

CLOSING THE GAP ON FOOD WASTE IN BATHURST

A TRIAL STUDY



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KEY ORGANISATIONS INVOLVED IN THE PROJECT



EXECUTIVE SUMMARY

Bathurst Regional Council (BRC) commissioned the University of Sydney to assist in conducting a Food Organics Garden Organics (FOGO) separation trial, for domestic and commercial areas in Bathurst, NSW.

This project was supported by Local Government NSW (LGNSW) with funding from the NSW Government, through the Local Government NSW Research and Innovation Fund, 2020/2021.

DOMESTIC AREAS STUDY

The purpose of this project is to determine the most effective configuration option for households in Bathurst, based on the following trial variables:

- Reduction in general (red lidded) bin size (240L to 140L)
- Change to the general waste kerbside collection frequency (weekly to fortnightly)
- Provision of kitchen caddy and compostable liners for FOGO separation (noting that caddies were provided at the commencement of the FOGO service in 2016).

The trial spanned 4 months across 7 trial areas, totalling 206 households. Compositional audits and visual analysis were performed on each trial area: pre, mid, and post-trial. The performance of each trial variable was determined through the change in specific waste categories between audits. The specific waste categories monitored are as follows:

- Kg/bin/week
- Total Recyclable Fraction
- Total FOGO Fraction
- Total General Waste Fraction
- Combined Recoverable Fraction (Recyclable + FOGO)
- Combined Cardboard Fraction
- Combined Food Fraction (Food + Food in packaging)
- Presentation rate of the bin at the kerbside on its collection day
- Fullness of bin at the kerbside on its collection day

Surveys were also sent to each trial area and participating business at the same intervals as the audits. The purpose of these surveys was to monitor participant enthusiasm and attitude towards the trial, as well as to obtain variable specific feedback, such as issues using the kitchen caddy, or difficulties managing having a smaller red bin.

FOOD WASTE PERFORMANCE

Across the 7 trial areas, decreases in the presence of FOGO waste in red bins was observed for all experimental variables. This averaged a 35% reduction for households with a kitchen caddy, a 42% reduction for households with a 140L bin, and a 46% reduction for households moved to fortnightly collection. Upon conducting a statistical regression analysis to isolate the effects of each variable, it was found that fortnightly collection was the most significant single variable in reducing FOGO in the red lidded waste bin, compared to BAU. Both the kitchen caddy and 140L bin were found to be less significant. This is attributed to behavioural factors, where the smaller bin collected weekly is easier to work around, if the bin reaches capacity before being collected, and where the caddy necessitates the most significant behavioural change, requiring users to separate their waste in the kitchen, compared to changes in collection modes.

The same trends were observed for each waste category, with an observed decrease in every waste category for all 3 variables. However statistical analysis revealed that fortnightly collection was strongly associated with reductions in red bin waste, while the 140L bin and caddy had minimal impact in isolation from other variables.

Presentation and fullness of the kerbside bin was affected by COVID-19 lockdown, owing to which data on the fullness of the kerbside bin was not collected at the end of the project. Although, by the end of the project, in all trial areas, the lime green lidded bin presentation rate on the kerbside had risen by 20%.

SURVEY RESULTS

The results of the 3 surveys sent to each trial area revealed several key findings:

- 93% of participants indicated that FOGO separation was either very important (56%) or important (38%).
- Only 2% of participants indicated that their motivation to separate FOGO waste decreased over the course of the trial, whereas 41% indicated that their motivation increased.
- 78% were satisfied with the clarity of the communication and information provided by BRC.
- 76% of participants agreed or strongly agreed that they had become more conscious of their waste habits due to the trial.

Feedback from those who had received a kitchen caddy included the following:

- 95% of participants responding between neutral to strongly agree that the caddy was easy to use
- 91% believed that the caddy was a good size
- 16-29% had issues with odours from the caddy
- Other comments included:
 - “[compostable] bags break easily”
 - “bin bags are not big enough”
 - “[issues include] the mess, the hassle and the smell”

General comments from the trial included:

- Requesting more information from the Council
 - “[I would like] pictures and information about the FOGO composting plant and process”
 - “Provide a collection calendar each year”
 - “Information on what can go in each bin...”
- Concerns about rates
 - “I’m not receiving what I pay for in my rates”
 - “Free green bin liners”
 - “Discounts/reductions in rates”
- Concerns about how specific demographics will be affected

- “Concerned about health issues of fortnightly collection for young and old families with nappies and ‘medical’ waste”
- “Household numbers vary greatly, and individuals should be afforded the option of having a 240L bin collected weekly”

ECONOMIC AND ENVIRONMENTAL MODELLING

A model was created to compare how a change in service configuration from Business as Usual (BAU) would affect council expenditure and how the associated increase in waste diversion would reduce emissions of CO₂-e.

It was calculated that the initial cost of providing kitchen caddies and liners to households was \$138,000. It is noted that this would be the total cost if BRC were to provide a caddy to every household; however, this cost does not take into account that many households may still have their original caddies, provided to them in the 2016 rollout, and may not need a replacement caddy, which would see a reduction in the total cost.

In the instance that previously supplied caddies have been lost or damaged, it may be a consideration for BRC to purchase a small number of caddies and provide these only to those households that have not retained their original caddy. It is recommended that BRC consider providing compostable liners as an addition to the previous standard.

The cost of changing household bins from 240L to 140L was estimated to be \$792,000.

It was found that for the recommended trial configuration of 240L bins, fortnightly collection with provided caddies and liners, there was a yearly cost saving of between \$756,000 - \$896,000, much of which can be attributed to halving collection frequency. This reduced frequency would not result in less staff time but would enable BRC to redeploy staff to other waste management services, improving service in other areas. These savings from halving collection frequency more than offset the associated cost of providing liners to households, which equated to \$57,000 a year. Based on the diversion efficiency of this recommended set-up, emissions reductions of between 4,800-6,200 tonnes- CO₂-e per year was calculated.

ANALYSIS OF OTHER NSW COUNCILS

43 of the 128 councils in NSW have implemented FOGO collection services, and an analysis of 38 of these councils was conducted by Rawtec (2020). Conclusions from this report support the results obtained from the trial and include:

- Performance of each service configuration can vary significantly by council, indicating that service configuration is not the only contributing factor to food waste diversion.
- On average, longer established FOGO services performed better (46% for >1 year) than less established services (34% for those <1 year and 28% for those in the trial period). Performance was found to vary across councils with the same length of service or with the same service configuration.
- Other factors, such as waste education are expected to be important for influencing food waste diversion outcomes.

Similar conclusions were reached by comparing case studies from specific councils. Specifically, there was a strong correlation between the quality of education and promotional campaigning and the success and performance of FOGO separation.

COMMERCIAL AREAS STUDY

With the commercial areas, 45 businesses received a 140L FOGO service with the option for multiple collections week provided in line with BRC's provision of standard Council services.

FOOD WASTE AND ITS REDUCTION RATE

During the regular FOGO service for 20 weeks from July to November, 28.16 tonnes of food and garden material from the participating food businesses in Bathurst was diverted. Although having a COVID closure affecting the trial period between weeks 7 to week 14 during the trial, a 1.78 tonnes of FOGO waste was collected per week and an average of 40.7 kg/businesses per week. It is estimated that at the same rate if all the food and garden waste generated go to a FOGO service, a total of 634 tonnes/year of waste will be saved from going into landfill. This waste could be utilised to prepare compost for the agriculture industry.

SURVEY RESULT AND BUSINESS INTEREST

Surveys were sent to businesses at the beginning and end of the trial. The key findings from the survey were that businesses were happy with Council's FOGO trial and six were interested to continue the green bin service after the trial at the cost of \$116/year. "Provide a compostable 60L bin liner" were the major comments from businesses to handle the mess around the food premise. Moreover, few comments were around using non-compostable plastic bags as a bin liner but separating the food and plastic bin liners when emptying into the kerbside bin. Further work needs to be undertaken on these issues.

ECONOMIC AND ENVIRONMENTAL MODELLING

Similarly, to household modelling, a model was created on economic and emissions savings for 300 businesses. Through the model, it was predicted that Council will save up to \$66,600/year from composting the waste from high food and organic waste generators. This figure considers the cost of composting only, therefore, after taking into consideration the operational costs to Council, this will still result in a saving of \$32,800/year from composting the material. (See Table 15.) There is also a potential saving of \$110 for businesses per year from introducing a commercial food and organics waste collection. With the approximate 300 food premises in Bathurst, it has been estimated from using Australian National Greenhouse Accounts, that 1,396 tonnes of CO₂-e would be avoided.

LIST OF ABBREVIATIONS AND GLOSSARY

ANL	Australian Native Landscapes
BAU	Business as Usual
BRC	Bathurst Regional Council
CBSM	Community-based Social Marketing
FOGO	Food Organics, Garden Organics
LGA	Local Government Area
LGNSW	Local Government New South Wales
MGBs	Mobile Garbage Bins
MUDs	Multi-Unit Dwellings
WMC	Waste Management Centre
TA	Trial Area
HDPE	High Density Polyethylene
PET	Polyethylene Terephthalate
GHG	Green House Gas
FO	Food Organics
GO	Garden Organics
Non-R	Non – Recyclable
CRS	Container Recycling Scheme
C&D	Construction & Demolition

1	INTRODUCTION	12
1.1	General Overview	12
1.2	Bathurst	12
1.3	Bathurst Waste Collection System	12
1.4	Rationale for the Research	13
1.5	Behaviour and Barriers	14
1.6	COVID-19 Affecting the Project Trial	15
1.7	Limitations	16
2	BACKGROUND	17
2.1	Alternative FOGO Operational Services	17
2.2	FOGO Kerbside Collection – NSW Case Studies	19
2.2.1	Bega Valley Shire	19
2.2.2	Kempsey Shire	21
2.2.3	Leichhardt Council	22
2.3	Analysis of NSW Food and Garden Bin Audit Data	25
2.4	Encouraging Waste Separation Behaviour Through Effective Education	26
3	METHODOLOGY	30
3.1	Research Area Selection	30
3.1.1	Households	30
3.1.2	Businesses	30
3.2	Household Compositional Analysis/Audit	31
3.3	Household Presentation and Fullness of the Bin	33
3.4	Businesses Data Analysis	34
3.5	User Guide Pamphlet Design	34
3.6	Survey Design	35
4	RESULTS AND DISCUSSION	36
4.1	Households	36
4.1.1	Compositional Analysis and Discussion	36
4.1.2	Food Waste	41
4.1.3	Visual Analysis - Presentation and Fullness	42
4.1.4	Survey Results and Discussion	43
4.1.5	Pre-trial Surveys	44
4.1.6	Mid-trial Survey	46
4.1.7	Post-trial Survey	49
4.2	Businesses	51
4.2.1	Business Waste Audit	52
4.2.2	Food Waste	52
4.2.3	Businesses Survey	53
4.3	Economics and Emissions Model	54

4.3.1	Household FOGO Economics	54
4.3.2	Household Operational Expenditure change	54
4.3.3	Household Capital Costs	56
4.3.4	Household Emission Impacts	56
4.3.5	Commercial FOGO Economics	58
4.3.6	Commercial Emission impacts	58
5	CONCLUSIONS AND RECOMMENDATIONS	59
6	REFERENCES	62
7	APPENDICES	64
7.1	Appendix B: Final audit photographs	64
7.1.1	Trial Area 1	64
7.1.2	Trial Area 2	64
7.1.3	Trial Area 3	65
7.1.4	Trial Area 4	65
7.1.5	Trial Area 5	66
7.1.6	Trial Area 6	66
7.1.7	Trial Area 7	67
7.2	Appendix C: Flyer	68
7.3	Appendix D: Letters	69
7.3.1	Pre-trial Letter for Businesses	69
7.3.2	Pre-trial Letters for Households (Trial Areas 1-7)	70
7.3.3	Letter Sent to Businesses at End of Trial.....	71
7.3.4	Letter Sent to Households at End of Trial	72
7.4	Appendix E: FOGO User Guide For Businesses.....	73
7.5	Appendix F: FOGO User Guide for Households.....	74
7.6	Appendix G: FAQ'S for Households pre-trial	75
7.7	Appendix H: FAQ'S for Businesses pre-trial.....	77
7.8	Appendix I: Calculation assumptions and corrections for compositional analysis	79
7.9	Appendix J: Surveys	80
7.9.1	Households Pre-trial (Generic One for All Trial Areas)	80
7.9.2	Households Mid-trial Survey (7 Different for Each Trial Area)	82
7.9.3	Households End of Trial Survey (Generic One for All Trial Areas)	86
7.9.4	Businesses Pre-trial Survey	88
7.9.5	Businesses End of Trial Survey	90

LIST OF TABLES

Table 1 - Average garden organics in FOGO bins, residual waste bins and total (kg/hh/wk), diversion efficiency (%) by configuration. Range of values (min - max) provided in brackets. Obtained from Rawtec (2020)	25
Table 2 - Trial areas with major changes for this project	30
Table 3 - A list of items sorted during each compositional analysis	32
Table 4 - Waste to CO ₂ -e Conversion Factor (DISER 2020).....	34
Table 5 - Survey response rate	44
Table 6 - Survey response rate: "How would you describe your household"	44
Table 7 - Survey response rate: "What motivates you to avoid waste".....	45
Table 8 - Survey response rate: "How important would you say separating your food and garden waste from your garbage waste is?"	45
Table 9 - Survey response rate: "What deters you from putting food waste into the green bin?"	46
Table 10 - Survey responses for selected mid-trial questions.....	47
Table 11 - Survey responses for trial areas given caddy	48
Table 12 - Selected survey responses for post-trial surveys	50
Table 13 - Cost estimation of change of service.....	56
Table 14 - Summary of OPEX savings and emission reductions for selected configurations.....	57
Table 15 - Commercial FOGO Trial and Predicted Emissions and Costings.....	58

LIST OF FIGURES

Figure 1 - Kerbside waste collection vehicles used during waste trial, Bathurst.	13
Figure 2 – Organic waste green lid bins.....	15
Figure 3 - General waste red bin used during trial and bagged food waste as a contaminant in red bin during visual audit	16
Figure 4 - Council waste collection and at-home caddy use	17
Figure 5 - Meta analysis of NSW EPA and Victorian Waste data on councils with FOGO services (2018/2019 data)	18
Figure 6 - NSW Organics Collection Services map. Obtained from EPA 2021.	19
Figure 7 - Changes to Bega Valley Shire's kerbside bin collection service	20
Figure 8 - Changes to Kempsey Shire's kerbside bin collection service	22
Figure 9 - Changes to Leichhardt Council's kerbside bin collection service in multi-unit dwellings of 10 or more units	23
Figure 10 - Example of updated education material sent to households in Leichhardt	24
Figure 11 - The front page of the information leaflet (translated from Swedish) used in the study by Linder et al. (2018)(Linder, Lindahl, and Borgström 2018)	29
Figure 12 -Waste sorting in progress.....	31
Figure 13 - Bin presentation and fullness	33
Figure 14 - Breakdown of waste composition for the 7 trial areas over 3 audits	39
Figure 15 - Regression coefficients of multivariable regression	39
Figure 16 - p-values for the multivariable regression. Horizontal line indicating $p = 0.05$	40
Figure 17 - Caddy, waste in bins with and without liners	42
Figure 18 – Fullness of red bins	43
Figure 19 - Business food waste bin	51
Figure 20 - Pre-trial business waste audit	52
Figure 21 - Weekly waste tonnage for participating businesses.....	53
Figure 22 - OPEX of the range of service configurations	55
Figure 23 - Summary of emission reductions for selected service configurations	57

1 INTRODUCTION

1.1 GENERAL OVERVIEW

Organic waste management is a major problem within the domestic and commercial waste sector. It is known that food waste produces eight per cent of global greenhouse gas emissions (GHG), as when food decomposes, it produces methane; a GHG 25 times more potent than CO₂. If food waste was a country, it would be the third largest greenhouse gas emitter, behind the USA and China (DAWE 2020). Due to the huge burden represented by organics in Australia, a national bipartisan agreement of the National Waste Action Plan 2019 agreed that Australia would progress to halving the amount of organic materials ending up in landfill. This target has been subsequently expanded upon by the NSW Net Zero Strategy 2020-2030 and NSW which has targeted Net Zero Emissions from organic waste. This goal aligns with global actions taken against the issue of food waste, in line with Sustainable Development Goal 12 – ensure sustainable consumption and production patterns- of the United Nations Transforming our world: *2030 Agenda for Sustainable Development* (United Nations 2015). Furthermore, the NSW Waste and Sustainable Materials Strategy 2041 has mandated the introduction of household Food Organics and Garden Organic (FOGO) waste services for all households by 2030 and major food waste producing businesses by 2025.

Unfortunately, despite these goals, significant gaps still exist between what is achieved currently and what is targeted. With this strong federal and state support of improving organic waste capture, Bathurst Regional Council acknowledged the significant impact that food waste is playing in the contributing to BRC's emissions and committed to improving its organic waste diversion. As such BRC has committed to closing the gap between what is currently achieved, and Australia's targeted organic waste management.

1.2 BATHURST

Bathurst is located approximately 200km west of Sydney in the Central Tablelands and covers 3,820 km². The average household size in Bathurst is 2.48 persons/dwelling (.id. 2021). It is known that 80% of the dwellings in Bathurst are standalone dwellings with a majority of remaining as Multi-Unit Dwellings (MUDs) as apartments or units. Bathurst has a largely English-speaking community with over 85% of residents identifying English spoken at home.

In 2020 Bathurst Region LGA was estimated to be home to 43,996 residents, over 85% of whom live in the greater township of Bathurst (.id. 2021). Council's kerbside waste collection service is provided to over 38,000 residents. BRC undertakes the collection of Bathurst's red lidded general waste bins and JR Richards undertakes the collection of the yellow lidded recycling bins and lime green lidded food and garden waste bins. BRC's waste services smart device app supports waste communication.

1.3 BATHURST WASTE COLLECTION SYSTEM

Bathurst residents have a three 240L bin system which includes a weekly collection of the lime green lidded FOGO bin; a weekly collection of the red lidded (previously dark green lidded) general waste bin; and a fortnightly collection of the yellow lidded recycling bin. According to BRC's annual report 2020/2021, a total of 6503 tonnes of waste was redirected from landfill which includes 4,638 tonnes of food and garden organics and 1,864 tonnes of recycling (Bathurst Regional Council, 2021).

The 240L FOGO lime green lidded bin service, along with an 8L kitchen caddy was introduced to the township (excluding strata units) in April 2016 (Bathurst Regional Council, 2017). BRC delivered

approximately 30,000 new FOGO waste bins which helped in diverting 635 tonnes of food waste in the first two and half months of the three-bin system introduction (Bathurst Regional Council, 2017). However, the recent audit demonstrated that only 7-8.5% of food and garden waste was being recovered through this system (Just Waste Consulting, 2017).

To enhance the rate of FOGO waste diversion from the red lidded general waste bin, Bathurst Regional Council trialled a new model of domestic and commercial food waste collection within its local government area. The project entitled “Closing the Gap on Food Waste” had an objective to minimize the food waste going to landfill and turning FOGO material into organic compost, which significantly reduces greenhouse gas emission from landfill. For which, Council randomly selected 206 residential households to represent the maximum waste produced from domestic areas to obtain a conclusive result. Forty-five food premise businesses voluntarily participated in the trial to get an average weight of food and organic waste from these high wastage areas.



Figure 1 - Kerbside waste collection vehicles used during waste trial, Bathurst.

1.4 RATIONALE FOR THE RESEARCH

A driver for the system changes to the waste management services of Local Governments across Australia, are the targets and mandates set out by the State and Federal Governments. These are listed below:

NATIONAL TARGETS

- Ban the export of waste plastic, paper, glass, and tyres, commencing in the second half of 2020
- Reduce the total waste generated in Australia by 10% per person by 2030
- Reach 80% average recovery rate from all waste streams by 2030
- Significantly increase the use of recycled content by governments and industry
- Phase out problematic and unnecessary plastics by 2025
- Halve the amount of organic waste sent to landfill by 2030
- Make comprehensive, economy-wide, and timely data publicly available to support better consumer, investment, and policy decisions

RELEVANT STATE EMISSION TARGETS

- Net Zero Emissions from organic waste by 2030

STATE RECYCLING MANDATES (NSW WASTE AND SUSTAINABLE MATERIALS STRATEGY 2041)

- Set a goal to triple the plastics recycling rate by 2030, as set out in the NSW Plastics Action Plan
- Reaffirm our commitment to the goal of net zero emissions from organic waste by 2030, as laid out in the NSW Net Zero Plan Stage 1: 2020–2030
- Phase out problematic single-use plastic items
- Financial incentives for manufacturers and producers to design out problematic plastics
- Government agencies preference recycled content and invested in research and pilots for recycling innovation
- Introducing tighter environmental controls for energy from waste in NSW, with further consideration of planning and infrastructure needs underway
- Mandating the source separation of food and garden organics for households and selected businesses
- Incentivising biogas generation from waste materials

1.5 BEHAVIOUR AND BARRIERS

The attitude to people not using the correct bins before the trial was widely acknowledged as “this is how it’s always been, so why should I change what I have always been doing?” This sentiment along with others, were barriers faced throughout the project. One of the main interesting observations from the trial being the fact that many people did not realise that food waste could be placed into the lime green lidded bin. Many people do not have knowledge of the array of items that can be placed into the lime green lidded bin such as newspaper, paper towel and compostable packaging. These materials are often found in the yellow lidded recycling bin and show that people are not using their lime green bin to its full extent, not on purpose but due to lack of knowledge. This is an indication that Council needs to invest in more waste education to ensure the entire community is aware of this going forward, to be able to reach the 2030 landfill diversion targets.

The pre-trial survey also indicated that the respondents find separating their waste “too time consuming” and the odour of food waste decomposing in the red bin as unpleasant.

A barrier that was encountered throughout the trial was in relation to recording the participants answers to the pre, mid, and post-trial surveys as there were many that were returned past the deadline therefore their responses could not be included in the overall data.

Along with the challenge of aiming to alter the participant’s behaviour for the better, there were also some barriers with a positive sentiment. Some people in the community heard about the trial and called Council volunteering themselves to participate. It had to be explained that the trial areas were randomly selected and due to the trial design and data collection, Council could not add more participants to the trial.

Another barrier in regard to a positive response was participants who were given a caddy and liners phoning Council wishing to collect more liners as they had run out. As this was great to hear those participants were diverting so much waste they needed more liners, Council was not able to provide these due to the limited stock.

It is important to note that it is often easier to implement one change such as changing bins to a fortnightly collection, however enforcing a complementary action such as using a caddy and liners as well can be challenging as people often think that one change in behaviour is adequate.

It is clear that the trial challenged the participants and forced them out of their comfort zone at times. Adapting to change in behaviours that have always been the same will only be achieved with extensive community education along with an overall change to the townships waste collection system.

The pre-trial and post-trial data signifies that there is a need for more FOGO education in Bathurst, but also that there is a want from the community in which the trial sparked many questions in relation to “what exactly can go into each bin?” With the lack of widely available FOGO information, people tend to guess which coloured bin they place their items into and feel that is enough.

Re-introducing a caddy and liners to each household is a mechanism to encourage people to do the right thing. It is inherent human nature to “want to do good”, leading people to feel good when they know they are doing the right thing, playing their part in helping their town and the environment. Whilst there are many people in the Bathurst community who are already doing the right thing, a collective change has the power to make a magnitude of difference and achieve the 2030 goals.



Figure 2 – Organic waste green lid bins.

1.6 COVID-19 AFFECTING THE PROJECT TRIAL

The trial was on track until COVID Stay-At-Home orders were introduced for Regional NSW on the 14th of August 2021. The closure of dine in food businesses reduced the food waste generation by approximately 25% whereas kerbside waste from households increased dramatically.

Similarly, with the compositional analysis, approximately 20% of total waste was analysed from each trial area at AUDIT 3 due to COVID whereas during AUDIT 1 and AUDIT 2 about 40-50% of total waste was classified. Moreover, visual analysis for calculation of fullness and contamination for AUDIT 3 trial area bins were not undertaken. However, a drive-by of the trial areas was completed to count the presentation rate of the bins.

In conjunction with the many issues encountered with COVID, the Bathurst Waste Management Centre had to close to the public on the 12th of September as a close contact was identified within the staff members. This caused major implications to the operations of the centre and thus, impacted the progress of the trial with trial area waste collections paused for a week.

After a week of taking all COVID safety measures and a shift in NSW Health advice, the trial waste collection started again, and the trial resumed to its normal pace as was before the outbreak.

1.7 LIMITATIONS

The limitations which had to be considered throughout the project and affected aspects of the trial to achieve the end goal included:

SAMPLE SIZE IN AUDITS AND HOUSE SELECTION

The sample of households randomly selected for this study was specifically in the Bathurst township with 206 residential houses chosen. Due to the project timeframe and budget, the randomised selection focused on streets instead of individually nominating houses around the town. The research in the small demographic yielded statistically significant results obtained through the surveys and compositional analysis. The amount of people dwelling in each household also provided practical limitations as not every household was the same.

TIME FRAME FOR SURVEY DATA COLLECTION

All selected households received 3 surveys during pre-trial, during and post-trial period. Similarly, businesses received 2 surveys at the beginning and end of the trial. The surveys were requested to be returned to Council either through email or posted back to Council in a pre-paid envelope provided. Most of the surveys were returned within 2-3 weeks which were counted for data analysis, but some were returned after 6 months of the surveys delivery which had to be discarded. To maintain the survey result status, a deadline was set after which responses were not counted for analysis, but the major comments were considered.

VISUAL ANALYSIS FOR BIN CONTAMINATION



Figure 3 - General waste red bin used during trial and bagged food waste as a contaminant in red bin during visual audit

The contaminants during the kerbside spot bin analysis were estimated by looking under the lid of the bin to view its contents, however there was the possibility of having more contaminants inside the bin. In some cases, a long metal rod was used as a “bin picker” to view the certain contaminants underneath the surface rubbish but in terms of bagged waste, it was categorised as “Bagged Rubbish”, “Bagged Recycling” and “Bagged Food Waste” based on incorrect use of the bin and bags. The project included many visual analyses recording the fullness, presentation, and contamination of the red, yellow, and lime green bins. This was undertaken as a tool to help recognise the main contents of the residential bins and help guide sustainable waste management in the Bathurst region.

When food waste contaminants were found in the red bin a red tag was applied to the bin stating ‘this bin is contaminated’, and a green tag was applied to advise where the food waste should be placed.

2 BACKGROUND

2.1 ALTERNATIVE FOGO OPERATIONAL SERVICES

No standard waste management service exists for councils across NSW and Australia relative to population density and dwelling type. Financial limitations and community perspectives have resulted in a mixture of waste services being provided by Councils across Australia.

With introduction of organic services predominantly garden waste only, there has been a concurrent rise across Australia with approximately 10% of the local government areas offering a FOGO service to households. However, it is known that waste behaviours need to be changed to drive residents to use these new services. This has been demonstrated with low uptake of many FOGO soft launches from existing GO services.

Currently, 43 out of 128 councils in NSW have implemented FOGO collection services, supported in part by the EPA's *Organics Collection Grant*, which offers up to \$1.3 million for councils implementing garden only (GO), food only (FO) or combined food and garden organics kerbside collection services. From the over 50 FOGO services that are in operation across Australia, there exists a wide range of how these services are provided/launched. The most common variations are in bin sizes, collection frequency and provisions of caddies and liners.

It is known that all these factors appear to have an impact on resource recovery rates, but little data exists on the combination effects and impacts on other services as a majority of the data exists only in the form of resource recovery rates¹. Meta analysis of available data from New South Wales and Victorian LGAs 2018-19 financial years indicates that transitioning from weekly to fortnightly general waste shows an increase in average resource recovery from kerbside collections. While changes to a 120/140L does appear to show a slight increase in diversion the data at the present is not significantly different from that of the 240L services.



Figure 4 - Council waste collection and at-home caddy use

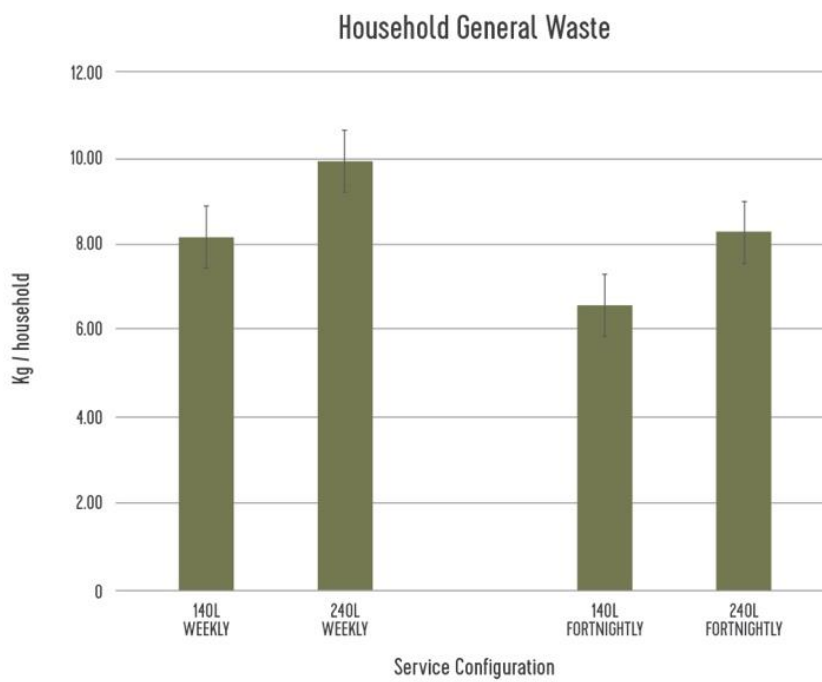
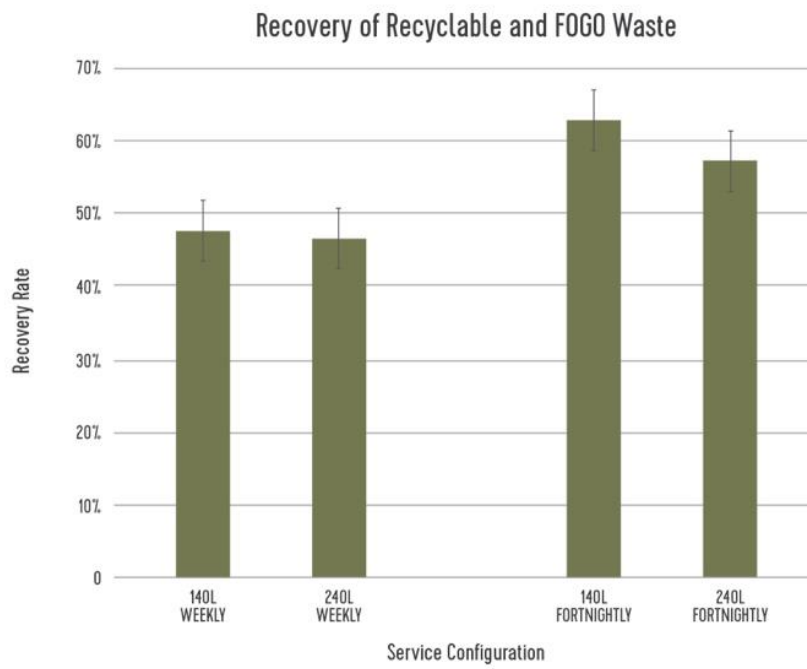


Figure 5 - Meta analysis of NSW EPA and Victorian Waste data on councils with FOGO services (2018/2019 data)

$$Resource\ recovery\ rate\ (\%) = \frac{Weight\ (Tonnes\ of\ material\ recycled-composted\ within\ LGA)}{Weight\ (Tonnes\ of\ material\ collected\ within\ LGA)}$$

Several councils have adopted to undertake the provision of caddies and liners with the launch of their FOGO services. BRC provided caddies upon the launch of the FOGO service to properties in 2016 but opted against provision of compostable liners.

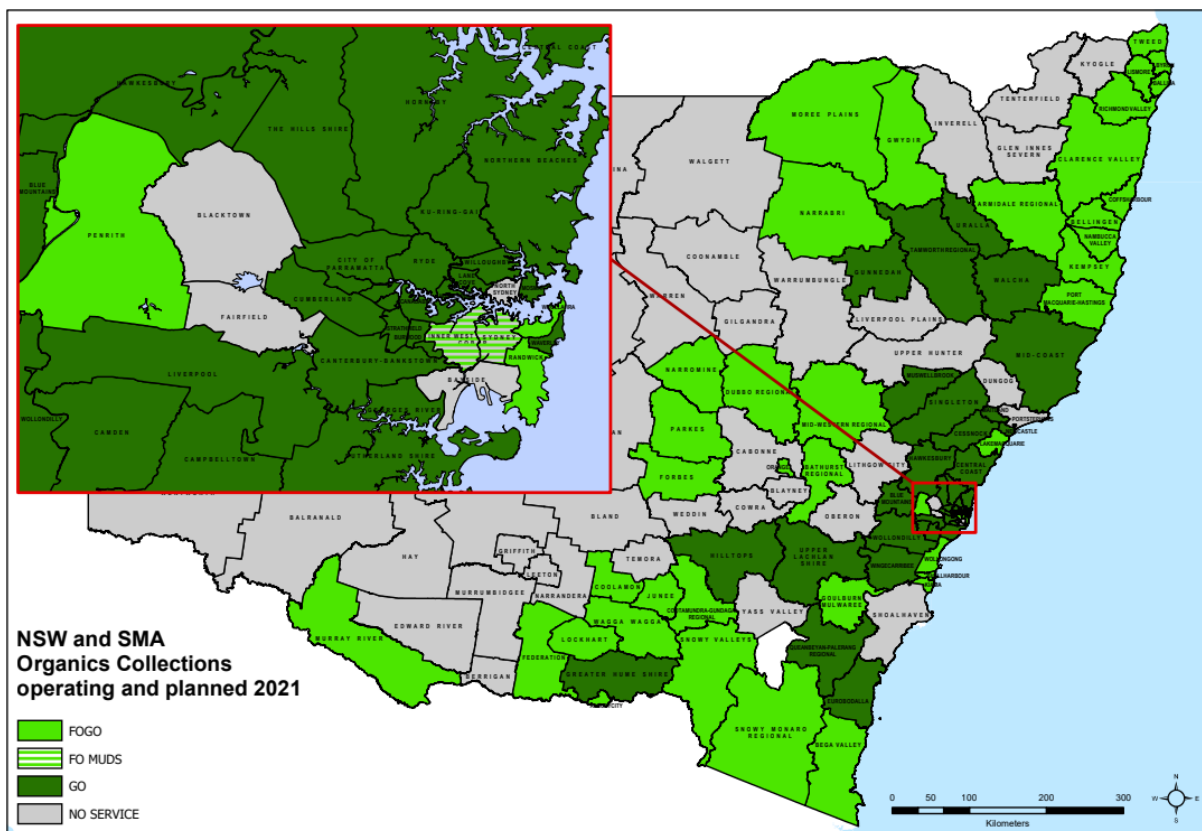


Figure 6 - NSW Organics Collection Services map. Obtained from EPA 2021.

As little data is publicly available on the impact of the provision of caddies and liners, only assumptions can be made as to their impacts thus far. Although available information does appear to indicate some positive increases to diversion with the provision of caddies and liners.

2.2 FOGO KERBSIDE COLLECTION – NSW CASE STUDIES

2.2.1 BEGA VALLEY SHIRE

Bega Valley Shire Council implemented a FOGO kerbside collection service in October 2018. The implementation was supported by an education campaign tagged ‘WTF – Waste ... The Facts’ with the dual impact of attracting attention and informing the local community on how to properly separate their food waste.

The changes to the kerbside collection service involved adding food to lime green (organic) bins provided to 13,000 urban households and changing their collection frequency from monthly to weekly. In addition, the 140L red (general waste) bin had its frequency changed from weekly to fortnightly. For residents living in multi-unit dwellings, specialty FOGO collections were provided.



Figure 7 - Changes to Bega Valley Shire's kerbside bin collection service

The education campaign included the production of *'The FOGOmentary'*, a 30-minute filmed documentary featuring local school children explaining what could go in the new bins. The documentary featured *Gardening Australia* host Costa Georgiadis, and the documentary premiered at a red-carpet event attended by 500 people. The *FOGOmentary* provided the basis for accompanying TV and social media campaigns, which primarily featured the region's children.

The social media campaign included the creation of the *WTF: Waste the Facts* Facebook page, providing information about the changes to collection services, maintaining an upbeat tone. Reception of the social media campaign was positive by the residents, who were able to have their questions asked by the page and fostered community engagement.

Information was also distributed via a dedicated FOGO webpage and an existing Bega Valley Waste app. The app provided personalised bin collection calendars with optional bin day reminders, notifications from the council regarding waste information, forms to request additional bins, and both a quick guide to kitchen bins and an A-Z list of materials and how to dispose of them.

Prior to the launch of the FOGO service, the Council delivered kitchen caddies, compostable liners, and an information pamphlet to 13,000 participating households. The launch was also paired with a dedicated *Green Team* hotline number, set up to respond to enquiries, receiving 600 calls, far fewer than anticipated, attributed to the comprehensive media campaign leading up to the launch.

After the rollout, the council continued to engage with the community through social media, hosting Facebook live events with Bega Valley Mayor Kristy McBain, organics processing staff and members of Rotary and schools.

Bin audits conducted before the implementation of the service showed that food and garden waste constituted 40% by weight of the contents of red bins going to landfill. In the first six weeks post-launch, there was a 27% reduction in household waste going to landfill, and a 0.6% contamination rate of the FOGO bins by week 3. Compost created by collected FOGO is available for purchase by the residents, with demand high enough that supplies regularly sell out.

2.2.2 KEMPSEY SHIRE

Following a FOGO collection trial in 2014, Kempsey Shire introduced a new FOGO collection system in 2017, noting a marked improvement over the trial. The changes to the collection service included an increase in red bin size from 140L to 240L, with an accompanying change in frequency from weekly to fortnightly. The lime green lidded bin was changed in collection frequency from fortnightly to weekly to accommodate the increased amount of waste being diverted to these bins. All households were provided with the option to downsize their red and green bins to 140L at a reduced cost to the resident, while the yellow bin (recycling) had the option to be upsized to 360L at an increased cost to the resident.

This collection service was paired with a community education program branded *Sort & Save* supporting the roll-out. Educational activities included local newspaper and radio advertising, distribution of printed material, social media campaigns and detailed information on the council's website. In addition to published materials, the council also ran community outreach activities at events, shopping centres and rural locations

It was noted that immediately post-launch the council received some negative feedback from residents, however, the overall community response was largely positive, which was attributed to the council's effective education campaign. The campaign began months before the service change and considered experiences from neighbouring councils.

The changes to the red bin collection from weekly to fortnightly meant residents needed to conserve bin space. The bin change paired with extensive information campaigns encouraged households to re-evaluate their daily practices and change their waste management behaviour.

Following the roll-out of the new FOGO service, there was an observed increase in Kempsey Shire's diversion rates by 15%. An audit performed in October 2017 in areas covered by the new collection service found that:

- The average household put 15.4 kilograms of FOGO into their kerbside bins each week
- 59% of food waste was being recovered in the organics bin
- 78% of loose food waste was recovered in the organics bin
- Contamination in organics bins was low at 1.5% by weight

It was found that Kempsey Shire Council's new service has:

- Reduced the cost of the waste levy on the local community
- Extended the life of the local landfill
- Reduced landfill air and water pollution as a result of less food and organic matter going to waste, including a reduction in methane production



Figure 8 - Changes to Kempsey Shire's kerbside bin collection service

2.2.3 LEICHHARDT COUNCIL

Leichhardt Council (in 2016 Leichhardt Council merged with Ashfield and Marrickville Councils to form the Inner West Council) introduced a FO recycling collection service in 2008, following a three-month trial in 2007. In addition to having implemented the service for over a decade, the changes to Leichhardt's kerbside collection primarily affected multi-unit complexes and represents the differing challenges of changing kerbside collection depending on the type of residence and resident demographic.

Following the three-month trial in 2007, the then Leichhardt Council introduced a FO recycling collection service to multi-unit dwellings of 10 or more units who shared their bins. The following items were given to each household in the unit complex:

- A benchtop bin with side vents
- A pack of 150 biodegradable corn starch bags (sufficient for one year's use)
- An educational brochure and information sheet

For every 10 households in a complex, the council supplied one 240 litre maroon-lidded bin solely for collecting food organics which was collected weekly.

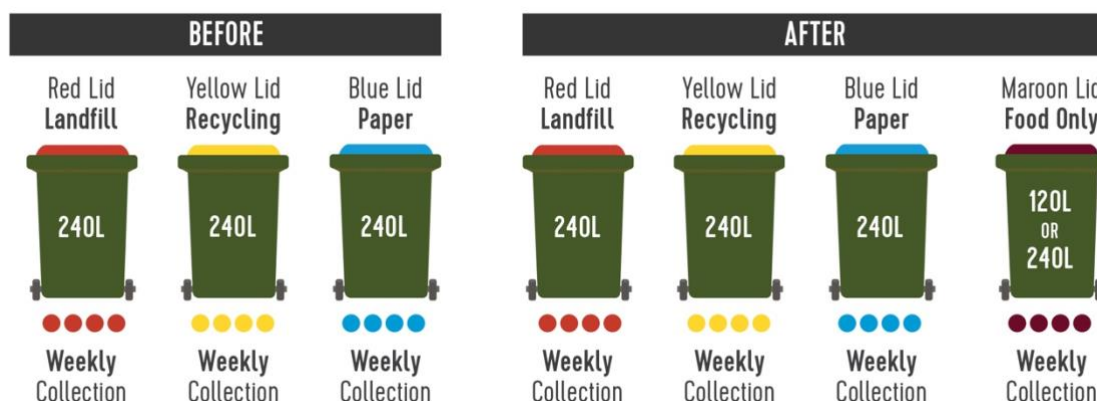


Figure 9 - Changes to Leichhardt Council's kerbside bin collection service in multi-unit dwellings of 10 or more units

The council commissioned a review to their food recycling service to identify barriers residents faced in utilising the new system. There were 43 recommendations provided by the report, including:

- Reviewing the kitchen caddy design because the vented bins leaked
- Increasing the frequency of compostable bag delivery
- Creating clearer communication material and more effective messaging
- Compiling briefing sheets for cleaners in multi-unit dwellings who might not be familiar with the FO separation service

Following these recommendations, in 2014 the council implemented newly designed kitchen caddies and arranged quarterly delivery of slim-line compostable bags in a pack that could be posted into letterboxes. Branded signage was also developed showing what could go into food bins and designed to be placed on noticeboards, stairwells, lifts, and bin rooms.

Residents were door-knocked in the early evening and offered a household kit that included the new caddy, a pack of compostable liners and a flash card showing what could be put into the bins. Residents were also invited to give feedback to the council.

The changes made to the service were met with positive reception from residents, describing the changes as 'fantastic initiatives' and that they were 'excited to have a new style kitchen bin'. Another household who described the older-style caddies as 'not effective' stated that 'the new bin looks much sturdier' and would try the system again. Building and strata managers of several blocks who had requested the removal of the maroon-lid bins were provided with the option to select smaller, non-vented 120L maroon-lidded bins if they had low user participation.

The door-knocking campaign resulted in the delivery of 3,500 bin and education kits delivered to units and more than 500 residents participated in conversations about the scheme. Audits following the campaign showed the average weight of food organic waste separated doubled, from 6 kilograms in 2014 to 12 kilograms in 2016. Four of the 21 blocks are recovering more than 80% of their food waste (EPA NSW 2021).

Resident feedback about the service included comments such as 'very positive – whole building excited about the food waste service' during the door-knocking campaign. This highlights the social potential of the scheme to bring neighbours together around the daily act of food recycling. Future

directions of the scheme include utilising information gathered from strata and building managers to further optimise the service, including information on bin bay rooms to assist with future mailout communication, and developing a more comprehensive understanding of the issues and relationships contributing to the food organics program success.



Figure 10 - Example of updated education material sent to households in Leichhardt

2.3 ANALYSIS OF NSW FOOD AND GARDEN BIN AUDIT DATA

In a report conducted by Rawtec, an analysis was conducted on data from 38 NSW councils who had implemented a household FOGO collection scheme (Rawtec 2020). The purpose of the report was to measure the efficacy of a range of service configurations including bin size and bin collection frequency. Table 1 shows the 6 configuration details measured and their performance with regards to their diversion efficiency and garden organics in residual waste bins.

Table 1 - Average garden organics in FOGO bins, residual waste bins and total (kg/hh/wk), diversion efficiency (%) by configuration. Range of values (min - max) provided in brackets. Obtained from Rawtec (2020)

Configuration	Garden organics in FOGO bin (kg/bin/wk)	Garden organics in residual waste bin (kg/bin/wk)	Total garden organics (kg/bin/wk)	Average Diversion Efficiency (%)
Configuration 1: FOGO fortnightly and small residual waste bin (120/140L) weekly	NA	0.01	NA	NA
Configuration 2: FOGO weekly and small residual waste bin (120/140L) weekly	12.50 (3.21 – 19.32)	0.25 (0.15-0.43)	12.75 (3.38 – 19.75)	98% (95% - 99)
Configuration 3: FOGO weekly and large residual waste bin (240L) weekly	15.04 (10.66 – 19.42)	0.97 (0.59 – 1.35)	16.01 (12.01 – 20.01)	94% (89% - 97%)
Configuration 4: FOGO weekly and small residual waste bin (120/140L) fortnightly	11.05 (0.94 – 23.5)	0.14 (0.01 – 0.47)	11.20 (1.06 – 23.67)	99% (89% 99.9%)
Configuration 5: FOGO weekly and large residual waste bin (240L) fortnightly	11.40 (8.66 – 13.21)	0.20 (0.1 – 0.64)	11.60 (8.82 – 13.59)	98% (95% - 99%)
Configuration 6: FOGO weekly and residual waste Other (user select bin size and/or frequency)	7.15 (3.31 – 11.25)	0.14 (0.02 – 0.3)	7.29 (3.15 – 11.32)	98% (97% - 99%)
All Configurations	10.86 (0.94 – 23.5)	0.21 (0.01 – 1.35)	11.08 (1.06 – 23.67)	98% (89% - 99.9%)

Key findings from the report were as follows:

- 44% of available food waste (1.45 kg/bin/wk) was diverted from landfill across the audited councils. This performance ranged significantly from 5% to 78%
- The average food efficiency across configurations ranged from 14% to 57%
- In general, councils providing fortnightly residual waste collection achieved higher food waste diversion efficiencies compared to those on a weekly service
- In general, councils providing smaller residual waste bins (120/140L) achieved higher food waste diversion efficiencies compared to councils with larger residual waste bins (240L)
- Performance can vary significantly by council within a service configuration. Therefore, service configuration is not the only contributing factor to food waste diversion performance.
- On average, longer established FOGO services performed better (46% for >1 year) than less established services (34% for those <1 year and 28% for those in the trial period). Performance was found to vary across councils with the same length of service or with the same service configuration
- Other factors, such as waste education are expected to be important for influencing food waste diversion outcomes.
- Anywhere from one third to three quarters of residents are not diverting any food waste and less than one third of residents are contaminating FOGO bins. Tailoring education campaigns to focus on these individuals may be more effective than continuing broader interventions targeting all residents.

2.4 ENCOURAGING WASTE SEPARATION BEHAVIOUR THROUGH EFFECTIVE EDUCATION

A key feature of many FOGO schemes implemented by NSW councils is that of education interventions. It is important to highlight that an effective food waste recycling service is the combination of a simple, non-disruptive service configuration in addition to effective messaging and education. In Leichhardt council, for example, limited success was achieved by their FO collection scheme during the initial 2008-2014 period (EPA NSW 2021). Following a commissioned review into methods of improving their scheme, it was highlighted that residents who stopped separating their food waste were unsure of what could be put into the bins, and that clearer messaging and more educational materials were required. Following a concerted door-knocking campaign, and the production of high-quality printed material, a marked increase in participation and food separation was observed.

The dangers of poorly implemented educational materials can be observed in literature surrounding the encouragement of individual waste separation behaviour. A case study in Swedish households, conducted by Bernstad (2014) investigated the effects on food waste separation by providing kitchen caddies for FO waste, in combination with the provision of informational pamphlets. The associated education campaign, called '*Around again*', focused on the environmental benefits of FO separation, noting that the amount of biogas which could be produced by the yearly FO waste separated by a single household was sufficient to drive a car one and a half laps around the earth. In addition to 'how-to' information outlining what could be put into the kitchen caddy, the brochure focused on environmental gains, describing the process of nutrient-recycling through anaerobic digestion and how the process could transform food waste into biogas as a substitute to fossil energy.

It was found that the distribution of this written information amongst households did not result in increased source-separation or long-term increases in the amount of separately collected household food waste. It was noted that this result contradicted previous studies which highlighted the importance and effectiveness of education and awareness raising on enhancing the performance of recycling services. The conclusions reached by the authors was that the campaign failed to engage the participants of the study. It was hypothesised that the focus on environmental messaging which related food waste to equivalent driving distances overestimated the background knowledge of the receiver. It was also suggested that the scientific language used in the pamphlets may have resulted in language difficulties for ethnically diverse households, and that the messaging used was ambiguous. Finally, the authors suggest that a single written pamphlet delivered at the start of the trial could have been insufficient in fully engaging and educating the trial participants, noting that the use of mass media could have improved the efficacy of their campaign.

The challenge of developing effective educational materials which promote pro-environmental behaviour has been investigated in the fields of environmental psychology and behavioural economics. There have been numerous studies within psychology research evaluating how and why informational interventions, such as those used in environmental campaign, succeed, or fail in changing behaviours. In a study conducted by Linder et al. (2018)(Linder, Lindahl, and Borgström 2018), informational pamphlets were designed based on the established framework and principles of community-based social marketing. In explaining their theoretical framework several key points were identified:

- The use of descriptive norms (the perceptions of which behaviours are typically performed) are more effective than injunctive norms (the perceptions of which behaviours are typically approved or disapproved of). For example, one study found that the slogan “Join your neighbours in conserving energy” was more effective than the more commonly used “Protect the environment by conserving energy” or even the self-interested “Save money by conserving energy”(Nolan et al. 2008)
- The more ‘local’ and specific the descriptive norm, the more effective. For example, a campaign used in a hotel to promote reusing towels is more effective with a message such as “The guests in this room tend to reuse the towel” rather than “The guests in this hotel tend to reuse their towel”(Goldstein, Cialdini, and Griskevicius 2008)
- The misuse of norms, and the dogmatic application of one type of norm over another, can generate unwanted backlash effects if perceived of as condescending or patronising, even increasing the behaviour the intervention was designed to prevent. (Cialdini 2003)

In applying these principles, the prominent theory in the promotion of pro-environmental behaviour is community-based social marketing (CBSM). CBSM has its roots in social marketing and seeks to influence behaviours that benefit individuals and communities for the greater social good.

There is a significant body of literature supporting CSBM as an effective framework for designing environmental interventions, such as promoting back-yard composting, reducing travel by car and increasing curb-side recycling rates (McKenzie-Mohr 2002). CSBM presents five steps to promoting behavioural changes:

1. Selecting behaviour
2. Identifying barriers and benefits
3. Developing strategies
4. Piloting
5. Broad-scale implementation

Linder et al. implemented informational pamphlets designed following CSBM principles to investigate the promotion of food waste recycling in urban households, in a longitudinal field study. The pamphlet was three-pages long, and the design of the front-page pamphlet can be seen in Figure 11. The pamphlet included the following key features:

- The descriptive local norm of “Join your neighbours in Hovmästargatan, recycle your food waste.”
- Prominently featuring an image of the provided kitchen caddy, addressing the identified barrier of the residents’ failure to identify the new sorting station.
- Vivid, tangible examples of the benefits of food waste recycling:
 - *“If all households in Hökarängen would sort their food waste it would be enough biofuel to support 15 garbage trucks for a year”*
 - *“A bus can drive 2.5 km on only one bag of food waste”,*
 - *“Every Swede produces on average 100 kilos of food waste per year”*
- Addressing the identified communal attitudes towards the issue of food waste, to align the participants with the community injunctive norms
 - *“In a survey recently sent out to households in Hökarängen around 8 out of 10 residents stated that they considered recycling food waste to be “very important”*
- In addressing the barrier of inconvenience, the pamphlet highlighted the included recyclable garbage bags provided to trial participants.

The results of the study indicated a statistically significant increase in food waste collected of 12.32kg collected per station every two weeks (an increase of 26%), compared to the control group. The study also found that the average amount of all household waste decreased in the intervention group by 212.9 kg per station compared to the control group (a decrease of about 48%). The longitudinal study revealed that while the benefits of the trial attenuated over the two years of the study, there was still a statistically significant difference between the control and trial groups and evidenced the success of the informational intervention.

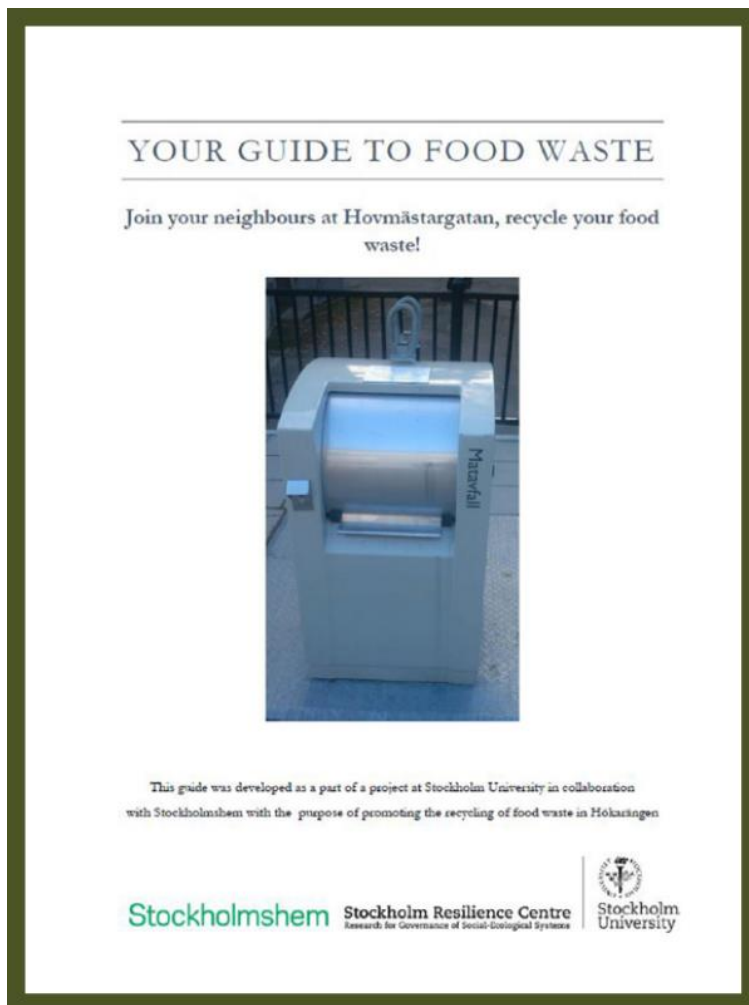


Figure 11 - The front page of the information leaflet (translated from Swedish) used in the study by Linder et al. (2018) (Linder, Lindahl, and Borgström 2018)

The conclusions of both Linder et al. (2018) and Bernstad (2014) is that there should be significant emphasis placed on the careful design and execution of any informational campaign used to promote the separation of food waste. There should be a focus on utilising existing community relationships and the principles of community-based social marketing in developing an accompanying educational campaign. A poorly designed educational intervention may result in minimal or even negative effects on the adoption of a new food waste collection service, while a well-designed campaign can significantly enhance the promotion of pro-environmental behaviours. As evidenced by the door-knocking campaign utilised by Leichhardt Council, an effective CBSM intervention can even reinvigorate a community's participation in a food waste separation service, years after initially being implemented (EPA NSW 2021).

3 METHODOLOGY

3.1 RESEARCH AREA SELECTION

Over the period of the four-month trial, households were randomly selected with the option to not participate for medical reasons or have alternative options provided for large families. With the businesses, information was provided to the owner or manager to willingly participate in the research project. The detailed selection procedure of the households and businesses are explained below:

3.1.1 HOUSEHOLDS

To represent the variation across Bathurst residences, seven different trial areas were randomly selected. IntraMaps was used to select sites, with three different potential sites selected for each trial area. After a site inspection of the 15 potential sites, 7 trial areas were chosen with 206 houses based on street accessibility, suburb, waste collection days and number of houses/units in the location.

With an aim to forecast a suitable and sustainable waste management system for Bathurst, seven different research measures with seven different trial areas were planned. The changes were made to waste collection weeks, size of bin and providing caddies with liners to research suitable waste management for Bathurst residents.

Table 2 - Trial areas with major changes for this project

Trial Areas	No. of households	Waste Collection Day	Caddy and liners provided	General waste bin size	General waste collection frequency
1	58	Monday	Yes	240L	Fortnightly
2	22	Tuesday	Yes	140L	Fortnightly
3	27	Wednesday	No	140L	Fortnightly
4	31	Thursday	No	240L	Weekly
5	25	Friday	No	240L	Fortnightly
6	20	Friday	No	140L	Weekly
7	23	Tuesday	Yes	240L	Weekly

3.1.2 BUSINESSES

Businesses participation for the project was voluntary. To get the retailers attention, Council officers hand delivered a flyer and provided detailed information on the FOGO service. Additionally, expression of interest for the participation in the project was advertised on Bathurst Business Chambers newsletter and others. The targeted commercial areas were food businesses but businesses including a florist and a childcare centre were highly interested to be a part of the research project.

For businesses, a 60L kitchen insert bin and 140L lime green lidded kerbside bin were provided to collect the food and organic waste produced from the food premise kitchen and customer's plate. Bin liners were not provided for the 60L kitchen bins, as hospitality food waste can be quite dense, which would have caused the liners to break. Businesses were given the option on the number of bins they required and pickup days which would work the best for their business. Kerbside bin collection was

based on size of the businesses, some businesses opted for a single day service in a week, whereas some businesses chose an everyday service.

3.2 HOUSEHOLD COMPOSITIONAL ANALYSIS/AUDIT

The compositional analysis took place three times during May, July-August, and October 2021. NSW EPA Guidelines were used to collect data from the selected sites general waste bins. All samples were collected and dropped in one pile at Bathurst Regional Council's Waste Management Centre. The samples were loosened using litter collection tools. Waste was sorted into 60L and 45L buckets and weighed on a commercial weighing scale. Waste material from 7 different sites were segregated and classified according to Table 3. To gather accurate data within the time limit, the sample pile was divided in half to undertake the audit to capture the maximum representation of recyclable, FOGO and general waste items.

Additionally, the sample waste data collected from the residences did not include any of the household's personal information, which was highlighted to the participants.

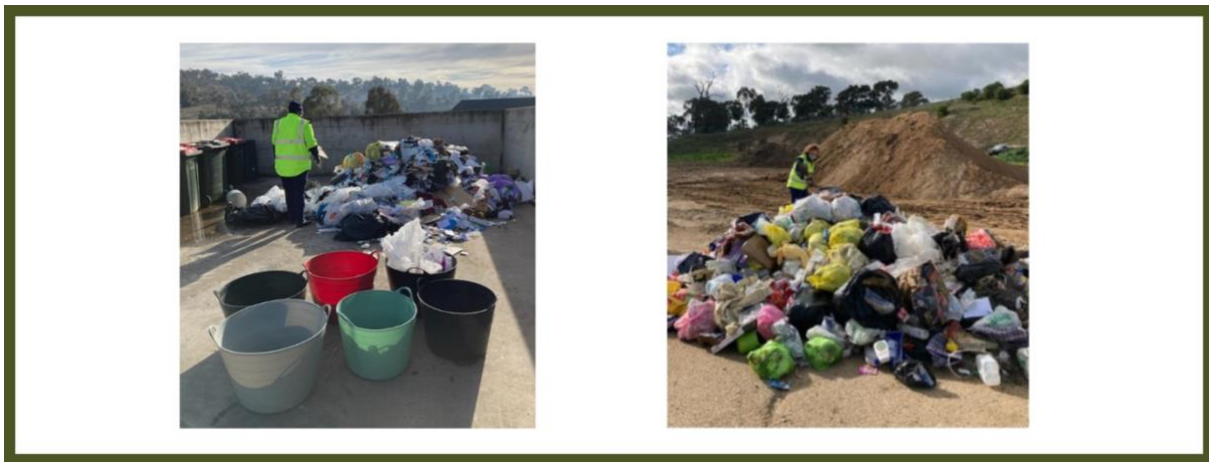


Figure 12 -Waste sorting in progress

Table 3 - A list of items sorted during each compositional analysis

	Items	Waste Type
1	Cardboard & Paper	RECYCLABLE 
2	Plastic	
3	CRS Plastic	
4	Glass	
5	CRS Glass	
6	Aluminium Can	
7	CRS Aluminium	
8	Metal	
9	Soiled Cardboard & Paper	FOGO 
10	Food	
11	Food in Packaging	
12	Garden	
13	Compostable	
14	Ash	
15	Animal Waste	
16	Tetrapak	General Waste 
17	Nappies	
18	Textiles	
19	Soft Plastics	
20	Polystyrene	
21	E-waste	
22	Treated Timber	
23	Non-R Glass	
24	Non-R Plastic	
25	Chemical	
26	C & D Waste	
27	Residual	

3.3 HOUSEHOLD PRESENTATION AND FULLNESS OF THE BIN

The kerbside bins of seven selected areas were inspected approximately five times during the period of the project to record the presentation and fullness in the yellow, green, and red lidded bins. The bins were inspected and analysed before kerbside collection was undertaken by Bathurst Regional Council and JR Richards. In each spot bin analysis, a visual top view inside the bin was analysed and recorded. Presentation data includes the number of bins presented in the kerbside on its waste collection day. Fullness of the bin was also recorded by visually estimating the percentage of the bin filled with waste material in both 140L and 240L bins. While having presentation and fullness of the bin observed, the major contaminates in each bin were recorded as well.

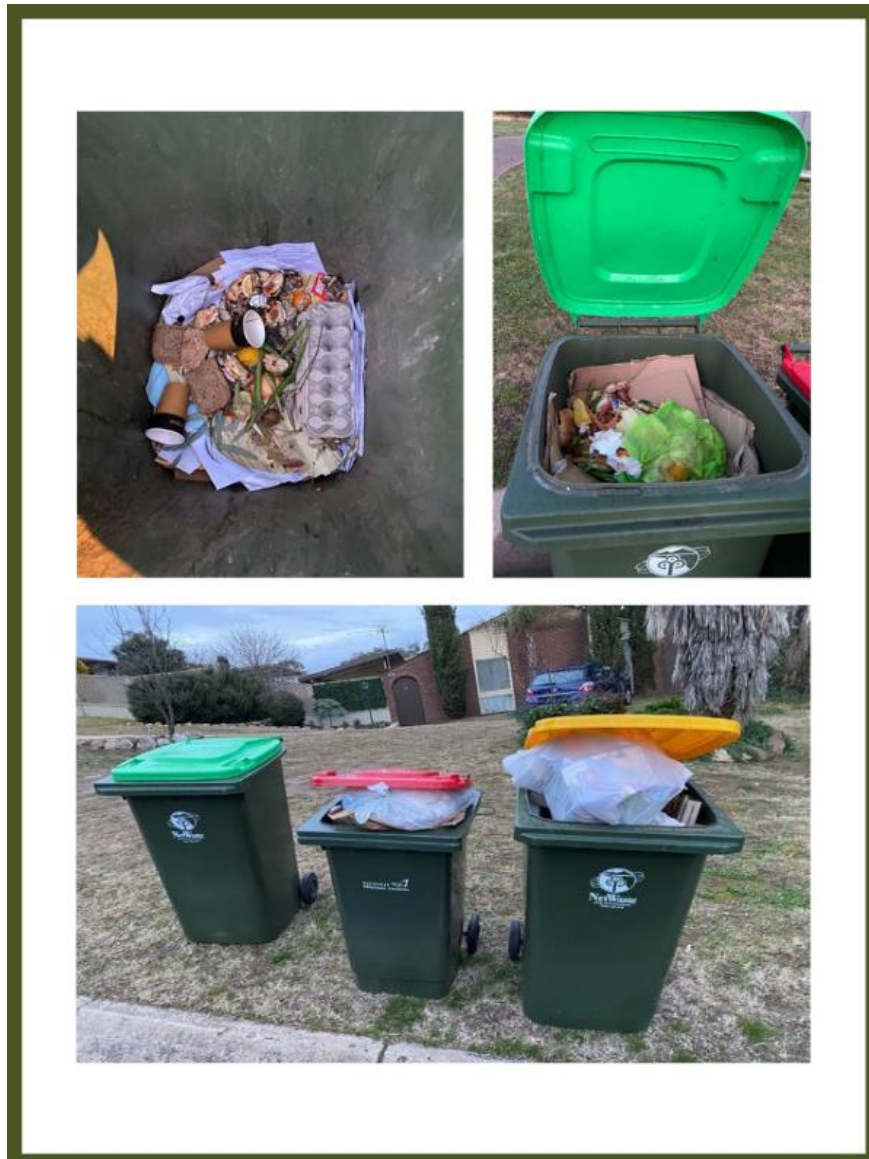


Figure 13 - Bin presentation and fullness

3.4 BUSINESSES DATA ANALYSIS

Data collected from the domestic trial was largely based on compositional analysis, presentation rate and fullness of the kerbside general waste bin. Whereas the data collected from the commercial trial was based on the tonnages collected from the participating businesses green bins per day. With collection of this data, the diversion rate of food waste from landfill was calculated. The data analysis was used to predict the total amount of food waste that could be diverted from landfill per annum if all of the food businesses in Bathurst were provided with a FOGO service. The predicted greenhouse gas (CO₂-e) emission savings have also been calculated. Australia's National Greenhouse Accounts Factors (NGA): 2020 was used for the conversion of tonnages into CO₂-e (as seen in Table 4 below).

$$\text{GHG emissions (t CO}_2\text{-e)} = Q_j \times \text{EF}_j$$

Q_j is the quantity of waste by type j

EF_j is the emission factor of waste type j

Table 4 - Waste to CO₂-e Conversion Factor (DISER 2020)

Waste types	Default DOC proportion	Conversion factor CO ₂ -e (t=tonnes)
	A	B
Food	0.15	t × 2.1
Paper and cardboard	0.4	t × 3.3
Garden and green	0.2	t × 1.6
Wood	0.43	t × 0.7
Textiles	0.24	t × 2.0
Sludge	0.05	t × 0.4
Nappies	0.24	t × 2.0
Rubber and leather	0.39	t × 3.3
Inert waste (including concrete/metal/plastics/glass)	0	t × 0
Alternative waste treatment residues	0.08	t × 0.7

3.5 USER GUIDE PAMPHLET DESIGN

An A4 double sided FOGO User Guide was given to those areas selected to receive a caddy and compostable liners for the trial, see Appendix F: FOGO User Guide. The guide was designed to be bright, engaging, and informative, highlighting facts specific to Bathurst, and waste tips to ensure utilising the caddy was an easy stress-free process with "How to use FOGO in 3 easy steps!" Positive feedback was received regarding the User Guide as many residents voiced that they did not previously know what items could and could not go into the FOGO bin. Council's contact information was placed on the bottom of the second page to allow trial participants to call if they had any further questions about how to use the FOGO caddy or lime green lidded kerbside bin.

3.6 SURVEY DESIGN

Surveys were provided to each participating household three times throughout the trial: pre-trial, mid-trial and post-trial. The surveys were undertaken in a “mixed response” format of ticking a box or providing a written response to capture qualitative and quantitative data. The surveys were administered by a mailbox drop to the 7 trial areas (total of 206 households). The method of hand delivery was chosen for the purpose of interacting with the participants if they were present at the time of delivery and give the option of speaking through the survey questions with them, which some opted to verbally supply the answers while a Council staff member filled out the survey. All surveys were delivered with a pre-paid envelope with a handwritten return address to the Waste Management Centre.

The purpose of the pre-trial survey was to establish demographic details such as household size, personal estimations of food waste production and perceptions of the importance of food waste separation, as well as identify the participants behaviours before the trial began. See Appendix 7.9.1 for a copy of the survey.

The objectives of mid- and post- trial surveys were to quantify sentiment regarding enthusiasm of participation in the trial and confidence in knowledge of how to properly separate waste. The mid- and post- trial surveys also allowed the monitoring of potential issues about the experimental set-up, such as the ease-of-use, cleanliness, and utility of the kitchen caddy. See Appendix 7.9.2 and 7.9.3 for a copy of the survey.

Whenever applicable, survey responses were presented in the form of a statement, allowing the participants to select from the following responses: strongly disagree, agree, neither agree nor disagree, disagree, strongly disagree. This allowed for the quantification of specific responses. Responders were also given the opportunity to write longer responses to certain questions, such as identifying and explaining any barriers to use for the kitchen caddy, and what changes they would like to see to the informational pamphlets.

Changes to the survey depending on the specific service configuration of the trial area needed to be made. For example, trial areas 3-6 were not provided with a caddy and therefore questions involving the caddy were removed, while trial areas which had their collection frequency of bin size altered had added questions about capacity issues with their bins.

Surveys were printed and delivered via mail, and responses were submitted via mail or email. Any further questions or feedback at any point in the trial were also received via email and phone.

4 RESULTS AND DISCUSSION

4.1 HOUSEHOLDS

4.1.1 COMPOSITIONAL ANALYSIS AND DISCUSSION

For each audit, the following waste categories were tracked explicitly:

- Kg/bin/week
- Total Recyclable Fraction
- Total FOGO Fraction
- Total General Waste Fraction
- Combined Recoverable Fraction (Recyclable + FOGO)
- Combined Cardboard Fraction
- Combined Food Fraction (Food + Food in packaging)

These categories were chosen specifically to determine the efficacy of experimental variables not only on the reduction of food waste in red bins, but to also measure potential secondary effects of source-separation of recyclable fractions, and reductions in waste generation. Despite the explicit purpose of the trial being the increased source-separation of food waste, it was hypothesised that awareness and participation in the trial might overcome psychological barriers resulting in the known disparity between the general support for recycling versus actual recycling behaviour (Hopper and Nielsen 1991).

Due to sampling errors, there were several outlier data points which needed to be corrected. A full list of outliers, assumptions and methods of amelioration is provided in Appendix I: Calculation assumptions and corrections for compositional analysis.

The percentage change in scaled weekly waste fractions between the pre-trial and post-trial audits (1 & 3) were calculated and a multiple regression was performed in Microsoft Excel to determine the influence of experimental factors on the change in red bin composition. Percentage changes were chosen over total weight reductions to avoid privileging waste categories with greater total masses, and to control for trial areas with differing baseline weights.

Please note, in the graphs shown Figure 14, 'TA' refers to Trial Area.

Figure 14 shows the change in kg/bin/week for each of the measured waste categories (excluding total waste generation). Figure 15 shows the regression coefficients of each waste category for each experimental variable, and Figure 16 shows the associated p-values for each regression.

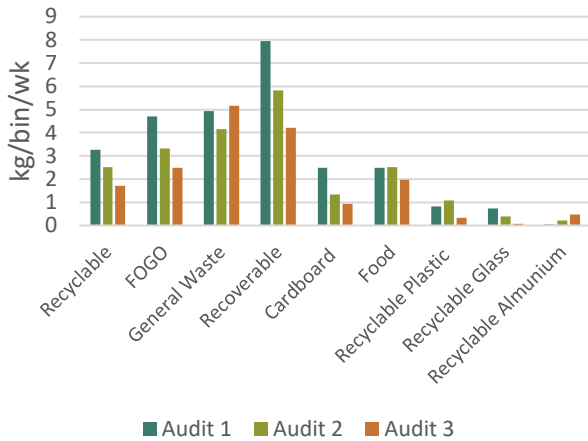
WASTE REDUCTION PERFORMANCE

Based on the results of the trial, the trial variable with the most significant impact on waste composition was moving to fortnightly collection. A multiple regression revealed that fortnightly collection had negative regression coefficients for every measured waste category, indicating that trial areas moved to fortnightly collection saw the most successful diversion of waste of all types.

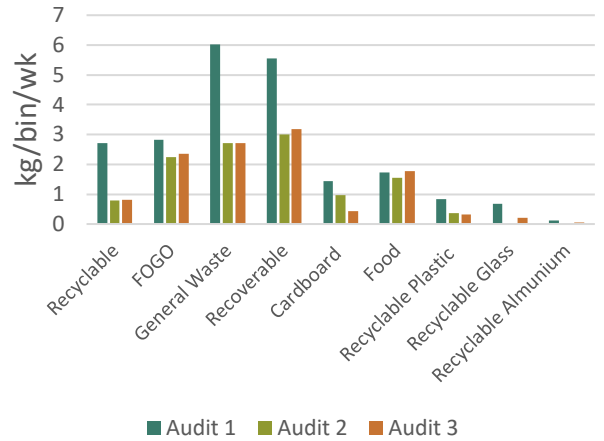
While reductions in waste were observed across all participating trial areas, statistical analysis revealed that the change to a 140L bin and the inclusion of a kitchen caddy and liners had minimal impact on the production of household waste. However, it was noted that the inclusion of the kitchen caddy specifically, provided households with a convenient method of separating their food waste and it was noted that households given a kitchen caddy were more conscious of their waste habits. Review of available literature concludes that the efficacy of systems requiring large behavioural changes such as the utilisation of the caddy are strongly correlated with both time and quality of education and promotion. It is therefore recommended that the provision of a kitchen caddy with free compostable liners is an effective way of increasing the accessibility and convenience of household separation and should be considered as part of a broader educational and promotional campaign to increase household participation in FOGO separation.

Based on these trial results and literature review, the recommended service configuration for the implementation of a FOGO separation scheme is 240L red bins, collected fortnightly, alongside the provision of kitchen caddies and compostable liners. Alternatives will be required in various circumstances, and options will be generated and reviewed.

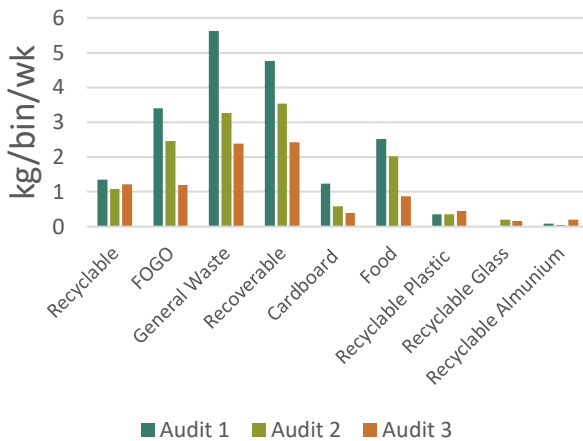
TA 1: Caddy, 240L bin, Fortnightly Collection



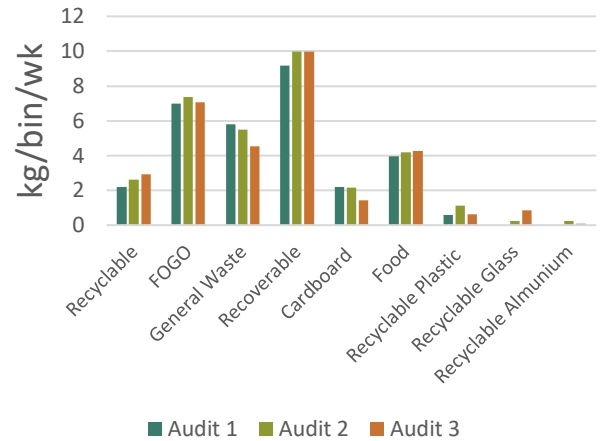
TA 2: Caddy, 140L bin, Fortnightly Collection



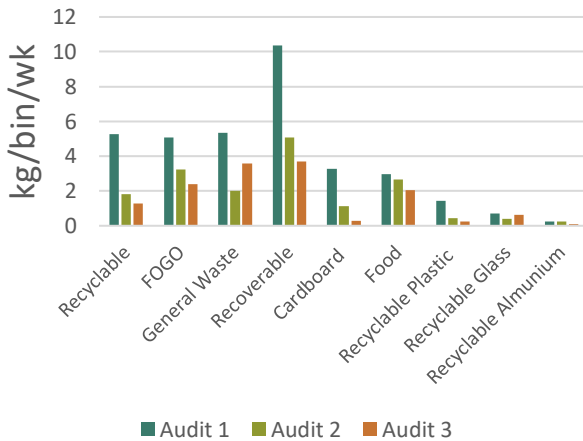
TA 3: No Caddy, 140L bin, Fortnightly Collection



TA 4: No Caddy, 240L bin, Weekly Collection



TA 5: No Caddy, 240L bin, Fortnightly Collection



TA 6: No Caddy, 140L Bin, Weekly Collection



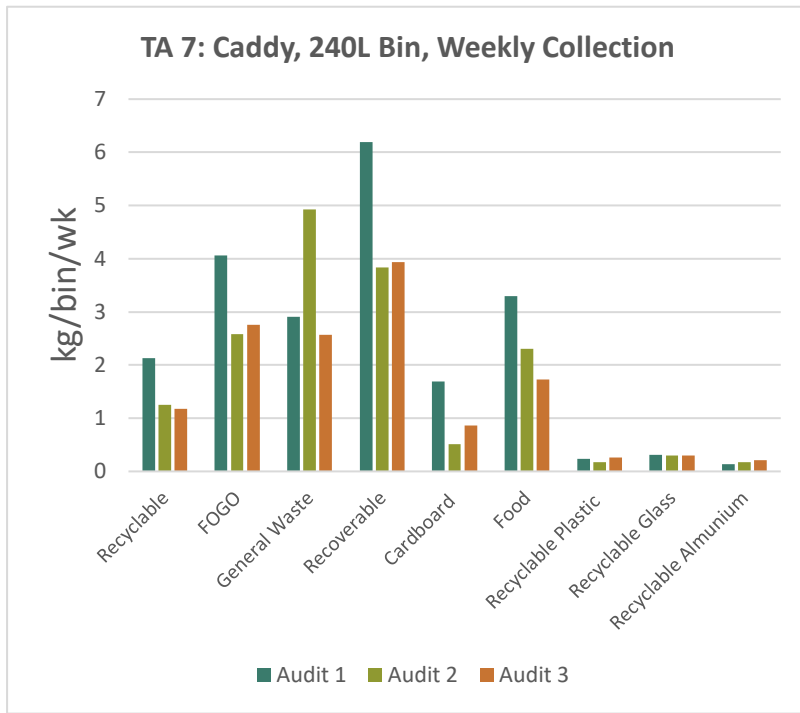


Figure 14 - Breakdown of waste composition for the 7 trial areas over 3 audits

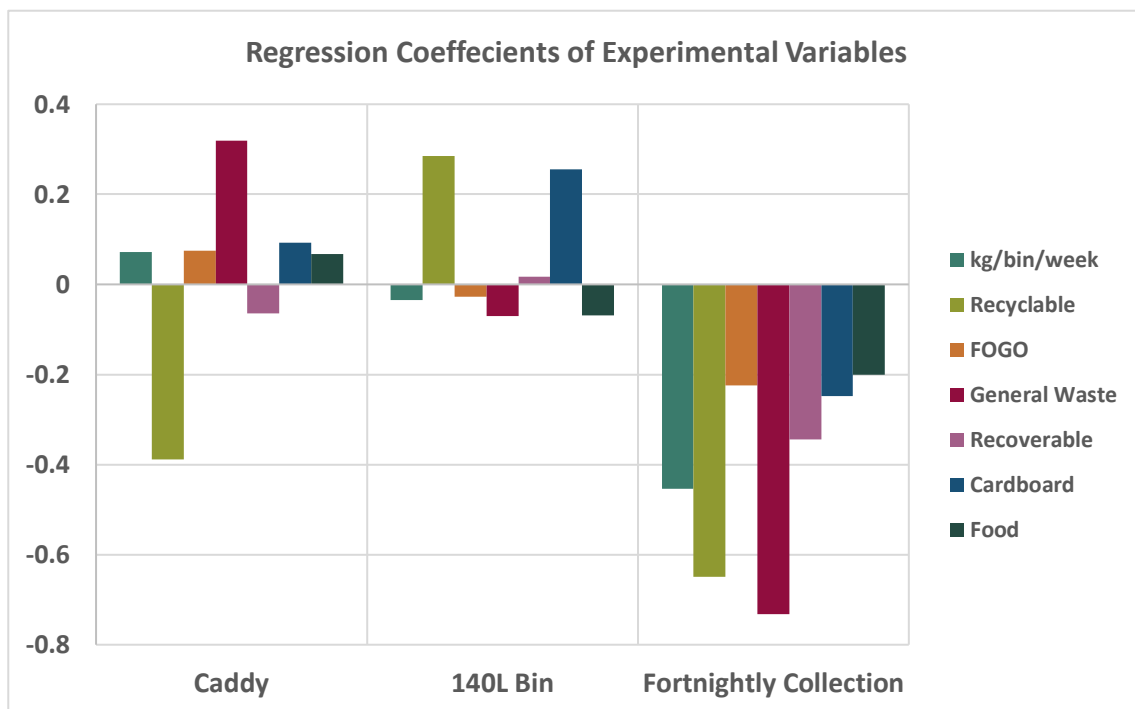


Figure 15 - Regression coefficients of multivariable regression

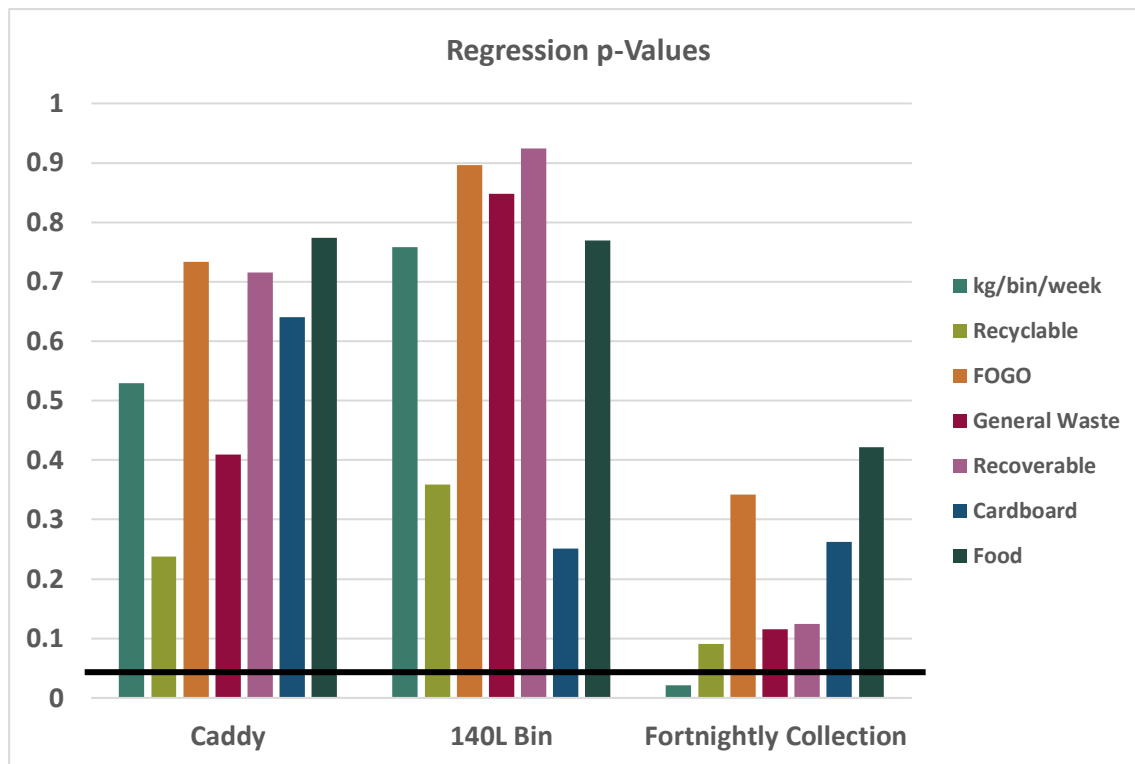


Figure 16 - p-values for the multivariable regression. Horizontal line indicating $p = 0.05$

Shown in Figure 15, there is no clear influence on the waste categories due to the caddy or the 140L bin. For the caddy, regression coefficients were almost consistently less than 0.1, with general waste and recyclable fractions as outliers, with coefficients of 0.31 and -0.39 respectively. These fractions represent the largest deviations of the control group, TA 4, and recalculating these values while ignoring the control eliminates their correlation with the caddy. A similar trend is observed for the change in bin size to 140L, with most coefficients falling well below 0.1.

As can be seen in the trial area breakdown shown in Figure 14, the control group, TA 4, experienced minimal deviation between all three audits, outside of a 34% increase to the presence of recyclable fractions, and a 34% decrease to general waste. The stability of the control group over the duration of the trial implies a minimal impact of seasonal variation and COVID-19 restrictions on household waste production.

There is an observed negative correlation on every waste category due to the change to fortnightly collection. The most pronounced changes were to general waste and recyclable fractions, with regression coefficients of -0.73 and -0.65 respectively. Despite both bin size reduction and fortnightly collection ostensibly achieving the same reduction in weekly household waste capacity, fortnightly collection was more strongly correlated with decreases in all waste categories, compared to the 140L bin. Without an audit of the yellow and green bins, it is unknown whether the decreased amount of waste associated with fortnightly collection resulted in an equivalent increase in waste in other bins. Since fortnightly collection had a strong correlation with a reduction in the general waste fraction, this may imply that participants are contaminating their green and yellow bins with general waste, instead of producing less general waste.

An alternative hypothesis between the two service configuration changes can be considered through the behavioural change required to adapt to the change in service. A smaller bin collected weekly can be considered easier to work around, if the bin reaches capacity before it is collected. Residents might overfill their bin (not observed in fullness measurements, however) or put overflowed waste into neighbour's bins on the night of collection. Under a fortnightly collection scheme, these options become less viable for residents, potentially exerting a greater pressure to be considerate of waste generation and space economy.

The marked difference in performance between bin size reduction and fortnightly collection highlights a key finding from the Rawtec report, specifically that performance of individual service configurations vary between councils (Rawtec 2020). While it is noted that a reduction in bin size is correlated with increased waste diversion, this does not appear to be the case based on trial results. The choice between reducing bin size and reducing collection frequency is one that councils often differ on, and whose efficacy can differ greatly depending on numerous factors, including residence type and demographics. Moreland City Council in Victoria is currently investigating a range of different scenarios for FOGO collection, including a change to fortnightly red bin collection, or weekly collection with a reduced bin size (Moreland City Council 2021). In a survey conducted amongst 1049 Moreland residents, 57% expressed a preference to weekly FOGO and fortnightly garbage collection, versus 32% who preferred fortnightly FOGO and weekly garbage collection, with just 11% preferring weekly FOGO and weekly garbage collection. This survey was also accompanied with a larger education campaign, where Moreland Council published the results of an independent review indicating that fortnightly garbage collection would also be the cheapest option for residents (Nyunt 2021).

4.1.2 FOOD WASTE

Comparing the reduction of food waste based on each individual trial area reveals a significant reduction of food waste from each non-control trial area. Across all trial areas which were given a caddy, there was an average decrease in FOGO waste in red bins of 35%. Across all trial areas who were given the 140L red bin, a 42% decrease was seen. The most significant decrease in FOGO waste came from areas who were moved to fortnightly red bin collections, seeing a 46% decrease in FOGO waste in the red bin across all audits.

The minimal effect of the caddy on any waste category can be analysed through several considerations. Primarily, the caddy necessitates the most significant behavioural change, requiring the user to separate their waste in the kitchen, compared to changes in collection modes, where change in waste behaviour is more easily accommodated. This is reflected in the Rawtec (2020), which strongly concludes that participation in FOGO separation increases over time, as people become more educated and accustomed to the new system. Bernstad (2014) reached a similar conclusion on the long-term benefits of the caddy, noting that convenience of separation was a primary factor in the effectiveness of FOGO separation, with participants noting that once they were accustomed to using the caddy, it was a much more convenient way of separating their waste. It is therefore suggested that despite the minimal statistical significance of the caddy, it should be invested in for its long-term potential in increasing convenience of separation.



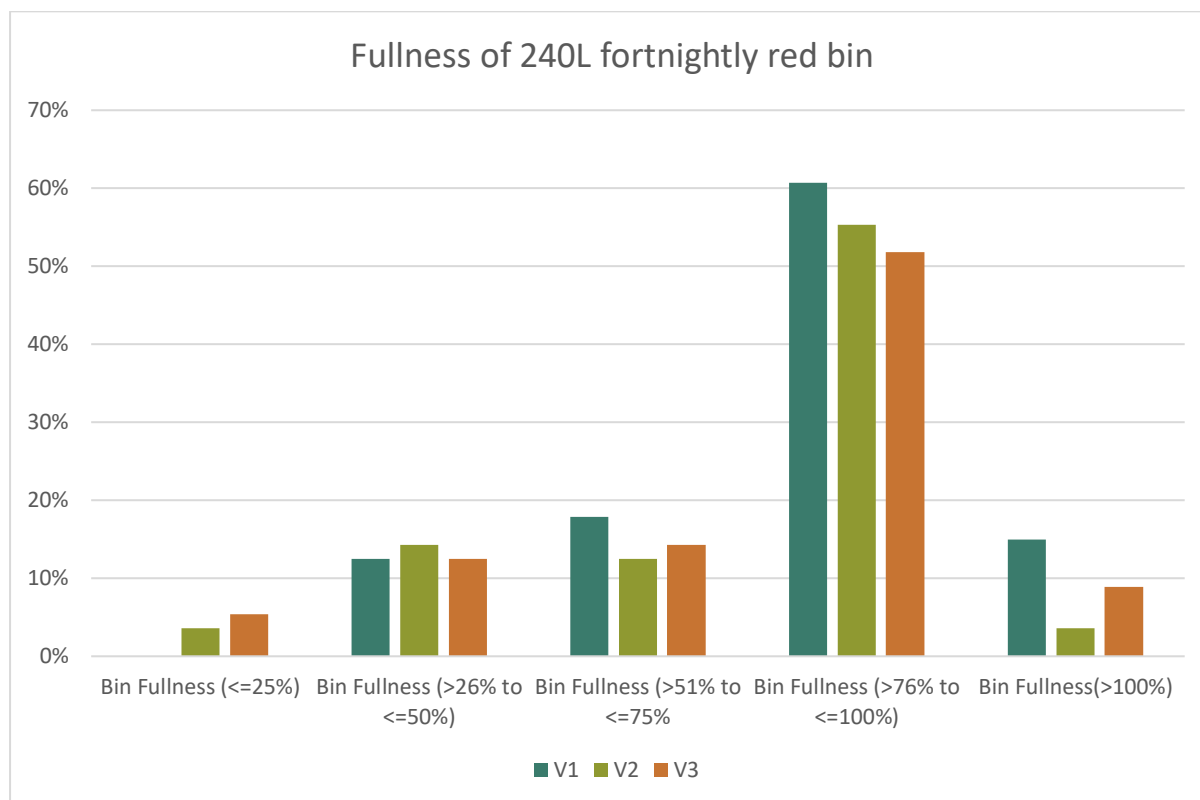
Figure 17 - Caddy, waste in bins with and without liners

4.1.3 VISUAL ANALYSIS - PRESENTATION AND FULLNESS

Visual analysis was highly affected by the COVID-19 government closure owing to which fullness and contamination of the kerbside bin at the end of the project wasn't assessed. However, the presentation rate was recorded by driving through the trial areas.

At the beginning of the project, the red lidded bin was found highly presented on the kerbside whereas green bins were least presented. However, by the end of the trial, it was found that green lidded bins presentation was increased in the trial areas up to 20%. The fullness of 240L fortnightly red bin collection significantly dropped from pre-trial to mid-trial and post-trial then fortnightly 140L, weekly 140L and caddies and liners with weekly collection.

As explained with compositional analysis, without a compositional audit of yellow and lime green bin, it is hard to determine if the waste associated with decrease in 240L fortnightly general waste had an equivalent rise in yellow and lime green bin. But, generally in all seven-trial area audits, it was noted that the food waste amount had significantly dropped while having compositional audits during the mid and post-trial. Additionally, it was observed during the visual analysis of general waste red bins.



V1: Visual analysis pre trial

V2: Visual analysis mid trial

V3: Visual analysis post trial

Figure 18 – Fullness of red bins

The educational material provided by Council has helped residents to understand kerbside waste separation and the right use of bin. With more knowledge sharing, Bathurst Regional Council can realistically achieve national targets on minimisation of resourceful waste going to landfill.

4.1.4 SURVEY RESULTS AND DISCUSSION

Over all the surveys sent, there was a response rate of 34%, 33% and 20% for the pre-, mid- and post-trial surveys respectively. Table 5 shows a breakdown of survey responses per trial area for each survey. Pre-trial surveys were not separated by trial area, due to their non-specificity, however mid- and post- trial surveys were recorded by trial area. Response rates across trial areas ranged from 22% to 73% for mid-trial surveys and 7% to 45% for post-trial surveys. While the response rate was similar between pre- and mid- trial surveys, there was a noted decrease in the response rate between the mid- and post- trial surveys, potentially owing to a decreased response time window. While surveys were able to be returned via both email and mail, the response rate could be improved through door-knocking campaigns, or the inclusion of an online surveys option. It is important to recognise that because of the participation rate of the trial, the results of the survey may be influenced by participation bias.

Table 5 - Survey response rate

Pre-Trial				Mid-Trial				Post-trial			
Trial Area	Returned	Sent	Response Rate	Trial Area	Returned	Sent	Response Rate	Trial Area	Returned	Sent	Response Rate
1	-	-	-	1	15	58	26%	1	8	58	14%
2	-	-	-	2	16	22	73%	2	10	22	45%
3	-	-	-	3	12	27	44%	3	2	27	7%
4	-	-	-	4	9	31	29%	4	8	31	26%
5	-	-	-	5	6	25	24%	5	2	25	8%
6	-	-	-	6	5	20	25%	6	5	20	25%
7	-	-	-	7	5	23	22%	7	7	23	30%
Total	71	206	34%	Total	68	206	33%	Total	42	206	20%

4.1.5 PRE-TRIAL SURVEYS

Questions included in the pre-trial surveys primarily consisted of establishing household demographics, attitudes towards food waste recycling and perceived barriers to food waste separation.

Out of the 71 returned surveys, the most common demographics were couples with no children (37%) and singles (32%). Households with children represented 23% of responses, while share houses represented only 4% of surveyed residences. The high proportion of smaller households (no children + single) represents an advantage in decreasing weekly waste capacity through smaller bins/fortnightly collection, however areas in Bathurst with a higher proportion of share houses/families may present a challenge facing adoption of a new service configuration.

Table 6 - Survey response rate: "How would you describe your household"

How would you describe your household?	Response Rate
Single	32%
Couple with no children	37%
Couple with young children	10%
Couple with adult children	6%
Single parent with children	7%
Group/share house	4%
Other	3%

Of the returned surveys, 93% indicated that separating food and garden waste from general waste was either very important (56%) or important (38%). 0% indicated that it was not very important or not at all important, while 7% were unsure. The general positive attitude towards food waste separation is frequently noted in literature (Hopper and Nielsen 1991) (Graham-Rowe, Jessop, and Sparks 2014), and the leveraging of community attitudes towards food waste separation represents an opportunity in education and promotion. This attitude was also reflected in the question of motivation towards waste reduction, with only 2% of respondents indicating that they were not motivated to avoid waste. 26% of participants indicated that their motivation to reduce waste was due to environmental concerns, while 36% indicated that it was to save money. While an individual's stated motivations are important to ascertain for policy development, for example, clear messaging on the financial benefits of a change in service configuration may motivate a larger proportion of the population, it is important to integrate these motivations with broader environmental psychology principles in the promotion of this service (Linder, Lindahl, and Borgström 2018).

Table 7 - Survey response rate: "What motivates you to avoid waste"

What motivates you to avoid waste?	Response Rate
Save money	36%
Save time	9%
Environmental concerns	26%
It's the right thing to do	27%
I'm not motivated	2%

Table 8 - Survey response rate: "How important would you say separating your food and garden waste from your garbage waste is?"

How important would you say separating your food and garden waste from your garbage waste is?	Response Rate
Very important	56%
Important	38%
Not very important	0%
Not at all important	0%
Unsure	7%

In identifying what participants perceived as barriers to food waste recycling, there was a range of answers between 10-20%. These included making the green bin smell (19%), unsure which items can go into green bin (14%) and the green bin being full of garden waste (14%). It is important to understand potential concerns residents may have with a FOGO recycling program, to better design programs which address any misconceptions or can alleviate issues such as odours. The most common response was "other" (31%) and included a written section for residents to expand on their response. Several responses included convenience issues, "It's a hassle to clean the bin when some items are rotten and stuck to the bottom", or pests "[the] biggest problem I've found is in the warmer months re: maggots etc.". A well designed-caddy can alleviate both issues with the inclusion of compostable

bin-liners, however this highlights the importance to both communicate proper usage and design an intuitive caddy to increase the effectiveness of the food and garden waste composting scheme.

Table 9 - Survey response rate: "What deters you from putting food waste into the green bin?"

What deters you from putting food waste into the green bin?	Response Rate
Too much hassle/time	5%
Makes the green bin smell	19%
I don't have an easy way to separate my waste	7%
Unsure which items can go into green bin	14%
My green bin is always too full of garden waste	14%
I am not deterred	12%
Other	31%

4.1.6 MID-TRIAL SURVEY

The purpose of the mid-trial survey was to monitor enthusiasm towards the trial, as well as to identify any self-reported behavioural changes regarding waste habits and any issues surrounding the caddy or bin fullness. The results to selected general questions can be found in Table 10.

Between trial areas there is no clear consensus regarding motivation to separate food waste. Participants selecting either "agree" or "strongly agree" range between 13% to 63% for TA 3 and TA 7 respectively, totalling 49% across all areas. TA 3 appeared to have the lowest motivation, with 63% of participants selecting either disagree to strongly disagree. TA 3 had both a decreased bin size and fortnightly collection, however this trend of low motivation was not observed for other trial areas featuring either the 140L bin or fortnightly collection, including TA 2 which contained the 140L bin, fortnightly collection and kitchen caddy.

Overall, participants reported confidence in knowing what waste belonged in the FOGO bin, with only 5 - 17% of participants stating that they disagreed. This conflicts with the compositional analysis, indicating that the presence of food waste in red bins was not significantly impacted over the course of the trial. While this could be attributable to social desirability bias, i.e. participants ascribing themselves traits which are socially desirable, the over-estimation of an individual's participation in pro-environmental efforts is a well-observed phenomenon in environmental psychology (Hopper and Nielsen 1991) (Perrin and Barton 2001). Most participants believe that FOGO recycling initiatives are useful, which is a perception that has remained high between the pre- (93%) and mid- (83% overall) trial survey. Most participants also believe the communications received from the council have been clear (83%).

Comments from those who stated that instructions were unclear included wanting more information: "[I would like] pictures and information about the FOGO composting plant and process", "provide a collection calendar each year"; wanting clearer guidelines: "information on what can go in each bin...", "The wording of the trial could have been explained clearer", "information on every bin"; and requests for more resources: "[from a trial area not provided with a caddy] provision of a kitchen caddy", "I'm not receiving what I pay for in my rates". These comments highlight the need for consideration of community requests in designing educational materials.

Table 10 - Survey responses for selected mid-trial questions

Since the trial began, I am more motivated to separate my food waste							
	TA 1 (28)	TA 2 (32)	TA 3 (9)	TA 4 (15)	TA 5 (8)	TA 6 (13)	TA 7 (14)
Strongly agree	22%	30%	0%	17%	25%	50%	50%
Agree	28%	25%	13%	33%	25%	0%	13%
Neither	22%	25%	25%	33%	13%	17%	13%
Disagree	0%	15%	25%	17%	0%	0%	13%
Strongly disagree	28%	5%	38%	0%	38%	33%	13%
I feel confident I know what goes into the green bin (FOGO)							
	TA 1 (19)	TA 2 (18)	TA 3 (7)	TA 4 (11)	TA 5(6)	TA 6 (5)	TA 7 (8)
Strongly agree	53%	50%	57%	45%	33%	100%	63%
Agree	42%	50%	43%	55%	50%	0%	38%
Neither	0%	0%	0%	0%	0%	0%	0%
Disagree	0%	0%	0%	0%	0%	0%	0%
Strongly disagree	5%	0%	0%	0%	17%	0%	0%
Do you believe the Food and Garden (FOGO) program is a useful initiative?							
	TA 1 (18)	TA 2 (16)	TA 3 (8)	TA 4 (9)	TA 5 (8)	TA 6 (5)	TA 7 (5)
Yes	61%	94%	75%	100%	75%	100%	100%
No	39%	6%	25%	0%	25%	0%	0%
How have you found the communications from Council regarding the trial?							
	TA 1 (15)	TA 2 (16)	TA 3 (7)	TA 4(9)	TA 5 (8)	TA 6 (5)	TA 7 (5)
Clear	67%	100%	86%	100%	50%	80%	100%
Unclear	33%	0%	14%	0%	50%	20%	0%

Trial areas which were provided with a kitchen caddy (TA 1, TA 2, TA 7) were asked additional questions about the usage of the caddy as well as any issues they may have experienced. 95% of participants responded between neutral to strongly agree that the caddy was easy to use, however, a slightly lower percentage of 91% believe that the caddy was a good size. While most were satisfied with the caddy size, there was a slight decrease in satisfaction with caddy size for TA 1 (83%) and TA 2 (94%), who both had reduced waste capacity (fortnightly collection for TA 1 and TA 2, 140L bin for TA 2).

While pests were not considered a major issue with the kitchen caddy, there was a significant percentage of participants who had issues with odours. Responses ranged between 16 – 29% of those who disagreed or strongly disagreed that there were no odour issues.

Odour issues and bin bag integrity were also identified as issues by participants who indicated that there were barriers to using the caddy (19%). Comments included: “bags break easily”, “[issues include] the mess, the hassle and the smell”, and “bin bags are not big enough”. A full-scale implementation of kitchen caddies in the FOGO program should seek to remedy these issues through stronger bags and a more isolated/odour-proof caddy design. Leichhardt Council identified that the caddy design used in their preliminary FOGO scheme resulted in leakages and odour issues through side-vents, a re-design of a sturdier bin resulted in a greater level of community satisfaction with the caddy.

Table 11 - Survey responses for trial areas given caddy

I feel the caddy is easy to use			
	TA 1 (18)	TA 2 (18)	TA 7 (7)
Strongly agree	44%	78%	71%
Agree	39%	17%	14%
Neither	11%	0%	14%
Disagree	0%	6%	0%
Strongly disagree	6%	0%	0%
I have no issues with odour coming from the caddy			
	TA 1 (19)	TA 2 (19)	TA 7 (7)
Strongly agree	21%	63%	71%
Agree	37%	11%	0%
Neither	26%	0%	0%
Disagree	11%	21%	29%
Strongly disagree	5%	5%	0%
I have no issues with pests around the caddy			
	TA 1 (20)	TA 2 (19)	TA 7 (7)
Strongly agree	35%	63%	71%
Agree	45%	26%	14%
Neither	0%	11%	14%
Disagree	10%	0%	0%
Strongly disagree	10%	0%	0%

The caddy is a good size			
	TA 1 (18)	TA 2 (17)	TA 7 (8)
Strongly agree	33%	82%	63%
Agree	50%	12%	38%
Neither	0%	0%	0%
Disagree	11%	6%	0%
Strongly disagree	6%	0%	0%
Have there been any barriers to using your kitchen caddy?			
	TA 1 (18)	TA 2 (19)	TA 7 (6)
Yes	22%	16%	17%
No	78%	84%	83%

4.1.7 POST-TRIAL SURVEY

The post-trial survey provided an opportunity for participants to reflect on their waste management behaviours and to give feedback on where the trial succeeded and failed. 76% of participants agreed or strongly agreed that they had become more conscious of their waste habits as a result of this trial, compared to 49% in the mid-trial survey. This increase in self-reported behaviour is supported by a further question about change in motivation, where 41% indicated that their motivation increased over the course of the trial. This has optimistic implications with regards to long-term implementation of a FOGO collection service, with the Rawtec report finding that FOGO separation rates were strongly correlated with the length of time the service had been in operation (Rawtec 2020). The report found that FOGO programs still in their trial saw a 28% diversion efficiency of FOGO waste, which increased to 46% for programs which had been established for longer than a year.

Out of three service configurations presented to participants (fortnightly collection/240L bin, weekly collection/140L bin, fortnightly collection/140L bin) the majority (58%) indicated a preference for weekly collection/140L bin. The next most preferred configuration was fortnightly collection/240L bin (26%).

78% of participants agreed or strongly agreed that the information provided by the council was clear in enabling them to easily participate in the trial. This was a similar response to that of the mid-trial survey (83%), indicating the relative success of communication efforts by the council. Comments from participants who were dissatisfied with the information material from the council were consistent with those from the mid-trial survey. These included requesting “more information about what can go into the bin – especially non-food items e.g. Papers etc”, “more clarification on yellow recyclable materials e.g. Explanation of the recycling plastic symbols” and “recognition on radio and/or letterbox drop to provide results and make people aware of the benefits”. Based on these comments and those provided in the mid-trial survey, the general community consensus is that a FOGO recycling scheme does not just provide an opportunity to educate residents on food waste, but to promote better household waste management practices holistically.

Other general comments expressed concern about how specific demographics may be impacted by a change in service: “Concerned about health issues of fortnightly collection for young and old families with nappies and medical waste”, “household numbers vary greatly, and individuals should be afforded the option of having a 240L bin collected weekly”. A transparent and open avenue of discourse between councils and communities can help draw out these concerns and address any issues residents may have, which is vital in ensuring participation.

Table 12 - Selected survey responses for post-trial surveys

I have become more conscious of my food waste habits as a result of the trial							
	TA 1 (8)	TA 2 (10)	TA 3 (2)	TA 4 (8)	TA 5 (2)	TA 6 (5)	TA 7 (6)
Strongly agree	38%	10%	0%	13%	0%	20%	67%
Agree	63%	60%	50%	75%	0%	40%	17%
Neither	0%	20%	50%	13%	0%	20%	17%
Disagree	0%	10%	0%	0%	50%	0%	0%
Strongly disagree	0%	0%	0%	0%	50%	20%	0%
Being more involved in the waste collection process was rewarding for me							
	TA 1 (8)	TA 2 (10)	TA 3 (2)	TA 4 (8)	TA 5 (2)	TA 6 (4)	TA 7 (6)
Strongly agree	38%	20%	0%	13%	0%	25%	67%
Agree	13%	40%	50%	63%	50%	25%	0%
Neither	38%	20%	50%	25%	0%	25%	33%
Disagree	13%	10%	0%	0%	0%	25%	0%
Strongly disagree	0%	10%	0%	0%	50%	0%	0%
Did you find your motivation changed throughout the trial?							
	TA 1 (8)	TA 2 (10)	TA 3 (2)	TA 4 (8)	TA 5 (2)	TA 6 (5)	TA 7 (6)
Motivation increased	38%	30%	50%	50%	0%	40%	67%
Motivation stayed the same	50%	70%	50%	50%	100%	60%	33%
Motivation decreased	13%	0%	0%	0%	0%	0%	0%
The information provided to me by Council was clear and enabled me to easily participate in the trial							
	TA 1 (8)	TA 2 (10)	TA 3 (2)	TA 4 (8)	TA 5 (2)	TA 6 (4)	TA 7 (6)
Strongly agree	38%	10%	50%	57%	0%	33%	60%
Agree	38%	80%	0%	29%	0%	33%	40%
Neither agree nor disagree	25%	10%	0%	14%	100%	33%	0%
Disagree	0%	0%	50%	0%	0%	0%	0%
Strongly disagree	0%	0%	0%	0%	0%	0%	0%

If Council were required to change its general waste service, what option would work best?							
	TA 1 (7)	TA 2 (6)	TA 3 (2)	TA 4 (6)	TA 5 (2)	TA 6 (3)	TA 7 (5)
Fortnightly collection of 240L general waste bin	29%	33%	50%	17%	0%	33%	20%
A smaller general waste bin (140L) collected weekly	43%	50%	0%	67%	100%	67%	80%
A smaller general waste bin (140L) collected fortnightly at a reduced cost	29%	17%	50%	17%	0%	0%	0%

4.2 BUSINESSES

As with the household analysis, businesses food waste was collected in terms of tonnes and number of bins. Despite having different waste collection days for the businesses, food waste collected during the weekends was higher than the weekdays. It can be explained with the higher number of people gathering in food premises during weekends. Additionally, the businesses waste generation rate was highly affected by the state-wide COVID closures.

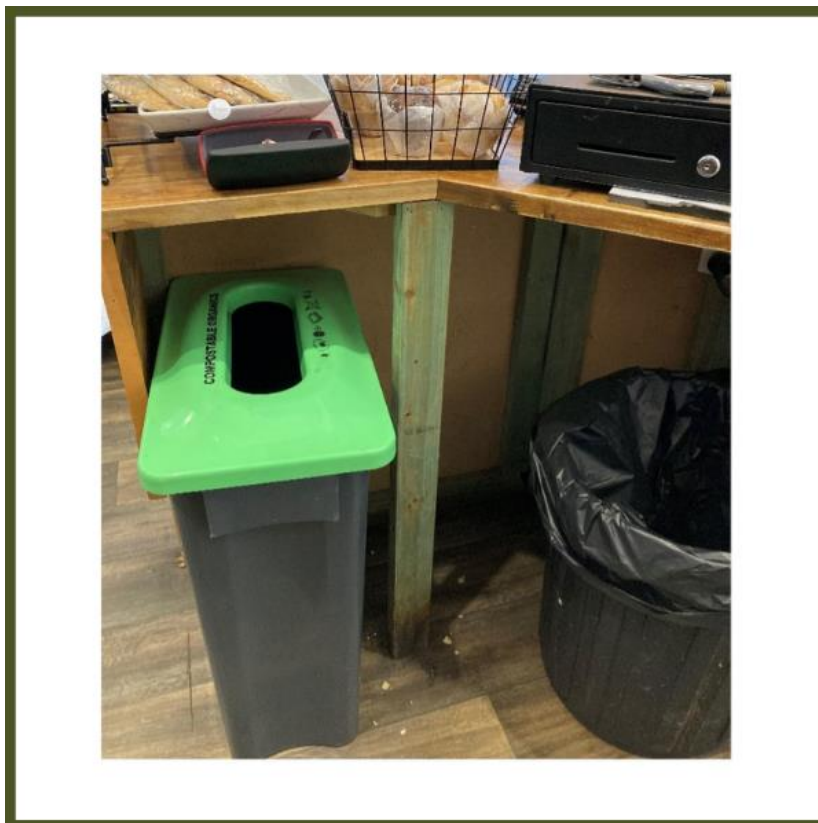


Figure 19 - Business food waste bin

4.2.1 BUSINESS WASTE AUDIT

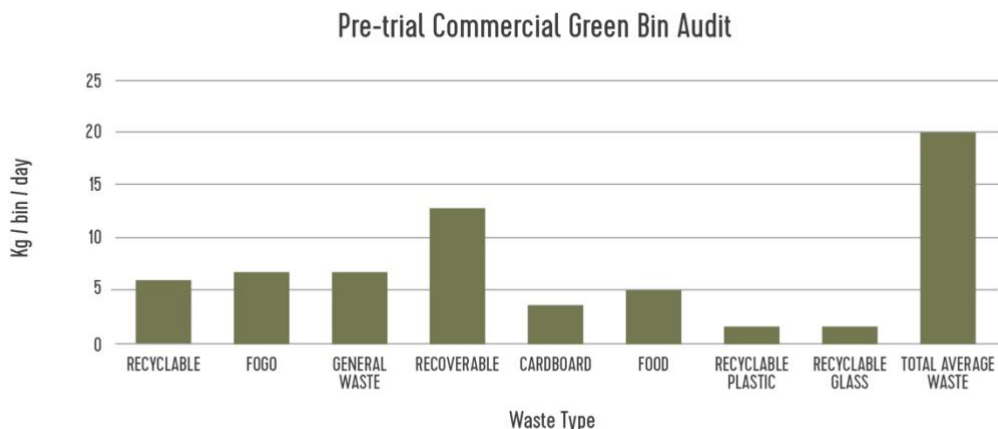


Figure 20 - Pre-trial business waste audit

A pre-trial audit was conducted on participating businesses to determine a baseline level of waste generation. The commercial enterprises involved in the study were all part of the food industry and included restaurants and cafes. It is important to consider FOGO separation schemes for such businesses, due to the high volume of food waste they produce. This is reflected in the high proportion of food waste present in red bins (25%). This is compounded by the large overall volume of waste generated by businesses, upwards of 20kg per bin per collection day.

Due to covid restrictions, which included lockdowns that disproportionately affected businesses, mid- and post- trial audits were deemed to be non-reflective of the trial conducted by businesses. It is recommended that further study be conducted on the influence of FOGO separation methods on businesses, as reductions in food waste in this sector represents a significant area of change.

4.2.2 FOOD WASTE

From the trial, 28.16 tonnes of food and garden materials were diverted from landfill, through the provision of this collection service. Over the entire period an average of 1.48 tonnes/week was collected, but there was a notable dip during the COVID period from weeks 7 until week 14. Weeks outside of COVID lockdown displayed an average 1.78 tonnes/week for the participating business.

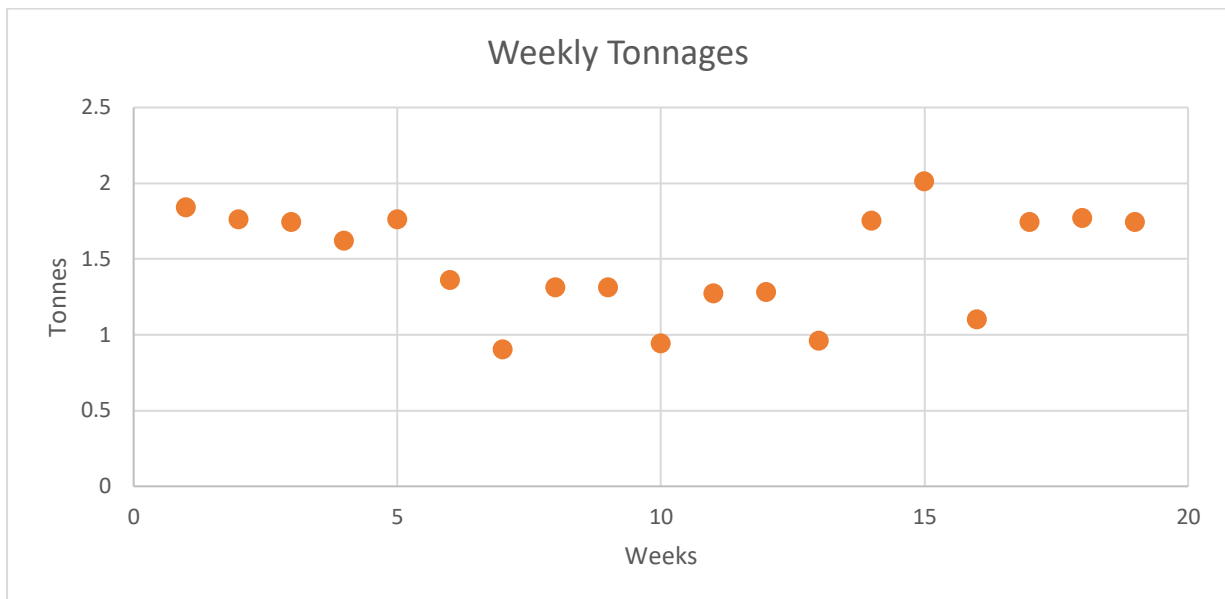


Figure 21 - Weekly waste tonnage for participating businesses

From the 1.78 tonnes of waste produced per week by all participating businesses combined; an average of 40.7kg per business per week was generated. There exists an estimated 300 suitable businesses within Bathurst Regional Council that could be partaking in a FOGO service. Within the trial each business utilised 1.65 lifts/week on average.

4.2.3 BUSINESSES SURVEY

Similarly, to the household surveys, the surveys to businesses were provided to the participating venues with their information pack. Positive responses from the survey highlighted the desire of these businesses to have their food waste utilised as a precious resource as opposed to ending up in landfill. Other positive responses indicated that many businesses would be inclined to continue with a FOGO service at a cost after the trial had ended.

The overall consensus from the business surveys were that the staff were highly motivated and strongly agreed with the provision of kitchen insert bins and 140L green lidded kerbside bins as an option of food separation in their commercial kitchens. Businesses were pleased with the informational material provided by Council and appreciated the option to choose their bin collection days and frequency.

The major comments which are concerning is the use of non-compostable liners in the kitchen insert bin. A business mentioned that to follow the guidelines of the project and minimise the mess in their kitchen bin, they “used plastic bags to collect the kitchen food waste, but then tipped the food waste into the 140L green lidded kerbside bin and put the plastic bag into the red bin”. This idea of using plastic bags to capture their waste was thought of as a good idea to reduce mess, however it is recommended to provide further information to businesses in order for them to understand the importance of ONLY using compostable bin liners in an organics bin. The comments and views of the participating businesses assisted Council during the trial to understand the need for this service.

A letter was sent to the businesses at the conclusion of the trial with a section asking business owners if they would be interested in continuing the FOGO service with a 240L green lidded food and garden waste bin at the cost of \$116 per year to be collected once per week (Appendix 7.3.3). In doing so,

Council received many responses on continuing the FOGO service for a period until the findings of the trial were determined. Unfortunately, large businesses were unable to continue the service as it would have needed to result in multiple collections per week. It was a useful exercise to gauge the desire for a green bin service for businesses.

4.3 ECONOMICS AND EMISSIONS MODEL

4.3.1 HOUSEHOLD FOGO ECONOMICS

The economic impacts of the major options were assessed and compared with BAU utilising 2021/22 values. It was found that several options would result in cost savings through the diversion of compostable materials from landfill and reduction of service demands. It is important to understand that these cost savings would likely increase over time with increasing landfill costs and would mediate any significant jump if BRC were subject to regional levies.

4.3.2 HOUSEHOLD OPERATIONAL EXPENDITURE CHANGE

Options that were modelled for their operational expenditure differ from BAU. Scenarios were modelled to include the operational costing of collection, hauling and processing/disposal costings of the materials.

General waste collection costings were calculated from Council's annual collection expenditure. A figure of \$1.529 (ex GST) per lift was used based on the available data. The OPEX analysis showed that all options except the scenario trialled in Area 7 (Provision of only caddies and liners) would result in cost savings to the ratepayers. These savings occurred with concurrent increases in resource recovery rates. Estimated cost savings of between \$756,000-\$896,000 are predicted with a change from weekly to fortnightly general waste collection services while retaining the 240L bin size. These services were also modelled to show the greatest increase in diversion of FOGO and recycling.

Changing to 140L bins for a weekly service would see an increase in resource recovery but cost savings would be \$107,000/year. Fortnightly 140L bins showed increased diversion and reduction in costs (\$661,000-\$968,000) but recovery rates were not significantly different from that achieved from 240L fortnightly services.

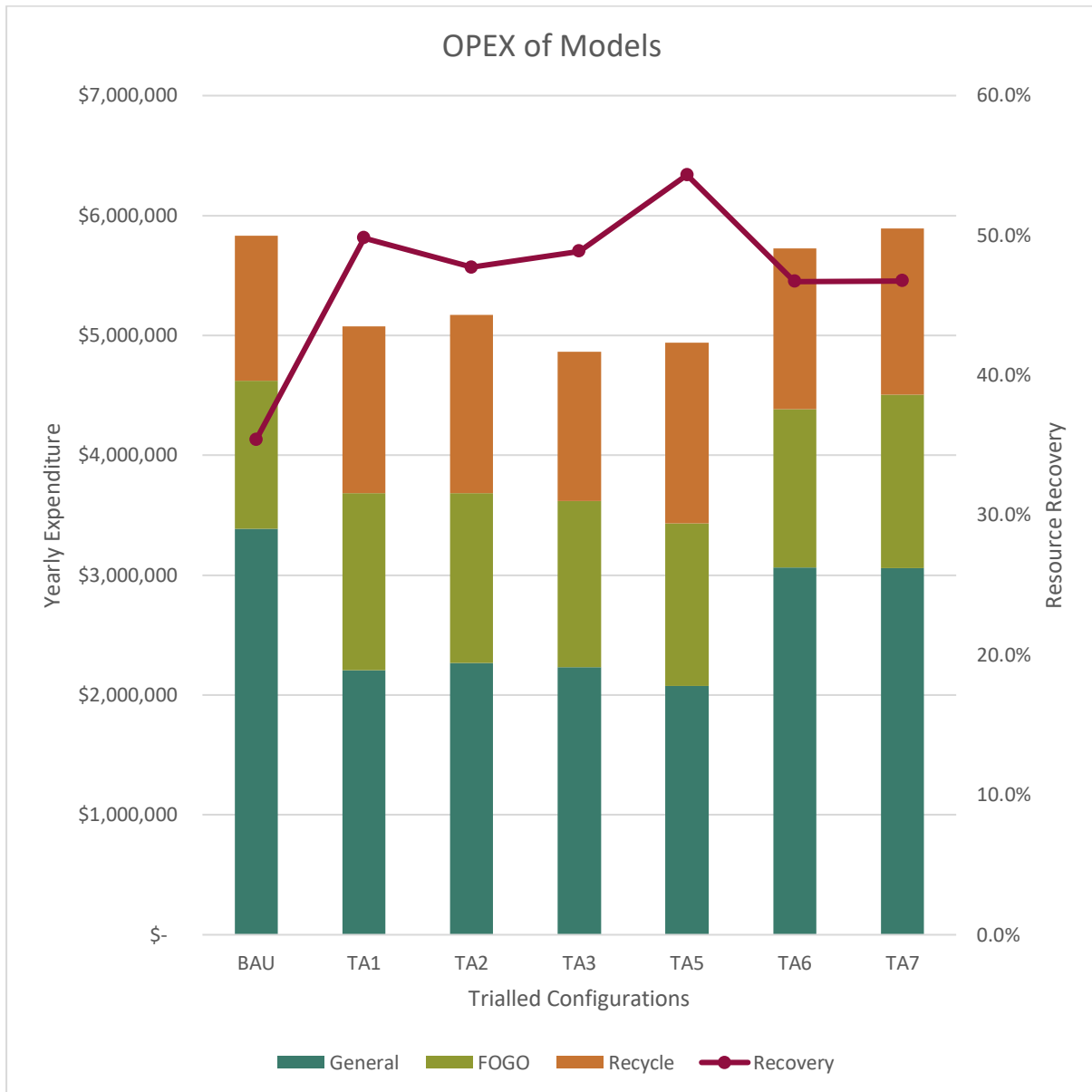


Figure 22 - OPEX of the range of service configurations

Trialed Configurations:

BAU: Business as usual (weekly collection of 240L general waste bin)

TA1: Caddy and Liners, Fortnightly Collection of 240L bin

TA2: Caddy and Liners, Fortnightly Collection of 140L bin

TA3: 140L bin, Fortnightly Collection

TA5: 240L bin, Fortnightly Collection

TA6: 140L bin, Weekly Collection

TA7: Caddy and Liners, Weekly Collection of 240L bin

4.3.3 HOUSEHOLD CAPITAL COSTS

The transition from a 240L bin to a 140L bin for the general waste service would require purchase and distribution of an estimated 18,000 new Mobile Garbage Bins for the service changes.

Costings were also modelled for providing new caddies alongside liners to all households receiving FOGO services. Costings are based on prices quoted in 2020 with delivery to houses included.

Table 13 - Cost estimation of change of service

	New Caddies	Replacing bins	140L Bin and Caddies
Capital Expenditure	\$138,000	\$792,000	\$930,000

As predicted, the transition to a 140L service would incur the highest capital costs for the project, while the caddies incur a smaller capital expenditure.

4.3.4 HOUSEHOLD EMISSION IMPACTS

All options trialled demonstrated a projected emissions reduction due to diversion of compostable materials (food waste, garden waste, paper, and cardboard) from the Bathurst landfill site. Secondary emissions reductions would likely be greater than the savings directly caused by the diversion of these compostable items, to calculate these a thorough life cycle assessment should be undertaken.

Primary emissions diverted through a change of service would be between 4,800-6,200 tonnes of CO₂-e per year. This diversion would be the result of the better utilisation of the FOGO and Recycling bins by residents.

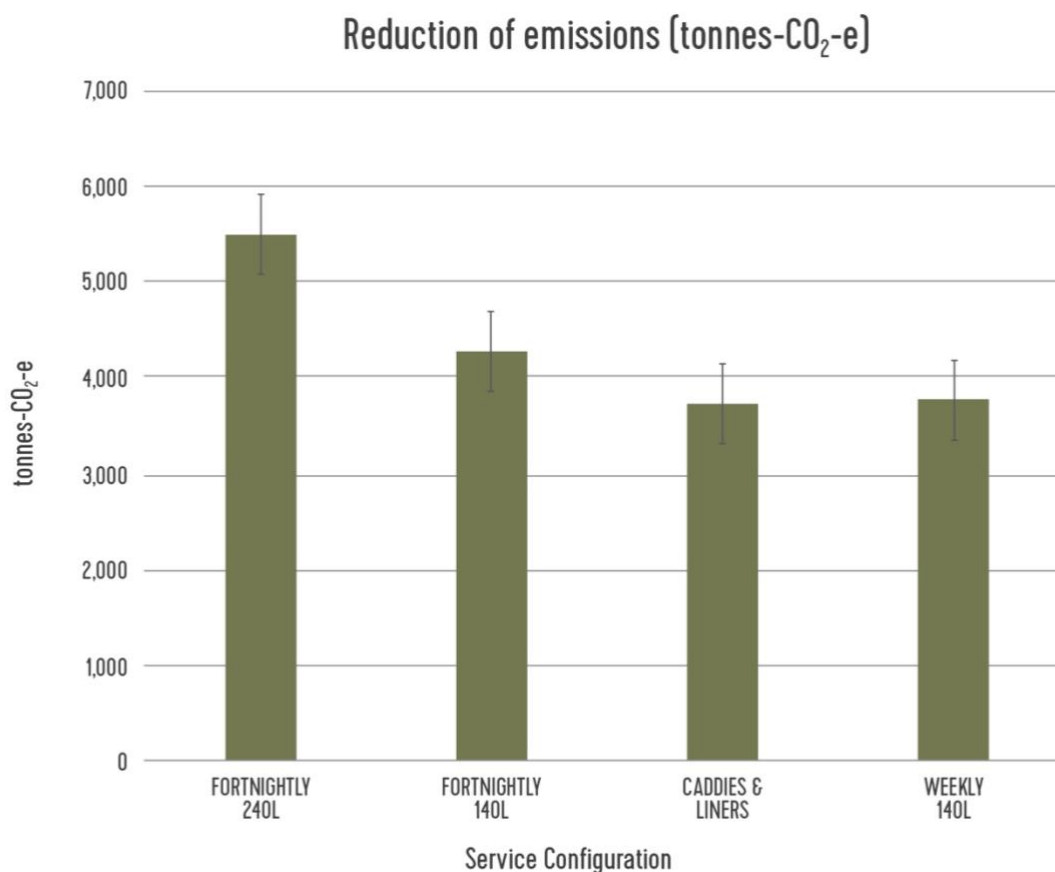


Figure 23 - Summary of emission reductions for selected service configurations

The following table demonstrates the predicted cost and emission savings for the trialled configurations in the project. With the consideration of the in-depth research, it is understood that 240L fortnightly general waste collection with caddies and liners for the FOGO bin will be a cost effective and emissions saving option in the long run.

Table 14 - Summary of OPEX savings and emission reductions for selected configurations

	240L Fortnightly Collection with Caddies and Liners	140L Fortnightly Collection	Caddies and Liners with Weekly Collection	140L Weekly Collection
Estimated cost savings per year	\$756,000 - \$896,000	\$ 661, 000 – \$ 968,000	-\$57,000 (Loss)	\$107,000
Estimated GHGs emission savings per year (tonnes-CO₂-e)	4,800 - 6,200	3,900-4,600	3,700	3,700

4.3.5 COMMERCIAL FOGO ECONOMICS

During the trial, 45 businesses received a 140L FOGO service with option of multiple collections per week provided in line with BRC's provision of standard Council services. Following engagement from the businesses, collections were set for Monday, Tuesday, Wednesday, Fridays, and Sundays. This trial ran over 20 weeks from 5th July until 21st November 2021.

The current landfill of this FOGO material from business is incurring \$115,300 in costs to Council per year, while composting of this material would only cost Council \$48,700 per year. Due to this, a transition to a FOGO provision to businesses in line with the NSW targets, a total estimated savings in provision of these services to business would be \$32,800/year for Council. Although collections on weekends should be considered, if possible, as several larger venues had their main waste generation days on Friday and Saturdays. Based on these waste generation results a potential saving of \$110/year per business could be achieved by the provision of these services. (See Table 15 below)



The estimated total cost for the roll out of mobile garbage bins and kitchen insert bins to businesses would be \$31,200 to Council based on the expenditures in the trial.

4.3.6 COMMERCIAL EMISSION IMPACTS

If a council wide FOGO service were implemented for high wastage businesses, an estimated 634 tonnes/ year of food and garden waste would be saved based on the diversion achieved with the trialled service. If this material was composted an estimated 1,396 tonnes of CO₂-e could be achieved via the diversion (modelled according to Table 4).

The following table represents the FOGO businesses prediction result based on the trial project for the cost saving and emission saving with the addition of kitchen insert bin and FOGO kerbside bin to the food premises.

Table 15 - Commercial FOGO Trial and Predicted Emissions and Costings

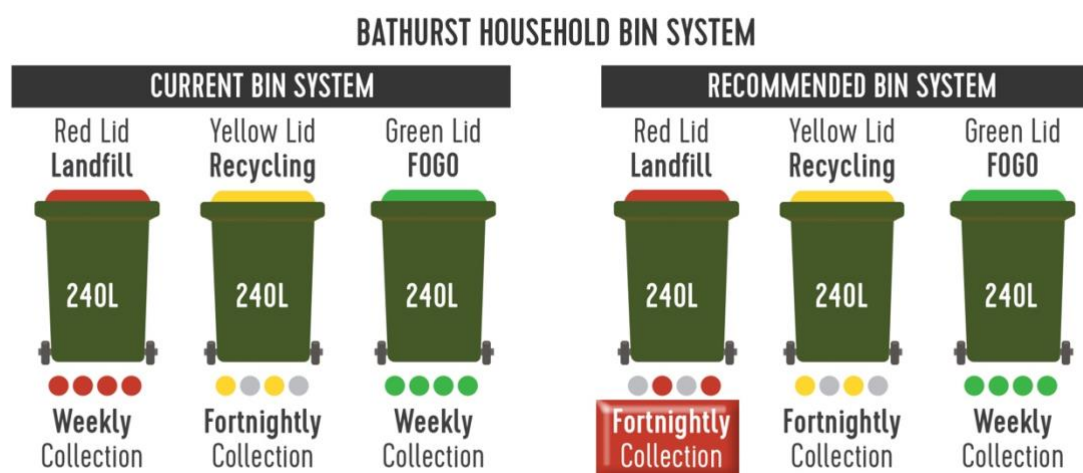
Businesses with FOGO	Trial	Predicted
Number of businesses	45	Approximately 300
Bins		
Food and Garden Waste diverted from landfill	1.78 tonnes/week	634 tonnes/annum
Towards zero carbon targets - Greenhouse gas emissions saved	3.91 tonnes of CO ₂ -e per week	1396 tonnes of CO ₂ -e per annum
Cost of FOGO going to landfill	\$ 40,000/trial	\$ 115,300/annum
Cost of FOGO composting	\$ 16,233/trial	\$ 48,700/annum
Estimated savings from FOGO composting ONLY	\$ 22,200/trial	\$ 66,600/annum

5 CONCLUSIONS AND RECOMMENDATIONS

Good food waste management practices can have a range of positive social, economic, and environmental impacts. Globally and locally, different steps have been taken to improve the management of food in its food chain, especially during consumption by households and food businesses. BRC has been tackling food waste but to accelerate the diversion rate, the current research presents promising measures to minimise the food waste and general waste going to landfill.

The major conclusions and recommendations reached by this report:

- 1) It is vital that Council engages with a non-technical, communications consultant in the development of a promotional and educational campaign. The importance of community outreach and education is highlighted in the case studies of successful FOGO separation schemes implemented by councils in NSW. This could be provided in addition to building on the existing capacity in Council, where waste education is currently being undertaken. There should be consideration of additional investment in internal capabilities to undertake further waste education. Education and promotion of FOGO separation is a long-term project, and the benefits of investment in it extend beyond FOGO separation and into more efficient source separation. In addition, a well-coordinated and executed media campaign is strongly correlated with improvements to the performance of a FOGO collection scheme.
- 2) Based on the results of the trial, the recommended change in service configuration are as follows: 240L red bin (no change) collected fortnightly as ideal, with alternative options available to suit customer needs. The trial showed significant reductions in all waste categories from a change to fortnightly collection, however minimal changes resulting from a reduced bin size. There are concerns from the community regarding provisions for groups such as the elderly, residents with disabilities, and families with young children. This should be addressed by offering supplementary services at reduced/no cost such as upsized bins, and Council should work on developing these for further consideration.



- 3) Transitioning from the current service from the current set up will save Council money and improve resource recovery in all scenarios trialled with exception of providing caddies and liners, which showed a slight increase in operational costs. The transition of these services could result in an estimated reduction of 5,500 tonnes-CO₂-e per year along with financial savings of \$756,000 – \$896,000 per year.

- 4) While the kitchen caddy had minimal effects on waste separation behaviour in the trial, it should be invested in as an element of improving convenience. Research shows that utilisation and community perception of the caddy improves over longer periods of time which in combination with an effective promotional campaign, can result in drastic improvements to household FOGO separation rates.

In addition to these primary conclusions, several other recommendations are presented here as well:

- 1) The commercial trial also demonstrated strong results with each business generating on average 40.9kg/week of food and garden waste. The lifting arm of a waste collection truck can display a “DANGEROUS” alert message if the kerbside bin has more than 85kg of waste, owing to which it is recommended to have 140L food bins as the food waste is heavier being wet/denser. Ultimately it was modelled that the provision of FOGO to businesses as outlined in the NSW Waste and Sustainable Material Strategy 2041 would lead to a cost saving of \$32,800/year for Council.
- 2) Businesses, especially large businesses were given the option of continuing the FOGO services after the trial ended but unfortunately, they were unable to continue due to single day collections in a week. It is highly recommended to Council to provide the option of multiple day waste collections in a week when introducing commercial FOGO.
- 3) Survey results show that the community views food waste separation as very important. Positive community perception of the value of FOGO separation can be utilised in the promotion of any changes to waste collection configurations.
- 4) Trial participants expressed concern over the caddy design and compostable liners. Some found that the caddy resulted in unpleasant odours, and that the compostable liners were easily teared. The caddy should be designed in a way to alleviate these issues and to address other community concerns. Caddy design was identified as an issue in Leichhardt Council’s implementation of their FOGO collection scheme.
- 5) The survey revealed a range of common community concerns that should be addressed by any education and media campaigns. These include:
 - a. Providing residents with more accessible information about what waste can go into the red/green/yellow bins.
 - b. How a change in service configuration will affect their rates. Moreland City Council provided transparent costing information for a range of different service configurations published by Blue Environment (Nyunt 2021), and can be used as a basis for conversations within the community.
 - c. The possibility of offering residents discounted compost produced from FOGO recycling as an incentive for participation. A similar scheme was implemented in Bega Valley Shire to great success.

The works undertaken in the project have indicated that the best course of action for BRC to meet the targets set out by the state and federal governments would be the transition from a weekly to fortnightly general waste service. This could be considered at the end of the current contract period in 2026 to allow for time to develop a range of service options to cater for customer needs.

Transition to a fortnightly general waste without the change in bin size is the most favourable option as it demonstrated high diversion rates, reduction in operational cost and did not incur the large capital expenditure required with change in bin sizing. Due to these advantages, it is advised that

Council begins planning on a transition to change to fortnightly general waste for those customers who can manage this option, to help BRC progress towards meeting the targets highlighted in the National Waste Plan and the NSW Waste and Sustainable Material strategy.

A program, such as the Love Your Leftovers recipe book that was developed by BRC in the past, is ideal as a vehicle to educate and raise awareness on how to use food leftovers safely to minimise food waste. Such an education program is expected to result in a significant reduction in food waste going to landfill, therefore is highly recommended for introduction, along with other related waste communication activities.

It is further recommended that Council provide compostable liners to households and businesses on an ongoing basis as these were a consistent request and were shown to drive positive mentality regarding the transition of service provisions. Council will continue to work with the contracted food and garden waste processor to identify any issues regarding compostable liners, and endeavour to resolve them. The provision of the liners and transition should be undertaken in conjunction with a thorough education campaign to help engage the community and overcome the perceived barriers highlighted in the main report.



6 REFERENCES

- .id. 2021. "Bathurst Regional Council: Community profile." Accessed September 24, 2021.
<https://profile.id.com.au/bathurst>.
- DISER. 2021. "National Greenhouse Accounts Factors" Australian National Greenhouse Accounts. Accessed October 2021.
<https://www.industry.gov.au/sites/default/files/August%202021/document/national-greenhouse-accounts-factors-2021.pdf>
- Bathurst Regional Council 2020, "Annual Report 2019/2020". Accessed October 21, 2021.
https://www.bathurst.nsw.gov.au/images/stories/council/annual%20reports/Annual_Report_2019-2020_V3.pdf.
- Bernstad, Anna. 2014. "Household Food Waste Separation Behavior and the Importance of Convenience." *Waste Management* 34 (7): 1317–23.
- Cialdini, Robert B. 2003. "Crafting Normative Messages to Protect the Environment." *Current Directions in Psychological Science* 12 (4): 105–9.
- EPA NSW. 2021. "Case Study: Food Organics Collection in Leichhardt." EPA.
<https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/wastegrants/18p0751-leichhardt-fogo-casestudy.pdf>.
- Goldstein, Noah J., Robert B. Cialdini, and Vladas Griskevicius. 2008. "A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels." *Journal of Consumer Research* 35 (3): 472–82.
- Graham-Rowe, Ella, Donna C. Jessop, and Paul Sparks. 2014. "Identifying Motivations and Barriers to Minimising Household Food Waste." *Resources, Conservation and Recycling* 84 (March): 15–23.
- Hopper, J. R., and J. M. Nielsen. 1991. "Recycling as Altruistic Behavior: Normative and Behavioral Strategies to Expand Participation in a Community Recycling Program." *Environment and Behavior* 23 (Mar 91): 195–220.
- Linder, Noah, Therese Lindahl, and Sara Borgström. 2018. "Using Behavioural Insights to Promote Food Waste Recycling in Urban Households—Evidence From a Longitudinal Field Experiment." *Frontiers in Psychology* 9 (March): 352.
- McKenzie-Mohr, Doug. 2002. "New Ways to Promote Proenvironmental Behavior: Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing." *Journal of Social Issues* 56 (December): 543–54.
- Moreland City council. 2021. "Reducing Our Waste: Improving Our Service. Stage 2: Summary of Consultation." https://hdp-au-prod-app-more-conversations-files.s3.ap-southeast-2.amazonaws.com/8416/2002/5483/3988.MorelandCityCouncil_SummaryStage2.v3.pdf.
- Nolan, Jessica M., P. Wesley Schultz, Robert B. Cialdini, Noah J. Goldstein, and Vladas Griskevicius. 2008. "Normative Social Influence Is Underdetected." *Personality and Social Psychology Bulletin* 34 (7): 913–23.
- Nyunt, Piya. 2021. "Moreland's Future Kerbside Waste and Recycling Options Assessment." Blue Environment.

Perrin, Darren, and John Barton. 2001. "Issues Associated with Transforming Household Attitudes and Opinions into Materials Recovery: A Review of Two Kerbside Recycling Schemes." *Resources, Conservation and Recycling* 33 (1): 61–74.

Rawtec. 2020. "Analysis of NSW Food and Garden Bin Audit Data - March 2020."

United Nations. 2015. "Transforming Our World: The 2030 Agenda For Sustainable Development." United Nations.
<https://sdgs.un.org/sites/default/files/publications/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>.



7 APPENDICES

7.1 APPENDIX B: FINAL AUDIT PHOTOGRAPHS

Final audit photographs to gauge the different waste in trial areas at end of trial.

7.1.1 TRIAL AREA 1



7.1.2 TRIAL AREA 2



7.1.3 TRIAL AREA 3



7.1.4 TRIAL AREA 4



7.1.5 TRIAL AREA 5



7.1.6 TRIAL AREA 6



7.1.7 TRIAL AREA 7



7.2 APPENDIX C: FLYER



Closing the Gap on Food Waste

Would your business like to be a part of an exciting FREE trial with Bathurst Regional Council?

Council's *Closing the Gap on Food Waste* project will trial innovative ways of diverting commercial food waste from landfill having many positive impacts on the environment and the economy. In 2019/2020 2.5 million kilograms of food and garden waste ended up in Bathurst landfill generating 4,800 tonnes of CO₂, so diverting food waste and turning into an organic composting product will lower Bathurst LGA'S emissions. Having your business involved will assist Council in developing strategies to better manage the regions food waste.

- Utilising the new FOGO service will be free of charge during the four- month trial and participating businesses will receive; a 60L kitchen insert bin and a 140L food waste bin which will reduce the load on your general waste bin.

If your business is interested in taking part in the trial, please contact Council on (02) 6338 2824 for further information.



7.3 APPENDIX D: LETTERS

7.3.1 PRE-TRIAL LETTER FOR BUSINESSES



Civic Centre
158 Russell Street
Private Mail Bag 17
Bathurst NSW 2795

Telephone 02 6333 6111
Facsimile 02 6331 7211
council@bathurst.nsw.gov.au
www.bathurst.nsw.gov.au

Dear Sir/Madam

Closing the Gap on Food Waste

Thank you for registering your business to partake in the exciting new project 'Closing the Gap on Food Waste' With Bathurst Regional Council. We hope that you enjoy being a part of this trial and find it beneficial for your business. Throughout this project we will be trialling new ways of collecting commercial food waste to divert it from landfill. As a part of this trial your business will receive two bins being a 60-litre kitchen insert bin (designed to aid you in moving food waste from the kitchen to the kerbside bin), and a 140- litre green lidded food waste bin, which will be collected daily from the kerbside. Utilising these bins will minimise the amount of waste going to landfill and ensure that your organic waste can be composted.

Food waste represents a growing economic and ecological concern nationwide, leaving a toll on not only the environment but on businesses too. In 2019/2020 an estimated 2.3 million kilograms of food waste ended up in Bathurst Landfill producing 4,800 tonnes of CO₂. The amount of food a business discards can also affect its efficiency and bottom line by incurring increased waste disposal costs. It is hoped that through conducting this trial, a cost effective and efficient method for diverting organics from landfill can be found which could in-turn reduce the costs to businesses for their waste disposal in the future.

We request that you put all of the food and biodegradable waste that your business generates into the 60-litre kitchen bin and from there tip it into your 140- litre green lidded kerbside bin. These bins are not only able to collect food waste, but all Food Organics Garden Organics (FOGO) waste including coffee grinds, tea bags, newspaper, serviettes, tissues, paper towel and compostable packaging. We have provided a poster of what can/cannot go into the FOGO bin for convenience for staff members.

The FOGO waste collected throughout the trial will be composted through Australian Native Landscapes (ANL) at Blayney and will be sent to local farms providing a nutrient rich material to be used in agriculture. The trial aims to identify the community's habits regarding food waste, and hopefully work towards breaking down the barriers that hinder people from separating their food waste from their general waste. Council is hopeful that the findings from this trial will assist us to work collaboratively with businesses to improve food waste collection methods resulting in greater food waste diversion from landfill.

We would ask that you please share this information with the property owner and/ or business owner as applicable to ensure that they are aware that there are no ongoing obligations or costs associated with the participation in this trial. Any permanent changes to waste services and associated costs would be determined by a resolution of Council and would include substantial community consultation.

Thank you for your participation. Your input is greatly appreciated as Bathurst Regional Council explores new and innovative ways of managing our regions food waste. Please refer to the attached document of Frequently Asked Questions about the trial and contact Council on (02) 6338 2824 if you have any further enquiries.

Yours faithfully


Darren Sturgiss
DIRECTOR
ENGINEERING SERVICES

Reference: RT.MO:14.00007-Bus1
Enquiries: Ray Trevorah 02 6338 2824 or email waste@bathurst.nsw.gov.au

BATHURST REGION... FULL OF LIFE

7.3.2 PRE-TRIAL LETTERS FOR HOUSEHOLDS (TRIAL AREAS 1-7)

A letter was sent to each of the 206 households, with slight alterations tailoring it to their specific trial area. This appendix shows the letter for TA1. The letters for the other trial areas contained similar information but stated the specific change to their service.



18 May 2021

Dear Resident

Trial Project - Closing the Gap on Food Waste

You have been selected to be a part of an exciting new project 'Closing the Gap on Food Waste'. Council hopes that you enjoy being a part of this trial. Throughout this project Council will be trialling new ways of collecting food waste to further divert organics from landfill.

You will be provided with a caddy and a roll of 100 compostable liners to last you for the duration of the four-month trial, and your red lidded general waste bin will only be collected fortnightly for the duration of this trial. If you are not currently using your lime green lidded Food and Garden waste bin, you are encouraged to place all your food waste into the caddy provided instead of your usual general waste bin, and from the caddy tip it into your lime green lidded food and garden waste bin rather than your red lidded general waste bin. This simple switch can make a huge difference! The trial will commence the week beginning 24 May 2021 and conclude the week ending 3 October 2021. Throughout the trial you may occasionally see Council staff inspecting your bins collecting important waste data. No identifiable or personal data will be captured during this project, staff will only be collecting data on bins weights and volumes. After the trial ends, your red lidded general waste bin collection frequency will return to weekly.

Did you know?

- ◆ In 2019-2020 an estimated 2.3 million kilograms of food waste ended up in the Bathurst landfill.
- ◆ Food waste has a range of environmental, social, and economic implications. Rotting food in landfill produces methane, which is more harmful than CO₂.

How this trial will address the food waste problem

The food waste collected throughout the trial will be composted at Australian Native Landscapes (ANL) at Blayney and will be sent to local farms providing a nutrient rich material to be used in agriculture. The trial aims to identify the community's habits regarding food waste, and together hopefully work towards breaking down the barriers that hinder people from separating their food waste from their general waste. Council is hopeful that the findings from this trial will assist us to work collaboratively with residents and businesses to improve food waste collection methods resulting in greater food waste diversion from landfill.

Home Composters/ Chicken Owners/Worm Farmers etc

If you already have your own composting method set up at home, that is great, keep up the good work! This trial is not aimed to take away from the good work you are already doing, but to complement it and take the pressure off your current system. The lime green Food and Garden waste bin can take the difficult to compost items & things that worms, and chickens do not like to eat such as pizza boxes, paper towel, citrus fruits, fish, bones, dairy products etc.

Thank you for your participation. Your input is greatly appreciated as Bathurst Regional Council explores new and innovative ways of managing our regions food waste. Please refer to the **attached** document of Frequently Asked Questions. Should you have any further enquiries regarding the trial please contact Council on (02) 6338 2824 or email waste@bathurst.nsw.gov.au

Yours faithfully

Darren Sturgiss
DIRECTOR
ENGINEERING SERVICES

Reference: RT.MO:14.00007-TA1

Enquiries: Ray Trevorah 02 6338 2824 or email waste@bathurst.nsw.gov.au

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158 Russell Street Facsimile 02 6331 7211
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7.3.3 LETTER SENT TO BUSINESSES AT END OF TRIAL



Civic Centre
158 Russell Street
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Bathurst NSW 2795

Telephone 02 6333 6111
Facsimile 02 6331 7211
council@bathurst.nsw.gov.au
www.bathurst.nsw.gov.au

28 October 2021

To the Business Owner

Dear Sir/Madam

Closing the Gap on Food Waste

Council wishes to thank you for participating in the *Closing the Gap on Food Waste* project. We hope you enjoyed taking part in this trial and that you found it beneficial for your business. Your contribution has provided valuable data that Council will use to make future decisions on waste services. The trial data will guide Council to further reduce the amount of valuable nutrients from food waste and organics going to landfill and lessen our greenhouse gas emissions.

Please note that the trial will conclude on Monday, 22 November 2021. Your 140L green lidded bins will be removed by Council staff on this day, therefore we ask that you please ensure your bin/s are left on the kerbside on Sunday, 21 November 2021 for an early morning collection the next day.

The 60L kitchen insert bins will not be collected, you are able to continue utilising these.

If you have found this service useful during the trial, Council is offering a standard 240L green lidded food and garden waste bin for your business at a cost of \$116 per year to be collected once per week while we review the findings of the trial. If this is something you are interested in, please call (02) 6333 6111 or email waste@bathurst.nsw.gov.au before Friday, 15 November 2021 to arrange this.

Thank you again for your co-operation.

Yours faithfully

Darren Sturgiss
DIRECTOR
ENGINEERING SERVICES

Reference: RT:MO:14.00007-BusFinal
Enquiries: Ray Trevorah 02 6338 2824 or email waste@bathurst.nsw.gov.au

BATHURST REGION... FULL OF LIFE

7.3.4 LETTER SENT TO HOUSEHOLDS AT END OF TRIAL

A letter was sent to each of the 206 households, with slight alterations tailoring it to their specific trial area. This appendix shows the letter for TA3. The letters for the other trial areas contained similar information but stated the specific change to their service.



Civic Centre Telephone 02 6333 6111
 158 Russell Street Facsimile 02 6331 7211
 Private Mail Bag 17 council@bathurst.nsw.gov.au
 Bathurst NSW 2795 www.bathurst.nsw.gov.au

28 September 2021

To the Householder

Dear Resident

Closing the Gap on Food Waste – Ending Soon

Council wishes to thank you for your participation in the *Closing the Gap on Food Waste* Project.

Your contribution has provided valuable data that Council will use to make future decisions on waste services. The trial data will guide Council to further reduce the amount of waste and organics going to landfill and lessen our greenhouse gas emissions.

Please note that the trial concludes for your area on Wednesday, 6 October 2021. This means that your red lidded bin will be emptied on that day, and we ask that you please leave your 140L bin on the kerbside so that it can be swapped back to your original 240L bin on that day.

Should you have any further enquiries regarding the trial please contact Council on (02) 6338 2824 or email waste@bathurst.nsw.gov.au

Thank you again for your co-operation.

Yours faithfully

Darren Sturgiss
**DIRECTOR
 ENGINEERING SERVICES**

Reference: RT:MO:14.00007-Biltman Place, Turner Place and Wilkinson Place
 Enquiries: Ray Trevorah 02 6338 2824 or email waste@bathurst.nsw.gov.au

BATHURST REGION... FULL OF LIFE

7.4 APPENDIX E: FOGO USER GUIDE FOR BUSINESSES

Welcome to FOGO!

What is FOGO?

FOGO stands for Food Organics Garden Organics. It's a convenient and environmentally friendly way to dispose of the organic waste your business may generate.

Why FOGO?

In 2019/2020 a staggering 2.5 million kilograms of food waste ended up in Bathurst landfill.

By collecting nutrient-rich food waste from hospitality businesses, we can produce high quality compost to be used on local farms. Therefore, avoiding valuable compostable material ending up in landfill and producing methane - a more potent greenhouse gas than carbon dioxide that contributes to climate change.

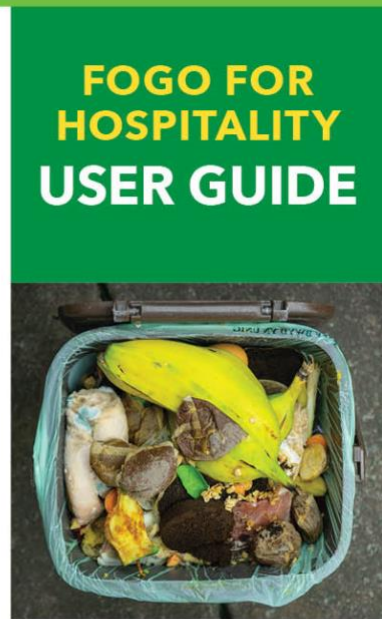
Already managing your businesses food waste?

That's great! The FOGO system does not replace your personal composting efforts but can work alongside it. The FOGO bin can take some of the hard to compost items in small scale composting, and things that worms don't like to eat such as meat, bones, dairy, seafood, and citrus. As well as compostable plates and cutlery.

FOGO tips

- Allow hot food to cool before putting into your FOGO bin.
- **Remember:** If it used to live or grow then its **FOGO!**
- Remove stickers from fruit peels and skins.
- All food can go into the FOGO bin, raw or cooked.
- Wrap food in newspaper or paper towel to reduce odour and soak up any liquid.

If you would like any further information or would like to tell us how FOGO is going for you, please call Council on (02) 6338 2824.



How to use your FOGO service in 4 easy steps!

Step one
Use the kitchen insert bin to collect all food scraps and plate waste.

Step two
Regularly empty the contents of the kitchen bin into the lime green lidded FOGO bin.

Step three
Put your FOGO bin out onto the kerb nightly to be collected the following morning.

Step four
Rinse out your kitchen insert bin if needed.

What CAN go into your FOGO bin

Fruit & Vegetable Scraps	Any cooked & uncooked food scraps	Meat, bones & seafood	Egg shells	Dairy products (e.g. cheese, butter)
Bread, pasta & cereals	Cakes & pastries	Soiled pizza boxes, cardboard & paper	Used napkins, serviettes & paper towel	Compostable packaging including cutlery, plates, cups, and chopsticks
Baking paper & newspaper	Coffee grinds & tea bags	Garden waste		

What CANNOT go into your FOGO bin

Plastic bags & soft plastics	Glass	Aluminium cans	General Waste	Plastic bottles & trays
Tins	Disposable Coffee Cups	Foil & cling wrap	Fruit stickers & labels	Plastic straws

If you would like any further information or would like to tell us how FOGO is going for you, please call Council on (02) 6338 2824.

7.5 APPENDIX F: FOGO USER GUIDE FOR HOUSEHOLDS

Welcome to the FOGO trial!

Commencing on the 24th of May, Bathurst Regional Council is conducting a fourth month trial in your area.

In 2019/2020, 2.5 million kilograms of food and garden waste ended up in Bathurst landfill.

Food and garden waste in landfill decomposes more quickly than other waste, generating methane which is a more potent greenhouse gas than carbon dioxide.

Why FOGO?

By diverting food waste from the general waste bin and into the lime green lidded FOGO bin, together we can reduce the number of organics going to landfill, therefore reducing the amount of greenhouse gasses produced.

FOGO – Food Organics Garden Organics User Guide



FOGO TIPS!

- ALL food waste can go into your caddy and green lidded FOGO bin, raw or cooked.
- Foods that you are worried about smelling in the caddy/bin can be frozen until collection day.
- You can wrap food scraps in newspaper or paper towel to reduce odour and soak up any liquid.
- Empty your caddy into your green lidded bin regularly.

Remember to always use compostable bags that have one of the following logos in your caddy. Plastic bags are prohibited in the FOGO bin.



How to use FOGO in 3 easy steps!

- 1 **Collect your food and organic waste**
Line your caddy with the compostable liners provided and place all your food scraps into it. Sprinkling bi-carb soda on top can help reduce odour.



- 2 **Empty your caddy into your FOGO bin**
Empty your caddy into the green lidded FOGO bin along with your other organic waste, garden clippings, leaves, grass etc.



- 3 **Place your FOGO bin out for collection day**
Place your lime green lidded FOGO bin out for collection as usual. Remember: It does not need to be full to be collected.



The FOGO waste collected is composted through ANL and is used on local farms!

What CAN go into your FOGO bin

- ✓ Fruit and vegetable scraps
- ✓ Meat and bones (raw and cooked)
- ✓ Coffee grounds and tea bags
- ✓ Eggshells
- ✓ Seafood
- ✓ Pasta, cereals, rice, bread, cakes
- ✓ Cardboard and pizza boxes
- ✓ Paper towel, tissues, and paper
- ✓ Compostable liners

What CANNOT go into your FOGO bin

- X Plastic bags
- X Plastic straws
- X Glass bottles/jars
- X Metal
- X Tins
- X Disposable coffee cups
- X Foil
- X Plastic packaging e.g., cling wrap, bags, and containers

7.6 APPENDIX G: FAQ'S FOR HOUSEHOLDS PRE-TRIAL

Closing the Gap on Food Waste trial – May 2021

Frequently Asked Questions



How long will the trial go for?

The trial will run for four months beginning in May 2021. Council will be in regular contact throughout the project period.

Why has the trial been introduced?

Food waste is a significant issue. In 2019/2020 around 2.5 million kilograms of food and garden waste ended up in Bathurst landfill, generating 4,800 tonnes of CO2.

Food waste is an economic and social problem, food and organic waste in the landfill creates methane which contributes to climate change and landfilling waste comes with a cost to Council and residents. As such, there are many reasons that we should attempt to divert as much waste away from landfill as possible.

Many councils around Australia have had success implementing a service such as this, so together we can make a positive difference by diverting our food waste to compost and using the kerbside bins correctly.

What will I receive by participating in the trial?

Households have been randomly selected to participate in various aspects of this trial. You may receive a caddy and caddy liners (Australian Standard compostable bags made completely from corn starch) which will be delivered together on the same day, or there will be an alteration to your bin collection frequency. The bins used for the trial will be marked differently.

Why has my household **not** been chosen to be a part of the trial?

All households that are a part of the trial have been randomly selected to participate. Best practise was applied in the selection process to ensure there was no bias.

Will there be a cost?

No, you will not incur a cost by participating in the trial. The cost of the trial is being funded by Council with support from a Research and Innovation grant provided by Local Government NSW (LGNSW) and the Department of Planning, Industry and Environment (DPIE).

Can I opt out of the trial?

No. To ensure we capture an accurate representation of the Bathurst population, we need the households selected to be actively involved, otherwise this will have an adverse impact on the data. By participating, you will be helping Council develop strategies to better manage the regions food waste which will provide long term solutions and benefit the whole community.

There will only be exemptions made for those with medical requirements who may not be able to utilise this service. Please contact Council on (02) 6338 2824 if this is the case.

What can I put in the FOGO bin?

Food waste: bread, vegetable and fruit scraps, meat, fish, bones, teabags, coffee grinds, eggshells. Garden waste: flowers, leaves, garden clippings etc, soiled pizza boxes, tissues and paper towel, compostable packaging, and pet waste.

The contents of this bin are composted so it is extremely important to keep glass and plastic out to ensure there is no contamination. Liners must be labelled as compostable not biodegradable. Plastic bags are prohibited in the green (FOGO) bin.

Will my bins be audited whilst I am participating in the trial?

Yes, you may occasionally see Bathurst Council staff checking bins during the trial. This is to collect data and ensure accurate results are achieved over the trial. Your waste data will be kept securely, and no personal information will be captured or included in the audit.

Council staff will have COVID safe measures in place when auditing bins.

What happens if I run out of liners?

We have provided you with enough compostable liners to last you the duration of the four-month trial. However, if you happen to run out of liners before the completion of the trial, Council will provide you with more, free of charge. Newspaper is also able to be utilized to line your caddy or wrap up food scraps.

Please note: If you run out of liners or do not wish to use them to contain food, your food scraps can be thrown into the caddy or straight into the green bin without the use of a liner or newspaper.

Council would prefer you use the liners supplied, however if you have your own bags you wish to use, they MUST comply with correct certification to ensure they are 100% compostable. Liners with these symbols are suitable:



What happens to the FOGO waste?

Your food and green waste will continue to be collected and sent to the organic composting facility at ANL Blayney. This compost will be used on local farms and in agriculture and horticulture around the region.

What do I do if my caddy and green bin begin to smell?

Tips to reduce odours:

- Use the liners provided
- Wash caddy: they are dishwasher safe
- Always keep the lid on
- Store your bins in a ventilated area
- Sprinkle bi- carb soda on top of waste to neutralize odours

What happens to my existing bins?

If your existing bin size or collection frequency was altered, it will be returned to standard operation upon completion of the four-month trial.

What happens to my bins after the trial?

If you received caddies and liners, you will be able to keep them to continue using after completion of the trial. Your bins will be returned to standard frequency.

7.7 APPENDIX H: FAQ'S FOR BUSINESSES PRE-TRIAL

Closing the Gap on Food Waste trial

Frequently Asked Questions – Businesses



How long will the trial go for?

The trial will run for four months beginning in June 2021. Council will be in regular contact throughout the project period.

Why has the trial been introduced?

Food waste is a significant issue. In 2019/2020 around 2.5 million kilograms of food and garden waste ended up in Bathurst landfill, generating 4,800 tonnes of CO₂.

Food waste is an economic and social problem, food and organic waste in the landfill creates methane which contributes to climate change and landfilling waste comes with a cost to Council, residents, and businesses. As such, there are many reasons that we should attempt to divert as much waste away from landfill as possible.

Many councils around Australia have had success implementing a service such as this, so together we can make a positive difference by diverting our food waste to compost and using the kerbside bins correctly.

What will my business receive by participating in the trial?

You will receive 1x 60-litre kitchen insert bin and 1x 140-litre green lidded kerbside FOGO bin for your food and organic waste.

Will there be a cost?

No, you will not incur a cost by participating in the trial. The cost of the trial is being funded by Council with support from a Research and Innovation grant provided by Local Government NSW (LGNSW) and the Department of Planning, Industry and Environment (DPIE).

My business has limited space in its kitchen, how can I find room to store my kitchen insert bin?

The kitchen insert bin has been designed to slide under a bench top or to be stored next to your other waste bins. By having a separate food waste bin, you should be able to reduce your number of landfill (red) and recycling (yellow) bins or consolidate two rubbish or recycling bins into one.

What can I put in the FOGO bin?

Food waste: bread, vegetable and fruit scraps, meat, seafood, bones, teabags, coffee grinds, eggshells.

Soiled pizza boxes, tissues, serviettes, paper towel, baking paper and compostable packaging such as BioPak. As well as garden waste: flowers, leaves, garden clippings etc.

The contents of this bin are composted so it is extremely important to keep glass and plastic out to ensure there is no contamination. Plastic bags are prohibited in the green (FOGO) bin.

I am worried the FOGO bins will attract pests

Tips to avoid this:

- Always keep lid closed
- Try not to overfill bins
- Once the kitchen insert bin is full, transfer the contents to the green lidded kerbside bin as soon as possible
- Wash out bins daily
- Utilise fly deterrents

As the FOGO bin will be collected daily, pests should not become too much of an issue.

Will my bins be audited whilst I am participating in the trial?

Yes, you may occasionally see Bathurst Council staff checking bins during the trial. This is to collect data and ensure accurate results are achieved over the trial. Your waste data will be kept securely, and no personal information will be captured or included in the audit.

Council staff will have COVID safe measures in place when auditing bins.

What happens to the FOGO waste?

Your food and green waste will be sent to the organic composting facility at ANL Blayney. This compost will be used on local farms and in agriculture and horticulture around the region.

What do I do if my kitchen bin and green bin begin to smell?

Tips to reduce odours:

- Wash out kitchen bin daily
- Always keep the lid on
- Store your bins in a ventilated area
- Sprinkle bi- carb soda on top of waste to neutralize odours

What happens to my existing bins?

There will be no alteration to your current Council general waste bins and the collection frequency will remain the same. You will just be receiving an additional green FOGO bin.

What happens to my bins after the trial?

After completion of the four-month trial, the kitchen bin and the green lidded bin will be collected and returned to Council. There may be a potential ongoing service, this will be reviewed throughout the trial.

7.8 APPENDIX I: CALCULATION ASSUMPTIONS AND CORRECTIONS FOR COMPOSITIONAL ANALYSIS

Trial Area 1

- Nil

Trial Area 2

- Audit 1 had an exceptionally large proportion of textiles in the general waste bin (31.3 wt% vs 12.85, 14.32 wt% for audits 2/3 respectively). It is assumed that the influence of the trial conditions should have minimal effect on textile presence, so the textile wt% was adjusted to be 13.59 (average of audits 2/3).
- Audit 3 had a Trial Area total of 15.45 kg/bin, which deviated significantly from the average weight value of 11.59 kg/bin. This was adjusted to 11.78 kg/bin which represents the average for the final four weeks of the trial.
- Final statistical comparison was performed between Audits 1 and 2, due to significant discrepancies between audits 2 and 3.

Trial Area 3

- Nil

Trial Area 4

- Audit 1 had a Trial Area total of 8.82 kg/bin, much lower than the average of 14.97. Since this was the control area, it was deemed reasonable to adjust this value to the average.

Trial Area 5

- Audit 1 had a Trial Area total of 23.8 kg/bin, significantly higher than the average of 15.7. This was adjusted to the average.

Trial Area 6

- Audit 1 had a Trial Area total of 7.2 kg/bin, significantly lower than the average of 9.64. This was adjusted to the average.

Trial Area 7

- Final statistical comparison was performed between Audits 1 and 2, due to improper collection during Audit 3, which included houses outside of the trial area.

7.9 APPENDIX J: SURVEYS

7.9.1 HOUSEHOLDS PRE-TRIAL (GENERIC ONE FOR ALL TRIAL AREAS)

Survey for households to complete before commencement of *Closing the Gap on Food Waste* trial- May 2021

Please tick the boxes that apply. Individual's answers will be kept confidential.



Q1. How would you describe your household?

- | | |
|--|---|
| <input type="checkbox"/> Single | <input type="checkbox"/> Single parent with children living at home |
| <input type="checkbox"/> Couple with no children | <input type="checkbox"/> Group/share house |
| <input type="checkbox"/> Couple with young children living at home | <input type="checkbox"/> Other: |
| <input type="checkbox"/> Couple with adult children living at home | |

Q2. How much food would you say your household throws away a week?

- | | |
|---|--|
| <input type="checkbox"/> Low volume (up to 3L per week) | <input type="checkbox"/> High volume (7L or more per week) |
| <input type="checkbox"/> Medium volume (3-7L per week) | <input type="checkbox"/> None |

Q3. What do you think is the main reason behind food being wasted in your household?

- | | |
|--|--|
| <input type="checkbox"/> Cook too much | <input type="checkbox"/> Unsure of how to store food properly |
| <input type="checkbox"/> Some members do not finish their meals | <input type="checkbox"/> Food is forgotten about in fridge/freezer |
| <input type="checkbox"/> We do not plan meals in advance | <input type="checkbox"/> We do not waste any food |
| <input type="checkbox"/> We don't use left-over ingredients in meals | <input type="checkbox"/> Other |

Q4. Do you currently do anything to manage your food waste?

- | | |
|--|--|
| <input type="checkbox"/> I give leftovers to my pets | <input type="checkbox"/> I compost for my garden |
| <input type="checkbox"/> I have chickens/ worms | <input type="checkbox"/> I put my food waste into my green recycling bin |
| <input type="checkbox"/> I give to a community compost | <input type="checkbox"/> I don't do anything |
| <input type="checkbox"/> Other: | |

Q5. What motivates you to avoid food waste?

- | | |
|---|---|
| <input type="checkbox"/> Save money | <input type="checkbox"/> It's the right thing to do |
| <input type="checkbox"/> Save time | <input type="checkbox"/> I'm not motivated |
| <input type="checkbox"/> Environmental concerns | |

Q6. How important would you say separating your food and garden waste from your garbage waste is?

- | | |
|---|---|
| <input type="checkbox"/> Very important | <input type="checkbox"/> Not very important |
| <input type="checkbox"/> Important | <input type="checkbox"/> Not at all important |
| <input type="checkbox"/> Don't know | |

1

Q7. Which of the following food items (if any) do you currently put in your green waste recycling bin?

- | | |
|---|--|
| <input type="checkbox"/> Plate waste | <input type="checkbox"/> Fruit and vegetable scraps |
| <input type="checkbox"/> Egg shells | <input type="checkbox"/> Coffee grounds/ coffee pods/ tea bags |
| <input type="checkbox"/> Meat/bones | <input type="checkbox"/> Bread/pasta/ bakery items |
| <input type="checkbox"/> Dairy products | <input type="checkbox"/> Fish/ seafood |
| <input type="checkbox"/> None | |

Q8. What deters you from putting food waste into the green waste recycling bin?

- | | |
|--|--|
| <input type="checkbox"/> Too much hassle/ takes too much time | <input type="checkbox"/> Unsure which food items can go into green bin |
| <input type="checkbox"/> Makes the green bin smell | <input type="checkbox"/> My green bin is always too full of garden waste |
| <input type="checkbox"/> I don't have an easy way to separate my waste | <input type="checkbox"/> Other: |
| (e.g., no caddy or space to put it) | |

Q9. Who usually separates the waste in your household?

- | | |
|---|--|
| <input type="checkbox"/> Adult female (18 years and over) | <input type="checkbox"/> Children (5-13 years) |
| <input type="checkbox"/> Adult male (18 years and over) | <input type="checkbox"/> Everyone in the household |
| <input type="checkbox"/> Adolescent (13-18 years) | |

Please mail this survey back to Council in the pre-paid envelope provided. Or take a picture/scan and send to waste@bathurst.nsw.gov.au.

Participants will be able to access the survey responses and data in the final report on the Council website.

7.9.2 HOUSEHOLDS MID-TRIAL SURVEY (7 DIFFERENT FOR EACH TRIAL AREA)

Each trial area was provided with survey questions specific to their changes. This is an example of such, provided to TA2 which had all the changes to their waste service.



Reference: TA2

Survey for households to complete mid-way in *Closing the Gap on Food Waste* trial

This survey is estimated to take less than 5 minutes to complete. Your valuable feedback from this survey will help guide Council in making future decisions regarding the way we reduce waste to landfill and greenhouse gas emissions. If you have any further comments please use the back of the page if there is not enough room on the front.

Please put a tick/cross in the box that applies. All answers will be kept confidential.

Q1. Have you noticed a change in your waste habits/doing anything differently since the beginning of the trial?

- I am now putting my food waste into the green bin instead of the red
- I have always separated my waste
- I am now using a kitchen caddy and liners
- I am not doing anything differently

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q2. Since the trial began, I am using my recycling bin more					
Q3. Since the trial began, I am more motivated to separate my food waste					

Q4. How have you found the communications from Council regarding the trial?

- The material I received (including the caddy user guide) clearly explained the trial, its purpose and what I was expected to do
- The material I received was unclear and confusing. Please explain why: _____

Q5. What else would you like to see in informational material in the future? _____

Q6. Do you believe the Food and Garden (FOGO) program is a useful initiative?

- Yes
- No. Please explain why: _____

Please place a tick/cross in the appropriate box below

Reference: TA2

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q7. I feel confident I know what goes into the red bin (general waste)					
Q8. I feel confident I know what goes into the yellow bin (recycling)					
Q9. I feel confident I know what goes into the food and garden green bin (FOGO)					

Please place a tick/cross in the appropriate box below

	Weekly	Fortnightly	More than fortnightly
Q10. How often does your red bin fill and you feel it needs to be collected?			
Q11. How often does your yellow bin fill and you feel it needs to be collected?			
Q12. How often does your food and garden green bin fill and you feel it needs to be collected?			

Please place a tick/cross in the appropriate box below

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Q13. I feel the caddy is easy to use					

Q14. The caddy is easy to clean					
Q15. The liners help with mess from food scraps (eg. liquid)					
Q16. The caddy fits easily on my kitchen bench/ under my sink					
Q17. I have no issues with odours coming from the caddy					
Q18. I have no issues with pests around the caddy					
Q19. The caddy is a good size					

Q20. Have there been any barriers with using your kitchen caddy?

Yes. If so, what are they? _____ No

Q21. Has anything prevented you from putting food waste into your food and garden green bin?

Yes. If so, what? _____ No

Q22. How full has your red lidded bin been at the end of the fortnight during the trial?

- Less than half full (10-30%) Half full (50%)
 More than half full (70-80%) Full (100%)

Q23. How many people are in your household? _____

Please put a tally mark in each box that indicates the age of every person in your household.

Age:					
<u>0-5</u>	<u>6-11</u>	<u>12-17</u>	<u>18-23</u>	<u>24-29</u>	<u>30-35</u>
<u>36-41</u>	<u>42-47</u>	<u>48-53</u>	<u>54-59</u>	<u>60-65</u>	<u>66-71</u>
<u>72-77</u>	<u>78-83</u>	<u>84-89</u>	<u>90-95</u>	<u>95+</u>	

Reference: TA2

Please place a tick/cross in the appropriate box below

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q24. Changing the size of the general waste bin has made me more conscious of sorting my waste					
Q25. Having a smaller general waste bin encourages me to put food waste into my food and garden green bin					
Q26. Being a part of the trial has encouraged me to purchase less when grocery shopping					
Q27. I have become more conscious if the packaging my items come in					
Q28. I make better use of leftover food					

Q29. If Council were to offer residents the option of a smaller sized bin at a reduced cost, would this be something your household may be interested in?

Yes

No

Unsure

Thank you for completing this survey. Please mail this survey back to Council in the pre-paid envelope provided. Or take a picture/scan and send to waste@bathurst.nsw.gov.au Should you have any further enquiries regarding the trial please contact Council on (02) 6338 2824 or email waste@bathurst.nsw.gov.au

Reference: TA2

7.9.3 HOUSEHOLDS END OF TRIAL SURVEY (GENERIC ONE FOR ALL TRIAL AREAS)



Survey for households to complete at the conclusion of the *Closing the Gap on Food Waste* trial

Thank you for participating in the Closing the Gap on Food Waste trial.

This survey is estimated to take less than 3 minutes to complete. Your feedback from this survey will help Council with its decision making on how we can reach State and Federal targets of 50% diversion of organics from Bathurst's landfill by the year 2030.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q1. I have become more conscious of my food waste habits as a result of the trial					
Q2. After the trial I will continue to separate my waste in my day-to-day life					
Q3. I will aim to keep putting food waste into the green bin so that it is kept out of landfill					
Q4. The trial has provided me with information about organics/waste/composting that I did not know previously					
Q5. Being more involved in the waste collection process was rewarding for me					

Q6. Did you find your motivation changed throughout the trial?

- My motivation increased
 My motivation stayed the same
 My motivation decreased

Q7. On a scale of 1-10, how would you rate your enthusiasm towards separating your households waste during the trial? (1 being poor, 10 being good)

1 2 3 4 5 6 7 8 9 10

Reference: TA1

Q8. How would you rate your own personal success with the trial, in regard to being more conscious of separating or reducing your food waste? (1 being poor, 10 being good)

1 2 3 4 5 6 7 8 9 10

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q9. The information provided to me by Council was clear and enabled me to easily participate in the trial					

Q10. If you disagree with Q9, what changes would you like to see in informational material from Council in the future?

Q11. Where would you like to find this information?

- Section on Council's website
 Letterbox drop (pamphlet, flyer etc)
- Email from Council
 "Wastewise" Phone App
 Other:

Q12. What incentives (if any) should Council have to ensure proper sorting of waste?

Q13. If Council were required to change its general waste service (red lidded bin) what option do you think would work the best?

- Fortnightly collection of the 240L general waste bin
- A smaller general waste bin (140L) collected weekly
- A smaller general waste bin (140L) collected fortnightly at a reduced cost

Any other comments; _____

Thank you for completing this survey. Please mail this survey back to Council in the pre-paid envelope provided. Or take a picture/scan and send to waste@bathurst.nsw.gov.au

Reference: TA1

Q9. How likely are you to want to continue to utilise this FOGO service after the trial ends?

- Very likely Somewhat likely/ unsure
 Unlikely/ don't think it will work for your
business long term

Q10. Would you be willing to continue using this service at a cost after the trial ends?

- YES NO
 MAYBE (Why?) _____

Thank you for your feedback. Could you please mail this survey back to Council in the pre-paid envelope provided, or take a picture/scan and send to waste@bathurst.nsw.gov.au.

Businesses will be able to access the survey responses from the trial in the final report published on the Council website.

Council will be in touch to discuss at the conclusion of the trial with the filling out of a final survey.

Should you have any further enquiries regarding the trial please contact Council on (02) 6338 2824 or email waste@bathurst.nsw.gov.au.



Survey for businesses to complete at the conclusion of the *Closing the Gap on Food Waste Trial*

Thank you for participating in the Closing the Gap on Food Waste trial. The trial will conclude for your business on **Monday the 22nd of November**.

This survey is estimated to take less than 3 minutes to complete. Your feedback from this survey will help Council with its decision making on how we can reach State and Federal targets of 50% diversion of organics from Bathurst's landfill by the year 2030.

Business name: _____

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Q1. The insert bin was useful to transport food waste from the kitchen to the green lidded bin					
Q2. The response to the trial from staff members was positive					
Q3. Our business had no trouble motivating staff to separate plate waste and utilise the food waste bins correctly					
Q4. The resources provided for organics separation were beneficial in decreasing waste accumulation					
Q5. There was little to no contamination of the food waste bins during the trial					
Q6. The informational material I received from					

Council was helpful and easy to understand					
Q7. The collection frequency of the green lidded bin/s was sufficient to meet my businesses demands					

Q8. Did you find much mess eg. Liquid, odours etc coming from your kitchen insert bin?

Yes

No

Q9. If you answered yes to Q8, what measures did you take (if any) to combat this?

Q10. What barriers (if any) existed in the kitchen to hinder using the service correctly and efficiently? _____

Q11. How did you overcome these barriers? _____

Q12. Did your green lidded bin/s ever overflow throughout the trial?

Yes

No

Q13. Would you like to continue using this service at a cost?

Yes

No

Q14. If you answered yes to Q13, what price are you willing to pay for this service? _____

Q15. Alternatively, if your business has multiple red lidded general waste bins, would you be interested in swapping one of these for a food waste bin at a reduced cost?

Yes

No

Q16. Any further comments about the trial: _____

Thank you for completing this survey. Please email this survey back to Council at waste@bathurst.nsw.gov.au