Waste Audit Report

for

University of New South Wales

Kensington Campus

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EXECUTIVE SUMMARY

The University of New South Wales (UNSW) engaged APC Environmental Management (APC) to undertake a general waste audit of the Kensington Campus. The audit was conducted to provide UNSW with recommendations on appropriate collection systems for the various types of waste found in the general waste stream and options for treatment and disposal.

This waste audit was undertaken over a one-week period from 20−24 September, 2010 during the second session and the peak student period. This waste audit collected, sorted and analysed 3.1 tonnes of general waste.

KEY FINDINGS:

- The majority of the waste stream is compostable 59% (37% organic and 22% paper and cardboard).
- A further 15% of the waste comprises recyclables that could be targeted through a container recycling program.
- Of the general waste stream, 26% is neither compostable nor recyclable.
- This general waste stream is suited to alternative waste treatment (AWT) processing as it has a high organic fraction and low contamination rate. Approximately 4% is problematic for AWT processing due to the nature of the material (ie. heavy, oversized, stringy, hazardous, construction and demolition material).
- The largest component of the overall waste composition for all locations is food waste at 33%, followed by contaminated paper at 12% and glass at 8%.
- The waste composition on the upper and lower campuses is generally similar. The main differences are contaminated paper (6%), glass (5%), vegetation (3%) and paper cups (2%).
- Where yellow lid recycling bins were available on campus, they were generally used effectively as container recycling bins.
- Of all the bin capacity provided in the existing waste bins on campus during the week audited, approximately 50% of the bin capacity was used. The average bin capacity used in the 660-litre bins was 65% and 47% of the 240-litre bins. While additional bin capacity needs to be provided for during peak periods, the amount of capacity currently allowed for may be excessive and result in additional waste collection and disposal costs if waste collection is charged by volume and per pickup. It is suggested that some current bins be stored on-site for overflow but not available for use on a day-to-day basis.
- The two waste audit data sets from 2005 and 2010 were similar. Recyclable paper has increased significantly (by 9%) in 2010, while organics has decreased by 10%. It is possible that in 2005 any paper in the garbage bin was considered to be organic rather than recyclable. The introduction of more plastics during the past five years is evidenced in the waste stream. Steel as a method of packaging has become less popular due to the costs and this is reflected in the audit results.

Waste management options including public place recycling, event recycling, reverse vending machines and alternative waste treatment (AWT) processing have been outlined based on the waste composition and existing infrastructure.

Recommendations have been made based on the audit results, discussions with staff at the University and through observations of the existing waste systems. They have been categorised into considerations for the University more broadly and also for inclusion in future tender documents.

Recommendations for the University:

- Review the condition of the existing bin fleet to determine the number of bins to be replaced/upgraded.
- Monitor the number of bins at each bin station and volume of waste to determine additional servicing information to provide with the waste collection tender documents. This information may be available by speaking to regular cleaners or the existing waste collectors about issues they are aware of and which bin stations are most frequently overfull.
- Increase promotion of the paper and cardboard recycling collection and review bin placement.
- Trial public event recycling at O-Week and Oktoberfest 2011 using the public place recycling best practice principles.
- If considering container recycling, approach the Packaging Stewardship Forum for assistance with funding for infrastructure and awareness materials.

Recommendations for the tender:

- Consider including a replacement bin fleet in the contract or prior to the contract. The University could keep existing bins that are in good condition as spares or for replacement parts. Maintenance and replacement could be the responsibility of the University or the contractor.
- Request the option of a cost/bin (1−15 bins, 15−50 bins, 50−100 bins) for delivery and servicing of container recycling bins for events.
- Request the option of a cost/bin for container recycling recovery around the campus with the contractor suggesting a solution based on the waste audit results.
- Indicate your preference is for AWT processing of residual waste and request expected recovery rates and details of how and where the waste would be processed.
- Consider using the Department of Environment Water and Climate Change template waste collection documents as a guide for contract considerations.

DEFINITIONS

Containerised food and liquid: Bottle or takeaway container with food and liquid still in it that would be considered a contaminant in a recycling or waste treatment facility.

Contaminant*: Item that is not accepted for processing in the bin it is placed in.

Comingled collection*: Pick up and transportation of mixed dry recyclable materials.

Recyclable*: Able to be recovered, processed and used as a raw material for the manufacture of useful new product through a commercial process.

Recycling stream: Material source separated for the purposes of recycling.

Recovery rate*: The amount of material recovered from a product group as a percentage of overall consumption.

$$\text{Recovery rate} = \frac{\text{Weight of recyclables in the recycling bins}}{\text{(Weight of recyclables in recycling bin + Weight of recyclables in garbage bin)}} \times 100$$

Source separation*: Physical sorting of the waste stream into its components at the point of generation.

Waste stream analysis*: Determination of the quantities and qualities of individual components present in a waste stream.

Waste stream characterisation*: Classification and analysis of the waste stream.

Waste stream composition*: Component material types by proportion of weight or volume.

*** Source: AS/NZS 3831:1998**

1 INTRODUCTION

The University of New South Wales (UNSW) engaged APC Environmental Management (APC) to undertake a general waste audit of the Kensington Campus bounded by Anzac Parade, High Street, Botany Street, Willis Street and Barker Street, Kensington.

The audit was conducted to provide UNSW with recommendations on appropriate collection systems for the various types of waste found in the general waste stream and options for treatment and disposal. The results of the audit will be used to develop tender documents for future waste collection services to UNSW.

UNSW operates a paper recycling system in various buildings and has an e-waste collection. There are no container recycling systems currently operating on campus.

A previous audit was undertaken in early October 2005 by the UNSW Environment Unit over a one-week period during the peak student period in the second semester. The 2005 audit analysed a representative sample of 516.28kg from a total aggregated collection of 14.6 tonnes and included off-campus sources that have not been included in this audit. This 2010 waste audit was also undertaken over a one-week period 20−24 September in the second session during the peak student period and analysed 3.1 tonnes of waste from the Kensington Campus.

1.1 Waste generation and general waste system

UNSW provided information on weekly generation and a waste bin schedule for UNSW. The weekly waste generation was calculated over one week (w/c 2/8/10) that is considered to be representative of waste generation during the academic second session. Table 1 details the daily aggregated generation for a typical week.

Table 1 − General waste weekly generation

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total
Date	2/08/10	3/08/10	4/08/10	5/08/10	6/08/10	
Tonnes	5.24	6.45	5.77	6.49	4.97	**28.92**

Table 2 details the number, size of bins and waste type for the general waste bins on the campus.

Table 2 – Campus waste bin configuration − daily schedule

Waste type	No. 660-litre bins	No. 240-litre bins	Total bin nos.	Potential total volumes m^3
General & kitchen waste	38	87	125	45.96
General & animal waste	1	20	21	5.46
General waste	55	185	240	80.7
Totals	**94**	**292**	**386**	**132.12**

2 METHODOLOGY

2.1 Pre-project meeting

APC's project manager attended a planning meeting with relevant UNSW staff at the Kensington Campus on Wednesday 15 September to discuss logistics, sorting categories and inspect the bin locations and proposed sorting sites at UNSW. The APC collection supervisor attended a subsequent meeting with UNSW's general services supervisor and the APC project manager to inspect bin locations and select an appropriate sorting facility.

The University requested that the scope of the proposal be expanded to capture a larger waste sample each day to try to capture as close to one tonne of waste a day as possible.

2.2 Sample size and selection

Following the planning meeting, a collection schedule was developed with the estimated weight of waste to be collected each day by bin location. This schedule was approved by UNSW prior to the commencement of the audit and is reproduced at **Appendix A** with the actual weight of the samples collected on each day of the audit included.

In order to meet the request to audit approximately one tonne per day, APC calculated the average weight of the contents a 660-litre bin as 30kg and a 240-litre bin as 18kg. These average weight estimates were based on previous audits undertaken by APC for audits of a similar nature, (ie. public place and cleaners' waste). However, not all bins that were presented were full, so the amount captured was less than anticipated.

The actual number of bins to be sampled at each location was calculated on the basis of the total number of bins on campus divided by the total number of bin types (ie. 240-litre or 660-litre), to give a percentage of the bin population by bin type. This proportion was applied as a percentage to the required weight to provide the estimated total potential weight per day over the audit week to achieve the total sample. Table 3 refers to these calculations.

Table 3 – Proposed sample size and estimated weights

Waste bin type	No. of bins	% of total bins	No. of samples required over 5 days	Total potential volume	Total potential weight	Daily sample weight
660-litre	94	24%	40	26.4m^3	1,200kg	240kg
240-litre	292	76%	211	50.6m^3	3,800kg	760kg
Total	**386**	**100 %**	**230**	**77m^3**	**5,000kg**	**1,000kg**

From the information provided above, a waste collection schedule was developed based on bin location as detailed in the map provided by UNSW (**Appendix B**). This included the number of bins at each location as presented and counted by UNSW staff

on the Friday before the waste audit commenced. UNSW advised that it was not possible to guarantee that those bins would remain at each location on any given day as they are moved and utilised by cleaning staff. Accordingly, the bin numbers and estimated weights were used as a guide only.

In order to provide a random selection of bins, the APC project manager used the random function of the Excel program to randomly select which bin locations would be collected each day. An adjustment was made to audit only upper campus bins on the Monday of the audit, as UNSW advised that the student peak on the lower campus occurred on Tuesday through to Thursday and that the lower campus should be avoided on Monday.

The audit has provided a representative sample of waste generation by bin location to provide robust data for analysis. This has provided baseline data on potential diversion and recovery and has enabled indicative compositional data to be extrapolated over a period of time to inform on appropriate methods of treatment and disposal.

2.3 Collection

UNSW advised that all bins are collected on a daily basis between 6.30am–9.30am by Randwick City Council (RCC), with a limited collection service provided over the weekend. It appeared that some bins were not required to be serviced each day.

During the audit week, UNSW requested that RCC delay its collection until after 10.30am to allow sufficient time for the APC collection crew to complete the collection of samples. The physical collection of the selected bin samples commenced each morning at 6.30am by an APC collection team comprising an APC collection supervisor and a collection assistant. APC provided a collection vehicle hired for this purpose. Samples were collected as per the approved run sheet.

Waste from each selected bin was emptied into heavy duty bags provided by APC and marked with a designated code indicating the source of waste (by bin location) and the date of collection. Each bin presented at the bin locations was recorded separately on the collection data sheet developed for the audit. This enabled the number of presented bins to have their volumes (%) and capacity (240-litre or 660-litre) recorded and to record the number of sampled bins at each location.

Each bag was placed in the collection vehicle and transported to the sorting area on campus. This procedure was repeated as many times each day as required until all the required bin samples were collected. In cases where the expected number of bins at a location was not presented, additional bins were collected in an attempt to achieve the required daily sample.

The number of bins recorded at each location was sometimes less than or greater than the number of bins that had been presented at those locations on the Friday before the audit. This was due to the cleaning staff removing the bins to work in various areas of the campus and not necessarily returning them to the bin location that they took them from.

At two of the locations, RCC had collected the waste prior to the APC collection team arriving at the location to collect the samples. This was despite a request from UNSW to delay the normal collection provided by RCC until after 10.30am. Where this occurred, the area was revisited to collect a sample the following day.

2.4 Sorting

UNSW provided a sorting site on the campus and 18 x 240-litre bins for the waste to be sorted into. A skip was also provided for the sorted waste and this was collected on a daily basis.

The waste was aggregated by bin location as recorded by the APC collection supervisor during the collection phase. The bags were then opened and tipped on to the sorting tables.

The contents of the bags were separated into the different categories as agreed with UNSW and placed into sorting trays or wheelie bins. Each bin/tray and contents was weighed on a set of electronic scales zeroed to the weight of the bin/tray. The weight in grams of each material or item was read off the display and entered into the appropriate space on the data sorting recording sheet. All material was re-bagged and placed into the waste disposal skip provided at the sorting location by UNSW and emptied daily or as required.

UNSW provided sorting categories based on the 2005 audit and the sorting categories were finalised at the pre-project meeting **(Appendix C)**. An additional category of 'disposable paper cups' was added by the sorting supervisor as there were large amounts of this material in the samples.

2.5 Confidentiality

All audit staff signed a confidentiality agreement that prohibits them from removing anything from the material they sort or from revealing any information they might obtain while sorting the audit samples.

3 DATA LIMITATIONS

The data for this study was collected and analysed using the best and most accurate methods available within the constraints of the available time and budget. This study is a survey, which means that a relatively small amount of data (3 tonnes) has been collected and then treated as representative of the total (a week's generation, 29 tonnes). As in any survey, there are limitations to the accuracy of the data, as described below:

Short timeframe – This audit was carried out over five days, taking samples distributed carefully from each of the bins over the site. The data was then used as being representative of the whole University. It should be noted that seasonal trends and University holidays would change waste generation and composition. Thus, the results of the audit should be treated with due caution when analysing this report.

Representativeness of the sample – The sample for this audit is necessarily small due to the high per capita cost and resource-intensive nature of auditing waste. This audit used random sampling to generate a robust sample.

Weight-based analysis – The collection of data for this audit was recorded by weight. This type of collection may cause some materials to appear to be present in quite small proportions due to their comparatively low densities (eg. plastic beverage containers). Weight-based analysis has been used in this audit because it is a standard measure and is the most accurate way to collect data on a number of different types of materials.

Limitations of sample size – All surveys carry an element of sampling error, which is the mathematical error associated with using a sample to represent the total operation. Sampling error can be reduced by taking larger samples.

4 RESULTS

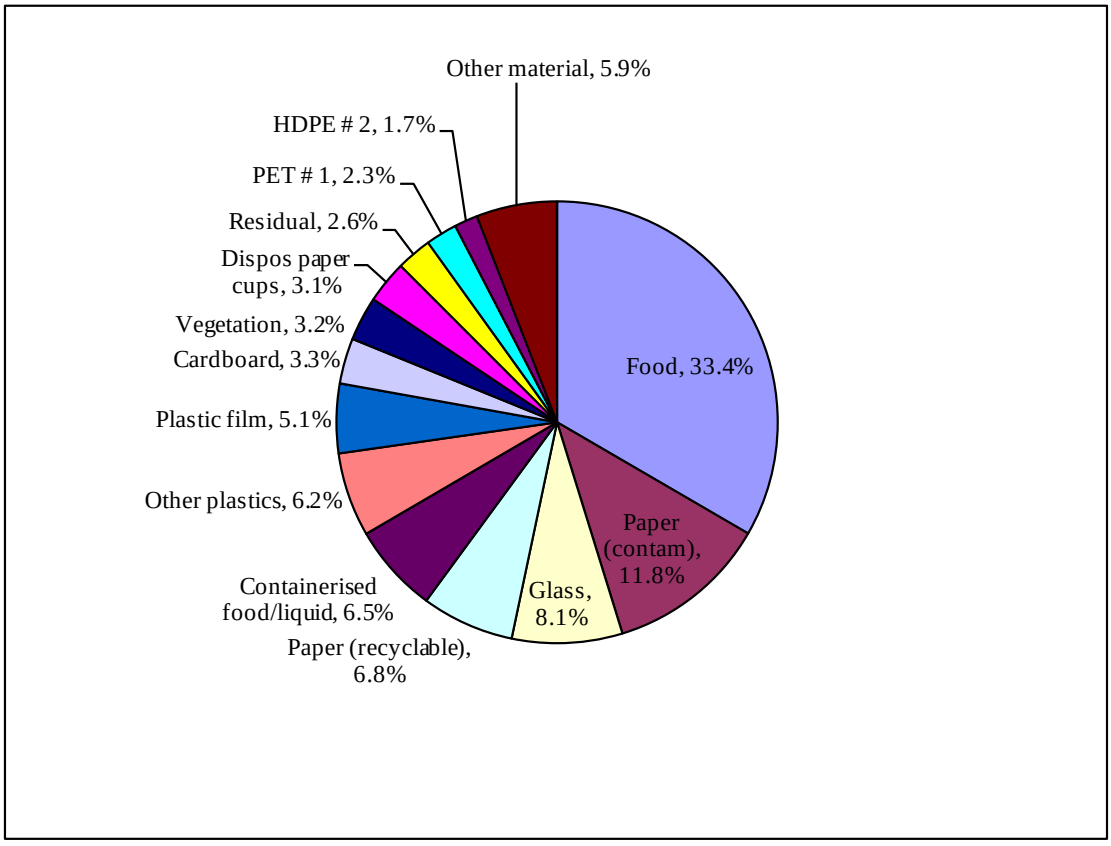
The results have been presented according to the overall campus, upper and lower campus results. The charts, table and photos have been presented in the following sections

- Bin composition
- Bin volumes
- Comparison with previous audit results.

4.1 Bin composition

Overall, waste composition for all locations in the waste stream is shown in Figure 1. It can be seen that the largest component is food waste at 33%, followed by contaminated paper at 12% and glass at 8%.

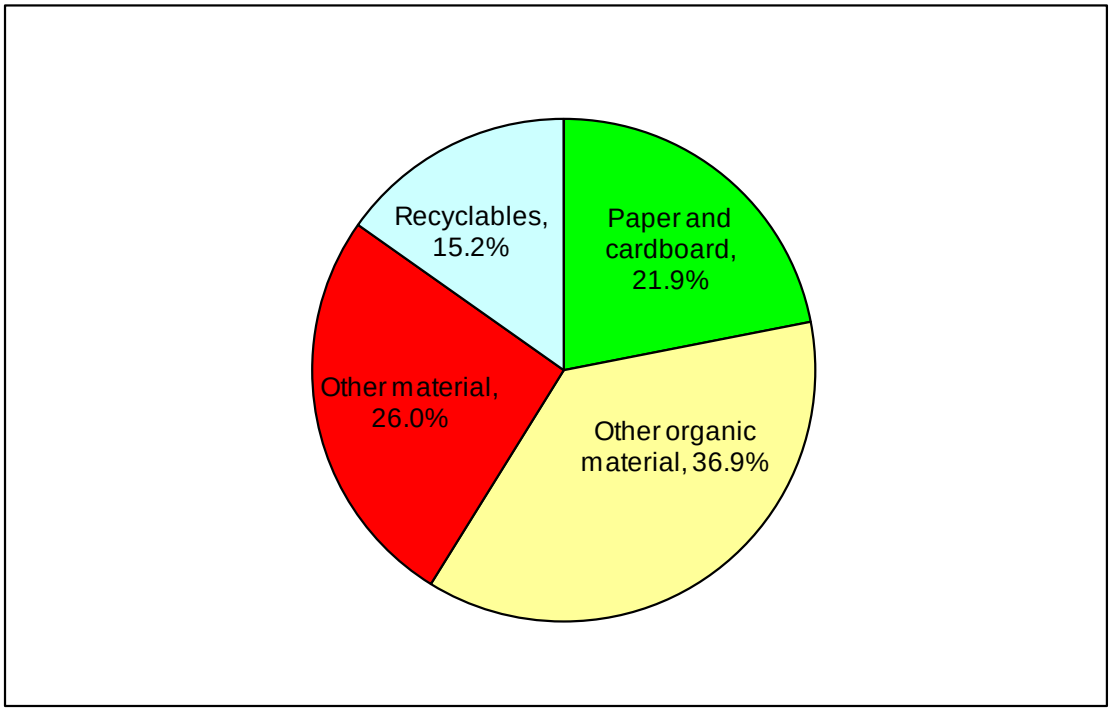
Figure 1 − Composition by weight of all materials audited



Other material included wiring, power cords, ceramics, toasters, dust, freezer bags, broken glass, lab materials, rubber gloves, first aid materials and vinyl folders. Hazardous materials included used dressings, syringes, surgical masks, razors, fluorescent light globes, urine specimens, epi-pens, a used condom and tablets. While this was in small quantities, none of this material should be disposed of in the general waste bins, especially if it is being processed through an AWT.

Figure 2 shows the composition of the waste consolidated into the key categories of organic, recyclable, paper and cardboard and 'other material'. The organic material could be processed effectively through an alternative waste treatment facility (AWT) and it is the majority of the waste stream at 59% (37% organic, and 22% paper and cardboard). If a recycling system was introduced, some of the 15% of recyclables would be recovered for higher value use. The paper and cardboard could be recovered through the existing paper recycling system or an AWT.

Figure 2 − Consolidated composition of all audited waste (by weight)



Figures 3 and 4 show the waste compositions on the upper and lower campuses. The waste streams are generally similar. The main differences are shown in Table 4 below:

Table 4 − Main differences in waste composition between upper and lower campuses

Material	Upper campus	Lower campus	Difference
Contaminated paper	9%	15%	6%
Glass	11%	6%	5%
Vegetation	5%	2%	3%
Disposable paper cups	4%	2%	2%

Figure 3 – Weight of all materials found on upper campus collections

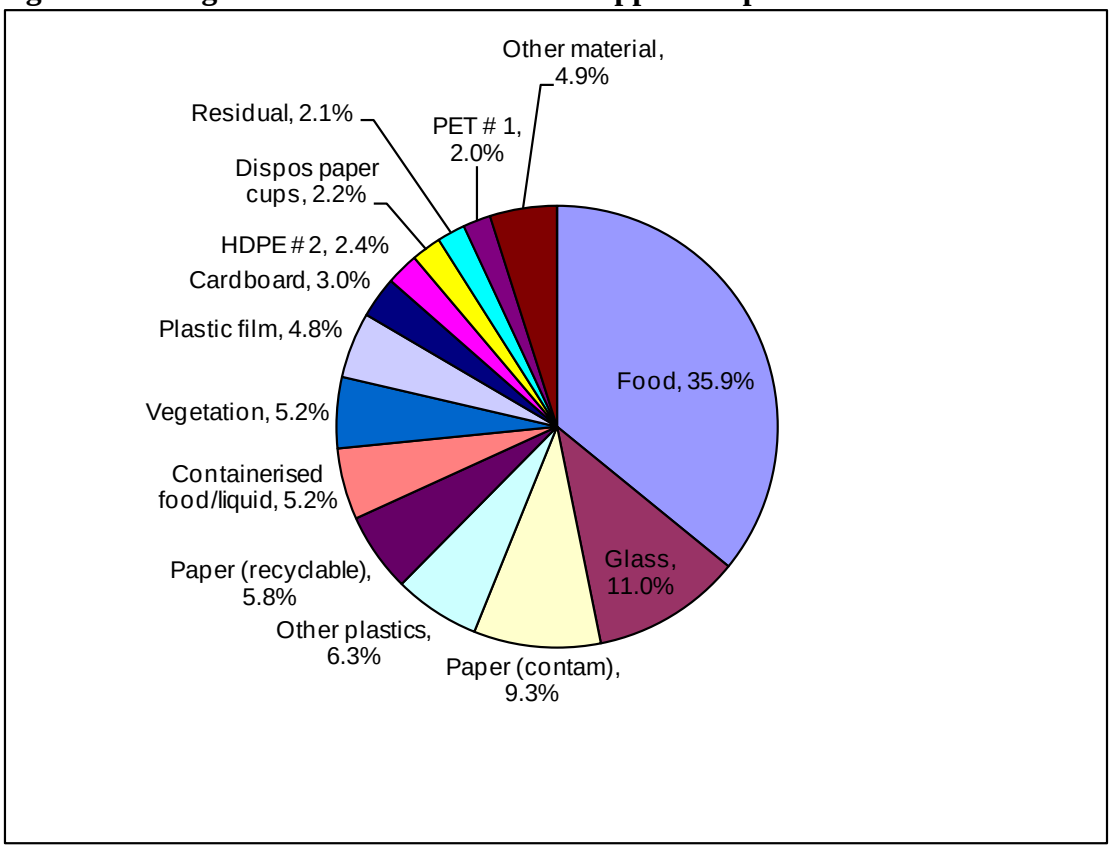
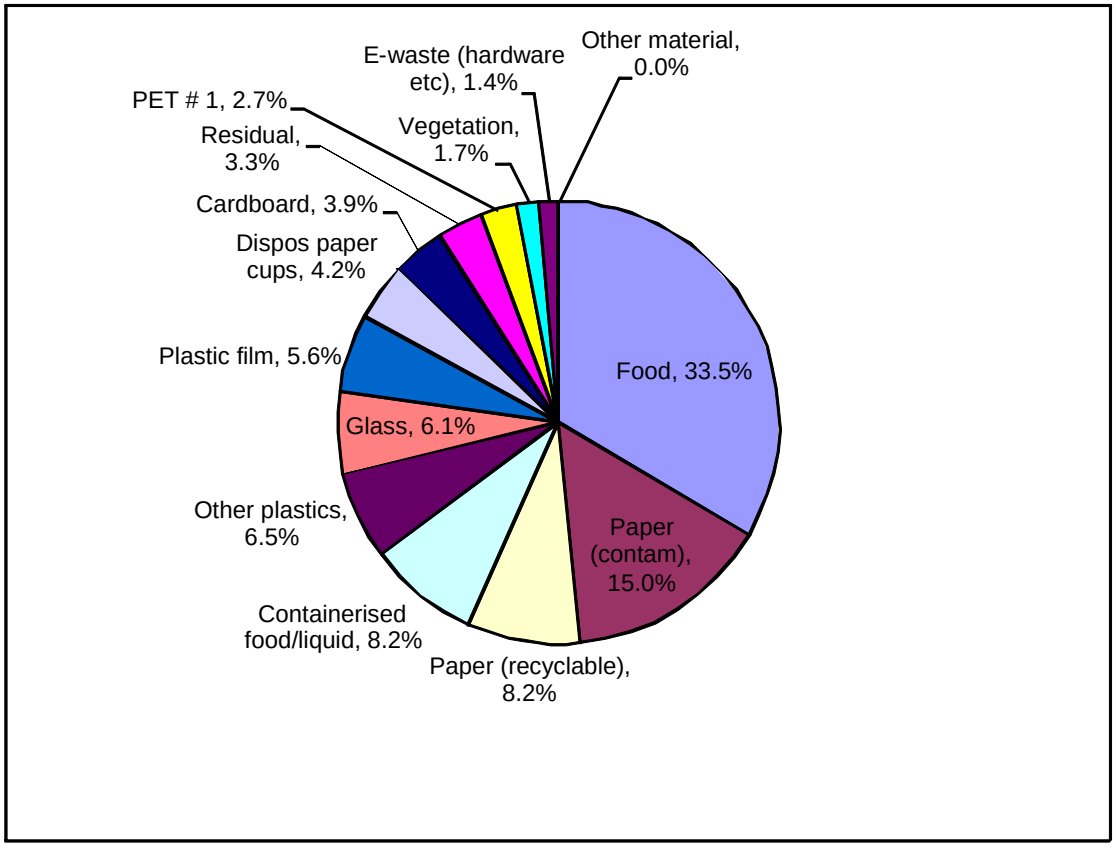


Figure 4 – Weight of all materials found on lower campus collections



A more detailed breakdown of the composition of the waste stream at the upper campus is provided in Table 5. Of 1.5 tonnes of material collected, 3kg was hazardous material (less than 0.5%). Other materials that affect AWT processing, such as heavy, oversize and stringy, construction and demolition waste and residual waste, were all very low.

Table 5 − Weight of all materials found on upper campus and percentage of total

Material type	Amount (kg)	Per cent
Paper (recyclable)	83.8	5.8%
Paper (contaminated)	134.6	9.3%
Cardboard	43.5	3.0%
Organics (vegetation)	75.3	5.2%
Organics (other)	2.7	0.2%
Organics (food)	519.4	35.9%
Glass	158.6	11.0%
Steel (ferrous)	29.1	2.0%
Aluminium (non-ferrous)	11.2	0.8%
Other metal (eg. stainless steel)	0.4	0.0%
Plastic film	69.9	4.8%
PET # 1	29.3	2.0%
HDPE # 2	34.5	2.4%
Other plastics	91.3	6.3%
Construction & demolition materials	6.7	0.5%
Peripheral e-waste (hardware etc)	1.5	0.1%
Office supplies	1.3	0.1%
Containerised food or liquid	75.5	5.2%
Reject (stringy, textile, oversize)	15.1	1.0%
Batteries	0.2	0.0%
Hazardous	3.1	0.2%
Nappies	0.0	0.0%
Residual	29.9	2.1%
Disposable paper cups	31.5	2.2%
Total material collected	**1,448.2**	**100.0%**

A more detailed composition by location in the upper campus is provided in **Appendix D**.

Table 6 shows a more detailed composition of the waste at the lower campus. This is similar to the composition of the upper campus. Approximately 1.5 tonnes of waste at each campus was analysed.

Table 6 − Weight of all materials found on lower campus and percentage of total

Material type	Amount (kg)	Per cent
Paper (recyclable)	128.4	7.6%
Paper (contaminated)	235.8	14.0%
Cardboard	60.8	3.6%
Organics (vegetation)	26.0	1.5%
Organics (other)	6.8	0.4%
Organics (food)	526.2	31.2%
Glass	95.1	5.6%
Steel (ferrous)	17.6	1.0%
Aluminium (non-ferrous)	21.2	1.3%
Other metal (eg. stainless steel)	2.6	0.2%
Plastic film	88.8	5.3%
PET # 1	42.5	2.5%
HDPE # 2	19.2	1.1%
Other plastics	101.9	6.0%
Construction & demolition materials	5.6	0.3%
Peripheral e-waste (hardware etc)	21.4	1.3%
Office supplies	7.7	0.5%
Containerised food or liquid	128.1	7.6%
Reject (stringy, textile, oversize)	15.0	0.9%
Batteries	1.6	0.1%
Hazardous	0.2	0.0%
Nappies	14.2	0.8%
Residual	51.4	3.1%
Disposable paper cups	65.9	3.9%
Total material collected	**1,684.0**	**100.0%**

A more detailed composition by location in the lower campus is provided in **Appendix E**.

Table 7 shows the potential for recovery through organics processing or recycling by location. If the University was to consider introducing a container recycling system at the University, the areas with the highest percentage for recycling (more than 25%) should be targeted initially.

It should be noted that at U7, the sample was not sufficiently large enough to make an adequate analysis. U8 and U22 had both yellow lidded recycling bins and general waste bins present. It can be seen from the results below that people are willing to separate out the recycling and that the contamination levels are fairly low at 4.5%.

Table 7 − Potential for diversion and recovery by location

	Components of waste (kg)				Proportions (%)	
Location	Organic	Recyc	Other	Total	% Organic	% Recycle
U1	233.0	83.3	47.6	363.8	64.0%	22.9%
U3	92.1	67.2	40.1	199.3	46.2%	33.7%
U4	56.3	0.5	0.0	56.9	99.1%	0.9%
U8 (G)	161.4	4.8	4.5	170.7	94.6%	2.8%
U8 (Re)	2.6	62.7	0.3	65.6	4.0%	95.5%
L13	73.3	43.0	30.8	147.1	49.9%	29.2%
L21	183.6	71.9	75.4	330.9	55.5%	21.7%
U2	71.6	18.2	16.7	106.5	67.2%	17.1%
U7	0.5	1.4	0.7	2.7	19.8%	53.0%
U22	33.2	125.4	7.0	165.6	20.1%	75.7%
L12	30.6	9.7	3.0	43.3	70.7%	22.5%
L15	44.3	32.1	22.9	99.4	44.6%	32.3%
L16	43.1	15.8	11.2	70.2	61.4%	22.5%
L17	25.2	14.2	11.3	50.7	49.7%	28.0%
L18	14.1	2.3	11.7	28.1	50.1%	8.1%
L23	77.9	29.2	24.6	131.7	59.1%	22.2%
L9	76.1	29.6	24.6	130.2	58.4%	22.7%
L14	72.8	46.4	6.7	125.8	57.8%	36.9%
L19	120.2	16.5	6.0	142.8	84.2%	11.6%
L20	105.7	21.6	18.0	145.4	72.7%	14.9%
U5	158.9	45.7	31.5	236.1	67.3%	19.3%
U6	49.8	15.0	16.3	81.1	61.4%	18.5%
L11	117.0	56.6	64.8	238.4	49.1%	23.7%
Total	**1,843.2**	**813.0**	**475.9**	**3,132.2**	**58.8%**	**26.0%**

* Note: Refer to Appendix B for map references to each location code.

4.2 Bin volume utilisation

To determine the current bin capacity utilisation, the volume of waste collected at each location was recorded. The average bin volume used is recorded in Table 8. Of all the bin capacity provided on campus during the week audited, approximately 50% of bin capacity was used. Of the 660-litre bins, the average capacity utilised was 65%. Of the 240-litre bins, the average capacity utilised was 47%. While additional bin capacity needs to be provided for peak periods, the amount of capacity currently allowed may be excessive and be resulting in additional waste disposal costs if waste collection is charged by volume.

Table 8 − Average bin utilisation at each location audited

Date	Location	Bins presented	Average bin volumes used
20/09/2010	U1, Gate 11	12 x 660-litre, 18 x 240-litre	69%
20/09/2010	U3, Gate 11	3 x 660-litre, 18 x 240-litre	86%
21/09/2010	U4, Gate 10	14 x 240-litre	21%
21/09/2010	U8, Gate 5	3 x 660-litre	49%
21/09/2010	U8, Gate 5	11 x 240-litre (Recyc)	85%
21/09/2010	L13, Gate 2	4 x 660-litre, 13 x 240-litre	84%
21/09/2010	L21, Gate 14	14 x 660-litre, 11 x 240-litre	52%
22/09/2010	U2, Gate 11	6 x 240-litre	135%
22/09/2010	U7, Gate 7	3 x 240-litre *	8%
22/09/2010	U22, Gate 14	9 x 240-litre	55%
22/09/2010	L12, Gate 2	3 x 240-litre	105%
22/09/2010	L15, Gate 2	4 x 660-litre, 3 x 240-litre	48%
22/09/2010	L16, Gate 14	11 x 240-litre	2%
22/09/2010	L17, Gate 14	1 x 660-litre, 9 x 240-litre	12%
22/09/2010	L18, Gate 14	1 x 660-litre	40%
22/09/2010	L23, Gate 14	3 x 660-litre	93%
23/09/2010	L9, Gate 4	3 x 660-litre, 21 x 240-litre	26%
23/09/2010	L14, Gate 2	8 x 660-litre, 12 x 240-litre	17%
23/09/2010	L19, Gate 14	10 x 240-litre	46%
23/09/2010	L20, Gate 14	4 x 660-litre, 2 x 240-litre	53%
24/09/2010	U5, Gate 8	12 x 240-litre	107%
24/09/2010	U6, Gate 8	2 x 660-litre, 6 x 240-litre	53%
24/09/2010	U7, Gate 7	2 x 240-litre	3%
24/09/2010	L9, Gate 4	3 x 660-litre, 21 x 240-litre	22%
24/09/2010	L11, Gate 2	10 x 660-litre, 10 x 240-litre	68%
24/09/2010	L16, Gate 14	11 x 240-litre	1%
Total campus	-	-	**51%**

* It appeared RCC had emptied these bins prior to collection.

Having indicated that some bins are underutilised, Figures 5 and 6 demonstrate the bin utilisation by day at various locations. These have been broken into two charts by day to provide the data more clearly. This analysis indicates that some bins are overfull (U2, L12 and U5) but a number of bins are well below capacity. It should be noted that U7 and L16 were audited twice in case the low volume was a result of the bins being serviced prior to APC arrival, however there was minimal waste on both occasions.

Figure 5 − Average bin volumes used (ranked), Monday−Wednesday

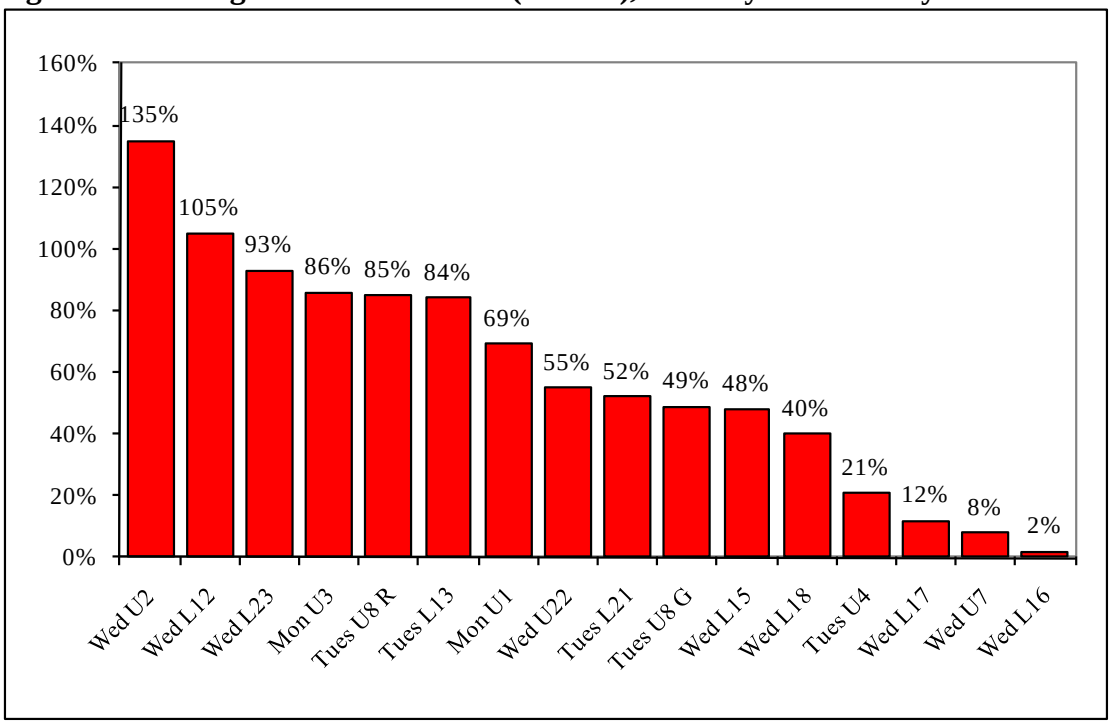
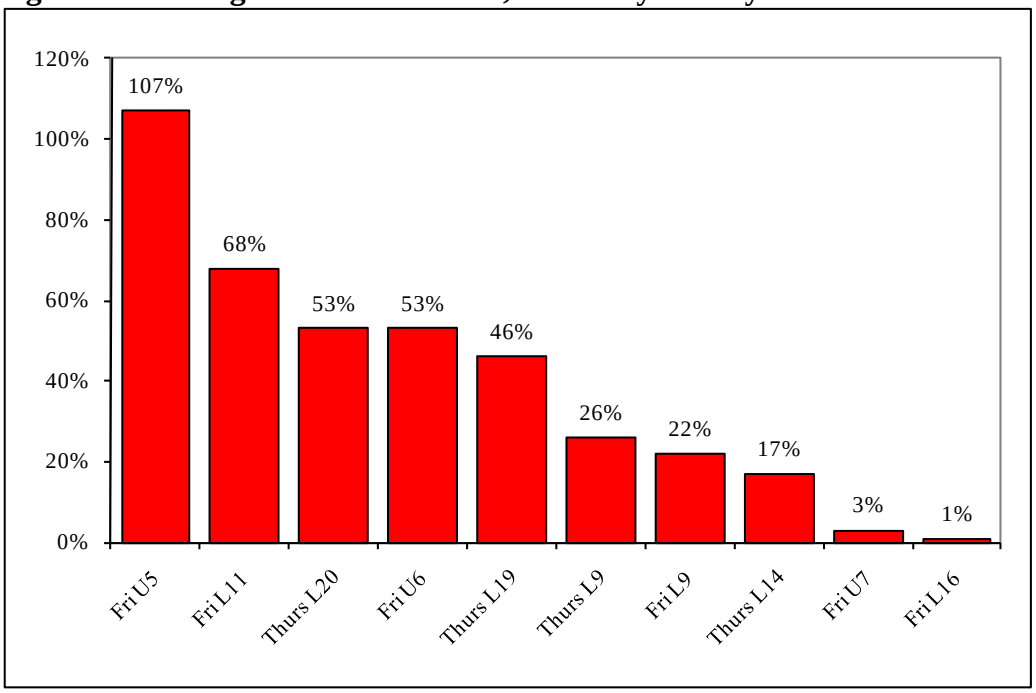


Figure 6 − Average bin volumes used, Thursday–Friday



4.3 Comparison with previous audit results

UNSW provided APC with a summary of the 2005 audit results. The two sets of audit data have been compared in Table 9. The categories used were slightly different between the two audits, which could explain some of the differences observed.

It can be seen that recyclable paper has increased significantly (by 9%) in 2010, while organics has decreased by 21%. It is possible that in 2005, any paper in the garbage bin was considered to be organic rather than recyclable. The introduction of more plastics during the past five years is evidenced in the waste stream.

In 2010, APC used the 'containerised food and liquids' category for food and liquids that are sealed in packaging. These materials are unlikely to be recovered for composting or recycling and will end up as residual material. In the 2005 audit, the liquid and food may have been emptied out of the containers, overstating the amount of potentially recoverable/recyclable materials.

Table 9 − Comparison of 2005 and 2010 composition results

Material type	2005 results	2010 results	Difference
Paper (recyclable) (incl card)	0.9%	10.1%	9.2%
Paper (contaminated)	12.1%	11.8%	-0.3%
Organics	58.1%	36.9%	-21.2%
Glass	6.5%	8.1%	1.6%
Steel (ferrous)	4.0%	1.5%	-2.5%
Aluminium (non-ferrous)	1.0%	1.0%	0.1%
Other metal	0.1%	0.1%	0.0%
Plastic film	3.1%	5.1%	2.0%
PET # 1	3.1%	2.3%	-0.8%
HDPE # 2	1.9%	1.7%	-0.2%
Other plastics	4.3%	6.2%	1.8%
Reject (stringy, textile, oversize)	2.2%	1.0%	-1.2%
Batteries	0.0%	0.1%	0.1%
Hazardous	0.0%	0.1%	0.1%
E-waste (hardware etc)	0.0%	0.7%	0.7%
Nappies	0.1%	0.5%	0.4%
Residual	2.7%	12.9%	10.2%
Total	**100.0%**	**100.0%**	

5 EXISTING WASTE INFRASTRUCTURE

The bin composition is typical of what would be expected at a University campus. There are slight differences in the waste composition based on the waste generation points. For example, areas closer to food courts have a higher proportion of food and packaging in them than those near lecture rooms, which contain more paper.
There is an opportunity to recover some materials from these bins, particularly paper and cardboard.

The issue of bin capacity is challenging, given the 'transient' nature of bins. For OH&S and ease of servicing, cleaners take the bins to the location where they are cleaning. Once the bin is full, they return it to the nearest bin station. This results in some bin stations having few bins in them and others having many. The number of bins in any one location can change on a daily basis. This means that when cleaners arrive with bags that need to be placed in the bins, sometimes there is no remaining capacity and bags are placed alongside the bins. It is recommended that a bin audit be carried out over a period of 2−3 weeks, tracking the number of bins in each bin station and how full they are prior to service. This will give a more accurate determination of the number of bins required in each bin station and assist with planning servicing requirements.

Image 1 − Overfilled bins.

Image 2 − Overfilled bins.

Due to the wide range of bin infrastructure, there appears to be some confusion over correct bin use. Access to bins appears to be an issue as well, with cleaners overfilling the accessible bins with the bins situated behind remaining empty. This could be addressed by reminding cleaners to move the full bins towards the back, and bring the empty bins forward. In some locations, the 660-litre bins could be placed sideways in a single row. This requires all cleaners being made aware of this when they are removing bins and bringing them back to the bin storage area.

Image 3 − Variety of bins.

Image 4 − Variety of bins.

There is an opportunity to review the bins to replace damaged or old bins and make the bin fleet relatively consistent. It appears that where yellow lidded recycling bins are provided, cleaners are utilising them correctly as recycling bins.

Image 5 − U22 Recycling bins.

6 WASTE MANAGEMENT OPTIONS

Due to the large number of requests to introduce some kind of recycling system, the University has asked APC to provide options for managing its waste and to consider options relating to introducing container recycling systems.

Options considered include:

- Public place recycling
- Event recycling
- Reverse vending machines
- Alternative waste treatment processing.

6.1 Planning a public place recycling system

With the success of kerbside recycling, the community also expects to be able to recycle at work and in public places. The University environment can be likened to other public places with some open sitting areas, food courts and walkways. There are a range of considerations for introducing public place recycling systems. The following information provides the key principles for a successful recycling system that achieves good recovery and low contamination rates.

The NSW Government released the *Public Place Waste Management Guidelines*, a step-by-step guide to establishing a waste management system in public places. The guidelines set out the critical elements for establishing a successful public place system (www.environment.nsw.gov.au/warr/publicplacerecycling.htm).

The findings of research for planning recycling infrastructure indicate that:

- Bins should be conveniently located.
- Clear labelling on the bin front, bin lid and overhead signs are essential to minimise contamination.
- Overhead signage should be readable from a distance and double sided where appropriate.
- Litter bins incorporated in the recycling centre and placed at each end of a row of recycling bins results in lower contamination.
- Multiple stand-alone bins in the general vicinity of recycling bins dramatically lower the quantities of recyclables retrieved at the recycling centre.
- Re-positioning and reducing the number of litter bins does not result in significant increases in littering.
- Public awareness campaigns are essential to avoid the dumping of garbage in recycling bins and scavenging.
- In the absence of clear signs overhead, people will look in the bins, and, if there is contamination, further contamination is highly likely.
- Recycling bin lids should be locked with restrictive apertures appropriate for the types of material accepted in the bin (ie. a rosette if containers only, a paper lot of only paper and card).

- Bins should be serviced regularly to prevent overflowing.

Another important element is promoting the recycling system. Prior to introduction, there should be as much promotion as possible to let the students know that the system is being introduced. Once the bins are in place, regular reminders about the service should be promoted. This can be done by:

- Showing bin locations on maps.
- Including information about the system in brochures and online.
- Including information about the system in newsletters and publications.

There is an Australian Standard AS 4123 for Mobile Waste Containers, as shown in Table 10, which should be used to encourage consistency in education messages.

Table 10 − Australian Standard for bin colours

Waste category	Bin body colour	Bin lid colour
Garbage	Dark green or black	Red
Recycling	Dark green or black	Yellow
Paper and cardboard	Dark green or black	Blue
Organics	Dark green or black	Lime green

The diagram below shows a public place recycling station with all its features.

Any waste management system requires ongoing monitoring, especially when newly introduced. Waste audits and visual inspections of bin contents and infrastructure location should be undertaken to monitor performance. It is suggested that an audit be carried out three months after the program is introduced and repeated annually and that regular inspections of various sites be ongoing. The audit results provide

feedback to the students about the effectiveness of the system and room for improvement. The feedback creates a sense of ownership and knowledge that the material is getting recycled appropriately and improving the environment.

6.1.1 Reverse vending machines

Reverse vending machines have recently been introduced into Australia in shopping centres and public places. They are an alternative to comingled recycling bins. They are currently being trialled at the University of Sydney. They are commonly used overseas as a way to recover high value recyclables. They reward people that use the machine with a voucher. EnviroBank is the main provider of this product in Australia (www.envirobank.com.au/about-us).

This system only accepts aluminium cans and PET plastic containers. These two items comprise approximately 100kg of the University's waste per day. If ALL of the material was captured, this could equate to 20 tonnes of waste/year. Realistically, if only 5 tonnes a year was diverted, this would still be a significant waste diversion.

There is a cost to rent the machines that may make comingled recycling a more cost-effective option. The University could enquire as to whether EnviroBank would be prepared to introduce some machines on a trial basis.

6.2 Public event recycling

The University runs a number of annual events that could be used to trial the effectiveness of public event recycling, prior to implementing a full public place recycling system.

Events such as Orientation Week and Oktoberfest provide a good setting where a significant quantity of beverage containers is consumed in a confined space and there is an opportunity to recover waste. Any event recycling system should be set up using the same principles as the public place recycling system, with clear infrastructure and signage. Due to the intensive nature of bin use at events, the bins need to be monitored and serviced regularly throughout the day. This can be managed by providing additional empty bins that can be exchanged for full bins. All of the full bins can be put to the side, ready for servicing after the event.

6.3 Alternative waste treatment

Alternative waste treatment (AWT) is the processing of residual waste through mechanical, biological and/or thermal treatment to produce organic growth medium, energy and recyclables. It is an alternative to landfill as it can create a higher use for products in our nutrient poor and energy demanding environment.

There are currently four operating AWT facilities in the greater Sydney area, with three further facilities planned. Many councils are processing their residual waste through these facilities as landfill capacity reduces significantly and disposal rates increase.

The University previously had a tonnage swap arrangement for waste to be 'diverted' through the alternative waste treatment. This swap is no longer in place but it is understood that the University is considering tendering to have all of its waste processed at an AWT facility. The aim of these facilities is to recover 60-70% of waste into a higher use product.

The University's current waste stream is approximately 60% organic. This means that the processing facility would need to remove the remaining 40% that would be placed in landfill. If the dry recyclable material is separated as much as possible prior to AWT processing (ie. through source separation) this increases the recovery rates for the University and the processing facility. The current waste composition and volume of waste generated may be appealing to some of the existing AWT facilities that have remaining capacity for a small amount of highly organic waste. Therefore, this is a serious option to canvass in the upcoming tender process.

7 SUMMARY OF RECOMMENDATIONS

The recommendations are based on the audit results, discussions with staff at the University and through observations of the existing waste systems. They have been categorised into considerations for the University more broadly and also for the tender documents themselves.

7.1 Recommendations for the University

- Review the condition of the existing bin fleet to determine the number of bins to be replaced/upgraded.
- Monitor the number of bins at each bin station and volume of waste to determine additional servicing information to provide with the waste collection tender documents. This information may be available by speaking to regular cleaners or the existing waste collectors about issues they are aware of and to identify which bin stations are most frequently overfull.
- Increase promotion of the paper and cardboard recycling collection system and review bin placement.
- Trial public event recycling at O-Week and Oktoberfest 2011 using the public place recycling best practice principles.
- If considering container recycling, approach the Packaging Stewardship Forum for assistance with funding for infrastructure and awareness materials.

7.2 Recommendations for the contract

- Consider including a replacement bin fleet in the contract or prior to the contract. The University could keep existing bins that are in good condition as spares or for replacement parts. Maintenance and replacement could be the responsibility of the University or the contractor.
- Request the option of a cost/bin (1−15 bins, 15−50 bins, 50−100 bins) for delivery and servicing of container recycling bins for events.
- Request the option of a cost/bin for container recycling recovery around the campus with the contractor suggesting a solution based on the waste audit results.

- Indicate the University's preference is for AWT processing of residual waste and request expected recovery rates and details of how and where the waste would be processed.
- Consider using the Department of Environment Water and Climate Change template waste collection documents as a guide for contract considerations.

Appendix A − Collection schedule

Appendix B − University map

Appendix C − Collection data sheet

Appendix D − Upper campus composition detail

Appendix E − Lower campus composition detail