Cardno
Shaping the Future

ASSESSMENT OF WASTE DISPOSAL AND MATERIAL RECOVERY INFRASTRUCTURE FOR PERTH

Towards 2020

December 2008
Job No. V8036

Waste Authority

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EXECUTIVE SUMMARY

Introduction

Recent temporary closures to some of the key waste management infrastructure in the Perth Metropolitan Region have highlighted the limitations on certain facilities and raised questions about the short and long term adequacy of waste management infrastructure in this region. The Waste Authority recognises these concerns amongst stakeholders and the desire for more effective waste infrastructure and contingency planning. The Waste Authority also recognises that shortfalls in the provision of waste management infrastructure across the Region may jeopardise optimal sustainable waste management practices. Increasing the provision of such infrastructure would assist in making the State vision of 'Towards Zero Waste' a more achievable target.

Cardno WA Pty Ltd (Cardno) has been contracted by the Waste Authority to conduct an "Assessment of Waste Disposal and Material Recovery Infrastructure for Perth". The main aim of the study is to assess the current infrastructure for waste and recycling in the Perth Metropolitan Region and anticipate the best way to respond to future demands. The timeframe for this report is projected towards 2020 (2019/20 financial year).

Total Perth Metropolitan Region Waste / Recycling Generation

The Perth Metropolitan Region continues to increase the amount of waste it produces (**Table E1**), however this is somewhat being offset by increased recycling activity. The Perth Metropolitan Region generated approximately 5.3 million tonnes of waste in 2006/07. Of this, 3.6 million tonnes was sent to landfill and 1.7 million tonnes was recycled (32% recovery rate). Commercial and Industrial (C&I) and Construction and Demolition (C&D)) have shown increases in waste to landfill and recycling, whilst MSW has varied somewhat over the past three financial years.

Table E1: Summary of total generation of waste (by waste stream) and destination (landfill or recycled) between 2004/05 and 2006/07 in tonnes

	2004/05		2005/06		2006/07	
Waste Stream	Landfill	Recycled	Landfill	Recycled	Landfill	Recycled
MSW	720,220	343,150	698,240	403,520	714,090	388,600
C&I	539,270	800,000	668,430	881,340	830,380	890,560
C&D	1,586,600	300,000	1,709,690	331,610	2,096,960	409,350
Total	**2,846,090**	**1,443,150**	**3,076,360**	**1,616,470**	**3,641.430**	**1,688,510**

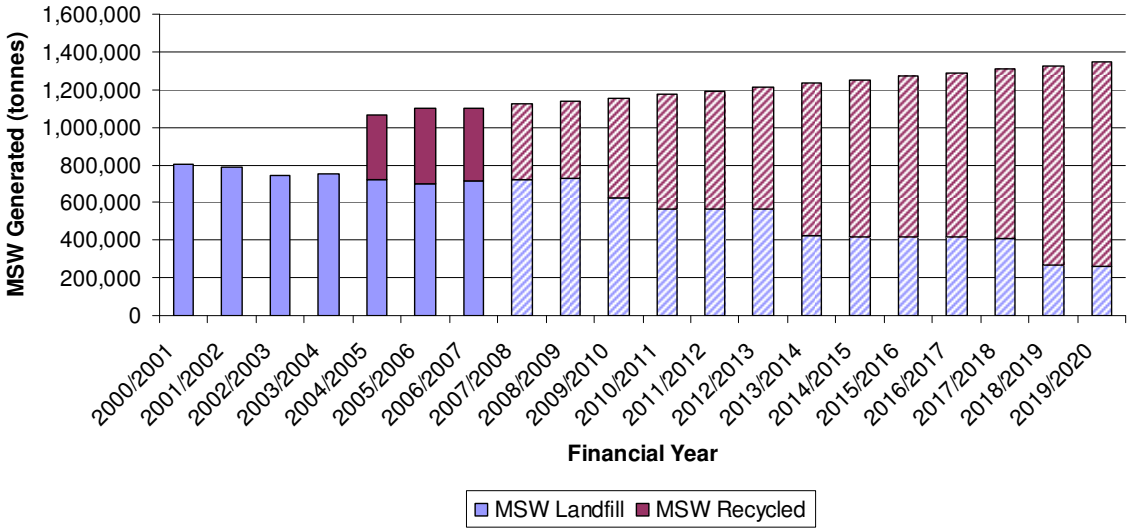
Note: Recycling totals are for Western Australia, however >95% can be considered from the Perth Region

Approximately 80% of the MSW kerbside waste is recoverable, whilst >90% of C&I and C&D is potentially recoverable if waste mixing / contamination is minimised.

Waste Projections - MSW

Figure E1 illustrates the predicted increase in MSW generation over time if it is assumed MSW waste generation is directly correlated with population and the predicted decline in MSW waste requiring landfill towards 2020. This decline can be mostly attributed to the commissioning of proposed Resource Recovery Facilities (RRFs) that will divert significant tonnages of organics and recyclables from the MSW waste stream.

Figure E1: Past and Future MSW projections for the Perth Metropolitan Region



Assumptions:
- AnaeCo (55,000 tonnes) and BioVision 2020 Stage 1 (100,000 tonnes) RRFs commence operation in 2009
- RRC RRF (100,000 tonnes) commences operation in 2011
- EMRC Stage 1 (100,000 tonnes), MRC Stage 2 (100,000 tonnes) and SMRC Stage 2 (80,000 tonnes) commence operation in 2013
- ATLAS contract is not extended post 2013
- MRC Stage 3 (100,000 tonnes) and EMRC Stage 2 (100,000 tonnes) commence operation in 2018
- RRFs all operate at design capacity
- RRFs divert 70% of MSW from landfill
- MSW / Recycling activity is correlated with population growth
- The Perth region will increase MSW recycling (rate per head of population) by 1% per annum
- All compost derived from the RRFs is marketable
- No thermal technologies are commissioned

Note:
- No recycling activity data has been collected prior to 2004/05
- An increase of recycling per head of population of 1% is over and above the impact of known RRFs, however this does not alter the diversion rate significantly
- Generally 30% of the weight of organics diversion is water. This total has been included in the projected "MSW recycled" to illustrate diversion rates. As 30% water has not been included for SMRC and ATLAS organic recycling totals between 2004/05 and 2006/07 recycling totals can be considered conservative.

Based on current projections (with assumptions) MSW generation is set to reach approximately 1.34 million tonnes (an increase of 241,000 tonnes or 22%) by 2019/20. Increased MSW recycling is predicted to decrease the amount of waste being sent to landfill per year by approximately 470,000 tonnes in 2019/20. This is equivalent to approximately 17% of the total amount of MSW waste generated requiring landfill by 2020.

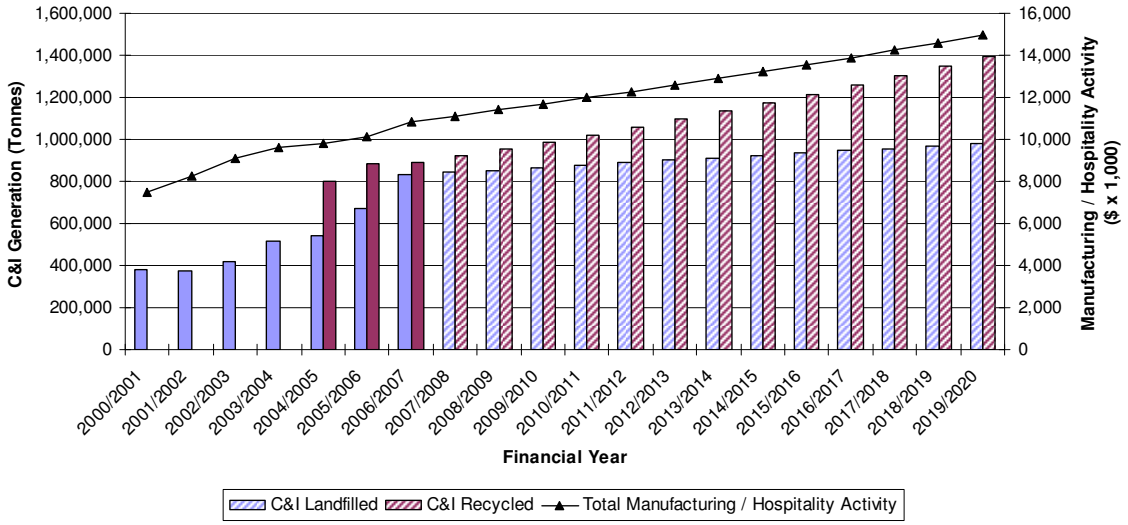
Sensitivity analysis (alternate assumptions) suggests the amount of MSW that will require landfill by 2019/20 will range between 194,000 and 360,000 tonnes per year (a decrease of between 355,000 and 520,000 tonnes over 2006/07 MSW to landfill tonnages).

Waste Projections – C&I

C&I waste to landfill has shown strong growth, with an average growth rate of 9% since 1998/99. The past two years have shown even stronger growth rates with 23% and 24% growth respectively. However, for the purposes of this study it has been assumed that C&I waste generation and certain statistical indicators that make up GDP are correlated. These statistical indicators include Manufacturing Activity and Accommodation / Cafes and Restaurant Activity (MACHR).

Figure E2 outlines the correlation between MACHR indicators, Reserve Bank (August 2008) GDP growth and C&I waste generation over the past seven years and assumed future projections to 2014/15.

Figure E2: Past and Projected C&I waste generation



Assumptions:
- C&I waste / recycling activity is correlated with GDP (MACHR)
- Average 2.5% growth (Reserve Bank 2008) in MACHR
- The Perth C&I businesses will increase recycling (above C&I activity) by 1% per annum
- No commercial RRFs to be commissioned

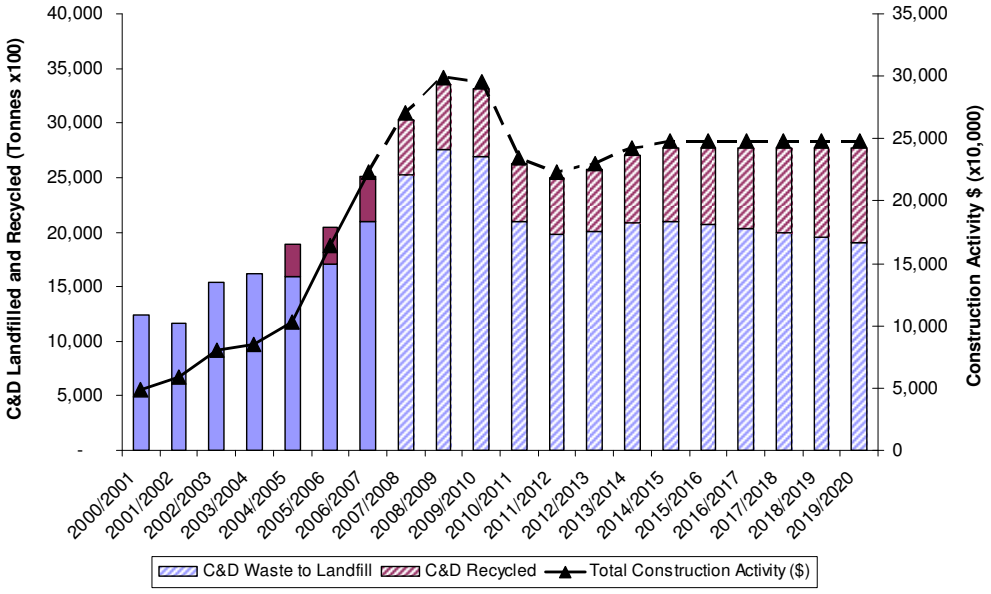
Note:
- No recycling activity data has been collected prior to 2004/05
- Reserve Bank only projects to 2010/11

Based on the projections outlined above the Perth Metropolitan Region is set to increase the amount of C&I waste being sent to landfill by approximately 19% (or 147,000 tonnes) by 2019/20. Sensitivity analysis (alternate assumptions) suggests the amount of C&I that will require landfill by 2019/20 is likely to range between 830,000 and 1.1 million tonnes. If C&I RRFs were to be constructed, C&I waste to landfill would decrease.

Waste Projections – C&D

For the purposes of this study Cardno has assumed there is a direct correlation between construction activity and C&D waste generation and recycling. Construction forecasts to 2014/15 have been obtained from the Construction Forecasting Council (CFC). **Figure E3** on the following page outlines this apparent correlation.

Figure E3: Past and Projected C&D waste generation



Assumptions:
- C&D waste / recycling activity is correlated with construction activity
- The Perth C&D industry will increase recycling (above construction forecast) by 5% per annum
- Construction Activity will remain at $25 billion post 2014/2015
- The number of recyclers will remain constant

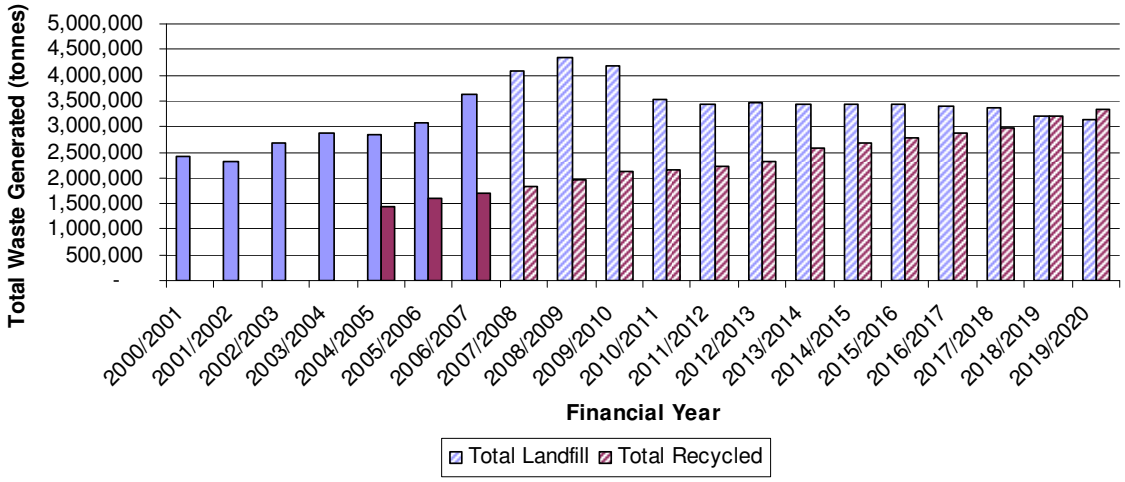
Note: No recycling activity data has been collected prior to 2004/05

As outlined above the amount of C&D waste generated is set to fluctuate over the next few years with construction activity set to peak in 2008/09 and then slow rapidly until 2010/11 and then remain static. Based on the projections outlined above the Perth Metropolitan Region is set to decrease the amount of C&D sourced waste to landfill by approximately 30% (or 640,000 tonnes) by 2019/20. Sensitivity analysis (alternate assumptions) suggests the amount of C&D that will require landfill by 2019/20 is likely to range between 1.7 and 2.3 million tonnes.

Waste Projections - Combined

Based on MSW, C&I and C&D statistical indicators and Cardno assumptions waste to landfill is predicted to peak in 2008/09 and will then gradually decline to 2019/20 (**Figure E4**). This will be a result of greater recycling activity and a slowdown in construction activity. It is predicted that approximately 50% of the total waste generated will be diverted from landfill by 2019/20, however 3.1 million tonnes of material will still require disposal to landfill. The majority of this waste will be C&I (978,000 tonnes) and C&D waste (1.91 million tonnes). Diversion of MSW to RRFs is set to significantly decrease the amount of waste being sent to landfill by 2019/20.

Figure E4: Past and projected total waste generation (landfill / recycling) in the Perth Metropolitan Region between 2000/01 and 2019/20



Waste Infrastructure Summary

The Perth Metropolitan Region has a number of geographically distributed waste infrastructure facilities that have a specific purpose depending on the waste stream that requires disposal or recycling. Facilities currently include Class I (inert) landfills, Class II / III (putrescible) landfills, a Class IV (hazardous) landfill, Inert and putrescible transfer stations, Material Recovery Facilities (MRFs), Resource Recovery Facilities (RRFs) and greenwaste processors. Other recyclable reprocessors are also located in the Perth Metropolitan Region, but are not concentrated on in this study.

Waste Infrastructure currently available or under construction are outlined in **Table E2**.

Table E2: Waste Infrastructure currently in place that service the Perth Metropolitan Region

Type of Facility	Number
Class I (inert) landfills	12
Class II / III (putrescible) landfills	7
Class IV (hazardous) landfills	1
Inert “recyclers”	2
Inert “transfer / recycling” stations	3
Inert “transfer” stations	3
Putrescible transfer stations	9
Municipal MRFs	7
Major commercial MRFs	2
Municipal RRFs	2 (2 under construction)
Greenwaste processors	15

The distribution of each type of waste infrastructure is outlined in the Appendices.

The summary of current throughput, maximum throughput, slack capacity, landfill airspace remaining and predicted life expectancy (based on current throughputs) for waste infrastructure in the Perth Metropolitan Region is presented in **Table E3** on the following page.

Table E3: Summary of Waste Infrastructure (actual / maximum) throughput, slack capacity, airspace remaining and estimated facility type lifespan within each Regional Council

Regional Council	Infrastructure	Actual throughput (T)	Maximum throughput (T)	Slack Capacity (T)	Remaining Airspace (m3)	Facility Lifespan (2006/07 throughput) (years)
MRC	Landfills (Putresible)	356,300	N/A	N/A	4,500,000	10
	Landfills (Inert)	1,065,275	N/A	N/A	3,720,000	5
	Material Recovery Facility (MRF)	22,000	32,000	10,000	N/A	Unknown
	Resource Recovery Facility (RRF)	66,000	66,000	-	N/A	Unknown
	Inert Recycler	No Inert Recyclers				
	Transfer Station (Putresible)	80,500	90,000	9,500	N/A	Unknown
	Transfer Station (Inert)	No Inert Transfer Station				
	Greenwaste	20,000	70,000	80,000	N/A	Unknown
EMRC	Landfills (Putresible)	356,225	N/A	N/A	13,200,000	30
	Landfill (Hazardous)	25,000	N/A	N/A	290,000	14
	Landfills (Inert)	114,560	N/A	N/A	70,000	1
	Material Recovery Facility (MRF)	40,000	45,000	5,000	N/A	Unknown
	Resource Recovery Facility (RRF)	No RRF at present				
	Inert Recycler	235,000	1,390,000	1,165,000	N/A	Unknown
	Transfer Station (Putresible)	29,750	35,000	5,250	N/A	Unknown
	Transfer Station (Inert)	130,000	-	-	N/A	Unknown
	Greenwaste	31,000	56,000	15,000	N/A	Unknown
RRC	Landfills (Putresible)	244,754	N/A	N/A	3,250,000	11
	Landfills (Inert)	90,000	N/A	N/A	200,000	3
	Material Recovery Facility (MRF)	19,500	19,500	-	N/A	Unknown
	Resource Recovery Facility (RRF)	No RRF at present				
	Inert Recycler	130,000	175,000	45,000	N/A	Unknown
	Transfer Station (Putresible)	14,500	15,000	500	N/A	Unknown
	Transfer Station (Inert)	-	-	-	N/A	-
	Greenwaste	35,000	81,250	46,250	N/A	Unknown
SMRC	Landfills (Putresible)	521,816	N/A	N/A	9,200,000	14
	Landfills (Inert)	962,151	N/A	N/A	9,500,000	15
	Material Recovery Facility (MRF)	150,500	212,400	61,900	N/A	Unknown
	Resource Recovery Facility (RRF)	100,000	115,000	15,000	N/A	Unknown
	Inert Recycler	155,000	279,000	124,000	N/A	Unknown
	Transfer Station (Putresible)	121,000	281,000	59,000	N/A	Unknown
	Transfer Station (Inert)	-	-	-	N/A	Unknown
	Greenwaste	74,600	98,000	23,400	N/A	Unknown
WMRC	Landfills (Putresible)	No Putresible Landfill				
	Landfills (Inert)	No Inert Landfill				
	Material Recovery Facility (MRF)	No MRF				
	Resource Recovery Facility (RRF)	No RRF (Operational 2009)				
	Inert Recycler	No Inert Recycler				
	Transfer Station (Putresible)	35,000	50,000	15,000	N/A	Unknown
	Transfer Station (Inert)	No Inert Transfer Station				
	Greenwaste	6,000	6,500	500	N/A	Unknown
Total	Landfills (Putresible)	1,479,095	N/A	N/A	30,150,000	16
	Landfills (Hazardous)	25,000	N/A	N/A	290,000	14
	Landfills (Inert)	2,231,987	N/A	N/A	13,490,000	9
	Material Recovery Facility (MRF)	249,000	333,900	84,900	N/A	Unknown
	Resource Recovery Facility (RRF)	166,000	181,000	15,000	N/A	Unknown
	Inert Recycler	390,000	1,669,000	1,289,000	N/A	Unknown
	Transfer Station (Putresible)	280,750	471,000	89,250	N/A	Unknown
	Transfer Station (Inert)	130,000	N/A	N/A	N/A	Unknown
	Greenwaste	166,600	311,750	165,150	N/A	Unknown

Note: - Life expectancy based on 2006/07 throughputs
- MRFs include municipal and commercial operations
- Total includes Greens Recycling (Bunbury)
- Reported MRF maximum throughput and slack capacity is based on a single eight hour shift
- It can be assumed that a double shift (16 hours) would double the current, maximum and slack capacity of MRFs
- 91% coverage (**Appendix A** presents responses)

The MRC and the SMRC are areas that accept the most waste in the Perth Metropolitan Area with approximately 1.45 million tonnes each. This can be attributed to the amount of waste infrastructure currently present in the areas, especially in regards to inert landfills. The MRC accepts significant amounts of MSW to Tamala Park due to its population size and SMRC accepts high amount of C&I waste due to its high commercial base.

Inert and putrescible landfills in 2006/07 accepted the highest quantity of waste in the Metropolitan Area with 2.2 million (inert C&I, C&D) and 1.5 million tonnes of waste (MSW, C&I and C&D) respectively. Life expectancy of putrescible landfills in each Regional Council ranges from 10 years (MRC) to 30 years (EMRC). Life expectancy of inert landfills in each Regional Council ranges from one year (EMRC) to 15 years (SMRC).

SWOT Analysis

A strengths, weaknesses, opportunities and threats (SWOT) analysis completed as part of this study is aimed at the ability of waste infrastructure in the Perth Metropolitan Region to provide adequate waste disposal and recycling options currently and into the future. The SWOT has been completed for each of the waste stream types (MSW, C&I and C&D). Infrastructure requirements for MSW and C&I waste generally include Class II / III landfill, putrescible transfer stations, MRFs, RRFs and greenwaste processors whilst C&D waste generally requires Class I (inert) landfill, inert transfer stations and C&D recyclers.

Key findings for each waste stream (MSW, C&I and C&D) are outlined in **Table E4**, **E5** and **E6** respectively. Other identified SWOT findings are outlined in the document and Appendices.

Table E4: Summary of key core issues for the provision of MSW infrastructure

	Helpful (to achieving the objective)	**Harmful (to achieving the objective)**
Internal Origin (attributes of the industry)	**STRENGTHS:** • Establishment of Regional Councils • Efficient management of well engineered landfills • Landfills, transfer stations, MRFs, RRFs well placed geographically • Proactive planning in RRFs • MRF and greenwaste available capacity	**WEAKNESSES:** • Difficulty in siting new MSW infrastructure • Difficulty in obtaining approvals for MSW facilities • Lack of planning for future waste facilities • Limited State Government guidance for future sites and technologies
External Origin (attributes of the environment)	**OPPORTUNITIES:** • Investigation of more RRF technology options • Better matching of collection systems to processing • Carbon Pollution Reduction Scheme impacts • Market developments for RRF products	**THREATS:** • Medium term life expectancy and need for future sites • Lack of diversity in RRF technology • Economic conditions and commodity prices

Table E5: Summary of key issues for the provision of C&I infrastructure

	Helpful (to achieving the objective)	Harmful (to achieving the objective)
Internal Origin (attributes of the industry)	**STRENGTHS:** • Efficient management of well engineered landfills • Recyclable materials of high quality, value • Mature and competitive service providers	**WEAKNESSES:** • Limited availability of sites for C&I transfer stations • Lack of dedicated recycling infrastructure • Weak compositional data for C&I waste stream • Lack of direction and regulatory focus for waste reduction
External Origin (attributes of the environment)	**OPPORTUNITIES:** • Establishment of appropriate infrastructure for recovery of C&I waste • Increase in landfill levy • Strategies for separate recycling collections within C&I precincts • Government funding for C&I infrastructure	**THREATS:** • Lack of peak body for C&I waste stream • Economic downturn and effect on commodity prices • Continuing growth of C&I waste

Table E6: Summary of key issues for the provision of C&D infrastructure

	Helpful (to achieving the objective)	Harmful (to achieving the objective)
Internal Origin (attributes of the industry)	**STRENGTHS:** • Reasonable distribution of sites and effective transport infrastructure • Availability of inert infrastructure and large slack capacity at C&D recycling infrastructure • Relatively low setup costs • Recycling industry not a threat to virgin extractive industry	**WEAKNESSES:** • Low percentage of waste being diverted to recyclers • Only recycling clean C&D streams • Difficult in siting new C&D infrastructure • Lack of quality control • Limited government policy support
External Origin (attributes of the environment)	**OPPORTUNITIES:** • Increase landfill levy / price mechanisms • Provide legislative framework to produce C&D waste plans • Use of policy tools to promote recycling of C&D material	**THREATS:** • Loss of current and potential sites due to encroachment • Cost of processing materials • Fuel costs

Summary

The population and economy of the Perth Metropolitan Region will continue to grow in the short to medium term and will result in a greater volume of waste being generated. Overall, current waste infrastructure in the Perth Metropolitan Region is well placed to continue accepting this material for either landfill or recycling towards 2020; however potential strains on waste infrastructure will become apparent in certain geographic areas over the next 10 years without any planning or efforts to increase the rate of recovery above current levels. These efforts will require improvements in waste policy and the use of market instruments to encourage diversion from landfill.

In regards to specific types of waste infrastructure currently in place throughout the Perth Metropolitan Area, a number of conclusions can be made in terms of life expectancy, geographic distribution and their ability to service the Perth Metropolitan Region. These are outlined below:

Class I (inert) landfills

Class I (inert) landfills throughout the Perth Metropolitan Region are readily available especially in coastal regions, rich in disused quarries that have the potential for development. A number of these facilities, especially in the northern and eastern areas, will become exhausted within five years, however current operators have indicated that they are pursuing new sites once the current sites are depleted.

Inert Recyclers

Inert recyclers occupy areas that are generally not serviced by Class I (inert) operators. These areas are in the eastern and southern areas in close proximity to the Central Business District (where good quality C&D waste is usually sourced). These C&D recyclers currently have potential to accept a significant increase in material, however due to encroachment and the difficulty in making some operations viable some recyclers may require closure in the coming years. This would significantly reduce the tonnage of material that the Perth Metropolitan Region recycles.

Class II / III (putrescible landfills)

Class II/III (putrescible) landfills are currently located in strategic locations on the rural urban fringe of the Perth Metropolitan Region. The majority of putrescible landfills have at least 10 years capacity remaining. Facilities with fewer than 10 years life expectancy may have the potential for expansion through the acquisition of land adjacent to the site. A number of operators are also assessing future landfill sites. The continued construction of RRFs will progressively reduce the demand for landfill.

Class IV (hazardous) landfills

The Class IV (hazardous) landfill at Red Hill currently has a high amount of capacity. Due to this type of waste stream not being generated in high quantities it is likely that the facility will continue to be the sole service provider in to the long term.

Municipal RRFs

The Perth Metropolitan Region is well advanced in the planning and construction of RRF technology for the processing of MSW. The SMRC, City of Stirling, WMRC and MRC either already have RRFs or are currently in the construction / commissioning phase of the project. The EMRC and RRC are in the advanced planning stages for their RRFs. Currently the RRFs are well distributed throughout the Perth Metropolitan Region, however some

problems have arisen at current facilities due to the close proximity to residents. Sites selected for the RRFs currently under construction or in the planning phase will not have these issues. It is assumed all RRFs will run at full capacity.

Municipal MRFs

Municipal MRFs are currently located in certain industrial precincts throughout the Perth Metropolitan Region and will continue to service the community into the future based on current design throughputs. The inadequacy of contingency plans in the past resulted in a number of incidences where recyclables would require landfill, however industry has reported that contingency plans have improved markedly over the past number of years and that the need to landfill recyclables in the event of a plant shut down is less likely. Plans for future MRFs by a number of stakeholders will reduce further the risk that recyclables being sent to landfill. However, recent economic events and the fall in commodity prices may have an impact on MRF operators in the short term.

Commercial MRFs and RRFs

Whilst a high amount of C&I waste is currently being diverted through scrap metal, organics and paper / cardboard recyclers, there are limited commercial MRFs and no RRFs at present in the Perth Metropolitan Region. This is resulting in a high amount of potentially recyclable material being sent to landfill. Current commercial MRF infrastructure is located in inner city industrial areas to minimise transport costs. Without stronger market or regulatory forces for the C&I sector to divert waste (especially food / kitchen organics), waste is likely to continue to be sent to landfill.

Inert and Putrescible Transfer Stations

As waste infrastructure facilities (especially landfills and RRFs) will continue to require being located in areas away from population centres (due to potential impacts and increasing land prices), transfer stations are increasingly required to reduce transport costs. Inert and putrescible transfer stations are well distributed throughout inner city industrial or waste zoned areas. The maximum potential throughput of these facilities is difficult to determine due to the rate of transfer being based on truck movements and personnel, however it is likely that the current transfer stations will be able to receive additional quantities of material into the medium term.

Greenwaste Processors

Greenwaste facilities are well distributed throughout the Perth Metropolitan Region. Many operations, especially soil blending facilities have a high amount of capacity for additional inputs. Due to the demand for quality soils, greenwaste will continue to be sought after by many facilities. Due to the low technology processing requirement and number of operators currently in the marketplace, there is minimal risk that greenwaste will be unable to be processed going forward.

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APPENDICES

1. INTRODUCTION

1.1 Background

Recent temporary closures to some of the key waste management infrastructure in the Perth Metropolitan Region have highlighted the limitations on certain facilities and raised questions about the short and long term adequacy of waste management infrastructure in this region. The Waste Authority recognises these concerns amongst stakeholders and the desire for more effective waste infrastructure and contingency planning. The Waste Authority also recognises that shortfalls in the provision of waste management infrastructure across the region may jeopardise optimal sustainable waste management practices. Increasing the provision of such infrastructure would assist in making the State vision of 'Towards Zero Waste' a more achievable target.

Cardno WA Pty Ltd (Cardno) has been contracted by the Waste Authority to conduct an "Assessment of Waste Disposal and Material Recovery Infrastructure for Perth". The main aim of the study is to assess the current infrastructure for waste and recycling in the Perth Metropolitan Region and anticipate the best way to respond to future demands. The timeframe for this report is projected towards 2020 (2019/20 financial year).

1.2 Project Objectives

This report has been prepared upon the guidance and direction of the Department of Environment and Conservation (DEC) and in line with their project objectives and desired outcomes.

To key objectives of the study are to:

- Obtain current waste treatment[1] data and waste stream quantities;
- Obtain current waste and recycling generation trends;
- Project future waste and recycling generation;
- Anticipate constraints in current waste infrastructure; and
- Undertake a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the existing and proposed waste infrastructures ability to absorb future demand.

1.3 Limitations of the Report

There are a number of limitations of this report including geographical area covered, and assumptions utilised in modelling and analysis works. The geographic area covered by the study is centred on the Perth Metropolitan Region, however Local Government Authorities (LGAs) in Perth's surrounds that have infrastructure that contribute to waste being treated and/or disposed from the Perth Metropolitan Region have also been included.

Assumptions have been made in this study to model waste generation projections and potential infrastructure constraints. Where assumptions have been used they have been clearly documented in this report and where appropriate have been referenced to their source.

A number of waste "reprocessing" infrastructure facilities (e.g metal, tyre, plastic reprocessing) have been omitted from the review as infrastructure requirements can be considered small when compared to major MSW, C&D and C&I facilities. Greenwaste reprocessors are an exception and have been included at the request of the DEC.

[1] Treatment relates to the processing, recycling, composting, recovery and disposal of waste and/or recyclable materials

Whilst it is recognised current and future Government policies / legislation will influence waste to landfill, no estimates of the potential impact have been modelled in this report (e.g landfill levy change, emission trading scheme, container deposit legislation, extended producer responsibility etc). For the purposes of this study, waste projections are solely based on current activity and Cardno derived waste growth / decline assumptions.

1.4 Data Reliability

Data has been collected from numerous stakeholders as part of this project. Confidence in the reliability of data varies between stakeholders based on the method of data collection and the ease with which this data could be retrieved from stakeholder databases / records. The majority of stakeholders presented approximations about their operations.

All putrescible landfills, major putrescible transfer stations, Material Recovery Facilities (MRFs) and Resource Recovery Facilities (RRFs) in the Perth Metropolitan Area are currently equipped with a weighbridge to record accepted material in tonnes. This enables an accurate representation of materials currently being accepted at these facilities. In regards to how putrescible landfills classify material coming into the facility, this can be more problematic and relies on the gate attendant and waste disposer to accurately reflect from where the waste has been sourced. The majority of inert transfer stations, inert landfills and greenwaste reprocessors do not have weighbridges on site and rely on cubic metre volume estimates to determine the amount of material entering the facility. As the determination of waste input is largely a visual assessment it is possible some totals may be over or underestimated.

Recycling data presented in this report is based on total recycling activity within all of Western Australia rather than the Perth Metropolitan Region only. Therefore totals can be considered overstated, however the majority of recycling activity in Western Australia occurs in the Perth Metropolitan Region. So the data can be taken as representative.

Overall due to the high response rate (91%) the data presented in this report can be considered the most comprehensive and up to date data currently available.

2. METHODOLOGY

2.1 Desktop Review

For the purpose of this study a number of background studies and data sources were sought for the collation of background waste stream data. These are outlined below.

- DEC Landfill Levy Data (1998/1999 - 2006/07);
- Review of Total Recycling Activity in Western Australia (2004/05 – 2006/07); and
- Zero Waste Plan Development Scheme – Phase 1 Survey Data (2006/07)

2006/07 is the baseline year of the waste data that was sought. These data sources enabled Cardno to make an assessment of the amount and type of waste being landfilled or recovered in the Perth Metropolitan Region by infrastructure type.

DEC landfill levy data accounts for the amount of waste being disposed to landfill in tonnes from the Perth Metropolitan Region by landfill type (Inert or Putrescible) and by waste stream. These waste streams include municipal solid waste (MSW), commercial and industrial (C&I) and construction and demolition (C&D). The Review of Total Recycling Activity also accounts for the amount of recyclables recovered from the MSW, C&I and C&D waste streams for Western Australia.

Information on infrastructure currently in place was sourced from the DEC, including their Infrastructure Census conducted by APrince Consultants and internal Cardno knowledge data of the Perth Metropolitan waste marketplace.

2.2 Industry Consultation

Whilst the background studies provided significant information on the overall amount of waste being recovered or sent to landfill, they are limited in the analysis of current or future infrastructure capacity to accept waste. Therefore, secondary consultation was undertaken with all waste infrastructure operators within and around the Perth Metropolitan Region.

For the purposes of this study waste infrastructure has been divided into the following categories:

- Class I (inert) landfills;
- Inert Transfer Stations / Recyclers;
- Class II / III (putrescible) landfills;
- Putrescible Transfer Stations;
- Resource Recovery Facilities (RRFs);
- Material Recovery Facilities (MRFs) (MSW and C&I); and
- Greenwaste Processors

A total of 65 waste infrastructure facilities were identified as part of this study (**Appendix A**). Of these 65, data was gathered from 59 facilities (91% coverage). Each facility operator was either consulted via a face to face interview or via telephone interview. In total 14 site visits were undertaken throughout the Perth Metropolitan Region. During the secondary consultation period a series of questions were asked of the site manager to gather required data. GIS coordinates for all waste infrastructure facilities are outlined in **Appendix A**.

Critical information requested varied between each site due to the nature of the operations. These questions allowed Cardno to make an assessment of the current and potential capacity / throughput constraints of the operations whilst seeking information in regards to potential barriers for the current site to accept further material.

2.3 Data Collation and Projections

Once all information was gathered from stakeholders, the data was collated into an excel spreadsheet where an overall picture could be developed for the Perth Metropolitan Region's waste. Data summaries were produced in regards to current waste infrastructure throughput, potential throughput / capacity and life expectancy. Summaries of data are presented throughout this document.

A number of assumptions for projections of waste and recycling into the future were made depending on waste stream types. These assumptions were based on statistical indicators that correlate with waste generation. Waste streams, assumptions and source of information are outlined below in **Table 2.1**

Table 2.1: Assumption made for each waste stream in regards to future projections

Waste Stream	Assumption	Source	Limitation
MSW	Population Growth	Western Australia Tomorrow Report No. 6 (2005)	2029/30
C&I	GDP (Manufacturing and Accommodation, Cafes and Restaurants)	Australian Bureau of Statistics (ABS) and Reserve Bank (2008)	2010/11
C&D	Construction Activity (Non-Residential + Residential + Engineering)	Construction Forecasting Council (CFC)	2014/15

In addition to the statistical indicators, Cardno has also conducted a sensitivity analysis in regards to assumed increased recycling rates beyond current trends and potential waste generation reductions into the future. Assumptions and results from the sensitivity analysis are outlined in relevant sections throughout the document.

Waste projections utilising the collected infrastructure data, statistical indicators (**Table 2.1)** and Cardno assumptions have allowed for the prediction of future infrastructure constraints and requirements.

2.4 Waste to Landfill Assumptions

As a requirement to operate a landfill in the Perth Metropolitan Region, waste volumes / tonnes must be reported to the DEC. The figures submitted are either expressed in cubic metres or tonnages depending on whether there is a weighbridge on site. All putrescible landfills, putrescible transfer stations, MRFs and RRFs in the Perth Metropolitan Region have been fitted with a weighbridge to record accurate tonnages. The majority of inert landfills, inert transfer stations and greenwaste facilities do not have a weighbridge. To maintain consistency all figures reported in this report are expressed in tonnes. Conversion of waste volumes (m^3) to mass (tonnes) and vice versa has been undertaken based on a number of assumptions and conversion ratios. These are highlighted in **Table 2.2**.

Table 2.2: Assumptions and conversion ratios used for the purpose of this study

Assumption	Waste Stream	Ratio	Reference
Compaction Ratio	MSW / C&I (inc cover)	800kg / m^3	Tamala Park Landfill (MRC)
	C&D	1550kg / m^3	GHD (2006)
	Greenwaste	250kg / m^3	Cardno Assumption

2.5 SWOT Analysis

As part of this study a Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis of the current waste infrastructure system was performed. The analysis was conducted on a waste stream and infrastructure type basis.

As part of the SWOT analysis phase of the project a workshop was conducted with key waste industry stakeholders. The workshop was held at the City of South Perth administration offices on the 14th October 2008 with attendees representing Local Government, Metropolitan Regional Councils, State Government, the Waste Authority and industry. **Appendix B** outlines all of the attendees that attended the workshop and all brainstormed ideas from the SWOT analysis. Key findings and issues identified through industry consultation and SWOT workshop processes are presented in **Section 8** of this report.

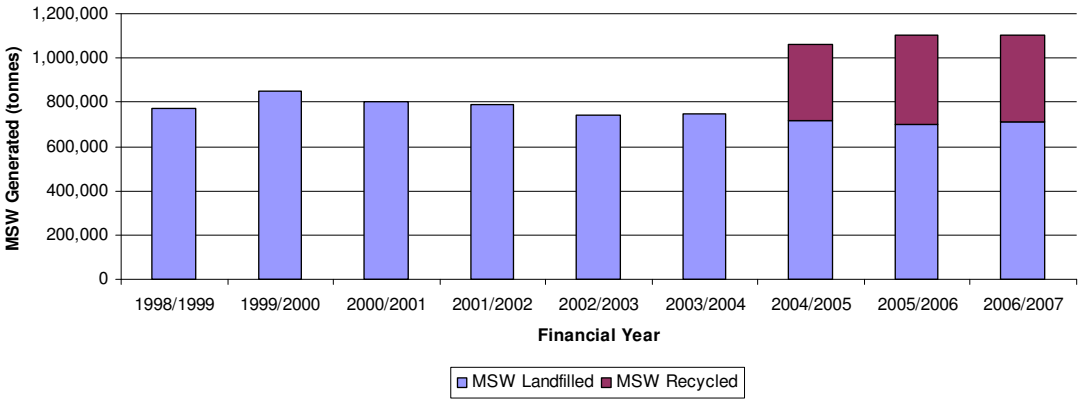
3. BASELINE WASTE GENERATION

Waste is generally divided up into three categories, namely MSW, C&I and C&D. These categories are also used by the DEC to collect landfill levy data and in the annual Recycling Review. Landfill data has been collected since 1998/1999, whilst recycling review data has only been collected since 2004/05. The following section briefly discusses waste generation from each category.

3.1 Municipal Solid Waste (MSW)

MSW can be considered all kinds of rubbish, refuse, junk, garbage or scrap that originates from residential and some commercial or institutional sources (DEC 2008). Since accurate records began there has been a general decline in MSW to landfill from approximately 850,000 tonnes in 1999/2000 to 715,000 tonnes in 2006/07 (**Figure 3.1**). This is equivalent to approximately 1% per year. Due to the absence of long term MSW recycling data, trends in regards to total waste generation are difficult to determine, however it can be assumed that there has been a steady increase over time due to population increases. Increased recycling has also offset any increases in MSW requiring landfill. Approximately 390,000 tonnes of MSW was recycled in 2006/07. Overall 1.1 million tonnes of MSW was generated in the Perth Metropolitan Region in 2006/07.

Figure 3.1: MSW landfilled and recycled in the Perth Metropolitan Region between 1998/1999 and 2006/2007



Note: Recycling data has only been collected since 2004/2005

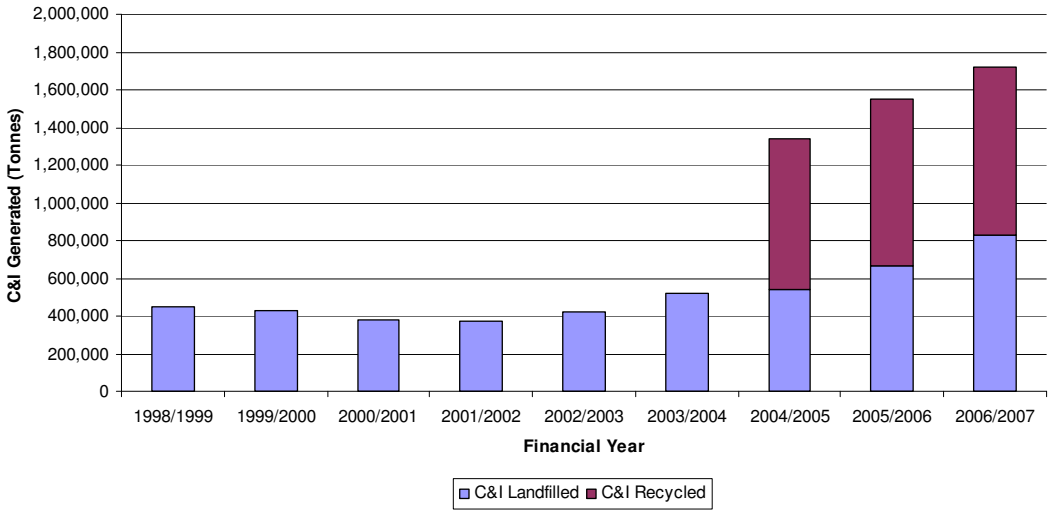
The waste composition of the MSW waste stream is outlined in **Appendix C**.

3.2 Commercial and Industrial (C&I)

C&I can be considered solid waste arising from the activities within commercial and industrial sites, including but not limited to offices, retail outlets, restaurants, factories and institutions. Waste from smaller businesses where local government waste collection agreements are in place is generally treated as MSW (DEC 2008). Between 1998/99 and 2001/02 there was a steady decline in C&I waste to landfill, however between 2001/02 and 2006/07 C&I waste to landfill has experienced growth of approximately 14% per annum. 830,000 tonnes of C&I waste was landfilled in Perth Metropolitan landfills in 2006/07 (**Figure 3.2**). On average between 1998/99 and 2006/07 there has been 9% growth per year.

C&I recycling activity is also considerable with approximately 890,000 tonnes of material being recycled in 2006/07. Like MSW, only three years of recycling activity has been gathered, however C&I activity is showing growth over time of approximately 5%. This is largely being driven by the diversion of scrap metals from landfill. Overall, the Perth Metropolitan Region generated approximately 1.72 million tonnes of C&I waste material in 2006/07 of which 890,560 was recycled.

Figure 3.2: C&I landfilled and recycled in the Perth Metropolitan Region between 1998/1999 and 2006/2007



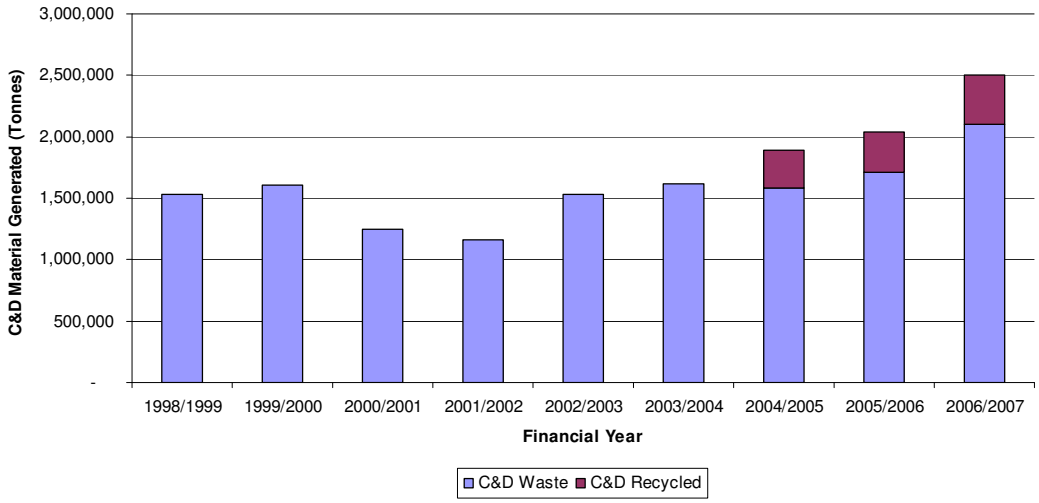
Note: Recycling data has only been collected since 2004/2005

The waste composition of the C&I waste stream is outlined in **Appendix C**.

3.3 Construction and Demolition (C&D)

C&D can be considered solid waste that is generated through activities associated with the construction, maintenance / repair and demolition of buildings, structures and pavements or highways. Materials including, but not limited, to sand, aggregates, plasterboard, asphalt, timber, bricks, concrete, tiles, roofing materials, electrical wiring and the packaging of these materials (DEC 2008). Like C&I waste, C&D waste to landfill declined between 1999/2000 and 2001/02 and then has experienced growth to 2006/07 (**Figure 3.3**). The growth rate on average has been approximately 13% per year since 2002/03. Approximately 2.1 million tonnes of C&D waste was disposed to landfill in 2006/07.

Figure 3.3: C&D landfilled and recycled in the Perth Metropolitan Region between 1998/1999 and 2006/2007



Note: Recycling data has only been collected since 2004/2005

C&D recycling activity also showed growth of approximately 15% per annum between 2004/05 and 2006/07. Approximately 410,000 tonnes of C&D material was recycled in 2006/07. Overall the Perth Metropolitan Region generated approximately 2.5 million tonnes of C&D waste in 2006/07.

The waste composition of the C&D waste stream is outlined in **Appendix C**.

3.4 Summary

Overall there has been a general increase in the amount of waste being generated in the Perth Metropolitan Region. **Table 3.1** summarises waste being landfilled or recycled by waste stream for the Perth Metropolitan Region between the 2004/05 and 2006/07 financial years

Table 3.1: Summary of total generation of waste (by waste stream) and destination (landfill or recycled) between 2004/05 and 2006/07 in tonnes

	2004/05		2005/06		2006/07	
Waste Stream	Landfill	Recycled	Landfill	Recycled	Landfill	Recycled
MSW	720,220	343,150	698,240	403,520	714,090	388,600
C&I	539,270	800,000	668,430	881,340	830,380	890,560
C&D	1,586,600	300,000	1,709,690	331,610	2,096,960	409,350
Total	**2,846,090**	**1,443,150**	**3,076,360**	**1,616,470**	**3,641.430**	**1,688,510**

Source: - Hyder Consulting 2006,
- Cardno BSD 2007, 2008
- DEC Landfill Levy Data 2004/05, 2005/06, 2006/07

Note: - Due to different assumptions being used for sources of C&D and C&I in the Hyder Consulting 2006 report (2004/05 figures), an approximate value has been set based on projected growth in recycling

4. WASTE GENERATION PROJECTIONS

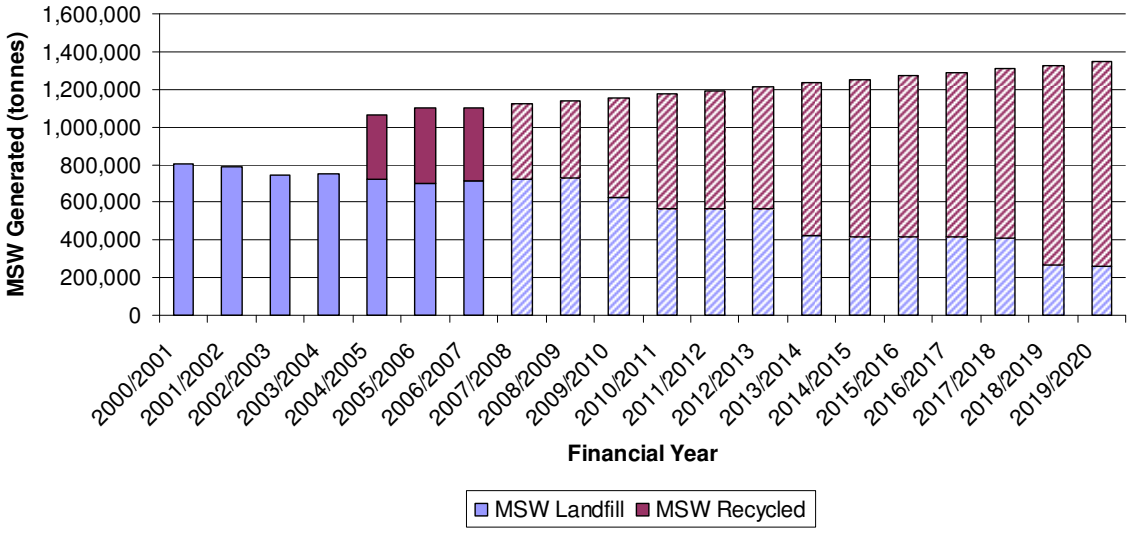
4.1 Population Growth and MSW Waste / Recycling Projections

The population of the Perth Metropolitan Region in 2006 was approximately 1.58 million people (ABS Census 2006). It is predicted that the population of the Perth Metropolitan Region will reach 1.92 million by 2020. Strongest population growth will be experienced in the district of the Rivers Regional Council (RRC) with an annual growth rate of approximately 2% / annum. The Eastern Metropolitan Regional Council (EMRC), Southern Metropolitan Regional Council (SMRC) and Mindarie Regional Council (MRC) are likely to experience approximately 1.5% / annum growth. The only Regional Council that is not expected to increase significantly is the Western Metropolitan Regional Council (WMRC) which has limited plans for expanding its population base due to its current density. It is set to grow at approximately 0.5% / year.

For the purposes of this study it has been assumed that population growth and MSW waste generation are correlated. Recycling activity from the MSW waste stream for this study is also assumed to be correlated with population growth; however in real terms there are many variables that influence recycling activity by residents. It has been assumed that the recycling rate per head of population will increase by 1% per annum. **Figure 4.1** illustrates the predicted increase in MSW generation over time due to population growth and the predicted decline in waste requiring landfill towards 2020.

This decline can be mostly attributed to the commissioning of proposed Resource Recovery Facilities (RRFs) that will divert significant tonnages of recyclables and organics from the MSW waste stream. This is further discussed in **Section 5.2.7**.

Figure 4.1: Past and Future MSW projections for the Perth Metropolitan Region



Assumptions:
- AnaeCo (55,000 tonnes) and BioVision 2020 Stage 1 (100,000 tonnes) RRFs commence operation in 2009
- RRC RRF (100,000 tonnes) commences operation in 2011
- EMRC Stage 1 (100,000 tonnes), MRC Stage 2 (100,000 tonnes) and SMRC Stage 2 (80,000 tonnes) commence operation in 2013
- ATLAS contract is not extended post 2013
- MRC Stage 3 (100,000 tonnes) and EMRC Stage 2 (100,000 tonnes) commence operation in 2018
- RRFs all operate at design capacity
- RRFs divert 70% of MSW from landfill
- MSW / Recycling activity is correlated with population growth
- The Perth region will increase MSW recycling (rate per head of population) by 1% per annum

- All compost derived from the RRFs is marketable
- No thermal technologies are commissioned

Note:
- No recycling activity data has been collected prior to 2004/05
- An increase of recycling per head of population of 1% is over and above the impact of known RRFs, however this does not alter the diversion rate significantly
- Generally 30% of the weight of organics diversion is water. This total has been included in the projected "MSW recycled" to illustrate diversion rates. As 30% water has not been included for SMRC and ATLAS organic recycling totals between 2004/05 and 2006/07 recycling totals can be considered conservative.

Based on current projections (with assumptions) of the Perth Metropolitan Region, MSW generation is set to reach approximately 1.34 million tonnes (an increase of 241,000 tonnes or 22%) by 2019/20. Increased MSW recycling is predicted to decrease the amount of waste being sent to landfill per year by approximately 470,000 tonnes in 2019/20. This is equivalent to approximately 17% of the total amount of MSW waste generated requiring landfill by 2020.

4.1.1 Sensitivity Analysis

As outlined in **Section 2.3**, a number of alternate scenarios were inserted into the Cardno model to project MSW source volumes to landfill. The sensitivity impact of changing assumptions and predicted results are outlined in **Table 4.1**. Whilst unlikely, the sensitivity analysis also factored in a reduction in waste generation from source.

Table 4.1: Sensitivity analysis based on MSW to landfill (in tonnes)

Assumption	RRFs	2009/10	2014/15	2019/20
No Change in Waste Volumes (2006/07 volumes)	No	714,090	714,090	714,090
Projected Population Only	No	749,390	809,980	870,160
Projected Population Only	Yes	640,890	466,140	358,830
Projected Population + 1% / annum increase recycling only (**Section 4.1**)	Yes	628,530	419,100	261,290
Projected Population + 1% / annum increase recycling + 1% / annum decrease waste generation	Yes	606,520	369,520	194,250

Note:
- Whilst unlikely Table 4.1 also outlines a scenario of waste reduction from source.
- RRFs assume biological treatment

Therefore the commissioning of additional RRFs will significantly reduce the amount of material being sent to landfill from the Perth Metropolitan Region by 2019/20. Overall the amount of MSW that will require landfill by 2019/20 will range between 194,000 and 360,000 tonnes per year (a decrease of between 355,270 and 519,840 tonnes over 2006/07 MSW to landfill tonnages).

If thermal treatment were chosen as an RRF technology, waste to landfill would further decrease due to thermal technologies having only approximately 5 - 10% residual after the process.

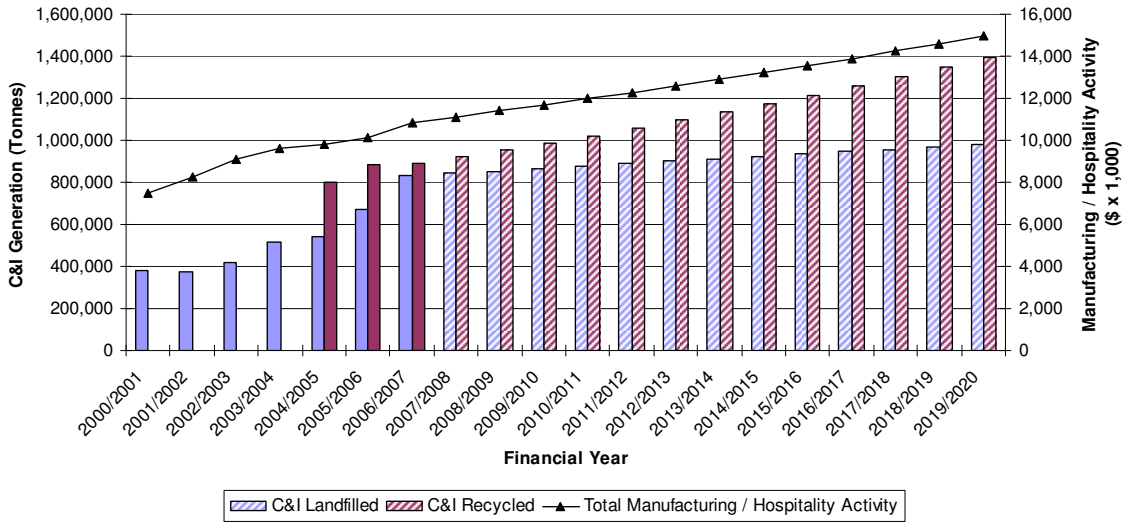
4.2 Gross Domestic Product Growth and C&I Waste / Recycling Projections

As discussed in **Section 3**, C&I waste to landfill has shown strong growth, with an average growth rate of 9% since 1998/99. The past two years have shown even stronger growth rates with 23% and 24% growth respectively.

However, for the purposes of this study it has been assumed that C&I waste generation and certain statistical indicators that make up GDP are correlated. These statistical indicators include Manufacturing Activity and Accommodation / Cafes and Restaurant Activity (MACHR). MACHR has shown relatively consistent growth of approximately 6% / annum for the past seven years. As there are no projected MACHR figures and recent market events suggest there will be a slowdown in the economy it has been assumed that MACHR will follow the projected GDP growth (2.5%) estimated by the Reserve Bank (2008) until 2019/20.

Figure 4.2 outlines the correlation between MACHR indicators and C&I waste generation over the past seven years and assumed future projections to 2014/15.

Figure 4.2: Past and Projected C&I waste generation



Assumptions:
- C&I waste / recycling activity is correlated with GDP (MACHR)
- Average 2.5% growth (Reserve Bank 2008) in MACHR
- The Perth C&I businesses will increase recycling (above C&I activity) by 1% per annum
- No commercial RRFs to be commissioned

Note: No recycling activity data has been collected prior to 2004/05

Based on the projections outlined above the Perth Metropolitan Region is set to increase the amount of C&I waste being sent to landfill by approximately 19% (or 147,000 tonnes) by 2019/20.

There is no official indication from the commercial market that a C&I RRF is planned to be commissioned, however some parties are investigating such options. The absence of a C&I RRF thus far can be attributed to the relatively low cost of landfilling compared to resource recovery in Perth. Consultation with Regional Councils has suggested that there is the possibility that commercial waste generators or collectors could be a customer at the RRFs if the input material compatible with the operations (e.g kitchen waste) and there is sufficient capacity.

4.2.1 Sensitivity Analysis

The sensitivity impact of changing assumptions and predicted results are outlined in **Table 4.2**. Whilst unlikely, the sensitivity analysis also factored in a reduction in waste generation from source.

Table 4.2: Sensitivity analysis based on C&I to landfill (in tonnes)

Assumption	2009/10	2014/15	2019/20
No Change in Waste Volumes (2006/07 volumes)	830,380	830,380	830,380
MACHR GDP Only	894,230	1,011,740	1,144,890
MACHR GDP + 1% / annum increase recycling only (**Section 4.2**)	865,600	923,220	977,880
MACHR GDP + 1% / annum increase recycling + 1% / annum decrease waste generation	839,600	850,980	856,330

Note: Whilst unlikely Table 5.2 also outlines a scenario of waste reduction from source.

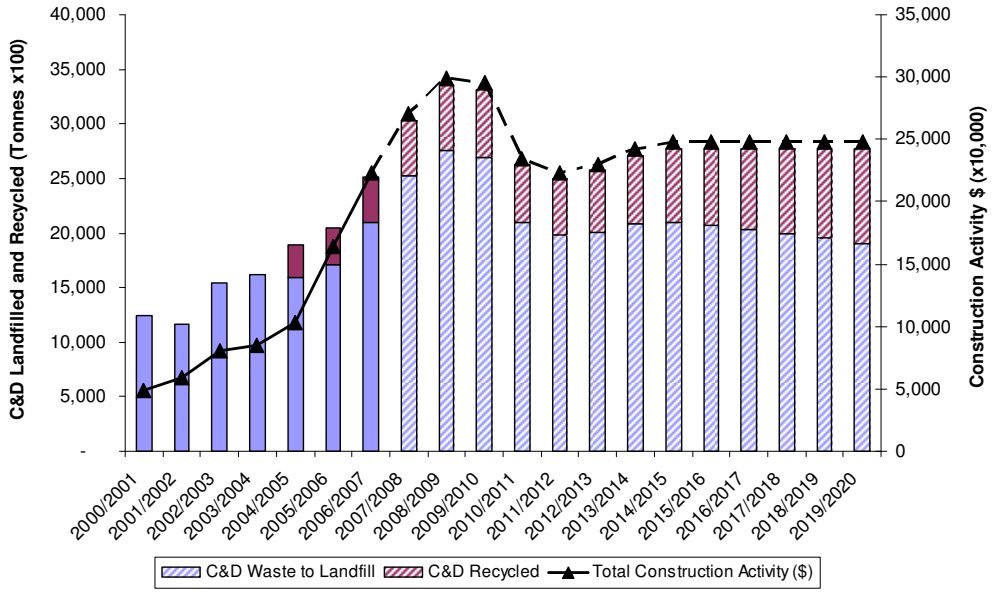
Therefore based on the assumptions in **Table 4.2** the amount of C&I waste that will require landfilling by 2019/20 is likely to range between 830,000 and 1.1 million tonnes. If RRFs were to be constructed, C&I waste to landfill would decrease.

4.3 Construction Activity and C&D Waste / Recycling Projections

Construction activity in the Perth Metropolitan Region has been very strong since 2000/01 with very high growth in all construction sectors, especially the engineering sector (earthworks and roads). For the purposes of this study Cardno has assumed there is a direct correlation between construction activity and C&D waste generation and recycling. Construction forecasts to 2014/15 have been obtained from the Construction Forecasting Council (CFC).

Figure 4.3 outlines the past and potential future trends in construction activity and waste generation (landfill and recycling). Overall construction (and therefore C&D waste generation) in the Perth Metropolitan Region is likely to remain strong for the foreseeable future, however will reduce from the historical highs currently being projected for the period up to 2009/10.

Figure 4.3: Past and Projected C&D waste generation



Assumptions:
- C&D waste / recycling activity is correlated with construction activity
- The Perth C&D industry will increase recycling (above construction forecast) by 5% per annum
- Construction Activity will remain at $25 billion post 2014/2015
- The number of recyclers will remain constant

As outlined above the amount of C&D waste generated is set to fluctuate over the next few years with construction activity set to peak in 2008/09 and then slow rapidly until 2010/11 and then remain static. Due to limitations in CFC data it has been assumed that construction will remain static until 2019/20. Based on the projections outlined above the Perth Metropolitan Region is set to decrease the amount of C&D sourced waste to landfill by approximately 30% (or 640,000 tonnes) by 2019/20.

4.3.1 Other Scenarios

The sensitivity impact of changing assumptions and predicted results are outlined in **Table 4.3**. Whilst unlikely, the sensitivity analysis also factored in a reduction in waste generation from source.

Table 4.3: Sensitivity analysis based on C&D waste to landfill (in tonnes)

Assumption	2009/10	2014/15	2019/20
No Change in Waste Volumes (2006/07 volumes)	2,096,964	2,096,964	2,096,964
Construction Activity Only	2,775,480	2,329,510	2,329,510
Construction Activity + 5% / annum increase recycling only (**Section 4.3**)	2,693,880	2,103,330	1,908,920
Construction Activity + 5% / annum increase recycling + 1% / annum decrease waste generation	2,619,920	1,939,320	1,671,020

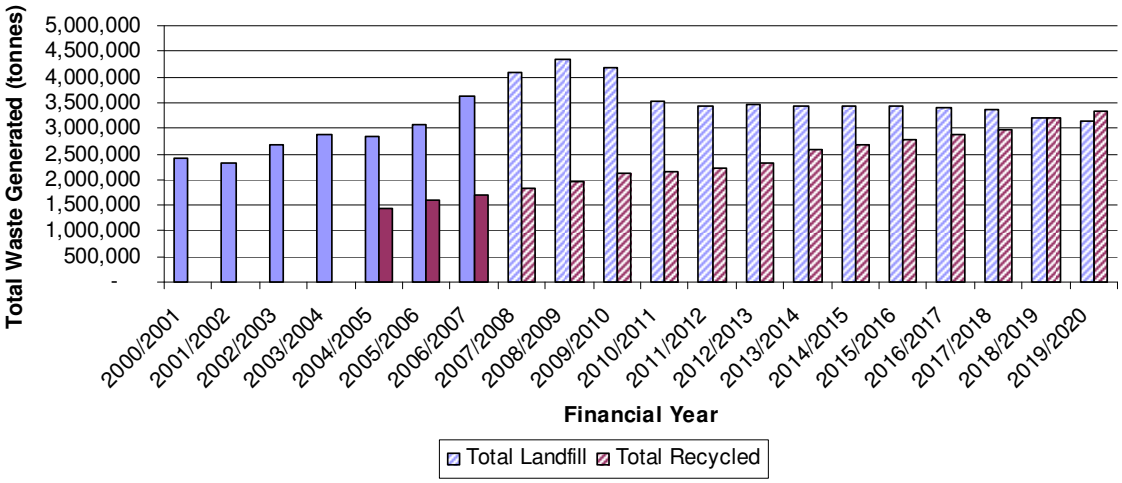
Note: Whilst unlikely Table 4.3 also outlines a scenario of waste reduction from source.

Therefore based on the assumptions in **Table 4.3** the amount of C&D waste that will require landfilling by 2019/20 is likely to range between 1.7 and 2.3 million tonnes by 2019/20.

4.4 Summary of Waste Generation Projections

The combination of MSW, C&I and C&D waste gives the total amount of waste generated in the Perth Metropolitan Region. If the actual past waste generation and future waste generation projections using assumptions in **Sections 4.1**, **4.2** and **4.3** are modelled the following trends in landfill and recycling activity can be illustrated (**Figure 4.4**).

Figure 4.4: Past and projected total waste generation (landfill / recycling) in the Perth Metropolitan Region between 2000/01 and 2019/20



Assumptions: Outlined in **Section 4.1, 4.2** and **4.3**
Note: No recycling activity data has been collected prior to 2004/05

Based on MSW, C&I and C&D statistical indicators and Cardno assumptions waste to landfill is predicted to peak in 2008/09 and will then gradually decline to 2019/20. This will be a result of greater recycling activity and a slowdown in construction activity. It is predicted that approximately 50% of the total waste generated will be diverted from landfill by 2019/20, however 3.1 million tonnes of material will still require disposal to landfill. The majority of this waste will be C&I (978,000 tonnes) and C&D waste (1.91 million tonnes). Diversion of MSW to RRFs is set to significantly decrease the amount of waste being sent to landfill by 2019/20.

5. ASSESSMENT OF WASTE MANAGEMENT INFRASTRUCTURE

5.1 Geographic Distribution of Waste Material

The Perth Metropolitan Region is made up of 30 Local Government Authorities (LGAs). To enable greater coordination of activities (especially waste) in the metropolitan area a number of LGAs have formed a Regional Council. Regional Councils' in the Perth Metropolitan Region include the EMRC, Mindarie Regional Council (MRC), Rivers Regional Council (RRC), Southern Metropolitan Regional Council (SMRC) and the Western Metropolitan Regional Council (WMRC). LGA members in each Regional Council are outlined in **Table 5.1**. The Shires of Murray and City of Mandurah, whilst not officially metropolitan LGAs, are also members of the RRC and have been included in this study.

Table 5.1: Regional Councils currently present in the Perth Metropolitan Region and respective Member Councils

Regional Council	LGA	Regional Council	LGA
EMRC	Town of Bassendean City of Bayswater City of Belmont Shire of Mundaring Shire of Kalamunda City of Swan	**RRC**	City of Armadale City of Gosnells City of Mandurah Shire of Murray Shire of Serpentine-Jarrahdale City of South Perth
MRC	Town of Cambridge City of Joondalup City of Perth City of Stirling City of Wanneroo Town of Vincent Town of Victoria Park	**SMRC**	City of Canning City of Cockburn Town of East Fremantle City of Fremantle Town of Kwinana City of Melville City of Rockingham
WMRC	Town of Claremont Town of Cottesloe Town of Mosman Park Shire of Peppermint Grove City of Subiaco	**No Membership**	City of Nedlands

For the purpose of this study waste infrastructure has been separated into the Regional Councils' outlined in **Table 5.1**. The City of Nedlands has been incorporated into WMRC totals for the purpose of this study.

5.2 Current Waste Infrastructure

5.2.1 Class I (Inert) Landfills

Class I (inert) landfills are unlined landfills designed to accept inert wastes. Inert wastes are non hazardous, non biodegradable containing contaminant levels less than Class I acceptance criteria but excluding paper and cardboard (DEC 2005). Generally Class I (inert) landfills can only accept C&D and some inert C&I materials.

As of 2006/07 there are currently 12 existing Class I (inert) Landfills in operation throughout the Perth Metropolitan Region (**Table 5.2**). **Appendix D** outlines the distribution of Class I (inert) landfills in the Perth Metropolitan Region.

Table 5.2: Current Class I (inert) Landfills in the Perth Metropolitan Region

Regional Council	Name	LGA	Owner
EMRC	Happy Valley	Shire of Kalamunda	Moltoni Corporation
	Mundaring Transfer	Shire of Mundaring	Shire of Mundaring
MRC	Eclipse Resources	City of Wanneroo	Eclipse Resources
	Non-Organics Disposals	City of Wanneroo	Non Organic Disposals
	RCG Nine Mile Quarry	City of Wanneroo	RCG
	Alexander Drive	City of Stirling	Atlas Group
RRC	Tims Thicket	City of Mandurah	Cleanaway
SMRC	Lefroy Road Quarry	City of Fremantle	City of Fremantle
	Bibra Lake Landfill	City of Cockburn	Moltoni Corporation
	Eclipse Resources	Town of Kwinana	Eclipse Resources
	RCG Quinns Quarry	Town of Kwinana	RCG
	Thomas Road Quarry	Town of Kwinana	Waste Stream Management
WMRC	No Landfill		

Class I (inert) facilities are generally either current extractive industry quarries that back fill with inert wastes or facilities that utilise disused quarries with the endeavour of filling the land for future land development. As the MRC and SMRC are rich in extractive industries (sand and limestone) and disused quarries, the majority of inert landfills are located in these regions.

5.2.2 Class II / III (Putrescible) Landfills

Class II or III landfills can be either unlined or lined landfills which may include a leachate collection system and can accept putrescible waste. The Class of landfill (II or III) is dependant on what types of materials can be accepted. Putrescible wastes are generally components of the waste stream that are likely to become putrid that are sourced from either the MSW or C&I waste sectors (DEC 2005). Putrescible landfills can accept MSW, C&I and C&D materials.

There are six putrescible landfills in place throughout the Perth Metropolitan Region of strategic importance (**Table 5.3**). **Appendix E** outlines the distribution of the putrescible landfills in the Perth Metropolitan Region.

Table 5.3: Current Putrescible Landfills (Class II/III) that service the Perth Metropolitan Region

Regional Council	Name	Class	LGA	Owner
EMRC	Red Hill	3	Shire of Mundaring	EMRC
MRC	Tamala Park	2	City of Joondalup	MRC
RRC	Hopkinson Road	3	City of Armadale	City of Armadale
	South Cardup	3	Shire of Serpentine-Jarrahdale	West Australian Landfill Services (WALS)
SMRC	Henderson Road	2	City of Cockburn	City of Cockburn
	Millar Road	3	City of Rockingham	City of Rockingham
WMRC	No Landfill			

Note: A limited amount of waste is also currently accepted from the Perth Metropolitan Region at the Dardanup Landfill

5.2.3 Class IV (Hazardous) Landfills

Class IV landfills are double lined landfills which may include a leachate collection system designed to accept contaminated soils and sludges (including encapsulated wastes). Contaminants can be considered substances that have come into contact or are mixed with a material that poses a risk of harm to human health or the environment (DEC 2005).

The Perth Metropolitan Region currently has one Class IV (Hazardous) landfill. This is located adjacent to the Class III landfill cell at Red Hill (**Appendix E**).

5.2.4 Inert Transfer Stations / Recyclers

Inert transfer stations are facilities where inert waste is collected and stored temporarily before transport to a final destination (DEC 2008). The level of recycling at inert transfer stations in the Perth Metropolitan Region varies depending on the operator, the source of the material, the type of material, sorting infrastructure and space at the facility.

For the purposes of this study transfer stations have been split into three types (“recycler”, “recycler / transfer” or “”transfer”). Recyclers are operators that source material with the intent of creating a product ready for market. These operators only attract feedstock that is relatively clean and free from contaminants such as putrescible material. Recycler / transfer operators accept all material and generally send a significant amount to inert landfill, however they attempt to recover as much material as possible for on-selling. Transfer station operators directly transfer inert material to landfill with minimal to no recycling on site. Inert transfer / recycling infrastructure currently present in the Perth Metropolitan Area is outlined in **Table 5.4** / **Appendix D**.

Table 5.4: Inert Transfer Stations / Recyclers in the Perth Metropolitan Region

Regional Council	Name	Inert Transfer Station Type	Location	Owner
EMRC	C&D Recycling	Recycler	Hazelmere	C&D Recycling
	Capital Demolition	Recycler	Bayswater	Capital Demolition
	Instant Waste	Transfer	Bayswater	Instant Waste
	Hazelmere Timber	Recycler	Hazelmere	EMRC
	Westbins	Transfer	Malaga	Westbins
MRC	No Inert Transfer Station Infrastructure			
RRC	All Earth Group	Recycler / Transfer	Maddington	All Earth
SMRC	Veolia Environmental	Recycler / Transfer	Jandakot	Veolia Environment Pty Ltd
	Waste Stream Management	Transfer	Welshpool	Waste Stream Management
	Total Waste	Transfer	Welshpool	Westmore Corporation

There are currently two inert “recyclers”, three “transfer / recycling” and three inert “transfer” stations in operation in the Perth Metropolitan Region. These facilities are generally located in the Eastern areas of the Perth Metropolitan Region where there are few inert landfills.

5.2.5 Putrescible Transfer Stations

Putrescible waste transfer stations are facilities where putrescible waste (MSW, C&I) is collected and stored temporarily before transportation to a final destination (DEC 2008). The level of recycling at putrescible transfer stations is generally small with the facilities acting as small resource recovery parks where there is opportunity for residents to drop-off material for reuse or recycling. Again the extent of recycling varies depending on the operator. The scale of operations and material acceptance also varies between sites with some facilities accepting refuse truck wastes, whilst others only accepting general trailer waste. Putrescible transfer stations located in the Perth Metropolitan Region are outlined in **Table 5.5** / **Appendix E**.

Table 5.5: Putrescible Transfer Stations / Recyclers in the Perth Metropolitan Region

Regional Council	Name	Location	Owner
EMRC	Bayswater Transfer Station	Bayswater	Cleanaway
	Walliston Transfer Station	Walliston	Shire of Kalamunda
	Mundaring Transfer Station	Mundaring	Shire of Mundaring
MRC	Balcatta Transfer Station	Balcatta	City of Stirling
RRC	South Perth Transfer Station	South Perth	City of South Perth
	Mandurah Transfer Station	Mandurah	Shire of Mandurah
SMRC	Ranford Road Transfer Station	Canning Vale	City of Canning
	Welshpool Transfer Station	Welshpool	WALS
WMRC	Brockway Transfer Station	Shenton Park	WMRC

Transfer stations are generally distributed in inner city areas or mid-points between putrescible landfills. Their purpose is to minimise the travel required by collection trucks or the general public disposing of waste. Material received at these facilities is generally compacted into large trailers and transported to landfill for disposal.

5.2.6 Material Recovery Facilities

Material Recovery Facilities (MRFs) are facilities that receive and separate recyclables by material type for baling and sale to market. Material received can be either from household or commercial enterprises. The majority of MRFs at present in the Perth Metropolitan Region primarily accept household recyclables. The VISY and AMCOR facilities are an exception as they receive commercial loads.

MRFs currently in operation in the Perth Metropolitan Region (and outer regions accepting Perth Metropolitan recyclables) are detailed in **Table 5.6** / **Appendix F**. MRFs are generally located in commercial / industrial areas.

Table 5.6: MRFs currently in operation in the Perth Metropolitan Region

Regional Council	Name	Location	Owner
EMRC	Bayswater MRF	Bayswater	Cleanaway
MRC	Wangara MRF	Wangara	City of Wanneroo
RRC	Maddington MRF	Maddington	Cleanaway
	Mandurah MRF	Mandurah	Cleanaway
SMRC	SMRC MRF	Canning Vale	SMRC
	Perth Engineering and Maintenance	Coogee	Perth Engineering and Maintenance
	VISY	Welshpool	VISY
	AMCOR	Canning Vale	AMCOR
Outer Region	Green Recycling	Bunbury	Perth Waste

Note: Perth Engineering and Maintenance was formally known as Australian Paper Recovery

5.2.7 Resource Recovery Facilities

Resource Recovery Facilities (RRFs) are facilities that process waste into potentially useful products such as compost, soil conditioners or fuel for energy production through thermal, biological or mechanical means, reducing the amount of waste being required to be sent to landfill (DEC 2008). Waste is generally sourced from the municipal sector. The composition of the waste processed depends on the technology used in the RRF. The technologies currently used in Perth are biological processes that treat / recover the organic fraction of the domestic refuse stream.

The Perth Metropolitan Region currently has two RRFs in operation. The ATLAS group operations in Mirrabooka and the SMRC operations in Canning Vale. Waste that is accepted at both of these facilities undergoes mechanical treatment to remove recyclables and contaminants from the organics waste stream. The recyclables separated are sent to market whilst the organics stream undergoes biological treatment to produce compost. The SMRC utilises in-vessel technology to accomplish this, whereas ATLAS takes the organics offsite to a farm in Calingiri in the Shire of Victoria Plains where it is composted in windrows. Residuals from both processes that are not marketable are sent to a putrescible landfill. **Table 5.7** / **Appendix G** outlines the current, confirmed and proposed / preferred sites for future RRFs.

Table 5.7: RRFs in operation, confirmed and proposed in the Perth Metropolitan Region

Regional Council	Name	Location	Owner	Commence Operation
EMRC		To be determined		To be determined
MRC	BioVision 2020	Neerabup	BioVision 2020	2009
	Atlas	Mirrabooka	Atlas	2001
RRC		Kwinana		2011
SMRC	SMRC RRRC	Canning Vale	SMRC	2003
WMRC	AnaeCo	Shenton Park	AnaeCo	2009

5.2.8 Greenwaste Reprocessing Facilities

As discussed in **Section 2** the only reprocessing facilities that have been addressed in this study are greenwaste mulching and soil blending facilities. Greenwaste is organic green and woody material from both public and private parks and garden areas. Greenwaste often includes grass clippings, tree limbs, vegetation trimmings and whole vegetation cleared for development (DEC 2008).

There are a number of greenwaste processing facilities in the Perth Metropolitan Region that currently accept greenwaste for mulching or soil blending operations. These are outlined in **Table 5.8** / **Appendix H**.

Table 5.8: Greenwaste Processing Facilities currently in operation in the Perth Metropolitan Region

Regional Council	Name	Location	Owner
EMRC	Purearth	Bayswater	Purearth
	Red Hill Landfill	Red Hill	EMRC
MRC	Eclipse Resources	Neerabup	Eclipse
	Soiland	Wangara	Soiland
	Greens Recycling Facility	Wangara	City of Wanneroo
RRC	Bioorganics	Oakford	Bioorganics
	All Earth	Maddington	All Earth Group
	Custom Compost	Nambeelup	Custom Compost
SMRC	Millar Road Landfill	Millar Road	City Rockingham
	Greenwaste Services	Henderson	Greenwaste Services
	Amazon Soils	Forrestdale	Richgro
	Biowise	Postans	SITA
	SMRC Greenwaste	Canning Vale	SMRC
	Eclipse Resources	Kwinana	Eclipse Resources
WMRC	WMRC Greenwaste	Shenton Park	WMRC

5.3 Current and Potential Waste Acceptance for Existing Waste Infrastructure

As discussed in **Section 2**, the DEC collects MSW, C&I and C&D tonnage information from all landfills in Western Australia that accept metropolitan wastes. Waste streams disposed in each respective Regional Council and regional area outside the Perth Metropolitan Region is outlined in **Table 5.9**.

Table 5.9: MSW, C&I and C&D wastes disposed to putrescible and inert landfills in each metropolitan Regional Council and outer regional areas in 2006/07 (in tonnes)

Area	MSW	C&I	C&D	Total
EMRC	176,830	179,300	114,650	470,780
MRC	300,720	122,690	997,320	1,420,730
SMRC	168,350	329,600	983,240	1,480,190
RRC	68,030	175,040	1,750	244,820
WMRC	-	-	-	-
Regional	150	23,750	-	23,900
Total	**714,080**	**830,380**	**2,096,960**	**3,640,420**

Source: DEC Landfill Levy Data

The MRC and the SMRC are areas that accept the most waste in the Metropolitan Area with approximately 1.45 million tonnes each. This can be attributed to the amount of waste infrastructure currently present in the areas, especially in regard to inert landfills. The MRC region accepts the highest amount of MSW in the Perth Metropolitan Region due to its population size and the SMRC region accepts the highest amount of C&I due to the high amount of commercial and industrial activity.

A significant amount of C&I waste (24,000 tonnes) is also now being transported outside the metropolitan area (namely to the Transpacific landfill at Dardanup) for disposal due to lower landfill gate fees. The Dardanup landfill is located approximately 15 kilometres south east of Bunbury or 160 kilometres south of Perth.

The summary of current throughput, maximum throughput, slack capacity, landfill airspace remaining and predicted life expectancy (based on current throughputs) is presented in **Table 5.10**. Life expectancy of each facility in **Table 5.10** is based on current volumes being accepted. Life expectancy based on economic, construction activity and population projections are further outlined in **Section 6**.

Inert and putrescible landfills in 2006/07 accepted the highest quantity of waste in the Metropolitan Area with 2.2 million (inert C&I, C&D) and 1.5 million tonnes of waste (MSW, C&I and C&D) respectively. 971,600 tonnes of material was accepted at recycling organisations (MRFs, RRFs, Inert Recyclers, Greenwaste Processors) during 2006/07.

Table 5.10: Summary of Waste Infrastructure (actual / maximum) throughput, slack capacity, airspace remaining and estimated facility type lifespan within each Regional Council

Regional Council	Infrastructure	Actual throughput (T)	Maximum throughput (T)	Slack Capacity (T)	Remaining Airspace (m3)	Facility Lifespan (2006/07 throughput) (years)
MRC	Landfills (Putresible)	356,300	N/A	N/A	4,500,000	10
	Landfills (Inert)	1,065,275	N/A	N/A	3,720,000	5
	Material Recovery Facility (MRF)	22,000	32,000	10,000	N/A	Unknown
	Resource Recovery Facility (RRF)	66,000	66,000	-	N/A	Unknown
	Inert Recycler	No Inert Recyclers				
	Transfer Station (Putresible)	80,500	90,000	9,500	N/A	Unknown
	Transfer Station (Inert)	No Inert Transfer Station				
	Greenwaste	20,000	70,000	80,000	N/A	Unknown
EMRC	Landfills (Putresible)	356,225	N/A	N/A	13,200,000	30
	Landfill (Hazardous)	25,000	N/A	N/A	290,000	14
	Landfills (Inert)	114,560	N/A	N/A	70,000	1
	Material Recovery Facility (MRF)	40,000	45,000	5,000	N/A	Unknown
	Resource Recovery Facility (RRF)	No RRF at present				
	Inert Recycler	235,000	1,390,000	1,165,000	N/A	Unknown
	Transfer Station (Putresible)	29,750	35,000	5,250	N/A	Unknown
	Transfer Station (Inert)	130,000	-	-	N/A	Unknown
	Greenwaste	31,000	56,000	15,000	N/A	Unknown
RRC	Landfills (Putresible)	244,754	N/A	N/A	3,250,000	11
	Landfills (Inert)	90,000	N/A	N/A	200,000	3
	Material Recovery Facility (MRF)	19,500	19,500	-	N/A	Unknown
	Resource Recovery Facility (RRF)	No RRF at present				
	Inert Recycler	130,000	175,000	45,000	N/A	Unknown
	Transfer Station (Putresible)	14,500	15,000	500	N/A	Unknown
	Transfer Station (Inert)	-	-	-	N/A	-
	Greenwaste	35,000	81,250	46,250	N/A	Unknown
SMRC	Landfills (Putresible)	521,816	N/A	N/A	9,200,000	14
	Landfills (Inert)	962,151	N/A	N/A	9,500,000	15
	Material Recovery Facility (MRF)	150,500	212,400	61,900	N/A	Unknown
	Resource Recovery Facility (RRF)	100,000	115,000	15,000	N/A	Unknown
	Inert Recycler	155,000	279,000	124,000	N/A	Unknown
	Transfer Station (Putresible)	121,000	281,000	59,000	N/A	Unknown
	Transfer Station (Inert)	-	-	-	N/A	Unknown
	Greenwaste	74,600	98,000	23,400	N/A	Unknown
WMRC	Landfills (Putresible)	No Putresible Landfill				
	Landfills (Inert)	No Inert Landfill				
	Material Recovery Facility (MRF)	No MRF				
	Resource Recovery Facility (RRF)	No RRF (Operational 2009)				
	Inert Recycler	No Inert Recycler				
	Transfer Station (Putresible)	35,000	50,000	15,000	N/A	Unknown
	Transfer Station (Inert)	No Inert Transfer Station				
	Greenwaste	6,000	6,500	500	N/A	Unknown
Total	Landfills (Putresible)	1,479,095	N/A	N/A	30,150,000	16
	Landfills (Hazardous)	25,000	N/A	N/A	290,000	14
	Landfills (Inert)	2,231,987	N/A	N/A	13,490,000	9
	Material Recovery Facility (MRF)	249,000	333,900	84,900	N/A	Unknown
	Resource Recovery Facility (RRF)	166,000	181,000	15,000	N/A	Unknown
	Inert Recycler	390,000	1,669,000	1,289,000	N/A	Unknown
	Transfer Station (Putresible)	280,750	471,000	89,250	N/A	Unknown
	Transfer Station (Inert)	130,000	N/A	N/A	N/A	Unknown
	Greenwaste	166,600	311,750	165,150	N/A	Unknown

Note: - Life expectancy based on 2006/07 throughputs
- MRFs include municipal and commercial operations
- Total includes Greens Recycling (Bunbury)
- Reported MRF maximum throughput and slack capacity is based on a single eight hour shift
- It can be assumed that a double shift (16 hours) would double the current, maximum and slack capacity of MRFs
- 91% coverage (**Appendix A** presents responses)

6. CURRENT AND PROJECTED LIMITATIONS IN WASTE INFRASTRUCTURE

6.1 Class I (Inert) Landfills

Inert landfill infrastructure in the Perth Metropolitan Region is currently adequate in the short term; however in the medium to long term it is apparent there will be limitations in the availability of currently licensed inert landfill airspace. There may also be limitations in geographic distribution, especially in the northern coastal region, however discussions with stakeholders indicate that they are pursuing other potential sites for future inert waste disposal. Due to commercial sensitivities potential future sites were not outlined by inert landfill stakeholders. Eclipse Resources have indicated that they have already sourced a site on Welshpool Road for a new inert landfill to replace the Flynn Drive landfill which is set to be exhausted within 12 months.

As discussed in **Section 5.3** Class I (inert) landfill life expectancy (based on current throughputs) is likely to be approximately nine years (2017/18). Based on construction activity forecasts (Construction Forecasting Council 2008) and assumed increased C&D recycling of 5% per annum, inert landfill life expectancy is likely to not change (2017/18).

Alternate assumptions for Class I (inert) landfills are outlined in **Table 6.1**.

Table 6.1: Sensitivity analysis of predicted Class I (inert) Landfill life expectancy in the Perth Metropolitan Region

Assumption	Exhausted
No Change in Waste Volumes (2006/07 volumes)	2017/18
Construction Activity Only	2016/17
Construction Activity + 5% / annum increase recycling only (**Section 4.3**)	2017/18
Construction Activity + 5% / annum increase recycling + 1% / annum decrease waste generation	2019/20

Note: Assumes no Class I landfills will be developed or recyclers shut down

Based on the assumptions in **Table 6.1** and the assumption that no additional Class I (inert) landfills are commissioned, it can be assumed that Class I (inert) landfills in the Perth Metropolitan Region will be exhausted between 2016/17 and 2019/20.

If a recycler in the current marketplace were to cease operations, it is likely that landfill life expectancy would be reduced. As outlined in **Section 3.3**, the C&D recycling industry diverted approximately 410,000 tonnes of material from landfill in 2006/07. A single recycler can process up to 100,000 tonnes per annum at present.

6.2 Class II/III (Putrescible) Landfills

Like inert landfills, putrescible landfill infrastructure in the Perth Metropolitan Region is currently adequate in the short term; however in the medium to long term it is apparent there will be limitations in the availability in landfill airspace. As discussed in **Section 5.3** putrescible landfill life expectancy (based on current throughputs) is likely to be approximately 16 years (2024/25). Based on increases in population and GDP (MACHR) and increased resource recovery of MSW and recycling of C&I, putrescible landfill life expectancy is unlikely to extend beyond 2025/26.

Projections have not been completed for individual landfills as circumstances on material being accepted over time can vary. It was also deemed commercially sensitive to report this data

Alternate assumptions for Class II/III (putrescible) landfills are outlined in **Table 6.2**.

Table 6.2: Sensitivity analysis of predicted Class II/III (Putrescible) Landfill life expectancy in the Perth Metropolitan Region

Assumption	RRF	Exhausted
No Change in Waste Volumes (2006/07 volumes)	No	2024/25
Population and MACHR GDP Only	No	2021/22
Population and MACHR GDP Only	Yes	2023/24
Projected Population + 1% / annum increase recycling (**Section 4.1**) and MACHR GDP + 1% / annum increase recycling (**Section 4.2**)	Yes	2025/26

Note: Assumes no Class II/III landfills will be developed

Based on the assumptions in **Table 6.2** and the assumption that no Class II/III (putrescible) landfills are commissioned it can be assumed that Class II/III (putrescible) landfills in the Perth Metropolitan Region will be exhausted between 2021/22 and 2025/26.

There are plans by two operators (Veolia and Vorina) to construct two new Class II or III putrescible landfills in the Shire of Gingin that will be willing to accept MSW, C&I and C&D waste streams in the medium term, however the capacity, throughput and timeline for construction have not been confirmed as all the necessary approvals have not been granted as yet. There may also be the opportunity to extend the life of the Henderson Road Landfill via the acquisition of land adjacent to the site (currently owned by Cockburn Cement). It is unknown how much land could potentially become available. To acquire the site there would be the need for a scheme amendment.

6.3 Class IV (Hazardous) Landfill

The Class IV (Hazardous) cell at Red Hill is currently the sole hazardous waste landfill cell in the Perth Metropolitan Region and is approximately at 5% of its capacity, however due to varying annual inputs the life expectancy of the landfill cell is difficult to predict. Based on reported airspace remaining and throughput for the 2006/07 financial year remaining consistent into the future, the Class IV cell has approximately 15 years remaining.

6.4 Inert Transfer Stations / Recyclers

Unlike landfills, transfer stations and recyclers do not have fixed life expectancies based on the maximum amount of material that can be accepted, however they are constrained by the amount of material they can process, labour availability, lease / contract terms and life expectancy of certain infrastructure within the transfer station.

If 5% growth per annum in Recycled C&D material is assumed to continue into the future, current infrastructure will need to absorb this increase. According to the recycled C&D industry there is currently potential to accept approximately 1.7 million tonnes of C&D material for processing. The amount of C&D waste material that is currently being generated in the Perth Metropolitan Region is 2.5 million tonnes (2.1 million tonnes to landfill and 0.4 million tonnes to recyclers). Therefore there is slack capacity in the current C&D marketplace of 1.3 million tonnes.

Based on projected recycled C&D volumes by 2019/20 (855,310 tonnes) and slack capacity of the C&D recycling operations at present, the current C&D recycling industry is well placed to accept additional material for some time to come.

There were data limitations in regards to the potential throughput of inert transfer stations for this study and therefore no predictions have been made in regards to the capacity of those facilities. Inert transfer stations in operation in the Perth Metropolitan Region currently accept at least 260,000 tonnes of material per annum. Of the inert transfer stations that forwarded information there is approximately 45,000 tonnes of slack capacity.

6.5 Putrescible Transfer Stations

As discussed in **Section 5.3**, putrescible transfer stations accept approximately 280,750 tonnes of material for disposal to landfill. A number of transfer stations also provide a recycling drop-off service. At present there is approximately 90,000 tonnes of slack capacity at existing putrescible transfer stations in the Perth Metropolitan Region.

Like inert transfer stations it is difficult to project how much material will be disposed at transfer stations instead of being disposed directly to putrescible landfill. Material accepted from LGAs or commercial enterprises can change with time. Whilst putrescible transfer stations have capacity at present, if additional throughput of material was required, transfer stations have the ability to modify operations via increased truck movements or constructing an additional bay to accommodate increased waste volumes in a relatively short period of time.

Over time with increased travel times and transport costs it is likely that more transfer stations will be constructed to provide an acceptable level of service to industry and the community.

6.6 Material Recovery Facilities

Municipal MRFs in the Perth Metropolitan Region (including Greens Recycling in Bunbury) have reported that as of 2006/07 approximately 203,900 tonnes of material can be processed through their facilities (based on a single shift). As of 2006/07, there is approximately 49,900 tonnes of slack capacity available per annum (based on a single shift).

Based on the assumptions in **Table 6.3** and the assumption that all MRFs will remain operational it can be assumed that MRFs in the Perth Metropolitan Region (including Greens Recycling) will have capacity until at least 2014/15. However constraints can potentially arise in a short period of time, especially if a MRF or MRFs require a temporary shut down.

Table 6.3: Sensitivity analysis of Municipal MRFs throughput constraints in the Perth Metropolitan Region (single shift)

Assumption	Infrastructure Constraint
No Change in accepted volumes (2006/07 volumes)	Indefinite
Projected Population Only	2026/27
Projected Population + 1% / annum increase recycling	2018/19
Projected Population + 2% / annum increase recycling	2014/15

Note: Assumes no MRFs or additional MRF capacity will be developed

Plant shut downs obviously result in increased volumes at remaining MRFs to prevent material being sent to landfill for disposal. **Table 6.4** outlines when potential future

constraints may occur based on the scenario of either one (50,000 tonnes) or two (50,000 + 40,000 tonnes) of the largest MRFs in the Perth Metropolitan Region were to temporarily shut down and currently accepted material needed to be diverted. As there is currently only 49,000 tonnes of slack capacity (based on a single shift), obviously other MRFs would require a shift beyond eight hours to process the material.

Table 6.4: Municipal MRF throughput constraints based on assumed scenarios

Assumption	Infrastructure Constraint
Projected Population + 1x MRF (50,000 tonne) shut down (single shift)	2006/07
Projected Population + 1x MRF (50,000 tonne) shut down (double shift)	2030+
Projected Population + 2x MRF (50,000 + 40,000 tonne) shut down (double shift)	2030+
Projected Population + 2% / annum increase recycling + 1x MRF (50,000 tonne) shut down (double shift)	2030+
Projected Population + 2% / annum increase recycling + 2x MRF (55,000 + 40,000 tonne) shut down	2028/29

Therefore, even in the unlikely scenario that two of Perth's largest municipal MRFs shut down, the system theoretically should be able to absorb the waste material for processing on extended shifts. However, given this, there are also a number of other variables that may restrict or increase the amount of material that current MRF infrastructure can absorb.

Further constraints on the amount of material that MRFs can currently accept include (but not limited to):

- Efficiency of current plants;
- Labour availability;
- Seasonal variations;
- Storage space (inputs); and
- Storage space (outputs)

MRFs are designed with a tonnes / hour throughput in mind. Decisions made at the design phase for material throughput include trummel size at the beginning of the process, conveyor belt width and the number of picking stations during the middle of the process and the size / throughput of the baling systems at the backend of the process. Therefore all plant in the Perth Metropolitan Region is rated to accept material based on a time period (per hour) basis. Annual throughput is based on 8 hours per day / 5 days week / 52 weeks per year).

MRFs have the ability to extend the annual design capacity of the plant via operating the plant for additional time. This will usually require the attainment of additional labour to process the material. Some MRFs may also be able to run on Saturdays. Theoretically MRFs have the ability to double the amount of material they can accept and process through a second shift (98,000 municipal MRF slack capacity), however practically MRFs would likely be unable to process this amount due to labour constraints and stresses that would become apparent on the plant. Labour is vitally important to keep the machinery running and to staff picking stations to minimise contamination.

In the past many MRFs employed their workforce directly. This proved to be problematic for the continuation of diversion of recyclables from landfill when a MRF had a temporary shut down and labour was unable to move freely between plants. Some of the problems that MRF operators experienced in the past in this regard are now being minimised through the

sourcing of labour through labour agencies that can shift labour from one plant to another in the event of a shut down.

MRF operators have indicated that the acceptance of material can be dynamic depending on the time of year / season. There is a marked increase of approximately 20% in material acceptance during the warmer months due to recyclable consumption variations by the Perth population. Therefore throughput constraints are more likely to occur during the warmer months (Nov – March). Due to the dynamic nature of material being accepted at facilities during the year it is difficult to predict the slack capacity of the Perth Metropolitan Region at any one point in time.

Other constraints that MRFs may exhibit include the amount of storage space on site for unsorted and processed material. Most MRFs have the ability to store material for approximately 2-5 days before requiring diversion of material elsewhere. Storage of baled materials ready for market may also restrict the amount of material that a MRF can accept and then process. MRFs export processed material on a daily basis from site, although this depends on their throughput.

The move towards weekly collections of recyclables is likely to have a significant impact on the amount of slack capacity currently present in the system. The SMRC has already held trials for a weekly collection of material and reported a 40% increase in yield and may implement this service in the near future.

The confidential nature of some MRF operators' contingency plans makes it is difficult to determine whether these plans are sufficient to divert all material in the event of a major shutdown (especially at larger MRFs). However, discussions have shown that there is a marked improvement in these plans since a number of high profile shutdowns in the past that resulted in recyclables being sent to landfill.

Due to the commercial sensitivities commercial MRFs (AMCOR and VISY) tonnage throughputs and slack capacity have not been reported, however discussions with these operators suggest that there is sufficient slack capacity at present and that contingency plans are currently in place in the event of a shut down at one of the plants.

In summary, municipal and commercial MRF infrastructure is well placed to accept increased projected volumes of material in the future. MRF infrastructure is also well placed to absorb any additional material if MRF infrastructure temporarily fails. However it is unknown whether municipal MRF contingency plans currently in place allow for the rapid transfer of recyclables and possibly labour to other facilities to cope with the increased volumes.

6.7 Resource Recovery Facilities

RRFs currently operating in the Perth Metropolitan Region (SMRC and Atlas) are currently running near capacity due to the volume of waste that the Perth Metropolitan Region produces. As more RRFs are commissioned (see assumptions in **Section 4.1**) it can be assumed that all RRF infrastructure will run at or close to at full capacity. If waste volumes generated by the LGAs do not reach the capacity of the plant, it is likely the operator will seek waste from other "commercial" customers to keep the plant running at near design capacity so economies of scale can be sustained.

Examples of this are already apparent at the SMRC where LGAs that did not contribute towards the project are sending material for processing (e.g City of South Perth, Town of Kwinana, City of Cockburn). The AnaeCo plant in Brockway Transfer Station will also be seeking material from outside the WMRC (City of Stirling) so it can run at near to maximum capacity (55,000 tonnes).

In the event of a shut down at one of the current or proposed RRFs, waste will be sent to an appropriate Class II/III landfill. Unlike in the event of a shutdown at a MRF, the disposal to landfill will not be as of much concern to the community in the short to medium term, however in the long term when it is envisaged all waste will be treated prior to landfill, the community may demand that waste be diverted to another RRF for treatment.

A short term shut down at a RRF is unlikely to affect the life expectancy of putrescible landfill significantly, however if a RRF were to shut down permanently or no additional RRFs were to become available this would reduce the putrescible landfill life expectancy projections outlined in this report. A shut down of a 100,000 tonne RRF would require approximately 70,000 tonnes of additional waste to be sent to putrescible landfill per year. The result of no commissioning of additional RRFs on landfill life expectancy is outlined in **Section 6.2**.

6.8 Greenwaste Processors

Greenwaste processors in the Perth Metropolitan Region have reported that as of 2006/07 there is the potential to process approximately 311,750 tonnes of material. Therefore there is approximately 165,150 tonnes of slack capacity available per annum.

Based on the assumptions in **Table 6.5** and the assumption that all greenwaste processing facilities will remain operational it can be assumed that greenwaste processors in the Perth Metropolitan Region will have capacity until at least 2020. However constraints can arise in a short period of time, especially if a greenwaste facility was to shut down. However, given the large slack capacity at present and ability for the greenwaste infrastructure to be commissioned quickly, it is unlikely there will be any constraints in the near future.

Table 6.5: Sensitivity analysis of Greenwaste Processors throughput constraints in the Perth Metropolitan Region

Assumption	Infrastructure Constraint
No Change in accepted volumes (2006/07 volumes)	2020 +
Projected Population Only	2020 +
Projected Population + 2% / annum increase recycling	2020 +

7. SWOT ANALYSIS

A SWOT analysis is a strategic planning method that is aimed at identifying key Strengths, Weaknesses, Opportunities and Threats of the subject of interest. For the purposes of this study the analysis is aimed at the ability of waste infrastructure in the Perth Metropolitan Region to provide adequate waste disposal and recycling options currently and into the future. The SWOT has been completed for each of the waste stream types. Infrastructure requirements for MSW and C&I waste include Class II / III landfill, putrescible transfer stations, MRFs, RRFs and greenwaste processors whilst C&D waste requires Class I landfill, inert transfer stations and C&D recyclers.

Table 7.1 summarises a SWOT analysis in relation to whether attributes are helpful or harmful and internal or external in origin.

Table 7.1: SWOT analysis model

	Helpful (to achieving the objective)	**Harmful (to achieving the objective)**
Internal Origin (attributes of the industry)	Strengths	Weaknesses
External Origin (attributes of the environment)	Opportunities	Threats

Strengths and opportunities can be considered attributes that are helpful in achieving the objective, whilst weaknesses and threats are likely to prevent objectives being achieved. Strengths and Weaknesses are attributes that can be found within the waste industry at present, whilst opportunities and threats are more attributes of the external environment.

As discussed in **Section 2**, as part of the SWOT analysis phase of the project a workshop was conducted with key waste industry stakeholders. Stakeholders included representatives from Local Government, Metropolitan Regional Councils, State Government, the Waste Authority and Industry. Attendees, organisation, expertise and waste stream SWOT are outlined in **Appendix B**.

Both “core” and “contextual” issues arose from the SWOT analysis of waste infrastructure in the Perth Metropolitan Region. Core issues can be considered issues that directly relate to waste infrastructure such as siting, geographic distribution, capacity etc. Contextual issues are issues that indirectly relate to waste infrastructure, however are still important in terms of diverting waste to recycling facilities (e.g. landfill levy, education, contamination etc).

Information presented below is a combination of the outcomes from the key issues of the SWOT workshop and internal Cardno conclusions from all information that has been gathered from third parties.

7.1 MSW

7.1.1 Strengths

As outlined in the previous section, a strength is an attribute that can be considered internal in origin and helps achieve the desired objective.

Core Strengths

A number of core strengths which directly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core strengths are summarised below.

- ***The establishment of Regional Councils to manage waste disposal and treatment of MSW.***

  The establishment of the five Regional Councils within the Perth Metropolitan area has produced waste management organisations of efficient size that are well resourced technically and financially. The services and facilities provided by the Regional Councils are generally of a high standard. This has also been a major factor in the implementation of Resource Recovery projects by all of the Regional Councils.

- ***Efficient management of well engineered landfills with good utilisation of landfill space***.

  The current regional putrescible landfills are large, well engineered facilities designed to meet community, environmental and economic needs. Best practice design and management techniques are generally employed at each site, including maximisation of the life of the landfill through good compaction and covering techniques.

  As outlined in **Section 5.3** and **6.2** putrescible landfills in each Regional Council have at least 10 years life expectancy. Therefore, there is not an immediate threat of landfill depletion in any region. This timeline provides each Regional Council with sufficient time to plan for the planning and construction of a new facility (if required).

- ***Provision of geographically well placed and well engineered putrescible landfills and transfer stations.***

  Putrescible transfer stations currently in operation are well engineered facilities that are generally located in inner city areas and accept large quantities of waste. These facilities allow for greater efficiencies in regards to transportation of waste to the large landfills on the outer urban fringe, minimising the need for standard rubbish trucks to transport waste. Putrescible landfills and transfer stations are well placed to continue accepting material into the medium term.

- ***Provision of geographically well placed material recovery facilities (MRFs) with spare capacity.***

  As discussed in **Section 6.6** MRFs are geographically well placed across the Perth Metropolitan Region and have sufficient capacity (approximately 49,900 tonnes per annum based on a single shift) to accept recyclables into the future even with a temporary shut down of any of the facilities.

- ***Proactive planning in development of Resource Recovery infrastructure***.

  The establishment of the ATLAS RRF in 2001 and SMRC RRF in 2003 has led to a significant decrease in the amount of waste sent to landfill in Perth. All other Regional Councils (WMRC, MRC, EMRC and RRC) are in the planning or construction stage for resource recovery facilities to process MSW in their respective regions. These facilities, along with the improvement of kerbside recycling have led/will lead to a decrease in the amount of MSW being sent to landfill.

  Additionally, the continued establishment of Resource Recovery Parks at landfills and transfer stations has allowed for the recycling of dry recyclables and bulk waste goods by residents that would have otherwise ended up in landfill.

- ***Sufficient capacity for greenwaste processing***.

  Greenwaste processing has shown strong growth over the past 5 years via the introduction of greenwaste drop-off facilities, periodic household vergeside collections and land development. Greenwaste processing infrastructure currently has capacity to accept additional material. There is strong demand at present in the Perth landscaping market place for processed greenwaste for use as a organic soil conditioning agent.

Contextual Strengths

A number of contextual strengths indirectly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual strengths are summarised below.

- *The establishment of representative bodies for Municipal Waste.*

  The establishment of the Municipal Waste Advisory Council as the peak municipal waste body has provided this sector of the waste industry with strong representation on matters affecting municipal waste.

  The Forum of Regional Councils has been established to provide a forum for the sharing of information and coordination of activities in regards to waste issues affecting Regional Councils.

- *Delivery of efficient collection services to all members of the community.*

  The provision to the community of efficient municipal waste collection and disposal services by Local Governments improves community acceptance of the waste industry and the need for MSW infrastructure. There is strong community support for recycling.

7.1.2 Weaknesses

Core Weaknesses

A number of core weaknesses which directly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core weaknesses are summarised below.

- ***Difficulties in obtaining approvals for establishing MSW facilities***.

  Obtaining environmental and town planning approvals for MSW infrastructure is often a difficult process, particularly due to concerns of the potential impacts on local communities. This can lead to lengthy and expensive lead times, particularly for more complex facilities such as RRFs

- ***Lack of planning for waste facilities in association with urban development.***

  It is becoming very difficult to site major facilities (landfills / RRFs) in close proximity to the Metropolitan Area due to property values and the risk of encroaching conflicting landuses. No provision is made for these facilities in the strategic planning instruments such as the Metropolitan Region Scheme. This limits the ability to locate facilities to serve the metropolitan region effectively.

  DEC has also indicated that it would prefer no more putrescible landfills to be located on the Swan Coastal Plain due to groundwater contamination risks. As this position has not been officially outlined in a policy document it has created some uncertainty in the marketplace. The proposed Veolia and Vorina Class II or III landfills to be located in the Shire of Gingin will be located on the Swan Coast Plain if approved.

- ***Limited State Government guidance on parameters for future sites and technologies.***

  A lack of guidance from the State Government on parameters for future MSW infrastructure provides a significant barrier on where future sites should be located and what technologies for processing waste are acceptable. This guidance should address what is required for achieving the goal of "Towards Zero Waste" to landfill.

Contextual Weaknesses

A number of contextual weaknesses which indirectly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual weaknesses are summarised below.

- *Current limited use of organic source separation collection systems.*

  Source separation of organics would increase the level of organic waste able to be recovered and diverted from landfill, decrease contamination rates, limit the requirements of mechanical processing, and ultimately increase the grade of compost / digestate produced. This is likely to become increasingly important with the growing awareness of the need to protect and improve our soils.

- *Lack of government policies on waste minimisation and recycling.*

  No significant progress has been made in minimising waste generation through such initiatives as introducing Extended Producer Responsibility (EPR) under the provisions of the Waste Avoidance and Resource Recovery Act 2001 (WARR Act).

- *Existing wide variety of collection systems and acceptable materials.*

  The different collection services offered by local governments can contribute to public confusion as to what services are offered and what materials can be collected.

- *Obstacles with legislation, including the Local Government Act.*

  The Local Government Act and its associated regulations do not readily accommodate the requirements of procuring major infrastructure projects such as RRFs. The current regulations limit the procurement process that can be followed and has proven to be restrictive in projects involving large capital costs, long contract terms and complex structures in terms of parties involved and risk distribution.

- *The Regional Council districts are not organised on practical geographical grounds.*

  Some problems have arisen from the Regional Councils not being organised on geographically practical grounds, including some Local Government's waste travelling further distances than required to be disposed of and/or treated.

7.1.3 Opportunities

Core Opportunities

A number of core opportunities which directly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core opportunities are summarised below.

- ***Investigation of more RRF options in terms of technology.***

  The increasing prevalence of RRFs throughout the world has led to an increase in the availability of proven RRF technology types that are designed to accept and treat MSW feedstock. A range of MSW treatment technology options, beyond the current predominance of biological technologies (aerobic and anaerobic), will be required to process all components of MSW. This is likely to result in the requirement to introduce alternative, non biological processes, such as gasification.

- ***Better matching of waste collection systems to processing.***

  The quality of products from RRFs can be improved by providing feedstock that is more closely aligned to the requirements of the RRF. This is often best achieved through source separation of waste, and adjusting the waste collection systems. **Appendix C** discusses, there are opportunities for most LGAs' to introduce a third "organics" bin which would reduce the percentage composition of organics in the residual bin and therefore landfill. Source separation would also allow for more efficient pre-treatment and processing of organic waste while reducing contamination rates.

- ***Carbon Pollution Reduction Scheme impacts on MSW waste management.***

  The introduction of a Carbon Pollution Reduction Scheme, and an associated emissions trading scheme are likely to affect the economics of particular waste management and treatment options. The cost of landfilling is likely to increase, with the need for operators to purchase emissions permits. Waste treatment technologies may become more financially attractive under this policy regime. The broader use of best practice landfill techniques is also likely to result to minimise greenhouse gas emissions.

  In addition, an opportunity for carbon sequestration exists with increased compost use as a soil conditioner and fertiliser, reducing the need for artificial fertilisers and increasing the amount of organic carbon in soils.

- ***Development of markets for RRF products.***

  Opportunities to develop markets for valuable RRFs products such as compost / digestate, biogas, syngas and char exist in the Perth Metropolitan Region. In particular, the development of markets for high quality compost for use as a soil conditioner is feasible considering the current regional preference for biological treatment facilities, and the current push for improved soil management and conservation.

Contextual Opportunities

A number of contextual opportunities which indirectly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual opportunities are summarised below.

- *Partnerships between waste management and other sectors.*

  Partnerships between the waste management sector and other sectors, such as the agricultural, environmental and planning sectors, may help identify and therefore reduce potential risks associated with the provision of MSW infrastructure and products from that infrastructure.

- *Improve community engagement and education.*

  The recent improvements in the level of coordination in community education relating to waste management (particularly MSW) are increasing its overall effectiveness. This will lead to improved community understanding of and support for resource recovery.

- *Engage with academia to undertake research and development (R&D) in MSW.*

  The MSW sector of the waste industry in Perth is going through a period of major change with a number of major new infrastructure projects underway. Undertaking R&D projects with academia has been shown to increase industry knowledge on MSW treatment and positively impact on future MSW infrastructure projects.

- *Establish an RRF working group.*

  The establishment of an RRF working group within the waste industry would improve the exchange information on the subject and provide a forum to represent the issues affecting that sector. This could include gaining better access to world-wide information, relating to alternative waste treatment technologies and collection systems.

- *Increase opportunities for local RRF providers.*

  There are increasing opportunities for local technology providers to be contracted to deliver RRF projects, particularly considering the current focus on working towards zero waste. Local technology providers generally have an advantage over international providers as they can monitor the local market and identify opportunities as they arise.

7.1.4 Threats

Core Threats

A number of core threats which directly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core threats are summarised on the following page.

- ***The short term need to identify siting of future MSW infrastructure.***

  Currently the putrescible landfills servicing Perth have only medium term life expectancies. Therefore there is an increasingly urgent need to locate appropriate sites proximate to Perth for the next generation of landfills. There is also a need to identify locations for other associated infrastructure such as transfer stations and resource recovery parks.

- ***Lack of diversity in alternative waste treatment plants.***

  Currently both of the established RRF facilities (Atlas and SMRC), and the facilities undergoing construction (WMRC and MRC) use/will use biological treatment technologies to process MSW. These technologies are welcomed and treat the organic portion of the waste stream that produces the greatest environmental impacts; however, biological processes are not able to treat inorganic fractions of MSW. In addition, the operational RRF facilities have approximately 30% residual waste that is sent to landfill. Together these factors provide a barrier to achieving zero waste, if the waste treatment technologies are limited to biological processes.

- ***Economic conditions and commodity prices***

  Recent world economic events that have resulted in a world economic downturn and reduced liquidity of money in the marketplace may impact the establishment of waste infrastructure in the Perth Metropolitan Area at least in the short term. This is especially the case for high capital infrastructure such as putrescible landfills, RRFs and MRFs.

  The economic downturn has also resulted in lower demand for raw materials and therefore the price paid for recovered recyclables. West Australia heavily relies on international markets for recovered recyclables. Excluding recycled C&D and organics from the local reprocessing industry, approximately 80% of the recyclables require export overseas (Asia). Weaker demand from Asia due to the reduced manufacturing and construction activity has seen commodity prices for recyclables fall and may impact the viability of some recycling operations in the short term and therefore capacity of the system.

Contextual Threats

A number of contextual threats which indirectly influence the provision of MSW-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual threats are summarised below.

- *Limited State Government guidance on parameters for alternative waste treatment*.

  The State Government has not provided guidance to assist the Regional Councils in selecting non biological waste treatment technologies. Cooperation between the State and Local Governments is likely to be needed to obtain community approval

and agency support for alternative technologies that are capable of treating inorganic waste.

- *Contamination of soil resources due to application of MSW compost / digestate.*

  Potential contamination of soil resources from the application of contaminated compost or digestate produced from MSW would threaten the environmental and potentially the economic effectiveness of the MSW treatment facilities.

- *Poor operational performance of MSW treatment facilities*.

  Poor operation of existing MSW infrastructure can threaten future provision of the same or similar facilities most often due to their impacts on public amenity.

- *Selective community acceptance of waste realities.*

  Local community acceptance of certain waste realities such as the need for strategic siting of waste infrastructure as well as the nature of the infrastructure is often selective based on their relative proximity to the communities.

- *Difficulty with retention of people and expertise in the waste management industry.*

  Poor retention of industry and government expertise within the waste management sector may reduce the capacity for implementing effective MSW management.

7.1.5 Summary of Key Findings for the provision of MSW Infrastructure

Key findings by Cardno from the MSW SWOT that are apparent for the adequate provision of MSW infrastructure and the recovery of MSW waste include:

- Provision of geographically well placed and well engineered putrescible landfills and transfer stations;
- Short term need to identify future putrescible sites;
- Difficulty in obtaining approvals for establishing MSW facilities;
- Limited State Government guidance on parameters for future sites; and
- Carbon Pollution Reduction Scheme and impacts on waste management

7.2 Commercial and Industrial

7.2.1 Strengths

Core Strengths

A number of core strengths which directly influence the provision of C&I related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core strengths are summarised below.

- ***Well engineered transfer stations and landfill facilities with good distribution in the Perth Metropolitan Area.***

  As discussed in **Section 7.1**, putrescible landfill infrastructure in the Perth Metropolitan (at which C&I waste is disposed) has good distribution and sufficient landfill capacity for the short-medium term (10-15 years). C&I contractors also have

the ability to dispose of waste at a number of LGA owned transfer stations (albeit at a higher rate), and therefore increase the efficiency of their service.

- ***Recyclable materials arising that are of high quality, high in value and from high waste generators.***

  Within the C&I sector a significant portion of recyclable materials are generated that are high in quality and have a relatively high commodity price. Material diverted in high quantities includes scrap metals, cardboard / paper and organics. Further, these recyclable materials are mainly produced by high waste generators. These are key factors in relation to the relatively good performance of the C&I sector which currently has a recycling rate of approximately 50%.

- ***Mature and competitive C&I service providers.***

  The waste collection markets for the C&I sector is highly concentrated with 4/5 key players in ownership of approximately 80% of the Perth market and therefore these companies have direct influence over the destination of the collected waste stream.

Contextual Strengths

A number of contextual strengths which indirectly influence the provision of C&I-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual strengths are summarised below.

- *C&I industries are generating high volume, consistent waste streams.*

  A number of C&I waste generators produce high volume and consistent waste streams which could prove critical in the establishment of recovery options for materials.

7.2.2 Weaknesses

Core Weaknesses

A number of core weaknesses which directly influence the provision of C&I related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core weaknesses are summarised below.

- ***Limited availability of sites for C&I transfer stations within waste generation catchment area.***

  Available (and appropriate) sites for C&I waste is currently limited in the Perth Metropolitan Area. This has resulted in the majority of commercial operators carting their waste directly to landfills for disposal. The availability of alternative options within the main catchment areas such as transfer station could increase the viability of further recovery of materials from this waste stream.

- ***Lack of dedicated recycling and recovery infrastructure at present in the Perth Metropolitan Area.***

  Currently there is no dedicated waste management infrastructure across the Perth Metropolitan area for the recycling or recovery of C&I waste such as a dirty MRF or a RRF. The development of such a facility within Perth could reduce the reliance on landfill for C&I waste. However, the cost of landfill disposal does not make these recovery opportunities currently attractive to C&I waste handlers.

- ***Lack of compositional data for the C&I waste stream.***

  The compositional data that is available on the C&I waste streams generated within Perth Metropolitan Region is limited and is open to high variation.

Contextual Weaknesses

A number of contextual weaknesses which indirectly influence the provision of C&I-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual weaknesses are summarised below.

- *Lack of strong linkage between C&I waste generators and environmental issues.*

  The environmental cost of the disposal of C&I waste is largely unknown and not given priority by waste generators. The out of sight / out of mind mentality provides a barrier to the establishment of sustainable waste management practices.

- *Lack of strong regulatory or market based tools that encourage the recovery of C&I materials.*

  Regulatory tools and market based instruments to improve the amount of material that is source separated for recycling is lacking at present in Western Australia. This is indirectly limiting the C&I sector (or local government sector) establishing waste infrastructure to process the additional material that would likely become available. This lack of regulation / market incentives is resulting in high quantities of material (especially unsorted) being sent directly to a transfer station or landfill for disposal (due to the lower cost of landfilling), instead of being treated or sorted at a recycling infrastructure (i.e. a RRF / dirty MRF).

- *A lack of commonality across the C&I waste stream.*

  Due to the various waste generators of C&I across the Perth Metropolitan Region, it is difficult to determine with certainty the amount and type of C&I waste that will be generated over a set time period.

- *Low confidence level in available markets for C&I recyclable materials.*

  The confidence level in available markets for recovered products is also of some concern to the C&I recycling sector, especially after the sorting of mixed waste for market. Recycled materials also largely follow international commodity prices and therefore can fluctuate over time depending on supply and demand. This further adds uncertainty to the C&I sector and may discourage the establishment of infrastructure to process such material.

- *Availability of space for the separation of recyclable materials at premises of C&I generators.*

  Due to the high density and therefore limited space within many commercial and industrial precincts, recycling can be problematic. Priority will always be given to the disposal of waste rather than the source separation of recyclables.

7.2.3 Opportunities

Core Opportunities

A number of core opportunities which directly influence the provision of C&I related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core opportunities are summarised below.

- ***Establishment of appropriate infrastructure for the recovery of C&I waste.***

  As discussed in **Section 7.2.2**, unlike the MSW sector, there has been no progression towards the recovery of mixed C&I waste through dirty MRF or RRF technology. The establishment of these facilities would lead to a significant amount of material diversion from landfill, especially as a large majority of C&I waste is potentially recyclable.

- ***An increase in the landfill levy to drive further recovery.***

  One of the key factors that could further divert C&I waste from landfill would be an increase in the landfill levy for C&I materials. Such an increase could aim to make the recovery of such materials more financially attractive than landfill.

- ***Strategies for separate recycling collections within C&I precincts.***

  There is the opportunity for source separation and collections of recyclables within individual commercial and industrial precincts. Strategically located MRFs, close to the source of the waste could be attractive to the C&I industry when the reduced cost of transport is considered.

- ***Government funding for C&I infrastructure.***

  A major opportunity for the development of C&I infrastructure to divert such materials from landfill would be funding from the government for the establishment of a dirty MRF and/or RRF. There are limited disposal opportunities for C&I waste close to the source of its generation. This has resulted in there being significant cost and vehicle emissions involved in the transportation of these materials to the landfill facilities where they are being disposed.

Contextual Opportunities

A number of contextual opportunities which indirectly influence the provision of C&I-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual opportunities are summarised below.

- *Undertaking of an extensive C&I waste auditing program on all C&I waste streams arising to obtain a greater understanding of the C&I waste stream.*

  As there have been a limited amount of audits completed, there is opportunity for further waste audits across the Perth Metropolitan Region for MSW, C&I and C&D being disposed at putrescible landfills. This information will inform the waste and recycling industry about the potential materials that are available. The composition of C&I waste being disposed at landfill is likely to vary geographically due to varying consumption patterns. C&I waste is also likely to vary over time due to economic changes or market demands for certain materials.

- *Establishment of waste working groups within each industrial precinct.*

  If industry working groups were formed in the large C&I precincts to address waste reduction, sharing of resources and potential uptake of waste materials (i.e. similar to the Kwinana Eco Industrial Precinct) there may be the potential to significantly reduce the amount of waste being generated.

- *Establishment of EPR systems for the diversion of C&I waste.*

  Under the *WARR Act 2007* there is the provision for the establishment of Extended Producer Responsibility (EPR). Under the scheme producers would be responsible for their waste stream and would therefore encourage sustainable waste management practices.

- *Use Emissions Trading Scheme (ETS) to promote recycling and use of C&D materials.*

  There is the opportunity to promote the proposed ETS to demonstrate the lower carbon footprint that recycled C&I products can provide over virgin extracted material.

7.2.4 Threats

Core Threats

A number of core threats which directly influence the provision of C&I related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core threats are summarised on the following page.

- ***Lack of a Peak Body focusing on the C&I waste steam.***

  Currently there is no over arching peak body established focusing on the C&I waste stream similar to those established for the MSW and C&D waste streams. Such groups take ownership of these waste streams and push for the adoption of sustainable waste management practices to divert these materials away from landfill. They also identify the key issues associated with these waste steams and communicate these to the waste industry, State Government bodies and relevant Ministers. The establishment of a Peak Body would help in the adoption and progression of sustainable waste management practices for the C&I waste stream.

- ***Economic downturn and the effect on commodity prices.***

  Recent events on world financial markets are a very serious threat to the establishment of C&I infrastructure, especially operations that need to raise / borrow significant amounts of money to establish a premises. This economic downturn may also result in a slump in commodity prices for recycled material. The scrap metal prices have already shown a sharp fall in the past number of months which will put strain on a number of industry players.

- ***Continuing growth of C&I waste.***

  As outlined in **Section 4.2** past growth trends and the RBA (August 2008 report) forecast of 2.5% growth over the coming 3 years suggests that it is likely that C&I waste will continue to grow at least in the short term. Therefore constraints may become apparent on existing recycling infrastructure and lead to the faster depletion of putrescible landfills.

Contextual Threats

A number of contextual threats which indirectly influence the provision of C&I-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual threats are summarised below.

- *Government policy and guidance on C&I waste treatment.*

  Biological waste processing technology, as currently being operated and developed in Perth, is not available for C&I waste. Government guidance and support for separation and treatment infrastructure including appropriate treatment technologies would be beneficial.

7.2.5 Summary of Key Findings for the Provision of C&I Infrastructure

Key findings by Cardno from the C&I SWOT that are apparent for the adequate provision of C&I infrastructure and the recovery of C&I waste include:

- Well engineered landfills and transfer stations with good distribution;
- No strong linkage between C&I waste generator sector and environmental issues;
- Low landfill gate fees;
- The lack of suitable MRFs and RRFs to recover C&I;
- Economic downturn;
- Funding / Market support is required to develop further C&I recovery;
- Lack of a peak body focussing on the C&I waste stream; and
- Lack of direction and regulatory focus for waste reduction

7.3 Construction and Demolition

7.3.1 Strengths

Core Strengths

A number of core strengths which directly influence the provision of C&D related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core strengths are summarised below.

- ***Reasonable distribution of sites and effective transport infrastructure.***

  Appendix D illustrates the current distribution of inert infrastructure in the Perth Metropolitan Region where inert material can be disposed. Inert landfills are mostly available and distributed within the MRC and SMRC, whilst transfer stations and inert recyclers are located in the eastern region (EMRC, RRC) where current or past quarries are unavailable. Infrastructure is generally located in proximity to effective transport routes (highways / freeways).

- ***Availability of inert infrastructure and large slack capacity at current C&D recycling infrastructure.***

  Inert infrastructure is readily available in the Perth Metropolitan Area with a number of landfills, transfer stations and recyclers having significant capacity for the long term, however inert landfill infrastructure in a number of Regional Councils will be exhausted over the coming 5 years.

If there were to be a reduction in the availability of Class I (inert) landfills, recyclers would be able to offset any loss in capacity. As outlined in **Section 6.4**, the C&D recycling industry has the potential to accept approximately 1.7 million tonnes of C&D material for processing or an additional 1.3 million tonnes of material over and above what is currently being processed.

- ***Relatively low set up costs.***

  When compared to MSW and C&I waste infrastructure, the C&D industry has relatively low set up costs due to the separation and processing of material being basic. Infrastructure will usually involve a screen and / or crushing apparatus to separate material types and get material to a uniform size. Inert landfills are mostly disused quarries, and therefore costly excavation works are not required.

Contextual Strengths

A number of contextual strengths which indirectly influence the provision of C&D-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual strengths are summarised below.

- *Formation of the WMAA industry group.*

  The WMAA C&D working group was established in 2007 with the purpose of establishing communication between stakeholders in the C&D industry. The purpose of this group is to promote the strengths of recycled C&D material whilst providing education to industry and government in regard to diverting material to recyclers instead of landfill.

  The group has had success in a number of initiatives including material testing and the establishment of a test road in the Perth-Bunbury Highway. The continued efforts of the C&D working group are increasing industry confidence in the use of the product.

- *Low operational maintenance of landfills and therefore low landfill costs / gate fees.*

  Due to the low operational maintenance of facilities, Class I (inert) landfills are able to provide very competitive landfill gate fees to the marketplace. These low prices compared to recyclers or transfer stations enable high quantities of feedstock to enter the facilities. The acceptance of inert waste material at Class I (inert) landfills is largely to reclaim the land for future development purposes.

- *Relatively small size of recycling industry.*

  Due to the competitiveness of inert landfill facilities, the recycling industry can be considered small. Even if C&D recycling were to grow and generate increased volume of C&D recycled products, there would still be minimal penetration into the virgin material market; such is the demand for raw materials in the Perth marketplace.

7.3.2 Weaknesses

Core Weaknesses

A number of core weaknesses which directly influence the provision of C&D related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core weaknesses are summarised below.

- ***Low percentage of C&D waste is diverted to recyclers / limited price signals.***

  Current and potential C&D recyclers are reluctant to invest in infrastructure due to the difficulty in attracting the required amount of raw feedstock to make their operations viable. This can be attributed to strength (outlined in **Section 7.3.1**) of Class I (inert) landfills being able to offer low gate fees for mixed inert waste streams compared to C&D recyclers.

- ***Recycling of clean C&D streams only.***

  Due to the high contamination and processing cost of mixed inert waste streams and the risk that C&D recyclers will not meet certain aggregate specifications, C&D recyclers mostly target clean waste streams. Due to the majority of C&D waste being mixed at source, a high volume of material requires landfilling.

- ***Difficulties in siting new C&D infrastructure.***

  Whilst inert C&D waste infrastructure does not have the environmental risks of putrescible infrastructure, its establishment can also be difficult. As outlined in **Section 7.1.2** there are a number of environmental and planning processes that need to be overcome prior to consideration by the relevant authorities. The surrounding community can also have a large influence on the siting of a facility.

- ***Lack of quality control among some recyclers and rogue operators.***

  Whilst a number of C&D recyclers have spent considerable resources developing a quality product and promoting it to the marketplace, there are also a number of operators who are not screening and processing to a standard that would be acceptable. These operations are producing below par recycled product and are causing damage to the viability of the C&D recycling industry in general.

Contextual Weaknesses

A number of contextual weaknesses which indirectly influence the provision of C&D-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual weaknesses are summarised below.

- *Limited environmental awareness from waste generators.*

  The environmental cost of the disposal of C&D waste is largely unknown by waste generators. The out of sight / out of mind mentality provides a barrier to the source separation of waste and a reduction of environmental impacts off site.

- *No requirements for the procurement of recycled C&D materials, coupled with industry reluctance to use recycled C&D materials.*

  The procurement of recycled C&D materials is currently only voluntary in the Perth Metropolitan marketplace. The majority of tender specifications stipulate that “virgin” or “quarried” material be used in construction activities which limit recycled material penetration into the marketplace. Due to their being no requirement or promotion of recycled C&D material, many contractors are unfamiliar with the product and are therefore reluctant to use the material.

- *Relative low cost / high availability of virgin materials.*

  Whilst recycled C&D material is cost competitive with virgin equivalents, there is not such a significant difference that companies would seek out recycled materials due to raw material cost savings. Due to the limited supply of recycled products, C&D recyclers cannot supply material in high quantities for large scale projects. Due to the economies of scale, the virgin extractive companies would also be able to provide material at a discounted rate.

7.3.3 Opportunities

Core Opportunities

A number of core opportunities which directly influence the provision of C&D related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core opportunities are summarised below.

- ***Increase landfill levy / better price mechanisms for C&D materials.***

  An increase in the landfill levy will reduce the demand by waste generators for Class I (inert) landfills and will therefore extend the life of existing sites and reduce the need / viability for future sites. Material is likely to flow to recyclers with more competitive gate fees. If infrastructure at some recyclers becomes constrained, upgrades to throughput could be established in a relatively short period of time.

Contextual Opportunities

A number of contextual opportunities which indirectly influence the provision of C&D-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual opportunities are summarised on the following page.

- *Provide legislative framework to produce C&D waste plans.*

  Whilst Local Government have the ability to request recycled aggregates in construction projects through the tendering processes, due to the current legislative framework (*Local Government Act 1995* and *WARR Act 2007*) LGAs have no power to impose waste management plans on contractors for construction / demolition projects. LGAs having the power to require a C&D waste plan would result in a high amount of material being diverted to recyclers for processing, rather than the cheaper and less sustainable option of landfill.

- *Use of policy tools to promote the recycling of C&D material to recyclers influence purchasing levels for Local / State Government / building code changes / policy tools / EPR.*

  There are a number of policy instruments that State and Local Government can implement to promote the recycling of C&D material. These could include mandatory purchasing levels, building code changes and extended producer responsibility

- *Use Emissions Trading Scheme (ETS) to promote recycling and use of C&D materials.*

  Like the recycling of MSW and C&I waste, there is the opportunity to promote the proposed ETS to demonstrate the lower carbon footprint that recycled C&D products can provide over virgin extracted material.

7.3.4 Threats

Core Threats

A number of core threats which directly influence the provision of C&D-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key core threats are summarised below.

- ***Steady loss of current and potential sites due to encroachment.***

  Due to the nature of C&D waste operations, there is the potential for conflict with surrounding land uses due to noise, dust and amenity issues. The Environmental Protection Authority Guidance Statement No. 3 recommends a 1,000m buffer to the nearest occupant for crushing and 500m for landfilling. Encroachment of commercial and residential development through strong growth in the Perth Metropolitan Area is making it difficult for some operations to retain their lease or extend their licence. Land availability close to the waste sources for new C&D waste operations is also becoming problematic due to the current zoning and availability of suitable land.

- ***Cost of processing of C&D materials.***

  The cost to process C&D waste at transfer stations and recycling centres is relatively high when compared to landfilling operators. An increase in operational costs such as fuel, labour and lease costs (due to rising industrial and commercial property prices) is a threat to the viability of these operations.

Contextual Threats

A number of contextual threats which indirectly influence the provision of C&D-related infrastructure in the Perth Metropolitan Region were identified during the SWOT analysis. Key contextual threats are summarised below.

- *Limited policy support / continuation low landfill levy.*

  The continued low cost of Class I (inert) landfills is a large threat to the viability of the C&D recycling industry. A number of recyclers have reported that without change in the competitiveness of recyclers, they will be forced to shut down. A strong market instrument to make C&D recyclers more competitive is the landfill levy. Whilst this market instrument has been in effect since 1998, with some slight increases over time, its continued low proportion of the cost of landfill has not significantly promoted C&D recyclers as an attractive alternative to landfill.

- *Fuel costs for transportation of materials.*

  Whilst world crude oil prices have reduced significantly in latter parts of 2008, fuel costs for transportation will continue to be a threat for recyclers. Fuel / trucking costs form a significant proportion of the cost of raw materials. The high amount of development on the urban fringe will continue to require a higher amount of fuel from recyclers to reach the destination. A high number of virgin extractive industries are in close proximity to these developments and will continue to be the supply of choice for basic raw materials.

- *Variable supply / demand of recycled products.*

  Like all products, recycled C&D material will show variable supply and demand trends depending on the requirement for construction activity. This may influence the amount of material being accepted at recyclers and will therefore reduce the economies of scale that these facilities currently have due to high construction activity. As outlined in **Section 4.3** construction activity is set to slow in the 2009/10 financial year and will reduce the amount of material available in the marketplace for recycling. However, if it is assumed that government policy and market instruments are modified or introduced to promote recycling it is likely that any downturn in the market will be offset by increased recycling.

7.3.5 Summary of Key Findings for the Provision of C&D Infrastructure

Key findings by Cardno from the C&D SWOT that are apparent for the adequate provision of C&D infrastructure and the recovery of C&D waste include:

- Low landfill gate fees;
- Low percentage of C&D waste is being diverted to recyclers;
- Large slack capacity of current C&D recycling infrastructure;
- Recycling industry not a threat to virgin extraction industry;
- High number of Class I (inert) landfills;
- Steady loss of current and potential sites due to encroachment; and
- Limited government policy support

8. CONCLUSIONS

The population and economy of the Perth Metropolitan Region will continue to grow in the short to medium term and will result in a greater volume of waste being generated. Overall, current waste infrastructure in the Perth Metropolitan Region is well placed to continue accepting this material for either landfill or recycling towards 2020; however potential strains on waste infrastructure will become apparent in certain geographic areas over the next 10 years without any planning or efforts to increase the rate of recovery above current levels. These efforts will require improvements in waste policy and the use of market instruments to encourage diversion from landfill.

In regards to specific types of waste infrastructure currently in place throughout the Perth Metropolitan Area, a number of conclusions can be made in terms of life expectancy, geographic distribution and their ability to service the Perth Metropolitan Region. These are outlined below:

Class I (inert) landfills

Class I (inert) landfills throughout the Perth Metropolitan Region are readily available especially in coastal regions, rich in disused quarries that have the potential for development. A number of these facilities, especially in the northern and eastern areas, will become exhausted within five years, however current operators have indicated that they are pursuing new sites once the current sites are depleted.

Inert Recyclers

Inert recyclers occupy areas that are generally not serviced by Class I (inert) operators. These areas are in the eastern and southern areas in close proximity to the Central Business District (where quality C&D waste is usually sourced). These C&D recyclers currently have potential to accept a significant increase in material, however due to encroachment and the difficulty in making some operations viable some recyclers may require closure in the coming years. This would significantly reduce the tonnage of material that the Perth Metropolitan Region recycles.

Class II / III (putrescible landfills)

Class II/III (putrescible) landfills are currently located in strategic locations on the rural urban fringe of the Perth Metropolitan Region. The majority of putrescible landfills have at least 10 years capacity remaining. Facilities with less than 10 years may have the potential for expansion through the acquisition of land adjacent to the site. A number of operators are also assessing future landfill sites for the future. The continued construction of RRFs will continue to reduce the demand for landfill.

Class IV (hazardous) landfills

The Class IV (hazardous) landfill at Red Hill currently has a high amount of capacity. Due to this type of waste stream not being generated in high quantities it is likely that the facility will continue to be the sole service provider in to the long term.

Municipal RRFs

The Perth Metropolitan Region is well advanced in the planning and construction of RRF technology for the processing of MSW. The SMRC, City of Stirling, WMRC and MRC either already have RRFs or are currently in the construction / commissioning phase of the project. The EMRC and RRC are in the advanced planning stages for their RRFs. Currently

the RRFs are well distributed throughout the Perth Metropolitan Region, however some problems have arisen due to current facilities located in close proximity to residents. Sites selected for the RRFs currently under construction or in the planning phase will not have these issues. It is expected that all RRFs will be able to source sufficient waste to run at full capacity.

Municipal MRFs

Municipal MRFs are currently located in certain industrial precincts throughout the Perth Metropolitan Region and will continue to service the community into the future based on current design throughputs. The inadequacy of contingency plans in the past resulted in a number of incidences where recyclables would require landfill, however industry has reported that contingency plans have improved markedly over the past number of years and that the need to landfill recyclables in the event of a plant shut down is less likely. Plans for future MRFs by a number of stakeholders will reduce further the risk of recyclables being sent to landfill. However, recent economic events and the fall in commodity prices may have an impact on MRF operators in the short term.

Commercial MRFs and RRFs

Whilst a high amount of C&I waste is currently being diverted through scrap metal, organics and paper / cardboard recyclers, there are limited commercial MRFs and no RRFs at present in the Perth Metropolitan Region. This is resulting in a high amount of potentially recyclable material being sent to landfill. Current commercial MRF infrastructure is located in inner city industrial areas to minimise transport costs. Without stronger market or regulatory forces for the C&I sector to divert waste (especially food / kitchen organics), waste is likely to continue to be sent to landfill.

Inert and Putrescible Transfer Stations

As waste infrastructure facilities (especially landfills and RRFs) will continue to require being located in areas away from population centres (due to potential impacts and increasing land prices), transfer stations are increasingly becoming required to reduce transport costs. Inert and putrescible transfer stations are well distributed throughout inner city industrial or waste zoned areas. The maximum potential throughput of these facilities is difficult to determine due to the rate of transfer being based on truck movements and personnel, however it is likely that the current transfer stations will be able to receive additional quantities of material into the medium term.

Greenwaste Processors

Greenwaste facilities are well distributed throughout the Perth Metropolitan Region. Many operations, especially soil blending facilities have a high amount of capacity for additional inputs. Due to the demand for quality soils, greenwaste will continue to be sought after by many facilities. Due to the low tech processing requirement and number of operators, there is minimal risk that greenwaste will be unable to be processed in the long term.

Key Findings of SWOT

The findings outlined in this report will assist the Waste Authority in its strategic outlook of infrastructure and waste management in the Perth Metropolitan Region. Key findings for each waste stream (strength, weakness, opportunity or threat), as discussed in **Section 7** are outlined below.

MSW

- There is geographically well placed and well engineered putrescible landfills and transfer stations throughout the Perth Metropolitan Region;
- Future putrescible sites need to identified in the short term due to a number becoming exhausted over the next 10 years;
- Obtaining approvals for establishing MSW facilities is difficult;
- There is limited State Government guidance on parameters for future sites;
- The provision of additional MSW infrastructure and services may be affected due to the current economic downturn; and
- The proposed Carbon Pollution Reduction Scheme by the federal government will likely have an impact on waste management in the future

C&I

- There is currently no strong linkage between the C&I waste generator sector and the environmental impact the waste causes;
- Low landfill gate fees at present at inert and putrescible landfills;
- There is a lack of suitable MRFs and RRFs to recover C&I waste;
- The provision of additional C&I infrastructure and services may be affected due to the current economic downturn;
- Additional funding and market support is required to develop further C&I recovery;
- Lack of a peak body focussing on the C&I waste stream; and
- Lack of direction and regulatory focus for waste reduction for the C&I waste stream

C&D

- A low percentage of C&D waste generated is being diverted to recyclers;
- Low landfill gate fees at present at Class I (inert) landfills;
- There are a high number of Class I (inert) landfills distributed throughout the Perth Metropolitan Area;
- There is currently large slack capacity at C&D recycling infrastructure;
- The recycling industry is not a threat to the virgin extraction industry in regards to market share;
- There is a steady loss of current and potential sites for C&D recycling due to encroachment by sensitive land uses; and
- Limited government policy support to increase diversion of C&D waste towards recyclers

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APPENDIX A

Stakeholders Contact List / GIS Coordinates

Waste Infrastructure Type	E	N	Information Supplied	Location	Contact
Putresible Landfill					
City of Armadale	402506	6437501	✓	Hopkinson Road	Bob Sutton
City of Cockburn	386600	6440907	✓	Henderson Road	Lyle Davison
City of Rockingham	388585	6426840	✓	Millar Road	Graham Rose
Eastern Metrolpolitan Regional Council	415183	6477412	✓	Red Hill	Adam Johnson
Mindarie Regional Council	379376	6491413	✓	Tamala Park	Mike Tolson / Ian Watkins
South Cardup	407661	6429918	✓	South Cardup	Stephen Elwell
Transpacific Industries	387573	6300692	✓	*Dardanup*	*Glenn Hutchinson*
Transfer Station					
City of Canning	395877	6450355	✓	Canning Vale	Steve Atwell
City of Bayswater (Cleanaway)	398317	6469694	✓	Bayswater	Rob Morris
City of Mandurah (Cleanaway)	383599	6402937	✓	Mandurah	Brad Gornell
City of South Perth	394429	6459273	✓	South Perth	Sebastian Camillo
City of Stirling	388230	6474018	✓	Balcatta	Viet Nyson
Shire of Mundaring	419249	6468954	✓	Mundaring	Adrian Dyson
WALS	401882	6460314	✓	Welshpool	Stephen Elwell
Western Metropolitan Regional Council	385882	6463621	✓	Shenton Park	Bernie Burnett
Resource Recovery Facility					
AnaeCo	385883	6463594	✓	Shenton Park	Bernie Burnett
Atlas	393623	6474000	✓	Mirrabooka	Viet Nyson
BioVision 2020	386995	6494634	✓	Neerabup	Viet Nyson
RRC	389430	6434843	✓	Postans	Alex Sheridan
SMRC	395308	6450697	✓	Canning Vale	Stuart McCall
Material Recovery Facility (Municipal)					
Cleanaway	398298	6469760	✓	Bayswater	Rob Morris
Cleanaway	405293	6455413	✓	Maddington	Rob Morris
Cleanaway	383505	6403015	✓	Mandurah	Brad Gornell
Greens Recycling	379778	6310320	✓	Bunbury	Robert McKay
Perth Engineering and Maintenance	382666	6449571	✓	Spearwood	Darren Thorpe
SMRC	394958	6450589	✓	Canning Vale	Stuart McCall
Wanneroo	390033	6481971	✓	Wangara	Robert Elliott
Material Recovery Facility (Commercial)					
AMCOR	397054	6452621	✓	Canning Vale	Jamie Young
VISY	401691	6462129	✓	Welshpool	Mark Lindup
Inert Landfill					
Atlas	393135	6474195	×	Mirrabooka	Brian Rowe Platts
City Fremantle	383457	6451297	✓	Beaconsfield	Ian Goodbody
Cleanaway (Tims Thicket)	370794	6386605	✓	Mandurah	Rob Morris
Eclipse Resources (North)	383611	6493502	✓	Neerabup	Richard Kerr
Eclipse Resources (South)	387699	6435177	✓	Kwinana	Richard Kerr
Happy Valley	407065	6468113	✓	Hazelmere	Robert Moltoni
Moltoni	387402	6446890	✓	Fremantle	Will Neethling
Non-Organic Disposals	391263	6480282	✓	Landsdale	Sam Salamoni
RCG	380230	6494777	✓	Neerabup	Colin Zampatti
RCG	386859	6440088	✓	Henderson	Colin Zampatti
Shire of Mundaring	429273	6473162	✓	Chidlow	Adrian Dyson
Waste Stream Management	386495	6434143	✓	Medina	Mike Rumford

Inert Recyclers / Transfer					
All Earth	404889	6454700	✓	Maddington	Heidi Dauth
Brajkovitch Demolition	386382	6440998	×	Henderson	
C&D Recycling	398466	6469409	✓	Hazelmere	Adrian Lester
Capital Demolition	405331	6467985	✓	Bayswater	Ray Gullotto
Instant Waste	398346	6469208	✓	Bayswater	Sam Mangione
Hazelmere Timber	405760	6468766	✓	Hazelmere	Rebecca Smith
Total Waste	392467	6445855	×	Welshpool	Greg Scott
Veolia Environmental	394100	6449188	✓	Jandakot	Michael Pardoen
Waste Stream Management	398780	6460271	×	Welshpool	Mike Rumford
Westbins	395886	6474333	×	Malaga	
Greenwaste Processing					
All Earth	404948	6454755	✓	Maddington	Heidi Dauth
Amazon Soils / Richgro	382770	6498809	×	Forrestdale	Tim Richards
Bioorganics	397544	6433770	✓	Oakford	Daniel Avila
Biowise	389209	6434700	✓	Postans	Karl Koevort
City of Armadale	402426	6437609	✓	Hopkinson Road	Bob Sutton
City of Rockingham	388740	6427108	✓	Millar Road	Peter Kerp
Custom Compost	390498	6404480	✓	Nambeelup	Dave Cullen
Red Hill	415519	6477875	✓	Red Hill	Brian Bushby
Eclipse Resources (North)	383801	6493461	✓	Nerrabup	Richard Kerr
Eclipse Resources (South)	388202	6434859	✓	Kwinana	Rodney Hanson
Garden Organics	392251	6445821	✓	Jandakot	Graeme Blane
Wangara Greenwaste	389898	6481813	✓	Wangara	Robert Elliott
Purearth	398335	6469391	✓	Bayswater	Paul Curtis
Soiland	390984	6481954	×	Wangara	Peter Pollock
WMRC	385886	6463650	✓	Shenton Park	Bernie Burnett
= Site Visit					

Italics = Outside Perth Metropolitan Region

APPENDIX B

SWOT Workshop

Attendees / Workgroups

Location: City South Perth Administration Centre
Date: 14 October 2008
Time: 10am – 4pm

Facilitator – John King (Cardno)

MSW Workgroup

Name	Organisation	Role
Kevin Poynton	MRC	Chairperson
Bernard Ryan	DEC	
Steven Fitzpatrick	EMRC	
Ross Parker	West Australian Planning Commission	
Bob Paulin	Department of Agriculture	
Bonnie Hall	Cardno	Scribe

C&I Workgroup

Name	Organisation	Role
Alex Sheridan	RRC	Chairperson
Bill Marchbank	Cardno	
Paul Tompkinson	Transpacific	
Brendon Doherty	SMRC	
John Stevenson	Forum of Regional Councils	
Ronan Cullen	Cardno	Scribe

C&D Workgroup

Name	Organisation	Role
Rebecca Brown	WALGA	Chairperson
Peter Tapsell	DEC	
Tim Hillyard	Department of Planning and Infrastructure	
Jan Grimoldby	Waste Authority	
Beryl Foster	WALGA	
Bernie Burnett	WMRC	
Robert Sim	Cardno	Scribe

Attendees were given five votes for each of the brainstormed ideas for each waste stream. The higher the number, next to each statement / issue, the greater the priority.

Municipal Solid Waste

Strengths

Issue	Priority Vote
Solid capability for green waste collection via verge pickup	
Excellent disposal facilities via landfill	
Other services on offer at landfill sites	
Good utilisation of landfill space	
Good range of MRFs and transfer stations	
Good progress on creation of resource recovery parks	
Two operational RRFs	
Proactive planning for future facilities	
Peak body (MWAC)	2
Waste management that meets needs of community	1
Informing communities of collection processes	
Delivering efficient service	
Utilising regional groupings for selected capabilities	
Consensus on the approach to resource recovery	
Providing some opportunities to treating problematic waste	
Good utilisation of landfill gas	
Solid post-closure management	
Standard collection practices	
Good economic process (rates)	
Management of MSW (overall)	
Creation of Regional Council structure	
Knowledge base and sharing of information by/between LGAs	
Appropriate regulatory framework	
Community acceptance	

Weaknesses

Issue	Priority Vote
State Government guidance on parameters for future sites e.g. Landfill	5
Lack of waste planning associated with urban development	1
Some issues with facilities approval	
Potential imbalance for facilities across metro region	
Unacceptable lead times for complex facilities	
Lack of source-separated organic collection`	1
No movement on EPR/CDL	
Wide variety of collection systems	
Barriers to joint activity e.g. Waste ownership	
Perceived heavy load on local government	
Obstacles with legislation (LG Act)	
Regions not organised along practical grounds	
Lack of understanding about how best to manage organic waste	
Nature of waste	

Opportunities

Issue	Priority Vote
Better matching of collection to processing	8
More resource recovery Facility options in terms of technology	6
Engaging with climate change agenda	6

Stability with government and waste authority	
Partnerships between waste and other sectors e.g. agriculture, environment	4
Improve community engagement	4
Development of markets for RRF products	3
Engaging with academia on R and D	2
Establishment of RRF working group	1
Opportunity for federal funding	1
Promote and support local RRF providers	1
Stability with government and waste authority	
Excellent policy capability within the department	
Better availability of world-wide information	
Application of matching principles to achieve consistency	

Threats

Issue	**Priority Vote**
Inadequate cross-governmental planning/lack of planning	8
Urban-centric planning processes/need for better regional planning	7
Limited landfill sties proximate to Perth	4
Lack of diversity in A.W.T. plants	1
Cost of facilities	1
Lack of political priority for waste issues	7
Lack of political will related to EPR	5
Impacts of climate change and economic cycle	4
Guidance on parameters for A.W.T.	2
Reallocation of responsibilities	2
Threats to soil resource associated with MSW compost – contaminants/heavy metals	1
Poor implementation of the RRF – design or operational phase/management	
Local government amalgamation	
Lack of clarity about use of organics	
Selective community acceptance of waste realities	
Difficulty with retention of people/expertise	

General Issues

Issue	**Priority Vote**
Management of problematic waste, including contaminated sites and household hazardous and e-waste	6
Metro vs. regional divide	
Importance of communication	
Adopting lessons from elsewhere to Perth in a relevant way and respect to culture	
Lack of political will for applying regulation	
Is a bioreactor landfill AWT?	

Commercial and Industrial

Strengths

Issue	Priority Vote
Over 50% recycling rate – good quality materials with value (timber, metals, cardboard)	2
Market share concentration of ~80% with 4/5 key players (collection)	2
Existing programs for specific materials	1
What's the composition of C+I waste stream – current have disposal based audit data	
Mature collect markets – service providers – standardised collection systems	
Working well without regulation	
Preparedness for industry to tackle source separated materials	
Large industries generating constant waste streams	

Weaknesses

Issue	Priority Vote
Low recovery of materials at Transfer Stations – dirty MRFs	
Availability of site for C+I waste within catchment areas/generation sources	
No strong linkage to environmental issues	5
Difficult to audit due to various sources	3
WA – no demand for certain recovered materials – glass, fibre	1
What's the composition of C+I waste stream	1
Lack of strong regulatory tools – MBIs	1
Lack of commonality across C+I stream	1
Confidence level in available markets	1
Leakage of C+I into MSW stream - ?? volumes	
No standard reporting process – sources of materials	
Very price sensitive for disposal – labour, - fuel	
Planning issue for number and storage of bins (source separation)	
Recyclers have a lack of confidence in supply of materials	

Opportunities

Issue	Priority Vote
Funding/Market support to develop C+I recovery	8
Dirty MRF at front of landfills for further recovery	7
Local/Industry parks strategies such as collection service	5
Federal government for infrastructure	2
Limited disposal opportunities within and around metro area	
Landfill levy – increase to drive further recovery	16
Joint ventures for industry and government local and regional	4
Extended producers responsibility = provisions under WARR Act	3
Linkage of composition within C+I and MSW recycling streams = organic and recyclables	3
Collection – only 3% LGAs do C+I collections	
New markets being established	
Innovated approach to source separation – target industry groups	
Structured environments within C+I entities	
Need for better understanding of C+I composition (potential)	
NPC funding for infrastructure – SA	
Kwinana = case study on a recycling scheme	

Threats

Issue	Priority Vote
Lack of responsibility for the C+I waste stream central	11
Low population densities through development	
Economic downturn – global markets	
C+I waste stream growing	
Lack of direction – regulatory focus – WARR Act	9
Lack of political will for certain technology options	7
Illegal dumping – C+I have been identified as a key stream of illegal dumps	1

Construction and Demolition

Strengths

Recycling

Issue	Priority Vote
Huge capacity	1
Limited players/known number	
Reasonable numbers (waste/recycling, good examples)	
Good cooperation/alliances	
Reasonable distribution of sites and good transport infrastructure	
Very flexible/innovative	
Reasonably low setup costs	
WMAA industry group	1
Proving quality/increasing confidence	
Recycling willingness to meet specs	
National approach	
Non-hazardous	

Landfill

Available	
Low gate fees	
Low maintenance	
Falls outside regulatory frameworks for contaminated sites	

Transfer Stations

Sorting capacity	
Siting in industrial areas	
Co-location ability	

Land Reclamation

Shortage in raw materials	
Demand for product	
Easy compaction/screening	

Weaknesses

Recycling

Issue	Priority Vote
Diversion to recyclers/low %	1
Recycling easy streams	
Steady loss	
Rouge operators	
Lack of quality control among some players	
Encroachment	
Limited price signals	5
No requirements to procure recycled material	2
Lack of industry cohesion	2
Cheap availability of virgin materials	1
Industry reluctance to use material	1

Landfill

Steady loss of capacity/sites	1
Not extending life of facilities	

Can only accept certain materials	
Sequential land uses	

Transfer

Encroachment	
Capacity constraints (surrounding facility)	
Transport – limited to certain road routes	
Cost of separation/disposal	
Processing cost	

Reclamation

Uncontrolled wastes/contamination	
Limited regulation	
Variable compaction	
Future landowner liabilities	

Other

Not the same level of buy in compared to MSW	
Limited producer/generator responsibility	
Limited timeframe for separation	
Lack of peak body	

Opportunities

Recycling

Issue	**Priority Vote**
State government funding	2
Shortage of raw materials	
Onsite reuse	
Better coverage across metro area	
Sequential source separation	
Price mechanisms	17
Building code changes	7
Mandatory purchasing levels for state government	7
Amend LGA Act to produce waste plan	5
Cradle to cradle	3
Policy tools	2
Life cycle assessments	1
Sustainability requirements	
EPR	
ETS	

Landfill

Actively engage in recycling	1
Create new category waste/clean fill	3
Sequential land uses	1

Transfer Stations

Include T.S into planning schemes	
Get more involved in construction industry wastes	
Divert to various end uses (recycle/landfill etc)	
Increase levy	
Sequential land use	

Reclamation

Source separation	
Confidence in specifications	
High performance of RBP	1
Use of case studies for education	1

Other

Relative small size of recycling industry/not a threat to virgin quality standards	7

Threats

Recycling

Issue	**Priority Vote**
Land availability for recyclers	1
Short term land use conflicts	
Cost of processing	
Continued cheap landfill	10
Lack of markets	4
Differential levy	2
Poor understanding of potential products	1
Limited policy support	1
No cost for clean fill	
General attitude/fear of unknown	
Fuel costs	
Variable supply/demand	
Price of virgin product	

Landfills

Land use conflicts	1
Lack of sorting	
Loss of income/volume from recyclers	

Transfer Stations

Zoning	
Loss of volume	

Land Reclamation

Zoning	
Material being diverted to recyclers	
Inappropriate material	

Other

Issue	**Priority Vote**
Changing road building networks	
Illegal dumping	
No increase in the levy	
Level/lack of experience in the use of recycled product	
Demonstrated material gone to recycler? (little auditing)	
Lack of proper definition of recycled C+D	

APPENDIX C

Waste Composition of the MSW, C&I and C&D Waste Streams in the Perth Metropolitan Region

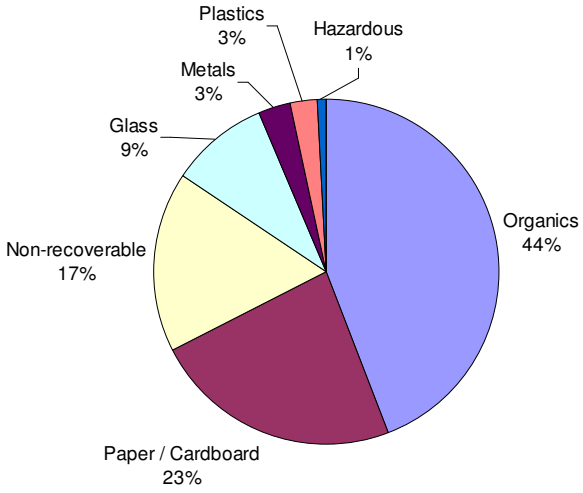
The following appendice outlines the composition of each landfilled and recycled waste stream (MSW, C&I and C&D). The information provided outlines the composition of current waste / recycle streams being sent to landfill and what additional products could be expected to be recovered if they were diverted from landfill. The identification of the composition of waste streams is important in determining the type of infrastructure required to increase recovery rates of waste material.

Waste to Landfill

Municipal Solid Waste

Cardno conducted a *Review of Kerbside Collection Systems* for the DEC in 2008. The assessment concluded that approximately 83% of municipal waste disposed in the Perth Metropolitan Area (from kerbside) is potentially recoverable. 38% of disposed waste is dry recyclables, 44% is organic wastes and 1% is hazardous. **Figure A1** outlines the typical composition of kerbside household waste produced in the Perth Metropolitan Area. It must be noted that MSW is not confined to kerbside collections. Other sources of MSW can include verge-side junk and greenwaste collections and trailer drop-off at landfills / transfer stations. Therefore **Figure A1** should be used with caution.

Figure A1: Composition of kerbside MGB waste from the Perth metropolitan municipal sector



The majority of dry recyclable material is paper, which makes up 18% of total waste production. Glass was the next largest contributor of the recyclable materials (9%), followed by cardboard (5%). Other materials that are potentially recoverable from the refuse bin include metals, plastics and hazardous wastes.

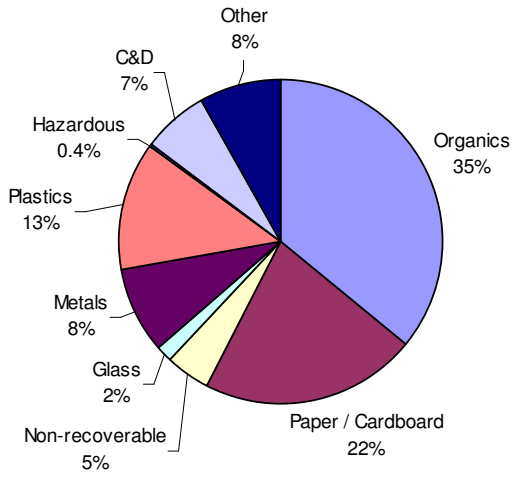
The composition of MSW waste is likely to remain largely consistent into the future due to consistent consumption patterns. The majority of LGAs now have a twin MGB (dry recyclables / residual) system. The introduction of a third “organics” bin (currently provided by the City of Nedlands and City of Bayswater) reduces the percentage composition of organics in the residual bin.

Commercial and Industrial

Golder Associates and Waste Audit conducted a waste audit of C&I material being disposed to putrescible landfill for the DEC in 2007. Results of the compositional analysis are outlined in **Figure A2**. The largest sources of waste include food / kitchen (26%), wood

/ timber (15%), cardboard (11%) and plastic (11%). Metals also comprise of 7% of C&I waste totals. 95% of the C&I waste is potentially recoverable.

Figure A2: Composition of material disposed by the C&I sector in 2007

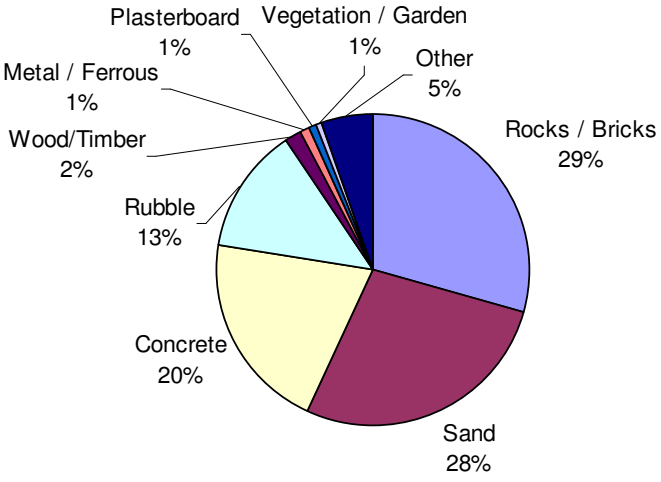


The composition of C&I waste into the future is inherently difficult to predict due to the variability in the types of waste and volumes that can be generated from the sector due to the various sources. C&I waste can vary between scrap metals and plastics from engineering firms to kitchen waste and glass bottles from restaurants and taverns. The types of waste generated will also vary geographically depending on the manufacturing or hospitality industry. Economic growth will also influence the percentage composition of this waste stream. In the absence of any clear trend to the contrary, it is reasonable to assume that the composition of C&I waste will remain relatively stable.

Construction and Demolition

Golder Associates and Waste Audit conducted a waste audit of C&D material being disposed to putrescible landfill for the DEC in 2007. Results of the compositional analysis are outlined in **Figure A3**. The largest sources of waste include rocks / bricks (29%), sand (28%), concrete (20%) and rubble (13%).

Figure A3: Composition of material disposed by the C&D sector in 2007

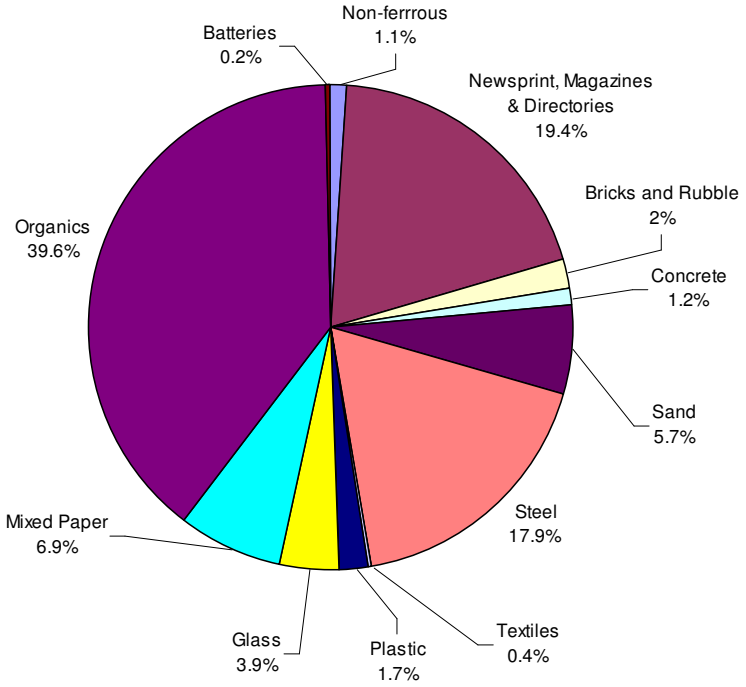


Recycling

Municipal Solid Waste

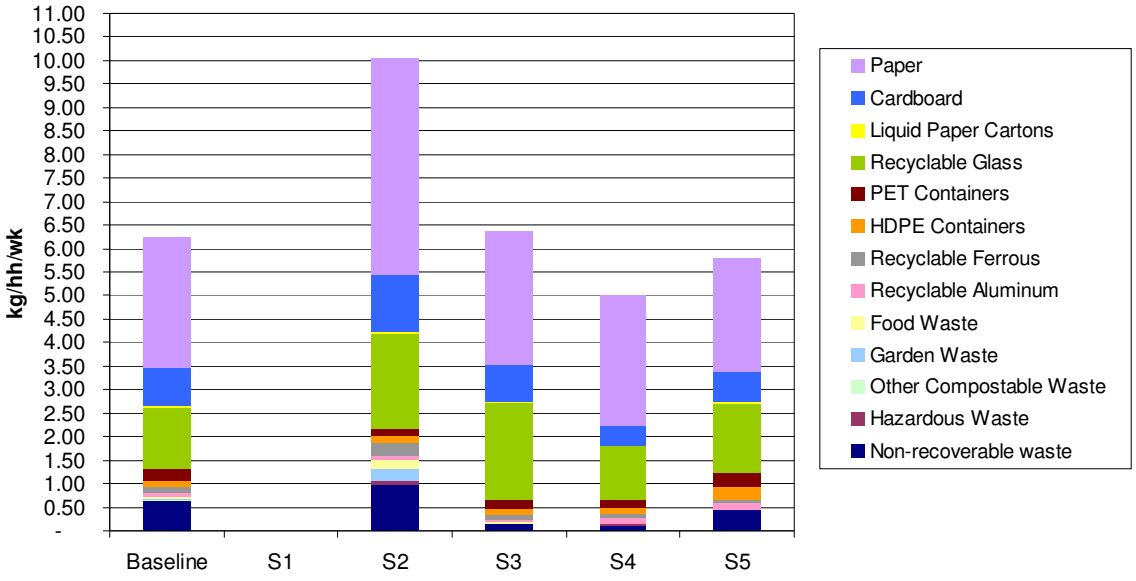
Cardno was appointed by the DEC in 2008 to conduct the annual *Review of Recycling Activity* in Western Australia. Results of the compositional analysis for municipal recycling activity are outlined in **Figure A4**. Waste types recycled in the highest quantities include organics (40%), newsprint magazines and directories (19%) and steel (18%).

Figure A4: Composition of material recovered from the municipal sector (2006/07)



Cardno conducted a *Review of Kerbside Collection Systems* for the DEC in 2008. As part of the project MSW kerbside recycling waste audits that had previously been conducted throughout the Perth Metropolitan Region were collated and averaged. **Figure A5** outlines the result of different kerbside recycling systems that are currently or have previously been employed by LGAs.

Figure A5: Composition of material recovered for reprocessing from the municipal sector (2006/07)



Source: Cardno BSD (2008)
Key:

Baseline	- 240L refuse weekly / 240L recyclable fortnightly
S1	- 240L refuse weekly (AWT Treatment)
S2	- 240L refuse weekly / 240L recyclable weekly
S3	- 120L refuse weekly / 240L recyclable fortnightly
S4	- 240L refuse weekly / 2x 60L bags weekly
S5	- 240L refuse weekly / 2 x 60L weekly

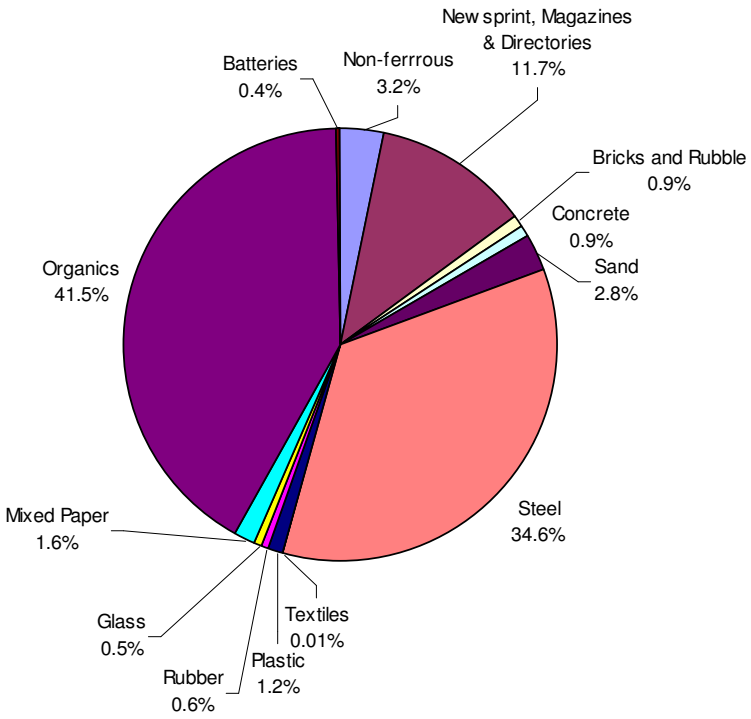
The baseline kerbside recycling system currently in place (240L refuse weekly / 240L recycling fortnightly) in most metropolitan LGAs suggest that approximately 6.25kg of recyclables are collected per household per week.

A recent trial in the SMRC for a weekly 240L kerbside collection resulted in a 40% increase in recyclables collected. Bag and crate systems are now only used in a select number of LGAs (City of Subiaco and Town of Victoria Park). This would obviously have an effect on the amount of recyclables being received at the SMRC MRF.

Commercial and Industrial

Cardno was appointed by the DEC in 2008 to conduct the annual *Review of Recycling Activity* in Western Australia. Results of the compositional analysis for C&I recycling activity are outlined in **Figure A6**. Waste types recycled in the highest quantities include organics (42%), steel (35%) and newsprint magazines and directories (12%).

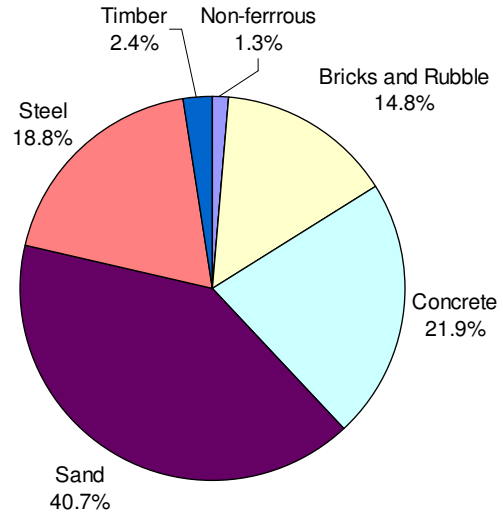
Figure A6: Composition of material recovered for reprocessing from the C&I sector (2006/07)



Construction and Demolition

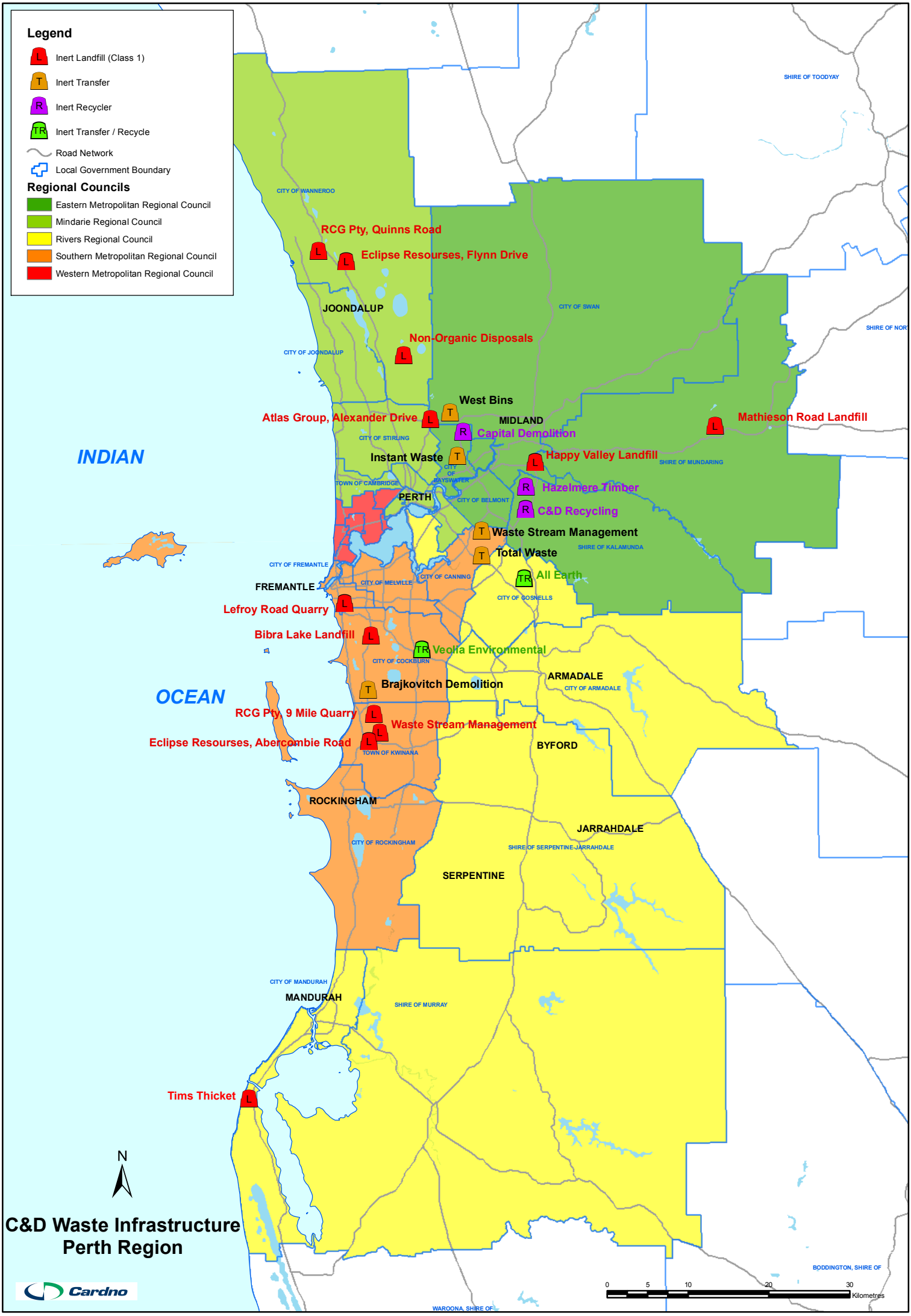
Cardno were appointed by the DEC in 2008 to conduct the annual Review of Recycling Activity in Western Australia. Results of the compositional analysis for C&D recycling activity are outlined in **Figure A7**. Waste types recycled in the highest quantities include sand (41%), concrete (22%), steel (19%) and bricks and rubble (15%).

Figure A7: Composition of material recovered for reprocessing from the construction and demolition sector (2006/07)



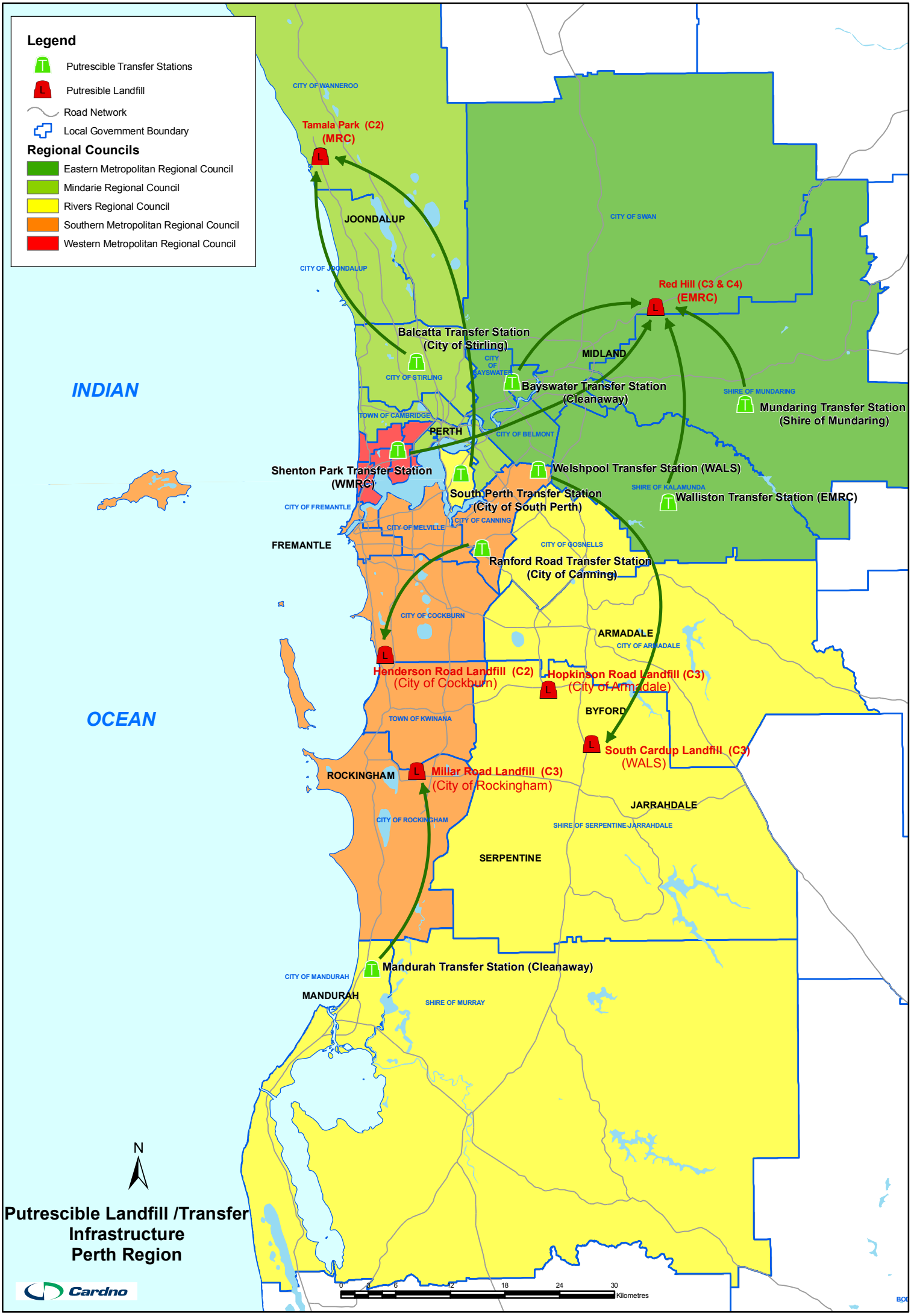
APPENDIX D

Inert Landfill / Transfer Infrastructure in the Perth Metropolitan Region


Legend
Inert Landfill (Class 1)
Inert Transfer
Inert Recycler
Inert Transfer / Recycle
Road Network
Local Government Boundary
Regional Councils
Eastern Metropolitan Regional Council
Mindarie Regional Council
Rivers Regional Council
Southern Metropolitan Regional Council
Western Metropolitan Regional Council
INDIAN
OCEAN
RCG Pty, Quinns Road
Eclipse Resourses, Flynn Drive
Non-Organic Disposals
West Bins
Atlas Group, Alexander Drive
Capital Demolition
Instant Waste
Mathieson Road Landfill
Happy Valley Landfill
Hazelmere Timber
C&D Recycling
Waste Stream Management
Total Waste
All Earth
Lefroy Road Quarry
Bibra Lake Landfill
Veolia Environmental
Brajkovitch Demolition
RCG Pty, 9 Mile Quarry
Waste Stream Management
Eclipse Resourses, Abercombie Road
Tims Thicket
JOONDALUP
MIDLAND
PERTH
FREMANTLE
ARMADALE
BYFORD
ROCKINGHAM
JARRAHDALE
SERPENTINE
MANDURAH
CITY OF WANNEROO
CITY OF JOONDALUP
CITY OF SWAN
CITY OF STIRLING
CITY OF BAYSWATER
TOWN OF CAMBRIDGE
CITY OF BELMONT
SHIRE OF KALAMUNDA
SHIRE OF MUNDARING
SHIRE OF TOODYAY
CITY OF FREMANTLE
CITY OF MELVILLE
CITY OF CANNING
CITY OF GOSNELLS
CITY OF COCKBURN
CITY OF ARMADALE
TOWN OF KWINANA
CITY OF ROCKINGHAM
SHIRE OF SERPENTINE-JARRAHDALE
CITY OF MANDURAH
SHIRE OF MURRAY
BODDINGTON, SHIRE OF
WAROONA, SHIRE OF
N
0 5 10 20 30
Kilometres
C&D Waste Infrastructure
Perth Region
Cardno

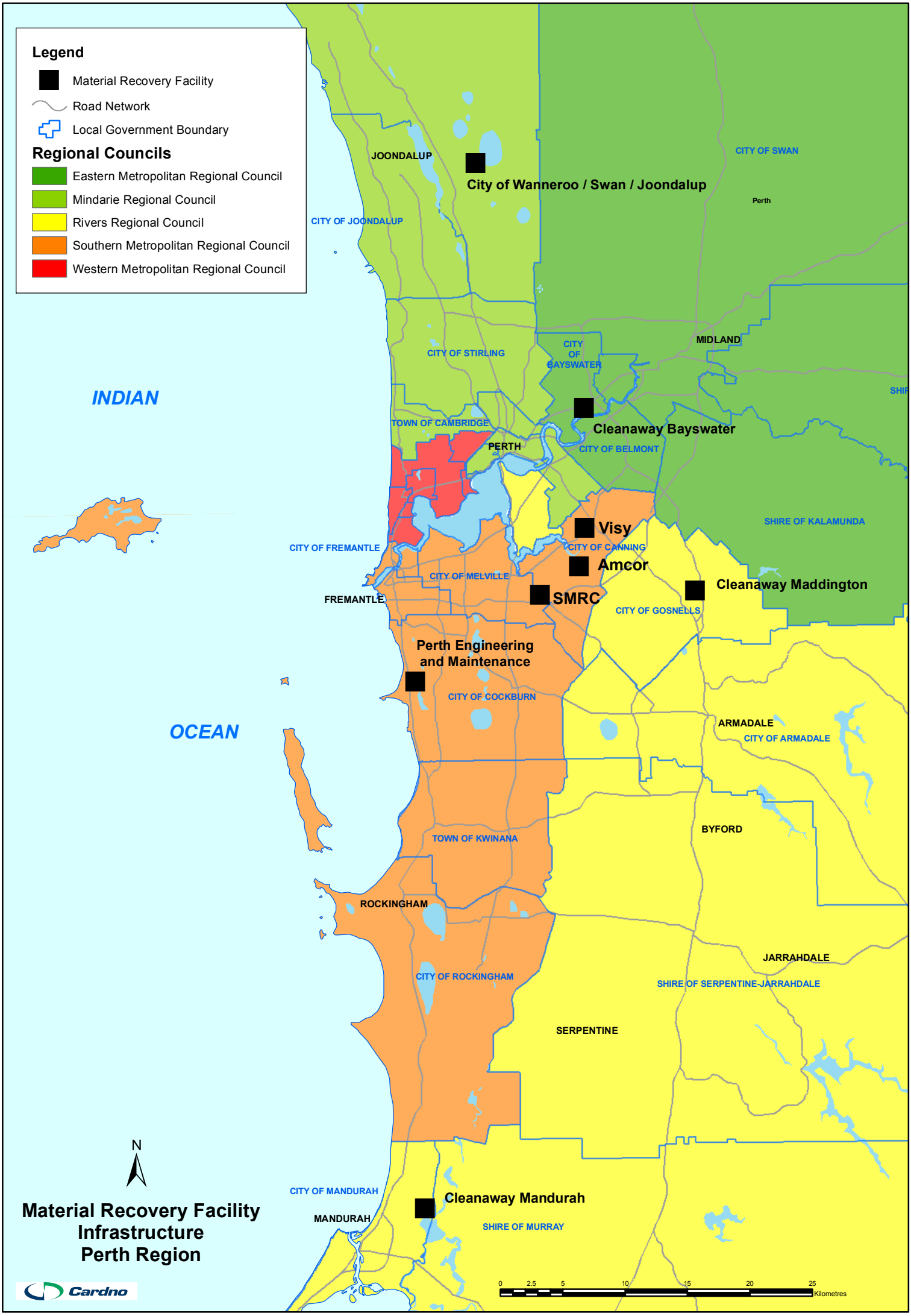
APPENDIX E

Putrescible Landfill / Transfer Infrastructure in the Perth Metropolitan Region


Legend
Putrescible Transfer Stations
Putresible Landfill
Road Network
Local Government Boundary
Regional Councils
Eastern Metropolitan Regional Council
Mindarie Regional Council
Rivers Regional Council
Southern Metropolitan Regional Council
Western Metropolitan Regional Council
INDIAN
OCEAN
CITY OF WANNEROO
Tamala Park (C2)
(MRC)
JOONDALUP
CITY OF JOONDALUP
CITY OF SWAN
Red Hill (C3 & C4)
(EMRC)
Balcatta Transfer Station
(City of Stirling)
CITY OF STIRLING
MIDLAND
CITY OF BAYSWATER
Bayswater Transfer Station
(Cleanaway)
SHIRE OF MUNDARING
Mundaring Transfer Station
(Shire of Mundaring)
TOWN OF CAMBRIDGE
PERTH
CITY OF BELMONT
Shenton Park Transfer Station
(WMRC)
Welshpool Transfer Station (WALS)
SHIRE OF KALAMUNDA
South Perth Transfer Station
(City of South Perth)
Walliston Transfer Station (EMRC)
CITY OF FREMANTLE
CITY OF CANNING
CITY OF MELVILLE
FREMANTLE
CITY OF GOSNELLS
Ranford Road Transfer Station
(City of Canning)
CITY OF COCKBURN
ARMADALE
CITY OF ARMADALE
Henderson Road Landfill (C2)
(City of Cockburn)
Hopkinson Road Landfill (C3)
(City of Armadale)
BYFORD
TOWN OF KWINANA
South Cardup Landfill (C3)
(WALS)
ROCKINGHAM
Millar Road Landfill (C3)
(City of Rockingham)
JARRAHDALE
CITY OF ROCKINGHAM
SHIRE OF SERPENTINE-JARRAHDALE
SERPENTINE
Mandurah Transfer Station (Cleanaway)
CITY OF MANDURAH
MANDURAH
SHIRE OF MURRAY
N
Putrescible Landfill /Transfer
Infrastructure
Perth Region
Cardno
0
6
12
18
24
30
Kilometres

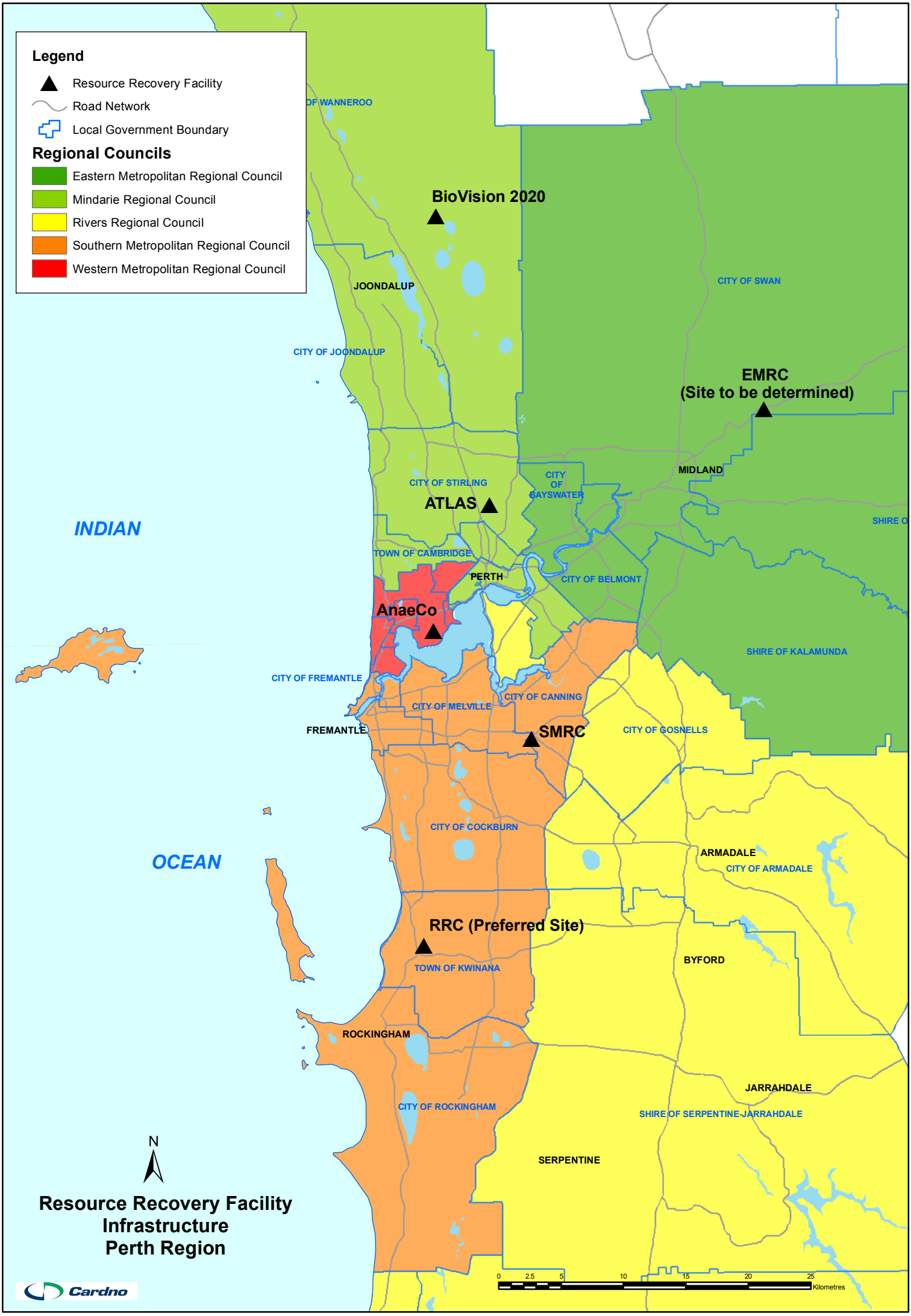
APPENDIX F

Material Recovery Facility Infrastructure in the Perth Metropolitan Region


Legend
Material Recovery Facility
Road Network
Local Government Boundary
Regional Councils
Eastern Metropolitan Regional Council
Mindarie Regional Council
Rivers Regional Council
Southern Metropolitan Regional Council
Western Metropolitan Regional Council
INDIAN
OCEAN
JOONDALUP
CITY OF JOONDALUP
City of Wanneroo / Swan / Joondalup
CITY OF SWAN
Perth
CITY OF STIRLING
CITY OF BAYSWATER
MIDLAND
TOWN OF CAMBRIDGE
PERTH
Cleanaway Bayswater
CITY OF BELMONT
SHIRE OF KALAMUNDA
Visy
CITY OF CANNING
Amcor
CITY OF FREMANTLE
CITY OF MELVILLE
FREMANTLE
SMRC
Cleanaway Maddington
CITY OF GOSNELLS
Perth Engineering and Maintenance
CITY OF COCKBURN
ARMADALE
CITY OF ARMADALE
BYFORD
TOWN OF KWINANA
ROCKINGHAM
CITY OF ROCKINGHAM
JARRAHDALE
SHIRE OF SERPENTINE-JARRAHDALE
SERPENTINE
N
CITY OF MANDURAH
MANDURAH
Cleanaway Mandurah
SHIRE OF MURRAY
0 2.5 5 10 15 20 25
Kilometres
Material Recovery Facility Infrastructure Perth Region
Cardno

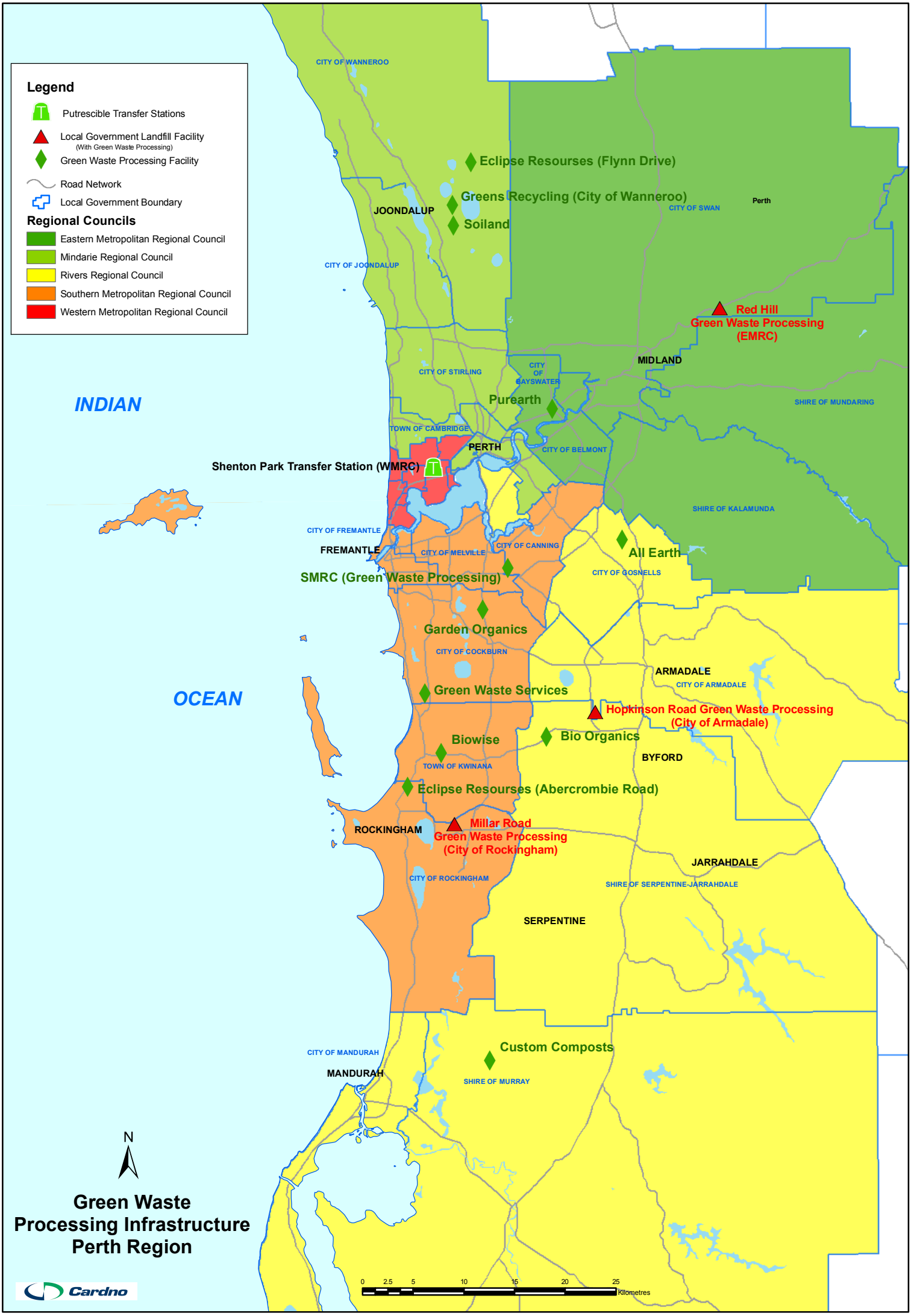
APPENDIX G

Resource Recovery Facility Infrastructure in the Perth Metropolitan Region


Legend
Resource Recovery Facility
Road Network
Local Government Boundary
Regional Councils
Eastern Metropolitan Regional Council
Mindarie Regional Council
Rivers Regional Council
Southern Metropolitan Regional Council
Western Metropolitan Regional Council
BioVision 2020
EMRC
(Site to be determined)
ATLAS
AnaeCo
SMRC
RRC (Preferred Site)
INDIAN
OCEAN
OF WANNEROO
JOONDALUP
CITY OF JOONDALUP
CITY OF SWAN
CITY OF STIRLING
CITY OF BAYSWATER
MIDLAND
TOWN OF CAMBRIDGE
PERTH
CITY OF BELMONT
SHIRE O
SHIRE OF KALAMUNDA
CITY OF FREMANTLE
CITY OF CANNING
CITY OF MELVILLE
FREMANTLE
CITY OF GOSNELLS
CITY OF COCKBURN
ARMADALE
CITY OF ARMADALE
TOWN OF KWINANA
BYFORD
ROCKINGHAM
JARRAHDALE
CITY OF ROCKINGHAM
SHIRE OF SERPENTINE-JARRAHDALE
SERPENTINE
N
0 2.5 5 10 15 20 25
Kilometres
Resource Recovery Facility
Infrastructure
Perth Region
Cardno

APPENDIX H

Greenwaste Processing Infrastructure in the Perth Metropolitan Region


Legend
Putrescible Transfer Stations
Local Government Landfill Facility
(With Green Waste Processing)
Green Waste Processing Facility
Road Network
Local Government Boundary
Regional Councils
Eastern Metropolitan Regional Council
Mindarie Regional Council
Rivers Regional Council
Southern Metropolitan Regional Council
Western Metropolitan Regional Council
INDIAN
OCEAN
CITY OF WANNEROO
Eclipse Resourses (Flynn Drive)
Greens Recycling (City of Wanneroo)
JOONDALUP
Soiland
CITY OF JOONDALUP
CITY OF SWAN
Perth
Red Hill
Green Waste Processing
(EMRC)
MIDLAND
CITY OF STIRLING
CITY OF BAYSWATER
Purearth
SHIRE OF MUNDARING
TOWN OF CAMBRIDGE
PERTH
CITY OF BELMONT
Shenton Park Transfer Station (WMRC)
SHIRE OF KALAMUNDA
CITY OF FREMANTLE
FREMANTLE
CITY OF MELVILLE
CITY OF CANNING
All Earth
CITY OF GOSNELLS
SMRC (Green Waste Processing)
Garden Organics
CITY OF COCKBURN
ARMADALE
CITY OF ARMADALE
Green Waste Services
Hopkinson Road Green Waste Processing
(City of Armadale)
Bio Organics
Biowise
BYFORD
TOWN OF KWINANA
Eclipse Resourses (Abercrombie Road)
Millar Road
Green Waste Processing
(City of Rockingham)
ROCKINGHAM
JARRAHDALE
CITY OF ROCKINGHAM
SHIRE OF SERPENTINE-JARRAHDALE
SERPENTINE
CITY OF MANDURAH
MANDURAH
Custom Composts
SHIRE OF MURRAY
N
0 2.5 5 10 15 20 25
Kilometres
Green Waste Processing Infrastructure Perth Region
Cardno