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WASTENOT: THE STREAMLINE RESOURCE EXCHANGE RESOURCE EXCHANGE

Final Report
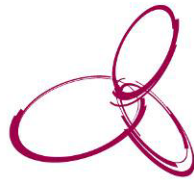
WASTENOT: THE STREAMLINE RESOURCE EXCHANGE

BACKGROUND, DEVELOPMENT AND CASE STUDIES

Prepared by

Institute for Sustainable Futures

**For Auburn City Council and
Parramatta City Council**

WASTENOT: THE STREAMLINE RESOURCE EXCHANGE

BACKGROUND, DEVELOPMENT AND CASE STUDIES

Final Report for the Waste Exchange component of the Triple Bottom Line project

For Auburn City Council and Parramatta City Council

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Institute for Sustainable Futures

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EXECUTIVE SUMMARY

This is the final report for the *WasteNot* Resource Exchange project, funded under the NSW Urban Sustainability Environmental Trust Grant. Our project aimed to work with businesses and Parramatta and Auburn councils in the Duck River Catchment areas of Silverwater and Camellia to further progress sustainability initiatives with a focus on waste reduction, diversion of waste to landfill by promoting resource recovery and waste exchange.

This focus on waste reduction and resource recovery and exchange was designed to be the catalyst for bringing businesses together to achieve practical, cost-effective sustainability outcomes. In doing so, the project assisted to develop a community of practice within the region, strengthening relationships between small, medium and large businesses and also councils and other stakeholders. The specific focus on including small and medium sized businesses was deliberate, as past initiatives have tended to focus exclusively on heavy industry. The trust and knowledge-sharing developed through these relationships, now provides the basis for further collaborative initiatives to be progressed between businesses with respect to water, energy and other issues in addition to waste.

A consultative approach was used in the project. This comprised a series of workshops with council, government and business stakeholders to build on a previous 'needs assessment', to develop a preferred approach to addressing the needs of business with respect to waste reduction and exchange. The following priorities were identified:

- Easy to use
- Covering a diversity of waste types from C&D, C&I, to furniture and organics
- Web-based 'one-stop-shop' of exchange opportunities and relevant information

In response, an online waste exchange tool was developed that serves both as a functional tool for businesses in the Duck River Catchment and as a pilot for the wider implementation of the approach in neighbouring and other areas.

Key features of the tool include:
- Listing and searching for available wastes by type and postcode/suburb
- Listing and searching of waste recovery services by waste type and postcode/suburb
- Aggregation and mapping of available wastes by type
    - making it easy for waste collectors to overcome minimum pick-up thresholds by seeing co-located businesses with small volumes that are significant in aggregate
    - helping councils and other authorities identify resource recovery gaps/needs within a given area
- Sharing of waste recovery success stories
- Email notifications of new listings of waste resources and services to minimise browsing times

As a result of the workshops and business engagement and tool development several waste exchanges have already taken place including:
- BCS Catering Solutions of Granville have been investigating sending food waste to waste processor Earthpower to be digested to produce electricity
- Yeast manufacturers AB Mauri, located on the Camellia peninsula, provided lubricant manufacturers Lubrizol of Silverwater with reusable industrial containers
- AB Mauri now sends waste yeast blocks, test bakery goods and potato starches to Earthpower

Such examples added to existing waste recovery activities in the region. Another component of the project was to examine three case studies in terms of their current and potential waste recovery measures, including waste exchanges. BCS Catering Solutions and AB Mauri were both case study subjects, along with Any Shape Plastics of Granville. In total, current waste exchanges and recycling activities amongst the case study subjects save approximately 73 kL of water, 42 t

CO$_2$, and the diversion of up to 160 tonnes of waste from landfill. As a direct result of their resource recovery measures, the case study businesses have saved nearly $50,000 between them. It is anticipated that the WasteNot tool will help replicate such waste recovery activities within and between many more businesses in the Duck River Catchment, and hence lead to greater sustainability benefits and cost savings into the future.

In addition to the above metrics, the success of the project is reflected in the enthusiasm and momentum expressed by businesses to further progress sustainability. These benefits of effective stakeholder engagement will help the future use of the tool within and beyond Duck River Catchment to achieve its potential as a catalyst for improving resource recovery rates and creating change toward sustainable futures.

ACKNOWLEDGEMENTS

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1.   INTRODUCTION

The Streamline *WasteNot* resource exchange is a web-based application/tool that allows businesses to list and search for waste resources within their local area so as to facilitate resource recovery through exchange, reuse and recycling of waste materials and products. It has been developed as part of the broader Streamline sustainable business program which was funded by an Urban Sustainability Grant from the NSW Environmental Trust.

The aim of the Streamline program is to unite the social, environmental and economic fabric of the Camellia and Silverwater industrial areas within the Duck River Catchment under the broad banner of sustainability. This resource exchange project has focussed on promoting sustainability in waste management practices amongst businesses, with the ultimate goals of fostering a community of practice around resource recovery and improving recovery resource rates within the Catchment. Thus the project was geared towards developing a strong understanding of the local business community and context through stakeholder consultation and engagement to harness ideas and gather data, and to promote the concepts of waste exchange and industrial ecology/symbiosis.

Commercial operations within the Duck River Catchment are diverse, ranging from micro-businesses to large industry. Wholesaling is the most common line of business with about 100 businesses handling a large variety of products including automotive parts, toys, pharmaceuticals and industrial valves. Other forms of commerce/industry include manufacturing and processing, retail, construction and demolition, auto and smash repairers, and information technology and communications, amongst many others. The *WasteNot* resource exchange tool has been developed in close consultation with a similarly diverse sample of these businesses through a series of workshops held within the Duck River catchment.

1.1 Project aims and objectives

The primary aim of this project was to design the form, function and operation of a waste/resource exchange program or tool tailored to the needs of the Duck River Catchment (herein 'the Catchment') business community. The specific objectives of the project were to

- Develop appropriate data collection and storage techniques

- Develop an input/output tool for identifying exchange opportunities

- Determine logistics of managing/administering the tool

- Identify and report on waste exchange case studies

This report documents the development of the 'input/output' tool, which also incorporates data collection and storage, administration requirements for the tool and the analysis of three business case studies.

1.2 Project scope and methodology

The project comprised six main phases:

1. Context analysis including institutional stakeholder consultation

2. Initial outreach and ongoing engagement of local businesses (recruitment to the Program)

3. Tool selection

4. Tool development

5. Collection of business waste and service data with which to pre-populate the tool

6. Formulation of case studies based on existing and potential resource recovery and waste exchange activities

This report focuses primarily on phases 4, 5 and 6. Phases 1, 2 and 3 were documented in detail in the project preliminary report *Designing the Duck River Waste Exchange Program* (Fyfe et al. 2009).

1.3 Report outline

This report documents the process and outcomes of the development of the web-based resource exchange tool (herein WasteNot), with particular focus on phases 4, 5 and 6 of the research described in the project scope (section 1.2). Section 1.1 provides a summary of the processes and outcomes of the initial stakeholder engagement and contextual analysis that were originally presented in detail in the preliminary report for this project (Fyfe et al. 2009). Documentation on the design, functions, operations and implementation of the web-based resource exchange tool, herein Waste Not, is provided in sections 3 and 4. Section 5 presents an analysis of three in-depth business case studies that have been used, in part, to inform the development of the resource exchange tool. Full case study details have been included in Appendix B. Recommendations arising from the outcomes of the research and the development of the tool are presented in 5.

2. BACKGROUND

Critical to the development of a useful tool for businesses in the Duck River catchment is an understanding of the context in which the tool would be operating, and the types of businesses that will be using the tool. The initial phase of this research involved an analysis of the institutional and business contexts, as well as a stakeholder consultation component. Full descriptions of these components were presented in the project's preliminary report (Fyfe et al. 2009), but to provide some background to this report, the key findings are presented below.

2.1 Institutional context

Considerations for developing a waste exchange tool/program:

- Anecdotal evidence suggests that companies are requesting support for waste exchange already – i.e. engaging with sustainability issues and feeling bad about disposing of waste, and seeking alternatives.

- Informal waste exchange is already taking place. E.g. by private brokers (especially in chemicals) and facilitated by government (on an ad-hoc, not advertised basis).

- Market prices for recyclables have dropped recently, and this means that diverting waste from general disposal (landfill) to recycling offers less financial savings than has at other times.

- Time is needed to establish relationships for waste exchange, and this process is likely to take longer than 12 month funding cycles for projects.

- Business need for commercial in confidence could pose problems for reporting who gave what to whom (waste exchange is one way to garner a financial edge in the market place, by reducing input or disposal costs – public reporting of this may therefore undercut this advantage by revealing the opportunity to their competitors).

- Small companies might want access to materials from big companies, and vice versa, but the considerations for engaging in waste exchange are likely to be different for these businesses.

Region-specific issues

- Parramatta and Auburn have significant NESB/CALD communities, and English literacy levels are variable

Considerations for engaging SME's in particular:

- SME's are not a homogenous group. SME can refer to micro, small and medium sized business, including sole traders or businesses made up of two or three people who operate from a family home. For this reason it can be difficult to design resources that meet the different needs.

- SME's are busy trying to keep their businesses running, which means that they lack time to research grant opportunities, different resources, better waste deals, etc.

- A single point of contact can help develop close relationships and keep businesses engaged in waste reduction or resource efficiency programs

- Very small operators may not have the technical 'language' required to negotiate exchange or explore waste disposal options.

- It is important to acknowledge the existing actions and efforts of businesses – message is: '*don't suggest I don't care. Congratulate me on what I have done'.*

- DECCW Sustainability Advantage 'light' might be a useful tool for engaging with SME's. However, it was not available at the time that this report was being compiled.

2.2 Business context and waste types

The prevalent line of businesses in the Duck River area is wholesaling with one in six businesses listed as a wholesaler. Other key local industries include manufacturing and processing, retail, construction and demolition, and information technology and communications. A business needs assessment canvassing 60 businesses revealed that many feel reasonably well informed on issues related to environmental sustainability and are proactive in responding to these issues. However, waste management was identified as the primary risk to productivity and the environment.

63% of businesses surveyed had already been involved with the exchange or sale of waste materials and 51% had actually used recycled materials or reused materials.

Analysis of business listings in the Catchment revealed that:

- There are 27 potential sources of e-waste; 13 likely generators of wood waste (not including those businesses in the construction and demolition sector); 13 likely sources of food waste; and six businesses that may generate waste carpet. The large number of wholesalers would suggest that wooden pallets and other packaging materials are likely to be significant waste streams within the Catchment.

- There are at least six listed businesses involved in waste management and recycling including; a food waste processor, a concrete recycler, building and demolition waste recyclers, and a liquid waste recycler.

2.3 Stakeholder consultation

Stakeholder consultation workshops were conducted over the course of 2009 to engage institutional stakeholders and local businesses. A workshop for institutional stakeholders was held first on 10 June 2009 to map contemporary activities in the field of waste exchange and industrial ecology in NSW, achieve a common understanding of where this project sits in relation to other activities and how the broader benefits of the project can be maximised. Attendees included government, business group and local government representatives with expertise in resource recovery, business engagement and waste exchange.

Consultation with local businesses also involved workshops, the first of which was held on 20 August 2009 and was designed to gain an understanding of local business needs and concerns in relation to waste management and to explore possibilities for a waste/resource exchange program and/or tool.

A second business workshop (held on 2 November 2009) was focussed on more detailed aspects of a proposed concept design of the waste/resource exchange and is described later in section 3.2.

The institutional stakeholder workshop helped to identify where the project fits in the bigger picture and define the broader role and objectives of the Duck River waste/resource exchange. The initial business workshop identified the more useful elements the waste/resource exchange might present to participants/users (i.e. businesses). Some recommendations arising from these first two workshops were:

- Communication of best practice waste management with the aid of business champions;

- Providing waste networking opportunities;

- Facilitation of collectively negotiated waste servicing contracts; and

- Encouraging recycling of food and other organic waste.

- Development of a web-based support tool that acts as a 'one-stop-shop' for business seeking to engage in waste exchange

Box 1 presents some more specific findings from the first business workshop.

Box 1 Initial business workshop and its implications for the Duck River Waste Exchange Tool

Many businesses agreed that a Duck River Catchment waste exchange has the potential to assist their businesses in a variety of ways pending the involvement of more businesses.

Some key program enablers were its local focus, its potential to reduce cost of engaging contractors to take waste away or treat waste, its potential for providing an opportunity for cost effective environmental inputs into processes, and that it was generally perceived to be good for the environment. It was also thought that the program could help overcome barriers to waste recovery, recycling and reuse. Some barriers identified in the workshop were lack of awareness/knowledge of available options, waste handling protocols and regulation, and load limitations (too small or large for a cost-effective individual collection contract).

Participants also identified a number of local barriers to the program including conservative business attitudes to waste management, a lack of manufacturers to utilise recovered waste and a sense that Council and Government waste codes and standards were in conflict.

There was general agreement that the program would benefit from a web-based tool which could be used to list and search for waste exchange opportunities. Participants felt that this tool should be a 'one-stop-shop', easy to use, and a source of as much relevant information as possible (for example regulations associated with waste recovery). It was also suggested that listings on the database could be spatially referenced and mappable.

Participants also identified various contributions that the two local councils could make to the program, including collection of target waste streams, land for an exchange depot, and dedicated staffing resources to manage the program.

The context analysis and the institutional and first business workshops were undertaken specifically to assess the broader resource recovery needs within the Duck River Catchment business community and to establish the need for and the role and objectives of the resource exchange tool. The next phases of the research were related to designing the tool within the parameters set by the context analysis and stakeholder consultation and are described in the following sections.

3.   TOOL DESIGN

The development of the Duck River Catchment waste exchange has been emergent in nature in that the form and function of the final tool/program has been refined as stakeholder consultation and other research progressed. The form, use and broader purpose of the tool were initially established through the literature review, context analysis and stakeholder consultation, as described in the preliminary report (Fyfe et al. 2009). The design, operation and administration of the tool were then established by further research and consultation, although at the time it was agreed that the tool had to remain a pilot rather than a finished product to meet the project budget. Subsequently, however, additional funding was made available to the project which allowed a reworking of the tool concept and design that incorporated new, innovative functionality, and permitted a greater degree of finishing both in terms of populating the tool with locally relevant data and more complete functionality. An overview of the outcomes have are provided in this section.

3.1   Preliminary concept

The review of waste exchange tools (see Fyfe et al. 2009) examined 19 existing waste exchange projects from the United States, the United Kingdom, Australia and New Zealand. While some of these examples appeared to be successful and well-used, they could not be easily used in or adapted to the local context in terms of form and functionality, or the type of wastes they dealt with and businesses they targeted. Many others appeared to be largely unused or difficult to navigate and provided strong examples of what to avoid in developing a new tool.

The context analysis revealed that while a range of resource recovery activities were taking place across Sydney and NSW, there were no active projects developing a waste exchange for SMEs. There was an industrial ecology network being established with the aid of the DECCW Sustainability Advantage Program that may seek to adopt some form of database tool to facilitate waste transactions between larger businesses/industry across NSW and potentially Australia. This network, however, did not have the focus on local and smaller business that the present waste exchange project was seeking to provide.

Since the initial context analysis was completed, a new website designed to help businesses improve resource recovery rates has been launched by Planet Ark. The site, Business Recycling, is essentially a database of recycling and other waste recovery service providers that cater to the commercial and industrial sector. The site is likely to be useful to businesses in the Duck River Catchment, but it does not have functionality to support waste exchanges between businesses.

Local businesses indicated that they had both personal and commercial imperatives to be more proactive in pursuing sustainability outcomes in waste management and that a **web-based tool** that facilitates waste/resource exchanges was the preferred form of a waste/resource exchange. A number of key characteristics and features that the tool should exhibit were identified including ease-of-use, relevant and up-to-date information and data, and spatial referencing/mapping of data.

In order to bring the scope and objectives of the waste/resource exchange into sharper focus, a meeting between ISF (the consultant) and Auburn and Parramatta City Councils (the clients) was held on 15 September 2009. With reference to the outcomes of the preceding research activities, a set of key underlying characteristics of the waste/resource exchange, as summarised in Table 3-1.

Table 3-1 Key characteristics of the waste/resource exchange tool

Target wastes	Food, e-waste, pallets, standard recyclables
Preferred form of recovery	Recycle / downcycle / reused by recycler
User types	Target SMEs but not to the exclusion of larger industry
Reach	Locally tailored but potential for broader adoptions
Role of exchange brokering	Tool may be assisted by 'active' brokering (see Fyfe et al. 2009)
Potential partnerships	DECCW, NSW Industrial Ecology Network, local business groups
Focus	Balance between attracting large numbers of participants and forging long-term networks and relationships

These characteristics were then used as a frame of reference in devising a preliminary concept design for the exchange, which comprised the following features:

Waste stream oriented
- Links to purpose-built web pages designed to cater to the particular waste stream

Decision support functionality
- Tool presents user with **options** for waste recovery and recycling, including local waste exchange opportunities

Data collection/collation functionality primarily developed for two of the following four waste priorities, depending on outcomes from the planned second business workshop and ongoing consultation with business:
- **food waste**
- **paper and cardboard**
- **wooden pallets**
- **e-waste**

Primary (local) recovery/recycling options identified for functional tool components to potentially include:
- Food waste to **EarthPower**
- Recyclables to **Sydney Turf Club** (STC)
- Coordinated collection service(s) or communal holding facilities
- Waste exchange opportunities

Web pages for other wastes may or may not have functionality / content
- May have functionality for data entry for general waste exchanges
- Where no functionality to support exchanges, the page may provide links to other tools (e.g. DECCW calculators), services (e.g. Planet Ark, Battery World etc.), websites (IE Network), information/fact sheets.

Spatial referencing
- Addressing confidentiality and clustering needs

This preliminary design was deemed to satisfy a number of particular issues including:

- Addressing dominant wastes streams in the commercial and industrial sector (DECCW 2009) and in the Duck River Catchment – paper and cardboard and food waste.
- Minimising user time commitments

- Providing a unique and locally-focused service not offered by other existing and planned waste recovery programs such as DECCW's SME tools, Sustainability Advantage or the NSW Industrial Ecology Network.
- Links the project components of tool development and case study generation
- Capitalises on existing and planned local business infrastructure for waste recovery and recycling

The budget available for the tool at that time was insufficient to produce both a fully developed and well presented tool that would satisfy the above provisos. Hence it was resolved that a less developed prototype would be developed that would strike a balance between the level of functionality provided (detail, capability) and delivery of a fully functional end product.

3.2 Concept testing with businesses

A second workshop with local businesses was held on 19 November 2009 in order to obtain feedback on the preliminary conceptual design described above. The feedback was then used to inform the final design of the waste/resource exchange, primarily in relation to its features and functionality, but also on aspects of ongoing management and administration of the tool.

3.2.1 Workshop objectives

The objectives of the workshop were to:

- consider whether the proposed program concept was appropriate, useful and beneficial;

- consider what form and functionality a waste exchange tool would be most appropriate for local businesses; and

- identify which program models / components should be prioritised for development.

3.2.2 Concept presented

Figures 4-1 to 4-2 (below) were shown as a starting point for discussion of what the waste exchange tool might look like, and how it might be expected to operate.
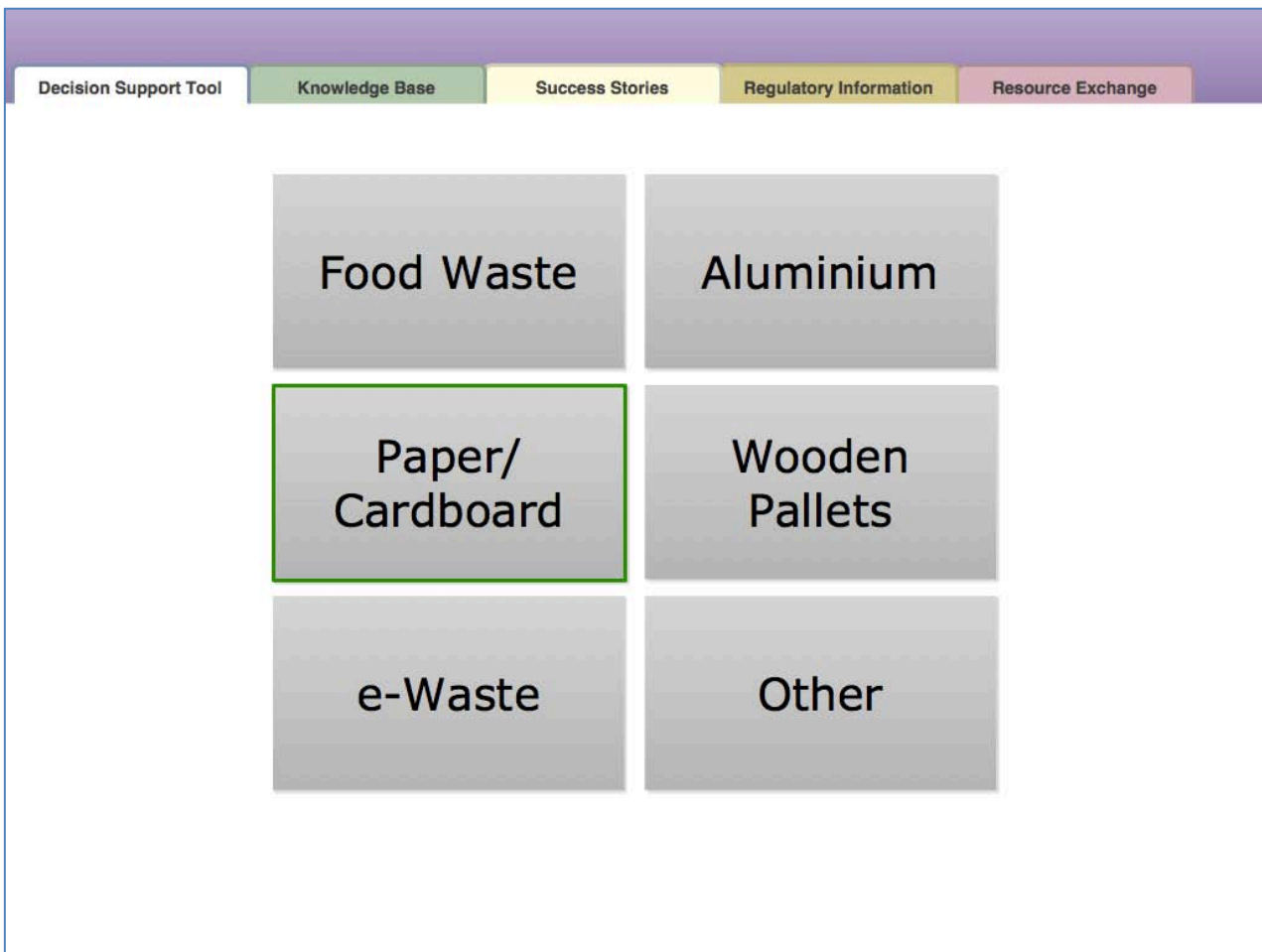
Figure 3-1 Proposed Entry Screen

Figure 3-2 Proposed Option Selection Screen

3.2.3 Waste demonstration activity

To introduce the concept of the tool, an activity was run whereby participants were asked to write down their main waste streams on a sticky note to stick to the white board under typical waste categories. This demonstrated the volume and diversity of waste being generated amongst the participant businesses and the potential for resource recovery. Figure 3-3 and Figure 3-4 show the outputs from this activity.

Figure 3-3 Stakeholder contributions to demonstration of waste generation in the Duck River Catchment

Figure 3-4 Stakeholder contributions to demonstration of waste generation in the Duck River Catchment - detail

Following this activity, participants worked in groups to discuss particular aspects of the proposed tool concept, the outputs from which are summarised below.

3.2.4 Response to preliminary concept

The concept for the program, including the orientation towards targeting waste streams, a decision support system, and an online tool, was generally well received. It was seen as an ideal means of sharing information and a helpful guide to businesses. It was suggested that the program, whilst based on the Duck River Catchment, should not be limited by geography as there are many waste recovery opportunities to be tapped outside the area.

Some general feedback on the concept included:

- coverage of the waste categories/items should be as broad as possible
- full brokering should not be ruled out as a component of the program
- Needs a human face as well as the tool
- Up-to-date information is essential not only to the effectiveness of the program but also to a positive perception amongst potential users
- Program would benefit from tie-in to CPRS so that businesses can claim credits for their waste exchange activities (this could be as simple as a link to a carbon reporting web page)
- Listing of waste recovery service providers as per Warringah Shire Council
- Sponsored links (as per Google)
- Look into regulatory support such as waste recovery equivalent of 'Dial-before-you-dig'
- Plastic wrap component (research profitability and service providers)
- Feedback loop/comments page/blog
- Feedback on specific categories used in data entry

Potential barriers to the proposed design were identified to be:

- Geographic boundary
- Keeping the tool options and info up to date
    o Requires a moderator
    o Expiry dates
- Ensuring adequate hits/links to register in Google searches
- Beta testing
- Lack of publicity, awareness
    o Could be promoted via rates invoices
    o New businesses to the area
    o CPRS or other carbon-reduction related credits

3.2.5 Desired functionality

Feedback was sought on the way in which the tool functions and the user interface. Specific suggestions related to data entry included:

Essential

- Consider check boxes instead of radio controls to allow greater list of options to be displayed
- Mapping
- Minimal reading and pages good
- "Other" [suggestion] box for a non-specified waste stream
- Resources wanted / available listing
- Appears current, live, not static and unused

Considerations for future development were:

- suggestive feedback on search results ("we have no results for that query, please try: ...")
- images in the listing ("like eBay")

Other suggestions for tool functionality included:

- revisit unit selection - tonnes more common
- language barrier assistance (e.g. icons for waste streams; <- query from Wendy)
- Search box
- Pre-selection to narrow search results
- Email notifications of items of interest, listing expiry, option expiry
- Top 10 search results
- Sponsored links
- email/print/PDF these results
- feedback / contact us link
- Links to Planet Ark and other waste recovery websites

3.2.5.1 Other models / tool components

Some participants suggested that regulatory info should be DECCW's job and could introduce liability issues. Accordingly, regulatory content should be limited to links to official web pages only. Others, however, said that categorized and searchable regulatory information was critical.

Third party brokering could be advertised on the tool as an optional service.

Some discussion revolved around the potential for shared waste services such as communal compactors/bins (from SITA). It was suggested that the tool could assist with provision of such services through:

- Statistical matching of candidates for shared facilities
- Statistical analysis of potential collection networks of particular waste streams

The resource listings component was also seen as critical and necessarily directly linked to the decision support component of the tool. It was suggested an email alert system provide updates on items of interest, listing expiry and recovery option expiry.

Possible expansions of the tool included:

- Blog / news page
- Periodic newsletters
- Advertising
- Links [logos] to sponsors of the site (e.g. waste processors)
- Business registration and waste profiling
- Spatial mapping component
- Data collection for statistical reporting
- A 'downloadable tool and monitoring product'

3.3 Final concept

The original budget available to the project only allowed for development of examples of the tool functionality with fixed logic for a limited number of businesses. However, it became increasingly evident that it was more important to present to the businesses in the Catchment, particularly those that had participated in Streamline projects, a working waste exchange tool rather than

simply a demonstration version. To facilitate this, additional funding was made available to the waste/resource exchange component of the Streamline and the conceptual design was altered to produce a complete tool that would remain useful to businesses and other organisations and could be delivered within the augmented budget.

It was clearly evident from the review of existing waste/resource exchange tools that there is no shortage of precedents on the broader web. Even within Australia there are a number of waste/resource exchange tools that businesses could potentially use to assist their waste recovery efforts. Thus if a new tool is to be introduced to the (Australian) market, it would have to display an element of innovation to distinguish itself and make it an attractive option to potential users, both businesses seeking to exchange waste materials and other organisations that might endorse or adopt the tool.

A key gap identified in existing on-line waste/resource exchange tools was the manner in which data was handled and presented. While most tools reviewed comprise a database that stores information on businesses and their waste streams, there appears to be limited use made of the data beyond listing waste materials wanted or available. With data on waste quantities being entered into such tools, there is a wealth of useful information on waste generation and recovery rates that could be harvested and presented for the benefit of all kinds of users including the business users, waste recovery service providers, planners and policy-makers. Hence it was proposed that the Streamline waste/resource exchange tool initiates this form of data 'mining' by introducing an internal data 'normalisation' process that allows the diverse forms of waste quantity data that may be entered into the tool to be directly compared and aggregated.

Businesses would be able to list their waste on the site and search of wastes they might be interested in as per a typical waste exchange. The unprecedented utility of the tool, however, would lie in its ability to collect waste data directly from businesses that can be used to understand the waste profile of a broader geographical area and gauge its resource recovery potential. This capability can facilitate generation of a range of useful statistics, but as a starting point, the tool would actually display aggregated figures for particular waste types within a given search. Such functionality would be useful to a range of potential users including waste service providers (private and local government), waste policy makers, researchers and anyone else interested in resource recovery. To help understand the distribution of waste resources, search results would be mapped on a standard Google Maps interface.

Additional features that were added to the tool concept were derived from the second business workshop. Users are to be able to sign up for email notifications about the availability of particular waste resources to allow them to find particular wastes without the need to constantly revisit the site. A page dedicated to presenting waste services also allows businesses to search for waste collection and recovery options. Primarily this page would be targeted towards dedicated waste processors such as scrap merchants, waste management companies such as SITA, or specialised waste processors such as Earthpower to list their services in a fashion similar to the new "Recycling Near You' website. However, it would also accommodate those businesses that are seeking to recycle or reuse waste products but whose core business is not waste management. Finally a moderated 'success stories' section would allow businesses to share their experiences in resource recovery with others.

3.3.1 Core features

Core features of the tool as it has now been deployed are:

- User-managed listing of wastes available for exchange (with sign up to a user account)
- User-managed listing of waste recovery service providers and businesses that are seeking wastes to use (with sign up to a user account)
- Flexible waste quantity data entry
- Aggregation of waste quantities by search area
- Mapping of search results for wastes or waste recovery services
- Page where businesses can submit and read about waste recovery success stories

- Sign up for email notifications of new wastes or waste recovery services
- Email reminders for users to update their listings
- Administration account with ability to edit user accounts, waste listings and other data and settings

3.3.2 Customisation to the Duck River Catchment

The tool has been tailored to the Duck River Catchment primarily through using feedback from local businesses to guide the design of the tool. In particular, the tool incorporates:

- Minimal navigation requirements
- Waste mapping
- Data collection and presentation
- 'Other' waste types selection and 'request new waste type' functionality
- User registration
- Email alerts and reminders to save browsing time
- A page dedicated to listings of waste recovery service providers

The tool has also been made locally-specific by inputting data from local businesses, including that from the case studies described in section 5. The business data used in the tool is described in section 4.5.2.

4. TOOL IMPLEMENTATION AND ONGOING MANAGEMENT

The final concept has been implemented as an open source application on the Ruby on Rails web application framework. Ruby on Rails is a rapid application development tool that has extensive support in the open source community and the largest following amongst the available model/view/controller frameworks.

The tool has been given the title 'WasteNot' and is referred to as the 'Streamline Resource Exchange'. This was intended to reflect the old adage of 'waste not, want not' and the current shift in terminology from 'waste management' to 'resource recovery'. Hence under the tool, wastes are listed under a 'Resources' page, while services are referred to as waste or resource recovery rather than waste management.

WasteNot has been assigned a subdomain under the Streamline website. The web address or URL of the WasteNot homepage is

<div align="center">

http://wastenot.streamline.org.au/

</div>

WasteNot has been developed to a point where it may be classified as a 'working proof of concept'. All elements included in the tool have complete functionality, but there are some desirable features and functions such as image uploads, search guidance and waste information links that remain undeveloped. Moreover, while some bug-testing has been undertaken, the tool has not been through a rigorous testing process to ensure its robustness under different usage conditions.

WasteNot has been designed to be populated and used by the business community itself. It has minimal administrative requirements that may be performed by anyone with basic web-browsing and data entry skills. Changes to the features and functionality of the tool, however, will require a developer with expertise in Ruby on Rails. Changes to the waste types and attributes data that have been loaded into the tool should be made in consultation with someone with some expertise in waste management and resource recovery.

A description of the tool is given in the following sections. The use and administration of the tool is described in a separate document: *Waste Tool Overview and User Manual*.

4.1 Tool structure

The structure of the website is depicted in Figure 5-1, which shows the main pages and associated activities. Searches for wastes (or resources) are performed by using dynamic drop-down boxes on the page, as is filtering of the search using postcode or suburb. Results of the aggregation of the waste quantities are also displayed in the side panel. Waste recovery service providers and businesses that are seeking wastes to exchange are lumped together under 'services'. They search facility for services is the same as for resources. Search results can be mapped directly by clicking on a 'map these results' link on the Resources and Services pages. Searches may also be performed on the Map page independently, although these searches generate results for both waste generators and waste processors.

The 'Success stories' page is simply a list of success stories about particular wastes. Businesses can freely submit new stories for moderation and posting by the administrator. Administrators can edit and assign waste types to success stories.

Businesses can 'sign up' (register) to list wastes that they produce or process, and to allow them to subscribe to receive email notifications about new resource or service listings. If they have already registered they can 'sign in' to edit their listings and subscriptions.

Administrators have additional control buttons that allow them to change basic tool settings (the hazardous waste message and administrator email address), edit waste types, waste attributes and business information (including resource and service listings), and nominate other administrative users.

The main function of the tool that is not apparent in its structural breakdown is the email reminder functionality. Registered users receive email notifications to update their information and resource/service listings once a year. Any resource listings that have a 'one-off' frequency also trigger reminder emails 90 days after the listing is posted to remind users to either refresh the entry (if the resource is still available) or to the system to delete the entry automatically in another 10 days time.

4.2 Hosting

The tool is hosted in a virtual private server (VPS) with Webbynode, which provides a contained and cost-effective hosting solution. The service provides functionality for rapid deployment and in-built support for application and data backups. The VPS has been configured to back up to a secure external service on a daily basis. ISF has been contracted to manage the hosting of the tool for the first twelve months of operation.

4.3 Tool administration

The tool is designed for simplicity of use for both users and administrators. It will require ongoing management by Council with some liaison with stakeholder businesses, although the commitment should be minimal, unless it receives very high levels of traffic, user registration and submission of success stories.

Administrative tasks include:

- Response to enquiries from the mailto: links
- Moderation of resource and services registrations and listings to check for misleading, false or otherwise problematic entries
- Moderation of success story submissions
- Addition of new waste types and attributes where requested by users

Accessing the administration pages of the tool is described in the *Waste Tool Overview and User Manual.*

Moderation of business registrations and resource/service listings may become more onerous as usage of the tool grows. At this stage the administrator can only review entries on the user interface, which, should there be a large number of registered users, may become unwieldy since there is no in-built search function. There is scope for data to be dumped from the system for review in other formats that may make the process quicker, although a dedicated, customised script would need to be developed for this purpose. In the early stages at least, usage is anticipated to be relatively low. Should usage grow to a level where moderation becomes difficult manage, other aspects of the tool functionality would also need to be reviewed and it is recommended additional funding be sought for this development.

4.3.1 Email account

WasteNot has a dedicated Google Apps email account which is used for receiving and responding to enquiries from site visitors and users, as well as specific requests to create new waste types. The email address is admin@wastenot.streamline.org.au. Account access details are provided in the *Waste Tool Overview and User Manual.*

4.3.2 Site monitoring

The tool is linked to Google Analytics to allow monitoring of site traffic. There is also a tab on each page of the site that allows users to provide developer feedback through a Get Satisfaction online community. Access to both of these accounts is made through the Google Apps account that supports the site email account and is detailed in the *Waste Tool Overview and User Manual.*

4.4 Data normalisation and aggregation algorithm

Data normalisation plays a useful role both to the user entering data into the tool and to collating and analysing data behind the scenes. For users it allows flexibility in the manner in which data can be entered into the tool. Since many businesses will be most familiar with their waste quantities in terms of the number of bins they use, the tool allows for waste quantities to be entered both volumetrically as the number of (standard) bins or in m^3, or in terms of mass (kg or tonnes). The rate at which waste is generated is also flexible such that the quantity specified in volumetric or mass units is ascribed to a frequency of one-off, daily, weekly, monthly, quarterly or yearly.

To allow data from different businesses and with differing units to be compared directly, the data entered as per above is then 'normalised' to two universal forms: m^3/year and tonnes/year. First, data that is entered in volumetric units is converted to m^3 and mass data is converted to tonnes. These values are then converted to yearly figures by multiplying the frequency of generation by the appropriate factor (e.g. 12 for monthly quantity).

Finally, to facilitate comparison and aggregation of all data, the tool is capable of converting normalised volumetric figures to mass units and vice versa. This is performed using figures for bulk density (where available) as described below.
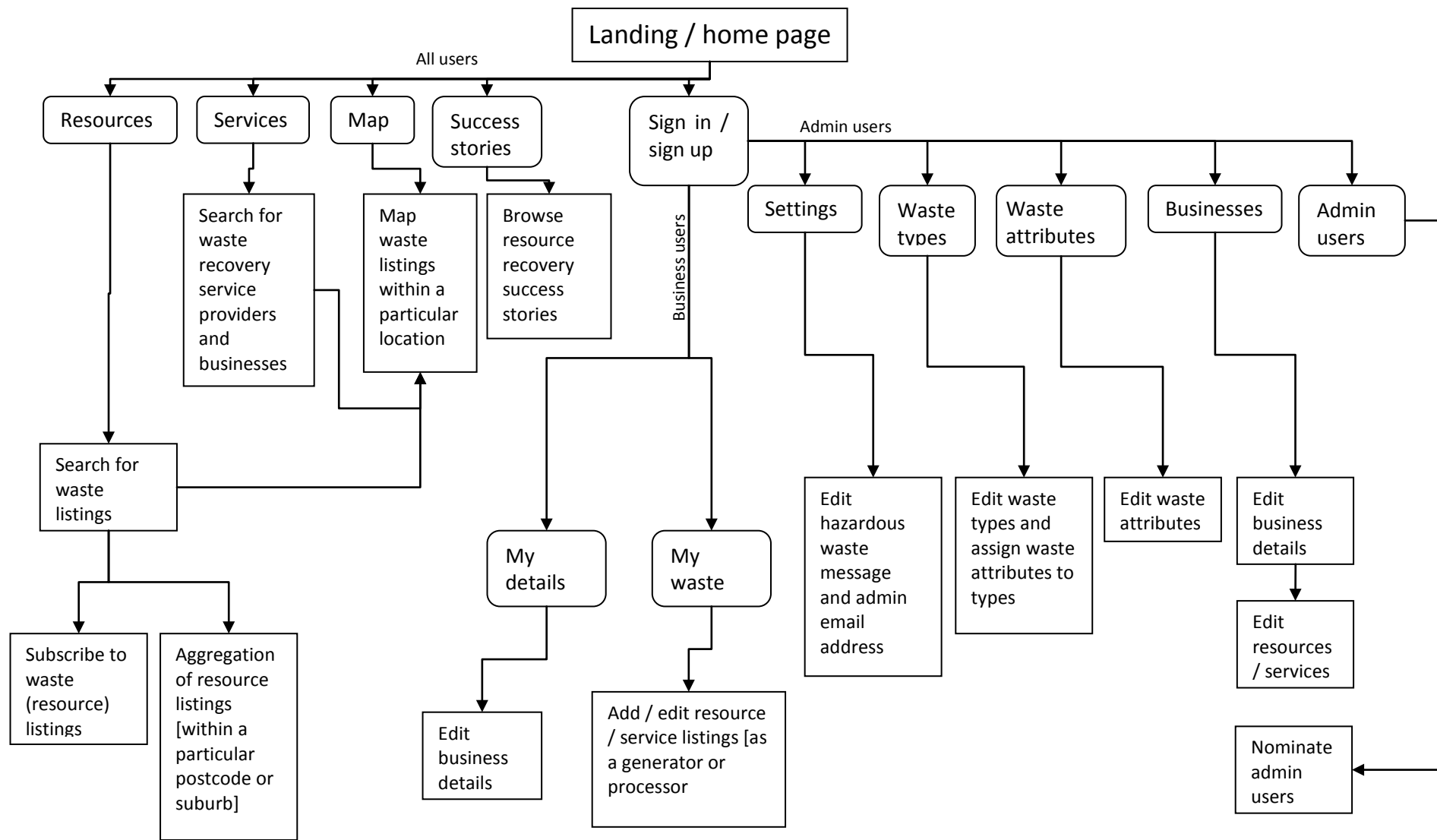
Figure 4-1 Flow chart representation of the structure of the WasteNot web tool interface

4.4.1 Converting between volumetric and mass units

Converting between volumetric and mass units was deemed most valuable for allowing waste quantities to be expressed in terms that make the most sense to both waste generators and waste service providers. Waste generators are provided with waste disposal bins, skips and containers that are referred to in terms of the volume of waste they can contain. In order to provide an easy interface for waste generators, to register the waste that they have for exchange, it was important to provide a convenient volume-based reference. However, waste service providers operate in terms of masses of waste, due to weight-based restrictions for waste sorting equipment and restrictions on the weights of vehicles that collect materials. Volume-to-mass conversion was also useful in aggregation of waste quantities.

The calculations for converting from volumetric to mass units and mass to volumetric units are simply:

$$Mass\ (tonnes) = \frac{Volume\ (m^3) \times Waste\ bulk\ density\ \left(\frac{kg}{m^3}\right)}{1000\ \left(\frac{kg}{tonne}\right)}$$

$$Volume(m^3) = \frac{Mass\ (tonnes) \times 1000\ \left(\frac{kg}{tonne}\right)}{Waste\ bulk\ density\ \left(\frac{kg}{m^3}\right)}$$

Each waste type is assigned a bulk density (where available) when it is first defined. Thus many waste types are ultimately defined by their physical state (e.g. whole, crushed, baled, etc.). Data on waste bulk density was taken from the literature and bulk materials handling websites. The bulk of the data were taken from standard engineering textbooks on solid waste management, which draw on waste studies undertaken in the United States, predominantly by the US EPA. Information of this type does not appear to be collected in a comprehensive way in Australia. The references used in gathering bulk density data are listed in Table 4-1.

Table 4-1 Bulk density data references

Vesilind et al. (2002)
Tchobanoglous et al. (1993)
Kreith (1994)
RecycleMania (n.d.)
Powder and Bulk Dot Com, Bulk Materials Handling Equipment Homepage, http://www.powderandbulk.com/resources/bulk_density/material_bulk_density_chart_a.htm
Anval Valves Pty Ltd, Bulk Density Chart, http://www.anval.net/Downloads/Bulk%20Density%20Chart.pdf
Powder Handling, Bulk Density Chart, http://www.powderhandling.com.au/bulk-density-chart

It is important to note that data could not be obtained for all waste types. Indeed quantities for many wastes (e.g. pallets and drums) are best expressed in terms of the number of items (which is an option for units in the tool) rather than by weight or volume, hence bulk density figures were not entered for these wastes.

Main assumptions in the generation of the data used to assemble the aggregation:

- That the figures for materials given in US MSW figure are acceptable for use in the Australian context.

- That figures taken from overseas for particular materials are similar to equivalent figures in Australia.

- That where a figure has not been provided with a description of compaction it is uncompacted.

An important improvement to this tool would be to obtain Australia-specific data on waste densities, potentially from companies that routinely undertake waste auditing of C&I and C&D waste streams.

4.4.2 Data aggregation algorithm

The aggregation of waste quantities is simply a summation of the normalised volumetric and mass data. The two figures for aggregated volume and mass may not always correspond directly on account of the fact that a bulk density figure was not available and therefore not entered into the tool database for a particular waste type. The number of discrete waste items is aggregated entirely separate from the mass and volumetric figures.

4.5 Email notifications

A critical suggestion from local businesses relating to tool functionality was the incorporation of email notifications to users to reduce the need to revisit the site to search for wastes or services. Thus, registered users have the option to 'subscribe' to a particular waste or service, which tells the system to send an email alerting the user to new wastes or services of the type they are interested in. To ensure that there is no barrier to a business finding and using this feature, the link is displayed as a 'sign up to subscribe' option to non-registered users, directing them to create an account to enable email notifications.

The tool also makes use of email reminders to help keep the database up to date. Businesses with waste or service listings are reminded once a year to check their details and waste/service listings. Businesses with one-off waste listings (i.e. wastes that are generated once only rather than consistently throughout the year) receive an email alert to check their entry after 90 days. To ensure that data on one-off entries does not remain in the database beyond the period that the waste is available, these entries are automatically deleted 10 days after the email reminder is sent to the user **if** the user fails to update the entry. If the user does log in and view that waste, the entry is retained for another 90 days, at which time the reminder cycle is initiated again.

4.6 Populated data

4.6.1 Waste types and attributes

The back end of the tool is populated with a comprehensive set of waste types that are defined using typical waste categorisations. The data is arranged in trees with up to five levels of sub-type as depicted in the example for paper in Figure 5-2. Bulk density for waste types are defined by default at the furthest branch extension of a tree (e.g. shredded office paper). Thus if a bulk density is defined at the outer most branch, a density cannot be assigned to a high branch. For example, if density is defined for shredded office paper, then it cannot be defined for office paper. However, if there are no bulk densities listed below an intermediate branch level such as office paper, bulk density may be defined for that branch.
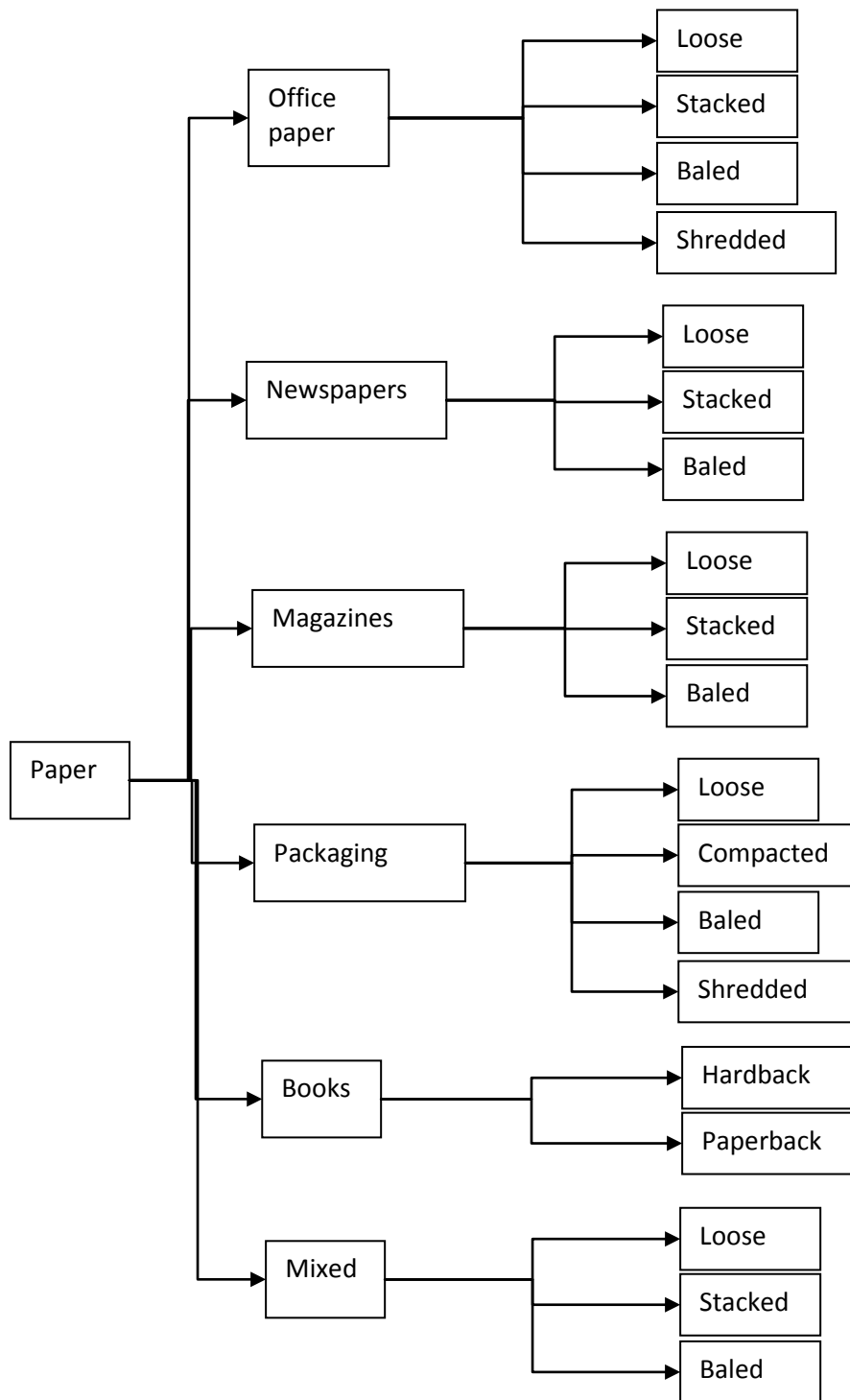
Figure 4-2 Waste type tree for paper

To provide additional detail to waste descriptions, a number of attributes have been defined and assigned to particular waste types (predominantly at the upper level of the tree). Attributes include characteristics such as state and contamination of the waste stream and constitute either a number of multi-selectable options or a choice of mutually exclusive options. There are also two universal attributes that apply to all waste types: 'current management' and 'transport'.

Administrator users can add or remove waste types and attributes as they see fit. In addition, all waste types and waste attributes and waste attribute options can be labelled as (potentially) hazardous by selecting a check box. This will cause a warning message to be displayed whenever a user selects the type, attribute or option.

Currently the tool contains 643 waste types and 162 waste attributes. Bulk densities have been defined for 255 waste types. 16 waste types and 14 waste attribute options have been identified as potentially hazardous.

4.6.2 Business listings

The tool has been pre-populated with data from 21 businesses from within and around the Duck River Catchment, including data from the three case study businesses. The names of the businesses included in the tool are given in Table 4-2.

Table 4-2 Businesses pre-populated in WasteNot

Waste generators	Waste processors
4 G Metals Pty. Ltd.	Maurice Kemp & Associates
Hungry Giant Pty Ltd	Mars Hill cafe
Galloway Environmental Waste Management	Printer Workz
OzHarvest	Signwave Parramatta
The Smith Family	CCS Technology Pty Ltd
EarthPower	Merck Sharp and Dohme
Radio Communication Services Pty Ltd	AB Mauri Yeast Australia Pty Ltd
SITA	Any Shape Plastics
JJ Richards	BCS Catering
Aspex Paper	Radio Communication Services Pty Ltd
All Size Cartons	Bluglass Ltd

5.   RESOURCE RECOVERY CASE STUDIES

Case studies were undertaken to help evaluate the application of the ideas canvassed during the stakeholder workshops. Businesses that had nominated themselves as being interested in further participation were asked about their waste streams as part of a preliminary assessment of their suitability. Businesses were chosen on the basis of the composition of their waste stream, with priority given to those with pallet, packaging and food waste streams.

Four businesses were then asked to provide background details about their location, size, employee numbers, length of establishment, existing waste policy and a self-evaluation of their current level of sustainability in the area of waste. They were also asked about the sources of information that they have used in the course of their decision making about their waste management. Finally, each business was asked about their waste streams and their current waste management practices.

The businesses chosen for this included a catering company (BCS Catering Solutions), a plastic signage manufacturer (Any Shape Plastics), an industrial yeast production plant (Mauri Yeast Australia), and an engineering firm that manufactures specialised equipment for researching solar cell and LED manufacturing processes (Bluglass Ltd). Details of the case studies have been provided in Appendix A of this report. This section of the report provides a brief analysis of the issues that the case studies raised in relation to the ongoing development of the waste exchange tool and the sustainability benefits of both existing and potential waste recovery options.

5.1   Comparison of case study subject circumstances

The businesses interviewed as case study candidates occupied a range of positions with respect to commitment to sustainability and existing/planned sustainability measures, access to information and technological resources and their ability to store waste materials on site. For instance, two of the businesses are a part of larger companies, a situation that provides these businesses with a larger pool of resources to undertake waste reduction and recovery, while the remaining businesses were small independent companies whose waste reduction and recovery strategies are determined locally.

Additional differences were evident in the extent to which each of the business was able to reduce their waste by negotiating with their suppliers for different (more recyclable or less) packaging or forms of raw materials, or by reusing materials in their own production processes.

Whether or not a business was involved with food production played a significant role in their approach to waste management in that both food producer businesses were constrained in their ability to store food waste on site for health and safety reasons. The smaller food business actually had limited physical space available for storage and also share bin facilities with a neighbouring business, which constrained their ability to undertake waste recovery. The larger producer (AB Mauri Pty Ltd) was not constrained by a lack of storage space or by shared waste management arrangements and as such was able to engage in more (non-food) waste recovery activities.

The extent to which the case study businesses were already engaged in waste reduction and reuse is also an interesting point of divergence. Three businesses are involved manufacturing of equipment and possess engineering expertise that facilitated a range of materials reuse on site. In these businesses, it was apparent that waste to landfill was more likely to be reduced through reuse of materials within the business than through cleaner production measures. For instance, Any Shape Plastics (ASP) has recently begun to use acrylic shavings generated in early stages of its sign and shop fitting manufacturing to create plastic adhesives used at a later stage. Bluglass uses crates and packaging from materials and equipment used in their production as packing materials for the equipment that they themselves produce. In each case, the business benefits from having less waste to dispose of and avoiding costs for the materials that they can reclaim from the waste stream. Even this small overview of the terms in which different businesses view and manage their waste reveals significant differences in the way in which a waste exchange could operate.

Space for storage, lack of control over shared waste facilities or arrangements, and issues around waste volumes were confirmed as key factors that might affect the viability of waste exchange and waste recovery in the catchment. Options for addressing these issues have been suggested in section 6 of this report.

Discussions with waste services providers, and case study businesses, also highlighted a necessity to address barriers arising from the scattering of comparatively low volumes of recoverable waste across the catchment. From these discussions, it became clear that a tool that could aggregate these waste resources to make them more attractive to waste recovery would have significant potential to improve outcomes for diverting these materials from landfill.

5.2   Quantifiable Sustainability benefits

This section quantifies the benefits of current and potential future waste exchanges in the Duck River Catchment as shown in Table 5-1. Current initiatives are shown in blue shading and potential future initiatives are shown in italics. Initiatives facilitated or arising from the current project are ticked.

Approximate calculations of the bulk density of various waste streams has been undertaken as part of the *WasteNot Resource Exchange* tool, and these have been used in the following analysis of the sustainability benefits arising from potential waste exchanges within the catchment Quantifiable sustainability benefits arising from the case studies have been calculated using factors provided by the NSW Department of Environment, Climate Change and Water (DECCW)[1].

Table 5-1 Benefits of waste exchange

	Avoided tonnes to landfill	Direct Cost savings[2]	Water savings (kL)	t CO_2 savings	Identified from Project
Baptist Community Centre					
• Recycling Paper Cardboard	1	$100	24	0.4	
• *Organics*	*57*	*$4,000*	*25*	*14*	✓
• *Steel cans*	*9*	*$600*	*10*	*7*	✓
AB Mauri					
• Yeast to Earthpower	130	$9,000	57	33	✓
• Potato starch filters to Earthpower	37	$2,500	16	9	✓
• Wooden pallets	11	$800	No data	6	
• *Molasses to farmer*	*2,900*	*$30,000*	*1,300*	*700*	
• *Cardboard boxes reused*	*~47*	*$2,000*	*1,450*	*40*	
• *Drums reused by Lubrizol*	*1*	*$100**	*1.3*	*2.1*	✓
Any Shape Plastics					
• Recycling Paper Cardboard	0.3	$30	7	.1	
• *Adhesive backed paper replaced by electrostatics*	*3*	*$300*	*72*	*1.2*	

*These are bulky items, so transport costs would be significant if taken to landfill

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[1] http://www.environment.nsw.gov.au/warr/BenefitRecycling.htm
[2] Conservative estimate based on landfill levy cost of $70.30 per tonne (http://www.environment.nsw.gov.au/wr/index.htm) which does not include transport costs

As shown in Table 5-1, the total savings to landfill arising from the above initiatives facilitated from this project are over 160 tonnes, saving 73 kL of water and 42 t of CO_2 per year. In addition, nearly 70 t of savings to landfill have been identified that could be achieved through future exchanges and saving approximately $5000 per year in direct costs to businesses and more than 20 t of CO_2 and 35 kL of water per year.

Such specific cases are only indicative of the extended benefits which could be captured with broader deployment and use of the *WasteNot Resource Exchange* tool.

6. RECOMMENDATIONS, FURTHER RESEARCH AND DEVELOPMENT

6.1 Constraints to waste/resource recovery

The research conducted as part of this project has identified a number of gaps in the information that is available on waste generation in Australia, as well as a number of issues that will need to be addressed if waste recovery and exchange is to play a large role in reducing waste to landfill.

6.1.1 Information gaps

There is a notable lack of detailed information on commercial and industrial and construction and demolition waste in Australia. While there are figures available for gross volumes and breakdowns by waste type in NSW, there is less information available related to other aspects of waste management such as:

- Bench-marking of waste generation rates for particular industries

- Australia-specific bulk density data for particular waste streams (all data used in this tool was sourced from overseas, primarily the U.S.)

- True costs to all stakeholders of developing new landfill sites for the purposes of comparing waste resource recovery

- Opportunities that local government might have to address existing barriers through the revision of development control plans and local environment plans.

6.1.2 Issues inhibiting resource recovery in the business sector

A key constraint amongst businesses, particularly at the smaller end of the scale, is availability of space to store/hold waste materials. Waste recovery, particularly waste exchange, can involve significant lag time between waste generation and recovery. To allow for this, businesses need to be able to stockpile wastes, which is often impractical, particularly for bulky wastes.

Other barriers related to waste/resource recovery and exchange include:

- the risk of commercial exposure whereby the release of operational data to other waste exchange participants may potentially result in loss of competitive advantage.
- Contamination and accuracy of contamination reporting -significant costs could be incurred to a receiving party if contamination is worse than reported, which is the experience of the EarthPower facility at Camellia (and Transpacific Industries).
- the risk of cross-contamination of other segregated waste streams by hazardous waste products which could raises significant occupational health and safety risks
- Generation of too small or too large waste quantities to contract waste recycling (further compounded by inconsistency of waste streams and types)
- Lack of knowledge of what disposal, recycling and reuse options are available
- Lack of education regarding on-site segregation methods
- Lack of access to centralised information on regulation and legislation

6.1.3 Options for councils and businesses to address these gaps and issues:

There are a number of strategies that Auburn and Parramatta City Councils and businesses can adopt to help alleviate some of the barriers identified above.

Council planning and policy measures that can encourage better resource recovery include:

- Adjustments to Development Control Plans (DCP)[3] and Local Environmental Plans (LEP)[4] to encourage dedicated waste separation and processing facilities in new buildings. This may be particularly important to incorporate in industrial estate/precinct scale type developments.
- Monitor the use of WasteNot and utilise the data to inform waste strategies.

Council facilities and services that might be considered to promote resource recovery include:

- Evaluate opportunities to improve access to secure waste management and recovery facilities on or near existing businesses
- Provision of council depots for storage of non-hazardous waste materials that a business makes available for exchange
- Collection of target (common) waste streams

The Councils could also actively foster the development of local business community advocacy

- Build on the networks developed during the Duck River project
- Extend Camellia model to Silverwater businesses or allow them to participate in the existing group
- Make sustainability a permanent item on the agenda of existing business group meetings.
- Utilise local issues associated with illegal dumping to raise the profile of waste exchange.

The Councils might also be able to leverage existing contracts for municipal waste collection to improve waste recovery outcomes. In particular, the Councils could favour contractors that utilise collection vehicles with weighing and data logging capabilities to encourage the adoption of such technology more broadly. This would help to address the lack of data on waste generation and bulk densities.

6.2 Tool limitations and future extension

The tool remains at proof-of-concept stage, with many desirable features identified through stakeholder consultation absent from the current implementation. Some suggested improvements to functionality include:

- Streamlining the database queries for waste searches
- Improving the waste data entry fields
- Creating a mechanism to track actual exchanges that arise from use of the tool
- Improving the waste aggregation algorithm
- Adding image uploads to resource listings
- Filtering success stories
- Creating a favicon
- Top ten search items list
- Streamlining other back-end (database and display) functions

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[3] The detailed guidelines contained within a DCP are in addition to the provisions of the legal planning instrument (SEPP, REP or LEP). DCPs are important in the planning system because they provide a flexible means of identifying additional development controls and standards for addressing development issues without the need for a formal statutory plan.

[4] A **Local Environmental Plan** is the principal legal document for controlling development at the council level. The zoning provisions establish permissibility of uses and standards regulate the extent of development. They are prepared by councils and approved by the Minister for Planning after public exhibition.

Perhaps a more important aspect of future research and development for the tool, however, is the collation of Australia-specific bulk density data with which to populate the tool. This may be pursued through collaboration with organisations that routinely conduct waste audits of commercial, industrial and construction/demolition operations.

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APPENDIX A

BUSINESS CASE STUDIES

A.1   Case Study 1

Name: Any Shape Plastics Pty

Location: Tennyson Street, Granville (Silverwater)

Type of Business: Manufacturer of Perspex/Acrylic Signage, product and point of sale displays.

Size of Business: 0-20 (Small SME)

Established: 17 years

Self-evaluation of sustainability: Early Stage - Started the program last year

Existing policies, initiatives and targets for waste:

Official company policy emphasises reducing materials and reusing as much as possible. Waste minimization takes place through procurement policies and strict adherence to maximum job specifications. Policies and targets are communicated at weekly staff meetings. Close attention is paid to turnover and demand, to ensure stock is suitable, based on regular client needs. Clients whose needs cannot be met within this stock are referred to other providers.

ASP also works with both clients and suppliers to minimise the potential for waste to be generated. Proactive negotiation with clients about the purpose served by the job has resulted in savings in materials and costs to clients. ASP advises clients that products without adhesive coating can and should be recycled. Clients are advised to call ASP for advice on disposal. ASP has also been proactive in considering whether materials for unusual jobs could be supplied from off-cuts held by their preferred suppliers.

ASP are moving to establish recycling 'stations' with clear signage.

Other waste reduction and sustainability policies include the replacement of solvent-based inks with water-based inks. ASP refills existing durable plastic cartridges rather than purchasing new cartridges of ink. Empty ink refill containers are cleaned and recycled where possible. Any Shape Plastics is also in negotiations with their suppliers to have the stocks of Perspex/acrylic supplied to them in protective masking that can be recycled with other paper.

Information Sources:

ASP use information provided by council websites to establish Council websites – what, how, frequency (aiming to reduce outputs as much as possible)

Business Operations and Waste Streams:

ASP produces banners, signs, make-up stands, and other plastic products (e.g. plastic lettering). ASP has a large group of regular clients whose needs are well understood. The waste generated by this activity consists of ink – water based, ink refill bottles, adhesive-backed vinyl for use in signage, protective paper masking from perspex/acrylic sheets, Perspex/acrylic off-cuts, and aluminium frame materials generated by manufacture of 'light box' style signage.

What is the quantity of waste generated and how is it currently managed?

Waste Type	Volume/weight	Management
Aluminium Scraps	No specific data	Collected by scrap merchants for recycling
Perspex/Acrylic (PMMA)	Between 4m3 (200-300kg) and 8m3 (400-600kg) per fortnight	Sent to suppliers in china for recycling and reuse in other products.
Adhesive-backed protective paper masking	4 m3 every 6 weeks	Disposed of at landfill with other general waste.
Wooden Pallets ('disposable')	No specific data	Disposed of at landfill with other general waste.
Metal straps from palletted materials	No specific data	Disposed of at landfill with other general waste.
Plastic straps from palletted materials	No specific data	Disposed of at landfill with other general waste.
Cardboard	2 – 3 2-m3 bins every 6 months	Recycled with JJ Richards
General waste (includes employee food waste)	No specific data	Disposed of at Landfill by JJ Richards
Rubber gaskets	No specific data	Sent to suppliers in china for recycling and reuse in same product.

Images for ASP

Aluminium off-cuts from light box-style signage	Sheets of rubber edged Perspex/acrylic with adhesive backed paper masking.	Metal strapping from pallet packed sheets of Perspex/acrylic (centre) and disposable pallets (left).	Perspex/acrylic off-cuts. Smaller pieces have been cut from the off-cut sheet at the front of the collected pieces.

Waste Exchange

No waste is currently exchanged with businesses within the Duck River Catchment; however, relationships with suppliers and customers have facilitated recycling and reuse.

What are the benefits to the environment of this exchange/reuse?

The environment benefits from ASP's reuse of materials through the waste diverted from landfill, as well as from the reuse of materials at the business. For example, ASP is now producing plastic adhesive for use in producing signage from acrylic shavings (swarf) generated by the cutting of signs and shop fittings.

The business benefits from having less waste to dispose of and avoids costs for commercially produced plastics adhesives.

What challenges has the business faced in getting the exchange / reuse established?
ASP offers clients the option of returning the signage once it is no longer needed for disposal, however some clients have proprietary concerns about branding and therefore dispose of signs and stands themselves.

Space has been a challenge for separating wastes. Expansion of its premises is allowing for sorting facilities.

ASP are negotiating with their suppliers as a means of diverting this paper waste to recycling facilities rather than landfill as general waste.

What are the most important factors for developing and sustaining exchange / reuse opportunities

- ASP recycles aluminium scrap with scrap metal merchants who appear willing to come and collect quite small amounts.
- ASP has improved its options for stockpiling wastes with the expansion of its premises. Currently it is still relatively well placed to stockpile wastes (up to 6-8 weeks), compared to other businesses in the catchment.

Options:

- Reduce the transport kilometres associated with the shipping of small acrylic off-cuts such as those produced in large numbers, as part of stock and point of sale display assembly, by investigating reuse locally, through groups such as Reverse Garbage.
- Reduce disposable wooden pallet waste to landfill by exploring a contractual arrangement with suppliers that limits or eliminates the shipping of 'disposable' wooden pallets with acrylic stocks, or investigating opportunities to supply disposable pallets to paper producers or high density manufactured wood product producers.
- Reduce waste to landfill by continuing to pursue an agreement with suppliers to use protective paper masking that is attached to acrylic sheets using an electro-static charge rather than an adhesive.

Case study contact: Warren Sheldon

Phone details: 02 9637 6455

A.2   Case Study 2

Name: Baptist Community Services (BCS) Catering

Location: East St (Silverwater)

Type of Business: Baptist Community Services (BCS) operates a commercial kitchen where preparation of bulk and individual meals takes place. These meals are distributed to BCS aged and community care services facilities across NSW.

Size of Business: 30 employees (Medium SME)

Self-evaluation of sustainability: Early stages at the level of sustainability in the workplace, but further ahead than many similar operations.

Existing policies, initiatives and targets for waste:
Existing policies, initiatives and targets for waste are oriented towards the "reduce" end of reduce, reuse and recycle.

As an organisation, Baptist Community Services (BCS) has initiated a sustainability strategy for all of their business activities. This strategy has been driven by the current CEO and outlines a program of activities for the period 2009 to 2012. The strategy targets resources, supply chain, people and buildings, with the objective of bringing all facilities, as much as possible, into alignment with the sustainability criteria that is being applied to new facilities. The strategy aims to reduce resource use across all facilities by 2 percent every year, to 2020, on a baseline of 2008/09. In the case of BCS Catering, the focus is on procurement and training procurement staff in material selection to reduce the amount of non-recyclable packaging. This also involves engaging with suppliers to take packaging back. Other initiatives involve improving information about appropriate portion sizes to eliminate waste of food.

Waste Information Sources:

BCS uses information provided by government departments and waste service providers to inform its decision-making. This information is trusted and seen as potentially valuable for benchmarking its progress.

Business Operations and Waste Streams:

7000 meals per day are prepared on premises in Granville between 4 am – 2 pm, and quick chilled for consumption 48 hours later. BCS delivers to its aged and community care facilities across NSW, as far away as Broken Hill, Griffith, Wagga-Wagga, and up to Ballina on the central coast. Waste generated by BCS Catering falls into three main categories of paper waste generated by administrative work, packaging waste associated with foodstuffs and food waste. Plastic packaging, steel cans are the main challenges. A waste audit undertaken in early 2010 provides details for this case study.

What is the quantity of waste generated and how is it currently managed?

Waste Type	Volume/weight	Management
Paper	2.3kg per day[5]	1.6kg sent to landfill as part of general waste.
Cardboard	1.7 per day	1.7kg sent to landfill as part of general waste.
Food waste	157.6 kg[6] per day	Currently being sent to landfill as part of general waste.
Steel Cans	24kg per day	Sent to landfill as part of general waste.
Wooden Pallets ('durable')	No specific data	Returned to suppliers?
Plastic (HDPE)	2.376 kg per day	Currently all of this goes to landfill as part of general waste.
Plastic (PVC)	1.782kg per day	Currently goes to landfill as part of general waste.
Plastic (PET)	0.0891 kg per day	Currently goes to landfill as part of general waste.
Aluminium	Foil Containers (0.2079 kg per day) Aluminium Cans (.297 kg per day)	Currently goes to landfill as part of general waste.
Plastic (Expandable Polystyrene – EPS)	.297kg per day	Currently goes to landfill as part of general waste.
Liquid Paperboard Containers	.5049kg per day	Currently goes to landfill as part of general waste.
Cardboard boxes	128.4 kg per day	6-8 Bales. Recycled by Grimmer
General waste	36.3kg per day	Disposed of at Landfill by SITA
Cooking Oil (Liquid Waste)	5,000L collected once every 2 months	Collected by SITA

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[5] as per audit period of 24 hours

[6] from table on p17 of waste audit

Images for BCS

Pre-peeled potatoes in plastic bags	General waste bin provided by SITA	Cardboard boxes broken down for baling and recycling	Containers and lids

Waste Exchange

Waste exchange is beginning to be taken up with respect to food waste. Negotiations are underway with Earthpower, a locally based producer of biogas and fertilizer, to divert the food organic waste currently going to landfill.

Recycling plastic waste has been challenging due to a lack of information on plastic packaging, but also due to an absence of space for storage of materials. Additional challenges arise from inconsistencies between residential waste services that require sorting existing business waste management requirements – this creates a certain level of cynicism amongst the staff, regarding the legitimacy of mixed waste recycling.

Additional issues for BCS arise from the fact that their product is food, which creates a higher level of concern for how wastes might be collected and stored on site. Maintaining suitable levels of cleanliness, in line with health regulations are very important, particularly as the meals are being prepared for groups who are considered to be more vulnerable than the general population.

However, larger business interests have provided experience that can be used in a particular facility – getting runs on the board in other areas has demonstrated the economic benefits of taking action on sustainability issues.

Pay offs for improving the sustainability of waste are not considered to be as significant as they have been for other areas such as energy and water efficiency. This is partly due to the fact that the complex from which BCS operates pays part of a general waste fee for all tenants, making it difficult to get data and understand the volumes of waste produced.

Options:

Reduce waste to landfill by acquiring or gaining access to equipment to compact large steel cans for more efficient storage and transport for recycling.

Reduce waste to landfill by using EarthPower services to dispose of food and organics waste.

Reduce waste to landfill by investigating more Individual meal packaging – meals on wheels - investigate the use of packaging that is more easily washed and recycled or composted.

Look at options for storing collecting cooking oil for collection by established services that might be picking up similar quantities from other businesses.

Cost Benefits:

Existing systems are as follows (from Waste Audit Feb 2010 p6):

> General Waste services provided by SITA : 1 x 1x 3m skip (daily) at $49.50/bin

> Paper & Cardboard services provided by Grimmer: 2 x 8-10 bales weekly at no cost with no rebate.

> Grease Trap Waste services provided by SITA: 5,000L collected once every 2 months at $287.50*

Annual totals:[7]

> Costs: $14595

> > Consisting of -

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* charge based on invoices

[7] Assumes a 5 day production period over 52 weeks of the year.

$12870 for general waste

$0 for paper and cardboard (rebate)

$1725 for grease traps

A.3   Case Study 3

Name: AB Mauri Yeast Australia Pty Ltd

Location: Grand Ave (Camellia)

Type of Business: Food manufacturer producing compressed yeast bricks that are supplied for use in industrial baking or further processed into retail products such as bread mixes for household breadmakers.

Size of Business: 70 employees (Large SME)

Established: 1984

Self-evaluation of sustainability: Good

Existing policies, initiatives and targets for waste:

Parent company has mission statement and CSR policy. Focus is on reducing waste coming into the business and to improve the efficient use of the materials that go out.

AB Mauri works with suppliers to reduce waste coming to the business. An example of this is contractual limits on the type of pallets on which production inputs are delivered. Few, if any, 'disposable' wooden pallets are used in deliveries to the facility.

The approach to reducing impact has also been to improve separation of wastes so that more can be diverted from landfill. This is also seen as a reputation enhancing initiative, as they are aware of an increasing interest in their client base, many of whom are seeking to secure their own reputation in areas of sustainability and corporate responsibility.

Information sources:

AB Mauri is part of a larger group of businesses whose research and development group provides both information and access to technology. The internet also provides a source of information for particular issues and the global technology department in Ryde that can help with the process of developing options. As a local business, AB Mauri also seeks greater engagement with relevant state and local government authorities.

Business Operations and Waste Streams:

AB Mauri make yeast for commercial food producers such as Bakers Delight. Waste from this process takes the form of water, ethanol, yeast product, filters for production machinery and baked goods from the in-house test bakery. Additional waste arises from packaging, including plastic films, metal strapping, pallets and boxes. Office paper, food and packaging waste are also generated in the course of general office activity.

Compared to a number of businesses in the Duck River Catchment, AB Mauri has large volumes of waste to manage, and large amounts of space in which to undertake management of waste. However, many waste streams are highly perishable, with significant potential for development of health and safety issues around the management of bacteria within the factory, and odour problems for surrounding businesses.

Waste Type	Volume/weight/number of items	Management
Molasses Co-Product	40,000 litres per week	Currently pay to apply to land near Willacia at $20 per tonne. Negotiating to give the co-product to a dairy coop on the South Coast for use as a feed supplement. The material is being analysed by nutritionalist to determine its benefits as a food supplement.
Waste active sludge	25 m^3 per day	Land applied at the Willacia property at the same cost. Currently testing drying process to incorporate the material into stock feed. Need to procure dewatering equipment to facilitate drying. Rated as a Grade A product (low in heavy metals and organic compounds).
Compressed Yeast Bricks	2.5 tonnes per week	Sent to EarthPower to be used in bio-digester, which generates electricity from the methane produced.
Test bakery goods	No specific data	Sent to EarthPower to be used in bio-digester, which generates electricity from the methane produced.
Potato starch filters	100 kg per day	Sent to EarthPower to be used in bio-digester, which generates electricity from the methane produced.
Wooden Pallets ('durable')	Between 30-100 pallets per month with an average of approximately 50 per month. High quality wood, AQUIS standard (fumigation etc.).	Reusable pallets stockpiled then given to neighbouring import/export business (Campbell's Transport) in exchange for use of forklift and other favours.
Metal scraps	1 tonne per month. 50% ferrous (including high grade stainless (316). 50% brass, copper	Collected by International Global Resources
Cardboard pallets or 'skids'	2 4-m3 bins collected each week (90% full)	Compacted with other cardboard and paper for recycling.
Plastic	No specific data	Mostly plastic film wrap. Baled on site and collected by International Global Resources along with metal scrap.
Cardboard boxes	47050 boxes in the past financial year.	Non-destructively broken down and sold to box reuse business. This method for disposal generates about $2000 in income per year.
General waste (includes employee food waste)	Size 6 and Size 1(admin) once per week. About 75% full.	Disposed of at Landfill by JJ Richards
Office paper	Unspecified proportion of all cardboard and office paper (approximately 15 cubic meters or 2.5 – 3 tonnes) per	Compacted with other cardboard and paper for recycling.

	quarter.	
Ethanol (low concentration)	No specific data	Vaporized and vented in accordance with EPA guidelines
Industrial Bulk Containers (1m^3)	60 per year	Sold to drum recyclers or given to farmers and other local businesses (including Lubrizol that have taken 12 in the past year to store waste oils). Drums with chemical residues (e.g. acid) are recycled. AB Mauri receives up to $50 per container recycled. IBCs with food residue (e.g. vegetable oil) also made available for (free) reuse.
Commingled recyclables	1 240-L bin per week	Collection by JJ Richards commenced about 8-10 weeks ago

Images for AB Mauri

Purpose-built cradle for six 240 litre wheelie bins containing organic waste for disposal by EarthPower.	Yeast block waste shown with Bio Bag bin liners in wheelie bins.

Waste Exchange

Waste exchange is currently being engaged in by AB Mauri in some areas such as with wooden pallets, molasses co-product, Industrial Bulk Containers (IBC).

AB Mauri is also engaged in the extended use of products, such as the sale of durable cardboard boxes to a box reseller, and using of what is left at the end of a production process, when it arranges for EarthPower to converting organic wastes to energy.

Several of these exchanges have been enabled by bringing the businesses together to learn about each other, while others have been facilitated by a third party outside of the Duck River Catchment. For example, a truck that services other organic waste customers can pick up waste from AB Mauri on its return journey. The ability to weigh and monitor the state of waste at each pick up point also allows a precise measurement for the purposes of charging for collection.

A larger and more complex exchange is being contemplated between AB Mauri and an adjacent waste management business. Each facility would assist in processing the others wastewater, using equipment that the other possesses.

What challenges has the business faced in getting the exchange / reuse established?
An earlier initiative to supply the Sydney Turf Club with waste waters (Molasses co-product) however, regulatory issues and practical issues surrounding inconsistent water quality were too complex to resolve using existing systems.

BioBag bin liners were introduced to the arrangement by Earthpower to make the transfer process of compressed yeast waste more straight forward – lessens the OHS issues of large bins for collectors and lessens the opportunities for putrefaction.

As a food producer, AB Mauri is also required to consider the public health and safety aspects that relate to their business when they consider their options for waste management.

What are the most important factors for developing and sustaining exchange / reuse opportunities from the perspective of the business/es involved in this case study?

AB Mauri has been very proactive in seeking out ways to reduce waste coming into and going out of their production. In many cases this has resulted in a position that can now only be improved by significant investments in expensive new equipment within their own facilities, or in infrastructure that will assist them to pool resources with other businesses to make better use of existing waste materials.

AB Mauri is currently investigating partnerships with neighbouring businesses that allow waste to be treated using existing equipment at another business in the local area. For example, different stages of processing can be undertaken on different sites if pipelines between these facilities can be built. High costs, and the risk associated with such investment, are currently a barrier to further development in this direction.

Options:

Reduce waste to landfill by encouraging staff to separate wastes, and divert employee food waste to the organic waste stream being converted to energy at EarthPower.

- Use of cradled wheelie bins and corn starch liners has reduced the need to wash the bins everyday to an average of once a week.