Kaipara District Compost Options Assessment Feasibility Study

Report Dated: 12th December 2020 – Version 3

Funding support from:

Ministry for the Environment
Manatū Mō Te Taiao
Waste Minimisation Fund

Report Commissioned by:

Sustainable Kaipara
Protect our precious place

Independent Reporting:

IMPACT Consulting Est. 1997

Strategic Insight for Social Good™

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Report Dated: December 2020

Report Disclaimer Notes:

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Contents

Executive Summary

1 Report Context

This independent report has been compiled by Impact Consulting on behalf of Sustainable Kaipara, with funding support from the Ministry for Environment. The report outlines our assessment of the best fit hot compost options for the Kaipara Region based on available information.

The report is broken into three sections:

1. Needs Assessment
2. Options Assessment
3. Recommendations

2 Regional Context

The Kaipara region features a geographically disbursed population of 24,100 people. The two main urban centres in Dargaville (5,027 people) on the West Coast and the rapidly growing area of Mangawhai and surrounds (5,548) on the East Coast.

Currently rubbish and recycling are collected via bags on a user pays basis. There is no organics or food waste collection and limited options for green waste disposal.

There are currently two council waste transfer stations within the Kaipara District. All landfills are now closed, with waste transported around 60km north to the Northland Regional Landfill (Puwera), in the Whangarei District.

The January 2020 Kaipara District waste audit indicated that by weight, 41% of household refuse was organic and food waste. Making it over 2.5 times heavier than the next largest waste stream. By volume organic and food waste accounts for around 6% of current household refuse.

It is estimated that organic material and food waste currently going to landfill in the Kaipara District, equates to approximately 1,165 tonnes per year. This is based on one rubbish bag per household per week and excludes self-haul waste.

3 Survey Results

Two online surveys were undertaken. One focussed on households with 268 responses and one focused on businesses, schools and community groups with 77 responses.

Survey results showed that:

- 34% of households and 38% of businesses / community organisations currently bin some, or all, of their food waste with their rubbish.
    - 45% of respondents would use a free weekly food waste collection service.
    - 45% of respondents would be willing to pay for weekly food waste collection.
    - An additional 25% would prefer to drop off their food waste.
    - 39% of businesses and community organisations would be willing to pay for weekly food waste collection.

- 73% of households and 38% of businesses / community organisations currently compost their green waste.

4 Options Summary

There are a wide range of possible hot composting options. Ranging from localised community composting boxes, through to large in-vessel composting systems and larger scale commercial scale windrow operations.

There are also a range of approaches to composting process. The main ones being 1) aerobic composting, which is turned or oxygenated via forced aeration and 2) fermentative anaerobic composting, which is inoculated with beneficial anaerobic microbes, effectively creating a scaled up bokashi type system.

5 Recommendations

In terms of environmental impact, removing food waste from landfill is one of the simplest things that, we as individuals and Kaipara as a region, can do to reduce our contribution to greenhouse gas emissions.

If global food waste were a country, it would be the third largest producer of greenhouse gasses and carbon emissions, behind China and the USA.[1]

The number one objective of the **Kaipara District Council Waste Management and Minimisation Plan (WMMP) 2017**, is to:

> *1. To reduce the quantity of recoverable material entering landfill.*
>
> *With the initial target being:*
>
> *1.1 To decrease the annual quantity of waste disposed of to landfill from the Kaipara district to below 200kg per capita per year (equates to > 30% diversion).*

Removing food and organic waste from rubbish bags provides the greatest potential gains in terms of achieving the Kaipara District Council's waste minimisation objectives (a weight-based target).

5.1 Implications for current system

Indications are that removal of food wate from household refuse would result in a 41% decrease in refuse to landfill by weight and 6% by volume. This means that households would theoretically buy 6% less rubbish bags. This is anticipated to have minimal impact on the viability of current services, with the worst case being the need for a $0.19c increase in bag price (6%).

5.2 Financial Incentive for Diversion

- There is currently very minimal financial incentive for households to divert their organic and green waste from landfill.
- Even with proposed landfill Waste Disposal Levy increases over the next 4 years from $10 per tonne to $60 per tonne, there is currently insufficient financial benefit for waste contractors to setup, staff and run an organics diversion system themselves, without additional funding input or establishment support, from Council or other public funding sources.

5.3 Funding

There are several potential funding models for hot composting and diversion of organic material from landfill. The following progression is recommended:

1. Short-term: User pay + waste minimisation grants
2. Medium-term: Waste minimisation funding
3. Long-term: Targeted or general rate

5.4 Recommendations

It is our view that as far as possible, localised solutions which limit transportation, employ local people, and produce high quality outputs should be prioritised. This includes encouraging home-based solutions first and foremost.

The following recommendations made based on our assessment of the best fit hot compost options for the Kaipara Region.

1. **HOME: Community Education**
   It is recommended that Kaipara District Council tag some waste minimisation funding for home composting education, encouraging home-based food waste solutions such as bokashi, worm farming and home composting. **Recommended allowance: $15K per year.**

[1] Love Food Hate Waste

2. **LOCAL: Community Composting**

It is recommended that community hot composting initiatives are supported at schools, marae and community gardens. These activities are localised, minimise waste transport and have a huge range of community building and educational benefits. Education of volunteers and effective ongoing management / support for these systems is important to get the best results. As such is it recommended that an annual site management / support contribution is funded by the Kaipara District Council, with the collection and composting activities locally funded by service users, or via other funding sources, or run by volunteers.

Recommended allowance: $2,750 annual grant per community composting site, with an initial objective of x10 sites regionally.

It is recommended that this funding is maintained for each new site, for a minimum of x3 years to enable them to get established, with consideration of longer-term support based on results.

3. **REGIONAL: Larger Scale Composting**

It is recommended that a Horizontal Composting Unit and/or a HotRot in vessel composting system are investigated in more detail and business case prepared, as potential future solutions for the Kaipara District. Depending transport logistics and site suitability, the composting hub/s may be located at waste transfer stations in the Dargaville and/or Mangawhai areas. Consideration should be given to the comparative advantage of having two sites, given the potential for staff to also run other transfer station activities, verses a single hub and with increased transport costs and environmental impact. Projected population growth should also be considered.

4. **OTHER: Sewage Sludge**

While not investigated in detail within this report, it is understood that Kaipara wastewater treatment sludge is currently transported to landfill. It is recommended that a HotRot system could be investigated in more detail for the processing of wastewater treatment sludge for the region (as is used in Palmerston North). With increasing landfill costs, ability to process wastewater sludge may enhance the viability of a composting system. While pasteurised within the system, consideration would need to be given to end product use and the potential for higher heavy metal content.

Acknowledgements

THANKS TO:

Impact Consulting would like to thank Sustainable Kaipara and the following organisations and individuals for their time and input into our research for this project. We hope it will prove to be a valuable resource.

Please note that while care has been taken in research, reporting and subsequent recommendations, this is an independent report and as such has not had direct input from the organisations listed. It therefore cannot be considered to represent the views of the Kaipara District Council or any of the individuals or organisations acknowledged or referenced.

KAIPARA

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Victoria del la Varis-Woodcock - Kaipara District Councillor & Love Kaipara
Rob Battcher - Kaipara Refuse
Kaipara Residents and Businesses - x345 Survey Respondents

OTHER NORTHLAND ORGANISATIONS

Trish Allen - Mangawhai Waste Busters
Susan Karels - Northland Eviroschools Co-ordinator
Andrew Sclater - Northland Waste

CONVERSATIONS WITH COMPOSTERS

Paul McGuire - Envirofert
Kate Walmsley - Kaicycle
Jess Barnes - Hampshire Urban Farm
Shannon Gormley - We Compost
Tim Bowater - OMG Auckland
Richard Wallis, Tim Bowater, Teresa Marinovich - The CarbonCycle Company
Rick Thorpe and Liz Stanway - Raglan Extreme Zero Waste
Ben Bushell - Community Compost
Prashanti Lovegrove - The Compost Co. Waiheke Resources Trust

OTHER CONVERSATIONS

Owen Embling - Convex Plastics (including compostable packaging)
Robert Murray – BioGro (organic certification)

Efforts were made to meet with additional Kaipara District Council and Northland Regional Council Staff and councillors. However, these were not possible, due to Auckland Covid-19 lockdown and resulting travel schedule changes.

NEEDS ASSESSMENT

SECTION 1

Needs Assessment

6 Context and Regional Overview

The Kaipara District is located within Northland and sits between three other territorial authorities, namely the Far North District and Whangarei Districts to the north and Auckland City to the south.

Kaipara is a geographically extensive district, centred around the northern reaches of the Kaipara Harbour (the largest harbour in the southern hemisphere)[2]. The District effectively span the entire northern freshwater catchment of the Kaipara Harbour on the west coast, plus the catchment of the Mangawhai Harbour on the east coast.

Area:	3,117 km^2
Main Centres:	Dargaville (pop. 5,000), Mangawhai (pop. 5,500 and growing)
Population:	24,100
Households:	9,962
Ethnicities:	83.3% Pākehā, 24.6% Māori, 8.3% other.
Landscape:	The Kaipara District has large areas of fertile land. Many areas are very low-lying, with an extensive tidal river network, and would be considered at risk of sea-level rise[1]. It is also a relatively hilly region with all main townships geographically separated by hills.
Road Network:	The Kaipara District has 1,572km of local roads of which 71% (or 1,119kms) are unsealed and 450kms which are sealed. Given its small population and the large geographic extent of the district, Kaipara finds it challenging to fund the maintenance and upgrading of this extensive roading network[1].
Industries:	The regional economy is founded on primary industries, particularly dairy, and supported by manufacturing[1].

[2] Kaipara, Place, People and Key Trends - Kaipara District Environmental Scan 2019

7 Regional Population Growth Projections

Infometrics Population Projections Report Summary[3]

Historically, most of Kaipara's population growth has taken place in the Mangawhai area. This pattern is expected to continue in future, particularly as further improvements to State Highway 1 reduce travel times into Auckland, thus improving the attractiveness of Mangawhai for commuting workers. The Mangawhai area is projected to more than double in population by 2051.

The population in the Dargaville urban area is expected to continue growing steadily, prompted by steady employment growth in Dargaville, as well as neighbouring rural areas prompted by the Kaipara Kai initiative. Population growth in the Dargaville urban area predominantly takes place in the Kaipara Coastal and Maungaru areas.

Population in Ruawai-Matakohe and Otamatea areas is expected to ease slightly. Despite a slight decline in population, the number of households is still expected to increase in these areas due to decreasing household sizes.

In 2019 there were an estimated 2.37 people per household within the Kaipara district.

Sub-District Population

Infometrics medium-high projection

Statistical Area 2	2019	2051	Change 2019-2051
Dargaville	5,027	5,097	70
Kaipara Coastal	3,796	4,241	445
Maungaru	1,890	2,207	316
Ruawai-Matakohe	2,520	2,420	-100
Otamatea	1,785	1,544	-241
Maungaturoto	1,318	1,588	270
Kaiwaka	2,217	2,658	442
Mangawhai	1,062	2,851	1,789
Mangawhai Heads	2,186	4,704	2,518
Mangawhai Rural	2,300	5,242	2,943
Total	**24,100**	**32,552**	**8,452**

Figure 1 – Population Projections[4]

Sub-District Households

Infometrics medium-high projection

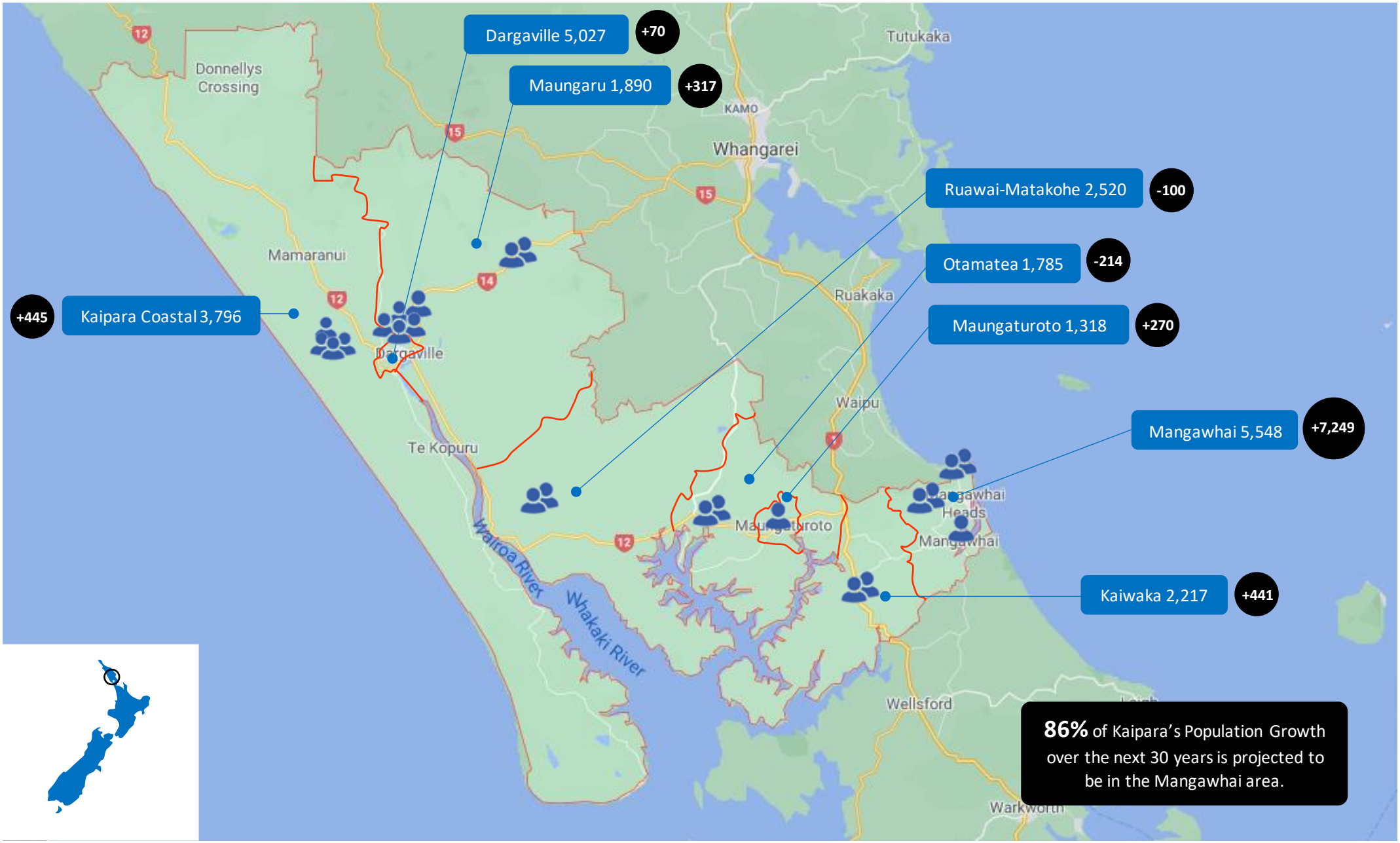
Statistical Area 2	2019	2051	Change 2019-2051
Dargaville	2,034	2,138	104
Kaipara Coastal	1,538	1,871	333
Maungaru	758	1,025	267
Ruawai-Matakohe	1,049	1,122	73
Otamatea	732	752	19
Maungaturoto	502	774	272
Kaiwaka	875	1,205	331
Mangawhai	472	1,320	848
Mangawhai Heads	1,001	2,103	1,102
Mangawhai Rural	1,000	2,303	1,304
Total	**9,962**	**14,614**	**4,651**

Figure 2 – Kaipara District Households projections[5]

[3] Population Projections 2018-2051 Kaipara District Council April 2020
[4] Population Projections 2018-2051 Kaipara District Council April 2020
[5] Population Projections 2018-2051 Kaipara District Council April 2020

Kaipara District - 2019 Population Geographic Distribution by Sub-district Areas and Projected Growth by 2051

Data source: Population Projections 2018-2051 Kaipara District Council April 2020



8 Communities

The Kaipara District Council Parks and Open Space Plan divides the District into six communities (Northwest Coast, Southwest Coast, Dargaville, Rural Heartland, Harbour Communities and Mangawhai). While different from the sub-district areas used for population projections, these are helpful when considering geographic catchments.

Figure 3 – Kaipara District Council Parks and Open Spaces Strategy 2006

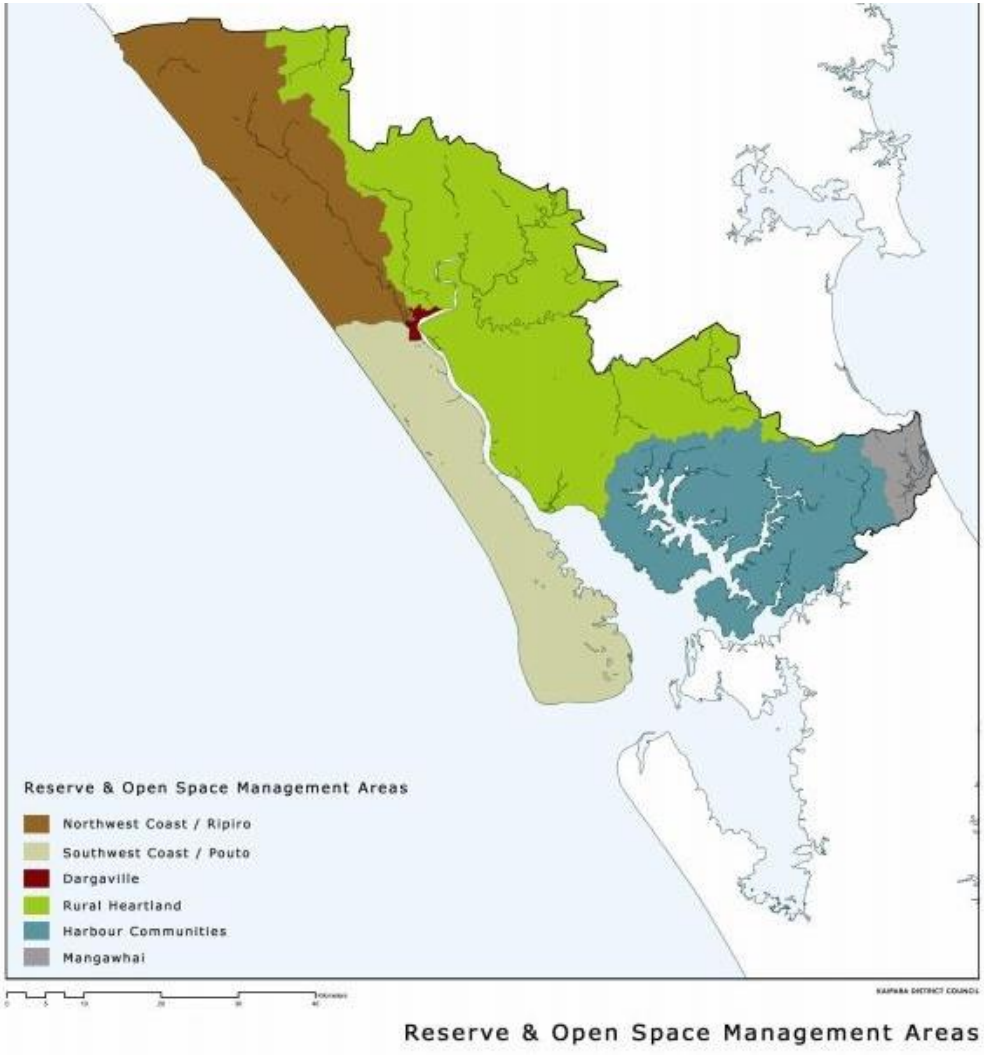


Figure 4 – Population projection sub-district areas

9 Existing Waste Management Facilities

There are currently only two council waste transfer stations for the whole of the Kaipara District. These are located at Hakaru and Dargaville. North Kaipara Transport also run a private transfer station at Maungaturoto.

Recycling: In addition, Kaipara Refuse have a sorting facility located at Ruawai which allows for recycling drop off. The team are open to exploring green waste and compost options.

9.1 Hakaru Transfer Station

Location: 636 Kaiwaka Mangawhai Road, Hakaru
Management: Northland Waste
Green Waste: On roadside signage, but not promoted or on price list. Green waste currently taken around the back of site and mulched. Sold as mulch.

Green Waste: Orang Otang Tree Trimmers have a facility at 126 Mangawhai heads road. They currently only collect their own green waste. This is mulched on site and then sold.

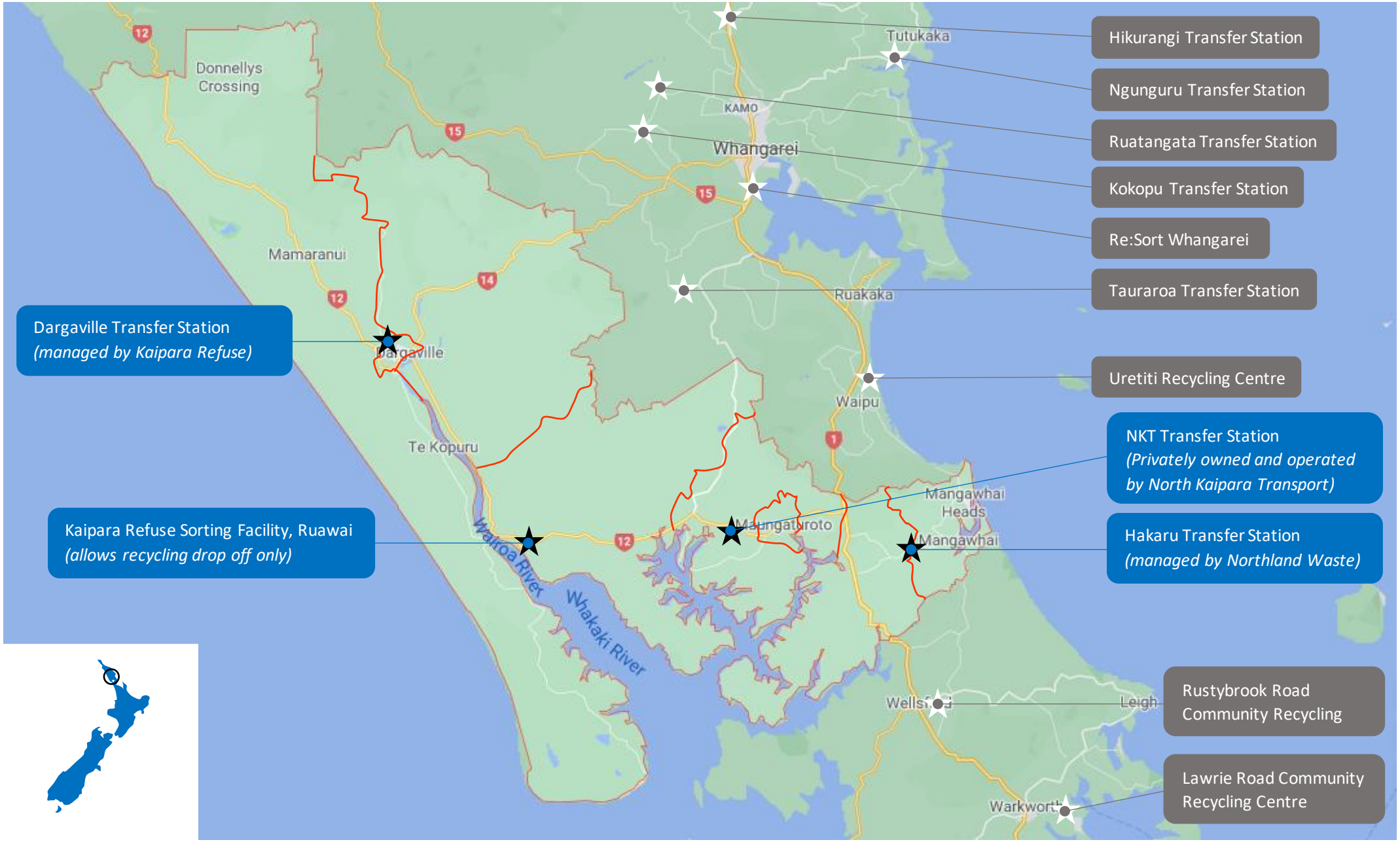
9.2 Dargaville Transfer Station

Location: 199 Awakino Road, Dargaville
Management: Kaipara Refuse
Green Waste: Collected and stockpiled on site. This has been composted, mulched and bagged for resale in the past by a private company, but was not economically sustainable.
Other: The site includes a material recovery store and recycling drop off station.

Hakaru Transfer Station

Dargaville Transfer Station

Waste Transfer Stations - Kaipara District and Surrounds



10 Travel Times

10.1 Travel times to existing waste transfer stations

When evaluating the potential for organic waste collection or drop-off, it is relevant to consider geographic distribution and travel times. The following table outlines travel times from the main townships and most remote settlements, to the nearest transfer existing station.

Distance to the nearest transfer station

Settlement	Nearest Transfer Station	Distance	Driving Time
Waipoua*	Dargaville	56km	53min
Baylys Beach	Dargaville	14km	14min
Dargaville	Dargaville	2.6km	3min
Tangiteroria	Dargaville	24km	21min
Pouto Point**	Dargaville	71km	1hr 9min
Ruawai	Dargaville	31km	24min
Paparoa	Hakaru	31km	26min
Maungaturoto	Hakaru	19km	17min
Mangawahi	Hakaru	7km	7min
Kaiwaka	Hakaru	7km	7min

*Figure 5 * Northern-most settlement, ** Southern-most settlement*

10.2 Travel Times from Main Centres

The following tables summarise travel times from main centres.

Dargaville: The main service centre and township for the Kaipara District.

Dargaville to...	Distance	Driving Time
Tangiteroria	24km	21min
Ruawai	28km	20min
Paparoa	49km	36min
Maungaturoto	61km	45min
Mangawahi	87km	1hr 6min
Kaiwaka	77km	56min
Other Centres Outside of the District		
Whangarei	56km	49min
Warkworth	115km	1hr 28min
Auckland Central	173km	2hrs 16min

Figure 6

Mangawhai: Historically a small township and holiday home location. However, the area now has a rapidly expanding residential population, which is projected to more than double by 2051. When including Mangawhai heads and rural properties, Mangawhai currently has a population greater than Dargaville.

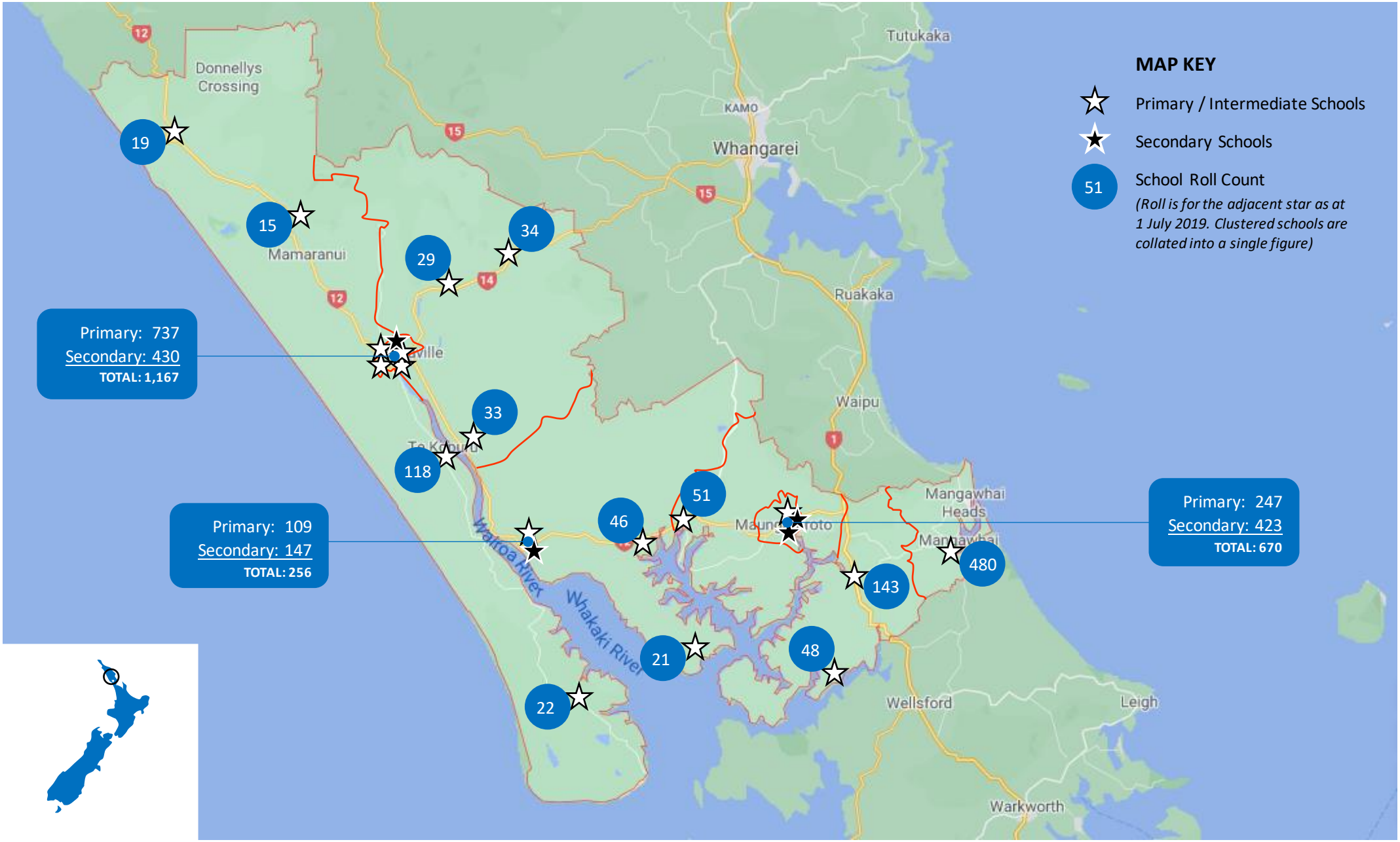
Mangawhai to...	Distance	Driving Time
Tangiteroria	98km	1hr 15min
Dargaville	87km	1hr 6min
Ruawai	59km	47min
Paparoa	38km	31min
Maungaturoto	26km	22min
Kaiwaka	14km	14min
Other Centres Outside of the District		
Whangarei	73km	1hr 6min
Warkworth	42km	40min
Auckland Central	99km	1hrs 26min

Figure 7

Schools Rolls (as a Proxy for Population and Potential Community Compost Hubs)

Each Student represents approximately x6.4 Residents

Notes: *1. **Many teenagers from Mangawhai currently go to school outside of the District due to limited options**. Although changing, the area traditionally has a higher proportion of retirees.*
2. Approximately 26% of residents aged 5 – 19 years of age go to school outside the region or are not in school (based on student numbers vs. Statistics NZ 2018 age group Census data).



11 Kaipara District - Household Waste Audits

The Kaipara District Council have commissioned four waste audits since 2015, the latest of which was undertaken in January 2020.

These audits consistently show that **putrescible (or organic waste)** to be the largest component of waste currently going to landfill across all collection areas, **accounting for 40.9% of household waste by weight** in the bags sampled during the week 20-24 January 2020. This is roughly consistent with previous audits from different times of the year, however an increase is seen over spring and summer. Over the four waste audit samples, **putrescible made up an average of 38% of household waste**.

Percentage of Organic Matter in Household Waste

Audit Date	Feb 2015	Jul 2017	Oct 2019	Jan 2020
Putrescible %	31.2%	37.60%	42.20%	**40.90%**

Figure 8 - Data Source: Kaipara Domestic Kerbside Collection – Waste Audits

The table below shows a breakdown of the top eight waste categories going to landfill in January 2020. Breakdown is by collection area.

Figure 9 – Data Source: Kaipara Domestic Kerbside Collection – Waste Audit Jan 2020

Waste Category	*Mangawhai*	*Dargaville*	*Paparoa / Maungaturoto / Kaiwaka*	*Mangawhare*	*Tangiteroria*
Putrescible	47.58%	40.78%	30.53%	35.79%	37.04%
Plastic - Non Recyclable	14.49%	13.64%	16.61%	17.69%	12.70%
Paper	10.22%	14.19%	7.89%	9.12%	19.05%
Nappies	6.81%	8.02%	11.47%	13.81%	0.00%
Glass - Recyclable	4.39%	4.11%	9.56%	6.70%	2.12%
Cardboard	3.84%	3.33%	5.38%	2.68%	2.65%
Textiles	2.82%	6.45%	5.14%	3.36%	7.93%
Potentially Hazardous	2.77%	2.75%	2.45%	6.43%	3.97%
Other	7.08%	6.73%	10.97%	4.42%	14.54%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Jan 2020 Kaipara Household Waste Audit Major Categories Breakdown

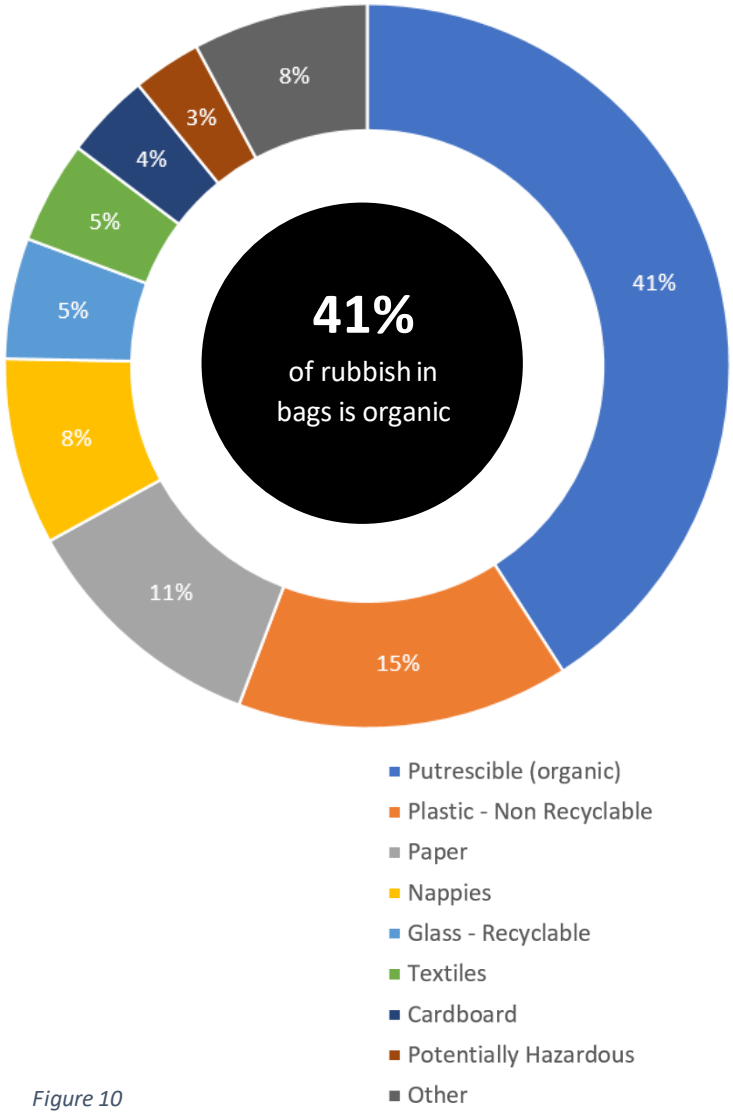


Figure 10

12 Overall Waste Volumes

The Kaipara District currently have limited available data on exact volumes of total waste from the region, due to the fact that a significant proportion of waste is self-hauled (around 40-50%) to transfer stations, rather than kerbside collection. Without accurate figures for both disposal methods, it is difficult to track overall waste trends.

A secondary factor is that due to larger shopping centres outside of the district and lower dumping fees for some items, some residents utilise facilities in neighbouring regions.

All landfill from the Kaipara District is currently transported to the Northland Regional Landfill, located in Puwera 8.5km south of Whangarei. The land fill was opened in 2009 and is owned in a 50/50 private partnership between Northland Waste Limited and the Whangarei District Council.

13 Estimated Household Organic Waste to Landfill Volumes

A Jan 2020 waste audit showed that by weight 40.9% of kerbside rubbish was organic waste (or putrescible). The following estimates are based on 1 rubbish bag per week per household. This would equate to **an estimated total of 1,165 tonnes per annum** or approximately **117kg per household per annum.**

Households	9,962	2019 population estimates
Average rubbish bag weight	5.5	kg (2020 waste audit)
Total Waste	54,791	Total kg waste per week (based on one rubbish bag per household)
Putrescible / organic	40.9%	2020 waste audit average
Organic material to Landfill	22	Total tonnes per week
Organic material to Landfill	**1,165**	**Total tonnes per year**
Total Rubbish to Landfill	286	Kg per household per year
Organic waste to portion	117	Kg per household per year
Total Rubbish to Landfill	118	Kg per individual per year
Organic waste to portion	48	Kg per individual per year

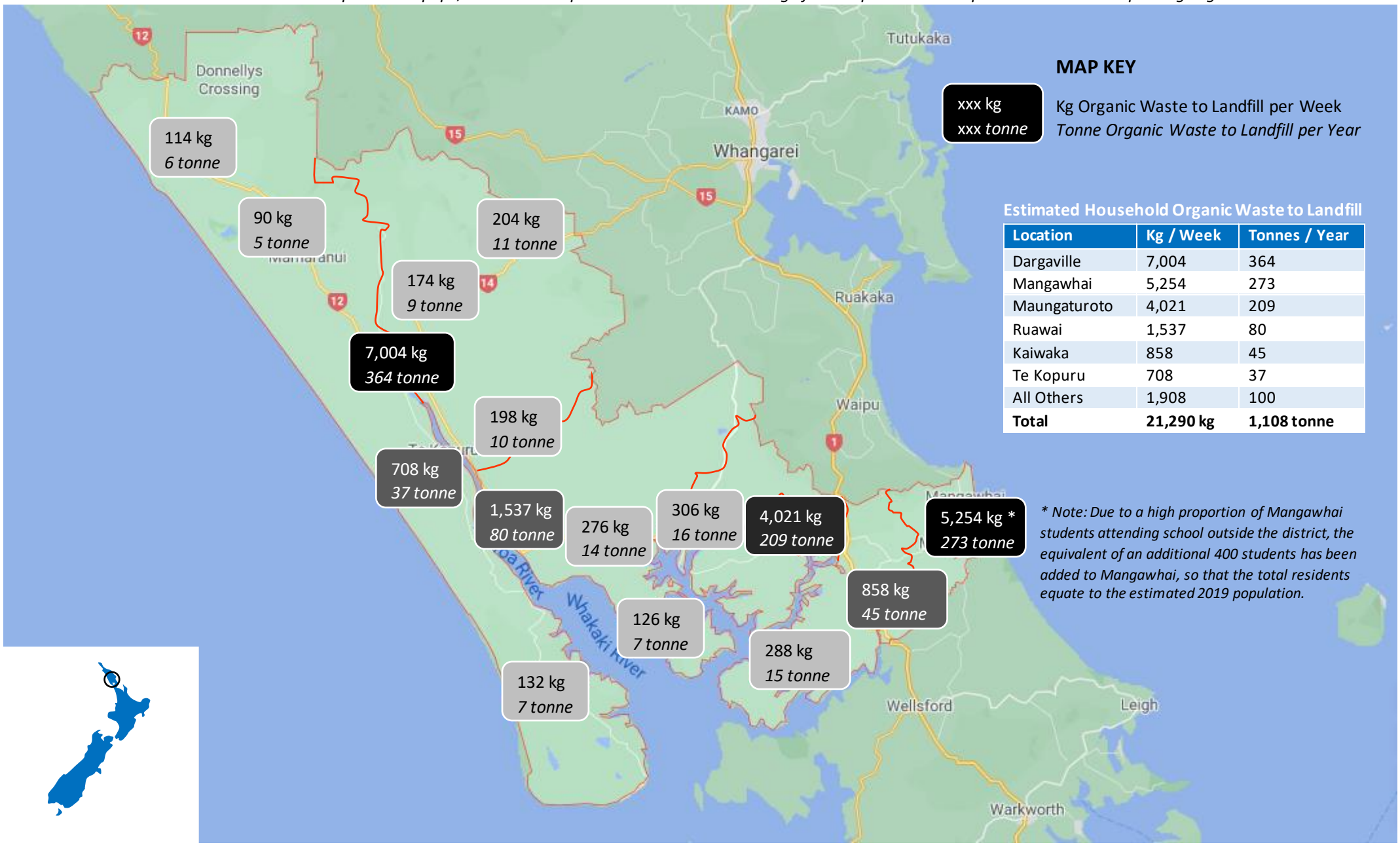
Kaipara Kerbside Waste Per INDIVIDUAL per Year

40.9% of Rubbish in Kaipara bags is organic material.

Kaipara Kerbside Waste Per HOUSEHOLD per Year

14 Estimated Household Organic Waste Going to Landfill by Area (Using School Based Population Distribution Proxy)

Estimates based on: x6.4 residents per school pupil, x1 household per 2.42 residents and x1 bag of waste per household per week with 40.9% per bag organic waste.



MAP KEY

xxx kg
xxx *tonne*

Kg Organic Waste to Landfill per Week
Tonne Organic Waste to Landfill per Year

Estimated Household Organic Waste to Landfill

Location	Kg / Week	Tonnes / Year
Dargaville	7,004	364
Mangawhai	5,254	273
Maungaturoto	4,021	209
Ruawai	1,537	80
Kaiwaka	858	45
Te Kopuru	708	37
All Others	1,908	100
Total	**21,290 kg**	**1,108 tonne**

** Note: Due to a high proportion of Mangawhai students attending school outside the district, the equivalent of an additional 400 students has been added to Mangawhai, so that the total residents equate to the estimated 2019 population.*

Survey Results

15 Methodology

Two online surveys were developed during October 2020 to assess current practices regarding organic waste and evaluate the potential demand for collection and composting services within the Kaipara District. These were distributed via Facebook posts and direct emails to relevant Kaipara based organisations and contact lists. The two surveys contained very similar question sets, with one tailored to households and other to businesses, schools and community organisations. Both surveys had a $100 voucher prize draw incentive.

NOTE: While both surveys were distributed as widely as possible, due to the nature of the survey topic, there is potential for a self-selection bias i.e. people who are interested in composting and waste reduction are more likely to have completed the surveys.

15.1 Household Survey

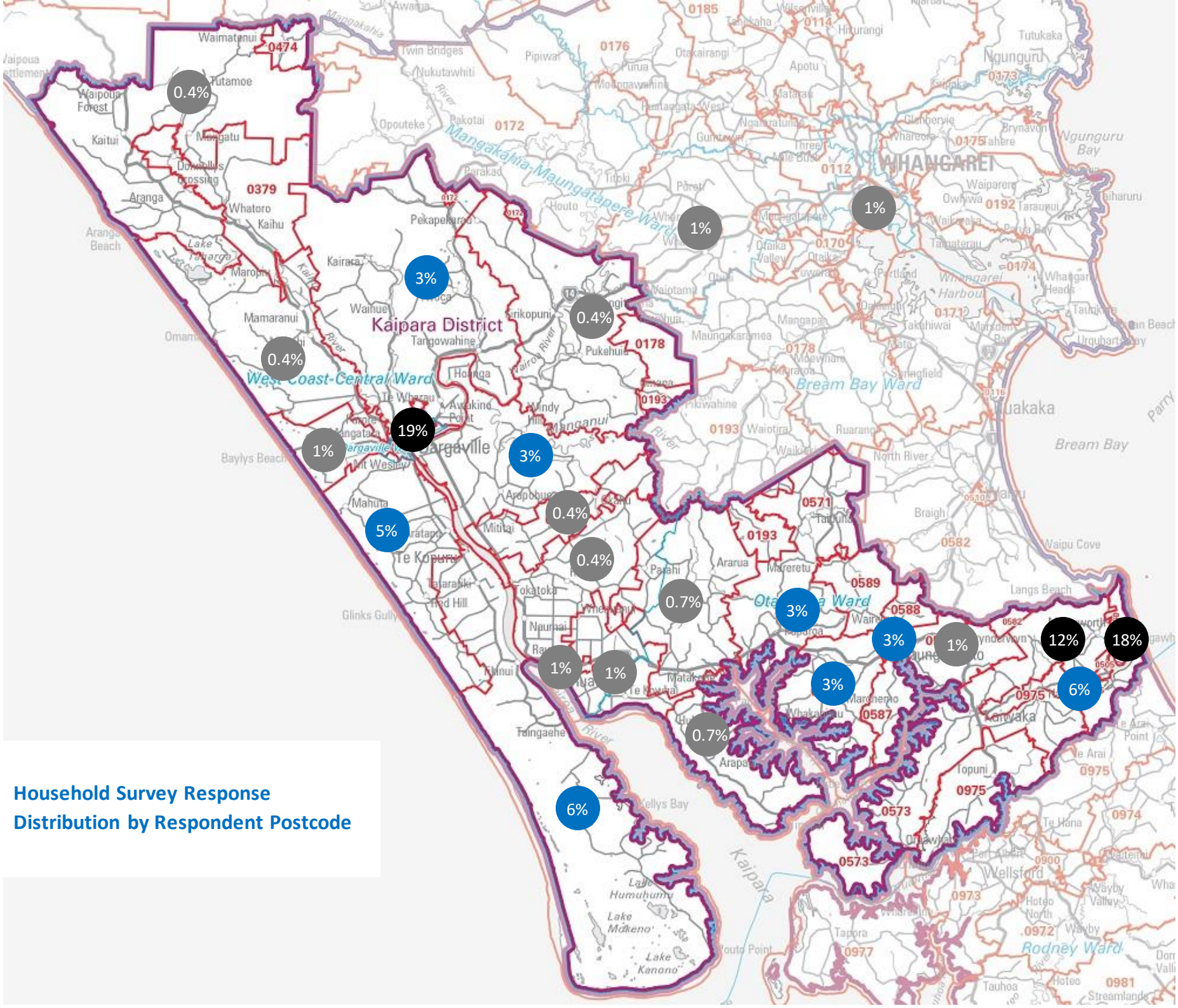
Questions:	7
Average time to complete:	3 minutes 48 seconds
Total responses:	268
Total District population:	24,100[6]
Assumed confidence level:	95%
Margin of error:	6%

15.2 Business and Community Organisations Survey

Questions:	10
Average time to complete:	3 minutes 46 seconds
Total responses:	77
Total Business within District:	3,492[7]
Assumed confidence level:	95%
Margin of error:	11%

[6] Population Projections 2018-2051 Kaipara District Council April 2020

[7] https://ecoprofile.infometrics.co.nz/Kaipara%2BDistrict/Businesses/Structure

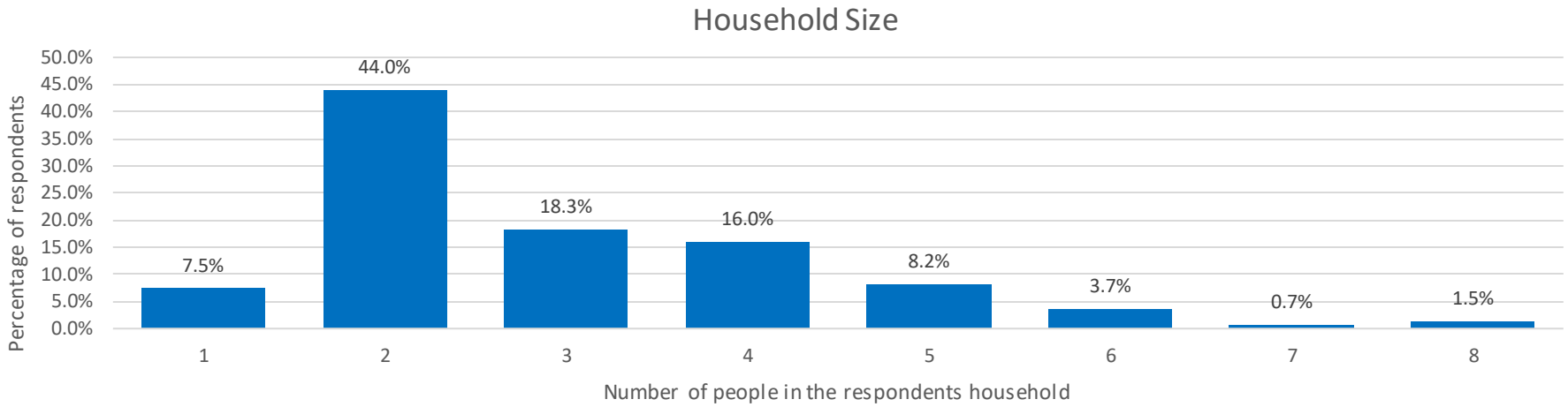


Household Survey Response Distribution by Respondent Postcode

16 Estimated Food Waste Volumes by Household Size

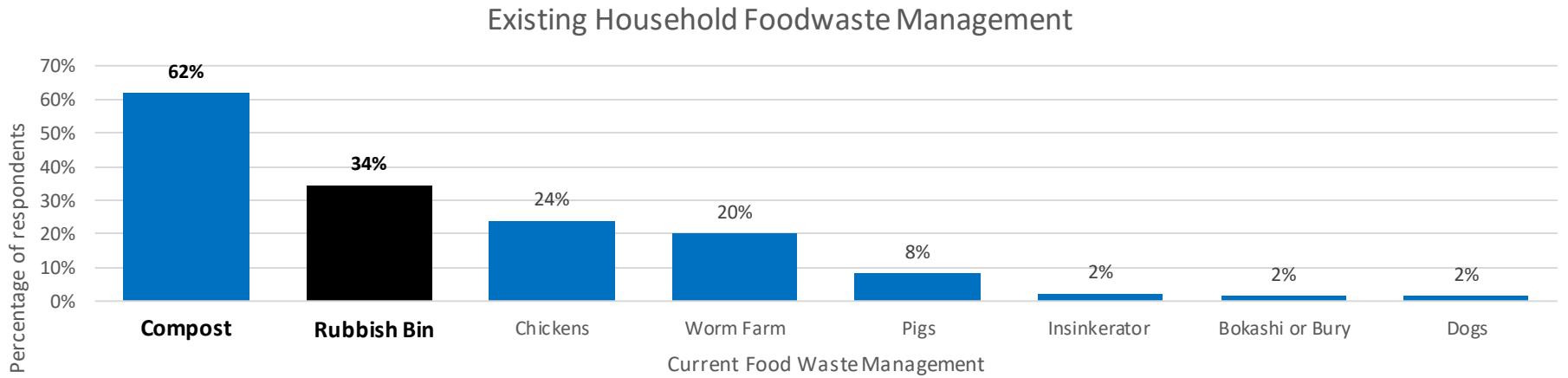
Love Food Hate Waste estimate that NZ households throw away 157,389 tonnes of food a year. This equates to approximately 32kg per person per year. On this basis Kaipara would produce 318 tonne per annum, with…

- 51% of Kaipara households are estimated to produce less than 1.5kg of food waste per week.
- 34% of households estimated to produce 1.5kg -2.5kg per week.
- 14% of household estimate to produce over 2.5kg per week.



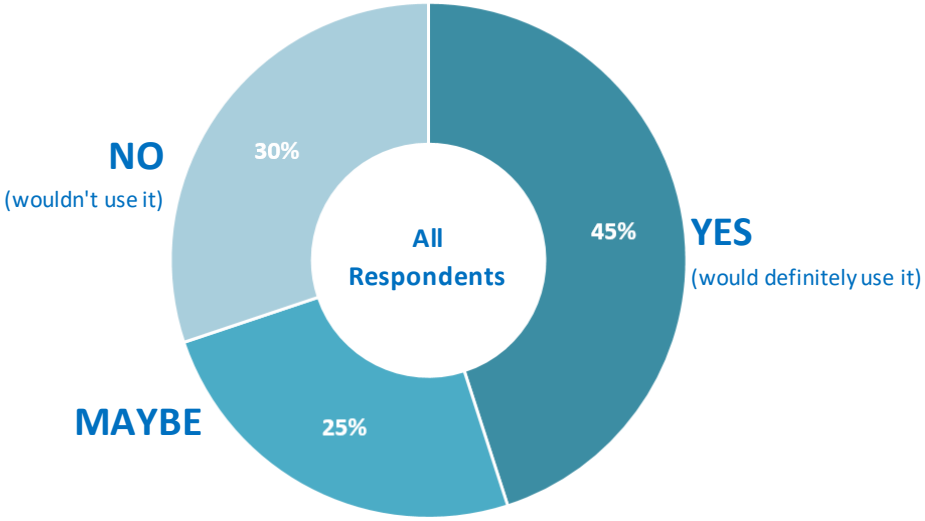
17 Domestic Food Waste Management (259 respondents)

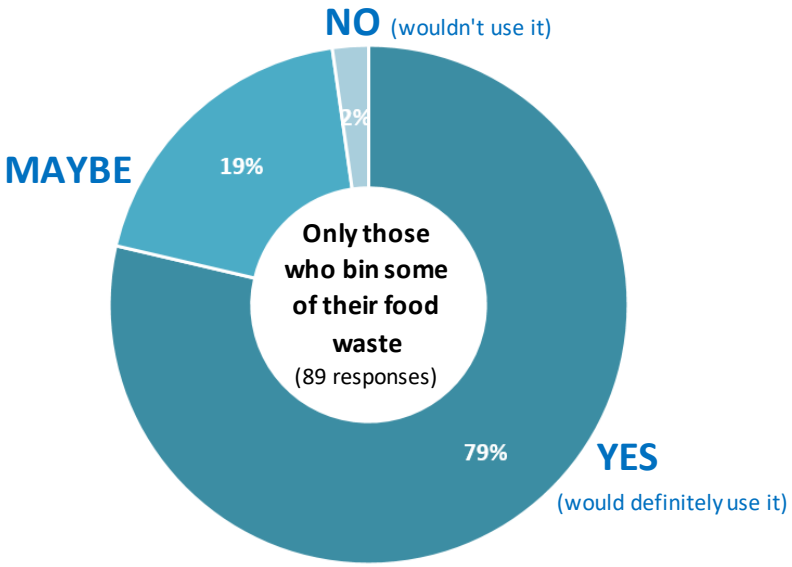
- 62% of survey respondents currently compost at least some of their food waste, 34% put some or all of it in the rubbish bin.
- Of the 160 respondents who compost, 64 also used chickens, pigs or worm farm and 19 of them still put some items in the bin.



18 Anticipated Uptake if Free Collection

- **Responses:** 262
- **Question:** If a FREE WEEKLY food waste collection service was available, how likely would you be to use it?





18.1 Additional Comments

53 People made additional comments in response to this question. The main themes were existing solutions and access. Almost all comments were supportive, for example:

- *"Great idea"*
- *"This service was available when I lived in Raglan. It was fantastic."*

66% of comments were 'No' due to existing solutions, such as:

- *"Love the idea so much. As we are rural would mostly continue to compost etc. at home, but know at my workplace we would use it, at Playcentre etc. and when in town"*
- *"I have 2 compost bins but love this idea!"*
- *"But I would support my friends who do not compost to use"*
- *"Brilliant idea but all my scraps are hen food or home compost."*
- *"Just for the meat and bones if acceptable"*

Several were in relation to accessibility and service provision, including:

- *"At the moment, where we live, even the rubbish pick up is 4ks down the dirt road and super inconvenient- hence our chickens and pigs"*
- *"I live in rural Kaipara and wouldn't expect this type of service to be available to me"*
- *"Don't get any rubbish collection at this point, but would love to have one"*
- *"Being in Te Kopuru I would assume this would not become available here for a long time if it ever does become a thing"*

Of respondents who currently bin a portion (or all) of their food waste, 26% lived in Dargaville and 38% in Mangawhai and Kaiwaka areas (post codes 0505 and 0573).

If offered, survey results show strong potential uptake of a free weekly food waste collection. Especially by those who currently bin a some (or all) of their food waste.

19 Willingness to Pay for Collection

To gauge propensity to pay for the proposed food waste collection service respondents were asked the following question.

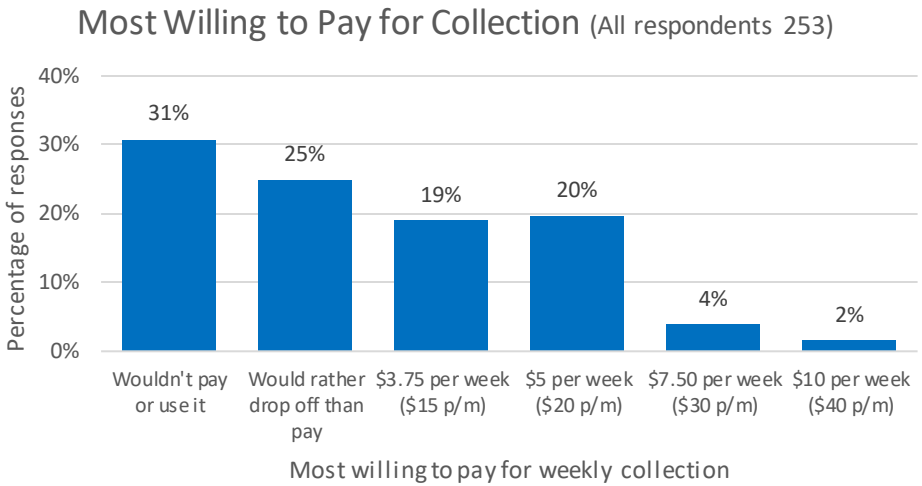
Question: What is the MOST you would PAY, if the WEEKLY food waste collection service was 1) provided by a not-for-profit community group 2) they washed your bucket / bin for you and 3) you could put the service on hold when you were away?

19.1 All Respondents

Respondents: 253

All Question Respondents		
Wouldn't pay or use it	78	31%
Would rather drop off than pay	63	25%
$3.75 per week ($15 p/m)	48	19%
$5 per week ($20 p/m)	50	20%
$7.50 per week ($30 p/m)	10	4%
$10 per week ($40 p/m)	4	2%
Total	**253**	**100%**

Survey results show 45% of all respondents would be willing to pay for collection and an additional 25% would rather drop off.

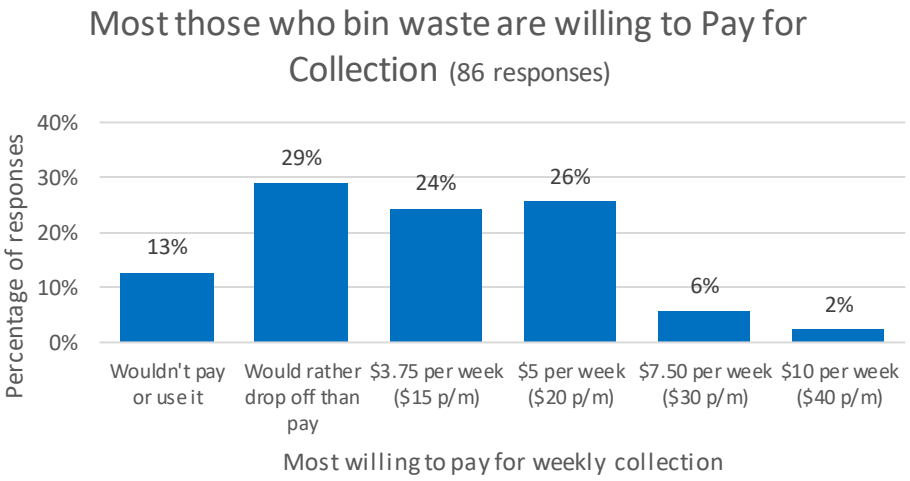


19.2 Only those who currently bin a portion of their food waste

Respondents: 86

Those who bin a some (or all) their food waste		
Wouldn't pay or use it	11	13%
Would rather drop off than pay	25	29%
$3.75 per week ($15 p/m)	21	24%
$5 per week ($20 p/m)	22	26%
$7.50 per week ($30 p/m)	5	6%
$10 per week ($40 p/m)	2	2%
Total	**86**	**100%**

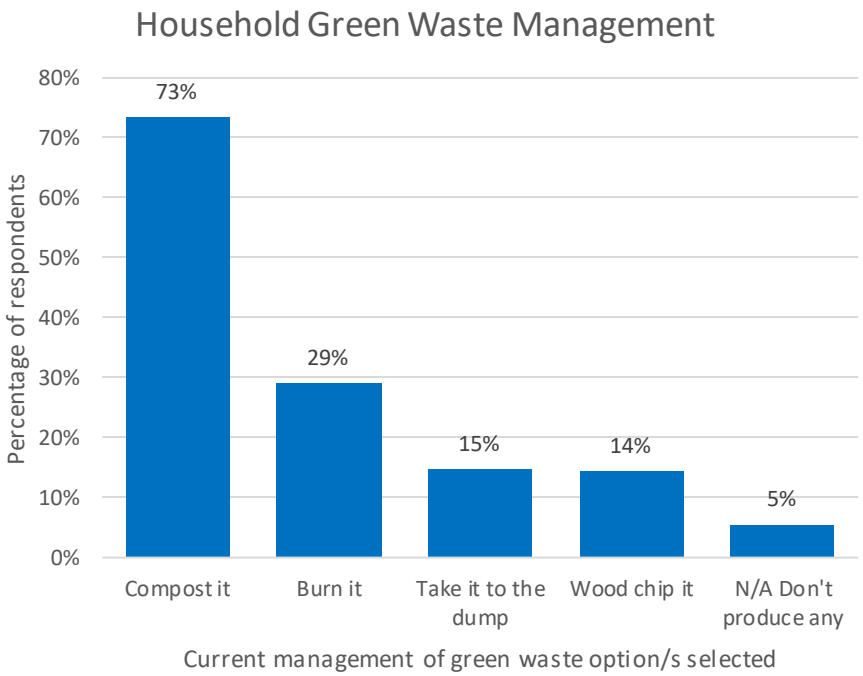
Of those who bin food waste, 58% would be willing to pay for collection and an additional 29% would rather drop off.



20 Household Green Waste

Respondents: 237

Question: What do you currently do with your hedge trimmings, lawn cuttings, garden and green waste?



- 73% of Kaipara households compost at least some of their green waste.
- 15% of households take at least some of their green waste to the dump.

21 Household Green Waste Volumes

Respondents: 253

Question: How much green waste do you estimate you produce per year?

Estimated Number of Small Trailer or Ute Loads per Year	Response Count	m^3 (Assuming each load $3m^3$)
Less than 1	42	63
1	42	126
2	48	288
3	30	270
4	20	240
5	39	585
6	1	18
7	1	21
8	1	24
10	9	270
12	4	144
15	2	90
20	1	60
27	1	81
40	1	120
100	1	300
	Total	**2,700m^3**

Based on the survey responses above, Kaipara households on average produce around $10m^3$ of green waste per year. Assuming 9,962 households district wide, this equates to approximately $100,000m^3$ of household green waste per year.

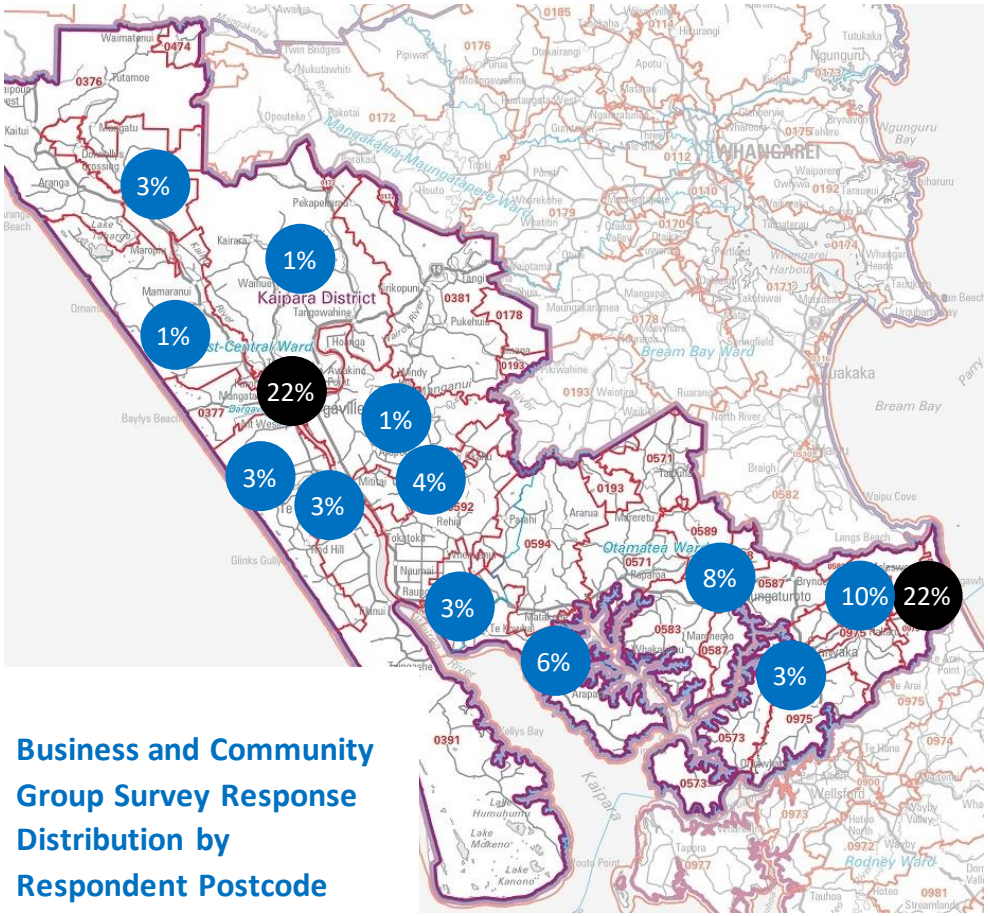
As respondents could select multiple options, the percentages in the green waste graph add to 136%. However, as a proportion of total responses 'burn it' and 'take it to the dump' represent 21% and 11% respectively. **This means as a preliminary gauge, a maximum of $32,000m^3$ of household green waste could theoretically be available district wide.**

Business and Community Organisations

22 Business and Community Group Participation Summary

Total Respondents: 77

22.1 Distribution by postcode



Business and Community Group Survey Response Distribution by Respondent Postcode

23 Respondents by Business or Organisation Type

Business and organisation types. Note: multiple selection was possible.

Industry or Sector	% of respondents	Count
Food - Cafe / Restaurant / Takeaway	13.9%	10
Education - Primary School	13.9%	10
Retail	9.7%	7
Agricultural / Farming / Forestry	9.7%	7
Accommodation / Tourism	8.3%	6
Coffee	6.9%	5
Food - Food Stall / Farmers Market	4.2%	3
Construction	4.2%	3
Education - Secondary School	4.2%	3
Professional or Business Services	4.2%	3
Wholesale / Commercial Supplies	2.8%	2
Church or Religious Entity	2.8%	2
Food - Supermarket / Dairy	1.4%	1
Landscape / Gardening / Tree Pruning	1.4%	1
Fishing	1.4%	1
Marae	1.4%	1
Medical	1.4%	1
Education - Early Childhood	1.4%	1
Manufacturing / Mechanical	0%	0
Transport / Logistics	0%	0
Social Service	0%	0
Other	27.8%	20
TOTAL	**120.9%**	**87**

Other responses included: *Annual Event, Art & Craft Gallery, Coffee Roaster, we collect green waste, Education, Enterprise - Consultancy, Furniture, Importing ex USA, KDC, Lifestyle block, small permaculture orchard, Local government, Museum, Non-profit Art/Craft Gallery, Plant nursery x2, Pools and leisure, Public Library, Real Estate, Sawmill, Veterinary Clinic.*

24 Organic Waste Types (excluding food)

Respondents: 50

Question: What organic or green waste does your business or organisation generate?

Waste Type	Count	%
None (OR food waste only)	30	42%
Green Waste - Pruning, clippings, branches	23	32%
Organic or Compostable Manufacturing by-product (eg. saw dust, brewing dregs, husks)	3	4%
Untreated Timber Waste	3	4%
Animal Manure - Stables, Calf Sheds, Woolsheds, Chicken Manure	6	8%
Other (please specify)	6	8%
Total Responses	**71**	**100%**

'Other' included: *Food and green waste, General office paper and fish carcases / frames, Old clothing, Paper, Paper and student lunches, takeaway cups and plates, Napkins.*

25 Business and Community Organic Waste Management

Respondents: 58

Question: What do you currently do with your organic, manufacturing or green waste?

Management	%	Count
Compost it	38%	29
Take it to the dump	11%	8
Wood chip it	9%	7
Burn it	9%	7
Spread it on paddocks	7%	5
Sell it	3%	2
Burry it	1%	1
Don't produce any	22%	17
Total Responses	**100%**	**76**

26 Organic Waste Volumes (excluding food)

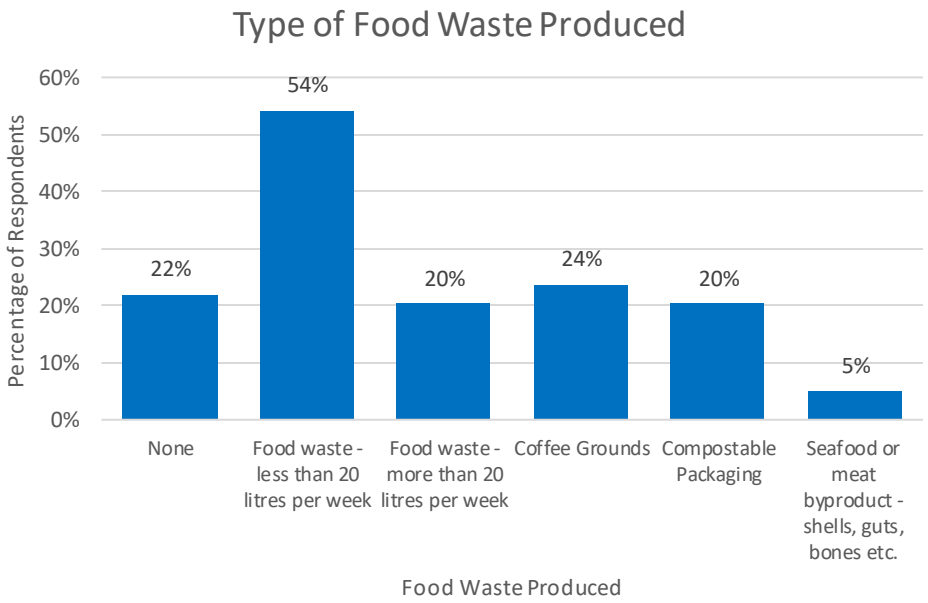
The following volumes are approximated based on a range of responses. The only entity / respondent producing significant quantities of organic waste was a sawmill, who currently burn, bury and sell their organic waste.

Approx. volume per week	Count	m^3 per week
None	3	0
Less than 1 bucket	11	0.11
Less than a rubbish bag	5	0.3
Less than 500 ltr	3	0.75
Less than a trailer	5	15
30+ m^3	1	30
Total	**28**	**46.16m^3**

27 Business and Community Food Waste

Respondents: 59

Question: What food waste does your business or organisation generate?



28 Food Waste Management

Respondents: 50

Question: What do you currently do with your scraps, food waste and compostable packaging?

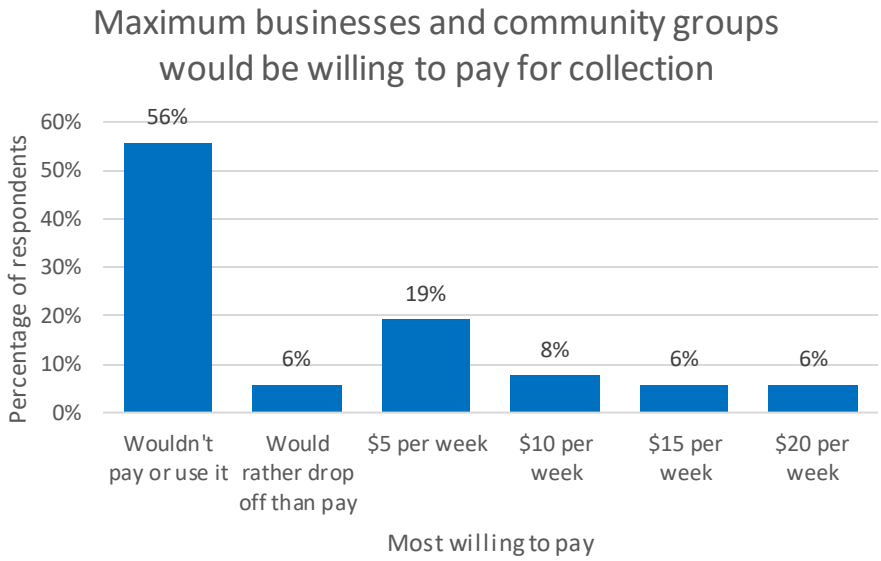
Comments included: *Give coffee grounds away to customers at the front door, staff take own scraps home, students take food waste home.*

29 Propensity to Pay for Collection

To gauge propensity to pay for the proposed food waste collection service respondents were asked the following question.

Respondents: 52

Question: What is the MOST you would PAY, if the WEEKLY food waste collection service was 1) provided by a not-for-profit community group 2) they washed your bucket / bin for you and 3) you could put the service on hold when you were away?



Many businesses and organisations said they wouldn't use a paid service because their volume was so low. One indicated that they wouldn't pay for food waste but would be willing to pay up to $40 for tree pruning removal per trailer load.

OPTIONS ASSESSMENT

Organic Waste Management Options Summary

Capacity: This is food waste capacity, **not total inputs.**
Cost: This is setup cost, not operational cost.

Household Scale Options

Home Compost (Cold)

- **Capacity:** 5-7kg per week
- **Cost:** $46 - $140

Bokashi

- **Capacity:** 12kg per week
- **Cost:** $100 (x2 bins)

Additive approx. $15 per 100kg waste.

Wormfarm

- **Capacity:** 14kg per week
- **Cost:** $120 - $375

Community Scale Options

Community Hot Compost

- **Capacity:** 50kg / week per box
  3-4 tonne / year per box
- **Cost:** $750 - $2,800 per box

Easily scalable via additional boxes. Distributed model means less waste miles. Greater capacity possible via using faster anaerobic fermentative processes and/or separate windrow maturation.

In-Vessel Automated (Bertha)

- **Capacity:** 3 tonne per week
  156 tonne per year
- **Cost:** $150K +GST

Stationary concrete truck barrel type design with automated turning / aeration. Food waste is pasteurised / brought up to temperature 3 times over 7 days. Requires power supply. 3-6 months' windrow maturation required.

In-Vessel Composting Turned Horizontal Composting Unit (HCU)

- **Capacity:** 5 tonne per week
  250 tonne per year
- **Cost:** $200K

12-week cycle from end to end. In process maturation. Aerated / turned using a digger.

Commercial Scale Options

In-Vessel Composting (Automated)

- **Capacity:** 0.25 - 52 tonne/week food
- **Cost:** $150K (2.8 t/w unit only)
  $1.5M (50t/w operational)

Variety of systems available at various scales. HotRot and VCU is are common systems in NZ, with in process maturation, producing stable compost in 12 days. Limited maturation required. Vermicomposting (or large scale worm farming) is sometimes operated as in-vessel.

Aerated Static Pile Composting

- **Capacity:** Limited by site / consents and suitable feedstock
- **Example:** 40,000 tonne p.a. (total)
- **Cost:** Approx. $2M equipment, plus land and consents.

Requires power supply. Requires leachate management. Lower cost at smaller scale and possible for community level, however generally commercial due to land required.

Aerated (Turned) Windrow

- **Capacity:** Limited by site / consents and suitable feedstock
- **Example:** 50,000 tonne p.a. (total)
- **Cost:** Est. $1.5M equipment, plus land and consents

Higher operational costs than a forced aeration static pile system (labour and fuel). Requires leachate management. Lower cost at smaller scale, generally commercial due to land required.

Community Hot Compost Boxes

CarbonCycle Bins

Bertha (Nelson)

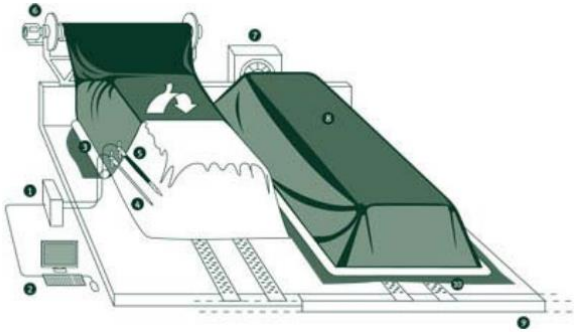
Above: Bertha Image Source *Below: VCU Image Source*

VCU (Vertical composting Unit)

Horizontal Composting Unit (HCU)

Above: HCU - Image Source

GORE-TEX (Covered aerated windrow) | Tunnel



Gore-Tex Covered Forced Aeration Windrow (Above) (Below)

Enclosed Composting Tunnel

Above: Custom In-Vessel Forced Aeration Compost Tunnel

HotRot

HotRot 1206 capacity of 0.2-0.4 tonne per day

HotRot 1811 capacity of 1.8-2.5 tonne per day

HotRot 3518 capacity of 10-15 tonne per day

Above: HotRot Systems

Windrow (Static Aerated) / (Turned)

Above: Static Aerated *Below:* Large Turned windrow

Below: Small turned windrow

Composting Basics

30 Main Factors

Producing a quality compost product relies on five main factors.

1. Feedstock and Nutrient Balance
2. Particle Size
3. Moisture Content
4. Oxygen Flow (or lack of it in a fermentative process)
5. Temperature

30.1 Feedstock and Nutrient Balance

Compost system inputs are often referred to as feedstock. Feedstock is made up of a mixture of high nitrogen (green) and high carbon (brown) inputs. For every tonne of inputs most composting systems will produce around 500kg of compost.

Regardless of the scale of the composting operation, being able to source enough suitable feedstock of each type to create a balanced mix is a critical factor in determining or limiting capacity.

30.2 Particle Size / Density

Grinding, chipping, and shredding materials increases the surface area on which microorganisms can feed. Smaller particles also produce a more homogeneous compost mixture and improve pile insulation to help maintain optimum temperatures. If the particles are too small, however, they might prevent air from flowing freely through the pile.

30.3 Moisture Content

Microorganisms living in a compost pile need enough moisture to survive. Water is the key element that helps transports substances within the compost pile and makes the nutrients in organic material accessible to the microbes. Optimal moisture content by weight is 40-60% (damp not wet, if you can squeeze more than a couple of drops from a handful, it is too wet).

30.4 Oxygen Flow

Turning the pile, placing the pile on a series of pipes, or including bulking agents such as wood chips and shredded newspaper all help aerate the pile. Aerating the pile allows decomposition to occur without the production of methane. Care must be taken, however, not to provide too much oxygen, which can dry out the pile and impede the composting process.

In a fermentative anaerobic composting process oxygen and airflow is avoided or deliberately limited, to promote the growth of the selected anaerobic organism which the compost has been inoculated (sprayed) with.

30.5 Temperature

Microorganisms require a certain temperature 45-65°C range for optimal activity. Certain temperatures promote rapid composting and destroy pathogens and weed seeds. A period of 3-4 days at temperatures greater than 55°C are required for pasteurisation. If the temperature does not increase, anaerobic conditions (i.e. rotting) occur. Controlling the previous four factors can bring about the proper temperature.

Source: Adapted from US EPA

Feedstock

31 Carbon vs. Nitrogen

All composting systems require a mixture of Carbon rich (brown) and Nitrogen rich (green) inputs (other than Bokashi, which can operate solely on food waste).

While brown and green feedstocks are often respectively referred to Carbon (C) and Nitrogen (N), the reality is that all organic matter contains both. The balance of these inputs is an important factor in producing good quality healthy compost. With excess carbon, decomposition slows down, with excess nitrogen, the compost will start to rot and get smelly.

The targeted C:N ratio for compost feedstock is generally in the range 25-30:1[8]. Food waste is generally in the range of 20-25:1 (C:N) meaning carbon rich inputs are also needed. These also act as bulking agents to aid with airflow, balance the density of the compost and help to absorb surplus moisture.

Carbon	Nitrogen
High carbon inputs may include: • Dry leaves • Twigs • Torn up wet carboard • Shredded paper • Egg trays • Small branches • Untreated saw dust • Bark chips • Straw • Coffee husks • Pine needles	High nitrogen inputs may include: • Fruit and vegetable scraps • Coffee grounds • Eggshells • Garden waste • Lawn clippings • Seaweed

Figure 11

[8] https://carboncyclecompost.com/the-carboncycle-composting-guide/

Browns – Carbon-rich	C:N
WOOD	
Wood chips	400:1
Sawdust	325:1
Ashes (wood)	25:1
WASTE	
Cardboard	350:1 – 560:1
Newspaper	175:1
Peanut shells	35:1
GARDEN	
Fruit waste	35:1
Leaves – oak	40:1 – 80:1
Leaves – mixed	60:1
Corn stalks	75:1
Pine needles	80:1
OTHER	
Peatmoss	50:1
Straw	75:1

Figure 12 - Source: CarbonCycle Composting Guide[5]

Greens – Nitrogen-rich	C:N
FOOD	
Coffee grounds	20:1
Food scraps – mixed	20:1
Food scraps – vegetables	25:1
GARDEN	
Mixed garden cuttings (not all green)	30:1
Weeds	30:1
Grass clippings – fresh	15:1 – 20:1
Grass clippings – sun dried	20:1 – 25:1
Alfalfa	12:1
OTHER	
Seaweed	19:1
Hay from legumes	15:1 – 20:1
Hay from grass	15:1 – 32:1
Clover	23:1
MANURE	
Poultry 3:1 – 15:1	3:1 – 15:1
Cow	20:1
Horse	20:1- 50:1
Others	15:1 – 25:1


Household
Scale
Options

Household Scale Organic Waste Options

32 Household Scale Organic Waste Systems

Home based systems are the most efficient way to reduce household organic waste going to landfill. The following table provides an overview of the main household organic waste management systems.

System	Summary	Limitations	Capacity and Ratio	Cycle Time	Cost
Worm Farm[9]  **14 kg** Per week	Uses stacked or continuous flow arrangements. Produces nutrient rich worm casting and worm tea for use in the garden.	Can't take meat, dairy, citrus, bread, pasta, cooked or processed food, spicy food, onion and garlic, acidic foods, oils or excess liquids such as soup.	Bins capacity 60-90kg in total. Worms can eat their own weight per day. Hungy Bin indicate capacity for up to 2kg per day. 70% green, 30% brown.	Casings need emptied every 6 months and drip tray as needed.	$70 - $325 bin cost depending on brand + $50 for 250g of tiger worms
Bokashi[10]  **12 kg** Per week *(with x2, 15ltr bins)*	Two stage anaerobic fermentation system (no oxygen), using a beneficial microbial culture. The first stage (7-14 days) is in the Bokashi Bucket, the second stage occurs when buried in soil or compost bin (2-4 weeks). Produces liquid and solid compost. Often used in conjunction with cold compost. Bokashi are subsidised by several councils around NZ.	Can't take oil or excess liquid. Need to drain liquid every 2-3 days. Can take all food scraps including raw or cooked meat, citrus, and fish and poultry with small bones included. Alternative systems are available for processing pet waste.	Standard bins are 15ltr, a 140ltr system is possible using modified wheelie bins for schools, cafes etc. Capacity limited only by bin size and the need for 1-2 tablespoons of microbial culture additive per 2ltr of feedstock. 100% green.	7-14 days in the Bokashi Bin. Plus, 2-4 weeks buried in soil or compost bin.	$49 - $79 bin cost – x2 bins required. + microbial culture additive $15 per kg (1kg is enough to process approx. 50-100 litres of organic matter)
Cold Compost[11]  **5-7 kg** Per week	Aerobic (oxygen) based decomposition. Requires air flow, moisture and correct ratio of green to brown inputs. Benefits from being covered and in a sunny position directly on the soil.	Can't take large amounts of fats or oils. In order to prevent pests most advice is to avoid meat, bread, pasta, egg, cooked or processed foods. Citrus peels, onions and garlic should be limited. Avoid weed seedheads, diseased or infested material, or invasive plants.	Total bin capacities generally range from 220 – 430 litre. Ability to cater for around 6-12 litres of food waste per week. 30% green, 70% brown.	3-6 months for the bottom third of the compost to be mature.	$46 - $140 bin cost

Figure 13 – Food waste assumed to weigh approximately 0.75kg per litre – Reference link

[9] https://compostcollective.org.nz/worm-farming/#Getting-started
[10] https://www.zingbokashi.co.nz/
[11] https://compostcollective.org.nz/composting-bin/#GETTING-STARTED

33 Household Organic Waste Option Inputs

33.1 Feedstock Ratios

The following infographics from The Compost Collective[12] provide a general overview of approximate feedstock ratios for household scale organic waste management options.

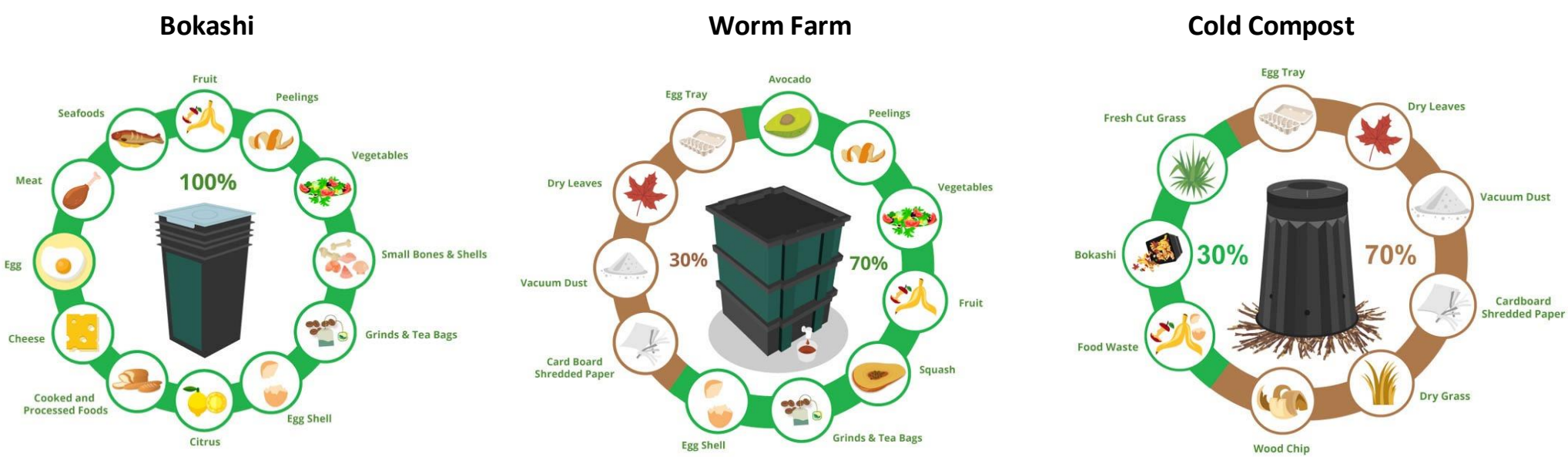


Figure 14 – Feedstock Ratios – The Compost Collective[9]

[12] https://compostcollective.org.nz

Image source: www.CarbonCycleCompost.com

Community Scale Organic Waste Options

34 Community Scale Composting Systems Overview

For the purpose of this report, community scale composting options, have been defined as those with capacity for up to approximately five tonne of food waste per week.

These options work well for small or distributed communities and are likely to be most relevant for the Kaipara District. Most are modular or scalable, which limits both transportation costs and associated the negative environmental impacts.

	1) Community based Hot Compost Boxes (Kaicycle, CarbonCycle etc.)	2) Bertha (Community Compost Nelson)	3) HCU Composter (Extreme Zero Waste Raglan, Innovative Waste Kaikoura, Ruapehu District Council etc.)	4) HotRot
Summary	Community based hot composters are generally 1.2m cubes with a total capacity of approximately 1,700 ltr. When properly managed the centre of these boxes reach pasteurisation temperatures of over 55°C. Multiple boxes with removeable sides are used to enable simple turning from one box to another by hand. Produces good quality compost and easily scalable.	Stationary concrete truck barrel type design with automated turning / aeration. Feed once a week. Food waste is pasteurised / brought up to temperature 3 times over 7 days. Requires power supply. 3-6 months' windrow maturation required. Electronic sensors to manage temperature and turning. Motor reversed to feed compost back out. Requires power.	Concrete channel with built in drainage and air holes. Holds approx. 200m^3 of compost (30m x 3m x 2.5m). Regularly aerated / moved over a 12-week cycle from one end to the other with a digger or tractor and backhoe. Removable roof panels to manage humidity, temperature and pests. In process maturation. Requires machinery.	Horizontal in-vessel system with tumbling, central shaft with paddles and forced aeration. Produces stable compost within about 12 days. Limited maturation required. Feed systems important. Designed to be fed via a hopper over 24hrs. Various sizes available doesn't require shed. Requires power and feed systems.
Cost	$2,800 per box[13]. Self-built boxes possible at lower cost. Functionality and pest proofing important considerations in for self-built boxes.	$150K +GST preliminary estimate from Ben Bushell.	The Kaikora HCU reportedly cost $30K[14] to build, the Raglan HCU reportedly cost $200K[15] (assumed to include consents).	Comet Composter - $55K HotRot 1206 - $145K (tipper) $225K (auto) HotRot 1811 - $405K (tipper) $550K (auto) HotRot 3518 - $1.8M
Food Waste Capacity	Approx. 800kg per box. Capacity limited by number of boxes and speed of composting cycle.	4 tonnes per week 200 tonnes per year	5 tonnes per week 260 tonnes per year	Comet Composter, 175-260kg per week HotRot 1206, 1 - 1.25 tonne per week HotRot 1811, 6.1 - 8.75 tonne per week HotRot 3518, 35 tonne per week Total capacity is double the figures above.
Collection	E-bikes and trailers.	E-bikes and trailers, plus a van.	Specially designed trailer.	Usually bin and truck based collection.
Additional Composting Equipment Required	Forks, shovels, wheelbarrows, hand sprayers, water source, machete or similar, mulcher / woodchipper (essential if accepting compostable packaging). Bagging system if selling by the bag.	Mulcher, 'Bertha' compost mixer system, tipping trailer and towing vehicle, available land area or secondary site for maturation phase.	Rotating head forklift, tractor and backhoe or 4.5 tonne digger or similar. A covered area for product mixing, auger and bagging equipment are also helpful.	Bin loaders / tippers, hopper, conveyors are for the most part included in preliminary price estimates above. Shredder / mulcher also needed, concrete pad and power required.

[13] https://carboncyclecompost.com/shop/#community-composting
[14] https://www.yumpu.com/en/document/read/35332930/zero-waste-bus-tour-report-south-island-2004-pdf-13-mb
[15] https://infocouncil.aucklandcouncil.govt.nz/Open/2018/12/GBI_20181211_AGN_7987_AT_files/GBI_20181211_AGN_7987_AT_Attachment_64105_1.PDF

35 Community Hot Compost Box Use Methodologies

The following table provides a comparative overview of the main approaches to community scale composting systems currently operating in New Zealand, aerobic and anaerobic. The main difference between the two approaches is the need for aeration or turning and the compost cycle times. Many community composting organisations are now using a combination of aerobic and anaerobic methods.

35.1 Aerobic Composting

This is the traditional method of hot composting. The aerobic composting process uses oxygen-dependent organisms to break down the organic matter. As such the compost is aerated and frequently turned to maintain oxygenation and achieve temperatures of over 55^{0}C (for periods of three or more days for pasteurisation). Turning of the compost varies by composter and organisation, as well as the density and makeup of the compost, ranging from twice per week through to once every 2 weeks.

35.2 Fermentative Anaerobic Composting

Fermentative Anaerobic Composting is an approach utilising a Beneficial Anaerobic Microbe mix (e.g. BAM which contains x12 species of fungi, yeasts and bacteria). Anaerobic composting is also known as Fermentative or SPIC Composting (Static Pile Inoculated Compost) and is effectively a scaled up Bokashi type system. As the compost is layered, or the box filled, it is sprayed with an inoculum containing beneficial anaerobic microbes, which break down the organic matter without the need for oxygen and while eliminating the production of methane. This significantly reduced the need for turning the compost. Several inoculants are commercially available, of which Nutri-Life B.A.M is one. Some community composting organisations are also experimenting with making their own.

NOTE: *Fermentative Anaerobic Composting is different from anaerobic digestion or anaerobic decomposition (rotting), which produces environmentally harmful methane and creates a sludge which is even more difficult to breakdown and typically still requires aerobic composting to be stabilised.*

35.3 Aerobic vs. Fermentative Anaerobic Compost Box Comparison

	Aerobic	Fermentative Anaerobic
Standard Compost Box Volume	• 1,700 litre (1.7m^3 or 1.2m cube)	• 1,700 litre (1.7m^3 or 1.2m cube)
Cycle Time	• 8-10 weeks minimum	• 6 weeks minimum
Turning	• 4-5 times minimum	• 2 times
Process considerations	• Cut or shred larger items • Many require water supply depending on inputs • Benefits from an aerated environment	• Cut or shred larger items • Requires sprayer for inoculant and water supply • Benefits from a sealed environment
Additional cost considerations	• Estimated $25 - $55 per cycle *Labour 15-30min per turn at $22.10 per hour (excludes filling and unloading).*	• Estimated $15 - $25 *BAM $4 per cycle (Requires 1Ltr per box per cycle and retails at $80 for 20Ltr). Labour 15-30min per turn at $22.10 per hour (excludes filling and unloading).*
Food waste capacity	• 800kg per box (at 50% ratio)	• 800kg per box (at 50% ratio)
Maturation post composting	• 8-12 weeks	• 8-12 weeks
Advantages	• No additives required	• Lower overall cost when including labour • Reduced need for turning • Faster cycle time

Figure 15

36 NZ Community Composting Groups

There are many community composting groups successfully operating user-pays systems around New Zealand. These groups have strong uptake and community buy-in, with most eventually reaching capacity for their sites. They employ local people and often contribute compost back to community gardens, transforming baren areas of unused land into high producing market gardens. Many groups also provide other indirect community benefits, such as youth mentoring and volunteering opportunities.

In addition, there are specialist commercial and social enterprise operations, such as Little & Brave whom both sell and take back compostable nappies and For the Better Good who do the same with compostable bottles.

The following community composting organisation summaries were largely collated by Kate Walmsley of Kaicycle as part of an open letter public submission in September 2020 to illustrate the community benefits and potential scalability of community composting.

Compost Co. on Waiheke Island works mainly with local restaurants and community groups to collect and process commercial food waste and shells. As the only hot-composting facility able to process compostable single-use packaging from zero waste events and coffee shops, Compost Co. operates under the Waiheke Resource Trust as a social enterprise, hosting volunteers and sharing knowledge about the Bokashi composting process.

www.wrt.org.nz/projects/compost-co/

The CarbonCycle Company are supporting community composting in schools, eight systems have been set up in Auckland schools so far. If this were to be expanded to half of Auckland's 538 schools, it would save 10,000 tonnes CO_2e each year by diverting just 4,000 tonnes of food waste.

https://carboncyclecompost.com/

Soil Factory in Auckland's dense city fringe provides community composting services by e-bike collection or drop-off to 55 households and businesses. Demonstrating a local model of integrated composting and regenerative food growing for Aotearoa's urban communities. Soil Factory currently diverts 3 cubic metres of food scraps and other organic materials from local households and businesses each month (if all food waste, this would equate to 1.8 Tonne).

https://www.soilfactory.co.nz/

Kaicycle in Wellington offers a much-in-demand e-bike food waste collection service, channeling compost into regenerative urban farming. Kaicycle currently diverts 40 tonnes food waste from landfill per year; planned expansions will at least double this in 2021. This expansion will be largely self-funded by the non-profit service's revenue to date, saved since 2015.

https://kaicycle.org.nz/

Community Compost has been serving Whakatū—the Nelson region—for three and a half years, collecting and hot composting over 1 tonne of food waste every week from over 75 business and residential customers. They work closely with The Red Cross and their ex-refugee programme and support many edible landscape projects. Community Compost has recently been chosen to deliver a 52-week, 220-home kitchen waste collection and composting trial by Nelson City Council. www.communitycompost.co.nz

Para Kore works to support marae, kura, kohanga and Māori communities to minimise waste and reclaim knowledge of gardening and soil regeneration , including composting, bokashi, and worm farms, to actively restore the wellbeing of whānau and the community, and enhance the mauri of the whenua. This is informed by the circular and interconnected relationships through whakapapa and is an empowering approach to community resilience building. http://parakore.maori.nz

Cultivate Christchurch's composting operation has recently scaled back after difficulty sourcing infrastructure investment, despite strong demand and community support. At its peak, Cultivate used an e-bike to collect and process 2.5–3 tonnes of local commercial food waste each week for 3 years, integrating employment training for youth not in employment or education, building soil for food production, with produce sold to local residents and chefs. https://cultivate.org.nz/

Why Waste offer worm farms on subscription. Why Waste's worm farm hire service empowers households, businesses and large organisations to transform their organic waste into soil through a growing network of professionally serviced worm farms. Why Waste currently services over 200 worm farms in the upper North Island and will be launching in Dunedin in October and in Wellington and Christchurch by the end of 2020. www.whywaste.co.nz

For the Love of Bees + OMG (organic market garden) utilise CarbonCycle compost boxes and have a waste drop off service in central Auckland. The group have transformed a barren section of unused railway land into a high producing Community Support Agriculture (CSA) market garden in less than two years and now have a full-time paid gardener. https://www.fortheloveofbees.co.nz/omg

For the Better Good are a social enterprise focused on reducing plastic bottles use and replacing them with their compostable version. They also hold compostable cup collection contract with Wellington Airport and partner with Hampshire Community Garden and Wellfed in Porirua, where their compost is made. www.forthebettergood.com

Case Study: Kaicycle

37 Summary

Kaicycle is a non-profit community organisation operating in Newtown, Wellington. They process 40 tonnes of food waste a year in conjunction with a small urban farm. Collection is via e-bike through a subscription service.

38 System Details

Capacity: Collect from 125 locations, a third of which are businesses. There are 11 compost bins on site with approximately 1,700ltr capacity each. Kaicycle are currently looking to expand their composting operation.

Nitrogen and Carbon sources: Food scraps make up the nitrogen component. Carbon source is predominately shredded documents. Arborist wood mulch, which is left to weather for 6 months, is used when available. This is free but in high demand. Coffee chaff has been used in the past but had issues with wind. Saw dust is used occasionally.

Decomposition: Kaicycle use an Anaerobic process using Beneficial Anaerobic Microbes (BAM). This reduces the need to turn compost to 1-2 times over an 8-week composting cycle. In the previous aerobic method, compost needed to be turned twice a week and would take around 45 minutes per bin.

Timing: Currently, a box is filled every 2-weeks, compost ready in 2 months.

39 Operations

Collection: Food scrap buckets are collected weekly by bike. Buckets are lined with compostable bin liners, which go into the compost. These make it cleaner and more efficient and reduces staining of buckets (black buckets are recommended for this reason). Buckets are rinsed with multipurpose cleaner and returned. Collection takes place Wednesday 9-3pm and Friday 9-4pm via two e-bikes with trailers (a small team works best as each run requires some knowledge of the properties). Each e-bike does x2 runs per day and collects around 50kg per run, totalling 400kg a week. One bike is owned by Kaicylcle, the other rented from Switched-on-bikes.

Kaicyclists are paid a living wage $23 per hour. A compost manager works around 15hrs per week, 10hrs of which is subscription management and admin. On top of this they volunteer around 15 hrs per week towards organisational / business development and community engagement.

Composting: Once on site, food waste is weighed and recorded, then mixed with shredded paper in the compost box. The mix is then wet down with water and inoculated (sprayed) with BAM mix. Approximately 1ltr of BAM concentrate is used per m^3 of compost (or per box) and is watered down at a ratio of 1 part to 9 parts water. BAM contains 12 species of fungi / bacteria, which break down the feedstock without the production of methane. Benefits include faster compost process, higher carbon sequestration, odourless, less turning and higher compost returns. No meat and dairy are accepted for health and safety of team members.

Maintenance: Compost moisture levels are managed as the piles are formed and covered with a tarp thereafter to keep birds out and prevent evaporation. The boxes are turned 1-2 times in the 8-week composting cycle.

Outputs: Feedstock reduces to approximately half the size by the end of the process. Currently almost all of the compost produced is used on the associated urban 0.1 hectare urban farm which operates on the same site.

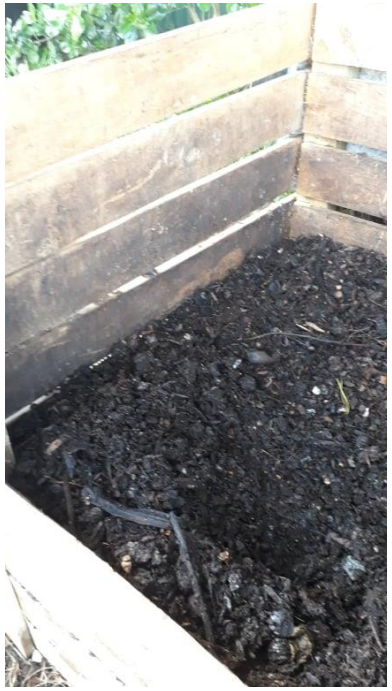
40 Income and Expenses

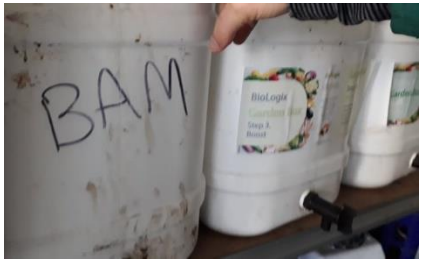
Charges: Households: $30+GST/month ($20+GST/month per additional bucket), Businesses: $60+GST/month ($40+GST/month per additional bucket)

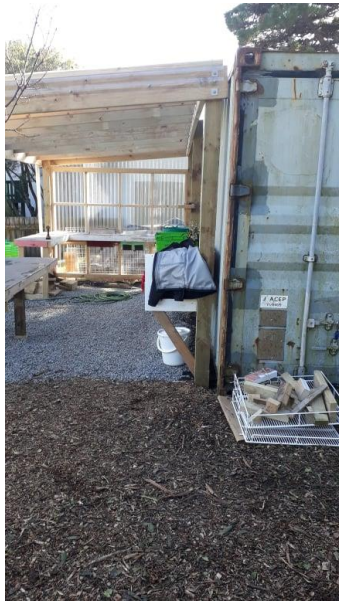
Income	2019-20	Expenses	2019-20
Subscriptions	$65,750	Kaicyclists	$32,000
Donations	$170	Manager	$10,000
Mojo grant	$2,170	Admin	$4,600
		Buckets & Equip	$1,000
		Site Rent	$330
		New Boxes	$750
		Bike hire	$5,000
		Other costs	$2,250
TOTAL	**$68,090**	**TOTAL**	**$55,930**

Figure 16 – Rounded figures from 2020 accounts

Kaicycle Images







Case Study: Extreme Zero Waste

41 Summary

Extreme Zero Waste is a non-profit community organisation operating all rubbish and waste collection services for Raglan (5-6K population and 30K over summer). Compost is one element of this, with a weekly kerbside food waste collection service. Composting of food and green waste is via a 30m long concrete Horizontal Composting Unit (HCU) capable of holding approximately 200m^3 of compost. Aeration is via a small digger. Strong believers that composting is a whole system, not just infrastructure, and that this needs greater emphasis when creating new sites. Happy to provide input and advice for others, along with design improvement recommendations.

42 System details

Capacity: Extreme Zero Waste processes around 5 tonnes of food waste from Raglan per week, plus 10 tonnes of green waste. Started with a 5-year trial of 100 households. Now collect from 2,000.

Nitrogen and Carbon Sources: Food waste is mixed with green waste at a ratio of approximately 1:2.

Decomposition: Extreme Zero Waste use two complimentary systems. The HCU composter is classified as an aerobic in-vessel composting system and takes all food waste plus a portion of green waste. Aeration is via a digger and turning of the compost twice per week. The majority of green waste collected (surplus to what is needed for the HCU) is composted via a windrow on a site adjacent to the HCU. Branches are left whole to aid with aeration of the windrow and turned occasionally. The whole pile is then chipped via by a contractor once or twice a year at a cost of $1,500 per hour. The resulting compost is much courser and is blended with the HCU compost to create different garden mixes.

Timing: The composting cycle takes 12 weeks from inputs at one end to coming out the other as maturate compost.

43 Operations

Collections: Collect from 2,000 houses through a kerbside collection system.

Households have a kitchen caddie with compostable liner (the bags are 3kg size and the caddie has holes in it to discourage liquids and allow evaporation of some of the food waste moisture). When full, the bag is tied up and placed into a lockable kerbside collection bucket.

Collection is weekly via a vehicle runners and buckets emptied into custom designed trailer (a left-hand lift truck was initially tried, but had a lot of problems). The trailer holds x4 dedicated food waste bins, which are aluminium, so they don't rust with acidic foods and are easier to clean. The bins have forklift holes halfway up and are emptied into the composter via a forklift with a rotating head.

All food waste is bagged and there is no handling of this. Extreme Zero Waste don't take fish waste as this ruptures the bags and gets smelly. Also, discourage cut flowers as these also rupture the bags.

Composting: Food waste is added to the uncovered end of the HCU as it arrives. It is immediately mixed-in to discourage birds and green waste added. Each week, the compost is moved along the HCU with a digger and mature compost removed after 12 weeks in the composter.

Maintenance: The compost in the HCU is turned twice per week with a 4.5 tonne digger. Aim for 65^{0}C temperature (if temperature goes above this the compost loses nitrogen and produces nitrous oxide, ammonia and methane).

Outputs: The HCU produces high quality compost which is then bagged and sold at $12 for a 30ltr bag. A $0.50c refund is given on returned bags. Discounted rates are offered for bulk. Compost is lab tested once a year.

44 Income

Council funded up until July 2020. Aiming to move to a targeted rating model.

Raglan Extreme Zero Waste Images


Commercial
Scale
Options

Commercial Scale Options Summary

The following general summaries of commercial composting approaches are sourced from the US Environmental Protection Agency.

45 In-Vessel Composting

In-vessel composting can process large amounts of waste without taking up as much space as the windrow method and it can accommodate virtually any type of organic waste (e.g., meat, animal manure, biosolids, food scraps). This method involves feeding organic materials into a drum, silo, concrete-lined trench, or similar equipment. This allows good control of the environmental conditions such as temperature, moisture, and airflow. The material is mechanically turned or mixed to make sure the material is aerated. The size of the vessel can vary in size and capacity.

This method produces compost in just a few weeks. It takes a few more weeks or months until it is ready to use because the microbial activity needs to balance and the pile needs to cool.

45.1 Things to Think About

- Some are small enough to fit in a school or restaurant kitchen.
- Some are very large, similar to the size of school bus. Large food processing plants often use these.
- Careful control, often electronically, of the climate allows year-round use of this method.
- Use in extremely cold weather is possible with insulation or indoor use.
- Very little odour or leachate is produced.
- This method is expensive and may require technical expertise to operate it properly.
- Uses much less land and manual labour than windrow composting.

46 Aerated Static Pile Composting

Aerated static pile composting produces compost relatively quickly (within 3-6 months). It is suitable for a relatively homogenous mix of organic waste and work well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g. food scraps, paper), such as local governments, landscapers, or farms. This method, however, does not work well for composting animal by-products or grease from food processing industries.

In aerated static pile composting, organic waste mixed in a large pile. To aerate the pile, layers of loosely piled bulking agents (e.g., wood chips, shredded newspaper) are added so that air can pass from the bottom to the top of the pile. The piles also can be placed over a network of pipes that deliver air into or draw air out of the pile. Air blowers might be activated by a timer or a temperature sensor.

46.1 Things to Think about

- In a warm, arid climate, it may be necessary to cover the pile or place it under a shelter to prevent water from evaporating.
- In the cold, the core of the pile will retain its warm temperature. Aeration might be more difficult because passive air flowing is used rather than active turning. Placing the aerated static piles indoors with proper ventilation is also sometimes an option.
- Since there is no physical turning, this method requires careful monitoring to ensure that the outside of the pile heats up as much as the core.
- Applying a thick layer of finished compost over the pile may help alleviate any odours. If the air blower draws air out of the pile, filtering the air through a biofilter made from finished compost will also reduce any of the odours.
- This method may require significant cost and technical assistance to purchase, install, and maintain equipment such as blowers, pipes, sensors, and fans.
- Having a controlled supply of air allows construction of large piles, which require less land than the windrow method.

47 Aerated (Turned) Windrow Composting

Aerated or turned windrow composting is suited for large volumes such as that generated by entire communities and collected by local governments, and high volume food-processing businesses (e.g., restaurants, cafeterias, packing plants). It will yield significant amounts of compost, which might require assistance to market the end-product. Local governments may want to make the compost available to residents for a low or no cost.

This type of composting involves forming organic waste into rows of long piles called "windrows" and aerating them periodically by either manually or mechanically turning the piles. The ideal pile height is between 1.25m and 2.5m with a width of 4-5m. This size pile is large enough to generate enough heat and maintain temperatures. It is small enough to allow oxygen flow to the windrow's core.

Large volumes of diverse wastes such as yard trimmings, grease, liquids, and animal by-products (such as fish and poultry wastes) can be composted through this method.

47.1 Things to Think About

- Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labour to maintain and operate the facility, and patience to experiment with various materials mixtures and turning frequencies.
- In a warm, arid climate, windrows are sometimes covered or placed under a shelter to prevent water from evaporating.
- In rainy seasons, the shapes of the pile can be adjusted so that water runs off the top of the pile rather than being absorbed into the pile.
- Windrow composting can work in cold climates. Often the outside of the pile might freeze, but in its core, a windrow can reach 140° F.
- Leachate is liquid released during the composting process. This can contaminate local ground water and surface-water supplies. It should be collected and treated.
- Windrow composting is a large-scale operation and might be subject to regulatory enforcement, zoning, and siting requirements. Compost should be tested in a laboratory for bacterial and heavy metal content.
- Odors also need to be controlled. The public should be informed of the operation and have a method to address any complaints about animals or bad odors.

Source: US Environmental Protection Agency.

48 Commercial Scale Composting Systems Parameters

The following table provides a helpful overview of some of the basic parameters for commercial scale composting options.

Technology	Aeration	Air purification	Investment cost	Land area required
Vermi-composting	Passive	No, but possible	Low to medium	Large to medium
Windrowing	Turning, passive aeration	No	Low	Very large
Aerated static pile	Positive/negative forced aeration	No, but possible	Medium	Medium
In-vessel composting	Agitation, mechanical turning, forced aeration	Yes, but exceptions	Large	Medium to small
Fully enclosed composting	Agitation, mechanical turning, forced aeration	Yes	Very large	Medium to small

Source: Department of Agriculture, Water and Environment Australia

49 Indicative Capital and Operational Costs for 10,000 tonne Windrow or In-vessel System

Table E- 3: Indicative Financial Costs for Processing Organic Waste

Baseline System	Total investment cost	Unit costs ($ per tonne of waste treated)			
		Annualised investment cost	Operating cost (excl revenues)	Revenues	TOTAL
Open Air Windrow					
OAW Low (10kt)	$1.9m	$26	$21	$15	**$32**
OAW High (10kt)	$2.3m	$32	$25	$0	**$57**
In-vessel Composting					
IVC Low (10kt)	$3.5m	$48	$36	$15	**$69**
IVC High (10kt)	$4.6m	$64	$42	$0	**$107**

Source: Earthcare NZ

50 Example systems operating in New Zealand in 2010

Facility Operator	Location	Technology
EnviroFert	Tuakau	Forced aeration static pile covered windrows
Sustainable Waste Management	Ruakaka	CTI aerated 'compost sausage'
Waitakere City Council, Solid Waste Business Unit	Waitakere Transfer Station	VCU in-vessel composting unit (currently out of commission)
Wastebusters	Kaikoura	Horizontal Composting Unit
Living Earth	Christchurch	Custom-designed tunnel system
Capital Composting Limited	Wellington	Custom-designed tunnel system
Selwyn District Council	Selwyn, Canterbury	HotRot in-vessel system
Mackenzie District Council	Twizel	VCU
Rakaia Resource Recovery Group	Rakaia	Part mechanically-assisted IVC, part windrow maturation with added worms & cover
TPI	Timaru	Gore-tex® covered windrows with forced aeration

Source: Bay of Plenty Regional Council

50.1 Additional Examples

Facility Operator	Location	System
Envirowaste	Hampton Downs	GoreTex static pile forced aeration
Xtreme Zero Waste Raglan	Raglan	HCU Horizontal Composting Unit
Wastebusters Trust Canterbury	Ashburton	Rotocom in-vessel
Ruapehu District Council	Taumarunui	HCU Horizontal Composting Unit

51 Process Equipment Requirement for Composting Facility

Process	Equipment required
Material Acceptance (storage and handling)	Hopper Conveyor or vehicle to load macerator - scale dependent, however most likely vehicle is a front-end loader Air extraction system (odour control)
Decontamination of food waste	Decontamination conveyor Air extraction system (odour control)
Pre-processing – food waste	Macerator Air extraction system (odour control)
Pre-processing – greenwaste	Shredder / chipper Conveyor or vehicle to load shredder / chipper – scale dependent Concrete pad (outdoors)
Blending – food and greenwastes	Blender bowl with a twin auger mixing system, or similar Conveyor or vehicle to load macerator - scale dependent, however most likely vehicle is a front-end loader Air extraction system (odour control)
Primary Composting	Refer to Table 1 for an overview of composting technologies available Air extraction system (odour control, not required for VCU)
Secondary Composting (curing)	Front-end loader, or similar, for turning of curing material
Product refinement (dependent upon end use)	Screen/s Bagging machine Blender for amendment of compost with other materials Loader to transport / load out product (separate to that that used for untreated wastes, to avoid recontamination of product with pathogens)
Monitoring	Temperature probes Facility inputs and outputs (quantity measurement)- eg. Weighbridge

Source: WasteMINZ

***Left:** Hungry Pig "Mix and Load" powered bobcat attachment designed to scoop bulk materials, then tip food waste bins directly into the mixing bucket and engage the mechanism to size reduce and mix material to form a suitable feedstock for composting.*
Image source

52 HotRot vs. VCU Comparison

	Advantages	Limitations
VCU	Vertical, in-vessel plug flow, static system with material discharged by turning rollers at the base, and movement of the pile down through the chamber via gravity. Aeration relies on convective air currents created by temperature difference between top and base of pile (typically 70+ at top down to 40°C at base), aided by a small fan. Range of conveyor options for feed and discharge systems.	
	• Relatively small footprint. • Flexible facility capacity. • Modularity in respect of maintenance • Odour control using feedstock to 'self-biofilter'. • No moving parts for turning composting material. • NZ based manufacturer and supplier.	• High capital costs. • Sensitive to overly wet or poorly mixed feedstocks. • Complex feed systems for larger facilities. • Limited access to material within the chamber. • Limited sites for temperature measurement. • No air injection through mass and limited cooling mechanism.
HotRot	Horizontal in-vessel tumbling solids bed system (cylindrical). Fixed cylinder with a central shaft and attached paddles. Shaft rotates and paddles transfer material from the inlet to the outlet, while tumbling material to mix and aerate. Aeration aided by a fan, tumbling action of shaft and blades and head space above pile. Range of conveyor options for feed and discharge systems.	
	• Flexible facility capacity. • Modularity in respect of maintenance. • Proven pathogen destruction. • Chamber inclined in opposite direction to material movement, preventing risk of reinfecting treated material with pathogens from wastes. • Access hatches along cylinder length to remove material if required. • Good material blending and aeration. • Sampling and monitoring of material possible. • NZ based manufacturer and supplier.	• High capital costs. • Complex feed systems for larger facilities. • Biofilter (or other odour treatment device) required to control odour. • Moving parts require servicing and maintenance. • Designed to be fed over 24 hours.

Source: WasteMINZ

Case Study: Envirofert

53 Summary

Envirofert is a commercial forced aeration static window composting site operating in Tuakau, northern Waikato. The facility processes regional green waste, along with food waste and a limited amount of compostable packaging from WeCompost in Auckland. The entire focus of the operation is on the quality of resulting compost, which is made to meet the nutrient requirements of a few large fruit growing customers. The Envirofert site is 28-hectares adjacent to the Waikato River. Only 6 hectares are used for composting, with the remainder used to manage and spread leachate. These paddocks are not grazed, but are used to grow hay and maize for sale and to reduce nitrogen levels. Gaining and retaining resource consent is one of the biggest challenges for any commercial composter, the site has 21 consents.

54 System Details

Capacity: 30,000 – 40,000 ton inputs (6-8 tonnes food waste and 30-40,000 tonnes green waste).

Nitrogen and Carbon Sources: Carbon and Nitrogen is carefully monitored. Nitrogen sources include green waste and food waste, they also accept some zoo manure. Carbon sources include compostable packaging, sawdust (non-tanalised) sourced from furniture manufactures, wood from shredder, gypsum dust from GIB factory and wood bark from Tauranga wharf.

Decompositions - Aerobic forced aeration windrow system.

Timing: Each windrow takes 9-10 weeks, plus a maturation period.

55 Operations

Collection: No private vehicles are allowed on the site. Drop off and pickup are outsourced via other organisations such as WeCompost, Reclaim, Rubbish Direct, Green Fingers and transfer station sites, with waste trucked to Envirofert. This also avoids health and safety hassle. Envirofert provide a wash-down facility for trucks.

Composting: Envirofert use a three-stage process. Phase 1 is the pre-mix stage in which Nitrogen and Carbon sources are shredded and mixed. If unshredded the composting process takes x2 longer and takes up more area.

Phase 2 uses static pile forced aeration windrow composting. Fans are used to blow air into the piles via a series of pipes for 9-10 weeks. Each fan has x8 4 inch pipes and is around 30-50m long and spaced 1m apart. Windrows are around 8-10m wide, 30-50m long and about 5m high. Fans are used to manage temperature and are generally on for approximately 20 minutes and off 40 minutes. The target temperature is around 65^0C. Only takes 6-8 hours to lose oxygen from the pile.

Phase 3 involves maturation, screening and creation of any specific mix requirements.

Maintenance: Compost is tested monthly for quality, in which they check nutrient values including NPK, Sulphur, Calcium, Heavy Metal, Herbicides, Pesticides and human pathogens.

Outputs: Envirofert produce 15-20,000 tonnes high grade nutrient rich compost per annum, which is screened to 12-14mm. Most of production is sold by advance order to fruit growers (6-8 big clients). For example, one new 180-hectare orchard site took 18,000 tonnes of compost. With compost application bringing the first fruiting season for new trees forward by a year.

Inputs and resulting compost are monitored and Assure Quality Organic Certification.

56 Income and Expenses

Setup costs include site resource consent/s, shredder $900K and screener $900k. Operational cost include power, machinery, staff and $1,200 per month for lab testing. Compost is sold almost exclusively to kiwifruit and avocado growers.

EnviroFert Images

SECTION 3

RECOMMENDATIONS

Recommendations Section

57 Section Introduction

The following section outlines our assessment of the best fit hot compost options for the Kaipara Region based on available information. While other possibilities could be considered, it is our view that as far as possible, localised solutions which limit transportation, employ local people and produce high quality outputs should be prioritised. This includes encouraging home-based solutions first and foremost.

58 Why Food Waste is Significant

In terms of environmental impact, removing food waste from landfill is one of the simplest things that, we as individuals and Kaipara as a region, can do to reduce our contribution to greenhouse gas emissions.

The Global Warming Potential (GWP) of a greenhouse gas is its ability to trap extra heat in the atmosphere over time relative to carbon dioxide (CO_2). This is most often calculated over 100 years and is known as the 100-year GWP.[16]

Methane is one of the main greenhouse gases produced when food rots, rather than being composted. 1 tonne of methane has a GWP of 25 tonnes CO_2e, where e stands for equivalent. Meaning that 1 tonne of methane is x25 more environmentally damaging (from a global warming perspective) over a 100-year period than 1 tonne of CO_2 (this is reduced over a longer time scale).

If global food waste were a country, it would be the third largest producer of greenhouse gasses and carbon emissions, behind China and the United States.[17]

[16] NIWA
[17] Love Food Hate Waste
[18] US Composting Council

The Environmental Benefit of Composting

"Every metric dry tonne* of food waste that goes to landfill, may generate 0.25 tonnes of methane in the first 120 days. Thus, composting this food reduces emissions by the equivalent of 6 metric tonnes of CO_2."[18]

** Approximately 5 metric tonnes of wet food waste.*

Organic Waste to Landfill p.a.	Landfill CO_2e produced	Composting CO_2e produced	CO_2e Prevention / Benefit from Composting p.a.
1,165 Tonnes	1,456.25[19] Tonnes	325.25 Tonnes	**1,131 Tonnes**[20]

Figure 18

A saving of 1,131 tonnes CO_2 per year by removing organic waste from Kaipara's refuse bags and composting it instead, is approximately equivalent to taking 2,930 cars off the road[19]. As a comparison running one of Kaipara Refuse's trucks 2,000km per week for a year is estimated to produce 22 - 34 Tonnes of CO_2 per annum[21].

Some landfill advocates argue that methane produced within modern landfills is collected as a sustainable energy source. This is true to some degree. However, decomposition of food waste is relatively rapid, so this claim would assume that the waste is immediately sealed, and the landfill capped. It also does not take into account the longer-term impact and environmental cost of managing the increased leachate and an unstable area of area of land with limited future uses, due to contamination risks and ongoing decomposition within the landfill.

[19] Based on 1,165 tonnes wet food waste = 233 tonnes dry food waste x 0.25 tonnes Methane x 25 CO2 equivalent = 1,456.25 Tonnes
[20] http://www.stopwaste.co/calculator/ (NOTE: this calculator uses US Short Ton for inputs)
[21] Isuzu FRR – 12.4ltr / 100km, Mitsubishi Canter 8.2ltr / 100km, Carbon Footprint Calculator

59 Achieving Kaipara's Waste Minimisation Objectives

The number one objective of the **Kaipara District Council Waste Management and Minimisation Plan (WMMP) 2017**[22], is to:

1. To reduce the quantity of recoverable material entering landfill.
   With the initial target being:

   1.1 To decrease the annual quantity of waste disposed of to landfill from the Kaipara district to below 200kg per capita per year (equates to > 30% diversion).

Organic waste currently makes up around 40.9% of Kaipara's bagged refuse by weight and is the largest proportion of the waste stream by weight (over 2.5 times larger than any other waste category by weight). By volume it represents approximately 6% of the bagged refuse waste stream.

Removing food and organic waste from rubbish bags provides the greatest potential gains in terms of achieving the Kaipara District Council's waste minimisation objectives (a weight-based target). However, to date, removal of food and organic waste seems to have very little mention or detailed consideration in Waste Minimisation Plans for the region.

60 Potential impacts of changing the status quo

The current refuse collection system is user pays, with rubbish bag sales covering the cost of collection and disposal. While there are implications for removal of food waste, there are also numerous clear benefits. If food and organic waste were removed from rubbish bags:

1. Landfill would reduce by up to 40% in weight per annum and up to 6% by volume per annum.

2. Issues with animals and pests would be significantly reduced.

3. Residents would have less incentive to regularly replace their bags, as they would not smell bad, so would make these last longer.
   - *The main remaining item which would potentially smell is nappies. By weight, these currently make up 8% of Kaipara's bagged refuse. It is estimated that a child will go through 6,000 nappy changes in their first 2.5 years of life. This represents more than a ton of waste per child.* [23]
   - *The smell, weight and volume of nappies can all be reduced by emptying most of the solids into the toilet prior to binning the nappies. This practice also reduces the negative environmental impact of the nappies in landfill and should be encouraged.*
   - *Assuming 1/3 nappies contain faeces, and that the faeces represent 75% of the nappy weight. Then by encouraging this practice alone, total nappies to landfill would reduce in weight by 25%, generating a total waste to landfill reduction for the Kaipara District of 2%, by weight. Other reduction strategies should also be promoted ie. just one cloth nappy per day would reduce the number of nappies in landfill by over 900 nappies per child over their first 2.5 years.*

4. Residents would (in theory) purchase around 6% fewer rubbish bags based on the current average organic content of refuse bags by volume. This is anticipated to have minimal impact on the viability of current services, with the worst case being a $0.19c (6%) increase in bag cost (this excludes increases resulting from landfill levy changes).

5. The waste minimisation landfill levy charges are based on weight, as are the Kaipara District Council waste reduction targets. Removing the heaviest waste stream from refuse bags is the most logical approach to achieving these targets, whilst having the least impact on the financial viability of existing refuse collection services.

[22] KDC Waste Minimisation Plans

[23] NZ Geographic / Waste Free Parenting

61 Additional Benefits of Organics Diversion

There are number of benefits of organics diversion beyond the landfill cost savings and the direct environmental benefits. These include:

61.1 Soil Improvement

Application of compost to soil is known to increase the soil moisture holding capacity and can reduce the need for fertilizers, herbicide or fungicide.[24] This could result in less need for irrigation for some applications. This is relevant for climate resilience building in the Kaipara Region, which has had water shortage challenges in some areas.

For fruit growing operations, Envirofert advised that some of their clients have reported being able to bring forward plant maturation and the first fruiting season of new sites by a year through compost application, both prior to planting and post planting. This has a significant financial benefit for the growers and is a potential future market for compost, especially as Kaipara Kai investigates future crop opportunities for the region. It must be noted that if selling compost to large scale growers, then the quality of the product from a chemical and nutrient perspective becomes much more important and must be considered when determining appropriate feedstocks for the compost.

61.2 Community Economic Benefit

- 6-8 jobs for every 1 job created through landfill.
- $2.80 local economic benefit for every $1 in wages.

"On average waste minimisation, prevention and re-use create 6-8 jobs, compared to one job created through sending it landfill. It is estimated that for every $1 paid in wages to a community-based employee, local economic activity increased by $2.80 due to local staff spending."[25]

[24] US Composting Council

[25] Waikato District Council 2017 Waste Assessment pg.42-43 / Valuing Recycling Town – Measuring which bucket has the most leaks : 2009 : Gary Kelk : Ministry for the Environment : NZ

62 Best Fit Options Assessment

The key factors in determining the best fit hot composting option/s for the Kaipara Region are:

1. Collection viability - geography and population density
2. Volumes - Estimated food and green waste volumes
3. Sites - Potential sites and available space
4. Green waste - Ability to manage green waste on the same site
5. Funding - Potential funding models and anticipated uptake
6. Operations - Staffing and management requirements, practicality, cost and community benefit

The first four factors are expanded on in the following table:

Factor	Notes
Collection Viability	Geography and population density have a large impact on collection viability from a practical and cost perspective. **Rural Areas** Kaipara has a geographically dispersed population. The region has lots of narrow roads, many of which are gravel / unsealed and collection trucks frequently turn around. Due to these factors it is not practical for existing refuse collection trucks to tow an organic waste trailer or economic for a regular stand-alone organics collection service to operate in rural areas. An additional factor in these areas is that a larger proportion of residents already have alternative food waste options in place, including composting, chickens, pigs and worm farms. The main possibilities for exploration in these areas are a dual waste stream collection truck or localised composting hubs. Composting and waste management are convenience services, i.e. people generally do not go out of their way to seek these out. Therefore, localised composting hubs would be best located at schools, marae or spaces where people already congregate. While collection may not be practical, multiple drop off locations would be possible via wheelie bins with sealable lids (as used on Waiheke Island). 25% of survey respondents indicated they would rather drop off their food waste than pay for collection. Although some schools and marae already compost, additional support training and funding input would be required to ensure these sites well managed, safe and producing high quality compost outputs (which could be sold as a fundraiser, if all other aspects of the system were funded through other sources). **Urban Areas** While there are cost considerations, collection is considered a practical option for the main urban centres of Dargaville and Mangawhai. This could be via bike, van or food waste trailer towed by existing refuse trucks.
Volumes	Estimated food and organic waste volumes (based on x1 rubbish bag per household at 40.9% organic content) are: **Dargaville:** 7 Tonnes per week **Ruawai:** 1.5 Tonnes per week **Mangawhai:** 5.25 Tonnes per week **Maungaturoto:** 4 Tonnes per week Given the geography of the region, it would be preferable that waste was not transported 50-90km to a centralised site, unless this was achievable in conjunction with existing refuse collection services. From a volume perspective, estimates indicate that if removing all organics from household refuse bags in urban areas then a HCU or in-vessel composting system are the most appropriately scaled systems (multiple community compost box sites and small scale aerated static pile or windrow are also possible). NOTE: Volumes would be significantly lower for an opt-in user pays system.

Sites	**Localised Systems** If possible, composting should be locally based. Community gardens, schools and marae are a natural fit option for consideration. These sites have complimentary activities such as educational benefits, and in many cases, they also have access to other community funding sources to help support the activity. **Larger Volume Centralised Sites** The Kaipara District has 14 consented landfills and 6 illegal or unconsented landfills. All of these are now closed, with Hakaru (near Mangawhai) and Awakino Road (near Dargaville) now operating as transfer stations. These sites are generally away from residential areas and are unproductive land with limited development potential. These are therefore the most appropriate council owned sites for a composting operation. Both Hakaru and Awakino Road have potential as sites for composting hubs. ***Note:*** *It is worth noting that at present North Kaipara Transport run a privately owned transfer station at Maungaturoto. This is currently for sale. It is uncertain if the new owner would continue the service. Given the estimate waste volumes for this area, discontinuation of the service may see the Kaipara District Council needing to consider a third transfer station to service this area.*
Green Waste	Green waste is an important low-cost carbon source for larger scale compost production. While green waste also has a high nitrogen content, it is generally more balanced than food waste. This reduces the amount of additional carbon need from other sources and ultimately produces better quality compost outputs.
	Ability to accept or manage green waste on the same site as the compost production is therefore seen as important for any larger volume operation. This makes the Hakaru and Awakino Transfer Stations a natural fit. While paper, coffee husks, oat husks, wood chips and other materials can be used the main reliable source identifies within the region was Kaihu Valley Sawmill, near Dargaville.

63 Potential Larger Volume Sites

63.1 Hakaru Waste Transfer Station

63.2 Awakino Road Transfer Station

Image source: Googlemaps

64 Financial incentive for food and organic waste diversion

Currently Kaipara District Council rubbish bags cost $3.10 for a 65ltr bag.

Organic waste currently makes up around 40.9% of Kaipara's bagged waste by weight. This translates to around 3.75 litres[26] or 6% by volume (assuming bags are filled on average to around 60 litres). Assuming a household uses x1 rubbish bag per week, then by diverting food waste from their rubbish bags, households would save around $10 per year. This shows there is very minimal financial incentive for Kaipara residents to divert their organic waste.

Cost of Rubbish Bags	Theoretical Bags Per Year	Cost of Refuse Per Annum	Cost per annum of putting organics in the bin (6% by volume)
$3.10	52	$161.20	$9.67

Figure 19

65 Potential Funding Streams for Organics Diversion

65.1 Medium-Long Term: Targeted rate

Use a of targeted (or general) rate is a potential approach, which has been utilised in numerous other urban centres, including Auckland where a rate of $67 per year has been applied (with an opt out provision, which applies only to owner occupied homes). The rational for this approach for Auckland is available online[27]. Based on the current average organic content of refuse bags and the resulting potential savings from reduced rubbish bag purchases, a similar approach and rate increase would have an approximate $57 net cost for Kaipara residents.

Rates funding is the best long-term solution to ensuring the financial sustainability of organics diversion and the associated environmental and community benefits. However, there can be resistance to implementation.

65.2 Short-Medium Term: Waste Disposal Levy

The Waste Disposal Levy came into force in 2009, in 2018 this levy was set at $10 per tonne of household waste to landfill, with 50% going to council for waste minimisation. Based on Kaipara District Council records[28], the waste minimisation levy accumulated within the 2018 year totalled $77,870.86. Indicating 15,574 tonnes of household refuse to landfill.

This levy is scheduled to increase to $60 per tonne over the next four years[29]. Based on 2018 landfill volumes, this will represent an $389,000 increase per annum in available waste minimisation funds for the Kaipara District.

Given that organic waste makes up the largest portion of Kaipara's household waste stream by weight, and diversion has significant environmental benefits, it is recommended that organic and food waste diversion should be considered a priority area for the available waste minimisation funding.

65.3 Short-term: User Pays

It is our assessment that an opt-in user pays community composting option is viable for the main urban centres of Dargaville and Mangawhai.

However, if entirely self-funding (around $30 per month per household), survey results indicated that it would only capture food waste from around 6% of households within its catchment area (this is a very small proportion considering the survey had a margin of error of 6%).

If 50% self-funding (around $15 per month per household) it could potentially capture food waste from up to 45% of households within its catchment area. This is a significant difference in anticipated uptake and indicates that consideration should be given to a subsidised service. Either via an annual fix operational grant or via a scaled subsidy based on the number of participating households.

[26] Based on food waste having an estimated bulk density of 600kg per m^3 (or 1.67ltr per kg) and Kaipara District rubbish bags averaging 5.5kg.
[27] Auckland City Council Rational for Targeted Rate
[28] Kaipara District Council Waste Minimisation Spending
[29] Waste Levy: $50 Increase Over 4 Years, Starting July 2021

66 Direct Savings from Organics Diversion

66.1 Cost to Landfill

The Ministry for the Environment's consultation document "Reducing waste: a more effective landfill levy", states that average bulk commercial landfill fee in NZ in 2019 was $79* +GST per tonne, including the current $10 waste disposal levy.[30]

Costs	Cost per Tonne
Landfill Gate Fee	$79*
Waste Disposal Levy Increase	$50[31]
Total	**$129**

Figure 20

** NOTE: This fee is an average, actual fees charged to Kaipara Refuse are commercially sensitive, but could be up to double when taking into consideration transport cost to Whangarei.*

66.2 Estimated Diversion Per Participating Household

- From our household waste survey, we know that only 34% of respondents put some of their food waste in the bin. This means that while the average organic content of rubbish bags by weight was 2.25Kg, this is much lower for 66% of the population.
- Assuming those who don't bin their food waste contribute 750g of organic material per week, then remaining 34% of households would be contributing 3.02kg per week. For these households, organic waste would make up around 8% of the waste by volume meaning annual rubbish bag savings of $13.43 (if using 1 bag per week).
- If a user pays opt-in composting system were established, it is fair to assume that only households who do not currently have another option would be willing to pay and participate. The landfill saving for council / council waste contractor can therefore be estimated based on 3kg per week per participating household.

[30] Ministry for the Environment. 2019. Reducing waste: a more effective landfill levy – consultation

[31] Waste Levy: $50 Increase Over 4 Years, Starting July 2021

Household Organics Diversion p.a. (3kg per week)	Revenue loss for Council or waste contractor from household savings on rubbish bags p.a.	Council or waste contractor savings on landfill p.a.	Net gain per participating household from removing organics per annum
156kg	-$13.43 (8%)	$20.12	$6.69

Figure 21 – The figures above are based on current Kaipara District bag charges and national average landfill costs. The figures are for households who currently bin food waste.

Based on this rational a Council or waste contractor contribution of $6.69 per participating household towards a user pays organics diversion system would have a net zero cost.

For an all of population collection system (rather than opt-in user pays), the average net gain per household per year would be $5.02, based on current Kaipara District bag charges and national average landfill costs.

66.3 Waste Contractor Financial Incentive for Diversion of Organics

It is our assessment that there would currently be insufficient financial incentive for Council waste contactor/s to staff and run an organics diversion system themselves, without additional funding input from Council or other public funding sources.

Area	Households (2019)	Diversion (Tonnes per year @ 2.25kg p/w)	Net Benefit ($5.02 p.a./ household)	Potential Compost Sales p.a. [32]	Total benefit per annum
Dargaville	2,034	238	$10,210	$8,567	$18,778
Mangawhai	472	55	$2,369	$1,988	$4,358
Mangawhai Heads	1,001	117	$5,025	$4,216	$9,241

Figure 22

[32] Based on a preliminary estimate of compost produced being 60% of inputs and sold at $60 per tonne.

67 LOCAL: Establishment & Operational Costs

67.1 Community Composting Establishment Costs

The cost of community composting systems range from around $750 to $2,800 per box. The lower end of the range being home-built and the upper end CarbonCycle Community Compost Boxes.

For home-built solutions consideration needs to be given to pest proofing, untreated timber and functionality, as a poor design can add considerable time to compost management. A minimum of X3 boxes are recommended per site to allow turning and maturation of the compost.

Item	Cost Estimate	Notes
Compost Boxes	$2,250 - $8,400	Based on x3 boxes
Manure / Compost Drag Fork	$170	Used for turning the compost from one box to another
Flat nose shovel	$40	
Regular Fork	$30	
Sharp Spade or Machete	$60	For cutting up larger items
Garden gloves	$20	X2 pairs
Garden sprayer	$30	For BAM inoculation
Thermometer	$30	For ensure compost reaches a safe temperature to pasteurise food waste
Digital Scales	$50 - $150	To measure food waste diversion rates
Sub-Total	**$2,660 - $8,930**	**All the above**
Tool Shed	$300	Optional
Shredder	$1,550	Optional, but essential if composting packaging.
Sub-Total	**$4,510 - $10,760**	**All the above**

Figure 23

Total establishment costs are around $3-10K per site.

Funding for establishment may come from a range of sources, including Council, the Ministry of Education, fundraising or other grants.

67.2 Potential Collection System Establishment Costs

- Collection equipment costs may be much lower depending on approach taken, bucket types and volumes purchased. The following are outlined to give a preliminary indication for a small-scale operation at retail prices.

	Per unit	Per 50 Households	
20ltr Kerbside Bins	$15	$750	Raglan Xtreme Zero Waste $15 per unit
7lt Kitchen Caddies	$20	$1,000	WeCompost
Kitchen Caddie Compost Instruction Stickers	$7.50	$375	We Compost
Total	**$43**	**$2,125**	

Figure 24

- With multiple drop-off points and a lower fee such as a gold coin / koha based drop-off charge, collection may not be required.

Bike Based Collection		
Electric Bike	$5,000 – $7,300	Electric Bike Team
Cargo Bike Trailer	$1,350	Bicycle Junction
	$6,350 - $8,645	

Figure 25

- In some locations electric bikes are hired rather than purchased. However, over a 1-2 year period, purchasing a bike makes more financial sense.

67.3 Community Compost Operational Costs Summary

The follow operational costs are based on a scaled back Kaicycle model and assume X50 households / collection sites and a living wage is paid to staff.

Note: While some of these roles may be undertaken by volunteers, the most successful models in NZ have paid staff.

It is proposed that Kaipara District Council contribute to the compost and feedstock management and testing cost, as this will maintain the quality and safety of the activity, while also acting as a multiplier in attracting other community support and funding to the region.

67.4 User Pays Opt-in Revenue Models Assessment

DROP OFF ONLY $2 per week: For a drop-off only, community composting service to be self-sustaining with paid staff, it would require 65-80 households paying $2 per week (range depending on whether compost sales are factored in). This approach is likely to have much lower uptake and consistency. Just as people forget their reusable shopping bags, many will also forget their compost.

COLLECTION SERVICE $30 per month: Survey results indicated that 6% of respondents would be willing to pay $30 or more per month for collection by a community composting group. Assuming the service paid staff, collected from 50 households and charging $30 per month, plus made $1,500 per year in compost sale profits; the service would have an approximate $3,000 per annum shortfall. (Breakeven would be possible with their own bike).

COLLECTION SERVICE $15 per month: Survey results indicated that 45% of respondents would be willing to pay $15 per month for collection by a community composting group. If paying staff, collecting from 50 households and charging $15 per month, the service would have an annual shortfall of around $12,000, this could be reduced to around $5,000 via having their own bike, charging participants for their compostable bags and having an additional 20 households dropping off at $2 per week. To cover this $5,000 shortfall they would require around 4hrs volunteer input per week.

Paid Staff Operational Cost Provisions (no collection)

Basic Costs	Hours	Rate	Weekly	Annually
Compost processing & prep.	4hr 15min	$23	$98	$5,096
Compost and Feedstock Management and Temperature Checking	2hrs 15min	$23	$52	$2,704
BAM		$2	$2	$104
		Total	**$152**	**$7,904**

Figure 26

POTENTIAL Collection and Additional Operational Cost Provisions

Basic Costs	Hours	Rate	Weekly	Annually
Collection (van or bike based)	6hr 15min	$23	$144	$7,488
Amin and subscription management	1hr 30min	$23	$35	$1,820
Compostable bags		$0.26	$20	$1,040
Shredder Fuel			$5	$260
Electric Bike Lease			$75	$3,900
		Total	**$278**	**$14,508**
Combined total operational & additional costs			**$430**	**$22,412**

Figure 27

68 REGIONAL: Establishment & Operational Costs

Based on available information and anticipated volumes, it is our assessment that the best fit larger scale hot composting systems for the Kaipara Region are a Horizontal Composting Unit or a HotRot in vessel composting system.

While other systems may be possible, these all require larger amounts of flat land (i.e. windrow, force aeration windrow, GoreTex covered forced aeration or the system being developed by Community Compost in Nelson).

Composting System	Capacity (including carbon)	Dimensions	Indicative Establishment Cost	Annual Operational & Staffing Costs
HCU (Horizontal Composting Unit)	1.4 - 2.1 Tonne per day 10 - 15 Tonne per week[33]	30m x 3m x 2.5m + loading and green waste processing areas	$103,000[34] + 4-5 Tonne Digger ($50,000 - $90,000)	$28,750 per annum (0.5FTE + digger fuel + digger maintenance)[35]
HotRot 1811 with bin lifter	1.7 Tonne per day 11.9 Tonne per week	13m x 2.2m. Typical footprint required including feed hopper, biofilter, feed and discharge augers is 120m2.	$ 405,000[36]	$22,700 per annum (0.25 FTE + power + maintenance)[37]
HotRot 1811 with 5m^3 feed hopper	2.5 Tonne per day or 17.5 tonne per week		$ 550,000[35]	$18,700 per annum (0.33 FTE + power + maintenance)[38]
X2 HotRot 1811 in tandem with 15m^3 feed hopper	5 Tonne per day or 35 Tonne per week	240m2 based on x2 of above	$895,000[35]	$36,000 per annum (0.4 FTE + power + maintenance)[39]

Figure 28 – Operational cost figures compare favourably to those presented for organic waste processing in Appendix F of this Ministry for Environment consultation document

68.1 System Notes

Composting System	System Notes
HCU (Horizontal Composting Unit)	The removable roof panels enable rain, humidity, temperature, odour and vermin to be controlled. Expected lifespan 50 years with minimal maintenance required. The HCU does not require electricity although does need a water supply as the compost process requires additional water. There is a simple leachate collection system which can offer leachate back into the compost process or use for other organic processes.
HotRot 1811 (bin lifter)	In vessel process which includes a biofilter, no leachate, scalable with additional units, 10-year design life span. Preliminary price includes bio-filter and bin tipper. The lack of a feed hoper limits capacity and increases labour costs by around $4K per year.
HotRot 1811 (feed hopper)	In vessel process which includes a biofilter, no leachate, scalable with additional units, 10-year design life span. Preliminary pricing includes 5m3 hopper, augers, bio-filter.
X2 HotRot 1811 in tandem	In vessel process which includes a biofilter, no leachate, scalable with additional units, 10-year design life span. Preliminary pricing includes 5m3 hopper, augers, bio-filter.

Figure 29

[33] The HCU can hold 200m3 or 120 tonnes of material, composting is completed over 8-12 weeks, giving a maximum capacity of 10-15 Tonne per week
[34] Based on the HCU built in Raglan in 2018, cost from 2019 annual accounts
[35] 0.4 FTE $24K (assuming living wage – based on Raglan Xtreme Zero Waste Green Waste operating hours of 20hrs per week & includes other related activities) + fuel estimate $3K + maintenance estimate $1.75K
[36] High level indicative pricing from Global Composting Solutions Ltd Managing Director
[37] 0.33 FTE $16K (assuming living wage) + Power $2,500 per annum (assuming 400 tonne throughput and $0.25c per kwh) + $4,200 maintenance provision for short and long-term maintenance
[38] 0.25 FTE $12K (assuming living wage) + Power $2,500 per annum (assuming 400 tonne throughput and $0.25c per kwh) + $4,200 maintenance provision for short and long-term maintenance
[39] 0.4 FTE $19K (assuming living wage) + Power $6,700 per annum (assuming 1,040 tonne throughput and $0.25c per kwh) + $10,300 maintenance provision for short and long-term maintenance

68.2 Urban Organic Waste Collection Costs

Large scale urban organic waste collection is estimated to cost around $45[40] per household per year. This rate will vary based on population density and travel distances and would require negotiation with the selected contractor.

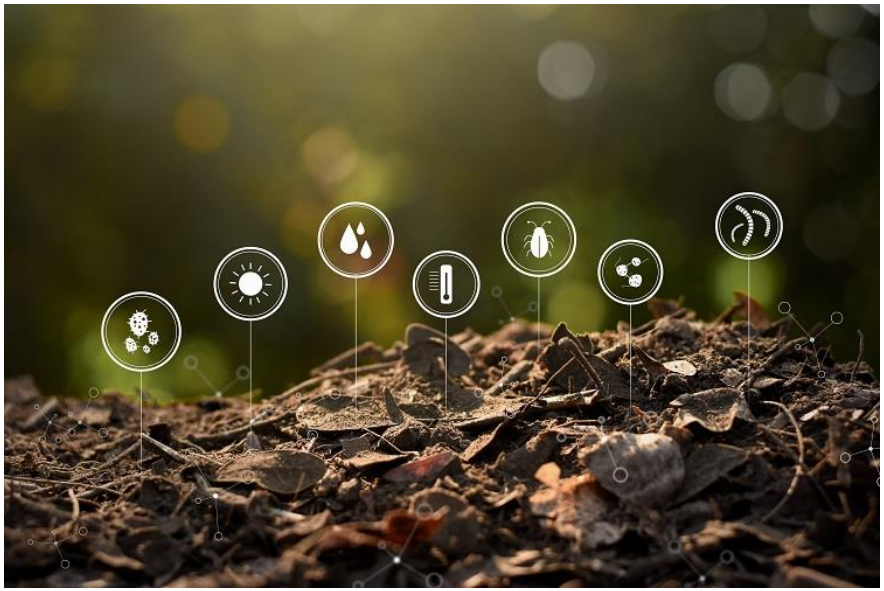
68.3 Establishment Costs

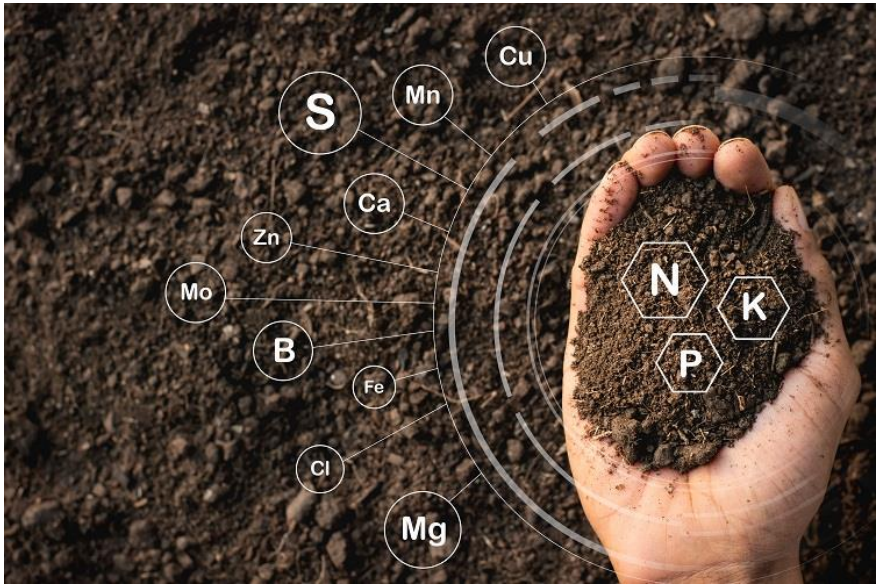
The following are additional potential costs for establishment of organics collection service.

Additional Costs	Cost	Notes
Kitchen Caddies	$17,535	Estimated based on Raglan pricing of $5 and starting with 3,507 households
Kerbside Bins	$52,605	Estimated based on Raglan pricing of $15 and starting with 3,507 households
Additional Collection Equipment	$50,000	PC Sum - Compost Collection Trailer, Aluminium or Stainless, Compost Collection Bins, Rotating Head Forklift
Total	**$120,140**	

Figure 30

Note: *Equipment cost is a basic provisional sum and has not been investigated in depth as a number of approaches could be taken to collection.*





[40] https://www.tvnz.co.nz/one-news/new-zealand/critical-recycling-report-pushes-food-waste-collection-and-nationwide-approach

Recommendations

69 Kaipara Hot Composting Recommendations

The following recommendations are made based on our assessment of the best fit hot compost options for the Kaipara Region.

5. **HOME: Community Education**
   It is recommended that Kaipara District Council tag some waste minimisation funding for home composting education, encouraging home-based food waste solutions such as bokashi, worm farming and home composting. As a preliminary example the Waiheke Resources Trust receive around $9K per annum via the Compost Collective for composting and community garden workshops for a population base of 7,600. **Recommended allowance: $15K per year.**

6. **LOCAL: Community Composting**
   It is recommended that community composting initiatives are supported. These activities are localised, minimise waste transport and have a huge range of community building and educational benefits. It is recommended that this is started with an initial trial site run by Sustainable Kaipara in Mangawhai and then implemented in other locations around the district with a focus on schools, marae and community garden sites. Education of volunteers and effective ongoing management / support for these systems is important to get the best results. As such is it recommended that an annual site management / support contribution is funded by the Kaipara District Council, with the collection and composting activities locally funded by service users, or via other funding sources, or run by volunteers. **Recommended allowance: $2,750 annual grant per community composting site, with an initial objective of x10 sites regionally.**
   It is recommended that this funding is maintained for each new site, for a minimum of x3 years to enable them to get established, with consideration of longer-term support based on results.

   In addition, it is suggested that council waste contractors could also be approached to consider sponsorship of annual grants, of $5 per annum per participating household, based on potential landfill cost savings. Funds would be significant for the community groups, despite only equating to only $250 per x50 households per annum.

7. **REGIONAL: Larger Scale Composting**
   It is recommended that a Horizontal Composting Unit and/or a HotRot in vessel composting system are investigated in more detail and business case prepared, as a potential future solutions for the Kaipara District. The best starting points for these investigations are Raglan Xtreme Zero Waste's consulting team and Global Composting Solutions. Depending transport logistics and site suitability the composting hub/s may be located at waste transfer stations in the Dargaville and/or Mangawhai areas. Consideration should be given to the comparative advantage of having two sites, given the potential for staff to also run other transfer station activities, verses a single hub and with increased transport costs and environmental impact. Projected population growth should also be considered.

8. **OTHER: Sewage Sludge**
   While not investigated in detail within this report, it is understood that Kaipara wastewater treatment sludge is currently transported to landfill. It is recommended that a HotRot system could be investigated in more detail for the processing of wastewater treatment sludge for the region (as is used in Palmerston North). With increasing landfill costs, ability to process wastewater sludge may enhance the viability of a composting system. While pasteurised within the system, consideration would need to be given to end product use and the potential for higher heavy metal content.

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