Glasgow Caledonian University

University for the Common Good

Waste Composition Analysis

(Britannia, W. Harley and H. Wood Buildings)

25 June 2019

Executive Summary

The University's commitments to safeguarding the environment include producing less waste through waste minimisation, re-use and recycling opportunities. To achieve this, the University has a Waste Minimisation and Recycling Plan that identifies waste composition analysis (WCA) as a mechanism for helping develop a better understanding of its waste.

This report presents the findings from the third WCA, carried out on 15th March 2019 for waste from the Britannia, William Harley and Hamish Wood buildings. The WCA was carried out by students from the School of Computing, Engineering and Built Environment's Environmental Assessment module and followed the methodology used in previous WCA.

In total, 112kg of waste were analysed, with 75% suitable for either recycling or, in the case of food, treatment in anaerobic digestion/composting facilities.

The most common materials presented in recycling bags were paper (other) (56%), plastic bottles (9%) and food (packaging) (8%), whilst food items (29%), food packaging (13%) and paper tissue (12%) were the most common materials in general waste bags (Figure 1).

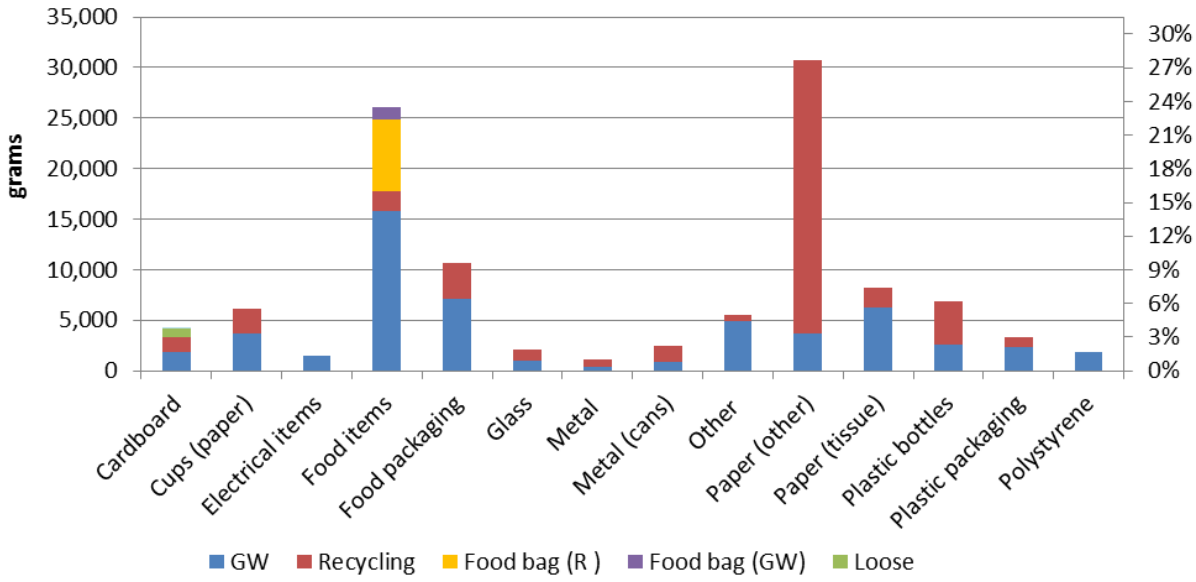

Figure 1 - Global composition by containment type (black, clear and food waste bags). Food bag (R) indicates a food waste bag, whilst Food bag (GW) indicates a food waste bag placed in a general waste bag.

Building specific patterns were evident, with some buildings generating slightly different quantities or materials and their segregation.

On a per capita basis, waste arisings were equivalent to approximately 365g per person per day (slightly higher than the 293g in 2018). The higher average value might be a result of the inclusion of

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waste potentially generated by students (whose numbers do not factor into the per capita calculations). Paper-other and waste food items made up the majority of waste generated on per capita basis (Figure 2).

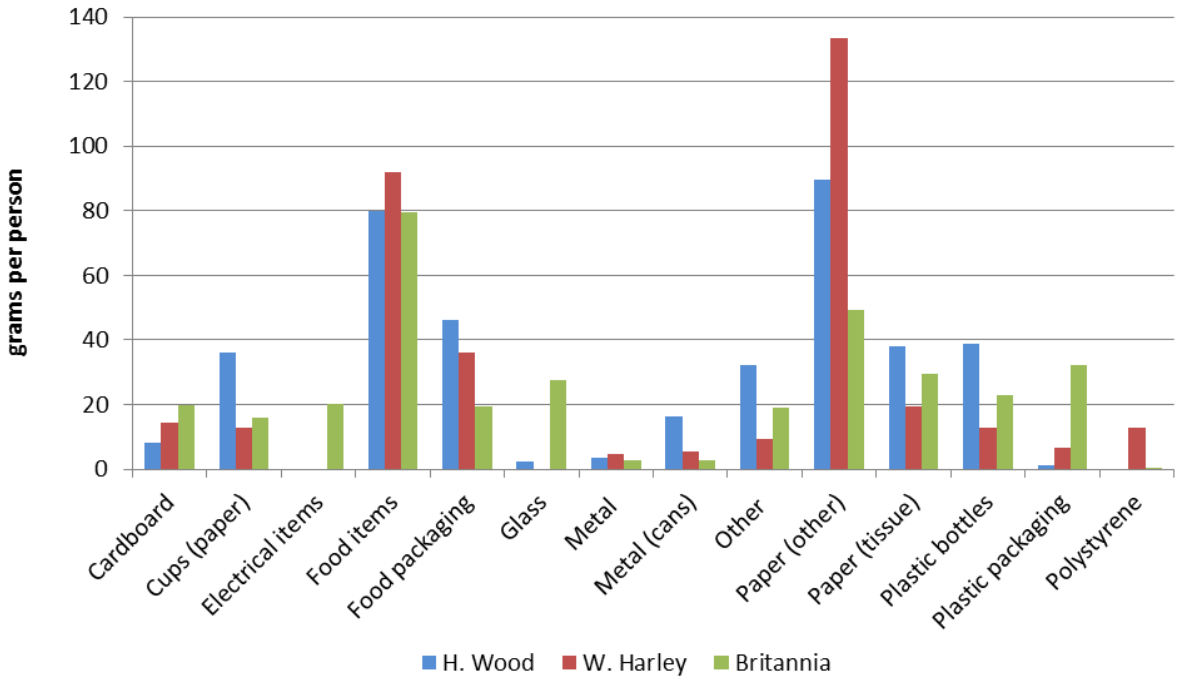

Figure 2 - Comparison of total arisings (grams) for the Britannia Building in 2017 and 2018.

The WCA highlighted similarities in the composition of waste from the three buildings and whilst existing collection arrangements are effective, there are opportunities for enhancing recycling through better segregation of waste food items, food packaging, plastic bottles, paper cups and cardboard.

Contents

Introduction

The University's commitments to safeguarding the environment, detailed in the Environmental Policy, include producing less waste through waste minimisation, re-use and recycling opportunities.

The University's Waste Minimisation and Recycling Plan highlights waste composition analysis (WCA) as an important exercise to help understand the effectiveness of existing recycling systems and arrangements and potentially identify further opportunities for waste minimisation, re-use and recycling.

This report presents the findings from Glasgow Caledonian University's (GCU) third WCA, carried out on 15th March 2019.

Aims & Objectives

As with previous WCA, the aim of the 2019 WCA was to help explore waste minimisation, re-use and recycling opportunities by:

- Developing a better understanding of the waste produced at the University.
- Gauging the effectiveness of waste segregation/recycling arrangements.
- Determining whether there are any building-specific patterns or trends.
- Identifying additional waste minimisation, re-use and recycling opportunities.

Methodology

The 2019 WCA was carried out using the same methodology as that used in previous WCA[1]. Table 1 details the waste categories used, internal collection arrangements and whether specific materials are recycled by the University's waste contractor.

The 2019 WCA analysed waste from the Hamish Wood, Britannia and William Harley buildings (left to right in Figure 3), the latter two include for continuity purposes.

[1] Waste Composition Analysis Reports

Figure 3 – Location (in red) of buildings surveyed for the 2019 WCA.

Category	Description	Readily Recyclable?	Containment
Cardboard	Mainly corrugated cardboard for the delivery/transportation of goods. May include lighter card.	Yes	Recycling bins or presented loose.
Food items	Un-eaten food and food items, such as fruit peels, sandwiches, tea bags and coffee grinds.	Separately	Food waste bins.
Electrical items	Electric/Electronic (IT) material	Separately	Dedicated collection/storage points.
Food packaging	An amalgamation of the following categories: paper, plastic, polystyrene, other.	No	General waste bins.
Glass	Glass jars and bottles.	Separately	Placed next to recycling bins.
Metal – cans	Drinks cans or food tins.	Yes	Recycling bins.
Metal	Any other metal items.	Yes	Recycling bins.
Paper - cups	Disposable paper cups.	No	General waste or cup bins.
Paper - other	Printed paper, whole or shredded. Includes leaflets. Excl. paper with visible traces of food (e.g. packaging)	Yes	Recycling bins.
Paper - tissue	Tissue paper/serviettes from bathroom waste bins and catering.	Yes	Recycling bins.
Plastic - bottles	Plastic bottles.	Yes	Recycling bins.
Plastic – packaging	Any other plastic items, excluding those used as food packaging. Waste/recycling bags were excluded.	No	General waste bins.
Polystyrene	Any polystyrene items, excluding those used as food packaging.	No	General waste bins.
Other	Any item not accurately described by the other categories.	No	General waste bins.

Table 1 - Description of waste category used in the WCA. Recyclability of each constituent part was provided by the University's waste contractor (Feb 2017).

Results

During the waste sorting session, approximately 112 kg (in an estimated 55 bags[2]) of general waste, recycling and food waste from the Britannia, William Harley and Hamish Wood buildings were separated and weighted (Table 2). The raw WCA data is available from the data section of GCU's sustainability pages.

[2] Due to an oversight, the number of bags analysed was not counted and had to be estimated using the average bag weight from the 2017 WCA.

Building	General waste kg (% of total)	Recycling bags kg (% of total)	Food waste bags kg (% of total)	Totals kg (% of total)
Britannia	17 (15%)	6 (6%)	1.6 (1.5%)	24.6 (22%)
H. Wood	18 (16%)	16 (14%)	1.1 (1%)	34.6 (31%)
W. Harley	20 (18%)	27 (24%)	6.5 (5%)	52.8 (47%)
Total	55 (49%)	49 (43%)	8.7 (7.5%)	112 (100%)

Table 2 – Weight (kg) and percentage breakdown by containment of total waste sorted (by building).

Table 2 shows that 49% of waste was placed in general (unsegregated) waste bags, 43% in recycling bags and the remainder (7.5%) in food waste bags.

Overall Waste Composition

Figure 4 and Table 3 show that overall, 75% of waste produced at GCU could either be recycled or, in the case of food, treated in anaerobic digestion facilities. The most common materials were paper – other (i.e. excl. tissue) (28%), food items (23%) and food packaging (10%).

However, only 36% of the contents of recyclable bags was recyclable (compared to 52% in 2018), whilst 30% of the contents of general waste bags could have been recycled (compared to 13% in 2018). Overall, these results indicate some deterioration in the effectiveness of GCU's internal waste and recycling separation arrangements.

The most common materials presented in recycling bags were paper (other) (56%), plastic bottles (9%) and food (packaging) (8%), whilst food items (29%), food packaging (13%) and paper tissue (12%) were the most common materials in general waste bags.

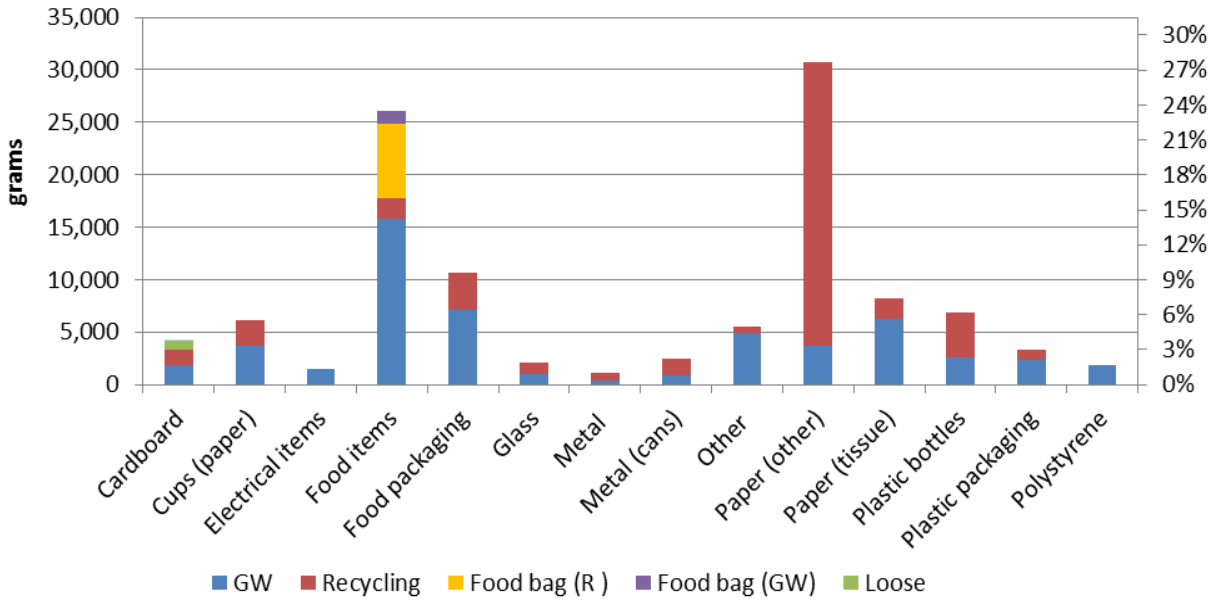

Figure 4 – Global composition by containment type (black, clear and food waste bags). Food bag (R) indicates a food waste bag, whilst Food bag (GW) indicates a food waste bag placed in a general waste bag.

Waste stream	General waste	Recycling	Food bag (R)	Combined
Cardboard	3%	3%	0%	4%
Cups (paper)	7%	5%	0%	6%
Electrical items	3%	0%	0%	1%
Food items	29%	4%	100%	23%
Food packaging	13%	8%	0%	10%
Glass	2%	2%	0%	2%
Metal	1%	2%	0%	1%
Metal (cans)	2%	3%	0%	2%
Other	9%	1%	0%	5%
Paper (other)	7%	56%	0%	28%
Paper (tissue)	12%	4%	0%	7%
Plastic bottles	5%	9%	0%	6%
Plastic packaging	4%	2%	0%	3%
Polystyrene	4%	0%	0%	2%

Table 3 - Waste composition (%) by containment type (black, clear and food waste bags).

Waste Composition – Britannia

The Britannia Building has three levels and provides primarily office accommodation for 72 staff in academic and administrative functions.

24.6kg of waste was analysed from the Britannia Building, 68% separated as general waste, 15% as recycling and 7% as food. In terms of composition, the most common materials in the waste produced in the Britannia Building were: food items (23%), paper – other (14%), followed by plastic packaging and paper tissues (both representing 11% of total waste).

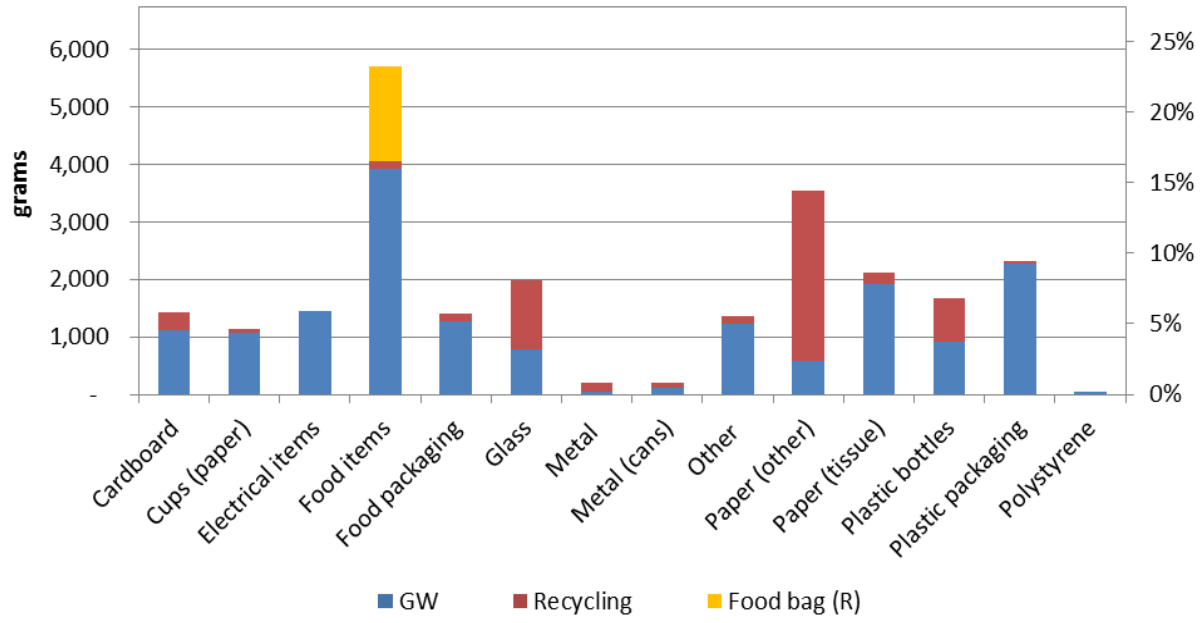

Figure 5 - Waste composition (weight and %) by containment type in the Britannia Building.

Nearly 80% of cardboard arising in the Britannia Building was placed in general waste bins, whilst the majority of food was placed either in general waste (69%) or recycling (2%) bags (only 29% was collected through the dedicated food waste collection). With regards to glass containers and plastic bottles, roughly equal proportions were placed in recycling and general waste bags.

The Britannia Building has had its waste composition analysed for three consecutive years and this has helped the University develop a longitudinal view of how its wastes arisings are changing as a result of news collection arrangements and staff moves.

Overall, there has been a reduction in both the per capita (Figure 6) and total amount of waste produced across most waste categories in the Britannia Building (Figure 7), with an 89% reduction (since 2017) in paper (other).

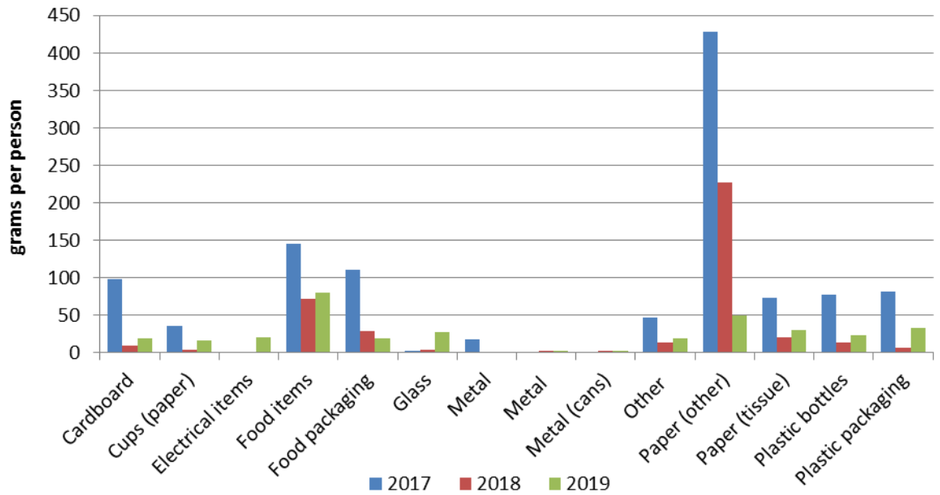

Figure 6 – Per capita waste arising in the Britannia Building in 2017, 2018 and 2019.

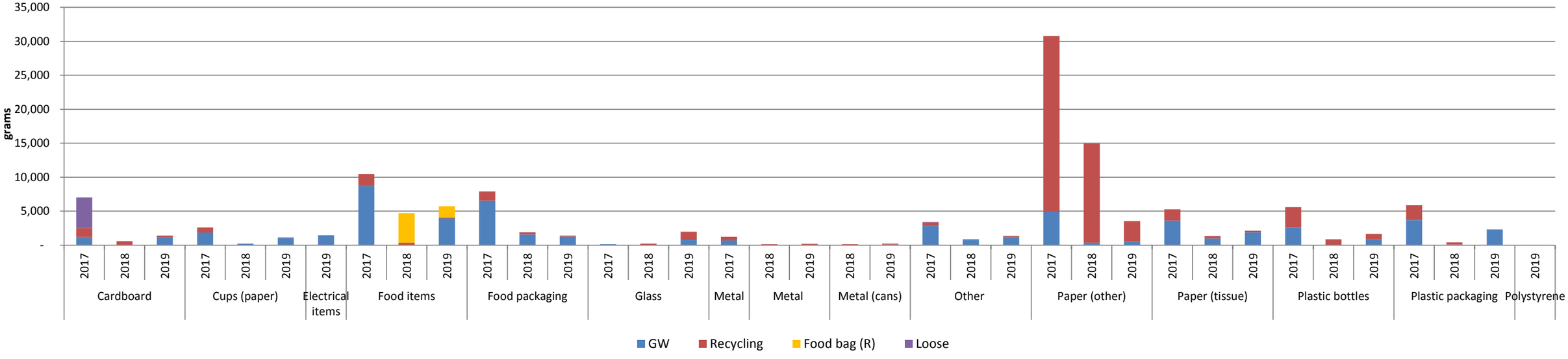

Figure 7 - Arisings (grams) and containment of waste presented for analysis from Britannia building during the WCA 2017, 2018 and 2019.

Waste Composition – Hamish Wood

The Hamish Wood has nine levels and provides office accommodation for approx. 88 staff and a range or teaching facilities (classrooms, lecture theatres and computer labs).

34.6 kg of waste was sorted from the Hamish Wood Building (31% of the total waste sorted), with 51% presented in general waste bags, 45% in recycling bags and 3% in food bags. The most common materials were paper – other (23%), food items (20%) and food packaging (12%).

The most common materials in the general waste were: food waste (27%), food packaging (14%), paper tissue and other (uncategorised materials) (14% each). In the recycling bags, the most common materials were: paper - other (39%), plastic bottles (14%), paper cups and food packaging (each 10% each) and Food items (7%).

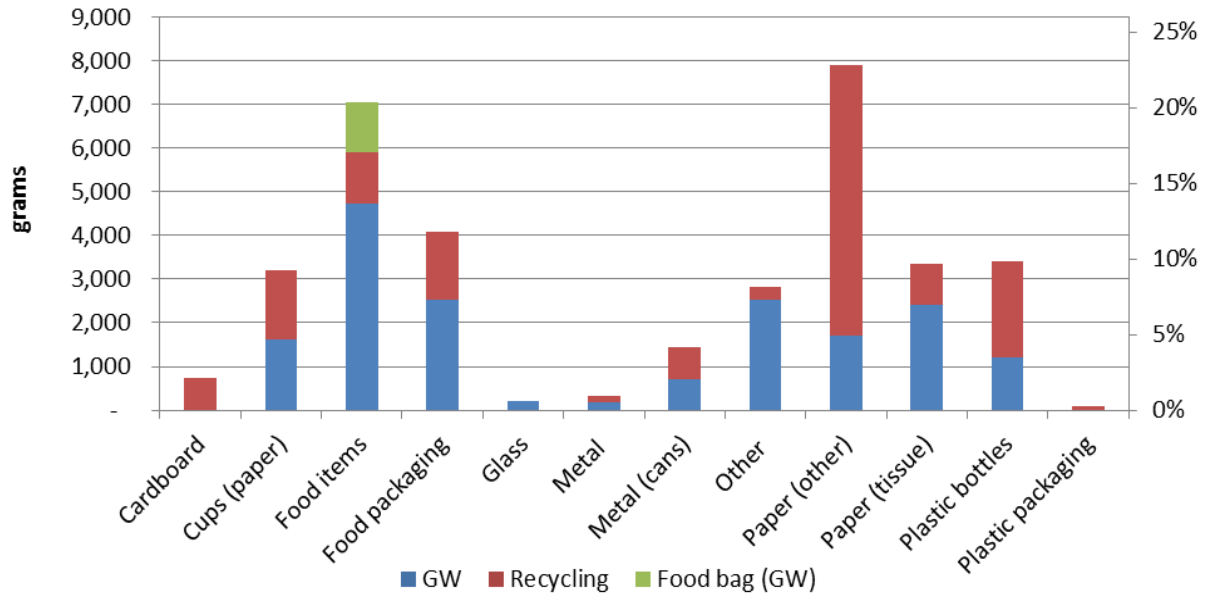

Figure 8 - Waste composition (weight and %) by containment type in the Hamish Wood Building.

Nearly two thirds of all waste food items in the Hamish Wood was placed in general waste bags and 17% in recycling bags (only 16% was placed in dedicated food waste containers - Figure 8). This was the highest proportion amongst the buildings sampled. Half of drinks cans, paper cups and all glass containers were placed in general waste, whilst nearly 40% of food packaging was placed in recycling bags.

Waste Composition – William Harley

The William Harley has three levels and primarily provides open-plan office accommodation for 147 staff in a range of administrative functions.

The William Harley had the highest amount of waste generated per building, but once adjusted on a per capita (staff) basis, it was the closest to the combined average.

52.8kg of the waste sorted (47%) was from the William Harley building, 37% presented in general waste bags, 51% in recycling bags, 11% in food bags and 2% loose. Paper - other (37%), food items (26%) and food packaging (10%) were the most common materials discarded in this building (Figure 9).

General waste bags contained 37% waste food items, 17% food packaging and 10% of both paper-tissue and polystyrene. Recycling bags contained mostly paper – other (68%) and food packaging (7%). Recycling bags also contained 91% of (non-food) plastic packing, 46% of paper cups and 37% of food packaging.

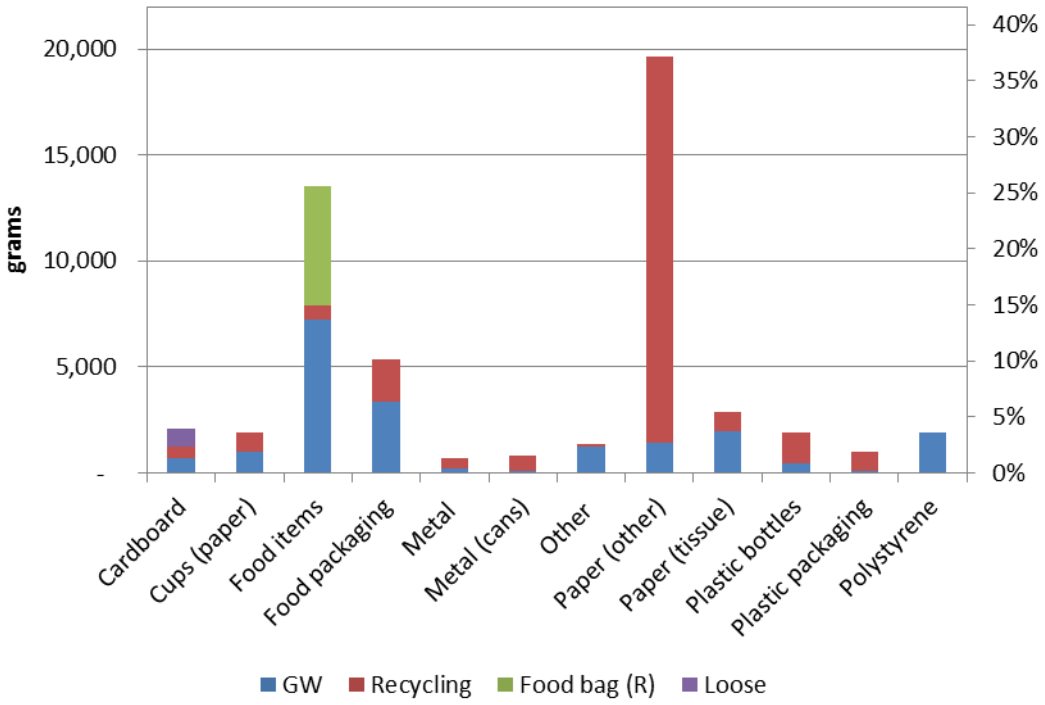

Figure 9 - Waste composition (weight and %) by containment type in the William Harley Building.

Per Capita Waste Arisings

On a per capita basis, waste arisings for occupants in the three buildings surveyed is equivalent to approximately 365g per person for the day prior to the WCA (a higher figure than that observed in

2018). The breakdown by building and constituent level is detailed in Table 4 and Figure 10 (respectively).

Building	Total waste - grams (2018 values)	No. Occupants (2018 values)	Grams per person (2018 values)
Britannia	24,575 (26,360)	72 (66)	341 (399)
Hamish Wood	34,580 (n/a)	88 (n/a)	393 (n/a)
William Harley	52,827 (60,472)	147 (225)	359 (270)
Combined	111,982	307 (338)	365 (293)

Table 4 – Per capita waste arisings (grams) for the day prior to the WCA. For comparison purposes, the numbers between parentheses correspond to the 2018 values).

The range of grams of waste per person was much narrower in 2019 than in 2018 (341-393 and 270-399 respectively) but it is important to note that waste from the William Harley includes waste generated by students, whose numbers are not included in per capita calculations (which are based on an estimate of the number of office occupants).

Paper-other and waste food items made up the majority of waste generated on per capita basis in the three buildings, with the William Harley generating 133g of paper - other and 95g of waste food (the highest amount of the three buildings). In contrast to 2018, the per capita arisings in the Britannia were 15% lower in 2019 (at 341g).

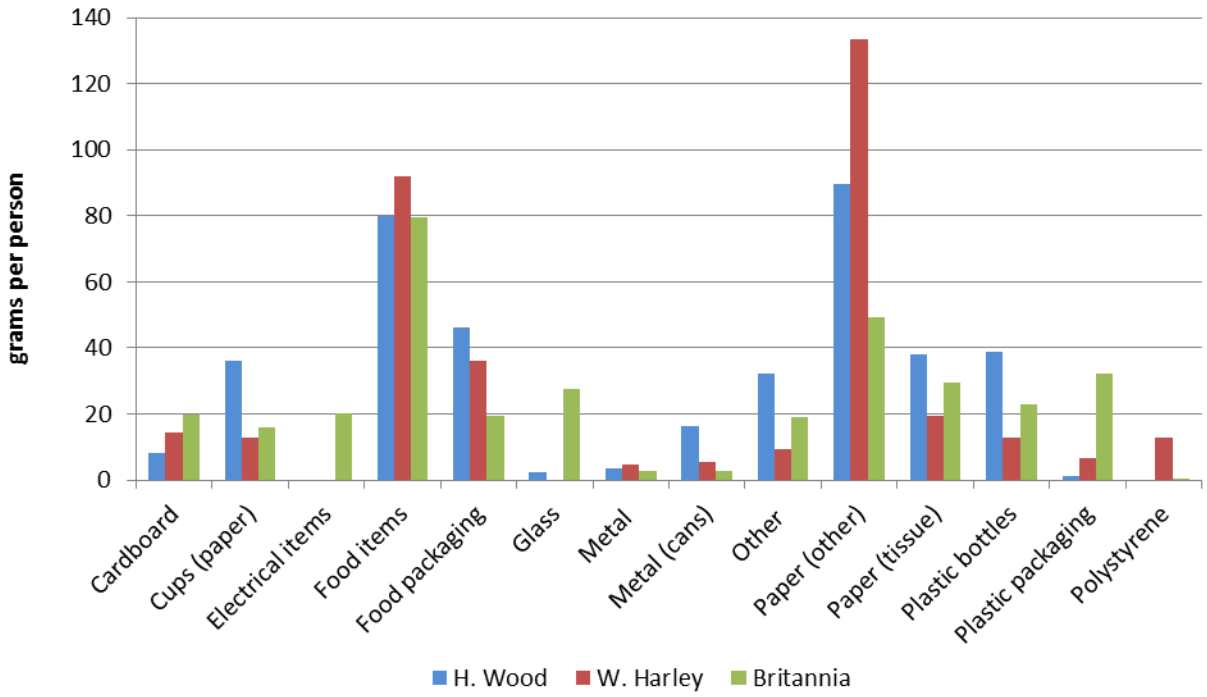

Figure 10 – Per capita waste arisings (grams) by constituent level in for the three buildings surveyed (in 2019).

Figure 10 show that with the exception of paper – other (in the Hamish Wood and William Harley) and plastic bottles and paper cups (Hamish Wood), per capita waste arisings are comparable across the three buildings.

Discussion

This section considers the results of the 2019 WCA and (where appropriate) those of previous WCA to evaluate:

1. Changes to the composition of the University's waste.
2. Gauge the effectiveness of waste segregation/recycling arrangements.
3. Determine whether there are any building specific patterns.
4. Identify additional opportunities for waste minimisation, re-use and recycling.

Changes in Waste Composition

As few buildings have been included in all three WCA, changes in waste composition can only be determined using data from the Britannia and W. Harley buildings. Although building specific trends are evident, the data suggests that with the exception of waste food items and paper, the composition of waste at the University is broadly unchanged.

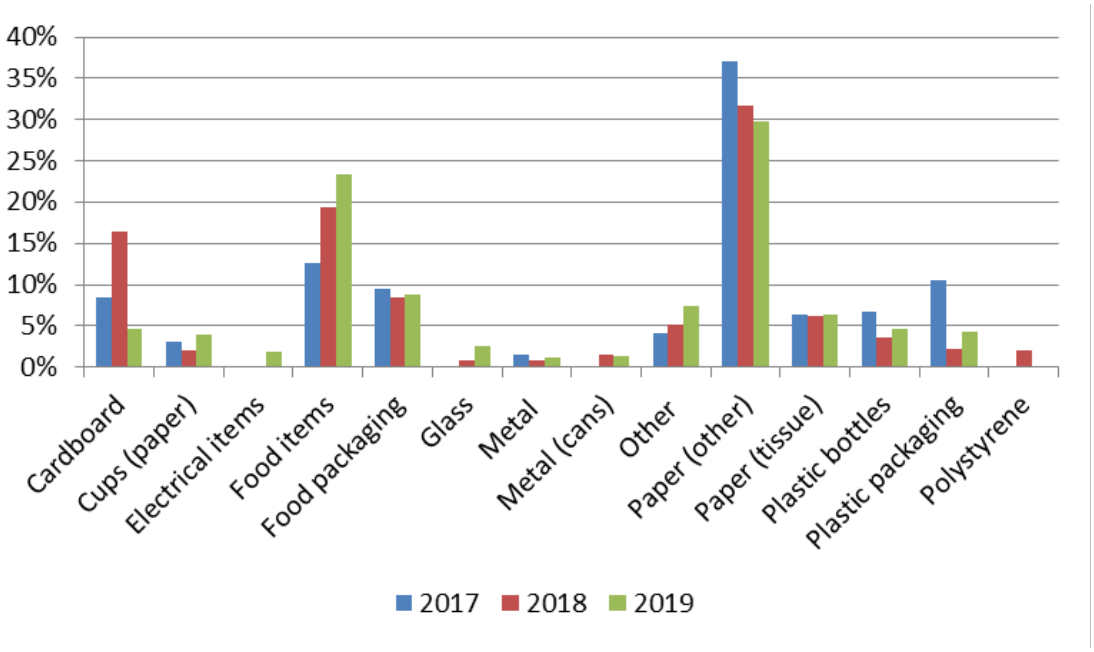

Figure 11 Waste composition (%) at GCU

The exceptions are an increase in waste food items and a decrease in paper (primarily in the Britannia Building). A more detailed analysis is difficult because of the frequency of the WCA makes results susceptible to un-usual events (e.g. computer deliveries which increase cardboard and polystyrene figures).

Effectiveness of Existing Arrangements

The WCA also provided an opportunity to review the effectiveness of waste segregation/recycling arrangements and whether there are any opportunities for improvement. Effectiveness is gauged on the proportion of recyclable and non-recyclable materials placed in the correct container (recycling or general waste).

Overall, whilst generally there is a high degree of segregation into the correct systems (Table 5), there has been a decline in the proportion of materials segregated for recycling (Figure 12).

Material	% total waste composition	Collection System				
		Recycling	General Waste	Food	Loose	Other
Paper (other)	27.64%	88.16%	10.18%			1.66%
Food items	21.97%	5.80%	60.21%	34.00%		
Food packaging	9.70%	33.86%	66.14%			
Other	8.10%	12.80%	87.20%			
Paper (tissue)	7.43%	24.42%	75.58%			
Plastic bottles	6.24%	62.98%	37.02%			
Cups (paper)	5.57%	40.71%	59.29%			
Cardboard	3.80%	36.39%	43.13%		20.48%	
Plastic packaging	3.04%	30.37%	69.63%			
Metal (cans)	2.20%	62.78%	37.22%			
Glass	1.94%	55.38%	44.62%			
Electrical items	1.29%		100.00%			
Metal	1.07%	63.07%	36.93%			

Table 5 - Proportion of waste collection system used for GCU waste stream.

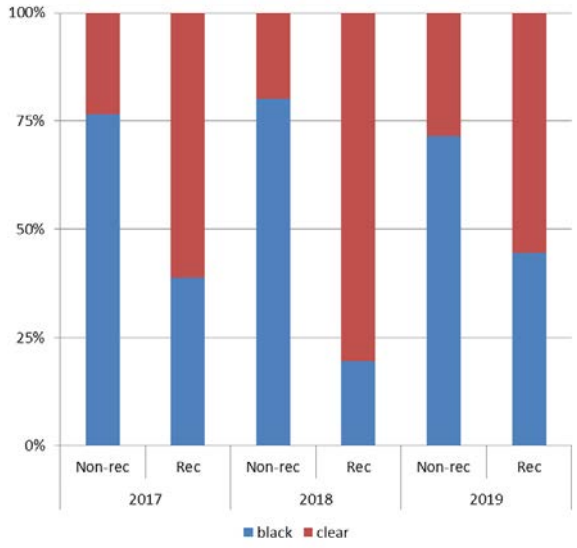

Figure 12 - Proportion of recyclable/non-recyclable materials in general waste (black) and recycling (clear) bags.

The main opportunities for improving the effectiveness of current waste separation and recycling systems include:

- Improved segregation of food waste. 66% of food items are placed in the general waste system and nearly 6% in the recycling systems with the fraction placed in the recycling system presenting a greater risk to the University's recycling performance (due to contamination of other materials separated for recycling).
- Diverting food packaging to general waste collections. 33% of food packaging is placed in the recycling system and presents a high risk of contaminating materials separated for recycling (due to the introduction of grease and difficult to recycle materials).
- Improving segregation of plastic bottles. 37% of plastic bottles are placed in the general waste system.
- 40% of paper cups are placed in the recycling system present a high risk of contaminating other materials separated for recycling (due to the potential introduction of fluids and difficult to recycle materials).
- 43% of cardboard was placed in the general waste system.

Building Specific Patterns

This section highlights building specific patterns and builds on the insights from the previous section. The most noticeable building specific patterns (on a per capita basis) are:

- More glass and plastic packaging arising in the Britannia. Whilst there seems to be some scope for improving how glass is presented (next to waste containers, rather than in them), there seems to be a clear understanding of where to place plastic packaging.
- The W. Harley generating more paper than in the other buildings, although building occupants appear to understand that paper should be recycled.
- Single use beverage containers (plastic bottles, paper cups and drinks cans) arise in greater quantities in the H. Wood than any of the other buildings. Unlike in the other two buildings, there seems to be some confusion with the correct disposal route for these waste streams (although this is not unique to the H. Wood).

New Opportunities

With the exception of enhancing the effectiveness of existing segregation arrangements, no new opportunities were apparent from the WCA.

Conclusions

The WCA help develop a better understanding of the nature of the waste arising at the University and how effective existing recycling arrangements are. They also provide some insights into which materials building occupants seem to have a difficulty understanding the correct disposal route.

The 2019 WCA revealed that waste at GCU had not changed significantly since previous years and that in general terms, although there is scope for improvement, the University's waste and recycling arrangements tend to function adequately.

The opportunity for improvement centres on enhancing the segregation of waste food items, food packaging, plastic bottles, paper cups and cardboard into the correct containment systems.

Acknowledgements

The 2019 WCA was carried out with assistance from students from the School of Computing, Engineering and Built Environment's (SCEBE) Environmental Assessment module and their contribution is gratefully acknowledged.

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