RECYCLING ACTIVITY IN WESTERN AUSTRALIA 2010-11

THE GOVERNMENT OF WESTERN AUSTRALIA

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WA...TOO GOOD TO WASTE

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DEPARTMENT OF ENVIRONMENT AND CONSERVATION

RECYCLING ACTIVITY IN WESTERN AUSTRALIA

2010-11

Final Report

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Appendix A

Reprocessor Survey

EXECUTIVE SUMMARY

The recovery of materials for recycling has many environmentally beneficial outcomes. Not only does it reduce the amount of material sent to landfill, it helps to conserve limited material resources and, in general, can help to reduce energy and water use required to manufacture new products, while simultaneously reducing associated greenhouse gas emissions.

Survey method

A survey of total recycling activity in Western Australia (WA) for 2010–11 was undertaken in August–September 2011 by Hyder Consulting. The survey covered all materials recovered for recycling in WA, as well as exported materials. Any materials imported into the state for recycling were excluded.

All known local (WA based) and interstate recycling destinations were identified, as well as overseas export destinations.

Recycling by material

Reported recycling in WA reached a total of 2 042 270 tonnes in 2010-11. Quantities of each material type reprocessed during 2010–11 are presented in Table E-1.

Table E-1 Annual recycling by material type 2010-11

Material Type	Tonnes	Proportion of Recycling (%)
C&D materials	764 454	38%
Organics	483 717	24%
Paper & cardboard	244 461	12%
Metals	487 070	24%
Glass	26 745	1%
Textiles	5 326	0.3%
Rubber	16 144	1%
Plastic	14 354	1%
TOTAL	**2 042 270**	**100%**

Recycling by sector

The C&D sector made up the highest proportion of recycling activity during 2010-11, accounting for over half of the material recovered for recycling in WA (Table E-2).

Table E-2 Sector origins of WA sourced reprocessed materials, WA 2010-11

Sector source	Quantity	
	(tonnes)	(%)
Municipal	561 156	27%
C&I	431 180	21%
C&D	1 049 934	51%
Total	**2 042 270**	**100%**

Recycling by geographic source

Of the materials presented for recycling in WA, 87% came from the metropolitan area and 13% from non-metropolitan areas (Table E-3). As the C&D sector makes up a large amount of materials recycled, a correspondingly large proportion of recycling is from the metropolitan area. The ratio of metropolitan and non-metropolitan sourced material does differ for particular materials.

Table E-3 Geographic source of WA sourced reprocessed materials, WA 2010-11

Material type	Metropolitan (%)	Non-metropolitan (%)
C&D materials	95%	5%
Organics	85%	15%
Paper & cardboard	83%	17%
Metals	67%	33%
Glass	99%	1%
Textiles	100%	0%
Rubber	93%	7%
Plastic	75%	25%
TOTAL	**87%**	**13%**

All C&D materials and most organics are reprocessed locally. As a result, 62% of material recycled in WA was reprocessed within the state, with most of the remainder going to overseas export (Table E-4).

Table E-4 Destination of WA sourced reprocessed materials, WA 2010-11

Destination	Number of destinations	Tonnes	%
Western Australia	70	1 274 145	62
Interstate	13	49 694	2
Export	Unknown	718 909	35
TOTAL	**83**	**2 042 748**	**100**

Waste Generation and Diversion

Landfill data for the metropolitan area during 2010-11 was provided by the WA Department of Environment and Conservation. Based on population data for metropolitan and non-metropolitan regions of WA, and assuming a similar waste generation rate for metropolitan and non-metropolitan regions, this data was extrapolated to estimate the total quantity of waste sent to landfill in WA. Data for both the metropolitan area and WA are provided in Table E-5.

Table E-5 Annual recycling and overall waste diversion

SUMMARY	2010-11	
	Metro	**WA**
Diversion from landfill (tonnes)	1 730 118	2 042 270
Waste to landfill (tonnes)[1]	3 106 689	4 491 170
Total waste generation (tonnes)	4 836 807	6 533 440
Diversion rate (%)	35.8%	31.3%
Population[2]	1 749 800	2 363 587
Per capita diversion (kg/person)	989	864
Per capita landfill (kg/person)	1 775	1 900
Per capita total waste (kg/person)	2 764	2 764

Per capita recycling in the metropolitan area, which was nearly 1,000 kg per capita in 2010-11, was almost 15% higher than the state average. While an interstate comparison was not possible due to the unavailability of 2010-11 recycling data for many of the other states and territories, a review of data reported in other jurisdictions over recent years indicated that WA recycling activity recorded in 2010-11 is much lower than that of other states on a per capita basis.

1 TOTAL RECYCLING IN WESTERN AUSTRALIA

The recovery of materials that have reached end of life for recycling into new products has many important environmentally beneficial outcomes. Not only does it reduce the amount of material sent to landfill and therefore the environmental impacts of landfilling, it helps to conserve limited material resources and it can help reduce energy and water use required to manufacture new products, as well as reduce associated greenhouse gas emissions. Measuring and reporting on recycling activity is an important exercise that allows responsible agencies to make appropriate planning and management decisions to further increase the proportion of generated waste recovered for recycling.

1.1 SURVEY METHOD

A survey of total recycling activity in Western Australia (WA) for 2010-11 was undertaken in August–September 2011 by Hyder Consulting. The survey covered all materials recovered for recycling in WA, as well as exported materials. Any materials imported into the state for recycling were excluded.

As far as practicable, all known local (WA based) and interstate recycling destinations were identified, as well as export destinations overseas.

Recycling data was obtained from the following sources:

1 Reprocessors

- site visits of the key recycling sites in the Perth metropolitan area
- telephone / e-mail surveys of all other known recycling companies.

2 Data collated from pre-existing annual surveys, undertaken by the following national organisations:

- Compost Australia
- Plastics and Chemicals Industries Association (PACIA)
- Publishers National Environment Bureau (PNEB).

3 Australian Customs Service export data

- Quantity of materials exported for recycling from WA for 2010-11.

Data on reprocessed materials was sought for the 2010-11 financial years on the quantity (by weight), origin and destination of reprocessed materials. The full questionnaire sent to reprocessors is provided in Appendix A. Reprocessors were identified through extensive consultation with government, recycling collectors and other reprocessors.

Data from known recycling destinations of material generated in WA has been compiled into this report and, as such, the reported recycling data is as comprehensive as possible, however it can be considered as conservative. It is possible that some smaller WA-based material reprocessors or interstate destinations may not have been identified, with the result that any errors have caused a minor underestimation of actual recycling quantities.

Sector origins have been split into the following categories:

- municipal
- commercial and industrial (C&I)
- construction and demolition (C&D).

Material collected for recycling was also split according to geographic source into the categories *metropolitan* and *non-metropolitan*.

It is noted that, due to rounding, percentages and tonnages included in tables throughout this report may not add to the totals shown.

1.2 STATEWIDE RECYCLING

Recycling in WA reached a total of 2 042 270 tonnes in 2010-11.

Western Australians recycled approximately 864 tonnes per capita during 2010-11. While an interstate comparison was not possible due to the unavailability of 2010-11 recycling data for many of the other states and territories, a review of data over recent years indicated that recycling activity recorded for metropolitan areas of WA has been consistently lower than that of other states on a per capita basis.

1.3 IMPROVING DATA QUALITY

The data for this report is collected through voluntary survey and the accuracy of the information presented in this report is entirely dependent on the accuracy of data submitted by recycling operators to the survey. A review of data presented in earlier *Recycling Activity in Western Australia* reports has raised questions about the accuracy of some of the data provided by some recycling operators to past annual surveys. In particular, the amount of recycled materials appears to have been significantly over-reported in the 2009-10 survey. While measures have been put in place to improve future survey data quality (discussed further below), the quality of the submitted data will continue to depend on the capability of operators to accurately measure and report on their recycling activities.

The *Recycling Activity in Western Australia* reports present quantities of recycled materials in tonnes. However, not all surveyed recyclers have a weighbridge and many record quantities of material in volumes. From 2011-12, the recycling survey will include an option for reprocessors to report data in volumes. A standard set of conversion factors will be used to convert reported volumes to tonnes. This measure will reduce the potential for errors caused by the use of inconsistent density data.

Additionally, data flagging has been introduced into the data analysis procedure to assist the detection of data anomalies. Reported quantities of recycled materials will be compared to previously reported quantities and large differences between the sets of data will be flagged for further investigation.

The current and future reports will now reference population data from the *Western Australia Tomorrow, Population Reports* published by the Western Australia Planning Commission (WAPC). This data set closely reflects the Estimated Resident Population (ERP) (from ABS), which is the official estimate of Australia's population. The DEC has chosen the WAPC as the preferred data set over the ERP because it includes population projections for WA to 2026. Previous *Recycling Activity in Western Australia* reports have used ABS Census data which may have underestimated actual population.

1.4 RECYCLING BY MATERIAL

Reported recycling in WA reached a total of 2 042 270 tonnes in 2010-11.

Figure 1-1 shows total recycling for each material category for of the 2010–11 financial year.

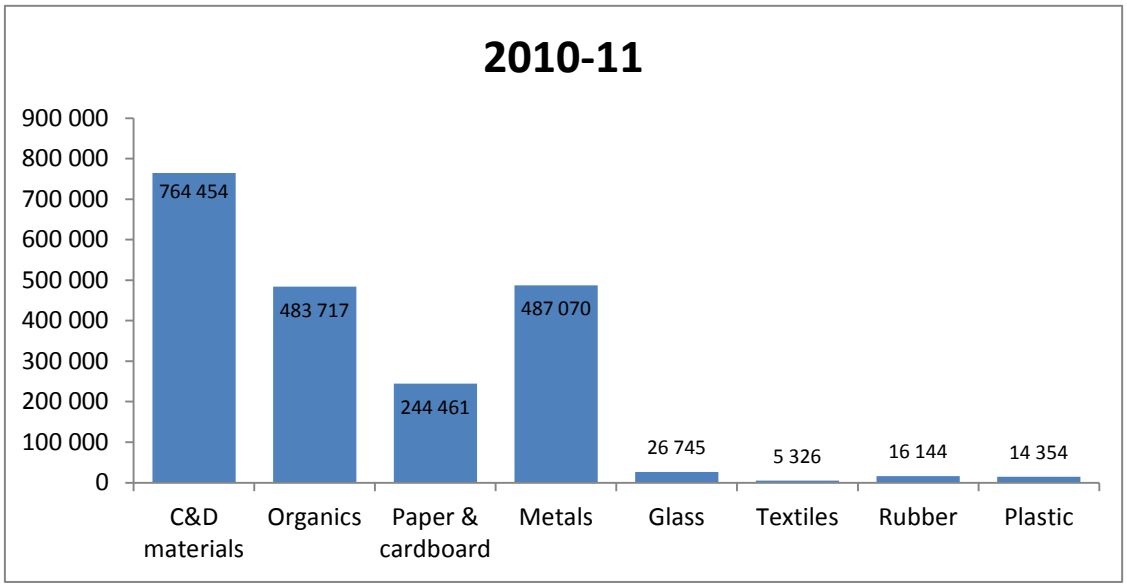

Figure 1-1 Total recycling by material category, WA 2010-11

Figure 1-2 shows the top 18 material types reprocessed in WA by material type. The quantity of steel (non-packaging) reprocessed during 2010–11 was by far the most significant of all material types, followed by concrete and sand, soil, clean fill and rubble.

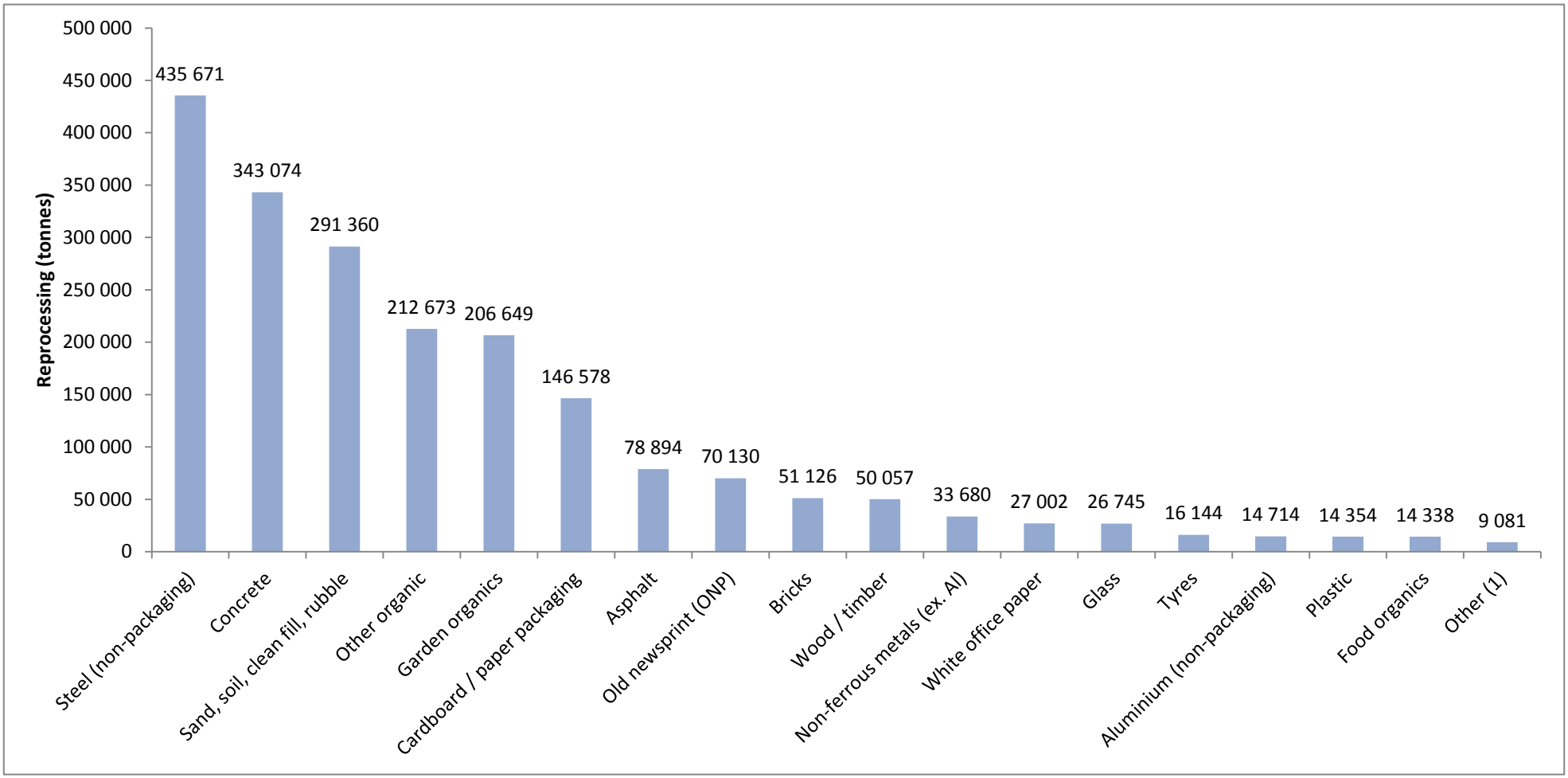

Figure 1-2 Recycling by material (by weight), WA 2010–11

1. Includes aluminium packaging, textiles, steel packaging and liquid paperboard.

1.5 RECYCLING BY SECTOR

The C&D sector made up the highest proportion of recycling activity during 2010-11, accounting for over half the material recovered for recycling in WA (Table 1-1).

Table 1-1 Sector origins of WA sourced reprocessed materials, WA 2010–11

Sector source	Quantity	
	(tonnes)	(%)
Municipal	561 156	27%
C&I	431 180	21%
C&D	1 049 934	51%
Total	**2 042 270**	**100%**

The breakdown of material types sourced from each sector—municipal, C&I and C&D—are presented in the figures below.

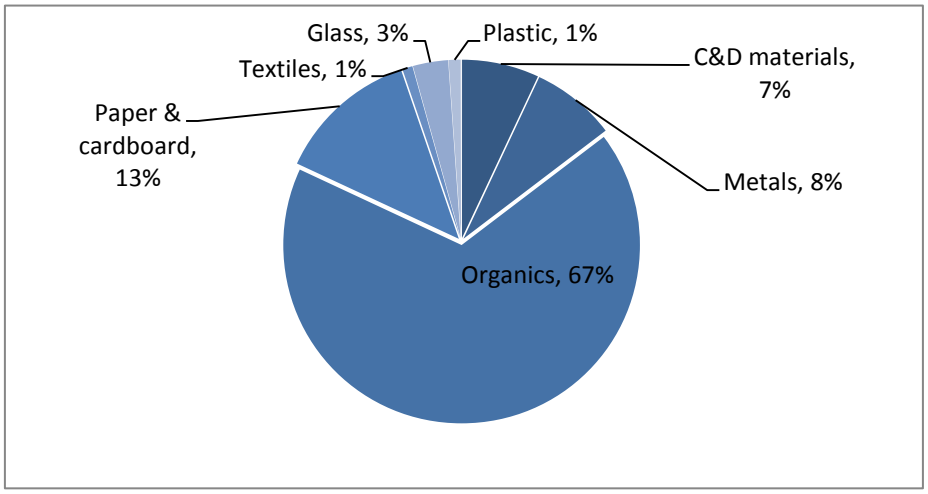

Figure 1-3 Municipal recycling composition, WA 2010–11

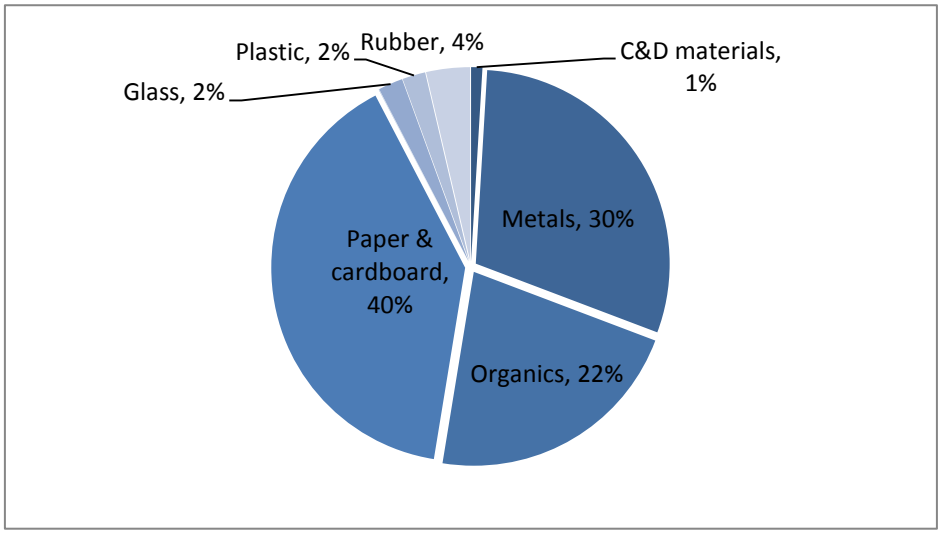

Figure 1-4 C&I recycling composition, WA 2010–11

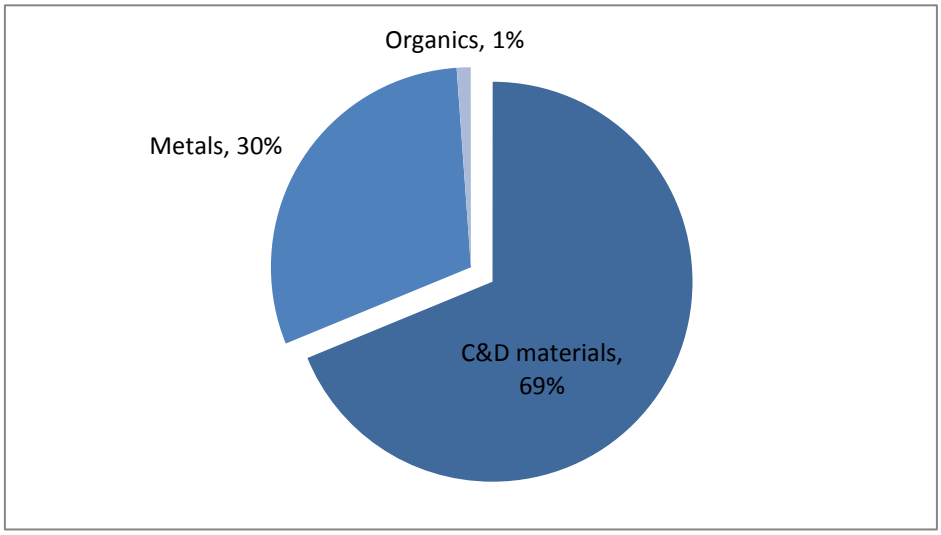

Figure 1-5 C&D recycling composition, WA 2010–11

1.6 RECYCLING BY GEOGRAPHIC SOURCE

Of the materials presented for recycling in WA, 87% came from the metropolitan area and 13% from non-metropolitan areas (Table 1-2). As the C&D sector makes up a large amount of materials recycled, a correspondingly large proportion of recycling is from the metropolitan area. The ratio of metropolitan and non-metropolitan sourced material does differ for particular materials.

Table 1-2 Geographic source of WA sourced reprocessed materials, WA 2010–11

Material type	Metropolitan (%)	Non-metropolitan (%)
C&D materials	95%	5%
Organics	85%	15%
Paper & cardboard	83%	17%
Metals	67%	33%
Glass	99%	1%
Textiles	100%	0%
Rubber	93%	7%
Plastic	75%	25%
OVERALL	**87%**	**13%**

The destination of recyclables also varies by material. All C&D materials and most organics are reprocessed locally and comprise a significant proportion of recycling, 37% and 24% respectively. As a result, 62% of material recycled in WA was reprocessed within the state, with most of the remainder going to export. Interstate transfer was a small component (Table 1-3).

There may be potential opportunities to increase the ratio of local recycling for materials such as glass, plastics, rubber and C&D materials. However, it is noted that this industry tends to be tightly constrained by market forces and the location of reprocessing activity can be strongly influenced by a range of factors such as commodity prices, international competition and the end-uses of the materials.

Table 1-3 Destination of WA sourced reprocessed materials, WA 2010–11

Destination	Number of destinations	Tonnes	%
Western Australia	70	1 274 145	62
Interstate	13	49 694	2
Export	Unknown	718 909	35
TOTAL	**83**	**2 042 748**	**100**

While not assessed in detail as part of this study, it is recognised that direct reuse of many products occurs on a significant scale without recycling. Where possible throughout this report, any reuse activity has been identified in general terms, but not quantified. Products regularly reused include cars, appliances, clothing, building materials and books.

1.7 WASTE GENERATION AND DIVERSION

Landfill data for the metropolitan area during 2010–11 was provided by WA Department of Environment and Conservation. Based on population data for metropolitan and non-metropolitan regions of WA, and assuming a similar waste generation rate for metropolitan and non-metropolitan regions, this data was extrapolated to estimate the total quantity of waste sent to landfill in WA. Data for both the metropolitan area and WA are provided in Table 1-4.

Total waste generation in the metropolitan area reached over 4 800 000 tonnes during 2010-11, and state-wide generation was over 6 500 000. The metropolitan diversion rate was 35.8%, while state-wide diversion was slightly lower at 31.3%.

Waste diversion is a measure of the proportion of material reaching end of life that is recycled rather than disposed. The diversion rate in WA lags well below that achieved in many other states. For instance, South Australia achieved a recovery rate of 79.9% during 2010-11, and has consistently achieved rates above 60% since their first survey year in 2003-04.

Table 1-4 Annual recycling and overall waste diversion

SUMMARY	2010–11	
	Metro	**WA**
Diversion from landfill (tonnes)	1 730 118	2 042 270
Waste to landfill (tonnes)[1]	3 106 689	4 491 170
Total waste generation (tonnes)	4 836 807	6 533 440
Diversion rate (%)	35.8%	31.3%
Population[2]	1 749 800	2 363 587
Per capita diversion (kg/person)	989	864
Per capita landfill (kg/person)	1 775	1 900
Per capita total waste (kg/person)	2 764	2 764

Notes:
1. Metropolitan landfill data provided by Department of Environment and Conservation, which includes tonnes of waste directly reported and estimated from survey and is the best available data at time of publication. WA landfill data has been extrapolated from metropolitan landfill data based on the assumption that waste generation rates for metropolitan and non-metropolitan regions will be similar, and back-calculated based on the ratio of metropolitan to non-metropolitan WA population.
2. 2010–11 population data is derived from the Western Australian Planning Commission publication *Western Australia Tomorrow, Population Report No. 7, 2006 to 2026* (Planning Western Australia, 2012)), as published in the Western Australia Local Government Waste and Recycling Census 2010-11 report (WA DEC, 2012).

2 RECYCLING INDUSTRY IN WESTERN AUSTRALIA

2.1 EMPLOYMENT IN THE RECYCLING SECTOR

Reprocessors were asked to provide the number of full-time equivalent (FTE) employees engaged in recycling activities within their company during the 2010-11 financial year. Approximately 93% of reprocessors surveyed by Hyder responded to this question, reporting 743 FTE employees engaged in recycling in WA. An additional 107 FTE employees were reported by interstate reprocessors of WA sourced material.

These figures do not however include those employees engaged in plastics or organics recycling, as this data is obtained from third parties who do not collect employment data. Furthermore, these figures represent employment associated with reprocessing activities only, and does not therefore include collection, sorting, and downstream use of reprocessed materials.

As reuse of products / materials is not a feature of this survey, the employment of people in activities such as clothing and e-waste resale and reuse, brick cleaning and building products reuse are not included. Hyder notes that the reuse sector is employment intensive and there may be a significant number of people working in this sector.

2.2 ESTIMATED ANNUAL TURNOVER

Reprocessors surveyed by Hyder were also asked to provide an estimate of their turnover associated with recycling activities during the 2010-11 financial year. As this is considered commercially sensitive information by many businesses, the response rate to this question was lower, at approximately 78%. Turnover reported by WA-based reprocessors totalled approximately $284,534,000 for 2010-11, with an additional $93,133,000 reported by interstate reprocessors of WA sourced material. Based on the overall recycling activity in WA, a pro rata calculation indicated an estimated turnover of over $524,100,000 in 2010-11.

As is the case for employment data, these figures do not include turnover for plastics or organics reprocessors, as data for these materials is obtained from third parties, which do not collect turnover data. Furthermore, these figures relate to turnover associated with the mechanical recycling process of sorted materials only, and do not therefore include turnover generated by the collection, materials sorting, downstream use of reprocessed materials, etc.

2.3 GATE FEES BY MATERIAL CATEGORY

Data was sought on the gate fees charged by reprocessors for accepting materials, or the payments made by reprocessors to purchase material for recycling. These fees vary widely depending on material type, geographic location, material quality and seasonal market volatility. For example, there are *more* than 10 material categories for aluminium and the market value of each may change daily.

The gate fees outlined in Table 2-1 represent a range of fees or payments and a more accurate typical (average) figure is provided where possible.

Table 2-1 Range of gate fees / payments by material type, WA 2010-11

Material category	Range of gate fees / payments	Average gate fee / payment
C&D materials	Reprocessors charge between $0 and $35 per m^3 for C&D materials.	Average gate fee for C&D materials is $13 per m^3
Organics	Source-separated materials are generally accepted by reprocessors at no cost.	
Metals	Reprocessors pay between $50 and $300 per tonne for steel and between $200 and $6000 per tonne for non-ferrous metals (including aluminium).	Average payment of $150 per tonne for steel. Average payment of $3100 per tonne for non-ferrous metals.
Paper & cardboard	Reprocessors pay between $0 and $230 per tonne.	Average payment of $70 per tonne.
Textiles	Materials are generally accepted by reprocessors at no cost, however one reprocessor reported paying 55 cents per kilo.	
Glass	Reprocessors pay between $25 to $45 per tonne.	Average payment of $40 per tonne.
Plastics	Data not available	
Rubber	Reprocessors charge between $70 and $180 per tonne.	Average gate fee of $140 per tonne.

3 SORTING FACILITIES DATA

Materials collected for recycling, especially those from the municipal and C&I sectors are often sent to material recycling facilities (MRFs) for sorting prior to recycling. Approximately 220,000 tonnes of the materials was reported in WA during 2010-11 as being processed at MRFs (Table 3-1). Sorting losses amounted to approximately 25%. Losses take two forms: recyclable materials that could not be sorted, and non-recyclable contaminants. The latter form is the most significant source of MRF losses.

Table 3-1 Material processed & recycling losses from material recycling facilities, WA 2010-11

	Tonnes	%
Material recovered (tonnes)	164,277	75
Recycling losses (recyclable)	20,656	9
Recycling losses (non-recyclable)	34,112	16
Total losses	**54,768**	**25**

4 CONSTRUCTION AND DEMOLITION MATERIALS

4.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The C&D material recycling data presented in this report has been provided by reprocessors. It includes asphalt, bricks, concrete, sand, soil, clean fill and rubble. Note: this material category does not include fly ash.

Over 760 000 tonnes of C&D materials were recycled during 2010-11. The quantity of each C&D material type is presented in Table 4-1 and Figure 4-1.

Table 4-1 C&D materials recycling, WA 2010-11

Material	Net recycling[1]	Recycling location		
	(tonnes)	WA	Interstate	Export
Asphalt	78 894	78 894	0	0
Bricks	51 126	51 126	0	0
Concrete	343 074	343 074	0	0
Sand, soil, clean fill & rubble[2]	291 360	291 360	0	0
TOTAL	**764,454**	**764,454**	**0**	**0**

1. Net recycling excludes recycling losses.

2. The 'sand, soil, clean fill & rubble' material type only relates to material that has been diverted from landfill.

There is ongoing debate about whether the use of sand and soils for land reclamation constitutes recycling. A view has also been expressed that material deposited in a separate cell of a landfill could be classified as recycling. For the purposes of this survey, neither of these activities was accepted within the definition of recycling.

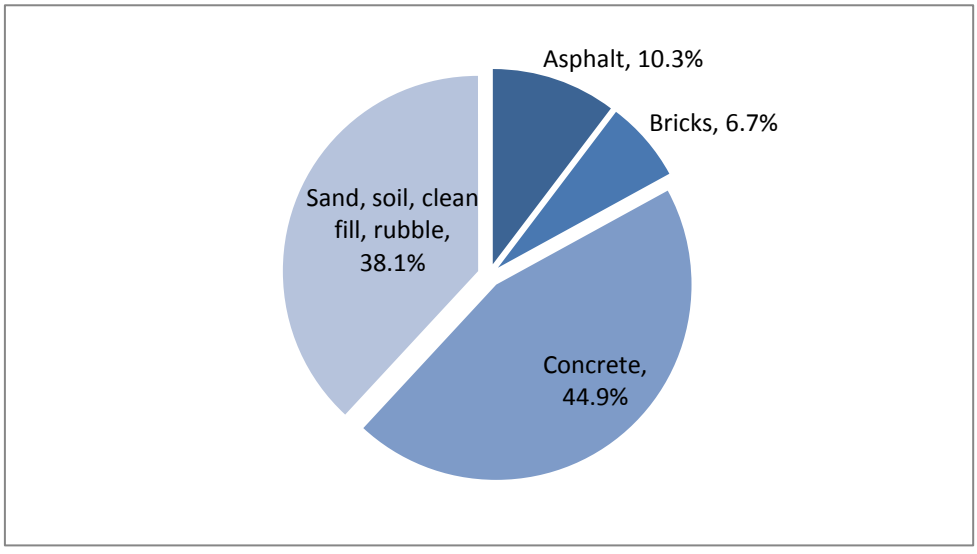

Figure 4-1 Composition of recycled C&D materials (by weight), WA 2010–11

With the exception of a relatively small amount of materials generated by the C&I and municipal sectors, most C&D materials (approximately 94%) were derived from the C&D sector (Table 4-2 and Figure 4-2).

Table 4-2 C&D material recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Asphalt	196	0	78 698	78 894
Bricks	1 764	0	49 362	51 126
Concrete	21 560	0	321 514	343 074
Sand, soil, clean fill & rubble	15 680	4 000	271 680	291 360
TOTAL	**39,200**	**4,000**	**721,254**	**764,454**

As seen in previous years, most C&D material recycled during 2010–11 (over 95%) was sourced from the metropolitan area (Table 4-3).

Table 4-9812 C&D material recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Asphalt	74 806	4 088	78 894
Bricks	51 126	0	51 126
Concrete	317 175	25 899	343 074
Sand, soil, clean fill & rubble	286 612	4 748	291 360
TOTAL	**729,719**	**34,735**	**764,454**

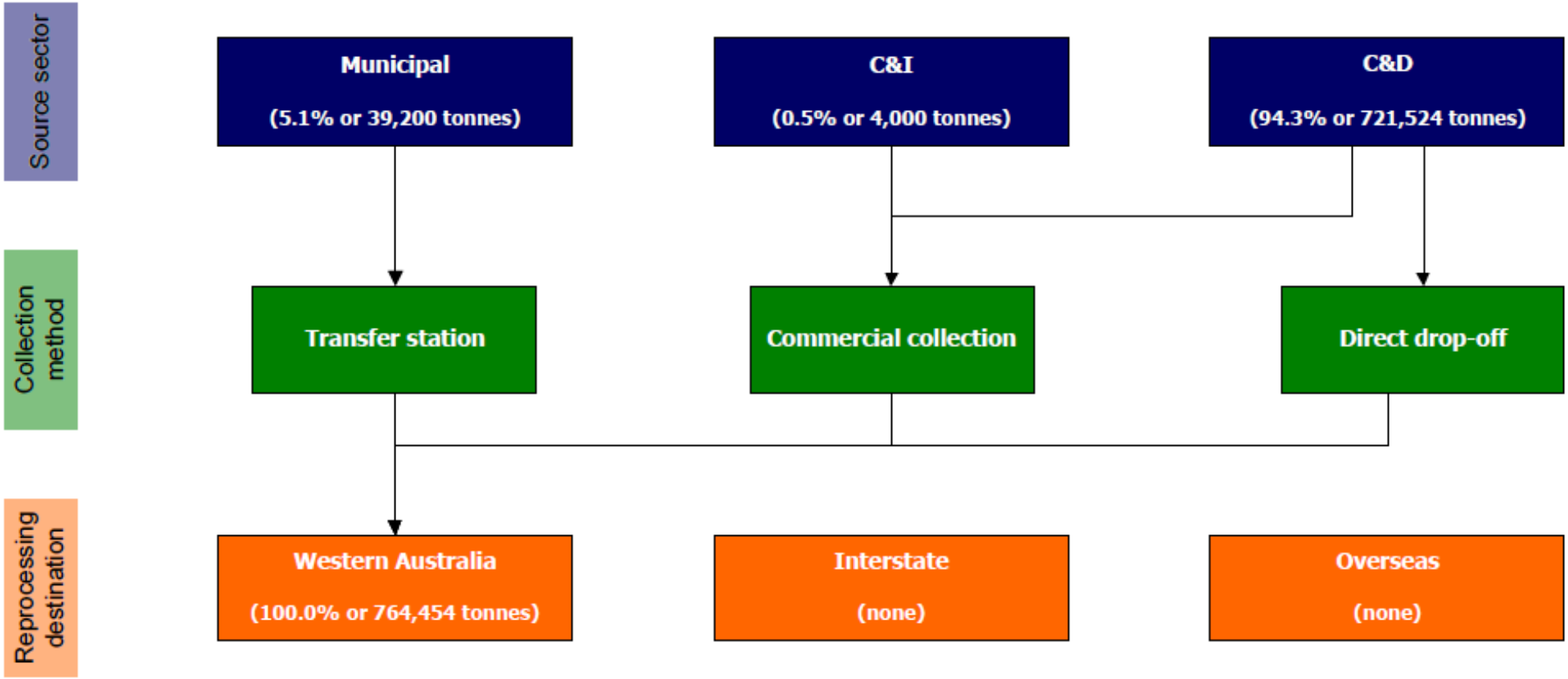

Figure 4-2 Flow of C&D material recycling, WA 2010–11

4.2 BARRIERS

The following were identified by the C&D recycling industry as some of the barriers to increasing recycling rates:

- the relatively low cost of landfilling and low rate of the landfill levy
- reprocessing / transport costs
- continued market resistance to reprocessed materials
- the reluctance of demolition contractors and builders to send materials for recycling
- planning constraints, restrictions on new operations and expansion of existing operations
- competition with unlicensed reprocessors

4.3 MARKET SIZE AND STRENGTH

The relatively low landfill levy continues to be cited as the major barrier to increased recycling in the C&D industry. Operators feel that a higher levy, based on tonnage rather than volume, is necessary to create a real economic driver for C&D recycling.

A major challenge for reprocessors is still the ability to get material redirected from landfill for recycling. Although many C&D recycling facilities are more conveniently located than landfills, demolition contractors and builders continue to prefer landfilling over recycling. Reprocessors report that the issue is no longer a lack of awareness, rather resistance to change and scepticism that recycling C&D waste is an economical alternative to landfilling.

During 2010-11, two major operators ceased recycling operations due to planning issues and an inability to compete in the industry. Additionally, several operators report that recycling activities are not currently economically viable and that their business is only able to survive through other parts of their business providing a subsidy, for example demolition and haulage contracts.

However, demand for material is reportedly strong and growing, particularly on major projects, with one operator reportedly securing a contract for the first major highway in WA to be constructed using recycled road base. There is an opportunity for government to support markets for recovered materials, both in terms of increasing demand for recycled products in internal operations and publicly-funded projects, as well as assisting to educate the wider marketplace. It is noted that Main Roads Specification 501 (Main Roads Western Australia, 2011) has been recently amended, and now includes a recommendation for use of recycled concrete as a sub-base for asphalt pavements. This is expected to have a positive impact on the C&D recycling industry, however the development of policies mandating the use of recycled C&D products would be of even greater assistance to the industry.

There is continuing concern amongst reprocessors that C&D material being crushed in a manner that is not compliant with Main Roads Western Australia specifications could damage the reputation for recycled aggregate and under-cut the price of quality material. Industry standards should be developed, in consultation with the government regulator, to limit the market access for reprocessors producing poor quality products, and give users confidence in end products. Further to this, enforcement of licensing and regulation is a key issue in the industry.

5 ORGANICS

5.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The organics recycling data presented in this report has been provided by Compost Australia (CA). CA undertakes an annual Organics Industry Survey of organics reprocessors across WA, NSW, Victoria and SA. In addition, some wood / timber recycling data has been provided separately by the C&D industry.

Over 480 000 tonnes of organic material was collected for recycling in WA during 2010–11 (Table 5-1). Garden organics and other organics each made up over 40% of organics recycling during this period, followed by wood/timber, with approximately 3% made up of food organics (Figure 5-1).

Table 5-1 Organics recycling, WA 2010-11

Material	Net recycling	Recycling location		
	(tonnes)	WA	Interstate	Export
Food organics	14 338	14 338	0	0
Garden organics	206 649	206 649	0	0
Other organics	212 673	212 673	0	0
Wood / timber	50 057	44 083	5 973	0
TOTAL	**483 717**	**477 743**	**5 973**	**0**

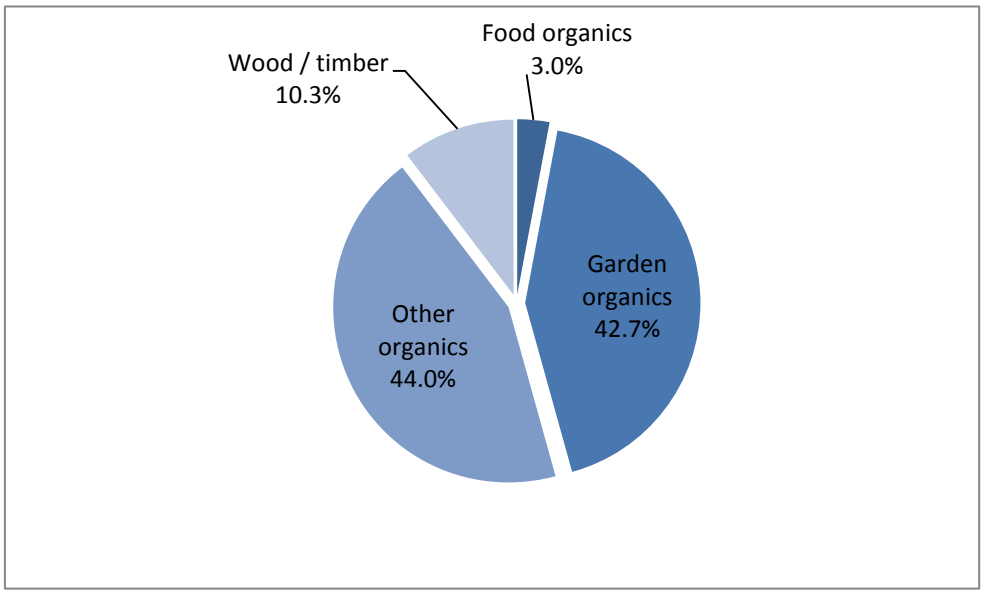

Figure 5-1 Composition of recycled organics (by weight), WA 2010-11

Garden organics are currently recovered through kerbside collection systems in a limited number of Perth municipalities, as well as through drop off sites at transfer stations and direct delivery to composting facilities. It should be noted that data for on-site organics processing, such as mobile shredding of material for direct use on parks and gardens, or direct spreading of

manures onto land, have not been included in this survey. Although these may be significant recycling activities, the collection of comprehensive data for all operators involved in on-site organics processing is not considered feasible and the reliability of any such data may be questionable.

Waste timber is generated in a number of forms. Structural timber is recovered from both residential and commercial demolition projects. Pallets, fencing and furniture are also sources of timber waste. In addition, timber off-cuts are generated from manufacturing processes and building construction sites.

The “other organics” category primarily consists of the organics fraction recovered from general municipal waste (87% by weight), which is primarily garden waste. A smaller quantity of other miscellaneous organics as well as oils, grease trap waste and sludges are also included in the "other organics” category. The breakdown of organics recycling by source sector and material type is presented in Table 5-3 and Figure 5-2.

In addition to the organic materials presented in Table 5-1, there are a number of other organics materials collected for recycling that were not included in the recycling rate for WA (Table 5-2). As these materials are related to primary industry and are not traditionally sent to landfill, their collection for recycling does not represent a diversion from landfill and they were therefore excluded from recycling calculations. This is consistent with the method adopted in other states and in previous WA studies.

Table 5-2 Additional organic materials collected for recycling, WA 2010-11

Material	(tonnes)
Forestry waste	158,826
Agricultural waste (excluding manures)[1]	37,463
Biosolids	33,721
Manures	32,523
TOTAL	**262,533**

[1] Includes straw, animal bedding, animal mortalities, paunch and other miscellaneous agricultural organics.

As source sector and geographic data is not collected by Compost Australia, the origins of recycled organics, as outlined below, have been estimated based on industry knowledge.

The majority of reprocessed organics consists of garden organics, approximately 80% of this material category is sourced from the municipal sector (Table 5-3).

Table 5-3 Organics recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Food organics	0	14 338	0	14 338
Garden organics	203 211	0	3 438	206 649
Other organics	165 898	46 775	0	212 673
Wood / timber	8 518	33 021	8 518	50 057
TOTAL	**377 627**	**94 134**	**11 956**	**483 717**

The majority of food organics and garden organics recovered for recycling were collected in the metropolitan region, due to greater access to appropriate recycling facilities (Table 5-4). Materials collected for recycling in the “other organics” category is also largely collected in the metropolitan region, as the largest component of this category is organic MSW material reprocessed at Perth’s various resource recycling facilities (RRFs).

Table 5-4 Organics recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Food organics	12 904	1 434	14 338
Garden organics	156 419	50 230	206 649
Other organics	199 916	12 757	212 673
Wood / timber	43 668	6 389	50 057
TOTAL	**412 908**	**70 809**	**483 717**

Figure 5-2 shows the flow of organics reprocessed in WA during 2010–11.

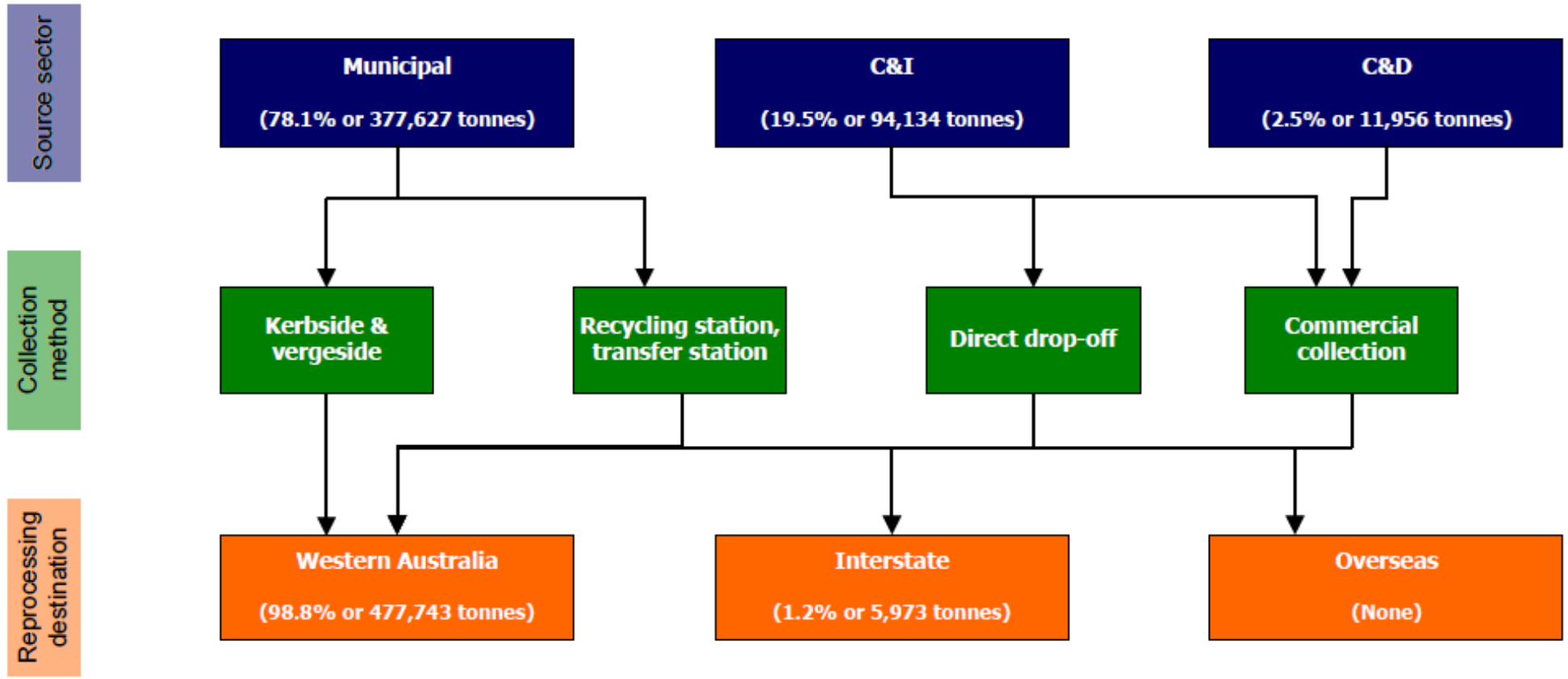

Figure 5-2 Flow of organics recycling, WA 2010–11

5.2 BARRIERS

The following were identified in the Compost Australia industry survey as the key barriers to increasing recycling rates:

- Reduction in land development is resulting in reduction in woody materials from land clearing
- Limited supply and increasing competition (and price competition) for clean garden organics and woody materials and increased price/ cost of acquisition
- Discontent and disruption amongst processors as traditional arrangements (and costs) associated with these materials are being challenged
- Limited availability of woody garden vegetation as a bulking agent. This has the effect of limiting capacity to process other organic waste materials
- Some product substitution and reformulation has been necessary for some processors because the usual bulking agents have been in limited supply

Compost Australia cites the impact of regulation, the licensing/planning challenges in establishing new facilities, and the absence of incentives, as issues of high concern amongst members of the industry. In particular, an ongoing tension was reported between the pursuit of resource recovery and the constraint of environmental regulations, with processors reporting operational obstructions to the achievement of resource recovery policy objectives.

Processors have also indicated that many councils are willing to use lower quality raw mulch rather than higher quality products, which is assumed to create difficulties in moving product.

6 METALS

6.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The quantity of metals recycled in WA totalled over 480,000 tonnes (Table 6-1). Steel (non-packaging) contributed approximately 90% of metal recycling during 2010-11. This material was recycled primarily through commercial collections, direct drop-offs and household recycling collections (Figure 6-2).

Table 6-1 Metals recycling, WA 2010-11

Material	Net recycling[1]	Recycling location		
	(tonnes)	WA	Interstate	Export
Aluminium (non-packaging)	14 714	46	0	14 668
Aluminium packaging	2 035	630	0	1 405
Non-ferrous metals (ex. Al)[2]	33 680	6 914	344	26 422
Steel (non-packaging)	435 671	4 810	0	430 861
Steel packaging	970	50	0	920
TOTAL	**487 070**	**12 449**	**344**	**474 276**

[1] Net recycling excludes recycling losses.

[2] Primarily lead and copper.

During 2010-11 only 2% of metals recovered for reprocessing in WA were reprocessed locally. The low instance of local reprocessing is due to the fact that no major metal reprocessor is located in WA and it is considered likely that any local reprocessing reported actually constitutes the sale of metals to local buyers, who ultimately export the material for recycling.

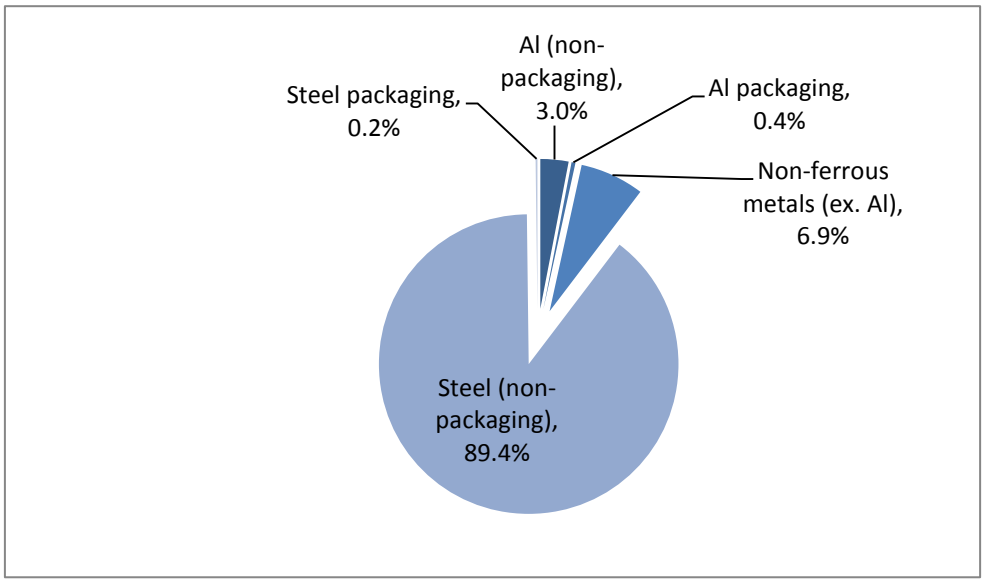

Figure 6-1 Composition of recycled metals (by weight), WA 2010–11

The majority of metals (over 64%) reprocessed in WA were sourced from the C&D sector, with 26% and 9% recycled from the C&I and municipal sectors respectively (Table 6-2).

Table 6-2 Metals recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Aluminium (non-packaging)	2 130	9 595	2 988	14 714
Aluminium packaging	311	1 083	641	2 035
Non-ferrous metals (ex. Al)	1 465	14 221	17 994	33 680
Steel (non-packaging)	38 832	103 142	293 697	435 671
Steel packaging	234	552	184	970
TOTAL	**42 972**	**128 593**	**315 504**	**487 070**

Approximately two thirds of metal recovered for recycling in WA during 2010–11 was sourced from the metropolitan area (Table 6-3 and Figure 6-2). This ratio was fairly consistent for all material types, with the exception of non-ferrous metals and aluminium packaging, of which 93% and 85% originated in metropolitan WA respectively.

Table 6-3 Metals recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Aluminium (non-packaging)	9 184	5 530	14 714
Aluminium packaging	1 725	311	2 035
Non-ferrous metals (ex. Al)	31 256	2 424	33 680
Steel (non-packaging)	283 170	152 501	435 671
Steel packaging	669	301	970
TOTAL	**326 004**	**16 1066**	**487 070**

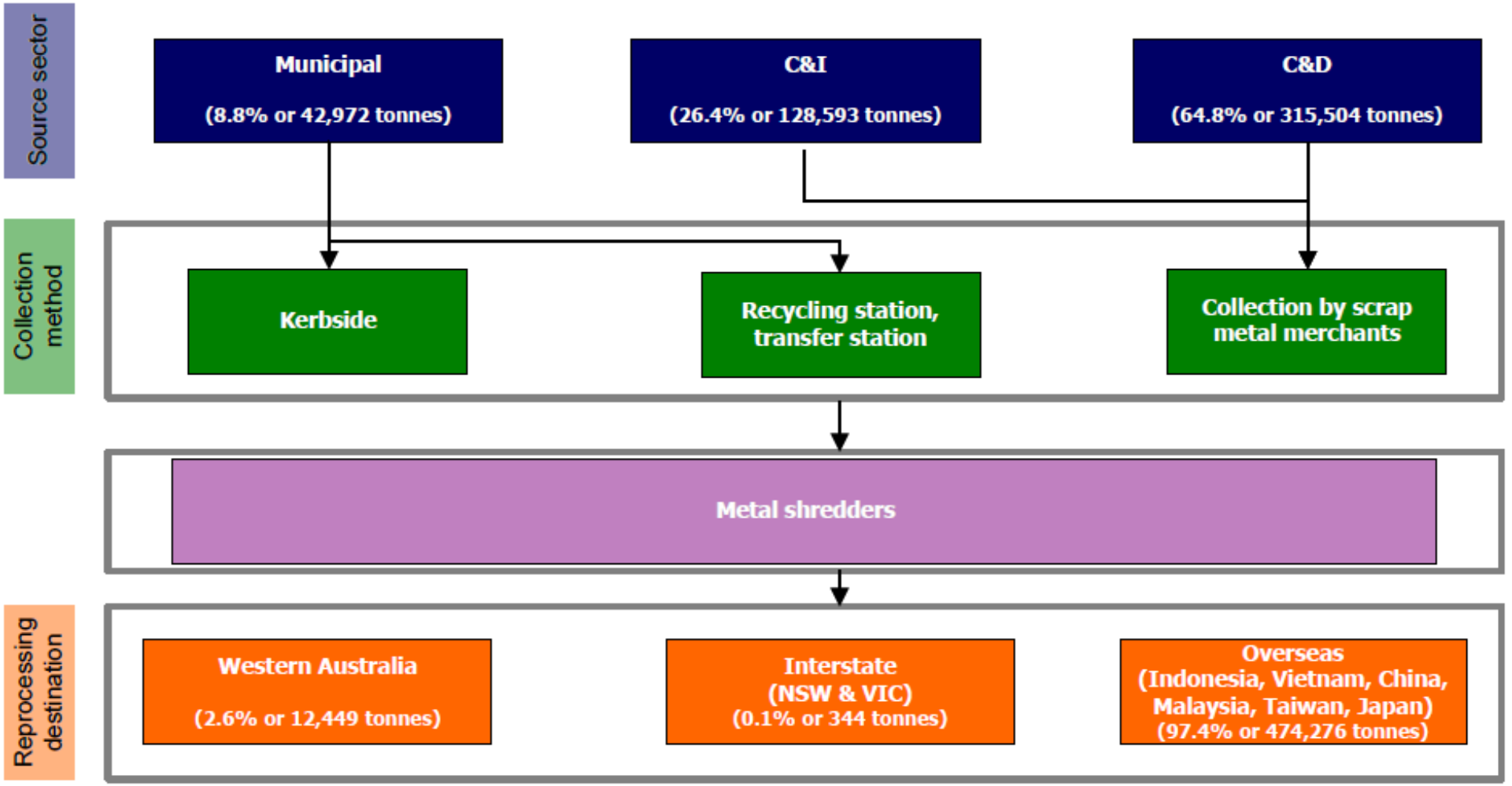

Figure 6-2 Flow of metal recycling, WA 2010–11

6.2 BARRIERS

The following were identified by the metal recycling industry as some of the barriers to increasing recycling rates:

- High cost of transport
- Difficulties in material separation, in particular achieving this cost effectively
- Strong value of the Australian dollar

6.3 MARKET SIZE AND STRENGTH

The market for metals is one in which sale prices are strongly linked to the London Metal Exchange. Reprocessors report that the strength of the international market for metals varies considerably, however is generally quite strong in South-East Asia, where access to scrap metal is limited.

7 PAPER AND CARDBOARD

7.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The paper and cardboard recycling data presented in this report has been collated from a range of industry sources, including industry groups and reprocessors.

In 2010-11, paper and cardboard recycling totalled approximately 244 000 tonnes (Table 7-1). A large proportion of this consisted of cardboard / paper packaging material, which amounted to 60% of paper and cardboard recycling.

Table 7-1 Paper & cardboard recycling, WA 2010-11

Material	Net recycling[1]	Recycling location		
	(tonnes)	WA	Interstate	Export
Cardboard / paper packaging	146 578	100	704	145 775
Liquid paperboard (LPB)	750	0	0	750
Old newsprint (ONP)	70 130	0	2 805	67 325
White office paper	27 002	0	17 581	9 421
TOTAL	**244 461**	**100**	**21 090**	**223 271**

[1]Net recycling excludes recycling losses.

Most of the paper and cardboard collected during 2010–11 was exported for recycling, with a relatively small proportion sent interstate.

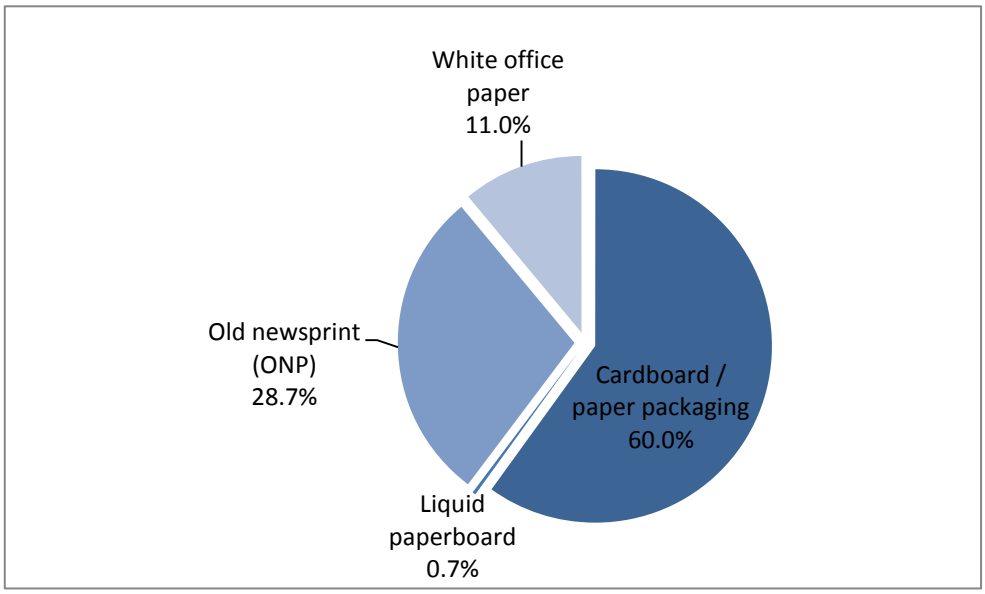

Figure 7-1 Composition of recycled paper & cardboard (by weight), WA 2010–11

The breakdown of paper and cardboard recycling by source sector and material type is presented in Table 7-2 and Figure 7-1. Most of the additional paper and cardboard recycled during 2010–11 was sourced from the C&I sector, with over 70% sourced from this sector in total.

Table 7-2 Paper & cardboard recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Cardboard / paper packaging	12 259	133 306	1 013	146 578
Liquid paperboard (LPB)	750	0	0	750
Old newsprint (ONP)	58 909	11 221	0	70 130
White office paper	0	27 002	0	27 002
TOTAL	**71 918**	**171 529**	**1 013**	**244 461**

More than 83% of paper and cardboard collected for recycling in WA during 2010–11 was sourced from the metropolitan area (Table 7-3).

Table 7-3 Paper & cardboard recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Cardboard / paper packaging	124 663	21 915	146 578
Liquid paperboard (LPB)	638	113	750
Old newsprint (ONP)	52 598	17 533	70 130
White office paper	25 933	1 069	27 002
TOTAL	**203 832**	**40 629**	**244 461**

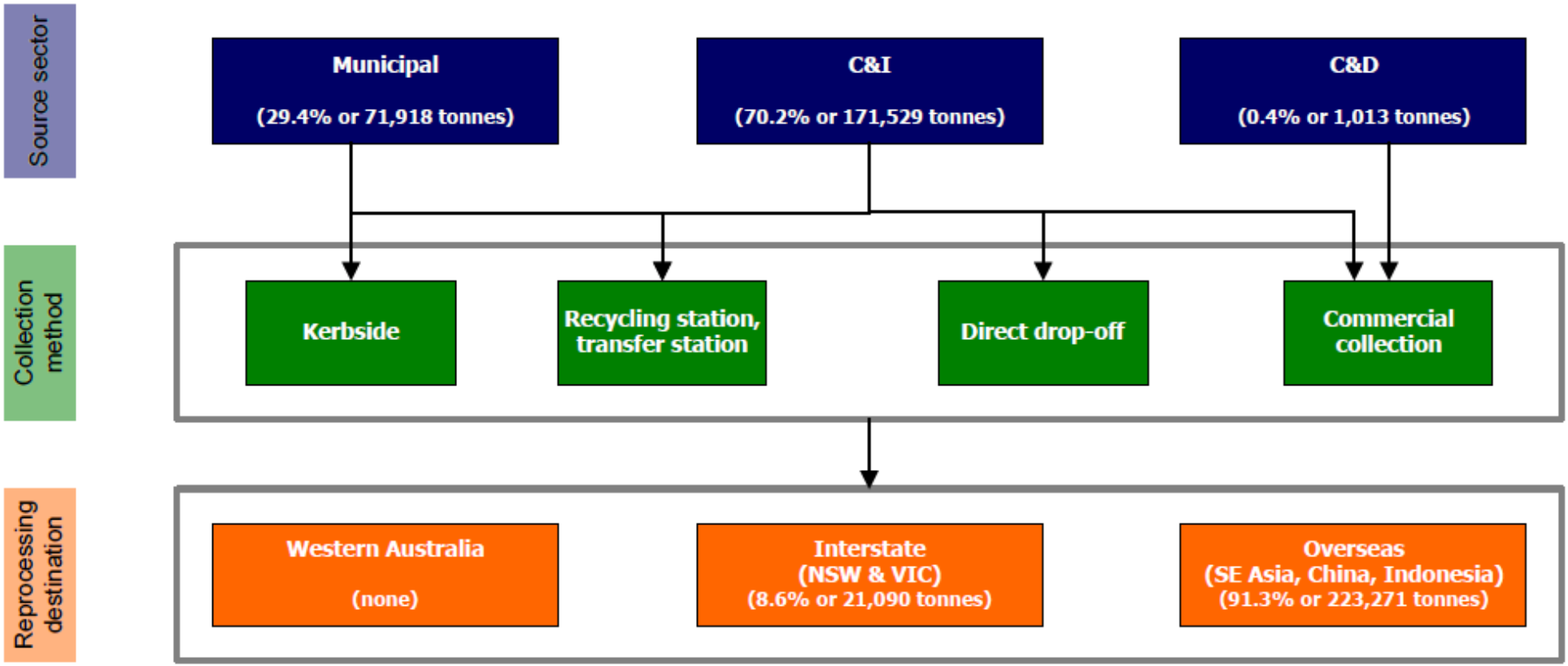

Figure 7-2 Flow of paper & cardboard recycling, WA 2010–11

7.2 BARRIERS

The following were identified by the paper and cardboard recycling industry as some of the barriers to increasing recycling rates:

- High transport costs, particularly in regional areas
- The Federal Government's insulation rebate scheme

7.3 MARKET SIZE AND STRENGTH

WA has no significant local market outlet for paper and cardboard, with most material going into interstate or export markets. In particular, the local insulation market has been strongly affected by the Federal Government's insulation rebate scheme: several reprocessors report that an influx of imported insulation has flooded the market.

The global market for all paper grades was strong during 2010–11. Most material is exported to Indonesia and China.

8 TEXTILES

8.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The reported quantity of textiles recycled in WA and the location of recycling, during 2010–11, is presented in Table 8-1.

Table 8-1 Textiles recycling, WA 2010-11

Material	Net recycling	Recycling location		
	(tonnes)	WA	Interstate	Export
Textiles	5 326	2 524	0	2 802
Net recycling excludes recycling losses.				

The breakdown of textiles recycling by source sector is presented in Table 8-2. Most textiles reprocessed were sourced from the municipal sector, as most material is sourced from donated clothing.

Table 8-2 Textiles recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Textiles	5 240	86	0	5 326

The majority of textiles recovered for recycling during 2010–11 were sourced from the metropolitan area (Table 8-3).

Table 8-3 Textiles recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Textiles	5 322	4	5 326

8.2 BARRIERS

The following were identified by the textiles recycling industry as some of the barriers to increasing recycling rates:

- low cost of imported rags outcompeting locally produced rags
- limited supply as charities find it more economical to export materials
- issues with collection systems, for example illegal dumping and restrictions on bin placement
- lack of staff / manpower
- cost of waste disposal of unusable materials

8.3 MARKET SIZE AND STRENGTH

Reprocessors tended to agree that the market has become more competitive during 2010-11, as the proportion of cheaper imported product has increased.

9 GLASS

9.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The quantity of glass recycled in WA and the location of recycling, during 2010–11, is presented in Table 9 -1. Total glass recycling reported in 2010–11 totalled 26 745 tonnes.

Table 9-1 Glass recycling, WA 2010-11

Material	Net recycling	Recycling location		
	(tonnes)	WA	Interstate	Export
Glass	26 745	6 040	19 921	784

The breakdown of glass recycling by source sector is presented in Table 9-2. Over 67% of glass collected for recycling in WA during 2010–11 was reported as being sourced from the municipal sector.

Table 9-2 Glass recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Glass	17 934	8 812	0	26 745

The geographic source of glass collected for recycling during the survey period is outlined in Table 9-3. Over 99% of glass collected was sourced from the metropolitan area.

Table 9-3 Glass recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Glass	26 503	242	26 745

9.2 BARRIERS

The following were identified by the glass recycling industry as some of the barriers to increasing recycling rates:

- quality of feedstock – contamination (ceramics)
- cost of transportation
- continued low cost of landfill

9.3 MARKET SIZE AND STRENGTH

Reprocessors report variable conditions in the market. The major market outlet for glass remains the beverage container manufacturing plants in South Australia, and one reprocessor indicated that this market had experienced a significant downturn over the past year, particularly in the wine industry, a major part of the end market.

As seen in previous years, only a small fraction of glass is exported, due to its relatively high weight and therefore freight cost.

10 PLASTICS

10.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The plastics recycling data presented in this report has been sourced from annual Plastics and Chemicals Industries Association (PACIA) surveys of plastics reprocessors.

The quantity of plastics recycled in WA and the location of recycling for 2010–11 is presented in Table 10-1. Total plastics recycling reported by PACIA was 14 354 tonnes during 2010–11.

Table 10-1 Plastics recycling, WA 2010-11

Material	Net recycling[1]	Recycling location		
	(tonnes)	WA	Interstate	Export
ABS / SAN	216	216	0	0
EPS	84	84	0	0
HDPE	6 056	4 361	0	1 696
L/LDPE	1 968	1 358	0	610
Nylon	6	6	0	0
PET	1 808	90	0	1 717
PP	1 904	1 218	0	685
PS	374	202	0	172
PU	931	931	0	0
PVC	288	202	0	86
Other plastic	718	718	0	0
TOTAL	**14 354**	**9 387**	**0**	**4 967**

[1] Net recycling excludes recycling losses.

HDPE was the largest contributor to plastics recycling during 2010-11 at over 42% of total plastics recycling (Figure 10-1).

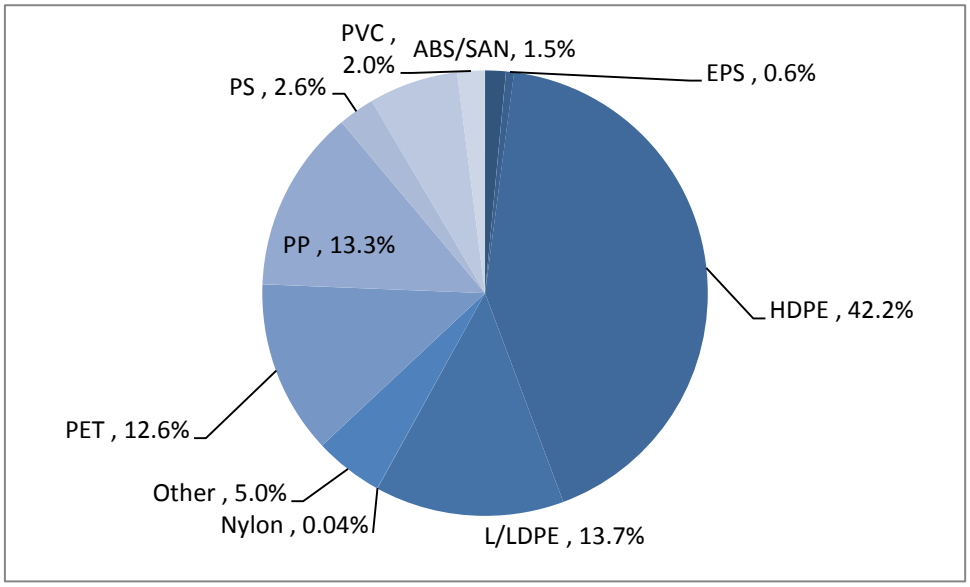

Figure 10-1 Composition of recycled plastics materials (by weight), WA 2010–11

PACIA reported approximately 58% of plastics reprocessed during 2010–11 as sourced from the C&I sector, with the remainder (42%) from municipal sources. A more detailed breakdown of plastics recycling by source sector and material type is provided in Table 10-2.

Table 10-2 Estimated plastics recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
ABS / SAN	56	160	0	216
EPS	33	50	0	84
HDPE	2 725	3 331	0	6 056
L/LDPE	709	1 260	0	1 968
Nylon	0	6	0	6
Other plastic	36	682	0	718
PET	1 537	271	0	1 808
PP	704	1 199	0	1 904
PS	202	172	0	374
PU	0	931	0	931
PVC	78	210	0	288
TOTAL	**6 081**	**8 273**	**0**	**14 354**

Geographic source data was not available for recycled plastics as this data is not collected as part of the PACIA survey, an estimated split was derived based on the relative population of metropolitan and non-metropolitan areas (Table 10-3 and Figure 10-4).

Table 10-3 Estimated plastics recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
ABS / SAN	162	54	216
EPS	63	21	84
HDPE	4 542	1 514	6 056
L/LDPE	1 476	492	1 968
Nylon	5	2	6
Other plastic	538	179	718
PET	1 356	452	1 808
PP	1 428	476	1 904
PS	281	94	374
PU	698	233	931
PVC	216	72	288
TOTAL	**10 765**	**3 588**	**14 354**

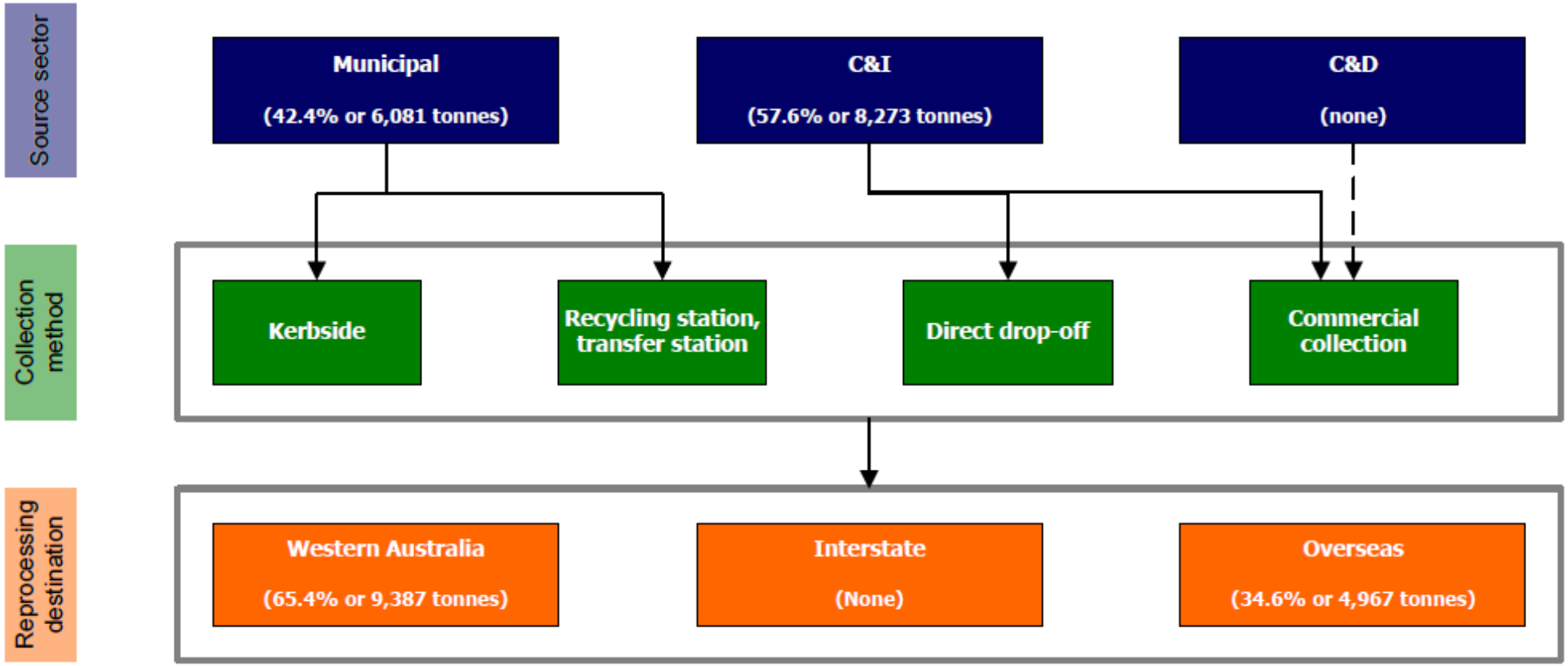

Figure 10-2 Flow of plastics recycling, WA 2010–11

10.2 BARRIERS

PACIA identified the following as some of the barriers to increasing plastic recycling rates within Australia (it is noted that information specific to WA was not available):

- A number of reprocessors reported experiencing tough competition from exporters for local material, and as the Australian dollar strengthens, competition from the imported recyclate is also growing. This import is driving down the local price for recyclate.
- Reprocessors report that they are losing business to overseas manufacturers, as imported finished goods made from recyclate are growing their market share. It was suggested that this may be causing surplus material in the marketplace, again putting some downward pressure on recyclate prices.

10.3 MARKET SIZE AND STRENGTH

PACIA reported the following summary of feedback with respect to Australian market conditions for the sale of plastic recyclate (it is noted that information specific to WA was not available):

- As in previous years a significant proportion of reprocessors reported difficult market conditions.
- Reprocessors reported mostly continuing high demand for clean good quality recyclate.
- A shift into the export market has been noted by a number of reprocessors, which offers higher prices.
- Across most polymers there was a squeeze between scrap purchase prices and sale price for recyclate. This issue has increased over the last few years.

11 RUBBER

11.1 QUANTITY RECYCLED AND RECYCLING LOCATION

The quantity of rubber recycled in WA and the location of recycling, during 2010–11, is presented in Table 11-1. Total rubber recycling was 13 161 tonnes in 2010–11.

Table 11-1 Rubber recycling, WA 2010-11

Material	Net recycling[1]	Recycling location		
	(tonnes)	WA	Interstate	Export
Rubber	16 622	1 448	2 366	12 809

[1] Net recycling excludes recycling losses.

Rubber collected for recycling consists primarily of tyres from the C&I sector (Table 11-2).

Table 11-2 Rubber recycling (by source sector), WA 2010-11

Material	Municipal	C&I	C&D	Total
Rubber	185	15 752	207	16 144

An overview of the geographic source of rubber collected for recycling is given in Table 11-3. Approximately 93% of rubber recycling was sourced from the metropolitan area, which also reflects the fact that most tyres are recycled through tyre retailers. Only very small amounts of off-road industry tyres are recovered for recycling due to size and distance to market.

Table 11-3 Rubber recycling (by geographic area), WA 2010-11

Material	Metro	Non-metro	Total
Rubber	15 065	1 079	16 144

11.2 BARRIERS

The key barrier to increased local recycling reported by reprocessors was the growing export of whole baled tyres. Whereas previously there was little competition for the supply of tyres, tyre recyclers now report having to compete with balers for access to tyres from retailers. Furthermore, reprocessors report that the increased export of whole baled tyres is resulting in reduced gate fees, impacting the cost of recycled end product.

11.3 MARKET SIZE AND STRENGTH

Reprocessors report that the domestic market for tyre derived product (TDP), including granules and powders, is fairly stable and minimal market growth is expected in the near future. However, the export market for baled and chip tyres continues to grow. In light of this trend, many recyclers themselves have increased exports of baled tyres. A major export destination for tyres is Vietnam, with reprocessors reporting significant exports to this destination.

Industry experts report that whole baled tyres exported to Vietnam from Australia have an end market in China. Anecdotal evidence suggests that whole baled tyres unloaded in Vietnam are transported by river and overland into China.

Once in China, whole baled tyres are used as an energy source, either directly in cement kilns or power plants. Some tyres are also reported to be undergoing pyrolysis in China to manufacture liquid fuel for use in ceramic kilns.

Reprocessors report that significant gains could be made in local recycling quantities, and the industry would benefit from government support to stem the flow of baled tyres currently being exported to Vietnam.

GLOSSARY

Acrylonitrile-Butadiene-Styrene (ABS)	A thermoplastic commonly used in engineered plastics applications such as mechanical parts. Is a common co-polymer of SAN.
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 (C&D) materials	Materials generally generated by construction and demolition activities and therefore commonly arise from the C&D sector. This group of materials consists of bricks, concrete, asphalt and sand, soil clean fill and rubble for the purposes of this report.
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.
Expanded polystyrene (EPS)	Made of pre-expanded polystyrene beads. Commonly used to form moulded sheets for building insulation and as a packing material.
Garden organics	Organics derived from garden sources e.g. grass clippings, tree prunings.
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.
Kerbside collection	Collection of household recyclable materials (separated or co-mingled) that are left at the kerbside for collection by local council collection services.
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.
Linear low density polyethylene (LLDPE)	A member of the polyolefin family of plastics. It is a strong and flexible plastic and usually used in film for packaging, bags and for industrial products such as pressure pipe.
Municipal waste	Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. 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.
Nylon	A flexible polymer typically used in fabrics and rope.
Packaging	Plastic material used for the containment, protection, marketing or handling of product.
PACIA	Plastics and Chemicals Industries Association
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 packaging, carpet fibres and housewares.

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.
Polyurethane (PU)	A flexible, rigid plastic that can be used in a range of applications including flexible and rigid foams as well as in coatings, adhesives, sealants and elastomers used on floors and automotive interiors.
Polyvinyl chloride (PVC)	A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.
Post-consumer material	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.
Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for recycling 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). Examples of this include paper mill 'broke' and plastics 'regrind'.
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.
Recyclate	Material able to be processed for recycling in a facility. Sometimes only to refer to materials actually recovered from recycling, excluding residual wastes.
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, recycling and manufacture into new products. It also covers the processing of by-products from manufacturing processes which may otherwise be disposed to landfill, for example bark from plantation timber (for compost), and meat waste from abattoirs (for fertiliser). Materials recovered from both pre-consumer (manufacturing losses) and post-consumer (product end-of-life) sources are defined as being able to be diverted from landfill for recycling. However, 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.
Reuse	Reuse involves recovering value from a discarded resource in its original state without recycling or remanufacture.
Styrene Acrylonitrile resin (SAN)	A copolymer plastic consisting of styrene and acrylonitrile. It is widely used in place of polystyrene owing to its greater thermal resistance. SAN is a common co-polymer of ABS.
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.
Tyre derived product (TDP)	Crumbed, granulated or powdered material, or steel, created during the recycling of end-of-life tyres.

References

Australian Bureau of Statistics (2011), Export data 2010-11 financial year.

Cardno (2008), *Review of total recycling activity in Western Australia 2006-07,* prepared on behalf of Department of Environment and Conservation, Perth 2008.

Department of Environment and Conservation WA (2012), *2010-11 metropolitan landfill quantities data.*

Department of Environment and Resource Management (2009), *The state of waste and recycling in Queensland 2008, technical report,* December 2009.

Department of Environment, Climate Change and Water NSW (DECCW) (2011), *Waste Avoidance and Resource Recovery Strategy Progress Report 2010*, February 2011.

Department of Territory and Municipal Services ACT (2012), *Rubbish and Recycling Statistics* (http://www.tams.act.gov.au/live/recycling-waste/about_ACT_NOWaste/progress_and_charts), Canberra, viewed January 2012.

Department of Territory and Municipal Services, *2008 Progress update towards No Waste*, Canberra.

Encycle Consulting (2010), *Impact of the landfill levy increase upon material received at construction and demolition facilities in Perth,* prepared on behalf of All Earth Group, Perth 2010.

Hyder Consulting (2010), *Recycling activity in Western Australia 2007-08 & 2008-09,* prepared for Department of Environment and Conservation on behalf of the Waste Authority, September 2010.

Hyder Consulting (2011), *Recycling activity in Western Australia 2009-10,* prepared for Department of Environment and Conservation on behalf of the Waste Authority, May 2011.

Hyder Consulting (2012), *Study into domestic and international fate of end-of-life tyres,* prepared for the COAG Standing Council on Environment and Water, May 2012.

Main Roads Western Australia (2011) *Pavements, Document 04/10110-04 Issue 01/12/2011,* Dec 2011.

Rawtec (2011), *SA Recycling Activity Report, 2009-10.* Prepared for Zero Waste South Australia, June 2011.

Rawtec (2012), *SA Recycling Activity Report, 2010-11.* Prepared for Zero Waste South Australia, May 2012.

IndustryEdge Pty Ltd (2011), *Old Newsprint Recovery Figures for 2010*, Prepared for Publishers National Environment Bureau, July 2011.

Sustainable Resource Use Pty Ltd (2011), *PACIA 2011 National Plastics Recycling Survey (July 2010 to June 2011 survey period),* prepared for Plastics and Chemicals Industries Association, 13 December 2010.

Publishers National Environment Bureau (2011), *ONP market report for Australia – 2011,* unpublished.

Recycled Organics Unit (2011), *Organics Recycling in Australia: Industry Statistics 2011*, unpublished.

Sustainability Victoria (2011), *Towards Zero Waste Strategy 2009-10 Progress Report*, Melbourne, Australia.

WA Department of Environment and Conservation (2012), *Western Australia Local Government Waste and Recycling Census 2010 – 2011,* February 2012.

Western Australia Planning Commission (WAPC) (2012) *Western Australia Tomorrow, Population Report No. 7, 2006 to 2026*, February 2012.

WA Waste Authority (2009), *Recycled concrete road base: transport subsidy for test pavement trial.* Prepared by Bowman & Associates Pty Ltd, August 2009.

APPENDIX A

REPROCESSOR SURVEY

Department of Environment and Conservation
Our environment, our future

Waste Authority

Hyder

Company:		
City & state of reprocessing site		
Contact name:		
Phone:		
Mobile:		
E-mail:		
Survey date:		

* Please fill out a separate form for each reprocessing site

REPROCESSING DETAILS

Material type	**MATERIAL 1**	**MATERIAL 2**	**MATERIAL 3**	**MATERIAL 4**	**MATERIAL 5**
Total tonnes reprocessed					
What is the estimated accuracy of the data? (± %)					
What were your reprocessing losses? (% or tonnes)					
What is the split of packaging vs. non-packaging material (if applicable)? (% or tonnes)					
What was the stockpile of the material at **1 July 2010**? (tonnes)					
What was the stockpile of the material at **30 June 2011**? (tonnes)					
Was the stockpiled material reprocessed or unreprocessed?					
What is the range of gate fees charged for this material? ($/tonne)					
What was the turnover of your reprocessing business activities for the 2010-11 financial year?					
How many employees at your company are directly involved in reprocessing activities? (full-time equivalent)					

MATERIAL SOURCES

Material type		**MATERIAL 1**	**MATERIAL 2**	**MATERIAL 3**	**MATERIAL 4**	**MATERIAL 5**
How much material reprocessed by your company came from the following sources? (tonnes or %) (i.e. did any of the material reported in Q1 originate outside of WA?)	Western Australia					
	Interstate Please identify state/s					
	Imported Please identify country/ies					
How much material reprocessed by your company came form metropolitan and non-metropolitan areas? (tonnes or %)	Metropolitan (i.e. Perth metro area)					
	Non-metropolitan (i.e. outsidethe Perth metro area)					
How much material reprocessed by your company came from the following sectors? (tonnes or %)	Municipal					
	Commercial and Industrial (C&I)					
	Construction and Demolition (C&D)					
If known, what are the source products?						
What is the split between pre & post consumer? (tonnes or %) (See definitions below)						

Pre-Consumer Material:
Recyclate from pre-consumer industrial sources, usually generated during product manufacturing (e.g. manufacturing scrap, manufacturing off-cuts).

Post-Consumer Material: Recyclate from post-consumer industrial and domestic sources, generated post-use from industrial and domestic applications.

MATERIAL DESTINATIONS

Material type		**MATERIAL 1**	**MATERIAL 2**	**MATERIAL 3**	**MATERIAL 4**	**MATERIAL 5**
What is the geographic destination of the reprocessed material? (tonnes or %)	Western Australia Please identify company/ies					
	Interstate Please identify state/s					
	Exported Please identify country/ies					
If known, what is the product destination of the reprocessed material? (i.e. what products are the reprocessed material manufactured into?)						
If known, what is the destination market sector of the reprocessed material (See definitions at top of the page)						

MARKET CONDITIONS

Material type	**MATERIAL 1**	**MATERIAL 2**	**MATERIAL 3**	**MATERIAL 4**	**MATERIAL 5**
What are the barriers or inhibitors to increased recycling in your opinion?					
Can you comment on the availability of source materials?					
Can you comment on the strength of the market into which you sell reprocessed products?					
Do you know of other reprocessors handling similar materials? Please name these companies.					