

Report



June 2015

Guidance on the Methodology for Waste Composition Analysis

For local authorities commissioning waste
composition analysis of municipal waste



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Acknowledgements: this guidance has been based on the 2008 SEPA document "National Methodology for Household Waste Composition Analysis in Scotland"

Glossary

ACORN (A Classification of Residential Neighbourhoods): a geo-demographic segmentation of the UK's population which segments small neighbourhoods, postcodes, or consumer households into 5 categories, 17 groups and 56 types. The segmentation is based on census data and other information such as lifestyle surveys. Further details can be accessed at <http://acorn.caci.co.uk/>

Area waste composition profile (WCP): the percentage of materials contained in a particular waste stream. This WCP profile will clearly differ for each source of waste – a kerbside WCP will be different from a HWRC WCP.

Carbon Metric: The Scottish Carbon Metric measures the environmental impact of its waste in order to support and record work to reduce waste and, where waste does occur, its damage to the environment. It uses whole life estimates of carbon impact, making Scotland the first country to measure the carbon impact of its waste in this way.

Close: the group of flatted properties accessed by the same common entrance.

Collection cycle: the period of time, usually either a week or a two week period, in which households have all components of kerbside household waste (residual, dry recycling and any organics collection, including garden and/or food waste) collected at least once.

Confidence interval: describes the amount of uncertainty associated with a sample estimate of a population parameter.

Council Tax band: the Council Tax splits every “dwelling” into one of eight valuation bands. Further information can be found at <http://www.saa.gov.uk/counciltax.html>

Geo-demographic package: a tool used to classify different area types, usually based on a combination of census, survey and other data sources; a tool used in drawing a stratified sample for WCA.

Household waste: According to SEPA (SEPA, 2011) household waste consists of waste from the following sources: wastes from collection rounds, bulky waste collections, separate collections of household hazardous wastes, drop off/bring systems including reuse centres and HWRCs. It does not include trade waste, street sweepings, litter bins, parks and gardens waste, beach cleaning waste and commercial waste at HWRCs.

Household Waste Recycling Centre (HWRC): a site provided for householders by a Local Authority for the recycling and disposal of household waste. HWRCs or Recycling Centres are also termed Civic Amenity sites.

MOSAIC: consumer classification based on demographic data. 155 Mosaic person types aggregate into 67 household types and 15 groups, to create a 3 tier classification that can be used at the individual, household or postcode level. Further details can be accessed at <http://www.experian.co.uk/assets/business-strategies/brochures/mosaic-uk-2009-brochure-jun10.pdf>

Output area classification (OAC): census based area classifications that group together geographic areas according to key characteristics common to the population in that grouping. The area classifications are hierarchical classifications, consisting of three tiers: supergroups, groups and subgroups. Further details can be accessed at <http://www.ons.gov.uk/ons/guide-method/geography/products/area-classifications/ns-area-classifications/ns-2011-area-classifications/index.html>

Recycling Point: publically accessible facilities provided by local authorities for the recycling of certain waste streams; typically these include packaging, paper, glass and textiles.

Sample: in the context of WCA a sample is an amount of waste that is selected for analysis in order to represent arisings within a particular stratum of the target area (which may be a key socio-economic/ demographic group within a Local Authority area), it is chosen to be sufficient to take account of variation in waste arisings whilst also being affordable within the project budget. A sample within a particular stratum in terms of the Zero Waste Scotland methodology is 50 households taken from a street block representing a particular stratum.

SIMD: The Scottish Index of Multiple Deprivation identifies small area concentrations of multiple deprivation across all of Scotland in a consistent way. The SIMD ranks small areas (called datazones) from most deprived to least deprived. Further information can be found at <http://www.scotland.gov.uk/Topics/Statistics/SIMD/>

Stratification: the process of dividing members of the population into homogeneous subgroups before sampling in a statistical survey.

Stratum/ strata: the term applied to each of the subgroups used to divide up the study area by the stratification process.

Street block: an area belonging to a particular stratum (e.g. 'more affluent retired households', 'area with households predominantly with young children' etc.,) that contains households serviced by the same collection round/ round day (residual and recycling services) from which a sample of waste from 50 households is obtained for WCA.

Scottish urban/rural classification: provides a standard definition of rural areas in Scotland. This classification is updated every two years to incorporate the most recent Small Area Population Estimates (SAPE) produced by National Records of Scotland (NRS) and Royal Mail Postcode Address File (PAF). Further information can be found at <http://www.scotland.gov.uk/Topics/Statistics/About/Methodology/UrbanRuralClassification>

WasteDataFlow (WDF): web based system used for municipal waste data reporting by UK local authorities to government.

Waste arisings: the combined waste generated from residual waste and from any source separated waste streams (dry recycling and organic wastes); the waste arisings for any source of waste is the sum of the reuse/recycled/recovered waste stream and any residual waste stream.

Waste composition analysis (WCA): a study that provides information on the weight of materials that are in a given waste stream and usually involves obtaining samples of these waste streams and sorting them into pre-defined categories which are then weighed.

1 Summary methodology requirements

The Zero Waste Scotland Guidance on the Methodology for Waste Composition Analysis (the methodology) has been designed as a standard template for the analysis of municipal waste by local authorities in Scotland. The table below summarises the methodology minimum requirements for a household kerbside waste composition analysis study (WCA).

Methodology minimum requirement	Section reference
Sampling and sorting of residual and co-mingled dry recycling	3.2 / 4.2
Sampling from both main door and multi-occupancy households where significant housing types in the area	3.2
Sampling for a whole collection cycle	3.2
Full sample weight sorted	4.2
Sampling of food waste	4.2
Stratification to create a sampling regime that is representative of the whole local authority area and takes account of housing type or area type and a socio-economic dimension;	4.3
Two seasons of fieldwork (strongly recommended)	4.3
Minimum of 4-5 samples	4.3
Sample size of 50 households	4.4
Reserve households identified on collection sheets	4.5
Residual and co-mingled dry recycling collected from same sample households	4.6
Collection of the residual waste stream first in the collection cycle	4.6
Recycling collected from the residual households only, with set-out of recycling bins recorded.	4.6
Sampling to cover full collection cycle for residual and co-mingled dry recycling in most cases	4.6
Standard sort categories	5.3

2 Introduction

2.1 Context

Waste composition analysis (WCA) provides information about the types and amounts of the materials that are in a given waste stream. Analysis enables local authorities to gather information on the range of materials in their waste stream as well as the amount of each of these materials and their relative proportions in their waste. If carried out at a number of intervals over the period of a year, analysis can also highlight differences in waste composition over different seasons.

Data is gathered by physically sorting the waste by hand into a number of predetermined categories. Each category is then weighed and the results are collated to provide a breakdown of the total composition of waste that has been sampled.

2.2 Purpose of this guidance

The Zero Waste Scotland Guidance on the Methodology for Waste Composition Analysis (the methodology) has been designed as a standard template for the analysis of municipal waste by local authorities in Scotland. It is a requirement of funding from Zero Waste Scotland that the methodology is followed for WCA studies.

Zero Waste Scotland provided funding in the 2013/14 and 2014/15 financial years for selected local authorities to carry out local WCA studies (the 2013–15 WCA fund for local authorities). The rationale for this was two-fold:

- 1 By provision of funding, and through the support of a Zero Waste Scotland Waste Composition Project Manager (WCPM), there would be a greater degree of consistency and therefore comparability between studies carried out in different local authorities and by different contractors.
- 2 Over time, Zero Waste Scotland can build a database of waste composition across many local authorities to create a 'live' composition of national waste at any given time. This will mitigate against the criticism of national waste composition studies that they are only a 'snapshot in time' which may age in value quite rapidly.

The funding was made available to local authorities in order to provide better and more consistent data on which authorities can plan and change their services to suit their needs. In addition, the data gathered from the Local Authority studies has been added to a national composition database. Local authorities, CoSLA, Zero Waste Scotland, SEPA and the Scottish Government will make use of these data for policy development, spotting economic opportunities and validating other data sources.

This methodology is applicable to any Local Authority kerbside WCA studies funded by Zero Waste Scotland and can be used by local authorities wishing to independently fund WCA studies. Any future studies funded by Zero Waste Scotland will continue to be incorporated into the database. The methodology will be periodically revised and updated.

This methodology has been based on the 2008 SEPA document 'National Methodology for Household Waste Composition in Scotland' (SEPA, 2008) which was based on studies carried out on behalf of the Welsh Assembly in preparation for the Welsh National Waste Strategy during 2003, other guidance documentation and reference material and Scotland-specific issues reflected in the associated stakeholder consultation. The methodology has been updated to align with the objectives of the 2013-15 WCA fund for Local Authorities, to take account of the findings of the 2012 study 'Building a WCA Strategy for Scotland' (Zero Waste Scotland, 2012) and to take account some of the finds from completion of the 2013-15 WCA fund for Local Authorities.

2.3 Scope and structure of guidance

The primary purpose of this methodology is to ensure a standard approach to WCA for the purposes of understanding the composition of waste within an area (particular property types within local authorities, a whole Local Authority area or a group of local authorities) and fits with Zero Waste Scotland requirements.

The focus of the methodology is the analysis of household kerbside waste; however, many of the principles used are standard and will be applicable to the analysis of other waste streams. Further guidance on analysis of other waste streams is given in 'Appendix B Sampling other waste sources'.

The methodology has been structured to take local authorities through the process of commissioning a WCA. The document outlines what is required of the Local Authority commissioning a study and the WCA contractors carrying out the fieldwork. It is recognised that in some cases the Local Authority may be conducting the WCA analysis in-house. In this case the requirements set out for the WCA contractor should be taken on board by the Local Authority.

The document clearly identifies the minimum requirements of the methodology; it is designed to standardise studies while still allowing flexibility in approach so that individual studies can meet the objectives of local authorities and allow WCA contractors to add value. The document also aims to clearly highlight responsibilities and the points at which local authorities can monitor the study.

Section 10 references sources that can provide more detail on certain aspects of WCA and related issues.

3 Purpose of conducting WCA studies

3.1 Overall considerations

WCA is not an exact science and it must be recognised that outputs have to be considered in the correct context:

- They are a snapshot in time based on waste sampled from a particular locality during a certain week (or weeks), season, set of weather conditions.
- The nature and quantity of waste set out at kerbside by households is subject to a large number of constantly changing variables such as householders' behaviour, demographics and materials used in the home.
- Although a large enough sample of houses could theoretically be chosen to take account all of this variability, it is usually difficult to determine how large the sample would likely be (discussed in Section 4.4), without first conducting a detailed (and expensive) pilot study of the waste in a particular area.

Despite these overriding caveats, WCAs can contribute valuable information, provided that the aims and objectives are well defined at the outset, the recommended approach to sampling is followed (Section 4) and that the uncertainties are acknowledged from the outset.

There is a basic distinction between the aims and objectives of WCAs carried out that aim to improve the efficiency and overall effectiveness of waste management systems within the study area; versus studies designed to inform long term strategy and infrastructure investment. The methodology here is primarily concerned with the first type. Local authorities should recognise that, given the uncertainties surrounding the variability of the waste stream, a larger sample size should be considered if using WCA for long term strategy and infrastructure investment, and it is likely that the financial cost of such an analysis will be significantly higher.

3.2 Aims and objectives for kerbside monitoring and scheme improvement

Information generated by WCAs can help local authorities to improve the efficiency and overall effectiveness of waste management systems. There are a number of reasons why it is useful to conduct kerbside waste composition analyses of which the following are examples:

- To enable the identification of how much of the recoverable material in the household waste stream is currently being captured for recycling/composting and how much remains in the residual waste. This will help provide information to focus the continued improvement of scheme performance.
- To implement and develop new recycling schemes. Analysis will help provide baseline information from which predictions can be made on how much material could be recovered from a new scheme.
- To compare and contrast alternative systems operating within an area, in order to inform scheme choice.
- To generate information to inform public information campaigns.
- To calculate the environmental impact of waste using the Scottish Carbon Metric (<http://www.zerowastescotland.org.uk/carbonmetric>)

The aims and objectives need to clearly define the waste streams within scope, to take account of the interaction between different kerbside components (residual, dry recycling and organics), consider coverage of housing type and consider the influence of the collection cycle. Outside of this the Local Authority may have other aims and objectives that can be incorporated in the WCA design e.g. 'pre' & 'post' designs to monitor scheme introduction, introduction of new guidance to householders on set-out and recycling contamination, assessment of waste prevention and re-use potential to inform waste prevention strategies, routing, fleet management (i.e. estimating vehicle capacity or potential new vehicle type/compartment characteristics).

Although WasteDataFlow provides details at Local Authority and national level of the overall split of materials that are separately collected for recycling/ composting at kerbside, for single stream and twin stream dry recycling schemes this split may not be available. It is also the case that some of the generic material categories reported within WasteDataFlow combine a mix of different fractions (e.g. 'paper and card'); WCA is needed to fill these gaps. For all recycling schemes, WCA provides a more detailed material split than WasteDataFlow is able to provide.

The methodology minimum requirements are that the aims and objectives need to cover:

- **Waste streams:** that residual and dry recycling are both included within scope. Where analysis is being used to monitor performance of kerbside collection, it is important to include the perspective of all collections from kerbside, not merely the residual bin composition in isolation. This information will ensure the results show the full context of each material in terms of its quantity in the waste stream, amount recovered where relevant and the amount remaining unrecovered in the residual bin.
- **Housing type coverage:** where both 'low rise' and 'high rise/ multi-occupancy' housing are significant housing types within the area the WCA will need to cover both (different methodologies will apply).
- **Kerbside systems operating at different collection frequencies:** that the full collection cycle needs to be considered (which has cost implications) for instance, with weekly residual waste and alternate week dry recycling/ organics, residual waste composition will differ across the cycle so consideration needs to be given to sampling residual waste in both weeks.

In drawing up the study aims and objectives it is also necessary to review the current state of knowledge from any previous WCAs carried out in the area. Use of historical datasets will need to

consider any significant demographic and waste service changes that may have occurred since these studies were undertaken.

4 Waste Compositional Analysis sampling strategy design

An effective WCA programme must be based on waste samples that are representative of the target area as a whole (usually a whole Local Authority), be sufficient to take account of variation in waste arisings whilst also being affordable within the project budget. A good sampling strategy is essential to achieving this difficult balance. This Section first considers the different sources of variation in relation to kerbside collected household waste and then describes the design of a WCA programme needed to ensure that a 'good' sample is obtained within the constraints of time and cost. For non-kerbside collected waste see 'Appendix B Sampling other waste sources'.

4.1 Factors influencing waste

A number of key variables will influence the waste stream (Table 1). These factors will need to be taken into account ('controlled for') when specifying kerbside waste sampling for a WCA: how many samples to take, when and from which areas.

Some of these influences are more generic: for instance areas housing families with young children will produce a very different waste profile to areas with predominantly retired populations. Others, such as the influence of waste service characteristics, are more specific to a particular Local Authority.

A sampling strategy should aim to account for as many of the most relevant variables as possible in order to represent arisings for the sampled waste stream for the area as a whole. A sampling strategy should also anticipate factors that may produce anomalous results, such as the influence of bank holidays.

Table 1 Factors affecting kerbside collected household waste

Factor	Influence on waste arisings
Socio-economic	The profile of waste arisings differs depending on a household's disposable income and lifestyle.
Demographic	The age and structure of a household: households with children will have a different waste profile to those without; household size influences waste per capita and waste per household e.g. smaller households typically have more waste per capita.
Housing type	Linked to both socio-economic and demographic factors; 'high rise' and 'low rise' will present different challenges to waste sampling.
Season, weather, climate	The seasonality of garden waste is an obvious factor, the proportion of other elements in the waste stream also fluctuates by season e.g. glass during festive season, carbonated drinks containers in hotter weather.
Waste service characteristics	Collection frequency, containment capacity, local by-laws and proximity to HWRC and bring sites can all influence kerbside household waste composition.

4.2 Sampling technique

Two available sampling techniques are discussed in **Box 1** highlighting the advantages and disadvantages of different approaches.

The methodology minimum requirements:

- Use of Method 1 as defined in Box 1. 'Street blocks' are selected to represent particular area types or households identified as belonging to a particular stratum. A bulk sample representing a set number of households within the selected area is then sorted.
- Sampling of residual waste.

Sampling of dry recycling where the collection is co-mingled.

Optional:

- Local authorities can choose to follow Method 2, household level sampling and sorting, but should recognise that this will be a more expensive approach.
 - Recording the weight of waste collected from each household is recorded even though the sample is bulked; this data can be used to understand the household level variability within the sample.
 - Sampling of segregated dry recycling where no data is available on the material splits (including contamination).
 - Sampling garden waste for weights only. This information improves the overall interpretation of WCA results e.g. capture rate, seasonal variation.
-

Box 1 Sampling techniques

The most statistically valid technique for sampling would be for each household to have an equal chance of their waste being selected for analysis and for the kerbside samples to be randomly drawn from a listing of all households within the study area (simple random sampling). The waste obtained would then be sorted on a household basis and the results compiled to represent the waste composition for the area as a whole. However, it is not realistic to use such a technique to sample kerbside waste, for the following reasons:

- the cost of collecting waste samples would be far higher than with a more clustered type of sample; and
- the operational realities of waste collection across a Local Authority area would make it difficult for highly scattered waste samples to be obtained on a particular day before the arrival of the collection crews.

With these constraints in mind, the sampling techniques that can be used in relation to kerbside collected household waste are:

Method 1: the most commonly used approach. Sampling at the kerbside at the level of street blocks with each sample representing a specified number of households, the whole sample bulk sorted (a sample is therefore a bulked sample of waste from a set number of households, from a particular area type); and

Method 2: sampling at the household level, with separate sorting of each household's waste, households selected from within street blocks representing particular area types (each household's waste is a separate sample).

Advantages/disadvantages

With both methods the provenance of the waste is more certain than methods that sample directly from collection vehicles or transfer stations/ depots and the methods do not require sub-sampling (coning and quartering) which can introduce further biases into the sampling process. The sorting of waste at the household level (Method 2) faces practical difficulties in identifying each household's waste, depending on how waste is set out at the kerbside, and is more expensive. However, it does give an indication of house-to-house variation in waste composition which may be particularly useful in the planning of kerbside containment capacity and detailed information that may be useful for waste prevention and recycling campaigns. For instance, if carried out alongside a household level questionnaire this approach provides a closer link between household characteristics, stated behaviour in relation to waste and recycling and a household's actual waste arisings.

The data derived through both methods can be supplemented at little or no extra cost by measuring the weight of waste and recycling associated with each individual household (this can be done using portable scales). This will allow for the calculation of the household level coefficient of variation for the total weight of kerbside waste streams and can be used to calibrate future street block sample sizes.

4.3 Stratification of the target population

The way in which the street block areas are selected requires a systematic means of classifying area/household types in terms of key factors that influence waste. This approach is termed a 'stratified random sample'. Stratification involves dividing the sample population into a number of different 'strata' (non-overlapping groups) that reflect the main variables that influence kerbside waste arisings (see Table 1).

The advantage of stratifying the sample is that fewer samples are required overall, as the waste arisings within each of the strata are less varied than would be the case from a simple random sample. Stratification therefore increases the accuracy of the compositional estimates obtained for the same research resource, provided that the choice of stratification and the way in which it is carried out reflects real differences in waste arisings. Stratification criteria are given in Table 2.

Waste samples should be taken from households selected from each stratum on a quota basis (i.e. a set minimum number of households sampled for each stratum, re-weighted at the analysis stage to reflect their proportions in the overall target population) rather than in proportion to their size in the actual population.

The methodology minimum requirements:

- That the stratification must take into account a housing type or area type dimension as well as a socio-economic dimension (e.g. if Council Tax banding is used it must be in combination with another element, such as an Urban/Rural classification).
- That whichever route is taken to stratify the target area between 4 and 5 strata should be used. If fewer than 5 strata are used then this will require justification in the sampling protocol. More strata can result in the need for a larger overall sample size and there is limited advantage in sampling more strata but with a smaller number of households sampled from each.
- As a minimum standard, each stratum should be represented by a minimum street block sample on a quota basis, with a sample size of 50 households per street block (see Section 4.5).

It is also recommended that the sample is stratified to account for seasonality (see Section 4.3.2).

Table 2 Stratification criteria

Stratification Criteria	Recommended means of stratification
Housing types	Commercial geo-demographic packages and Output area classifications (OAC) (see below) incorporate some dwelling type information within their classifications; however, if an alternative approach is taken any stratification strategy should take into account housing type at a basic level - at a minimum, a distinction should be made between own-door (kerbside) and flatted properties. Strata could include: • Multi-occupancy properties / tenements. • High / low density housing. The problem of using housing type alone is that within a single housing type there is likely to be a wide variation in householder socio-economic profiles. Due to this variation stratification by housing type on its own should not be considered. The use of housing type will require an extensive in-house database of housing types which can be used to extrapolate the sample data. Publically available housing type information is available from Scottish Neighbourhood Statistics at data zone level and covers detached, semi-detached, terraced and flatted properties; however, distinctions between high rise, tenements and 4-in-a-block properties are not made. It should be noted for OAC that output areas often contain a mix of housing type and that it should not be assumed that all properties within in the flatted property categories are in fact flatted properties.

Stratification Criteria	Recommended means of stratification
Socio-economic factors	Commercial and publically available geo-demographic classifications include socio-economic characteristics within their assessment; however, there are other standard methods for classifying a sample according to its socio-economic characteristics. Council Tax bandings and SIMD are factors that could be used as a component within a stratification methodology but they should not be used in isolation. Council Tax banding has the advantage of transparency, it is clear how the sampling is organized, but used alone does not reflect all the factors affecting waste generation. It is based on 1991 property valuations rather than incomes and there is a lack of equivalence in banding between different local authorities. SIMD also has the advantage of transparency and the data is readily available. A potential limitation is that SIMD is an indicator of deprivation rather than a measure of affluence i.e. very rich and middling areas may not appear that different on SIMD if both are lacking poverty. Further discussion is given in Section 3.3.1.
Seasonality	Seasonality should be considered in the design of the analysis programme, budgets rarely allow for more than two phases, so careful choice of timing in order to represent seasonal variation is crucial. This factor is discussed further in Section 4.3.2.
Area type	Recommended strata would allow a division of an area between urban, rural and mixed urban rural districts. The Scottish Government Urban Rural classification provides one means of classifying areas on this basis; OAC also take account of rurality. The use of the Scottish Government's urban-rural classification is conceptually clear but, again, used alone does not reflect a wide enough range of factors affecting waste generation to have great stratification benefits. As the Waste (Scotland) Regulations make a distinction between urban and rural areas in terms of Local Authority obligations for kerbside food waste collections from 2016 this may become a relevant factor for some local authorities. Stratification by urban/ rural mix alone should not be considered.
Collection system type	Strata can represent local conditions ; these might include: • Co-mingled / kerbside sort collection systems. • Households with access to kerbside collection. • Households with communal bins / individual bins. • Households with a mature recycling collection scheme / those with a newly developed/ pilot scheme.

4.3.1 Stratification for socio-economic and area type factors

Three different stratification approaches can be used to classify areas based on a combination of socio-economic, housing and area type factors for sampling within kerbside WCA studies:

- Use of publically available geo-demographic classification i.e. OAC.
- Use of commercial geo-demographic packages to classify areas or households (e.g. tools such as MOSAIC or ACORN); these are based on a combination of census, Electoral Register and survey

data on lifestyles and consumer preferences and also take into account housing type, socio-economic, lifestyle and demographic differences.

- Use of a bespoke classification incorporating at least two stratification criteria e.g. Council Tax banding, urban-rural classifications, SIMD.

The advantages and disadvantages of each are summarised in Table 3 with further detail below.

Table 3 Different socio-economic stratification methods – advantages/disadvantages

Method	Advantages	Disadvantages
Publically available geo-demographic classification	Free. No data restrictions. Reflects area type and socio-economics. Simplifies collection as households grouped by Output Area. Output areas widely used and understood within local authorities.	Can be hard with 8 super-group classifications to identify only 4-5 samples. Own door vs. multi-occupancy difficulties as classification does not clearly identify housing type. Not updated as often as commercial packages. Not widely used by WCA contractors.
Commercial geo-demographic packages	Reflects area type and socio-economics. Widely used and understood within many local authorities and WCA contractors. Can work at different levels and are useful as a means of identifying particular sub-groups that are well represented within the study area. Are readily available.	Licence restrictions – potential data disclosure limitations. Cost for data purchase. Sometimes the labels attached to particular groupings are inappropriate or difficult to understand. Many different variables may be used as the basis for the classification, not all of which are locally derived. As a result it is difficult to know which of the variables most likely to influence waste have been influential in the grouping obtained. Possible to over simplify i.e. only look at top level not sub-level classifications. Own door vs. multi-occupancy difficulties as classification does not clearly identify housing type.
Bespoke	Cost free but requires initial investment in manipulation of relevant local datasets. Data within the public domain. Transparent. Council Tax banding widely used and understood within many local authorities and WCA contractors.	Can mean emphasis on outdated information e.g. Council Tax banding. Cross comparisons between local authorities less reliable. Does not reflect as many factors influencing waste generation. May require additional resources and prior experience of manipulating large data sets. Extensive in-house datasets of housing type may also be required. Complicates collection – Council Tax bands don't always allow for collection of contiguous households.

Care should be taken when considering the use of commercial geo-demographic classification systems to ensure they will be fit for purpose. Licensing conditions may limit what can be disclosed between different parties involved with the WCA work, and the use of the data beyond the period covered by the licence (see the requirement for a data management plan in Section 7.2).

If a project is to be funded by Zero Waste Scotland the Local Authority should discuss stratification approach with Zero Waste Scotland in the first instance.

4.3.2 *Stratification for seasonality*

Seasonality should always be considered in the design of WCA programmes (see Box 2), however budgets rarely allow for more than two phases, so careful choice of timing in order to represent seasonal variation is crucial.

The methodology strongly recommends stratification for seasonality:

- Represent seasonality by means of two phases of sampling.
- Two phases of sampling timed to take place in spring/ early summer and autumn/early winter.
- Refrain from fieldwork during of December and January due to waste production patterns and the operational risks as a result of bad weather and short day lengths. The operational risks involved with fieldwork during November and February should also be taken into consideration.

Studies funded by Zero Waste Scotland not following the above recommendations should provide a strong justification for this decision.

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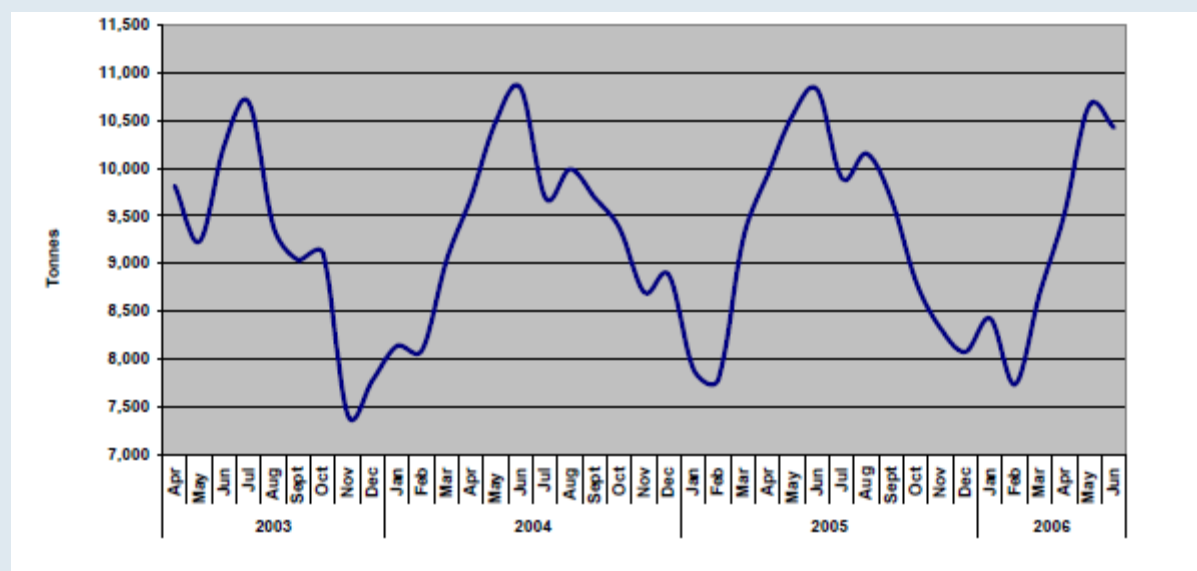
Studies funded by Zero Waste Scotland not following the above recommendations should provide a strong justification for this decision.

Box 2 Seasonality in kerbside waste production

Waste arisings vary over the year on a seasonal basis reflecting changes in particular sub-fractions of the waste stream. This is a key factor that needs to be addressed in the design of WCA sampling strategy. The most obvious variation in the household waste stream relates to the production of garden waste. In the spring and summer months, garden waste production is typically double the winter months and the peak months for garden waste production can be four to five times higher than the lowest months. Examples of other significant seasonal and temporal effects relate to glass bottles (festive season), carbonated drinks containers (in hotter weather) and the amount of DIY waste.

As a rule, total waste arisings would be expected to be at their highest during the summer (peaking during the school holidays) and lowest at midwinter. Midpoints in the variation are reached during spring and autumn. There will always be additional peaks and troughs in waste arisings following major holiday or festival periods, such as during the festive season or Easter. The figure below shows a typical example of the variation in MSW arisings, taken from monthly data for a Scottish Local Authority.

Example of seasonal variation in total MSW arisings, Scottish Local Authority



Ideally for the WCA programme to represent seasonality in household waste, repeat samples would be required to represent each season (although there may well be more than four seasons in relation to waste and the influence of weather during the fieldwork period will also be a significant variable in any chosen period). However, organisational or financial restraints make multi-phase sampling unrealistic and in areas with separate garden waste collections the seasonality in total arisings (but not composition) is apparent within Local Authority tonnage records and WasteDataFlow returns. The best compromise is to conduct a repeat analysis using two phases at the 'mid-points' associated with spring/early summer and autumn.

4.4 Sample size: how many households?

The number of households representing a particular stratum within a street block sample has varied across different WCA studies, and in many cases has been too small to fairly represent variability within each stratum when using a stratified sampling method.

Statistically, the size of the sample to be taken to represent each stratum is dependent on the variation in the waste stream, and the desired accuracy of the results. In practice, the size of the sample is often limited by the resources available in terms of time and cost and the practicalities of how much waste a team of contractors can collect and sort in a day. Where material is analysed in a single 'bulk'

sample from household representing a particular stratum within a street block, it is not possible to provide a measure of the variability of the sample at the household level. Also it is not possible to estimate the precision of the estimate obtained from a bulk sample as there is nothing to compare the 'bulk' sample to. It is necessary to consider whether or not the total number of households sampled within a street block is likely to be sufficient to represent waste arisings within that stratum across the Local Authority area and within that season. We have determined that the minimum number of households to be sampled within each stratum should be 50 based on the natural variation in different categories of waste across households; further discussion is given in Appendix A.

The methodology minimum requirement for sample size is 50 households to be sampled within each stratum/ street block; depending on any additional research strategies, local authorities may wish to sample more households.

4.5 Householder selection

In order that the study results can be considered valid, it is necessary to choose a randomly selected sample of households for each street block sample. Given the logistical constraints involved in putting together and implementing the sampling strategy, households are often selected on the basis that they are adjacent, easy to access, or where the time of the regular waste collections fits with the timings of the proposed study. Whilst this guidance recognises the validity of these constraints, it is also important to point out that basing selection on these predetermined criteria, rather than on a random basis is likely to skew the final results.

The methodology minimum requirements:

- That a process based on that outlined in Box 3 is used to choose households.
- That a householder selection process includes creation of a 'reserve' list of households (see Box 3).

Box 3 Householder selection process

1. Assemble a complete list of household addresses within the area to be sampled.
2. Group households within strata chosen for the study, in cases where the method of stratification allows for classification at household level.
3. Randomly select 'statistical areas' from each stratum: these may be streets or housing blocks.
4. Randomly select a list of households within each statistical area from which to sample bins.
5. If a Local Authority decides to give householders an option to opt out, notification letters explaining the value of the work, with clear instructions should residents choose not to take part, need to be sent several weeks in advance of planned fieldwork.

Step 3 may be further subdivided if a large area is being sampled.

To allow for contingencies during the sample collection it is recommended that additional 'reserve' households are identified within each statistical area that could be used in place of households in the main sample. Common reasons for these being required may include:

- Householder absent and not presenting bin, or house empty (see collection cycle rules in Section 4.6);
- Householder choosing not to take part;
- Misinformation regarding house locations;
- Bins already been collected by regular service or collected on different day to expected.

'Reserve' households should only be used for the first cycle of sampling (see Section 3.6). Once a household has had one stream of waste sampled it is necessary to retain this household on the sampling list for subsequent sampling days (and for no other households to be added on future

sampling days) in order to capture all the waste arising from that household and for the residual waste sample to correspond to the recycled materials stream samples.

The number of reserve households identified should take into account Local Authority knowledge of set-out rates in the sampling areas. A reserve list of at least 20-30 households is recommended.

4.6 Collection cycles

The WCA need to take account of the variation in collection frequency of residual waste versus dry recycling, i.e. to consider the full collection cycle; two examples are given in Figure 1:

- Local Authority 1: as dry recycling and residual collections operate on alternate weeks, to cover the full collection cycle residual waste would need to be sampled in the first week of fieldwork and dry recycling would need to be sampled in the second week of fieldwork.
- Local Authority 2: as there is variation in material set out for recycling each week, to cover the full collection cycle sampling of the dry recycling system would need to involve both week 1 and week 2.

Residual waste and dry recycling should be collected from the same set of households to interpret the combined results from each street block sample, the 'fit' between residual and dry recycling samples may become distorted by households with atypical recycling behaviour for which only one of the two elements was sampled. It is also not possible to reliably calculate recycling capture rates if different households are used.

The methodology minimum requirements:

- That residual waste and dry recycling are collected from the same households.
- That residual waste is collected in the first week of fieldwork, whichever type of collection regime is in place.
- That in most cases the sampling covers the full collection cycle for residual and dry recycling.

In some cases there may be justification for not including the full collection cycle e.g. where there is one kerbside glass collection every 4 weeks it would not be necessary to collect all residual and all other recycling collections for a full 4 weeks.

Figure 1 Example of two different kerbside systems with collection cycles that require sampling over a two week period

Local Authority 1	Week 1	Week 2	Local Authority 2	Week 1	Week 2
Food waste			Food waste		
Dry recycling			Dry recycling		
Refuse			Refuse		

As not all households set-out all kerbside streams on collection day, it is important that the sampling strategy follows a clear set of rules in determining which households to sample. As the set-out for residual waste is generally higher than for dry recycling and organics, this represents the starting point in the procedure:

- In the first week of fieldwork:
 - Collect and sort residual waste. Use the collection schedule to record the 50 households from which residual waste is collected for sorting. A collection schedule of 50 households plus reserves will usually be needed to obtain a sample of residual waste from 50 households, as set-out is unlikely to be 100%.
 - Collect and sort dry recycling (if applicable to kerbside service regime) from the 50 households from which residual waste collected.
 - Weigh food waste (if applicable to kerbside service regime) from the 50 households from which residual waste collected. This can be achieved by kerbside weighing or collection and weighing at the sort site.
 - Record set-out: record set-out for all collection streams.
- If a second, third or fourth week of sampling is required the collection schedule should only contain the 50 households from the week 1 sample.
 - Record on the collection schedule the set-out for all material streams presented from those 50 households.
 - Any residual waste and/or dry recycling from the 50 households should be weighed and collected for sorting.
 - Any food waste from the 50 households should be weighed.

Depending on the study objectives, the street block sampling may also need to separately tag residual waste samples from households depending on their participation in setting out materials for recycling. This information can then be used to determine the material recognition rate for participating

households. For further guidance on these aspects, see WRAP's guidance on monitoring capture rates (WRAP, 2010).

4.7 Sampling from multi-occupancy dwellings

Sampling from multi-occupancy introduces a further element of complication to the process. Sampling should largely resemble that for the own-door households but also take into consideration the points below.

For some local authorities waste and/or recycling is collected using on-street communal containers that cannot be attributed accurately to an exact number of households or that may be used by commercial premises or passing traffic. It should be noted that there will be considerable uncertainty association with data obtained if these areas are included. However, local authorities may consider it important to understand the composition of waste in these areas despite the uncertainty.

The term 'close' is used to mean the group of flatted properties accessed via the same common entrance and stairwell – this is to avoid confusion with the concept of the 'street block'.

- Household addresses should be compiled in terms of close address and individual household address within the close.
 - As bins are often shared between flatted properties, all waste and recycling from the close should be sampled.
 - Care should be taken to select closes where the waste is easily distinguishable from the neighbouring closes. Site visits may be required to assess:
 - The distinctness of each close back court i.e. to ensure that bins or bin sheds are not shared and that fences or walls clearly segregate each back court from its neighbour.
 - The appropriateness of the selected households – your database may not identify certain types of household you may wish to avoid, depending on representativeness e.g. you may inadvertently select sheltered housing when you intend to sample regular flatted properties
 - Site visits prior to the fieldwork day are recommended where the Local Authority staff aren't familiar with the collection areas (but at the same time of day as the planned waste uplift will take place). This will identify any closes where secure entry or access issues may hinder the study; such closes should be removed from the study. If the bins are accessible by the public the potential for misuse by commercial waste producers should be taken into account.
 - It should be ensured that waste from **at least** the minimum required number of households (i.e. 50) should be included in the sample. Depending on the number of households per close it may be necessary to take waste from more than 50 households e.g. for closes containing six households all waste from nine closes must be uplifted (i.e. $9 \times 6 = 54$ households) rather than from eight closes (48 households).
 - Where possible it should be attempted to identify if any flatted properties that are unoccupied – these dwellings would not count towards the required sample numbers and this should be recorded in the sample notes.
 - The data analysis should make use of separate tonnages for multi-occupancy and own door properties where these are available; this is particular relevant where the service regimes for different property types are different.
 - WCA contractors should be aware of the higher likelihood of heavy items where there are shared bins and take this into account, where necessary, in the data analysis.
 - Local authorities should consider when specifying a project that incorporation of multi-occupancy properties can be more expensive. Properties often have more frequent collections than own door properties adding to the complexity of the project and the collection requirements.
 - Contamination and uplift policy:
 - Contaminated bins should not be uplifted if according to collection policy they would not normally be collected i.e. would be collected as residual waste.
-

- Sampling crews should ensure during the residual uplift week that residual waste is only collected from blocks where the recycling containers are not excessively abused in order to ensure the selection of households where an adequate recycling sample can be obtained.

5 Waste categorisation

5.1 The purpose of standard categories

The development of a suitable and clear list of waste categories is central to the successful design of a waste analysis programme. Using a standard clear categorisation across Scotland will enable different WCA contractors to segregate materials in the same way. This consistency will improve the consistency of studies across Scotland and hence the generation of national waste composition data.

5.2 Different classification methods and levels

The waste categories used in WCA are generally broken down into a primary level, secondary level (sub-categories) and tertiary level (sub-categories of the secondary categories).

Waste classifications are most commonly broken down by material type (e.g. paper, plastic, metal, glass), but can also be categorised by function (e.g. packaging), potential use or disposal route (e.g. recyclable, combustible) or origin (e.g. garden waste, construction and demolition waste).

Secondary and tertiary sub-category classifications are used to provide further detail within the data set but maintain the ability to be collapsed into the main material based categorisation at a primary level.

The greater the level of sub-categorisation the wider the confidence intervals are likely to be in relation to the more detailed level of sub-categories for a given number of samples. Addition of categories can also slow the sorting procedure and can also create confusion and lead to errors and inconsistencies during the sorting process.

5.3 Standard Scottish waste categorisation

The standard Scottish waste classification is shown in 'Appendix C Standard Scottish waste categorisation' and gives primary and secondary operational category classifications.

The waste categories have been selected so that there is:

- Sufficient detail so that data helps local authorities plan service and infrastructure developments e.g. availability of different types of plastics, availability of materials with the potential for reuse.
- Alignment with the European Waste Statistic Regulation classifications requirements, WasteDataFlow and the Carbon Metric.
- Sufficient detail to monitor progress with actions in the Zero Waste Plan e.g. reduction of avoidable food waste.
- Avoidance of any overlap between categories which might cause inconsistencies between sorting teams.

The categories are a minimum requirement and should be used for any Zero Waste Scotland funded kerbside WCA study.

Additional sub-categories can be added at the tertiary level to further inform assessment of collection systems e.g. dense plastic packaging may need to be split according to the types of packaging accepted in the kerbside recycling system. Local Authorities should bear in mind the potential impact on sort times and statistical reliability. It is important that any additional categories can be fully justified

and that the extra information generated will be of practical benefit, rather than 'nice to know'. It is recognized that other waste streams, such as commercial waste, waste handled at HWRCs or by bulky waste collections will require more detailed category lists in certain areas.

Further guidance on classification, which can be used as an aide memoir for sort teams, is given in 'Appendix D Guidance on waste classification'.

6 Procurement

This Section provides advice on procurement where local authorities will be obtaining the services of an external WCA contractor. It is assumed that local authorities will follow their own procurement processes and detail of the procurement journey has not been repeated here.

6.1 Cost

Local authorities should bear in mind the internal costs that may be incurred in addition to any contractor costs e.g. management, overtime payments (if collections crews are going to be involved in picking up samples). It is assumed that the Local Authority will bear the costs of correct disposal of the waste and costs of data manipulation if a bespoke stratification option used.

Cost for collection and sorting will be influenced by a number of factors e.g.:

- The number of households per sample: the methodology requires samples to include 50 households.
- The way in which the waste is sorted e.g. household by household versus bulk sorting; this methodology does not require household by household sorting but it is recommended that waste from each household within a sample is weighed.
- The number of street block samples and strata used to represent waste arisings.
- The tonnage of waste: average bin weights vary by Local Authority and area type.
- The inclusion of additional waste sort classifications.
- The type of waste: residual waste takes a lot longer to sort than co-mingled recycling; co-mingled dry recycling with glass takes longer to sort than co-mingled dry recycling excluding glass.
- The collection frequency and how the WCA proposes to cover the collection cycle.
- The level of supervision and method of collection e.g. local authorities may collect the sample to reduce costs, WCA contractors may require additional staff if collecting from large bins.
- The amount of travel required to collect the samples e.g. remoteness, rurality and property frequency.
- The location where the waste is sorted: if a Local Authority is able to provide a sort site this is generally lower cost than a contractor arranging the sort site.

The main additional costs will include staff costs for project management, data analysis and reporting; there may also be costs associated with purchase of data and additional travel and subsistence costs for project meetings. The additional costs will be influenced by the level of management, data analysis and reporting required which in turn relate to the project aims and objectives (see Section 3.2).

Contractor costs for WCA can vary considerably. The variation in terms of cost during procurement can be minimised by included as much detail as possible with respect to the sample size (including bin weights), collection schedule and data analysis and reporting requirements (see Section 6.2). Illustrative contractor costs are given in **Error! Reference source not found.**; these costs have been taken from the tenders submitted during the 2013-15 funding programme. The costs are per sample area excluding VAT. A sample covers waste from 50 households, includes sorting of residual and co-mingled dry recycling (and in some cases weighing of food and garden waste) and included 2 phases of fieldwork. The costs given includes both successful and unsuccessful tenders; so the actual costs were at the minimum rather than maximum end of the scale.

Table 4 Contractor WCA costs per sample for two phases of fieldwork (excluding VAT)

Per sample cost	All 2 season	Including collection	Excluding collection
Min	£2,700	£3,819	£2,700
Max	£10,383	£10,383	£7,200
Median	£5,430	£5,814	£5,158

6.2 Brief

Local authorities should ensure that following key elements are drawn out in the specification of requirements:

- Scope (see Section 3.2): outline the aims and objectives of the study, how the data will be used by the Local Authority. Outline what is required in terms of the methodology; if a study is funded by Zero Waste Scotland the brief will need to make clear that contractors will be required to follow the minimum requirements set down in the Zero Waste Scotland methodology contained in this document.
- Zero Waste Scotland requirements: if a study is funded by Zero Waste Scotland highlight the role Zero Waste Scotland will have in the study and what is required from the contractor as a result.
- Waste sort classifications (see Section 5): make sure the standard sort categories are included together with any additional sort categories that you want to include.
- Sampling and stratification (see Section 4): outline the sampling and stratification required. Flexibility can be left for the contractor to propose their own solution to the programme design as long as the brief makes it clear the minimum requirements of the methodology. There needs to be emphasis on the credibility of the sampling strategy in relation to the project objectives.
- Estimated sort weights: include an estimate of average bin weights for residual and recycling streams so that contractors can determine the appropriate staffing levels required.
- Methodology protocol (see Section 7.2): should be required as a deliverable.
- Data management plan including data protection policy (see Section 7.2 and Section 8): should be required as a deliverable.
- Data analysis: outline the data analysis required (see Section 8). In scoping the data analysis requirements consider the overall objectives of the study.
- Reporting standards and information to be included (see Section 8): the brief should be clear about what data and information is required and how it is to be presented. Request to be provided with the raw data files as well as a final report.
- Staffing (see Section 7.4): WCA teams will have varying degrees of experience and resource; for instance, contractors may have to employ agency staff. The experience of the team appointed must cover statistical waste sampling, waste collection, waste sorting and data analysis. Details of the personnel that will be used on the actual sorting should be provided together with the level of supervision that will be put in place. An experienced team will not only be quicker, but will be more accurate and consistent in identifying and classifying materials. The contractors should be asked to supply a supervisor to accompany the collection crew even where the Local Authority will be doing the collections.
- Timescales: detail when the fieldwork should take place and any identified restrictions e.g. bank holidays.
- Insurance: evidence of appropriate insurance.
- Health and Safety: an up to date Health and Safety policy and procedures. If residual waste is on a 3 or 4 weekly collection regime then contractors should be requested to provide mask protection for all team members, consider need for local exhaust extraction and conduct risk assessment.

- Quality management systems: details of quality management systems, identification of key risks and mitigation measures.
- Registered waste carrier: the contractor appointed must be a registered waste carrier. A copy of an up to date certificate must be included in the tender.

A tender invitation template for a kerbside WCA is given in 'Appendix E Tender specification template'.

6.3 Tender assessment

6.3.1 *Assessment criteria*

Typical tender assessment criteria are suitable for a project of this type:

- Interpretation of the brief - understanding of the specific project requirements, challenges and deliverables.
- Methodology and approach proposed – approach to each task which covers the safe, effective and satisfactory completion of the fieldwork. This assessment criteria could be split by approach to sampling and approach to fieldwork
- Allocation of resources and project management: appropriate level of suitable resources with the required expertise, approach to managing the project and how relationships will be managed.
- Delivery timescales – ability to complete the study within the proposed timescales.
- Price – total cost of project and day rates for staff.

6.3.2 *Value for money*

Aside from the usual considerations (track record, experience, Health and Safety, insurance etc.), the tender evaluation will often come down to a trade-off between methodology and price. Bids are often decided on price, because it can be difficult to sufficiently differentiate between the relative merits of different suggested methodologies. This can sometimes lead to an unsatisfactory methodology being used simply because it is the cheapest. Where there does appear to be a significant difference on price between bids, careful attention should be paid to ensure that the suggested methods meet the requirements of the brief, the minimum standards set out in this document and are able to deliver comparable levels of quality.

Within the assessment of price, any elements that add value to the quality and coverage of the WCA should also be taken into account. This may include items such as extra households per street block sample, bulk density measurements and bespoke stratification that goes beyond the minimum standard.

7 Operational aspects

7.1 Responsibility for management

Responsibility for overall management of the WCA should sit with the Local Authority commissioning the study. In some cases more than one Local Authority may be involved with an individual study. In all cases a single individual should be given overall responsibility for managing the contract and communicating with others, both within the Local Authority and with the WCA contractors.

The following sections outline Local Authority and WCA contractor roles and responsibilities at each stage of a WCA study. Section 9 gives an overview of the process and highlights monitoring opportunities.

7.2 Project initiation

The project initiation stage is important from the perspective of confirming the project boundaries, establishing lines of communication, establishing roles and responsibilities and reviewing logistical arrangements and challenges.

The Local Authority responsibilities:

- Attendance at the project initiation meeting.
- Review, comment and sign off of the methodology protocol and data management plan.
- Provision of data and information as agreed with the WCA contractor.

WCA contractor responsibilities:

- Production of a methodology protocol document that is circulated and signed off by the Local Authority. Ideally a draft should be circulated prior to the inception meeting, but alternatively can be circulated after the inception meeting after aspects of project delivery have been agreed. Minimum requirements for this document are:
 - Communication arrangements including contact information.
 - Project aims and objectives.
 - Waste streams being collected.
 - Sample collection details.
 - Waste categories.
 - Sorting protocol.
 - Health and Safety.
- Production of a data management plan: the plan must contain a clear statement on the following points:
 - Compliance with the Data Protection Act;
 - How datasets collected will be stored.
 - How datasets will be transferred between the WCA contractor, Local Authority and Zero Waste Scotland. If funded by Zero Waste Scotland the Local Authority will be required to transfer datasets to Zero Waste Scotland. It will be useful for Zero Waste Scotland to have the data split by each stratum but this is not absolutely essential. The data will need to make clear which WDF components are covered by the WCA and whether or not the compositional profile is representative of the Local Authority as a whole (or just particular household types within the area).
 - If a commercial geo-demographic package is used to stratify the sample the plan must also cover how any data derived from that commercial database will be used (see Box 4).

Box 4 Use of data from commercial geo-demographic packages

If a commercial geo-demographic package is used for the study the WCA Contractor and Local Authority must be clear on how this data can be used, stored and transferred to other parties under the terms of the agreement with the private sector data provider. It is particularly important that the data provider is aware of the intended use of the data in relation to both the Local Authority's and Zero Waste Scotland's objectives.

The sharing and usage requirements for the data must be explicitly approved in writing by any private sector data provider at the outset of the work. Permissions need to cover all the uses to which the data will be put, including use for analysis and reporting by a third party contractor (where relevant), the right to include it at an appropriate level of detail in reports (whether these are to be published or not), and clarification on what can be shared with other third parties (e.g. Zero Waste Scotland).

The data management plan should cover:

- The nature of any agreement that the WCA contractor or Local Authority has with the data provider in relation to reporting the results and disclosure to third parties (i.e. the Local Authority and Zero Waste Scotland).

- Whether the agreement restricts the reporting of results by each stratum or will also permit the results to be displayed in relation to the area profile generated by the geo-demographic package (i.e. the % of the population/ number of households within each sampled stratum).
- How the WCA contractor intends to inform all relevant parties of any data restrictions that apply or any requirements to cite the data sources made by those providing the data.

Further information on data reporting is given in Section 8.

- Organisation of an inception meeting attended by the Local Authority manager, the WCA contractor manager and others as deemed necessary. A representative from the Local Authority waste operations/services team should attend; it is very important to the success of the project that there is good co-ordination between the WCA contractors and the waste service team. The following should be discussed at project inception:
 - Project timescales including sample collection and sorting, data analysis and reporting.
 - Project team communications including co-ordination between contractors and service teams.
 - Risk assessment and Health and Safety.
 - Sampling plan.
 - Sorting protocol including agreeing waste categories.
 - Collection arrangements including agreeing if site waste audits required, determining days of sample collection and normal collection times.
 - External communications.
 - Sort site location and arrangements for waste disposal post sorting, including which waste streams will be recycled.

Further details on these elements are given in Section 4 and the sections below.
- Submission of a data request to the Local Authority for any data required to design the sampling plan.

7.3 Health & safety

The Local Authority responsibilities:

- Carry out a suitable and sufficient risk assessments of all activities, in accordance with internal protocols and procedures, prior to conducting the WCA.

The WCA contractor responsibilities:

- Provide Health and Safety policy.
 - Work with the Local Authority to complete suitable and sufficient risk assessments of all activities;
 - Generate a Health and Safety procedure specific to the project covering at a minimum:
 - PPE;
 - vaccinations;
 - hygiene procedures;
 - provisions for lifting and emptying containers;
 - waste handling;
 - sorting waste;
 - Circulate the Health and Safety procedure to the sort team. All sort operatives should sign a document to indicate they have read and understood the health and safety procedures.
 - Provide written incident reports to the local authorities within 24 hours.
-

Where local authorities have a 3 or 4 weekly residual waste collection additional health & safety considerations apply:

- Mask protection a minimum for team members during collection and sorting.
- Contractors should consider the need for local exhaust extraction depending on local circumstances.
- Consideration of the collection frequency must be included in the risk assessment.

Further information can be found in the research report 'The potential health impacts of reducing the frequency of non-recyclable waste collections': <http://www.zerowastescotland.org.uk/content/report-potential-health-impacts-reducing-frequency-non-recyclable-waste-collections-0>

7.4 Staff training and supervision

All staff carrying out the WCA must receive appropriate training to ensure they are competent to carry out their appointed tasks safely and according to the methodology agreed.

The WCA contractor responsibilities:

- Provide an experienced supervisor for each sort team.
- Provide an appropriate level of supervision and keep levels of supervision under review. A ratio of 1 supervisor to 2 sort team operatives is typical. A lower level of supervision may be acceptable in some circumstances e.g. when collecting waste from large containers.
- Conduct a briefing for all of the sort team at the sort site prior to fieldwork commencing to cover at a minimum:
 - Reasons for the study;
 - How the study fits into wider Local Authority objectives;
 - The importance of high quality data;
 - Health and safety procedures;
 - Collection arrangements; and
 - The methodology protocol (including waste classifications).
- Provide the sort team with copies of the methodology protocol.
- Provide evidence of training to the Local Authority e.g.:
 - Signed register of attendance.
 - Signed documentation.

7.5 Communications – project team

The Local Authority responsibilities:

- Schedule a project inception meeting and regular project catch-ups with WCA contractor project manager.
- Provide the WCA contractor with contact details for the Local Authority manager including mobile phone and email.
- Provide the WCA contractor with contact details for the facility manager at the sort site.
- Provide the WCA contractor with contact details for the waste operations/service team. The WCA contractor must be able to check the day before collection that the collection crews have been briefed on which households will be involved in the study.
- Provide regular updates to the waste operations/services team.
- Respond to requests from the WCA contractor within an agreed timeframe.

The WCA contractor responsibilities:

- Provide the Local Authority with contact details for the project manager and fieldwork supervisors including mobile phone and email.
- Provide daily updates to the Local Authority nominated project manager during fieldwork. These should highlight any issues arising and should, at a minimum, be weekly. Daily contact may be necessary to ensure issues are quickly resolved and do not impact on subsequent collections.
- Provide regular updates to the Local Authority nominated project manager, e.g. weekly, during the project.
- Respond to requests from the Local Authority manager within an agreed timeframe.

7.6 Communications - external

It is important that the Local Authority and the WCA contractors avoid giving householders any cause for complaint in the process of identifying and collecting the correct sample. As a minimum the following steps must be taken.

The Local Authority responsibilities:

- Determine whether residents should be informed in advance of fieldwork being undertaken (see Box 5).
- Local Authority call centre should be briefed and provided with a 'frequently asked questions' sheet to answer questions from householders;
- Collection crews should be suitably briefed on which routes are going to be included in the analysis.
- Other Local Authority staff likely to come into contact with the study should be suitably briefed;
- Local police should be informed of where and when the study is taking place.
- Provide WCA contractor with letter on headed paper authorising the collection and explaining the study. This letter can be given to householders in case of queries during collection.

The WCA contractor responsibilities:

- Collection staff should wear appropriate clothing including identification badges, high visibility jackets. The uniform should be similar to that used by the normal collection crew.
 - Collection staff and vehicles (if applicable) should carry clear identification markings.
 - Collection staff should respect any householder who approaches them and does not wish their bin to be included in the study.
 - Each collection team should include a supervisor briefed to answer questions from householders.
-

Box 5 Keeping Householders Informed

The Local Authority should determine whether residents should be informed in advance of fieldwork being undertaken. The decision should be made by senior management.

If householders are given the option to opt-out advance notice should as a minimum take the form of a letter from the Local Authority informing residents of the purpose of the study, how the data will be used, the arrangements in place to ensure security of personal information, and the timeframe within which fieldwork will take place. In particular, it is important residents understand that the study aims to understand the types and amounts of waste the Local Authority has to manage in order to improve service effectiveness, and that results are anonymous and never linked back to individual households. It may also be helpful to highlight that all waste collected for the study is subsequently dealt with responsibly (e.g. recycled waste is recycled). Giving advance notice should reassure householders both about the aims of the study, and that, on the day of the fieldwork, they do not need to be concerned if they see waste being collected by the WCA contractor rather than their normal Local Authority collection crew.

Advance notice will extend project timelines, and increase cost, and this should be planned for. Advance notice should be sent at least three weeks before fieldwork, and preferably longer. The process for opting out should be simple and clearly stated. Both the Local Authority and WCA contractor must ensure they have an appropriate procedure in place to avoid sampling households that do choose to opt out.

From a research perspective, it is sometimes suggested that advance notice can change householder behaviour, and thus change WCA results. In practice, this is unlikely to make a significant difference in a well-designed and scheduled study.

As detailed above, the WCA contractor, relevant Local Authority staff (e.g. the call centre) and the police should all be informed about the study, so that they can respond to any concerns or questions raised by residents during fieldwork.

7.7 Sort site selection

The Local Authority or contractor responsibilities:

- Identify a suitable sort site for the WCA contractor such as a transfer shed. The site should have a current waste management license and be licenced to receive waste of the type of be sorted; contact the SEPA Local Office for advice on suitability of alternative sites for waste sorting. The site should at a minimum, have:
 - sufficient space available for easy working and for the storage of waste to be sorted and for already sorted waste awaiting disposal/ recycling. The space required is likely to vary depending on contractor and project requirements with contractors generally requesting a space between 36m² and 100m²;
 - a covered and enclosed sorting area to protect the team from birds, insects and the weather;
 - a sealed concrete floor in the sorting area;
 - facilities for cleaning the sorting area (water supply, hoses);
 - adequate natural light or electric lighting;
 - a sorting area that is easily accessed by the vehicle used to transport the waste samples;
 - washing and changing facilities for staff nearby;
 - the sorting area and associated working areas well ventilated;
 - a sorting area that is cordoned off from heavy vehicles.
 - suitable site security.

The site location must also allow for easy disposal and recycling, according to Local Authority's available services, post sort.

- If available, provide use of a loading shovel.
- If the Local Authority is providing the site the WCA contractor should be provided with the name of the on-site contact.

7.8 Equipment

The WCA contractor responsibilities:

- Provide suitable equipment with which to conduct the WCA as specified including collection, general handling and sorting and weighing. At a minimum this must include:
 - waterproof labelling to identify collected material by unique ID code.
 - a range of scales with different sensitivities for weighing large and small weights. Smaller range scales for detailed analysis must be capable to weighing light fractions e.g. plastic film.
 - sieve / screen to separate waste with less than 10mm particle size.
 - magnet to help distinguish between ferrous and non-ferrous metals
 - Ensure all equipment is calibrated and prepared for use. Scales should be calibrated using known weights. Tare weights should be obtained for each sort container and checked daily. Scales should be accurate enough to weigh light fractions but have sufficient range to cater for heavy items. It would be suitable to have scales that weight down to 10g. All staff should be trained to use scales and be able to zero scales correctly.
 - Provide information for the sorting team to help in the identification of materials (see 'Appendix D Guidance on waste classification').
-

7.9 Kerbside sample collection

The Local Authority responsibilities:

- Work with the WCA contractor to produce a collection schedule.
- Review the need for, and conduct if determined necessary, a waste audit visit to establish suitable collection routes, gather information on potential access issues (e.g. shared driveways, location of service buzzers to access bin storage areas) and confirm collection points. A visit is likely to be particularly important when multi-occupancy properties are being included. There would be value in carrying out any visits in conjunction with WCA contractor.
- Ensure that the normal waste collection crews are aware that the WCA is taking place and the routes on which it is taking place.
- Ensure that all waste collection points in multiple occupancy schemes are cleared of all waste and recycling on the scheduled collection day prior to sampling – this ensures that the waste sampled represents that which is generated over the cycle.
- Provide the WCA contractor with details of the size and number of bins used by each household in the sample (including the reserve households).
- Provide the WCA contractor with details of any households within the sample that receive an assisted lift and the usual collection points.
- Provide member of staff to accompany sort teams during waste collection.

The WCA contractor responsibilities:

- Work with the Local Authority to produce a collection schedule detailing the roads to be used, the number of households and collection times, details of the size or number of bins used by the household and reserve households. This should be designed so that the households collected from can be recorded on waste collection. It would be useful if information is also recorded on household type and bin fill level.
 - Collect the sample on the same day, and at a similar time, as the normal collection for the households concerned. The collection must include all side waste. The Local Authority may be collecting the sample but a supervisor should accompany the collection vehicle.
 - Collect and identify waste from each of the 50 household sample units separately.
 - If specified by the Local Authority, record the weight of waste set-out that will not be sorted (e.g. organic food) so that the weight of the total waste stream can be calculated.
 - Securely mark each sample collected using a waterproof tag so that it can be grouped into the appropriate strata by the sorting team at the sort site. Marked samples should be identified using a reference number and **not** the householder address, to ensure the confidentiality of the household. This requirement applies in all cases even if the Local Authority is collecting the waste for sorting rather than the WCA contractor. If waterproof tagging is not possible, e.g. if a refuse vehicle is used for collection, a robust alternative method must be used to clearly identify the sample that is equivalent.
 - The exact addresses and postcodes uplifted should be recorded. This ensures that the same households are collected in multi-week sampling. Additionally, accurate record keeping ensures that where households opt out of a study, they are indeed excluded. This information also allows for the sample area profile to be accurately understood, which can be especially helpful for comparison studies undertaken at a later date.
All address data recorded for this purpose should be handled in line with data protection rules. Address data should not be linked to the actual individual waste samples (see previous point).
 - If the sample unit involves a large volume, large street-bins for example, a dedicated RCV may be used; ideally these vehicles should not compress the waste. Make a record of any anomalies or significant events during sample collection e.g. bulky/HWRC type waste, unusually large numbers
-

of bins, evidence of party waste, bin misuse from passers-by, side waste, and potential commercial waste.

7.10 Waste sorting and data recording

The Local Authority responsibilities:

- Agree a sorting protocol with the WCA contractor prior to fieldwork commencing.
- Visit the sort site at least once during fieldwork to verify waste sort is being conducted according to the sorting protocol. Verification visit should include:
 - Checking sort categories being used on site match those agreed.
 - Checking sort team are segregating waste according to waste categories agreed.
 - Checking all sort staff have access to the sorting protocol and guidance on how to apply the sort categories.
 - Checking the level of supervision and training of the sort team is as agreed.
 - Reviewing with the sort supervisor data recording and storage arrangements.
 - Reviewing with the sort supervisor any issues arising.

The WCA contractor responsibilities:

- Produce and agree a sorting protocol with the Local Authority prior to fieldwork commencing. The sorting protocol can be included in the health and safety and methodology protocol document. A basic sorting protocol is given in 'Appendix F Basic waste sorting protocol' which gives the minimum requirements.
 - Compliance with data protection legislation. This includes anonymity of households in any reporting, secure treatment of all the operational data that does require a household identifier and ensuring contractors deal appropriately with any confidential waste (e.g. documents) in sorting.
 - Include within the sorting protocol details of how frequently checks will be made of sort sheets and how data will be recorded.
 - Weigh the entire waste sample using scales. Weighbridge can be utilised as a cross-check only.
 - Sort the waste as soon as possible after collection; ideally this will be on the same day as collection but logistically this may not be possible in all cases.
 - **Sort the entire sample, not a sub-sample.**
 - Use the waste categories and guidance on categories as stated in Section 5.
 - Provide the sort team with guidance and training on how to apply the sort categories.
 - Make a record of any anomalies and significant events during waste sorting e.g. evidence of commercial waste, large quantities of one type of material, large quantities of hazardous waste.
 - Record data using pre-prepared data sheets.
 - Use of a suitable method for data recording that will minimise risk of data loss e.g. no carbon required forms (NCR) or electronic data entry.
 - Check of all data sheets by site supervisor to ensure the sample weight matches the sum of the sort category weights. A running total for the sample weight should be kept to assist with early identification of errors.
 - Check of all data sheets by the site supervisor before any staff leave site.
 - Compilation by the site supervisor of all sort sheets at the end of each day, before the sort team leave the site.
 - Double entry of data when transferring from paper records.
 - Ensure copies are made of any data sheets mailed by post.
-

The density of waste is easy to measure and is not an expensive addition to a WCA study. It can provide useful information if planning services changes. Methodologies can be found in the SEPA methodology for WCA (SEPA, 2008).

7.11 'What if'

Box 6 highlights some of the common 'on the ground' scenarios that WCA teams will encounter and details how these should be managed.

Box 6 Operational scenarios

What if side waste is presented?

All side waste should be collected along with the waste presented in the collection containers.

What if the recycling is contaminated and would not normally be accepted by the Local Authority?

- Own-door: all recycling should be collected even if contamination is present.
- Multi-occupancy:
 - Contaminated bins should not be uplifted if according to collection policy they would not normally be collected i.e. would be collected as residual waste.
 - Sampling crews should ensure during the residual uplift week that residual waste is only collected from blocks where the recycling containers are not excessively abused.

What if a householder approaches the collection crew with an enquiry?

The collection team should be fully briefed on the study and have a letter on Local Authority headed paper to give out to any householder with questions about the study.

What if a householder does not wish to take part in the study?

If householders have been given the choice of opting out prior to fieldwork a substitute household can be selected from the reserve list in advance. However, if on the day of the fieldwork a householder approaches the collection crew and does not want to take part in the study their waste should be left on the kerbside, or returned to them if already collected, and the Local Authority's normal collection crew contacted to request that they collect the waste. A letter about the study, containing contact details of the Local Authority and/or the project team, should be given to them in case they wish to contact anyone later. The sort team should select a replacement household from the 'reserve' list.

What if target waste stream for sampling e.g. residual waste, dry recycling, green and food waste, has not been presented to kerbside at the time of collection?

During the first week of residual waste collection this household should be ignored and a replacement selected off the 'reserve' list. During subsequent weeks if the waste stream is not presented a record should be made on the collection sheet; no replacement should be selected i.e. the aim is to collect all waste presented by the same set of 50 households per sample of which all have had residual waste collected.

WCA contractors should not go onto private property to collect bins, unless this reflects how bins are normally collected by the Local Authority (e.g. an assisted collection).

What if there are not enough 'reserve' households to make up for the households who have not presented their waste at kerbside?

This should be recorded on the collection schedule. Waste must not be taken from any households that have not been listed. Expected set-out rates should be taken into consideration during the creation of the sampling plan and the number of reserves selected should reflect set-out rates.

What if damage is caused to property during collection?

All contractors must have adequate insurance. All incidents must be reported to the Local Authority within 24 hours.

What if waste has already been collected by the collection crew?

Every effort should be made to avoid this situation. Collection crews should be contacted the day before collection, by the WCA contractor or Local Authority project manager, to confirm details. The waste should collect the sample 30 mins-1 hour before normal collection times.

During the first week, if collection mistakes do arise, replacement households can be selected off the 'reserve' list.

What if HWRC/bulky waste presented at kerbside or in bin shed?

HWRC/bulky waste should not be collected as part of WCA that is being carried out on kerbside residual/ dry recycling collections. Local authority protocols can be followed on what constitutes acceptable kerbside residual waste.

What if it is not possible to associate the bin to an address e.g. shared driveway?

During the first week of residual waste collection this household should be ignored and a replacement selected off the 'reserve' list.

8 Data analysis and reporting

8.1 Consolidating and analysing data

Reporting requirements partly depend on the specific WCA aims and objectives, but for a study that combines samples of residual waste and kerbside dry recycling the following statistics would be required at a minimum:

- Overall compositional profile for kerbside collected household waste: total, residual waste, dry recyclable (by stream in the case of two stream systems), expressed as % weight and as mean kg per household per week.
- Clear identification within the tables of which materials were targeted by the kerbside collection.
- Composition % weight and mean kg per household per week for each stratum.
- Analysis of capture rates for dry recyclable materials and interpretation of priorities.
- Assessment of % contamination and % non-target materials within dry recycling.
- In relation to kerbside recycling: set-out and recognition rates, overall and for each stratum sampled.

The number of households sampled per street block/ stratum would need to be stated alongside any factors associated with the fieldwork period that may have influenced recycling performance.

8.1.1 *Weighting results and creating an area profile*

The raw data obtained from WCA for each stratum sampled will require weighting for the overall results to reflect the profile for the Local Authority.

Weighting to reflect the area profile is calculated using the percentage breakdown of the entire dwelling stock into each classification stratum.

The kg/hh/wk result and % by weight composition figures for each sort category should be multiplied by the percentage represented by that stratum. If, for example, the profile groups for stratum1 represent 22% of the sample population, the calculated result (kg/hh/wk or % weight composition) will be multiplied by 22% to provide a weighted figure. The weighted figures for each sort category will then be summed to give an overall weighted figure for the five strata for both kg/hh/wk and % weight

composition as shown below. Where the waste samples don't represent 100% of the population the weighting figures also need to be adjusted to total 100%.

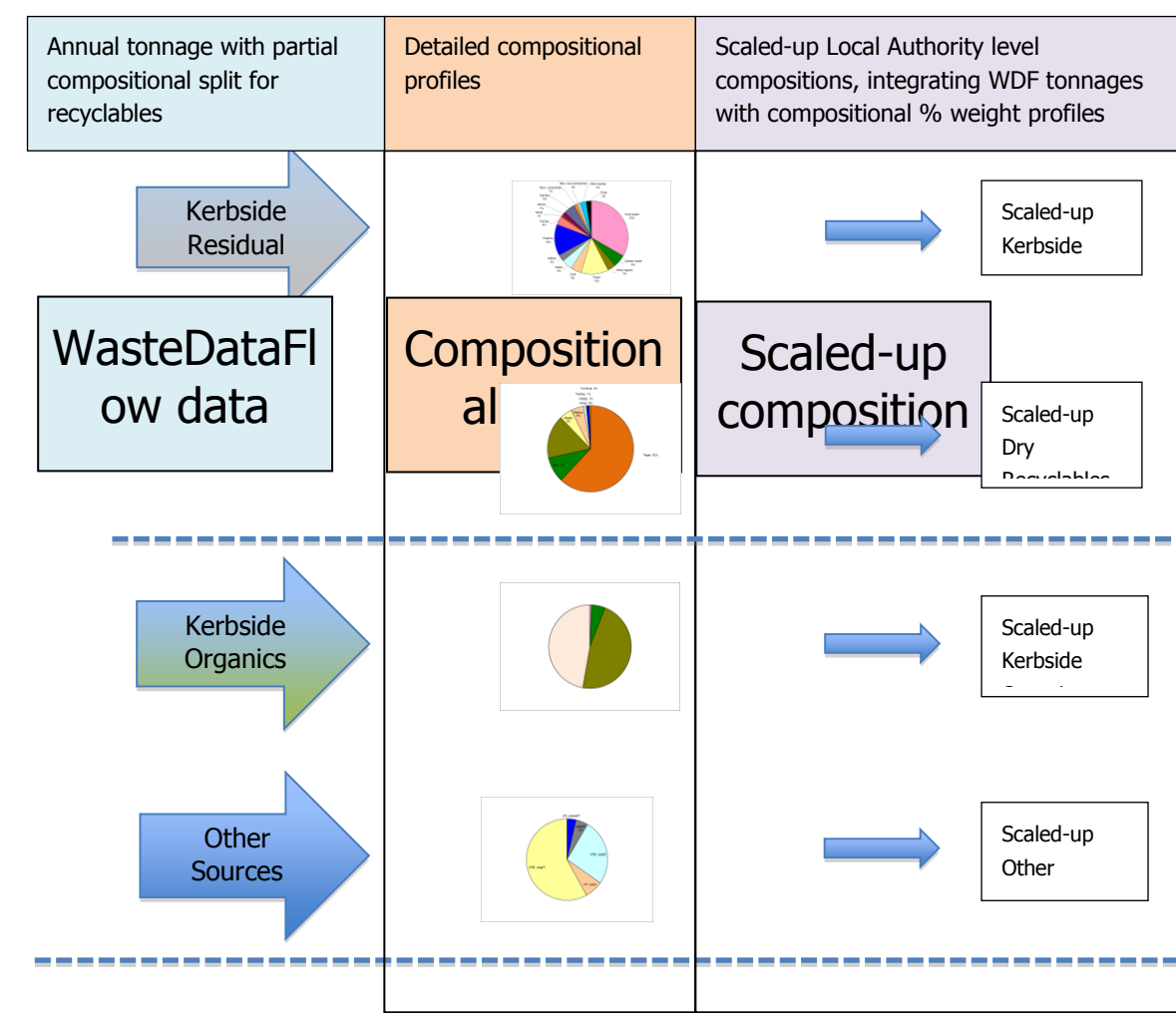
Weighting for stratum	<i>u</i> %	<i>v</i> %	<i>w</i> %	<i>y</i> %	<i>z</i> %	$u\% + v\% + w\% + y\% + z\% = 100\%$
Stratum	1	2	3	4	5	WEIGHTED TOTAL
% comp or kg/hh/wk	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	$=(u\% \times a) + (v\% \times b) + (w\% \times c) + (y\% \times d) + (z\% \times e)$

Figure 2 Calculation of weighted average

8.1.2 Tonnage estimates

WCA results cannot be reliably scaled-up to produce total tonnage estimates for the Local Authority area, due to sampling error and the list of intervening factors discussed in Section 4 that make it difficult to obtain a representative waste sample from 'snap shot' sampling. The formal reporting of operational tonnages through WasteDataFlow, when integrated with the relevant compositional profile obtained from WCA (Figure 3) provides the best approach to reporting overall compositional estimates for the area as a whole. This will also need to take account of the Local Authority approach to reporting commercial waste and waste from other sources.

Figure 3 Integration of WasteDataFlow and compositional data to produce Local Authority level compositional estimates



8.2 Reporting

For the purposes of this guidance it is assumed that the sampling and analysis programme has been carried out simply to achieve the aims set out at the start of the document, and analysis is restricted to:

- Quantifying compositional profiles for total kerbside waste and the individual waste streams sorted.
- Identifying the proportion of recyclable materials in the residual stream and contamination in the co-mingled dry recycling.
- Calculating capture rates for the recyclable waste streams collected at kerbside and included in the WCA.

As a minimum standard, the WCA report should include all of the items set out in Table 5. In addition to the raw data reported in the appendices, it is also necessary to keep copies of the raw data in spreadsheet form. Having the raw data allows further analysis of if necessary and cross-comparisons with future WCA for the area are easier to carry out.

Care must be taken with systems that use commercially based geo-demographic packages that the level of reporting does not infringe any legal restrictions governing disclosure of profiling associated with the study area. The sharing and usage requirements for the data must be explicitly approved in writing by any private sector data provider at the outset of the work.

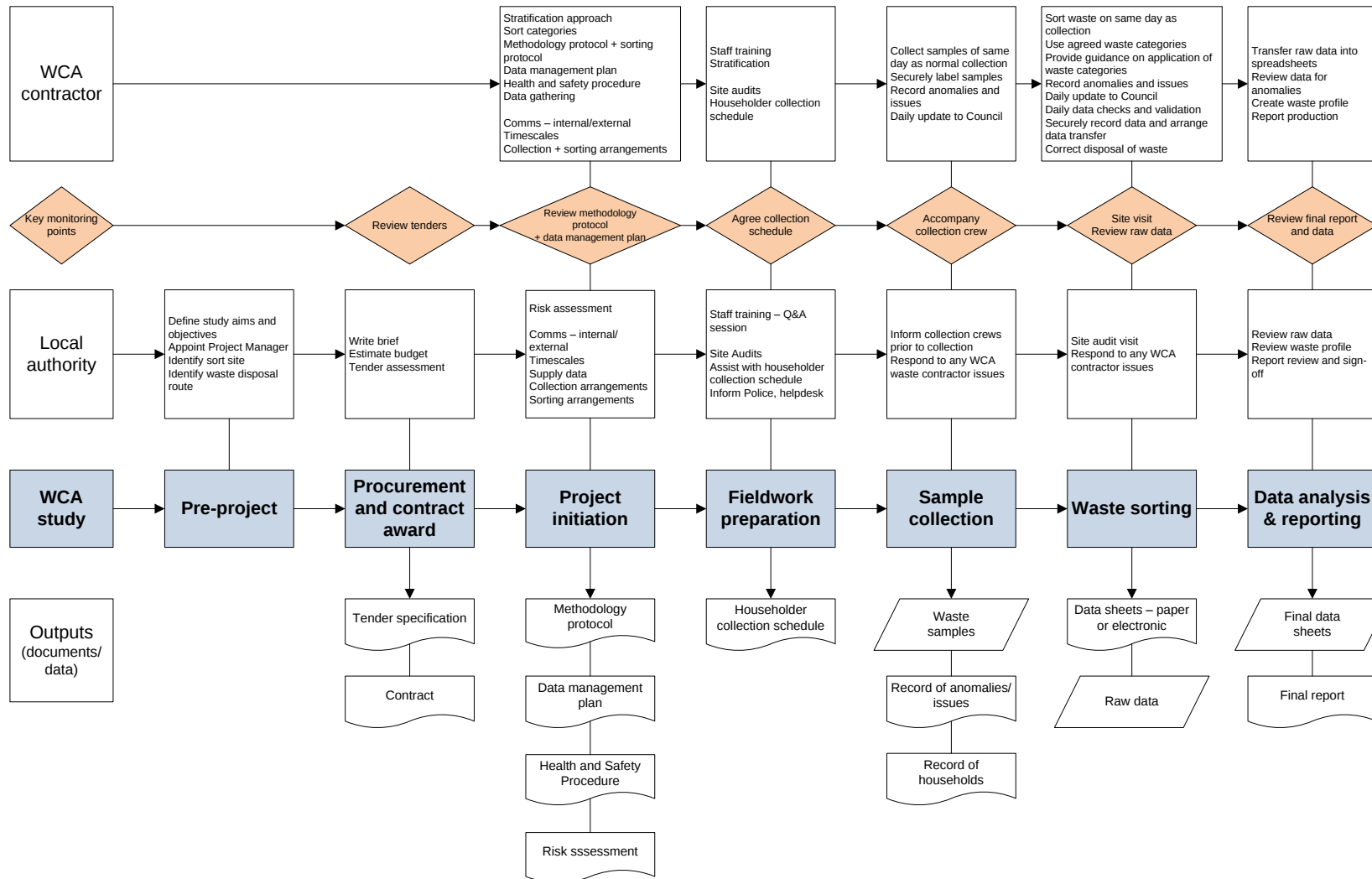
Table 5 Essential reporting requirements

Objectives and scope	The main research objectives, including a precise description of the waste streams within scope.
	Context of the research within the waste and recycling services provided by the Local Authority.
Timing & methodology	Dates on which the fieldwork was conducted.
	Location and description of the sample areas.
	Stratification method used and how areas for sampling selected.
	Sampling procedures: selection of household samples, approach to sampling in relation to kerbside collections with more complex collection frequencies i.e. alternate week systems.
	Sorting methodology: including any guidance issues to sort teams for deciding which items are included in the various classifications.
	Approach to primary and secondary sort categories used.
Results	The presence of any potential biases in the results, e.g. seasonal factors, weather conditions, special local events, and discussion of any methodological issues that arose with the fieldwork.
	A careful description of the results, including interpretation of the findings along with conclusions and recommendations where appropriate.

	Caveats should be supplied alongside the key statistics, including any anomalies in the data which may affect their interpretation.
	Overall composition: profile for the district. Where multiple waste streams were sampled, e.g. residual and kerbside recycling, tables displaying the compositional split within separate waste streams should be supplied. In the case of multi-phase studies reporting more than one phase: comparative analysis by phase and in total should be provided.
	More detailed explanation of stratification technique. Primary and secondary sort categories: table and explanation. More detailed tables and sub-analyses within strata. Postcodes from which waste uplifted.

Appendices

9 Overview and summary



10 References

- European Commission/SWA Tool Consortium (2004) SWA-Tool: User Version, Waste Composition Analysis methodology, designed under the EU 5th Framework Programme. - http://www.wastesolutions.org/fileadmin/user_upload/wastesolutions/SWA_Tool_User_Version_May_2004.pdf
- SEPA (2011) Zero Waste Plan – Guidance for Local Authorities: Use of Data to Support the Zero Waste Plan – Local Authority Recycling Targets, Landfill Diversion and the Landfill Allowance Scheme.
- SEPA (2008) National Methodology for Household Waste Composition. http://www.sepa.org.uk/science_and_research/idoc.ashx?docid=7d7026d7-6715-4c95-bac2-128bada54a02&version=-1.
- Zero Waste Scotland (2012) Building a WCA Strategy for Scotland. Unpublished
- AEA Technology (2003) The composition of municipal solid waste in Wales. Welsh Assembly Government - <http://wales.gov.uk/docs/desh/publications/031201municipalwasteen.pdf>
- WRAP (2010) Improving the Performance of Waste Diversion Schemes: A Good Practice Guide to Monitoring and Evaluation: Monitoring Capture Rates - <http://www.wrap.org.uk/content/monitoring-and-evaluation-guidance-chapter-7-monitoring-capture-rates>

Appendix A

Variability in waste streams and the selection of sample size

It is difficult to determine how many households should be sampled in relation to the variability of different waste categories found within the household waste stream for the following reasons:

- The street block (or the individual households sampled within it) identified to represent a particular stratum may not be homogenous with respect to the characteristics of the wider population of households within that street block and the block selected may not be representative of that stratum across the authority as a whole.
- Variation in some sub-categories of waste, particularly at the 'secondary' level is greater than for others (e.g. waste categories that have high variability include those that are not regularly produced by all households, such as date boxes, batteries and small electrical items). A significantly larger number of households would need to be sampled in such cases in order to estimate the arisings of these sub-fractions with the same precision as those which exhibit less variation.
- Greater seasonality in some sub-fractions and weather related arisings of particular components will add to the variance (e.g. barbeque related waste, grass clippings); it is difficult to achieve the same precision in the estimates obtained for waste categories with these characteristics;
- Interaction between kerbside recycling and residual waste systems and the extent of householder participation will increase variability of fractions within residual and recycling streams depending on variation in participation rates, house-to-house.

One method of considering how many household samples should contribute to each street block sample is to calculate the coefficient of variation for particular waste categories using household level data. The required sample size can then be estimated in relation to a set level of statistical confidence and assumed sampling error. The coefficient of variation expresses the level of variation in relation to the mean and is calculated by dividing the standard deviation by the mean.

Unfortunately there is only limited household level data available on which to base such analysis, and only two sources of data have been used as the basis of our recommended sample size per street block:

- a Europe-wide study of waste sampling methods (European Commission, 2004); and
- historical household level data from the work carried out in Wales in 2002 (Welsh Assembly Government, 2003) in which household level analysis was carried out.

From the Welsh study, CVs for the 'more predictable' fractions of the residual waste stream (such as food waste and plastic bottles) of the region of 50-60% (**Table A**) can be assumed at the primary category level within stratum and season. **Table B** which is based on results from the SWA-Tool methodology (European Commission, 2004), gives an approximate indication of the necessary number of samples in relation to CVs, an assumed level of random sampling error and required statistical confidence level. The European study assumed a CV for the household waste stream of 30% with a 10% allowance for sampling error to give a minimum number of sampling units of 35. As most household waste sub-fractions have CV's above 50% in the Welsh study, samples of 50 households would be a more appropriate choice for each stratum. For many of the sub-fractions with higher CVs, the level of precision (or margin of error) is likely to be well above 25% and results will need to be treated with caution.

Table A Examples of CV calculated from household-level data from the 2002 Welsh compositional analysis

	Coefficient of variation		Notes
	spring samples	autumn samples	
total weight of refuse at kerbside	42%	35%	
garden waste	240%	233%	influenced by recycling infra-structure
food waste	64%	51%	no recycling infra-structure available in areas sampled in 2002
newspaper & magazines	122%	97%	influenced by recycling infra-structure
plastic bottles	62%	59%	no recycling infra-structure available in areas sampled in 2002
cardboard and card packaging	76%	82%	influenced by recycling infra-structure
Textiles	237%	188%	infrequently discarded

Table B Indicative number of sampling units to represent each stratum

Coefficient of Variation	Minimum Number of Sampling Units (n) at 95% Confidence Level (listed with Maximum Allowance for % Random Sampling Error)					
	2.5%	5%	10%	15%	20%	30%
15%	138	35	9	4	2	1
20%	246	61	15	7	4	2
25%	384	96	24	11	6	3
30%	553	138	35	15	9	4

35%	753	188	47	21	12	5
40%	983	246	61	27	15	7
45%	1245	311	78	35	19	9
50%	1537	384	96	43	24	11
55%	1859	465	116	52	29	13
60%	2213	553	138	61	35	15
70%	3012	753	188	84	47	21
80%	3934	983	246	109	61	27
90%	4979	1245	311	138	78	35
100%	6147	1537	384	171	96	43
120%	8851	2213	553	246	138	61
140%	12047	3012	753	335	188	84
160%	15735	3934	983	437	246	109
200%	24586	6147	1537	683	384	171

Appendix B

Sampling other waste sources

Introduction

Waste streams beyond those associated with regular kerbside collections of household waste may also require WCA for the same reasons: the need to profile the composition in order to identify further recycling potential and assess material capture rates. The main 'other waste sources' that are often the subject of WCA include HWRC, litter, commercial waste and bulky waste collections. It is not possible to provide full guidance on how best to conduct these studies as there are many local and circumstantial factors that will need to be taken into account. This appendix covers some of the main factors to be taken into account when designing a WCA for these waste streams.

HWRC

Studies used to determine waste composition at HWRC fall into two broad categories that have different overall research objectives:

- Input studies: these are visitor-based samples designed to monitor the total waste stream brought to a site by the public. Usually the fieldwork involves sampling from a set proportion of vehicles entering a site and the waste is separately sorted rather than bulk sampled. This approach may be combined with very brief householder questionnaires to provide analysis of geographical information on catchment areas, demographics, and attitudinal data in relation to recycling and use of the HWRC.
- Output studies: where WCAs are used to determine the waste composition based on bulk samples taken from the HWRC skips.

There are advantages and disadvantages associated with both methods. The first approach produces data that can be linked to householder characteristics and may avoid some of the potential biases associated with sub-sampling residual waste skips; however, draw-backs include:

- at busy sites (especially during sunny weekends) interception of waste brought in by the public can be very disruptive to site operations and the set sampling frequency may become unworkable; and
- the method cannot readily determine the actual fate of material: for instance, staff working at the site will intercept readily recyclable material erroneously placed in a residual skips by the householder.

The second approach has the advantage of avoiding the uncertainty over the intended disposal route, but it should be carried out on uncompacted waste and care needs to be taken over how skips are sub-sampled. A particular problem is how to randomly sample from a mix of larger items (for instance, discarded kitchen units) within a matrix of smaller items.

The table below identifies some of the main factors and considerations when planning a HWRC WCA.

Key Factors	Considerations and recommendation
Seasonality of site use	This is a very important aspect for HWRC sampling due to the effect of the growing season on garden waste and the seasonality of DIY (home improvement) activity. Typically the period with the greater tonnage is from April to September. To cover seasonality the sampling strategy should cover both high and low periods. It is recommended that control for seasonality in HWRC waste arisings should involve repeat sampling from selected sites in both 'high' (typically April-September) and 'low' season (October-March).
Where to sample at the site?	Output studies provide a more reliable estimate of HWRC waste composition.
What to sample at the site?	At a minimum residual skip waste should be sampled.
Weekday and weekend analysis and other temporal factors	The use of sites is different in the week compared with weekends. It is essential that a study controls for this factor by balancing weekend and week day fieldwork; Mondays are best-avoided, due to spill-over from weekend; bank holidays should be avoided as the results are not likely to be typical of annual composition. As a minimum waste from each site should be sampled on one week day (excluding Mondays) and one weekend day.
Number of HWRC sites to sample?	There may well be a number of different types of HWRC (possibly run by different contractors). The study design should assess key differences in site layout and different catchment types (urban, urban fringe/ rural; level of affluence/ deprivation). Overall, the selection of sites needs to be a representative cross-section of those within the area as a whole.
Sort categories	HWRC categorisation differs to systems applied to kerbside WCA, due to variation in the list of materials accepted and in how sites are run. Generally the number of secondary categories will be greater for HWRC sorts than for kerbside, e.g. the number of categories used to describe WEEE and furniture. The sort categories given in 'Appendix C Standard Scottish waste categorisation' should be used with additional detail added as required.
Sort method	WCA should use physical sorting of material rather than visual assessment methods.
Assessment of reuse potential	It is not self-evident which items taken to HWRCs have the potential to be reused. A specialist assessment will be required by a person with knowledge of the local reuse market/ charity sector. This issue is discussed further in the bulky waste section.
Separate black-bag sort	WCA at HWRC should sort all black-bag waste in order to provide a complete sample of all waste handled by the site. If black-bag waste is not sorted, opportunities to maximize HWRC recycling rates may be missed and knowledge of residual waste composition will be incomplete.
Other considerations	Does site have trade waste restrictions in place? Depending on the research objectives and the site layout, trade waste may be excluded from the analysis.

Commercial waste

Conducting a representative WCA study of commercial waste is challenging given the variety of different premises and the logistical difficulties of obtaining waste samples. In addition, if commercial waste is co-collected with household waste, sampling methodologies will depend on whether or not the WCA aims to profile the household and commercial premises separately.

Local authorities should first consider if data already available are sufficient before embarking on a commercial WCA:

- Data on the composition of mixed waste from a number of commercial sectors in Scotland is available from the Zero Waste Scotland report: The Composition of Mixed Waste from Scottish Health and Social Care, Education, Motor, Wholesale and Retail Sectors in 2011 – <http://www.zerowastescotland.org.uk/sites/files/wrap/The%20composition%20of%20waste%20from%20three%20sectors%20in%20Scotland.pdf>.
- Data on the composition of Local Authority commercial waste is available from the Zero Waste Scotland report: The Composition of Municipal waste in Scotland - <http://www.zerowastescotland.org.uk/content/composition-municipal-waste-scotland>

There are three potential scenarios for conducting a commercial WCA:

- To gain greater understanding of the waste composition of waste collected from existing Local Authority commercial collections.
- To gain greater understanding of the split between commercial and household waste where there is co-collection of the waste streams.
- To understand the waste composition of waste from commercial properties that could be covered by Local Authority commercial routes in the future.

The table below identifies some of the main factors and considerations when planning a commercial WCA.

Local Authority

Key factors	Key considerations and recommendations
Stratification	As with household studies stratification of the sample is required. Previous studies have used three-digit SIC code and employee size band to group businesses into representative samples of those within the study area. If selecting co-collected rounds to sample, in order to be representative of such rounds within the area stratification must take into account the characteristics of the commercial component as well as the household component. If sampling from municipally operated commercial waste rounds, different rounds should be profiled in terms of the businesses represented in order to arrive at representative 'clusters' or sections of collection rounds to sample from. As with household sampling, this will compromise the desired random sample, but will make the samples easier to collect.
Sampling framework	If the Local Authority is sampling waste from a wider cross-section of commercial premises beyond those listed on their own collections, specialist advice will be needed on different methods of developing a

Key factors	Key considerations and recommendations
	sampling frame for the target area.
Telephone survey	This stage is necessary to get agreement to participate in the study if the premises are not already serviced by the Local Authority. The telephone survey can also be used to obtain information on the size and frequency of collection of waste from the site. Studies should over-recruit by more than 10% to build in some flexibility and allow for drop outs at the recruitment and at the waste sampling stages.
Waste audits / waste sampling	Waste audits may be necessary to physically identify the bins sizes, confirm any access problems when sampling, identify days of collection and obvious Health & Safety issues on site. If premises are not already serviced by the Local Authority adequate time is required to enable the normal waste contractor to be contacted to verify collection services to a business unit prior to the scheduled collection for compositional analysis. Need to avoid bias in sampling due to rejection of business units that cause significant operational or logistical problems during fieldwork. All units presenting unusual containers, or those with known health and safety risk, need to have individual plans made for collection.
Waste containers and receptacles	Many businesses operate from communal offices or shopping areas and have some form of shared waste disposal. It is necessary that waste from the individual business units is identified or all businesses using the bin are identified. Businesses can be asked to use alternative bags for the period of the study e.g. coloured sacks. In practice this can cause issues as some businesses view this as too much work or are suspicious that they were being scrutinised. A protocol is required for weighing and collecting large samples. Commercial waste is stored in a huge variety of containers and some businesses utilise skips (both open and closed), compactors and paladins. Compacted waste can be difficult and dangerous to sort. An alternative is to arrange for material to be collected in an alternative container for the period of the study. Time should be allowed during the study planning stages to set up an alternative methodology.
Waste Transfer Notes	Full consideration should be given to whether it will be necessary to issue Waste Transfer Notes to the organisations involved in the study.
Waste sort categories	The material classifications presented in this methodology are designed for household waste. Further sub-classification of waste streams to account for materials that occur in the commercial sector should be considered in the research design. The primary level categories should remain the same as those given in 'Appendix C Standard Scottish waste categorisation'.
Using WCA to generate waste arising figures	There are particular issues with using the data from WCA to gross up to estimates of the amount of waste arising. Studies should be used to identify the waste profile only where relevant annual tonnage estimates

Key factors	Key considerations and recommendations
	for municipally collected commercial waste are available from WasteDataFlow.

Bring sites, litter and Recycle on the Go

Bring sites: it is unlikely that a WCA would be required unless there are significant contamination issues associated with the materials collected. Good operational data reported through WasteDataFlow should suffice. Greater granularity of weight data might be beneficial e.g. weighing by bring point/collection period, rather than after it has been bulked up.

Recycling on the Go (RotG): RotG is unlikely to be subject to the focus of WCAs. Such facilities currently account for only a small proportion of Local Authority waste arisings and those services that do exist are highly varied. The main use of composition analysis for RotG would be to identify contamination and non-target material levels or the split in material types for co-mingled collections. Otherwise useful monitoring data can be obtained by monitoring fill levels rather than undertaking a WCA.

Litter / street cleaning: this waste stream is again only a small part of the total municipal waste in most areas and WCA represents a difficult sampling problem as littering occurs in such a variety of different contexts and environments. Two different sorts of techniques are applied to the assessment of litter composition:

- Bulk samples (usually obtained from a number of different 'litter zones' in order to represent an area) are obtained from litter collections and hand sorted. The sample may or may not require sub-sampling;
- Visual analysis methods that involve tipping the representative sample onto a tipping floor. The sample is raked across the floor and each primary category within the litter is recorded either as a count or as a percentage volume.

Waste Stream	Key sampling considerations
Bring sites	Locational considerations (e.g. street locations, front of store facilities) different segregation types and measurement of contamination; profile of materials collected for recycling at kerbside; effectiveness of site servicing/ cleansing to reduce contamination.
Litter and street sweepings	Different litter zones and locations will need to be sampled at different times of day and days of the week. It is important that the design takes into account the different zoning of litter/ street cleaning (i.e. the service intensity) in the design of the sampling strategy. To be able to apply results to WasteDataFlow the sampling will need to reflect what WasteDataFlow records (litter, flytipping, sweepings etc.). The sampling may want to make a clear distinction between what is in litter bins versus litter on the ground.
Recycling on the go	Sampling considerations include ensuring coverage of different locations (particularly variations in local footfall and usage patterns), different containers and signage, variations in site servicing/ cleansing and seasonal variation e.g. containers in parks are unlikely to be highly used during winter months.

Bulky waste

For determination of bulky waste composition the chosen method depends on where the bulky waste arises: either at kerbside, through local authority bulky waste collections, or at HWRCs. Generally a wider range of bulky items arise at HWRCs compared with kerbside collections. A full account of

methods applied to determination of bulky waste composition can be found at <http://www.wrap.org.uk/cy/system/files/private/Technical%20Report%20v2.pdf>

For local authorities that provide a bulky waste collection service by prior arrangement, the best way to generate data on the overall profile of the waste stream and the likely number and weight of re-usable goods is to use administrative data to make an estimate. Some authorities have set up their databases in such a way that this data can be pulled off routinely. Data from the collection service are then converted to tonnage using detailed standard weight tables in order to estimate the overall bulky waste profile:

Although this approach will tell you the total quantity of each type of item collected in the bulky waste, it won't tell you the quality and whether or not there is a local reuse need for an item. To obtain a meaningful estimate of the proportion of the waste stream that has reuse potential you will need to do an assessment based on several test samples of bulky waste. This should be done by someone involved in the resale of items since what is reusable in practice is different to what is reusable in theory and will depend on local demand. Once this is done, generate some general rules about the proportion of each type of bulky item that is reusable and apply it to your figures. When you compare this figure with what is actually diverted for reuse currently, you will have a good idea of how well your schemes are performing.

Appendix C Standard Scottish waste categorisation

The table below gives the operational waste sort categories; WCA studies should follow the Level 1 and Level 2 categories (see Section 5). In addition the table shows how the sort categories align with WasteDataFlow and European Waste Classification waste categories; this link is important for wider data analysis.

Items in italics are commonly HWRC type wastes and do not need to be included in the kerbside sort list. Additional detail may be added by incorporating Level 3 categories but it must be possible to aggregate data back to the Level 2 and Level 1 categories.

Data analysis categories		Operational sort categories	
WDF category	EWC	Level 1 category	Level 2 category
Green glass	Glass wastes	Glass waste	Green container glass
Brown glass			Brown container glass
Clear glass			Clear container glass
Mixed glass, green glass, brown glass, clear glass			Non-packaging glass
Paper	Paper and cardboard wastes	Paper and Card	Newspaper, magazines
Paper			Other recyclable paper
Paper			Non-recyclable paper
Card			Board packaging
Card			Thin card packaging
Card			Other card
Books			Books
Yellow pages			Yellow Pages/Directories
Cardboard beverage	Mixed and undifferentiated materials		Cardboard beverage packaging/cartons
Steel cans	Metal wastes, ferrous	Metal – ferrous and non-ferrous	Cans - steel
Aluminium cans	Metal wastes, non-ferrous		Cans - aluminium
Aluminium foil			Aluminium packaging
Mixed cans, other scrap metal	Metal wastes, mixed ferrous and non-ferrous		Other Scrap metal
Aerosols	Chemicals		Aerosols - aluminium
Aerosols			Aerosols - steel

Data analysis categories		Operational sort categories	
WDF category	EWC	Level 1 category	Level 2 category
HDPE	Plastic wastes	Plastic bottles	HDPE drink bottles
PET			PET drink bottles
Mixed plastic bottles			Other plastic bottles
Mixed plastics, other plastics and plastics by polymer e.g. LDPI		Dense plastic	Dense plastic packaging exc. EPS
Video tapes, DVDs and CDs			Expanded polystyrene packaging
Mixed plastics, other plastics and categories for each polymer e.g. LDPE			Video tapes, DVDs and CDs
			Other dense plastic – non-packaging
		Plastic film	Carrier bags
Bin bags			
Other plastic film			
Green garden waste only	Vegetal wastes	Garden wastes	Green garden waste
Other compostable waste			Woody garden waste
Soil			Soil
Waste food only	Animal and mixed food waste	Food wastes	Avoidable food waste
Waste food only			Unavoidable food waste
Vegetable oil			Cooking oils/fats
Wood	Wood wastes	Wood wastes – non furniture and garden waste	Wood - treated
Wood			Wood - untreated
Chipboard and MDF			Chipboard and MDF
Composite wood materials			Composite wood materials
WEEE - Large	Discarded electrical and	Waste	WEEE - Large Domestic

Data analysis categories		Operational sort categories	
WDF category	EWC	Level 1 category	Level 2 category
Domestic App	electronic equipment	electrical and electronic equipment (WEEE)	<i>Appliances</i>
WEEE - Small Domestic App			WEEE - Small Domestic Appliances
WEEE - Cathode Ray Tubes			<i>WEEE - Cathode Ray Tubes</i>
WEEE - Fridges & Freezers			<i>WEEE - Fridges & Freezers</i>
Car tyres, van tyres, large vehicle tyres, mixed tyres	Rubber wastes	Tyres	
Furniture	Household and similar wastes	Miscellaneous combustible	Soft furniture (including cushions from sofas)
Furniture			<i>Wooden furniture</i>
Bric-a-brac			Bric-a-brac
Mattresses			<i>Mattresses</i>
			Other combustible materials not otherwise specified.
Textiles and footwear	Textile wastes	Textiles & footwear	Clothing textiles
Textiles and footwear			Shoes, belts & bags
Textiles and footwear			<i>Carpet & underlay</i>
Textiles and footwear			Non clothing textiles (e.g. duvets and pillows)
Rubble	Construction and demolition waste	Misc. non-combustible	Rubble
Plasterboard			Plasterboard
			Other construction and demolition waste (sand, gravel, ceramics)
			Other non-combustible materials not otherwise specified
Fire	Chemical wastes	Hazardous	Fire extinguishers

Data analysis categories		Operational sort categories	
WDF category	EWC	Level 1 category	Level 2 category
extinguishers		wastes <u>NB each item to be weighed and listed separately. Items in the same Level 2 category can be grouped and weighed together.</u>	
Gas bottles			<i>Gas bottles</i>
Ink and toner cartridges			Ink & toner cartridges
Paint			Paint
			Pesticides, varnish, inks and other chemicals
WEEE - Fluorescent tubes, low energy light bulbs and other light bulbs	Discarded electrical and electronic equipment		WEEE - Fluorescent tubes, low energy light bulbs and other light bulbs
Mineral oil	Used oils		Mineral Oil (motor/machine oil)
Automotive batteries	Batteries and accumulators wastes		<i>Automotive batteries</i>
Post-consumer non-automotive batteries			Non-automotive batteries
	Healthcare waste	Healthcare waste	Disposable Nappies
			Other absorbent hygiene products
			Potentially hazardous healthcare waste
			Dead animals
			Pet excrement and bedding
	Sorting Residues	Fines (<10mm)	

Appendix D Guidance on waste classification

The table below aims to give guidance on the items included under each Level 2 waste sort category; this guidance is not exhaustive. If any items are found during sorting which are difficult to categorise a note should be made of the item together the weight and the category used.

Level 2 category	Illustrative examples – the list of examples will not be exhaustive. Operatives should refer to their supervisors if further guidance is required.
Green container glass	Green bottles and jars. Blue bottles and jars.
Brown container glass	Brown bottles and jars.
Clear container glass	Clear bottles and jars.
Non-packaging glass	Mirrors, reinforced glass, drinks glasses, vases.
Newspaper, magazines	Newspapers, glossy magazines, catalogues, travel brochures.
Other recyclable paper	Paper which is easily recycled: Letter/writing paper, computer paper, loose leaf paper, photocopies; unused wall paper, paper bags, paper packaging, mail in an envelope, diaries, envelopes, posters, books, travel tickets, non-glossy pamphlets, wrapping paper, envelopes with plastic windows.
Non-recyclable paper	Paper that cannot be recycled due to food contamination (this can only be based on the state of paper within the sample, regardless of when contamination occurred). Paper that may be difficult to recycle due to production process: Food contaminated wrappers, paper napkins, hand towels, wall paper removed from walls, photos, facial and toilet tissues, kitchen paper. Some paper not normally recycled, e.g. food contaminated wrappers, hand towels, paper napkins, can sometimes be accepted in food waste collections. In this case local authorities may want to add an additional category 'Paper recyclable in food waste collection' based on their local specification for food waste collection. This will enable the Local Authority to quantify the amount that of the paper stream that could be diverted to the food waste collection while still allowing aggregation of data so that it is cross-comparable with other studies.
Board packaging	Corrugated card,
Thin card packaging	Boxes and packets for: pre-prepared foods, cereal, washing powder, eggs, tissues, powdered milks, washing soda, biscuits, ice cream, etc.
Other card	Greetings cards, postcards, beer mats, files.
Books	Hardback books, softback books.

Level 2 category	Illustrative examples – the list of examples will not be exhaustive. Operatives should refer to their supervisors if further guidance is required.
Yellow Pages/Directories	Yellow pages, other directories
Cardboard beverage packaging/cartons	Tetrapak, juice cartons, milk cartons.
Cans - steel	Cans for pet food, food.
Cans - aluminium	Cans for beer, fizzy drink, ring pulls.
Aluminium packaging	Foil trays, foil, milk bottle tops, yoghurt tops.
Other Scrap metal	Keys, cutlery, bike locks, paper clips, safety pins, tools, car parts, oil filters, biscuit tins, radiators, metal shelving units, copper pipe, stainless steel sink unit, saucepans, bike parts.
Aerosols - aluminium	Perfume, hairspray.
Aerosols - steel	Perfume, hairspray
HDPE drink bottles	Type 2. Fizzy drink bottles, milk bottles and beer bottles, shampoo bottles.
PET drink bottles	Type 1. Fizzy drink bottles, milk bottles and beer bottles, cleaning product bottles.
Other plastic bottles	Plastic bottles other than Type 1 and Type 2. Fizzy drink bottles, milk bottles and beer bottles; shampoo, ketchup bottles, vegetable oil bottles; vinegar bottles, detergent bottles
Dense plastic packaging exc. EPS	Pre-prepared food trays and boil in the bag food pouches; packaging household and industrial chemicals, snack and food packages, margarine tubs, bottle tops, yoghurt containers, drinking straws, medicine containers, vitamin bottles, fast food trays, fruit netting.
Expanded polystyrene	Expanded polystyrene e.g. egg boxes food trays, protective packaging for fragile items and insulation
Video tapes, DVDs and CDs	Video cases, DVD cases, DVDs, CDs
Other dense plastic – non-packaging	Disposable cutlery, vending cups, seed trays, plastic coat hangers, buckets, rigid pipes, crates, garden furniture & flower pots; pipes & fittings, credit cards, synthetic leather products, large moulded products such as battery casings. (NB toys go in bric-a-brac)
Carrier bags	Single use carrier bags, plastic 'bags for life'.
Bin bags	Refuse sacks, rubble bags.
Other plastic film	Garment and produce bags, packaging films, bubble wrap, cereal box liners, boxed wine liner, plastic freezer bags crisp packets, pasta packaging.
Green garden waste	Grass cuttings, weeds, flowers.
Woody and bulky garden waste	Tree branches, shrub branches, hedge trimmings, logs.

Level 2 category	Illustrative examples – the list of examples will not be exhaustive. Operatives should refer to their supervisors if further guidance is required.
Soil	Soil
Avoidable food waste	Food and drink thrown away that was, at some point prior to disposal, edible. Food and drink that some people eat and others do not, or that can be eaten when a food is prepared in one way but not in another: Mouldy slice of bread, rotten apples, meat, bread crusts, potato skins, chicken skin.
Unavoidable food waste	Waste arising from food or drink preparation that is not, and has not been, edible under normal circumstances: Meat bones, egg shells, pineapple skin, tea bags, coffee grinds, shells. NB Shells are not suitable for anaerobic digestion facilities. WCA of commercial wastes may want to consider separately classifying shells.
Cooking oils/fats	Vegetable oil, butter, margarine, olive oil.
Wood - treated	Wooden boxes, pallets, cork packaging, wood from DIY, wood fencing. Excludes wood furniture.
Wood - untreated	Wooden boxes, pallets, cork packaging, wood from DIY, wood fencing. Excludes wood furniture.
Chipboard and MDF	Chipboard, MDF
Composite wood materials	Kitchen work tops, plywood
WEEE - Large Domestic Appliances	Stereos, cookers
WEEE - Small Domestic App	Kettles, toasters, radios, electric toothbrushes, computers
WEEE - Cathode Ray Tubes	Cathode ray tubes
WEEE - Fridges & Freezers	Fridges, freezers
Soft furniture (including cushions from sofas)	Cushions from sofas, sofas, armchairs, beanbags.
Wooden furniture	Tables, chairs, stools, desks, side tables, chest of drawers.
Bric-a-brac	Crockery, toys, vases, ornaments,
Mattresses	Mattresses
Other combustible materials not	Elastic bands, bicycle inner tubes.

Level 2 category	Illustrative examples – the list of examples will not be exhaustive. Operatives should refer to their supervisors if further guidance is required.
otherwise specified	
Clothing textiles	Trousers, t-shirts, skirts, dresses, underwear, socks, hats, gloves.
Shoes, belts & bags	Shoes, belts, bags.
<i>Carpet & underlay</i>	Carpet, underlay, rugs.
Non clothing textiles (e.g. duvets and pillows)	Duvets, pillows
Rubble	DIY rubble (bricks etc.)
Plasterboard	Plasterboard whole sheets or small fragments
Other construction and demolition waste (sand, gravel, ceramics)	Sand, gravel, ceramic toilets, ceramic wash basins, concrete, stones.
Other non-combustible materials not otherwise specified	Washing up liquid, detergent, other non-hazardous cleaning products
Hazardous (non-healthcare)	Fire extinguishers; ink & toner cartridges; paint; pesticides; varnish, other chemicals; Fluorescent tubes; low energy light bulbs; other light bulbs; motor/machine oil; automotive batteries, non-automotive batteries; fluorescent tubes, low energy light bulbs, LED light bulbs, halogen light bulbs; motor oil, machine oil; <i>automotive batteries; non-automotive batteries (A/AA/C/D batteries, rechargeable or alkaline batteries, button cell batteries, laptop batteries)</i>
Disposable Nappies	Disposable nappies.
Other absorbent hygiene products	Tampons, pads, liners, continence care products.
Potentially hazardous healthcare waste	Needles, unused medicines, plasters, syringes, dressings, stoma and catheter bags.
Dead animals and hair	Dead animals, hair
Pet excrement and bedding	Cat litter, pet excrement.

Appendix E Tender specification template

Given below is a suggested tender specification template for Local Authority kerbside WCA studies. This has taken account of the main elements of the Zero Waste Scotland methodology for WCA. Local authorities should ensure that they use this template for guidance only and incorporate their own internal requirements e.g. specific data requirements, insurance.

Invitation to Tender – Waste Composition Analysis

Project: <insert project code/title>

<insert date>

Introduction

This document constitutes an invitation to prepare and submit an offer to <insert Council> to undertake work which <insert Council> wishes to commission, the scope and parameters of which are described below.

<add any additional necessary details about procurement>

Timetable

The target timetable for this process is as follows:

- Deadline for receipt of questions relating to this tender <insert date>
- Deadline for receipt of tender submissions <insert date>
- Notification of decision <insert date>
- Commencement of work <insert date>*
- Completion of work <insert date>*

* <insert Council> reserves the right to change the timetable if deemed necessary.

Application procedure

<add details specific for Council procurement route e.g. how tenders should be submitted, contact name, how tenders will be accessed etc.>

Background and Scope of Work

<insert Council> has received funding from Zero Waste Scotland to complete a waste composition analysis (WCA) of the household wastes collected by the Council. As well as addressing local information needs, the data from this study will be used by Zero Waste Scotland to begin compiling a national waste composition database, which will be used by Zero Waste Scotland and its strategic partners (Scottish Government, CoSLA, SEPA and WRAP).

<insert Council> and the successful contractor are required to follow the Zero Waste Scotland Methodology for Waste Composition Analysis (available at <http://www.zerowastescotland.org.uk/node/14749>) in order to comply with the conditions of the Zero Waste Scotland funding. The contractor should ensure that they refer to the most recent version of the methodology available.

The objective of the work is <insert objective of work e.g. 'to provide xxx Council (the Council) with an accurate view of the composition of the household waste stream collected at kerbside, based on a robust compositional analysis of the residual waste and a robust compositional analysis of the dry recycle collections to allow the Council to understand the total composition of household waste in the Council area.' Ensure all waste streams to be collected and sorted are included>

<insert Council> will use the analysis to identify or confirm:

- The percentage of waste in <insert Council area> household collected waste streams which is recyclable overall;
- The percentages of dry mixed recyclables (DMR) items remaining in the residual waste and therefore capture rates for these materials at the current time;
- Contaminants within the mixed recycling so future communications campaigns can be targeted to include these materials.

<amend above as necessary> >

The budget for the WCA study is <insert budget> (including VAT and expenses).

At the time of the waste composition analysis waste will be collected from households via the following services:

- <insert summary of services including:
- residual,
- dry recycling,
- food waste,
- garden waste,
- Recycling Points and HWRCs>

Requirements of Services

The contractor will carry out the WCA according to the requirements of the Zero Waste Scotland Methodology for Waste Composition (available at <http://www.zerowastescotland.org.uk/node/14749>). Some specific requirements are identified in this document but contractors should also make full reference to the methodology document to ensure their proposed approach is compliant.

The contractor will complete two phases of compositional analysis of:

- household residual waste; and
- household recycling, where this is collected co-mingled, <insert details of streams to be sorted>The fieldwork will take place in <insert month> and <insert month>. <include here any other identified restrictions to timescales e.g. bank holidays, school holidays>

The contractor will produce a methodology protocol document outlining the approach to the study and incorporating a sampling protocol:

The contractor will produce a sampling plan to include a representative sample of households based on street blocks, rather than a random selection of households. The Council will support production of the sampling plan by providing collection route information. The contractor will stratify the sample to ensure that the sample is representative of the Council area. Please indicate in your bid how this will be achieved. <highlight here if particular elements to stratification that is considered important e.g. properties that should be included e.g. flatted properties, urban/rural split>. At least xx strata <normally 5 but the Council should consider if more or less required> should be identified. Each sample should consist of 50 households but additional reserve households should be identified on the collection lists. The sampling plan should take into account the collection cycle for each of the waste streams to be sampled and ensure that residual waste is collected in the first week of each phase of fieldwork. This sampling plan will be submitted to the Council and Zero Waste Scotland for review and sign-off.

The contractor will produce a data management plan covering compliance with the Data Protection Act; how datasets will be stored; and how data will be transferred to the Council and Zero Waste Scotland. If a commercial geo-demographic package will be used to stratify the sample the data management plan must also cover how the any data derived from the commercial database will be stored and transferred.

The contractor will produce a health and safety procedure specific to the project covering at a minimum PPE, vaccinations, hygiene procedures, provisions for lifting and emptying containers, waste handling and sorting of waste.

The contractor will attend an inception meeting held at the Council's offices to agree arrangements with the Council to safely carry out the waste analysis to their satisfaction. This is likely to include arrangements for: -

- Project team communications
- Sampling
- Sorting protocol
- Sort site location and arrangements for waste disposal
- When the analysis will take place
- Collection arrangements
- Data management plan
- Health & safety requirements or considerations
- What is required from Council staff
- What equipment is required
- External communications

The contractor will gather sufficient data from the Council to complete the analysis to the level where they can understand their waste arisings by material. This will require data gathering from the Council and analysis of WasteDataFlow.

<insert Council> will collect all waste samples from the properties identified within sampling plan. In the first week this will involve collection of residual waste from 50 households for each sample area. For subsequent waste streams the same households will be visited with all waste set-out collected for sorting. The contractor is required to accompany the collections to ensure that the right bins are collected and that a record of set-out rate is made. <amend as necessary if contractor collecting waste>

<insert Council> will deliver the waste samples to <insert sort site location> where the analysis will be carried out. This site has a covered, lit area suitable for WCA that meet health and safety standards and is licenced to receive waste of the type to be sorted.

<include here whether the contractor is required to weigh food waste. This is a recommended requirement of the Zero Waste Scotland Methodology for Waste Composition but depends on the services provided in the Council area and whether the Council or Contractor will be collecting the waste>

The analysis of materials should follow the waste sort classifications included in the Zero Waste Scotland Methodology for Waste Composition. *<insert any additional breakdown of categories required by the Council>.*

Tenders should make clear the maximum amount of waste that their teams are able to sort. Failure to sort the amount of waste specified will be deemed a breach in contract and may affect payment. *<Give indication of amount of waste contractors will be sorting i.e. average bin weights for residual and recycling.>*

Waste should be sorted at an appropriate site that meets health and safety standards, makes logistical sense and is licenced to receive waste of the type to be sorted *<include here whether the Council can help the contractor to identify such a site or if it will be the responsibility of the contractor alone>*

to the contractor will respond to any queries made by the Council or Zero Waste Scotland deemed necessary to confirm fieldwork and data verification has been carried out in line with the contractor's proposal and the Zero Waste Scotland Methodology for Waste Composition. This may include an audit site visit during the fieldwork.

The contractor will prepare a data spreadsheet for analysis by Zero Waste Scotland and the Council after each phase of fieldwork. This spreadsheet will be submitted to the Council and Zero Waste Scotland for review and sign-off. The spreadsheet should:

- Not be locked;
- Be set out in a logical manner;
- Contain a navigation map;
- Contain the raw data established from the audits including raw scale weights for each waste stream;
- Contain all the data and equations to allow manipulation by the Council;
- Contain all assumptions used;
- Provide individual composition for each waste stream audited.

The data analysis should include at least the minimum requirements set out in the Zero Waste Scotland Methodology for Waste Composition; this includes but is not limited to:

- Compositional profiles for total kerbside collected household waste: phase 1, phase 2 and combined– kg/household/wk and % composition:
 - To calculate total kerbside composition WDF tonnages should be used including incorporation of any segregated streams not sorted. Tonnages should exclude any non-kerbside household or commercial waste.
 - The composition profile should be generated based on weighting the strata based on the stratification profile.
-

- Composition profiles (as above) for residual kerbside collected household waste – kg/household and % composition.
- Composition profiles (as above) for co-mingled dry recyclate collected household waste – kg/household and % composition.
- <The composition profile for main door properties – kg/household and % composition <include if different household types on different service regimes included>>.
- <The composition profile for flatted properties – kg/household and % composition<include if different household types on different service regimes included>>.
- Composition % weight and mean kg/household for each stratum.
- % contamination and % non-target materials within the dry recycling.
- % capture rates for food and target materials in the dry recycling.
- Identification of any anomalies in the dataset which might skew the results e.g. disposal of a large amount of a particular material from particular household and/or obvious DIY wastes from a particular household.

The contractor will prepare a report showing objectives and scope, timing, methodology and results. The structure of this report shall be agreed with *<insert Council>* prior to the draft report being prepared. The data must be signed-off prior to the draft report being prepared. The report will be provided to the Council and Zero Waste Scotland for review.

Confirmation of deliverable(s)

- | | |
|---|----------------------------|
| • Inception meeting | <i><insert date></i> |
| • Methodology protocol and sampling plan | <i><insert date></i> |
| • Data management plan and Health Safety protocol | <i><insert date></i> |
| • Completion of fieldwork (Phase 1) | <i><insert date></i> |
| • Completion of draft data (Phase 1) | <i><insert date></i> |
| • Completion of fieldwork (Phase 2) | <i><insert date></i> |
| • Completion of draft data (Phase 2) | <i><insert date></i> |
| • Completion of final data | <i><insert date></i> |
| • Completion of draft report | <i><insert date></i> |
| • Completion of final report | <i><insert date></i> |

Please provide the following in your bid or offer:

Your tender submission should be limited to no more than 10 x A4 sides at minimum 10pt font (excluding cover page, index, executive summary, company details and appendices). Tenderers should keep their tender responses focussed on the requirements and specific objectives. Pen profiles of proposed project team members highlighting relevant experience is to be included in the main document with full CVs in the appendices.

If your submission exceeds the stated maximum number of sides, please note that the evaluation panel will not assess beyond the stated maximum. This may result in your bid being deemed non-compliant.

Your tender submission must include the following information in the order indicated:

- **A description of your working methods:** A description of the methodology employed to deliver the work, including:
 - an outline programme of work detailing tasks and timescales;
 - a description of quality management systems and the methodology for data management to ensure data quality and avoid loss of data;

- a risk assessment including identification of key risks and mitigation measures.
- **A description of the project team who will manage and deliver the work.** This must include a list of individuals, their respective roles within the organisation and, for the purposes of this work their relevant skills and experience including any relevant professional qualifications.
- **A full breakdown of costs (inclusive of VAT).** To include the distinct elements of the work including the time allocation of each member of the project team for each element. Expenses should be identified separately but must be included as part of the total cost of the work.
- Copies of up to date risk assessments, data protection policy and health & safety policy and procedures should be included as appendices.
 - Data Protection: You will be required to show how the confidentiality and security of any personal or sensitive data collected as part of the WCA will be protected, in accordance with the Data Protection Act 1998 (hereinafter referred to as 'the Act').
 - The data collected as part of the WCA will be owned by the Council and Zero Waste Scotland will be the Data Controller, as required by the Act. You will define the Data Processor, as required by the Act.
- A copy of an up to date registered waste carriers certification should be included as an appendix *<this can be excluded if the Council (or its contractors) is going to be collecting the waste>*

Evaluation Criteria *<amend as necessary according to the Council procurement procedure>*

The Council must be satisfied that each potential contractor has the appropriate capabilities and resources available to undertake the work to Zero Waste Scotland's requirements and provide the necessary services.

The process the Council uses to select its contractors is a competitive one. Your tender submission should be written to address the key requirements and scope of the work and demonstrate how it meets the evaluation criteria below:

Criteria	Weighting
Methodology	30%
Tenders will be assessed on the approach to each task in relation to the methodology which covers the safe, effective and satisfactory completion of project.	
Allocation of resources & project management	15%
Tenders will be assessed on the number of days allocated to the project and the appropriateness, experience and knowledge of the personnel nominated in relation to the task identified for them. The level of knowledge and experience within the project team in relation to the tasks to be delivered within this project and the ability to manage the project effectively to the timelines stated will also be considered in this criterion. The team appointed must have experience covering statistical waste sampling, waste collection, waste sorting and data analysis.	
Health and Safety	15%

Tenders will be assessed on how health and safety obligations will be met, provision of risk assessments and a health and safety policy.	
Price	40%
Tenders will be assessed on price based on total cost of the project and day rates of staff assigned to the project.	

Other Information

Tender submissions must be received, by email with attachment(s), quoting **<insert TID title>**, by <insert time and date> to: <insert name>, <insert job title>, <insert email>.

<insert Council> reserves the right not to follow up this invitation to tender in any way and in particular not to enter into any contractual arrangement.

<insert Council> will not be responsible for any costs incurred in the preparation of any tender.

All queries should be made via e-mail to <insert name>, <insert job title>, <insert email>.

Appendix F Basic waste sorting protocol

General

1. Scales should be regularly calibrated.
2. Weigh the weight of each sorting container.
3. Weigh incoming waste over a weighbridge to give a weight of waste for a sample. The total weight of the sample should also be obtained by sorting the whole waste sample. Weighbridge data should only be used to cross check for the total sort weight.
4. Empty bags into the sorting area a few at a time. A complete sample can be emptied into the sorting area if there is both space and the time to sort the material in a working day. Open bags adhering to the health and safety protocol.
5. Sort waste into waste categories adhering to the health and safety protocol. NB for heavier fractions it is acceptable to sort directly into Level 2 categories with the sum of the weights being used for the Level 1 category. It is advised that for lighter fractions, e.g. plastic film, waste should be sorted to the Level 1 category first.
6. Sort team supervisor should regularly check sorted waste, remove any incorrectly sorted material and transfer to the correct container.
7. Weigh each category, using scales with sensitivity appropriate to the weight of the fraction, and check sum of weights. Weighing should be carried out twice to check weights. If any differences are noted then the sample should be re-weighed. This procedure should be followed throughout when recording weights. If any errors are found re-measurements should be made, or if this is not possible, data excluded from study.
8. Weighing the containers will not necessarily be only when they are full. Containers need to be weighed and emptied:
 - a. Before they become too heavy to safely lift onto the scales
 - b. At the end of each day
 - c. At other times as deemed necessary for cleanliness / health and safety purposes
9. Record the weight of the bin contents on an appropriate form or handheld device. Care should be taken to ensure that writing is legible and the decimal point is in the right place.
10. Empty bins into disposal facilities provided, recycling where facilities have been provided.
11. Continue until all waste has been analysed.

Additional guidance

1. Sharps (hypodermic needles etc.) should be placed in the sharps bin provided using litter-pickers.
2. Separate waste materials into their material parts.
3. Where two materials are inseparable the item should be allocated to the material category contributing the greatest weight.
4. Don't force any material through the screen holes
5. Don't separate paint and other potentially hazardous liquids from its packaging; it should be classified in the appropriate category together with its packaging.
6. Separate out liquid in drinks containers, e.g. glass bottles, plastic bottles, drinks cans. The liquid should be weighed separately and included in the 'Avoidable food waste' category.
7. Refer to the guidance on material categories and refer to your sort team supervisor if you are unsure which category to allocate.



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