2010) may have particularly influenced this recovery and this reporting of recovery during 2010-11.
    - Usual fluctuations in construction and building activity that occur from year to year.
    - Not every company or organisation involved with resource recovery of masonry materials may have consistently reported or provided complete data sets in every survey year.
- During consultations, the industry has indicated that a slowdown in construction activity was starting to appear in the latter part of the 2010-11 financial year, which may reduce resource recovery occurring in this sector during 2011-12.

4.1.3 Re-processing Destinations

Table 4.1.3 includes the final destination reported in 2010-11 for re-processing of each material.

- All of the masonry materials recovered were re-processed and ultimately sold or recycled in South Australia in the final form of a manufactured product, e.g.
    - Recovered asphalt was mixed with fresh asphalt to lay new bituminous road or paved surfaces
    - Concrete and bricks were crushed into fine rubble and sold or reused as aggregate or fill for road or construction projects
    - Whole bricks were re-processed and re-used for paving or building houses
    - Plasterboard was processed and recycled through organics processing
    - Clay, rubble, fines & soil were re-processed and sold or directly reused as fill in construction projects

4.1.4 Sector & Geographical Origin

Table 4.1.4 (below) shows the reported sector and geographical origins for each masonry material.

- The sector origin of the reported resource recovery is 99% C&D, which is what would be expected by virtue of the definition for C&D waste.
- The split between metropolitan and regional areas was reported as 98% and 2% respectively. This percentage of masonry resource recovery occurring for regional areas is much less than during 2009-10 (when it was 8%) and reflects the disproportionate impact of large infrastructure projects occurring in metropolitan Adelaide during 2010-11.

Table 4.1.4 Masonry materials sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Asphalt	0%	0%	100%	99%	1%
Bricks	0%	1%	99%	98%	2%
Concrete	0%	1%	99%	96%	4%
Plasterboard	5%	0%	95%	51%	49%
Clay, fines, rubble & soil	1%	0%	99%	100%	0%
Total	**0.5%**	**0.5%**	**99%**	**98%**	**2%**

4.1.5 Industry Barriers

The following were identified by the masonry reprocessing industry as some of the barriers to increasing recovery rates.

- Some participants did not see any barriers to increasing recovery rates. The ongoing increases in landfill disposal costs or gate fees (driven by increases in the Waste Levy) are making alternative options for residual from C&D processor residual more viable.
- The limited requirement for government bodies (Federal, State and Local) to use a meaningful percentage of recycled content material in government projects is still a barrier for C&D recyclers. It was reported that many customers still specify or adopt Australian standards for materials that are biased towards virgin materials or unintentionally exclude potential for recycled material use.
    - However, it was noted by the industry that the South Australian Department of Transport and Infrastructure had recently been conducting several projects and initiatives to address this barrier, which could help encourage and enable greater recycled material use in its road and construction projects. These initiatives were expected to positively influence road construction projects in other sectors, including local government.

4.1.6 Market Expectations

A number of re-processors were pessimistic and projected the market would slow in 2011-12 due to the completion of a number of major infrastructure projects, as well as reduced private developer activity caused by ongoing economic uncertainty and funding/lending challenges.

4.2 Metals

4.2.1 Source & End Products

Tables 4.2.1 and 4.2.2 below give the source and end products commonly identified with resource recovery and recycling of metals (ZWSA 2010). In SA,

- Metals in South Australia are recovered primarily through:
  - Commercial collections direct from industrial manufacturers or via scrap-metal merchants.
  - Household and container recycling collections.
  - Commercial salvage operations that recover metals from collection or drop-off of consumer products, industrial equipment and/or C&D sources.
- There are some significant local re-processors for steel, e.g. steelworks and foundries.
- Apart from this local recycling activity, a significant portion of the recovered metals are largely sent interstate or exported for re-processing.

Table 4.2.1 Typical sources of recovered metals

Material	Source products
Steel	Steel Pre- and post-consumer, automotive (car bodies), general heavy steel and structural steel, whitegoods, appliances, iron roofing, steel packaging
Aluminium	Windows and doors, automotive engines, assorted industrial scrap and production scrap, aluminium cans, electrical cable, electronic and electrical waste
Non-ferrous metals	Copper pipe, automotive batteries and cable, general industrial and production scrap, electrical cable

Table 4.2.2 Typical end-products for recycled materials

Material	End Products
Steel	Many, including car parts, general rod and sheet, foundries.
Aluminium	Valves and extrusions, consumer products, automotive parts, building industry and aluminium cans.
Non-ferrous metals	Many, including batteries, cables, valves and extrusions.

4.2.2 Quantities & Trends

The quantity of recovered metals reported for South Australia during 2010-11, including the estimated reporting error and final reprocessing destination for each material, are presented in Table 4.2.3 below.

Figure 4.2.1 (overleaf) summarises the relative proportions of metals recovered in 2010-11 compared with 2009-10.

Figures 4.2.2 and 4.2.3 show the trend in recycling activity of metals that has occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity for metals.

- The reported quantity recovered of metals in 2010-11 was approximately 441,500 tonnes, an increase of 17.5% on 2009-10.
    - This rise occurred across all of the metal materials–
        - Steel was up by 17%
        - Aluminium up by 7%
        - Non-ferrous metals by 32%
    - The increase in metal recovery can be attributed to several factors, all generally related to the passing of the Global Financial Crisis.
        - Steady economic and industrial activity has increased consumption and industrial outputs of scrap metal.
        - Both demand and market prices for scrap metals have recovered and a buoyant world market for metal existed during 2010-11.
    - Quantities of recovered metals (steel) now exceed levels seen prior to 2008-09.

Table 4.2.3 Metals recovery and reprocessing location, SA 2010-11

Item	Net recovery [1]	Reporting Error		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Steel	391,000	59,000	15%	30%	11%	59%
Aluminium	19,400	3,000	15%	0%	16%	84%
Non-ferrous metals	31,100	3,800	12%	0%	45%	55%
Total	**441,500**	**66,000**	**15%**	**26%**	**14%**	**60%**

1. Net recovery excludes reprocessing losses

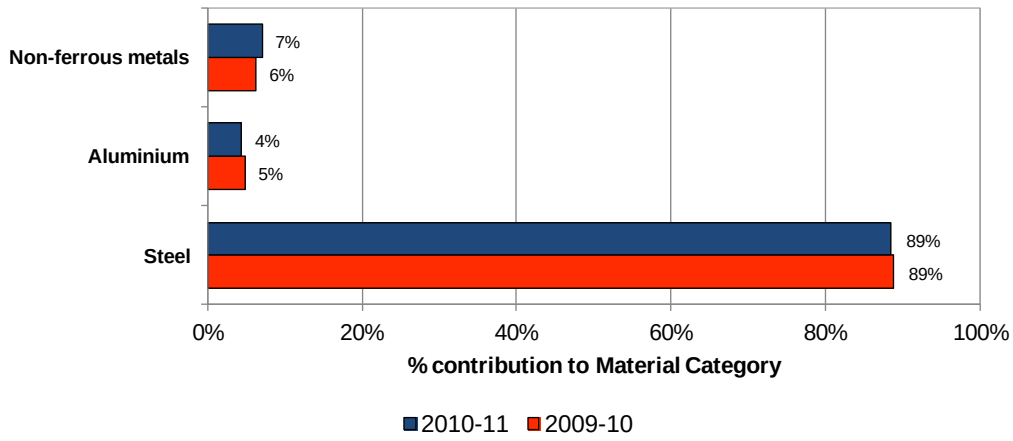

Figure 4.2.1 Changes in percent composition of recovered metals (by weight), SA, between 2009-10 and 2010-11

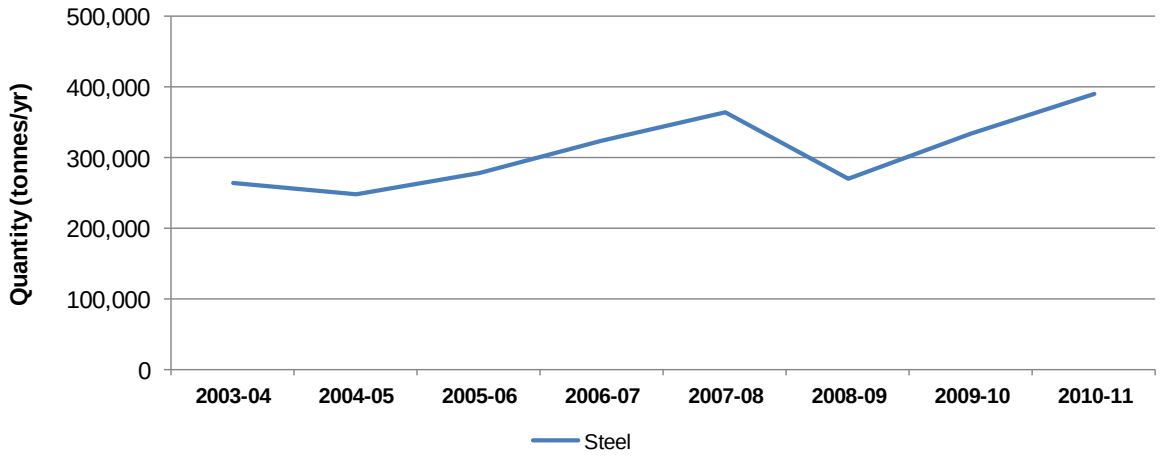

Figure 4.2.2 Changes in reported metal quantities since 2003-04 - Steel

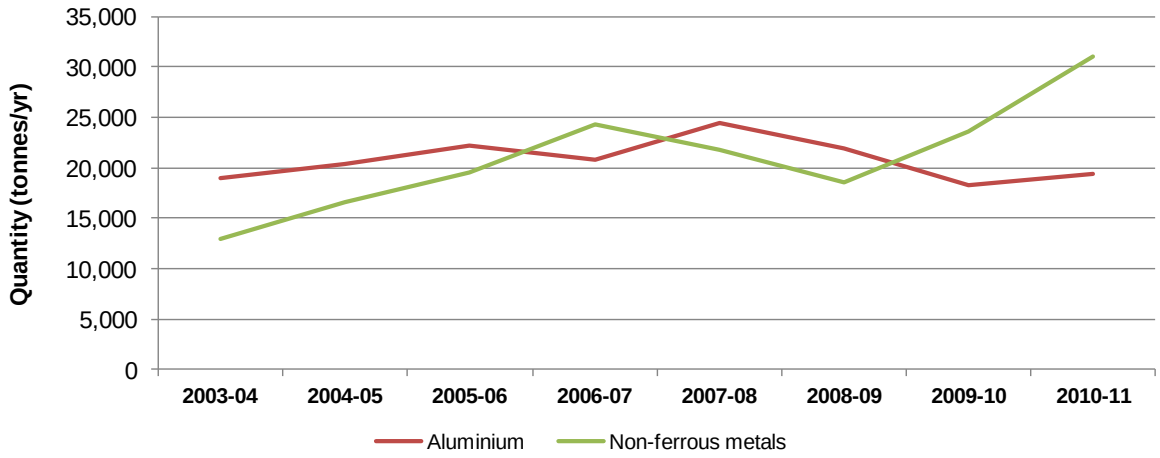

Figure 4.2.3 Changes in reported metal quantities since 2003-04 – Aluminium and Non-ferrous metals

4.2.3 Re-processing Destinations

Table 4.2.3 includes the final destination reported in 2010-11 for re-processing of metals.

- The destination for re-processing of metals was split approximately 26% and 74% between re-processors in SA and those interstate and overseas.
    - SA has a local steelworks and metal foundries that accept substantial amounts (about 30% of total in 2010-11) of scrap steel for re-processing.
    - Virtually all Aluminium was reported as being sent for re-processing at smelters overseas or interstate.
    - Negligible amounts of non-ferrous metals reported as being re-processed in SA, with the rest being shipped interstate or overseas.
- Each year the proportion of recovered metals being re-processed locally and/or interstate or exported overseas would fluctuate according to demand from local re-processors and commodity prices available for these materials.

4.2.4 Sector & Geographical Origin

Table 4.2.4 below shows the reported sector and geographical origins for metals recovered during 2010-11.

- The sector origin for reported metal recovery in 2010-11 was largely (67%) C&I.
    - There was a significant re-configuration of the source sector reported by SA recyclers and re-processors for steel and non-ferrous metals during 2010-11, away from C&I (which was reported as 95% of total metals in 2009-10) towards C&D and Municipal sources.
    - This re-configuration is attributed to improved understanding by SA recyclers and re-processors of survey objectives and these source sector classifications when reporting their data.
- The reported split between metropolitan and regional areas was 92% and 8%, respectively.

Table 4.2.4 Metals sector and geographical origins, SA 2010

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Steel	15%	67%	18%	92%	8%
Aluminium	25%	66%	9%	95%	5%
Non-ferrous metals	11%	58%	31%	98%	2%
Total	**15%**	**67%**	**18%**	**92%**	**8%**

4.2.5 Industry Barriers

Limited barriers were identified in 2010-11 by the metals reprocessing industry.

- Most did not identify any significant barriers to their industry now metals prices have exceeded pre-GFC prices.
- The solid waste levy and carbon tax implication to operating costs as well as landfill rates were identified as impacts to profitability of the metals reprocessing industry.
    - The processing of scrap steel in SA produces 10-15% wt residual waste from the non-metallic component which is disposed, attracting significant landfill and solid waste levy costs.
    - The carbon tax will have direct impact on metal recovery costs and also substantially impact the costs of local re-processors, which may result in more material being exported overseas for re-processing.

4.2.6 Market Expectations

- The outlook for the price of metals for recycling is positive, subject to no significant global downturn occurring.
- Tonnages of metals are expected to remain steady.
- Local re-processors continue to be concerned about the introduction of the carbon tax and the high Australian dollar, and therefore, their ability to remain competitive.

4.3 Organics

4.3.1 Source & End Products

Tables 4.3.1 and 4.3.2 below give the source and end products usually identified for resource recovery and recycling for organics (ZWSA 2010). In SA:

- The majority of food and garden organics are recovered through kerbside collection systems in metropolitan areas and from drop off sites at transfer stations or delivered directly to composting facilities.
- Commercial food organics collections in metropolitan areas from offices and businesses for composting are increasing.
- Timber derived from C&D waste in the Adelaide metropolitan area is being re-processed and converted into an alternative fuel.
- Timber derived from forestry and timber processing operations in some regional areas is being collected and composted.
- For other organics, sources are largely C&I and not all of this material is initially sent for composting but may be subject to an intermediate re-processing step. For example, organics produced by the food processing industries are often first re-processed to extract valuable by-products or create another manufactured product.
- Some operators have also started re-processing bio-solids by composting, to make them more suitable for use by SA farmers and irrigators for soil improvement of agricultural land.

Table 4.3.1 Typical sources of recovered organic materials

Material	Source products
Food Organics	Kerbside collected and commercial food wastes
Garden Organics	Kerbside collected, other municipal, commercial garden organics
Timber	Timber Barks, sawdust, wood/timber packaging, general wood/timber
Organics - Other	Organic-derived by-products from food processing industries; Commercial and/or industrial grease trap waste and other organic-based sludges; Bio-solids from sewage treatment plants or STEDS schemes; Paper pulp, miscellaneous agricultural organics, animal bedding, paunch, animal mortalities (or otherwise not classified above).

Table 4.3.2 Typical end-products for recycled organic materials

Material	End Products
Food Organics	Composted soil conditioners, potting mixes and mulches
Garden Organics	Composted soil conditioners, potting mixes and mulches
Timber	Composted soil conditioners, potting mixes and mulches; Alternative fuel source
Organics - Other	By-product extraction or processing to other manufactured product, Composted soil conditioners, potting mixes and mulches; Animal feed; Direct land application for soil improvement

4.3.2 Quantities & Trends

The quantity of recovered organic materials reported for South Australia during 2010-11, including the reporting error and final reprocessing destination for each material, are presented in Table 4.3.3 overleaf.

Figure 4.3.1 (also overleaf) compares the relative proportions of organic materials recovered in 2010-11 and 2009-10.

Figures 4.3.2 and 4.3.3 show the changes in recycling activity for organics since 2003-04.

The following key points or observations can be made about the reported recycling activity for organic materials included in Table 4.3.3.

- The reported quantity recovered of organics in 2010-11 was 954,400 tonnes, an increase of about 50% on that reported in 2009-10.
    - This rise has occurred due mainly due to a substantial rise in Organics – Other (which has nearly tripled since 2009-10).
    - This increase on Organics- Other was largely driven by growing quantities from the following recycling activity which has been newly reported since 2008-09 and constituted 311,000 tonnes.
        - Industry Organics
            - Organic materials or by-products arising from food production by SA industry, mainly from wine production and meat processing. These materials are not necessarily composted, but are re-processed to extract or create valuable by-products, with residuals recycled as animal feed or for agricultural soil improvement by land application. Without recycling, this product would otherwise have gone to landfill.
        - Biosolids
            - This refers to waste sludge that is re-processed at sewage treatment plants.
            - Large amounts of this material are being directly reused in SA for agricultural soil improvement by land application.
    - Reported quantities for other organic material categories also increased during 2010-11, with the exception of food organics which decreased.
        - Food organics – Down 24%
            - This reduction has occurred for two reasons:
                - Organic waste material from one food manufacturer is no longer composted and is disposed of to landfill.
                - Food organics collected via the council kerbside collection is not being separately identified and instead has been reported as garden organics.
            - Food organics recycling from the C&I sector, however, has continued to increase slowly.
        - Garden organics – Up by 4.5%
            - The increased volume of garden organics appears to have been mainly influenced to ending of the drought, with higher rainfall and relaxed water restrictions, allowing greater garden activity and plant growth.
        - Timber – Up by 6.9%

Table 4.3.3 Organic material recovery and reported re-processing destination, SA 2010-11

Item	Net recovery [1]	Reporting Error		Reported Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Food Organics	4,400	200	5%	100%	0%	0%
Garden Organics	230,000	16,000	7%	100%	0%	0%
Timber	280,000	42,000	15%	100%	0%	0%
Organics - Other [2]	440,000	39,000	9%	95%	4%	1%
Total	**954,400**	**97,200**	**10%**	**97.5%**	**2%**	**0.5%**

1. Net recovery excludes reprocessing losses
2. Organics other includes bio-solids and industry organics

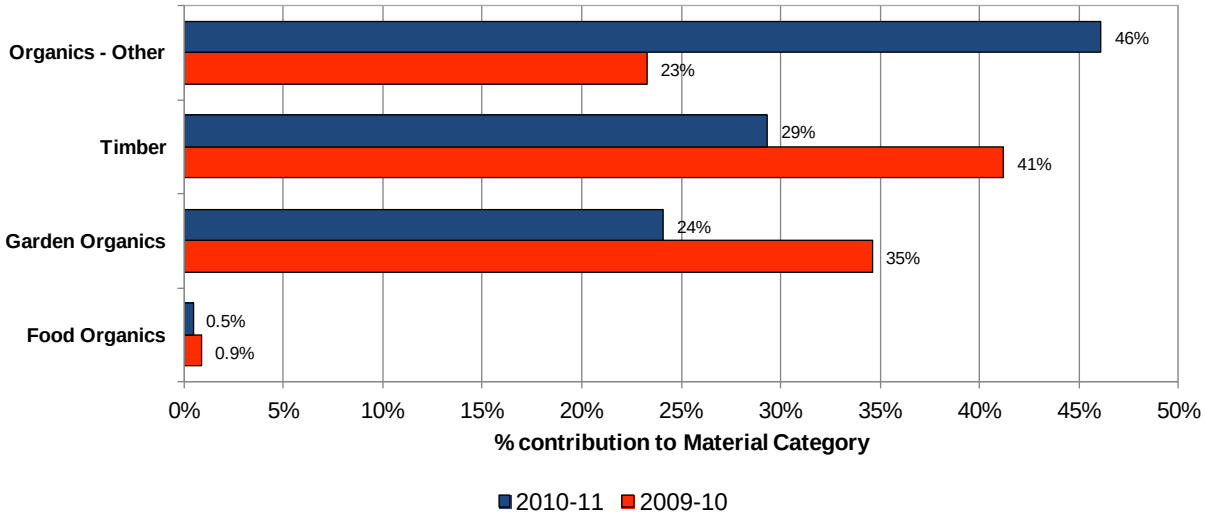

Figure 4.3.1 Changes in percent composition of recovered organics (by weight), SA, between 2009-10 and 2010-11

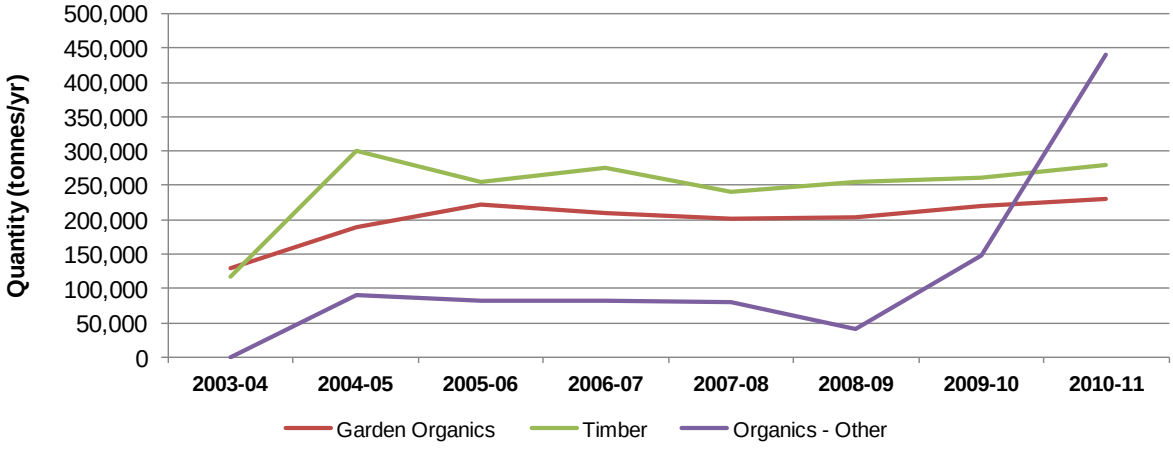

Figure 4.3.2 Changes in reported organic material quantities since 2003-04 – Garden organics, Timber and Organics - Other

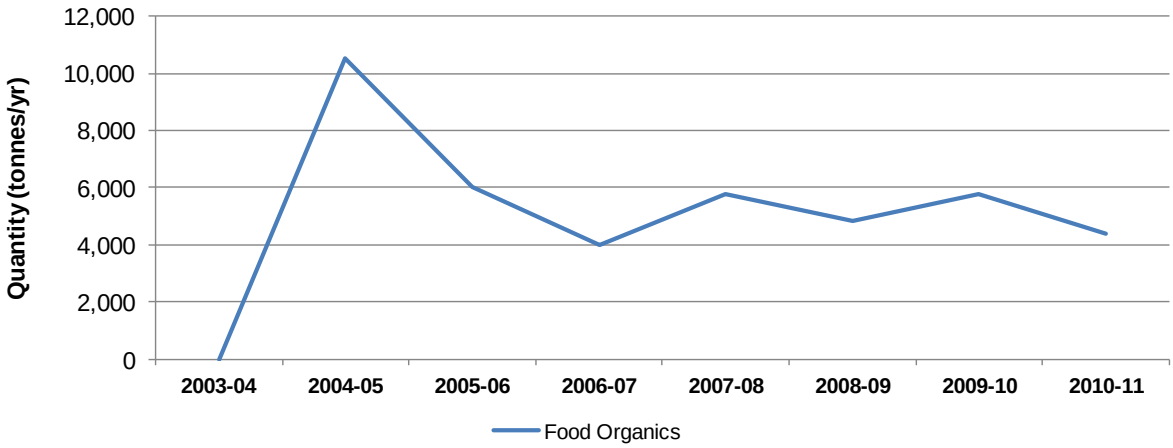

Figure 4.3.3 Changes in reported organic material quantities since 2003-04 – Food organics

4.3.3 Re-processing Destinations

Table 4.3.3 includes the final destination reported in 2010-11 for re-processing of organics.

- South Australia was the reported destination for re-processing for 98% of organics recovered for recycling.
- 2% was sent interstate for reprocessing, which was material being recovered for meat rendering.

4.3.4 Sector & Geographical Origin

Table 4.3.4 below shows the reported sector and geographical origins for organic material recovered during 2010-11.

- The sector origin for organic recovery was majority (>54%) C&I.
- The split between metropolitan and regional areas was 58% and 42%, respectively.
    - The contribution of regional areas to recovered organic materials can be largely credited to timber and industry organic materials, which originate from industries based in regional South Australia.

Table 4.3.4 Organic material sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Food Organics	0%	100%	0%	88%	12%
Garden Organics	78%	18%	5%	87%	13%
Timber	3%	83%	13%	35%	65%
Organics - Other	3%	97%	0%	44%	56%
Total	**37%**	**54%**	**9%**	**58%**	**42%**

4.3.5 Industry Barriers

A number of the key issues and barriers are common from previous periods, but some new issues have arisen.

- There has been a significant reduction in the demand of urban landscape products, as a function of less large landscape projects. Stockpiles of processed organics at some locations have increased significantly as a result.
- Contamination of raw materials remains a major issue, particularly for composters or where residual organic material was used as animal feed or agricultural soil improvement. Even with new significant education programs in place by State and Local government, some organics processors are seeing contamination increase, rather than decrease.
- Slower than expected uptake of food organics from the C&I sector, driven by economics and relatively low landfill pricing in the market.
- Use of food waste in piggeries, which bypasses the regulatory requirements faced by others in the organics industry.
- There are still barriers for organic products finding their way into the higher volume agricultural market.
    - This includes application of more stringent standards for contaminants in organic material used for agricultural soil improvement.
- The market will still only pay low gate fees for organics recycling relative to landfill disposal options and costs.
- Generating market demand for products is an ongoing challenge, particularly when wetter seasonal conditions reduce demand for moisture retention products.

4.3.6 Market Expectations

- The outlook for landscaping and commercial products is negative for the next period, whilst incoming tonnes continue to steadily increase. This imbalance is problematic to the industry.
- Some participants have had some success in delivery of product into the broad acres farming sector, which they hope to build on in the coming year.
- Some participants see good opportunity in the organics sector, particularly with the introduction of the carbon price from 1/7/12 and the Carbon Farming Initiative (Australian Government Program).
- The food waste stream from municipal and commercial collections is expected to increase significantly over the next few years.
- Most organic re-processors are generally positive and expect steady growth in the industry to continue.

4.4 Cardboard & paper

4.4.1 Source & End Products

Tables 4.4.1 and 4.4.2 below give typical source and end products identified for resource recovery and recycling of cardboard and paper (ZWSA 2010). In SA:

- Cardboard and paper materials are recovered from a diverse range of sources.
- Cardboard is sourced substantially from kerbside collection and packaging used by commercial and industrial organisations.
- Liquid paperboard originates principally from container deposit recycling and kerbside collection.
- Newsprint and magazines are largely picked up in the kerbside collection or returned waste material from the publishing industry.
- Phone books are also picked up by the kerbside collection.
- Printing & writing paper are generally the result of commercial collections with some material also picked up by kerbside collection.
- There is very little SA-based re-processing of cardboard & paper materials except via composting or vermiculture, with most material sent to interstate mills or exported overseas for re-processing.
- The quantities that are sent interstate as opposed to overseas usually depend on the demand and price fluctuations in the Australian and international markets for these materials.

Table 4.4.1 Typical sources of recovered cardboard & paper materials

Material	Source products
Cardboard & waxed cardboard	Mostly corrugated cardboard use for the packaging of industrial and consumer goods
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.
Magazines	Pre-consumer waste and post-consumer magazine material
Newsprint	Both pre- and post-consumer newsprint and some magazine material. Includes magazines and TV guides printed on newsprint or improved newsprint. Reuse for fire-lighting or animal bedding
Phonebooks	Phone books
Printing & Writing Paper	Office paper and a small amount of packaging paper from office sources

Table 4.4.2 Typical end-products for recycled cardboard & paper materials

Material	End Products
Cardboard & waxed cardboard	Packaging
Liquid Paperboard	Printing and writing paper
Magazines	Composted soil conditioners, potting mixes and mulches
Newsprint	Newsprint, packaging, cat litter, insulation, building products and composting
Phonebooks	Newsprint and packaging
Printing & Writing Paper	Packaging and writing paper

4.4.2 Quantities & Trends

The quantity of recovered cardboard and paper material reported for South Australia during 2010-11, and final reprocessing destination for each material, are presented in Table 4.4.3 below.

Figure 4.4.1 (overleaf) compares the relative proportions of each material recovered in 2010-11 with 2009-10.

Figures 4.4.2 and 4.4.3 summarise the changes in recycling activity of cardboard and paper that have occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity.

- The reported quantity recovered of Cardboard & paper in 2010-11 was approximately 211,300 tonnes. This is a decrease of 4.9% on the quantity reported in 2009-10
  - The 2010-11 data suggests a marked decrease in reported recovery of:
    - Cardboard & waxed cardboard – down by about 8,000 tonnes or 4.9%
    - Liquid Paperboard (LPB) – down by 400 tonnes or 10%
    - Printing and Writing Paper– down by 2,800 tonnes of 17%
  - However, one material category rose: Magazines – up 3.6%
- The reasons for these fluctuations between this and last year do not appear to be a result of any specific changes but the comments below are considered relevant.
  - Cardboard and Waxed Paperboard:
    - Quantities of cardboard from kerbside recycling appear to have reduced. This could be due to a range of reasons including less cardboard packaging presenting in households, higher contamination and/or lower recovery.
    - Reduction in domestic demand for cardboard due to Eastern seaboard flooding and cyclone activity has reduced Australian mill outputs, which appears to have increased exports.
  - Liquid paper board is slightly down in line with Cardboard from kerbside recycling
  - Magazines, Newsprint and Phonebooks were consistent with reported values from 2009/10
  - Printing and Writing Paper
    - It is believed that Printing and Writing Paper has not reduced significantly (-17%), but rather less is simply being reported by industry. The recycling of printing and writing paper is considered relatively steady, with a slight increase from offices offset by a slight reduction from the print industry (pre-consumer).

Table 4.4.3 Cardboard & paper material recovery and reported destination, SA 2010-11

Item	Net recovery [1]	Reporting Error		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Cardboard & waxed cardboard	154,000	11,000	7%	2%	60%	38%
Liquid Paperboard	3,500	340	10%	0%	33%	67%
Magazines	5,700	330	6%	0%	39%	61%
Newsprint	32,000	1,700	5%	0%	58%	42%
Phonebooks	2,500	370	15%	0%	100%	0%
Printing & Writing Paper	13,600	1,100	8%	0%	54%	46%
Total	**211,300**	**14,800**	**7%**	**1%**	**59%**	**40%**

1. Net recovery excludes reprocessing losses

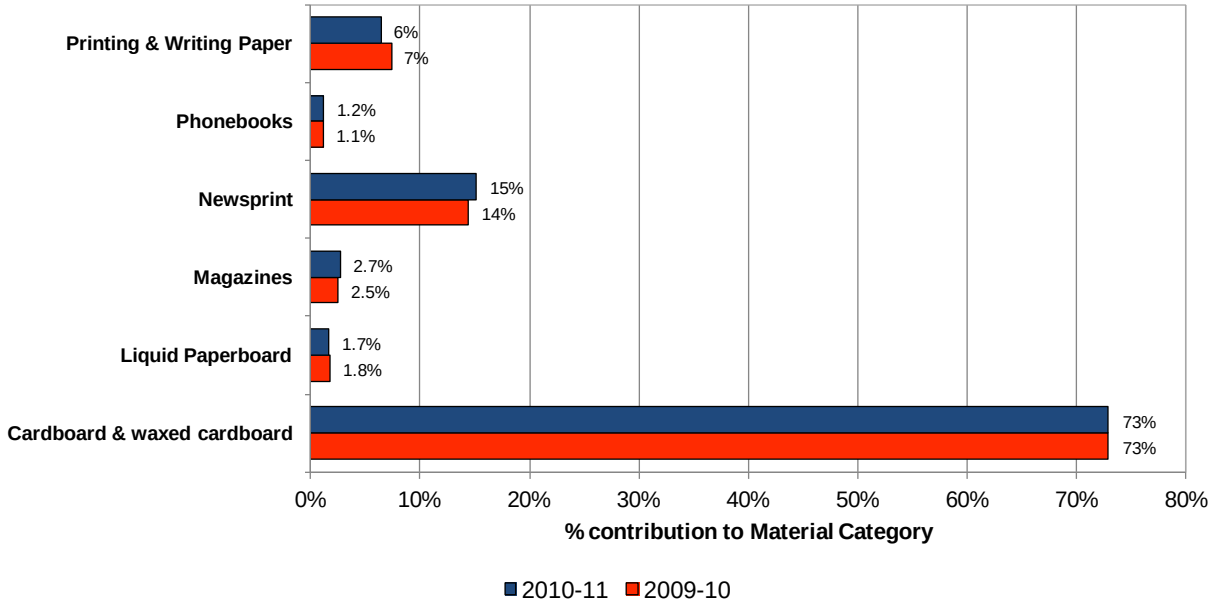

Figure 4.4.1 Changes in percent composition of recovered Cardboard & paper (by weight), SA, between 2009-10 and 2010-11

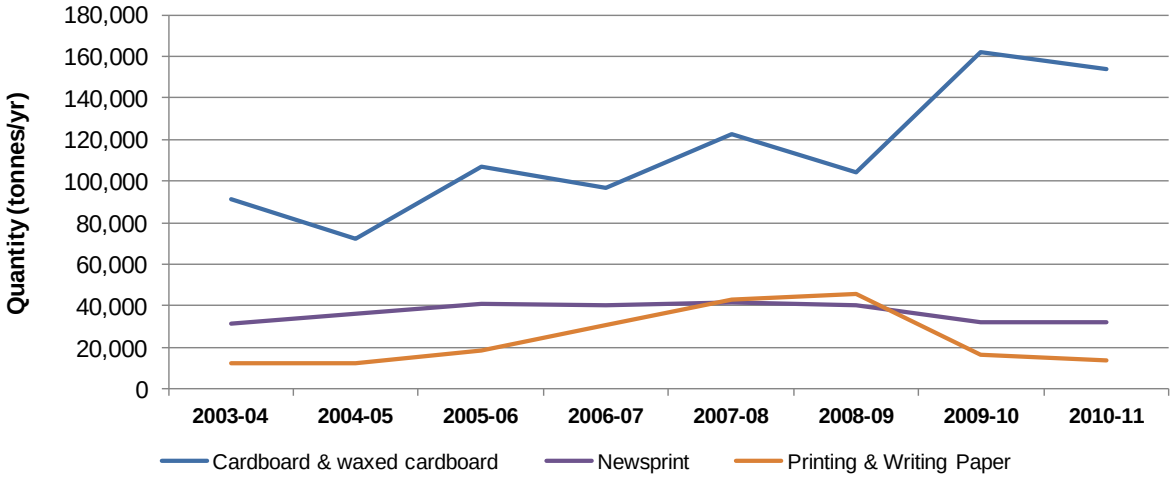

Figure 4.4.2 Changes in reported Cardboard & paper quantities since 2003-04 – Cardboard & waxed cardboard, Newsprint and Printing & Writing Paper

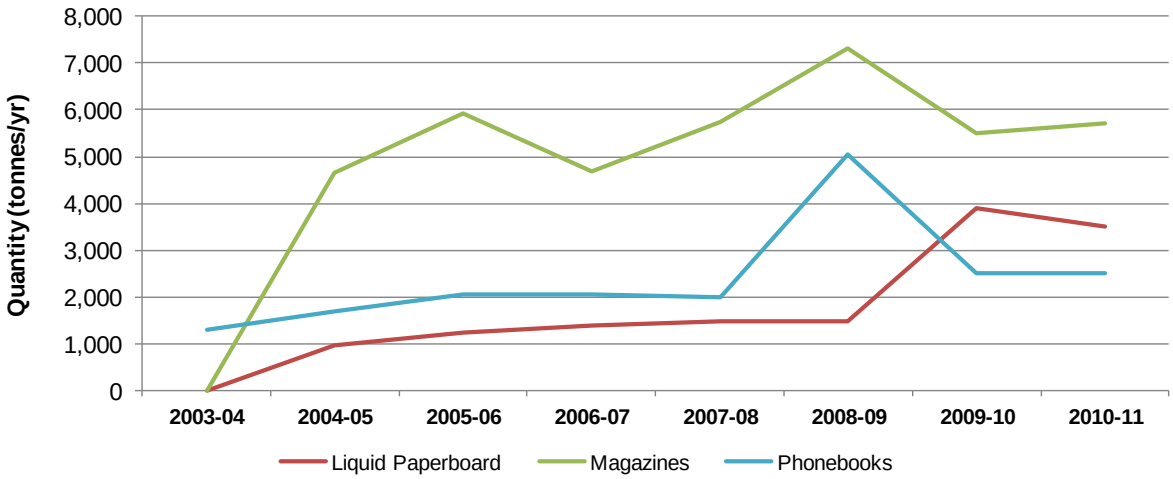

Figure 4.4.3 Changes in reported Cardboard & paper quantities since 2003-04 – Liquid Paperboard, Magazines and Phonebooks

4.4.3 Re-processing Destinations

Table 4.4.3 includes the final destination reported in 2010-11 for re-processing of Cardboard & paper material.

- Virtually all cardboard & paper material was reported as being sent interstate or exported overseas for re-processing
- There was some local re-processing of cardboard material (approx. 3000 tonnes) for vermiculture.

4.4.4 Sector & Geographical Origin

Table 4.4.4 shows the reported sector and geographical origins for cardboard & paper material recovered during 2010-11. The sector origin for cardboard & paper recovery was split between Municipal (47%), C&I (51%) and C&D (2%).

- Municipal sources through kerbside collection were dominant for LPB, Magazines, Newspapers and Phonebooks
- C&I sources were foremost for cardboard and waxed cardboard and printing & writing paper

The metropolitan to regional areas split was 86% and 14% respectively.

Table 4.4.4 Cardboard & paper material sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Cardboard & waxed cardboard	41%	57%	3%	84%	16%
Liquid Paperboard	93%	7%	0%	80%	20%
Magazines	68%	32%	0%	88%	12%
Newsprint	78%	22%	0%	91%	9%
Phonebooks	100%	0%	0%	92%	8%
Printing & Writing Paper	15%	85%	0%	92%	8%
Total	**47%**	**51%**	**2%**	**86%**	**14%**

4.4.5 Industry Barriers

- The industry did not raise any major barriers for the Cardboard and Paper recycling sector.
- There appears to have been on-going growth in Cardboard and Paper recycling in regional areas in the last year and expanding to comingled and commercial recycling services in the regional areas is expected to continue this trend.
- The shutting down of a major Victorian Paper mill in 2012 could lead to the majority of Cardboard and Paper recovered in SA being exported. This will present a barrier to the industry whenever overseas demand reduces and/or commodity pricing falls.

4.4.6 Market Expectations

- The recovery of cardboard and paper is expected to remain relatively stable and slowly expand with population growth in SA.
- A number of industry participants indicated plans to expand volumes and/or upgrade processing capabilities where the market opportunity presents.
- A recent sharp downturn in the Cardboard and Paper international commodity prices of up to 40% in late 2011 was expected to recover by the end of 2011/12 financial year, subject to no global downturn. Market prices prior to this commodity down turn were at historically high levels.

4.5 Plastics

4.5.1 Source & End Products

Tables 4.5.1 and 4.5.2 below give common source and end products identified for resource recovery and recycling of plastics. In SA:

- Large quantities of PET and HDPE and lesser amounts of other plastics originate from consumer packaging obtained from kerbside collection and container deposit recycling.
- Outside of these municipal contributions, the remainder of plastics is largely recovered from industrial sources
- Some mixed plastic material is also recovered from C&D sources.
- There is also high level of reuse of plastic freight packaging in the forms of crates, drums and pallets – this data was not captured by this recycling activity survey.
- SA has some relatively substantial plastics re-processors that take most types of recovered plastic materials and turns them into substitute feedstock to replace virgin materials or manufactured products.
- The exception to this is PET, where there are no local reprocessors and all materials are sent interstate or exported overseas.
- The plastics not used locally are sent interstate or overseas.
- The split between materials sent interstate or overseas strongly depends on demand and price fluctuations in the Australian and international markets for these materials.

Table 4.5.1 Typical sources of recovered plastics

Material	Source products
Polyethylene terephthalate (PET)	Soft drink bottles, fruit juice bottles
High density polyethylene (HDPE)	Milk bottles, sheet liners and covers, manufacturing scrap, other packaging bottles, mobile garbage bins, drums, pipes, crates and pallets
Polyvinyl chloride (PVC)	Manufacturing scrap
Low density polyethylene (LDPE)	Flexible film used as distribution packaging, packaging bottles and manufacturing scrap
Polypropylene (PP)	Manufacturing scrap, rigid packaging applications, pallet strapping and automotive parts
Polystyrene (PS)	Manufacturing scrap, pipe supports, EPS freight packaging and rigid food packaging
Mixed &/or Other plastics (MIX)	Manufacturing scrap and domestic durables

Table 4.5.2 Typical end-products for recycled plastic materials

Material	End Products
Polyethylene terephthalate (PET)	Soft drink bottles, other packaging applications, fibre applications
High density polyethylene (HDPE)	Pallets, agricultural pipes, bins, industrial film, water tanks, crates and mixed polymer timber replacement products
Polyvinyl chloride (PVC)	Floor coverings, pipes, electrical conduit, clothing, shoes, hose fitting and garden hoses
Low density polyethylene (LDPE)	Builders film, damp course linings, garbage bags, retail carry bags, mixed polymer timber replacement products, irrigation piping, timber replacement products and garden furniture
Polypropylene (PP)	Crates, boxes, plant pots, building materials, electrical cable cover, automotive parts, irrigation fittings and mixed polymer timber replacement products
Polystyrene (PS)	Waffle pods, produce boxes, building materials, concrete reinforcement stools, extruded polystyrene and mixed polymer timber replacement products
Mixed &/or Other plastics (MIX)	Various, including composite materials for bollards and posts

4.5.2 Quantities & Trends

The quantity of plastics reported for South Australia during 2010-11, including the reporting error and final reprocessing destination for each material, are presented in Table 4.5.3 below.

Figure 4.5.1 (overleaf) compares the % composition of plastics recovered in 2009-10 and 2010-11.

Figures 4.5.2 and 4.5.3 show the changes in recycling activity for plastics since 2003-04.

The following key points or observations can be made about the reported recycling activity for plastics.

- The reported quantity recovered of plastics in 2010-11 was 23,700 tonnes. This is an increase of approximately 16% on the quantity reported in 2009-10.
  - The 2010-11 data suggests a major increase since 2009-10 in Mixed &/or other plastics (up 263%) has occurred, as well as an increase in LDPE (up 10%).
    - Source separated LPDE collections have continued to increase
    - Mixed plastic collections have increased and reallocation from other plastics streams have increased mixed plastics.
  - PP has stayed relatively stable since last year.
  - However, there was a significant drop in PET (-25 %).
    - Part of this decrease resulted from clarification by an aggregator of their sources of PET material, which prevented double-counting of reported resource recovery from other industry parties (that may have been occurred in previous reporting years).
    - There was also a reported reduction (of several hundred tonnes) in the PET recycled deposit (CDL) container volumes during 2010-11.

Table 4.5.3 Plastic material recovery and reported destination, SA 2010-11

Item	Net recovery [1]	Reporting Error		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Polyethylene terephthalate (PET)	4,100	1,040	25%	0%	100%	0%
High density polyethylene (HDPE)	4,600	1,450	32%	94%	4%	2%
Polyvinyl chloride (PVC)	170	26	15%	0%	100%	0%
Low density polyethylene (LDPE)	4,600	820	18%	75%	0%	25%
Polypropylene (PP)	4,000	590	15%	99%	1%	0%
Polystyrene (PS)	430	65	15%	97%	3%	0%
Mixed &/or Other plastics (MIX)	5,800	140	2%	44%	1%	55%
Total	**23,700**	**4,000**	**17%**	**62%**	**20%**	**18%**

1. Net recovery excludes reprocessing losses

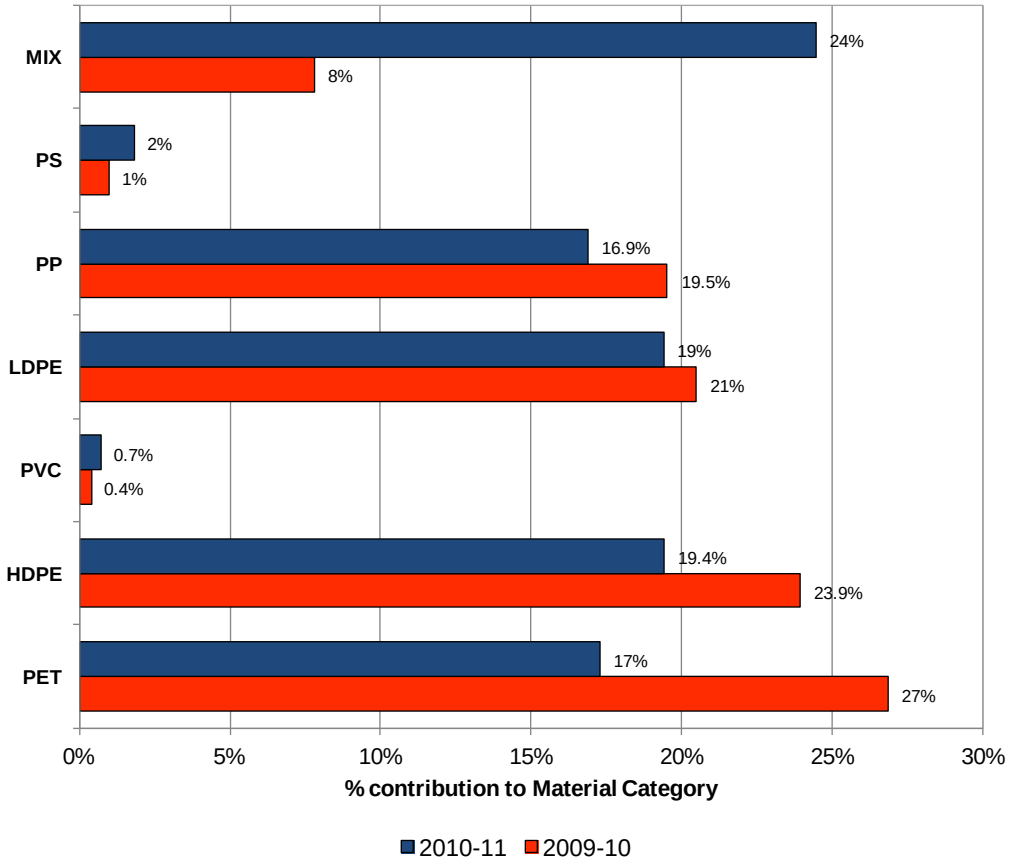

Figure 4.5.1 Changes in percent composition of recovered plastics (by weight), SA, between 2009-10 and 2010-11

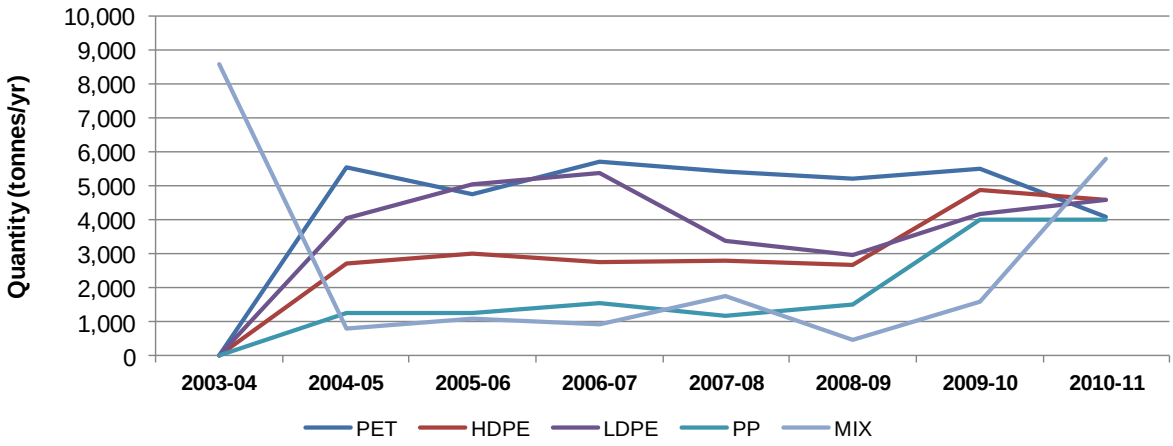

Figure 4.5.2 Changes in reported plastics since 2003-04 – PET, HDPE, LDPE and Mixed Plastics

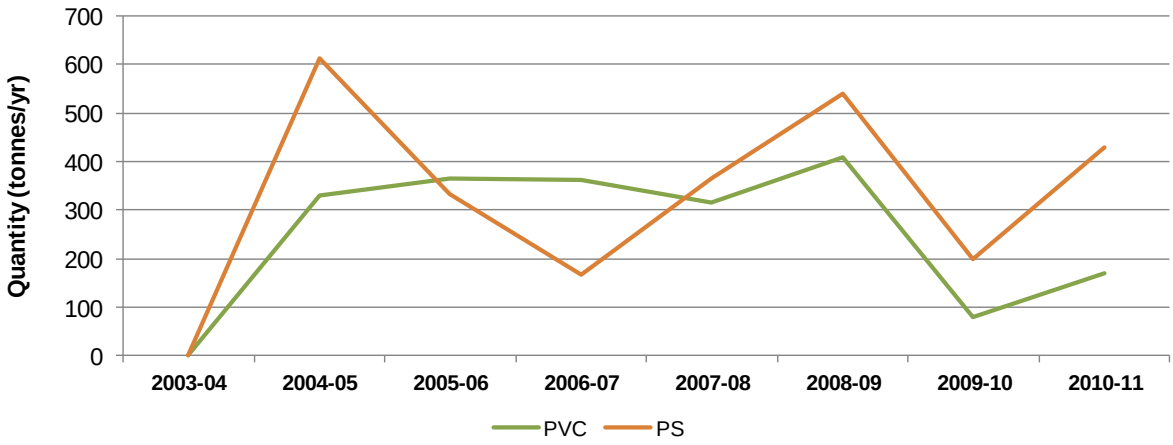

Figure 4.5.3 Changes in reported plastics since 2003-04 – PVC and PS

4.5.3 Re-processing Destinations

Table 4.5.3 includes the final destination reported in 2010-11 for re-processing of plastics.

- Reprocessing in SA accounts for 62% of all plastic material collected, with most recovered HDPE, LDPE, PS and PP being absorbed by the local reprocessors.
- The balance of the plastic materials is either sent interstate (20%) or overseas (18%). The splits between interstate and overseas destinations for individual plastic materials would depend on relative demand and prices available in local and international markets.

4.5.4 Sector & Geographical Origin

Table 4.5.4 overleaf shows the reported sector and geographical origins for plastic material recovered during 2010-11.

- C&I at 61% were reported as the majority contributor to plastics recovery.
- Municipal sources through kerbside collection and deposit container recycling contributed nearly all of the remainder.
- The impact of kerbside recycling and deposit container recycling can be clearly seen for PET, where 70% of material comes from Municipal sources.

The reported split between metropolitan to regional areas was 85% and 15% respectively.

These results are similar to those reported last financial year but are some slight differences in sector and geographical splits that have occurred between 2009-10 and 2010-11.

- It cannot be determined whether these differences are real changes, but most likely are simply an artefact of data reporting variations by recyclers and/or re-processors between these two years.

Table 4.5.4 Plastic material sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Polyethylene terephthalate (PET)	70%	30%	0%	76%	24%
High density polyethylene (HDPE)	15%	85%	0%	83%	17%
Polyvinyl chloride (PVC)	2%	0%	98%	98%	2%
Low density polyethylene (LDPE)	9%	91%	0%	86%	14%
Polypropylene (PP)	10%	90%	0%	94%	6%
Polystyrene (PS)	4%	96%	0%	97%	3%
Mixed &/or Other plastics (MIX)	54%	19%	27%	92%	8%
Total	**32%**	**61%**	**7%**	**85%**	**15%**

4.5.5 Industry Barriers

The following general challenges to recovery and re-processing of plastic was reported by the industry.

- Continuing issues with contamination: product residues and labels where plastic was used for packaging.
- Rising prices and interstate and overseas competition for plastic materials are making it increasingly difficult for SA re-processors to source local plastic materials at commercially viable prices.
    - The industry also reported that some overseas companies are setting up local operations to directly procure waste plastic material and export it overseas to Asia for resource recovery re-processing.
- The rising Australian dollar which is making exports less competitive and imports cheaper.
- Poor or reluctant market uptake or acceptance of some recycled plastics products as substitutes for traditional materials e.g. recycled plastic vineyard posts as an alternative to CCA wood by the wine industry.
- Existing product and technical standards arbitrarily impede or do not permit use of recycled materials, through designation of material or testing requirements and/or specifications, even though recycled materials would be appropriate and fit-for-purpose in the intended application.

4.5.6 Market Expectations

- There has been a drop in late 2011 in international recycled plastics commodity prices which impacts on the profitability of plastics recovery for exporters.
- Increasing quantities of plastics recovery are expected to occur as South Australia's population continues to grow and source separation programs continue to influence behaviour.

4.6 Glass

4.6.1 Source & End Products

Tables 4.6.1 and 4.6.2 below give the typical source and end products identified by industry for resource recovery and recycling of glass. In SA,

- Large quantities of glass are collected from kerbside collections and deposit container recycling
- This collected glass is generally sorted at a MRF, CDL depot or by other glass merchant into different types or grades (i.e. green, flint, amber).
- Unless sent interstate, the glass material is further beneficiated by local re-processor.
- Virtually all glass from South Australia is then re-processed locally into glass bottles and packaging.

Table 4.6.1 Typical sources of recovered glass

Material	Source products
Glass	Building glass, Packaging – beer, wine, food

Table 4.6.2 Typical end-products for recycled glass

Material	End Products
Glass	Bottle manufacture, reflective beads for road marking, aggregate for road base

4.6.2 Quantities & Trends

The quantity of glass reported for South Australia during 2010-11, including the reporting error and final reprocessing destination, are presented in Table 4.6.3 below.

Figure 4.6.1 (overleaf) shows the changes in recycling activity of glass that have occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity for glass.

- The reported quantity recovered of glass in 2010-11 was 58,000 tonnes, and is therefore comparable to the recovery which was reported in 2009-10.
- The industry reports that there is a growing trend to light weighting manufactured glass products.
    - If this results in significant changes to glass content in manufactured products in Australia, this may eventually lead to lower quantities of glass being recovered.

Table 4.6.3 Glass material recovery and reported destination, SA 2010–11

Item	Net recovery [1]	Reporting Error		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Glass	**58,000**	**9,000**	**16%**	**95%**	**5%**	**0%**

1. Net recovery excludes reprocessing losses

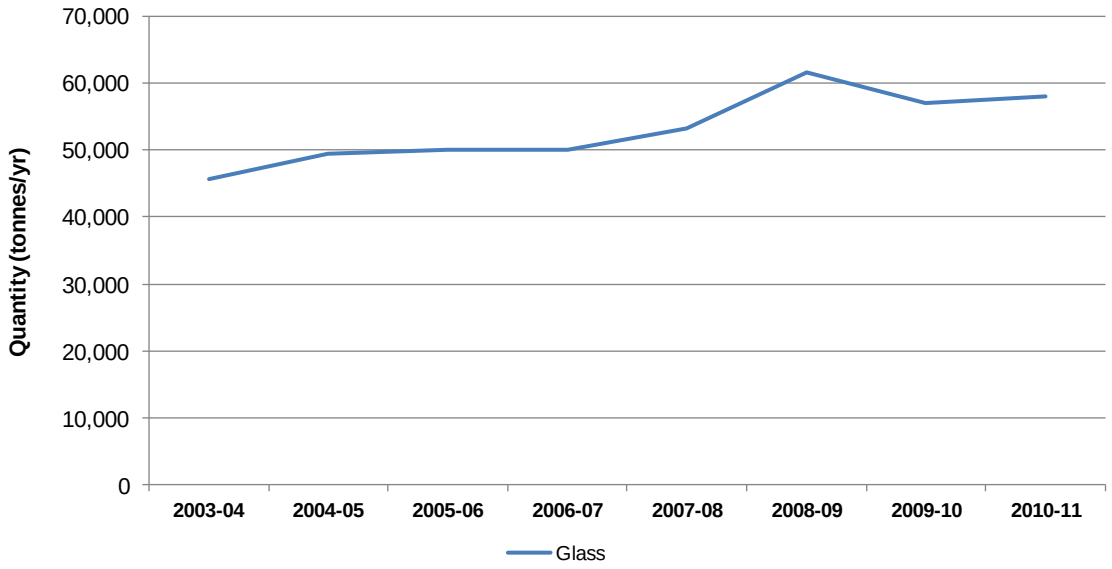

Figure 4.6.1 Changes in reported glass since 2003-04

4.6.3 Re-processing Destinations

Table 4.6.3 includes the final destination reported in 2010-11 for re-processing of glass.

- 95% of glass material was re-processed in South Australia.
- The remaining 5% was sent interstate for reprocessing.

4.6.4 Sector & Geographical Origin

Table 4.6.4 below shows the reported sector and geographical origins for glass material recovered during 2010-11.

- Nearly all glass recovered in South Australia originated from kerbside collections or container deposit recycling.

There are some differences between the reported sector and geographical splits in 2010-11 when compared with 2009-10.

- These differences appear to be attributable to changes in how recyclers and/or re-processors have reported these sector and geographical origins during 2010-11.

Table 4.6.4 Glass sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Glass	**90%**	**10%**	**0%**	**77%**	**23%**

4.6.5 Industry Barriers

The following general challenges to recovery and re-processing of glass were consistent with what was previously reported by the industry.

- Securing more quantities of high-quality sorted glass and cullet with low contamination. [Locally-sourced glass was considered superior to imported interstate glass because of the high level source separation systems in SA.] Local re-processors of beneficiated glass have substantial additional demand should more high-quality sorted glass become available.
- Commercial arrangements between re-processors and glass merchants, which were locking out access to local glass supplies for some re-processors.
- Rising energy costs and the introduction of the carbon tax affecting the viability of glass manufacture altogether.

4.6.6 Market Expectations

- The current steady market conditions are expected to continue, with some industry players looking to invest in expanded/upgraded glass beneficiation when suitable conditions present.
- Local reprocessing demand for the beneficiated glass is very important to this market stability.
- However, there are concerns about future demand for glass bottles by the local wine industry if this sector contracts. This may impact on the viability of local re-processors.
- The impacts of the NT container deposit legislation which began in January 2012 may provide additional high quality glass material for beneficiation in SA.

4.7 Other Materials

4.7.1 Source & End Products

Tables 4.7.1 and 4.7.2 below give the typical source and end products identified by industry for resource recovery and recycling of the materials included in the other category. In SA,

- Fly ash
  - Sourced from coal-fired power generation.
  - Recycled for cement production.
- Foundry sands
  - Sourced from foundries.
  - Recycled in cement production and manufactured soils.
- Leather & Textiles
  - Sourced from waste clothing, usually obtained from charities.
  - Re-processed and recycled as cleaning clothes.
- Tyres & Rubber
  - Sourced from end-of-life car tyres or other waste rubber materials.
  - Tyres re-treaded, reprocessed to rubber mats or exported for energy production overseas.

Table 4.7.1 Typical sources for recovery of Other materials

Material	Source products
Fly Ash	Coal-fired power generation
Foundry sands	Foundries
Leather & textiles	Clothes, other textiles
Tyres & rubber	Tyres, other rubber products

Table 4.7.2 Typical end-products for recycling of Other materials

Material	End Products
Fly Ash	Cement manufacture, fill , soil stabilisation, fertiliser production
Foundry sands	Cement manufacture, fill , manufactured soils, blending with composts
Leather & textiles	Cleaning clothes
Tyres & rubber	Tyre re-treads, rubber matting, alternative rubber

4.7.2 Quantities & Trends

The quantity of other materials reported for South Australia during 2010-11, including the reporting error and final reprocessing destination for each material, are presented in Table 4.7.3 below.

Figure 4.7.1 (overleaf) compares the composition of other materials recovered in 2010-11 with 2009-10.

Figures 4.7.2 and 4.7.3 show the changes in recycling activity for other materials since 2003-04.

The following key points or observations can be made about the reported recycling activity for other materials.

- Fly ash
  - The reported quantity recovered of fly ash in 2010-11 was 200,000 tonnes. This is an increase of about 18% on the quantity reported in 2009-10, but is consistent with annual variations previously observed.
  - Note: There was increased data accuracy in reported fly ash quantities in 2010-11 compared with 2009-10.
- Foundry sands
  - At 31,800 tonnes, reporting of foundry sand has again increased significantly in 2010-11 (by 167% since 2009-10).
  - This increase appears to have been driven by growing beneficial reuse of this material for cement manufacture.
- Leather & textiles
  - The reported quantity of 3,900 tonnes in 2010-11, consistent with the previous period.
- Tyres & Rubber
  - Recovery of tyres has been gradually increasing since 2004-05 and did so again in 2010-11, up 13% over 2009-10 to 17,000 tonnes.

Table 4.7.3 Other material recovery and reported destination, SA 2010-11

Item	Net recovery [1]	Reporting Error		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Fly ash	200,000	11,000	6%	100%	0%	0%
Foundry sands	31,800	300	1%	100%	0%	0%
Leather & textiles	3,900	600	15%	0%	81%	19%
Tyres & other rubber	17,000	5,100	30%	0%	26%	74%
Total	**252,700**	**17,000**	**7%**	**92%**	**3%**	**5%**

1. Net recovery excludes reprocessing losses

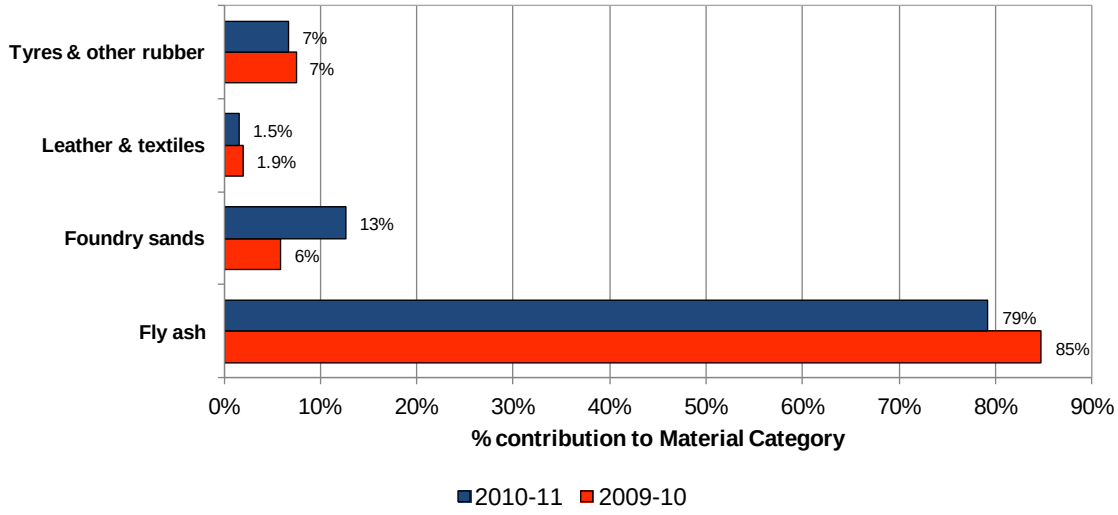

Figure 4.7.1 Changes in percent composition of recovered other materials (by weight), SA, between 2009-10 and 2010-11

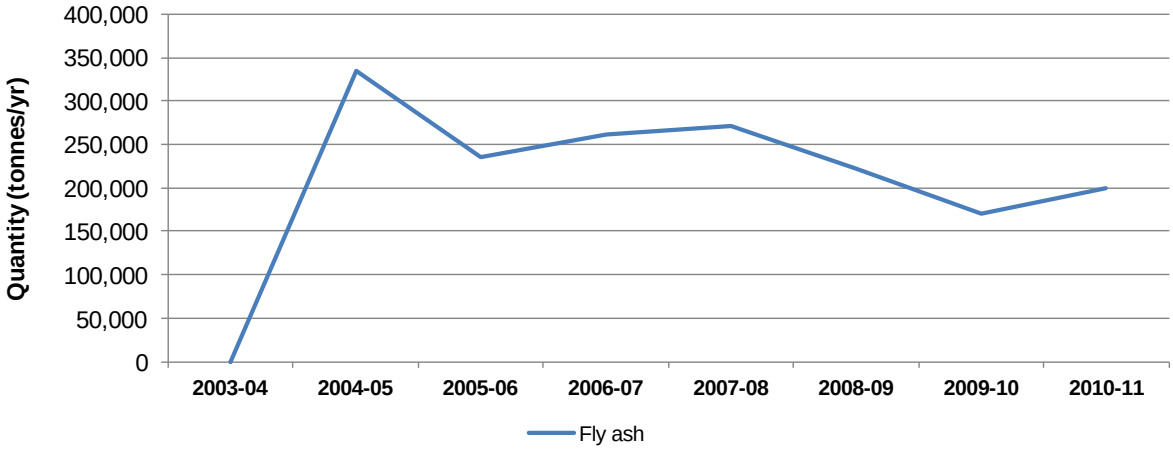

Figure 4.7.2 Changes in reported other materials since 2003-04 – Fly ash

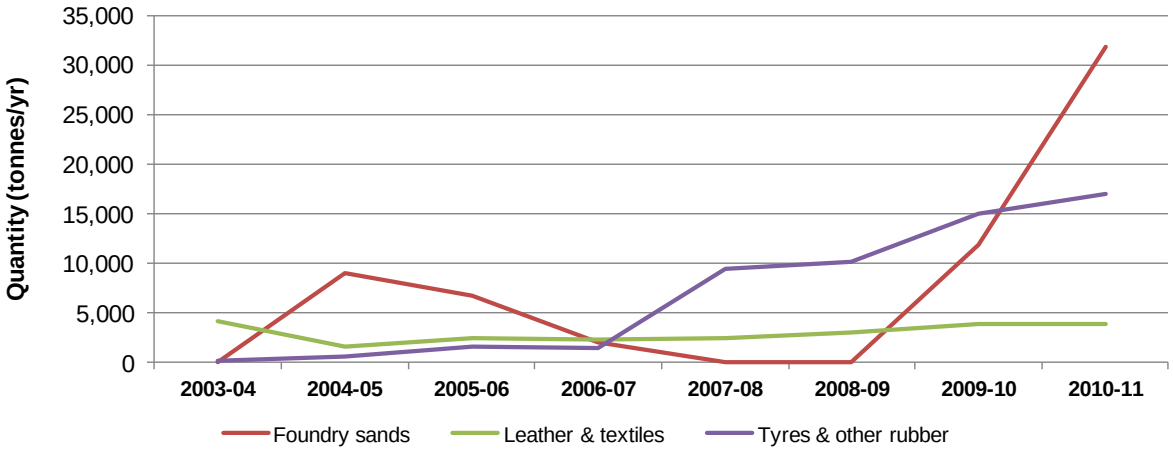

Figure 4.7.3 Changes in reported other materials since 2003-04 – Foundry sands, Leather & textiles and Tyres & other rubber

4.7.3 Re-processing Destinations

Table 4.7.3 includes the final destination reported in 2010-11 for re-processing of other materials.

- Fly ash and foundry sands – Were reprocessed in South Australia, ending up part of manufactured products.
- Leather & Textiles – All of this material was sent interstate or overseas for reprocessing into cleaning clothes. [All of this reprocessing ends up taking place overseas.]
- Tyres & rubber – This material was sent interstate or overseas for reprocessing. Part of the material sent interstate was being re-processed into a rubber-based product, with the rest was exported overseas from an interstate port. The rubber material exported from Australia is believed to end up being recycled as a fuel for energy production.

4.7.4 Sector & Geographical Origin

Table 4.7.4 shows the reported sector and geographical origins for other materials recovered during 2010-11.

- C&I was the sole source reported for all of the materials.
- All of the fly ash was generated at coal-fired power stations outside of the metropolitan area.

Table 4.7.4 Other material sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Fly ash	0%	100%	0%	0%	100%
Foundry sands	0%	100%	0%	100%	0%
Leather & textiles	0%	100%	0%	90%	10%
Tyres & other rubber	0%	100%	0%	90%	10%
Total	**0%**	**100%**	**0%**	**20%**	**80%**

4.7.5 Industry Barriers

The following general challenges to recovery and reprocessing of these materials was reported by the industry.

- Fly ash
  - The rebound in fly-ash quantities is expected to stabilise in the next period, after being affected by plant shutdowns in 2009-10 period.
- Foundry sands
  - The price for foundry sand reprocessors can afford to pay is finely balanced with the cost of landfill disposal for foundries. The balance appears to have tipped in favour of recovery and use in cement manufacture versus sending to landfill
- Tyres & rubber
  - Local reprocessing is being inhibited because higher returns are obtained by exporting this material.

4.7.6 Market Expectations

- Fly ash
    - The future of coal power stations in SA is uncertain, with the introduction of the carbon tax and its displacement by natural gas or renewable alternatives, and these circumstances will dictate future fly ash resource recovery volumes.
- Foundry sands
    - The quantity of foundry sands to cement manufacture is expected to continue to increase albeit at a slower rate as the cost of landfill disposal increases.
    - However, the shrinking manufacturing base in South Australia may mean reduced local availability of this resource.
- Tyres & rubber
    - The landfill ban on tyres introduced in September 2010 under South Australia's new Waste-to-Resources EPP[15] will mean greater demand for recycling of these materials.

[15] SA Government (2010b); Environment Protection (Waste to Resources) Policy 2010

4.8 E-waste

4.8.1 Source & End Products

Tables 4.8.1 and 4.8.2 below give the typical source and end products identified for resource recovery and recycling of e-waste materials. In SA,

- Virtually all e-waste materials are dismantled and disassembled into their material constituents, such as metal, plastics and other materials/commodities, which are then sent for re-processing.
- However, common exceptions are:
  - Printer cartridges – which can be refilled and reused.
  - Computers – Where the whole computer or constituent components may also salvaged and or reused.
- There is currently considerable and growing interest and activity in e-waste recycling given the hazardous materials these items can contain.
  - Local government and Zero Waste SA have been jointly involved in organising e-waste collection events for the general public in metropolitan and regional areas.
  - Some SA councils offer e-waste collection services to their residents via hard waste collection or drop-off at council-owned waste transfer stations.
  - A number of local commercial collectors are offering e-waste collection or drop-off services.
  - A national Product stewardship scheme is being developed to manage end-of-life televisions / monitors[16] starting in the second half of 2012.

Table 4.8.1 Typical sources of e-waste materials

Material	Source products
Printer cartridges	Empty or redundant ink-jet or laser printers
Compact fluorescent lamps	End-of-life lighting
Batteries	End-of-life lighting primary & secondary consumer batteries. Excludes automotive batteries
Computers	End-of-life computer equipment, accessories and peripherals
Televisions / Monitors	End-of-life CRT, LCD or LED televisions or computer monitors
Mobile phones	End-of-life mobile phones, including accesories and batteries
Other e-waste	All other end-of-life electrical and electronic equipment, including household electrical appliances

Table 4.8.2 Typical end-products for e-waste materials

Material	End Products
Printer cartridges	Re-filled cartidges, dissasembly to material constituents for re-processing
Compact fluorescent lamps	Dissasembly to various material constituents for re-processing
Batteries	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Computers	Salvage and/or refubishment for reuse of components, Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Televisions / Monitors	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Mobile phones	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Other e-waste	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing

[16] Environment Protection and Heritage Council (2009); Decision Regulatory Impact Statement: Televisions and Computers

- Several industry sectors or companies that sell electronic and electrical items already run their own voluntary product stewardship or return schemes.
- There are also not-for-profit environmental organisations, such as Planet Ark, running their own e-waste collection campaigns, usually in conjunction with industry and retail partners.
- There are companies, both in South Australia and interstate, which accept the collected e-waste from SA and dismantle it into its constituent materials, which can then be sent for re-processing or further resource recovery.
- Under its new Waste-to-Resources EPP (SA Government, 2010b), South Australia is to progressively moving towards banning landfill disposal of all e-waste items in the period between September 2012 and September 2014.

4.8.2 Quantities & Trends

The quantity of e-waste materials reported for South Australia during 2010-11, including the reporting error and final reprocessing destination for each material, are presented in Table 4.8.3 overleaf.

As there were not many data points reported for each item, the destination analysis, as well as the sector and geographical origins analysis were aggregated.

Figure 4.8.1 (also overleaf) compares the relative proportions of the e-waste material recovered in 2010-11 with the same in 2009-10.

Table 4.8.4 (two pages overleaf) compares the recycling activity for e-waste materials between this year and 2009-10 (when survey of this material category commenced in SA).

The following key points or observations can be made about the reported recycling activity for e-waste.

- The total quantity of e-waste reported in the 2010-11 survey was 3,220 tonnes, significantly up (by 78%) on the 1,805 tonnes reported in 2009-10.
    - This increase is attributed:
        - The Digital TV Switchover which commenced in regional areas of South Australia during 2010-11, which appears to have contributed to a four-fold increase in reported recovery of televisions/monitors from 2009-10.
        - Additional recycling opportunities and services presented to SA residents and businesses through Zero Waste SA and Council facilitated collections (campaign and on-call) and commercial waste contractors.
        - Recovery of e-waste from materials destined for landfill at some transfer stations.
        - Preparations for landfill bans for e-waste in September 2012 has increased awareness of the public and other organisations for the need to direct e-waste to recyclers.
- The major e-waste constituents by weight were televisions/monitors (57%), computers (20%) and other e-waste items (17%).
- However, printer cartridges also made a sizeable contribution (4%), reflecting its high use as a consumable item.

Table 4.8.3 E-waste material recovery and reported destination, SA 2010-11

Item	Net recovery[1]	Reporting Error		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Printer cartridges	130					
Compact fluorescent lamps	18					
Batteries	1					
Computers	660					
Televisions / Monitors	1,840					
Mobile phones	30					
Other e-waste	540					
Total	**3,220**	**390**	12%	61%	39%	0%

1. Net recovery excludes reprocessing losses

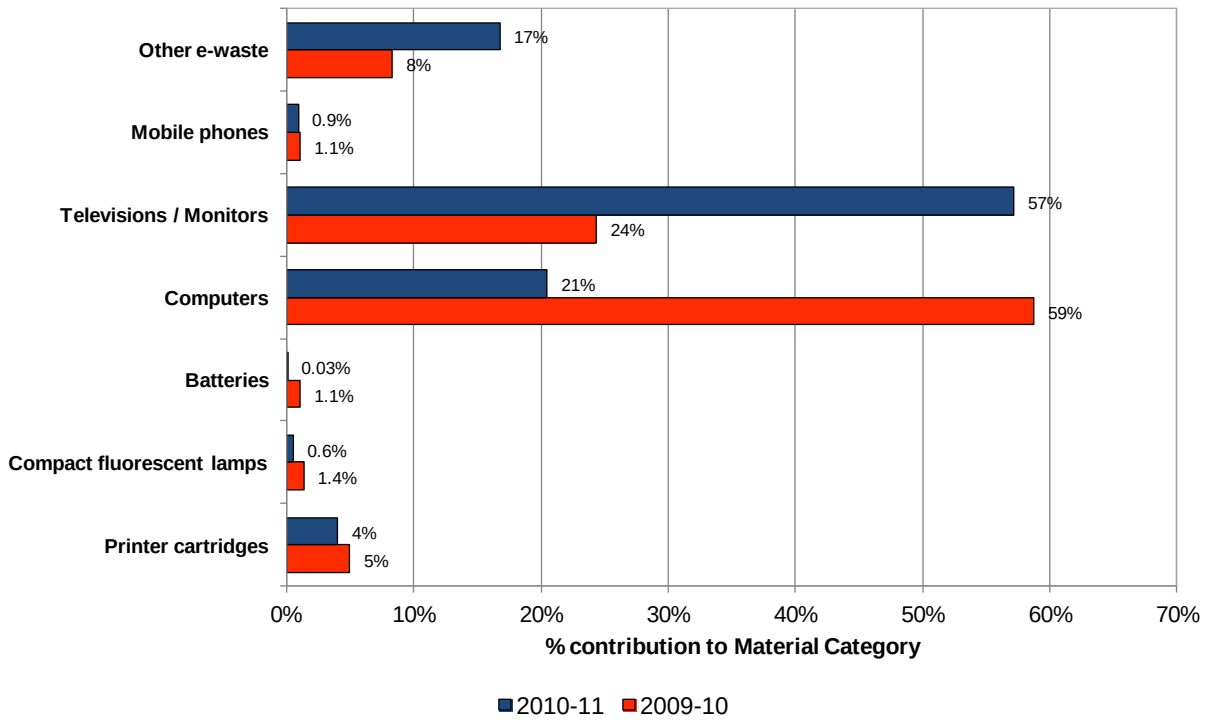

Figure 4.8.1 Changes in percent composition of recovered e-waste (by weight), SA, between 2009-10 and 2010-11

Table 4.8.4 Changes in reported E-waste between 2009-10 and 2010-11

Item	2009-10	2010-11	% change 09-10 to 10-11
Printer cartridges	90	130	44%
Compact fluorescent lamps	25	18	-28%
Batteries	20	1	-95%
Computers	1,060	660	-38%
Televisions / Monitors	440	1,840	318%
Mobile phones	20	30	50%
Other e-waste	150	540	260%
Total	**1,810**	**3,220**	**78%**

4.8.3 Re-processing Destinations

Table 4.8.3 includes the final destination reported in 2010-11 for re-processing of e-waste materials.

- Whilst the destination for 71% of the materials is reported as South Australia, this does not necessarily involve reprocessing.
    - This is the destination of dissembled metal, plastic and other material constituents, which are disposed of to local aggregators/merchants.
    - These local aggregators/merchants then determine where the material will be re-processed.
        - It is not possible to accurately discern the ultimate re-processing destination for all of these materials.

4.8.4 Sector & Geographical Origin

Table 4.8.5 overleaf shows the reported sector and geographical origins for e-waste recovered during 2010-11.

- The majority (65%) of the e-waste originated from Municipal sources through e-waste or hazardous waste collections organised by Local Government and/or Zero Waste SA.
- The balance was e-waste came from C&I sources via commercial collections from government or business.

The estimate split between e-waste material sourced from metropolitan and regional areas was 77% and 23%, respectively.

- The above contribution achieved by regional areas is a marked increase in the reported 9% contribution in 2009-10, and can be attributed to the Digital TV Switchover which commenced in regional areas of South Australia during 2010-11.

Table 4.8.5 E-waste sector and geographical origins, SA 2010-11

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Total	65%	35%	0%	77%	23%

4.8.5 Industry Barriers

The following general challenges to recovery and re-processing of e-waste materials was reported by the industry.

- The main barrier is that the majority of e-waste is still sent to landfill as this is a significantly cheaper disposal option when compared to recycling.
- However, this barrier will be removed when the landfill bans for e-waste are progressively introduced in SA and the National Product Stewardship Scheme (Televisions and Computers) is rolled out in the second half of 2012.
- Manual disassembly is considered the safest and most efficient method for maximising resource recovery and minimising contamination, but high labour costs mean that some companies interstate are simply shredding e-waste items whole. Shredding is said to reduce resource recovery efficiency.
- The general public is still largely uneducated about correct disposal and the benefits of recycling e-waste.
- Collection depots, systems and infrastructure are still largely undeveloped and inconvenient for the public to access.

4.8.6 Market Expectations

- The e-waste resource recovery sector is rapidly expanding and this growth will accelerate when new product stewardship schemes and landfill bans in South Australia are introduced.
- A report for the Australian Department of the Environment, Heritage, Water and the Arts (2010) has projected that e-waste recovery in Australia could substantially increase, almost by a factor of 8 times current levels, within 5-10yrs.
- The perception of the future market potential is therefore very positive, so long as some of the above challenges/issue can be successfully overcome.

5 Packaging materials

5.1 Introduction

This section of the report provides a summary of packaging recovery that was achieved by South Australia in 2010-11. The packaging recovery data is extracted from both industry and reference data collected during the recycling activity survey.

- *As such, the quantities identified in this section are not in addition to material quantities reported in Section 4, but are a sub-set that provides more specific information on packaging recovery. The method for determining these packaging rates was outlined in Section 2.*

5.2 Packaging recovery overview

Estimated packaging recovery in SA during 2010-11 is summarised in Table 5.1 below.

- *Total packaging recovery was estimated at 219,940 tonnes, of which 47,000 tonnes (21%) was recovered through the container deposit system, and 172,930 tonnes (79%) was recovered from other sources.*
- *This is consistent with last year's reported packaging recovery of 220,870 tonnes.*
- *The container deposit recovery in 2010-11 decreased (down 5.5%) from that reported in 2009-10.*
- *This year's survey achieved greater engagement and cooperation from recyclers and/or re-processors in reporting of packaging material.*
    - *This helped to achieve improving accuracy and resolution in reporting of some material categories; particularly for plastics, where substantial increases in reported packaging quantities were seen.*

Table 5.1 Estimated packaging recovery, SA 2010-11

Packaging Material	Origin (tonnes)		Total packaging(tonnes)	% (packaging) of total material recovered
	Container Deposit	Other		
Steel Cans		1,120	1,120	0.3%
Aluminium Cans	3,900	400	4,300	22.2%
Cardboard Packaging		138,200	138,200	89.7%
Liquid Paperboard Cartons	800	2,500	3,300	94.3%
PET Packaging	4,010	90	4,100	100%
HDPE Packaging	200	3,200	3,400	73.9%
PVC Packaging		4	4	2.4%
LDPE Packaging		2,200	2,200	47.8%
Polypropylene Packaging		20	20	0.5%
Polystyrene Packaging		400	400	93.0%
Other Plastics packaging		4,900	4,900	84.5%
Glass bottles & jars	38,100	19,900	58,000	100%
Total	**47,010**	**172,930**	**219,940**	

Table 5.1 also includes the percentage that the packaging material was of the total amount of recycling activity reported for the material category the packaging came from, e.g. Cardboard packaging data is derived from cardboard recycling activity.

- *From this analysis, it can be seen that packaging materials constitute a high proportion of the total amount of recycling activity reported in SA, e.g.*
    - *Cardboard packaging was 89.7% of the total amount of cardboard recycling activity being reported during 2010-11;*
    - *Glass packaging was 100% of total glass recycling activity;*
    - *Liquid Paperboard was 94.3% of total liquid paperboard recycling activity;*
    - *PET packaging was 100% of total PET recycling activity; etc.*

5.3 Container deposit packaging

South Australia remains the only state or territory to have a container deposit system for return of recyclable bottles and cans.

Figure 5.1 below illustrates the relative proportions of the returned recycled deposit containers.

- *The major constituent by weight was glass at 81%.*

Table 5.2 below gives the return rates achieved for recycled deposit containers in 2010-11.

- *The average return rate in 2010-11 was 82% (by weight) from approximately 738 million containers (estimated as used in SA during this period).*
- *This return rate is slightly less than the value (83%) seen in 2009-10 (for 770 million containers used).*

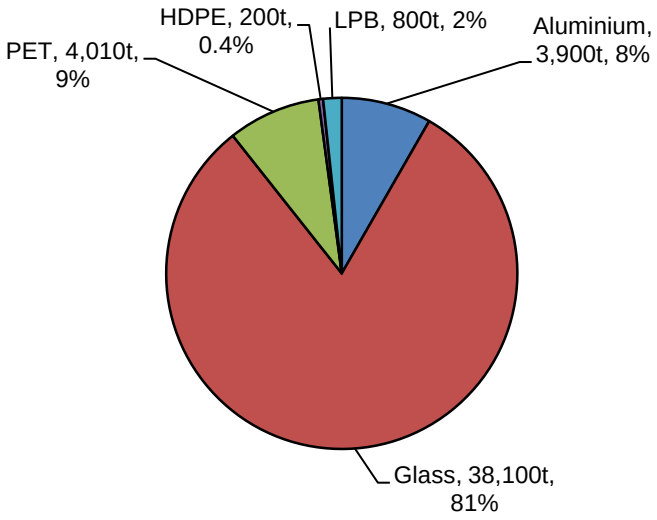

Figure 5.1 Relative proportions of returned recycled deposit containers (by weight), SA 2010–11

Table 5.2 Return rates for recycled deposit containers, SA 2010-11

Material	Recovered (tonnes)	Return rate (%)
Aluminium	3,900	89%
Glass	38,100	83%
PET	4,010	72%
HDPE	200	59%
LPB	800	55%
Total	**47,010**	82%

5.4 Other packaging material

Other packaging material is collected through other routes such as kerbside recycling and commercial collections. Figure 5.2 below summarises the relative proportions of the other packaging materials. The major constituent of the other packaging material was cardboard materials (at 138,200 tonnes).

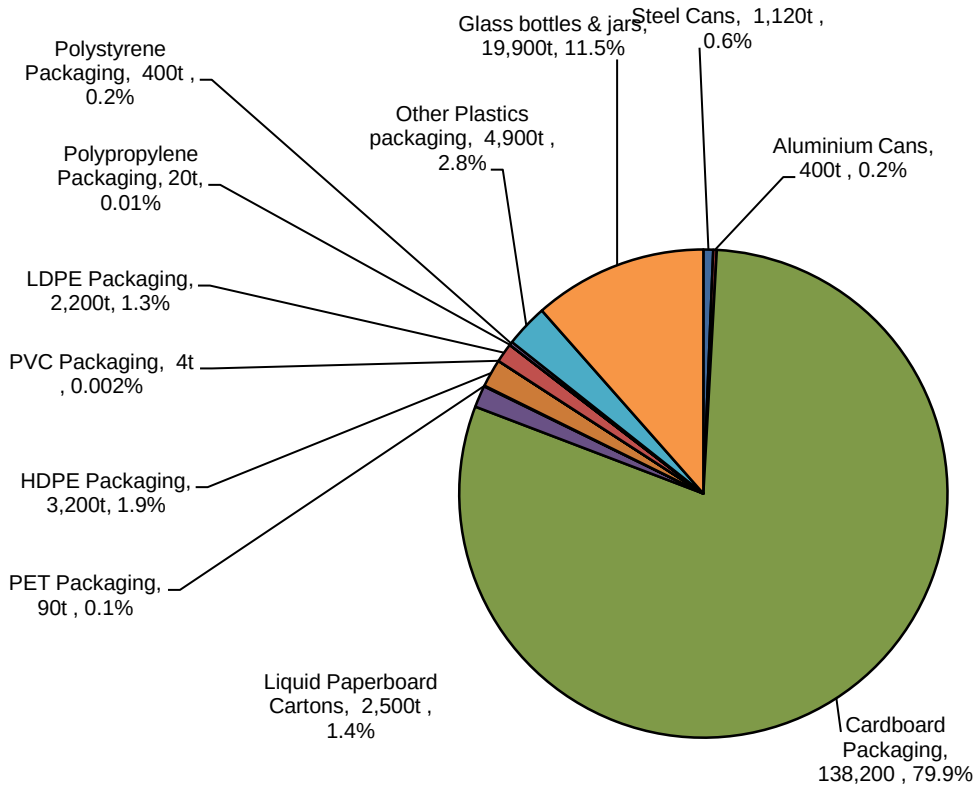

Figure 5.2 Relative proportions of recovered other packaging by weight, SA 2010-11

6 Environmental Benefits of Recycling

6.1 Introduction

This section quantifies the following environmental benefits of recycling based on the material data collected for the 2010-11 recycling activity survey and the conversion and emission factors given in Appendix 2. The environmental benefits have been calculated for each material except e-waste and reuse items.

- ***Greenhouse Gas Savings*** (quantified as tonnes of CO_2-e) – The reduction in greenhouse emission achieved by replacing virgin materials with recycled materials.
- ***Cumulative Energy Demand saved*** (as Gigajoules (GJ) – The amount of energy saved, including all fossil, renewable, electrical and embodied energy, by using recycled materials.
- ***Water Savings*** (as kL H2O) – The savings in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

The estimated environmental benefits achieved by recycling in South Australia, 2010-11, for each of the above are given in Table 6.1 overleaf.

6.2 Greenhouse Gas Savings (or avoided emissions)

Recycling reduces Greenhouse Gas (GHG) emissions primarily by:

- Decreasing the amount of energy used by industry to make products compared with using virgin raw materials. The majority of energy supplied to South Australia is still generated using fossil fuels, which produce greenhouse gas emissions.
- Reduced emissions of greenhouse gases achieved from diverting recovered materials from landfills (e.g. methane). This is particularly relevant to organics-based and putrescible materials which biologically decompose in landfill.

The estimated greenhouse gas savings (in tonnes CO_2-e) achieved by recycling of each material in South Australia for 2010-11 are included in Table 6.1 overleaf, and are also summarised by material category in Table 6.2 overleaf. Figure 6.1, two pages over, illustrates the relative contributions of each material category to these greenhouse gas savings.

- The total estimated greenhouse gas savings from recycling in South Australia during 2010-11 is about 1.3 million tonnes of CO_2-e.
  - This is an increase of about 34% on the value reported for 2010-11.
  - The higher estimated greenhouse gas savings is a combination of several factors:
    - An increase in reported material recovery.
    - Specifically, the large increases in reported recovery for masonry, metal and organic materials.
  - Metals (at 49%) contribute disproportionately to greenhouse gas savings over other recovered materials because a virgin metal is highly energy intensive to manufacture. The greenhouse gas savings per unit tonne delivered by recycling metals far outstrip the relative contributions made by other materials.

Table 6.1 Estimated environmental benefits as a result of recycling in SA, 2010-11

	Material	Material Quantity	GHG Emissions Saved	Energy Saved	Water Saved
		tonnes	tonnes CO2-e	TJ LHV	ML
	Masonry				
1	Asphalt	145,000	2,300	295	128
2	Bricks	100,000	900	12	126
3	Concrete	860,000	24,900	475	1,101
4	Plasterboard	300			
5	Clay, fines, rubble & soil	1,260,000	109,000	851	554
	Metals				
6	Steel	391,000	240,500	3,105	-923
7	Aluminium	19,400	286,600	3,319	3,526
8	Non-ferrous metals	31,100	105,600	1,122	186
	Organics				
9	Food Organics	4,400	2,300	7	3
10	Garden Organics	230,000	53,000	108	110
11	Timber	282,000	92,600	372	152
12	Organics - Other	440,000	211,600	953	101
	Cardboard & paper				
13	Cardboard & waxed cardboard	154,000	46,800	1,930	5,088
14	Liquid Paperboard	3,500	2,200	32	57
15	Magazines	5,700	2,600	52	126
16	Newsprint	32,000	14,900	290	709
17	Phonebooks	2,500	600	31	83
18	Printing & Writing Paper	13,600	7,900	177	423
	Plastics				
19	Polyethylene terephthalate	4,100	4,200	208	-86
20	High density polyethylene	4,600	3,200	257	-16
21	Polyvinyl chloride	170	300	7	11
22	Low density polyethylene	4,600	3,200	257	-16
23	Polypropylene	4,000	6,600	235	-52
24	Polystyrene	430	600	26	-8
25	Mixed &/or Other plastics	5,800	7,900	352	-102
	Glass				
26	Glass	58,000	34,600	372	140
	Other Materials				
27	Fly ash	200,000	5,800	110	252
28	Foundry sands	31,800			
29	Leather & textiles	3,900			
30	Tyres & other rubber	17,000	20,200	1,142	891
	Total	**4,310,000**	**1,290,900**	**16,096**	**12,566**

Table 6.2 Estimated greenhouse gas savings as a result of recycling in SA, 2010-11

Sector Origin	GHG Emissions Saved tonnes CO2-e	Equivalent trees planted required for carbon absorption	Equivalent cars off the road (1 year)
Masonry	137,100	205,000	31,500
Metals	632,700	946,000	145,500
Organics	359,500	537,000	82,700
Cardboard & paper	75,000	112,000	17,300
Plastics	26,000	39,000	6,000
Glass	34,600	52,000	8,000
Other Material	26,000	39,000	6,000
Total	1,290,900	1,930,000	297,000

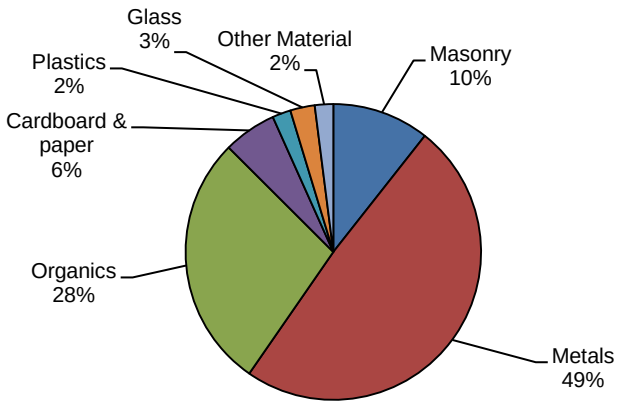

Figure 6.1 Avoided greenhouse gas emissions (by material category), as a result of recycling in SA 2010-11

- These greenhouse gas savings are considered approximately equivalent to:
  - About 2 million trees that would have to be planted to absorb the same amount of CO_2.
  - The greenhouse gas emissions that approximately 300,000 cars would produce in a single year[17].
- The greenhouse gas savings from SA recycling, 2010-11, equate to:
  - Approximately 18% of South Australia's total Community sector GHG emissions in 2009[18].

[17] Average car GHG emissions value ≈ 4.25 tonnes CO_2-e/yr; Source: SA 2008-09 Recycling Activity report (Zero Waste SA, 2010)

[18] The Community sector includes GHG emission associated with residential stationary energy use and passenger vehicle use; Source: SA DENR (2011), Report on the operation of the 'Climate Change and Greenhouse Emissions Reduction Act 2007.

6.3 Energy Savings

The projected energy savings (in Terajoules or TJ[19]) achieved by recycling of each material in South Australia for 2010-11 are included in Table 6.1, and are also summarized by material category in Table 6.3 overleaf. Figure 6.2, also overleaf, illustrates the relative contributions of each material category to these energy savings.

- The total projected energy savings from recycling in South Australia during 2010-11 was 16,096 TJ.
  - Metals again contribute disproportionately, at 47%, to projected energy savings even though they represent only 10% of the material being recovered in SA.
  - Similarly, plastics contribute to 8% of energy savings even though 0.5% of the material recovered
  - Behind metals, Cardboard & paper (at 16%) is the next most significant contributor to energy savings
- These energy savings are considered approximately equivalent to:
  - Energy use by 313,200 average households in one year.[20]
  - The energy supplied by 2.8 million barrels of oil.
- The energy savings from SA recycling, 2010-11, equate to:
  - Approximately 4.6% of South Australia's total energy consumption reported for 2008-09.[21]

Table 6.3 Estimated energy savings as a result of recycling in SA, 2010-11

Sector Origin	Energy Saved TJ LHV	Equivalent households (1 year)	Barrel of Oil Equivalents (BOE)
Masonry	1,632	31,800	286,000
Metals	7,546	146,800	1,324,000
Organics	1,440	28,000	253,000
Cardboard & paper	2,511	48,900	441,000
Plastics	1,342	26,100	235,000
Glass	372	7,200	65,000
Other Material	1,252	24,400	220,000
Total	16,096	313,200	2,824,000

[19] 1 Terajoule or TJ = 10^{12} Joules (J) = 1,000 Gigajoules (GJ)

[20] Average household energy use value ≈ 51.4 GJ/yr; Source: National Appliance and Equipment Energy Efficiency Committee (1998)

[21] Source: DRET (2011), Energy in Australia, 2011

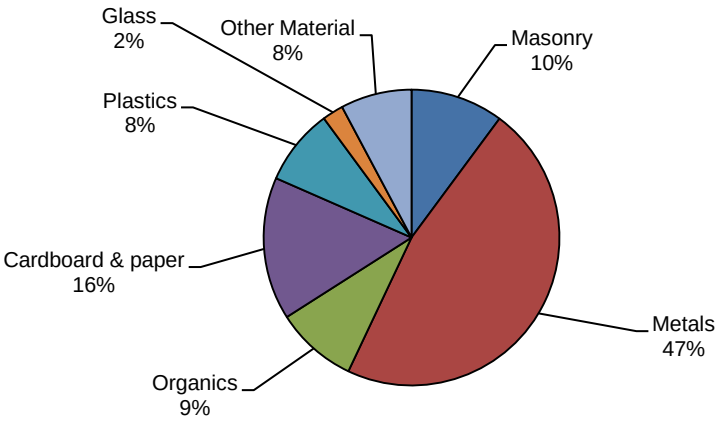

Figure 6.2 Avoided energy consumption (by material category) as a result of recycling in SA, 2010-11

6.4 Water Savings

The estimated water savings (in Megalitres or ML[22]) achieved by recycling of each material in South Australia for 2010-11 are included in Table 6.1 overleaf, and are also summarized by material category in Table 6.4 (also overleaf). Figure 6.3 illustrates the relative contributions of each material category to these water savings.

- The total projected water savings from recycling in South Australia during 2010-11 was 12,566 ML.
  - Cardboard & paper contribute most significantly (at 49%) to water savings achieved from recycling. The manufacture of virgin cardboard and paper materials consumes large volumes of water.
  - Metals are also a significant contributor at 21%. These water savings principally result from recycling of aluminum which consumes substantial quantities of water in its manufacturing process
  - Recycling of some plastics consume more water than they save.

[22] 1 Megalitre or ML = 10^6 Litres (J) = 1,000 kilo-Litres (kL)

Table 6.4 Estimated water savings as a result of recycling in SA, 2010-11

Sector Origin	Water saved ML	Equivalent households (1 year)	Olympic Swimming Pools
Masonry	1,909	10,050	760
Metals	2,789	14,680	1,120
Organics	367	1,930	150
Cardboard & paper	6,486	34,140	2,590
Plastics	-269	-1,420	-110
Glass	140	740	60
Other Material	1,143	6,020	460
Total	12,566	66,140	5,030

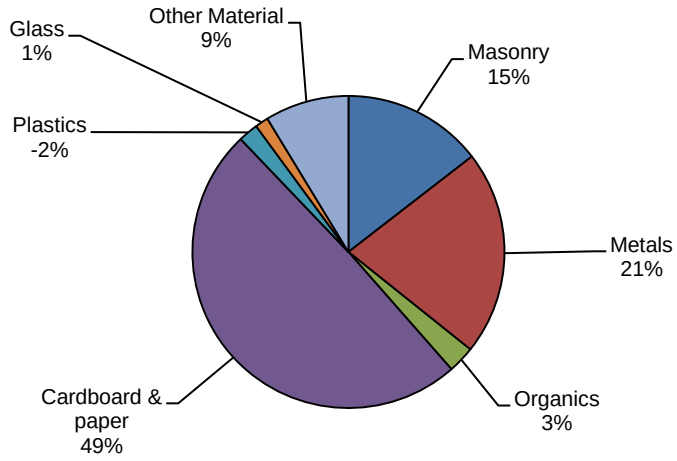

Figure 6.3 Avoided water consumption (by material category) as a result of recycling in SA, 2010-11

- These water savings are considered approximately equivalent to:
  - Water use by 66,140 average Adelaide households in one year.[23]
  - The water contained in about 5,000 Olympic-sized swimming pools.[24]
- The water savings from SA recycling, 2010-11, equate to:
  - Approximately 9% of Metropolitan Adelaide's total water consumption reported for 2010-11.[25]

[23] Average household water consumption value ≈ 190 kL/yr; Source: SA Government (2009)

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

[25] Source: SA Water (2011); South Australian Water Corporation Annual Report: For the year ending 30 June 2011

7 Acknowledgements

Zero Waste SA and Rawtec would like to recognise and thank the following participants in the 2010-11 SA Recycling Activity Survey. The list below does not indicate all organisations who participated in the survey but those that agreed to be recognised.

- AAA Recycling
- Adelaide Brighton Cement
- Adelaide Hills Recycling
- Adelaide Hills Region Waste Management Authority
- Adelaide Pallet Recycling
- Adelaide Resource Recovery
- Alinta Energy
- AMCOR Recycling
- Associated Metals SA
- Bin-It Waste Transport & Recycling
- Boral
- Close the Loop
- CMA Eco Cycle
- SA Government, Department of Planning, Transport and Infrastructure (DPTI)
- DoloMatrix
- Downer Group
- E-cycle Recovery
- Foodbank SA
- Fleurieu Regional Waste Authority
- Fulton-Hogan
- Green Team
- Integrated Waste Solutions
- Intercast & Forge
- Jeffries Group
- Lucas Waste Management
- Master Butchers Co-operative
- Mobile Muster
- Naracoorte Lucindale Council
- Naracoorte Recycables
- Normetals
- Norske Skog Paper Mills (Australia)
- O-I Asia Pacific
- Peats Soils and Garden Supplies
- ResourceCo
- SA Water
- Shredlogix
- SITA Australia
- SITA Resource Co
- Southern Region Waste Resource Authority
- Statewide Recycling
- T & R Pastoral
- Tarac Technologies
- Visy Recycling

8 Glossary[26]

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.
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.
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.
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.

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

Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for reprocessing 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 reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product. The term recycling is used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. Waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap) are not defined as recycling for the purpose of this study.
Reprocessing	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 reprocessing 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.

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Appendix 1: 2010-11 Recycling Activity Survey Questionnaire

Government of South Australia
Zero Waste SA

Survey Questionnaire – Recycling Activity in SA, 2010-11

Issued: 24 November 2011

1. Survey Company & Contact Details

Rawtec Pty Ltd (www.rawtec.com.au)

- Chris Colby, Principal Consultant, p: (08) 8294 5571, m: 0410 088 839, e: chris.colby@rawtec.com.au
- Mark Rawson, Principal Consultant, p: (08) 8294 5571, m: 0447 772 970, e: mark.rawson@rawtec.com.au
- Kat Heinrich, Consultant, p: (08) 8294 5571, m: 0432 254 454, e: kat.heinrich@rawtec.com.au

2. Survey Questions for Period 1 July 2010 - 30 June 2011

1.	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.	**Please fill in Table 1 (overleaf) for each relevant material. This is the critical information required for the survey.** Please select relevant materials from list in Table 2 (two pages over).
3.	What is the estimated accuracy of the data provided in Table 1 (overleaf), e.g. ±5%?
4.	Where any of the reported materials derived from packaging? If yes, (for each material) approximately what proportion (as % of total)?
5.	Have there been any significant changes in quantities, sources or destinations from last financial year?
6.	The approximate number of people employed by your operations
7.	Where do you receive most of your material from, e.g. Councils, manufacturing, retail, hospitality, etc.?
8.	Where do you send most of recovered or re-processed materials and how are they recycled, e.g. compostors, building construction, plastics re-processor, material aggregator, e-waste recycler, quarry, etc.?
9.	Your opinion about the market strength/prospects for recycled materials.
10.	Does your company or organisation intend to expand or contract its SA facilities? If yes, what will this involve?
11.	Are there any significant barriers, e.g. market, regulatory, technology, for your SA operations?
12.	What are the names of other recyclers in your area of the SA recycling industry?
13.	Are you happy for your company to be recognised in the report as participating in the 2010-11 SA Recycling Activity survey? Yes/No

Table 1: Data entry of estimated quantities of relevant materials for 2010-11

		MATERIAL SOURCE/INPUT					MATERIAL DESTINATION/OUTPUT				STOCKPILE	RESIDUAL
ID	Material	Materials received for recycling (in tonnes):		Source of material (in tonnes or %)			Destination of material for re-processing (in tonnes or as %)				Quantities stockpiled (in tonnes) at beginning and end of financial year	% waste by-product (if any) generated from recovery or re-processing to landfill
		SA-Metro	SA-Regional	Municipal	Commercial & Industrial	Construction & Demolition	Your SA facility(ies)	Elsewhere in SA	Sent Interstate	Sent Overseas		
	EXAMPLE	23,000	30	25%	70%	5%	10,000	530	10,000	2,500	Not applicable	10%

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

Definitions:

Municipal- Domestic household sourced waste

Commercial and Industrial- Industry and business sourced waste

Construction and Demolition- Building, construction and demolition waste

Table 2: List of Materials 2010-11 Recycling Activity Survey

Category	ID	Material
A	***Masonry***	
	1	Asphalt
	2	Bricks
	3	Concrete
	4	Plasterboard
	5	Clay, fines, rubble & soil
B	***Metals***	
	6	Steel
	7	Aluminium
	8	Non-ferrous metals
C	***Organics***	
	9	Food Organics
	10	Garden Organics
	11	Timber
	12	Meat Rendering
	13	Waste Grease & Fat
	14	Waste Sludge & Bio-solids
	15	Organics - Other
D	***Cardboard & paper***	
	16	Cardboard & waxed cardboard
	17	Liquid Paperboard
	18	Magazines
	19	Newsprint
	20	Phonebooks
	21	Printing & Writing Paper
E	***Plastics***	
	22	Polyethylene terephthalate [PIC 1]
	23	High density polyethylene [PIC 2]
	24	Polyvinyl chloride [PIC 3]
	25	Low density polyethylene [PIC 4]
	26	Polypropylene [PIC 5]
	27	Polystyrene [PIC 6]
	28	Mixed &/or Other plastics [PIC 7]
F	***Glass***	
	29	Glass
G	***Electronic Waste***	
	30	Printer cartridges
	31	Compact fluorescent lamps
	32	Batteries
	33	Computers
	34	Televisions / Monitors
	35	Mobile phones
	36	Other e-waste
H	***Alternative Fuels***	
	37	Alternative Fuel
I	***Other Materials (exc. e-waste)***	
	38	Fly ash
	39	Foundry sands
	40	Leather & textiles
	41	Tyres & other rubber
J	***Re-use Materials***	
	42	Auto-Parts
	43	Home Furnishings & Goods
	44	Clothes
	45	Food Products

Appendix 2: 2010-11 Environmental Benefits Conversion & Emission Factors

Table A2.1 Emission and conversion factors adopted for estimation of environmental benefits of recycling, SA 2010-11

	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 w eighted 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 w eighted 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