

Waste Management Board of Western Australia



Review of Total Recycling Activity in Western Australia



Final Report

28 February 2006

Report no: 2



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Executive Summary

The Waste Management Board of Western Australia (the Board) is an independent body that provides strategic advice to the Minister for the Environment on waste management issues in Western Australia. The Department of Environment (DoE) Waste Management Branch carries out services and activities on behalf of the Board.

As part of its Data Collection Program, the Department of Environment engaged Hyder Consulting Pty Ltd (formerly Nolan ITU Pty Ltd) to conduct a survey of recycling activity in Western Australia over the 2004-2005 financial year. The data sets a baseline on the current quantities of materials being recycled in Western Australia, a first for Western Australia.

The term 'recycling' covers a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. For this project, the focus of recycling is on the reprocessing of solid waste materials. Excluded from the definition of recycling are waste materials that are reclaimed and reutilised within the same processes that generated it (i.e. process scrap) and all forms of reuse.

Forty-two local recyclers were identified. Recycling estimates were obtained by undertaking site visits with the key reprocessing sites in the Perth metropolitan area, supported by telephone surveys of recycling companies. It is estimated that at least 95% coverage for all materials was achieved.

Data was sought for the 2004–05 financial year on the quantity (by weight), and source sector, of material and products (where possible) recovered from the Western Australian waste stream for recycling.

The study found that in the 2004–05 financial year a total of **972,610 tonnes** of material was recycled in Western Australia, with **566,780 tonnes (59%) reprocessed locally** in Western Australia (Figure ES-1).

The export of recyclables, principally metals, paper and plastics, is a key component of recycling activity in Western Australia. **Over 362,900 tonnes (37%) was exported** for reprocessing, largely to Asia. The limited reprocessing infrastructure in Western Australia and access to Asian export destinations are the main reasons for this.

Materials **sent interstate** for reprocessing accounted for the remaining **4% (42,930 tonnes)** of total recovery. Interstate destinations included:

- South Australia — glass and plastics
- New South Wales — metals and paper
- Victoria — metals, paper, plastics and rubber.

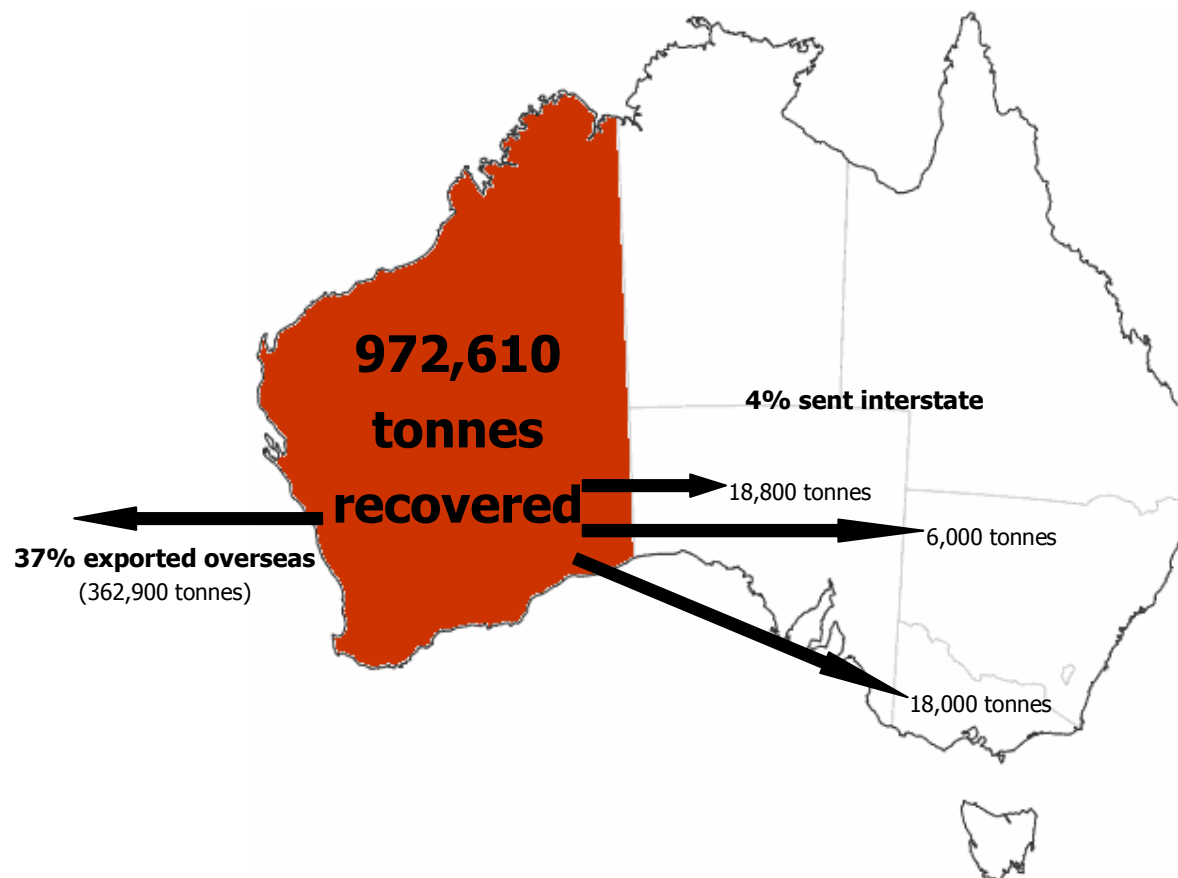


Figure ES-1 Recycling destinations of recovered materials, Western Australia 2004–05

Highlights from the survey include:

- Construction and demolition materials, such as concrete, sand, brick and rubble accounted for the highest amount of recycling by weight (333,870 tonnes or 35%). Metals, paper, food and garden organics were also recovered in large quantities, 276,500 tonnes (28%), 185,820 tonnes (19%), and 148,150 tonnes (15%) respectively.
- As a single item, steel (in a range of forms) accounted for the greatest amount of recycling by weight (tonnes). Other products recycled in large quantities were: food and garden organics; sand; concrete; brick and rubble; newsprint and magazines; and cardboard / paper packaging (Figure ES-2).

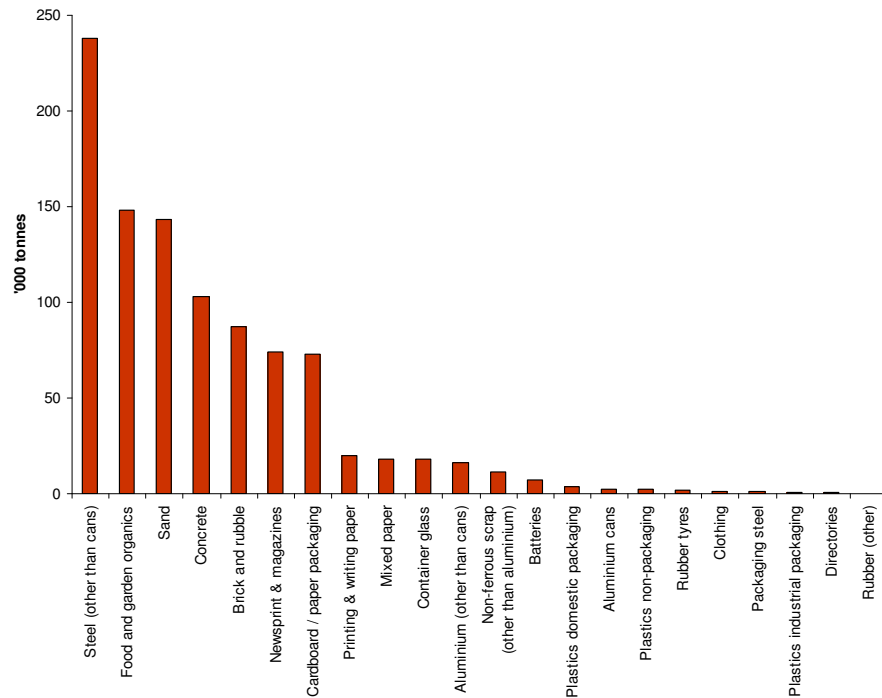


Figure ES-2 Total tonnes recycled by material or product (where possible), Western Australia 2004-05

- Nearly half (42%) of the materials recycled in 2004–05 were sourced from the **construction and demolition sector**. This included steel, non-ferrous metals, sand, concrete, brick and rubble.
- A further **33%** was sourced from the **commercial and industrial sector**, largely steel, cardboard / paper packaging, newsprint and magazines. These products are generally recovered in large quantity as a clean and homogenous stream, reflecting the recognised gains to business from recycling.
- The **municipal sector** accounted for the remaining **25%** of total recovery. Food and garden organics accounted for the greatest

amount of recycling by weight (tonnes) from the municipal sector. Other materials recycled in large quantities from this sector included steel, newsprint, magazines & directories, mixed paper and glass. With the exception of steel, these items are primarily recovered through household kerbside recycling collections.

Overall the level of recycling activity in Western Australia is strong with opportunities for potential growth in several areas.

There is a high export ratio for many materials. While reprocessing in Western Australia offers employment benefits, the likelihood is that export of metals, paper and plastics will continue to be a strong feature of the Western Australian market due to the geographic proximity to Asian destinations.

There remains a strong need for further infrastructure investment and market assistance. This is particularly the case for materials such as concrete, asphalt, timber, garden and food organics.

In the short term, major increases will come from the increased recycling of concrete, asphalt, sand, brick rubble, paper and timber.

Much recycling activity remains hidden from the Western Australian community. It will be important to highlight the achievement of community and industry in recycling by informing the general public of the current recycling activity and to use this to drive future increased activity. It will also be important to promote existing reprocessors, demonstrating the importance of the recycling industry to the Western Australian community.

It will be important to monitor future growth in recycling. It is recommended that recycling data be coupled with landfill data to establish overall waste generation in Western Australia. This will enable the Department of Environment to monitor and report against the achievement of the *Strategic Direction for Waste Management in Western Australia: Vision & Priorities*.

1 Introduction

1.1 Strategic context

The Waste Management Board of Western Australia (the Board) is an independent body that provides strategic advice to the Minister for the Environment on waste management issues in Western Australia. The Department of Environment (DoE) Waste Management Branch carries out services and activities on behalf of the Board.

In September 2004 the Board released the *Strategic Direction for Waste Management in Western Australia: Vision & Priorities*. This document articulates the framework for achieving the strategic vision for the Western Australian community, which is: Towards Zero Waste in Western Australia.

As part of the strategic framework for the management of waste products, the Board identified the need to measure performance in meeting the principles outlined in the Strategic Directions for Waste Management document.

The Department of Environment engaged Hyder Consulting Pty Ltd (formerly Nolan ITU Pty Ltd) to conduct a survey of reprocessing and recycling activity in Western Australia as part of its Data Collection Program.

The data sets a baseline on the current quantities of materials being recycled in Western Australia, a first for Western Australia. The provision of this data will help the Department of Environment: assess how well programs and initiatives are at effectively managing and reducing waste in Western Australia; allow considered, well-informed policy decisions to be taken; and communicate the achievement in the level of recycling to the community, government, and industry stakeholders.

As comparisons of performance become available over time, the data will play a vital role in evaluating Western Australia's success at moving towards Zero Waste.

1.2 Background

In October 2005 Hyder Consulting commenced the survey on the level of material recovery and reprocessing activity provided by the Western Australian recycling industry over the 2004–2005 financial year.

The term 'recycling' covers a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. The focus on data gathering in this survey was on the reprocessing stage of the material life cycle.

Reprocessing is defined as changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to add financial value to the processed material. Reprocessed materials

feature as a material input, in lieu of a new primary material, for a manufacturing process. Without reprocessing, the beneficial use of waste materials would be lost.

Whilst the definition of recycling for this project does include some pre consumer industrial scrap diverted from the waste stream during a manufacturing process, excluded are waste materials that are reclaimed and reutilised within the same 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'.

Also excluded from the definition of recycling for this project are all forms of reuse. Reuse involves recovering value from a discarded resource in its original state without reprocessing or remanufacture, such as garments sold through second hand or charity stores. The exclusion of reuse has not been made to underrate the importance of this activity in resource conservation but to avoid double counting of material data and provide parameters to this quantification of recycling.

For this project, the focus of recycling is on solid waste materials ranging from municipal garbage to industrial waste. Excluded from the definition of solid waste are gaseous, liquid, hazardous, clinical and intractable wastes.

Outside the scope of this study were glass and organic materials. A total recovery figure for glass, obtained from a separate exercise, has been included in this report. The recovery of organic materials from all source sectors, however, was not available at the time of finalising this report. This data are currently being looked at by a separate exercise that is expected to cover garden organics, timber and a range of food processing wastes. Data on food and garden organics recovered solely from kerbside and bulky green waste collections, and sent for composting, were available from the recovery rebate scheme. This tonnage has been incorporated into this report.

1.3 Methodology

A complete listing was developed of the reprocessing companies operating in Western Australia (i.e. local reprocessing operations), as well as recycling companies that source used materials from Western Australia for direct export overseas or reprocessing in another Australian state.

The task was to identify the total quantity (by weight) of material and products (where possible) recovered from the Western Australian waste stream for recycling during the 2004–05 financial year for the following:

Material	Product
Steel	Packaging steel
Aluminium	Aluminium cans
Non-ferrous	
Paper	Cardboard / paper packaging

Material	Product
	Newsprint & magazines
	Printing & writing paper
	Directories
	Concrete
	Sand
	Brick
	Rubble
Organics	Food and garden organics
Glass	Container glass
Rubber	Rubber tyres
Plastics	Domestic packaging
	Industrial packaging
	Non-packaging
Textiles	Clothing

Forty-two local recyclers were identified. Recycling estimates were obtained by undertaking site visits with the key reprocessing sites in the Perth metropolitan area, supported by telephone surveys of recycling companies. This ensured a high response level. Of the companies identified, thirty-seven provided data for the survey, representing an 88% response rate. As such the data from the remaining five reprocessing companies cannot be included, and the stated recovered tonnes will be slightly less than the actual value. It is estimated that at least 95% coverage for all materials was achieved.

The survey sought to identify for the 2004–05 financial year:

- Levels of local reprocessing
- Flows of recovered material interstate for reprocessing
- The quantity of recovered material exported for reprocessing
- Source sector from which recovered material was received for reprocessing – municipal, commercial & industrial, construction & demolition
- Recycling activity trends and barriers.

Data on the export of materials to reprocessing destinations overseas was sought from the Australian Customs Service (ACS) through the Australian Bureau of Statistics (ABS).

Where industry associations are active in collecting or aggregating data for a material or product, the results have been incorporated into this report to

avoid duplicating the data gathering exercise or used to substantiate the data collection methodology to ensure consistency.

For reporting purposes, data has been aggregated at the state level into totals for each material and product recovered. This ensures company specific information remains strictly confidential.

Data on recycling activity includes materials generated in Western Australia that are reprocessed locally, interstate and overseas. This provides a snapshot of the quantity, source, and destination of all materials recycled in Western Australia. It is noted that the export of recyclables in the categories of metals, paper and plastics is a key component of recycling activity in Western Australian.

2 Total Recycling Activity

2.1 Recovery in Western Australia

In 2004–05, Western Australian’s recycled approximately 972,610 tonnes of used materials, at an overall rate of 484 kg per person. Materials were recovered from across the municipal, commercial & industrial, and construction & demolition waste streams for conversion into new products - locally, interstate and overseas.

As shown below in Figure 2-3, construction and demolition materials, such as concrete, sand, brick and rubble accounted for the highest amount of recycling by weight (tonnes).

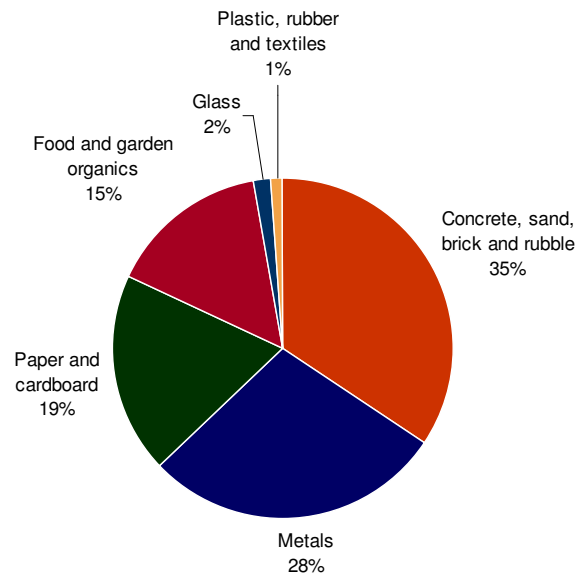


Figure 2-3 Composition of material recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

Figure 2-4 below shows the quantity of each individual material or product (where possible) within material groupings. As a single item, steel (in a range of forms) accounted for the greatest amount of recycling by weight (tonnes).

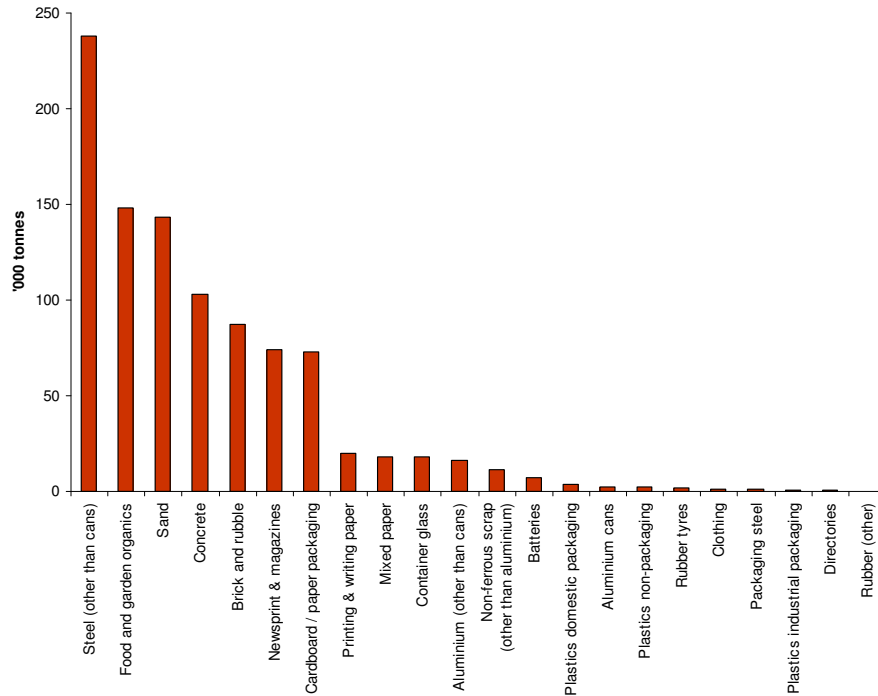


Figure 2-4 Total tonnes recycled by material or product (where possible), Western Australia 2004-05

2.2 Source sector of material

In Australia, solid waste is commonly divided into three main source sectors:

- municipal
- commercial and industrial
- construction and demolition

Some materials are recovered purely from one of these sectors while most are drawn from the waste stream across two or all of these sectors. For example, newsprint might be identified as coming 95% from municipal sources and 5% from commercial and industrial (e.g. offices, airports and retail).

In the survey, reprocessors were asked to identify the sources of the materials they received. This enabled an estimate of the source sector split to be established. As shown in Figure 3-3a, nearly half (42%) of the

materials recycled in 2004–05 were received from the construction and demolition sector. The proportion of recycled materials from each of the three sectors is summarised in Figure 3-3(b-d).

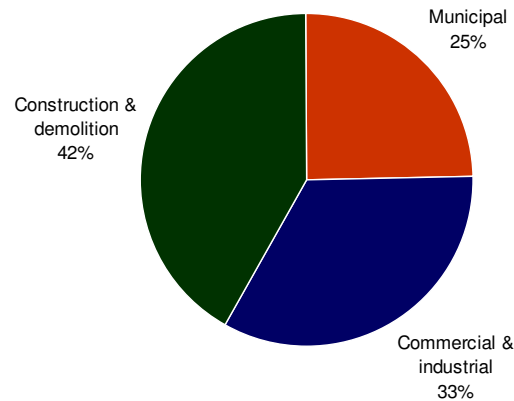


Figure 2-3a Source sector of material recovered by weight (tonnes for reprocessing, Western Australia 2004-05

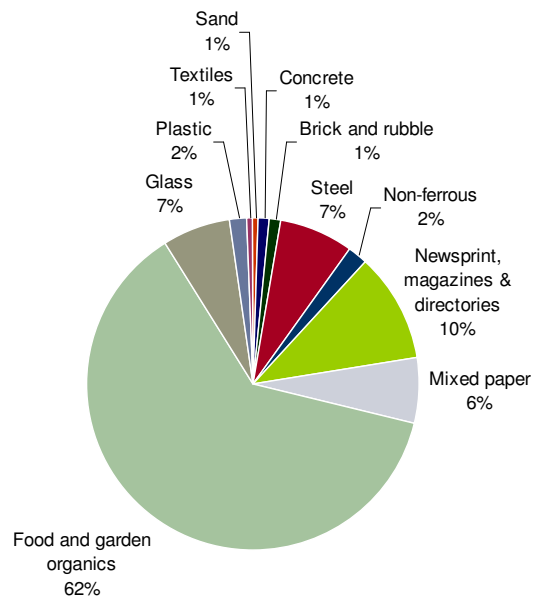


Figure 2-3b Composition of material recovered by weight (tonnes) for reprocessing from the municipal sector, Western Australia 2004-05

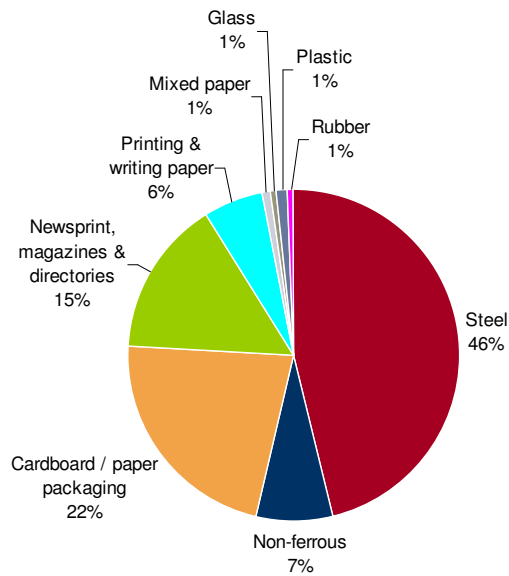


Figure 2-3c Composition of material recovered by weight (tonnes) for reprocessing from the commercial and industrial sector, Western Australia 2004-05

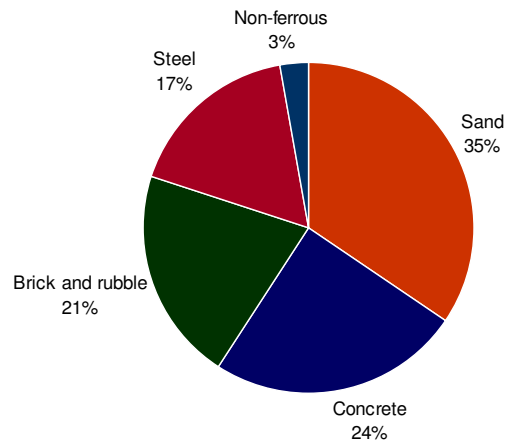


Figure 2-3d Composition of material recovered by weight (tonnes) for reprocessing from the construction and demolition sector, Western Australia 2004-05

2.3 Destination of recovered material

The survey results, coupled with data obtained from the ABS, provide information on the destination of recovered material (within state, interstate or overseas).

Of the material recovered and diverted from landfill in Western Australia during the 2004-05 financial year, over half (59%) was utilised by local reprocessing industries (Figure 2-5). These industries include:

- Foundries
- Crushing plants and auxiliary screening of construction and demolition materials
- Paper mill
- Insulation industry
- Rubber recycler
- Plastic converters
- Manufacturers of rags and felt-like materials

As shown in Figure 2-5, the export of used materials for reprocessing is a key component of the recovery of materials from the Western Australian waste stream. In 2004-05, 37% of used materials were exported, largely to Asia.

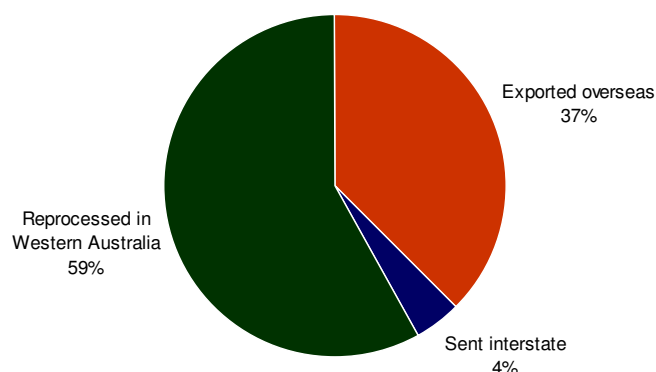


Figure 2-5 Destination of materials recovered by weight (tonnes) for reprocessing, Western Australia 2004-05

This large export component is dramatically higher than for other states in Australia. By comparison the percentage of recyclables sent interstate or overseas for reprocessing from Victoria in 2003–04 was just 9%. The lack of key reprocessing infrastructure in Western Australia is the primary reason for this. This is particularly the case for metals and glass. The access to Asian export destinations also favours the shipping of paper, metals and plastics to overseas destinations.

Nearly all (99.98%) of the materials exported were scrap metals, wastepaper and plastics. These materials are globally traded commodities used in recycling operations worldwide.

Table 2-1 shows the tonnes and destination of materials and products (where available) recovered for recycling in Western Australia during the 2004–05 financial year.

Table 2-1 Material and products (where available) recovered for reprocessing, Western Australia 2004–05

Material	Exported overseas	Sent interstate	Reprocessed in WA	Total Recovery
<u>Concrete, sand, brick and rubble</u>				
Brick (whole)	—	—	5,070	5,070
Brick and rubble	—	—	82,450	82,450
Concrete	—	—	103,110	103,110
Sand	—	—	143,240	143,240
Total concrete, sand, brick and rubble	—	—	333,870	333,870
<u>Metals</u>				
Aluminium cans	2,470	—	—	2,470
Aluminium (other than cans)	13,340	3,000	170	16,510
Batteries	1,260	6,160	—	7,420
Non-ferrous scrap (other than aluminium)	10,630	—	600	11,230
Packaging steel	970	—	—	970
Steel (other than cans)	227,870	—	10,030	237,900
Total metals	256,540	9,160	10,800	276,500
<u>Paper</u>				
Cardboard / paper packaging	17,450	2,500	53,040	72,990
Directories	—	—	390	390
Mixed paper	18,070	—	—	18,070
Newsprint & magazines	63,140	—	11,110	74,250
Printing & writing paper	3,180	12,000	4,940	20,120
Total paper	101,840	14,500	69,480	185,820
<u>Organics</u>				
Food and garden organics	—	—	148,150	148,150
Total organics	—	—	148,150	148,150
<u>Glass</u>				
Container glass	—	18,000	—	18,000
Total glass	—	18,000	—	18,000
<u>Plastic</u>				
Domestic packaging	3,520	n.a.	n.a.	3,880
Industrial packaging	890	—	—	890
Non-packaging	40	n.a.	n.a.	2,360
Total plastics	4,450	1,240	1,440	7,130
<u>Rubber</u>				
Rubber tyres	—	—	1,800	1,800
Other rubber	70	30	—	100
Total rubber	70	30	1,800	1,900
<u>Textiles</u>				
Clothing	—	—	1,240	1,240
Total textiles	—	—	1,240	1,240
TOTAL ALL MATERIALS	362,900	42,930	566,780	972,610

2.4 Benchmarking of recycling activity

The total tonnes of material recycled in Western Australia equates to 484 kg per person. Based on discussions with key recyclers this figure is considerably higher than was the case five years ago. Despite this increase, Figure 2-6 shows that recycling activity is higher in a number of other states. Recycling in the construction and demolition sector is more advanced in South Australia, New South Wales and Victoria, and this accounts for the major difference in recycling activity overall. The reasons for this are likely to include the following:

- The low cost of waste disposal in Western Australia including landfill levies
- The lack of well publicised market specifications for recycled concrete, asphalt and brick rubble in road making and building construction
- Limited infrastructure for large scale crushing and screening.

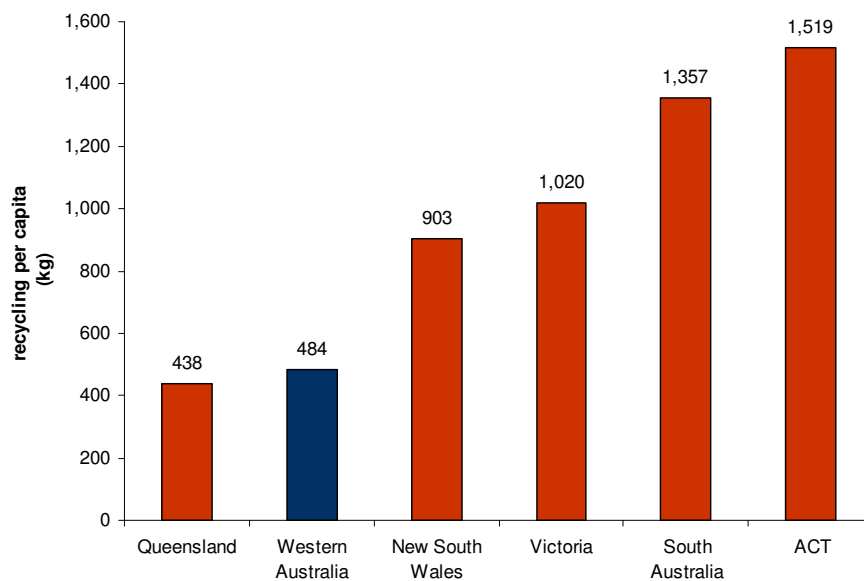


Figure 2-6 Comparison of per capita recycling activity by State

The data in Figure 2-6 should be viewed with some caution as data on total organics recovery from all source sectors are included in the other states but are not incorporated in the Western Australian figure. Figure 2-7 below compares the recycling activity in other states where the organics component has been removed.

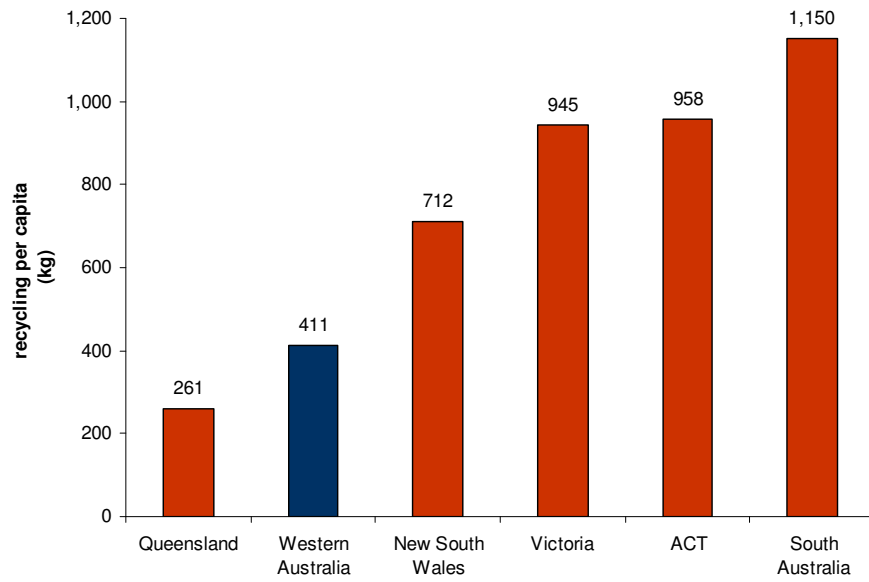


Figure 2-7 Comparison of per capita recycling activity (excluding organics) by State

3 Concrete, sand, brick and rubble

3.1 Concrete, sand, brick and rubble recycling process

The recycling of masonry products such as concrete, brick and asphalt is done utilising large scale heavy duty crushing equipment. In order to ensure the purity of the end product and to maximise the product value, pre-sorting of concrete, brick, asphalt and other material is undertaken. Reinforcing metals are removed from concrete during a primary crushing stage. Subsequent crushing is then undertaken to reduce material to a more uniform aggregate size range. Most material is then screened to produce aggregate based on uniform sizings.

Some brick material is kept separate and cleaned for use in an intact brick form. For wirecut bricks, this material is crushed with rock and other rubble.

A high volume of sand (143,240 tonnes) is screened across Perth and reutilised in a clean form. Infrastructure for crushing and sorting construction materials is not generally as well developed as that operating in Melbourne, Adelaide and Sydney. The major contaminant material in crushing plants is asbestos and therefore great care is taken to ensure loads received are completely asbestos free.

The major construction and demolition waste materials currently recovered in Western Australia for recycling are:

- Concrete
- Bricks
- Rubble
- Soil
- Steel (the recycling activity for steel is addressed in section 4)

There appears to be a large proportion of construction and demolition waste from skip bins compared to large demolition works than is the case in other states, making mixed rubble a large component of recycled stream.

Figure 3-8 shows the source of concrete, sand, brick and rubble recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

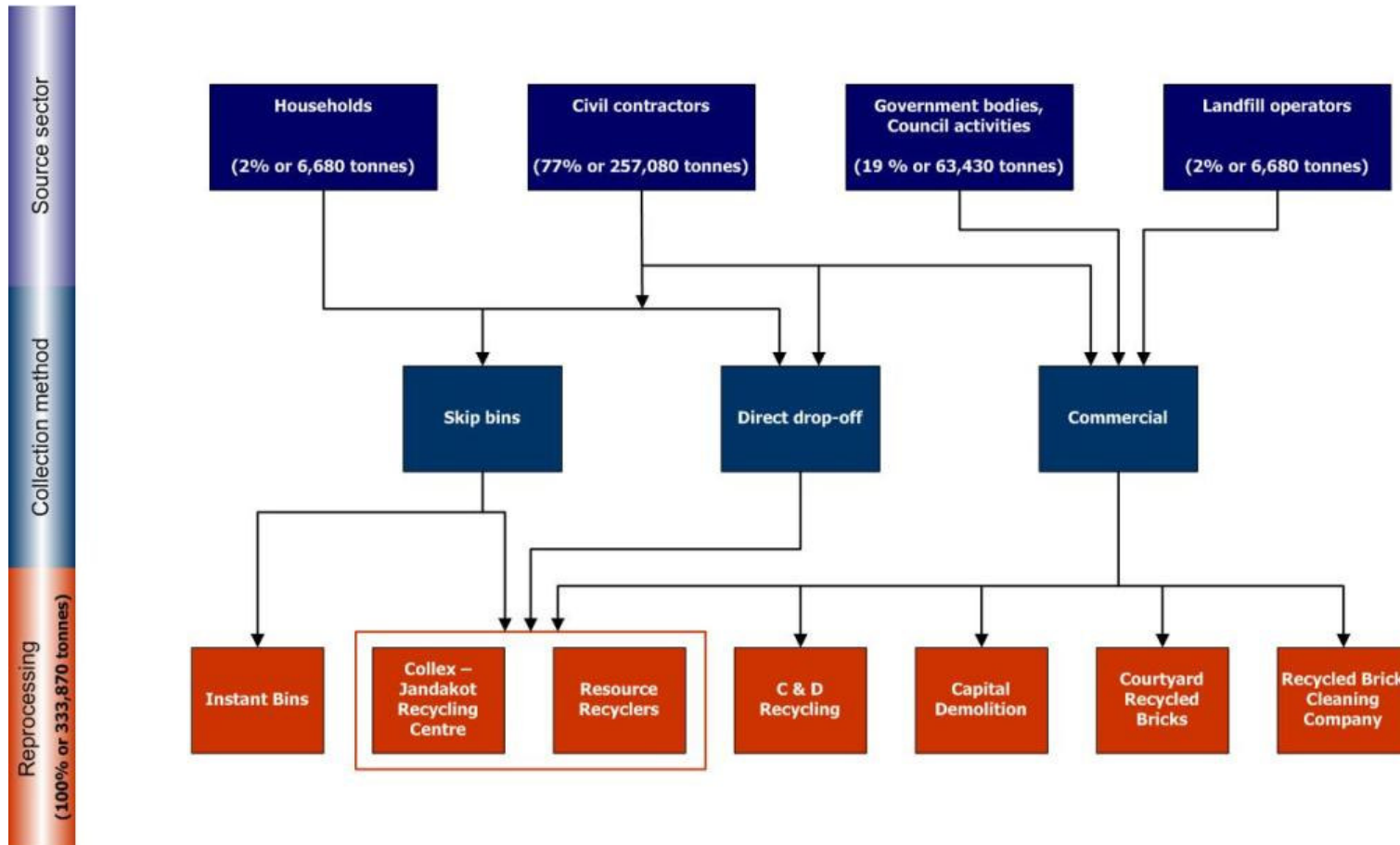


Figure 3-8 Flow of concrete, sand, brick and rubble recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004-05

3.2 Concrete, sand, brick and rubble recovery

Recovery of construction and demolition material in the 2004-05 financial year was approximately 333,870 tonnes. The break up of recycled construction and demolition materials is depicted below in Figure 3-9. Sand made up the largest proportion of construction and demolition waste materials recovered. This sand is screened prior to being sold for reuse. The high level of sand recycling reflects the geological nature of the Perth area when compared to other capital cities.

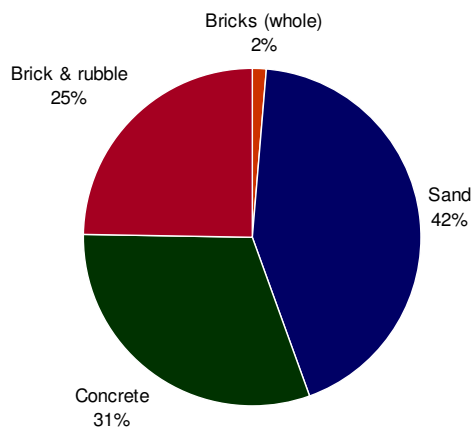


Figure 3-9 Composition of construction and demolition materials recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

3.3 Source sector of recovered concrete, sand, brick and rubble

Commercial operators, such as contractors, demolition companies, and bobcat operators, are the major source of construction and demolition materials recovered for reprocessing (Figure 3-10).

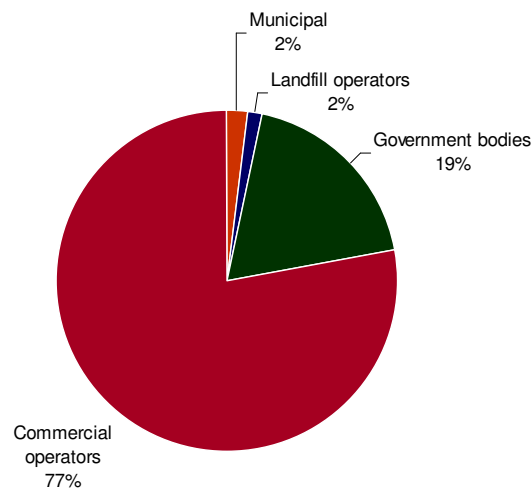


Figure 3-10 Source of construction and demolition materials recovered by weight (tonnes) for reprocessing, Western Australia 2004-05

3.4 Destination of reprocessed concrete, sand, brick and rubble

All concrete, sand, brick and rubble is crushed and screened within Western Australia – no material is exported or sent interstate.

Recovered concrete is crushed and then screened to make a range of aggregate products for a variety of applications. These are used as an alternative to quarry based products. Specifications have been established in Western Australia for the use of crushed recycled concrete for sub-base and basecourse.

In the case of reinforced concrete, the steel reinforcing is removed using magnets following crushing. The steel is then on-sold to metal recyclers.

There are a number of brick cleaning companies who generally accept pre 1955 bricks. These bricks are cleaned using a combination of machinery and manual labour, palletised and then resold for use for paving and building applications.

Most construction and demolition waste material is transported to a processing site rather than being dealt with through mobile equipment on the generating site. This reflects the pattern of other states although mobile concrete crushing equipment is used more extensively in regional centres in other states.

4 Metals

4.1 Metal recycling process

Metals are a group of materials that are readily recyclable with no reduction in product quality. It includes ferrous metals (steel, iron) in a range of forms and non-ferrous metals (copper, brass, lead, aluminium, stainless steel, nickel).

Western Australia has an extensive network of scrap metal merchants and dealers who receive metals from a wide variety of products. This includes old car bodies and parts, household appliances, electrical and electronic goods, packaging, industrial and agricultural equipment, and building products. The material is generally received and shredded as mixed feedstock.

Metals are recycled by the following method. Material is sorted into different metal groupings using magnets and eddy currents. The material is then reduced in size using a shredding process. Most material goes to a large scale mechanical shredder prior to being sent for reprocessing. There is one existing shredder operating in Western Australia by Sims Metal. A second shredder is being built presently by Smorgon Steel. This enables both companies to send scrap metals to a variety of mills for recycling in Australia and overseas.

There are some contaminant concerns at the shredding stage. These include unwashed chemical drums and cylinders (portable gas cylinders, automotive fuel tanks and fire extinguishers), that can explode during shredding. These need to be safely punctured prior to recycling.

Shredded material is then fired in a furnace and formed into new product. Due to the high temperature of the furnaces, most contaminant material is burnt off in the process, e.g. paints, plastics, timber.

Most metal recycled in Western Australia is exported to mills and foundries overseas as there is limited reprocessing infrastructure in Western Australia. No metal smelters operate in Western Australia. There are a number of local foundries that utilise a small proportion of the total scrap metal recovery.

Figure 4-11 shows the source of scrap metals recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

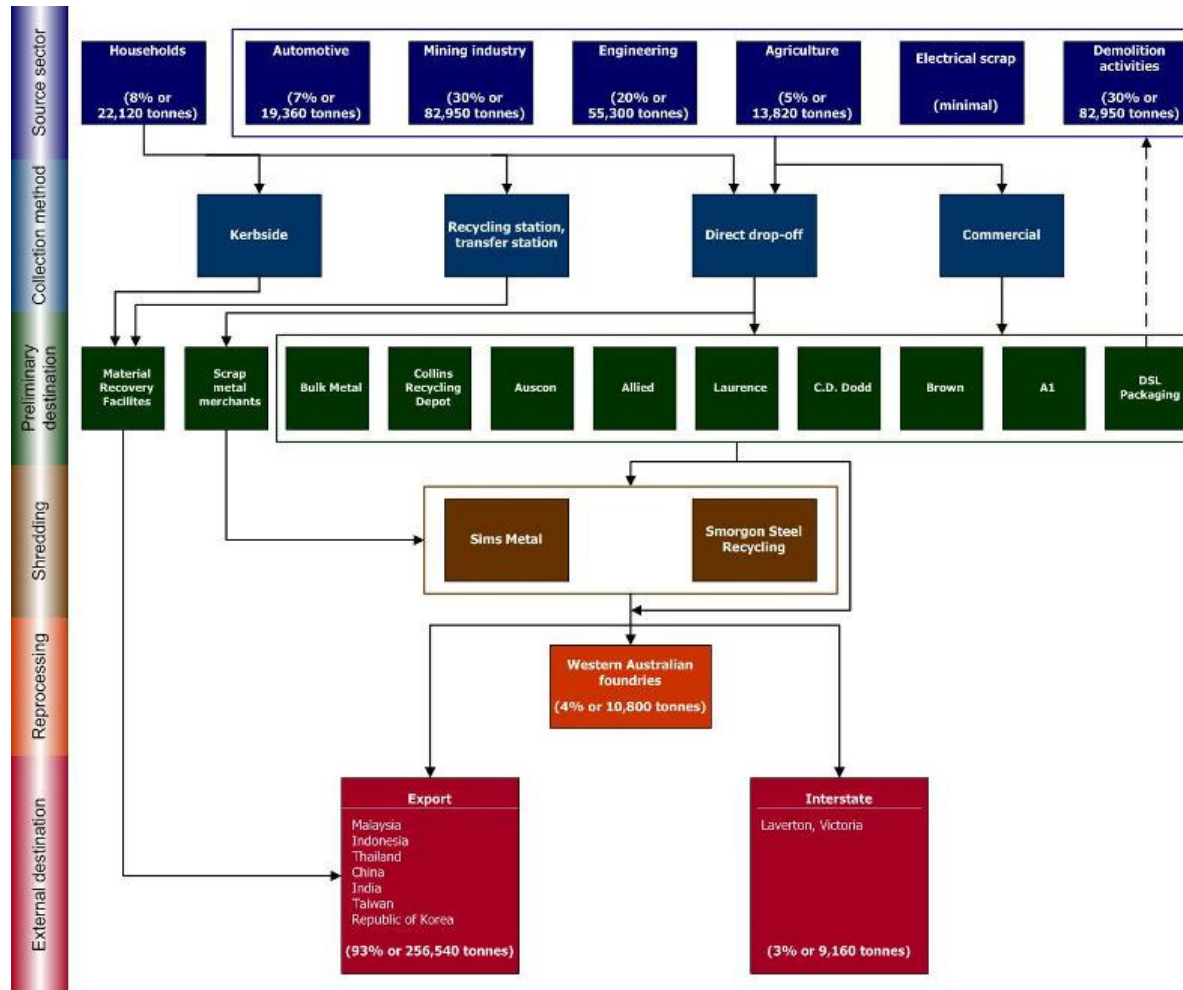


Figure 4-11 Flow of metals recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004-05

4.2 Metal recovery by material

The total quantity of metal recycled in the 2004-05 financial year is approximately 276,500 tonnes, with scrap steel accounting for the greatest proportion (Figure 4-12). Steel is recovered for recycling from a range of products including old car bodies, cans, appliances, farm equipment, industrial machinery and building materials.

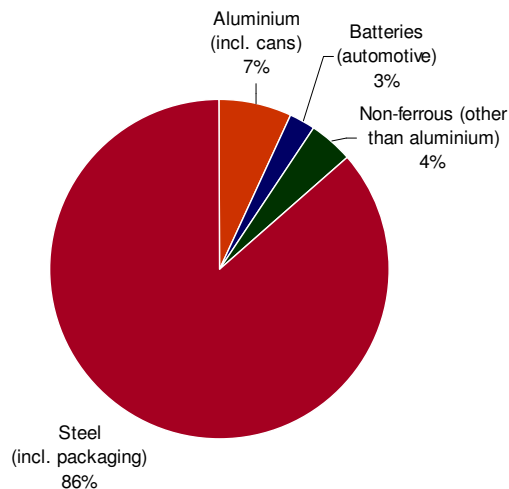


Figure 4-12 Composition of metals recovered by weight (tonnes) for reprocessing, Western Australia 2004-05

4.3 Metal recovery by product

The stakeholders contacted noted that metal products received for recycling are diverse, ranging from old tanks from the demolition of a mine site to household pots and pans. The mixed nature of the feedstock for metals makes it extremely difficult for industry to identify the proportion of products that make up the incoming stream. Based on discussions with key stakeholders an estimated split is presented in Figure 4-13.

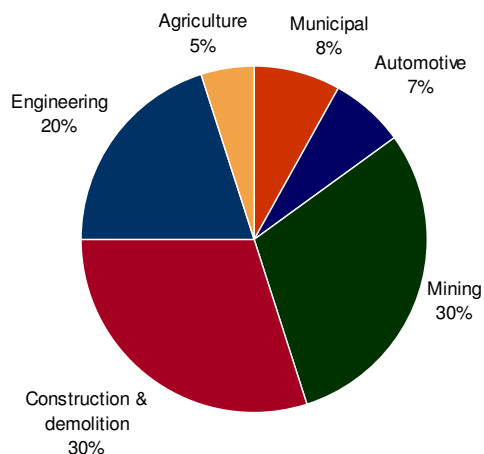


Figure 4-13 Estimated proportion of metal products recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

4.4 Source sector of metals

Scrap metals recovered for recycling were estimated to have been received largely from the commercial and industrial sector, whereby a significant quantity was generated from the mining industry (Figure 4-14).

Stakeholders further identified products received from the commercial and industrial sector to include off-cuts from manufacturing processes, copper cables, medical gear, license plates, printing press plates, farm scrap, cording and metal strapping, electrical cabling and goods, pipes, tools, nails and screws.

Metals recovered from the municipal sector were received largely from direct drop-off on site by the public and included products such as aluminium pots and pans, fly screens, door frames, windows, awnings, lead weights and mag wheels. Also recycled from the municipal sector was packaging (i.e. aluminium and steel cans), collected primarily through kerbside recycling services, recovered at sorting facilities and exported overseas for use in Asian smelters.

A higher proportion of scrap metal is received from construction and demolition activities compared with Victoria and South Australia. This is likely to be due to the more significant heavy industry base in these states, e.g. automotive and ship building sectors.

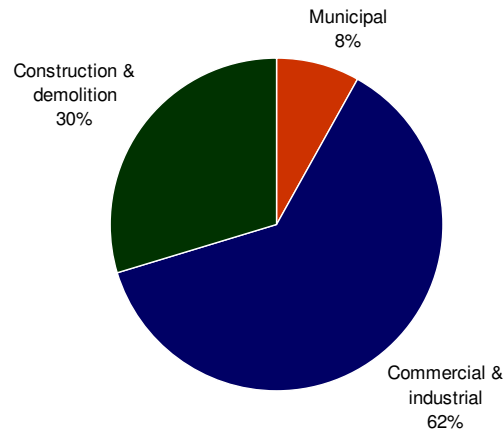


Figure 4-14 Source sector of metals recovered by weight (tonnes) for reprocessing, Western Australia 2004-05

4.5 Destination of recovered metals

The majority of metals recovered in Western Australia for recycling were exported overseas, largely utilised by mills in South East Asia (Figure 4-15). The absence of local smelting operations and access to Asian export destinations are the main reason for this. The remaining tonnes are split between utilisation in local foundries and interstate destinations.

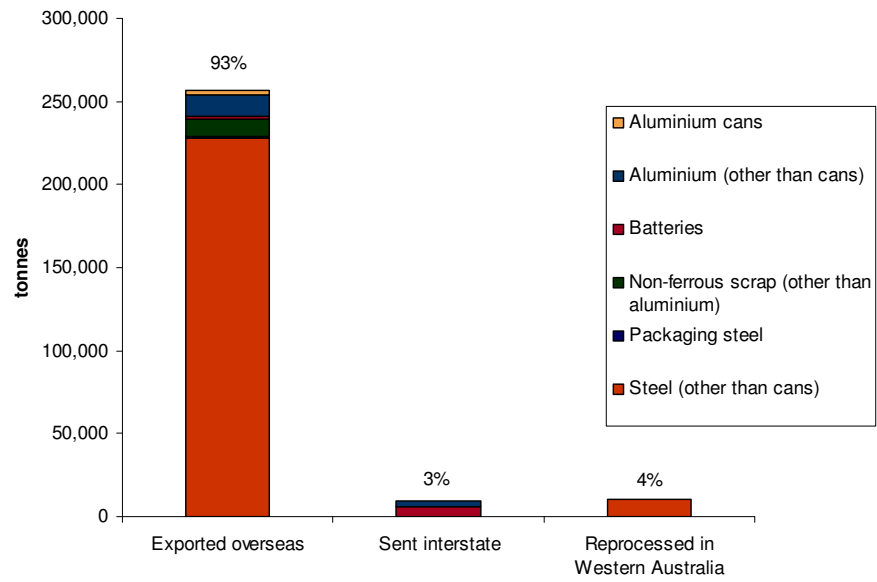


Figure 4-15 Destination of metals recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

5 Paper

5.1 Paper recycling process

Waste paper has been collected and recycled for over one hundred years in Australia and nationally we have some of the worlds highest recycling rates for paper grades such as newspaper and cardboard.

Waste paper is mostly recovered in Western Australia through commercial collections and household kerbside recycling collections. Often collected as mixed grades it is generally sorted into grades before being transferred to paper mills locally, interstate or overseas.

Paper is recycled at the paper mills by mixing with water in a pulping process. This frees the paper fibres for recovery and reforming into new paper sheet. Often recycled paper fibre is blended with virgin fibre sourced pulp to provide the maximum technical characteristics (strength, smoothness).

Contaminant materials are removed during the pulping process and associated screening. This includes inks, metals, plastics and adhesives. Mixed grade papers can be pulped and used in a blended form for some new paper products. Increasingly, sorted grade waste paper can be used to produce higher quality paper products. Some moisture resistant paper products such as milk and juice cartons need to be shredded prior to pulping to ensure adequate fibre separation in the period of pulping.

There are a broad range of paper commodity grades. For this survey of recycling activity in Western Australia, paper was split into the following grades:

- Cardboard / paper packaging
- Newsprint & magazines
- Printing & writing paper
- Directories
- Mixed paper

Figure 5-16 shows the source of paper recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

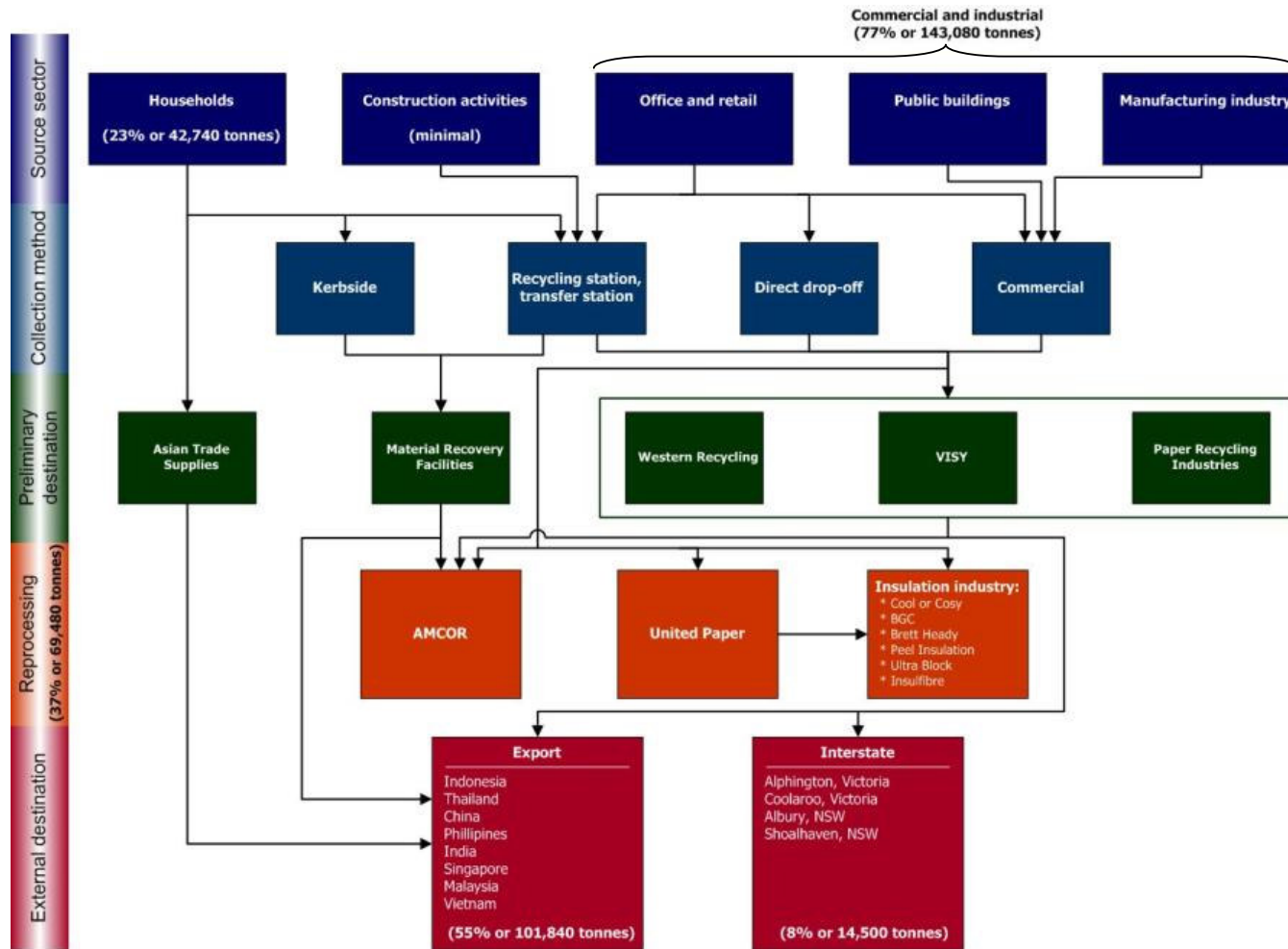


Figure 5-16 Flow of paper recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004-05

5.2 Paper recovery by product

Paper recovery in Western Australia for the 2004–05 financial year was recorded at 185,820 tonnes. This material was recovered through commercial collections and household kerbside recycling collections. Cardboard / paper packaging and newsprint & magazines each accounted for equal volumes making up a combined 80% of total wastepaper recovery (Figure 5-17).

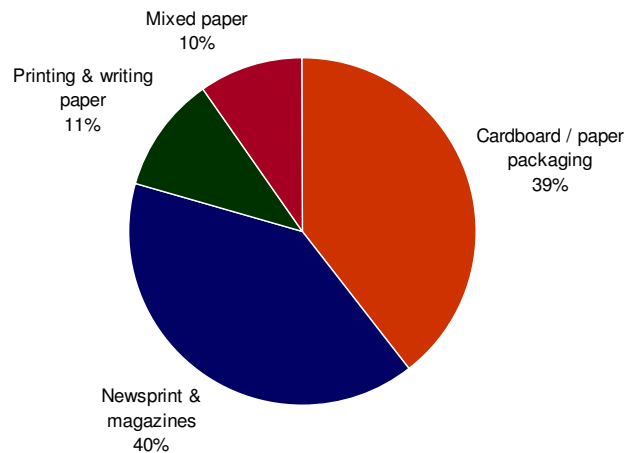


Figure 5-17 Composition of paper products recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

Cardboard / paper packaging is mostly corrugated cardboard box material used for the packaging of industrial and consumer goods. It includes both primary product packaging such as cereal boxes and secondary packaging boxes for transport across most products from fresh food to white goods.

Magazines are generally recycled with newspapers. The coatings in magazines are a valuable input to the newsprint manufacturing process.

5.3 Source sector of paper

Three-quarters of the paper collected for recycling in Western Australia in 2004–05 was sourced from the commercial and industrial sector (Figure 5-18). Paper sourced from commercial and industrial sites is generally a large quantity of clean and homogenous material with a high cardboard content. Collections occur from retailers, industrial facilities, offices and schools.

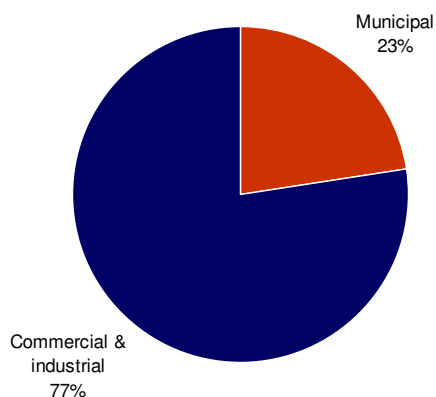


Figure 5-18 Source sector of paper material recovered by weight (tonnes) for reprocessing, Western Australia 2004-05

The proportion of recycled paper products from each of the source sectors is summarised in Figure 5-19. As shown, the municipal stream consists primarily of newsprint and mixed paper collected through kerbside recycling collections. As the major Western Australian reprocessing destination prefers higher cardboard content waste paper, most kerbside waste paper is exported, often in a mixed form.

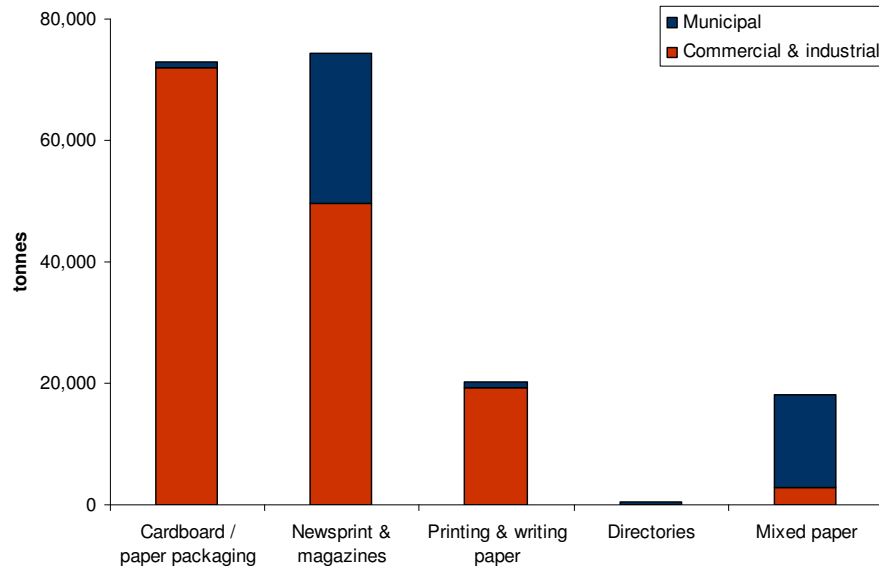


Figure 5-19 Source of paper products recovered by weight (tonnes) from all sectors for reprocessing, Western Australia 2004–05

5.4 Destination of recovered paper

More than half of all wastepaper recovered from the Western Australian waste stream was exported overseas (Figure 5-20). Newsprint & magazines were the dominant grade exported, sent to paper mills in Indonesia for newsprint production.

A further 37% of paper material recovered from the Western Australian waste stream was utilised by local reprocessing operations. Most of this material was cardboard and paper packaging products consumed by the paper mill for conversion back into corrugated boards and papers. The local insulation industry utilised a small amount of newsprint for insulation production.

The remainder, largely printing and writing paper, was sent interstate for use in the production of new printing and writing paper, tissues and coatings for packaging grade paper.

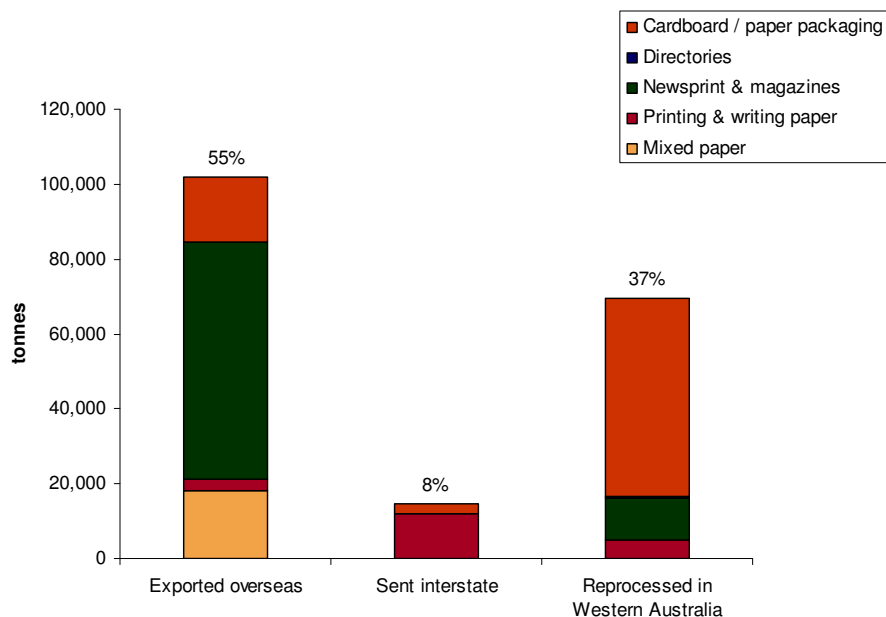


Figure 5-20 Destination of paper products recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

6 Container glass

6.1 Container glass recycling process

Glass can be recovered and recycled in a continuous cycle without an erosion of quality. Container glass (bottles and jars) is used across a range of beverage and food applications and is recovered through kerbside recycling collections. Recovered container glass is generally sorted to exclude contaminant materials and to separate into the three colour groupings: amber, green and flint (clear). In Western Australia no colour sorting is currently undertaken. All glass is transported to South Australia. This follows the closure of the Perth based glass packaging manufacturing plant.

The material is melted in a high temperature furnace with waste glass (cullet) blended with virgin materials (silica, soda ash). It is possible to make glass entirely from cullet.

The major contaminant concerns in glass recycling are materials that do not melt at the same temperature as container glass. These are ceramics and other glass forms such as glass oven ware (pyrex). This can lead to container imperfections and packaging failure and therefore great attention is paid to keeping ceramics out of glass cullet. Optical sorting of ceramic as cullet is now undertaken in Victoria, but not on Western Australian sourced material which is utilised in South Australia for the manufacture of new glass containers.

6.2 Container glass recovery

The total quantity of glass packaging collected for recycling in 2004–05 was 18,000 tonnes. This material is shipped to Adelaide in a mixed colour form. The price paid for the collected glass in Perth is significantly lower than that offered in other capital cities.

7 Plastics

7.1 Plastics recycling process

Plastics are a group of materials which, when collected as a mixture of plastic types, generally require separation prior to reprocessing. Most separation is done manually. There is some automated separation of polymer types, usually based on technology that exploits density differences between plastic type.

In the reprocessing process plastics are usually reduced in size to a flake and then washed to remove any contaminants such as metals, inks and adhesives. Polymer separation based on density can then be undertaken using water as the separating fluid. This is effective for separating polyethylene (lighter than water) from PET and PVC (Both heavier than water). The similar densities of polymers such as PVC and PET mean these can not be separated by water floatation and will contaminate the reprocessing of the other plastic if present. Plastics are then heated and extruded into a pellet or powder form prior to being used in new product manufacture. Recycled plastic material is also often mixed with other virgin plastic resin. Due to the presence of colour and other additives in recycled plastic it is often used to manufacture different products from the original product, e.g. bottle material used for bin manufacture, bank notes used for plant pots.

Figure 7-21 shows the source of plastics recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

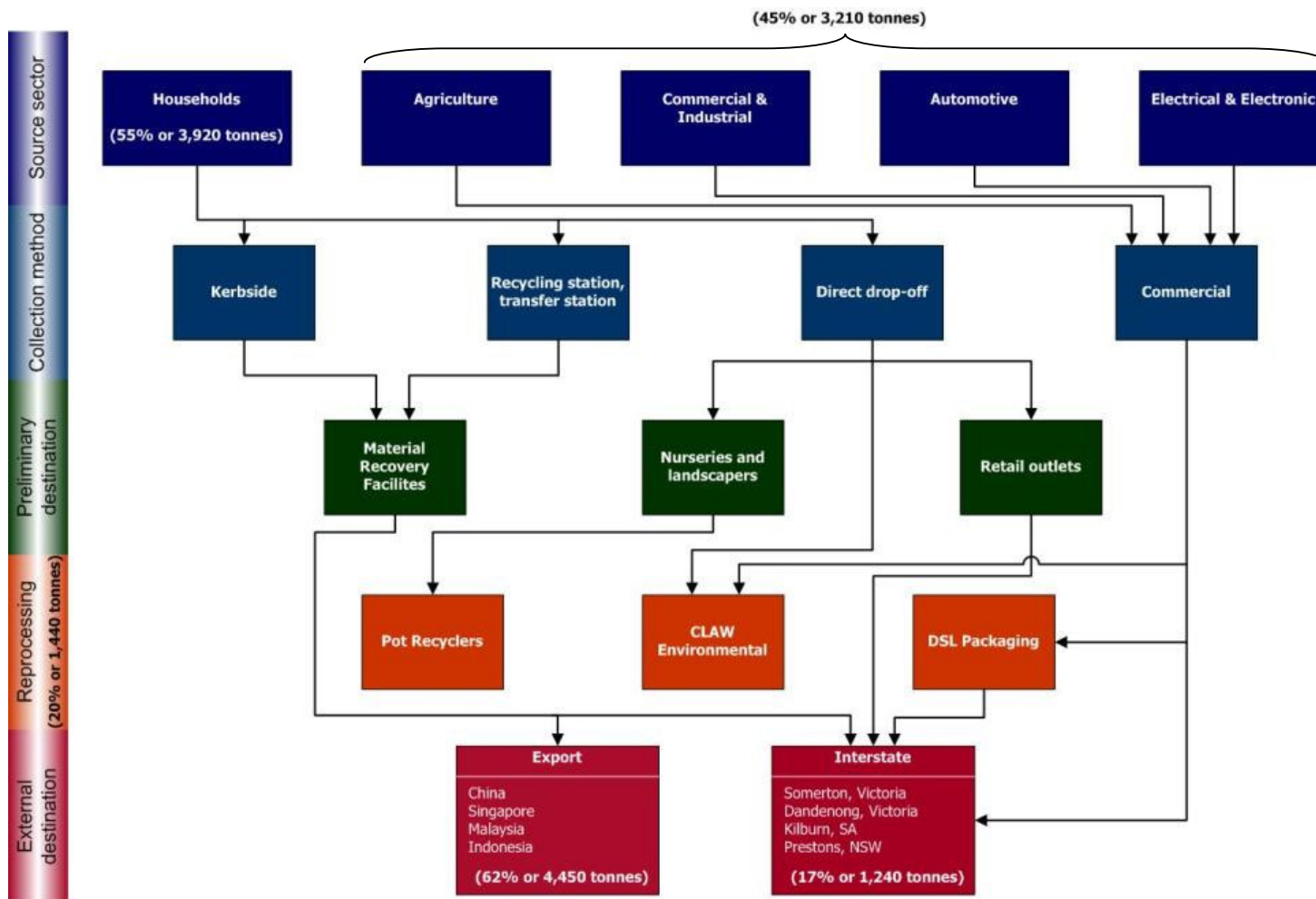


Figure 7-21 Flow of plastics recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004–05

7.2 Plastics recovery

Each year the Plastics and Chemicals Industries Association (PACIA) collects data on plastics reprocessing as part of the National Plastics Recycling Survey. To avoid seeking the same information from these companies, the results available in the PACIA survey have been incorporated into this report. The PACIA survey is comprehensive and fulfils the data requirements of this study.

Overall recovery of plastics from Western Australia during the 2004 calendar year was 7,130 tonnes, with packaging products accounting for two-thirds of this amount¹ (Figure 7-22). Due to the small number of plastics reprocessors operating in Western Australia, plastics recovery data cannot be provided by polymer type as this would disclose commercially sensitive company specific data.

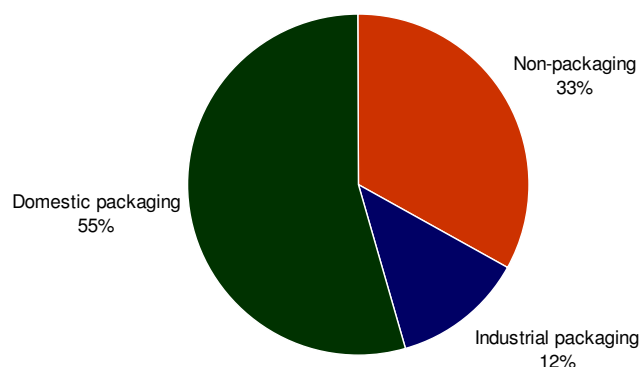


Figure 7-22 Composition of plastics recovered by weight (tonnes) for reprocessing, Western Australia 2004

The Western Australian plastics with the highest recovery rates and total recovery (in tonnes) were PET, HDPE and L/LLDPE.

¹ * Non-packaging plastics recovered in Western Australia includes the polymers PVC, PS, EPS and polyurethane.
 * Industrial packaging plastics recovered in Western Australia includes the polymers L/LLDPE and PS.
 * Domestic packaging plastics recovered in Western Australia includes the polymers PET, HDPE, PVC, PP and PS.

Despite the significant increase in plastics recovery in Western Australia over the last 4 years, the overall recycling rate of 4.8% remains below the national average (12.6%). This is likely to be due to a relatively small plastics reprocessing sector and a minimal plastics manufacturing industry. A limiting factor on the Western Australian plastics reprocessing sector is the lack of a local plastics manufacturing industry and the ease of access to Asian reprocessing markets.

The Western Australian plastics packaging recycling rate at 7.6%, is also below the national average of 22.2%.

One notable plastics recycling initiative is the introduction of polypropylene plant pot recycling by Pot Recyclers. They are currently the sole Australian reprocessor of used polypropylene plant pots. Pot Recyclers converts plastic pots back into a high quality granulated recycle by shredding and then washing pots in a bath containing a patented cleaning emulsion. The polypropylene recycle is suitable for substitution of virgin resin in many applications, including new plant pots.

7.3 Source sector of plastics

Just over half of the plastics recovered in Western Australia were sourced from the municipal sector² (Figure 7-23). This material was entirely packaging, collected as a mixed stream from households through kerbside recycling services and recovered at sorting facilities.

The remaining plastics were sourced from the commercial & industrial sector³. These included items such as stretch and shrink wrap. Most of these polymers were processed in Australia, both locally and interstate (1,370 and 940 tonnes respectively).

² Includes the polymers PET, HDPE, PVC, PP and PS.

³ Includes the polymers HDPE, PVC, L/LDPE, PP, PS, EPS, and polymers with the ID code 7.

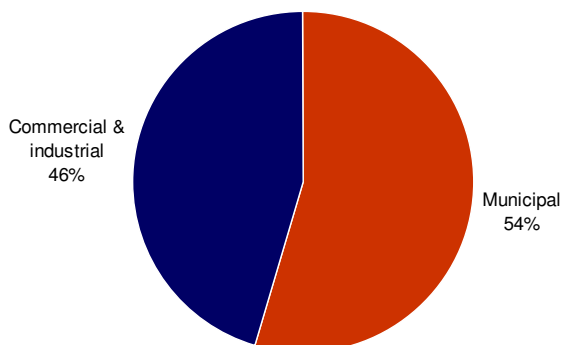


Figure 7-23 Source sector of plastics recovered by weight (tonnes) for reprocessing, Western Australia 2004

7.4 Destination of recovered plastics

Nearly two-thirds of plastics recovered in Western Australia were exported overseas for reprocessing, largely to China (Figure 7-24). The destination for the remainder of the plastic polymers recovered is split between utilisation by local reprocessing facilities and interstate destinations.

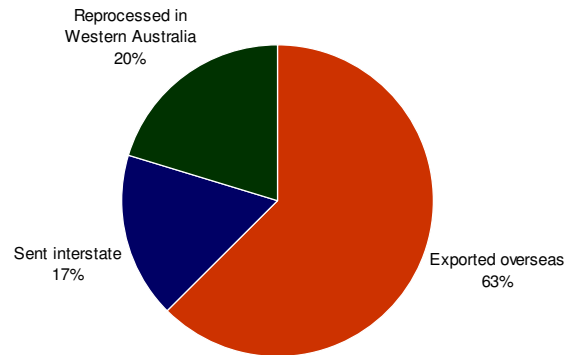


Figure 7-24 Destination of plastics recovered by weight (tonnes) for reprocessing, Western Australia 2004

As shown in Figure 7-25, the majority of exported waste plastics (79% of total exports) were domestic packaging polymers retrieved from households through kerbside recycling collections.

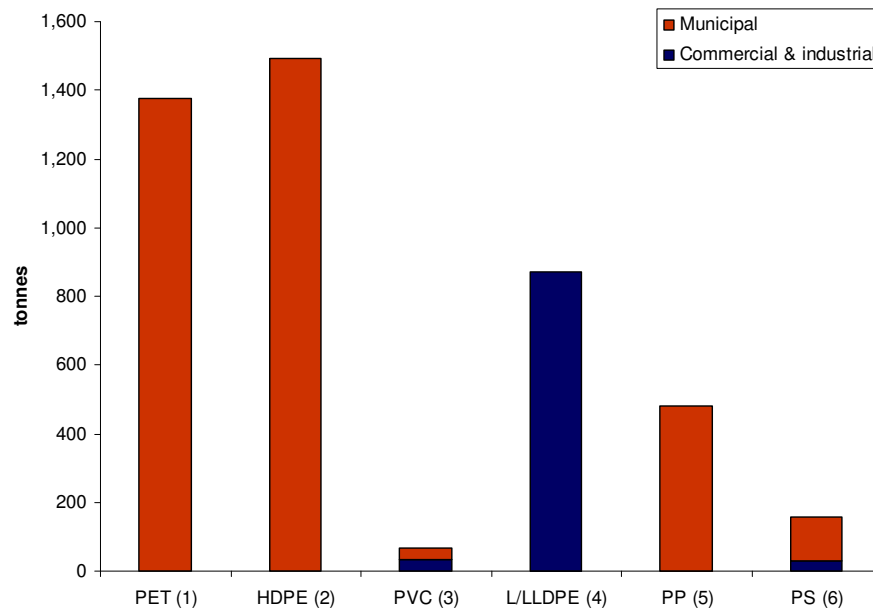


Figure 7-25 Recovered plastic polymers exported by weight (tonnes) for reprocessing, Western Australia 2004

Listed below in Table 7-2 are the polymers reprocessed either within Western Australia or sent interstate. Due to the small number of plastics reprocessors operating in Western Australia, plastics recovery data cannot be provided by polymer type as this would disclose company specific information.

Table 7-2 **Polymers reprocessed in Western Australia and sent interstate**

Polymer	Plastics ID code	Reprocessed in Western Australia	Sent interstate
HDPE	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PVC	3		<input checked="" type="checkbox"/>
L/LLDPE	4	<input checked="" type="checkbox"/>	
PP	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PS	6		<input checked="" type="checkbox"/>
EPS	6	<input checked="" type="checkbox"/>	
Other	7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Total (tonnes)		1,400	1,200

8 Rubber

8.1 Rubber recycling

The total quantity of rubber recovered for recycling in 2004–05 was 1,900 tonnes. Almost all rubber reprocessed was in the form of truck tyres (Figure 8-26).

The focus on truck tyres rather than passenger tyres is based on the volume of recovered rubber due to larger size, thicker walls, lower textile component, and a higher value rubber compound.

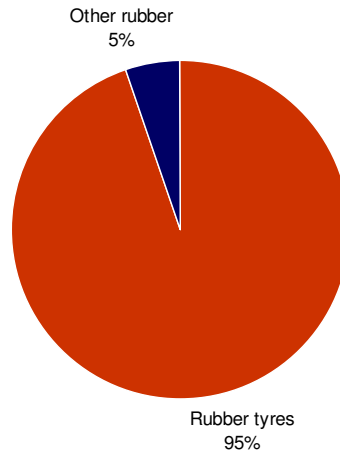


Figure 8-26 Composition of rubber recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

There is also a level of reuse of rubber products through second hand tyres and retreading, as well as the reconditioning of conveyor belts for the mining industry. These reuse activities are not included in this survey.

Figure 8-27 shows the source of rubber recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

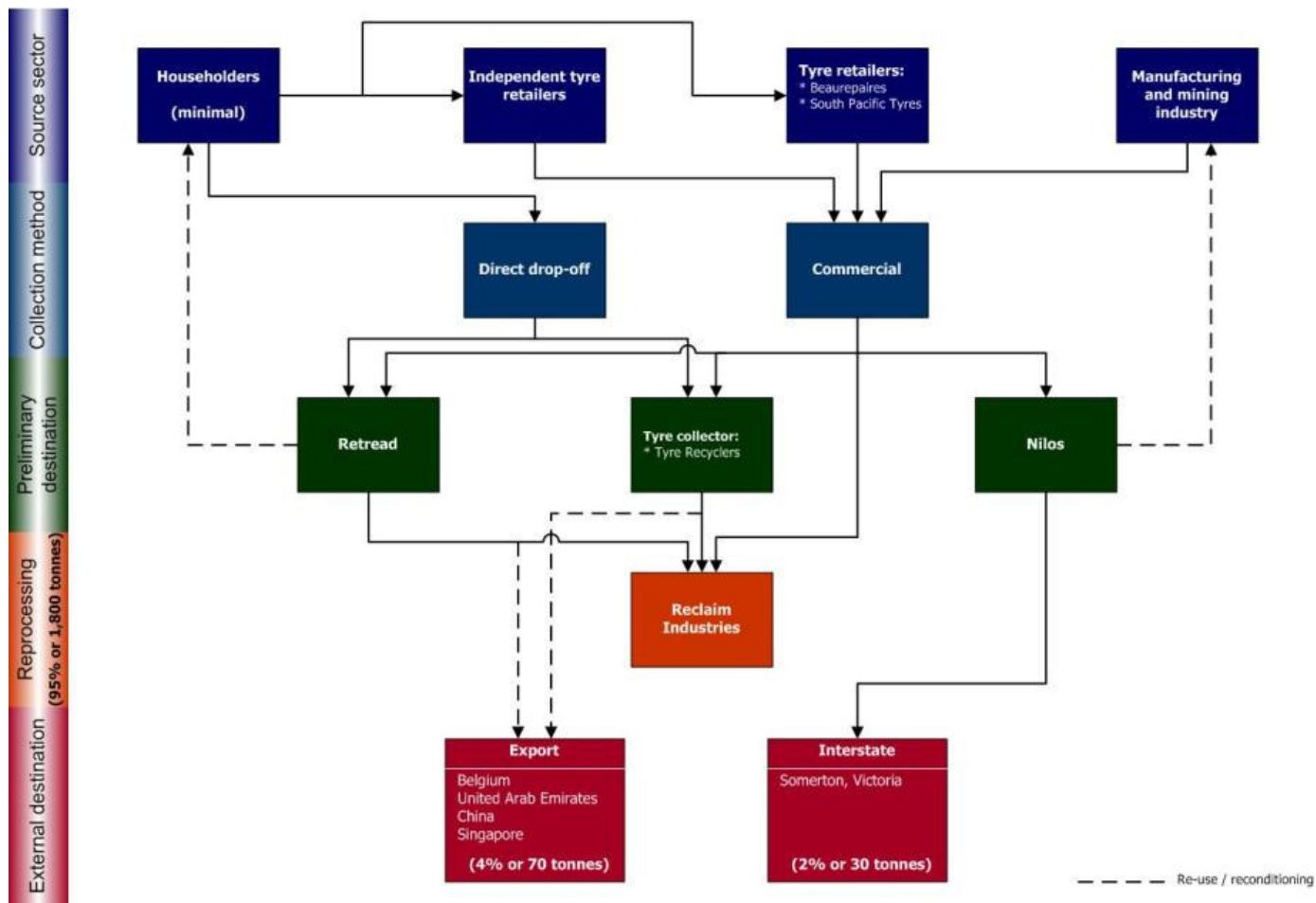


Figure 8-27 Flow of rubber recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004–05

8.2 Source sector of recovered rubber

Rubber recovered for recycling in Western Australia was sourced entirely from the commercial and industrial sector, largely truck tyres received from tyre retailers (Figure 8-28). These tyres are kept for collection when new tyres are fitted.

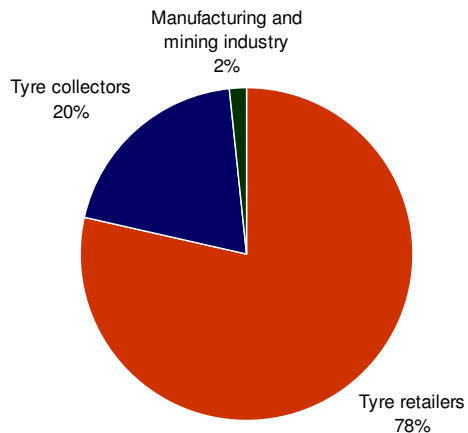


Figure 8-28 Source of rubber recovered by weight (tonnes) from all sectors for reprocessing, Western Australia 2004-05

8.3 Destination of recovered rubber

Of the rubber recovered for reprocessing in Western Australia during 2004 –05, most was utilised locally (Figure 8-29), with the recycled rubber products sold into a wide range of industries in both domestic and international markets. The minimal amount of rubber sent interstate was rubber buffings from the reconditioning of conveyor belts for the mining industry.

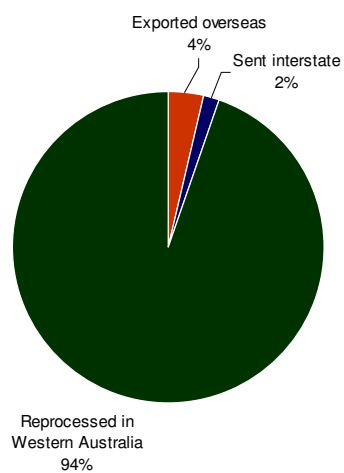


Figure 8-29 Destination of rubber recovered by weight (tonnes) for reprocessing, Western Australia 2004–05

9 Textiles

9.1 Textiles recycling process

Textiles in the form of clothing are recovered for recycling across Perth. The recycling of clothing occurs with garments that are unsuitable to be reused as clothing either through charity outlets in Western Australia or in developing countries.

The garments are sorted and cotton clothing is cut up for use as rags in a broad range of industrial applications. The recycling process involves staff cutting garments to size and to remove bands, cuffs, etc. Material is then scanned to ensure no metals or contaminant material is detected.

Woollen garments are processed using combing equipment to reform the material in a felt-like form for use in padding and protective sheet applications, e.g. removalist rugs, upholstery wadding, mattress pads, underlay.

Figure 9-30 shows the source of clothing recovered from the waste stream for reprocessing and the route this material takes to recycling destinations.

9.2 Clothing recovery

The quantity of clothing collected for reprocessing in Western Australia in 2004–05 is estimated to be 1,240 tonnes. This does not include resale for use as clothing through second hand or charity stores, or clothing exported as relief aid.

9.3 Source sector of clothing

Clothing reprocessed in Western Australia was sourced entirely from the municipal sector, collected by local charities.

9.4 Destination of recovered clothing

All of the clothing recovered in Western Australia was reprocessed locally. There are a number of reprocessors of clothing operating in Perth. These companies manufacture rags and felt-like padding and protective sheet products.

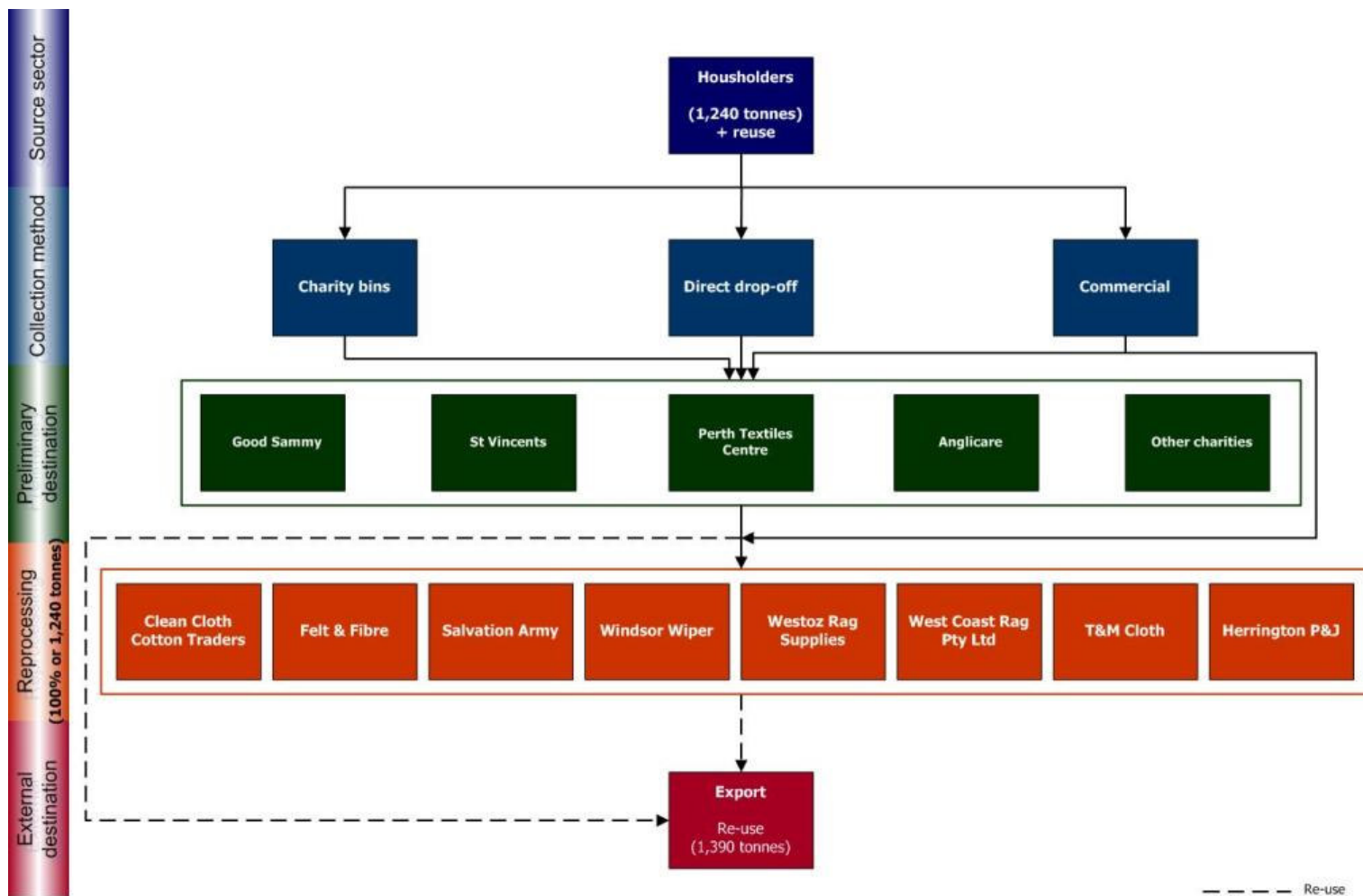


Figure 9-30 Flow of clothing recovered for reprocessing from sector of origin through to recycling destinations, Western Australia 2004–05

10 Conclusions and Recommendations

Conclusions

Overall, the level of recycling activity in Western Australia is strong with opportunities for potential growth in several areas.

This survey of recycling activity represents a major step forward in understanding the range and scale of activity across all materials and products (where available) state wide.

It shows a very strong recovery level for both ferrous and non ferrous metals sourced from household and industry sources particularly industries such as mining, automotive, and construction and demolition.

Paper and cardboard recycling is also strong with material being processed in large volumes in Perth and also exported.

In recent years growth in recovery across many materials has been strong. This includes materials such as rubber, plastics and concrete. This growth has come off a low level of activity and in interstate terms recycling levels in Western Australia are still well below those of New South Wales, Victoria and South Australia.

A key reason for this is the ease and relatively low cost of disposal to landfill in Perth and regional areas. This works against the development of recycling infrastructure. This is most apparent in the construction and demolition sector where reprocessing for concrete, sand, brick and rubble is minimal.

Recommendations

There remains a high export ratio for many materials. While reprocessing in Western Australia offers employment benefits, the likelihood is that export of metals, paper and plastics will continue to be a strong feature of the Western Australian market due to the geographic proximity to Asian destinations.

The strong performance in metals is likely to continue with additional shredding infrastructure being acquired. Similarly, paper recycling remains strong in both metropolitan and regional areas. To enhance the current level of paper recycling there needs to be a larger focus on the recovery of office grade paper.

Glass packaging remains an issue with all material being sent to South Australia for reprocessing. Despite this there is the potential for all glass recovered to be recycled. This will likely occur through the further upgrading of household recycling services and the expansion of away from home recycling efforts.

There remains a strong need for further infrastructure investment. This is particularly the case for materials such as concrete, asphalt, timber, garden and food organics.

Government, at a state and local level, will need to work closely with reprocessors to identify barriers to increase recovery. This may be infrastructure costs, disposal costing or government recycled product purchasing.

Market assistance will also be crucial to further growth in recycling with the development and promotion of product specifications for recycled content products and purchasing policies.

In the short term, major increases will come from the increased recycling of concrete, asphalt, sand, brick rubble, paper and timber.

In consideration of restrictions of landfill activity to drive recycling (e.g. landfill bans), it is suggested that the focus be materials where recycling infrastructure is available and there is currently no impediment to diverting/recovering more from the waste stream. These materials include metals and metal products (e.g. appliances, car bodies), and paper and cardboard.

Much recycling activity remains hidden from the Western Australian community. It will be important to highlight the achievement of community and industry in recycling by informing the general public of the current recycling activity (972,610 tonnes or 484 kg/person). This will help to build confidence within the community that recycling is working and to use this to drive future increased activity.

It will also be important to promote existing reprocessors, including those that remain largely hidden (e.g. textiles, plastics) The survey provides a good mechanism to build relationships with the reprocessing industry through ongoing engagement, as well as demonstrate the importance of the recycling industry to the Western Australian community.

In building on its current impressive recycling achievements, Western Australia should look to other states in areas where there is a high level of performance to understand optimal approaches. This would include:

- New South Wales — organics, paper
- Victoria — concrete, asphalt, newspaper, plastics
- South Australia — concrete, brick, timber, organics.

In summary, the individual recycling efforts of individual Western Australian householders and companies produce a strong overall outcome. With support, this is likely to result in over a million tonnes of recycling in the near future with a consequent gain in resource efficiency for the Western Australian community.

Data collection in future years

The estimated degree of accuracy for recycling activity in Western Australia in 2004–05 across all material types is presented in Table 10-3.

It will be important to monitor future growth in recycling. It is recommended that a methodology similar to this study be adopted and that this be consistent with the approach of other states to enable meaningful benchmarking.

It is also recommended that recycling data be coupled with landfill data to establish overall waste generation in Western Australia. This will enable the Department of Environment and the community to monitor whether Western Australians actually are reducing waste and recovering more material from the waste stream. It will be important to link waste generation levels to economic growth and identify any 'dematerialisation of the economy'.

Table 10-3 **Estimated degree of accuracy for recycling activity data, Western Australia 2004–05**

Material / Product	Total Recovery (tonnes)	Estimate degree of accuracy
<u>Concrete, sand, brick and rubble</u>		
Brick (whole)	5,070	High (<5%)
Brick and rubble	82,450	Moderate (<20%)
Concrete	103,110	Moderate (<20%)
Sand	143,240	Moderate (<20%)
Total concrete, sand, brick and rubble	333,870	
<u>Metals</u>		
Aluminium cans	2,470	Moderate (<20%)
Aluminium (other than cans)	16,510	High (<5%)
Batteries	7,420	V High (<2%)
Non-ferrous scrap (other than aluminium)	11,230	High (<5%)
Packaging steel	970	Moderate (<20%)
Steel (other than cans)	237,900	High (<5%)
Total metals	276,500	
<u>Paper</u>		
Cardboard / paper packaging	72,990	V High (<2%)
Directories	390	Moderate (<20%)
Mixed paper	18,070	High (<5%)
Newsprint & magazines	74,250	High (<5%)
Printing & writing paper	20,120	Moderate (<20%)
Total paper	185,820	
<u>Organics</u>		
Food and garden organics	148,150	not applicable
Total organics	148,150	
<u>Glass</u>		
Container glass	18,000	not applicable
Total glass	18,000	
<u>Plastic</u>		
Domestic packaging	3,880	V High (<2%)
Industrial packaging	890	V High (<2%)
Non-packaging	2,360	V High (<2%)
Total plastics	7,130	
<u>Rubber</u>		
Rubber tyres	1,800	V High (<2%)
Other rubber	100	V High (<2%)
Total rubber	1,900	
<u>Textiles</u>		
Clothing	1,240	High (<5%)
Total textiles	1,240	
TOTAL ALL MATERIALS	972,610	

11 Glossary

Clinical waste:

Waste generated by medical, nursing, dental, veterinary, pharmaceutical or other related activity which is poisonous or infectious; likely to cause injury to public health; or contains human tissue or body parts.

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.

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.

Intractable waste:

Waste which is a management problem by virtue of its toxicity or chemical or physical characteristics which make it difficult to dispose of or treat safely, and is not suitable for disposal in Class I, II, III and IV landfill facilities.

Kerbside collection:

Collection of household recyclable materials (separated or co-mingled) that are left at the kerbside for collection by local council collection services.

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.

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. 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.

Packaging:

Plastic 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 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.

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.

Pre-consumer industrial scrap:

Scrap off-cuts and off-specification items 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). 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 recovered (reclaimed) as a material input, in lieu of a new primary material, for a recycling or manufacturing process.

Reprocessing:

Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to add financial value to the processed material.

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.

12 Acronyms

C&D	Construction and Demolition
C&I	Commercial and Industrial
EPS	Expanded Polystyrene
HDPE	High Density Polyethylene
L/LLDPE	Both Linear Low Density and Low Density Polyethylene
PACIA	Plastics and Chemicals Industries Association
PET	Polyethylene Terephthalate
PVC	Polyvinyl Chloride
PP	Polypropylene
PS	Polystyrene