Lake Macquarie City Council

Strategic Waste Options and Triple Bottom Line Analysis (Contract No. T842)

PART 4
Implementation Considerations

November 2010
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</thead>
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<tr>
<td>AD</td>
<td>Anaerobic Digestion</td>
</tr>
<tr>
<td>AWD</td>
<td>Australian Waste Database</td>
</tr>
<tr>
<td>AWT</td>
<td>Advanced Waste Treatment of MSW having two major processes in Australia – MBT (Mechanical Biological Treatment) and AD (Anaerobic Digestion)</td>
</tr>
<tr>
<td>AS</td>
<td>Australian Standard</td>
</tr>
<tr>
<td>BAU</td>
<td>Business as Usual</td>
</tr>
<tr>
<td>Biosolids</td>
<td>Organic solids or semi-solids produced by municipal sewage treatment processes</td>
</tr>
<tr>
<td>CCM</td>
<td>Consolidated Cost Model – MRA proprietary model for predicting future options costs including transport, transfer station and processing costs for multiple technologies</td>
</tr>
<tr>
<td>CDL</td>
<td>Container Deposit Legislation</td>
</tr>
<tr>
<td>C+I</td>
<td>Commercial and Industrial waste</td>
</tr>
<tr>
<td>C+D</td>
<td>Construction and Demolition waste including Building Demolition waste as defined in the Awaba landfill input waste categories</td>
</tr>
<tr>
<td>COAG</td>
<td>Council of Australian Governments</td>
</tr>
<tr>
<td>CO₂-e</td>
<td>Carbon dioxide equivalent</td>
</tr>
<tr>
<td>Commingled</td>
<td>Commingled recyclables includes plastic, glass and steel but does not include paper and cardboard; as compared to fully commingled (FCM)</td>
</tr>
</tbody>
</table>
Cover Material

Material used to cover solid wastes deposited in landfills

CPI
Consumer Price Index – Australian Bureau of Statistics

CPRS
Carbon Pollution Reduction Scheme (as proposed by the Commonwealth Government and expected to be introduced in some form, from 2013 despite delays)

DCC
Department of Climate Change (Commonwealth)

DECCW
Department of Environment Climate Change and Water (NSW)

DRF
Data Recording Form

DWC
Domestic Waste Charge (Council)

EfW
Energy from Waste

EPHC
Environment Protection and Heritage Council

EPS
Polystyrene

ERA
Extended Regulated Area including Cessnock, Lake Macquarie Shellharbour, Wyong, Gosford, Maitland, Shoalhaven, Hawkesbury, Newcastle, Wingecarribee, Kiama, Port Stephens, Wollongong

FCM
Fully commingled recycling (paper, cardboard, plastic, steel and glass all in one bin); as compared to split bin or commingled

General solid waste (putrescible)

Waste (putrescible) (including household waste for the purposes of this report) means waste (other than special waste, hazardous waste, restricted solid waste or liquid waste) that includes any of the following:

1. household waste containing putrescible organics,
2. waste from litter bins collected by or on behalf of local councils,
3. manure and nightsoil (cans),
4. disposable nappies, incontinence pads or sanitary napkins,
5. food waste,
6. animal waste,
7. grit or screenings from sewage treatment systems
General solid waste (non-putrescible)

Waste (including for the purposes of this report C+I and C+D waste) as per the POEO Schedule 1 means waste (other than special waste, hazardous waste, restricted solid waste, general solid waste (putrescible) or liquid waste) that includes any of the following:

1. glass, plastic, rubber, plasterboard, ceramics, bricks, concrete or metal, paper or cardboard;
2. household waste from municipal clean-up;
3. street sweeping;
4. grit, sediment, litter and gross pollutants collected in, and removed from, stormwater treatment devices;
5. garden waste;
6. wood waste;
7. waste contaminated with lead (including lead paint waste);
8. containers, having previously contained dangerous goods;
9. oil filters (mechanically crushed), rags and oil absorbent materials;
10. motor oil containers;
11. non-putrescible vegetative waste from agriculture or horticulture;
12. building cavity dust waste;
13. synthetic fibre waste (from materials such as fibreglass, polyesters and other plastics) virgin excavated natural material;
14. building and demolition waste;
15. asphalt;
16. biosolids;
17. cured concrete waste; and
18. residues of resins, glues, paints, coatings and inks.

GHG Greenhouse Gas

Green waste

Household and commercial garden waste including grass and tree clippings

Hazardous waste

Means waste (other than special waste or liquid waste) that includes any of the following:

1. a substance of Class 1, 2, 5 or 8 within the meaning of the Transport of Dangerous Goods Code;
2. containers, having previously contained a substance of Class 1, 3, 4, 5 or 8 within the meaning of the Transport of Dangerous Goods Code;
3. coal tar or coal tar pitch waste;
4. lead-acid or nickel-cadmium batteries; and
5. lead paint.

HDPE  High Density Polyethylene
LC    Lloyd Consulting
LDPE  Low Density Polyethylene
LGA   Local Government Authority

LG Swap Tool
Local Government Strategic Waste Action Planning Tool

Liquid waste
Means any waste (other than special waste) that includes any of the following:
   i) becomes free-flowing at or below 60°C or when it is transported; or
   ii) is generally not capable of being picked up by a spade or shovel.

MBT   Mechanical Biological Treatment (organics processing via sorting and then composting processes)
MGB   Mobile Garbage Bin
MRA   Mike Ritchie and Associates Pty Ltd, environmental consultants
MRF   Materials Recovery Facility
MSW   Municipal Solid Waste
MUDs  Multi Unit Dwellings (e.g. flats and townhouses)
NGER  National Greenhouse and Energy Reporting
NRA   Non Regulated Area as defined by DECCW
NWP   National Waste Policy 2010
OH+S  Occupational Health and Safety
Organics  Waste materials that originate from plant or animal sources and include food waste, garden waste, sewage, paper and wood. Organic waste for the purposes of this report refers to organics in the following waste streams:

1. Domestic waste organics;
2. Bulk waste organics;
3. Parks waste organics;
4. Residential waste organics;
5. Green waste;
6. Food waste from households and commercial operations; and

PET  Polyethylene Terephthalate

PPE  Personal Protective Equipment

PP  Polypropylene

Provider  The AWT or SSO private operator who provides the service to LMCC

PS  Port Stephens Advanced Waste Treatment plant owned by SITA

PT Stephens  Port Stephens Advanced Waste Treatment plant (longer name version where space permits

PVC  Polyvinyl Chloride

Recycling  Set of processes (including biological) for converting recovered materials that would otherwise be disposed of as wastes, into useful materials and or products. In the context of kerbside recycling this includes the kerbside recycling bin (yellow lid)

Residential waste

Includes and is primarily self hauled household waste

Residual AWT

Advanced waste treatment technology for domestic residual waste from a residual bin which includes both food and green waste

Residual MSW

Solid waste after recyclables have been extracted. May include food and green waste and always includes all other household waste such as nappies, textiles, ceramics, film plastic etc

RRA  Regional Regulated Area as defined by DECCW
SMA  Sydney Metropolitan Area as defined by DECCW

**Special waste** Means any of the following:

1. clinical and related waste
2. asbestos waste
3. waste tyres
4. Anything that is classified as special waste pursuant to an EPA Gazettal notice.

**Split bin**  Commingled containers on one side of recycling bin; paper and cardboard on the other; materials kept separate in truck and MRF

**SSF**  Source Separated Food waste – household and commercial food waste separated at point of generation into a designated bin. It can include meats

**SSG**  Source Separated Green waste – garden waste including lawn and tree clippings but not including food separated at point of generation.

**SSO**  Source Separated Organics which includes Green and Food waste and is sorted at the point of generation into a designated bin

**SSO process**  A process (most commonly tunnel composting) for converting source separated food and green waste streams provided from a 3 bin system with low contamination rates, to reusable products

**SUD**  Single Unit Dwelling (house)

**WEE**  Waste Electronics and Electricals

**WtE**  Waste to Energy
Executive Summary

The Need

Lake Macquarie City Council (LMCC) is exploring waste management options as part of its waste management strategy. Two issues are putting pressure upon council to act now. Firstly NSW’s mandated WARR target of 66% waste diversion from landfill and secondly a more practical issue. Space in Awaba landfill is running out. The WARR target and landfill depletion dates roughly coincide and in both cases time is running for the council. To achieve the 2014 WARR diversion targets new infrastructure is needed. The time required to tender, plan and build a resource recovery facility or landfill extensions is substantial.

In determining the best waste management solution for the future, council has embarked in a process identifying and evaluating available options. A series of modelling exercises has assisted in establishing suitable options that have the potential to achieve LMCC’s targets.

Council’s decisions around waste management have the potential to affect greatly the environmental footprint of the City as a whole. Resources consumed and preserved, local environmental impact, the generation of greenhouse gases, and influencing community knowledge and behaviour will all be affected by the City’s waste strategy.

The implementation of a waste strategy will represent one of the largest cost decisions LMCC is likely to make.

Due to the scale of the service alone, any decision on the waste strategy will represent a large and probably long term commitment to the expenditure of funds. As waste services are separately funded by direct charge to the community, the financial implications of any waste strategy decisions have a direct influence to charges borne by service users.

LMCC faces a number of drivers to re-consider its waste management system:

- LMCC’s commitment to a more sustainable future;
- the consumption of the airspace at Awaba landfill;
- the rapid increases in landfill costs in future due to the NSW WARR Act S.88 levy and likely federal carbon taxes;
- the NSW Government’s waste diversion targets; and
- LMCC’s currently below average resource recovery performance.
In early September 2010, LMCC released the Part 2 Report of this investigation which explored the systems and technologies available to the people of Lake Macquarie to reduce their waste to landfill.

The ten technologies and systems considered were:

1. 3 bin Source Separated Green waste (SSG) windrow composting;
2. 3 bin Source Separated Organic (SSO; food and green) in-vessel composting;
3. 3 bin phased SSO in-vessel composting;
4. 3 bin SSO Anaerobic Digestion;
5. 2 bin landfill;
6. 2 bin bioreactor landfill;
7. 2 bin in-vessel composting AWT;
8. 2 bin in-vessel composting AWT at Port Stephens;
9. 2 bin in-vessel composting AWT at Port Stephens with Energy from Waste; and
10. 2 bin Anaerobic Digestion.

The recommendation of the Part 2 Report was that LMCC investigate a number of non-thermal, low risk and high value options for processing waste and diverting it from Awaba landfill (Table 1).

Table 1. Recommendations from Part 2 Report for more detailed investigation

<table>
<thead>
<tr>
<th>Option</th>
<th>Rank</th>
<th>Characteristics</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL (PHASED INTRODUCTION)</td>
<td>880</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL</td>
<td>824</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>2 BIN MSW ENCLOSED COMPOSTING OF MIXED WASTE (AWABA)</td>
<td>802</td>
</tr>
</tbody>
</table>

The Part 3 Report considered a wide range of other initiatives which could also be pursued by LMCC related to other non-residential waste streams. Initiatives were proposed for a range of waste streams including Mattresses, Polystyrene, Cardboard and paper, Concrete, Commercial and Industrial Waste, Construction and Demolition waste, Textiles, Fluorescent tubes etc.

This Part 4 Report examines in more detail the preferred options which emerged from the Part 2 Report and specifically the costs and benefits of a 3 bin SSO phased system against a 2 bin residual AWT system.
The Part 4 Report considers the benefits and dis-benefits of the phased introduction of the SSO 3 bin system over non-phased.

**Describing the Processes**

Currently, LMCC implement a kerbside collection system with two bins one for the collection of general waste and one for recyclables collection. In addition, LMCC offer a drop off facility for green waste recycling, drop off for mixed waste and two bi-annual kerbside collection services for bulk goods and source separated green and metal waste.

**SSO**

The full description of the SSO option is Phased Source Separated Organics (Garden & Food Waste) Composted In-Vessel (Option 3). **Table 2** sets out the timing for introduction of the SSO option.

**Table 2. Phased 3 Bin SSO In-vessel composting implementation**

<table>
<thead>
<tr>
<th>Date</th>
<th>Actions</th>
<th>Option implemented</th>
<th>Collection frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 2012</strong></td>
<td>Prepare windrow site at Awaba</td>
<td>2 Bin landfill (business as usual)</td>
<td>Weekly MSW</td>
</tr>
<tr>
<td><strong>2012-2015</strong></td>
<td>Add green bin</td>
<td>3 Bin SSG Windrow</td>
<td>Weekly MSW</td>
</tr>
<tr>
<td></td>
<td>Green bin cost added as one-off to 2012 waste management costs</td>
<td></td>
<td>Fortnightly SSG</td>
</tr>
<tr>
<td></td>
<td>Process SSG via Windrow at Awaba</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private operator to build In-vessel composting facility for SSO at Awaba</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>From 2015</strong></td>
<td>Add food waste to the green bin</td>
<td>3 Bin SSO In-vessel Composting</td>
<td>Fortnightly MSW</td>
</tr>
<tr>
<td></td>
<td>Process SSO through new In-vessel Composting facility</td>
<td></td>
<td>Weekly SSO</td>
</tr>
</tbody>
</table>

In 2012, Garden (SSG) waste would be separated, at the home, and presented for kerbside collection in a third bin. The third bin would be collected fortnightly. The phasing would revolve around the introduction of food waste to the third bin.
SSG processing on its own has the disadvantage of not being able to achieve diversion targets, estimated to achieve only about 44%. Other organic streams need to be added if the 66% target is to be reached.

The second phase of the service would see the introduction of food waste to the third bin. At the time food is introduced, collection of the third bin (the organics bin) is typically shifted to weekly to minimise amenity issues (odour, bin cleanliness) for users. This has implications for the collection frequency of the residual bin which are discussed later.

This option permits LMCC to introduce the green waste service first and achieve resident understanding and support for the green waste recycling before adding food.

The introduction of food requires the process to move to enclosed “in-vessel” processing systems, rather than in open windrows to control odour.

The SSO composting process has the advantages of:

- Lower capital cost than MSW AWT ($20 million estimate vs $40 million);
- Lower operating cost overall;
- High recovery of organics and achievement of the 66% diversion target;
- Tunnel composting of SSO is well proven, tried and tested;
- Low risk in terms of the technology used;
- Low risk in terms of use and disposal of the output composts;
- The addition of food waste improves the quality of the compost by introducing additional nutrients to the mix;
- Overall, better quality compost product than AWT (no restrictions in use, ready markets etc);
- Planning approvals process is likely to be easier and simpler than AWT; and
- Relatively easy to communicate to users what can and cannot be presented for collection. (Note however that this is still more complicated than the two bin option).

The phased 3 bin option is slightly cheaper in the short term than the non-phased 3 bin option, though over time the cost of both becomes very close. The analysis in this report of the phased 3 bin SSO option is equally applicable to the non-phased option.

**MSW AWT**

The third highest ranked option from Part 2 is the retention of a two bin system, the same as the current collection system, with the separation of organics being managed at a processing facility. That is, the mixed waste is collected as it is now and delivered to a processing plant, rather than the tip face, at Awaba.

The proper description of this option is AWT processing of the MSW residual bin through an Aerobic Composting System.
The processing system could have a number of variations but in principle the likely key stages would comprise preliminary sorting to remove recyclables and oversized and non-organic items, mechanical mulching, initial composting in controlled conditions (i.e. in-vessel to manage odours), maturation composting potentially outdoors, and final refinement to remove a proportion of contaminants.

Table 3 sets out the timing for the AWT processing option. Note that it will take at least 4-5 years for this option to commence because of the extensive approval process and the more complicated construction program.

Table 3. AWT processing - 2 bin In-vessel MSW composting

<table>
<thead>
<tr>
<th>Date</th>
<th>Actions</th>
<th>Option implemented</th>
<th>Collection frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2015</td>
<td>Build In-vessel composting facility for MSW at Awaba</td>
<td>2 Bin landfill (business as usual)</td>
<td>Weekly MSW</td>
</tr>
<tr>
<td>From 2015</td>
<td></td>
<td>2 Bin In-Vessel</td>
<td>Weekly MSW</td>
</tr>
</tbody>
</table>

The 2 bin system has the advantages of:

- Achieving higher diversion rates than three bin options;
- Generating a smaller carbon footprint than three bin options;
- Facilitating dry recyclables recovery from the waste stream;
- Reducing the education ‘burden’ of introducing a third bin;
- Reducing the extent of change management required in Council’s own operations;
- Providing flexibility in future waste options, including a pathway to an energy from waste facility;
- Reducing the extent of service dissatisfaction opportunities amongst multi-unit dwelling occupants; and
- Has the capacity to introduce a third bin for SSO in the future should drivers dictate but this would make much of the AWT plant redundant and thus be a very expensive option.

The relative disadvantages of the two bin system are that it will likely be more costly than a three bin solution. This is because of the higher capital and operating costs of the mixed waste AWT processing plant.

The other disadvantage is that the compost product emanating from the process has limited application, being controlled due to the potential existence of contaminants within it, and it is subject to a strict regulatory regime as defined by the Organics Output General Exemption. Notwithstanding this LMCC is well placed to market such compost products due to its close proximity to the Hunter Valley’s mine site rehabilitation needs.
The location of an AWT processing plant at Awaba is subject to other approvals, which involves some approvals risk.

**Analysis and Results**

Historically, landfill has been the safe haven for price for disposal of waste and as such a preferred option for local Councils. This is no longer true. In fact the reverse is now true.

Landfill pricing is rising rapidly and now has considerable uncertainty driven by landfill levies, EPA requirements, CPRS and rising community expectations for performance.

Such policies have been the main driver for strong SSO / AWT development in NSW and the recent interest in such solutions by numerous NSW councils, including LMCC.

Well designed SSO and AWT plants can have a very long life and good returns on investment, while also producing a useful product.

**Costs – SSO Slightly Ahead as the Better Option**

After 10 years, in 2019, the key findings of the report are:

- The 3 bin option is cheaper per household than 2 bin AWT after 10 years SSO ($329 mill) and AWT ($333 mill).
- This is reflected in the average cost per householder rising from its current $297 to $575 for SSO and $609 for AWT in 2019. (Note that these are modelled costs and do not necessarily reflect all of the costs in the LMCC Domestic Waste Charge).
- The AWT plant is more expensive in 2019 and costs each householder an additional $34 per tenement per year.

After 30 years, in 2039, Lake Macquarie’s SSO composting option also costs less than the AWT option.

- SSO ($1,769 mill) is significantly cheaper than AWT ($1,909 mill).
- This is reflected in the average cost per householder rising from its current $297 to $1,491 for SSO and $1,657 for AWT in 2039 (**Figure 1**).
Diversion of Waste – SSO Best Over 10 Years Then AWT Slightly Ahead

Typically, MSW AWT composting technologies achieve 60% diversion of the input stream, whereas SSO achieves 95% - simply as a function of the cleaner input materials.

However, the MSW AWT processes a far larger tonnage of material and can extract not only the organics but also the recyclables left in the residual bin. Therefore, the AWT system can divert slightly more material over the longer term but the differences are small.

In the case of LMCC, the Source Separated Green (SSG) component of the phased introduction of SSO can be commenced from as early as 2012 (compared to AWT at 2015). Consequently, the SSO system can deliver a better diversion from landfill in the first 10 years than AWT.

- SSO diverts slightly more material from landfill over 10 years (486,633 t versus 471,703) because it commences earlier than the AWT process and particularly so with the phased system commencing in 2012.
Consequently, the SSO system sends less waste to landfill (433,516) over the first 10 years than AWT (448,446 t).

The average diversion rate is higher for SSO (52.1%) than AWT (50.2%) in the first 10 years.

Over 30 years, however, that starting advantage is eroded. Consequently, AWT delivers a better diversion rate over the longer time period.

- SSO diverts less material from landfill over 30 years (2.13 mill t) versus AWT (2.245 mill t) because AWT has a higher percentage recovery rate.
- The average diversion rate, including the first years where waste was being landfilled, is lower for SSO (61.5%) than AWT (64.2%) over the 30 year period.
- The AWT delivers a slightly higher diversion from landfill since it is able to capture and process all of the organics and some of the residual plastic, steel, glass and aluminium as well.

Commencement – SSO Ahead

SSO options can be commenced in 2012 rather than 2015 for AWT.

The transition to a full 3 Bin In-vessel SSO composting system is gradual, meaning there is no disruption to waste management and there is enough time to implement educational initiatives to promote the use of the third bin.

It should be noted that the transition from SSG to SSO will require a sophisticated education and marketing campaign by LMCC. It has been achieved successfully elsewhere but the campaign will need to be carefully targeted to local issues and resident needs.

Quality of Output – SSO Ahead

The end product of SSO composting processes is of considerably higher quality and value than MSW AWT composts.

The compost produced by 2 bin AWT is of lower value with restricted applications. Its use is currently restricted by the Organic Outputs General Exemption to forestry, mine site and landfill rehabilitation.

If any Council or private company is to produce AWT compost then LMCC is one of the best placed to do so due to the proximity to the Hunter Valley’s mine site rehab requirements.

Compatibility with Add-On Energy Options – SSO and AWT Same

3 Bin SSO AD could provide energy through AD generation and has worked well overseas. However, the only large scale anaerobic digesters in Australia have suffered economic and operational difficulties.

2 bin AD has proved very problematic in Australia and is not recommended for LMCC.
Both options lend themselves to thermal treatment of the dry residuals though, currently, thermal treatment may be difficult to obtain approvals for.

**Sensitivity Analysis and NPV**

The two options were also subjected to various sensitivity analyses as well as NPV comparisons for each variant. This analysis provides the following conclusions.

**Landfill levy increment 2015-2020:**

- 3 bin SSO is cheaper than 2 bin AWT at any landfill levy price;
- The NPV saving of SSO over AWT is affected minimally by the levy’s rate of increase and ranges from $48 million (at $0 levy increment) to $47 million (at a $2 increment); and
- As landfill levies increase both options become more expensive.

**Carbon sequestration credits:**

- After incorporating credits for carbon sequestration, 3 bin SSO is cheaper than 2 bin AWT at any carbon price;
- The NPV saving of SSO over AWT increases very slightly from $48.05 million (at $20 carbon price) to $48.42 million (at a $40 carbon price);
- As carbon prices rise and therefore, the sequestration credit becomes more valuable, the costs of both options decrease; and
- The decrease in costs for both options is marginal when compared to a scenario where sequestered carbon is not credited.

**Landfill gas capture rates for Awaba landfill:**

- 3 bin SSO is cheaper than 2 bin AWT at any gas capture rate from Awaba landfill;
- The NPV saving of SSO over AWT ranges from $30 million (at 0% gas capture at Awaba) to $63 million (at a 80% gas capture rate); and
- As the gas capture rate at Awaba improves from 0% to 80% the costs of both options decrease.

This NPV analysis suggests that the 3 bin SSO delivers a better cost outcome than the 2 bin AWT option over the 30 year period of the modelling irrespective of what assumptions are made about:

- landfill levy increases;
- the approval of carbon credits for sequestration of carbon in soil;
- the value of those carbon credits; and
- the degree of gas capture at the Awaba landfill for residuals produced by the processes.

However, cost differences are relatively small and at best they represent a 4% to 8% cost saving depending on the tested assumption. In assessing the results of the sensitivity analysis,
it is important to consider that these assumptions cannot be controlled by council (with the possible exception of gas capture).

**Implementation**

The most common configuration of SSO services is a weekly collection of the green bin and a fortnightly collection of the residual (red) bin. This alternates with the fortnightly collection of the yellow top recycling bin.

The alternative is sometimes to have both the SSO bin and the Residual bin collected weekly. This requires that every second week 3 bins are placed at the kerb. These configurations are summarised in Table 4.

**Table 4. Bin collection frequency – the effect on households**

<table>
<thead>
<tr>
<th>Waste Treatment Option</th>
<th>Fortnightly Residual service</th>
<th>Weekly Residual service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The inefficiencies associated with weekly collections of both the SSO and the Residual bins are obvious. It requires 3 truck passes of each house every second week. This is not recommended and would have a significant effect on cost.

NB: A fortnightly residual service was assumed in modelling the 3bin SSO scenario.

**Bins and Biobags**

All of the broad scale SSO services in Australia have utilised a 240 litre MGB.

The provision of kitchen tidies was found by all studies to improve diversion as well as participation rates. Vented kitchen containers combined with clearly identifiable compostable liner bags were shown to increase user satisfaction (Hyder 2010).

Bio bags must be clearly identified as distinct from shopping bags which are not biodegradable or compostable.
The use and merits of biobags and kitchen tidies may be considered in a future implementation paper once LMCC determines its preferred direction and options.

SSO systems such as tunnel composting plants can accept a certain amount of contamination. Generally, operators will set a maximum acceptable contamination level of 6-10%. Thereafter, they may require the payment of a contamination penalty.

Building in education funding to the contract will guarantee adequate information and contamination reduction programs. “Three strikes” policies of advising households which contaminate their bins of the ultimate sanction of removing their bins, have also proved successful, and in some communities, have been necessary.

A number of Councils have provided for smaller residual bins in association with both AWT and SSO systems. The common practice is to reduce the Residual (red lidded garbage bin) from a 240 litre weekly service to a 140 litre bin collected fortnightly.

The reduction in bin size can be either compulsory or voluntary.

One important consideration is the magnitude of the discounted collection fee provided for smaller residual bins (say from 240 litres to 140 litres). Polluter pays principles would dictate that those households using smaller bins and generating less waste should receive a price discount on collection costs via their Domestic Waste Charge.

The discount should only be a proportion of the marginal cost savings. The council still bears an “availability cost” associated with the fixed costs of the truck driving by the house, the costs of the driver, the costs of the processing facility etc.

Typically, the discount rate is 20-30% of the Residual component of the Domestic Waste Charge. LMCC should calculate this cost but it is likely to be less than $30 per household per year.

Given the recent experiences in Australia, LC would recommend the following:

- The green lidded SSO bin be 240 litres;
- Aeration holes to prevent odour would be advantageous but not a necessity;
- Residual red lidded bins should be 240 litres as per current;
- Residual 140 litre bins be optional; and
- Residual 140 litre bins be offered at a discounted collection cost with the discount approximating the variable cost reduction associated of the Residual waste component of the Domestic Waste Charge.
Project Alternatives and Market Forces

The continued usage of Awaba landfill as a long term solution for waste management is deemed unstable. Rising costs due to the increasing levy are just one part of the equation. The NSW government is increasingly regulating and legislating against the landfilling of waste. Recently, the SEPP was amended shifting emphasis for approval of future landfill sites from justifiable demand to increased recovery and waste minimisation before disposal. In other words, landfills will only be granted approval if waste is minimised before disposal. In real life terms, this means that waste has to be treated either through an SSO plant or through an AWT.

In order to maximise waste diversion, a number of initiatives warrant further examination. Home composting, reuse shops and strategies to minimise leakage of recyclables are actions that are compatible with either of the suggested approach.

However, both of these options have strengths and weaknesses:

**SSO**

- The market for provision of 240 litre MGBs, biobags and kitchen tidies is very competitive.
- The market for collection of green waste is highly competitive.
- The market for processing of SSG, SSO and combinations thereof are highly competitive.
- The market for high value AS4454 compliant composts is good.

**AWT MSW Residual Composting**

- The market for the supply of AWT composting processes for mixed residual MSW in Australia is high.
- The AWT MSW residual composting plants produce a lower grade compost characterised by physical contaminants (glass and plastic fragments) and variable chemical contaminants (often lead and zinc).
- The market for the lower grade AWT residual composts is expanding in mine site rehabilitation in the Hunter Region.

There is no doubt that the market for SSO compost is more buoyant than that for MSW residuals.

LMCC can be confident that with a well designed, targeted and implemented procurement strategy, that it should be in a position to achieve an excellent processing and collection outcome.
Tendering and Contracting

Procurement is an important aspect of the technology selection process. Done right, it ensures that council will bear a weighted proportion of the risk associated with this kind of investment in order to ensure a gate fee that is not inflated due to the Provider taking on risk that is best held by council. If either Council or the Provider shoulder risk that should be best held by the other party the risk profile of the project increases and so do the costs.

In calling for tenders, LC recommends that the documentation specifically request tenderers to supply options for SSO in-vessel composting and potentially for AWT residual MSW composting. These systems have a proven track record in Australia, satisfy the test of having a 3 year profitable P+L and are robust technologies capable of handling changes in waste streams over time.

It is also desirable that tenderers be allowed to put forward options for other higher risk and energy based systems if they wish to do so. However, these should be clearly identified as non-conforming options to clearly signal to the market the Council’s direction. It is very important to minimise the number of options and variations requested by tenderers to the ones that council really wishes to pursue.

Designing a collection system once the treatment technology is decided is relatively straightforward. Irrespective of the preferred system, Providers always prefer to lock Council in long term contracts (minimum of 15 years) to ensure depreciation of the assets.

If Council determines to contract over a shorter period then a bubble contract can be agreed allowing the transfer of viable assets to Council for an agreed price based on an agreed valuation process.

To the extent that Council can guarantee certain aspects of the contract the lower the risk to the operator and consequently the lower the cost of the service.

The report provides a detailed discussion of the following relevant issues and process specific recommendations:

- Tender design and process;
- Contracting process and design;
- Risk understanding and mitigation;
- Council obligations towards tenderers;
- KPI’s;
- Performance measurement;
- Emissions trading and government policies;
- Waste education; and
- Willingness to pay.
Recommendations

Both preferred systems achieve the 66% diversion target and are relatively low risk. The 3 bin can be phased and start very soon, in 2012. As a result it diverts a higher percentage of the waste over the short term. Over the longer-term 2 bin AWT performs better.

However, a 3 bin SSO system delivers better compost for which there is currently a good market whereas AWT compost application is constrained by the 3F exemption. This is also one of the main reasons that during community consultation sessions LMCC residents overwhelmingly supported the 3 bin SSO system.

On balance, 3 bin SSO provides slightly higher benefits at low risk and lower cost. Moreover, the currently very competitive market for tunnel composting is likely to provide even better value for money. Therefore, LC recommends that council adopt a low risk, high value processing technology for SSO with a management transition arrangement to commence SSG from 2012.

In brief, it is recommended that LMCC:

- Run a tender for SSO 3 bin phased processing to commence in 2014/2015;
- Allow for non conforming AWT variants;
- Commence 3 bin SSG once tender determined (if 3 bin option is confirmed); and
- Engage in community education as soon as possible.
1.0 Introduction

Lake Macquarie City Council (LMCC) is one of the largest councils in NSW and provides a diverse range of waste services to the community, including domestic kerbside waste and recycling collections, specialised waste collections (sharps, oil, and hazardous waste), commercial and industrial collection services, as well as maintaining key associated waste infrastructure such as landfill and Teralba Worm Farm.

The termination of plans for a regional Advanced Waste Treatment (AWT) facility in 2009 has produced a need for Council to rapidly assess its remaining landfill capacity and waste disposal options and develop new, strategic, and flexible plans for waste management in the short, medium, and long term. In this regard, Council has embarked on a Waste Strategy Development project to ensure it meets the waste management needs and expectations of the community in long-term financially, ecologically, and socially sustainable ways.

1.1 Objectives of the Waste Strategy Project

Developing a new Waste Strategy for the City is being carried out through modules of sequential and concurrent tasks outlined in LMCC’s Waste Strategy Project Plan.

The overarching aims of LMCC’s Waste Strategy Development Project are to develop a new Waste Strategy that delivers a waste management system that:

- is consistent with Council’s environmental, social and economic policies and Corporate Plan, that has support from the business and residential community;
- is a safe, cost-effective and convenient waste management service for its customers and workers, that utilises wherever possible best available waste management technologies and delivery methods appropriate to the local situation;
- retains flexibility, in order to adapt to rapidly developing technological, financial, environmental, social and legislative contexts – allowing Lake Macquarie to maximise opportunities and minimise risks; and
- implements immediate, short term actions that have been identified as beneficial, whatever final strategy prevails.
Waste management activities that are currently being undertaken to achieve (and/or as supportive pieces of research to underpin) development of a strategy include:

1. Promoting increased uptake of home composting;
2. Investigation of diversion opportunities from Awaba landfill;
3. Roll-out of a broad scale waste awareness and education media campaign;
4. Collection of waste stream data from audits at Awaba landfill and of bins presented for collection;
5. Completion of a global best practice review of waste management strategies potentially applicable to Lake Macquarie;
6. Completion of a model determining the benchmark value of airspace at Awaba; and
7. Options for extension of the existing Awaba landfill.

Council has identified potential options to manage wastes including:

1. Extending the life of the existing Awaba landfill;
2. Developing a new landfill in the LMCC local government area;
3. Developing a new alternative waste treatment facility in the LMCC local government area (may include a landfill component);
4. Access to landfill(s) operated by others;
5. Access to an alternative waste treatment facility operated by others;
6. Development of resource recovery initiatives and/or facilities; and
7. Combination of 2 or more of the above.

This report includes analysis of the costs and benefits of the most likely processing methods, collection methods, disposal costs, transport costs, impacts on employment, risks associated with each technology, risks associated with community involvement, acceptability to the community and feasibility within the context of Lake Macquarie’s waste targets and other imperatives.

This analysis considers the feasibility of each likely option and risks associated with each option in relation to:

- Potential location of site(s).
- Life-spans and/or timeframes for waste acceptance options.
- Resource recovery potential for each option and subsequent quantities destined for landfill.
- Transport impacts of options including direct haul, transfer stations and bulk haul options.
- Capital and operating cost estimates.
- The flexibility of each solution to respond to changing technology and policy, legislation (including pricing and tax determinations) and community attitudes during the life of the service. This should include an estimate of the period any solution needs to be 'locked in' for financial or resource utilisation reasons.
- Development consent process and potential issues of contention for each option including probable timeframes for approvals, construction and commissioning.
- Carbon and/or energy footprints for each.

Part 1 of this work involved a Review of Waste Input Data and Forecasting Assumptions. Data sourced from kerbside audits (2008), landfill audits (2010) and Awaba weighbridge was incorporated into a 10 year model.

Part 2 takes up the main theme of processing MSW putrescible waste.

Part 3 examines recycling options for all of the other main waste streams.

Part 4 examines the implementation of the preferred options affecting the municipal waste streams (this report).
2.0 Scope of this Paper

This paper will undertake:

1. Analysis of selected strategic options;
2. Detailed financial analysis of the preferred waste strategy options;
3. Include consultation outcomes from key stakeholders;
4. Strategic risk assessment of preferred options;
5. Determination of synergies in service delivery or site management;
6. Articulation of commercial or other risks;
7. Analysis of the flexibility of each solution to respond to changing policy, legislation and community attitudes during the life of the service;
8. An estimate of the period any solution needs to be locked in for financial or resource utilisation reasons;
9. Development of clear objectives and outputs for future assessment of performance following implementation;
10. Development and articulation of preferred arrangements for service delivery of collection, bin sizes and pricing, asset and facilities ownership, recycling and disposal facilities;
11. Benchmarking preferred strategy against existing facilities and prices;
12. Determination of likely cost increments;
13. Development of gate price funding model and implications for rates;
14. Identification of offsets e.g. compost sales and commodity values;
15. Incorporation of market research on willingness to pay;
16. Examination of external price and policy influencers;
17. Liaison with DECCW and other stakeholders; and
18. Provision of information for development of a public discussion paper.

The deliverables for this project are an LMCC Preferred Waste Strategy describing waste management solutions identified as optimal. The Strategy will examine in detail financial implications, associated risk and will perform a residual risk assessment, quantifying any cross linkages or synergies.
3.0 Background to this Report – Setting the Scene

3.1 Drivers of Waste Reform at Lake Macquarie

The most critical issues driving the need for an urgent response include:

3.1.1 Awaba Waste Management Facility Capacity

Council’s only active landfill at Awaba has limited capacity to continue accepting waste. Under the terms of the existing approval for the site, it has a maximum estimated life of 5-6 years.

3.1.2 Waste Levies

In order to discourage landfilling, the NSW Government charges a levy, on a per tonne basis, for all material that is disposed of in a landfill. The levy for Lake Macquarie is set at $65.30 per tonne for FY 2010/11 and is scheduled to increase by $11.50 per tonne plus CPI until 2015/16.

In total, Council forfeited $6.1 million to the NSW Government in waste levies in the 2009/10 financial year. The annual cost of the levy to the Lake Macquarie waste service is likely to be about $18.7 million by 2016 if no increase in diversion away from landfill is achieved.

3.1.3 Carbon Price

Landfill operations generate methane through the anaerobic decomposition of organic materials interred within them. Methane is a powerful greenhouse gas with 21 times the global warming potential of carbon dioxide (the IPCC has revised this number to 25 but DCC has not adopted this yet).

There is a real possibility that a carbon price will be enacted in this period of Government and certainly within a 5 year period.

The draft CPRS included methane emissions from landfill in the coverage of the carbon price but excluded legacy waste emissions. The CPRS would have added an estimated $600,000 to the cost of operating Awaba landfill in year 1 increasing to $1.3 million by year 3.

It is not possible to predict the timing, nature or quantum of new carbon pollution reduction schemes in Australia, but current indications are it will be on the agenda of the new Federal Government in the current parliamentary term.
3.1.4 **NSW Waste Diversion Policies**

The NSW Government has adopted a policy of diverting a minimum of 66% of domestic waste from landfill by 2014.

There are also diversion targets for Commercial and Industrial Waste (63%) and Construction and Demolition Waste (76%), also by 2014. These are known as the WARR Targets (Waste Avoidance and Resource Recovery).

There is no legislative enforcement of these diversion targets, and currently no direct link to the payment of WASIP performance payments although such a link has been mooted by the NSW DECCW. In the current financial year, LMCC can expect a WASIP payment of approximately $890,000 growing to $1.5 million in 2016.

It is likely that future WASIP payment will be linked to achievement or actions towards achieving the NSW 66% MSW diversion targets.

3.1.5 **Community Expectations**

The work undertaken to formulate the 10 Year Community Plan identified a community expectation that Council, in its operations and services, should become more sustainable over time.

In the 2009 community plan, the environment ranked very highly (2nd in importance) amongst Council’s areas of responsibility.

Though satisfaction with current waste management services ranks highly amongst residents, it would be reasonable to expect that satisfaction to fall away as costs rise (e.g. due to the waste levy) without a commensurate improvement in environmental performance.

3.2 **The Process to Date**

The Strategy development process includes 4 independent reports.

1. *Review of Waste Input Data and Forecasting Assumptions Part 1.* The part one report sets out the basic assumptions for modelling options and forecasts for the subsequent reports.


4. *The Part 4 Report* (this report) examines the evaluation and implementation arrangements for the two preferred systems which were proposed in Part 2.

### 3.3 Outcomes of the Part 2 Report - Summary

The Part 2 Report provided the basis of this Implementation Report.

In early September 2010, LMCC released the Part 2 Report of this investigation which explored the systems and technologies available to the people of Lake Macquarie to reduce their waste to landfill. The ten waste management options which were considered are set out in Table 5.

These options were identified by examining Lake Macquarie’s existing domestic waste stream to determine what fractions needed to be processed or recovered to achieve the state target of 66%.

Available technologies were then identified and their performance, particularly in Australia determined. This list of potential options incorporating available technologies was compared to the risk profile agreed by the Waste Advisory Committee (workshop of 19 November 2009).

**Table 5. Technologies reviewed for LMCC**

<table>
<thead>
<tr>
<th>Waste Option</th>
<th>Kerbside bin configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>3 Bin SSG Windrow</em></td>
<td>Residual MSW Recycling Green only-SSG</td>
<td>3 bin, source separated green only to windrow composting</td>
</tr>
<tr>
<td>2. <em>3 Bin SSO In vessel Comp</em></td>
<td>Residual MSW Recycling Organics- SSO</td>
<td>3 bin source separated green and food to In Vessel composting</td>
</tr>
<tr>
<td>3. Phased 3 Bin SSO In-vessel Comp</td>
<td>Residual MSW Recycling Organics - SSO</td>
<td>Initial 3 bin source separated garden and subsequent garden &amp; food to In Vessel composting</td>
</tr>
<tr>
<td>4. <em>3 Bin SSO AD</em></td>
<td>Residual MSW Recycling Organics - SSO</td>
<td>3 bin source separated green and food to Anaerobic Digestion</td>
</tr>
<tr>
<td>Waste Option</td>
<td>Kerbside bin configuration</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>7. 2 Bin Invessel Comp</td>
<td>Residual MSW Recycling</td>
<td>2 Bin MSW enclosed composting</td>
</tr>
<tr>
<td>8. 2 Bin Invessel Comp PS</td>
<td>Residual MSW Recycling</td>
<td>2 Bin MSW enclosed composting</td>
</tr>
<tr>
<td>9. 2 Bin Invessel Comp PS +EfW</td>
<td>Residual MSW Recycling</td>
<td>2 Bin MSW enclosed composting + Energy from Waste on residuals</td>
</tr>
<tr>
<td>10. 2 Bin AD</td>
<td>Residual MSW Recycling</td>
<td>2 Bin MSW Anaerobic Digestion</td>
</tr>
</tbody>
</table>

Key:
- AD Anaerobic Digestion
- EfW Energy from Waste
- PS Port Stephens
- SSG Source Separated Green only
- SSO Source Separated Organics (including green and food)

The bin configurations for each of these options is summarised in Table 6.

Table 6. Options and bin configurations assessed in Part 2 Report

<table>
<thead>
<tr>
<th>No</th>
<th>Waste Treatment Option</th>
<th>Bin Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 Bin Source Separated Green Waste – Windrow Composting</td>
<td>[Images]</td>
<td>Green garden waste only (i.e. excluding food waste) collected in a third bin and composted in open windrows.</td>
</tr>
<tr>
<td>2</td>
<td>3 Bin Source Separated Organics - In-vessel Composting</td>
<td>[Images]</td>
<td>Green and food waste collected in a third bin and composted in enclosed tunnels.</td>
</tr>
<tr>
<td>3</td>
<td>Phased 3 Bin Source Separated Organics – In-vessel Composting</td>
<td>[Images]</td>
<td>Green and food waste collected in a third bin and composted in enclosed tunnels. Same end situation as option 2, but staged so that the third bin collection starts out with garden waste only, composted in open windrows (same as option 1). When Council chooses (+3 years used for analysis), food waste collection in the third bin commences and composting occurs in enclosed tunnels.</td>
</tr>
<tr>
<td>4</td>
<td>3 Bin Source Separated Organics – Anaerobic Digestion</td>
<td>[Images]</td>
<td>Green and food waste collected in a third bin and composted in the absence of oxygen, anaerobic digestion. Methane produced, captured and burnt for energy.</td>
</tr>
</tbody>
</table>
The most significant result of analysing performance and risk was to remove options to burn waste (pyrolysis, mass burn, gasification and incineration), as stand-alone solutions. These options are typically grouped as thermal processing options.

One energy from waste (EfW) option was retained (Option 9), but only as a longer term potential add-on to an existing proven facility, namely the Bedminster composter at Port Stephens (Pt Stephens). This option might be permitted as a variation to Option 7.

The other key outcome of the risk and performance analysis was the identification of reservations with regards to the performance of anaerobic digestion (AD) solutions for waste management.

The consensus in Council’s project team reflects the industry position that AD promises a very attractive waste management solution. It requires a small footprint, achieves very high diversion rates, maximises energy recovery, produces composites that are attractive for their carbon content, and produces virtually no amenity issues for adjoining land uses.
The difficulty with the technology is that it is expensive, is highly susceptible to problems arising as a result of heterogeneous feedstock and as such the technology has not performed well in processing mixed residual household waste. Further, until electricity prices rise substantially, AD facilities depend almost entirely on the input gate fee (like the composting facilities) and are, therefore, no more commercially viable than composting technologies. In practice, AD for MSW in Australia has promised much but suffered operational and subsequent commercial difficulties.

Each option was assessed against a range of criteria including current and future costs, cost per household, diversion from landfill and greenhouse gas emissions. The results are summarised in Figure 2.

Figure 2. Summary of cost and diversion capacity of each option over 10 years
The Part 2 Report determined that while landfill is the cheapest option in 2010 it becomes considerably more expensive over 10 and 30 years compared to the alternatives. It also fails to achieve the Councils goal of meeting the State Government target of 66% diversion of household waste from landfill by 2014.

The options were ranked on a Sustainability Assessment Index which included factors of cost, risk, environmental improvement, acceptability, integrity with existing systems etc. The 10 options evaluated are set out in Table 7.

Table 7. Sustainability scores of options

<table>
<thead>
<tr>
<th>OPTION</th>
<th>RANK</th>
<th>CHARACTERISTICS</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL (PHASED INTRODUCTION)</td>
<td>880</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL</td>
<td>824</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>2 BIN MSW ENCLOSED COMPOSTING OF MIXED WASTE (AWABA)</td>
<td>802</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>3 BIN SOURCE SEPARATED GARDEN WASTE COMPOSTED IN OPEN WINDROW</td>
<td>796</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>2 BIN IN VESSEL COMPOSTING @ PT STEPHENS +EfW (NB: EfW Option currently not available)</td>
<td>792</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>2 BIN MSW ENCLOSED COMPOSTING (PT STEPHENS – EXISTING AWT)</td>
<td>770</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>2 BIN MSW SORT + ANAEROBIC DIGESTION OF MIXED WASTE</td>
<td>764</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>3 BIN SOURCE SEPARATED GARDEN AND FOOD WASTE TO ANAEROBIC DIGESTION</td>
<td>763</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>2 BIN + BIO-REACTOR LANDFILL</td>
<td>658</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>2 BIN + LANDFILL (BAU)</td>
<td>663</td>
</tr>
</tbody>
</table>
Of these ten the preferred options were Options 3, 2 and 7 which scored highest on the Sustainability Assessment.

Phased three bin source separation of organics (including food and green waste) best aligned with LMCC’s circumstances and goals. The option for weekly or fortnightly collection of the residual bin is discussed in this Part 4 Report.

The other high scoring system is a two bin system using a high quality mechanical sorting facility with enclosed composting.

The issue of two bins or three bins is pivotal and further work on public acceptability needs to be done to inform this decision by LMCC. The public are far more interested in issues such as bin options and charging regimes than they are in what happens to their waste post collection.

An exemplary processing system coupled with an unpopular collection or charging regime is likely to damage the spirit of co-operation that is needed between Council and the public.

Consideration of the various implementation issues for the preferred options forms the basis of this Part 4 Report.
4.0 Detailing the Preferred Options - SWOT

4.1 Preferred Options

The highest ranking options identified by the Part 2 Report were:

<table>
<thead>
<tr>
<th>OPTION</th>
<th>RANK</th>
<th>CHARACTERISTICS</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td><strong>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL (PHASED INTRODUCTION)</strong></td>
<td>880</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td><strong>3 BIN SOURCE SEPARATED GARDEN &amp; FOOD WASTE COMPOSTED IN VESSEL</strong></td>
<td>824</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td><strong>2 BIN MSW ENCLOSED COMPOSTING OF MIXED WASTE (AWABA)</strong></td>
<td>802</td>
</tr>
</tbody>
</table>

4.2 Describing the Processes

Currently, LMCC implement a kerbside collection system with two bins one for the collection of general waste and one for recyclables collection. In addition, LMCC offer a drop off facility for green waste recycling, dry recyclables, e-waste drop off for mixed waste and two bi-annual kerbside collections for bulk goods and source separated green waste.

All options retain these services. Therefore, even in systems with 3 kerbside bins, the green waste drop off facility is operational *(Table 8)*.

<table>
<thead>
<tr>
<th>Kerbside bin configuration</th>
<th>MSW processing facility</th>
<th>Description</th>
</tr>
</thead>
</table>
| **3 Bin SSO In-vessel Comp** | 1. Residual MSW  
2. Recycling  
3. Organics  
Awaba  
3 bin source separated green and food to Vessel composting. Options for phased introduction |
| **2 Bin In-vessel Comp** | 1. Residual MSW  
2. Recycling  
Awaba  
2 Bin MSW enclosed composting |
### 4.3 Source Separated Organics 3 Bin Option

The full description of this option is Phased Source Separated Organics (Garden & Food Waste) Composted In-Vessel (Option 3)

Table 9 sets out the timing schedule for the phased introduction of the 3 bin SSO option.

<table>
<thead>
<tr>
<th>Date</th>
<th>Actions</th>
<th>Option implemented</th>
<th>Collection frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2012</td>
<td>Prepare windrows at Awaba</td>
<td>2 Bin landfill (business as usual)</td>
<td>Weekly MSW</td>
</tr>
<tr>
<td>2012-2015</td>
<td>Add green bin</td>
<td>3 Bin SSG Windrow</td>
<td>Weekly MSW Weekly Green</td>
</tr>
<tr>
<td></td>
<td>Green bin cost added as one-off to 2012 waste management costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process greens via Windrow at Awaba</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private operator to build In-vessel composting facility for SSO at Awaba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 2015</td>
<td>Add food waste to the green bin</td>
<td>3 Bin SSO In-vessel Composting</td>
<td>Fortnightly MSW Weekly Organics</td>
</tr>
<tr>
<td></td>
<td>Process organics through new In-vessel Composting facility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In 2012, Garden (green) waste would be separated, at the home, and presented for kerbside collection in a third bin. The third bin would be collected fortnightly. The phasing would revolve around the introduction of food waste to the third bin.

In Phase 1, only garden (green) waste would be collected in the third bin. This would allow its processing through open (outdoors) windrow composting. Phase 1 SSG has the advantages of:

- I don’t think we have visited a site treating MGB collected SSG waste via open air windrow composting? I understand Wyong is / has doing this via contract with ANL? What were / are contamination rates like? Are they able to market output compost?
- Being low capital intensive and low cost overall;
- Requiring limited infrastructure to undertake, it requires a relatively brief lead time for its commencement;
- Low risk in terms of the technology used and disposal of the outputs;
- Likely to enjoy a relatively brief approval process; and
- Relatively easy to communicate to users what can and cannot be presented for collection.

Green organic processing on its own has the disadvantage of not being able to achieve diversion targets, estimated to achieve only about 44%. Other organic streams need to be added if the 66% target is to be reached.
The second phase of the service would see the introduction of food waste to the third bin. At the time food is introduced, collection of the third bin (the organics bin) is typically shifted to weekly to minimise amenity issues (odour, bin cleanliness) for users. This has implications for the collection frequency of the residual bin which are discussed later.

This option permits LMCC to introduce the green waste service first and achieve resident understanding and support for the green waste recycling before adding food.

The introduction of food requires the process to move to enclosed “in-vessel” processing systems, rather than in open windrows to control odour.

The SSO composting process has the advantages of:

- Lower capital cost than AWT ($20 million estimate vs $40 million);
- Lower operating cost overall;
- High recovery of organics and achievement of the 66% diversion target;
- Tunnel composting of SSO is well proven, tried and tested;
- Low risk in terms of the technology used;
- Low risk in terms of use of the output composts;
- The addition of food waste improves the quality of the compost by introducing additional nutrients to the mix;
- Output composts are overall of much better quality than AWT composts and enjoy market acceptance;
- Planning approvals process is likely to be easier and simpler than AWT; and
- Relatively easy to communicate to users what can and cannot be presented for collection.

4.3.1 Non-Phased Option for SSO

The non-phased SSO variant provides the same end-point as option 3 but does not include the phasing. That is, from the outset, food as well as garden organics is placed in the third bin to be collected for processing in-vessel. This arrangement would also require the organics bin to be a weekly service to manage user amenity.

The phased 3 bin option is slightly cheaper in the short term than the non-phased 3 bin option, though over time the cost of both becomes very close. The phased option sends less organics to landfill because it begins diverting green waste from landfill in 2012 as opposed to 2014/15 for the SSO non-phased option.

The analysis in this report of the phased 3 bin SSO option is equally applicable to the non-phased option.

4.4 MSW AWT Enclosed Composting 2 Bin (Option 7)

The third highest ranked option is the retention of a two bin system, the same as the current collection system, with the separation of organics being managed at the processing stage.
That is, the mixed waste is collected as it is now and delivered to a processing plant, rather than the tip face, at Awaba.

The processing system could have a number of variations but in principle the likely key stages would comprise preliminary sorting to remove recyclables and oversized items, mechanical mulching, initial composting in controlled conditions (i.e. in-vessel to manage odours), maturation composting potentially outdoors, and final refinement to remove a proportion of contaminants.

**Table 10** sets out the timing for the phased AWT processing option. Note that it will take at least 4-5 years for this option to commence because of the extensive approval process and the more complicated construction program.

**Table 10. AWT processing - 2 bin In-vessel MSW composting**

<table>
<thead>
<tr>
<th>Date</th>
<th>Actions</th>
<th>Option implemented</th>
<th>Collection frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up to 2015</strong></td>
<td>Build In-vessel composting facility for MSW at Awaba</td>
<td>2 Bin landfill (business as usual)</td>
<td>Weekly MSW</td>
</tr>
<tr>
<td><strong>From 2015</strong></td>
<td></td>
<td>2 Bin In-Vessel</td>
<td>Weekly MSW</td>
</tr>
</tbody>
</table>

The 2 bin system has the advantages of:

- Doesn’t require purchase and delivery of a third bin;
- Avoids collection of a third bin;
- Less truck damage to roads
- Generating a smaller carbon footprint than three bin options;
- Achieving higher diversion rates than three bin options;
- Facilitating dry recyclables recovery from the residual waste stream;
- Reducing the education ‘burden’ of introducing a third bin;
- Reducing the extent of change management required in Council’s own operations;
- Providing flexibility in future waste options, including a pathway to an energy from waste facility; and
- Reducing the extent of service dissatisfaction opportunities amongst multi-unit dwelling occupants.

The relative disadvantages of the two bin system are that it will likely be more costly than a three bin solution. This is because of the higher capital and operating costs of the mixed waste AWT processing plant.

The other disadvantage is that the compost product emanating from the process has limited application, being controlled due to the potential existence of contaminants within it, and it is subject to a strict regulatory regime as defined by the Organics Output General Exemption.
The location of a processing plant at Awaba is subject to approvals and therefore, is subject to some approvals risk. The Awaba label is used in describing option 7 to distinguish it from the Port Stephens options (Part 2 options 8 and 9) and to provide a basis for modelling the collection task.

4.4.1 **SWOT - SSO**

The SWOT of the 3 bin option is given in Table 11 below. For the purposes of this Part 4 Report Options 3 (phased) and Option 2 (non-phased) are considered together.

**Table 11. SWOT Analysis 3 bin Source Separated Organics in-vessel composting**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent diversion from landfill of compostable /GHG emitting material</td>
<td>New facility needs to be built</td>
</tr>
<tr>
<td>Local site (Awaba), minimal transportation</td>
<td>Capital cost</td>
</tr>
<tr>
<td>Proven, reliable technology (already operational in Australia)</td>
<td>Lower landfill diversion than incineration technologies</td>
</tr>
<tr>
<td>Highly controlled option unaffected by weather</td>
<td>Extra cost of 3rd bin</td>
</tr>
<tr>
<td>Product (compost) of high quality- can be certified to Australian Standards</td>
<td>Additional collection costs</td>
</tr>
<tr>
<td>Existing market for clean compost</td>
<td>Additional road maintenance costs</td>
</tr>
<tr>
<td>Reasonably priced option</td>
<td>Depends on community participation and acceptance of the 3rd bin</td>
</tr>
<tr>
<td>Reduces costs of landfilling</td>
<td>Once Council decides on this technology, it will be a long term contractual commitment. Therefore, council will not be able to take advantage of potential market competition that could lead to a reduction in waste management prices</td>
</tr>
<tr>
<td>This local solution complies with “extended product responsibility” principle- waste is recycled and disposed of where it is generated</td>
<td></td>
</tr>
<tr>
<td>Residual MSW bin will be dry- no vermin or odour problems (In 2nd phase)</td>
<td></td>
</tr>
<tr>
<td>MSW residuals collection will be fortnightly (In 2nd phase)</td>
<td></td>
</tr>
<tr>
<td>Council portrayed as progressive and green</td>
<td></td>
</tr>
</tbody>
</table>

09-524-5.2-R-004 (FINAL Strategic Waste Options & TBL Analysis - PART 4 Implementation Considerations)
Addition of 3rd bin, in-vessel composting of SSO

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Assists council in achieving the 66% WARR landfill diversion target</td>
<td></td>
</tr>
<tr>
<td>• Awaba jobs maintained</td>
<td></td>
</tr>
</tbody>
</table>

Opportunities

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Creation of green jobs within LMCC LGA</td>
<td>• Third bin will result to lower green drop off that potentially may lead to a decrease in the sale of compost products- reduced exposure of customers to the product</td>
</tr>
<tr>
<td>• Education campaign for 3rd bin could act as a preamble to further recycling education</td>
<td>• Risk of low community participation in source separation</td>
</tr>
<tr>
<td>• People involvement in waste management</td>
<td>• May result to oversupply of compost- market constrains</td>
</tr>
<tr>
<td>• Strengthening community ties</td>
<td>• Risks of constructing and operating a new facility (processes will need fine tuning, equipment adjustment etc)</td>
</tr>
<tr>
<td>• Giving people a sense of contributing to a better environment (their actions matter)</td>
<td></td>
</tr>
<tr>
<td>• Potential for partnership with community groups (such as community gardens)</td>
<td></td>
</tr>
<tr>
<td>• Promotion of sustainability- green living</td>
<td></td>
</tr>
</tbody>
</table>

4.4.2  SWOT Residual AWT Processing

The SWOT of the 2 bin option is given in Table 12 below.

Table 12. SWOT Analysis - 2 bin in-vessel composting

<table>
<thead>
<tr>
<th>In-vessel composting of MSW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
</tr>
<tr>
<td>• Well established and effective treatment process especially with MSW having high organic fraction</td>
</tr>
<tr>
<td>• Small facility footprint</td>
</tr>
</tbody>
</table>
- Excellent diversion from landfill of compostable /GHG emitting material
- Local site (Awaba), minimal transportation
- Proven, reliable technology
- The technology is already operational in Australia
- Product (MSW compost) is approved for controlled land application
- Reasonably priced option but costlier than 3 bin solutions
- This local solution complies with “extended product responsibility” principle- waste is recycled and disposed of where it is generated
- Council seen as technologically advanced and proactive with regards to waste management
- Assists council in achieving the 66% WARR landfill diversion target
- Less education / promotion required for success.
- Proximity to Hunter Valley for marketing output compost
- Lower landfill diversion than incineration technologies
- Capital and operational costs
- MSW compost product of low quality
- Limited market/applications for MSW compost products
- Once Council decides on this technology, it will be a long term contractual commitment and will not be able to take advantage of potential market competition that could lead to a reduction in waste management prices

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Creation of green jobs within LMCC</td>
<td>- Resistance to siting of the facility in Awaba</td>
</tr>
<tr>
<td>LGA</td>
<td>- 3F exemption for the land application of MSW composts could be revoked in the future</td>
</tr>
<tr>
<td>- Market potential for MSW composites</td>
<td>- The future of the CPRS is uncertain</td>
</tr>
<tr>
<td>- Promotion of sustainability and</td>
<td>- Market oversaturation- unable to sell/apply MSW compost to land and having to landfill it</td>
</tr>
<tr>
<td>environmentally responsible waste</td>
<td></td>
</tr>
<tr>
<td>management</td>
<td>- Risks of constructing and operating a new facility (processes will need fine tuning, equipment adjustment etc)</td>
</tr>
</tbody>
</table>
The remainder of this report looks at the relative costs of these options in more detail, the practical implications of delivering these options, the sensitivity of the options to changing assumptions and stronger or weaker drivers and then the detailed requirements of tendering for either or both options.
5.0 Assumptions –Detailed Cost Modelling

5.1 Purpose
This section explores detailed cost modelling of the two options taking into account the
detailed commencement issues, the likely risks and hurdles for introduction in Lake
Macquarie and the additional drivers over time.

5.2 Assumptions

1. CPI:
   a) 3% annual increase.
   b) Applied to all costs.

2. Revenue Stream:
   a) Revenue from the sale of by-products of waste management has been
      incorporated into the gate fee (such as sale of Energy from Waste or of compost
      products). The gate fee is the net value of sales of commodities, operating costs,
      and profit.
   b) Risk related to the sale of composts from both scenarios is operator risk and is
      front ended into the gate fee payable by Council.
   c) It is assumed that there are adequate markets for SSG, SSO and MBT MSW
      composts. SSO markets are expected to have positive cash flow of $15/t while
      AWT MSW composts are assumed to sell at approximately negative $15/t and
      that this cost is imbedded in the gate fee payable for the service.

3. Tenements in LMCC:
   a) 73,918.
   b) All tenements are assumed to be SUDs as MUDs are very few as a percentage of
      total tenements. For the purpose of this report (comparing different technologies)
      this distinction is not important as any differences will be relative and any
      additional costs or savings would apply equally to all modelled options. At a later
      stage this distinction could warrant further attention.

4. Annual Kerbside Waste Projections:
   a) MSW for 2009: 58,993t.
   b) Recyclables for 2009: 17,858t.
   c) Green waste drop off: 7,243t.
d) Waste (including MSW, recyclables and green drop off) is increasing by 2% annually, on par with population increase. Refer Part 1 Report. (This is a conservative estimate as it assumes increases in per capita consumption and waste production are zero. The NWP has assumed 1.3% for per capita consumption growth. The reason it was set at zero was to dampen other additive effects).

e) Recycling as a proportion of total waste generation does not increase over time.
Table 13. Cost assumptions for each option (collection, processing and disposal)

<table>
<thead>
<tr>
<th>Option</th>
<th>Residual Bin</th>
<th>Green/Organics Bin</th>
<th>Recycling Bin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collect $/t</td>
<td>Processing $/t</td>
<td>Collect $/t</td>
</tr>
<tr>
<td>Phased 3 Bin SSO – In-vessel Comp</td>
<td>$1.56 per bin lift</td>
<td>$121.7 operating cost to council</td>
<td>n/a</td>
</tr>
<tr>
<td>2 Bin In-vessel MSW Composting</td>
<td>$1.56 per bin lift Weekly</td>
<td>$200</td>
<td>$121.7 operating cost to council (per tonne of residuals)</td>
</tr>
</tbody>
</table>

Note:  *Landfill levy and CPRS costs not included
**As per LMCC waste data return to NSW DECCW
5. Residuals:
   a) Residual percentages are assumed on the basis of the performance of comparable technologies operating in Australia.
   b) Gate fee for processing does not cover the disposal of residuals. As per standard operator contracts, council is liable to pay disposal fees on any residuals up to the percentage of guaranteed diversion i.e. if the contract specifies a minimum diversion of 60%, council is liable to pay for the landfilled of 40% of total waste. (This can be varied at the contract stage is LMCC prefers to put all disposal costs onto the Operator).
   c) Residuals from processing facilities (AWT, composting, Anaerobic Digestion etc) are inert for CPRS purposes.

6. Capital expenditure:
   a) Processing facilities provided by third party operator.
   b) Option Phased 3 Bin SSO In-vessel composting requires the purchase of New Green/Organic bins:
      i) All LMCC tenements get a third bin.
      ii) Cost per 240L bin is $45 inclusive of delivery costs.
      iii) One bin is purchased per LMCC tenement.
      iv) The total cost for bin purchase is factored in 2012.

7. Landfill costs:
   a) LMCC is part of NSW’s Extended Regional Area (ERA).
   b) Awaba landfill is part of NSW’s Extended Regional Area (ERA).
   c) Landfill operational costs increase at an annual rate of 3%. These have been increasing at an average real rate of 5% per year in NSW. The new Landfill SEPP will involve still further recycling obligations upon Councils and is likely to result in higher real costs.
   d) Landfill operational cost increase is additional to annual CPI.
   e) Levy is additional to gate fees (operating cost to council).
   f) The levy will be $65.30 in 2010-11 (including CPI) and will increase by an additional $11.50/tonne (+ CPI) per year until 2013-14 when the SMA and ERA will reach parity, from which time the increase for the ERA will be at a rate of $10 per year (+ CPI) (Source: Clause 5 of the Protection of the Environment Operations (Waste) Regulation 2005).

8. Awaba landfill emissions:
   a) CO2-e generation for 2009 is assumed to be 71,500t (based on approximately 74,000t of MSW and C+I landfilled annually).
   b) 1 tonne of incoming waste (MSW+C+I) generates 1 tonne CO2-e.
   c) A Sydney University review of gas capture at Awaba has determined gas capture efficiency of 80%.
   d) For modelling purposes, it is assumed that the 80% figure represents Awaba’s “whole of life” gas capture efficiency.
9. CPRS (carbon permits):
   a) All waste deposited from now on is assumed to generate new emissions.
   b) AWT and source separated composting facilities are not captured under CPRS (CH₄ and N₂O emissions are negligible).
   c) Any scope 3 emission and energy savings due to recycling and subsequent reduced use of natural resources (e.g. iron ore), are not accounted for here.
   d) Facility (landfill) emissions threshold is 25,000t CO₂-e.
   e) Carbon permits required from 2013 onwards.
   f) Carbon permit cost per tonne of CO₂-e:
      i) $10 for year 1;
      ii) $25 for years 2;
      iii) $30 for year 3; and
      iv) $5/year increase, thereafter.
   g) CPI applies to carbon permits.

10. Green Waste drop off:
   a) The green waste drop off facility would still be available to receive waste even in the scenarios where an additional organics bin is introduced.
   b) 80% of current drop-off green waste would be diverted to a 3rd green bin when implemented (only applies to Phased 3 bin SSO In-vessel option).

11. Green and Organic bins:
   a) 90% of available green and organic (green and food) in MSW is collected in SSO bins.
   b) A winter instantaneous bin audit at LMCC (in July 2010) returned the following:
      i) 28% food;
      ii) 22% garden;
      iii) 9% other compostable organics; and
      iv) 18% recyclables (i.e. including paper).
   c) To avoid seasonality bias and ensure a better representation of waste stream in the long term, NSW defaults have been used:
      i) MSW is 37.1% food; and
      ii) MSW is 24.6% compostable greens (includes 10.16% of paper compostable material).

5.3 Sensitivity Analysis

12. Landfill levy price increase scenarios after 2015:
   a) $0/t.
   b) $1/t.
   c) $2/t.
From 2020 onwards the levy price increase is $0/t.

13. Carbon permit cost scenarios (starting in 2013)
   a) 0/t.
   b) $20/t.
   c) $40/t.

14. Carbon sequestration credit scenarios (starting in 2015)
   There is a possibility that the government will offer credits for avoided emissions. In such a scenario a $ value would be placed on each tonne of organics spread to land (either as SSO compost or AWT DORF).
   a) $10/t of CO₂-e sequestered.
   b) 1t of organics spread on land returns 10% of one credit.
   c) Therefore for the Carbon permit costs presented in point 13 above, carbon credits would be worth:
      i) 0/t of CO₂-e sequestered;
      ii) $2/t of CO₂-e sequestered; and
      iii) $4/t of CO₂-e sequestered.
   d) 1t of SSO organics yields 0.5t of compost.
   e) 1t of MSW yields 0.3t of AWT DORF compost.
   f) Annual carbon credit benefits are subtracted from the annual cost of waste management (only used in NPV calculations).
6.0 Costs and Performance of Options

6.1 Summary of Costs

6.1.1 The Base Case in 2010

Given the long lead times in planning approvals, development consent and construction of infrastructure it is not feasible that either option could be implemented in 2010. Hence, Figure 3 indicates that both options refer to the status quo of landfilling at Awaba. This constitutes the base case for both options.

Figure 3. Base Case (Neither options is implemented by 2010 and rely on landfilling in 2010. Thus all values are identical.)

In summary, the current system costs residents of Lake Macquarie:

- $21.92 million per year; and
- $297 per household (this approximates the Domestic Waste Charge but does not include all costs which are captured by the DWC).
The current system results in the following outcomes:

- 59,510 tonnes of household MSW are landfilled per year;
- 24,520 tonnes of household recyclables are recovered through the kerbside and other systems; and
- The diversion rate is 29% and substantially below the target of 66%.

### 6.1.2 Detail of Costs: 2010 - 2019

Over the 10 year period Figure 4 suggests that the 2 bin AWT option is marginally more expensive than the 3 bin SSO option. This is driven primarily by the higher costs of capital for the AWT option as reflected in higher gate fees. The difference is approximately $22 million over the period.

**Figure 4. Cost over 10 years.**

The costs and performance over the 10 year period is given in the following Table 14. It indicates that for both options, annual costs increase significantly in 2015 when construction of the organics tunnels and the AWT respectively is completed.
Table 14. Costs and performance of each option over 10 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Total annual cost (million $)</th>
<th>Cost per tenement ($)</th>
<th>Diversion from landfill (t)</th>
<th>Waste landfilled (t)</th>
<th>Annual diversion from landfill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phased 3 bin SSO</td>
<td>2bin invessel</td>
<td>Phased 3 bin SSO</td>
<td>2bin invessel</td>
<td>Phased 3 bin SSO</td>
</tr>
<tr>
<td>2010</td>
<td>$21.92</td>
<td>$21.92</td>
<td>$297</td>
<td>$297</td>
<td>24,525</td>
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<tr>
<td>2011</td>
<td>$23.79</td>
<td>$23.79</td>
<td>$322</td>
<td>$322</td>
<td>25,015</td>
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<tr>
<td>2012</td>
<td>$30.15</td>
<td>$25.77</td>
<td>$408</td>
<td>$349</td>
<td>38,411</td>
</tr>
<tr>
<td>2013</td>
<td>$28.71</td>
<td>$27.89</td>
<td>$388</td>
<td>$377</td>
<td>39,180</td>
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<tr>
<td>2014</td>
<td>$30.64</td>
<td>$30.04</td>
<td>$415</td>
<td>$406</td>
<td>39,963</td>
</tr>
<tr>
<td>2015</td>
<td>$35.56</td>
<td>$37.03</td>
<td>$481</td>
<td>$501</td>
<td>61,402</td>
</tr>
<tr>
<td>2016</td>
<td>$37.17</td>
<td>$38.87</td>
<td>$503</td>
<td>$526</td>
<td>62,630</td>
</tr>
<tr>
<td>2017</td>
<td>$38.86</td>
<td>$40.80</td>
<td>$526</td>
<td>$552</td>
<td>63,883</td>
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<tr>
<td>2018</td>
<td>$40.63</td>
<td>$42.84</td>
<td>$550</td>
<td>$580</td>
<td>65,160</td>
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<tr>
<td>2019</td>
<td>$42.50</td>
<td>$44.99</td>
<td>$575</td>
<td>$609</td>
<td>66,464</td>
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<tr>
<td>Total</td>
<td>$329.93</td>
<td>$333.94</td>
<td>$4,463</td>
<td>$4,518</td>
<td>486,633</td>
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<tr>
<td>Average</td>
<td>$32.99</td>
<td>$33.39</td>
<td>$446</td>
<td>$452</td>
<td>48,663</td>
</tr>
</tbody>
</table>

In summary, over 10 years:

- SSO ($329 mill) is marginally cheaper than AWT ($333 mill).
- This is reflected in the average cost per household rising from its current $297 to $375 in 2019 for SSO and $609 for AWT in 2019.
- SSO diverts slightly more material from landfill over 10 years (486,633 t versus 471,703) because it commences earlier than the AWT process.
- Consequently the AWT system sends more waste to landfill over the first 10 years (448,446 t versus SSO (433,516) but the differences are slight.
- The 10 year average diversion rate is higher for SSO (52.1%) than AWT (50.2%).
- Once both systems are fully operational, SSO is cheaper to run but AWT diverts more from landfill.
6.1.3 **Detail of Costs: 2010 - 2039**

The costs and performance over the 30 year period is given in the following Table 15.

**Table 15. Costs and performance of each option over 30 years**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total annual cost (million $)</th>
<th>Cost per tenement ($)</th>
<th>Diversion from landfill (t)</th>
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<th>Annual diversion from landfill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phased 3 bin SSO compost</td>
<td>2bin invessel AWT</td>
<td>Phased 3 bin SSO compost</td>
<td>2bin invessel AWT</td>
<td>Phased 3 bin SSO compost</td>
</tr>
<tr>
<td>2010</td>
<td>$21.92</td>
<td>$21.92</td>
<td>$297</td>
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<td>2011</td>
<td>$23.79</td>
<td>$23.79</td>
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<tr>
<td>2012</td>
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<td>$349</td>
<td>38,411</td>
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<tr>
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<td>$377</td>
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<tr>
<td>2014</td>
<td>$30.64</td>
<td>$30.04</td>
<td>$415</td>
<td>$406</td>
<td>39,963</td>
</tr>
<tr>
<td>2015</td>
<td>$35.56</td>
<td>$37.03</td>
<td>$481</td>
<td>$501</td>
<td>61,402</td>
</tr>
<tr>
<td>2016</td>
<td>$37.17</td>
<td>$38.87</td>
<td>$503</td>
<td>$526</td>
<td>62,630</td>
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<td>2017</td>
<td>$38.86</td>
<td>$40.80</td>
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<td>$552</td>
<td>63,883</td>
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<tr>
<td>2018</td>
<td>$40.63</td>
<td>$42.84</td>
<td>$550</td>
<td>$580</td>
<td>65,160</td>
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<tr>
<td>2019</td>
<td>$42.50</td>
<td>$44.99</td>
<td>$575</td>
<td>$609</td>
<td>66,464</td>
</tr>
<tr>
<td>2020</td>
<td>$44.44</td>
<td>$47.23</td>
<td>$601</td>
<td>$639</td>
<td>67,793</td>
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<tr>
<td>2021</td>
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<td>$49.56</td>
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<td>$670</td>
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<td>$52.01</td>
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<td>$54.59</td>
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<tr>
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<td>$60.20</td>
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<tr>
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<td>$73.39</td>
<td>$910</td>
<td>$993</td>
<td>81,019</td>
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### Table 1: Strategic Waste Options & TBL Analysis - PART 4 Implementation Considerations

<table>
<thead>
<tr>
<th>Year</th>
<th>Total annual cost (million $)</th>
<th>Cost per tenement ($)</th>
<th>Diversion from landfill (t)</th>
<th>Waste landfilled (t)</th>
<th>Annual diversion from landfill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phased 3 bin SSO invessel compost</td>
<td>2bin AWT</td>
<td>Phased 3 bin SSO invessel compost</td>
<td>2bin AWT</td>
<td>Phased 3 bin SSO invessel compost</td>
</tr>
<tr>
<td>2030</td>
<td>$70.55</td>
<td>$77.16</td>
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<td>2031</td>
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<td>2032</td>
<td>$77.70</td>
<td>$85.36</td>
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<td>$1,155</td>
<td>85,978</td>
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<tr>
<td>2033</td>
<td>$81.59</td>
<td>$89.81</td>
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<td>$1,215</td>
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<td>2034</td>
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<td>2036</td>
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<td>2037</td>
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</tr>
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<td>2038</td>
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<td>$116.22</td>
<td>$1,417</td>
<td>$1,572</td>
<td>96,825</td>
</tr>
<tr>
<td>2039</td>
<td>$110.20</td>
<td>$122.46</td>
<td>$1,491</td>
<td>$1,657</td>
<td>98,761</td>
</tr>
<tr>
<td>Total over 30 years</td>
<td>$1,769</td>
<td>$1,909</td>
<td>$23,933</td>
<td>$25,825</td>
<td>2,133,822</td>
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<tr>
<td>Average</td>
<td>$58.97</td>
<td>$63.63</td>
<td>$797.79</td>
<td>$860.86</td>
<td>71,127</td>
</tr>
</tbody>
</table>

In summary, over 30 years:

- SSO ($1,769mill) is somewhat cheaper than AWT ($1,909 mill).
- This is reflected in the average cost per householder rising from its current $297 to $1,491 for SSO and $1,657 for AWT in 2039.
- SSO diverts less material from landfill over 30 years (2.13 mill t) versus AWT (2.245 mill t) because AWT has a higher percentage recovery rate.
- The average diversion rate is lower for SSO (61.5%) than AWT (64.2%) over the 30 year period.

The total costs over the 30 year period are summarised in Figure 5. It indicates that the AWT residual process costs $140 million more than SSO over 30 years (or an average premium of $4.6 million per year).
These costs and comparisons are now considered in more detail in the following section, providing more detailed explanation of the results.
7.0 Cash Flow Trends and Performance - Detail

7.1 Trends in Costs and Cash Flow over Time

7.1.1 Trend in Costs and Council Cash Flow: 2010 - 2019

This modelling assumes that the capital costs and cash outflows rest with the Provider of the service and not with Council. Council pays a gate fee to the Provider on a long term contract basis.

The cash flow of the 3 bin SSO option is therefore only affected by the capital costs of providing new bins to residents (a cost which is assumed to be retained by Council). It follows the costs of landfill until 2012 when the green bins are supplied and the green waste service commences.

In 2015, the food waste service commences and the charges by the Provider rise according to the additional processing costs of the tunnel composting plant.

On the other hand the AWT MSW follows the costs of landfill until the AWT is built (Figure 6).

The residual AWT has a higher ongoing operating cost.

Figure 6. Annual waste management cost ($ million) for each option over 10 years
7.1.2 **Trend in Costs and Council Cash Flow: 2010 - 2039**

Over a 30 year period, the higher average operating cost of the MSW AWT composting plant asserts itself to drive the costs higher per year.

The effect being that by 2039 the two bin option is running at $12 million per year more expensive than the 3 bin option (Figure 7).

![Figure 7. Annual waste management cost ($mill) for options over 30 years](image)

7.2 **Waste Diversion from Landfill**

7.2.1 **Summary of Diversion: 2010 - 2019**

In the first 10 years, the SSO 3 bin option delivers a higher diversion from landfill. This is primarily because it commences 3 years earlier than the AWT. As such, it reduces the financial exposure to landfill levies earlier.

On the other hand, the AWT takes more than 5 years to become fully operational. The difference over the first 10 years is, however, fairly small.
7.2.2 **Summary of Diversion: 2010 - 2039**

Over 30 years, however, it is clear that the residual AWT delivers a higher net diversion of waste from landfill (64% vs 61%) total Council diversion (Figure 9).

(Note: In relation to the State Government 66% diversion target, these figures do not include the additional 7% diversion expected from improvements in the kerbside recycling recovery rate. Together, these figures ensure both systems easily achieve the state targets. Moreover, Figure 9 shows average diversion over 30 years. On an annual basis, both systems achieve the NSW target of 66% once fully operational—Figure 10 and Figure 12.)

---

**Figure 8. Waste diversion (%) from landfill under each option over 10 years**

**Figure 9. Waste diversion (%) from landfill for each option over 30 years**
7.2.3  Trend in Waste Diversion: 2010-2019

The bar graph of diversion from landfill clearly shows the effect of commencing the SSG service earlier than the AWT plant. The first jump represents the commencement of green waste collections and the second jump coincides with the introduction of food waste collection and processing (Figure 10).

It should be noted that food waste can only be added when a full scale odour controlled tunnel composting facility is available. That will take at least 4 years to plan, approve and build from 2010.

Figure 10 also demonstrates that both options are able to achieve the 66% diversion target with the diversion rate at 2015 being 67% for SSO and 72% for the MSW AWT (assuming the 7% gains of the kerbside recycling improvements are achieved, total diversion would be even higher).

Figure 10. Annual waste diversion (tonnes) per option over 10 years

Looking at the trend in total tonnages processed over time gives a slightly different picture. As the population grows and per capita consumption rises, the plants must process an ever increasing load simply to retain the 67% and 72% diversion rates.

Figure 11 demonstrates that the tonnages processed for both options rise over time as the input tonnages increase. The SSO commences earliest as the green bin is rolled out first and services only green waste for the first 3 years before food is added.

One notable complexity with this option, which is discussed later, is the frequency of the green bin collections. If, when food is added the Council adopts a weekly collection of the food service, then the residual bin needs to drop back from a weekly to a fortnightly service to retain the same collection patterns. This has been assumed in the costings, but it could have implications for resident satisfaction levels.
7.2.4 **Trend in Waste Diversion: 2010-2039**

It is clear that once the AWT plant is operating at full capacity it is able to achieve and maintain a higher diversion capacity than the SSO bin, although the difference is relatively small (Figure 12). Both systems are able to achieve the state government’s target of 66% diversion from landfill.

---

**Figure 11. Growth in tonnage processed over 10 years.**

**Figure 12. Annual waste diversion (tonnes) per option over 30 years**
Over time the amount of waste generated by LMCC increases. Therefore, the plants need to be able to cope with an ever increasing load. Both options are able to maintain the minimum 66% diversion when a kerbside recycling system continues to operate at current or better levels of efficiency (Figure 13).

Over an extended period, the 2 bin AWT option performs slightly better than the 3 bin option and diverts on average an additional 7,500 tonnes per year.

Figure 13. Waste diversion over 30 years. AWT plant performs slightly better.

7.3 Trend in Waste to Landfill

7.3.1 Trend in Waste to Landfill: 2010-2019

Looking at the figures from the perspective of residual material to landfill, it is clear that the earlier start date for the 3 bin SSO delivers earlier reductions in landfill tonnages. These are most significant over the initial ten year period (Figure 14).

These early reductions in waste to landfill could benefit the council financially and operationally, as it will save valuable airspace that might otherwise be very costly to obtain in the short term. In assessing the relative merits of the two systems, this parameter should be taken into consideration.
7.3.2 **Trend in Waste to Landfill: 2010-2039**

Over the 30 year period, however, the 3 bin option is unable to divert the same percentage and total tonnage from landfill as the residual AWT plant. The consequence is that the SSO system has a higher residual to landfill burden over the 30 year period (Figure 15).

---

**Figure 14. Waste landfilled annually (tonnes) per option over 10 years**

---

**Figure 15. Waste landfilled annually (tonnes) per option over 30 years**
7.4 Fate of Waste

7.4.1 Fate of Waste: 2010 - 2019

Analysing for the ‘fate of waste’ brings these two factors together. It indicates that, over the shorter term, the 3 bin option delivers almost exactly the same result as does the AWT 2 bin option (Figure 16). The gains of the early commencement of the 3 bin option are all but lost to the lower diversion rate this option achieves for the remainder of the 10 year period.

Figure 16. Fate of waste over 10 years

7.4.2 Fate of Waste: 2010 - 2039

On the other hand, the AWT facility achieves a better recycling rate and higher diversion than the 3 bin option over the 30 year period (although the difference is slight) (Figure 17).

Figure 17. Fate of waste over 30 years
7.5    Greenhouse Gas Emissions

7.5.1    Avoided Greenhouse Gas Emissions: 2010-2019

Over 10 years, the 3 bin SSO system delivers a better greenhouse gas outcome than the two bin system. This is again for the reason that the 3 bin option can commence earlier than the AWT system and therefore, is able to divert material from landfill sooner and therefore, reduce landfill generation of greenhouse gas in the form of methane (Figure 18).

Figure 18. Avoided greenhouse gas emissions over 10 years (t CO2e)

7.5.2    Avoided Greenhouse Gas Emissions: 2010-2039

Over a 30 year period however, the relationship swaps with the AWT delivering a better greenhouse gas performance. Again, this is a function of its higher diversion of organic wastes from landfill and therefore, avoidance of landfill generated methane gases (Figure 19).

Figure 19. Avoided greenhouse gas emissions over 30 years (t CO2e)
7.6 Cost and Diversion Comparisons

7.6.1 Comparison of Costs and Environmental Performance: 2010 and 2019

The most useful comparison of the performance of these two options is to compare the cost at each period with the diversion achieved at that time.

Figure 20 indicates that the costs of 3 bin vs 2 bin in 2010 are the same (since neither option can commence) but by 2019 the AWT is the more expensive.

On the other hand, the 3 bin option delivers an early higher diversion only to lose that advantage by 2019. However, the costs associated with managing each tonne of waste are always lower in the 3 bin system.
7.6.2 **Comparison of Costs and Environmental Performance: 2010 and 2039**

Within 30 years, the differences become starker. From a similar starting position in 2010 on costs, the AWT 2 bin option becomes substantially more expensive at 2039. However, it is able to divert a slightly higher number of tonnes from landfill at 2039 than the 3 bin option (Figure 21).

![Figure 21. Comparison of annual environmental performance against costs for two points in time 30 years apart.](image)

7.7 **Performance Per Household**

7.7.1 **Comparison of Performance and Cost Per Household: 2010 and 2019**

Undertaking the same form of analysis on the diversion performance of each option against the cost per household delivers a similar result.

At 2010, neither system is operational but the green waste service commences relatively more quickly.
The AWT plant is more expensive in 2019 and costs each householder an additional $34 per tenement per year. It delivers a slightly higher diversion from landfill (Figure 22) since it is able to capture and process all of the organics and some of the residual plastic, steel, glass and aluminium as well.

Figure 22. Comparison of annual environmental performance to cost per household for two points in time 10 years apart.

7.7.2 Comparison of Performance and Cost Per Household: 2010 and 2039

Similarly, in 30 years’ time, the two bin AWT solution provides a greater diversion from landfill but at a slightly higher overall cost (Figure 23).
Figure 23. Comparison of annual environmental performance to cost per household for two points in time 30 years apart.

Cost per tenement ($)  
Phased 3 bin SSO Invessel composting  
2010 Cost per tenement  
2039 Cost per tenement  
2010 Landfill diversion  
2039 Landfill diversion

7.8 Greenhouse Gas Performance

LMCC assumes that 80% of all greenhouse gases generated by waste decomposition at Awaba landfill are captured and thus not discharged to atmosphere.

The effect of this high capture rate is to bring the Awaba landfill below the National Greenhouse and Energy Reporting (NGER) threshold. As a result, the landfill does not attract a CPRS obligation and financial cost.

Even though both options result in a percentage of waste going to landfill it is insufficient in both instances to attract a CPRS cost.

Very efficient gas capture results in lower overall emissions in the 3 bin SSO system within the first 10 years compared to the MSW AWT process option.
8.0 Sensitivity Analysis

In order to evaluate the potential impacts of government policy and price changes, a sensitivity analysis was conducted for the following variables:

- Landfill levy increases between 2015 and 2020;
- Greenhouse gas emissions penalties; and
- Carbon sequestration offset credits.

8.1 Landfill Levy Sensitivity Analysis

The effect of 3 different assumptions on landfill levy prices ($0, $1 and $2 increments for the period 2015 -2020) was evaluated. The period 2010 -2015 has already been specified by the NSW Government. All options assume a $0 levy increase after 2020. This in itself is a very conservative assumption. It is likely that a future government would continue to push up landfill pricing beyond 2020.

Figure 24 indicates that variations in the price of the levy for the 5 year period 2015-2020 have had minimal effect on the model’s projected pricing.
The effect on the total cost of the variation in the levy is insignificant over 30 years (Figure 25).

**Figure 25. Price sensitivity to landfill levy over 30 years – 3 bin SSO**

Effect of landfill levy price on annual waste management cost under a 2 bin invessel AWT system is given in **Figure 26**. Again, it shows that variations in assumptions of the landfill levy in the 2015-2020 period are insignificant over 30 years.

**Figure 26. Landfill levy price sensitivity on annual waste management cost - 2 bin AWT**
This is also borne out over the total cost of the contract for the 30 year period (Figure 27).

Figure 27. Price sensitivity to landfill levy over 30 years – 3 bin SSO

8.2 Greenhouse Gas Sensitivity Analysis

Three greenhouse gas CPRS costs were assumed for the sensitivity analysis - $0, $20 and $40 per tonne of CO2e.

At an 80% LFG capture rate, emissions at Awaba remain below the CPRS reporting thresholds throughout the modelling period. As a result, LMCC is not financially liable for any emissions up to at least 2039. This holds true for either of the examined systems.

In summary, the cost of a carbon pollution permit under either SSO or AWT scenarios has no cost effect as Awaba landfill does not incur CPRS liabilities (Figure 28 and Figure 29).
8.3 Carbon Sequestration Offset Credits Sensitivity

The sequestration credits argument requires assumptions about the quantity of organics which may be sequestered to land over the compliance period (generally defined as 100 years by the Department of Climate Change Canberra). That is the amount of carbon that might be locked up in soil and therefore, not released to the atmosphere to contribute to global warming.
For the purposes of the sensitivity analysis the following assumption were made (as per the assumptions section):

- Tonnes compost generated per tonne of input material to plant; SSO=0.5t AWT =0.3t;
- Carbon credits per tonne of compost applied to land; SSO=0.1 AWT =0.1;
- Carbon credit value scheme starting in 2013; $0, $20 and $40 per tCO2e; and
- NPV assumption 5% real discount rate.

The results indicate that carbon sequestration credits are not a significant driver of variation in cost for SSO at any price. The model indicates monetary rebates (credits) obtained through long term storage of carbon are so small (compared to the annual cost of waste management) that overall there is no visible price differentiation according to the credit value (Figure 30, Figure 31).

For SSO, over 30 years, credits derived from carbon storage would total just over $4million. Over the same period, the total cost of managing LMCC’s waste is projected to be in the order of $1.8 billion. Compared to that, an overall credit revenue of $4 million is small and cannot be depicted on graphs of the scale presented below. Nevertheless, carbon credits could represent an annual cost saving of $40 to $220 thousand dollars, depending on the value of credits, and therefore warrant council’s further attention should the government acknowledge carbon sequestration.

Figure 30. Effect of carbon sequestration income on cost - Phased 3 bin SSO.
For the reasons discussed earlier, the results indicate that carbon sequestration credits are also not a significant driver of variation in cost for AWT at any price. The model indicates that annual management cost is only marginally affected by the value of the carbon price (Figure 32 and Figure 33).
8.4 Net Present Value (NPV)

The Net Present Value allows the cost of the two options, which extend over time, to be compared on an equivalent cost basis today.

The total cost of waste management for each option; taken against landfill levy, sequestration, credit value and the landfill gas emission profile for Awaba, over 30 years; are given in Table 16.

(Note: Both options include a percentage of residuals which are sent to Awaba landfill. These residuals may generate methane which adds to the cost of that option where there is a carbon price for emissions i.e. a CPRS or a carbon tax. The higher the gas capture rate the better. The Awaba gas capture rate is currently not well documented but has been specified by council at 80%. At this capture rate Awaba is not captured by CPRS and therefore, is exempt from emission payments. Assuming a lower capture rate affects the cost of waste management as emission payments would need to be made under CPRS).
Table 16: NPV’s of total cost over 30 years (discount rate of 0.05).

<table>
<thead>
<tr>
<th>Landfill levy increment</th>
<th>Base scenario</th>
<th>$0</th>
<th>$1</th>
<th>$2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phased 3 bin SSO</td>
<td>$757.36</td>
<td>$754.72</td>
<td>$757.36</td>
<td>$760.01</td>
</tr>
<tr>
<td>2 bin AWT</td>
<td>$805.05</td>
<td>$802.80</td>
<td>$805.05</td>
<td>$807.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Carbon sequestration credit ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon credits obtained</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>$0/t CO2-e price on carbon</td>
</tr>
<tr>
<td>$20/t CO2-e price on carbon</td>
</tr>
<tr>
<td>$40/t CO2-e price on carbon</td>
</tr>
<tr>
<td>Phased 3 bin SSO</td>
</tr>
<tr>
<td>2 bin AWT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landfill gas capture rate as % of whole of life emissions ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas capture %</td>
</tr>
<tr>
<td>0%</td>
</tr>
<tr>
<td>35%</td>
</tr>
<tr>
<td>80%</td>
</tr>
<tr>
<td>Phased 3 bin SSO</td>
</tr>
<tr>
<td>2 bin AWT</td>
</tr>
</tbody>
</table>

This analysis provides the following conclusions.

Landfill levy increment 2015-2020:

- 3 bin SSO is cheaper than 2 bin AWT at any landfill levy price;
- The NPV saving of SSO over AWT ranges from $48.08 million (at $0 levy increment) to $47.29 million (at a $2 increment); and
- As landfill levies increase both options become marginally more expensive.
Carbon sequestration credits:

- 3 bin SSO is cheaper than 2 bin AWT at any carbon price;
- The NPV saving of SSO over AWT ranges from $47.68 million (at $0 carbon price) to $48.42 million (at a $40 carbon price); and
- As carbon prices rise and therefore, the sequestration credit becomes more valuable, the costs of both options decrease. Albeit marginally.

Landfill gas capture rates for Awaba landfill.

- 3 bin SSO is cheaper than 2 bin AWT at any gas capture rate from Awaba;
- The NPV saving of SSO over AWT ranges from $30 million (at 0% gas capture at Awaba) to $63 million (at a 80% gas capture rate); and
- As the gas capture rate at Awaba improves from 0% to 80% the cost of both options decrease. The decreases are small overall but are more significant for SSO than for AWT.

This NPV analysis suggests that the 3 bin SSO delivers a better cost outcome than the 2 bin AWT option over the 30 year period of the modelling irrespective of what assumptions are made about:

- landfill levy increases;
- the approval of carbon credits for sequestration of carbon in soil;
- the value of those carbon credits; and
- the degree of gas capture at the Awaba landfill for residuals produced by the processes.
9.0 System Issues

9.1 Bin Collection Frequency

Twelve Councils in Australia have recently introduced permanent food and green collection or trial services. These are summarised in Table 17 below.

Table 17. Case studies of organics and food collection in Australia

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
<th>Refuse bin</th>
<th>Organics bin</th>
<th>Diversion of organics kg/hh/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Macquarie NSW</td>
<td>SSO</td>
<td>140 F</td>
<td>240 W</td>
<td>390</td>
</tr>
<tr>
<td>Coffs Harbour</td>
<td>SSO</td>
<td>140 F</td>
<td>240 W</td>
<td>146</td>
</tr>
<tr>
<td>Penrith</td>
<td>SSO</td>
<td>140 F</td>
<td>240 W</td>
<td>728</td>
</tr>
<tr>
<td>Lismore</td>
<td>SSO</td>
<td>140 F</td>
<td>240 W</td>
<td>333</td>
</tr>
<tr>
<td>Goulburn</td>
<td>SSO</td>
<td>240 W</td>
<td>240 M</td>
<td>119</td>
</tr>
<tr>
<td>Berridale NSW</td>
<td>SSO</td>
<td>120 F</td>
<td>240 F</td>
<td>431</td>
</tr>
<tr>
<td>Norwood</td>
<td>SSO</td>
<td>240 W</td>
<td>240 W</td>
<td>270</td>
</tr>
<tr>
<td><strong>Average SSO</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>345</strong></td>
</tr>
<tr>
<td>Shoalhaven NSW</td>
<td>Wet organics</td>
<td>Bags F</td>
<td>240 F</td>
<td>348</td>
</tr>
<tr>
<td>Burnside SA</td>
<td>SSF</td>
<td>240 W</td>
<td>240 F</td>
<td>62</td>
</tr>
<tr>
<td>Chifley ACT</td>
<td>SSF</td>
<td>140 F</td>
<td>SUDs 85 W</td>
<td>223</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MUDs 240 W</td>
<td></td>
</tr>
<tr>
<td>Waverley Randwick NSW</td>
<td>SSF HC</td>
<td>240 W</td>
<td>Home compost bin</td>
<td>234</td>
</tr>
<tr>
<td>Leichhardt NSW</td>
<td>SSF</td>
<td>240 W</td>
<td>46 W</td>
<td>67</td>
</tr>
<tr>
<td><strong>Average SSF</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>187</strong></td>
</tr>
</tbody>
</table>

W – weekly; F – fortnightly; SSO - Source Separated Organics; SSF – Source Separated Food; HC – Home Composting; Sources :DWM Hyder Study Kerbside Organics Service 2010; Lismore City Council; Penrith City Council
Of these, Port Macquarie, Coffs Harbour, Penrith and Lismore have progressed to long term SSO services with an average diversion rate of 345 kg/household/year. In all cases the Organics bin collection frequency has been weekly.

More importantly, the residual collection (standard service) frequency has shifted from weekly to fortnightly for all of these Councils.

Feedback from each of the Councils reveals that at the time of introduction there was some resistance to a fortnightly residual service but that concern waned over time with education and the provision of additional options for a small number of residents.

In particular, Penrith Council moved from 240 litre weekly residual to 140 fortnightly residual services. That move was widely criticised in the media. In response, Penrith Council provided the option for residents to utilise a 240 residual bin and/or retain a weekly residual collection service but at a premium price to the standard service. This has alleviated many of the community concerns.

It is also clear from the table above that combined SSO (food and green) systems provide on average, a higher recovery rate for all households at 345kg/household/year than segregated food only systems at 187.

In terms of capture rates, Lismore reported it captured 86% of all available organics from the household including food and green waste. 14% was lost to the residual waste stream.

Port Macquarie reported a 40% increase in capture of organics with the introduction of a weekly service. All Councils have reported significant drops in organics in the residual bin.

Recent experience by MRA at Penrith Council found a significant increase in organics recovery with diversion of green and food wastes, averaging 728kg/hh/yr and representing over 70% of the available organics. This percentage is still growing.

The most common configuration of SSO services is a weekly collection of the organics (green)bin and a fortnightly collection of the residual (red) bin. This alternates with the fortnightly collection of the yellow top bin.

The alternative is sometimes to have both the SSO bin and the Residual bin collected weekly. This requires that every second week 3 bins are placed at the kerb.
These configurations are summarised in Table 18.

Table 18. Bin collection frequency – the effect on households

<table>
<thead>
<tr>
<th>Waste Treatment Option</th>
<th>Fortnightly Residual service</th>
<th>Weekly Residual service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The inefficiencies associated with weekly collections of both the SSO and the Residual bins are obvious. It requires 3 truck passes of each house every second week.

For this reason, most Councils opt for a fortnightly residual bin service. Since most of the food and decomposing material has been transferred from the residual bin to the SSO bin, odour problems can be managed.

The single biggest problem with a fortnightly residual bin service is the presence of nappies in the residual bin. These are not currently able to be placed in the SSO bin and as such remain in the residual bin for a fortnight. The general solution to such malodorous products is to seal them in a single use plastic shopping bag.

Experience indicates that up to 30% of organic material may also remain in the residual bin. This requires ongoing and substantial educational programs.

Most trials of food waste have included a weekly food service. Fortnightly collection of food has proven problematic in all but a few Council trials or services.

Weekly combined organics services (food and green) provide the highest diversion and participation rates.

The reduction of the residuals service to fortnightly in a 120 or 140 litre MGB supports higher diversion of material into the combined organics service but it has proved problematic in implementation (see Table 19 below).
As stated in the DECCW “reduction in residuals service intervals and size of container can be met with some market initial resistance from residents. Concerns are raised about disposable nappies and the requirements of large families. Incentives for reduced servicing of residuals can overcome a lot of resident resistance”

The recent launch of a food and green collection service in Penrith City Council offers good insights into optimal solutions and pitfalls to avoid.

Table 19. Pros and cons of the Penrith 3 bin system roll out

<table>
<thead>
<tr>
<th>Successes</th>
<th>Comment</th>
<th>Pitfalls</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bin changes</td>
<td>From 240 residual weekly</td>
<td>Changing too many bins</td>
<td>Two of the three bins were changed in colours and frequency at the same time, resulting in resident confusion.</td>
</tr>
<tr>
<td></td>
<td>240 recycling fortnightly</td>
<td>simultaneously</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To 140 residual fortnightly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>140 green and food weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>240 recycling fortnightly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekly food and green</td>
<td>Organic recovery of 12kg/hh/wk</td>
<td>Resulted in organic waste smeared throughout the bin. Residents were encouraged to wrap their waste in newspaper but many still complained to Council.</td>
</tr>
<tr>
<td></td>
<td>Weekly food and green without a biobag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>Engaging 80,000 households</td>
<td>Where the new service is dramatically different from the old it may have been beneficial to stage the changes and rollout.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in a comprehensive recycling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staged implementation required</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>140 litre residual bin</td>
<td>The smaller residual bin</td>
<td>Significant community reaction to the smaller bin. Retaining the 240 litre residual bin and providing the smaller 140 bin on an “as requested” and price discounted basis, would have been more widely acceptable. Users requesting a larger bin now pay a $50/yr price penalty which has been widely criticised.</td>
</tr>
<tr>
<td></td>
<td>provides a volume pressure for improved</td>
<td>140 litre bin mandated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>diversion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Successes</td>
<td>Comment</td>
<td>Pitfalls</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Contamination reduction</td>
<td>Significant investment in education has reduced contamination from 30% to 15%</td>
<td>Contamination</td>
<td>15% remains too high and reflects the complexity of the roll out. Staging might reduce this.</td>
</tr>
<tr>
<td>Biobags</td>
<td>Council is now supplying one year’s supply of biobags free of charge. Biobags must be distinguishable from shopping bags.</td>
<td>Biobag supply</td>
<td>Biobags were not part of the original scheme or tender. They were not available over summer. Complaints about flies and odour were numerous.</td>
</tr>
</tbody>
</table>

Penrith is now, 12 months after commencement, achieving a productivity rate of 14 kg/household per week of food and green waste, reducing waste to landfill by almost 40,000 tonnes per year. Contamination rates have been reduced from 30% to less than 15%.

While Penrith Council suffered considerable community disquiet in moving from a 240 litre MGB weekly to a 140 litre MGB fortnightly residual service, such problems are not always the norm.

Lismore Council for example changed its system from a 240 weekly residual to a 140 litre MGB fortnightly in one step more than 6 years ago. There was very little community concern and this primarily in relation to concurrent changes to the kerbside recycling service and not the residual service.

It is recommended, however, that if LMCC is considering a reduction in the residual bin size it do this at a later stage (not part of a new bin roll out) and offer price incentives for smaller residual bins compared to larger bins.

### 9.1.1 Bins and Kitchen Tidies

240 litre MGB’s are the most popular collection system for food and green waste services in Australia. Aerated 240 litre bins have been utilised when the food and green is collected fortnightly in hot or wet climates or when used in conjunction with vermiculture (maintaining aeration for the worms). Split bins and smaller bins are far less effective for green and food services.

All of the broad scale SSO services in Australia have utilised a 240 litre MGB.

The provision of kitchen tidies was found by all studies to improve diversion as well as participation rates. Vented kitchen containers combined with clearly identifiable compostable liner bags were shown to increase user satisfaction (Hyder 2010).
Bio bags must be clearly identified as distinct from shopping bags which are not biodegradable or compostable.

Kitchen tidies wholesale for approximately $8-10 each while biodegradable bags for approximately 10 cents each. Consequently, the provision of a kitchen tidy and daily biobags will cost LMCC $10 one off and $36 per year in biobags per household. For 72,000 households that is $0.72 million for bins one off and $2.6 million annually for bags. That comprises an additional $27 million over the life of a 10 year contract for the SSO system. These costs were incorporated into the original costings in the Part 2 Report.

DECCW is currently reviewing the guidelines for claiming biodegradable status for organic bags and a report will be available in November 2010. The timing works well for LMCC’s ongoing deliberations.

The use and merits or otherwise of biobags and kitchen tidies may be considered in a future implementation paper once LMCC determines its preferred direction and options.

9.2 Contamination of Organics

SSO systems such as tunnel composting plants can accept a certain amount of contamination. Generally, operators will set a maximum acceptable contamination level of 5% (by weight SSG) and 6-10% (by weight SSO). Thereafter, they may require a contamination penalty which compensates them for the additional costs of processing, removing and disposing to landfill of the contamination.

Penrith SSO commenced at around 30% contamination rates and resulted in a significant cost variation from the operator SITA. As a result of a proactive program by Penrith Council the contamination rate has fallen over the first 12 months to 15% and continues to decline.

Requiring the collector of the organics to take responsibility for both collection and processing have tended to resolve some of the potential conflicts surrounding organics contamination.

Integrating complementary contamination requirements in both the collection and processing contracts, that involve penalties and compensation, have been widely utilised in both organics, green and recyclables collections.

Building in education funding to the contract will guarantee adequate information and contamination reduction programs. “Three strikes” policies of advising households which contaminate their bins of the ultimate sanction of removing their bins, have also proved successful, and in some communities, have been necessary.
9.3 Voluntary Systems

One option adopted by a number of Councils has been the introduction of voluntary green waste systems.

In relation to the phased introduction (Option 3) of the SSO bin this could provide a low risk, low capital entry option for LMCC.

In effect, LMCC could offer a new 240 litre green lidded Green Waste service on a “at cost” basis to residents. Typically, this is at a cost of around $50-80 per household per year for servicing.

Council would need to determine whether to charge for the green bins which wholesale for $45-60 per bin. Typically, Councils give away the bins.

Every tonne of green waste collected in this manner is a tonne that is not presented in the residual garbage bin and is not landfilled. The marginal cost of landfilling at Awaba is no less than $93/t plus collection costs. The marginal cost of composting at Awaba is approximately $40/t and thus constitutes a significant saving to Council in disposal costs. The Part 2 Report showed that the Green waste only service was a cost effective option for LMCC although in the medium term it did not achieve the 66% diversion target and had a limited effect on preserving the Awaba airspace.

However, LMCC may wish to consider a voluntary green waste service (at cost) as an interim “soft start” to a SSO system. Such a start is compatible with the later introduction of an SSO bin but has the drawback of further delaying the diversion of substantial tonnes from Awaba.

9.4 Bin Sizes and Pricing

Table 17 indicates that a number of Councils have provided for smaller residual bins in association with both AWT and SSO systems.

The common practice is to reduce the Residual (red lidded garbage bin) from a 240 litre weekly service to a 140 litre bin collected fortnightly.

The reduction in bin size can be either compulsory or voluntary.

The question then arises from many members of the community as to whether price discounts should be available for those who take up the smaller bin. This is particularly so when the bin frequency and size adjustments are introduced concurrently.

One important consideration is the magnitude of the discounted collection fee provided for smaller residual bins (say from 240 litres to 140 litres). Polluter pays principles would dictate that those households using smaller bins and generating less waste should receive a price discount on collection costs via their Domestic Waste Charge.
The discount should only be a proportion of the marginal cost savings. The council still bears an “availability cost” associated with the fixed costs of the truck driving by the house, the costs of the driver, the costs of the processing facility etc. These fixed costs cannot be avoided. Consequently, the discount offered should be a function of the variable cost savings associated with less waste being collected from that house.

Typically, the discount rate is 20-30% of the Residual component of the Domestic Waste Charge. LMCC should calculate this cost but it is likely to be less than $30 per household per year.

Given the recent experiences in Australia, LC would recommend the following:

- The green lidded SSO bin be 240 litres;
- Aeration holes to prevent odour would be advantageous but not a necessity;
- Residual red lidded bins should be 240 litres as per current;
- Residual 140 litre bins be optional;
- Residual 140 litre bins be offered at a discounted collection cost with the discount approximating the variable cost reduction of the Residual waste component of the Domestic Waste Charge; and
- The yellow topped recycling bin be retained at 240 litres but Council explore the introduction of a 360 litre optional yellow top bin for those houses that require it. Council would separately need to determine whether it will subsidise the provision of these bins. They retail for approximately $96-100 each.

## 9.5 Site Availability

LMCC has engaged consultants GHD to review the availability, scale and location of void space in the Awaba landfill for future disposal. This study will inform the site selection issues.

One of the most important criteria for the development of AWT or any form of waste processing capacity, is the availability of an approved and appropriately licensed site. Obtaining a license to process waste on an existing landfill has been demonstrated time and again to be the least cost, most advantageous route to a successful development. A range of sites were evaluated as part of this study including:

1. Awaba landfill;
2. Teralba Worm Farm and composting plant;
3. Concrush; and
4. Other private sites.

It is clear that Awaba remains the preferred site for an organics processing facility.

LMCC is currently exploring development approvals processes for the site and on adjoining land. Those processes are not part of the terms of reference of this paper.
It is, therefore, assumed that suitable land can be found within the Awaba site precinct or immediately adjoining it. The only exception to this is transport to the existing Port Stephens AWT at Raymond Terrace. This option provides a number of advantages in terms of existing site approvals and options for EfW but has the significant drawback of transport costs. The relative cost benefit was investigated in Part 2 and this option remains one of the versions of the residual AWT processing solutions (Option 7).

9.5.1 Planning Approvals

Planning for AWT and other technology in NSW tends to be applicant driven and the NSW Government plays no active role in strategic planning for waste infrastructure.

If the facility is larger than 75,000 tonnes it will become a Part 3A ‘State significant development’.

However, if as a result of the GHD studies LMCC determines that Awaba is the preferred site then LMCC should commence the approvals process for a generic AWT or SSO plant forthwith. Not only will that expedite the approvals process but it will substantially reduce Provider risk and thus the costs to LMCC households.

Given the Awaba landfill already has waste receival and processing approvals, it would be reasonable to assume that appropriate development and license consents would be granted by the Department of Planning and the DECCW respectively.

9.5.2 Transport and Traffic

The incoming traffic generated by an AWT/SSO process on the Awaba site would be no different to the traffic to the landfill at present. However, there would be a small additional traffic loading generated by the sales and removal from the site of reprocessed and recycled commodities. Experience elsewhere indicates that this is less than 10% of the total traffic movement.

While a third bin would generate more truck visits up suburban streets the absolute numbers of trucks arriving at Awaba will remain generally constant, as each truck will have the same payload but of only one type of material.

If there are additional routes required or changes to driver rostering this may have a slight effect on trip movements but these again are unlikely to be significant.

Therefore, it is expected there would be a less than 10% traffic flow increase with the construction of an AWT or similar processing plant or the introduction of a third bin.
9.5.3 **Odour Management**

The choice of technology and technology provider is crucial to good odour management.

It is generally accepted that if the process includes food or biosolids or other noxious and odorous materials, it should be fully enclosed and odour controlled.

The only exceptions to this rule are in South Australia where Jeffries Soils is composting food and green waste at scale and Dulverton Waste Management in Tasmania which is composting food, green, biosolids and fish waste at 40,000 t/year scale.

These plants are licensed to receive and compost such waste outdoors because they are remote, have no adjoining neighbours and are not subject to stringent odour licensing requirements. This is unlikely to be the case at Awaba.

Consequently, LMCC should only consider outdoor windrow composting for source separated green waste (SSG). That would only be applicable if LMCC were considering a phased start to the introduction of its SSO service (Option 3).

All other options will need to be fully enclosed with appropriate air extraction and air cleansing systems such as a biofilter.

9.5.4 **Environmental Effects Including Dust and Litter**

Given the options considered are primarily fully enclosed and odour controlled the risk of significant odour problems is mitigated during the waste processing phases.

Only outdoor windrow composting of green waste will give rise to significant dust concerns during the processing phase.

However, all AWT and SSO technologies have compost maturation phases. Modern facilities use indoor maturation facilities unless specifically exempted to mature outdoors.

The following facilities have indoor maturation:

- Bedminster Cairns;
- Bedminster Port Stephens;
- SMRC Perth;
- VHM Melbourne;
- ArrowBio Sydney;
- Biomass Solutions Coffs Harbour; and
- SITA Mindarie.
The following facilities have outdoor maturation processes:

- UR3R Eastern Creek;
- SITA Kemps CK;
- Remondis Port Macquarie; and
- Tryton Lismore.

Obviously, a requirement to utilise indoor maturation can be specified by LMCC. This is a significant consideration in respect to costs.

LC recommends that Council determine a specific position on indoor/outdoor maturation prior to the tender documents being finalised. Council may choose to leave the issues of dust and litter to the tenderers to provide solutions.

Given that Awaba is relatively remote LC considers that outdoor maturation is appropriate with suitable environmental controls and standards of operation.

If Council determines that outdoor maturation is acceptable, dust and litter will need to be managed in the Standard Operating Procedures and Controls (SOP) placed upon the operator and will include such measures as, inter alia:

- Use of litter fences;
- Keeping the compost damp;
- Requirements for covering of outdoor stockpiles during high wind events;
- Continuous removal of stockpiles; and
- Ensuring sufficient buffer distances and types.
10.0 Financial Arrangements

10.1 Availability of Markets for Compost

Australia has some of the most degraded soils in the world. High grade composts such as those from SSO 3 bin systems have potentially unlimited markets.

Low grade composts such as those derived from 2 bin AWT processes, have more restricted markets but LMCC benefits from proximity to the Hunter Region which has one of the highest densities of degraded mine sites in Australia.

The market for low grade compost for mine site rehabilitation has proved positive though additional regulation requiring mine site repair would further stimulate this market.

Most AWT producers of low grade compost price the value of this material at negative $15/t. That is, they model their costs to include a $15 transport costs and giving the material away for free.

In 2010, they have been outperforming this benchmark with the value of AWT composts now covering their costs of transport. That is the value of the commodity is $0 inclusive of transport.

10.1.1 Compost Risk

Because of the lack of control on what a householder places in their residual bin, residual composting has a higher inherent risk than green or organics composting.

The new General Exemption for Output Organics from Mixed Waste (3F General Exemption) has provided the market and waste generators with improved certainty as to the markets and costs of supplying those markets.

The effect of the General Exemption is to make the market more certain but to make compliance requirements more stringent if an operator chooses to utilise the General Exemption route.

The alternative, which has not been changed in any way, is for AWT operators to apply for a specific licence to apply composts to a particular parcel of land under the normal licensing requirements in NSW. The General Exemption provides an additional alternative route to approval.
The compliance standards set down in the General Exemption become progressively more stringent over the next 3 years to 2013 and will be reviewed in 2013. The details of the exemption criteria were provided in the Part 2 Report.

The SAWT plant in Sydney is already achieving the 2013 standards for application of composts to land. Other plants are working with DECCW to lift their compliance so that they can avail themselves of the Gateway General Exemption. In particular, several residual composting plants are currently below the Gateway specified contamination levels and need to improve their performance.

The compost from the SSO composting plant will be required to meet AS4454, the Australian standard for compost. Council should also require that it be accredited under the new Compost Australia “5 tick” system. This will ensure that the compost has unlimited application in all land uses. Council may also choose to buy back these composts for use in the parks and gardens of Lake Macquarie or as a free giveaway to residents.

10.2 Market Competitiveness and Dynamics

The key market dynamics in the organics collection and processing market are set out below:

10.2.1 SSO

- The market for provision of 240 litre MGBs for green waste recycling bins is very competitive with SULO, Nylex and imported brands.
- The market for kitchen tidies and biobags is also very competitive amongst the same companies and others.
- The market for collection of green waste is highly competitive with more than 20 companies operating in the collection space across NSW. Council operates internal collection systems for garbage, and as such Council may wish to collect the third bin. There will be some synergies with either Council or the existing external contractor collecting the third bin in terms of management overheads, vehicle maintenance, bin maintenance etc.
- The market for processing of SSG, SSO and combinations thereof are highly competitive and a range of technologies and operators will respond to a well targeted and constructed tender process. These include SITA SAWT, Biomass Solutions, Remondis, Veolia, Thiess, WSN, VHM, Dulverton Waste Management, Phoenix, Tryton, GRL and a range of green waste composters.
- The market for high value AS4454 compliant composts is good and Council can have high levels of confidence that the technology provider will have a healthy market for the output compost product.
10.2.2 AWT MSW Residual Composting

- The market for the supply of AWT composting processes for mixed residual MSW in Australia is high with a wide range of companies developing or experienced in the field. These include SITA SAWT, SITA Bedminster, Biomass Solutions, Remondis, Veolia, Thiess, WSN, GRL, ArrowBio, Anaeco and SMRC.
- SSO and AWT residual composting share a similar short history in Australia with less than 10 operating plants nationally. (Most existing composting plants process SSG).
- The AWT MSW residual composting plants produce a lower grade compost characterised by physical contaminants (glass and plastic fragments) and potentially, chemical contaminants (often lead and zinc). These are regulated in NSW through the Output Organics from Mixed Waste General Exemption made under the 3F regulation of the POEO Act.
- The market for the lower grade AWT residual composts is expanding in mine site rehabilitation in the Hunter Region. In fact much of Sydney’s residual composts are being transported to the Hunter. However, market evidence is that while this is a large potential market there are few regulatory or price drivers requiring mines to commence rehabilitation work at all. The net effect is low demand and a requirement for AWT compost generators to continue to subsidise the transport and disposal of this lower grade compost. This risk rests with the AWT operator.

There is no doubt that the market for SSO compost is more buoyant than that for MSW residuals. This is one reason the SSO composting plant does not need to receive as high a gate fee as the MSW residual plant (see below). The compost can be sold for a profitable return whereas AWT composts are generally subsidised by up to $15 per tonne for transport and disposal.

In summary, LMCC can be confident that with a well designed, targeted and implemented procurement strategy, it should be in a position to achieve an excellent processing and collection outcome.

10.3 Financial Risk – Revenue Sources

The revenue from the sale of commodities is a relatively small proportion of the revenue stream of a waste processing plant. As stated previously, almost all recycling in Australia is underpinned by a processing gate fee paid by the waste generator.

This is more so for the residual AWT composting plants than for SSO plants since SSO plants produce a higher grade of compost targeted at a more vibrant market.
The typical process flow of an AWT residual waste sorting and processing plant in Australia is set out in Figure 34.

Figure 34. Typical AWT waste processing plant operating costs flow

Figure 34 shows that where the residual percentage to landfill is high as is the case for AWT processes (typically 40% for residual AWT waste bins), then the processing gate fee needs to be higher to offset the higher disposal costs.

Gate fees for residual AWT composting plants in Australia have been rising rapidly in recent years as a function of the higher cost of landfill disposal of residuals (driven by levies) and the reallocation of risk from Councils to AWT providers (discussed below).

10.4 Markets for Recyclables

This is also dealt with in detail in Part 3 of the Strategy.

LMCC is in a very positive position in respect to the sale of most commodities from any and all processing technologies. The output streams are listed in the table below with options for sale and disposal.
Table 20. Markets and uses for recovered products and commodities

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost AS4454 A grade</td>
<td>Potentially unlimited agricultural markets in the region</td>
</tr>
<tr>
<td>Compost NonAS4454 B grade</td>
<td>Extensive degraded mine sites throughout the Hunter</td>
</tr>
<tr>
<td>Electricity</td>
<td>NSW electricity grid e.g. Energy Australia,</td>
</tr>
<tr>
<td>Paper and Cardboard</td>
<td>Sydney or local buyers and pre-processors e.g. Visy, Amcor</td>
</tr>
<tr>
<td>Metals</td>
<td>Sydney or local buyers and pre-processors e.g. Sims, Sell and Parker, CMA</td>
</tr>
<tr>
<td>Plastics</td>
<td>Sydney or local buyers and pre-processors e.g. Polytrade</td>
</tr>
<tr>
<td>Glass</td>
<td>Sydney or local buyers and pre-processors e.g. OI, Visy</td>
</tr>
</tbody>
</table>

There are a number of ‘commodity’ streams for which markets are either poorly developed or alternative solutions are required.

Sale of commodities into these markets may be at a negative value (i.e. the Council or operator will need to pay either transport or transport and disposal) to dispose of the materials. These include but are not limited to materials described in Table 21 below.

Table 21. Uses and disposal options for residual streams

<table>
<thead>
<tr>
<th>Residuals</th>
<th>Disposal Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass fines</td>
<td>Local engineering works and landscaping</td>
</tr>
<tr>
<td>High calorific residuals</td>
<td>Future energy generators</td>
</tr>
<tr>
<td>Leachate</td>
<td>Awaba landfill and water treatment plants</td>
</tr>
<tr>
<td>Rocks, stones, dirt</td>
<td>Local engineering works</td>
</tr>
</tbody>
</table>

Source: Landfill Capacity and Demand Review DECCW 2010

The markets for all commodities are constantly rising and falling in line with international and local trends. As such, the above statements depend entirely on a range of issues including international market competitiveness, Australian market competitiveness, technology improvements and local innovation.
Finally, it is important to note that commodity risk will generally be taken on by the waste processor (not the Council). As such, the risk is baked into the gate price payable by the Council for the processing of the waste. Thereafter, it is the operator’s risk and responsibility to manage commodity sales. If Council is the operator then it will bear these risks.

Council needs to determine at the outset whether it is willing to take commodity risk. If it is then it will need to share both the upside and the downside commodity risks. If it chooses to enjoy higher commodity prices but not accept any of the downside risk, this will be priced into the gate fee by the Processor and will result in a higher gate fee.

These issues are considered further under the section on tendering and contract structure.

10.5 Capital and Operating Costs

The capital and operating costs of technologies are best determined through a market based competitive tender. Indicative prices for different technologies were provided in the previous results section.

Where the Council outsources the processing of waste, it will generally meet the capital costs through the gate fee payable to the processor over the term of the contract. Therefore, Council’s requirements for capital raising are limited.

Having said that, Council can borrow money (through Treasury Corp) at a lower rate than can most private sector companies. As such, LMCC may wish to consider designing, constructing and owning (DCO) the facility and then leasing it to an operator for a peppercorn rent. This is a higher risk option as it requires Council to own the plant and is not considered in detail in this report.

In relation to operating costs, generally all costs will be incorporated by the operator into the gate fee payable by Council. The main exception to this rule is the costs of disposing of residual waste from the processing facility which is often paid directly by the Council to the landfill operator. LMCC as the owner of the Awaba landfill will need to consider options around payment of these expenses in its contract drafting.

Given that LMCC is the landfill operator, it would be sensible for LMCC to consider bearing the costs of residual disposal up to a specified diversion level (arrived at through the tender process).

Where a third bin is involved there are additional collection costs and a one off bin purchase capital cost. There may also be a requirement for one or two additional trucks depending upon the existing allocation and resourcing schedules of the existing vehicle fleet. These costs were baked into the collection cost in the modelling.
10.5.1  **Likely Cost Increments**

The costs of each option were outlined in the results section. (To repeat: this analysis is on the basis that a private provider supplies most of the capital equipment. The major capital costs are baked into the gate fee payable by Council.)

For the purposes of the modelling, the annual cost per household commences at $297 per year (as per current payments by residents for use of the Awaba landfill).

As each option commences the cash flow rises to reflect the additional costs incurred by the Provider in processing the waste.

**Figure 35. SSO, AWT and landfill cost trends over 10 years**

10.5.2  **SSO**

The only significant capital outlay is the purchase of the 3\textsuperscript{rd} bin. Each bin costs $45 and for 74,000 bins translates to a one off expenditure of $3.3 million. On a per household basis, however, that translates into a one off $45 fee in 2012 (**Figure 35**).
The costs rise in 2012 with the one off costs of the new bin (amortised over 1 year) and then drop back to a normal operating expense.

In 2015, with the addition of food waste, the higher capital and operating costs of the enclosed tunnel composting plant drive Councils gate fee costs higher.

Again only the gate fee effect of the new tunnel system is seen by Council (and residents). The cash flow for the capital is absorbed by the Provider. If Council is the Provider the cost model should remain the same.

10.5.3 AWT MSW Composting

In the case of the MSW AWT process, the major cash flow for the private provider commences in 2012 and continues until 2015 when construction is completed. Again, Council does not experience this cash flow horizon.

Council and householders only start paying for the new service from commencement in 2015. Up until that point Council and householders continue to use Awaba and are subject to the increasing landfill costs associated with the landfill levy.

Both options then reflect a constantly rising operating cost with the cost of the MSW AWT being higher per tenement for all periods (Figure 35).

At 2019 the cost per tenement for AWT processing is $34/household more expensive per year than SSO as described previously in Figure 6 (Annual waste management cost ($ million) for each option over 10 years).

10.5.4 Over 30 Years

Both SSO and AWT MSW composting are cheaper than landfill over 30 years (Figure 36).

The cost of the MSW AWT tends to increase at a higher rate than the 3 bin option over the extended period. These additional costs are driven by the higher capital and operating costs of the AWT as described previously at Figure 7 (Annual waste management cost ($mill) for options over 30 years).
10.5.5 Development of Gate Price Funding Model and Implications for Rates

Figure 35 indicates that the cost of SSO from 2010 to 2014 will rise by a median of $25 per household per year or from $297 in 2010 to $415 in 2014. For this option it also spikes to $408 in 2012 to cover the costs of the new bins.

The AWT option follows exactly the landfill BAU option (because no AWT can be built before 2015 so this option is using Awaba landfill for this period). It also rises from $297 in 2010 to $406 in 2014 but without the spike in 2012. The AWT costs then rise at a slightly faster rate than SSO for the remainder of the 30 year period.

Note that these estimates are based on market estimates and not on tendered prices. The only way to determine the actual price increments will be to undertake a tender. Only at tender will private operators put forward their true and final commercial position.

In terms of the rates revenue needed by LMCC to cover these costs, funds will be raised through the Councils Domestic Waste Charge.
Irrespective of which option Council chooses SSO, AWT or BAU landfill, the costs of waste disposal are expected to rise by a median of $25 per year until 2014 and beyond. The increases in the DWC are, therefore, inevitable (Figure 35).

Over 30 years both options become substantially cheaper than landfill even with very conservative assumptions around CPRS and landfill levy pricing.

10.5.6 Domestic Waste Charge

It is not possible to introduce higher recycling and recovery rates without an increase in costs to ratepayers. The value of recycled commodities is simply not sufficient to offset the costs of additional collection and processing of waste.

Lake Macquarie’s Domestic Waste Charge is currently in the middle of the range (6th) from highest (Cessnock) to lowest (Shoalhaven) within the Extended Regulated Area. The ERA includes 13 councils (Figure 37).

Figure 37. Domestic waste charge LMCC v ERA Councils

![Graph showing domestic waste charge comparison between LMCC and ERA councils](source: DECCW 2008)

Of the Councils in the ERA and SMA LMCC’s Domestic Waste Charge ranks 30th out of 49 Councils (Figure 38).

A higher-than-normal increase in the Domestic Waste Charge will be necessary to fund the introduction of a new SSO/AWT service.
Figure 38. Domestic waste charge LMCC v ERA and SMA

Source: DECCW 2008
If Council increased the DWC by $25 (year 1) it would rise from the 6th in the region to the third highest (assuming the other Councils do not raise their charges). It would still be at the average across the SMA and ERA.

There is, therefore, some room to consider passing on costs through the Household Domestic Waste Charge. (On the other hand Council may decide to fund all additional costs from general rates, but this would run counter to appropriate fiscal management within Council).
Technology risk was identified by LMCC as one of two (only) preeminent assessment criteria (the other was carbon emissions).

The Australian experience of waste processing technologies has been similar to those of Europe and the United States. In all countries new technologies and technologists have emerged, developed pilot projects and then struggled to commercialise the technology. That has left a number of stable, staple technologies which have persisted for several decades.

11.1 Defining Risk for the AWT Sector

Technology risk in the waste sector is a function of the probability that:

1. The technology will be able to be scaled up successfully;
2. The cost will be in the expected range: acquisition cost, capital, operating and maintenance costs;
3. The system will be available, and the supplier solvent at the time contracted for delivery and operation;
4. The supplier will be available throughout the life of the equipment for servicing and operating assistance;
5. The system will perform as expected;
6. The system will have good reliability, over 85% operation when waste is available;
7. The system complies with the regulatory definition of the system (e.g., if it is regulated as an incinerator regardless of what the supplier calls it, then it is an incinerator), and complies with the permitting required by the regulatory authorities;
8. The system stands up to the legitimate concerns of NGOs (environmental groups, citizen committees, etc.); and
9. The system addresses the needs and concerns of the legislature or other governmental policy groups and their surrogates, etc.

The relative risk of 3 bin SSO and 2 bin MSW AWT is provided in the following figure (Figure 39) compared to the other technologies assessed in the Part 2 Report.
The analysis above indicates that the risks associated with source separated organics processed via enclosed (In-vessel) composting systems, have both a lower risk of failure and also a lower consequence of failure (the severity of the risk). (Other SSO composting options were rejected in the Part 2 Report due to the fact that the sites needed to be completely remote from households and industry. This is not the case for Awaba).

On the other hand, the MSW AWT processing plant has a slightly higher risk of both failure (more machinery to fail) and the consequence (severity) of failure. This is mainly a function of the higher processing complexity associated with MSW AWT and the risk that the plant fails to operate for a period.

Having said that, both of these technologies have substantially lower inherent risk than other technologies available in Australia and this was a major reason they were recommended from Part 2.
11.2 Community Feedback on Risk

LMCC and LC undertook two separate rounds of consultation with residents in both August and September 2010. These workshops were designed to explore the tolerance for risk and the community acceptability of different technological and process solutions. Over the 8 workshops more than 300 residents were involved.

The workshops identified and prioritised a range of risks to LMCC including:

1. Residents expressed a slight preference for a source separated 3 bin solution over mixed MSW AWT. The primary reason was the higher value and lower risks associated with the production and use of composts.
2. Residents are comfortable with non-thermal treatments. Thermal treatments are higher risk.
3. The technology must be able to guarantee significant diversion from landfill and the Awaba air space must be preserved.
4. Residents were concerned about the operational issues associated with the 3 bin including bin collection frequency, odours and available storage space.
5. The technology must be robust, tried and tested to ensure that breakdowns are minimised.
6. The cost to ratepayers must be reasonable.
7. The facility needs to ensure odour is properly controlled to avoid complaints.

The key outcome of the workshops was that the residents of the area, like the Council, have a fairly low tolerance for technology, financial and operational risk.
The general risks associated with the two preferred systems are given in Table 22.

### Table 22: Technology risk summary from Australian and international experience

<table>
<thead>
<tr>
<th>Technology</th>
<th>Risk and Reliability</th>
<th>Probability of Adverse Event</th>
<th>Consequence</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosed composting SSO – 3 bin</td>
<td>Leachate</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Litter</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Odour</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Gas migration</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Energy recovery systems</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Contamination inputs</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Product quality and contamination</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Operational breakdowns</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Enclosed composting of mixed residual MSW – 2 bin</td>
<td>Leachate</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Litter</td>
<td>Low</td>
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<td>Odour</td>
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<td></td>
<td>Gas migration</td>
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<tr>
<td></td>
<td>Operational breakdowns</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
12.0 Flexibility of Solution

Historically, landfill has been the safe haven, from a price perspective, for disposal of waste and as such a preferred option for local Councils. This is no longer true.

In fact the reverse is now true. Landfill pricing is rising rapidly and now has considerable uncertainty driven by landfill levies, EPA requirements, CPRS and rising community expectations for performance.

Such policies have been the main driver for strong AWT development in the Sydney area and the recent interest in such solutions by numerous NSW councils, including LMCC.

SSO and AWT systems have been built not because of their short term competitiveness, but because they are projected to become viable options in the long term keeping in line with National, State and Council policies of increased resource recovery.

Moreover, landfills have a finite capacity and therefore, a limited life. Well designed AWT plants can have a very long life and high returns on investment while also producing a useful product.

In that context, composting options become much more appealing despite their initial set up cost. There are also additional benefits of AWT methods such as: resource reuse, virgin resource use avoidance, sense of community, wellbeing and contributing to a better environment.

12.1.1 Could LMCC Just Keep Using Awaba landfill?

Figure 36 showed that there are good commercial reasons to move away from a dependency upon landfill, as landfill costs will rise sharply driven by landfill levies and the CPRS. (This modelling has used conservative assumptions on both drivers).

The summary of the Part 2 and Part 4 analysis is:

8. Awaba’s life is limited and alternatives must be sought over most time frames;
9. Landfill costs are rising steeply due to the landfill levy and CPRS;
10. Both SSO and AWT are cheaper than landfill over the medium term using conservative assumptions on landfill costs; and
11. Both AWT and SSO processes deliver good GHG outcomes compared to Awaba.
How quickly landfill becomes more expensive than SSO or AWT depends upon the assumptions made in relation to movements in the landfill levy and the introduction of a carbon price.

The cost competitiveness of SSO/AWT options compared to the landfill BAU was considered by the NSW State Government Public Review of Landfill Capacity and Demand. It suggested that the cost of landfill would rise above AWT by 2014 based on a Sydney landfill price of $200 in 2014 (Figure 40).

With the levy at LMCC coming into alignment with the levy in Sydney, the analysis is very applicable to Awaba and LMCC.

Figure 40. Sydney landfill gate price outstrips AWT gate fee from 2015

Source: NSW State Government Public Review of Landfill Capacity and Demand 2009

Despite an existing premium for use of AWT (in 2010 AWT costs more than landfill Figure 40), over time landfill gate fees will outstrip AWT gate price driving AWT/SSO competitiveness.

For LMCC, this is particularly true given that the life of Awaba is between 6 and possibly 24 years with (at risk) extensions. The additional 18 year extension depends upon what assumptions are made in relation to expanding the existing footprint (refer GHD’s Awaba landfill Footprint Review, 2010 pers. comm. and LC’s Awaba landfill Opportunity Value Report to LMCC, June 2010).
The preliminary analysis of the extension options finds:

- The current footprint will be exhausted in 6 years at current filling rates;
- There is available airspace for 18 years of additional filling within the current land holding;
- There are no obvious environmental impediments to a well run landfill extension on that site;
- There are considerable planning and approvals processes to be undertaken;
- Project risk relates to the approvals process. There is no guarantee of approval of the extension; and
- The new landfill SEPP requires that in association with an application for approval of a new or extended landfill, LMCC introduce AWT/SSO processes anyway.

Therefore, both the cost of Awaba and the risks of not achieving the required landfill approvals make a move to an alternative system both prudent and conservative.

12.2 Leakage of Recyclables to Garbage Bins

Current data from other jurisdictions indicate significant loss of recyclates into the waste bin.

The NSW Government estimates that 23% (by weight) of the residual bin in NSW is recyclable materials. That translates to 33% of all recyclates lost (by weight) to the residual bin.

There are only three reasons why recyclables might be lost from the recycling bin to the residual bin:

1. Lack of knowledge as to what is recyclable which is best managed by education and engagement;
2. The “I don’t care” factor which is best managed by education and engagement; and
3. Capacity constraints in the recycling bin causing leakage back to the residual bin (when good recyclers fill their recycling bin they have nowhere else to put recyclables than in the garbage bin).

Several jurisdictions are now examining or trialling the new SULO 360 litre recycling bin as a way of overcoming capacity constraints (problem 3 above). Brisbane City and Lismore Council are cases in point.

LMCC can both trial and introduce larger 360 litre bins without impacting on either of the preferred options. In fact the reverse is true. Take up of 360 litre recycling bins will reduce the presence of recyclables in the SSO bin and the residual bins. This will improve the efficiency of either preferred option.
12.3 Home Composting

LMCC is exploring the roll out of subsidised home composting bins.

Home composting is compatible with either the AWT or SSO options. In fact every tonne of organic waste that is composted at home is a tonne that is not collected, transported, processed and sold. The savings to Council in commercial terms are not yet clear but experience elsewhere indicates that home composting provides a positive return on investment. Any SSG or SSO contract entered into by LMCC should be cognisant of the presence of home composting systems and note the effect of home composting on composition characterisation of the kerbside organics streams.

In 1996, the Home Composting Council of the USA reviewed 249 backyard composting programs in 40 states and two Canadian provinces and concluded that such programs are successful and cost-effective throughout the United States, regardless of community size or socioeconomic status. Total net benefit was $43 to $44 per ton of solid waste.

The Part 2 Report summarised the mechanisms for introducing home compost bins:

- Focus efforts on single-family households, targeting home gardeners first;
- Develop a home composting brochure;
- Harness volunteers and community support and offer workshops;
- Distribute information through the media and local groups;
- Include grass recycling tips in any promotional and educational information;
- Consider a mobile or neighbourhood chipping program;
- Structure economic incentives for home composting;
- Consider subsidised compost bin purchase program;
- Provide a home composting hotline; and
- Monitor results, participation and diversion rates, and cost per ton diverted.

On-going monitoring of participation and community attitudes is essential in ensuring the program evolves to suite the demographic and community of LMCC.

12.4 Reuse Shops

Reuse shops at Awaba and in the city are entirely compatible with either the AWT or SSO solution.

Charities are often the key drivers of tip shop success as they have a different cost and benefit structure to their business operations.

Charities often operate the large item collection service to households on behalf of Council. Similarly giving charities a “first pass” right to capture re-usables from the kerbside during bulk waste clean ups can also deliver reductions in waste to landfill. Both are compatible with the systems LMCC is considering.
13.0 Community Consultation Process

13.1 Round One

An interesting overriding conclusion that can be derived from consultation sessions held so far is the widespread lack of awareness on waste issues. Most participants did not know that space is running out at Awaba landfill or that there are state government targets that need to be achieved by 2014. In fact, participants were surprised to find out that the majority of LMCC waste was going to landfill along with a lot of recyclables that are placed in the general rubbish bin.

In fact, participants seemed surprised to find out the high percentage of green waste being landfilled through the general waste bin. Such attitudes reveal that the public is largely unaware of what goes to landfill as the composition of their waste bin just “isn’t something they think about”.

The lack of information and waste education means that residents do not have enough information to develop weighted views and expectations with regards to waste management. As a result they often resort to instinct.

A good example of that was provided when participants were asked their opinion on a separate green waste collection. Most were negative, presumably because they thought of it as additional work for them and the collection crews. However, when informed of the composition of the average bin and the amount of green waste in it, most turned in favour of source separated green collections.

LMCC staff involved in waste management and education, are all too well aware of the need to disseminate such information to the public. The issue was a recurring comment in the staff consultation sessions.

Following round one consultation sessions, overwhelmingly participants stated that the sessions enabled them to gain a better understanding of the challenges facing LMCC with regards to waste management.
13.2 Round Two

Round two consultation sessions attracted 116 participants from the community and aimed to present the waste strategy development to date and seek resident feedback on the two preferred systems (3 bin SSO and 2 bin AWT). Table 23 below summarises the positive and negative elements of each system as identified by participants.

Table 23. Qualitative assessment of the preferred waste management options by LMCC residents participating in round two of the consultation process

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 bin SSO</td>
<td></td>
</tr>
<tr>
<td>Enables residents to act on waste issues personally</td>
<td>Space issues - where to keep the extra bin</td>
</tr>
<tr>
<td>Slightly cheaper option</td>
<td>Increased traffic to collect extra bin</td>
</tr>
<tr>
<td>Higher grade compost</td>
<td>Doesn’t recover as much waste from landfill</td>
</tr>
<tr>
<td>2 bin AWT</td>
<td></td>
</tr>
<tr>
<td>Easier, more convenient for residents</td>
<td>Doesn’t deal with disposal issues of green waste</td>
</tr>
<tr>
<td>Better for units/ people on small blocks</td>
<td>Less flexible than 3 bin system</td>
</tr>
<tr>
<td>More effective and efficient waste diversion from land fill</td>
<td>Lower grade compost- potential long-term environmental issues</td>
</tr>
</tbody>
</table>

Following discussions on the merit of each option, participants were asked to express their preference. Four possible choices were given:

1. Option 1: Prefer 3 bin SSO;
2. Option 2: Prefer 2 bin AWT;
3. Either option: “I’m comfortable with either Option 1 or Option 2”; or
4. Neither option: “None of these options are acceptable to me”.

A total of 61 residents, more than half of the 106 voting participants, expressed their preference for the 3 bin source separated organics system. Another 17 were happy with either system while 27 preferred the 2 bin AWT. Only one person rejected both options outright (Figure 41).
13.2.1 *Online Consultation Sessions*

In addition to the group consultation sessions, there is also an ongoing online discussion in LMCC’s waste strategy forum. A total of 168 users have been debating on the preferred options and commenting on specific implementation issues of a 3 bin solutions. Residents in favour of a 3 bin solution have been expressing a preference for a green waste only bin rather than an organics one.

Nevertheless on a two option preference vote, a 3 bin system solution is the clear winner in the online forum as well. In support of that, three quarters of the voters readily declare that they can accommodate a 3rd bin in their property (see Table 24).

**Table 24. Online waste consultation survey results for the period September 18th to October 1st 2010.**

<table>
<thead>
<tr>
<th>What bin system do you want?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 bin system (3rd bin for food and green waste)</td>
<td>60% (12)</td>
</tr>
<tr>
<td>2 bin system</td>
<td>40% (8)</td>
</tr>
<tr>
<td>Do you have room for a 3rd bin?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>75% (18)</td>
</tr>
<tr>
<td>No</td>
<td>25% (6)</td>
</tr>
</tbody>
</table>
14.0 Tender Scope and Contract Design

14.1 Introduction

AWT and SSO processing has developed rapidly in Australia in the last decade to now stand at 12 plants, processing a combined 1 million plus tonnes of material (or 5% of MSW general waste).

The AWT market is vibrant and competitive, with a number of new technologies and providers competing for Council (generally) domestic waste supply.

An AWT purchase is a considerable financial undertaking for a Council. Given that AWT infrastructure is generally procured for a 10-20 year period, AWT purchases are usually the highest value procurement decision a Council will make.

The contract value for LMCC will range between $40 million and $160 million over the life of a 20 year contract.

Therefore, it is essential that the procurement process be undertaken with rigour and with a focus on a positive outcome for all stakeholders.

The history of AWT procurement in Australia has been mixed. There have been a number of notable failures mixed with considerable successes. Too little attention has been paid to the procurement process and to the large sums of money at risk if the process chosen for this essential service fails technically or does not achieve the minimum diversion rate specified by the relevant State Government.

AWT procurement processes need to be properly resourced by Councils including specialist expertise in AWT technology, tender evaluation, financing of major projects, evaluation of Provider security etc.

Private companies would expect to spend 0.5-1% on planning and procurement costs for such projects ($500 thousand - $1 million). Few Councils have allocated such budgets to obtaining the best process with the best outcomes.

The VARRI process in Victoria has allocated $10million for AWT planning, infrastructure assessment and procurement processes.
The biggest concern facing waste processors (both AWT and SSO composters) is the allocation of risk in tenders. That is, Council allocating risk to Providers which would better be placed with Council.

Risk is related to cost. As their risk rises, Providers of services simply price it into the Gate Fee they charge for their AWT service. Misallocation of risk simply creates costs for LMCC and ratepayers.

However, it makes no commercial sense for either Council or the provider to shoulder risk that should be best held by the other party. To do so increases the risk profile of the project per se and thus the costs of the project.

14.2 Tender Scope

LC has recommended low risk, high performance processes and supporting collection systems. These systems have a proven track record in Australia, satisfy the test of having a 3 year profitable P+L and are robust technologies capable of handling changes in waste streams over time.

LC further recommends that the tender documentation specifically request tenderers to supply options for AWT residual MSW composting and SSO in-vessel composting. Options for additional treatments or variations should also be provided (refer procurement section of this report).

This does not preclude LMCC from exploring and allowing tender respondents to put forward options for other higher risk and energy based systems but these should be clearly identified as non-conforming options.

In the interests of market transparency, LC would recommend that any such tender be quite clear in its preference for AWT MSW or SSO composting as lower risk and higher performing options.

Already in 2010 three AWT and composting tenders have been terminated mid process. This leads to great frustration on the part of industry participants and will have the effect of dampening tenderer enthusiasm.

Consequently, LC advises LMCC to limit the conforming tender scope to composting AWT and SSO systems. This does not preclude non-conforming Anaerobic Digestion, energy etc options but provides very clear guidance to the market on Council’s perspectives.

LC further advises that the processing tender should be run independently and in advance of any review of the collection contract.

The chosen system for processing will dictate the type, scale, frequency and roll out of the complimentary collection system.
If, as recommended by LC, LMCC adopts a low risk, high value processing technology such as SSO or SSG with food as an optional add on, then collection system design is relatively straightforward.

As described above, it will involve the delivery of a third (green lidded) bin for green waste or green/food.

Council has a choice as to whether to provide kitchen tidies, biobags and aerated or non-aerated MGB’s (Mobile Garbage Bins). Council may also wish to explore bin size options (considered elsewhere in this report).

14.3 General Principles

The following general principles apply to the LMCC waste processing procurement process:

- Uncertainty = Risk = Cost = Higher Gate Fee.
- The higher the uncertainty and risk, the higher the gate fee will be from the outset of the contract.
- Risk should be shared and held by the party most able to mitigate and manage it.
- Contract risk can be minimised by accurate data and clarity in tender and contract documentation.
- AWT contracts tend to be of a Master-Servant style. There are currently no Alliance Contracts for AWT operation in Australia.
- Master (Council) Servant (AWT Provider) contracts can work well particularly when the Servant understands exactly what is required and has the information to make informed decisions.
- Information is often lacking in current AWT tender processes and some Providers have been caught out. There have been some notable commercial failures in the AWT sector as a result of (but not limited to) contract risk issues.
- Providers will claim variations where operating risk is uncertain and ill defined.
- Rise and fall provisions should reflect actual movement in costs and should not be used to reduce risk, revenues or as a cost reduction tool.
- The number of options being evaluated, modelled, priced and submitted adds to the cost of the service. Focussing the tender on the options acceptable to Council will reduce tender costs and risks.
- To put this in context the tender approval process for one international AWT provider requires it to both design, cost and lock in a Guaranteed Maximum building Price (GMP) for each AWT option (before the final tender is submitted). This can add $50,000-100,000 per option to the costs of tendering. These costs need to be recovered somewhere in the system.
- The contract should not only permit but encourage operators to source additional input tonnages of C+I and C+D organic wastes (green, food, biosolids, soiled cardboard etc). This will improve plant efficiency and reduce costs to Council.
14.4 Tender Process

- Tender processes for LMCC should involve the following:
  - Define the project.
  - Establish criteria to assess proposals against project objectives.
  - Write documentation inviting proposals.
  - Determine weightings to apply to assessment criteria.
  - Establish who will conduct the assessment.
  - Invite, receive and assess proposals.

- Non conforming bids should be invited and encouraged. Many contracts discourage nonconforming tenders. Non conforming tenders permit innovation and contract redesign. A conforming tender must be submitted also.

- LMCC recognises the risk of providing incorrect data and should not warrant its accuracy. LMCC should provide substantial and up-to-date, supporting information in the tender specification.

- The NSW DECCW AWT Assessment Methodology should be utilised as the basic framework for the tender.

- Late tenders should not be permitted.

- LMCC should specify in the documents, the duration of the tender and post tender negotiation processes.

- The period for submission of a tender for AWT should be no less than 3 months.

- AWT tenders now amount to many hundreds of pages. These should be able to be submitted electronically as well as in hard copy. (Note: if electronic there must be protocols in place for identifying the tender applicant on each page to ensure clarity).

- AWT Providers’ roles need to be well defined in AWT tender documents. This minimises contracting risk to all parties.

14.5 Contractual Design

LMCC will need to consider which contractual model it wishes to pursue. There are a large number of possible contracting models:

- BOO – Build Own Operate;
- BOOT – Build Own Operate Transfer (to Council);
- D+C – Design and Construct;
- DCO – Design, Construct and Operate;
- DCCTT (Design, Construct, Commission, Train and Transfer);
- Local Government owned and operated;
- Alliance contracting (shared risk and opportunities); and
- Joint Venture (e.g. an incorporated body).
These models have various advantages and disadvantages depending upon the duration of the contract, the value of the contract and the style of operational control the Council is seeking. There is no simple solution.

Typically, the AWT and SSO processing contracts operating in Australia (from Councils perspective) are BOO or BOOT contracts. That is Council enters a contract with a private operator to build, own and operate a facility to service Council’s waste for a period of time. The Council pays a gate fee to the operator which covers the operating costs, the costs of capital and the profit of the private provider.

That provider may then enter a D+C contract with a builder to have the facility constructed but this is typically not a matter for the Council.

14.6 Costs of Tender

The costs of procuring an AWT or processing solution can be very expensive (but still a small percentage of the overall contract costs). Typically a tenderer will spend $100-200,000 on an AWT tender including design and costings for the facility.

It is quite common for the experienced AWT providers to enter into binding D+C, or maximum price contracts with builders prior to lodgement of their tender. This locks in their maximum construction costs and thus mitigates risk associated with market movements between the tender and final approval to commence construction.

It is important that Council manages the tender process properly to not put operators to undue cost in preparing options which may not really be solutions from Council’s perspective.

One of the recurring complaints from operators is the number of options and variations that tenderers have to provide. If the tenderer is costing each option and entering into binding maximum construction arrangements prior to tendering, then each option or variation adds considerable complexity and cost.

14.7 Optimal Contract Period

For the optimal price, the AWT contract should be for the maximum period possible allowing for longer asset depreciation schedules. Having said that, contracts should provide for shorter terms or variations associated with the emergence of new processes, innovations, movement in markets or changes to regulatory regimes.

The external building and civil works of both an AWT or an SSO tunnel composting plant will generally be depreciated over a life of 40 years, the tunnels and any other stationary installations, over 20 years. Mobile equipment and sorting equipment will generally be depreciated over 10 years.
For this reason, most Build Own Operate contractors prefer long term contracts over which they can fully or nearly fully depreciate the assets.

If Council determines to contract over a shorter period then a bubble contract can be agreed allowing the transfer of viable assets to Council for an agreed price based on an agreed valuation process.

The ACCC recently approved 15 years while other AWT’s have been provided on 15+5 years.

### 14.8 Council’s Role and Obligations

- LMCC’s roles need to be well defined. Council as the author of the contract and the Master in the Master-Servant contract relationship, needs to understand their acceptable risk.
- LMCC should provide an up to date waste strategy with the tender, which clearly outlines Council’s future intentions for waste including future options for diversion, recycling and energy from waste.
- LMCC should provide an up to date (<2 year old) waste characterisation study as part of the tender specification to all tenderers. This will greatly improve facility design and reduce operational, design, building and therefore finance risk. A minimum sample size of household bins should be used to ensure lowest possible standard deviations and best possible characterisation of the waste stream.
- LMCC does not need to guarantee a minimum supply of tonnage (because it is householder generated and LMCC cannot control it) but Council should, guarantee 100% of the supply that is generated. Such as, "Council will guarantee supply but not the quantity of that supply, of Council owned household waste material".
- LMCC will need to specify whether other Councils may be future users of the facility at the tender specification stage. Options for multiple Councils to enter and not enter the final contract, places enormous uncertainty on the Provider and requires multiple design options to be considered. This is a significant driver of Operator Risk, Gate Fee prices and tender costs.
- The contract should specify an expected monthly upper and lower bound tonnage supply to the facility. One contract used a 30% band around an average (uses a 70% lower bound and 130% upper bound) to describe monthly tonnage to be supplied. Outside this range, contract variations may be considered.
- LMCC will need to guarantee a minimum characterisation (the mix of waste) to a facility for a period of time. Council should specify as closely as possible when decisions will be made which might affect future waste characterisation. These should be clearly listed as an Addendum to the Tender documents.
- LMCC will need to supply relevant demographic, planning and other data as necessary to limit uncertainty as to future growth projections. (This is not the same as guaranteeing future tonnes).
- LMCC should involve itself in recyclables trading only so far as it is also prepared to share all of the risks. Recyclable markets are highly volatile and LMCC taking the upside sales benefits but not the downside risks, simply pushes up the Gate Fee that the Provider requires to achieve benchmark return on capital.
- LMCC may wish to be involved in future carbon trading. The same issues for recyclables apply but the nature of the future market is more uncertain.
- The tender should permit innovation in Energy from Waste by allowing future innovation and performance improvement. Benefits should be disproportionately allocated to the Provider to encourage further innovation.
- LMCC should consider releasing its draft contract to the industry for comment prior to inviting tenders (e.g. through WMAA).
- LMCC should clearly specify its goals for the tender process so that Providers can understand Councils intentions and strategic direction. This specifically includes Councils desire to achieve the State Government waste reduction target of 66% by 2014.
- The tender assessment criteria and weightings should also be released as part of the tender pack.

14.9 Minimising Bias and Risk

- Councils in NSW have generally avoided identifying sites for AWT. That places a significant financial burden on Providers and can substantially bias the tender around issues of land availability rather than technological and operator superiority. On the other hand Western Australian AWT tenders generally specify the site and EPA licence requirements prior to the tender.
- LMCC has expressed a desire to locate a facility on land adjoining the existing Awaba landfill. This should be resolved and specified in tender documents. Site data should be available to tenderers.
- LMCC should, consider lodging the preliminary 3A application, Development Approval and EIS to the Joint Regional Planning Panel in advance of the tender process. This will substantially reduce tender costs, risk premiums and ultimately the cost to LMCC households.
- An example is the Gosford AWT process where the Council has not only offered the site for the AWT, but has also sought Development Approval and conducted an EIS prior to the Expression of Interest stage. This provides a high level of confidence to Providers, that LMCC is serious about the procurement process and delivering an outcome.
- LMCC should enter into the supply contract only after the plant has been fully commissioned. Some AWT tenders have required the Provider to take responsibility for waste disposal from the date of award of the contract. Requiring AWT providers to take responsibility for Council waste before the AWT is built increases risk and leaves the AWT provider beholden to the closest landfill operators (LMCC and Summerhill). This is inappropriate.
- LMCC should retain “interim” disposal responsibility and risk. The same applies to s.88 levy costs.
To the extent possible LMCC should specifically state the residual disposal costs at Awaba landfill for residual disposal from the AWT and the SSO processing plant and specify this in the tender. This should be based on a full cost recovery approach by LMCC with factors for unknowns such as a future carbon price and landfill levy adjustments. This will reduce tenderer risk.

The contractor bears responsibility and risk for use and disposal of materials under the Organic Outputs Gateway Exemption and the operator needs to take this into account in assessing which wastes to accept into its facility. If Council were the operator, this would lie with Council.

The LMCC tender document should specify the standard required of output materials from the AWT/SSO plants such as AWTDORF, AS4454, definition of Alternative Daily Cover etc.

14.10 Time Span for Commissioning

DECCW 2005 Waste and Resource Recovery – Service Delivery Timelines estimates that the minimum time to establish a new waste collection contract is 2 years with the possibility it could take considerably longer.

The main phases in procuring the collection system are summarised by DECCW in Table 25.

Table 25. DECCW predicted timeframe for a collection contract

<table>
<thead>
<tr>
<th>Activity</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation and planning</td>
<td>9 months</td>
</tr>
<tr>
<td>Tender preparation and documentation</td>
<td>3 months</td>
</tr>
<tr>
<td>Tendering</td>
<td>4 months</td>
</tr>
<tr>
<td>New service commissioning</td>
<td>8 months before and 6 months after service</td>
</tr>
<tr>
<td>Monitoring and review</td>
<td>Ongoing</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22 months or more</td>
</tr>
</tbody>
</table>

Recent experience in process technology procurement indicates that procurement can take at least 3 years inclusive of development applications and construction.

For advanced technologies, construction and commissioning can often be faster than the development approval processes.
Construction of the $60 million SAWT plant for example took 1 year, commissioning 6 months and approval 3.5 years. The total process from Development Application to Final Wet Commissioning took 6 years.

14.11 Procurement Process Summary

The specific issues of relevance in the procurement process are summarised below and were canvassed in the Part 2 Report (Table 26).

Table 26. Procurement process issues

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Waste Management Committee</td>
<td>Review Council’s Tendering Procedures</td>
<td>Advertise tender</td>
<td>Interview tenderers</td>
<td>Implement roll out plan</td>
<td>Contractor performance</td>
</tr>
<tr>
<td>Review Current Situation</td>
<td>Establish contract committee</td>
<td>Process for tender documentation</td>
<td>Final evaluation and report</td>
<td>Contract management plan</td>
<td>Community education and training</td>
</tr>
<tr>
<td>Conduct Trials of Collection Services (Optional)</td>
<td>Review Council’s tendering requirements</td>
<td>Pre tender meeting</td>
<td>Advise successful and unsuccessful tenderers</td>
<td>Implement community education plan</td>
<td>Reports to council</td>
</tr>
<tr>
<td>Review Accuracy of Council’s Rates Database</td>
<td>Review legislation and guidelines</td>
<td>Close/opening of tender</td>
<td>Finalise and sign contract</td>
<td>Revise equipment requirements</td>
<td>Contract management</td>
</tr>
<tr>
<td>Performance Review of Existing Services</td>
<td>Review DECCW model contracts</td>
<td>Display tender list</td>
<td>Contractor roll out plan</td>
<td>Customer service and support</td>
<td>Service performance</td>
</tr>
<tr>
<td>Community Attitudes Survey</td>
<td>Compile Tender Supporting Information</td>
<td>Preliminary evaluation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undertake Waste Audits</td>
<td>Customer Service &amp; Complaints</td>
<td></td>
<td></td>
<td>List of addresses</td>
<td></td>
</tr>
<tr>
<td>Research best-practice and expert advice</td>
<td>Education and Promotion</td>
<td></td>
<td>Bin distribution plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key Performance Indicators (KPI’s)</td>
<td>Contamination Management</td>
<td></td>
<td>MGB distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Market-Test Survey</td>
<td>Review and Adapt Tender Evaluation</td>
<td></td>
<td>Commissioning evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop Waste Strategy</td>
<td>Legal Review</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OH+S plan</td>
<td>Consider Tender Briefing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Education Strategy</td>
<td>Service Roll-out Plan &amp; Tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appoint a Probity Officer</td>
<td>Compile Tender Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

104
1. Consultation and planning
2. Tender documentation
3. Tendering
4. Evaluation
5. Commission
6. Monitoring

<table>
<thead>
<tr>
<th>Develop Service Options</th>
<th>Tender package compiled and ready.</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor Consultation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Service Review</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit preferred approach to Council</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 14.12 Summary

To the extent that Council can guarantee certain aspects of the contract the lower the risk to the operator and consequently the lower the cost of the service. In particular, Council should examine its ability to manage the following risks:

- Guarantee the duration of the contract in the tender with optional extensions;
- Guarantee a minimum tonnage to the facility or for example “all residual waste produced through the domestic waste collection system”;
- Forecast as closely as possible future population increases;
- Forecast as closely as possible future per capita consumption;
- Acknowledge the potential for changing feedstock to the plant and select technologies with a high tolerance for variability in waste characterisation;
- Guarantee market buy back for high grade composts;
- Establish minimum environmental performance standards to which all tenderers must comply;
- Require tenderers to either supply 3 years worth of operating Profit and Loss (P+L) for their systems or an operational characterisation which proves the technology risks are appropriately managed;
- Limit the scope of conforming tenders to acceptable technologies;
- Permit non-conforming tenders for other technologies and systems; and
- Additional merchant capacity should be permitted to reduce Council costs.
15.0 Performance Objectives and KPIs

All of the existing AWT and SSO contracts in Australia at present are “Master-Servant” relationships with Council setting and measuring performance against specific Key Performance Indicators.

Alliance contracting on the other hand, offers risk reward sharing. If Councils want to participate more fully in AWT/SSO processing then Alliance contracting should be given consideration. Shared capital funding may be part of an Alliance agreement but need not be. The KPI’s for an Alliance contract are very different from that of a Master-Servant contract. In Alliance contracting the key criteria for assessing the merits of an action or course of action is “what is in the interests of the project” and not a reliance on contractual terms and conditions.

The remainder of this section considers the KPI’s appropriate to a Master-Servant contract wherein Council tenders for and receives an acceptable proposal for a BOO or BOOT contract.

15.1 Objectives and KPI’s

15.1.1 Diversion

The preferred options must assist council to achieve the WARR 2014 target of 66% diversion. More often than not, these options are also seen by the public as progressive and as an improvement to landfill while they also reduce the cost of landfilling.

The most common means of enforcing a diversion commitment is to make the Provider liable for the disposal costs of any material in excess of that commitment. So for example if the Provider commits to a 60% diversion from landfill (40% residuals to landfill) then Council would typically pay the costs of disposal of 40% of the waste. If the Provider only diverts 55% and sends 45% to landfill then the Provider would be liable for the additional disposal costs of that 5% inclusive of the levy. With landfill prices at $180/t and rising, this is an onerous penalty. Council may consider options for mitigating this risk by accepting more or less of the burden for disposal of non-recoverable residuals.

LMCC needs to be careful that such an onerous burden and therefore Provider risk is not simply built into the operating gate fee of the facility. This is one of the main reasons that the AWT (Option 7) tends to have a higher operating gate fee.
15.1.2 Climate Change

Climate change is the most significant emerging problem in environmental and economic management in Australia. Australia is the 15th largest emitter of greenhouse gases in the world and one of the top 10 emitters per capita.

Australia’s landfills generate 3% of Australia’s greenhouse gas emissions and as such, are targeted by the Federal and State governments for both reductions in organics disposal and improved gas capture requirements.

Both composting options benefit from reducing greenhouse gas emissions associated with putting degradable organic carbon into landfill. As such, both Options would have been granted Carbon Credits under the Government’s Greenhouse Friendly Accreditation Scheme were it still in operation.

A performance target around creation of offset credits or carbon emissions avoidance would encourage the Provider to divert maximum quantities of organics and high embodied energy materials from landfill.

15.1.3 Commodity Markets

While this paper recommends that LMCC not get directly involved in commodity trading and sales, it does recommend that a KPI be established for the removal and sale of commodities from the site. Appropriate penalties for non-conformance would also be developed.

The recommended composting options have the benefit of creating useful products of differential value. In the case of composting of SSO it produces an AS4454 compliant compost for which there are existing markets for high quality, accredited, composts.

The KPI would relate to the production of AS4454 accredited composts and the removal of those products from the site. The commercial value of those products is a matter for the Provider not the Council.

The output material from Residual AWT Composting plants is a lower grade compost than that of SSO plants. As such, it has more restrictive controls applied to its use by the EPA. However, LMCC is close to the Hunter mining region which is currently one of the major outlets for Sydney AWT composts.

15.1.4 Employment

A further important strength that is specific to options based at Awaba landfill, is the retention of waste sector jobs within the LMCC area and the potential to create more through the construction and operation of new waste management facilities. The technology choice however, might be the facility’s weakness or strength.
Moreover, while the construction and operation of new waste facilities within LMCC boundaries is seen as an opportunity for the creation of additional jobs, any processing and disposal of waste outside LMCC jurisdiction threatens the creation of jobs within the LGA.

ACOR estimates that for every 2200 tonnes of materials recycled the sector creates 1 direct job and 1.8 indirect jobs. A KPI on job creation may be feasible but difficult to enforce.

## 15.2 Key KPI’s and Minimum Contract Specifications

The key criteria and KPI’s required for a successful AWT or SSO processing contract are summarised in Table 27.

### Table 27. Key LMCC KPI’s and minimum contract specifications

<table>
<thead>
<tr>
<th>Preferred tender structure and KPI's (based on NSW DECCW AWT Tender Specification)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The project objectives</td>
<td>Must be clearly defined by LMCC</td>
</tr>
<tr>
<td>The financial capacity of the service provider</td>
<td>Capable of financing the project; with a track record in waste processing</td>
</tr>
<tr>
<td>The performance of the technology</td>
<td>Suggested 3 year operating P+L for a reference plant of similar scale</td>
</tr>
<tr>
<td>The probity of the technology/service provider selection process</td>
<td>Minimum requirements per the Local Government Act</td>
</tr>
<tr>
<td>Possible changes to the composition or quality of the waste stream - minimum guarantees from Council</td>
<td>Council should consider a boundary range outside which price adjusts</td>
</tr>
<tr>
<td>Possible short and long-term variations in the quantity of waste are specified</td>
<td>Council should document expected future changes to systems that might affect quantity</td>
</tr>
<tr>
<td>Changes in market conditions for processing, sale of recovered products and residue disposal</td>
<td>Council should document expected future changes to systems that might affect sales</td>
</tr>
<tr>
<td>Impacts of routine maintenance, emergency facility shutdown and catastrophic shutdown</td>
<td>Council should specify its minimum expectations</td>
</tr>
<tr>
<td>Waste types requiring treatment and principal services required</td>
<td>Council should specify its minimum expectations</td>
</tr>
<tr>
<td>Roles and responsibilities of relevant parties</td>
<td>Council should specify its minimum expectations</td>
</tr>
<tr>
<td>Institutional arrangements in relation to facility ownership and operation</td>
<td>Council should specify its willingness to be a provider, alliance partner, Master</td>
</tr>
<tr>
<td>Specifications for end-products and Council involvement</td>
<td>Council should specify whether it wishes to accept rewards (and risks) of commodity trading</td>
</tr>
<tr>
<td>Acceptable treatment techniques - e.g. conventional landfills excluded</td>
<td>Council should limit scattergun tender specification to its preferred/acceptable systems + innovations</td>
</tr>
<tr>
<td>Sites for processing</td>
<td>Council should confirm site availability to all tenderers</td>
</tr>
<tr>
<td>Expectations in relation to disposal of residues</td>
<td>Council should document if it has requirements for disposal of residuals, where and at what price</td>
</tr>
<tr>
<td>Tender process</td>
<td>Broad areas of economic, environmental, social and technical Council should specify its KPI's for performance of the system</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tender process run in accordance with AWT Assessment Method and Handbook 2003</td>
<td>Base case - many do not</td>
</tr>
<tr>
<td>Period for tender submission &gt; 12 weeks</td>
<td>Tender process should take no less than 3 months to prepare.</td>
</tr>
<tr>
<td>Optional pre tender meeting - for clarity</td>
<td>Mandatory meetings add tender uncertainty - if a significant supplier cannot attend they must be rejected. Optional preferable.</td>
</tr>
<tr>
<td>Submission of tender by electronic format (with footer naming Proponent) or printed</td>
<td>Reduces printing costs and labour</td>
</tr>
<tr>
<td>EOI open and transparent</td>
<td>Minimises gaming amongst service providers</td>
</tr>
<tr>
<td>Public opening of tender bids but prices remain confidential</td>
<td>Promotes transparency without damaging competition</td>
</tr>
<tr>
<td>Council has utilised an independent adviser on the tender process and technology</td>
<td>No Council officer will have sufficient time to assess the range of technologies and risks</td>
</tr>
<tr>
<td>Must lodge a conforming tender</td>
<td>Ensures all providers have a minimum skill set and experience; permits comparison</td>
</tr>
<tr>
<td>A draft contract is provided with the tender - comments permitted</td>
<td>Permits Provider certainty and limits risk</td>
</tr>
<tr>
<td>Tender process allows for some material to be varied - may be rejected for noncompliance but not mandatory rejection</td>
<td>Not all providers are able to submit exactly to Council's specification. The tender should allow for minor variation. &quot;If the tender does not include all the information in the format required or is incomplete, it may be rejected&quot;.</td>
</tr>
<tr>
<td>Tender process permits non conforming bids and they are encouraged</td>
<td>This permits innovation; no Council is omnipotent in its tender design or technology specification. To eliminate nonconforming tenders is to limit possible innovation</td>
</tr>
<tr>
<td>Council provides as much data certainty as possible - does not warrant it</td>
<td>Providers do not expect Council to warrant what is put into bins. Just that all of it is provided to the provider under the contract terms</td>
</tr>
<tr>
<td>Tender specifies that expensive presentation aids are not required</td>
<td>Limits costs</td>
</tr>
<tr>
<td>All commercial information is kept confidential</td>
<td>Limits gaming</td>
</tr>
<tr>
<td>Formal process to raise concerns around impartiality and bias</td>
<td>Several EOI's have had accusations of bias made against them</td>
</tr>
<tr>
<td>Late tenders not considered</td>
<td>Limits gaming and private negotiations</td>
</tr>
<tr>
<td>Compensation generally not provided for tender bids</td>
<td>Councils need to consider compensation when they greatly increase bidder costs due to multiple options and unclear specifications; recognise this biases in favour of large providers</td>
</tr>
<tr>
<td>Acceptance of tender min 3 months max 18 months</td>
<td>Tender process should be no less than 3 months to prepare. Tender negotiations cannot roll on indefinitely. It is a cost to all parties. If not completed in 9 months then a new process should be considered.</td>
</tr>
<tr>
<td>Contractors role and obligations clearly defined</td>
<td>Council specifies acceptance criteria clearly with a waste schedule</td>
</tr>
<tr>
<td>Accept all contracted materials - residual and or green, food etc</td>
<td>Council specifies acceptance criteria clearly with a waste schedule</td>
</tr>
<tr>
<td>Treat all wastes</td>
<td>Council specifies disposal site, price and licencing</td>
</tr>
<tr>
<td>Dispose of appropriately</td>
<td>Council places obligations upon tenderers for due diligence and licencing, approvals etc</td>
</tr>
<tr>
<td>Obtain prior consent for activities outside specification</td>
<td>Minimum requirement</td>
</tr>
<tr>
<td>Operate in accordance with the contract</td>
<td>Minimum requirement</td>
</tr>
<tr>
<td>Established Performance Management Committee</td>
<td>Minimum requirement</td>
</tr>
<tr>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Established dispute resolution process to be used</td>
<td>Minimum requirement</td>
</tr>
<tr>
<td>Provider accepts contamination risk</td>
<td>Councils cannot control what is put in bin - correct risk allocation</td>
</tr>
<tr>
<td><strong>Council role and obligations clearly defined</strong></td>
<td></td>
</tr>
<tr>
<td>Waste strategy is provided as part of the tender pack</td>
<td>This minimises some of the uncertainty risk around material supply</td>
</tr>
<tr>
<td>Composition and characterisation report available as part of tender pack</td>
<td>This minimises some of the uncertainty risk around material supply</td>
</tr>
<tr>
<td>Guaranteed minimum tonnes - know which Councils are participating and bind their tonnes in advance</td>
<td>This provides significant risk minimisation for operator - not having to scale the plant design to various and often unknown input tonnages. Uncertainty around future tonnage increases provider risk and is built into gate prices. If tonnages fall then building depreciation is spread over fewer tonnes - gate fees must rise. Most providers must design, price and contract a builder on fixed price contracts for each tonnage option. This can add $100k per option.</td>
</tr>
<tr>
<td>Council supply guarantee - to supply all tonnes generated by that stream (not an absolute tonnage)</td>
<td>“Council will guarantee supply but not the quantity of that supply, of Council owned material”. This can significantly reduce risk.</td>
</tr>
<tr>
<td>Tonnes per month defined within bounds - high and low (30% each way)</td>
<td>Permits operator to build to a known flexibility - reduces costs</td>
</tr>
<tr>
<td>Variations thereafter if outside bounds</td>
<td>Permits operator to build to a known flexibility - reduces costs to all parties</td>
</tr>
<tr>
<td><strong>Guaranteed minimum type of material e.g. MSW including organics</strong></td>
<td></td>
</tr>
<tr>
<td>Residual MSW (general domestic waste)</td>
<td>AWT design depends upon the input characteristics - these should be known and defined within boundaries in the tender specification</td>
</tr>
<tr>
<td>SSO - Source Separated Organics (Green waste and Food)</td>
<td>SSO plants will require a specification of tonnage, content and quality</td>
</tr>
<tr>
<td>Other residual waste</td>
<td>Exclude from processing contract other than contamination handling</td>
</tr>
<tr>
<td>Recyclables</td>
<td>Exclude from processing contract other than contamination handling</td>
</tr>
<tr>
<td>Community Facilities and litter</td>
<td>Exclude from processing contract other than contamination handling</td>
</tr>
<tr>
<td>Rejected kerbside recycling materials</td>
<td>Exclude from processing contract other than contamination handling</td>
</tr>
<tr>
<td>Commercial and Industrial (C+I) and Construction and Demolition (C+D)</td>
<td>Merchant arrangements should be specified at the outset. Prohibiting an operator from sourcing other waste streams pushes up Council costs</td>
</tr>
<tr>
<td><strong>Clarity on future waste decisions</strong></td>
<td></td>
</tr>
<tr>
<td>Retention or otherwise of green in the input stream</td>
<td>Will vary for SSO and residual AWT tenderers</td>
</tr>
<tr>
<td>Retention or otherwise of food in the input stream</td>
<td>Will vary for SSO and residual AWT tenderers</td>
</tr>
<tr>
<td>Schedule of future waste changes provided - dates and tonnues</td>
<td>Will improve tenderer costing and targeting</td>
</tr>
<tr>
<td>Population, housing stock and other growth drivers provided in tender pack (data &lt;2yrs old)</td>
<td>Will improve tenderer costing and targeting</td>
</tr>
<tr>
<td>Existing contracts in place are specified e.g. Council preferred bin supplier etc. if relevant</td>
<td>Will improve tenderer costing and targeting</td>
</tr>
<tr>
<td>Council does not get involved in recyclable trading</td>
<td>Recyclable markets are highly unstable. If Council wants to share in the upside of market booms it should share in the downside of collapses. This just increases risk. Providers are best able to estimate prices and will bake this into the Gate Fee.</td>
</tr>
<tr>
<td>Council provide options for future Carbon trading or pricing</td>
<td>Carbon markets are still unstable and evolving. Councils are not historically engaged in carbon markets and trades. Future involvement will involve upskilling. However, Councils may seek a risk and benefit sharing arrangement</td>
</tr>
</tbody>
</table>
Tender provides for future innovation such as Energy from Waste

Contracts should permit further innovation in EfW and other

<table>
<thead>
<tr>
<th>Stated Goals of the LMCC Strategy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource recovery goals of strategy</td>
<td>66% diversion of LMCC MSW from landfill by 2014</td>
</tr>
<tr>
<td>Maximum recovery and diversion from landfill</td>
<td>Specified in the LMCC waste strategy</td>
</tr>
<tr>
<td>Highest environmental value and beneficial reuse</td>
<td>Specified in the LMCC waste strategy</td>
</tr>
<tr>
<td>Responsibility defined</td>
<td>Specified in the LMCC waste strategy</td>
</tr>
<tr>
<td>Local management of waste issues</td>
<td>Specified in the LMCC waste strategy</td>
</tr>
<tr>
<td>Environmentally responsible disposal of residuals</td>
<td>Specified in the LMCC waste strategy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stated Goals of the Tender process</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource recovery residual AWT</td>
<td>Minimum diversion suggested 60% AWT residual including organics and recyclables in the residual MSW bin.</td>
</tr>
<tr>
<td>Resource recovery SSO composting</td>
<td>Minimum diversion suggested 95% of input organics SSO</td>
</tr>
<tr>
<td>Acceptance and disposal of residual waste</td>
<td>Specified in the tender documents</td>
</tr>
<tr>
<td>Maximum recovery rewards</td>
<td>Provide commercial incentives for maximum diversion based on landfill cost savings to Council</td>
</tr>
<tr>
<td>Secure favourable price</td>
<td>The purpose of the tender</td>
</tr>
<tr>
<td>Maximise sustainability performance</td>
<td>Requirement for tenderer to document</td>
</tr>
<tr>
<td>Recover resources for highest and best use</td>
<td>Minimises costs of overall service. Tenderer to document</td>
</tr>
<tr>
<td>Minimise reliance on landfill</td>
<td>Achieve the state target of diversion of 66% by 2014</td>
</tr>
<tr>
<td>Achieve the Government's 66% resource recovery target</td>
<td>It is surprising that few Councils name the State Government target as a driver and an obligation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defining the assessment criteria and KPI's</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic viability</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Delivering value to LMCC</td>
</tr>
<tr>
<td>Financial capacity of provider</td>
<td>Minimum 3 year operating and profitable P+L at similar scale reference plant</td>
</tr>
<tr>
<td>Technology reliability</td>
<td></td>
</tr>
<tr>
<td>Flexibility regarding input streams</td>
<td>Technology must be able to deal with a wide range of materials which may vary over time</td>
</tr>
<tr>
<td>Flexibility regarding contamination</td>
<td>AWT residual streams are not controllable by Council. SSO streams - up to 30% contamination possible</td>
</tr>
<tr>
<td>Modularity</td>
<td>Plant capacity can be cost effectively increased with population and waste generation growth</td>
</tr>
<tr>
<td>Capacity to accommodate changing waste inputs specifications</td>
<td>AWT residual streams are not controllable by Council. SSO streams - up to 30% contamination possible</td>
</tr>
<tr>
<td>Capacity to accommodate changing product output specifications</td>
<td>AWT DORF - General Exemption for Organic Outputs from mixed waste. SSO AS4454 A grade.</td>
</tr>
<tr>
<td>Location of receipt facility</td>
<td>Preferably Awaba</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Technology experience</td>
<td>At least one reference plant with long term operational success and 3 year P+L profitability</td>
</tr>
<tr>
<td>Efficiency of waste reduction</td>
<td>Diversion commitment made by Provider</td>
</tr>
<tr>
<td>Operational reliability</td>
<td>Breakdown history and plant availability statistics</td>
</tr>
<tr>
<td>Demonstration facilities - operating</td>
<td>Reference plants in operation at similar scale</td>
</tr>
</tbody>
</table>

### Environmental footprint

<table>
<thead>
<tr>
<th>Environmental footprint</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming and emissions reduction</td>
<td>GHG reductions, offset credit generation potential, Emissions footprint</td>
</tr>
<tr>
<td>Air emissions including odour</td>
<td>Guarantees of odour footprint, price penalties for failure, airshed modelling</td>
</tr>
<tr>
<td>Biofilter operations</td>
<td>Scale, experience and documentation</td>
</tr>
<tr>
<td>Water emissions</td>
<td>Quantity and quality, on site treatment capacity</td>
</tr>
<tr>
<td>Resource recovery and conservation</td>
<td>Diversion and type of materials recovered, commitment to innovation</td>
</tr>
<tr>
<td>Dust</td>
<td>Footprint, measurement, reporting and mitigation</td>
</tr>
<tr>
<td>Noise</td>
<td>Footprint, measurement, reporting and mitigation</td>
</tr>
<tr>
<td>Diversion commitment</td>
<td>Absolute % diversion commitment, Landfill levy exemption to this level</td>
</tr>
<tr>
<td>Traffic management</td>
<td>Footprint, measurement, reporting and mitigation</td>
</tr>
<tr>
<td>Visual impact</td>
<td>Footprint, measurement, reporting and mitigation</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>Footprint, measurement, reporting and mitigation</td>
</tr>
<tr>
<td>Housekeeping</td>
<td>Experience, reference facility, SOP, resources, plant processes to minimise requirements</td>
</tr>
<tr>
<td>Environmental innovation</td>
<td>Commitment and price incentives shared</td>
</tr>
</tbody>
</table>

### Social impacts

<table>
<thead>
<tr>
<th>Social impacts</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community impacts and relations</td>
<td>Experience, commitments, measurement, reporting and engagement</td>
</tr>
<tr>
<td>Residential amenity</td>
<td>Complaints management and number</td>
</tr>
<tr>
<td>Employment</td>
<td>Direct and indirect job creation - construction and permanent; value adding</td>
</tr>
<tr>
<td>Natural and cultural heritage impacts</td>
<td>Document and mitigate</td>
</tr>
<tr>
<td>OH+S</td>
<td>Experience, commitments, measurement, reporting and control</td>
</tr>
<tr>
<td>Industrial relations</td>
<td>Experience commitments, measurement, reporting and control</td>
</tr>
</tbody>
</table>

### Other

<table>
<thead>
<tr>
<th>Other</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality assurance</td>
<td>Commitment and experience; product quality; outreach and extension services</td>
</tr>
<tr>
<td>Management and staff resources</td>
<td>Experience commitments, measurement, reporting and control</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Contract program and commencement arrangements</td>
<td>Flexibility, requirements and penalties</td>
</tr>
<tr>
<td>Marketing and promotion</td>
<td>Experience commitments, measurement, reporting and control</td>
</tr>
</tbody>
</table>

**Minimising bias and risk**

<table>
<thead>
<tr>
<th>A land parcel provided as part of the tender site options or requirements</th>
<th>Provided by LMCC at Awaba or similar site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land is identified and Development Approvals are sought by Councils for generic AWT prior to tender</td>
<td>Recommended for LMCC. Most Western Australian AWT procured in this manner - eliminates land title as a factor in technology tenders</td>
</tr>
<tr>
<td>Land purchase and DA's</td>
<td>The single biggest bias is the availability of land pre zoned and available.</td>
</tr>
<tr>
<td>Landfill disposal before Facility commencement rest with LMCC</td>
<td>Putting disposal obligations onto the Provider prior to contract commencement significantly biases the tender in favour of Providers who own landfills and can accommodate this risk.</td>
</tr>
<tr>
<td>S.88 landfill disposal costs before Facility commencement rest with LMCC</td>
<td>Putting disposal obligations onto the Provider prior to contract commencement significantly biases the tender in favour of Providers who own landfills and can accommodate this risk.</td>
</tr>
<tr>
<td>Location of residual waste disposal facility is specified and the price is pre-contracted by LMCC and in tender</td>
<td>Council should supply a gate fee price and all tenders are based on this fee. If a provider wishes to offer a cheaper fee that is a separate consideration.</td>
</tr>
<tr>
<td>The Awaba or Summerhill disposal landfill gate price is negotiated by LMCC in advance and is fixed in the contract specification</td>
<td>Council should supply a gate fee price and all tenders are based on this fee. This also limits the pre-tender negotiations between parties.</td>
</tr>
<tr>
<td>Output material specification or guideline is provided in the Tender docs e.g. AS4454, AWT DORF</td>
<td>Minimum expected standards of output products should be specified in the tender docs including AWT residual compost (General Exemption Mixed Waste) and SSO AS4454 A grade.</td>
</tr>
<tr>
<td>Alternative Daily Cover is clearly defined and specified e.g. similar to AWTDORF standard</td>
<td>Council may be able to utilise some residual composts and residuals as ADC. If so the specification should be specified in a schedule to the contract.</td>
</tr>
</tbody>
</table>

**Maximising performance and value**

<table>
<thead>
<tr>
<th>Duration of contract should be as long as possible but subject to innovation and review:</th>
<th>Council should keep to a practical minimum the number of options it requests as each requires separate modelling and considerable expense.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;7</td>
<td>A processor should also be able to tender for the period they prefer. At present most tenders require them to provide pricing for all periods.</td>
</tr>
<tr>
<td>&gt;10</td>
<td>ditto</td>
</tr>
<tr>
<td>&gt;15</td>
<td>The longer the term the cheaper the price all other things being equal; but whatever the contract length the contract should allow for review and variation to ensure innovations, changes to market and law etc. are all permitted.</td>
</tr>
<tr>
<td>15+5</td>
<td>The contract should be as clear as possible on Councils expectations.</td>
</tr>
<tr>
<td>Other extensions specified in tender docs and contract</td>
<td>Merchant arrangements should be specified at the outset. Prohibiting an operator from sourcing other waste streams pushes up Council costs. This may impact upon other KPI’s eg residual disposal and needs to be built into the contract management.</td>
</tr>
<tr>
<td>Additional merchant capacity approved - site can be used for other suppliers</td>
<td>Council pays the levy only on the residual % specified by the provider - the rest is risk</td>
</tr>
<tr>
<td>Provider guarantees a minimum diversion %:</td>
<td>This puts risk in the right location</td>
</tr>
<tr>
<td>Council pays the levy only on the residual % specified by the provider - the rest is risk</td>
<td>This puts risk in the right location. Where Provider reduces landfill % they retain the s.88 contribution in several tenders as a bonus.</td>
</tr>
<tr>
<td>Termination of the contract limited to only major infractions</td>
<td>Most contracts allow termination for minor infractions which simply increase operator risk; dispute mechanisms are more appropriate</td>
</tr>
<tr>
<td>Council consider alliance risk and benefits sharing</td>
<td>Councils have not yet entered alliance partnerships for AWT but this provides a model for risk sharing</td>
</tr>
<tr>
<td>Limit penalty payments to the most critical KPI's</td>
<td>Use of Penalty Units simply increases Provider Risk and does not necessarily improve performance. It can lead to significant revenue risk for the provider and is reflected in Gate Fees at time of tender</td>
</tr>
</tbody>
</table>

09-524-5.2-R-004 (FINAL Strategic Waste Options & TBL Analysis - PART 4 Implementation Considerations)
<table>
<thead>
<tr>
<th>The provider should indemnify Council for some, but not all liability</th>
<th>Councils try to put all risks on the provider even where the issue is Council's responsibility- this just pushes up costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obligation to provide finance security</td>
<td>Limits gaming</td>
</tr>
<tr>
<td>Council states No obligation to accept cheapest option</td>
<td>Limits gaming</td>
</tr>
<tr>
<td>CPI source and Rise and Fall calculators are specified in the contract</td>
<td>Several AWT contracts limit CPI adjustments to a fraction of CPI to adjust for fixed building and other costs against variable. This needs to be carefully calibrated.</td>
</tr>
</tbody>
</table>

**Education**

<table>
<thead>
<tr>
<th>Educational responsibilities are clearly defined in the tender</th>
<th>Education is a direct pass through and can be specified exactly in the contract as $ or resources or both. It is impossible for a provider to know what Councils expectations are unless they are told.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost or resource requirements are clearly specified in the tender</td>
<td>Education is a direct pass through and can be specified exactly in the contract as $ or resources or both.</td>
</tr>
</tbody>
</table>
16.0 External Price and Policy Influencers

16.1 Emissions Trading

It remains unclear how soon either the Federal Government or Opposition will introduce a market based price for carbon or a CPRS in particular.

The Opposition has now hardened its position to say that it will never introduce a carbon price but will achieve its emissions reductions targets through direct action and direct funding from the budget. This is regarded as not much more than a stopgap as it will have an ever increasing burden on the budget and demands for limited financial resources.

On the other hand, the Prime Minister has announced a policy to prosecute the argument for a carbon price over the first term from 2010-2013, with a review between 2012 and 2013. There is limited funding for direct action.

As such, it is difficult to put a specific price on carbon in the modelling and financial analysis. The assumptions currently operating in the model are a $10/t CO2e price from 2013 rising to $20 and ultimately capped at $40/t. This is regarded as conservative, given that Europe is already at A$50/t CO2e.

The price of carbon does not have a significant effect on model options and is swamped by the effect of landfill levies, landfill operating costs and CPI.

It does, however, have a relative effect between options.

Erring on the side of caution, LC recommends that LMCC include a relatively low carbon price (as has been done) but operate as if to expect a carbon price increase over the next 5 years.

16.2 EPR Schemes

The EPHC on November 2009 adopted a new National Waste Policy (refer earlier discussion). As part of that policy, the nation’s Environment Ministers agreed to the introduction of product stewardship legislation to be applied to televisions and computers.

There is a strong focus in the National Waste Policy on moving away from end-of-pipe solutions to waste management and tackling responsibility through the manufacturing supply chain.
The EPHC met again on 13th July 2010 and reaffirmed that Product Stewardship will be a “primary focus” over the next 3 years. That was reinforced in the National Waste Policy Implementation Plan also released on the same day.

In terms of implications for LMCC MSW the interaction will be relatively weak. The EPR schemes are expected to apply directly to televisions, computers, possibly car batteries, mercury containing lighting and used tyres.

Of these, the presence of car batteries in the waste stream will affect the operation of a SSO, SSG, or Residual AWT system.

In the case of Residual AWT processing lead acid batteries have caused significant problems for waste plant operators and a program to take car batteries out of the residual waste stream would be welcomed.

It would result in a slightly lower gate fee (payable by Council) as it would reduce some of the costs of sorting batteries out of the waste stream and importantly reduce some of the obligations for heavy metal auditing and measurement. Nevertheless, it is impossible to ensure complete diversion of such materials.

16.3  National Waste Policy Implementation Plan

The National Waste Policy Implementation Plan released in July 2010 provides clear guidance on the focus of the nation’s Environment Ministers over the next 5 years.

Clear priorities include:

- Identifying opportunities where nationally consistent waste classification and data would be beneficial in supporting evidence based decisions;
- Supporting agencies to use sustainable procurement principles;
- Facilitating development of national standards and/or specifications for reuse of concrete and tyres and reprocessed organics in specific applications;
- Developing strategies to reduce greenhouse gas emissions from landfills and other waste activities;
- Establishing an approach to reduce hazardous substances in products and articles;
- Monitoring environment for selected chemicals of concern;
- Undertaking an infrastructure audit for selected remote indigenous communities; and
- Publication of the 2013 national waste report.

In particular, the Product Stewardship Schemes and regulatory framework should be in place by mid 2011 for televisions and computers. A scheme for tyres should be developed by May 2011 and commence by the end of 2011.
Other key areas of actions and their time lines are provided in Table 28 below.


<table>
<thead>
<tr>
<th>Key Direction</th>
<th>Action</th>
<th>Milestone date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taking Responsibility</strong></td>
<td>Australian Packaging Covenant part 3</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Product Stewardship and Fluorocycle</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Biodegradable bag standard for home composting</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>National Product Stewardship legislation</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>National TV and Computer schemes</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>National Tyre Scheme</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>Sustainable Procurement reports</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>Australian standard for E Waste recycling</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>Sustainable procurement guidance</td>
<td>2013</td>
</tr>
<tr>
<td><strong>Improving the Market</strong></td>
<td>Standards and specs for C+D recycling and Organic waste clarified</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Definition of waste refined</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Safe reuse of waste scoping paper</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>Benefit and cost of national waste classification</td>
<td>2014</td>
</tr>
<tr>
<td></td>
<td>Standards and specs for C+D recycling and Organic waste clarified</td>
<td>2015</td>
</tr>
<tr>
<td><strong>Pursuing Sustainability</strong></td>
<td>Document approaches to C+I recycling</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>Greenhouse gas strategy for waste</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>Review impediments to recycling</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>Review impediments to C+D recycling</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Best practice review of landfill management</td>
<td>2014</td>
</tr>
<tr>
<td><strong>Reducing Hazard and Risk</strong></td>
<td>Stockholm convention review</td>
<td>2011</td>
</tr>
<tr>
<td></td>
<td>Risk management body established for chemicals</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>Hazardous waste labelling review</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>Inventory of hazardous waste infrastructure</td>
<td>2014</td>
</tr>
<tr>
<td><strong>Tailoring Solutions</strong></td>
<td>Audit of waste services in indigenous communities</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Funding and service levels agreed for indigenous services</td>
<td>2012</td>
</tr>
<tr>
<td>Key Direction</td>
<td>Action</td>
<td>Milestone date</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Providing the Evidence</td>
<td>National waste report</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Assessment of value of nationally consistent data</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td>Short term improvements to data</td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>2013 national waste report</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>National waste data option report</td>
<td>2014</td>
</tr>
<tr>
<td></td>
<td>National waste data approach agreed</td>
<td>2015</td>
</tr>
</tbody>
</table>

It remains to be seen whether this list of initiatives is funded and driven by the EPHC. Of these, the requirements for a consolidated set of definitions of waste and the move to establish Product Stewardship Schemes are the only actions likely to influence LMCC and its decision making process.

### 16.4 Food Waste Recovery

In July 2010, the South Australian Government announced $6.1 million in funding to assist Councils to develop SSF services to more than 600,000 households. The incentive was designed to cover 50% of the start-up costs. Trials were held at 10 Councils and the funding is directed towards the supply of kitchen bench top containers for food, and biodegradable bags.

Appropriate advocacy to the NSW Government under landfill levy funding through the City and Country Environment program may prove fruitful for roll out and implementation with financial support from DECCW.

### 16.5 Landfill SEPP

As stated earlier, in July 2010 the Government amended the Infrastructure State Environmental Planning Policy (SEPP) for Landfill Applications (2007) relating to mandatory considerations for determining applications for landfill facilities under Part 3A and Part 4 of the Environmental Planning and Assessment Act 1979.

Clause 123 of the Infrastructure SEPP prescribes criteria that consent authorities must consider when assessing and determining applications for landfill facilities. On 7th July 2010, clause 123 was amended to reflect changes in market conditions for landfill disposal. The new criteria shift the emphasis from “justifiable demand” towards increased waste recovery and other improved environmental outcomes.
The new criteria to be applied to landfill applications (including Awaba and any possible future Awaba bioreactor option) include:

1. Whether there is a suitable level of recovery of waste, such as by using AWT or the composting of food and garden waste, so that the amount of that waste is minimised before it is placed in the landfill.
2. Whether the development:
   a) Adopts best practice landfill design and operation; and
   b) Reduces the long term impacts of the disposal of waste, such as greenhouse gas emissions or the offsite impact of odours, by maximising landfill gas capture and energy recovery.
   c) If the proposal relates to a new or expanded landfill;
      i) Whether the land on which the development is located is degraded land such as a disused mine site; and
      ii) Whether the development is located so as to avoid land use conflicts, including whether it is consistent with any regional planning strategies or locational principles included in the publication WIS Guideline: Landfilling (DOP 1996) as in force from time to time.
   d) Whether transport links to the landfill are optimised to reduce the environmental and social impacts associated with transporting waste to the landfill.

As such, any application to extend the life of Awaba is likely to be captured by the landfill SEPP and require the introduction of significant recycling and resource recovery actions.

Consequently, the BAU option applies for only the remaining existing 6 year life of Awaba. If Awaba is to be extended beyond its current footprint via an application for a footprint extension or filling amendment it will be captured by the landfill SEPP. Therefore, the BAU option is only a 6 year option. Thereafter, it becomes an enhanced BAU option, wherein the government will require improved recycling activities. This will put the focus back onto the other 9 options outlined in this paper.

### 16.6 Education Costs

Experiences elsewhere show that best practice waste reduction involves an integrated set of behavioural change programs that capitalise on specific local opportunities.

Education costs are a direct pass through of the AWT/SSO composting business.

It is not possible for Providers to estimate Councils commitment to education spending in advance. It should, therefore, be documented in the tender specification. For example “the Provider is required to provide $300k per year for waste education to be administered by LMCC”. This will simply be added to the service costs.
The common problem with Government-run community education programs is the difficulty in quantifying any improvements and thus the budgets remain vulnerable to the whims of “efficiency”.

It will need to be remembered that there is an educative “journey” that the public will progress along from awareness through to action. LMCC needs to identify a wide spectrum of indicators for their community engagement so that they do not lose sight of gains in public awareness and other less tangible outcomes.
17.0 Willingness to Pay

In 2009, Lake Macquarie City Council commissioned a random community survey of 1,000 residents in an effort to assess the priorities of the community and their attitudes to Council’s performance.

For the purposes of this report it is sufficient to document that the survey findings including:

1. The relatively high importance given to waste issues by LMCC residents.
2. The current relatively high levels of satisfaction with waste services.
3. The slowly declining trend in satisfaction with waste services over time.
4. The need for action in some specific areas including recycling in public places and litter control.
5. The high satisfaction rating pointing to a high level of willingness to participate in new programs to improve waste services.

Waste related matters ranked four times in the Top 10 issues important to residents, including position one.

Table 29. LMCC householder’s priority issues 2009

<table>
<thead>
<tr>
<th>Importance ranking</th>
<th>Service/facility</th>
<th>Importance mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waste collection</td>
<td>4.69</td>
</tr>
<tr>
<td>2</td>
<td>Maintaining road surfaces</td>
<td>4.65</td>
</tr>
<tr>
<td>3</td>
<td>Community safety/Crime prevention</td>
<td>4.62</td>
</tr>
<tr>
<td>4</td>
<td>Kerbside recycling collection</td>
<td>4.62</td>
</tr>
<tr>
<td>5</td>
<td>Road and traffic safety</td>
<td>4.58</td>
</tr>
<tr>
<td>6</td>
<td>Litter control</td>
<td>4.47</td>
</tr>
<tr>
<td>7</td>
<td>Generating local employment opportu</td>
<td>4.46</td>
</tr>
<tr>
<td>8</td>
<td>Maintaining drains</td>
<td>4.42</td>
</tr>
<tr>
<td>9</td>
<td>Recycling bins in public places</td>
<td>4.42</td>
</tr>
<tr>
<td>10</td>
<td>Beach patrol</td>
<td>4.37</td>
</tr>
</tbody>
</table>
Of the waste issues residents believed collection, kerbside recycling and litter control were the most important and of those, litter was the least performing (Figure 42).

Figure 42. Importance and satisfaction with each issue

The survey points strongly toward a public willingness to engage with Council in the introduction of new systems and technologies to improve waste management and recycling in Lake Macquarie.

17.1 WMAA Willingness to Pay Survey

In 2008, the Waste Management Association of Australia conducted research on resident willingness to pay for recycling technologies.

Undertaken by Taverner Research the study involved interviewing 700 random Australian householders (3.8% error margin).

The key findings of the research were:

- More than 93% of ratepayers support for the concept of AWT treatment of household waste (Figure 43).
- 70% of ratepayers would willingly pay an additional $1/week ($50/yr) for recycling systems for their waste.
- Residents of NSW had a similar willingness to pay as the national average.
Figure 44 indicates a very high willingness to pay for new recycling and resource recovery systems amongst Australians in general and Tasmanians in particular. 90% of respondents were prepared to pay 20 cents per week ($10/yr) for improved waste systems while 70% were prepared to pay an additional $1 per week ($50/yr). Tasmanians were notably more willing to pay for improved recycling systems with 83% prepared to pay an additional $1 per week compared to the national average of 70%.

50% of NSW residents were prepared to pay an additional $5/week for improved services ($250/year).
More significantly, 75% of NSW residents were prepared to pay an additional $1 per week ($50 per year) for improved recycling and resource recovery services. $50 per year per household is approximately the additional cost expected for LMCC to deliver either the SSO composting or AWT residual processing solutions.

The key element of the research was a high willingness to pay for improved resource recovery solutions so long as the money raised was 100% hypothecated to delivery of those services and not siphoned off to other purposes.
18.0 Summary and Recommendations for Consideration

LMCC is exploring waste management options as part of its waste management strategy. Two issues are putting pressure upon council to act now. Firstly NSW’s mandated WARR target of 66% waste diversion from landfill and secondly the more practical issue of space in Awaba landfill running out. The WARR target and landfill depletion dates roughly coincide and in both cases time is running for the council. To achieve the 2014 WARR diversion targets new infrastructure is needed. The time required to tender, plan and build a resource recovery facility or landfill extensions is substantial.

In determining the best waste management solution for the future, council has embarked in a process identifying and evaluating available options. A series of modelling exercises has assisted in establishing suitable options that have the potential to achieve LMCC’s targets.

This report concentrated on the two most effective and desirable options. A 3 bin SSO system and a 2 bin AWT system. The main outcomes of the financial and performance assessment of these systems are as follows:

- **3 bin SSO system:**
  - implementation can start sooner providing immediate rewards in the form of improved waste diversion (phased implementation);
  - gate fees are lower therefore it the cheapest solution;
  - tunnel composting of SSO is well proven, tried and tested (lower risk);
  - achieves the 66% WARR diversion target once fully operational;
  - produced compost is clean and of high quality;
  - unlimited market for clean compost (including in agriculture);
  - very competitive market for tunnel composting;
  - preferred by LMCC residents;
  - diversion rate is lower than AWT; and
  - requires the introduction of a 3rd bin adding collection costs and potentially resulting to consumer confusion.

- **2 bin AWT system:**
  - higher diversion rate, enough to bring council well above the WARR 66% target;
  - no need to change bins or collection system;
  - lower GHG emissions profile;
maximum resource recovery- allows the recovery of dry recyclables from the waste stream;
consistently more expensive in the long run;
AWT compost is of low quality and its use is restricted to certain applications; and
close proximity to Hunter region mine sites could improve marketability of AWT compost.

Both options retain a landfill levy component for the disposal of residuals. The landfill levy is projected to keep increasing in the future but specifics are uncertain. In evaluating this uncertainty, sensitivity analysis showed that the relative cost of the two options was not affected significantly by the levy’s cost. 3 bin SSO remains the cheapest option under all scenarios. The results where similar for two more variables, the introduction of carbon sequestration credits and the rate of landfill gas capture at Awaba. Although there are small changes, the relative cost of each option does not change with 2 bin AWT remaining the most expensive of the two.

In view of these findings LC recommends that council pursue a 3 bin source separated solution as the main feature of its new waste management strategy. In brief it is recommended to:

- Introduce a green bin and begin fortnightly collections and processing of garden waste through windrows in 2012;
- Initiate a waste education campaign to support the new system;
- Contract a private operator to build and operate an SSO tunnel composting facility at Awaba;
- Introduce food in the green bin in 2015, shift organics collection to weekly and drop residuals collection to fortnightly; and
- Use biobags and kitchen tidies to reduce householder complaints and increase participation and food diversion rates.

The procurement process is one of the most important steps in securing the desirable outcome for council. LC recommends that council:

- Specify the Awaba site as the desired one;
- Initiate the planning approval process;
- Provide detailed and up to date related information (waste statistics, population data etc.) to tenderers;
- Request tenderers to supply options for SSO in-vessel composting allowing submissions for AWT residual MSW composting;
- Clearly indicate LMCC’s preference for these two systems but still allow tenderers to innovate and put forward options for other higher risk and energy based systems if they wish to do so; and
- Adopt an open and fair tender evaluation process to increase tenderer confidence and minimise gaming.
19.0 References


NSW DECC (Department of Environment and Climate Change) (2007a) *Waste Avoidance and resource Recovery Strategy 2007*


Waste Audit and Consultancy Services (2007a) 'Disposal Based Audits for the C+I and C+D Waste Streams for the Department of Environment and Conservation'

Waste Audit and Consultancy Services (2007b) 'Disposal based survey, Zero Waste South Australia, October/November 200T


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www.epa.vic.gov.au

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www.mwmg.vic.gov.au
www.nt.gov.au/nreta/

www.regionalwasteforum.com

www.sustainability.vic.gov.au


www.zerowaste.com.au

www.zerowaste.sa.gov.au


Appendix A. Penrith SSO Bin Collection Offers
<table>
<thead>
<tr>
<th>Service Code</th>
<th>Service Description</th>
<th>Organics Bin (Green Lid)</th>
<th>Recycling Bin (Yellow Lid)</th>
<th>Residual Garbage Bin (Red Lid)</th>
<th>2009/10 Domestic Waste Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST140</td>
<td>Standard Service</td>
<td>240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$245</td>
</tr>
<tr>
<td>ST14XR</td>
<td>Standard Service with Extra Recycling</td>
<td>2 x 240 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$283.70</td>
</tr>
<tr>
<td>ST14XO</td>
<td>Standard Service with Extra Organics</td>
<td>2 x 240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$295</td>
</tr>
<tr>
<td>ST14W</td>
<td>Standard Service Weekly</td>
<td>240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre weekly</td>
<td>$206</td>
</tr>
<tr>
<td>ST14WXR</td>
<td>Standard Service Weekly with extra Recycling</td>
<td>240 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$333.70</td>
</tr>
<tr>
<td>ST14WXO</td>
<td>Standard Service Weekly with extra Organics</td>
<td>2 x 240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$345</td>
</tr>
<tr>
<td>SM140</td>
<td>Small Service</td>
<td>140 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$195</td>
</tr>
<tr>
<td>SM14XR</td>
<td>Small Service with Extra Recycling</td>
<td>140 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$253.70</td>
</tr>
<tr>
<td>SM14W</td>
<td>Small Service Weekly</td>
<td>140 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>140 Litre weekly</td>
<td>$275</td>
</tr>
<tr>
<td>SM14WXR</td>
<td>Small Service Weekly with Extra Recycling</td>
<td>140 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>140 Litre fortnightly</td>
<td>$313.70</td>
</tr>
<tr>
<td>LG240</td>
<td>Large Service</td>
<td>240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>240 Litre fortnightly</td>
<td>$295</td>
</tr>
<tr>
<td>LG24XR</td>
<td>Large Service with Extra Recycling</td>
<td>240 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>240 Litre fortnightly</td>
<td>$333.70</td>
</tr>
<tr>
<td>LG24XO</td>
<td>Large Service with Extra Organics</td>
<td>240 Litre weekly</td>
<td>240 Litre fortnightly</td>
<td>240 Litre fortnightly</td>
<td>$345</td>
</tr>
<tr>
<td>LG24X24</td>
<td>Large Service with Extra Residual Garbage</td>
<td>240 Litre weekly</td>
<td>2 x 240 Litre fortnightly</td>
<td>2 x 240 Litre fortnightly</td>
<td>$400</td>
</tr>
</tbody>
</table>
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Appendix B. Organics Summary Australia

The following table (Source WME 2010) summarises the existing position of Australian AWT technologies in the MSW and Organics fields.
Organic Options: What to do Where

ORGANIC matter makes up a huge proportion of Australia’s waste stream, and there is a growing list of options for those looking to recover some value from the material. The flip side of having more options, of course, is the greater confusion when trying to decide the best approach. The following table, with input from consultants including Stephen Thompson of SIA and Matthew Warnken of Crucible Carbon, helps narrow down the possibilities.

<table>
<thead>
<tr>
<th>Process description</th>
<th>Approx. gate fee</th>
<th>Australian examples</th>
<th>Feed stock</th>
<th>End product</th>
<th>Process duration</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open windrow composting</td>
<td>$20-50/t</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8–16 weeks composting and maturation time.</td>
<td>$140-220/t</td>
<td>Extensive need of labour and space.</td>
</tr>
<tr>
<td>Aerated static pile composting</td>
<td>$20-50/t</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4-6 weeks composting and maturation time.</td>
<td>More space efficient, reduced temperature variance, good process control.</td>
<td></td>
</tr>
<tr>
<td>In-vessel systems</td>
<td>$90-150/t</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7 to 21 days</td>
<td></td>
<td>Aerated systems can dry out quickly and need to be continuously monitored for optimum levels.</td>
</tr>
<tr>
<td>Anaerobic digestion</td>
<td>$140-220/t</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Residence time may vary depending on type of feed material and configuration of digestion system from 14 to 40 days.</td>
<td>Reduces emissions. Renewable energy source.</td>
<td>High capital expenditure, absolute maintenance of moisture content required.</td>
</tr>
<tr>
<td>Bio-char</td>
<td>$0-50/t</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fast and slow pyrolysis, high and low temperature processes. Residence times of material in process can vary from seconds to hours.</td>
<td>Has the potential to sequester carbon. Reduces CO₂, methane and NOx emissions.</td>
<td>Obstacles may include technology cost, system operation and maintenance.</td>
</tr>
</tbody>
</table>

The odour issues raised from open windrow system can be overcome by eliminating the windrow tuming process during the initial stages of composting. Controlled aeration aided by perforated piping yields better process control for rapid biogasification. Can take place in open or covered windrows, or in closed containers.

<table>
<thead>
<tr>
<th>Process description</th>
<th>Feed stock</th>
<th>End product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled, aerobic, decomposition of organic garden waste in a windrow with the help of microorganisms to form stabilized debirs (compost). Process involves passive aeration with periodic turning to build porosity, release trapped gas and heat.</td>
<td>Mainly green waste but capable of processing other organics segregated or separated from domestic waste, including commingled (food and packaging) without plastics and foil.</td>
<td>Compost for land reclamation, field works and public works. Suitable also for horticulture and farming, commercial and domestic applications if well stripped of plastic and metal.</td>
</tr>
<tr>
<td>Aerated systems support the degradation of organics in an enclosed reactor (metallic tank, tunnel, rotating shell, concrete bunker, etc.) resulting in effective control of air and temperature. Air is supplied under temperature control to maintain optimum conditions for rapid and assured composting.</td>
<td>Green waste and bio-solids (desaturated biosludge at about 14% dry solids) at Kwanan and Deer Park, VIC.</td>
<td>Compost for land reclamation, field works and public works. Suitable also for horticulture and farming, commercial and domestic applications if well stripped of &quot;contaminants&quot;.</td>
</tr>
<tr>
<td>In-vessel systems support the degradation of organics in an enclosed reactor (metallic tank, tunnel, rotating shell, concrete bunker, etc.) resulting in effective control of air and temperature. Air is supplied under temperature control to maintain optimum conditions for rapid and assured composting.</td>
<td>Bi-solids and grease trap wastes in blends with large quantities of recycled compost or shredded green waste to facilitate moisture control and provide a permeable blend for rapid composting.</td>
<td>Depends on quality of feedstock, ranging from high-grade compost to low-grade products suitable for land rehabilitation.</td>
</tr>
<tr>
<td>Anaerobic digestion is best suited for wet organic materials. The breakdown of the organic wastes in this process is carried out in the absence of oxygen by anaerobic bacteria, forming a digestate. Gases released can be captured and used for power generation.</td>
<td>Any biodegradable material, the yield of methane in the biogas is proportional to the putrescibility of the feed, but so is the odour issue.</td>
<td>Biogas (methane 60% and carbon dioxide 30%), digestate (the remaining organics and mineral matter) and waste water (usually acidic).</td>
</tr>
</tbody>
</table>

| Bio-char | Applicable to most organic waste. Waste stream should be free of, or able to be cleaned from, any contaminants not acceptable for fuel or land application. | Common products include: Solids: stable & carbon-rich residue (biochar). Liquids: bio-oil, volatile organic chemicals. Gaseous: fuel energy (syngas). |

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