Disposal based survey of the commercial and industrial waste stream in Sydney

NSW GOVERNMENT | Environment, Climate Change & Water

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Executive summary

Manufacturers, shops and businesses of all sizes and types are some of the many sources of commercial and industrial (C&I) waste. The majority of C&I waste that ends up in landfills in NSW is made up of organic, degradable materials that emit greenhouse gases as they break down. Many of the diverse materials in the waste could be diverted before they reach the waste stream or have potential resource value if they could be recovered or recycled cost-effectively.

Increased resource recovery from the commercial and industrial sector will help reduce greenhouse gas emissions, save water and energy and help reach the NSW Waste Avoidance and Resource Recovery (WARR) Strategy target of recycling 63% from the C&I waste stream by 2014.

The 2008 WARR Progress Report confirms recycling rates of 44% and 42% for C&I waste in 2006-07 in NSW and the Sydney Metropolitan Area (Sydney) respectively. Although Sydney recycled 1.5 million tonnes of C&I waste that year, about 2 million tonnes of C&I waste, including wood, food, plastics, paper and cardboard, still ended up in landfills. In total, NSW recycled 2.3 million tonnes of C&I waste the same year, and nearly 3 million tonnes went to landfills.

The Department of Environment, Climate Change and Water NSW (DECCW) carried out a comprehensive field survey in 2008 to get a clearer and more accurate understanding of what is in the C&I waste stream.

The field survey

The field survey took place at six landfills and six transfer stations in Sydney between June and August 2008.

It included a gatehouse survey of all C&I loads delivered to identify the industry source and delivery vehicle type. A panel of waste auditors who were registered with DECCW helped develop the methodology for visual assessment of C&I loads and the weight-based garbage bag sorting.

Sites participating in the field survey were given individually summarised, site-specific raw data. The information from the gatehouse survey, visual assessment of loads and the garbage bag sorting was then analysed in detail using the Australian Waste Data classification to categorise what was in the C&I waste stream, and breakdown the industry source and delivery vehicles.

What did the survey find in the C&I waste stream?

In 2007-08, 2,223,856 tonnes of C&I waste was sent to Sydney landfills. Most of the C&I waste came from mixed loads (1,737,594 tonnes — 78%) and the remaining 486,262 tonnes (22%) were segregated single material loads.

To get a sense of perspective of the sheer scale of 2,223,856 tonnes of C&I waste disposed to landfill in Sydney, it is estimated it would fill over 7,000 Olympic swimming pools or weigh as much as 1.8 million cars.

Although Sydney recycled 1.5 million tonnes of C&I waste in 2006–07, about 2 million tonnes of C&I waste, including wood, food, plastics, paper and cardboard, still ended up in landfills. It is estimated that the 2,223,856 tonnes of C&I waste disposed to landfill in Sydney would fill over 7,000 Olympic swimming pools.

The gatehouse survey recorded and analysed data for vehicle numbers, type and tonnage delivered and industry sectors where the mixed loads and single material loads were collected.

At six landfills surveyed for two days, 655 vehicles delivered a total of 3,135 tonnes of C&I mixed and single material loads and 255 vehicles delivered transfer station loads. Only mixed and single material loads were visually assessed.

At six transfer stations surveyed for two days, a total of 2,054 tonnes of mixed C&I and single material loads were delivered by 1,022 vehicles. These loads were visually assessed on delivery at the transfer stations.

By weight, bulk-bin trucks (32%) and front-lift trucks (31%) were the two most common types of trucks used to deliver C&I waste to landfills and transfer stations. Front-lift vehicles delivered 84% by weight of the waste generated by the mixed small to medium-sized enterprises (SMEs). Bulk-bin trucks delivered 64% by weight of manufacturing sector waste.

Composition of single material loads in the C&I waste stream

The composition of single material loads was based on the data obtained from the on-line Waste Contributions Monthly Report (WCMR), as submitted by licensed waste disposal facilities in Sydney for 2007-08.

The Single material loads in the C&I waste stream are mainly made up of **contaminated soil** (55%) and **residues** from processing sites (28%). Smaller quantities of **non-contaminated soil, glass, hazardous/special material** and **vegetation** also are delivered in single material loads.

Composition of mixed C&I loads

The **main** materials contained in the **mixed C&I loads** sent to landfills are **garbage bags** (18.7%), **wood** (16.0%), **food** (14.6%), **plastic** (12.5%), **paper and cardboard** (11.8%) **construction and demolition material** (9.6%), **textiles** (3.9%) and **vegetation** (3.1%). Chart 1 gives a detailed breakdown.

Chart 1 – Composition of mixed C&I Waste (with garbage bag as a category)
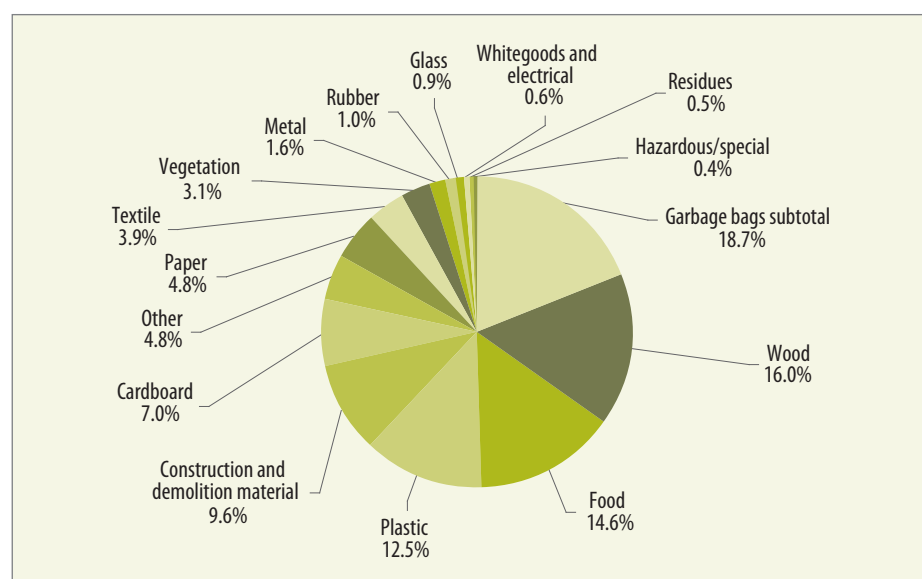
Comparison with the 2003 survey results

A comparison of the breakdown of **the mixed C&I waste stream** with the results of a similar survey done in 2003, as shown in Chart 2, reveals that food waste has increased substantially from 4% in 2003 to 14.6% in 2008. The other main types of material wood (from 13% to 16.0%) and plastics (from 9% to12.5%) have increased marginally. Textile and vegetation remain the same. Paper and cardboard have decreased marginally and construction and demolition (C&D) waste has halved.

Chart 2 – Comparison of mixed C&I waste stream, 2003 and 2008
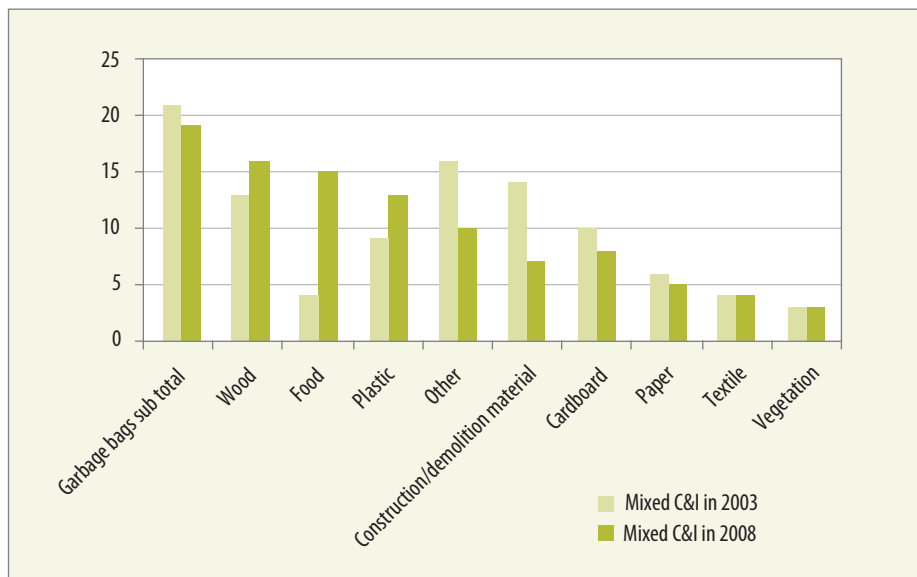
What was in the average C&I garbage bag?

Garbage bags from mixed loads sourced from eight pre-selected industry sectors, and delivered to five landfills and four transfer stations, were picked up and taken to a nominated location where the contents were sorted into predetermined material categories and weighed. Table 1 shows the average composition of the garbage bags.

Table 1 – Garbage bag composition

Categories	Total %	Categories	Total %
Paper	29.2%	Construction/demolition material	1.5%
Food	27.7%	Hazardous/special	1.4%
Plastic	15.1%	Rubber	0.7%
Other *	7.0%	Whitegoods/electrical	0.7%
Textile	4.5%	Wood	0.3%
Cardboard	4.1%	Residues	0%
Glass	3.8%	**Total**	**100%**
Metal	2.4%		
Vegetation	1.6%		

* The 'other' material category is made up of 3.2% of 'fines', 3.2% comprised of nappies, ceramic, fibreglass insulation etc and a liquid correction of 0.6%.

Composition of mixed C&I waste stream (garbage bag contents distributed)

As Chart 3 shows, when the garbage bag contents are distributed across the mixed load composition, the percentages of the **main** materials increase marginally: food (17.4%), wood (16.7%), plastic (16.9%), paper and cardboard (17.4%), construction and demolition material (9.8%), textile (5%) and vegetation (3.3%).

Chart 3 – Composition of mixed C&I waste with garbage bag contents distributed
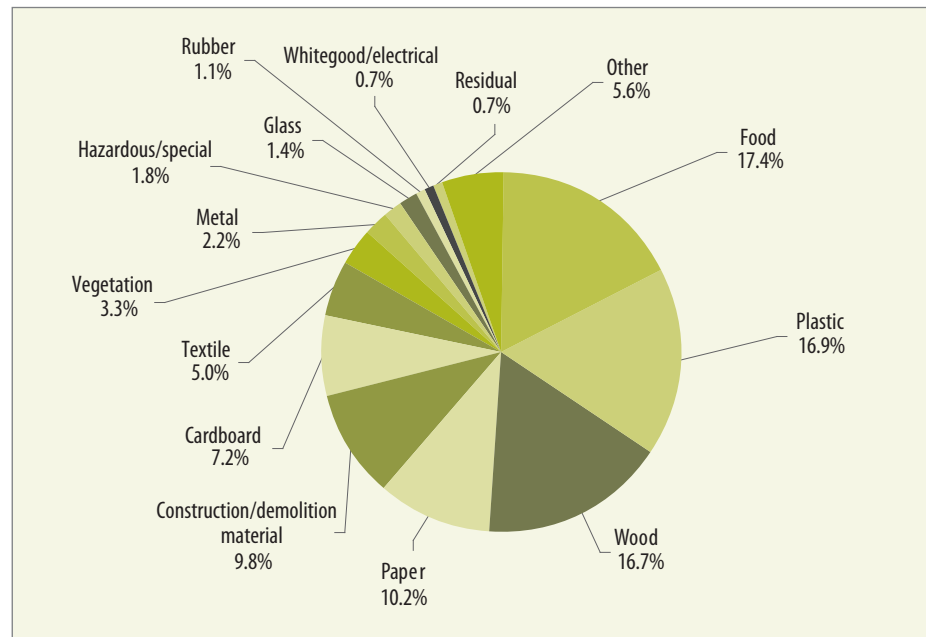
Using the main material categories in the **mixed C&I waste stream in 2007–08**, this translates into 303,164 tonnes of food, 301,067 tonnes of paper & cardboard, 293,741 tonnes of plastics, 288,366 tonnes of wood, 123,566 tonnes of C&D material, 87,548 tonnes of textiles and 56,482 tonnes of vegetation.

It is estimated the food waste would not only fill the Olympic Pool at Homebush nearly 200 times, it also equated to nearly 610 million meals, or enough for one 500 g meal each day for every Australian for a month.

The paper and cardboard consolidated category in the mixed C&I waste stream mainly consists of dry cardboard (over 100,000 tonnes), office paper (48,500 tonnes), wet cardboard (18,000 tonnes) and other paper (13,000 tonnes). All the paper and cardboard sent to landfill is estimated to be equivalent to cutting down 24,000 trees.

The wood in the mixed C&I waste stream is mostly from pallets (49% or 140,000 tonnes), MDF/chipboard (27% or 77,000 tonnes) and furniture (13% or 37,500 tonnes). If the wooden pallets were stacked on top of each other it is estimated they would make a stack 533 km high and reach beyond the orbiting International Space Station.

Plastic in the mixed C&I waste stream mainly consists of plastic bags and film (46% or 136,000 tonnes), hard plastic (29% or 85,000 tonnes), containers (22,000 tonnes), polystyrene (10,000 tonnes in huge volumes) and other plastic (40,000 tonnes). This would be enough to fill the Olympic Pool at Homebush 1000 times.

C&D materials in the mixed C&I waste stream are mainly made up of soil/clean fill (22% or 38,000 tonnes), rubble (20% or 34,000 tonnes), concrete/cement (16% or 28,000 tonnes), clay (11% or 20,000 tonnes) and plasterboard (10% or 18,000 tonnes)

Textiles in the mixed C&I waste stream mainly consist of carpets/underlay (40,000 tonnes), clothes (30,000 tonnes) and furniture (12,000 tonnes). This would be enough to fill the Olympic Pool at Homebush nearly 220 times, and there would be enough carpet to cover 2,167 basketball courts.

Vegetation in the mixed C&I waste stream is mainly from branches/grass clippings (94% or 53,000 tonnes).

Table 2 shows the breakdown of the C&I waste stream overall (mixed C&I loads + Single material loads).

Degradable organic carbon material disposed to landfill in Sydney is estimated to be 60% (one million tonnes in 2006-07) and packaging material is at 18% (320,000 tonnes) of the mixed C&I waste stream.

Table 2 – Breakdown of C&I waste stream overall (garbage bag contents distributed)

Consolidated material composition categories	2007–08 Total	
	Tonnes	**(%)**
Hazardous/special (mainly contaminated soil)*	309,579	13.9%
Food	303,855	13.6%
Plastic	293,925	13.2%
Wood	288,366	13.0%
Paper	177,501	8.0%
Construction/demolition material	170,834	7.7%
Other	146,351	6.6%
Residues	135,858	6.1%
Cardboard	126,367	5.7%
Textile	87,746	3.9%
Vegetation	75,752	3.4%
Glass	40,074	1.8%
Metal	33,220	1.5%
Rubber	21,774	1.0%
Electrical/electronic equipment	12,653	0.6%
Total	**2,223,856**	**100%**

* Contaminated soil from excavation could be potentially reclassified as construction and demolition waste rather than C&I waste from 2008-09. This will directly impact on the composition of the single material loads and the overall C&I waste stream.

Other key findings

Degradable organic materials constitute 60% of the **mixed** C&I waste stream, which amounts to over one million tonnes of carbon-based material contributing greenhouse gas emissions. Degradable organic material in the **overall** C&I waste stream amounts to 48%.

Packaging materials constitute 18% (320,000 tonnes) of the **mixed** C&I waste stream, which highlights the need to improve performance in manufacturing and service industry practices to reduce packaging material use, and increase reuse and recycling. Packaging material in the **overall** C&I waste stream amounts to 15%.

Who generates C&I waste?

Among the industry sectors generating wastes in Sydney, mixed SMEs are the largest contributor (45%) followed by manufacturing (18%), retail trade (7%), property and business services (6%) and construction (5%). Chart 4 shows the industry sector breakdown.

Chart 4 – Industry sector breakdown
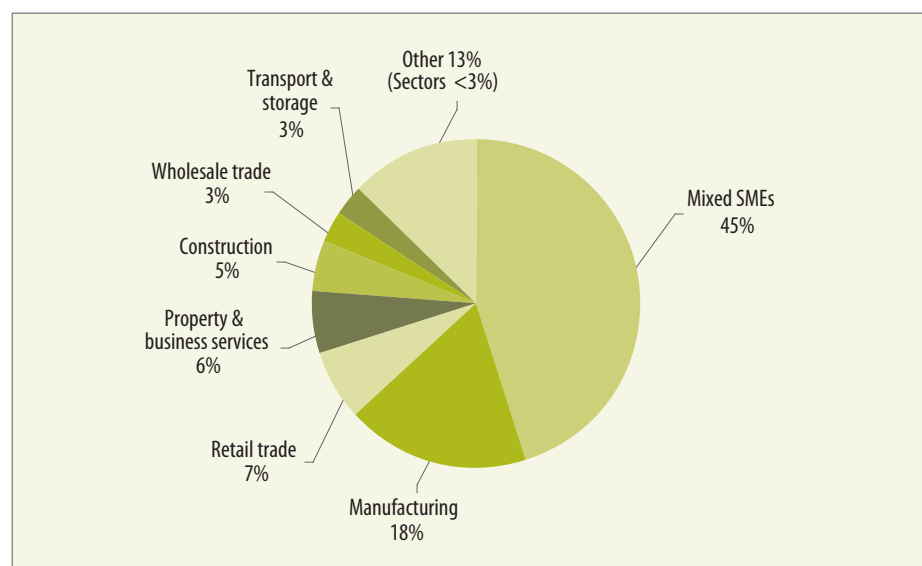
Analysis of the mixed C&I waste stream by industry

A surprising 31% of **SME** waste is food and kitchen waste followed by paper and cardboard (23%), plastics (18%) and wood (9%). The garbage bag component of 28% is the highest among the industry sectors surveyed.

Manufacturing sector waste mainly consists of plastic (21%), wood (20%), paper and cardboard (15%) and food (12%). The garbage bag component is about 8%.

Retail sector waste is mainly made up of food (35%), paper and cardboard (18%) with wood and plastic each 12%. The garbage bag content was 24% and contributed substantial food waste into the stream generated by this sector.

Property and business sector waste contains a substantial quantity of construction and demolition materials (35%), wood (27%) and paper and cardboard and plastics each 6%. The garbage bag content was small at 2.5%.

The main way we dispose of waste from our homes, businesses and industry throughout Australia is to send it to landfill. Each year, millions of tonnes of waste from businesses and industry in Sydney end up in landfill. As much of the waste comes from organic carbon-based materials like food, wood, paper and cardboard, it eventually breaks down in landfill and emits carbon dioxide and methane into the atmosphere.

1 Introduction

If we reuse or recycle materials, instead of sending them to landfill, we will benefit from conserving resources, saving water and energy, reducing carbon pollution, saving on landfill disposal space and reducing disposal costs.

Water and energy are needed to transform virgin resources into materials to make goods. The energy may, for example, be electricity from coal-fired power stations, which creates greenhouse gases. Recycling materials and substituting them for virgin materials in products can reduce greenhouse gas emissions because using recycled materials generally demands less energy[1]. Recycled paper, metals and plastics provide particularly good savings.

There is strong support for recycling in Australia, and governments and industry alike encourage it. Recycling has less environmental impact than conventional waste disposal, such as landfill.

The NSW *Waste Avoidance and Resource Recovery Strategy 2007* (WARR) provides a framework for conserving as much as possible of our natural resources and minimising environmental harm from waste management and disposal of solid waste. Its target is to recover 63% of the C&I Waste Stream in NSW by 2014.

In 2006–07, the estimated recycling rates for C&I waste in NSW and the Sydney Metropolitan Area (Sydney) were 44% and 42%[2], respectively. This is an increase from the 2000 baseline rate of 28% and the 2004-05 rate of 35% for Sydney. Although Sydney recycled 1.5 million tonnes of C&I waste in 2006-07, over two million tonnes of C&I waste, including wood, food, plastics, paper and cardboard, still ended up in landfills. In total NSW recycled 2.3 million tonnes of C&I waste the same year, and nearly three million tonnes went to landfills.

In 2007–08, a total of 2,223,856 tonnes of C&I waste was sent to landfill in Sydney. The waste was in two categories, mixed C&I loads of which 1,737,594 tonnes was delivered to landfill directly and via transfer stations. The remaining 486,262 tonnes were segregated, single material loads directly delivered to landfill.

A compositional visual assessment of the C&I Waste Stream in Sydney was last done in 2003; a weight-based garbage bag survey was carried out in 2005. In 2008, the Department of Environment, Climate Change and Water NSW (DECCW) used field surveys to get a clearer and more accurate understanding of what is in C&I waste.

Between June and August 2008, DECCW surveyed loads of mixed C&I waste that arrived at six landfills and six transfer stations in Sydney. This included visually assessing C&I loads at the selected 12 waste sites, and sorting by weight garbage bags generated by eight selected industry sectors that were dropped off at nine of the sites.

1 Carre Andrew, Jones Ian, Bontick Paul-Antoine and Di-Mauro Hayes Glenn June 2009, *Extended Environmental Benefits of Recycling (EEBR) Project*, Centre for Design, RMIT University, p12.
2 *Waste Avoidance and Resource Recovery Progress Report 2008* on DECCW website:
   www.environment.nsw.gov.au/resources/warr/09155WARRreport08.pdf

2 Key findings of the C&I waste stream survey

The 2008 C&I Waste Survey was designed to find out what was in the waste stream, which materials accounted for most of the waste, and the waste materials generated by different industry sectors.

The survey methodology is described in Appendix 1.

Visual assessment of mixed C&I loads sent to six landfills and at six transfer stations, plus the weight-based garbage bag survey, have provided a profile of the C&I waste stream in Sydney. When the 2007–08 tonnage for Sydney is also factored in, there is now substantial information about the C&I waste stream in Sydney.

The gatehouse surveys at the 12 sites on the days of the survey have provided information on C&I waste source types, geographical locations and delivery vehicle types. DECCW has used the information to generate industry-specific waste profiles, define a regional split for waste generation and highlight potential interception points for resource recovery.

The key findings from the visual assessment of the C&I loads and the garbage bags sorted by weight are summarised in the snapshot that follows. See Appendix 2 for detailed findings.

Composition of mixed loads

The survey team visually assessed mixed loads received at six landfills and from six transfer stations and identified garbage bags as a category. Table 3 shows the breakdown of material categories. Table 4 shows the breakdown of consolidated material categories.

Table 3 – Mixed C&I waste – garbage bag as a category

Material composition categories	2007–08 Total	
	Tonnes	**(%)**
Garbage bags	324,067	18.7%
Food/kitchen	229,958	13.2%
Wood – pallets/other	139,218	8.0%
Plastic – bags and film	91,598	5.3%
Plastic – hard	90,084	5.2%
Compacted dry cardboard	81,793	4.7%
Wood – MDF/chipboard	79,554	4.6%
Other	68,460	3.9%
Paper – all other	67,421	3.9%
Vegetation – branches/grass clips	50,574	2.9%
Wood – furniture	36,251	2.0%
Rubble >150 mm	33,135	1.9%
Soil/clean fill	30,699	1.8%
Textile – carpet/underlay	30,224	1.7%
Concrete/cement	29,455	1.7%
Metal – ferrous	25,412	1.5%
Food – dense	23,109	1.3%
Textile – cloth	21,796	1.3%

Material composition categories	2007–08 Total	
	Tonnes	**(%)**
Plastic – other	21,786	1.3%
Loose dry cardboard	20,091	1.2%
Plasterboard	19,532	1.1%
Clay	19,454	1.1%
Paper – office	15,465	0.9%
Tiles	14,308	0.8%
Compacted wet cardboard	14,078	0.8%
Stormwater	11,172	0.6%
Textile – furniture	10,721	0.6%
Wood – fencing/board/pole (treated)	10,045	0.6%
Glass – plate	10,040	0.6%
Sawdust	9,217	0.5%
Electronics/electrical television etc.	8,531	0.5%
Rubber – other	8,512	0.5%
Bricks	8,374	0.5%
Polystyrene/foam	8,360	0.5%
Rock	7,728	0.4%
Hazardous/special – chemical/clinical	6,218	0.4%
Plastic – recyclable containers	5,557	0.3%
Wood – fencing/board/pole (untreated)	5,532	0.3%
Rubber – tyres/tubes	5,380	0.3%
Glass – containers/other	5,253	0.3%
Foundry sand	4,812	0.3%
Loose wet cardboard	4,650	0.3%
Sludge	4,116	0.2%
Vegetation – tree stumps/logs	3,675	0.2%
Textile – leather/other	3,401	0.2%
Rubber – shredded tyres	2,798	0.2%
Textile – mattress	2,362	0.1%
Metal –non-ferrous	2,298	0.1%
Christmas decorations	1,931	0.1%
Compacted dry cardboard production spoils	1,529	0.1%
Insulation	1,519	0.1%
Waxed cardboard	1,465	0.1%
Whitegoods – washing machine/fridges	1,191	0.1%
Fibreglass	853	< 0.1%
Animals	764	< 0.1%
Sand	519	< 0.1%
Ceramic	441	< 0.1%
Computer/office equipment	392	< 0.1%
Hazardous/special – light globes	270	< 0.1%
Asphalt	240	< 0.1%
Dirt	152	< 0.1%
Loose dry cardboard production spoils	54	< 0.1%
Batteries	0	< 0.1%
Toner cartridges	0	< 0.1%
Total	**1,737,594**	**100%**

Table 4 – Mixed C&I loads main categories

Composition of consolidated categories	2007–08 Total	
	Tonnes	**(%)**
Garbage bags sub total	324,067	18.7%
Wood	279,817	16.0%
Food	253,067	14.6%
Plastic	217,385	12.5%
Construction/demolition material	165,968	9.6%
Cardboard	122,195	7%
Other	84,233	4.8%
Paper	82,886	4.8%
Textile	68,504	3.9%
Vegetation	54,249	3.1%
Metal	27,710	1.6%
Rubber	16,690	1%
Glass	15,293	0.9%
Whitegoods/electrical	10,114	0.6%
Residual	8,928	0.5%
Hazardous/special	6,488	0.4%
Total	**1,737,594**	**100%**

Garbage bags as a category accounted for 18.7% of the mixed C&I waste stream. The other main categories are food, wood, plastic, paper and cardboard combined and textiles. See Appendix 2 for a more detailed breakdown. Chapters 4–9 discuss each of the key materials.

Average garbage bag composition

The survey team picked up garbage bags from mixed loads sourced from eight pre-selected industry sectors delivered to five landfills and four transfer stations and took them to a nominated location where they sorted and weighed the contents into pre-determined categories.

Table 5 shows the average composition of the garbage bags. See Appendix 2 for the industry-specific composition of garbage bags.

Table 5 – Average composition of garbage bags

Category	% (by weight)
Paper	29.2%
Food	27.7%
Plastic	15.1%
Other *	7.0%
Textile	4.5%
Glass	3.8%
Cardboard	4.1%
Metal	2.4%
Vegetation	1.6%
Construction/demolition material	1.5%
Hazardous/special	1.4%
Rubber	0.7%
Whitegoods/electrical	0.7%
Wood	0.3%
Residual	0%
Total	**100%**

The 'other' materials are made up of 'fines' (3.2%); nappies, ceramics, fibreglass insulation (3.2%); and a liquid correction (0.6%).

Composition of mixed C&I waste – garbage bag contents apportioned

The actual material breakdown of the mixed C&I waste stream was established by apportioning the garbage bag breakdown against the corresponding material categories. Table 6 shows this breakdown.

A more detailed breakdown is shown in Table A2–3 in Appendix 2.

Table 6 – Composition of mixed loads — garbage bag contents distributed

Consolidated material composition categories	2007–08 Total	
	Tonnes	**(%)**
Food	303,164	17.4%
Plastic	293,741	16.9%
Wood	288,366	16.7%
Paper	177,501	10.2%
Construction/demolition material	170,400	9.8%
Cardboard	125,746	7.2%
Other	97,866	5.6%
Textile	87,548	5.0%
Vegetation	56,482	3.3%
Metal	37,631	2.2%
Hazardous/special	30,368	1.8%
Glass	24,632	1.4%
Rubber	19,527	1.1%
Whitegoods/electrical	12,653	0.7%
Residues	11,969	0.7%
Total	**1,737,594**	**100%**

Composition of single material loads

DECCW compiled the composition of the single material loads in the C&I waste stream in Sydney from the Waste Contributions Monthly Report (WCMR), which records data submitted by disposal facilities in Sydney. The WCMR provided useful information on segregated single material loads sent to landfills and a regional split on disposal tonnages across Sydney.

Table 7 shows the breakdown of consolidated categories that individually constitute >2.0%. Table 8 shows the breakdown of material categories weighing <2.0%.

Table 7 – Breakdown of single material loads (consolidated)

Consolidated material composition categories	2007–08 Total	
	Tonnes	(%)
Contaminated soil	265,365	55%
Residues[3]	135,811	28%
Soil – not venm[4] nor contaminated	20,246	4%
Glass	15,442	3%
Pharmacy or clinical	15,137	3%
Asbestos (N220)	13,916	3%
Wood, trees or timber	10,812	2%
Other*	9,533	2%
SINGLE MATERIAL LOAD sub-total	**486,262**	**100%**

Table 8 – Breakdown of the 'other' material

*Other (includes)	
Veterinary waste	<1%
Tyres	<1%
Grease trap waste	<1%
Composts or mulches	<1%
Commingled recyclables	<1%
Ash	<0.2%
Food or kitchen	<0.2%
Paper or cardboard	<0.2%
Garden or vegetation	<0.2%
Textiles/rags	<0.2%
Plastic	<0.2%
Dredging spoil	<0.2%
Plasterboard	<0.2%
Car bodies (ferrous)	<0.2%
Paint	<0.2%
Wool wash	<0.2%
Other sub-total	**2%**

3 Residues – residues and rejects from various processing plants, including material recycling facilities (MRFs), metal recyclers.

4 Venm – virgin excavated natural material.

Composition of the overall C&I waste stream

Table 9 shows the composition of the overall C&I waste stream when the material composition determined for the mixed C&I waste stream is combined with the garbage bag contents and the segregated single material loads, as reported online by the disposal facilities.

Table 9 – Composition of overall C&I waste stream — garbage bag contents distributed

Aggregated composition categories 07–08	2007–08 Total	
	Tonnes	(%)
Hazardous/special*	309,579	13.9%
Food	303,855	13.6%
Plastic	293,925	13.2%
Wood	288,366	13%
Paper	177,501	8%
Construction/demolition material	170,834	7.7%
Other	146,351	6.6%
Residues	135,858	6.1%
Cardboard	126,367	5.7%
Textile	87,746	3.9%
Vegetation	75,752	3.4%
Glass	40,074	1.8%
Metal	33,220	1.5%
Rubber	21,774	1%
Electrical/electronics/equipment	12,653	0.6%
Total	**2,223,856**	**100%**

* Hazardous/special material is mainly made up of contaminated soil (86%).

Garbage bag retained as a separate category

Table 10 shows the breakdown of the consolidated categories within the overall C&I waste stream with garbage bag kept as a separate category.

Table 10 – Composition of overall C&I waste stream garbage bag as a category

Material categories	2007–08 Total	
	Tonnes	(%)
Garbage bags	324,067	14.6%
Wood–timber	279,817	12.6%
Food	253,758	11.4%
Plastics	217,569	9.8%
Cardboard	122,815	5.5%
Paper	82,886	3.7%
Vegetation	67,413	3%
Other*	875,531	39.4%
Total	**2,223,856**	**100%**

* The 'other' category includes hazardous, special, residues and other material.

Composition of overall C&I waste by landfill type

C&I waste is mainly disposed of at General solid waste putrescible and General solid waste non-putrescible landfills in Sydney and at Woodlawn Bio-reactor Landfill at Goulburn.

General solid waste putrescible landfills are licensed to take putrescible waste, that is waste likely to rot or become putrid. A total of 863,412 tonnes of overall C&I waste was sent to General solid waste putrescible landfills in 2007-08 (38.8%).

General solid waste non-putrescible landfills accept only non-putrescible and inert waste. A total of 1,354,757 tonnes was sent to General solid waste non-putrescible landfills in 2007-08 (60.9%).

A total of 5687 tonnes of C&I waste were sent to licensed liquid waste and incineration facilities in Sydney in 2007-08 (0.3%).

Composition of mixed C&I waste disposed at landfills

The mixed C&I waste received at general solid waste putrescible landfills contains mainly food (29%), paper and cardboard (18%), plastic (14%) and wood (13%). Chart 5 shows the composition of mixed C&I waste disposed of at General solid waste putrescible landfills. The total mixed C&I waste disposed of at General solid waste putrescible landfills is 816,231 tonnes (47%).

Chart 5 – Composition of mixed C&I waste at General solid waste putrescible landfills
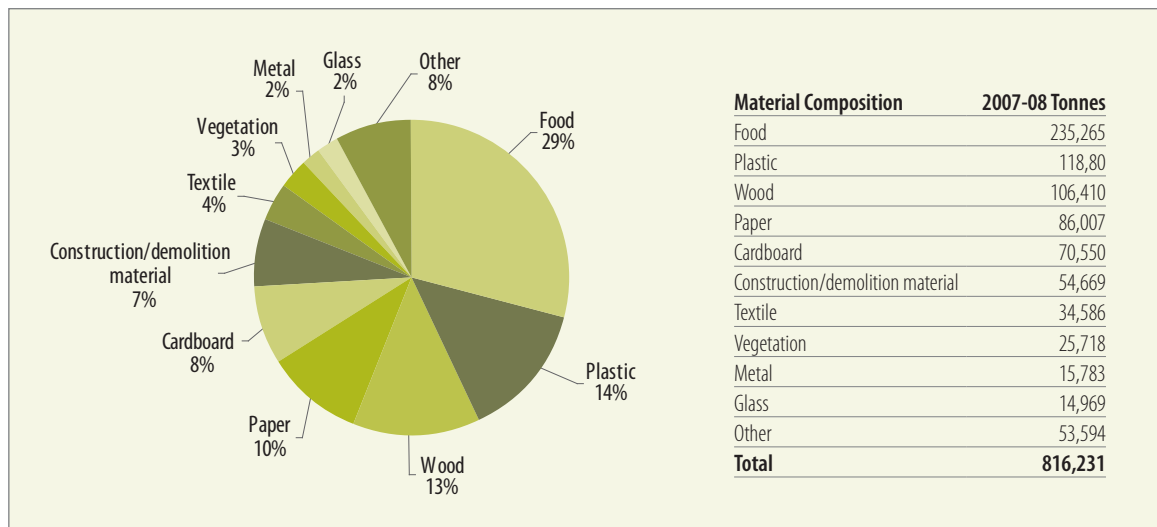
Material Composition	2007-08 Tonnes
Food	235,265
Plastic	118,80
Wood	106,410
Paper	86,007
Cardboard	70,550
Construction/demolition material	54,669
Textile	34,586
Vegetation	25,718
Metal	15,783
Glass	14,969
Other	53,594
Total	**816,231**

The mixed C&I waste received at General solid waste non-putrescible landfills is mainly made up of wood (20%), plastic (19%) and paper and cardboard (16%) and construction and demolition material (12%). Chart 6 shows the composition of mixed C&I waste disposed of at General solid waste non-putrescible landfills. The total mixed C&I disposed of at General solid waste non-putrescible landfills is 924,820 tonnes (53%).

A total of 3,457 tonnes of mixed C&I waste is directed to incinerators.

Chart 6 – Composition of mixed C&I waste at General solid waste non-putrescible landfills

Material categories	2007-08 Tonnes
Wood	182691
Plastic	175668
Construction/demolition material	116367
Paper	91771
Food	67978
Other	62472
Cardboard	53156
Textile	53147
Vegetation	30892
Hazardous/special	27074
Metal	21940
Rubber	13983
Residual	12044
Glass	9683
Whitegoods/electrical	5954
Total	**924820**
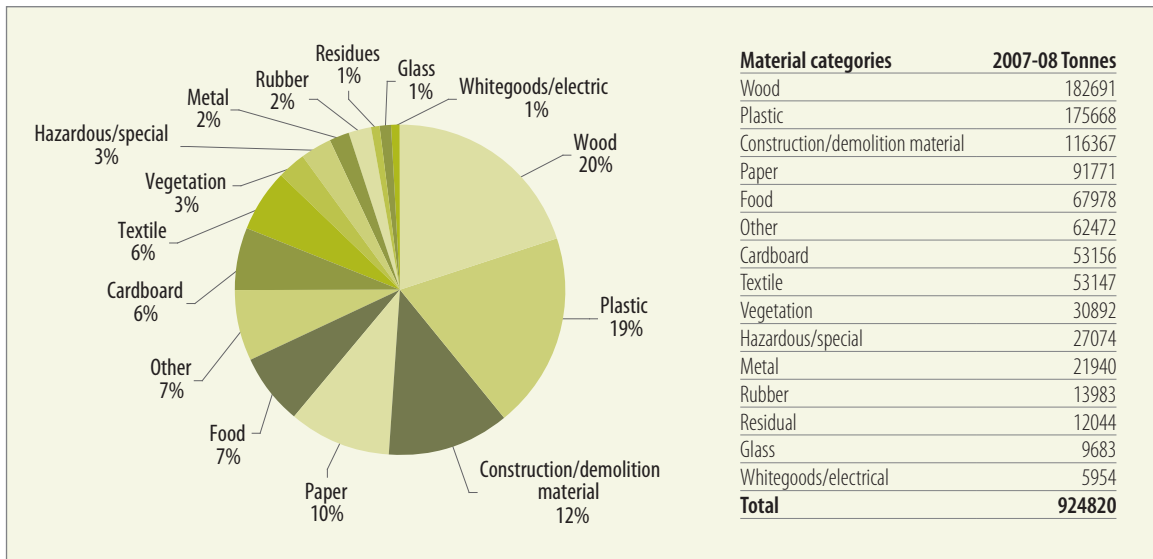
Composition of single material loads of C&I Waste disposed at landfills

The single material loads received at General solid waste putrescible landfills is mainly made up of Asbestos (29%), residues from processing plants (18%), pharmaceutical related material (17%) and glass (14%). Chart 7 shows the composition of the single material loads disposed to General solid waste putrescible landfills.

Chart 7 – Composition of single material loads of C&I waste disposed at General solid waste putrescible landfills
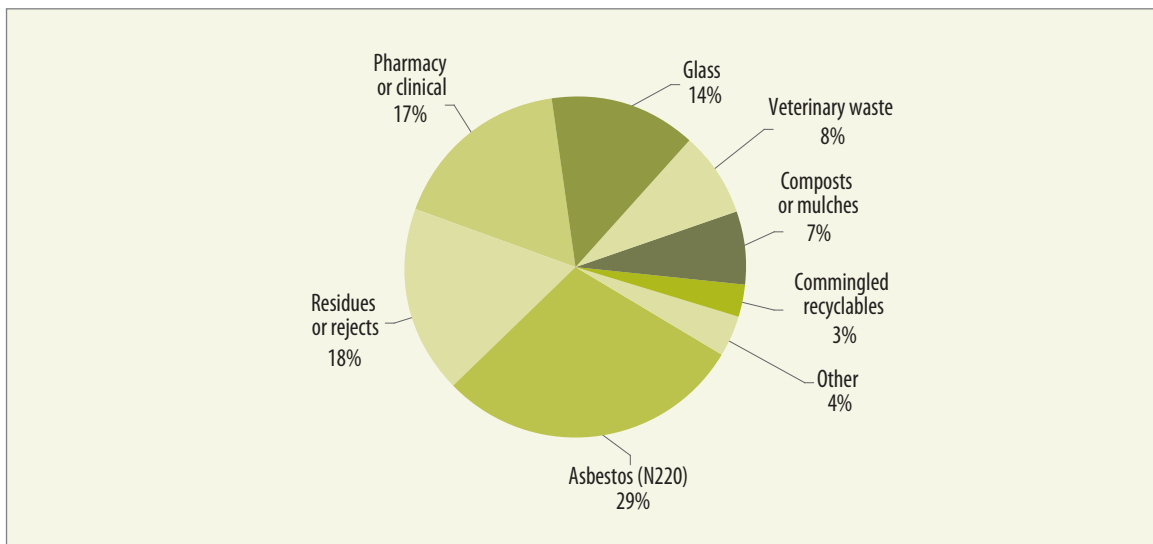
The single material loads received at General solid waste non-putrescible landfills are mainly made up of contaminated soils (61%) and residues or rejects (30%) from material recycling facilities (MRFs) and other processing plants including metal shredders. Chart 8 shows the composition of single material loads disposed to General solid waste non-putrescible landfills.

Chart 8 – Composition of single material loads of C&I waste disposed at General solid waste non-putrescible landfills
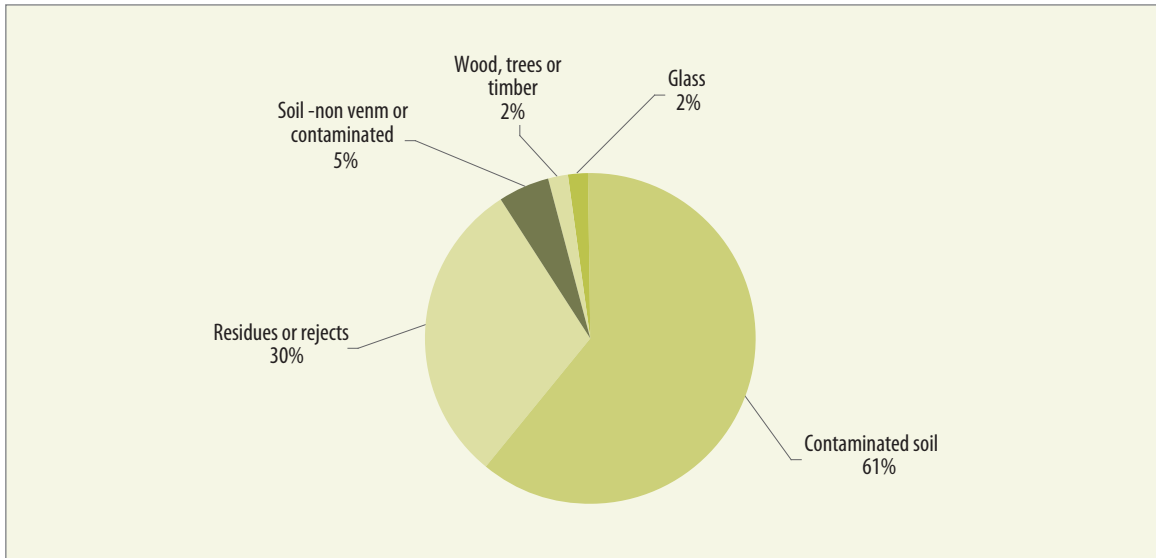
Composition of C&I waste at transfer stations

Mixed C&I loads were assessed on delivery at transfer stations. Chart 9 shows a combined composition.

Chart 9 – Composition of mixed C&I waste at transfer stations
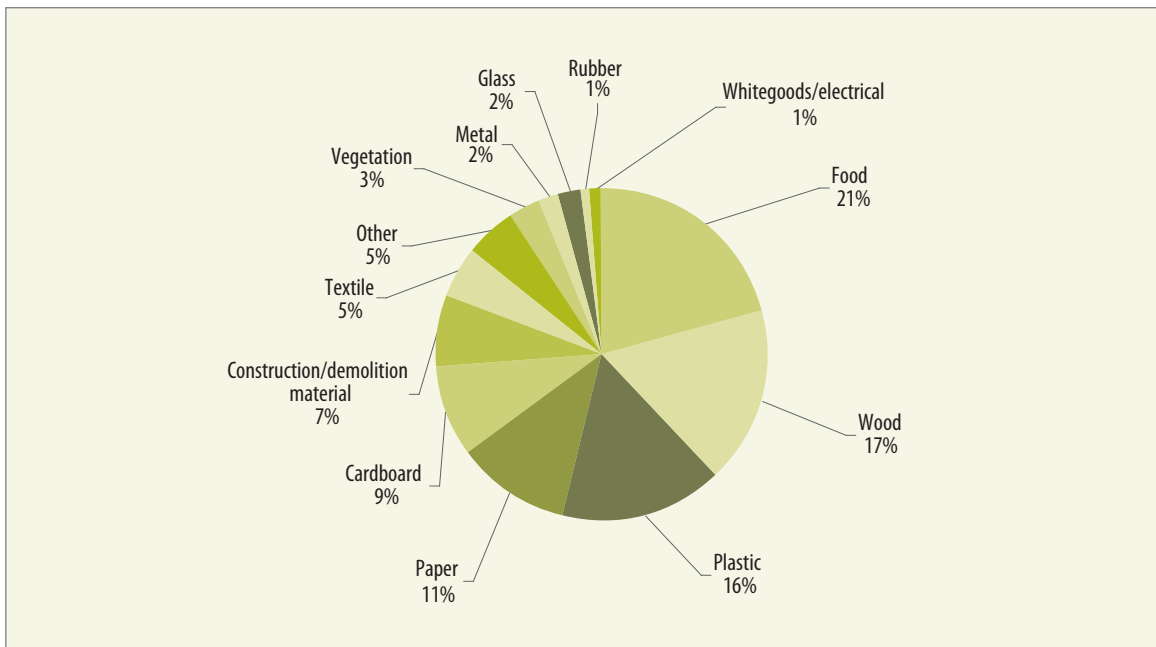
Organic content in the mixed C&I waste stream

Organic materials in the mixed C&I waste stream constitute 60% of the total (1,045,389 tonnes).

Organic material composition in the mixed C&I waste stream

Table 11 shows the various material categories that make up the organic materials present in the mixed C&I waste stream (after garbage bag contents are distributed across).

Table 11 – Composition of organic material in the mixed C&I waste stream

Material composition categories	2007-08 Total (tonnes)	As a fraction of the organic component (%)
Food	303,164	29%
Wood	288,366	28%
Paper	177,501	17%
Cardboard	125,747	12%
Textile	87,548	8%
Vegetation	56,482	5%
Other organic	6,582	1%
Total organic component	**1,045,390**	**100%**

The food, wood, paper and cardboard, textiles and vegetation are the organic materials that lead to greenhouse gas emissions at landfills.

Organic material in the overall C&I waste stream

When combined with the single material loads, the organic material component in the overall C&I waste stream is 48% (1,063,562 tonnes out of 2,223,856 tonnes). Table 12 shows the various material categories that make up the organic material present in the overall C&I waste stream, including what is in garbage bags.

Table 12 – Organic material in the overall C&I waste stream

Material composition categories	2007-08 Total (tonnes)	As a fraction of the organic component (%)
Food	303,855	28.6%
Wood	288,366	27.1%
Paper	177,501	16.7%
Cardboard	126,367	11.8%
Textile	87,746	8.3%
Vegetation	75,752	7.1%
Other – organic	3,975	0.4%
Total organic component	**1,063,562**	**100%**

Organic material in the garbage bags

Refer Table A2-11 in Appendix 2 for a detailed breakdown of organic material in the garbage bags sorted from eight different industry sectors.

On average, 69% of a garbage bag's contents are organic material. Bags from the Health & Community Services sector contain the highest quantity of organic material (77%) and bags from the Hospitality sector contain the least (63%).

Food and kitchen waste accounts for close to one-third of the organic material in the garbage bags, and paper & cardboard are equivalent to another third.

Variations in material categories used to calculate methane emissions from landfill

The default, weight-based composition for C&I waste, used for reporting under the National Greenhouse and Energy Reporting Scheme (NGER) Act 2007[5], is taken from the *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines*[6], recently released by the Commonwealth Department of Climate Change (DCC).

The C&I composition in Sydney as determined from the survey and the NGERS material composition differed in some categories of materials, notably in the food and inert waste categories. Without examining the detailed methodologies and data sources behind the NGER values, it is not possible to identify specific differences in approach. Table 13 compares NGER and DECCW's material composition categories.

Table 13 – Comparison of NGERS default compositions to the 2008 C&I survey composition

C&I waste mix type	NGER 2008 C&I waste default %	NGER 2009 C&I waste default %	DECCW 2007/08 C&I waste: including contaminated soil %	DECCW 2007/08 C&I waste: excluding contaminated soil %
Food	6.0	21.5	13.7	15.5
Paper and paper board	55.0	15.5	13.7	15.5
Garden and park	3.0	4.0	3.1	3.6
Wood and wood waste	14.0	12.5	13.0	14.7
Textiles	2.0	4.0	3.8	4.3
Sludge	3.0	1.5	0.3	0.3
Nappies	0.0	0.0	0.0	0.0
Rubber and leather	1.0	3.5	1.1	1.3
Inert waste (including concrete, metal, plastic and glass)	16.0	37.5	51.4	44.8

The NGERS 2009 values are derived from waste audits in states and territories in Australia. The 2009 composition value is reduced from 55% to 15.5% paper and paperboard. In contrast, the default value for food has increased from 6% in 2008 to 21.5% in 2009, and inert waste has increased from 16% in 2008 to 37.5% in 2009. As default compositions in both 2008 and 2009 guidelines are unreferenced, it is difficult to

5   www.climatechange.gov.au/reporting/
6   www.climatechange.gov.au/reporting/guidelines/

say whether these variations (apart from the paper and paperboard category) are entirely the result of a readjustment of values in response to a more realistic figure for paper and paper board, or actual changes in waste composition over time (as reflected in audit results), or other factors.

Table A3 -1 in Appendix 3 gives the grouping of material sub-categories to harmonise the DECCW material categories with that under NGERS.

Packaging material in the C&I waste stream

Mixed C&I waste streams

Packaging materials constitute 18% of the mixed C&I waste stream. Close to half of the packaging material in the mixed C&I loads currently sent to landfills is the combined category of plastic bags and films (43.1%) followed by cardboard (39.8%) and recyclable glass, metal and plastic containers (14%). The recyclable containers in the mixed C&I waste amount to 45,000 tonnes or 2.5% of the mixed C&I waste stream. This is made up of plastic, glass, ferrous and non-ferrous metal and waxed cardboard containers.

Table 14 shows the make up of packaging material in the mixed C&I waste stream.

Table 14 – Breakdown of packaging material – mixed C&I waste stream

Material composition categories	2007-08 Total (tonnes)	As a fraction of the packaging component (%)
Plastic – bags & film	136,102	43.1%
Compacted dry cardboard	77,499	24.5%
Loose dry cardboard	25,998	8.2%
Plastic – recyclable containers	22,414	7.1%
Glass – containers/other	15,542	4.9%
Compacted wet cardboard	13,224	4.2%
Polystyrene/foam	9,732	3.1%
Loose wet cardboard	5,320	1.7%
Metal – ferrous (packaging)	3,448	1.1%
Metal – non ferrous (packaging)	2,984	0.9%
Waxed cardboard	2,181	0.7%
Compacted dry cardboard production spoils	1,254	0.4%
Loose dry cardboard production spoils	270	0.1%
Total	**315,968**	**100.0%**

The proportion of packaging material found in the overall C&I waste stream (including single material loads) reduces to 15% as a result of additional non-packaging material entering the stream as single material loads. The only notable packaging material that is delivered to landfills at present as single material loads is glass, which increases from 15,542 tonnes (mixed stream) to 40,074 tonnes (overall stream). Table 15 shows the breakdown of packaging material in the overall C&I waste stream.

Overall C&I waste stream

Table 15 – Breakdown of packaging material – overall C&I waste stream

Packaging materials		
Material composition categories	**2007-08 Total (tonnes)**	**As a fraction of the packaging component (%)**
Plastic – bags and film	136,102	39.9%
Cardboard – dry	105,022	30.8%
Glass	40,074	11.7%
Plastic – recyclable containers	22,414	6.6%
Cardboard – wet	18,544	5.4%
Polystyrene/foam	9,732	2.9%
Metal – ferrous (packaging)	3,448	1.0%
Metal – non-ferrous (packaging)	2,983	0.9%
Cardboard – waxed	2,181	0.6%
Paper or cardboard (mixed)	620	0.2%
Total	**341,120**	**100%**

Timber pallets are not included as a packaging material because they are not covered in the National Packaging Covenant [7].

Packaging material in garbage bags

Table A2–11 in Appendix 2 shows the breakdown of packaging material in the garbage bags sorted from eight different industry sectors.

On average, packaging material makes up 26% of a garbage bag. Bags from the Hospitality sector contain the highest quantity of packaging material (34%) and those from Health & Community services contain the least (22%).

The main packaging materials in the garbage bags in the C&I waste stream are containers (11%), plastic film (8%) and paper & cardboard (6%).

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7   www.environment.gov.au/settlements/waste/covenant/

Regional data for C&I waste in Sydney

To understand the geographical source of the C&I waste across Sydney, the data collected through the gatehouse surveys undertaken at all twelve sites was analysed and compiled against the regions and sub-regions listed in Table 16.

Table 16 – Description of regions within Sydney

Region (within Sydney)	Sub-region	Local government areas (within Sydney)
Inner Sydney	Sydney City	City of Sydney
	Inner West	Ashfield, Burwood, Canada Bay, Leichhardt, Strathfield
Southern Sydney	South	Kogarah, Hurstville, Canterbury, Rockdale, Sutherland, Marrickville
	East	Botany Bay, Randwick, Waverly, Woollahra
Northern Sydney	Inner North	Lane Cove, North Sydney, Ryde, Willoughby, Hunters Hill, Mosman
	North	Hornsby, Ku-ring-gai
	North East	Pittwater, Warringah, Manly
Western Sydney	West Central	Auburn, Bankstown, Fairfield, Holroyd, Parramatta
	North West	Baulkham Hills, Blacktown, Blue Mountains, Hawkesbury, Penrith
Macarthur	South West	Camden, Campbelltown, Liverpool

C&I waste source breakdown across Sydney

As the facilities surveyed do not represent some regions adequately, the data should be treated as indicative only. The low waste source figures for the Inner Sydney and Northern Sydney regions are because of the lack of facilities surveyed in those regions.

The 'Mixed' category (1%) shown in Charts 10 and 11 accounts for waste received from more than one region and any wastes received from outside Sydney have been accounted for under the category 'outside Sydney' (2%).

Chart 10 – Breakdown of waste source by region – mixed C&I waste stream
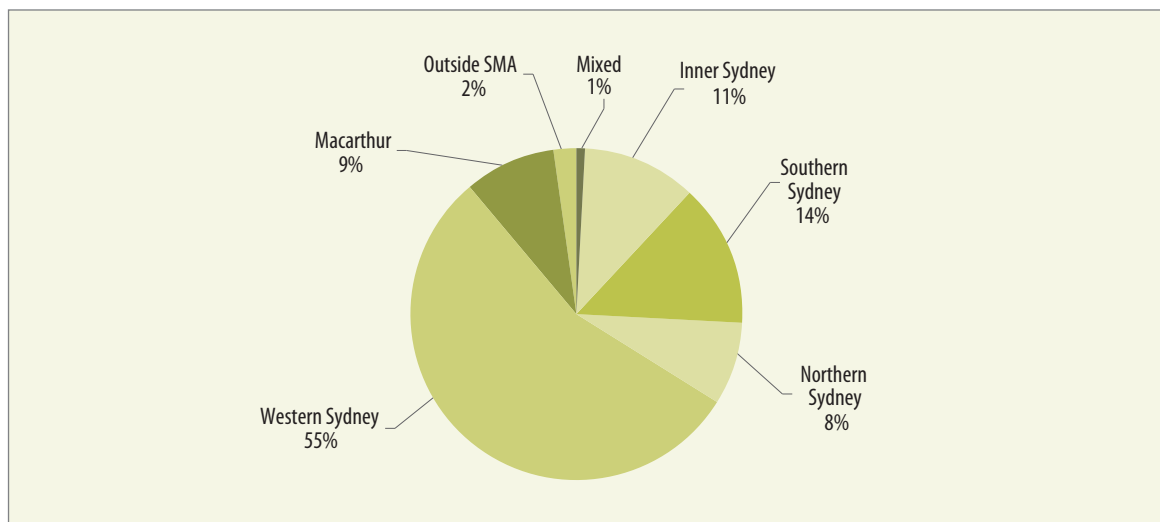
Chart 11 – Breakdown of waste source by sub-region – mixed C&I waste stream
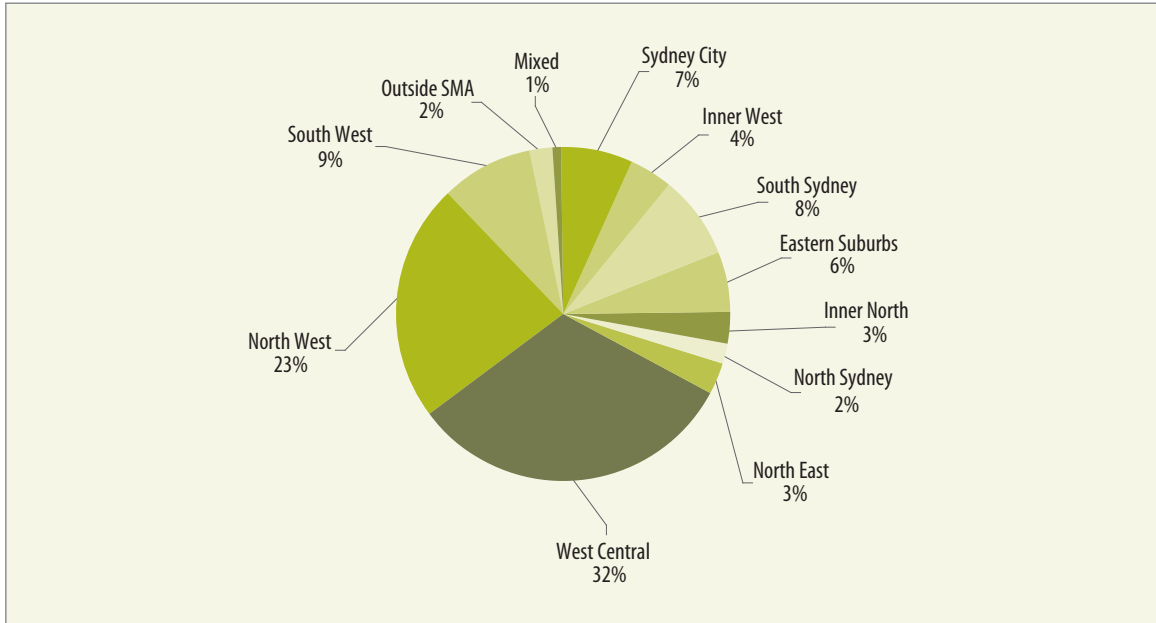
Overall C&I waste disposal in Sydney by region

Waste facilities are required to report on the waste they receive. DECCW used these reports to work out the breakdown of C&I waste disposed of at these facilities. More than half the waste generated in Sydney is disposed of in the Western Region. Facilities outside Sydney that receive waste include the Veolia Woodlawn Bio-reactor Landfill.

Chart 12 – Breakdown of overall C&I waste disposed to landfills – by region
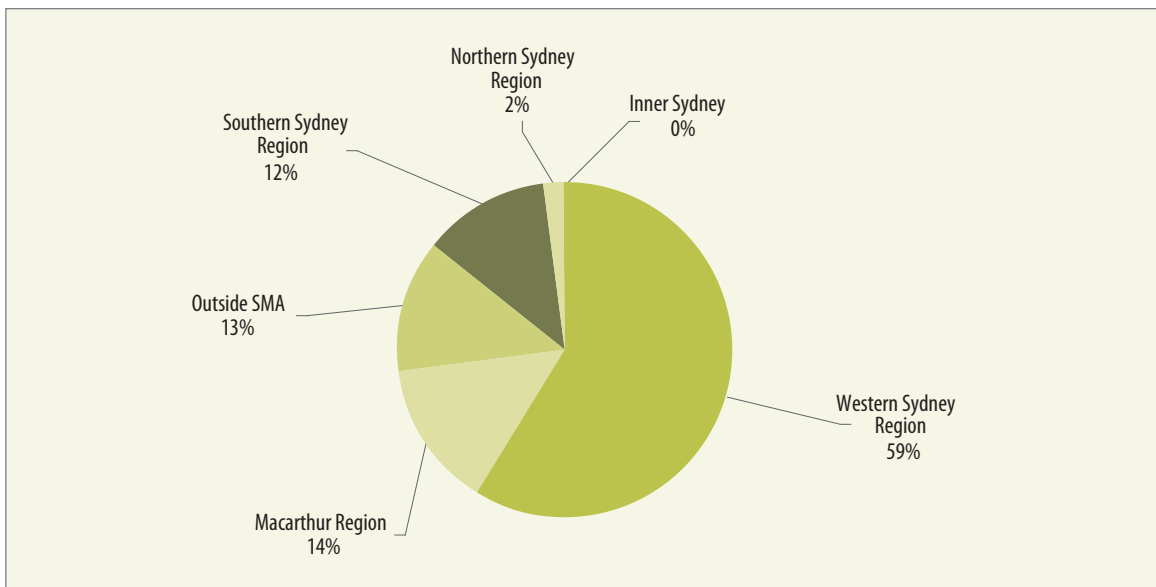
Chart 13 – Overall C&I waste disposed to landfills by sub-region

Northern Sydney (North East) Sub Region 2%
Northern Sydney (North West) Sub Region 1%
Western Sydney (Central West) Sub Region 6%
Southern Sydney (South) Sub Region 12%
Outside SMA 13%
Western Sydney (North West) Sub Region 52%
Macarthur Sydney (South West) Sub Region 14%
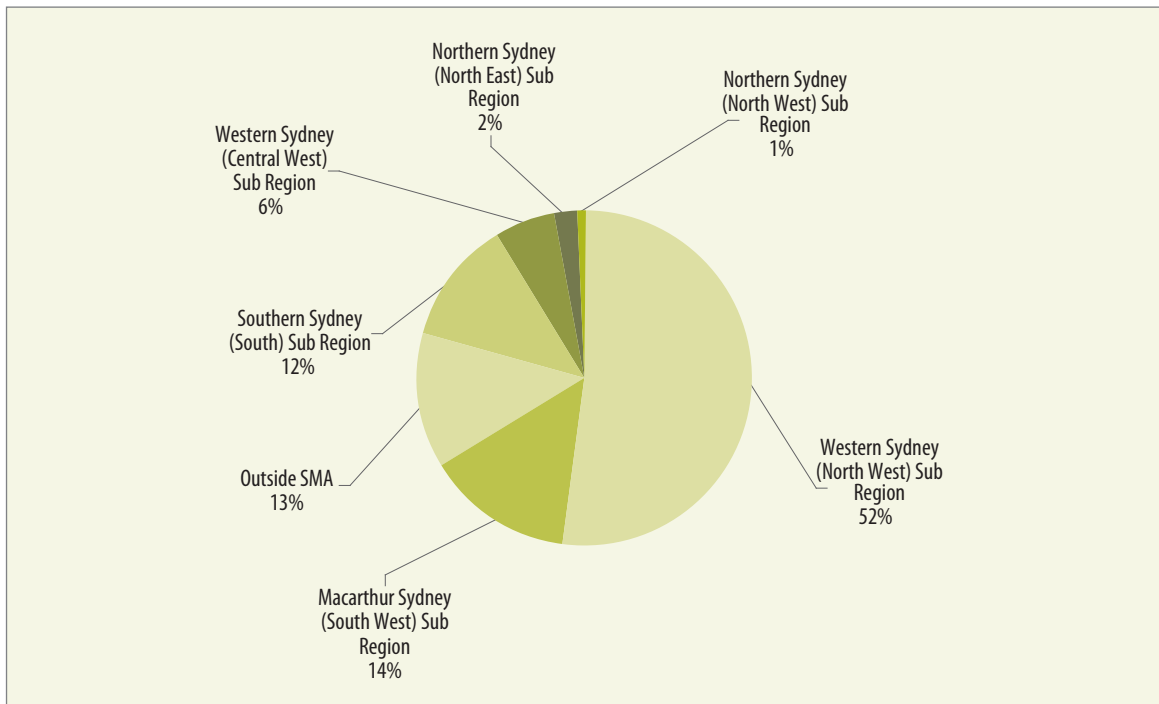
Composition of overall C&I waste disposed – by region

Charts 14–17 give the breakdown of the composition of overall C&I waste disposed at landfills in the five regions across Sydney.

Chart 14 – Southern Sydney Region – overall C&I waste stream

Other 8.1%
Cardboard 8.0%
Paper 9.7%
Wood 12.6%
Construction/ demolition material 6.0%
Textile 4.3%
Vegetation 3.8%
Plastic 12.8%
Metal 1.8%
Glass 1.7%
Hazardous/special 1.0%
Food 28.2%
Residual 0.2%
Rubber 0.8%
Electrical/electronics/ equipment 1.0%
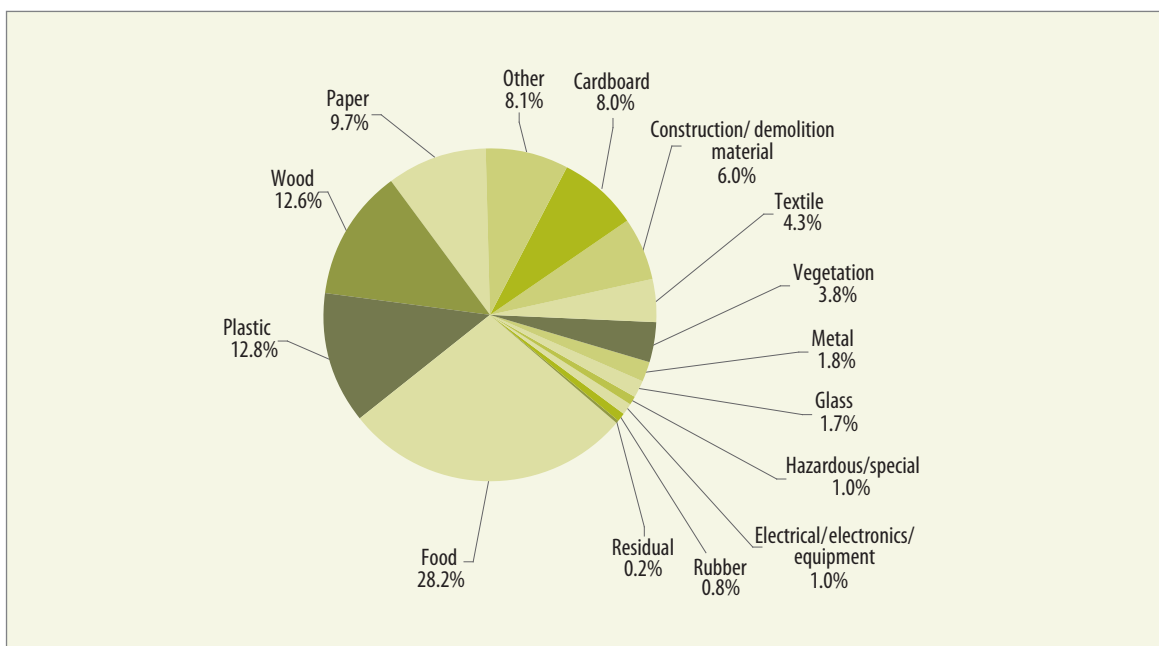
Chart 15 – North Sydney Region – overall C&I waste stream

Other 13.2%
Paper 7.3%
Vegetation 6.6%
Hazardous/special 5.8%
Cardboard 5.1%
Construction/ demolition material 14.2%
Textile 4.9%
Food 2.1%
Residual 1.7%
Metal 1.5%
Rubber 1.2%
Plastic 15.9%
Electrical/ electronics/ equipment 0.7%
Wood 19.3%
Glass 0.5%
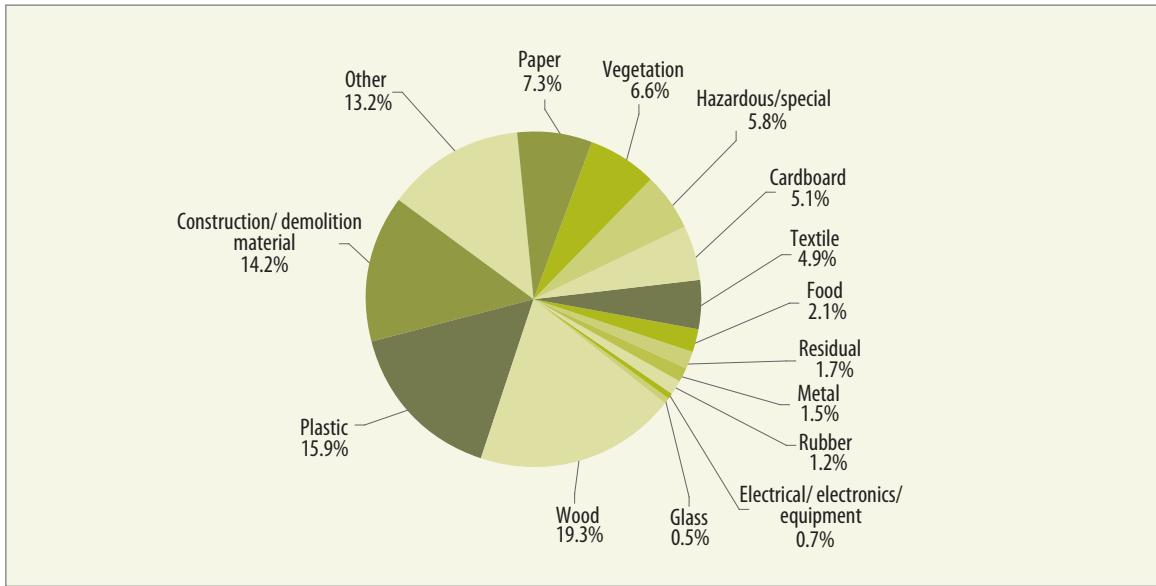
Chart 16 – Macarthur Region – overall C&I waste stream

Other 7.6%
Construction/demolition material 7.2%
Paper 7.1%
Wood 11.9%
Cardboard 4.9%
Textile 3.3%
Plastic 12.1%
Vegetation 3.3%
Glass 3.0%
Residual 1.8%
Metal 1.5%
Food 12.8%
Rubber 0.8%
Hazardous/special 22.2%
Electrical/electronics/ equipment 0.5%
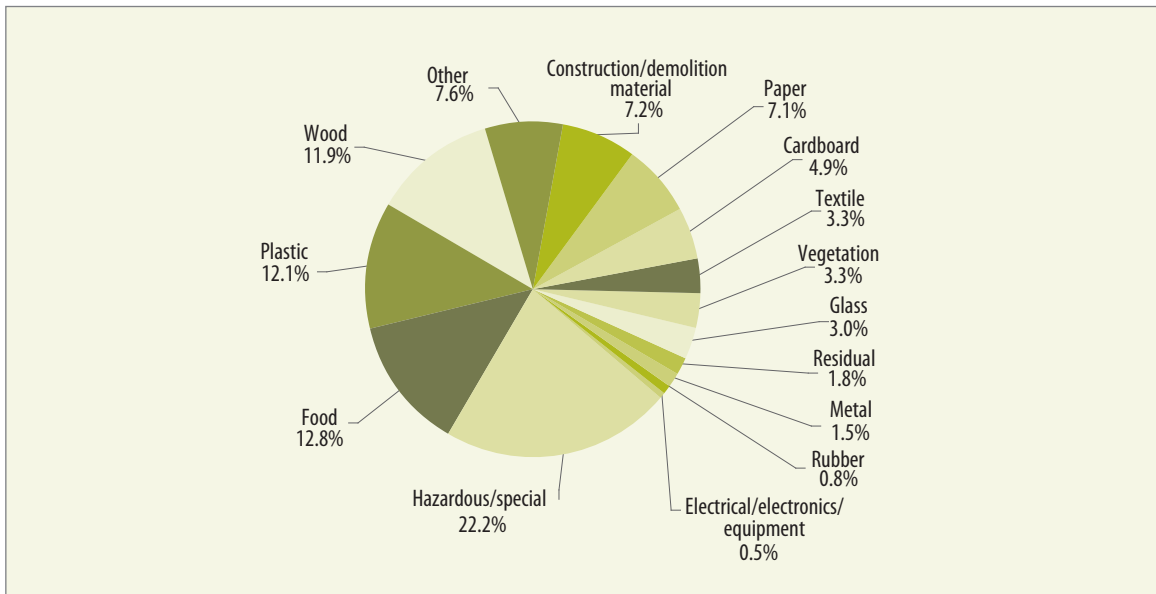
Chart 17 – Western Sydney Region – overall C&I waste stream

Construction/demolition material 8.1%
Paper 7.4%
Food 8.6%
Other 6.2
Residues 9.8%
Cardboard 4.7%
Textile 3.8%
Vegetation 3.4%
Wood 12.6%
Glass 1.6%
Metal 1.3%
Rubber 1.1%
Plastic 13.2%
Hazardous/special 17.8%
Electrical/electronics/equipment 0.4%
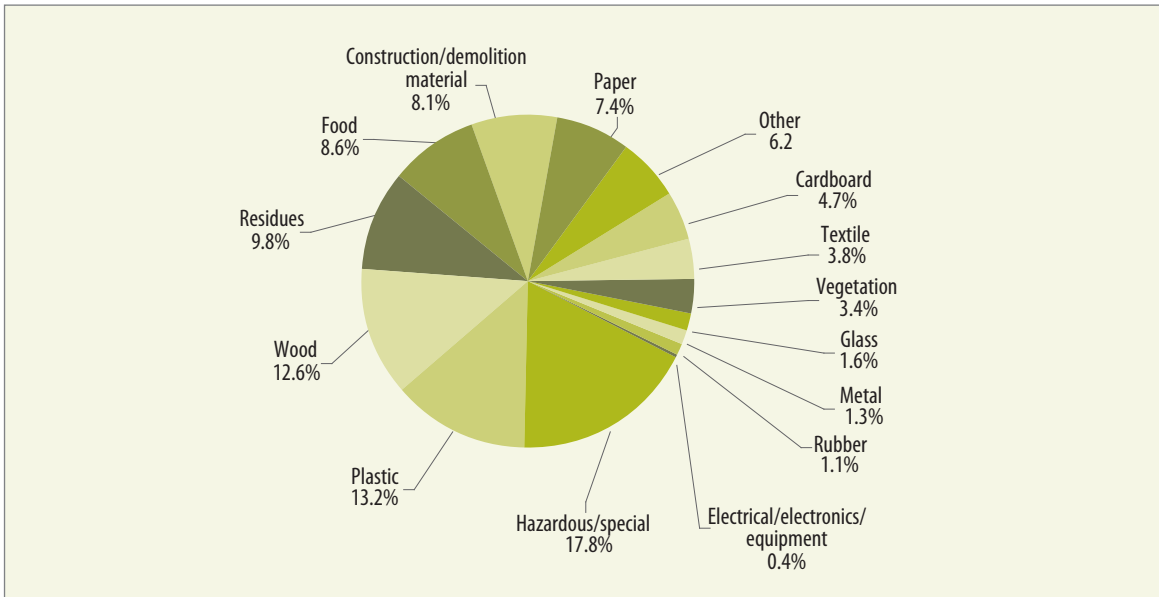
Chart 18 – Disposed outside Sydney – overall C&I waste stream

Paper 10.5%
Cardboard 9.3%
Construction/demolition material 7.2%
Plastic 15.1%
Textile 5.0%
Vegetation 2.8%
Wood 15.8%
Metal 2.2%
Glass 1.8%
Electrical/electronics/equipment 1.0%
Rubber 0.7%
Food 28.0%
Hazardous/special 0.6%
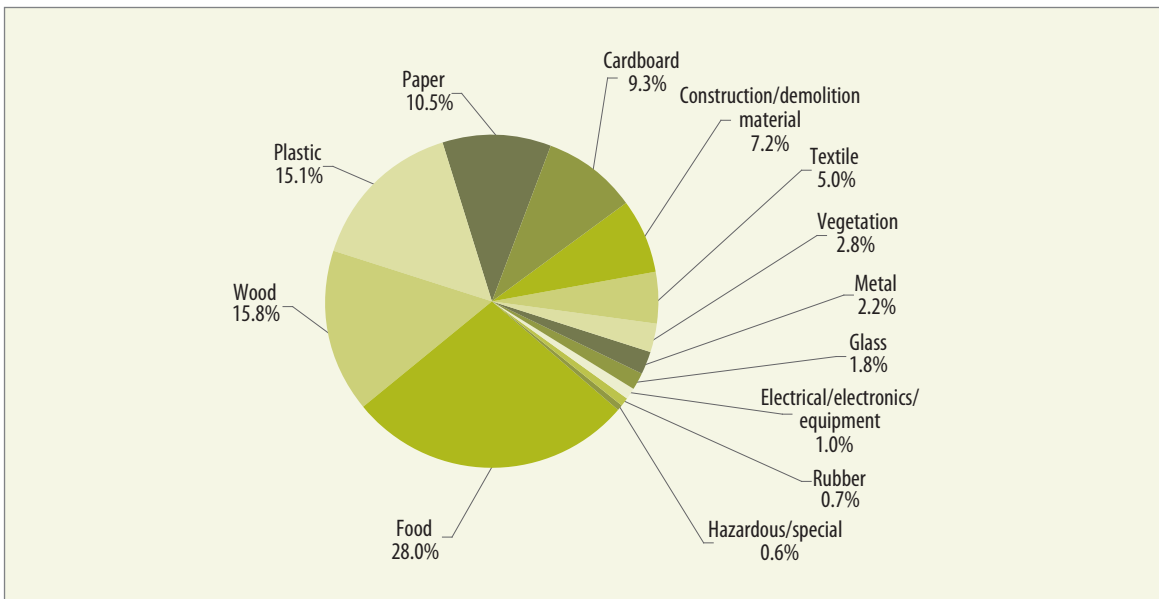
Breakdown of delivery vehicles

The gatehouse survey also recorded and analysed data for vehicle numbers, type of vehicles and tonnage they delivered and industry sectors from where the mixed loads and single material loads were collected. Bulk-bin trucks (32% by weight) and front-lift trucks (31% by weight) were by far the two main types of trucks that delivered C&I waste to landfills and transfer stations.

Chart 19 – Vehicle breakdown (%) by weight
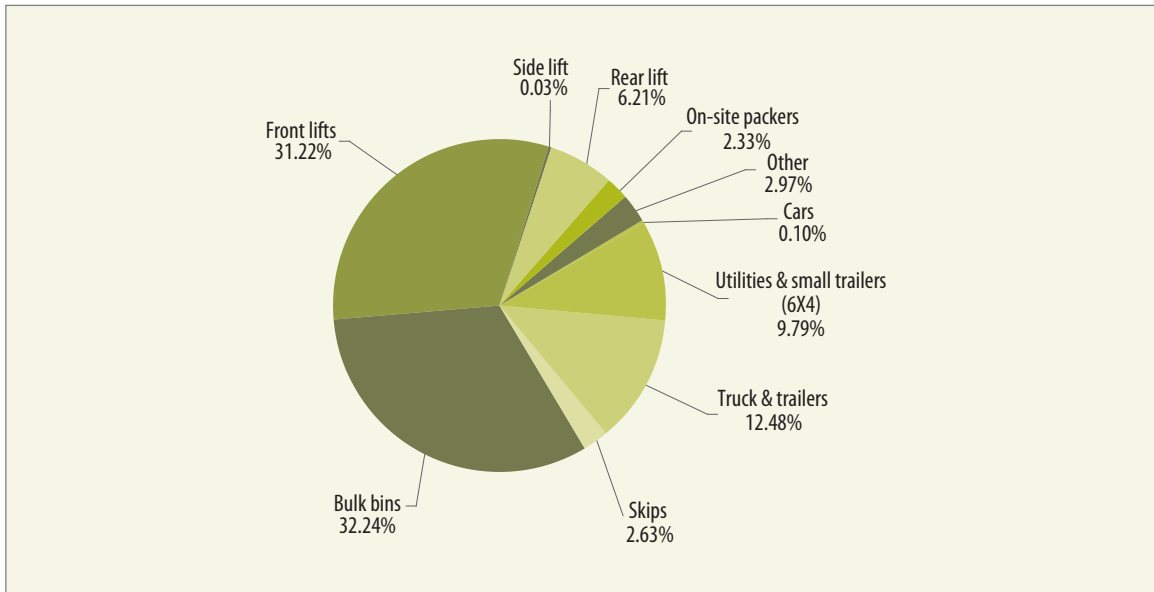
Refer to Charts A2–2 to A2-8 in Appendix 2 for detailed breakdowns of vehicles overall and by industry.

C&I waste contribution from industry sectors

The survey team analysed the data collected from the gatehouse survey to identify the split of mixed C&I waste loads delivered to landfills and transfer stations for disposal from industry sectors as defined under the Australian New Zealand Industry Classification Code (as shown in Table A1-3 in Appendix 1). Chart 20 below shows the breakdown by industry sector.

Chart 20 – Industry sector breakdown
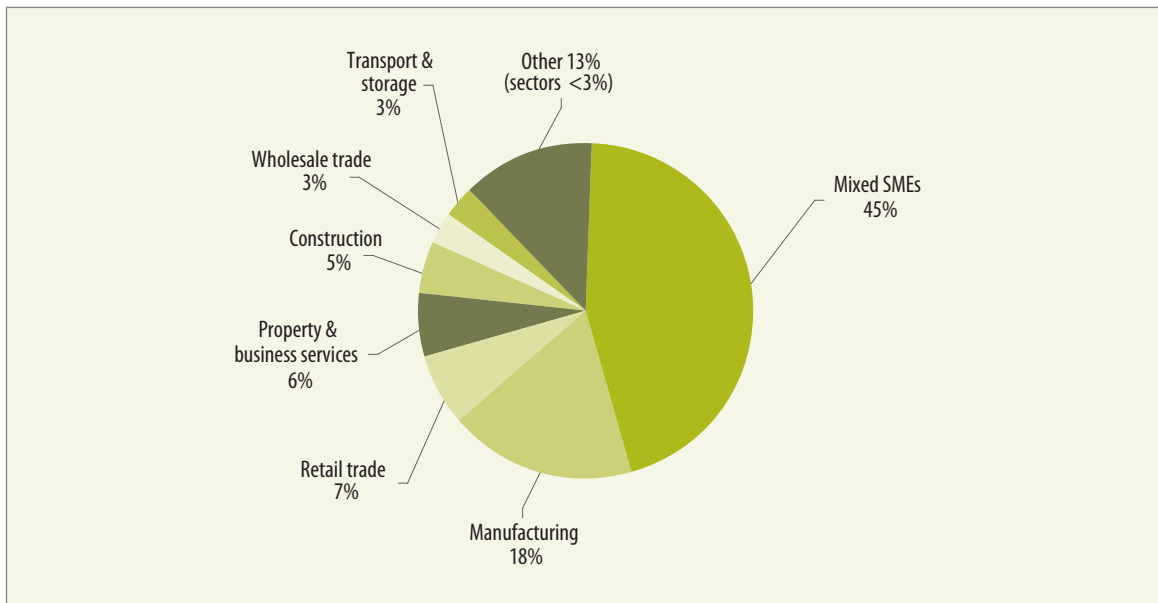
The team then compiled the composition of mixed C&I loads received from these sectors using the visual assessment of the corresponding loads and the weight-based sorting of the garbage bags collected from the same sectors. The composition of loads from the two main industry sectors, mixed SMEs and manufacturing are included in this section. Refer Tables A2-12 to A2-23 in Appendix 2 for the composition of key sectors in detail.

Among the industry sectors generating wastes in Sydney, mixed SMEs are the largest contributor (45%) followed by manufacturing (18%), retail trade (7%), property and business services (6%) and construction (5%). Table 17 gives tonnage details.

Table 17 – Industry split

Industry sectors	2007–08 Total	
	Tonnes	(%)
Mixed SMEs	781,673	45%
Manufacturing	316,690	18%
Retail trade	111,571	7%
Property & business services	104,750	6%
Construction	91,828	5%
Wholesale trade	57,993	3%
Transport & storage	57,385	3%
*Other sectors (<3.0%)	215,704	13%
Total	**1,737,594**	**100%**

* Breakdown of 'other sectors' (<3.0%)	2007–08 Total	
	Tonnes	(%)
Services supply	47,178	2.7%
Health & community services	40,117	2.3%
Resource recovery	30,601	2.0%
Trade (plumber, kitchen fitter)	20,385	1.2%
Hospitality	17,645	1.0%
Unknown	16,136	1.0%
Personal & other	12,863	0.7%
Education	11,064	0.6%
Government/admin/defence	10,682	0.6%
Communication services	3,749	0.2%
Cultural & entertainment	3,415	0.2%
Agriculture/forestry/fishery	1,495	0.1%
Mining	270	<0.1%
Finance & insurance	104	<0.1%
Total of 'other sectors' (<3.0%)	**215,704**	13%

Mixed C&I waste composition from mixed SMEs

Waste generated by mixed SMEs makes up almost half (45%) of the mixed C&I waste and is mainly delivered to landfills by front lift trucks (83.5%).

The mixed C&I loads generated by mixed SMEs are mainly made up of garbage bags (28%), food (22%), paper & cardboard (16%), plastic (13%), wood (9%) and vegetation (nearly 3%). Table 18 provides more details.

Table 18 – Composition of mixed C&I from mixed SMEs (garbage bag as a category)

Mixed SMEs industry sector	2007–08 Total	
Aggregated composition categories 07–08	Tonnes	(%)
Garbage bags	218,359	27.9%
Food	172,783	22.1%
Plastic	101,932	13.0%
Wood	72,826	9.3%
Cardboard	69,886	8.8%
Paper	47,561	6.1%
Vegetation	21,585	2.8%
Textile	21,365	2.7%
Other	18,860	2.5%
Construction/demolition material	10,800	1.4%
Rubber	9,212	1.2%
Metal	8,678	1.1%
Glass	5,689	< 1.0%
Whitegoods/electrical	2,083	< 1.0%
Hazardous/special	54	< 1.0%
Total disposed	**781,673**	**100.00%**

Composition of garbage bags found in the mixed C&I loads received from SMEs

The garbage bags from the SMEs are mainly made up of food (29%), paper (26%), plastic (16%), glass (7%), cardboard (6%) and metal (4%). Table 19 shows the breakdown in more detail.

Table 19 – Breakdown of garbage bags from the mixed SME sector

Garbage bags from mixed SMEs	2007–08 Total	
Consolidated categories	**Tonnes**	**(%)**
Food	63,390	29.0%
Paper	56,097	25.7%
Plastic	34,959	16.0%
Glass	15,984	7.3%
Cardboard	12,032	5.5%
Metal	8,931	4.1%
Other	7,794	3.6%
Textile	5,808	2.7%
Construction/demolition material	5,219	2.4%
Vegetation	3,319	1.5%
Hazardous/special	1,922	< 1.0%
Rubber	1,594	< 1.0%
Whitegoods/electrical	830	< 1.0%
Wood	480	< 1.0%
Total disposed	**218,359**	**100%**

Composition of mixed C&I loads from the SMEs with garbage bag contents apportioned

When the garbage bag contents are apportioned across the material categories, the composition changes marginally with food/kitchen waste (31%), paper & cardboard (23%), plastic (18%) and wood (9%). Chart 21 shows the breakdown of consolidated material categories.

Chart 21 – Composition of mixed C&I loads from mixed SMEs (garbage bag content redistributed)
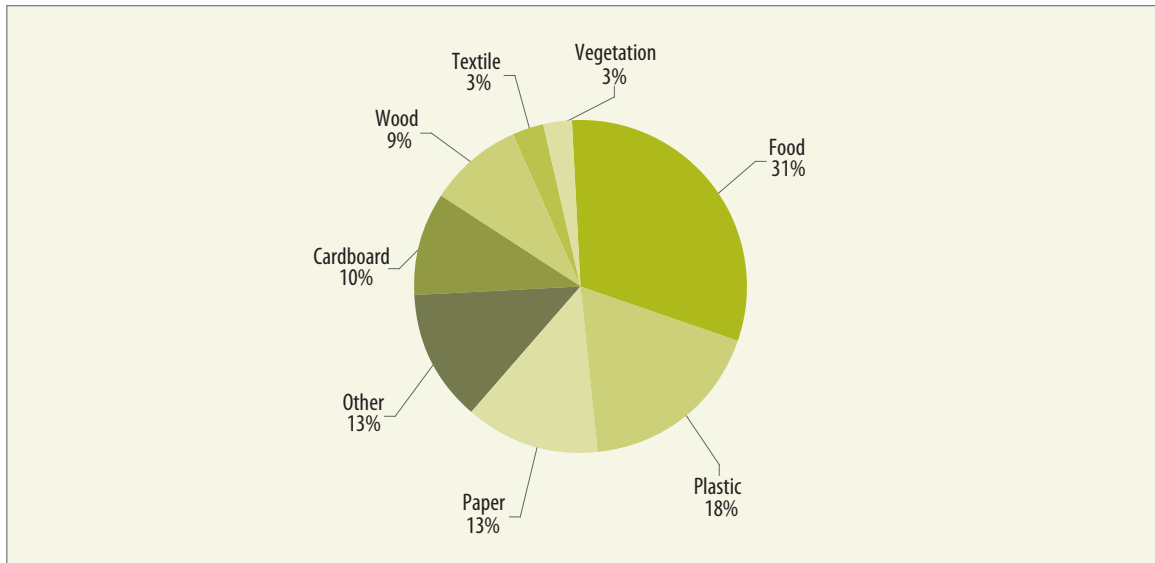
Mixed C&I composition from manufacturing

Mixed C&I loads from manufacturing contribute 18% of the mixed C&I waste stream in Sydney. These loads are mainly made up of plastic (20%), wood (20%), paper % cardboard (12%), food (10%), garbage bags (8%) and construction & demolition material (5%). Table 20 provides further detailed breakdown.

Table 20 – Composition of mixed C&I waste with garbage bag as a category

Mixed C&I loads from the Manufacturing sector	2007–08 Total	
Consolidated Categories	Tonnes	(%)
Plastic	63,408	20%
Wood	63,246	20%
Other	40,799	13%
Food	31,890	10.1%
Garbage bags	26,186	8.3%
Paper	20,389	6.4%
Cardboard	18,165	5.8%
Construction/demolition material	15,430	4.9%
Textile	7,316	2.3%
Vegetation	6,174	2%
Metal	5,601	1.8%
Rubber	5,527	1.8%
Glass	4,582	1.5%
Residual	3,822	1.2%
Hazardous/special	2,494	< 1.0%
Whitegoods/electrical	1,661	< 1.0%
Total disposed	**316,690**	**100%**

Composition of garbage bags in the mixed C&I loads received from manufacturing

The garbage bags found in the mixed C&I loads received from manufacturing are mainly made up of paper & cardboard (32%), food (21%), plastic (18%) and textile (8%). Table 21 provides further details.

Table 21 – Composition of garbage bags from manufacturing

Mixed C&I loads from manufacturing	2007–08 Total	
Consolidated categories	**Tonnes**	**(%)**
Paper	7,382	29%
Food	5,523	21.1%
Plastic	4,590	17.5%
Other	3,150	12%
Textile	2,194	8.4%
Cardboard	1,047	4%
Glass	587	2.2%
Metal	474	1.8%
Hazardous/special	364	1.4%
Whitegoods/electrical	259	1.0%
Vegetation	236	< 1.0%
Rubber	186	< 1.0%
Construction/demolition material	113	< 1.0%
Wood	81	< 1.0%
Total disposed	**26,186**	**100%**

Composition of mixed C&I loads from manufacturing, with garbage bag contents apportioned

Chart 20 shows that when the contents of the garbage bags are apportioned across the material categories, the composition changes with plastic (21%), wood (20%), paper & cardboard (15%) and food (12%).

Chart 22 – Composition of mixed loads from the manufacturing sector – garbage bag contents redistributed
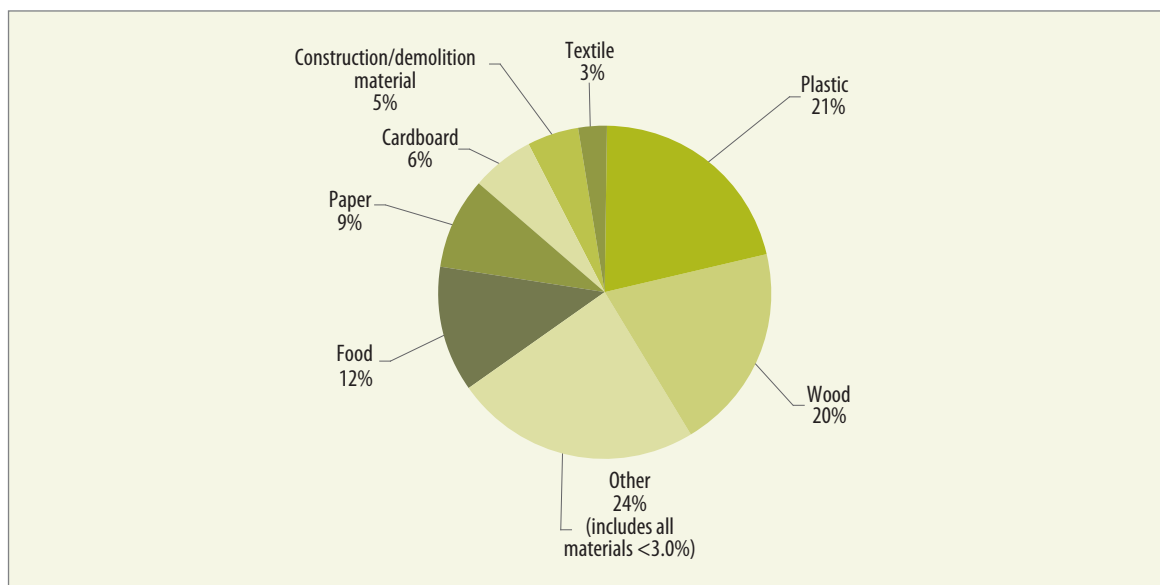
3 Potentially recoverable materials in the C&I waste stream

Material specific generation rates are estimated by adding corresponding disposal rates to the recovery rates derived from re-processor surveys undertaken for the reporting period as shown in Table 22.

Table 22 – Material recovery rates for the C&I waste stream in Sydney 2006–07

Material category	Disposed [c]	Recycled [d]	Generated [e]	% Recovery [f]
Paper and cardboard	311,151	324,684	635,835	51%
Plastic	262,275	19,136	281,411	7%
Glass	34,233	24,985	59,218	42%
Ferrous	23,330	427,271	450,601	95%
Non-ferrous	5,743	52,226	57,969	90%
Garden organics	69,757	109,273	179,030	61%
Food	340,425	16,911	357,336	5%
Timber	279,722	61,801	341,523	18%
Concrete/brick/const	52,199	446,581	498,780	90%
Asphalt	3,761	0	3,761	0%
Sand/soil/rubble	114,702	30,313	145,015	21%
Plasterboard	19,316	4,514	23,830	19%
Other recyclables [a]	13,278	10,263	23,541	44%
Other (waste) [b]	556,984	0	556,984	0%
Total	**2,086,876**	**1,527,958**	**3,614,834**	**42%**

(a) Other recyclables include rubber, textiles and mixed recyclables.
(b) Other (waste) includes all non-recyclable materials during the reporting period.
(c) C&I waste stream composition derived from the survey in 2008 applied to the disposal tonnage reported online by licensed facilities in 2006-07.
(d) Taken from the NSW Resource Recovery Industry Survey done on materials recovered in 2006-07
(e) The sum of tonnages disposal of and recycled.
(f) Percentage fraction of recycled out of the waste generated.

It is evident from Table 22 that recovery efforts should be directed towards food (only 5% recovered), plastic (7%) and timber (18%) in the C&I waste stream. Textiles, glass, rubber and garden waste could also be recovered.

Materials that could be recovered are classified as

- **currently recoverable** with available technology and improved waste acceptance practices, see Table 23

- **potentially recoverable in the future** by deployment of better source separation and emerging new technologies, see Table 24

- **non-recoverable**, ie hazardous or contaminated, see Table 25.

Chart 23 shows the tonnage breakdown for potentially recoverable waste and Tables 23 to 25 shows the tonnages of material 'currently recoverable', potentially recoverable' and 'non recoverable' based on the disposal tonnages reported online by licensed waste facilities in 2007-08 (most recent data available).

Chart 23 – Recoverability of C&I waste
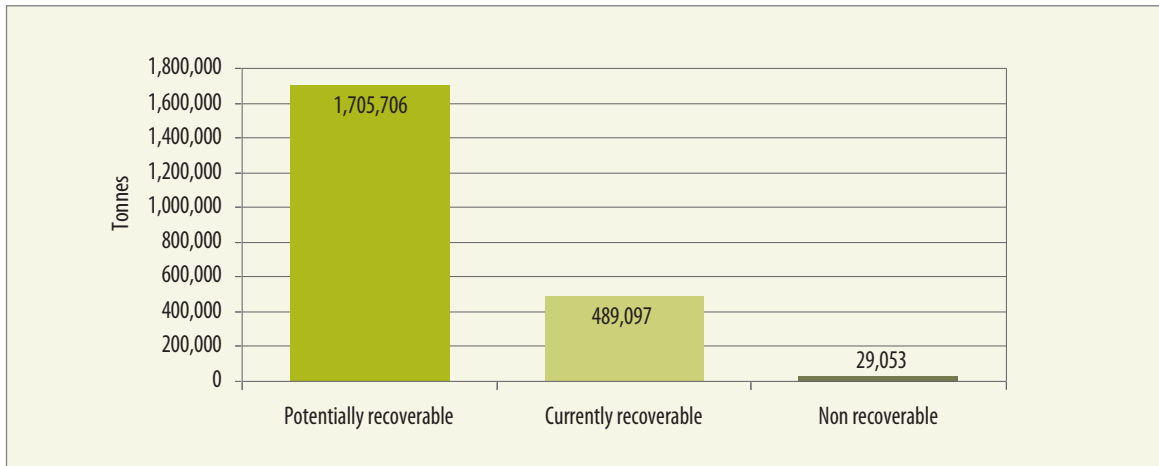
Material recovery rates listed in Table 23 can be achieved through otimising available markets for recycled material, introducing recovery infrastructure based on available technology (MRFs and AWTs etc) and streamlining the waste acceptance practices and the gate fee structure.

Table 23 – Breakdown of 'currently recoverable' material

Material categories	2007–08 Total	
	Tonnes	**(%)**
Cardboard – dry	105,022	4.7%
Plastic – hard	84,727	3.8%
Soil – not venm nor contaminated	58,368	2.6%
Vegetation	53,300	2.4%
Paper – office	48,531	2.2%
Bricks or concrete	35,793	1.6%
Metal – ferrous	27,915	1.3%
Fines	25,812	1.2%
Plastic – recyclable containers	22,414	1.0%
Polystyrene/foam	9,732	0.4%
Biosolids or manures	6,206	0.3%
Metal – non-ferrous	5,305	0.2%
Grease trap waste	2,086	0.1%
Composts or mulches	1,956	0.1%
Other (commingled recyclables)	1,517	0.1%
Batteries	222	0.0%
Tonner cartridges	191	0.0%
Aggregate/rdbase/ballast	0	0%
Transformers	0	0%
Sub-total	**489,097**	**22.0%**

The levels of recovery as indicated in Table 24 can be achived only through the introduction of very effective separation of recyclates at source that is supported by suitable collection systems, commissioning appropriate infrastructure and treatment on site (tilling or bio remediation of hydrocarbon contaminated soils etc).

Table 24 – Potentially recoverable in the future

Categories	2007–08 Total	
	Tonnes	(%)
Food or kitchen	303,855	13.7%
Contaminated soil*	265,365	11.9%
Wood – pallets/other	142,079	6.4%
Plastic – bags and film	136,102	6.1%
Residues – other	135,858	6.1%
Paper – all other	128,969	5.8%
Other (non-recyclable)	97,824	4.4%
Wood – MDF/chipboard	77,329	3.5%
Other – C&D	47,100	2.1%
Plastic – other/mixed	40,950	1.8%
Glass	40,074	1.8%
Textile – carpet/underlay	39,745	1.8%
Wood – furniture	37,512	1.7%
Textile – cloth/rags	30,710	1.4%
Hazardous waste	30,076	1.4%
Cardboard – wet	18,544	0.8%
Plasterboard	17,995	0.8%
Wood – fencing/board/pole (untreated)	14,587	0.7%
Trees and stumps	14,290	0.6%
Textile – furniture	11,968	0.5%
Wood – fencing/board/pole (treated)	11,911	0.5%
Rubber – tyres/tubes	11,520	0.5%
Electronics/electrical/television etc	11,003	0.5%
Ceramics, tiles, pottery	10,781	0.5%
Rubber – other	10,254	0.5%
Wood – sawdust	4,948	0.2%
Veterinary waste	3,975	0.2%
Textile – leather/other	3,305	0.1%
Cardboard – waxed	2,181	0.1%
Textile – mattress	2,017	0.1%
Ash	797	< 0.1%
Whitegoods – washing machine/fridges	743	< 0.1%
Computer/office equipment	716	< 0.1%
Paper or cardboard (mixed)	620	< 0.1%
Sub-total	**1,705,706**	**76.7%**

* Better handling and operation practices and pre-treatment techniques could minimise soil being contaminated with asbestos, hydrocarbons and other hazardous substances.

Table 25 – Non-recoverable material breakdown

Categories	2007–08 Total	
	Tonnes	**(%)**
Pharmacy or clinical	15,137	0.7%
Asbestos	13,916	0.6%
Sub-total	**29,053**	**1.3%**

Composition of loads for disposal delivered by charities

The composition of loads delivered by charities during the two days of field survey carried out at six landfills and six transfer stations is summarised below in Table 26. The chief materials that could be recovered are textiles (74%), wood (13%) and plastic (6%). The charity loads contribute 0.4% of the C&I loads delivered for disposal.

Table 26 – Breakdown of charity loads received for disposal

Material categories	Tonnage recorded on days of survey	Total (%)
Paper – all other	0.36	1.8%
Paper – all sub-total	**0.36**	**1.8%**
Compacted dry cardboard	0.04	0.2%
Loose dry cardboard	0.14	0.7%
Cardboard – all sub-total	**0.18**	**0.9%**
Food – all sub total	**0.00**	**0%**
Vegetation – all sub-total	**0.00**	**0%**
Wood – pallets/other	0.12	0.6%
Wood – furniture	1.35	6.7%
Wood – MDF/chipboard	1.07	5.3%
Wood – all sub-total	**2.54**	**12.6%**
Textile – furniture	0.80	4%
Textile – carpet/underlay	0.34	1.7%
Textile – mattress	0.07	0.4%
Textile – cloth	11.89	59.1%
Textile – leather/other	1.73	8.6%
Textile – all sub-total	**14.83**	**73.7%**
Rubber – all sub-total	**0.00**	**0%**
Glass – containers/other	0.10	0.5%
Glass – plate	0.02	0.1%
Glass – all sub-total	**0.12**	**0.6%**
Plastic – bags and film	0.20	1%
Plastic – hard	1.04	5.2%
Plastic – all sub-total	**1.24**	**6.2%**
Garbage bags	0.01	< 0.1%
Garbage bags sub total	**0.01**	**< 0.1%**
Metal – ferrous	0.18	0.9%
Metal – all sub-total	**0.18**	**0.9%**

Material categories	Tonnage recorded on days of survey	Total (%)
Concrete/cement	0.12	0.6%
Construction/demolition material – all sub-total	**0.12**	**0.6%**
Hazardous/special – light globes	0.04	0.2%
Hazardous/special – all sub-total	**0.04**	**0.2%**
Whitegoods – washing machine/fridges	0.04	0.2%
Electronics/electrical television etc.	0.30	1.5%
Whitegoods/electrical – all sub-total	**0.34**	**1.7%**
Other	0.17	0.8%
Other – all sub-total	**0.17**	**0.8%**
Total	**20.13**	**100%**

Comparison with other jurisdictions

Table 27 shows a comparison of the composition of the total C&I waste stream visually surveyed in South Australia, Victoria and Western Australia. Table 28 compares the industry sector split between these jurisdictions.

Table 27 – Comparison of material breakdown

Jurisdiction	Sydney	South Australia [1]	Western Australia [2]	Victoria [3]
Year of survey	**2008**	**2007**	**2007**	**2005**
Material categories	Breakdown of main material categories in the total C&I waste stream			
Food	11%	26%	21%	18%
Garbage bags	15%	21%	20%	20%
Cardboard	6%	7%	11%	7%
Paper	4%	3%	2%	3%
Wood-timber	12%	8%	15%	10%
Vegetation	3%	5%	5%	4%
Plastics	10%	3%	6%	6%
Other	39%	27%	20%	32%
Total	**100%**	**100%**	**100%**	**100%**

Table 28 – Comparison of industry contribution to C&I waste stream

Jurisdiction	Sydney	South Australia [1]	Western Australia [2]	Victoria [3]
Year of survey	2008	2007	2007	2005
Industry categories	Breakdown of industry sector contribution			
Manufacturing	18%	37%	12%	28%
Retail	7%	17%	23%	18%
Mixed SMEs	45%	19%	37%	19%
Personal other	1%	3%	3%	9%
Hospitality	1%	8%	5%	4%
Property and Business	6%	2%	2%	12%
Other sectors combined	22%	14%	18%	10%
Total	**100%**	**100%**	**100%**	**100%**

(1) Landfill Survey, Zero Waste South Australia, 2007 – www.zerowaste.sa.gov.au

(2) Disposal Based Audits, Western Australia, Mar-07 – www.zerowastewa.com.au

(3) Disposal Based Waste Survey, Vicoria, Jun-05 – www.sustainability.vic.gov.au

4 Garbage bags

Garbage bags constituted 18.7% (or 324,070 tonnes) of the mixed C&I waste. A minimum of 10 garbage bags from any single material load received from eight pre-selected industry sectors were picked up for weight-based sorting. For statistical validity, bags from 30 loads from each sector were sorted and data analysed.

Based on this analysis, the garbage bag composition for each industry sector surveyed and an overall garbage bag composition for the mixed C&I stream were determined. The survey found that garbage bags amounted to 28% of the mixed C&I loads from SMEs, 24% of the loads from Retail sector, 8% of the loads from the Manufacturing Sector and 3% of the loads from Property and Business sector.

The three predominant categories of materials found in the overall garbage bag composition were food (27.7%), paper (29.2%) and all plastic (15.1%).

Photo 1 – Example of load with garbage bags

5 Food

Food makes up 13.6% (or 303,855 tonnes) of the overall C&I waste stream and 17.4% (303,164 tonnes) of the mixed C&I waste stream after garbage bag contents are apportioned across the material categories. Table 29 gives the breakdown of food category in the **mixed** C&I stream.

Table 29 – Food waste summary, including garbage bags composition apportioned

Material sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	(%)
Food/kitchen	282,735	16.2%
Food – dense	20,429	1.2%
Food – all sub-total	**303,164**	**17.4%**

Food waste is generally classified as pre-consumer and post consumer waste. Post-consumer waste is typically generated by food service industries, shopping malls and shopping strips.

Pre-consumer waste is mainly generated by food transport, manufacturing, processing, wholesale and retail industries.

The survey found that 74% of the total food waste to landfill in Sydney (225,000 tonnes) can be described as pre-consumer and 26% (about 79,000 tonnes) as post-consumer food waste. Table 30 provides more description of what sub-categories make up the pre- and post-consumer food waste in Sydney.

Photos 2–5 show typical pre-consumer food waste reaching the landfills.

Table 30 – Description of pre- and post-consumer food waste

Pre-consumer food waste	Post-consumer food waste
■ Includes food from manufacturers, food processing facilities, market gardens, supermarkets, and commercial kitchens. ■ Typically generated as a result of commercial/industrial food production or preparation for consumption, and in some cases may include food that is still edible. ■ Defined as food that requires some form of preparation before it is served to people to consume, and/or stocks of food not for consumption which require disposal (eg out of date, or spoiled), and/or are off-cuts from preparing food for human consumption. ■ Overproduction, trim waste, expired items and spoilage. ■ Can be found in open bins, compactors and plastic bin liners.	■ Food that has been served to consumers and is not recoverable for human consumption. ■ Food (including packaged food) prepared to be served to people for consumption. Includes plate scraps and foods not consumed that cannot be served again. ■ Generally found in plastic bin liners.

Based on the gatehouse survey and the visual assessment of the loads received from different industry sectors, the industry contribution of pre-consumer food waste to landfills is shown in Table 31. Table 32 shows the industry contribution of post-consumer food waste to landfills.

Table 31 – Pre-consumer food waste received from various industry sectors

Pre-consumer food waste	74% of overall food waste
Agriculture/forestry/fishery	0.2%
Health & Community services	1.2%
Hospitality	2.6%
Manufacturing	14.8%
Mixed SMEs	66.7%
Retail trade	11.1%
Unknown	1.0%
Wholesale trade	2.4%
Total	**100.0%**

Table 32 – Post-consumer food waste received from various industry sectors

Post-consumer food waste	26% of overall food waste
Education	4.3%
Communication services	< 0.1%
Construction	0.4%
Government/admin/defence	3.4%
Health & Community services	2.7%
Hospitality	1.0%
Manufacturing	0.1%
Mining	< 0.1%
Mixed SMEs	71.5%
Personal & other	0.1%
Property & business services	0.9%
Retail trade	11.1%
Services supply	0.1%
Transport & storage	0.5%
Trade (plumber, kitchen fitter)	0.1%
Unknown	2.3%
Wholesale trade	1.4%
Resource recovery	< 0.1%
Total	**100.0%**

Photo 2 – Packaged food product – bottled sauce

Photo 3 – Production waste – flavoured milk

Photo 4 – Packaged food product – tortillas

Photo 5 – Production waste – cool pops

6 Wood/timber

Wood waste represented 13% (or 288,366 tonnes) of the total C&I waste stream and 16.7% of the mixed C&I waste stream within Sydney for the reporting period. Table 33 shows a breakdown of wood sub-categories present in the mixed C&I stream with garbage bag contents distributed.

Table 33 – Wood waste summary

Wood – sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	**(%)**
Wood – pallets/other	142,079	8.2%
Wood – furniture	37,512	2.2%
Wood – fencing/board/pole (treated)	11,911	0.7%
Wood – fencing/board/pole (untreated)	14,587	0.8%
Wood – MDF/chipboard	77,329	4.5%
Sawdust	4,948	0.3%
Wood – all sub-total	**288,366**	**16.7%**

It should be noted that single material loads recorded as 'wood, trees or timber' have been assigned to the category 'vegetation'.

The survey found pallets and packing crates contributed nearly 50% (142,079 tonnes) of wood/timber in the mixed C&I waste stream.

Wood sub-categories

Pallets

Single-use, softwood packing crates and wooden pallets, both imported and manufactured in Australia, form the main component of wood waste. It is sent to landfill from a large number of generators across a wide range of sources, especially transport and storage, primary industries, manufacturing and construction. It is estimated less than 1% of this wood waste is chemically treated with permanent preservatives[8] but most of it contains nails and other metal fixtures.

MDF/chipboard

Manufacturing is responsible for most of the discarded engineered timber products, for example from furniture and kitchen fittings, found in wood waste. These materials include medium density fibreboard (MDF), particleboard, laminated timber beams and plywood. These often incorporate glues, binders and laminated surfaces as part of the product.

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8 Such as Copper Chrome Arsenate (CCA). Reference: National Timber Product Stewardship Group website at: www.timberstewardship. org.au/resources.html

Furniture

Furniture sent to landfill from commercial and industrial sources includes painted and varnished office furniture, wooden partitions and retail display material.

Fencing (untreated)

Includes a mixture of plantation softwood and hardwood.

Fencing (treated)

This consists of hardwood and softwood, typically treated by paints, stains and/or copper chromium arsenic (CCA) and derived from households, businesses and agriculture.

Sawdust

Generated by a range of timber milling, processing and manufacturing companies and is usually sent to landfills in bags.

Photo 6 – Timber pallets

Photo 7 – A load of office furniture still in good condition

Photo 8 – A load of off-cuts from a kitchen manufacturer

7 Cardboard and paper

Cardboard was 5.7% (or 126,367 tonnes) of the total C&I waste stream, and 7.2% (or 125,746 tonnes) in the mixed C&I waste stream. Table 34 shows cardboard sub-categories in the mixed C&I waste stream.

Table 34 – Cardboard waste summary

Cardboard – sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	(%)
Compacted dry cardboard	77,499	4.4%
Compacted dry cardboard production spoils	1,254	0.1%
Compacted wet cardboard	13,224	0.8%
Loose dry cardboard	25,998	1.5%
Loose dry cardboard production spoils	270	0.0%
Loose wet cardboard	5,320	0.3%
Waxed cardboard	2,181	0.1%
Cardboard – all sub-total	**125,746**	**7.2%**

Photo 9 – Example of a load containing a very high proportion of cardboard packaging waste

Photo 10 – Unused filing boxes

Paper

Paper was 8% (177,501 tonnes) of the total C&I waste stream and 10.2% (or 177,501 tonnes) of the mixed C&I waste stream. Table 35 shows the breakdown of paper in the mixed C&I waste stream.

Table 35 – Paper waste summary

Paper – sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	**(%)**
Office – paper	48,532	2.8%
Paper – all other	128,969	7.4%
Paper – all sub total	**177,501**	**10.2%**

Office Paper

The majority of officer paper is recyclable. Paper that has been separated into specific colour types will attract better rebates. Paper is also easy to separate at the source without substantial demands on staff and storage. Paper prices are fairly stable as is infrastructure for reprocessing.

Photo 11 – Waste paper

Photo 12 – Load full of packaged brochures

8 Textiles

Photo 13 – Load of foam underlay

Photo 14 – Textiles collected in charity cloth bins

Photo 15 – Mattresses from a clean-up

Textiles accounted for 3.9% (or 87,746 tonnes) of the total C&I waste stream and 5.1% (or 87,547 tonnes) of the mixed C&I waste stream. Table 36 shows the breakdown of textiles in the mixed C&I waste stream.

Table 36 – Textile waste summary

Textiles – sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	**(%)**
Textile – furniture	11,968	0.7%
Textile – carpet/underlay	39,745	2.3%
Textile – mattress	2,017	0.1%
Textile – cloth	30,512	1.8%
Textile – leather/other	3,305	0.2%
Textile – all sub-total	**87,547**	**5.1%**

The photos on the left show the extent of potentially recoverable textile material wasted at landfills.

9 Plastic

Plastic was 13.2% (or 293,925 tonnes) of the total C&I waste stream and 16.9% (or 293,741 tonnes) in the mixed C&I waste stream. Table 37 shows the breakdown of plastic in the mixed C&I waste stream.

Table 37 – Plastic waste summary

PLASTIC – sub-categories	Mixed C&I 2007–08 Total	
	Tonnes	(%)
Plastic – bags and film	136,102	7.8%
Plastic – recyclable containers	22,414	1.3%
Plastic – hard	84,727	4.9%
Plastic – other	40,766	2.3%
Polystyrene/foam	9,732	0.6%
Plastic – all sub-total	**293,741**	**16.9%**

The photos below and over the page show the extent of potentially recoverable plastic material wasted at landfills.

Photo 16 – Label waste from a factory

Photo 17 – Empty plastic packaging from a food manufacturer

Photo 18 – Another example of empty plastic packaging from a food manufacturer

Photo 19 – Load from a beverage manufacturer containing a significant quantity of bottle tops

Photo 20 – Load from adhesive and abrasive materials manufacturer containing a significant quantity of rejected products

Photo 22 – Foam off-cuts

Photo 21 – Load of unused plastic folders manufactured for a bank

Photo 23 – Polystyrene and foam packaging