

DEPARTMENT OF SUSTAINABILITY, ENVIRONMENT, WATER, POPULATION AND COMMUNITIES QUEENSLAND DEPARTMENT OF ENVIRONMENT AND RESOURCE MANAGEMENT

CONSTRUCTION AND DEMOLITION WASTE STATUS REPORT

MANAGEMENT OF CONSTRUCTION AND DEMOLITION WASTE IN AUSTRALIA



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APPENDICES

Appendix 1 LIST OF STAKEHOLDERS CONSULTED Appendix 2 KEY PARAMTERS FROM A SELECTION OF RELEVANT SPECIFICATIONS

GLOSSARY

This glossary provides definitions of the core terms used in this report.

Asphalt millings The fine particles of bitumen and inorganic material that are produced mechanical grinding of bituminous concrete surfaces					
Consumption	Total use of products and materials.				
Disposal	Solid waste that is disposed of to landfill, and solid waste that is incinerated without energy recovery.				
End-of-life	Products and materials that have become a waste.				
Energy recovery; waste to energy; EfW	The combustion of solid waste or the combustion of methane collected from landfill as a fuel for an industrial process and/or electricity generation.				
Landfill	A site used for the controlled and legal deposit of solid waste onto or into land.				
Masonry material	Includes asphalt, concrete and bricks (jurisdictional variations may exist & will be defined)				
MRF	Material recovery facility				
RAP	Recycled Asphalt Pavements				
Recovery rate	Solid waste recovered as a proportion of waste generation.				
Recovery; resource recovery	Solid waste collected for recycling and energy recovery.				
Recycling	A set of processes (including biological) that converts solid waste into useful materials or products.				
Recycling rate	Solid waste recycled as a proportion of waste generation.				
Reuse	The use of a used product or material in its original state without reprocessing or remanufacture.				
Rouge operators	A loosely defined but commonly used expression generally describing market participants who are perceived by other stakeholders to be operating outside of existing regulatory or best practice industry standards				
Solid waste	Waste products and materials that are 'spadeable'.				
tpa	Tonnes per annum				
VENM	Virgin excavated natural material				
Waste generation	The total of products and materials collected for recycling, energy recovery or disposal.				

A number of additional terms are defined throughout the report.

EXECUTIVE SUMMARY

A total of 19.0 million tonnes of construction and demolition (C&D) waste was generated in Australia in 2008-09¹. Of this total waste stream, 8.5 million tonnes was disposed to landfill while 10.5 million tonnes, or 55%, was recovered and recycled.

This C&D Waste Status Report shows performance in terms of resource recovery from the C&D stream is highly variable across the different Australian jurisdictions. In the best performing jurisdictions, recovery rates of greater than 75% are being achieved. The key factors driving resource recovery in each jurisdiction – and the key barriers to improving performance - are highlighted throughout this report.

The following general conclusions about resource recovery performance can be drawn from the information contained in this report:

- Resource recovery rates are highest in those regions where there is strong market demand for recycled C&D materials, with well-defined and well-publicised specifications supporting the use of recycled products
- Where the cost of landfill disposal is sufficiently high, the cost to dispose of mixed waste will be high compared to the cost to reprocess uncontaminated streams of specific C&D waste materials. This provides strong incentive for high volume and regular generators of C&D waste to source separate materials and allow for easier reprocessing
- High landfill disposal costs provide an incentive to process mixed C&D waste in order to recover certain high value and high volume components, and avoid landfill disposal costs.

Hyder Consulting and its project partners Encycle Consulting and Mike Haywood – Sustainable Resource Solutions liaised with over 110 organisations and individual stakeholders involved in the Australian C&D waste sector in order to compile this report. Information gathered from these stakeholders is detailed throughout the report, and the individual stakeholders that were consulted are listed in Appendix 1.

Many of the barriers and opportunities identified within this report are jurisdiction-specific, and especially relate to potential mechanisms and roles for State and Territory Governments to encourage better performance. This report provides a distinct overview of the performance within each State or Territory, including an explanation of materials in the C&D waste stream, discussion of the current processing capacity for recovering materials, an outline of the key products and end use markets for recovered C&D materials, and details of the barriers and opportunities in relation to improving performance.

There are many aspects of C&D waste and recycling that present common issues across all Australian jurisdictions. These common issues, themes and information have been drawn together and compiled into a National Overview.

More than 65 key conclusions and recommendations are drawn from this report and summarised in Section 8, with 22 of these considered to be of relevance to all Australian jurisdictions. The key themes detailed in the national recommendations include:

• A national body responsible for coordinating, compiling, storing and promoting information, including National Standards for the production and use of recycled products, would help increase stakeholder confidence in the suitability of recycled C&D materials, which would encourage greater uptake of products.

¹ This is the most recent year for which national data is available, as outlined in the *Waste and Recycling in Australia 2011* report compiled by Hyder for the Australian Government.

- Asbestos contamination is a critical issue in C&D recycling, and Federal intervention may be required to produce a workable solution for all stakeholders. Best Practice Guidelines for screening incoming loads to minimise contamination risk, coupled with adoption of a small allowable limit of <0.001% contamination in end products, may provide a solution.
- A national approach to supporting sustainable resource use could include a pricing mechanism, similar to the UK Aggregates Levy, which seeks to better reflect intrinsic environmental costs in the price of virgin aggregates and, in doing so, improve the competitiveness of recycled aggregate alternatives, and support the more efficient use of virgin aggregates.
- The wider adoption of sustainable procurement practices, particularly through government agencies, would help increase market demand for recovered C&D materials. Government agencies should favour procurement of material containing recycled C&D content where they meet defined performance criteria / specifications.
- The Roads Towards Zero Waste (Roads TZW) partnership program between Sustainability Victoria, the Municipal Association of Victoria (MAV), the Australian Road Research Board (ARRB) and VicRoads, provides a model that should be considered nationally for all jurisdictions. The focus is on the use of recycled products in road construction applications in partnership with local government.
- Processing techniques are relatively well developed in relation to source separated C&D materials. Facilities for sorting mixed waste will be an investment priority in those areas where C&D resource recovery rates are already high.
- South Australia provides a model where landfill disposal of some materials will be prohibited unless waste has first been subject to resource recovery efforts. Similar regulatory instruments could be considered for use in other jurisdictions, and this would support the recovery of material presented in mixed loads.
- The residual waste fraction from mixed C&D waste recycling operations, with a high timber and plastic component, may be suitable for energy recovery processes and this may provide a higher order use than landfill disposal of these materials, particularly where the waste material displaces the use of fossil fuels for energy generation.
- Opportunities to encourage the integration of C&D reprocessing activities within existing quarry operations should be considered, especially as this may facilitate the extension of recovery activities into regional communities by reducing the need to establish new sites and associated infrastructure.

1 INTRODUCTION

This status report on the management of construction and demolition waste in Australia (C&D Waste Status Report) has been prepared for the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) and the Queensland Department of Environment and Resource Management (DERM), by Hyder Consulting (Hyder), and its project partners Encycle Consulting and Sustainable Resource Solutions.

The report addresses the generation, recovery, markets and products for construction and demolition (C&D) waste materials across all eight jurisdictions (States and Territories) in Australia.

The jurisdictional reviews involved extensive stakeholder engagement, with over 110 organisations from the C&D sector, waste management industry, reprocessing sector and government sectors consulted. The information gathered has been distilled into a national overview which seeks to:

- Improve knowledge of C&D waste management in Australia
- Inform the development of a national approach to address the use of recovered C&D waste materials, and
- Highlight opportunities to grow the market for recycled C&D waste materials

The overall national summary is presented in the introductory chapters of this report. The information presented is distilled from the extensive reviews undertaken for each jurisdiction, which are presented in the following chapters of this report.

The national summary chapters address the:

- National data summary
- Regulatory frameworks
- C&D waste management practices
- Material profiles
- Products and markets, and
- Barriers, opportunities and recommendations

This report therefore provides a national overview on the status of C&D waste in Australia, while also providing stand alone summaries of the current status and opportunities available for C&D waste management in each of the individual jurisdictions.

The jurisdictional summaries vary in detail, based in part on the level of activity in the C&D sector, and on the level of stakeholder participation in the review. The State and Territory summaries highlight that, overall, there was positive engagement in this process with the stakeholders indentified in Appendix 1, which were drawn from the C&D sector, waste management industry, reprocessing sector and government.

This engagement process has provided significant insight into the opportunities available for this sector, which are outlined in the findings and recommendations of this report.

2 METHOD

The delivery of this C&D Waste Status Report involved a series of tasks that supported the review and analysis of the sector, and identified potential opportunities to improve performance at both the jurisdictional and national levels.

2.1 Legislative framework overview

The jurisdictional and national environmental regulatory framework was reviewed and elements relevant to C&D waste generation and recovery have been highlighted.

The legislative review covered issues relating to construction, demolition, transport, disposal, recovery and secondary material use, along with permitting and licensing requirements in each jurisdiction, where applicable.

This framework review also involved addressing the coverage and scope of standards and specifications, and this was further supplemented by the stakeholder consultation.

2.2 C&D data review

The Waste and Recycling in Australia 2011² report prepared by Hyder for DSEWPaC has formed the basis of the C&D data used in the national overview for this report. This is the most current and consistent data available across the jurisdictions, compiled using a standard methodology that is outlined in the National Waste and Recycling Reporting – A More Uniform Approach to Data report, prepared by Hyder for DSEWPaC in 2010. At the time of publication the Waste and Recycling in Australia 2011 report was undergoing peer review.

The C&D data review in this current report seeks to provide jurisdictional summaries and a national overview of waste generation, recovery and disposal. There may be discrepancies between some figures quoted in the national summary section (where data is based on the *Waste and Recycling in Australia* methodology) and the data quoted in some of the jurisdictional summary sections.

An example of potential data discrepancies relates to the treatment of soil. Soil may be included in the C&D waste stream data for some jurisdictions. The national recycling figures sourced from the DSEWPaC method for *Waste and Recycling in Australia 2011*, however, does not include soil. Where there are inconsistencies in the data between the summary presented in Section 3 and the jurisdictional reviews, these are noted and explained.

In addition with each jurisdictional summary, data and information may have been accessed through a range of sources including industry assessments and reprocessor site information. In these instances reference has been made to identify the source and timeframe of the information.

2.3 Stakeholder identification & consultation

A broad range of stakeholders were identified and an initial list was compiled for each jurisdiction by Hyder. The collective list was provided to DSEWPaC and DERM as the project clients, to seek any further additions. Although the lists were extensive, Hyder highlighted the key organisations and individuals that would be engaged in consultation. This was done on the basis of seeking to engage a range of organisations that represented the C&D sector, waste management industry,

² DSEWPaC (2011) Waste and Recycling in Australia 2011, prepared by Hyder Consulting

reprocessing sector and government. The final list of target stakeholders was agreed to in direct consultation with DSEWPaC and DERM.

Appendix 1 provides a list of the organisations consulted in each jurisdiction, however it should be noted that organisations beyond those listed were invited to participate but may have declined to be included, or were unavailable at the time of consultation.

The range of organisations and individuals consulted included:

- Waste generators residential / commercial C&D sectors
- Transporters & waste management industry
- Material reprocessors & disposal sites
- Government agencies at local, regional, state and national levels policy development, infrastructure management, procurement etc.
- Peak industry associations

The breadth of consultation was to ensure that the range of organisations spanning the C&D sector was covered, and that their engagement was sought. It should be acknowledged that the timeframe and resources available for the study meant that consultation was targeted. A broad range of stakeholders were consulted, although this does not represent an exhaustive list of all the individuals and organisations involved in the Australian C&D sector. The commentary seeks to clarify this when discussing various issues that are highlighted throughout the review.

The consultation was undertaken predominantly face-to-face, however where this was not possible interviews were conducted over the phone to discuss issues including:

- Material flows
- Pricing strategies
- Products and markets
- Incentives and programs
- Barriers and opportunities across all the aspects of the sector

On the basis of the interviews, jurisdictional summaries were developed for each State and Territory, which provide a summary of the responses gained through a variety of sources.

2.4 Reporting

On the basis of the information collected through the process outlined in this method, the information has been presented in this report and provides:

- A national overview on the status of construction and demolition waste management
- Jurisdictional status reports on construction and demolition waste for each State and Territory

3 NATIONAL DATA SUMMARY

Following the method used to compile data for *Waste and Recycling in Australia 2011³*, the definition of construction and demolition waste used throughout this report is consistent with the definition used in the *National Waste Report 2010*, being:

... waste produced by demolition and building activities, including road and rail construction and maintenance and excavation of land associated with construction activities. The C&D waste stream usually covers only some of the generation, disposal and recycling of C&D wastes, as these materials can also be found in the MSW and C&I streams, or as hazardous wastes.

In accordance with the method used to compile data for *Waste and Recycling in Australia 2011*, clean fill has been excluded from the scope of C&D waste. For the purposes of this report, clean fill refers to earthen material in a raw or unrefined state (including soil, sand, and rock). In some jurisdictions clean fill, or materials that can be construed as clean fill, are included in the calculation of C&D waste.

Table 3-1 shows the tonnes of C&D materials disposed and recovered in each Australian jurisdiction for the 2008–09 financial year. The information shown is drawn from *Waste and Recycling in Australia 2011* report⁴.

The table shows a total of 8,529,374 tonnes of C&D waste disposed nationally in 2008-09, and a total of 10,468,186 tonnes recycled. This gives a national resource recovery rate from the C&D waste stream of 55%.

It should be noted that information on the weight of waste and recycling contained in *Waste and Recycling in Australia 2011* is based on an interpretation of government and industry data performed by Hyder Consulting. This includes publicly available reports and information sourced directly from industry.

Data has been manipulated, where necessary, to better align the scope of material covered in each jurisdiction, and/or to provide source sector and material splits using national averages. In some cases, this produces results that are different to what is reported on by the jurisdictions themselves. Key differences between reporting methodologies are outlined in the *National waste and recycling reporting – A more uniform approach to data* report.

Reliable data relating to material composition of the waste and recycling streams is not publicly available in all jurisdictions. Where jurisdiction-specific information was not available or is considered to be incomplete, estimates have been based on national figures that draw on average composition data across those jurisdictions where information is available.

The composition data for material disposed in NSW, Queensland, Victoria, Tasmania and the ACT, as shown in Table 3-1, is based on average data drawn from South Australia, Western Australia, NSW and Victoria.

The composition data for material recycled in NSW, Queensland, Tasmania and the ACT, as shown in Table 3-1, is based on average data drawn from South Australia, Western Australia and Victoria.

³ DSEWPaC (2011) Waste and Recycling in Australia 2011, prepared by Hyder Consulting

⁴ At the time of publication, this report was undergoing peer review

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		N	sw	Q	LD	v	IC	v	VA	s	A	1	AS	N	IT ⁶	Δ	ст
Material		Disposal	Recycling	Disposal	Recycling	Disposal	Recycling	Disposal	Recycling	Disposal	Recycling	Disposal	Recycling	Disposal	Recycling	Disposal	Recycling
	Asphalt	15,802	_					3,108	171,756	161	104,288	_		unknown	unknown		
Masonry	Bricks	192,691	1 311 952	1,275,229 1,	1,128,916	1,003,806	1 762 228	620,827	16,141	23,553	117,142	33 738	33,738 9,216	unknown	unknown	21 211	165 916
materials	Concrete	235,369	4,544,552				1,702,220	435,450	354,054	26,784	1,011,942	33,730		unknown	unknown	21,511	155,010
	Other masonry	634,294						876,236	196,998	240,501	20,378			unknown	unknown		
Metals		28,637	419,986	33,884	109,122	26,662	118,906	24,324	88,363	4,913	79,203	896	891	unknown	unknown	626	15,061
Organics		163,611	102,596	193,545	26,657	152,328	22,632	64,695	1,417	41,503	68,824	5,120	218	unknown	unknown	3,474	3,679
Paper & card	board	13,079	874	15,480	227	12,177	-	9,906	76	2,364	585	409	2	unknown	unknown	278	31
Plastics		14,298	3,253	16,923	845	13,312	2,380	9,494	352	2,537	277	447	7	unknown	unknown	317	117
	Glass	2,294	207	2,723		2,136		3,726	6,861	1,210		72	-	unknown	unknown	158	
Other	Leather & textiles	10,596	-	12,543	54	9,865	84	4,962	-	4,308	117	332	-	unknown	unknown	293	7
	Tyres & other rubber	197	-	287		183		-	-	216		6	-	unknown	unknown	6	
Herendeus	Contaminated soil	313,269	-	370,576	-	291,665	-	7,022	-	55,068	_	9,803	-	unknown	unknown	8,394	-
Hazardous	Asbestos	221,046	-	261,485	-	205,803	-	-	-	27,679	_	6,917	-	unknown	unknown	5,547	-
	TOTAL	1,845,183	4,871,868	2,182,674	1,265,820	1,717,938	1,906,230	2,059,749	836,018	430,795	1,402,756	57,739	10,334	194,890	449	40,405	174,712

⁵ DSEWPaC (2011) Waste and Recycling in Australia 2011, prepared by Hyder Consulting

⁶ As outlined in *Waste and Recycling in Australia 2011*, NT disposal, recycling and energy recovery data is for the 2008–09 financial year. Recycling data was taken directly from the National Environment Protection Council Annual Report for 2008-09 and represents kerbside and drop-off recycling for two councils only (12% of all NT councils). Waste disposal data represents disposal in the Darwin metropolitan area only. No figures were provided on C&D disposal and recycling. Tonnage has been estimated using the NGER 2009 waste splits for the MSW, C&I and C&D streams.

4 REGULATORY FRAMEWORKS

4.1 National C&D Waste Legislation, Policies and Standards

The following section presents findings from a review of legislation, policies, standards and guidelines occurring at a national level and on a state/territory basis relevant to C&D waste. Information on the policies and strategies being implemented in each state and territory has been sourced from *The Blue Book – Australian Waste Industry, 2007/08 Industry and Market Report*⁷, as well as the following sources for each state and territory.

Table 4-1 Summary C&D related legislation

State	Source of information						
New South Wales	Office of Environment & Heritage (OEH) website, www.environment.nsw.gov.au						
	NSW OEH (2007) Waste Avoidance and Resource Recovery Strategy 2007						
	NSW Government (2006) State Plan, A New Direction for NSW						
	NSW OEH (2010) NSW Waste Avoidance and Resource Recovery Strategy – Discussion Draft: Strategic Directions and Implementation Plan 2011 – 2015						
	NSW OEH (2010) NSW Extended Producer Responsibility Priority Statement 2010						
	NSW OEH (2007) Report into the Construction and Demolition Waste Stream Audit 2000-2005						
	NSW Roads and Traffic Authority (RTA) Environment						
	http://www.rta.nsw.gov.au/environment/index.html						
Victoria	Sustainability Victoria website: www.sustainability.vic.gov.au						
	EPA Victoria website: <u>www.epa.vic.gov.au</u>						
	Metropolitan Waste Management Group website: www.mwmg.vic.gov.au						
	State Government of Victoria (2005) Towards Zero Waste Strategy						
	Department of Sustainability and Environment (2009) Metropolitan Waste and Resource Recovery Strategic Plan						
	Sustainability Victoria (2010) Towards Zero Waste Strategy Progress Report for 2008–09						
	VicRoads Documents http://webapps.vicroads.vic.gov.au/VRNE/csdspeci.nsf/						
Queensland	The Department of Environment and Resource Management (DERM) website: www.derm.qld.gov.au						
	Department of Environment and Resource Management (2010) Queensland's Waste Reduction and Recycling Strategy 2010–2020						
	Department of Transport and Main Roads (DTMR) Standard Specifications Roads <u>http://www.tmr.qld.gov.au/</u>						
South Australia	Zero Waste SA website: <u>www.zerowaste.sa.gov.au</u>						
	EPA South Australia website: <u>www.epa.sa.gov.au</u>						
	Zero Waste SA (2010) South Australia's Waste Strategy 2010–2015 Consultation Draft						
	South Australia Environment Protection (Waste to Resources) Policy 2010, under						

⁷ WCS Market Intelligence and Waste Management and Environment Media, (2008) *The Blue Book – Australian Waste Industry,* 2007/08 Industry and Market Report

	the Environment Protection Act 1993					
	EPA South Australia (2010) Waste Guidelines–Waste Levy Regulations					
Western Australia	Department of Environment and Conservation website: www.dec.wa.gov.au					
	ZeroWaste WA website: <u>www.zerowastewa.com.au</u>					
	Western Australian Waste Authority (2010) Draft II Waste Strategy for Western Australia March 2010					
Tasmania	Department of Primary Industries, Parks, Water and Environment website: <u>www.environment.tas.gov.au</u>					
	Department of Infrastructure energy and resources website: www.dier.tas.gov.au					
	Taswaste website: www.taswaste.com.au					
	Department of Environment, Parks, Heritage and the Arts www.dpipwe.tas.gov.au					
Australian Capital Territory	Department of the Environment, Climate Change, Energy and Water (DECCEW) website: www.environment.act.gov.au					
	Department of Territory and Municipal Services (TAMS) website: <u>www.tams.act.gov.au/live/recycling-waste</u>					
	Department of the Environment, Climate Change, Energy and Water (2010) Draft ACT Sustainable Waste Strategy 2010–2025					
Northern Territory	Northern Territory Government website: www.territory2030.nt.gov.au					
	Northern Territory Department of Natural Resources, Environment and the Arts website: www.nt.gov.au/nreta					
	Environment Protection Authority website: www.epa.nt.gov.au					
	The Department of the Chief Minister (2009) Territory 2030 Strategic Plan					
	Packaging Stewardship Forum of the Australian Food and Grocery Council website: www.afgc.org.au/psf/remote-and-indigenous.html					

4.2 Australian Government Waste Legislation

The Australian Government does not directly legislate management of C&D waste. The management of environmental issues, including all waste streams, is largely the responsibility of Australian state and territory governments. Exceptions to this general principle are where international treaties are involved (i.e. the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal) or developments are deemed to be of significant environmental importance to the nation.

Waste management and resource recovery in Australia is dependent on the regulatory framework of a particular State or Territory. Because of this, the approach commonly adopted by the Australian Government is one of multi-stakeholder engagement and the introduction of multi-party agreements. These may be supported by underpinning legislative measures in instances where all parties support the need for such fall-back legislation at a jurisdictional level⁸.

⁸ WCS Market Intelligence and Waste Management and Environment Media, (2008) *The Blue Book – Australian Waste Industry,* 2007/08 Industry and Market Report

4.2.1 Australian and New Zealand Government Framework for Sustainable Procurement

In May 2006, the Australian Procurement and Construction Council (APCC) established a working group to develop an Australian and New Zealand Government Framework for Sustainable Procurement (the Framework). The Framework delivers an agreed national and trans-Tasman approach to integrating sustainable development considerations in Australian and New Zealand public procurement.

The purpose of this Framework is to provide a set of national principles to assist the governments of State, Territory and Commonwealth jurisdictions and New Zealand to integrate the principles of sustainability into the procurement of goods, services and construction. The four guiding principles are supported by best practice implementation activities which agencies can use to develop sustainable procurement strategies, policies, guidance material, training and tools:

- Principle 1 Adopt strategies to avoid unnecessary consumption and manage demand.
- Principle 2 In the context of whole-of-life value for money, select products and services which have lower environmental impacts across their life cycle compared with competing products and services
- Principle 3 Foster a viable Australian and New Zealand market for sustainable products and services by supporting businesses and industry groups that demonstrate innovation in sustainability
- Principle 4 Market Development

4.2.2 National Road Pavement Guidance

Austroads is the association of Australian and New Zealand road transport and traffic authorities. Its members are the road transport and traffic authorities from all eight Australian jurisdictions (States and Territories), the Department of Infrastructure and Transport, the Australian Local Government Association (ALGA), and the New Zealand Transport Agency (NZTA). Austroads provides guidance to the jurisdictional road authorities and local government on the planning, design, construction, maintenance, operation and stewardship of roads.

Austroads' *Guide to Pavement Technology Part 4E: Recycled Materials* was released in 2009 and profiles recycled pavement products manufactured from various wastes (not exclusively C&D) that are accepted through registered recycling and reprocessing facilities. It addresses the specification, manufacture and application of a range of pavement products made from the recovery of C&D waste and recycled asphalt paving (RAP). Additionally, but beyond the scope of this review which is focused on C&D waste, it also addresses the use of waste from other sources in pavement production, such as recycled glass containers, and industrial slags and ash.

4.3 State and Territory Legislation and Policy

The majority of waste management and resource recovery policy directions and management activities are undertaken at the state and territory level. The key legislative and policy provisions guiding C&D waste management in each state are summarised in tables within each jurisdictional section below.

4.3.1 New South Wales

The NSW strategic policy framework⁹ integrates planning and assessments for new waste infrastructure with regulatory provisions to manage potential environmental impacts in managing waste, and policy to drive waste reduction and resource recovery. The policy framework has been strengthened in recent years by the development of new legislative measures aimed at streamlining waste infrastructure development and clarifying conditions in which waste can be recovered and used as a potential resource.

Relevant legislation, planning and policy instruments relevant to the C&D waste and resource recovery sector in NSW are presented in Table 4-2 below.

Table 4-2 NSW Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance	to C&D wa	aste	Potential barriers / benefits		
Protection of the Environment Operations (POEO) Act 1997	Includes an in the use o recovery or Includes wa disposal (ap (thermal tre- storage, res recovery. Wastes in N transport int responsibilit waste to cla to the enviro facilitates th disposal.	objective t f materials recycling o ste licensin oplication to atment), w ource reco ISW are cla to categoria y of those ssify it into pomment and eir manag	and the re and the re of materials ing categori o land), wa aste proces overy and e assified for es. It is the who gener o groups tha d human he ement and	In Provides legislative framework for promoting C&D recycling infrastructure and business development for recycling C&D waste materials.		
Waste Levies under the POEO Act	Under Secti waste facilit received at annually:	on 88 of th ies pay a c the facility.	e POEO A contribution The rates	ct, licensed for waste increase	A range of exemptions and deductions are applied to the levy in order to promote resource recovery, for example on waste received at a waste facility tha	
	Year	SMA	ERA		has been processed, recovered or recycled by the facility and transported from the facility for lawful use	
	2008-09	\$40.70	\$40.00		The scheduled substantial increases in	
	2009-10	\$58.80	\$52.40	\$10.00	the Waste and Environment Levy will	
	2010-11	\$70.30	\$65.30	\$20.40	encourage greater waste avoidance and	
	2011-12	\$82.20	\$78.60	\$31.10	source separation by the generator and diversion of C&D waste from landfills.	
					The levy provides an economic incentive for landfill operators to recover and reprocess mixed C&D waste into products.	
rotection of the EnvironmentOEH encourages the recovery of resourcesperations (Waste) Regulationfrom waste by issuing both general and005specific resource recovery exemptions.					Regulatory requirements making it easier to determine when a licence is required for a waste or resource recovery	

⁹ NSW Waste Avoidance & Resource Recovery Strategy 2007

	Where no general exemption is available for the intended use, a specific exemption may be issued after an application is made to the OEH. Specific exemptions are not publicly available.	operation in NSW. The Office of Environment and Heritage (OEH) has developed the Waste Classification Guidelines which outline a clear and easy-to-follow, step-by-step process for classifying waste under the current classification system.				
		The general exemptions relevant for C&D waste currently in force include: Excavated natural materials (25 July 2008)				
		Foundry sand (17 November 2008)				
		Treated drilling mud (24 January 2011)				
		Recovered aggregate exemption (13 September 2010)				
		Cement fibre board exemption (20 June 2008)				
		Glass sand exemption (30 June 2008)				
		Railway ballast (20 June 2008)				
		Coal ash (14 June 2011)				
		Slags (24 December 2010 and 14 June 2011)				
Waste Avoidance and Resource	Objectives include:	Provides legislative framework for				
		0				
Recovery (WARR) Act 2001	to encourage the most efficient use of resources	promoting C&D recycling infrastructure and business development for recycling				
Recovery (WARR) Act 2001	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste.	promoting C&D recycling infrastructure and business development for recycling C&D waste materials.				
Recovery (WARR) Act 2001	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste. to ensure that industry shares with the community the responsibility for reducing and dealing with waste.	promoting C&D recycling infrastructure and business development for recycling C&D waste materials.				
Recovery (WARR) Act 2001 Waste Avoidance and Resource Recovery Strategy 2007	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste. to ensure that industry shares with the community the responsibility for reducing and dealing with waste. Objective to increase recovery and use of secondary materials - By 2014 increase	promoting C&D recycling infrastructure and business development for recycling C&D waste materials. The WARR target is a major driver for recovery and use of materials from the				
Recovery (WARR) Act 2001 Waste Avoidance and Resource Recovery Strategy 2007 The WARR Act requires the development of a NSW Waste Avoidance and Resource Recovery Strategy described below.	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste. to ensure that industry shares with the community the responsibility for reducing and dealing with waste. Objective to increase recovery and use of secondary materials - By 2014 increase recovery and use of materials from the construction and demolition sector, from 65% (in 2000) to 76%	promoting C&D recycling infrastructure and business development for recycling C&D waste materials. The WARR target is a major driver for recovery and use of materials from the C&D sector.				
Recovery (WARR) Act 2001 Waste Avoidance and Resource Recovery Strategy 2007 The WARR Act requires the development of a NSW Waste Avoidance and Resource Recovery Strategy described below. Reducing Waste: Implementation Strategy 2011- 2015	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste. to ensure that industry shares with the community the responsibility for reducing and dealing with waste. Objective to increase recovery and use of secondary materials - By 2014 increase recovery and use of materials from the construction and demolition sector, from 65% (in 2000) to 76% The NSW Government's review of progress towards achieving the 2014 waste targets proposed five new focus areas, including:	promoting C&D recycling infrastructure and business development for recycling C&D waste materials. The WARR target is a major driver for recovery and use of materials from the C&D sector. Continuing to drive national action to introduce product stewardship schemes to tackle new priority wastes, including timbor in addition to the aviation priority.				
Recovery (WARR) Act 2001 Waste Avoidance and Resource Recovery Strategy 2007 The WARR Act requires the development of a NSW Waste Avoidance and Resource Recovery Strategy described below. Reducing Waste: Implementation Strategy 2011- 2015	to encourage the most efficient use of resources to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste. to ensure that industry shares with the community the responsibility for reducing and dealing with waste. Objective to increase recovery and use of secondary materials - By 2014 increase recovery and use of materials from the construction and demolition sector, from 65% (in 2000) to 76% The NSW Government's review of progress towards achieving the 2014 waste targets proposed five new focus areas, including: - Reducing or removing problem wastes to improve resource recovery and produce	promoting C&D recycling infrastructure and business development for recycling C&D waste materials. The WARR target is a major driver for recovery and use of materials from the C&D sector. Continuing to drive national action to introduce product stewardship schemes to tackle new priority wastes, including timber, in addition to the existing priority including packaging.				

		plastics, glass, garden waste, and cardboard).		
		Supporting expansion of waste and resource recovery infrastructure and the development of markets for potentially recyclable materials.		
		Results in increased C&D waste avoidance and resource recovery by C&D waste generators, reprocessors and landfill operators. Promotes C&D recycling infrastructure and business development for recycling C&D waste materials.		
Extended Producer	EPR policies engage producers and others	Results in increased C&D waste		
The WARR Act established a framework for extended producer responsibility schemes for industry	product to take responsibility the design and manufacture of a product, as well as the management at the end of its life (including resource recovery and proper disposal).	avoidance and resource recovery by C&D waste generators, and C&D waste recovery by reprocessors and landfill operators. Promotes C&D recycling infrastructure		
	Of the 17 wastes of concern that have been nominated include the following C&D waste materials:	and business development for recycling C&D waste materials.		
	- Packaging			
	- Polyvinyl Chloride (PVC)			
	- Treated timber			
Environmental Planning and Assessment Act 1979	Encourages the proper management, development and conservation of natural and artificial resources and ecologically sustainable development.	Promotes proper management of resources, hence promotes recovery of C&D.		
State Environmental Planning Policy No 48 1995 - Major Putrescible Landfill Sites	Objective to ensure that the use of landfill sites as a means of waste disposal is weighed against other waste management and waste disposal alternatives.	Promotes increased recovery of C&D waste by landfill operators.		
State Environmental Planning	Objectives include:	Affects the planning process for		
Policy (Major Projects) 2005	to identify development to which the development assessment and approval process under Part 3A (major infrastructure and other projects) of the Environmental Planning and Assessment Act applies.	developments of C&D waste reprocessing and disposal infrastructure.		
	to identify any such development that is a critical infrastructure project for the purposes of Part 3A of the Act.			
NSW Government Sustainability Policy 2008	In terms of C&D wastes, the Policy states that all NSW Government agencies and State- Owned Corporations are required to develop and implement a Waste Reduction and Purchasing Plan (WRAPP) to reduce waste in four areas, including C&D waste.	Promotes increased avoidance and recovery of C&D waste materials. All budget dependent agencies are required to give priority to buying materials with recycled content where they are cost and performance competitive, which promotes development of C&D waste recovery		

reprocessing infrastructure and expands the markets for recyclable materials.

Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage 2010 (Greenspec)	The OEH updated and enhanced the Specification published in June 2003, to meet a need for an industry wide specification for the use of recycled materials in a range of public works. The aim of this Specification is to encourage local government professionals and other key players within both the private and public works engineering sector to use recycled concrete, brick and asphalt materials.	Provides greater clarity on the use of suitable waste-derived materials for earthworks, pavements and drainage. Used for the selection of recycled materials, primarily crushed concrete, brick and reclaimed asphalt blends for use in local road and pedestrian pavements, minor supporting earthworks and as backfill material for drainage lines and drainage structures. Use of other recycled materials such as crushed glass fines and fly ash as well as blends of recycled and virgin materials is provided for under the Guide.
		Future Greenspec additions include use of glass fines in concrete and asphalt wearing surfaces and in gravel pavement design.
		Promotes recycling of C&D waste and expands the markets for recycled materials.
RTA Waste Minimisation Policy	In line with the NSW Government agencies and State-Owned Corporations commitment and requirement to develop and implement a Waste Reduction and Purchasing Plan (WRAPP) to reduce waste, the RTA has a Waste Minimisation Policy in place.	Opportunity to use recycled C&D material in road construction; hence the policy promotes recycling of C&D waste and expands the markets for recycled materials.
	RTA contractors are required to propose recycled-content materials where they are cost and performance competitive.	

4.3.2 Victoria

In 2005, the Victorian Government launched Victoria's Environmental Sustainability Framework, an over-arching strategy designed to achieve environmental sustainability, and the Towards Zero Waste Strategy. It also established a new statutory authority, Sustainability Victoria, to replace both EcoRecycle Victoria and the Sustainable Energy Authority.

Table 4-3 Victoria Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
The Environment Protection Act 1970	Subordinate regulations under these Acts relating to waste management include:	See descriptions of regulations below.
The Environment Protection	- Environment Protection Regulations	
(Resource Efficiency) Act 2002	- Industrial Waste Management Policies	
The Environment Protection	- Waste Management Policies	
(Amendment) Act 2006	and are outlined below.	
Sustainability Victoria Act 2005	The functions of Sustainability Victoria are to:	Result in increased efforts to promote
	- facilitate the implementation of environmentally sustainable measures in all sectors including local government, business and households;	C&D waste avoidance and resource recovery by C&D as the Act supports and facilitates development of C&D recycling infrastructure.
	- encourage and promote the development and use of environmentally sustainable practices, markets, technologies and industries, including resource efficiency;	
	- promote waste avoidance, waste reduction and recovery, reuse, recycling of resources and best practices in waste management;	
	 facilitate the uptake of fledgling technologies, industries, markets and practices in environmental sustainability. 	
Environment Protection (Distribution of Landfill Levy) Regulations 2010	Funds defined activities supporting waste management and recovery infrastructure, industry waste reduction programs, education regulatory controls and enforcement.	The landfill levy is a key policy lever for the C&D industry. The scheduled n,increases in the levy will result in increased C&D waste avoidance and
	The objective of these Regulations is to specify how landfill levies are to be distributed for the purposes of section 70(6B) of the Environment Protection Act 1970, i.e. in accordance with regulations specifying who the money is to be paid to for the purposes of fostering environmentally sustainable uses of resources and best practices in waste management.	resource recovery by C&D waste generators, and C&D waste recovery by landfill operators.
	The Environment Protection (Amendment) Ac 2006 introduces increased and differential levies on the disposal of prescribed industrial waste (see below for C&D material included under this category) to landfill, The levy has increased annually form 2007 and seek to	it

	provide a financial incentive to industry to accelerate waste avoidance, reuse and recycling and will expand industry programs to reduce waste.	
Environment Protection (Industrial Waste Resource) Regulations 2009	The Environment Protection (Industrial Waste Resource) Regulations 2009 have replaced both the Environment Protection (Prescribed Waste) Regulations 1998, and the Industrial Waste Management Policy (Prescribed Industrial Waste) 2000.	Provides framework for promoting C&D recycling infrastructure and business development for recycling C&D waste materials.
	The regulations assist industry to implement the principle of wastes hierarchy, prescribe requirements for assessing, categorising and classifying industrial waste, encourage industry to utilise industrial waste as a resource through reuse, and prescribe requirements for the transport and management of industrial waste.	
	C&D waste materials included in the prescribed industrial waste schedule are:	
	- Bitumen or asphalt	
	- Brick	
	- Cardboard	
	- Concrete	
	- Formed metal components	
	- Glass	
	- Green waste	
	- Plastic	
	- Timber	
Industrial Waste Management Policy (Movement of Controlled Waste Between States and Territories) 2001	The policy provides a nationally consistent statutory framework in Victoria for the management of the movement of controlled wastes between the State and other states and territories originating from commercial, trade or business activities and assist in minimising the potential for adverse impacts associated with the movement of controlled waste on the environment and human health.	Gives priority to re-using and recycling, not disposing, controlled C&D waste materials, which promotes development of C&D waste recovery reprocessing infrastructure.
	For example, the Environment Protection Authority may refuse to issue a consignment authorisation for:	
	- controlled waste intended for disposal in Victoria, where there is an appropriate facility for the reuse, recycling, treatment or disposal of that kind of waste in the jurisdiction of origin.	
	- controlled waste intended for treatment in Victoria, where there is an appropriate facility for the reuse, recycling, or treatment of that kind of waste in the jurisdiction of origin.	

Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999	This policy establishes a management framework and sets specific requirements for the management, including reuse and disposal, of waste acid sulphate soils in an environmentally responsible manner.	Provides framework for the appropriate disposal or treatment for reuse of waste acid sulfate soil. The disposal or reuse should be carried out in accordance with environmental management plans which have been prepared in accordance with the conditions and requirements of the policy.
Waste Management Policy (Siting, Design and Management of Landfills) 2004 (which replaced the 1991 state environment protection policy, SEPP)	The policy encourages minimisation of the development and use of landfills and diversion of waste materials for reuse or recycling instead of disposal and provides a mechanism for continuous improvement and the adoption of best practice by those responsible for the siting, design and management of landfills.	The policy promotes increased efforts to recover C&D waste by landfill operators.
Waste Management Policy (Used Packaging Materials) 2010	 The goals of the policy are to: reduce environmental degradation arising from the disposal of used packaging. conserve virgin materials through encouraging waste avoidance and the reuse and recycling of used packaging materials. The scope of this policy is limited to the recovery, reuse and recycling of used consumer packaging materials and one of the focuses will be on materials used for packaging retails products consumed in industry and commercial premises. 	The policy provides support for developing materials recovery systems and infrastructure for reprocessing of used packaging materials, such as the C&D materials cardboard and plastic.
Metropolitan Waste Management Group (MWMG) Regional Waste Management Groups	MWMG was formed from the amalgamation of the four Regional Waste Management Groups in metropolitan Melbourne, to plan and facilitate waste management activities for its 30 member councils. The regional waste management groups are	fCollaborative efforts to enhance recovery sof C&D waste and develop C&D waste recovery infrastructure.
	responsible for planning municipal solid waster management in rural and provincial Victoria and were established in 1996.	•
Towards Zero Waste Strategy	The strategy sets strategic targets to minimise waste generation and maximise recovery. The TZW C&D waste recovery rate are: - 2002-03: 57% (actual) - 2008-09: 65% (interim target), 71% (actual)	The TZW target is a major driver for recovery and use of materials from the C&D sector through its 2014 C&D waste recovery target and targeted priority C&D materials and products.
	 - 2014: 80% (target) TZW outlines the priority materials and products for each sector. Priority materials and products identified for the C&D sector are: <u>Products:</u> Industrial/transport packaging including film 	

	plastics	
	- Treated timber	
	Materials:	
	- Timber	
	- Concrete, bricks, asphalt	
	- Fill material	
	- Garden organics	
Draft Solid Industrial Waste Management Plan 2003	Statewide Plan for the management of solid industrial waste (SIW).	Driver for developing and establishing C&D waste recovery infrastructure and
	The plan been developed to reflect the goals, targets and priorities for SIW.	systems.
	According to the Plan, to achieve the TZW targets, the C&D waste systems and infrastructure will need to be established to ensure that by July 2006 all construction and demolition waste in metropolitan and provincial city regions is processed for resource recovery prior to disposal to landfill.	
Metropolitan Waste and Resource Recovery Strategic Plan	The Plan was developed to ensure that the key deliverables and targets of TZW for the metropolitan Melbourne would be met.	Provides information and guidelines on waste minimisation, reuse and recycling programs.
	The most recent information available shows that the C&D sector has already achieved interim targets for 2008-09.	
	The priorities for recovery include garden organics, cardboard, concrete/bricks/asphalt and timber (both treated and untreated).	
	In terms of sectors to target, the priorities include small- to medium-sized enterprises and the residential sector for C&D waste.	
Environmentally Sustainable Design and Construction (ESDC)	The goals of these Principles and Guidelines include:	Provides a detailed methodology to ensure the integration of ESDC
Principles and Guidelines 2003	- lead, educate and inform government, the building industry and all other stakeholders of the significance and effective incorporation of ESDC principles into the building design and construction process	principles and therefore a driver for development of C&D waste recovery infrastructure and the development of markets for potentially recyclable materials.
	- create buildings that minimise the draw on natural resources	
	Key targets include:	
	- At least 20% of building materials to be used are recycled and 15% reused from existing building.	
	 At least 90% by weight of any demolition material is to be reused or recycled. At least 95% of construction waste generated on project in metropolitan area, Geelong, Ballarat, Bendigo, Shepparton and Wodonga 	
	to be diverted for reuse or recycling. For all	

	other areas at least 70% to be diverted.	
	- Reuse of rock and topsoil from excavation works. Maximise the use of recycled green organics in additional required composts, soil conditioners and mulches if no more than 5% more expensive.	
VicRoads Standard Specifications for Roadworks and Bridgeworks: Section 820 - Crushed Concrete fo Pavement Subbase and Light Duty	VicRoads has developed standard specifications for the supply and placement of recycled crushed concrete, cement-treated recycled crushed concrete and crushed rock for pavement subbase applications.	These standards open the way for the use of recycled C&D materials on road construction.
Base	VicRoads has also developed standards for	
Section 821 - Cementitious Treated Crushed Concrete for Pavement	the supply and placement of sands for sprayed bituminous surfacing	
Subbase	The agency also has codes of practice that	
Section 801 – Source Rock for the Production of Crushed Rock and	address the accreditation of both quarry products and recycled aggregates:	
Aggregates	Assessment of sites, their material sourcing,	
Section 812 – Crushed Rock for Base and Subbase Pavement	product consistency and testing	
Section 818 – Crushed Scoria for Base and Subbase Pavement	Registration of specific mixes Surveillance of all of these processes of site	
Section 832 - Sands for Sprayed Bituminous Surfacing	management, product manufacture and testing	
Section 407 – Hot Mix Asphalt		
Section 407.09 – Recycled Asphalt Product	1	
VicRoads Codes of Practice:		
RC500.22 – Code of Practice for Selection and Design of Pavements and Surfacings		
RC500.02 - Registration of Crushed Rock Mix Designs		

4.3.3 Queensland

In Queensland, the Department of Environment and Resource Management (DERM) has statutory responsibility to "manage the environmental impacts of waste in Queensland and to minimise adverse effects on human health and the environment". DERM was established on 26 March 2009 following a machinery-of-Government change. The department is made up of the former Environmental Protection Agency and the former Department of Natural Resources and Water.

There have been significant developments in waste management and resource recovery since the introduction of the Environmental Protection Act 1994 and subsequent introduction of the Environmental Protection (Waste Management) Policy 2000 and Environmental Protection (Waste Management) Regulation 2000. This is reflected in the 2010 release of the *Queensland's Waste and Recycling Strategy 2010 – 2020*¹⁰.

The five part approach to achieving this Strategy includes the implementation of a levy of \$35 per tonne on commercial and industrial, construction and demolition waste, and contaminated and acid sulfate soils, with other associated levy pricing signals for lower-hazard regulated waste (\$50 per tonne), and higher-hazard regulated waste (\$150 per tonne). No levy has been applied to municipal solid waste.

The revenue collected from the levy will be managed through the Waste Avoidance and Resource Efficiency (WARE) Fund, which over the first four years of the levy's implementation is anticipated to be \$159 million. These monies will be invested back into a range of state and local government waste and environmental programs¹¹.

Table 4-4 Queensland Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
Environmental Protection Act 1994	The Environmental Protection Act 1994 deals primarily with protecting the environment and managing the pollution impacts of activities, including managing the impacts of waste after it has been generated.	There is little ability under the current framework for undertaking or improving actions associated with waste avoidance, product stewardship and resource recovery and efficiency.
	Subordinate legislation made under the Environmental Protection Act 1994 gives effect to various aspects of the Act, and are outlined below.	
Environmental Protection (Waster Management) Regulation 2000	eThe Environmental Protection (Waste Management) Regulation 2000 objectives are	The regulation includes management requirements for specific waste,
Reprinted as in force on 10 December 2010	to minimising the impact of waste on the environment and establishing an integrated framework for minimising and managing waste under the principles of ecologically sustainable development.	regulated waste tracking and local government administration of waste management activities within their local government area.
Environmental Protection Regulation 2008	This regulation supports the environmental impact statement process, and identifies	The regulation identifies certain waste management activities as

¹⁰ DERM (2010) *Queensland's Waste and Recycling Strategy 2010 – 2020* prepared by the Waste Reform Division

¹¹ DERM (2011) What Does an Industry Waste Levy Mean for Queensland?

Reprinted as in force on 15 April 2011	environmentally relevant activities (ERAs) prescribed under the Environmental Protection Act 1994.	environmentally relevant activities. These include landfills, regulated waste storage and treatment, and transfer stations.
The Environmental Protection (Waste Management) Policy 2000	The Environmental Protection (Waste Management) Policy 2000 outlines requirements for state and local governments to prepare and implement strategic waste management plans and introduces the waste management hierarchy into legislation. The policy's principles for achieving good waste management include: polluter pays, user pays and product stewardship.	The policy promotes waste avoidance, reuse and recycling as a result of including of the waste management hierarchy and the polluter pays, user pays and product stewardship principles, and is therefore a driver for development of C&D waste recovery infrastructure.
Queensland's Waste Reduction & Recycling Strategy 2010–2020	The Strategy identifies waste diversion targets for each waste sector and identifies series of priority waste and products for attention. The targets in the Strategy relevant to C&D waste are: 2008 baseline: 35% - By 2014: 50% - By 2014: 50% - By 2020: 75% The Strategy also includes targets to increase recycling of regulated waste: - 2008 baseline: 30% - By 2014: 35% - By 2017: 40% - By 2017: 40% - By 2020: 45% The range of priority C&D products / materials includes: - Mixed C&D materials (highest priority) - Packaging (secondary priority)	The strategy's targets are a major driver for recovery and use of materials from the C&D sector through its C&D waste and regulated waste recovery targets and targeted priority C&D materials and products.
Proposed Industry Waste Levy Consultation Draft	 Timber, concrete (highest priority) The Proposed Industry Waste Levy Consultation Draft paper was prepared as a companion document to the Waste Strategy consultation draft to provide information for stakeholders about the Queensland Government's proposal to introduce an industry waste levy from 1 July 2011. These levies include: C&D waste \$35/tonne Contaminated & acid sulphate soils \$35/tonne Lower hazard regulated waste \$50/tonne Higher hazard regulated waste \$150/tonne The levies will be reviewed every three years. 	The proposed levies will result in increased efforts to avoid and recover waste by C&D waste by generators, and to recover C&D waste by landfill operators.
Main Roads Specification MRS35 - Recycled Materials for	This publication has been created for use in the design, construction, maintenance and	This specification opens the way for use of the C&D materials crushed rock and

Pavements	operation of road transport infrastructure in Queensland by or on behalf of the State of Queensland. This specification applies to the material requirements for recycled materials to be used in pavements for road construction, rehabilitation and maintenance.	gravel and sands on r rehabilitation and main inclusion and accepta recycled C&D materia
	The Main Roads permitted asphalt aggregates are:	
	Coarse aggregate Crushed rock or crushed gravel	
	Fine aggregate Natural sand particles and/or crushed rock or crushed gravel particles	
	Filler Natural sand particles and/or crushed rock or crushed gravel particles	

4.3.4 South Australia

The Environment Protection Authority (EPA) is South Australia's primary environmental regulator, responsible for the protection of air and water quality, and the control of pollution, waste, noise and radiation. The EPA is an independent statutory authority within the Environment and Conservation Portfolio, with its own Chief Executive and a governing Board.

The environmental impacts of the waste and resource recovery industry are regulated primarily under the Environment Protection Act 1993 and the Development Act 1993.

Table 4-5 South Australia Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
Environment Protection Act 199	 3The EPA regulates the waste and resource recovery industry through the provisions of the Environment Protection Act 1993. The objects of the Act include the requirement to prevent, minimise or eliminate harm to the environment as far as possible. The EPA does this by regulating activities, products, substances and services that may cause environmental harm from pollution or production of waste. Objects also include ecologically sustainable development and a precautionary approach to the assessment of environmental harm. 	The Act defines who needs to pay the waste levy and is linked to the Environment Protection Regulations t2009 which contains additional information on the levy.
Development Act 1993	An Act to provide for planning and regulate development in the State; to regulate the use and management of land and buildings, and the design and construction of buildings; to make provision for the maintenance and conservation of land and buildings, including minimising the environmental impacts of the waste and resource recovery industry.	Provides legislative framework for developing C&D recycling infrastructure.
Zero Waste SA Act 2004 Zero Waste SA Act 2004 requires the preparation of a Waste Strategy for the State.	The Act to establish a statutory corporation, Zero Waste SA (ZWSA), with the function of reforming waste management in the State. ZWSA is the primary agency responsible for the target to reduce waste to landfill by 25% by 2014 as per South Australia's Strategic Plan. The primary objective of ZWSA is to promote waste management practices that eliminate waste to landfill; and advance the development of resource recovery and recycling.	Provides legislative framework for promoting C&D recycling infrastructure and business development for recycling C&D waste materials, which results in increased C&D waste avoidance and resource recovery by C&D waste generators, and C&D waste recovery by reprocessors and landfill operators.
	ZWSA is guided by the waste management hierarchy; the principles of ecologically sustainable development; best practice methods and standards in waste management; and the principle that government waste management policies should be developed through a process of	

Environment Protection (Waste to Resources) Policy 2010	To support the delivery of South Australia's Strategic Plan 2007 target to reduce landfill disposal by 25% by 2014, and to facilitate the delivery of the objectives of the Draft Strategy EPA South Australia delivered a new regulatory framework in 2010. Under the Environment Protection Act 1993, the EPA introduced the Environment Protection (Waste to Resources) Policy 2010 (W2REPP), which came into effect on 1 September 2010. The Policy requires waste from metropolitan	The landfill disposal limitations will promote waste avoidance, reuse and recycling of the listed C&D materials. The waste levies will encourage greater waste avoidance and source separation by the generator and diversion of C&D waste from landfills. The levy provides an economic incentive for landfill operators to recover and reprocess mixed C&D waste into products.
	Adelaide to be taken to resource recovery facilities prior to disposal at landfill, and ban a variety of wastes from landfill. It will also provide improved enforcement options for dealing with the unlawful disposal of waste (including illegal dumping and inappropriate stockpiling of wastes), the safe management, handling and disposal of various waste types, and will require a transparent and consistent approach to the assessment of waste and resource recovery facilities.	
	Objectives include introducing landfill disposal limitations on the following C&D materials: 1 September 2010: aggregated ¹² cardboard and paper; aggregated metals; aggregated high density polyethylene (HDPE) plastic packaging	
	 September 2011: polypropylene (PP) or low density polyethylene (LDPE) plastic packaging; whitegoods. September 2012: polyvinyl chloride (PVC) or polystyrene (PS) plastic packaging. 	
	<u>Solid waste levies:</u> Non-metro rate \$13/tonne Metro rate \$26/tonne	
Hazardous Waste Strategy 2006- 2010	This strategy was released in 2008 and was been designed to work with the current waste management environment in South Australia. It provides a state-wide direction for the management of hazardous waste that will take industry to 2010, after which a review of the strategy should be undertaken. Actions identified in the strategy relevant to C&D waste include:	The strategy promotes efforts to prevent disposal of treated timber, and C&D waste reuse and recycling can also be achieved as a result of developing product stewardship and extended producer principles.

¹² Aggregated recoverable materials: where a system exists to segregate materials or someone has gone to the effort of keeping the materials separate ready for recovery.

	Develop a national approach to minimising the capacity and environmental risks associated with the disposal of unwanted treated timber Recommend to other jurisdictions that the program be developed using a product stewardship or extended producer approach.	
Integrated Waste Strategy for Metropolitan Adelaide 1996-2015	The Integrated Waste Strategy for Metropolitan Adelaide accounts for a range of principles whilst providing a practical framework for waste management.	-
	Although a number of the objectives and programs within the Metropolitan Strategy have been met, the rapidly changing nature of waste management since 1996 has diminished its usefulness.	f
	A new strategy was developed by Zero Waste SA in accordance with Zero Waste SA Act 2004.	2
	The new Waste Strategy for South Australia has had regard to many of the initiatives identified in the Integrated Waste Strategy for Metropolitan Adelaide 1996-2015, and is described below.	
South Australia's Waste Strategy 2010–2015 Consultation Draft	The strategy focus on reducing waste to landfill, maximise the value of resources and avoid and reduce waste. The strategy outlines waste diversion targets. The targets relevant to C&D waste are to recover 85% of C&D waste by 2012 and 90% by 2015.	The diversion targets are a major driver for recovery and use of materials from the C&D sector. The actions promote increased resource recovery and developing recycled material markets.
	The strategy sets out a series of actions that seeks to deliver these targets, including:	
	Develop markets and remove barriers to the use of secondary materials	
	Improve the quality of recycled materials ensuring fit for purpose	
	Promote source separation wherever feasible	
	Ensure planning decisions take account of waste generation and waste reduction	
	Promote green procurement, especially in the government sector	
	Apply financial instruments to drive change	
	Support the implementation of the Environment Protection (Waste to Resources) Policy)
	Embed waste reduction and management practices in construction courses	
	Encourage salvaging and reuse of building materials	
	Engage industry training and association	

	bodies to implement apprentice training that includes avoidance, reduction and recycling within a sustainability context Promote better design of the built environment and adoption of new and more sustainable building materials	
Waste-derived materials— guiding principles for determining approval processes and product standards	All policies, guidelines and standards relating to waste derived products will be developed with regard to the Guiding Principles. The Guiding Principles define the approach that will be consistently applied to determine acceptable methods for waste processing and for reuse standards. The Guiding Principles are intended to ensure that resource recovery is suitable for an intended beneficial use, will maximise value and minimise any adverse impacts.	These principles will define standards for C&D waste derived products and will, if implemented, open the way for use of recycled C&D materials in various applications.
Standard for the production and use of Waste Derived Fill	This standard describes the information and processes that are required by the Environment Protection Authority (EPA) to support the beneficial reuse of a range of wastes specifically recovered for use as fill. Sources of waste material described as being potentially suitable for use as a waste derived fill (WDF) include waste soil (soil, clay, rock, sand and other natural mineralogical matter) proposed for direct reuse, and processed Construction and Demolition Waste (C&D Waste) such as clean crushed concrete, bricks and ceramics.	This standard will be used to help assess proposals and determine compliance with the Environment Protection Act 1993 (EP Act) to ensure that the production and use of waste derived fill constitutes a genuine waste resource recovery and reuse activity, as distinct from waste disposal. The document aims to provide clarity to industry and the broader community on the issues that need to be addressed to demonstrate the suitability of the proposal to use fill taking a balanced risk-based approach.
Recycled Fill Materials for Transport Infrastructure - Operational Instruction 21.6 Policy	The policy was developed to assist the Department for Transport, Energy and Infrastructure (DTEI) in implementing the reuse of fill materials, including asphalt, concrete, timber and soil, in transport-related construction and maintenance activities across the State.	It provides a methodology for sampling imported fill materials and recycled materials and classification for reuse or disposal.
Specification: Part 215 Supply of Pavement Materials	Allowance for use of recycled material is detailed in DTEI's Specification: Part 215 Supply of Pavement Materials which specifies the requirements for the supply and delivery of pavement materials, including recycled crushed quarry products, natural gravel, sand and recycled pavement materials to be used for construction of roadworks for the Commissioner of Highways.	This specification opens the way for use of the C&D materials crushed quarry products, natural gravel, sand and recycled pavement materials for use as pavement materials.
ESD Guide Note Planning, Design and Delivery of new and refurbished buildings	DTEI's ESD Guide Note Planning, Design and Delivery of new and refurbished buildings has been called up by the SA Government Parliamentary Public Works	Briefing documentation for consultants during the design includes references to reducing material waste and the selection of sustainable materials.

	Committee and is a requirement for all projects greater than \$4 million. The ESD Guide Note provides coverage of a range of environmental impacts including waste and materials.	Construction contractors are required to prepare a Waste Management Plan that separates demolition and construction waste into waste streams, i.e. rubble, clean fill, metal, timber, plasterboard, glass etc. These need to be quantified and their disposal to waste recyclers recorded.
ESD Guide Note Sustainment of Existing Buildings	DTEI's ESD Guide Note Sustainment of Existing Buildings is incorporated in the across government Facilities Management Contract Arrangement that DTEI manages on behalf of government. The contract includes opportunities to focus on energy, water and waste reduction.	All DTEI managed facilities are required to give priority to selecting materials for their future ability to be recycled, which promotes increased recovery of C&D waste materials.
	Waste related objectives include: Assess / select products and systems for their future ability to be recycled and from renewable sources Assess / select construction, modification / refurbishment technologies, products and materials for their future ability to be re-cycled	r
SA Sustainable Procurement Guideline	The SA Sustainable Procurement Guideline provides information and practical advice to public authorities regarding the procurement of sustainable goods and services and supports the Government's commitment to implementing the APCC Australian and New Zealand Government Framework for Sustainable Procurement.	The principles include: Adopt strategies to avoid unnecessary consumption Select products and services which have lower environmental impacts across their life cycle compared with competing products and services Foster a viable market for sustainable products and services by supporting businesses and industry groups that demonstrate innovation in sustainability

4.3.5 Western Australia

The Department of Environment and Conservation (DEC) was formed in 2006 when the former Department of Environment and Department of Conservation and Land Management merged. DEC has a broad role in facilitating and implementing the management of wastes in WA. It is responsible for developing policy in collaboration with the Waste Authority, and provides support or assistance to other statutory authorities and boards, including the Environmental Protection Authority, and the Keep Australia Beautiful Council.

The EPA was established by Parliament as an independent Authority with the broad objective of protecting the state's environment.

The Waste Authority's responsibilities include developing, promoting and reviewing a waste strategy for Western Australia, coordinating the strategy's implementation, promoting community awareness and understanding of resource efficiency, and facilitating waste avoidance and resource recovery¹³.

Table 4-6 Western Australia Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
Environmental Protection Act 1986	This Act provides the basis for much of WA's waste management regulation through its provisions, powers to make waste policies, and in particular its subsidiary regulations. While many of the powers established under the Act can be considered to apply to waste, there are also specific provisions for dealing with waste and waste management. In addition, the industry licensing provisions apply to many sectors of the waste management industry.	The Act deals with the Landfill Levy scheme, which is clearly of high relevance to C&D waste management.
Waste Avoidance and Resource Recovery Act 2007	 The Waste Avoidance and Resource Recovery Act 2007 and its associated regulations established the Waste Authority on 1 July 2008. The key responsibilities of the Authority are: the development of a long-term waste management strategy for Western Australia; 	The diversion targets are a major driver for recovery and use of materials from the C&D sector. The targets are further described below.
	 to improve waste services; to avoid generating waste; to set targets for resource recovery 	
Waste Avoidance and Resource Recovery Levy Act 2007	The Waste Avoidance and Resource Recovery Levy Act 2007 established the power to prescribe a levy that is to be payable in respect of waste received at disposal premises. The levy revenue is used to fund waste management initiatives through the Waste Avoidance and Resource Recovery	Its function forms part of the incentive to industry to reduce the amount of waste generated (thereby reducing their landfill levy expenses) as well as providing funds to be used in achieving waste management goals.

¹³ www.zerowastewa.com.au

	Account. The levies have risen substantially for 2010. For instance, landfill levies for putrescibles increased from \$8 per tonne in 2009 to \$28 per tonne for 2010. Similarly, for inert materials the levy increased from \$3 per tonne in 2009 to \$12 per tonne for 2010.			
Environmental Protection Regulations 1987	These Regulations provide detail for the functioning of the Environmental Protection Act 1986. Much of the Regulation deals with prescribing the sorts of activities and premises which attract the attention of the Act, the considerations which should be taken into account in deciding whether to permit those activities, and the licensing and fees for those activities and premises.	Part 9 deals with the Landfill Levy, which is an important part of waste management.		
Environmental Protection (Controlled Waste) Regulations 2004	The Regulations control the controlled waste (including asbestos) by setting out a licensing and tracking system for transportation and disposal of such waste and making it an offence to not comply with any of the requirements.	The Regulations provide for the licensing of carriers, drivers and vehicles involved in the transportation of controlled wastes on public roads.		
Waste Avoidance and Resource Recovery Levy Regulations 2008 (WARR Levy Regulations)	The Waste Avoidance and Resource Recovery Levy Regulations 2008 (WARR Levy Regulations), outline the levy requirements for the disposal of waste to landfill. The levy for inert landfills is \$12/cubic metre. The levy for putrescible landfills is, from 2010 and onwards, \$28/tonne.	The levies will encourage greater waste avoidance and source separation by the generator and diversion of C&D waste from landfills. The levy provides an economic incentive for landfill operators to recover and reprocess mixed C&D waste into products.		
Waste Avoidance and Resource Levy Regulation Administration Policy 2009	This policy relates to the WARR Act 2007, the WARR Regulations 2008 and the WARR Levy Regulations 2008 and provides a summary of the procedures and requirements for the assessment and calculation of the landfill levy payable on all waste received at licensed landfills in the metropolitan region, and all waste collected in the metropolitan region which is received at licensed landfills outside the metropolitan area.	Published to assist in the interpretation of the landfill levy regulations.		
Draft Waste Strategy for Western Australia 2010	One of the priority actions for the Waste Strategy include: The Waste Authority will recommend to the government that it require its agencies and government owned instrumentalities to take 50% of the current construction and demolition waste stream for use as raw material. To fulfil the principles of the Strategy, a series of strategies and targets have been articulated, including: By 2016 C&D waste recovery rate of 50% (up	The diversion targets are a major driver for recovery and use of materials from the C&D sector. In the public response to the Draft Strategy there were repeated calls to establish markets for recyclables, especially construction and demolition waste. A commonly expressed view was that governments and government instrumentalities should take the lead in creating markets for recyclables. The proposed actions and targets		
	from 14% in 2006/07) By 2010 C&D waste recovery rate of 70%	promote increased resource recovery and development of recycled material markets.		
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Extended Producer Responsibility Policy Statement	To ensure implementation of EPR programs, the Draft II Strategy has identified the following 'problem wastes' (C&D materials only shown) as priorities for product stewardship schemes: packaging (and containers)	EPR policies engage producers and others involved in the whole supply chain of a product to take responsibility the design and manufacture of a product, as well as the management at the end of its life (including resource recovery and proper disposal)		
	products containing hazardous materials	The policy will results in increased C&D waste avoidance and resource recovery by C&D waste generators, and C&D waste recovery by reprocessors and landfill operators.		
		Promotes C&D recycling infrastructure and business development for recycling C&D waste materials.		
Main Roads Western Australia Specification 501 – Pavements	In August 2006, Main Roads WA (MRWA) released a revision of Specification 501 – Pavements, which includes specifications for recycled concrete road base (RCRB) materials. Prior to this, RCRB materials were not allowed for use as sub-base or basecourse in road construction.	This specification opens the way for use of recycled concrete for use as pavement materials.		
Reducing Construction and Demolition Waste Going to Landfill in WA – Draft discussior paper (November 2010) by Hon Dr Sally Talbot MLC WA Labor Shadow Minister for Environment; Planning; Climate Change; Lands; Youth	In a draft discussion paper on reducing C&D waste going to landfill, WA Labor's Shadow Environment Minister Dr Sally Talbot suggests 'a sounder, more responsible way to radically decrease the amount of C&D waste going to landfill would be to put in place a range of initiatives such as providing support for producers to separate C&D waste into its various components and requiring development applications to include C&D waste management plans as part of the planning approval process'. According to the paper, the most important single measure to take may 'be to legislate to require the State Government to replace a proportion of the virgin material used in road	If this policy would be enforced, it would promote waste avoidance, reuse and recycling of C&D waste through its pinitiatives to support producers to separate C&D waste and replace a proportion of virgin material used in road base products with recycled material.		
	base products with recycled material'. This draft paper was circulated to key stakeholders for feedback on the content.			
	According to the draft paper, one possibility is 'that WA Labor would commit to a policy requiring the State Government to include in all its tenders to construct, rehabilitate and maintain state roads a requirement that a			

4.3.6 Tasmania

In April 2006, the responsibility for the regulation of waste management activities in Tasmania was transferred to the Department of Tourism, Arts and the Environment (from the Department of Primary Industries, Water and the Environment). It is responsible for the regulation of activities related to waste treatment and disposal and project of state significance including management, transport and disposal of controlled waste; permitting and regulating landfills receiving more than 100 tonnes of waste annually; and implementing the Landfill Sustainability Guide 2004.

Under the *Environmental Management and Pollution Control Act* 1994, responsibility for the regulation of activities that may cause environmental harm is shared by local government authorities.

Table 4-7 Tasmania Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
Environmental Management and Pollution Control Act 1994	Under the Environmental Management and Pollution Control Act 1994, responsibility for the regulation of activities is shared by local government authorities. Local government is responsible for activities that may cause environmental harm. The Department of Tourism, Arts and the Environment is the Department responsible for regulation including a range of manufacturing activities and activities related to waste treatment and disposal.	Provides regulatory framework in preventing environmental degradation by promoting reuse and recycling of materials and waste minimisation programs.
Environmental Management and Pollution Control (Waste Management Regulations) 2010	The purpose of the regulations is to prevent environmental harm from occurring through unsatisfactory waste management practices. The regulations prescribe requirements and offences relating to the management of controlled waste (substances listed in the National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 2004) and general waste. The controlled waste provisions apply to all phases of management: removal from a site, receiving, storing, reusing, recycling, reprocessing, salvage, incineration, treatment disposal and use for energy recovery. The general waste provisions apply mainly to disposal to landfill.	Provides regulatory framework in relation to all stages of the management of controlled wastes and the disposal of general waste.
Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010.	The regulations have been developed to provide a legal basis for the Controlled Waste Tracking System (CWTS) and to enable tracking requirements to be enforced.	The regulations prescribe offences for non-compliance with registration conditions and tracking obligations, unauthorised movement of waste, failure to retain records, provision of false or misleading information and other matters.
Tasmanian Waste and Resource	The Tasmanian Waste and Resource	Creates and supports markets for

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Management Strategy 2009

Management Strategy supports the Tasmanian Government's 'Tasmania Together Goal 12 for achieving Sustainable Management of our Natural Resources'.

The Strategy developed a series of strategic actions including:

Developing collaborative strategies with the C&D sector to reduce the amount of waste deposited to landfill.

Creating and supporting local markets for resource recovery through implementation of appropriate purchasing practices.

Developing policies and deliver services and programs which stimulate investment in technologies, facilities and systems to promote resource recovery and reduce the disposal of resources to landfill.

Specific targets are not articulated. The Strategy notes that the performance measures are often written in broad terms due to a lack of available data. It is noted that once the data is collected, that performance measures will be further developed and incorporated with timeframes.

recycled C&D materials and promotes investment in technologies, facilities and systems to promote recovery of C&D waste.

4.3.7 Australian Capital Territory

In the Australian Capital Territory (ACT) the Department of the Environment, Climate Change, Energy and Water (DECCEW), which is now part of the Environment and Sustainable Development Directorate, develops and implements sustainable environmental policies and practices, including in the area of waste management. This includes the development of the ACT's waste strategy.

The Department of Territory and Municipal Services (TAMS) is responsible for the implementation of the ACT waste strategy through its business unit, ACT NOWaste. Waste management is regulated under the *Environment Protection Act* 1997 and the Environment Protection Regulation 2005. The Environment Protection Authority (EPA) sits within the DECCEW. It has legislative responsibility through the *Environment Protection Act* 1997¹⁴ for activities including waste transport and disposal.

Table 4-8 Australian Capital Territory Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits	
Environment Protection Act 199	7An Act which provides for the protection of the environment, and for related purposes.	Provides legislative framework for the management of waste.	
Environment ProtectionMade under the Environment Protection ActRegulation 20051997.		Provides legislative framework for the management of waste.	
Regulation 2005 1997. Waste Minimisation Act 2001 The main objects of this Act are as follows • to establish a waste management hierarchy • to ensure that government, industry community representatives are invol in the development of ACT-wide was policy; • to minimise the consumption of naturesources and the final disposal of w by encouraging the avoidance of wa and the reuse and recycling of waste • to ensure that industry shares with th community the responsibility for minimising and managing waste; • to promote and ensure the efficient resourcing of waste service planning and delivery; • to achieve integrated waste planning and services;		Provides regulatory framework in relation to all stages of the management of waste and promotes waste avoidance and resource recovery.	
Draft ACT Sustainable Waste Strategy 2010–2025	The aim of the ACT Sustainable Waste Strategy 2010–2025 is to ensure that the ACT leads innovation to achieve full resource	Encourages the reuse of C&D waste by waste generators and promotes development of markets for recyclable materials through the Resource	

¹⁴ www.environment.act.gov.au

recovery and a carbon neutral waste sector. The targeted rate of resource recovery will increase as per below:

- over 80% by 2015
- over 85% by 2020
- over 90% by 2025

One of the key areas for better resource recovery identified in the strategy includes recovery of wood waste as there has been a significant increase in stockpiling of wood from the C&D sector in recent years.

Strategy 1.5 involves encouraging on-site reuse of C&D waste.

Strategy 2.7 involves developing markets for recyclable materials and strengthening regional connections.

Strategy 3.6 involves increasing reuse and rehabilitation of soil from construction sites.

Waste Minimisation in the Construction and Demolition Industry Handbook is a NOWaste initiative to aid waste reduction in the C&D industry.

One of the strategies includes putting a price on waste. The Draft Strategy highlights that the ACT Government will continue to develop its regulatory and pricing approach as the system for waste management evolves to incorporate new treatment and sorting facilities.

Recovery Market Development Officer and supports local recycling businesses in the ACT.

4.3.8 Northern Territory

In 2007, the Northern Territory Government introduced legislation to establish the Northern Territory Environment Protection Authority, which is an independent statutory body responsible for advising and making recommendations to NT Government, business and the community in relation to ecologically sustainable development. This includes addressing priority issues associated with human settlements and resource consumption, which include waste management.

The NT Department of Natural Resources, Environment, the Arts and Sports (NRETAS) also houses a Waste and Pollution Management unit which supports the Government to achieve its commitments in relation to managing waste.

Table 4-9 Northern Territory Legislation, Policy and Standards Overview

Legislation / Policy / Standard	Relevance to C&D waste	Potential barriers / benefits
Waste Management and Pollution Control Act 1998	The objectives of the Act are to protect, and where practicable, to restore and enhance the quality of the Territory environment by: preventing pollution reducing the likelihood of pollution occurring effectively responding to pollution avoiding and reducing the generation of waste increasing the reuse and recycling of waste effectively managing waste disposal	Provides regulatory framework for a undertaking environmentally sound practices in managing pollution, and promotes waste avoidance, reuse and recycling.
Waste Management and Pollution Control (Administration) Regulations	The Regulations detail the administration of approvals and licences of activities as specified in Schedule 2 of the Waste Management and Pollution Control Act, and provides a list of waste types deemed to be "listed waste". The Regulation sets fees and establishes the infringement notice regime	Regulatory requirements making it easier to determine when a licence is required for a waste activity.
Territory 2030 Strategic Plan 2009	The Plan acknowledges that waste is a real issue for the NT. Waste management is addressed under some key areas of the Plan. These include objectives addressing the Territory making headway into lifestyle illnesses, where a target has been set to 'improve environmental health in remote communities to a standard similar to rural and urban communities by 2020.' Delivering effective waste management systems is seen as one action to deliver on this target.	To support the practical implementation of the objectives of the Plan, the NT Government makes funding available through its annual EnvironmeNT Grants. The grants are available to schools, community groups, local government and industry associations for environmental projects and educational activities in the NT. Funding include projects with a waste and resource recovery focus.
	A further objective addresses sustainable living, and identifies a target to 'reduce the amount of waste being taken to our rubbish dumps by 50% by 2020'.	The waste to landfill reduction target is a driver for waste avoidance and recovery and reuse of materials.
Litter Abatement and Resource Recovery Strategy 2003	The Strategy established five key themes:	Promotes the development of recycling infrastructure and establishes better
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	Achieving behavioural change	regulatory mechanisms to support C&D		
	Improving litter and recycling services and infrastructure	waste industry stakeholders.		
	Establishing better regulatory mechanisms to support industry and community initiatives			
	Obtaining better information			
	Revitalising government, community and industry dialogue			
Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory 2003	The Guidelines encourage those responsible for solid waste to adopt an integrated approach that includes avoidance, recycling, minimisation, treatment and disposal, and advocates that the disposal of waste to landfil should only be taken as a last resort. However, it concludes that despite waste minimisation efforts and the growing viability of recycling, landfilling is the only practicable method for dealing with many wastes in the Northern Territory.	Encourages waste avoidance and recycling by waste generators, waste processors and landfill operators.		

4.4 Australian C&D Waste Recycling Targets¹⁵

Table 4-10 provides a summary of the resource recovery targets established in each Australian jurisdiction in relation to the C&D waste stream (where such targets exist). The 2008-09 recovery rate for each jurisdiction is also shown. As noted previously, this data is based on the *Waste and Recycling in Australia 2011* report, and represents the most up-to-date information that is available across all jurisdictions at the time of publication.

	NSW	VIC	QLD	SA	ACT	WA	NT	TAS
2008-09 recovery rate ¹⁶	73%	53%	37%	77%	81%	29%	<1%	15%
Target recovery rate	76% recovery by 2014	80% recovery by 2014	50% by 2014 60% by 2017 75% by 2020	90% diversion by 2015 (target based on 2009 estimated diversion of 80% C&D from landfill, Adelaide metro only)	Overall over 80% recovery by 2015 (no specific C&E target)	Inert (mainly C&D) 100% recovery by 2015	Overall target to reduce waste being taken to rubbish dumps by 50% by 2020 (no specific C&D target)	No specific targets are articulated

Table 4-10 Resource recovery rates (2008-09) and future targets by jurisdiction

¹⁵ Based on information sourced from jurisdictional strategies, referenced previously in Section 4.3.1 – 4.3.8

¹⁶ Based on the information shown in Table 3-1, from *Waste and Recycling in Australia 2011*

4.5 International C&D Waste Legislative Framework Overview

International legislation pertaining to C&D waste can be categorised as policy / instruments promoting C&D recycling or policy / instruments promoting the use of recycled C&D materials. National, overarching environmental laws tend to facilitate implementation of both types of policy, but rarely address C&D in specific terms. Instruments directed at increasing the recovery of C&D waste and minimising landfilling of C&D materials, such as economic incentives, penalties, permits and guidelines, are often implemented at regional or municipal levels. Reprocessed C&D materials are predominantly used in civil works projects and their application is either regulated through material specifications or recommended through guidelines.

Government procurement policies can also have a significant impact on the use of recycled product. Specifications and guidelines are generally provided by national sector bodies, such as government departments responsible for infrastructure. Hyder consulted with a number of contacts in the international waste sector to identify examples of relevant legislation. The following sections provide an overview of selected policies and instruments implemented in European, Asian, and North American jurisdictions that are available for review. The following review is not exhaustive, but provides some international context, and attempts to identify some novel approaches.

4.5.1 Policy and instruments promoting C&D waste recycling

Europe

European waste management is driven by the European Commission's Waste Framework Directive (WFD). The WFD was amended in 2008 to specifically address C&D waste and presents the following target for member states:

By 2020, the preparing for reuse, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70% by weight...

The European Waste Catalogue (EWC) is an index that lists all waste types and assigns each a numerical code. C&D wastes listed in Chapter 17 of the catalogue include 44 waste types, 16 of which have been classified as hazardous wastes. The treatment, collection, transfer and disposal of hazardous material are subject to additional regulatory controls.

Construction and demolition waste makes up approximately 25% of all waste generated in the European Union (EU)¹⁷, and has therefore been identified as a priority waste stream by the EU. This means that particular attention will be paid to policies and measures to ensure increased recycling of C&D waste. Member states implement their own legislation to comply with the WFD.

The following sections present examples of member state policy with a direct impact on C&D waste recovery.

¹⁷ EIONET (<u>http://scp.eionet.europa.eu/themes/waste#4</u>)

Ireland

Ireland's national waste policy requires at least 85% recycling of C&D waste by 2013. Current recycling rates are around 80%. Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects were published in July, 2006 by the Department of the Environment, Heritage and Local Government. The Guidelines promote an integrated approach to the management of C&D waste and introduce the concept of integrated waste management planning for construction projects above certain thresholds. In summary, the purpose of the Guidelines is to:

- Introduce the concept of project based C&D waste management planning;
- Apply to both public and private sector projects above certain thresholds;
- Represent a 'cradle-to-grave' approach across all stages of a project from conception to completion;
- Include waste audits which will improve information on waste flows in this sector;
- Be supported and endorsed by the construction industry through the National Construction and Demolition Waste Council (NCDWC);
- Suggest appointment of a C&D waste manager to oversee activities at the site level.

England

Site Waste Management Plans (SWMPs) have been the main driver for reducing C&D waste to landfill in England since their introduction in 2008. In combination with an escalated landfill tax, SWMPs have had a considerable impact on England's C&D waste management. C&D recycling rates are currently around 70%¹⁸. The aim of the SWMP is to ensure that building materials are managed efficiently, waste is disposed of legally, and material recycling, reuse and recovery is maximised. Local authorities and the UK Environment Agency (EA) have power to enforce the application of SWMPs through penalties or prosecution.

An SWMP is required for all construction projects worth over £300,000 (Site Waste Management Plans Regulations 2008). SWMPs must include the following information:

- types of waste removed from the site
- identity of the person who removed the waste and their waste carrier registration number
- a description of the waste
- site that the waste was taken to
- environmental permit or exemption held by the site where the material is taken (for projects estimated at >£500,000)

SWMPs are currently voluntary in Wales, Scotland, and Ireland.

Germany

At the national level, Germany's Ministry of the Environment, Nature Conservation and Nuclear Safety, supported by the Federal Environmental Agency, is responsible for the development of legislation on C&D waste. The national level of responsibility includes the provision of technical instructions regarding the disposal of wastes, the setting of targets and goals, and transposition of EU Directives.

¹⁸ COWAM (2006). Construction and Demolition Waste Management in Germany.

In 1994 Germany introduced an Act promoting closed substance cycle waste management and ensuring environmentally compatible waste disposal. Within this overriding Act, construction material manufacturers are responsible for ensuring that their products are designed in such a way as to reduce wastage (for example different lengths of floorboards to reduce cutoffs), facilitate recovery after usage, work towards making them recyclable, and make them environmentally compatible with post recovery applications. Furthermore, building owners, developers and their agents (engineers and architects) are responsible for integrating a waste management strategy into their construction plan. This includes the use of recyclable building materials.

The Commercial Wastes Ordinance was enacted in 2003 and regulates the separation of certain types of recyclable waste from the construction and demolition industry. A further law pertaining to C&D waste is the Waste Wood Ordinance, also enacted in 2003, which requires all wood waste to be either recycled or used to generate energy (energy from waste), and bans wood waste from landfill.

Regional governments (the 'Laender') are responsible for the implementation and enforcement of regulations meant to achieve C&D waste goals set by the Federal government of Germany and the EU. Local German authorities hold the primary responsibility for ensuring the proper treatment of C&D waste.

This includes the administration and issuing of demolition and construction permits that may incorporate detailed deconstruction plans and detailed recycling specifications of the building's materials. All federal level legislation overrides regional and local legislation when conflicts arise¹⁹. Currently more than 86% of C&D waste is recovered in Germany²⁰.

The Netherlands

In conjunction with its '*Landelijk Afvalbeheerplan 2009-2021*' (the national waste management plan, 2009-2021), the Netherlands introduced a new approach to waste management entitled "ketengericht afvalbeleid" (chain oriented waste policy). This policy refers specifically to C&D waste. Key elements of the policy are government procurement policies, grants for research and development, taxes on products or processes that pollute the environment, polluter-pays instruments, and investment.

It is interesting to note that almost all C&D waste is currently recycled in the Netherlands (98%)²⁰. However, the policy is being implemented in anticipation of significant growth in the C&D market over the next decade, and concerns about the capacity of the market to absorb reprocessed materials. The Ministry of Housing, Spatial Planning and the Environment (VROM) is investing in research to find new uses for concrete and wood wastes²¹.

The following policy instruments have contributed to the Netherlands' high rate of C&D recycling:

- Landfill bans on combustible materials
- Reuse targets
- Recycling targets
- Landfill tax

¹⁹ COWAM (2006). Construction and Demolition Waste Management in Germany.

²⁰ European Topic Centre on Sustainable Consumption and Production (2011). *Europe as a Recycling Society*.

²¹ VROM (2010). Getting Ahead with a Successful Chain Approach.

United States

In the US, most C&D waste is regulated at the state level, with around half the states applying specific C&D regulations. However, when C&D waste contains hazardous materials such as lead-based paint, asbestos, or elements such as lead, mercury, cadmium, PCBs and arsenic, disposal is regulated under the Federal Resource Conservation and Recovery Act (RCRA).

Some states and cities have implemented policies to encourage C&D recycling, including the following:

- Demolition contractors are required to pay a deposit in order to receive a building permit the deposit is refunded if the contractor can demonstrate that the C&D waste was taken to a certified recovery facility²².
- Contractors are required to produce a complete site plan prior to receiving a building permit

 the site plan must detail recycling of rubble (concrete/asphalt), land-clearing debris,
 corrugated cardboard, metals and wood.
- State solid waste legislation specifies recycling goals for counties, and a certain amount of C&D waste is allowed to count toward those goals.

Japan

Japan has adopted an integrated waste and material management approach that promotes dematerialisation and resource efficiency. The government's 'sound material cycle society' initiative launched in 2000 brought with it a number of new regulatory codes including specific laws targeting construction materials.

In 2002 Japan introduced the construction waste recycling law, which has resulted in high rates of recycling (for example 99% of concrete in 2006²³). The law enforces the recycling of a broad range of construction and demolition materials. Demolition contractors are required to separate and recycle specific construction wastes such as concrete, asphalt, and timber. The law applies to large-scale demolition projects that exceed a specified threshold and includes registration of demolition operators, noise regulations and countermeasures for asbestos.

4.5.2 Policy and instruments promoting the use of recycled C&D materials

Europe

Various European member states have active research, policies, and programs promoting the use of recycled C&D materials in civil works, including Sweden, Denmark, Germany, the Netherlands, and France. In these countries, drivers for the implementation of policies and regulatory instruments range from a lack of virgin material, to public opposition to aggregate mining, high transportation costs, opposition to landfilling, and high population densities.

²² Houston-Galveston Area Council (2005) *C&D Debris Regulations, Recycle C&D Debris Handbook*

²³ <u>http://www.thefifthestate.com.au/archives/21423</u>

High levels of use of reprocessed C&D aggregates are achieved across most member states. The following sections highlight examples of regulatory and voluntary instruments that promote the use of recycled product in the EU.

United Kingdom

In the UK, specifications and design guidelines exist for the use of recycled C&D materials in various construction applications, for example:

- Specification for Highway Works
- Design Manual for Roads and Bridges

C&D materials covered by these specifications include:

- Reclaimed asphalt
- Recycled Concrete Aggregate
- Recycled Aggregate

The UK Environment Agency (EA) usually requires any waste treatment, recovery or disposal operation to be authorised by a permit. However, certain low-risk waste handling activities may qualify for a waste exemption. For example, use of recycled material on a construction site may qualify and thereby reduce a contractor's permitting requirements for waste.

In the UK resource consumption associated with the exploitation of virgin quarry aggregate is also being addressed through the implementation of the Aggregates Levy which has been in place since 2002. Under the levy, aggregate is defined as sand, gravel and rock, with some exceptions.

The levy is payable by anyone who is responsible for commercially exploiting aggregate in the UK. It is calculated on the basis of the weight of aggregates (per tonne). Similar levies / taxes are employed in EU countries including France, Sweden and Denmark. The levy was introduced to address the environmental impacts of the extraction and transportation of virgin aggregates, which include but are not limited to noise, dust, vibration, visual amenity, and loss of biodiversity.

The levy seeks to make the price of virgin aggregates better reflect their intrinsic environmental costs, and in doing this improve the competitiveness of recycled aggregate alternatives while supporting the more efficient use of virgin aggregates. A Sustainability Fund was established to manage the levy revenue and to invest funds into programs that support environmentally beneficial practices such as the use of recycled aggregates²⁴

Austria

In Austria, quality criteria for construction materials made of recycled C&D waste exist, but are only voluntary. To address issues of quality assurance, Austria established a C&D recycling association which introduced a voluntary system of third party quality assurance for recycled material, based on obligatory environmental and technical quality criteria²⁵. The association has introduced a series of 'Technical Guidelines for C&D recycling materials' and 'Ecolabel for C&D recycling materials'²⁶. Guidelines specify quality criteria, such as concentration limits for pollutants in the material. The Ministry for Environment recommends the use of these guidelines.

²⁴ www.hmrc.gov.uk

²⁵ www.brv.at

²⁶ <u>http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/constructionanddemolitionwaste/bycountry?country=AT</u>

Belgium

Belgium's sectoral implementation plan 'Environmentally sound material use and waste management in the building trade^{,27} describes the policy planning for the management of materials and waste in the Flemish building trade for the period 2007-2010.

The Flanders Government has developed a voluntary tool for 'Materials in the construction sector', which defines the environmental impact of construction products based on environmental performance, taking into account the application of the product. This tool can be used by architects and builders to inform their clients about the advantages of certain materials for certain applications.

United States

Road construction can absorb significant quantities of recycled waste materials, particularly aggregates. The US Department of Transportation, Federal Highway Administration (FHWA) provides a set of 'User Guidelines for Waste and Byproduct Materials in Pavement Construction', for six major highway construction applications:

- (1) Asphalt Concrete
- (2) Portland Cement Concrete
- (3) Granular Base
- (4) Embankment or Fill
- (5) Stabilized Base, and
- (6) Flowable Fill.

The recycled C&D materials specified in the guidelines are Reclaimed Asphalt Pavement (RAP); roofing shingle scrap; and reclaimed concrete.

Individual states may also have instruments in place that encourage use of recycled C&D wastes. The Department of New York State will issue a Beneficial Use Determination (BUD) for waste materials with demonstrable applications. A BUD results in the material ceasing to be considered a solid waste. In some instances, issuance of a BUD enables market development for a material (i.e. a BUD issued for reprocessed plasterboard means it can now be incorporated in pavement)²⁸.

²⁷ Belgium's sectoral implementation plan – reference D/2007/5024/70, October 2007

²⁸ NEWMOA (2009). *Construction & Demolition Waste Management in the Northeast in 2006.* Report for Northeast Waste Management Officials' Association

C&D WASTE MATERIAL MANAGEMENT

Table 5-11 provides a brief summary of various challenges and activities across the different segments of the Australian C&D marketplace. Further detail on the various segments is provided in the following supporting text.

Table 5-11 Construction and demolition sector summary

Sector	Commercial	Residential	
	Includes commercial / civil activities Design, procurement & building related waste generation can be influenced & reduced	Includes residential development sites through to single dwelling construction & extensions / renovations	
	through mechanisms including performance requirements & rating programs (such as Green Star)	Site constraints mean materials predominantly presented in mixed loads Small builders through to volume builders	
	Waste is often in fit out phase, with the challenges of managing specialist sub-	have limited staff & have a strong reliance on sub-contractors	
	contractors installing building utilities and interiors	Supply & install arrangements are common where a material manufacturer /	
Construction	Changing focus & waste profile in building phases presents challenges	supplier manages the provision & installation of materials during	
	Fit out throughout the life of the building presents ongoing waste challenges	construction Large developers / companies rely on	
	Companies rely on advice from waste management contractors	advice from waste management contractors	
	Overall building activity generates predominantly mixed loads	Smaller builders may use bin hire & site cleanup contractors	
	Civil works differ & clean loads are more likely to be generated from activities such as site preparation works & road wearing course maintenance (as examples)	,	
	Largest contributing stream to C&D material recovery & reprocessing	Mechanised demolition especially at this scale means materials are disposed in mixed waste loads	
Demolition	Recovery is dominated by source separated loads of materials with strong markets for their associated reprocessed products – (strong focus on masonry)	Environmentally friendly salvage options (where specific materials may be recovered for reuse before demolition),	
	Mechanised commercial demolition has implications for the recovery of materials such as timbers, plasterboard and plastics, these are generally presented as mixed waste loads	mechanised demolition Operations include renovations where materials are also generated in mixed loads and bin hire contractors are used	

5.1 Construction Sector

5.1.1 Commercial

Commercial construction includes commercial / civil activities for the design, construction and maintenance of works such as buildings, site preparation, roads, bridges and similar infrastructure. In this review of C&D activity it also includes the construction and maintenance of road pavements, and construction site preparation works that may include excavation.

The economics of large scale construction generally mean businesses are more likely to seek to reduce waste from the outset through efficient design, procurement and building practices that seek to minimise wastage where possible. The challenges for waste management in commercial buildings are often in the fit out phase, where a range of specialised sub-contractors are engaged to install utilities and tailor interiors to the needs of tenants. In the life of a commercial building (whether corporate or residential), the fit out phase will not only happen at the point of establishment, but many times over the lifetime of the building. Some reuse may happen during the refurbished fit out phase, but generally these works generate mix loads of waste which are unlikely to be recovered.

Compliance with programs such as the Green Building Council of Australia's (GBCA) Green Star rating program have meant systems of recovery are being required through tendering processes for large scale construction sites. Construction companies that may be seeking government contracts or reputational advantage are supporting systems of material recovery and also working to improve their star rating by using recycled products in developments.

A challenge is the changing nature of the waste stream at different phases of building construction. The Green Star program and associated assessment tool address materials as part of the rating system. This includes the use of 'Eco-Preferred Content', which can be materials with 'reused content' and 'recycled content'. Independent verification of reused / recycled content is required either through GBCA recognised third party certification, or from an auditor registered by RABQSA (in Australia), or other national / international auditor accreditation systems. Additionally material recovery options in conjunction with manufacturers and suppliers such as take back and recycle arrangements can be included to improve a company's rating.

As highlighted, the construction phase is only one aspect of the development of a commercial structure, and programs such as Green Star support efforts to improve resource efficiency in this phase. Another challenge for this sector is the management of construction waste during the life of the building.

Included in commercial operations is civil road maintenance works which are the source of materials including recovered and recycled asphalt. This predominantly involves the top layer of asphalt, known as the wearing course, being removed and re-laid typically every 10 to 15 years. The recovered material is generally taken to an asphalt plant for sorting and batching for recycled asphalt product.

5.1.2 Residential

Information from the Housing Industry Association (HIA²⁹) indicates the top 100 housing companies nationally ('The Housing 100') had a 38% market share of housing starts in 2009-10. This equated to 60,580 housing starts, which comprised 51,602 detached houses and 8,988 units

²⁹ HIA – COLORBOND® steel, *Housing 100, 2009/10*

/ townhouses. The remaining 62% of activity, approximately 98,840 of houses / units / townhouses constructed in the same period, were undertaken by small-to-medium sized builders.

The residential construction sector generates a range of materials that are presented as mixed loads, either to landfill or to reprocessing sites. The limited available space on building sites often makes it challenging to have systems that provide for the separation of materials into different streams for recovery. Often there is one mixed material disposal system (commonly a single skip bin on site).

The collection contract arrangements and the value of the content of the bins will more likely determine whether materials are separated out for recovery before disposal to landfill.

Complications with introducing recycling systems are also compounded by the residential building sector being dominated by small-to-medium sized builders, who are likely to either be sole operators or have few staff directly in their employ, and which also operate on tight margins.

Regardless of the size of the residential housing company, it is standard practice in this sector to rely heavily on skilled sub-contractors to undertake a range of works during construction. This may also include the builder or company establishing 'supply and install' arrangements with manufacturers. In these instances, an arrangement is made with the manufacturer / supplier to manage the provision and installation of materials during construction (for example roofing). Where these arrangements are established for a material, the builder or company has little influence over decisions associated with the management of supply chain and installation practices.

Industry estimates suggest the cost of disposal of waste generated during the construction of a residential house could be \$2,000 to \$3,000 per house. Additional preliminary assessments in Victoria suggest the volume of waste generated in the construction of a volume builder house on a flat block could be 18 to 23 cubic metres of waste per house. The figures on volume per house do not include soils and excavated materials from the site. Industry partnerships between volume builders and peak industry associations are seeking to investigate these claims in more detail and determine opportunities for improvement.

Bin hire companies have a profile in this area of residential construction. Builders do tend to use bin hire companies for the recovery or disposal of residential construction wastes. Some bin hire companies servicing builders may recover high value materials such as metals, concrete and soils, for which they have established market outlets, with the remainder of waste generally being sent to landfill.

5.2 Demolition Sector

5.2.1 Commercial

The greatest contributing sector to C&D material recovery and processing at present is the commercial demolition sector. This is strongly reflected in the jurisdiction data on material recovery presented in this review.

The relative homogeneity of waste materials generated during commercial demolition mean certain large volume heavy materials, such as steel and masonry (concrete and bricks etc), can be readily recovered. Where disposal charges are applied by weight, these materials can be relatively expensive to landfill. Diversion of this material into reprocessing has also been driven by market opportunities for recycled products, with steel being recycled back into steel products and the masonry materials primarily going into pavement applications.

Many large demolition companies have established their own reprocessing sites for certain materials (mostly masonry), or have developed partnerships with reprocessors and quarry

companies, in order to improve the business model of their demolition activities by improving operating margins through reduced disposal costs.

The nature of mechanised commercial demolition has had implications for the recovery of other materials such as timbers, plasterboard and plastics. These materials are generally presented in mixed waste loads unless salvage arrangements have been made prior to the demolition phase.

5.2.2 Residential

Several challenges exist in relation to the recovery of C&D materials from residential demolition works (which may include renovations). According to demolition industry feedback, environmentally friendly salvage options generally come at greater expense (and take more time to implement) than mechanised demolition practices.

On this basis, the industry highlighted most residential demolition (as opposed to renovation) is mechanised, and unlike larger commercial demolitions, the volumes of valuable materials are low and mixed with other materials that are considered contaminants by reprocessors.

Additionally, any building, whether commercial or residential, that was built prior to 1990 may potentially have components that include asbestos, which may present a significant barrier to resource recovery. Removal of this hazardous material prior to demolition is a priority for demolition companies. The potential presence of asbestos contamination presents one of the most problematic issues in the C&D waste recovery market. Occupational Health and Safety (OHS) legislation across jurisdictions is in place to regulate the handling and management of asbestos.

Due to the widespread use of asbestos material over many years, resource recovery operators who adopt the most stringent acceptance and testing regimes cannot fully guarantee there are no asbestos fibres in materials coming into their sites and in their final products. In some jurisdictions there is a zero tolerance approach to asbestos, while others have allowable limits of < 0.001% of asbestos in products. On this basis, where there is any doubt, loads may be landfilled at a suitably licensed facility, generally at a greater expense than an uncontaminated mixed load.

5.3 Materials Being Accepted / Processed

Recyclers of source separated and mixed C&D loads face different issues, with a range of performance outcomes and end products. As with all waste recovery operations, separation of materials at the source of generation enables much simpler, cheaper and more effective processing. However, a large proportion of the C&D waste stream is presented in mixed form. This mixed material currently represents the majority of C&D waste that is disposed to landfill, although as the cost of landfill disposal increases there is growing incentive for organisations to invest in mixed C&D waste processing.

The C&D recycling industry is currently dominated by reprocessors accepting high volume, clean source separated loads, with limited recovery of mixed loads. The data on C&D material reprocessing highlights a focus on masonry materials, and metals. Materials such as timber, plastic and cardboard wastes generated through C&D activities have generally received less focus in C&D recovery activities.

A challenge in reviewing C&D sector waste generation and material recovery nationally has been that each jurisdiction collects and categorises data somewhat differently, as previously outlined in the review of data.

5.4 C&D Waste Recyclers

There is a general market distinction between reprocessors whose preference is to accept source separated loads and those that will take and sort mixed loads. This approach is reflected in pricing mechanisms, which favour clean loads of materials with strong markets for associated reprocessed products. Large C&D reprocessors highlighted that their primary driver for seeking source separated material was based on the markets for their reprocessed products. On this basis, they accepted materials for which there was a distinct and strong market demand.

Businesses recovering materials from mixed loads commonly did so to reduce disposal costs (including levy costs where these existed), and focused their recovery efforts on the high value materials that they could divert to other local reprocessors, or for which they had an established market outlet.

5.4.1 Source Separated Reprocessors

Source separated loads are predominantly generated through commercial and civil activities, particularly from the demolition sector. Traditionally these reprocessors have located themselves in close proximity to the source of large scale C&D waste generation and market outlets for their products. In this way they are both a competitive with landfills in respect to ease of waste disposal, and to quarries in respect to providing alternative options to crushed virgin aggregates.

The industry consultation for certain metropolitan centres, as outlined in the jurisdictional summaries, provide examples of these observations. In Sydney, due to the high cost of landfill and limited access to quarry products within close proximity to the metropolitan area, there are a large number of source separated reprocessors with a ready supply of material and access to markets for their products. In centres like Melbourne, Brisbane and Perth, where landfill charges are lower and landfills and quarries are more accessible within the metropolitan area, the supply of recovered materials and market outlets for reprocessors is more competitive. In these three cities, there are larger yet fewer reprocessors.

Consultation has highlighted that siting of reprocessing facilities in close proximity to, or within, landfill precincts and in proximity to urban communities could mean site planning, licensing and operational challenges. These challenges are not unique to source-separated reprocessors, although there were concerns expressed by reprocessors (especially in Victoria) that the beneficial nature of the reprocessing industry was not appropriately acknowledged. This included challenging government motivations where businesses felt approval processes and the application of enforcement action were applied in a blanket manner across these precincts. The perception was that there was little or no distinction / investigation into the source of the issue or recognition of the beneficial nature of reprocessors' operations.

In regional locations, some larger scale C&D projects may support source separation through the use of dedicated bin systems for individual materials. In these instances delivery is to local recyclers of materials including concrete, brick, plasterboard and other construction materials where there may be a local market.

This is supported in some jurisdictions with resource recovery facilities and transfer stations that provide dedicated areas for separated C&D waste streams. These facilities may charge a fee for acceptance of clean loads, although this fee is generally below the fee charged for mixed loads. This price differential is to encourage source separation by the waste generator, and also provides some income for the site to offset the management and transfer of this material to another reprocessor.

Mobile crushing and screening equipment is often employed in regional areas to reprocess source separated materials such as concrete and bricks for local market applications, where investment in permanent infrastructure may not be viable for the limited material available.

5.4.2 Mixed Load Recyclers

As highlighted in the jurisdictional summaries, industry information indicated that where mixed waste recycling options are available, processing charges for these loads are charged at higher rates than source separated loads, but are generally slightly less than landfill gate fees for C&D waste disposal.

The industry review indicated there are limited examples of fixed equipment and automated sorting systems being employed to separate mixed C&D waste by material stream, although those fixed-equipment operators were found to be handling a high portion of the total tonnes of material reprocessed. The more common approach (by number of sites, if not by waste volumes) was for smaller bin hire operators to segregate materials from mixed C&D waste loads using a high degree of manual labour, coupled with rudimentary mechanical equipment such as skid steers and excavators.

Mixed C&D waste comes in large part from skip bins used on projects where there are space constraints or insufficient waste volumes to justify investment in the multiple container systems required to source separate materials. This includes a large portion of residential C&D activity.

The degree to which separation of materials occurs within the bin hire industry is difficult to know. However, information from bin hire companies servicing builders suggests that, where they have the facilities to do so, they are physically sorting and recovering high value materials such as metals, concrete and soils, for which they have established market outlets. The remainder of the waste is sent to landfill although in some instances, where the landfill site has capacity, these loads may be sorted again for material recovery.

The bin hire company is generally charged the landfill gate fee, regardless of any further recovery and diversion of materials by the landfill operator.

Mixed loads were more common in regional areas, however these loads generally incurred full landfill gate fee charges, so similar to the bin hire companies, high value materials such as metals, concrete, bricks and asphalt tended to be recovered prior to disposal where possible. Lower processing volumes in regional areas did reduce the economic case for operators to make significant investment in higher-order processing equipment, which meant there is reduced ability to produce higher-specification output products, regardless of potential market demand. In some instances a site's ability to reprocess recovered material also relied on it being able to stockpile quantities of material until it was viable to engage a contractor with mobile crushing equipment.

5.4.3 Mobile Processing

Some resource recovery facilities and transfer stations, including those owned and operated by local governments, provide dedicated areas for the drop off of separated C&D waste streams. Mobile crushing and screening equipment may be employed at these sites to process batches of material on a campaign basis. This is especially true in regional locations.

In metropolitan centres, the local government managed recovery sites may have arrangements with material reprocessors for collections at a reduced rate in comparison to landfill, when stockpiles are of a certain quantity and it is viable for the reprocessor to collect the material as part of a broader collection run.

Feedback from the reprocessing industry, and one regulatory authority, suggests there may be some inequities in the level of regulation and scrutiny applied to mobile crushing operations compared with fixed processing facilities in some jurisdictions. In addition, operators of fixed plant may face challenges when establishing new facilities for C&D waste reprocessing, which may sometimes involve lengthy and expensive approval processes and the establishment of conditions and monitoring requirements that are not applied to the operators of mobile plant.

6 MATERIAL PROFILES

The level of resource recovery of a material stream, and the market demand for associated products, appears to owe much to geography and pricing. Where materials are heavy and being generated in large volumes, they will cost more to dispose to landfill, especially where there is an appropriate disposal pricing structure which may include an associated levy. This results in certain materials receiving priority attention for recovery and market development in the C&D sector due to specific physical properties (generally weight) and generation volumes. These materials, such as metals and masonry, are predominantly generated from the commercial demolition sector and civil activities such as pavement maintenance or site excavation works.

A range of issues exist that have implications for the level of recovery or otherwise of C&D material streams. Following is a summary of some of the key challenges and opportunities as they relate to the recovery of specific materials generated from C&D activities. The jurisdictional summaries have more specific accounts of issues as they relate to the different geographic regions across the country.

6.1 Concrete and Bricks

Concrete reprocessing involves the use of relatively uncomplicated and well-established crushing techniques. Where high landfill disposal fees exist, there is strong incentive to avoid weight-based disposal charges by recovering this heavy component of the C&D waste stream. This diversion also supports significant end markets for the recycled products in some metropolitan locations, where reprocessing sites can produce products that are competitive with quarry products.

Bricks are often presented as 'mixed masonry' or 'builders rubble' mixed with concrete and, like source separated concrete, this component of the C&D waste stream is relatively simple to process, with similar end markets in aggregate products.

The key markets for crushed concrete and brick include use in low-grade roads (such as all weather applications), and in pavement sub-bases (such as roads and non-structural applications), as a substitute for virgin crushed rock. One significant advantage of crushed concrete is that, compared to crushed quarry rock, the same weight of recycled material may offer an additional 10-15% product volume – effectively meaning end users get more material when purchasing a tonne of recycled product.

In Sydney, the high disposal costs and limited access to quarry products within close proximity to the metropolitan area mean the reprocessed product has strong market outlets. In centres including Adelaide and Melbourne, a market for the products has helped to drive recovery, in partnership with regulatory tools such as increased landfill and levy charges and, in South Australia, the prohibition of materials at landfill which have not been subject to pre-sort processes.

Additionally, Victoria and South Australia have long had specifications that support the use of recycled masonry materials in pavement applications, and this has helped improve the markets for recycled products which compete with virgin quarry products.

In centres including Perth, Brisbane and Melbourne, where quarry products and recycled masonry products are available in the same proximity to markets outlets, cost competitiveness and market acceptance of the recycled product is important. On this basis, Melbourne offers an example to the other two centres because, as previously highlighted, the higher cost of landfilling and associated specifications for recycled products has improved both the cost competitiveness of material recovery efforts, and the product markets.

Both Perth and Brisbane have recently introduced or increased levies. The challenge in Perth has been that the cost of the levy in some instances has been absorbed by the site operators and has

not always equated to increases in landfill charges. With time, improvements in the diversion of these materials should be achieved if increases in landfill charges are realised. Improved diversion will also be supported through government endorsed product specifications, and associated education programs to overcome perceptions of recycled product quality.

In regional locations, unless there is a local market and the ability to process materials in close proximity to where they are generated, C&D wastes are more likely to be landfilled. Materials tended to be transported to the closest site, whether this was a landfill or reprocessor, due to the expense of material cartage and the relatively low value per tonne of recovered product.

In Victoria, the same landfill levies are applied to provincial cities as are applied in metropolitan Melbourne, so there is significant recovery activity and markets for materials in cities such as Geelong and Ballarat. However, resource recovery from C&D waste streams in the North Eastern and Mildura regions of Victoria is hampered by the cross-border movement of wastes to landfills in NSW, where landfill costs were typically lower, in part due to the absence of landfill levies outside of the regulated regions of NSW.

In WA, this review has found there is limited recycling of concrete and bricks in regions such as the Pilbara and Kimberley, even though there was increased construction activity around mine sites in these areas. Some recycling activity did occur in these regions, although it was generally targeted at other materials such as cardboard, timber, glass and clays.

In Tasmania the approach to concrete reprocessing has varied depending on the reprocessor and available markets. Operations include mobile crushing and fixed facilities. However, a recently opened concrete reprocessing plant in Southern Tasmania is understood to be having some difficulties securing end use markets for its product, because there is a low level of demand for recycled C&D materials. A more focused approach to market development may be of benefit.

The review has highlighted some problematic practices associated with the management of concrete and brick materials in some jurisdictions. In the ACT, for example, reprocessors, waste generators, and regulators highlighted the high incidence of illegal dumping (or stockpiling) of C&D materials such as concrete and brick on privately owned land. This practice was seen as a major deterrent to encouraging waste generators to recycle, and impacts on the business feasibility of established reprocessors.

In WA, recycling activity reported by individual reprocessors was variable during 2009–10, with some reprocessors reporting significant increases in material reprocessed, while others handled less material compared with the previous year³⁰. This review found that most C&D reprocessing sites across regional WA did not have weigh bridges installed, and also that C&D reprocessor operating licenses were based on volumes of waste accepted. Accurate information on tonnages of materials is therefore not readily available. When reviewing data from WA for the C&D sector, there are further challenges with a reclassification in 2009-10 of mixed loads containing asphalt and bricks being recorded as concrete.

Additionally in Victoria, consultation with industry suggests that there is a widespread practice of disposal of some solid inert wastes without charging the landfill levy, when materials such as concrete and brick waste is used in applications such as the construction of internal site roads. In Victoria, EPA's publication 332.1 requires landfill operators to collect the landfill levy on all materials disposed into their site unless they have written approval from EPA Victoria to receive the waste without collecting the levy.

³⁰ Department of Environment & Conservation (2011) *Recycling Activity in Western Australia*, prepared by Hyder Consulting for the Waste Authority

6.2 Asphalt

Asphalt material is generated through the civil road construction sector. Asphalt is potentially 100% recyclable. This level of recycling and use of recycled content in pavements has not been fully realised in Australia, although there are efforts to work towards improving this within certain sectors of the industry.

Asphalt pavements on average are 4% bitumen and 96% aggregate. Generally the top layer of asphalt, known as the wearing course (which is generally between 25–40mm thick), is removed and re-laid every 10 to 15 years. This is done using a milling machine which removes the wearing course. The recovered material is generally taken to an asphalt plant for sorting and batching, to ensure the physical properties of the mix are maintained. These include, but not are limited to, the ratio of bitumen to aggregate, the aggregate size, and correct proportions of air voids.

Reclaimed or recycled asphalt pavement (RAP) used in new asphalt is allowed in mixes in Australia. Permissible levels vary across jurisdictions. Mixes generally include 10 to 15% recycled asphalt content, however the level can be higher if the mix is appropriately managed. Recycled asphalt can also go into the base course and road base layers, but mostly goes back into the wearing course of pavements.

In some jurisdictions there has been trialling not only of the percentage of RAP included in mixes, but also of the inclusion of other recycled content such as glass fines (from beverage container recycling), and investigations of the energy efficiency savings that may be realised in moving from hot mix to warm mix application of asphalt wearing courses.

As previously noted, in WA there was a reclassification in 2009-10 of mixed loads containing asphalt and bricks being recorded as concrete. On this basis, the total recovery and recycling of asphalt may not be fully understood.

6.3 Metals

Scrap metal prices are subject to international forces and during the Global Financial Crisis there were reports of serious disruptions to the market for recovered scrap. While the price that reprocessors will pay for mixed steel scrap is highly variable, the current ballpark figure is around \$250/tonne. Coupled with the value of avoided landfill disposal costs, there is a strong economic incentive to recover this material stream.

The majority of metals being recovered from the C&D sector are coming from commercial demolition sites (industry estimates place this at about 90%). Of this material, the vast majority is steel (estimates place this at up to 95% of what is recovered), and the remaining materials are non-ferrous metals. This non-ferrous component mostly includes aluminium (1 to 2%), stainless steel, and copper piping / wire.

Ferrous metals such as steel can be easily recovered from the waste stream using relatively inexpensive magnets.

In metropolitan markets, there is likely to be very little metal from the C&D waste stream that ends up in landfill. Reprocessors point out there are 'two bites at the cherry' for recovery of this material from C&D projects, where it is either source separated and salvaged onsite, or is easily recovered by skip bin companies and landfill operators when it is disposed as mixed waste.

Even in regional areas, where landfill fees are lower and there may be limited metal reprocessors, indications are that scrap metal is separated from other materials and put aside at local transfer stations, resource recovery facilities and landfills, ready for collection once there is a sufficient stockpile to warrant the recovery and transport costs.

This observation is supported by stakeholder consultation that suggested the growth in metal recovery tonnages over the past 10 years was likely to be coming from increased diversion through resource recovery facilitates and transfer stations. Because loads had already been sorted once they arrived at the metal recycling sites, the source of generation of these materials could not always be confirmed, although it was understood that some content may be coming from mixed loads of C&D waste that had been recovered and sorted at these localised sites.

This may also suggest that, even where small-to-medium sized building companies send construction materials into one system for disposal, the bin hire companies that manage the supply and collection of these systems will recover the metal components.

In relation to industry trends, it was highlighted that when demolition activity was high and prices for metals were strong, demolition companies would bring their materials for recycling to the key metal recyclers. However, when there was a downturn in both activity and metal prices, it was suggested that the demolition companies were more likely to stockpile the metals if they could and wait for improved commodity prices.

In jurisdictions including Tasmania, some contractors regarded metal recycling as the only costeffective waste recovery activity.

Metals coming from the C&D sector are also sourced from concrete reinforced with steel (known as reo). In the demolition phase there can be a ratio of 80% concrete to 20% steel. Demolition companies recover and reprocess the concrete. However, it was estimated that even after this processing of the reo, it generally has about 10% concrete (contamination) remaining with the steel.

Metal recyclers consulted during this study indicated they did not actively pursue reo material, but would process it when it was delivered to site. It was generally a low percentage of intake (less than 10%). Where taken, the reprocessors indicated that it was standard practice to make deductions in the sale price based on the estimated weight of associated concrete in the load.

6.4 Timber

Most timber is generated from the demolition sector. Nationally the market demand for recovered timber is more limited than other components of the C&D waste stream. The end product uses, such as mulch, are low value and compete with other waste timber sources that are less contaminated.

There is a high-value market for the reuse of quality hardwood timber, with prices well in excess of \$1,000/m³ for some high grade Australian timbers, although the volume of material recovered is relatively low. It is estimated the market for reuse of timber equates to around 60,000m³ nationally.

Indications from industry are that the salvage market for reusable timber is generally functioning well, due to the potential for high economic returns. A barrier to growing the reuse market is the increasing mechanisation of demolition works (primarily due to time pressures and OH&S requirements on site), which make it more difficult for salvage operations to take place, and increases the potential for high value timbers to be damaged.

Another significant source of salvageable hardwood is 'infrastructure timber' such as power poles and railway sleepers, for which there is strong demand for use in landscaping applications. There may be a high component of residual waste off-cuts after processing some treated or heavily weathered timbers (such as power poles). In jurisdictions where there is a high landfill disposal cost, the cost of managing this residual component may significantly impact the economic business case for attempting to recover these infrastructure timber wastes. According to both generators and reprocessors of waste timber consulted during this project, it is the recovery and markets for products derived from lighter mixed timbers that are much less developed. Much of this material is currently shredded and used as mulch in landscaping purposes. The recovery of untreated timber was found to be hindered where it was assumed that loads may also include treated timbers and timber products such as particle board. Particle board, as a timber product, can be recycled back into particle board, but this is generally confined to pre-consumer manufacturing wastes, or clean off-cuts of particle board recovered at the time of installation.

Contamination with even small levels of treated material (including copper chrome arsenate (CCA) timber and painted products) presents a barrier to recovering more material from mixed loads of timber. CCA timbers are not allowed in products applied to land, such as mulch, nor as a replacement fuel source. Technology solutions to better identify CCA and other treated timbers, such as handheld analysers, are becoming more economically viable and could potentially be used to increase confidence that mixed loads and timber stockpiles do not contain contamination. There have also been efforts to improve education of generators and reprocessors about how to visually identify treated timbers, so that they can be separated from untreated timbers.

A potentially significant market being developed for recycled timber is as use in animal bedding, especially in poultries.

There are competing sources of recovered timber waste beyond the C&D sector, such as those generated from the C&I sector, which are often recovered in cleaner and larger volumes, and which may be used in similar end market applications. These include recovered wood waste such as sawdust and off-cuts from forestry operations.

Reprocessors have suggested that, with the introduction of carbon pricing, more emphasis may be placed on the recovery of timber, as landfill operators may be required to assess, report on and pay a price for their CO2-e emissions³¹. It is estimated that of the 500 organisations emitting more than 25,000 tonnes of CO2-e a year and therefore likely to be exposed to the most recently proposed Carbon Tax, about 190 are from the waste management industry³². Due to the organic composition of timber, it may make its recovery through reuse and recycling applications more viable.

A positive example exists in South Australia at the SITA-ResourceCo Alternative Fuels operation. The plant sorts waste loads into its various material components, and through this process over 90% of the material is recycled. Manufacturing the alternative fuel involves separating non-combustible from the combustible materials.

Timber is one of the combustible materials recovered through this process, which contributes to the manufacture of SITA-ResourceCo's 'process engineered fuel', that can be used as an alternative fuel source to coal or gas in high combustion applications³³, notably the Adelaide Brighton Cement Kiln. There are similar examples in Tasmania, where some recovered wood waste is used as an alternate fuel to help power a pulp mill.

While some regulatory and economic barriers may need to be overcome for similar Energy from Waste operations in other jurisdictions³⁴, there is potential for this development to open up a

³¹ There is significant uncertainty about how carbon pricing may impact the waste sector. The Australian Government may, for example, introduce waste-type specific DOCf values, which would reflect much lower methane generation rates for wood than some other organic materials.

³² The Age (July 13, 2011) *Eighty-five Victorian companies on carbon tax hit list*

³³ www.resourceco.com.au

³⁴ These are outlined in the jurisdictional summaries, where appropriate

significant additional market for recovering the lower-value mixed C&D waste including timber materials. Other jurisdictions have expressed interest in energy-from-waste (EfW) technology to deal with waste materials including recovered timber. It was suggested that standards could be developed for timber-based refuse-derived fuel, which would provide reprocessors with a level of market certainty for this alternative fuel market.

It should be noted that regulatory barriers in relation to EfW generally exist in order to prevent harmful levels of toxic materials in residual ash and air emissions resulting from the combustion of certain materials. These potentially harmful consequences could be mitigated by rigorous screening of incoming source materials to exclude materials unsuitable for combustion, and through the use of appropriate EfW technology to prevent pollution.

In addition to the mixed timber waste material generated from C&D operations, there is also a significant quantity of timber pallets disposed of from the C&D sector. The potential for a higher level of recovery of these exists (both for reuse and recycling). A recovery plan for this material could yield a significant diversion of timber from the waste stream.

6.5 Plastics

The Plastics and Chemicals Industries Association (PACIA) annual recycling survey provides a useful overview for all material source sectors, including C&D, in terms of the levels of plastics recovery, recycling and market outlets³⁵.

The PACIA report highlights that the construction (or building) sector is one of the key markets for plastics in Australia.

Polymer	Major uses related to building / construction	Other uses related to building / construction
HDPE PVC	Film, blow moulded containers, pipes	Irrigation tube, pallets, cable covers, extruded sheet, moulded products, building and industrial film, slip sheets, drip sheets for water, wood substitutes and mixed plastics products (e.g. fence posts, bollards, kerbing, marine structures and outdoor furniture), vertical blind components, materials handling and roto-moulded water tanks.
PVC	Pipe, floor coverings	Hose applications and fittings, pipes including foam core pipes, profiles & electrical conduit, general extrusion and injection moulding.
L/LLDPE	Film (incl. builders & agricultural film, concrete lining), agricultural piping	Trickle products, vineyard cover, pallets, shrink wrap, roto- moulding, slip sheets, irrigation tube, wood substitutes, cable covers, builders' film, timber replacement products, and building industry applications.
PP	Crates, boxes	Electrical cable covers, vertical blind components, building, irrigation fittings, agricultural & garden pipe, drainage products (such as drain gates) and tanks, builders film, kerbing, bollards, concrete reinforcing and a wide variety of injection moulded products.

Table 6-12 Use of recycled plastics in Australia with applications in building / construction

³⁵ Hyder Consulting (2009), 2009 National Plastics Recycling Survey, report to the Plastics and Chemicals Industries Association

PS	Industrial spools	Building components, industrial packing trays, wire spools and a range of extrusion products.
EPS	Waffle pods for under slab construction of buildings	Synthetic timber applications (including decorative architraves, fence posts), XPS (extruded polystyrene) insulation sheeting, lightweight concrete, waffle pods.
ABS/SAN	Injection moulded products	Laminate edging, a wide range of moulded products, sheet extrusion, drainage covers
Polyurethane	Carpet underlay	
Nylon	Injection moulding compound	A range of injection moulded products.
Other and mixed	Agricultural piping	Fence posts, bollards, garden stakes, kerbing, marine structures, post & rail systems, scaffold pads, rail bridge transoms, and sheet extrusion.

The plastics used in construction fall across the two distinct categories which are packaging and durables (or non-packaging). This categorisation of plastics is associated with the life-span of the plastic product.

Even though there are broad applications for plastic products in construction projects, as outlined in Table 6.1, the most prevalent products are packaging films, waffle pods and pipes.

The PACIA study highlights that very little plastic material is recovered from the C&D sector, but acknowledges that there is growing activity around recycling of used plastics from the industry.

The challenge for plastics recovery from the C&D sector is to address recovery of short-term single-use products, such as film, through to long-term durable products such as piping. The issue with piping is that some waste will be generated at the time of installation from off-cuts, but because of its application in plumbing works, beyond the initial installation, the bulk of this material may not enter the waste stream for many years, if at all (for example HDPE and PVC pipes buried in the ground). The study acknowledges that the recycling of packaging and non-packaging materials also differs widely in collection methods and overall recycling rates.

Drop off opportunities do exist for plastics in some jurisdictions, and some manufacturers support the recycling of PVC waste where these material are brought to their sites. There are also regional opportunities for the recovery of piping plastics, but these are highly localised³⁶.

Flexible plastic films are generally considered contaminants in the recycling streams of the construction sector. They also present a litter issue when disposed of inappropriately on construction sites, and when disposed to landfills can present these sites with one of their most significant litter issues.

Some established businesses have invested in the recovery of clean flexible plastic films (particularly freight packaging), which presents significant opportunities for broader recovery of packaging films from other sources, including the construction sector. Very little government and industry attention has gone directly into the recovery of plastics from the C&D waste stream.

³⁶ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

6.6 Plasterboard

Any diversion of plasterboard from landfill is mostly from construction activity, because the nature of mechanised demolition processes means this friable material is not readily separated from mixed loads. It is also considered a contaminant when presented in recovered C&D materials. For this reason it is one of the most challenging materials when seeking to improve the recovery of mixed C&D loads, even though plasterboard itself is highly recyclable.

Most plasterboard recovery is from construction sites and is often achieved through arrangements between the builder / construction company and the material manufacturer / supplier. Plasterboard manufacturers who supply construction sites will regularly support the recovery of clean product from the sites / companies who purchase their materials. This has been a process supported in eastern Australia for some time, and has recently been introduced in Perth. When the material is recovered it is either recycled with pre-consumer manufacturing waste, or provided to outlets seeking a replacement for virgin gypsum. In most instances where plasterboard is recovered, the plasterboard is ground down for reuse as virgin gypsum substitute.

Where plasterboard is landfilled, its presence will cause management issues for sites with clay liners. The gypsum (present in the plasterboard) is used in agricultural applications to improve soil structure, and it does this by attaching itself to the clay particles. This creates space for air and moisture which loosens and breaks-up the soil structure. On this basis, the presence of gypsum from plasterboard in landfills may create issues over time in terms of the structural integrity of sites with clay liners. In order to keep plasterboard separate from other materials, the feasibility of point of sale drop off should be explored with plasterboard suppliers.

6.7 Rock and Excavation Stone

This material is recovered when civil or site preparation works are undertaken and, depending on the geology of an area, a great deal of excavated rock and stone can be produced as a biproduct. On this basis, the generation of excavated rock and stone is coming predominantly from the construction sector.

Both the level of recovery of these materials and end markets for associated products has, again, much to do with the geography of where the material is generated and the local market outlets for products, as well as landfill pricing which may discourage the disposal of this heavy voluminous material.

Similar to crushed concrete and brick, the excavated rock and stone is a source of inexpensive aggregate for a range of applications in pavement sub-base, and so in markets including Melbourne - where there are significant volumes - it competes with the recycled C&D concrete and brick products.

In some instances the preference in the market is for the crushed rock product over the crushed concrete equivalent, as it bears no difference to quarried products when crushed and only the extraction method of this rock and stone has varied. In this way, as the rock and stone has been excavated at the expense of a site developer, it is generally cost competitive with quarried products when sold to the market.

Large C&D reprocessors as well as many traditional quarrying companies will reprocess this material. For the quarry companies, it was highlighted during stakeholder consultation that every tonne of this excavated rock and stone that they recycle helps to extend the life of their own quarry. Additionally, civil contracting and demolition companies generally transport these materials to quarry sites, if they are not processing it themselves, so this further reduces the

expense to the quarry operators. As there is no real distinction between rock sourced by this method and quarried material, it is generally not defined as recycling.

6.8 Soil / Sand

Soil and sand is generated from site preparation and excavation works associated with construction activities. Large volumes of fine materials are generated through these activities and, unless the material can be reused on site, it will require treatment and/or disposal. This includes soil and sand as well as other sub-4.75mm particles from mixed skip bin waste.

This is one of the more complicated and problematic material streams in C&D waste. This is due to the volume of material combined with the confluence of two issues: the first is the potential for significant contamination within this material stream, and the second is the perception by many market participants that any excavated dirt is benign 'clean fill'.

Skip bin fines, which may contain a large portion of soil material, can also contain a range of problematic contaminants, including asbestos. Some operators consulted during this project estimated that excavated material and fines make up around 50% of the volume in mixed skip bin C&D waste.

In NSW, gate fees ranged from \$40/tonne for certified Virgin Excavated Natural Material (VENM), and \$95/tonne for non-certified excavated soils that meet the environmental regulator's acceptance criteria. It was highlighted, however, that there did not appear to be widespread insistence on certification being produced before material was accepted at recycling facilities.

There are significant requirements involved in some jurisdictions in meeting the environmental regulators' standards for excavated natural materials so that they can legally be applied to land. The C&D sector is an acknowledged source of this material³⁷.

For some operators it was considered that the compliance burden in certain jurisdictions was so challenging that it was better to just landfill this material. Organisations who claim to be complying with the regulators' requirements for recovery of excavated materials noted that the level of difficulty and cost in doing so lead them to question their competitors ability to comply with these regulatory requirements where they were charging low fees to process mixed C&D waste.

An issue highlighted during consultation for this review was that untested excavated material, or skip bin fines, was being mixed with other products and branded as soil products. Suggestions of illegal activity within the C&D waste processing sector focused on the possibility that some operators may be 're-birthing' material as virgin soil. This has included public accusations³⁸ of illegal activity that involved falsifying test reports, which have led to prosecutions.

In jurisdictions such as Victoria, where soil is used as a landfill cover material it is subject to landfill levies. Where soils are classified as 'fill material' and are used as cover, the municipal levy rate applies. Where materials other than 'fill material' are used as cover (for example Category C contaminated soil), then the levy rate for Category C prescribed industrial waste is applicable. EPA Victoria guidance notes that a fixed rebate of 15% of all waste deposited onto land at a landfill (from external sources) is provided for in the Act, but reinforces that all cover material used must be included in the levy calculations. The only exception is material excavated on-site³⁹.

³⁷ EPA SA (January 2010) Standard for the production and use of Waste Derived Fill

³⁸ <u>www.insidewaste.com.au/storyview.asp?storyid=1034576</u>

³⁹ EPA (September 2010) Publication 332.2 Calculating the landfill levy and recycling rebates

Similarly with excavated rock and stone (previously discussed), the soil and sand has been excavated at the expense of a site developer, and so was competitive with quarried products when sold to the market.

The large C&D reprocessors and traditional quarry companies recover this material and, as previously highlighted, for quarry operators the recovery of this material helps to extend the life of their own sites. In some circumstances it may also broaden the range of materials they can offer to customers. As with excavated rock and stone, civil contracting and demolition companies generally transport these materials to quarry sites, if they are not processing it themselves, so this further reduces the expense to the quarry operators.

6.9 Roof Tiles

Roof tiles are a common waste material on residential construction sites, however recovery information is not provided that separates out this specific material. It is believed it may commonly be recorded with 'brick rubble' under the 'brick' recovery classification, or that in many instances recovery is low and it is not recorded at all.

Site practices mean that it is often necessary to undertake 'cutting-in' of roof tiles. This is the cutting of tiles so they fit into smaller spaces or along edges. The off-cuts from this practice are discarded around the entire house as the tilers move around the roof area cutting and laying the tiles.

This practice of discarding tile off-cuts around the house block generally means the waste material is managed at the point of site cleanup when bobcats are employed to scrape the materials off the ground. Because of this, the roof tile material is disposed in mixed loads, which are also likely to contain large amounts of top soil.

Reprocessors that accept and process clean loads of concrete, bricks and other masonry will also accept roof tiles, and similarly will crush this material into an aggregate. Roof tiles also have high potential for reuse where they have not become brittle.

6.10 Asbestos

Asbestos is no longer permitted for use in applications including building products, although buildings constructed before 1990 may have used materials containing asbestos. On this basis the greatest potential for asbestos contamination comes from demolition and renovation works, not new construction. Asbestos is an issue in all jurisdictions, however the two jurisdictions of Victoria and NSW provided interesting contrasts to the approach that has been taken to deal with this issue.

Victoria moved to address the management of asbestos in the C&D waste reprocessing sector by preparing and releasing guidance to the industry in 2007. This process was managed by Victoria's Workcover Authority, *WorkSafe Victoria*, in partnership with the C&D industry, representative unions and the State government agencies of EPA Victoria and Sustainability Victoria.

The document, *Recycling Construction and Demolition Material, Guidance on Complying with the Occupational Health and Safety (Asbestos) Regulations 2003,* seeks to assist the industry in meeting its obligations under the regulations. It provides guidance on an auditable procedure that can be used to verify that asbestos containing materials have been removed from C&D loads prior to recycling.

In WA the Summary of the Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia, released in May 2009, also provides guidance that allows for an asbestos limit of <0.001% in soils. Other guidance exists for civil

applications for crushed recycled concrete used in base courses, which notes that the tolerable limit of asbestos is zero. This example highlights that approaches to asbestos may be varied within a jurisdictions, depending on the C&D material being managed⁴⁰.

In NSW, consultation for this review has highlighted that the presence of asbestos contamination presents one of the most problematic issues for the C&D waste recovery market. Due to widespread use of asbestos material over many years, even resource recovery operators who adopt the most stringent testing regimes and make all possible effort to avoid any asbestos coming onto their sites cannot fully guarantee there is no asbestos fibres in their final products. However, the NSW regulator currently has zero tolerance of asbestos in recovered materials.

One example provided in the review concerned a recent project where 600 tonnes of recycled material was supplied to a client at around \$20/tonne (total value approximately \$12,000), and a small amount of asbestos material was found in the material (less than 1kg). The cost for the company to remove all material and clean up the site was estimated at more than \$150,000.

Industry participants in NSW highlight the adoption of allowable levels of asbestos (<0.001%) in Victoria and some applications in WA as a workable solution. The adoption of a small allowable limit of asbestos in C&D products has been highlighted as an option for jurisdictions with a zero tolerance approach. Such a process of change across jurisdictions would need to acknowledge that the human health, environmental, legislative and political issues associated with asbestos material are complex, and that change may be slow and difficult to implement.

In seeking to establish an allowable limit for asbestos, it is suggested that, because the presence of asbestos may present health issues, the process for the development of guidelines be lead by either jurisdictional WorkCover Authorities or Health Departments, working in partnership with the C&D reprocessing industry and appropriate environment agencies.

6.11 Cardboard

In the C&D sector cardboard is predominantly generated during the fit out stage of construction and at the point of occupation, especially in the residential construction sector. The industry is unsure of the potential quantities coming from the residential construction sector, and it was acknowledged that reprocessors were not actively chasing cardboard material from the C&D sector.

A key issue with the recovery of cardboard is that it is presented in mixed loads and may therefore be highly contaminated with abrasive materials that reduce the quality of cardboard and may damage processing equipment. Additionally, in operations where mixed loads are sorted using a manual picking line, it was suggested that if materials were sourced from the C&D sector there could be potential occupational health and safety issues associated with manual handling, where mixed loads may include materials such as timber with nails. On this basis it was acknowledged that any recovery programs may require the cardboard to be separated at source.

It was highlighted that several other challenges existed for recovery from the residential construction sector. These included limited space on site for additional bin systems and the need for quick bin turnover, due in part to short interior fit out timeframes, and also the increased risk of contamination when bins were on site awaiting collection over extended periods.

It was suggested that longer term, larger scale residential development sites with multiple dwelling construction could offer more successful recovery options for cardboard.

⁴⁰ ACIL Tasman (June 2008) Civil works and recycled content prepared for the Department of Environment and Conservation WA

Options for recovery of clean material may exist where waste contractors offered clients a new and separate bin collection for cardboard, or where opportunities for the recovery of cardboard were linked to point-of-sale diversion. A study or trial of this should be undertaken to assess the potential for this approach.

Site collection systems may be feasible where 1,100 litre bins are employed. Bin loss is more likely to occur where 660 litre bins are used as they have more potential applications.

The option of linking recovery to point-of-sale or a network of suppliers / retailers could include plumbing distribution centres / whitegoods retailers or the like, where cardboard material could be returned for recovery the next time the tradesperson went back to the outlet. The recovery of cardboard could also be linked to initiatives by whitegoods retailers where they offer to take back old whitegoods when delivering new appliances; in these instances packaging could also be included in the recovery.

Regardless of options being site based or through point-of-sale outlets, transport will be a key issue, and consolidation of the cardboard may be important for efficient recovery.

It was acknowledged that opportunities exist to trial potential solutions with larger volume builders and developers. However, management of the recovery systems would need to be addressed and resolved because it was suggested that responsibility was often shifted between developers, site managers and subcontractors. Additionally, as the waste management contractor may only be recovering small tonnages of cardboard relative to the larger volume materials on site, the change in collection and potential reduction in costs may not be significant enough to the developer for the perceived effort.

In these instances supporting pre-sorting at landfill may be an option, if some level of sorting is not occurring through other resource recovery options prior to disposal.

7 PRODUCTS AND MARKETS

Large C&D reprocessors indicated throughout this consultation that their primary driver for material recovery was based on the market demand for their reprocessed products. They actively sought and accepted C&D materials they could develop into products for which they had distinct and strong markets.

Nationally, the present strength in markets is for masonry products. The demand for these recovered products is driven by the construction sector, particularly for use in civil applications.

Businesses recovering C&D materials from mixed loads did so to firstly reduce disposal costs. High value materials that could easily be recovered were diverted, either to other local reprocessors or to established local markets.

In some jurisdictions, challenges associated with environmental and planning regulations for both waste and extractive industry operators are seeing these businesses looking to extend the life of their sites, through partnerships and practices that are more environmentally sustainable and focused on resource efficiency.

Regulatory frameworks that have supported improved recovery of C&D materials and associated product development in some jurisdictions have included but are not limited to:

- Pricing mechanisms such a landfill levies which place a higher cost on the disposal of C&D wastes
- Prohibition of specific materials from landfill, or requirements for mixed wastes to have been subject to a pre-sort prior to disposal
- Resource recovery exemption provisions that facilitate appropriate reuse of certain waste materials, including those applied to land, and require minimum quality standards for recycled products.

Previous discussion on mixed load recyclers (see Section 5.4.2) highlighted that key challenges exist in the recovery of mixed loads, and the associated development of products and markets for some of these materials. In the recovery and product development of materials from source separated C&D loads, challenges include increasing market acceptance of recycled products.

7.1 Products

Just as the range of materials recovered and reprocessed from the C&D sector is diverse, so too is the range of products that are being produced from these materials. Although not exhaustive, general examples of products from reprocessed C&D waste includes:

- Crushed concrete and brick used as aggregate in road pavement subbase, drainage, irrigation and landscaping applications
- Crushed rock and stone from excavation works used as aggregate in road pavement subbase, drainage, irrigation and landscaping applications
- Reclaimed asphalt pavement (RAP) used in new asphalt
- Ground plasterboard used as a gypsum replacement, or mixed with organics material to improve soil structure in agricultural applications
- Ferrous and non-ferrous metals that are recycled back into metal products
- Pelletised plastic that is recycled into a range of plastic or plastic composite products for agricultural, residential and infrastructure applications (such as piping, decking, fencing)
- Chipped timber used in landscaping applications

 Soil that is used in soil conditioners or mixed with organic material to improve soil structure in gardening and landscaping applications.

The development of product specifications for recycled C&D waste has involved a strong focus on masonry materials for pavement applications. The materials recovered beyond masonry, if they are in a clean form, are generally managed in the same way they would be if they were generated and recovered through the C&I waste stream. This is especially true for metals, plastics, plasterboard and cardboard. Where they are recovered at all, it is predominantly through the use of Material Recovery Facilities (MRFs). On this basis, possible solutions for improved recovery and reprocessing of these materials from the C&D waste stream include linking recovery into C&I waste management systems (as previously detailed in relation to cardboard).

For masonry materials, product development has been supported through national guidance from organisations including Austroads, which is the association of Australian and New Zealand road transport and traffic authorities. Its members are the road transport and traffic authorities from all eight Australian jurisdictions (States and Territories), the Department of Infrastructure and Transport, the Australian Local Government Association (ALGA), and the New Zealand Transport Agency (NZTA). On this basis Austroads provides guidance to the jurisdictional road authorities and local government on the planning, design, construction, maintenance, operation and stewardship of roads⁴¹.

Austroads' *Guide to Pavement Technology Part 4E: Recycled Materials* was released in 2009 and profiles recycled pavement products manufactured from various wastes (not exclusively sourced from the C&D stream) that are accepted through registered recycling and reprocessing facilities. It addresses the specification, manufacture and application of a range of pavement products made from the recovery of C&D waste and RAP. Additionally, but beyond the scope of this review, it also addresses the use of waste from other sources in pavement production, such as recycled glass containers, industrial slags and ash⁴².

The national regulatory framework outlined Section 4.1 of this report, as well as the jurisdictional summaries which follow, highlight that the national Austroads guidance is supplemented by jurisdictional specification sections / clauses and codes of practice on pavement technology. This supplementary information has been developed to compliment the Austroads guidance.

The supplementary jurisdictional information is varied, and generally provides directives on the production and application of recycled C&D materials in pavement applications, which includes but is not limited to guidance on:

- Crushed concrete for pavement subbases
- Cementitiously treated crushed concrete for subbase pavement
- Recycled Asphalt Product
- Registration of mix designs.

Key parameters from a selection of jurisdictional specifications have been summarised and are included in Appendix 2 of this report.

Beyond pavement applications, crushed masonry products can also be used in non-structural bedding and drainage applications. This area of product development has been limited for some reprocessors. While government agencies including State Road Authorities (SRAs), water authorities and local governments may allow for the use of crushed concrete or brick (or glass fines as a substitute for sand), specifications often state the use of 'natural' products is required.

⁴¹ www.austroads.com.au

⁴² Austroads (2009) Guide to Pavement Technology Part 4E: Recycled Materials

In this application 'natural' products mean materials such as rock and sand. Where such statements are included, the civil contracting companies undertaking these works on behalf of the agencies are limited in their ability to substitute 'natural' products with recycled products.

7.2 Markets

With the C&D recovery sector dominated by private companies, basic economic principles dictate that when there is sufficient market demand and price for a product, the supply side of the equation will (to a large extent) look after itself. The reverse is not true. There is no incentive to increase supply of products for which there is no market demand.

Industry consultation highlighted that stimulating demand for recycled products was considered to be a very important factor in helping improve resource recovery performance across the C&D sector. As previously highlighted, some international jurisdictions have introduced mandatory procurement requirements, for example setting a minimum level of recycled content that must be contained in certain products. Others have set pricing incentives that place a levy on extraction of virgin materials where there are sources of quality recycled product in the same market place.

Significant work has been undertaken nationally in relation to product development associated with masonry products and their use in pavement applications. Table 7-13 highlights the total number of kilometres of roads in each jurisdiction, and their management responsibility. It is evident that the application of currently available Austroads guidance and associated jurisdictional specifications for the use of recycled aggregates in road pavement subbase as well as wearing course treatments for RAP creates the potential for immense product demand.

Jurisdiction	State Road Authority (SRA) managed roads (km)	Local government area (LGA) managed roads (km)	Total (km)
Australian Capital Territor	y 5,625		5,625
New South Wales	20,858	163,224	184,082
Northern Territory	1,270	22,731	24,001
Queensland	33,535	143,465	177,000
South Australia	22,498	72,502	95,000
Tasmania	3,650	20,350	24,000
Victoria	22,340	178,000	200,340
Western Australia	17,800	159,900	177,700
Total Australia	127,576	760,172	887,748

Table 7-13 Approximate kilometres of roads and management responsibility⁴³

The use of recycled aggregates and RAP in road pavements has been most strongly supported by SRAs. However, as show in Table 7-13, SRAs are generally responsible for high volume roads in their jurisdictions, and nationally this accounts for an estimated 14% of total kilometres of roads. The remaining 86% comes under the management of local government agencies.

⁴³ GHD (2008) The use of crushed glass as both an aggregate substitute in road base and in asphalt in Australia Business Case for the Packaging Stewardship Forum of the Australian Food and Grocery Council

The C&D reprocessing industry has indicated that it has been more challenging to have products accepted and used by local governments. This is largely due to a range of negative perceptions about the performance of recycled materials in pavement applications.

With the backing of agencies like Austroads and the jurisdictional SRAs, who generally support the use of these recycled products where they meet specifications, it appears the negative perceptions of some local governments are misplaced. Market development opportunities with local government have not been fully realised. The discussion of jurisdictional specific *Opportunities* will outline programs within certain jurisdictions, (such as one facilitated by Sustainability Victoria) that are seeking to address these issues with local governments and their civil contractors.

Beyond local government, material reprocessors also considered there were market development opportunities available through partnerships with the water authorities in their jurisdictions. Some reprocessors were pursuing these opportunities directly; others had found challenges in the acceptance of their products. Generally, the current challenges identified by the reprocessing industry in relation to the water authorities were that there had not been the development of specifications across their sector that supported the use of recycled concrete and brick aggregates for non-structural bedding and drainage applications. Current specifications generally state the use of 'natural' products is required.

In developing markets, members of the C&D reprocessing industry indicated the environmental credentials of recycled aggregate products was often of secondary interest to customers, and that ultimately the selling point of these products was that they met specifications and were cost competitive.

A review of green purchasing in Australia highlights that a challenge for most local governments is decentralised purchasing systems⁴⁴. This compounds the challenges that already exist for the specification and purchase of recycled C&D products. In relation to local government, the national review of green purchasing also acknowledged the 'huge potential' for environmental specifications to be included in contracts and capital works projects.

Significantly, the national review acknowledged the shift both internationally and in Australia from 'green purchasing' (with a primary focus on environmental outcomes), towards 'sustainable procurement' models. Sustainable procurement is a process where organisations seek to meet their needs for goods and services through procurement practices and decision making that addresses environmental, economic, social and ethical parameters. An organisation championing this approach, which could help develop significant opportunities to increase the uptake of recycled C&D products, is the Australian Procurement and Construction Council (APCC). Sustainable Procurement is addressed in the national recommendations of this report.

Representatives consulted from both the construction and demolition industries highlighted that complying with the Green Building Council of Australia's (GBCA) Green Star rating program⁴⁵ meant that systems of recovery were being required on construction sites, and that construction companies seeking government contracts or reputational advantage were seeking to improve their star rating by using recycled products in their developments.

The Green Star program and associated assessment tool addresses materials as part of the rating system. This includes the use of 'Eco-Preferred Content', which can be materials with 'reused content' and 'recycled content'. Independent verification of reused / recycled content is required either through GBCA recognised third party certification, or from an auditor registered by RABQSA (in Australia), or other national / international auditor accreditation systems.

⁴⁴ NetBalance (2009) *Green Purchasing in Australia* for EcoBuy

⁴⁵ www.gbca.org.au/green-star
Additionally, material recovery options that are implemented in conjunction with manufacturers and suppliers, such as take back and recycle arrangements can be identified to help improve a company's rating.

Programs like Green Star are further reinforced by jurisdictional programs. In NSW, for example, one of the most significant projects has been the development of the *Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage*, otherwise known as the 'GreenSpec'. The primary aim of GreenSpec is to encourage local government professionals, as well as other key players within both the public and private works engineering sector, to use recycled concrete, brick and asphalt materials. Opportunities for leveraging from these programs are addressed in the national recommendations.

Overall, the present review of the status of C&D waste in Australia has determined that market development has to date been strongly focused on the high volume masonry materials, and has developed through a combination of competitive pricing strategies and proximity to source materials and market outlets. The reprocessing industry has highlighted that development of a healthy and consistent market demand is critical for future success.

Market development has been assisted within jurisdictions which have a supportive regulatory framework. While this is a critical first step, direct engagement of the C&D industry, peak industry organisations and government agencies is also important in the market development processes. The framework cannot rely on regulatory mechanisms alone. Attention is also required in assuring consistent practices, production of quality products that meet clearly defined and broadly supported product specifications, and procurement practices that support the purchase of these products as a priority where quality standards are met.

For the other, non-masonry C&D material generated (such as metals, plastics and timber), there are opportunities for reprocessors and government agencies to apply these observations to support broader ranging market development opportunities for end products.

8 BARRIERS, OPPORTUNITIES AND RECOMMENDATIONS

The current report identifies a range of barriers to improved resource recovery from C&D waste material, some of which are common to all jurisdictions and others which reflect unique conditions in different parts of Australia. These barriers are outlined and explained in the detailed jurisdictional summary sections and, where possible, opportunities to overcome the barriers have been outlined and discussed.

Key conclusions and recommendations are summarised below. These arise primarily from the detailed stakeholder consultation undertaken during this review. Further detail supporting the summary below is contained within the jurisdictional summaries that follow.

8.1 National

- 1 A national body responsible for coordinating, compiling, collating and publicising information could increase stakeholder confidence in the suitability of recycled C&D materials for industry applications, and encourage greater uptake of products. There are multiple opportunities to raise awareness of existing specifications regarding recycled products.
- 2 A national body reviewing C&D sector waste generation and material recovery would help support more consistent collection and categorisation of data across all jurisdictions. This would enable analysis of gaps in C&D infrastructure and services, and assist jurisdictions in focusing resources to fill those gaps.
- 3 The establishment of National Standards for the production and use of recycled products would be of significant benefit, particularly for use in projects that are partly funded at the Federal level.
- 4 National consistency in process standards and recycled material specifications would enable successful operators to more easily apply their experience and expand across jurisdictional borders. As an interim goal, the use of consistent terminology between jurisdictions would be advantageous.
- 5 Asbestos contamination is a critical issue in C&D recycling, and Federal intervention may be required to produce a workable solution for all stakeholders. Victoria's adoption of an allowable limit of <0.001% contamination in end products may provide a solution, if nationally adopted, but only if an acceptably low health risk can be confirmed.
- 6 A national approach to supporting sustainable resource use could include a pricing mechanism, similar to the UK Aggregates Levy, which seeks to better reflect intrinsic environmental costs in the price of virgin aggregates and, in doing so, improve the competitiveness of recycled aggregate alternatives, and support the more efficient use of virgin aggregates.
- 7 The wider adoption of sustainable procurement practices, particularly through government agencies, would help increase market demand for recovered C&D materials. Government may consider supporting development of a framework that would address:
 - The financial, social, ethical and environmental implications of the purchase of goods and services, and
 - Development of specifications, accreditation, quality assurance and awareness processes

- 8 Government agencies should favour procurement of material containing recycled C&D content where they meet defined performance criteria / specifications. Performance criteria may give consideration to products that are certified and producers that are accredited through Government agency programs, and materials that are cost competitive with alternatives.
- 9 Leverage should be sought from existing programs, such as the GBCA's Green Star rating program and the NSW GreenSpec program, to improve both the procurement and the recovery of materials during construction projects.
- 10 The Roads Towards Zero Waste (Roads TZW) partnership program between Sustainability Victoria, the Municipal Association of Victoria (MAV), the Australian Road Research Board (ARRB) and VicRoads, provides a model that should be considered nationally for all jurisdictions. The focus is on the use of recycled products in road construction applications in partnership with local government. Outcomes seek to deliver:
 - Short-term a reduction in annual stockpiles of crushed concrete, brick and glass
 - Medium-term changing the procurement practices of local government in relation to road construction arrangements, and delivering major CO_{2e} emission reductions
 - Long-term achieving more sustainable uses of current quarry reserves and reducing the number of new quarries opened
- 11 Processing techniques are relatively well developed in relation to source separated C&D materials. Facilities for sorting mixed waste will be an investment priority in those areas where C&D resource recovery rates are already high.
- 12 South Australia provides a model where landfill disposal of some materials will be prohibited unless waste has first been subject to resource recovery efforts. Similar regulatory instruments could be considered for use in other jurisdictions, and this would support the recovery of material presented in mixed loads.
- 13 A detailed gap analysis of infrastructure needs for each capital city and key regional centre would be of benefit to help direct infrastructure funding toward the most effective use.
- 14 The ability to site reprocessing facilities in close proximity to (or within) landfill precincts and in proximity to urban communities needs to be addressed across all jurisdictions. In licensing and operational reviews, responsible government agencies should seek to acknowledge the beneficial nature of the reprocessing industry.
- 15 A review across all jurisdictions of the regulations applied to both fixed and mobile crushing and screening equipment may encourage more equitable management of both systems, which supports cost efficient resource recovery and adherence to environmental standards.
- 16 The residual waste fraction from mixed C&D waste recycling operations, with a high timber and plastic component, may be suitable for energy recovery processes and this may provide a higher order use than landfill disposal of these materials, particularly where the waste material displaces the use of fossil fuels for energy generation.
- 17 Fears of contamination from the small volumes of treated timber in C&D waste present a barrier to increasing the recovery of untreated timber, for which there are defined markets. The broader use of handheld analysers, and education of generators and reprocessors to improve the identification of treated timbers, may help to improve timber recovery.
- 18 There is a need to further investigate the potential for improved material recovery and market development opportunities in relation to the plastics component of the C&D waste stream, with particular emphasis on packaging films, waffle pods and pipes.

- 19 Where appropriate, point-of-sale recovery systems and associated infrastructure should be investigated for specific C&D materials including (but not limited to) cardboard and plastics.
- 20 Opportunities to encourage the integration of C&D reprocessing activities within existing quarry operations should be considered, especially as this may facilitate the extension of recovery activities into regional communities by reducing the need to establish new sites and associated infrastructure.
- 21 Industry standards should be developed (or existing best practice standards more widely adopted) relating to the process of receiving waste, with a view to ensuring recycled end products are free of contaminates, especially asbestos.
- 22 Industry partnerships between volume builders and peak industry associations should be supported to indentify the key waste materials being generated through all stages of the building lifecycle, which will support the industry to determine opportunities for improvement.

8.2 New South Wales

- 23 The NSW environmental regulator should require the same standard of record keeping for operators of licensed recycling facilities as is required of licensed landfill facilities.
- 24 Mandatory licensing of all sector participants, including transporters as well as reprocessors, should be considered in response to the increasing economic incentives to be involved in the C&D recycling sector.
- 25 Asbestos contamination is one of the most critical issues in the NSW market. Victoria and WA have adopted small allowable limits of asbestos to solve this issue. NSW is unlikely to independently progress toward a similar solution.
- A certification scheme that recognises consultants with the appropriate skills and understanding to perform testing and analysis work in relation to defined specifications and Resource Recovery Exemption requirements would be of benefit in NSW.

8.3 Victoria

- 27 The Victorian Government should support national efforts that seek to encourage the adoption of sustainable procurement practices.
- 28 There is an opportunity to create new market development programs for challenging C&D materials (including timbers, plastics and plasterboard), using the learnings of programs including Roads Towards Zero Waste.
- 29 The integration of C&D waste management planning into all phases of a structure's lifecycle procurement, planning, design, construction and decommissioning should be developed in partnership with government and industry.
- 30 Priority consideration should be given to the integration of waste management requirements in all planning permit processes for construction and demolition works.
- 31 The localised planning capacity of Regional Waste Management Groups (RWMGs) is currently limited to municipal waste streams. Greater engagement and associated resourcing of the RWMGs for planning across all solid waste streams – including C&D – could deliver more effective, regionally targeted solutions.

- 32 Investment priorities should include infrastructure for the sorting of mixed loads in metropolitan Melbourne and infrastructure for non-metropolitan sites in provincial centres, with the ability for these operators to service smaller towns in regional locations using mobile equipment.
- 33 The ability and capacity of local transfer stations and resource recovery facilities to provide a more comprehensive network of drop-off and processing sites for C&D waste materials should be further investigated.

8.4 Queensland

- 34 Introduction of a \$35/tonne landfill levy on industrial wastes will provide a strong and immediate incentive to improve recovery of C&D waste materials. There has been a significant increase in development and planning activity in anticipation of the levy's introduction.
- 35 A five year rolling infrastructure program that prioritises infrastructure in key C&D waste generation areas should be developed. On the basis of C&D quantities generated, and potential for recovery, planning should give consideration to fixed or mobile facilities to service material volumes as appropriate.
- 36 Where obvious gaps exist in the geographic spread of existing facilities in relation to the generation of C&D waste, DERM could work with local governments to support the incorporation of C&D waste recovery infrastructure and programs in waste management strategy reviews. The process should include identifying opportunities for new infrastructure associated with local government capital works programs, linked to funding opportunities provided through the WARE fund. This funding should also be linked to performance measures that include C&D materials recovery.
- 37 Funding should also be linked to performance measures that include but are not limited to:
 - Reduced C&D volumes to landfill
 - Improved rates of recovery of C&D materials
 - Development of local markets for recovered / recycled C&D products
 - The adoption of sustainable procurement practices.
- 38 Mixed C&D loads are a key challenge for all jurisdictions. The introduction of a landfill levy in Queensland may see some of these mixed load materials diverted in the short term. Longer term options may include evaluating the performance of South Australia's requirements to pre-sort waste prior to disposal.
- 39 One of the key approaches of Queensland's Waste and Recycling Strategy 2010-2020 is the development of partnerships. In the public realm, peak agencies including Local Government Associations will help to facilitate planning and resource sharing, and the development of local market outlets for materials. Additionally, government agencies such as QBuild and Project Services within the Department of Public Works should be considered priority partners.
- 40 Private partnerships should also be supported. Beyond obvious partnerships with the waste management industry and reprocessors, opportunities exist within the civil sector and quarrying industry. These relate particularly to the most immediate opportunities in material recovery and market development in regards to recycled masonry materials.
- 41 Planning and operational measures also need to be managed. DERM has the opportunity to work proactively, and in partnership with industry, to support the development of guidance. Priority should be given to:

- The siting and operational requirements of both fixed and mobile equipment, to manage expectations as the industry goes through a growth phase
- Guidance on the management of asbestos in the C&D waste reprocessing sector

8.5 Australian Capital Territory

- 42 Illegal dumping of C&D waste on privately owned land in the ACT is a major deterrent to increasing recycling activities in the territory and, left unregulated, will create a disadvantage for C&D waste reprocessors.
- 43 C&D reprocessors in the ACT are not operating to capacity and could meet a considerable increase in demand and supply of materials.
- 44 The key end-market that requires development in the ACT are government projects currently, there are no procurement policies stipulating the use of recycled C&D products on government construction projects.
- 45 Private contractors would be more likely to use recycled C&D products if procurement policies stipulated their use, if material specifications existed, and if standards were in place to provide some assurance of quality.
- 46 For many waste generators in the ACT, cost is not a major incentive to increase recycling efforts, and education is seen as critical to improving material recovery rates.
- 47 Opportunities exist for improving education and awareness of both waste generators and consumers. The ACT government could play an enhanced role in disseminating information regarding recycling practices and the use of recycled product.

8.6 South Australia

- 48 In order to maintain or increase the current level of reprocessing in South Australia, the industry needs to further develop standards for the production of recycled products to ensure the quality of materials will be established and maintained, giving security to end users that materials are of consistent quality and fit for purpose.
- 49 Industry standards should be developed for the process of receiving waste, with a view to ensuring recycled end products are free of contamination (especially asbestos).
- 50 The establishment of National Standards for the production and use of recycled products would be of significant benefit for promoting reuse in South Australia, particularly in projects that are part federally funded.
- 51 There are opportunities to develop sustainability management plans for transport infrastructure projects that incorporate requirements for contractors to prepare an implementation plan that includes the reduction of waste and use of recycled materials.

8.7 Tasmania

- 52 There is currently a lack of data regarding C&D activity and waste in Tasmania.
- 53 There are currently no financial incentives to recycle C&D materials as gate fees at reprocessing facilities are not competitive with landfill costs.

- 54 There is currently no financial incentive to use reprocessed C&D materials as virgin materials are readily available, and generally cheaper.
- 55 Government procurement policies would help stimulate the market for reprocessed products.

8.8 Western Australia

- 56 There is need for government to support markets for recovered materials, both in terms of increasing internal demand for products as well as assisting to educate the wider marketplace
- 57 Industry standards should be developed, in consultation with the government regulator, to force operators not producing product to specification out of the marketplace and give users confidence in end products
- 58 Source separation by commercial and residential developers and building companies in particular should be further encouraged.
- 59 More emphasis on source separation may encourage reprocessors to establish facilities in regional areas.
- 60 Local governments need to be supported to improve C&D waste performance, especially those in regional areas that are dealing with increased waste from mining developments.
- 61 The reprocessing industry needs to be able to supply consistent, quality products 'on demand' in order to capitalise on end market opportunities.
- 62 There is need for government support to develop policies mandating the use of recycled C&D products.

8.9 Northern Territory

- 63 Landfill disposal costs in the NT are low, compared to other Australian jurisdictions
- 64 There is generally no landfill disposal charge for community ratepayers
- 65 There is very little baseline data
- 66 The Shoal Bay landfill facility has a relatively short operational life remaining (up to 20 years) which may provide a driver for reform in Darwin
- 67 Darwin City Council is undertaking a review of waste in the city area
- 68 Darwin City Council has signed a four year agreement with NT Recycling Service to remove C&D materials from the waste stream.

9 NEW SOUTH WALES

9.1 Overview

Of the 6.6 million tonnes of C&D waste generated in NSW during 2008/09, approximately 74% or 4.8 million tonnes was diverted away from landfill. Almost all this material was recycled, with only a tiny fraction (less than 0.1%) being used as an alternate fuel source. Compared to other Australian states, NSW is by far the greatest generator of C&D waste materials, accounting for 37% of all C&D waste in the nation. It is also one of the best performers in terms of resource recovery from this material stream.

Two primary economic drivers for C&D recycling in NSW are avoidance of landfill disposal charges, and the value of recycled products in defined end markets. Both factors impact all market participants, although the relative strength of these drivers changes between regional and metropolitan areas, and especially between two general groupings of C&D recyclers: those processing mixed C&D loads, and those processing source separated loads.

	Source separated recyclers	Mixed waste recyclers
Avoiding disposal costs	Secondary driver	Primary driver
Market value of products	Primary driver	Secondary driver

9.1.1 Material Sources

According to NSW Government audit results⁴⁶, around 50% of the 450,000 tonnes of C&D waste that was landfilled in Sydney during 2004/05 could potentially be recovered, while the remaining material included asbestos and contaminated materials for which landfill disposal was the most appropriate pathway. Based on the audit data available, it would appear logical for policy makers to seek to increase recovery of some major material streams, including concrete and timber, as well as seeking to encourage development of new markets for other niche materials.

Industry operators, however, are of the general opinion that most high-quality material is already being recovered in metropolitan markets, and that – if anything – the major problem in the sector is over-zealous recovery of materials that really should not legally be recycled. There is already a very strong economic incentive to avoid landfill disposal, and this price signal is scheduled to increase further over coming years.

As outlined in section 9.5.1, data quality is a significant issue in the C&D waste market. While there is little confidence in the data available, different stakeholders are able to come to very different conclusions about current performance. This is a major barrier to stakeholders being able to make informed investment and policy decisions. Mandatory reporting by the recycling industry may help overcome this problem.

All stakeholders agree the mixed waste skip bin market is the area of primary concern in terms of both improving recovery rates, and seeking to ensure appropriate environmental outcomes. Improvements could be achieved through encouraging greater on site separation of waste stream, although this does not provide a definitive solution to the issue. The more likely opportunity is to consider pre-sorting options prior to landfill, which may be through the skip hire operator or at the landfill site.

⁴⁶ DECC (2007) Report into the Construction and Demolition Waste Stream Audit 2000-2005 Sydney Metropolitan Area

9.1.2 Gate Fee/Disposal Pricing

The landfill gate fee for inert (Class II) waste is around \$120-180/tonne in Sydney. This is significantly higher than the gate fee charged by C&D waste recyclers, especially for source separated materials. There is no shortage of C&D recycling facilities (especially compared to landfill facilities), and it was suggested by reprocessors that it would not make sense for C&D waste generators to be regularly disposing materials to landfill in Sydney or the Extended Regulatory Area (including the Illawarra and Newcastle).

The NSW Government's Section 88 Landfill Levy has recently been extended to include an even greater area of the state, with the Regional Regulated Area (RRA) stretching along the coastline from Newcastle north to the Queensland border. The landfill levy in the RRA was \$20.40/tonne in 2010/11 (compared with \$70.30/tonne in the metropolitan region), but is scheduled to rise by \$10+CPI each year until 2015/16. A significant price incentive to recover resources from C&D waste is quickly developing.

Following the introduction of the Landfill Levy in the border region of northern NSW, there is anecdotal evidence that C&D waste disposal levels dropped off significantly, with the inference that a portion of this material was disposed in much cheaper landfills across the Queensland border. Skip bins of C&D waste are by their nature very transportable, and most private operators will weigh the pros and cons of increasing transport costs to achieve lower disposal costs. It is not uncommon for less sophisticated transporters (such as the multitude of 'a man with a truck' operations) to focus more on the disposal cost, especially where they are of the view 'the truck doesn't owe me anything'.

In the non-regulated areas of regional NSW, where there is no Section 88 Waste and Environment Levy applied, the cost to landfill material is significantly lower. In some areas, local council waste facilities are fully funded through residential rates and will offer free disposal for locally-sourced C&D waste material.

There is also likely to be less competition for, and potentially more access to, sources of virgin products that compete with recycled products in end use markets. With less economic incentive to recover C&D materials, there are naturally less facilities designed to do so – making it difficult for those operators who do wish to recover resources from C&D waste, often for philosophical or marketing reasons.

Scrap metal has significant economic value, and is likely to be recovered (to some extent) within all areas of NSW. 'Builders rubble' included mixed concrete and bricks, and 'clean fill' (Virgin Excavated Natural Material - VENM) is commonly set aside at regional landfills and often used as landfill cover material.

9.1.3 Geographic Catchment

In the Sydney market, operators discuss an imaginary line dissecting the city between Parramatta and Liverpool. The majority of C&D waste is generated to the east of this line, while the major demand for recycled products occurs west of this line. There is significant movement of both raw feedstock and recycled products within the market.

While transport costs can be significant, there are numerous examples of C&D material being transported long distances – past the gate of other available disposal facilities – in order to be delivered to a specific processing or disposal facility. This includes examples of material from as far south as Camden, as far north as Hornsby, and as far East as Bondi being regularly processed at a Western Sydney facility.

While a high portion of material is undoubtedly delivered to the processing/disposal point closest to where it was generated, there are several complicating factors which dictate this logical

assumption may not always prove correct. For example, a builder or transporter that lives in the western suburbs but has undertaken a project in the eastern suburbs may elect to deliver C&D waste to a disposal point near their home at the end of the work day, rather than seeking out a processing point close to the job site.

In terms of large demolition projects, on top of the strong economic incentive to find the lowest processing/disposal price (and a willingness to travel greater distances if there is a significant price differential), another contributing factor may be ease/speed of unloading. For example, generators may elect to send material to a more distant site that has a higher capacity if this means truck fleets spend less time queued at a weighbridge waiting to unload.

9.1.4 Material Processing

Mixed waste recyclers and source separated reprocessors face different issues, with different performance outcomes and end products. As with all waste recovery operations, separation of materials at the source of generation enables much simpler, cheaper and more effective processing. However, a large portion of the C&D waste stream presents in mixed form, and as the cost of landfill disposal increases, there is growing incentive for organisations to invest in mixed C&D waste processing.

Mixed C&D Waste Recyclers

The gate fee to process mixed C&D waste loads in Sydney is highly variable, but generally slightly cheaper than landfill disposal (starting at around \$120/tonne) while significantly higher than the gate fee charged for the higher-quality source separated materials (generally \$0-30/tonne for masonry). The clear price differential means generators producing a significant volume of C&D waste have a very strong and clear economic incentive to source separate materials, at least to the level of removing metals and masonry from other materials. However, there remain a large number of smaller C&D waste generators – particularly within the residential sector - that produce mixed waste loads.

There is at least one mixed C&D waste facility in Sydney using fixed equipment with automated systems to separate mixed C&D waste by material stream. The more common approach, however, is for operators to segregate materials from mixed C&D waste loads using a high degree of manual labour, coupled with rudimentary mechanical equipment such as skid steers and excavators.

Residual waste of less than 30% was claimed by some mixed C&D waste processors interviewed. However, site observations of the incoming feedstock, on site processes, and separated material piles at a number of the facilities visited during this consultation lead the author to suggest recovery rates greater than 70% from the mixed C&D waste stream appear to be somewhat optimistic.

Mixed C&D waste comes in large part from skip bins used on projects where there is not sufficient waste volumes, or sufficient space on-site, to justify investment in the multiple containers that would be required to source separate materials. This includes a large portion of residential C&D activity.

The disposal cost for a Skip Bin of mixed C&D waste can reportedly equate to as low as \$40/tonne for some regular customers in Sydney, although a casual skip bin user would expect to pay higher rates.

Online quotes for a 2m³ skip bin for mixed 'heavy waste' (with no weight limit on the bin) to be delivered to site within the Sydney region, collected when full and transported to a disposal point, started at around \$250. The cost for the same collection service of source separated 'clean fill' (either soil, concrete or bricks) was quoted as \$180, around 25-30% below the cost of mixed waste disposal.

Roughly three tonnes of concrete or soil may be contained in a 2m³ skip bin, suggesting collection, transport and disposal costs of at least \$80/tonne for mixed loads on a casual basis, and at least \$60/tonne for source separated materials.

The metropolitan price differential that is evident between mixed and source separated C&D waste materials is not necessarily present in regional areas. Regional C&D waste generators interviewed by Hyder reported they may consider source-separating scrap metal due to the resale value (either privately or in a designated area at the local landfill), and may also be encouraged to set clean 'builders rubble' aside at the landfill for potential use as cover material.

In some regional areas the operation of disposal facilities are fully subsidised by local council ratepayers, and there is no additional charge applied for the disposal of locally sourced material (including C&D material). Where this occurs there is little economic incentive to source separate or recover materials. Some recovery activity does still take place, with the main driver for these small regional generators being a personal philosophical alignment with the concept of resource recovery, or a perceived marketing advantage in providing a 'greener' building service than their competitors.

Lower processing volumes in regional areas also reduces the economic case for any operator to make significant investment in higher-order processing equipment, such as Pug Mills, which means there is reduced ability to produce higher-specification output products, regardless of potential market demand.

Whether individual components of the C&D waste stream are delivered as a source separated material direct to a reprocessor, or are delivered to a primary recycling facility where they are separated from mixed C&D waste materials, reprocessing techniques and end product markets for the individual materials are similar.

9.2 Material Profiles

The (then) NSW Department of Environment and Climate Change's *Report into the Construction and Demolition Waste Stream Audit 2000-2005* outlines the results of a compositional study of C&D waste disposed to landfill on the Sydney Metropolitan Area during the period January 2000 to June 2005. The composition of mixed C&D waste by weight is shown in Figure 9-1.





Concrete and Bricks

Concrete reprocessing involves the use of relatively uncomplicated and well-established crushing techniques. There are significant end markets for the recycled material outputs, and there is a strong incentive to avoid weight-based disposal charges by recovering this heavy component of the waste stream. There is a mature, well functioning market for recovery and reprocessing of this material in NSW, and especially in metropolitan markets.

In the Sydney market, the gate fee for generators of source separated concrete currently range from \$0-11/tonne. At some facilities the published gatefees will vary weekly in response to changes in material stockpiles and output demand. There have been recent of facilities *paying* generators for source separated concrete loads in order to ensure sufficient supply to meet their output commitments.

Material recovery rates greater than 99% are claimed by most reprocessors of source separated concrete, with the residuals stream including some light materials such as mixed plastics and timber.

The gate fee charged by metropolitan operators to process source separated bricks varies from around \$15/tonne to \$35/tonne, depending on the operator's demand for this material in its final end products. There is also a salvage market for reuse of bricks. This generally requires some manual processing to remove mortar and clean the bricks.

Bricks often presents as 'mixed masonry' or 'builders rubble' mixed with concrete and, like source separated concrete, this component of the C&D waste stream is relatively simple to process, with well developed end markets for aggregate products.

In regional NSW, where there are processing options available for generators of mixed masonry materials, gatefees currently range from \$10-20/tonne.

Metals

Scrap metal prices are subject to international forces and during the Global Financial Crisis there were reports of serious disruptions to the market for recovered scrap. While the price reprocessors will pay for mixed scrap is highly variable (and generally one of the industry's most carefully guarded secrets), the current ballpark figure is around \$250/tonne. Coupled with the value of avoided landfill disposal costs, there is a strong economic incentive to recover this material stream.

Due to the value of scrap metal, it is consistently separated from other materials and put aside at local landfills, ready for collection once there is a sufficient stockpile for recovery. This is generally the case across all of NSW, including regional areas where there is no landfill tipping fee for C&D waste generators, and there are no local metal reprocessors.

In metropolitan markets, there is likely to be very little metal from the C&D waste stream that ends up in landfill. Reprocessors point out there are 'two bites at the cherry' for recovery of this material from C&D projects, where it is either source separated and salvaged onsite, or is easily recovered by landfill operators when it is disposed as mixed waste.

While the NSW audit results⁴⁷ show 5.1% of landfilled C&D waste is ferrous metals (equating to 15,000-30,000 tpa) metal reprocessors contacted by Hyder were of the view that 'not much is missed by the time the waste is finally landfilled'. At \$250/tonne, the nominal value of 15,000 tonnes of scrap would be \$3.75 million, plus avoided landfill disposal costs of at least \$1.8 million.

Ferrous metal can be recovered from the waste stream using relatively inexpensive magnets.

⁴⁷ DECC (2007) Report into the Construction and Demolition Waste Stream Audit 2000-2005 Sydney Metropolitan Area

Timber

In NSW there is generally lower market demand for recovered timber, compared to other components of the C&D waste stream.

There is a high-value market for the reuse of quality hardwood timber, with prices well in excess of \$1,000/m³ possible for some high grade Australian timbers, although the volume of material recovered is relatively low. It is estimated the market for reuse of timber equates to around 60,000m³ nationally, of which approximately 35% (21,000m³) is sourced from the NSW market.

Indications from industry are that the salvage market for reusable timber has 'a bit of room to increase' but is generally functioning well in NSW, due to the potential for high economic returns. A barrier to growing the reuse market is the increasing mechanisation of demolition works (primarily due to time pressures and OH&S requirements on site) which makes it more difficult for salvage operations to take place, and increases the potential for high value timbers to be damaged. This may be addressed where large demolition contractors have identified the value of this material, and seek to salvage reusable timber prior to mechanised demolition work. Some large demolition contractors have established specialised timber recovery operations to address this issue, where it is economically viable to do so.

Another significant source of salvageable hardwood is 'infrastructure timber' such as power poles and railway sleepers, for which there is strong demand for use in landscaping applications.

It is potential markets for products from lighter mixed woods that are much less developed in NSW, compared to in other regions. The majority of this material is currently shredded and used as mulch in landscaping purposes. However, the threat of contamination of raw timber with treated timbers and engineered wood products is considered a barrier to increasing reuse through such mechanisms.

Treated timber, including CCA timber and painted products, are estimated to account for around 6% of total C&D waste wood in NSW. While the portion of material is low, contamination with even small levels of treated material presents a barrier to recovering more from the mixed wood waste stream.

The NSW environmental regulator does not allow any treated timber, or engineered wood products such as MDF board, to qualify for a Resource Recovery Exemption that would allow them to be applied to land (such as in mulch products). The non-standard fuels guide in NSW also prohibits the inclusion of this material as a replacement fuel source⁴⁸.

Technology solutions to better identify treated timber, such as handheld analysers, are becoming more economically viable and could potentially be used to increase confidence that stockpiles do not contain contamination. There have also been efforts to improve education of generators and processors about how to visually identify treated timbers, so that they can be separated from raw timbers.

A potentially significant market being developed for recycled timber is as use in animal bedding, especially in poultries.

Beyond the regulatory framework outlined, NSW operators face other economic headwinds to increasing recovery of C&D woodwaste. These barriers include a large supply of materials that compete in the marketplace with recovered woodwaste (such as sawdust and off-cuts from the state's forestry operations), relatively cheap power in the form of coal, and a lack of major industrial users (such as particle board manufacturers) within easy transport distance of the major metropolitan markets.

⁴⁸ DEC (2005) Guidance Note Assessment of Non-Standard Fuels

In a well-publicised attempt to establish a new market for this material stream, Visy Pulp and Paper committed significant resources attempting to use recovered waste wood as an alternative fuel source at its Tumut Kraft Mill. Eventually, however, the company deemed it was not economically viable to use woodwaste from the Sydney market compared to biomass material that could be sourced from local forestry operations.

A view was expressed by reprocessors that a price signal on carbon may increase demand for woodwaste material to be used as an alternative fuel in NSW. While some regulatory barriers may need to be overcome for this to be achieved (specifically in relation to specifications in the non-standard fuels guide), there is potential for this development to open up a significant additional market for recovering the lower-value mixed woodwaste material.

Plastics

Based on the DECC *Report into the Construction and Demolition Waste Stream Audit 2000-2005*⁴⁹, 2.9% of C&D waste landfilled in metropolitan Sydney was plastic. Applying that material split to the 2008-09 tonnage data (1,845,000 tonnes of C&D waste landfilled in NSW) suggests that 53,500 tonnes of NSW C&D waste may be plastic material.

The most recent PACIA National Plastics Recycling Survey, covering July 2009 to June 2010, reports 68,508 tonnes of plastic was recycled in NSW, with just 2.4% of this material – 1,644 tonnes – sourced from the building, construction and demolition sector⁵⁰. These figures suggest an apparent resource recovery rate of plastic material from the C&D stream in the order of 10%. While it is likely that significantly higher recovery rates could be possible through better use of existing systems, it should also be noted that some low-value mixed plastic material may be a desirable feedstock for potential energy from waste facilities.

Soils, Sands and Fines

Large volumes of fine materials are generated through C&D activities and, unless they can be reused on site, will require treatment and/or disposal. This includes soil and sand as well as other sub-4.75mm particles from mixed skip bin waste. This is one of the more complicated and problematic material streams in C&D waste, due to the volume of material combined with the confluence of two issues: the first is the potential for significant contamination issues within this material stream, and the second is the perception by many market participants that any excavated dirt is benign 'clean fill'.

Skip bin fines, which may contain a large portion of soil material, can also contain a range of problematic contaminants, including asbestos. Some operators estimate excavated material and fines make up around 50% of the volume in mixed skip bin C&D waste.

One of the recyclers surveyed by Hyder charged a gatefee of \$40/tonne for certified Virgin Excavated Natural Material (VENM), and \$95/tonne for non-certified excavated soils that meet the environmental regulator's acceptance criteria. However, there does not appear to be widespread insistence on certification being produced before material is accepted at recycling facilities.

There are significant testing requirements involved in meeting the environmental regulator's standards for VENM or for Excavated Natural Material (ENM) to gain a Resource Recovery Exemption so that it can legally be applied to land. One low-volume processor (handling less than 10,000 tonnes of this material per annum) told Hyder the compliance burden was so high 'it's almost better off to landfill it'. This organisation claimed the operational cost of testing and

⁴⁹ DECC (2007) Report into the Construction and Demolition Waste Stream Audit 2000-2005 Sydney Metropolitan Area

⁵⁰ Hyder Consulting (2010), 2010 National Plastics Recycling Survey, report to the Plastics and Chemicals Industries Association

processing material is around \$75/tonne, with the majority of that cost associated with the need for landfill disposal of around 70% of the material processed.

This operator claimed the cost of complying with contamination testing requirements for material from individual sites made it more economical to landfill excavated material unless at least 30-40 tonnes was to be generated through an individual project. Another operator estimated the annual cost of testing and compliance in regards to excavated material at more than \$200,000.

General feedback from the organisations who claim to be complying with the regulator's requirements for recovery of excavated materials is that the level of difficulty and cost in doing so leads them to seriously doubt their competitors are able to comply with regulatory requirements when they are charging low fees to process mixed C&D waste.

A major issue within the industry is the temptation for untested excavated material, or skip bin fines, to be mixed with other products and branded as soil products. Accusations of illegal activity within the C&D waste processing sector often centre on the issue of operators 'rebirthing' material as virgin soil.

This has included public accusations⁵¹ of illegal activity relating to falsifying test reports. There have been several prosecutions for illegal reprocessing activity in NSW over recent years.

9.3 Processing Capacity

A significant issue in the C&D recycling market is the inconsistency of material supply. A large portion of material feedstock for the reprocessors of source separated materials comes from project based activities, where a company will bid to accept all material generated from a particular project. This can produce significant quantities of material over a short timeframe, and lead to serious issues with stockpile management.

Several of the source separated material reprocessors contacted by Hyder suggested they were operating at or near capacity, and had expansion plans in place. Of those operators, each was of the view that there was not currently a significant volume of additional material in the market place to be captured though expanded operations, and they would be aiming to gain a 'larger piece of the existing pie' rather than increasing the overall volume of material reprocessed.

It was also noted by several operators that while there is sufficient processing capacity to handle current feedstock volumes, the Global Financial Crisis and mild economic downturn in NSW over recent years has reduced construction activity and therefore volumes of C&D waste. Unless existing facilities are expanded or new ones built, the industry may face processing capacity constraints during the next economic boom cycle, where more material will be available.

There has been an established C&D recycling market in Sydney for many decades, and Hyder gathered some particularly interesting insights from market veterans with long (30+ years) experience operating in the industry. This included reflections on the cyclical nature of the sector, not just in terms of following construction activity attached to economic cycles, but also to the impact of labour cycles on resource recovery levels.

One operator expressed the view that the industry has recently returned to a similar point as was experienced in the 70s when labour was relatively cheap, materials were relatively expensive, and a large portion of C&D material was source separated and recycled. This operator claimed that, during the 80s and 90s, materials became relatively cheap compared to labour. This flowed on to present a barrier to recovery activities, given the reliance on manual labour and source separation of materials to achieve the highest recovery rates.

⁵¹ www.insidewaste.com.au/storyview.asp?storyid=1034576

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9.4 Products and Markets

The majority of recycled C&D materials are used in civil engineering projects and the general view of market participants in the Sydney region is, 'if you make good quality recycled material, you can't meet demand'. A major contributing factor to this is the fact the last of Sydney's hard rock quarries closed more than five years ago, meaning virgin quarried rock must be transported a significant distance for use in Sydney projects, and are therefore relatively expensive compared to locally-sourced recycled material.

In terms of one of the most developed market segments, concrete recycling, one operator suggested there is currently a significant imbalance between the availability of raw materials to process and the market for sales, with potential market demand at least 40% higher than potential supply of locally sourced material.

9.4.1 Products

In April 2008 the NSW Government introduced significant changes under clause 51 and 51A of the Protection of the Environment Operations (Waste) Regulation 2005⁵² in order to facilitate appropriate reuse of certain waste materials. All waste material must now qualify for a Resource Recovery Exemption before it can be legally applied to land. Exemptions dictate minimum quality standards for recycled products, and can be considered as a 'specification'.

There are currently 16 General Exemptions and around 80 Specific Exemptions that have been developed in NSW and may be relevant to C&D waste processing and reuse.

General Exemptions are developed by the regulator (with input from industry groups) for commonly recovered materials such as concrete, brick, asphalt and fines. They can be used by all market participants, without notifying the regulator, providing the conditions of the Exemption are met.

Specific Exemptions are developed by individual organisations and granted by the regulator for recover materials that are not covered by a General Exemptions or do not meet the definitions or conditions that are prescribed in an existing General Exemption.

9.4.2 Markets

With the C&D recovery sector dominated by private companies, basic economic principles dictate that when there is sufficient market demand for a product, the supply side of the equation will (to a large extent) look after itself. The reverse is not true: there is no point increasing supply of materials for which there is no market demand.

Stimulating demand for recycled products is therefore a very important factor in helping improve resource recovery performance in the C&D sector. Some international jurisdictions have introduced mandatory procurement requirements, for example setting a minimum level of recycled content that must be contained in certain products.

The NSW Government has to date pursued more subtle strategies of stimulating demand for products, including through support and promotion of research and performance demonstration projects for certain recycled materials.

⁵² NSW Government (24 April 2008, Number 109) *Protection of the Environment Operations Amendment (Scheduled Activities and Waste) Regulation 2008* under the Protection of the Environment Operations Act 1997

One of the most significant projects has been the development of the *Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage*, otherwise known as the 'GreenSpec'. The first draft specification was published in August 2001. OEH contracted the Institute of Public Works Engineering Australia (NSW) to update and enhance this specification, with an updated version released in 2010⁵³.

The aim of GreenSpec is primarily to encourage local government professionals, as well as other key players within both the public and private works engineering sector, to use recycled concrete, brick and asphalt materials.

A hard copy of the GreenSpec was distributed to all councils within NSW, and the publication is freely available online. There is no hard data on how the document is being used at the moment, although anecdotal evidence (including requests for the Institute of Public Works Engineering Australia – IPWEA - to give presentations explaining GreenSpec) suggests it is generating significant interest in recycled products.

A key message is that recycled materials may perform *differently* to virgin products, but this does not necessarily mean they are *inferior* to virgin materials: it simply means users need to be aware of the differences and know how to use recycled products, rather than simply substituting materials. In some instances recycled products can perform better than virgin materials.

Stakeholder consultation highlighted that the major gap in the Sydney market – as it is in other jurisdictions - appears to concern reuse options for a portion of low-value mixed timber materials recovered from C&D waste.

In seeking to provide support for increased recovery, the government must clearly be cautious of not disadvantaging those existing players who have already made significant private investment in processing plant and equipment. However, the government may have more scope to provide policy or infrastructure funding support where it is helping to develop a totally new market.

Development of systems to recover energy from material that has high calorific value and a lack of other higher-order reuse options should be considered a priority, as this would open a new end use market for a large portion of the C&D waste that is currently consigned to landfill disposal.

9.5 Barriers

9.5.1 Data Quality

During consultation, market participants uniformly acknowledged issues with the quality of data available to decision makers, and the issues of having policy directions and targets established from potentially misleading baselines. This is a particular issue regarding the NSW Waste Avoidance and Resource Recovery (WARR) targets for the C&D, C&I and MSW streams.

It was highlighted during the consultation that the classification of waste to a particular sector may be determined by the decisions of onsite staff. It was indicated that in some instances gatehouse staff may classify C&D waste as C&I if the source is not defined. This obviously has implications for accurately quantifying waste streams.

Several of Sydney's source separated recyclers suggested almost all concrete is currently reprocessed, and figures which suggest otherwise – including the Government's estimate of 70,000-130,000 tonnes being landfilled in 2004/05 - may be due to incorrect recording of data at weighbridge facilities.

⁵³ OEH (2010) Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage (Issue 3)

On the other hand, several mixed waste reprocessors suggested there may be significant leakage from the system, in the order of 300,000-600,000 tonnes per year, with a major concern being the illegal 're-birthing' of material as virgin excavated natural material.

Given voluntary reporting of data, and issues of potential illegal activities, the accuracy of the figures available has been questioned and many stakeholders believe there is a 'high degree of guesswork' behind the data. This low confidence in the accuracy of available data is undoubtedly a major barrier to making improved policy and planning decisions. A more robust data set would be beneficial for industry operators, and government policy makers.

A potential solution to this issue, which has the support of several of the industry participants consulted, is to require the same standard of record keeping for operators of licensed recycling facilities as is required of licensed landfill facilities.

There appears to be significant support from within the reprocessing sector to require operators to record and report data on all materials entering and leaving a licensed facility. While this would increase the regulatory 'GreenTape' burden on operators, it would allow a mass balance approach to analysing data.

The consultation also found support from various stakeholders for government to consider more stringent licensing requirements of waste transporters to address their role in the issues raised above.

9.5.2 Asbestos

It is acknowledged by all market participants that the presence of asbestos contamination presents one of the most problematic issues in the NSW C&D waste recovery market. Due to widespread use of asbestos material in the NSW construction market over many years, even resource recovery operators who adopt the most stringent testing regimes and make all possible effort to avoid any asbestos coming onto their sites cannot fully guarantee there is no asbestos fibres in their final products. However, the NSW regulator currently has zero tolerance of asbestos in recovered materials.

The current situation is extremely problematic, with the potential to completely destroy the C&D resource recovery sector. So long as there is zero allowable limit of asbestos in end products, and no way for even the most diligent operators to guarantee this outcome, all operators carry continual risk of being in breach of legal requirements. All stakeholders expressed a view that the current situation is unsustainable.

One operator described a recent project where 600 tonnes of recycled material was supplied to a client at around \$20/tonne (total value approximately \$12,000). A small amount of asbestos material was found in the material (less than 1kg), and the cost for that company to remove all material and clean up the site was estimated at more than \$150,000.

While the regulator is increasing the financial assurances required of some licensed C&D waste reprocessors, it is not difficult to envisage situations where rehabilitation costs could quickly outstrip the value to an organisation of continuing to operate, in which case the organisation may be tempted to walk away and leave the community to pay cleanup costs. This is especially true of unlicensed operators⁵⁴ that face low barriers to entry and do not have any financial assurances in place.

⁵⁴ In NSW, a licence is required to conduct any activity stated in Schedule 1 of the *Protection of the Environment Operations Act* 1997 (POEO Act). Most activities in Schedule 1 of the POEO Act specify a threshold at or below which a licence is not needed and above which a licence is needed. Source: OEH (2009) Guide to licensing under the *Protection of the Environment Operations Act* 1997

Industry participants point to the adoption of allowable levels of asbestos in Victoria and WA as a workable solution to this potentially debilitating issue. The allowable limit adopted in Victoria and WA is <0.001%. While this is a very small percentage, it should be noted that, due to the high volumes of end products coming out of the C&D recycling sector, this could equate to a considerable amount of asbestos being legally allowed into the marketplace. In the example above involving 600 tonnes of products, an allowable limit of 0.001% could equate to 6kg of asbestos at the project site.

An alternative solution that has been discussed by some industry operators is to close their operations and altogether cease attempting to recover resources from C&D waste streams. While wholesale abandonment of existing operations by established and profitable organisations is certainly an extremely unlikely outcome, it should be noted that the issue of asbestos does have the potential to completely close down the C&D resource recovery market in NSW.

WorkCover NSW recently produced a guide for the *Management of asbestos in recycled construction and demolition waste*. The document was produced in consultation with industry, and is considered a best practice guide to minimising the risk of asbestos contamination in recovered C&D material. The use of this guide, combined with the adoption of some very small allowable limit of asbestos in C&D products, as implemented in Victoria and WA, is worthy of serious consideration. However, the human health, environmental, legislative and political complexities surrounding asbestos in NSW mean that and any change to the government's approach on this issue would require careful management.

The management of asbestos in C&D waste recovery and recycling will require the engagement of the State's WorkCover Authority or health department. In Victoria this approach was taken in collaboration with environmental agencies and the unions representing employee interests, to achieve an outcome that was satisfactory to all parties.

9.5.3 Unlicensed Players and Enforcement

Established market participants consulted throughout this project raised the issue of the presence of unlicensed market participants who can avoid licensing requirements due to low processing volumes. The view was strongly expressed that some of these participants stockpile and/or process significantly more material than the allowable thresholds, while avoiding the environmental compliance requirements expected of the major players.

Various opinions were offered in relation to the presence of unlicensed operators. It was suggested by one of the organisations Hyder surveyed that 'unlicensed players are an irritation, but not the main problem'. Other operators were of the view that, given the economic incentives to avoid landfill disposal, all operators should be licensed and threshold limits should either be abandoned or significantly revised.

Most of the organisations interviewed were of the opinion that some or all of their competitors did not perform to the same standards as themselves, and did on occasion breach certain regulatory requirements.

A constant theme from all reprocessors contacted was the desire for more vigorous enforcement of existing regulations (particularly as they applied to the respondent's competitors). Several participants suggested the root of the problem was a lack of resources within the environmental regulator, and that policing of the market could be significantly improved with a small number of additional, well trained staff conducting regular site inspections. It was suggested there is a strong business case for the regulator to increase compliance activities as one of the major areas of concern was the illegal supply of material that should be considered a 'waste' and therefore disposed to landfill, where it would attract a significant government levy. During the consultation, representatives of the environmental regulator acknowledged an issue is its restricted capacity to discuss or promote actions that could negatively impact market participants and the sector overall. This includes barriers to discussing any actions that may potentially be used as part of a legal case against participants. The timelines for legal action can be protracted to a point of frustration for industry participants who perceive the companies operating inappropriately are not being dealt with quickly enough.

Several stakeholders commented on the risk based approach taken by the regulator to compliance activities. It was stated that those participants that are perceived as lower risk of non-compliance, which are generally the well established organisations with a good track record of compliance, receive less attention from the regulator than those market participants which are considered to be at higher risk of non-compliance.

Established, lower-risk participants are more likely to have a higher-profile within the industry, such as through membership of organisations such as the Waste Management Association of Australia's C&D Working Group. The opinions of these participants may be better communicated to the public, and therefore influence the perception of the level of enforcement that is taking place, compared to how some organisations deemed to be 'higher risk' may perceive the current enforcement situation.

The low barriers to entry and high number of small 'man and his truck' operators in the C&D waste transporting industry presents a significant challenge for the environmental regulator. One way to create a database of market participants, and enable the regulator to more effectively police their activities, would be to introduce mandatory licensing requirements for any operator involved in the industry – including transporters as well as reprocessors.

9.5.4 Over Specification of Materials

In metropolitan NSW, healthy demand for products containing recycled C&D material tends to mask some underlying barriers to increasing product uptake. While these barriers may not be critical in metropolitan markets where there are numerous end-use options, there is one particular issue that has the potential to significantly increase market demand, especially in regional areas.

A well-recognised barrier to increasing uptake of recycled materials in the construction of local roads is the tendency for over-specification by local government engineers. The root cause of the issue is that risk-adverse engineers tend to defer to RTA Specifications, which have been developed for high-traffic freeways and major roads.

The GreenSpec developed through the Institute of Public Works Engineering Australia (IPWEA) seeks to address this specific issue.

Additional methods for improving education about the value of recycled products, such as promoting use of the GreenSpec, should be the focus of further work at State Government level, and some insight may be provided through similar programs in Victoria such as the Roads Towards Zero Waste project (see Section 10).

9.5.5 Opinion Shopping

There are various reasons that incoming feedstock and outgoing products may require sampling, including to determine the level of contamination in a particular feedstock, which impacts the ability, method and cost of processing. For outgoing materials, representative sampling may be required to ensure a product meets a defined specification or the requirements of a Resource Recovery Exemption which in NSW is required to establish that the material is no longer a waste before it is applied to land.

On both fronts, market participants acknowledged there are sometimes issues with the quality of testing and reports performed by third party consultants, and that there may be a temptation for 'opinion shopping' where an initial report contains unfavourable findings. A potential solution is to establish some form of certification scheme that recognises consultants with the appropriate skills and understanding to perform the required work.

9.5.6 On Site Processing

Operators that have invested significant funds into their facilities, and which have high compliance costs in meeting the regulatory requirements applied to their sites, can be at a disadvantage to on-site reprocessors of material. There is a view within many reprocessing organisations that the standards of processing performed on site may be inferior to what is performed at dedicated facilities.

There are, however, potentially significant advantages from increasing on-site processing, including reduced transport requirements which may provide a range of social, economic and environmental benefits.

A middle ground solution is to ensure on site processors are held to similar standards of operation as those who have established dedicated recycling and reprocessing facilities.

Until material leaves the site where it is generated it is not classed as a waste, and is therefore not subject to the same regulatory settings as material which is transported offsite. It is the view of the environmental regulator that there are other regulatory frameworks which suitably govern on-site processing of materials. This includes requirements of specific Environmental Management Plans that are set and approved by various determining authorities depending on the project, potentially including local governments and/or the NSW Department of Planning.

9.5.7 Once a Waste Always a Waste

Based on definitions contained in the POEO Act 1997, a substance is not precluded from being 'waste' merely because it is or may be processed, recycled, reused or recovered.

This "once a waste, always a waste" approach by the environmental regulator presents more than just a philosophical problem for those operating in the resource recovery industry because it flows through to impact on their ability to market products.

Some overseas jurisdictions have approached the same challenge of establishing standards for recovered waste material by emphasising the recovery potential. For example, the UK's Waste Reduction Awards Program's (WRAP) Quality Protocols have been developed to provide a uniform control process for producers, from which they can reasonably state and demonstrate that their product has been fully recovered and is no longer a waste.

9.6 Opportunities

The major opportunities for increasing diversion of C&D materials from landfill in the NSW market appears to relate to increasing the processing of material that currently presents as mixed waste, especially from regional generators and smaller generators in metropolitan areas. Recovery can be increased through a combination of encouraging increased separation of materials, and increasing market demand for recycled end products.

9.6.1 Increased Education

In metropolitan areas of NSW, and to a lesser extent in regional areas, there are likely to be potentially significant economic advantages for generators that source separate their C&D waste materials. Generators that produce a regular or high-volume stream of C&D waste material will quickly notice the price signals, although those infrequent generators – especially in the residential C&D market – may not be as aware of the advantages of source separation, or of appropriate operating methods.

These in-frequent and low-volume generators are also less likely to be aware of regulatory requirements concerning appropriate waste disposal, including safe handling and disposal methods for hazardous material such as asbestos.

While mass-media campaigns are unlikely to be a cost effective method of providing education, there are opportunities to develop information pathways that would allow for improved information flows to members of the industry – especially the smaller 'man and his truck' operators – in order to improve understanding and compliance with regulatory conditions.

While moves to increase regulatory requirements are not generally popular, the consultation undertaking for this project highlighted a belief that, given the NSW Government has recently increased the Landfill Levy and introduced Resource Recovery Exemption requirements, it should also ensure a level playing field for all participants, not only those which are of sufficient size to be easily identified and contacted.

It was suggested by several market participants that all operators involved in the C&D waste sector should be required to be licensed, including transporters as well as processors. It was argued that knowledge of regulatory requirements should be considered an important prerequisite for licensing. Such an approach could improve information flows throughout the sector, especially for the skip bin transporters who interface with lower volume generators of C&D waste.

An appropriate licensing system could be developed within the current framework facilitated under the POEO Act, with appropriate amendments that addresses the scale of materials handling and production of the smaller operators. This licensing would also create a database of C&D sector participants, which would allow the government to communicate important changes if and when they occur. This would help to overcome the current issues associated with informing smaller operators of changes to regulatory requirements.

9.6.2 Central Coordinating Agency

The high resource recovery rate from C&D waste material in NSW is partly a response to landfill disposal costs, but also due to the significant market demand for recycled products in civil engineering projects. This market demand has increased in Sydney due to restrictions on the availability of competing virgin materials, and the experience in NSW (and especially Sydney) suggests strong markets for use of recovered C&D materials is a key factor in improving resource recovery performance.

Market demand will increase where potential users of recycled products have confidence in the suitability of the materials for use in specific projects. One potential method of increasing confidence and providing education about the suitability of recycled products could be the development and promotion of a central repository of information about recycling and recycled products.

It was suggested by one NSW stakeholder that the UK's Waste & Resources Action Programme (WRAP) could provide a model for the development of a coordinating body in Australia that would be tasked with supporting and keeping track of various trials and specifications, and ensuring the results are widely publicised so that all relevant stakeholders are able to access the information.

9.7 Key Conclusions

- 1. The NSW environmental regulator should require the same standard of record keeping for operators of licensed recycling facilities as is required of licensed landfill facilities.
- 2. Mandatory licensing of all sector participants, including transporters as well as reprocessors, should be considered in response to the increasing economic incentives to be involved in the sector.
- 3. Asbestos contamination is one of the most critical issues in the NSW market. Victoria and WA have adopted small allowable limits of asbestos to solve this issue. NSW is unlikely to independently progress toward a similar solution.
- 4. A national agency responsible for coordinating, compiling, collating and publicising information could increase stakeholder confidence in the suitability of recycled C&D materials.
- 5. A certification scheme that recognises consultants with the appropriate skills and understanding to perform testing and analysis work in relation to defined specifications and Resource Recovery Exemption requirements would be of benefit in NSW.

10 VICTORIA

10.1 Overview

The Victorian *Towards Zero Waste Strategy* (TZW) set a series of resource recovery targets up until 2014 for the three key solid waste streams of municipal solid waste (MSW), commercial and industrial waste (C&I) and construction and demolition waste (C&D). Table 10-14 outlines the progress towards achieving the targets set for C&D waste.

Table 10-14 C&D recovery rates in Victoria 2008-09 relating to TZW targets⁵⁵

Sector	2008-09	Actual progress	2014 target	
	progress target	2008-09		
Construction & demolition	65%	71%	80%	

Sustainability Victoria has responsibility for C&D and C&I waste planning, and the Victorian regional waste management groups (RWMGs) have responsibility for MSW, with oversight from Sustainability Victoria, the Department of Sustainability and Environment (DSE) and EPA Victoria.

The data that is included in this jurisdictional summary for Victoria varies from the data presented previously in this report, in that it includes quantities of soil and sand. DSEWPaC's preferred method for waste and recycling data collection in Australia has been applied in the presentation of data earlier in this report. Sand and soil figures are only included in this summary for Victoria because they highlight certain C&D waste management practices on sites and so present a material that is managed by the C&D waste reprocessors.

A total of 3.15 million tonnes of C&D material was recovered for reprocessing in Victoria in 2008-09, however 47% of waste to landfill was generated from the C&D sector. Currently the majority of C&D material recovery in Victoria is coming from the commercial demolition sector, with a strong focus on masonry materials in both recovery and market development.

To improve both the recovery rates and end use markets for C&D materials, a series of opportunities have been identified. These include, but are not limited to, seeking improvements relating to:

- C&D waste management planning at all levels of government, in partnership with industry
- Sustainable procurement including a framework that addresses:
 - The financial, social, ethical and environmental implications of the purchase of goods and services, and
 - Development of specifications, accreditation, quality assurance and awareness processes
- Sustainable resource use which has links to sustainable procurement practices
- Investment in infrastructure and product development in proximity to markets

⁵⁵ Sustainability Victoria (2010) *Towards Zero Waste Strategy Progress Report 2008-09*

10.1.1 Materials/Source

Sustainability Victoria's definition of C&D waste (on which its data is based) 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 from owner / occupier renovations, which is included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the C&I sector."⁵⁶

Information gathered by Sustainability Victoria, as outlined in Figure 10-2, indicates that C&D material recovered for reprocessing (by weight) in Victoria is predominantly concrete, and that this is consistent with previous surveys for this sector. In Sustainability Victoria's survey period⁵⁷ a total of 3.15 million tonnes of C&D material was recovered for reprocessing. The report highlights that the historic trend for C&D material recovery in Victoria is one of high and strong diversion. It also indicates that historic growth in C&D recovery rates is beginning to slow, and it is expected that future growth will remain slow. This slowing in growth reflects that most large scale demolition waste is already being captured and recovered.



Figure 10-2 Composition of construction and demolition waste (by weight) recovered for reprocessing, Victoria 2008-09

With Sustainability Victoria's earlier definition of C&D waste in mind, the sources of C&D material recovery in Victoria are outlined in Figure 10-3. The information indicates that the greatest proportion of recovery of C&D material is understandably from the C&D sector itself, with small proportions also generated from the commercial and industrial, and municipal waste streams.

It is estimated that regional Victoria generates approximately 26% of Victoria's total solid waste, or about 2.8 million tonnes annually. This 26% of the state's solid waste includes approximately 7% of the MSW, 8% the C&I waste and 11% of the C&D waste. The current recovery rate of C&D waste in regional Victoria is estimated to be between 35 to 50% ⁵⁸.

⁵⁶ Sustainability Victoria (2010) *Victorian Recycling Industry Annual Survey 2008-09*

⁵⁷ Survey period was 2008-09 financial year, with the results published by Sustainability Victoria in June 2010

⁵⁸ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria



Figure 10-3 Waste stream sources of construction and demolition waste (by weight) received for reprocessing, Victoria 2008-09

This review has highlighted that the dominant materials recorded in Figure 10-2 (concrete, rock / excavation stone, brick, asphalt – see Table 10-19 for actual tonnages), are predominantly sourced from commercial and civil activities that provide clean, high-volume, and generally homogenous materials for reprocessing.

This jurisdictional review and associated assessment further highlight that beyond rock / excavation stone, which is predominantly sourced from excavation activities at development sites, and asphalt, which is recovered from civil road maintenance activities, the majority of C&D material recovery in Victoria is coming from the commercial demolition sector.

The source report for the information in Figure 10-2 (and Table 10-19), Sustainability Victoria's *Victorian Recycling Industries Annual Survey 2008-09* (published in 2010) also separately highlights that 17% of metals received for reprocessing in Victoria in 2008-09 were sourced from the C&D sector. The C&D sector also provided 5% of organic waste (which includes wood / timber) and 3% of plastic waste received for reprocessing. These materials are not accounted for in the information in Figure 9-1 (and Table 10-19). This suggests that lower volume or light materials in the C&D waste stream (also known as 'lights' in the industry), may not be receiving the same level of attention from the industry and government agencies in relation to recovery and market development as other waste materials, even when, as Figure 10-4 later highlights, C&D materials still make up 47% of waste going to landfill in Victoria.

Many of these lower volume or light materials present a challenge for recovery because they are generally disposed through mixed C&D loads which are less likely to be recovered, and if these types of loads are sorted, the light materials are often not extracted due to limited secondary reprocessors and associated markets.

Additionally, as outlined, the greatest contributing sector to C&D material recovery and processing at present in Victoria is the commercial demolition sector, which is dominated by heavy materials that have more established market outlets. Hence there is less incentive to seek to recover what would be considered peripheral materials by this sector of the C&D industry.

Information from the HIA⁵⁹ indicates that nationally the top 100 housing companies ('The Housing 100') had a 38% market share of housing starts in 2009-10. This equated to 60,580 housing

⁵⁹ HIA – COLORBOND® steel, *Housing 100, 2009/10*

starts, which comprised 51,602 detached houses and 8,988 units / townhouses. The remaining 62% of activity, approximately 98,840 of houses / units / townhouses constructed in the same period, were undertaken by small-to-medium sized builders in the industry.

The residential building sector generates a range of materials during construction that would be presented as mixed loads, either to landfill or reprocessing sites. These materials do not feature strongly in Figure 10-2 (and Table 10-19), and represent a challenge for recovery. The available space on building sites often limits the opportunity to introduce systems that provide for the separation of materials into different streams for recovery. There is one container system (a skip bin or similar) in which mixed materials are disposed. The collection contract arrangements and the value of the content of the bins will more likely determine whether materials are separated out for recovery before disposal to landfill.

Complications with introducing recycling systems are also compounded by the residential building sector being dominated by small-to-medium sized builders, who are likely to either be sole operators or have few staff directly in their employ, and which also operate on tight margins.

Regardless of the size of the residential housing company, it is standard practice in this sector to rely heavily on skilled sub-contractors to undertake a range of works during construction. This may also include the builder or company establishing 'supply and install' arrangements with manufacturers. In these instances, an arrangement is made with the manufacturer / supplier to manage the provision and installation of materials during construction (for example roofing). Where these arrangements are established for a material, the builder or company has little influence over decisions associated with the management of supply chain and installation practices.

Industry estimates suggest the cost of disposal of waste generated during the construction of a residential house could be \$2,000 to \$3,000 per house. Additional preliminary assessments in Victoria suggest the volume of waste generated in the construction of a volume builder house on a flat block could be 18 to 23 cubic metres of waste per house. The figures on volume per house do not include soils and excavated materials from the site. Industry partnerships between volume builders and peak industry associations are seeking to investigate these claims in more detail and determine opportunities for improvement.

Bin hire companies have a profile in this area of residential construction. Builders do tend to use bin hire companies for the recovery or disposal of residential construction wastes. Some bin hire companies servicing builders may recover high value materials such as metals, concrete and soils, for which they have established market outlets, with the remainder of waste generally being sent to landfill.

10.1.2 Gate Fee/Disposal Pricing

Sustainability Victoria in 2005 commissioned a series of disposal based surveys of landfills in metropolitan and regional Victoria⁶⁰. The disposal based waste survey did not include waste material from domestic kerbside collections, so the landfill based survey was supplemented in 2008 with additional information from domestic kerbside waste audits⁶¹ which was added to the total waste to landfill information from 2005.

The overall determination of the composition of waste to landfill is presented in Figure 10-4, and highlights that C&D waste was estimated to be 47% of the total composition of solid waste by weight going to landfill. No material breakdown is provided on this 47% of C&D waste going to

⁶⁰ Sustainability Victoria (2005) *Disposal Based Waste Survey*

⁶¹ Sustainability Victoria (2008) *Kerbside garbage composition*

landfill. This lack of appropriate data presents issues in addressing the management of this waste and its potential component materials.



Figure 10-4 Composition of waste to landfill in Victoria by weight (2005, 2008)

Table 10-15 outlines the waste levies charged for municipal solid waste and industrial waste. The levy for industrial waste is applied to C&D waste disposed to landfill that does not contain prescribed industrial waste (PIW). Packaged asbestos waste has a levy of \$30/tonne (2011-12) which is applied to encourage the safe handling and disposal of this PIW.

Coorrenkie eree	Waste levy (per tonne)	Forecast waste levy		
Geographic area	2010-2011	2011-2012	increase	
Metro / provincial	MSW - \$30	MSW - \$40	Increasing to \$53.20 for both MSW and	
	Industrial - \$30	Industrial - \$40	industrial by 2014- 15	
Rural	MSW - \$15	MSW - \$20	Increasing to \$26.60 for MSW and \$46.6	
	Industrial - \$25	Industrial - \$35	for industrial by 2014-15	

Table 10-15 MSW & Industrial waste levies for Victoria

Victoria has a long history of landfill levy application. This experience has seen the state move from a differentiated levy in metropolitan and provincial areas for MSW (\$4/tonne) and industrial waste (\$5/tonne) in 2002-03, to a non-differentiated levy of \$30 tonne for both waste streams in 2010-11. This non-differentiation seeks to end any misclassification of non-hazardous materials, so that all solid non-hazardous waste in metropolitan and provincial areas is charged the same levy rate. Although levy rates will continue to vary for rural areas, levies are still applied across the entire state to limit the transportation of waste between regions.

The information illustrated in Figure 10-5 is based on work undertaken by Hyder Consulting for Sustainability Victoria⁶². The relationships represent an estimate of responses to the price of landfill, (including levy rate rises) for the three key waste streams of MSW, C&I and C&D. The chart indicates that C&D waste generation is likely to most rapidly respond to a pricing signal, resulting in increased waste being diverted from landfill.

This stakeholder consultation has highlighted that the non-recycled portion of waste from the C&D sector is predominantly mixed load materials from the construction sector, and from small demolition sites (particularly in the residential sector). The consultation has found that these operations continue to prove challenging in relation to efforts to improve source-separation and associated improvements in material recovery.



Figure 10-5 Assumed diversion responses of waste streams to increases in the price of landfill

The information in Table 10-15 and Figure 10-5 seeks to illustrate the potential implications of waste disposal pricing on the disposal and recovery of C&D materials.

As illustrated in Table 10-16, this review found a strong preference among reprocessors for accepting source separated loads of clean material, and pricing therefore favoured this form of presentation, especially in metropolitan Melbourne. Pricing in metropolitan Melbourne also favoured materials, such as concrete, that have strong markets for associated reprocessed products. This was less the case for the non-metropolitan sites, where charges for clean loads, regardless of the material, appeared fairly constant.

Mixed loads incurred the same charges as materials going to landfill, particularly in metropolitan Melbourne. Where these loads were then sorted by the receival site and certain materials recovered for reprocessing, the receival sites indicated that the ultimate saving / return of the levy differential (\$30/tonne 2010-11 in metropolitan Melbourne) meant they were able to reinvest this money into the site recovery and reprocessing activities.

⁶² Hyder Consulting (Sept 2009) *Towards Zero Waste Review - Options Analysis* for Sustainability Victoria

Table 10-16 Landfill and material specific gate fee ranges of reprocessors consulted (March 2011)

Materials	Metropolitan reprocessor gate fee range \$ tonne	Non-Metropolitan reprocessor gate fee range	Landfill gate fee range	
		\$ tonne or m ³	\$ / tonne (including levy)	
Concrete (clean load)	Free	20 – 30 tonne	_	
Brick (clean load)	0 - 30	~20m ³	_	
Asphalt (clean load)	0 - 30	~20m ³	50 – 70 metro	
Plasterboard (clean load)*	~15	~20m ³	- 00 - 80 non-metro	
Mixed loads	50-70 (same as landfill rate)	70		

* Limited sites, generally recovery is through collections at construction sites organised through an arrangement between the developer and the plasterboard manufacturer

As outlined in the Section 10.1.3, this review found that not only was pricing important but the geographic location of reprocessors was also important in terms of facilitating C&D material recovery, especially in metropolitan Melbourne.

A study of resource recovery in regional Victoria, commissioned by Sustainability Victoria⁶³, found resource recovery from C&I and C&D waste streams in the North Eastern and Mildura regions of Victoria was significantly hampered by the movement of wastes to landfills in NSW, where landfill costs were typically lower (in part due to the absence of landfill levies in the non-regulated area of NSW). The study indicated this made landfill disposal a cheaper alternative for many materials, compared to separation and recovery.

The study indicated that in some instances the cost differential between townships in Victoria could be double those in NSW. The analysis indicated that cross border movement from Victoria into NSW did not occur to a large degree in the Central Murray region because NSW landfill costs in this area were only slightly lower than Victorian landfills. For example, residents at Koondrook (Victoria) have access to resource recovery centres in neighbouring Barham (NSW).

Consultation with industry also suggests that other issues exist in relation to disposal charging. It was stated that there is a wide spread practice of disposal of some solid inert wastes without charging the landfill levy when the materials are used in applications such as the construction of internal site roads. This is despite EPA publication 332.1 requiring landfill operators to collect the landfill levy on all materials disposed into their site, unless they have written approval from EPA Victoria to receive the waste without collecting the levy.

10.1.3 Geographic Catchment

Sourcing C&D Materials

Landfills that take solid industrial waste in metropolitan Melbourne are predominantly located in the west, north and south east of the City. The largest and dominant C&D material reprocessors are predominantly located in the inner and middle-western suburbs of Melbourne, followed by a growing presence and investment in the south east and to the north of the City. The largest concentration of C&D material reprocessors is based in the western suburbs including (but not limited to) Laverton, Brooklyn and Sunshine. This may change overtime with the current investment in facilities in the south east.

⁶³ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

The commercial demolition sector typically generates the highest tonnage of material, and such activity is commonly undertaken in the central business district (CBD) and inner suburbs of Melbourne. Reprocessors confirmed a trend in metropolitan Melbourne where the catchment for C&D material reprocessing sites did not generally extend beyond 20 kilometres from the location of C&D waste generation. Table 10-17 indicates the general source of C&D materials for reprocessors based on their geographic location in metropolitan Melbourne.

Table 10-17	Geographic range of C&D reprocessors and source materials	

Geographic region in metropolitan Melbourne	General geographic source of C&D waste materials			
Western Melbourne (10 – 20 km from CBD)	CBD, inner west and western suburbs			
South Eastern Melbourne (~ 20 km from CBD)	CBD, inner east and south east suburbs			
Northern Melbourne (~ 20 km from CBD)	Inner north, north and north eastern suburbs			

In regional Victoria, recovery opportunities for C&D are highly dependent on the availability of facilities located in close proximity to waste generation sources. On this basis the strongest C&D waste recovery and reprocessing is in the jurisdictions of the RWMGs with large provincial centres, such as Barwon RWMG (Geelong) and Highlands RWMG (Ballarat)⁶⁴.

Markets for Products

The location of the C&D recovery and reprocessing sites is not only based on siting that offers a competitive option in relation to landfilling. It is also based on the location of markets for the products generated from C&D material recovery and reprocessing activities.

The geology of Melbourne and much of western Victoria plays a role in determining the areas where a strong supply of virgin material stifles demand for recycled C&D materials. The region to the west of the Yarra River is dominated by a basalt plain. This basalt plain, and the associated quarries that are in close proximity to metropolitan markets, are a source of inexpensive aggregates for a range of applications, particularly in pavement sub-base, which compete with recycled C&D products, such as crushed concrete.

Markets for recycled C&D materials will be discussed in further detail, however the review has found products such as crushed concrete were cost competitive with virgin quarry aggregate products used in the same applications in the metropolitan area. The recycled crushed concrete was found to be either the same price or in some instances 10-15% cheaper than the comparative quarry product. The physical properties of crushed concrete were considered to provide another economic incentive for use, as for the same product weight as crushed quarry rock, the crushed concrete alternative offered an additional 10 - 15% product volume.

In regional Victoria, transport costs and the relatively low value per tonne of recovered product sees the markets for C&D products generally located close to the source of waste generation. Some limited cross regional movement of C&D products takes place, subject to the proximity of markets relative to the reprocessed material⁶⁵.

This is reinforced in Table 10-18 which provides estimates of typical costs for transporting recycled crushed concrete.

⁶⁴ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

⁶⁵ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

Table 10-10 Typical costs of transporting recycled concrete aggregat	Table 10-18	transporting recycled concrete aggreg	aggregate ⁶
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Material	Typical material value (\$) per tonne	Typical material value (\$) per load	Typical loss of value / 100km
Crushed concrete	15-20	300-400	40–80%

Table 10-18 highlights that, because the unit value of the reprocessed material is low, the cost of transport can quickly reduce the value of the material. This underscores the importance for reprocessing facilities to be located in close proximity to market outlets.

10.1.4 Material Processing

Materials being Accepted / Processed

Figure 10-6 is based on Sustainability Victoria information that indicates 47% of the waste received for reprocessing in Victoria in 2008-09 was sourced from the C&D sector, equating to 3.155 million tonnes of material.



Figure 10-6 Source sector of materials collected for reprocessing in Victoria, 2008-09

Figures for C&D material recovery and reprocessing from 1999 to 2009, as reported by Sustainability Victoria, are outlined in Table 10-18. As previously highlighted, materials such as concrete, rock / excavation stone, brick and asphalt, are predominantly sourced from commercial and civil activities, with the rock / excavation and soil / sand likely to have been sourced from excavation activities at development sites, and the asphalt recovered from civil road maintenance activities. In Victoria, this review found materials such as concrete and brick are predominantly coming from the commercial demolition sector, as opposed to the residential demolition sector.

⁶⁶ Hyder Consulting (2009) *Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft* for Sustainability Victoria – modified version of Table 4-6, using pricing estimates at 2011

Year	Asphalt	Brick / brick rubble	Concrete	Mixed demolition & construction	Plasterboard	Rock / excavation stone	Soil & sand	Total construction & demolition waste recovered
Tonnes ('	000)							
1999-00	59	228	577	-	5	-	2	871
2000-01	68	318*	811	-	4	56	16*	1,273*
2001-02	65	293	942	-	8	359	49	1,716
2002-03	84	250	1,161	-	21	293	42	1,852
2003-04	170	425	1,525	-	22	428	49	2,618
2004-05	162	395	1,477	-	24	367	68	2,492
2005-06	139	385	1,734	-	27	419	209	2,913
2006-07	190	438	1,695	81	22	505	239	3,170
2007-08	152	293	1,717	111	33	668	72	3,047
2008-09	226	244	1,731	91	37	656	170	3,155

Table 10-19 Construction and demolition material recovered for reprocessing, Victoria 1999-00 to 2008-09⁶⁷

* Evaluation and cross referencing of reported and actual data has led to an adjustment of previous financial year data

The preference for most reprocessors in metropolitan Melbourne is to process for high volume, clean source separated loads, and there is limited recovery of mixed loads, as highlighted in Table 10-19. This review found large scale reprocessors did not tend to seek out mixed C&D loads and, when they did accept these loads, they did so only on the basis that contamination levels were low (5% or less) and the gate fee charged was comparative to local landfill charges.

In addition to the information presented in Table 10-19, Sustainability Victoria estimates that annual stockpiles of some of these materials exist in Victoria, due to challenges associated with market development. Product and market barriers and opportunities are addressed in Section 10.5 and 10.6. The estimates suggest that currently 1.2 million tonnes of concrete and 0.6 million tonnes of brick are being stockpiled.

The data on C&D material reprocessing presented in Table 10-19 tells a story in relation to the focus of C&D material recovery, reprocessing and market development in Victoria over the past decade. The table highlights a focus on recovery of masonry materials. This review has found materials such as metals, timber, plastic and cardboard wastes, which may also be generated through C&D activities, have received less focus in terms of resource recovery efforts.

Further discussion of material acceptance follows in relation to key aspects of activities associated with C&D material recovery and reprocessing.

⁶⁷ Sustainability Victoria (2010) Construction & demolition waste recovery in Victoria 2008-09 (Victorian Recycling Industry Annual Survey 2008-09)

C&D Waste Recyclers

In Victoria there is a clear distinction between reprocessors whose preference is to accept source separated loads and those that will take mixed loads. This approach is reflected in pricing mechanisms, which favour clean loads of materials with strong markets for associated reprocessed products. As with jurisdictions including NSW, the large C&D reprocessors highlighted their primary driver for seeking source separated material was based on the markets for their reprocessed products.

Similarly, as in NSW, those businesses recovering materials from mixed loads did so to reduce disposal costs (including levy costs), and focused recovery efforts on the high value materials they could divert to other local reprocessors, or for which they had an established market.

Source Separated Reprocessors

The large metropolitan Melbourne reprocessors are driven primarily by market outlets for their clean source separated materials. These operators have invested over the past 10 to 15 years in establishing robust markets for their products, and refining their processing infrastructure to improve product quality. Their efforts have helped establish the strong diversion and reprocessing rates in Victoria for specific C&D waste materials, as detailed in Table 10-19.

As previously outlined, these established reprocessors have also located themselves in close proximity to the source of large scale C&D waste generation (commercial demolition projects within the inner city) and the market outlets for their products. In this way they are both a competitive option to landfills in respect to waste disposal, and to quarries in respect to providing aggregates for use in new construction projects.

In regional Victoria, larger scale C&D projects may in some instances support on-site source separation through the use of dedicated bin systems for individual materials. In these instances material is delivered to local recyclers of materials including concrete, brick, plasterboard and other construction materials where there may be a local market⁶⁸.

In both metropolitan Melbourne and regional Victoria there are a number of resource recovery facilities and transfer stations that provide dedicated areas for separated C&D waste streams. In regional Victoria, mobile crushing and screening equipment is often employed at these sites to reprocess concrete and bricks for local market applications. In metropolitan Melbourne, resource recovery facilities and transfer stations that take small volumes of source separated C&D materials may charge a small fee for acceptance of clean loads, which is less than that for mixed loads. This price differential is to encourage source separation by the waste generator, and also provides some income for the site to offset the management and transfer of this material to another reprocessor

Mixed Load Recyclers

Mixed loads were found to generally incur the same gate fee charges as C&D waste disposed to landfill facilities, particularly in metropolitan Melbourne. Where mixed loads were accepted by large scale reprocessors, generally they would be only taken if contamination levels were low (5% or less).

The degree to which separation of materials occurs within the bin hire industry is generally difficult to know. However, bin hire companies servicing builders appear, where they have the facilities to do so, to be physically sorting and recovering high value materials such as metals, concrete and sometime soils, for which they have established market outlets.

⁶⁸ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

The remainder of their waste is sent to landfill and, in instances where the landfill site has the capacity, these loads may be sorted again for material recovery. In this situation the bin hire company is, however, generally charged the full landfill gate fee, regardless of any further recovery and diversion of materials by the landfill operator.

Mixed loads were also more likely to be accepted in regional Victorian sites, however these loads incurred high charges and, as is the case with the bin hire companies, only the high value materials tended to be recovered. Where the capacity existed, these materials were either reprocessed on site or sent on to a local reprocessor.

These observations are reinforced by the Sustainability Victoria review of regional Victoria, which found collection and recovery of C&D waste was dependent on the scale of the projects and location of resource recovery centres. Small scale projects generally disposed of waste in mixed load skips, with the waste then managed by the bin hire company. The study determined the recovery of material in these instances required sorting of the mixed C&D waste, which added to the cost of recovery⁶⁹.

Mobile Processing

As highlighted above, some resource recovery facilities and transfer stations in regional Victoria provide dedicated areas for separated C&D waste streams, and mobile crushing and screening equipment may be employed at these sites to reprocess these materials.

In metropolitan Melbourne, issues relating to the regulation of mobile plant were highlighted by some reprocessors. EPA Victoria confirmed the key differences in regulating mobile and permanent crushing operations, which are outlined in Table 10-20.

Table 10-20 Regulation of crushing operations

Mobile crushing plant	Permanent C&D crushing operations			
EPA does not have best practice guidelines Operations may require council planning permits , but this is dependent on council. not EPA	Subject to strict planning permit requirements which EPA is involved in through its responses and advice the permit referrals it receives from councils			
 EPA would expect: There to be a water supply to the crusher The operation not to cause pollution from noise or dust (no visible dust) 	EPA has also made submissions to Panel Hearings and VCAT to influence planning decisions and ensure Best Practice Environmental Management (BPEM) requirements and monitoring programs are addressed			
• Siting that has regard for weather and wind directions before operating				

The differences in the level of regulation for mobile crushing operations, as outlined above, were of concern to some operators of fixed facilities. These operators expressed the view that the current regulatory requirements for fixed plant meant their existing facilities were the focus of a level of scrutiny that was not applied to mobile crushing operations in the local vicinity.

In addition, operators of fixed plant have faced extensive challenges in recent years in establishing new facilities for the reprocessing of C&D waste, which in some cases has involved lengthy and expensive approval processes and where the ultimate approval has come with a range of specific conditions and monitoring requirements that are not applied to the operators of mobile plant.

⁶⁹ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

10.2 Material Profiles

Both the level of recovery of a material stream, and the end markets for the products, owes much to geography and pricing, as has been previously highlighted. Where materials are heavy and being generated in large volumes, they will cost more to dispose to landfill - especially where there is an appropriate disposal pricing structure, as highlighted in Figure 10-5.

On this basis it is evident that metals and masonry materials receive priority attention for recovery and market development in the C&D sector due to their physical properties (weight and generation volumes). These materials are predominantly generated from the commercial demolition sector and civil activities, such as pavement maintenance or site excavation works.

The notion of materials receiving 'priority attention' is best illustrated by reference to the limited list in Sustainability Victoria's account of materials recovered from the C&D sector, as presented in Table 10-19. As previously highlighted, Sustainability Victoria separately accounts for metals, organic waste (which includes wood / timber) and plastics generated and recovered from the C&D sector⁷⁰, which are not included in Table 10-19⁷¹.

In seeking to include these figures in an overall review, and using the separate accounts of the C&D recovery figures for these three materials (metals, organics, plastics) as outlined in the Sustainability Victoria report, Table 10-21 has been prepared. The recalculation highlights that in 2008-09, the tonnes of metals recovered from the C&D sector (most likely from demolition operations) was higher than Soil / sand; plasterboard; and mixed C&D.

Year	Asphalt	Brick / brick rubble	Concrete	Mixed C&D	Plaster- board	Rock / excavn. stone	Soil & sand	Metals	Plastics	Organics	Total
Tonnes	; ('000)										
2008-											
09	226	244	1,731	91	37	656	170	194	4	37	3,390
%	6.7	7.2	51.1	2.7	1.1	19.3	5	5.7	0.1	1.1	100

Table 10-21 Recalculated C&D recovery in Victoria 2008-09 including metals, plastics and organics*

* Sustainability Victoria (2010) *Victorian Recycling Industries Annual Survey 2008-09*, highlights that 17% of metals; 5% of organic waste (which includes wood / timber) and 3% of plastic wastes were sourced from the C&D sector

It has also been outlined in this review that, beyond metals, the lower volume or light materials are more likely to be generated through the residential construction sector and disposed in mixed C&D loads, which are less likely to be recovered.

As highlighted, building site constraints will also have implications for the level of separation and recovery, especially for materials generated through the residential construction sector.

An account of the challenges and opportunities identified in the Victorian review, as they relate to the recovery of specific materials generated from the C&D sector, is presented in Section 10.5 and 10.6. Further discussion will also follow in this Victorian summary in relation to specific products and markets for C&D materials.

⁷⁰ Sustainability Victoria (2010) Victorian Recycling Industry Annual Survey 2008-09

⁷¹ Sustainability Victoria (2010) *Construction & demolition waste recovery in Victoria 2008-09* (Victorian Recycling Industry Annual Survey 2008-09)
Concrete and Bricks

Figure 10-2 and Table 10-19 outline that concrete (55%) and bricks (8%), account for 63% of the C&D materials recovered for reprocessing in Victoria. If the data in Table 10-19 and Table 10-21 is reviewed, and materials are excluded which relate more to civil activities (such as asphalt, which is generated from activities such as pavement maintenance) and site excavation works (such as rock / excavation stone, and soil / sand), a picture that is focused more on recovery predominantly from the demolition sector emerges. In this re-evaluation of the information, presented in Table 10-22, concrete becomes even more dominant (~74%) and when combined with brick (~10.4%), accounts for 84.4% of the materials listed.

	\$	and)						
Year	Brick / brick rubble	Concrete	Mixed demolition & construction	Plasterboard*	Metals	Plastics*	Organics	Total
Tonnes ('000)								
2008-09	244	1,731	91	37	194	4	37	2,338
%	10.4	74	3.9	1.6	8.3	0.2	1.6	100

Table 10-22 Recalculated C&D recovery (excluding asphalt, rock / excavation stone and soil / sand)

* All of the materials listed may have some recovery through the residential construction sector, however in this table it is suggested that these two materials are most likely to be coming predominantly from the that sector, not the demolition stream

Regardless of the variation on the data presented (Table 10-19, Table 10-21 & Table 10-22), strong recovery of these two materials exists although (as will be discussed in further detail under in 10.4.2), issues do exist for both materials in terms of stockpiles of reprocessed materials. Consultation with Sustainability Victoria representatives highlighted that current estimates received from industry indicate 1.2 million tonnes of concrete and 0.6 million tonnes of brick are being stockpiled.

The commercial demolition sector is the main source of recovery of these two materials, and this is generally through clean source separated loads. In some instances the concrete may include steel reinforcement, but the demolition sector is well equipped to manage this, and also benefits from separating as much of this metal out from the concrete as possible. Steel from reinforced concrete will be addressed further under the discussion on metals.

The key markets for crushed concrete and brick will be addressed in further detail, and include use in low-grade roads (such as all weather applications), and in pavement sub-bases (such as roads and non-structural applications), as a substitute for virgin crushed rock.

As previously highlighted, consultation with industry suggests there is a wide spread practice of disposal of some solid inert wastes without charging the landfill levy when the materials are used in applications such as the construction of internal site roads. It is anticipated that the majority of this 'un-levied' solid inert material is likely to be concrete and brick material, but the quantities of these materials are not known. Further investigations of the scale of this practice may be warranted by the EPA.

Rock and Excavation Stone

Figure 10-2 and Table 10-19 highlight that significant amounts of rock and excavation stone are recovered from the C&D sector (approximately 21% of total recovered material). As outlined previously, the geology of Melbourne and much of Victoria west of the Yarra River is dominated by basalt plain.

Apart from this geology supporting a number of associated quarries in close proximity to Melbourne, it also means that when civil or site preparation works are undertaken, a great deal of excavated rock and stone can be produced as a by-product. On this basis, the generation of excavated rock and stone is coming predominantly from the construction sector.

Again, both the level of recovery of these materials and end markets for associated products has much to do with the geography of where the material is generated and the local market outlets for products, as well as landfill pricing which discourages the disposal of this heavy voluminous material.

Similar to crushed concrete and brick, the excavated rock and stone is potentially a source of inexpensive aggregate for use in a range of applications in pavement sub-base, and so it competes with the recycled C&D concrete and brick products. In some instances the preference is for the crushed rock product over the crushed concrete equivalent, as it bears no difference to quarried products when crushed and it is effectively only the extraction method of this rock and stone that has varied.

As the rock and stone in this circumstance has been excavated at the expense of a site developer, it is cost competitive with quarried products when sold to the market. The large C&D reprocessors, as well as traditional quarrying companies, are involved in reprocessing this material. For the quarry companies, it was highlighted that every tonne of this excavated rock and stone they recycle helps to extend the life of their own quarry. Additionally, civil contracting and demolition companies generally transport these materials to quarry sites, if they are not processing it themselves, so this further reduces the expense to the quarry operators.

Asphalt

Asphalt constitutes approximately 7% of the C&D materials recovered for reprocessing in Victoria (Figure 10-2 and Table 10-19). The material is generated through the civil road construction sector. Asphalt is potential 100% recyclable. This level of recycling and use of recycled content in pavements has not been fully realised in Australia, however there are efforts to work towards improving this within certain sectors of the industry, and this will be addressed further in discussion of markets.

Asphalt pavements on average are 4% bitumen and 96% aggregate. Generally the top layer of asphalt, known as the wearing course (which is generally between 25–40mm thick), is removed and re-laid every 10 to 15 years. This is done using a milling machine which removes the wearing course. The recovered material is generally taken to an asphalt plant for sorting and batching, to ensure the physical properties of the mix are maintained. These include, but not are limited to, the ratio of bitumen to aggregate, the aggregate size, and correct proportions of air voids.

The addition of reclaimed or recycled asphalt pavement (RAP) in new asphalt is allowed across Australia, and in Victoria the standard mix generally contains 10-15% recycled asphalt content, although the level can be higher where the mix is managed well. Recycled asphalt can also go into the base course and road base layers, but mostly goes back into the wearing course of pavements.

Metals

Sustainability Victoria figures for 2008-09 estimate that 194,000 tonnes of metals were recovered from the C&D sector. This constituted 17% of the overall metal recovery in Victoria.

This review found the majority of metals that are being recovered from the C&D sector are coming from commercial demolition sites (estimates place this at about 90%). Of this material, the vast majority is steel (estimates place this at up to 95% of what is recovered), and the remaining materials are non-ferrous metals. This non-ferrous component mostly includes aluminium (1-2%), stainless steel and copper piping / wire.

The value of recovered scrap metal is a primary driver for recovery, with a price in the order of \$250/tonne paid for recovered scrap metal.

During this review stakeholders highlighted that, when demolition activity was high and prices for metals were strong, demolition companies would bring their materials for recycling to the key metal recyclers. However, when there was a downturn in both activity and metal prices, it was suggested the demolition companies were more likely to refocus their attention on upgrading their own infrastructure to reuse and recover these metals and add value to their operations, or stockpile the metals if they could and wait for improved commodity prices.

Sustainability Victoria's estimate of 17% of metals coming from the C&D sector is understood to include concrete reinforced with steel (known in the industry as reo). In the demolition phase there can be a ratio of 80% concrete to 20% steel. Demolition companies obviously recover and reprocess the concrete. However, it was estimated that even after this processing of the reo, it generally had about 10% concrete (contamination) remaining with the steel.

Metal recyclers did not appear to pursue reo material, however it did come to their sites and was reprocessed, but was a low percentage of the intake (perhaps less than 10%). Where it is accepted, the standard practice is to make deductions in the purchase price based on the estimated weight of associated concrete in the load.

An industry observation suggested the growth in metal tonnages over the past 10 years was likely to be coming from increased diversion through material recovery facilitates (MRFs) and transfer stations. Because loads were sorted once they arrived at the metal recycling sites, the generation source of these materials could not be confirmed, although it was believed some content may be coming from mixed loads of C&D waste that had been recovered and sorted at these localised sites.

This may also reflect that, even where small-to-medium sized building companies dispose of construction materials into a single mixed waste system, they more readily seek to recover the valuable metals that may be produced. The bin hire companies that manage the supply and collection of these systems may recover remaining metals.

Timber

Sustainability Victoria does not provide any material composition data on C&D material disposed to landfill (representing 47% of all waste to landfill in Victoria, as shown in Figure 10-4), and the actual tonnes of timber in this waste stream is therefore not well known.

What is separately accounted for in the compositional information on waste to landfill is that 'wood / timber waste' makes up 5% of all landfilled material. It could be assumed the source of this 'wood / timber waste' material is more likely to be either the MSW or C&I streams, and not the C&D stream, because the current accounting for C&D waste to landfill provides a collective figure; industry information indicates the mixed C&D waste disposed to landfill does include timber.

Sustainability Victoria's definition of C&D waste, which was previously outlined, includes the following reference to specific materials:

"Includes waste from residential, civil and commercial construction and demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber..."⁷²

The specific reference to 'timber' as a C&D material is interesting as no actual figure is provided for this material. Timber is included as a material in the organic waste stream. The data on organic waste recovery highlights that 37,000 tonnes of material is sourced from the C&D sector

⁷² Sustainability Victoria (2010) *Victorian Recycling Industry Annual Survey 2008-09*

(or 5% of the total organic waste recovered by weight). This could include a range of materials such as trees and other plants from site preparation works, and timber waste from a range of construction and demolition sources.

Most timber is likely to be generated from the demolition sector, however the nature of large scale mechanised demolition processes means quality timbers are increasingly less likely to be salvaged unless prior arrangements have been made for recovery. Some of the demolition companies have timber salvage operations, and some smaller specialised salvage companies exist. These operators go in and salvage timbers, then value add and on sell. As this industry is seen as 'reuse', the material recovered may not be accounted for in reprocessing and recycling figures.

The improved recovery of quality timbers may be improved where large demolition contractors have identified the value of this material, and seek to salvage reusable timber prior to mechanised demolition work. Large demolition contractors in Victoria, such as the Delta Group, have established specialised timber recovery operations to address this issue where salvage is economically viable.

The recovery of untreated timber was found to be hindered where it was assumed loads may also include treated timbers and timber products such as particle board. Particle board, as a timber product, can be recycled back into particle board, but this is generally confined to pre-consumer manufacturing wastes, or clean off-cuts of particle board recovered at the time of installation.

In some instances, timber was considered among the 'lights' in the C&D material stream, along with plastics and paper / cardboard. However, it was suggested in some instances 'lights' could collectively constitute up to 40% by weight of the C&D materials going to landfill. If this assumption is correct, timber from C&D sources could potentially make up 19% of the waste to landfill. If combined with the known wood / timber waste component (5%) currently accounted for in waste to landfill, it could constitute some 24% of total waste to landfill.

Where timber is recovered, beyond specialised salvage for reuse, it is generally chipped, composted or used in energy recovery applications (for example in kilns and cogeneration opportunities), regardless of whether this is in metropolitan Melbourne or in regional communities⁷³.

It was suggested by the reprocessors consulted that if carbon pricing is implemented, more emphasis may be placed on the recovery of timber, as landfill operators may be required to assess, report on and pay a price for their CO_{2-e} emissions. As the decomposition of timber in the anaerobic environment of a landfill may produce methane and increase the site's carbon price obligations, a carbon pricing mechanism may therefore make timber recovery through reuse and recycling applications more viable.

Plastics

Sustainability Victoria bases its plastics recovery information on the Plastics and Chemicals Industries Association (PACIA) annual calendar year survey⁷⁴. In Victoria, about 3% of the plastics recovered for recycling came from the C&D sector, which constituted about 4,000 tonnes.

In reviewing the PACIA findings, Victoria had the highest plastics recovery from the C&D sector (as well as highest overall recovery) across all jurisdictions. This is due to Victoria having the largest number of plastics recyclers of any jurisdiction.

⁷³ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

⁷⁴ Hyder Consulting (2009), 2009 National Plastics Recycling Survey, report to the Plastics and Chemicals Industries Association

The PACIA report highlights the construction (or building) sector is one of the key markets for plastics in Australia. Even though there are broad applications for plastic products in construction, the most prevalent products are packaging films, waffle pods and pipes.

The PACIA study highlights that very little material is recovered from the C&D sector, but acknowledges that there is growing activity around recycling of used plastics from the industry.

The challenge for plastics recovery from the C&D sector is to address recovery of short-term single-use products like film, through to long-term durable products like piping.

Drop off opportunities do exist for plastics in metropolitan Melbourne and some manufacturers, including Vinidex, a leading manufacturer of thermoplastic pipe systems, support the recycling of PVC waste where these material are brought to their sites. For example, Vinidex will recycle PVC waste from building sites, decommissioned pipe works, packaging waste and off-cuts from other industries. There are also regional opportunities for the recovery of piping plastics, but these are very localised.⁷⁵

Flexible plastic films are considered contaminants in the recycling streams of the construction sector. They may also present a litter issue when disposed of inappropriately on construction sites, and when disposed to landfills can present these sites with one of their most significant litter issues. Some major businesses have invested in the recovery of clean flexible plastic films, (particularly freight packaging), which may present opportunities for broader recovery of packaging films from other sources including the construction sector.

Plasterboard

Figure 10-2 highlights the current recovery rate of plasterboard from the C&D sector in Victoria is around 1%. This equates to approximately 37,000 tonnes, as outlined in Table 10-19.

The review has determined that basically all of this diversion can be attributed to recovery from the construction sector, as the nature of mechanised demolition processes means this friable material is not readily separated from mixed loads. It is also considered a contaminant when presented in recovered materials. For this reason it is one of the most challenging materials when seeking to improve the recovery of mixed loads of C&D materials, even though plasterboard itself is highly recyclable. An overall summary of the issues associated with this material is provided in Section 6.6 of the report.

Soil / Sand

An estimated 5% of recovered C&D material is soil and sand. This is primarily generated from site preparation and excavation works. Similarly with excavated rock and stone, the soil and sand has been excavated at the expense of a site developer, and so is generally competitive with quarried products when sold to the market. Similarly, the large C&D reprocessors and quarry companies recover this material, and as previously highlighted, for quarry operators the recovery of this material helps to extend the life of their own sites. In some circumstances it may also broaden the range of materials they can offer to customers.

As with excavated rock and stone, civil contracting and demolition companies generally transport these materials to quarry sites, if they are not processing it themselves, so this further reduces the expense to the quarry operators.

Although recovery of soil and sand is occurring, it appears that this is generally only when there are clean loads from excavation related activities. Site practices during construction, especially on

⁷⁵ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

residential sites, (this includes single house sites or larger residential development sites), often sees materials such as roof tile off-cuts dropped directly onto the ground around each house. To clean the site, bobcats are used to scrape the materials off the ground. This means large amounts of top soil can be lost in mixed waste loads, which are more likely to be landfilled than recovered. At the point of site cleanup, this can see almost a third of some skips being filled with valuable top soil. For larger scale residential developers, site cleanups are more regular, and this loss of top soil also can mean additional top soil being required to be brought into the site at the time of landscaping. The cost of waste disposal and material purchase is included in construction costs, and is ultimately passed through to home buyers.

As previously highlighted, some bin hire companies servicing builders appear, where they have the capability, to be physically sorting and recovering high value materials including soils, for which they have established market outlets.

In Victoria, where soil is used in landfills for cover material, the material is subject to the landfill levy. Where soils are classified as 'fill material' and are used as cover, the municipal levy rate applies. Where materials other than 'fill material' are used as cover (for example Category C contaminated soil), then the levy rate for Category C prescribed industrial waste is applicable. EPA Victoria guidance notes that a fixed rebate of 15% of all waste deposited onto land at a landfill (from external sources) is provided for in the Act, but reinforces that all cover material used must be included in the levy calculations. The only exception is material excavated on-site⁷⁶. This percentage allowance is Victorian specific.

Roof Tiles

Roof tiles are a common waste on residential construction sites, however recovery information is not provided that separates out this specific material. It is believed it may be recorded with 'brick rubble' under the 'brick' recovery classification, or that in many instances recovery is low and it is not recorded at all. A summary of issues associated with this material is provided in Section 6.9.

Asbestos

Asbestos is no longer permitted for use in applications including building products, although buildings constructed before 1990 may have used materials containing asbestos. On this basis the greatest potential for asbestos contamination comes from demolition and renovation works, not new construction.

Victoria moved to address the management of asbestos in the C&D waste reprocessing sector by preparing and releasing guidance to the industry in 2006. This process was managed by Victoria's Workcover Authority, *WorkSafe Victoria*, in partnership with the C&D industry, representative unions, and the State government agencies of EPA Victoria and Sustainability Victoria. The document, *Recycling Construction and Demolition Material, Guidance on Complying with the Occupational Health and Safety (Asbestos) Regulations 2003⁷⁷ seeks to assist the industry in meeting its obligations under the regulations.*

It provides guidance on an auditable procedure that can be used to verify that asbestos containing materials have been removed from C&D loads prior to recycling.

Cardboard

Sustainability Victoria data does not highlight any recovery of cardboard from the C&D sector. Cardboard is predominantly generated during the fit out stage in a development and at the point

⁷⁶ EPA (September 2010) *Publication 332.2 Calculating the landfill levy and recycling rebates*

⁷⁷ WorkSafe Victoria (2006) Recycling Construction and Demolition Material, Guidance on Complying with the Occupational Health and Safety (Asbestos) Regulations 2003 1st Edition

of occupation, especially in the residential construction sector. The industry is unsure of the potential quantities coming from the residential construction sector, and it was acknowledged that reprocessors were not chasing cardboard from the C&D sector. A summary of the issues associated with this material is provided in Section 6.11 of this report.

10.3 Processing Capacity

Large scale reprocessors of masonry materials sourced from the C&D sector generally indicated they could process more materials if consistent market outlets were available, and if existing stockpiles were moved into the marketplace. The reprocessors of source separated loads are generally driven by market demand for their end products, and on this basis would be prepared to invest in infrastructure upgrades and extension of operations if market outlets were assured.

In relation to these sites being able to (or being interested in) processing more mixed loads, it was generally considered that, because of the issues of contamination, the expense of sorting, the quality of the materials recovered, and the general lack of consistent market outlets for some of the material streams, these mixed material loads are not being actively targeted for recovery.

In instances where the reprocessor was a demolition contracting company, or had associations with a landfill disposal site, it was observed during this project that the interest in taking mixed loads was greater. For the demolition contractors, this was because they were in control of the initial material recovery on site. For operators associated with a disposal site, the capacity to sort mixed loads was strongly associated with charging an appropriate gate fee for receival of the load, and then reinvesting the levy differential which was saved through site recovery operations (\$30/tonne 2010-11 in metropolitan Melbourne), back into these activities on the site.

Bin hire companies seek to cover all the potential expenses of their operations in their bin hire charges. These costs include but are not limited to administration, bin delivery, collection, transport, sorting (if they have the capabilities) and disposal. The industry is very competitive. The business case of individual operators is improved where they have the capability to sort and recover high value materials for which they have established markets, as this will also reduce their disposal costs.

Capacity for these companies also requires them to have the ability to rapidly change over bin infrastructure for the builders they service, which means having enough bin infrastructure as well as vehicles to manage their clients' needs.

10.4 Products and Markets

Product and market development appears to have been influenced by landuse related issues. As the urban fringe encroaches on extractive industry and waste management operations, it is becoming more challenging for these two industries to seek extensions or changes in their site operations. This is seeing both waste and extractive industry operators looking to extend the life of their existing sites, through partnerships and practices that are more environmentally sustainable and focused on resource efficiency.

For some quarry companies this has included preserving the quarry resources they have and extending business operations into recycling C&D masonry materials to develop crushed aggregate products. For landfill operators this has included a growing interest or actual investment in pre-sorting activities for C&D waste, or the development of partnerships with reprocessors.

As previously outlined, Sustainability Victoria has identified that stockpiles exist for some C&D sector materials, with estimates of 1.2 million tonnes of concrete and 0.6 million tonnes of brick. This is due to challenges associated with finding consistent market outlets for material.

With the State government focus on achieving the TZW targets for C&D waste recovery, as well as the implementation of increased levies on non-hazardous industrial waste (which includes C&D waste), C&D reprocessors consulted for this review generally felt more investment could be made to support the industry, with market development considered to be the area requiring a primary focus.

10.4.1 Products

Just as the range of materials recovered and reprocessed from the C&D sector is diverse, so too are the products which are being (or can be) produced from these materials. Although not exhaustive, general examples of products from reprocessed C&D waste includes:

- Crushed concrete and brick used as aggregate in road pavement subbase, drainage, irrigation and landscaping applications
- Crushed rock and stone from excavation works used as aggregate in road pavement subbase, drainage, irrigation and landscaping applications
- Reclaimed asphalt pavement (RAP) used in new asphalt
- Ground plasterboard used as a gypsum replacement, or mixed with organics material to improve soil structure in agricultural applications
- Ferrous and non-ferrous metals that are recycled back into metal products
- Pelletised plastic that is recycled into a range of plastic or plastic composite products for agricultural, residential and infrastructure applications (such as piping, decking, fencing)
- Chipped timber used in landscaping applications
- Soil that is used in soil conditioners or mixed with organics material to improve soil structure in gardening and landscaping applications

The development of product specifications for recycled C&D waste has, to date, had a strong focus on masonry materials for road pavement subbase applications.

Partnerships between large reprocessors and government agencies including VicRoads saw the development of specifications for the use of crushed concrete for pavement subbase as early as 1993 in Victoria. Crushed concrete has since been used in subbase applications for the Western Ring Road, Grand Prix Circuit at Albert Park, East Link and Geelong Freeway to name a selection of high-profile examples.

Product development has been supported through national guidance from organisations such as Austroads, the association of Australian and New Zealand road transport and traffic authorities. Its members are the road transport and traffic authorities from all eight Australian jurisdictions (States and Territories), the Department of Infrastructure and Transport, the Australian Local Government Association (ALGA), and the New Zealand Transport Agency (NZTA).

On this basis Austroads provides guidance to the jurisdictional road authorities and local government on the planning, design, construction, maintenance, operation and stewardship of roads⁷⁸.

Austroads' *Guide to Pavement Technology Part 4E: Recycled Materials* was released in 2009 and profiles recycled pavement products manufactured from various wastes (not exclusively C&D) that are accepted through registered recycling and reprocessing facilities. It addresses the specification, manufacture and application of a range of pavement products made from the recovery of C&D waste and RAP. Additionally, but beyond the scope of this review, it also

⁷⁸ www.austroads.com.au

addresses the use of waste from other sources in pavement production, such as recycled glass containers, and industrial slags and ash.

In Victoria Austroads' guidance is supplemented by specification sections / clauses and codes of practice on pavement technology prepared by VicRoads, which is the agency responsible for high volume roads in Victoria. To compliment the Austroads guidance, VicRoads provides directives on the production and application of recycled C&D materials in pavement applications, which includes but is not limited to:

- RC500.22 Code of Practice for Selection and Design of Pavements and Surfacings (July 2010)
- Section 820 Crushed Concrete for Pavement Subbase and Light Duty Base
- Section 821- Cementitiously Treated Crushed Concrete for Subbase pavement
- Section 801 Source Rock for the Production of Crushed Rock and Aggregates
- Section 812 Crushed Rock for Base and Subbase Pavement
- Section 818 Crushed Scoria for Base and Subbase Pavement
- Section 407 Hot Mix Asphalt
- Section 407.09 Recycled Asphalt Product.

VicRoads acknowledges the key to quality products for use in road pavement applications is the control of the process associated with the development of the product. To ensure this, the agency has a quality assurance process which is applied to both quarry products and recycled aggregates. Companies must seek to become accredited. Elements of the VicRoads Quarry Accreditation process include:

- Assessment of sites, their material sourcing, sorting and manufacturing capabilities, product consistency and testing
- Registration of specific mixes
- Surveillance of all of these processes of site management, product manufacture and testing.

There are a series of Codes of Practice that provide guidance on each aspect of the accreditation process, including the *RC500.02* - *Registration of Crushed Rock Mix Designs* which also covers the registration of mixes made from recycled material such as crushed concrete.

Reprocessors of crushed concrete seeking its application in VicRoads managed roads must register mixes through this process. There have been varied approaches taken within the C&D reprocessing industry, with some metropolitan and regional reprocessors ensuring their sites, mixes and testing regimes are accredited through this process so that they can compete directly with quarry products used in the same applications.

Beyond pavement applications, crushed concrete can also be used in non-structural bedding and drainage applications. This area of product development has been limited for some reprocessors because Water Authorities and agencies including VicRoads may allow for the use of crushed concrete (or glass fines as a substitute for sand), however specifications (including those of VicRoads) state the use of 'natural' products. This means that civil contracting companies undertaking these works on behalf of the agencies are limited in their ability to substitute 'natural' products with recycled products.

10.4.2 Markets

Significant work has been undertaken nationally, and in Victoria, in relation to product development associated with masonry products and their use in road pavement applications. Table 10-23 highlights the total number of kilometres of roads in Victoria, and nationally, and their

management responsibility. It is evident that the application of the currently available specifications for the use of recycled aggregates in road pavement subbase as well as wearing course treatments for RAP is immense.

Jurisdiction	State Road Authority (SRA) managed roads (km)	Local government area (LGA) managed roads (km)	Total (km)
Victoria	22,340	178,000	200,340
Australia	127,576	760,172	887,748

Table 10-23 Approximate kilometres of roads and management responsibility⁷⁹

The use of accredited recycled aggregates and RAP in road pavements has been supported and well established in the management of high volume roads by VicRoads (Victoria's SRA) which is responsible for about 11% of roads in the state. The reprocessing industry, however, has indicated it has been more challenging to have their products accepted by local government agencies, which collectively manage the remaining 89% of roads in the State. This is due to a range of perceptions about the performance of recycled materials in pavement applications.

With the backing of agencies including Austroads and VicRoads, which support the use of recycled content products where they meet specifications and comply with accreditation processes (equivalent to quarry products), it appears the negative perceptions of some local governments are misconceived. On this basis, market development opportunities with local government have not been fully realised.

The discussion of 'opportunities' in both the national summary and this jurisdictional summary provide an overview of programs that are seeking to address these issues with local governments and their civil contractors.

Industry estimates provided in this review suggest the quantity of quarry products used annually in Melbourne, across a range of applications, is 6.5–7 tonnes per person. In Melbourne, industry estimates also suggest the current proportion of market share for aggregate material within about a 15-20 kilometre radius of the CBD per year is approximately:

- 18 million tonnes of quarry product
- 3.5 million tonnes of recycled product

As previously outlined, this review has found products such as crushed concrete are cost competitive with virgin quarry aggregate products used in the same applications in the metropolitan area. The recycled crushed concrete was found to be either the same price or in some instances between 10–15% cheaper than the comparative quarry product.

The physical properties of crushed concrete were considered to provide another economic incentive for use, as for the same product weight as crushed quarry rock, the crushed concrete alternative offered an additional 10 - 15% product volume.

Similarly, it was highlighted that in regional Victoria, transport costs and the relatively low value of recovered material means markets for products are generally located close to the source of waste generation. Overall, and regardless of metropolitan or regional location, most markets for C&D recycled materials, especially masonry products, is currently in the construction sector itself, and particularly in civil engineering applications.

⁷⁹ GHD (2008) *The use of crushed glass as both an aggregate substitute in road base and in asphalt in Australia Business Case* for the Packaging Stewardship Forum of the Australian Food and Grocery Council

Sustainability Victoria estimates annual stockpiles of recycled C&D materials in the State currently include 1.8 million tonnes of concrete and brick. Sustainability Victoria is seeking to support industry and local government in the development of new markets for this material now and into the future through a program called Roads Towards Zero Waste (Roads TZW), which will be discussed further in Section 10.6.2.

Beyond local government, material reprocessors also considered there were market development opportunities available through partnerships with water authorities. Some reprocessors were pursuing these opportunities directly, others had found challenges in the acceptance of their products, an issue Sustainability Victoria acknowledged it had been made aware of by industry.

Generally, the challenges identified by the reprocessing industry in relation to the water authorities was that there had not been the development of specifications across their sector that supported the use of recycled concrete and brick aggregates for non-structural bedding and drainage applications. Current specifications generally state the use of 'natural' products is required.

In developing markets, the Victorian review has also found the environmental credentials of recycled aggregate products was of secondary interest to customers, and ultimately the selling point of these products was that they met specifications and were cost competitive.

It was highlighted that many government agencies, including local government, were members of 'green purchasing' programs such as Eco-Buy in Victoria, and had supporting policies and affirmations of their 'green credentials' on websites. However, as confirmed by Sustainability Victoria and its investment in programs like Roads TZW, support for 'green purchasing' was not necessarily being translated into the widespread specification and use of recycled aggregates in pavement applications.

Eco-Buy's 2008-09 report on green purchasing for Victorian local government⁸⁰ highlights that of the 56 member councils (out of 79 Victoria local governments), 39 reported on their annual green purchasing. Of these 39 councils, only 7% (3 in total) acknowledged they included 'green' specifications in contracts for 'civil contract management'.

Table 10-24 outlines the responses in this Eco-Buy report from the 39 councils, in relation to their use and expenditure on recycled C&D products in 2008-09.

Product	Number of Councils using product (out of 39)	Expenditure (\$)	
Asphalt	14	6,773,934	
Crushed rock	10	1,066,030	
Crushed concrete*	12	743,834	
Concrete aggregate*	Not provided	331,861	

Table 10-24 Use and expenditure on recycled C&D products in road & footpath applications, 2008-09

* As no definition of the two forms of concrete is provided in the Eco-Buy report, it could be assumed that crushed concrete may have been used in applications like footpath subbase and potentially 'concrete aggregate' was used in road subbase

⁸⁰ Eco-Buy (2010) The State of Victorian Local Government Green Purchasing in 2008/09

A review of green purchasing in Australia highlights that a challenge for most local governments is that they have decentralised purchasing systems⁸¹. The Eco-Buy report on Victorian local government members for 2008-09 reinforces this finding. It highlights 95% or 37 of the 39 respondents have either a decentralised purchasing system (73%) or operate a hybrid decentralised and centralised system (22%). This compounds the challenges that already exist for the specification and purchase of recycled C&D products.

In relation to local government, the national review of green purchasing also acknowledged the 'huge potential' for environmental specifications to be included in contracts and capital works projects.

Significantly, the national review acknowledged the shift both internationally and in Australia from 'green purchasing' (with a primary focus on environmental outcomes), towards 'sustainable procurement' models. Sustainable procurement is a process where organisations seek to meet their needs for goods and services through procurement practices and decision making that addresses environmental, economic, social and ethical parameters. An organisation championing this approach, which could help develop significant opportunities to increase the uptake of recycled C&D products, is the Australian Procurement and Construction Council (APCC). Sustainable Procurement is addressed in the national recommendations of this report.

Representatives consulted from both the construction and demolition industries highlighted that complying with the Green Building Council of Australia's (GBCA) Green Star rating program⁸² meant that systems of recovery were being required on construction sites, and that construction companies seeking government contracts or reputational advantage were seeking to improve their star rating by using recycled products in their developments.

The Green Star program and associated assessment tool addresses materials as part of the rating system. This includes the use of 'Eco-Preferred Content', which can be materials with 'reused content' and 'recycled content'. Independent verification of reused / recycled content is required either through GBCA recognised third party certification, or from an auditor registered by RABQSA (in Australia), or other national / international auditor accreditation systems. Additionally, material recovery options that are implemented in conjunction with manufacturers and suppliers, such as take back and recycle arrangements, can be identified to help improve a company's rating.

Programs like Green Star are further reinforced by jurisdictional programs. In NSW, for example, one of the most significant projects has been the development of the Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage, otherwise known as the 'GreenSpec'. The primary aim of GreenSpec is to encourage local government professionals, as well as other key players within both the public and private works engineering sector, to use recycled concrete, brick and asphalt materials. Opportunities for leveraging from these programs are addressed in the national recommendations.

Overall, the review has determined that market development has been strongly focused on the high volume masonary materials, and has developed through competitive pricing strategies and proximity to source materials and market outlets. Significant and consistent market outlets have resulted where the reprocessing industry has engaged with peak industry organisations and government agencies to develop a framework that assures consistent practices, which produce quality products that meet clearly defined and broadly supported product specifications.

For the C&D material generated beyond masonry, there are opportunities for reprocessors and government agencies to apply these observations to support broader ranging market development opportunities for their products.

⁸¹ NetBalance (2009) Green Purchasing in Australia for EcoBuy

⁸² www.gbca.org.au/green-star

10.5 Barriers

Key barriers identified in this section are based on discussions with a range of stakeholders and the assessment of information which formed part of this jurisdictional review. While these are not the only barriers identified, they were commonly raised and are considered to be significant.

10.5.1 Planning

Challenges exist for integrating C&D waste management planning across all phases of the building lifecycle, including procurement, planning, design, construction and decommissioning. Being able to manage the peaks and troughs in C&D waste recovery opportunities was important for reprocessors in managing incoming materials for processing and ensuring that they could meet market demand for their products.

Framework

Sustainability Victoria currently has responsibility for C&D and C&I planning, and the RWMGs have responsibility for MSW. This limits the RWMGs ability, on behalf of their member councils and local industries, to comprehensively plan for the management of all solid waste streams (MSW, C&D and C&I), as well as to access funding for targeted infrastructure and market development solutions that would support the recovery of materials from the C&D and C&I solid waste streams.

Additionally, the study of resource recovery in regional Victoria, commissioned by Sustainability Victoria⁸³, highlighted the need for regional C&D facilities to have processes which better inform them of upcoming major C&D works to allow for the planning of C&D waste recovery and market development opportunities for product.

Siting & Infrastructure

Issues associated with siting and infrastructure included:

- Operations of reprocessors needing to be located both within the proximity of material supply and market demand for products to be competitive, due to the competitive nature of landfilling and suppliers of virgin quarry materials
- The generation of mixed loads from the construction sector being attributed to issues of limited space on site for source separation and also site operational arrangements that mean limited supervision and varying responsibility for on-site management
- Generators of mixed loads not necessarily having ready access to sites that would process these loads, due in part to large scale residential developments being on the urban fringe. Where mixed load processing options were available, the charges were generally comparative to landfill disposal prices
- A perception that infrastructure funding for the reprocessing industry was not proportional to current and potential diversion rates, considering the reprocessors provided a beneficial use for materials, and that the landfill levy had been significantly increased for 'industrial' waste which included C&D materials
- There are significant challenges for reprocessors in managing material flows and site requirements on stockpiling materials because feedstock receival and processing do not always relate to market demand for product

⁸³ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

- Siting of reprocessing facilities in close proximity to (or within) landfill precincts, and in proximity to urban communities, creates site planning, licensing and operational challenges. There are concerns that the beneficial nature of the reprocessing industry is not appropriately acknowledged. This includes challenging government motivations where businesses felt approval processes and the application of enforcement action were applied in a blanket manner in these precincts, with little or no distinction / investigation into the source of the issue or recognition of the beneficial nature of reprocessors' operations
- Inequities in the lack of regulation of mobile crushing operations in comparison to fixed facilities
- Non-metropolitan operations often relying on the ability to stockpile materials and to access mobile crushing infrastructure to improve the viability of processing materials for local use

10.5.2 Procurement

Procurement practices were considered as crucial in the discussions with stakeholders. Comments focused on issues including:

- The cost of waste management during construction (which could be \$2,000 \$3,000 per house) is being passed on to the home buyer, so it is built into site development / house construction costs and there seems little incentive for change
- Builders / construction companies rely on advice from service providers, such as their waste management contractors, as to the disposal options available to them
- Waste generation on construction sites may in part result from procurement procedures in the ordering of materials, as well as through the procurement of services where subcontractors do not have responsibility for the waste they generate or the associated costs of management
- Where specifications for products such as recycled masonry exist and have been proven, they may not always be referred to in tenders
- A lack of understanding from government agencies (primarily local government, and including procurement staff) relating to the performance capabilities of recycled products in comparison to quarry products
- References often being made in tender specifications to the use of 'natural' products. Where this occurs contractors may feel obligated to use quarry products over recycled products, even if they regularly use recycled products in other works
- Certain units / departments within a government agency may support the use of recycled products, but this is often overridden by entrenched procurement practices where standard clauses are accessed for tendering processes (see also later references to asset management issues in these agencies under 'quality assurance')
- The misperception that a product having 'green' credentials was a significant marketing advantage, when ultimately decisions were made on price and product quality (this is especially an issue where industry sees agencies espousing environmental credentials or promoting buy-recycled purchasing policies, but issuing tenders and making procurement decisions that do not reflect this in relation to C&D products, even when price competitive)
- The need for government agencies to show leadership, by specifying and supporting the purchase of quality recycled products
- Quarries having the 'default' product and so having a market advantage

10.5.3 Quality Assurance

Based on the consultation for this review, members of the C&D recycling industry believe there are many misconceptions about their products, but they also acknowledged that isolated incidents associated with quality may not be contributing constructively to improving overall perceptions. The identified quality issues included:

- Perceptions that recycled products where inferior to products made from virgin materials even when industry specifications, product accreditation and in field application have proven otherwise
- Purchasers of product branding the industry, as a whole, as lacking in quality when they
 purchased products that may not have met specifications or not had product accreditation,
 because they were cheaper than other sources of recycled product with these additional
 assurances
- The risk adverse nature of local government (noted by the sector itself and industry). Industry highlighted that asset management staff in agencies stated they would not accept responsibility / liability for assets that included the use of recycled materials, or requested the material reprocessors needed to give maintenance guarantees over and above any which would be requested from the manufacturers of products made from virgin materials (especially in relation to recycled crushed concrete)
- Concerns from some operators that mobile plant is not subject to the same regulation and enforcement as fixed crushing infrastructure, and therefore may potentially have issues associated with the quality of operations and the products manufactured
- In non-metropolitan markets, the expense of product accreditation / testing, and concerns (whether founded or otherwise) about potential asbestos content mean product markets may be limited in smaller communities beyond the provincial centres

10.6 Opportunities

The discussions and assessment of information associated with this jurisdictional review also sought to identify opportunities to improve C&D waste recovery and markets for the recovered products. What follows were not the only opportunities identified, however they are considered the most significant.

10.6.1 Planning

The ability to comprehensively plan for a coordinated approach to solid waste management is challenging in the current framework which, as previously highlighted, limits the localised planning capacity of the RWMGs to MSW. The current Victorian Government is undertaking a review of Sustainability Victoria's role, which is being facilitated by the DSE. With Sustainability Victoria presently having responsibility for the planning of the solid waste management beyond MSW (being the C&D and C&I streams), the review could address the current planning framework, to facilitate greater engagement and associated resourcing of the RWMGs for planning across all solid waste streams to deliver effective regionally targeted solutions.

To address opportunities for regional C&D facilities to be better informed of upcoming C&D works, and so improve planning for waste recovery and market development, consideration could be given to the integration of waste management requirements in planning permit processes for C&D works where this does not currently exist⁸⁴. Attention should be given to both commercial

⁸⁴ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

and residential C&D activities, however it is suggested that - to date - the residential sector has had the least scrutiny and would benefit from more of a focus through the permit approvals process. Waste management is more likely to be required or addressed through the approvals process for larger scale C&D activities. This level of integration would require engagement from local government, their representative RWMG, and local or regional reprocessors.

Additionally, issues associated with the regulation of mobile crushing operations could also then be included in the planning permit approvals process as an activity included under C&D waste management.

Planning could address the review of regulatory instruments beyond levies, to prevent the disposal of certain C&D wastes to landfill. South Australia provides a model where the disposal of materials including some C&D wastes in landfill is prohibited where market outlets for products exist, and where the waste has not first been subject to a pre-sort process prior to disposal.

Further opportunities to address planning, funding and siting of infrastructure are outlined under the discussion relating to investment in Section 10.6.4.

Issues have been highlighted around the challenges for reprocessors when they are located in precincts that are in close proximity to urban communities. The Kwinana Estate in Western Australia provides a positive example of collective management of an industrial estate. Through the Kwinana Industrial Council, member businesses are taking responsibility for operations within the estate, through an approach which adopts the principles of industrial ecology⁸⁵. It is model that could be applied to similar industrial estates in Victoria.

10.6.2 Procurement Frameworks and Practices

Much focus was made on the opportunities associated with improving procurement frameworks and practices.

Framework

- Government agencies favouring the procurement of recycled C&D products in projects, where they met defined specifications, where products and producers were accredited through Government agency programs (i.e. VicRoads quarry accreditation program which is also applied to recycled products), and where the products are cost competitive with virgin material alternatives
- To address issues of competition it was suggested that, rather than specifying for certain products (from virgin or recycled sources) or practices (source separation etc.), those tendering to procure goods / services could require that certain performance criteria are met. In this way those contracting to provide these goods / services would be required to outline how they would meet these requirements
- In support of the two previous points, there is desire to see government procurement move away from 'green' purchasing to sustainable procurement practices, which address the financial, social, ethical and environmental implications of the purchase of goods and services. In this way decision making is comprehensive and is applied not only to the purchase of products but also services (examples include moves to adopt this approach within the industry through organisations such as the Australian Procurement and Construction Council)

⁸⁵ www.kic.org.au

Awareness and Education

- Where reprocessors had engaged in the development of specifications with government agencies, prepared products to these specifications, and sought to accredit these products, there was frustration that the level of acceptance of the technical data and field applications was still doubted by end users after almost 20 years (for example government authorities; design consultants; civil contractors; and clients). Stakeholders believed opportunities existed for State Government agencies to raise awareness
- Sustainability Victoria and the Municipal Association of Victoria (MAV) have acknowledged these challenges and have invested in the Roads Towards Zero Waste (Roads TZW). The focus is on the use of recycled products in road construction applications, but the process serves as a model for other programs. Two key aspects of the project include – (i) testing and peer review, and (ii) application of products at four demonstration sites. The ARRB, VicRoads and local government have been engaged through this arrangement. Outcomes are expected to include:
 - Short-term a reduction in annual stockpiles of crushed concrete, brick and glass
 - *Medium-term* changing the procurement practices of local government in relation to road construction arrangements, and delivering major CO₂ emission reductions
 - Long-term achieving more sustainable uses of current quarry reserves and reducing the number of new quarries opened

The project includes a web-based interactive hub. Councils are asked to sign up to the program and adopt the recycled content specifications. The hub provides information on the specifications, demonstration sites, frequently asked questions to address misconceptions, and links councils with reprocessors.

The program also seek to address the issues of local councils transferring risk to civil contractors. Sustainability Victoria will seek that councils' tender processes request engineering expertise in the use of recycled aggregates in pavement applications. On this basis councils will be procuring the services of contractors that are capable of managing the mechanical properties of the materials.

- Sustainability Victoria reinvigorating its market development portfolio to extend the Roads TZW model into the less developed C&D recycled product ranges to improve awareness and associated procurement practices
- The GBCA working in partnership with government agencies to raise developer, building industry and consumer awareness of the elements of the Green Star rating system, to ensure that material selection and waste avoidance aspects are being requested and being as thoroughly addressed as energy efficiency elements. Additionally, any associated cost savings, especially as they relate to waste avoidance during construction, should flow through to consumers, or be used to off-set other resource efficiency measures in construction

10.6.3 Shift to Sustainable Resource Use

Several stakeholders consulted during this review made reference to recent challenges faced by quarry operators in applications to extend their sites and operations. The Sustainability Victoria Roads TZW program acknowledges that one of its long term objectives is to achieve more sustainable uses of current quarry reserves and reduce the number of new quarries opened.

Additionally, reference has been made to the introduction of a price on carbon, which may increase financial incentives for the recovery of certain organic materials going to landfill (such as

timber, paper and cardboard), as well as potentially reducing the use of some virgin products in the manufacture of concrete and asphalt, especially those with high embodied energy.

Resource consumption associated with the exploitation of virgin quarry aggregate is being addressed in the UK through the implementation of the Aggregates Levy which has been in place since 2002. Under the levy, aggregate is defined as sand, gravel and rock, with some exceptions. It is payable by anyone who is responsible for commercially exploiting aggregate in the UK. It is calculated on the basis of the weight of aggregates (per tonne).

Similar levies / taxes are employed in EU countries including France, Sweden and Denmark. The UK levy was introduced to address the environmental impacts of the extraction and transportation of virgin aggregates, which include noise, dust, vibration, visual amenity, and loss of biodiversity. The levy seeks to adjust the price of virgin aggregates to better reflect their intrinsic environmental costs, and in doing this improve the competitiveness of recycled aggregate alternatives, as well as supporting the more efficient use of virgin aggregates. A Sustainability Fund was also established to manage the levy revenue and to invest funds into programs that support environmentally beneficial practices such as the use of recycled aggregates.⁸⁶

A similar levy could be considered for Victoria. Additionally, there may be opportunities to integrate C&D reprocessing activities within existing quarry operations⁸⁷. This is an approach that has been recently adopted by some large players in the quarrying industry, and could be extended into regional communities to reduce the need for establishing new sites and associated infrastructure. The practice has supported the extension of quarry resources and added another aspect to the portfolios of the businesses.

10.6.4 Investment

Infrastructure

Most large scale reprocessors of masonry materials sourced from the C&D sector indicated they could process more materials, if there was market demand for the end products. These reprocessors of source separated loads claimed, in many instances, to be prepared to invest in infrastructure upgrades and extension of their operations where there was market demand for their products. However, they also indicated they would welcome infrastructure funding assistance, and would be able to deliver significant additional diversion if support was provided.

The most immediate infrastructure investment needs appear concentrated in two areas. Firstly, infrastructure for the sorting of mixed loads in metropolitan Melbourne, and secondly, infrastructure for non-metropolitan sites in provincial centres with the ability for these operators to service smaller towns in regional locations using mobile equipment.

A facility to manage mixed loads in metropolitan Melbourne would be difficult to site, but should be within close proximity of the CBD (5–10 kilometres), with ready access to main arterial road connections.

Such a site could focus on separating material streams and diverting these materials to established reprocessors with existing market demand for products. Where markets do not warrant further sorting of residual materials, or the component materials of the residual waste do not currently have established markets, opportunities could be explored for this residual fraction (especially the 'lights') to be used in any future waste to energy facility.

⁸⁶ www.hmrc.gov.uk

⁸⁷ Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

A review of advacned resource recovery technologies (ARRT) has been undertaken through the Victorian Advanced Resource Recovery Initiative (VARRI), which was facilitated by DSE with collaboration from other agencies including the Metropolitan Waste Management Group (MWMG). The VARRI process was exploring the provision of new ARRTs and was aimed at improving organic waste recovery across metropolitan Melbourne. Opportunities may exist, depending on the ARRTs explored through this process, for some technologies to also take mixed residual materials from sources including the C&D waste stream, especially where market outlets are limited.

A business case was being developed to be presented to the State Government from the VARRI process. The VARRI business case was expected to be completed in 2010-11. Until this information is available, future directions with regard to ARRT projects remain unclear⁸⁸.

To address the recovery of smaller source separated and mixed loads from residential C&D streams (building, renovation, demolition), opportunities exist across the state to explore the ability and capacity of local transfer stations and resource recovery facilities (TS & RRF) to provide a more comprehensive network of drop-off and processing sites. A number of TS & RRF already provide these services for C&D materials that are free of asbestos.

However, as already highlighted, the ability to comprehensively plan for a coordinated network of local government and private C&D recovery and reprocessing options is currently a challenge given that the RWMGs only have limited planning responsibility for MSW.

As previously suggested, an opportunity exists in the current review of Sustainability Victoria's role by DSE to consider a greater role for the RWMGs in planning oversight of all the solid waste streams, to deliver effective localised / regional recovery and market development solutions.

As has been implemented through regulation in South Australia, there are opportunities to seek to prohibit the landfill disposal of certain materials, including C&D wastes which have not been subject to a pre-sort process prior to disposal. Were such an approach supported, investment would be required in appropriate pre-sort infrastructure to manage the processing of mixed loads of C&D waste.

Point-of-sale recovery systems and associated infrastructure should be investigated for C&D materials including cardboard and plastics.

Government funding for infrastructure investment in Victoria is drawn from the recovery of landfill levy monies. To guarantee the required funds are being recovered, the EPA needs to ensure landfill operators understand all materials disposed into landfill sites incur the landfill levy, unless the site has written EPA approval to receive the waste without collecting the levy. It is believed the disposal of some solid inert wastes may be occurring without charging the landfill levy when the materials are used in applications such as the construction of internal site roads.

Market Development

A range of market development opportunities are available and have been presented in this review. The challenge in more recent years in Victoria has been the coordination of opportunities and a clear focus on market development for C&D materials.

The former EcoRecycle Victoria had a focus on the development of resource recovery infrastructure and markets for products across the state. With the challenges of a broadened portfolio for Sustainability Victoria, and a focus for RWMGs on MSW, market development for C&D recovered materials appears to have received less of a focus until recently. The Roads TZW project has refocused attention on opportunities for market development in specific material

⁸⁸ Metropolitan Waste Management Group (September 2010) Annual Report 2010, Enabling Change for a Sustainable Future

streams for use in pavement applications. The partnership and awareness raising model at the core of this project offers a framework that could be appropriately modified for application in the development of markets for other more challenging C&D materials, such as timber, plastics and cardboard as outlined in this jurisdictional review.

10.7 Key Conclusions

A total of 3.15 million tonnes of C&D material was recovered for reprocessing in Victoria in 2008-09, however 47% of all waste to landfill was generated from the C&D sector. The majority of C&D material recovery in Victoria is currently coming from the commercial demolition sector, with a strong focus on masonry materials in both recovery and market development.

To improve both the recovery and markets for C&D materials, a series of opportunities have been identified. Key conclusions and recommendations in relation to C&D waste in Victoria are:

- 1. The Victorian Government should support national efforts that seek to encourage the adoption of sustainable procurement practices.
- 2. There is an opportunity to develop new market development programs for challenging C&D materials (including timbers, plastics and plasterboard), using the learnings of programs including Roads Towards Zero Waste.
- 3. The integration of C&D waste management planning into all phases of a structure's lifecycle procurement, planning, design, construction and decommissioning should be developed in partnership with government and industry.
- 4. Priority consideration should be given to the integration of waste management requirements in all planning permit processes for construction and demolition works.
- 5. The localised planning capacity of Regional Waste Management Groups (RWMGs) is currently limited to municipal waste streams. Greater engagement and associated resourcing of the RWMGs for planning across all solid waste streams – including C&D – could deliver more effective, regionally targeted solutions.
- Investment priorities should include infrastructure for the sorting of mixed loads in metropolitan Melbourne and infrastructure for non-metropolitan sites in provincial centres, with the ability for these operators to service smaller towns in regional locations using mobile equipment.
- 7. The ability and capacity of local transfer stations and resource recovery facilities to provide a more comprehensive network of drop-off and processing sites for C&D waste materials should be further investigated.

11 QUEENSLAND

11.1 Overview

The C&D recycling sector in Queensland is reasonably mature and several significant players are actively involved in the sector. Based on consultation undertaken for this study, four main industry players processed over 2 million tonnes of C&D waste for recycling between them in 2009/10.

The proposed introduction of a \$35/tonne landfill levy on industrial wastes disposed from December 2011 will produce a significant additional incentive for the diversion of C&D material, which is relatively heavy and also relatively cheap to reprocess, especially when separated at source.

The challenges involved with the introduction of a landfill levy in Queensland have been extensively discussed in public forums since 2007. This includes the development of conversion factors for current volume-based disposal charges (for example '3m³ per tonne'), and the installation of weighbridges to more accurately record the tonnes of material generated, recycled and disposed across the state.

Despite these implementation challenges, the C&D recycling sector is likely to rapidly expand as the levy is applied, and estimates provided by four main industry players suggest this expansion is already underway. Figures for the 2009-10 reporting year, which were gathered directly from industry stakeholders during compilation of this report, indicate an increase in recycling of approximately 700,000 tonnes compared with the 2008-09 data presented in Table 3.1, which had Queensland's C&D recycling at 1,265,820 tonnes.

It should be noted some tonnage data shown in this jurisdictional summary will differ from data shown in the national summary section of this report. The data in the national summary section has been gathered using a standard methodology across all Australian jurisdictions. There are several differences between the standard national methodology and that used to gather and report waste information in Queensland, especially in relation to the treatment of clean fill.

The table below shows the targets for C&D recycling as set out in *Queensland's Waste Reduction and Recycling Strategy 2010–2020*. DERM will have responsibility for the ongoing development and implementation of programs that will arise out of the waste strategy.

Table 11-25 C&D target rates in Queensland Waste Strategy 2010-2020⁸⁹

2008 Baseline	By 2014	By 2017	By 2020
35%	50%	60%	75%

Achieving the 50% recycling target by 2014 will require the recovery of at least 650,000 tonnes of additional C&D material (excluding soils and clean fill), compared to 2008-09 levels of recovery. The total tonnes of material that will need to be processed to achieve a 75% recovery rate in 2020 will depend on waste generation rates and population growth, but it is likely to be more than 3 million tpa. Achieving this target will require the development of significant additional processing infrastructure.

It is anticipated that introduction of the landfill levy, and the associated increased attention on waste flows throughout the sector, will improve the flows of data available to DERM, and this will provide important insight into the planning and priorities for investment in C&D recovery across

⁸⁹ Department of Environment and Resource Management (2010) *Queensland's Waste and Recycling Strategy 2010-2020*

the state to achieve the 75% recovery target set for 2020. Recovery of levy funds will also provide the opportunity to help fund future investments.

The Queensland Government has a strong will to direct waste away from landfill and – despite some concern within industry as to how the levy will be applied in practice – it is clear the introduction of a \$35/tonne landfill levy will send a very strong price signal to the market. Discussions with industry during this project found there are currently plans in place for at least two additional C&D recycling facilities servicing the Brisbane region, in anticipation of the levy's introduction.

Table 3-1 shows more than 1.2 million tonnes of masonry material landfilled in Queensland during 2008-09⁹⁰. As evidenced by the operations in other jurisdictions outlined in this report, masonry material is relatively easy to reprocess when it is separated at source; processing costs as low as \$5/t can be achieved for concrete reprocessing in high volume plants with fixed equipment.

Introduction of a \$35/t levy on industrial waste is therefore likely to establish a clear price differential between recycling and landfilling C&D waste material, so long as the required infrastructure to process source separate materials is in place, and there is sufficient market demand for the use products containing recycled C&D materials.

Information gathered by DERM in 2008⁹¹ is outlined in Figure 11-7. This data also highlights significant volumes of C&D material going to landfill in Queensland. Consultation for this review highlighted this was a particular issue outside of the major metropolitan area. This is somewhat linked to the issue of the distance to recycling depots compared to the distance to landfill, especially in regional and remote parts of the state. However, this issue is not isolated to areas outside the South East corner of the state: Ipswich was suggested by several stakeholders as an area that is currently undergoing significant development of community infrastructure, but where there is little or no recycling infrastructure available to recover waste materials generated. Industry is hoping the introduction of the levy will go some way to address this.

The introduction of a landfill levy will be the major step in driving improved recovery performance from Queensland's C&D sector, although it should be noted this step alone will not necessarily increase recycling rates to achieve the state's recovery targets for C&D waste. While the levy will provide a major incentive for private investment in C&D recycling infrastructure in some parts of the state, DERM should consider options for encouraging infrastructure and market development in other parts of the state. Reference is made to the opportunities available in Section 11.9 of this review.

11.2 Material sources

The glossary to the *Queensland Waste Reduction and Recycling Strategy 2010–2020* defines C&D waste as:

Waste that is generated as a result of building, refurbishing, renovating or demolishing structures, buildings and infrastructure such as roads, bridges and docks, and includes material such as timber, clean soil, concrete, asphalt, plasterboard, steel, bricks, ceramic and clay tiles, and aluminium.

Information gathered by DERM in 2008 and outlined in Figure 11-7 shows a breakdown of the various waste materials disposed in the state during 2008-09. 'Concrete and clean fill' accounts

⁹⁰ Based on the Waste and Recycling in Australia 2011 figures, as detailed in Table 3-1.

⁹¹ DERM (2009) The State of Waste and Recycling in Queensland 2008 Technical Report

for 1,146,000 tonnes of material to landfill, while there is 1,200,000 tonnes of 'other C&D waste'. Combined, these two streams represent one third of all waste disposed in Queensland during the reporting period.



Figure 11-7 Total materials disposed to landfill during 2008-09

In terms of resource recovery from the C&D waste stream, Figure 11-8 shows 1,034,000 tonnes of concrete and cleanfill was recovered and recycled back into the marketplace, and 631,000 tonnes of 'other C&D waste' was also recovered during the same reporting period.



Figure 11-8 Total materials recycled during 2008-09

As previously highlighted, industry consultation suggests there has been significant growth in the C&D resource recovery market since the reporting period of 2008-09. Reprocessors indicated this was due mainly to a growing market for recycled product (from the inert fractions of C&D waste) in the metropolitan area. The materials received and processed include timber, plaster, concrete, bricks, rubble, soils, and asphalt.

Consultation suggested there were market opportunities for the use of timber waste in mulch and wood chip for agricultural use, and as a fuel source for sites such as the Rocky Point Power Station. Investment of landfill levy funds should be considered in supporting a more rigorous review to determine potential markets for recovered C&D timber waste.

11.2.1 Gate Fees

Landfill disposal costs are relatively inexpensive in Queensland, compared to other mainland states. While the proposed introduction of the \$35/tonne levy on industrial wastes will significantly increase disposal costs, the historically low cost of landfill disposal is reflected in the most recent resource recovery figures (drawn from the 2008-09 reporting period). It is difficult to be precise on cost per tonne for disposal in Queensland, as most disposal rates are on a volumetric rate.

11.2.2 Gate Fees and Comparison with Landfilling

Discussions with stakeholders in the C&D recycling industry highlight that, unless the presented material is sorted concrete or asphalt, the gate fee charges for reprocessing are largely the equivalent of landfill disposal charges. Often the recycling activities are carried out at a landfill

facility, with the operator charging customers the same gate fee to receive material, and then making internal business decisions as to whether to dispose the materials to landfill or direct them into recycling.

The introduction of levies for disposal, which will be paid to the State Government, will produce a substantial incentive for operators to divert additional materials toward recycling activities.

Materials	Metropolitan reprocessor gate fee (\$ tonne)	Landfill gate fee (\$/tonne)
Concrete (clean load)	\$5-12	
Asphalt (clean load)	\$0-30	
Mixed loads	\$47	\$47

Table 11-26 Landfill and material specific gate fee ranges of reprocessors surveyed (March 2011)*

* The above rates are average charges across operators consulted for this study – a list of stakeholders consulted is provided in Appendix 1 of this report.

11.3 Geographic Catchment

11.3.1 Sourcing C&D Materials

The decentralised distribution of the Queensland population means the expense of transporting materials for recovery - combined with access to cheap disposal points, especially in regional areas - presents a major barrier to gaining a consistent source of C&D materials for reprocessing. A majority of the processing in metropolitan Brisbane is confined to existing landfills and processing sites around the airport (where land is already licensed and very accessible to end market opportunities within the city).

Queensland has regional centres with significant populations and potential local demand for recycled products, and these centres could accommodate C&D recycling facilities. The challenge in these centres is the availability of low cost landfills that are often sited in close proximity to the source of waste generation. A discussion of regional councils follows in Section 11.4.2.

Opportunities could be considered to integrate C&D reprocessing activities within existing quarry operations throughout the state. This is an approach that has been adopted by some large operators in the quarrying industry in Victoria, and could be extended into regional communities in Queensland to reduce the need for establishing new sites and associated infrastructure. The practice has supported the extension of quarry resources and added another aspect to the portfolios of the quarrying businesses.

11.3.2 Regional Councils

The following table details average gate fees / disposal prices for five regional councils in Queensland. The intention is to provide some insight into the diversity of approaches taken to charging for waste receival and disposal.

Table 11-27 Average gate fees / disposal prices in selected regional centres (March 2011)⁹²

Jurisdiction	Mixed C&D waste	Clean concrete, pavers etc	General Waste	Greenwaste
lpswich	N/A	N/A	\$65 ²	N/A
Townsville	\$57 ¹	N/A	\$14.50	\$14.50
Mackay	\$98 ³	N/A	\$37-42	\$31
Central Highlands	\$28	Free	\$58	Free
Toowoomba	N/A	\$15	\$35-43 ⁴	Free

1 Mixed C&D in Townsville is a rate per tonne; the other rates are in m³

2 Ipswich sort all waste and charge accordingly; an additional fee is charged if the materials cannot be sorted into the appropriate bins. There is no public access to the landfill.

3 Mackay charges are for commercial loads

4 General Waste in some areas of Toowoomba is free for vehicles under 3 tonnes loaded.

Following is an outline of three regional councils in Queensland where there have been recent and significant developments in waste management activities. The selection highlights the diversity in approaches to the management and recovery of C&D waste. Following this selected summary is the identification of more general opportunities for the increased recovery and reprocessing of C&D materials in regional Queensland.

Cairns

Cairns has an innovative waste management program and is well advanced in implementing systems for enhanced resource recovery. It has Queensland's only Advanced Waste Treatment (AWT) facility for recovering resources from municipal waste.

Cairns Regional Council's current waste management strategy has addressed opportunities to show leadership in market development within the C&D sector. The council intends to conduct a feasibility study to identify opportunities for C&D waste diversion, with particular emphasis on the recovery of concrete and the trialling of concrete crushing⁹³.

Mackay

Mackay Regional Council has developed a 38 hectare parcel of land into one of the most advanced waste management facilities in Queensland. The Paget Waste Management Centre, located in the industrial hub of the city, is the centrepiece to the council's \$21 million Integrated Waste Management Strategy. In addition, Mackay has a stabilised engineered landfill at Hogan's Pocket (about 50km west of Mackay) and transfer stations in key rural areas including Kolijo, Bloomsbury and Seaforth. As outlined in Table 11-27, C&D materials are accepted at selected transfer station sites.

Toowoomba

Toowoomba Regional Council approved a new Waste Management Strategic Plan in July 2010⁹⁴. The council is proposing an extensive process to close and consolidate a number of waste management sites. This will leave the region with a total of 17 transfer stations and six landfills.

⁹² Content for this table was sourced through publicly accessible fee information on council websites

⁹³ Cairns Regional Council (2010) Waste Management Strategy 2010 – 2015 Waste Strategy Action Plans

⁹⁴ Toowoomba Regional Council (2010) Annual Report 2009 - 2010

The council sorts C&D waste to remove the inert fractions, and brings in a mobile crusher to produce a road base product that is used on site to construct all weather roads as per existing licence conditions.

There is an active C&D recycler in the area - Beutel Oughtred and Sons - that operates several mobile crushers as well as a recycling facility that produces a wide range of quarry products including road base, aggregates and packing sand.

In the past that company has sorted skip bins for other companies. The company also processes greenwaste for compost and sells large volumes of screened soils.

Regional opportunities

On the basis of direct consultation in Queensland, as well as the learnings from other Australian jurisdictions presented in this report, there are a range of opportunities to further develop C&D waste recovery and associated markets for products in regional Queensland. This includes:

- Seeking to upgrade and extend the network of council owned facilities that accept C&D waste (Table 11-28 outlines the councils that indicate they already recycle C&D materials)
- Where these sites are restricted to taking resident's C&D waste, consider extension to include self-haul loads from local trades people and other commercial businesses, where licences and capacity allows
- In terms of developing local markets for the use of recovered and recycled C&D materials, the most immediate opportunity is to support the acceptance and implementation by local government of the Department of Transport and Main Roads specifications for Recycled Materials for Pavements⁹⁵. The Victorian Roads Towards Zero Waste program provides a model to support engagement and implementation
- Where there may be perceived access issues for communities and local C&D operators in terms of travel distances, councils may seek to incorporate these considerations into waste management strategy reviews and identify infrastructure upgrades.
- Where reprocessing infrastructure is not presently available, or there are site restrictions for stockpiling and reprocessing, mobile crushing equipment may provide a solution. A similar solution has been adopted for the processing of green waste in areas including Central Queensland, through a regional contract for mobile chipping. This has involved councils working in partnership with the Central Queensland Local Government Association (CQLGA). Where appropriate, recovered timber may be able to be included in the materials processed through this mobile chipping arrangement. Additionally, this approach could be adopted for the processing of C&D material, such as masonry, using mobile crushing technologies.
- Addressing issues that have been highlighted in other jurisdictions, the State Government could encourage development of guidance on the siting and operation of mobile crushing equipment to ensure standards are met in both the operation and materials produced from masonry products. DERM should seek to develop this guidance in partnership with industry and local government.
- Local planning requirements may present barriers to the siting of recovery and processing operations. DERM should seek to work with councils to overcome these issues where possible. This may include regional DERM staff working through options, which support beneficial recovery sites operating within industrial areas in close proximity to townships, if / where planning requirements do not currently permit this.

⁹⁵ Department of Transport and Main Roads (2010) Main Roads Specification MRS 35 Recycled Materials for Pavements

- There is potential to integrate C&D reprocessing activities within existing quarry operations throughout the state. This is an approach that has been adopted by some large operators in the quarrying industry in Victoria (including Boral and the Delta Group). As an example, Boral has seven metropolitan and 12 country locations in Queensland⁹⁶. The involvement and partnering of other companies could extend the potential reach of such an approach. Such partnerships could reduce the need for establishing new sites and associated infrastructure. Additionally, this will support the extended lifespan of quarry resources.
- Longer term planning could follow the example of jurisdictions such as South Australia and seek opportunities to encourage the pre-sorting of waste prior to landfill disposal.

Local Government Area	Council type	Statistical Division
Bundaberg	Regional Council	Wide Bay
Charters Towers	Regional Council	Northern
Fraser Coast	Regional Council	Wide Bay
Gladstone	Regional Council	Fitzroy
Gold Coast	City Council	Gold Coast
lpswich	City Council	Brisbane
Isaac	Regional Council	Mackay
Mackay	Regional Council	Mackay
Moreton Bay	Regional Council	Brisbane
Napranum	Aboriginal Shire Council	Far North
Northern Peninsula	Regional Council	Far North
Redland	City Council	Brisbane
Rockhampton	Regional Council	Fitzroy
Roma	Regional Council	South West
South Burnett	Regional Council	Wide Bay
Southern Downs	Regional Council	Darling Downs
Sunshine Coast	Regional Council	Sunshine Coast
Tablelands	Regional Council	Far North
Torres Strait	Regional Council	Far North
Townsville	City Council	Northern
Whitsunday	Regional Council	Mackay

Table 11-28 Queensland councils that recycle construction and demolition waste streams, as reported in The State of Waste and Recycling in Queensland 2008 Technical Report⁹⁷

⁹⁶ www.boral.com.au

⁹⁷ DERM (2009) The State of Waste and Recycling in Queensland 2008 Technical Report

11.4 Material Processing

Reprocessors consulted through this review indicated there was a fairly mature market for the recovery of the inert fractions of C&D waste in metropolitan Queensland, with the scale of operations growing. The materials received and processed include concrete, bricks, rubble, soils, and asphalt.

Four of the major operators in Queensland were consulted during this review. Table 11-29 outlines that, collectively, these major operators reported processing over 2 million tonnes of C&D materials in the 2009-10 financial year.

	Company 1	Company 2	Company 3	Company 4	Total
Mixed Waste	150,000	50,000	284,000		484,000
Concrete/Brick	120,000	10,000	120,000	1,020,000	1,270,000
Asphalt	25,000			120,000	145,000
Clay Rubble	30,000	10,000	70,000	60,000	170,000
TOTAL	325,000	70,000	474,000	1,200,000	2,069,000

Table 11-29 C&D reprocessing by major operators – 2009-10

As shown in the table above, three of the major Queensland operators reported processing mixed C&D waste as well as source separated materials. During the consultation, Company 4 highlighted that it was reluctant to get involved in processing mixed C&D waste until it better understood how the introduction of the landfill levy would affect the disposal of the residual component of this waste stream.

11.4.1 Source separated reprocessors

As with other jurisdictions, a primary driver to encourage source separation by waste generators is the application of differential gate fees. All reprocessors work on the principle that better quality products can be processed from better quality source materials. With the introduction of the Main Roads Specifications for Recycled Materials for Pavements⁹⁸ it is now more imperative than ever that operators produce clean and high quality materials for use in this market sector.

Consultation for this review determined the large metropolitan recyclers use price differentials to encourage C&D waste generators to source separate materials prior to transport to site. These differentials are particularly effective at influencing behaviour of the high-volume or regular generators of C&D waste. The established recycling operators have invested a substantial amount of time and money in developing their processes for producing high quality materials.

In metropolitan Brisbane, resource recovery facilities and transfer stations that take small volumes of source separated C&D materials charge a lower fee for acceptance of clean loads, substantially less than what is charged for accepting mixed waste loads.

In regional Queensland, most of the sites that recycle the inert fraction of C&D material stockpile the material until there is sufficient volume to make it economical to engage mobile crushing and screening equipment to reprocess concrete and bricks for local market applications.

⁹⁸ Department of Transport and Main Roads (2010) Main Roads Specification MRS 35 Recycled Materials for Pavements

11.4.2 Mixed load recyclers

The driver for mixed waste recycling is often to reduce waste disposal volumes, conserving airspace in landfill and avoiding disposal charges, including levies. With the introduction of a landfill levy there is likely to be a greater emphasis on the recovery of material from mixed C&D waste, although there will be also clearer incentives for waste generators to source separate materials where possible.

Where mixed C&D loads were accepted for recycling, the gate fee charges were found to be generally similar to the charges for waste disposed to landfill. This is particularly apparent in metropolitan Brisbane, where the same operators that manage landfills also operate recycling facilities. Indeed, the majority of recovery facilities are built on existing waste management sites, mainly current or disused landfills.

On this basis, the site operators decide internally whether to direct specific material loads to disposal or recycling. Consultation in jurisdictions like Victoria and NSW highlights that, with the introduction of levies, operators with both landfill and reprocessing interests on the same site have increased their diversion of C&D materials once these have passed through the gate. In metropolitan Melbourne, for example, mixed loads incurred the same charges as materials disposed to landfill. Where these loads were then sorted by the receival site and certain materials recovered for reprocessing, the receival sites indicated the ultimate saving / return of the levy differential (\$30 / tonne 2010-11 in metropolitan Melbourne) meant they were able to reinvest this money into the site recovery and reprocessing activities.

As with other Australian jurisdictions, the degree to which separation of materials occurs within the bin hire industry is difficult to determine. Insights from other jurisdictions indicate these companies will seek to recover valuable materials before their loads are taken to landfill. The Queensland consultation indicated the waste management industry has seen an increase in the number of bin hire companies servicing builders. Waste industry stakeholders indicated that, where the bin hire companies had the facilities, they were physically sorting waste and recovering higher value materials such as metals, concrete and soils, to reduce overall disposal costs before transporting residuals to landfill. This also supports the findings of consultation in NSW and Victoria.

In regional Queensland many of the smaller waste management sites are unstaffed. Consultation with waste industry stakeholders highlighted that these sites often accepted small volumes of inert materials, such as concrete, but the disposal pathway of this material was not clear. It was suggested it may be disposed to landfill. In larger regional centres, industry stakeholders indicated that, because volumes of C&D waste were larger, greater sorting and recovery of materials occurred. However, due to the mixed nature of the loads, a high portion of material was still being disposed to landfill.

The introduction and collection of landfill levy revenue will help to better quantify the amount of C&D materials going to landfill across the state. It will also help to highlight regions where resources could be provided to better target the recovery of materials presented in mixed loads, and support the development of local markets for these materials.

11.5 Processing Capacity

The introduction of a \$35/tonne levy that will apply to the landfill disposal of most C&D material is expected to support a major shift in the Queensland marketplace, with a significant expansion of processing capacity likely to result. The consultation highlighted planning to develop at least two additional facilities in South East Queensland.

Significant capital investment will be required to recover the additional material needed to achieve the state's C&D recycling targets. The capital costs for a 300,000 tonne per annum C&D recovery

facility may be in the order of \$10 million, and several facilities of this capacity would be required to meet the State's 2015 target for 50% recycling of C&D waste.

There is also likely to be a significant role for mobile crushing equipment in Queensland, which would enable batch processing of stockpiled material in regional areas on a campaign basis. The cost of mobile crushing equipment is in the order of \$1 million for plant with capacity of 300-350 tonnes per hour.

To support a planned approach to infrastructure and market development, the following pathway is proposed.

- Using more detailed data drawn from operators following introduction of the landfill levy, develop a five year rolling infrastructure program that prioritises infrastructure in key C&D waste generation areas. The benefit of a 'rolling' program is that it can be updated annually as more data becomes available and more obvious recovery and disposal patterns are identified.
- On the basis of C&D quantities generated, and taking account of the potential for recovery of the materials presenting in the waste stream, planning should give consideration to the use of fixed or mobile facilities to service material volumes as appropriate.
- Beyond the provision of infrastructure by private industry, where investment decisions will be primarily driven by market demand and end product outlets, consideration should be given to upgrading existing local government sites and infrastructure. DERM and local government could partner in this process, with some funding provided through the WARE fund. This funding should also be linked to performance measures that include C&D materials recovery.
- Where obvious gaps exist in the geographic spread of existing facilities in relation to the generation of C&D waste, DERM could work with local governments to support the incorporation of C&D waste recovery infrastructure and programs in waste management strategy reviews. The process should include identifying opportunities for new infrastructure associated with local government capital works programs, linked to funding opportunities provided through the WARE fund. This funding should also be linked to performance measures that include C&D materials recovery.
- Partnerships should be fostered with the range of stakeholders involved in C&D waste and recovery. In the public realm, this may include peak agencies such as Local Government Associations that will help facilitate resource sharing (like mobile crushing equipment), and the development of local market outlets for materials. Private company partnerships should also be supported, and the network of existing quarry companies could present a particular opportunity to extend facilities into regional areas.
- Support for waste management infrastructure development (whether public or private) should not only be linked to performance measures that include C&D materials recovery, but also to the development of local markets for recovered and reprocessed materials.
- As has been highlighted in other jurisdictions, planning and operational measures also need to be managed. DERM has the opportunity to work proactively to support the development of industry guidance. Priority should be given to:
 - The siting and operational requirements of both fixed and mobile equipment, to manage expectations as the industry goes through a growth phase
 - Guidance on the management of asbestos in the C&D waste reprocessing sector (as previously highlighted, Victoria provides an example of how this could be managed)
- In the longer term, monitor the progress of initiatives in jurisdictions such as South Australia, which mandate requirements for waste to be subjected to some resource recovery efforts (pre-sorted) prior to landfill disposal.

11.6 Products and Markets

11.6.1 Recycled Pavement Materials

As with all Australian jurisdictions reviewed, there is a significant market for recovering the masonry materials from the C&D waste stream for use as an alternative to quarry equivalent pavement materials, sands and aggregates. The Queensland reprocessors consulted indicated there was growing market demand for recycled product. As highlighted earlier, figures gathered directly from industry in relation to 2009-10 suggest a 700,000 tonne increase in recovery compared with the *Waste and Recycling in Australia 2011* figures for 2008-09.

The reprocessors consulted indicated that approximately 80% of all the masonry materials recovered and recycled in Queensland were used in civil engineering applications such as pavements, as a substitute for bedding sand, and in drainage applications.

The release in October 2010 of the Department of Transport and Main Roads (DTMR) *Main Roads Specification MRS 35 Recycled Materials for Pavements*⁹⁹ will further support the development of material diversion and market opportunities in road pavement applications.

The three key elements of the DTMR¹⁰⁰ documents are:

MRS 35	Main Roads Specification Recycled Materials for Pavements
MRTS 35	Main Roads Technical Standard Recycled Materials for Pavements
MRTS 35.1	Annexure – Recycled Materials for Pavements

The specification supports the reuse of the following recycled materials in road pavements:

- Crushed Concrete
- Reclaimed Asphalt Pavement (RAP) Material
- Crushed Brick
- Glass Cullet

This presents Queensland with similar opportunities as are available in other jurisdictions. However, lessons learnt from other jurisdictions suggest these specifications will predominantly be used in applications supported by the State Road Authority (SRA), which is DTMR. As Table 11-30 highlights, the SRA is responsible for only 19% of Queensland's roads. The other 81% comes under the management of local government authorities, and programs to encourage uptake of recycled materials in these markets should be considered.

Table 11-30 Approximate kilometres of roads and management responsibility¹⁰¹

Jurisdiction	State Road Authority (SRA) managed roads (km)	Local government area (LGA) managed roads (km)	Total (km)
Queensland	33,535 (19%)	143,465 (81%)	177,000
Australia	127,576 (14%)	760,172 (86%)	887,748

⁹⁹ Department of Transport and Main Roads (2010) Main Roads Specification MRS 35 Recycled Materials for Pavements

100 www.tmr.qld.gov.au

¹⁰¹ GHD (2008) *The use of crushed glass as both an aggregate substitute in road base and in asphalt in Australia Business Case* for the Packaging Stewardship Forum of the Australian Food and Grocery Council

Highlighting the fact that development of specifications is not a 'silver bullet' solution to increasing C&D recycling, Victoria has had specifications for the use of recycled materials in road pavements since 1993, although operators are still facing challenges in terms of developing end markets for recovered C&D materials, especially in regards to use by local government. The challenge is to ensure specifications are not only fully endorsed by the SRA, but that they are broadly adopted. Queensland should consider the following opportunities, based on learnings from Victoria.

- Government agencies should look to favour the procurement of recycled C&D products in their projects where they meet defined specifications, and where products and producers are accredited through government agency programs (see following point)
- DTMR should consider supporting the development / extension of the prequalification program (quarry accreditation) to include its application to recycled products for use in pavement applications
- DTMR should consider supporting the promotion of companies that comply with their accreditation program for recycled products, in partnership with agencies including DERM and local government associations
- There is an opportunity to adopt a similar approach to the Victorian Roads Towards Zero Waste (Roads TZW) program. The focus is on the use of recycled products in road construction applications. The project involves a partnership between the State Environment Agency, the peak local government association, the SRA and the ARRB. Two key aspects of the project include – (i) testing and peer review, and (ii) application of products at selected demonstration sites. Outcomes are expected to include:
 - Short-term a reduction in annual stockpiles of crushed concrete, brick and glass
 - *Medium-term* changing the procurement practices of local government in relation to road construction arrangements, and delivering major CO₂ emission reductions
 - *Long-term* achieving more sustainable uses of current quarry reserves and reducing the number of new quarries opened.

The Roads TZW project includes a web-based interactive hub. Councils are asked to sign up to the program and adopt the recycled content specifications. The hub provides information on the specifications, demonstration sites, frequently asked questions to address misconceptions, and also links councils with reprocessors.

The Victorian program will also seek to address the issues of local councils transferring risk to civil contractors. The program will seek that council tendering processes request engineering expertise in the use of recycled aggregates in pavement applications. On this basis councils will be procuring the services of contractors that are capable of managing the mechanical properties of the materials.

Any similar Queensland program should also engage the network of civil contractors who often subcontract to local government. This should include direct engagement and participation of associated peak industry bodies including the Civil Contractors Federation of Queensland.

11.6.2 Soils, Clay & Plasterboard

Reprocessors consulted during this review indicated there was an established market for processed soils for landscaping and general fill applications in Queensland. The reprocessors estimated more than 150,000 tonnes of this material annually was recovered and sold back into these applications. They also indicated there was a small market for crushed plasterboard, (approximately 10,000 tpa), which was used as a soil enhancer in the landscaping industry.

11.6.3 Mixed Waste

At the sites consulted, the recycling of mixed waste loads focused on reducing the weight of the material being disposed to landfill by removing the heavy inert and metals fractions. This fraction is generally a mixture of soil, concrete and bricks. The concrete and bricks were generally processed into materials for pavement applications, while the soil fraction was screened and reused in the landscaping industry.

The reprocessors consulted indicated that, in Queensland, the recovered timber from mixed loads was generally processed as mulch or sold as wood chips for alternative fuels. One outlet for this material highlighted by reprocessors in South East Queensland is the Rocky Point Power Station (which has capacity to take up to 200,000 tonnes/year). Other components of mixed C&D material are also sorted for recycling where a market exists for the recovered material. Reprocessors indicated there was some recovery of mixed plastics, paper and cardboard. However, where the loads were considered too contaminated to be economically sorted, they were disposed to landfill.

Mixed loads of C&D waste have presented issues for all the jurisdictions reviewed. This especially applies to the recovery of plastics and timbers, which have been addressed in the national overview. As previously highlighted, the introduction of the landfill levy may see some of these mixed load materials diverted in the short term, although longer term options for Queensland may include evaluating the performance of mandated pre-sort activities in jurisdictions such as South Australia.

11.7 Barriers

Consultation during this review indicated there was a perceived lack of awareness of the Department of Transport and Main Roads (DTMR) *Main Roads Specification MRS 35 Recycled Materials for Pavements*¹⁰². As previously highlighted under Section 11.7.1, a range of opportunities have been proposed to increase awareness of these specifications and to encourage their practical application.

As discussed in Section 11.7.1, a key element of this would be to extend DTMR prequalification programs for quarry products used in road pavement applications to include recycled materials. Such an approach has been adopted in other jurisdictions, including Victoria, and this can provide valuable learnings for jurisdictions, including Queensland. This prequalification process means that, during tendering, end users can seek material sourced from sites that are registered under the DTMR program. This would helps to ensure quality and confidence in products, as well as protecting the reputation of the reprocessing companies that comply with DTMR standards.

As highlighted in other jurisdictional summaries, crushed masonry products can also be used in non-structural bedding and drainage applications. This area of product development has been limited for some reprocessors because government agencies, including State Road Authorities (SRAs) water authorities and local government, may allow for the use of crushed concrete or brick (or glass fines as a substitute for sand), although technical specifications commonly state the use of 'natural' products is required. Where such statements are included, the civil contracting companies undertaking works on behalf of the agencies are limited in their ability to substitute 'natural' products with recycled products. The reprocessors consulted indicated this was also an issue in Queensland.

¹⁰² Department of Transport and Main Roads (2010) Main Roads Specification MRS 35 Recycled Materials for Pavements

NSW provides some guidance for Queensland in this area. As previously highlighted in the NSW jurisdictional summary, this State has developed the *Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage*, otherwise known as the 'GreenSpec'¹⁰³.

Beyond addressing the use of recycled materials, such as crushed concrete, brick and reclaimed asphalt blends in road and pedestrian pavements sub-bases, the GreenSpec also specifies for the use of these materials in minor earthworks applications and as backfill material for drainage lines and drainage structures. This provides an example for Queensland to consider in the development of similar applications for recycled material use in drainage lines and drainage structures.

11.7.1 Market Development

Significant market development opportunities are highlighted in previous sections including Section 11.4.2 Regional Councils and Section 11.7.1 Recycled Pavement Materials. Other options include government leading the way and providing leverage through programs over which it has some control. One example is through the operations of agencies such as QBuild and Project Services.

QBuild is one of five commercialised business units in the Queensland Department of Public Works (DPW). The DPW is responsible for the policies and programs related to government buildings, capital works initiatives, procurement development and administrative services. QBuild provides building maintenance and construction services for the government. Another business unit in the DPW, Project Services, provides project management, advisory and design services. It is the intention that, collectively, the two business units deliver building asset management solutions from the stage of asset planning design and construction, through to the end of the life of the asset¹⁰⁴.

In July 2009 the Queensland Department of Public Works introduced the *Recycling Policy for Buildings and Civil Infrastructure* in response to an all-of government commitment that requires all Queensland government departments and government owned corporations to develop resource recovery programs.

The program covers key infrastructure, except where departments manage their own assets, such as in the case of portfolios such as education and health. The recycling policy is designed to apply to large projects. While there appears to be the opportunity to leverage off this program to increase the uptake of recycled C&D materials in major construction projects, the program does not currently require reporting on outcomes and it is unclear how effective it has been in driving significant change to date.

Further opportunities exist for improving education and awareness of both waste generators and consumers. The government could play an enhanced role in disseminating information regarding recycling practices and the use of recycled product, in particular targeting the major engineering companies. There is a need to dispel unfounded concerns amongst consumers regarding the integrity and comparative durability of reprocessed products. Awareness campaigns initiated by the government and aimed at consumers could include clearly communicated research on relevant materials and case studies.

¹⁰³ OEH (2010) Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage (Issue 3)

¹⁰⁴ www.qbuild.qld.gov.au

11.8 Key Conclusions

Queensland's Waste and Recycling Strategy 2010-2020¹⁰⁵ provides a valuable framework within which the state can address and improve the recovery of C&D waste materials. The Strategy seeks to address change through a series of related processes which include:

- Regulatory reform
- The introduction of the price signal (levy)
- Reinvestment of levy funds into a range of programs
- The development of strategic partnerships.

Work recently undertaken by DERM to review licensed waste management sites across the state, and the anticipated increase in data availability following introduction of the landfill levy, will help to provide DERM with valuable information to develop and review a 'rolling' plan of infrastructure requirements to support the recovery and reprocessing of C&D materials.

As with all the jurisdictions reviewed, the immediate priority should be to support and further develop the existing reprocessing industry by seeking to create and/or expand end markets for recovered product. To this end, the government could play an enhanced role in disseminating information regarding recycling practices and the use of recycled product. Opportunities exist to do this for recycled pavement materials, as outlined in Section 11.7.1.

The challenge is then to extend these opportunities into new geographical regions as well as new market sectors. Recommendations have been made in Section 11.4.2 to address opportunities for regional councils, with a key concept being the ability to co-locate C&D recprocessing facilities with existing quarrying infrastructure. This would allow more rapid development of recycling industries in regions where there is existing demand for quarry materials.

Key conclusions and recommendations in relation to C&D waste in Queensland are:

- 1 Introduction of a \$35/tonne landfill levy on industrial wastes will provide a strong and immediate incentive to improve recovery of C&D waste materials. There has been a significant increase in development and planning activity in anticipation of the levy's introduction.
- 2 A five year rolling infrastructure program that prioritises infrastructure in key C&D waste generation areas should be developed. On the basis of C&D quantities generated, and potential for recovery, planning should give consideration to fixed or mobile facilities to service material volumes as appropriate.
- 3 Where obvious gaps exist in the geographic spread of existing facilities in relation to the generation of C&D waste, DERM could work with local governments to support the incorporation of C&D waste recovery infrastructure and programs in waste management strategy reviews. The process should include identifying opportunities for new infrastructure associated with local government capital works programs, linked to funding opportunities provided through the WARE fund. This funding should also be linked to performance measures that include C&D materials recovery.
- 4 Funding should also be linked to performance measures that include but are not limited to:
 - Reduced C&D volumes to landfill
 - Improved rates of recovery of C&D materials

¹⁰⁵ Department of Environment and Resource Management (2010) Queensland's Waste and Recycling Strategy 2010-2020
- Development of local markets for recovered / recycled C&D products
- The adoption of sustainable procurement practices.
- 5 Mixed C&D loads are a key challenge for all jurisdictions. The introduction of a landfill levy in Queensland may see some of these mixed load materials diverted in the short term. Longer term options may include evaluating the performance of South Australia's requirements to pre-sort waste prior to disposal.
- 6 One of the key approaches of Queensland's Waste and Recycling Strategy 2010-2020 is the development of partnerships. In the public realm, peak agencies including Local Government Associations will help to facilitate planning and resource sharing, and the development of local market outlets for materials. Additionally, government agencies such as QBuild and Project Services within the Department of Public Works should be considered priority partners.
- 7 Private partnerships should also be supported. Beyond obvious partnerships with the waste management industry and reprocessors, opportunities exist within the civil sector and quarrying industry. These relate particularly to the most immediate opportunities in material recovery and market development in regards to recycled masonry materials.
- 8 Planning and operational measures also need to be managed. DERM has the opportunity to work proactively, and in partnership with industry, to support the development of guidance. Priority should be given to:
 - The siting and operational requirements of both fixed and mobile equipment, to manage expectations as the industry goes through a growth phase
 - Guidance on the management of asbestos in the C&D waste reprocessing sector.

12 AUSTRALIAN CAPITAL TERRITORY

12.1 Overview

Around 7% of waste landfilled in the ACT is C&D material, including soil, timber, plasterboard, and bricks¹⁰⁶. More than 400,000 tonnes of C&D waste are recycled annually by reprocessors operating in the territory, which equates to a recycling rate of approximately 70%. The reprocessing sector supplies recycled products to primarily civil works projects.

Based on consultation undertaken for this project, the key drivers for contractors to recycle materials on-site are a desire to 'do the right thing', and in some instances cost savings. Stakeholders also identified a steady supply and demand of the key recycled C&D materials, such as cement, brick, and asphalt, with only timber identified as a problem material requiring development of end-markets. The reprocessing sector in the ACT has spare capacity and sees opportunities for both encouraging higher rates of recycling and expanding existing markets for products, particularly with government agencies through procurement policies and specifications.

12.1.1 Materials/Source

Based on industry stakeholders consulted during this project, the majority of C&D waste (60-90%) reprocessed in the ACT is derived from commercial sector C&D activities. Operators indicated that 20-50% of waste results from construction activities, whereas 50-80% results from demolition. Evidently, these figures vary through the year depending on the occurrence of major demolition projects – reprocessors emphasised that flows of materials through their facilities could vary widely from month to month.

12.1.2 Gate Fee/Disposal Pricing

Gate fees for mixed loads of C&D waste ranged from \$104 to \$118 per tonne, although the reprocessor charging \$118 per tonne negotiates lower rates with specific customers. Landfill disposal costs ranged from \$113 to \$118 per tonne. Source-separated materials attract much lower gate fees at reprocessing facilities, typically less than \$20 per tonne, and as low as \$5 per tonne for concrete, bricks, and asphalt. Metals are generally accepted without charge.

12.1.3 Geographic Catchment

All reprocessors interviewed received waste from the entire ACT and Queanbeyan area, and generally sold product exclusively to the ACT market. Reprocessors selling product into NSW are required to comply with NSW specifications for recycled materials (see page 82).

12.1.4 Material Processing

The C&D reprocessing sector in the ACT is relatively small, with two companies largely dominating the market and receiving approximately 200,000 tpa each. Skip hire companies generally deliver loads to the major reprocessors; several smaller reprocessors also manage skip hire businesses. Most companies accept both source-separated and mixed loads of all C&D waste materials, with mixed loads sorted on-site using simple conveyor belt systems, excavators, and manual sorting. Some smaller operators, accepting up to 80,000 tpa, focus on specific materials such as concrete, brick, and asphalt, and there are a number of small, specialist

¹⁰⁶ APC (2010), ACT Landfill Audits, Combined Final Audit Report for ACT NOWaste.

businesses targeting reusable items from demolitions (i.e. doors, whole bricks, hardwood timber, etc). The development of the reprocessing industry is largely motivated by the market for recycled materials used in civil works, specifically asphalt, road base and aggregate (produced from recycled concrete and brick), and landscaping products, such as soil, rocks, and crushed brick.

Reprocessors interviewed claimed high recovery rates, from 70% (for mixed loads) to 95% (for source-separated materials)¹⁰⁷. Timber and plastic were cited as the main materials requiring disposal, although some companies were mulching and stockpiling timber. Contractors involved in civil works projects occasionally purchase this coarse mulch product, but there is a very limited market.

The primary drivers for waste generators to recycle C&D material in the ACT appear to be an increasing awareness that this is the 'right thing' to do, and to a lesser degree lower gate fees at reprocessing facilities for source-separated materials. It should be noted, however, that all stakeholders (reprocessors, waste generators, and regulators) mentioned the high incidence of illegal dumping (or stockpiling) of C&D waste on privately owned land within the ACT. This practice is seen as a major deterrent to encouraging waste generators to recycle, and impacts on the business feasibility of reprocessors.

12.2 Material Profiles

12.2.1 Asphalt

To date, asphalt millings¹⁰⁸ collected by reprocessors in the ACT have been on-sold to asphalt manufacturers, generally outside the ACT, for around \$15 - \$17 per tonne. However, two new asphalt (hot mix) plants are due to be constructed in the territory in 2011, both with the ability to incorporate up to 30% recycled asphalt content in the mix. One plant will be operated by BORAL and will initially accept only millings generated by the company's demolition activities. It is uncertain how the second plant will impact on demand and therefore sales price of recycled asphalt in the region.

All reprocessors interviewed were selling 100% of asphalt received, with an abundance of endusers for the recovered material. Asphalt hot-mix containing recycled millings appeared to be a readily accepted product amongst building contractors for road works. Civil works companies also mentioned recycling asphalt on-site into hot-mix to create site access roads.

12.2.2 Concrete and Bricks

Civil works in the ACT seem to absorb as much reprocessed concrete and brick products as companies can produce. End-markets for concrete backing, sub-base, aggregate, crusher dust, brick dust, crushed brick, and whole bricks are well-developed. Main clients are private building contractors and wholesale landscape suppliers. Sub-base, aggregate, and crusher dust sell for \$12 - \$16 per tonne, concrete backing sells for around \$7 per tonne, and crushed brick commands a premium price at around \$33 per tonne (for landscape applications).

Although gate fees for source-separated concrete and brick are far cheaper than landfill disposal costs (i.e. \$7-\$10 per tonne versus approximately \$115 per tonne), there is reportedly a high incidence of illegal dumping of concrete and brick by contractors on privately owned land. Therefore, cost savings are not always a major driver for waste generators to recycle this material

¹⁰⁷ Note that Hyder did not physically inspect sites or examine records to verify these claims.

¹⁰⁸ Asphalt millings are generally defined as the fine particles of bitumen and inorganic material that are produced by the mechanical grinding of bituminous concrete surfaces.

in the ACT. Several interviewees implied that higher rates of recycling could be achieved for concrete in particular if illegal dumping and stockpiling were addressed.

12.2.3 Metals

Reprocessors in the ACT do not generally charge gate fees for source-separated metal waste, which is on-sold to a scrap metal merchant. Metal is sorted from mixed-loads using both manual techniques and magnets (for ferrous metals). Since metal is a relatively valuable commodity, negligible amounts are sent to landfill from reprocessing facilities. Scrap metal prices vary according to international markets.

12.2.4 Timber

Timber is a major material of concern for ACT reprocessors and regulators, and large quantities of timber are recovered from C&D activities. There is limited recovery of reusable hardwood for resale, and there is no large-scale timber reprocessor within feasible transport distance of the ACT. The majority of recycled, untreated timber is coarsely mulched by local reprocessors and offered for sale at around \$7 per cubic meter. However, interviewees reported limited markets for the material leading to significant volumes of mulch being stockpiled on-site. Although there is a somewhat larger market for a finer mulch product, this requires more processing effort and consumers are concerned about the risk of contamination from mulched treated timber. Generally, treated timber is disposed of to landfill.

Regulators and reprocessors alike expressed keen interest in energy-from-waste (EfW) technology to deal with recovered timber. If an EfW facility were established in the ACT, standards could be specified for timber-based refuse-derived fuel, which would provide reprocessors with a level of market certainty for a timber product. The Draft ACT Sustainable Waste Strategy 2010 – 2025 clearly identifies EfW as a preferred option for the territory's non-recyclable paper and wood wastes.

12.2.5 Soils, Sands and Fines

Civil works contractors claim to reuse the majority of excavated soil on-site, or stockpile on privately owned land for use on future projects. 'Clean fill' attracts a sale price of \$1 to \$5 per tonne, whereas 'soil' (VENM) is sold for around \$10 per tonne. Although reprocessors had limited comments on issues around soil recovery, regulators identified soil as an area of concern. Once soil is mixed with general C&D waste it easily becomes contaminated, which limits options for beneficial reuse. A large quantity of soil is recovered during sorting of mixed C&D, but it can only be classed as VENM if stringent sampling standards are applied. Reprocessors generally find the cost of sampling to be excessive, and will on-sell as 'fill' material for limited applications. One ACT regulatory respondent believed there needed to be a system established to correctly assess the risk of contamination and ensure that soil resulting from the sorting process could be beneficially reused without the need for excessive sampling.

12.3 Processing Capacity

None of the reprocessors interviewed in the ACT identified capacity as a limiting factor for their operations, and there did not seem to be concern regarding land availability for possible expansion of operations. Facilities are generally not operating at capacity and could accept significantly more material for reprocessing. Reprocessors reported a fast turn-around of materials – the only product that tends to be stockpiled on-site is timber or timber mulch.

A potential user of recycled products in the government infrastructure sector felt that the ACT reprocessing sector was not able to guarantee availability of materials for large-scale

infrastructure projects. This is more likely a reflection on the drivers to recycle materials, rather than the capacity of businesses to reprocess materials into usable product.

12.4 Products and Markets

The majority of C&D materials recycled in the ACT are used in civil engineering projects. Similar to observations made in NSW, market respondents in the ACT generally agreed that if the recycled material was of sufficient quality, there was guaranteed demand for it.

One reprocessor who also operates a quarry for virgin aggregate offered an interesting perspective on products and markets. They noted that many customers would refuse to use recycled material due to concerns over material integrity, specifically trace amounts of other substances in concrete. Since recycled concrete is of varying age and quality, it is not possible to guarantee that the product will be of a consistent quality and make-up. However, customers need to be educated about the relevance of trace amounts of other substances in the product, since virgin material can also contain trace contaminants (even naturally occurring asbestos). The interviewee also noted that the ACT has more quarries per capita than any other state or territory in Australia, and that reprocessed concrete costs more than virgin material to produce, therefore the drivers for increased use of recycled material are limited. Currently, the desire to 'do the right thing' is the strongest market driver.

Market demand for the major materials (concrete, brick and asphalt) is largely dictated by private civil works contractors. The government is not currently seen as a key player since all government jobs are tendered to private contractors, and there are no contractual obligations to use recycled content materials.

12.5 Barriers

12.5.1 Barriers to Materials being Reprocessed

Reprocessors identified a range of barriers to materials coming to their sites, including: prevalence of illegal dumping of C&D waste on privately owned, vacant land in the ACT; education and awareness of building contractors; and laziness of waste generators. There appears to be a delicate distinction between contractors stockpiling C&D waste materials on their own land for future application, and contractors dumping C&D waste materials on their own land to avoid disposal or reprocessors' gate fees. Reprocessors and regulators alike highlighted the need for better regulation, monitoring, and prosecution of illegal dumping in the ACT. Several operators believed that, if this cheap, easy disposal option were eliminated, then significantly greater quantities of material would enter the reprocessing market.

The need for improved education and awareness were key themes raised by interviewees in the ACT. Stakeholders generally felt there was a low level of understanding amongst waste generators regarding the options available for recycling C&D waste and the wider implications of source-separation and material recovery. In addition, some contractors simply perceived landfill disposal as the most convenient option, regardless of their knowledge of alternate options.

Civil engineering projects can often involve a number of subcontractors, and management of multiple waste generators with varying levels of understanding was noted as a challenge for ensuring source-separation of materials on-site. One major civil works contractor described their business as a 'clean operation' with an excellent reputation for on-site waste management. They believed that the company's culture ensured all employees adhered to site management policy.

Based on consultation with industry stakeholders, there do not appear to be sufficient incentives to motivate all building contractors to source-separate materials on site and ensure loads reach a reprocessor. One C&D recycling facility operator regularly observed skips of mixed C&D waste

being driven past their gate to the landfill down the road, despite the landfill disposal fees being higher than the reprocessor's gate fees.

12.5.2 Barriers to the Use of Reprocessed Products

During stakeholder consultation a lack of government procurement policies and specifications was identified as a major barrier to the increased use of reprocessed product in the ACT. The government initiates the majority of civil engineering projects in the territory, but engages private contractors to undertake the work. Currently there are no specific government procurement policies or material specifications applied to C&D materials; however, ACT NoWaste is developing a set of standards and guidelines (anticipated for release in 2012), which are likely to reflect those applied in NSW. Some concern was raised over the impact that a procurement policy could have on projects, particularly if the policy requires a percentage of recycled material to be used, with insufficient regard for material quality or longevity (in some instances, recycled materials are thought to be less durable than virgin product).

Technical specifications for general civil works exist, and several interviewees noted that, if a reprocessed product meets these specifications and offers a cost-effective alternative to virgin material, then contractors will – and do – use it. However, 'availability / source supply' and 'consistent quality' remain outstanding issues of concern regarding reprocessed materials.

Some stakeholders also identified consumer ignorance of reprocessed C&D materials as a significant barrier to market development. Building contractors may not trust reprocessed materials to perform as well as virgin product, regardless of whether this mistrust is well founded. Material specifications and quality standards would increase trust and provide consumers with a level of product assurance. Specifications and procurement policies would also improve market conditions for reprocessors and potentially stimulate operators to expand operations and develop more and higher quality products.

12.6 Opportunities

Although 'access to reprocessing facilities' was not identified as a barrier to recycling C&D materials in the ACT, 'improving access to reprocessors' was noted by waste generators as an opportunity to increase material recovery. The Land Development Agency (LDA) is preparing to trial an on-site builders' recycling facility, set-up for the duration of a major civil construction project (estimated five years), to provide all subcontractors with convenient access to recycling infrastructure. The facility will be operated by an ACT-based reprocessor, and if successful, may become a key element of future site management plans for the LDA.

The creation of procurement policies, preferential selection of contractors specifying use of recycled materials, and specifications would generate significant opportunities for the use of recycled C&D materials on government projects. It should be reiterated that none of the reprocessors interviewed had difficulty finding end-markets for products (apart from timber); however all reprocessors indicated that they could increase processing capacity if supply and demand improved. Government procurement is clearly the key to increasing demand for recycled materials in the ACT. One interviewee suggested implementation of a set of national standards for the most commonly used reprocessed C&D materials.

Further opportunities exist in improving education and awareness of both waste generators and consumers. The ACT government could play an enhanced role in disseminating information regarding recycling practices and the use of recycled product, in particular targeting the major engineering companies. There is undoubtedly a need to dispel unfounded concerns amongst consumers regarding the integrity and comparative durability of reprocessed products. Awareness campaigns initiated by the government and aimed at consumers could include clearly communicated research on relevant materials and case studies.

12.7 Key Conclusions

- Illegal dumping of C&D waste on privately owned land in the ACT is a major deterrent to increasing recycling activities in the territory and, left unregulated, creates a disadvantage for C&D waste reprocessors.
- 2. C&D reprocessors in the ACT are not operating to capacity and could meet a considerable increase in demand and supply of materials.
- 3. The key end-market that requires development in the ACT are government projects currently, there are no procurement policies stipulating the use of recycled C&D products on government construction projects.
- 4. Private contractors would be more likely to use recycled C&D products if procurement policies stipulated their use, if material specifications existed, and if standards were in place to provide some assurance of quality.
- 5. For many waste generators in the ACT, cost is not a major incentive to increase recycling efforts, and education is seen as critical to improving material recovery rates.
- 6. Opportunities exist in improving education and awareness of both waste generators and consumers. The ACT government could play an enhanced role in disseminating information regarding recycling practices and the use of recycled product

13 SOUTH AUSTRALIA

13.1 Overview

The market for C&D recycling in South Australia is very mature and there are several significant players established in the industry. Based on consultation with stakeholders during this review, the major market for C&D materials, the road base industry, uses about 800,000 tonnes of product, which is worth approximately \$20 million per annum and leads to the employment of some 60 people directly, plus significantly more indirectly in such areas as transport and maintenance.

Adelaide also has a significant mixed C&D waste processing industry that recovers resources from residual materials, which are recycled, processed into an engineered fuel to displace fossil fuel use in cement kilns, or disposed at landfill.

Adelaide has significant history of recycling C&D waste, following early introduction of landfill levies and the establishment of Zero Waste SA in 2004. The gradual increase in weight-based landfill disposal costs has facilitated a significant investment in recycling for the C&D waste stream, which is relatively heavy.

Several stakeholders consulted represented businesses established to manufacture materials from the inert fraction of the C&D waste stream, predominantly sourced from demolition activities. The larger reprocessing sites are mainly situated near the city of Adelaide in the north west suburbs and, of recent times, smaller facilities have been established in the southern area.

In the year 2000, Transport SA introduced Transport SA Specification 2000/02428 - *Standard Specification for Supply and Delivery of Pavement Materials* that accommodates the reuse of recycled products on an equal basis to traditional quarry products. Prior to its introduction, recycled pavement materials were often classed as non-conforming materials within most tenders, because road specifications generally referred to quarry products.

The introduction of the specification for recycled materials caused a significant take up of products and the market for recovered materials more than doubled. There has also been three new businesses established to meet the market demand for product.

There are still some hurdles to overcome in terms of market demand. At a high level, the State Government is a strong proponent of recycling and the use of recycled materials. However, there are operational barriers including that Department of Administrative Services (DAIS) tenders state that 'Recycled Products are not suitable for use in DAIS projects'.

While the development of specifications as outlined above has helped stimulate market demand for recycled materials, it should be noted that the recently produced *Standard for the production and use of Waste Derived Fill* has the potential to add another level of cost in reprocessing, which will make it harder to market the material on commercially attractive rates to virgin alternatives.

13.1.1 Gate Fee/Disposal Pricing

While there is capacity at several recycling sites to process additional tonnes of C&D material, one of the barriers to operators securing additional tonnes is that there is not sufficient differential between landfill gate fees for disposal and the processing costs associated with recovering resources from the waste stream.

There are two main areas for disposal in Metropolitan South Australia, which are to the north west and to the south of Adelaide. It should be noted that high volume waste generators may receive up to a 30% discount on publicly listed landfill gate-fees in South Australia.

Landfill disposal gate-fees in the north west are listed at between \$115 and \$122/tonne, however most volume producers can dispose at either one of these sites for less than \$80/tonne including the \$26.40 landfill levy. Waste disposal costs in the south are even lower, with rates as low as \$60/tonne.

13.1.2 Geographic Catchment

The sources of materials were historically from the construction industry, although the introduction of the Clean Sites program - a joint venture between KESAB and the building industry - caused a significant reduction in the volume of waste produced during construction. This may provide a model for other jurisdictions to consider in working to engage the construction industry to achieve better waste outcomes.

The process of construction 10 years ago in South Australia allowed for the stockpiling of large volumes of waste that was eventually cleaned up by a bobcat and large truck and trailer. This volume in large trucks allowed for the transporting of the material to regional, poorly operated landfills.

The Clean Sites program operated to address this on three fronts:

- 1. Undertaking audits of the waste stream and educating the building industry of the sheer volume of waste being produced
- 2. Stopping the stockpiling of waste materials until the end of the project, a practice that had produced waste volumes that accommodated potential transport to regional landfills
- 3. Pushing for the use of skip containers on site to reduce litter and overall waste volumes.



The picture above shows nearly a full pallet of roofing tiles. The builder has paid for the tiles and then again for disposal. The Clean Sites program included educating construction industry workers about the costs of waste on a building site.

The program also promoted the concept of 'a clean site is a safer site'. It is estimated that through the introduction of the Clean Sites program, in conjunction with education of the construction industry through industry forums, there has been a waste reduction from more than eight tonnes per dwelling constructed to less than 2-3 tonnes.

This program has reduced the volume of C&D waste being generated and requiring processing and/or disposal in South Australia.

Most regional councils in South Australia do not receive significant volumes of waste concrete, bricks and rubble. Those that do generally set aside the material for internal use, particularly landfill roads construction. Some sites set the material aside until they have sufficient volume to call in a mobile crusher.

In the case of Port Lincoln, recovered C&D material is presented to a local quarry where it is blended into quarry material products for beneficial reuse.

13.2 Products and Markets

The South Australian Government has been very proactive in supporting recycling and resource recovery, and more than 75% of all C&D waste material is recycled in the state. This currently represents a higher recovery rate than is being achieved by the other Australian states.

The government has introduced levies and sent other signals to the industry that it is focused on increasing the volumes of C&D materials recovered. A review of the Zero Waste SA website¹⁰⁹ reveals the agency actively promotes what it considers to be innovative and successful aspects of its waste management policies:

"South Australia's waste management achievements have been recognised in the UN-HABITAT publication Solid Waste in the World's Cities, which assesses the waste and recycling systems of more than 20 cities worldwide," states the Zero Waste SA website.

The UN-HABITAT publication describes South Australian as an innovative jurisdiction in terms of implementing waste management policies:

"South Australia has demonstrated a high level of political commitment and willingness to 'stick its neck out' and implement some policies and legislation upon which other administrations take a more conservative position. The Zero Waste Act and Plastic Bag Ban are two excellent samples of South Australia's government showing leadership by putting in place arrangements to support a major drive towards the 3R's (reduce, reuse, recycle)."

As described on the agency's website, Zero Waste SA's establishment "was the result of the South Australian Government realising a new strategy was needed to increase waste avoidance and recycling. It was recognised that waste management in South Australia was still fundamentally reliant on landfill, despite efforts to change this".

The recent passing into law of *The Environment Protection (Waste to Resources) Policy 2010* (W2R EPP) has added an additional signal to the market place, with the implementation of landfill bans on certain materials effective from September 1, 2012.

The Department of Transport, Energy and Infrastructure (DTEI) also has several policies¹¹⁰ in place that are designed to encourage the use of recycled products, including the *Green Plan* – *Response to Greening of Government Action Plan (2007)*. This document identifies targets and

¹⁰⁹ www.zerowaste.sa.gov.au/about-us

¹¹⁰ DTEI policies available at www.dtei.sa.gov.au/BuildingManagement/policies/esd

actions to reduce the department's ecological footprint, including areas of focus on waste, resource use and procurement.

The DTEI Transport Services Division - Recycled Fill Material for Transport Infrastructure - Operational Instruction 21.6 provides guidance on the approval requirements for use of recycled materials including asphalt, concrete, timber and soil.

The *DTEI ESD Guide Note Planning, Design and Delivery* of new and refurbished buildings has been 'called up' by the SA Government Parliamentary Public Works Committee and is a requirement for all projects greater than \$4 million. It provides coverage of a range of environmental impacts, including waste and materials.

Under the ESD Guide Note, briefing documentation for consultants during the design of buildings includes reference to reducing material wastage and the selection of sustainable materials. Building construction contractors are required to prepare a Waste Management Plan that separates demolition and construction waste into waste streams, for example rubble, clean fill, metal (aluminium, copper, galvanised iron etc) timber, plasterboard, and glass. The volumes of these materials need to be quantified and their disposal to waste recyclers recorded.

The *DTEI ESD Guide Note Sustainment of Existing Buildings* is incorporated in the government Facilities Management Contract Arrangement, which DTEI manages on behalf of the State Government. The contract includes opportunities to focus on energy, water and waste reduction. Waste reduction applies to the minimisation of wastage during maintenance activities through selection of materials, recycling and other means to reduce waste to landfill.

DTEI also leases office accommodation on behalf of government agencies and has a Green Fit Out Guide that advises on a range of environmental practices including minimising waste, selecting materials with low environmental impact and recycling.

DTEI is currently reviewing the use of Recycled Asphalt Profiles (RAP) in the batching of hot mix asphalt; there is currently up to 10% RAP added to hot mix and DTEI is investigating options for an increase in the percentage of RAP that can be added on its projects.

DTEI has been very successful in supporting the use of recycled products and is at the forefront of state policies in this area, although other sectors of government have the potential to influence the effectiveness of the programs developed and implemented by DTEI. For example, tender documentation put out by the Department of Administration & Information Services (DAIS) expressly states that recycled pavement materials are not suitable for use in its projects. It is unclear why the materials are not considered suitable.

DAIS projects include schools, kindergartens, hospitals and police stations. This meant that, for all of the Federal Government's recent stimulus spending on the 'Education Revolution', tenders for construction excluded the use of recycled materials. However, any waste materials generated during the construction projects did have to be taken to recycling facilities.

The recycling industry processes incoming inert materials into a wide range of quarry products, and tries to balance sales efforts with their incoming raw feeds. Transport SA has developed a specification (*Part 215 – Supply of Pavement Materials*) that accommodates the use of recycled product in road and pavement construction, which represents a large source of demand for recycled C&D materials. The following is a summary of the specification:

Table 13-31 PM 2000 Specifications

Material Classification	Quarry Graded	Quarry Mix Design	Recycled Graded Product	RECYCLED Mix Design
Class 1 20mm	PM 1 20 QG	PM 1 20 QM	PM 1 20 RG	PM 1 20RM
Class 1 40mm	PM 1 40 QG	PM 1 40 QM	PM 1 40 RG	PM 1 40RM
Class 2 20mm	PM 2 20 QG	PM 2 20 QM	PM 2 20 RG	PM 2 20RM
Class 2 40mm	PM 2 40 QG	PM 2 40 QM	PM 2 40 RG	PM 2 40RM
Class 3 20mm	PM 3 20 QG	PM 3 20 QM	PM 3 20 RG	PM 3 20RM
Class 3 40mm	PM 3 40 QG	PM 3 40 QM	PM 3 40 RG	PM 3 40RM
Non Spec Rubble	Comes as a 20mm or 40mm but does not meet a grading curve			

Class 1 Materials are otherwise known as base coarse, used directly under asphalt. The material has a very tight grading curve.

Class 2 Materials are known as sub base and meet a slightly wider grading curve and have a different set of additional specifications. These materials are usually used under concrete, base coarse, or as a hard stand.

Class 3 Materials are generally used as bulk fill, and have a very wide grading curve. This materials is also used under a sub base.

Non Spec Materials can be used as just a standard fill, and does not need any particular geotechnical qualities - but it does have to be free of deleterious contaminants.

If the material is suitable for use in a certain class but does not meet the required specification, companies can apply to Transport SA for an approved mix design. Certificates are supplied and the company can refer to their product as an approved mix design.

QM is quarry mix design, while RM is recycled mix design.

QG is quarry graded materials, while RG is recycled graded material.

DTEI is currently undertaking a project that involves working with the recycling industry in order to increase the use of recycled asphalt profiling. The potential implications of a range of potential limits for recycled content have been considered, starting at 15% and increasing over subsequent years.

Consultation undertaken for this project revealed some concern that the broad range of stakeholders involved in the building and construction process – including project proponents, project designers, suppliers and contractors – forms a complex supply chain, and this complexity can produce a barrier to increasing the use of recycled products. The central issue is that all stakeholders must be aware of the appropriate use of recycled materials, as any one link in the chain may potentially veto the use of recycled materials throughout the project. There does not appear to be a simple solution to this issue, which will require broad engagement and education of all relevant stakeholders.

13.3 Barriers

The SA C&D recycling market is very mature and, as previously stated, this jurisdiction has a higher resource recovery rate from this waste stream than any other Australian jurisdiction, excepting the ACT. Based on the information displayed in Table 3-1, the resource recovery rate from this stream was over 76% in 2008/09. As such, relatively little of the inert C&D material such as concrete, bricks and rubble ends up in landfill within the metropolitan area. The barriers to expanding this industry are largely around maintaining the level of recycling activity, given some of the quality issues with recycled product that have been an issue within the industry over the last few years.

The industry has had some asphalt failures due to the inclusion of poor quality materials in the base coarse. Asphalt 'popping' (or blistering) can be caused by contamination (for example aluminium fines) in the base coarse material. Such failures have occurred because the material used was not suitable for the specific task. The development of a quality blend of base coarse, specifically for use under asphalt, has gone a long way to addressing the issue.

The recently released *Standard for the production and use of Waste Derived Fill*, and its application to the industry in regards to recovered products from the C&D waste stream, could lead to an increase in the cost of production due to more onerous conditions being placed on the material, which require additional testing of materials prior to sale.

13.4 Opportunities

The recycling industry was recently awarded a grant by Zero Waste SA to develop marketing and product quality standards for the production of recycled products from the processing of concrete, bricks and rubble.

The funding was used to help establish Sustainable Aggregates SA, which describes itself as "an industry led group committed to maintaining high benchmark standards of its products and providing a consultative link with its stakeholders". This program has been intentionally established in a form that would make it very adaptable to a national program, such as Sustainable Aggregates Australia.

Sustainable Aggregates SA is actively seeking to expand to have a national presence by linking in with the Waste Management Association of Australia's various state-based C&D working groups. The aim is to try and implement nationally consistent third party accredited branding, which would assist end users to have confidence in the quality of the recycled aggregate products available for purchase.

Additional benefits of such a national program would include allowing for easier transition of specifications across borders, while allowing for the establishment of best practice within the industry and encouraging the implementing of recycled products into road building projects at a national and local level.

13.4.1 The Combustible Fraction

The Alternative Fuel Company is a joint venture owned by SITA ResourceCo and has an off take agreement with Adelaide Brighton Cement that will utilise up to 75,000 tpa of processed engineered fuel. The majority of the material is made up of cellulose based materials - timber, cardboard and paper - that is generally too contaminated and mixed with other products to allow for higher value end uses. The fuel also contains up to 8% comingled plastics.

During the processing of the engineered fuel product, scrap steel is also removed for salvage. Approximately 3% of the total 145,000 tonnes input to the facility is scrap metal.

There is a push through the industry for expansion of such energy from waste projects to recover further resources from residual wastes, and the SA EPA has developed a guideline for the production and use of Waste Derived Fuel. This document sets out the EPA requirements for an energy from waste facility.

The cement industry has a role to play in the reprocessing of mixed C&D waste, due largely to the ability of the existing cement making process to readily take alternative fuels, co-fired with natural gas or coal. A challenge for this process, however, is that a cement kiln can have a substantial downtime (often three weeks or more at a time) when the furnace is periodically relined. By contrast, waste feedstock comes into a treatment facility every day except (Christmas day and Good Friday) and there is therefore an outlet/stockpiling issue to be resolved.

13.5 Key Conclusions

South Australia actively promotes its history of innovation in relation to waste policies and programs, and several initiatives may be useful for other jurisdictions to consider. This includes the successful Clean Sites program - a joint venture between KESAB and the building industry – which enabled a significant reduction in the volume of waste produced during construction, as well as the more recent moves to ban specific materials from landfill disposal and to mandate the sorting of residuals prior to disposal.

The C&D reprocessing industry in South Australia is very mature but, in order to maintain or increase the current level of reprocessing, the industry needs to further develop standards for the production of recycled products. This will ensure the quality of materials will be established and maintained to give end users security that materials are of consistent quality and fit for purpose.

Ongoing work by DTEI will create extended markets for the use of recycled products, which in turn will flow into the civil contract industry. The establishment of National Standards for the production and use of recycled products would be of significant benefit to DTEI in being able to promote their use, particularly in projects that are part federally funded.

The role of the regulator will also determine the continued success of recycled products in the market place. The development of the recently released guidelines for the production and reuse of waste derived fill and its application to recycled products has the potential to affect the ongoing success of the fuel recycling industry in South Australia.

With the enactment of the Environmental Protection Policy in SA on the 1st of September 2012 there will be a substantial change in the way that waste is managed both at an industry and a regulatory level. The regulator will need to work very closely with the industry to create an environment for innovation and investment that will allow for an overall increase in the recovery of resources from the waste stream.

Zero Waste SA and The EPA will need to work closely together to develop strategies that will give the industry a road map on what is acceptable waste management. There are already a series of released guidelines that address the reuse materials from the waste stream:

- Guideline for Stockpile Management Waste and Waste Derived Products for Recycling and Reuse;
- Standard for the production and use of waste derived soil enhancer;
- Standard for the production and use of waste derived fill;
- Standard for the production and use of refuse derived fuel.

These guidelines will support the direction of the Government to meet its vision of diverting 90% of waste materials from landfill by 2015.

Key conclusions and recommendations in relation to C&D waste in South Australia are:

- 1 In order to maintain or increase the current level of reprocessing in South Australia, the industry needs to further develop standards for the production of recycled products to ensure the quality of materials will be established and maintained, giving security to end users that materials are of consistent quality and fit for purpose.
- 2 Industry standards should be developed for the process of receiving waste, with a view to ensuring recycled end products are free of contamination (especially asbestos).
- 3 The establishment of National Standards for the production and use of recycled products would be of significant benefit for promoting reuse in South Australia, particularly in projects that are part federally funded.
- 4 There are opportunities to develop sustainability management plans for transport infrastructure projects that incorporate requirements for contractors to prepare an implementation plan that includes the reduction of waste and use of recycled materials.

14 TASMANIA

14.1 Overview

A clear understanding of the status of C&D waste in Tasmania is severely hampered by the lack of data. To date, the Tasmanian Government (through the Department of Primary Industry, Parks, Water and Environment) has focussed resources on the management of putrescible and hazardous waste streams. Since most of the C&D waste stream does not fall in either of these categories, its management has been neither regulated nor monitored. C&D waste is largely classified as inert, and the State Government does not intervene in or regulate the market for inert materials. Demolition rubble is also classified as 'clean fill', the disposal of which is considered a Level 1 activity, regulated by local councils and generally unmonitored. Therefore, quantities of C&D waste being generated, recovered and landfilled in Tasmania can only be speculated.

Available data would suggest that less than 85,000 tpa of C&D waste are generated in Tasmania, and that C&D waste accounts for 5-15% of total waste landfilled each year. However, the validity of this data is uncertain – quantities reported are based on tonnages of waste recorded at landfill weighbridges and provided to the EPA, and there appear to be anomalies in reporting (possibly due to confusion over waste classifications)¹¹¹. Regardless of current waste generation, the Tasmanian construction industry has been steadily growing over the past decade¹¹², and quantities of C&D waste are likely to increase in the future. There is certainly a growing awareness of the need for increased infrastructure, as evidenced by the recent refurbishment of the Mornington Park Waste Transfer Station to better process C&D waste (the facility has increased its recovery of materials from an average of 3.5 tonnes per month in 2010 to 35 tonnes per month in 2011).

Tasmania's C&D recycling sector is characterised by predominantly small reprocessing companies (<100,000 tpa), council-run sorting facilities (transfer stations) and small building contractors. The largest reprocessing facility is a private operation run by Hazell Bros Group in Kingston, which handles around 180,000 tpa of predominantly aggregate material. Even the larger reprocessing facilities are simple operations relying on manual sorting and basic equipment such as front end loaders.

Tasmania has relatively few major civil works developments, which can both generate considerable amounts of C&D waste as well as absorb large quantities of recycled product. The state's relative isolation and small population challenge the potential for development of C&D processing infrastructure and markets for reprocessed products.

The following sections describe the Tasmanian C&D recycling sector from the perspective of a number of waste generators (building contractors), reprocessors (representing both private and council-run facilities) and regulators. Again, given the lack of verifiable state-wide data on C&D waste flows, it is difficult to put stakeholders' comments into context.

14.1.1 Materials/Source

Tasmanian reprocessors suggest that the commercial construction and demolition sector generates the majority of waste materials accepted at their facilities (75% - 90%). Waste

¹¹¹ Personal communication, Department of Primary Industry, Parks, Water & Environment (April 2011)

¹¹² ABS data (<u>http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1307.6Main+Features10Dec+2009</u>)

generation from the commercial sector appears evenly split across construction and demolition activities.

14.1.2 Gate Fee/Disposal Pricing

Information on gate fees was provided by several recycling/reprocessing facilities, including both a private business and council-run transfer stations. Fees range from \$9 per tonne for clay, fines and rubble to \$47 per tonne for timber and \$50 per tonne for mixed loads. The gate fee for plasterboard varies enormously from \$27 at the private site to \$52 per tonne at the council facility. There is currently no landfill levy in Tasmania and gate fees for landfill disposal range from \$50 to \$80 per tonne.

Waste generators commented on the fact that landfilling C&D waste is cheaper than recycling, and that gate fees at reprocessors presented a disincentive to recover material.

14.1.3 Geographic Catchment

Materials for reprocessing are sourced regionally, with loads transported more than 30km in some instances. However, it is apparent from discussions with industry stakeholders that a division is perceived between activities taking place in Northern and Southern Tasmania. Reprocessors generally described their material sources as being in either North or South Tasmania.

14.1.4 Material Processing

Most common C&D wastes are accepted for reprocessing, either as mixed loads or sourceseparated. Significant material streams are discussed below.

14.2 Material Profiles

14.2.1 Asphalt

The fate of waste asphalt is unclear in Tasmania. Reprocessors surveyed indicated that they accepted waste asphalt (for around \$27 per tonne), but did not provide a 'sell' price or describe an end-market. Anecdotal evidence suggests some quantity of millings is being recycled into hot mix for use on service roads (i.e. at a council-run landfill)¹¹³.

14.2.2 Concrete and Bricks

Some level of concrete and brick recycling is taking place in Tasmania. Waste generators surveyed reported high recycling rates (>80%) for both concrete and bricks. The approach to concrete reprocessing varies depending on the reprocessor and available markets. At one council facility, a private building contractor operates a mobile concrete crusher on-site to produce aggregate to a particular specification for its own use. Another private facility crushes concrete to sell as pavement sub-grade. However, anecdotal evidence suggests the market for reprocessed concrete is limited: a recently opened concrete crushing plant in Southern Tasmania is apparently finding it difficult to sell its product.

¹¹³ Personal communication, Department of Primary Industry, Parks, Water & Environment (April 2011)

14.2.3 Metals

Metal recycling is estimated to exceed 80%. All the recycling facilities surveyed charge a gate fee for metals (\$26 - \$47 per tonne). Recycling facilities, and even some waste generators, sell the metal to scrap merchants. Metal recycling is regarded by some of the contractors interviewed as the only cost-effective waste recovery activity in Tasmania.

14.2.4 Timber

Reprocessors who participated in the survey described several different approaches to managing timber waste. A small amount of wood is salvaged for reuse at some facilities. One reprocessor sends any treated timber to landfill and mulches the remaining wood waste to on-sell as a product for landscaping. Another facility shreds all wood waste (treated and untreated), removes any metal using magnets, and sends to a paper mill for use as furnace fuel – although the process is labour intensive and does not generate a revenue, the avoided landfill costs are substantial and the paper mill accepts as much wood waste as the reprocessor generates.

14.3 Processing Capacity

Processing capacity was not a limiting factor for the reprocessors who participated in the survey. None of the facilities surveyed claimed to be operating at maximum capacity.

14.4 Products and Markets

Several specialised products have been developed from wastes in Tasmania to meet specific local market needs. Shredded waste timber for furnace fuel – as described above – is one such example. Another example is recycled (granulated) container glass being used by a major building contractor for applications such as pipe embedment and concrete slab fill. As mentioned previously, there appears to currently be a limited market for concrete aggregate, at least in Southern Tasmania. One of the surveyed facilities is producing a 'B-grade' soil for landscaping applications, with high market demand.

In general, products and markets do not appear to be well developed. Contractors that participated in the survey claimed to not have easy access to reprocessed products, and do not perceive recycled materials to be cost competitive. However, if a client is willing to pay additional cost to use recycled materials, then contractors are prepared to find sources – there is no apparent concern over quality of reprocessed materials. One interviewee mentioned a client requiring use of recycled aggregates as part of a Green Star rated development. Contractors expressed frustration over the fact that being 'green' was not economically feasible.

14.5 Barriers

14.5.1 Barriers to Materials being Reprocessed

All stakeholders consulted in the course of this study agreed that there is no financial incentive to recycle in Tasmania – for waste generators, landfill costs are cheaper than the costs involved in recovering materials. This is the primary barrier to materials being source-separated and recycled. Not only are landfill gate fees low (there is no mandatory landfill levy in the state), but transport costs for cartage operators add to higher gate fees for reprocessing operations.

Several additional, project-related barriers were suggested by building contractors, such as space restrictions, which can limit the ability to segregate materials on site. Contractors also noted time

constraints for delivering projects, and the additional time required for segregating recyclable wastes, which often meant all material was sent to landfill.

A private reprocessing facility indicated that competition from council-run recycling centres was a further deterrent to material reaching their site, with more centres being established by councils (for examople the recently refurbished Mornington Park Waste Transfer Station).

14.5.2 Barriers to the use of Reprocessed Products

The major barrier to increasing use of reprocessed products in Tasmania is cost. Both reprocessors and contractors interviewed in the course of this study indicated that recycled products generally cost more than virgin materials. From the reprocessors' perspective, processing costs involved in generating products from C&D waste mean sale costs have to be high. One operator also noted that it was difficult to achieve efficiencies of scale from the region, which kept processing costs high.

An additional barrier was identified by contractors as guarantee of material quality. Consumers are unsure of the performance of recycled materials compared to virgin equivalents, and there is limited information available to allay doubts or promote reprocessed products. Given the ready availability of virgin materials for most applications, contractors are not motivated to take the extra time and effort necessary to find suitable recycled materials.

However, if reprocessed products were specified by a customer, contractors surveyed indicated that they would be happy to find and use appropriate products. The use of recycled products is not 'core business' for most contractors, so 'core business products' will take precedence. Specific government procurement policies could improve the market, and to some extent already exist within specific departments. For example, the Department of Treasury and Finance has issued *Treasurer's Instructions 1227¹¹⁴*, which is a 'Climate change and environmental impact' procurement policy for building and road activities. The policy does not appear to be well-known within government, or widely applied.

The Department of Infrastructure, Energy & Resources (DIER) has in place a series of specifications for planning and design purposes, which refer to the use of recycled materials. These include use of materials such as recycled concrete (R40 Base Subbase) and asphalt (R55 Asphalt Placement), and general specifications for road design and construction (G1 to G8)¹¹⁵. Most local councils use the DIER specifications for their own works projects, but it is unclear whether recycled materials are featuring prominently. DIER also has an environmental policy, which could broadly apply to procurement/use of recycled materials, but is not currently being applied in this manner.

14.6 Opportunities

Contractors surveyed would like to see development of guaranteed supply agreements ensuring continuity of recycled products, as well as development of industry standard specifications across all States and Territories. Improved (and actively applied) government procurement policies were identified as a key opportunity for developing the market for reprocessed materials.

Education is a key issue – many businesses are unaware of the availability of reprocessed materials, their application, and 'triple bottom line' benefits. Contractors would be more receptive to using reprocessed products if more information were available, including sources and

http://www.tenders.tas.gov.au/domino/dtf/dtf.nsf/v-ti/94C106B1C74E27DFCA25720A00163918

¹¹⁵ <u>http://www.transport.tas.gov.au/road/specifications/specification_listings</u>

availability in Tasmania. Increasing awareness would develop acceptance and improve the market for products. Government-funded training courses for contractors would also ensure correct application of recycled products for projects.

Contractors surveyed mentioned they have limited capacity to store left over materials from one project, to use in another. One suggestion to address this issue, as well as limited space for sorting materials on site, was for establishment of recycling/reuse centres with yards to store surplus demolition materials without charge, which the company could buy back at a competitive rate (therefore less than the cost of virgin material) and use in another project.

Several contractors suggested a carbon tax or similar mechanism may help alleviate the expense of reprocessed materials and make their pricing more competitive. They expressed the view that, if companies that used recycled product could qualify for some form of carbon tax benefit or equivalent, this may help provide additional financial incentive to offset the extra cost of purchasing recycled product.

14.7 Key Conclusions

Key conclusions and recommendations in relation to C&D waste in Tasmania are:

- 1. Data reporting mechanisms in this jurisdiction are not well developed and at this stage. With so little information on the quantities of C&D waste being generated, recycled and landfilled, any detailed inferences on the status of the sector are likely to be incorrect.
- 2 There is currently no financial incentive to recycle C&D materials gate fees at reprocessing facilities are not competitive with landfill costs.
- 3 There is currently no financial incentive to use reprocessed C&D materials virgin materials are readily available and generally cheaper.
- 4 Government procurement policies would help stimulate the market for reprocessed products.

15 WESTERN AUSTRALIA

15.1 Overview

Table 3-1 shows the resource recovery rate from the C&D waste stream in WA was 29% in 2008-09, which is a significantly lower recovery rate than is being achieved in the other mainland states. There is therefore significant scope to increase the tonnes of C&D material diverted from landfill in this jurisdiction.

The cost of inert landfill across WA is considered too low and difficult to compete with by most of the reprocessors of inert C&D materials, such as concrete and bricks. This is especially true of mixed loads of C&D waste, where the cost to process and recover material may exceed the cost of landfill disposal. Access to recycling facilities is also a barrier, especially in regional areas of the state where there may be landfills in close proximity but recovery activities would incur additional costs of cartage.

Most stakeholders consulted during this review indicated operations were at about 90% capacity (with the notable exception of the largest steel processor in the state, which has significant additional processing capacity). However, most respondents also noted that preliminary investigations into new plant have already been conducted, so decisions could be made quite rapidly to increase processing capacity.

Consistency of supply and volumes were raised as more restrictive issues to reprocessing than availability of markets for all C&D materials.

The greatest opportunity by identified by stakeholders was for governments (state and local) to specify the use or purchase of recycled product in policies, procurement and tender documentation and contracts.

15.1.1 Materials/Source

Key Findings

There is no consistency in terms of percentage split for sources of material from construction or demolition and residential or commercial across the reprocessors. Percentage estimations varied for all respondents, possibly due to the following factors:

- Reprocessors tend to target one or two categories of material, for example glass, plastics, timber, cardboard, plastics and cardboard.
- Where reprocessors target several categories, it is generally aggregate material that is, concrete, bricks, clays, sand, and green waste for mulch.
- Where several aggregate material categories are targeted, the reprocessors contacted seem to concentrate more on certain market segments, for example residential construction commercial demolition or bulk residential demolition.
- Notwithstanding, there is some competition for material sources across reprocessors.

15.1.2 Gate Fee/Disposal Pricing

Key Findings

- Whether gate fees are charged or not depends on the material type. Mostly, reprocessors do not charge gate fees for disposal of plastics, cardboard and metals. Generally, a rebate is given for disposal of cardboard and metals.
- Where gate fees are charged, prices are dependent on the level of source separation. Mixed or contaminated loads tend to incur higher disposal fees than separated loads.
- Contamination of concrete, asphalt and brick waste includes glass, plastics, cardboard, general waste. It is noted that some of these materials could be recycled if separated on site.
- Some reprocessors set fees for skip bins, thus gate fees are essentially included in the skip bin fee.
- Landfill costs are considerably more expensive for disposal of materials that can be recycled, namely plastics, cardboard and metals for commercial loads.
- The cost of inert landfill across WA is considered too low and difficult to compete with by
 most of the reprocessors of inert materials, such as concrete and bricks. This is especially
 true of mixed loads that are simply disposed to landfill where landfills are in closer proximity
 to source sites. At a reprocessor's site, separation of mixed loads incurs higher processing
 costs, which leads to higher gate fees.

Reprocessors gate fees (\$/m ³)	Reprocessors gates fees (\$/t)*	Inert landfill fees (\$/t) - metro	Inert landfill fees (\$/t) – regional**	Putrescible landfill fees (\$/t)
\$45	\$69.75	\$47		
No gate fees Run own collectior service	1			\$145
\$25	\$38.75	\$47	\$20 - \$80	
\$5	\$7.75	Free - \$5		
\$18	\$27.90	\$66		
\$16	\$24.80			
\$12	\$18.60	\$47	\$20 - \$50	
		\$66		
1.6 to 10 m ³ ranges from \$180 to \$560		\$47		
No gate fees Run own collectior service	1			\$145
	Reprocessors gate fees (\$/m ³) \$45 No gate fees Run own collection service \$25 \$5 \$18 \$16 \$12 1.6 to 10 m ³ ranges from \$180 to \$560 No gate fees Run own collection service	Reprocessors gate fees (\$/m³)Reprocessors gates fees (\$/t)*\$45\$69.75\$45\$69.75No gate fees Run own collectionservice	Reprocessors gate fees (\$/m3)Reprocessors gates fees (\$/t)*Inert landfill fees (\$/t) - metro\$45\$69.75\$47No gate fees Run own collection service	Reprocessors gate fees (\$/m³) Reprocessors gates fees (\$/t)* Inert landfill fees (\$/t) - metro Inert landfill fees (\$/t) - regional** \$45 \$69.75 \$47 (\$/t) - regional** \$45 \$69.75 \$47

Table 15-32 Comparison of gate fees at C&D reprocessing facilities to inert landfill

Materials	Reprocessors gate fees (\$/m ³)	Reprocessors gates fees (\$/t)*	Inert landfill fees (\$/t) - metro	Inert landfill fees (\$/t) – regional**	Putrescible landfill fees (\$/t)
Metals (ferrous and non ferrous)	Can be paid for disposal		\$66	\$20 - \$80	
	Free disposal				
	Can be bin pick up fee (not usual))			
Timber	\$5	\$7.75		\$11	\$145

*Conversion based on 1.55t/m3 (DEC (2006), Report for Waste Measurement Model, Available:

http://www.zerowastewa.com.au/documents/waste_measurement_mdl_small.pdf) Note: this is a guide only as reprocessing sites for concrete etc. tend not to have weighbridge facilities and thus charge on a m3 basis for disposal of materials. These figures are given to show comparisons to landfill prices on a per tonnage basis. They should not be used as definitive pricing from industry, where gate fees may depend on terms and conditions established between the reprocessor and the generator.

**Inert landfill gates fees for regional facilities appear to vary to the distance of regional centres to reprocessing facilities. For instance, Shire of Wyndham has lower gate disposal fees than City of Albany for C&D waste. (Tonnage conversion factor used for analysis purposes).

15.1.3 Geographic Catchment

- Source catchment zones tended to vary across reprocessors surveyed, potentially due to competition for materials, and also any special bulk transport rates established with generators.
- Issues in capturing materials from the source include the cost of transport over the required distance compared to the proximity of landfills to source sites.
- In regional Western Australia, materials are frequently disposed of from greater than 30km away owing to large distances between towns and catchment zones for waste materials.
- Interestingly, transporters surveyed collect materials from varied distances including over 30km. Materials are transported to the closest disposal site, landfill or reprocessor. Disposal of material is dependent on arrangements between transporters and reprocessors, size of project (and therefore amount of materials), distance to facilities, and size of transporters operations.

15.1.4 Material Processing

Key Findings

- All categories of C&D waste indicated in Table 15-32 below are currently accepted for reprocessing in Western Australia, though there is reduced capacity for some materials in regional areas.
- C&D processing facilities and capabilities are predominantly located in the Perth metropolitan area with some facilities in regional areas such as Geraldton, Kalgoorlie, Bunbury and Albany.
- Generally C&D company operating licenses are based on volumes of waste accepted and thus tonnage data is not readily available.
- Most C&D reprocessing sites across regional Western Australia do not have weigh bridge facilities.

 Not all reprocessors provided data on quantities processed, however, from those who did it can be estimated that tonnages of C&D waste received at facilities exceed 700,000 tpa (predominantly from the Perth metropolitan area).

Table 15-33 Categories of C&D waste accepted and processed across Western Australia

Materials accepted and processed across Western Australia

Mixed loads	\checkmark
Aluminium	\checkmark
Asphalt	\checkmark
Bricks	\checkmark
Cardboard	\checkmark
Clay, fines, sand & rubble	\checkmark
Concrete	\checkmark
Glass	\checkmark
Mixed loads	\checkmark
Non ferrous metals	\checkmark
Plasterboard & cement sheeting	\checkmark
Plastics	\checkmark
Steel	\checkmark
Timber	\checkmark

15.2 Material Profiles

15.2.1 Asphalt, Bricks, Concrete

Facilities in regional areas of the Pilbara and Kimberley tend to be centred on cardboard, timber, glass, plastics, clays and 'fines' recycling. There is limited capacity to recycle asphalt, bricks and concrete in regional areas, even in areas of increased construction activity around mine sites.

15.2.2 Plasterboard

There is limited capacity to recycle plasterboard in regional areas; recycling of plasterboard and cement sheeting has commenced in metropolitan Perth in early 2011. Only plasterboard from new construction sites that is free from contamination is accepted, and processed into gypsum for use in new plasterboard and/or agricultural products.

15.2.3 Timber

The predominant reprocessor of timber waste processes 15,000 tonnes of untreated timber per annum into woodchip for particleboard, animal bedding and mulch.

15.2.4 Plastics & Cardboard

- In excess of 85,000 tpa of cardboard is processed from Western Australia.
- Most of the larger and smaller waste contactors / collection companies dispose of cardboard and / or plastics to larger processing facilities.
- There is opportunity for more plastics reprocessing to occur directly in Perth if volumes could be guaranteed. This would perhaps require more partnerships and cooperation between collection companies and current reprocessors.

15.2.5 Metals

Ferrous and non-ferrous metals are processed in Western Australia with materials collected state-wide. Materials are generally taken to Perth or Darwin for sorting and are then exported to Asian markets.

15.3 Processing Capacity

15.3.1 Key Findings

- Most respondents indicated operations were at about 90% capacity. This excludes the largest steel processor in the state, which indicated it has significantly greater processing capacity than the volumes of material available.
- Most respondents noted that preliminary investigations into new plant have already been conducted, so decisions could be made quite rapidly to increase processing capacity.
- Consistency of supply and volumes were raised as more restrictive issues to reprocessing than availability of markets for all C&D materials.
- Processing of some materials can be carried out by other reprocessors in the chain depending on the company's operations. For instance, a reprocessor may receive all categories of C&D materials, process some, and send other categories to other facilities e.g. timber, glass, plastics.
- Data on overall processing capability by all respondents indicated that there is currently
 approximately 400,000 tpa capacity (note: not all reprocessors have been contacted for this
 project, however, data collection from most surveys has focused on the large operators who
 treat the significant majority of C&D waste).
- Processing capacity for categories of C&D materials varies with type of material and equipment utilised, responses include:
 - 140 t/hr for 8 hours per day for crushing materials such as concrete, bricks, rubble (from one of the larger processors of this type of material)
 - 50,000 tpa for processing of untreated timber waste by predominant reprocessor
 - At least 30,000 tpa for plastics
 - At least 75,000 tpa for cardboard
 - Significantly exceeds current processing capacity for metals.

15.4 Products and Markets

- C&D material in the form of cement, bricks, rubble and sand is generally reprocessed in Western Australia and sold to the local markets.
- There appears to be a strong market for clean fill, in part possibly owing to the construction of Perth housing being predominantly double brick.
- Cardboard, plastics and steel tend to be sorted and graded and exported via Perth or Darwin to Asian markets. Respondents indicated that volumes received do not warrant the capital expenditure required to invest in reprocessing plants and technology.
- Table 15-34 below lists product types and markets sold into.

Product	Market	Comments	Indicative	Meets specification
			sale price (\$/t	t)
Road base	Potentially Main Roads	Meets specifications for Main Roads fo	r \$8	Depends on supplier
	and more Local	use, however, uptake by Main Roads		but most road base
	Governments road	has been slow according to		meets Main Roads WA
	infrastructure and	reprocessors.		specifications (and
	drainage projects	Discussions with Main Roads		consequently will meet
	Several Local	Sustainability Department indicates that	ıt	any Local Government
	Governments have	the use of recycled materials in not		specifications)
	trialled and / or use	currently included in the 'Sustainability		
	recycled road base in	Policy', and hence does not translate		
	road infrastructure	into 'Specifications' for product use, or		
	projects including City	into procurement for contract tenders.		
	of Canning, City of	Discussions also indicated that the		
	Geraldton, Pilbara	project needs extensive testing to		
	Shire, City of Albany,	ensure it will perform in the same		
	Shire of Augusta	manner as virgin materials. Testing of		
	Margaret River	recycled road base was conducted for		
	Shire of Wyndham	the construction of the New Perth		
	East Kimberley are	Bunbury Highway. Discussions with		
	proposing to include	reprocessors indicated that there has		
	the use of recycled	been no follow-up to this.		
	materials in	Local Government tend to adopt		
	procurement and road	practices / products utilised by Main		
	infrastructure tenders	Roads for major artery roads, hence		
	Water corporation has	this market can also be somewhat		
	used in the	stagnant. Notwithstanding, there are		
	construction of the	many examples of road base that has		
	desalination plant	been used for construction of rural, less	3	
		important roads.		
		Discussions with three local		
		governments and WA Local		
		Government Association indicates that		
		there are limited procurement policies		
		or guidelines for the use of recycled		
		materials in contract tenders. There		
		are exceptions to this within Local		

Table 15-34 Products and Markets

Product	Market	Comments	Indicative sale price (\$/t)	Meets specification
		Government including City of Geraldton, City of Canning.		
Sand	Commercial builders Earthmoving contractors		\$2	
Drainage rock	Civil contractors for deep drainage projects		\$10	
Glass	Used in manufacture o asphalt (about 20,000 tpa)	fHas been used successfully by Shire of Augusta Margaret River in road construction. City of Canning requires the use of 5% recycled glass and 10% recycled asphalt in all of the asphalt laid. Other Local Governments are investigating its use in a similar manner.	\$18	Meets specifications stipulated by Local Governments that have used product
Plastics	Plastic pellets used in local manufacture of containers Baled plastics exported mainly to Chinese markets	Recent legislation in China stipulates that plastics must be sorted by grades. Plastic bottles cannot be included with gother plastics or the batch will not be accepted.	Price varies constantly with markets, and depend on grades	Meets specifications of export markets
Cardboard	Corrugated clippings	Sent to Eastern States for reprocessing into cardboard	Price varies constantly with markets	Meets specifications of export markets
Steel	Ferrous metals are exported to mils across Asia, and manufactured into car bodes etc. Non-ferrous metals are exported to mils across Asia	There is no domestic market in WA for sreprocessing of metals, and the cost to transport via sea containers to Asia is less expensive than to send via road train to Eastern States.	Price varies constantly with markets	Meets specifications of export markets
Timber	Wood chip and wood fines for use in manufacture of particleboard and animal bedding, and limited amounts of coloured mulch	Products are sold to local markets including the Laminex Group, poultry farmers, and landscape suppliers.	\$60	Meets industry specifications for use of products as animal bedding and in manufacture of particleboard

15.5 Barriers

Responses to questions about the barriers to industry development tended to vary depending on the type of C&D waste material. Barriers to all types of materials included:

- Difficulties in negotiating government systems in order to establish or expand operating facilities. Several of the reprocessors consulted during this project said that this is a barrier that impedes development of facilities in both the metro and regional areas of WA.
- Approvals and licensing can take in excess of 12 months. It is too difficult for industry to commit to purchasing capital and plant to open or expand premises given the length of time it takes to comply with all regulations, licensing, planning etc. The process needs to be streamlined and requirements need to be clearly outlined for operators to follow.
- Lack of government (federal, state and local) procurement policies, specifications and tenders for the purchase and use of recycled materials. This again rated high with reprocessors as a barrier to development as governments are seen to be a large potential market and one which can drive other markets. For example, civil contractors will not use recycled product if not outlined in Main Roads WA specifications.
- State and local government representatives interviewed generally responded that there were no policies, specifications or requirements in tender documentation to purchase or use recycled materials. There are some exceptions, for example the City of Geraldton has a policy on use of recycled materials in road infrastructure.
- The presence of 'rogue' operators was highlighted by several of the established stakeholders consulted during this project. The opinion expressed is that rouge operators may devalue products sold from reprocessors of quality products and thus create an image of inferior recycled products. It was suggested that 'Industry Standards' are required, and should be rigorously enforced.
- Lack of awareness of builders and developers as to what materials can be recycled, where and how to dispose of and how much waste management costs (and thus where cost savings can be made).
- Lack of source separation on site, which can affect volumes of mixed waste disposed. This
 is even more pronounced in regional areas as volumes generated are unlikely to amount to
 volumes required to establish reprocessing facilities.
- Timber waste in particular is a material stream that must be uncontaminated (source separated) in order to be recycled. Attaining adequate and consistent volumes of supply can therefore become issues for operations.

Product	Barriers	Rank*	Notes
Concrete, bricks, asphalt	Product perceived as inferior to virgin materials	Low	
	Limited markets if product does not meet specifications for building, civil works, road infrastructure	High	A number of reprocessors produce products that meet market specifications. It would appear to depend on resources in terms of capital, labour and marketing. Most reprocessors stated that the quality of their product is high and comparable to virgin materials.
	Less expensive source of virgin materials	Medium	This is especially true in the Perth metropolitan areas where a number of quarries are located in relatively close proximity to reprocessing facilities.
Glass	Perception of use of glass in manufacture of asphalt	High	Again, Main Roads WA was seen as a barrier in the trial / use of asphalt. Some local governments have used the product e.g. Shire of Augusta Margaret River and been satisfied with results.
			It should be noted that the use of this material on roads is of less primary importance than those which Main Roads WA is responsible for, and thus there may be less of a 'risk factor' in the use of this material.
Cardboard	Tends to be sent for recycling by generators if there are sufficient volumes to source separate for one collection / bin	High	This view is supported by reprocessors in that they do not tend to receive a lot of cardboard from construction sites, but rather from the commercial / industrial sector.
Metals	Tends to be sent for recycling by generators if there are sufficient volumes to source separate for one collection / bin	High	This view is supported by reprocessors in that they do not tend to receive a lot of cardboard from construction sites, but rather from the industrial / mining sector. There is possibly also a degree of 'scavenging' of metals from sites.

Table 15-35 Barriers to C&D industry development specified by material types

*Rank is based on an aggregation of all surveys and also from discussions held with all sectors surveyed and how often and in how much detail certain barriers were discussed. It is noted therefore that the rankings are based on qualitative data analysis.

15.6 Opportunities

The greatest opportunity by far identified (and recorded from most respondents as a key 'take home message') was for governments to specify the use or purchase of recycled product in policies, procurement and tender documentation and contracts. Other opportunities identified by respondents included:

- To work with Main Roads WA (and other end markets) in trialling recycled products that perform and meet expectations on a large area of road infrastructure
- There appears to be an opportunity for reprocessors to educate and/or provide markets with consistent, high quality products in ample volumes when required. The comment on lack of available, quality products for road base was made in the end market and generator surveys.
- To educate waste generators (and more so the companies contracted, for example builders and developers including architects, engineering firms, designers, waste transporters) as to how and where materials can be recycled / recycled products bought, and how much the cost of disposal / purchase compares to 'business as usual'.

15.7 Key Conclusions

Key conclusions and recommendations in relation to C&D waste in Western Australia are:

- 1 There is need for government to support markets for recovered materials, both in terms of increasing internal demand for products as well as assisting to educate the wider marketplace
- 2 Industry standards should be developed, in consultation with the government regulator, to force operators not producing product to specification out of the marketplace and give users confidence in end products
- 3 Source separation by commercial and residential developers and building companies in particular should be further encouraged.
- 4 More emphasis on source separation may encourage reprocessors to establish facilities in regional areas.
- 5 Local governments need to be supported to improve C&D waste performance, especially those in regional areas that are dealing with increased waste from mining developments.
- 6 The reprocessing industry needs to be able to supply consistent, quality products 'on demand' in order to capitalise on end market opportunities.
- 7 There is need for government support to develop policies mandating the use of recycled C&D products.

16 NORTHERN TERRITORY

16.1 Overview

Consultation with stakeholders in the Northern Territory quickly revealed there is very little data relating to the recycling of C&D materials in this jurisdiction. Stakeholders expressed the view that this lack of data is in large part due to the lack of C&D recycling in the Northern Territory. As shown in Table 3-1, there is insufficient information to draw any conclusions about the material composition of the C&D waste stream in this jurisdiction, and the resource recovery rate from this waste stream is believed to be less than 1%.

While this lack of data makes it difficult to draw specific conclusions about C&D waste in the Northern Territory, the low baseline of resource recovery suggests that there is a significant opportunity in this jurisdiction for large improvements in resource recovery performance.

16.2 Processing Capacity

All of Darwin's waste is disposed in the Shoal Bay Landfill owned by the City of Darwin and operated by MACMAHON Holdings (MACM). MACM are paid by the tonne for the waste that is disposed at the facility, and the basis of the consultation undertaken for this report it appears there is no financial incentive for MACM to divert any waste away from the landfill void.

The agreement with MAMC was recently re-signed for a period of 18 months. It is understood the current landfill site has 10-20 years capacity remaining, depending on waste volumes disposed.

The site is made up of:

- Stage 1 A closed Cell
- Stage 2 An inert landfill area (Hardfill)
- Stage 3 The main landfill

There is also a transfer station (with six bays) for the general public operated by MACM, and a greenwaste area for trailers. However, the main volume of greenwaste coming from the commercial sector is directed straight to landfill disposal, because of potential contamination concerns. There is no removal or monitoring of concrete bricks, or any other inert materials.

Rates charged for general waste are \$47/tonne (including GST) and \$32/tonne for greenwaste. Free disposal is available for all ratepayers.

NT Recycling Services has recently been awarded a four year contract with the City of Darwin to remove recyclable materials from the waste stream. The effectiveness of this arrangement may potentially be hampered, however, by the lack of financial incentives for the landfill operator to accept reduced tonnes of waste for disposal.

There is some reuse of waste spoil from excavations, and also reuse of asphalt profiling conducted at the site.

16.3 Products and Markets

Darwin City Council is currently reviewing its waste program and has recently appointed an officer to undertake a review of waste and recycling in the City. There has also been an audit of the waste stream, although that has not been publicly released.

The Department of Natural Resources, Environment, The Arts and Sport (NRETAS) is currently the body that licences landfills in the Northern Territory, and it is currently working on a waste policy with a target of mid next year to release it for discussion. It is intended that the policy will cover off on the three main waste streams of C&D, C&I and MSW.

There is no current policy for procurement of recycled products. There is a strategic policy 2030 in which the Territory is aiming for a 50% reduction in waste to landfill by 2020. The main issue is that there is a lack of clarity around what the current volume/tonnes to landfill are, making it difficult to actually measure the success of this policy.

There are no technical specifications for recycled materials in the NT, as they are not used for any purposes other than as a general fill.

16.4 Key Conclusions

While there is currently no significant infrastructure in place for recycling in Darwin, there is only one waste management site in Darwin at Shoal Bay, so if infrastructure was constructed there would be not issues with multiple sites competing for materials. This one site is also accessible to the whole of Darwin.

Key conclusions and recommendations in relation to C&D waste in the Northern Territory are:

- 1 Landfill disposal costs in the NT are low, compared to other Australian jurisdictions
- 2 There is generally no landfill disposal charge for community ratepayers
- 3 There is very little baseline data
- 4 The Shoal Bay landfill facility has a relatively short operational life remaining (up to 20 years) which may provide a driver for reform
- 5 Darwin City Council is undertaking a review of waste in the city area
- 6 Darwin City Council currently encourages recycling through a two bin collection system
- 7 Darwin City Council has signed a four year agreement with NT Recycling Service to remove C&D materials from the waste stream.

17 REFERENCES

ACIL Tasman (June 2008) *Civil works and recycled content* prepared for the Department of Environment and Conservation WA

APC (2010), ACT Landfill Audits, Combined Final Audit Report for ACT NOWaste.

Australian Bureau of Statistics data (http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1307.6Main+Features10Dec+2009)

Austroads website: www.austroads.com.au

COWAM (2006). Construction and Demolition Waste Management in Germany

Department of Environment and Climate Change (2007) Report into the Construction and Demolition Waste Stream Audit 2000-2005 Sydney Metropolitan Area

Department of Environment and Conservation (2011) *Recycling Activity in Western Australia*, prepared by Hyder Consulting for the Waste Authority

Department of Environment and Conservation (2005) *Guidance Note Assessment of Non-Standard Fuels* (NSW)

Department of Environment and Resource Management (2011) What Does an Industry Waste Levy Mean for Queensland?

Department of Environment and Resource Management (2010) *Queensland's Waste and Recycling Strategy 2010-2020*

Department of Environment and Resource Management (2009) The State of Waste and Recycling in Queensland 2008 Technical Report

Department of Environment, Climate Change and Water (2009) *Guide to licensing under the Protection of the Environment Operations Act 1997*

Department of Environment, Climate Change and Water (2010) Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage (Issue 3)

Department of Infrastructure, Energy and Resources (Tasmania) website: http://www.transport.tas.gov.au/road/specifications/specification_listings

Department of Sustainability, Environment, Water, Population and Communities (2011) *Waste and Recycling in Australia*, prepared by Hyder Consulting

Department of Transport and Main Roads (2010) *Main Roads Specification MRS 35 Recycled Materials for Pavements*

Eco-Buy (2010) The State of Victorian Local Government Green Purchasing in 2008/09

EIONET website:

http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition/constructionanddemolitionwaste/ bycountry?country=AT

EIONET website: (http://scp.eionet.europa.eu/themes/waste#4)

EPA SA (January 2010) Standard for the production and use of Waste Derived Fill

EPA SA The Environment Protection (Waste to Resources) Policy 2010

EPA Victoria (September 2010) Publication 332.2 Calculating the landfill levy and recycling rebates

European Topic Centre on Sustainable Consumption and Production (2011). *Europe as a Recycling Society*

GHD (2008) The use of crushed glass as both an aggregate substitute in road base and in asphalt in Australia Business Case for the Packaging Stewardship Forum of the Australian Food and Grocery Council

HM Revenue & Customs website: www.hmrc.gov.uk

Housing Institute of Australia - COLORBOND® steel, Housing 100, 2009/10

Hyder Consulting (Sept 2009) *Towards Zero Waste Review - Options Analysis* for Sustainability Victoria

Hyder Consulting (2009), 2009 National Plastics Recycling Survey, report to the Plastics and Chemicals Industries Association

Hyder Consulting (2009) Analysis of market drivers and objectives for resource recovery in regional Victoria, Background Report Consultation Draft for Sustainability Victoria

Inside Waste website: www.insidewaste.com.au/storyview.asp?storyid=1034576

Kwinana Industries Council website: www.kic.org.au

Metropolitan Waste Management Group (September 2010) Annual Report 2010, Enabling Change for a Sustainable Future

NEWMOA (2009) Construction & Demolition Waste Management in the Northeast in 2006, report for Northeast Waste Management Officials' Association

NetBalance (2009) Green Purchasing in Australia for EcoBuy

ResourceCo website: www.resourceco.com.au

SA Department of Transport, Energy and Infrastructure (2007) Green Plan – Response to Greening of Government Action Plan

SA Department of Transport, Energy and Infrastructure (2006) *Transport Services Division* - *Recycled Fill Material for Transport Infrastructure - Operational Instruction* 21.6

Sustainability Victoria (2005) Disposal Based Waste Survey

Sustainability Victoria (2008) Kerbside garbage composition

Sustainability Victoria (2010) Victorian Recycling Industry Annual Survey 2008-09

Sustainability Victoria (2010) Towards Zero Waste Strategy Progress Report 2008-09

Sustainability Victoria (2010) *Construction & demolition waste recovery in Victoria 2008-0*9 (Victorian Recycling Industry Annual Survey 2008-09)

Tasmanian Government Tenders website: http://www.tenders.tas.gov.au/domino/dtf/dtf.nsf/v-ti/94C106B1C74E27DFCA25720A00163918

The Age (July 13, 2011) Eighty-five Victorian companies on carbon tax hit list

The Fifth Estate website: http://www.thefifthestate.com.au/archives/21423

UN-HABITAT (2010) Solid Waste Management in the World's Cities

VROM (2010), Getting Ahead with a Successful Chain Approach

WCS Market Intelligence and Waste Management and Environment Media, (2008) *The Blue* Book – Australian Waste Industry, 2007/08 Industry and Market Report
APPENDIX 1

LIST OF STAKEHOLDERS CONSULTED

Construction and Demolition Waste Status Report Hyder Consulting Pty Ltd-ABN 76 104 485 289

Overview – Stakeholders Consulted

A range of stakeholders were contacted during the consultation phase of this project. A series of questionnaires were developed in order to gather relatively consistent information from stakeholders in each of the broad categories (being reprocessors, government agencies, and other stakeholders).

Consultation was undertaken through a mixture of telephone interviews and face-to-face meetings undertaken at various facilities.

The organisations listed in the following tables provided significant input to this report. The numerous organistions that were approached but declined to be interviewed, or which were uncontactable, are not listed in the following tables.

Victorian Organisations Consulted*

Contact	Position Organisation			
Material reprocessors				
Peter Murphy	Managing Director	Alex Fraser Group		
Debbie Skidmore		City Circle Demolition		
Andrew Neideck				
Mike Baker	General Manager	Norstar Steel recyclers		
Tom Buxton		Sunshine Groupe		
Paul Hilton	General Manager recycling	Amcor Paper & Recycling		
Dominic Santullo	GM, Recycling, Purchasing, Transport & Logistics	Delta Group		
Anthony O'Brien	National Purchasing & Logistics Manager	Delta Group		
Fred Moschini	General Manager – Concrete & Quarries (Victoria)	Barro Group		
Beata Robertson		Apex Waste Control		
Allen McPhee		Fyansford		
Duane Brown		Gippsland Concrete Recycling		
Graeme Long		Greater Shepparton Resource Recovery Centre		
Peter Baenziger		Mansfield Construction		
Industry specialist				
Chris Cox	Principal Consultant	Ellerslie Consulting		
Government agencies				
Matthew Gordon	Project Manager, Sustainable Solutions Unit	EPA Victoria		
Brock Baker	Project Manager Materials Efficiency	Sustainability Victoria		
John Polhill	Business, Innovation & Technology			
Vern Steele	Strategic Resource Efficiency	Metropolitan Waste		
Clarissa Forster Strategic Resource Recovery Team		Management Group		

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Andrew Walker	ndrew Walker Manager Construction Materials		
Graeme Newman	Specialist Consulting Quarry Materials	Team)	
Sven Scheppokat	Quarry Products Consultant		
lan Butterworth	GM, Infrastructure and Engineering	Maribyrnong City Council	
Gary Balcalm	Manager Engineering Projects		
Steve Boukavalis			
lan Hirth			
Peak industry organisa	itions		
Andrew Tytherleigh	Executive Officer	Victorian Waste Management Association	
John Hennessey	Sector Development Consultant	Municipal Association of Victoria	
Janine Strachan	Executive Director Building Products and Sustainable Technology	Housing Industry Association	
Philip Alviano	Sustainable Building Advisor	Master Builders Association of Victoria	
John Lambert Chief Executive Officer Australian Asp Association		Australian Asphalt Pavement Association	

NSW Organisations Consulted*

Contact	Position	Organisation	
Material reprocessors			
Terry Martin		Brandown Quarry, Waste & Recycling Services	
David White	Resource Development	Benedict Industries	
David Reid	Senior Project Manager - Recycling	Metropolitan Demolitions	
Brent Lawson	Managing Director	Concrete Recyclers	
Peter McLaughlin	Manager Strategic Planning	Cardinal Group (Reefway Waste)	
lan Collier		Boral Recycling	
Kerry Whitehead	Operations Manager Civil and Open Space	Fairfield City Council	
Luke Parker	Managing Director	Sell & Parker	
Andy Divall	Owner	Divalls Bulk Haulage (Goulburn Soil and Soil)	
Government agencies			
John Street	Senior Project Officer	Office of Environment & Heritage (Formerly DECCW Sustainable Programs Division)	
Henry Moore	Manager Waste Reform	Office of Environment & Heritage (Environment Protection and Regulation Group)	
Chris Mcelwain	Manager of Waste Management	Office of Environment & Heritage (Environment Protection and Regulation Group)	
Kerry Whitehead	Operations Manager Civil and Open Space	Fairfield City Council	
Peak industry organisatio	ns		
Mick Savage	Manager Roads & Transport Directorate	Institute of Public Works Engineering Australia	
Tony Khoury	Executive Officer	Waste Contractors & Recyclers Association (NSW)	
lan Collier	NSW C&D Working Group - President	Waste Management Association of Australia	
Stephen Mitchell	Sustainability Program Manager	Timber Development Association (Australia)	

Queensland Organisations Consulted*

Contact	Position	Organisation	
Material Reprocessors			
Bernard Murphy	General Manager – Consultant	BMI Waste	
Chris Alexander	General Manager – Resource Recovery	Veolia Environmental	
Mark Deker	Manager Projects QLD	Trans Pacific Industry	
Rodney Johnson	State Manager	QLD Recyclers (Alex Fraser)	
Ken Beutel	General Manager	Beutel Oughtred & Sons	
Government Agencies			
Kylie Hughes	Director, Waste Reform Policy & Legislation	DERM	
Warren Muller	Project Design WARE	DERM	
Zoe Tkali	Waste Reform WARE Program Development	DERM	
Sandra Flanagan	Manager – Environmental Sciences, Rockhampton	DERM	
Tony Baker	Senior Environmental Officer, Rockhampton	DERM	
Shari Grinke	Senior Environmental Officer, West QLD Office	DERM	
Chris Buckingham	Principal Environmental Officer, Far North Region	DERM	
John Harper	Acting Manager, Waste Management Branch	Toowoomba Regional Council	
Peak Industry Organisation	IS		
Rick Ralph	Executive Officer	WAQRA	
Rod Welford	CEO	ACOR	

Australian Capital Territory Organisations Consulted*

Contact	Position	Organisation		
Industry Personnel				
Shirley Carandang		Delta Pty Ltd		
Brian Corkhill		Corkhill Bros Sales Pty Ltd		
Mathew Kon		Boral ACT		
Peter Poulos		ACT Recycling Pty Ltd		
Government Personnel				
Lea Durie		Land Development Agency – ACT Government		
Peter Thompson		Roads ACT		
Michael McGee		ACT No Waste – Industry and Market Development		
Bruce Edgerton		Department of the Environment, Climate Change, Energy and Water (DECCEW)		
		Sustainability and Climate Change Policy Branch		

South Australian Organisations Consulted*

Contact	Position Organisation				
Industry Personnel					
Stan Kapoulitsas	Managing Director	All State Group			
Simon Brown	Managing Director	ResourceCo			
Chris Latham	SA Manager – Demolition	McMahon Services			
Mathew Size	General Manager	Adelaide Resource Recovery			
Robert Rodato	Manager	SA Waste Management			
Engineering Companies					
Paul Lightbody	Partner	Tonkin Consulting			
Jeremy Clapp	National Civil Manager FMG consulting				
Government Personnel					
Vaughan Levitzke	CEO	Zero Waste SA			
Andrew Evans	Senior Policy Officer SA EPA				
Dave Polo	Material Technology Manager DTEI				
Anne Welsh	Principal Environmental Officer	DTEI			
Regional Government Pers	sonnel				
Craig Matner	Works Manager	Port Lincoln			
Darren North	Manager	Port Pirie			
Darryl Secton	Director Opp Services	Mt Gambier			

Tasmanian Organisations Consulted*

Contact	Position	Organisation	
Industry Personnel			
Peter Bennett		Hazell Bros Group	
		Leslie Vale Quarry	
		Kingston Tasmania	
Craig Edmunds		Fairbrother	
Bill Pearse & Celia Hall		Mornington Park Waste Transfer Station	
Government Personnel			
Brian Watson		Department of Infrastructure, Energy and Resources	
Jamie Clarke		Department of Primary Industries, Parks, Water and Environment	
Jeff Holmes		Hobart City Council	

Western Australia Organisations Consulted*

Contact	Position	Organisation	
Louis Bettini	Sustainability Coordinator	Main Roads WA	
Jo Partridge	State Manager	InterfaceFLOR	
Colin Leek	City of Canning	Project Engineer	
Greg Simpson	Manager, Environmental Health Services	Shire of Augusta, Margaret River	
Katya Tripp	Environmental Projects Officer	Shire of Wyndam, East Kimberly	
Malcolm Beckwith	State Manager	Laminex	
Len Brajkovich		WA Broilers Association	
	Manager	Soils ain't Soils	
Mark Wong		City of Geraldton Greenough	
Reuben Gregor	Project Coordinator – Waste Management Branch	Department of Environment & Conservation	
Wendy Muir	Manager – Strategic Partnerships	Office of the Waste Authority	
Rebecca Brown	Manager – Waste & Recycling	Municipal Waste Advisory Council	
Carolyn Marshall		BMW	
Adam Proctor	WA Operations	ReGyp	
Craig McGrath		Sims Metals	
Heidi Dauth		All Earth Group	
Dave Markham		Capital Recycling	
Brian Jones		EMRC – Hazelmere Timber	
Gavin Corps		Damien Cole Group	
Jamie Young		Amcor	
Peter Harkins		Colmax	
Terry Gleeson		Fulton Hogan Industries	
Francis Burke	Director	Earthcare Recycling	
Jarrad Green	General Manager	Instant Waste	
Ken Cowl	Perth C&I Manager	Transpacific Industries	
Eddie Spadek	Sales Manager	SITA	
Vinh Nguyen	Senior Environmental Advisor	Georgiou Group	
lan Counsell	Manager – Corporate Services	Broad Construction Group	
		Brookfield Multiplex	
Nigel Smith		Diploma	

Northern Territory Organisations Consulted*

Contact	Position	Organisation	
Industry Personnel			
Leon Schultz	Managing Director	NT Recycling Services	
Mark Johnson	General Manager NT	Veolia NT	
Dirk Dunser	Operations Manager	Veolia NT	
Matt Wheeler	Regional Manager NT	TPI Cleanaway	
Phil Bubner	National Demolition Manager	McMahon Svc	
Local & State Government	Personnel		
Meredith Newall	Team Leader – Waste & Recycling	Darwin City Council	
Ewan Gunn	Manager – Environmental Operations	NRETAS**	
Dr. Emma Young	Director, Policy & Programs	NRETAS**	
Wendy Walsh	Environmental Policy Officer	NRETAS**	
Libby McAllister	Senior Policy Officer	NRETAS**	

* Other organisations were invited to participate but were either unavailable or declined.

** The Department of Natural Resources, Environment, The Arts and Sports

APPENDIX 2

KEY PARAMTERS FROM A SELECTION OF RELEVANT SPECIFICATIONS

Key Specification Parameters – Overview

There are a range of potential end use markets for recycled C&D waste materials, although by far the greatest tonnes of material is used in civil engineering works. The tables presented in this Appendix highlight key performance characteristics specified in a selection of relevant specifications in NSW, Victoria, Queensland, South Australia and Western Australia. The information is based on summary tables published by Sustainable Aggregates SA¹¹⁶.

This Appendix does not cover an exhaustive list of specifications in each jurisdiction, and does not include all characteristics within those specifications. The tables are primarily presented to allow a simplified comparison of key specifications across different jurisdictions.

NEW SOUTH WALES			
Specification R1, R2 (2009 greenspec)			
Particle Size Distribution	R1	R2	Typical Result
Sieve size (mm)	Percent Finer	Percent Finer	
26.5	100	100	100
19	95-100	85-100	98
13.2	70-90	70-90	87
9.5			
6.7	50-70	45-70	60
4.75			
2.36	35-55	30-55	35
0.43	10-30	10-30	20
0.08	5-15	5-15	7
Atterberg Limits			
Liquid Limit (LL)	27		25
Plasticity Index (PI)	5		2
Strength Characteristics			
Wet Strength	min 70	min 50	57
Wet Dry Strength variation	max 35	max 40	23
Max Dry Compressive Strength	min 1.7	min 1.0	2.4
Unconfined compressive strength	max 1.5	max 1.5	0.5
Foreign Materials			
Metal, glass and ceramics	3	5	
Plaster, clay lumps and other friable materials	0.2	0.2	
Rubber, plastic, bitumen, paper, cloth, paint, wood and other vegetable matter	0.1	0.1	

¹¹⁶ More information and links to the specifications are available at <u>www.sustainableaggregates.com.au</u>

VICTORIA	VICTORIA				
Section 820 Light Duty Basecourse CC2, CC3, CC4					
Particle Size Distribution	CC2	CC3	CC4	Typical Result	
Sieve size (mm)	Percent Finer	Percent Finer	Percent Finer		
26.5	100	100	100	100	
19	95-100	95-100		98	
13.2	78-92	75-95		87	
9.5	63-83	60-90		70	
4.75	44-64	42-76		56	
2.36	30-48	28-60	42-76	35	
0.43	13-21	10-28	10-28	20	
0.08	5-9	2-10	2-10	7	
Atterberg Limits					
Liquid Limit (LL)	35	35	40	25	
Plasticity Index (PI)	6	10	20	2	
Los Angeles Abrasion					
	max 35	max 40	max 45	37	
California Bearing Ratio (CBR)					
	min 100	min 80	min 20	120	
Foreign Materials					
High density materials such as metal, brick and glass	2	3	5		
Low density materials such as plastic, rubber, plaster, clay lumps and other friable material	0.5	1	3	ОК	
Wood and other vegetable or decomposable matter	0.1	0.2	0.5	OK	

QUEENSLAND					
MRTS35 – Recycled Materials for Pavements					
Particle Size Distribution	RM001	RM002	RM003	RM004	RM005, RM006
Sieve size (mm)	Percent Finer	Percent Finer	Percent Finer	Percent Finer	Percent Finer
26.5	100	100	100	100	100
19	95-100	95-100	95-100	95-100	84-100
13.2	78-92	78-92	75-95	75-95	69-95
9.5	63-83	63-83	60-90	60-90	56-90
4.75	44-64	44-64	42-76	42-76	37-77
2.36	30-48	30-48	28-60	28-60	23-63
0.425	13-21	13-21	10-28	10-28	8-30
0.075	5-9	5-9	3-11	3-11	2-14
Atterberg Limits					
Liquid Limit (LL)	35%	35%	35%	35%	40%
Plasticity Index (PI)	6%	8%	8%	12%	14%
Strength Characteristics					
Wet Dry Strength variation	35	40	45	45	45
California Bearing Ratio	80	60	45	35	15
Unconfined compressive strength at 7 days	0.7	0.7	0.7	0.7	0.7
Foreign Materials					
Brick, metal, glass, ceramics and slag	3%	3%	3%	3%	2 (metal, ceramics and slag)
Plaster, clay lumps and other friable materials	1%	1%	1%	1%	1%
Rubber, plastic, bitumen, paper, cloth, paint, wood and other vegetable matter	0.2%	0.2%	0.2%	0.2%	0.2%

SOUTH AUSTRALIA						
Part 215 Master Road Specification PM1, PM2, PM 3						
Particle Size Distribution	PM1/20	PM2/20	PM3/20	Typical Result		
Sieve size (mm)	Percent Finer	Percent Finer	Percent Finer			
26.5	100	100	100	100		
19	95-100	90-100	90-100	98		
13.2	77-93	74-96		87		
9.5	63-83	61-85		70		
4.75	44-64	42-66	40-65	56		
2.36	29-49	28-50		35		
0.43	13-23	11-27		20		
0.08	5-11	4-14	5-15	7		
Atterberg Limits						
Liquid Limit (LL)	max 25%	max 28%	35	25		
Plasticity Index (PI)	1%-6%	1%-8%	15	2		
Linear Shrinkage (LS)	max 3%	max 4%	8	1		
Los Angeles Abrasion						
	max 30	max 45	max 45	37		
Foreign Materials						
High density materials, brick, glass	20	20	20			
Low density materials such as plastic, rubber, plaster, clay lumps and other friable material	max 1%	max 1%	max 1%	ОК		
Wood and other vegetable or decomposable matter	max 0.5%	max 0.5%	max 0.5%	ОК		
Bitumen Content	max 1%	max 1%	max 1%	Nil		

WESTERN AUSTRALIA				
Particle Size Distribution	Limits	Typical Result		
Sieve size (mm)	Percent Finer	Percent Finer		
26.5	100	100		
19	71-100	98		
13.2				
9.5				
6.7				
4.75	36-65	56		
2.36				
0.43				
0.08	2-14	7		
Atterberg Limits				
Liquid Limit (LL)	45	25		
Plasticity Index (PI)		2		
Linear Shrinkage	4			
Strength Characteristics				
California Bearing ratio (CBR)	min 50	120		
Unconfined compressive strength	max 1.0	0.5		
Foreign Materials				
High Density Materials (brick, glass, etc)	15			
Low Density Materials (plastic, plaster, etc)	3			
Wood and other vegetable matter	1			