SEMRC

REGIONAL RESOURCE RECOVERY FACILITY
TASK 8 – WASTE COLLECTION SYSTEMS

FINAL

DECEMBER 2006

REPORT NO: 2006/220

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1. INTRODUCTION

1.1 Background

The South East Metropolitan Regional Council (SEMRC) was established in 2001 by the Cities of Armadale, Gosnells and South Perth to develop and implement strategic regional approaches to waste management in the region. One of the key strategic activities is waste education across the region.

In undertaking its work, the SEMRC is cognisant of the following requirement in the section 1.3 of the *Local Government Act 1995:*

"In carrying out its functions a local government is to use its best endeavours to meet the needs of current and future generations through an integration of environmental protection, social advancement and economic prosperity."[1]

The SEMRC is a formally constituted Regional Council under the Local Government Act 1995. Each Member Council elects two Councillors to the Regional Council. The Regional Council, which meets every two months, makes decisions relating to strategic waste management issues. The Regional Council currently employs a part-time Chief Executive Officer and a Regional Waste Education Officer.

The Regional Council is advised on technical matters associated with waste management by the Technical Advisory Committee (TAC) comprising the relevant Director and Manager of Waste Services from each Member Council.

1.2 Aim

In December 2004, the SEMRC adopted a Strategic Plan for Waste Minimization and Resource Recovery. This plan can be downloaded from the SEMRC website at www.sermc.wa.gov.au.

The SEMRC called tenders for a suitable consulting team to assist it in implementing aspects of its strategic plan. After reviewing the submitted Tenders, a consultancy team lead by Clifton Coney Group was commissioned to develop a Business Plan for achieving its vision for waste management in the region. The project team is in the process of completing a range of investigations defined by the Tender Brief. The scope of the project brief is presented in summary form in Appendix 1, which consists of a series of tasks.

Following the substantial completion of the first three tasks, the Council was approached by a number of other LGAs expressing interest in contributing to the Study with a view to perhaps becoming participating members should the feasibility demonstrate this would be of benefit to ratepayers of both the SEMRC and these additional LGAs.

It has been resolved by the SEMRC that the following LGAs could participate in the Study as contributing members (although they are not members of the Regional Council):

- The City of Mandurah

- The Shire of Murray.

The Shire of Serpentine-Jarrahdale decided that it would prefer to maintain an observer status rather becoming a full participating member. However, the study will account for the possibility that it may eventually become full member of Council.

1.3 Report Requirements

This report has been prepared in response to the scope of work required by Task 8 in Phase 1 of the Tender Brief and requires completion of the following:

Task 8 Waste Collection Systems

Prepare a report in consultation with the SEMRC and SEMRC Participants about:

1. A single mobile garbage bin (MGB) collection system against a multiple garbage bin collection system or other systems of collection of Municipal Waste;
2. Whether a uniform waste collection system of Municipal Waste is beneficial and feasible; and

3. Systems of collection of Waste other than Municipal Waste and the impact collection of that Waste will have on the Project.

The selection of an appropriate waste collection system is critical to achieving a successful resource recovery facility. The following approach to Task 8 has been taken:

- Evaluate current practice and the published literature to identify the available collection systems and the cost and benefits associated with each.

- A qualitative triple bottom line assessment of the systems that balances the often competing interests of community expectation and ease of use, environmental outcome in the form of optimal resource recovery and economic efficiency in terms of minimum cost.

- The preferred collection systems will be recommended for inclusion into the overall (RRRF and collection system) financial assessment in terms of costs and yields.

2. DRIVERS FOR RECYCLING IN AUSTRALIA

2.1 Introduction

In 1975 Canterbury Council became the first Australian municipality to start separating some recyclable materials from household waste (www.planetark.com). During the late eighties and early nineties kerbside recycling collection programs were extended through most Council areas.

The principal drivers for the introduction of kerbside recycling services were:

- A general increase in community concern regarding environmental protection and resource conservation.
- Concerns regarding the scarcity of suitable landfill space.
- Council concerns regarding rising landfill prices.
- Increasing demands from ratepayers that the waste collection service incorporates some form of separate collection for recyclables.

2.2 Government Waste & Recycling Policies

Waste and recycling is generally regulated at a State level in Australia. Local Government Associations (LGAs) were originally responsible under the Health Act provisions for the safe collection of waste. In most jurisdictions, waste is now regulated as an environmental protection measure but health is still carefully addressed. In Western Australia the Health Act still prevails.

Although limited legislative backing exists which require waste minimisation and recycling, there is an increasing trend for governments to formulate policies and legislation. Some examples of significance are listed in the section.

In 1992, the Commonwealth Government released the National Waste Minimisation and Recycling Strategy with a target of reducing the amount of solid waste going to landfill per capita by 50% from 1990 to 2000.

Following this, the Australia and New Zealand Environment and Conservation Council adopted the National Kerbside Recycling Strategy to extend and improve kerbside collection. The National Kerbside Recycling Strategy (PARR, 2005) aims to:

- Set recycling targets for the different major packaging materials (such as glass containers and aluminium cans).
- Require all Governments to have a municipal waste management plan.
- Require all households in major urban areas and 50% of households elsewhere to have access to kerbside recycling.
- Require all urban households to have a durable container for kerbside collection.

2.2.1 Waste Minimisation Act

The Waste Minimisation Act 2001 supports both the enactment of the National Environmental Protection Measures (NEPM) as well as future aspects of the Waste Strategy. The Waste Minimisation Act 2001 is based on an encouragement of voluntary approaches but allows for regulations to be established when satisfactory results are not being achieved.

2.2.2 National Environment Protection Council Act

Members of the National Environment Protection Council (NEPC) are required by the *National Environment Protection Council Act 1994* (section 23) to report annually on the overall assessment on the implementation and effectiveness of the National Environment Protection (Used Packaging Materials) Measures (NEPM). This NEPM was introduced in July 1999 and was subsequently revised in 2004.

2.2.3 Western Australia: Waste Avoidance and Resource Recovery (WARR) Bill 2006/ WARR Levy Bill 2006

The *WARR Bill 2006* builds upon work undertaken by the State Government to progress the commitment to the development of comprehensive waste legislation, including extended producer responsibility.

The main features of the *Waste Avoidance and Resource Recovery Bill 2006* are the following as detailed in the Explanatory Notes for the Waste Avoidance and Resource Recovery Bill 2006:

- Establishing a statutory waste authority with various non-regulatory functions and powers including:
    - Strategic policy and planning for the transition towards zero waste to landfill in Western Australia.
    - The implementation of policies, plans and programs to achieve that transition.
    - The administration of funds raised through the collection of the landfill levy.
- Allowing for regulations to be made and implemented by the Department of Environment and Conservation (DEC) to effect waste avoidance and resource recovery in Western Australia.
- The provision of powers for compliance and enforcement in relation to those regulations.
- Creating the head powers for establishing extended producer responsibility (EPR) schemes and product stewardship schemes, and implementation of the associated instruments for significantly reducing 'priority wastes'.
- Consolidation of certain (but not all) waste provisions currently in the *Environmental Protection Act 1986*, the *Health Act 1911*, and the *Environmental Protection (Landfill) Levy Act 1998*.

2.2.4 Western Australia: State Recycling Blueprint

The Department of Trade and Commerce (WA) in 1993 released the *State Recycling Blueprint.* The document detailed a plan to halve waste to landfill in Western Australia by the year 2000.

2.2.5 Strategic Direction for Waste Management in Western Australia

The *Statement of Strategic Direction for Waste in Western Australia: Vision and Priorities (DoE, 2004)* was released following the *Strategic Direction for Waste Management in Western Australia* discussion paper in late 2003. The statement outlines the broad strategic framework and the fundamental principles that guide the Waste Board's perspective on the new Strategic Direction for waste management in Western Australia. It also affirms the *Towards Zero Waste* vision and our fundamental principle around waste avoidance at every stage of each product's lifecycle.

2.2.6 Western Australia: Landfill Levy

In 1998 Western Australia introduced a landfill levy on waste sent to landfill in the Metropolitan area; $3 per tonne for putrescible wastes and $1 per tonne for inert wastes. This was introduced an environmental measure to divert waste from landfill as outlined in the 1997 Waste Reduction and Recycling Policy, 1997. In late 2005 it was announced that the Levy will increase to $6 per tonne for biodegradable waste and $3 per cubic metre for inert waste in 2006-07.

As noted by the Minister for the Environment, Mark McGowan in Zeroing In (15th June 2006) the Landfill Levy was raised as a step towards the vision of zero waste. The increase will also provide resources to help undertake a wide range of policy and program initiatives, support partnerships, research and data collection and progress effective communication and behavioural change strategies. In addition to increasing the Levy the Minister also committed to establishing a statutory waste authority to oversee the expenditure of the additional funds raised.

2.2.7 NSW Waste Avoidance and Resource Recovery Strategy 2003

The NSW Waste Avoidance and Resource Recovery Strategy 2003 provide a framework for reducing waste and making better use of resources. The strategy was a first for Australia, where it looks at where NSW want to be in the future, and the challenges that will be encountered in order to achieve it. It established targets and an action agenda which were both realistic and visionary and which reflect Australian and international best practices and performance. Furthermore, the actions and targets in the Strategy have been endorsed by the NSW Government.

The Strategy identifies four key areas:

- Avoiding and preventing waste.
- Increased use of renewable and recovered materials.
- Reducing toxicity in products and materials.
- Reducing litter and illegal dumping.

The Strategy is reviewed every two years, coordinated by Resource NSW.

3. EXISTING SEMRC COLLECTION SYSTEMS

3.1 Introduction

In the following section, SEMRC is delineated as Armadale, Gosnells and South Perth. Additional partners (as noted in Section 1) include Mandurah, Murray and Serpentine and Jarrahdale. All of the LGAs provide kerbside waste and recyclable collections for residential and small commercial premises.

LGAs weekly waste collections (for residual waste) are based on 240 litre mobile garbage bins (MGBs) with pickups by side trucks. Cleanaway undertakes the fortnightly kerbside collection of recyclables which are directed to Cleanaway's Material Recycling Facility in Bayswater and Mandurah. Here recyclable products are recovered and a small residual waste stream is collected for final disposal at landfill.

In addition, several times per year a verge side collection services for junk and green waste is also provided.

South Perth currently directs its waste to a combination of the Southern Metropolitan Regional Councils Resource Recovery Facility in Canning Vale and the MRC landfill facility at Mindara. The City of South Perth operates a transfer station/drop off centre located centrally with South Perth.

The City of Armadale operates a landfill facility at Hopkinson Road.

The City of Gosnells and Shire of Serpentine/Jarrahdale directs their waste to the landfill operated by WA Landfill Services at South Cardup.

The City of Mandurah disposes of waste at Millar Road Landfill in Baldivis.

3.2 Recycling Services

The dry recyclable materials collected in Armadale, Gosnells, South Perth, Mandurah, Murray and Serpentine and Jarrahdale via a co-mingled MGB collected on a fortnightly basis include (www.recyclingnearyou.com.au):

- Glass Bottles & Jars
- Aluminium Cans
- Newspapers
- Magazines
- Office Paper
- Envelopes - with a window
- (South Perth & Armadale only)
- Envelopes - without a window
- Phone Books
- Pizza Boxes (Clean)
- (South Perth and Gosnells only)
- Egg Cartons
- Cardboard
- Steel Food Cans
- Steel Paint Cans (Empty)
- Milk Cartons
- Juice Cartons
- Plastics, each LGA collects some or all of the following:
  - PET
  - HDPE
  - PVC
  - LDPE (Gosnells and Mandurah only)
  - PP(Gosnells, South Perth, Mandurah only)
  - PS (Gosnells and Mandurah only)

A more detailed assessment of present and future waste volumes generated within SEMRC and additional LGAs is presented in Appendix 3.

4. ASSESSMENT OF COLLECTION SYSTEMS

4.1 Introduction

During the past 10 years, kerbside collection systems have changed significantly in Australia. Changes have been motivated by numerous factors including occupational health and safety and the drive for improved recycling participation and efficiency. Most LGAs now provide residents with a recycling service. This is commonly in the form of an MGB(s) or crates(s), enabling residents to separate recyclables from general waste. Some LGAs supply bags; however this is becoming increasingly uncommon.

An Australian Standard is being developed for Mobile Waste Containers (AS 4123), which will detail design, dimensions, performance requirements, testing, colours, heath and safety and environmental requirements (DEC (NSW) 2006).

Many factors influence the type of collection system adopted by a Council and include but are not limited to the following:

- The nature of the final disposal or treatment option for MSW and collectable recyclables.
- Performance of any MRF or RRRF.
- Financial Performance.
- Environmental Performance.
- Social Performance.

4.2 Methodology

4.2.1 Qualitative Assessment

There are many techniques available for the assessment of the relative merits of different waste collection systems. However, for a quantitative assessment to be meaningful it generally needs to address the complete waste management system from collection through to treatment and disposal. It also needs to take into consideration the value of the end products and the disposal cost for any residual waste streams that may arise from the resource recovery facility.

This report presents a qualitative assessment of a number of collection systems based on previous research and published literature. The potential benefits and limitations of each of the systems will be explored in the assessment. The qualitative assessment includes a multi-criteria analysis (MCA). This is a decision making tool which is widely employed by organisations when making complex decisions where there are wide range of factors that can affect the outcome. However, this form of analyses, as previously discussed, would be more meaningful when undertaken in the context of the complete waste management system, from collection through to treatment and disposal. As this overall analysis will be completed at a later date, this MCA makes some default assumptions about the collection system and the receiving environment.

Care has been taken to compare the systems without bias. Subsequent chapters will present the results of a quantitative assessment using the Financial Model to be completed as part of Task 9.

The qualitative assessment will be broken down into the following components:

Operational Performance

An overview of the performance of the system will be conducted, including occupational health and safety.

Financial Performance

A qualitative financial assessment of each of the collection systems focusing on:

1. Materials supply (receptacles)
2. Transport costs (in association with collection frequency)
3. Staff requirements
4. Landfill disposal costs
5. Recovered materials market value
6. Education

Environmental Performance

A qualitative environmental assessment of each of the collection systems focusing on:

1. Resource conservation
2. Quality and quantity of recovered materials
3. Landfill requirements
4. Water and air pollution
5. Energy requirements
6. Greenhouse emissions.

Social Performance

A qualitative social assessment of each of the collection systems focusing on:

1. Impacts on residents
2. Convenience for residents
3. Local economy
4. Impacts on the surrounding environment
5. Community engagement
6. Education

4.2.2 Assessment Criteria

In order to complete the MCA, a spreadsheet model was developed (in accordance with the Task 3 Report) which allowed each of the collection systems to be scored in the range 1-10 (1 very poor -10 outstanding). Factors were defined which were grouped under the main sustainability assessment factors of social, environmental and financial (as detailed in Section 4.2.1 above).

An assessment of each of the collection systems detailed in this report as been conducted by members of ATA upon completion of a detailed review of the submitted information. The spreadsheet has been populated with these scores.

4.2.3 Assessment Output

The MCA model then has the ability to apply a different weighting to the environmental, social and economic scores and then evaluate the impact of these changes in weighting on the ordering of the preferred collection system. Sample outputs from the model are included as Appendix 4. Four different outputs are included in Appendix 4.

- Equal weightings to each factor (i.e. Social = 1, Environment = 1, Economic = 1).
- High Social Weighting (i.e. Social = 2, Environment = 1, Economic = 1).
- High Environment Weighting (i.e. Social = 1, Environment = 2, Economic = 1).
- High Economic Weighting (i.e. Social = 1, Environment = 1, Economic = 2).

The recommendations given in this report will then be used in the overall financial assessment of the RRRF and collection system.

Main sources of information used in the assessment have been sourced from:

1. Australian Bureau of Statics (2005) Year Book 2005
2. DEC (NSW) (2004) Getting more from our recycling systems: Assessment of domestic waste and recycling systems.
3. DEC (NSW) (2004) Getting more from our recycling systems: Good practice performance measures for kerbside recycling systems.
4. EcoRecycle Victoria (2004) Guide to Preferred Service Standards for Kerbside Recycling in Victoria.
5. Nolan-ITU & SKM (2001) Independent Assessment of Kerbside Recycling in Australia
6. Planet Ark Recycling Report (2005) Ten Years of Recycling – The Good, The Bad and The Ugly.

4.3 Assessment Limitations

The assessments made in this report are qualitative. Any recommendations given in the conclusions will be used in the quantitative assessment of the overall RRRF and collection system. This will look in detail at the financial implications of the recommended collection systems.

The assessments do not take into account metropolitan or inner city areas which are densely populated. The collection systems in such areas would require to be specifically tailored for residents in these areas.

4.4 Available Collection Systems

The selection of a resource recovery facility is intrinsically linked to the collection system and vice versa. A collection system assessed in isolation may appear to be more expensive than another; however, it may require a less expensive resource facility or provide increase resource recovery rates overall. Accordingly the overall system (RRRF and collection system) should be assessed financially.

A considerable number of possible collection systems exist and it would be impossible to assess the full array in this report. Therefore three possible collection systems will be assessed which are based on the three main streams of waste that emerge from household waste:

- ***Type 1: Single Bin (Section 5)***
  One bin is used for all material.

- ***Type 2: Separated Recyclables (Section 6)***
  Bin(s) for recyclables and one bin for general household waste.

- ***Type 3: Separated Recyclables and Organics (Section7)***
  Bin(s) for recyclables, one bin for organics (green waste) and one bin for the residual waste.

Numerous configurations are possible within the three basic types of collection systems detailed above. This is due to possible variation in collection receptacles (size and type) and the frequency of collections.

For the purpose of this report the collection assessment will concentrate on the basic three types of collection systems given above and not the possible configurations within it. It is presumed that each of these collection types are suitable for each of the RRRF facilities described in Task 3- Preliminary Technical and Financial Assessment. Recommendations given at the end of this report will suggest the exploration of certain configurations (e.g. receptacle size) in the subsequent quantitative assessment based on the findings of this report.

4.5 Public Place Recycling

Until now this report has focused on kerbside collection of recyclables from the home. However, nowadays people are often away from home and use public facilities for waste disposal.

The Minster for the Environment (Dr Edwards) WA noted in a media statement on the 27/11/05 that Perth's kerbside recycling system was performing well. However, by itself kerbside recycling could not cater for regional areas and did not pick up the increasing amount of packaging waste generated away-from-home. Dr Edwards has initiated an investigation of a number of different models for container deposit schemes that could be used in WA. These will cover both manual and automated collection systems for used containers.

Container deposits are not a new idea but they have an important a role in a new product take-back regime. Container deposits schemes exist in over 30 nations around the world including America, Canada and European countries as well as South Australia.

Experiences in these countries show that container deposits:

- Raise funds for recycling collection and infrastructure.
- Positively change packaging disposal behaviour.
- Increase recovery rates for packaging.
- Decrease contamination rates.

However, container deposits can be viewed as inefficient as they can duplicate kerbside and public place recycling services. They can reduce participation in kerbside collection schemes and

subsquently impose sizeable costs on the industry which are then passed onto the community. The environmental benefits may also be reduced due to the additional resources (i.e. transport) consumed by the public returning containers to collection points rather than putting them out for kerbside collection.

5. TYPE 1: SINGLE BIN

5.1 Operational Assessment

Due to technology advances there is a potential to revert to the single bin approach for waste collection, where householders are not required to source separate waste. Instead, recyclables are recovered through sorting prior to waste treatment at a RRRF. As reported by DEC (NSW) 2004a this approach has significant implications for established methods and infrastructure that has been developed for recycling.

In 2001 the City of Stirling began recycling the contents of every household bin put out for disposal. This was done through a total materials recovery facility designed by Atlas Pty, Ltd. The facility is able to sort a mixture of household discards to recover compostable organics (food scraps, garden waste and paper), glass bottles and jars, plastic bottles, steel and aluminum cans. This enables City of Stirling to use a single bin for general waste and recyclable materials, removing the need for residents to sort their own waste. (http://www.stirling.wa.gov.au).

This system potentially presents low health and safety concerns as it requires minimal interaction of the work force with the MGBs and the waste. This is mainly due to the sophisticated automatic facilities now available on waste collection vehicles.

A single bin system requires the collection of a single waste stream. The choice of receptacle is commonly a 240L or 360 L MGB collected on a weekly basis.

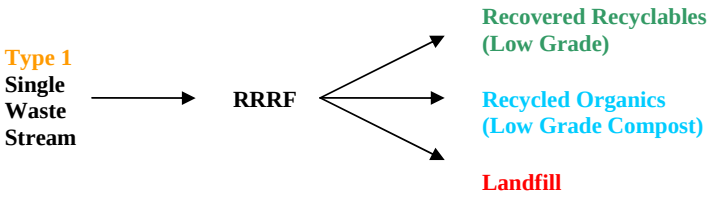

Figure 1: Schematic Arrangement of Type 1: Single Bin

5.1.2 Collection Regimes and Vehicles

The final decision on the collection frequency for the single bin will be influenced by the cost to the Council and the preference of the residents. Numerous vehicle types are available for collecting single type waste.

5.2 Financial Assessment

As previously discussed, the cost of implementing a single bin collection system cannot be explored in isolation of the RRRF. This will be examined as part of the overall financial analysis of the RRRF and collection scheme. A single bin system offers the following potential cost benefits and limitations.

5.2.1 Potential Financial Benefits

- A single receptacle is required for the collection of the single waste stream.
- Only one collection service is required per week.
- Low staff requirements.
- Reliable collection methods.
- The need for education programs that address inappropriate mixing of waste are largely eliminated, with the exception of household chemical wastes.
- This system can appear attractive financially as it can offer cheaper collection methods and it also avoids the social and educational costs associated with kerbside recycling.

5.2.2 Potential Financial Limitations

- Where a two bin system exists (currently the case for all municipalities in this study), the existing collection system would require modifications (e.g. removal of existing recycling facilities).

- Higher volumes of mixed waste require sorting and processing in the resource recovery facility.

- Where a system presents a mixed waste stream to a recovery centre, it will almost inevitability result in a lower product recovery rate and a higher quantity of residual waste will require landfill disposal. Therefore, the system costs will remain quite heavily dependant on landfill gate fees, which are expected to rise significantly in the future.

- The use of recycled materials in manufacturing and composting often relies on the recovered materials being reasonably consistent and pure. The quality of the recovered materials from a mixed waste stream is reduced; this lowers the market value of and demand for the product.

- The system will not allow for recovery of paper and cardboard for paper recycling. Instead paper is incorporated into organic compost which has a significantly lower end use and market value. This in turn also makes the paper industry more reliant on virgin materials.

- The diversion of waste from landfill and the recovery of materials is highly dependant on the plant design and its operation. Therefore the system may be vulnerable to the plant reliability.

5.3 Environmental Assessment

A single bin system offers the following potential environmental impacts which have been assessed in accordance with Section 4 of this report.

5.3.1 Potential Environmental Benefits

- Reduced transport impacts, as only one collection service is required.
- Maximises the participation rates.

5.3.2 Potential Environmental Limitations

- More landfill capacity is required due to lower diversion rates.
- Possible degradation of air and water quality due to processing of mixed waste in larger volumes.
- The system does not meet the requirements of the National Kerbside Recycling Strategy.
- Generally higher energy requirements are required for processing mixed waste.
- Generally lower recovery of materials will be achieved at reduced level of quality which tends to reduce demand and value.
- It does not allow the recovery paper and cardboard for reprocessing into higher value paper products.

5.4 Social Assessment

The following paragraphs detail a qualitative assessment of the potential social implications a single bin system may have on a local community.

From a social perspective residents are primarily concerned with waste collection. The single bin option keeps the obligation on the resident at this basic level and does not involve the resident with waste beyond its collection. It also imposes less responsibility and inconvenience on the resident in terms of separating waste. However, this approach has significant implications for established recycling philosophies and methods that have been used for kerbside collection and education purposes. In addition, the following social implication should be considered:

- It disengages prior public waste education aimed at kerbside separation of waste.
- It may cause confusion in surrounding areas not involved in the scheme.
- It takes away the opportunity for resident to make a direct contribution to the environment and reduce their community spirit.
- Removes the opportunity to engage with residents to provide education, creating waste awareness.
- It encourages a ‘dispose and forget’ mentality amongst the community.

6 TYPE 2: SEPARATED RECYCLABLES

6.1 Operational Assessment

Kerbside recyclables collections have contributed significantly to the development of paper and packaging recycling.

The system involves the separation of 'dry recyclables' from the residual of household waste for recycling. Generally collection receptacles are provided for both recyclables and residual household waste. This is the most common approach to kerbside recycling in Australia.

The type of kerbside recycling collection provided by a LGA depends on the requirements of the local community and the processing facilities available. Generally the following materials are collected for recycling:

- Paper/Cardboard
- Plastic (PET, HDPE and others)
- Steel
- Glass
- Aluminium

Consequently, the markets for recovered materials are an important component of the kerbside collections. The separation of materials at the source can often help to ensure a consistent and high quality product which in turn has a higher market value.

Kerbside collections vary according to the LGA. Factors that vary include:

- Materials collected
- Collection container(s)
- Size of collection container(s)
- Type of collection container(s)
- Frequency of collections
- whether materials are sorted at kerbside or at a Materials Recovery Facility (MRF)

For the purpose of this report, Type 2: Separated Recyclables refers to those collection systems that require separate kerbside collection of 'dry recyclables' and residual household waste. It is common for LGAs to provide the following service for individual waste streams:

Residual General Household Waste

This is the fraction of household waste remaining following the separation of dry recyclables. Typically collection arrangements include:

- 240 or 140L MGB collected weekly. The smaller size is sometimes considered to encourage recycling and home compositing. However if insufficient in volume, it can encourage residents to contaminate the recyclables bin with residual household waste.

Recyclables

The collection of recyclables can be conducted through numerous types and sizes of receptacles. Typical arrangements include:

- MGBs co-mingled collected fortnightly; or
- MGBs split (i.e. one side for paper and the other for containers), collected fortnightly; or
- Two separate MBG/crates, one for paper and the other for containers.

A split bin which incorporates both household waste and recyclables is not discussed in this report as previous research indicates that high levels of contamination commonly occur (DEC (NSW) 2004a).

The potential health and safety concerns presented from this type of collection will depend on the chosen receptacle for the materials. In particular, crates present handling and lifting concerns for both residents and the work force which are overcome with the use of MGBs. The study undertaken by NPCC (Nolan-ITU *et al.*, 2001) indicated the following:

- In inner metropolitan areas mechanical lifting is not considered practicable due to restricted access and storage capacities.

- In outer metropolitan/metropolitan fringe/major provincial centres mechanical lifting is considered practical as it is cost competitive with crate based systems and it is not limited by access restrictions.

- Cost modelling undertaken for smaller provincial centres and rural/remote areas indicated that the costs for mechanical lifting systems were higher than with a two crate system with a single collection vehicle.

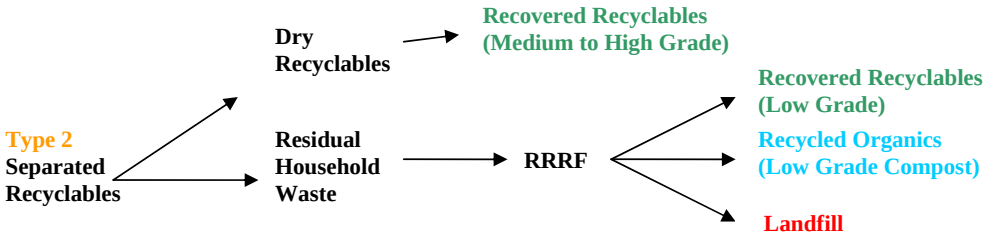

Figure 2: Schematic Arrangement of Type 2: Separated Recyclables

6.1.2 Collection Regimes and Vehicles

Recyclables can be collected on either the same day or on a different day to the residual household waste. The factors that influence the collection day include the cost to the Council and the preference of the residents. It has been reported that the collection of waste materials bears no relationship to resident participation (Woodard *et al.*, 2005).

The residual general household waste is usually collected on a weekly basis and recyclables are generally collected on a fortnightly basis.

A separate recyclables collection system requires several collection vehicles; one (or more) for the recyclables and another for the residual waste component. There are many different types of collection vehicles available, including ones with split bodies and/or compartments. For public awareness, vehicles collecting separated recyclables should be readily distinguishable from residual household waste vehicles.

6.2 Financial Assessment

The cost of implementing a separate recyclables collection system cannot be explored in isolation from the RRRF. This will be examined as part of the overall financial analysis for the RRRF and collection scheme. A separate recyclables system can offer the following potential financial benefits and limitations:

6.2.1 Potential Financial Benefits

- Reduced volume of mixed waste material requires sorting and processing at the resource recovery facility.
- Recyclables separated at the source are more likely to have a higher market value and demand.
- Increased recycling rates can be achieved, as it presents the opportunity to recover resources from both kerbside collections and at the resource recovery facility.
- Lower volume requirements for landfill.
- This type of system is already in place in most, if not all LGAs, therefore existing infrastructure can be utilised.

6.2.2 Potential Financial Limitations

- Collection receptacles are required specifically for recyclables. Kerbside recycling facilities are already provided by SEMRC. However, depending on the final receptacle configuration chosen, some alteration to the existing scheme maybe required.
- Separate collections of recyclables with additional transport and labour costs. Kerbside recycling collections are already provided by SEMRC. However, depending on the number of final waste streams, some alteration to the existing scheme maybe required.
- Increased labour costs due to collection requirements.
- Contamination adversely affects yields.
- The financial success of the system is dependant on yields.
- The use of recycled materials in manufacturing relies on the recovered materials being reasonably consistent and pure.

6.3 Environmental Assessment

As reported by NPCC (Nolan-ITU *et al.*, 2001) the most significant environmental value in the waste recycling system arises from the ‘avoided product credits’ which include all of the life

cycle impacts avoided by displacing virgin materials with recycled ones. A separated recyclables collection system gives the opportunity to increase recycling rates through:

- Kerbside recycling (dry recyclables)
- Resource recovery facility (Dry recyclables and organics)

A source separated recycling system can offer the following potential environmental benefits and limitations which have been assessed in accordance with Section 4 of this report:

6.3.1 Potential Environmental Benefits

- Saves valuable resources.
- Increases recycling rates which reduce volumes of waste sent to landfill.
- Saves energy - re-processing waste materials requires less energy than processing the original raw materials.
- Source separation reduces energy used in recovery facilities.
- Reduced environmental degradation associated with landfill and waste processing.
- Conserves the local landscape due to fewer requirements for landfill.
- Recycling of paper and cardboard provide significant environmental benefits when compared with incorporating them into mixed waste derived compost.
- Residual waste treatment provides additional benefits.

6.3.2 Potential Environmental Limitations

- Additional collections (i.e. transport) are required in comparison to a single bin approach which results in increased energy use and greenhouse emissions.

6.4 Social Assessment

The success of a separate recyclables collection regime is highly dependant upon the residents' commitment to separating the dry recyclables from the residual household waste. This approach to kerbside collection immediately engages the community and encourages waste awareness. If this type of approach is implemented, the LGA must work closely with the community and provide clear information regarding separating wastes and the benefits of doing so.

A broad range of materials can be recycled; however, there are often difficulties with contamination. This is where inappropriate waste types are mixed, often having serious implications for the recovery of the materials. This is usually due to a lack of information, as residents are often confused about what is and isn't acceptable for recycling and the implications of contamination.

Kerbside recycling requires greater interaction between residents and their waste. MGBs are far more convenient for residents than using recycling bags or crates. In addition crates provide less recycling capacity and involve higher collection costs. However, they are useful in high density environments and rural remote locations where mechanical collection may not be practical.

6.4.1 Potential Social Benefits

As reported by NPCC (Nolan-ITU *et al*., 2001) the social benefits of source separated recycling can include:

- A sense of community involvement.
- A positive view of LGAs.
- New industries and employment opportunities for design, collection and sorting of recyclables.
- A source of funds for service groups or disadvantaged people.
- Opportunities for a sustained lifestyle.
- Education opportunities.
- New local jobs are created.

6.4.2 Potential Social Limitations

- Additional truck movements along residents' streets.

7. TYPE 3: SEPARATED RECYCLABLES AND ORGANICS

7.1 Operational Assessment

Recently Councils in Australia have begun to focus on the garden and organic (kitchen) waste stream. PARR, 2005 reported that many metropolitan LGAs now offer a third bin for garden/organic waste collections. Home composting is also encouraged through the use of compost bins or worm farms to process some garden/organic waste in gardens.

According to the Australian Bureau of Statistics in 2005, Western Australia had the lowest recorded % of residents composting at home in Australia.

Where organic waste is collected by the LGA it is generally used in:

- Large scale mulching or composting.
- Bio-digestion plants.
- Anaerobic digestors.
- Fuel for waste to energy plants.

The City of Seattle in Northern America provides residents with an addition receptacle (96 gallon cart) for the collection of food and food-soiled paper waste. Wastes that are acceptable include (www.seattle.gov)

- **Food-soiled paper** such as paper towels, food cartons, pizza boxes, paper bags and milk cartons.

- **Food scraps (vegetative waste)** such as fruit & vegetables, bread, pasta, grains, eggshells, nutshells, coffee grounds & filters and tea bags.

- **Plant material** including grass, leaves, plant and tree trimmings and branches and twigs (up to 4 inches in diameter and 4 feet in length)

The collected organics are sent to Cedar Grove Composting Facility where the organic waste is converted into compositing products which are produced in accordance with a composting standard recognised in America. Cedar Grove Composting started accepting the first residential yard waste from the City of Seattle over 17 years ago. Since that time, the program has grown 20-fold in volume and participation, and has expanded into a full scale residential organics recycling program inclusive of yard and food wastes (www.cedar-grove.com).

In the UK, WRAP have produced a report titled the *Food Waste Collection Guidance* which provides Local Authorities with guidance on diverting organic material from landfill through the separate collection of food waste. In addition to providing information on various aspects of organics collection it also looks at the container types used to collect organic materials which include:

- Internal containers: Food caddies which can have a lid and/or be vented.
- Liners which are often used to line food caddies made from biodegradable organic materials.
- External container: Wheeled bins (80, 120, 140, 240 and 360 litres) and ventilated bin (240 litres).

The Type 3 collection system is similar to that used for Type 2: Separated Recyclables detailed previously however, an additional regular service is provided for organics (kitchen)/garden waste.

Separating organics at the source, as with all recyclables, can help to deliver a secondary product (compost) that is more consistent having higher demand and value in the market place. Generally LGAs often provide the following service for individual waste streams:

Residual Waste
This is the fraction of household waste remaining following the separation of dry recyclables and organics. Typically collection arrangements include:

- 240 or 140L MGB, a smaller size is sometimes considered to encourage recycling and home compositing. However if insufficient it may encourage residents to contaminate the recyclables bins. Due to the removal of the organic fraction this may be collected on a less frequent basis i.e. fortnightly.

Recyclables
The collection of recyclables can be conducted through numerous types and sizes of crates and MGB. Typical arrangements include:

- MGBs co-mingled collected fortnightly; or
- MGBs split (i.e. one side for paper and the other for containers), collected fortnightly; or
- Two separate bins/crates, one for paper and the other for containers.

Organics
Organics (food waste which can incorporate garden waste) can be collected in a number of ways, which can include indoor and outdoor receptacles. Typical arrangements involve:

- 240 or 140L MGB for kitchen waste with or without garden waste.
- 5L Kitchen food caddie (with or without liners).

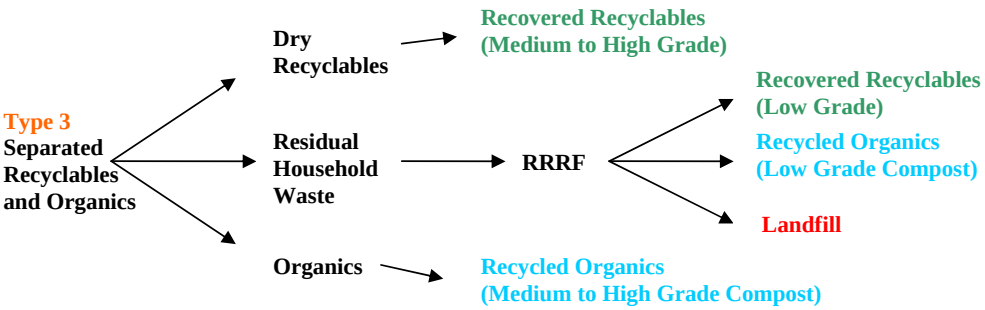

Figure 3: Schematic Arrangement of Type 3: Separated Recyclables and Organics

7.1.2 Collection Regime and Vehicle

The collection frequency and receptacle type are extremely important factors which influence participation in organic collection schemes. Commonly organics (food waste which can include garden waste) are collected weekly due to environmental health concerns and odours.

This type of collection system will require two or more collection vehicles. One (or more) for the recyclables (dry and organic) and another for the residual waste. In addition a kitchen food caddie may be considered as this is a way of storing the food waste before it is placed in the external container. The provision of a food caddie may increase participation.

There are many different types of recyclables collection vehicles available, including vehicles with split bodies or compartments. Organics can be collected in the same vehicle as the dry recyclables, where the vehicle is split bodied. However, potential contamination issues must be considered. For public awareness, the vehicles collecting separated recyclables should be distinguishable from residual household waste vehicles.

7.2 Financial Assessment

The cost of implementing a separate recyclables and organics system cannot be explored in isolation of the resource recovery solution. However, this will be examined as part of the overall financial analysis for the resource recovery scheme. A separate recyclables and organics system can offer the following potential financial benefits and limitations (in addition to those in Section 6.2):

7.2.1 Potential Financial Benefits

- Reduced volumes of residual material requiring sorting and processing at the RRRF.
- Increased recycling rates which diverts organics from landfill.
- The production of high quality compost which have the potential to meet the specific requirements of the end-user.
- It gives the opportunity to recover organics from both kerbside collection and at the resource recovery facility.
- Organics compose a significant proportion of household waste. The diversion and production of a useable end product would have significant cost saving implications.
- Less frequent collection of residual waste due to the removal of the organic fraction.

7.2.2 Potential Financial Limitations

- Requires separate collection of organics on a weekly basis.
- Kerbside contamination is possible.
- Heavily dependant on yields.
- It is a relatively new concept that will require public consultation and education.
- The use of recycled organics (compost) relies on the recovered materials being reasonably consistent and pure. This may restrict the collection of food and garden waste together.

7.3 Environmental Assessment

A separate recyclables and organics system can offer the following potential environment benefits (in addition to those in Section 6.3):

7.3.1 Potential Environmental Benefits

- Recovery and beneficial use of an otherwise wasted resource.
- Help to ensure the production of high quality compost that will meet the specific needs of the end-user.
- Recycling of organics diverts the single largest fraction in the domestic waste stream from being landfilled.
- Reduction of landfill gas and leachate emissions associated with landfilling of organic waste.
- Beneficial effects of compost use on soil fertility and productivity.
- Reduces the need for fertilisers.

7.3.2 Potential Environmental Limitations

- Additional collections (i.e. transport) are required for both recyclables and organics in comparison to a single bin approach, which results in increased energy use and greenhouse emissions.

7.4 Social Assessment

A separate recyclables and organics system can offer the following potential social benefits and limitations (in addition to those in Section 6.4).

Potential Social Benefits

- Establishment of a resource recovery scheme that is well adapted for rural communities.
- Local processing and use of recycled organic material are visible and offer opportunities for community activities and development of community spirit.
- Job creation and supports the local economy.
- Provides educational opportunities.
- Reduced landfilling requirements.

Potential Social Limitations

- Environmental health concerns.
- May discourage home composting.
- Additional waste handling and segregation.
- Inconvenience.

8. DISCUSSION

A variety of approaches can be taken to financially, environmentally and socially assess kerbside collection systems. As previously discussed, the RRRF chosen by SEMRC will influence the collection system implemented. Task 3 – Preliminary Technical and Financial Assessment looked at 10 possible technologies that could be used in the RRRF. The Task 3 report detailed the most common collection system used with each of the ten technologies assessed, ranging from single bin to separated waste streams. However, the majority of the 10 technologies can be tailored to accommodate any of the three types of collection systems discussed in this report.

8.1 Financial

Table 1 below summarises the potential financial benefits and limitations associated with each of the separate collection systems. The distinction between benefits and limitations are subjective and can be interpreted depending on the perspective taken, however care has been taken not to be bias to a particular system. The results of the MCA conducted in accordance with Section 4 of this report are given in Appendix 4.

TABLE 1
SUMMARY OF FINANCIAL ASSESSMENT

Collection System	Potential Financial Benefits	Potential Financial Limitations
Type 1 Single Bin	✓ Single bin. ✓ Single collection. ✓ No contamination issues. ✓ Low education costs for residents. ✓ Low staff requirements. ✓ Reliable and simple collection methods.	▪ High volumes of mixed waste require treatment. ▪ Dependant on landfill, with rising gate fees. ▪ The quality and consistency of recovered material is low. ▪ Diversion of waste from landfill is totally dependant on the operation of the waste recovery facility.
Type 2 Separated Recyclables	✓ Reduced volumes of mixed waste require treatment. ✓ Recyclables are likely to have a higher market value. ✓ Two possible opportunities to recover recyclable material. ✓ Increased diversion from landfill. ✓ Not dissimilar to the collection system already in place. ✓ New industries and employment opportunities for design, collection and sorting of recyclables. ✓ Potential to recover costs through container deposits.	▪ Multiple collection receptacles (already in place). ▪ Additional kerbside collection (already in place). ▪ Multiple collection vehicles (already in place). ▪ Landfill is still required, but to a lesser extent. ▪ System is vulnerable to contamination issues. ▪ Success is dependant on yields. ▪ Yields are dependant on participation and education of residents. ▪ Educational costs.

Collection System	Potential Financial Benefits	Potential Financial Limitations
Type 3 Separated Recyclables and Organics	In addition to the benefits for Type 2 above: ✓ Further reduced volumes of mixed waste require treatment. ✓Less frequent collection of the residual fraction of household waste due to removal of the organic component. ✓ Compost is likely to have a higher market value. ✓ Two possible opportunities to recover organic material. ✓ Diversion organics from landfill, thereby reducing landfill gate fees.	In addition to the limitations for Type 2 above: ▪ Three collection receptacles. ▪ Additional kerbside collection. ▪ Additional collection vehicles. ▪ System is vulnerable to contamination issues. ▪ Success is dependant on yields. ▪ Yields are dependant on participation and education of residents. ▪ Organics recycling would be a relatively new concept which would require trials and education. ▪ The economics of treating the smaller mixed waste stream may be poor. ▪ Education costs.

The single bin system provides the most cost effective solution when qualitatively assessed in isolation of RRRF, as it avoids the recyclables collection costs. However, the potential cost savings need to be measured against the increased cost of processing a mixed waste stream and the ever increasing cost of landfill. In addition the consistency and quality of recovered material is low, therefore adversely affecting the market value and demand for the end product. The materials recovery rate of a single bin collection is limited by the efficiency of the chosen technology, which cannot necessarily be easily improved upon without additional cost.

Both of the recycling collection approaches (Type 2 and 3) offer potential additional financial benefits. Those benefits are primarily gained through:

- The recovery of materials which meet the requirements of the end user and have a higher market value.
- Increased recycling rates that divert waste from landfill.
- Support of local economy.

Kerbside recycling depends heavily on yields, which require high resident participation and low contamination. This can be achieved through community consultation and education, which comes at a cost. The NPCC (Nolan-ITU *et al*., 2001) reported that generally, the cost efficiency of a collection systems declines when the yields fall below around 1.8 kg per household per week.

The separation of organics would have considerable cost benefits as it diverts a large component of household waste from landfill. It also has the potential to produce a product (compost) that can be controlled to meet the requirements of the end user (e.g. farmers). This can be further enhanced through the development of an industry standard for recycled organics and growth of markets for recycled organics. Mixed waste streams produce recycled organics that have numerous difficulties and limitations due to the chemical and physical characteristics which cannot be closely controlled.

Recycling of organics within a kerbside collection scheme requires additional infrastructure and issues of high contamination can be problematic. Many Councils in Australia have explored organics recycling and have gone on to adopt separate kerbside organics collection. Typically trials are undertaken to explore kerbside collection of organics (e.g. Christchurch, New Zealand and Burnside, South Australia), as close consultation with the residents is required. Varying degrees of success have been achieved, and some LGAs have gone on to offer this service only on a user pay basis.

In 2003/2004 40 out of 79 Victorian LGAs provided a green organics collection service. Over 176,500 tonnes (or 115 kg per household) of green organics was collected (up from 96 kg per household in 2002/2003). This was at an average cost of $15 per household per year.

A national study commission by the National Packaging Covenant Council (Nolan-ITU *et al*., 2004) into kerbside recycling reported the following key financial findings:

- For metropolitan systems the collecting sorting and delivery costs of recycling ranges between $36 and $60 per household per year.

- For regional systems the collecting sorting and delivery costs of recycling ranges between $36 and $53 per household per year.

The study concluded that the combined financial cost of kerbside recycling systems and environmental benefits show a net benefit to Australian communities of around $42 per household per year.

In light of the above it is likely that the Type 2-seperated recyclables will be more cost effective than Type 3-seperated recyclables and organics. This is mainly due to the relative infancy of a Type 3 arrangement. However, this will be financially assessed in the overall quantitative assessment.

8.2 Environmental

Table 2 below summarises the potential environmental benefits and limitations associated with each of the separate collection systems. The distinction between benefits and limitations are subjective and can be interpreted depending on the perspective taken. The results of the MCA conducted in accordance with Section 4 of this report are given in Appendix 4.

TABLE 2
SUMMARY OF ENVIRONMENTAL ASSESSMENT

Collection System	Potential Environmental Benefits	Potential Environmental Limitations
Type 1 Single Bin	✓ Reduces transport impacts, as only one collection service is required. ✓ The success of the system is not vulnerable to contamination.	▪ Landfill dependant. ▪ Environmental impacts of processing of mixed waste in larger volumes. ▪ Recycling rates are limited by the recovery facility. ▪ The system does not meet the requirements of the National Kerbside Recycling Strategy. ▪ The recovered materials do not always meet the requirement of the end user. ▪ No recovery of paper and cardboard for paper processing.
Type 2 Separated Recyclables	✓ Displacement of virgin materials with recycled ones. ✓ Diversion from landfill. ✓ Encourages paper recycling. ✓ Production of recycled materials which meet the requirement of the end user. ✓ Reduced processing of mixed waste, reducing operation impacts of the facility on air and water quality. ✓ Reduced energy requirements. ✓ Residual waste treatments provide additional benefits.	▪ Increased environmental impacts from additional collection (i.e. transport). ▪ Landfill is still required but to a lesser extent.

Collection System	Potential Environmental Benefits	Potential Environmental Limitations
Type 3 Separated Recyclables and Organic	In addition to the benefits for Type 2 above ✓ Recovery and beneficial use of an otherwise wasted resource. ✓ Help to ensure the production of high quality compost that will meet the specific needs of the end-user. ✓ Recycling of organics diverts the single largest fraction in the domestic waste stream from being landfilled ✓Reduction of landfill gas and leachate emissions associated with landfilling of organic waste. ✓ Beneficial effects of compost use on soil fertility and productivity. ✓ Reduces the need for fertilisers	In addition to the limitations for Type 2 above ▪ Increased environmental impacts from additional collection (i.e. transport).

Table 2 suggests that the potential environmental benefits that can be achieved through kerbside recycling outweigh the single bin approach significantly.

Advantages presented by the Type 1 single bin system include less vehicle movements, reduced fuel consumption and reduced number of bins required. The single bin approach works on a mixed waste stream and as such all paper and cardboard can only be recycled as part of the organic fraction of the waste. As reported in DEC (NSW) 2004a the recycling of paper to make paper provides significant environmental benefits. These are much higher than the use of paper for mixed derived compost which is provided under the single bin approach.

Although the single bin approach does achieve a degree of recycling it is to a lesser extent when compared to the kerbside recycling Type 2 and 3. Here materials are separated at the source and two opportunities are available to recover recycled materials (i.e. kerbside and RRRF). It is frequently documented in recycling assessments that recycling yields are the single most important factor in the environmental performance of the system. The higher the yield, the greater the benefit is to the recycling system.

On this basis Type 2 and 3 offer significant environmental benefits when compared to Type 1. The benefits can be increased through increased yields and decreased contamination.

8.3 Social

Table 3 below summarises the potential social benefits and limitations associated with each of the separate collection systems. The distinction between benefits and limitations is subjective and can be interpreted depending on the perspective taken. The results of the MCA conducted in accordance with Section 4 of this report are given in Appendix 4.

TABLE 3
SUMMARY OF SOCIAL ASSESSMENT

Collection System	Potential Social Benefits	Potential Social Limitations
Type 1 Single Bin	✓ Convenient for residents. ✓ Minimal waste handling for residents.	▪ Limited community benefits ▪ Does not contribute to local education of environmental issues.
Type 2 Separated Recyclables	✓ A sense of community involvement. ✓ A positive view of LGAs. ✓ New industries and employment opportunities for design, collection and sorting of recyclables. ✓A source of funds for service groups or disadvantaged people. ✓ Opportunities for a sustained lifestyle. ✓ Reduced landfill impacts.	▪ It does require resident participation (this can also be perceived as a benefit). ▪ Increased outdoor space required for additional bins. ▪ Inconvenience. ▪ Increased collections which require additional vehicle movements.
Type 3 Separated Recyclables and Organics	In addition to the benefits for Type 2 above ✓ Establishment of a resource recovery scheme that is adapted for rural communities. ✓ Supports the local economy ✓ Possible business opportunity for the agricultural sector. ✓ Requires the Council to educate residents with regard to waste awareness. ✓ Local processing and the use of recycled organic material are 'visible' and offer opportunities for community activities and development of community spirit. ✓ Reduced landfill impacts.	In addition to the limitations for Type 2 above ▪ Potential odour issues. ▪ Potential cost implications for Council rates ▪ Environmental health implications. ▪ May discourage home composting ▪ Public perception and handling of organic wastes is often negative. ▪ Increased outdoor space required for additional bins. ▪ Increased collections which require additional vehicle movements.

As highlighted in the NPCC (Nolan-ITU *et al*., 2001) report there is little information regarding social impact assessments of kerbside systems in comparison with alternatives. DEC (NSW) 2004b suggested that many Councils capture only collection quantities and costs. Therefore the majority of information regarding social impacts is perception based rather than impact based.

The main social drivers of waste collection are to:

- Achieve safe collection of waste.

- Increased resource recovery and limit impacts on the environment.
- Minimal impacts on residents and communities.
- Involvement of residents and communities.
- Meet the needs and conditions of the community.
- Adds to the local economy.

The success of any collection system relies on the residents using it correctly. The single bin approach is undoubtedly, out of the three systems, the easiest and most convenient system for the residents. However, this system does not raise waste awareness or give the residents the opportunity to directly contribute and improve the environment they live in.

In contrast collection Types 2 and 3 rely heavily on the residents and their participation. On this basis these collection systems offer quite different social benefits than the single bin approach. The social benefits of recyclables collection system (Type 2 and 3) are enhanced with increasing yields and the reduction of contamination. Contamination issues are usually due to a lack of community knowledge regarding the true benefits and implications of recycling.

In order to provide consistency for residents the colour of the MGBs (including the lid) should be given careful consideration. The Department of Environment and Conservation (NSW) has published a guide titled the Preferred Resource Recovery Practice by Local Councils (2006) which details the preferred minimum service levels for kerbside waste collection from single dwellings. It is understood that an Australian Standard is being developed for Mobile Waste Containers (AS 4123), which will detail design, dimensions, performance requirements, testing, colours, heath and safety and environmental requirements.

Education is essential to any kerbside recycling scheme and it will help to decrease contamination rates and increase participation. PARR 2005 highlighted the need to keep information simple and easy to understand, avoiding the use of technical language used in the waste and recycling industry. Common approaches to communication promoting waste management include (Read, 1999):

Passive Approach

This includes advertising, displays at public events, household leaflets, newspaper articles, reminder cards and stickers to designate recycling bins.

Active Approach

This includes promotional videos, community newsletter, display boards, cards delivered door-to-door explaining the collection system and collection receptacles provided free to residents.

Interactive Approach

This includes door-to-door surveys, presentation in schools and groups (societies), public meeting, radio spots and adverts, telephone hotline and organised visits to recycling centres/education facilities.

The presence of recycling schemes in places other than the home, such as schools and in public areas will make recycling common practice. This would provide a consistent approach to waste management when at home and away from home and help to prevent confusion.

ABS conducted a survey in 2000 and reported the following as the main reasons for non-participation in recycling schemes (PARR 2005):

- The lack of recyclable materials to begin with.
- The lack of recycling services or facilities provided
- Little interest in recycling or recycling seen as requiring too much effort.

Since 2000 Planet Ark commissioned annual Roy Morgan research polls into recycling attitudes of Australians and their awareness of waste and recycling information (PARR 2005). Over the five years 95-96% agreed that recycling services are important to them. However, Australians find it confusing to figure out what can and can't be recycled. The challenge facing kerbside recycling is for householders to make better use of the recycling services offered. It is anticipated that future increases in landfill costs will increase the incentive to recycle. Economic incentives are also often thought to increase participation. Commonly user fee systems and fine-and reward systems are implemented. Councils such as Boroondara have looked at an alternative. They provide a 240 litre bin for the residual household waste component. The Council then also offers the opportunity to trade in the 240 litre bin for a 120 litre bin, offering a saving of $279 a year to the resident. If 80 litre bin is chosen a saving of $369 a year is offered.

It is considered that a single bin system is not capable of meeting the varying requirements of local communities, although it is the most convenient system out of the three system types.

9. CONCLUSIONS AND RECOMMENDATIONS

The overall assessment of potential collection systems requires the consideration of many factors. The conclusions drawn in this report should be viewed as a qualitative assessment of three main kerbside collection types, which has been conducted using a MCA as shown in Appendix 4. On this basis, the conclusions will be used in a quantitative assessment of the overall RRRF and collection system.

Type 1: Single Bin

Advantages presented by this system include less vehicle movements, reduced fuel consumption, less householder effort and a minimal number of bins required. However, the collection system does not perform environmentally and socially as well as Type 2 and 3 as shown in the MCA in Appendix 4. It is considered unlikely that this type of collection system will be able to meet the needs of SEMRC on the following basis:

1. High volumes of mixed waste require processing and treating at the RRRF, which present high energy requirements and potential impacts on the environment.

2. The system does not have the ability to achieve the same rate of material recovery as Types 2 and 3.

3. Recovered materials are generally of low quality and therefore have a lower demand and market value.

4. The mixed waste approach does now allow the recovery of paper and cardboard for use within the paper manufacturing industry.

5. The diversion of materials from landfill is 100% dependant on the processing and treatment technology chosen in the RRRF and is limited by the capacity and ability of such.

6. The system does not create waste awareness in the community or present educational opportunities.

7. The system does not follow the philosophies adopted by Western Australian Government or SEMRC. It also does not meet the requirements of the National Kerbside Recycling Strategy.

Type 2: Separated Recyclables

This system has potential financial, environmental and social benefits and implications. The main implications are linked to contamination issues and yields. Both of which can be resolved through community engagement and education. This would not be a significant issue for SEMRC, as waste education across the region is one of their key strategic activities.

The MCA (Appendix 4) indicated that this option was the preferred collection system when assessed socially, environmentally and finically in accordance with the methodology outlined in

Section 4. The adoption of this type of system would be a continuation of the system already in place and would offer the following benefits when delivered with the RRRF:

- Improved recycling rates.
- Reduced waste disposal costs.
- Recovered materials are of higher quality therefore having a higher market value.
- Supports paper and cardboard recycling.
- Reducing the environmental impacts associated with landfilling.
- Gives the local community the opportunity to become involved and contribute.
- Opportunity to educate: Brings about waste awareness.
- It follows the philosophies of local government and the waste hierarchy.

The main limitation of separated recyclables collection is participation and contamination issues. The effectiveness of kerbside collection scheme can be enhanced through numerous methods including:

- Education.
- Incentives.
- Community consultation.
- Recycling in public places and events.
- Container deposits.

This type of collection system is commonly recommended in Australia and is highlighted through the examples below.

The NPCC (Nolan-ITU et al., 2001) reported the following as the preferred kerbside collection and recycling systems which maximise the benefits, and limit worker health and safety risks:

- Weekly two crate system in inner city areas with small dwelling, restricted space, street parking etc, and in small provincial and rural/remote LGAs.

- 240L MGBs, preferably split (i.e. one side for paper and the other for containers), collected fortnightly for outer metropolitan areas and larger provincial centre's; and

- MGBs for containers and collection of paper separately in a crate, or the two bin recycling system (one MGB each for containers and paper) may deliver good results for LGAs that wish to explore less common systems which appear to have high net benefits, or where residents have expressed a preference for such systems.

DEC (NSW) 2004a stated that following its assessment, the best performing recycling systems were in order of performance:

1. Kerbside recycling systems employing fortnightly collection of co-mingled containers in a mobile bin and fortnightly collection of paper/cardboard in a separate mobile bin.

2. Fully co-mingled collection in a mobile bin (co-mingled containers and paper cardboard) collected fortnightly; and

3. Separate crates- one for co-mingled containers and one for paper cardboard.

EcoRecycle Victoria (2004) noted its preferred collection systems for Victoria were:

- 240L MB-Fully co-mingled fortnightly collection.
- 240L MB- Split fortnightly collection.
- 120L MB- Fully co-mingled weekly collection.

Type 3: Separated Recyclables and Organics

As reported by PARR, 2005 many more metropolitan LGAs now offer a third bin for garden/organic waste collections. Separating organics at the source, as with all recyclables, can help to deliver a secondary product (compost) that has a higher demand and value in the market place. This prospect is very appealing; however is it a relatively new concept that requires additional infrastructure and community education. The MCA (Appendix 4) indicated that this collection system was the second preferred option. Possible limitations associated with this collection type are mainly associated with the relative infancy of such a concept.

Further research and assessment is required for organics collections including:

- An assessment of the key issues; such as waste diversion potential and the end use of the recycled organics and the markets for them.
- The type of treatment facility and infrastructure would be required to process such organic materials.
- An assessment of the most efficient collection system i.e. collecting food waste or food and garden waste and the implications such collections have on the end product.
- The collection frequency and the cost implication of such.
- On what basis the scheme is introduced i.e. on an opt-in or opt-out basis.
- An assessment of the collection vehicles and the waste receptacles suitable for an Australian climate. Would vented MGBs worthwhile?
- The potential implications the scheme can have on home composting.
- Is the provision of a kitchen food caddie required and what benefits does it provide?
- The use of bin liners.
- The food waste types that are acceptable.
- Consultation and education with residents.

Most Councils approach separate organics recycling on a trial basis involving considerable consultation with the local communities. Organic recycling schemes are in relatively early stages of development in Australia, evidence of participation and levels of contamination pre and post collection is limited.

Burnside in South Australia is undertaking Australia's largest organics collection trial using a compostable bag and bin which started in September 2005. The aim of the system is to understand the communities use and acceptance of new technology and determine the systems potential to reduce household waste going to landfill.

In 2005 The Department of Environment and Conservation (NSW) (DEC (NSW) 2005)) undertook a triple bottom line assessment of garden organics collection systems. It provides an up-to-date analysis of options for dealing with garden organics. The study includes estimates of the environmental costs and benefits of collection, transport, processing and beneficial use/ disposal for three common collection systems for metropolitan LGAs with both high and low garden waste generation rates, as well as for rural/regional LGAs (www.environment.nsw.gov.au).

In light of the above it is recommended that the potential cost implication of adopting this collection scheme is explored. However, it is not recommended that such a scheme is to be endorsed without conducting trials. This collection system, if proven effective, can be introduced comfortably in unison with a Type 2 scheme which separates dry recyclables.

9.1 Overall Conclusions and Recommendations

The following options should be explored in the overall financial assessment of the RRRF and collection system:

1. *Residual Waste*: 140L or 240L MGB
   Recyclables: 240L MGBs split (i.e. one side for paper and the other for containers) collected fortnightly.
   Verge side collections: Junk and large garden waste.

2. *Residual Waste*: 140L or 240L MGB
   Recyclables: Separate 240L MGBs containers and collection of paper, collected fortnightly
   Verge side collections: Junk and large garden waste.

3. Residual Waste: 140L or 240L MGB
   Recyclables: Separate 240L MGBs for containers and collection of paper, collected fortnightly.
   Organic/garden waste: Food caddie/MGB
   Verge side collections: Junk and large garden waste.

Crates/bags will not be explored as potential receptacles for the collection of dry recyclables as MGBs are currently used within the study area for dry recyclables collection.

Alternative solutions may be needed for any high density areas where the operation of automated collection vehicles might be restricted.

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Town of Cottesloe website www.cottesloe.wa.gov.au

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APPENDICES

APPENDIX 1

APPENDIX 1: TASKS (as outlined in SEMRC Request for Tender)

PHASE 1

Task 1 Project Management Plan And Schedule

Prepare a detailed Project Management Plan including a Project schedule in the form of a Gantt chart specifying the dates when the Tasks will be commenced and completed and identifying important milestones for the Project.

The chart is to be prepared having regard to the SEMRC overall project completion schedule and in consultation with the SEMRC.

The Project Management Plan should explain the logic for any proposed changes to the SEMRC Project schedule.
The Project Management Plan is to be updated as required.

Task 2 Land and Technology Options Guiding Principles

The consultant shall workshop with the Community Reference Group (CRG) and the SEMRC's Technical Advisory Committee (TAC) in the development of Guiding Principles for land and technology options that will be used in assessing suitable options. The principles need to be signed off by the Regional Council.

Task 3 Preliminary Technical & Financial Assessment
Gather technical and commercial information and prepare a report on RRF technologies that may be applicable for the Project. Incineration will not be considered at this time.

Prepare a report on preliminary estimates of capital costs and operating costs for the Project, eligibility for environmental credits, the SEMRC's waste disposal requirements, current and projected for the next 20 years and staging of the Project. Use this data for the development of potential gate fees based on current dollars.

The report should include a life cycle analysis for key waste sectors using different technologies.
Present the report to the TAC and SEMRC.

Note: The technologies should be assessed by multi-criteria assessment against the SEMRC Guiding Principles and Technology Evaluation Criteria (Task 2)

Task 4 Consultation With Community Reference Group (CRG)
Refer Task 2 development of Land and Technology Options Guiding Principles in association with the CRG.

Together with the SEMRC nominated representatives conduct workshop/s with the CRG on the findings of Tasks 3, 5 and 7 and at other stages as directed by the SEMRC Chief Executive Officer.

In conjunction with the CRG , identify the levels of community consultation to be undertaken across the broader community and the key points and processes which should be used at each consultation point.

Provide a report on the consultation with the CRG and present the report to the TAC and SEMRC.

Note: The consultation is to include input from the CRG on the types of technology suited to potential sites, site selection and design and operating requirements for the Project.

The SEMRC may eliminate technologies after consultation with the CRG.

Additional community consultation will be the subject of a separate consultancy as required.

Task 5 Preliminary Assessment Of Sites and Technologies

Prepare a report: -

1. About land options available as the site for the Project with details of the different technologies that can be established at those sites.

2. Recommending which of the technologies identified in Task 3 can be used at those sites considering:-
   - the Site Selection Criteria and Technology Selection Criteria;
   - Statutes relating to planning and environmental issues;
   - whether the permitted use and zoning applicable to potential sites includes the establishment of a RRF;
   - whether authorisations are required for the Project at the potential sites and whether the Authorisations can be obtained;
   - an evaluation of the whole of life transport costs to the SEMRC Participants for the potential sites;
   - triple bottom line considerations and
   - a life cycle analysis (desktop research) of the recycling processes

Consult with the CRG on the outcomes of the preliminary assessment and include comments from the CRG in the report.

PHASE 2

Task 6 SEMRC Participant Consultation

Assist the SEMRC to plan, prepare and conduct consultations with the SEMRC Participants (participating councils) about the Project.

Talk to the other potential Participants outside of the region.

Make two presentations to each of the SEMRC Participants over the course of Phases 1-3.

Respond to inquiries from officers of the SEMRC Participants about the Project and the presentations.

Provide a report on the consultations and inquiries.

Note: The SEMRC Participant consultation is to include input from the Participants on the types of technology suited to potential sites, site selection, design and operating requirements for the Project.

Task 7 Preferred Sites and Technologies For The Project
Prepare a report:

1. Recommending which of the potential sites determined in Task 6 is the preferred site for the Project and which technology should be used for the Project;
2. Specifying the purchase price or the cost of leasing the site;
3. Specifying the annual costs of owning or leasing the site;
4. Specifying the availability and costs of essential services including roads/rail, sewers, drains, power, water, gas, telecommunications and incidental physical infrastructure;
5. Reviewing geotechnical data and reports about the sites;
6. Incorporating a conceptual design layout for the Project at the preferred site.;
7. Details of companies which have had experience in the establishment of a RRFand the projects they were involved with and
8. Addressing the triple bottom line assessment

Present the report to the TAC, CRG and SEMRC.

Task 8 Waste Collection Systems

Prepare a report in consultation with the SEMRC, SEMRC Participants about:

1. A single mobile garbage bin collection system against a multiple garbage bin collection system or other systems of collection of Municipal Waste;
2. Whether a uniform waste collection system of Municipal Waste is beneficial and feasible; and
3. Systems of collection of Waste other than Municipal Waste and the impact collection of that Waste will have on the Project.

Task 9 Financial Models

Assist the SEMRC to prepare financial models for the Project incorporating a BOO, BOOT or D&C, using Microsoft Excel spreadsheets.

Note: The models will need to be developed as details of capital, operating and marketing costs are obtained for the Project.

The purpose of the financial models is to: -

- determine the feasibility of the investment by the SEMRC and the SEMRC Participants in the Project;
- identify potential sources of finance for the investment; and
- evaluate the costs of financing and operating the RRF taking into consideration capital and operating costs, revenues from gate fees, revenues from the sale of by-products,

different bin collection systems, the capacity of the RRF and future expansion options for the RRF
- to show the financial position of the SEMRC and the SEMRC Participants consequent upon the completion of the Project.

PHASE 3

Task 10 Staging Of The Project

Prepare a report on staging of the Project considering and specifying:

1. Economy of scale;
2. Projected quantities of Municipal Waste to be disposed of at sites controlled by the SEMRC;
3. Projected quantities of Waste other than Municipal Waste to be disposed of at sites controlled by the SEMRC;
4. Changes in technology;
5. The effect of a RRP on the amount of Waste to be disposed of at sites controlled by SEMRC participants;
6. Markets for products derived from the Project;
7. The State of Western Australia policy on the use of a RRF;
8. The different stages of the Project, the capacity of each stage, the ability of each stage being upgraded, the benefit of the Project being established in stages compared against establishing the Project in one stage, the benefits and detriments of using different technologies in different stages, the benefits and detriments of disposing of Waste by a RRF compared against disposing of Waste at a Landfill;

Task 11 Contract Delivery Mechanism

Prepare a report:

1. On the difference between the establishment and operating costs and tax issues if the RRF is established as a BOO or a BOOT or a D & C or by another method that may be recommended by the Consultant; and
2. Recommending the preferred method of establishment of a RRF using the technology recommended pursuant to Tasks 6 and 8, including a comparison between the gate fee for each method of establishment of the RRF against the gate fee for the disposal of Waste at a Landfill.

Task 12 Business Plan, Participating Members Agreement And Project Plan

Assist the SEMRC to prepare the Business Plan, Participating Members' Agreement and Project Plan for the Project as required by the Local Government Act 1995 and the Establishment Agreement for the SEMRC.

Liaise with the other potential participants to determine their involvement in the Project.

PHASE 4

Task 13 Expression Of Interest Preparations

Prepare a methodology for pre-Expression of Interests workshops.

Conduct the workshops which will be attended by the SEMRC and its invitees and record minutes of the workshops.

Note: The purpose of the workshops is to agree the requirements, scope and assessment process for an Expression of Interest for the Project taking into consideration the SEMRC Guiding Principles and Technology Selection Criteria, and the findings and recommendations from other Tasks.

Task 14 Expression Of Interest

Assist the SEMRC to issue an Expression of Interest for the Project including preparation of documents required for the issue of the invitation to submit an Expression of Interest.

Conduct a mandatory briefing meeting for the respondents to the Request for Expression of Interest and record minutes of the meeting. Respond to inquiries about the invitation to submit an Expression of Interest.

Task 15 Evaluate Expression Of Interest

Evaluate the Expression of Interest of each respondent and prepare a report about the evaluation and recommending acceptable tenderers.

Present the report to the SEMRC and its invitees.

Note: As part of the evaluation it is expected the Consultant and nominees of the SEMRC will inspect existing RRF installations and installations of an RRF which are in the process of being established so the various technologies can be seen in a working environment.

PHASE 5

Task 16 Environmental Approvals

Prepare requests for environmental authorisations for the Project relating to the preferred site. This may involve a request for use of more than one technology.

Prepare a Department of Environment (DOE) scoping document.

Prepare a public environmental report based on the requirements of the DOE.

Prepare responses to relevant inquiries made during the public review period.

Conduct consultations with relevant parties during the public review period.

Attend meetings with the DOE and other statutory authorities as required to obtain environmental approvals for the Project.

Note: Nothing in this Task requests or authorises the consultant to sign or submit documents on behalf of the SEMRC.

Task 17 Town Planning Approvals

Prepare requests for planning approvals required for the Project at the preferred site and for the issue of all Authorisations required to enable the establishment of the Project.

Note: - Nothing in this task requests or authorises the consultant to sign or submit documents on behalf of the SEMRC.

Task 18 Tender Preparations

Prepare a methodology for pre-Tender workshops.

Conduct the workshops which will be attended by the SEMRC and its invitees and record minutes of the workshops.

Note: The purpose of the workshops is to agree the requirements, scope and assessment process for a Tender for the Project taking into consideration the SEMRC Guiding Principles, Technology Selection Criteria and the findings and recommendations from other Tasks.

PHASE 6

Task 19 Tender

Assist the SEMRC to issue a Tender for the Project including preparation of documents required for the issue of the invitation to submit a Tender.

Conduct a mandatory briefing meeting for the respondents to the invitation to submit a Tender and record minutes of the meeting. Respond to inquiries about the invitation to submit a Tender.

Task 20 Tender Evaluation

Evaluate the Tender of each respondent and prepare a report about the evaluation.
Present the report to the SEMRC and its invitees.

Note: As part of the evaluation it is expected the Consultant and nominees of the SEMRC will inspect existing RRF installations and installations of an RRF which are in the process of being established so the various technologies can be seen in a working environment.

The SEMRC will engage an independent auditor to verify the probity of the Tender process.

Task 21 Contract

Assist the SEMRC in the negotiation and preparation of contracts for the Project.

PHASE 7

Task 22 Contract Administration

Assist the SEMRC to manage contracts for the Project.

Prepare monthly reports about the progress of performance of contracts for the Project and supplementary reports as required.

CONCURRENT TASKS

Task 23 Attendance At Meetings

The Consultant is required to attend as a minimum

- monthly TAC meetings (budget for 12);
- Council meetings (budget for 6) and
- CRG meetings (budget for 6)
- Participating councils briefings (budget for 2 per council – total 6)

throughout the process and provide a separate quote for additional meeting attendance.

Ongoing contact is required with the Project Manager and CEO of the SEMRC.

Task 24 Progress Reports

A formal progress report to the SEMRC (presented through the TAC) is required, as a minimum, at the end of each phase.

Progress reporting is required at monthly TAC meetings and at the completion of each Task on that Task.

APPENDIX 2

APPENDIX 2: LITERATURE REVIEW OF KERBSIDE RECYCLING

1. Introduction

The following literature review outlines kerbside recycling regimes that have been adopted throughout Australia, concentrating on those practices implemented in Western Australia. The review will also briefly look at kerbside recycling philosophies that have been adopted outside of Australia.

1.2 Reliable Sources of Information on Recycling

Detailed national recycling data in Australia is somewhat scarce although, member parties are required to report annually on the implementation and effectiveness of NEPMs. The lack of reliable data has been notably highlighted through:

- Nolan ITU & SKM (2001) National Packaging Covenant Council (NPCC): Independent Assessment of Kerbside Recycling in Australia.
- OECD (1998) Environmental Performance Reviews –Australia.
- DEC (NSW) 2004 Getting more from our recycling systems: Good practice performance measures for kerbside recycling systems.

The Federal Treasurer and Minster for the Environment announced in October 2005 that the Productivity Commission would conduct a 12 month inquiry to examine the way Australia manages its waste. The Commission released its finding in May 2006 in a draft report *Productivity Commission 2006, Waste Management*. The report, which was not widely supported by waste management practitioners, argues that a move away from landfill was not really justified and questioned whether the push for recycling and waste minimization could be fully justified.

1.3 Current Kerbside Recycling in Australia (Year Book Australia, 2005)

The Year Book Australia, 2005 provided by the Australian Bureau of Statistics (http://www.abs.gov.au) indicated the following statistics for recycling in Australia.

- Almost all households in Australia engage in some form of recycling and/or re-use of waste, and the level of participation continues to increase over time.

- In March 2003 about 95% of Australian households recycled waste, 83% re-used waste, while only 2% did not recycle or re-use at all. Households in Victoria, the Australian Capital Territory and South Australia had the highest rates (99%) of recycling and/or re-using waste.

- Paper and cardboard (88%) were the items most commonly recycled or re-used in Australia. Plastic bottles and plastic bags were the two next most common waste items recycled or re-used by Australian households.

- About 87% of waste recycling by Australian households occurred through a regular kerbside collection service. This method of recycling was practised across Australia; highest in the Australian Capital Territory (97%) and Victoria (95%).

1.4 Kerbside Recycling in Western Australia

The Western Australian Government has taken a zero waste approach to waste management (http://www.zerowastewa.com.au) specifically implementing the waste management hierarchy which aims to:

- Prevent the generation of waste.
- Maximise recovery and recycling of resources from waste.
- Analyse the residual waste stream and make improvements to move toward zero waste by 2020.

The Statement of Strategic Direction for Waste Management in Western Australia 2004 details a commitment to:

- Encourage and support improvements to markets for recyclables.
- Continual improvement in kerbside recycling and secondary resource processing.
- Look to extend kerbside recycling from domestic to commercial precincts, where possible.
- Encourage and support resource efficiency in Government, for example, through Eco Office and procurement initiatives.
- Improvements in recovery and recycling of the valuable resources in waste.

Currently, there are no mandatory requirements imposed by the State Government in Western Australia to implement kerbside recyclables collection systems. However, most LGAs throughout Western Australia provide some form of service. The two MGB system is becoming the standard adopted by the majority of LGAs in the Perth Metropolitan Region and gradually extending to major regional centres.

The following sections describe current practice in the Perth Metropolitan Region.

1.4.1 Southern Metropolitan Regional Council

Residents of Canning, Melville, Cockburn, Rockingham, Fremantle and East Fremantle have the same two bin collection system. In 1996/7 the Regional Council resolved to construct state of the art Regional Resource Recovery Centres (RRRC), with the aim of maximising waste diversion from landfill to the extent feasible.

The first of the RRRC's was constructed at a site in Canning Vale, The MRF has been operational since 2001 and the in vessel compositing has been operation since 2003. The RRRC incorporates facilities for accepting and treating:

- Municipal Solid Waste (MSW) in a Bedminster facility.
- Kerbside recyclables collected in a separate receptacle.
- Segregated green waste delivered by a trailer or truck which is mulched and sold-on.

This first RRRC primarily services the municipalities of Canning, Melville, East Fremantle and Fremantle with the waste from the other member LGAs continuing to go to landfill. It is envisaged that a second RRC will be constructed at the Millar Road Landfill to service the Cities of Rockingham, Cockburn and Kwinana.

The integrated collection system provides each household with a comprehensive disposal service comprising (www.smrc.com.au):

- Weekly collection of a 240 litre mobile bin for the disposal of general household waste including food and small green waste.
- Fortnightly collection of a 240 litre mobile bin for the disposal of co-mingled dry recyclables.
- Three verge side collections each year of large green waste items such as tree pruning's and branches.
- An annual bulk waste collection.

The SMRC identified the separate collection of recyclables in a two bin system as an essential requirement for successfully producing compost from the Bedminster system. Source separation of recyclables from other household waste using a two bin system considerably reduces organic contamination of the recyclables stream and reduces glass contamination in the organics stream. This results in a higher diversion of waste from landfill and the production of compost which is of a higher quality and is subsequently more marketable.

Consideration has recently been given to trial use of 360 litre recycling bins. This has the potential to further reduce the quantity of recyclables disposed into the MSW stream; by ensuring households have ample recycling capacity available.

1.4.2 Eastern Metropolitan Regional Council

EMRC (Eastern Metropolitan Regional Council) works on behalf of six member LGAs to deliver services within Perth's Eastern Region. Currently EMRC is diverting only about 23% of household waste through Council recycling, green waste mulching and composting programs. EMRC plan to have a Resource Recovery Facility in place by 2010, or sooner (www.emrc.org.au). The goal EMRC's Resource Recovery Project is to develop and implement a resource recovery system that maximises the social, environmental and economic benefits to Perth's eastern region and recognises the importance of waste minimisation.

EMRC member LGAs each provide green and yellow top 240 litre MGBs to the residents. While Bayswater also provides a third brown topped bin for segregated green waste collections. The overall waste collection service consists of:

- Weekly collection of the green top MSW bin. This bin is for all kitchen waste, general household waste and small garden waste such as lawn clippings and small pruning's. This material is currently directed to Redhill landfill.

- Fortnightly collection of the yellow topped bin. This bin handles commingled recyclables and is collected on the same day as the MSW bin, but at a reduced frequency. The collected recyclables are directed to an MRF for sorting.

- The brown top bin (Bayswater residents only) collects garden waste such as grass, leaves, weeds etc. and are collected fortnightly on alternative weeks to the yellow top recycling bin.

- Residents also have access to regular bulk refuse collection services from the verge side.

1.4.3 Mindarie Regional Council

The Mindarie Regional Council consists of the Municipalities of Waneroo, Joondalup, Stirling, Perth, Vincent, Victoria Park and Cambridge.

This region has a diverse range of collection services and waste management approaches. City of Stirling directs its waste to the Atlas facility in Balcatta, where it is processed to produce compost, recyclables and residual material which is disposed of at the Tamala Park Landfill facility. Stirling is the only Council in the Perth Metropolitan Region to provide a single receptacle for all waste types. This method of collection does have lower collection costs but also a lower diversion rate of waste from landfill than could be achieved by a system that incorporates a separate receptacle for recyclables.

Currently, all municipalities other than Stirling direct MSW to the Tamala Park Landfill facility.

The Cities of Wanneroo and Joondalup provide a recycling service based around the use of bags, which have a much lower capital cost than MGBs. However, they require regular replacement and higher weekly servicing costs while delivering a far lower recovery rate of recyclables per household due to capacity restrictions and lack of convenience (which can markedly reduce the participation rate).

The City of Perth (www.perth.wa.gov.au), the Town of Vincent (www.vicent.wa.gov.au) and the Town of Victoria Park (www.vicpark.ws) provide crates for recycling collection and 240 litre MGBs for residual waste. Perth and Vincent provide two crates for recyclables collected on a fortnightly basis, where Vincent also encourages the separate stacking of cardboard and newspaper next to the recyclables crates. Victoria Park provides just one recyclables crates collected on a weekly basis. Residents also have access to regular bulk refuse collection services from the verge side.

The Town of Cambridge (www.cambridge.wa.gov.au) provides a 120 litre MBG for recyclables collected on a fortnightly basis, where a 240 litre MGB maybe provided at a cost. A 240 litre MGB is provided for residual waste collected on a weekly basis. Residents also have access to regular bulk refuse collection services from the verge side.

1.4.4 Western Metropolitan Regional Council (WMRC)

The WMRC consists of the municipalities of Mosman Park, Peppermint Grove, Cottesloe, Claremont and Subiaco. The WMRC is also a member of the EMRC for the purpose of waste disposal and receives member rates when disposing of MSW at the Redhill Landfill facility.

The WMRC operates the transfer station (Brockway Road) in addition to the greenwaste recycling facility.

The City of Subiaco provides separate bags for recyclables collected on a weekly basis. MGBs are provided for group dwellings of four or more units (www.subiaco.wa.gov.au). In addition the City conducts four household bulk rubbish collections and 8 green waste collections each year. Residual waste is collected in a 80, 120 or 240 litre MGB collected weekly.

The Towns of Mosman Park (www.townofmosmanpark.wa.gov.au), Cottesloe (www.cottesloe.wa.gov.au) and Claremont (www.claremont.wa.gov.au) all provide a 120 litre MGB for the collection of residual wastes which is emptied on a weekly basis. Recyclables are collected in a 240 litre MGB emptied on a fortnightly basis. Residents also have access to regular bulk refuse collection services from the verge side.

1.5 Other Parts of Australia

1.5.1 New South Wales (NSW)

Department of Environment and Conservation (DEC) (NSW) in 2004 examined 21 LGAs and their systems. In the DEC (NSW) 2004 report it was noted that the LGAs most likely to achieve better recycling results have the following service attributes:

- 120 litre receptacle per dwelling for garbage and 240 litre split or co-mingled MGB per dwelling for recyclables; or a 'three bin' system.
- Fortnightly recycling collections.
- Collections of PET, HDPE, steel, aluminium, glass, paper, cardboard, and liquid paperboard.
- An established community education strategy.

Case Study: Lismore City

Lismore City has been operating a weekly kerbside collection for mixed organics for over five years. It covers the metropolitan area only, which includes around 10,400 homes and 1,300 businesses. Residual waste is collected fortnightly and currently there is no provision for recyclables collection.

The householders need to provide their own kitchen bin, and the Council provides a 120 litre kerbside bin for the mixed organics. Kitchen waste is wrapped in newspaper prior to placement in the kerbside bin. Food scraps, paper, cardboard and light green waste are collected, whereas nappies and animal waste are not. The organics are taken to a vermiculture composting facility, where they are shredded and pre-composted prior to being fed to the worms.

The participation rate in the scheme is around 90%. There have been instances of continual contamination in some low socio-economic areas characterised by transient populations. After various attempts at education the collection service was withdrawn in these areas.http://www.liscity.nsw.gov.au

1.5.2 Victoria

An analysis of kerbside recycling in Victoria noted the following (http://www.sustainability.vic.gov.au).

- Most LGAs with a kerbside recycling service opted for a bin based system (48%) while 42% still used a crate based system.
- 240 litre co-mingled or split recyclables mobile bins delivered the greatest yield per household and a higher diversion rate compared to a crate and tied bundle.

- LGAs using smaller garbage bins (120 litres) generated less waste and had greater diversion rates than those using larger bins.

The introduction of the Preferred Service Standards in 2000 has given LGAs and the recycling industry in Victoria a guide on the adoption of cost effective kerbside recycling systems. Through the guide there has been a strong shift towards the use of mobile bins for recycling schemes.

The Preferred Service Standards 2004 detail the following kerbside recycling base targets for Victoria:

1. An average weekly recycling yield of at least 3.5kg for households.

2. A collection and sorting cost per tonne per year of less than:
   - $170 for metropolitan & large provincial centers.
   - $200 for small provincial centers and rural townships.

3. A collection and sorting cost per household per year up to:
   - $45 for metropolitan and large centres.
   - $50 for small provincial centres and rural townships.

Collection Systems for Victoria

- 240L MB-Fully co-mingled fortnightly collection.
- 240L MB- Split fortnightly collection.
- 120L MB- Fully co-mingled weekly collection.

The Department of Environment and Heritage (http://www.deh.gov.au) reports more than half of Victorian households (57%) have access to regular green organics collection services (EcoRecycle Victoria, 2003). Organics kerbside collection systems in Victoria incurred an average cost of just under $13 per household per year (collection only).

1.5.3 Queensland

In Queensland most of the LGAs that provide a kerbside waste service use 240 litre MGBs.

LGAs vary with regards to the types of materials that they collected for recycling. Over 90% of Queenslanders live in LGAs that collected aluminum cans, glass and steel cans, typically providing a fortnightly collection frequency for recyclables and weekly for MSW. Less than half of Queenslanders lived in municipalities that collected cardboard, polypropylene, liquid paperboard and PVC. (http://www.epa.qld.gov.au).

1.5.4 South Australia

National Environment Protection Council Annual Report 2004 – 2005 reported on kerbside recycling in South Australia. Where the following receptacles were used by LGAs for kerbside recycling:

- 1 LGA: 140 litre bin
- 12 LGAs: 240 litre bin

- 6 LGAs: 240 litre split bin

The remaining 14 LGAs use either 60 litre crates, 48 litre crate or container bag. Average premises fee charged by Council for Recycling Services:

- Residential $ 24.18
- Non-Residential $ 17.94

The following targets for South Australia are characterised but not limited to the following as detailed in the Government of South Australia's South Australia's Waste Strategy 2005-2010:

- Achieving a minimum recycling yield of 3 kg per household per week.
- Limiting the maximum weekly residual waste bin capacity to 140 L.
- Providing mobile bin receptacles for all materials (recyclables, garden organics, waste)
- Collecting a minimum range of recyclable materials including glass bottles and jars, steel cans and aerosols, aluminium cans, aerosols, plastics, liquid paperboard, newspaper, magazine, printing and writing paper, phonebooks, and cardboard
- Providing garden organics collection services to residents (metropolitan LGAs)
- Providing hard waste collection and recovery services to residents (metropolitan LGAs)
- Encouraging adoption of standard colours for recycling, garbage and green waste receptacles consistent with Australian Standards (in preparation)
- Providing community drop-off facilities for high volume, low hazard household products such as waste oil and paint.
- Providing ongoing information and education to residents.

1.5.5 Australian Capital Territory (ACT)

National Environment Protection Council Annual Report 2004 – 2005 indicates that most households in ACT are provided with a 240 litre co-mingled wheeled bin for kerbside recycling.

In August 2000 the ACT Government conducted a 10 month household organic material collection trial for approximately 1000 households with a weekly collection. Participation was initially high at 90% but declined throughout the trial.

Householders were provided with a 5 litre kitchen bin and an 85 litre kerbside MGB. No bin liners were used. Kitchen scraps and green waste were accepted for collection. It was recommended that householders wrap their kitchen scraps in newspaper and line their kerbside bins with leaves or twigs.

A permanent organics collection system was rejected after the trial on the basis that the recovery rate of organics from household waste (60%) could not justify the expense of more refuse collection trucks at the time. As an alternative to source separation of waste, the ACT government is investigating an advanced material recovery facility with mechanical separation of a mixed waste stream.

1.5.6 Northern Territory

National Environment Protection Council Annual Report 2004 – 2005 indicates that most LGAs provide a 240 litre co-mingled wheeled bin for kerbside recycling.

Average premise's fee charged by Council for recycling services are as follows:

- Residential $ 42.75 (estimate reported by one local authority)
- Non-Residential $ N/A.

1.6 England

The Government has set out its vision for sustainable waste management in Waste Strategy 2000, the national waste strategy. The government is also committed to reducing the amount of biodegradable municipal waste landfilled, in accordance with European Directives.

The Household Waste Recycling Act 2003 amends the Environmental Protection Act 1990. It requires that where English waste collection authorities (WCAs) have a general duty to collect household waste they shall ensure that by the end of 2010 they collect at least two types of recyclable waste separate from the remainder of the waste. Reducing organic waste arisings is a key objective of both national and international policy and legislation, e.g. the Waste & Emissions Trading Act and Landfill Allowance Schemes (LAS) and the EC Landfill Directive.

Kerbside collections in England vary according to the Council. In 2003/04 42% of household recycling was collected via kerbside recycling schemes. Almost all materials for household recycling were collected by local authorities (www.defra.gov.uk). Although the majority of kerbside recycling schemes in the UK are focused on the collection of dry recyclables, there is a widening interest in the separation of organics (www.wrap.org.uk).

In 2003/04 65% of all households had a dedicated paper or card kerbside recycling collection and compostable material was collected from 43% of households. 24% of households received a co-mingled collection, and a large proportion of these collections will include some combination of paper, glass and cans.

The majority of kerbside recycling schemes are carried out on a fortnightly basis, in 2003/04 56% of households had a fortnightly kerbside collection whereas 20% had a weekly collection (www.defra.gov.uk).

1.7 Germany

Germany is also committed to reducing the amount of biodegradable municipal waste landfilled, in accordance with European Directives. Generally three 120 litre wheeled bins are provided to each household for the separate collection of:

- Residual refuse
- Inorganic recyclable material
- Organic material

Collection is typically fortnightly although seasonal variations typically occur. Organic collection typically includes both garden and food waste and the collection frequency increases during the summer season to address increased volumes and to minimise odour problems.

1.8 USA

Kerbside collection schemes in the USA are variable. Surprisingly, recycling world reported in August 2006 (http://www.mrw.co.uk) that a recent survey by the American Forest and Paper Association trade group revealed that 27% of recycling programmes in the USA now use single bin systems, up from 10% in 2000.

Commonly in USA collection systems are incentive based, where the residents are charged a fee based upon the quantity of waste they generate (Strategy Unit, 2002).

Case study: Hutchinson

Hutchinson has a voluntary citywide kerbside collection operation for kitchen waste and green waste. The Council provides residents with two biodegradable bags per week for kitchen waste and an MGB.

Residents may choose between a 30, 60 or 90 gallon MGB. They are provided with the incentive of a reduced monthly refuse bill by down sizing. Residents also have the option of purchasing more biodegradable bags or using paper grocery bags if they need more than their allocation.

The collection frequency of the organic waste is weekly in the summer months and fortnightly in winter to take account of seasonal variations in temperature and therefore the difference in odour generation potential throughout the year.
http://www.ci.hutchinson.mn.us/pdf/organiccompostprog.pdf

1.9 Canada

Due to increased landfill fees (300%), the City of Toronto implemented a weekly kerbside collection for organics. This is supported by fortnightly collections of co-mingled recyclables and residual waste, and seasonal collection of green waste.

Residents are provided with a kitchen bin (19 cm in height, approximately 2-3 litre capacity) and a kerbside MGB (67 cm in height, approximately 120 litre capacity). The organics collection includes kitchen waste, household plants, nappies, sanitary products and animal waste. The collected material is processed in a two step composting facility. The material is sterilised by anaerobic digestion and then composted. Biogas is a by-product of the digestion process.

The City of Toronto provides the option of lining the kitchen bin with a plastic shopping bag for hygiene purposes. It is recommended that the bag is twisted or loosely tied closed so that the manual separation at the treatment plant is easier.

A waste survey was undertaken in 2003 to gather data on participation rates and waste composition (City of Toronto Policy and Planning Group). The survey found:

- participation in the "green bin" collection service was high, at 89% of households
- the average recovery rate of organic waste was 72.19%

- materials in the kerbside organic bin comprised 96.3% (by weight) solicited organic materials, 2.41% film plastic (including bin liners and contaminants) and 1.29% other contaminants
- a significant quantity of film plastic was present as a contaminant (i.e., other than film plastic used as a bin liner), and the study recommended introducing programmes to reduce this source of contamination
- the residual waste comprised 30.36% (by weight) organics.

http://www.city.toronto.on.ca/greenbin/index.htm

APPENDIX 3

APPENDIX 3:EXISTING SEMRC COLLECTION SYSTEMS

1.1 Estimates of Waste Volumes and Staging

Future volumes of waste's requiring collection and treatment from the LGAs within the study area are critical for both the Regional Resource Recovery Facility (RRRF) design and the capacity of the kerbside collection system implemented. The following data has been extracted from Task 3 Report- Preliminary Technical and Financial Assessment.

Table 1 is reproduced from SEMRC "Regional Resource Recover Facility Background Paper – Site Selection and Technology Criteria". It summarised the waste generation in each of the three SEMRC cities, Mandurah and Murray.

TABLE 1
SEMRC, MANDURAH AND MURRAY WASTE GENERATION SUMMARY

	City of Armadale	City of Gosnells	City of South Perth	Sub-Total	City of Mandurah	Shire of Murray	Sub - Total
Population	52,015	93,279	38,930	**184,224**	62,144	12,163	**86,765**
Area (km^2)	545	127	19.9	**691.9**	179	1,821	**2,905**
Dwellings	22,000	31,775	18,154	**71,929**	24,190	5,128	**34,211**
Domestic Waste – MGB (tpa)	15,250	29,643	13,978	**58,871**	20,055	2,220	**22,275**
Domestic Recyclables (tpa)	4,094	7,515	4,001	**15,610**	6,761	920	**7,680**
Domestic Greenwaste (tpa)[2]	1,797	3,273	1,373	**6,443**	1,683	-	**1,683**
Domestic Junk Collection (tpa)	827	2,023	825	**3,675**	6,761	920	**7,681**
Total Domestic Waste Generation (tpa)	21,968	42,454	20,177	**84,599**	35,260	4,060	**39,320**
Other Waste	30,047[1]	50,825[1]	18,753[1]	**99,625[1]**	26,884[1]	8,103[1]	**34,987[1]**
Total Waste	**52,015[2]**	**93,279[2]**	**38,930[2]**	**184,224[2]**	**62,144[2]**	**12,163[2]**	**74,307[2]**

Comment [LD1]: It is assumed that these are correct

Notes:
[1] Other Waste = Total waste – Total domestic waste
[2] Estimated as 1 tonne per head of population

Based on Table 1 above the following assumptions can be made:

1.1.1 SEMRC

- The total domestic waste generation in 2005/06 was 84,599 tpa for a population of 184,224.
- For a population of 184,224, 71,929 dwellings were recorded which approximately equates to 2.6 persons per household.
- On this basis each household (2.6 persons/household) produces 1.176 tonnes of domestic waste/year/household

1.1.2 Mandurah and Murray

- The total domestic waste generation in 2005/06 was 39,320 tpa for a population of 86,765.
- For a population of 86,765, 34,211 dwellings were recorded which approximately equates to 2.5 persons per household.
- On this basis each household (2.5 persons/household) produces 1.149 tonnes of domestic waste/year/household

1.2 Estimates of Future Waste Volumes

No published information is available which projects future waste production growth within the study area. In the absence of any published information, the tonnages of waste produced have been projected based on population projections and the per capita Total Domestic Waste Generation production data presented in Table 1 above.

Table 2 presents population data that has been extracted from Appendix 5.1 and 6 of the Department of Planning's report titled "Western Australia Tomorrow" released in November 2005 (The case presented is the 'medium' – scenario).

This information shows the following projected populations for member LGAs.

TABLE 2
POPULATION PROJECTIONS 2011-2026 (MEDIUM CASE)

Council	2011	2016	2021	2026
Armadale	62,100	66,800	70,700	73,200
Gosnells	92,200	97,300	103,300	106,700
South Perth	41,000	42,300	43,800	44,900
Total SERMC	**195,300**	**206,400**	**217,800**	**224,800**
Mandurah	72,500	84,300	No data available	No data available
Murray	14,900	16,700	No data available	No data available
Total Mandurah & Murray	**87,400**	**101,000**	**-**	**-**

Table 3 and 4 present projected volumes of Total Domestic Waste generated from 2011 to 2026 for SEMRC and Mandurah and Murray respectively. The projections have been calculated based on the following assumptions:

- The per capita waste generation remains unchanged from 2005/6 (Table 1).
- The persons per household remains as 2005 (Sections 3.3.1 and 3.3.2 above).
- The trends and types of waste generated remain unchanged 2005/6 (Table 1).
- Future populations for 2011 to 2026 are as shown in Table 2 above.

TABLE 3
PROJECTED VOLUMES OF DOMESTIC WASTE GENERATION 2011-2026 FOR SEMRC

Year	Projected Population*	Estimated No. Dwellings**	Estimated Production of domestic waste tonnes/year/household***	Estimated Total Domestic Waste Generation (tpa)
2011	195,300	75,115	1.176	**88,335**
2016	206,400	79,385	1.176	**93,357**
2021	217,800	83,769	1.176	**98,512**
2026	224,800	86,462	1.176	**101,679**

* See Table 2
**This is based on the assumption of 2.6 persons per household (as per 2005/6)
*** See Section 3.3.1 above

TABLE 4
PROJECTED VOLUMES OF DOMESTIC WASTE
GENERATION 2011-2016 FOR MANDURAH AND MURRAY

Year	Projected Population*	Estimated No. Dwellings**	Estimated Production of domestic waste tonnes/year/household***	Estimated Total Domestic Waste Generation (tpa)
2011	87,400	34,960	1.149	**40,169**
2016	101,000	40,400	1.149	**46,420**

* Based on the See Table 2
**This is based on the assumption of 2.5 persons per household (as per 2005/6)
*** See Section 3.3.2 above

Tables 3 and 4 above are only estimated projections of future waste generations that have numerous assumptions. However, they indicate the following:

- The total domestic waste produced by SEMRC in 2005/6 was 84,599 tpa (Table 1), Table 3 indicates that this can be expected to rise to 101,679 tpa by 2026, an increase of approximately 20% over a 20 year period.

- The total domestic waste produced by Mandurah and Murray in 2005/6 was 34,987 tpa (Table 1), Table 4 indicates that this can be expected to rise to 46,420 tpa by 2016, an increase of approximately 33% over a 10 year period.

Although the figures above incorporate waste growth, they do not show the likely nature of the growth. Significant increases in small residential premises (e.g. flats) within SEMRC can have serious implications for collection systems. The space available for collection bins and the accessibility of collection vehicles can become critical parameters. Often collection systems require tailoring to meet such demands. Clearly a different approach may be adopted if other LGAs were to join the SEMRC in the venture or a decision was made to treat wastes other than domestic wastes.

APPENDIX 4

APPENDIX 4

MULTI-CRITERIA ANALYSIS OF SELECTED TECHNOLOGIES

(Weightings: Social - 1, Environmental - 1, Economic - 1)

Rank		Collection Type		Social									Environmental									Economic										Overall	
Unweighted	Weighted		Impacts on Residents (Including Participation)	Social Convenience/ Similarity to systems already in place	Support of the Local Economy/ Creation of Local Markets	Impacts on Surrounding Environment (Including Transport Impacts)	Community involvement and the opportunity to create environmental awareness	Requirement for Education	Unweighted Total	Normalising Factor	Weighted Total 1	Resource Conservation: Potential Recyclables Recovery	Quality and Quantity of Recovered Materials	Dependency on Landfill	Water and Air Pollution	Energy Requirements: Processing of mixed waste streams	Greenhouse Emissions (Including Transport)	Level of Collection Control/ Maturity of collection system	Recovery of paper for paper recycling	Unweighted Total	Normalising Factor	Weighted Total 1	Capital Cost: Materials Supply	Transport Costs	Staff Costs	Landfill Disposal Costs	Recovered Materials Market Value	Maturity of System: Risk of Cost Increases due to Contamination Issues	Educational Costs	Unweighted Total	Normalising Factor	Weighted Total 1	Unweighted Total	Weighted Total
3	**3**	**Type 1**	10	9	3	8	2	2	**24**	**32**	**32**	2	2	2	5	2	6	10	1	**26**	**26**	**26**	7	10	9	2	2	10	8	**48**	**55**	**55**	**113**	**113**
1	**1**	**Type 2**	7	9	8	5	8	8	**38**	**51**	**51**	8	8	7	7	7	6	7	10	**44**	**44**	**44**	9	6	7	7	8	5	6	**48**	**55**	**55**	**150**	**150**
2	**2**	**Type 3**	4	5	10	3	10	10	**38**	**51**	**51**	10	10	9	8	9	4	4	10	**44**	**44**	**44**	4	3	5	9	10	3	2	**36**	**41**	**41**	**136**	**136**

Note: Ranking of 1 = Very Poor
10 = Outstanding

The normalising factor is applied so that social/environmental/financial analysis have equal weightings despite the differing number of sub-factors

MULTI-CRITERIA ANALYSIS OF SELECTED TECHNOLOGIES

(Weightings: Social - 2, Environmental - 1, Economic - 1)

Rank		Collection Type		Social									Environmental									Economic										Overall	
Unweighted	Weighted		Impacts on Residents (Including Participation)	Social Convenience/ Similarity to systems already in place	Support of the Local Economy/ Creation of Local Markets	Impacts on Surrounding Environment (Including Transport Impacts)	Community involvement and the opportunity to create environmental awareness	Requirement for Education	Unweighted Total	Normalising Factor	Weighted Total 2	Resource Conservation: Potential Recyclables Recovery	Quality and Quantity of Recovered Materials	Dependency on Landfill	Water and Air Pollution	Energy Requirements: Processing of mixed waste streams	Greenhouse Emissions (Including Transport)	Level of Collection Control/ Maturity of collection system	Recovery of paper for paper recycling	Unweighted Total	Normalising Factor	Weighted Total 1	Capital Cost: Materials Supply	Transport Costs	Staff Costs	Landfill Disposal Costs	Recovered Materials Market Value	Maturity of System: Risk of Cost Increases due to Contamination Issues	Educational Costs	Unweighted Total	Normalising Factor	Weighted Total 1	Unweighted Total	Weighted Total
3	**3**	**Type 1**	10	9	3	8	2	2	**24**	**32**	**64**	2	2	2	5	2	6	10	1	**26**	**26**	**26**	7	10	9	2	2	10	8	**48**	**55**	**55**	**113**	**145**
1	**1**	**Type 2**	7	9	8	5	8	8	**38**	**51**	**102**	9	8	7	7	7	6	7	10	**44**	**44**	**44**	9	6	7	7	8	5	6	**48**	**55**	**55**	**150**	**201**
2	**2**	**Type 3**	4	5	10	3	10	10	**38**	**51**	**102**	10	10	9	8	9	4	4	10	**44**	**44**	**44**	4	3	5	9	10	3	2	**36**	**41**	**41**	**136**	**187**

Note: Ranking of 1 = Very Poor
10 = Outstanding

The normalising factor is applied so that social/environmental/financial analysis have equal weightings despite the differing number of sub-factors

MULTI-CRITERIA ANALYSIS OF SELECTED TECHNOLOGIES

(Weightings: Social - 1, Environmental - 2, Economic - 1)

Rank		Collection Type		Social									Environmental									Economic										Overall	
Unweighted	Weighted		Impacts on Residents (Including Participation)	Social Convenience/ Similarity to systems already in place	Support of the Local Economy/ Creation of Local Markets	Impacts on Surrounding Environment (Including Transport Impacts)	Community involvement and the opportunity to create environmental awareness	Requirement for Education	Unweighted Total	Normalising Factor	Weighted Total 1	Resource Conservation: Potential Recyclables Recovery	Quality and Quantity of Recovered Materials	Dependency on Landfill	Water and Air Pollution	Energy Requirements: Processing of mixed waste streams	Greenhouse Emissions (Including Transport)	Level of Collection Control/ Maturity of collection system	Recovery of paper for paper recycling	Unweighted Total	Normalising Factor	Weighted Total 2	Capital Cost: Materials Supply	Transport Costs	Staff Costs	Landfill Disposal Costs	Recovered Materials Market Value	Maturity of System: Risk of Cost Increases due to Contamination Issues	Educational Costs	Unweighted Total	Normalising Factor	Weighted Total 1	Unweighted Total	Weighted Total
3	**3**	**Type 1**	10	9	3	8	2	2	**24**	**32**	**32**	2	2	2	5	2	6	10	1	**26**	**26**	**52**	7	10	9	2	2	10	8	**48**	**55**	**55**	**113**	**139**
1	**1**	**Type 2**	7	9	8	5	8	8	**38**	**51**	**51**	9	8	7	7	7	6	7	10	**44**	**44**	**88**	9	6	7	7	8	5	6	**48**	**55**	**55**	**150**	**194**
2	**2**	**Type 3**	4	5	10	3	10	10	**38**	**51**	**51**	10	10	9	8	9	4	4	10	**44**	**44**	**88**	4	3	5	9	10	3	2	**36**	**41**	**41**	**136**	**180**

Note: Ranking of 1 = Very Poor
10 = Outstanding

The normalising factor is applied so that social/environmental/financial analysis have equal weightings despite the differing number of sub-factors

MULTI-CRITERIA ANALYSIS OF SELECTED TECHNOLOGIES

(Weightings: Social - 1, Environmental - 1, Economic - 2)

Rank		Collection Type		Social									Environmental									Economic										Overall	
Unweighted	Weighted		Impacts on Residents (Including Participation)	Social Convenience/ Similarity to systems already in place	Support of the Local Economy/ Creation of Local Markets	Impacts on Surrounding Environment (Including Transport Impacts)	Community involvement and the opportunity to create environmental awareness	Requirement for Education	Unweighted Total	Normalising Factor	Weighted Total 1	Resource Conservation: Potential Recyclables Recovery	Quality and Quantity of Recovered Materials	Dependency on Landfill	Water and Air Pollution	Energy Requirements: Processing of mixed waste streams	Greenhouse Emissions (Including Transport)	Level of Collection Control/ Maturity of collection system	Recovery of paper for paper recycling	Unweighted Total	Normalising Factor	Weighted Total 1	Capital Cost: Materials Supply	Transport Costs	Staff Costs	Landfill Disposal Costs	Recovered Materials Market Value	Maturity of System: Risk of Cost Increases due to Contamination Issues	Educational Costs	Unweighted Total	Normalising Factor	Weighted Total 2	Unweighted Total	Weighted Total
3	**3**	**Type 1**	10	9	3	8	2	2	**24**	**32**	**32**	2	2	2	5	2	6	10	1	**26**	**26**	**26**	7	10	9	2	2	10	8	**48**	**55**	**110**	**113**	**168**
1	**1**	**Type 2**	7	9	8	5	8	8	**38**	**51**	**51**	9	8	7	7	7	6	7	10	**44**	**44**	**44**	9	6	7	7	8	5	6	**48**	**55**	**110**	**150**	**205**
#N/A	**2**	**Type 3**	4	5	10	3	10	10	**38**	**51**	**51**	10	10	9	8	9	4	4	10	**44**	**44**	**44**	4	3	5	9	10	3	2	**36**	**41**	**82**	**136**	**177**

Note: Ranking of 1 = Very Poor
10 = Outstanding

The normalising factor is applied so that social/environmental/financial analysis have equal weightings despite the differing number of sub-factors