Appendix A: Waste Management Options Review and Modelling – Executive Summary
Auckland Council i
Waste Management Options Review and Modelling
May 2017

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SLR
EXECUTIVE SUMMARY - OVERVIEW

Auckland has set ambitious future targets in the context of waste management and carbon emissions and is seeking to move towards a Zero Waste culture which reflects the position adopted by cities that are recognised as World leaders in environmental performance.

Fundamental to achieving these targets is the development and implementation of an integrated waste management strategy which delivers new practices and new infrastructure to support a move away from the unsustainable practice of landfill disposal and towards maximising opportunities to reuse, recycle and treat future waste arisings.

Baseline Position

Auckland's total waste arisings are currently c.5.82 million tonnes per annum\(^1\), approximately 1.63 million tonnes (c.28%) of which is currently landfilled, with the remainder being diverted either as recycling or sent to clean or managed fills. Total waste arisings\(^2\) are predicted to increase by c.66% by 2040.

Key Findings

SLR's analysis of environmental and commercial considerations through comparison with best international practice and robust financial modelling has identified and prioritised some key options for Council to focus on over the next 10 years to divert and reduce waste to landfill. Of the 1.63m tonnes currently sent to landfill, it is estimated that up to 40% can be influenced and diverted through the following key initiatives:

- Increase in landfill levy - to support existing and new commercially sustainable enterprises in developing processes and technologies that will create products from waste that meet a market demand;
- Compulsory Waste Management Plans in the building construction and building demolition sectors to promote sustainable developments – high levels of diversion of Construction and Demolition waste and recyclables can be achieved;
- Source separated domestic food waste collections - this complements existing food waste prevention and home and community based composting programmes;
- Diversion of putrescible non-domestic waste; and
- Diversion of refuse from Domestic and Non Domestic Sources by treatment in Energy from Waste facilities (subject to policy landscape and viability).

These focus areas could potentially reduce carbon emissions by c.80%, which underpins the delivery of Council's Low Carbon targets, and also support the key strategic objectives of Auckland's Waste Management and Minimisation Plan in increasing the pace of:

- Reducing Auckland's reliance on landfills;
- Restricting organic waste going to landfill;
- Developing Infrastructure and processes to maximise resource recovery; and
- Preventing harm from waste.

---

\(^{1}\) 2016 arisings data
\(^{2}\) Excluding Other Waste and Waste to Clean or Managed Fills
Landfill Levy

Fundamentally, the current low cost of landfilling in Auckland makes the development of waste treatment alternatives financially unviable, and increasing the cost of landfilling should be Council’s main priority. A mechanism by which this imbalance can be addressed is already in place, in the form of the landfill levy.

The existing landfill levy of $10 per tonne, if implemented effectively, is predicted to generate levels of income which would allow Council to contribute a 15% share of the estimated capital investment required to deliver new waste treatment facilities.

However, maintaining the levy at current levels is not expected to encourage private sector investment in additional waste treatment facilities, as the relative cost of waste disposal to landfill is significantly lower than that of waste treatment alternatives. Therefore, Council should advocate to increase the landfill levy over a period of time, providing clarity and certainty to the private sector and their investors regarding long term plans for waste management in Auckland.

Initial assessments indicate that the following minimum levy rates are required (exclusive of collection and transfer costs):

- $50 per tonne to achieve diversion of organic waste; and
- $125 per tonne to achieve diversion of refuse.

Increases could be implemented in a phased manner and with provision of longer term certainty (e.g. legislation which sets out future increasing levy rates) to minimise short term market disruption whilst ensuring provision of appropriate treatment facilities.

Organic Waste Management

Organic waste represents c.53% (c.45% food waste, c.8% green) of Auckland’s household refuse collected at kerbside, providing a significant potential contribution towards achieving Zero Waste goals and a significant reduction in carbon emissions from household waste. Developing treatment infrastructure for domestic organic waste will have the added benefit of encouraging diversion of organic waste from Non Domestic sources.

There is no ‘one size fits all’ solution for implementing an effective organic waste management system. A holistic approach is needed to ensure that waste collection and transfer arrangements (in terms of both location and method) are aligned as closely as possible with recycling and treatment solutions, so that the overall system works as effectively as possible. An optimised service configuration could realise savings in other services, e.g. by reducing refuse collection frequencies, which will at least partially offset additional costs for organic waste management.

Infrastructure and Investment Needs

Additional waste processing and treatment facilities are needed to deliver Auckland’s landfill diversion targets, particularly in the context of the organic waste and refuse streams.

Total organic waste treatment facility capacity requirements (for domestic and non-domestic waste) equate to approximately 7 facilities (including existing locations) assuming a typical facility capacity of 50,000 tonnes per annum.

---

3 Food waste proportion is 44% of all household refuse arisings (including transfer stations)
Refuse treatment capacity requirements are likely to range from 700,000 to 800,000 tonnes per annum by 2040. Assuming an Energy from Waste treatment solution, this would equate to approximately 3 facilities on the basis of a typical facility capacity of 300,000 tonnes per annum. It is understood from discussions with Council that due to Central Government’s drive to use renewable energy in New Zealand rules out use of Energy from Waste facilities, provision of Energy from Waste facilities are currently not practical for Council despite their potential for significantly improve landfill diversion performance.

To accommodate projected 2040 waste arisings for all streams, the total capital expenditure requirement for delivery of waste treatment infrastructure, excluding refuse treatment, is currently estimated to be c.NZ$237 million (in net present value terms).

Investment in additional waste treatment facilities is expected to generate c.425 direct and c.1,200 indirect\(^4\) additional employment opportunities by 2040. These facilities, once operational, will also create directly associated jobs (e.g. in material reprocessors, waste hauliers, export providers etc.).

**Future Direction**

To deliver substantial positive changes to the current waste management regime in Auckland, measures will need to be introduced which have not been widely implemented elsewhere in New Zealand to date. Council may therefore consider it prudent to phase the implementation of new waste management practices, as a means of achieving its longer term environmental aims and also providing an environment in which private sector participation can expand and flourish, whilst Council’s exposure to financial risk can be controlled.

### Table ES1
#### Future Direction

<table>
<thead>
<tr>
<th>Phase</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term</td>
<td>- Effectively implement the current $10 per tonne levy to maximise diversion of core dry recyclables and green waste (for which alternatives to landfill appear to be economically viable within the current levy regime)</td>
</tr>
<tr>
<td>(c.0-3 years)</td>
<td>- Lead the development of organic waste infrastructure and commence weekly kerbside collection of household food waste to meet short term WMMP target</td>
</tr>
<tr>
<td></td>
<td>- Optimise collection service frequencies (e.g. fortnightly refuse collections)</td>
</tr>
<tr>
<td></td>
<td>- Encourage reuse and waste prevention measures (e.g. through delivery of the Resource Recovery Network and Community Recycling Centres)</td>
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<td></td>
<td>- Agree the approach to be taken to increase the landfill levy</td>
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<td>- Lobby national government for a harmonised, nationwide increase in landfill levy rates to prevent transport of waste between regions for cheaper disposal</td>
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<tr>
<td></td>
<td>- Develop complementary legislation to align with Council targets and aspirations (e.g. requirement for Site Waste Management Plans, planning and permitting requirements for new waste infrastructure, quality standards for compost and/or digestate), whilst also providing certainty to the private sector and potential investors (e.g. future landfill levy escalator)</td>
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<tr>
<td></td>
<td>- Collate more robust data on all waste arisings and management routes</td>
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<td></td>
<td>- Establish mechanisms to support funding of relevant recycling and organic waste treatment infrastructure and commence their procurement</td>
</tr>
<tr>
<td></td>
<td>- Develop added clarity regarding Council’s Zero Waste ambitions</td>
</tr>
<tr>
<td>Medium Term</td>
<td>- Increase the landfill levy to a level which supports diversion of all organic waste, domestic and non-domestic</td>
</tr>
</tbody>
</table>

\(^4\) Construction jobs
<table>
<thead>
<tr>
<th>Phase</th>
<th>Actions</th>
</tr>
</thead>
</table>
| (c.3-7 years)    | • Provide additionally required materials recycling and organic waste treatment capacities, to build on weekly collection of food waste and/or recyclables to encourage recycling  
                   • Develop markets for additional recyclables (e.g. digestate, nappies, plastics, special waste)  
                   • Develop data capture and reporting systems to more accurately assess environmental performance  
                   • Consider material specific landfill bans to complement increased landfill levy rates e.g. organic waste  
                   • Establish mechanisms to support funding of relevant refuse treatment infrastructure and commence their procurement |
| Long Term        | • Advocate to further increase the landfill levy to a level which maximises diversion of refuse (and possibly special waste)  
                   • Provide additionally required refuse treatment capacities  
                   • Develop markets for additional recyclables (e.g. Incinerator Bottom Ash)                                                                                                         |

By following a phased approach Council will achieve outcomes in a more managed way and provide greater certainty and confidence to both Council and the private sector. Council would gain further experience and develop skillsets by initially investing in lower risk and less capital intensive infrastructure (e.g. recycling and sorting facilities, composting plants, anaerobic digestion facilities).

Lessons learned from implementation of such infrastructure, in addition to improved robustness of waste arisings data, can then be utilised to refine arrangements for delivery of refuse treatment facilities, which are relatively capital intensive and therefore ‘higher risk’ projects. A phased approach should also reduce the risk of procuring surplus (or unutilised) capacity refuse treatment facility capacity, as diversion of recyclables and organics should have significantly improved prior to investment in refuse treatment.

The above approach will see Auckland align with the adopted practices of some of the best performing cities in the world for waste management and environmental performance.
1.0 INTRODUCTION

In October 2016, SLR Consulting Limited (SLR) was appointed to advise Auckland Council (Council) on future waste management strategies and service delivery options to meet its Zero Waste ambitions, with consideration to relevant international best practice. This is within the context of Council reviewing its 2012 Waste Assessment and Waste Management and Minimisation Plan (WMMP).

1.1 Objectives

This report presents a non-technical Executive Summary of the work that has been undertaken by SLR, the full details of which have been reported to Council at Options Review Workshops held on October 21st and November 29th 2016.

The work undertaken by SLR has sought to develop an understanding of the baseline position for Auckland, consider the approaches adopted in similar cities around the World that are recognised as leaders in environmental performance, and provide a high level assessment of the potential application of key measures to Auckland in the context of:

- policies to drive improved waste management;
- infrastructure capacity and investment needs for recycling and organic and refuse processing;
- optimisation of waste transfer mechanisms; and
- the preferred approach to management of organic waste streams.

This report incorporates the following principal sections:

- Auckland Baseline Position (Section 2.0);
- City Case Studies (Section 3.0);
- ‘Game Changer’ Policies (Section 4.0);
- Waste Flows and Treatment Facility Capacity Estimates (Section 5.0);
- Waste Transfer Options (Section 6.0);
- Organic Waste Management Options (Section 7.0); and
- Conclusions and Recommendations (Section 8.0).

It should be noted that all cost modelling referenced within this report and supporting presentations has been based on an assumed currency exchange rate of $NZ 1.70 to £GBP 1.00.
2.0 AUCKLAND BASELINE POSITION

This section summarises the baseline position (based on data provided by Council) from which recommendations for improving solid waste practice in Auckland have been derived.

2.1 Demographics

In 2015, Auckland had a population of c.1.53 million, living in c.530,000 households. Household numbers are predicted to increase by 53% by 2040, with the population growing 40% in the same period.

The number of residents per household is therefore predicted to fall slightly and it is expected that waste generation per household will be lower in the future (through smaller family sizes and behaviour change), although overall waste arisings will increase.

2.2 Waste Arisings

Based on data provided by Council:

- Non-Domestic Waste is the most significant waste source and is projected to increase by 81% by 2040 (compared to 2015); and
- Domestic Waste represents c.9% of current total waste arisings and is projected to increase by c.31% by 2040 (compared to 2015), as presented in Figure 1 below.

![Figure 1: Projection of Future Waste Arisings](image)

2.3 Landfill Diversion

Total diversion of waste from landfill disposal was c.54% in 2015, comprising Non-Domestic Waste diversion of 55% and Domestic Waste diversion of 43%. Council currently manages c.13% of the waste disposed of at landfills.

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5 Excludes ‘Other Wastes’ and ‘Waste to Clean or Managed Fills’ but includes Special Waste within Non Domestic Waste
According to Council’s internal audited analysis, waste diversion initiatives have delivered a decrease of 9% household waste to landfill per head of population from 160kg in 2011 to 146kg as at December 2016.

### 2.4 Council Vision and Plans

As stated in the WMMP:

“.... to become the most liveable city in the world, Auckland will aim for the long-term, aspirational goal of Zero Waste to Landfill by 2040”

The WMMP sets eight objectives, specifically to:

- reduce Auckland’s reliance on disposal of waste to landfill;
- achieve operational efficiencies in Domestic Waste management and recycling services;
- reduce harm from waste;
- restrict organic waste going to landfill;
- develop an infrastructure and processes to maximise resource recovery;
- reduce Council’s responsibility for dealing with end-of-life consumer products and packaging through appropriate advocacy;
- maximise local economic development opportunities; e.g. jobs created by diverting waste from landfill; and
- reduce litter and illegal dumping and related costs.

### 2.5 Long Term Targets

Targets are defined in the WMMP and also the Low Carbon Action Plan as follows:

<table>
<thead>
<tr>
<th>Document</th>
<th>Relevant Target</th>
</tr>
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<tbody>
<tr>
<td>WMMP</td>
<td>To reduce total Council and private-sector-influenced waste to landfill by 30% from the baseline of 0.8 tonnes per capita per year by 2027; To reduce council’s in-house waste by 30% per capita by 2018; and To reduce domestic kerbside waste by 30% by 2018.</td>
</tr>
<tr>
<td>Low Carbon Action Plan</td>
<td>To reduce greenhouse gas emissions by 40% by 2040; To achieve 30% reduction in per capita waste to landfill by 2020, from a baseline of 977 kg per capita (2007/08); and 60% reduction in per capita waste to landfill by 2030, from a baseline of 977 kg per capita (2007/08).</td>
</tr>
</tbody>
</table>

### 2.6 Conclusions

It is clear from the baseline assessment for Auckland that, to significantly improve environmental performance and divert waste from landfill disposal, suitable mechanisms will need to be adopted by Council and other stakeholders to drive behavioural change.

---

6 As informed by Council
This is particularly critical given the predicted future increases in waste arisings. Failure to change current practices is likely to result in significantly higher amounts of waste being disposed to landfill which:

- conflicts with the future environmental targets for Auckland;
- creates potential adverse environmental impacts which will need to be managed; and
- will accelerate the consumption of available landfill void space.

Discussion of how a selection of similar cities around the World have gone about achieving these goals, and the lessons learned from their experience, is provided in the following section.
3.0 CITY CASE STUDIES

Seven cities were selected for assessment based on having similar populations to Auckland, high environmental performance / commitments and the employment of varying approaches (e.g. landfill bans, landfill levies, introduction of treatment technologies, etc.).

In addition, Birmingham and Brisbane were included in the assessment as examples of cities which are broadly similar to Auckland, but are considered to have achieved lower overall environmental performance (in terms of recycling performance and landfill diversion, respectively).

3.1 Factors Common to High Performing Cities

A detailed summary of the approaches adopted in each city is provided in the November 29th 2016 workshop presentation, and the key performance indicators for each are summarised in Table 3-1 below.
Table 3-1
Key Performance Indicators from Case Study Cities

<table>
<thead>
<tr>
<th>Key Performance Indicator (KPI)</th>
<th>Vancouver</th>
<th>Stockholm</th>
<th>Adelaide</th>
<th>Seattle</th>
<th>Copenhagen</th>
<th>Austin</th>
<th>San Francisco</th>
<th>Brisbane</th>
<th>Birmingham</th>
<th>Auckland</th>
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<td><strong>Disposal Costs</strong></td>
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<tr>
<td>Landfill (NZ$ per tonne)</td>
<td>c. $90–$140</td>
<td>&gt;$130</td>
<td>c. $99</td>
<td>c. $63</td>
<td>&gt;$100</td>
<td>$29</td>
<td>$34</td>
<td>c. $31</td>
<td>&gt;$179</td>
<td>$45 - $55</td>
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<tr>
<td>Organics (NZ$ per tonne)</td>
<td>c. $71</td>
<td>&gt;$79</td>
<td>c. $37</td>
<td>c. $43</td>
<td>c. $60</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>c. $41</td>
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<td><strong>Payment System</strong></td>
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<tr>
<td>Variable User Charge</td>
<td>✔</td>
<td>✔</td>
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<td>Flat Rate</td>
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<td><strong>Service Delivery</strong></td>
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<td>Contracted / In-house</td>
<td>✔</td>
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<td>✔</td>
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<td>Commercial Market</td>
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<td><strong>Contract Structure</strong></td>
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<tr>
<td>Combined collection / treatment / disposal</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Separate Contracts</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td><strong>Use of EFW</strong></td>
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<td>EfW Infrastructure</td>
<td>✔</td>
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<td>Do not use EfW</td>
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<td><strong>Organics</strong></td>
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<tr>
<td>Collection Schemes: Separate Food (SF); Separate Garden (SG); Mixed (M)</td>
<td>M</td>
<td>SF</td>
<td>M</td>
<td>M</td>
<td>SF SG</td>
<td>SG M</td>
<td>M</td>
<td>SG</td>
<td>SG</td>
<td>SG</td>
</tr>
<tr>
<td>Treatment: Compost (C); Anaerobic Digestion (AD); both (C&amp;AD)</td>
<td>C &amp; AD</td>
<td>C &amp; AD</td>
<td>C</td>
<td>C</td>
<td>C &amp; AD</td>
<td>C</td>
<td>C &amp; AD</td>
<td>C</td>
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<tr>
<td><strong>Diversion from Landfill</strong></td>
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</tr>
<tr>
<td>All waste streams</td>
<td>-</td>
<td>91%</td>
<td>-</td>
<td>-</td>
<td>98%</td>
<td>34%</td>
<td>80%</td>
<td>c. 44%</td>
<td>-</td>
<td>57%</td>
</tr>
<tr>
<td>Household or MSW</td>
<td>c. 70%</td>
<td>99%</td>
<td>c. 80%</td>
<td>c. 60%</td>
<td>99%</td>
<td>40%</td>
<td>c. 60%</td>
<td>25%</td>
<td>94%</td>
<td>36%</td>
</tr>
</tbody>
</table>
The following key lessons learned have been identified.

### Table 3-2
Lessons Learned from Case Study Cities

<table>
<thead>
<tr>
<th>KPI</th>
<th>Key Lessons Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landfill Disposal Costs</strong></td>
<td>• In most high performing cities the landfill disposal costs are significantly higher than the current rates in Auckland.</td>
</tr>
</tbody>
</table>
| **Payment System**              | • The majority of high performing cities adopt a user charge approach to payments, primarily by charging higher rates to users with larger refuse bin capacities.  
• The two ‘lower performing’ cities (Brisbane & Birmingham) both adopt a flat user charge via Council tax, plus charges for additional bins or garden waste collection.  
• Auckland currently has a variety of legacy funding systems for Domestic Waste and recycling services, with plans to implement ‘pay as you throw’ (PAYT) measures. |
| **Service Delivery**            | • Many high performing cities have a focus on diverting organic waste from landfill through separate collections and processing infrastructure.  
• All of the cities use either a contracted waste management company or an authority controlled entity to deliver their collection services.  
• The main exceptions to this are for multi-occupancy dwellings (e.g. flats / apartments) where for some cities (e.g. Vancouver and Austin) the majority of collections are provided by the commercial market.  
• Auckland has the unusual circumstance of an active commercial market which is in direct competition with Council’s collection contractor. |
| **Contract Structure**          | • None of the cities have fully combined collection, treatment and disposal contracts.  
• In some cases (e.g. San Francisco) the same entity may be contracted separately for each service.  
• Auckland has several legacy contracts for waste collection, treatment & disposal. |

### 3.2 Priorities of High Performing Cities

SLR’s assessment identified the following criteria which appear to have been given the highest priority by the high performing cities:

- Environmental (waste minimisation, improving efficiency of resource use, improving management of household organic waste);  
- Socio-economic (opportunities for public involvement and engagement); and  
- Operational (developing infrastructure / processes to maximise resource recovery).

Cost considerations alone do not appear to have been given the highest priority by the high performing cities. Deliverability / risks and local transport impacts also appear to have been lesser considerations.

### 3.3 Conclusions

International experience shows that, in order to divert waste from landfill disposal and promote the adoption of measures for waste reuse, recycling and treatment (to align with the aims of the WMMP and Low Carbon Action Plan), it is imperative that the cost of landfill is sufficiently high to provide a competitive environment in which alternative approaches become viable.
Without a sufficient financial incentive to avoid landfill disposal, service delivery, payment and contractual structures become secondary considerations which are unlikely to achieve the level of environmental performance that Auckland aspires to achieve.

One approach which is commonly adopted to ensure that landfill costs increase at all sites is the application of an appropriate level of landfill tax or levy. This, along with a selection of other ‘game changer’ policies that have been applied in other international jurisdictions, is discussed in the following section.
4.0 GAME CHANGER POLICIES

The following section provides an overview of three policy ‘game changers’ which Council could consider to help deliver improved solid waste management in Auckland, namely:

- increasing the Landfill Levy above the current level of $10/tonne (drawing on case studies from the UK, the Netherlands and South Australia);
- introducing a statutory requirement for Site Waste Management Plans at construction sites to maximise reuse and recycling opportunities and minimise use of landfilling (drawing on case studies from the UK, New South Wales (Australia) and San Francisco (USA)); and
- introducing an Organic Waste Landfill Ban (drawing on case studies from Metro Vancouver (Canada), Seattle (USA) and Connecticut (USA)).

For each policy, the lessons learned from the case studies and conclusions / considerations on how each policy might be applied to the Auckland context, are summarised in Table 4-1 below.
Table 4-1
Review of Game Changer Policies

<table>
<thead>
<tr>
<th>Landfill Levy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lessons Learned</strong></td>
</tr>
<tr>
<td>administration can be straightforward through charging of operators</td>
</tr>
<tr>
<td>can be highly effective in driving diversion performance</td>
</tr>
<tr>
<td>reduces demand for landfill, making landflling less profitable, and may bring gate fees down</td>
</tr>
<tr>
<td>level must clearly incentivise non-landfill options for biodegradable wastes (e.g. for the UK this occurred in the c.NZ$70-NZ$100 range after introduction of an annual escalator which provided future certainty)</td>
</tr>
<tr>
<td>a lower levy can be sufficient to drive diversion for construction and demolition (C&amp;D) waste, where processing costs are significantly lower</td>
</tr>
<tr>
<td>if tax is banded according to waste type, site reporting needs to be carried out and carefully monitored to identify abuse of the system</td>
</tr>
<tr>
<td>annual increases above the general rate of inflation can accelerate results, and provide greater future market certainty for potential developers of treatment facilities (and their investors)</td>
</tr>
<tr>
<td>if levy revenues are used to support the waste management industry, the inevitable decline in revenues over time needs to be considered</td>
</tr>
</tbody>
</table>

| **Relevance to Auckland** |
| total cost of landfiing needs to be increased - current levy of NZ$10 per tonne plus typical gate fee of NZ$30-40 per tonne + taxes is not sufficient to make alternative technologies cost competitive |
| comparable costs in high diversion EU States c. NZ$180+ per tonne |
| comparable costs in Australia are in excess of NZ$100 per tonne |
| consider a defined escalator mechanism to provide market certainty over a prolonged period of time |
| consider how revenues are to be used – noting that net revenues could decline if landfilling activity falls significantly |
| application of a higher levy locally could encourage transport of waste for cheaper disposal elsewhere, or lead to an increase in waste crime |
| consider market availability for waste derived materials |
| potential benefits in extending the life of existing landfills |
| consider method of administration – differentiating the levy by waste type can be effective but requires greater resourcing to administer |

---

<table>
<thead>
<tr>
<th>Site Waste Management Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lessons Learned</strong></td>
</tr>
<tr>
<td>benefits</td>
</tr>
<tr>
<td>improved data capture and understanding of the issues (if robust management measures are in place)</td>
</tr>
<tr>
<td>encourages / enforces consideration of more sustainable practice</td>
</tr>
<tr>
<td>reduces use of virgin resources</td>
</tr>
<tr>
<td>prolongs lifespan of existing landfill facilities</td>
</tr>
<tr>
<td>best practice EU States achieve 80-90% diversion</td>
</tr>
<tr>
<td>stimulates growth of recycling businesses, leading to job creation</td>
</tr>
<tr>
<td>separating materials at source supports recycling opportunities</td>
</tr>
<tr>
<td>potential cost savings for developers</td>
</tr>
<tr>
<td>embeds sustainable waste management in future developments</td>
</tr>
</tbody>
</table>

| **Relevance to Auckland** |
| consider whether a requirement for mandatory plans is necessary to achieve the improvements |
| highest performance levels are market driven, not necessarily due to legal requirements for a plan |
| must be accompanied by fiscal penalties for disposal to landfill, development of recycling / recovery infrastructure and markets and standards for recycled materials in order to be effective |
| the system would need to be regulated to ensure delivery of results |
| demolition phase - demolition waste (highest proportion of C&D waste) tends to be more contaminated / mixed, and more difficult to recover. Encourage selective demolition – remove contaminants where possible |
# Site Waste Management Plans

## Lessons Learned

- **disadvantages**
  - may not be effective at driving performance during demolition / construction unless developers can clearly see financial benefits
  - must be accompanied by availability of recycling infrastructure and stable local markets for recycled materials
  - local impact could be reduced without comparable measures at National level (cross-boundary transport for cheap disposal option)
  - could require parallel development of quality schemes for recycled materials to promote confidence and uptake
  - perceived additional ‘red tape’ could inhibit development
  - audit or enforcement needed to prevent abuse of the system (e.g. use of generic documents)

## Relevance to Auckland

- prior to demolition (keeps other materials ‘cleaner’)
- site preparation phase – encourage reuse of excavated material on site
- construction phase - waste from new construction usually less mixed, less contaminated, and recovery potential higher than for demolition waste, although comparatively small tonnage
- operation phase – needs to deliver infrastructure that aligns with waste management targets and collection / treatment systems (should be addressed at the planning stage)
- Circular Economy - could link to design targets to incorporate recycled materials and also incorporate design measures to facilitate future demolition / recycling
- public procurement initiatives promote uptake of materials

# Organic Waste Landfill Ban

## Lessons Learned

- availability of suitable collection resources and processing facilities must be aligned with any landfill ban
- provides long term market certainty, encouraging investment in alternative treatment technologies
- Anaerobic Digestion (AD) solutions provide additional source of renewable energy – technology and collection systems must be aligned
- pilot schemes (collection and treatment) can be useful in assessing which approaches deliver best outcomes
- financial incentives for separation at source (e.g. free recycling collections, reduced fee for organics, tiered charging for refuse) are effective at driving performance
- need for proactive engagement with stakeholders prior to implementation
- need for robust enforcement after implementation
- staged implementation can be effective in ramping up stakeholder support
- essential component in achieving high levels of landfill diversion?
- can deliver a strong contribution to climate change targets

## Relevance to Auckland

- potentially significant contributor to Zero Waste goal – if implemented effectively
- consider either a full ban or commercial sources only
- As a 50% shareholder in Whitford landfill Council could lead by example
- separate (and at least weekly) organic waste collections would facilitate a reduction in refuse collection frequency
- consider the regional / national interest in developing AD facilities (e.g. renewable energy targets)
- consider fast track compliance process for development of facilities – planning, permitting and associated timelines
- consider what are the most effective incentivisation mechanisms for waste producers to drive performance
- consider a mechanism for monitoring / enforcing compliance
- local policy could result in ‘waste tourism’
- needs to ensure the support of collection service providers
4.1 Conclusions

Certain policies and tools, if implemented and managed appropriately, can be highly effective in changing behaviours and delivering step changes in the way in which solid waste is managed.

Landfill levies are highly effective at driving waste diversion if set at an appropriate level. The current level (combined with gate fees and environmental charges) is considered to be too low in Auckland to incentivise alternative waste management options.

A step change from the current levy and/or escalator mechanism may be needed to deliver certainty to the market, and the total cost of landfilling may need to be at least doubled to be effective in increasing the viability of waste recycling and treatment facilities.

Site Waste Management Plans are recognised as good practice and a useful tool in promoting sustainable practice in the construction / development sector. Robust auditing and enforcement mechanisms are needed to make the system effective, and sufficient resourcing (staff and funding) must be in place to maximise beneficial impacts. Any requirement introduced needs to avoid unnecessary bureaucracy that could impact on development activity.

Organic waste represents c.55% (45% food waste\(^7\), c.10% green) of Auckland’s household refuse collected at kerbside, providing a significant potential contribution towards achieving Zero Waste goals and a significant reduction in carbon emissions from household waste. The most suitable mechanism for diverting organic waste (which may not necessarily be a ban) needs to be considered holistically to include:

- collection systems (high performing local authorities around the World typically include a separate organic waste collection in their strategies);
- transfer arrangements;
- treatment technology; and
- stakeholder engagement / incentives.

Any measures introduced to divert organic waste from landfill will need to be supported by concurrent development of alternative treatment systems and infrastructure.

\(^7\) Food waste proportion in total household refuse arisings (including transfer stations) is 32%
5.0 WASTE FLOWS AND TREATMENT FACILITY CAPACITY ESTIMATES

To assess what Auckland’s medium to long term requirements might be in terms of waste management infrastructure, it is first necessary to consider the types and quantities of waste which are currently being produced, and how those types and quantities might change in the future.

The following section provides a high-level capacity assessment of future waste treatment infrastructure requirements for Auckland, including indicative costs, based on a high level ‘mass-flow’ analysis covering Domestic and Non Domestic Waste. It has been assumed that outlets will continue to be provided for c.1.63 million tonnes of Non Domestic Waste that is currently being diverted and therefore this tonnage has been excluded from the capacity assessment. ‘Other Waste’ and ‘Waste to Clean or Managed Fills’ have also been excluded from the capacity assessment study.

Full details of SLR’s assessment process and outcomes are provided in the workshop presentation upon which this summary report is based.

5.1 Key Assumptions

Using waste composition data and future waste arisings projections provided by Council, SLR has modelled three potential options for treatment of refuse, specifically:

- Mechanical Treatment (MT);
- Mechanical Biological Treatment (MBT); and
- Energy from Waste (EfW)\(^8\).

A scenario without any provision for refuse treatment was also considered for comparison purposes.

In addition, three recycling scenarios (to reflect low, medium and high capture rates for specific materials – e.g. paper, card, plastics, metals) have been applied to estimate additional recyclable and putrescible materials that could be diverted from the refuse stream.

5.2 Total Waste Requirements

Based on SLR’s modelling and assessment work, Auckland’s potential total waste flows (in tonnes) and management requirements for 2040 are summarised in Figure 2 below.

The graphic shows the respective tonnages that are forecast to be generated under the high, medium and low recycling scenarios and the resultant processing / treatment and disposal infrastructure that would be required to handle specific waste streams.

These projections are based on future Domestic and Non Domestic Waste arisings projections and waste composition data and assumptions, combined with assumed capture rates and facility acceptance criteria for the three recycling scenarios. Council’s growth estimates for Non Domestic Waste are based on current GDP projections.

Waste composition assumptions have been based on the most appropriate data available, however it should be noted that the composition of the Non-Domestic Waste stream is more

\(^8\) Although Central Government's drive to use renewable energy in New Zealand rules out use of Energy from Waste facilities, it has been included to estimate their relative landfill diversion performance and costs.
uncertain than that of Domestic Waste. Capture rates have been assumed and informed by SLR's experience and in-house databases where information was not otherwise publically available.
Figure 2: Forecast Total Waste Arisings and Management in tonnes by 2040
5.3 Conclusions

By providing a forecast of likely future waste arisings and assessing potential technologies for treatment of waste streams in preference to landfilling, it is possible to derive an informed estimate of future requirements for new waste management facilities, and also the potential costs of developing and operating the required infrastructure.

5.3.1 Facility Size and Number

The following table summarises typical individual facility sizes for the processing / treatment of specific waste streams and then identifies (based on the predicted future waste arisings for Auckland) the number of facilities which may be required to provide a viable alternative to landfilling under the 'high recycling' scenario.

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Typical Facility Capacity (tpa)</th>
<th>Additional Facilities Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2023</td>
</tr>
<tr>
<td>Domestic Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>60,000</td>
<td>0.9</td>
</tr>
<tr>
<td>Green Waste</td>
<td>50,000</td>
<td>0.3</td>
</tr>
<tr>
<td>Food Waste</td>
<td>50,000</td>
<td>1.5</td>
</tr>
<tr>
<td>Specialist Recyclables</td>
<td>10,000</td>
<td>0.3</td>
</tr>
<tr>
<td>Refuse</td>
<td>300,000</td>
<td>0.4</td>
</tr>
<tr>
<td>Non-Domestic Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>60,000</td>
<td>1.1</td>
</tr>
<tr>
<td>Putrescibles</td>
<td>50,000</td>
<td>0.7</td>
</tr>
<tr>
<td>Construction and Demolition Waste</td>
<td>50,000</td>
<td>1.2</td>
</tr>
<tr>
<td>Refuse - Treatment</td>
<td>300,000</td>
<td>1.3</td>
</tr>
</tbody>
</table>

It should be noted that these reflect additional facility requirements, over and above those which are already operational.

5.3.2 Performance Against Targets

To put the outcomes of the assessment into context, the following table summarises the respective performance of each recycling and treatment scenario against Council's key future targets.
The table suggests that, long term per capita landfill diversion targets under the Waste Minimisation and Management Plan and Low Carbon Action Plan are unlikely to be met under any of the refuse treatment options.

However, refuse treatment in Energy from Waste has greater potential to meet the WMMP target and long term LCAP target of 60% landfill diversion if Special Waste is excluded from landfill diversion performance calculation.

5.3.3 Costs

Subsequent to the workshop in November 2016, a net present value assessment study was commissioned to estimate costs required for the provision of additional waste treatment capacities for the following three waste management options:

- Option 1 – Zero untreated (non-inert) waste to landfill. This option estimates the net present value of treatment infrastructure requirements for all Waste Streams of Domestic and Non Domestic Waste;
- Option 2 – Zero organic waste to landfill. This option estimates the net present value of infrastructure required for treating all Waste Streams except refuse (from Domestic and Non Domestic Wastes); and
- Option 3 – Zero organic waste (Domestic Waste and Non Domestic Waste) and zero untreated Domestic Waste to landfill. This option estimates the net present value of infrastructure required for treating all Waste Streams except construction and demolition waste and refuse from Non Domestic Waste.

Cost estimates have been developed to reflect development and operation of the predicted treatment capacity requirements described above. The costs presented in the following table are based on meeting anticipated waste treatment requirements for the period from 2017 to 2040 under the ‘high recycling’ scenario, and for Option 2. Options 1 and 3, which assume refuse treatment in Energy from Waste facilities, have been excluded from further discussion in this report on the basis that they are currently not viable due to Central Government’s drive to use renewable energy in New Zealand rules out use of such facilities. However, relative landfill diversion performance and costs of these options are included in the Net Present Value Modelling Report submitted separately to Council.

<table>
<thead>
<tr>
<th>Target</th>
<th>Recycling Scenario</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWMP per capita target</td>
<td>Low</td>
<td>None of the options would achieve this target if special waste is included. If not, the MBT and EFW options are expected to deliver this target.</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>None of the options would achieve this target if special waste is included. If not, the MBT and EFW options are expected to deliver this target.</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>None of the options would achieve this target if special waste is included. If not, the MT, MBT and EFW options are expected to deliver this target.</td>
</tr>
<tr>
<td>Local Carbon Plan landfill diversion</td>
<td>Low</td>
<td>All options are expected to deliver the 30% target only if Special Waste is excluded. EFW option is expected to achieve the 60% target if Special Waste is excluded.</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>All options are expected to deliver the 30% target only if Special Waste is excluded. EFW option is expected to achieve the 60% target if Special Waste is excluded.</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>All options are expected to deliver the 30% target only if Special Waste is excluded. EFW option is expected to achieve the 60% target if Special Waste is excluded.</td>
</tr>
</tbody>
</table>
The cost estimates are calculated based on known capital expenditure (capex) costs for various European facilities. Operational costs (opex) reflect known operational expenditure for various European facility types.

Actual costs incurred will depend on a range of variables such as facility size, configuration, operational efficiencies and the total number of facilities developed to meet capacity needs. Cost efficiencies can usually be achieved by having fewer, larger facilities.

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Tonnage Diverted as % of Total Waste Arisings</th>
<th>Net Present Value (2017 - 2040) (NZ $)</th>
<th>Total Tonnage Diverted (2017 - 2040) Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2040</td>
<td>Total Capex</td>
</tr>
<tr>
<td>Domestic Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>7%</td>
<td>7%</td>
<td>$9m</td>
</tr>
<tr>
<td>Green Waste</td>
<td>4%</td>
<td>4%</td>
<td>$5m</td>
</tr>
<tr>
<td>Food Waste</td>
<td>0.01%</td>
<td>3%</td>
<td>$30m</td>
</tr>
<tr>
<td>Specialist Recyclables</td>
<td>0.1%</td>
<td>0.2%</td>
<td>$1m</td>
</tr>
<tr>
<td>Bulkly Waste (for disposal)</td>
<td>n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Domestic Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>0%</td>
<td>3%</td>
<td>$12m</td>
</tr>
<tr>
<td>Putrescible</td>
<td>0%</td>
<td>1%</td>
<td>$14m</td>
</tr>
<tr>
<td>Construction &amp; Demolition Waste</td>
<td>0%</td>
<td>3%</td>
<td>$18m</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refuse</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Special Waste</td>
<td>0%</td>
<td>0%</td>
<td>$59m</td>
</tr>
<tr>
<td>Other Waste</td>
<td>0%</td>
<td>0%</td>
<td>$88m</td>
</tr>
<tr>
<td>Total</td>
<td>11%</td>
<td>21%</td>
<td>$237m</td>
</tr>
</tbody>
</table>

The table indicates that, in order to deliver the additional waste processing infrastructure required to maximise diversion of recyclables and organic waste from landfill:

- Net present value of capital costs could range from c.NZ$240 million; and
- Net present value of net costs including capex, lifecycle costs, opex and revenue\(^9\) could range from NZ$1.83 billion.

If Council were to fund 15% of the capital investment required for Domestic Waste treatment facilities (for treatment of both Domestic and Non Domestic Waste), the required share from Council is expected to be c.$9million (Option 2). This could increase to c.$118million (Option 1) is refuse treatment in Energy from Waste facilities is also considered.

It is estimated that income generated from the current landfill levy would be sufficient to fund Council's 15% share of capital expenditure.

Landfill Levy - Tipping Points

The net cost of a treatment facility relative to landfill disposal cost is a good proxy for the level at which to set the landfill levy, to make waste treatment economically favourable compared to landfill disposal.

Based on the analysis, the current levy of $10 per tonne incentivises diversion of recyclables and green waste from Domestic Waste. However, the levy should be increased to at least

---

\(^9\) Revenue from process outputs only. Income from gate fees and the landfill levy have not been included.
c.$50 per tonne and c.$125 per tonne respectively if diversion of food waste and refuse are to become financially preferable to landfill disposal (see table below).

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>All Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Waste</td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>$9</td>
</tr>
<tr>
<td>Green Waste</td>
<td>-$18</td>
</tr>
<tr>
<td>Food Waste</td>
<td>$49</td>
</tr>
<tr>
<td>Specialist Recyclables</td>
<td>$102</td>
</tr>
<tr>
<td>Bulky Waste (for disposal)</td>
<td>$46</td>
</tr>
<tr>
<td>Non-Domestic Waste</td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>$24</td>
</tr>
<tr>
<td>Putrescible</td>
<td>$48</td>
</tr>
<tr>
<td>Construction &amp; Demolition Waste</td>
<td>$127</td>
</tr>
<tr>
<td>General</td>
<td></td>
</tr>
<tr>
<td>Refuse</td>
<td>$123 to $207</td>
</tr>
</tbody>
</table>

Please note that the levy rates indicated above are based solely on treatment costs, and would need to be adjusted to include appropriate consideration of costs for waste collection and transfer, to facilitate diversion of targeted waste streams from landfills.

5.3.4 Employment Opportunities

Diversion of Domestic and Non Domestic recyclables and organic waste from landfill for treatment in waste management facilities (i.e. Option 2) is expected to generate c.425 direct and c.1,200 indirect\(^\text{10}\) employment opportunities between 2017 and 2040.

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Additional Direct Employment by 2040</th>
<th>Additional Seasonal Employment by 2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Green Waste</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Food Waste</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>Specialist Recyclables</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Bulky Waste (for disposal)</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Non-Domestic Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Dry Recyclables</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Putrescible</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Construction &amp; Demolition Waste</td>
<td>60</td>
<td>200</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refuse</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Special Waste</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Other Waste</td>
<td>-3</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>425</td>
<td>1,200</td>
</tr>
</tbody>
</table>

It is expected that the facilities, once operational, will create directly associated jobs (e.g. material reprocessors, waste hauliers, export providers etc.) in addition to the employment opportunities estimated above.

\(^{10}\) Construction jobs
6.0 WASTE TRANSFER OPTIONS

An integral part of any successful solid waste management strategy is the provision of suitable infrastructure to optimise the transfer of wastes from the point of collection to the point of treatment or disposal, for example a Resource Recovery Network.

The following section provides high level commentary on the potential costs and benefits associated with using road, rail and water transport as a means of waste transfer, and elements which should be considered when developing Auckland’s future strategy.

6.1 Current Position

A variety of transfer mechanisms and routes are currently employed, moving wastes from the point of collection to recycling, landfill or composting facilities by either:

- direct delivery to the end destination; or
- delivery to a transfer station (operated by either Council or private operators) where collected materials are processed and/or bulked up prior to onward transport to the end destination.

The majority of transfer activity currently takes place via road transport, although Council is keen to consider all options when developing its future waste management strategy, to identify the most effective economic and environmental solution.

6.2 Alternative Options

Rail and shipping transfer options become increasingly cost competitive when the required transfer distances increase. However, the majority of anticipated transfer distances within Auckland are unlikely to be sufficient to justify alternatives to road transport from a purely financial perspective. Clearly shipping will be required in some instances, e.g. on / off island transfer services.

There are also significant carbon benefits in using rail and shipping in preference to road transport, although it should be noted that the aggregate carbon impact of waste transfer activities is typically of much lower significance than the carbon impact of the waste treatment process or processes selected.

Any adoption of rail and shipping solutions will also be dependent on the practicalities of port and railhead locations.

6.3 Future Considerations

There is clearly an opportunity to generate transfer efficiencies when considering the locations of new waste management infrastructure.

A holistic approach is needed to ensure that waste transfer arrangements (in terms of both location and method) are aligned as closely as possible with recycling and treatment solutions, so that the overall system works as effectively as possible.

A site optimisation study would help to determine the optimum solution and deliver best value for Council.
7.0 ORGANIC WASTE MANAGEMENT OPTIONS

More effective management of organic wastes (in particular food waste) will be fundamental to not only delivering an improved overall solid waste management strategy, but also in meeting the wider environmental targets for Auckland. The following section provides a summary of SLR’s assessment of potential organic waste management options.

7.1 High-Level Options

There are various options for the management of organic wastes, which have been categorised in Table 7-1 below.

<table>
<thead>
<tr>
<th>Option</th>
<th>Collection, Transfer and Treatment Characteristics</th>
</tr>
</thead>
</table>
| Home / Community Composting | • No separate collection required  
  • Review of future suitability of infrastructure would be required based on waste and resource projections  
  • Cost effective method of recycling garden waste (no central collection or treatment costs incurred)  
  • Regulatory acceptance of food waste composting may be prohibitive  
  • Not appropriate for all households  
  • Hard to measure performance |
| Secondary Segregation (i.e. treatment via MBT) | • No separate collection required  
  • Review of future suitability of infrastructure would be required based on waste and resource projections  
  • MBT treatment comprises mechanical separation of organic fraction for biological treatment (e.g. AD or bio-drying to produce refuse derived fuel)  
  • Additional recyclables may be recovered from the non-organic fraction  
  • Mixed feedstock (including refuse) can significantly impact the availability of outlets for MBT treatment products (e.g. digestate) due to quality and contamination issues |
| Mixed Food and Garden Waste Collections (which may be delivered via dedicated collection vehicles or via co-collection with other materials using multi-compartment vehicles) | • Separate collection required  
  • Dedicated organic collections - transfer / tipping points can be optimised  
  • Co-collection - transfer / tipping points would need to be located close to, on route or ideally on the same site as the co-collected materials (e.g. refuse or recyclables)  
  • Preferred treatment process is In-vessel Composting (IVC), although some dry-AD technologies can process mixed organic streams  
  • Lower gate fees compared to refuse treatment facilities  
  • IVC does not include energy generation  
  • Requires availability of suitable outlets for compost or digestate, due to quality and contamination issues |
| Dedicated Food Waste Collections | • Separate collection required  
  • Dedicated organic collections - transfer / tipping points can be optimised  
  • Co-collection - transfer / tipping points would need to be located close to, on route or ideally on the same site as the co-collected materials (e.g. refuse or recyclables)  
  • Separated food waste is acceptable in a wider range of AD technologies, for energy recovery via biogas  
  • Lower gate fees compared to refuse treatment facilities  
  • Would enable garden waste to be processed either through home or open windrow composting  
  • Requires availability of suitable outlets for digestate |
The options selected by Council for further assessment comprised secondary segregation (treatment by MBT), dedicated food waste collections, collection of food waste using split body vehicles, and collection of food waste using pods (all with treatment by AD).

Figure 3: Co-Collection Vehicle Configuration – Split Body (L) and Pod (R)\(^\text{11}\)

### 7.2 Indicative Collection Costs

The costs of providing a separate food waste collection service vary according to the characteristics of the local area, e.g. for urban areas, provision of dedicated food waste collection vehicles is typically cheaper (per household) than co-collection with other waste streams in separate compartments on the same vehicle, whilst the reverse is true for more rural areas, as summarised in Figure 4 below.

![Figure 4: Indicative Organic Waste Collection Costs in Different Areas\(^\text{12}\)](image)

Trials carried out by Council suggest that Auckland households could capture approximately 85kg of food waste per year. By taking into account the collection cost per household, plus the anticipated cost of providing separate containers to households for food waste, it is possible to estimate the indicative total costs of collection per tonne of waste produced. For

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\(^{11}\) Vehicle illustration source: [www.dennis-eagle.co.uk](http://www.dennis-eagle.co.uk)

\(^{12}\) Based on WRAP (UK) 2009 report on household food waste costs, which categorised local authority areas into six 'rurality groups', based on housing densities (and impact on collection costs due to travel distances) and deprivation (and impact on collection costs due to levels of participation)
the two most urban area types, which most closely reflect the majority of the Auckland region, this total collection cost is summarised in Table 7-2 below.

### Table 7-2

<table>
<thead>
<tr>
<th>Area Type</th>
<th>Total Collection Cost (per Tonne per Year)</th>
<th>Separate Vehicle</th>
<th>Co-Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major urban area</td>
<td></td>
<td>c.NZ$250</td>
<td>c.NZ$390</td>
</tr>
<tr>
<td>Large urban area</td>
<td></td>
<td>c.NZ$370</td>
<td>c.NZ$435</td>
</tr>
</tbody>
</table>

Full consideration needs to be given to the nature of all areas within Auckland to derive the most appropriate configuration for the overall collection service for the region.

### 7.3 Indicative Treatment Costs

Based on UK industry data from 2015/16, average gate fees charged by organic waste treatment facilities are in the order of:

- NZ$145 per tonne for MBT facilities (secondary segregation); and
- NZ$68 per tonne for AD facilities (source segregation).

However, it should be noted that the comparative cost of treating organic waste via MBT will reflect the proportion of organic waste in the mixed refuse stream. Whilst the $145 per tonne gate fee for an MBT facility reflects the price per tonne of mixed refuse, only an estimated 44% of Auckland’s household refuse comprises food waste\(^{13}\), therefore the true cost of treating food waste could be NZ$145 / 0.44 which equates to NZ$328 per tonne.

In addition, AD facilities in the UK are currently eligible for economic incentives (feed-in tariffs or FiTs) for the production of green energy. In the absence of these incentives, it is considered that the typical gate fee could be closer to NZ$115 per tonne. As it is currently unclear what incentives (if any) might be available for future AD facilities in Auckland / New Zealand, this higher value has been applied when considering total costs.

In terms of environmental impact (i.e. indirect costs), AD offers the lowest carbon footprint for treatment of source segregated food waste. Whilst this does not impact directly on the financial calculations carried out in support of this report, it should be considered in the context of Auckland’s wider environmental objectives.

### 7.4 Total Costs

Taking into account the above cost calculations, the overall estimated cost of treatment of food waste can be derived and compared against the cost of treatment Data for the two most urban area types, showing estimated costs and potential cost is summarised in

Table 7-3 below.

\(^{13}\) 45% if only refuse collected at the kerbside is considered
Table 7-3
Indicative Organic Waste Collection and Treatment Costs

<table>
<thead>
<tr>
<th>Collection / Treatment Method</th>
<th>Combined Collection &amp; Treatment Cost per Tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Major Urban Area</td>
</tr>
<tr>
<td></td>
<td>Estimate</td>
</tr>
<tr>
<td>Secondary Segregation (MBT treatment)</td>
<td></td>
</tr>
<tr>
<td>- No separate collection</td>
<td>NZ$328</td>
</tr>
<tr>
<td>Source Segregation (AD treatment)</td>
<td></td>
</tr>
<tr>
<td>- Separate collection vehicles</td>
<td>NZ$369</td>
</tr>
<tr>
<td>- Co-collection vehicles</td>
<td>NZ$505</td>
</tr>
</tbody>
</table>

The table shows how local area characteristics can influence key decision making processes at regional level, and it is essential to note the importance of key sensitivities which impact on calculations of this type. Of particular significance in this case are:

- the impact of fluctuations in the amount of food waste captured per household on the estimation of collection costs per tonne; and
- the impact of the proportion of food waste within the refuse stream on the estimation of MBT treatment costs per tonne.

Fluctuations in these two key parameters (and indeed other parameters such as the potential future availability of financial incentives for certain treatment technologies) can have a significant effect on the apparent costs associated with organic waste management. For this reason, a full and detailed waste flow and cost modelling exercise should be carried out in order to determine the optimum collection and treatment solution for Auckland.

For example if the amount of food waste captured per household was to rise to approximately 114kg compared to 85kg, this could result in a cost of NZ$303 per tonne compared to NZ$369 per tonne for collection in separate vehicles.

7.5 Charging Considerations

As described above, there are likely to be significant cost considerations in the provision of an effective organic waste management service. Whilst these may be at least partially offset by other service changes which become viable as a result of implementing organic waste collections (e.g. reducing the frequency of refuse collections), it is important to establish how future services are to be paid for.

For organic (food) wastes, which are typically high density but low volume, it may be difficult to incentivise segregation by waste producers under a volume-based PAYT system. Council needs to consider how it might best apply user charges to its future waste collection services, to ensure that waste producers are clearly incentivised to fully participate in any separate organic waste collection service which may be adopted.

7.6 Conclusions

There is no ‘one size fits all’ solution for implementing an effective organic waste management system.
For garden waste treatment, home / community composting can be a cost-effective solution, but regulatory restrictions may prohibit its use for the treatment of food waste. Alternatively Council could consider the implementation of a separate garden waste collection service on a subscription only basis.\textsuperscript{14}

Food waste may be collected either by separate dedicated collection vehicles, or through use of separate compartments on the same vehicle. Dedicated food waste collection vehicles provide the most cost-effective solution for the most urban areas and the greatest opportunity for food waste transfer optimisation. An optimised food waste collection service may include varying collection methodologies, for example the co-collection of waste streams in the most rural areas. Best practice indicates that weekly collection of food waste provides the best diversion results.

Whilst additional collection services are not required for secondary segregation options (e.g. an MBT treatment solution), the lower prorated gate fees at dedicated organic waste treatment facilities (compared to MBT) and reduced refuse collections may be sufficient to offset the costs of providing additional food waste collection services.

For the treatment of food waste, Anaerobic Digestion provides the additional environmental benefit of delivering the lowest carbon impact, which is of significance when considering Auckland’s wider environmental goals. The development of Anaerobic Digestion facilities could be accelerated by offering financial incentives, e.g. for the production of green energy. Whilst some operational efficiencies may be gained through co-location of Anaerobic Digestion plants for food waste at existing wastewater treatment works, establishing the optimum treatment facility location is likely to be the determining factor.

The total costs associated with organic waste collection and treatment services vary according to area type and a range of other technical sensitivities. It should be noted that an optimised service configuration could realise savings in other services, e.g. by reducing refuse collection frequencies. These savings will at least partially offset additional costs for organic waste management.

A site optimisation study and detailed cost analysis should be undertaken to assist in the identification of the optimum solution in terms of implementing collection methods and locating transfer and treatment infrastructure which best suits the specific needs of Auckland and its constituent areas.

\textsuperscript{14} A measure that is being adopted by an increasing number of UK local authorities
8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Headline Conclusions

Auckland has set ambitious future targets in the context of waste management and carbon emissions and is seeking to move towards a Zero Waste culture which reflects the position adopted by cities that are recognised as World leaders in environmental performance.

Fundamental to achieving these targets is the development and implementation of an integrated waste management strategy which delivers new practices and new infrastructure to support a move away from landfill disposal and towards maximising opportunities to reuse, recycle and treat future waste arisings. Although modern landfills may be robustly engineered and well managed, landfill disposal is regarded as a poor waste management option, particularly in the context of managing organic wastes.

The current cost of landfilling in Auckland is too low to drive the development of alternative approaches to solid waste management. Investment and support for non-landfill facilities and clear financial incentives are required to drive behavioural change, particularly for Non Domestic Waste, which is largely outside of Council’s direct control.

Additional waste processing and treatment facilities are needed to deliver Auckland’s landfill diversion targets, particularly in the context of the organic waste and refuse streams.

Total organic waste treatment facility capacity requirements\(^{15}\) (for Domestic and Non Domestic Waste) are likely to range from 220,000 to 270,000 tonnes per annum by 2040 dependent on the material capture rates which can be achieved. This would equate to approximately 5-6 facilities (including existing capacity) assuming a typical facility capacity of 50,000 tonnes per annum.

Refuse treatment capacity requirements are likely to range from 700,000 to 800,000 tonnes per annum by 2040. Assuming an EfW treatment solution, this would equate to approximately 3 facilities on the basis of a typical facility capacity of 300,000 tonnes per annum. However, EfW facilities are considered not viable currently in New Zealand due to Central Government’s drive to use renewable energy in New Zealand rules out use of such facilities.

To accommodate projected 2040 waste arisings for all streams, the total capital expenditure requirement for delivery of recyclables and organic waste treatment infrastructure (excluding refuse treatment) is currently estimated to be c.NZ$237 million.

Policy / legislative direction needs to be clearly established across all major waste streams (including they key organics and refuse streams to inform infrastructure needs for treatment of Domestic Waste), with integration where required to optimise progress towards the agreed Zero Waste goals. Clearly defined strategies are required to provide a roadmap of how short, medium and long term waste management targets are to be achieved.

Strategy development should consider all waste streams holistically, such that an optimised solution is developed which takes due account of the impact of changes to the management of one stream (e.g. organic waste) on other streams (e.g. refuse), particularly in the context of collection and treatment infrastructure requirements.

\(^{15}\) Including green waste
8.2 Recommendations

8.2.1 Policy Changes

The level at which the Landfill Levy is set should be reviewed and an increased rate implemented, which may be accompanied by a commitment to further future increases. This is a fundamental step in moving towards Auckland’s environmental targets. It is recognised that this is a national issue and could not be introduced in isolation in Auckland.

The mandatory use of site waste management plans could be a useful tool in improving the environmental performance of the construction / development sector, which is a significant waste generator in terms of tonnage. Council needs to consider how the system would be introduced and administered to maximise potential benefits.

Implementation of a full or partial ban on the disposal of organic waste to landfill should be considered, as this is a proven mechanism for significantly improving environmental performance. However, this should only be carried out following the development of a complementary strategy for the management of organic waste (see below).

Identification of appropriate collection charging mechanisms will be fundamental in incentivising householders to maximise recycling and minimise generation of refuse. Rigorous householder / stakeholder education and engagement will also be needed to promote key messages and encourage participation.

8.2.2 Organic Waste Management Strategy

A robust organic waste management strategy is likely to be a fundamental element of Council’s overall Zero Waste strategy and is a recurring theme for high performing cities worldwide (i.e. those recognised internationally for their holistic approach to sustainable waste management, considering carbon / climate impacts and not just diversion from landfill). The strategy should include:

- confirmation of Council’s preferred treatment solution (including consideration of renewable energy incentives and climate change aspirations);
- identification of optimal facility locations; and
- determination of the most appropriate organic waste segregation / collection system.

8.2.3 Refuse Management Strategy

To minimise waste disposal to landfill, Council needs to develop a clearly defined strategy for the future management of refuse. The strategy should include:

- confirmation of Council’s preferred refuse treatment technology (to achieve long term targets); and
- identification of optimal treatment facility locations.

SLR’s assessment suggests that Auckland’s future targets for reducing waste to landfill are unlikely to be achievable without adopting an EfW refuse treatment solution at some stage in the future.

8.2.4 Supporting Measures

To provide suitable waste transfer infrastructure to optimise collection systems and transport requirements, the number, size and location of facilities needed must be identified. This will
be informed by Council’s preferred collection and treatment systems and should be considered in parallel.

To support the development of the waste management strategies, detailed consideration also needs to be given to the development of viable markets for waste treatment outputs, for example (dependent on the waste treatment technologies adopted):

- compost / digestate from organics processing facilities;
- ‘compost like outputs’ from MBT facilities; and
- Incinerator Bottom Ash (IBA) from EfW facilities, if implemented.

In the absence of such markets, there is a risk that treatment outputs end up being disposed to landfill, which not only impacts on the ability to achieve future diversion targets, but also sends out a negative message on the merits of waste segregation and treatment.

Fundamentally, Council needs to confirm what Zero Waste means in the Auckland context and the preferred route towards achieving its goals / aspirations, which may be a phased approach. Council also needs to have a clear understanding of all waste arisings (sources and types) to inform further development of appropriate future strategies.
9.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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