



Summary Report Food Organics Research Project



In 2022 five Northern Sydney councils co-operated in a research project to improve the information available to Councils considering the introduction of food organics waste collection services in the future. The project was in the form of a trial food organics service for over 2,000 premises across four local government areas, between March and July.

The five Councils that participated in the FO (food organics) projects have well-established cooperative waste management arrangements in place and have worked together since 2014. They currently engage Veolia Environmental Services Pty Ltd (Veolia) to process a portion of their mixed waste at the company's Woodlawn Eco-Precinct to produce a soil additive known as Woodlawn Organic Output (WOO) used to rehabilitate a mine site tailings dam, shown in this image.

The project was funded by grants to the councils (Hunter's Hill, Ku-ring-gai, Lane Cove, Ryde and

Willoughby) and to the Northern Sydney Regional Organisation of Councils (NSROC) by the NSW Environment Protection Authority.

The NSROC Food Organics Project was developed and delivered as a co-operative project between NSROC and Waste Alliance Councils by: John Carse, Jude Colechin, Brandon Louie, Kathryn Odgers, Emma Paxton, Janine Ricketts, Denise Torres and Kristian Wynn.

The report was drafted by the project manager, drawing from the advice and analysis of specialist consulting services engaged to develop, deliver and support the FO Project.

This summary report is a shortened form of the full report on the project, which documents the methodology and results of the Project in detail. The full report is available on the NSROC website www.nsroc.com.au.



Methodology

A large sample of households/organisations was identified in different suburbs in four of the council areas, from five types of residences and from a group of non-residential premises. All residents in the three residential areas (Lane Cove, City of Ryde and Willoughby) were asked to participate in a 14-week trial of separating food organic waste (FO) from mixed waste so that it left the premises in a food collection service bin. A concurrent project was undertaken for the City of Ryde on a sample of houses separating food organics and disposing them in combination with garden organics (FOGO).

The trial FO waste collection service encompassed:

- Food organics separately collected from 706 houses (two areas in Lane Cove) and from 1,447 residencies in three types of multi-unit buildings (four areas of low-rise apartments and townhouses in Ryde, and one area of high-rise apartments in Willoughby); and
- Food organics separately collected from food businesses and other non-residential premises from a group of 69 food waste-generating organisations (businesses and not-for-profit organisations such as schools) which agreed to participate.

All premises were offered a food caddy and bin by personal contact, and most materials were either accepted or left at the door after multiple calls at the residence.

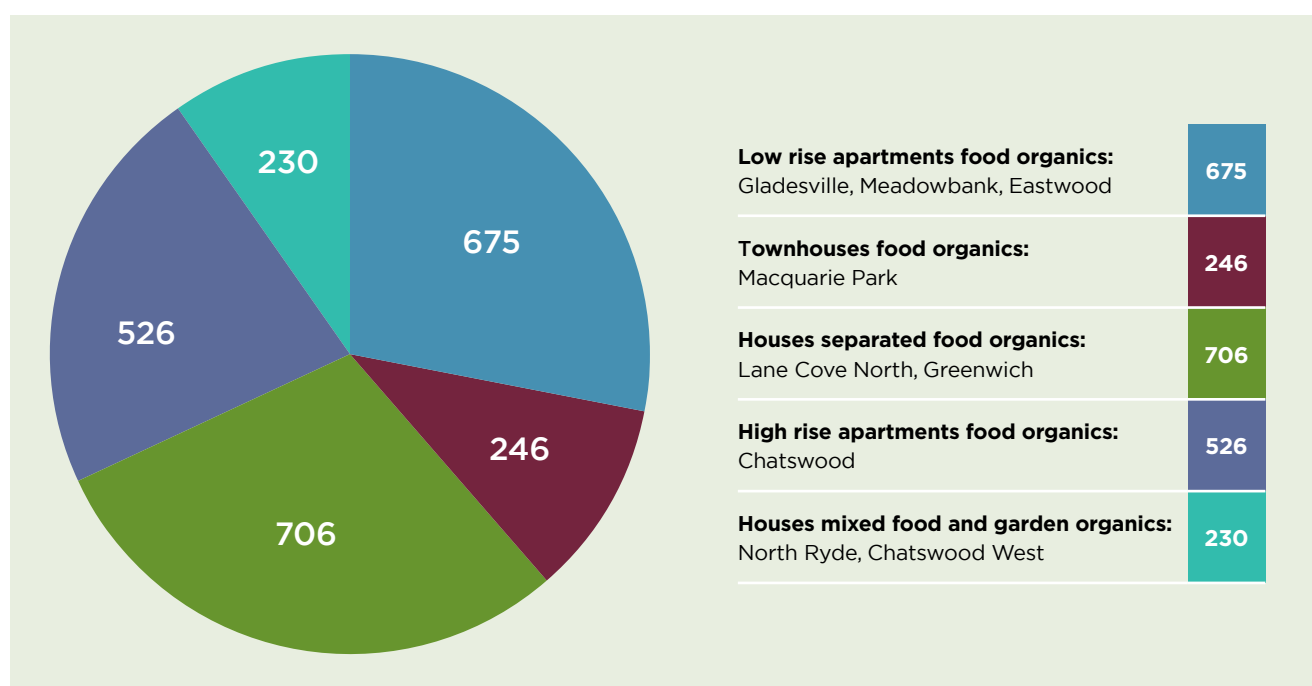
The Food Organics residential trial areas were selected to align with the suburbs mapped in community profile data published by the ABS so that other possible contributing factors to variation in participation, apart from dwelling type, could be mapped.

Chart 1 shows the sample size of each of the types of dwellings in the residential trial areas.

A specialist consultant in waste management research was engaged to verify the sampling scheme and to devise the audit methodology for the Project so that reliable data was collected to answer this set of research questions agreed amongst the councils as being important to future waste management:

- How much food is presented for collection by councils in houses, units, businesses?
- How much food waste is correctly segregated into a separate food container and how much remains in the mixed waste bin?
- What are the contamination levels in food organics loads and what proportion of collected organics would be recovered or rejected by re-processors?
- What resource recovery outcomes are achieved from the separately collected food waste in the trials?
- What are the views of participating households on the food segregation service?
- What are the additional costs of providing a food organics collection service for houses, apartments and food businesses?
- How do the resource recovery outcomes from segregated food waste compare to inclusion of food in mixed waste processing under existing agreements?

Chart 1 Participating households by location and types of dwelling



To answer these questions the principal forms of data collection for the FO Project were:

- Food organics totals each week for each of the 8 sample areas
- Weights of contaminated material removed from delivered loads
- Records of resident inquiries and complaints categorized by area and issue
- Full load or randomised sub-sampling of all loads of garbage and food organics waste collections in two weeks of the trial (audit period)
- Analysis of FO volumes for each area for 14 weeks of the trial
- Analysis of contamination and sources in the food organics bins for each building type in the audit period
- Analysis of all material in the general waste bins in the audit period
- Comparison of resource recovery outcomes from food organics processing from the amount and type of food organic material collected during the trial, compared to mixed waste processing to produce WOO
- Assessment of costs of conducting the trial
- Social research to seek input from participant households on attitude to the service, usefulness of food collection materials and the effectiveness of communications
- Analysis of the correlation between food presentation and contamination and four demographic characteristics in 7 of the trial areas (household income and size, tenure type and English proficiency), based on Community Profiles in the ABS 2021 Census.

The Project’s methodology also included a detailed communications and engagement plan developed with specialist advice, and a dedicated website and call centre for communicating with residents before and during the trial.

The communications plan included key messages applied to communications across all channels and the distribution of:

- Letters to residents (separate apartment and house versions) delivered three weeks before delivery of the food caddy and bags. Short-form information included in traditional and simplified Chinese and in Korean on the reverse of the letter
- Food caddies and compostable caddy liners for the kitchen and bins for bin bays, chute rooms and houses.
- Four-page A5 brochure (three versions for the three household types) showing how to use the caddy which was delivered with food caddy and bags by personal contact (door-knock delivery program).



- ‘Sorry we missed you’ cards left at households not responding to the door-knock when food collection materials were delivered, inviting contact, and introducing the trial.
- DL-sized prompt with magnet for fridge, showing what goes into the kitchen caddy, and what does not, delivered with the food caddy and bags.
- Vegetable peelers labelled ‘For Your Food Scraps’ delivered with all kitchen caddies.
- Posters for use in foyers and lifts in apartment buildings.
- Bin stickers for household FO/FOGO bins and apartment bins in chute rooms and bin bays. Bin stickers in simplified Chinese for all apartment areas.
- Email updates every month to all residents who provided their email addresses (480).
- An end-of-trial survey posted and emailed to all residences and organisations in the trial.

Key Findings

The results of the FO Project provide a significant resource for councils to use in planning future waste services to maximise resource recovery in an economically and environmentally sustainable manner.

Analysis of the waste data collected during the trials is summarised in **Table 1**. These figures are drawn from averages calculated from both the 14-weeks of the trial and the two-week waste audit period. The definitions and sources are in the endnotes on page 11.

Amount of Food

On average around 35% of household's mixed waste generated each week, that is, waste that would usually go into the red-lid bin, is food waste, which is referred to as Available Food. Available Food includes all food waste that could be used to form compost if correctly disposed of and for research purposes includes uncontaminated (loose food and food in approved compostable liners) and contaminated/containerised food presented by residents in both mixed waste (MSW) and FO bins during the trial.

The Available Food waste share of all mixed waste is consistent across houses, low-rise apartments and townhouses and is a little less in high-rise apartments (33%). In FOGO houses, Available Food was 31% of all mixed waste during the audit period.

Between 2.2 kgs and 3.8 kgs per week of food waste is generated by each household, varying by household type.

In all areas over the 14 weeks of the trials, most of the Available Food remained in the red-lid bin.

Participation in the food trial (food waste presented in the food organics bin as a share of Available Food) was between 26% and 47%, varying by household type.

Chart 2 shows how food presentation varies between types of dwelling.

Householders living in houses with food organics bins correctly separated the greatest share of food waste. They averaged 3.8kgs of Available Food per week, and of this amount 47% was correctly placed in the food organics bin over the 14 weeks of the trial.

Householders living in any of the multi-unit dwellings in trial areas averaged 2.4 kg of Available Food per week, and on average between the three types of multi-unit dwellings, 33% was correctly placed in the food organics bin.

Houses with mixed organics bins averaged 3 kgs of Available Food per week and correctly separated a similar share to high-rise apartment and townhouse residents (34%).

Contamination

Significant variations were found in the amount of contaminated food presented in the food organics bins by different household types. Contamination of food organics under the EPA standard means the presence of any material other than loose food and food in commercial standard compostable bags.

Contamination was generally in the form of food or other material presented in the food bin in plastic bags or food containers. Some of this waste would have been useable if the supplied compostable bags had been used. Residents in apartments reported concerns about the compostable bags breaking. It is likely that this uncontaminated amount could be reduced with more communication about options such as double-bagging or wrapping waste in newspaper, emptying caddies more frequently or by supplying sturdier caddy liners.

Contamination and food amount data does not include whole loads not picked up and taken to the delivery terminal due to the presence of general waste on top of the bin. This occurred on multiple occasions over the 14 weeks in the low-rise apartment areas and the non-residential area.

Uncontaminated food waste presented by residents in the food organics bins averaged between 71% and 94%

Table 1 Mixed waste and food by dwelling type, per week, kgs (see definitions and sources in endnotes)

	Houses FO	High rise apartments FO	Low rise apartments FO	Townhouses FO	Houses FOGO
Total MSW	10.6	7.8	6.16	6.85	9.9
Available Food (potential)	3.77	2.56	2.24	2.48	3.05
Presented Food (participation)	1.78	0.94	0.59	0.83	1.03
Useable Food (useability)	1.67	0.7	0.57	0.69	0.73



of total food waste weight. This share is referred to as Useable Food.

Houses with separate food organics bins presented the largest share of useable food material in the FO bins while in multi-unit dwellings (low-rise and high-rise apartments, and townhouses) a much higher share of unuseable material was found in the food bins during the two-week audit period.

Houses with mixed organics (FOGO) bins presented more unuseable food waste than houses with FO bins, and low-rise apartments presented a higher share of general and other waste in the food bins than high-rise apartments and houses.

Chart 3 shows the shares of Useable (uncontaminated) Food correctly segregated, and in the MSW bin.

Demographic variations

Demographic variations between trial areas correlated with variations seen in both contamination and food volume presentation. The correlation between data on food volume, contamination and community profile characteristics found that:

- Household size was strongly correlated to the amount of food presented. Larger household sizes presented more food and more uncontaminated food than areas with smaller average households.
- A strong positive correlation was found between areas with higher household incomes and the amount of food presented, and a negative correlation was found between areas with higher average household incomes and the amount of contamination.
- Areas with less rental housing presented high food volumes on average. A negative correlation was found

between the amount of food presented in a trial area and the number of rental households.

- Low levels of English language proficiency were negatively correlated with food volume and positively correlated with contamination. That is, trial areas with higher shares of the population with lower proficiency in English presented lower food volumes and higher levels of contamination.

Resident contact and feedback

The end of trial survey achieved a 25% response rate from the number of total residences in the trial, and more than 50% of the 547 responses came from residents in houses.

Attitudes to the food segregation trial collected through the post-trial survey showed high levels of satisfaction with the experience. Weighted by trial area population, 44% of respondents were very satisfied with the food segregation trial and a further 37% were satisfied.

Only 20% of residents in low-rise apartment areas responded to the survey, which is consistent with results of the amount of food presented and suggests that non-participating apartment residents did not generally respond to the survey, even with the incentive of a \$20 shopping voucher offered when surveys were lodged.

Care is required when interpreting the results of the survey. It is likely that residents who participated in the trial were the dominant group responding to the survey. Even accepting this, the high levels of caddy use claimed in responses to the survey did not align with the actual average of food waste collected in any of the trial areas. This suggests that the person filling in the survey was not the person responsible for waste disposal in the household.

Feedback during the trial through direct contact showed that apartment residents were concerned about the compostable liners breaking, the caddies creating odour in the kitchen and the shared food bins being smelly and unclean.

Residents in the trial areas with the lowest per household food presentation were also the areas where a larger share of households were not directly contacted when the food caddies were delivered because there was no answer to the door-knock delivery after two or more attempts.

This difference indicates that the door-knock, personal approach to engage with the resident was likely to have been effective in the initiating correct use of the food collection materials and engendering a willingness to engage in separating food from general waste.

The reasons most often chosen for not using the food caddy in houses was that home composting was already in place. At the end of the trial house residents were offered a compost bin, and in the Lane Cove areas, 108 of the 706 participating households expressed interest in the offer. Having little food waste was the second most frequently nominated reason from both houses and multi-unit apartment residents.

Chart 2 Available food presentation - FO bin and Mixed waste bin, by type of dwelling

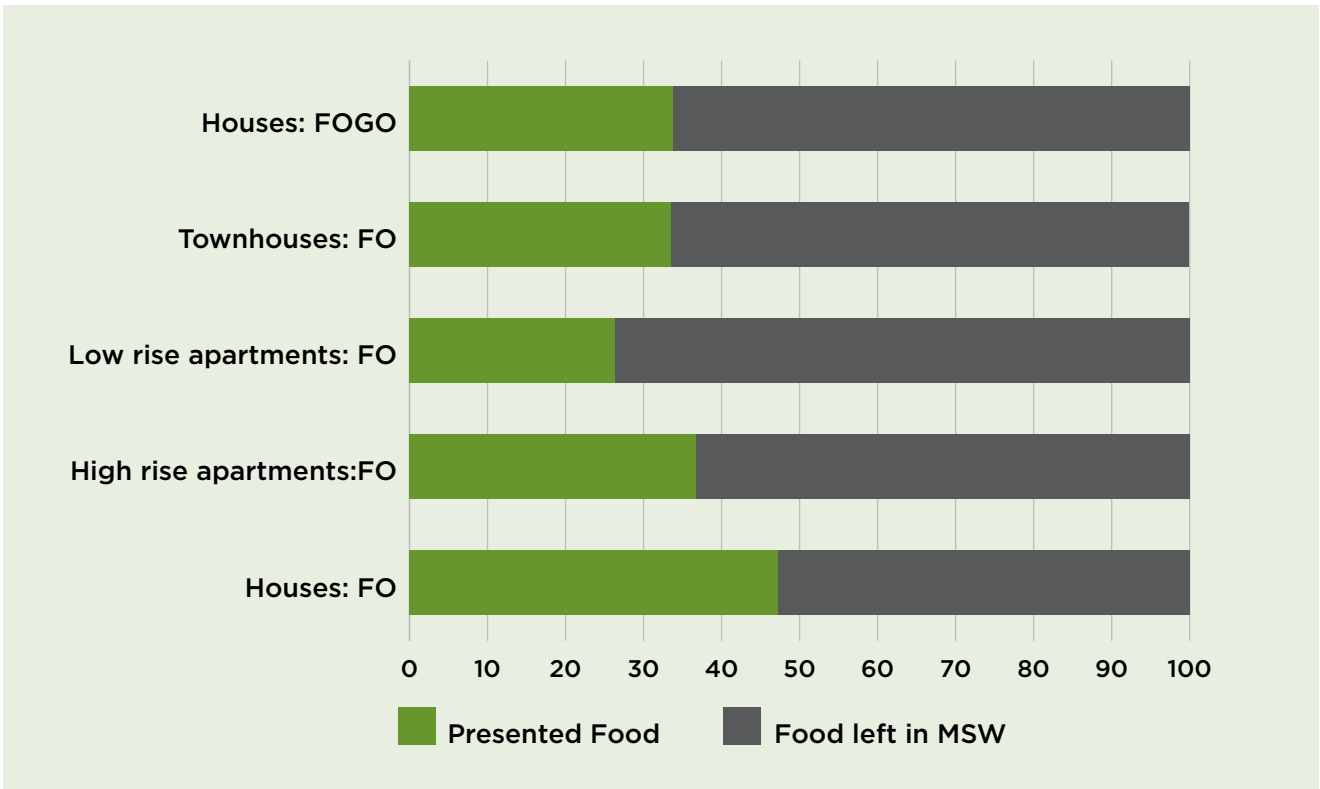
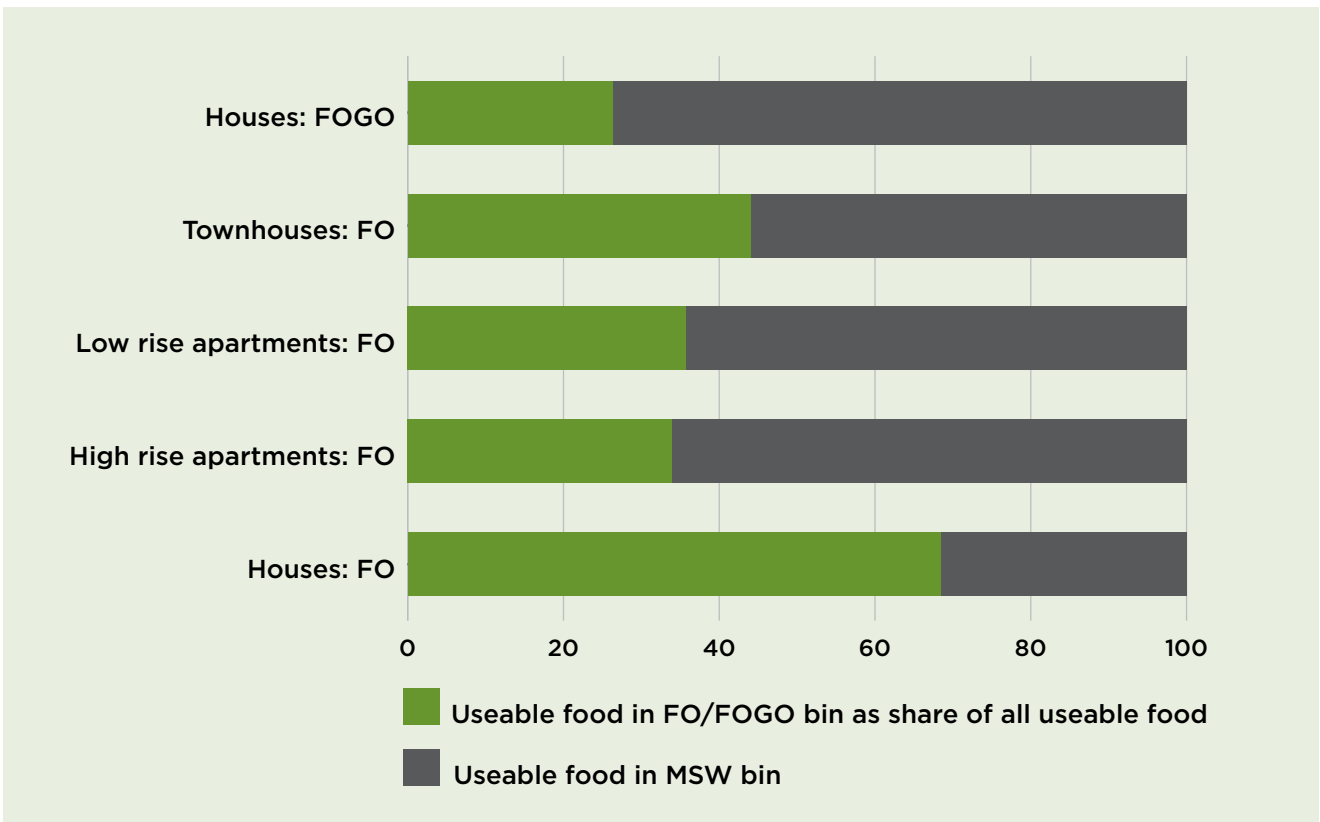


Chart 3 Useable food



Non-residential food organics trial

The non-residential trial supplies evidence of substantial amounts of food waste in business/service organisations that are similar to the 69 participants from the Gladesville/Hunters Hill area.

Between 17 and 20 kgs of food waste per organisation per week was presented. These numbers may understate available food due to the fact that food bins were regularly rejected due to being contaminated with general waste, mostly where bins were located in public areas. 81 bins were rejected at the point of pick-up due to the presence of general waste during the trial.

Cafes and restaurants presented segregated food waste more consistently than other organisations and bakeries, education services and cafes presented the least contaminated food for collection.

Available food presented in the food organics bins was more than 85% of the contents in the audit weeks in waste from cafes, bakeries, and schools.

Trial costs

Councils reported food collection costs (an additional truck per area) and cleaning of bins in apartment areas as the two major additional costs in offering the food organics collection service.

The additional service costs to deliver the food organics trial more than offset the small reduction in the cost of disposal of the slightly reduced tonnage of mixed waste.

Some costs arose from establishing the service, such as distributing food collection materials, while others were recurrent costs that would have to be budgeted for in a future service.

The focus of the trials' data collection was not on costs of a permanent service because the FO Project was a research study focused on the amount of food and the resource recovery potential of Presented Food. These costs provide the basis for further analysis:

- the provision and collection of FO bins for 706 houses over 15 weeks cost about \$50,000.
- The cost of and responsibility for emptying and cleaning chute room food bins was an additional cost in trialling the food service that would have to be accounted for in a mandated food collection service in high-rise apartments. Cleaning every chute room bin every week in apartments was an unforeseen cost at \$2,000 per week for 526 high-rise properties and \$1,000 per month for 921 low-rise apartments.
- The cost of communications materials and delivery rollout of food collection materials to reach 2,000 households was about \$60,000.
- Food collection materials were another substantial cost item - caddies at \$4.50 each and caddy liners at \$5.65 per roll of 75. Each household was given 1 roll but many more liner rolls were requested and provided as problems emerged from caddy liners breaking.

- Councils reported significant staff time in procurement, communications, and contractor monitoring during and before the trial.

Resource recovery

Under existing contracted services, Waste Alliance Councils have access to processing of a portion of mixed waste through a mechanical biological treatment (MBT) facility operated by Veolia. Waste processing of unsegregated mixed waste results in about 30% resource recovery including production of a beneficial soil additive for mine site remediation (WOO). Waste education costs are minimal and only one waste bin collection is required for the material used in this processing.

Recovery from mixed waste includes pumped landfill gas to generate energy. In 2021-22 the five councils' share of energy production from the Woodlawn landfill was 3,940 Megawatt hours.

Resource recovery from a separate food waste collection service would reduce the WOO production and landfill gas production by the fraction of organics removed.

The FO Project data indicates that the best case of food separation is that about 50% of Available Food is removed from the mixed waste bin in houses and presented in the food bin. The average in multi-unit dwellings is about 33%.

Contaminated material was accepted by the waste transfer and processing companies in the trial, despite the presence of plastic bags and other food containers.



The organics processing company advised that by using their decanting and debagging equipment 95% of the delivered residential food waste could be used as part of a blending process to make compost. They also advised that their open windrow process results in 50% evaporation of food waste during the three to four months of the composting process.

On a modelled basis, accepting that 35% of the mixed waste bin is Available Food and applying the participation rates across types of dwelling as revealed in the trials, the Project data supports these comparative results:

- one tonne of waste in a residential area dominated by houses delivered as unsegregated mixed waste results in recovery of 300 kgs (evaporation and soil additive) plus energy generation from landfill gas production.
- one tonne of mixed waste delivered as two streams from houses (food and mixed waste) results in recovery of 175 kgs (evaporation and soil additive).
- one tonne of mixed waste delivered as two streams from multi-unit dwellings (food and mixed waste) results in recovery of 116 kgs (evaporation and compost).

Food waste collection issues

Residents expressed concerns during the trial that the colour of the lid of the food collection bins (burgundy) was too close to the colour of the lid of the mixed waste bins (red). The food bin colour is a standard prescribed by the EPA. It is reasonable to conclude from the results in shared bin areas that this colour closeness added to the amount of general waste presented in the food organics bins.

Apartment residents also expressed concerns about managing the kitchen food caddy in their kitchens, with limited space for an extra container for waste. Caddies of 7 litres, while standard, may not be suitable for smaller households.

In high-rise apartments, the odour created in chute rooms from the food bin was a source of aversion to continued participation. This is likely due to both the experience of using the food bin being unpleasant and the spread of bin-room odours into other shared spaces such as hallways and lift wells.

The trial experience shows that separate food waste collection in high-rise apartment buildings requires lengthy consultation and adaptation to each building's waste facilities to gain agreement to participate from building/strata managers and residents.

Caddy liners compliant with the Australian Standard for commercially compostable liners were provided to residents. Many residents found the liners to be too flimsy for transporting to the food bins (in low-rise apartments in particular) and others reported that the liners started to break down after two days regardless



of the amount of waste in them. This feedback is thought to account for some of the non-participation level in multi-unit households and could not be fully addressed by waste education as compliant liners are designed to breakdown as moisture is formed.

Waste collection services found identification of bins that should not be collected due to contamination very difficult and tended to default to non-collection. Responsibility for identifying and removing contamination from food bins needs to be resolved and time to do so costed before services could be specified for tenders.

To determine the resource recovery benefits of separating food, more information is required on organics processing services that are accessible to councils in the Sydney metropolitan area and are also compliant with regulations applicable to the collection and treatment of food waste collected either as FO or FOGO.

The future availability of the Veolia MBT waste processing option depends on the results of the WOO trial approved up to 2025, so capacity to achieve the modelled estimate for resource recovery after that date depends on EPA approval for more WOO production. Demand from the mine owner for this material is expected to continue, as the toxic mine site tailings dam covers an area of 100 hectares, of which the trial site for WOO placement over five years is 5 hectares.

In the absence of this knowledge about committed investment planned by industry and about compliance standards and enforcement by the regulator, councils will be unable to specify the performance standards for resource recovery from household waste for tenders. Without this information an equitable approach to risk apportionment and costs in a contract is objectively unattainable.

Conclusions & Next Steps

- Each LGA's food organics presentation volume and useable food fraction varies according to its share of different types of dwelling types and its demographic characteristics. Planning for food organics waste management should not apply averages generalised from mixed dwelling areas to estimate food weights or food contamination.
- Residents in houses who participate in segregating food waste can be expected to mainly present uncontaminated food.
- The evidence from the food weights, waste audits, contact records and survey responses indicate that a large share of residents in apartments did not participate in separating food waste during the trial and about half of house residents did not participate.
- To address the low food volumes presented from apartments will require significant time and expenditure on new approaches to waste collection and management in bin rooms and bin bays to reduce odour and perceptions of the food bins as unhygienic.
- Under presently available waste services and based on the trial experience of participation in food segregation, processing of separately collected food waste does not result in more resource recovery than processing mixed waste through the Veolia MBT.
- There are barriers to participation in areas with higher numbers of residents who have low proficiency as English speakers. These areas were correlated with lower food presentation, higher contamination in food bins and lower response to the end-of-trial survey.
- There is a limited market of organics processing service providers for outputs of residential food organics collections of either FO or FOGO. Current services are located at long distances from Sydney, requiring long-distance trucking or rail delivery of material that is generally heavy, being 50% moisture. This is an inefficient spatial industry structure, particularly when scaled up to the whole metropolitan area.
- There is inadequate information available to councils on food waste contamination standards at delivery terminals and how contamination could be managed by collectors, consolidators and processors of food organics.
- There is uncertain demand in agriculture for compost which includes residential food waste. Expanded processing services will need to identify and align with market demand to determine the useability of residential food waste in compost production.
- Waste contracts are long-term engagements and require significant lead times to prepare and scope, and given the limited supply service market, adequate market information is needed to ensure value for money in procurement.
- Councils need more information on the timing and standards of new organics processing capacity so that tenders can be prepared with sound information on efficiency, contamination standards, risk sharing, cost, location, technology and greenhouse gas capture.
- The results of the non-residential trial make a case for a more focused trial that would be designed to incorporate the lessons learned from the trial: clearer identification of food waste bins, more reliable collection services and direct engagement with the most prospective organisational types with either or both consistent amounts of food waste (food services) and higher volumes (education and health care delivery).
- Based on the data there appears to be a different approach to waste education and information needed for mixed organics bins as the participation rate (Presented Food as a share of Available Food) was much lower than in houses with a separate food organics bin.
- Food waste service introduction will require a significantly increased investment in waste management and community education over a long period. Service introduction is more complex than giving residents a caddy, food bin and compostable liners. Personal contact delivery of food collection materials and direct communication with residents were effective methods to engage residents' interest in food waste segregation and are likely to need to be embedded as an additional council service under a mandated service.
- Regardless of waste education measures, compliance with food segregation depends on residents' commitment to the extra tasks involved in separately disposing of food waste. There is an efficiency case in terms of maximising the presentation of Useable Food for food organics segregation to be an opt-in offer to residents who are committed to this task, which is 33% to 50% of residents, varying with dwelling type.
- Based on the trial, the best prospects for collecting Useable Food waste are from opt-in or targeted services for:
 - Residents in houses with a separate food organics bin (not combined with garden organics)
 - Residential areas with larger average household size
 - Certain types of commercial and retail businesses where there are contiguously located so that collection services can function efficiently.

Endnotes

Page 5 Table 1 Definitions and sources

Total MSW: this is the average weekly waste volume in households that would have been in a single MSW bin. Data for this category was sourced from the waste audit which sampled large amounts from each MSW collection in each of two weeks. Sample data scaled up to reflect actual averages based on total volume divided by number of households from which the waste was collected. In the audit weeks, MSW from trial areas was separately collected to match the households with food bins.

Available Food: this is average weekly food waste and includes both useable (uncontaminated) **and** unuseable (contaminated) food organic material. Data for this category was sourced from average weekly food presented in the FO or FOGO bins in the seven residential trial areas over the 14 weeks of the trial **plus** the average weekly food presented in the mixed waste (red-lid bin) in the 2-week audit. For FOGO houses the food in the FOGO bin data is a 10% share of all 14 weeks data of FOGO **plus** the average weekly food presented in the mixed waste (red-lid bin) in the 2-week audit.

Presented Food: this is food placed in the food organics collection bins and includes both useable (uncontaminated) **and** unuseable (contaminated) food organic material. Data is from the 14 weeks of the trial for the seven FO residential areas. Data for FOGO houses the food in the FOGO bin data is a 10% share of all 14 weeks data of FOGO (audit result).

Useable Food: this is the average weekly volume of uncontaminated food. Data is from the audit results of the FO and FOGO bins food material.



This project is a NSW Environment Protection Authority initiative funded from the waste levy



Northern Sydney Regional Organisation of Councils

